Installation Guide

Ijinus' Battery powered Loggers with radio wireless connectivity

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1. Introduction

Some Ijinus loggers are equipped with a water height measurement by aerial ultrasonic, with automatic measurement cycle changes depending on thresholds, flow rate transformation through conversion tables,… . Some sensors are equipped with connectors for coupling with an overflow detector or to control water sampler.

In addition to measuring, these sensors can also be paired with others or serve as data concentrators (for version with communication 2G, 3G, LTE or NB-IoT).

2. Three main ranges of measurements (depending on max distance to measure)

LNU06V4	**LNU10V4**	**LOG10V4**
Measure up to 6m	Measure up to 10m	Measure up to 10m external ultrasonic sensor

For example, the figure below shows the indication of the diameter of the area that will be studied the ultrasonic sensor according to the distance:

Distance between the sensor and the water (m)	Diameter of the surface circle (m)
0,2	0,06
0,5	0,16
1	0,32
1,5	0,48
2	0,64
2,5	0,80
3	0,96
3,5	1,12
4	1,28
4,5	1,44
5	1,60
5,5	1,76
6	1,92
6,5	2,08
7	2,23

3. Equipment (4 configuration examples)

a. Temporary Installation

The sensor is autonomous and battery powered (lithium battery), it measures water level by air ultrasonic waves. It has internal logger and data can be retrieved on-site (by radio using the programming kit : Wiji).

Ultrasonic sensor	Lithium battery	Programming kit

Water sampler cable	Overflow detector

Fixations: Bracket, fixations either with single
or double metal plate with bracket

b. Permanent installation of a unique level sensor (continuous monitoring or self-monitoring of water networks)

For level measurement that is battery powered (replaceable lithium) and send data by 2G, 3G, LTE or NB-IoT (depending on the sensor).

Sensor integrating a logger, communication modem and its deported antenna

c. Permanent installation of several level sensors and a logger (Permanent diagnosis or CSO equipment):

The level sensor that is battery powered send data locally by short range radio and the logger retrieve the data of the level sensors or others and send them by cellular communication.

Data logger as a radio/3G access point

d. Other configurations.

Actually, the communication protocols available for the Ijinus devices are the following:

- Radio for a HF configuration and data retrieval: Wiji protocol
- Wireless communication for remote data monitoring: 2G, 3G, LTE and NB-IoT
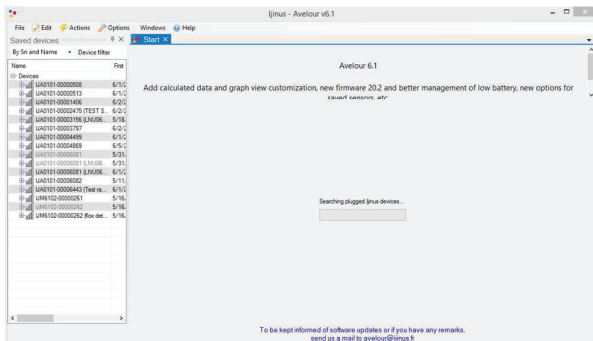- Wired communication with a PLC: Modbus RS 485

4. Quick configuration with the software Avelour

We will show here the classical version of the system programing, level measurement and data sending by 2G, 3G, LTE or NB-IoT.

a. Necessary equipment

- The Avelour software

- Programing Wiji kit or Wiji key


| Avelour | Wiji kit | Wiji key |

a. Prerequisite

- The material is considered to be directly functional

- All indications contained in this document correspond to programming with Avelour

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### b. First step : Run Avelour and connect to the sensor to configure

