DLRO 10 and DLRO 10X
Digital Microhmmeter

- **NEW interchangeable test lead terminations**
- **Auto current reversal cancels standing emfs**
- **Protected to 600 V**
- **Automatically detects continuity in potential and current connections**
- **Multiple operating modes including fully automatic**
- **Alpha-numeric keypad for entering test notes (DLRO 10X)**
- **User selectable high and low limits (DLRO 10X)**
- **Printer output and memory (DLRO 10X)**

DESCRIPTION

DLRO 10 and DLRO 10X set the standards for low resistance measurement, also known as the Megger 'Ducter™' test.

History of 'Ducter' testing

For over 100 years the 'Ducter test' has been used to describe a simple test for measuring very low contact resistances and "Ducter", which is still used as a trade mark, was the name originally given to the low resistance ohmmeter manufactured by Megger. The name Ducter was registered by Megger in June 1908 and 'Ducter' has since become the industry standard.

DLRO 10 and DLRO 10X are fully automatic instruments, selecting the most suitable test current up to 10 A d.c. to measure resistance from 0.1 μΩ to 2000 Ω, on one of seven ranges.

For users who desire more control over the measurement process, DLRO 10X uses a menu system controlled by a two-axis paddle to allow the user to manually select the maximum test current.

DLRO 10X also adds real time download of results and on board storage for later download to a PC.

Both instruments are built into a strong, lightweight case that is equally at home in the field or in the laboratory. Light enough to be worn around the neck, they are small enough to be taken into areas that were previously too small to access.

DLRO 10 uses a large, bright 4 1/2 -digit LED display while DLRO 10X has a large, backlit LCD display. Normally, measurements are made with forward and reverse currents to cancel the effects of any standing voltages across the test sample.

The average value is then displayed within 3 seconds, to a basic accuracy of 0.2%. DLRO 10X displays both forward and reverse measurements as well as the average of the two.

DLRO 10X allows the user to set high and low pass limits, thereby enabling simple go-no-go testing.

At the end of a test DLRO10X will store the test results, as well as any notes relevant to the test.

To ensure customers are able to choose the best test leads to suit their application, the DLRO10 and DLRO10X may be purchased in one of two packages. The first option is supplied with a pair of duplex handspikes with 1.2 m (4 ft) leads, the second option is supplied without test leads to allow customers to order exactly the test leads they require from the accessory list.

The instruments are supplied as standard with a Nickel Metal Hydride (NiMH) battery pack. The battery packs are interchange-able so that an exhausted battery may be recharged using the external charger supplied while testing continues using a spare pack. Although full charging will take 4 hours, a fast charge mode allows the battery to be 90% charged within 2 1/2 hours from a 12 volt battery or from a standard 120/230 V AC supply via the supplied charger. The battery pack contains its own battery state indicator, which allows the charge-state to be monitored, even without being connected to the instrument.

In addition an optional mains / line power supply, the DLRO10LPU is available. This enables the instruments to be directly powered from 90V to 264V, 50/60Hz ideal for repetitive testing applications such as manufacturing production line use.

DLRO 10X is fitted with RS232 communications that will allow results to be downloaded in real time or stored for later retrieval.

Up to 700 sets of results may be stored within DLRO 10X complete with notes containing up to 200 characters which may be added using the on board keypad. These results can also be downloaded to a PC.

MEASUREMENT MODES:

A variety of measurement modes are available. Since the introduction of V2.0 firmware, Normal, Auto, Continuous and Inductive mode are available on both the DLRO 10 and the DLRO 10X.

DLRO 10 will display the average of the measurements achieved using forward and reverse current, while DLRO 10X displays both individual measurements and the average.

Normal mode initiates a test by pressing the Test button on the instrument front panel after connecting the test leads. Continuity of all four connections is checked, forward and reverse currents are applied.

Auto mode allows forward and reverse current measurements to be made and the average displayed simply by making contact with all four probes. This mode is ideal when working with the supplied handspikes. Each time the probes are removed and reconnected to the load another test will be performed without the need to press the test button on the instrument.

Continuous mode allows repeated measurements to be made on the same sample. Simply connect the test leads and press the test button. The measurement is updated every 3 seconds until the circuit is broken.

