3M™ Dynatel™
Advanced Pipe/Cable Locator 2220M
Operator Manual

CE

78-9000-0021-3-A
December 2007

3M

Contents

Introduction

Congratulations! You have just purchased one of the finest, most advanced locating devices available today! When you choose a quality 3M™ Dynatel™ Advanced Pipe/Cable Locator 2220M, you get outstanding performance and reliability.

The 2220M locator is an excellent instrument for tracing all underground utilities. The 2220M provides one audio frequency for locating long sections of cable and one radio frequency for tracing pipes that may have high resistance insulators and rubber gaskets that are often found in water and gas distribution systems. The 2220M also provides three sonde locating frequencies.

Standard 3M™ Dynatel™ 2220M Locator Equipment Packages

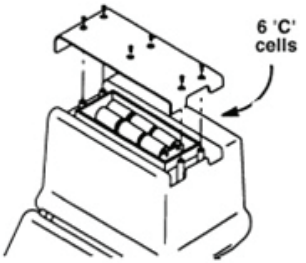
Model Number	Included in Equipment Package
2220M-U3W	2220M Receiver 3 Watt Transmitter Direct Connect Cable (Utility size clip 5/8") Ground Rod Operator Manual Carrying Bag
2220M-U3W-CPLR	2220M Receiver 3 Watt Transmitter Direct Connect Cable (Utility size clip 5/8") 4.5" (114 mm) Dyna-Coupler clamp Coupler Cable Ground Rod Operator Manual Carrying Bag
2220M-C3W-CPLR	2220M Receiver 3 Watt Transmitter Direct Connect Cable (Telecom size clip ¼") 3" (76 mm) Dyna-Coupler clamp Coupler Cable Ground Rod Operator Manual Carrying Bag

Optional 3M Dynatel Accessories

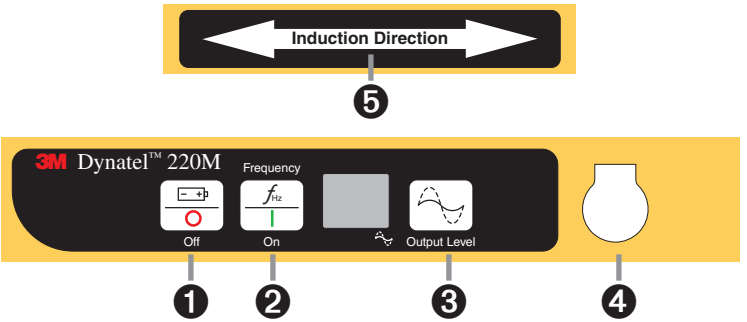
- 3" (76 mm) Dyna-Coupler Clamp 3001
- 4.5" (114 mm) Dyna-Coupler Clamp 4001
- 6" (150 mm) Dyna-Coupler Clamp 1196
- Coupler Cable 9011
- Direct Connect Leads (Small Telecom clips) 2892
- Ground Extension Cable 9043

Quick Start

Transmitter Battery Installation



Transmitter Overview

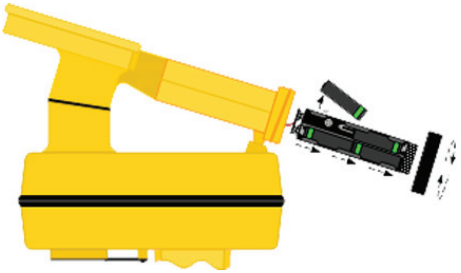


1. **Power OFF / Battery Level Indicator** – Press and hold.
   Display reads:
   "OK" with solid tone = good
   "LO" with pulsing tone = low
   "- -" with no tone = replace
2. **Power ON / Frequency Select** – Powers on the unit. When pressed repeatedly, it will cycle through the available frequency modes:
   a. Single audio frequency - 8 kHz
   b. Single radio frequency - 82 kHz
   c. Dual frequency – Both 8 kHz and 82 kHz are transmitted simultaneously.
3. **Output Level** – Toggles the output power level between Normal output and High output. Flag will flash over output icon on display when in High output mode.
4. **Output Jack** – Direct Connect and 3M™ Dynatel™ Dyna-Coupler Clamp port.
5. **Induction Direction Arrows** – Indicates orientation of transmitter in relationship to target path.

