Wire Tracer
XT25

User Manual v. X1.1

VESALA®

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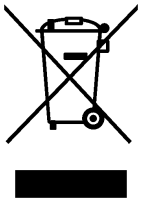

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1. Overview

1.1. General information on cable tracing

A cable tracer does not locate the actual cable, rather the magnetic or electric field, which exists in the cable by nature or has been induced to it using the transmitter. As the shape of the magnetic field depends on other wires and pipes that may be located near the target object, it is important for the user to be familiar with the properties of the device as well as possible. We recommend that this manual be read thoroughly prior to using the **XT25** tracer.

1.2. Purpose of the device

Despite its small size **XT25** is a versatile and complete cable tracing system, suitable for telecom technicians' everyday tasks. This device has intentionally limited output power, therefore it is not recommended for out-door buried cable tracing.

The XT25 is designed for:

- Distinguishing wire pairs and individual wires from others
- Tracing and distinguishing individual cables from other cables
- Detecting traffic and voltage in wire pairs interference-free
- Interference-free wire tracing with the **HSJ15R** feeder cable (accessory)

2. XT25 equipment

2.1. XT25 basic set-up and accessories

XT25 basic set-up

XTT25 Transmitter for generating the tracing signal, for listening to line audio and communication and for DC indication

PJ15p Feeder cable for connecting the transmitter to the cable or the pair (1.5m RCA / banana plugs and alligator clips)

XTR25 Receiver for receiving the signal of the transmitter

KA6 Capacitive probe for identifying wire pairs

LA5 Inductive probe for tight places

AK1 and BNC adapter Probe cord and adapter for connecting a probe (1.0m BNC / BNC)

KO/XT25 User Manual

KPP5 Carriying bag for the ready-to-use equipment, accessories and other installation tools (nylon, approx. 220 x 130 x 200 cm.)

Accessories

LA1 Inductive close range probe for following the route of cables or wires in close distance (< 20 cm)

