Megger

CI TX

Cable Identifying Generator

USER GUIDE

Issue: B (10/2021)
EN

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Consultation with Megger

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.

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Terms of Warranty

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

Megger warrant that at the time of delivery Megger 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, Megger 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.

Megger 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 Megger.

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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 Megger. 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, Megger can be made liable only in case of severe negligence or intention. Any liability for slight negligence is disclaimed.

Table of Contents

1 Safety Advice

Safety precautions

This manual contains basic advice for the installation and operation of the *CI TX*. It is essential to make this manual accessible to the authorised and skilled operator. He needs to read this manual closely. The manufacturer is not liable for damage to material or humans due to non-observance of the instructions and safety advices provided by this manual.

Locally applying regulations have to be observed.

Working with equipment of Megger

All electrical regulations of the country where the system is operated have to be observed as well as national regulations for prevention of accidents and existing regulations for the safety and operation of equipment of the involved companies.

Original accessories ensure safe operation of the equipment. It is not allowed and the warranty is lost if other accessories than the original ones are used with the equipment.

Intended application

The operating safety is only guaranteed if the delivered system is used as intended (see page 7). Incorrect use may result in danger to the operator, to the system and the connected equipment.

The limits described under technical data may not be exceeded.

Five safety rules

The following five safety rules must always be followed when connecting the CI TX to a cable to be identified:

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

2 Technical Description

Necessity

The positive identification of a single cable from a bunch poses a technical problem which is often faced by cable technicians.

The purpose of a cable identification is to avoid damage to cables in service with utmost reliability and to protect the operating personnel.

It must however be mentioned right from the start, that a cable identification, no matter how reliable it seems to be, should never prompt the operator to neglect the prescribed VDE safety regulations.

Prior to cutting a cable, it must be made sure that the cable core is earthed. This can only be achieved by means of an adequate safety cutting system.

Function

The cable identifying generator *CI TX* can be used for the selectively identification of low voltage cables and medium voltage cables. The optional transmitter clamp *SZ 80* does also allow measurement at live cables up to 300V CAT IV.

For such a cable identification procedure, the receiver *CI RX* is required additionally. The handling of the receiver is described in a separate operation manual.

The impulse generator sends out pulses up to a peak current value of 100 A into the cable to be identified. This test current generates an electromagnetic field around the cable which is picked up by a flexible identification clamp attached to the cable.

The test current of these identification permits a determination of the current value and of the direction of the measuring pulse, thus leading to a safe and reliable identification of the cable.

Technical Data

Parameter	Value
Indicators	○ Signal quality LED (red/yellow/green) ○ Power / battery status LED (red/yellow/green)
Pulse voltage	50 VDC
Pulse current	Max. 100 A
Pulse sequence	30 per minute
Pulse width	72 ms
Power supply external: internal:	 100 V … 240 VAC, 50/60 Hz 12 VDC (accumulator)
Operation time (accumulator)	4 h
Charging time (accumulator)	6 h
Weight	1.6 kg
Dimensions	201 mm x 120 mm x 80 mm
Protection class[1]	IP 54
Operating temperature	-10°C … 60°C
Operating humidity	Max. relative humidity 93% at 30°C
Storage temperature	-10°C … 60°C
Measurement Category (EN 61010-1) Mains input Impulse output	 300V / CAT II 300V CAT IV - if connected via transmitter clamp *SZ 80* (galvanic connection to de-energized cables only)

[1] The specified IP code (protection against dust and water) can only be assured, if fitting plugs are plugged into all sockets or the sockets are covered with the corresponding protective caps.

3 Scope of Delivery

Standard scope of delivery

The following items are included with the standard shipment of the generator:

- Fused test lead 2.0 m with clamp, black
- Fused test lead 2.0 m with clamp, red
- Earthing lead (1.5 m) with clamp, green/yellow
- Case
- Manual

Necessary accessories

- Mains supply lead 2.0 m

Optional accessories

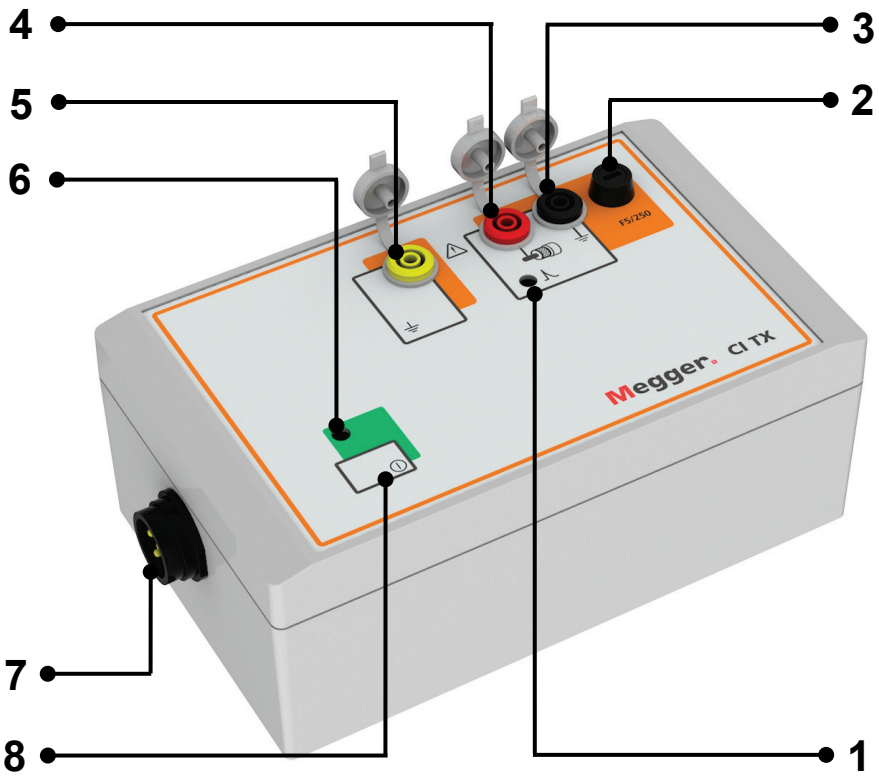
In addition to the standard shipment, the following optional items are available:

Accessory	Description	Item number
Transmitter clamp *SZ 80*	Transmitter clamp (incl. connection leads) for inductive coupling of the transmission pulses into the cable	2007615

4 Design

The *CI TX* identifying generator is built into a sturdy ABS plastic housing. The unit is in protection class IP 54.

The following figure shows the generator and its elementary controls and sockets:



Item	Description
1	Signal quality LED (red/yellow/green)
2	Fuse
3	Socket for screen connection
4	Socket for core connection
5	Socket for earthing connection
6	Power / battery status LED (red/yellow/green)
7	Mains connection (100 V … 230 V, 50/60 Hz)
8	On/off button

5 Safety Mechanisms

Overvoltage protection

The generator has a built-in overvoltage protection. In case, the generator is connected to a live cable - contrary to the safety advises - the fuse [2] blows in order to prevent the unit from being damage (but no warranty can be given).

After the overvoltage protection has been responded, it is necessary to change the fuse (F 5/250 E) using a screwdriver in order to put the generator back to operating state.

Over-temperature protection

At too high temperatures, the pulse transmission is automatically stopped until the temperature has dropped below a certain threshold. If the over-temperature protection is active, the signal quality LED [1] is lit red permanently and the audible indicator does not sound.

6 Start-up

6.1 Protective Earthing

Protective Earthing

Inspite of the fact that the identification generator does not deliver dangerous voltages, the safety practices must not be neglected.

On mains operation, protective earthing of the generator is provided from the earth contact mains connection lead. Caution! In many substations, the earth conductors in the sockets are not connected in order to avoid hum pick up during measurements. Moreover, most of these sockets are not properly marked.

If the instrument is operated from the accumulator, then the earthing socket [5] has to be connected to system earth via the supplied earthing lead.

6.2 Direct connection to the cable to be Identified

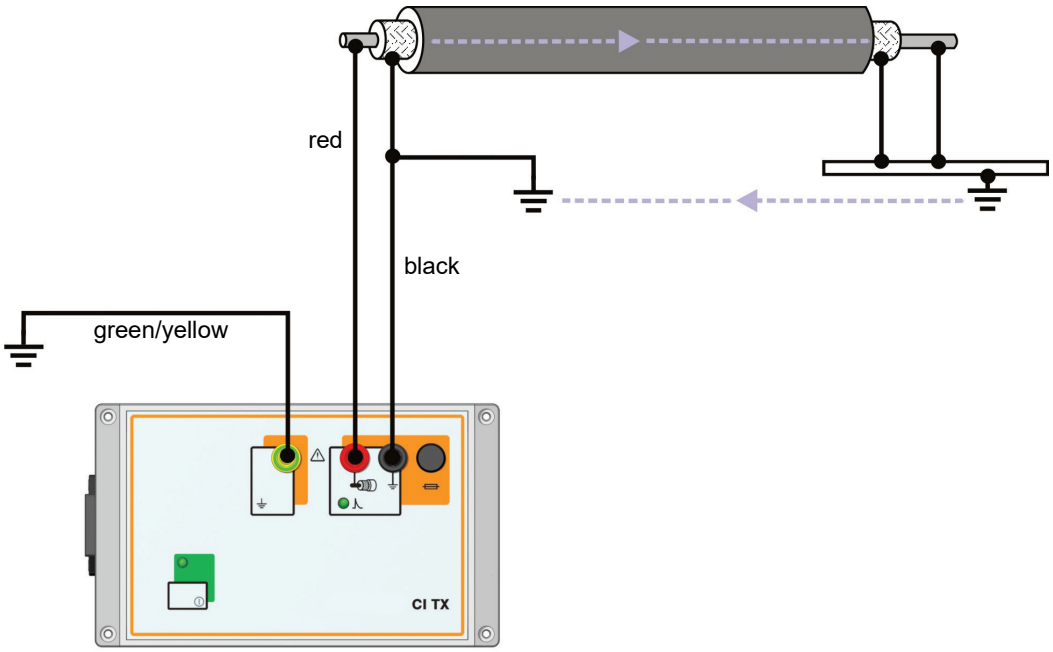
Preparation the cable to be identified

Both ends of the cable have to be disconnected and the far end has to be connected to system earth.

