# ENGLISH

# User manual



Release IT 1.00 - 16/03/2009

**Indice:**

# 1 SAFETY PRECAUTIONS AND PROCEDURES

This instrument conforms with safety Standard IEC/EN61010-1 related to electronic measuring instruments. For your own safety and to avoid damaging the instrument follow the procedures described in this instruction manual and read carefully all notes preceded by this symbol ⚠.

When taking measurements:

- It is important to observe the general electric regulations of the particular country in which the device will be setup and used, as well as current national regulations for accident prevention and current company internal regulations (work, operating and safety regulations
- The use of original accessories ensures system safety and reliable operation. The use of other parts is not permitted and shall result in termination of the warranty
- Connections to live cables should be made by qualified personnel
- Keep you insulated from the object under test
- Do not touch exposed metal parts such as test lead ends, sockets, fixing objects, circuits etc
- Avoid doing that if you notice anomalous conditions such as breakages, deformations, fractures, leakages of battery liquid, blind display etc
- HT-5000 can only locate lines which emit a signal. Therefore it is important to always exercise extreme caution when digging, even if no lines have been found
- Refer always to the user manual. An improper use may damage the instrument or its components

The following symbols are used on meter and in manual:

CAUTION - refer to the instruction manual - an improper use may damage the instrument or its components

Double insulated meter

# 2 DESCRIZIONE GENERALE

The **HT-5000** location system is designed for the uncomplicated and user-friendly determination of the location, orientation and depth of metallic lines (e.g. cable and pipe lines). It can be used to probe areas for unknown lines or for locating specific lines.
HT-5000 (composed by a **TX5000** transmitter unit and **RX5000** receiver unit) is distinguished by the following features:

- Robust construction for use in poor weather and in harsh environments
- Simple, user-friendly operation concept with a minimum number of controls
- Reliable battery status indicator

The RX5000 receiver is distinguished by the following features:

- **passive** signal modes for locating lines without the TX5000 transmitter
- **active** signal modes for locating lines / probes when used together with a transmitter
- Automatic depth determination when used together with a transmitter
- Semi-automatic depth estimation in passive signal modes
- Sensitivity level can be adjusted automatically or manually
- Lighted display for use in dim environments

# 3 PREPARATION FOR USE

## 3.1 INITIAL

This instrument was checked both mechanically and electrically prior to shipment.
All possible cares and precautions were taken to let you receive the instrument in perfect conditions. Notwithstanding we suggest you to check it rapidly (eventual damages may have occurred during transport – if so please contact the local distributor from whom you bought the item).

Make sure that all standard accessories mentioned in paragraph 6.4. are included.

Should you have to return back the instrument for any reason please follow the instructions mentioned in chapter 7

## 3.2 SUPPLY VOLTAGE

The TX5000 unit is supplied by 6x1.5V alkaline batteries type IEC LR20 included as standard accessories. The battery life is about 40 hours. The RX5000 unit is supplied by 10x1.5V alkaline batteries type IEC LR06 with battery life of about 40 hours

## 3.3 CALIBRATION

The instrument complies with the technical specifications contained in this manual and such compliance is guaranteed for 12 months

## 3.4 STORAGE

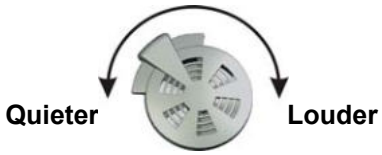
After a period of storage in extreme environmental conditions exceeding the limits mentioned in paragraphs 6.1 and 6.2 let the instrument resume normal operating conditions before using it

# 4 OPERATING INSTRUCTIONS

## 4.1 INSTRUMENT DESCRIPTION

### 4.1.1 Description of the receiver RX5000


Fig. 1: Description of the receiver RX5000

| Item | Description |
|---|---|
| **1** | **Control panel with display** (see paragraph 4.1.2) |
| **2** | **Speaker with volume control**<br>The speaker plays back various acoustic signals (e.g. beeps with modulating pitch relative to the signal strength)<br>  <br><br>When the receiver is switched on, the volume is set at a standard level. The receiver will only start with the volume at a different level if the volume has been manually increased before switching off the receiver |
| **3** | **Headphone jack**<br>To connect headphones with a 3.5 mm plug connector |
| **4** | **Battery compartment** |
| **5** | **Floor cap**<br>This replaceable floor cap serves to protect the housing |

### 4.1.2 Display and control panel of RX5000

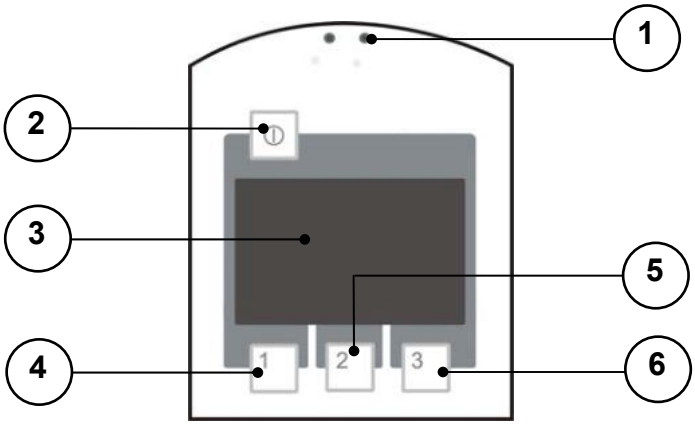



Fig. 2: Display and control panel of RX5000

| Item | Description |
|---|---|
| **1** | **Light sensor**<br>Light sensitive photo cells to automatically regulate the display lighting<br>The display lighting can be manually activated for one minute by briefly covering the light sensor |
| **2** | **On/Off switch**<br>By quickly pressing this button the receiver can be switched on or off<br>The RX5000 will switch off automatically if no functions are carried out within 7 minutes of being switched on |
| **3** | **Display**<br>Provides a visual indication of reception strength, line depth, mode of operation, battery status and menu items |
| **4** | **Function key 1**<br>Depending on the status of the system, this button is used to:<br>• Manually decrease reception sensitivity<br>• Start measuring depth |
| **5** | **Function key 2**<br>Depending on the status of the system, this button is used to:<br>• Adjust reception sensitivity<br>• Start measuring depth |
| **6** | **Function key 3**<br>Depending on the status of the system, this button is used to:<br>• Select the mode of operation / receiving frequency<br>• Manually increase reception sensitivity |

### 4.1.3 Description of transmitter TX5000

The TX5000 transmitter is distinguished by the following features:

- **Inductive coupling** of the signal using the integrated antenna or transmitter clamp
- **Direct (galvanic) coupling** of the signal using connected equipment (such as the measurement cable and power socket adapter)
- Two-step adjustable transmission power (0.1W / 0.5W)
- Selectable signal output continuous or pulsed

