Megger

DLRO10HD
10 A Digital Low Resistance Ohmmeter

USER GUIDE

⚠ SAFETY WARNINGS

These safety warnings must be read and understood before the instrument is used.

Whenever possible, circuits should be de-energised before testing.

If it is impossible to de-energise the circuit, (e.g. high voltage batteries cannot be switched off while their connections are tested) the user must be aware of the dangers. The instrument terminals will become live when connected to the circuit. Therefore when used on hazardous voltages custom Megger DH7 test leads must be used

Testing inductive circuits can be hazardous:

After testing an inductive load there will be an amount of energy stored in the inductance. This energy is released in the form of a discharge current. Disconnecting an inductive load while current is still flowing will cause a high voltage arc, which is a danger to both the user and the item under test.

Although the DLRO10HD is not designed as transformer ohmmeter, it is fitted with a test in progress lamp associated with the TEST button, which indicates that current is flowing in the C1-C2 loop. This lamp and a warning triangle on the LCD will flash at end of a test on an inductive load whilst a discharge current is still flowing and will stop flashing when the current has decayed to less than 1 mA.

For testing large inductive resistances the current carrying leads should be connected securely to the item under test before starting the test. It is not recommended that duplex handspikes be used to carry out tests on inductive loads. If inadvertently using the DH4 handspikes on an inductive load, the L1 lamp on the handspikes will flash amber while discharge current flows, thereby duplicating the function of the 'I' lamp on the instrument. It is important to maintain contact until the L1 light stops flashing amber and turns green indicating the end of the test.

This product is not intrinsically safe. Do not use in an explosive atmosphere.

Do not operate the instrument or connect it to any external system if it shows any visable signs of damage or if it has been stored for prolonged periods in unfavourable conditions.

Inspection

Before each use of the instrument, visually inspect the instrument case, test leads and connectors to confirm that their condition is good, with no damaged or broken insulation.

Charging and mains/line operation

In normal circumstances the instrument is completely safe. However, in case of an unforeseen emergency ensure instrument is positioned to allow fast disconnection of mains/line plug.

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Symbols used on the instrument


Caution: Refer to accompanying notes


HV warning


Equipment protected throughout by Double or reinforced Insulation (Class II)


Equipment complies with current EU Directives



Equipment complies with ‘C tick’ requirements


Do not dispose of in the normal waste stream


On/Off position

Fuse


Line power


Backlight


Contrast


Socket

Cleaning

Disconnect the instrument and wipe it with a clean cloth slightly damped with soapy water or Isopropyl alcohol (IPA).

GENERAL DESCRIPTION

The Megger DLRO10HD enhances Megger's existing family of 10 Amp DC low resistance ohmmeters (DLRO10 and DLRO10X). This heavy duty model combines simplicity of operation with selected high power ranges and the ability to simultaneously make measurements and charge the battery from line power. Designed in a rugged case it is equally suited to harsh environments or factory testing. The unit is IP65 rated with lid closed and IP54 when operating from battery power. The lid is removable to facilitate simple connection of test leads. Megger's DH4 Duplex Handspikes with 1.2 m leads are standard with other lengths and terminations available.

This instrument provides significantly enhanced compliance and is capable of delivering 10 A while measuring up to 250 mΩ and 1 A while measuring up to 2.5 Ω. In the high current 10 A modes test current is maintained for up to 60 seconds. The use of a four terminal measurement technique removes the test lead resistance from the measured value. Additionally, before and during a test, test lead contact is monitored to reduce the chance of erroneous readings. The instrument is powered by a rechargeable, sealed lead acid battery, which permits up to one thousand 10 Amp tests to be completed on a single charge. An auto power off function preserves battery life when operating from battery power. The battery contains intelligent circuitry, which prevents damage to the battery from overcharging and charging under extreme temperatures. A degassing safety vent is provided in the unlikely event of the battery degassing during charge.

