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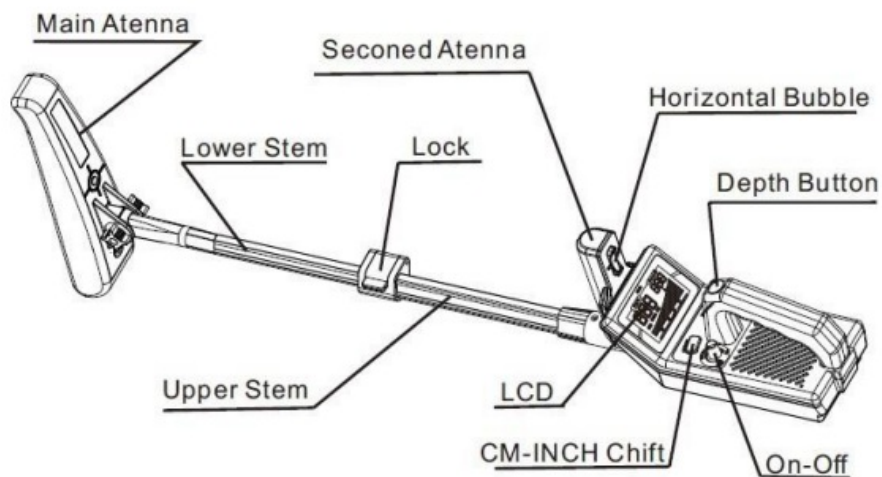


## Forbest FB-R2022 Pipe Locating Device



## Description

Welcome to the user manual for the TL2022 pipe locating device. The working frequency of the TL2022 is 512Hz, and it works in tandem with a 512Hz transmitter (not included) to form a positioning system. The receiver digitizes the 512Hz signal and displays its strength on an LCD to show transmitter depth and positioning. In order to ensure accurate depth and positioning locating, please read instructions carefully.



**Figure 1**

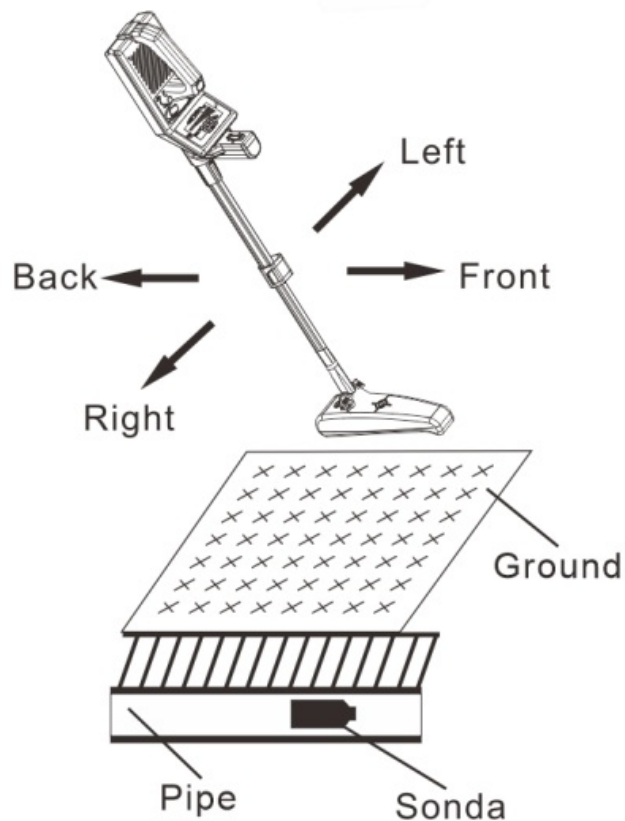
## Quick Start Guide

### a. Startup and Adjustment

Put 6 AA batteries into the receiver, turn on the power, and adjust the volume to an appropriate level. Adjust the link length to suit your arm length. The main antenna dish should be parallel to the ground.

### b. Quickly Locate 512Hz Transmitters

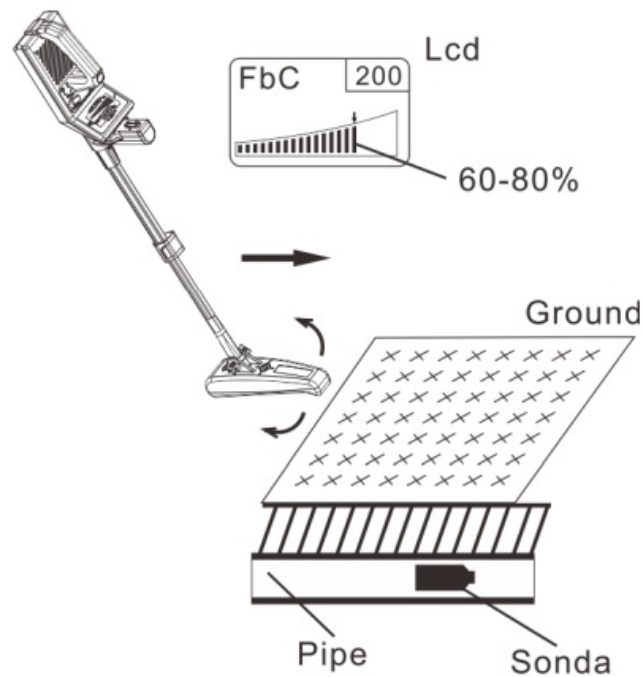
Guide the transmitter into the pipeline, scan the ground with the receiver at the desired transmitter position, and start looking. Hold the receiver's gain "+" button and keep the antenna of the receiver parallel to the ground, about 2 cm away from the ground. Slowly sweep the antenna over the ground in a fan shape, and move forward slowly at the same time. Observe the change of the LCD signal bar, and adjust the gain "+" or "-" to keep the signal bar roughly at 60-80% (see Figure 2).



