

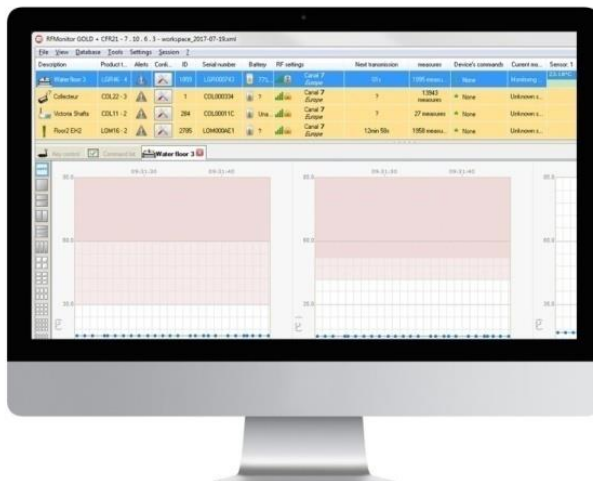
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# TRP Installation and user guide

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Reference : TRP55

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# 1 TRACKERS DESCRIPTION

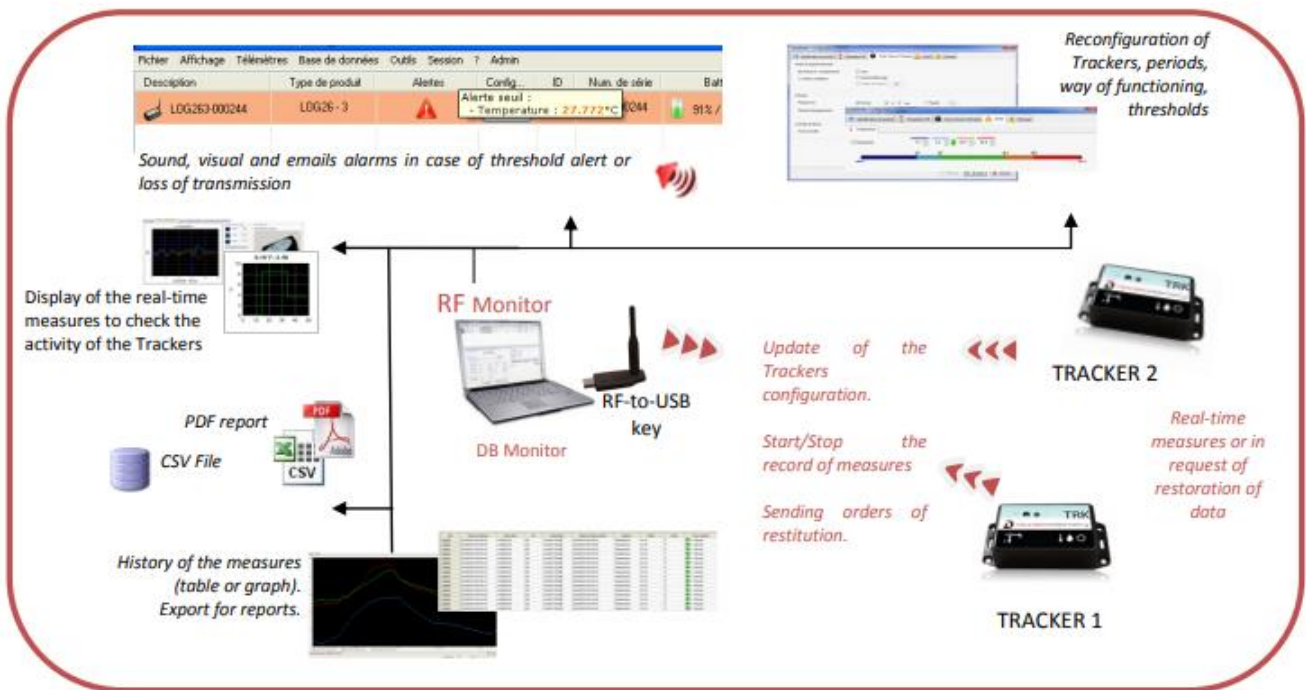
TRP55 tracker main functions:

- Shocks and tilt measurements on 3 axis, free fall and temperature
- Time-stamped measures stored in a flash memory
- GPS position recording

Integrated sensors:

- 3 axis accelerometer and temperature sensor
- GPS

# 2 RF MONITOR INSTALLATION OVERVIEW



## 2.1 General description

At your measurement site, you need to have a dedicated PC with RF Monitor installed to:

- Configure the operating modes, the measurement periods, the thresholds and the alarms
- Display the measures, generate CSV or PDF files
- Collect your trackers measures (using a RF-to-USB key)
- Fill in the database

It is possible to access the database using the software DB Monitor provided.

### 3 INSTALLATION OF RF MONITOR AND DB MONITOR

**PLEASE NOTE THAT YOU MUST HAVE ADMINISTRATOR RIGHTS ON THE COMPUTER TO INSTALL RF MONITOR**


➤ **1<sup>ST</sup> SOLUTION :** 

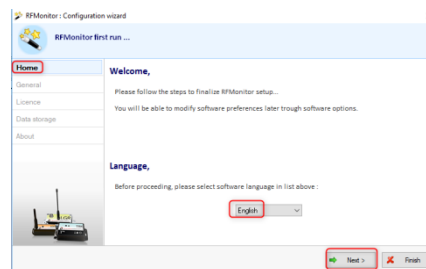
Connect the metallic USB storage key

Via Windows explorer, display the content of the USB key and double-click on **NewsteoKit\_vX.X.X\_ooooo0000\_setup.exe**.

➤ **2<sup>ND</sup> SOLUTION : DOWNLOAD RF MONITOR FOLLOWING THE LINK**

**<http://support.newsteo.com/customer/fr/portal/articles/1133777-t%C3%A9l%C3%A9chargement-rf-monitor>**

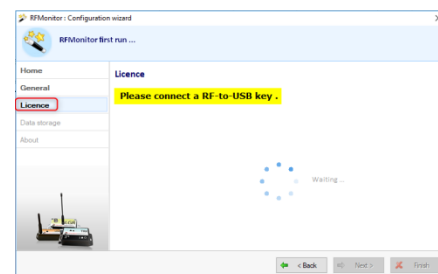
- On the first window select the language, then for a quick installation keep the default settings by validating the successive windows from the setup program. At the end of the installation, select the option « **Reboot now** » and click on « **Finish** ».
- Once the computer restarts, launch RFMonitor software by double-clicking on the shortcut created on the desktop or from the start Menu 
- On the « **Home** » window of the configuration wizard, select the language and click on « **Next** »



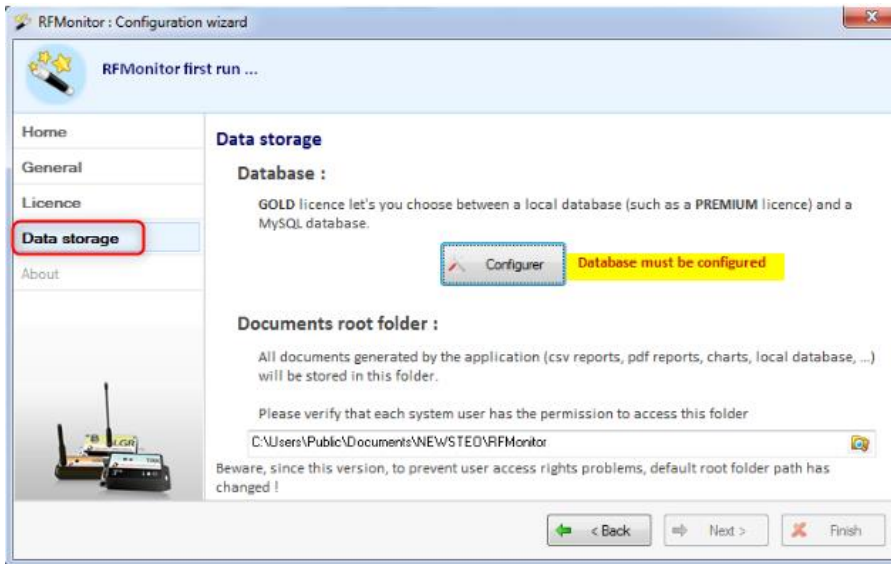
- On the « **General** » window of the configuration wizard click on « **Next** ».

