

TraceMaster®

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

Instruction Manual

Schonstedt Instrument Company
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Additional information, tutorial videos and basic locating instructions, service information and instructions are available on our website at:

www.schonstedt.com

Important Notice

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 VII: 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 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.

Warranty voided if serviced/repared by unauthorized repair facility and/or individual.

FOR SERVICE OR REPAIR

Please ship TraceMaster® to:

Schonstedt Instrument Company
 100 Edmond Road
 Kearneysville, WV 25430
 Attn: Customer Service Dept.

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SECTION VI: TECHNICAL SUPPORT

Schonstedt offers technical support and sales. For any reason regarding usage and application please contact our technical support team at 888-32-TRACE (888-328-7223).

**TECHNICAL SUPPORT
TOLL-FREE 888-32-TRACE
(888-338-7223)**

Tested to Comply with FCC Standards.
This Class A device complies with Canadian ICES-003
Cet appareil de la classe A est conforme a la norme
NMB-003 du Canada

This device contains RF modem MHX-910 from
Microhard Systems, Inc.
FCC ID: NS999P2 CANADA: 3143 102 1527A

This device contains RF modem MC4490 200M from
Laird Technologies, Inc.
FCC ID: KQLAC4490-100 / KQLAC4490 / KQL-4x90200

SECTION V: ACCESSORIES

1- Receiver

Included with the receiver are:

- Padded Receiver carrying case
- Batteries

2- Transmitter

Included with the transmitter are:

- Shoulder strap
- Ground stake
- Conductive clips
- Operation Manual

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

3- Optional

The Inductive Clamp is an optional accessory. Three different clamp sizes are available for the TraceMaster®, a 3" ID, 5" ID and 7" ID. .

Other accessories available are:

- Large Heavy Duty Conductive Clips
- Small Heavy Duty Conductive Clips
- Sondes* (512 Hz & 82Khz).

Please contact Schonstedt for details.

* Software must be installed in receiver unit to operate sonde.

SECTION I: GENERAL

1- Modes of Operation

The TraceMaster® has several operating modes. A combination of factory configuration and the way the transmitter is connected to the target utility determines what particular modes and frequencies are available. The following is a brief description of each mode. More details and references to these modes can be found throughout this manual.

1.1- Passive Mode

In this mode the transmitter is not active (either turned off or with its output shut down). The receiver searches for the AC power signal (factory selected to be either 50 or 60 Hz) off buried cables and pipes.

1.2- Active Modes

In the active modes the transmitter is turned on and it is used to impose a tracing signal on the target utility. Three basic active modes are available: Conductive, Inductive and Inductive Clamp. They differ on the method used to impose the tracing signal.

The TraceMaster® is capable of operating in the following active frequencies:

Low Frequency (575 Hz) - This frequency will not jump to adjacent conductors and is typically used with good conductors, in congested areas, or when a long distance trace is required.

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 is a good general-purpose frequency for medium length tracing in areas with low congestion.

High Frequency (82 kHz) - This frequency can typically jump to adjacent conductors and is commonly used for short tracing in poor conductors, such a cast iron and other similar pipes.

1.2.1- Conductive Mode

In this mode the transmitter is connected directly to access points on the utility to be traced using the red and black conductive clips and the ground stake. The transmitter current circulates out of the transmitter into

the target utility, from where it leaks to ground and returns to the transmitter via the ground stake, forming a closed circuit with strong coupling of the signal. The following frequencies are available when the TraceMaster® is operating in this mode: 575 Hz, 8 kHz and 82 kHz.



1.2.2- Inductive Mode

In this mode conductive clips are not used and must be disconnected from the transmitter jack. The transmitter emits a signal using a built-in inductive antenna. When the transmitter is placed on the ground, and in accordance with the orientation indicated on the label, the signal emitted by the antenna induces a current in the utility being traced. It is very important that at least one end of the utility is grounded to facilitate current flow. The utility and the soil around it form a closed circuit that allows the current to circulate, but the current is much smaller than that induced in conductive mode. This translates into shorter tracing distances and shallower depths, when using this mode. The following frequencies are available when the TraceMaster® is operating in this mode: 82 kHz.

