

FISHER[®] RESEARCH LABS

TW-82P

**DIGITAL LINE TRACER
WITH PASSIVE POWER DETECTION**



Operating Manual

Revision Level 0

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INTRODUCTION

The TW-82P Digital Line Tracer components include a Transmitter, Receiver and Ground-Rod Assembly.

The TW-82P is an active single-frequency and passive power current line tracer that is used to locate and trace buried utilities using any of the following four tracing methods:

1. **Conductive Method.** With this method, the Transmitter energizes the buried utility by making a direct electrical connection to it with Conductive Tracing Cables. In most cases, this method generates the strongest magnetic field for the Receiver to detect above ground.
2. **Inductive Method.** When a direct physical connection to the utility is unavailable, the utility may be energized indirectly by magnetically coupling an energizing current from the Transmitter. Some prior knowledge of the utility's location is required so that the Transmitter can be placed and oriented, on the ground, near the utility in the most effective manner.
3. **Coupling.** In some cases a utility may be exposed, but does not provide a direct connection for the conductive tracing cables. The optional accessory coupling clamp can be clamped around the exposed utility to magnetically couple an energizing current from the Transmitter into the utility.
4. **Passive Power.** 50Hz and 60Hz electric current flows on underground power lines and also on underground utilities that are not power lines. In Passive Power Mode, the TW-82P can detect this electric current using the Receiver as a stand-alone instrument without need for a transmitter.

Never make direct contact with electrical or communication lines that are in service. To trace such lines in service, perform an inductive trace, either with or without the coupling clamp.

CONTENTS



Carrying Case

Ground-Rod Assembly
(Ground-Rod & Conductive Tracing Cables)



Transmitter

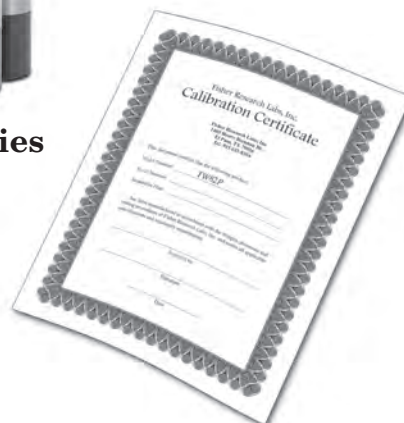
Receiver



6 D-cell Batteries



Operator's Manual



Calibration Certificate

TW-82P TRANSMITTER



The Transmitter has two controls:  &  .
The  button has a dual function:

1. When the Transmitter is powered on,  switches the device between normal (1/4 watt) and high (1.0 watt) output.
2. With the Transmitter powered off:
 - A. Press-and-hold  to program the **Auto Power-Down** feature.

Successive presses of  will show a flashing battery indicator, followed by a blank screen or the illuminated battery indicator.

 - An illuminated battery indicator means **Auto Power-Down** is activated.
 - A blank screen means **Auto Power-Down** is deactivated.
 - B. After you release  , the transmitter power will turn on.

With the **Auto Power-Down** feature activated, the Transmitter will automatically turn off 60 minutes after the last key-pad press by the user. This is a battery saving feature. The Transmitter will warn of power-down by switching ON and OFF as described on the top of the following page.

Low Battery Power-Down Warning

When the Transmitter batteries are near the end of their useful life, the Transmitter will warn the operator before shutting down.

Five minutes before shutting down, the Transmitter will alternately stop and start transmitting at approximately one-second intervals. The operator using the Receiver, even at a distance from the Transmitter, will notice the signal turning on and off before the power turns off completely.

Accessory Output

1. Flip up the black protective cover to expose the Accessory Output Jack.
2. Connect the conductive tracing cable plug for conductive tracing.

When the conductive tracing cable is connected, Signal Current will be displayed. The Signal Current Bar Graph shows the quality of the connection.

Vertical Bars will illuminate to indicate the current as follows:

mA indication	1	2	4	8	15	25	50	100	200
Actual Range (mA)	0.5-1.4	1.5-2.9	3.0-5.9	6.0-12.9	13.0-18.9	20.0-39.9	40.0-74.9	74-149	150+

Automatic Load Impedance Matching adjusts output to provide full rated power over a wide range of loads (e.g. utility types and conditions). It is tolerant of both dry (high resistance) and shunted (low resistance) ground connections.