Inductive mode is intended for use when measuring inductive loads. When measuring inductive loads it is necessary to wait for the voltage to stabilise. This means that the measurement could take a few seconds or several minutes. The test leads are firmly connected to the item to be measured and the Test button is pressed. The instrument will pass a current through the sample and wait for the voltage to stabilise. If possible the current will be increased. This procedure will be repeated until the voltage detected falls into the range 15 mV to 200 mV. The instrument will then continue to take readings, which will gradually decrease to the true value as the voltage stabilises further. The operator decides when the result is stable and presses the test button to terminate the test. Measurement is made with forward current only.

Unidirectional mode, on DLRO 10X only, applies a current in one direction only. This does not enable any standing emfs to be negated but speeds up the measurement process. Test starts automatically when probes are connected.

APPLICATION

The needs for accurate low resistance measurement are well known and very diverse. They range through Goods Receiving inspection of components to ground bonding and welded joints. Typical applications include, but are not limited to, making d.c. resistance measurements of:

- **Switch and contact breaker resistance**
- **Busbar and cable joints**
- **Aircraft frame bonds and static control circuits**
- **Integrity of welded joints**
- **Inter-cell connections on battery systems up to 600 V peak**
- **Quality control of resistive components**
- **Transformer and motor winding resistance**
- **Rail and pipe bonds**
- **Metal alloys, welds and fuse resistance**
- **Graphite electrodes and other composites**
- **Wire and cable resistance**
- **Transmitter aerial and lightning conductor bonding**

FEATURES AND BENEFITS

- **Small, lightweight and portable - can be used in tight places, reduces the need for extra long leads and two person operation.**
- **Four terminal resistance method shows the true resistance of the item under test.**
- **Bright LED (DLRO 10) and LCD (DLRO 10X) displays are easily visible under all lighting conditions and reduce human error.**
- **Automatically applies forward and reverse currents which cancel out any standing voltages across the sample under test.**
- **Checks for undue noise during measurement, reducing the possibility of recording the incorrect result.**
- **Automatically detects continuity in P and C circuits, preventing erroneously high reading to be taken due to high resistance contact.**
- **Battery module has a battery condition indicator allowing the user to check the state of spare batteries without connecting to the instrument.**
- **RS232 connector on the DLRO 10X allows downloading of results in real time or stored for later retrieval.**

NEW DUPLEX CONNECT TEST LEADS – NOW SUPPLIED AS STANDARD

- **Carry one lead set and swap terminations**
- **Simple push and twist for a quick change**
- **Lockable twist cap secures the leads**
- **Extension leads available**

The Megger DLRO duplex connect four terminal test lead system is designed to provide the most cost effective and convenient way to provide the user with all off the test lead terminations and lead lengths required for the many different applications encountered in low resistance testing.

At the centre of this unique test lead system is a bespoke connector allowing terminations such as kelvin clips or duplex test probes to be changed as required.

SUPPLIED LEADSET OPTIONS:

DLRO10 + NO LEADSET SUPPLIED =
DLRO10-NLS, order code 1006-660

DLRO10 + LEADSET SUPPLIED =
DLRO10 + DH4-C, order code 1006-598

DLRO10X + NO LEADSET SUPPLIED =
DLRO10X-NLS, order code 1006-659

DLRO10X + LEADSET SUPPLIED =
DLRO10X + DH4-C, order code 1006-600

OPTION MAINS / LINE POWER SUPPLY UNIT

The DLRO10 and DLRO10X may be also powered from an optional mains / line power supply unit the DLRO10LPU. This unit is simply fitted to the instrument in place of the standard battery pack.

When in use a red LED is illuminated when the instrument is powered from a mains / line power supply

The DLRO10X is seen here fitted with the optional DLRO10LPU

The DLRO10X will particularly benefit providing the ability to store test results with memos whilst powered from a mains / line supply.

Ideal for repetitive testing applications such as manufacturing production line use

Resistance ranges			Full scale volts		Test current	
Full Scale	**Resolution**	**Accuracy***	**Resistive**	**Inductive**	**Resistive**	**Inductive**
1.9999 mΩ	0.1 µΩ	±0.2% ±0.2 µΩ	20 mV	n/a	10 A	n/a
19.999 mΩ	1 µΩ	±0.2% ±2 µΩ	20 mV	20 mV	1 A	1A
199.99 mΩ	10 µΩ	±0.2% ±20 µΩ	20 mV	200 mV	100 mA	1 A
1.9999 Ω	100 µΩ	±0.2% ±0.2 mΩ	20 mV	200 mV	10 mA	100 mA
19.999 Ω	1 mΩ	±0.2% ±2 mΩ	20 mV	200 mV	1 mA	10 mA
199.99 Ω	10 mΩ	±0.2% ±20 mΩ	20 mV	200 mV	100 µA	1 mA
1999.9 Ω	100 mΩ	±0.2% ±0.2 Ω	200 mV	200 mV	100 µA	100 µA

