

FUJI PIPELINE AND CABLE LOCATOR

PL-G.MAX

OPERATION MANUAL

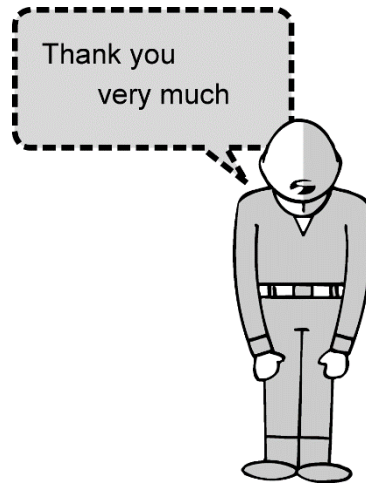


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INTRODUCTION

Welcome Message



Thank you very much for purchasing the Fuji Tecom PL-G MAX Pipeline Locator.

It is highly recommended that you read this instruction manual to ensure safe and effective operation of the locator.

This instruction manual will go over the many features of the Fuji Tecom PL-G Max, along with recommended approaches in locating pipes in different scenarios.

Applications

The Fuji Tecom PL-G MAX Pipeline and Cable locator can be used to detect all continuous underground metallic cables, pipes, electric lines, and metallic water pipelines.

Testing and Maintenance of Fuji Tecom Pipe Locators

This document details the recommended testing procedures for preventative maintenance and troubleshooting operations of Fuji Tecom Pipe Locators.

We recommend performing this procedure on a weekly basis, or prior to use if the tool has not been checked within the recommended weekly basis.

Test Procedures

***Test results should be retained in a log book.**

1. Set up a test location, with a known underground facility
2. Ensure you put fresh batteries in transmitter and receiver before conducting tests.
3. Examine all old batteries when replacing with new batteries for evidence of leakage
4. Put a permanent mark for transmitter location for initial test and all subsequent tests
5. Turn transmitter on and place over underground facility with correct orientation
6. Precise placement and orientation of the transmitter is necessary to repeat test results
7. Permanently mark 2-3 set distances from the transmitter (approx.. 20 feet apart) where readings will be taken with the receiver, for initial test and all subsequent tests
8. Using the receiver go to first marked receiver location on underground facility, place the footplate of the receiver on the ground over centerline of underground facility
9. Take a depth reading by pressing depth button, wait for prompt to pull up. With on foot on footplate, pull receiver upwards extending the slide pipe fully.
10. Allow receiver to compute the values
11. With the depth displayed, record all required information including, Depth, sensitivity and Current Measurement
12. Repeat at other pre-marked locations
13. Repeat steps 5-10 using locate tools additional frequencies by first changing the frequency on transmitter and then the receiver.
14. The locate tool should be tagged and sent in for service and calibration if a change is identified in the following readings.

Test Results

- **Any Location** change in the (X?Y orientation, or left or right over the test line) the Receiver should consistently read a maximum reading indication when directly above or on the test points
- **Depth** reading of +or – 10% (Z orientation or depth of test line)
- **Sensitivity** readings at the receiver are a function of output from the transmitter (it tells you if the transmitter is working properly). To test and confirm repeatability of sensitivity, the transmitter must be precisely placed in the exact location and orientation as of where the original test data was documented. Sensitivity reading may vary depending on the placement of the transmitter. The distance from the receiver to the transmitter will also vary significantly if the receiver is not precisely at the same location and orientation as the original test data points. Battery strength may affect sensitivity to some degree.
- **Current Measurement** readings at the receiver are a function of reception of the signal from the pipeline. The current measurement indication changes when moving along the test line away from the transmitter. Orientation of the transmitter to the receiver will change the current response. Distance from the transmitter to the receiver will change the current measurement. To replicate original test readings, precise placement of both transmitter and receiver is required.

Good Practices

- Remove batteries if the tool will not be used for extended periods of time
- Keep the tool in clean condition and specifically avoid metallic dust.

Troubleshooting known errors that may occur

“Push Down” is displayed when the receiver is at center of the line and the depth button pressed. This may indicate the footplate assembly has unthreaded, so check and screw it tight if it has become loose. Another possible cause is due to a dirty optic sensor. This will prevent the receiver from being able to read the position of the slide pipe

“Over Current” is displayed on the transmitter. This issue may stem from multiple issues, but this transmitter is not working to manufacturer specs.

Difficult to extend and depress slide pipe. The slide pipe should move freely, with minimal resistance and noise. Be sure to continually clean slide pipe of moisture and debris, to keep it from jamming up and bringing dust, dirt and water inside the housing of the receiver.

Acid Damage. When changing batteries always check that battery compartments are free of dirt, moisture and acid damage. All batteries and equipment should be taken inside during cold temperatures and you should never heat up cold batteries. Monitoring of the battery housing for traces of acid damage can help avoid serious damage, if an issue arises see below for “leaking Battery Procedure”

Weak Signal. This issue can occur in the transmitter or receiver and will be noticed during the testing by comparing it to previous values recorded. If a drastic change is noticed in location, depth or current measurement or sensitivity are found, the locate tool should be tagged and sent in for service / calibration.

If any of the above problems occur ensure that the locate tool is tagged and sent in for service/calibration.

Leaking Battery Procedure

Whenever replacing batteries, thoroughly examine dead or low batteries for evidence of leakage. Look in battery compartments and look for evidence of residue. Do not put new batteries in transmitter or receiver if any residue is observed. In the event of leaking batteries, remove them to reduce further damage.

If an incident has occurred:

1. Remove batteries. Do not replace with new batteries.
2. Neutralize and clean battery compartment with baking soda, 3-4 tablespoons in battery compartment.
3. Close battery compartment and shake
4. Open battery compartment shake out any excess baking soda and clean battery terminals with soft brush
5. The locate tool should be sent in for service/calibration after this procedure is complete.

Wet Locate Tool Procedure

Receiver

1. Remove the battery pack
2. Extend slide pipe fully out and towel off any moisture
3. Lay receiver on its side, in a warm dry environment
4. Do not place in close proximity of a heat source
5. Do not stand it right side up, or upside down, as any condensation may migrate to the circuit boards in the head or the top of the receiver

Transmitter:

1. Remove all batteries and towel out any moisture in the battery compartment or anywhere else on transmitter.
2. Lay transmitter flat with battery compartment open to dry, in warm dry environment.
3. Do not place in close proximity to a heat source
4. The locate tool should be tested after drying is complete

Repair and Calibration Protocol

Prior to sending tool in for service and or calibration, call and explain issue to Fuji Pipe Locators Ltd (403) 277-3300 or ben@leaklocate.com

COMPONENT



This instrument comes with the following components. Please confirm all components are present with your purchase.

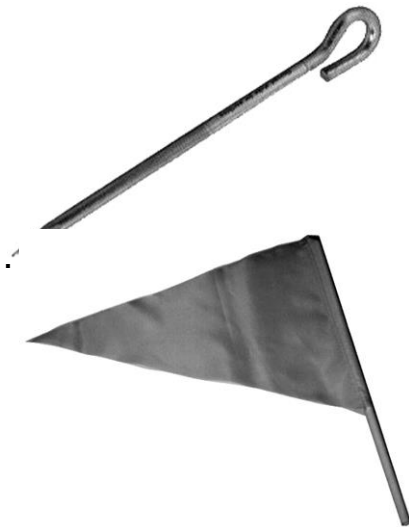
Fuji Tecom takes all possible measures to ensure quality, but if any of the components are missing, please contact the store you bought your locator from immediately.

1. Transmitter Unit



2. Receiver Unit

3. Ground Stake (30 cm).



4. Warning Flag.

5. Direct Mode Cable



6. Soft Carrying Bag.



OPTIONAL ACCESSORIES

The following accessories are available for the Fuji Tecom PL-G MAX Locator.

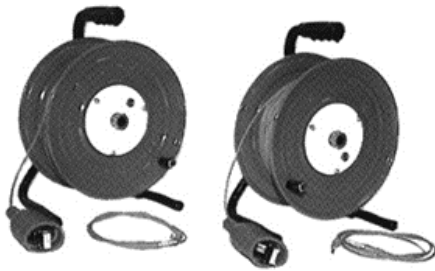


- 1. External Induction Coil and Cable.**
For locating energized power lines.

- 2. External Coil Bar**



- 3. External Power Supply Cable**



- 4. Cable Drum with 50 meter cable.**
For the Loop Cable Mode



- 5. Sonde (Small & Large)**

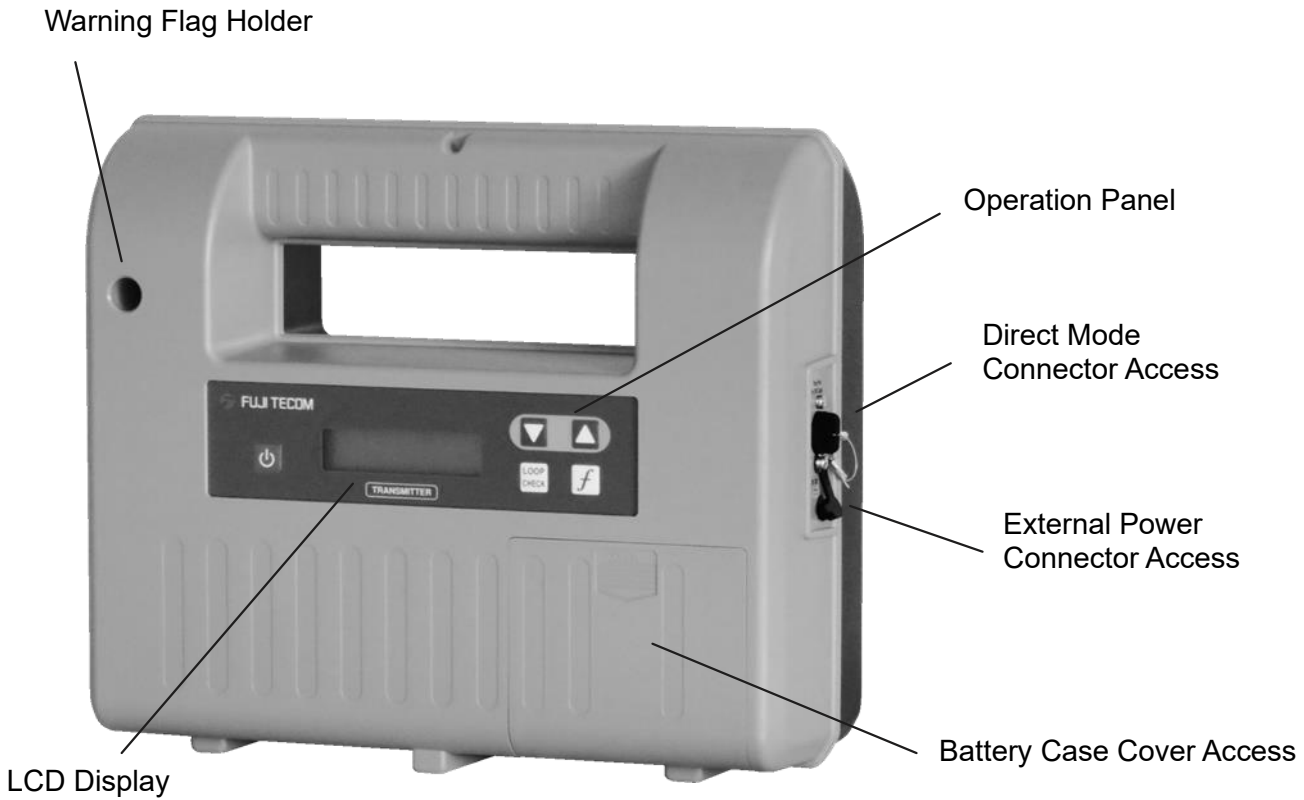
- 6. Headphone**

- 7. Soft Carrying Bag with earth function**

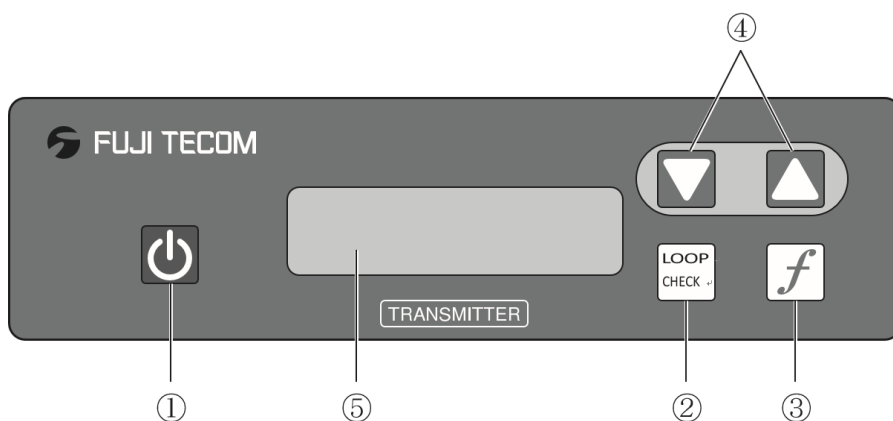
EQUIPMENT

2-1 Transmitter

2-1-1 Main Unit

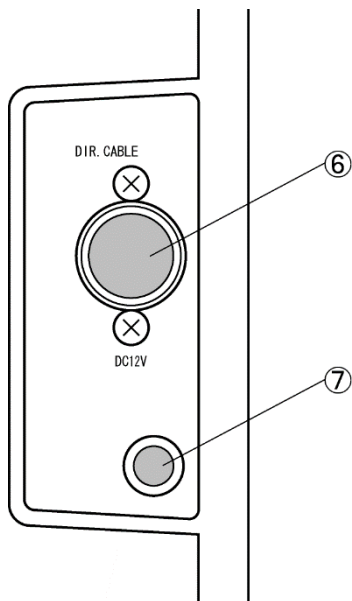


2-1-2 Operation Panel



- ① Power Switch Key (On/Off Switch)
- ② Loop Check Key (pg. 20)
- ③ Frequency Selection Key.
- ④ Output Power Control Keys.
- ⑤ LCD

EQUIPMENT

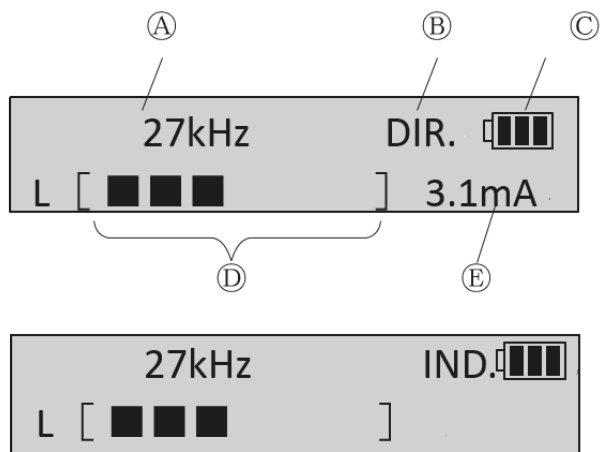


- ⑥ Direct Mode Receptacle & External Inductive Clamp
- ⑦ External Power Receptacle to 12 Volt Supply



NOTE: plugging into the direct mode receptacle will cause the transmitter to automatically switch to direct mode “DIR”.

2-1-3 TRANSMITTER DISPLAY

Transmitter output automatically goes from Inductive Mode “IND” to Direct Mode “DIR” when direct Mode Receptacle is being used, as shown in the images to the left.



- ① **Displays frequencies of choice.**
 Induction Mode : 83kHz or 27kHz.
 Direct Mode : 83kHz or 27kHz or 8kHz or MIX.
- MIX means the simultaneous output of 83kHz, 27kHz and 8kHz.
- ② Output Mode Display.
 IND = Induction Mode.
 DIR = Direct Mode.

- ③ Displays power source shown as:-
 = Internal D Size Residual Battery Condition.
 = External 12 volt Power Supply

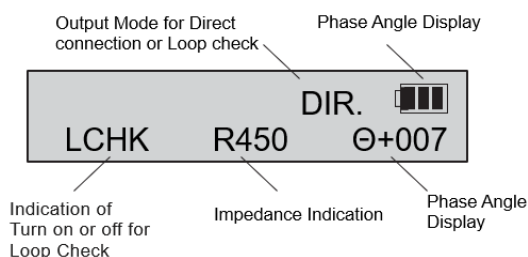
- ④ Output Level in 8 steps from 0 to 7.
- ⑤ Output Power Condition in the Direct Mode.
 ● Output Power Supply Value: 0.00 to 999 mA

The transmitter has an Auto OFF Function that shuts down after One Hour.

To turn on “Continuous”, hold down the Frequency key and turn on the transmitter. Keep holding the Frequency key until “Continuous” appears on the screen.

When you turn off the transmitter, the tool will default back to the auto-off setting.

□ Loop Check Display

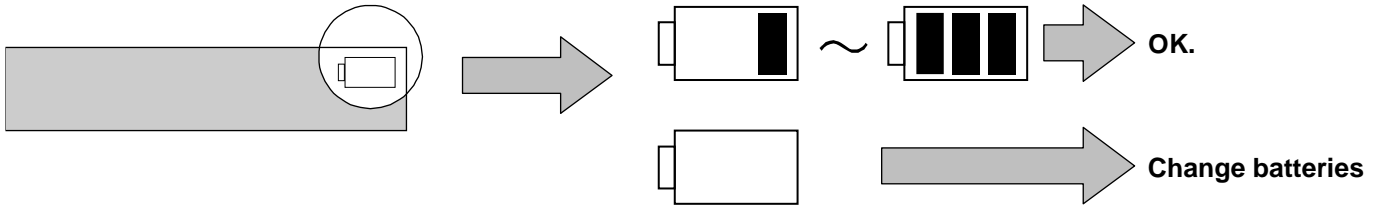


EQUIPMENT

2-1-4 Replacement of Battery

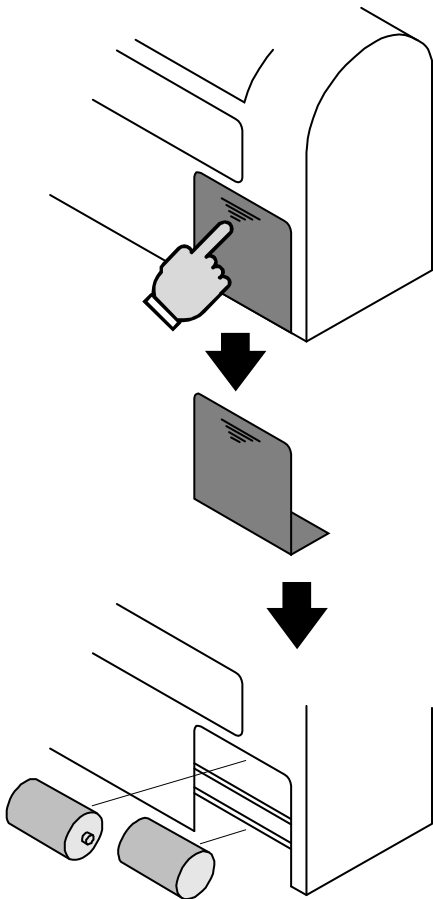
When the battery indication displayed on the LCD is reduced to Zero, replace "ALL" batteries.