A direct connection between the end of the core and the screen has to be avoided, since in this method the identification clamp can only evaluate the differential current from the outgoing and returning currents. The two fields generated by the outgoing and returning currents would cancel out and could not be measured. This has to be taken into account especially when dealing with new cable installations which are not yet in service. The return current has to flow through the soil or on neighbouring cable sheaths or neutrals.

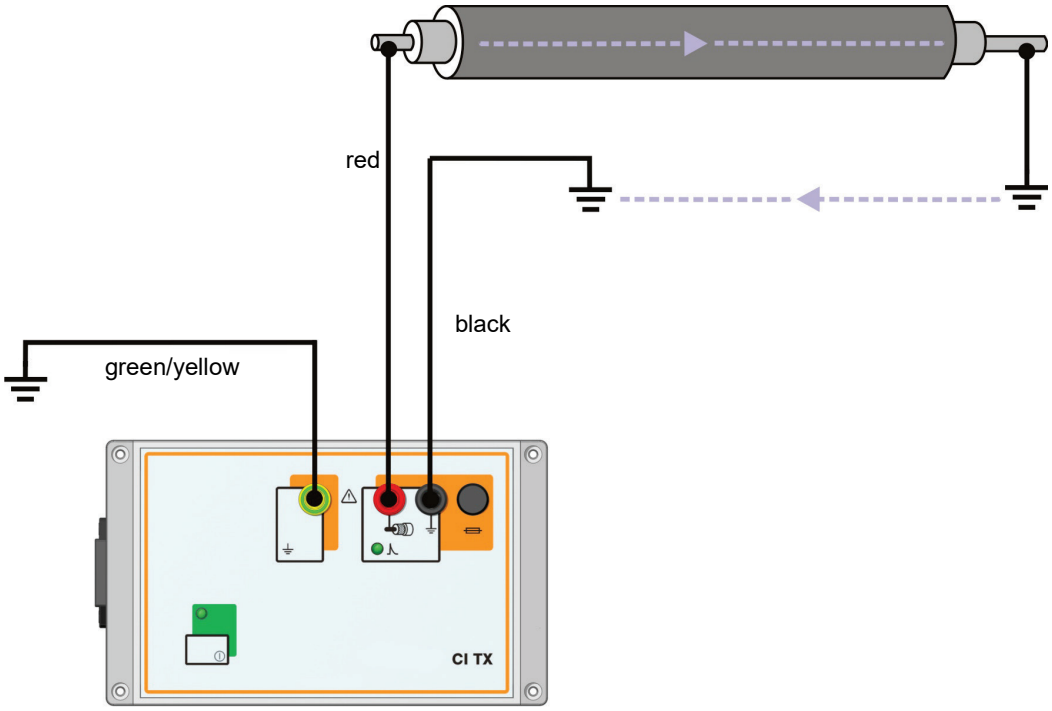
Coupling with screened cables

The generator has to be connected to a screened cable as shown in the figure below:



Coupling with unscreened cables

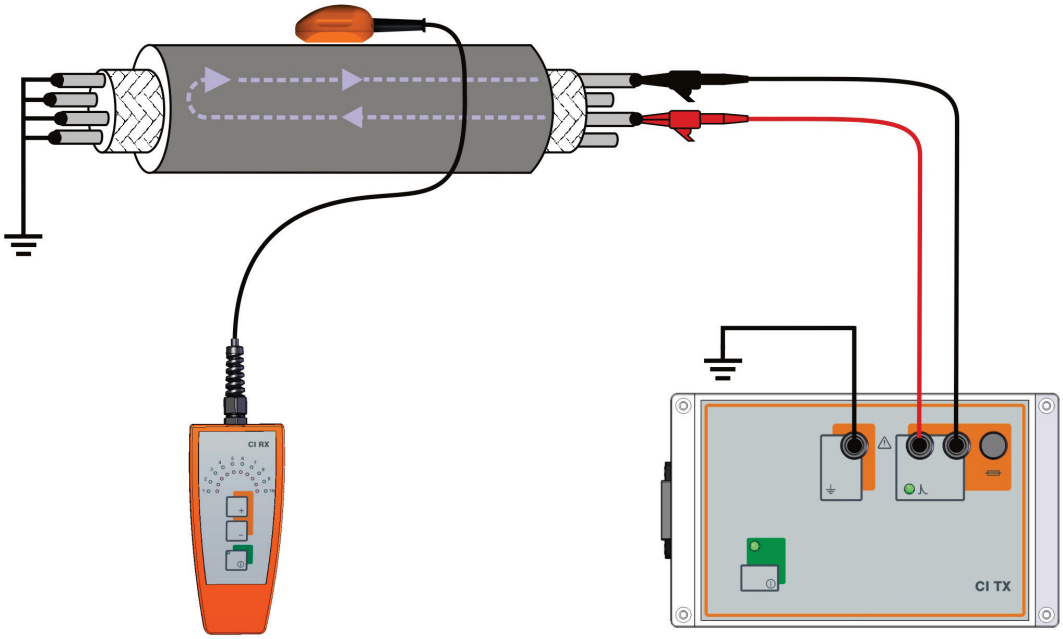
If the cable does not have a screen (e.g. NYY) or the system earth is not accessible at the cable end, then one should proceed as shown in the figure below. The far end of the core is connected directly to an existing earthing system, e.g. a lightning protective system. At the near end of the cable, the identification generator is connected to the core to be identified and to a different earthing system.



Connection between two phases

The generator can also be connected between two phases of a multi-conductor cable. With this type of connection, the identification of the cable is performed **according to the "Twisted-Field" method** by means of the optional *TFS CI* sensor (moved along or around the cable).

The black and the red test lead must be connected to any two phases of the cable. These two phases must be bridged at the far end.



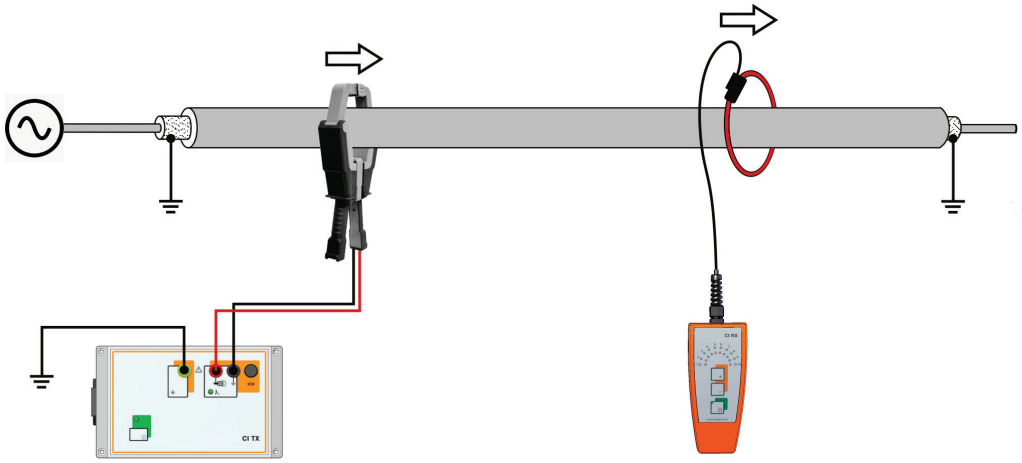
6.3 Inductive transmission of the cable to be identified

Transmission pulses can also be inductively coupled into the cable using the optional *SZ 80* transmitter clamp as log as the diameter of the cable does not exceed 80 mm and the loop resistance is not greater than 8 Ω. Even if galvanic coupling is generally favoured as a result of stronger transmission impulses, inductive transmission can also be extremely useful, particularly in the following cases of application:

- In the case of non-accessible conductors (e.g. in case of SF_6 switchgear).
- To identify off-load, live cables. Normally, inductive coupling cannot be successfully applied, if a load current flows through the cable!
- In order to identify unknown cables in a manhole.

What's more, the inductive transmission increases security when the cable is being cut, since it can remain earthed at both ends whilst being identified. This ensures that one end of the two cable sections remains earthed after the cable has been cut.

The arrow on the transmitter clamp must be pointing in the direction of the far end of the cable – just like the arrow on the identification clamp.



6.4 Power Supply

Mains connection

For mains supply, the mains socket [7] is connected to a earthing contact socket (100 V … 240 VAC, 50/60 Hz) by means of the mains connection lead NKG 1.

Operation with accumulator

No special measures are required, except the separate protective conductor connection. It should however be noted that the maximum operating time of the identification generator is about 4 hrs, depending on the output current. If necessary, charge the battery prior to the measurement.

6.5 Switching on

After the test leads are connected to the cable to be identified, the generator can be switched on using the On/off button [8].

