

GAZELLE[®]

G9321 Underground Utility Locator User Manual



NOTICE

Thank you for choosing our devices.

Read the instruction carefully before using, specially pay attention to the security warning and tips.

Device is protected by below patents and we reserved all the rights:

2005 1 0012542.1

2005 1 0012543.6

2005 2 0024150.2

2005 2 0024149.X

2005 2 0024148.5

Please don't maintain device by yourselves. Contact us if any breakdown or error.

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1. GENERAL DESCRIPTION

Pipe locator consists a G9321T transmitter and a G9231receiver, it can be used for route tracing, pipe exploration and depth measurement of the underground cables and metallic pipes. Matched with the sonde (optional) it could do the nonmetallic pipe roue tracing and depth measurement.

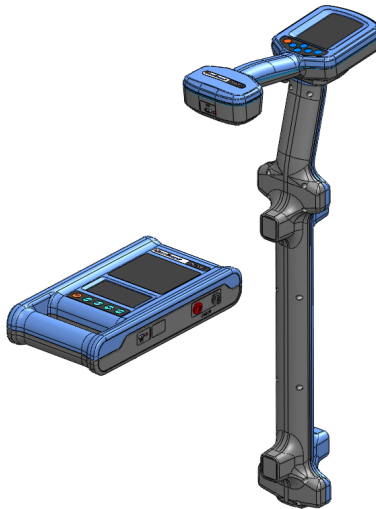


Fig 1-1-1 device appearance

1.1 FUNCTION FEATURE:

- Multiple detection modes: Underground pipelines are all in sight.
- High sensitivity, 0.5Hz ultra-narrow bandwidth reception, highly resistant to interference.
- Real-time depth measurement: Real-time depth measurement.
- Passive detection: Power frequency band + Radio frequency band.
- Transmitter clamp: Coupling signals to running cables.
- Sonde mode: In combination with a sonde (optional), it can measure the path and depth of non-metallic pipes.

- Digital power amplifier signal transmission, fully automatic impedance matching, and automatic protection.
- Multiple signal output methods for the transmitter: Direct connection output, clamp coupling, and radiation induction.
- Fully digital processing for transmission and reception, stable and reliable.
- Built-in large-capacity lithium-ion battery pack, automatic shutdown when under-voltage, and automatic shutdown after long periods of inactivity.

1.2 TECH. SPECIFICATION

(Full-function version, details configuration refer configuration table)

1.2.1 TRANSMITTER

- Output Mode: Direct connection, Clamp coupling (Optional), Radio (Optional)
- Output Frequency: 512Hz, 1024Hz, 8kHz, 33kHz, 82kHz
- Output Power: 6W max
- Maximum Output Voltage: 60V
- Maximum Output Current: 200mA
- Impedance Matching: Fully Automatic
- Over-voltage and Over-current Protection: Fully Automatic
- Human-Machine Interface: 480×240 LCD
- Power Supply: Built-in Lithium-ion Battery Pack, Nominal 7.4V, >5Ah
- Dimensions: 278×143×52mm
- Weight: 1.15kg

1.2.2 RECEIVER

- Reception method: Built-in coil
- Detection mode: Wide peak, narrow peak, valley
- Active frequency: 512Hz, 1024Hz, 8kHz, 33kHz, 82kHz
- Passive frequency band: Power frequency and its harmonics, high, medium and low frequency bands of radio frequency
- Human-machine interface: 320×480 LCD
- Maximum detection depth: 5m
- Communication: Bluetooth (optional)
- Maximum detection depth of Sonde: 10m
- Power supply: Built-in lithium-ion battery pack, nominal 7.4V, >2.5Ah
- Dimensions: 628×287×98mm
- Weight: 1.18kg

1.2.3 OTHER

- Charger Input: AC 100-240V, 50/60Hz
- Operating Conditions: -25°C to 60°C, <90% RH, <4500m
- Protection Level: IP54

1.3 DEVICE CONFIGURATION

1.3.1 G9321T TRANSMITTER

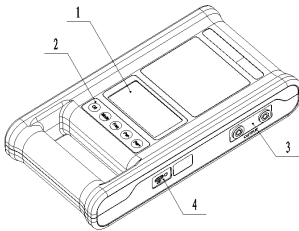


Fig.1-3-1 transmitter

- 1. LCD screen
- 2. Key board
- 3. Output socket
- 4. Charger socket

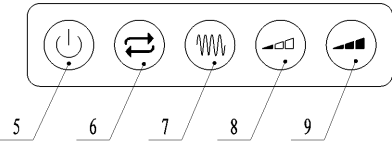


Fig. 1-3-2 key board

- 5. On/off: hold to power on/off
- 6. Output mode
- 7. Frequency key
- 8/9. output power reduce /increase

1.3.2 G9321 RECEIVER

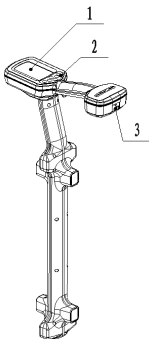


Fig1-3-3 receiver

- 1. LCD screen
- 2. Key board
- 3. Charger socket

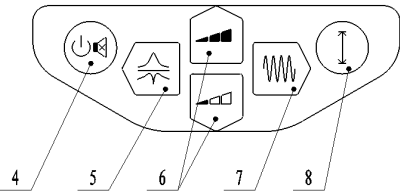
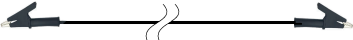


Fig.1-3-4 key board

- 4. On/off button/mute: hold to power on /off, short click to control the loudspeaker
- 5. Mode
- 6. Gain reduce/increase
- 7. Frequency
- 8. Measurement key

1.3.3 STANDARD ACCESSORIES

No	Item	Reference pic.	Qty
1	Transmitter direct connection output cable		2
2	Earth stake		2
3	Grounding extension cable		1
4	Gallium nitride fast charger	Type-C interface for 1 charger and 2 charging cables. DC interfaces for 2 chargers.	1

1.3.4 OPTIONAL ACCESSORIES

(Please specify during ordering. If not specified, they will not be included by default.)

No	Item	Reference pic.	Qty
1	Transmitter clamp		
2	SONDE signal		

1.4 RECEIVER INFORMATION AND MENU SETTING

When the device is under the off state, first press the measurement key  on the far right, then press the power button  to turn it on. Keep both keys pressed without releasing them until the following information and the initial settings interface appear:

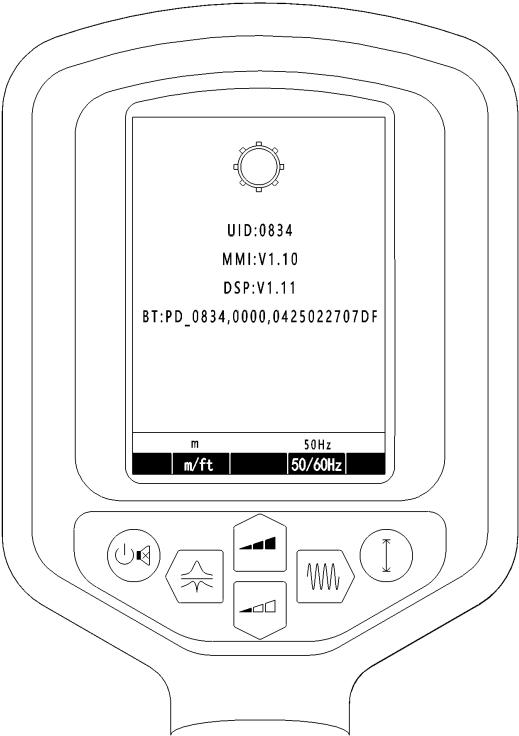


Fig1-4-1 receiver information and set interface demo

Take this picture as an example to illustrate it, please notice different instruments will display different information:

1. UID: 0834: This indicates that the unique ID of this device is 0834.
2. MMI: V1.10; DSP: V1.11 are the program version numbers.
3. BT: PD_0834, 0000, 0425022707DF: This represents the internal Bluetooth name as PD_0834, the pairing PIN code as 0000, and the MAC address as 0425022707DF. If the Bluetooth communication function is not selected, this information will not be displayed.
4. m/ft selection: By pressing the mode key to select the depth unit: meters (m) or feet (ft).
5. 50/60Hz selection: By pressing the frequency key to select the industrial frequency: 50Hz or 60Hz.
6. After the settings are completed, press and hold the power button to power off. The instrument will automatically save the settings.