1.2.3- Inductive Clamp Mode

This mode uses the optional inductive clamp, which is available in 3 different sizes (3", 5" and 7" diameter) and is plugged into the transmitter jack. The transmitter drives a signal through the clamp, which has to be placed around the utility to be traced, completely surrounding it, and making sure that it closes so that the two ends touch. It is also very important that at least one end of the utility is grounded to facilitate current flow. When the clamp is placed correctly the signal driven by the transmitter induces a current in the utility being traced. The utility and the soil around it form a closed circuit that allows the current to circulate. Although the current is much smaller than that induced in conductive mode, it typically is larger than that induced in the Inductive Mode, therefore this is a preferred method over the Inductive Mode, if available. The following frequencies are available when the TraceMaster® is operating in this mode: 8 kHz and 82 kHz.

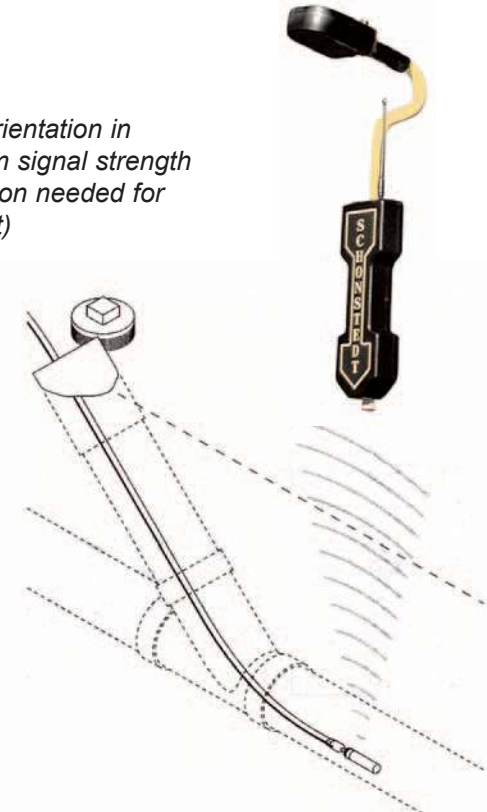
Once in the surroundings of the sonde, it is important to differentiate whether you are positioned along the axis of the sonde (the direction of the pipe) or off to either side. In the sonde mode the arrows are not functional, so the signal strength is the only indication available, and it will be "null", very close to zero (see Figure 1), if the receiver is placed on the axis of the sonde with the plane of the sensors perpendicular to it. Move away from the axis and follow the direction that results in increasing signal strength. Rotate the receiver back and forth and move in the direction that produces the maximum or "peak". As the receiver gets closer to the sonde the signal strength increases to a maximum when directly over the sonde.

2.3- Measuring Depth (see Figure 2)

To measure depth simply place the tip of the unit on the ground and press the DEPTH button when the signal strength is at a maximum. Reliable depth readings depend on a number of factors, but typically it is possible to read depth up to 15 ft, depending on the sonde frequency and the application.

Figure 2

Showing receiver orientation in "Peak" or maximum signal strength detection. (Orientation needed for depth measurement)



If the RF link is not disabled and the transmitter is OFF, you will not be able to change the receiver to a sonde mode frequency if it is currently set for a non-sonde mode frequency, or the passive mode.

Access the sonde mode by pressing the "FREQ" switch a few times, until the dots next to the "Passive" and either the "575 Hz" legend (for a 512 Hz sonde) or the "82 kHz" legend (for an 82 kHz sonde) on the display are BOTH lit.