⚠ Warning
Potential for electric shock exists when handling connection cables while the transmitter is ON. Make all connections prior to powering on the unit. Turn the transmitter OFF before handling connection cables.

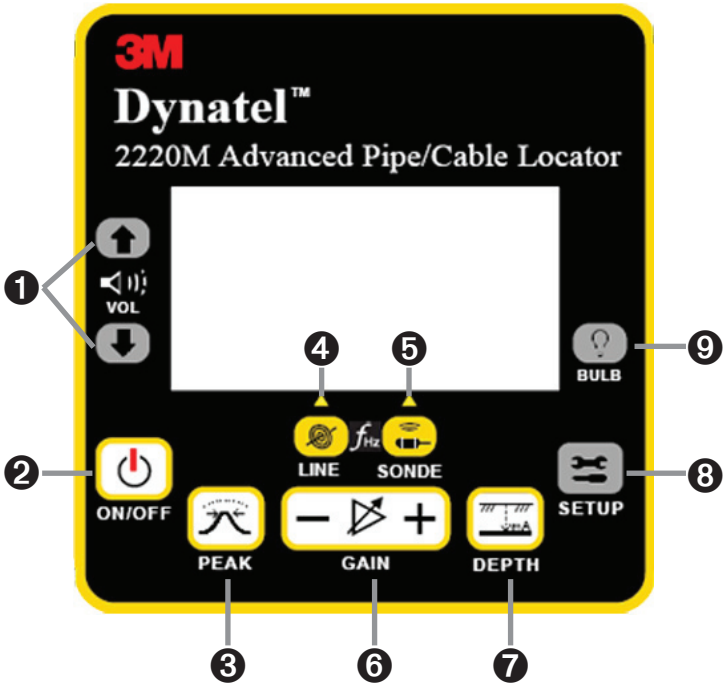
⚠ Warning
Voltage greater then 240 volts will damage equipment and could cause personal injury or death. Make all connections before turning on the transmitter. Follow standard procedures for reducing the voltage.

Receiver Battery Installation



The Receiver displays the battery level across the bottom of the start up screen when the unit is powered on.

Receiver Overview



1. **Volume Control** – Adjusts the volume of the receiver through three levels of audio and off.
2. **Power Key** – Powers the receiver on and off.
3. **Peak Key** – Toggles between Directional Peak and Single Peak antenna configuration.
4. **Line Locate Key** – Places the Receiver in Pipe/Cable locating mode and selects frequency. When toggled, it will cycle between 8 kHz, 82 kHz, and 60 Hz (Power Mode). (More frequencies are available in setup mode).
5. **Sonde Locate Key** – Places the receiver in sonde locate mode and selects sonde frequency. When toggled, it will cycle between 512 Hz and 33 kHz. More frequencies are available in setup mode.
6. **Gain Adjust** – Adjusts the sensitivity of the receiver either up (+) or down (-) to maintain a satisfactory audio and bar graph response.
7. **Depth Key** – Displays depth to target pipe/cable/sonde.
8. **Setup Key** – Configure receiver depth units, enable/disable line and sonde frequencies, select 50/60 Hz power frequencies.
9. **Bulb Key** – Turns the display backlight on and off.

Transmitter Operations

There are three different methods of applying the transmitter's locating signal to the target conductor: Direct Connection, 3M™ Dynatel™ Dyna-Coupler Clamp, and Induction.

Direct Connection

This is the preferred mode of operation because the transmitter is connected directly to a metallic portion of the target conductor (hydrant, meter, riser, valve, sheath, or tracer wire).

1. While the transmitter is off, plug the direct connect cable into the output jack of the transmitter.
2. Attach the red lead of the direct connect cable to the target conductor.
3. Extend the black lead as far as possible from the target conductor at a right angle (90 degrees) to the suspected path of the target.
4. Insert the external ground rod and attach the black lead of the transmitter.
5. Turn the transmitter ON by pressing the frequency button. Select 8 kHz, 82 kHz, or both (8 K and 82 K will flash on the display).
6. An audible tone, indicating the continuity of the signal path will sound for 10 seconds and the output current will display in mA.
    a. Solid tone = Good signal
    b. Fast Beep = Moderate signal
    c. Slow Beep = Minimal signal
    d. No tone = Poor signal
7. The frequency will flash alternately with the current of the target conductor on the display.
8. Trace the signal path with the receiver. (*See* **Receiver Operations**, *page 8*.)

