AQUA
LEAK DETECTION

OPERATION MANUAL FOR

AQUA-PRO

TABLE OF **CONTENTS**

INSTRUMENT COMPONENT OVERVIEW:

Nine Wireless Floor Sensors (Probes):

PRODUCT OVERVIEW:

The AQUA-PRO is our new fully automatic elite leak detector which allows the user to cover large areas when looking for a leak underground. Nine individual wireless floor sensors are spread one meter apart in any order throughout a dedicated surface area to uncover a leak quickly and efficiently, rather than listening to one sensor at a time with a standard leak detector.

1. The general method comprises the following steps:
   Arranging and placing each wireless floor sensors (probe) in a linear or matrix array above a suspicious leak point.
2. Setting the mode of the display screen to **"wireless mode"** instructs each wireless floor sensor (probe) to collect data simultaneously, and according to the number of sensors used, each value is then stored when sampling data. The screen allows the user to determine the leak's location by comparing the data.

ADVANTAGES:

1. The AQUA-PRO's heightened response is due to the latest digital signal processing chip and digital filter chip, integrated controller and 16M cache.
2. 7-inch FULL HD colour LCD touchscreen display, 800 * 480 resolution.
3. It uses a 9-sensor wireless module to send signals directly to the display screen. All nine sensors can be used simultaneously to measure, significantly increasing the measurement range and reducing the time to find the leak: all wireless, no wiring.
4. Take readings from up to 1000 meters away.
5. The sensor frequency can be adjusted between a range of 70-9000HZ.
6. Real-time display of the noise signal at the frequency distribution within the 70-9000HZ range.
7. A sensor within the pre-amplifier circuit, using rubber ring sealing, cushioning and professional acoustic methods, provides a superior ability to capture noise compared to most other leak detection equipment on the market today.
8. A large lithium-ion battery provides more than 10 hours of operation on one charge.

CAUTION:

1. It is essential to pay attention to the correct method of operation and avoid dropping the equipment. Proper use will extend the life of the instrument.
2. The instrument is not waterproof. Please do not immerse in water or operate in the wet weather.
3. Please do not strike or drop anything on the LCD screen, and do not expose it to direct sunlight for prolonged periods. If the operation appears faulty, please shut down and restart the equipment and confirm that each step taken during set-up was accurate.
4. To ensure the normal operation of the instrument, please handle it with care.
5. After use, please clean the instrument and all of its components, place it in the special provided container, and place the parts in the correct positions. Do not place any pressure on the screen.
6. The instrument should be stored in a cool, dry place away from direct sunlight.
7. Please do not tamper or disassemble the instrument, as this may cause data errors or system crashes.

SPECIFICATION AND TECHNICAL PARAMETERS:

Model No.	Dept	Frequency Channel	Amplify Gain	Frequency Range	Operating Mode	LCD
AQUA-PRO	8 meters	144 adjustable frequency, 21 centre frequency analysis	100-level Gain adjustment, 100-level volume adjustment, and 8-level signal multiple adjustment	50HZ-9000HZ	Spectral Analysis, Filter Analysis, Automatic Analysis	7-inch HD colour LCD touch screen
Model No.	**Opera--ting Temp**	**Saving Temp**	**Working Voltage**	**Working Current**	**Battery**	**Charger**
AQUA-PRO	-10˚C~ 50˚C	-10˚C~ 50˚C	7.4V±20%	480mA±10%	7.4V - 5000mA rechargeable battery	Smart charger

OPERATION:

Wireless Probe Adjustment and Settings

Place the wireless probes in a matrix (3x3 formation) or linear pattern (in a straight line) on a flat surface above a suspicious leak point, connect the receiver antennas to each sensor, and turn on the wireless probes. The probes are arranged along the top of the pipe and no further than one meter apart. An illuminated light indicates that the wireless probe is transmitting signals and within range. (See Figure 1).

Figure 1

Probe Placement

Open the display screen. Insert the receiver antenna into the main antenna port, tighten and then press the power switch on the display screen. The boot screen will appear, as shown in Figure 2.

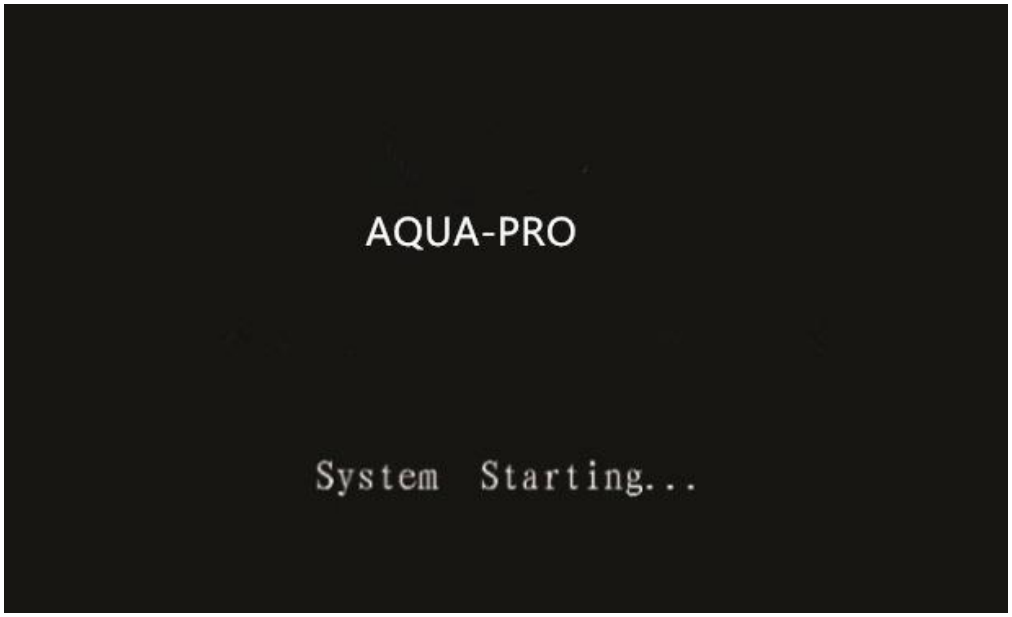


Figure 2: Boot Screen

START MENU:

The Start Menu will then appear, as shown in Figure 3, with the following options:

- Auto Analysis
- Spectrum Analysis
- Filtering Analysis
- Live Recording
- Settings
- Services

Figure 3: Start Menu

Double-click the **“Auto Analysis”** option. The following screen should appear as shown in Figure 4 below.