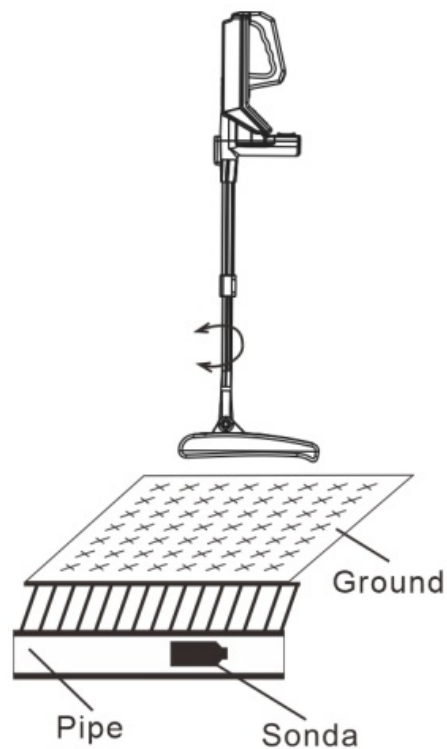
**Figure 2**

Move in the direction where the signal gets stronger until the signal is maximum (i.e. any movement and rotation of the antenna will make the signal smaller). At this point, the center of the antenna dish is roughly above the transmitter. Make a mark under the center of the antenna dish, which is the long axis direction of the transmitter (that is, the direction of the pipeline). The center of the antenna dish is the center position of the transmitter (see Figure 3, Figure 4).

You can change the positioning path and repeat the above operations to verify that the positioning is correct.



**Figure 3**

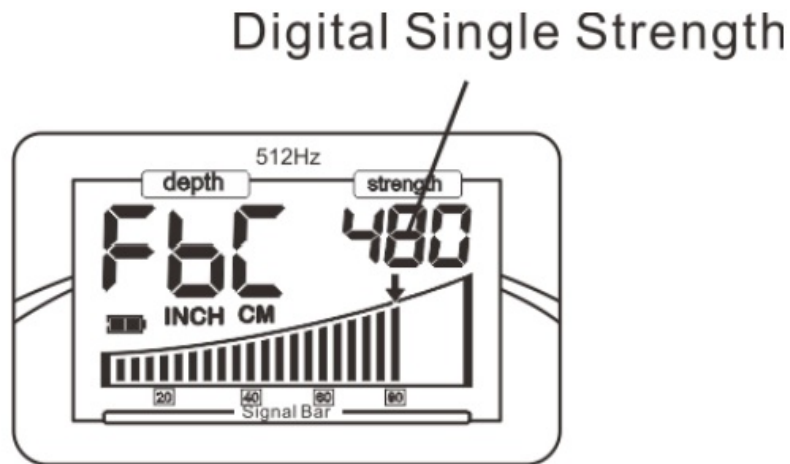


**Figure 4**

### **c. Tips for reducing positioning errors**

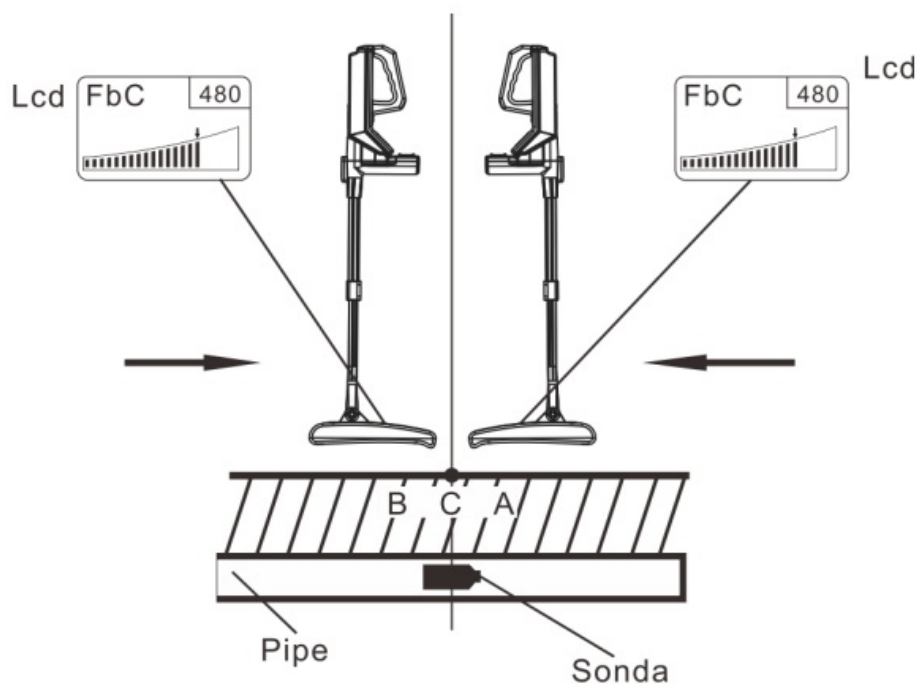
When changing the positioning path and repeating the operation, it will be found that the transmitter axis is basically the same, but due to the influence of the accuracy of the signal bar, its position may not be a point, but a small surface, resulting in a large error. The following methods can be used to reduce positioning errors. At the position where

the signal bar reaches the maximum value, move or rotate the antenna plate slightly, and observe the change of the digital signal in the upper right corner of the LCD until it reaches the maximum value (see Figure 5). The location marked again will be more accurate than it was before. Because the accuracy of the digital signal is higher than that of the signal bar, the positioning error will be smaller.



**Figure 5**

Positioning errors may still occur, especially in areas with electromagnetic interference and other objects. Of course, you can move the antenna along the opposite path, position it again, and take the average to correct its position (see Figure 6).



**Figure 6**

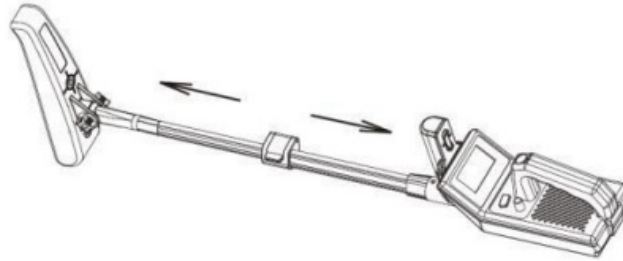
*(Point C is a more accurate location)*

Even so, the location of the positioning can only be used as a reference for excavating

the pipeline.

