C-17 Water Leak Detector

User Manual

Shijiazhuang Bondi Technology Co., Ltd

preface

Dear customers!

Thank you for choosing to use the C-17 pipeline leak detector. If you are using this product for the first time, please read the following product instructions and use instructions carefully.

The C-17 operation manual details the composition, function, operation process, precautions of the underground pipeline leakage detector, and the methods of pipeline inspection and leakage positioning by using the C-17 pipeline leakage detector. Please carefully read and fully understand the use manual before operating or using the C-17 pipe leak detector. If you have any questions about the operation and use of C-17, you can call our company at any time, and our company will provide you with timely and sincere technical support and service. Thank you for your cooperation!

Please keep the manual properly for reference when necessary. If the manual is lost or damaged, please contact us immediately.

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1 Technical parameters

The technical parameters of C-17 pipeline leakage detector are shown in Table 1.1, Table 1.2 and Table 1.3

Table 1.1 Technical parameters of the sensor

Type	Piezoelectric type
Pattern	Survey mode and positioning mode
Appearance size	78mm diameter 50mm height (excluding connecting line)
Weight	300g

Table 1.2 Technical parameters of the host machine

Enlargement factor	100db
Frequency range	50-7500Hz
Source	Lithium battery 12.6V 5000mah, supporting the charger
Operating temperature range	-20℃~+55℃
Continuous working hours	36 hours (no backlight on)
Display screen	Dot Matrix LCD 128*64
Connection terminal	Power switch X1 Sensor connector X1 The 3.5mm headphone jack is X1 DC5.5 * 2.1 Charging socket X1
Filter	A：200Hz-1000Hz
	B：50Hz-800Hz
	C：120Hz-1500Hz
	D：1500Hz-7500Hz

Depth of investigation	5m
Size	184mm ×138mm×80mm
Weight	850g

Table 1.3 Technical parameters of the headset

The voice mode	surround sound
Operational principle	Fully enclosed listening headphones
The horn diameter	40mm
Response frequency	20Hz-22KHz
Impedance	32Ω

2. Instrument composition

C-17 pipeline leakage detector consists of main engine unit and software system.

The C-17 pipeline leak detector host unit includes a sensor and control handle for obtaining a leak signal, a host for leak signal processing and information display, and a high-fidelity headset for listening to identify the leakage status. When the host system inspects or locations the leakage, the control status information of the leakage detection is displayed in sound, data and graphics through the LCD screen and headset on the host panel.

2.1 Product composition

The product composition of the C-17 pipeline leak detector is shown in Table 2.1.

Table 2.1 Components and composition of the tester

Host unit 1 piece	1 piece of the multi-function sensor	1 indoor sensor
		
One handle	One piece of headphones	One charger
		
Host package 1 piece	One instrument box	
		

2.2 Host unit composition

The host unit unit is the main component of the detector, including the host unit (including power supply, main interface, liquid crystal display, etc.), control handle and sensor, headset, battery pack and charger. This section will detail the distribution functions, specifications and performance, connection mode, etc. of the host unit composition.

2.2.1 Host machine

2.2.2, the LCD display area

The LCD display is located in the middle of the front panel of the detector, as shown in Figure 2.2.

