

KEWTECH

KT35 digital multi function tester



Instruction manual

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I Safety Notice

Electricity can cause severe injuries even with low voltages or currents. Therefore it is extremely important that you read the following information before using this Insulation Tester.

- 1.1** This instrument must only be used by a competent trained person and in strict accordance with the instructions. Kewtech will not accept liability for any damage or injury caused by misuse or non-compliance with instructions or safety procedures.
- 1.2** This instrument must not be used on live circuits. Ensure all circuits are de-energised before testing.

- 1.3 Never open the instrument case except for battery or fuse replacement.
- 1.4 Always inspect your Insulation Tester and test leads before use for any sign of abnormality or damage. If any abnormal conditions exist (broken test leads, cracked case, display faulty, inconsistent readings, etc) do not attempt to take any measurements. Return to Kewtech for rectification.
- 1.5 Never replace the protective fuse inside the instrument with any other than the specified or approved equal (0.5A/600V) fast acting ceramic to IEC127.
- 1.6 This meter has been designed with your safety in mind. However, no design can completely protect against incorrect use. Electrical circuits can be dangerous and/or lethal when a lack of caution or poor safety practice is used. Use caution in the presence of voltages above 50V as these pose a shock hazard.
- 1.7 Pay attention to cautions and warnings which will inform you of potentially dangerous procedures.
- 1.8 If at anytime during testing there is a momentary degradation of reading, this may be due to excessive transients or discharges on the system or local area. Should this be observed, the test should be repeated to obtain a correct reading. If in doubt always contact Kewtech.
- 1.9 Never assume an installation circuit is not live. Confirm it is de-energised before commencing testing.
- 1.10 Replace worn and/or damaged leads with new ones approved by Kewtech immediately.
- 1.11 It is essential to understand and follow the safety rules contained in this manual. They must always be observed when using the instrument.
- 1.12 Warning: This product is an insulation/continuity tester and is designed for use on de-energised systems. It

incorporates voltage warning circuits in case of accidental connection to an AC voltage. On no account should the product be used to measure voltage. Voltages should be measured with a dedicated voltage measuring instrument and it is recommended that fused test leads are always used for personal safety when measuring such voltages especially on high energy circuits.

Note: This product is supplied with ACC020 unfused leads. These can be converted to fully fused types by attaching the optional ACC040 fused module.

- 1.13 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 circuit. 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.
- 1.14 Always keep your hands and fingers behind finger guards on test leads used with this instrument. For safety reasons always use the accessories approved by Kewtech. The use of other accessories is prohibited as they may not have the same safety features built in.

2 Features and Principles of Measurement

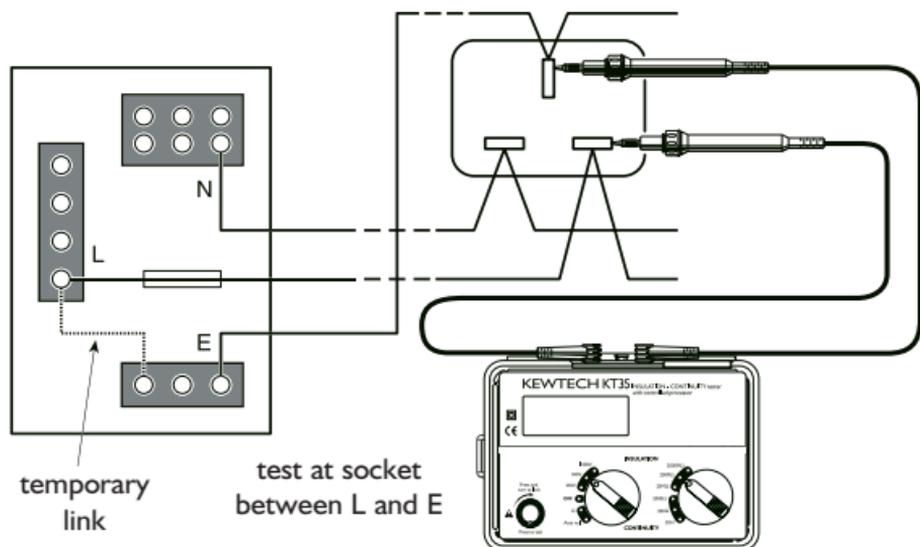
2.1 Features

- ▲ 3 1/2 Digit Microprocessor Controlled Insulation Tester
- ▲ Three Insulation test voltages 250V, 500V, 1000V
- ▲ Three continuity ranges, 20 Ω , 200 Ω and 2000 Ω
- ▲ Three insulation resistance ranges 20M Ω , 200M Ω , 2000 Ω M