**Remark :** Once the installation has been completed , the configuration may still be changed (right-click on the line of the tracker then click on « **Configuration** » on the RFMonitor program option

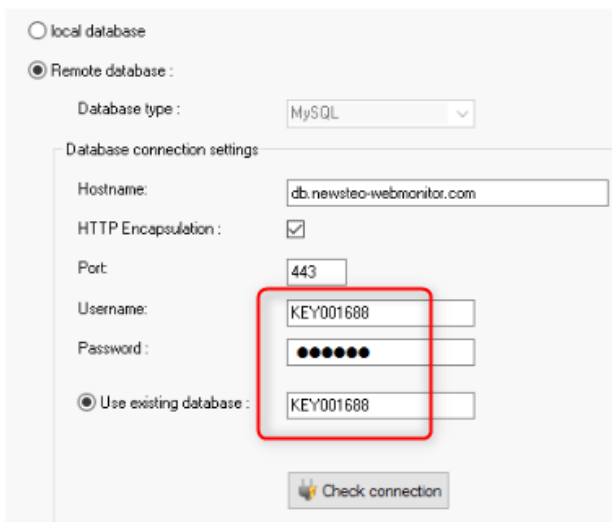
- When requested by the setup wizard, remove the label «install the software before inserting» and insert the **RF-To-USB key** preferably using the **USB extension**



- In the wizard window « **Licence** »
- click on « **Next** ».
- In the window « **Data storage** » you need to configurate the database connection



You need to select "Remote database" and complete the information with the username, password and database name.

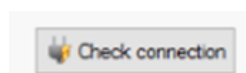


This information is provided on the label supplied with the device

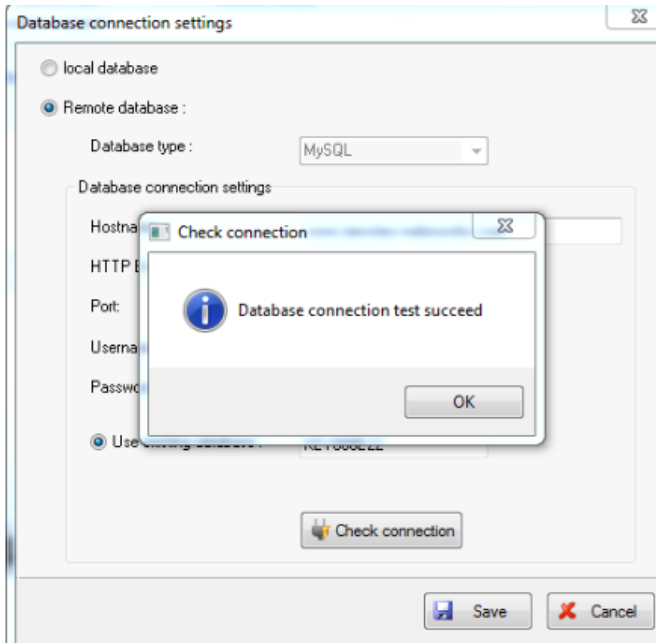
If you don't have this information please contact your supplier.



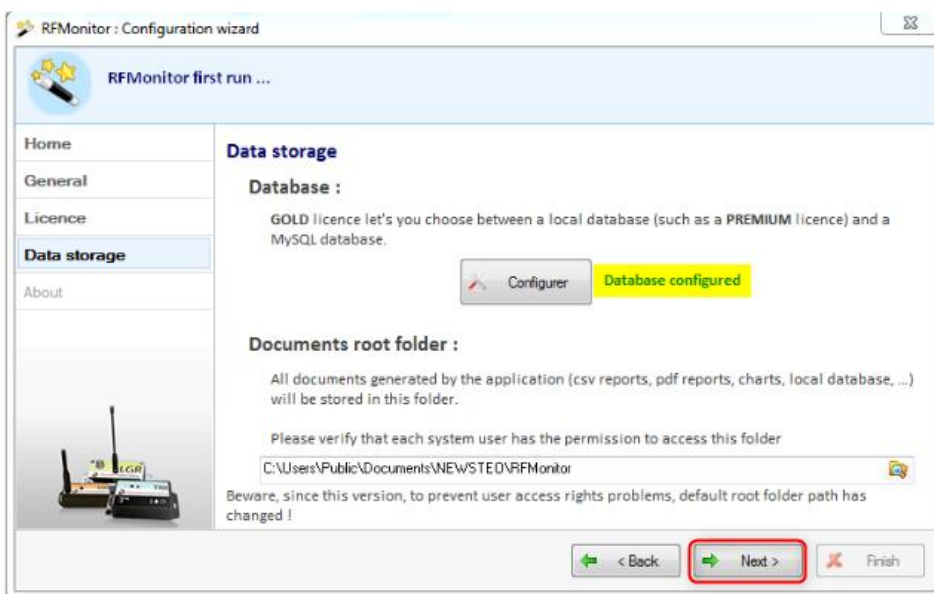
Check the connection



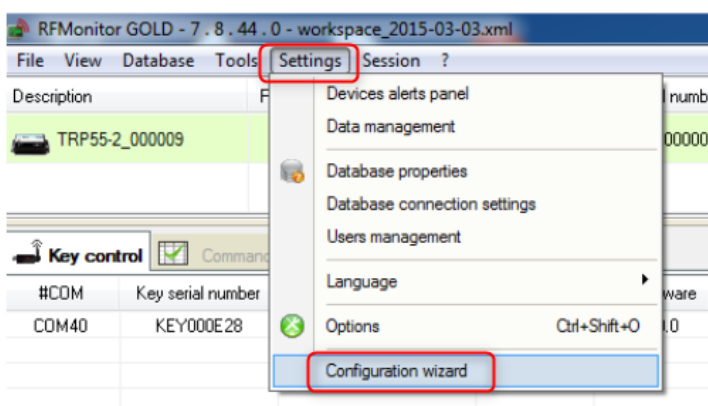
A message will be displayed if the connection succeeded.



- click on « **Next** ».



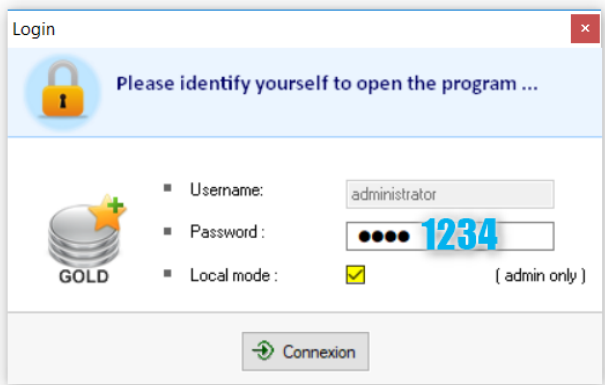
Please note that if you want to postpone the data storage configuration, you will be able to return to it from RF Monitor: Setting > Configuration wizard



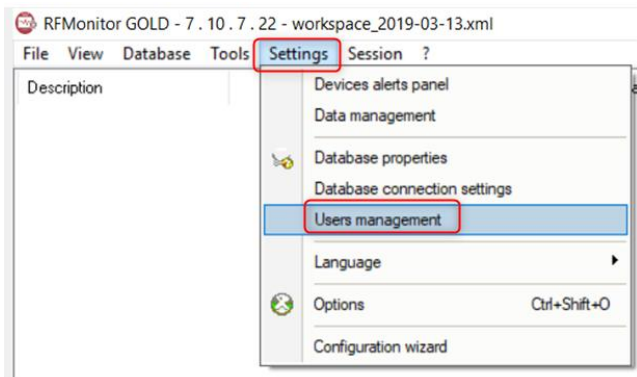
By default the administrator connection login is as follows :

Select the local mode

Password: 1234



If you need to modify the administrator login you may do so from the Settings > Users management:



## 4 STARTING THE TRACKER WITH RF MONITOR

### 4.1 RFM Launch – Starting the tracker

The tracker is delivered in Hibernation mode (sleeping mode).