Afterwards, the power / battery status LED [6] indicates the power supply status:

Mains operation:	green	
Battery operation	green	fully charged
	yellow	partially discharged
	red	almost completely discharged

The signal quality LED [1] indicates the current output and, in this way, the quality of the signal coupling into the cable to be identified:

Flashing green	Good coupling conditions (>30A)
Flashing yellow	Increased impedance (30 A > I > 10 A)
Flashing red	Unsure coupling conditions (<10 A)
Permanently red	No signal transmission

In addition, an audible indicator sounds in time with the pulses transmitted into the cable (every 2 seconds).

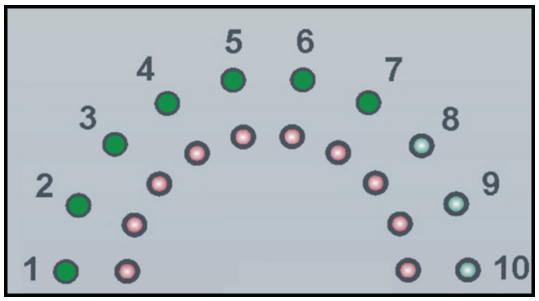
7 Operation

7.1 Check Measurement

Having connected and switched on the generator, a check measurement should be conducted in the vicinity of the connection point.

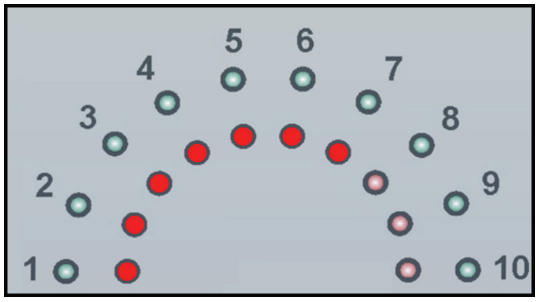
For this purpose, the clamp of the receiver has to span the entire cable - not only one lead. When connecting the clamp, the direction of the arrow on the clamp has to be noted.

Preferably, the arrow should always point towards the far end of the cable, in which case some of the green LEDs of the *CI RX* receiver should indicate the received signal strength level.



If necessary, the sensitivity of the receiver has to be readjusted, so that a clearly identifiable deflection of the green LED bar is obtained.

As a counter check, the clamp should be attached to the cable in the other direction which should cause a deflection of the red LED bar.



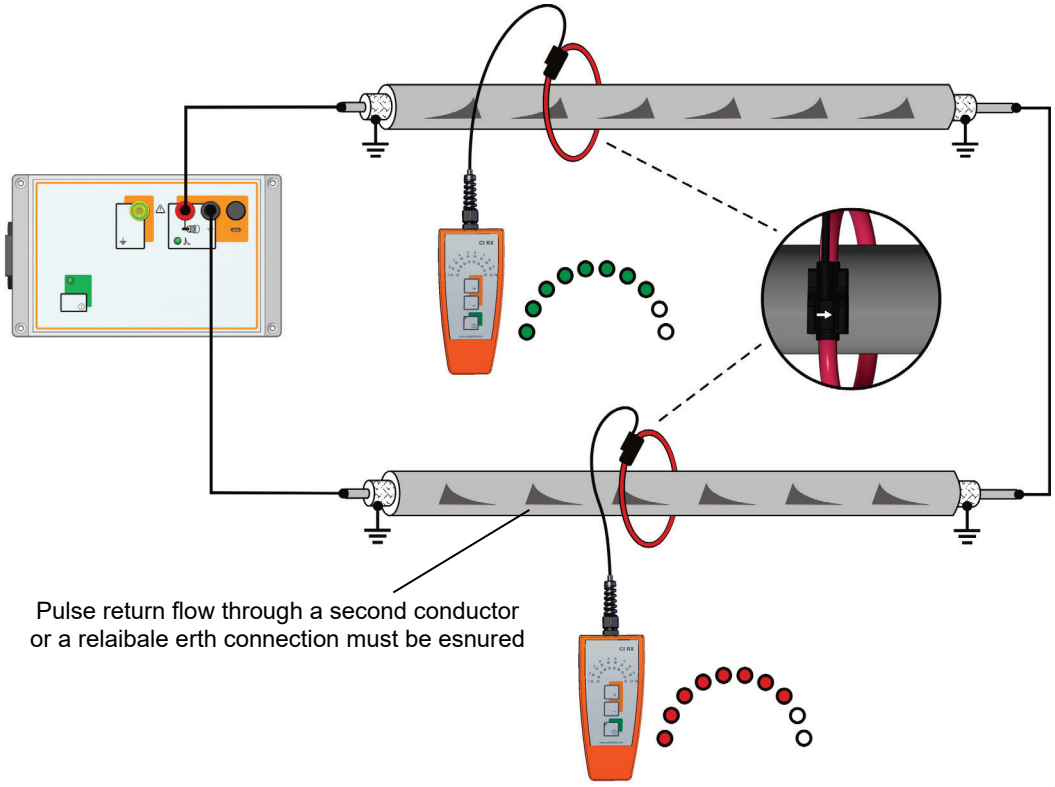
In the case of inductive transmission through the optional *SZ 80* transmitter clamp, a higher sensitivity needs to be selected as a matter of principle!

7.2 Performing a Cable Identification

At the location where the cable is to be identified from a bunch, the clamp is attached to each individual cable with the arrow pointing towards the far end, until a distinct deflection of the green LED bar is obtained on the receiver. If required, readjust the sensitivity.

Neighbouring cables are either causing no deflection or a deflection of the red LED bar (if return current is flowing through the cable). If the return current is spread along multiple conductors, the deflection of the red LED bar obtained at those conductors is accordingly lower.

The following figure illustrates exemplary current flow trough the cable to be identified and an auxiliary conductor:



If no readable deflections are obtained, it should be checked (using a line locator) whether the cable to be identified is part of the bunch at all.

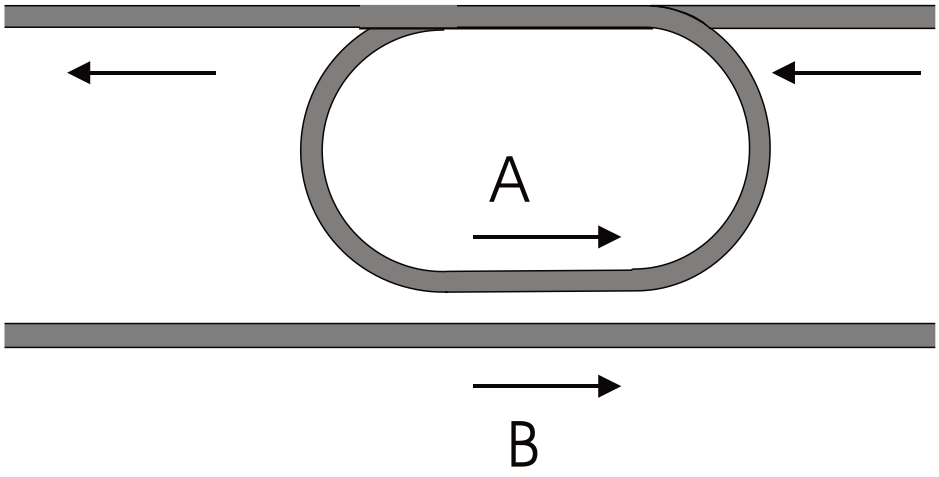
The cable identification with the current pulse method described in this section must be conducted with the flexible identification clamp! Using the “Twisted-Field” sensor *TFS CI* may lead to false identification!

7.3 Erroneous Measurements

A cable identification in power cables does in no way replace the need for determining whether the cable is dead as called for in the five safety rules. However, a cable identification will most probably prevent a live cable from being cut. This avoids danger to human life and in some cases enormous material damage – including power failure.

Even reliably identified cables must not be directly cut or opened, since despite clear deflections, the cable could be transposed. The figure below shows the cause of such an erroneous measurement.

At the test points A and B different directions are indicated due to a loop in the cable. This can lead to erroneous measurements, especially when measuring in the vicinity of substations where sometimes cable loops are installed.



