

# Buried Plastic Gas Pipe Locator

USER GUIDE



# GAS TRACKER 2

CAUTION: Read this manual before using the device



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## MODIFICATION'S DIRECTORY

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This manual is important for your safety. Read it carefully in its entirety before using the equipment and keep it for future reference.

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This document is the **Gas Tracker 2** User's Guide. It describes the implementation of the device, as well as the different modes of operation to facilitate its use.

# 1. **SAFETY INFORMATION**

## 1.1. **Safety recommendations**

Please read this guide carefully before unpacking, configuring or using this equipment. Note all indications of danger and other warnings. Failing to observe these recommendations could result in serious injury to the operator or could damage the equipment. To ensure that the protection provided by this equipment is appropriate, do not use or install it other than in accordance with the conditions indicated in this manual.

Dismantling the cases is forbidden. This operation is limited exclusively to personnel qualified by MADE.

## 1.2. **Following the safety recommendations**





**DANGER:** Indicates an eminently or potentially hazardous situation which, if not avoided, could result in death or serious injury.

**WARNING:** Indicates a potentially hazardous situation which could result in superficial or moderate injury.

**Remark:** Information requiring particular attention.

### 1.3. Warning labels

Read all labels and labels affixed to the instrument. Personal injury or damage to the instrument may occur if instructions are not observed.

	Symbol requiring reference to the instruction manual for instructions concerning operation or safety recommendations.
	Dangerous Voltage
	Ac current
IP 21	IP standard – Protection against dust and water : TRANSMITTER
IP 54	IP standard – Protection against dust and water : RECEIVER
	Do not throw away with household waste

## **2. OVERVIEW**

GAS TRACKER 2 is an equipment used for tracing, above ground, buried polyethylene gas pipes.

The GAS TRACKER operates on gas pipes operating at low pressure (21 mbar) or medium pressure (4 bars). Use with "air" pipe is possible.

The principle used is the transmission of an acoustic signal through the gas under pressure in the network causing the pipe to vibrate. The localization, operated by an acquisition and calculation ground sensor, makes it possible to locate the vertical of the tube, even in perturbed zones with high sound levels.

Two connection modes are possible:

- On a customer connection after disconnecting the meter; It is the method that gives the best results in terms of detection range. This is the recommended method for detecting a main pipe.
- Connection to the pressure valve (French network only), without disconnecting the customer; it is more practical but with a lesser detection range (location of a service pipe for example).

### **2.1. Gas Tracker set**

GAS TRACKER 2 consists of :

- A carrying case containing the transmitter, the injection box, and associated connectors,
- A carrying case containing the tablet receiver, the acquisition round sensor, the charger, and connection accessories.



### **2.1.1. Composition of the transmitter case**

- Carrying case with integrated transmitter.
- Retaining strap.
- Connecting cable to transmitter (3m).
- Flexible connection pipe (according to country option).
- Purge tube.
- Supporting leg.
- Cigarette lighter adapter.
- External power cable.
- Safety Shunt.

### **2.1.2. Composition of the receiver case**

- Carrying case.
- Tablet receiver.
- Tablet charger.
- Resonator tank.
- Sphero-conical fittings (optional).
- U-shaped copper fitting (optional).



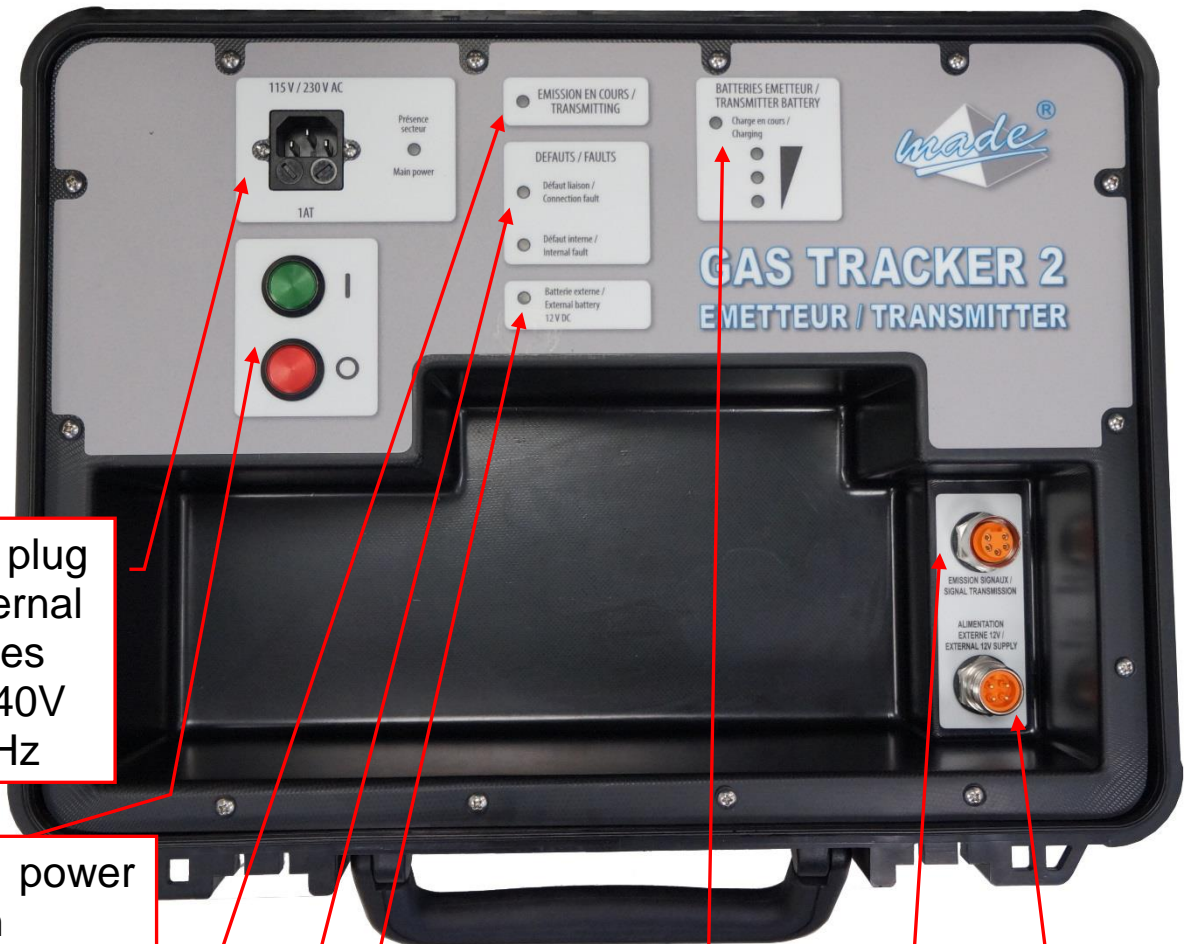
## OVERVIEW

- Acquisition ground sensor.
- Telescopic rod.
- Set of long legs for the ground sensor.
- Charger for the ground sensor.
- Flexible connection for pressure tapping.
- User guide and plastic covered instruction sheet.