3M Dynatel Dyna-Coupler Clamp

If a direct connection to the target facility is not possible, use the Dyna-Coupler clamp to apply the locating frequency on the metallic target conductor. In order to trace a target using the Dyna-coupler method, both ends of the target must be well grounded.

1. While the transmitter is off, attach the coupler cable to the Dyna-Coupler clamp and plug it into the output jack of the transmitter.
2. Clamp the Dyna-coupler around the metallic target. The jaws of the coupler must be fully closed.
3. Select 8 kHz or 82 kHz on the transmitter by pressing the frequency key.
4. Select High Output level for the best signal-to-noise ratio.
5. Trace the signal path with the receiver. (*See* **Receiver Operations**, *page 8*.)

Induction Method

If you cannot make a direct connection, or use the 3M™ Dynatel™ Dyna-Coupler clamp to apply a locating signal on the target, use the induction method. This method uses the internal coil of the transmitter to generate a magnetic field. This is the least preferred method of applying a signal on a target conductor because it can easily be picked up by other non-target conductors in the area. However, it is the preferred method of applying a signal to multiple cables/pipes in the same trench.

1. Verify battery level of transmitter and remove any cables from the output jack.
2. Position the transmitter over the target facility, with the hinge of the transmitter over and in line with the cable/pipe path.
3. Align the Induction Direction arrows on the transmitter with the target conductor.
4. Turn on the transmitter by pressing the frequency key.
5. Select High Output level for the best signal-to-noise ratio.

Note: If nothing is plugged into the output jack of the transmitter, the transmitter will automatically turn on the internal antennae, and 82 kHz will broadcast in induction mode. For best results, the receiver should be at least 40 feet (12 m) away from the transmitter to begin tracing the target path. Attempting to trace the target close to the transmitter may lead to false indications due to the receiver detecting the large magnetic field radiating from the transmitter.

Receiver Operations

Initial Settings

From the manufacturing facility, the receiver is configured as follows:

Line Locate Frequencies	Selection	Default
8 kHz	Always Enabled	Enabled
82 kHz	Always Enabled	Enabled
Power	Always Enabled	Enabled
Radio	Enable/Disable	Disabled
CATV	Enable/Disable	Disabled
CPS	Enable/Disable	Disabled

Sonde Locate Frequencies		
512 Hz	Enable/Disable	Enabled
640 Hz	Enable/Disable	Disabled
33 kHz	Enable/Disable	Enabled
Units	inch or cm	Inch
Power Frequency	50 Hz or 60 Hz	60 Hz
Contrast	Up or Down	Middle
Depth Measurement	Live or One-Shot	One-Shot

The setup function will allow you to enable or disable additional locating and sonde frequencies.

Receiver Setup

Any of the available frequencies of the 3M™ Dynatel™ Advanced Pipe/Cable Locator 2220M can be activated or deactivated. When a frequency is activated, a check mark will appear beside the frequency in the middle of the setup screen. All frequencies that are activated in the setup menu, will be available in the locate screens.

When the Setup key is pressed, the receiver will cycle through the following screens.

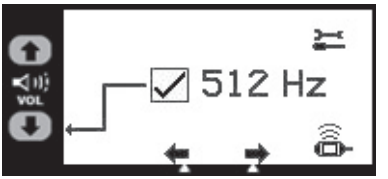
Select the left/right arrow keys (← →) to cycle through the setup screens.

Contrast Adjust

Press the up or down arrows (● or ○) to adjust the screen contrast.

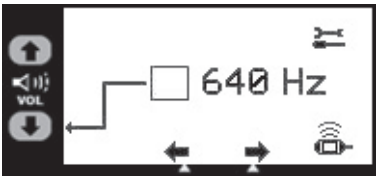
512 Hz – Sonde frequency indicated by sonde icon.

Press the down key to enable/disable the frequency. A check mark will appear in the box when the frequency is enabled.



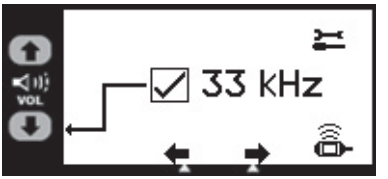
640 Hz - Sonde frequency indicated by sonde icon.