The residual power is indicated on the LCD.



■ How to change the batteries.

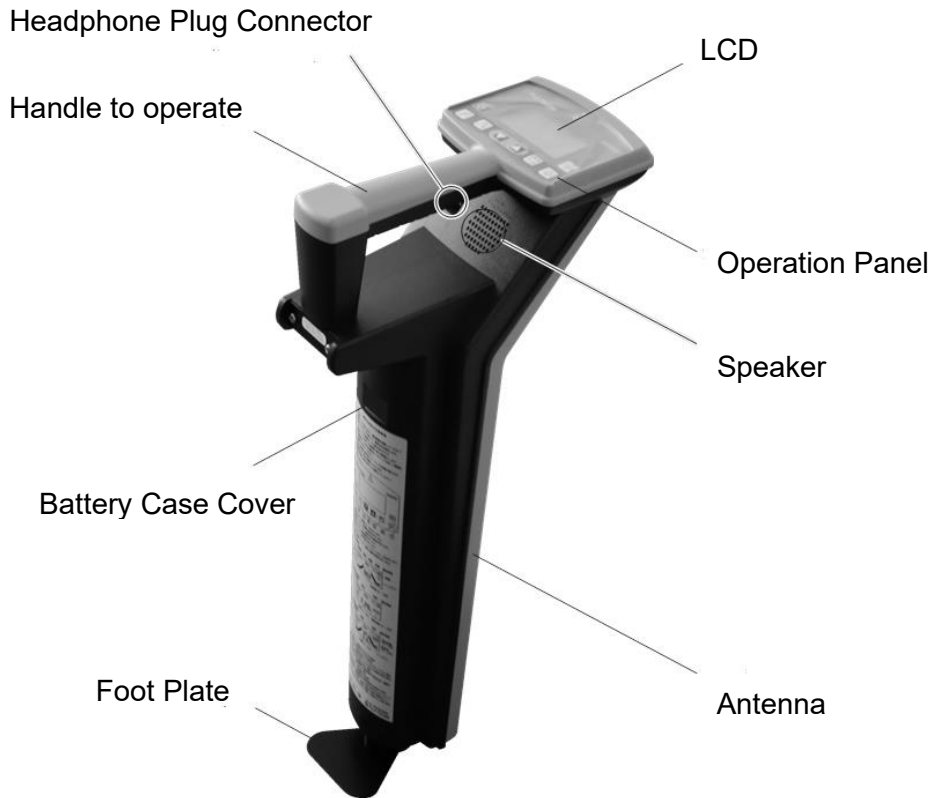
NOTE: Confirm the polarity of battery when the batteries are mounted in the Battery Case.



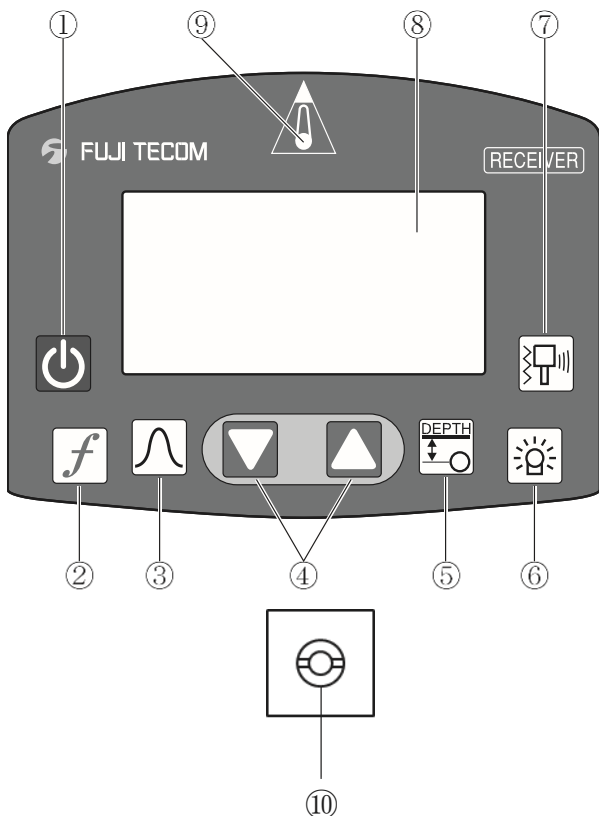
EQUIPMENT

2-2 Receiver

2-2-1 Main Unit



2-2-2 Operation Panel



- ① Power Switch Key.
- ② Frequency Selection Key.
- ③ Mode Selection Key.
- ④ Sensitivity Adjustment Key.
- ⑤ Depth Measurement Key.
- ⑥ Back Light Key.
- ⑦ Sound Volume Control Key.
Adjust speaker volume with short presses
Turn vibrations ON or OFF with long presses
- ⑧ LCD.
- ⑨ LED.
- ⑩ Headphone Plug Connector
*Located at the back side of Receiver.

EQUIPMENT

2-2-3 Display Screen

Ⓐ : Frequencies

83kHz. 27kHz. 8kHz.

Ⓑ : Selected exploration method

Maximum Mode = (人)

Continuous Depth Mode = (↑)

Bar Antenna Mode = (BAR)

Sonde Mode = (🔍)

Ⓒ : Sensitivity Level transmitted from the Transmitter

00~40

Ⓓ : Battery level display

Ⓔ : Vibration on / off

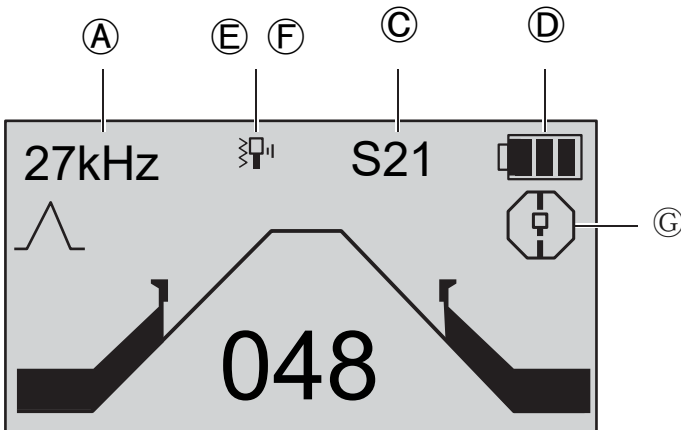


Ⓕ : Speaker volume level

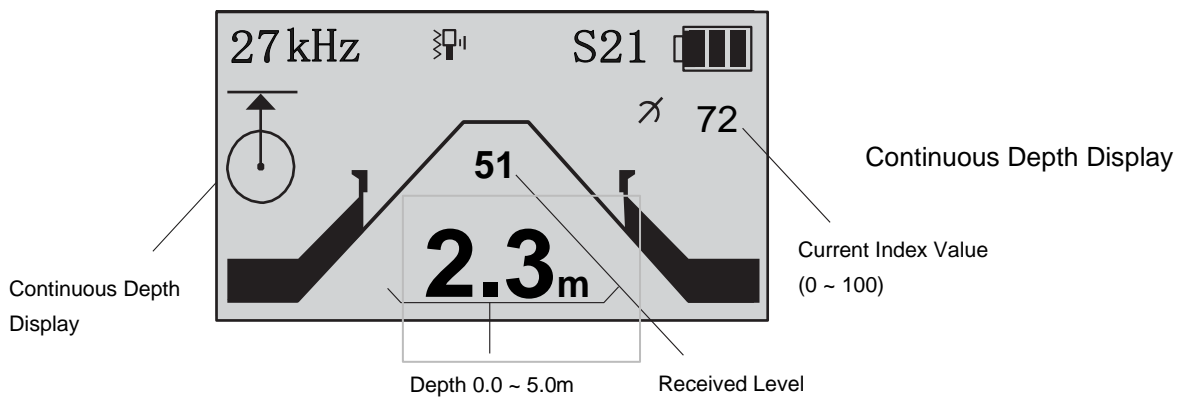
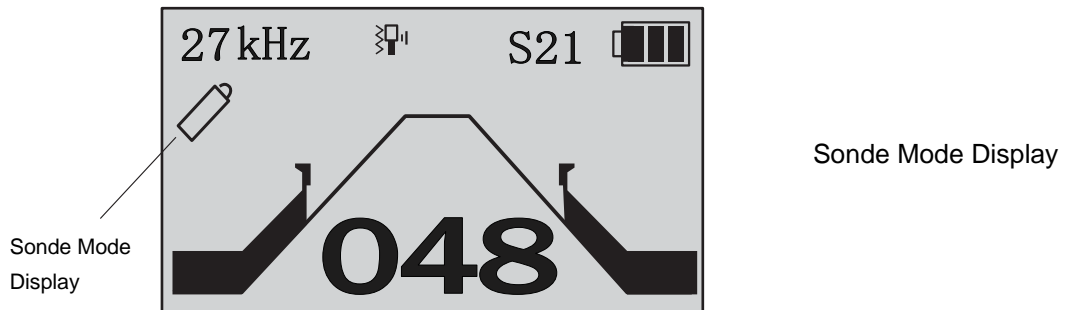
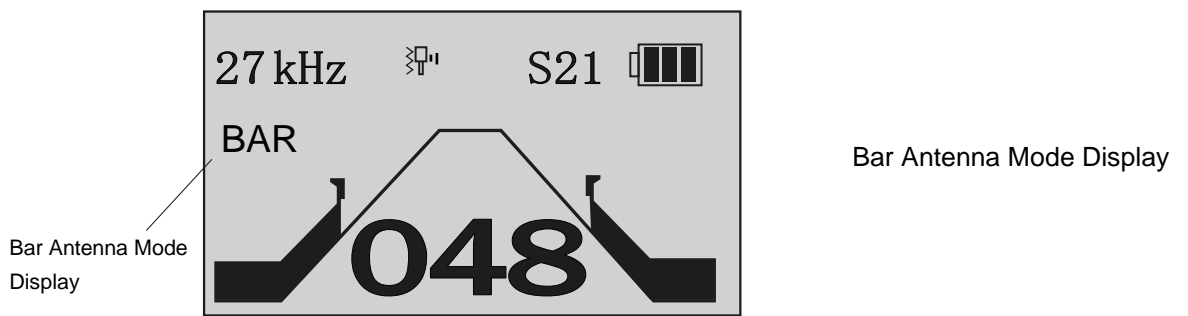
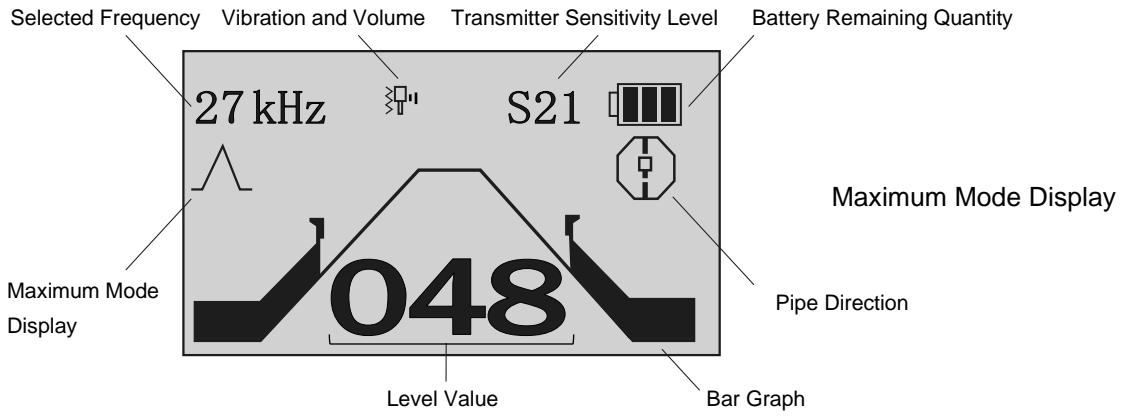
Low ⇔ High



Ⓖ : Pipe direction



EQUIPMENT



EQUIPMENT



Pull Up Depth Display

Depth 0.0 ~ 5.0m

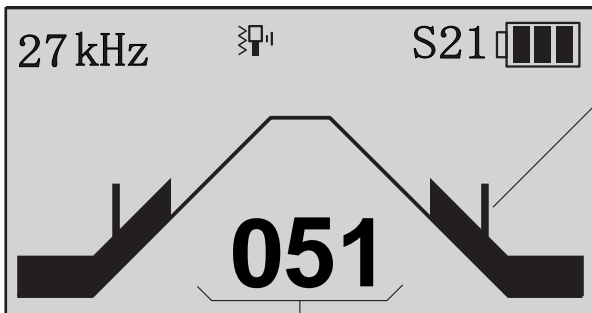
Current Index Value (0 ~ 100)

Pull-Up Depth Display

NOTE: Depth measurement is not available in BAR Mode.

■ How to check Current Index Value

Display shows the “current value” of the pipeline detected by the Receiver



Marker

Transverse Depth Display (pg. 30)

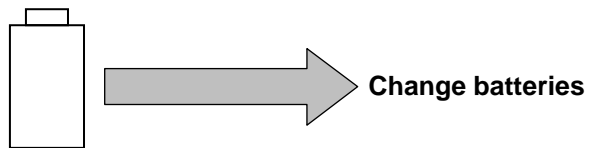
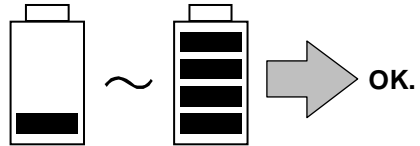
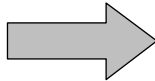
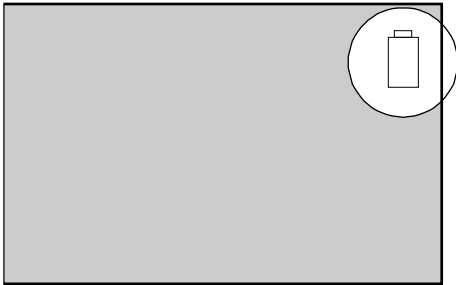
Level Value

EQUIPMENT

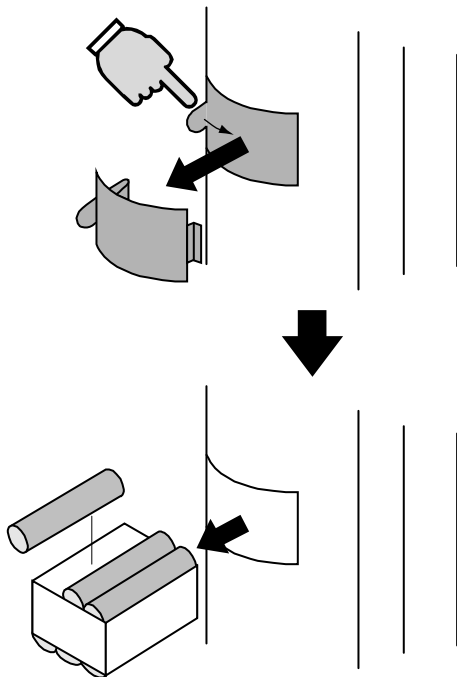
2-2-4 Replacement of Battery

When the battery icon on the LCD display is reduced to Zero as shown, please replace all batteries

The residual power is indicated on the LCD.



■ How to change the batteries.



NOTE : When the Battery indication reduces to Zero, the Receiver Turns OFF automatically.

PRINCIPLE & USAGE

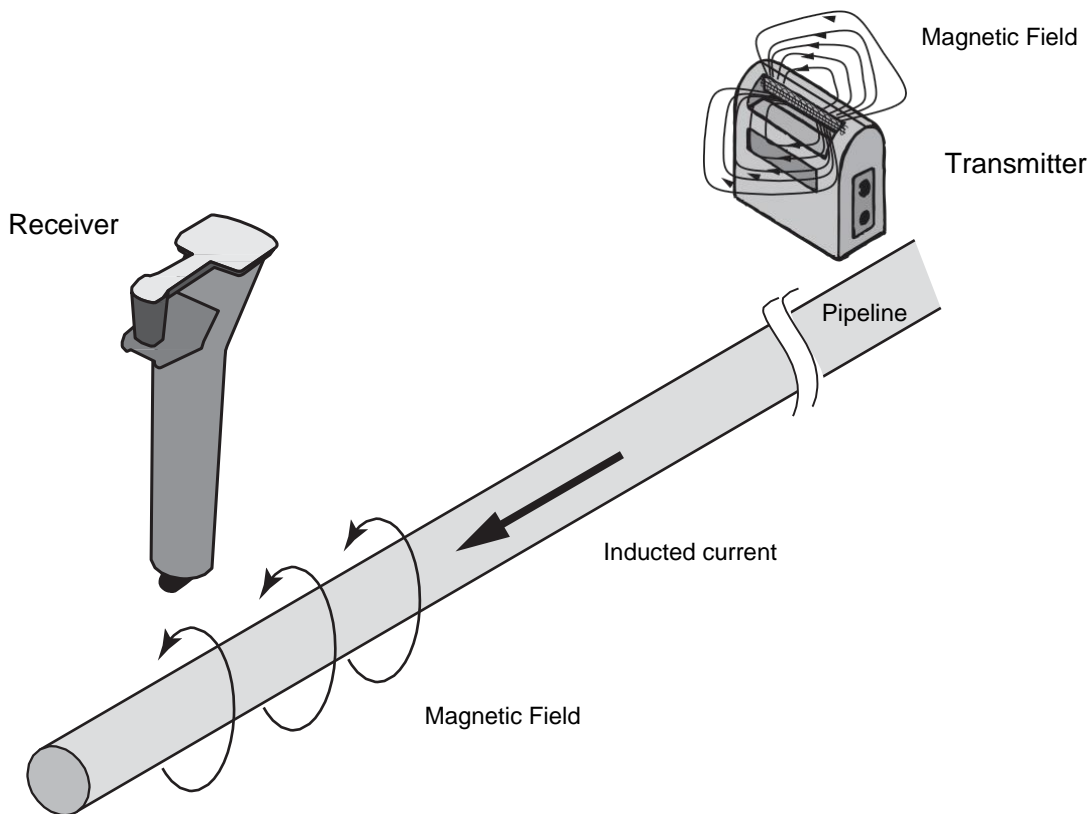
3-1 Principle of Operation

Briefly explain the principle of a metallic pipe and cable detector.