- 1- Launch RF Monitor
- 2- Connect your RF-to-USB key, it will be appearing in channel 1

| #COM | Key serial number | RF settings                                 | Key hardware | Key firmware | Baud rate | License type | License number               |
|------|-------------------|---|--------------|--------------|-----------|--------------|------------------------------|
| COM9 | KEY001E7C         | Chl EU11 10dBm 30mA<br><b>RADIO CHANNEL</b> | KEY111       | v19.0.9      | 625000    | Premium      | 1H0T-HDM5A-6LPAM-MUK33-LRYNE |

- 3- Open the TRP and place the batteries
- 4- Activate your tracker by swiping the magnet on the designated area



A support video is available following the link :

<http://support.newsteo.com/customer/fr/portal/articles/2776482-vid%C3%A0go-d-aide-pour-les-newsteo-tracker---r%C3%A0g%C3%A0gences-tre-et-trp>

This action will immediately force the communication between the Key and the Tracker



5- On RF Monitor, the tracker will automatically appear in the list of devices:


| Description | Product I... | Alerts | Conf... | ID   | Serial number | Battery     | RF settings    | Next transmi... | measures    | Device's commands | Current mode/status | Sensor: 1 | Sensor: 2 | Sensor: 3 | Firmware           |
|-------------|--------------|--------|---------|------|---------------|-------------|----------------|-----------------|-------------|-------------------|---------------------|-----------|-----------|-----------|--------------------|
| TRE TEST    | TRE35 -2     |        |         | 2022 | TRE0007E6     | 84% / 3.46V | Canal 7 Europe | 00s             | 12 measures | None              | Live / Presence     |           |           |           | 1.4.45 Live/record |

Annotations for the table above:

- Identification of the Tracker (points to Description)
- Configuration menu (Start/Stop record) (points to Conf...)
- Battery level (points to Battery)
- Radio channel (points to RF settings)
- Time remaining before the next transmission (points to Next transmi...)
- Number of commands on hold-indicates whether the radio transmission took place (points to Device's commands)
- State of the tracker (Live/Record) (points to Current mode/status)
- Firmware version (points to Firmware)

## 5 CONFIGURATION OF THE TRACKER WITH RF MONITOR

### 5.1 Configuration menu

- Click on the tool icon  of the logger's line ( Or right-click on the logger's line)
- Then click on "Configuration".

| Serial number | Battery     | RF settings    | Next transmi... | measures    | Device's |
|---------------|-------------|----------------|-----------------|-------------|----------|
| TRE0007E6     | 86% / 3.47V | Canal 7 Europe | 47s             | 19 measures | None     |

Context menu options:

- Display curves of measures
- Configuration

### 5.2 Execution of the commands

For a command to be taken into account :

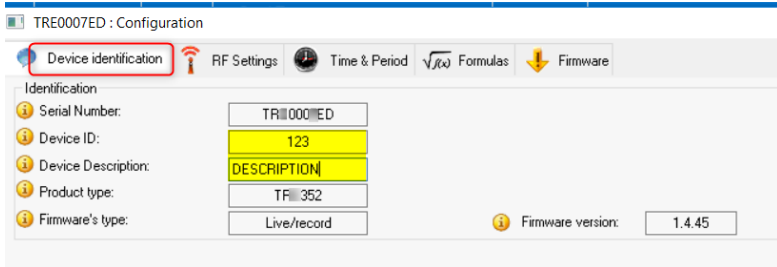
- Swipe the magnet on the tracker to execute the command
- Or Wait for the next radio transmission (<1 minute)  
*The tracker sends a radio signal presence every minute*

| Description | Product I... | Alerts | Conf... | ID   | Serial number | Battery     | RF settings    | Next transmi... | measures    | Device's commands        | Current mode/status | Sensor: 1 | Sensor: 2 | Sensor: 3 | Firmware           |
|-------------|--------------|--------|---------|------|---------------|-------------|----------------|-----------------|-------------|--------------------------|---------------------|-----------|-----------|-----------|--------------------|
| TRE TEST    | TRE35 -2     |        |         | 2022 | TRE0007E6     | 86% / 3.47V | Canal 7 Europe | 09s             | 19 measures | 1 command(s) waiting ... | Live / Presence     |           |           |           | 1.4.45 Live/record |

- The message « 1 command waiting » disappears as soon as the command has been taken into account.

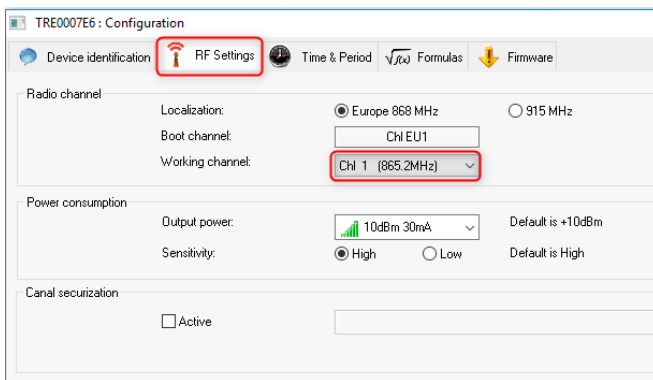
### 5.3 Product identification

- Select the tab « **Device identification** »
- Select a personalised identifier (ID, number between 0 and 65535)
- Enter a description
- Click on “Send” to validate the modifications

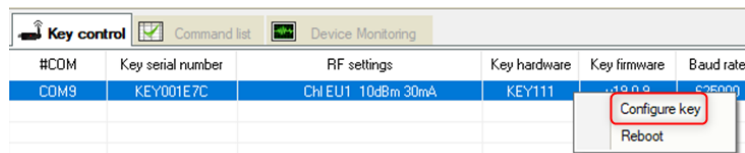


### 5.4 Changing the radio channel

- Select the tab « **RF Settings** »



- **By default** the trackers and the RF-To-USB key are set on **channel 1** – *Channel 1 properties: When the key is set on Channel 1, you can detect the trackers which are on any other channel. The channel 1 is a detection channel.*
- If needed you may change the radio channel following these steps:
  1. First you need to change the channel of the tracker
  2. Wait for the next transmission or swipe the magnet on the tracker to execute the command
  3. Change the channel of the RF-To-USB key by right-clicking on the line of the key

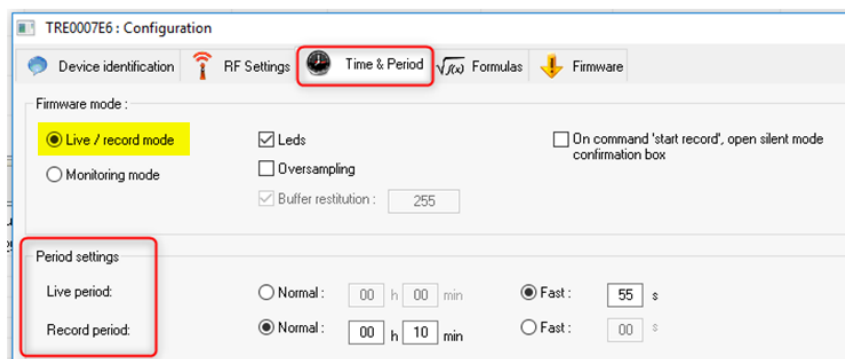


4. Change the radio channel in « **RF Settings** »



## 5.5 Live/record mode

Select the tab « *Time and Period* »



« **Live period** » : measures recorded outside the recording period

*The TRP55 takes a measure at the configured live period (10s by default) and sends it to the PC.*

*RF Monitor displays the measure without recording it. The user can also check the tracker functioning, set the thresholds and the measurement period for the coming measurement campaign.*

« **Record period** »: measurement period during the recording

- NORMAL : measurement period from 1 minute to a 4 hours
- FAST : measurement period from 1 second to 59 seconds

## 5.6 Which mode should you select?

For the TRP55 select the live/record mode (set up by default)

## 5.7 Measurement frequency

The higher the measurement frequency is, the faster the memory will be full.

For example: a 1 mn period will fill the memory in 2 months with 20500 recorded shocks and temperatures.

