

Instruction Manual

Model XTpc Pipe & Cable Locator Product Line

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Important Notice

Schonstedt believes the statements contained herein to be accurate and reliable; however, their accuracy, reliability, or completeness is not guaranteed.

Schonstedt's only obligation shall be to repair or replace any instrument proven to be defective within three years of purchase. Schonstedt shall not be responsible for any injury to persons or property, direct or consequential, arising from the use of any instrument.



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 undesired operation.



Application of Council Directive(s):
All models except XTpc+:
EMC 89/336/EEC as amended by 92/31/EEC & 93/68/EEC
XTpc+:
Directive 1999/5/EC (R&TTE Directive)

Standard(s) to which Conformity is declared:
All models except XTpc+:
EN 50082-1, EN 61000-4-2, EN 61000-4-3, EN 55022:1998 +
A1:2000 and A2:2003
XTpc+:
ETSI EN 301 489-1 V1.9.2 (2011-09)
ETSI EN 301 489-3 V1.6.1 (2013-08)
ETS1 EN 300 330-2 V1.6.1 (2015-03)

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SECTION I: OPERATING MODES

Pipe and cable locators in general can operate in a variety of modes and frequencies. The following is a brief description of the basic operating modes supported by the XTpc line of pipe and cable locators, and it is not intended to be a comprehensive locating tutorial. For additional information on pipe and cable locating theory and techniques, refer to Schonstedt's training section online at www.schonstedt.com.

Passive 50/60 Hz (P)

In the passive mode, the transmitter is not used at all. Instead, the receiver searches for an appropriate harmonic of 60 or 50 Hz signals (factory preset). These signals are typically present in energized power cables, making it possible to locate them without using a transmitter to impose a tracing signal onto them.

Passive Cathodic (PC)

Long pipelines usually have to deal with the issue of corrosion. A known group of techniques used to control corrosion involves the use of periodic cathodes along the pipeline and the circulation of low-level currents rectified from the power grid. The passive cathodic mode does not use the transmitter at all. Instead, the receiver searches for an appropriate harmonic of rectified 60 or 50 Hz from the power grid. Therefore, it is possible to trace pipelines for long distances without using a transmitter to impose a tracing signal onto them.

Conductive (C)

In the conductive mode, the transmitter imposes a signal of the "active" frequency onto the pipe or cable to be traced. It does so by making direct contact with the pipe or cable at a point where it comes up to the surface (a transformer box, a water hydrant, a telephone switch box, a gas meter, etc.). The circuit is closed, providing a return path by a ground stake that is buried in the ground in the vicinity of the transmitter.

Inductive Clamp (IC)

In the inductive clamp mode, the transmitter imposes a signal of the "active" frequency onto the pipe or cable to be traced. It does so by energizing a "clamp" that is placed completely encircling the pipe or cable at a point where it comes up to the surface (a transformer box, a telephone switch box, a gas meter, etc.). The clamp then induces a current onto the pipe or cable. In this mode, it is not necessary to provide a return path for the induced current to the transmitter. The induced current will travel on the pipe or cable for a distance making it possible to trace it.

Inductive (I)

In the inductive mode, the transmitter imposes a signal of the "active" frequency onto the pipe or cable to be traced. It does so by radiating a signal through the inductive antenna, which is placed on the ground in a direction perpendicular to the pipe or cable being traced. The inductive antenna then induces a current onto the pipe or cable. In this mode, it is not necessary to provide a return path for the induced current to the transmitter. The induced current will travel on the pipe or cable for a distance making it possible to trace it.

Sonde (S)

In the sonde mode, the transmitter is not used at all. This mode is used to trace non-metallic pipes or metallic pipes where the other modes are inapplicable or inefficient. A small sonde, or "beacon transmitter", is pushed through the pipe, and the receiver searches for the signal emitted by the 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. Due to the nature and strength of the sonde signal, it is necessary to have some idea of where the sonde is (in order to narrow the search area to a radius of several feet centered around 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.