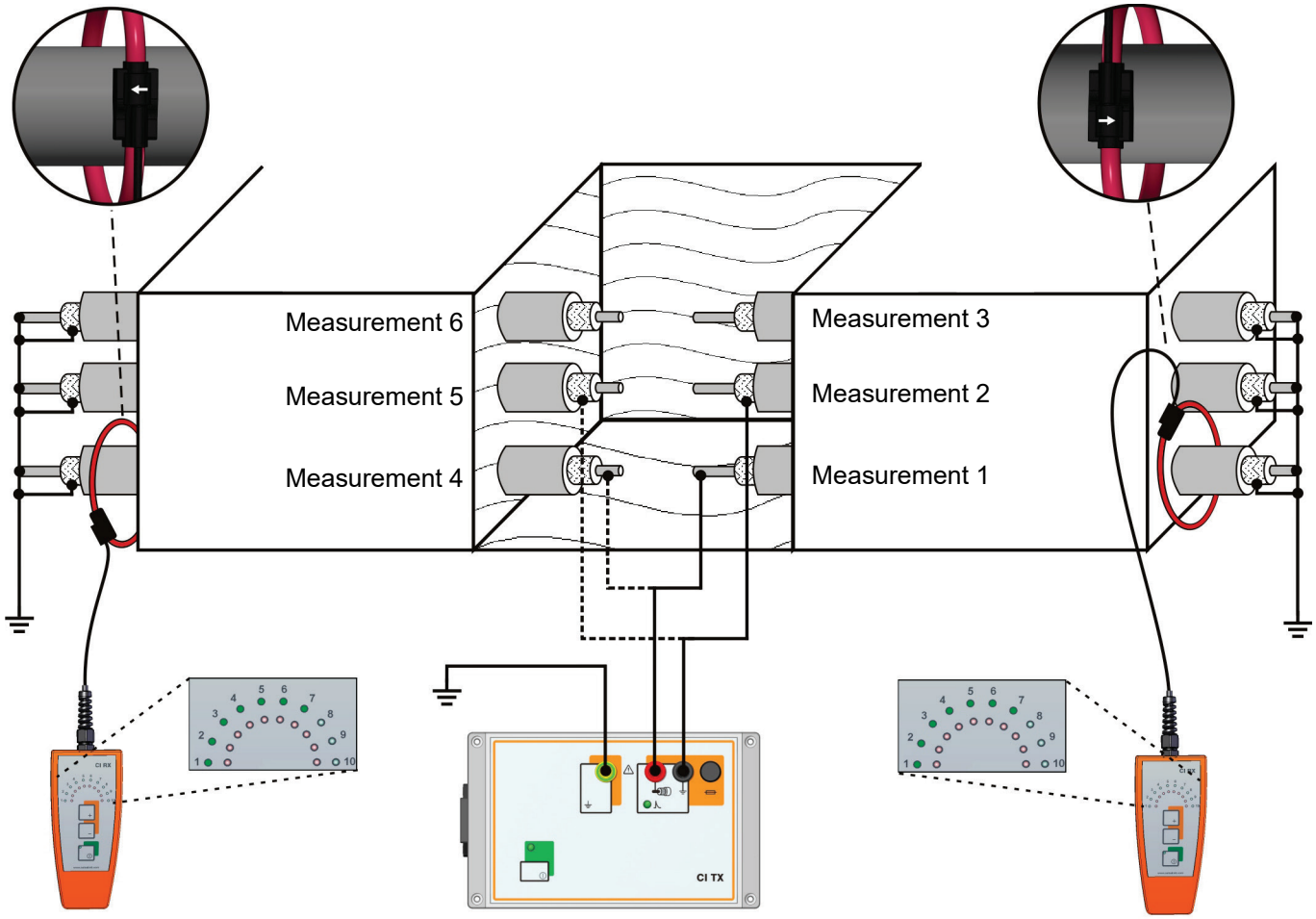
7.4 Phase Determination During Cable Installation

Although special instruments are available for phase determination during cable installation (e.g. PIL 8 of Megger), one can also use the cable identification instrument *CI TX* with the receiver *CI RX* for this purpose.

In this mode of phase determination, a cable is cut somewhere and it is necessary to safely identify the individual phase conductors. This is complicated by the short-circuiting and earthing device which, as prescribed by VDE, has to be connected at both ends of the cable.

This device must only be disconnected under observance of other safety measures. Using the *CI TX* and *CI RX*, the earthing device can remain connected at the cable end.

The individual phase conductors are identified as shown in figure below:



For this purpose, the identification generator is connected to one core and earth at the point where the cable is cut. Afterwards, the generator is switched on. For earthing, the screen of one of the other cables is used.

When measuring at the near end of the cable, the core carrying the test current can then be easily identified by a deflection of the green LED bar (provided the clamp is aligned in the direction as shown in the figure).

The technician there will then notify his colleague via radio of the designation of the phase conductor showing the deflection. Subsequently, this measurement is also to be carried out on the two other phase conductors (with the clamp aligned in the same direction).

One of the conductors should not carry a signal while the other measurement should result in a deflection of the red LED bar. In this way, the two remaining phase conductors are identified one after the other. A transposition is not possible.

The phase position of the individual conductors to the far end is determined using the same method.

It is important to note that in this test method, the short-circuiting and earthing devices at both cable ends remain connected. They are indispensable for this test method.

8 Charging the Accumulator

The accumulator is charged via the built-in charger. During the charging process, the instrument should be switched off. The charging time is automatically limited, i.e. when the accumulator is fully charged, the unit switches over to trickle charge thus avoiding an overcharge.

The charging time is max. 6 hours and depends on the state of the accumulator.

The power / battery status LED [6] indicates the status of the charging process:

Yellow	Accumulator is charging
Green	Accumulator is fully charged

Megger

CI RX

Cable Identifying Receiver

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Products of Megger are continuously being enhanced according to the state of the technology but such enhancements shall not constitute any ground for claims of any kind, particularly indemnity claims, for older versions of the product.

Intended application

The cable identifying receiver *CI RX* may only be operated with low and medium voltage cables, measurement category 600 V / CAT IV (EN 61010-1), according to the intended application as described in this manual.

Safe operation is only realised when using the equipment for its intended purpose.

The limits described under technical data may not be exceeded.

2 Technical Description

Function

The cable identifying receiver *CI RX* can be used to identify low voltage cables and medium voltage cables out of a bunch of cables.

The receiver has to be operated in combination with one of the generators (*LCI TX*, *LCI TX-440* or *CI TX*) which transmit specific pulses into the cable to be identified.

These current pulses generate an electromagnetic field around the cable which is picked up by the flexible identification clamp clamped around the cable.

Thus, the operator is able to determine the cable to be identified securely.

Technical data

Parameter	Value
Display	○ Power status LED (green) ○ LEDs for indication of signal strength and gain stage (red/green)
Sensors	○ Flexible identification clamp *AZF 250-CI*, Ø min. 240 mm ○ Flexible identification clamp *AZF 150-CI*, Ø min. 130 mm (optional) ○ *PAS CI* phase identification sensor (optional) ○ “Twisted-Field” sensor *TFS CI*
Gain stages	10-stage (-3 dB … 24 dB dynamic range)
Power supply	2 x 1.5 V AA batteries
Operating time	>50 h
Weight	0,4 kg (with batteries and sensor)
Dimensions (w x h x d)	150 mm x 65 mm x 35 mm
Protection class	IP 54
Operating temperature	-10°C … 60°C
Operating humidity	Max. relative humidity 93% at 30°C
Storage temperature	-10°C … 60°C
Measurement category	600 V / CAT IV

3 Scope of Delivery

Standard scope of delivery

- Cable identifying receiver *CI RX*
- “Twisted-Field” sensor *TFS CI*
- 2 x 1.5 V AA batteries

Necessary accessories

- Flexible identification clamp *AZF 150-CI* or *AZF 250-CI*

Optional accessories

The following accessories can be ordered by your Megger representative, if required:

Accessories	**Description**	**Order number**
Case	Suitable for a complete cable identifier system	90004532
Flexible identification clamp *AZF 150–CI*	Flexible identification clamp (Ø min. 130 mm)	820013106
Flexible identification clamp *AZF 250–CI*	Flexible identification clamp (Ø min. 240 mm)	820013107
Phase identification sensor *PAS CI*	Used for the identification of a single phase in low-voltage distribution networks	820014535

4 Design

The *CI RX* identifying receiver is built into a sturdy ABS plastic housing. The integrated flexible identification clamp has a diameter of min. 240 mm (min. 130 mm optional) and a cable length of 1.5 m. The unit is in protection class IP 54.

The following figure shows the receiver and its elementary control and display elements:

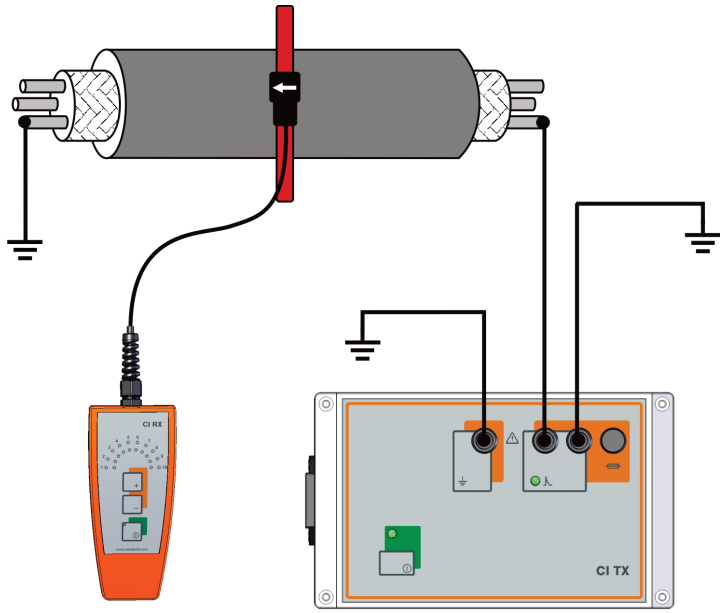
- Green signal LEDs [1]
- Red signal LEDs [2]
- Increase gain [3]
- Decrease gain [4]
- On/off button with LED [5]

5 Start-up

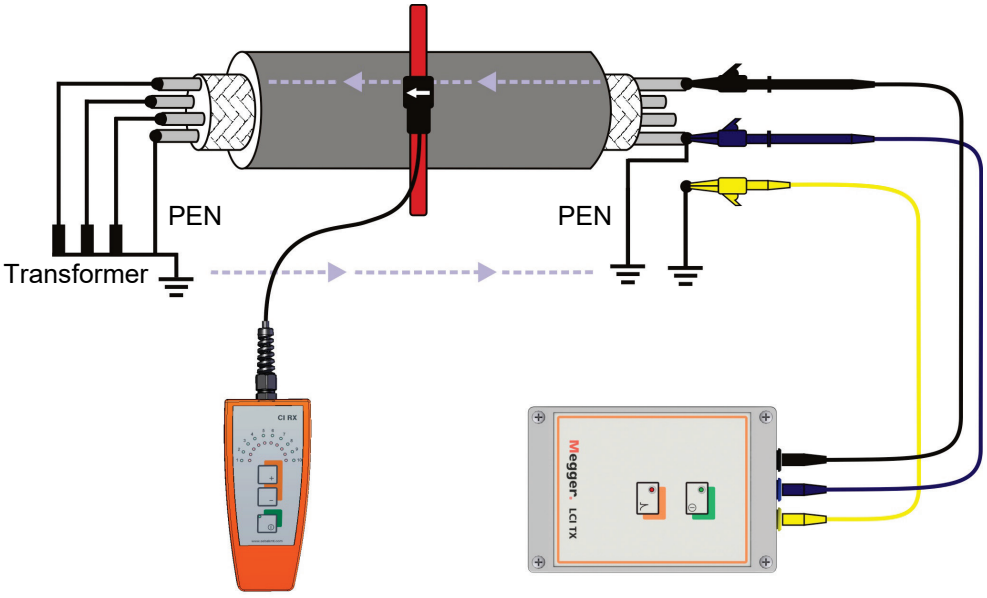
Connecting the flexible identification clamp

When using the DC pulse method to identify a cable, special attention has to be paid to the orientation of the identification clamp.