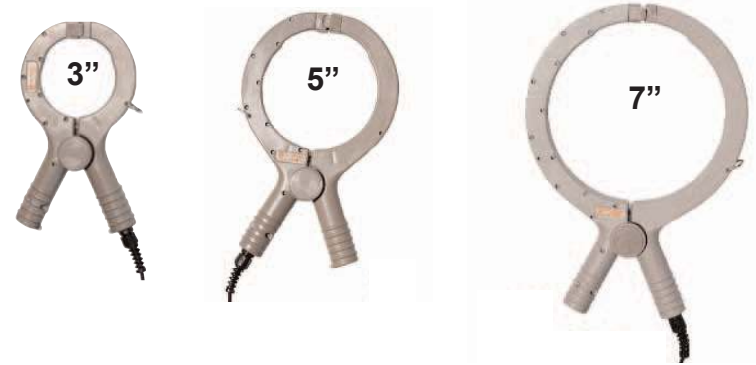
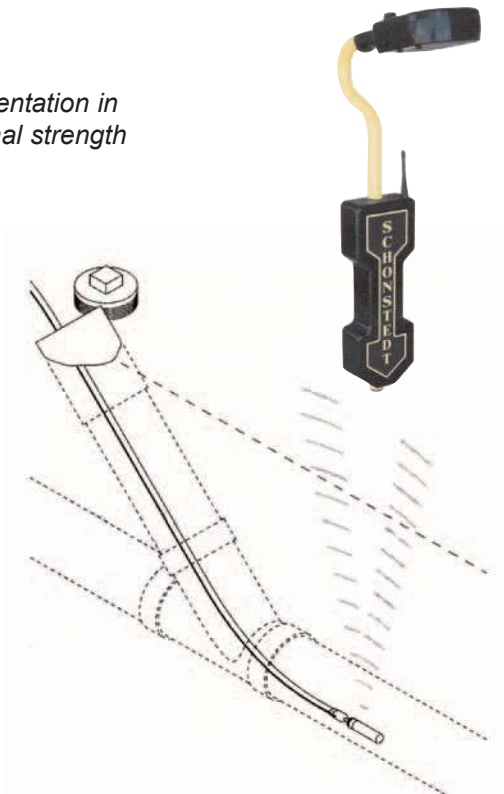
NOTE: Make sure to re-enable the RF link when you are finished with the Sonde Mode.

2.2- Searching for the Sonde

Due to the nature and strength of the sonde signal, it is necessary to have some idea of where the sonde is, to narrow the search area to a circle of several feet radius centered at the sonde. This is usually not much of a problem, since the sonde is "guided" by a device under control of the work crew, often with a camera attached to it.

Figure 1

Showing receiver orientation in "Null" or lowest signal strength detection.



1.3- Sonde Mode

This mode is not strictly an active mode, since the transmitter is not active. However, an alternate source of signal is necessary. That alternate source is a mini transmitter or "sonde" that is battery operated and small enough to be attached to devices that are sent through sewer pipes or water pipes. The emitted frequency penetrates the walls of such pipes, making it possible to be detected by the TraceMaster® receiver.

If your TraceMaster® unit is fitted with the sonde option then it supports the detection of one or more of these sondes:

- Schonstedt's 512 Hz sonde
- 512 Hz sondes from any other manufacturer
- Schonstedt's 82 kHz sonde

See SECTION IV, OPERATION - Locating a Sonde, for details about locating a sonde.



512 Hz Mini-Sonde
(2-1/4" long x 3/4" diameter)



82 kHz Sonde (3-1/2" long x 1" diameter)



512 Hz Sonde (4-1/2" long x 1-5/8" diameter)

2- The Remote Link

The TraceMaster® includes a Remote Link between the transmitter and the receiver. The link is accomplished through a radio frequency (RF) two-way communications channel, and makes it possible to change the transmitter's frequency from the receiver. The link also allows the receiver to monitor the transmitter battery status and other operating parameters, such as whether the transmitter is operating in conductive mode or not.

It is possible to defeat the Remote 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 under other circumstances when it is desirable to set the receiver and transmitter operating modes manually. The Radio Link can be toggled between active and inactive 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 both the DEPTH and the FREQ controls before you turn the master ON/OFF switch CW.
- d- When the Radio Link is disabled, the antenna symbol will blink about once per second

Optionally, the TraceMaster® can be purchased without the Remote Link. In that case the TraceMaster® system preserves all of its locating features. However, the frequency has to be changed manually for both the receiver and the transmitter, and there is no monitoring of transmitter status from the receiver.

- 11) Depth Measurement - Place the bottom of the receiver against the ground, and then push the DEPTH button. The digital display will indicate the approximate depth. For more accurate measurements, make sure that both arrows and the center bar are ON.

2- Locating a Sonde

Since the signal being traced by the receiver is produced by the sonde, and not travelling along the pipes, there are some differences in the way the receiver is used. The following paragraphs explain how to use the Tracemaster® receiver for sonde operation.

2.1- Setting the Receiver for Sonde Mode

How you set your receiver for sonde operation will vary slightly depending on whether you have purchased a receiver-only unit or a complete TraceMaster® unit (receiver and transmitter). In both cases, you will know you are in the sonde mode because the dot next to the "PASSIVE" and the dot next to another frequency legend on the display will BOTH be lit. The frequency legend with a dot next to it will either be 575 Hz (for a 512 Hz sonde) or 82 kHz (for an 82 kHz sonde).