SPECIFICATIONS

Measurement mode	DLRO 10: Manual, Auto, Continuous, Inductive DLRO 10X: Manual, Auto, Continuous, Inductive, Undirectional
Measurement control	DLRO 10: Fully Automatic DLRO 10X: Fully Automatic/Manual
Measurement speed	<3s for forward and reverse current and to display average
Display	Measurement : 4 $^{1}/_{2}$ digit seven segment LED
Range and safety:	DLRO10 LED indications DLRO10X Large backlight LCD
Test method	Single cycle reversing d.c. ratiometric measurement - average result display.
Test current accuracy	±10%
Test current stability	<10 ppm per second
Lead resistance	Maximum 100 mΩ total for 10 A operation irrespective of battery condition.
Voltmeter input impedance	>200 kΩ
Noise rejection	Less than 1% ±20 digits additional error with 100 mV peak 50/60 Hz. on the potential leads. Warning will show if hum or noise exceeds this level.
Data transfer	DLRO10X: Real Time or from storage via RS232
Data storage	DLRO10X: 700 tests
Memo field	DLRO10X: Up to 200 characters per test via integral alphanumeric keypad
Battery type	7Ah NiMH rechargeable
Battery life	Typical 1000 x 10 A tests before recharge
Battery charge time	Via external 90 V - 260 V 50/60 Hz charger from 12 to 15 V dc supply Standard: 2.5 hours to 90% capacity, 4 hours to fully charged Slow Charge: +10 °C to + 45 °C (50 °F to 113 °F)

Operating temperature range and humidity	+5 °C to +45 °C (41 °F to 113 °F) at full accuracy -10 °C to +50 °C (14 °F to 122 °F) at reduced accuracy <90% RH @ 40 °C (104 °F) non-condensing
Storage temperature range and humidity	-30 °C to +70 °C (50 °F to 113 °F) <90% RH @ 40 °C (104 °F) non-condensing
Temperature co-efficient	<0.01% per °C, over range 5 °C to 40 °C (<0.0006% per °F from 41 °F to 104 °F)
Maximum altitude	2000m (6562 ft) to full safety specifications
Safety	In accordance with IEC61010-1, CAT III 600 V - only when DH6 leads are used.
EMC	IP65 case closed, IP54 battery operation In accordance with IEC61326-1 (Heavy industrial)
Dimensions	220 x 100 x 237 mm
Weight	2,6 kg including battery

* The accuracy stated assumes forward and reverse measurements.

Inductive mode or undirectional mode will introduce an undefined error if an external EMF is present.

ORDERING INFORMATION

Description	Order Code
DLRO10 + NO LEADSET SUPPLIED = DLRO10-NLS,	1006-660
DLRO10 + LEADSET SUPPLIED = DLRO10 + DH4-C,	1006-598
DLRO10X + NO LEADSET SUPPLIED = DLRO10X-NLS,	1006-659
DLRO10X + LEADSET SUPPLIED = DLRO10X + DH4-C,	1006-600
Included Accessories	
7 Ah NiMH battery module.	6121-492
DH4-C Duplex handspikes (2), one with indicator lights. 1.5m (Not NLS models)	1006-444
Battery charger for operation from 115/230 V . 50/60Hz supply.	6280-333
Cigar lighter adapter for battery charging.	6280-332
User guide.	6172-473
Warranty card.	6170-618
Optional Accessories at extra cost	
Connect test lead options – see data separate sheet DLROTestLeads_DS_en_V01	
Standard test lead option – see data separate sheet DLRO_TL_DS_en_V01	
Carrying case for DLRO10/10X and all standard accessories.	6380-138
Carrying bag for cables	18313
Calibration Shunt,10 Ω, current rating 1 mA.	249000
Calibration Shunt, 1 Ω, current rating 10 mA.	249001
Calibration Shunt, 100 mΩ current rating 1A.	249002
Calibration Shunt, 10 mΩ current rating 10 A.	249003
Certificate of Calibration for Shunts, NIST	CERT-NIST
DLRO10LPU-EU Mains power attachment - schuko plug	1003-172
DLRO10LPU-UK Mains power attachment - UK plug	1003-093
DLRO10LPU-US Mains power attachment - US plug	1003-171
Replacement tips for DH4, DH5 and DH6 handspikes.	
Needle point	25940-012
Serrated end	25940-014