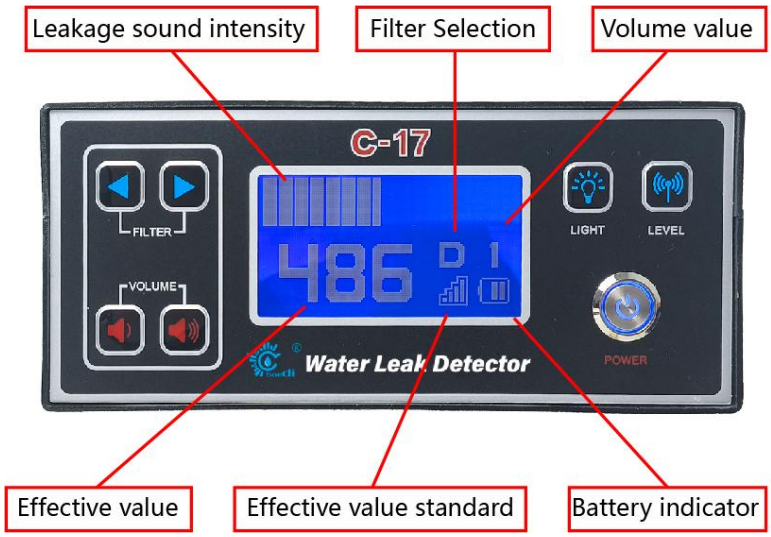

Figure 2.2 The LCD display

The LCD display is used to display the leaking sound size light column, filter control information, and host status information.

The leak sound intensity is displayed in real time in the top of the screen.

The number on the lower left of the LCD screen indicates the valid value of the leaked sound intensity in the latest continuous detection time window (the interval between the handle button to the release).

2.2.3 3 Operation panel

The operation panel is distributed around the LCD screen, as

shown in Figure 2.3.

Figure 2.3 Operation interface

Power Supply Switch (POWER)

After the boot, the host starts to work. After the initialization of the instrument host, the screen stays in the horizontal bar display mode. After shutdown, the power is cut and the screen shows not display.

	Check the power supply status after startup / shutdown to prevent abnormalities.

Effective value adjustment push button (LEVEL)

Select the measurement standard of valid value to adapt to different work occasions such as inspection or positioning.

Backlight Button (LIGHT)

Used for displaying screen backlight on / off switching. The LCD backlight can be turned on / off by the cycle press-release.

Filter Select Button (FILTER)

According to the actual requirements, users choose one of the filter channels to select the leakage signal to detect the leakage signal to meet the leakage detection needs under different materials / pipe diameter

pipes and different working sections (buried media).

Filter	A：200Hz-1000Hz	Suggestion: For outdoor pipe testing
	B：50Hz-800Hz	
	C：120Hz-1500Hz	Suggestion: For indoor pipe testing
	D：1500Hz-7500Hz	

2.2.4 4 Main interface

The main interfaces on the host unit are distributed on the left and right sides of the host unit. As shown in Figure Figure 2.4.

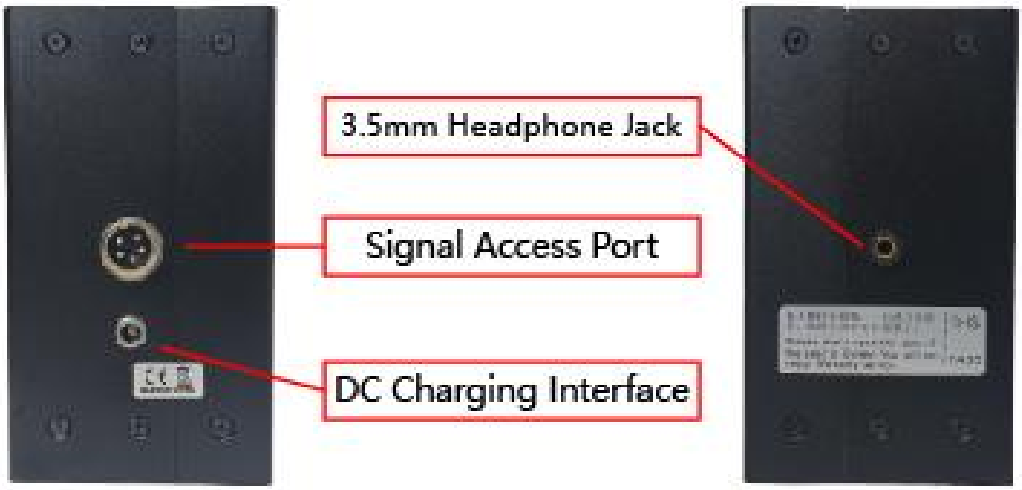

Figure 2.4 Main Interface

1. Headphone jack

Use to plug in the Φ 3.5mm headset plug to connect to the high-fidelity listening headset. The headphone jack will output a leaking vibration audio signal.