Electromagnetic waves are propagating through the ground at relatively low frequencies. This detector utilizes this property.

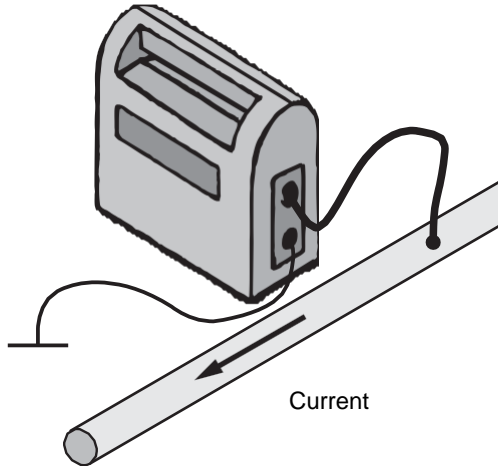
A current is generated in a pipe by a transmitter, and a magnetic field is generated by the induced current.

This detector picks up the magnetic field by a receiver to detect a buried pipe.



PRINCIPLE & USAGE

3-2 Direct mode & Induction mode



【How to select modes】

☞ Condition of pipeline

Case 1 : There is a part exposed on the ground

➔ Direct Mode

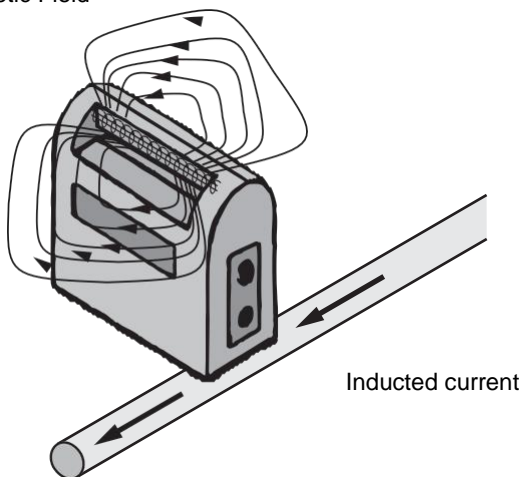
Case 2 : There are no parts exposed on the ground

➔ Induction Mode

【Direct Mode】

Connect the target pipe and the transmitter with a cable and apply the electric current directly to the pipeline and generate a magnetic field that can be detected by the receiver.

Magnetic Field



【Induction Mode】

A magnetic field is generated by the transmitter, and an electric current is generated in the pipeline from the magnetic field and simultaneously secondary magnetic field is generated to be detected by the receiver.

PRINCIPLE & USAGE

3-3 Proper use of Frequency

There are 3 frequencies available.

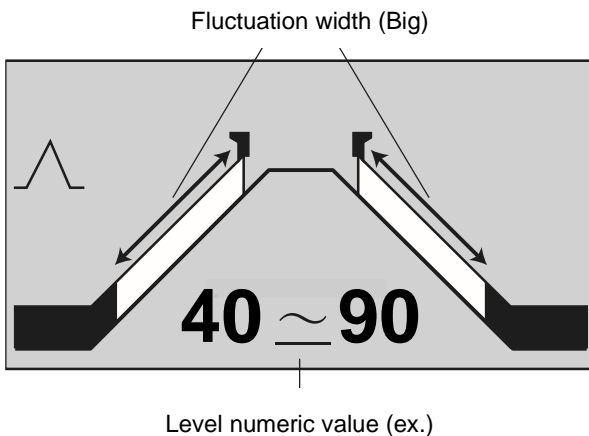
Direct Mode: 83kHz, 27kHz, 8kHz, MIX

Induction Mode: 83kHz, 27kHz

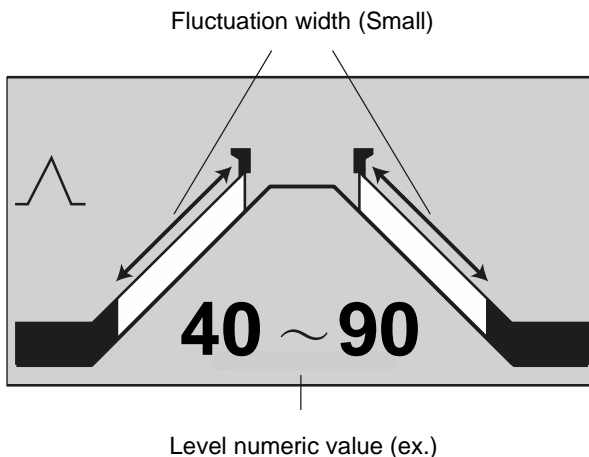
The lower the frequency becomes the longer the distance
between transmitter and receiver.

【Determining the best frequency】

Switch frequencies to identify the magnitude stability
from the Fluctuation Width (level bar)



When the fluctuation width of the bar graph is large (unstable): Selected frequency is inappropriate



■ Direct Mode

Appropriate selection of frequency

83kHz: for short pipes, branch pipes, and pipeline detections
with mechanical Insulated joints.

27kHz: for cables, and pipeline detections with welded joints

8kHz: for cables and long-distance pipeline detection with
electrical conduction joints, and trace wires

MIX for 3 types: Simultaneous output (83kHz, 27kHz, 8kHz)

POINT : Use the MIX Mode to select the best frequency.

POINT : When in the Mix Mode, the Transmitter operates at
a lower output.

■ Induction Mode

Appropriate selection of frequency

83kHz: The default frequency for ordinary pipeline detection and
congested areas with multiple utilities.

27kHz: for Long-distance single pipeline tracking. Select this
frequency if the fluctuation of the bar graph is stable.

PRINCIPLE & USAGE

3-4 Transmitter Auto Power Off & Continuous Power On Mode

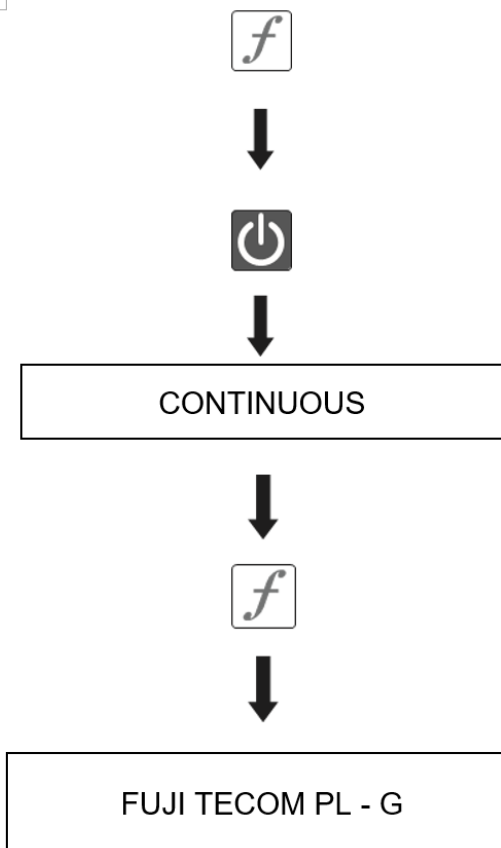
- **AUTO-OFF MODE:** When the Transmitter is turned ON, it automatically defaults to operation in auto-off mode. After one hour of use, the Transmitter will turn off to preserve battery life. Simply turn the Transmitter back on to continue locating.
- **CONTINUOUS MODE:** If you wish to keep the Transmitter on during use, the Transmitter will stay "ON" until the batteries are depleted.

The following are instructions on how to enable "CONTINUOUS", with the mages on the left acting as guides.

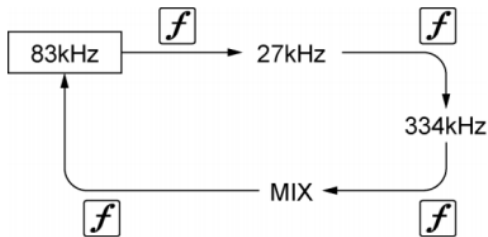
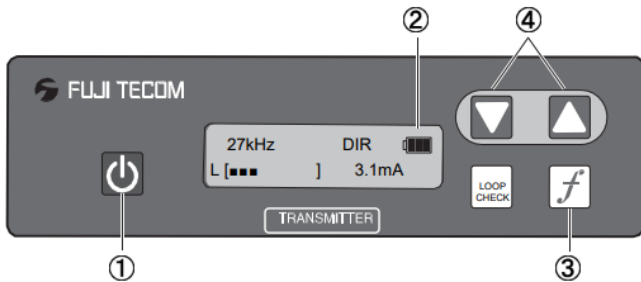
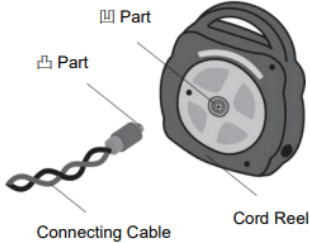
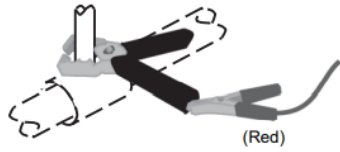
1. Turn off the Transmitter
2. Hold down the Frequency key
3. Turn on the Transmitter (While still holding down Frequency)
4. The Transmitter LCD screen should display "CONTINUOUS", and the tool is now functioning continuously.

NOTE:

Turning off the transmitter can not be set to "CONTINUOUS" as a default setting, follow aforementioned steps when this mode is required.



INSTALLATION OF TRANSMITTER



83kHz is chosen automatically when the Power Switch is turned on.

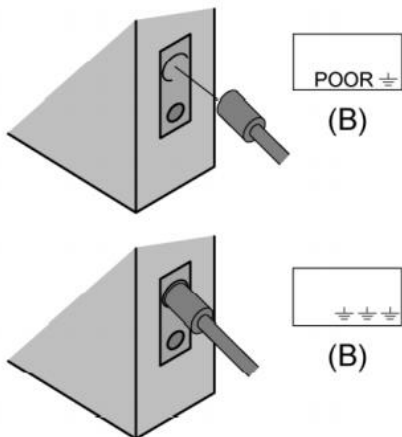
4-1 Direct Mode

4-1-1 Transmitter Main Unit

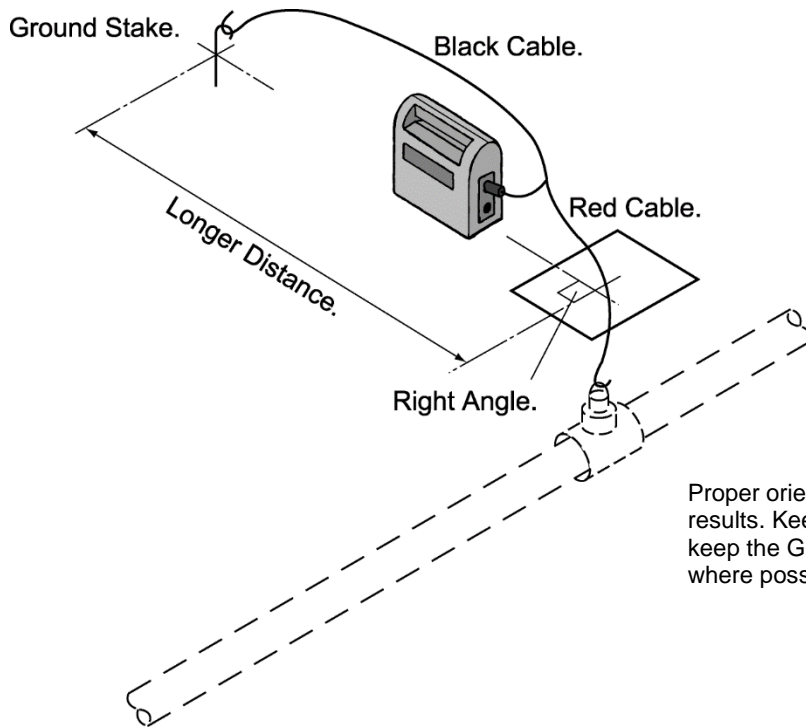
1. The Red cable is connected to the pipeline.
The Black cable is connected to the Grounding stake.
2. Turn on the Power Switch ①. When the power switch is turned on, the sound signal "Tick Tack" is repeated four times. Confirm the residual battery power (A) ②
3. Choose the frequency from the following: (27 kHz, 83kHz, MIX, 8kHz). ③
 - 27kHz is useful for locating straight pipelines over a longer distance. This produces wider X/Y detection above the pipeline.
 - 83kHz is most commonly used. It is useful for congested areas and pipelines of a shorter distance. This produces a clear, tight X/Y orientation above the pipeline.
 - 8kHz is used only in the IDT mode, useful for locating tracer cables and branch pipelines.
 - MIX is the simultaneous output mode of 27kHz, 83kHz, and 8kHz.
5. Set the Output Level with the Key ④ as shown.
6. Confirm the Output Level by connecting the Direct Mode Cable to the Transmitter.

Output levels of around 3.0mA means a good connection.

0.00 mA is displayed when the Direct Mode Cable is disconnected. A numeric value greater than 0.00 mA will appear if the Direct Mode Cable is connected.



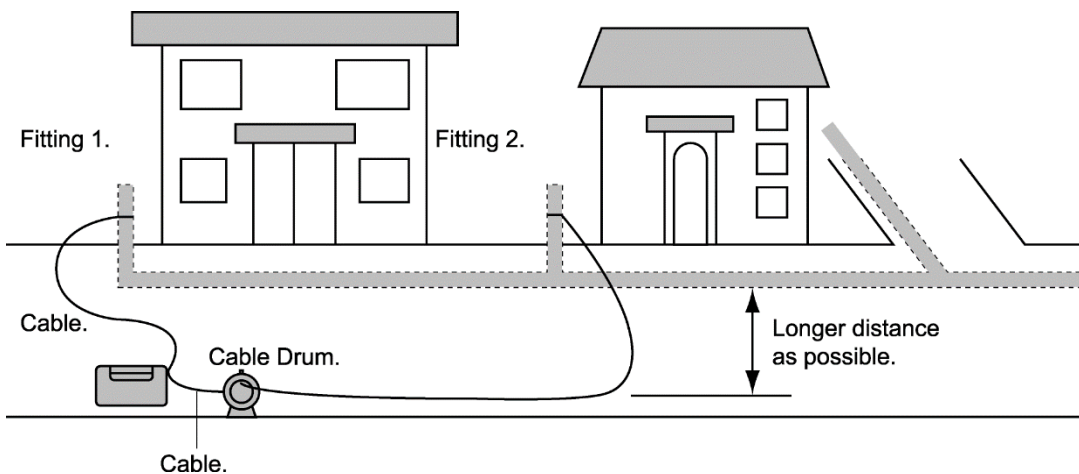
INSTALLATION OF TRANSMITTER



Proper orientation of the Transmitter is helpful in producing the best results. Keep the Transmitter at a right angle to the pipeline, and keep the Ground Stake a good distance away from the pipeline where possible. Refer to the image to the left.

INSTALLATION OF TRANSMITTER

4-1-2 Installation in Loop Mode (optional use)

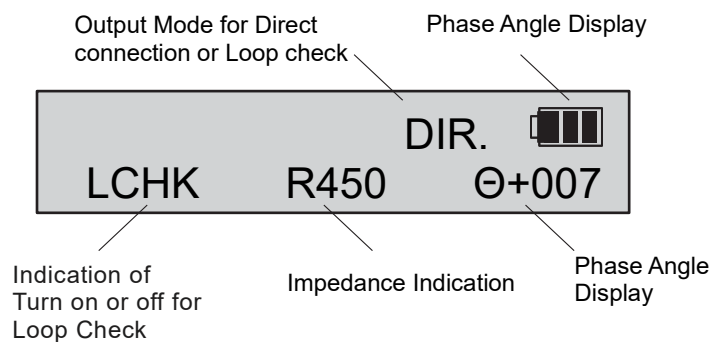


NOTE : The Loop Mode needs the optional Cable Drum with 50 meter cable as shown by the above figure.

Loop Mode is useful for locating only one pipeline when there are multiple parallel pipelines or telephone cables.

1. Look for the two Pipe Fittings as shown in the above figure and connect the Transmitter by using Direct Mode Cable and the Cable Drum with 50 meter cable.
2. Locate the buried pipeline with the Receiver between the two **Fittings 1** and **2**

Loop Check Display



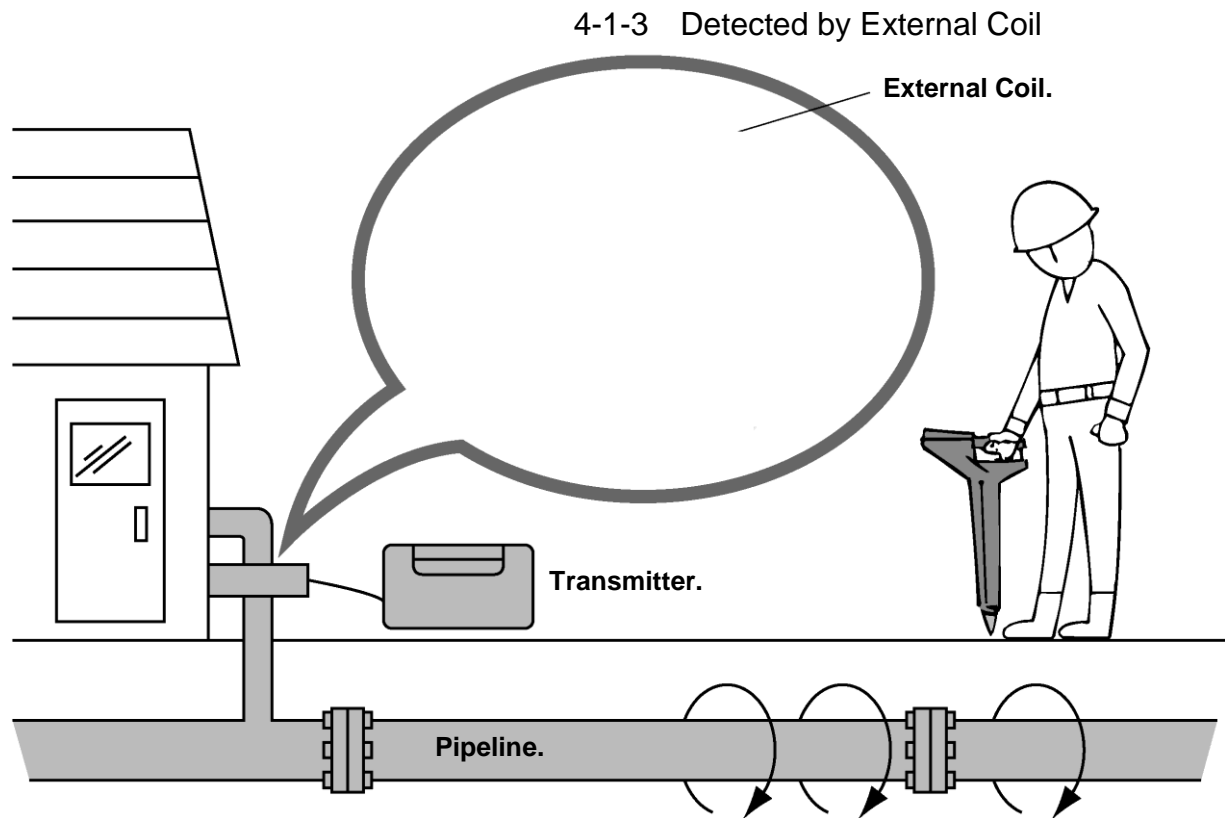
(1) In Direct Mode, pressing the L-CHK button enters a loop check operation. it is then easy to check the connection state with the pipe.