2.1.1- Receiver Only or Receiver Without Remote Link

If your TraceMaster® is a "Receiver Only" system, or was purchased without the remote link, then pressing the "FREQ" button will cycle through the "Passive" mode, "Sonde" modes and the active frequencies (if any are available). That simple!

2.1.2- Receiver with Transmitter and Remote Link

To use the sonde mode, first make sure the RF link is disabled (see Section I: General, 2- Remote Link) or the transmitter is ON.

If the RF link is disabled the transmitter is irrelevant, it does not matter if its ON or OFF.

If the RF link is not disabled and the transmitter is ON, the receiver frequency can be changed to the sonde frequency because it knows it is in sonde mode and will not try to synchronize with the transmitter at those frequencies.

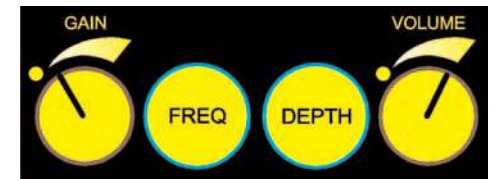
- 6) Turn on the transmitter power by pressing the ON/OFF button and observe the LCD for important information that is dependent on the mode of operation chosen. If in conductive mode you will be able to determine if there is DC or AC voltage present on the line, the line resistance (which will give you an indication of how good your connection is), and you will be able to select the output power (frequency dependent). Operating the transmitter when AC or DC voltage is present on the line is not recommended and can be hazardous to the transmitter and the operator.
- 7) Make sure the master ON/OFF switch built-in the receiver's 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.
- 8) Verify that you have established a good remote link by observing the antenna symbol on the receiver's LCD display and the transmitter's LCD display.
- 9) 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 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.
- 10) Locating Target with arrows - As the operator moves toward the buried target, one of the arrows will indicate in which lateral direction to move (right or left). 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.

SECTION II: RECEIVER

1- Introduction

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. The receiver's front panel includes everything necessary to use the Remote Link effectively. In addition, the receiver can determine the approximate depth of the target, and has the ability to operate in manual or automatic gain modes.

2- 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 ON/OFF 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, if the MASTER ON/OFF SWITCH is on. When the trigger is released (the receiver is put down or stored away), 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.

VOLUME - The volume control adjusts the volume of the tones 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.

NOTE: When tracing a target in congested areas and/or with strong interference, the directional arrows and center bar may not be precisely over the target. This will be noticed because the peak signal strength will not coincide with the arrows and bar. In that case rely on the peak signal strength, rather than the arrows.

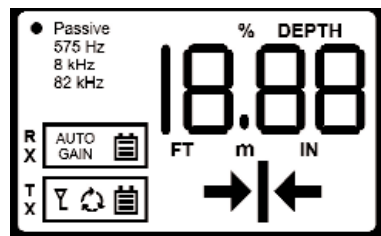
FREQ - An operating frequency can be selected by depressing this button consecutively until the desired frequency is indicated on the display of the receiver. Some frequencies are uniquely associated with a certain mode of operation, others are available in more than one of the modes of operation. The passive mode(s) and sonde mode(s) are also accessible via this button. What modes and what frequencies are available is determined by the system configuration and the way the transmitter is connected to the target utility.

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.

DEPTH - To determine the depth of the target place the receiver directly over the target, as indicated by the arrows and center bar, then press the depth button. If locating a sonde see Section IV: Operation - Locating a Sonde for additional considerations. 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 momentarily, 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.

3- 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.

SECTION IV: OPERATION

1- Operating Hints

- 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. In the passive mode the TraceMaster's transmitter does not transmit the signal, 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. In this mode best results are achieved when the cable or pipe to be traced is grounded at one or both ends.
- 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. In this mode best results are achieved when the cable or pipe to be traced is grounded at near end or both ends.
- 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". The transmitter will also change to the Passive mode (via the RF link), then you can turn it back off or leave it in the very low power consuming Passive mode. Alternatively, the RF link can be defeated as explained in Section I: General - The Remote Link.

