

F-999K Water leakage detector

User manual



ShijiazhuangBondiTechnology Co.,LTD

Preface

Dear customers!

Thank you for choosing to use the F-999K pipeline leak detector. If you are using this product for the first time, please read the following product instructions and use instructions carefully.

F-999K The operation manual details the composition and function, operation process, matters needing attention, and the methods of pipeline inspection and leakage positioning by using f-999k pipeline leakage detector. Please carefully read and fully understand the use manual before operating or using the F-999K pipe leak detector. If you have any questions about the operation and use of F-999K, 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

Enlargement factor	120db
Frequency range	200-3000Hz
Source	Lithium battery is 8.4V 2000Mah, equipped with a charger
Operating temperature range	-20°C~+55°C
Continuous working hours	≥36hour
Display screen	LED Nixie tube
Filter	The 4 lanes are switchable
Depth of investigation	1m
Size	184mm×138mm×80mm

1.3 Technical parameters of headphones

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

2 Instrument composition

The F-999K pipeline leakage detector is composed of the host unit and the software system.

The F-999K pipeline leak detector host unit includes a sensor and control handle for obtaining a leakage signal, a host for leak signal


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processing and information display, and a high-fidelity headset for listening to identify the leakage state. When the host system inspects or locations the leakage, the control status information of the leakage detection is displayed in the way of sound and digital tube through the LED digital tube and headset on the host panel.

2.1 Product formation

F-999K The product composition of the pipeline leak detector is shown in Table 2.1.

2.1 The component composition of the detector

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

2.2 Host unit composition

The host unit is the main component of the detector, including the host unit (including power supply, main interface, LED digital tube, 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 Main engine



Figure: LED digital tube display

LED digital tube is used to display leakage sound size, filter control information, and host status information. The leakage sound intensity is related to the value of the LED digital tube. The higher the value displayed by the LED digital tube, the greater the leakage sound intensity.


2.2.2 Operation panel

The operating panels are distributed around the LED digital tubes, as shown in Figure 2.2.

Figure 2.2 Operation interface

Power switch with volume adjustment(POWER OFF)

Use for the power switch and adjust the volume,

	Check the power supply status after startup / shutdown to prevent abnormalities.
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Filter regulation (SOUNDFILTRE)

According to the actual requirements of the user, in order to meet the leakage detection needs of different materials / pipe diameter pipes and different working sections (buried media) (commonly used 4 channels). **Note: The filter adjustment is adjusted by the operator according to the field situation.**

LED digital tube and pointer table

The LED digital tube has the same function as the pointer table to indicate the intensity of the detected leaking sound signal.

2.2.3 Pilot lever

The control handle assembly is used to connect the sensor to the host component, as shown in Figure 2.6.


按下手柄开关声音断开
Press the handle switch to disconnect the sound



Figure 2.3, Control handle

The operator releases the mute switch to connect the headset signal channel when the headset output leaks the vibration audio signal; when the handle mute switch is pressed. At this time, the headset is silent, with no audio signal output.

	In the process of moving the sensor, press 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.
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	<p>The handle switch has electronic circuit and mechanical structure, do not dismantle without authorization. Otherwise, it may cause the functional damage of the handle. 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.</p>
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2.2.4 Sensor

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 2.4.



Figure 2.4. Sensors

The F-999K is equipped with three sensors, which are used in different use scenarios. The touch sensor has high sensitivity and should be used as the first choice in use, for flat ground or wall, and prohibit contact with the ground with water. Multiple sensors can be used on uneven ground or ground with slight water.

2.2.5 Earphone

The headset is used to output the leakage and vibration audio signal of the host machine. The F-999K is configured with high-fidelity stereo headphones, as shown in Figure 2.5.



Figure 2.5 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. 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.

2.2.6 Battery pack and the charger

The F-999K pipeline leakage detector uses a high-performance, large-capacity rechargeable lithium-ion battery module, and is equipped with a DC 8.4V charger. As shown in Figure Figure 2.6



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Figure 2.6 The Charger

The F-999K pipeline leak detector is equipped with a dedicated automatic charging adapter that needs to be plugged in the DC charging socket for charging. The charger indicator is red when charging and green when the charge is full.



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 An F-999K tester was used

3.1 The fully installed F-999K pipe leak detector is shown in Figure 3.1.





Figure 3.1 F-999K Installation and connection of pipeline leakage detector

3.2 Check before use

Please ensure that the following 3 inspection steps are done before using the F-999K pipeline leak detector to ensure that the detector reaches the optimal working state during the leak detection.

1. Check the instrument component connections

Check whether the host machine and accessories are complete, whether the sensor connection is reliable; whether the shoulder strap is clean, firm and reliable.

2. Check the operation of the instrument

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

- ① Turn on the power switch, and the LED digital tube displays the number.
- ② Put on the headphones and press or release the handle mute switch to check for sound in the headphones.
- ③ Check whether the values of the LED digital tube and pointer table change.

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.

4 Detection method of pressure pipe leakage

Sand ome, 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.尽管有包括 F-999K

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

4.1 Pipeline leakage sound and characteristics

4.1.1 1 Leaking sound components

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

(1)The sound of friction between damaged damage and pressure water flow;

(2)Vibration sound at damaged pipes;

(3)The jet water flow shocks the buried pipe medium to produce the shock and vibration sound;

(4)The sound of jet 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 Leak sound, frequency characteristics

The leaky 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 the 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 The 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 earphone 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.