- ▲ 200mA continuity short circuit test current
- ▲ 1mA test current at the minimum load on insulation ranges
- ▲ Bar graph indicates test voltage-rise and decay can be observed during insulation tests
- ▲ Warning of external voltage presence
- ▲ 'Press to test' button with lock down feature. Releasing the test button automatically discharges the capacitance of a circuit under test
- ▲ Auto null feature

2.2 Principles of Measurement

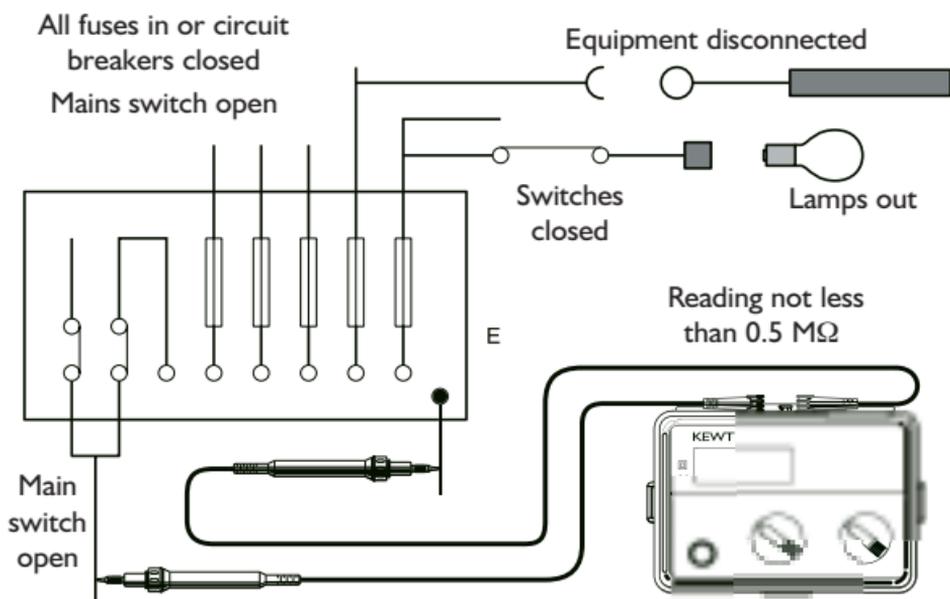
An Insulation/Continuity Tester performs two basic functions. As a continuity tester the instrument can be used to measure low values of resistance between two points in an electrical circuit. In this mode the instrument acts as a low voltage current source. The resistance is calculated from the measurement of the voltage and the current through the conductor. Careful



Typical arrangement for measuring the continuity of protective conductors. Before proceeding with tests conductors must be proved to be de-energised.