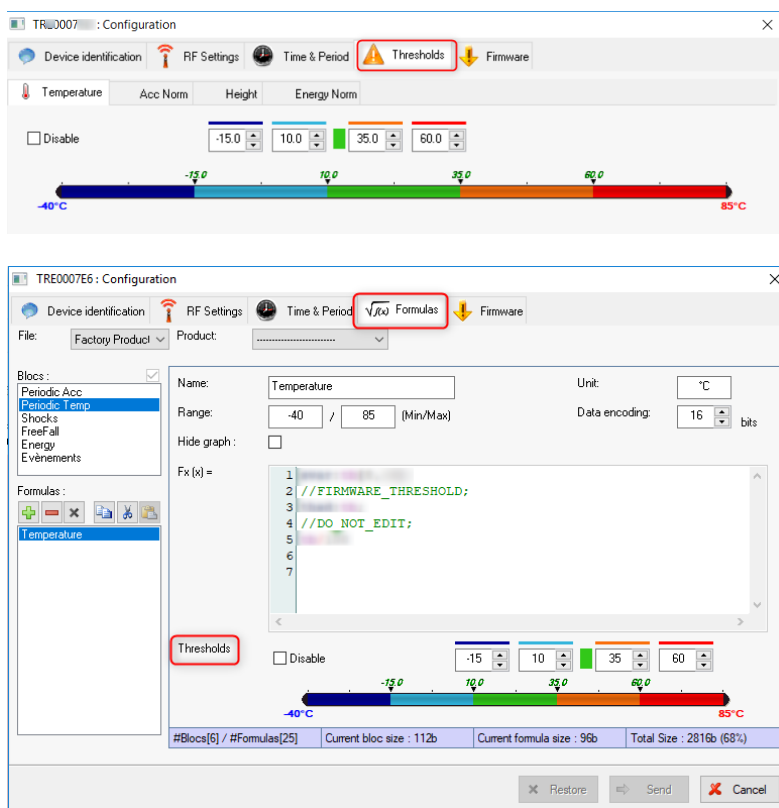
Whereas a 15 mn period will fill the memory in 2 years with 29000 recorded shocks and temperatures.

## 5.8 Oversampling

- The oversampling option allows to have a higher measurement frequency when the threshold is reached.
- Please bear in mind that this option increases the battery consumption
- When the threshold is exceeded :
  - ✓ The measurement period changes to 1 measure / minute in the **NORMAL** period
  - ✓ The measurement period changes to 1 measure / second in the **FAST** period

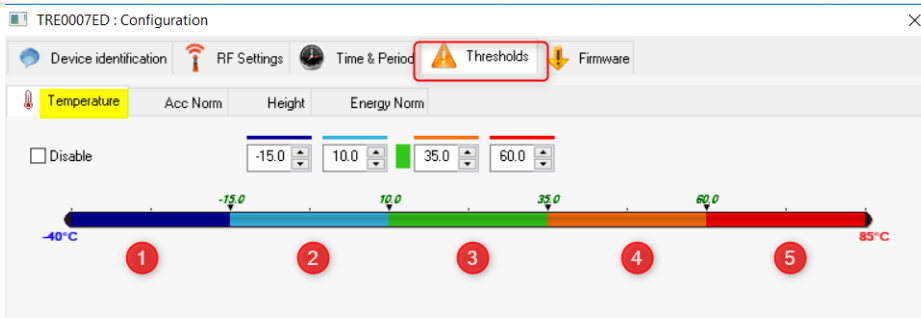
## 5.9 Thresholds

- Right-click on the line of the device then on «**Configuration**»
- Select the tab «**Thresholds**» or «**Formulas**»



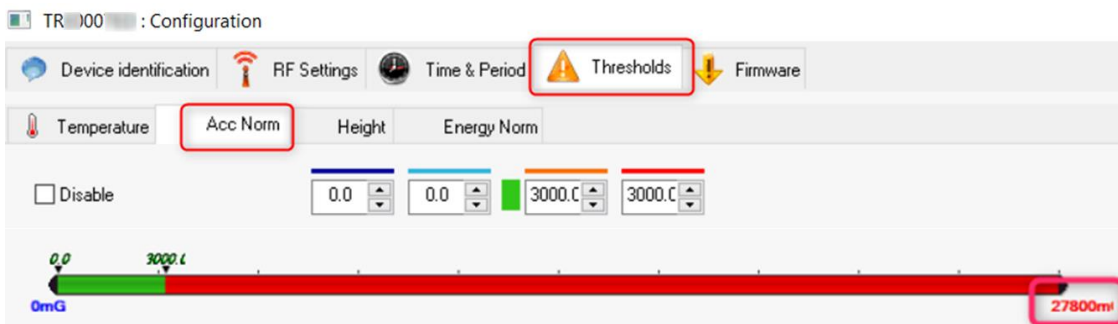
## 5.10 Configuration of the temperature thresholds

- Set the thresholds which correspond to the desired level of alerts for the tracker :



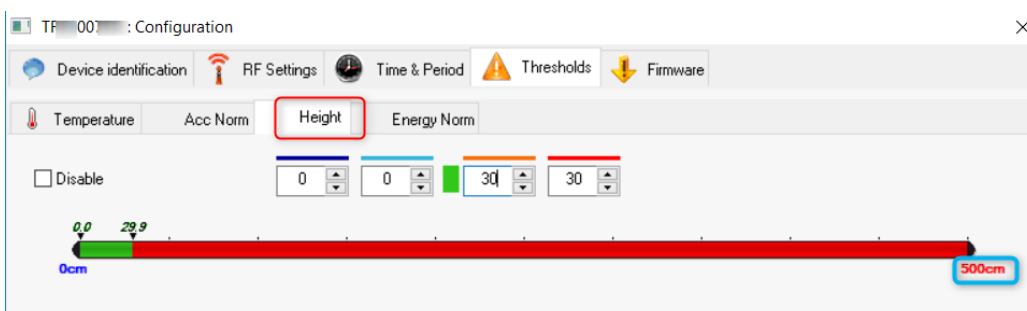
1. Dark blue range : triggers very low alerts
2. Light blue range : triggers low alerts
3. Green range : no alerts (normal range)
4. Orange range : triggers high alerts
5. Red range : triggers very high alerts

### 5.11 Configuration of the shocks thresholds



- For the shocks you can't have shocks lower than zero
- The unit above is in mG
- In our example :  
For any shock higher than 3G (3000mG), the TRP55 records the event (refer to section 9.3)  
For the shocks lower than 3G the TRP55 takes the measures regularly (refer to section 9.2)

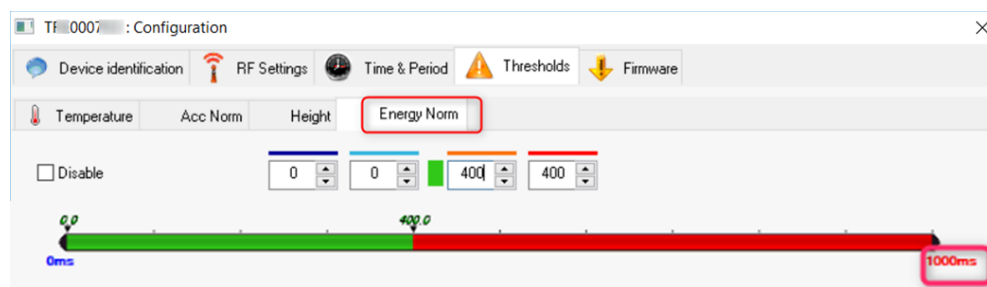
### 5.12 Configuration of the height thresholds



- For the falls, you can't have a height lower than zero
- The unit above is in cm

In our example above:  
 For the falls higher than 30cm the TRP55 records the event (refer to section 9.4)

### 5.13 Configuration of the Energy Norm thresholds



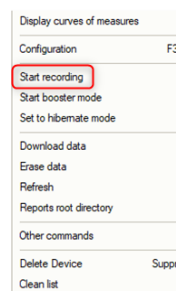
- The energy calculation takes into account the duration of the shock in ms, you can't have a fall lower than zero
  - The unity above is in ms
- Example below :

For a shock with a duration higher than 400ms, the TRP55 records the shock and calculates the shock energy taking into account the shock duration and the measure of the shock.