SECTION II: THE XTPC PRODUCT LINE

While emphasizing portability, size, and convenience, the XTpc line of pipe and cable locators offers several choices to suit almost any type of locating challenge. The unique ability of XTpc locators to collapse (for portability) and expand (for greater sensitivity and full functionality) is unparalleled in the industry.

In the design our locators, Schonstedt has incorporated more than sixty years of experience in producing the world's finest locating products for aerospace, military and civilian applications. All Schonstedt products are manufactured following high standards of reliability, durability and performance.



Products Covered by this Manual

This manual covers all of the current versions and models in the XTpc line with features including various passive, active, and sonde modes. Feature description and specifications in this manual are applicable to all models and versions in the line, unless otherwise noted.

As of this publishing, the XTpc line includes the following locators:

- XTpc-33
- XTpc-33-PC
- XTpc-33-512
- XTpc-82
- XTpc-82-PC
- XTpc-82-512
- XT-512
- XTpc+

The next section provides a quick comparative overview of the main features and characteristics of each of these locators. Detailed operation is covered elsewhere in the text.

Model Comparison Chart

Model	P	PC	C	IC(1)	I(2)	S (freq.)	TX Freq.	Depth
XTpc-33	Y	N	Y	Y	Y	Y (33 kHz)	33 kHz	Y
XTpc-33-PC	Y	Y	Y	Y	Y	N	33 kHz	Y
XTpc-33-512	Y	N	Y	Y	Y	Y (512 Hz)	33 kHz	Y
XTpc-82	Y	N	Y	Y	Y	Y (82 kHz)	82 kHz	Y
XTpc-82-PC	Y	Y	Y	Y	Y	N	82 kHz	Y
XTpc-82-512	Y	N	Y	Y	Y	Y (512 Hz)	82 kHz	Y
XT-512	Y	N	N	N	N	Y (512 Hz)	N/A	Y
XTpc+	Y	N	Y	Y(3)	Y(4)	Y (512 Hz)	512 Hz 33 kHz 82 kHz	Y

- (1) Requires optional inductive clamp
- (2) Requires optional inductive antenna, except for XTpc+
- (3) 33 kHz and 82 kHz only
- (4) 82 kHz only

Note: P = passive mode, PC = passive cathodic mode, C = conductive mode, IC = inductive clamp mode, I = inductive mode, S = sonde mode. See SECTION I: OPERATING MODES for a description of these modes.

Automatic and Manual Gain

XTpc receivers have the ability to operate in automatic gain mode or in manual gain mode. In the automatic gain mode, the sensitivity of the receiver is adjusted automatically, based on the strength of the detected signal, to produce a relatively constant and strong signal strength indication. In the manual gain mode, the user has the ability to adjust the sensitivity up or down to suit different locating scenarios.

Directional Indication

XTpc receivers are equipped with directional indicators. These visual and audible indicators help the user locate the pipe or cable by showing which direction he/she should move in order to get closer to the target. These indicators are not available in the Sonde mode.

Depth Measurement

XTpc receivers have the ability to measure the approximate depth of the target pipe or cable being traced. The bottom tip of the receiver must touch the ground when depth measurement is made, and best results are obtained when the receiver is in a fully extended position. Depth measurements should only be made when the directional indication says that the target is directly below the receiver and the signal strength is adequate. Special considerations are required for the Sonde mode (see SECTION VIII: OPERATING RECOMMENDATIONS for details).

Automatic and Manual Output Power

The transmitters of the XTpc line of pipe and cable locators deliver power to the "load" connected to them. In the conductive mode, the load is the circuit formed by the cable or pipe being traced, the soil return, and the ground stake. In the inductive clamp and inductive modes, the loads are the clamp and the antenna, respectively. The inductive clamp and inductive modes require the maximum power that the transmitter can deliver. Therefore, the transmitter automatically operates at maximum power output, and there is no need for manual power adjustment.