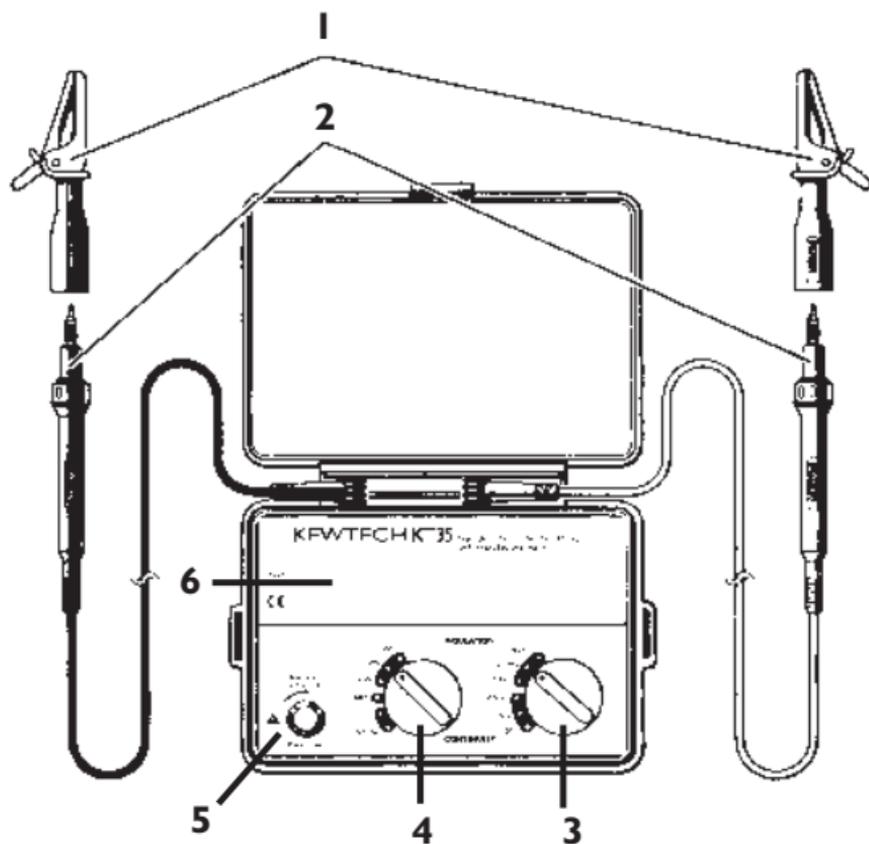
connection to the circuit under test is essential to avoid measurement errors. Circuits connected in parallel to the circuit under test may also effect the accuracy of the measurement.

Possible insulation resistance measurement errors may be caused by the circuit under test being wet and/or dirty. Errors may also occur when testing large installations where the insulation resistances may effectively be in parallel.



Note: Insulation testing must only be undertaken on de-energised circuits.

3 Instrument layout



- 1 Crocodile Clip
- 2 Prod
- 3 Range Switch
- 4 Function Switch
- 5 Test Button
- 6 LCD Display

4 Specifications

Insulation Resistance Measurement Specification

Test Voltage	250V	500V	1000V
Measuring Ranges	0 -20M Ω	0 -20M Ω	0 -20M Ω
	0 -200M Ω	0 -200M Ω	0 -200M Ω
	0 -2000M Ω	0 -2000M Ω	0 -2000M Ω
Nominal Output Voltage (UN)	250V DC min. at 0.25M Ω	500V DC min. at 0.5M Ω	1000V DC min. at 1M Ω
Nominal Output Current (In)	1mA DC min. at 0.25M Ω	1mA DC min. at 0.5M Ω	1mA DC min. at 1M Ω
Intrinsic Accuracy	20M Ω 200Mz	$\pm(5\% \text{ rdg} + 5 \text{ dgt})$	
	2000M Ω	0 to 1G Ω 1G to 2Gz	$\pm(10\% \text{ rdg} + 3 \text{ dgt})$

Continuity Resistance Measurement Specification

Measuring Ranges	0 -20 Ω	0 -200 Ω	0 - 2000 Ω
Open circuit voltage (Uq) on the 20 Ω range	4 - 9V		
Nominal output current (In) on the 20 Ω range	200 mA		
Intrinsic accuracy	0 -20 Ω $\pm(1.5\% \text{ rdg} + 5 \text{ dgt})$	0 -200 Ω + 0 - 2000 Ω $\pm(1.5\% \text{ rdg} + 3 \text{ dgt})$	

Reference Conditions

Ambient Temperature: $23 \pm 5^{\circ}\text{C}$

Relative Humidity: $60 \pm 15\%$

Supply Voltage: 9 V

Altitude: Less than 2000m

Insulation Resistance Operating Error

Range	Operating Range Compliant with EN 61557-2 Operating Error
20M Ω	0.2M Ω to 20M Ω
200M Ω	2M Ω to 200M Ω
2000M Ω	20M Ω to 1000M Ω