#### **d. Quick transmitter depth measurement**

After completing the quick positioning, the depth of the transmitter can be quickly measured. Loosen the LOKE NUT and pull the connecting rod to the longest. (See Figure 7)



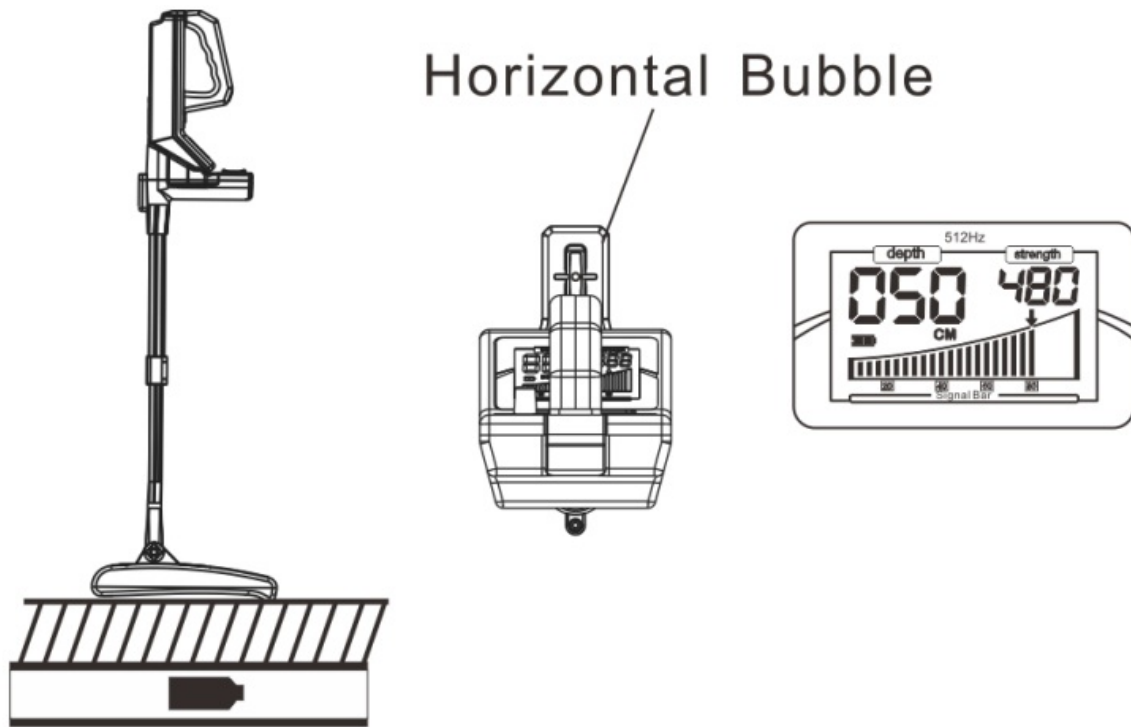
**Figure 7**

Rotate the main antenna dish so that it is perpendicular to the connecting rod. (See Figure 8)



**Figure 8**

Put the receiver perpendicular to the ground, place the center of the antenna dish directly above the transmitter, so that the main antenna is parallel to the axis of the transmitter, and center the horizontal bubble (see Figure 9). Adjust the gain key so that the signal bar indicates “depth measurement position”. Press the red depth button; the depth cursor will flash and display the depth of the transmitter and keep it for about 5 seconds.



**Figure 9**

It should be noted that in areas with interfering magnetic fields and other conductors, rapid measurement will introduce large errors, and the obtained data is only a reference.

## **Product specification**

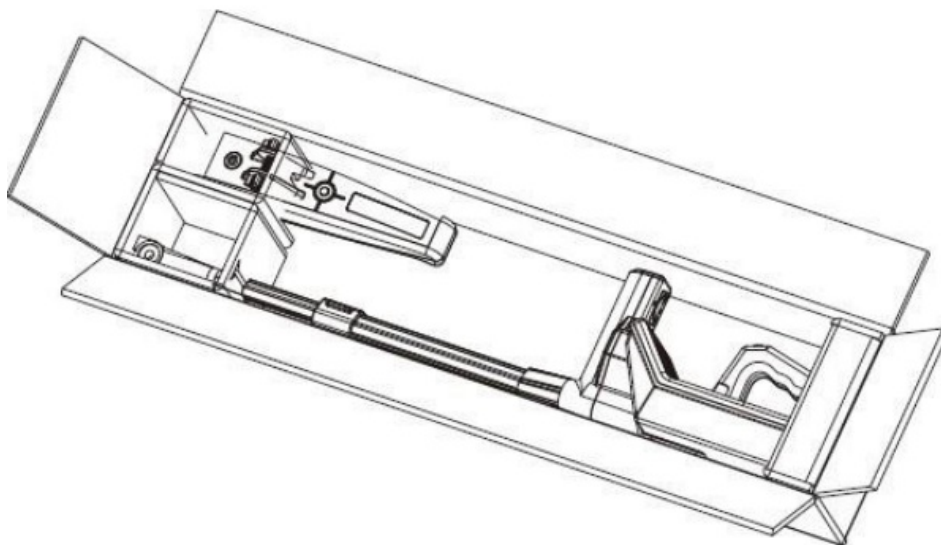
- a. Frequency 512Hz
- b. Quiescent current less than 35mA
- c. Working mode: Positioning/depth measurement.
- d. Gain adjustment (+, -) step and continuously adjustable.
- e. Signal strength bar display LCD shows 24 levels of signal strength; the 20th level is marked as “depth measurement bit”.
- f. The signal strength digital display shows three digits, which can display the signal strength in detail.
- g. The maximum positioning depth is related to the power of the transmitter. When equipped with TL2001 transmitter, the maximum positioning depth is about 8-10 Feet.
- h. Depth measurement: Press the red measurement button, and the three digits will display the depth. Hold for about 5 seconds each time. When equipped with TL2001 transmitter, the maximum depth measurement range is about
- 0.3-4 meters.

