Preface

Thank you for purchasing our underground pipe detector.

Using advanced cable testing technology, the design is lightweight and the appearance conforms to ergonomic principles.

Please read this manual carefully before use. The information in this manual was correct at the time of publication. Our company will continue to improve our products. The company reserves the right to make changes to its products.

Operators using this instrument must undergo strict safety and operation training. Only fully trained personnel should use this product.

Please contact our company or local agents to inquire about the latest product information and other product series.

Although the instrument has powerful functions and superior performance, it is always a tool to assist people in solving problems. It is impossible to directly tell people the specific locations of lines and faults. However, the operator can easily Judge and draw conclusions based on the various information reflected.

Our company will make unremitting efforts in product improvement and improvement, and continuously launch new products with more advanced technology, superior performance, and more complete functions, and provide you with a solid material foundation and strong technical support in the field of cable monitoring and testing. , and we hope that users can give us more valuable opinions.

In order to ensure safe and smooth use of this instrument and to maximize the function of the instrument, please read the user manual carefully before using the instrument.
Please do not operate without strict training.

Equipment Safety and Maintenance

Qualifications That Operators Should Have

Operators must receive professional training in the application of cable path detectors before use.

Safety Requirements For On-site Operations

- Strictly comply with the safety regulations of the company and the cable management department.
- Do not connect the transmitter to unknown conductors without authorization.
- Before connecting the wire to the transmitter, make sure that the ground pin is firmly inserted into the ground.
- After the transmitter is turned on, do not touch the ground pin or any non-insulated part of the clamp.
- Do not open the receiver or transmitter case without authorization.
- Please use this equipment in strict accordance with the operation manual in an environment where flammable and explosive substances are present.

Batteries And Charging

Both the transmitter and receiver are powered by lithium rechargeable batteries and are equipped with special chargers. When charging the rechargeable batteries of the receiver and transmitter, you must use the charger provided.

- If the use time of the rechargeable battery does not meet the expectation, please fully discharge it and then charge it continuously for 6 hours.
- If using 12V car power supply for charging, the car charger should be disconnected when parking.
- If you need to replace the rechargeable battery, please contact our company and replace the battery under the guidance of relevant company personnel.
- The battery cannot be disassembled. Do not dispose of batteries in fire.
- Regarding the disposal of used batteries, you must comply with relevant local regulations and do not discard used batteries at will.
- Please pay special attention: Batteries contain dangerous chemicals and are easily affected by water immersion or heating. They are flammable and explosive under certain environmental conditions and may also cause electric shock.

Equipment Maintenance

- Use the device strictly in accordance with the requirements of this user manual.
- Should be stored in a dry place and protected from high temperatures.
- Do not immerse any part of this equipment in water.

- If you do not use the device for a long time, be sure to charge it once within three months to avoid battery failure.

Precautions For Use

This device uses the electromagnetic field signal of underground cables to locate the cables and gives depth and current readings, thereby realizing the cable detection function. In most cases, the electromagnetic field signal from the cable is sufficient for the fiber optic cable route detector to correctly detect the exact location and depth of the underground cable.

- Please note: Interference factors in some special occasions may distort the electromagnetic field signal of the target cable, resulting in
- There are deviations or even errors in the detection data.
- During the detection process, please follow the correct operating methods learned in the training to analyze the data displayed by the receiver.
- Please note that the depth detected by the cable path detector refers to the depth of the center of the electromagnetic field, which is the center depth of the cable.

Specifications That The Equipment Complies With

USA

This device's transmitter and receiver comply with Part 15 of the FCC Rules:

CFR 47 Part 2: 2004

CFR 47 Part 15: 2006

ANSI C63.4: 2003

Europe

This equipment complies with the relevant provisions of European Directive 1999/5/EC:

ETSI EN 300 330-2:2006

ETSI EN 301 489-1:2005

ETSI EN 301 489-3: 2002

China

CJJ 61-2003 Technical regulations for urban underground cable detection

Transmitter Introduction

Basic Structure

Transmitter Instrument Panel And Function Introduction

The transmitter is a signal source that can emit sufficient power and is one of the cores of this set of instruments. It has complete functions, high degree of intelligence and simple operation.

Panel Introduction

Note: See the picture above

①On/off key ②Output port ③LCD display area ④Frequency composite key ⑤Power adjustment composite key ⑥Menu composite key

⑦Charging port

Function Introduction

①On/off key: This switch is a self-locking switch; press it to turn on the power, and the transmitter is in working state; pop it up to disconnect the power, and the transmitter is in shutdown state.

②Output port: This interface is a multi-core dedicated aviation socket; used to change the output mode of the signal. Connect the direct connection line to the direct connection mode; connect the coupling clamp connection to the coupling mode; do not connect the connection to the induction mode.

③LCD display area: displays the required basic information.

④  Frequency key: This key is a soft switch; each time you press it, you can change the frequency of the output signal; the initial power-on setting is 577Hz. Initially 8KHz in sensing mode. In the frequency setting menu interface, press this button to select or cancel the frequency covered by the light bar; in multi-frequency mode setting, press this button to choose to change the output frequency channel.

⑤  Power key: This key is an inching soft switch; each time you press it, you can change the output power, switching between low, medium, high, and full. The initial power-on setting is low; when in the frequency setting menu interface, press this button to flip up and down. Frequency menu; in multi-frequency mode setting, press

this key to select the output frequency.

⑥ 
Menu key: This key is an inching soft switch; press this key to cycle through the frequency setting menu, resistance measurement mode, and multi-frequency mode setting.

⑦ Charging port: This port is a Φ2.1 charging stand; it is used to connect a special charger to charge the battery.

Interface Introduction

Normal output interface (picture on the right):

Note: The illustration takes the direct connection mode as an example

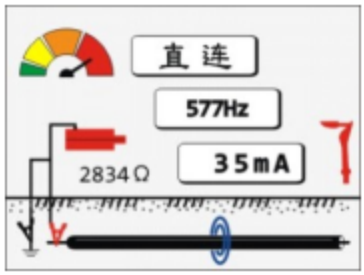
Frequency: Displays the current output frequency.

Power: Displays the current output power; it can display low, medium, high and full gears respectively.

Mode: Displays the current working mode; direct connection, coupling, and induction can be displayed respectively.

Current: Displays the current loop current value; the effective display is 0-999 mA.

Impedance: Displays the current loop impedance value; the effective display is 00001-20000 ohms.



Power: Prompts the current battery power; represented by the battery symbol, all black means full power, and the current power percentage is displayed on the left.

Matching Tips: When the ring at the bottom of the picture starts to scroll, it means that the transmitter is working stably.

Frequency Setting Menu Interface (picture on the right):

①: Display the page number of the frequency setting menu;

②: Current operating frequency;

③: ☐ Indicates that the current frequency is not selected;

◉ Indicates that the current frequency is selected;

Resistance Measurement Mode Menu Interface (right picture):

Features an ohmmeter to test the current external continuous resistance value.

Multi-frequency Mode Menu Interface (right picture):

Can output 3 different frequencies at the same time;

①: Currently adjustable frequency frame.