(2) The smaller the value of the terminal impedance (1Ω or less), the better the connection state of the loop to be located. Also, the smaller the phase difference (phase angle) of the signal returned, the better the connection state becomes (+ -15 or less).

(3) If the impedance value is high, there is a high possibility another pipe or insulated joint is interfering, so please review the connection situation.

(4) Please keep the red and black of the direct mode cable as far as possible. If the direct connection mode cable is tangled, the probability of error in the impedance value increases.

INSTALLATION OF TRANSMITTER



The External Coil Mode requires the optional External Coil.

1. The External Coil Mode is useful for locating short Branch Pipelines, Power Cables and Telephone Cables.
2. Clamp the External Coil on the pipeline or cable as shown by the above figure.

Note:

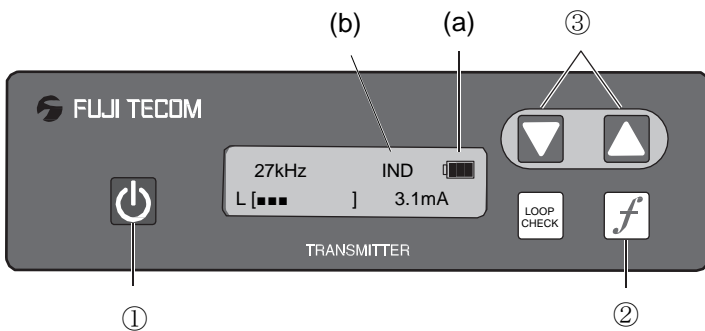
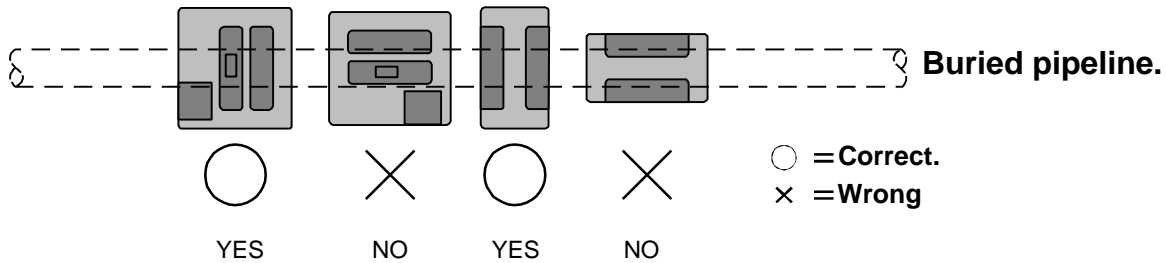
To avoid electric shock, wear rubber gloves while the External Coil is clamped on the power cable, wear

3. The Transmitter is operated in the same way as the Direct Mode. 83kHz is used for the External Coil Mode.

HOW TO OPERATE THE TRANSMITTER

4-2 Induction Mode

In induction mode, place the transmitter in the correct position as shown below.



1. Push the Power Switch Key and confirm the following points.
 - ① Check the residual battery power by the indication of (a).
 - ② Confirm the operation mode of IND (Induction Mode) (b).
When switching ON again soon after switching OFF, wait ten seconds before turning ON to stabilize the transmitter P.C.B.

2. Choose the frequency of 83kHz or 27kHz.
27kHz is useful for locating straight and long pipelines.
83kHz is useful for locating pipelines of a shorter distance, and for locating pipelines in congested areas
Choose the frequency in accordance with the condition on site.









The default frequency of 83kHz is automatically selected when the Transmitter turns on.

The frequency of 8kHz can be used with the Direct Mode.

3. Adjust the output level. ③
The default output level of maximum is selected when the Transmitter turns on.
The " L " on the LCD shows the output level with 8 power levels.

OPERATION OF RECEIVER

5-1 Operational procedure 5-1-1 Measurement Mod

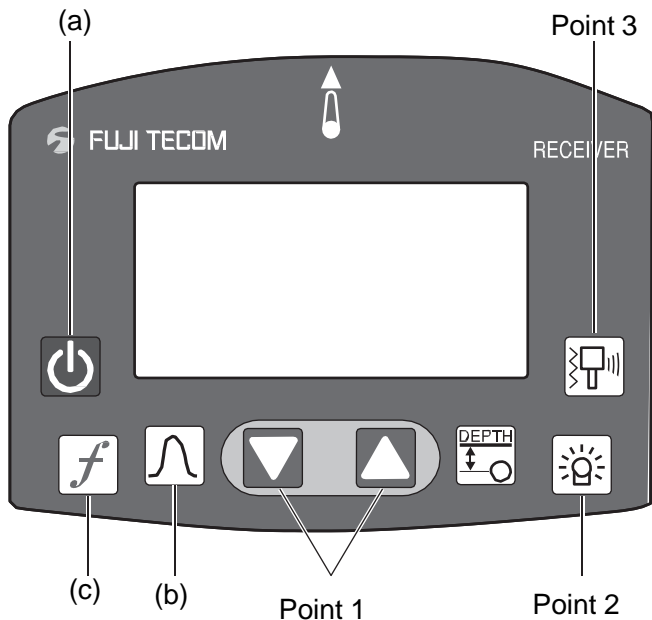
MODE	EXPLANATION	Depth Measurement	
		Pull-Up	Horizontal
Maximum Mode	To locate the position of pipeline correctly.		
Continuous Depth	To grasp the change of depth of the pipeline.		
Bar Mode	To locate the pipeline over a longer distance		
Sonde Mode	By use of Sonde (probe), non-metallic pipeline can be located.		

NOTE: Pull-up depth measurement is the most precise

5-1-2 Operational Procedure of Receiver

- (a) Push the Power Switch Key
- (b) Choose one of above modes
- (c) Choose one frequency

NOTE : Use the same frequency for both the transmitter and receiver.



About 5 meters away from the transmitter, keep the direction and angle of the antenna perpendicular to the pipeline as illustrated in next page, and move sideways to pinpoint the pipeline.

Point 1. Operate the gain control switch to facilitate the measurement.

Point 2. For night operation, press the backlight switch to illuminate the LCD display.

Point 3. Press the volume switch until the volume is appropriate for operation.

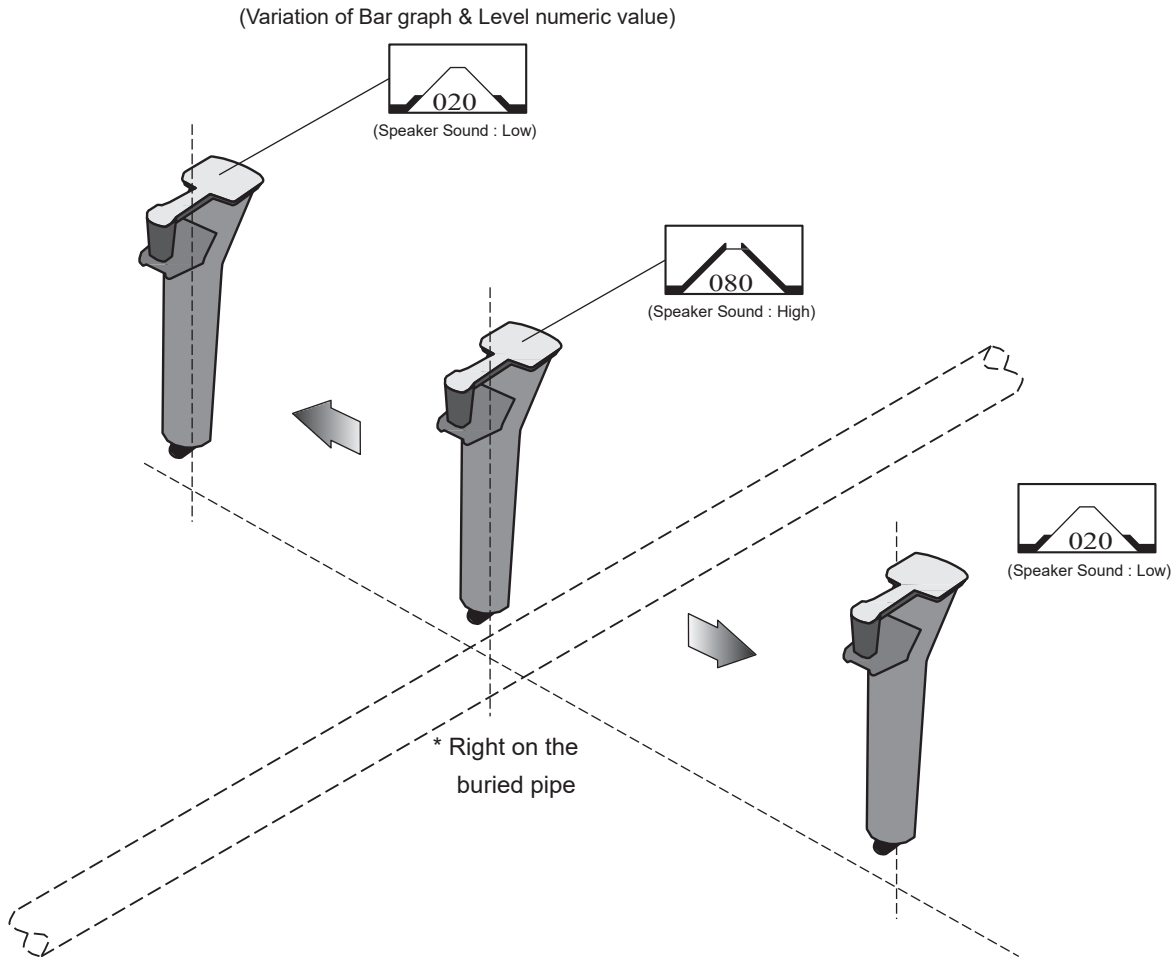
Large → Medium → Small → OFF

*The vibration function is turned ON/OFF by long press.

OPERATION OF RECEIVER

5-2 Display screen & Measuring method

5-2-1 MAXIMUM, BAR, and SONDE Mode



Location of pipeline or cable

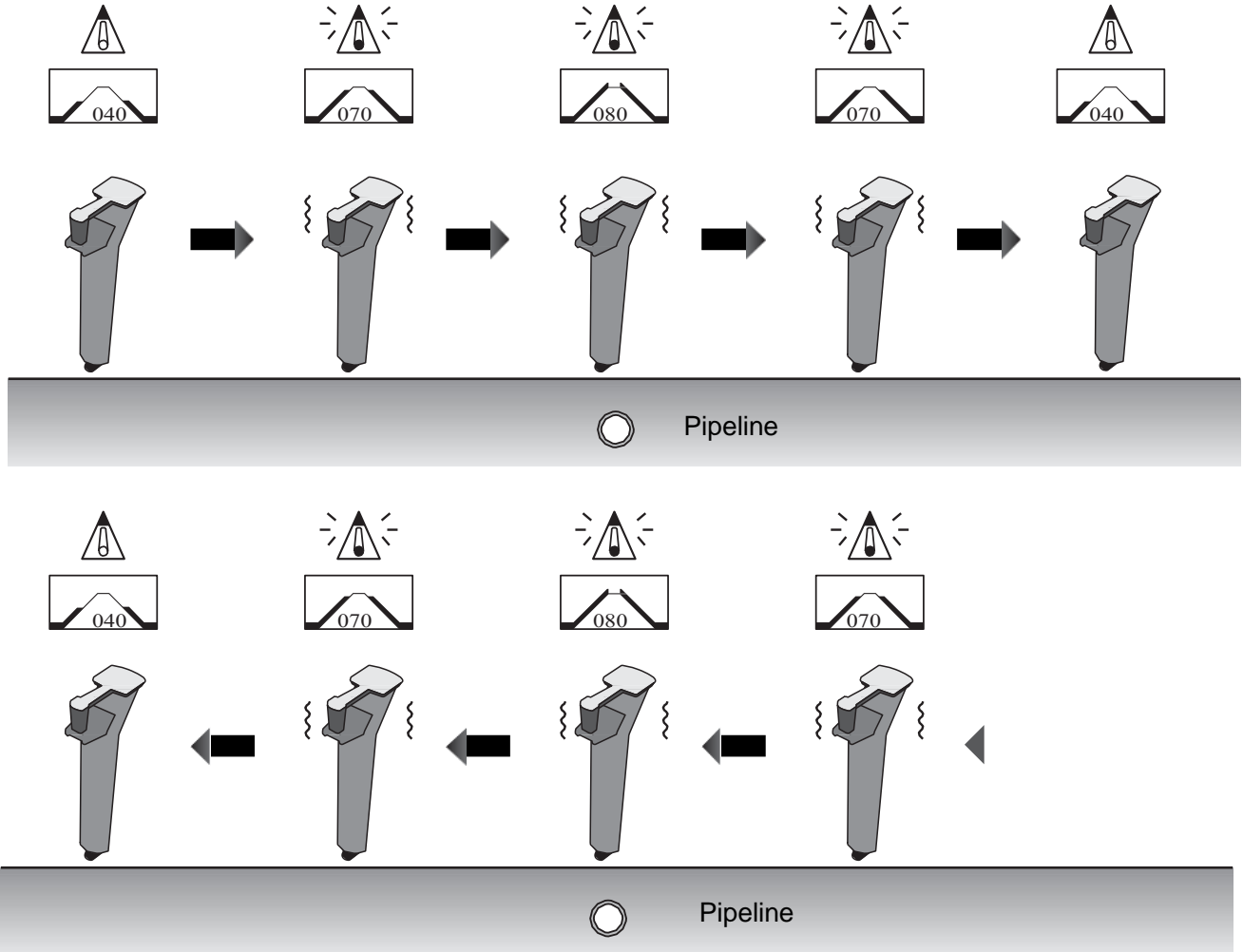
Location of pipeline is indicated as the point where the peak of the bar graph in the panel display is the maximum.

Point : In the event the bar graph scale swings widely, it is possible that some pipelines are buried closely.

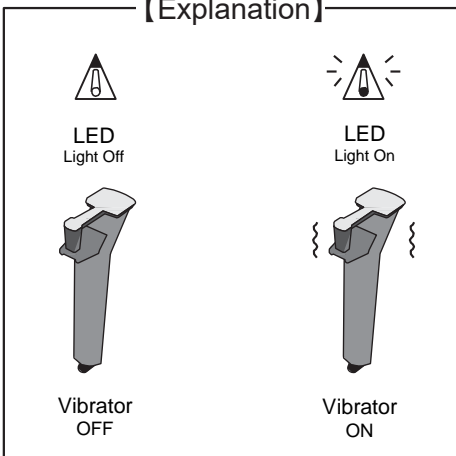
Refer to page 38 (section 6-3)

OPERATION OF RECEIVER

Motion of LED & Vibrator



【Explanation】



LED/Vibrator operation can be turned ON/OFF by holding down the key for a long time.



OPERATION OF RECEIVER

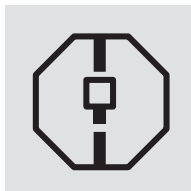
5-2-2 Pipe Axis Display



This icon is the RECEIVER and the surrounding black markings indicate the approximate orientation of the pipeline.

The Axis displays the direction of the pipeline. The correct direction may not be shown accurately on parallel pipelines or lines that bend.

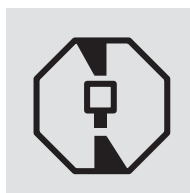
NOTE : The correct direction may not be shown on parallel pipes and bent pipes.



<- The direction of the receiver and the pipeline are the same

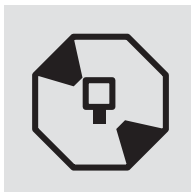


Left



Right

<- The direction of the receiver is somewhat different from the direction of the pipe

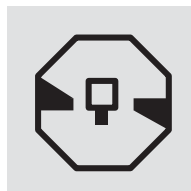


Left

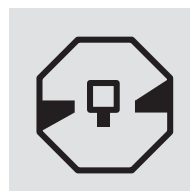


Right

<- The direction of the receiver is offset by 45 degrees from the direction of the pipe

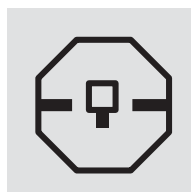


Left



Right

<- The direction of the receiver is almost offset by 90 degrees from the direction of the pipe

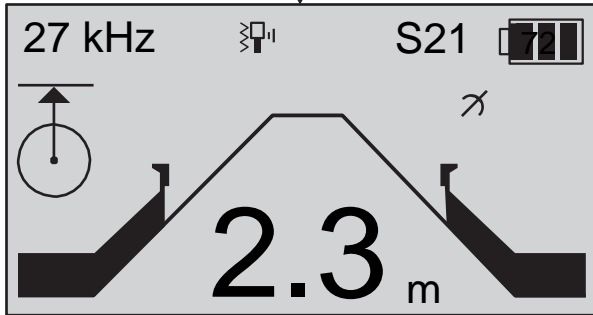


<-The direction of the receiver is offset by 90 degrees from the direction of the pipe


OPERATION OF RECEIVER


5-2-3 Continuous Depth Measurement Mode

 Push 1 time



Step 1. Locate a pipeline using MAXIMUM (PEAK) MODE in advanced.