- i. Unit conversion: Depth unit can be either inches or centimeters. No signal was received for two sounds, about 400 Hz frequency. Received a signal, switched to a frequency of about 800 Hz.
- j. The sound changes when the signal strength changes.
- k. Volume adjustment potentiometer continuously adjusts speaker
- l. Power: 6 AA alkaline batteries
- m. Low voltage prompt 7.2V
- n. The connecting rod can be adjusted in length from 80cm to 95cm
- o. Dimensions 100cmx10cmx10cm
- p. Weight about 1500g
- q. Operating temperature -10°C—+50°C

## Product Assembly

Assembly of the TL2022 does not require special tools.

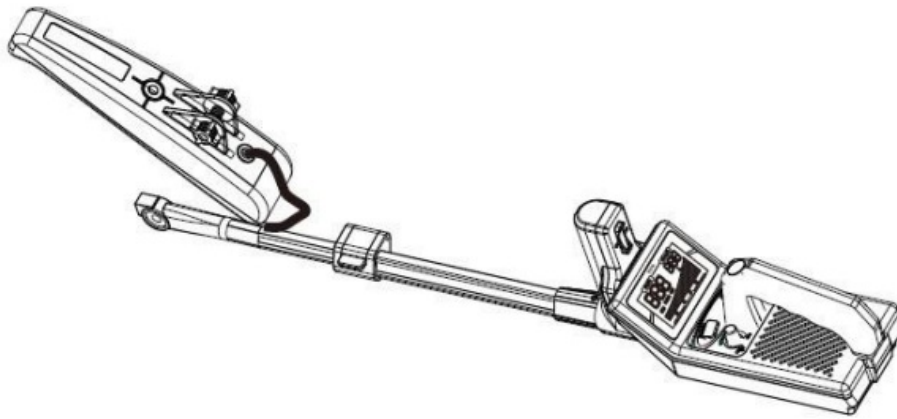
- a. Open the box (see Figure 10).



**Figure 10**

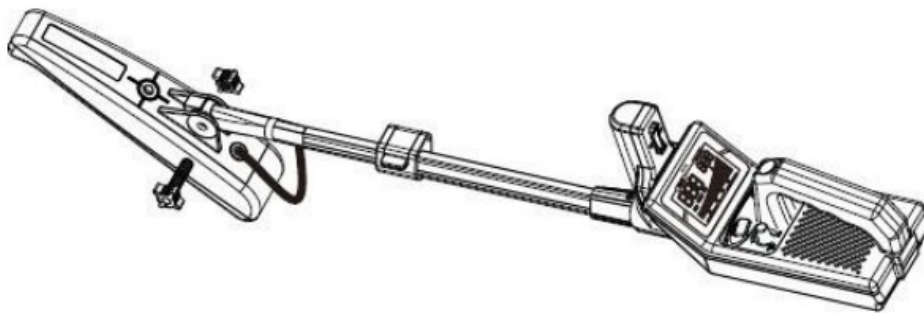
- b. Gently take out the receiver tray and receiver host. Do not pull the connection cable on the receiver tray with strong force. (See Figure 11)





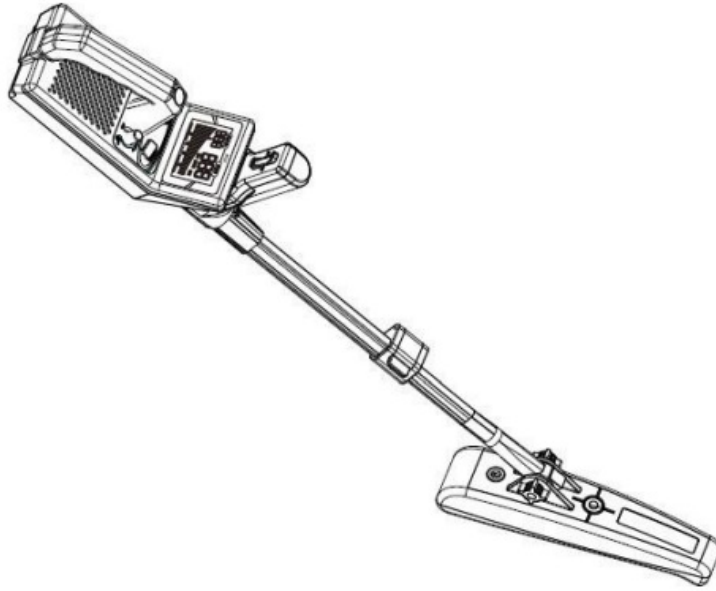
**Figure 11**

c. Loosen the lock button on the lower link and remove the bolt. Press and install the lower link on the antenna plate and lock it (see Figure 12). Note that the rubber gasket should not be missing



**Figure 12**

d. Loosen the lock sleeve on the upper link, adjust the length of the lower link inserted into the upper link. You can adjust the total length of the link, so that you can straighten your arm and perform detection comfortably (see Figure 13). Then lock the lock sleeve.

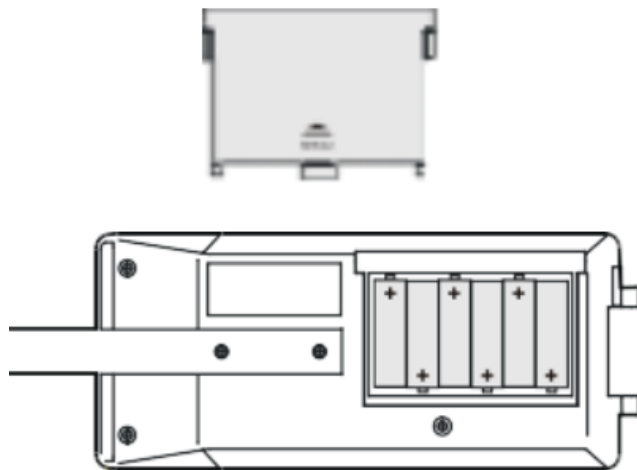


**Figure 13**

## **Battery**

Please use 6 alkaline AA batteries

- a. Push out the battery cover in the direction of the “OPEN” arrow on the battery box. Then install 6 AA batteries according to the battery polarity mark on the battery box. (See Figure 14)



