

# 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  $\mu\Omega$  to 2000  $\Omega$ , 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 interchangeable 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**

|                                  |   |   |
|----------------------------------|---|---|
| <b>Measurement mode</b>          | DLRO 10:<br>Manual, Auto,<br>Continuous, Inductive<br><br>DLRO 10X:<br>Manual, Auto,<br>Continuous, Inductive,<br>Undirectional   | <b>Operating temperature range and humidity</b><br>+5 °C to +45 °C<br>(41 °F to 113 °F)<br>at full accuracy<br><br>-10 °C to +50 °C<br>(14 °F to 122 °F)<br>at reduced accuracy<br><br><90% RH @ 40 °C (104 °F)<br>non-condensing |
| <b>Measurement control</b>       | DLRO 10:<br>Fully Automatic<br><br>DLRO 10X:<br>Fully Automatic/Manual  | <b>Storage temperature range and humidity</b><br>-30 °C to +70 °C<br>(50 °F to 113 °F)<br><br><90% RH @ 40 °C (104 °F)<br>non-condensing  |
| <b>Measurement speed</b>         | <3s for forward and reverse<br>current and to display average   |   |
| <b>Display</b>                   | Measurement :<br>4 1/2 digit seven segment LED  | <b>Temperature co-efficient</b><br><0.01% per °C, over range 5 °C<br>to 40 °C (<0.0006% per °F<br>from 41 °F to 104 °F)   |
| <b>Range and safety:</b>         | DLRO10 LED indications<br><br>DLRO10X Large backlight LCD   | <b>Maximum altitude</b><br>2000m (6562 ft) to full<br>safety specifications   |
| <b>Test method</b>               | Single cycle reversing d.c.<br>ratiometric measurement -<br>average result display.   | <b>Safety</b><br>In accordance with IEC61010-1,<br>CAT III 600 V - only when<br>DH6 leads are used.   |
| <b>Test current accuracy</b>     | ±10%  | <b>EMC</b><br>IP65 case closed,<br>IP54 battery operation   |
| <b>Test current stability</b>    | <10 ppm per second  | In accordance with IEC61326-1<br>(Heavy industrial)   |
| <b>Lead resistance</b>           | Maximum<br>100 mΩ total for 10 A<br>operation irrespective<br>of battery condition.   | <b>Dimensions</b><br>220 x 100 x 237 mm   |
| <b>Voltmeter input impedance</b> | >200 kΩ   | <b>Weight</b><br>2,6 kg including battery   |
| <b>Noise rejection</b>           | Less than 1% ±20<br>digits additional<br>error with 100 mV peak<br>50/60 Hz.<br>on the potential leads.<br>Warning<br>will show if hum or noise<br>exceeds this level.  | * The accuracy stated assumes forward and reverse measurements.<br><br>Inductive mode or undirectional mode will introduce an undefined<br>error if an external EMF is present.   |
| <b>Data transfer</b>             | DLRO10X:<br>Real Time or from storage<br>via RS232  |   |
| <b>Data storage</b>              | DLRO10X:<br>700 tests   |   |
| <b>Memo field</b>                | DLRO10X:<br>Up to 200 characters per<br>test via<br>integral alphanumeric keypad  |   |
| <b>Battery type</b>              | 7Ah NiMH rechargeable   |   |
| <b>Battery life</b>              | Typical 1000 x 10 A<br>tests before recharge  |   |
| <b>Battery charge time</b>       | Via external 90 V - 260 V<br>50/60 Hz charger from 12 to<br>15 V dc supply<br><br>Standard: 2.5 hours to<br>90% capacity,<br>4 hours to fully charged<br><br>Slow Charge: +10 °C to<br>+ 45 °C<br>(50 °F to 113 °F) |   |

**DLRO 10 and DLRO 10X**  
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**ORDERING INFORMATION**

| <b>Description</b>  | <b>Order Code</b> |
|---|-------------------|
| DLRO10 + NO LEADSET SUPPLIED =<br>DLRO10-NLS,   | 1006-660          |
| DLRO10 + LEADSET SUPPLIED =<br>DLRO10 + DH4-C,  | 1006-598          |
| DLRO10X + NO LEADSET SUPPLIED =<br>DLRO10X-NLS,                                       | 1006-659          |
| DLRO10X + LEADSET SUPPLIED =<br>DLRO10X + DH4-C,                                      | 1006-600          |
| <b>Included Accessories</b>   |                   |
| 7 Ah NiMH battery module.   | 6121-492          |
| DH4-C Duplex handspikes (2), one with indicator lights.<br>1.2m/4 ft (Not NLS models) | 1006-444          |
| Battery charger for operation from 115/230 V .<br>50/60Hz supply.                     | 6280-333          |
| Cigar lighter adapter for battery charging.   | 6280-332          |
| User guide.   | 6172-473          |
| Warranty card.  | 6170-618          |
| <b>Optional Accessories at extra cost</b>   |                   |
| Connect test lead options – see data separate sheet<br>DLROTestLeads_DS_en_V01        |                   |
| Standard test lead option – see data separate sheet<br>DLRO_TL_DS_en_V01              |                   |
| Carrying case for DLRO10/10X and<br>all standard accessories.                         | 6380-138          |
| Carrying bag for cables   | 18313             |
| Calibration Shunt, 10 $\Omega$ , current rating 1 mA.                                 | 249000            |
| Calibration Shunt, 1 $\Omega$ , current rating 10 mA.                                 | 249001            |
| Calibration Shunt, 100 m $\Omega$ current rating 1A.                                  | 249002            |
| Calibration Shunt, 10 m $\Omega$ current rating 10 A.                                 | 249003            |
| Certificate of Calibration for Shunts, NIST   | CERT-NIST         |
| DLRO10LPU-EU Mains power attachment -<br>schuko plug                                  | 1003-172          |
| DLRO10LPU-UK Mains power attachment - UK plug   | 1003-093          |
| DLRO10LPU-US Mains power attachment - US plug   | 1003-171          |
| <b>Replacement tips for DH4, DH5 and DH6 handspikes.</b>                              |                   |
| Needle point  | 25940-012         |
| Serrated end  | 25940-014         |

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