

TraceMaster

**Pipe and Cable Locator
Multi-Frequency Receiver
and
Radio Linked to Transmitter**

Instruction Manual

Schonstedt Instrument Company

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Important Notice

FCC ID: NS999P2

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

SECTION I: GENERAL

Introduction

The TraceMaster™ is the first pipe and cable locator on the market to offer a Remote Link between the transmitter and the receiver units. This is accomplished through a radio frequency (RF) two-way communications channel, and makes it possible to change the transmitter frequency from the receiver. The link also allows the receiver to monitor the transmitter battery status and other operating parameters.

The TraceMaster™ operates on a passive mode and three different active modes (conductive, inductive and clamp). In the passive mode the transmitter shuts down its output and the receiver searches for 50/60 Hz signals. In the active modes the transmitter operates at a low frequency (575 Hz), a mid-range frequency (8 kHz), a high frequency (82 kHz), and a very high frequency (455 kHz). The choice of frequencies depends on the specific active mode, as explained elsewhere in this manual. In addition, the receiver can determine the approximate depth of the target, and has the ability to operate in manual or automatic gain modes.

Receiver

The receiver's front panel is designed to be intuitive and require a minimum of training for effective use of the instrument. The controls and the information display area are large and easy to understand. Yet they include everything necessary to control and monitor the transmitter remotely.

Controls

MASTER ON/OFF SWITCH - This switch is built into the VOLUME control. When the VOLUME control is in the full CCW position, past its "click", power to the unit is removed, and the ON/OFF TRIGGER SWITCH is disabled. The intention of this switch is to prevent accidental turn on by depression of the trigger switch when the unit is stowed away.

ON/OFF TRIGGER SWITCH - The trigger switch is located in the handle of the receiver and it applies power when the unit is picked up and held by the handle. When the trigger is released (the receiver is put down or stored away), the power is removed from the instrument. There is a 5-second delay to prevent premature power removal when changing hands or letting the handle go momentarily. This switch helps to conserve battery power by preventing the user from leaving the power on accidentally.

NOTE: The trigger switch is enabled by the MASTER ON/OFF switch built into the volume control (see description above).

VOLUME - The volume control adjusts the volume of the tone coming from the speaker. The volume increases as the control rotates in the CW direction.

GAIN - When the gain control is in the full CCW position, past its "click", the receiver is in the automatic gain mode. In this mode the receiver adjusts its sensitivity as a function of the strength of the detected signal. When the control is rotated CW, the receiver is in the manual gain mode. The sensitivity of the receiver increases as the control rotates in the CW direction.

FREQ - An operating frequency can be selected by depressing this button consecutively until the desired frequency is indicated on the display of the receiver.

NOTE: When the FREQ control is depressed, the "Antenna" symbol comes on while the receiver sends the new frequency command to the transmitter and awaits for confirmation that the frequency has changed. Because of this, a delay of up to 2-3 seconds will occur before the new operating frequency is indicated on the display. If the new frequency is not indicated on the display shortly after the "Antenna" symbol goes off, then try to depress the FREQ control again. See Section III "Operation" for additional hints on operating the FREQ control.

The TraceMaster comes standard with five operating frequencies:

Passive Frequency - In this mode the transmitter is not active (see note below). The receiver picks up the AC power (factory selected 50 or 60 Hz) off the buried cables and pipes.

NOTE: The receiver "remembers" the last frequency it was operating at when it was turned off. When the power to the receiver is restored, you will have to depress the FREQ button to switch away from the frequency "remembered". If the transmitter power is turned off, the transmitter will not acknowledge receiving the commands to change frequency, and therefore the receiver will not be able to change to passive frequency. You will have to temporarily turn the transmitter on to allow it to go to passive, then you can turn it back off or leave it in the very low-power consuming "passive" mode.

Low Frequency (575 Hz) - This frequency will not jump to adjacent conductors and can only be induced with the conductive clips connected directly to access points on the utility to be traced.

Mid-range Frequency (8 kHz) - This frequency will not usually jump to adjacent conductors, but may jump across non-conductive joints in a pipe for longer tracing. It can only be induced with the conductive clips connected directly to access points on the utility to be traced, or the optional inductive clamp.