2. Signal input interface

Use to connect the output of the handle control cable, connect the sensor and input the leakage vibration signal to the host.

3. DC charging jack

DC5.2 * 2.1 Charging port for charging the lithium battery of the main engine

2.2.5 5 Control handle

The control handle assembly is used to connect the sensor to the

host component, as shown in Figure 2.5.

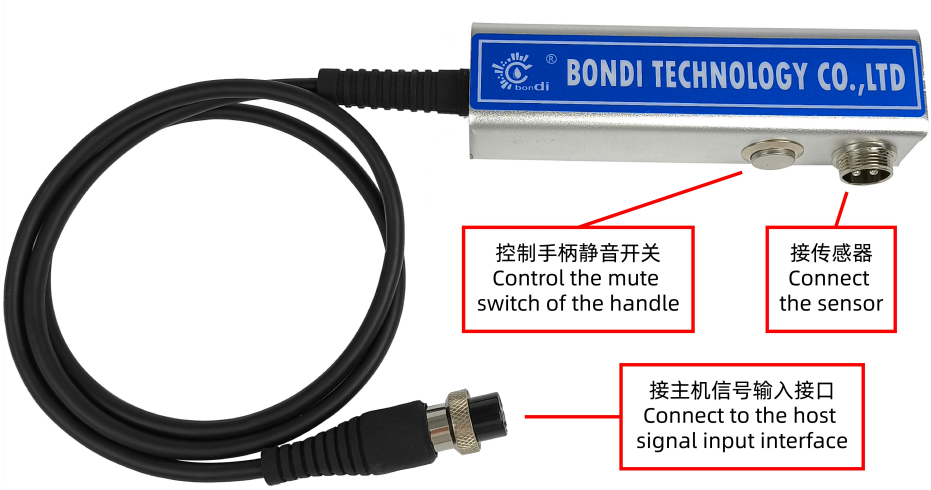

Figure 2.5, Control handle

When the operator presses the mute switch to connect the headphone signal channel, the headset output the vibration audio signal. When the handle mute switch is released, the switch will return naturally. At this time, the headset is silent, with no audio signal output.

	In the process of moving the sensor, release the mute switch to cut off the signal to the headset to prevent excessive sound intensity impact on the operator's hearing and cause hearing damage.

	The handle switch has an electronic circuit and mechanical structure inside, do not dismantle without authorization. Otherwise, it may cause the handle functional damage. The handle switch is not waterproof and dustproof, please use it in a dry and clean environment. Otherwise, it may cause the handle function reliability to decline or damage.

2.2.6 6 Sensors

The sensor is placed on the surface of the measured pipe and buried pipe to obtain the vibration signal of the pipe leakage, as shown in Figure 2.6.