The DLRO10HD provides five test modes each of which is selected via a rotary switch. Controls are simple and easy to operate in all weather conditions and with gloved hands operation. The five operating modes include two automatic modes that sense connection of the probes to minimise test time and increase productivity. To overcome thermal EMFs current is passed through the unit under test in both directions and the resulting resistance averaged. If a user wants to make a series of quick tests and is not concerned about minor EMF effects, a unidirectional automatic mode halves the test time by passing current in only one direction. Other modes include continuous testing with a new result every three seconds and a unidirectional inductive mode.

A large, clear, backlit LCD display with an oversize five digit main display is easy to read from a distance.

In common with other members of the DLRO10 family the DLRO10HD is rated CAT III 300 V. A range of test leads, are available to suit the application. The instrument is protected against accidental connection to external voltages up to 600 V DC applied between any pair of the four terminals for up to 10 seconds. As soon as an external voltage is sensed measurements are inhibited and the HV warning triangle shows on the LCD plus a red LED on the keyboard illuminates.

APPLICATION

The DLRO10HD measures low resistance values in applications ranging from railways and aircraft to resistance of components in industry. Any metallic joint can be measured but users must be aware of measurement limitations depending on application. For example, if a cable manufacturer plans to make resistive measurements on a thin wire, a low test current should be selected to prevent heating the wire thereby changing its resistance.

The DLRO10HD is well suited to measuring thick conductors, bonds and quality of welding because of its 10 A range for resistance values up to 250 mΩ. Measurements on electric motors and generators will be inductive and require the user to understand the inductive mode and charging process before a correct result is achieved. Electromagnetic noise induced into the leads can interfere with a reading. A noise symbol alerts the user and prevents a measurement when the instrument detects noise above its threshold.

When dissimilar metals are joined a thermocouple effect is created. Users should select a bidirectional mode to ensure cancellation of this effect. The instrument measures with current flowing in both directions and averages the result. Typical applications of the DLRO10HD include DC 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 300 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

Test Modes

Test mode, is selected by a six (including off) positioned rotary selector switch that activates the following modes:

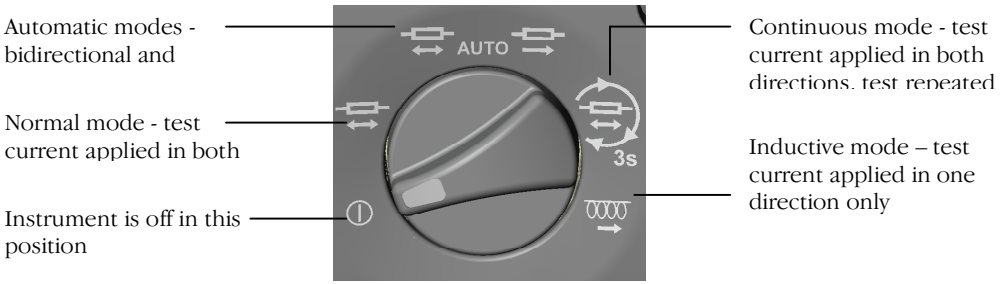
Normal mode – The test is initiated by pressing the 'Test' button after connecting the test leads to the unit under test. Continuity of all four connections is checked. Current is applied in both forward and reverse direction following which the measurement result is displayed. **Please note that in this mode both the current and voltage leads must be connected across the test sample before the Test button is pressed.**

Automatic mode – The test is started as soon as the probes make contact. Forward and reverse current measurements are made and the average value is displayed. 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.

Automatic unidirectional mode – Here current is applied in one direction only to speed up the measurement process. However standing EMF's setup during the test are ignored so lower accuracy can result. Test starts automatically when probes are connected. To make another measurement simply break contact with the test sample and remake contact on next test sample.

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 three seconds until the circuit is broken. **Please note that in this mode both the current and voltage leads must be connected across the test sample before the Test button is pressed.**

Inductive mode – When measuring inductive loads it is necessary to wait for the voltage to stabilise, so the measurement process can take a few seconds or several minutes. The test leads are firmly connected to the item to be measured and the 'Test' button pressed. The instrument will pass the selected current through the sample continuously in one direction only. The instrument will take repetitive readings, which will gradually decrease to the true value as the voltage stabilises. The operator decides when the result is stable and presses the 'Test' button to terminate the test. **When measuring inductive loads it is essential that the current carrying leads are securely clamped to the item being tested and that they are not removed before any stored charge has been discharged at the end of the test. Failure to comply with these instructions might result in an arc being produced, which might be dangerous for the instrument and the operator.**



Warning Messages

Noise

Noise in excess of 100 mV 50/60 Hz will activate the noise icon ~ that will flash and no result will be displayed.

