



UltraTEV Locator Probe Operating Manual

Model Number: UTL2

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Safety Precautions and Procedures

The UltraTEV Plus² and Locator probe are designed to detect partial discharge sources in High Voltage (HV) Plant.

If no discharges are detected, this does not necessarily imply that an item of HV Plant is discharge free. Discharge sites often have dormant periods and insulation structures can fail through causes other than those attributable to partial discharges.

If discharges of considerable magnitude are detected in plant that is connected directly to the high voltage power system, the authority responsible for the plant should be notified.

Warnings

- The UltraTEV Plus² and Locator probe are designed for use at ground potential only.
- When testing electrical plant ensure that the metalwork is earthed before applying the UltraTEV Plus² and Locator probe.
- Maintain safety clearances between structures at high voltage and the instrument and the operator at all times.
- Adhere strictly to local safety procedures.
- Do not make measurements when there are electrical storms in the vicinity.
- Do not make measurements immediately following the energisation of a circuit.
- Do not disturb plant during measurements either mechanically e.g. by shaking or striking it, electrically e.g. by increasing the voltage or physically e.g. by applying heat.
- Do not operate the instrument or its accessories in an explosive atmosphere.

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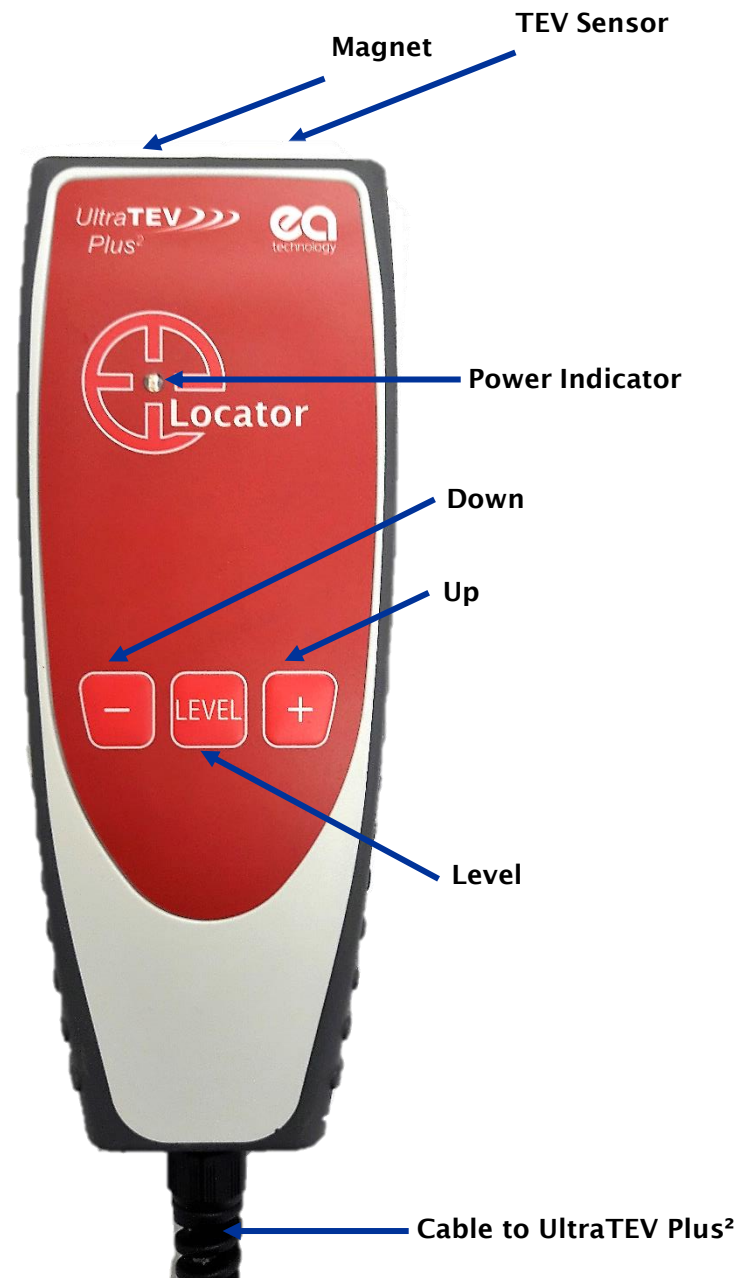
1. General Description

1.1 The UltraTEV Locator Probe

The Locator probe is used in conjunction with the UltraTEV Plus² to further locate TEV activity, detected during a routine PD survey of substation assets.