### 3. GAS TRACKER TRANSMITTER

The GAS TRACKER transmitter injects the acoustic signal into the gas network.

#### 3.1. Description of the front panel of the transmitter



Mains plug for internal batteries  
110-240V  
50/60Hz

Mains power switch

Transmitting indicator

Default indicator

External battery power indicator

Battery charge indicator

Plug for connecting the resonator tank

External 12V  
3A power supply plug

## 3.2. Operation of the Gas Tracker transmitter

### 3.2.1. Power supply

The GAS TRACKER Transmitter can be operated on batteries or mains. The mains connection recharges the internal batteries.

A plug for connecting to a vehicle battery (alligator clips) or a cigarette lighter socket is provided. If this supply is used, the internal battery pack is deactivated.

Maximum consumption of the transmitter unit: 3A under 12V or 36W.

### 3.2.2. Connection to the transmitter network

- A "U" connection Ø 20 makes it possible to connect directly to the customer shut-off valve upstream of the meter or pressure regulator on 4-bar networks. Other adapters are provided for different diameters.
- A flexible connection for connection to the pressure connection (depending on country)





The resonator tank leans on the customer meter box. A supporting leg is integrated into the handle of the tank. The leg is adjustable by a knob to accommodate the height of the box. A retaining strap is provided for high installation.

### **3.2.3. Procedure for putting the transmitter into service:**

In addition to the following instructions, please follow the procedures applicable at your local gas network operator. Transmitter allows the acoustic signal to be

1. Remove the meter.
2. Connect the resonator tank to the inlet valve, the purge valve must be open. Use the supporting leg and the copper fittings if required.
3. **OPEN the GAS by SLOWLY OPENING the CUSTOMER TAP so as not to damage the inner membrane.**
4. Leave the drain valve open for 5 seconds and close.
5. Check the connection for leaks.

**6. Connect the power supply.**

**7. Press the ON button (green).**

The signal then propagates into the gas and vibrates the pipe.

- Check the battery level, if it is **orange** or **red** then ,
  - Use the external connection cord (connection to vehicle battery or cigarette lighter adapter)
  - Connect to the mains using the cord provided to the transmitter (the transmitter will be recharged during use).

### **3.2.4. Procedure for removing the transmitter:**

**1. Close the inlet valve.**

**2. Switch off the transmitter and disconnect the electrical cable from the tank.**

**3. Vent the tank by opening the drain valve for a few seconds (approx. 5 seconds) and then close it.**

**4. Replace the shunt connected to the gas tap and customer installation.**

**5. Remove the tank and take care not to damage the inlet valve.**

**6. Reassemble the customer installation.**

## 4. GAS TRACKER RECEIVER

The transport case includes the GAS TRACKER receiver assembly.

The Gas Tracker receiver consists of 2 main components :

- The Ground acquisition sensor
- The Tablet for displaying results

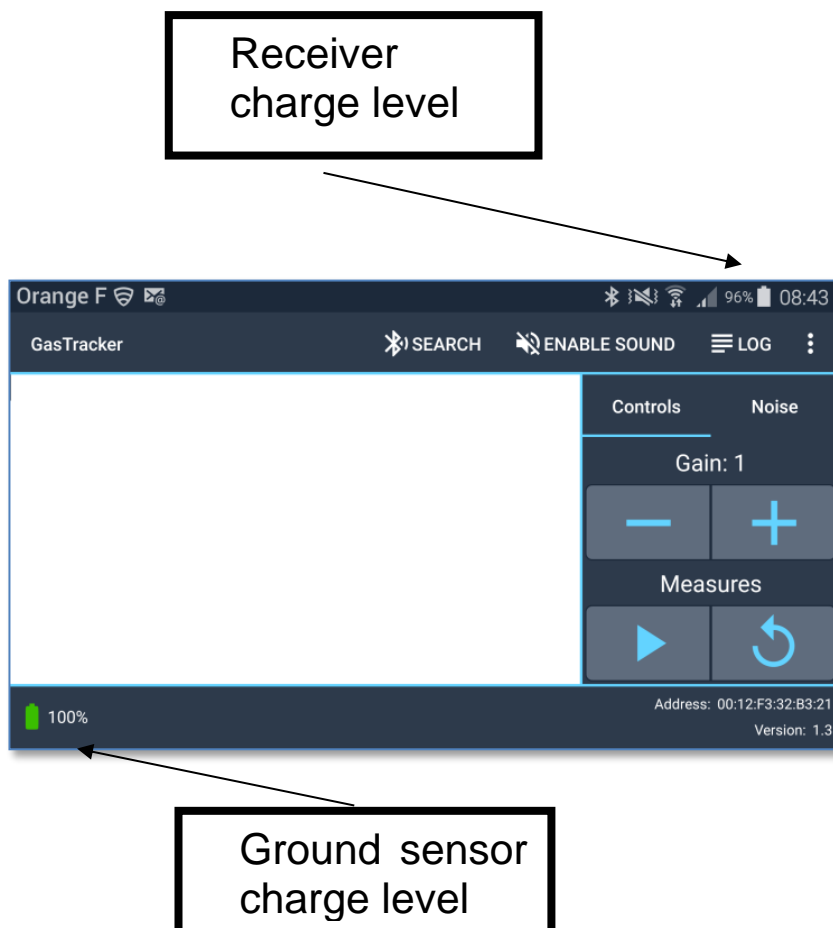


## GAS TRACKER RECEIVER

A "bluetooth" wireless link ensures communication between the acquisition sensor and the Tablet. The Tablet has a touchscreen, all user commands are passed by pressing the screen on the corresponding ideograms and commands.

### Battery:

- The charge level is displayed on the receiver GT2 application. To recharge it, use the charger provided for this purpose.
- The Tablet has its own batteries, rechargeable with a charger supplied by the manufacturer and delivered with the GAS TRACKER 2.
- An inverter / DC / AC converter allows the vehicle's cigarette lighter socket to be used to charge the BASE (Optional)



## 4.1. Using the receiver



Tablet



Ground sensor



### 4.1.1. Ground sensor

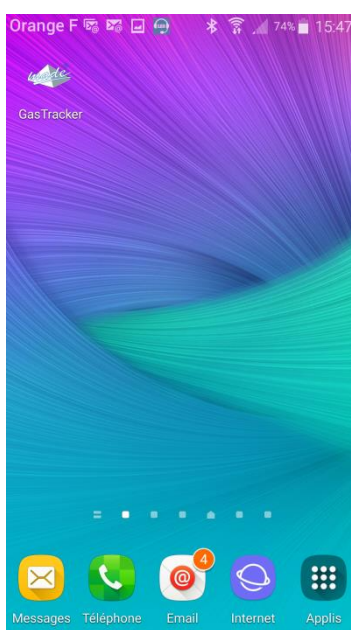
Move the sensor using the removable stick. You can adjust the length of the stick if needed.