Press the down key to enable/disable the frequency. A check mark will appear in the box when the frequency is enabled.



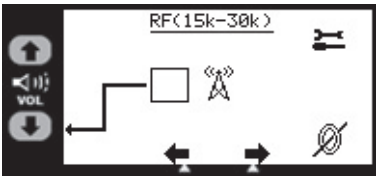
33 kHz - Sonde frequency indicated by sonde icon.

Press the down key to enable/disable the frequency. A check mark will appear in the box when the frequency is enabled.



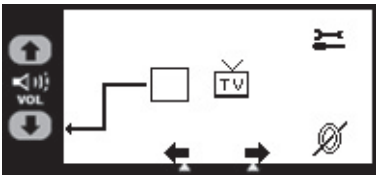
Radio or LF - Low Frequency Band: 15 Khz–30 kHz

Press the down key to enable/disable the frequency. A check mark will appear in the box when the frequency is enabled.



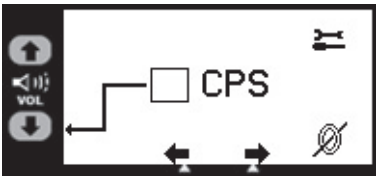
CATV – 31.5 kHz

Press the down key to enable/disable the frequency. A check mark will appear in the box when the frequency is enabled.



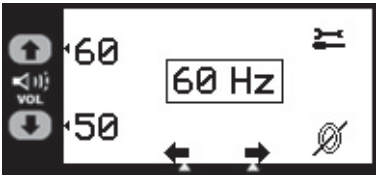
CPS – Cathodic Protection System– 120 Hz or 100 Hz (based on 60/50 Hz selection)

Press the down key to enable/disable the frequency. A check mark will appear in the box when the frequency is enabled.



50 Hz / 60 Hz

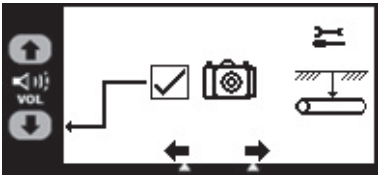
To change the power frequency selection, press the up (60) or down (50) key. The selected frequency will appear in the box at the center of the screen.



Snapshot/Continuous Depth Modes

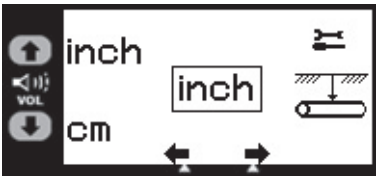
Continuous depth measurements can be displayed on the screen in live mode or the depth can be frozen in snapshot mode.

Press the down key to enable/disable snapshot depth mode. A check mark will appear in the box when snapshot is enabled.



Depth Units

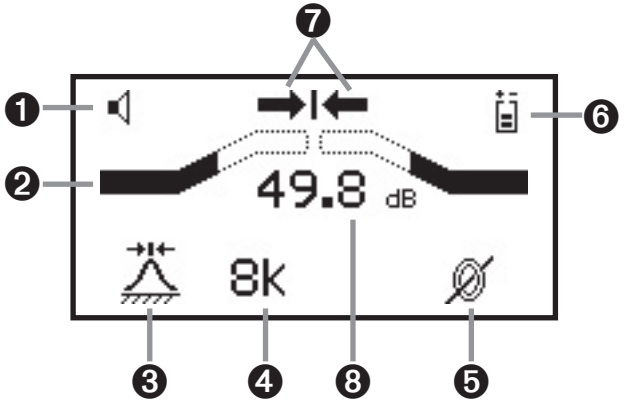
Select the up (inch) or down (cm) key to select the preferred units of measure. The selection will appear in the box at the center of the screen.



Information

This screen provides important information including the product serial number, as well as the software and hardware versions of the unit.

