Metrohm

CE

E1620

DIGITAL MILLI-OHMMETER

INSTRUCTION MANUAL

CMR0073

Issue 4 07/04

Martindale Electric Co Ltd

Metrohm

CE

E1620

CABLE JOINTS, CABLE TERMINATIONS, CABLE GLANDS, CABLE CLEATS
FEEDER PILLARS, FUSE LINKS, ARC FLASH, CABLE ROLLERS, CUT-OUTS

11KV 33KV CABLE JOINTS & CABLE TERMINATIONS
FURSE EARTHING
www.cablejoints.co.uk
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1. SAFETY RULES

The E1620 has been designed with safety in mind. However, no design can completely protect against incorrect use. Electrical circuits can be dangerous and even lethal through lack of caution or poor safety practises. The following rules will minimise the danger:

(1) Read the Instruction Manual carefully and completely before using this instrument. Fully understand the instructions before using this tester. Follow the instructions in the Manual for every test. Take all the precautions recommended. Never exceed the limits of this tester.

(2) The circuit to be tested must be de–energised and isolated before connections are made to it.

(3) Do not use test leads, probes or crocodile clips that are dirty, damaged or have broken or cracked insulation. Such accessories should immediately be removed and repaired.

(4) Always disconnect the test leads before replacing the internal fuse or the batteries. Always replace the fuse or batteries with the type specified and ensure that they are correctly fitted.

(5) Double check the switch setting and lead connections before taking measurements.

14. LIMITED WARRANTY

Martindale Electric Limited warrant instruments and test equipment manufactured by them to be free from defective material or factory workmanship and agree to repair or replace such products which, under normal use and service, disclose the defect to be the fault of our manufacturing, with no charge for parts and service. If we are unable to repair or replace the product, we will make a refund of the purchase price. Consult the Instruction Manual for instructions regarding the proper use and servicing of instruments and test equipment. Our obligation under this warranty is limited to repairing, replacing or making refund of any instrument or test equipment which proves to be defective within 24 months from the date of original purchase.

This warranty does not apply to any of our products which have been repaired or altered by unauthorised persons in any way so as, in our sole judgement, to injure their stability or reliability, or which have been subject to misuse, abuse, misapplication, negligence or accident or which have had the serial numbers altered, defaced or removed. Accessories, not of our manufacture used with this product, are not covered by this warranty.

ALL WARRANTIES IMPLIED BY LAW ARE HEREBY LIMITED TO A PERIOD OF 24 MONTHS, AND THE PROVISIONS OF THE WARRANTY ARE EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES EXPRESSED OR IMPLIED.

The purchaser agrees to assume all liability for any damages and bodily injury which may result from the use or misuse of the product by the purchaser, his employees, or others, and the remedies provided for in this warranty are expressly in lieu of any other liability Martindale Electric Limited may have including incidental or consequential damages.

Martindale Electric Limited reserve the right to discontinue models at any time, or change specification, price or design, without notice and without incurring any obligation.

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To register a claim under the provisions of this warranty, return the instrument or test equipment to Martindale Electric Limited, Metrohm House, Penfold Trading Estate, Imperial Way, Watford WD24 4YY, UK. Upon our receipt and inspection of the product we will advise you as to the disposition of your claim.

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7. SPARES AND ACCESSORIES

Standard Kelvin Lead Set:	DFK 0094
Carry Case:	DFK 0064P
Instruction Manual:	CMR 0073

(6) Do not touch exposed wiring, connections or other 'live' parts of an electrical circuit. If in doubt, check the circuit first for voltage before touching it.

(7) This instrument should not be used in wet conditions.

NOTE: This instrument should only be used by a competent, suitably trained person

Explanation Of Symbols Used

Caution, risk of electric shock.

Caution, refer to the instruction manual.

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Explanation Of Symbols Used

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2. GENERAL DESCRIPTION

The E1620 digital milli–ohmmeter is a hand–held, high current instrument with which stable, accurate measurements of resistance can be made over a wide range of values. Resolution on the lowest range is 10μΩ and the highest range has a maximum value of 20Ω. Measurements are displayed on a 3½ digit, custom liquid crystal display with large digits. This instrument incorporates a high efficiency converter which allows it to be powered by either manganese alkali cells or rechargeable nickel–cadmium cells. A hold function is incorporated in the display circuit to assist in reducing the power consumption of this tester.