The Transmitter has a built-in antenna for inductive locating. When the Cable Jack is not connected, the inductive antenna automatically engages and begins transmitting. When locating inductively, the Signal Current Bar Graph will not be displayed, as there is no conductive trace load to be measured.



WARNING: Do not handle output leads unless power is off.
ELECTRIC SHOCK HAZARD: Servicing to be performed by qualified personnel only.

NEVER connect conductive cables to an energized power line.

INDUCTIVE LOCATING

Inductive locating is most effective with the Transmitter straddling the utility as illustrated, with the utility perpendicular to the Transmitter's batteries.

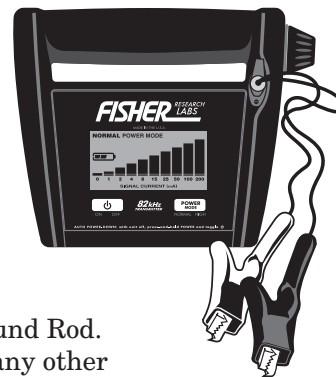
If the utility direction is unknown, place Transmitter on the ground, power on, and sweep the Receiver a complete 360° around the Transmitter, keeping at least a 25-foot (8-meter) distance between the Transmitter and Receiver. If unsuccessful, move the Transmitter to another location. When located, the Receiver's azimuth indicator will show the direction of the utility.

In inductive mode, the Transmitter's LCD will not display Signal Current. When the conductive tracing cables are plugged in, the Signal Current display will illuminate.



CONDUCTIVE LOCATING

1. Place the Transmitter on the ground and turn it off.
2. Connect the Conductive Tracing Cables to the Transmitter.
3. Push the Ground Rod into the earth at a 90° angle to the direction of the utility.
4. Connect the red clamp to the non-energized utility.
5. Connect the black clamp to the Ground Rod. Be sure not to place the wires over any other utility.
6. Turn Transmitter On.
7. With Receiver in hand, move at least 25 feet (8 meters) away from the connection point.
8. Sweep the Receiver in a circle around the connection point.
9. Using information provided on the display, find the areas that need to be traced and analyze the situation in more detail to find the buried utility.



TW-82P RECEIVER



TW-82P Receiver

CONTROL PANEL



1. Press-and-Hold to turn ON.
2. Press-and-Hold to turn OFF.
3. Choose Metric/Imperial unit of measure (see instruction p17).



VOL

Press to select volume settings

- In Standard and Lateral Modes, tap the button to adjust volume:
 1. Mute
 2. Low Volume
 3. Medium Volume
 4. High Volume
- In Passive Power Mode, no mute is available. Only volume settings 2, 3 & 4 are available.

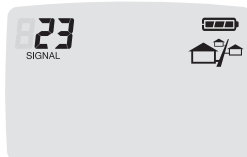


MODE

Press to select from any of 3 modes



Standard



Lateral



Passive Power



Adjust GAIN in Passive Power Mode
These keypads have no function in the Standard or Lateral Modes.

STANDARD MODE

In this default configuration, the TW82P Receiver requires no operator intervention to trace a line under most circumstances. Only the volume can be adjusted in this mode.

The following values & conditions are displayed on the LCD display in Standard Mode:

- Signal Strength
- Left/Right & Over-Target
- Azimuth
- Current Measure
- Depth
- Battery Strength

- 1. Signal Strength:** Indicates your proximity to the center of the electromagnetic field emitted by the utility.

999: maximum value

0: minimum value

You may find different locations where the Signal Strength value is high. Use this reading as a relative indicator as to where the utility is located. Signal Strength is strongly influenced by the depth of the utility.



- 2. Left/Right & Over-Target:** These indicators show your position relative to the center of the electromagnetic field.