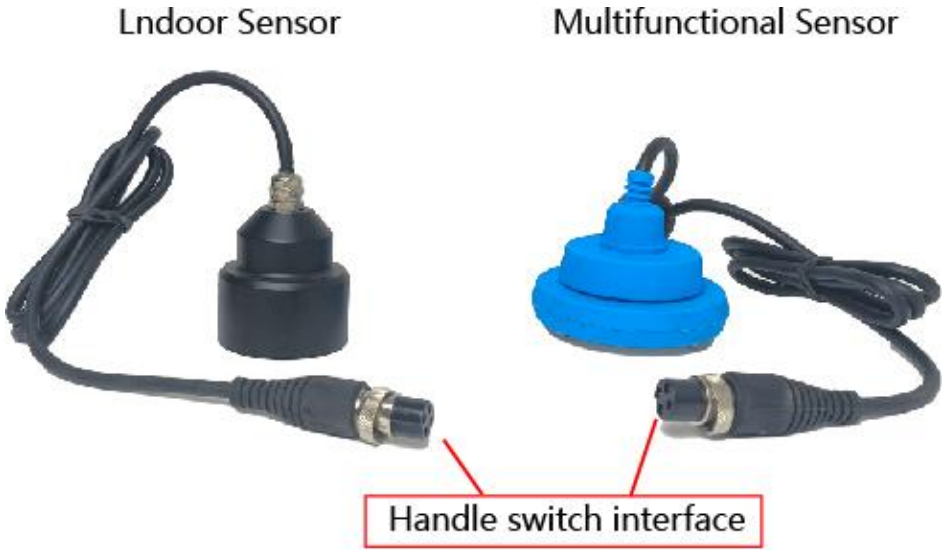

Figure 2.6. Sensors

The sensor uses sensitive parts and the shell, which can effectively reduce the interference noise caused by the connection cable shaking and environmental disturbance. In order to meet the needs of the actual leakage detection process inspection and positioning to the different frequency response of the sensors, we are equipped with two sensors.

	The position and direction of the sensor have a great influence on the detection effect. The study shows that the midline direction of the symmetry axis is consistent with the radial direction of the leakage pipe, and the detection effect is optimal.

2.2.7 7 Headphones

The headset is used to output the leakage and vibration audio signal of the host machine. The C-17 is equipped with high-fidelity stereo

headphones, as shown in Figure 2.7.

Figure 2.7 Headphone

Headphone speakers are left and right. For some people, the left and right ears are not sensitive to sound, so please wear the left (L) right (R) marked on the headset. You can also, according to the actual situation, change the order of the left and right speakers, to better complete the sound detection.

	The dynamic range of the actual leaky vibratory audio signal is large. Sometimes the output audio signal intensity is very large, so when wearing the earphone for sound detection, special attention should be paid to the ability to adjust the volume (by adjusting the "sensitivity" knob), so as not to damage the ears of the testing personnel or can not hear the sound around to cause danger.

2 2 .2.8 8 Battery pack and the charger

The C-17 pipeline leak detector uses a high-performance, large-capacity rechargeable lithium-ion battery assembly, and is

equipped with a DC12.6V charger. As shown in Figure Figure 2.8

Figure 2.8 The Charger

The C-17 pipeline leak detector is equipped with a dedicated automatic charging adapter, and the battery components can be charged on the instrument by the charger.

In use, the battery level is always displayed on the bottom right side of the LCD screen. In order to prevent damage to the battery due to excessive discharge, the corresponding protection circuit is set inside the instrument and the battery module to ensure that the instrument can automatically shut down before the battery will run exhausted, and the instrument can continue to be used after charging.

	It is recommended not to turn on the power of the main engine switch during charging to prevent damage to the instrument or to extend the charging time.

3 by using the C-17 tester

3.1 Install the C-17 tester

1. Remove the host, cable with control handle, sensor and headset from the instrument box.

2. Connect the end with the control handle cable to the sensor.

3. Connect the other end with the control handle cable to the host machine.

4. Insert the headset plug into the headphone jack on the side of the host, so that the headset can receive the audio signal output by the host.

5. Adjust the length of the connecting line to extract the sensor; adjust the host package belt to meet the convenience and comfortable carrying during inspection.

The fully installed C-17 pipe leak detector is shown in Figure 3.1.

Figure 3.1 C-17 Installation and connection of pipeline leakage detector

3.2 Check before the use

Please ensure that the following 3 inspection steps are done before using the C-17 pipe leak detector to ensure that the detector reaches the optimal working state during the leak detection.

1. Check the instrument components

Check whether the main engine and accessories are complete; whether the sensor connection is reliable; whether the shoulder strap is clean and reliable; whether the battery compartment lid is tight; etc.

2. Check the battery level

Before starting the instrument, be sure to check the battery level to make sure the battery is sufficient. The method to check the battery power is to turn on the power switch and open the host machine. There is a battery power icon in the state area in the upper right corner of the display screen of the host machine, as shown in Figure 3.2.

Figure 3.2 The working interface shows the battery level

Three filled small cells in the battery power icon indicate the battery power surplus. In the process of use of power consumption, filling small cell also gradually reduced. When all the small cells in the battery capacity disappear, please charge the battery immediately.