### 5.14 Recording campaign

#### 5.14.1 Starting the recording

- Once the mode **Live/record** has been selected
- Click on « **Start recording** »



- Wait for the next radio transmission or swipe the magnet on the trackers magnet area to execute the command. The loggers sends a presence radio signal every minute

| measures   | Device's commands        | Current mode/status |
|------------|--------------------------|---------------------|
| 5 measures | 1 command(s) waiting ... | Record / Presence   |

The command has been treated

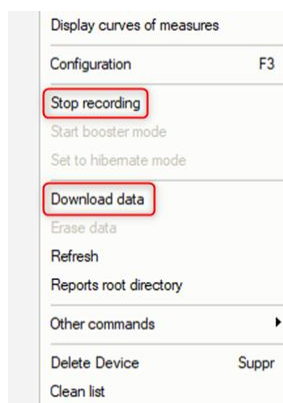
| measures   | Device's commands | Current mode/status |
|------------|-------------------|---------------------|
| 6 measures | None              | Live / Presence     |

### 5.14.2 Recording

- The tracker records and stores the measures in its memory at the period fixed by the user
- Every minute the tracker sends a presence radio signal to indicate its status, the thresholds which have been exceeded and the number of measures in memory.
- The number of measures in memory are displayed in the column "measures" on the line of the device
- When the memory is full the TRP55 doesn't record any new measures and keeps the first recorded measures

### 5.14.3 End of recording

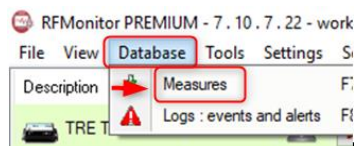
- Click on « **Stop recording** » then on « **Download data** »



## 5.15 Data recovery

### 5.15.1 Access the database

- Click on « Measures »



### 5.15.2 Data files location

When downloading, the tracker generates 2 or 3 file types depending on the mode which has been selected:

**.csv file -> Excel format**

**.pdf file -> Campaign report** (recording mode only)

**.bin file -> Database**

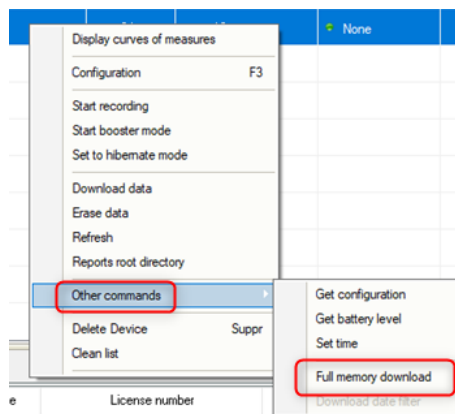
| Nom        | Modifié le       | Type                |
|------------|------------------|---------------------|
| graphs     | 02/10/2018 11:00 | Dossier de fichiers |
| maps       | 02/10/2018 11:00 | Dossier de fichiers |
| reports    | 14/12/2018 16:08 | Dossier de fichiers |
| RFDatabase | 26/12/2018 14:50 | Dossier de fichiers |
| traces     | 26/12/2018 09:25 | Dossier de fichiers |

In **Record mode** : the tracker downloads its data in the folder « **RESTITUTION** » and generates a **PDF** or **CSV** file

| Nom          | Modifié le       | Type                | Taille |
|--------------|------------------|---------------------|--------|
| live         | 20/12/2018 14:59 | Dossier de fichiers |        |
| restitutions | 13/12/2018 09:48 | Dossier de fichiers |        |

### 5.16 Saving data in the tracker

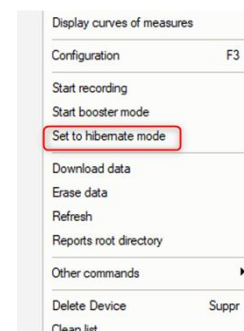
- At any time you can download the last 32000 recorded measurements of each device.
- All measurements are registered in the buffer memory and are only cleared when the tracker rewrites on these measurements.
- By clicking on « *Full memory download* » you can retrieve the last 32000 measures



### 5.17 Hibernate the tracker

The tracker must be **hibernated** (sleeping mode) at the end of the campaign or test measurements to **save its batteries during storage**.

- Right-click on the line of the tracker then « set to hibernate mode »



- Check on the logger line that the status has been changed to « **Hibernating** »
- To reactivate the tracker, simply insert the RF-To USB key and swipe the magnet on the magnet area.

## 6 USING THE TRACKER WITH THE MAGNET AND THE LEDS

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### 6.1 Start a measurement campaign with the magnet

- You can start a measurement campaign with the magnet. To do please follow the procedure :
- First, you need to take 2 magnets :
  - One to activate the LEDs ,
  - The other one to interact with the Tracker.
- During the process, place the first magnet next to the *LED AREA* to activate the LEDs.



When a tracker is in Hibernation mode, when the magnet is placed on the *LED AREA*, all the LEDs should be switched off.

**STEP 1:** Place the magnet on the *SYS AREA* label until the LED "**Batt.**" turns **RED** (few seconds) and the other LEDs are switched off. Then remove the magnet.

**Alert Radio Batt.**



A **bip sound** is produced when this step has been completed.

**STEP 2:** Place the magnet on the *SYS AREA* label until the LED "Radio" turns **ORANGE**. Then remove the magnet.

**Alert Radio Batt.**



Two bip sounds are produced when this step has been completed.

**STEP 3:** Place the magnet on the *SYS AREA* until the LED "Alert" turns **GREEN**. Then remove the magnet.

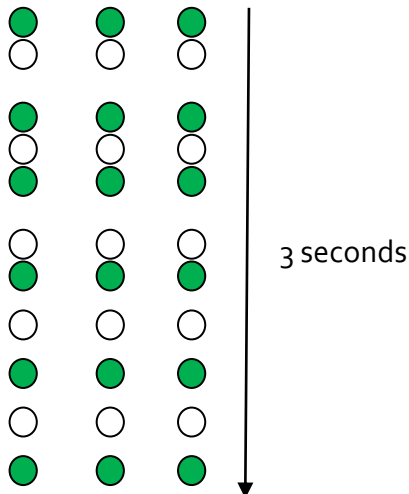
**Alert Radio Batt.**



Three bip sounds are produced when this step has been completed.

**STEP 4:** If the process is followed, the three LEDs will flash simultaneously in **GREEN** during three seconds. The Tracker is then set to **Record mode** and the measurement campaign has started.

**Alert Radio Batt.**



**STEP 5:** Place the magnet on the *SYS AREA*

**Alert Radio Batt.**



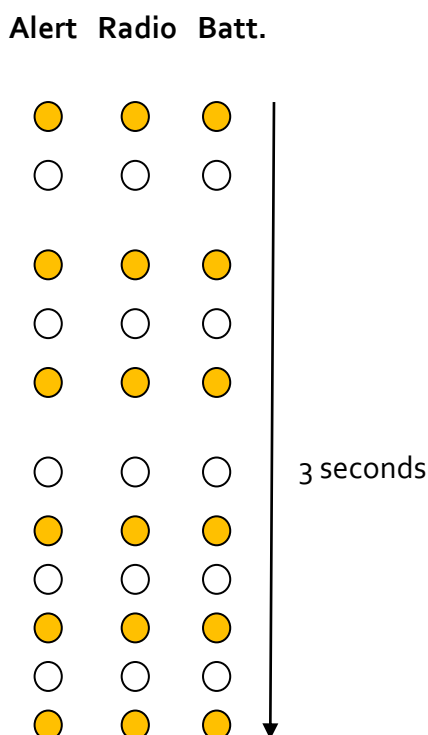
Le TRP is on Record mode.



## 6.2 Stop a measurement campaign with the magnet

You can stop a measurement campaign with the magnet. To do please follow the procedure :  
 Like for the starting measurement campaign, you need to have 2 magnets :  
 Place the first magnet next to the *LED AREA* to activate the LEDs.

**STEP 1:** Place the magnet on *SYS AREA*. The 3 LEDs will simultaneously flash in **ORANGE** during trois seconds (max.). During these 3 seconds the stopping procedure can be performed.



**Remark:** If the three seconds period has elapsed before step 2 or if the stopping process hasn't been finalized, a measure will be stored in the internal memory.

**STEP 2:** Place the magnet on the *SYS AREA* until the LED "**Batt.**" lights **GREEN**. Then remove the magnet.



A bip sound is produced when this step has been completed.

