Operating Manual

Portable Fault Locating System

EZ-Thump

Mess- und Ortungstechnik
Measuring and Locating Technologies

Elektrizitätsnetze
Power Networks

Kommunikationsnetze
Communication Networks

Rohrleitungsnetze
Water Networks

Leitungsortung
Line Locating

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ENG

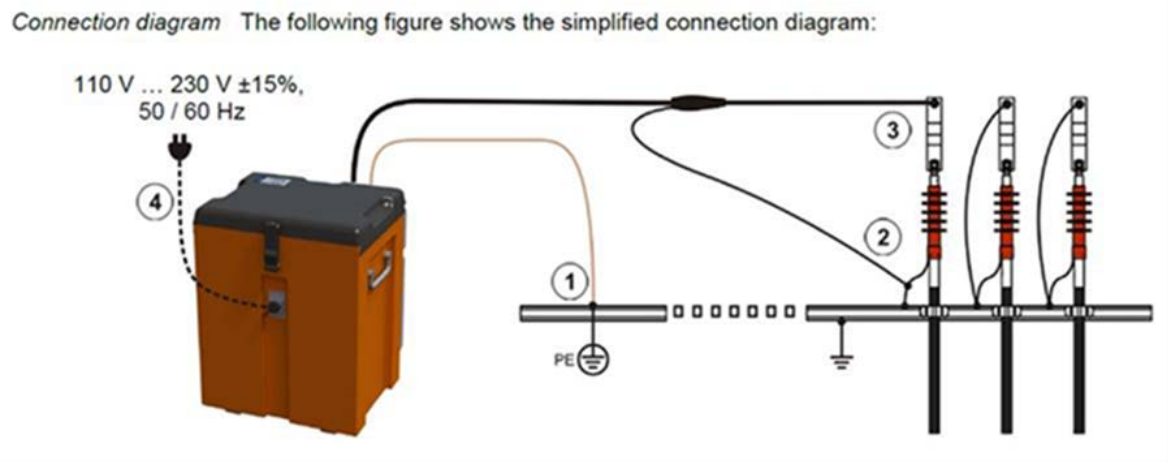
IMPORTANT ADVISORY NOTICE

It has recently come to our attention that some users are not connecting the EZ Thump correctly. Safety is paramount and Megger is acting upon this information as a responsible supplier to ensure that it conveys the importance of using this equipment within the guidelines.

The EZ Thump MUST be connected as explicitly stated in the User Guide that accompanies the instrument. If the user fails to follow these instructions, a hazard may arise exposing a risk to the user, with subsequent damage to the equipment.

The diagram below is an extract from the User Guide:

The EZ thump has one High Voltage output lead (labelled 3) and two earth return leads. The HV earth return lead (labelled 2) is the measurement lead and must be connected to the test piece and to earth (ground) for safety. The safety earth (labelled 1) is an additional earth return path that must also be connected to ground, close to the user, so that if the HV return is accidentally disconnected this additional safety earth redirects the output current safely through the unit.



To ensure correct earth connection between return earth (2) and additional safety earth (1), a measurement must be made using an appropriate ohmmeter. The user can then confirm the resistance between earth connections 1 and 2 is no more than 5 ohms. This information is specified in the User Guide.

In Version 1 EZ Thumps it is also advised to check the safety earth, before connection to the test piece. This is done by measuring between the HV earth return and safety earth return leads (labelled 1 and 2 in the diagram). This value should be 100 ohms +/- 10 ohms. If the measurement is not 100 ohms +/- 10 ohms, please return the unit to your local Megger Authorised Service centre for investigation.

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V1 EZ Thumps can be identified by the serial number sticker on the operator plate. Another means of identifying V1 units have their associated leads stored in the back of the unit.

Version 2 EZ Thumps have an additional earth measurement functionality (F-Ohm). This continuously monitors the earth return and automatically disables the test if a reading between measurement and safety earth exceeds 5 ohms. Consequently, the advisory comment above regarding the 100 ohm check does not apply.

V2 units can be identified by the serial number sticker on the operator plate. Another means of identifying V2 units is that the leads are stored in a fabric case on top of the lid, as well as an IEC socket on the front of the unit. V2 units are always grey in colour.