F-999K The volume adjustment knob is used to adjust the output volume of the headset. 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 Check along the pipeline

When there is sufficient information to indicate the direction of the

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detected pipeline, the leakage detection and positioning. The method of testing along the line is shown in Figure 4.2. Figure 4.2 Change of leakage sound size during detection along the pipeline

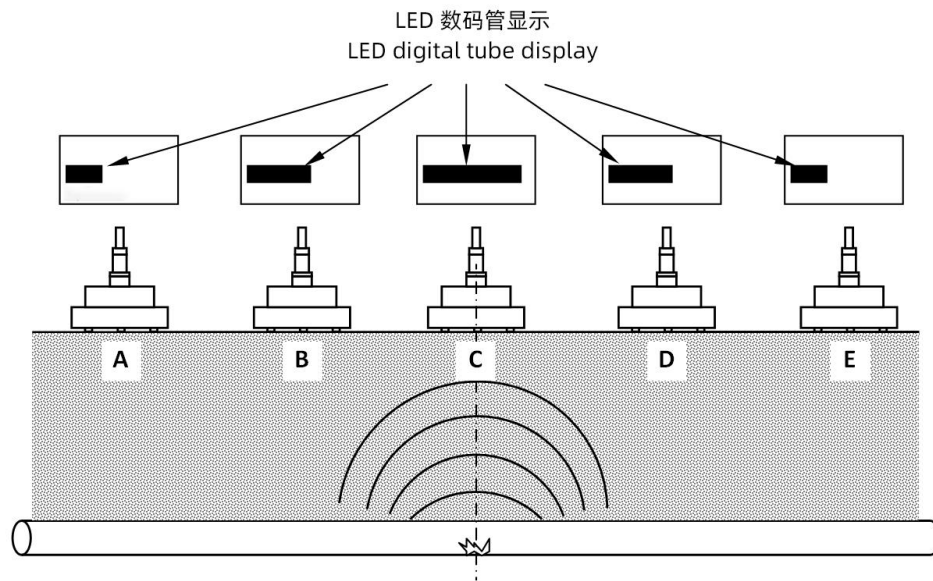


Figure 4.2 Change of leakage sound size during detection along the pipeline

Start the test from any point of the ground above the line (Figure 4.2 point A) according to the line direction. The test 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 handle to mute the control switch. 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) Listen to sound detection. Relax the connecting 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, but also observe the change of the horizontal column bar in the LED and remember the minimum value detected at that point.

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

(5) Multiple detection times around the detection point with the largest minimum value among multiple detection points (point C in the

figure) to accurately achieve leakage positioning.

	<p>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.</p>
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4.3 3 Locate the leak 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 4.3.

(1) Check the leak point from above the line that can be determined. For example, in Figure 4.3. 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 4.3.

(2) Starting in point B, perpendicular to the AC, start the second step of 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 4.3.

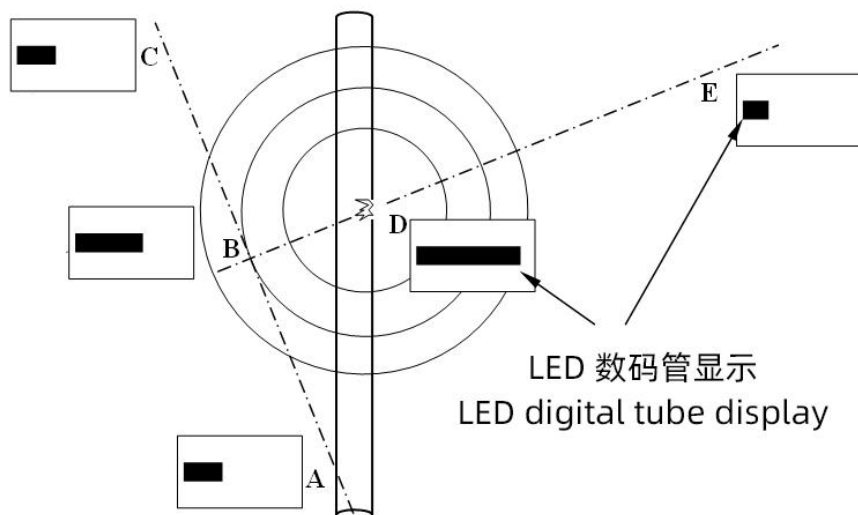


Figure 4.4 A two-step method

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 sound 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, the following points should be paid attention to 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 decay and absorption of leakage high frequency sound of soft buried layer is obvious, and the solid buried layer is conducive to the transmission of high frequency signal. The above judgment helps in selecting an appropriate band-pass filtering frequency band 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. From another perspective, when the leakage sound or minimum level bar shows the maximum value in the latest time, the sensor is not necessarily directly above the leakage point, depending on the ground, buried layer, etc.

5. Trouble answer

Fault phenomenon	Cause	Exclusion measures
The LED digital tubes do not display numerical value	Battery power is insufficient.	Charge the instrument
The headset does not sound, and there is no value display	Sensor, handle, and host connections are unreliable	Check the connector for a reliable connection
Some value show that the headphones can not hear the sound	The headset is not reliable to the host	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
Short term automatic shutdown	The battery voltage is insufficient	Battery charge or replace a new battery