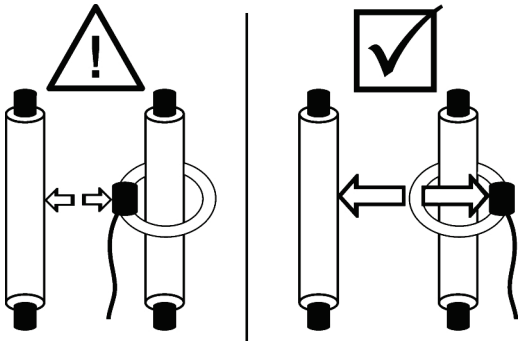
When working with the *CI TX* generator, encircle the cable to be identified in such a way that the direction arrow on the identification clamp points towards the grounded end of the cable as shown in the figure below:



To identify live cables in combination with the *LCI TX* or *LCI TX-440* generator, the identification clamp should be placed around the cable with the direction arrow pointing towards the supply transformer as shown in the figure below:



In order to minimize the risk of stray field induction, the flexible identification clamp (including the connection cable) must be connected at a distance of at least 10 cm from nearby cables. If there is not enough room for this, then at least the clamp closure and the connection cable should be positioned as far away as possible from the nearby cables (see diagram).



It is particularly important for the above instructions to be observed, if measurements are being taken from a multi-conductor cable and if the nearby disruptive object could be a phase of this cable that conducts return current. In the case of accessible individual phases (e.g. in low-voltage distributors), it is generally advisable to use the PAS CI sensor for phase identification (see section 6.3).

Commissioning the generator

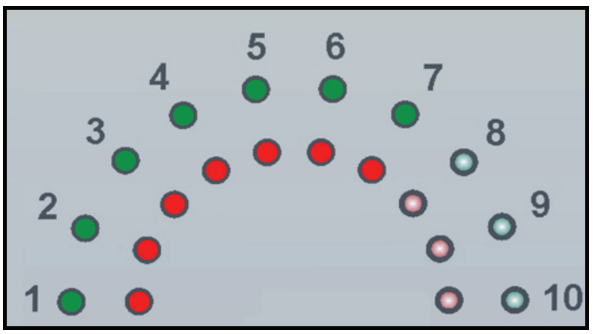
Prior to the actual cable identification with the identification receiver, the generator must be commissioned and connected to the cable to be identified.

For detailed instructions, please refer to the user manual of the respective generator.

Switching-on

The unit can be switched-on by pressing the on/off button [5].

If the receiver is ready for operation, the power LED on the on/off button lights up green. Subsequent to the switch-on process, the green [1] and red [2] signal LEDs indicate for three seconds the preselected gain stage (1 up to 10). The following figure shows an example for gain stage 7:



After the three seconds, the receiver starts to evaluate the signal level picked up by the identification clamp. It may take a few seconds until the receiver is able to clearly identify the incoming pulses and to indicate them appropriately.

In the case of low batteries, all red and green signal LEDs are flashing for a short period of time immediately after switch-on. Afterwards, the unit switches off automatically. The batteries have to be replaced (see section 8).

6 Operation

6.1 General Handling of the Device

Prior to the actual cable identification, a control measurement should be performed at the cable to be identified in the immediate vicinity to the generator in order to determine an adequate gain stage.

The gain which can be adjusted in ten 3 dB-stages (-3 dB … 24 dB) using the soft keys [3] and [4] should be set to the lowest stage which causes all 10 signal LEDs to light up. Afterwards, the receiver can be switched-off, whereby the selected gain stage is saved.

For ideal measuring conditions, a good signal quality should be given even in low gain stages (1 – 4). If you need to increase the gain stage to 5 or higher in order to obtain full deflection, you have to verify and improve the connection conditions of the generator. This is almost imperative since higher gain stages increase the danger to pick up interfering signals which can lead to wrong estimations of the measurement results at worst.

If no deflection of the signal LEDs can be achieved using the preset gain stage, it can be readjusted using the respective soft keys.

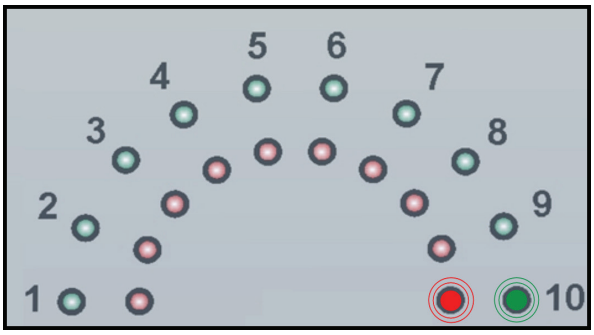
If – despite of galvanic coupling of the generator – gain stages >5 are required, the signal transmitted by the generator is compensated by return current for the most part. In this case and in the case of a high signal level difference compared to the control measurement, it is recommended to check the connection conditions.

Automatic switch-off

If the receiver is not used for a period, the unit will automatically switch-off three minutes after the last key press.

Overload

If the signal level is too high for a certain conclusion, the green and the red stage 10 LEDs flash to indicate overload.



Reduce the gain to resolve the problem.

6.2 Identifying a Cable Using the DC Pulse Method (Current Flow Direction Determination)

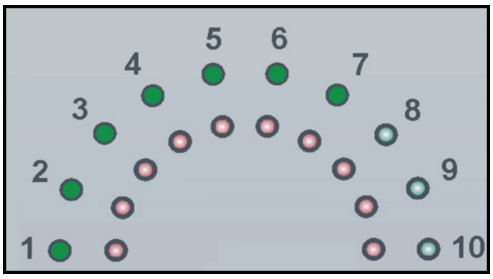
The signal level of the pulses transmitted by the generator is picked up by the flexible identification clamp and indicated by the green [1] or red [2] signal LEDs (depending on the direction of the current flow).

In accordance with the number of signal LEDs, the indication of the signal level is divided into 10 stages.

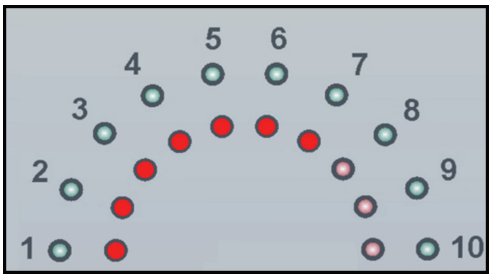
Since the both types of generators are transmitting a single pulse every 2 seconds, the receiver should indicate the pulses with exactly the same offset.

If the identification clamp is placed the right way round, the green signal LEDs indicate the cable to be identified.

For all adjacent cables, either no signal or a signal with reverse current flow direction (indicated by the red LEDs) should be received.



Right current flow direction



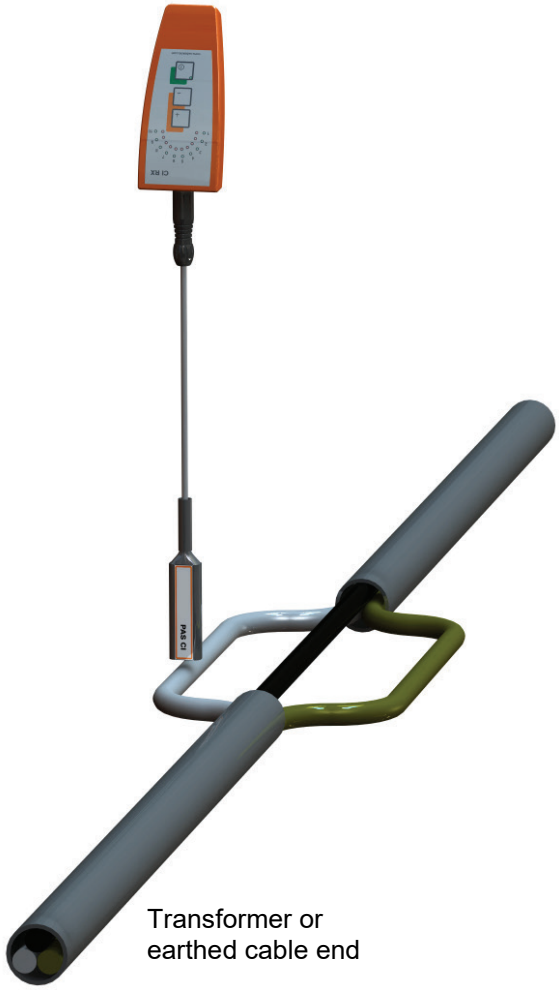
Wrong current flow direction

If more than one cable cause a deflection of the green LEDs, the identification clamp may be placed the wrong way round (see previous section).