### 4.1.2. Running the GT2 application on the Tablet :

Operate as follows:

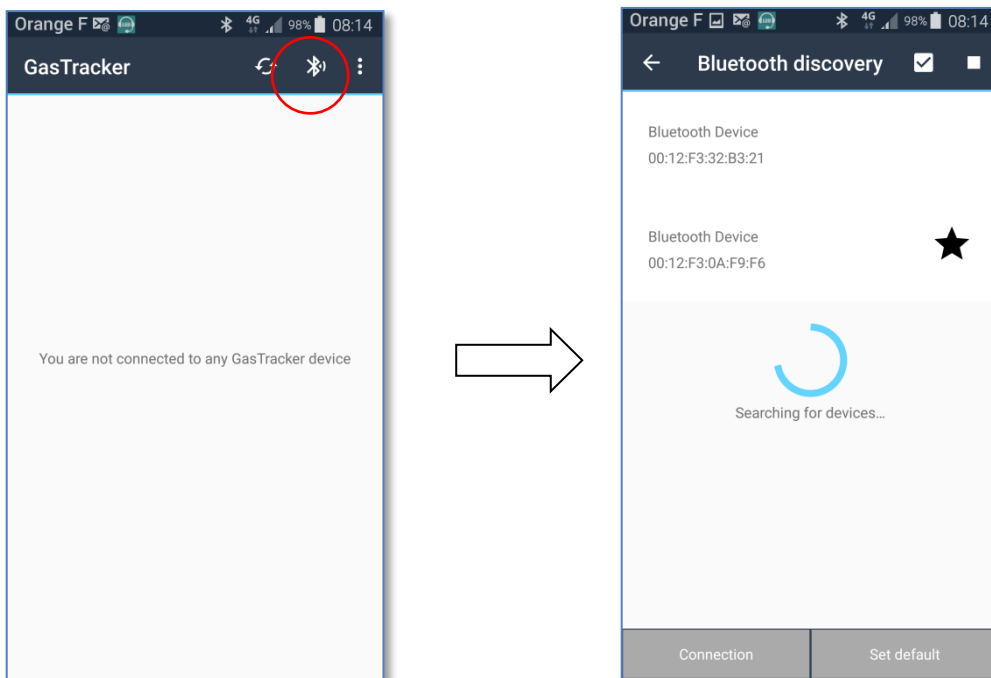
- The transmitter must be connected to the gas network according to the instructions for use (see § 4.2).
- The ground sensor must be switched on with the push-button on the top (the red LED flashes rapidly for 5s, then slowly, indicating that the initialization phase is complete).
- The application must be started on the receiver by pressing GasTracker 2 (see screen below).
- If the application is started before the sensor, the connection will fail; In this case, switch on the sensor, wait until the end of the initialization and press “connection”.



### 4.1.3. Pairing the Tablet with the sensor via bluetooth

When starting the application, if the default base is on (red LED flashing slowly) the connection is automatic. If for some reason this is not the case:

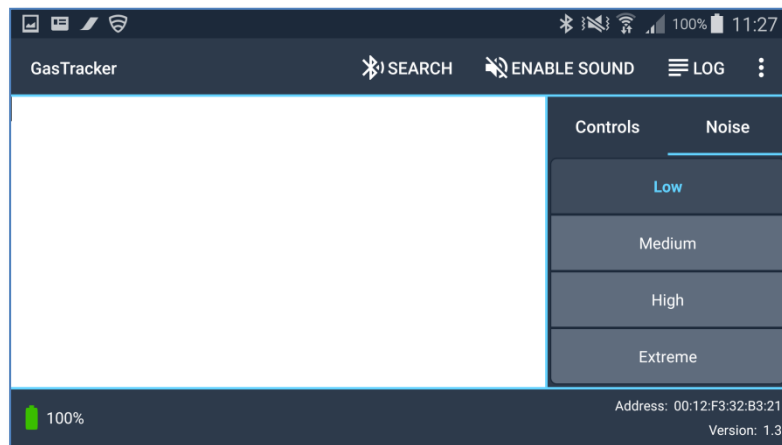
- Switch on the base (press the button and wait for the red LED to flash slowly)



- All detected databases appear in the list, they are identified by their hardware address in the following format XX: XX: XX: XX: XX: XX).
- Then press SET AS DEFAULT button if you want to set the selected base as default.
- Then press CONNECTION

#### 4.1.4. Initial settings

- First choose the Noise level mode (estimated ambient noise level).



### MODES

There are 4 MODES corresponding to 4 levels of noise

- Low
- Medium
- High (default)
- Extreme

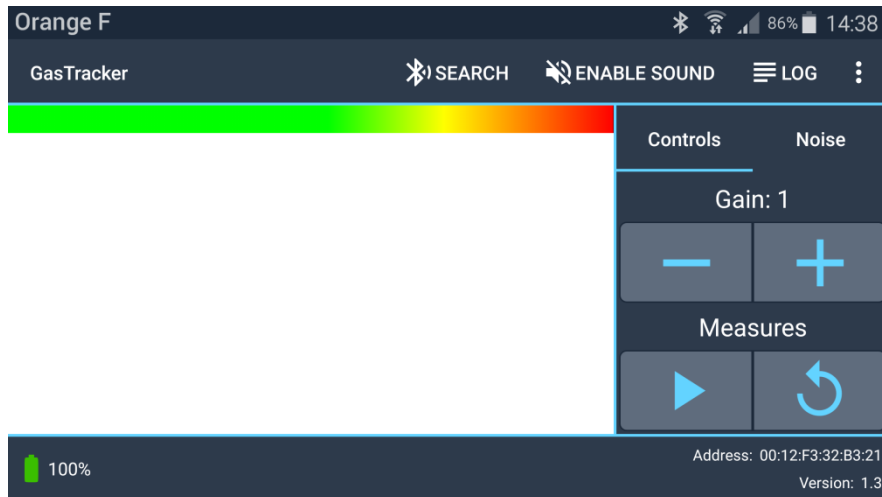
The Mode selection directly impacts the acquisition time; the higher the noise level, the greater the acquisition time in order to avoid induced acoustic perturbations. This choice is not definitive because at any time, this parameter can be changed simply by activating the MODE selection drop-down list at the top left of the measurement window.

#### 4.1.5. Measurements

Once the MODE is selected, the measurement window appears fully; you can start the measurements.

Areas of the measurement window, from top to bottom:

- Mode selection (ambient noise)
- Battery level of the Tablet
- Battery level of the ground sensor
- Status of bluetooth connection
- Bargraph and measurement histogram
- Command area (Measurement, Reset, Gain)



An additional function is available on the tablet: the sound activation is used to play pulse sound signal with a repetition period proportional to the intensity of the ground signal.