The instrument has two principle circuits; a high efficiency D.C. converter and a digital D.C. milli–voltmeter. Employing feedback techniques, the D.C. converter supplies a constant current to the resistance being measured via the current terminals. Voltage drop across this resistance is monitored by the milli–voltmeter via the potential terminals. As the analogue to digital converter in the milli–voltmeter utilises a ratiometric technique, the resistance is measured precisely and is unaffected by variations of the test current.

The E1620 has a custom, 3½ digit liquid crystal display with 18mm high digits which are readily viewed in most lighting conditions. This display also indicates low battery voltage, overrange and reverse polarity of load conditions. The decimal point changes to correspond with the range selected. Two LED indicators warn the operator that the test current is low or that mains voltage is present on the input terminals.

Drop Test:	IEC1010, Clause 8.4
Impact Test:	IEC1010, Clause 8.2
Weight:	0.75kg (with batteries and leads)

6.3 Environmental

Operating Temperature Range:	-15ºC to +55ºC
Storage Temperature Range:	-20ºC to +65ºC
Humidity:	93% RH at +40ºC
Cold Temperature:	IEC68-2-1
Dry Heat:	IEC68–2–2
Damp Heat:	IEC68–2–3

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The ranges are selected by a four–position rotary switch, and

Drop Test:	IEC1010, Clause 8.4
Impact Test:	IEC1010, Clause 8.2
Weight:	0.75kg (with batteries and leads)

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Operating Temperature Range:	-15ºC to +55ºC
Storage Temperature Range:	-20ºC to +65ºC
Humidity:	93% RH at +40ºC
Cold Temperature:	IEC68-2-1
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Damp Heat:	IEC68–2–3

		150Ω on 2 and 20Ω ranges
Battery:		6 off, AA size, manganese–alkali or nickel cadmium cells
Battery Low Voltage:		6.7V
Battery Life:		2000 operations typical with manganese–alkali batteries 550 operations typical with nickel cadmium batteries (an operation is assumed to be a 10–second measurement with a 2 minute display period)
Protection Fuse:		2 amp, FF, HBC, 5 X 20mm, DIN
Safety:	LVD:	To BS EN 61010-1
	EMC:	To BS EN 50081-1 BS EN 50082-1

6.2 Mechanical

Case Height:	190mm
Case Width:	90mm
Case Depth:	60mm
Bump Test:	IEC68–2–29
Vibration Test:	IEC1010, Clause 8.3

The ranges are selected by a four–position rotary switch, and test is initiated by pressing the push–button, test switch.While this switch is depressed the instrument takes a measurement, and when it is released the instrument retains he last reading taken for two minutes before automatically switching itself off.

The tester is packaged in a rugged, hand–held, moulded plastic case. The standard accessory kit consists of a moulded polypropylene carry case, a set of Kelvin leads and an instruction manual.

3. FRONT PANEL LAYOUT

150Ω on 2 and 20Ω ranges

Battery: 6 off, AA size, manganese–alkali or nickel cadmium cells

Battery Low Voltage: 6.7V

Battery Life: 2000 operations typical with manganese–alkali batteries
550 operations typical with nickel cadmium batteries
(an operation is assumed to be a 10–second measurement with a 2 minute display period)

Protection Fuse: 2 amp, FF, HBC, 5 X 20mm, DIN

Safety: LVD: To BS EN 61010-1
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4. PREPARATION FOR USE

The Metrohm E1620 is delivered in a shipping container. When it is unpacked, it should be inspected for any visible signs of damage, and the preliminary checks described in the operating instructions should be performed to ensure that it is operating correctly. If there is any sign of damage, or if the instrument does not operate correctly, return it to the supplier.

This instrument can be powered from six, AA size, manganese–alkali (MN1500, LR6) or nickel cadmium cells. During use, if the battery low warning symbol appears on the display, then the batteries should be replaced or recharged in the case of the nickel cadmium batteries. It should be noted that nickel cadmium batteries should be kept at +5ºC to +35ºC as their performance deteriorates outwith the temperature band, even though they can operate from -40ºC to +60ºC. Always check with the battery manufacturer regarding their disposal.