6.3 Phase identification using the *PAS CI* (optional)

When using the *PAS CI* to identify a single phase of an energized or de-energized cable (in combination with the *LCI TX* or the *CI TX*), the sensor must be placed as shown in the picture below.

The type label must face the direction of the feeding transformer / grounded end. Consequentially, the white arrow on top of the sensor points towards the same direction.



The identification of the phase is basically performed the same way as the identification of a cable (see section 6.2).

If the sensor orientation is correct, the green LEDs [1] should only light up on the phase which is connected to the generator, while the red LEDs [2] should light up on all other conductors.

Any return currents flowing through the conductors of adjacent cables should always result in the red LEDs lighting up.

6.4 Using the “Twisted-Field” Sensor (“Twisted-Field” Method and Load Current Detection)

The *TFS CI* sensor is only to be used for cable identification according to the “Twisted Field” method and load current detection as described in this section. Using it for the identification of untwisted cables may lead to false identification!

6.4.1 Cable Identification with the “Twisted-Field” Method

Purpose

The cable identification with the ‘Twisted-Field’ method, which is required by various standards, is used specifically in the following scenarios:

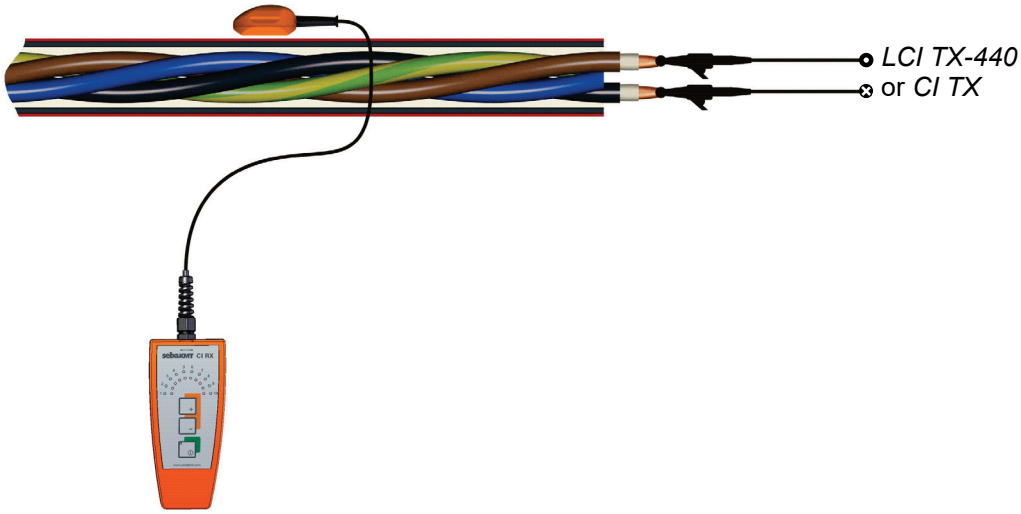
- Inaccessible cables (cannot be gripped by identification tongs)
- Cable systems without alternative earth return path (e.g. IT networks)
- Undefined return current conditions (e.g. paper-insulated lead covered (PILC) cables with metal sheath in contact with earth)

Prerequisites

Unlike in normal cable identification, the identification generator must be connected between two phases when using the “Twisted-Field” method. Only the identification generators *LCI TX440* (identification under voltage) and *CI TX* can be used.

For detailed information how to connect the generator to the cable to be identified, please refer to the user manual of the generator.

The *TFS CI* sensor must be connected to the receiver instead of the identification tongs. Sensor orientation is not important in simple cable identification.

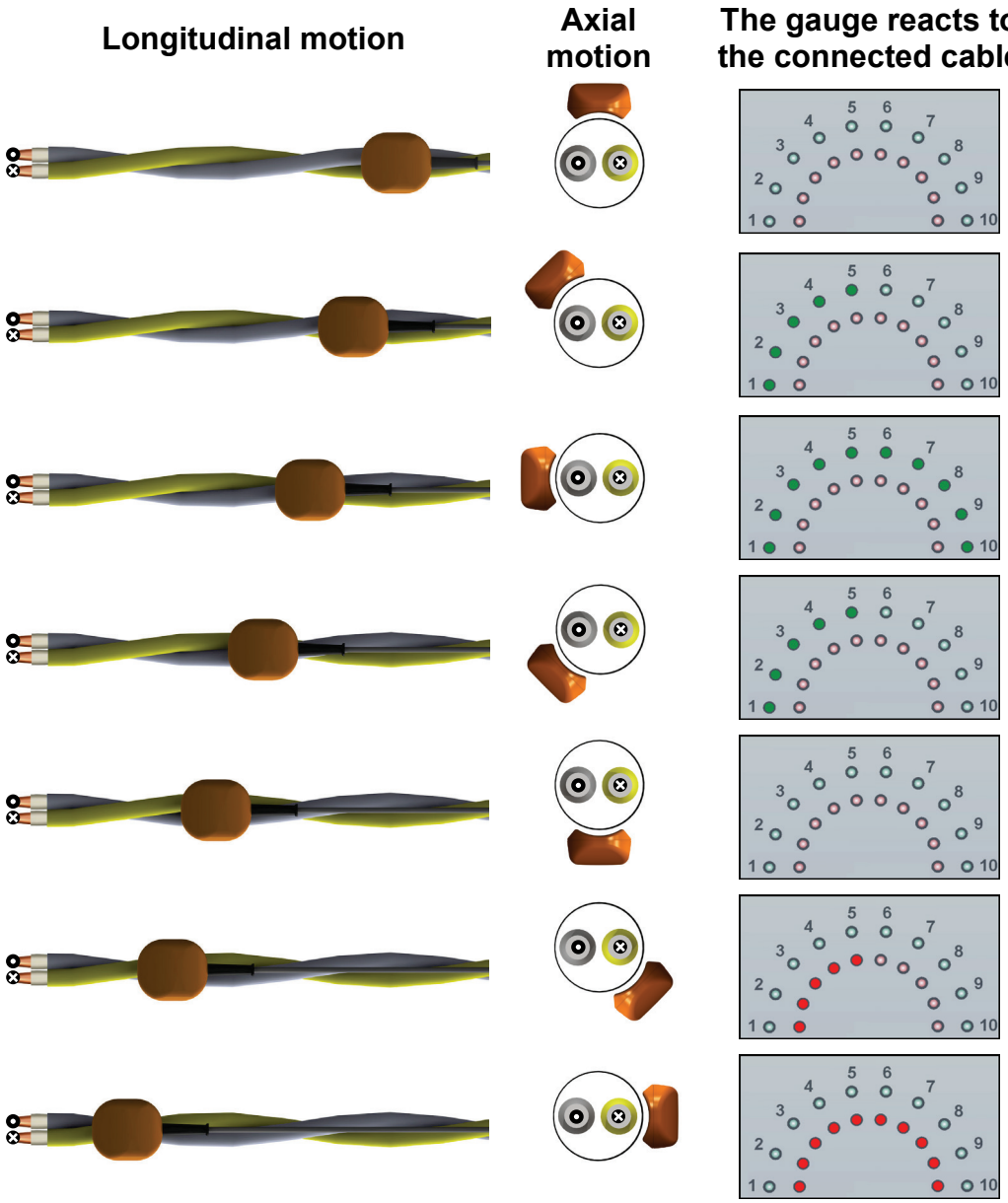


Process

Due to the twist of the conductors along the cable, the fields formed around the two conductors are counter rotating.As the *TFS CI* sensor is moved along or around the cable to be identified, the green [1] and red [2] LEDs on the receiver light up in rotation.

Adjacent cables do not produce any activation of the LEDs.

When examining the sensor travel along a twisted bifilar cable, the following signal behavior becomes apparent:



Current flow: ⊗ → ⊙

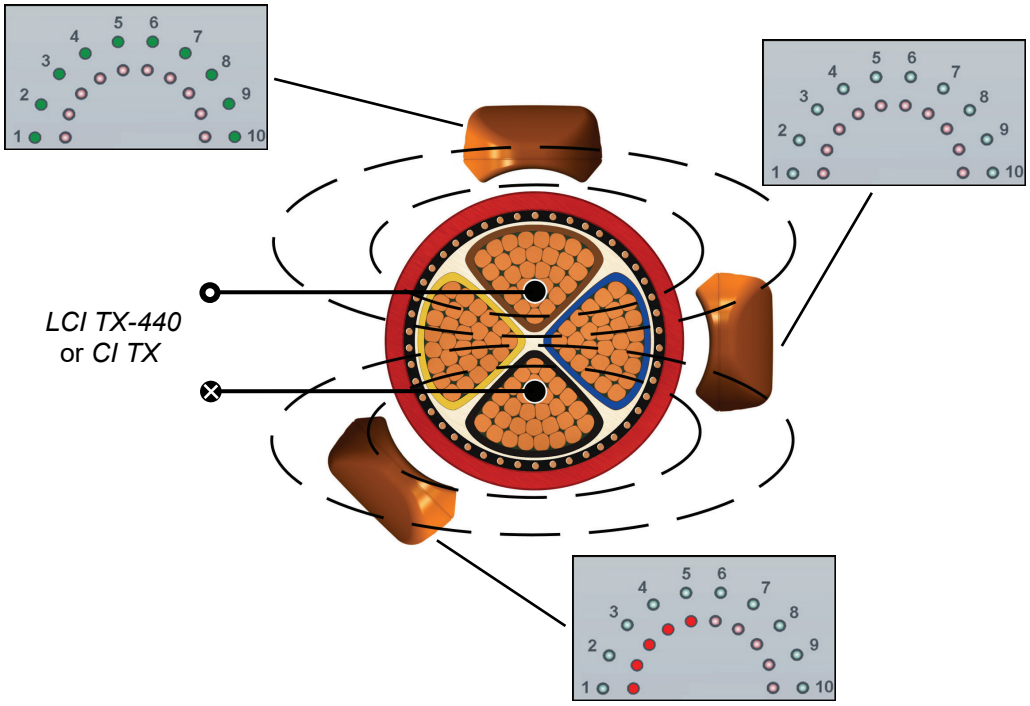
An interval of min. 2 seconds is required between the individual motion phases, which corresponds to the signal pause of the identification generator. Sensor motion must be carried out slowly, taking these signal pauses into consideration!