2. GENERAL SIGNAL OUTPUT METHOD

There are three methods of transmitting signals to the pipeline: direct connection, clamp coupling and radiation induction.

2.1 DIRECT CONNECTION MODE

This method is to connect the output cable directly to the metallic pipe and inject the signal. It adapts the metallic water pipeline and gas pipeline, telecom cable, power cable, cathodic protection pipe testing point and other access points, or other line characteristics continuous metal structure.

Current from transmitter flows into the earth through pipeline access points, or distributed capacitance between earth and pipe, and at last return to the transmitter. This current on the pipe will generate electromagnetic radiation. Receiver will detect the pipe by receiving this magnetic field information.

Compared with other mode, this mode will get the max. transmission current for better testing result. We suggest to use this mode condition permit.

2.1.1 DIRECT CONNECTION MODE CONNECTION DIAGRAM

Connect the red and black plugs at one end of the output cable directly to the corresponding red and black output sockets on the transmitter.

Attach the red alligator clip to exposed metal parts of the pipeline (such as cable core/wire or valves), and connect the black alligator clip to a grounding rod driven into the earth/soil. If the grounding wire is not long enough, use an extension wire to connect it.

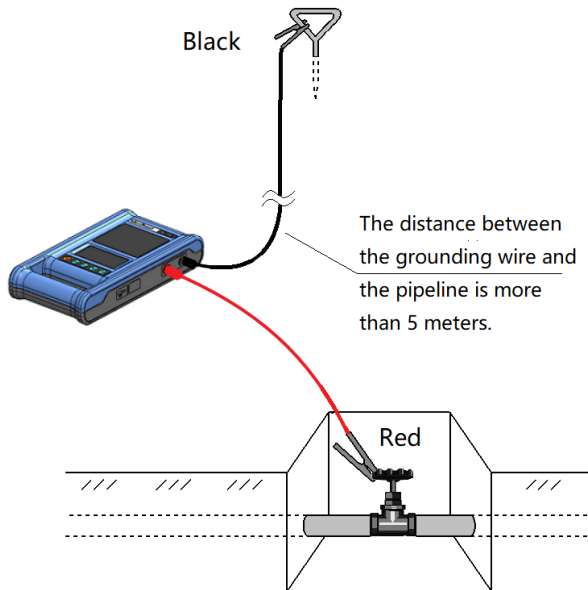


Fig2-1-1 direct connection wiring

NOTE:



- Grounding rod position should be over 5m from the pipe and try to make the black grounding cable perpendicular to the pipe direction.
- Both ends of the pipeline must be grounded to generate signals.

Grounding can be continuous grounding (such as uninsulated pipelines) or grounding at both ends (such as the metal armor of high-voltage power cables being grounded at both ends).

- Between different sections of the pipeline or between pipe fittings and pipelines, they may be insulated. If insulated, it is necessary to ensure an electrical connection; otherwise, the clamp coupling method cannot be used.
- Whether the current is effectively detected on the pipeline can only be determined by the detection effect of the receiver. If it cannot be detected normally, use other signal transmission methods.
- When the pipeline is jammed, ensure that the jaws of the clamp are fully closed and that there are no foreign objects or rust on the jaws. Different sections of the pipeline or between pipe fittings and pipes may be insulated. If insulated, the direct

connection method cannot be used, or it is necessary to find a way to electrically connect the two insulated parts. Inspection method: After confirming the wiring is correct, turn on the transmitter to observe the output current. If the current is too small to enable normal detection, it may be that the pipeline is insulated.

WARNING!

transmitter max. output voltage is 60vpp! don't touch the output clip

2.1.2 INTERFACE INTRODUCTION AND PIPE VOLTAGE MEASUREMENT

Note: The device automatically starts outputting after being powered on. Therefore, it should connect the wires first and then turn on the device.

Press and hold the power button  to turn on the transmitter. By default, the device operates in direct connection mode upon startup.

In the direct connection mode, the device will first measure the voltage of the pipeline itself. The screen will display as follows:

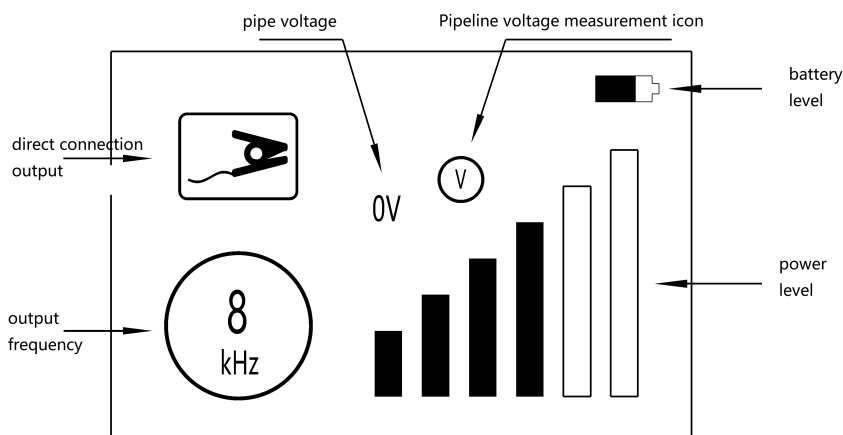


Fig2-1-2 pipeline voltage measurement interface

If pipe voltage over limitation 50V, device will keep the voltage measurement interface and display the alarming mark as below:

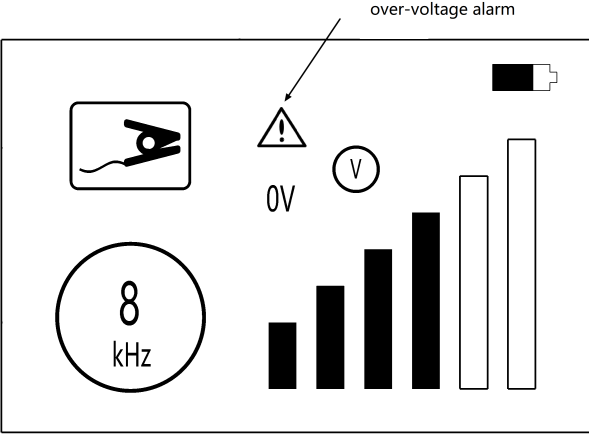


Fig2-1-3 Pipeline voltage over-voltage warning interface

If voltage is normal, device automatically outputs signal after several seconds. Screen display as below