'C' & 'P' Indicators

A good measurement requires both the current carrying circuit and the voltage detection circuit to be completed by the unit under test. DLRO10HD checks for continuity in both C and P circuits. When connectivity is detected, **C 1---2** and **P 1---2** indications are displayed in the left bottom sector of the LCD. If there is poor continuity in either circuit, the "---" indicators will flash between C and/or P circuits to indicate a continuity problem.

External Voltage Warning

If external voltage is applied *between* the terminals and the instrument is on, the HV warning ⚠ will flash on the display. This is a warning that the item under test is live and might be dangerous and testing is disabled. The HV warning ⚠ message will flash if more than 50 V potential difference is applied between voltage terminals and current terminals. This warning will not appear if all terminals are at the same high voltage.

Please note - The warning will not operate if the instrument is turned off.

Discharge Voltage/Current Warning

The HV warning ⚠ and the red HV lamp on the panel will flash if a current greater than 1 mA is still flowing after an inductive test is completed. This suggests that the inductive load has been tested and is discharging. Do not disconnect the current loop while the discharge warning is showing.

TEST TECHNIQUES AND APPLICATIONS

TESTING USING DH4 DUPLEX HANDSPIKES

Each handspike is marked with the letter P. This indicates the potential terminals. These should be the 'inside' contacts when making a measurement. One of the DH4 handspikes is fitted with two lamps marked L1 and L2 and an extra lead. This lead should be plugged into the 4 mm socket labelled ⊗ next to the P2 terminal. These lamps provide information to the operator that would otherwise only be available on the instrument display. The meaning of these lamps is described below.

For example, using the DH4 Duplex Handspikes with the DLRO10HD in one of the AUTO test modes:

1. Press the TEST button on the instrument.
2. Lamp L1 will illuminate a continuous red to indicate contact failure.
3. When all four contacts connect, L1 will extinguish.
4. No lamps will show during the test unless contact fails.
5. Lamp L2 will light a continuous green when current flow has decayed to less that 1 mA to signal end of test.
6. Removing the probes will extinguish the green L2 (end of test) and
7. Light the red L1 (no contact).

Since your DLRO10HD always ensures good contact before applying the full test current, there should be no erosion of the contact tips. However, if the tips become worn or blunted, they can be simply replaced by pulling out the worn tips and inserting new ones.

DH4 Handspikes used with DLRO10HD

Lamp L1	Lamp L2	Meaning
Red	Off	Inadequate continuity at C or P contacts
Flashing Red	Off	Voltage present between contacts
Off	Green	Current , 1mA, test Complete
Off	Red	Measurement fail

TESTING USING DUPLEX HANDSPIKES OR INDIVIDUAL LEADS

Connect the four leads as shown. In all cases ensure that the potential probes (P1 & P2) are inside the current (C1 & C2) probes.



GENERAL OPERATION DLRO10HD

Out of the Box

First connect the test leads to their respective measurement terminals. To simplify lead connection to the DLRO10HD the lid can be removed by lifting it to approximately 45° from closed position and sliding it to the right.

Connect line power lead if line power is available. If the instrument is to be operated from the internal battery, ensure that the battery is charged. Care should be taken to avoid running down the battery to a very low level. The lead acid battery requires charging at least every three months if the instrument is not in use for long periods. Charging should be performed in well, ventilated areas.