High Frequency (82 kHz) - This frequency can typically jump to adjacent conductors and can be induced by the conductive clips, the optional inductive clamp, or the built-in inductive antenna.

Very High Frequency (455 kHz) - This frequency can easily jump to adjacent conductors and it is a good frequency to use for total field survey or "quick scan" of a small area. It can be induced by the conductive clips, the optional inductive clamp, or the built-in inductive antenna.

DEPTH - To determine the depth of the target place the receiver directly over the target, then press the depth button. . There is a delay of 2.0 seconds between pressing the depth button and displaying the depth on the LCD. The measured depth will continue to be displayed on the LCD for as long as the button is depressed, otherwise (if the button is pressed and quickly released), the depth will show on the LCD for a few seconds, along with the word "DEPTH" on top of the LCD. Then the LCD will revert back to display signal strength. The TraceMaster can be factory set to display depth in feet and inches or in meters.

NOTE: Depth can only be measured when the unit is centered on the target, which is indicated by both arrows and the center bar being on, and the unit beeping (see LCD Display section).

NOTE: The DEPTH button can also be used on power up to "defeat the RF link". See section III "Operation" for details.

NOTE: Depth is not available at 455 kHz.

LCD Display

The LCD display has five general areas to display information to the user: a Receiver (RX) Window, a Transmitter (TX) Window, a Frequency Indicator, a Direction Indicator, and a Numeric Display.

The TraceMaster has an ambient light sensor located right under the "s" of the word "TraceMaster". Under very dim or dark lighting conditions, this sensor activates backlighting of the LCD to improve readability.



RX WINDOW - This window groups a symbol (battery) and a legend concerning the receiver status.

The "**Battery**" symbol indicates the receiver's battery status as follows: when all 3 segments inside the battery symbol are present, the battery is fully charged. When only 2 segments are present the battery has a medium charge. A single segment present signals a low battery. Always replace the receiver batteries when only the bottom segment is visible.



The "**AUTO GAIN**" legend indicates when the gain is in the automatic mode. If the legend is not visible the receiver is operating in the manual gain mode.

TX WINDOW - This window groups three symbols concerning the transmitter status. These symbols are automatically updated via the RF link every 10 seconds.

The "**Battery**" symbol indicates the transmitter's battery status as follows: when all 3 segments inside the battery symbol are present, the battery is fully charged. When only 2 segments are present the battery has a medium charge. A single segment present signals a low battery. Always replace the receiver batteries when only the bottom segment is visible.



The "**Inductive Mode**" symbol indicates that the transmitter is operating in the inductive mode. If the symbol is not visible the transmitter is operating in either the conductive or the clamp mode because the conductive clips or the optional inductive clamp are plugged into the transmitter's jack. For additional information on how to switch modes see the transmitter section.



The "**Antenna**" symbol indicates that the receiver is attempting to communicate with the transmitter via the RF link. It comes on briefly each time the FREQ switch is depressed, and also every 10 seconds to request a status update from the transmitter.



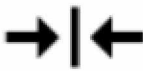


NOTE: The "Antenna" symbol should only come on for a brief period and then go off. This is an indication of a good communications link with the transmitter. If it stays on longer (up to about 3 seconds), the communications link with the transmitter is poor or non-existent. See also Section III - Operation - "Defeating the RF Link".

FREQUENCY INDICATOR - When a dot appears to the left of a given frequency, that frequency is active in the receiver and the transmitter.

NOTE: In the passive mode the transmitter is not active. However, a dot next to the "Passive" indicator on the LCD means that the transmitter has successfully received the command to go "inactive".

DIRECTION INDICATOR - The purpose of the arrows and center bar in this indicator are to tell the operator in which direction to move the receiver in order to be directly over the target.

-  Right Arrow - Receiver should be moved to the right to get closer to the target.
-  Left Arrow - Receiver should be moved to the left to get closer to the target.
-  BOTH ARROWS and BAR - Receiver is placed directly over the target. This is also accompanied by a beeping sound.

NOTE: When all three elements of this indicator are OFF, the signal strength is not adequate to make a directional determination. Keep searching based on the signal strength indication (see below) and the audio feedback, until one of the arrows comes ON. Directional indication is not available at 455 kHz.