If the sensor orientation is reversed, the colour of the signal LED is reversed as well.

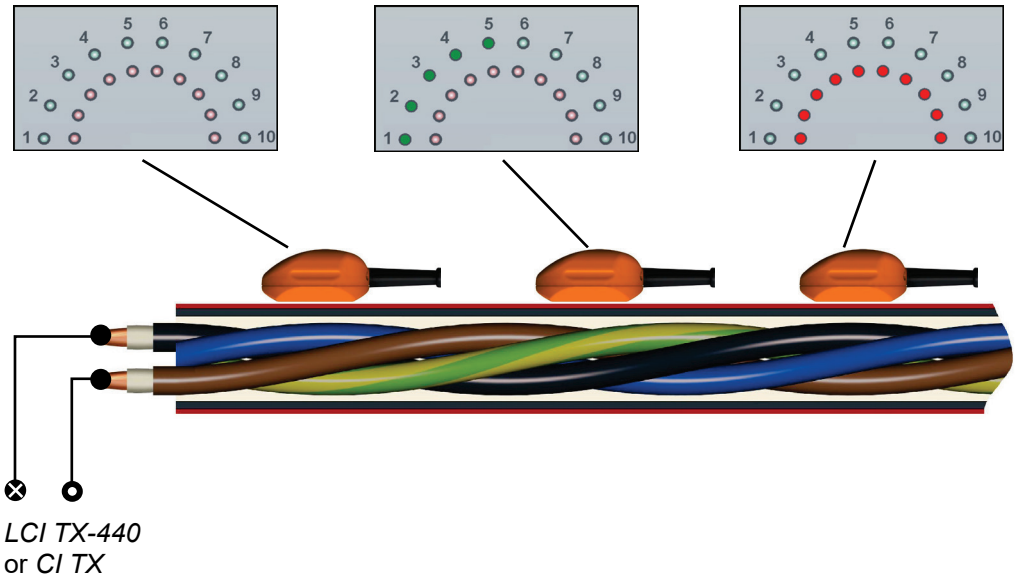
The “Twisted-Field” method can also be applied to three- or four-core cables without any problems.

For four-core cables, it is recommended to connect the identification generator to two opposite strands to be able to identify the described polarity reversal as clearly as possible (see images).

The following diagram illustrates the signal response when the sensor is moved around a four-core cable in a radial direction:



The following diagram illustrates the signal response when the sensor is moved along a four-core cable:



6.4.2 Load Current Detection

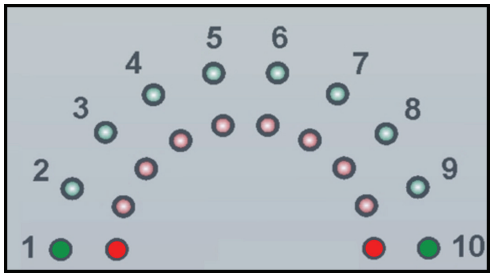
CAUTION	It is only possible to detect load current for shielded cables to a very limited degree.

Purpose

The determination of the current flow direction and the “Twisted-Field” identification represent straightforward and reliable cable identification methods. An additional recording of load currents with a frequency of 50 Hz or 60 Hz can further increase the reliability of the cable identification in certain cases, e.g. in the case of two cables of which only one is definitely under voltage.

Switching to load current detection

When the receiver is switched on, it is always in identification mode. To switch to load current detection mode, press the **+** [3] and – [4] buttons simultaneously (for 2 seconds). After the mode has been switched successfully, the following continuous display shows that load current detection is activated:

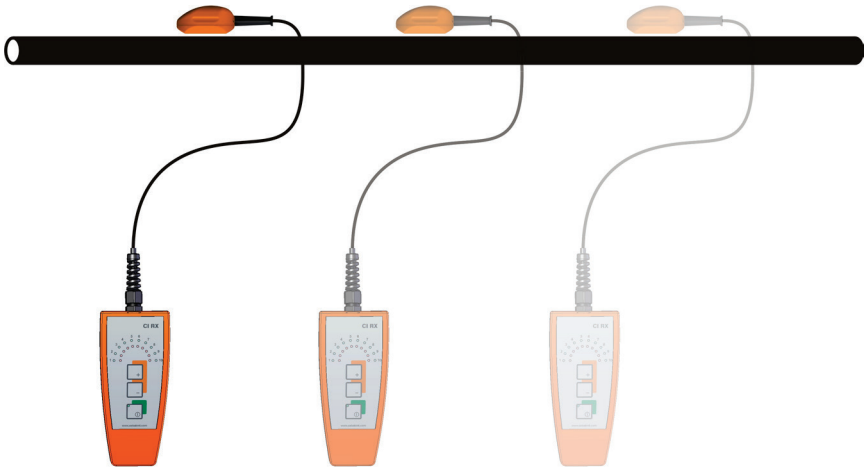


Gain adjustment

Setting the gain is performed in a similar way to the identification mode (see section 6.1). Unlike the identification mode, in load current detection mode, LEDs 1 and 10 flash to display overload. If this happens even when gain stage 1 is selected, then you should increase the distance between the sensor and the cable (e.g. by placing your hand in between them).

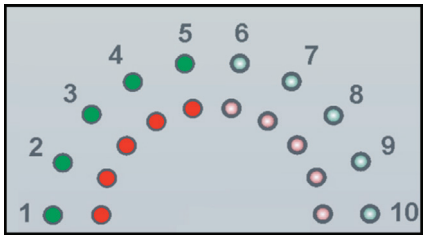
Procedure

To perform load current identification, the *TFS CI* sensor must be placed onto the cable that is to be checked. The sensor should be kept in this position for several seconds. If the display on the receiver does not respond, this means that no load current could be detected. This result should be verified at other points along the cable for good measure.

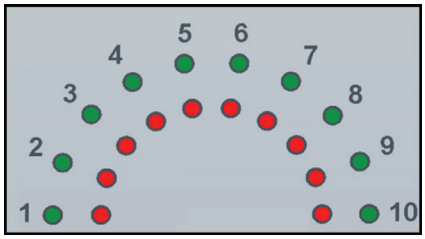


WARNING	Even if no load current has been detected, the cable must not necessarily be de-energized! The *CI RX* cannot be used to test the absence of voltage! If load current has been detected, on the other hand, the cable must be considered as live.

If a detectable current is flowing through the cable, then this is signaled by the red and green LEDs flashing every second. The following differentiation is made:



Half-scale deflection



Full-scale deflection

Depending on the gain setting of the *CI RX*, the following conclusions can be drawn:

	Gain					
	1 … 5	**6**	**7**	**8**	**9**	**10**
Full-scale deflection	>50 A					
Half-scale deflection	>10 A	>7 A	>5 A	>3,5 A	>2,5 A	>1.75 A

CAUTION	The detection of load current does not replace a current measurement with a calibrated current clamp. Ampere measurements can only be considered as estimated values and they are independent of the sensor's distance and position with relation to the current-conducting phases / shields.

Load current detection can also be performed when a cable identifying generator is connected. However, a comparative measurement should be taken near to the generator in advance in order to estimate whether a reading can be expected at the actual measurement point.

7 Troubleshooting

Failure to identify a cable clearly may be due to the following reasons:

- The cable to be identified is not among the cables tested.
- The identifying generator (only for *LCI TX* / *LCI TX-440*) has been connected to an IT or TT protective-conductor system. Connection is ineffective in this case owing to the system's isolation from earth.
- The cable to be identified is in a ring.
- The cable to be identified consists of several parallel cables, resulting in current distribution of the test pulse (only for *LCI TX* / *LCI TX-440*).
- The current in the cable to be identified is > 120 A or the transient disturbances are too high (only for *LCI TX* / *LCI TX-440*).
- The battery of the identifying receiver is flat.
- Reverse currents which are carried by the cable screen, PEN or metal sheath are compensating the signal.
- Sensor motion too fast during twisted field identification.

8 Changing the Batteries

The battery housing is located on the back side of the unit and can be opened using the slide closure. Two identical 1.5 V AA batteries have to be used as replacement.

Tento symbol indikuje, že výrobek nesoucí takovéto označení nelze likvidovat společně s běžným domovním odpadem. Jelikož se jedná o produkt obchodovaný mezi podnikatelskými subjekty (B2B), nelze jej likvidovat ani ve veřejných sběrných dvorech. Pokud se potřebujete tohoto výrobku zbavit, obraťte se na organizaci specializující se na likvidaci starých elektrických spotřebičů v blízkosti svého působiště.

Dit symbool duidt aan dat het product met dit symbool niet verwijderd mag worden als gewoon huishoudelijk afval. Dit is een product voor industrieel gebruik, wat betekent dat het ook niet afgeleverd mag worden aan afvalcentra voor huishoudelijk afval. Als u dit product wilt verwijderen, gelieve dit op de juiste manier te doen en het naar een nabij gelegen organisatie te brengen gespecialiseerd in de verwijdering van oud elektrisch materiaal.