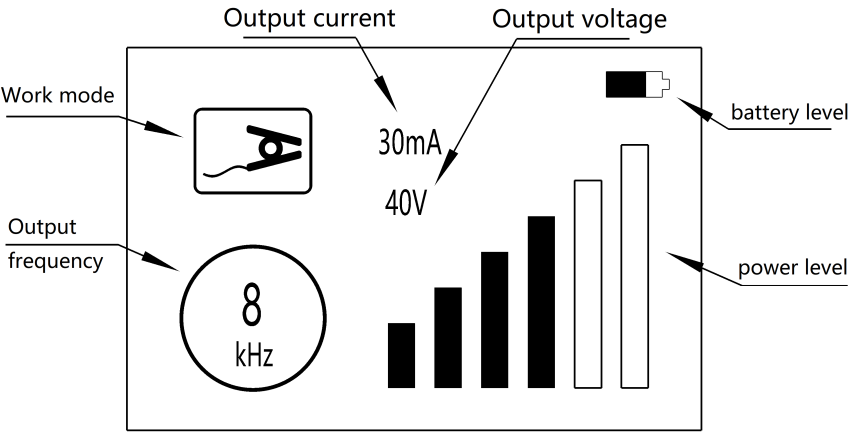


Fig.2-1-4 Direct connection interface

2.1.3 FREQUENCY SELECTION

Press frequency key  to select the transmitting frequency. Some frequency selection suggestions:

- Common good grounding cable and pipe, suggest to use the default 1024Hz. It can complete most of the testing requirements.
- Choose low frequency such as 512 Hz&1024 Hz, to do long pipe route tracing. Low frequency is long transmission distance and not easy to induce to another pipe.
- Common pipe tracing uses the middle-high frequency (8Hz). This frequency spread far and not easy to induce to another pipe.
- For high resistance pipe, such as the cable core with floating opposite end, pipe with anti-corrosive coating, cast iron pipe, we suggest to use high frequencies, such as 33kHz,82kHz. The high frequency radiation capacity is high but near transmission and easy to induce to another pipe.
- For normal detection we suggest to choose low frequency first.

2.1.4 ADJUST OUTPUT POWER LEVEL

Press output decrease button  and output increase button  to adjust the output levels. Adjust output levels according different requirements:

- Big current contributes to detection stabilization and veracity.
- If high frequency (8Hz and above) and shallow depth (in 1 meter), high current output will bring receiving saturation distortion to make receiver nonlinear responding and depth measurement error. And now should decrease output level.
- Decrease output power is contribute to extend battery using time.

2.2 CLAMP COUPLING MODE

This method is used for the naked Pipelines while it is difficult or unable to reach the metal part, and both ends grounded, especially useful for the power cables.

Signal transmission of clamp coupling mode equals to a transformer: clamp magnetic core is transformer magnetic core, clamp internal winding equals to transmitter primary, pipe-earth loop equals to secondary (single-turn), transmitter offer primary current, pipe-earth coupling generate secondary current. The coupling current is related to the loop resistance. The smaller resistance the bigger current, the bigger resistance the smaller current, until it's too small to detect.

The clamp coupling mode is easy to use and no need electrical connection so no effect to pipe normal running and will reduce the induce to other pipe. But the coupling current is smaller than direct connection mode, require pipe both ends good grounding, this doesn't apply to all cases.

2.2.1 CLAMP CONNECTION

Insert the red and black plugs of the transmitting caliper into the red and black output sockets of the transmitter respectively.

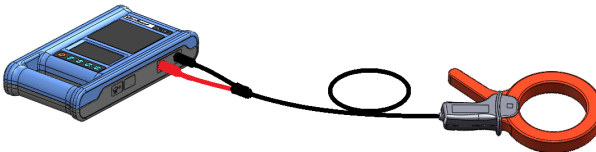


Fig.2-2-1 Clamp accessories connection

2.2.2 CLAMP THE PIPE NAKED PART AS BELOW:

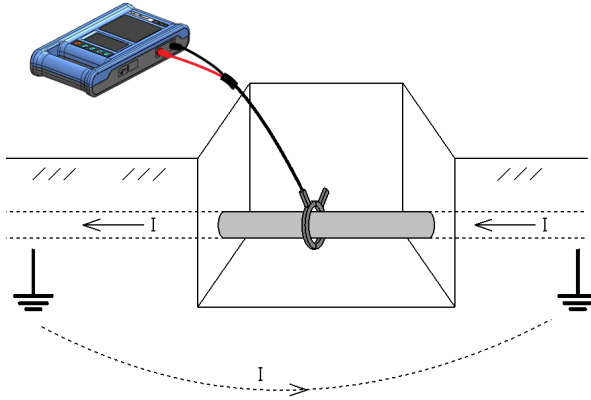


Fig.2-2-2 Clamp coupling method

NOTE:



- Make sure that the both ends of the pipe/cable are grounded. The grounding can be continuous grounding (shield grounding) or both-end grounding (high voltage power cable shield grounding at both ends).
- Different segment of the cable/pipe, or fitting with tube maybe insulated, we need to make them electrically connected, or we cannot use this method.
- Judge whether it can induce signal on the pipe/cable only by the receiver detection result. If cannot detect properly, we need to use other methods.
- Make sure the clamp is fully closed when we use it to clamp the pipe/cable. Clear the Clip before using, to make sure there is no other things between or it is rusted.

2.2.3 INTERFACE INTRODUCTION:

The transmitter is set to direct connection output mode. The screen displays as follows: At this time, the output voltage and output current refer to the voltage and current output to the clamp.

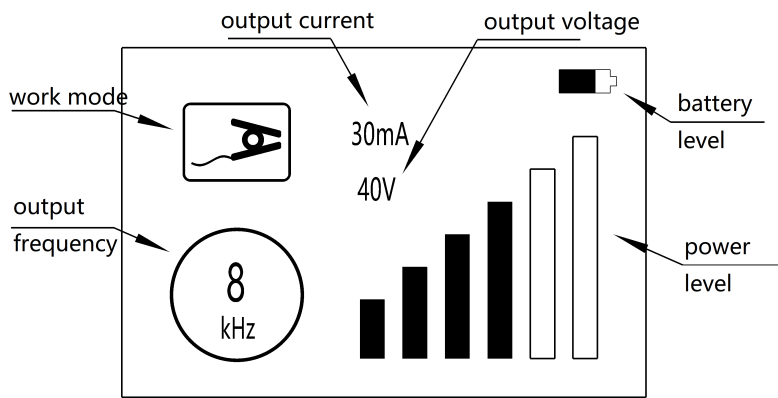


Fig.2-2-3 Clamp coupling output interface

2.2.4 FREQUENCY SELECTION

The frequency selection method of the clamp coupling method is the same as that of the direct connection method.

2.2.5 OUTPUT POWER ADJUSTMENT

Press output decrease button  and output increase button  to adjust the output levels.

The current coupled to the pipe is much lower than direct connection mode, so to use the max. level output.

Clamp coupling mode can't display the coupled voltage and current.

2.3 RADIO MODE

If there is no bald part for the pipe, or detection before excavation, we need to use Radiation mode.

The Transmitter uses the internal radiation loop to radiate high frequency magnetic (primary), the metal tube-earth loop will induce current, and the induced current will radiate magnetic again (secondary), the receiver can receive secondary magnetic for the pipe detection.