NUMERIC DISPLAY - The numeric display consists of 3 ½ digits (the half-digit can only be a "1" or be off) and it is used to display signal strength and depth.

Signal Strength - This is an indication of the relative signal level detected by the receiver and is a function of the gain setting. Good signal strength will typically be between 20 and 80, however see also Section III - Operation - "Gain", for a better understanding on how to interpret the signal strength readings.

Depth Reading - When measuring depth the word DEPTH lights up above the numeric display. Then, after the calculation is done, the depth of the target in feet and inches (or meters) is displayed as shown below for as long as the button remains depressed, or for just a few seconds if the button was pressed and released:

12 4 or (factory set) 4.10
FT IN m

SPEAKER - An audible indication of signal strength is also provided. The pitch of the sound will increase with increasing signal strength. However, the volume is determined only by the VOLUME control. See section III - "Operation" - "Gain"- for additional hints on the effective use of the signal strength indicators.

Transmitter

The transmitter's frequency setting is performed automatically via the RF link at the receiver. The user needs only to plug in the conductive clips, optional inductive clamp, or nothing (to operate in inductive mode), then turn the transmitter ON. Turning the transmitter ON/OFF cannot be performed remotely from the receiver.

Controls

With only three controls plus the ability to change frequencies from the receiver, the TraceMaster's transmitter is very simple to operate.

ON/OFF - This is a momentary push-button switch that toggles the power to the transmitter on and off. When power to the transmitter is ON, the nearby green LED will illuminate and remain ON.

NOTE: The ON/OFF switch needs to be pressed until the green LED illuminates, then released, to turn the unit ON. Press the switch again until the green LED goes off to turn the unit OFF

NOTE: Power to the transmitter must be ON before the receiver is able to communicate with the transmitter through the RF Link.

SHOW STATUS - In order to conserve battery power all LED's (except "Power ON") remain OFF unless this switch is pressed (see LED Indicators section). Press and hold this switch to display LED indicators.

SELECT - Press to manually select an operating frequency or to place the transmitter in the "Passive" mode. Each press advances the frequency/mode as follows: Passive >> 575 Hz >> 8 kHz >> 82 kHz >> 455 kHz >> Passive, and so on. However, in induction mode the 575 Hz frequency and the 8 kHz frequency are skipped (there is no induction mode at these frequencies). In addition, while using the optional inductive clamp all frequencies not supported by the clamp will be skipped.

NOTE: The only reason to use the manual selection of a frequency is in the event a remote link with the receiver fails to be established due to environment conditions (distance, obstacles, etc.), or a broken RF antenna. When the remote link is established it ALWAYS takes precedence over the manual selection. In some cases it is necessary to press the FREQ control in the receiver to synchronize the receiver and transmitter units. See Section III "Operation" for additional hints.

LED Indicators

The transmitter has three LED Indicator sections on the front panel. They are labeled REMOTE, FREQUENCY, and STATUS/MODE. In order to see these indicators the "SHOW STATUS" button must be pressed and held, as explained in the previous section. The only exception to that rule is when the SELECT button is pressed to select a new frequency. In that case the LED corresponding to the new frequency will light up GREEN while the SELECT button is pressed.

NOTE: To conserve battery power, and because of the fact that the RF link allows the information the user needs to know about the transmitter to be displayed on the receiver's display, the LED's are relatively dim, especially under bright lighting conditions. Usually a hand shade is all that is needed to adequately see the LED's.

REMOTE - The single indicator in this section is labeled "Link". It will glow GREEN every time a successful "status request" is received from the receiver. It will glow RED when more than 20 seconds have passed without receiving a successful "status request" from the receiver.

FREQUENCY - One of the five (5) indicators in this section will glow GREEN to indicate the current operating frequency.

STATUS/MODE - There are four (4) indicators in this section providing information about the operating mode and status of the transmitter battery. They are:

CONDUCTIVE/CLAMP - This LED will glow GREEN when the conductive clips or an optional inductive clamp is plugged into the jack (see Transmitter Jack section).