Continuity Resistance Operating Error

Range	Operating Range Compliant with EN 61557-4 Operating Error
20 Ω	0.2 Ω to 20 Ω
200 Ω	10 Ω to 200 Ω
2000 Ω	100 Ω to 2000 Ω

The influencing variations used for calculating the Operating Error are:

Operating Temperature: 0°C to 40°C
Relative Humidity: 85% maximum
Supply Voltage: 7V to 9V

General Specification

Storage Temperature: -10°C to 50°C
Storage Relative Humidity: 85% maximum
Power Supply: 6 X 1.5V batteries type AA or equivalent
Fuse (user replaceable): 500mA/600V fast acting ceramic
Weight (minus batteries): 538g

Possible number of operations during battery life:

When the following resistance is connected to a measuring terminal alternating between 5 seconds loading and intervals of 25 seconds, the number of measurements that it is possible to make, until the battery voltage falls 7.0V shall be:

250V Range 0.25M Ω approx. 1200 times or more

500V Range 0.5M Ω approx. 1200 times or more

1000V Range 1M Ω approx. 400 times or more

20 Ω Range 1 Ω approx. 300 times or more

Applied Standards

Operation:	EN 61557-1/2/4
Safety:	EN61010 Cat.III 300V
Protection:	IEC60529 (IP40)

Accessories

ACC020

Test Leads Pouch

5 Functions

5.1 Bar Graph

While conducting insulation resistance tests, the LCD will display the value of insulation resistance. **The bar graph will display the DC test voltage present across the ends of the test leads.** This means that the user can verify that the circuit is being stressed by the full DC test voltage (250V, 500V or 1000V).

For circuits that have a large capacitance the bar graph will rise more slowly than for those with low capacitance. When used in the Trac mode the bar graph will display the real time fluctuations in insulation test voltage and show breakdown. This can be used to indicate good and bad circuits as a rapidly fluctuating bar graph indicates unstable conditions.

5.2 Auto Null

When conducting continuity tests it is important to remember that the measured resistance includes the resistance of the test leads. An electronic leads null function is provided which auto-

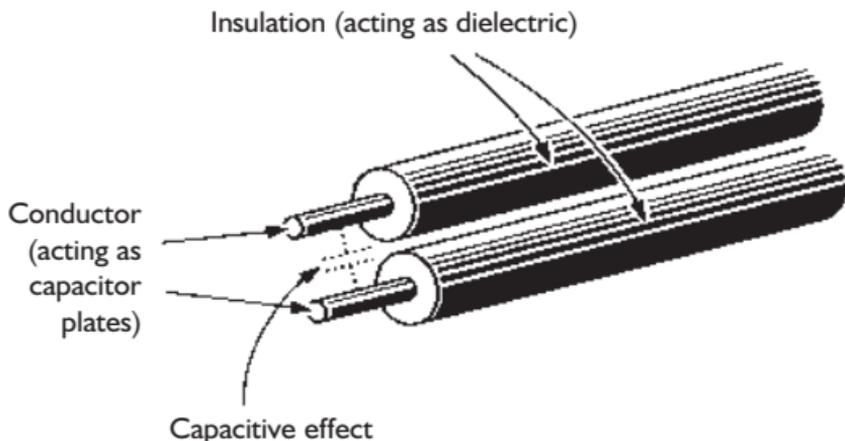
matically subtracts the test lead resistance before displaying the real continuity resistance value. A full description of how this feature can be used will be found in paragraph 9.2.

6 The Nature of Insulation Resistance

Live conductors are separated from each other and from earthed metal by insulation, which ensures that the current flowing between conductors and to earth is kept to an acceptably low level. In simple theory, insulation is perfect, so that its resistance is infinite and there is no current flow through it at all. In practice, there will always be a current between conductors and to earth. And this is known as leakage current. This current is made up of three components.