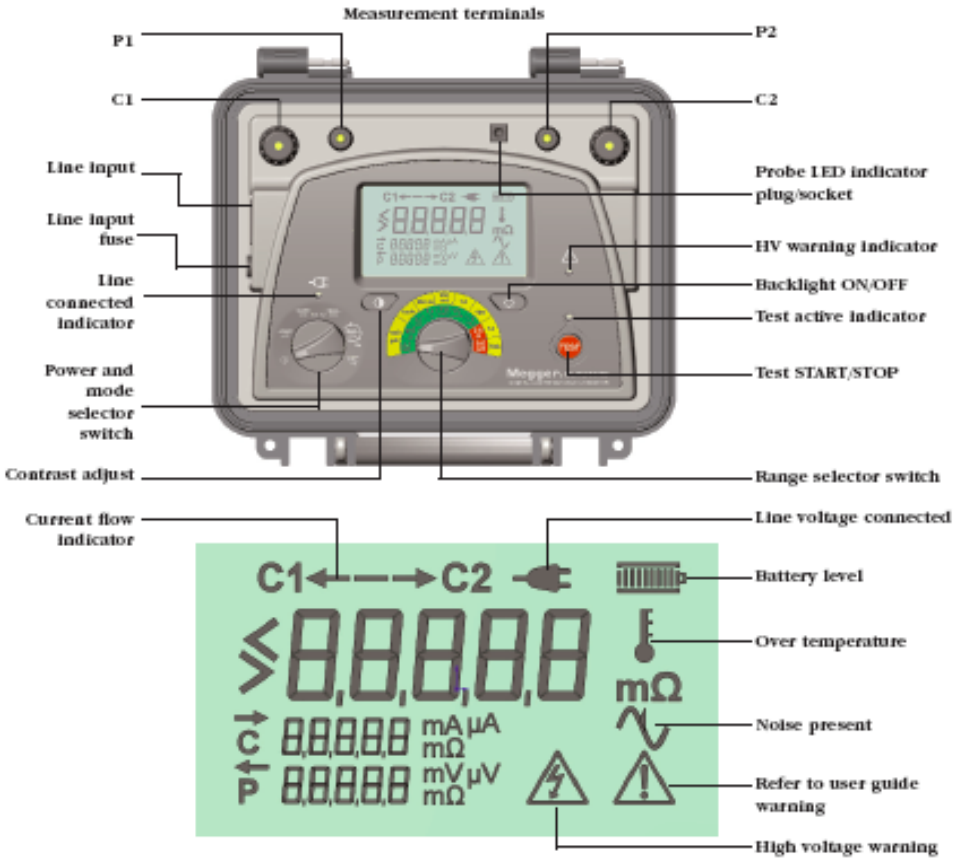
The DLRO10HD is switched on at the power and mode selector switch. On switch on the LCD shows the battery level symbol and, if line power is applied, the line voltage symbol.

It may be necessary to adjust the display contrast by repetitively pressing the contrast adjust button. Contrast setting will scroll through its range from min to max and back to min etc. The backlight ON/OFF button toggles the state of backlight that will timeout if left on for more than

Test Process

Select the test mode required by rotating the mode selector the respective icon. The range/current selector is set based on expected resistance value of the device under test. Alternatively, use the 100 A, 2.5 kΩ range to obtain an initial magnitude of the resistance and then select the most appropriate range setting.

The TEST button starts and stops all tests. The two automatic (AUTO) modes will only show a result on correct connection of test probes and stop current flow on disconnection.



After starting a test the user will see confirmation of successful continuity testing on the LCD. If the dashes are not shown connecting 1 & 2 C and/or P leads connection has not been detected.

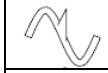
C 1---2

P 1---2

The resistance result is displayed on the large 5-digit digit display in either Ω or mΩ ranging from 2500 Ω to 0.0001 mΩ (0.1 Ω).

The result in bidirectional modes is the average of two readings shown by the two secondary displays with arrows to indicate direction of current flow. The large arrow at the top of the display between 'C1' and 'C2' indicates measurement current flow.

LCD Icons

	Battery icons with battery charge level indicator
	Line power connected
	Temperature extreme limit warning (can inhibit battery charging if ambient temperature is too low/high)
	Noise present above instrument noise threshold
	Warning – refer to user guide
	HV warning – used to indicate voltage present
	Directional arrow to indicate current flow above C indicator
	Directional arrow to indicate current flow above P indicator
	Arrows used to show direction of current during test

POWER LEAD AND BATTERY CHARGING

If the power lead supplied is not suitable for your mains connection, do not use an adaptor. Always use a power lead fitted with the correct plug. The instrument is fitted with a two-pin IEC60320 power inlet. Most power leads are made with three-core cable, so the ground connection will not be used.