OUTPUT POWER - This LED provides a rough indication of how good a circuit the transmitter is hooked to, by attempting to measure the impedance range. It is only meaningful when the transmitter is in conductive mode, ignore it in any other operating mode. It will glow as follows:

GREEN when the circuit is very good, which typically means the impedance is below 2 kohms;

GREEN & RED, alternating when the circuit is of medium quality, which typically means the impedance is between 2 and 4 kohms.

RED when the circuit is poor, which typically means the impedance is higher than 4 kohms.

NOTE: If the indicator is RED or alternating GREEN & RED, you should try to improve the connection (check the cables, the clips, the ground stake, wet the ground, clean rust or dirt, etc.). However, in many cases the reason for the high impedance is the soil itself (sandy or very dry) and/or the composition of the pipe or cable you are trying to trace (cast iron pipes, rusted or broken wires, heavy insulation to ground, etc.), and you may not be able to improve the connection. This DOES NOT MEAN that you won't be able to locate, it just means that there is a smaller amount of current circulating in the circuit and you may have to increase your receiver gain, or not be able to trace the signal as far as you would with a higher current.

INDUCTIVE - This LED will glow GREEN when there is nothing plugged into the transmitter jack. Therefore the transmitter is emitting its signal via the built-in induction antenna.

BATTERY - This LED will glow GREEN when the battery is fully charged. It will glow RED when the battery has a medium charge, and it will flash RED when the battery voltage reaches a level where the batteries must be replaced. Always replace the transmitter batteries when this LED is flashing RED.

NOTE: Certain operating modes and/or frequencies tax the batteries more than others. It is possible for the battery indicator to indicate different levels of charge while operating in different modes/frequencies. If the LED flashes RED consistently in most operating modes the batteries should be replaced.

Transmitter Jack

This jack is used to connect the conductive clips or the optional inductive clamp to the transmitter. The unit automatically detects what accessory has been plugged in and adjusts its operation and indicators accordingly.

NOTE: It is recommended that you turn the transmitter's power OFF before removing or inserting accessories from/into the jack.

WARNING

DO NOT CONNECT CONDUCTIVE CLIPS TO LIVE POWER LINES! THIS IS A HAZARDOUS PRACTICE AND CAN PERMANENTLY DAMAGE THE TRANSMITTER. IF YOU ARE CONNECTING TO DEAD POWER LINES, MAKE PROVISIONS TO AVOID ACCIDENTAL ACTIVATION OF POWER TO THE LINES.

SECTION II : SPECIFICATIONS

TraceMaster Specifications

Receiver

Operating Voltage	12 V (8 "AA" alkaline batteries)
Battery Life	60 hours (alkaline batteries, intermittent usage @ 70°F)
Audio Output	10 - 3000 Hz determined by signal strength 0 - 70 db SPL (Sound Pressure Level), volume controlled
Weight (incl. batteries)	3.9 lb. (1.7 kg.)
Operating Temp.	-4°F to 140°F (-20°C to 70°C)
Overall Dimensions	29.5" L x 5.0" W x 2.2" D (75 cm L x 12.7 cm W x 5.6 cm D)
Max. Depth Capability	19' (7.5 m) at 575 Hz, 8 kHz, 82 kHz and Passive
Sensors	Peak and Null (575 Hz, 8 kHz, 82 kHz and Passive) Peak only (455 kHz)

Transmitter

Operating Voltage	12 V (8 "D" alkaline batteries)
Battery Life	40 hours (alkaline batteries, intermittent use @ 70°F)
Weight (incl. batteries)	9.6 lb. (4.3 kg.)
Operating Temp.	-4°F to 140°F (-20°C to 70°C)
Overall Dimensions	13.0" W x 10.3" D x 6.0" H (33 cm W x 26.0 cm D x 15.0 cm H)
Operating Frequencies	575 Hz, 8 kHz, 82 kHz and 455 kHz
Output Power	
(Conductive Mode)	1 W maximum at 82 kHz and 455 kHz (FCC limited) 2.5 W typical at 575 Hz and 8 kHz
Operating Modes	Conductive: All frequencies Inductive: 82 kHz and 455 kHz Optional Clamp(s)

