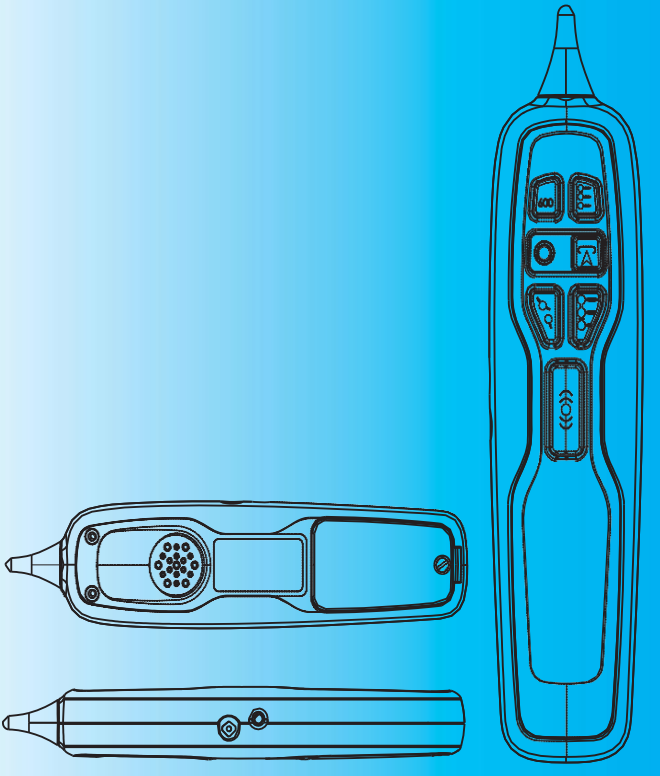
TX 916
LOOP a LINE
Operator's Manual



1. PHYSICAL DESCRIPTION

Figure 1-1 Oscillator

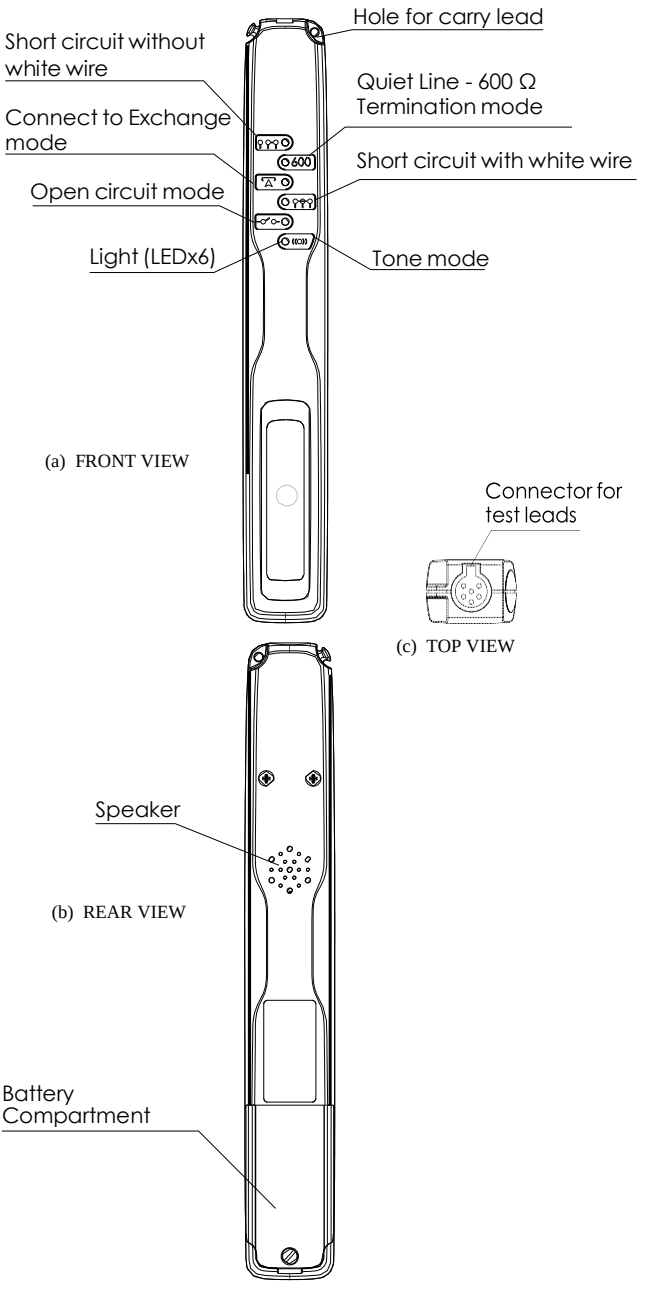
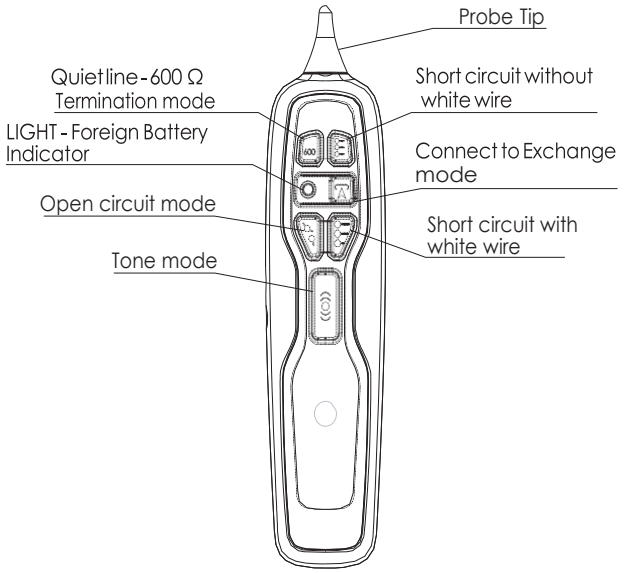
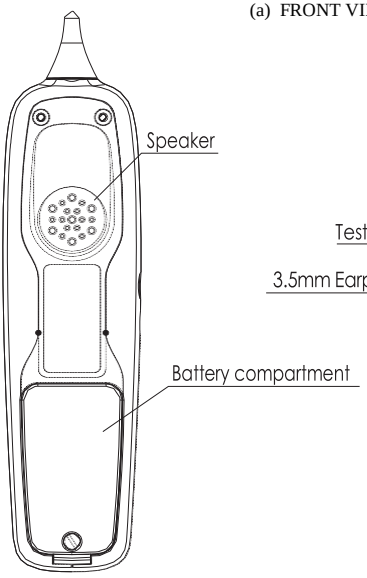


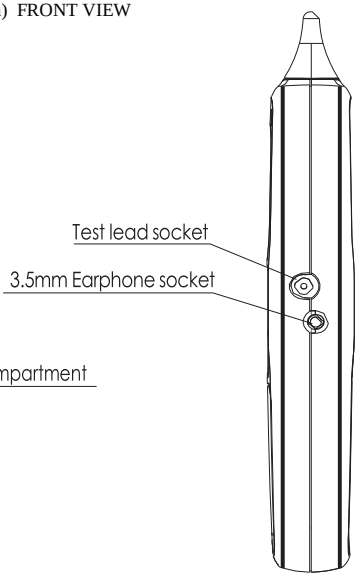
Figure 1-2 Probe



(a) FRONT VIEW



(b) REAR VIEW



(c) SIDE VIEW

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2. SAFETY INFORMATION

To avoid injury read "Safety Information" and "Warnings and Precautions" before using this instrument

Safe Working Practices
Review the safety information and adhere to the safe working practices described in this manual and elsewhere.

Protection may be impaired if the instruments are used for purposes other than described in this manual.