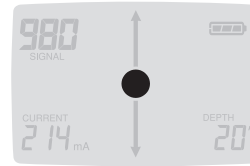
Move to
the left



Move to
the right



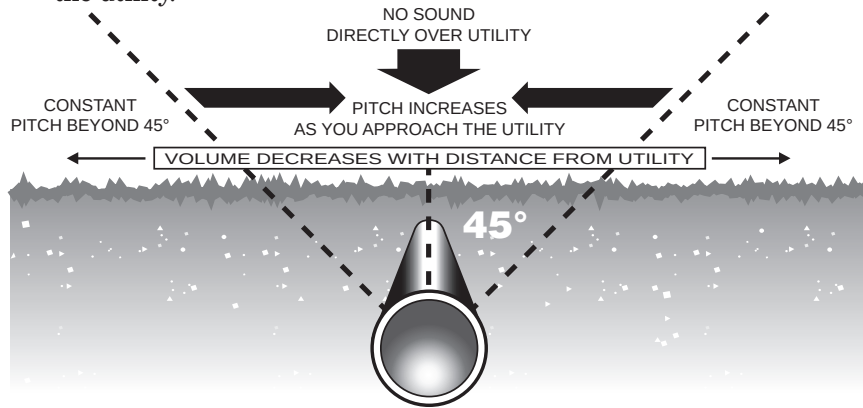
You are over
the target



STANDARD MODE *continued*

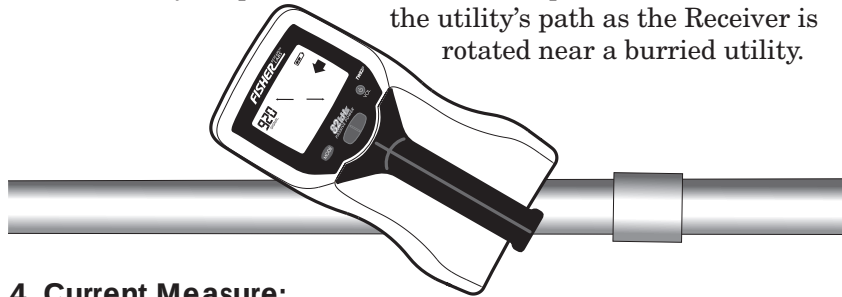
Audio: When you move within a 45° angle of the center of the electromagnetic field, the audio pitch will change; the pitch increases as you approach the utility. Outside the 45° zone, the pitch does not change.

When the Receiver is directly over the utility, it goes silent. The over-target indicator, ●, also appears when the Receiver is directly over the utility.



When you are standing to the right of the utility, you will hear a constant tone, and to the left, a pulsating sound.

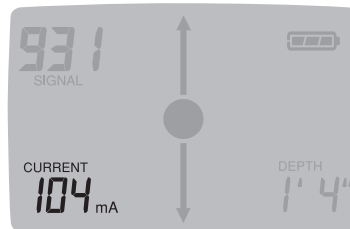
- 3. Azimuth:** These rotational arrows indicate the utility's path relative to your position. The arrows will point in the direction of the utility's path as the Receiver is rotated near a buried utility.



4. Current Measure:

mA (milliamperes) of current flowing on the conductor.

Use Current Measure as an aid for distinguishing utilities in close proximity. The Current Measure will generally be the highest on the utility you are connected directly to, regardless of the utility's depth.



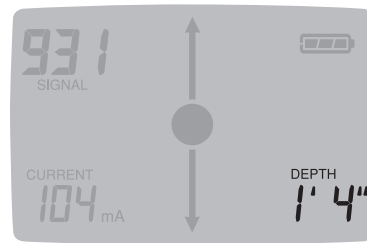
STANDARD MODE *continued*

5.Depth:

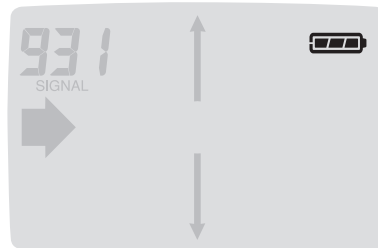
The depth reading is only accurate if the electromagnetic field is perfectly round.

The electromagnetic field must have enough energy for the Receiver to accurately calculate the depth. The weaker the signal strength, the less reliable the depth indicator. For this reason, depth readings for inductively located utilities will tend to be less accurate than conductively located ones. The depth reading is a measure of the distance between the tip of the Receiver blade and the *center* of the buried utility. When the device is directly over a buried utility, as indicated by the Over-Target indicator, depth will automatically be displayed in feet and inches (meters if metric).

In general, the accuracy of any depth measurement will be influenced by factors such as proper azimuth orientation of the device, field strength and the *roundness* of the field. The only 100% reliable method for determining the depth of any buried utility is to hand-excavate.



- 6. Battery Strength:** When battery life declines to less than one hour of operation, the battery indicator outline will be illuminated with no segments. When the batteries reach the end of their useful life, the screen will go blank and the battery icon will flash before the Receiver shuts off. Expect about 100 hours of battery life from a set of high quality D-cell alkaline batteries.