HSJ15R Interference-free feeder cable

2.2. XTT25 transmitter interface

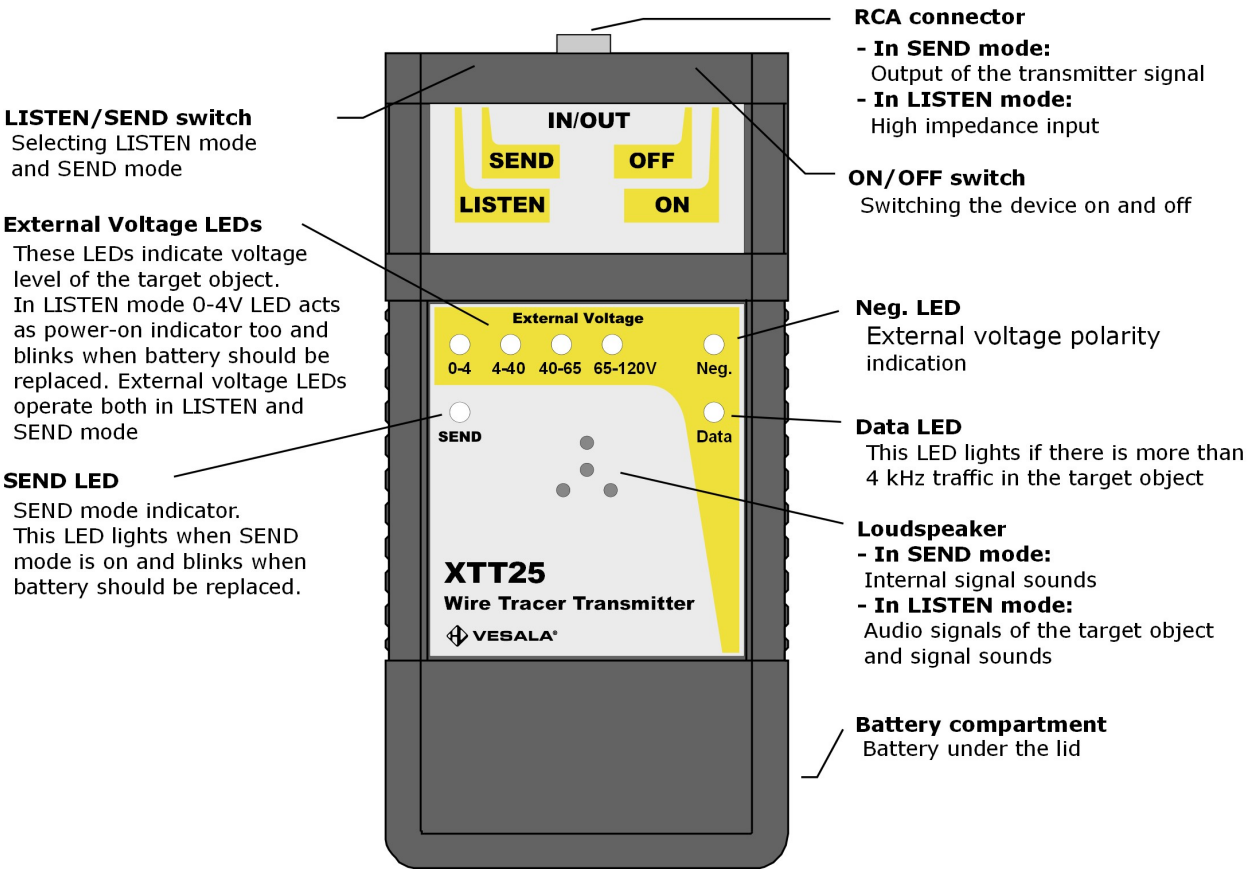

Figure 2.2. Components of the XTT25 interface

Functions and use of the interface

ON/OFF switch

Switching the device on and off. **SEND** or **0-4V** LED is lit when the device is switched on. If either LED blinks, battery is low.

LISTEN/SEND switch

Selecting between the two operation modes. When the **SEND** mode has been chosen, device beeps twice at start-up. The same applies when changing from **LISTEN** mode to **SEND** mode.

External voltage LEDs

0-4V –led is lit when device is in **LISTEN** mode. If device detects a voltage that is higher than 4V, a LED corresponding the voltage level is lit:

- **4-40V** is the typical range for open analogue telephone pair, alarm lines and other special lines.
- **40-65V** suggests to an un-opened analogue telephone line
- **65-120V** usually means ISDN pair or some data line. If **65-120V** blinks, voltage is more than 120V.

Neg. LED	This LED is lit when the red plug of the feeder cord has negative voltage with reference to black plug. LED blinks if alternating voltage is present at the **RCA** input.
Data LED	This LED is lit when there is traffic having more than 4kHz at the RCA input. If LED blinks, frequency is more than 30kHz.
Loudspeaker	In **SEND** mode **loudspeaker** produces inetrnal signal sounds. In **LISTEN** mode **loudspeaker** produces both the signal sounds and the possible audio frequencies of the traced object.
RCA connector	In **SEND** mode the connector acts as the output of the transmission, in **LISTEN** mode as a high ohmic input. Connection is made using the **PJ15** cord. Polarity has significance only in **LISTEN** mode (see **Neg.** LED).
Battery compartment	Battery (1pc. 9V 6LR61) is located in the **battery compartment** underneath the lid. Instruction for changing the battery is provided in section 3.1.
Wrist loop (not shown)	The openable wrist strap can be used for hanging the device on a rack, for example.

More detailed instructions for using the XTT25 are provided in sections 3.2 and 3.3.