Transmitter Working Method

Working Principle

This instrument is a high-tech product designed based on the principle of reflection of electromagnetic waves during transmission and the principle of electromagnetic induction, combined with digital filtering, wireless reception, and software control.

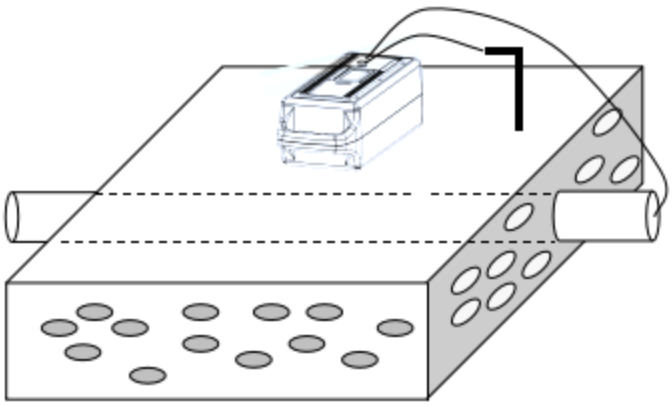
Electromagnetic induction: Its basic working principle is: the transmitter generates electrical and magnetic waves and transmits the signal to the underground cable to be detected through different transmission connection methods. After the underground cable senses the electromagnetic wave, an induction occurs on the surface of the underground cable. The current and induced current will propagate far along the cable. During the propagation of the current, electromagnetic waves will be radiated to the ground through the underground cable. In this way, when the underground cable detector receiver detects on the ground, Electromagnetic wave signals will be received on the ground directly above the underground cables, and the location and direction of the underground cables can be determined by changes in the strength of the received signals.

The conditions for the realization of this principle: first, there must be a signal source that can emit sufficient electrical energy to form a current in the line capable of transmitting electrical energy. During the flow of the current, a magnetic field is generated around the line; secondly, there must be a signal source that can receive this specific The magnetic field circuit displays the changing process of the magnetic field in the form of electrical signals.

Signal Output Mode - Transmitter Working Mode

The transmitter can output different AC signals, which can be applied to the target cable in three ways (direct connection, coupling, induction). To ensure reliable signal transmission on the target cable, there must be a reliable loop in the line. It can be an indirect loop composed of the earth, a capacitive loop composed of distributed capacitance formed between a long enough cable and the earth, or a direct loop composed of short circuit fault points between lines. Different circuits meet different tests

Direct Connection Method



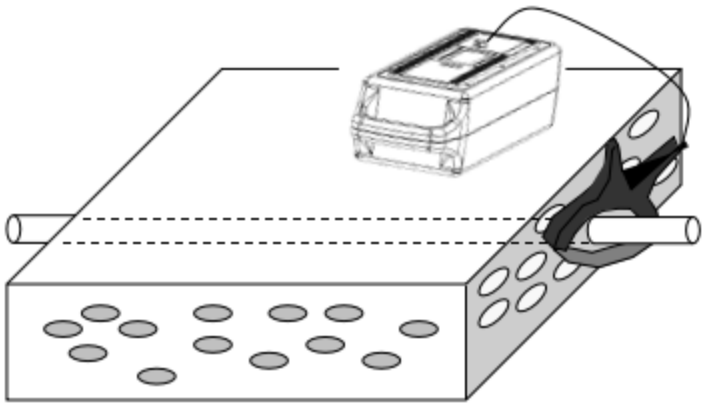
The signal from the transmitter is directly applied to the target cable (power outage cable) using a direct connection line that is, the direct connection method. The direct connection line is divided into red and black lines. The red line is connected to a certain line of the cable. The black line is the instrument working ground wire and should be grounded independently and reliably. In order to ensure reliable one-way transmission of signals in the line, it is required to disconnect at least one end of the ground wire of the target cable so that the signal can flow back through the earth in the form of an

indirect loop or a capacitive loop, as shown in the figure.

The direct connection method uses cables to directly transmit signals. The transmission process has small attenuation, strong signals, and long transmission distances. It is the best method for signal application. It is suitable for the transmission of any kind of signal and is the preferred method for testing.

Coupling Method

The signal from the transmitter is applied to the target cable using a coupling clamp, that is, the coupling method. In order to ensure that the coupled signal can be transmitted reliably in the line, the clamp must be completely closed, and both ends of the cable must have contact points related to the ground, as shown in the figure.



The strength of the cable coupling to the signal is directly related to the frequency of the signal. Low frequency coupling is weak, and high frequency coupling is strong. Sometimes it is also related to whether the line is running. At the same frequency, the signal coupled to the running cable is stronger than that of the non-running cable. Therefore, the coupling method is particularly suitable for live path measurement and live identification.

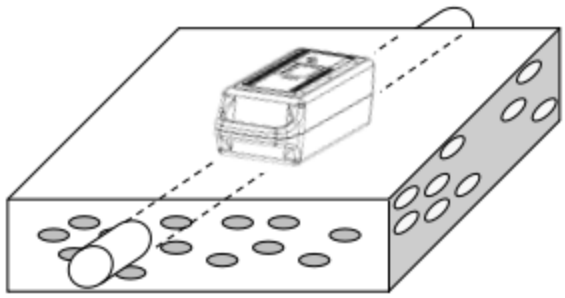
Induction Method

1. Sensing conditions

1) There must be a grounding point or a point related to the ground at both ends of the cable.

2) The placement of the transmitter requires that the induction test line must be consistent with the direction of the cable.

3) The burial depth cannot exceed 10 meters.



2. Induction signal application

Press the power switch of the transmitter, select 82KHz for frequency or 133KHz for full power. When the icon on the lower right side of the LCD appears, it means that the transmitter is working normally.

The transmitter is placed over a known point on the cable and the sensing test leads are aligned with the direction of the cable at this point.

Extension of Induction Detection —Blind Test

1. Blind test principle

Blind testing is a testing method that uses the induction mode of the instrument to detect unknown metal pipelines and various cables. It uses the built-in antenna of the transmitter to transmit 82KHz or 133KHz electromagnetic signals underground (and also into the air) in a

certain direction. When the electromagnetic signal hits the underground metal pipeline, the signal will be transmitted by the metal pipeline in the form of current. The pipeline radiates a secondary magnetic field. The receiver can receive this secondary magnetic field signal above the pipeline, which not only locates a point of the pipeline location, but connects the measured pipeline location points to determine the specific location and direction of the pipeline. , this is the principle of blind testing.