6.1 Capacitive Current

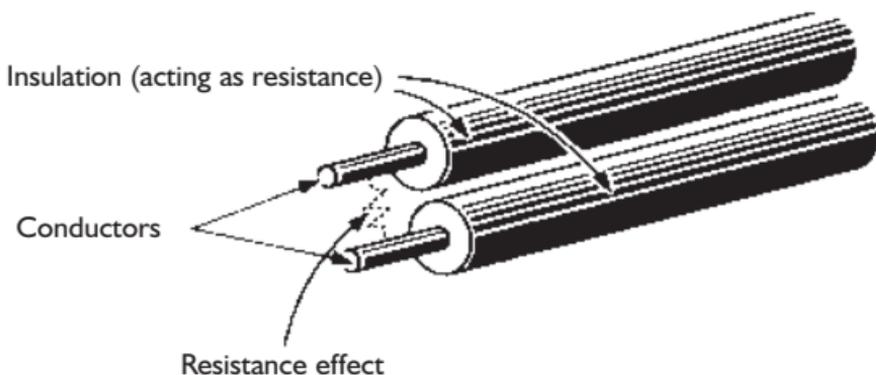
The insulation between conductors at different voltages behaves as the dielectric of a capacitor, the conductors behaving as the capacitor plates. When a direct voltage is applied to the conductors, charging current will flow to the system but will quickly die away (usually in much less than one second) as the effective capacitor becomes charged. If an alternating voltage is applied, there will be alternating charge and discharge currents so that there will be a continuous flow of alternating current to the conductors.



6.2 Conduction Current

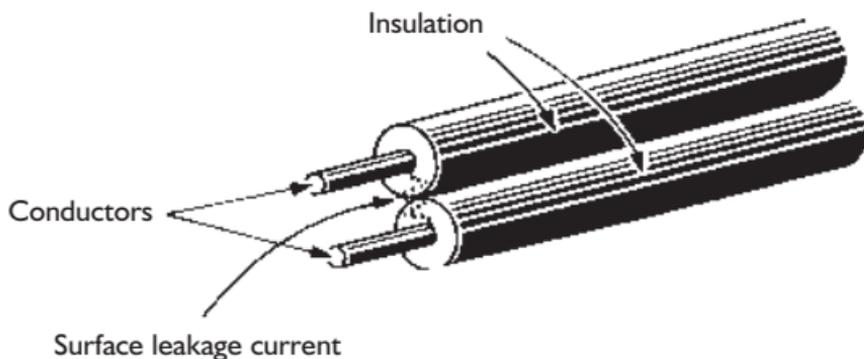
The resistance of the insulation is not infinite, so a small current flows through it. Ohm's Law applies, so the leakage current can be found from:

$$\text{Leakage Current } (\mu\text{A}) = \frac{\text{applied voltage (V)}}{\text{insulation resistance (M}\Omega\text{)}}$$



6.3 Surface Leakage Current

Where the insulation is removed, for connection of conductors and so on, current will flow across the surfaces between the bare conductors. If the surfaces are clean and dry, the amount of leakage current is very small indeed, but it may become significant in wet and dirty conditions.



6.4 Total Leakage Current

The total leakage current is effectively the sum of the capacitive, conduction and surface leakage currents described above. Each current, and hence the total leakage current is affected by factors such as ambient temperature, conductor temperature, humidity and the applied level of voltage. If a circuit is fed with an alternating voltage, the capacitive current (6.1) will always be present, and can never be eliminated. This is why direct voltage is applied to test insulation, the capacitive current quickly falling to zero so that it has no effect on the measurement. A high voltage is used because this will often break down poor insulation or surface leakage paths and thus show up insulation faults which would not be present at lower voltage levels. The insulation tester measures the applied voltage and the resulting leakage current flow, displaying the resistance which is obtained by an internal calculation based on Ohm's Law:

$$\text{Insulation Resistance (M}\Omega\text{)} = \frac{\text{Test Voltage (V)}}{\text{Leakage Current (\mu A)}}$$

As the effective capacitance of the system charges up, so the leakage current reduces. A steady insulation resistance reading indicates that the system capacitance is fully charged and that the capacitive component of current has fallen to zero. It should be noted that the system charges up to the test voltage used (250V, 500V, or 1000V). Thus, it can be dangerous for people or animals to make contact with an electrical installation which is under test. Even when the test voltage is removed, the wiring system may remain charged for a significant time unless steps are taken to provide a path for discharge current. The KT35 automatically connects a discharge resistor across the circuit when the test button is released to provide a path for discharge current.