Power lead connection table

Connection	K/International	USA
Earth/Ground	Yellow/Green	Green
Neutral	Blue	White
Live (Line)	Brown	Black

If using a fused plug, ensure that it is fitted with a 3 Amp fuse.

The instrument can be powered from 90 - 265 Vrms a.c. at 50/60 Hz. The battery will charge as long as the mains supply is connected, except when a test is in progress. For optimum battery life, charge the battery after each use. A completely exhausted battery will take 8 hours to recharge.

Battery Charge indication

 Full battery

 Battery low

 Empty battery – instrument will shut down automatically.

When line power is connected the battery will charge and the indicated charge level will increment from low to full charge in steps and continue cycling as long as line power is applied and the battery is charging. When the battery is fully charged the battery icon will remain static.

ELECTRICAL SPECIFICATIONS

Resistance/Current Ranges

The green resistance ranges on the keypad indicate low output power (<0.25 W) outputs. Red ranges indicate higher 2.5 W (1 A) and 25 W (10 A) power outputs.

Resolution and Accuracy
Test current accuracy ±10%
Voltmeter input impedance >200 kΩ
Max. lead resistance at 10 A <100 mΩ

Test Current	Resistance Range	Resolution	Basic Accuracy *	Full scale voltage	Max. power output
0.1 mA	0 to 2500.0 Ω	100 mΩ	±0.2% ±200 mΩ	25 mV	2.5 μW
0.1 mA	0 to 250.00 Ω	10 mΩ	±0.2% ±20 mΩ	25 mV	2.5 μW
1 mA	0 to 25.000 Ω	1 mΩ	±0.2% ±2 mΩ	25 mV	25 μW
10 mA	0 to 2500.0 mΩ	100 μΩ	±0.2% ±200 μΩ	25mV	250 μW
100 mA	0 to 250.00 mΩ	10 μΩ	±0.2% ±20 μΩ	25 mV	2.5 mW
1 A	0 to 25.000 mΩ	1 μΩ	±0.2% ±2 μΩ	25 mV	25 mW
10 A	0 to 2500.0 μΩ	0.1 μΩ	±0.2% ±0.2 μΩ	25 mV	0.25 W
1 A	0 to 2500.0 mΩ	100 μΩ	±0.2% ±200 μΩ	2.5 V	2.5 W
10 A	0 to 250.00 mΩ	10 μΩ	±0.2% ±20 μΩ	2.5 V	25 W

* The accuracy stated assumes forward and reverse measurements.

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

Basic accuracy at reference conditions.

GENERAL SPECIFICATION

Temperature Coefficient	< 0.01% per °C, from 5°C to 40°C
Maximum Altitude	2000 m (6562 ft) to full safety specifications
Display size/type	Main 5 digit + 2 x 5 digit secondary displays
Voltage input range	90 – 264 V rms 9 – 17 VA, 50/60 Hz
Line input fuse	T 1.25 A, 250 V, HBC ceramic 20mm x 5mm
Battery type	6 V, 7 Ah sealed lead acid (return instrument to a Megger authorised repair agent for replacement)
Charge time	8 hours
Backlight	LED backlight
Battery life	1000 Auto (3 sec) tests
Auto power down	180s after inactivity
Mode Selection	Rotary switch
Range Selection	Rotary switch
Weight	6.7 kg
Case dimensions	L315mm x W285mm x H181mm
Pouch for test leads	Yes (lid mounted)
Test leads	DH4 lead set included
IP rating	IP65 case closed, IP54 battery operation
Safety rating	In accordance with IEC61010-1, CATIII 300 V when used with DH7 leads
Application	IEC 61010 defines measurement categories from I to IV relating transient over voltages and the location within electrical installations. This instrument is designed for use at Category III (Building installation level) on 300 V phase to earth systems, 520 V phase to phase.
Operating temperature and humidity	-10°C to +50°C (14°F to 122°F) <90% RH
Reference conditions	20°C ±3°C
Storage temperature and humidity	-25°C to +60°C, <90%RH
EMC	In accordance with IEC61326-1 (Heavy industrial)
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.
Maximum lead resistance	100 mΩ total for 10 A operation irrespective of battery condition.