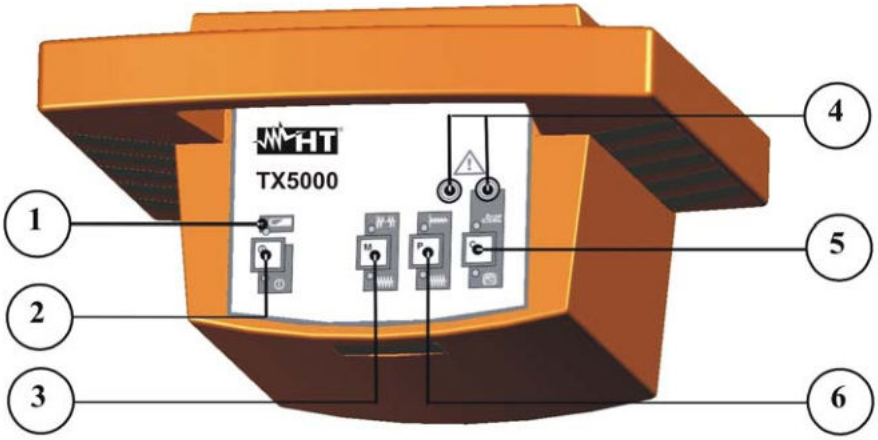


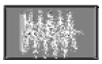

Fig. 3: Front panel of transmitter TX5000

| Item | Description |
|---|---|
| **1** | **Battery status indicator**<br>When the battery status LED blinks in red, the batteries need to be replaced |
| **2** | **On/Off switch**<br>By quickly pressing this button the TX5000 can be switched on or off.<br>All appropriate LED's blink when the transmitter is on, depending on operating function |
| **3** | **Signal type function key**<br>This key is used to switch between continuous and pulsed signal output |
| **4** | **Jacks for connecting accessories**<br>These jacks are used to create a direct galvanic connection with the target line or to create a connection using a special connection set (e.g. 100mm transmitter clamp or house connection set) |
| **5** | **Mode function key**<br>This key is used to switch between **inductive** and **direct** signal coupling (galvanically or via transmitter clamp) |
| **6** | **Signal strength function key**<br>This key is used to select one of two signal strength levels (0.1W or 0.5W) |

## 4.2 CONNECTION AND INITIAL USE OF TRANSMITTER TX5000

### 4.2.1 Transmitter signals and operation modes

The type and strength of the output signal can be configured by the user as follows to meet the specific requirements of either the line to be located or the site to be surveyed:

| Symbol | Signal type |
|---|---|
|  | **Pulsed signal**<br>As it is more easily distinguished from other signals, the pulsed signal is helpful for locating when there is interference within the frequency range of the transmitter. This also helps to conserve the batteries<br><br>**Depth measurements cannot be made using a pulsating signal** |
|  | **Continuous signal**<br>This signal type has to be activated before a taking a depth measurement |
| **Symbol** | **Signal strength** |
|  | **Low output signal strength (0.1W)**<br>Low signal strength conserves the batteries |
|  | **High output signal strength (0.5W)** |
| **Symbol** | **Operation modes** |
|  | **Inductive connection**<br>In this mode of operation the transmitter's signal is emitted through the integrated antenna and is thereby inductively coupled with any metallic lines located within a certain radius |
|  | **Direct connection**<br>In this mode of operation the signal is directly coupled with a metallic line via the measurement cable which is connected to the jacks on the front panel of the transmitter. Transmitter clamps, alligator clips or power socket adapters (for example) may be used to connect the measurement cable to the lines |

### 4.2.2 Options for direct and inductive signal coupling

**CAUTION**

If the transmitter is connected to electrical service cables, it has to be considered that the device is designed to achieve CAT II / CAT III 440 V and CAT IV 300 V with Class 2 protection (double insulation) according to IEC / EN 61010-1. This means that the maximum voltage between the two terminals must not exceed 440 V in measurement categories CAT II / CAT III and 300 V in measurement category CAT IV

#### 4.2.2.1 Direct coupling on cables and pipes

Direct galvanic coupling is practical for cables which are easily accessible and free of current. The method of connection is dependent upon the position and nature of the lines (e.g. insulation, cable conduit, accessibility of the cable ends).
Direct coupling presents a reliable option for selective cable location, as the signal can be coupled onto a specific cable with virtually no loss.
The following illustration shows an example of direct coupling:

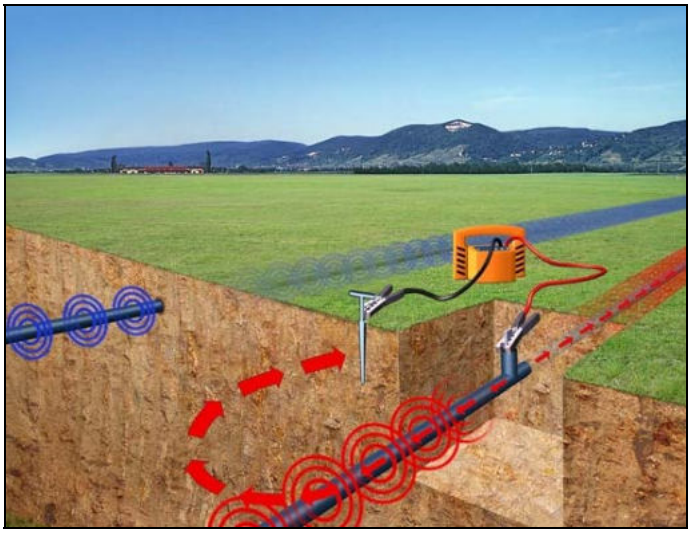


Fig. 4: Direct coupling on cables and pipes

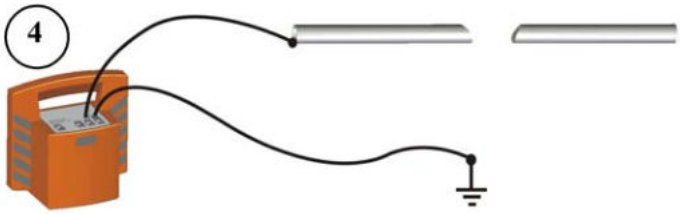
**CAUTION**

If the lines being located are energised, the following five safety precautions should be taken before connecting the transmitter:

1. Disconnect power supply
2. Secure against reconnection
3. Check for presence of current
4. Make earth connection and short circuit of parts
5. Cover or block access to adjacent components which are energized

**If the system cannot be de-energized the use of the inductive coupling clamp is possible to perform the location of objects**

The following table explains various basic principles of direct galvanic coupling.