It is recommended that the E1620 be calibrated every two years, and that it should be carried out by the manufacturer or his appointed agent. If the tester develops a fault, it should be returned to the manufacturer for repair.

removed and replaced with a fuse of the correct type and rating.

5.9 Input Limits

The maximum continuous voltage that can be applied across the potential terminals or across a potential and current terminal is 240V A.C. 240V A.C. applied across the current terminals will cause the protection fuse to blow.

6. SPECIFICATION

6.1 Electrical

Ranges:	0 to 20mΩ in steps of 0.01mΩ 0 to 200mΩ in steps of 0.1mΩ 0 to 2Ω in steps of 1mΩ 0 to 20Ω in steps of 10mz
Accuracy:	±0.5% of reading ±2 digit (over operating temperature range, -15ºC to +55ºC, with standard leads)
Test Current:	1A d.c. on 20mΩ range 0.1A d.c. on 200mΩ range 10mA d.c. on 2A and 20Ω ranges
Test Current Accuracy:	±10%
Max. Circuit Resistance: (with 9V battery voltage)	1.2Ω on 20mΩ range 15Ω on 200mΩ range

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should be followed to access the fuse. The blown fuse should be removed and replaced with a fuse of the correct type and rating.

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Accuracy:	±0.5% of reading ±2 digit (over operating temperature range, -15ºC to +55ºC, with standard leads)
Test Current:	1A d.c. on 20mΩ range 0.1A d.c. on 200mΩ range 10mA d.c. on 2A and 20Ω ranges
Test Current Accuracy:	±10%
Max. Circuit Resistance: (with 9V battery voltage)	1.2Ω on 20mΩ range 15Ω on 200mΩ range

to 10.40mΩ at 30ºC. Account should be taken of this effect in making measurements.

When measuring the resistance of item, such as current shunts, which have joints of dissimilar conductors, thermal EMFs can affect the accuracy of the measurement. This condition can be detected if the reading alters when the leads are reversed. To compensate for this effect, the average of the two readings should be taken as the true measurement.

5.7 Battery Replacement

If the 'BAT' symbol appears on the LCD during a test, testing should be discontinued until the batteries are replaced or recharged in the case of nickel–cadmium cells. Before accessing the batteries, the test leads should be removed for safety reasons. Access to the batteries is via the lid in the base of the instrument. The two plastic screws should be loosened to allow the lid to be removed. The discharged batteries can then be removed and replaced with new or recharged batteries. The orientation of the batteries should be as indicated by the polarity symbols in the battery compartment. The lid can then be replaced and the plastic screws tightened.

5.8 Fuse Replacement

Fuse protection is provided on the current terminals, C1 and C2, and it is indicative of a blown fuse if the low current warning lamp 'I' is lit and the resistance across terminals C1 and C2, is less than 1Ω. The fuse is positioned in the battery terminal and the same procedure, as was described in the previous section, should be followed to access the fuse. The blown fuse should be

5. OPERATING INSTRUCTIONS

5.1 Preliminary Checks

(1) With the leads disconnected, select the 20mΩ range and switch on the instrument by pressing the test switch and holding it depressed.

(2) The low current warning lamp 'I' should light and the LCD should indicate the overrange condition as shown in Fig. 1.

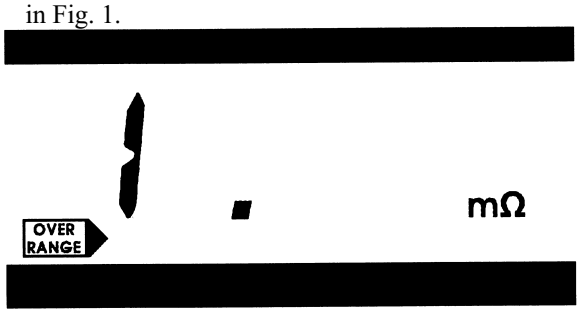

Fig. 1

(3) If the warning lamp or the LCD display do not operate, check that batteries have been correctly installed in the instrument.

