Megger

Model 8 Mk7
AVOMETER®

USER GUIDE

~~**GUIDE DE L'UTILISATEUR**~~

~~**BEDIENUNGSANLEITUNG**~~

~~**GUÍA DEL USUARIO**~~

⚠SAFETY WARNINGS

- The circuit under test must be switched off and de-energised **before** test connections are made for Resistance measurement.
- To measure current, **de-energise** the circuit to be tested, connect the test leads **and then** re-energise the circuit.
- Selector switches **must** be set to the correct positions.
- When taking voltage measurements, **never** switch to Current (**mA** or **A**) or resistance (**Ω**).
- **Do not use** with current transformers.
- Check that the Instrument protection fuse is intact before and after making any measurement.
- Replacement fuses **must** be of the correct type and rating.
- UK Safety Authorities recommend the use of fused test leads when measuring voltage on high energy systems.
- Test leads, prods and crocodile clips **must** be in good order; clean, and with no broken or cracked insulation.
- Use fully shrouded test leads and take extra care when taking measurements above 50 V a.c.
- The instrument **must not** be used if any part of it is damaged.
- Warnings and precautions must be **read and understood** before an instrument is used. They must be observed during use.

NOTE

THE INSTRUMENT MUST ONLY BE USED BY SUITABLY TRAINED AND COMPETENT PERSONS.

CONTENTS

TRANSIT POSITION FOR SWITCHES

During transit and when not in use the left-hand switch should be set to 'off' and the right-hand switch should be set to "DC ..."

GENERAL DESCRIPTION

DESIGN AND CONSTRUCTION

The Model 8mk7 instrument comprises a moulded front panel on which are mounted the whole of the switching apparatus, the movement and other components. A carrying strap is fixed to moulded lugs on the rear case. The front panel is fitted into this case with a dust proof joint.

When the instrument is set for operation on d.c. the moving coil is associated with a universal shunt and series multipliers, whilst on a.c. diodes and a transformer are also introduced.

RANGE CONTROLS

The left-hand switch provides all the d.c. current and voltage ranges and the right-hand switch the a.c. current and voltage ranges and also the resistance ranges. These switches are electrically interlocked so that readings can only be made after a.c. or d.c. measurement and range has been selected. Resistance tests require the left-hand switch to be set to '**Ω**' and the right-hand one to the desired range.

The ranges are marked on the front panel and arrow heads indicate the actual range selected. The current ranges are indicated by a red arc and the voltage ranges by a grey arc. Resistance ranges have a black arc. Wide coverage in resistance has been achieved by having a fundamental range as marked on the scale, together with ranges of '**x 100**' and '**x 10 k**' to supplement it. Each resistance range has its own zero adjustment control.

In addition a 200 megohm range, marked 'ins' is available, using an external d.c. voltage source.

THE MOVEMENT

The meter movement in the Model 8mk7 is a robust AVO® centre pole movement type ACP1, fitted with spring mounted jewelled bearings. The meter has a full scale deflection of 37,5 µA. A knife edge pointer enables very fine readings to be taken, whilst the whole movement is balanced and damped so that the pointer quickly comes to rest.

SCALING

The scale plate has three calibrated scales. One is for resistance measurement and is marked 0 to 2000 ohms, the second is for current and voltage (both a.c. and d.c.) and is marked 0 to 10 with 100 divisions whilst the third scale calibrated 0 to

3 has 60 divisions and is used for a.c. and d.c. current and voltage measurements.

CUT-OUT

The sensitive cut-out, with very positive latching action is triggered by the meter movement when overloaded i.e. when the pointer deflects rapidly to beyond the full scale position. The cut-out is reset by a push-button on the front of the meter.

The '**off** position on the left-hand switch selects heavy damping of the meter movement for transit purposes.

PROTECTION

The circuit incorporates a 10 A fuse in series with the '**COMMON**' terminal. This fuse is fitted to give the user increased protection should the instrument be connected across a high energy source while its range switches are incorrectly set.