2.3. XTR25 receiver interface

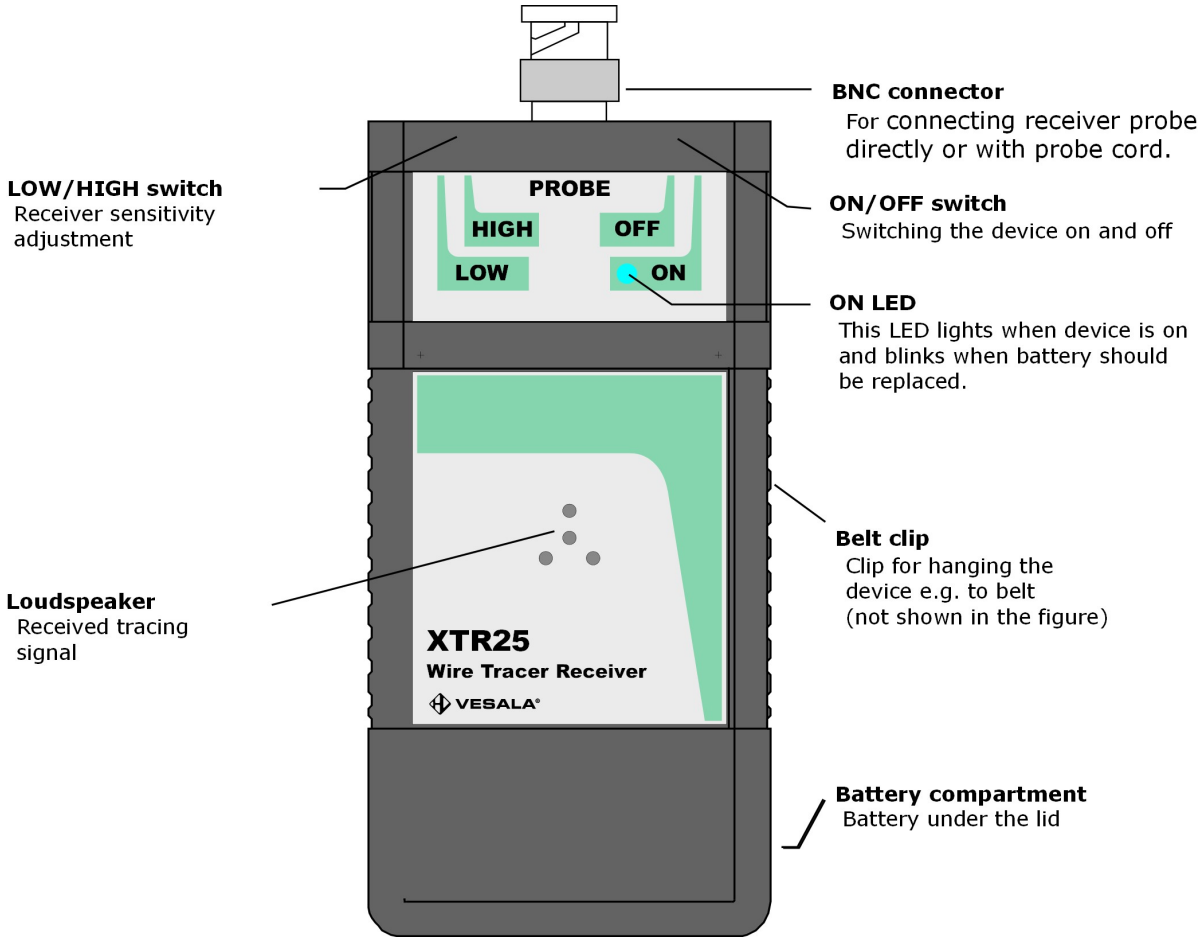

Figure 2.3. Components of the XTR25 Interface

Functions and use of the interface

ON/OFF switch	Switching the device on and off. When the device is switched on, **ON** LED is lit. If LED blinks, battery is low.
HIGH/LOW switch	Receiver sensitivity adjust. In **LOW** position sensitivity has been reduced by approx. 20dB.
BNC connector	This connector is used for connecting the correct probe either directly or with the **AK1** probe cord.
Loudspeaker	**Loudspeaker** produces sound demonstrating the intensity of the received signal according to which e.g. wire tracing is done.
Battery compartment	Battery (1pc. 9V 6LR61) is located in the **battery compartment** underneath the lid. Instruction for changing the battery is provided in section 3.1.
Belt clip (not shown)	Clip for hanging the device e.g. to belt, pocket etc.

More detailed instructions for using the XTR25 are provided in section 3.4.

3. Using the tracer

3.1. Batteries

Both the **XTT25** transmitter and the **XTR25** receiver use one 9V 6LR61 alkaline battery. If the device indicates that the battery is low (the corresponding LED is blinking), the battery should be changed as soon as possible in order to ensure the optimal functioning of the equipment.

Either device can also use rechargeable 9V NiCd or NiMH batteries, which have to be recharged in a separate re-charger unit.

3.2. Using the transmitter in the LISTEN mode

The high impedance **LISTEN** mode makes it easy to check the voltage and traffic present in an object. It is worth always using **LISTEN** mode prior to connecting **XTT25**'s transmitting signal to an unknown telecommunications pair in order to avoid causing interference to the traffic that may be present in the pair.