The Locator probe adds a second TEV sensor to the UltraTEV Plus². Both TEV sensors listen for TEV pulses, and when they both detect pulses they calculate the difference in arrival time. The standard Locator mode shows which probe detected the signal first, indicating the source is closer to that probe.

In some cases of PD, such as when multiple sources are present, it can be useful to have more information than which probe is closer to the source. For such cases the Locator Advanced Mode provides additional information in the form of a histogram which can be used to accurately assess the live data. This live data can be used to locate multiple sources at the same time.



The Locator probe is supplied in its own carry case which can be attached to the top or bottom of the UltraTEV Plus² carry case, by rotating the blue T-lock.

1.2 Non-Intrusive Detection of Partial Discharge Activity

Partial discharges are electric discharges that do not completely bridge the electrodes. The magnitude of such discharges is usually small however they do cause progressive deterioration of insulation that may lead to eventual failure.

Non-intrusive partial discharge detection provides a means for identifying these potential sources of insulation failure that result not only in loss of supply to customers but can also endanger staff.

A partial discharge emits energy in the following ways:

Electromagnetic:

- Radio
- Light
- Heat

Acoustic:

- Audio
- Ultrasonic

Gases:

- Ozone
- Nitrous oxides

The most practical techniques for non-intrusive testing are based on the detection of the radio frequency part of the electromagnetic spectrum and ultrasonic emissions. The UltraTEV range has been specifically developed to enable electromagnetic and ultrasonic activity to be detected in a single simple to use instrument.

Airborne Ultrasonic Discharge Activity

Acoustic emission from partial discharge activity occurs over the whole acoustic spectra. Audible detection is possible but depends on the hearing ability of the individual. Using an instrument to detect the ultrasonic part of the acoustic spectra has several advantages. Instruments are more sensitive than the human ear, are not operator dependent and operating above the audible frequency are more directional.

The most sensitive method of detection is using an airborne ultrasonic microphone centred at 40 kHz. This method is very successful at detecting partial discharge activity provided there is an air passage between the source and the microphone.

Electromagnetic Discharge Activity

When partial discharge activity occurs within high voltage switchgear it generates electromagnetic waves in the radio frequency range which can only escape from the inside of the switchgear through openings in the metal casing. These openings may be air gaps around covers, or gaskets, or other insulating components. When the electromagnetic wave propagates outside the switchgear it also impinges on the metal casing of the switchgear producing a transient in the earth potential. The Transient Earth Voltage (TEV) is only a few millivolts and lasts only a short time with a rise time of a few nanoseconds.

2. Preparations for use

2.1 Connecting the Locator probe to the UltraTEV Plus²

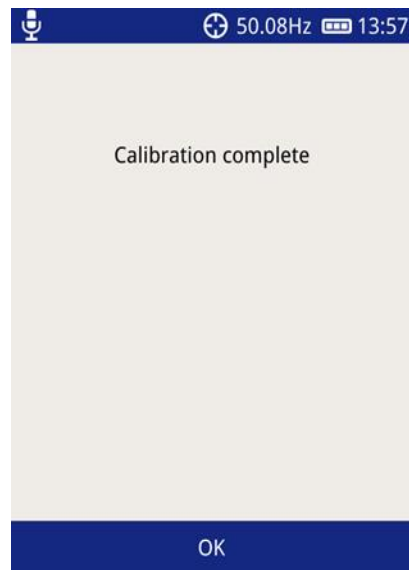
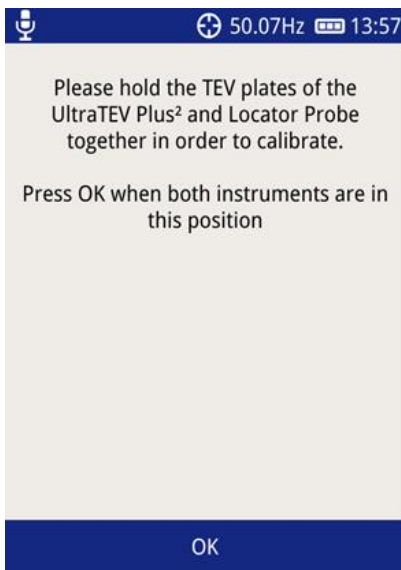
The Locator probe has a fixed 2m cable and a 6m extension cable for a maximum location range of 8 metres. The Locator probe is plugged directly into the UltraTEV Plus² accessory port. When the Locator probe is connected, the UltraTEV Plus² will automatically program the Locator probe with the correct version of firmware. This process takes between 2 and 4 seconds. When the Locator probe is ready to use, the Power Indicator will illuminate red.