Step 2. Set the detection mode to "Continuous Depth Measurement Mode" by pressing the depth measurement key: 

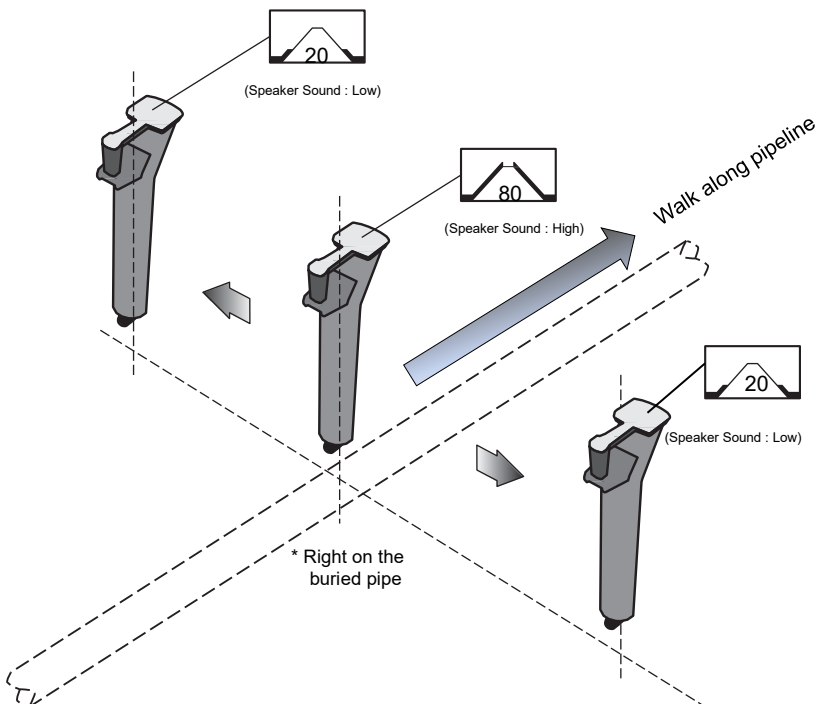
It is in the correct mode when this icon is displayed: 

Then, place the receiver on ground level above the pipelines.

Step 3. Slowly walk along the presumed pipeline while carrying the receiver as close to the ground surface as possible. This will help generate accurate depth readings. Ensure you also maintain correct orientation while walking, as shown in the diagram to the bottom-left.

NOTE: Pressing the depth measurement key again will activate

(Variation of Bar graph & Level numeric value)

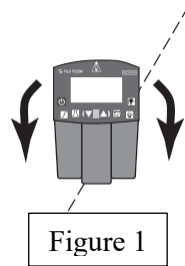


OPERATION OF RECEIVER

5-2-4 Pull-up Depth Measurement

Set up the transmitter

☞ Orient the Transmitter correctly to the pipeline



Operation of Receiver (Standard Depth Measurement)

Enter MAXIMUM MODE

*Set as Sonde Mode when in use of Sonde

Orient the receiver above the pipeline as shown by the arrows in figure 1, and stop when the LCD screen reaches maximum indication. See page s6 (section 5-2-2)

Push down the antenna "completely" and press the depth measurement switch ①.



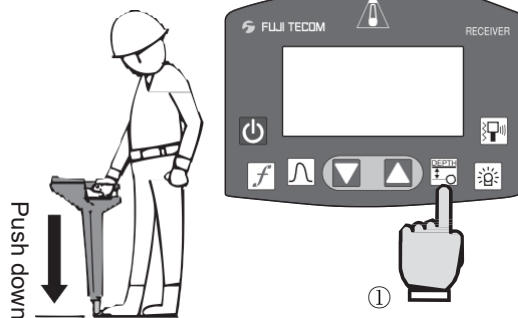
NOTE: depth cannot be measured with Bar mode.

When you see "PULL UP" on the LCD screen, fully pull Up/extend the antenna. ②

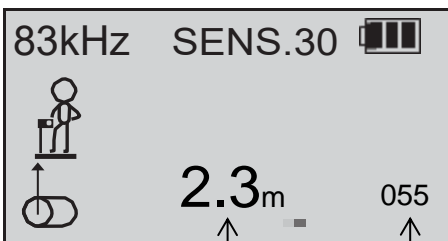
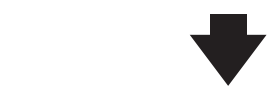
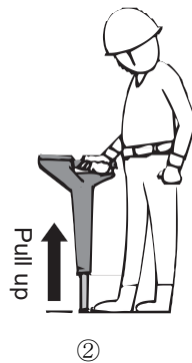
After pulling up completely, ③ the measured value will be displayed on the LCD screen.

【Attention】

- Do not move the antenna after pressing the depth measurement key until "PULL UP" appears on the display.
- Do not move the antenna after pulling up the antenna until the depth result is displayed.
- After taking a depth measurement, pressing the Sensitivity Adjustment key will display the previous screen. Pressing the depth key will display the horizontal displacement depth measurement screen.



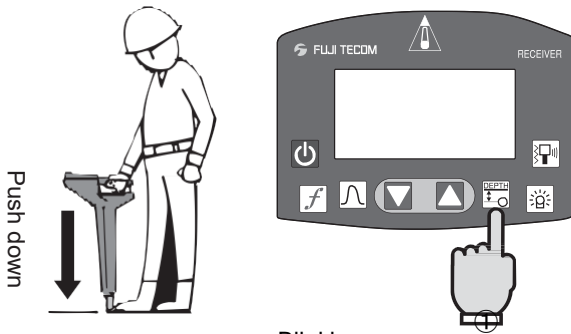
PULL UP



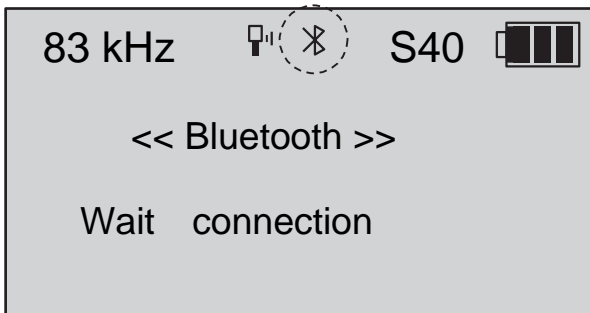
Measured depth value Current index value

③
Measured value
is displayed

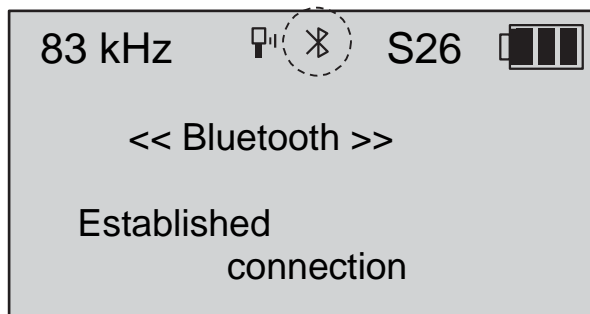
OPERATION OF RECEIVER



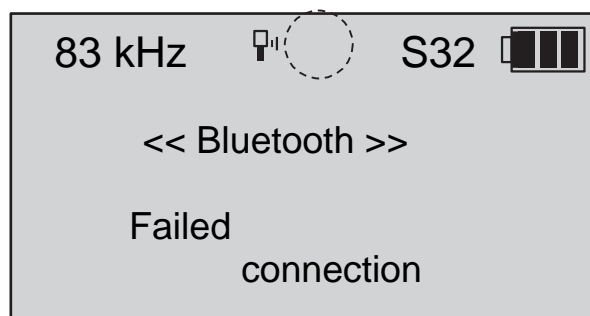
Blinking



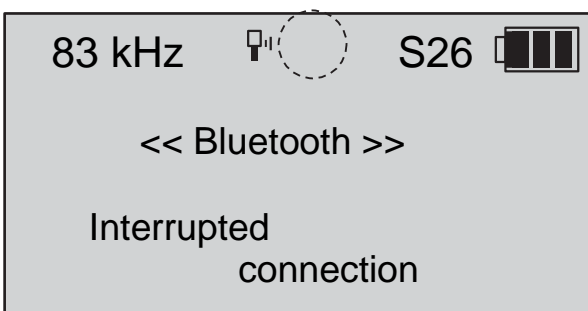
Solid



Invisible



Invisible



BLUETOOTH DEPTH & DATA COLLECTION

(Bluetooth app functionality)

The receiver comes equipped with Bluetooth, a wireless communication method. With this, you can record depth information to a smartphone using the PL-AP Android app. You may find this on the Android Play Store.

Connecting your PL-G MAX Receiver with the Bluetooth PL-AP Android App:

1. Open Bluetooth settings on your Android device and have it ready. Make sure it is still OFF in this step. Refer to page 6 to learn how to find the Bluetooth settings.
2. Turn on the PL-G Receiver by pressing the red power button, and wait until "Processing" is complete.
3. Hold down the "Depth" button on the PL-G until it says "Wait Connection".
4. Quickly, on your Android device, turn your Bluetooth on and connect to "PL-G.MAX" as soon as it appears. If prompted, confirm the connection by selecting PAIR or OK.



5. Quickly find and open the PL-AP app and select "PL-G".
6. Quickly Select the "Data Transfer" button. This button should then turn into a "Stop Transfer" button.
7. The PL-G receiver will now say "Established Connection", and you will be instructed to immediately begin operating the Receiver.

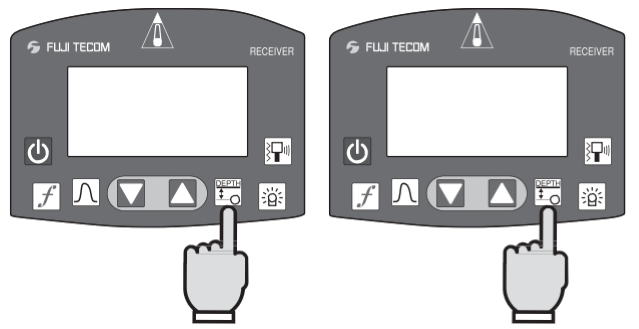
To learn more about the PL-AP Android App and how to use it, please refer to the PL-AP App Manual.

If a Bluetooth connection is not established within 60 seconds, the receiver will display "Failed Connection".

To interrupt the connection process, press the Sensitivity Up or Down button. The receiver will then revert to the previous operation mode.

OPERATION OF RECEIVER

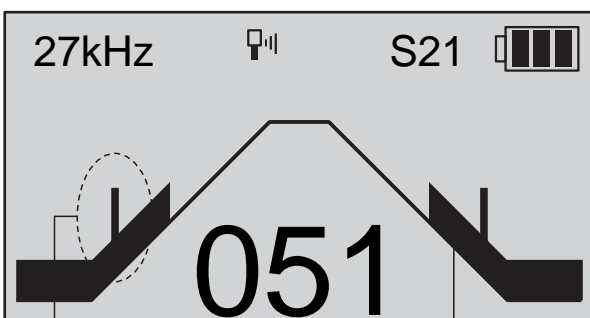
5-2-5 Transverse Depth Measurement



② Press 1 time

① Press 1 more time

③ Transvers depth measurement screen



Marker

Bar graph

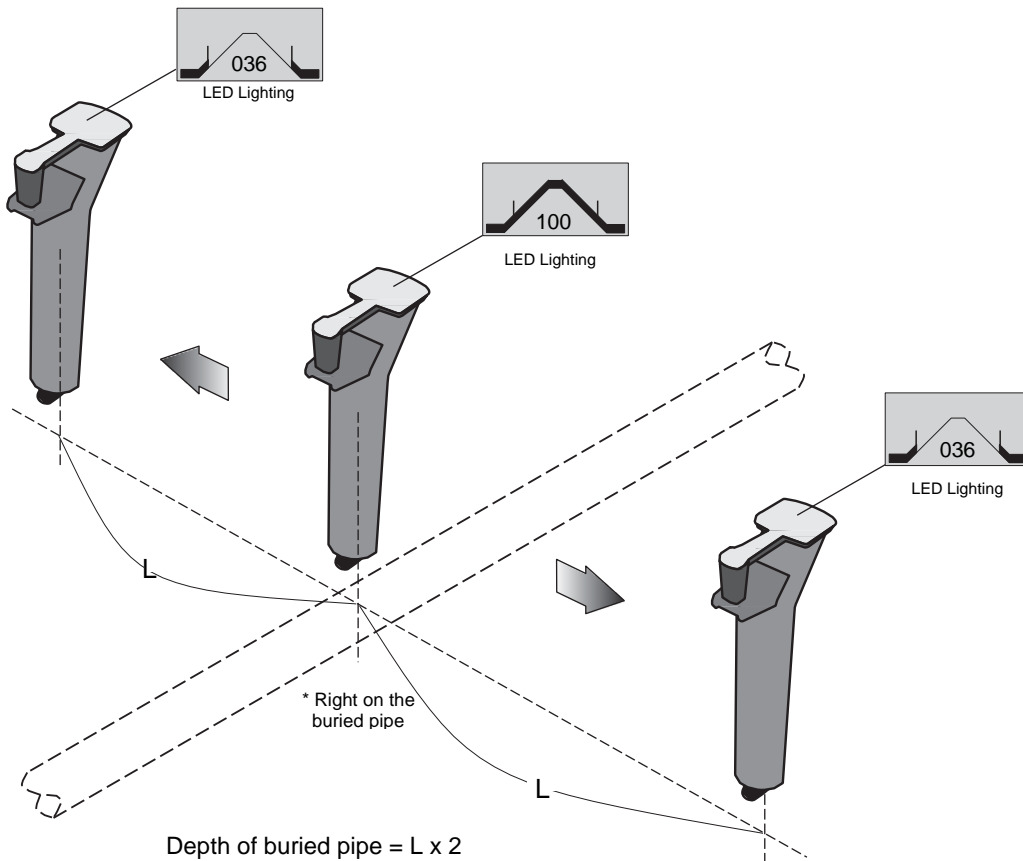
1. Set the receiver to MAXIMUM/PEAK mode:
2. Press the Depth key once:
The display will then say "Pull Up".
3. Without pulling up, press the Depth key again:

The receiver should now be in Transverse Depth Measurement mode.

4. Move the receiver along one of the perpendicular sides to the pipeline, as shown in the diagram to the left.
5. Mark the point where the marker and bar graph align. The buzzer should also be audible.
6. Repeat the process on the other side of the pipeline.

The total distance equals the depth. This method is suitable for depths of 0.5-2.0 meters.

To return to the MAX/PEAK mode, press the Sensitivity Adjustment key.



OPERATION OF RECEIVER

5-2-6 Detection by Sonde

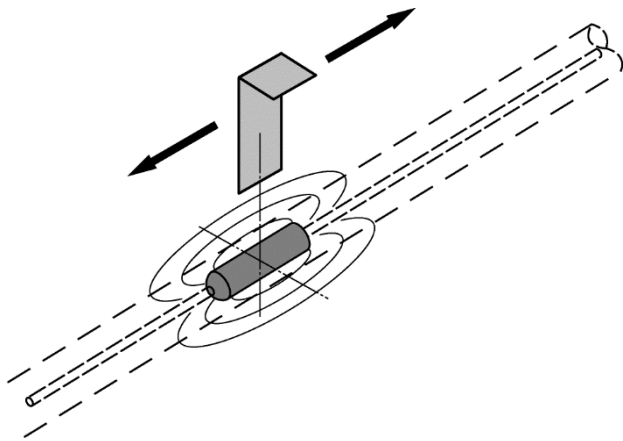
(Option : Sonde is necessary)

When a non-metallic pipeline such as a plastic or asbestos cement pipeline is required to be located, the Sonde is pulled into the pipeline using a wire as shown by the following figure.

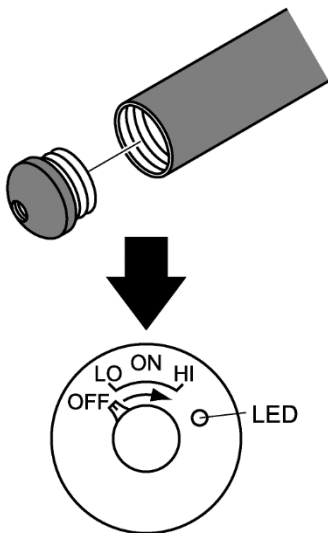
1. Push the Power Switch Key **(1)** and check the battery power displayed on the LCD.
2. Choose Sonde Mode with the Mode Selection Key **3**. See page 24 to learn about Sonde.

NOTE : The Receiver must be oriented parallel to the pipeline as shown by the figure to the left. The Receiver should move in the direction of the arrows in accordance with the movement of Sonde, as shown in the figures.

NOTE : The Transmitter is not used in Sonde Mode.

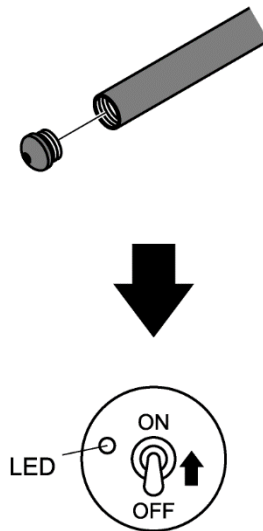


Large Sonde.



Detectable Depth : 3.5 meters by LO (Low).
5 meters by HI (High).

Small Sonde.

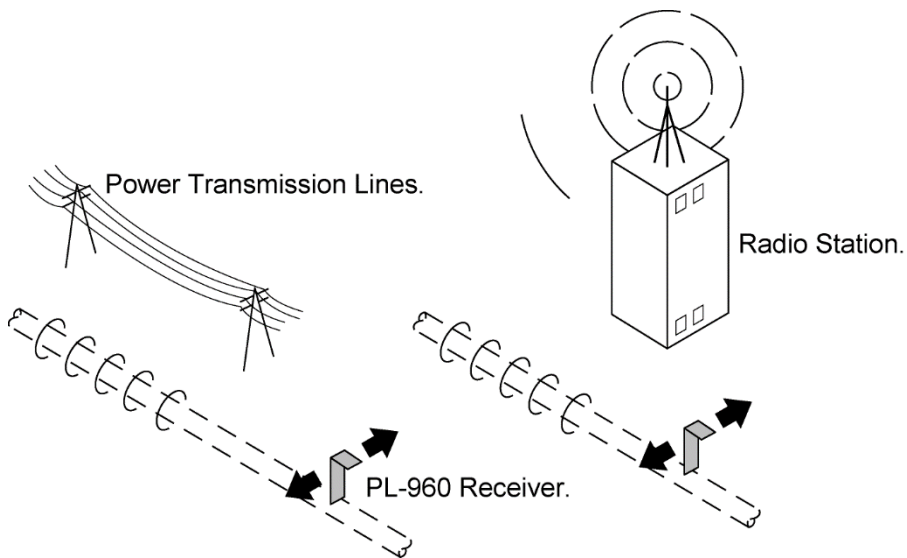


Detectable Depth : 3.5 meters.

NOTE : The LED turns on and off while the battery still has power to operate the Sonde.