It is most important that the integrity of this fuse is checked before and after any measurement is made. This is done using the instruments own lowest resistance range.

METER REVERSAL

If a d.c. quantity is measured with a polarity in the opposite sense to that assumed by the connection of the red and black test leads, the meter pointer will try to deflect to the left. Operation of the '**Rev MC**' self-latching push-button enables a correct reading on the scale to be made by reversing the direction of the meter deflection.

BATTERY AND FUSE COMPARTMENT

A special compartment to contain the batteries (to supply power for resistance measurements) and fuses is moulded into the rear of the case.

The Model 8mk7 is a general purpose, multi-range, portable meter for measurement of voltage, current and resistance. The 20 000 Ω/V sensitivity matches the data given in most service manuals for electronic equipment.

The instrument is suitable for general fault finding work, installation and commissioning work and for use in the laboratory, in both the electrical and electronic fields.

To enhance the use and measuring capabilities of the instrument, many accessories are available.

OPERATION

CAUTION:
TESTING CURRENT TRANSFORMERS
It is undesirable to use a fuse protected meter for testing current transformers (CTs). A fuse rupture would cause an open circuit on the CT which could give rise to a safety hazard by producing a high voltage situation.

⚠WARNING

1. **Before and after making a measurement, check that the instrument's 10 A fuse is intact by selecting the 'x 1 Ω' resistance range and performing a continuity test with the leads shorted together.**
2. Ensure that when measuring voltages the instrument is not switched to any of the current or resistance ranges.
3. Use extreme care when measuring voltages above 50 V.
4. Avoid connecting the test leads to a '**live**' circuit whenever possible.
5. When making current measurements ensure that the circuit is not '**live**' before opening it in order to connect the test leads.
6. Before making resistance measurements ensure that the circuitry is completely de-energized.
7. Do not leave the instrument exposed to direct heat from the sun for long periods. Instruments used in dusty atmospheres should be stripped and cleaned periodically.
8. Ensure that the test leads are in good condition with no damage to the insulation.
9. Do not switch off by rotating either of the range selection knobs to a blank position.
10. Special care must be taken when using the instrument to service television receivers or other apparatus employing capacitors or large capacitance, for the inclusion of such components in a circuit may mean that very heavy peak currents may flow when the apparatus is switched on. Such surges produce a peak wave form and although these peaks are only of a few milli-seconds duration, they may, never-the-less, damage the instrument diodes.
11. The AVO® Model 8mk7 is fitted with a **1 A** and a **10 A HIGH BREAKING CAPACITY**

CERAMIC FUSE. It is essential that any replacement fuses fitted to the instrument conform to this specification. **GLASS FUSES MUST NOT BE USED** due to their low rupturing capacity. Failure to observe this may result in injury to the operator, damage to the instrument, or both.

GENERAL PRECAUTIONARY NOTES

The instrument circuit incorporates a 10 A fuse in series with the '**COMMON**' terminal, to give the user additional protection should the instrument be connected across a high energy source when its range switches are set wrongly. It is most important that the integrity of this fuse is checked (by a continuity test with the leads connected together) before and after any measurement is made.

A check before measurement ensures that a circuit under test does not appear falsely to be "**dead**". A check after measurement ensures that the reading is valid and that the fuse did not rupture while the measurement was being made.

Establishing that a circuit is de-energized before making connection for current and resistance may be achieved by (i) checking that the appropriate switches are off and (ii) testing, with the instrument set to a voltage range, to see that there is no potential present.

When measuring current or voltage, ensure that the instrument is set to either "**AC ~**" or "**DC ⎓**" as appropriate, and switch to a suitable range before making connections to the circuit under test. When in doubt always switch to the highest range and work downwards, there is no necessity to disconnect the leads as the switch position is changed. Do not, however, switch off by turning to a blank position.