2.2 Calibrate

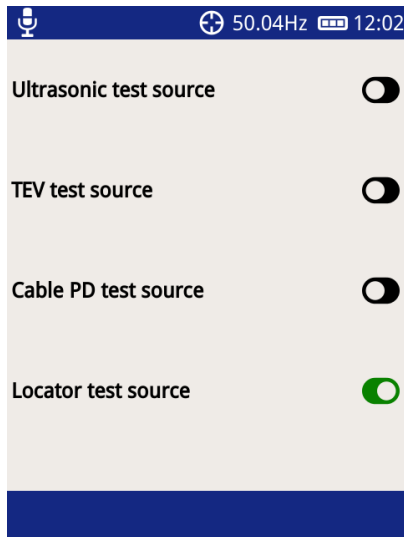
Each time a Locator probe is connected to an UltraTEV Plus², it will need to be calibrated to the UltraTEV Plus².

With the Locator probe connected to the UltraTEV Plus², select Locator/Locator Advanced Mode and follow the on screen instructions.

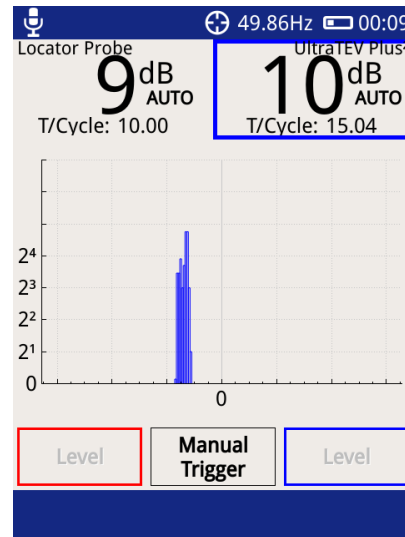


2.3 Locator probe Function Check

The Locator probe function check is designed to allow users to verify the functionality of their instrument using an in built test source. From the Main Menu, navigate to Function Check then toggle on the Locator Test Source and navigate back to the Locator Advanced screen. Hold the Locator probe and the UltraTEV Plus² together (TEV plate to TEV plate), the Locator Advanced screen will show the histogram peak on the left hand side of 0, closest to the Locator probe, as shown below:



Function Check Menu



Function Check in Locator Advanced Screen



Do not take measurements with the test source turned on.

The Calibrate process and Function Check are not a substitute for annual factory calibration.