All users must be aware that this instrument outputs high voltage and must only be used by competent, trained engineers. Full operational details are in the user guide which shall always accompany the unit. All safety warnings in the user guide must be adhered to. Megger can provide training on the EZ thump and any other Megger products if required.

If you have any queries on the above, please contact Megger.

Consultation with SebaKMT

The present system manual has been designed as an operating guide and for reference. It is meant to answer your questions and solve your problems in as fast and easy a way as possible. Please start with referring to this manual should any trouble occur.

In doing so, make use of the table of contents and read the relevant paragraph with great attention. Furthermore, check all terminals and connections of the instruments involved.

Should any question remain unanswered, please contact:

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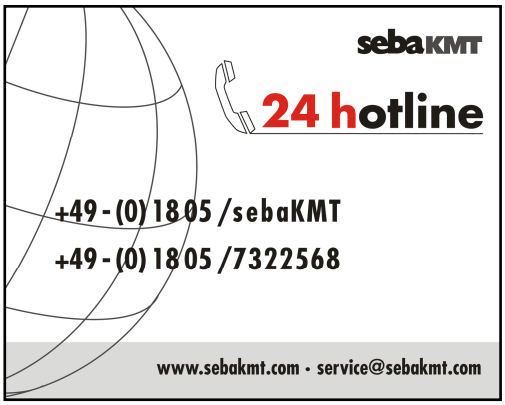


Terms of Warranty

SebaKMT accept responsibility for a claim under warranty brought forward by a customer for a product sold by SebaKMT under the terms stated below.

SebaKMT warrant that at the time of delivery SebaKMT products are free from manufacturing or material defects which might considerably reduce their value or usability. This warranty does not apply to faults in the software supplied. During the period of warranty, SebaKMT agree to repair faulty parts or replace them with new parts or parts as new (with the same usability and life as new parts) according to their choice.

SebaKMT reject all further claims under warranty, in particular those from consequential damage. Each component and product replaced in accordance with this warranty becomes the property of SebaKMT.

All warranty claims versus SebaKMT are hereby limited to a period of 12 months from the date of delivery. Each component supplied by SebaKMT within the context of warranty will also be covered by this warranty for the remaining period of time but for 90 days at least.

Each measure to remedy a claim under warranty shall exclusively be carried out by SebaKMT or an authorized service station.

To register a claim under the provisions of this warranty, the customer has to complain about the defect, in case of an immediately detectable fault within 10 days from the date of delivery.

This warranty does not apply to any fault or damage caused by exposing a product to conditions not in accordance with this specification, by storing, transporting, or using it improperly, or having it serviced or installed by a workshop not authorized by SebaKMT. All responsibility is disclaimed for damage due to wear, will of God, or connection to foreign components.

For damage resulting from a violation of their duty to repair or re-supply items, SebaKMT can be made liable only in case of severe negligence or intention. Any liability for slight negligence is disclaimed.

Contents

1 Safety Advices

1.1 General Notes

Safety precautions

This manual contains basic instructions on commissioning and operating the EZ-Thump system. For this reason, it is important to ensure that the manual is available at all times to authorised and trained personnel. Any personnel who will be using the devices should read the manual thoroughly. The manufacturer will not be held liable for any injury or damage to personnel or property through failure to observe the safety precautions contained in this handbook.

Locally applying regulations have to be observed.

Labelling of safety instructions

Important instructions concerning personal, operational and technical safety are marked in the text as follows:

Symbol	Description
 **WARNING**	Indicates a potential danger that may lead to fatal or serious injury.
 **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or material damage.
	The notes contain important information and useful tips for using the system. Failure to observe them can render the measuring results useless.

Working with products from SebaKMT

It is important to observe the general electrical regulations of the country in which the device will be installed and operated, as well as the current national accident prevention regulations and internal company rules (work, operating and safety regulations).

After working with the equipment, make sure to de-energise, protect against re-energising, discharge, earth and short-circuit the instrument and installations that have been worked on.

Use genuine accessories to ensure system safety and reliable operation. The use of other parts is not permitted and invalidates the warranty.

Operating staff

This system and its peripheral equipment may only be operated by trained or instructed personnel. Anyone else must be kept away.