If a wiring system is wet and/or dirty, the surface leakage component of test current will be high, giving a low insulation resis-

tance reading. If an electrical installation is large, its individual circuit insulation resistances are all effectively connected in parallel. so that the total insulation resistance will be lower than that of each individual circuit. The greater the number of circuits connected, the lower will be the overall insulation resistance.

7 Preparation for Measurement

7.1 Before testing always check the following:

The 'battery low' indicator is not showing.

There is no visual damage to the tester or test leads.

Test Lead Continuity.

Select the continuity function and 20Ω range. Short the test leads together.

An overrange (OR) indication will mean that the leads are faulty or instrument fuse is blown. (see fuse replacement section 12).

8 Insulation Resistance Testing

Warning: Insulation tests should be conducted on circuits that are de-energised. Ensure circuits are not live before commencing testing.

8.1 Select the required test voltage (250V, 500V or 1000V) by rotating the function dial.

8.2 Select the required range (20M, 200M, 2000M) by rotating the range selector.

8.3 Attach the test leads to the instrument and to the circuit to be tested. If the voltage warning bleeper sounds, do not press the test button and disconnect the instrument from the circuit. The circuit is live and should be de-energised before further testing. The KT35 indicates the presence of external AC voltage on the LCD by showing a flashing symbol and the actual value

of AC system voltage.

8.4 Select either Trac mode or Lok mode as required and press the test button. The value of insulation resistance in megohms will be displayed. The bar graph will display the insulation test voltage. If in Lok mode the bar graph will rise and then decay to zero with the insulation resistance reading remaining on the LCD for as long as the test button is depressed. The insulation test voltage is only applied for as long as indicated by the bar graph.

Caution: Never turn the function dial whilst the button is depressed. This may damage the instrument. Never touch the circuit under test during insulation testing.

When testing is complete ensure that the test button is released before the test leads are disconnected. This is because the system may be charged up and it must be allowed to discharge through the tester's internal discharge resistor. The KT35 will show this discharge as a decaying bar graph.

9 Continuity Testing (Resistance Tests)

Warning: Ensure circuits are not live before commencing testing.

9.1 Select the continuity test by rotating the function dial.

9.2 Select the 20Ω range by rotating the range selector and connect the test leads to the instrument. Short the tips of the leads. Press and hold down the test button by twisting it a quarter turn clockwise. The display will show the resistance of the test leads.

The KT35 has an auto null function which enables the tester to automatically subtract this resistance before displaying the system continuity resistance. To enable this function, turn the function dial to the Auto null position whilst still pressing the test button and shorting the leads. Wait for the display to stabilise

(at least 3 test bleeps) When this happens release the test button by turning it anti-clockwise and turn the function dial back to the continuity position. Whilst still shorting the test leads press the test button and ensure the display reads zero before proceeding. A flashing Ω symbol on the display indicates that Autonull is on. Remember the auto null procedure has to be repeated if the tester function dial is switched to OFF or is rotated past the OFF position.

9.3 Connect the test leads to the circuit under test. Ensure the circuit is not live by checking that the live circuit bleeper does not sound. The KT35 will indicate the value of external AC voltage (see section 8.3).

Note: On the 20 Ω range the end of test bleep has a lower tone for resistances less than approx. 5 Ω .

10 General

If at any time the display shows OR this means that the value being measured is greater than the range selected. Switch to a higher range in this case. The test button can be locked down for ease of use. **Do not forget** to release the test button **first** before disconnecting the test leads from the system otherwise the circuit may be left in a charged state. Each Time the tester makes a measurement and updates the display end of test bleep will sound.