After connection of the Wiji kit (or the Wiji key) on your computer USB port, run the Avelour software. Click on the button "Connect to a wireless device" then the logger will be directly visible by its part number (SN) without the need to activate anything else (ex: IJA0101-0000 3559). Locate the sensor's serial number (SN) on the sensor label and click "OK".
On the first connection with the sensor only the serial number will appear. The following connections you will see also the name of the installation site or another name that you define.
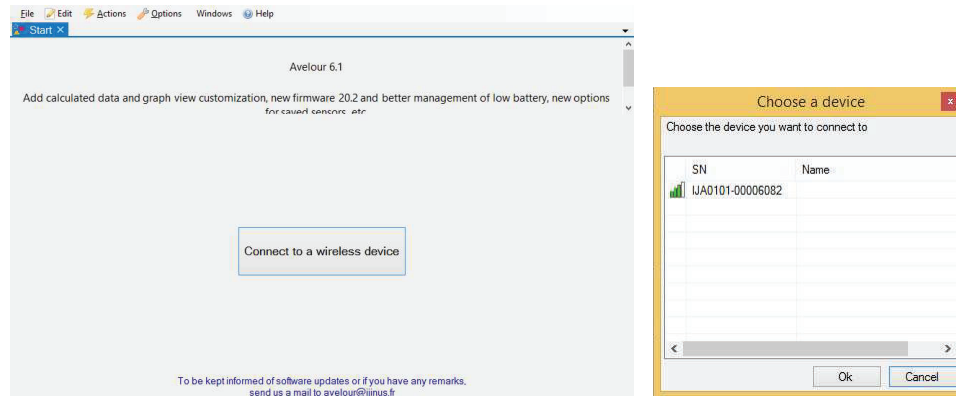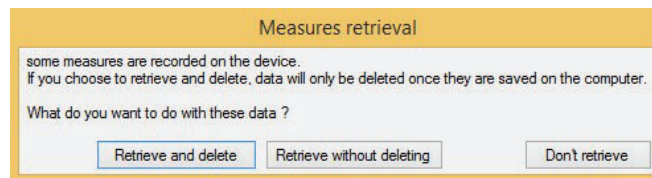

c. Second step : Selection of the sensor to configure, eventually a firmware update would be suggested

During its connection with the sensor, the following pop up appears:
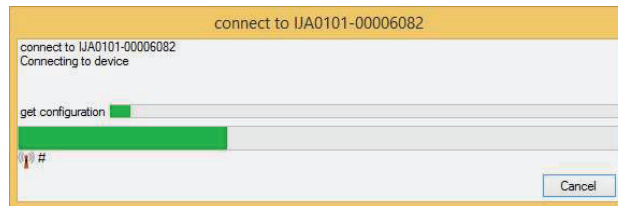

When connected, and only if the sensor already has measurements in memory, the following options will suggest you to retrieve the measures:

After your choice of these options, if the sensor is not up to date (case of new firmware developed since your last connection or you are now connected with a new version of the software Avelour). It is strongly recommended to read carefully the different messages in the options windows.

The firmware update can last a moment, so it is advised to do it while in your office. On-site prefer the best radio connection (so not if the metal cover of a manhole is closed).

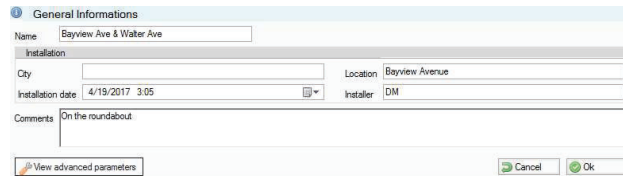When the sensors is ready, Avelour will look like bellow:
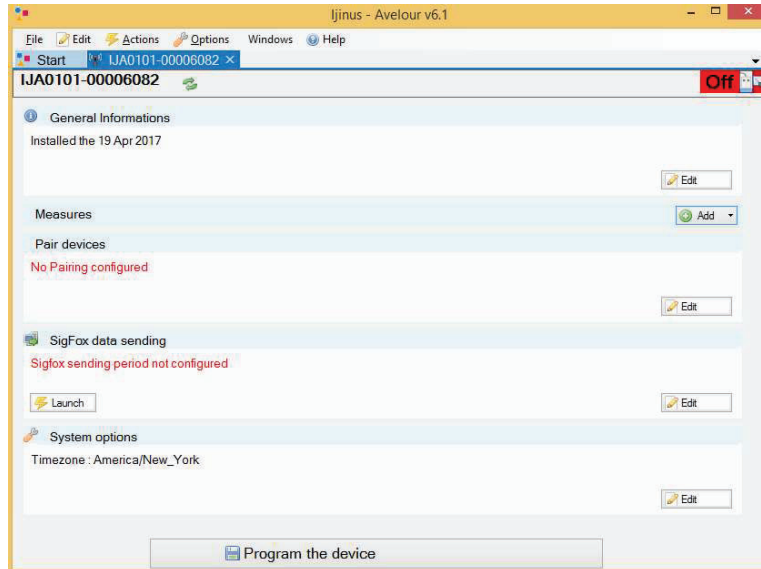
d. Third step : Configuration of Measurement part