The system may only be installed by an authorised electrician. DIN VDE 0104 (EN 50191), DIN VDE 0105 (EN 50110) and the German accident prevention regulations (UVV) define an electrician as someone whose knowledge, experience and familiarity with the applicable regulations enables him to recognise potential hazards.

Repair and maintenance

Repairs and service must only be done by SebaKMT or authorised service departments of SebaKMT. SebaKMT recommends having the equipment serviced and checked once per year at a SebaKMT service location.

SebaKMT also offers direct on-site support. Please contact our service office for more information.

1.2 General Cautions and Warnings

Intended application

Safe operation is only realised when using the equipment for its intended purpose (see chapter 2.1). Using the equipment for other purposes may lead to human danger and damage of equipment of involved installations.

The limits described under technical data may not be exceeded. Operating products of SebaKMT in condensing environment may lead to flash-over, danger and damage. The instruments should only be operated under tempered conditions. It is not allowed to operate SebaKMT products at direct contact with humidity, water or near aggressive chemicals nor explosive gases and fumes.

Behaviour at malfunction of normal operation

The equipment may only be used when working properly. When irregularities or malfunctions appear that cannot be solved consulting this manual, the equipment must immediately be put out of operation and marked as not functional. In this case inform the person in charge who should inform the SebaKMT service to resolve the problem. The instrument may only be operated when the malfunction is resolved.

Five safety rules

The five safety rules must always be followed when working with HV (High Voltage):

1. De-energise
2. Protect against re-energising
3. Confirm absence of voltage
4. Earth and short-circuit
5. Cover up or bar-off neighbouring energised parts

Using cardiac pacemaker

Physical processes during operation of high voltage may endanger persons wearing a cardiac pacemaker when near these high voltage facilities.

Wear Ear Protection

Surge operation can cause high and sudden noise levels. It is strongly recommended to wear hearing protection during surge operation. Keep in mind that this will limit the operators awareness for ambient dangers.

Ventilation

The surge operation creates ozon. It is necessary to operate the instrument under well ventilated condition to keep ozon levels below limit values for the operator.

Fire fighting in electrical installations

- According to regulations, carbon dioxide (CO_2) is **required to be used** as extinguishing agent for fighting fire in electrical installations.
- Carbon dioxide is electrically non conductive and does not leave residues. It is safe to be used in energized facilities as long as the minimum distances are maintained. A CO_2 fire extinguisher must be always available within electrical installations.
- If, contrary to the regulations, any other extinguishing agent is used for fire fighting, this may lead to damage at the electrical installation. SebaKMT disclaims any liability for consequential damage. Furthermore, when using a powder extinguisher near high-voltage installations, there is a danger that the operator of the fire extinguisher will get an electrical shock from a voltage arc-over (due to the powder dust created).
- It is essential to observe the safety instruction on the extinguishing agent.
- Applicable is DIN VDE 0132.

WARNING

Dangers when operating with HV

Special attention and safety-conscious behaviour is needed when operating HV facilities and especially non-stationary equipment. The regulations VDE 0104 about setting up and operation of electric test equipment, i.e. the corresponding EN 50191 as well as country-specific regulations and standards must be observed.

- The EZ-Thump generates a dangerous voltage of up to 12 kV during operation. This is supplied via a HV cable to the test object.
- The system may not be operated without supervision.
- Safety installations may not be by-passed nor deactivated.
- To avoid hazardous electric charges of metallic parts in the vicinity, all metallic parts must be earthed.

2 Technical Description

2.1 System Description

Functional description

The EZ-Thump is a compact and light weight fault locating system intended to be used for locating faults on power cables in low voltage and medium voltage networks.