| Application | Principle of coupling |
|---|---|
| **Single-wire lines or pipes (with or without insulation against earthing)**<br>The distance between the earth spike and the ends of the connected lines should be as great as possible<br>There is a danger of the return current flowing through the earth into adjacent lines, which could result in their path being follow |  |
| **Single-wire cable with metallic screen and earthing insulation**<br>Short circuit between internal conductor and screen at the end of the cable with earthing at the beginning and end of the cable as well<br>If the earth connections made are unfavourable, the current in the internal conductor and the return current in the screen will cancel each other out. Under certain circumstances this can prevent the cable from being detected. Alternatively, a connection without an earth connection can also be made |  |
| **Multiple-wire cable (internal conductor connected or disconnected) with metallic screen and earthing insulation verso terra**<br>Same application as in example 1 |  |
| **Metallic conduit (with or without insulation against earthing)**<br>The earth spike and the conduit should be spaced as far apart as possible. Under certain circumstances, optimum positioning of the earth spike may require several attempts |  |
| **If a return wire is available**<br>The spacing of the return wire should correspond to at least 10 times the depth of the line being located |  |
| **Pair of wires (with or without screen) with short circuit at the end of the cable**<br>Adjacent conductors<br>**horizontal** ⇨<br>Minimum of the reception signal<br>**vertically** ⇨<br>Maximum of the reception signal |  |

#### 4.2.2.2 Coupling with special accessories

The signal from the transmitter can be directly coupled into plug sockets, antenna connections coax and telephone jacks with the aid of a suitable adapter cable (Cod. **890008852**). In doing so, it is not necessary to disconnect the lines.


Fig. 5: Couplng via adapter cable

The transmitter signal can be coupled onto easily accessible cables with the aid of a 100mm transmitter clamp (Cod. **820005314**). In doing so, it is **not** necessary to disconnect the cables

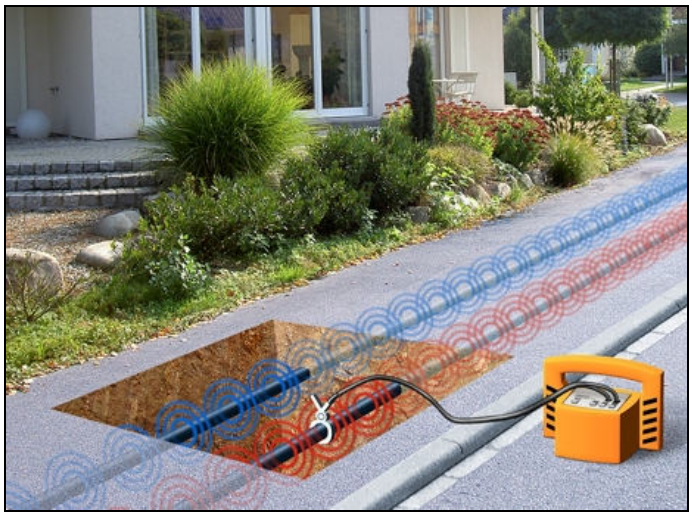


Fig. 6: Coupling via transmitter clamp

By ensuring that the transmitter clamp is completely closed around the cable, only a small leakage field will be generated. This can significantly reduce the unwanted coupling of the signal onto neighbouring lines.

Ideally the cables will be grounded at both ends, but even if they are not grounded at one end, selecting high power transmitter output will assist easy location

#### 4.2.2.3 Inductive signal coupling

For lines which are not easily accessible, the signal from the transmitter has to be inductively coupled via the integrated antenna. The inductive coupling of the signal is highly recommended if unknown lines are to be located (e.g. at a construction site).

To determine the orientation of a specific line, the transmitter has to be positioned directly above the presumed line as shown in Fig. 7. In doing so, the best signal coupling is achieved when the handle of the transmitter housing is aligned with the presumed lay of the line

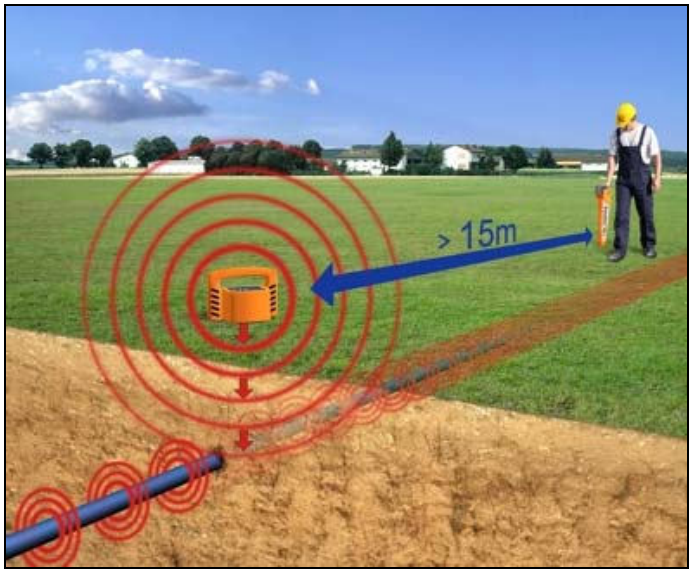



Fig. 7:Inductive signal coupling

**CAUTION**

When locating lines using inductive signal coupling, the following guidelines should be observed:

- As the signal can be coupled onto other conductors when using inductive coupling, direct coupling of the transmitter is always preferable when locating lines selectively. Inductive signal coupling should only be opted for in cases where the line being located is not easily accessible (see paragraph 4.2.1 and 4.2.2)
- While taking measurements, make sure that a distance of **at least 15m** is always maintained between the receiver and transmitter in order to prevent the coupling of the transmitter's signal through the air
- When searching for unknown lines at a site, the position of the transmitter has to be changed at least once by one metre and 90°
- It is also a good idea to position the transmitter at visible cable ends such as at distribution boxes or light poles

Under certain circumstances lines at lower depths can 'hide' deeper, adjacent lines, thus making it more difficult to locate them.

In such cases, the transmission characteristics of the transmitter TX5000 can be fully utilised and the lines which have already been located can be masked out (see Fig. 8)

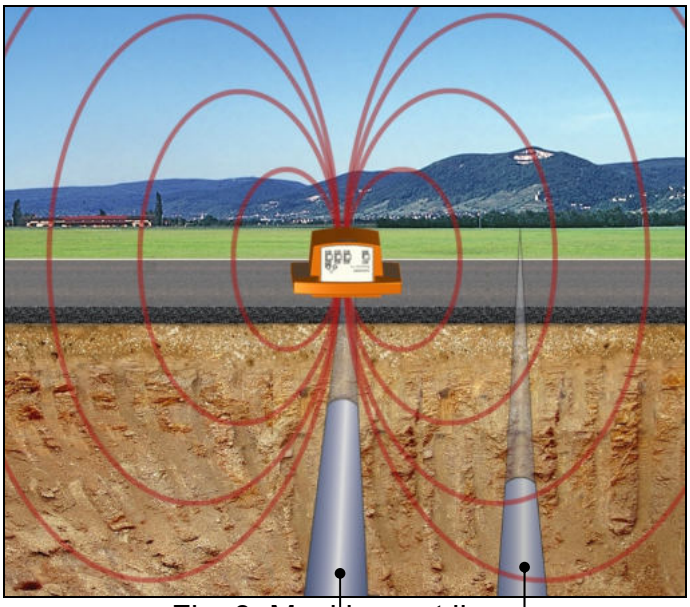



Fig. 8: Masking-out lines

Follow the steps listed below in order to locate lines by masking-out adjacent lines