3. Check the operation of the instrument

Connect the sensor and headset to the host separately and check as follows:

① Turn on the power switch and wait for a few seconds to see if there is a waiting work screen;

② Press the handle and put on the headset to check whether there is any sound in the headset;

③ Press the handle and check for changes in horizontal bars.

If you find any problems during the inspection, please check the "5. Troubleshooting" later in this manual. If there are still problems that cannot be solved, please contact our company.

3.3 Startup process

1. Turn on the power supply switch;

2. Wait for 2 seconds to display and enter the working interface;

3. If the handle is pressed, the display screen displays the detection signal strength horizontal bar; it also displays the effective value of the signal strength when the handle is continuously pressed;

4. The handle is released, and the signal strength column horizontal bar and the effective value area are cleared.

4 Detection method of pressure pipeline leakage

Sand oma, damage, cracks and other injuries occur in the buried pressure pipeline. Due to the pressure inside the underground pipeline, there is a pressure difference inside and outside the pipeline, which leads to the outward injection of water flow. In this process, the jet water and the damage cause friction and cause vibration in the damage, the pressure jet water shocks the buried pipe medium resulting in the vibration, the leakage water flow outside the pipeline to produce the turbulent sound is the general sense of the sound of leakage.

Despite the help of advanced detector, including C-17, due to the leakage sound intensity and spectrum distribution (tone) will be affected by the pipe pressure, buried media, pipe material, pipe diameter and other factors, so in the actual leak process to determine the leakage point, also need to detect rich practical experience to accurately determine whether the leakage vibration signal.

4.1 Sound and characteristics of pipeline leakage

4.1.1 1 Leak sound components

The composition of the leaking sound mainly consists of the following four parts:

(1) The friction sound between the pipe damage and the pressure and water flow;

(2) Vibration sound at damaged pipes;

(3) The jet water flow impacts the buried pipe medium to produce the impact vibration sound;

(4) The sound of a vortex formed by the jet of water spinning around the damage.

The above (1) and (2) sound sources propagate along the pipeline axis. Therefore, in the actual leak detection process, if conditions permit, find the pipe above the ground, and the sensor is placed on the measured pipe. Such as the pipe itself, valves, fire hydrants, etc.

The above (3) and (4) sound sources propagate outward in spherical wave vibration in the buried tube medium. Therefore, in the actual leak detection process, the general direction of the pipeline buried in the medium is found. Place the sensor on the surface of the buried pipe

medium directly above the pipe direction. And as perpendicular to the wavefront.

4.1.2 2 Leaking sound, frequency characteristics

The leakage sound is composed of multiple audio source vibration signals and has complex frequency components. It is generally believed that the spectrum range of the leakage vibration signal is roughly distributed in the range of 20Hz-5000Hz, and the mainstream spectrum distribution of common pipeline leakage is about 200Hz-2000Hz.

The frequency of the leakage sound output of the headset is affected by the pipe material. Under the same pipe diameter conditions, metal pipes have more high-frequency leakage sound components. According to different materials such as cast iron / steel pipe / copper pipe, the frequency spectrum range of water leakage sound is about (400Hz~600Hz) - - (1200Hz~3000Hz). Plastic or PVC pipes have more low-frequency leakage components, and the spectrum range is about (100Hz~400Hz) - (600Hz~800Hz).

The frequency of the leakage sound of the headset is affected by the buried media of the pipe. Generally speaking, hard and solid media (such as concrete) is conducive to sound transmission, high frequency composition. Loose medium with gaps (such as sand, mud, grass, etc.) on the absorption of sound energy is obvious, the sound is low, the volume is low.

4.1.3 3 Intensity of the leaking sound

The intensity of the leaking sound can be simply understood as the volume size of the leaked sound. The leakage sound intensity of the headset output is affected by many factors, such as the leakage source, water supply pressure, pipe diameter, buried pipe medium, buried pipe depth and so on.

Generally speaking, the sound below 20 decibels is quiet; 20-40 decibels is quiet. A sound of 40-60 decibels is normal. Above 60-70 decibels is noisy, and the sound above 80 decibels begins to damage the hearing nerve.