7- Specifications

Charger input voltage:	22-30 VDC, 1.5 Amperes
Operating Voltage:	12 V, rechargeable NiMH pack
Battery Life:	8 hours (intermittent usage @ 70° F)
Weight (incl. Batteries):	9.1 Lb (4.1 kg)
Operating Temperature:	-4° F to 140° F (-20° C to 70° C)
Overall Dimensions:	14" W x 10.5" D x 6" H (35.5 cm x 27 cm x 15 cm)
Resistance Measuring Range:	500 Ω to 5 MΩ
Backlighting:	White LED array, ambient light sensing
Environmental:	IEC 605 29, IP56, Mil-Std 810F
Voltage Measuring Range:	0-260 VAC and 0-60VDC
Maximum Output Voltage:	100 V RMS
Operating Frequencies:	575 Hz, 8 kHz, and 82 kHz
Output Power: (Conductive Mode)	1 W maximum at 82 kHz (FCC limited) Selectable 1 W, 2 W or 5 W max. at 575 Hz and 8 kHz
Operating Modes	Conductive: All frequencies Inductive: 82 kHz only Inductive Clamp (optional): 8 kHz and 82 kHz
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)

The "BATTERY" symbol indicates the receiver's battery status as follows:



- 3 segments ON = battery is fully charged
- 2 segments ON = battery has a medium charge
- 1 segment ON = low battery (replace the batteries when only the bottom segment is visible)
- All segments flashing = extremely low battery, RF link disabled

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 receiver's battery status as follows:

- 3 segments ON = battery is fully charged
- 2 segments ON = battery has a medium charge
- 1 segment ON = low battery

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.

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 time. 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.

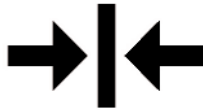
FREQUENCY INDICATOR - When a dot appears to the left of a given frequency, that frequency is active in the receiver and the transmitter. When the receiver operates in the sonde mode two dots will appear (as shown), one to the left of the "Passive" legend and one to the left of the

- Passive
- 575 Hz
- 8 kHz
- 82 kHz

sonde's operating frequency. 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".

- Passive
575 Hz
8 kHz
82 kHz

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



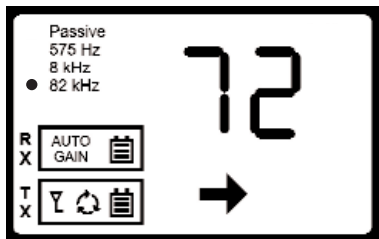
Right Arrow - Receiver should be moved to the right to get closer to the target.

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.

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, depth, and transmitter output current.

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.



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 just momentarily if the button was pressed and released:

battery back up to full capacity if it has been completely discharged. If you suspect the battery has been fully depleted, such as when it has been in storage for a long time, or when the transmitter won't even turn on, it is recommended to do at least two consecutive charging cycles before resuming normal use of the battery. Make sure you unplug the charger from the battery in between the two cycles.

If the charger is charging the battery in normal charge mode, and the temperature rises above 140°F (60°C) before the battery is fully charged, then the charger will switch to trickle charge mode. In this case full charge may not be achieved after the normal 4 hours of charging time. The battery pack also contains a thermostat that will open the circuit for safety, if it gets too hot.

When the Tx5 transmitter detects that the battery charger is plugged in, and if the power is turned ON, it will display "bAt CHA" on the LCD and the bars inside the battery indicator will "roll". When the battery is fully charged, it will display "bAt FUL" on the LCD, as shown below.



6.2- Recommendations for Battery Charging and Storage

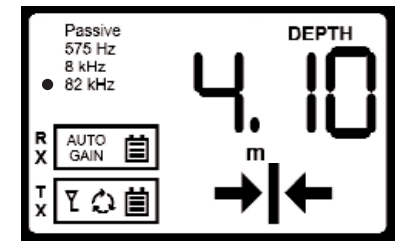
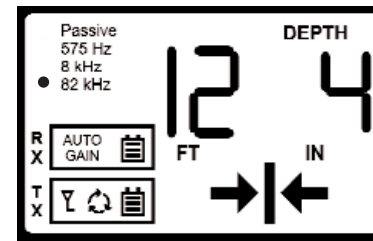
Before normal charging can begin, the battery pack temperature and voltage must fall within predetermined acceptable limits. The temperature must be between 50° and 104°F (10° and 40°C). When the charger detects that these two conditions are not met, it will continue to do just a "trickle charge" until the two conditions are met. Then it will start normal charging.

If the battery is faulty, and it never reaches acceptable voltage to start normal charging, the charger continues to trickle charge until the safety timer runs out (~ 6 hrs), then it stops.

If the battery is good, but the temperature never reaches acceptable range to start normal charging, the charger continues to trickle charge. In this case only a small fraction of full charge will be reached after the normal 4 hours of charging time.