| Step | Action |
|---|---|
| **1** | Use the RX5000 and TX5000 to locate and pinpoint a buried line (see paragraph 4.3.2) |
| **2** | With the RX5000 rested on the ground straight above the located line, ask a colleague to place the TX5000 on its back (see Fig. 8) nearby the line path (**at least 15m** away from the receiver) |
| **3** | Slide the TX5000 across the line until the signal strength bargraph is lowest, indicating that the transmitter is directly above the line which, thus, is masked-out<br>Note that adjacent lines may not be parallel with the first cable route, so sweep the receiver around in a circle about 10m - 15m radius from the transmitter, with the handle pointing towards the transmitter. Any metallic lines within 2.5m of the transmitter will be coupled with the transmitted signal |
| **4** | Pinpoint and determine the direction of any buried lines (see paragraph 4.3.1.2) |

#### 4.2.2.4 Signal coupling in non-metallic pipes

With the aid of the FlexSonde **GOK50-R** the transmitter's signal can be transmitted through non-metallic pipes, as shown in the picture below:


Fig. 9: Signal coupling in non-metallic pipes

Alternatively, any other active probe (e.g. a camera probe) with adequate transmitting frequency can be located using the receiver. For a detailed description, please refer to the manual of the respective product.

When locating non-metallic pipes, the following guidelines should be observed:

- Contrary to the line location, a probe location has to be performed in perpendicular position to the probe, i.e., the handle of the receiver has to be hold at right angle to the probe
- Practice locating the probe or FlexSonde head before pushing it into the drain or duct.
- Strongest signal will be detected when the receiver is above and perpendicular to the probe (as shown in Fig. 9)

The signal transmitted by the probe results in three signal maxima on the ground surface level. Typically, there is a smaller maximum in front of the actual signal maximum and one behind it.

For this reason, it should be always evaluated whether there are further signal maxima in front of or behind the detected signal maximum. An accurate depth determination can only be performed directly above the actual (highest) signal maximum.

If the receiver is operated in automatic sensitivity level adjustment mode, these lower signal maxima are usually masked-out

### 4.2.3 Initial use of the transmitter TX5000

Follow the steps listed below in order to prepare the transmitter to search for lines in conjunction with the receiver:

| Step | Action |
|---|---|
| **1** | Connect the transmitter to the line to be located using the most suitable method, or place the transmitter on the site to be searched see paragraph 4.2.2 |
| **2** | Press ⏻ to switch on the transmitter |
| **3** | Select the desired output signal using the P and M function keys (see paragraph 4.1.3)<br>A green LED indicates that the respective setting is active |
| **4** | Select the desired mode of operation using the C button (see paragraph 4.1.3) |
| | **Result:**<br>In **Direct** mode, an LED next to the  symbol indicates how good the connection is to the connected line:<br>• **Green blinking**: good (low-resistance) connection<br>• **Alternating red and green**: sufficient connection<br>• **Red blinking**: poor/no (high-resistance) connection |
| **5** | As described in paragraph 4.3.1 use the RX5000 to locate metallic conductors |

## 4.3 USE OF RECEIVER RX5000

### 4.3.1 Modes of operation for the receiver RX5000

If a TX5000 transmitter is not available, a site can also be probed by means of passive line location.

The RX5000 receiver is capable of detecting radio signals in the frequency range between 15kHz to 23kHz as well as power signals in the frequency range between 50/60Hz.

The following pictures illustrate how each of the signals couple onto conductors buried in the ground:

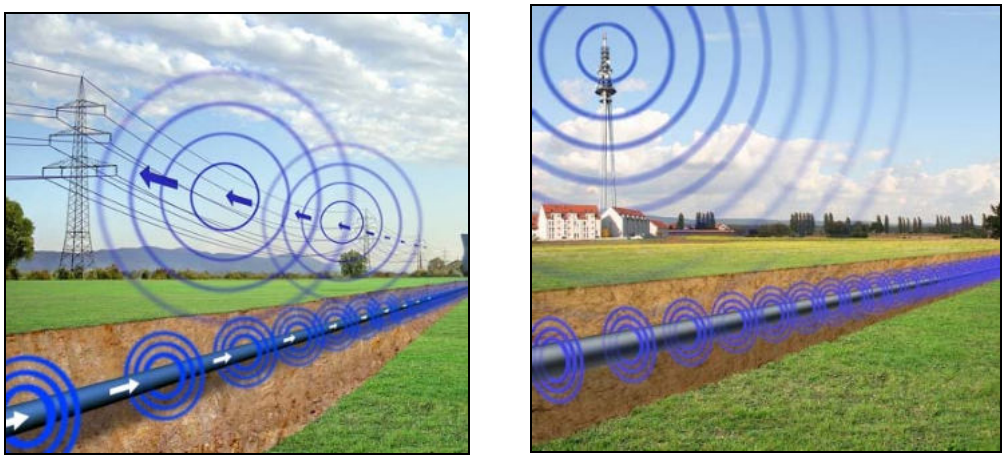


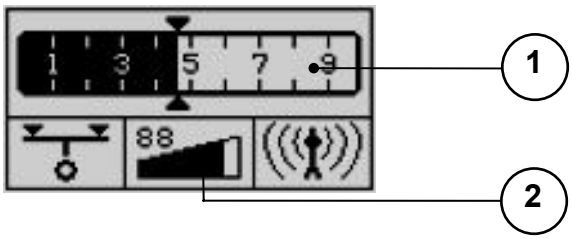
Fig. 10: Use of receiver RX5000

The two options explained above for passive location together with the options of active location with a transmitter or a probe transmitting a signal with an appropriate frequency result in the following modes of operation:

| Symbol | Mode of operation |
|---|---|
| | **RADIO**<br>For locating cables which are carrying VLF reradiated radio signals |
| | **POWER GRID**<br>For locating mains power supply cables, through which current with a grid frequency is flowing |
| | **TRANSMITTER**<br>For locating cables or pipes, onto which the signal from an active transmitter is coupled. The figure indicates the currently selected frequency which has to correspond to the frequency of the transmitter TX5000 |

#### 4.3.1.1 Regulating the sensitivity level to match the reception signal strength

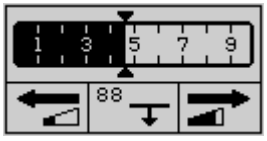
Reception signal strength and sensitivity are shown in the following segments of the display:




| Item | Mode of operation |
|---|---|
| 1 | **Reception signal display bargraph**<br>The strength of the reception signal is represented by this bargraph scale. These are relative values which are based on the sensitivity level set in the receiver<br>The triangles (▲▼) above and below the scale are a visual marker for maximum values. They move towards the right as long as the signal strength increases and continue in this direction until it either levels off or decreases. The maximum marker remains in this position for 3 seconds and thus provides the user with a helpful visual aid for determining the maximum signal strength |
| 2 | **Sensitivity display (gain level in %)**<br>The sensitivity level set in the receiver (which coincides with the total spectrum which the receiver is capable of processing) is represented by this scale. The higher the level of sensitivity is set, the more capable the receiver is of detecting weaker signals.<br>The numeric display above the bars shows the utilisation factor as a percent |

Should the scale for reception signal strength bargraph provide virtually no indication, or the display is completely utilised, either a manual or automatic adjustment of the sensitivity level has to be made.