For a successful fault location procedure, the operator must only follow the instructions on the display. The EZ-Thump guides the operator through the following three modes of operation which are performed one after the other in an automated procedure:

- DC test (cable is tested to determine breakdown voltage)
- Prelocation (distance to fault is determined through ARM method)
- Direct surge mode (fault is pinpointed)

Features

The EZ-Thump system unites the following features and functions in a single device:

- DC test up to 4 or 12 kV with automatic breakdown detection
- ARM prelocation up to 4 or 12 kV
- Automatic surge mode with 500 J of energy
- Battery operation
- Sturdy and weatherproof for outdoor use

Scope of Delivery

The scope of delivery of the EZ-Thump system comprises the following components:

- Charger
- AC power cord
- Connection clamps (attached to the leads of the HV connection cable)
- Operating manual

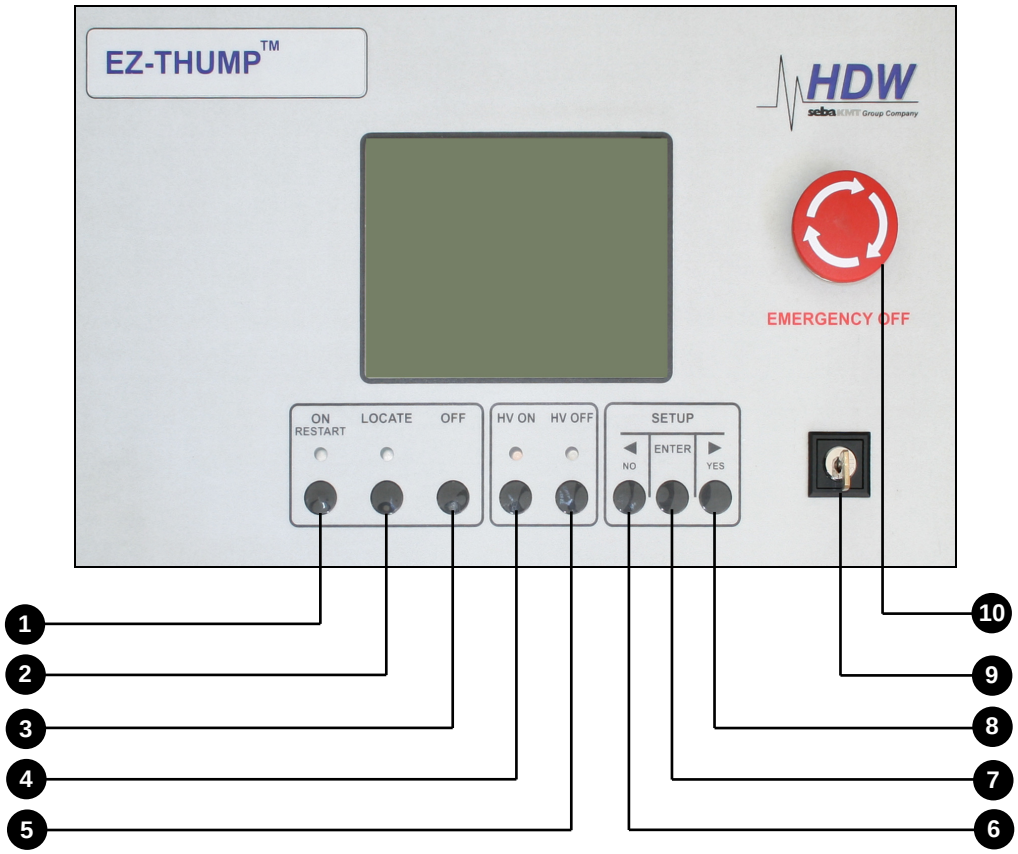
2.2 Technical Data

The EZ-Thump system is defined by the following technical parameters:

Parameter	Value
Test voltage	0 … 12 kV, alternatively 0 … 4 kV (4 kV version)
Surge voltage	0 … 12 kV, alternatively 0 … 4 kV (4 kV version)
Surge energy	500 J at maximum surge voltage
Power supply	110 V … 230 V ±15%, 50 / 60 Hz
Battery	24 V / 5 Ah, integrated
Operating time battery	>30 min (in direct surging mode)
Power consumption	250 VA
Operating temperature mains-operated battery-operated	 -25 ℃ ... +55 ℃ -0 ℃ ... +55 ℃
Storage temperature	-40 ℃ ... +65 ℃
Dimensions (W x H x D)	355 x 280 x 533 mm
Weight	32 kg
Display	320 x 240 pixel LCD
Protection class (in accordance with DIN VDE 0140 Part 1)	I
Protection type (in accordance with EN 60529)	IP 54

2.3 Control Elements

The system has the following controls:



Element	Description
❶	ON / RESTART button with status LED
❷	LOCATE LED - flashes when high voltage is generated (button without function)
❸	OFF button with status LED
❹	“HV ON” button with status LED
❺	“HV OFF” button with status LED
❻	Move cursor left / decrease value / confirm with NO
❼	ENTER button
❽	Move cursor right / increase value / confirm with YES
❾	HV “interlock” key switch
❿	Emergency stop button

3 Setting Up the System

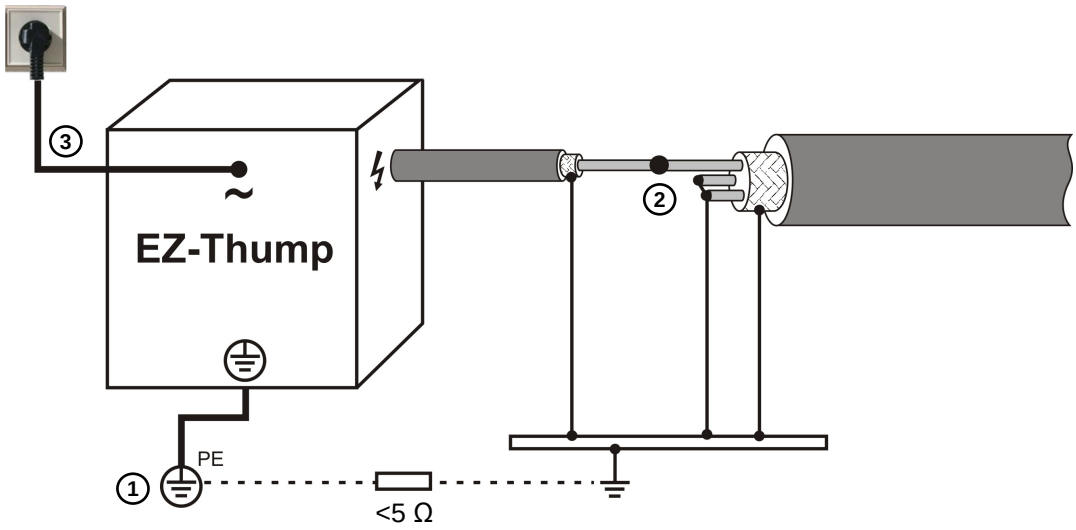
 **WARNING**	**Safety instructions for setting up** • Select a location which is sufficient for the weight and size of the system and ensures that it stands securely. • Never locate the system on top of cable path. • When setting up the system, ensure that it does not impair the function of any other systems or components. If other systems and components have to be modified in order to set up and operate the test system, be sure to reverse these actions when the work is finished. Always take the special requirements of these systems and components into account and only carry out work on them after consulting and obtaining approval from whoever is in charge of them. • Install protective equipment (such as railings, chains or bars) around the test site to block access to the danger zone and prevent the risk of touching live parts. • Always operate the EZ-Thump system in a vertical position. Earth and HV contacts both require a vertical orientation to ensure proper functioning as well as a “Fail Safe Position” in case of an AC or DC power failure or if the unit is shut off.

3.1 Electrical Connection

 **WARNING**	**Safety instructions for the electrical connection** • Always follow the safety instructions in chapter 1 - in particular the five safety rules - before connecting the cable to be tested. • The system may only be connected to or disconnected from a test object when it is switched off, and only when the test object is earthed and shorted. • Since the voltage applied to the test object can assume values that pose a risk of incidental contact, the cable ends must be shielded in accordance with VDE 0104 to avoid this. When doing so, be sure to take all cable branchings into account. • After granting clearance to the test object, make sure that dangerous voltage cannot reach unprotected places or technical equipment. • The discharge switch installed in the device is merely an apparatus for safely discharging capacitance, and not an earthing and shorting device as described by VDE 0104. • All cables which are out of operation and not connected to the system must be shorted and earthed.

Connection diagram

The following figure shows the simplified connection diagram:



Connection sequence

Connect the system in the following order:

Step	Action
①	Connect the safety earth lead from the EZ-Thump unit (flexible copper braid) to a suitable point on the protective earthing system of the station.
②	Connect the HV return lead to the earthed screen of the specific cable to be tested. The resistance between the HV return (operational earth) and protective earth must not be greater than 5 Ω (check with ohmmeter). Connect the HV test lead to the phase conductor to be tested.
③	Plug the supplied power cord into the power socket on the front of the unit and connect it to a mains socket. If no power connection can be established, the unit is operated from internal battery.