The C-17 sound sensor is used to adjust the volume of the headset output through the volume adjustment button. According to the actual

situation, adjust the volume of the headset to the sound more comfortable range of the leak detector (vary from person to person).

4.2 2 Inspection along the pipeline

When there is sufficient information to indicate the direction of the detected pipeline, the leakage detection and positioning. The method of testing along the line is shown in Figure 4.1.

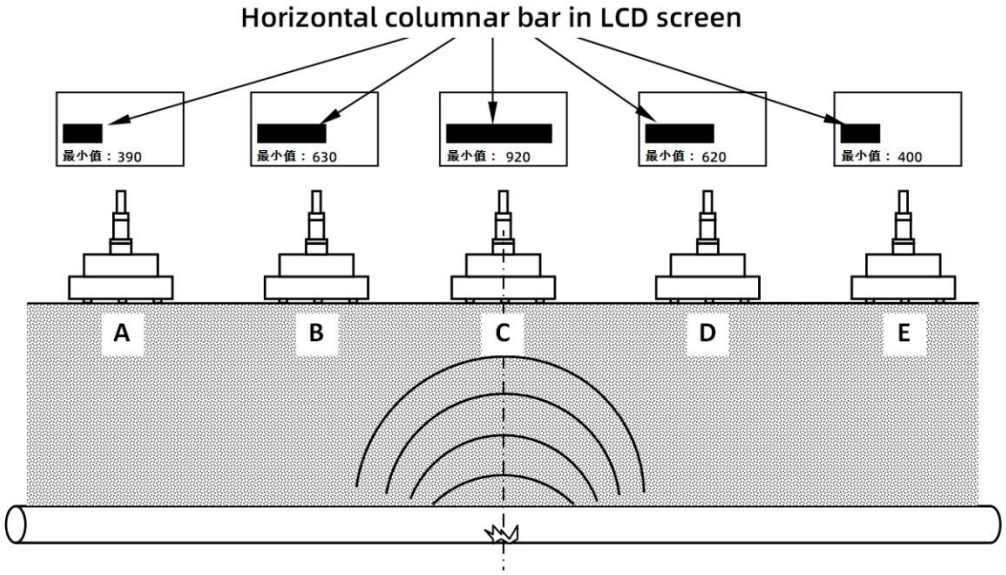

Figure 4.1 Change of leakage sound size during detection along the pipeline

Start the test from any point of the ground above the line (Figure 4.1, point A) according to the line direction. The detection method and procedure are as follows:

(1) Place the sensor on the ground directly above the line, for example at point A.

(2) Press the mute control switch of the handle. If there is a leak in the pipe, there will be a significant continuous leak sound in the headset. If the pipe does not leak, the sound in the headset is small, or only random bursts in the surrounding environment.

(3) Listening to sound detection. Relax the connection line between the sensor and the handle, keep the sensor fixed and stable, and select the relatively calm moment around. In addition to carefully identifying the size and audio of the leaking sound, observe the change of the horizontal bar bar in the LCD screen, and remember the minimum value detected at that point.

(4) Release the handle and move along the pipeline direction, 0.2~1.0 m, to other points (like B, C, D, E) repeat (1) ~ (3).

(5) Conduct multiple detection around the detection point with the smallest value (the C point in the figure) to accurately achieve leakage positioning.

	When detecting leakage along the pipeline, multiple detection points selected should make the minimum value undergo a process from small to large to small. If the minimum value of the detection point selected along the pipeline is gradually smaller, the detection point should be selected in the opposite direction.

4.3 3 Position the leakage point

In the actual leakage detection, if the pipeline direction is not clear or the pipeline direction deviates from the data, the following two-step method can be adopted to achieve the leakage positioning, which is shown in Figure 4.2.

(1) Check the leakage point from above the pipeline that can be determined. For example, in Figure 4.2. Starting from point A along the straight line A-B-C, gradually detecting point C, the leaky listening sound and minimum value will experience from small to large, from large to small. The detection point with the largest minimum value in this process was determined as the starting point for the next detection step, as shown in point B in Figure 4.2.