3. Operating Instructions

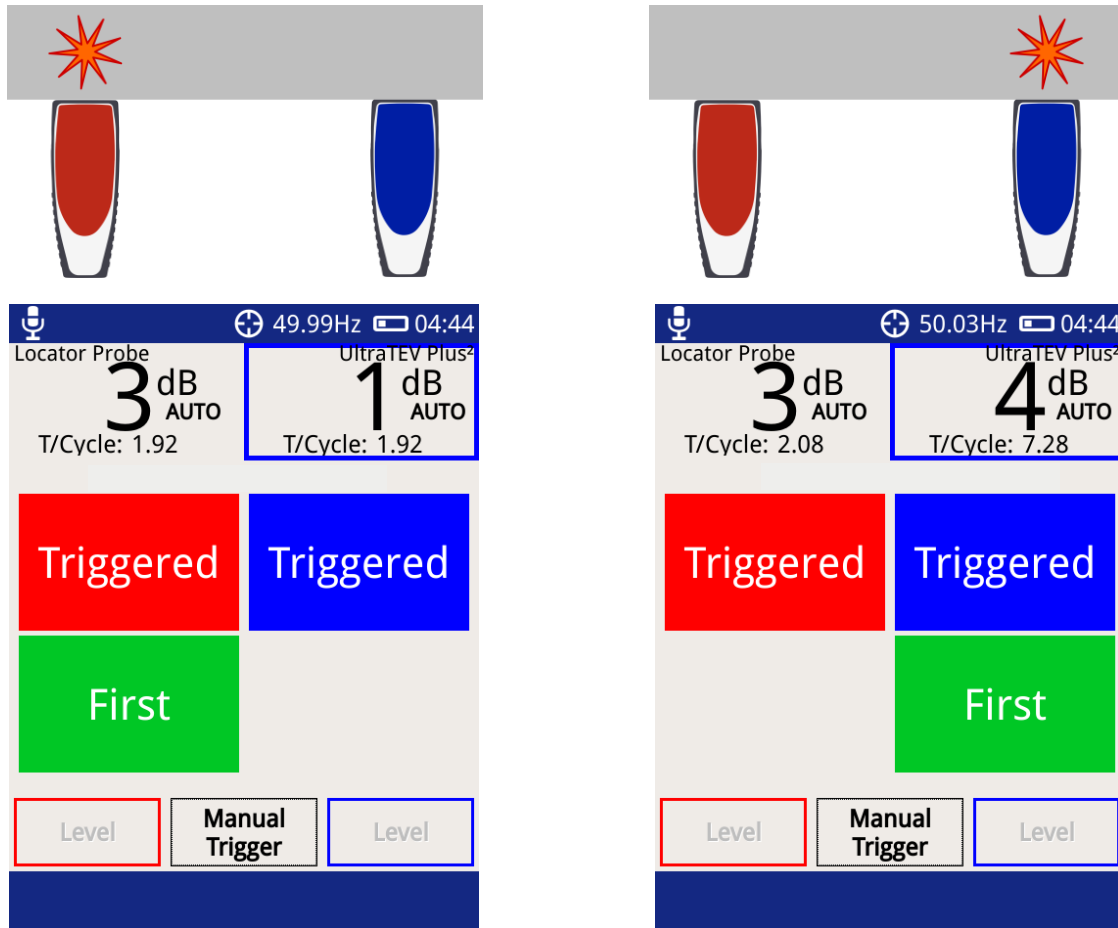
It is recommended, but not required, that during locating, the user holds the UltraTEV Plus² in their right hand and the Locator probe in their left hand, so the trigger levels and indicators are on the correct sides of the UltraTEV Plus² screen. When locating across larger distances, the Locator probe can be attached to the switchgear using the magnet which is located behind the TEV plate at the top of the probe. The Locator probe should be placed on the switchgear in a vertical position, to allow correct fixing of the magnet.



The Locator Probe and UltraTEV Plus² should be used 10cm or more apart, to allow discrimination between the two probes.

3.1 Locator Mode

From the UltraTEV Plus² Main Menu, select TEV and then Locator. Locator mode can be used to locate PD by showing which probe detected the TEV signal first. It shows this with a green 'First' indicator on the blue/right side if the UltraTEV Plus² is closest to the source, or the red/left side if the Locator probe is closest to the source.