The instrument is flash tested at 7 kV a.c., but if it is used, with accessories, on circuits operating at voltages in excess of 1 kV, it should be kept at the low potential end of the circuit, (near earth potential), or other suitable safe-guards must be applied.

The instrument is intended for use horizontally. The meter pointer should rest over the zero position on the top scale, when there is nothing connected to the terminals. If it does not adjustment may be made using the slotted screw head on the front panel.

NON SINUSOIDAL WAVEFORMS

In as much as rectifier moving coil instruments give readings on a.c. proportional to the mean and not the r.m.s. value of the waveform with

which they are presented, they depend for their accuracy, not only upon their initial calibration, but also upon the maintenance of a sinusoidal waveform. Since the form factor (r.m.s. value divided by mean value) of a sine wave is 1,11, this has been taken into account in calibrating the meter, which does, therefore, indicate r.m.s. values on the assumption that the normal sine wave will be encountered. Generally speaking, considerable waveform distortion can occur without appreciably affecting the form factor and resulting accuracy of measurement, but the user should recognise the possibility of some error when using distorted waveforms, near square wave-shapes producing high readings and peaky ones, low readings.

POLARITY REVERSE CONTROL

If d.c. voltage is required both positive and negative with respect to a reference point, or the direction of current flow is reversed, in order to simplify the matter of lead alteration, a polarity reverse push-button marked '**Rev MC**' is provided. It should be noted that the polarity indicated at the terminals is for normal use and does not apply when the '**Rev MC**' button is in the raised position. The button is a self latching type and must be pressed to release for reversal of meter movement direction.

OVERLOAD PROTECTION

One of the most attractive features of the instrument is the provision of an automatic cut-out which gives a very high degree of overload protection, and imparts to the user a feeling of confidence.

If an overload is applied to the meter, either forward or in reverse, the '**Cut-Out**' button springs up from its normal position, thus breaking the main circuit and the red portion of the button will now be extended. This button has only to be depressed its full amount to render the instrument ready to use again. It is important to note that the cut-out should never be reset when the instrument is connected to an external circuit, and the fault which caused the overload should be rectified before the meter is reconnected.

Although the overload mechanism gives almost complete protection to the meter, it cannot be guaranteed to completely fulfil its function in the very worst cases of misuse, such as the mains being connected across the meter when set to a current range. It should be noted that mechanical shock to the instrument will sometimes trip the cut-out mechanism. Additional protection is provided on resistance ranges by a 1 A fuse connected in the circuit on the '**Ω x 1**' and '**Ω x 100**' resistance ranges.

A 10 A fuse in series with the '**COMMON**' terminal gives increased protection to the user should the instrument be incorrectly used in high energy situations.

MEASUREMENT IN HIGH FAULT ENERGY SITUATIONS

Particular care must be taken with all testing equipment when making measurements in high fault energy situations, e.g. main power distribution systems.

Always ensure the correct range is selected before connecting the instrument to the circuit under test.

Fused test leads, fitted with **High Rupture Capacity** fuses, can be used to increase user safety in the event of incorrect range selection. It is most important when fused leads are used, that the continuity of the test leads be checked before every measurement. This may be performed as follows: select the lowest resistance range; connect the test leads to the instrument and short together the test prods or clips; check that the resistance is low.

Note:– The instrument itself has a 10 A fuse for added protection but this does not negate the need for test leads with fused prods.

Suitable test leads with fused prods and clips can be obtained as an optional accessory, part no. 6111-287.

VOLTAGE MEASUREMENT

When measuring voltage, it is necessary to set the appropriate switch to "**AC ~**" or "**DC ⎓**" as required and to select the required range (on the other switch). Connect the test leads to the circuit to be measured.

If the value of the voltage is unknown, set the instrument to its highest range, connect the test leads and decrease the range step by step until the most suitable one has been found. The readings are taken from the 0-3 or 0-10 scale and multiplied by the appropriate factor i.e. 10, 100 or 1000.