- To start an **automatic** sensitivity level adjustment, the [2] button has to be pressed once. The sensitivity level of the receiver will be automatically adjusted so that the strength of the signal currently being received will be optimally displayed (fill half of the scale)
- To start a **manual** sensitivity level adjustment, the [2] button has to be pressed for about 2 seconds. The following indicator will appear in the display:




- Now the sensitivity of the receiver can be decreased by one percent by pressing the [1] button, or increased by one percent by pressing the [3] button. This process can be accelerated by holding down the respective button
- To exit the manual sensitivity level adjustment menu, the [2] button has to be pressed for two seconds. By pressing the button only short, the depth measurement process will begin

#### 4.3.1.2 Handling the receiver and locating the line

In order to be able to determine the position and orientation of a metallic conductor, the following rules should be internalised and applied when locating lines.
As shown in Fig. 11 the receiver should always be held **in front of the body** in an upright position and as close to the ground as possible. When the transmitter is brought directly over a metallic conductor, the maximum signal strength will be measured. If the receiver is moved away from the conductor towards the side and is not rotated while doing so, the signal will drop off proportionately

Fig. 11: Handling the receiver RX5000

The alignment of the receiver in relation to the orientation of the conductor (the antenna being the starting point of alignment) has the following effects on the reception signal strength:

- Receiver **in line** with the conductor ⇨ **maximum signal strength**
- Receiver **perpendicular** to the conductor ⇨ **minimum signal strength**

Fig. 12: Alignment of the receiver RX5000

#### 4.3.1.3 Changing of the system settings

Proceed as follows to change the settings:

| Step | Action |
|---|---|
| **1** | Briefly press the ⏻ button while continuing to hold down the 1 key until an audible signal is heard. The following image is display:<br>  |
| **2** | Now one of the following depth measurement processes may be selected by pressing the 1 key:<br>  Select this symbol if you want to determine the depth of a probe which has been pushed into a non-metallic pipe<br>  Select this symbol if you want to determine the depth of a line, the signal of an active transmitter is coupled onto<br>Now a unit of length used by the system may be selected by pressing the 3 key:<br>  **Feet (ft)**<br>  **Metre (m)** |
| **3** | Press the 2 key to save the settings. The changes will remain in effect even after the receiver is switched off and back on again |

Proceed as follows to change the receiving frequency of operation modes with more than one possible frequency:

| Step | Action |
|---|---|
| **1** | Briefly press the ⏻ key while continuing to hold down the 3 key until an audible signal is heard. The selectable frequencies are now visible in the display:<br>  |
| **2** | Use the 1 and 3 keys to switch between 50 and 60Hz. The active setting is marked with a black background |
| **3** | Press the 2 key to save the settings. The changes will remain in effect even after the receiver is switched off and back on again |

### 4.3.2 General site surveying

A general site probing urgently needs to be conducted and there is inaccurate or no information available as to the location and orientation of metallic conductors on a site planned for construction (e.g. excavation work).

When a site is to be searched for unknown conductors, a systematic approach should be taken. The following picture illustrates how to proceed:

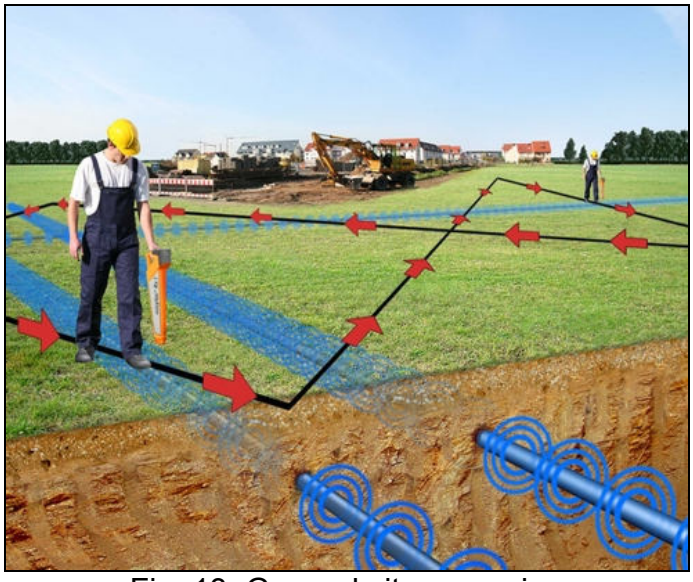


Fig. 13: General site surveying

Carry out a passive survey in **POWER GRID** and **RADIO** modes using a grid search pattern to cover the site and locate conductors in all directions

If the site will be surveyed with the aid of the TX5000 transmitter used on induction, the position of the transmitter should be changed by at least one metre and 90° after the first sweep of the site and the site should be probed again in the same manner. The minimum spacing of **15m** between the transmitter and receiver must always be maintained

Follow the steps below when probing a site for unknown metallic conductors:

| Step | Action |
|---|---|
| **1** | If the site will be searched with the aid of the TX5000 transmitter, it needs to be configured as described in paragraph 4.2.3 before proceeding |
| **2** | Press ⏻ to switch on the receiver RX5000 |
| **3** | Select the desired mode of operation by pressing the 3 key (see paragraph 4.3.1). The symbol for the currently selected mode of operation is shown in the lower right-hand corner of the display |
| **4** | Pace off the site as previously described and make a grid search of the site (see Fig. 13). Adjust the sensitivity of the receiver as needed if the signal level is too strong / weak (see paragraph 4.3.1.1) |
| **5** | When a conductor is located, pinpoint the strongest signal (see paragraph 4.3.1.2) and mark the location |