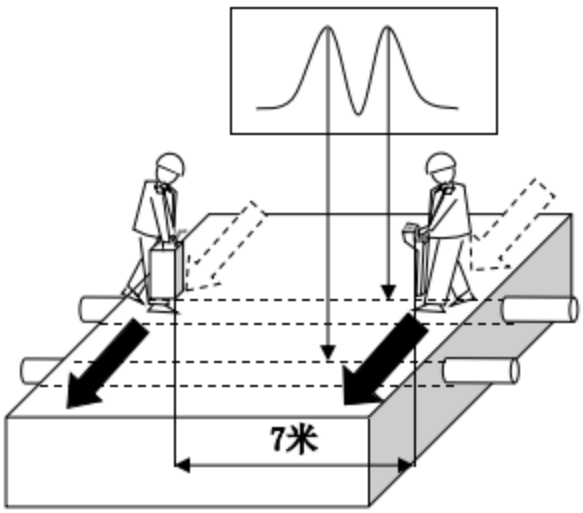
Blind testing using instrument induction method is an effective method of detecting pipelines, but it is also affected and restricted by factors such as the site environment, the material of the pipeline, and the depth of burial. Therefore, the surveying and mapping of an area must be combined with the site surroundings and existing drawings. data, surveys of local users, on-site observations and other means.

2. Blind test method:

1) Preparation before testing: Before blind testing, the receiver must be placed within a certain distance from the transmitter, usually between 5-10 meters, preferably around 7 meters. One person should carry the transmitter as close to the ground as possible (as close to the ground as possible). Do not connect any wires, turn on the transmitter, select 82KHz or 133KHz for frequency (133KHz is recommended), and select high power for power. Another person is holding the receiver, with the head pointing towards the panel (front) of the transmitter. The two machines are about 7 meters apart. At this time, turn on the receiver, select the frequency corresponding to the transmitter, and then adjust the gain to make the receiver as unaffected as possible by the magnetic field signal radiated by the transmitter in the air. Generally, reduce the gain (around 50DB) so that the receiver signal strength is displayed at Around 500, use this signal strength as the base, keep the gain unchanged, maintain this distance, and then conduct blind testing. (Note: The two machines are close to each other. The gain of the receiver drops very low, which reduces the detection depth and reduces the test blind zone. The distance between the two machines is far, and the receiver is far away. The gain of the receiver drops less, which can ensure the test depth, but The radiated secondary signal is weaker than the near point, and the blind area increases.)

a) Blind test method one: face-to-face test

(1) Operation: Based on the pre-test preparation, the two machines face each other and move in parallel. The moving speed cannot be fast but must be moved slowly so that the instrument has sufficient reaction time for the test. The transmitter is active and the receiver is passive. Always keep the head of the receiver pointed at the front of the transmitter and the two machines are consistent. When the receiver signal strength suddenly increases (the gain remains unchanged and is greater than the base determined before the test), it means that there is a metal pipeline between the transmitter and the receiver. At this time, you can lift the receiver up a little to see if the signal strength decreases, and stick it down to the ground to see if the signal strength increases. If so, it is definitely judged that there is a pipeline below. In



盲测示意图

this way, all metal pipelines perpendicular to the direction of movement (deviation angle is ± 10°) and within a depth of 2.5 meters can be measured. Once the known points are measured, the path of the metal pipeline can be measured using the induction method, and then By changing the moving direction, the pipeline perpendicular to the moving direction can be found. In this way, the pipelines in the working surface can be found out.

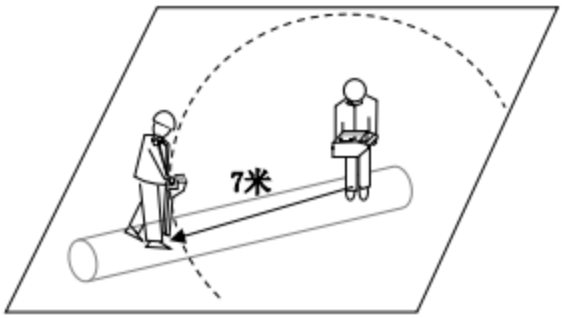
(2) Advantages: Fast testing speed

(3) Disadvantages: There is a blind spot on a test surface because the parallel movement cannot be divided into too thin angles and there are pipelines that suddenly turn.

(4) Features: This method is the fastest, most effective and most suitable for finding pipelines whose direction has been determined but whose specific location is not known.

a) Blind test method 2: point test

(1) Operation: Based on the pre-test preparations, the two machines face each other and keep a distance. One machine (transmitter) rotates on the human axis (center of the circle) at the measured point, and the other machine (receiver) rotates synchronously on the circle with a radius of about 7 meters away from the two machines (note: the two machines must rotate face to face, That is, the receiver head points to the front of the transmitter.). The rotation must be as slow as possible so that the instrument has enough time to respond and display. When moving to a certain position, the signal strength of the receiver suddenly increases (the gain remains unchanged and is greater than the base set before the measurement), indicating that there are metal pipelines between this point on the circumference and the center of the circle. At this time, you can lift the receiver up a little to see if the signal weakens, and then stick it down to the ground to see if the signal strengthens. If so, it is definitely judged that there is a pipeline below. By rotating in this way, the pipeline passing through the measured point (R≤0.5 meters) and buried within 2.5 meters can be measured. (Suggestion: During the rotation process, the instrument on the circumference is the active one, and the instrument on the center of the measured point is the passive one, and they rotate face to face synchronously. Because the rotation amount on the circumference is large and the rotation at the center of the circle is very small, the axis rotates with the human being). After measuring the two known points of the pipeline, the path of the pipeline can be measured using induction.



盲测-点测示意图

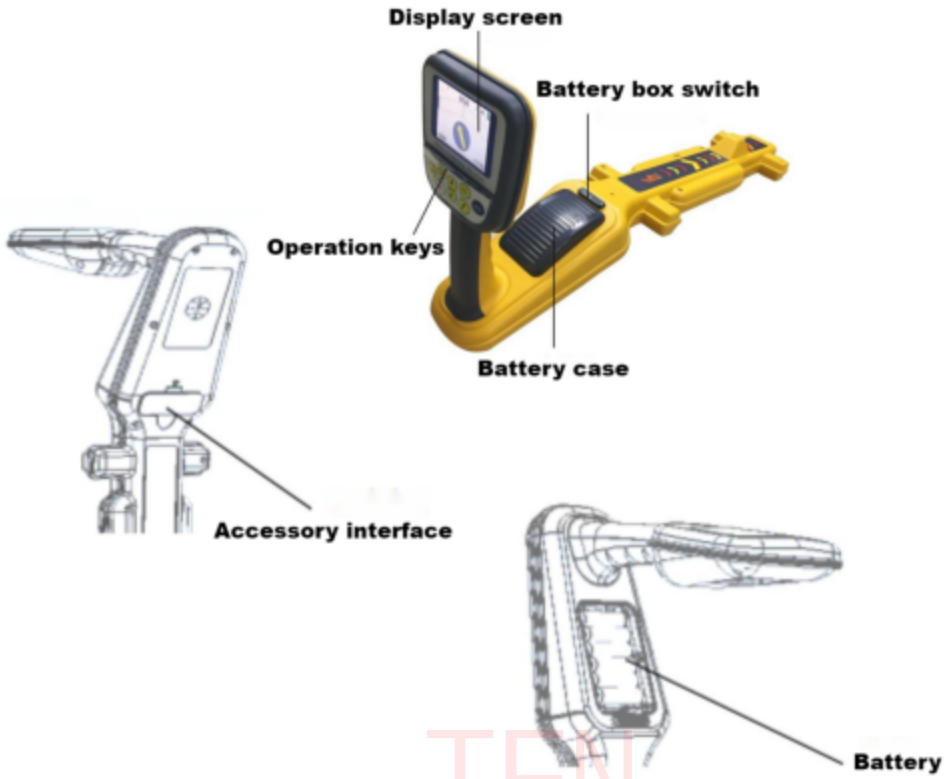
(2) Advantages: For a certain point, the test speed is fast and accurate, and there are no blind spots.