## 4.1.6. Bargraph

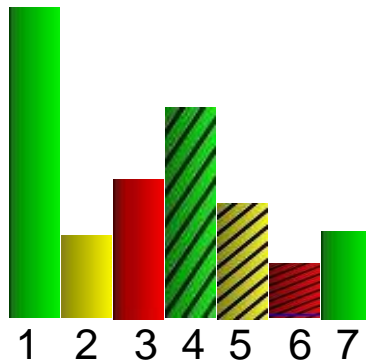
- The bargraph makes it possible to quickly evaluate the signal level detected by the sensor before digital processing.

It displays this information from left to right by first filling in green, then yellow and finally in red the display area.

To make an acquisition in the best conditions, the display must be located mostly in the green zone (if not, decrease the gain).

### 4.1.7. Histogram

The histogram collects all the measurements and displays them from left to right. The height of a rectangle gives the amplitude (level), the color (green, yellow, red) is related to the quality of the measurement, and the hatching refers to the saturation of the sensor.



#### Histogram in detail



Means an excellent quality measurement (very good signal to noise ratio), the height represents the signal level.



Means an acceptable quality measurement (good signal to noise ratio), the height represents the signal level.







Means a measure of insufficient quality (low signal-to-noise ratio), the height is only an approximation of the signal level.



Means that the measurement has been made with a gain too high and that the sensor saturates: the height is not really representative of the level of the signal being searched. The color always indicates the quality of the measurement (the sensor may be saturated but produce measurements with a good signal-to-noise ratio).

- To increase the quality of the measurement (change from red to yellow or yellow to green), the **MODE** must be "increased". (i.e. switch to a stronger noise selection)
- Conversely, if all the measurements are green, it is certainly possible to "decrease" the **MODE** and thus shorten the acquisition time.
- To eliminate saturation, reduce the **GAIN**.

#### 4.1.8. Icons

- The button  triggers a measurement; once done, the result is displayed in the histogram.
- The button  removes all measurements from the display.
- The button  increases the gain (with re-scaling of previous measurements) of the ground sensor.
- The button  decreases the gain (with re-scaling of previous measurements) of the ground sensor.

#### 4.1.9. Location

If the location service is available on the Android device, its activation is proposed to the user at the application start-up. The activation of this service allow to associate each measure to GPS coordinates (latitude and longitude) expressed by using the DD (Decimal Degrees) format. If the location service is not enabled, the coordinates of each measure will be replaced by the mention N/A (Not Available).

The location service will never be activated without the express agreement of the user.

If an extra GPS device is connected, the application will use it by default.

#### 4.1.10. Log

The log keeps tracks of what happened. Before everything else, it shows some information that allow you to read correctly what will appear next,

like the range of values for each quality color for a measure. Each entry on the log will be dated at the time it was added.

The most important thing that will be logged is the measures, with their signal strength, quality, saturation level and associated gain. Clearing the measures of the histogram will not clear the log. However, each clearing or noise mode change will be logged so can you know what was done and when.

If you want, you can clear the log by pressing the  button on the top menu.

You can scroll the log up and down using the touchscreen.

```
Application vesion: 2.0-beta4
Base address: 00:12:F3:32:B3:21
Base version: 1.3
The values of a measure are expressed in
percentages
Quality colors:
  Red: Quality < 30
  Yellow: 30 <= Quality < 60
  Green: Quality >= 60
Saturation:
  Hatched: Saturation >= 10
Log started the December 19, 2018 at 10:25:25
=====
10:25:52> Your are now connected to Bluetooth
Device [00:12:F3:32:B3:21]
10:26:08> Measure 1
| Signal:    005
| Quality:   008
| Saturation: 000
| Gain:      001
| Latitude:  N/A
| Longitude: N/A
```


Log screen

### 4.1.11. Log files

This application also store the measures in log files in CSV (Comma-Separated Values) format. A new file is created each time you start the application and is named according to the current date and time. To retrieve the files on your computer, plug your Android device to it using USB cable. All the log files are stored inside the directory GasTracker/logs at the root of your Android device's internal memory.

Those files contain all information about each measure: the date and time when it was performed, le signal strength, the quality, the saturation, the gain, the latitude and the longitude (the last 2 are replaced by the mention N/A if not available). All those values are separated by a semicolon and each measure is stored on a new line. When you clear the histogram, an

empty line will be written as a separator so you can see the different sets of measures.

When you are on the acquisition screen, you can change the name of the current log file by pressing the  button on the top menu

### **4.1.12. Location files (Android Tablet)**

Following the same principle as the log files, it is possible to generate LOCATION files containing only selected points (latitude and longitude) that have been chosen and validated by the operator. The resulting file will have the same CSV .format as the LOG file:

Date	Signal	Quality	Saturation	Gain	Latitude	Longitude
17/05/2018						
11:51	46	79	0	20	56,111343	40,536946
17/05/2018						
11:53	40	71	0	30	56,111333	40,536804
17/05/2018						
12:06	45	79	0	30	56,111103	40,536139
17/05/2018						
12:07	36	74	0	30	56,111149	40,536163
17/05/2018						
12:10	31	48	0	50	56,111025	40,535927
17/05/2018						
12:13	42	61	0	50	56,111103	40,53596
17/05/2018						
12:14	32	47	0	50	56,111039	40,535953

Note that this format is proprietary and not directly exportable in any information system.

- To create a LOCATION file:  
 Open and name new file: MENU -> NEW LOCATION FILE -> XXXXXXXX -> OK

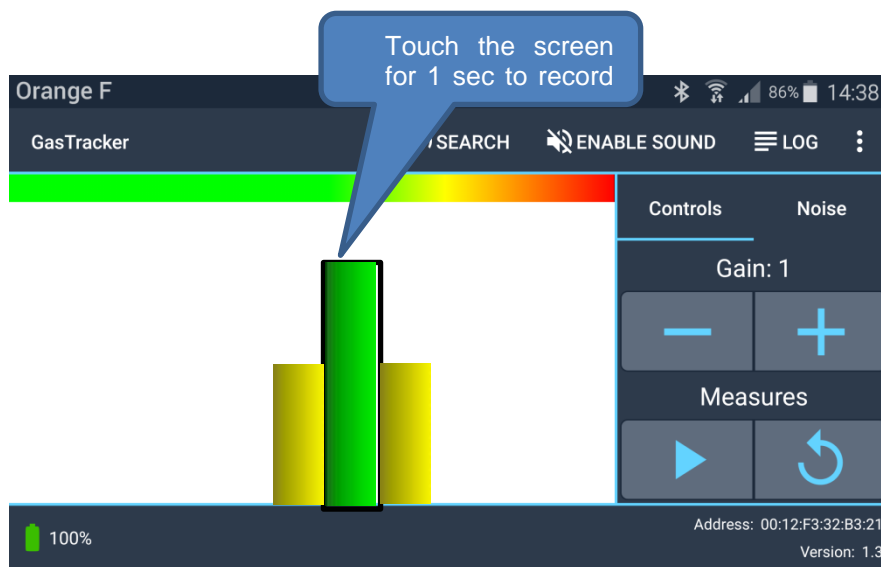


- To enter a new point :

After doing a set of measures, simply touch the point you want to save for more than 1 second.