NOTE. Overhead Power Line

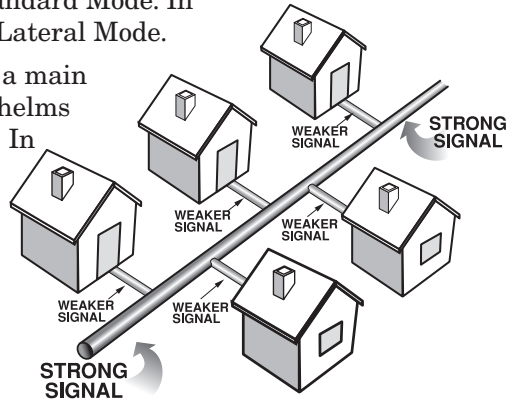
Interference: When the Receiver encounters an interfering overhead electrical field stronger than the field from an energized buried line, the Receiver will display zeros, “000”, for the Depth and Current measurements.

In this case, the field from the overhead power line is interfering with the signal from the buried line you are trying to trace. You may still be able to trace the buried line, but the accuracy of your trace will be impaired by this interference.

LATERAL MODE

At some sites, utility lines branching off from a main line may be difficult to trace using the Standard Mode. In these circumstances, use the Lateral Mode.

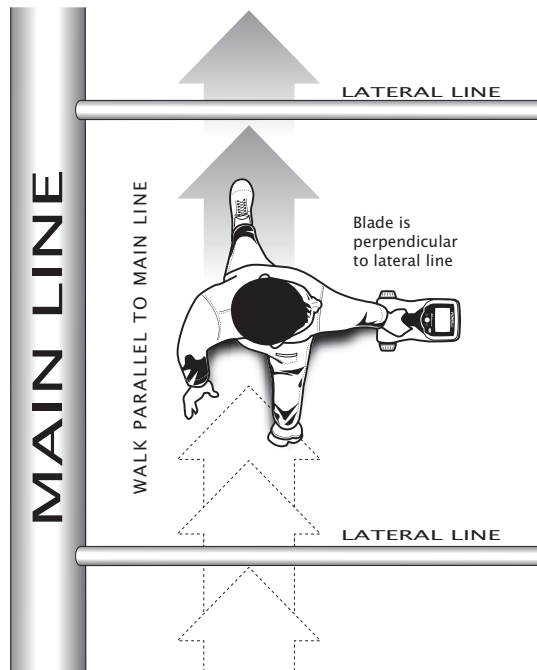
At such sites, the signal from a main line is so strong that it overwhelms the single from a lateral line. In this illustration, gas service lines connecting to homes from a main gas line may carry far less current than the main line. This weaker current could be the result of a lateral line that is shorter than the main line, or a lateral that is not well grounded.



When conducting a trace of the Lateral line, select LATERAL Mode and walk parallel to the main line (as in the illustration below). You must use Lateral Mode in this situation because in the Regular Mode, you may detect the signal from the main line all of the way up to the house, even with the blade of the Receiver parallel to the main line.

The Lateral Mode is configured to ignore the signal coming from the parallel main line and detect signals coming from the perpendicular lateral lines. The Lateral Mode may still detect the main line in very close proximity, even though the Receiver blade is parallel to it. So maintain a minimum distance of 6 to 12 feet from the main line when tracing lateral lines.

Walk parallel to the main line, holding the blade of the Receiver perpendicular to the lateral lines.



LATERAL MODE *continued*

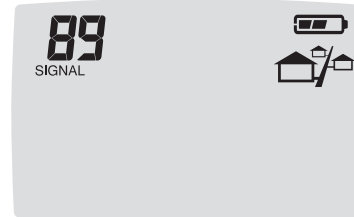
Press **MODE** to enter Lateral Mode.

 will appear on the LCD display.

LATERAL TRACING OPERATION

While tracing a line using the Lateral Mode, the display will appear as illustrated below. The SIGNAL number indicates the strength of the field emitted by the buried line. The buried line is located at the spot where the maximum SIGNAL number is indicated. If you move left or right of the spot where the maximum SIGNAL number is found, the value displayed will fall.

Walk across the location of the lateral line with the blade perpendicular to the lateral line.



Programming:

While in Lateral Mode, press-and-hold **MODE** to program:

- To exit Lateral programming, press-and-hold **MODE** again.
- To set the upper limit of the signal range, press **MODE**.