When measuring high a.c. and d.c. voltages (say above 800 V) unless the common negative terminal is either earthy or connected to earth, errors will be introduced if the instrument is touched during a measurement.

On the d.c. ranges, the meter consumes only 50 microamps at full scale deflection corresponding to 20 000 Ω/V. In the case of the a.c. ranges above consumption of 0,5 mA (2000 Ω/V). The 10 V a.c. range is 1000 Ω/V and therefore

consumes 1 mA at full scale deflection. The 3 V a.c. range consumes 10 mA at full scale deflection (100 Ω/V). The meter maintains a high degree of accuracy for audio frequency tests up to 15 kHz on ranges up to 300 V a.c.

All current consuming voltmeters, however sensitive, draw current to varying degrees from the circuit under test, thus causing the voltage to fall at the point of measurement. Owing to the high sensitivity of the Model 8mk7 d.c. ranges, this effect is unlikely to be of importance except in a very few instances. It might affect the measurement of e.h.t. voltage on a television set or the tapping on a potential 'divider', where the resistances are comparable with the resistance of the instrument on the range in use. It is generally possible to use an instrument on a higher range than absolutely necessary where the higher instrument resistance causes less disturbance. At the same time adequate pointer deflection for reasonable accuracy should be attained.

When it is essential to obtain an accurate indication of the voltage developed across a high value resistor it is sometimes preferable to insert the instrument in series with it and to measure the current flowing. The reading in milliamps, multiplied by the value of the resistance in thousands of ohms, will give the developed voltage.

Great care must be exercised when making connections to a live circuit and the procedure should be entirely avoided if possible.

CURRENT MEASUREMENT

To measure current the instrument should be switched to "**AC ~**" or "**DC ⎓**" as appropriate and a suitable a.c. or d.c. range set by the other switch. Connect the instrument in series with the circuit under test, do this only when that circuit is switched off.

The voltage drop at the meter terminals is approx. 710 mV on the 10 A d.c. range at full load reducing to 100 mV on the 50 µA d.c. range at full load. In the case of a.c. it is 390 mV at 10 A and 480 mV at 10 mA. Standard meter leads have a resistance of 0,02 ohm per pair.

RESISTANCE MEASUREMENT

There are three self-contained ranges covering resistances from 1 Ω to 20 mΩ.

On resistance ranges the meter must have, in addition to the normal instrument mechanical zero, a resistance zero corresponding to the full scale deflection of the meter. Before carrying out

tests of resistance, a check should be made to ensure that the instrument actually indicates zero ohms irrespective of the condition of the battery (within the limits of adjustment described later).

The accuracy should be within ± 5% of the reading about centre scale, increasing up to about ±10% of the reading around deflections corresponding to 10% and 90% of full scale.

Resistance tests should never be carried out on components which are already carrying current.

On the three ranges which utilize the internal source of voltage, a positive potential appears at the black common (negative) terminal of the instrument when set for resistance tests. The resistance of some components varies according to the direction of the current through them and readings therefore depend upon the direction in which the test voltage is applied quite apart from its magnitude. Such cases include electrolytic capacitors and rectifiers.

When measuring the leakage resistance of an electrolytic capacitor, the black (negative) lead from the instrument should be connected to the positive terminal of the capacitor and the ohms '**x 10 k**' range employed.

Before making resistance tests the pointer should be adjusted to the resistance range zero in the following sequence:

1. Set the left hand switch at **Ω**.
2. Connect the test leads to the instrument and join them together.
3. on the '**Ω x 1**' range adjust zero by means of the knob marked '**Ω x 1**'.
4. On the '**Ω x 100**' range adjust zero by means of the knob marked '**Ω x 100**'.
5. On the '**Ω x 10 k**' range adjust zero by means of the knob marked '**Ω x 10 k**'.

To measure a resistance, set the right-hand switch at the range required, the leads being connected across the unknown component.

Resistance is read directly on the '**Ω x 1**' range but readings should be multiplied by 100 and 10 000 on the '**Ω x 100**' and '**Ω x 10 k**' ranges respectively.