(4) On releasing the test switch, the reading should remain on the LCD for about two minutes after which the instrument will automatically switch off. Where customer test leads are used, their connection to the item to be tested should be as illustrated in Fig. 4.

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When measuring the resistance of item, such as current shunts, which have joints of dissimilar conductors, thermal EMFs can affect the accuracy of the measurement. This condition can be detected if the reading alters when the leads are reversed. To compensate for this effect, the average of the two readings should be taken as the true measurement.

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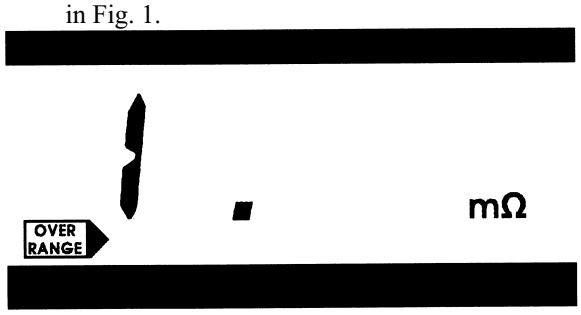

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(4) On releasing the test switch, the reading should remain on the LCD for about two minutes after which the instrument will automatically switch off. Where customer test leads are used, their connection to the item to be tested should be as illustrated in Fig. 4.

(5) Connect the standard Kelvin lead set into the E1620. One pair of leads should be connected into the C1 and P1 sockets, and the other into the C2 and P2 sockets as illustrated below in Fig. 2. Connect the two Kelvin crocodile clips to a shorting bar.

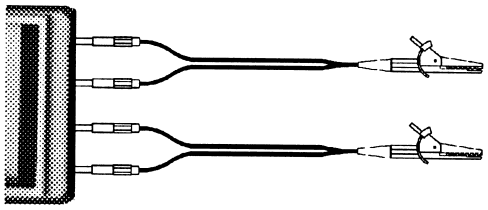

Fig. 2

(6) Switch on the instrument by pressing the test switch and holding it depressed.

(7) The low current warning lamp 'I' should not light and the LCD should indicate zero within a digit.

(8) If the negative sign appears on the LCD, as shown in Fig. 3, this indicates that the potential leads are reversed in relation to the current leads. This is rectified by reversing the potential leads to the sockets P1 and P2

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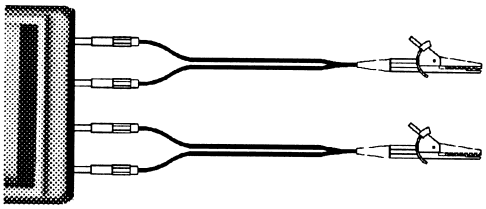

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Current Leads

1. Shrouded, 4mm, safety plugs are required at one end of each lead as before.

2. Insulated, 16/0.2mm, tinned copper wire is recommended.

3. The length of these two leads should be chosen so that the overall lead resistance is less than 1Ω.

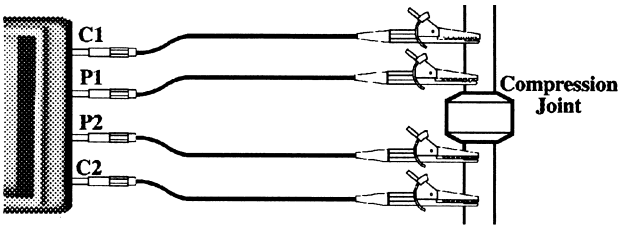

Fig. 4

5.6 Thermal Effects

Temperature can have a significant effect on the performance of this instrument due to the temperature coefficient of resistance and thermal EMFs across connections of dissimilar conductors.

Most conductors have a large temperature coefficient of resistance, e.g. 0.4%/ºC for copper. As an example, a copper conductor that has a resistance of 10.00mΩ at 20ºC will increase

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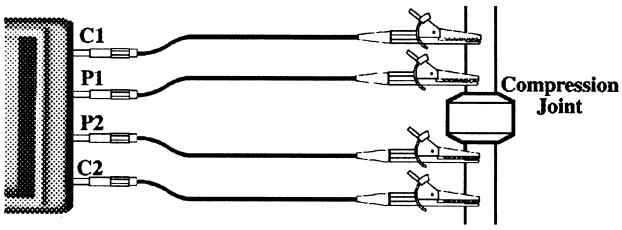

Fig. 4

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(vi) Testing and maintenance of switchboard/ sub–station equipment on such items as fuses, joints, contacts and bonds.