1) Connect the feeder cable to **XTT25** and switch the device on in **LISTEN** mode
2) Connect the transmitter to the target object
3) **External Voltage**, **Neg** and **Data** LEDs indicate DC or AC voltages on the pair, DC polarity and possible data on it. Also see paragraph 2.2.
4) **Loudspeaker** will indicate any speech or other audio that may be present in the pair. Audio volume cannot be adjusted.

NOTE! Dial tone of a telephone line can only be heard if the line is opened separately using a **telephone**; **XTT25** does not open the line!

Transmitter must not be connected to a live mains cable or wire!

Avoiding interference with telecommunication is always the responsibility of the user.

3.3. Using the transmitter in the TRANSMIT mode

Connecting

1) Connect the device to the target object with the **PJ15** feeder cord.
2) Choose **SEND** mode. (Device beeps twice when switched from **LISTEN** to **SEND** mode or when device is started in **SEND** mode.)
3) **External Voltage** LEDs indicate possible voltages on the pair.

NOTE! If the target object impedance is less than 1 kilo-ohms, transmitter starts beeping. The quicker the beep intervals, the lower is the impedance. Beeping stops automatically after 30 seconds, unless impedance changes within this time.

The transmitter must not be connected to a live mains cable or wire!

Transmitter must not be connected to a target object carrying more than 120V voltage!

3.4. Using the receiver

Choosing a probe

Choose the receiver probe according to the situation at hand:

- Use **KA6** for detecting wire pairs
- Use **LA5** for tracing wire pairs inductively e.g. at tight joints
- Use **LA1** for tracing cables inductively at short distances or for distinguishing specific cables from others

Connecting and disconnecting the probes

Prevent the **XTR25**'s **BNC connector** from turning by holding it by its base. Push the probe into the **BNC connector** so that the two pins slide to the corresponding slots. Turn the probe clockwise almost a half turn until the pins snap to their locking positions. To disconnect a probe, just turn it anti-clockwise and pull the probe out. Same method also applies to the **BNC adapter**.

Receiver sensitivity adjust

One can adjust the receiver sensitivity with the **HIGH/LOW** switch, if necessary. In **LOW** position sensitivity is reduced by approx. 20dB and it helps to distinguish wires in cross-talk situations.

4. Basics of cable tracing

Tracing a cable or another such object is always based on detecting the magnetic (**inductive tracing**) or electric field (**capacitive tracing**) of a conductive object.

4.1. Capacitive tracing

The shape of a capacitive field is always such that the receiver emits the loudest signal when the capacitive probe **KA6** is at its closest to the target cable or an individual wire. The position of the probe is therefore of no significance. The field strength usually follows the shape shown in figure 4.1.

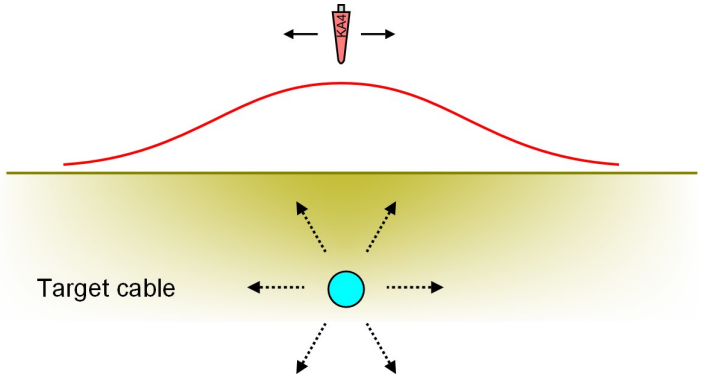

Figure 4.1. Shape of a Capacitive Field

4.2. Inductive tracing

Inductive tracing is based on detecting the magnetic field created by the current that runs in the wire. The stronger the current, the louder the signal will be in the receiver.

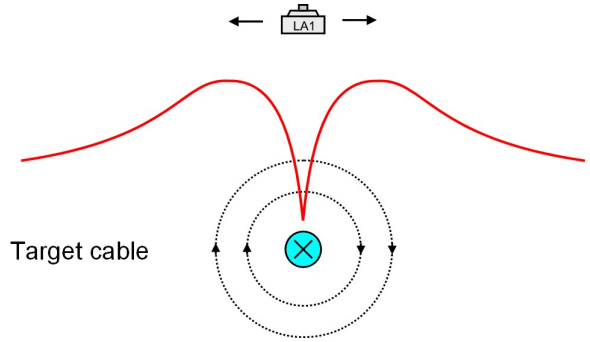

Figure 4.2.a. Shape (Strength) of the Inductive Field of a Straight Wire)

Using the receiver when distinguishing a certain cable from others

When distinguishing a certain cable from others using the **LA1** probe (**LA5** can also be used), the minimum point often appears to undulate as shown in figure 4.2.b. This is a normal phenomenon, which results from the twisted structure of the cable.