The symbols used on the instrument and in this manual are:

	**Safety Information Warning, Refer to Manual**
	**Conforms to European Union Directives**
	**Do not dispose of in general domestic waste. Refer to local authorities for direction.**

Warnings and Precautions

To avoid possible electric shock or personal injury, and to avoid possible damage to the instrument or to the equipment under test, adhere to the following practices:

This equipment is to be used by trained technicians only. Use caution when using this equipment. Voltages in excess of 30Vac, 42Vpeak or 60Vdc may be present on lines being tested. These voltages pose a potential shock hazard.
Before using the equipment inspect the case. Do not use the equipment if it is damaged. Look for cracks in the case or missing parts. Pay particular attention to the insulation around the connectors.
Inspect the test leads for damaged insulation or exposed metal. Check the test leads for continuity. Replace damaged test leads before using the equipment.
Do not use the equipment if it operates abnormally. Protection may be impaired. When in doubt have the equipment serviced.
Do not apply more than the rated voltages to the equipment.
Use the correct connections and functions for your measurements.

Take extra care when Insulation Resistance is being measured. There may be voltage applied to the line as high as 500 Vdc. Ensure you warn others when insulation Resistance is measured.
Ensure that equipment is removed from the line and the test leads are disconnected before opening the case. Do not operate the equipment with the case open.
Use only 9V alkaline batteries. Ensure the battery is installed correctly.
Replace the battery as soon as BATTERY FLAT is indicated.
Remove the batteries if they are worn out or before storing your device; they can become hot and cause burns.
Always remove old, weak or worn-out batteries promptly and recycle or dispose of them in accordance with Local and National Disposal Regulations.
If a battery leaks, remove it, taking care to keep the leaked fluid from touching the skin or clothes. If fluid from the battery comes into contact with skin or clothes, flush skin with water immediately. Before inserting new batteries, thoroughly clean the battery compartment with a damp paper towel or follow the battery manufacturer's recommendations for clean-up.
Breaking electrical connections may generate sparks. This instrument is not to be used in areas in which flammable gases exist, or may exist.
Disconnect earphones before connecting probe test leads to the line.
TX916 is suitable for telecommunications lines and is not rated for Mains use (>220Vac).
This equipment must not be connected to mains supply circuits. Do not apply more than the rated voltages to the equipment.
When connecting the test clips be sure to keep your fingers away from potentially live metal parts.
Disconnect test leads before opening battery compartment. Do not operate the equipment with the battery cover removed.
Clean only with a damp cloth and detergent. Do not immerse in water.
To protect from electrical shock, only use the test leads provided.
Do not use this device during electrical storms.

3. INTRODUCTION

Teletech's TX916 Loop-a-Line consists of two battery operated devices known as the PROBE and the OSCILLATOR. Together these devices are used by the communication technician to aid in telephone installation and cable fault location and repair.

A communication technician can work unassisted by remotely controlling an OSCILLATOR (located at the exchange MDF or street cabinet) from a PROBE located on the same line up to 20km away. This eliminates multiple journeys along the cable path and dramatically cuts repair and installation costs.

Operating modes:

- Pair identification
- Disconnect/connect service to the exchange
- Open circuit pair
- Short circuit pair (with or without white wire)
- Insert 600 Ω line termination.

When a Loop-a-Line is used in conjunction with a Resistance Bridge or TDR instrument; loop, insulation resistance, resistance balance measurements and fault locating can be performed.

3.1. BATTERY REPLACEMENT

Both devices are powered by a 9 V alkaline battery (IEC 6LR61) which can be inserted or removed by removing the battery lid on the rear of the device using a flat head screw driver. Orient the battery according to the polarity diagram within the battery compartment.

WARNING: Disconnect all test leads before removing the battery lid to avoid possible connection to high voltages sometimes present on telephone lines.

3.2. TEST LEADS

The OSCILLATOR and PROBE each have their own test leads which are inserted into their sockets (see Figure 1-1).

Next to the PROBE's test connector (see Figure 1-2) is a 3.5mm audio jack that allows earphones to be inserted and is useful when performing Pair Identification in noisy environments.

WARNING: Due to large voltage spikes sometimes present on telephone lines, don't insert the earphones when the PROBE's test leads are connected to the line.