If on joining the leads together it is impossible to obtain a zero ohms setting or, if the pointer will not remain stationary but falls steadily, the internal battery or cell concerned should be replaced. It is important that an exhausted battery

should not be left in the instrument, since it might cause damage by leaking electrolyte. If it is impossible to obtain readings on the '**Ω x 1**' and '**Ω x 100**' ranges, the 1 A fuse located in the battery compartment should be checked.

Note:- A 15 V battery may age in such a manner that although it indicates a potential of 15 V, its internal resistance has increased so much that some loss of accuracy can occur on the high resistance ('**Ω x 10k**'). If errors are suspected on the high resistance range, remove the battery and check its short circuit current on the 100 mA d.c. range. If the reading is below 15 mA it should be discarded. Do not short circuit for more than two seconds.

INSULATION RESISTANCE MEASUREMENT

High resistance measurements may be made using an external d.c. voltage of approximately 150 V. The left-hand switch should be set at '**Ω**' with the right hand switch at 'ins', then the instrument test leads should be connected to the d.c. voltage source. The pointer should be brought to zero on the ohms scale by means of the adjuster knob marked '**Ω x 10k**'.

To test, connect the unknown resistance in series with the meter and its value will be that shown on the ohms scale multiplied by 100 000. Resistance up to 200 megohms can therefore be read on this range.

DECIBEL MEASUREMENT

The graph on page 14 can be used to determine the dB values corresponding to r.m.s. voltage values across a 600 ohm resistive load. A dB value is defined as the number of decibels above or below a reference level of 1 mW in 600 ohms at 1 kHz. Zero dB, therefore, would indicate a power level of 1 mW; 10 dB, 10 mW; 20 dB, 100 mW etc. Because dB are defined with respect to a 600 ohm load, power levels correspond to voltage levels. Decibels can be measured in terms of r.m.s. voltages across a 600 ohm resistive load. For example, 0,775 V r.m.s. indicates 0 dB and 7,75 V r.m.s. indicates 20 dB. Whilst these measurements must be made with a sine waveform to avoid waveform error, any frequency may be used within the range of the Model 8mk7. The decibel and ear response curves have their closest correlation at 1 kHz.

Power levels can be read along the top of the graph. If the r.m.s. voltage is measured across a resistive load other than 600 ohms the correction factor given below must be added algebraically to the dB values read from the graph. The following

formula should be used for determining the correction factor.

$$\text{Correction Factor} = 10 \log_{10} \frac{600}{R}$$

where R is the load resistance in ohms. If R is greater than 600 ohms the Correction Factor is negative.

FITTING AND REPLACEMENT OF BATTERIES AND FUSES

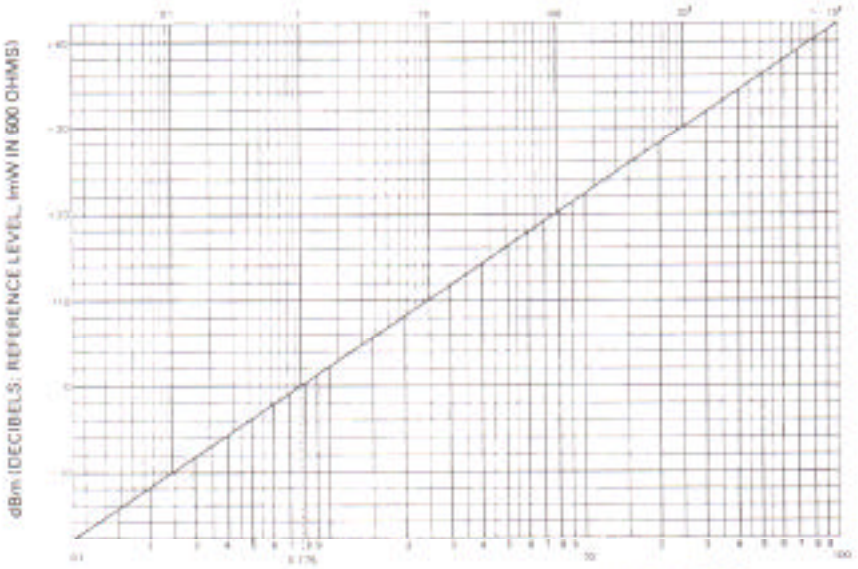
The compartment containing the batteries and fuses is in the rear of the case above the instruction plate. The compartment cover is removed by turning the 1/4 turn fastener at the top until the slot is vertical (i.e. at the '**O**' position) and lifting off. The 15 V battery, 1,5 V cell and 1 A ceramic fuse all push into easily accessible clips.