OPERATION OF RECEIVER

5-2-7 Radio Mode

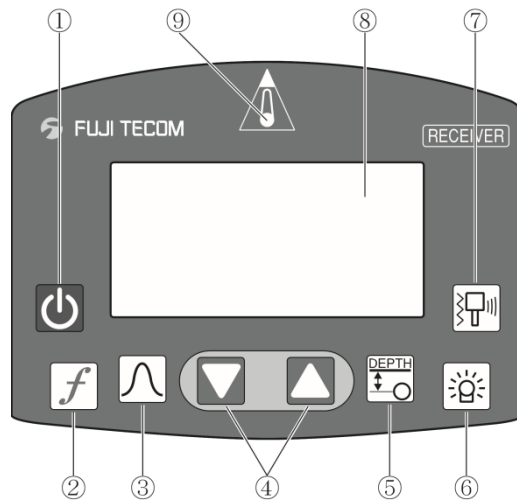


The Radio Mode does not need the Transmitter. the PL-G Receiver can locate pipelines by using magnetic fields induced onto the pipeline.

1. Push the Frequency Selection Key **2** and choose the Radio Mode displayed on the LCD screen.
2. Select MAXIMUM / PEAK Mode with the Mode Selection Key **3**.
3. Adjust the sensitivity with the Sensitivity Adjustment Key **4**.

NOTE: The depth of a pipeline cannot be measured when in RADIO Mode.
Use MAXIMUM Mode to measure the depth of a pipeline.

OPERATION OF RECEIVER



5-2-8 AC/CP Mode

AC/CP mode **does not** require the use of the transmitter.

To operate the receiver in AC/CP mode, follow these instructions:

1. Push the Power key ① and confirm that there is enough battery remaining to operate the receiver.
2. Push the Frequency Selection Key ② and choose the Live Cable Mode as displayed on the LCD screen.
3. Select Maximum Mode or Bar Mode with the Mode Selection Key ③.


Use Maximum mode initially for sharp peak indication of cables. Sensitivity increases with bar mode but peak indication over cable is wider.

OPERATION IN EACH SITE SITUATION

6-1 Detection by Induction Mode


(When the position of a pipeline can be predicted)

6-1-1 With 2 surveyors

- ① Turn transmitter and receiver on. 
 - Check the remaining battery power
 - Confirm the output mode of the transmitter is IND. (Induction mode)

- ② Adjust the frequency  of the transmitter and receiver

* The default frequency when you start up the transceiver is 83 kHz.

- ③ Set the detection mode of receiver  to Maximum / Peak Mode

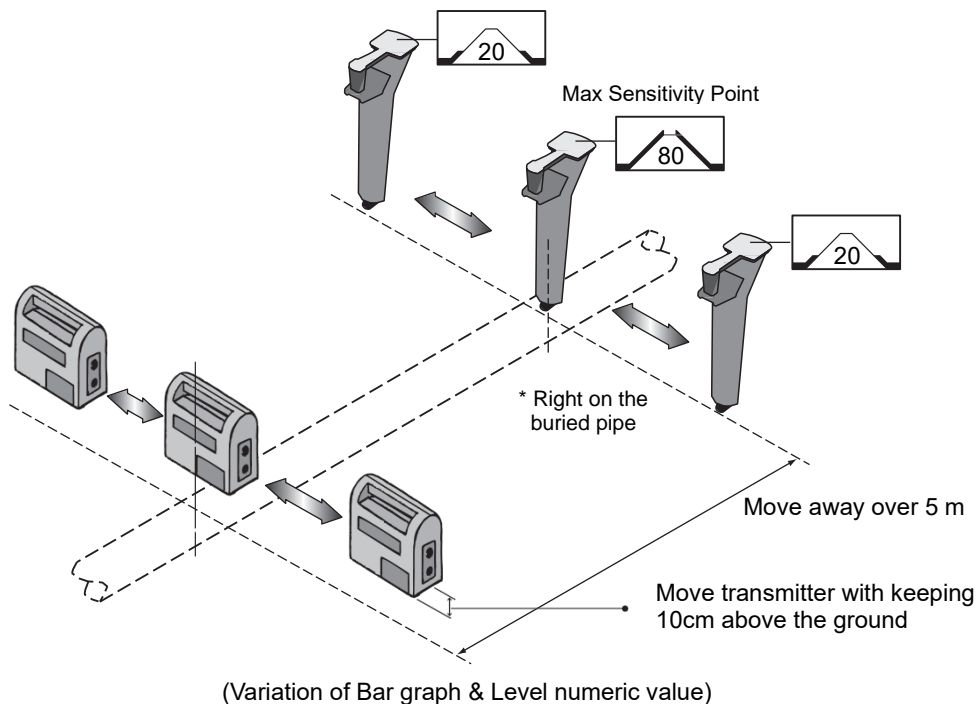
- ③ Change the output level of the transmitter to 2 ~ 5

*Output level will vary for different sites.

- ④ Search for a position where the receiver's bar graph and numerical value reaches a maximum while moving the transmitter and receiver sideways, as shown in the diagram below.

*Adjust the sensitivity of the receiver to a level that is easy to distinguish.

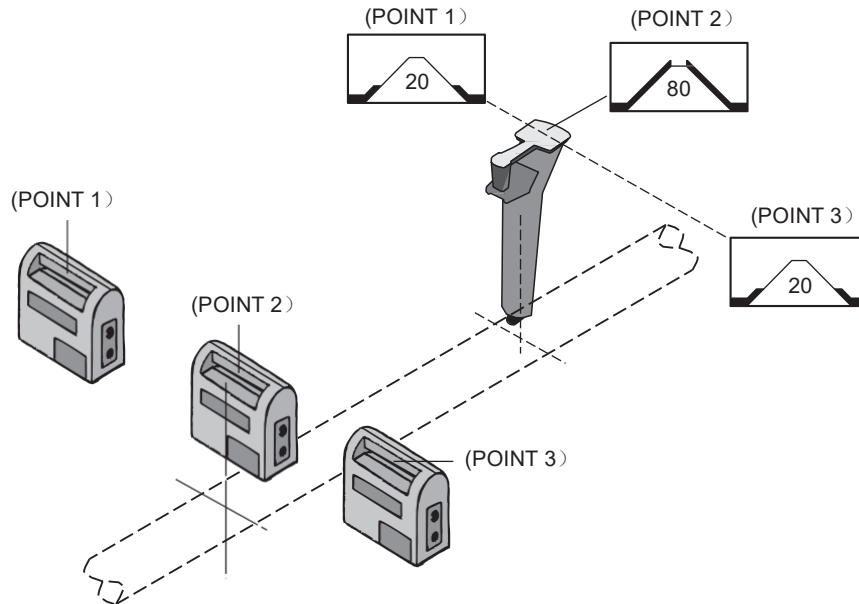
*Maintain a constant distance between the transmitter and Receiver when moving sideways.



OPERATION IN EACH SITE SITUATION

- ⑤ Place the receiver where you detected a maximum point and move the transmitter to where it was when the receiver's bar graph and numeric value reached maximum points.

(Variation of Bar graph & Level numeric value)



- ⑥ You may now perform pipeline detection work

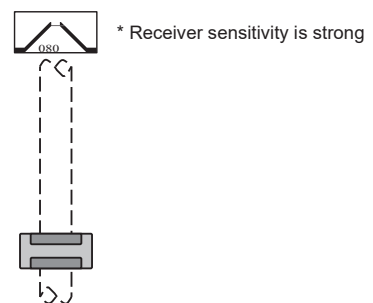
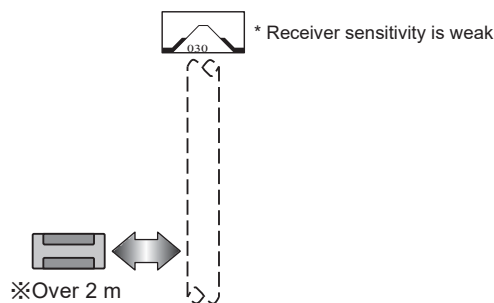
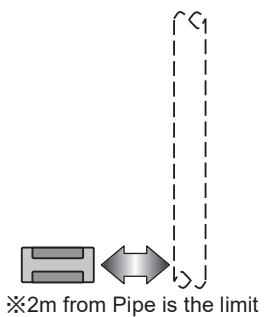
- * Adjust output of the transmitter.
- * Select frequencies of the transmitter and receiver.

*Since maximum allowed distance between the transmitter and buried pipeline is approx. 2 m, make sure to select the detecting position

(Installation Advice)

(Ex.1 distance from pipe is over 2 m)

(Ex.2 Transmitter is right on the buried pipe)



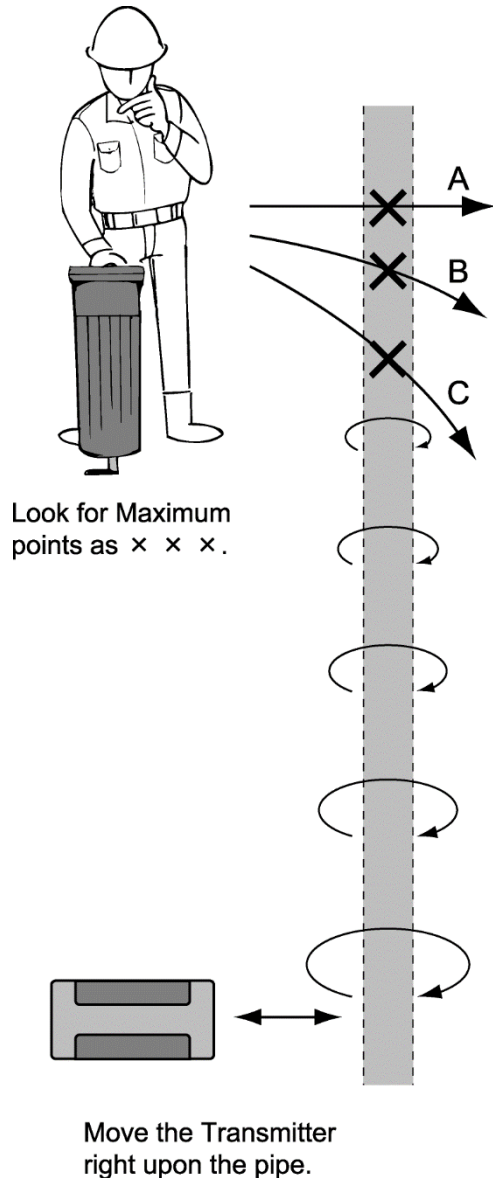
Adjust direction of the transmitter is perpendicular to direction of the pipe

OPERATION IN EACH SITE SITUATION

6-1-2 With 1 surveyor

If the PL-G MAX will be used by just 1 person, please follow these instructions:

- ① Ensure there is enough battery power in the Transmitter.
- ② Confirm that the Transmitter is set to IND (Induction Mode)
- ③ Choose the frequency of Transmitter:
Either 83KHz or 27kHz may be used useful to confirm the location of a pipeline.
- ④ Adjust the output power with the Output Power Control Key between levels 2 and 5.
The Power Level should be chosen in accordance with site conditions.
- ⑤ Place the Transmitter on the ground where the pipeline is presumed to be buried.
- ⑥ Turn on the Receiver and select the same frequency as the Transmitter (83kHz or 27kHz).
- ⑦ Have approximately 5 meters or more between the Transmitter and the Receiver.
The Transmitter is must face the Receiver as shown by the figure on the left
- ⑧ Locate the point where the Receiver displays the maximum Bar Graph and Numerical Value as shown by the left figures **(A)** **(B)** **(C)**. Those points are the location of the buried pipeline.
The Transmitter is required to be placed on the line shown by the figure **(A)** **(B)** **(C)**.



NOTE : Ensure the transmitter is oriented correctly with the pipeline.

OPERATION IN EACH SITE SITUATION

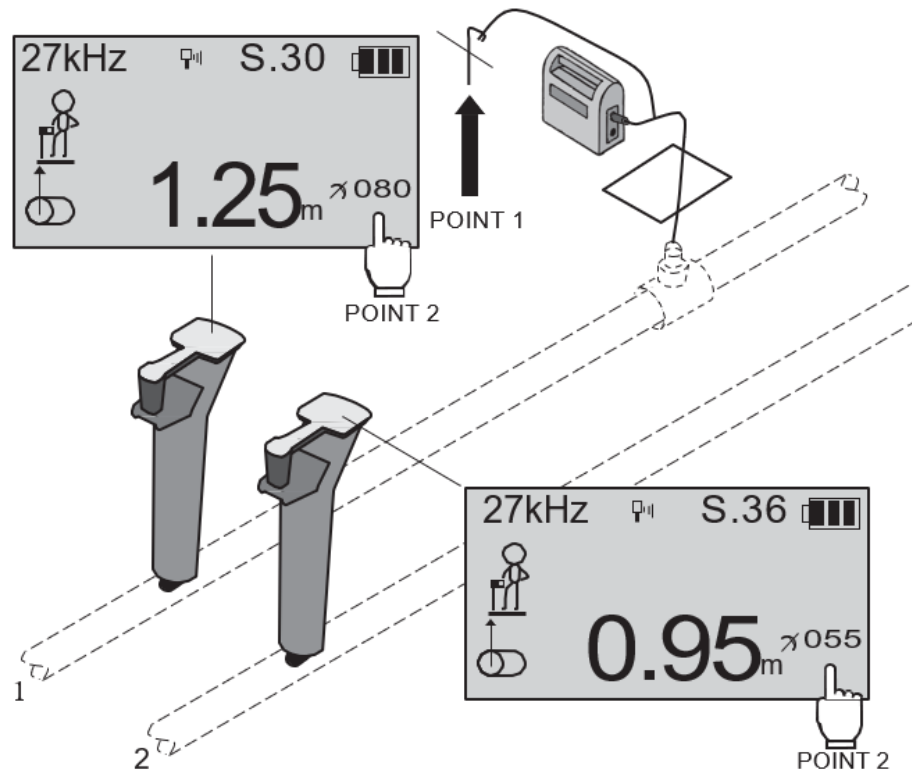
6-2 Depth and current of close parallel pipes

When you measure a depth, the depth value and the current index value of the measurement pipe line are displayed on the LCD screen simultaneously.

The response of a current is an important tool for differentiating pipelines that are in close proximity to each other. The placement of the Transmitter and the depth of each pipeline will determine the current response of each pipeline being located.

As the operator tracks the pipeline away from the transmitter, the current response decreases. It is common for each pipeline to have a different current response in relation to each other.

Observing the current response allows the operator to differentiate pipelines for one another.



OPERATION IN EACH SITE SITUATION

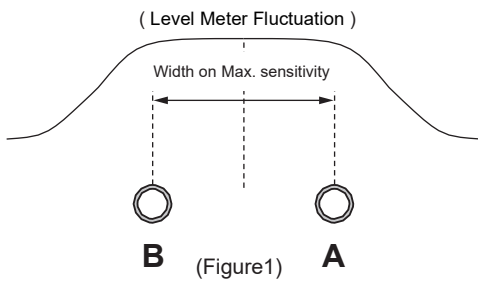
6-3 Detection of parallel pipes in close proximity

*please use Direct mode as much as possible if there are parallel pipes.

1. Set the transmitter to Inductive mode approximately 2 meters off the pipeline, as shown below (A).
2. Locate pipeline A and B. The location of pipeline A is accurate, whereas the location of pipeline B may be slightly distorted, as shown in the diagram below.
3. Move the transmitter over to pipeline B, approximately 2 meters off pipeline B.
4. Locate pipeline A and B.

*Depending on field conditions, the line indications may be slightly distorted.

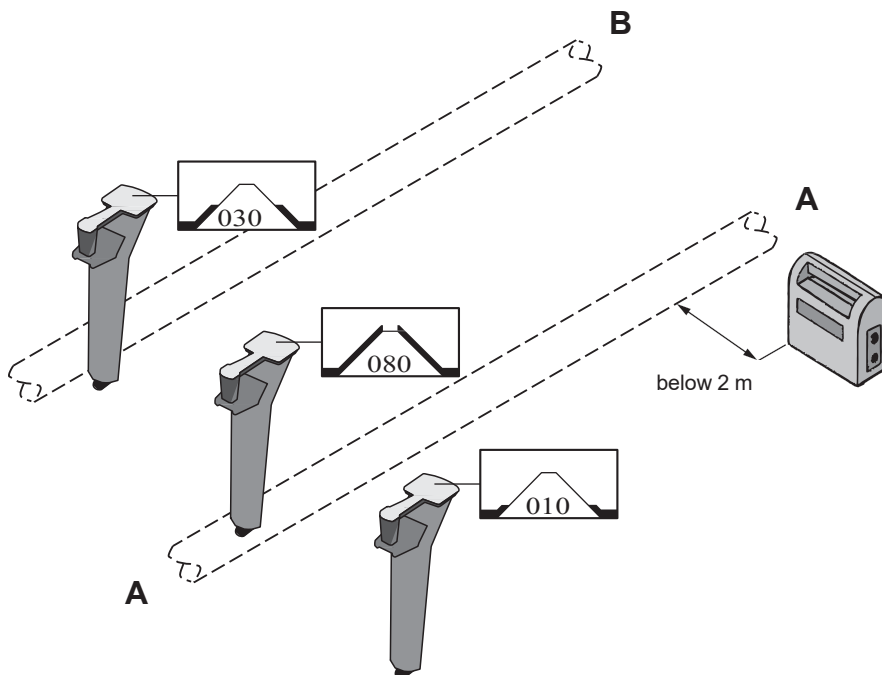
5. Place the transmitter above each pipeline and take depths. Compare the depths gathered as shown in the diagram below.



Detection by Induction Mode

As shown in Fig. 1, it is confirmed that the buried pipe is in parallel because the maximum sensitivity width is wide.

If you want to detect pipeline A, set the transmitter within 2 m from the maximum sensitivity point, as shown in the pipe diagram.