Answer “Yes” to the question: do you want to save this data? The measure will then be marked by a black rectangle.

It is possible to remove the point from the file if you are not happy with it. Simply touch the measure again and answer “Yes” to the question: do you want to remove this data ?



## 4.1.13. Tips for good use

- Do not make any measurements too close to the transmitter (less than 10 meters).
- 
- When possible, try to use the bargraph; it indeed makes it possible to immediately visualize whether the signal being searched is present (Check for the red line which represents the average level of the desired signal, the remainder being noise, often with large variations). Do not hesitate to adapt the GAIN according to what is read.
- 
- Prioritize measurements in low or medium noise MODES whenever possible (faster acquisition time).

- Do not initially search for maximum positional accuracy, but rather try to ascertain the global direction of the desired pipe rapidly. Once done, it will then be easier to take up a few precise points at the most probable positions of the pipe.
- Do not hesitate to change GAIN and MODE when necessary.
- 
- Above the pipe, the signal level is maximum: if this is not the case - diffuse measurement, improbable location of the maximum – this could mean that something in the soil prevents direct propagation. Proceed with other measurements a little further on.
- 
- When a local maximum is identified, clear the histogram and move to a new search.

## 5. LIMITS AND CONDITIONS OF USE

The principle used in GAS TRACKER is the transmission of an acoustic signal, carried by the gas contained in the pipeline.

This signal results in a vibratory phenomenon in contact with the PE and propagates to the surface. The propagation is therefore closely linked to the nature of the soil and its compaction. If cavities interfere between the PE pipe and the surface, the signal will not be able to propagate normally, as will a "poorly compacted" soil.

The surface of the pavement is important and reception on an earthy or rocky ground is linked to the quality of the coupling between the acquisition sensor and the ground. Optimal reception is obtained on macadam or concrete.

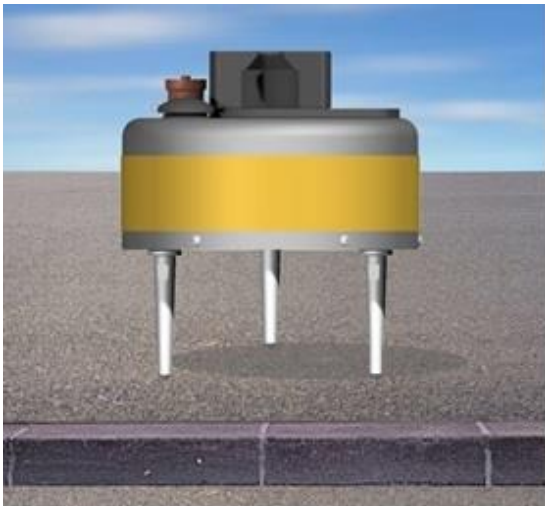
## 6. PRACTISING ON THE FIELD

### 6.1. Using the acquisition sensor on different types of soil

The measurement quality of the Gas Tracker is directly linked to the acoustic coupling quality of the acquisition sensor on the ground.

There are two main types of situation:

- **Hard ground**



The sensor is simply placed on the ground. Ensure that the 3 legs are always in contact with the solid part of the covering, avoiding gravel as much as possible.

Do not hesitate to "crush" the sensor with the foot to force the adhesion to the ground and to get rid of the pebbles that could hinder the contact of the legs.

Do not walk around the sensor during measurement to avoid noise.

- **Soft ground**



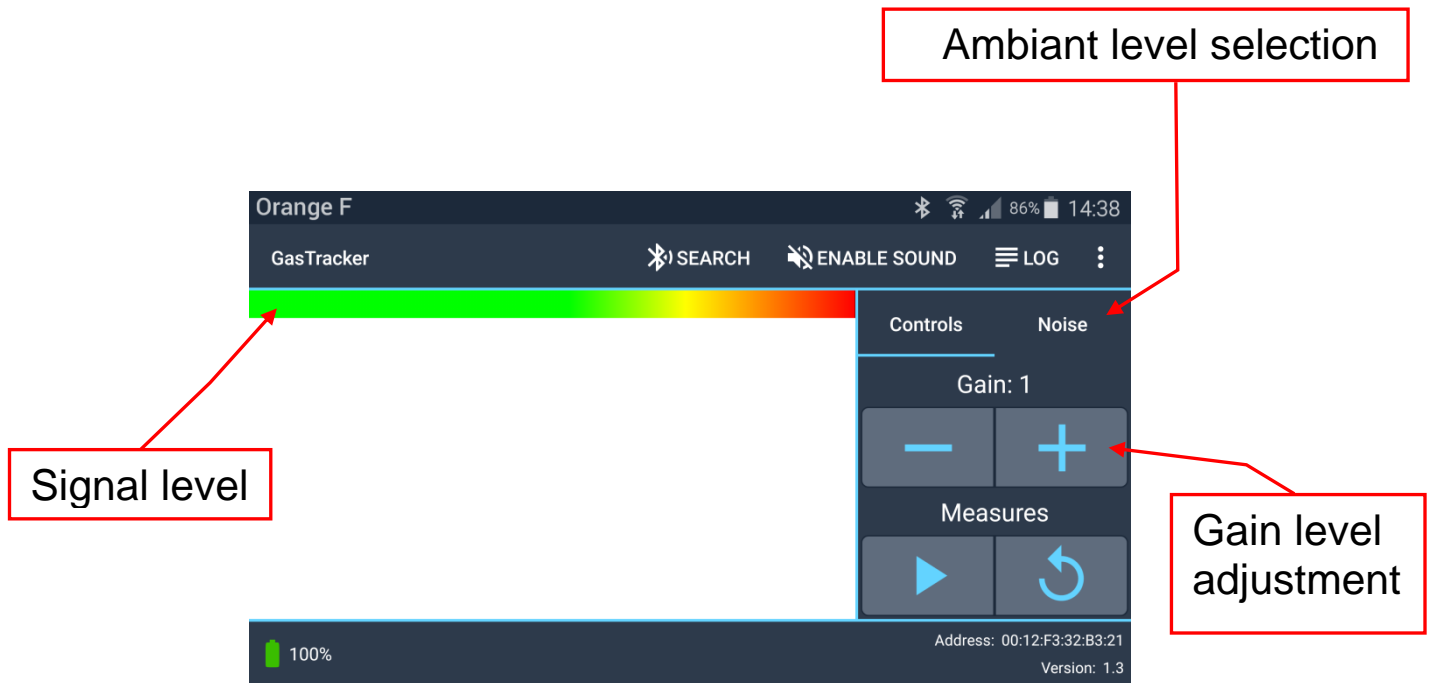
In the presence of soft soil (grassy ground, trench recently plugged but not compacted), push as much as possible the sensor in the soil.