4. OSCILLATOR OPERATION

4.1. OSCILLATOR POWER UP

Inserting the test lead into to the OSCILLATOR's socket initiates the OSCILLATOR power up cycle.

The OSCILLATOR flashes all six of its lights (LEDS) once simultaneously (< 0.5sec) to indicate that the leads have been correctly inserted and battery power is present. The OSCILLATOR then performs a battery level check and displays the battery strength in the form of a light array bar graph. Maximum battery capacity displays all six lights but if the battery is nearly flat and needs replacing, only one light is displayed (See figures 4-1a, 4-1b, 4-1c). If no lights are displayed then the battery voltage is insufficient for any operation and should be replaced.

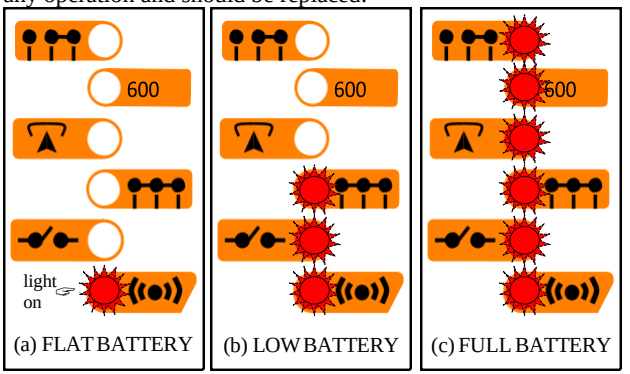


Figure 4-1 Light array indicating: (a) FLAT, (b) LOW, (c) FULL battery level

After indicating the battery level the OSCILLATOR enters TONE mode. The light next to the ((•)) symbol will flash every 3 seconds indicating that the OSCILLATOR is on and generating a tone signal.

The factory default tone is referred to as the Warble. This is the tone that will be heard coming from the PROBE when using the OSCILLATOR in TONE mode for the first time. Three other tones are available and can be selected using the PROBE (refer to section 5.3 TONES).

4.2. OSCILLATOR POWER OFF

Removing the OSCILLATOR's test lead from the socket immediately turns off the OSCILLATOR.

4.3. CABLE SHORT CIRCUIT DETECTION

When this feature is enabled, the OSCILLATOR can be used for confirming traces over short distances without using a PROBE.

To enable this feature, connect the PROBE leads to the OSCILLATOR Blue test leads, either directly or via an unbroken cable pair. Press the PROBE's ⊷ and **600** keys *simultaneously* and hold them down for about 1 second until a beep is heard. This places the OSCILLATOR into TONE mode (the *warble* tone will be produced) and causes the OSCILLATOR to sound its buzzer if either a short circuit or a reverse polarity battery is present between its Blue test leads. The enabled / disabled status is non-volatile and will not change, even if the battery is removed. If enabled, the oscillator will beep three times when it is turned on.

To disable this feature, perform a factory reset, i.e. connect the PROBE leads to the OSCILLATOR Blue test leads, and press the PROBE's ⊷ and ⁞⁞⁞ keys *simultaneously* and hold them down for about 1 second until a beep is heard.

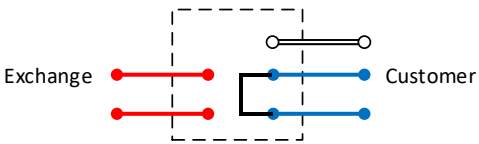
Note: When in TONE mode, the OSCILLATOR applies a nominal 4.5 V DC to the cable pair to which it is connected. This voltage is necessary for the OSCILLATOR to be able to detect a short circuit.