The Radio mode is easy to use and no cable connection is needed, especially useful for the detection of pipe that has no bald part. The disadvantage is that it has low induced current, especially if the pipe is deep. And it will induce all the pipes and output signal so it will be not useful for special pipe detection.

2.3.1 TRANSMITTER POSITION

Using the mode key, adjust the transmitter mode to the radio mode.

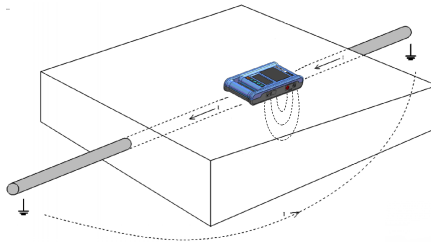


Fig.2-3-1 Radio mode

For pipeline tracking: Above the expected pipeline, place the transmitter vertically on the ground and ensure it is perpendicular to the expected pipeline direction. During the detection process, it needs to be coordinated with the receiver. Adjust accordingly based on the actual direction and position of the detected pipeline, as shown in the figure above.

For pipe detection: this needs two people to cooperate for the detection, keep the

Transmitter and Receiver at certain distance and move them simultaneously, they should have same direction. Please refer to [page 38 Radiation detection](#).



- Make sure that the both ends of the pipe/cable are grounded, or it can not induce signal. The grounding can be continuous grounding (shield grounding) or both-end grounding (HV power cable shield grounding at both ends).
- If the pipe is well insulated and it is not grounded at either end, we can not use the Radiation method. For example, some low voltage cables have no metal shielding, or the shielding is not grounded, we can not use this method.
- Can not put the Transmitter on the metal well covering or concrete with steel bar reinforcement, because the signal will be isolated by them.
- The transmitter will transmit signal not only to the targeted cable/pipe, but also to other medias, so we need to keep some distance between the Receiver and Transmitter.

2.3.2 INTERFACE INTRODUCTION

When the transmitter is powered on, by using the mode key , adjust the transmitter mode to the radiation mode. The screen will display as follows

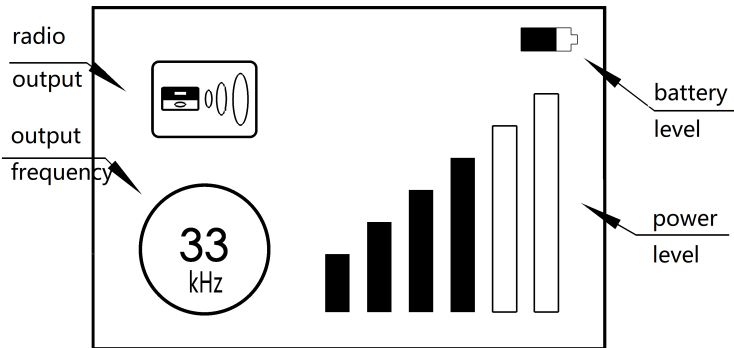


Fig.2-3-2 Radio output display

2.3.3 INTERFACE INTRODUCTION

Press frequency decrease button  and frequency increase button  to choose the transmitting frequency.

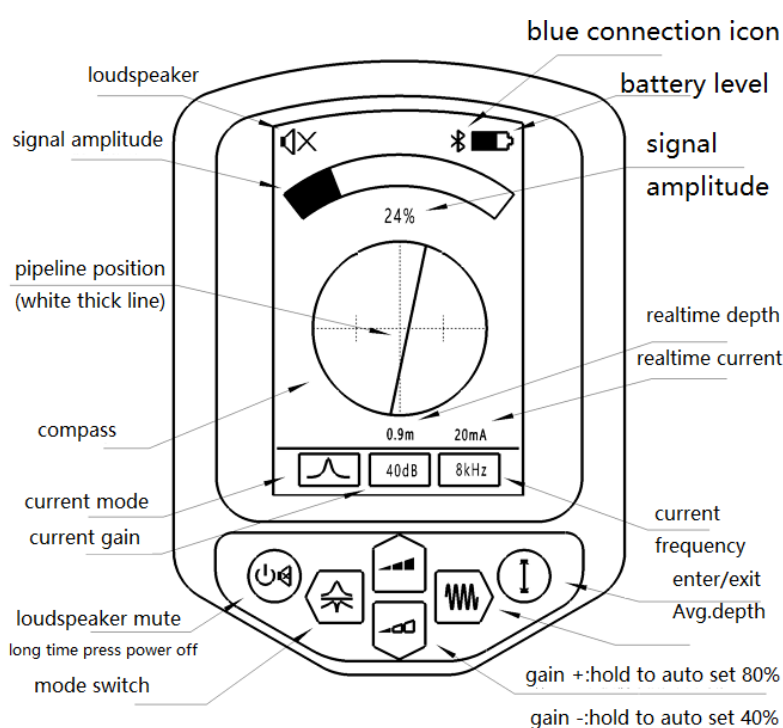
Notice:

- High frequency has the feature of better induce effect, but short propagation distance and easy to induce signal to another pipe.
- Low frequency can propagate long distance, not easy to produce interference, but the induce effect is not good.
- For detection of high resistance pipe, we should select high frequency. Low-frequency will hardly be able to detect an applicable signal.

2.3.4 POWER ADJUSTMENT

Press output decrease button  and output increase button  to adjust the output levels.

- Use low output level will decrease to induce to other pipe and reduce the receiving-transmitting distance.
- If detect deeper pipe, we suggest to rise output level.
- The transmitter can't test and display the pipe induced current value, so we have to repeated attempt according detection effect.



3. ACTIVE DETECTION

Active (source) detection requires the selection of appropriate methods to inject signal to the pipeline as

described in Chapters 2.

3.1 PIPE ROUTE TRACING

3.1.1 RECEIVER OPERATION INTERFACE

Long press the receiver Switch/mute button  to turn on the power of the receiver.

Fig.3-1-1 active detection receiver interface display

3.1.2 SETTING RECEIVING FREQUENCY

Press frequency decrease button  to select the receiving frequency. Make sure transmitting and receiving frequency is same.

Below frequencies for selection: 512Hz、1024Hz、8kHz、33kHz、82kHz

3.1.3 SETTING MODE

Press Mode button  to choose wide peak mode, narrow peak mode, valley mode.

- **Wide peak mode:**

Signal response of the lower horizontal coil. In the wide Peak mode, the signal right above the cable/Pipe is the strongest. The advantage for this method is with high sensibility, and wide range; the disadvantage is that it responding curve changes slowly, and not easy to distinguish the parallel cables.



- **Narrow peak mode:**

Differential signal response of lower horizontal coil and upper horizontal coil. Similar to the wide Peak method, it has sharp responding curve, easy for parallel cable/pipe detection; the disadvantage is that it has low sensibility.

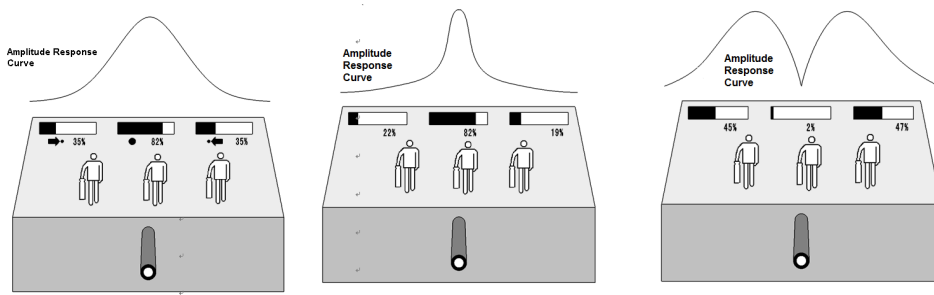


- **Valley mode:**

Signal response of the vertical coil. The signal just above the cable/pipe is weakest, and it changes rapidly besides the cable/pipe. The advantage of this method is that it is easy to precisely pinpoint; the disadvantage is that it has low anti interference ability.