Optimal coupling is achieved when the sensor touches the ground.

Do not walk around the sensor during measurement to avoid noise.

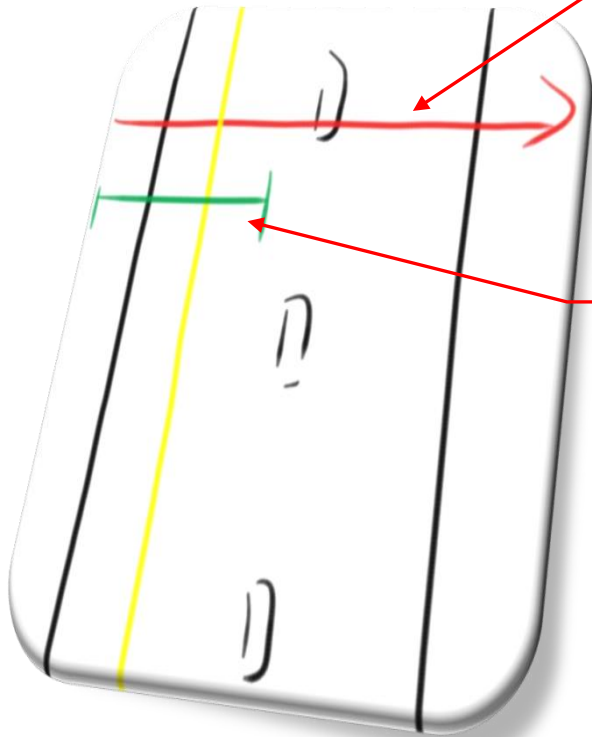
## 6.2. Pre-locating

Before proceeding with any precise locating, it is necessary to pre-locate a search area. To do this, the bar graph is used which makes it possible to visualize the acoustic measurement continuously.



1. Weak signal or zero signal. Increase the gain if needed.
2. Saturated signal – Lower the gain.
3. Optimal reception. The red line represents the average value of the desired signal. Ideally, in the presence of a significant signal, this red line remains relatively static, as opposed to the maximum of the bar graph, which tends to continue to move as a function of ambient noise.

## PRACTISING ON THE FIELD



On the ground (roadway, concrete, grassy ground, etc ...), pre-locate by making measurements spaced maximum of 50 cm. Proceed methodically !

Restrict the search area to a band of approximately 1m50. Depending on the measurements and clues taken from the field, in association with the existing mapping, position along the (supposed) perpendicular line of the pipeline to be located.

### 6.3. Locating

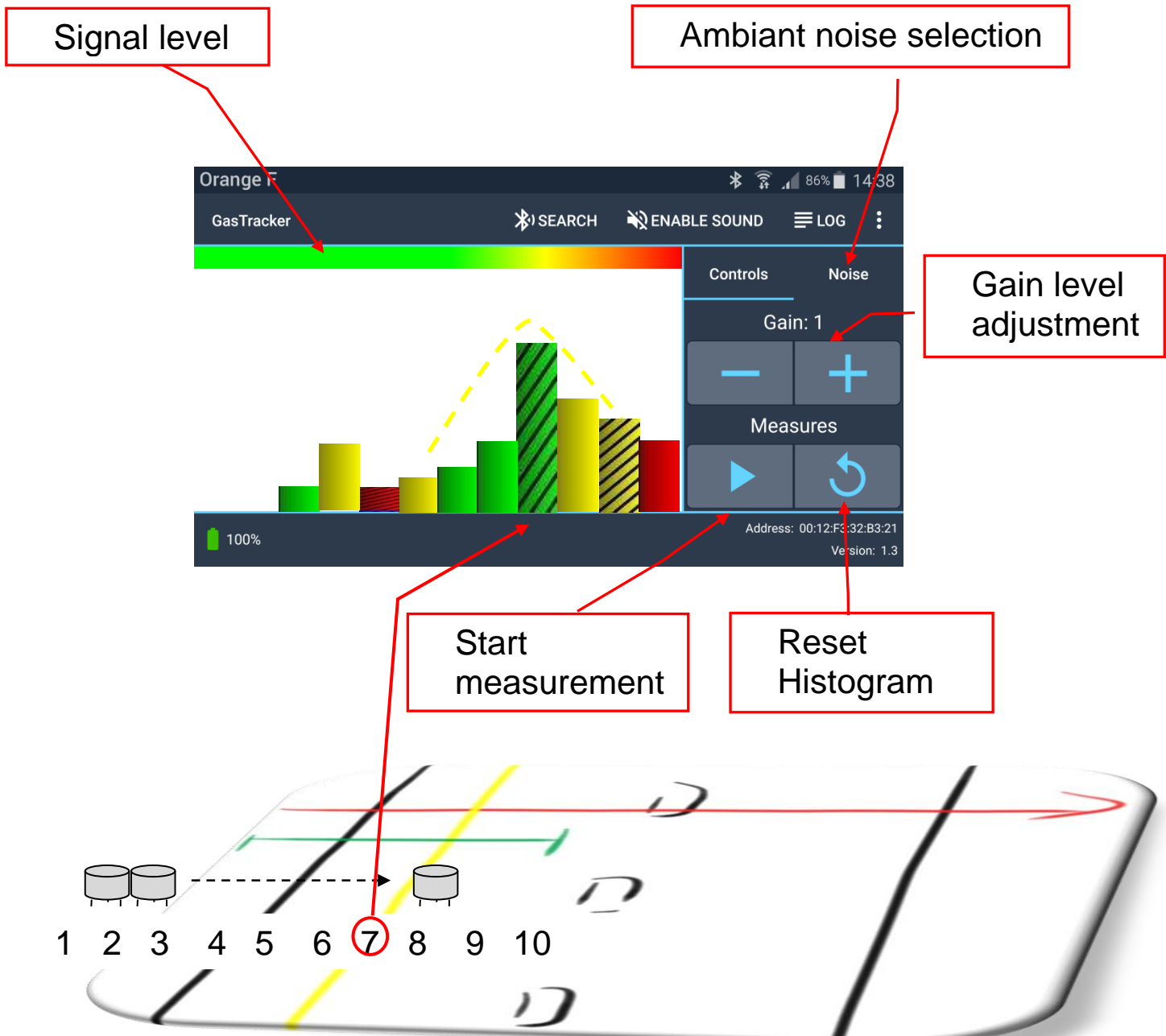
To precisely locate a pipe, measurements are made along an axis perpendicular to the supposed direction of the pipe, by spacing each measurement of the width of the ground sensor.

Perform a reset of the histogram if necessary.

Do a series of measurements methodically, setting a starting point and a point of arrival.