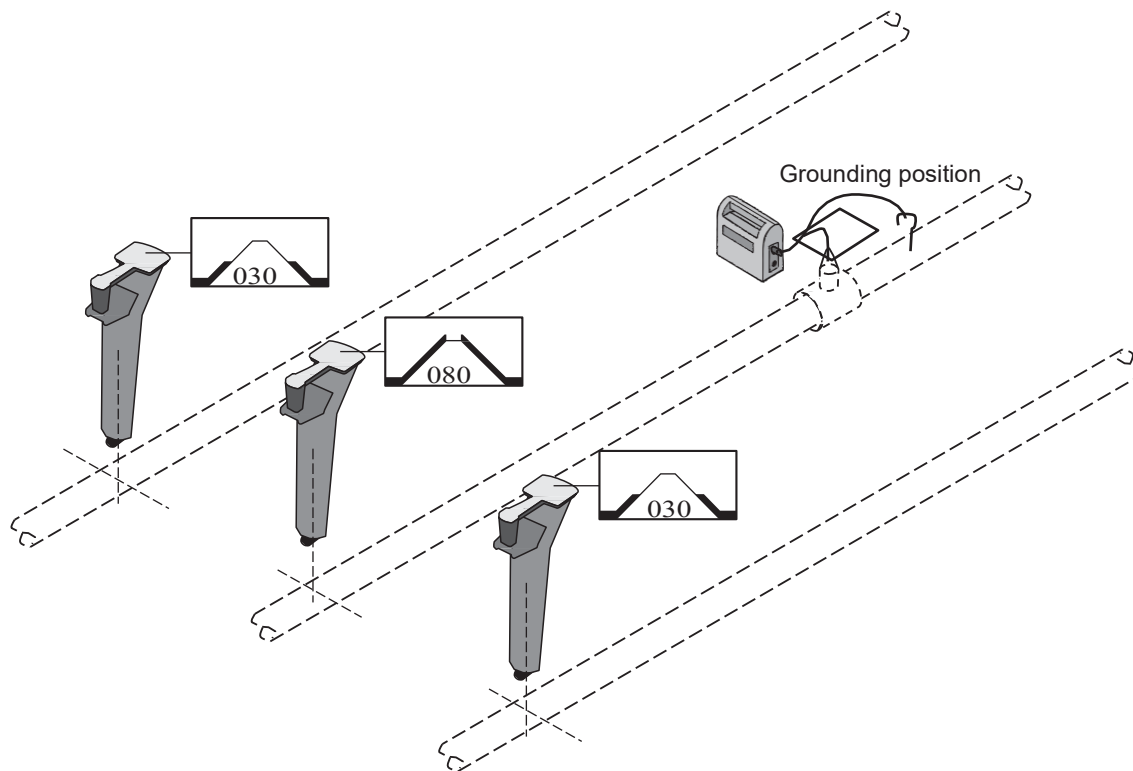


OPERATION IN EACH SITE SITUATION

Detection by Direct Mode

*please use Direct mode as much as possible if there are parallel pipes.

The diagram below shows what to expect in this setting. Using exposed parts of each parallel pipeline, grounding closely to a pipeline will aid in detecting other pipes one by one.



OPERATION IN EACH SITE SITUATION

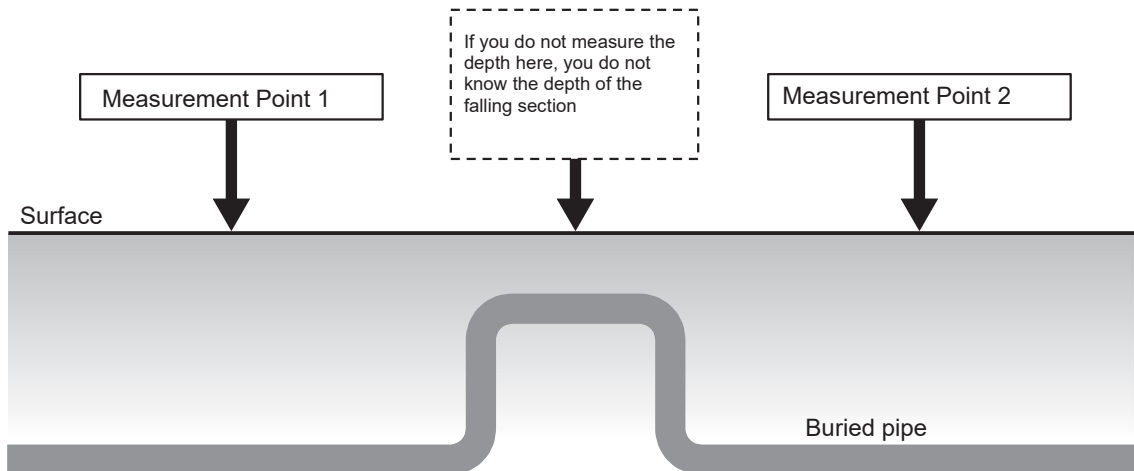
6-4 Measuring a depth near the end of a pipeline and near a bend.

At the end of the pipeline or near a bend, the magnetic field surrounding the pipe is disturbed. Therefore, the risk of error when measuring its depth increases. Using the **Transverse depth measurement mode** makes it less susceptible to magnetic field disturbances. Use this mode for such situations after confirming there is an end or bend in the pipeline.

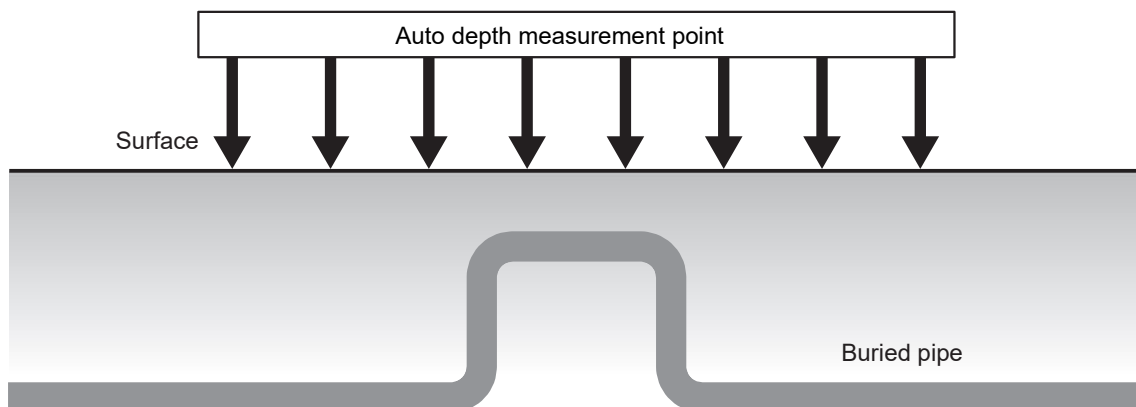
6-5 Confirmation of buried depth condition of pipeline

When using the **conventional** depth mode, there is a chance of misinterpreting the depth/shape of a pipeline when there are sudden changes in pipeline depth, as shown in the first diagram below. When using the **continuous** depth mode, the pipeline depth is measured in certain intervals with the measurement depth displayed, as shown in the second diagram below. This mode makes it easier to accurately confirm the depth situation of the pipeline. This mode is also useful when trying to find obstacles to avoid (such as bends in pipes etc.) when installing new pipelines.

■ Example of **conventional** depth measurement mode



■ Example of **continuous** measurement mode



OPERATION IN EACH SITE SITUATION

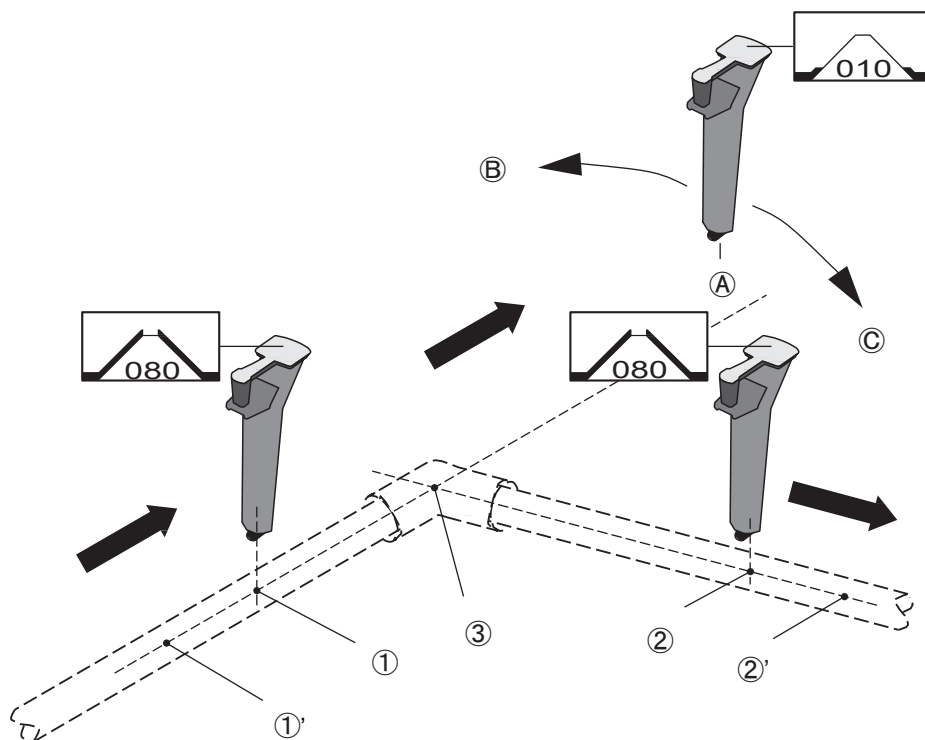
6-6 Detection of Elbow's, T's, and bends in a pipe

Setting up the Transmitter

Please select either Induction mode or Direct mode
In accordance with the site conditions.

Using the Receiver

- (1) While using the receiver in the direction of the arrows, the receiver will be most sensitive.
When passing through Point ③, the bar graph will decrease sharply.
- (2) Find the maximum point of the sensitivity by moving the receiver in a circular motion
in the direction of ③ and ④ to find where the sensitivity decreases.
- (3) Find the maximum point in sensitivity around ② ②' and plot
① ①' and ② ②' to help find the bend at point ③.



OPERATION IN EACH SITE SITUATION

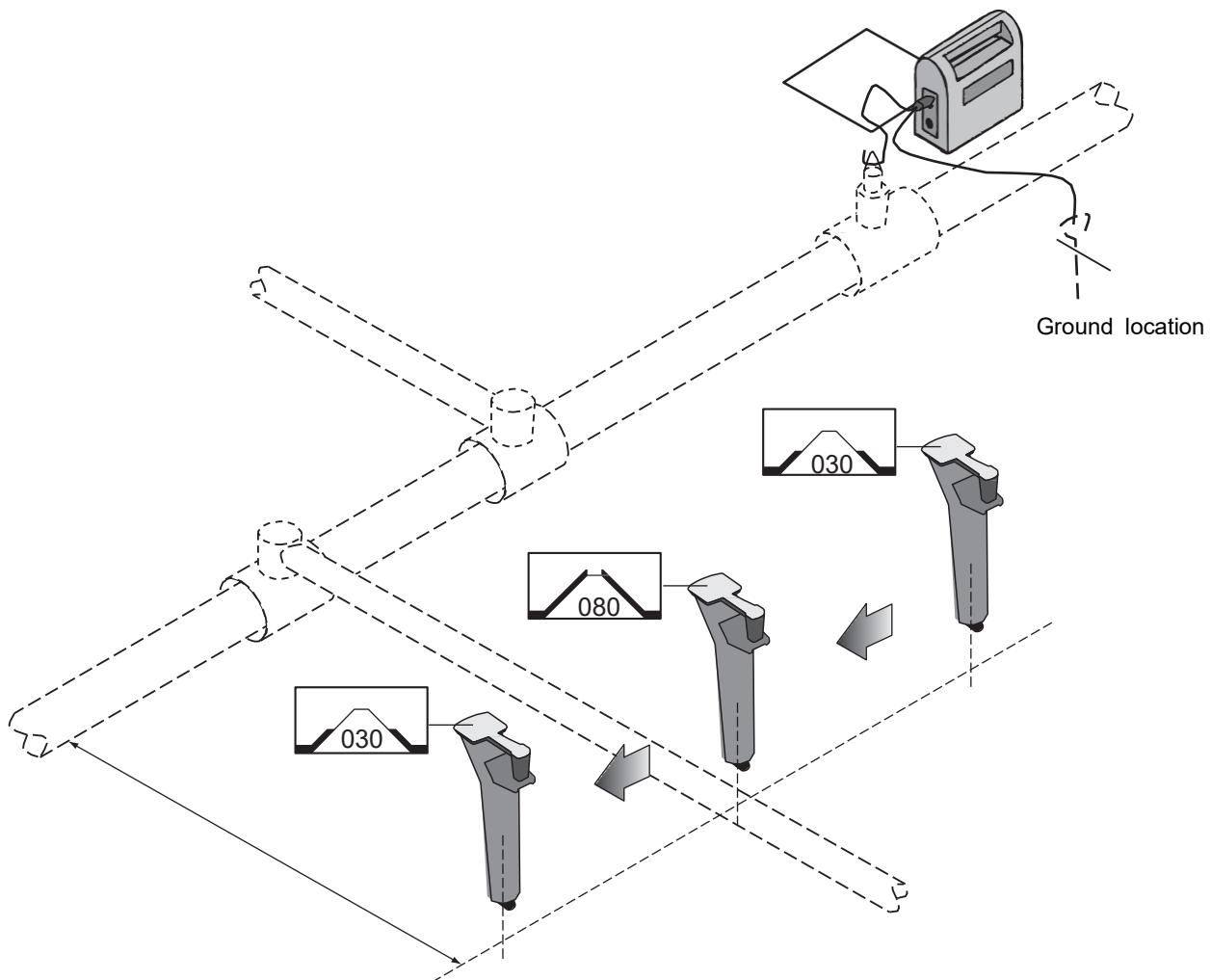
6-7 Detection of branch pipes

Direct Mode

- (1) In the case of the figure below, the grounding position of the ground is such that the ground is grounded on the right side for detecting the branch pipe on the right side.

Set the frequency to 83 kHz.

- (2) As shown in the figure, the receiving antenna moves about 1 m away from the main pipe, in parallel with the direction of the thick arrows, and looks for the maximum sensitivity point.



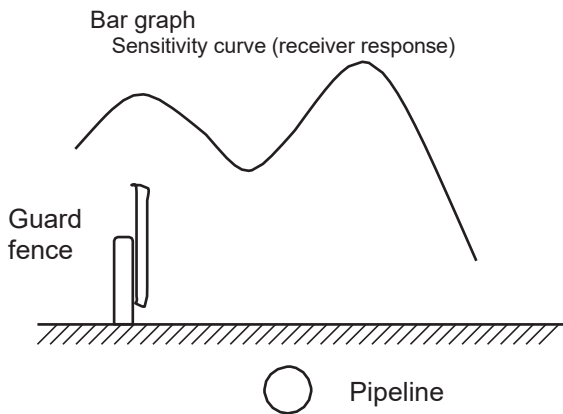
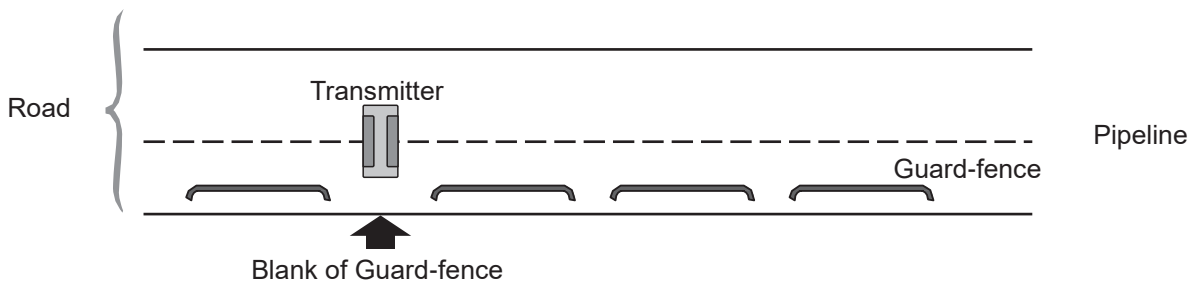
OPERATION IN EACH SITE SITUATION

6-8 When there are Guard-fences or Curbs nearby.

Setting up the transmitter

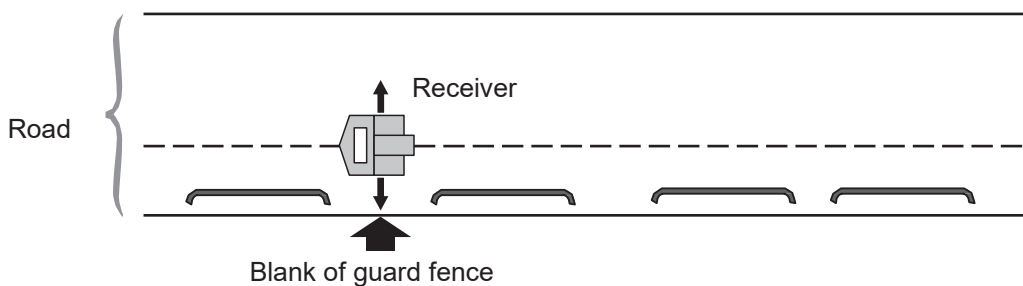
Begin by selecting Direct mode (DIR).

In circumstances where only induction mode can be used, please set it next to a guard-fence or curb as shown in the diagram below.



Operation of receiver

If crash barriers, curbstones, etc. are located close to the pipeline, these effects will be noticed on the receiver.

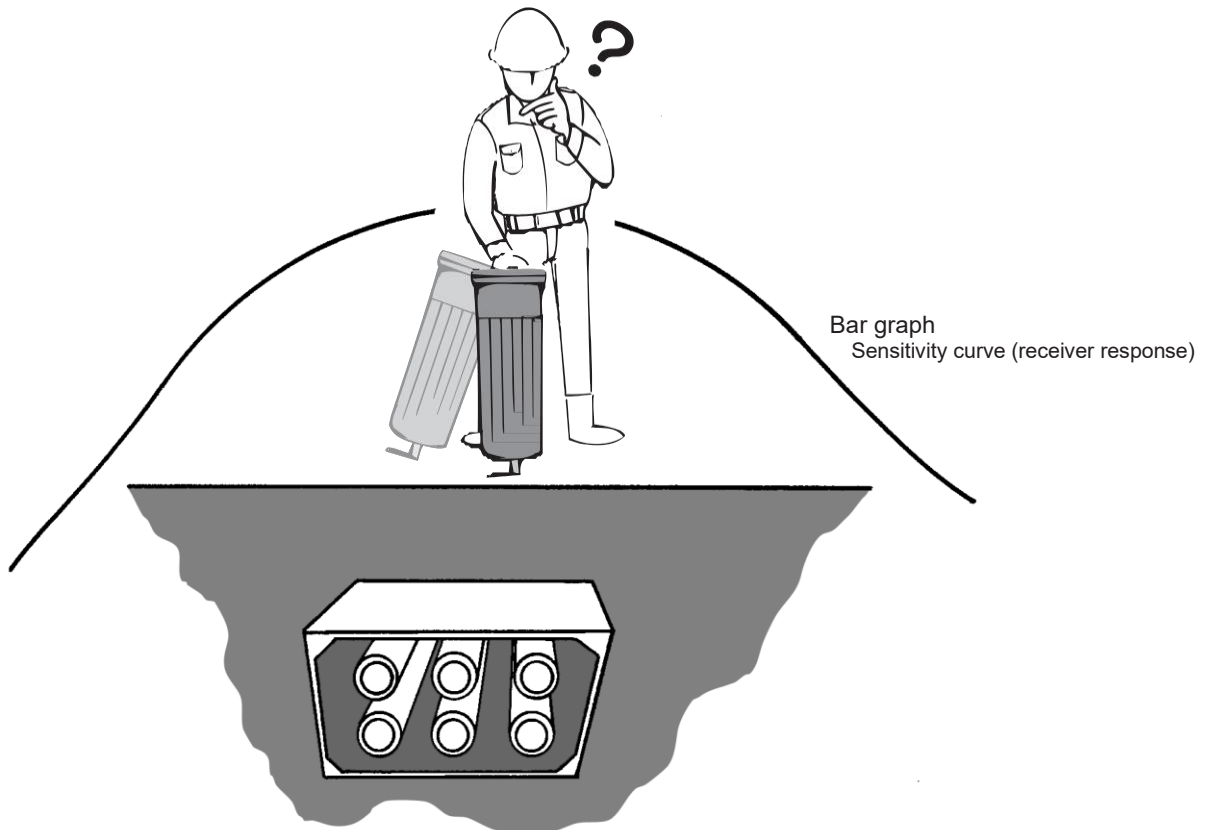


On such a site, please perform the detection next to the guard-fence or the curb as shown above.