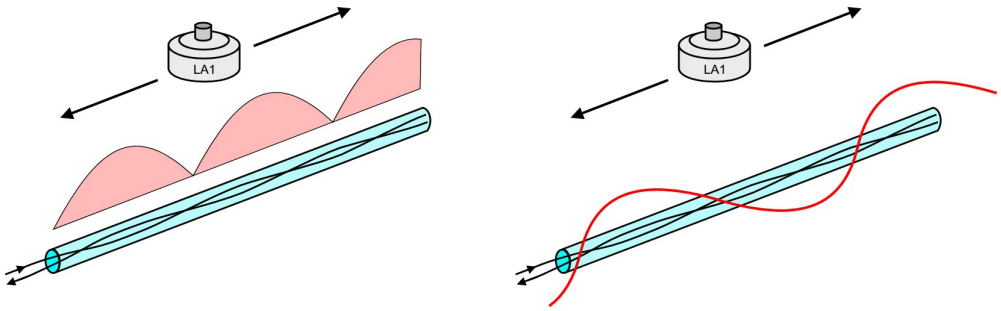

Figure 4.2.b. Twisted cable structure causes signal fluctuation on top of the cable and the minimum point seems to undulate from side to side.

5. Examples of use

5.1. Distinguishing a certain cable from others

Transmission methods for distinguishing a certain cable

As the objective is to distinguish a certain cable from others, the signal must be transmitted galvanically between two wires. Choose wires that are as far away from each other as possible to enable tracing of a thick cable. With the receiver, use preferably **LA1** probe, though in most cases **LA5** will work well too.

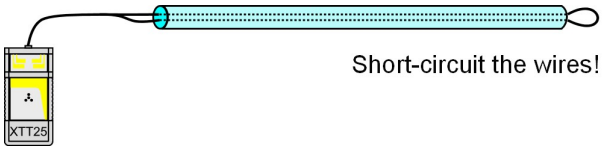

Figure 5.1.a. ***Recommended transmission method****. The signal does not cross talk with other cables. The wires should be as far away from each other as possible – it is not worth transmitting an output to the wires of a single pair alone.*

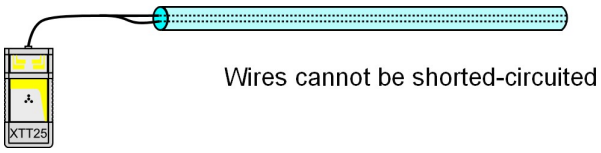

Figure 5.1.b. As with 5.1.a but only suitable for long cables. The signal strength is weaker than in figure 5.1.a and very weak towards the end.

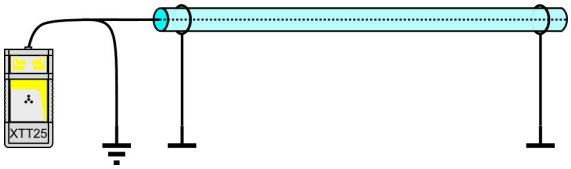

Figure 5.1.c. This situation corresponds to following the route of a cable. The signal is more likely to cross talk with other cables. Especially with short cables, grounding of either pole of the transmitter should be done directly to the ground outside (not to the protective earthing or a water pipe).

5.2. Distinguishing a certain wire pair from others

Transmission methods for distinguishing a certain wire pair

The transmitter is always connected galvanically to the target pair.

Figure 5.2.a. Transmission should always be connected to a pair: If the output is transmitted to wires of a different pair or wires located in different quads, cross talk with other wires will result.