**STEP 3:** Place the magnet on the *SYS AREA* until the LED "Radio" lights in **ORANGE**. Then remove the magnet.

Alert Radio Batt.



Two bip sounds are produced when this step has been completed.

**STEP 4:** Place the magnet on the *SYS AREA* until the LED "Alert" lights in **RED**. Then remove the magnet.

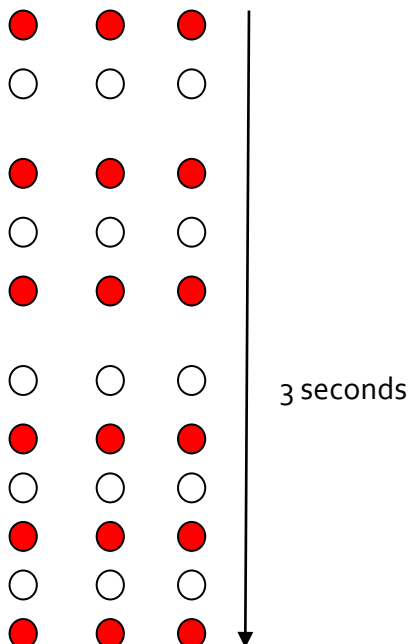
Alert Radio Batt.



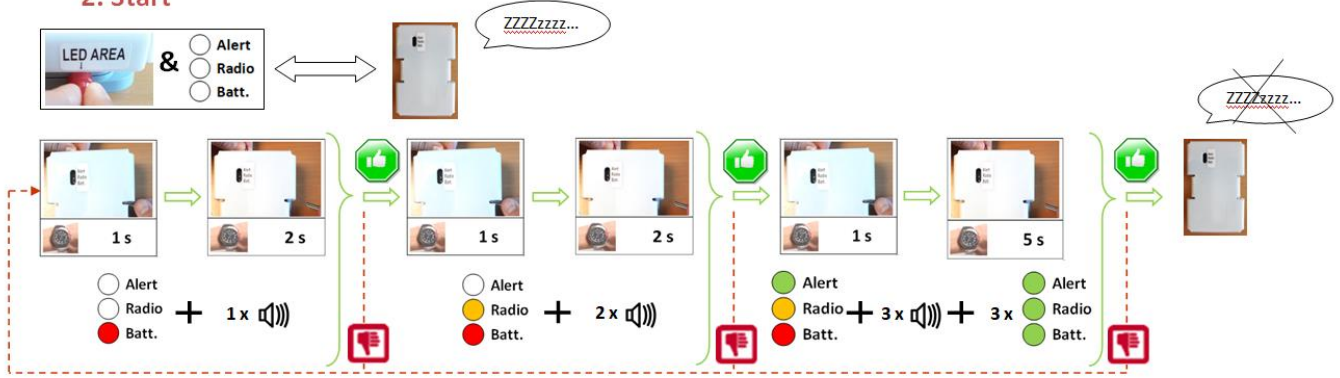
Three bip sounds are produced when this step has been completed.

If this process is followed, the three LEDs will flash simultaneously in **RED** during three seconds. The Tracker is then set to *Hibernating mode* and the measurement campaign has stopped.

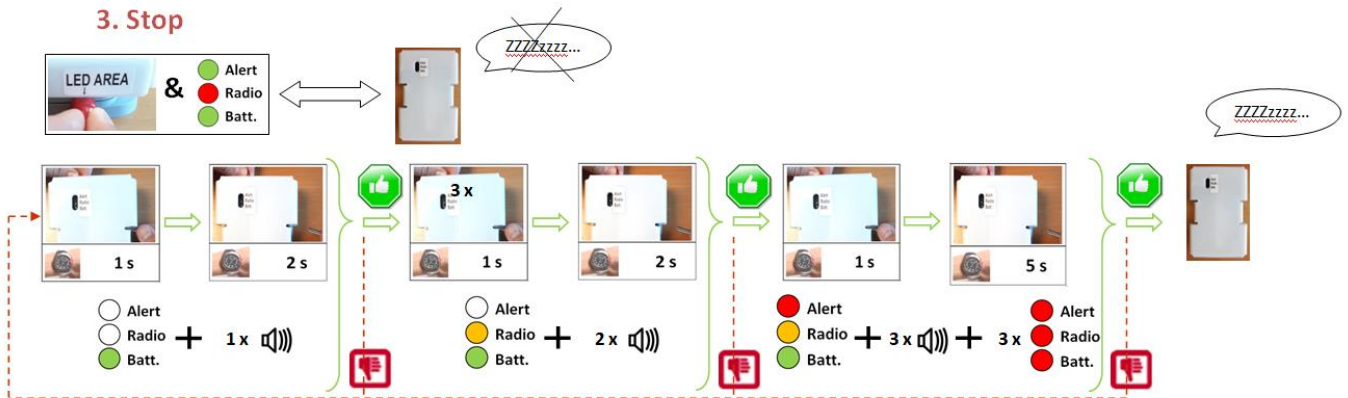
Alert Radio Batt.



### 2. Start



### 3. Stop

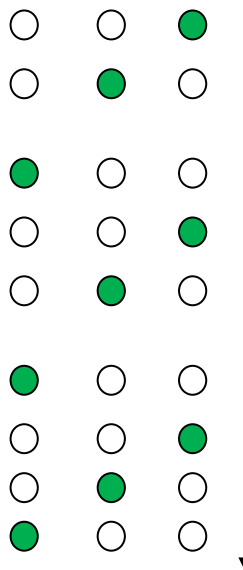


### 6.3 Signal during a GPS acquisition

When a GPS acquisition is ongoing, the three LEDs alternatively light up every second in **GREEN**.

The maximum duration for this scenario is **go seconds** (case when the acquisition has failed).

Alert Radio Batt.



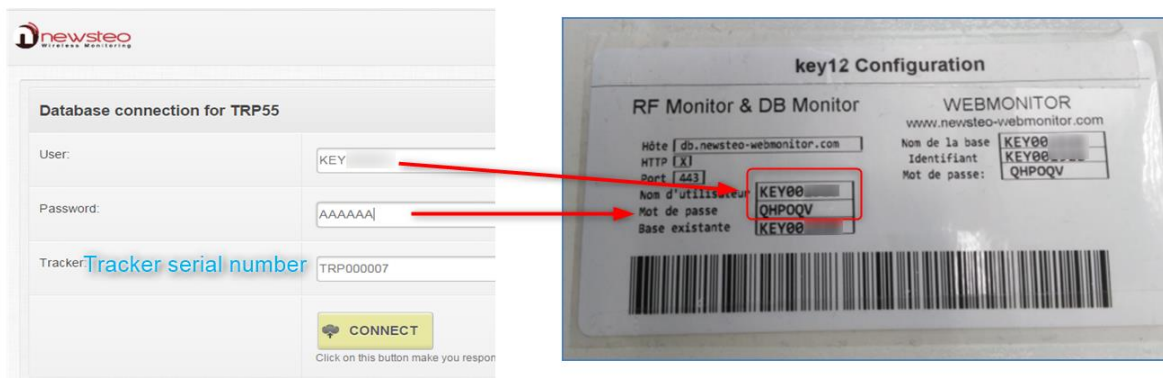
Up to go seconds max.

## 7 DATA EXPLOITATION ON GOOGLE MAPS

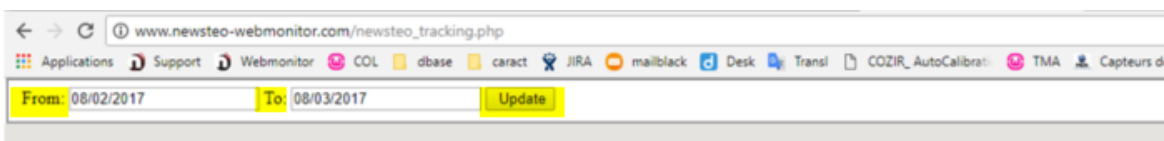
This function allows you to exploit the measures recorded by the Tracker using the Google Maps feature (available with RF Monitor GOLD kit only and if the PC connected to internet).