Different mode responding as below



Wide peak

Narrow peak

Valley

Fig.3-1-3 signal responding under different modes

3.1.4 ADJUST GAIN

Short press Gain +/- button to adjust the gain value. The gain decibel value is displayed right below the screen.

Hold the Gain + button to do auto gain adjustment to 80%

Hold the Gain- button, the gain will be auto 40%

3.1.5 PIPE TRACING ACCORDING SIGNAL AMPLITUDE AND AUDIO (TRADITIONAL METHOD)

It is needed to begin to locate the pipe at the Transmitter side but not be affected.

- Use the clamp method and radio method. The transmitter will interfere the detection if the distance is too near, so we need to keep some distance. The interfere is related of the transmitting power and frequency. The bigger power and frequency the stronger interfere.
- The minimum distance between the Transmitter and Receiver needs to be determined by experiment, normally of 5m for the Clamp method and 20m for radiation method could be seen as suitable distance without interference.

Use the Peak mode (Wide Peak or Narrow Peak) to find the point where signal is strongest, and begin to trace the cable/pipe at this point. Swing the Receiver, the signal amplitude will change as Fig. 3-1-3 shows, follow the peak position (highest point at Peak mode) or null position (lowest point at Null mode), till we get the route of the cable/pipe.

Use Null mode, we can quickly locate the trace, the weakest point is right above the pipe, at the both sides of the cable/pipe, the signal will increase obviously. But because Null mode is easy to be interfered, we need to change to Peak mode after some time to

ensure the tracing result.

Receiver loudspeaker sound output can reflect the current signal strength, which is helpful to track line, but this function is mainly to serve the users accustomed to using traditional path instrument, and use a compass function, can more quickly intuitive tracking line and generally do not need to voice prompt, so the loudspeaker is off as default.

If necessary, short press switch/mute key  to turn on or off the speaker.

3.1.6 COMPASS ORIENTED QUICK TRACING METHOD (NEW METHOD)

When the receiver approaches above the pipeline, the compass in the center of the screen can visually display the pipeline's position directly beneath the receiver, allowing for rapid tracking of the pipeline. Observe the straight-line position and angle representing the pipeline in the compass and adjust the receiver's position accordingly. When the straight line is vertical and located at the center of the compass, the receiver is directly above the pipeline.

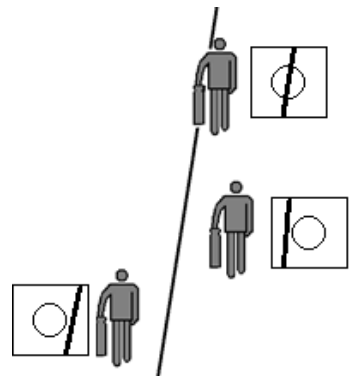


Fig.3-1-4 compass indication

NOTE:



Attention:

- If nearby pipe has strong signal, and the receiver is near, compass still indicate but please notice, this will display the nearby pipe but not the target pipe.
- If nearby pipe has large interference, the compass will have deviation. If need accurate position, please refer Accurate positioning of this segment.

3.1.7 RADIO METHOD

For this method, we will need the Receiver and Transmitter, and at least two operators. Please make sure the target zone and the possible directions pipe crossing, set the working mode of the Transmitter to Radiation, and select same frequency for the Receiver and Transmitter. One operator controls the Transmitter and one operator controls the Receiver, keep the direction of the Transmitter and the Receiver perpendicular to the cable/pipe. The two operators should keep distance for 20 meters, and move simultaneously at the direction perpendicular to the cable/pipe. When the Transmitter passes the cable/pipe, the signal will be inducted into the pipe and the Receiver will receive signal. Observe the receiver responding and mark on the ground when peak responding above the pipe. Refer Fig. As below:

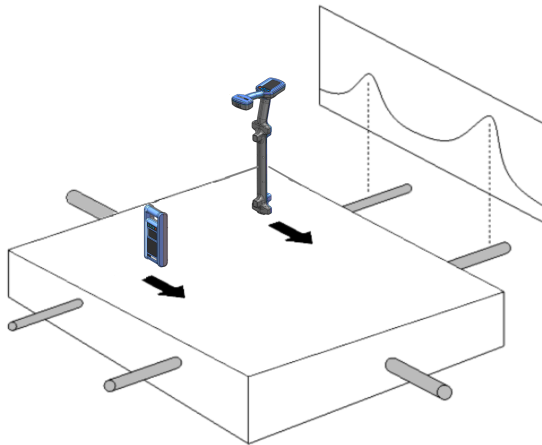


Fig.3-1-5 radio zone detection

After detecting the area in one direction, the operators need to exchange the position of the Transmitter and Receiver, and search the area again in opposite direction.

If possible, the operators need to detect the area at all possible direction.

Mark all the positions of the cable/pipe, put the Transmitter above the pipe, use the Receiver to trace each cable/pipe.

Radiation method is the most reliable method for area cable/pipe detection, but limited to

the radiation method itself, the cable/pipe must be grounded and the concrete with metals cannot use, we cannot ensure that all the cables/pipes can be detected.

3.1.8 PRECISE POSITIONING.

Compass method will have deviation if interference or nearby pipe effect. If need to do the following to increase the location accuracy, we suggest to use below manual measurement method to verification.

Find the target pipeline general position, use PEAK or Valley method and adjust the gain:

- A. Keep the Receiver perpendicular to the suspected cable/pipe, find the position where there is strongest response.
- B. Don't move Receiver and rotate it, to find the angle that has the strongest response.
- C. Keep the angle, move the Receiver left-right, find the point has the strongest response, mark it.
- D.

Repeat the above steps, if possible, to improve accuracy. Refer below

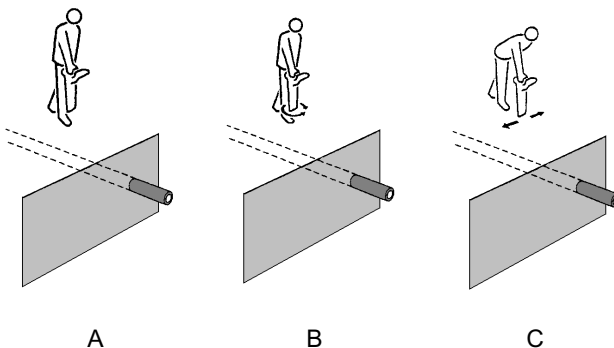


Fig.3-1-6 precise positioning.

Use the Valley method to find the point where has weakest points (refer B), and mark that. If the positions we get using Peak or valley method are the same, then the positioning is accurate. If not, it shows that there is nearby cable/pipe interference, we need to do the position correction.

As shown in the right figure, both the peak and valley points are deviated to the same side of the pipeline. The actual position is on the opposite side of the peak point, at a distance of half the peak-to-valley distance from the peak point.