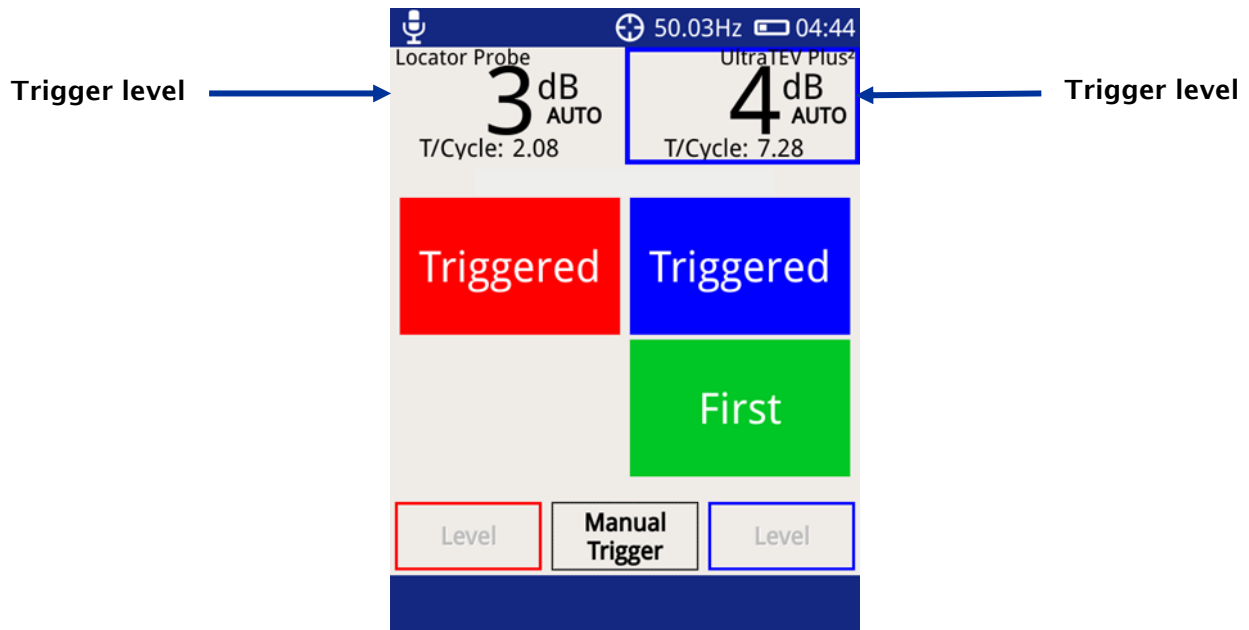
PD source closest to Locator probe

PD Source closest to UltraTEV Plus²

3.1.1 Trigger Levels

For accurate determination of precedence, it is important that the trigger levels are set to a suitable value. The trigger level sets the threshold of the detection circuits so that no pulses/signals below the trigger level are detected. Therefore, it is important to ensure that the trigger levels are set to higher than the noise floor, whilst also comfortably below the maximum level of the PD.

In most situations, the trigger levels should be of similar value on each probe and not deviate by more than 5dB. Having the trigger levels more than 5dB apart may effect the accuracy of results.



3.1.2 Auto Trigger Mode/Manual Trigger Mode

The Locator probe can be used in either Auto Trigger mode or Manual Trigger mode.

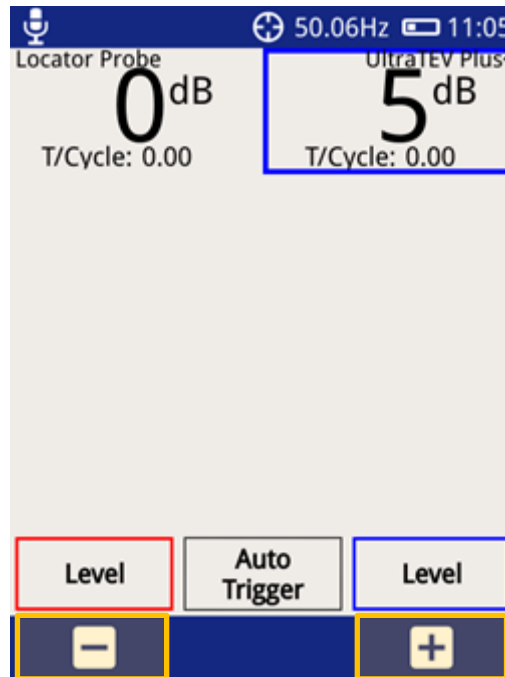
In Auto Trigger mode, the Locator probe will automatically set the trigger levels to be slightly above the noise floor, meaning triggers are always present (unless the noise floor is below 0dB). This mode can be used to determine the approximate noise floor of the measurement and to get an approximate overview of the current PD activity.

To set the Locator into Auto Trigger mode, press the Auto Trigger button in the bottom centre of the screen. If the button contains the following text "Manual trigger" the unit is currently in Auto Trigger Mode.

In Manual Trigger mode, the trigger levels are manually controlled using either the Locator probe or UltraTEV Plus² buttons. Manual Trigger mode gives the user more control meaning the user can adjust the trigger levels as the situation requires, allowing more accurate measurements to be taken.

To set the Locator probe into Manual Trigger mode, press the Manual Trigger button in the bottom centre of the screen. If the button contains the following text "Auto Trigger" then the unit is already in Manual Trigger mode.

You can also set the Locator probe into Manual Trigger mode by pressing the Level button on the Locator probe, or the level button's on the UltraTEV Plus² screen.



When in Manual Trigger mode, the level buttons on the UltraTEV Plus² screen can be used to control the trigger levels for each probe.

3.1.3 Level Buttons

The Locator probe also has an automatic levelling function. This function determines the maximum trigger levels present and sets the trigger level to comfortably below this value. If the level buttons are pressed when in Auto Trigger mode, the unit is set into Manual Mode automatically.

The level functionality can be completed on both probes independently.