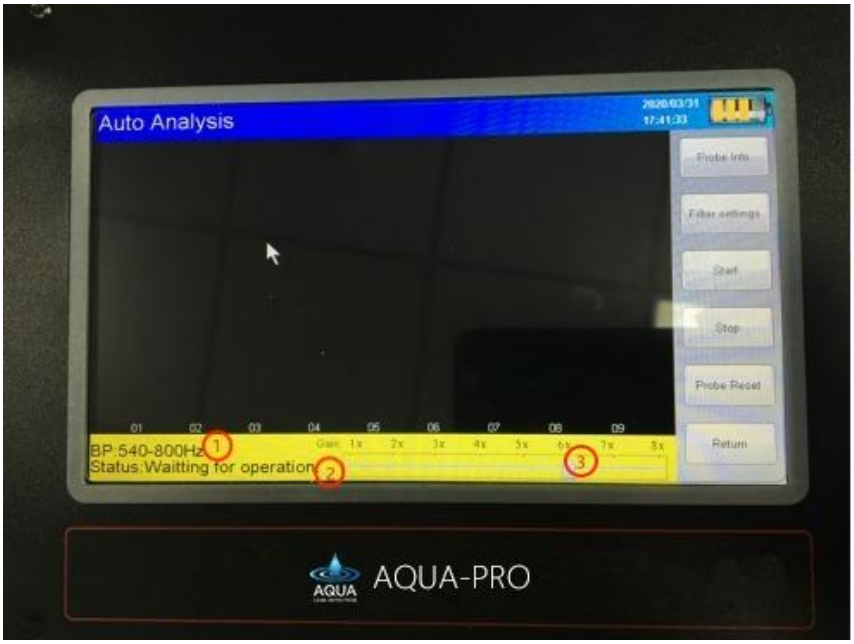


Figure 4: Automatic Analysis screen

(Each red circled number represents the following):

1. This displays the current wireless probe filter parameters.
2. This displays the operation and working status.
3. Drag the slider to set the wireless probe gain. The larger the value, the higher the sensitivity of each sensor (this is useful when a burst is hard to locate as some pipelines are deeper below ground and sometimes harder to hear).

(The sidebar on the right side represents the following):

[Probe Information] Read probe information and probe calibration.
[Filter settings] Set the wireless probe filter parameters.
[Start] Click to start reading the real-time signal value of each wireless probe.
[Stop] Click to start automatically analysing sound beneath the probes. The indicator light will flash when the analysis is complete.
[Probe Reset] Initialise all wireless probes and re-record signal values.
[Return] Click to return to the previous screen (Main Menu).

Read the wireless probe information and probe calibration.

Click **"Probe Info"** in the upper right corner of the **“Auto Analysis”** screen to ensure that each probe is active, and click **"Adjust"**. After observing the data of each probe on the screen, click **"Save"** (As shown in figure 5 below).

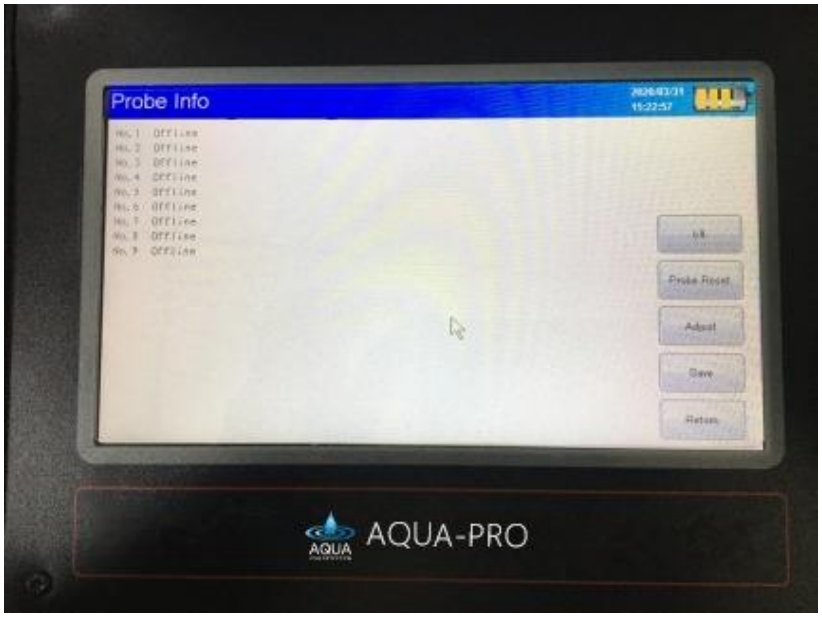


Figure 5

The instrument will automatically calibrate the data from all nine probes. From the first to the fourth step, the minimal data in each phase is consistent with the stages given. When the minimum value in step 4 is met, and the variations between the numbers are negligible, click **"save"**. The instrument's probe calibration is now complete.

There are eight adjustment levels to tweak the wireless probes' gain; the higher the value, the higher the sensitivity of each wireless probe.

[Probe Reset] Initialise the wireless probe and clear the calibration coefficients.

[Adjust] Clicking **"Calibration"** after each probe data is stable will generate a new calibration coefficient. Before calibration, the previous calibration coefficient must be cleared to save the latest data.

[Save] Save the calibration coefficient. This is necessary to complete the calibration.

[Return] Click to return to the previous screen.

Note:

- There is a separate calibration coefficient for each level of sensitivity. Calibration is generally not required.
- Every time the value increases or decreases, you must re-enter the probe information interface to read the online status; otherwise, the probe signal cannot be read.

Set the wireless probe filter parameters

Click the **"Filter Settings"** button to display the filter parameter setting dialogue box (as shown below in Figure 6).

Probe Info Detection Screen

When **"Save"** is complete, click the **"Return"** button to return to the Automatic Analysis screen. Click the **"Filter Settings"** and select the desired measurement frequency range. **Note:** the **"HP"** frequency is chosen as the lower frequency limit, and the **"LP"** is the upper-frequency limit. So, a signal will not appear if the **"LP"** frequency is higher than the **"HP"** (Figure 6 below).

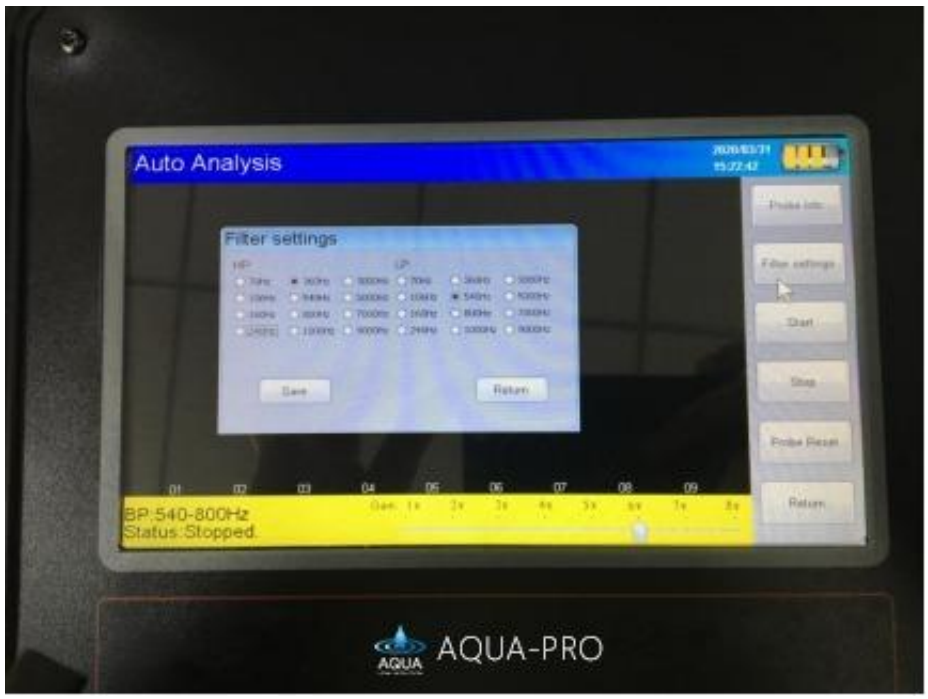


Figure 6: Filter Settings

Click the **"Start"** button on the Automatic Analysis screen. The display screen will begin to receive signals from each wireless probe, and you can observe the signal intensity displayed by each probe signal column. If the signal column is too high or too low (as shown in Figures 7 and 8), adjust the **"Gain"** slider in the yellow frame.