To do so follow this link , using your favourite browser :

- 1) [http://www.newsteo-webmonitor.com/newsteo\\_launcher.php](http://www.newsteo-webmonitor.com/newsteo_launcher.php)  
(prior to that, you must have completed a measurement campaign with your TRP and downloaded your data via your USB RFM gold key).
- 2) Complete the database connection information



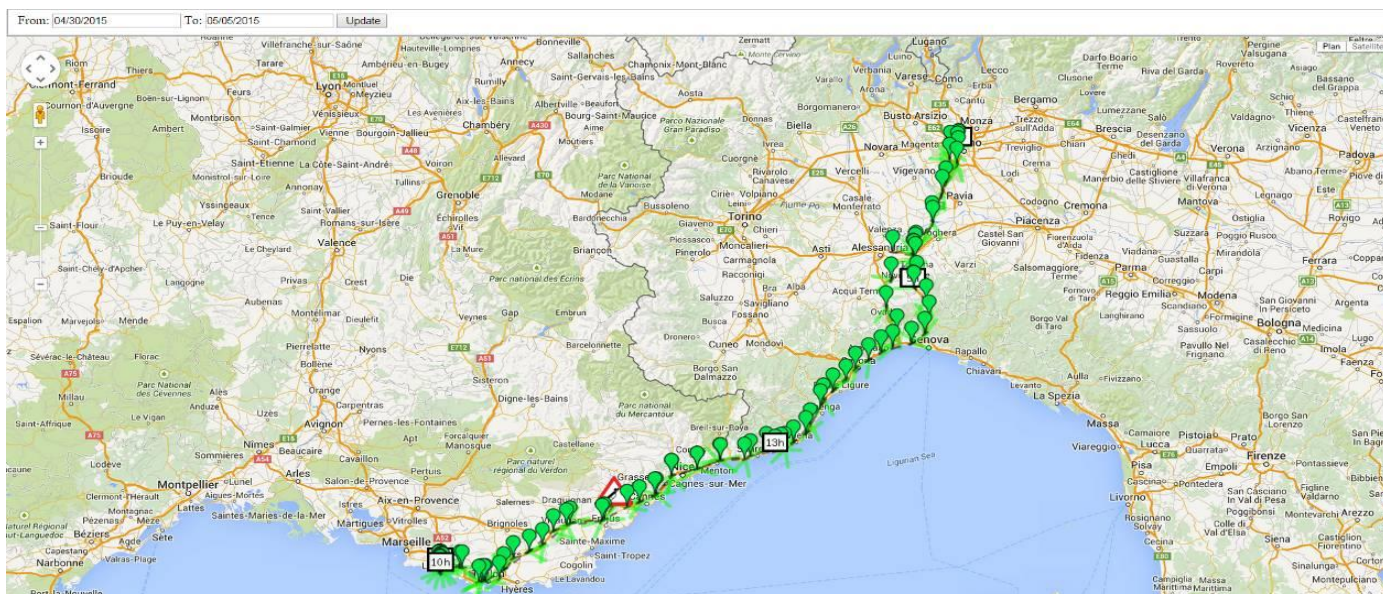
- 3) Select the time period and download the data by clicking on "Update"



- 4) Google map track points with the following information

- TRP55 positioning
- Duration of the stops
- Shock values if the threshold has been overrun
- Shock position and exact time in case a threshold has been reached


## Example of track points



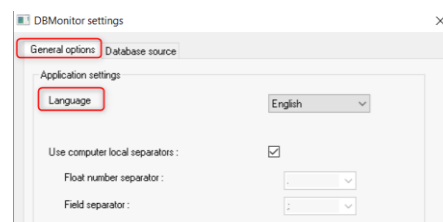
### 5) Demo database for the period 01/06/2017 to 01/08/2017

- User : **KEY00192B**
- Password : **QHPOQV**
- Tracker : **TRP000037**
- Period : du **01/06/2017** au **01/08/2017**

## 8 DB MONITOR INSTALLATION TO CONSULT THE DATA

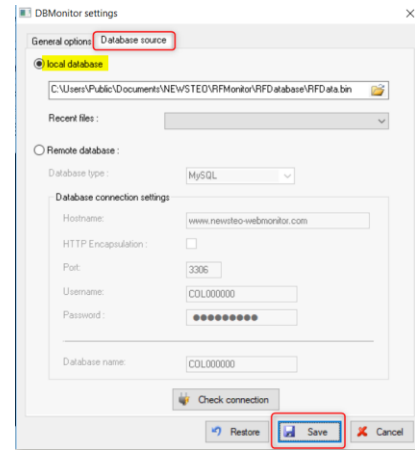
- Once RF Monitor has been installed, launch DB Monitor by double-clicking on the desktop shortcut  or from the « Start » menu.

- In the configuration wizard "General options",
- select the language and click on "Save".



- In the configuration wizard “*Database source*”,
- select « *Local database* »
- Enter the path of the local database

Click on “*Save*”.



- In the configuration wizard “*Finalisation*” click on « *Validate* » then on « *Finish* ».

## 9 TRACKER USE

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### 9.1 Generalities

Main functions of the TRP Tracker.

- Temperature, shock and 3 axis tilt measurements
- Time-stamped measures recorded in the flash memory
- Voltage of the 3 batteries Vbat<sub>1</sub>, Vbat<sub>2</sub>, Vbat<sub>3</sub>
- Displacement speed
- Azimuth
- GPS positioning : longitude / latitude

### 9.2 Measurements at regular intervals

Depending on the frequency set by the user, the tracker measures, time-stamps and stores:

- Temperature
- The tilt of the device on each of the 3 axis
- Voltage of the 3 batteries Vbat<sub>1</sub>, Vbat<sub>2</sub>, Vbat<sub>3</sub>
- Displacement speed
- Azimuth
- GPS positioning : longitude / latitude

Pdf extract report

| Packet | Date       | Time     | Ax       | Ay       | Az       | AngleX     | AngleY     | AngleZ    |
|--------|------------|----------|----------|----------|----------|------------|------------|-----------|
| 000005 | 2019/03/13 | 09:41:00 | 0.000 G  | 0.000 G  | -0.922 G | -180.000 ° | -180.000 ° | -67.202 ° |
| 000010 | 2019/03/13 | 09:41:10 | -0.137 G | -0.156 G | -0.902 G | -172.142 ° | -171.011 ° | -64.468 ° |
| 000013 | 2019/03/13 | 09:41:20 | -0.160 G | -0.164 G | -0.906 G | -170.784 ° | -170.557 ° | -64.992 ° |
| 000016 | 2019/03/13 | 09:41:30 | -0.184 G | -0.227 G | -0.871 G | -169.421 ° | -166.905 ° | -60.586 ° |

| Packet | Date       | Time     | Board Temp | Ground speed | Azimuth | vbat1   | vbat2   | vbat3   |
|--------|------------|----------|------------|--------------|---------|---------|---------|---------|
| 000004 | 2019/03/13 | 09:41:00 | 22.590 °C  | 0.000 km/h   | 0.000 ° | 1.600 V | 1.500 V | 1.500 V |
| 000009 | 2019/03/13 | 09:41:10 | 22.590 °C  | 0.000 km/h   | 0.000 ° | 1.600 V | 1.500 V | 1.500 V |
| 000012 | 2019/03/13 | 09:41:20 | 22.690 °C  | 0.000 km/h   | 0.000 ° | 1.600 V | 1.500 V | 1.500 V |
| 000015 | 2019/03/13 | 09:41:30 | 22.690 °C  | 0.000 km/h   | 0.000 ° | 1.600 V | 1.500 V | 1.500 V |

## Bloc : GPS

| Packet | Date       | Time     | Latitude | Longitude |
|--------|------------|----------|----------|-----------|
| 000003 | 2019/03/13 | 09:41:00 | 0.000 °  | 0.000 °   |
| 000008 | 2019/03/13 | 09:41:10 | 0.000 °  | 0.000 °   |
| 000011 | 2019/03/13 | 09:41:20 | 0.000 °  | 0.000 °   |

**9.3 Measurements in case of shocks**

**In case of shocks** when the acceleration data - Acc Norm - exceeds the threshold set by the user, the tracker measures, timestamps and stores the following values :

- Maximum acceleration on the 3 axis: Max Ax, Max Ay, Max Az
- Calculation of the vector acceleration norm: Acc Norm
- Calculation of energy on the 3 axis : Energy X, Energy Y, Energy Z
- Calculation of the energy vector norm: Energy Norm
- Shock duration
- Azimuth
- GPS Positioning : Longitude / Latitude

The GPS position is recorded if the TRP55 picks up the satellite signal

- If the shock duration is less than 5 minutes after the last position acquisition, the new GPS position and the speed are not recorded. However if the shock takes place 5 minutes after the last position acquisition, the speed and the new GPS position are recorded.