To complete the level function on the Locator probe;

- Press the level button on the Locator probe.
- Press the Locator probe channel level button on the UltraTEV Plus² screen.

To complete the level function on the UltraTEV Plus²;

- Press the UltraTEV Plus² channel level button on the UltraTEV Plus² screen.



The trigger level returned by the level functionality is not a PD TEV measurement. The Locator probe algorithms have been specifically designed to return a value which is below the maximum TEV level detected. For TEV measurements the UltraTEV Plus² should be used.

3.1.4 Triggers Per Cycle

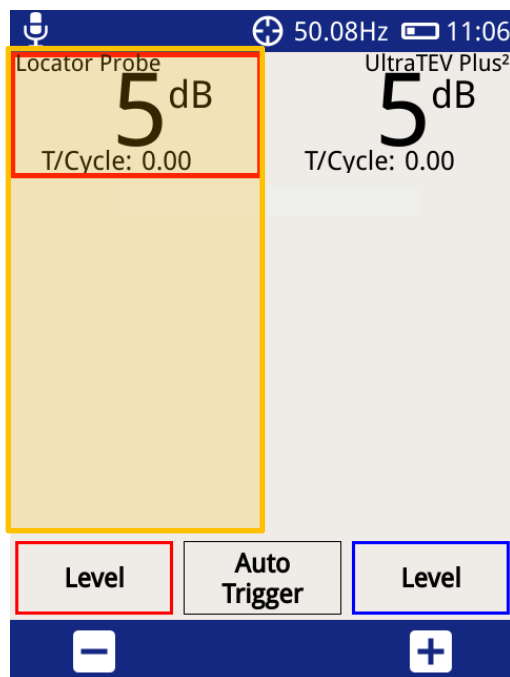
For each probe there is a T/cycle indication which correlates to the number of triggers detected per 20mS (the period of a 50Hz phase cycle).

This can be used to confidence check that the unit is triggering on PD. For example, if the T/cycle indicator is in the hundreds, it is likely that the trigger levels have entered the noise floor. PD is nominally between 1 – 30 T/cycle.

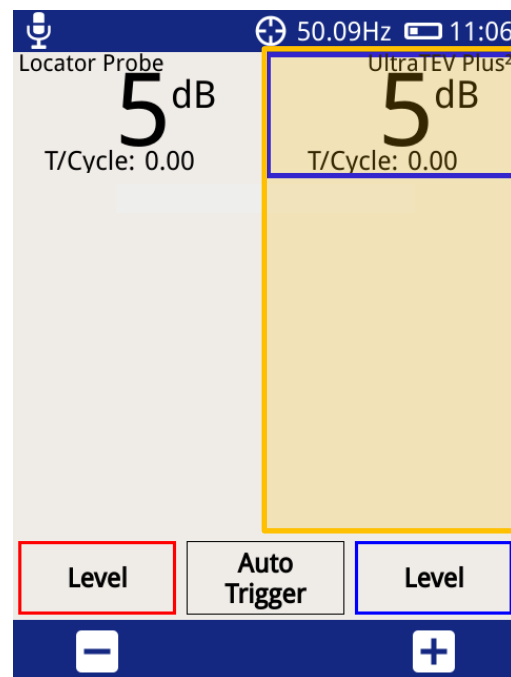
3.1.5 Controlling the Locator probe from the UltraTEV Plus²

The Locator probe settings can be changed from the UltraTEV Plus². This can be useful if you are using the extension cable with the Locator probe fixed in place while moving around with the UltraTEV Plus².

The highlight around the trigger level indicator shows which sensor is being controlled from the UltraTEV Plus². By default, this is on the UltraTEV Plus² channel, press on the left half of the screen to switch control to the Locator probe, indicated by that channel highlighted in red. Press on the right side of the screen to switch control back to the UltraTEV Plus².