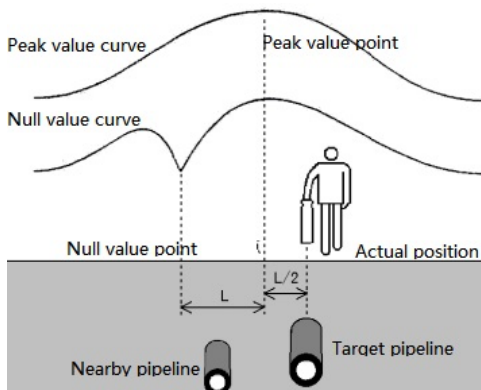


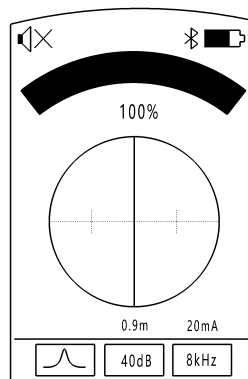
Fig.3-1-7 position correction.

3.2 DEPTH MEASUREMENT

3.2.1 REAL-TIME DEPTH MEASUREMENT.

When it is judged that the receiver is basically above the pipeline, do the real-time depth and current measurement and the test result is displayed on the right side of the screen, as shown in the figure below:

- The depth measurement is most accurate when the compass shows that the pipeline is vertical and in the center of the compass, and the receiver is directly above the pipeline. The greater the horizontal deviation (the line is to the left or right of the compass), the greater the depth and the smaller the current. When the horizontal offset and tilt Angle are greater than the instrument set value, the depth and current display will disappear.
- If the signal amplitude displays the distortion words in addition to the percentage, such as "135% distortion!", indicating that the transmitted signal is too strong and the receiver is saturated with distortion. At this time, the depth measurement error will increase with the increase of the distortion degree. It is necessary to operate the



transmitter and press the  key to reduce the output level until the distortion is no longer indicated.

Fig.3-2-1 real time depth and current measurement

3.2.2 AVERAGE MEASUREMENT

- If the depth display is unstable due to various reasons, user can press the measurement key  to carry out continuous average measurement to get gradually stable and accurate measurement results.
- After pressing the measurement button , it enters the continuous average measurement mode. For example "[10] [0.9m] [20mA]" indicates that 10 average measurements have been conducted, with a depth of 0.9m and a current of 20mA. The maximum number of average measurements is 150 (1 minute), and the measurement will automatically end upon timeout. It can also exit the average measurement by short-pressing the measurement button at any time. If it has Bluetooth communication function, at this point, long-press the measurement button to send the measurement results via Bluetooth, as shown in the figure on the right:

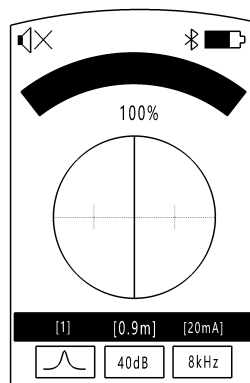


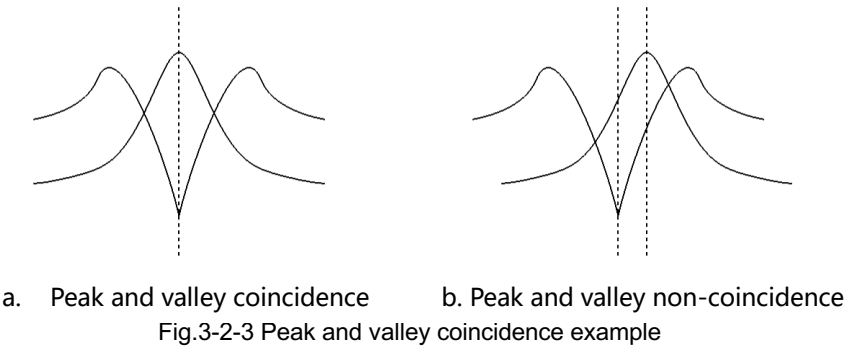
Fig.3-2-2 Average measurement depth and current measurement

3.2.3 ENHANCE MEASUREMENT RELIABILITY BY PEAK-VALLEY COINCIDENCE

Referring to the description of "precise positioning" in the previous section, if the peak and valley are judged to be coincident, the depth measurement directly above it is credible, otherwise it is not accurate (generally, the measurement is too large and the current is too

small).

The following figure is an example, the peaks and valleys in Figure A coincide, the depth measurement is reliable. If screen display similar as in the peaks and valleys in Figure B not coincide, then the depth measurement is not accurate.



3.2.4 WIDE PEAK 80% METHOD DEPTH MEASUREMENT

Using the wide peak method, find the point with the strongest signal on the pipeline, long press the gain + key, and the amplitude of automatic gain adjustment is 100%.

Using the wide peak method, locate the point with the strongest signal on the pipeline. Press the gain + key for a long time to automatically set the gain adjustment amplitude to 80%. Then move the receiver horizontally left and right to find the two points where the signal amplitude drops to 64%. The distance between these two points is equal to the depth of the pipeline. As shown in the figure as below

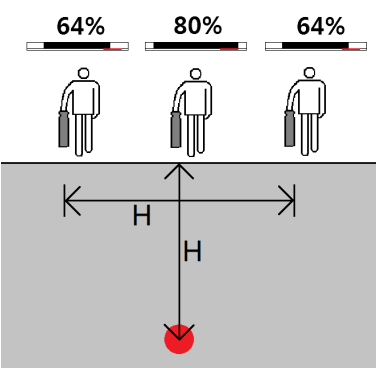


Fig.3-2-4 Wide peak 80% method depth measurement

3.2.5 NARROW PEAK 70% METHOD DEPTH MEASUREMENT

Using the narrow peak method, locate the point with the strongest signal on the pipeline. Press the gain + key for a long time to automatically set the gain adjustment amplitude to 80%. Then move the receiver horizontally left and right to find the two points where the signal amplitude drops to 56%. The distance between these two points is equal to the depth of the pipeline. As shown in the figure.

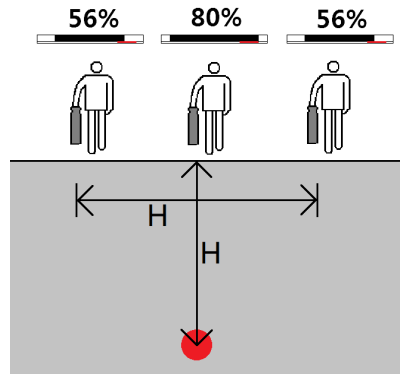


Fig.3-2-4 Narrow peak 70% method depth measurement

Advantages: Compared with the wide peak 80% method, the narrow peak 70% method has stronger anti-interference ability (especially in far-field interference).

Disadvantages: The wide peak 80% method has no theoretical error, while the theoretical error of the narrow peak 70% method increases with depth. When the depth is less than 2m, there is basically no theoretical error. After 2m, the theoretical error begins to increase. At 4.75m, the relative theoretical error is 5%, and at 8m, the theoretical error reaches 10%. The measured values are all larger than the actual values.

Note: The above statements, whether for the wide peak 80% method or the narrow peak 70% method, refer to the theoretical relative error under ideal conditions. However, in actual testing, additional errors will be introduced due to various reasons.

Recommendation: For shallow depths, use the narrow peak 70% method, as it has stronger anti-interference ability and can meet the accuracy requirements basically. But for large depths, be aware of the increase in error. It is recommended to conduct

cross-validation with other methods.