Each press of **MODE** toggles through the program choices:
50, 100, 150, 200, 250 or 300

Set this upper limit just above the maximum SIGNAL strength number that appears during your lateral trace.

The correct setting will make it easier to hear the peak in the signal as you pass over the lateral line.

Set the number just above the highest SIGNAL number.

Examples:

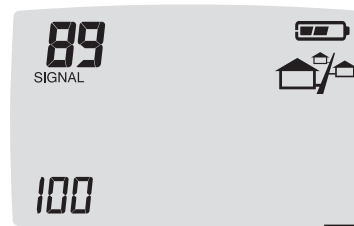
If the highest lateral
SIGNAL number is:

137
159
310

Set to:

150
200
300 (300 is the maximum possible)

Changes to this upper limit of the SIGNAL RANGE are saved to memory. Changing this upper limit is similar to the gain adjustment on other line tracers which use a peak mode of operation. Set the number just above the highest SIGNAL number, as described above.



PASSIVE POWER MODE

While the Standard and Lateral Modes use the 82kHz signal injected by the Transmitter, in some cases it is desirable to locate buried utilities by tracing electric power currents running through them. Buried utilities may be energized by the electric power currents running directly through them, current coupling into them as a result of leakage from power cable faults, defective electrical loads that leak AC power into ground connections or from cathodic protection on metal pipelines.

The Passive Power Mode detects both 50Hz and 60Hz electric currents as well as harmonics of these frequencies resulting from distortions caused by electrical loads being served by the utility. Cathodic Protection (at 100Hz or 120Hz) is also detected. This mode will usually, but not always, detect underground AC power lines. It does not detect voltage and will usually not detect a power line which is not delivering current, i.e. one that is not under a load. The operator must use his knowledge of infrastructure and each specific area being located to interpret the character of each underground utility.

ABSENCE OF A DETECTABLE POWER SIGNAL DOES NOT GUARANTEE THAT NO POWER IS PRESENT.

Among the important uses of the Passive Power Mode is to check ground connections being considered for use as a transmitter connection to do a conductive trace. **Many “grounds” are in fact improperly grounded and/or have substantial AC power flowing through them** due to defective installation or defective loads. Ground connections should always be treated as though they have dangerous voltage or current on them. If the Passive Power Mode detects power current flowing in a proposed ground connection, it is usually advisable to use some other ground connection if available. REMINDER: This mode does not detect voltage. A floating ground with power voltage on it will probably not be detected. A high-impedance AC voltmeter can be used to detect voltage provided that another ground is available to measure the voltage differential. Floating grounds with full line voltage on them can usually be detected with a neon bulb line tester without the need for a second ground connection; follow the instructions provided by the manufacturer.

PASSIVE POWER MODE *continued*

Operating Controls

Press **(MODE)** to enter Passive Power Mode
The display will appear as illustrated to the right.

Press **(+)** to increase gain.

Press **(-)** to decrease gain.

Press **(MODE)** again to exit Passive Power Mode.



Locating Procedure

1. Enter Passive Power mode.
2. Set gain at maximum, 100%.
3. If necessary, reduce the gain so that the Receiver is silent when not over a detectable power line.
4. Walk forward, swinging the Receiver from side to side.
5. When a line is located, the Receiver will emit a raspy/buzzing sound.

Note: Audible-search only. No visual indicators.

Passive Power detection relies only on audio feedback to locate the utility. No indicators will appear on the LCD display.

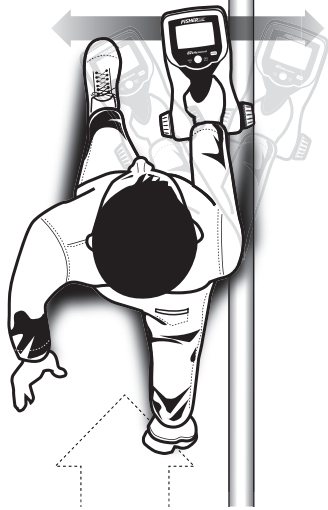
Azimuth, depth and left/right guidance will not be provided.