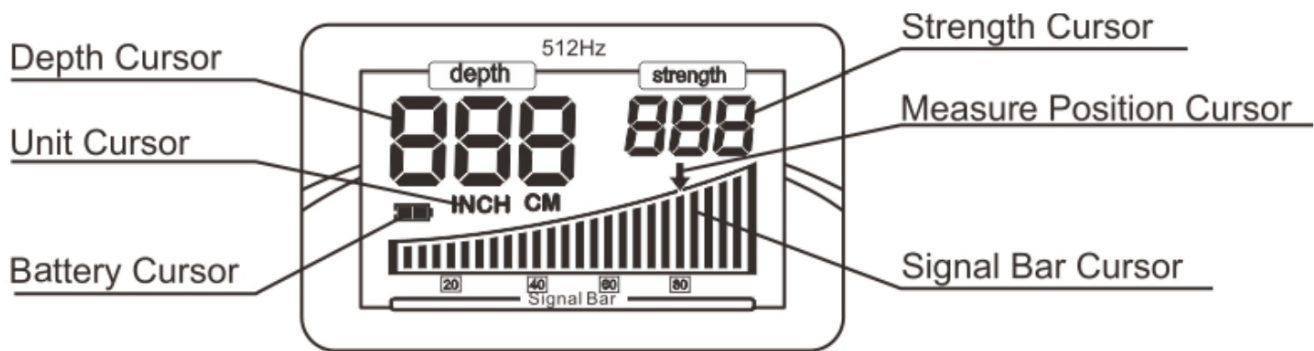
**Figure 14**

- b. Close the battery cover, you will hear a “KaTa” sound.
- c. 6 alkaline batteries can be used for more than 20 hours.

If the instrument is not used for a long time, please take the battery out of the battery box. Note: Please do not mix old and new batteries.

## Product panel controller, LCD and antenna

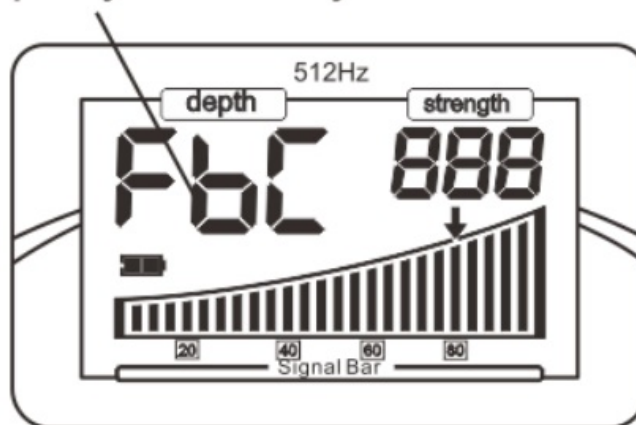
### e. LCD screen (see Figure 15)



**Figure 15**

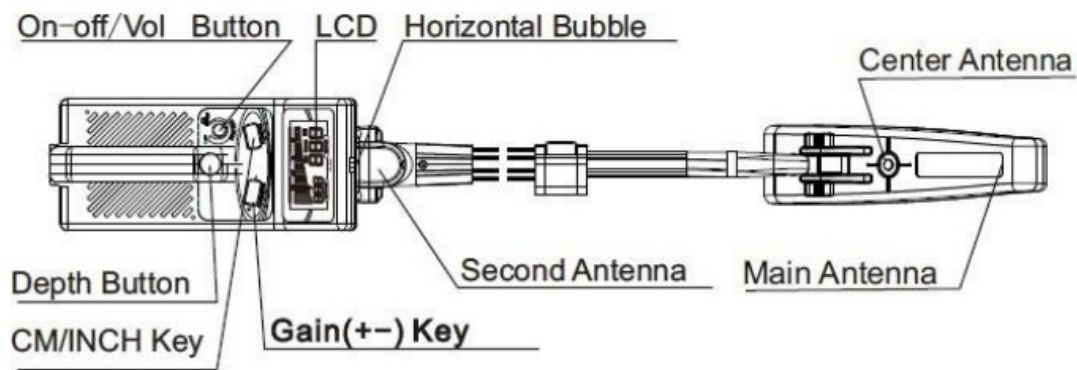
- Strength Cursor: There are 24 bars in total, showing the signal strength. When positioning, adjust the gain key to keep the signal bar at 60-80%.
- Measure Position Cursor: When measuring the depth, adjust the gain key so that the signal strength bar indicates this position. This is affected by the power of the transmitter. When approaching the maximum depth, the signal strength bar may not be adjusted to the measurement position (at this time, the depth of display error will become larger).
- Signal Bar Cursor: Three-digit display. The signal strength can be displayed in detail.
- Depth Cursor: Three-digit display. Normal display "FbC" (abbreviation of Forbest Company, see Figure 16). When measuring the depth, it will display the depth and hold for about 5 seconds after each measurement.

### Company's Acronym



- Unit Cursor: inches or centimeters, only displayed when measuring depth.
- Battery Cursor: Displays the battery level. When the battery is low, the cursor blinks.

**f. Control panel and antenna (see Figure 17)**



***Figure 17***

- On-off/Vol Button: Power on/off/adjust volume.
- Depth Button: Press the depth key, the depth cursor will flash and display the depth of the transmitter and keep it for about 5 seconds. After the depth cursor disappears, you can press the depth key again for the next measurement.
- CM-INCH Key: Select the unit when measuring depth. The default is centimeters.
- Gain Key: Long press to quickly adjust the gain. Short press to adjust gain step by step. Adjust this key during the positioning process so that the signal strength bar indicates 60-80%, to observe its changes. Adjust this key during depth measurement so that the signal strength bar indicates "Measurement position."
- Horizontal Bubbles: When measuring the depth, it helps to judge whether the connecting rod is perpendicular to the ground.
- Main Antenna and Center Antenna: Used to receive 512Hz signal. Its center is used to express. When measuring the depth, the main antenna dish should be perpendicular to the connecting rod.
- Second Antenna: Used to accept 512Hz signal. Works when measuring depth.