(3) Disadvantages: The test area is small, less than R=0.5 meters.

(4) Features: Most suitable for testing point-shaped working surfaces.

Receiver Introduction

Basic Structure:



Receiver Panel And Function Introduction

A receiver is an integration of system circuits that can receive a specific magnetic field, convert it into an electrical signal, display it, and prompt the operator. It is the second core of this set of instruments. It is fully functional, highly intelligent, portable, lightweight and easy to operate. Optional external devices extend its functionality.

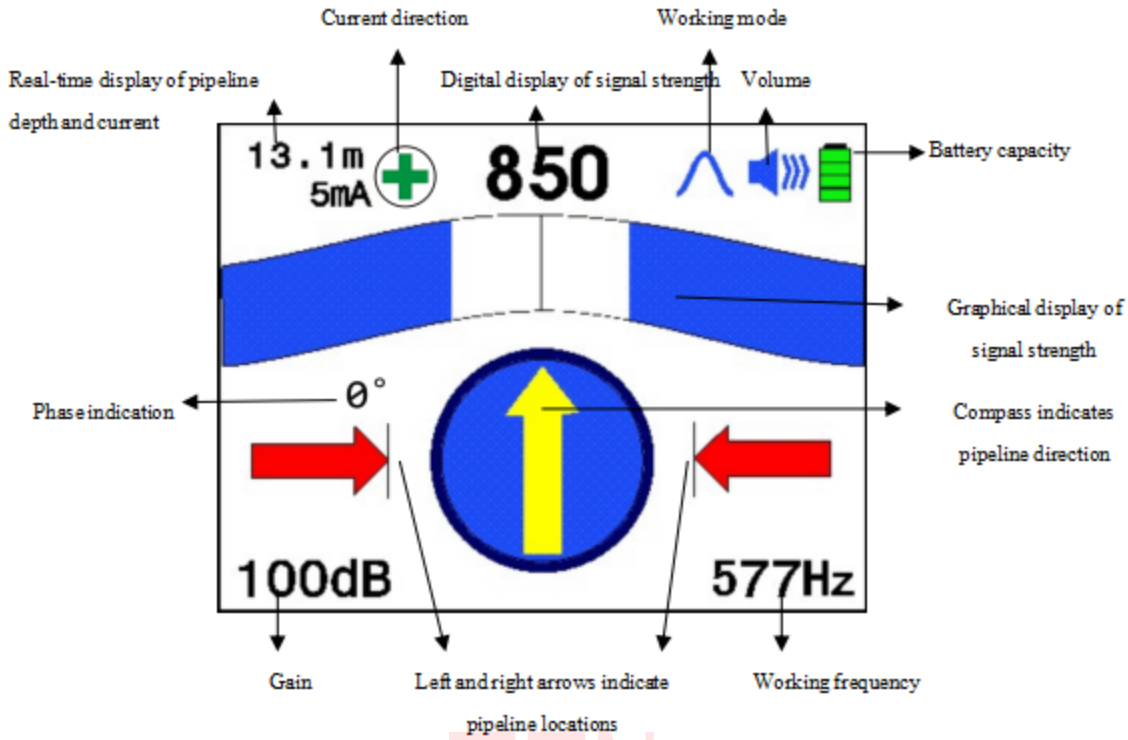
Panel Introduction

Note: See the picture below

Receiver Panel Diagram

Receiver Introduction

Introduction To Interface Display Content Function



Receiver wide peak arrow mode interface

Frequency: Displays the current receiving frequency value; the initial power-on value is 577Hz.

Grating: The length of the grating indicates the signal strength; the grating moves from both sides to the middle, and a full grating indicates that the signal is too strong or out of range.

Three digits: The size of the number indicates the signal strength; the valid range is 00.0-99.9. When 99.9 is displayed, the signal is too strong and out of range.

Color compass: indicates the direction of the pipeline.

Depth & Current: Indicates the depth of the measured underground pipeline and the current on the pipeline.

Gain: Indicates the amplification factor of the signal currently processed by the receiver, with a dynamic range of 000-140db; automatically adjusted by default. The initial power-on value is 60db.

Mode: Indicates the way the receiver receives signals, displayed separately:narrow peak, broad peak, trough, broad peak arrow, crest + trough, External devices; There is a broad peak at startup. Can automatically identify external devices.

Power: Prompts the current battery power; represented by the battery symbol.

Volume: Indicates the current working status of the buzzer, represented by a horn symbol plus a line. One line indicates low loudness, two lines indicate medium loudness, three lines indicates high loudness, and a cross indicates turning off the buzzer. The buzzer is turned off initially upon

startup.

Left and right arrows: Arrows will automatically appear if you deviate from the cable indicates cable location; shown above cables two arrows.

Current direction: When using SS frequency, this function can display the direction of signal current to assist the operator in path finding.

Phase indication: When using SS frequencies, the receiver will display the phase of the signal. Long press the frequency key to clear the phase.

Introduction To Keypad Content And Functions

Frequency key: This key is a soft switch; each press can change the frequency of the received signal, and the multiple frequencies selected by the user are cycled through; 9 frequencies are selected by default at startup, namely 50Hz, 60Hz, LF, SSLOW, SSHIGH, 577Hz, 8KHz, 33KHz, 82KHz, 133KHz, initially 577Hz.

Mode key: This key is a soft switch; each press can change the way of receiving signals, from narrow peak to, broad peak, trough, broad peak arrow, crest + trough cycle selection

Gain key: This key is a two-touch soft switch. The upward arrow indicates that the gain can be increased, and the downward arrow indicates that the gain can be reduced. When the signal is less than 10.0, press the increase gain key once to adjust the signal strength to about 60.0. When the signal When it is greater than 88.0, press the gain reduction key once to adjust the signal strength to about 60.0. When the signal strength is between 10.0 and 88.0, press the increase or decrease key once to increase or decrease the gain by one dB.

External mode switching key: In external mode, press this key to switch between fault location mode and identification mode.

Receiver Introduction

Backlight key: Press this button to adjust the brightness of the LCD backlight, which is divided into 5 levels and can be adjusted cyclically.

Volume key: This key is an inching soft switch. Each time you press it, you can change the buzzer loudness. You can cycle through high loudness, medium loudness, low loudness, and off the buzzer. The buzzer is turned off initially upon startup.

On/off key: This switch is a soft switch; press it once to turn on the power, and the receiver is in working state; press it again to disconnect the power, and the receiver is in shutdown state.