This part is divided in several paragraphs. Each part will be detailed.

General informations

This part is useful to describe the measurement point. The most important information would be the name that will help you to find your sensor at a future connection.

Measures

**Choice of the application to configure**

This part is the most important, it allows you to configure your sensor.
First, click on the button "Add", then choose "Water height" for example.
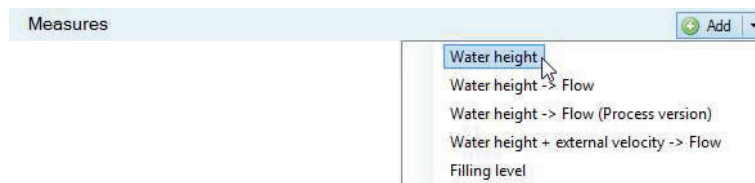
Choice of the measurement period

In this new menu, select the measurement frequency (in this example every 15min).
To the right of the measure period selector, 2 little icons allowing a deferred programming according to the time period and day of the week you can choose from. So far the sensor is not calibrated.
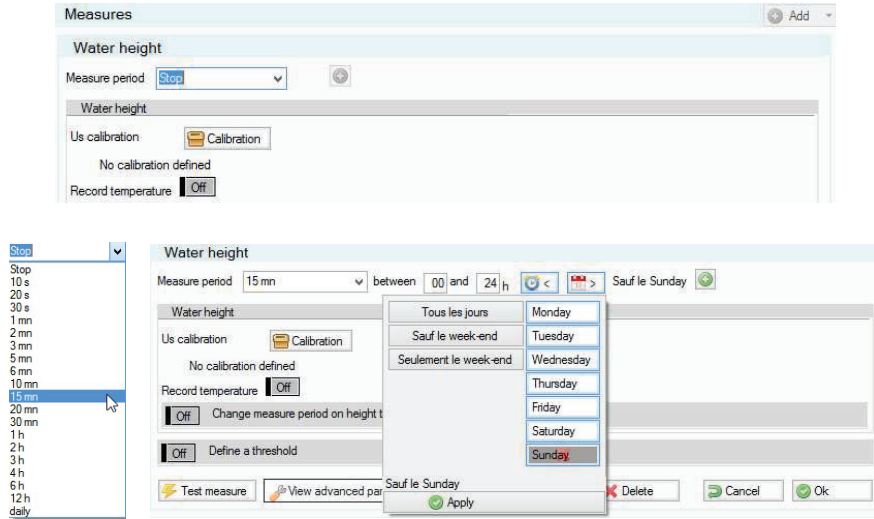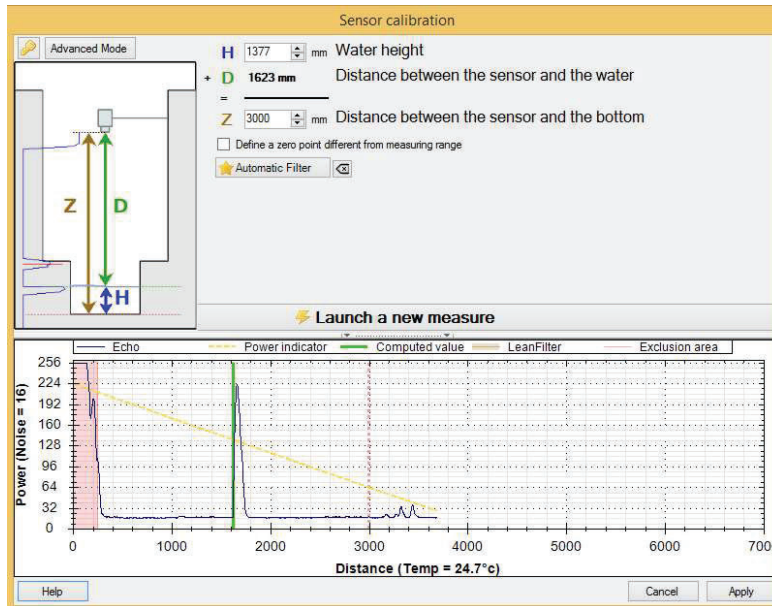