(2) From point B, perpendicular to the AC, start the second detection along B-D-E. In the second step of detection, the detection point with the largest or the smallest leakage listening value was determined as the leakage point. Point D in Figure Figure 4.2.

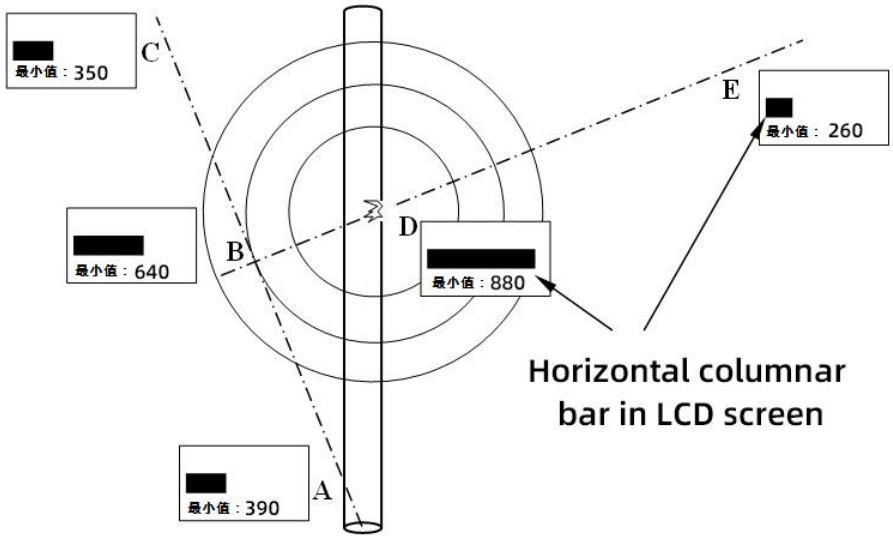

Figure 4.2 Two-step method to achieve leak detection and positioning

4.4 4 Effect of dispersion on leakage localization

The vibration signal generated by leakage is transmitted to the ground through various media such as pipe and buried layer, and is detected and identified by the sensor to realize leakage detection. When the leakage vibration signal passes through the buried layer of different media, some signal components are absorbed and some are attenuated. Compared with the leakage signal, the vibration signal transmitted to the ground has a large change in the loudness and the tone, which is the dispersion phenomenon. Frequency dispersion is an objective physical phenomenon, and corresponding countermeasures need to be taken for this detection.

In view of the dispersion phenomenon, we should pay attention to some points in the leakage detection.

First, before leakage detection, carefully understand the media condition of the ground to determine whether the pipeline buried layer is soft or tight. Generally speaking, the attenuation and absorption of leakage high frequency sound by soft buried layer is obvious, and the solid buried layer is conducive to the transmission of high frequency signal. The above judgment facilitate the selection of appropriate band-pass filtering bands before detection.

Secondly, in listening detection, in addition to paying attention to the loudness of the sound, but also pay special attention to the change

of sound tone. If the tone changes significantly in a smaller range, further testing should be performed to determine whether it is leakage or water, or buried mutation.

Due to the complex situation of media such as buried layer, a slightly moving sensor may appear near the point of suspicious leakage, and the leakage sound or minimum value will suddenly become larger / small. This may also result from the dispersion. In another way, when the leakage sound or the minimum level bar shows the maximum value in the latest period of time, the sensor is not necessarily directly above the leakage point, depending on the ground, buried layer, etc.

5 Difficult answers

fault phenomenon	cause	Exclusion measures
The instrument cannot be turned on	Low battery capacity.	Charge the instrument
No dynamic light bar display on the screen Show, headphones silent	The connection between the sensor and the handle cable is unreliable.	Check the connector for a reliable connection
The headphones are howling	Sensors and headphones are too close	Do not keep the headset close to the sensor, and lower the volume of the headset appropriately
After starting up in a very short time since Move the shutdown	The battery voltage is insufficient	Battery charge or replace a new battery
The LCD page appears in a garbled code	Operation error or overshoot	Restboot the instrument to normal.