CAUTION	The unit is equipped with a NiMH battery. Due to the limited temperature range of that type of batteries, the unit must not be charged or run from battery at ambient temperatures below 0°C or above 55°C.

3.2 Switching On the System

Switching on

Before it is switched on with the **ON** button ❶, the device is in the 'Standby' state.

Once the button is pressed, the system is in the 'Ready for operation' state. The operational readiness is indicated by the lit LED. The controls are activated and the first message appears on the display.

In this state, the high voltage source is still switched off and the high voltage output is earthed via a discharge resistor.

4 Operating the System

High voltage control

Whenever the system needs to generate high voltage, the **HV ON** LED ❹ lights up and the operator is asked to press the **HV ON** button. After the button has been pressed, the **HV ON** LED goes off and the **HV OFF** LED ❺ lights up instead. The system is now in “HV enabled” state and the discharge resistor is disconnected. High voltage can now be present at the HV output.

High voltage can be switched off at any time during the course of the fault location procedure via the **HV OFF** button ❺. In doing so, the HV source is switched off and the HV output is discharged. The fault location procedure can be resumed from the last step by enabling HV again.

In case of an emergency, the system can be instantly switched off by pressing the **emergency stop button** ❿. The system is switched to 'Standby' mode. The HV source is switched off and the HV output is discharged.

The **HV “interlock” key switch** ❾ can be used to interlock HV generation by switching it in ⊖ position. The key can be removed in both positions in order to prevent unauthorized persons from switching position.

Starting the fault location procedure

After the system has been switched on as described in section 3.2, a message on the display prompts to start the HV test. Pressing the **YES** button ❽, starts the complete fault location procedure beginning with the DC test (see section 4.1).

By pressing the **NO** button ❻ the first two steps of the procedure (DC test and fault prelocation) can be skipped and the surge mode can be directly accessed (see section 4.3)

4.1 DC Test (HIPOT)

After the HV test has been started, the system performs a DC test (HIPOT) with a test voltage of up to 4 kV / 12 kV in order to determine the breakdown voltage of the fault.

The operator has to press the **HV ON** button ❹ to start the test. Afterwards, a short system self test followed by the DC test are performed.

After completion of the test, the system automatically switches HV off and displays one of the following messages:

Message	Description
FLASH-OVER AT __ KV	A voltage breakdown has been occurred at the indicted test voltage.
NO FLASH-OVER DETECTED	The cable has successfully withstood the applied DC test voltage.
CABLE FAILED AT 0KV	The cable could not be charged with the test voltage.

This message remains on the display for 5 seconds. Afterwards, the system automatically skips to prelocating mode (see section 4.2).

4.2 Cable Fault Prelocation

After the DC test has been finished, a display message prompts to specify the propagation velocity (V/2) of the cable under test.

If the pre-selected value is correct, the prelocating mode can be started directly by pressing the **YES** button ❽.

By pressing the **NO** button ❻, the pre-selected V/2 value can be changed using the ◄ and ► buttons. The new value can be confirmed pressing the **RESTART** button ❶.

Afterwards, a low voltage impulse is applied to the cable under test to record a reference trace and to identify the cable end. One of the following messages is displayed:

- **NO CABLE DETECTED** (please check the HV connection)
- **OPEN: __ m**
- **SHORT: __ m**

By pressing the **HV ON** button ❹, the operator can now initiate a surge discharge with 4 kV / 12 kV in order to record the fault trace. Depending on whether a fault flash-over took place, one of the following messages appears on the display:

- **NO FLASH-OVER DETECTED**
- **FLT: __ m**

With the information obtained during DC test and fault prelocation, the following conclusions can be drawn:

DC test result	Prelocation result	Most possible conclusion
„FLASH-OVER AT ____ KV“	“FLT: __ OPEN: __m”	The distance indicated behind “FLT:” is the fault distance.
“CABLE FAILED AT 0KV”	“NO FLASH-OVER DETECTED SHORT: __ m”	The fault is most likely a bolted fault or dead short that does not flash-over.
“NO FLASH-OVER DETECTED”	“NO FLASH-OVER DETECTED OPEN: __ m”	The cable is healthy or the breakdown voltage is higher than 4 kV / 12 kV. Repeat the test from other side to confirm.