Calibration of the water height

After clicking the calibration button the bellow windows appears:
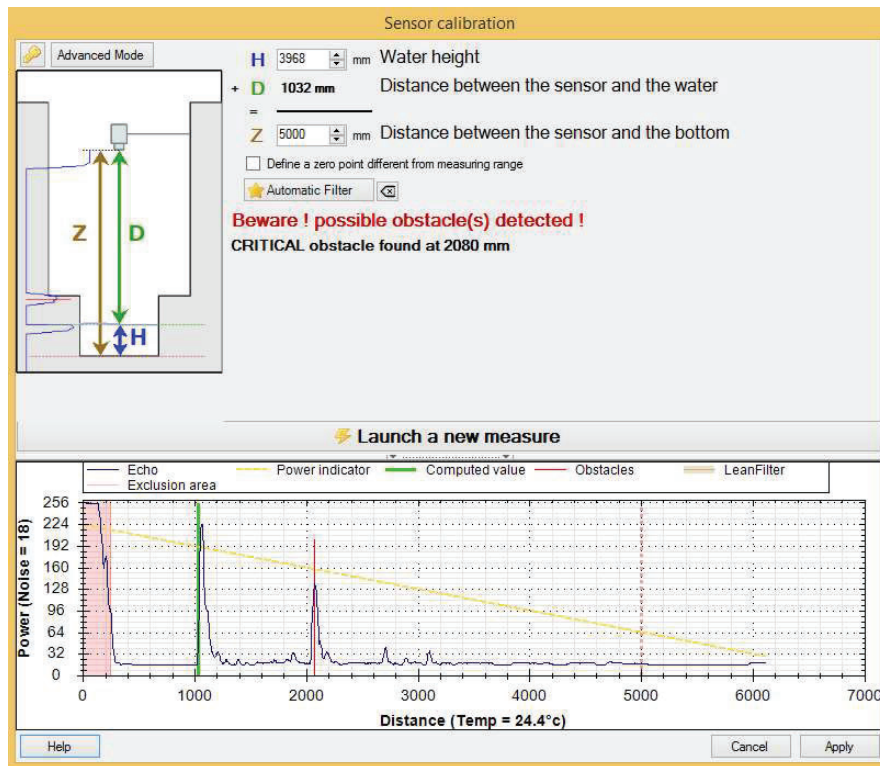
It is difficult to establish rules but globally 3 cases may arise:

<u>CASE 1</u> : **Ideal case: unique echo (test in lab or if the sensor front flat water surface for example)**
A simple calibration would be possible.