### 4.3.3 Determining the direction of a line

| Step | Action |
|---|---|
| **1** | If the direction of the conductor will be determined with the aid of the TX5000 transmitter, couple the transmitter's signal onto the metallic conductor in such a way that there is as little signal loss as possible (see paragraph 4.2.2 and paragraph 4.3.1) |
| **2** | Press [⏻] to switch on the receiver |
| **3** | Select the desired mode of operation by pressing the [3] key (see paragraph 4.3.1). The symbol for the currently selected mode of operation is shown in the lower right-hand corner of the display |
| **4** | Hold the receiver perpendicular to the position of a known metallic conductor, e.g. above a location which was marked during the probing of the site (see paragraph 4.3.2) |
| **5** | Rotate the receiver (through its own axis) over this location until the maximum signal strength is indicated (see paragraph 4.3.1.2) |
| | **Result:** The receiver is in line with the conductor when it is positioned where the signal is strongest, which is prerequisite for determining the direction of the line |
| **6** | To determine the path over an extended distance, proceed by moving forward while maintaining the maximum signal strength. If the signal becomes weaker, check that the conductor has not changed direction or become deeper, move and/or rotate the receiver to the left and right until the maximum signal strength is detected again.<br><br>The path of the metallic conductor should always be followed until it exits the site being searched, and its path should be clearly marked along the way with paint/chalk or marker flags<br><br>Adjust the sensitivity of the receiver as needed if the signal level is too strong / weak. It is advisable to manually adjust the sensitivity level (see paragraph 4.3.1.1) |

### 4.3.4 Determining the depth of a line

The RX5000 receiver has an **automatic** push key depth measurement feature. One precondition is that a clear signal from the TX5000 transmitter is coupled onto the conductor to be measured. For this procedure, the transmitter's signal has to be continuous (not pulsed) (see paragraph 4.2.1).

In addition to this precondition, **automatic** depth measurement will only function when the mode of operation of the receiver is set to **TRANSMITTER**. It will not function if set to **POWER GRID** or **RADIO**

If these preconditions are not met, a **rough estimate** of the depth may be made using the manual method

If the depth of a non-metallic pipe needs to be determined, the measurement has to be made with aid of a probe, e.g. FlexSonde **GOK50-R** (see paragraph 4.2.2.4). In order to accommodate the transmission characteristics of a probe, the RX5000 receiver has a special depth measurement mode which has to be activated through the system settings (see paragraph 4.3.1.3)

As a result, the way a depth measurement can be performed depends not only on the active operation mode but also on how the depth measurement mode is set (Transmitter or Probe). A symbol in the lower left of the display indicates which mode is currently accessible

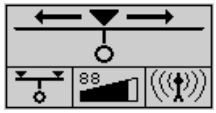
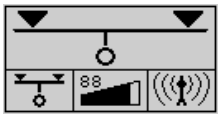
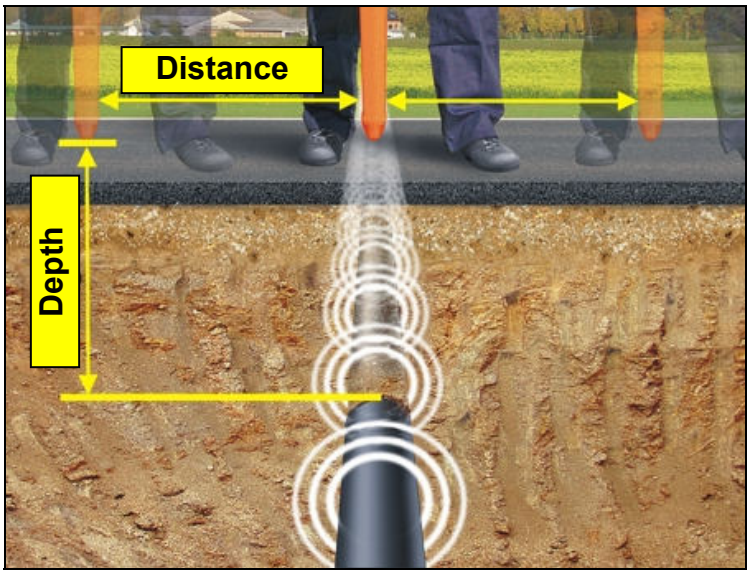
| Symbol | Description |
|---|---|
|  | For determining the depth of a probe which has been pushed into a non-metallic pipe |
|  | For determining the depth of a line, the signal of an active transmitter is coupled onto |
|  | For determining the depth of a line which carries radio signals or grid frequency signals |

**ATTENZIONE**

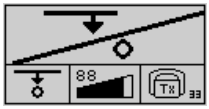
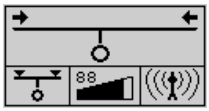
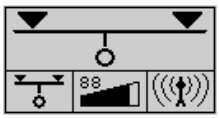
Even after the depth has been successfully determined, all excavation work should be done with caution. This is particularly important if a **rough estimate** of the depth was made, as this can result in even greater deviations

Follow the steps below to determine the depth of a metallic conductor:

| Step | Action |
|---|---|
| **1** | If the depth of the conductor will be determined with the aid of the TX5000 transmitter, couple the transmitter's signal onto the metallic conductor in such a way that there is as little signal loss as possible (see paragraph 4.2.2 e paragraph 4.3.1)<br>Do not forget to set the transmitter to continuous signal, not a pulsed signal when measuring depth |
| **2** | Press [⏻] to switch on the receiver |
| **3** | Select the desired mode of operation by pressing the [3] key (see paragraph 4.3.1). The symbol for the currently selected mode of operation is shown in the lower right-hand corner of the display |

<table>
<tr><td>4</td><td colspan="2">With a steady grip, hold the receiver perpendicular to the position of a known metallic conductor, e.g. above a location which was marked during the site survey. The signal strength bargraph should show zero (see paragraph 4.3.2). In doing so, the tip of the receiver should touch the ground</td></tr>
<tr><td>5</td><td colspan="2">Rotate the receiver (through its own axis) over this location until the maximum signal strength is indicated (see paragraph 4.3.1.2)</td></tr>
<tr><td rowspan="3">6</td><td colspan="2">Press the [1] button to begin measuring the depth</td></tr>
<tr><td>For automatic depth measure (while working in TRANSMITTER or PROBE mode)…</td><td>For making a rough estimate of the depth (while working in RADIO or POWER GRID mode)....</td></tr>
<tr><td>…the depth value is displayed (<br>  <br>The other steps can be skipped</td><td>…the herewith symbol is shown<br>  <br>continue from step 7</td></tr>
<tr><td>7</td><td colspan="2">Move slowly to one side until the following symbol appears in the display and an acoustic signal sounds:<br>  </td></tr>
<tr><td>8</td><td colspan="2">Mark this spot, then move in the opposite direction to the other side of the line until the symbol appears in the display again</td></tr>
<tr><td rowspan="2">9</td><td colspan="2">Mark this spot as well, then measure the distance between the two spots</td></tr>
<tr><td colspan="2">Result: Half the distance between the two spots corresponds approximately to the depth of the line<br>  </td></tr>
</table>