4.4. OSCILLATOR MODES

The OSCILLATOR has six operating modes. The selected operating mode is indicated by a flashing light on the OSCILLATOR next to the mode symbol. The modes are:

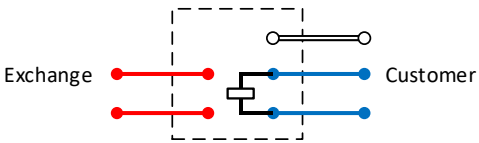
⁞⁞⁞ **Short Circuit (Without White Wire)**

The OSCILLATOR tone generation is stopped and the cable line is looped. The White lead and the Red leads are open circuit. After disconnecting the PROBE leads from the line, the loop resistance and ground leakage can be measured. An RFL Bridge can be used to locate any short circuit faults on the line (See section 6.3.1, Two Wire Test). A TDR can measure the distance to the OSCILLATOR.



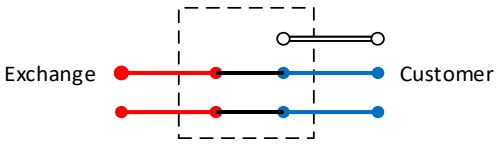
600 Quiet Line – 600 Ω termination

The OSCILLATOR tone generation is disconnected and the line is terminated with an AC coupled 600 Ω. This termination is suitable for measuring line noise or Return Loss. The White lead and the Red leads are open circuit. The termination is 900 Ω in regions where this is the standard network termination.



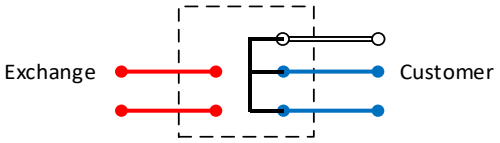
Exchange Connect

The OSCILLATOR tone generation is disconnected and the line is connected through to Exchange using the Red leads. The White lead is open circuit.



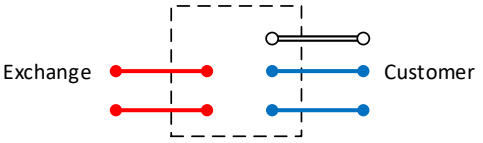
Short Circuit (With White Wire)

The OSCILLATOR tone generation is disconnected and the line is looped. The White lead is shorted to the Blue leads and the Red leads are open circuit. After disconnecting the PROBE leads from the line, the loop resistance and ground continuity may be measured. This termination is also used for a Three Wire RFL test, (refer to section 6.3.2 Three Wire Test).



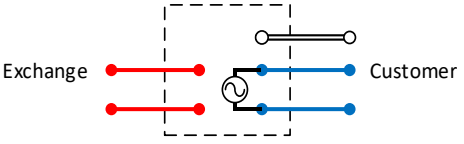
Open Circuit

The OSCILLATOR tone generation is disconnected and the line is isolated from the Exchange. After disconnecting the PROBE leads from the line, insulation resistance, foreign battery voltage or TDR open circuit tests can be performed.



Tone Mode (Pair Identify)

The OSCILLATOR is disconnected from the Exchange and a tone signal is output on the Blue test leads. The White lead is open circuit. The PROBE tip is used to detect the tone signal at the Far End (refer to section 6.1 PAIR IDENTIFICATION).



5. PROBE OPERATION

5.1. SIGNAL TRACING

To trace the tone signal generated by the OSCILLATOR, slowly move the PROBE's antenna within close proximity to the cables under test. A tone signal picked up on the PROBE antenna will be reproduced as an audible tone. The audible tone volume increases as the PROBE antenna tip is brought closer to the cable carrying the tone signal. This tracing technique is used in Pair Identification (refer to section 6.1 PAIR IDENTIFICATION.).

5.2. MODE SELECTION

Each key on the PROBE selects one of the six OSCILLATOR modes. The symbols on the PROBE keys are identical to the symbols displayed on the OSCILLATOR, (refer to section 4.4 OSCILLATOR MODES).

The PROBE must be connected to the same unbroken line as the OSCILLATOR to control the OSCILLATOR. Holding a single key down for about 1 second will cause the PROBE to transmit a command to the OSCILLATOR to change operating mode. The PROBE will then beep once and power down, except in the case of TONE mode, where it will remain powered for 2 minutes and then power down automatically.