In order to repeat the prelocation procedure, the **YES** button ❽ has to be pressed.

By pressing the **NO** button ❻, the direct surge mode is started (see section 4.3).

4.3 Direct Surge Mode

The system does automatically pre-select a surge voltage 4 kV higher than the determined breakdown voltage.

By pressing the ◄ and ► buttons, the preselected value can be changed manually.

The selection has to be confirmed with the **RESTART** button ❶.

By pressing the **HV ON** button ❹ automatic surging is started.

Subsequently, the surge capacitor is continuously discharged into the cable as soon as the capacitor has been charged with the specified surge voltage.

Meanwhile, the fault can be pinpointed at the determined fault position with a surge wave receiver like the Digiphone.

 **WARNING**	Don't leave the system accessible and unattended while pinpointing the fault. Protect the site against unauthorized access or instruct an authorized person to supervise the system.

After the fault has been pinpointed, surging can be stopped by pressing the **ENTER** button ❼.

4.4 Completing the Operation

After the fault location procedure has been finished, the system has to be switched off by pressing the **OFF** button ❸ and disconnected from power.

The test object is to be earthed and shorted. Afterwards, the system can be disconnected from the test object.

 **WARNING**	• Follow the five safety rules described in section 1.2. • Switching off by pressing the **OFF** button ❸ sets the unit into 'Standby' state. The unit can be set completely inoperative by disconnecting from mains and turning HV "interlock" key switch ❾ to locked position. • Disconnect the power cord from the mains socket before disconnecting the power cord from the power supply socket of the unit. • Even if proper disconnection and discharging has taken place, system components which have been under voltage should only be touched, if they have been visibly earthed and shorted. • Do not undo the earthing and shorting measures until the test object is put into operation again.

5 Changing System Settings

The setup menu of the EZ-Thump system offers the possibility to change the following system settings:

- Start marker (end of HV connection cable)
- default propagation velocity
- default trigger delay

Perform the following steps to access the setup menu and change the system settings:

Step	Action
1	Make sure the system is in 'standby' state.
2	Press and hold **ENTER** button (7) and press **ON** button (1).
	Result: The system starts in setup mode and the following message is displayed: **SETUP MODE** **START MARKER**
3	Press **ENTER** button (7) to start the procedure of adjusting the start marker.
	Result: The following message is displayed: **SHORT HI VOLTAGE LEADS TOGETHER AND PRESS "ENTER"**
4	Short the HV connection cable and press **ENTER** button (7).
	Result: The following message is displayed: **OPEN HIGH VOLTAGE LEADS AND PRESS "ENTER"**
5	Disconnect the leads of the HV connection cable again and press **ENTER** button (7).
	Result: The new start marker has been set and the following message is displayed: **TRANSFORMER SEARCH MARK**
6	Press ► button to skip this step.
	Result: The following message is displayed: **CABLE SPEED**
7	Press **ENTER** button (7) and use the ◄ and ► buttons to adjust the V/2 value.
8	Press **ENTER** button (7) button to confirm the selected value.
	Result: The following message is displayed: **TRIGGER DELAY**
9	Press **ENTER** button (7) and use the ◄ and ► buttons to adjust the trigger delay value. Typically, there should be no need to change the default setting of 699 ms unless a particular test setup requires an adapted trigger delay value.
10	Press **ENTER** button (7) to confirm the selected value and press **OFF** button (3) to turn the unit off.
	Result: The system reboots with the new settings.

6 Maintenance

Storage If not in use, the system should be stored in a dust free and dry environment. Humidity (condensation) by itself or in combination with dust can reduce critical distances within the equipment, which are necessary to maintain safe high voltage performance.

Charging The internal battery should only be charged using the supplied charger. It takes about 3 hours to charge the battery.

 **CAUTION**	In order to prevent damage to the charger, the system must not be operated with the charger connected to the unit.