In the conductive mode, the power delivered to the load is highly dependent on the external elements (soil, type of conductor, stake placements, etc.). In some cases, more power is desired to achieve more distance or depth; in other cases, less power is desired to avoid bleeding to nearby conductors. Therefore, while in the conductive mode, the user has the ability to adjust the output power manually (see SECTION III: OPERATING CONTROLS / Transmitter for details on how to adjust the output power).

Transmitter Current Measurement

When operating in the conductive mode, transmitters of the XTpc line of pipe and cable locators measure and display the amount of current flowing into the utility being traced. This is very useful in determining how good a circuit has been established by the operator, whether or not some improvements should be made by relocating the ground stake, or if the metal to metal contact of the conductive clips needs improvement. A low current reading can indicate a poor trace conductor, poor soil conductivity, or poor ground stake contact/placement. Higher current readings indicate a better circuit and a better chance at tracing long distances and deep conductors.

If the current reading is low, try improving the connection to see if the current increases (check the cables, clips, and ground stake; wet the ground; clean rust or dirt; etc.). Often, the reason for the low current is the soil itself (sandy or very dry) and/or the composition of the pipe or cable that is being traced (cast iron pipes, rusted or broken wires, heavy insulation to ground, etc.). If an improved connection cannot be made, there may be a small amount of current still circulating in the circuit. Try increasing the output power manually and/or increase the gain on the receiver.

Note: If the conductive clips are plugged in, the transmitter provided with the XTpc+ model (the Tx5) will measure the resistance and any AC or DC voltage that is between the conductive clip terminals upon powering up. If a voltage is present, it must be removed before proceeding to the conductive

mode of operation. The resistance measurement provides an additional indication of the quality of the locating circuit.

Transmitter Time Out

The transmitters of the XTpc line of pipe and cable locators will turn themselves off, under the conditions listed below, to protect the battery from an extremely deep discharge:

A) All transmitters:

When the battery voltage has reached a critically low level and the charger **IS NOT** plugged in. This low voltage cutoff will occur regardless of the timeout conditions listed below.

B) All transmitters **EXCLUDING** the Tx5:

- 1) The charger, conductive clips, inductive clamp or inductive antenna **ARE NOT** plugged in. In this case, the time out is 15 minutes from the last time the power was turned on or a button was pressed.
- 2) The conductive clips, the inductive clamp, or the inductive antenna **ARE** plugged in. In this case, the time out is 4 hours from the last time the power was turned on, a button was pressed, or an accessory was changed.

SECTION III: OPERATING CONTROLS

The product controls are designed to be intuitive and require a minimum of training for effective use. The receiver can easily be operated with one hand. The transmitter automatically recognizes which accessory is plugged in, requiring no adjustments in the inductive and inductive clamp modes.

Receiver

A) All Models:



ON/VOLUME - This switch powers on the receiver and automatically sets the volume to High. Additional depressions of this switch will cycle the volume through Off (no sound), Medium, and High settings.



OFF - This switch removes power from the receiver.



UP/DOWN Arrows - When the receiver is operating in manual gain mode, pressing the UP or DOWN arrows will increase or decrease the gain from its current setting. When the receiver is operating in the automatic gain mode, the first press of the UP or DOWN arrow will switch the receiver to the manual gain mode.



AUTO - When the receiver is operating in the manual gain mode, pressing the AUTO button will switch the receiver to operate in the Automatic gain mode. In this mode the receiver adjusts its sensitivity as a function of the strength of the detected signal.



or



DEPTH - When the proper conditions to measure depth are present, pressing this switch will display the target's depth on the LCD (after a delay of 2.0 seconds). The depth will continue to be displayed on the LCD, along with the word "DEPTH", for as long as the switch is depressed. If the switch is pressed and quickly released, the depth will show on the LCD momentarily. The XTpc can be factory set to display depth in feet and inches or in meters. If the depth cannot be determined due to a weak or noisy signal the LCD will show 3 dashes "---".



or



SONDE - If the sonde mode is available and the receiver is not operating in sonde mode, pressing this switch will cause the receiver to go to the sonde mode of operation. If the receiver is already operating in sonde mode, pressing this switch will cause the receiver to stop the sonde mode of operation.