5.3. TONES

There are four selectable OSCILLATOR tones available for use in pair identification, they are:

- *Warble;*
- *Continuous*
- *Two high beeps repeating;* and
- *Three high beeps repeating*.

The factory default tone generated by the OSCILLATOR is the Warble, and this is the tone heard when using the OSCILLATOR for the first time in TONE mode.
To select a different tone, first connect the PROBE to the same line as the OSCILLATOR. The technician must then hold the PROBE's TONE ((•)) key down for about 1 second until a SINGLE beep is heard. If the key continues to be held down for a further second after the first beep is heard, the PROBE will generate a double beep indicating that the PROBE has changed from low to high sensitivity (soft to loud). The PROBE will continue to cycle between high and low sensitivity until the TONE key is released.

The selected tone is saved when the OSCILLATOR is powered off. For example, if the tone is on 'Warble' and the technician changes the tone to 'Two high beeps repeating', the OSCILLATOR will then start up next time with the 'Two high beeps repeating'.

The factory default tone can be restored by simultaneously pressing and holding down the and keys on the PROBE for 1 second until a beep is heard, see Figure 5-1.

Figure 5-1. Reset Tone to Warble (Factory Default)

5.4. CONNECTED TO EXCHANGE

The PROBE has a red/green light located to the left of the key. This will light up when the PROBE is connected to a cable pair that has a battery connected to it that is > 15 V DC. The light colour displayed indicates the polarity of the line: Green light indicates a negative Exchange battery on the test lead's Black clip. Red light indicates a negative Exchange voltage on the test lead's Red clip.

5.5. AUDIO BATTERY LEVEL INDICATOR

If the PROBE battery is almost flat, the PROBE will emit a long and descending pitch screech whenever a key is pressed. This is easily distinguishable from the normal higher pitch beep emitted when a key is pressed when operating from a sufficiently charged battery. The battery should be replaced to ensure correct operation.

6. LINE TESTS

6.1. PAIR IDENTIFICATION

Power on the OSCILLATOR by inserting the test lead into the 6-pin socket.

For Pair Identification it is sufficient to connect the OSCILLATOR's blue leads to the line as follows:

- Blue test lead with Red clip to Pair 'a' wire
- Blue test lead with Black clip to Pair 'b' wire

Note: Reverse the clips if the OSCILLATOR beeps, indicating incorrect polarity.

However, should the technician wish to perform additional tests following the Pair Identification process, it is recommended that the following connections be made prior to commencing Pair Identification:

- Red test lead with:
  - Red clip to Exchange 'a' wire (+'ve);
  - Black clip to Exchange 'b' wire (-'ve);
- Blue test lead with:
  - Red clip to Exchange 'a' wire (+'ve);
  - Black clip to Customer 'b' wire (-'ve);
- Connect White lead to the cable sheath ('e');
- Remove jumper.

Note: If the leads are not connected this way then it is possible to short a customer's working service if the cross-connection (links, jumper, etc.) have not been opened and the OSCILLATOR is switched to EXCHANGE CONNECT mode. Similarly, a short circuit can occur when the cross-connection is being restored and the Oscillator has been left in EXCHANGE CONNECT mode.

Move to the Far End of the Line and use the PROBE tip to identify the cable pair carrying the OSCILLATOR tone signal. Confirm the pair by selecting a different mode and checking that the OSCILLATOR's tone stops. The PROBE's sensitivity (volume) can be adjusted by using the TONE key (refer to section 5.3 ((•)) TONES).

6.2. CHECK FOR BALANCED PAIR

This is accomplished by moving the PROBE tip between the 'a' and 'b' wires of the cable pair carrying the signal and identifying a null point (place of negligible signal volume). If no null point is found then the cable pair is unbalanced and a cable fault is likely present (refer to section 6.3 FAULT LOCATION).