The 10 A fuse is fitted into a holder located above the 1,5 V battery cell. This holder has a screw-in cap into which the fuse is mounted. (A spare 1 A fuse and a spare 10 A fuse are housed in the battery compartment).

When fitting the 15 V battery and 1,5 V cell they must be inserted the right way round to ensure the correct polarity. The '**+**' and '**–**' are marked on the case moulding. (Refer to the specification page 7 for the correct type of replacement for battery, cell and fuses).

The battery and cell should be examined from time to time to ensure that the electrolyte is not leaking. If the instrument is to remain unused for a long period of time, batteries should be removed and stored separately.

Decibel Conversion Graph



USING RANGE EXTENSION ACCESSORIES

HEAVY CURRENT MEASUREMENT

(a) Currents between 10 A and 1000 A d.c. may be measured by use of an appropriate shunt accessory.

(b) Current Clamp DCM2031

Currents to 400 A a.c. may be measured using the multimeter current clamp DCM2031.

Full instructions for their use are supplied with the current clamps.

TEMPERATURE MEASUREMENT

The Model 8mk7 may be adapted to measure temperature by using one of a range of multimeter temperature probes available.

The right hand switch on the instrument is set to the "**DC ⎓**" position and the left hand switch to the appropriate range for the probe being used. Many probes have a sensitivity of 1 mV/°C. Therefore, set it to the 100 mV (50 µA) or 3 V position (on this latter range deflection will be limited by the max. temperature of the probe). Connect the probe leads to the red and black instrument terminals matching the colours to give the correct polarity. For negative temperatures the '**Rev MC**' button may be used to give an 'on scale' reading.

To obtain a temperature measurement, apply the probe tip to the item under test and press the push-button on the probe handle.

SPECIFICATION

Ranges	d.c. voltage	100 mV* 3 V 10 V 30 V 100 V 300 V 600 V 1000 V
	a.c. voltage	3 V 10 V 30 V 100 V 300 V 600 V 1000 V
	d.c. current	50 µA 300 µA 1 mA 10 mA 100 mA 1 A 10 A
	a.c. current	10 mA 100 mA 1 A 10 A
	resistance	0-2 kΩ 0-200 kΩ 0-20 MΩ
	decibels	-10 dB to +55 dB using a.c. voltage scale
	insulation resistance	up to 200 MΩ using ohms scale and external 150 V d.c. supply
		*Select 50 µA d.c. range
Accuracy at 20°C	d.c.	± 1% of full scale deflection
	a.c.	± 2% of full scale deflection at 50 Hz
	resistance	± 5% of indication at centre scale
Sensitivity	d.c.	20 000 Ω volt all ranges
	a.c.	100 Ω/ volt-3 volt range
		1000 Ω/ volt-10 volt range
		2000 Ω/ volt-30 volt range and upwards
Voltage Drop at Terminals	d.c.	100 mV at 50 µA a.c. 480 mV at 10 mA
		350 mV at 300 µA 110 mV at 100 mA
		390 mV at 1 mA 240 mV at 1A
		400 mV at 10 mA 390 mV at 10 A
		410 mV at 100 mA
		490 mV at 1A
		710 mV at 10A