This symbol indicates that the product which is marked in this way should not be disposed of as normal household waste. As it is a B2B product, it may also not be disposed of at civic disposal centres. If you wish to dispose of this product, please do so properly by taking it to an organisation specialising in the disposal of old electrical equipment near you.

Този знак означава, че продуктът, обозначен по този начин, не трябва да се изхвърля като битов отпадък. Тъй като е B2B продукт, не бива да се изхърля и в градски пунктове за отпадъци. Ако желаете да извърлите продукта, го занесете в пункт, специализиран в изхвърлянето на старо електрическо оборудване.

Dette symbol viser, at det produkt, der er markeret på denne måde, ikke må kasseres som almindeligt husholdningsaffald. Eftersom det er et B2B produkt, må det heller ikke bortskaffes på offentlige genbrugsstationer. Skal dette produkt kasseres, skal det gøres ordentligt ved at bringe det til en nærliggende organisation, der er specialiseret i at bortskaffe gammelt el-udstyr.

Sellise sümboliga tähistatud toodet ei tohi käidelda tavalise olmejäätmena. Kuna tegemist on B2B-klassi kuuluva tootega, siis ei tohi seda viia kohalikku jäätmekäitluspunkti. Kui soovite selle toote ära visata, siis viige see lähimasse vanade elektriseadmete käitlemisele spetsialiseerunud ettevõttesse.

Tällä merkinnällä ilmoitetaan, että kyseisellä merkinnällä varustettua tuotetta ei saa hävittää tavallisen kotitalousjätteen seassa. Koska kyseessä on yritysten välisen kaupan tuote, sitä ei saa myöskään viedä kuluttajien käyttöön tarkoitettuihin keräyspisteisiin. Jos haluatte hävittää tämän tuotteen, ottakaa yhteys lähimpään vanhojen sähkölaitteiden hävittämiseen erikoistuneeseen organisaatioon.

Ce symbole indique que le produit sur lequel il figure ne peut pas être éliminé comme un déchet ménager ordinaire. Comme il s'agit d'un produit B2B, il ne peut pas non plus être déposé dans une déchetterie municipale. Pour éliminer ce produit, amenez-le à l'organisation spécialisée dans l'élimination d'anciens équipements électriques la plus proche de chez vous.

Cuireann an siombail seo in iúl nár cheart an táirgeadh atá marcáilte sa tslí seo a dhiúscairt sa chóras fuíoll teaghlaigh. Os rud é gur táirgeadh ghnó le gnó (B2B) é, ní féidir é a dhiúscairt ach oiread in ionaid dhiúscartha phobail. Más mian leat an táirgeadh seo a dhiúscairt, déan é a thógáil ag eagraíocht gar duit a sainfheidhmíonn i ndiúscairt sean-fhearas leictrigh.

Dieses Symbol zeigt an, dass das damit gekennzeichnete Produkt nicht als normaler Haushaltsabfall entsorgt werden soll. Da es sich um ein B2B-Gerät handelt, darf es auch nicht bei kommunalen Wertstoffhöfen abgegeben werden. Wenn Sie dieses Gerät entsorgen möchten, bringen Sie es bitte sachgemäß zu einem Entsorger für Elektroaltgeräte in Ihrer Nähe.

Αυτό το σύμβολο υποδεικνύει ότι το προϊόν που φέρει τη σήμανση αυτή δεν πρέπει να απορρίπτεται μαζί με τα οικιακά απορρίμματα. Καθώς πρόκειται για προϊόν B2B, δεν πρέπει να απορρίπτεται σε δημοτικά σημεία απόρριψης. Εάν θέλετε να απορρίψετε το προϊόν αυτό, παρακαλούμε όπως να το παραδώσετε σε μία υπηρεσία συλλογής ηλεκτρικού εξοπλισμού της περιοχής σας.

Ez a jelzés azt jelenti, hogy az ilyen jelzéssel ellátott terméket tilos a háztartási hulladékokkal együtt kidobni. Mivel ez vállalati felhasználású termék, tilos a lakosság számára fenntartott hulladékgyűjtőkbe dobni.Ha a terméket ki szeretné dobni, akkor vigye azt el a lakóhelyéhez közel működő, elhasznált elektromos berendezések begyűjtésével foglalkozó hulladékkezelő központhoz.

Questo simbolo indica che il prodotto non deve essere smaltito come un normale rifiuto domestico. In quanto prodotto B2B, può anche non essere smaltito in centri di smaltimento cittadino. Se si desidera smaltire il prodotto, consegnarlo a un organismo specializzato in smaltimento di apparecchiature elettriche vecchie.

Šī zīme norāda, ka iztrādājumu, uz kura tā atrodas, nedrīkst izmest kopā ar parastiem mājsaimniecības atkritumiem. Tā kā tas ir izstrādājums, ko cits citam pārdod un lieto tikai uzņēmumi, tad to nedrīkst arī izmest atkritumos tādās izgāztuvēs un atkritumu savāktuvēs, kas paredzētas vietējiem iedzīvotājiem. Ja būs vajadzīgs šo izstrādājumu izmest atkritumos, tad rīkojieties pēc noteikumiem un nogādājiet to tuvākajā vietā, kur īpaši nodarbojas ar vecu elektrisku ierīču savākšanu.

Šis simbolis rodo, kad juo paženklinto gaminio negalima išmesti kaip paprastų buitinių atliekų. Kadangi tai B2B (verslas verslui) produktas, jo negalima atiduoti ir buitinių atliekų tvarkymo įmonėms. Jei norite išmesti šį gaminį, atlikite tai tinkamai, atiduodami jį arti jūsų esančiai specializuotai senos elektrinės įrangos utilizavimo organizacijai.

Dan is-simbolu jindika li l-prodott li huwa mmarkat b'dan il-mod m'għandux jintrema bħal skart normali tad-djar. Minħabba li huwa prodott B2B , ma jistax jintrema wkoll f'ċentri ċiviċi għar-rimi ta' l-iskart. Jekk tkun tixtieq tarmi dan il-prodott, jekk jogħġbok għamel dan kif suppost billi tieħdu għand organizzazzjoni fil-qrib li tispeċjalizza fir-rimi ta' tagħmir qadim ta' l-elettriku.

Dette symbolet indikerer at produktet som er merket på denne måten ikke skal kastes som vanlig husholdningsavfall. Siden dette er et bedriftsprodukt, kan det heller ikke kastes ved en vanlig miljøstasjon. Hvis du ønsker å kaste dette produktet, er den riktige måten å gi det til en organisasjon i nærheten som spesialiserer seg på kassering av gammelt elektrisk utstyr.

Ten symbol oznacza, że produktu nim opatrzonego nie należy usuwać z typowymi odpadami z gospodarstwa domowego. Jest to produkt typu B2B, nie należy go więc przekazywać na komunalne składowiska odpadów. Aby we właściwy sposób usunąć ten produkt, należy przekazać go do najbliższej placówki specjalizującej się w usuwaniu starych urządzeń elektrycznych.

Este símbolo indica que o produto com esta marcação não deve ser deitado fora juntamente com o lixo doméstico normal. Como se trata de um produto B2B, também não pode ser deitado fora em centros cívicos de recolha de lixo. Se quiser desfazer-se deste produto, faça-o correctamente entregando-o a uma organização especializada na eliminação de equipamento eléctrico antigo, próxima de si.

Acest simbol indică faptul că produsul marcat în acest fel nu trebuie aruncat ca şi un gunoi menajer obişnuit. Deoarece acesta este un produs B2B, el nu trebuie aruncat nici la centrele de colectare urbane. Dacă vreţi să aruncaţi acest produs, vă rugăm s-o faceţi într-un mod adecvat, ducând-ul la cea mai apropiată firmă specializată în colectarea echipamentelor electrice uzate.

Tento symbol znamená, že takto označený výrobok sa nesmie likvidovať ako bežný komunálny odpad.Keďže sa jedná o výrobok triedy B2B, nesmie sa likvidovať ani na mestských skládkach odpadu. Ak chcete tento výrobok likvidovať, odneste ho do najbližšej organizácie, ktorá sa špecializuje na likvidáciu starých elektrických zariadení.

Ta simbol pomeni, da izdelka, ki je z njim označen, ne smete zavreči kot običajne gospodinjske odpadke. Ker je to izdelek, namenjen za druge proizvajalce, ga ni dovoljeno odlagati v centrih za civilno odlaganje odpadkov. Če želite izdelek zavreči, prosimo, da to storite v skladu s predpisi, tako da ga odpeljete v bližnjo organizacijo, ki je specializirana za odlaganje stare električne opreme.

Este símbolo indica que el producto así señalizado no debe desecharse como los residuos domésticos normales. Dado que es un producto de consumo profesional, tampoco debe llevarse a centros de recogida selectiva municipales. Si desea desechar este producto, hágalo debidamente acudiendo a una organización de su zona que esté especializada en el tratamiento de residuos de aparatos eléctricos usados.

Den här symbolen indikerar att produkten inte får blandas med normalt hushållsavfall då den är förbrukad. Eftersom produkten är en så kallad B2B-produkt är den inte avsedd för privata konsumenter, den får således inte avfallshanteras på allmänna miljö- eller återvinningsstationer då den är förbrukad. Om ni vill avfallshantera den här produkten på rätt sätt, ska ni lämna den till myndighet eller företag, specialiserad på avfallshantering av förbrukad elektrisk utrustning i ert närområde.