Using the receiver when tracing wire pairs

1) Connect **KA6** probe to the receiver
2) Take **KA6** near (less than 5 cm) the pairs of the cable, either at the end of the cable or at a terminal or an open intersection
3) The volume is only high in the immediate proximity of the correct wire (figure 5.2.b). If signal is too loud, switch to **LOW** sensitivity. Possible cross talk may be a result of the structure of the cable or the signal having been transmitted to the wires of different wire pairs. A very narrow minimum can be detected between the a and b wires of the correct pair.
4) Once the correct wire pair has been distinguished, verification is carried out by short-circuiting the wires of the pair, whereby the signal disappears and transmitter starts to beep (see the verification method on the next page).

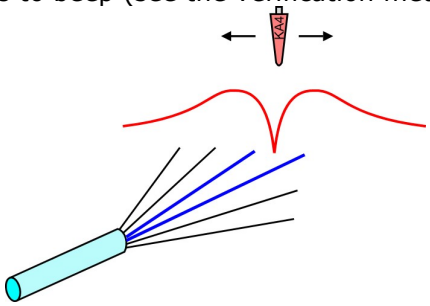

Figure 5.2.b. Shape of the Field When Tracing a Wire Pair

A wire pair can be detected using **LA5** probe if even a minor current can be fed to the pair: the bigger current, the louder signal. Feeding to a short-circuited pair makes it even possible to distinguish a certain cable from others. Probe is inserted between the pairs and when the tip of the probe gets near the correct pair, a loud signal can be heard.

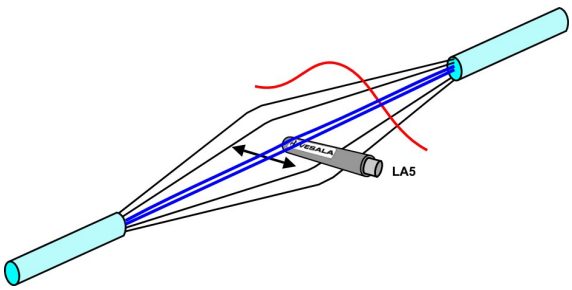

Figure 5.2.c. Distinguishing a short-circuited pair using the LA5

Also **LA1** probe can be used to trace a short-circuited pairs, but its larger size may affect its usability especially at narrow joints.

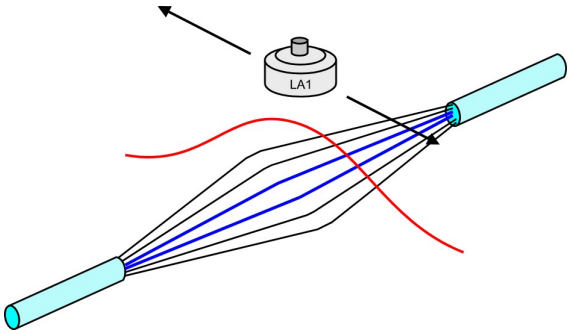

Figure 5.2.d. Distinguishing a Short-circuited Pair Using the LA1

Using the verification method

Person operating the receiver may produce a verification signal to the person at the transmitter by short-circuiting the wire pair indicating that the pair has been found. This verification method works with pairs that are in use too. Since the transmitter beeping interval is dependant on the target impedance, it should be noted that if transmitter was already beeping when connected to the pair, beeping only gets continuous when pair is short-circuited. Transmitter beeping will last 30 seconds if the impedance does not change in the meantime. Also person operating the receiver will get verification, as the receiver signal disappears when the correct wires are short-circuited.

5.3. Locating a wire cut

A cut in an unshielded wire can be located with **KA6** using the method described below: One transmitter pole is connected both to the un-cut wire and to ground. The other pole is connected to the cut wire. A loud signal can be heard on the receiver up to the cut location after which signal will weaken considerably.

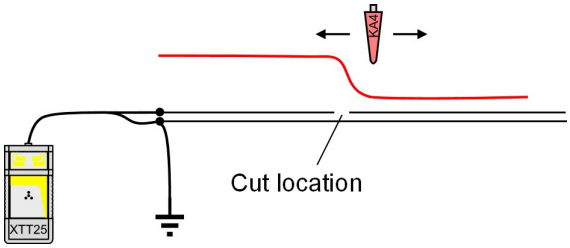

Figure 5.3. Shape of the field of a cut wire.

5.4. Locating a short circuit in a certain cable

Transmission methods for locating a short circuit

It is normally a good idea to connect the transmitter to the end of the cable that is the *furthest* away from the suspected fault area. The other end of the cable should be isolated to be as short as possible.