NOTE:



- Loudspeaker output will have slight interference to the real time depth measurement. So, if possible, please make it mute.
- Method to verify whether the depth value is reliable: measure the receiver close to the ground once, raise it by 0.5m (or 2ft) and measure it again, if the difference between the two-depth data is about 0.5m (2ft), the result is reliable.
- If use Radiation method, the accuracy will be lower than the Direct Connection method or Clamp Coupling method. If must use Radiation method the distance between the Transmitter and Receiver should be at least 20m.
- Try not to measure near the turn or T joint as possible, at least 5m far from it
- The measured depth refers to the distance between the bottom of the receiver and the center of the pipeline, while the depth at the top of the pipeline is less than the depth reading, and the difference is more obvious when the pipeline diameter is larger.
- It can help identify the target pipe by current value. In some cases, the parallel pipeline current is small but the depth is shallow, resulting in the adjacent line signal is larger than the target line signal, easy to cause error tracking. The current of the side-by-side lines is measured separately, and the line with the highest current (rather than the strongest signal) is the target line.
- It can help analyze the condition of the pipeline according to the change of the current value with distance. The transmitter applies a signal to the target pipeline. With the increase of distance, the current intensity will gradually decrease (gradually leaking back to the transmitter), and the attenuation degree is related to the type of pipeline and the soil quality. If the decay rate of the current remains stable without a sudden drop, the line is normal. If the current drop occurs, one case is that the pipeline has a tee (cable T connection) here, and the current is shunt; The other case is that the insulation is broken and grounded here.
- The current measurement is based on the correct depth measurement, if the depth

Attention!

In some strict pipeline exploration specifications, no matter what equipment is used, the results of automatic sounding are not accepted, so automatic sounding is convenient but can only be used as a reference. To obtain reliable sounding results, multiple methods are needed to cross-validate!

data is not trusted, the current value is not trusted

4. PASSIVE DETECTION

Passive (No source) detection does not require a transmitter to inject signal to the pipeline, but only uses a receiver to detect the pipeline using signals radiated by the pipeline itself.

4.1 ROUTE TRACING

4.1.1 SELECT THE FREQUENCY

Long press the frequency key  to switch to passive detection frequency. The following frequency bands are available for selection:

- Industrial frequency band: The fundamental wave (50Hz or 60Hz) and its 2nd and 5th harmonics. The 2nd harmonic is used for detecting the cathodic protection (CPS) current of pipelines under external influence.
- Radio frequency band: It is divided into three frequency bands: low, medium and high, ranging from 5 to 15kHz, 15 to 25kHz, and 25 to 40kHz respectively.

4.1.2 WORK MODE:

In passive mode, short press the mode key  to switch the mode. Both wide peak and narrow peak modes are supported.

It is recommended to use the narrow peak mode: In passive detection, the signal source is completely uncontrolled, the signal-to-noise ratio is relatively low, especially in the same frequency band, far-field interference may be quite severe. If the pipeline is mainly detected based on the signal amplitude, it is recommended to use the narrow peak mode

more frequently. To some extent, it can suppress far-field interference.

If needs to carefully detect whether there are underground pipelines in the current area without missing any, it is recommended that a grid search should be conducted in the area to be inspected after a rough detection, as shown in the figure.

When starting the scanning, it is suggested to first long-press the "Gain" key to set the signal amplitude to 40%. During the scanning process, if strong signal distortion is encountered, gradually reduce the gain to avoid missing any. Different pipelines may have significant differences in their radiation capabilities. After finding the pipeline with the strongest signal, the gain should be increased again for re-scanning. Known strong signal distortions can be ignored. Observe if there are weaker signal pipelines appearing to avoid missing any. Also, mark them on the ground in time.

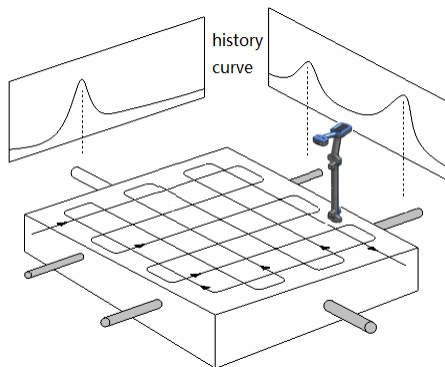


Fig.3-2-5 Scan demo

4.2 DEPTH MEASUREMENT

The measurement method is the same as that of active detection.

Attention!

- In passive sounding, no matter which method is used, the result cannot be very reliable.
- Wherever possible, use active sounding methods, such as caliper coupled injection signals.
- A variety of methods can be used for cross-validation.

5. NON-METALLIC PIPE DETECTION SONDE (OPTIONAL FUNCTION)

5.1 SIGNAL TRANSMITTING

The detection of non-metal pipes requires the use of the transmitting probe Sonde (optional) as the signal source, which is fixed at one end of the duct rodder and inserted into the pipe, as shown below:



Fig 5-1-1 Cable roller



5-1-2 sonde

An alternating magnetic dipole field is formed around the Sonde, similar to the shape of the Earth's magnetic field, as shown below. The receiver can locate the probe on the ground to determine the direction and depth of the pipe.

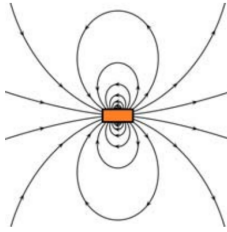


Fig 5-1-1 Dipole field illustration

The transmitting probe generally has the following three frequencies: 512Hz, 8kHz (8192Hz) and 33kHz (32768Hz), and a probe can only support one frequency, the most commonly used is 8kHz.

When in use, put the battery into the battery compartment, tighten the battery cover, and the Sonde will start to work. After the work is completed, remove the battery and store it separately.

5.2 SONDE POSITIONING

5.2.1 THE DETECTION PRINCIPLE

The Sonde emits an alternating magnetic dipole field in an underground tube, and there are three iconic locations on the ground: poles at the points where the two magnetic field lines vertical to the ground, and midlines where the magnetic field lines are horizontal to the ground. The Sonde can be positioned when three marker positions are found, as shown below:

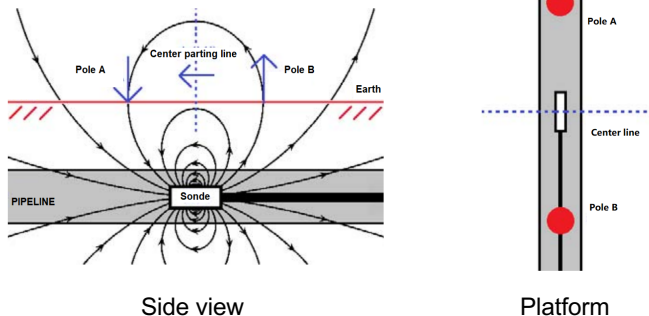


Fig. 5-2-1 Receiver mode and frequency selection

5.2.2 THE DETECTION PRINCIPLE

When positioning the pipeline probe, it is similar to the metal pipeline path detection. The receiver should be oriented towards the possible pipeline direction, as shown in the figure:

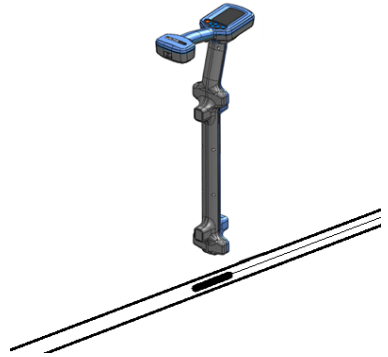


Fig. 5-2-2 Receiver direction

The receiver must press the mode key  for a long time to enter the sonde positioning mode.