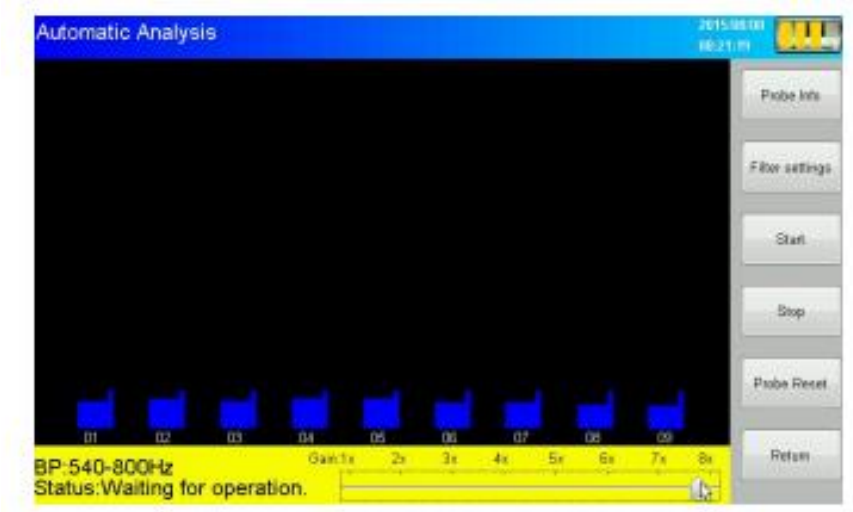


Figure 7: Signal column is too low

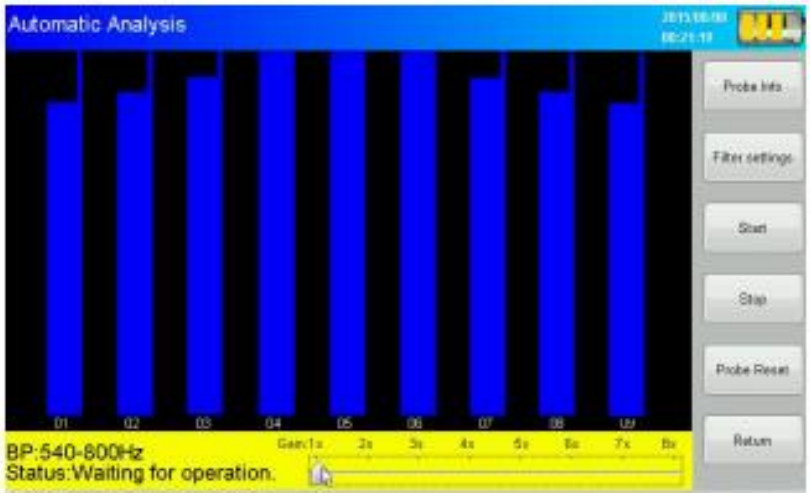


Figure 8: Signal column is too high

Pipeline Leak Testing

Place all probes in the area that needs testing. In the image below (Figure 9), the signal column is not significantly higher than the anomaly, indicating a leakage has not been detected.

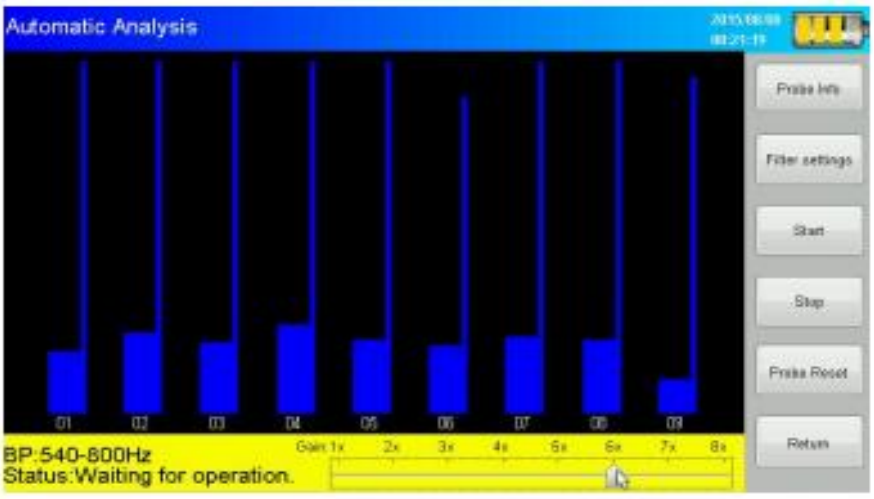


Figure 9

Then, move the wireless probes to the next detection area, and repeat the above steps until the signal column is significantly higher than the average (Figure 10).

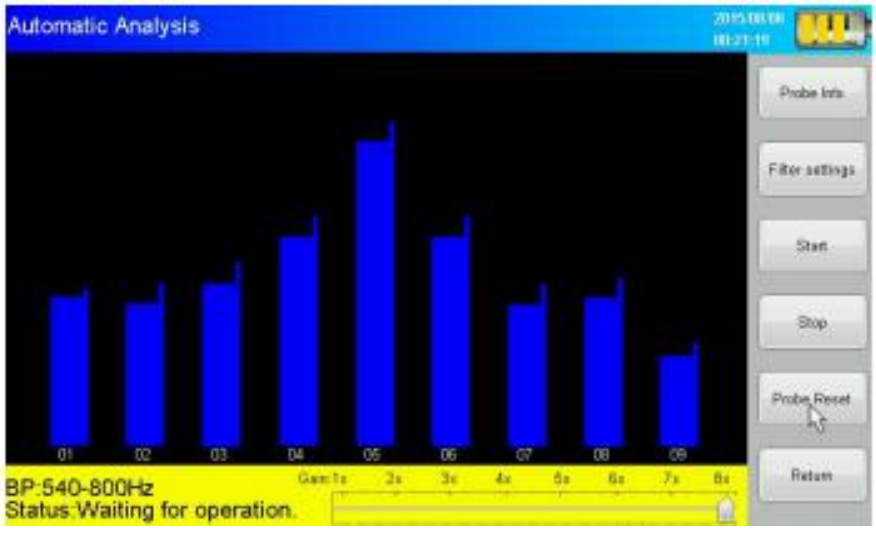


Figure 10

Note:

1. If the signal column amplitude is too low, adjust the gain.
2. If there are no apparent abnormalities between the signal columns, the area may not have a leakage. Filter parameters can be changed for further determination.

After the abnormality is found, click the **"Stop"** button, and the probe with the highest signal

column will flash green. The probe location is the suspected leak point.

After reading the probe information and setting the filter parameters, click the start button, and the instrument will start reading automatically.

To ensure the reliability of the data, the longer the reading time, the better. Multiple clicks at the same time will not help, thus slowing down the leak detection process.

The reset button causes the wireless probes to re-record data. When the value is stable, click the stop button, and the probe indicator of the abnormal point will flash, and the probe's position is a suspected water leak.