B) All models EXCLUDING XTpc+ :



PASSIVE - If the receiver is not operating in passive mode, pressing this switch will cause the receiver to go to the passive mode of operation. If the receiver is already operating in passive mode, pressing this switch will cause the receiver to stop the passive mode of operation.



PC - If the passive cathodic mode is available and the receiver is not operating in passive cathodic mode, pressing this switch will cause the receiver to go to the passive cathodic mode of operation. If the receiver is already operating in passive cathodic mode, pressing this switch will cause the receiver to stop the passive cathodic mode of operation.

C) XTpc+ model ONLY:



FREQ - An operating frequency can be selected by depressing this switch consecutively until the desired frequency is indicated on the display of the receiver. Some frequencies are uniquely associated with a certain mode of operation; therefore, the user should ensure that the same frequency is selected on both the receiver and the transmitter. The passive modes are also accessible via this button. Which mode and which frequency should be used is determined by the system configuration and the way the transmitter is connected to the target utility.

Transmitter

A) All Models:



ON/OFF - This is a momentary push-button switch that toggles the power to the transmitter on and off. When the transmitter power is off, press this switch until the LCD indicators come on, then release it to turn the transmitter on. When the transmitter power is on, press the switch until the LCD indicators go off, then release it to turn the transmitter off.

B) All models EXCLUDING XTpc+ :



UP/DOWN Arrows - In the conductive mode, the output power can be adjusted manually up or down using these controls. After the first press of an arrow, the power adjustment mode switches to manual, and it can be adjusted to go above or below the setting of the Auto mode. To return the transmitter to auto power, turn it OFF and then ON again.

C) XTpc+ model ONLY (the Tx5 transmitter):



FREQ - An operating frequency can be selected by depressing this switch consecutively until the desired frequency that matches the receiver's frequency is indicated on the display of the transmitter. The passive mode, which puts the transmitter in a stand-by state, is also accessible via this button. What frequency should be used is determined by the way the transmitter is connected to the target utility.

**OUTPUT
POWER**

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-L (1/2 watt) >> P-1 (1 watt) >> P-2 (2 watts) >>
P-5 (5 watts) >> P-L (1/2 watt), and so on.

At the 82 kHz operating frequency, only 1/2 and 1 watt are available (due to FCC regulations).

SECTION IV: VISUAL AND AUDIBLE INDICATORS

The information display areas for the receiver and the transmitter are large and easy to understand. In addition, the receiver has audible indicators to facilitate operation in heavy traffic areas.

Receiver

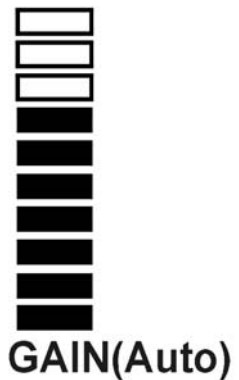
All visual indicators for the receiver are on the LCD display, which has six general areas to display information to the user: a Battery Indicator, a Gain Indicator, a Frequency/Mode Indicator, a Direction Indicator, an Alphanumeric Display and a Volume Indicator.

BATTERY INDICATOR - The "Battery" symbol indicates the receiver's battery status. When all 3 segments inside the battery symbol are present, the battery is fully charged. When only the 2 bottom segments are present, the battery has a medium charge. When only the bottom segment is present, the battery has a low charge and should be replaced. If there are no segments present, the battery is extremely low and you should replace it immediately.