Common

RF Link Frequency	Spread Spectrum ISM band (902 MHz to 928 MHz)
RF Link Range	1000' line of sight or better (nominal)

(Specifications subject to change without notice)

SECTION III : OPERATION & ACCESSORIES

Operation

- 1) Determine which is the best method to induce the transmitted signal into the cable or pipe. The choices are one of the active modes (conductive, inductive, or inductive clamp) or the passive mode. Technically in the passive mode the signal is not transmitted by the TraceMater's transmitter, but it is already there due to AC power lines. Whenever possible use the conductive mode, which provides the strongest and best coupled signal.
- 2) For Conductive Mode plug the conductive clips into the transmitter jack BEFORE TURNING THE POWER ON. Connect the red clip to the access point for the cable or pipe. Connect the black clip to the ground stake, which should be buried on a line perpendicular to the utility to be traced and as far from it as possible.
- 3) For Inductive Mode make sure nothing is plugged into the transmitter jack. It is recommended that the conductive clips or the inductive clamp be removed while the transmitter power is OFF. Place the transmitter case over the buried cable or pipe in the direction indicated by the arrows on the transmitter case.
- 4) For the optional Inductive Clamp Mode insert the plug into the transmitter jack BEFORE TURNING THE POWER ON, open the jaws of the clamp and place it so that it completely encircles the desired cable or pipe. Make sure the clamp can fully close so that both ends touch.
- 5) For Passive mode it is not necessary to turn the transmitter on. However, the receiver always remembers the last frequency it was operating at when it was turned off. Therefore it is possible for the receiver to power up in a frequency other than "Passive". If that is the case it is necessary to turn the transmitter on to allow the RF link to be established and the receiver frequency to be changed to "Passive". Alternatively, the RF link can be defeated as explained later in this section.
- 6) Turn on the transmitter power by pressing the ON/OFF button on the transmitter and waiting for the power on indicator to glow.
- 7) Verify that you are operating in the desired operating mode by pressing and holding the "SHOW STATUS" button on the transmitter and observing the STATUS/MODE LED's.
- 8) Verify that you have a good circuit by checking the output power LED as described in the "LED Indicator" section.
- 9) Make sure the master ON/OFF switch built-in the volume control is ON, and pick up the receiver by its handle. The hand pressure action on the trigger switch will turn its power ON.
- 10) Fold up the transmitter's RF antenna so that it is perpendicular to the panel. Make sure the receiver's RF antenna is also in the vertical position.
- 11) Verify that you have established a good remote link by observing the antenna symbol on the receiver's LCD display and the "Link" LED indicator on the transmitter front panel (remember to press and hold the "SHOW STATUS" button). The "Link" LED should glow green after 10 seconds, indicating that you have established a link with the receiver.

NOTE: Depress the **FREQ** control on the receiver a couple of times, as described in Section II, to verify correct operation of the RF link.

12) Frequency changes - The frequency of both the receiver and the transmitter can be changed from the receiver by pressing the **FREQ** button on the receiver. Alternatively the **SELECT** button on the transmitter can be used to manually select the frequency, but after the first status request from the receiver, the remote link will always cause the transmitter's frequency to revert back to the frequency selected by the receiver.

NOTE: Selecting the "Passive" mode on the receiver and the transmitter (via the RF link or manually) will render the transmitter inactive (except for the RF link) and provide transmitter battery savings. See item 5 above for further details.

13) Gain - When the gain control is in the fully CCW direction, the gain is set automatically. For best results, the experienced operator has the option to set the gain manually by rotating the control in the CW direction, beyond the "click". As the control is rotated in the CW direction, the gain increases. As a guideline, always operate at the minimum gain that

shows a clear "peak" over the target. It is not important what the signal strength number is at the peak, as long as it clearly decreases on each side of the target. It is NOT necessary to operate with a signal strength close to 99, in fact, if "99" appears on the numeric display, the signal is saturating the amplifiers and the gain should be reduced. For best results keep between 20 and 80.

14) Locating Target with arrows - As the operator moves toward the buried target, one of the arrows will indicate in which direction to move. If the operator moves beyond the target, the other arrow will indicate that the operator should reverse direction. When the operator is right over the target the tone will reach maximum pitch and the digital reading will reach a maximum. Both arrows and the center bar on the display will be ON, and the receiver will start beeping.