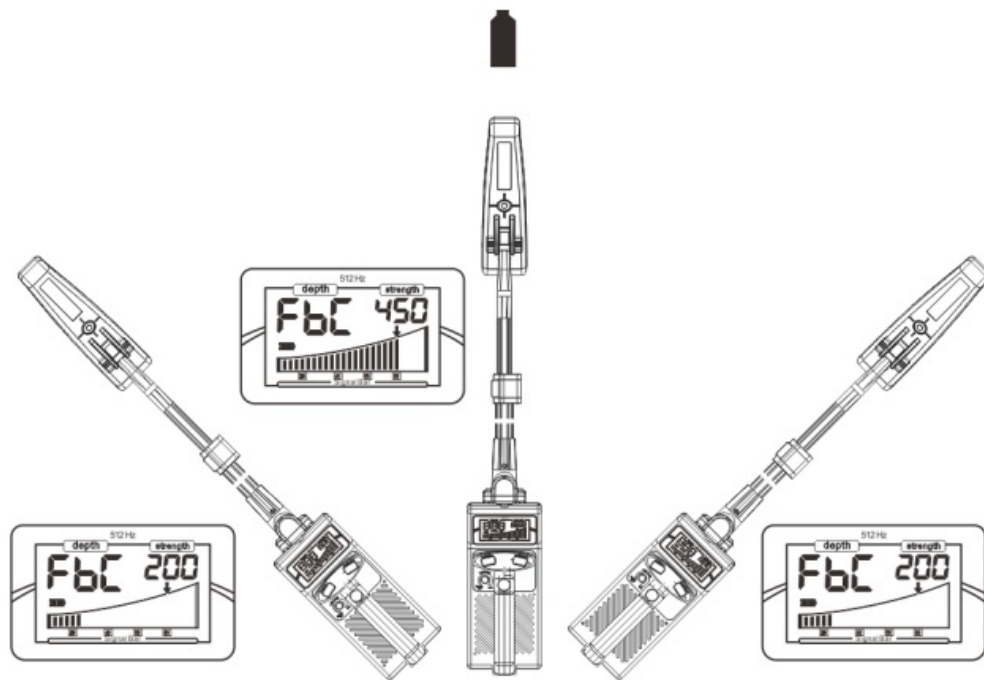
**Tips for Familiar with Positioning**

Prepare a 512Hz transmitter and find an outdoor ground with less interference for practice.

**g. Let the receiver "know" the transmitter.**

Put the battery on the transmitter and put it on the ground. Turn on the receiver, walk

around the transmitter, and turn the direction of the main antenna. Increase the gain; you should receive a 512Hz signal. The sound of the speaker will change, the strength signal bar and the digital strength signal will start to indicate a signal. In order to determine whether the received signal is an interference signal, you can remove the transmitter's battery. If the signal on the receiver disappears, it means the signal is from the transmitter. If the signal does not disappear, it means that there is an interference signal nearby. Try to avoid the interference area. (See Figure 18)

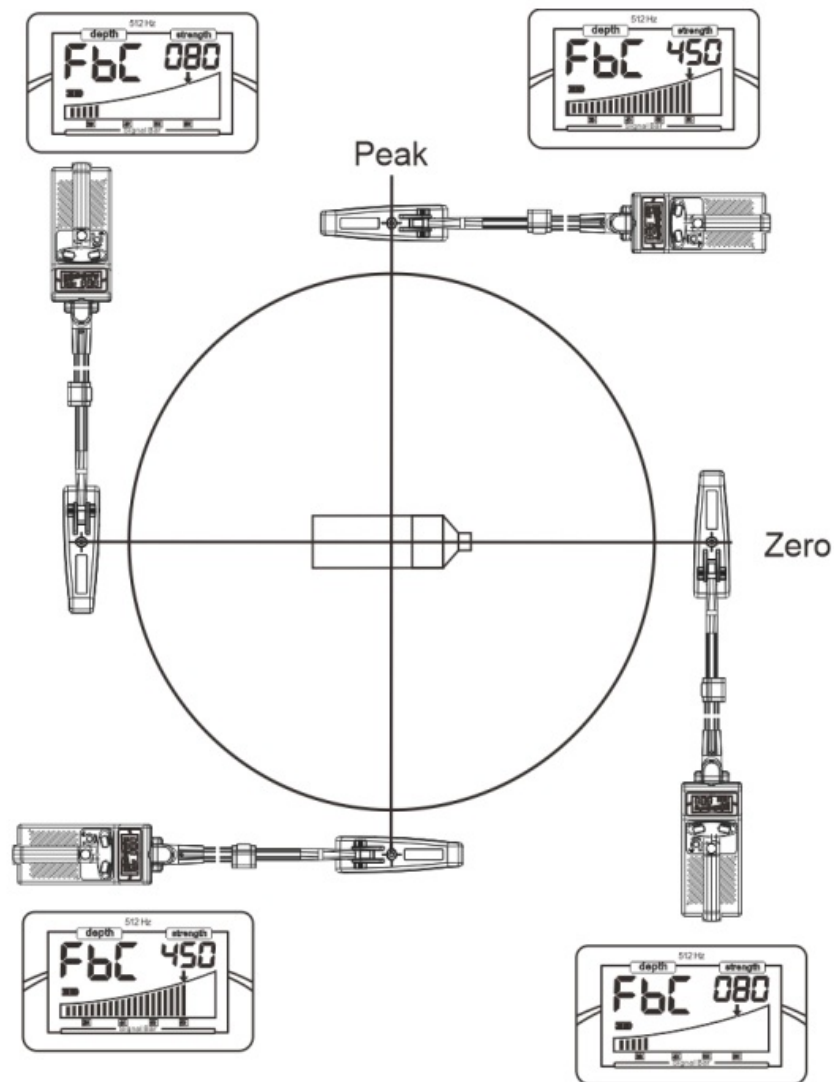


**Figure 18**

a. Correctly finding zero and peak signals is the key: The transmitter is loaded with batteries, placed on the ground, and the receiver is turned on.