Adjusting the Locator probe



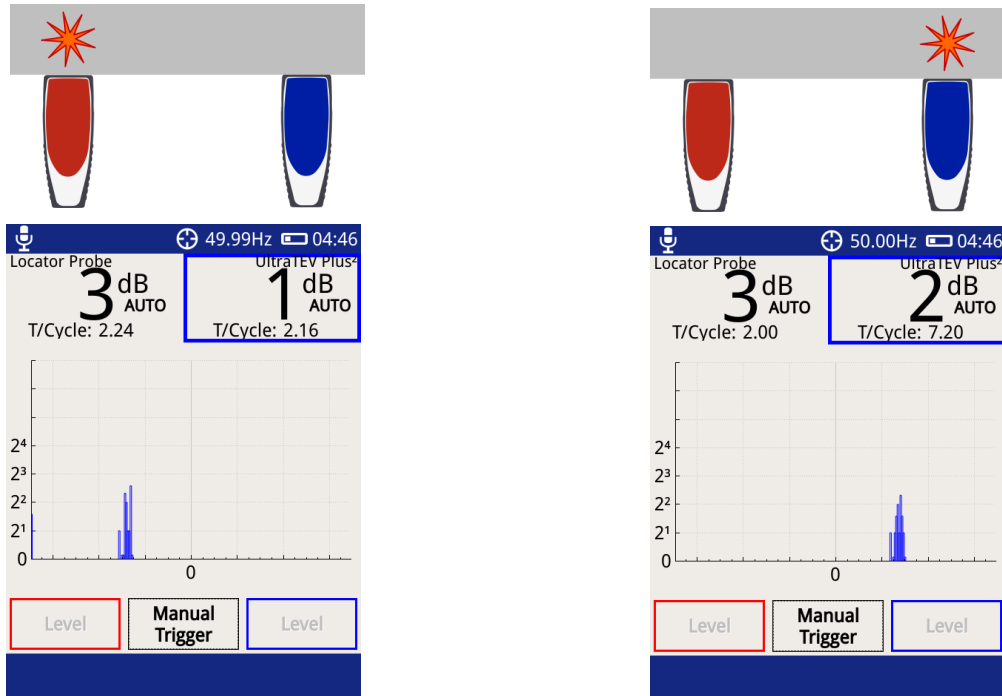
Adjusting the UltraTEV Plus²

3.2 Locator Advanced Mode

When more detail is required than simply knowing which probe a PD source is closest to, for example when there is more than one source, Locator Advanced mode can provide more information than the standard Locator mode.

The controls, trigger levels and basic operation is the same as standard mode, however the UltraTEV Plus² display shows a histogram of all received pulses. This can show not only which probe is closest to the source but can be used to locate multiple sources.

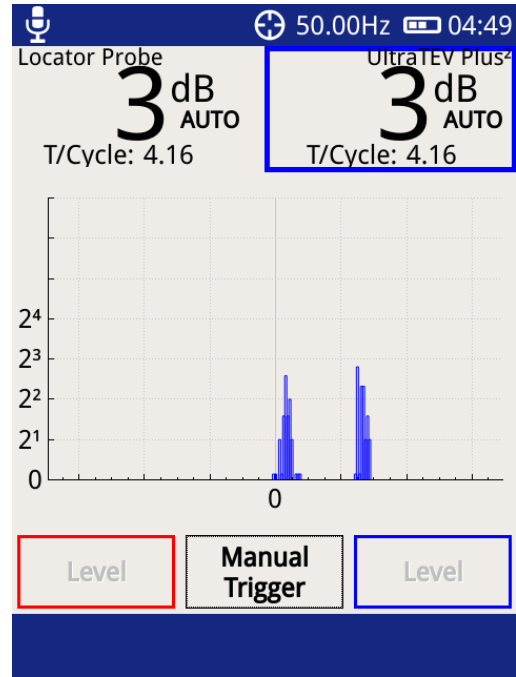
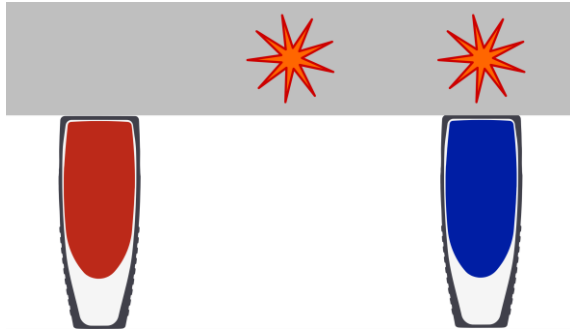
The below images show locating a single source with Locator Advanced mode:



When the histogram peak is on the left hand side of 0, the source is determined to be closer to the Locator probe.

When the histogram peak is on the right hand side of 0, the source is determined to be closer to the UltraTEV Plus².

Multiple PD sources will show as separate peaks on the histogram. On the example below, one source is directly between the two probes, and one is closer to the UltraTEV Plus².