Line Locating Screen



1. **Speaker Icon** – Indicates audio level
2. **Bar graph** – Graphical representation of received signal
3. **Peak Mode Indicator** – Indicates single or directional peak mode
4. **Selected Line Locating Frequency** – Displays the frequency the receiver will detect
5. **Line Locating Icon** – Indicates line locating mode vs. sonde mode
6. **Battery Icon** – Indicates battery level of receiver
7. **Directional Arrows** – Left/right indicators for path tracing
8. **Signal Level** – Numerical reading of received signal (dB)

Pipe and Cable Locating

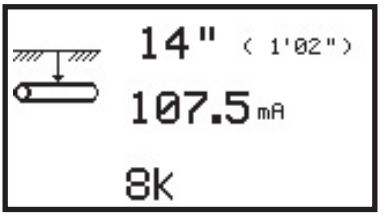
1. Press the on/off key.
2. Press the line key to match the frequency that the transmitter is sending.
3. Sweep the receiver across the area in a left right motion, while watching the bar graph, directional arrows, and signal strength.
4. When a magnetic field is detected, the bar graph will close, the signal strength and the audio will increase.
5. Adjust the gain so that the bar graph opens when the receiver is not on target and closes when directly over it by pressing the + or – gain key.
6. Pinpoint the target by moving the receiver left and right over the magnetic field until both arrows appear.
7. Place the tip of the receiver on the ground over the target path and measure depth of the conductor by pressing the Depth key.
8. Verify the depth of the target is as expected, and the current is comparable with the current displayed on the transmitter.

Depth and Current

To measure the depth of a target, place the tip of the receiver on the ground. Press the Depth key.

The depth to the target conductor and the current will display for five seconds.

Refer to receiver set up section to select “snapshot” of “live” depth modes.

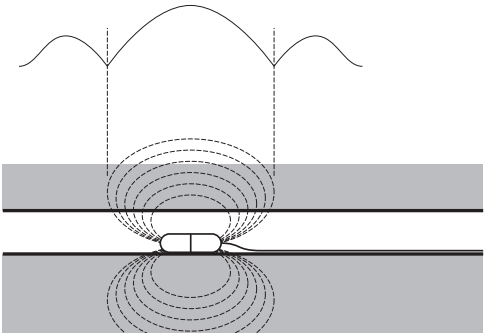


Note: To further verify target, this current reading can be compared to the current reading on the transmitter.

Sonde Locating

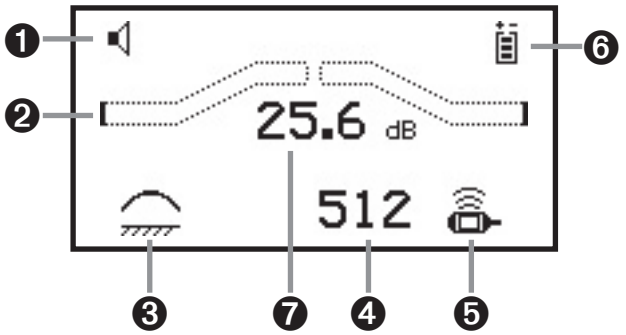
A sonde is a small transmitter that enables the user to trace metallic and nonmetallic pipes, sewers, drains, or ducts. It can also be used to find a blockage or collapse. Refer to sonde manufacturer's guide for proper selection of sonde for the desired application.

A representation of a sonde transmission field appears below.



There are typically three peak signals present. The strongest peak signal is over the center of the sonde. The signal will drop off each 'side' or 'end' of the sonde, and then rise again. The 'drop off points' are referred to as nulls.

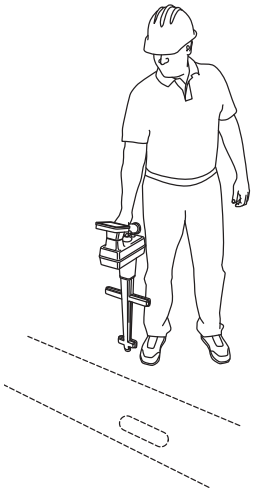
Sonde Locating Screen



1. **Speaker Icon** – Indicates audio level
2. **Bar graph** – Graphical representation of received signal
3. **Antennae Icon** – Indicates single peak mode
4. **Selected Sonde Frequency** – Toggles through activated sonde frequencies (512, 640, or 33 k)
5. **Sonde Icon** – Indicates sonde mode vs. line locating
6. **Battery Icon** – Indicates battery level of receiver
7. **Signal Level** – Numerical reading of received signal (dB)

Pin-Pointing the Sonde

Note: The receiver handle must be oriented perpendicular to the sonde. The cross bar of the receiver must be in line with the sonde (the opposite of line locating).