Receiver characteristics

1) Cable positioning: Select the wave crest method and use parallel antenna positioning to quickly track the target cable. When above the cable, the signal is the largest and decreases on both sides. Choose the valley method and use vertical antenna positioning. When there are no adjacent cables and interference sources, the positioning is more accurate and reliable. When the receiver is above the cable, the signal is the smallest and the signals on both sides are large.

2) Depth measurement: In direct connection mode, measure depth directly. Place the receiver directly above the pipeline and keep the instrument body still when the compass indicates the direction pointing straight ahead. The real-time depth measurement value is displayed in the upper left corner.

Sound Prompt

A great feature of this instrument is the sound prompt, which can reduce the operator's eye fatigue when working for a long time and make the detection work simpler and clearer. The volume of sound emitted by the receiver is directly proportional to the strength of the received signal. Under unified gain, when the sound emitted by the receiver is loud and rapid, it means the received signal is strong, otherwise it means the received signal is weak. When the receiver is in the crest method, the sound is loudest and rapid just above the cable, and the sound on both sides is small and sparse. When the receiver is in the valley method, the sound is the smallest and sparsest directly above the pipeline, and the sound on both sides is loud and compact.

Receiver

Working Method

Working Principle

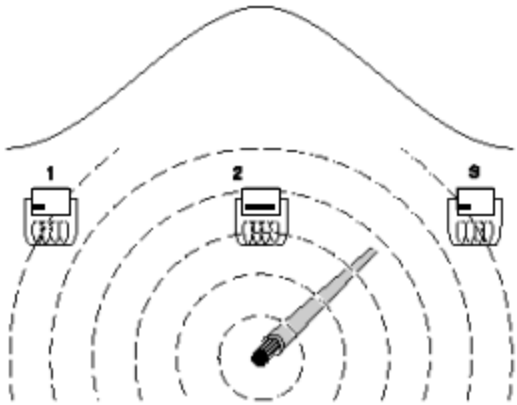
When a signal is applied to the cable, there is a current on the cable, and the current generates a magnetic field that radiates around the cable. The frequency of the magnetic field is consistent with the frequency of the applied signal. The intensity is radiated outward with the cable as the center of the circle, and the direction is the tangent direction of a certain point on the radiation circle.

The receiver receives the magnetic field signal or leaked electric field signal radiated by the cable through the internal antenna or external input device respectively. It can process it in two different working modes and notify the operator of the signal strength changes.

Signal Reception Mode - Receiver Working Mode

Crest method (narrow peak、broad peak、broad peak arrow、peak + trough)

The signal measured by the receiver is the strongest directly above the cable transmitting a certain signal; the signal measured by the receiver moving left and right on the same plane will then attenuate, so it is named the crest method. In fact, it uses the horizontal antenna in the receiver to induce magnetic field signals.



Principle diagram of wave crest method

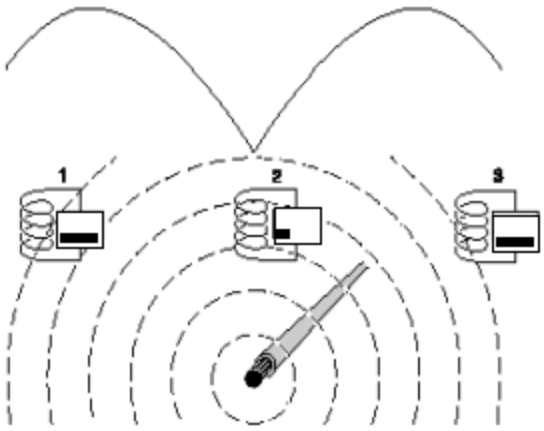
When the horizontal magnetic field passes through the horizontal antenna, an induced current is generated in the coil. The magnitude of the induced current changes with the amount of magnetic field (magnetic flux) passing through the horizontal antenna. The magnetic field passing through the horizontal antenna only when it is directly above the cable is the most (the largest magnetic flux), that is, the signal measured by the receiver is the strongest. as the picture shows:

The wave crest method is suitable for path detection, depth testing, fault prediction, etc.

Trough method (Trough)

Directly above the cable transmitting a certain signal, the signal measured by the receiver is the weakest. If the signal measured by the receiver is moved left and right on the same plane, the signal will be strengthened immediately, which is opposite to the crest, so it is named the trough method. In fact, it uses the vertical antenna in the receiver to induce magnetic field signals.

When the magnetic field in the vertical direction passes through the vertical antenna, an induced current is generated in the coil. The magnitude of the induced current changes with the amount of the



Principle diagram of trough method

magnetic field (magnetic flux) passing through the vertical antenna. It only passes through the vertical antenna when it is directly above the cable or far away from the cable. The magnetic field is the smallest (the magnetic flux is the smallest), which means the signal measured by the receiver is the weakest.

Because the signals above the cable and away from the cable are weak, the trough method is designed with an azimuth indicator on the display; it is suitable for path verification and 45 ° method sounding.

Path Detection

The detection path is one of the main functions of this instrument. Different signal application methods can be used at different sites. The priority of selection is: direct connection, coupling, induction. Signal reception and detection are not affected by the way the signal is applied, and the operations are the same.

Direct Connection Method Detection Path

1. Direct connection conditions:

1) It must be a power outage cable.

2) Know at least one end of the cable and isolate the known end from the system, including neutral and ground wires.

2. Signal application: (transmitter)

1) The multi-core aviation head of the direct connection line is connected to the multi-core aviation seat (output port) of the transmitter.

2) Connect the red clip to a certain phase of the cable under test; if conditions are met, the other end of this phase can be grounded. (Forming an indirect loop) The effect is better.

3) The black clip is the working ground of the transmitter. The principle of selecting the grounding point is not to allow the return signal to flow back from this cable, so as to minimize the impact of the return signal on the test. Generally, it is required to make a separate grounding electrode. The method is to insert the ground solder away from the cable into the moist soil. When the cable is completely separated from the system, the grounding point can be selected as the system ground.

4) After connecting the wires, press the power switch and the transmitter will start working; if the instrument is turned on when not connected, after connecting the wires, press the power button and the transmitter will start working. Automatically detect the loop impedance to ensure working in the best matching output state. When the concentric circle icon in the lower right area of the LCD starts to move, it indicates that the transmitter is working stably. At this time, observe the loop impedance value. Generally, 1-3000 Ω is suitable. If it exceeds 3000 Ω, it means that the impedance is too large and the signal in the line is very weak. Adjustments and improvements should be made from the following three aspects.

First, improve the grounding condition of the grounding electrode, humidify or change the grounding of the system.

Second, connect the phase of the cable to which the signal is applied to ground at the other end.

Third, adjust the frequency from 577Hz at startup to 82KHz.

5) The power is low when it is turned on. For direct connection detection, the power level can be selected according to the situation.

3. Signal search and tracking. (receiver)

1) Hold the handle of the receiver, relax your wrists and arms, and let the body droop naturally. Use your thumb to operate the buttons and stay a certain distance away from the signal application point. The purpose is to avoid the grounding pole and ground wire, and avoid obstacles such as power distribution cabinets and buildings.