6.3. FAULT LOCATION

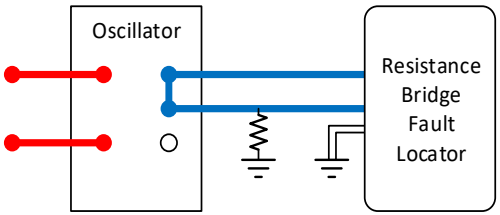
A technician should refer to their fault location test instrument's manual for more details. In these manuals the Oscillator is often referred to as a Remote or Far End Device (FED).

6.3.1. **Two Wire Test**

This test is performed on a pair containing one good wire and one faulty wire with leakage to ground. The test requires the use of a Resistance Bridge in addition to the Loop-a-Line. The test is as follows:

- At the Exchange, connect the Blue and Red OSCILLATOR leads (refer section 6.1 PAIR IDENTIFICATION);

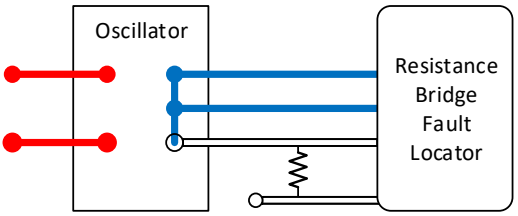
- At the customer end, identify the line pair and connect the PROBE test leads, then press key;
- Disconnect the PROBE and connect the Resistance Bridge and locate the fault (as per the instrument's manual).



6.3.2. **Three Wire Test**

The Three Wire Method for resistance fault location is used when there is a "good" pair available in the cable and the other two wires of the "faulty" pair have fault resistance between them, or both have fault resistance to ground. If only one wire of the pair is faulty, the Two Wire Method can be used. The Three Wire test is performed as follows:

- Connect the Blue Oscillator leads to a good pair and the White Oscillator lead to one wire of the faulty pair;
- Connect the PROBE's blue leads to the good pair at the Far End;
- Press SHORT (WITH GROUND) to connect the Blue leads and the White lead together;
- Disconnect the PROBE and carry out fault location using a Resistance Bridge.



6.3.3. **Pulse Echo Test (PET/TDR)**

The SHORT / OPEN mode can be used to calibrate a PET (TDR) for length of line to Oscillator.

7. SPECIFICATIONS

7.1. OSCILLATOR

- Battery 9 V, alkaline IEC 6LR61
- LED low battery indication
- Short circuit detection, battery reverse polarity on Blue test leads
- Weight and dimensions: 110 g 240 mm x 35 mm x 25 mm

Mode 1: Tone (Pair I/D)
- Tone output 1 kHz-2 kHz
- Selectable warble(default), continuous, two tone beeps repeating and three tone beeps repeating
- Enable/disable buzzer for short circuit & battery reverse polarity detection
- Max consumption, line pair short circuited and buzzer enabled = 8.8 mA (70.5 hours, 580 mAh battery)
- Tone output level into Line +9 dBm into 600 Ω
- Output impedance 600 Ω

Mode 2: Open Circuit
- Current consumption approx. 0.75 mA
- Resistance between terminals > 1GΩ
- Max open circuit voltage 500 V dc
- Line Balance: 54 pF (black clip-red clip), 58 pF (black clip-ground plane), 72 pF (red clip-ground plane)

Mode 3, Mode4: Short Circuit (with or without ground)
- Current consumption approx. 0.75 mA
- Max short circuit current 2 A
- Resistance between terminals, < 0.30 Ω

Mode 5: Connect Exchange
- Current consumption approx. 0.75 mA

Mode 6: 600 Ω termination
- 600 Ω or 900 Ω cable pair termination, configuration for noise measurement
- Current consumption approx. 0.75 mA

7.2. PROBE

- Battery 9 V, alkaline IEC 6LR61
- Low battery indication using low frequency beep
- Tone receiver, loudspeaker or earphone output (<2000 Ω)
- High and low tone sensitivity settings
- Tone receiver mode automatically powers off after 2 minutes
- Max current consumption in tone receiving mode approx. 98 mA
- Current consumption in other modes <1 uA
- Green/Red LED shows exchange connected
- Weight and dimensions: 130 g 200 mm x 50 mm x 28 mm