<u>CASE 2</u> : **Case of a classic manhole with an invert channel in the bottom. The figure bellow shows two echoes (the invert and the water). A calibration in advanced mode will be possible. First, check that the sensor is well positioned, fronting and perpendicular to the water.**
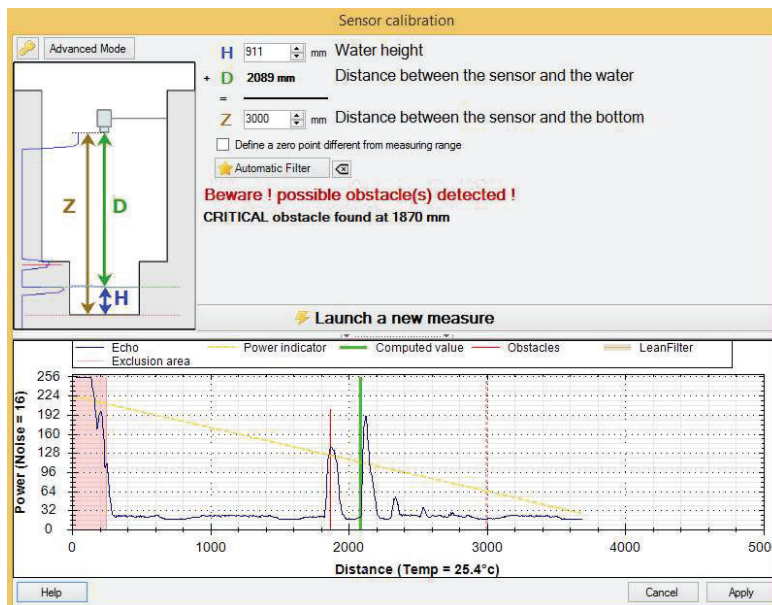
<u>**CASE 3**</u> **: Complex case**

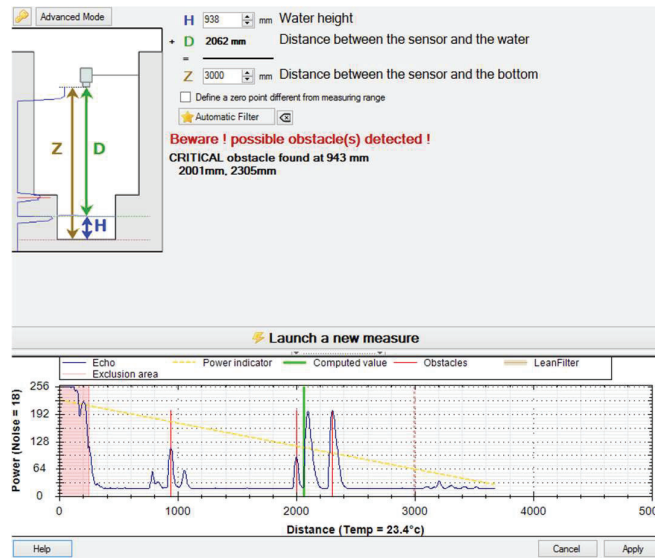The presence of many echoes make difficult the calibration the easiest way. **A priority should be to move the sensor if possible otherwise go to the expert mode. (Only for experienced users).**
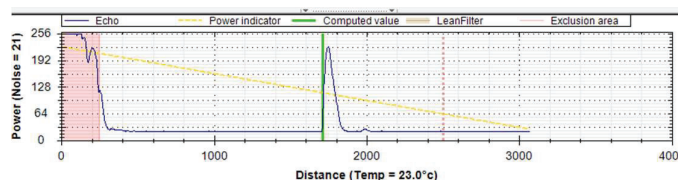

Calibration of the sensor Case N°1 (Ideal)

The first case presenting only one echo, you only need to adjust the water height **H** or the maximal distance between the sensor and the bottom **Z** and relaunch a measure. Note that it is possible to define a different zero point (zero at the level of an overflow threshold for example), very useful for CSO (Combined Sewer Overflow).
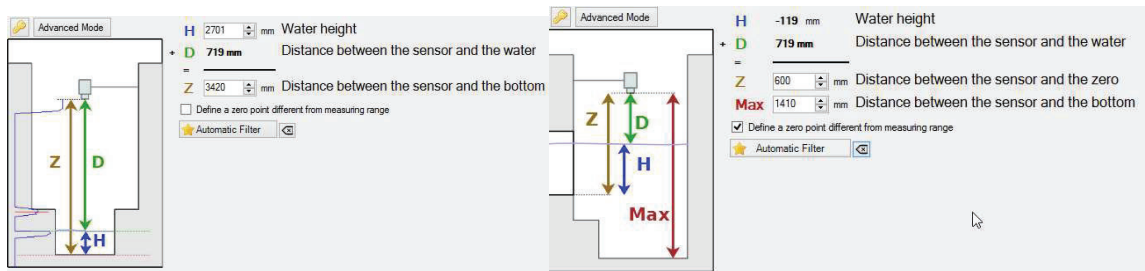