2) Press the power switch, select the peak mode (the initial power-on mode is peak, ∧ you don't need to select it again) and the frequency corresponds to the transmitter, face the signal

application point, and the machine head points to the beginning of the cable. and search for signals around the starting point. The initial gain at startup is 60dB. At this gain, if a three-digit signal is found and displays 99.9, indicating that the grating is full, the gain will be reduced so that the digital display is around 75.0. At this time, keep the gain unchanged and continue searching. If the three-digit number displays 99.9 again, it means that the signal here is stronger than the last time you searched. Reduce the gain again so that the digital display reaches around 75.0 again. Search in this way for a circle, and finally determine the minimum The gain is a point below the location of the cable where the strongest signal is. This process is to search for the secondary magnetic field radiated by the cable transmitting the applied signal, and eliminate the secondary magnetic field caused by the ground wire string interfering with non-target cables.

3) Keep the current gain unchanged, and use the currently received signal strength as the reference (three-digit value) to rotate the receiver around the axis of this point. The received signal will weaken with the rotation. When it is reduced to the weakest, The direction of the machine head is at an angle of 90° to the direction of the cable at that point. Continue to rotate the receiver, and the received signal will increase with the rotation. When the intensity is the same as the reference value, the direction of the machine head is the path direction of the cable, and the strongest signal will be tracked forward along the direction of the machine head. The exact path of the cable is detected. This process is the tracking of the signal, and the path is also detected.

Coupling Method Detection Path

1. Coupling conditions

1) Cables must have known exposure points.

2) There must be a grounding point or a point related to the ground at both ends of the cable.

3) The coupling position should be as far away from the terminal as possible, and do not get the ground wire stuck in the clamp.

4) The coupling effect of running cables is better than that of non-running cables, and running cables can block phase line coupling and signals.

2. Coupling signal application (transmitter)

1) The four-core aviation head of the coupling clamp is connected to the four-core aviation seat on the clamp body, and the multi-core aviation head is connected to the multi-core aviation seat of the transmitter to complete the connection between the coupling clamp and the transmitter.

2) Place the coupling clamp on the exposed point of the cable under test. This point is the signal application point. Note that the clamp must be closed.

3) Press the power switch and select the appropriate frequency and power. It is recommended to select 82KHz for the frequency and high-end power. When the concentric circle icon in the lower right area of the LCD starts to move, it indicates that the transmitter is working stably.

3. Signal search and tracking (receiver)

It is exactly the same as the previous section, signal search and tracking.

Radiation Induction Method Detection Path. (It is known that the cable is buried at a certain point and the direction of this point is known)

1. Sensing conditions

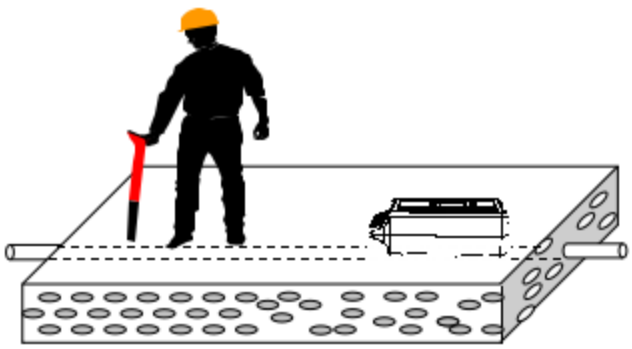
1) There must be a grounding point or a point related to the ground at both ends of the cable.

2) The placement of the transmitter requires that the induction test line must be consistent with the direction of the cable.

3) The burial depth cannot be greater than 10 meters.

2. Induction signal application

Press the power switch of the transmitter, select 82KHz for frequency or 133KHz for high power. When the icon in the upper right corner of the LCD starts to move, it means the transmitter is working normally.



The transmitter is placed over a known point on the cable and the sensing test leads are aligned with the direction of the cable at this point.

3. Signal search and tracking (receiver)

Consistent with direct connection method

Extension Of Radiation Induction Detection —Blind Test

a. Blind test principle

Blind testing is a testing method that uses the induction mode of the instrument to detect unknown metal pipelines and various cables. It uses the built-in antenna of the transmitter to

transmit 82KHz or 133KHz electromagnetic signals underground (and also into the air) in a certain direction. When the electromagnetic signal hits the underground metal pipeline, the signal will be transmitted by the metal pipeline in the form of current. The pipeline radiates a secondary magnetic field. The receiver can receive this secondary magnetic field signal above the pipeline, which not only locates a point of the pipeline location, but connects the measured pipeline location points to determine the specific location and direction of the pipeline. , this is the principle of blind testing.

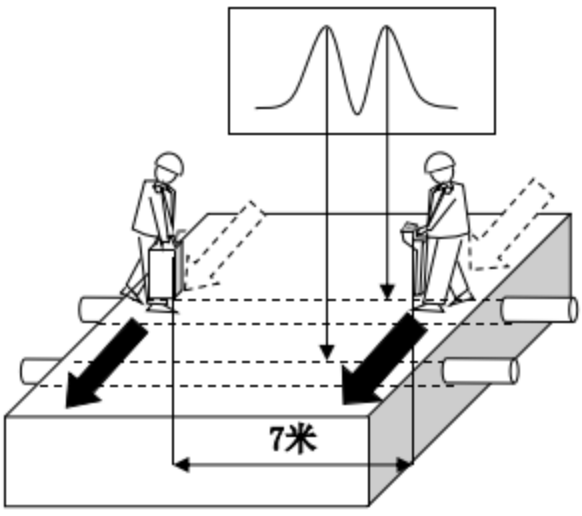
Blind testing using instrument induction method is an effective method of detecting pipelines, but it is also affected and restricted by factors such as the site environment, the material of the pipeline, and the depth of burial. Therefore, the surveying and mapping of an area must be combined with the site surroundings and existing drawings. data, surveys of local users, on-site observations and other means.

b. Blind test method:

1) Preparation before testing: Before blind testing, the receiver must be placed within a certain distance from the transmitter, usually between 5-10 meters, preferably around 7 meters. One person should carry the transmitter as close to the ground as possible (as close to the ground as possible). Do not connect any wires, turn on the transmitter, select 82KHz or 133KHz for frequency (133KHz is recommended), and select high power for power. Another person is holding the receiver, with the head pointing towards the panel (front) of the transmitter. The two machines are about 7 meters apart. At this time, turn on the receiver, select the frequency corresponding to the transmitter, and then adjust the gain to make the receiver as unaffected as possible by the magnetic field signal radiated by the transmitter in the air. Generally, reduce the gain (around 50DB) so that the receiver signal strength is displayed at Around 500, use this signal strength as the base, keep the gain unchanged, maintain this distance, and then conduct blind testing. (Note: The two machines are close to each other. The gain of the receiver drops very low, which reduces the detection depth and reduces the test blind zone. The distance between the two machines is far, and the receiver is far away. The gain of the receiver drops less, which can ensure the test depth, but The radiated secondary signal is weaker than the near point, and the blind area increases.)

c. Blind test method one: face-to-face test

(1) Operation: Based on the pre-test preparation, the two machines face each other and move in parallel. The moving speed cannot be fast but must be moved slowly so that the instrument has sufficient reaction time for the test. The transmitter is active and the receiver is passive. Always keep the head of the receiver pointed at the front of the transmitter and the two machines are consistent. When the receiver signal strength suddenly increases (the gain remains unchanged and is greater than the base determined before the test), it means that there is a metal pipeline between the transmitter and the receiver. At this time, you can lift the receiver up a little to see if the signal strength decreases, and stick it down to the ground to see if the signal strength increases. If so, it is



盲测示意图

definitely judged that there is a pipeline below. In this way, all metal pipelines perpendicular to the direction of movement (deviation angle is ±10°) and within a depth of 2.5 meters can be measured. Once the known points are measured, the path of the metal pipeline can be measured using the induction method, and then By changing the moving direction, the pipeline perpendicular to the moving direction can be found. In this way, the pipelines in the working surface can be found out.