HOW TO USE SPECTRUM ANALYSIS:

Assemble the instrument, put on the headset, turn it on and enter the standby interface after the system starts. Double-click **"Spectrum Analysis"** to enter, place the sensor on the ground above the pipe, and adjust the volume to a comfortable level. Generally, change it to about 15 and the gain to about 10-15. Turn on the earphone noise prevention switch. Hold the reset switch on the handle, and walk along the ground directly above the pipeline to explore the possible leak point. If the pipeline's location is unknown, it can be detected by walking in a **"Z"** pattern. Detect every two steps; the indication sound will be louder near the leak. The headphones will emit a noticeable sound if the instrument is above the leak. There will be several blue light signal columns on the screen of the instrument, which will continue to be in the range close to the peak value and will not return.

This is a preliminary indication of a suspected leak point in this case. Accurate readings will not be provided if probes are moved, kicked, slid, etc. (Each wireless probe needs to be stationary and stable). In addition, when the water flow is fast, the water from the pipeline will also produce a constant sound. Therefore, detecting at night when the water flow is considered "stable" may be a better option. Because generally, water is used less at night – allowing the pipeline to resonate a consistent sound.

PRECAUTIONS:

1. Generally, the monitoring time at a specific location should be about 10-15 seconds. First, place the sensor on the ground and press the reset button. Be cautious and only activate the probes once placed on the ground to avoid a harsh and loud sound if headphones are kept over the ears.
2. There must be pressure in the pipeline during the test. The higher the pressure, the stronger the signal generated at the leak point, and the better and more accurate the results will be.
3. You only need to place the sensor on the ground for hardened ground. On soft, muddy ground, you can screw the listening rod into the screw hole under the sensor and insert the listening rod into the ground. The closer the sensor is to the leak, the easier it is to determine the leak and signals will be more prominent.
4. To avoid excessive external noise interference, detect at night when less noise-pollution is present.

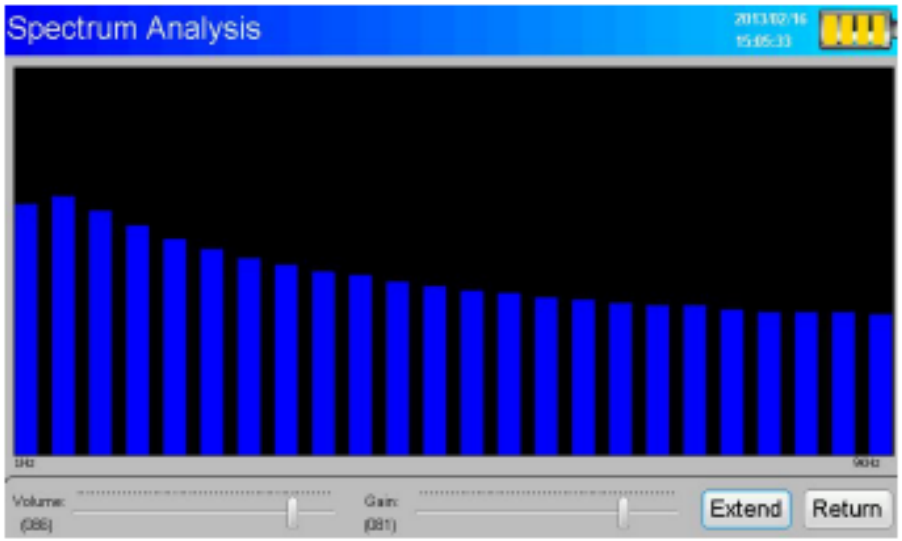
When verifying that the leak is in fact on the specific location, configure the display screen for **"Spectrum Analysis"** and **"Filtering Analysis"**.

Plug the five-core cable into the display screen interface.

Plug the four-core cable into the interface of the sensor.

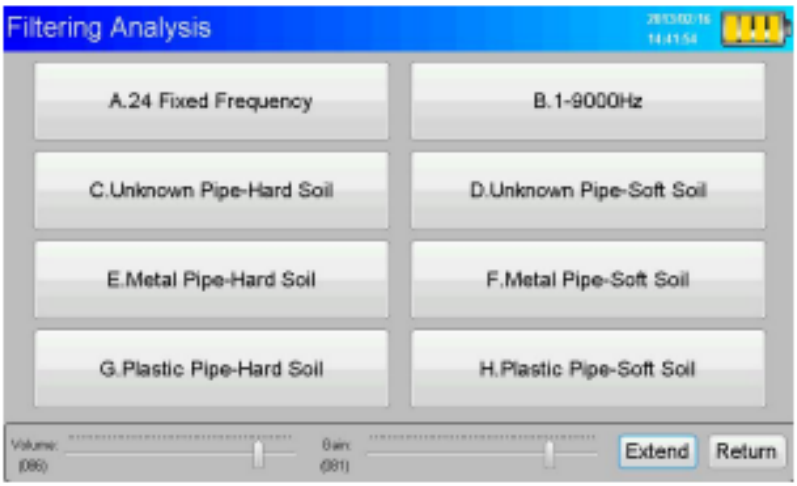
Plug the headphones into the headphone jack, and ensure there is a good connection.

SPECTRUM ANALYSIS:



The screen displays instantaneous noise signals within the range of 1-9000Hz. Scroll bars indicate the noise intensity corresponding to the band. The volume and sensitivity default are 100. Move the slider at the base of the screen to adjust the frequency according to external ambience and background noise.

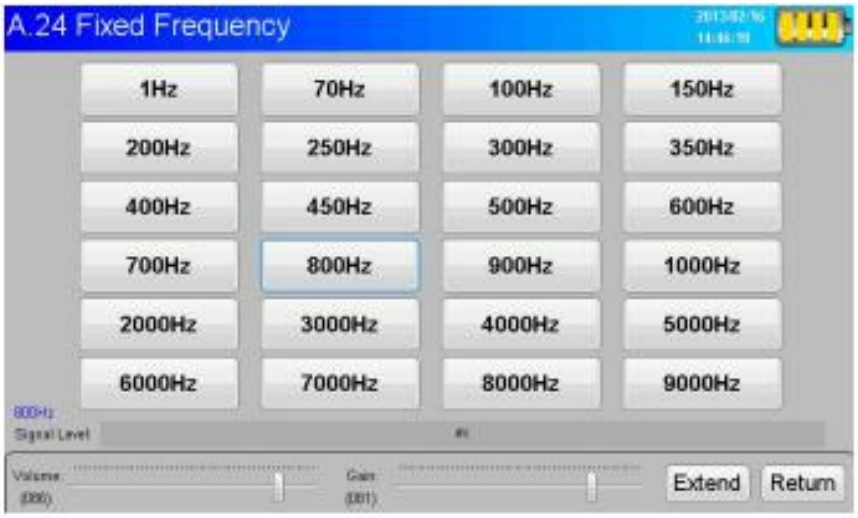
FILTERING ANALYSIS:



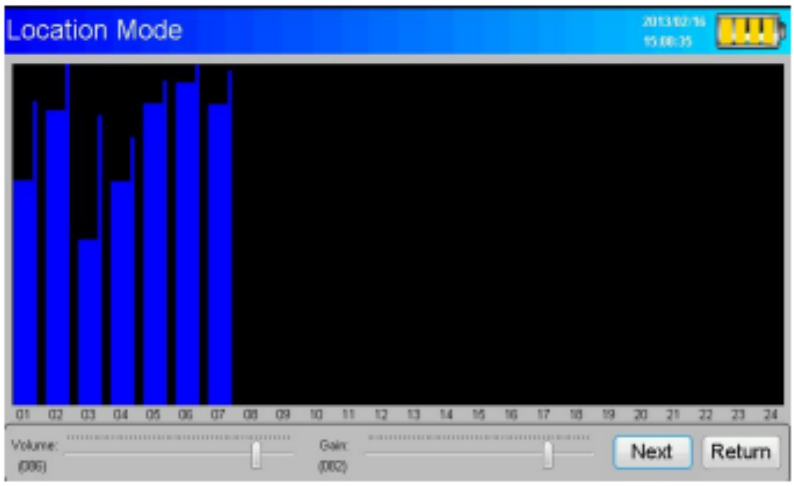
The screen displays eight options, A ~ H. These options are the eight test conditions based on the corresponding frequency configuration. Click to select one of the options, and then click again to enter the option.

For non-professionals, choose the corresponding pipe material (metal or non-metal pipe) and the surface soil (hard or soft soil) according to the actual measurement environment. For professionals: Select **"24 fixed frequencies"** to select the corresponding frequency according to the exact measurement needs.

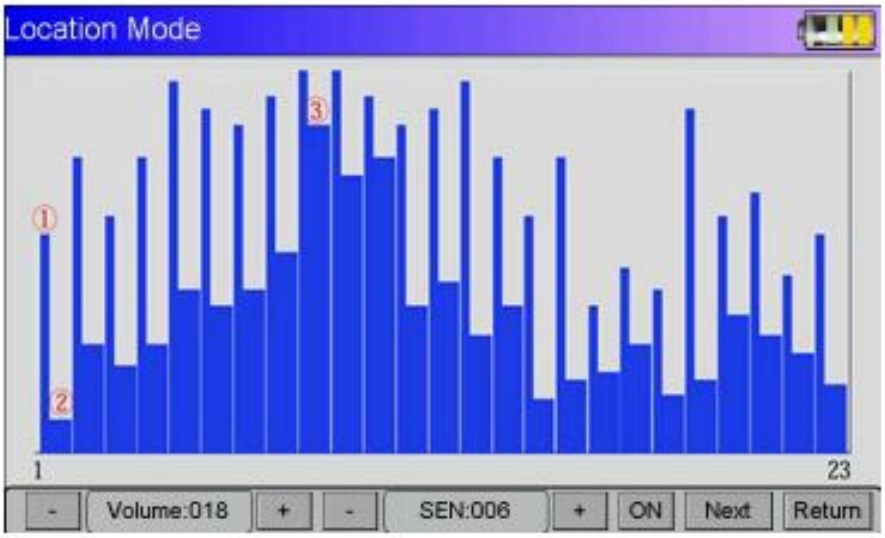
If you select **"A. 24 Fixed Frequency"**, you will see 24 frequency buttons. Click to select the button that indicates the mid-frequency of the band-pass filter. The on-screen scrollbar shows the instantaneous intensity of the mid-frequency of noise signal. The scroll bar's right side represents the noise signal's corresponding value (generally, choose the frequency between 200-1000Hz). – This may vary depending on the leak's nature, location, background noise and ambience, etc.



LOCATION MODE:

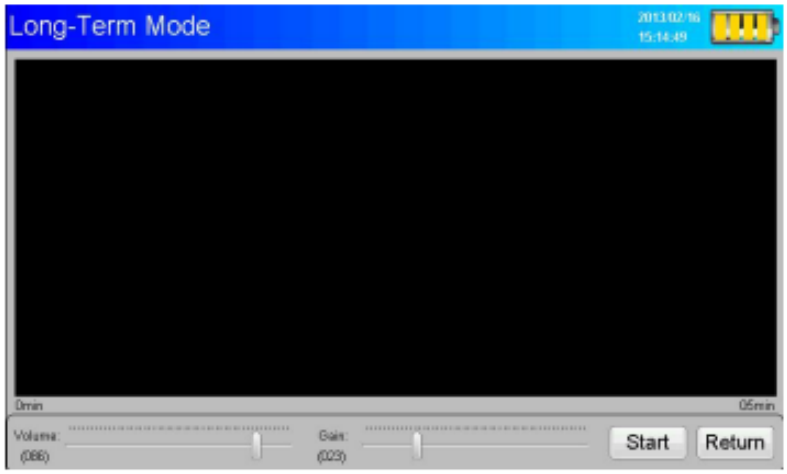


Click **"Extend"** to enter the **"Location Mode"**. Location mode refers to detecting a leak precisely (this mode is used when precisely locating the burst). This mode is designed to detect a leak in a noisy environment. You don't need to wear headphones while using this mode, as the software enables it to eliminate the interference of environmental noise and automatically captures the suspected leak signal. The following diagram is an example:



1. Instantaneous value (the slimline is external ambient/background noise).
2. The minimum value (the thick line is the leak sound – generally not considered the leak point).
3. Suspected leak point (generally, the high spectrum indicates the leak point).

LONG-TERM MODE:



Long-Term Mode is a further analysis conducted to confirm suspected leakage points detected in a preliminary investigation. The purpose is to exclude suspected leaks. Also, there is no need to wear headphones while in this Mode.

Using the point measurement mode, locate the sensor at a suspected leakage point, and choose an appropriate monitor time (5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes, 30 minutes) to automatically record the minimum value of each segment of the noise signal within a given time.