The higher the storage temperature, the faster the battery will self-discharge, reducing its shelf life. The recommended storage temperature is 50° to 70°F (10° to 20°C). Storing the battery at higher temperature can reduce its overall life, storing at colder temperatures is preferred and beneficial.

Due to battery composition and safety features built into the charger, it maybe necessary to do two or more full-charging cycles to bring the



4- 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

5- Battery Installation

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.



6- Specifications

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' 11" (6.1 m) at 575 Hz, 8 kHz, 82 kHz and Passive
Sensors	Peak and Null
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)

6- Battery and Battery Charger

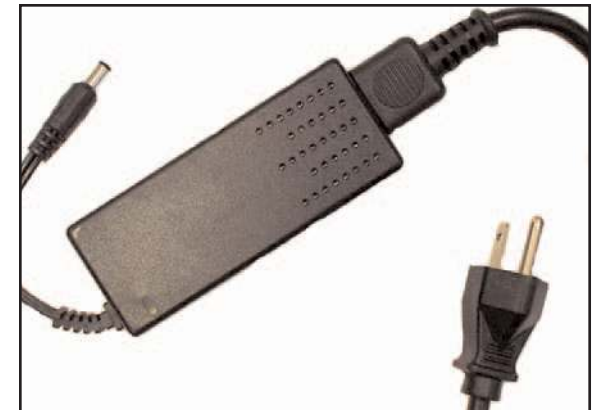
The battery is a custom 10-cell rechargeable NiMH pack that produces 12 volts; replacement should not be attempted. It is recommended to first charge the batteries for at least 4 hours before the initial use. If you suspect that the batteries are malfunctioning please contact Schonstedt Instrument Company.

6.1- Battery Charger

The battery charger is built-in the Tx5 transmitter. It will typically charge a fully discharged battery in under 4 hrs and it has smart safety features to monitor the charge process. An external power supply is provided with the unit and can be plugged directly into any household outlet or a vehicle DC-to-AC inverter capable of supplying 100 W of power. The power supply is universal and will accept any AC input voltage in the 100-240V range, 50 or 60 Hz. A variety of power cords are available to accommodate different style plugs around the world. The output of the power supply simply plugs into the matching plug inside the accessories compartment, as shown below.



Charger Jack inside Transmitter Case



Transmitter External Power Supply

BATTERY INDICATOR - The Battery symbol indicates the transmitter's battery status as follows:

- 3 segments ON = battery is fully charged
- 2 segments ON = battery has a medium charge
- 1 segment ON = low battery (should be recharged)

If there are no segments present, the battery is extremely low and should be recharged immediately. In addition, if the battery voltage drops below a preset threshold the transmitter will shut itself off.

4- 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. It is recommended that you turn the transmitter's power OFF before removing or inserting accessories from/into the jack. The jack is covered with a spring - loaded plastic cap to prevent water and dust from damaging it.



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.

5- Transmitter Time Out

The transmitter will turn itself off after approximately 85 minutes without receiving a status request from the receiver via the RF Link. This is a battery saving and a safety feature.

SECTION III: Tx5 TRANSMITTER

1- Introduction

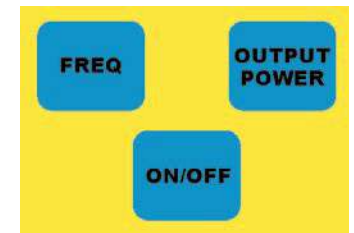
The TraceMaster® comes equipped with a Remote Link between the receiver and the transmitter. The transmitter's frequency setting is performed automatically via the RF link at the receiver. The transmitter can function in conductive, inductive, or inductive clamp modes. It will automatically sense the mode by monitoring the external jack to determine whether conductive clips or an inductive clamp is connected. If nothing is connected it will operate in inductive mode. Turning the transmitter ON/OFF cannot be performed remotely from the receiver.

If the TraceMaster® was purchased without the Remote Link, or the Remote Link is temporarily disabled, as explained in Section I: General, 2-The Remote Link, the transmitter can be fully operated from its front panel. However, the frequency for the receiver has to be changed manually to match the transmitter's frequency selected.

When the transmitter detects that the conductive clips are connected to its jack upon powering up, it will measure the resistance and any AC or DC voltage seen at the conductive clip terminals. If a voltage is indicated, the transmitter may be damaged if it is switched to an active frequency to proceed to operate in the conductive mode. It is recommended that the voltage present be removed before proceeding to the conductive mode of operation.