NOTE: Directional indication is not available at the 455 kHz frequency.

15) Depth Measurement - Once the arrows and center bar indicate that the operator is over the target, place the bottom of the arrow against the ground, and then push and hold the DEPTH button. The digital display will indicate the approximate depth. The reading will show as long as the button is depressed.

NOTE: Depth is not available at the 455 kHz frequency.

16) Defeating the RF Link - It is possible to defeat the RF link to allow the setting of the receiver and transmitter frequencies independently. This may be needed in situations where the environment prevents a reliable RF link to be established or if there is a need to operate in passive mode without a transmitter and the receiver powers up in a different mode, as explained in item 5 above. The RF link can be toggled between active and defeated by the following sequence:

- a- Turn master ON/OFF switch off (click CCW)
- b- Hold the unit by the handle so that the trigger is activated
- c- Press and hold the DEPTH control before you turn the master ON/OFF switch CW.

NOTE: The antenna symbol will blink continuously while the RF link is defeated. Each time the unit is turned on with the DEPTH button depressed, it alternates between operating with the RF link active and operating with the RF link defeated. In other words, repeating the procedure above will re-enable the RF Link..

Standard Accessories

The accessories that are included with this instrument are:

- Padded Receiver carrying case
- Transmitter Hard Case
- Shoulder strap
- Ground stake
- Conductive clips
- Batteries
- Operation Manual

The ground stake and conductive clips are located in the accessory compartment of the transmitter.

Optional Accessories

Inductive Clamp - Three different clamp sizes are available for the TraceMaster, a 3-1/8" ID, 5" ID and 7" ID. The clamps are optimized for best results at 82kHz. They can also be used at 8kHz and 455kHz. The inductive clamp is not operative at 575Hz.

A few other accessories are available, such as larger clips and cable reel. Please contact Schonstedt for details.

SECTION IV : BATTERY INSTALLATION

Receiver

The batteries for the receiver are located in the back of the LCD display head. There are eight (8) 'AA' batteries. A battery access door with two thumbscrews is provided. Make sure the batteries are inserted following the orientation illustrated inside the battery holder. After replacing the batteries secure the door in place with the thumbscrews.

Transmitter

The batteries for the transmitter are located in a battery holder attached to the door at the bottom of the storage compartment in the transmitter case. Slide both latches back and lift the door to expose the batteries. There are eight (8) 'D' batteries. Make sure the batteries are inserted following the orientation illustrated inside the battery holder.

NOTE: In order to prevent accidental dislodging of the batteries during transport, the battery holder for the transmitter is very tight and it requires deliberate action to both remove and insert batteries. It is recommended that old batteries be removed using a flat screwdriver to pry them out at the center joint of each pair. For each of the four pairs, always insert the battery near the spring first.

SECTION V : TECHNICAL SUPPORT

Technical Support

Schonstedt offers technical support on a 24-hour a day basis, 7 days a week (including holidays). For any reason regarding usage and application please contact our technical support team at 888-32-TRACE (888-328-7223).

SECTION VI : WARRANTY INFORMATION

Limited Warranty

The Schonstedt Instrument Company (Schonstedt) warrants each product of its manufacture to be free from defects in material and workmanship subject to the following terms and conditions. The warranty is effective for 3 years (with the return of the Customer Registration Card) after the shipment by Schonstedt to the original purchaser.

Schonstedt's obligation under the warranty is limited to servicing or adjusting any product returned to the factory for this purpose and to replacing any defective part thereof. Such product must be returned by the original purchaser, transportation charges prepaid, with proof in writing, to our satisfaction, of the defect. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. Prior to repair, in this instance, a cost estimate will be submitted. Service or shipping information will be furnished upon notification of the difficulty encountered. Model and serial numbers must be supplied by user. Batteries are specifically excluded under the warranty.

Schonstedt shall not be liable for any injury to persons or property or for any other special or consequential damages sustained or expenses incurred by reason of the use of any Schonstedt product.

FOR SERVICE OR REPAIR

Please ship TraceMaster to:

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Attn: Customer Service Dept.