The trigger levels, Auto Trigger/Manual Trigger modes, Level functionality and T/Cycle indicators function the same in Locator Advanced mode as the standard Locator Mode.

4. Technical Specification

4.1 General

4.1.1 TEV Measurements

Sensor:	Capacitive
Measurement Range:	0 – 60 dBmV
Measurement Bandwidth:	3 – 80 MHz
Resolution:	1dB
Accuracy:	±1dB

4.1.2 Precedence

Resolution	0.1nS
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4.1.3 Hardware

Enclosure:	Self-coloured injection moulded plastic case
Indicators:	Power indicator LED
Controls:	3 x Push-Buttons
Connectors:	Cable to UltraTEV Plus ²
Operating Time:	~5hrs

4.1.4 Dimensions

Size:	201mm x 76mm x 34mm
Weight:	0.36kg

4.2 Environmental

Operating Temperature:	-20 to +50 °C
Humidity:	0 - 90 % RH non-condensing
IP Rating:	42

4.3 Accessories and Options

The Locator probe is supplied in a protective carry case containing:

UltraTEV Locator probe
Extension Cable 6m (8m total)
Operating Manual

For spares and accessories please contact:
Email: sales@eatechnology.com

5. Declaration of Conformity

Hereby, EA Technology declares that the equipment described in this document is in compliance with all applicable EU Directives and UK Statutory Instruments.

The full text of the EU and UK declarations of conformity are available at the following internet address: www.eatechnology.com/declaration

Claims of compliance made in any document other than the relevant declaration of conformity are for guidance only.

6. Maintenance

No attempt should be made to gain access to the internal circuitry of the UltraTEV Plus², Locator probe or its accessories. Advice should be sought from the manufacturer, or the supplier, if any doubt exists over the equipment's performance or operation.

Avoid storage in damp and humid conditions and do not subject it to temperature extremes, excessive vibration or shocks

7. Warranty Policy

What Does the Warranty Policy Cover?

EA Technology products and accessories are warranted against defects in material and workmanship for twelve months from the date of despatch from our premises.

During the warranty period, EA Technology will, at its option, either repair or replace products, parts or accessories which prove defective.

What is Not Covered by the Warranty Policy?

The following are not covered: damage caused by accident, misuse, abuse, product modification or neglect; damage resulting from failure to follow instructions contained in your operating manual; damage resulting from the performance of repairs by someone not authorised by EA Technology.

Warranty Policy for Repairs

Repaired products are warranted against defects in workmanship and materials for a period of six months, or the remainder of the original warranty period, whichever is greater.



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8. Calibration

The Locator probe does not require recalibration. We recommend that it is returned for a functional check with the UltraTEV Plus², during annual calibration of the UltraTEV Plus².

For information about calibration of the UltraTEV Plus², please refer to the UltraTEV Plus² operating manual.

9. Repair

For information on repairs



product-support@eatechnology.com

10. Waste Electrical and Electronic Equipment Directive (WEEE)

EA Technology is a member of an approved compliance scheme as defined by the WEEE directive. When an EA Technology product reaches the end of its operational life, it must be recycled by a licensed waste management operator or returned to EA Technology for recycling.

11. Continuous Improvement

EA Technology has a policy of continual product development and enhancement. Consequently, there may be minor variations in specifications or operation that are not covered in this operating manual.

Every effort has been made to ensure that the information provided in this operating manual is accurate at the time of going to print.

If any errors or omissions are noticed, please notify



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13. Record of Changes

Date	Version	Changes
June 2018	V01.00.00	First Issue
August 2019	V01.01.00	Specification & calibration section updated
July 2021	V01.02.00	Removed DoC to website
July 2021	V01.03.00	Added Maintenance information

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Global Footprint

We provide products, services and support for customers in 90 countries, through our offices in Australia, China, Europe, Singapore, UAE and USA, together with more than 40 distribution partners.



Our Expertise

We provide world-leading asset management solutions for power plant and networks.

Our customers include electricity generation, transmission and distribution companies, together with major power plant operators in the private and public sectors.

- Our products, services, management systems and knowledge enable customers to:
- Prevent outages
- Assess the condition of assets
- Understand why assets fail
- Optimise network operations
- Make smarter investment decisions
- Build smarter grids
- Achieve the latest standards
- Develop their power skills

Safer, Stronger,
Smarter Networks