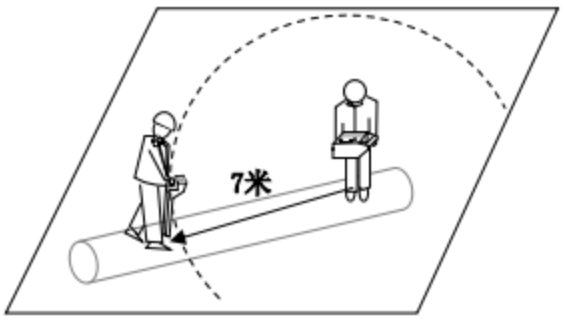
(2) Advantages: Fast testing speed

(3) Disadvantages: There is a blind spot on a test surface because the parallel movement cannot be divided into too thin angles and there are pipelines that suddenly turn.

(4) Features: This method is the fastest, most effective and most suitable for finding pipelines whose direction has been determined but whose specific location is not known.

d.Blind test method two: point test

(1) Operation: Based on the pre-test preparations, the two machines face each other and keep a distance. One machine (transmitter) rotates on the human axis (center of the circle) at the measured point, and the other machine (receiver) rotates synchronously on the circle with a radius of about 7 meters away from the two machines (note: the two machines must rotate face to face, That is, the receiver head points to the front of the transmitter.). The rotation must be as slow as possible so that the instrument has enough time to respond and display. When moving to a certain position, the signal strength of the receiver suddenly increases (the gain remains unchanged and is greater than the base set before the measurement), indicating that there are metal pipelines between this point on the circumference and the center of the circle. At this time, you can lift the receiver up a little to see if the signal weakens, and then stick it down to the ground to see if the signal strengthens. If so, it is definitely judged that there is a pipeline below. By rotating in this way, the pipeline passing through the measured point (R≤0.5 meters) and buried within 2.5 meters can be measured. (Suggestion: During the rotation process, the instrument on the circumference is the active one, and the instrument on the center of the measured point is the passive one, and they rotate face to face synchronously. Because the rotation amount on the circumference is large and the rotation at the center of the circle is very small, the axis rotates with the human being). After measuring the two known points of the pipeline, the path of the pipeline can be measured using induction.



盲测-点测示意图

(2) Advantages: For a certain point, the test speed is fast and accurate, and there are no blind spots.

(3) Disadvantages: The test area is small, less than R=0.5 meters.

(4) Features: Most suitable for testing point-shaped working surfaces.

Depth Test

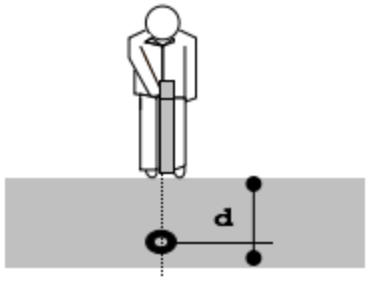
The depth test is completed synchronously in the path detection state. The specific operations are as follows:

Direct reading depth

1) Place the receiver directly above the cable, point the machine head in the direction of the

cable path, and keep the machine stable; observe that the signal is stable, and the compass pointing display is centered. The upper left corner of the instrument can display depth (unit m) and current (unit mA) in real time.

2) When measuring depth, do not test at turns, ups and downs, or fault points. This may cause excessive depth measurement errors or test failure.



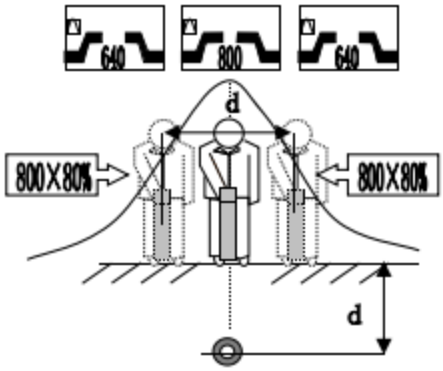
Direct reading depth diagram

80% method depth sounding

1) The receiver is placed directly above the cable, and the machine head points to the same path as the cable, keeping the machine stable and motionless;

2) Adjust the gain so that the three-digit value is displayed between 70.0-90.0, for example, the current display is 85.0.

3) Take the currently displayed value as the base and multiply it by 0.8 to get a new value, such as 85.0 × 0.8=68.0. This value is not displayed on the LCD, but is remembered in the author's mind.



80%测深示意图

4) At this time, the receiver maintains the same horizontal position along the direction perpendicular to the path, and moves once to the left and right. Each time it moves to the three-digit value of the LCD, it stops moving when it reaches the value in mind, such as 68.0, and writes down these two times. The moving position point.

5) Use a ruler or visually measure the distance between these two points, which is the burial depth of the cable.

Cable Identification

The principle of cable identification is the same as the path test, and the signal application is the same as the path test. It uses an external coupling clamp of the receiver to detect the signal at the exposed point of the cable to achieve point-to-point detection, so it is called cable identification.

Power Outage Cable Identification (Direct connection to apply signal)

1. Test conditions

1) It must be a power outage cable, and the power discharge must be checked before testing.

2) Untie at least one end of the ground wire (neutral wire, ground wire, armored shielded ground wire)

2. Signal application

1) The multi-core aviation head of the direct connection line is connected to the multi-core aviation seat (output port) of the transmitter.

2) The red clip is connected to a good phase of the cable under test; the other end of this phase is reliably grounded (to prevent the middle phase sequence from being disordered, the end core can be short-circuited to ground).