5.5 Customer Test Leads

The Kelvin crocodile clips supplied with the instrument are suitable for connecting to conductors up to 15mm in diameter or bus bars 15mm thick. There will be, however, instances where the item being tested requires larger jaws, and the user is advised to make up his own leads. Furthermore, there will be occasions when longer leads are required due to the geometry of the item being tested. The following guidance notes should assist in the assembly of such leads:

Potential Leads

1. Shrouded, 4mm, safety plugs are required at one end of each lead for connection to the E1620 measuring sockets.

2. Insulated, 16/0.2mm, tinned copper wire is recommended.

3. The two potential leads should be the same length to minimise inaccuracies due to unbalance.

4. For practical reasons, the lead length should be as short as possible to

minimise pick up.

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2. Insulated, 16/0.2mm, tinned copper wire is recommended.

3. The two potential leads should be the same length to minimise inaccuracies due to unbalance.

4. For practical reasons, the lead length should be as short as possible to minimise pick up.

Fig. 3

(9) If the 'BAT' symbol appears on the LCD during these checks, as shown in Fig. 3, the batteries require to be replaced or recharged. Follow the instructions for replacing batteries outlined in the proceeding section.

5.2 Precautions

(1) Always ensure that the circuit to be measured is switched off, isolated and completely de–energised before connecting the test leads.

(2) If it is probable that the instrument's protection has been impaired due to electrical, mechanical or environmental damage, it must not be used. It should be returned to the manufacturer or his appointed agent for checking and repair.

(3) To prevent damage to the liquid crystal display, the minimum storage temperature of -20ºC must be observed. It should also be noted that below 0ºC the operation of this display will be sluggish.

(4) If the exterior of the instrument requires cleaning, it should be done with a sponge and a mild solution of

Fig. 3

(9) If the 'BAT' symbol appears on the LCD during these checks, as shown in Fig. 3, the batteries require to be replaced or recharged. Follow the instructions for replacing batteries outlined in the proceeding section.

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detergent and water. Other chemical cleaning agents must not be used.

5.3 Taking Measurements

(1) Perform the preliminary checks previously described, and ensure that the precautions listed are observed.

(2) Connect the standard Kelvin test leads to the instrument as illustrated in Fig. 2 and check that the resistance to be measured is isolated from the supply and completely de–energised. Connect the Kelvin crocodile clips across the resistance to be measured.

(3) If the voltage warning lamp lights (ϟ), there is a dangerous voltage across the resistance to be measured. The source of this dangerous voltage must be isolated before proceeding. It should be noted that the voltage warning lamp does not indicate for dangerous voltages between the resistance being measured and earth/ ground. Only good working practises will eliminate such a source of danger.

(4) Set the rotary selector switch on the E1620 to the desired range. Press the test switch and hold it depressed until a steady reading is obtained on the display. Release the test switch. The reading will be retained on the display for a further two minutes.

(5) If the low current warning lamp 'I' lights while the test switch is depressed, the reading obtained must not be

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accepted as there will be inaccuracies due to the resistance between the current terminals, C1 and C2, being too great. This problem can usually be circumvented by selecting a higher measurement range or by reducing the resistance of the leads to the current terminals.

(6) If the instrument indicates the over–range condition as shown in Fig. 1, then a higher measurement range should be selected.

5.4 Applications

The E1620 digital milli–ohmmeter, with its measuring range of 10μΩ to 19.99Ω, is suitable for a wide range of applications such as:

(i) Measuring the winding resistance of electric motors, generators and transformers.

(ii) Bond testing in aircraft, mines, railways, ships anddomestic and industrial wiring installations.

(iii) Ring main continuity testing in industrial and domestic wiring installations.

(iv) Measuring resistance in electronic equipment on such items as resistors, shunts, PCB tracks, switch and relay contacts, etc.

(v) Checking compression joints on overhead lines.

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