OPERATION IN EACH SITE SITUATION

6-9 In the event there are multiple nearby pipes (congestion)

When pipes are buried closely together, the buried depth becomes unclear.



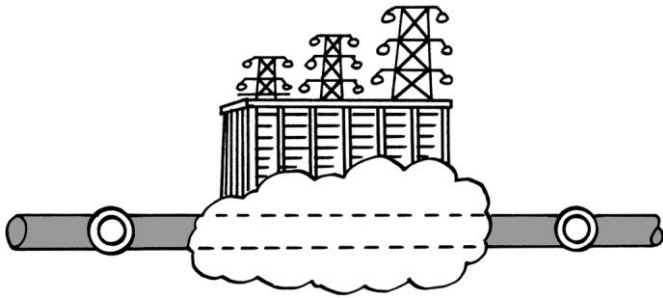
In such a site, please detect with an external induction coil for pipeline inspection.

[CAUTION]

It is impossible to detect the depth of a single buried pipe in places where there are multiple tightly packed pipelines, such as the ones shown in the diagram.

OPERATION IN EACH SITE SITUATION

6-10 When there is a power station nearby



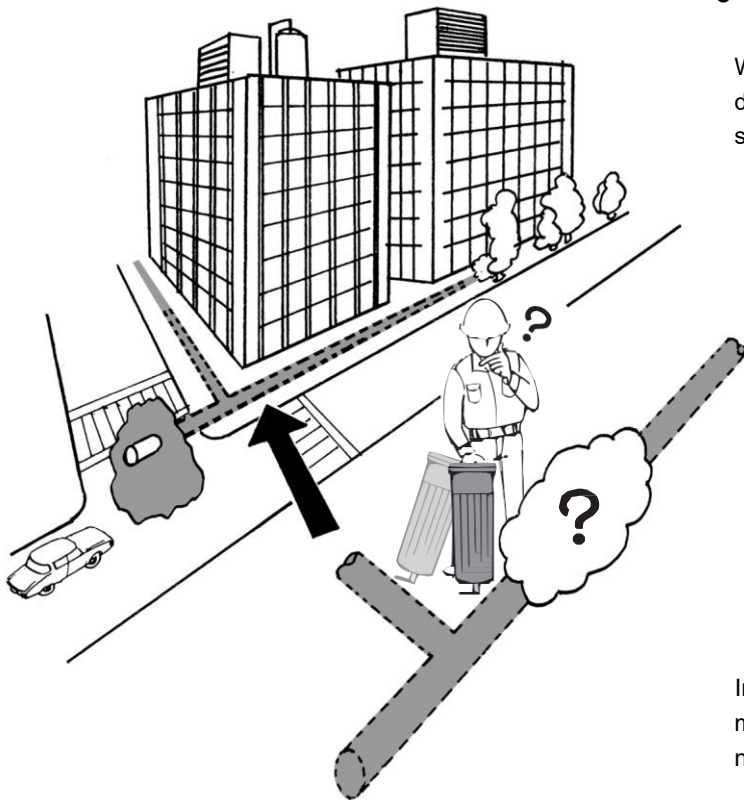
Begin by selecting Direct mode (DIR).

When there is a nearby substation, the pipeline(s) may not be detectable due to the interference of high-voltage lines, or the Substation facility.

In such a case, find a place before and after the interference of high voltage lines and substation equipment, as shown in the diagram to the left. Detect the pipelines from both areas.

You may then assume the pipeline's shape and direction in between the two points.

6-11 When detecting near buildings

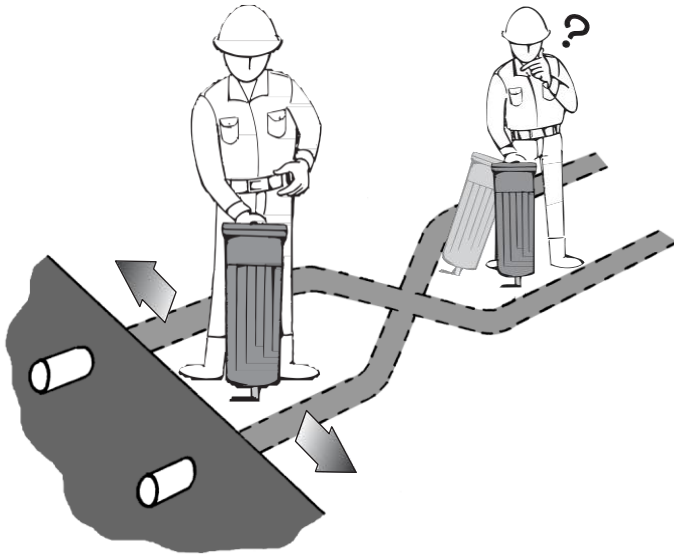


When a pipeline is buried near buildings, the position and depth may become unclear due to the interference of steel structures etc.

In such a case, use the direct mode (DIR), with an external magnetic coil. Additionally, perform the detection next to the break of the building or guardrail.

OPERATION IN EACH SITE SITUATION

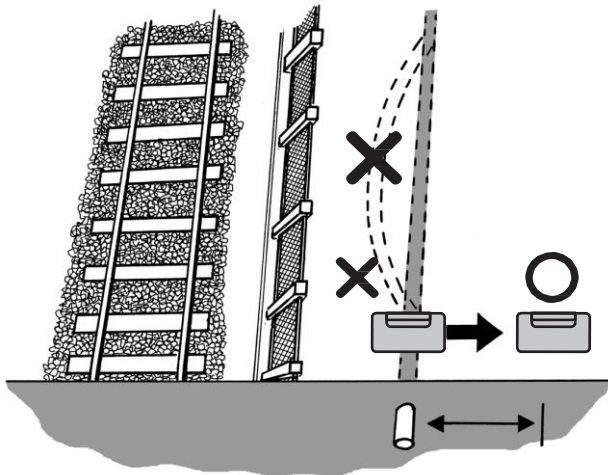
6-12 When there is a pipeline crossing



If another pipe intersects with the target pipe, the Depth of the buried pipe becomes unknown.

When this occurs, the measurement of depth and location becomes difficult. In particular, it cannot detect when buried pipes are in contact with each other. If they are not in contact, please move to the location where the receiver signal becomes stable. In order to perform more accurate detections, it is recommended to detect using Direct mode (with or without an external magnetic coil).

6-13 When there are nearby railways



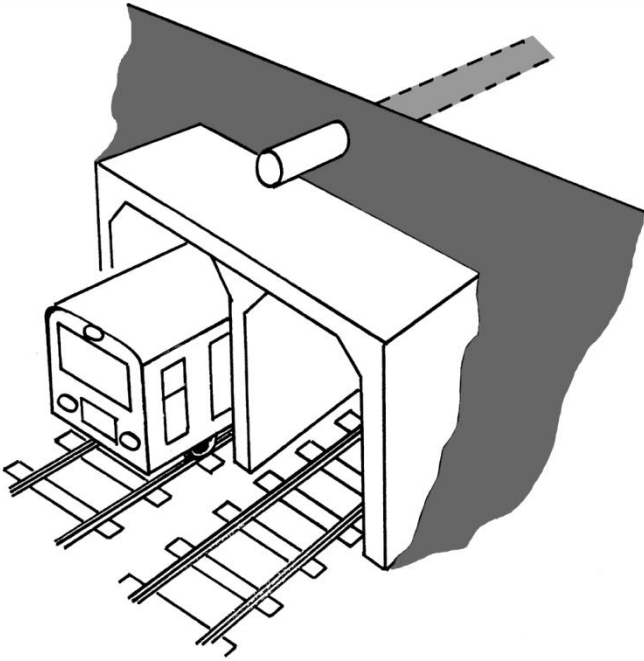
In the event the pipeline is next to a railway track, the tracks and fences may cause signal interference

In such a case, please use a transmitter on the outside of the fence, as shown in the diagram to the left.

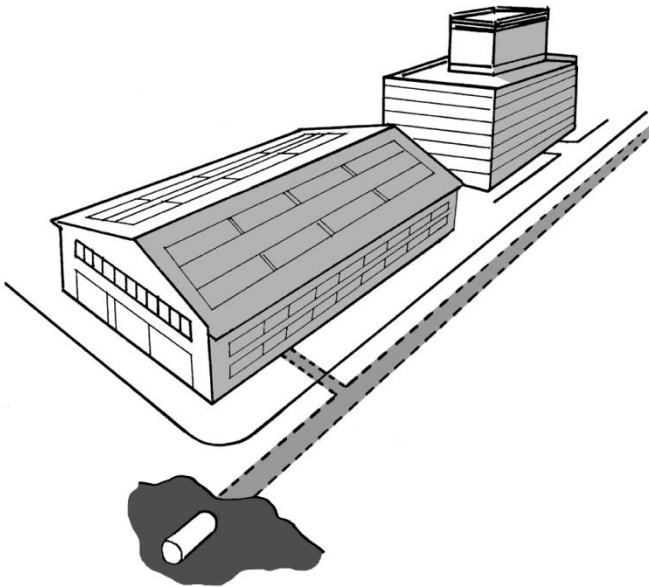
Caution :

Never enter the railway track to probe. It is prohibited by law.
You also cannot place the transmitter on the track.

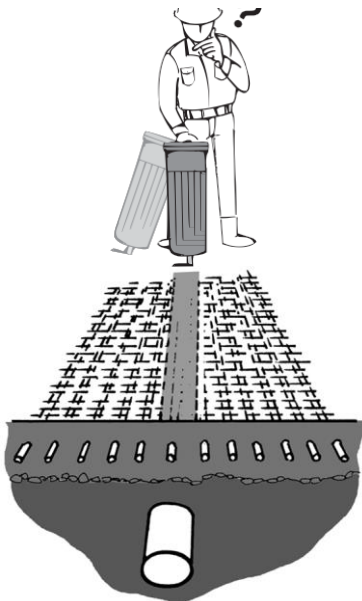
OPERATION IN EACH SITE SITUATION



When a subway is passing below the buried pipeline.



When the pipeline is in a factory



6-16 When there are reinforcement bars in the pavement

There may be cases in which rebar is in the pavement, such as in gas stations, or a factory where a large vehicle enter. This makes locating and depth measurement of a pipe impossible.

TROUBLESHOOTING

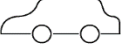

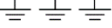
When the PL-G MAX Locator has a trouble locating a buried pipeline, use the following troubleshooting guide.

TROUBLE	COUNTERMEASURE
1. Cannot turn on the device	<ul style="list-style-type: none"> a) Confirm proper polarity of batteries in tool. When a tool is stored for extended periods of time, remove the batteries. The correct polarity of batteries is shown in battery compartment of the Transmitter (+ -) b) Check the residual battery power displayed in the LCD. When there is no power remaining, replace all the batteries. c) Check the polarity of the batteries mounted in the Battery Case. The correct battery polarity is shown in the Battery Case
2. When the Receiver does not receive any signal from the Transmitter.	<ul style="list-style-type: none"> a) Confirm if there are batteries in the Transmitter, and if the Transmitter is turned on. b) Confirm that both the Receiver and Transmitter are operating on the same frequency.
3. When the sensitivity readings of the Receiver is weak	<ul style="list-style-type: none"> a) The farther the transmitter is from the receiver, the weaker the signal from the transmitter is. A weak signal affects the measurement of depths. Move the transmitter closer to the Receiver. b) Do not set up the Transmitter on iron surfaces such as manhole covers. The Transmitter can not induce a magnetic field on to the buried pipeline in this case. c) Confirm if the Transmitter is oriented correctly in the direction of the pipeline. d) Confirm if the Ground Stake is placed effectively.
4. When the pipeline cannot be located	<ul style="list-style-type: none"> a) Check if there are insulating materials used in the joint of a pipeline. Insulated joints do not transmit magnetic fields to the pipeline. b) Confirm the material of the pipeline. Plastic Pipelines cannot be located with Metallic Pipe Locators.

MESSAGES DISPLAYED ON THE LCD

PL-G MAX Transmitter and Receiver displays the following messages on the LCD.

1. Transmitter displays:-

- **CHANGE BATT.** : indicates a battery replacement is needed.
- **OVER CURRENT** : indicates an overcurrent.
An automatic adjustment will attempt to solve this. If it does not work effectively, turn off the Power Switch.
- **IND.** : Induction Mode.
- **DIR.** : Direct Mode.
-  : indicates use of a Car battery / 12 volt external power source.
- **POOR**  : indicates a weak output level by the Direct Mode.
-  : indicates a good output power. Three marks are the maximum output levels.
- **CONTINUOUS** : indicates the cancellation of "Automatic OFF" function.
- **POWER OFF** : indicates "Power OFF" after one hour of idling, or if the tool was turned off.

2. Receiver displays:-

- **OVER SIGNAL** : indicates the signal strength is too high.
- **PUSH DOWN** : indicates that the Antenna is not pushed down completely.
- **ERROR DEP** : indicates the depth of a pipeline could not be measured.
- **FUNCTION NOT AVAILABLE** : indicates the depth measurement cannot be taken in this mode of operation.
- **NO SIGNAL** : indicates the signal is too weak from the Transmitter.
- **GAIN ERROR** : indicates an unstable signal.
- **PROCESSING** : indicates a time when an automatic adjustment and depth measurement is being processed.
- **PULL UP** : indicates an instruction of the user to pull up the Antenna to measure the depth of pipeline.
- **POWER OFF** : indicates the receiver turning off after idling for 5 minutes.
- **CHANGE BATT.** : indicates a battery replacement is needed.
- **PRESS ANY KEY** : indicates to change the message display into the operation display without the switch key.

DETECTION PERFORMANCE

Location detection

	Maximum method
Depth (1.2 m)	Within ± 2 cm
Depth (2.0 m)	Within ± 5 cm
Depth (5.0 m)	Within ± 25 cm

Depth detection

(Pull Up Type)

Depth (1.2 m)	Within $\pm 5\%$
Depth (2.0 m)	Within $\pm 5\%$
Depth (5.0 m)	Within $\pm 10\%$

(Measurable depth range 0 m to 5 m)

(Transverse type)

Effective depth range 0.5 to 2 m $\pm 10\%$

(Continuous type)

Effective depth range 0 to 2 m $\pm 20\%$

- ※ According to the test and test conditions of our company's technical development center.
- ※ Usage in Direct mode (D I R).

SPECIFICATION

Transmitter

Frequency	83kHz	27kHz	8kHz	MIX
Maximum output (Induction mode)	0.5W	0.5W	-	-
Maximum output (Direct mode)	3.0W	3.0W	3.0W	-
Transmitting mode	: CW (Non-modulation)			
Power supply	:DC 6V - D size batteries x 4 (LR20 Dry Batteries x 4) or 12V Car Battery			
Battery life	:Induction mode (Maximum output) = App. 8 hours :Direct mode (Maximum output) = App. 3 hours (In case of Level 4) = App. 8 hours			
Operation temperature	-10 ~ 55°C			

Receiver

Frequency	: 83kHz, 27kHz, 8kHz Radio Mode (15kHz ~ 25kHz) AC/CP Mode (50 & 60Hz)	
Level Change Display	: Bar graph and pitch change in the liquid crystal screen (Display of reception level: 3 digit number display)	
Depth measure	: 3 digit number display on liquid crystal screen (2 digit display at continuous depth measurement)	
Current measure	: 3 digit number value on LCD screen	
Power supply	: DC9V – AA size batteries x 6 (LR6 Dry Batteries x 6)	
Battery life	: 8 hours (no signal) 5 hours (Volume: Big, Back Light: On)	
Operation temperature	-10 ~ 55°C	

Weight and Size

Transmitter	288mm x 241mm x 105mm	2.0Kg (Inc. Batteries)
Receiver	131mm x 280mm x 610mm	2.1Kg (Inc. Batteries)

SPECIFICATION

Code reel type direct method code

(Code reel type direct mode code body)

Body size : (L) 150 mm × (W) 47 mm × (H) 192 mm

Direct mode code (red) Length : 4 m (excluding clip)

Direct mode code (black) Length : 4 m (excluding clip)

Cord reel connecting cable length : 50 cm

Weight : 0.65 kg (complete set)

(Large alligator clip)

Applicable tube diameter : maximum ϕ 100 mm

Size : (Width) 167 mm × (Thickness) 33 mm × (Length) 174 mm

Weight : 0.38 kg

Outer magnetic coil (option)

(Outer magnet coil body)

Applicable frequency : 8 kHz to 334 kHz

Applicable tube diameter : Outside diameter ϕ 100 mm or less

Size : (Width) 184 mm × (Thickness) 29 mm × (Length) 206 mm

Weight: 0.4 kg

(code)

Length : 5 m

WARRANTY

FUJI warranty period is one year (12 months) after the purchase date of the PL-G MAX Pipeline and Cable Locator from a FUJI distributor.

A Warranty Card is attached to each PL-G MAX Locator in the event that maintenance services are needed.

If your PL-G MAX Locator is malfunctioning during ordinary use or handling, you can have it repaired free of charge within the warranty period.

Please send the malfunctioned PL-G MAX Locator to a FUJI distributor within the warranty period, and identify the defective condition(s) in detail.

After the warranty period, we or our distributor will require the expense incurred in repairing your PL-G MAX Locator.