Frequency Response	For voltage ranges from 10 V to 300 V, the change in reading due to a change in frequency is not greater than ± 3% over the range 15 Hz to 15 kHz. This is in addition to the accuracy figure specified for 50 Hz.
Response Time	Typically 1 second to full scale
Magnetic Field Effect	Variation due to external magnetic fields is within the limits of BS 89 1977
Lead Resistance	0,01 Ω per lead (approx.) for standard Megger test leads.
Temperature Range operation	–5 °C to +35 °C
storage	–40 °C to +50 °C
Temperature effect	Variation due to temperature change, not greater than 0,15% per degree C
Flash Test	7 kV a.c. r.m.s.
Overload Protection	High speed electro-mechanical cut-out with fuse on the two lower resistance ranges
Fuses	1 A (F) ceramic HBC 32mm x 6mm 10 A (F) 500 V ceramic HBC 32 mm x 6 mm (Belling Lee L693)
Batteries	one 1,5 V cell IEC R20 type, one 15 V battery IEC 10F15 using adaptor part no. 5210-064 supplied, or IEC 10F20 without adaptor.

⚠**SAFETY:**	The instrument meets the requirements for double insulation to IEC 1010-1 (1992), EN 61010-1 (1993) to Category III, 250 Volts d.c.; 500 V a.c. phase to earth, and 500 Volts a.c. phase to phase. For use above these levels to 1 kV Category III, a.c. & d.c. use fused probes Megger part number 6111-286. The instrument can also be used up to 1 kV a.c. Category I between terminals, or to earth on low energy systems.
E.M.C.	In accordance with IEC61326 including amendment No.1
Dimensions	192 mm x 167 mm x 115 mm ($7\ ^{9}/_{16}$ in x $6\ ^{9}/_{16}$ in x $4\ ^{1}/_{2}$ in) (excluding handles and lugs)
Weight	2,2 kg ($4\ ^{3}/_{4}$ lb) approximately with batteries and leads.
Cleaning	Wipe disconnected instrument with a clean cloth dampened with soapy water or Isopropyl Alcohol

ACCESSORIES

SUPPLIED WITH THE INSTRUMENT	Part No.
one 1 m (3 ft 3 in) long plug-in test lead, red/black	6220-261
pair of long reach safety clips, (one red, one black)	6220-007
standard bulldog clip (two supplied)	6120-003
one 1,5 V battery	25511-013
one 15 V battery	25511-182
one battery adaptor	5210-064
spare fuse 1 A ceramic cartridge HBC 32 mm x 6 mm	25413-292
spare fuse 10 A ceramic HBC 32 mm x 6 mm	25950-013
user guide	6171-369

	AVAILABLE AS AN OPTIONAL EXTRA	Part No.
**	1,8 m (6 ft) hook-ended test lead, black/red	6220-090
**	3,05 m (10 ft) hook-ended test lead, black/red	6220-092
**	1,2 m (3 ft 11 in) test lead set, hook-ended, including prods and clips	6120-452
*	FPK4 1,5 m (5 ft) fused test leads with prods and clips (660 V a.c., 500 mA fuse)	6111-28
	light-weight safety test lead set including retractable prod	6131-340
	Prods, standard pair (one red, one black)	6220-499
*	Comply with Health and Safety Executive Guidance Note GS38	
**	For reasons of personal safety it is strongly recommended that these test leads should not be used above 50 V. Metal connections become exposed at the instrument terminals.	
..	ever-ready leather case	6320-052
	400 A a.c. clamp-on current transducer, DCM2031	6111-226

Note

Users of this equipment and or their employers are reminded that Health and Safety Legislation require them to carry out valid risk assessments of all electrical work so as to identify potential sources of electrical danger and risk of electrical injury such as from inadvertent short circuits. Where the assessments show that the risk is significant then the use of fused test leads constructed in accordance with the HSE guidance note GS38 '**Electrical Test Equipment for use by Electricians**' should be used.