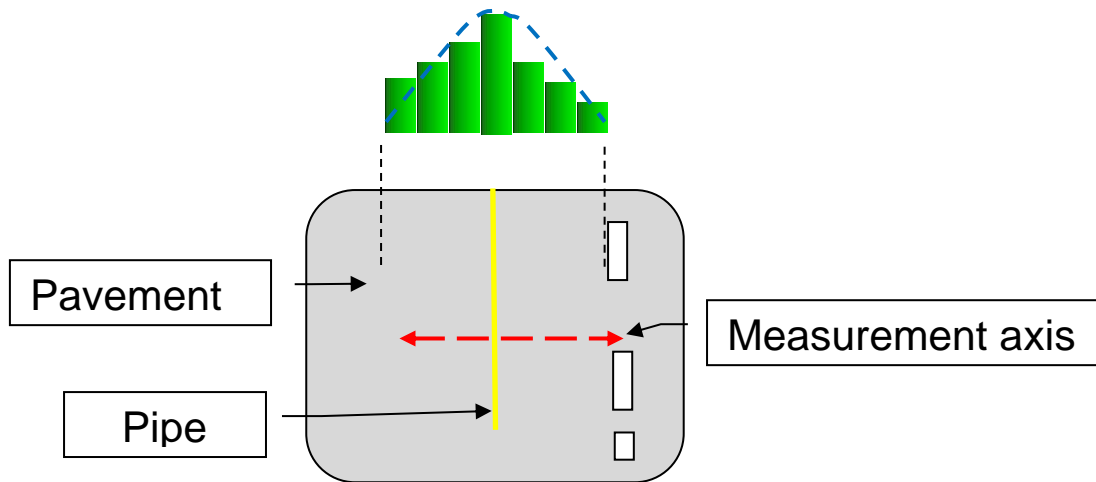
In case of saturation, the gain can be adjusted during the series of measurements, the histogram will rescale automatically.

Find an extremum according to an increasing / decreasing curve, the pipeline location corresponds most of the time to the maximum level detected



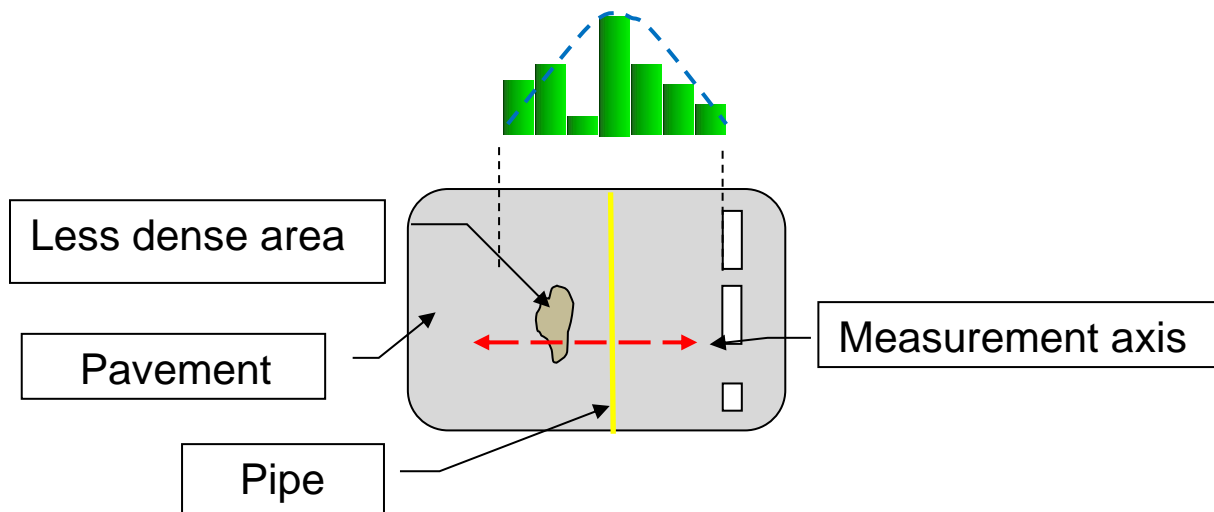
- **Usual case: homogeneous soil**

Ex: Concrete, grassy ground, pavement, well compacted trench.



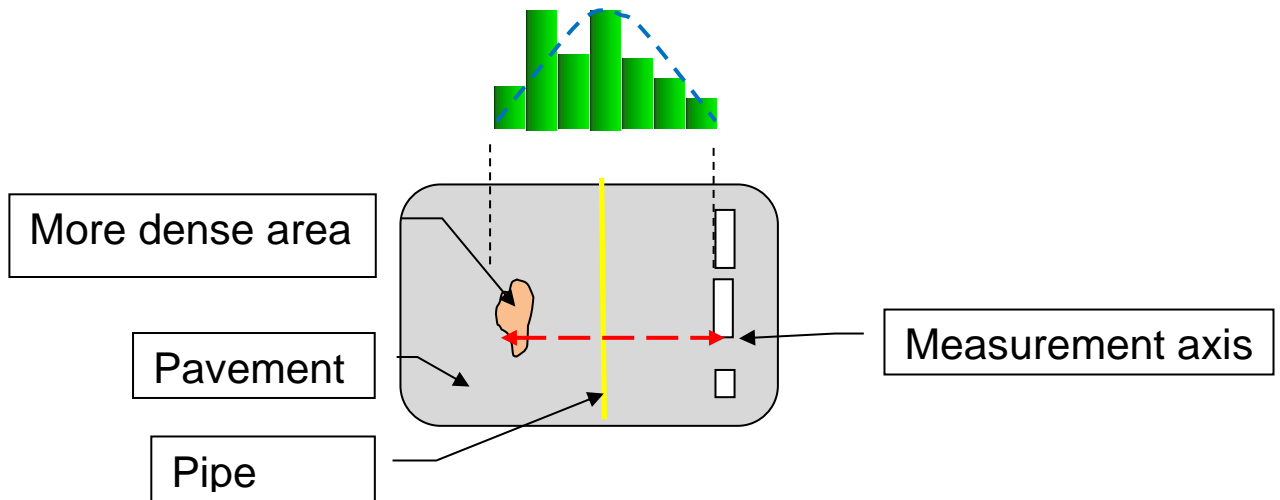
- **Particular case: Soil with localized elements of lower density**

Ex: Buried cavity, localized soft part, etc.