The frequency of the receiver must be selected to be the same as the frequency of the transmitting probe. The supported selectable frequencies are: 512Hz, 8kHz or 33kHz.

5.2.3 SONDE DETECTION

Before pushing the Sonde into the pipeline, it should be verified that the Sonde is working properly: near the probe, the receiver should be able to collect a stable and strong signal. First push the Sonde into the pipeline about 5 meters, the receiver on the ground along the possible direction of the pipeline scanning, when located directly above the Sonde, the signal amplitude is strongest, deviating in any other direction, the signal is weakened. Continue to push the probe forward, constantly locate the position of the probe and make marks, and determine the pipeline path.

5.2.4 POSITION THE POLE POINT AND CENTER LINE

By looking for poles and center line, the sonde position can be more accurately located.

When approaching the sonde, the compass will display the pole or center line, the arrow in the center of the screen points in the direction of the pole, and move in this direction until the pole appears, as shown right:

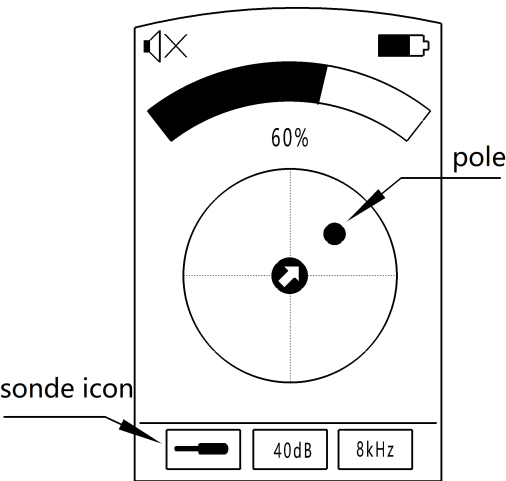


Fig. 5-2-3 find the pole

Move the receiver until the distance between the two parallel lines is minimal or even overlapping, and the line is horizontal. At this time, the center line is positioned and marked on the ground, as shown in the figure right.

The signal amplitude at the pole is very weak. The signal amplitude may increase or decrease as it moves along the pipeline path. A midline will appear when the signal amplitude becomes stronger.

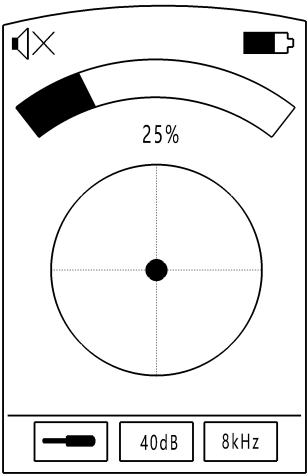


Fig. 5-2-4 pole position

If the midline does not appear continuously, try moving in another direction. After crossing the midline, the signal amplitude weakens again. Locate the second pole based on the arrow of the pole and mark it. Between the two poles, a median line will be displayed, as shown in the following figure:

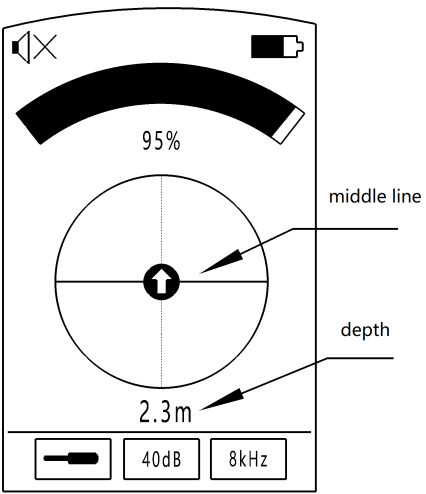


Fig. 5-2-5 fine the middle line

Move the receiver until the center line is centered and horizontal. Mark it on the ground. If the center line is basically equidistant from the two poles, it indicates that the probe is basically horizontal to the ground. Otherwise, it indicates that the probe is tilted. This could be caused by the pipeline's own tilt or by the probe tilting during the advancement in a horizontal pipeline. When the receiver determines that the center line spacing is small enough and basically horizontal, it automatically displays the depth, as shown in the figure above. If a more precise and stable depth value is needed, press the measurement key to perform continuous average measurement. The value with angle brackets below the real-time depth is the average depth.

Note: The depth measured by the probe method is only for reference. If excavation is required, it must be verified and confirmed.

6. BLUETOOTH TRANSMISSION FUNCTION (OPTIONAL)

6.1 BLUETOOTH INFORMATION

After the Bluetooth connection between the receiver and the upper computer is successful, the link sign will be displayed in the lower right corner of the screen, as shown in the figure on the below:

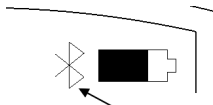


Fig.6-1-1 successful Bluetooth connection

If the Bluetooth communication module is not selected, or the connection is not successful, this symbol will not appear.

Detailed Bluetooth information can be accessed through the initial interface.

BT: PD_0834, 0000, 0425022707DF

The sequence is: Name, PIN, Mac, Connection Status:

- BT Name: Bluetooth Name: PD_0834. This name is associated with the unique identification code UID of the receiver. If the receiver's UID is 0834, then the Bluetooth name is PD_0834.
- PIN: Connection Password: 0000
- Mac Address: 04 25 02 27 07 DF

6.2 BLUETOOTH INFORMATION FOR FIELD OPERATION

After precisely locating the pipeline, briefly press the measurement button  to perform continuous average measurement to obtain more stable and accurate depth measurement data. Once the values stabilize, press the storage button  a long time. If the current Bluetooth connection is successful, the data will be simultaneously transmitted to the upper computer via Bluetooth. It can be combined with high-precision RTK to measure the position of the pipeline.

6.3 DATA FORMAT

For detailed transmission protocol, please contact the dealer.

7. MAINTENANCE AND WARRANTY

7.1 CHARGING

After each use, the manufacturer's special charger should be used as soon as possible to charge the battery of the equipment; If not used for a long time, charge the host every six months; Before use, please turn on the battery to check the battery voltage. When the battery energy is less than 30%, charge it before use. Charge must have a special care, fully charged to unplug the charger power in time, continuous charging does not exceed 8 hours; Do not charge in sub-zero temperatures.

In use, the battery level icon is displayed at the bottom left of the screen, the level of battery power in the green part of the icon, all green represents full power, all empty and blinking indicate that the battery is under voltage, the power is completely used up, and it will automatically shut down after a few seconds.

When it is necessary to charge, connect the AC plug of the charger to the AC220V/110V mains socket

In the off state, it takes about 3-4 hours for the transmitter to be fully charged from the undervoltage state. The receiver takes about 1.5-2 hours.

Depending on the use and maintenance conditions, the battery pack can generally carry

out 300-500 charge and discharge cycles. As the number of charge and discharge increases, the battery capacity will gradually decrease, and the working time of the instrument will be shortened accordingly. If it is too short to be acceptable, please contact the manufacturer/agent to replace the battery pack.

7.2 WARRANTY AND MAINTAIN

Device main unit and accessories are one year guarantee of free maintain, battery is one-year free replacement. Beyond one year, only charge for basic component cost for maintaining.

For device breakdown by incorrect using (in the warranty) or device quality problems over warranty, we are responsible for maintaining and only charge basic component cost.

When auto power-off, unable to power on or immediately shut after power on, it's possible because low battery. Charging first and again.

If other problems, don't to maintain by yourself, contact with us first.

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