11 Battery and Fuse Replacement

Caution: Always disconnect the test leads from the instrument before attempting battery or fuse replacement.

11.1 Battery Replacement

When the LCD shows the low battery flag, the batteries need

replacing. Six batteries (AA or equivalent) are required. Alkaline types are recommended. Open the battery compartment lid on the back of the instrument by unscrewing the metal screw. Detach the battery holster and replace all six batteries with new ones observing the correct polarity as marked on the holster. Close the battery compartment lid and replace the metal screw **before** using the tester.

11.2 Fuse Replacement

If the fuse has blown or is suspected of being faulty (see section 8.1) replace it using the recommended type or its approved equal-a quick blow ceramic fuse to IEC 127 is required. Open the battery compartment lid as per 12.1. Remove the old fuse and replace with the new one. Screw the battery compartment lid back on before using the tester.

12 Servicing & Calibration

If this product requires cleaning use a damp cloth to wipe it. Do not use strong cleaning agents as these may damage the plastic surfaces. Ensure that it is perfectly dry before switching on. If this tester should fail to operate correctly, return to Kewtech marked for the attention of the Service Department, stating exact nature of fault. Make sure that:

- a) Operating instructions have been followed
- b) Leads have been inspected
- c) Fuse has been checked
- d) Batteries have been checked
- e) The unit is returned with all accessory leads

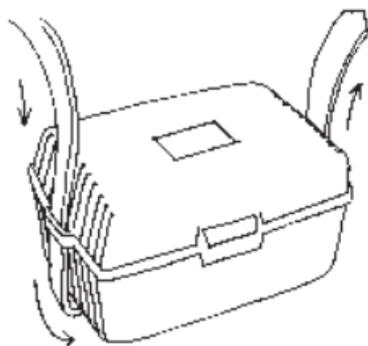
Regular re-calibration is recommended for this instrument. We recommend that with normal use this unit is calibrated at least once in every 12 month period. When the unit is due for re-calibration, return to Kewtech marked for the attention of the calibration department and be sure to include all accessory leads

as they are part of the calibration procedure.

Kewtech reserve the right to improve specifications and designs without notice and without obligations.

Case, strap, shoulder-pad and test lead pouch assembly

Assemble the shoulder strap through the case lugs and the test lead pouch in the following sequence:



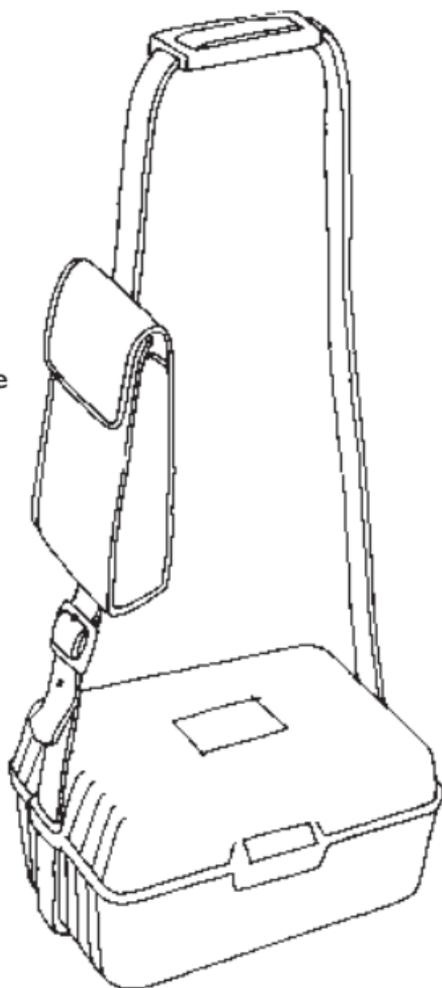
1 Pass the strap **down** through the first lug, under the case and **up** through the other lug.



2 Slide the shoulder pad onto the strap



3 Feed the strap **down** through the slots in the back of the test lead pouch.



4 Pass the strap through the buckle, adjust the strap for length and secure.

Distributor

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