The receiver is flat on the waist, the main antenna dish is parallel to the ground, placed directly above the transmitter, and rotated. When the main antenna of the receiver is parallel to the long axis of the transmitter, the signal strength on the LCD becomes larger, and any movement or rotation of the antenna will weaken the signal strength, which is the peak signal (see Figure 19).





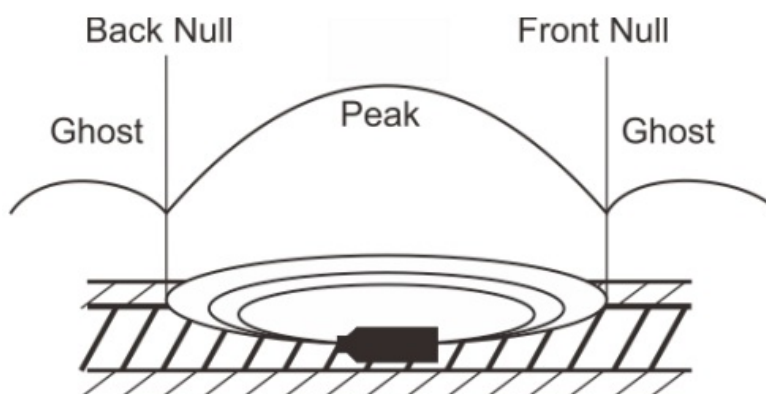
**Figure 21**

- b. Locate with signal strength bar: Dig a hole in the ground, load the transmitter with batteries, and place it in the hole. Cover it with a plank so that you cannot see where it is.
  1. Turn on the receiver, make sure the main antenna dish is parallel to the ground, and make a sector scanning movement. Adjust the gain so that the signal strength bar stays at 60-80%. Continue moving in the direction to make the signal strength bar larger. When you feel that you have reached the maximum position of the signal strength bar, that is, if you move or turn in any other direction, the signal will become weaker. The center of the main antenna is the approximate position of the transmitter (this position needs to be corrected).
  2. The direction of the antenna dish is the long axis of the transmitter. Do a good job of marking.
  3. Walking a circle around the approximate location of the emitter, you can find two peaks and two nulls. Below the intersection point of the line connecting the peak



point and the line connecting the zero point is the more accurate position of the transmitter. 18

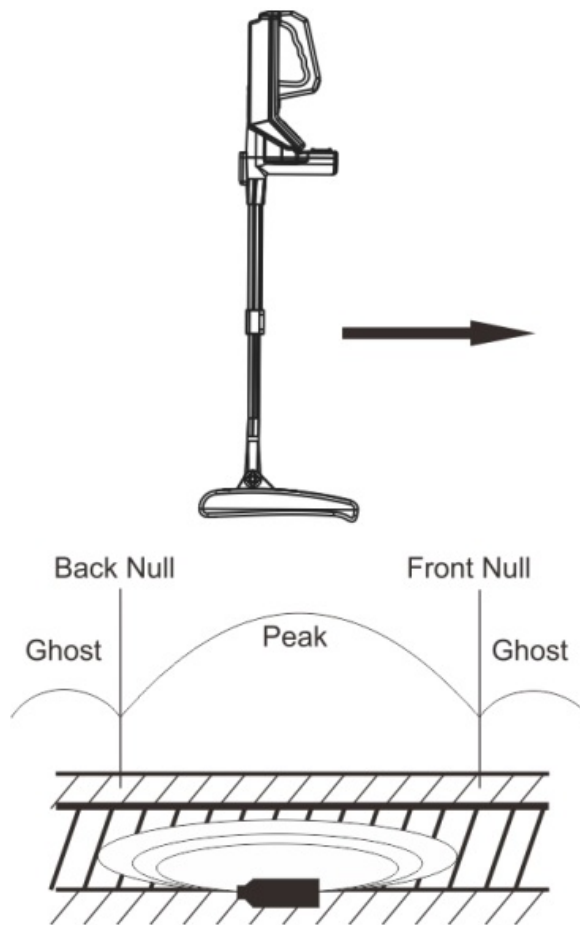
- Locate with a three-digit signal: Signal strength bars are limited by resolution, and positioning is often a plane. To improve positioning accuracy, the three-digit strength signal can be used to determine the peak and zero positions. (See Quick Guide 3.)
- d. Calculate Depth with “Front Null and Back Null: The radiation pattern of the transmitter is shown in Figure 22. It can be seen that along its long axis, the signal directly above it is the strongest. The signal gets smaller as you move away from the emitter along its axis. However, there is an abnormal concave point in the front and back, that is, the Null point. The distance between two Null points is related to the depth. The depth of the emitter can be calculated by measuring the Null point.