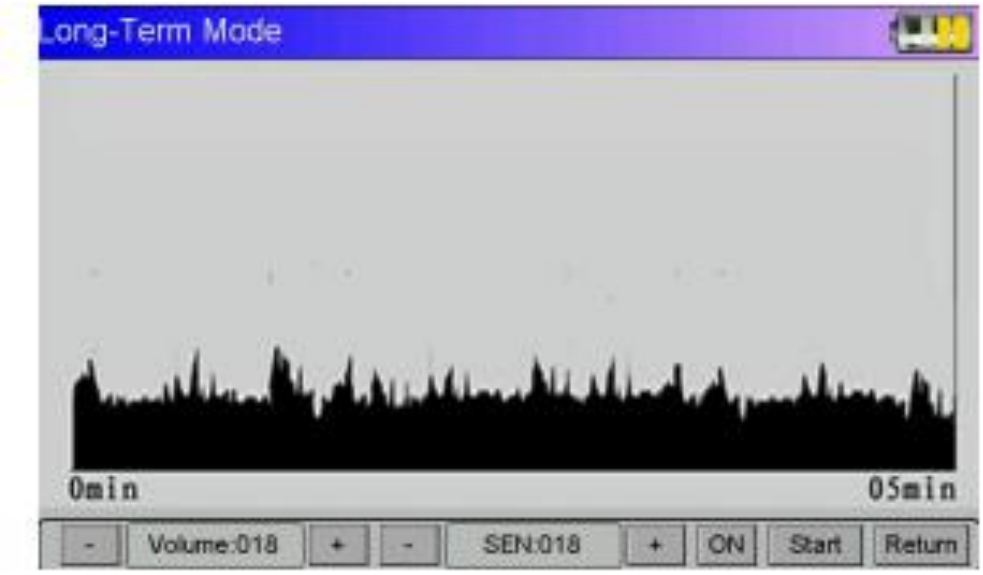


Figure 1

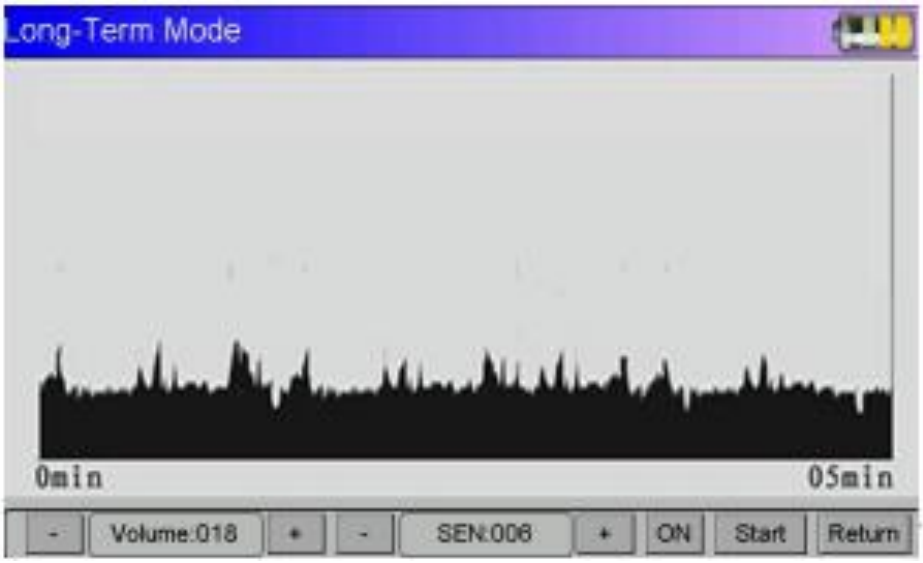


Figure 2

If the curve is large, one can judge where the leak is present (see Figures 3 and 4)

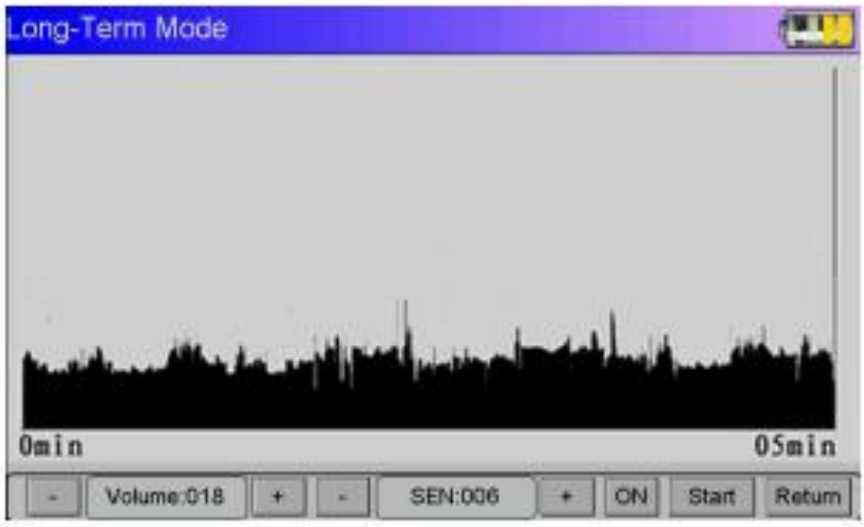


Figure 3

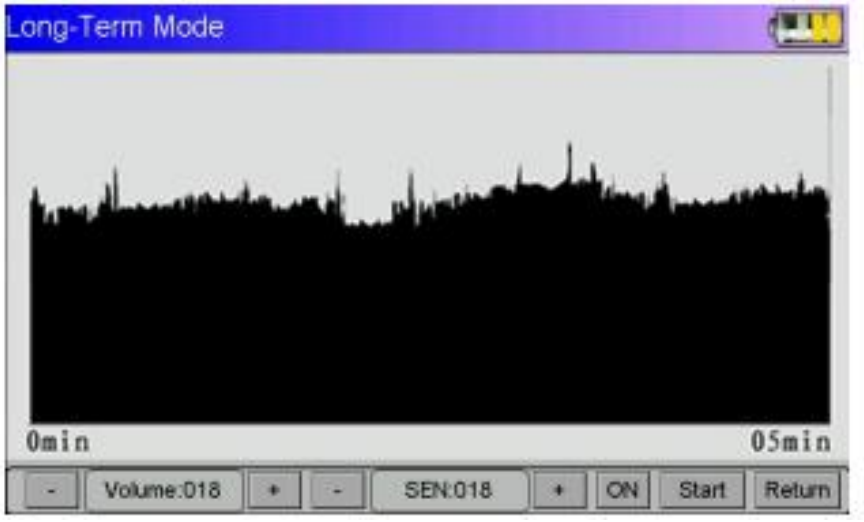


Figure 4

Intermittent signals increase and decrease in pipelines, and larger amplitudes raise or lower the sensitivity. The amplitude of increase and decrease is insignificant; one can judge where the leak is not present (see Figures 5 and 6).