6. When an audible signal indicates the detection of a utility:
 - a. Move left and right, sweeping beyond the range of the signal each time as you sweep the Receiver.
 - b. Determine the approximate center of the signal, midway between the right-most and left-most edges of the audible signal.
 - c. Lower the gain as you sweep left and right of the approximate center. This will narrow the search.
 - d. Continue to lower the gain to the minimum possible while still detecting the buried utility with an audible alert.
7. With the utility pinpointed at one spot, move both forward and backward to verify the direction of the utility.
8. If possible, follow the signal to a known access point, or origin, to find a connection point visible above ground.
9. If appropriate, use inductive or conductive modes to locate the utility and verify the location of the utility.

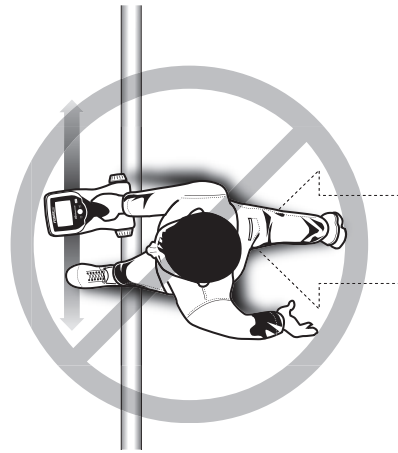
PASSIVE POWER MODE *continued*

Grid Search: To ensure complete coverage of the area, map out a grid of intersecting lines covering the search area. Walk the grid at intersecting right-angles. Power lines will be detected when the blade of the Receiver is perpendicular to the utility. You will not detect the line when crossing over parallel to a utility.

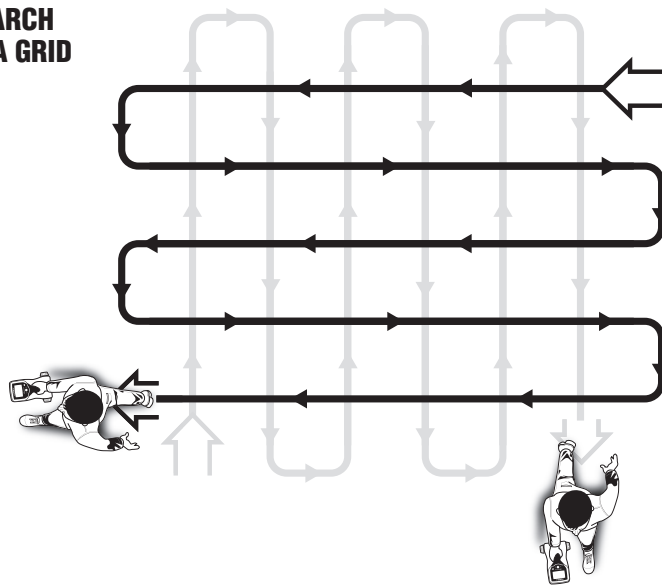
WALK WITH BLADE
PERPENDICULAR
TO THE UTILITY



UTILITY **WILL NOT**
BE DETECTED WHEN
THE RECEIVER
BLADE PASSES PARALLEL



**SEARCH
IN A GRID**



AUTO POWER-DOWN, RECEIVER

When 90 minutes have passed without the operator pressing any control buttons, the Receiver will automatically power down.

- Lower left of the display will indicate “OFF”.
- Lower right of the display will count down from 10 to 0.
- The Receiver will then turn off.

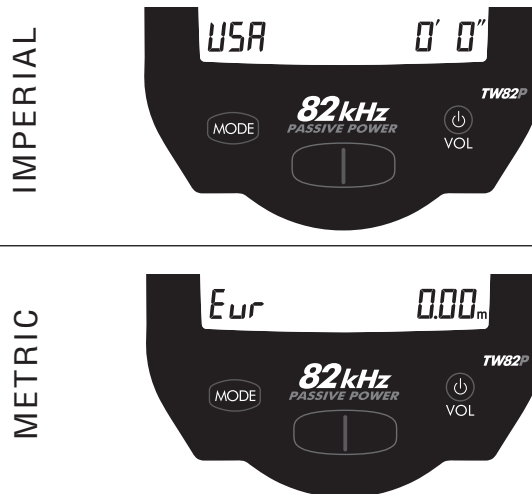
To stop Auto Power-Down, press any button once.

METRIC / IMPERIAL UNIT OF MEASURE

To change the Receiver unit of measure, follow this procedure:

1. Start with the Receiver OFF.
2. Press-and-Hold  for 6 seconds.
 - a. The Receiver will turn on in Standard mode.
 - b. After 6 seconds, the new unit of measure will indicate at the bottom of the display.
 - c. If you continue to hold , the alternate unit of measure will be displayed.
 - d. When you see the desired unit of measure, release . The Receiver will commence operation using the last displayed unit of measure.