GAIN INDICATOR - The "(Auto)" legend next to the "GAIN" legend indicates that the gain is in the automatic mode. In this mode, the receiver adjusts its sensitivity as a function of the strength of the detected signal. No bar graph is shown in this mode.

If the "(Auto)" legend is not visible, the receiver is operating in the manual gain mode; therefore, a means to show the user the gain setting is necessary. The bar graph indicates the relative strength of the gain, with each bar roughly representing one tenth of the full scale available. Each time the UP or the DOWN arrow is pressed, the gain is adjusted roughly by 1/30th of the full scale range. Therefore, it takes approximately 3 presses of the UP arrow to add one bar to the graph and approximately 3 presses of the DOWN arrow to delete one bar from the graph.



FREQUENCY/MODE INDICATOR - This LCD area consists of 4 icons: "SONDE", "33 kHz", "82 kHz", and the "Passive Arrow". These icons are used by themselves or in various combinations to indicate different operating modes, as shown in the following table.



All models EXCLUDING XTpc+:

	SONDE	33 kHz	82 kHz	PASSIVE ARROW
C, IC, I at 33 kHz	Off	On	Off	Off
C, IC, I at 82 kHz	Off	Off	On	Off
Sonde at 33 kHz	On	On	Off	Off
Sonde at 82 kHz	On	Off	On	Off
Passive 50/60	Off	Off	Off	On
Passive Cathodic (*)	On	Off	On	Off
Sonde at 512 Hz	On	Off	Off	Off

(*) Models with Passive Cathodic support do not support sondes

Note: C = conductive mode, IC = inductive clamp mode, I = inductive mode, See SECTION I: OPERATING MODES, for a description of these modes.

B) XTpc+ model ONLY:

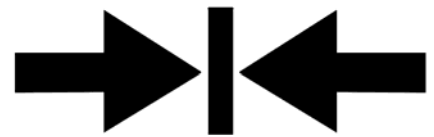
	SONDE	33 kHz	82 kHz	PASSIVE ARROW
C, IC at 33 kHz	Off	On	Off	Off
C, IC, I at 82 kHz	Off	Off	On	Off
C at 512 Hz (*)	Off	Off	Off	Off
Sonde at 512 Hz (*)	On	Off	Off	Off
Passive 50/60 (**)	Off	Off	Off	On

(*) The number 512 shows briefly on the numeric display upon entering this frequency.

(**) The number 50 or 60 shows briefly on the numeric display upon entering this mode, indicating which line frequency the unit is programmed to locate in passive mode.

Note: C = conductive mode, IC = inductive clamp mode, I = inductive mode, See SECTION I: OPERATING MODES, for a description of these modes.

DIRECTION INDICATOR - The arrows and center bar in this indicator tell the operator in which direction to move the receiver in order to be directly over the target (see also "Alternate Directional Indication" Section). The direction indicator does NOT work in the Sonde operating mode.



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.

When all three elements of this indicator are OFF, the signal strength is not adequate to make a directional determination or you are not close to the pipe or cable being traced. Keep searching based on the signal strength indication and the audio feedback, until one of the arrows comes ON.

ALPHANUMERIC DISPLAY - The alphanumeric display is used to display signal strength and depth. On XTpc+ models, the numeric display is also used for temporary indications of certain operating modes, frequencies (see table on page 14), and other brief information messages.

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 200 and 800. The display range for signal strength is 0 to 999; however, a very high signal strength is not necessarily better. If readings of 995 or higher are consistent, the signal is too strong and steps should be taken to reduce it. If a reading of "OL" is observed, a signal is present which interferes with the signal the receiver is set to detect. Steps should be taken to identify the source of interference or to change the locating mode.

Depth Reading - When measuring depth, the word DEPTH lights up above the numeric display and the depth of the target in feet and inches (or meters) is displayed as shown below:

12 4 Ft - in or 4.10 m

The display range for depth in feet and inches is 0" to 19 ft 11" and in meters is 0.00 m to 5.99 m. The choice of feet and inches or meters is factory set.