Zero of the sensor (example of ideal case) – On the right a different zero point

Once done, **the calibration has to be validated by clicking on "Apply" button**. The configuration is then automatically saved in a file called "configuration" that is visible with the software even when not connected to the sensor. Please note that the figure presenting the echo as a power indicator, showing by a yellow dot line (oblique from left to right). This one is very useful to fine tune the sensor. The echo should ideally be upward that line. A weak echo means measurement not precise, a too high echo provides accurate measures but use faster the energy. A temperature checking during the measure has also to be done (23°C in this example). While the measure is temperature compensated, you should not calibrate a sensor when the temperature is too high and then asking it to measure on a different environment (typical case of 15°C under a sewer manhole).

Calibration of the sensor Case N°2 (Classic example of a manhole with an invert channel)

In case no. 2, with an echo having several peaks, the software indicates the presence of "critical" obstacles that can disturb the measurement if no modification is done to the calibration. These critical obstacles appear in red on the graph, while the echo reported by the sensor as the measurement is shown in green. The power indicator (yellow line) is always present.
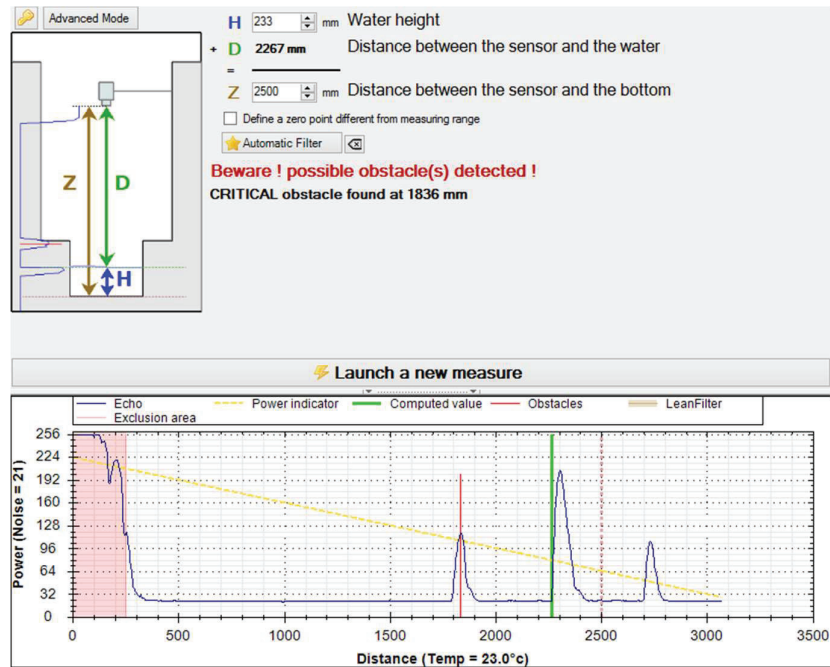
In this case, follow the following procedure:

- Activate the **advance mode** by clicking on the button at the top,

The software displays a first step of calibration that is more precise and named "Measures parameters": This parameter allows to extend the exclusion area corresponding roughly to the dead band of the sensor. This parameter is to be modified, mainly in the case of probes 0-6m if there are interfering echoes in this zone, or in the case of a probe mounted on an angular return bracket. The manipulation consists in increasing the value of the pink zone so it covers the different peaks for distances close to the probe,
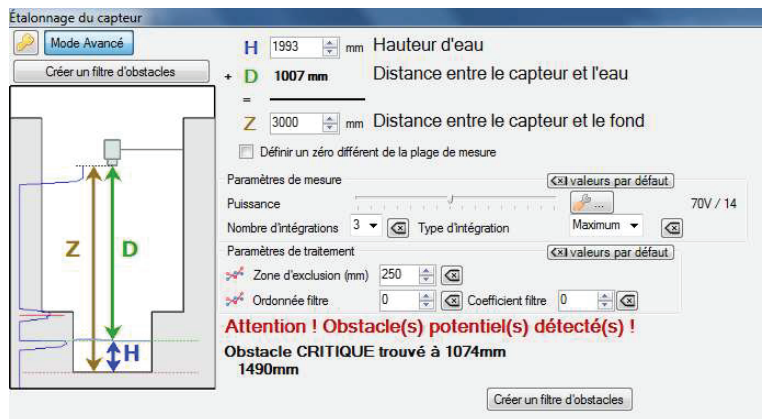
- This advanced mode also allows to create an "obstacle filter" that consist in masking obstacles echoes that disturb the measure like in the case of invert, ladder rungs present in the field of view of the sensor.

After clicking on "Create an obstacle filter", you need to choose with the tick box the obstacle matching the wanted measure (water height), press "Create".
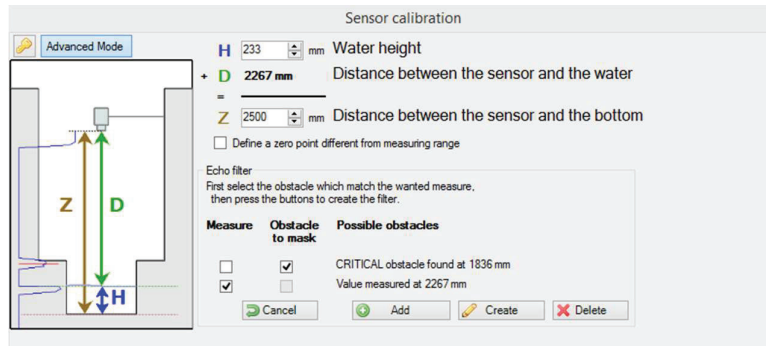

- Once the filter has been made and checked, you need to validate it by clicking the button "Launch a new measure", then adjust either the H or the H2 to ensure the quality of water height measurements.

Finally, this advanced mode allows to two other optimization operations and another filtered particularly efficient.

One computation parameter often named "oblique filter" works as follow:

- Choose a Filter y-axis of 160 for example

- Adjust the filter slope until it becomes parallel to the power indicator (yellow line) and ends to the zero of the sensor.

- If you can't see that oblique filter, adjust the y-axis.

The integrations count option, available for minimum, average and maximum, is the successive ultrasonic shoots treatment (3 by default). The average option does an average of those shoots. Most of the time the maximum option is to be chosen to get reliable measurements (and especially in presence of condensation) but also depends of the power setting of the sensor.
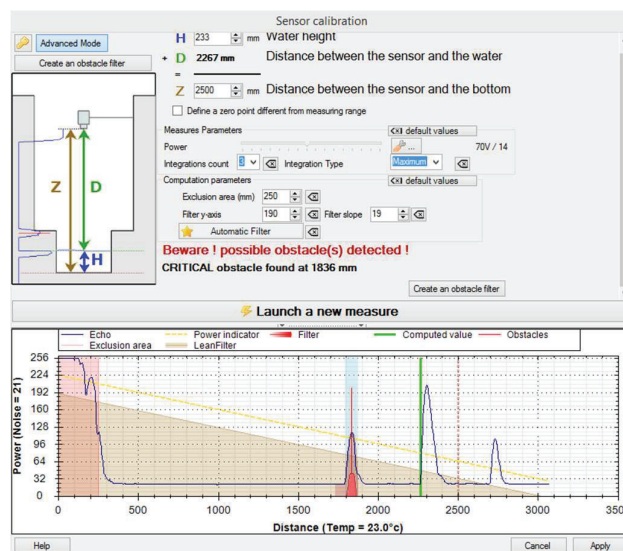
Finally, you need to launch a new measure to check the relevance of the result so:

- The green line position used for the measure,

- Values of the echo slightly higher than the power indicator,

- and validate by pressing the Apply button

Calibration of the sensor Case N°3 (complex) – Expert mode

The expert mode is to be used only in complex cases and need user experience and knowledge of ultrasonic measure data processing. Various parameters and options are then available but won't be in this document. You need a password to go on expert mode. Please contact your sales representative or the after-sale services, the password as well as some information will be given.