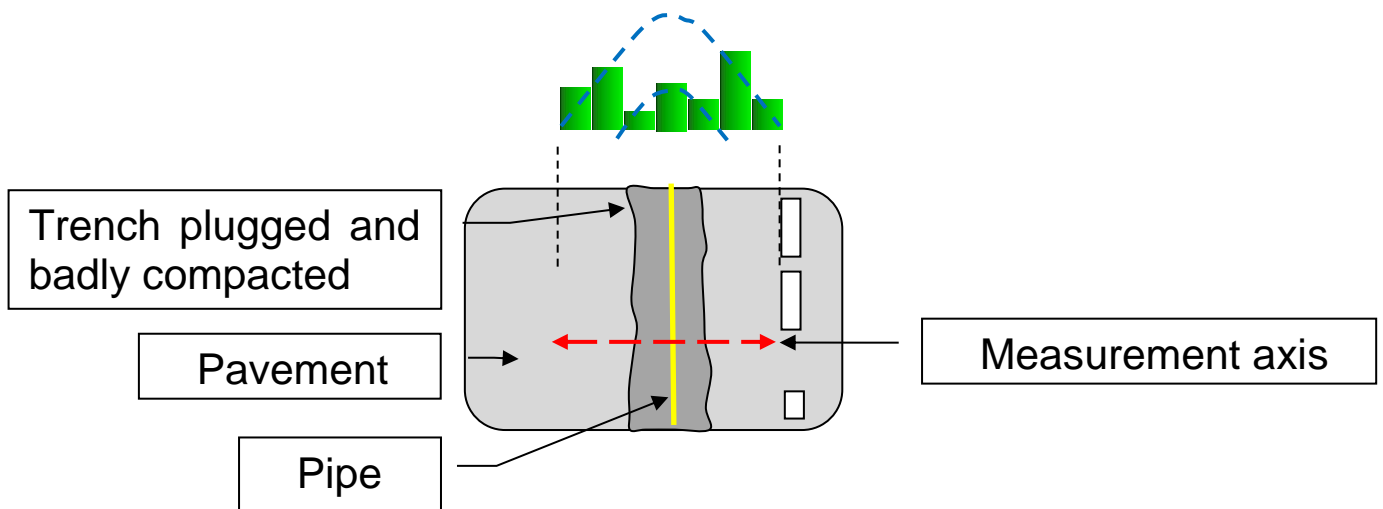


- **Particular case : soil with localized elements of greater density**

Ex: Buried rock, concrete block, localized dense part, etc.



- **Particular case: soil with plugged trench badly compacted**



The difference in compaction of the trench causes a damping of the measured signal.

A local secondary extremum is found above the pipe.

**Note:**

The presentation of these particular cases aims to help the operator do a very precise locating of the desired pipe (+/- 15 cm in XY). If you only consider the extremum as the locating of the pipeline (without performing a finer interpretation), the result will still be very good - in any case more precise than any excavator!



➤ Examples from the field

- Usual case



Classical bell curve, the pipe is located under point n°3.

- Case of a badly compacted trench, with differences in propagation between the trench and the rest of the roadway.



The signal decreases sharply when passing through the trench, due to a different compaction. The interpretation is shown schematically by 2 interlocking bell curves. The point 10 (relative extremum in the trench) designates the pipe.

## 7. TECHNICAL FEATURES

- Transmitter :
  - Acoustic technology using a horn driver under pressure in a resonator tank:
    - 400 Hz < Injection frequency < 500 Hz
    - Sound pressure level : 110 dB
  - AC power supply 100-240V 50/60Hz, integrated battery, external batteries using the connectors provided (vehicle cigar lighter adapter or battery 12V/3A)
  - Integrated Lead batteries 7,6AH 12V (autonomy : 4H)
  - Temperature : -20 to +60 °C, 90% relative humidity
  - Protection : IP54
  
- Tablet :
  - Batterie li-ion 8000 mAh
  - Micro USB chargeur
  - Temperature : -20 to +55 °C, 95% relative humidity
  - Protection : IP67
  
- Acquisition Ground sensor :
  - Sensor & signal processing unit for sound acquisition
    - Sensitivity adjustment (gain : 1 to 100)
    - Ambient Noise Filtering selection (4 levels, Low to Extreme)
  - Bluetooth connection to Tablet
  - Removable telescopic rod
  - Battery (autonomy 10H)
  - Charger 20W 100-240v 50/60Hz
  - Temperature : -20 to +60 °C, 90% relative humidity
  - Protection : IP53
  
- Total weight : 28,7 kg
  - Transmitter : 13,5 kg
  - Receiver : 15,2 kg
    - Resonator tank : 5,1kg
    - Ground sensor : 1,3kg

- Dimensions :

- Transmitter case : 472 x 347 x 194 mm
- Receiver case : 560 x 347 x 239 mm

Terms of use:

Fluctuation of the supply voltage up to +/- 10% of nominal voltage, transient overvoltage up to overvoltage category II, pollution degree 2.

## **8. MAINTENANCE, RECYCLING AND GARANTEE**

### **8.1. Maintenance**

Dismantling systems is forbidden. This operation is limited exclusively to personnel qualified by MADE.

Note: Breaking the security seals voids the guarantee.

An annual inspection can be carried out in our premises.

For cleaning the system use a soft, dry cloth.

Never use solvent, or a solvent-based product, to clean the system and / or its accessories.

### **8.2. Recycling**

In accordance with the decree n° 2005-829 of July 20, 2005 relating to the waste disposal of electrical equipment and electronic (WEEE), the user ensures and takes responsibility for the collection and the elimination of the WEEE under the conditions of the articles 21 and 22 of this decree.

### **8.3. Garantie**

MADE guarantees this product, to the initial purchaser, against all material or functional failure during a period of one year from the date of delivery, unless otherwise indicated in the product manual. If a defect

is discovered during the period of the guarantee, MADE agrees, at its choice, to either repair or replace the deficient part, excluding the expenses of handling and of initial delivery.

All parts repaired or replaced under the terms of this agreement will be guaranteed only for the remainder of the period of initial guarantee of the system.

### **8.3.1.Limitations**

This guarantee does not cover:

- Break of the security seals
- Damage caused by a "cause beyond control", natural disasters, strikes, wars (declared or not), terrorism, social conflicts or any acts under governmental jurisdiction
- Damage due to misuse, to carelessness, to any accident or an unsuitable application or installation
- Damage caused by a repair or an attempted repair not authorized by MADE
- Any product that is not used in accordance with the instructions provided by MADE
- Cost of transport back to MADE
- Cost of transport by express delivery of parts or products under guarantee
- Cost of travel for a repair on site under guarantee

This guarantee constitutes the unique explicit guarantee established by MADE for its products. All implied guarantees, including, but not limited to, guarantees on the commercial value of the product and its suitability for a particular use are positively rejected.

The present guarantee confers certain rights: the legislation of the country or jurisdiction can grant others. This guarantee constitutes the final declaration, complete and exclusive, of the terms of the guarantee and nobody is allowed to give other guarantees or promises on MADE's account.

### **8.3.2.Claims limitations**

Claims having for object repair or replacement are the only allowable claims in case of the breaking of this guarantee. The MADE Company cannot be held responsible, whether on the basis of strict responsibility or any other legal basis, of any incidental or consecutive damage resulting from a violation of the guarantee or from carelessness.

### **8.4.Copyright**

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