3) The black clip is connected to the system ground (system ground bar or special grounding solder)

4) After connecting the wires, press the power switch, select SSlow for frequency and full for power. Wait for the transmitter to output stably and observe the ring resistance value displayed on the screen. If the ring resistance is too large, check the cause and improve it (1. Is the black clip grounded well? 2. Is the end core grounded well? 3. Is the test terminal core and the terminal ground core in the same phase)

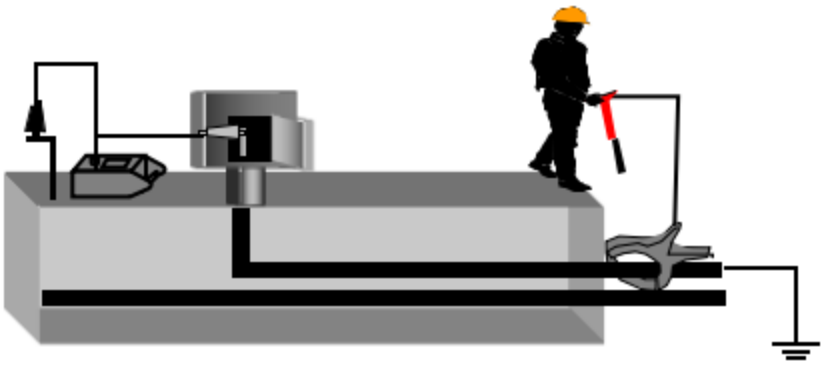
3. Signal calibration

1) Use a cable with four-core aviation connectors at both ends to connect the coupling clamp to the receiver.

2) Press the power button once and the receiver will automatically enter the external device mode. , Press the button to switch the external mode to the caliper recognition mode. The frequency selection SSlow is consistent with the transmitter.

3) To calibrate the reference signal, use a coupling clamp to clamp (cover) the red line of the direct connection line or clamp (cover) the cable head. Note that after the clamp is placed on the cable, the aviation socket is toward the end of the cable. Press and hold the button for three seconds. The upper left corner of the receiver appears , the phase angle displays about 0 degrees, and the reference signal calibration is completed. Adjust the gain to keep the signal value around 800.

4) Keep the receiver powered on to the location to be identified, and use coupling pliers to clamp (cover) the exposed cables one by one. Note that after the clamps are placed on the cables, the aviation socket is toward the end along the cable. Connect a cable and observe the phase symbol displayed in the upper left corner. If it is displayed , it means that the cable is the target cable. If it is displayed , it means that it is not the target cable. If the phase symbol is not displayed, the signal value is very small, which means that it is not the target cable. All cables at the test point must be tested one by one to find the only target cable.

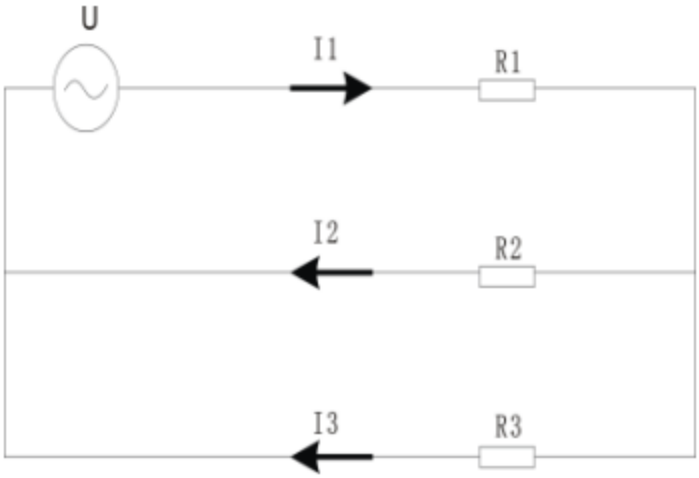


★ **Special note: If you need to saw the cable later, be sure to use a special power outage identification device to confirm before sawing, and prick it with a thorn device to ensure safety before operating.**

Current Direction Function

This product supports current direction and phase indication functions. It has unique technology that can display the current direction and phase of the tracking signal, effectively improving the accuracy of finding the path. For forward cables, the receiver will clearly indicate the positive sign and display the phase value from -45° to +45°; for the reverse return signal, the receiver will clearly indicate the negative sign and display the phase value from -135° to 225°. value.

This technology solves the problem of cross signals in traditional path search. There are two main reasons for the string signal. One is that the adjacent cables are too close, and the transmitter current is directly coupled to the adjacent cables due to the parasitic capacitance, causing an artifact during path search; the other reason is that two parallel cables The end armors are all grounded, causing reverse return signals on non-target cables. Both of these problems can be perfectly solved using current direction technology.



To use this function, first connect the transmitter directly to the armor of the target cable. When the ring resistance is small, the coupling application method can also be tried. Apply the signal correctly, select SS Low or SS High frequency for both transmitter and receiver, and the receiver will display current direction indication and phase indication.

Common Problem

Press and hold the frequency key directly above the known target cable to clear the phase, and then perform path search normally.

Keep the receiver head direction always pointing to the far end. For the target cable, the phase value will not have a sudden change and should be within the range of -45° to 45°, and indicate  . The phase on the adjacent return cable will be in the range -135° to 225° and will be displayed  . By always following the cable path showing the positive sign, the operator can greatly improve the accuracy of path finding.

Daily Maintenance

The equipment should be stored in a dry and room-temperature environment and charged regularly, usually once every three months, with a charging time of 8-12 hours.

The equipment should avoid long-term exposure to sunlight and long-term use at low temperatures (below -10° C). Otherwise, the LCD will be damaged and the casing will age.

Try to avoid using it on rainy days. If it cannot be avoided, please be prepared to prevent rain and moisture. Once the instrument is exposed to rain and moisture, remove the water and moisture as soon as possible, otherwise it will cause damage to the instrument.

If you find any abnormalities with the instrument during use, please contact the manufacturer in time to avoid affecting use and delaying work.

Charge Correctly

Connect the charger to the AC 220 V 50HZ mains power supply. The charger indicator light is on (green). Then insert the charging head into the charging base of the instrument (the host being charged is in the shutdown state). At this time, the charger indicator light turns red, indicating that the system is charging normally. After a period of time, the charging indicator light changes from red to green. This does not mean that the battery is fully charged. It just means that the charger changes from a high-current fast charging state to a low-current slow charging state. As long as the charging time reaches 8-12 hours, Can. If the charger indicator light remains red after the transmitter charging head is inserted into the charging base of the host (the host being charged is in the off state), and there is no display when the power is turned on, it means that the battery inside the machine is loose or has poor contact. At this time, open the battery cover and remove the battery. Just install it.

Instrument Self-test

Panel button check

1. Transmitter: Function introduction and operation of each key are normal.
2. Receiver: Function introduction and operation of each key are normal.

Working status check

1. Mutual inspection of signal output and reception

Insert the multi-core aviation head of the direct-connect cable into the multi-core aviation seat of the transmitter. Separate the wires straightly and short-circuit the two clips. Press the power switch of the transmitter and the impedance will display 1 Ω. The icon rotates.

The handheld receiver is located near the direct line. Press the power switch of the receiver, set

the receiver to the same frequency and select the wave peak method. After a few seconds, the receiver will work stably and receive the signal on the direct line and display it. The signal display of the mobile receiver will change. The signal is the largest and the sound is the most compact when the receiver head is pointed at the transmitter. It means that the transmitter and receiver are working normally.

2. Inspection of coupling clamp

The coupling clamp is connected to the transmitter. Press the power switch of the transmitter, the concentric circle icon will appear, and you will hear the sound of the coupling clamp (most obvious at 577Hz). It means that the coupling clamp is working properly.