See also SECTION III: OPERATING CONTROLS/Receiver/DEPTH.

VOLUME INDICATOR - The volume indicator consists of a speaker symbol with 3 sound wave bars. If the volume is off, the speaker symbol with NO bars is shown, for medium volume the speaker symbol with 2 bars is shown and for maximum volume the speaker symbol with 3 bars is shown. The speaker produces an audible indication of signal strength. The pitch of the sound will increase with increasing signal strength. However, the volume is determined only by the VOLUME control, as explained above.



Volume OFF



Medium Volume



High Volume

Transmitter

A) All models **EXCLUDING** XTpc+:

All visual indicators for the transmitter are on the LCD display, which has four general areas to display information to the user: a Battery Indicator, a Power Indicator, a Numeric Display, and a Mode Indicator. There are no audible indicators for the transmitter.

BATTERY INDICATOR - The "Battery" symbol indicates the transmitter's battery status. When all 3 segments inside the battery symbol are present, the battery is fully charged. When only the 2 bottom segments are present, the battery has a medium charge. When only the bottom segment is present, the battery has a low charge and should be recharged as soon as possible. If there are no segments present, the battery is extremely low and it should be recharged immediately. If the battery reaches a voltage dangerously close to the level when continuous operation can damage it, the empty battery box will begin to flash and transmitter shutdown is imminent (See Section II: The XTPC Product Line – Transmitter Time Out). In addition, the battery indicator is used to show that the charger is plugged in correctly. The battery box will be on, with all 3 segments rolling. See SECTION VI: BATTERIES AND CHARGER for additional information on the battery charging visual indicators.



POWER INDICATOR - The power indicator consists of a 10-bar graph located to the right of the word "POWER" on the faceplate, plus the legend (Auto) at the bottom and to the right of the bar graph. Its objective is to provide an indication of what type of power adjustment mode the transmitter is operating at and, if operating in manual adjustment mode, provide a relative indication of the output power being delivered to the circuit.



NUMERIC DISPLAY - The numeric display consists of 3 digits and it is used to display the measured output current delivered to the circuit, as well as mode indications in the other operating modes. The output current is displayed in mA (milliamperes) and it can range from 0 to 180 mA (internally limited for safety and battery life considerations).

MODE INDICATOR - The transmitter operates only at its factory set active frequency (see Model Comparison Chart). When the transmitter is on and operational, the operating frequency will be displayed at the top left corner of the LCD.

The transmitter automatically detects the operating mode when an accessory is plugged in (conductive clips, inductive clamp, inductive antenna, or battery charger). Once detected, the mode is indicated to the user by a combination of display indicators and legends, as shown in the following table:

Accessory Plugged In	Operating Mode	Mode Indicator
None	Non operational - Idle	Numeric Display Legend says "On" Battery Symbol = Lit Frequency Indicator = Lit Arrow indicators pointing to mode printed on the faceplate, along the right side edge of LCD, are all flashing
Battery Charger	Non operational – Charging	Numeric Display Legend says "CHA" Battery Symbol = Rolling bars inside battery box Frequency Indicator = Lit Arrow indicators = All OFF
Conductive Clips	Conductive	Numeric Display Legend = Shows output current in mA Battery Symbol = Lit Frequency Indicator = Lit Arrow indicator = Pointing to CONDUCTIVE
Inductive Clamp	Clamp	Numeric Display Legend says "CLP" Battery Symbol = Lit Frequency Indicator = Lit Arrow indicator = Pointing to CLAMP
Inductive Antenna	Inductive	Numeric Display Legend says "Ind" Battery Symbol = Lit Frequency Indicator = Lit Arrow indicator = Pointing to INDUCTIVE

B) XTpc+ model ONLY (the Tx5 transmitter):

All visual indicators for the transmitter are on the LCD display, which has four general areas to display information to the user: a Battery Indicator, several Units Indicators, a Large 3-digit Numeric Display, and a Small 3-Digit Numeric Display. There are no audible indicators for the transmitter.