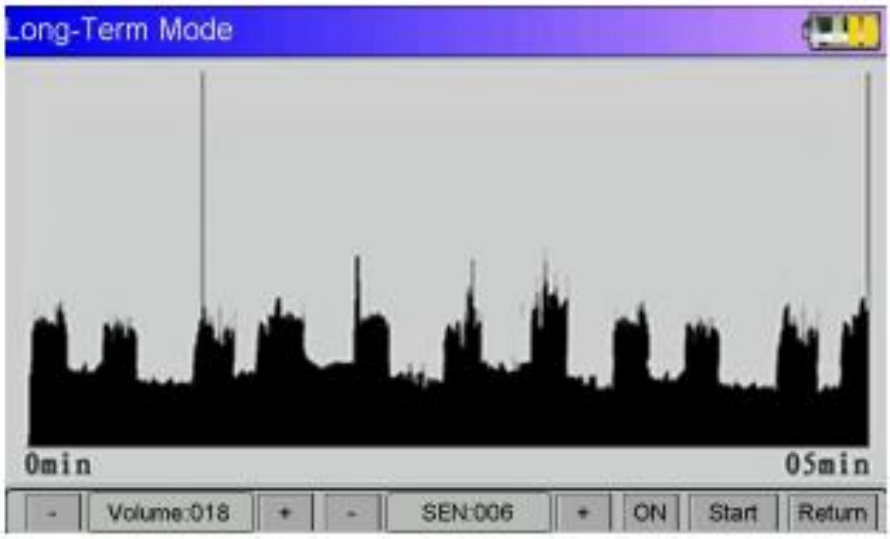


Figure 5

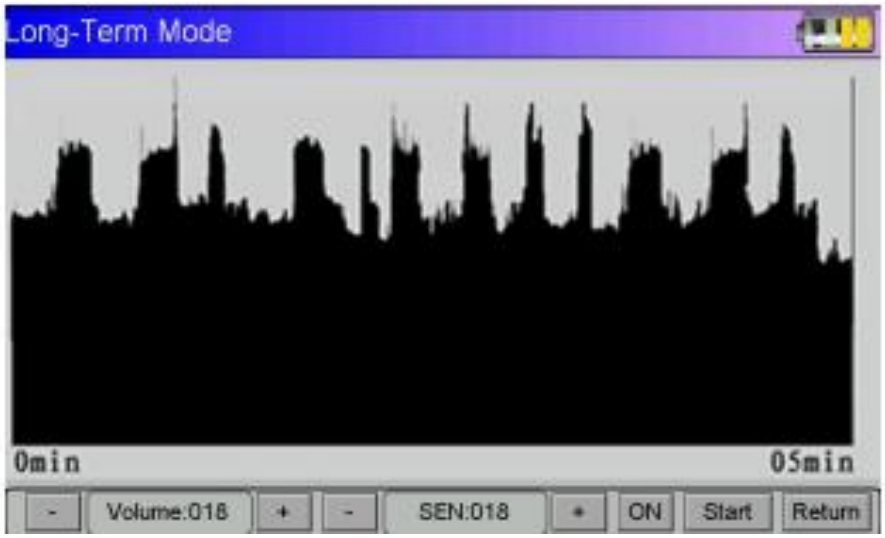


Figure 6

Whether to raise or lower the sensitivity, the recess amplitude of increase and decrease is significant; one can judge where the leak point is present (see Figure 7 and Figure 8).

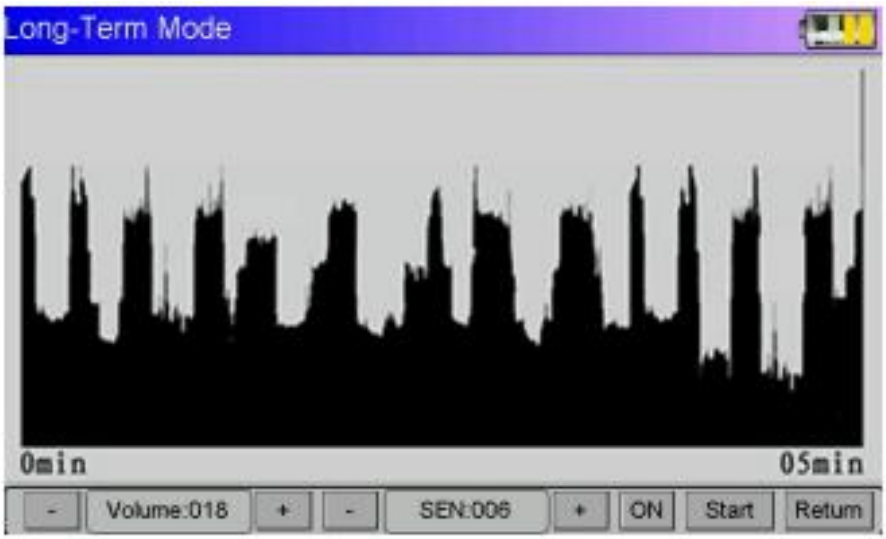


Figure 7

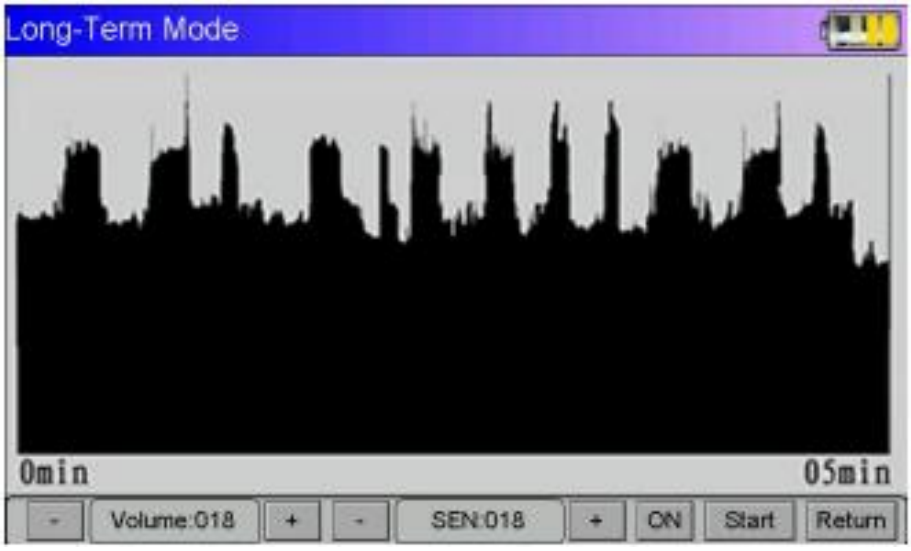


Figure 8

PIPELINE FLOW IS LARGER:

The leak point cannot be established if the set sensitivity is higher or lower and the curve magnitude shows higher values. Then you should monitor at a different time.

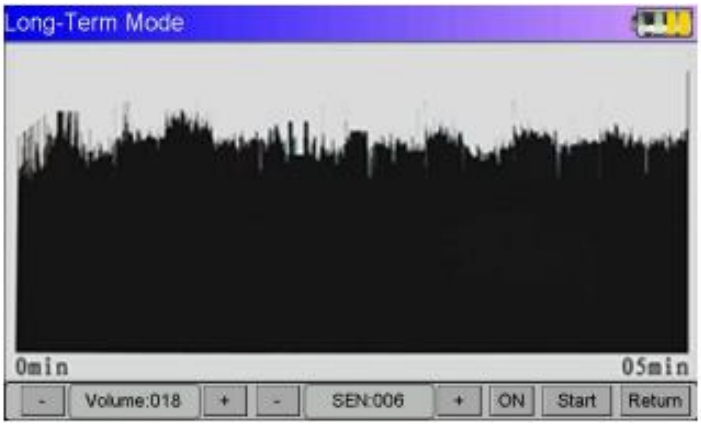


Figure 9

The sensor is placed on the ground above the water leakage point, carrying out continuous monitoring in two different periods of peak flow and minimum flow (this varies throughout the day). In this case, the sensitivity value should be set to the same. At the same suspected leakage point, the curve amplitude is high at peak flow, while the curve at low flow showed higher amplitude. (See Figures 10 and 11).