2- Controls

With only three controls plus the ability to change frequencies from the receiver, the Tx5 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 LCD will light up and display information pertinent to its operational state, as described in the next section. Power to the transmitter must be ON before the receiver is able to communicate with the transmitter through the RF Link.

FREQ - This switch is used to manually select an operating frequency or to place the transmitter in the "Passive" mode. Each press advances the frequency/mode as follows: Passive >> F1 >> F2 >> F3 >> Passive, and

so on. The frequencies available depend on the current Mode of Operation, see Section I: General - 1- Modes of Operation, for details.

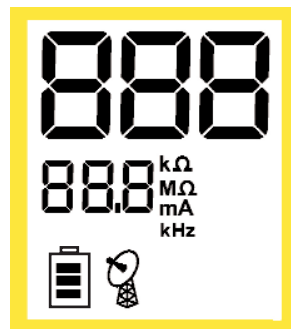
NOTE: The only reason to use the manual selection of a frequency is in the event a remote link with the receiver fails to be established due to environment conditions (distance, obstacles, etc.), or a broken RF antenna, and therefore it needs to be disabled. When the remote link is established it ALWAYS takes precedence over the manual selection.

OUTPUT POWER - This switch is used to manually select the output power in the Conductive mode only. It has no use in the Inductive and Inductive Clamp modes, where the output power is internally fixed. Each press increases the output power as follows: P -1 (one watt) >> P -2 (two watts) >> P-5 (five watts) >> P -1 (one watt), and so on. At the 82 kHz operating frequency only 1 watt is available due to FCC regulations. The output power cannot be changed using the Remote Link.

3- LCD Display

The Tx5 transmitter uses an LCD display to show all visual indicators to the user. The LCD display has five general areas to display information to the user: an Antenna Indicator, several Units Indicators, a Large 3-Digit Area, a Small 3-Digit area, and a Battery Indicator,.

The Tx5 has an ambient light sensor located to the left of the LCD. Under very dim or dark lighting conditions, this sensor activates backlighting of the LCD to improve readability.



ANTENNA INDICATOR - When it is ON solid, this symbol indicates that the Tx5 transmitter is communicating with the receiver via the RF link. If it is blinking, the communications link with the receiver is poor or non-existent. For proper Remote Link system operation this symbol should be ON solid all the time.

UNITS INDICATORS - During normal operation, or when the Tx5 transmitter is measuring line voltage and resistance, it is necessary to display information to the user with the appropriate units. The indicators on the LCD are as follows:

kΩ
MΩ
mA
kHz

- Ω Ohms, a resistance measurement unit
- kΩ kilo-Ohm = 1000 Ohms
- MΩ Mega-Ohm = 1,000,000 Ohms
- A Ampere, an electrical current measurement unit
- mA milli-Ampere = 1/1000 Ampere
- Hz Hertz, a frequency measurement unit
- kHz kilo-Hertz = 1000 Hertz

LARGE 3-DIGIT AREA - This area is used to display operating mode information as follows:



- PAS: Transmitter output signal is shut down and is not active
- Ind: Transmitter operating in the Inductive mode
- CLA: Transmitter operating in the Inductive Clamp mode
- P-X: Transmitter operating in the Conductive mode. X is 1, 2 or 5 to indicate output power in Watts



XXX: A 3 digit number displayed momentarily on power up indicating the current software version (i.e. 121 = Version 1.21). Upon connection of the conductive clips the numbers will alternately display the value of DC volts, AC volts and resistance (in Ω, kΩ or MΩ) until a frequency is selected via the front panel or the Remote Link.

SMALL 3-DIGIT AREA - There are two distinctive uses for this area. Upon entering the conductive mode, and during the time the Tx5 is measuring the line voltage and resistance, this area will display "dc", "AC", or an indication of the resistance accompanied by the correct units indicator (i.e 85.2 kΩ, 500 Ω, etc.). If the resistance is larger than 5 MΩ, "---" will be briefly displayed, followed by "OL"



to indicate an open line. The second use is to indicate the operating frequency, again accompanied by the correct units indicator (i.e. 82 kHz, 575 Hz, etc.). In addition, when the transmitter is operating in the conductive mode, the frequency display alternates with a display of the amount of current put out by the transmitter into the utility being traced (i.e. 42 mA, 124 mA, etc.).