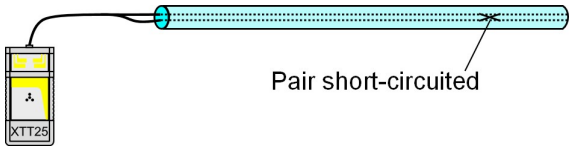

Figure 5.4.a. Transmission method for finding a location where a certain wire pair has short-circuited, i.e. where wires a and b are in contact with each other.

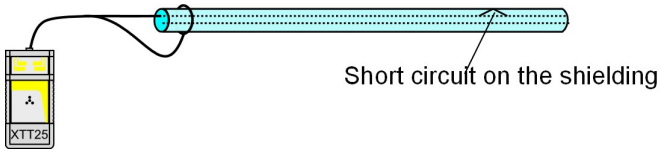

Figure 5.4.b. This method is used when looking for a point where a certain pair has short-circuited on the shielding or the ground.

Using the receiver when locating a short circuit

1) Connect **LA1** probe (or **LA5**) to the receiver.
2) Follow the signal along the surface of the cable from the transmitter towards the short circuit.
3) The loudness of the signal remains unchanged until the receiver is positioned directly above the short circuit. The signal increases clearly (figure 5.4.c). After the short circuit the signal dies away but begins to strengthen again slowly after a while.

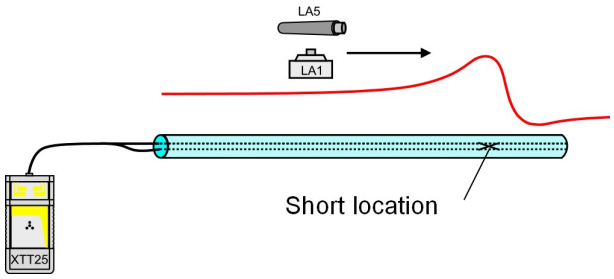

Figure 5.4.c. Strength of the field around a short circuit

6. Technical data, maintenance and service

6.1. Technical data

Transmitter	**XTT25**
Signal frequency	341.3Hz/10kHz alternating 2.5V square wave
SEND output impedance	Approx. 60 ohms
LISTEN input impedance	80kohm@5kHz, 45kohm@20kHz, 12kohm@100kHz 3,3kohm@500kHz, 1,0kohm@2MHz
Output connector	RCA female
Indicators	4 voltage LEDs, polarity LED, Data LED and SEND mode LED Loudspeaker for sound indications e.g. for data
Battery	1 pc. IEC 6LR614 alkaline battery Low battery warning indication (at approx. 6V)
Power consumption	6 ... 40mA
Enclosure	ABS 120x60x24mm
Weight	Approx. 145g with battery

Receiver	**XTR25**
Probe connector	BNC (male)
Receiving frequency	10kHz
Indicators	Power LED, sound indication for traced signal level
Sensitivity adjustment	HIGH / LOW slide switch, (approx. 20dB attenuation with LOW)
Battery	1 pc. IEC 6LR614 alkaline battery Low battery warning indication (at approx. 6V)
Power consumption	6 ... 40mA
Enclosure	ABS 120x60x24mm
Weight	Approx. 145g with battery

6.2. Maintenance, storage and warranty

The **XT25** Wire Tracer does not have any parts that require maintenance by the user, excluding the changing of batteries (see section 3.1). A damaged device must be returned to the manufacturer for repair. A soiled device can be cleaned using a damp cloth and it must be dried carefully before returning it to the carrier bag. We recommend that the device is stored in its own carrier bag under dry conditions and at room temperature. If the device(s) become(s) immersed in water, the batteries must be immediately removed and the lid of the **battery compartment** left open in order to allow the device to dry. The device is left to dry at room temperature.

H.Vesala Oy (Ltd.) shall not accept liability of any financial losses or damages, nor for any damage incurred to people, the environment, telecommunications traffic or similar as a result of the use of or the failure to use the device.

XT25 has a one-year warranty against factory defects. The warranty shall not cover batteries or faults resulting from normal wear and tear or misuse. Users are advised to contact the manufacturer in case of faults or queries relating to the use of the device. The product has been designed and manufactured in Finland. VESALA® is a registered trademark of H.Vesala Oy (Ltd.).

Manufacture, sales and maintenance

H.VESALA Oy

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