During the depth measuring process, the following symbols are used to notify the user about certain characteristics and errors:

| Symbol | Meaning |
|---|---|
|  | For of one of the following reasons, the depth could not be measured:<br>• The signal received was too weak or too irregular<br>• The receiver was not held steady enough during the measure<br>• The receiver was not positioned directly above the line at the beginning of the process |
|  | The depth of the metallic conductor / probe exceeds the measuring range (5m / 7m). Depth measurement cannot be performed |
|  | The depth of the metallic conductor amounts to less than 30 cm (1 ft). Such conductors must be specially marked in order to prevent damage during construction |
|  | The receiver was moved too far to the left or right while making a **rough estimate**. Move in the opposite direction until the following symbol appears<br>  <br>Proceed as described in **step 8** on the previous page |

### 4.3.5 Functional test of the receiver

If problems or strange measuring results occur during a line location procedure, it may be helpful to check the functionality of the receiver using the integrated self-test. This test may provide information about possible malfunctions of the instrument. Preferably, the self-test should be performed in an interference-free environment without live cables

Proceed as follows to perform a self-test:

| Step | Action |
|---|---|
| **1** | Switch off the receiver RX5000. The test can be started by pressing and holding [2] followed by [⏻] for at least 3 seconds<br><br>If the self-test is successfully accessed, the display should show the software and hardware versions of the receiver components:<br>  |
| **2** | Press the [2] function key to start the self-test |
| **3** | If the test is successfully passed without any problems, the display shows the following information:<br>  <br>If a fault is recognized during the test, the self-test procedure is terminated and the display indicates the respective error code (see next page):<br>  <br>If this is the case, the error code should be forwarded to the service department of HT ITALIA |
| **4** | Press the [2] function key to exit the self-test |

| Error code | Description |
|---|---|
| **000** | Unimplemented frequency |
| **201** | Not enough battery power for the self-test procedure |
| **210** | Interferences too strong for the self-test procedure<br><br>In this case, the self-test should be repeated in an environment with less interferences |
| **220** | Fault internal module L1. Contact service dept of HT ITALIA |
| **230** | Fault internal module L2. Contact service dept of HT ITALIA |
| **240** | Fault internal modules L1 and L2. Contact service dept of HT ITALIA |
| **250** | Generic fault. Contact service dept of HT ITALIA |

# 5 MAINTENANCE

## 5.1 REPLACEMENT FLOOR CAP OF THE RECEIVER RX5000

The plastic floor cap, which prevents the tip of the receiver from being damaged, can be easily replaced with the aid of a pointed object (e.g. screwdriver).

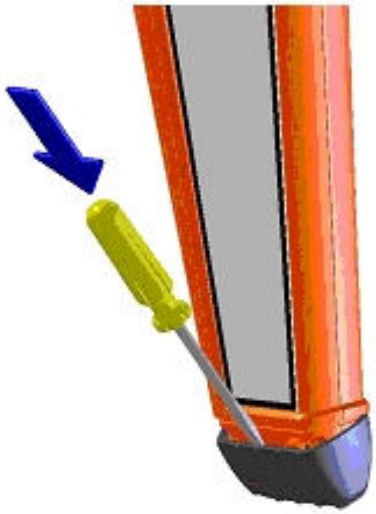
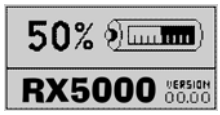


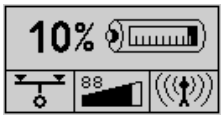
Fig. 14: Replacement of the floor cap

## 5.2 REPLACEMENT BATTERIES OF RECEIVER RX5000

The status of the receiver's batteries is checked upon start-up and indicated in the display:




The system regularly checks the battery strength as well. If battery capacity falls below 10 % of the threshold value, an audible warning signal is given and the current status of the batteries is shown in the upper part of the display:




In order to replace the 10x1.5V batteries type AA, the battery housing must be removed (e.g. using a coin) as described in the following illustrations

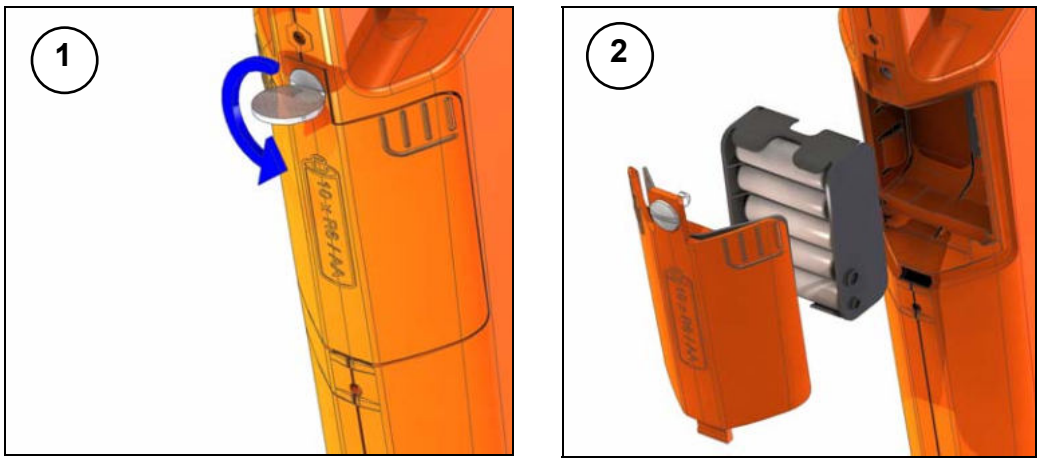
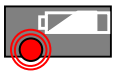


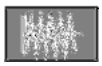
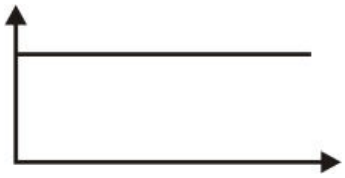

Fig. 15: Replacement internal batteries of RX5000

## 5.3 REPLACEMENT BATTERIES OF TRANSMITTER TX5000

The batteries in the transmitter TX5000 have to be replaced as soon as the red LED battery indicator starts to blink



Should this occur while the user is busy locating a line with the receiver, he/she will be informed of the weak batteries via the reception signal:

| Type of signal | Normal signal | Signal when batteries are weak |
|---|---|---|
|  |  |  |
|  |  |  |

In order to change the 6x1.5 V batteries type LR20, both screws on the back of the transmitter must be (e.g. with the aid of a coin) turned through ¼ turn (1) and the battery tray must be pulled (2) (see Fig. 16). Please note that all the batteries are fitted in the same direction