**Figure 22**

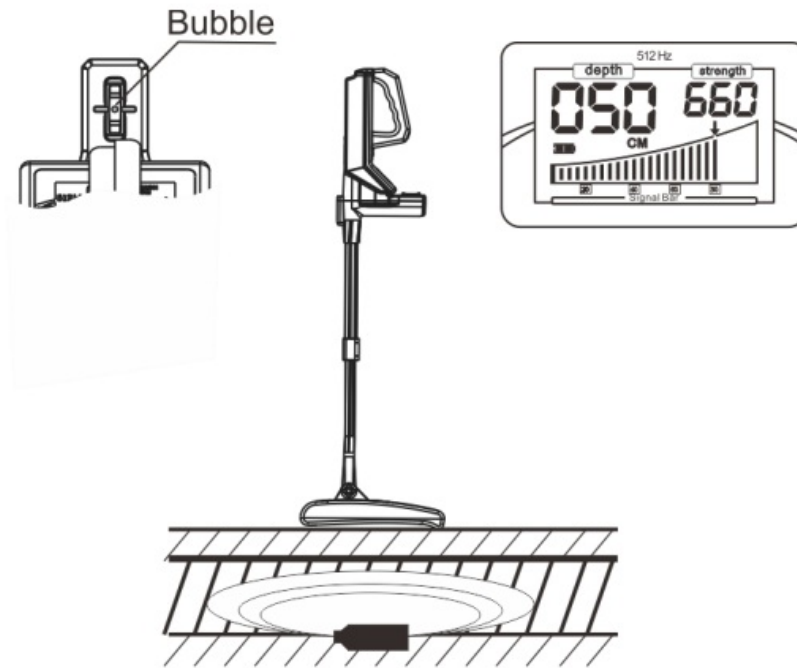
Make sure the receiver antenna is parallel to the ground, and the gain is adjusted to the highest. From the peak position, move away from the emitter along the long axis of the emitter until the signal is minimal. Then reverse to the peak. Adjust the gain while walking to ensure that the signal strength indicator is at 60-80%. At a certain point before reaching the peak, you will find that the signal suddenly drops, and when you continue to move forward, the signal suddenly rises again. This point is called “Front Null.” Record the location of the Front Null and repeat to confirm. Keep going, you will find the peak signal when passing the peak point. Keep moving in the same direction and you will find another point where the signal suddenly drops, called “Back Null.” Also, record the location of the Back Null, and repeat to confirm. “Front Null”, “Back Null”. 0.7 times the distance between these two points is the depth of the emitter. (See Figure 23) The determination of “Front Null” and “Back Null” is very important for measuring the depth of the transmitter.





**Figure 23**

Release the lock on the connecting rod and pull the connecting rod to the longest. The main antenna dish is perpendicular to the connecting rod. Place the receiver directly above the transmitter. Center for the horizontal bubble. Rotate the antenna dish slightly to maximize the signal. Adjust the gain so that the signal strength bar is at the measurement position. Press the red measurement button; the depth cursor flashes, followed by a three-digit number indicating the approximate depth of the transmitter. (See Figure 24)



**Figure 24**

## Field operation

Before the actual operation, it is necessary to make preparations.

- First of all, it is necessary to determine whether there is any source of interference in the work area. Do not turn on the transmitter; first turn on the receiver, turn up the gain, walk back and forth in the working area, and observe whether the receiver can receive the signal. If there is interference, remember the location of the interference source and signal characteristics, so as not to misjudge the interference signal as the transmitter signal.
- Second, the battery power of the transmitter must be sufficient. The operating current of the transmitter is generally relatively large. After one use, the power is often insufficient, and it is difficult to replace after being sent to the pipeline. It is best to use a new battery, so as not to cause unnecessary trouble for positioning.
- Finally, if there are other metal pipes, large metal objects, or electromagnetic interference nearby, it may affect the detection results.

### **h. Positioning:**

Feed the emitter into the pipe. The main antenna dish of the receiver is close to the ground, parallel to the ground, and the gain is increased. Make a sector scan movement

over your desired emitter area. Note the change in the signal strength bar. Move the receiver in the direction that makes the signal stronger. If the signal is very strong, you can lower the gain so that the signal strength bar is always displayed at 60-80% until you reach the position where the signal is strongest. That is, every time you move or turn, a lower signal will appear. Make a note of this location.

Repeat positioning steps in other directions, if always return to the same position. This is the approximate location of the emitter in the pipeline. You can walk a 1.5-meter circle around the peak point. Find the two peaks and zeros, the intersection point of the connecting line is the position of the emitter in the pipeline.

### **i. Determine the direction of the pipeline**

After completing the first positioning step, two zero positions are found. The connection line between two zero points is the current pipeline direction.

Push the launcher 2-3 meters and use the same method to determine the direction of the next section of the pipeline.

### **j. Determine Depth**


Through the previous operations, you have determined the peak position, found two zero points, and pointed out the direction of the pipeline. Next, you can determine the depth. From the peak position along the zero point connection, walk to the farthest point where the signal can be received. The main antenna dish is close to the ground, and the antenna dish is in the same direction as the pipeline. Adjust the gain to the highest level and slowly move towards the peak point. After receiving the signal, continue towards the peak. Adjust the gain while walking to ensure that the signal strength indicator is at 60-80%. At a certain point before reaching the peak, you will find that the signal suddenly drops, and when you continue to move forward, the signal suddenly rises again. This point is called "Front Null". Record the location of Front Null, and repeat to confirm. Go ahead and pass the peak point, keep moving in the same direction, you will find another point where the signal suddenly drops, called "Back Null", also record the position of Back Null, and repeat to confirm. The two points "Front Null" and "Back Null" are approximately equal in distance from the peak point, and 0.7 times the distance between "Front Null" and "Back Null" is the approximate depth of the emitter. Depth can also be measured with the second antenna. Release the lock on the connecting rod and pull the

connecting rod to the longest. The main antenna dish is perpendicular to the connecting rod. Place the receiver directly above the transmitter. Center for the horizontal bubble. Rotate the antenna dish slightly to maximize the signal. Adjust the gain so that the signal strength bar is at the measurement position. Press the red measurement button, the depth cursor will flash, and then three digits will appear, indicating the approximate depth of the transmitter. In particular, the situation of underground pipelines is very complicated. There are various kinds of soil underground, and various cables and conductors may be distributed around the materials of pipes are also different, and interference is almost everywhere. These factors all affect the accuracy of positioning and depth measurement. When locating or measuring depth, although you can use different methods for comparison, it is only a reference value. Only by practicing repeatedly and accumulating experience can we get better data.

## FAQ

- **Q: How can I ensure accurate depth and positioning locating with TL2022?**
  - A: Follow the Quick Start Guide instructions carefully, maintain proper antenna positioning, and utilize tips for reducing positioning errors as outlined in the manual.

## Documents / Resources

	<a href="#">Forbest FB-R2022 Pipe Locating Device [pdf]</a> Instruction Manual FB-R2022, FB-R2022 Pipe Locating Device, Pipe Locating Device, Locating Device, Device
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## References

- [User Manual](#)

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