1. Set the receiver to Sonde mode by pressing the Sonde key until the frequency of the sonde appears on the locate screen.
2. Holding the receiver perpendicular to the suspected path, walk the path until the receiver detects the first peak signal of the sonde.
3. Adjust the gain down if the bar graph closes completely.
4. Continue to walk the path. Observe the response of the receiver as the center (and strongest) peak of the sonde's magnetic field is detected.
5. Continue past this strong peak. The signal will fall and then rise again as the last weak peak is detected.
6. Retrace your steps, watching the receiver.
7. The sonde has been pinpointed when the center of the strongest peak has been found.
8. Measure the depth of the sonde by placing the tip of the receiver on the ground and pressing the depth key. Refer to receiver set up section to select "snapshot" of "live" depth modes.

Specifications

Receiver	
Locating Modes	Special (Single) Peak, Dual Peak w/Direction, Depth & Current
Gain Adjustment	Automatic with Manual override
Frequencies Active Passive Power Passive LF Passive CATV Cathodic Protection Auxiliary/Sonde (Receive only)	 8 kHz, 82 kHz 50 Hz or 60 Hz VLF 15 k – 30 kHz 31.5 kHz * 100 Hz or 120 Hz 512 Hz, 640 Hz, 33 kHz
Display Resolution	0.1 dB
Depth Display Range	0–30 ft (9 m)
Depth Units	cm, inch & ft-in
Depth Accuracy **	± 2% ± 3 in (5 cm) 0–60 in (1.5 m) ± 6% ± 3 in (5 cm) 61–120 in (1.5 m–3 m) ± 10% ± 3 in (5 cm) 121–180 in (3–4.5 m)
Cable Current Display	0.01 mA resolution Units: mA
Battery type	8 AA size, Alkaline
Typical Battery Life	30 hrs
Display	Large Graphic high contrast LCD w/ backlight
Speaker	0.25 W
Headphone Jack	Standard Mini Jack
Serial Port	Standard RS232 serial w/DB9 connector

* American NTSC, television set on

** Locators are tested in model field conditions with no adjacent signals. Actual operating conditions may result in decreased depth accuracy due to outside signal disruptions.

Transmitter	
Output Frequencies Trace Mode Induction mode	 8 kHz, 82 kHz 82 kHz
Output voltage (max) Trace	 60 Vrms
Output Power	Normal setting: 0.5 W High setting: 3 W @ 8 kHz, 1 W @ 82 kHz
Output Protection	240 Vrms
Battery type	6 C size, Alkaline (LR14)
Typical Battery Life	Normal output level: 45 hrs High output level: 7 hrs

Environmental	
Operating Temperature	–4° F to 122° F (–20° to 50° C)
Storage Temperature	–4° F to 158° F (–20° to 70° C)
Standard	IP54
Regulatory	CE

Physical Specification		
	Size (H x W x D) in (cm)	Weight (w/ batteries)
Transmitter	6.75 x 11.25 x 7.75 (17.2 x 28.6 x 19.7)	5.2 lb (2.4 kg)
Receiver	10.25 x 10.5 x 30 (26.7 x 26.1 x 76.2)	4.05 lb (1.9 kg)
Shipping	N/A	17 lb (7.9 kg)

Cleaning Instructions

Use a soft damp cloth to clean the product and test leads if necessary.

CE Compliance

Statement of Conformity

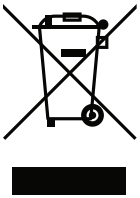
“Hereby, 3M declares that this Underground Locating Product is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.”

www.3m.com/market/telecom/access/conformity/

Statement of Intended Use

The 3M™ Dynatel™ Advanced Pipe/Cable Locator 2220M models are designed and tested for use in locating buried cables, pipes, utilities and structures. These products have not been tested or proven safe for other uses. The use of these products may be subject to licensing restrictions.

CE This product is in accordance with the requirements of the European directive 99/5/EC.



This is the EU symbol for equipment that is covered under the Waste from Electrical and Electronic Equipment (WEEE) directive per CENELEC Specification 5041. It indicates that certain products should not be discarded in the trash, but rather should be recycled. This applies to all electronic pluggable and battery powered products.

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