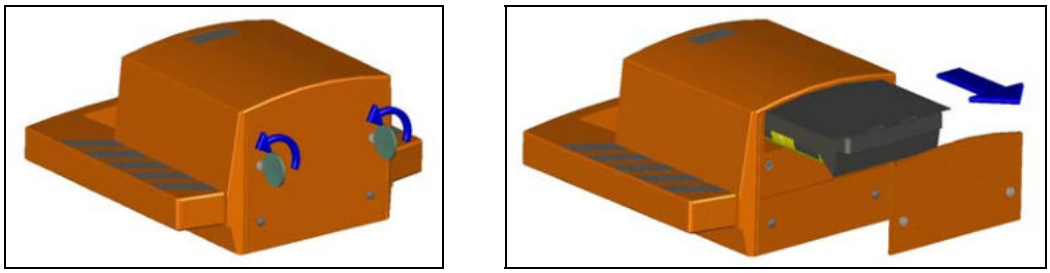


Fig. 16: Replacement batteries of TX5000

## 5.4 CLEANING

To clean the instrument use a soft dry cloth. Never use a wet cloth, solvents or water

## 5.5 END OF LIFE

**CAUTION**: this symbol indicates that equipment and its accessories shall be subject to a separate collection and correct disposal

# 6 TECHNICAL SPECIFICATION

## 6.1 TECHNICAL CHARACTERISTICS OF RECEIVER RX5000

| Parameter | Value | |
|---|---|---|
| **Frequency ranges**<br><br>• Mode 1: **Radio**<br>• Mode 2: **Power network**<br>• Mode 3: **Transmitter** | <br><br>15kHz ÷ 23kHz<br>50Hz / 60Hz<br>32.768kHz | |
| **Sensitivity**<br><br>• Mode 1**: Radio**<br>• Mode 2**: Power network**<br>• Mode 3**: Transmitter** | Refer to a depth of 1m<br><br>> 20μA<br>> 7μA<br>> 5μA | |
| **Depth determination** | **…of a conductor** | **…of a probe** |
| • Depth range<br>• Resolution<br>• Accuracy (signal without disturb)<br>- Mode 1: **Radio**<br>- Mode 2: **Power network**<br>- Mode 3: **Transmitter** | 0.3m÷5m (12in÷16ft)<br>0.1m<br><br>±20%rdg<br>±20%rdg<br>±5%rdg (up to 2m)<br>±20%rdg (2÷5m) | 0.3m÷7m (12in÷23ft)<br>0.1m<br><br><br><br>±10%rdg (up to 2m)<br>±20%rdg (2÷7m) |
| **Power supply** | 10x1.5V batteries type IEC AA LR06 | |
| **Battery life** | 40 hours (for intermittent use with alkaline batteries, 20 °C) | |
| **Working temperature**<br>• Operation<br>• Storage | according to IEC/EN60068-1<br>-20 ÷ 55°C (-4 ÷ 131°F)<br>-30 ÷ 70°C (-22 ÷ 158°F) | |
| **Size (LxWxH)** | 660 x 252 x 99mm (26 x 10 x 4)” | |
| **Weight** (included batteries) | 2.5kg (5lb) | |
| **Mechanical protection**<br>Dust and water protected | according to a IEC/EN60529<br>IP67 up to the lower edge of the battery<br>IP56 for all parts above this delineation | |

## 6.2 TECHNICAL CHARACTERISTICS OF TRANSMITTER TX5000

| Parameter | Value |
|---|---|
| **Transmitted power** (switchable) | 0.1W / 0.5W |
| **Frequency** | 32.768kHz |
| **Power supply** | 6x1.5V batteries type IEC LR20 |
| **Battery life** | 40 hours (for intermittent use with alkaline batteries, 20 °C) |
| **Working temperature**<br>• Operation<br>• Storage | according to IEC/EN60068-1<br>-20 ÷ 55°C (-4 ÷ 131°F)<br>-30 ÷ 70°C (-22 ÷ 158°F) |
| **Category of measure** | CAT II / CAT III 440V, CAT IV 300V |
| **Size (LxWxH)** | 260 x 255 x 140mm (10.2 x 10 x 5.5)” |
| **Weight** (included batteries) | 1.7kg (3lb) |
| **Mechanical protection**<br>Dust and water protected | according to a IEC/EN60529<br>IP56 |

## 6.3 GENERAL SPECIFICATIONS

| Parameter | Value |
|---|---|
| **Sinusoidal vibrations**<br>Peak acceleration<br>Frequency | According to IEC / EN 60068–2–6<br>20m/s$^2$<br>10Hz ÷150Hz |
| **Free fall**<br>Max. height (packaged) | According to IEC/EN60068-2-32<br>80cm (weight up to10kg) |
| **Safety** | IEC/EN61010-1 |
| **Protection class** | III (according to IEC/EN61140) |
| **Insulation** | Double insulation |
| **Relative humidity** | max 93% at 30°C |

## 6.4 ACCESSORIES

### 6.4.1 Standard accessories

- Transmitter TX5000
- Receiver RX5000
- 2 cables R/B banana + alligator clip, 2m
- 1 cable black banana + alligator clip, 10m
- 1 earth metal probe
- 6x1.5V batteries IEC LR20
- 10x1.5V batteries IEC LR06
- Carrying bag
- User manual

### 6.4.2 Optional accessories

- Flexi sonde set for locating non-metallic pipes – Cod **GOK50-R**
- Transmitter clamp, 100mm diameter for the inductive coupling – Cod. **820005314**
- Set of cables (Shuko plug + cable with RJ11 + coax cable) – Cod. **890008852**

# 7 SERVICE

## 7.1 WARRANTY CONDITIONS

This instrument is guaranteed for one year against material or production defects, in accordance with our general sales conditions. During the warranty period the manufacturer reserves the right to decide either to repair or replace the product.
Should you need for any reason to return back the instrument for repair or replacement take prior agreements with the local distributor from whom you bought it. Do not forget to enclose a report describing the reasons for returning (detected fault). Use only original packaging. Any damage occurred in transit due to non original packaging will be charged anyhow to the customer.

The warranty doesn't apply to:

- Accessories and batteries (not covered by warranty).
- Repairs made necessary by improper use (including adaptation to particular applications not foreseen in the instructions manual) or improper combination with incompatible accessories or equipment.
- Repairs made necessary by improper shipping material causing damages in transit.
- Repairs made necessary by previous attempts for repair carried out by non skilled or unauthorized personnel.
- Instruments for whatever reason modified by the customer himself without explicit authorization of our Technical Dept.
- Use not provided by the instrument's specifications or in the instruction manual.



**Our products are patented and our logotypes registered. We reserve the right to modify specifications and prices in view of technological improvements or developments which might be necessary**.

## 7.2 SERVICE

Shouldn't the instrument work properly, before contacting your distributor make sure that batteries are correctly installed and working and replace them if necessary.
Should you need for any reason to return back the instrument for repair or replacement take prior agreements with the local distributor from whom you bought it. Do not forget to enclose a report describing the reasons for returning (detected fault). Use only original packaging. Any damage occurred in transit due to non original packaging will be charged anyhow to the customer.
The manufacturer will not be responsible for any damage to persons or things.