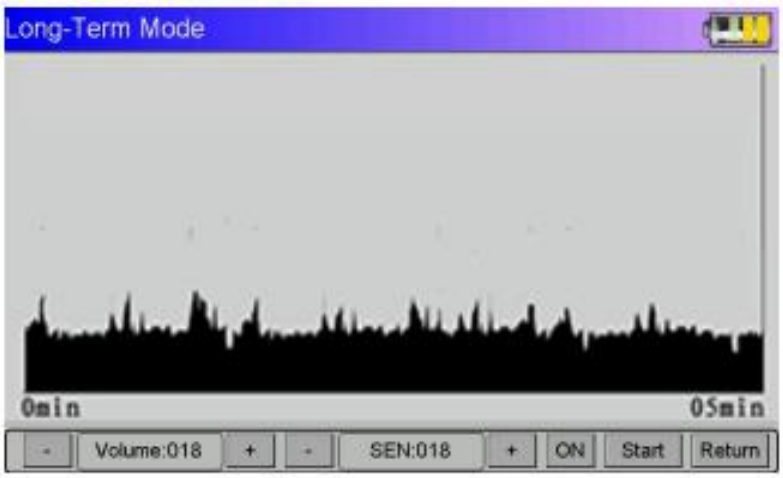


Figure 10

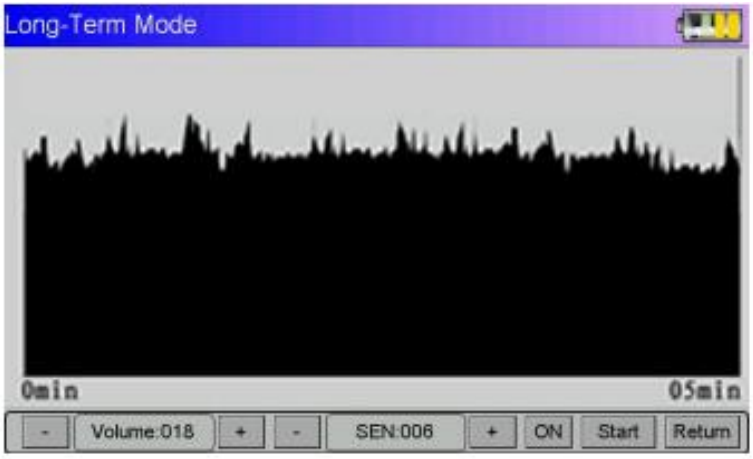


Figure 11

At the suspected leak point, the curve amplitude is higher at peak flow, while the curve amplitude is reduced at the low water level (see Figures 12 and 13).

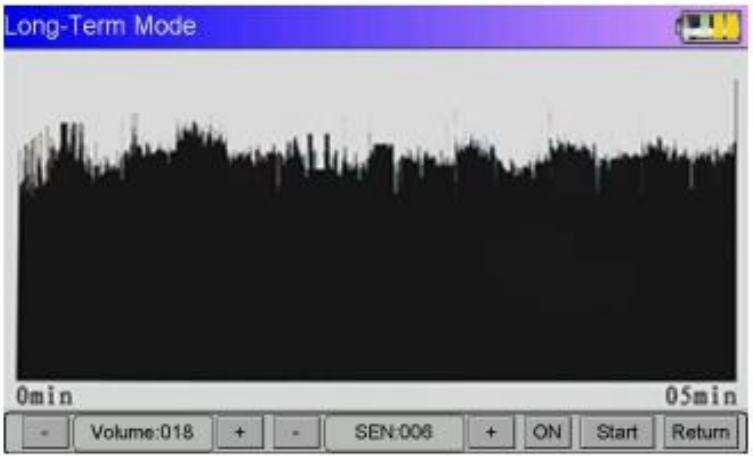


Figure 12

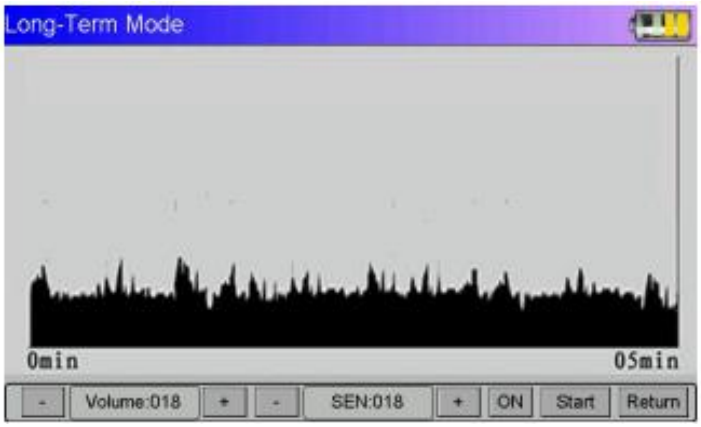


Figure 13

Settings (Figure 1).

Adjust the system time and language (Figure 2), and screen brightness (Figure 3),

Figure 1: Settings screen

Figure 2: System date

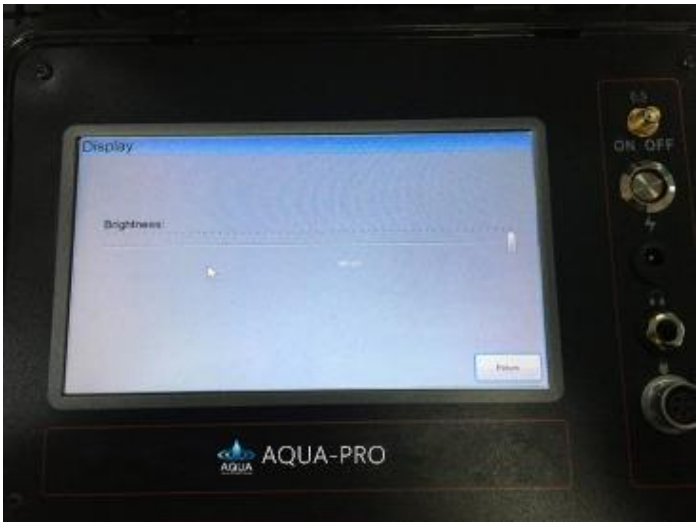


Figure 3: Display brightness level

About

You can view real-time Voltage and Current, as well as the instrument Name and Model.

COMPONENTS:

Display screen.....1 Pc
Wireless probes.....9 Pcs
Sensor.....1 Pc
Wireless antenna..... 10 Pcs
Listening rod.....3 Pcs
Battery chargers.....10 Pcs
Connection cable.....1 Pc
Headset.....1 Pc
Lockable case.....1 Pc

THINGS TO KEEP IN MIND:

1. Before testing the to locate a water leak, it is necessary to know the position and direction of the pipeline and apply pressure to the pipeline with a pressure pump or gas.
2. HP and LP: The noisier the environments, the higher levels/frequencies should be; quieter environments require lower levels/frequencies. On average, the norm is 360 and 540. (This can be adjusted to suit specific requirements. The rule is that HP selects a low value, and LP selects a high value.)
3. Place each probe in an empty space and calibrate each at the same gain (example 6X). Calibration is essential. The instrument can only be tested with the calibrated gain. So, if you only adjust 6X, you can only find the leak under 6X.
4. All nine probes should be used. The probes should be placed in a rectangular matrix array or linear formation (linear formation if the direction of the pipeline is known in a straight line).
5. The unit has a noise reduction switch. Turn this switch on when you need to test accurately. Please keep in mind that you will not be able to hear anything if the volume knob is switched to OFF.
6. If the probe has been calibrated once, it does not need to be calibrated again when the instrument is moved to a new location.
7. **"Spectrum Analysis"** and **"Filtering Analysis"** are used for accurate leak detection. **"Spectrum Analysis"** and **"Filtering Analysis"** require headphones and probes to accurately locate a pipe leak.
8. **"Auto Analysis"** is needed for most leak detection scenarios.
9. The distance between the two probes should not exceed 1 meter.

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10. Aqua Leak Detection reserves the right to modify equipment specifications without notice.
11. All images in this manual are for reference only. Every leak is unique and differs, thus providing different results.
12. Aqua Leak Detection's products are protected and patented.
13. Imitation and replication of our products will result in legal action.
14. The instrument is a pipeline leak detection tool and must be used in suitable site conditions by persons with leak detection experience. Aqua Leak Detection does not take any responsibility whatsoever for any loss caused by product misuse or any damage caused during its operation.

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