Temperature recording

You can log the temperature thank to the internal temperature probe used to compensate the level measurement with ultrasonic.

For information, the sound speed in the air at 10°C is 337,6m/s.
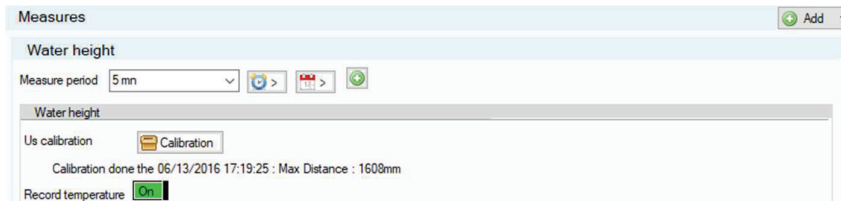
Change measure period on height threshold

For some sensors, you can have two different time of data acquisition depending on water height measures. For example, you can measure every hour when the level is low and accelerate to 2 minutes when level goes above a threshold. This measurement period acceleration can be set to some time slots, following an exceedance of level (with or without hysteresis) and with the choice of a minimum time before deceleration.

The limit of this acceleration is that it can only be done with a water height measurement. If you wish to accelerate the measures as soon as the water go over one level between two measurements, you have to connect one of our overflow detectors to the ultrasonic level sensor.
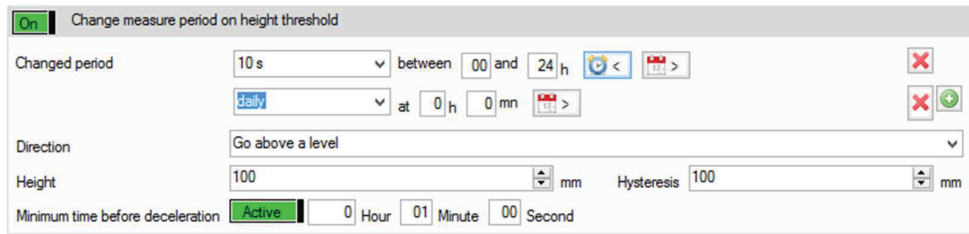
Define a threshold / software overflow detection (Two can be set)

After the programing of the first threshold, you can then define a second one.
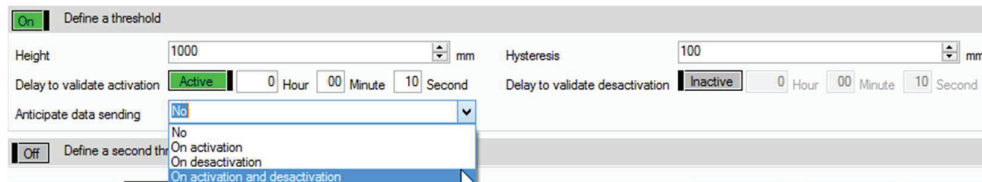
To go further and use the advanced parameters: Zoom on the debugging echoes (acoustic signature) and the replacement values in case of loss of echoes.

All advanced parameters won't be explain here, but two zooms on very useful functionalities:

Debugging echoes

The record of debugging echoes is very useful to log, when there is a difference between two successive measures (on rise and or on lowering: here 75mm for both), the acoustic signature of the measures named ultrasonic echo. A post review allows you to evaluate the quality of level measurements and to correct them if needed.

For your first or complex installations, we strongly advice to activate this functionality.