Accessories

Standard Accessories supplied with instrument.

DH4 Duplex handspikes (2), one with indicator lights.

1.2m / 4 ft	6111-627
User guide on CD	2000-869
Warranty book.	6170-618

Optional Accessories at extra cost

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

Replacement tips for DH4, DH5 and DH7 handspikes.

Needle point	25940-012
Waffle end	25940-014

Optional Test Leads at extra cost

Duplex Leads

DH5 straight duplex handspikes (2).

One has indicator lights.	2.5m/8ft	6111-517

DH7 Duplex handspikes (2) suitable for working on 600 V. systems.

	2.5m/8ft	1001-035

Duplex Handspikes (2)with spring loaded helical contacts.

	2m/7ft	242011-7
DH1	2.5m/8ft	6111-022
	5.5m/18ft	242011-18
DH2 only 1 lead supplied	6m/20ft	6111-023
	9m/30ft	242011-30
DH3	9m/30ft	6111-024

Straight Duplex Handspikes (2) Heavy Duty with fixed contacts.

2m/7ft	242002-7
5.5m/18ft	242002-18
9m/30 ft	242002-30

Duplex Heavy Duty 5cm (2") C-Clamps. (2)

2m/7ft	242004-7
5.5m/18ft	242004-18
9m/30ft	242004-30

Duplex handspikes with replaceable Needle Points

2m/7ft	242003-7

Duplex 1.27 cm (1⁄2") Kelvin Clips. (2)

gold plated 2m/7ft	241005-7
silver plated 2m/7ft	242005-7

Duplex 3.8 cm (11⁄2") Kelvin Clips. (2)

2m/7ft	242006-7
5.5m/18ft	242006-18
9m/30ft	242006-30

Single Leads

Single handspikes (2) for potential measurement.

2m/7ft	242021-7
5.5m/18ft	242021-18
9m/30ft	242021-30

Current clips (2) for current connections.

2m/7ft	242041-7
5.5m/18ft	242041-18
9m/30ft	242041-30

Repair and Warranty

The instrument circuit contains static sensitive devices, and care must be taken in handling the printed circuit board. If the protection of an instrument has been impaired it should not be used, and be sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if, for example, the instrument shows visible damage, fails to perform the intended measurements, has been subjected to prolonged storage under unfavourable conditions, or has been exposed to severe transport stresses.

New Instruments are warranted for 12 months, from the Date of Purchase by the User.

Note: Any unauthorised prior repair or adjustment will automatically invalidate the Warranty.

Instrument Repair and Spare Parts

For service requirements for Megger Instruments contact:-

Megger Limited
Archcliffe Road
Dover
Kent, CT17 9EN.
England.
Tel: +44 (0) 1304 502100
Fax: +44 (0) 1304 207342

or

Megger Valley Forge Corporate Centre
Van Buren Avenue
2621 Norristown, PA 19403
U.S.A.
Tel: +1 (610) 676-8579
Fax: +1 (610) 676-8625

or

Megger
Bronze Way,
Dallas, Texas, TX75237-1019
U.S.A.
Tel: +1 (800) 723-2861

or an approved repair company.

Approved Repair Companies

A number of independent instrument repair companies have been approved for repair work on most Megger instruments, using genuine Megger spare parts. Consult the Appointed Distributor / Agent regarding spare parts, repair facilities and advice on the best course of action to take.

Returning an Instrument for Repair

If returning an instrument to the manufacturer for repair, it should be sent freight pre-paid to the appropriate address. A copy of the Invoice and of the packing note should be sent simultaneously by airmail to expedite clearance through Customs. A repair estimate showing freight return and other charges will be submitted to the sender, if required, before work on the instrument commences.

Note: The battery is a sealed Lead-acid type and if changed the disposal of old cells should be in accordance with local regulations.

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