Display during Programming



SPECIFICATIONS

RECEIVER

Frequency	82.175 kHz
Standard Mode	Automatic response
Lateral Mode	Programmable
Left/Right Guidance	Audible and visual
Azimuth Indicator	Visual
Over-Target Indicator	Visual and audible
Battery Status	Visual
Signal Strength Indicator	Numeric display & audible
Signal Current Measurement	Numeric display, automatic
Depth Measurement	Numeric display, automatic
Battery Type	Two D-cell batteries (included)
Battery Life	From 80 to 130 hours, depending on the volume setting
Weight, with batteries	3.60 lbs
Passive Power	50Hz and 60Hz detection. Cathodic Protection detection.

TRANSMITTER

Output Frequency	82.175 kHz
Output Power (nominal)	Normal Setting = 0.25 watt High Setting = 1.0 watt
Conductive Tracing	[Normal Power: 2 to 8,000 ohms -6dB High Power: 2 to 3,000 ohms -6dB
Impedance Matching Range	
Inductive Tracing	[Normal Power: 15 Vm ² High Power: 25 Vm ²
Magnetic Strength	
Battery Type	Four D-cell batteries (included)
Battery Life	Typically 130 hours with high quality alkalines
Weight, with batteries	4 lbs

ENVIRONMENTAL

Ingress Protection Rating	IP65 (stands up to water jets)
Operating Temperature Range	-4°F to 140°F (-20°C to +60°C)
Relative Humidity	0 to 95% noncondensing
Shipping Weight (packaged)	17.5 lbs
Field Carry Weight, w/accessories	15.5 lbs*

**Includes Carry Case, Batteries, Ground Rod and Conductive Tracing Cables*

**Fisher Research Laboratory does not warrant suitability to specific use.
Fisher Research Laboratory shall in no event be liable for any direct,
incidental, consequential or indirect damages.**



QUALITY

Fisher detectors are renowned for their quality.
Each detector is handcrafted in the USA with pride.

PERFORMANCE

The worldwide underground utility industry relies on Fisher.
Our instruments are durable, dependable and locate deeper.

REPUTATION

Fisher produced the first patented metal detector in 1931. For
over 85 years, the Fisher logo has been a mark of excellence.

2 - YEAR LIMITED WARRANTY

Proof of purchase is required to make a claim under this warranty.

NOTE TO CUSTOMERS OUTSIDE THE U.S.A.

This warranty may vary in other countries; check with your
distributor for details.

Warranty does not cover shipping costs.

SERVICE

Should you have any questions or problems, contact:

According to FCC part 15.21, changes or modifications made to this device,
not expressly approved by the party responsible for compliance, could void
the user's authority to operate this equipment.

This device complies with FCC Part 15 Subpart B Section 15.109 Class B.

Not to be used with conductive tracing cables longer than 6.5' (1.98 m)

TW-82P ACCESSORIES



3-Inch Coupling Clamp

– CCLAMP-3

Useful for in-service and electrical power line tracing when a metal-to-metal hookup is not possible



5-Inch Coupling Clamp

– CCLAMP-5

Useful for in-service and electrical power line tracing when a metal-to-metal hookup is not possible



Hard Carry Case

– 1802050000

Shock absorbent protective hard carrying case with contoured foam insert custom made to house the TW-82.
35" x 7" x 16"



Fisher Sonde Signal Transmitter 82kHz

– SONDE-82.175

Small transmitter used to trace the path of non-metallic pipes and locate blockage in lines. Sonde is inserted into a pipe or duct by means of a push rod and located using a Fisher receiver.

- Rugged Design
- Long Battery Life
- Outstanding Distance & Depth
Locate up to 15' deep
- Operating Frequency: 82.175 kHz
- Weight 6.4 oz
- Length 6"
- Diameter 2"
- Battery Life: 70 hrs
- Operating Temperature
-20 to +60 C (4° to 140°F)
- End Cap Thread 3/8"-16 x 3/4"



Wide-Mouth Ground Rod Assembly

– GROD-TW6-L

Heavy Duty clamp (1 1/4" opening), with 6 1/2" grounding rod.

MTW82P

Manual Revision # 0

101615