The measurements are made by a 3-axis accelerometer; the unit of measurement is in g (unit for gravitation).

The accelerometer takes measures at a frequency of 3200Hz which ensures that no shock can be missed.



## Pdf extract report

### Bloc : Shocks

| Packet | Date       | Time     | Max Ax   | Max Ay   | Max Az   | Duration   | Acc Norm |
|--------|------------|----------|----------|----------|----------|------------|----------|
| 000006 | 2018/12/28 | 11:09:23 | 0.840 G  | 0.801 G  | 1.578 G  | 25.000 ms  | 1.959 G  |
| 000008 | 2018/12/28 | 11:09:32 | 9.148 G  | 3.125 G  | 3.688 G  | 4262.00 ms | 10.347 G |
| 000010 | 2018/12/28 | 11:09:33 | 13.813 G | 15.977 G | 15.813 G | 777.000 ms | 26.383 G |

## 9.4 Measurements in case of free fall

In case of free fall when the value exceeds the threshold set by the user, the tracker measures, time-stamps and stores the following values:

- Free fall height
- Maximum acceleration on the 3 axis : Max Ax, Max Ay, Max Az
- Calculation of the norm of the vector acceleration : Acc Norm
- Calculation of the energy on the 3 axis : Energy X, Energy Y, Energy Z
- Calculation of the energy vector norm : Energy Norm

## Pdf extract report

### Bloc : FreeFall

| Packet | Date       | Time     | Height    | Energy     |
|--------|------------|----------|-----------|------------|
| 000013 | 2018/12/28 | 11:09:42 | 36.556 cm | 3.586 J/kg |

## 9.5 GPS Position

To save battery:

If after 90 seconds no satellite is detected, the position acquisition process will be stopped until the next measurement period.

If within the 90 seconds at least one satellite has been detected, the acquisition process is restarted for a period of 1 minute. If the acquisition process is successful, the TRP generates 3 bip sounds. Then the TRP generates 1 bip per detected satellite. The acquisition process stops after 5 consecutive minutes.

To save battery, if the TRP doesn't detect any movement higher than 250mG since the last position, only the last position will be recorded, no new position will be recorded.

If the position acquisition fails, no new position will be recorded.



## 9.6 Energy measurements

The energy measurement is calculated from a function that takes into account the acceleration value and the duration of these accelerations.

## 9.7 Earth gravity

The 1g of Earth gravity is measured and displayed on RF Monitor when the TRP is in « LIVE » mode. In the event of a shock, the firmware deduces the 1g of Earth gravity from the acceleration measurements generated by the shock.

## 9.8 Determination of shock thresholds

If the acceleration threshold is set too low (for example 1.5 g) the memory of the tracker will be quickly full.

To avoid such a situation, pre-tests must be carried out with the TRP, configured in « LIVE » mode and fixed on its final support, to determine the relevant threshold that should be used during registration campaigns.

## 9.9 Interpretation of shock and energy measurements

Shocks are accelerations of very high amplitude. For example, an accelerometer that falls from a height of 20 cm on a 5 cm thick sheet of steel will be subject to an acceleration of 8000 g at impact, and on a 50 pages thick note book of, it will be subject to an acceleration of 90 g.

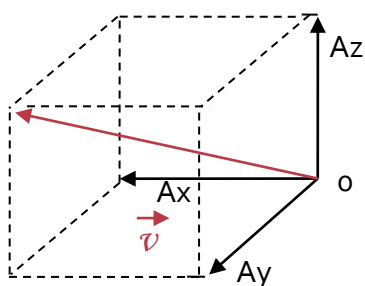
The values of the acceleration measures depend on several physical parameters:

- Structure rigidity
- Flexibility of the TRP support
- Distance between the shock and the TRP positioning
- 

The TRP measures the value, the duration and the energy of the shock, these 3 magnitudes, associated with a test campaign will allow users to interpret a part of the events which are at the origin of the shocks.

### 9.10 Acceleration measurements : Acc Norm

Acc Norm represents the norm of vector  $\vec{v}(A_x, A_y, A_z)$  :

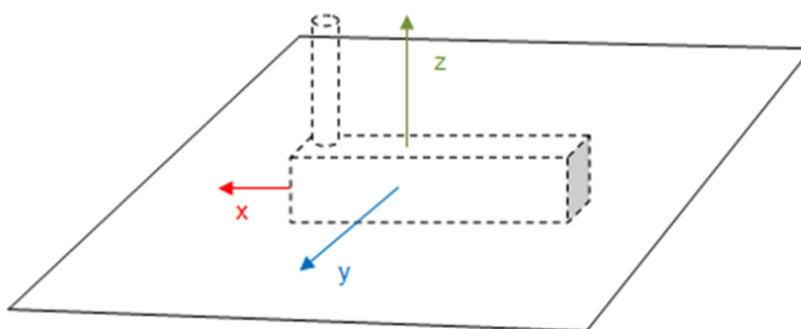


$$Acc\ Norm = \sqrt{(A_x^2 + A_y^2 + A_z^2)}$$

### 9.11 Tilt measurements: angle X, angle Y, angle Z

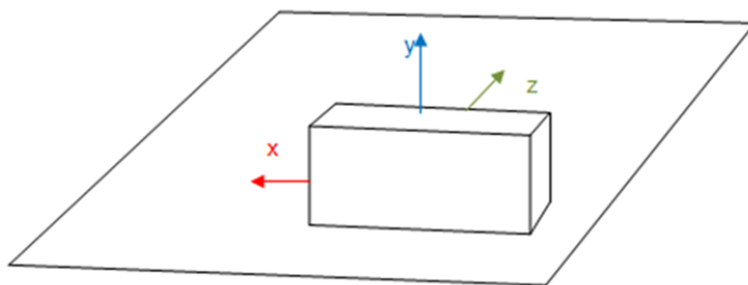
Angle X, angle Y, angle Z = angle of axis x, y and z on a horizontal plane

Case n°1 : The TRP is placed on a horizontal plane



$$\theta_{A_y} = 0^\circ \text{ or } 180^\circ \quad \theta_{A_x} = 0^\circ \text{ or } 180^\circ \quad \theta_{A_z} = 90^\circ$$

The axis Z of the TRP is perpendicular to the horizontal plane

Case n°2 : Titling of the TRP against the horizontal plane

$$\theta_{Ax} = 0^\circ \text{ or } 180^\circ \quad \theta_{Ay} = 90^\circ \quad \theta_{Az} = 0^\circ$$

The axis of the TRP is perpendicular to the horizontal plane

## ANNEX : TECHNICAL DATA

| MAIN FEATURES                      |  |
|------------------------------------|--|
| <b>Operating temperature range</b> | -40°C to 60°C with Thionyle lithium batteries , size A with a specific connector<br>-10°C to +60°C with alkaline batteries, size AA / LR6<br>Recommended temperature range to maximize the device autonomy : +5°C to +35°C.  |
| <b>Batteries autonomy @25°C</b>    | 2 years, with the battery supplied (Thionyle Lithium battery, size A)<br>User-replaceable battery  |
| <b>Flash memory</b>                | 16 Mbits Flash equivalent to 129000 measurement blocks (a shock takes 2 blocs)<br>For example, it allows a 2 years campaign : <ul style="list-style-type: none"> <li>- With a periodic measurement (temperature and tilt) every 15 minutes (70080 recordings)</li> <li>- And 29000 shocks</li> </ul> |
| <b>Radio communication</b>         | Operating on the ISM band<br>This device is designed to be used on the European market (using the 868MHz band).  |
| <b>Radio frequency range</b>       | 100 meters in free field   |
| <b>IP Level</b>                    | IP54   |