The Tx5 transmitter 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.

BATTERY INDICATOR - The "Battery" symbol indicates the transmitter's battery status. When all 3 segments inside the battery symbol are present, the battery is fully charged. When only the 2 bottom segments are present, the battery has a medium charge. When only the bottom segment is present, the battery has a low charge and should be recharged as soon as possible. If there are no segments present, the battery is extremely low and it should be recharged immediately. If the battery reaches a voltage dangerously close to the level when continuous operation can damage it, the empty battery box will begin to flash and transmitter shutdown is imminent (See Section II: The XTPC Product Line – Transmitter Time Out). In addition, the battery indicator is used to show that the charger is plugged in correctly. The battery box will be on, with all 3 segments rolling. See SECTION VI: BATTERIES AND CHARGER for additional information on the battery charging visual indicators.



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:

Ω	Ohms, a resistance measurement unit
k Ω	kilo-Ohm = 1000 Ohms
M Ω	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 NUMERIC DISPLAY - 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 L, 1, 2 or 5 to indicate output power in Watts. (L means 1/2 Watt).
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 , k Ω , or M Ω) until a frequency is selected.

SMALL 3-DIGIT NUMERIC DISPLAY - 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 k Ω , 500 Ω , etc.). If the resistance is larger than 5 M Ω , "---" 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 (e.g. 82 kHz, 512 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 (e.g. 42 mA, 124 mA, etc.).

The transmitter automatically detects when the inductive clips, the inductive clamp, or the charger are plugged in. When the charger is plugged in, it overrides everything else, and the transmitter will go into battery charging mode, see SECTION VI: BATTERIES AND CHARGER / Transmitter Battery Charger, for additional details.

SECTION V: CONNECTORS AND ACCESSORIES

Receiver Connector

The 3.5mm headphone jack accepts any mono or stereo earphones or headphones. The receiver automatically detects the insertion of the plug and routes the audio signals to the earphones or headphones, silencing the internal speaker.

Transmitter Connector

A) All models EXCLUDING XTpc+:

This circular, lock-type, 8-pin connector is used to connect the conductive clips, the optional inductive clamp, optional inductive antenna, or the battery charger to the transmitter. The transmitter 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 connector.



B) XTpc+ model ONLY (the Tx5 transmitter):

This 1/4" phone jack is used to connect the conductive clips or the optional inductive clamp to the transmitter. The transmitter 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 connector or connecting to a utility. The connector is covered with a spring-loaded plastic cap to prevent water and dust from damaging the transmitter.



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.

Standard Accessories

The following accessories are included with **ALL** models **EXCLUDING** XT-512:

- Belt receiver holder cup
- Ground stake
- Conductive clips
- Universal power supply for battery charger with power cord

In addition, the following accessories are included, depending on the model:

A) All models **EXCLUDING** XT-512 and XTpc+:

- Hard carrying case
- Battery charger with power cord for Transmitter Battery
- Vehicle power supply adapter for battery charger
- Headphone jack plug

B) XT-512 and XTpc+ models **ONLY**:

- Soft carrying bag
- Headphone jack plug

Optional Accessories

Many optional accessories are available for the XTpc pipe and cable locator line. The following list includes the most common ones. Please contact Schonstedt or your local dealer for details.

- Inductive antenna (33 kHz or 82 kHz)
- Inductive clamp (3" ID, 5" ID and 7" ID)
- Sondes (512 Hz)
- "Carry All" duffel bag
- Headset for receiver
- Padded transmitter and accessory belt-pouch with belt
- Shoulder strap
- Medium size conductive clips
- Large size conductive clips



SECTION VI: BATTERIES AND CHARGER

Receiver Battery

The XTpc receiver is powered by one 9-volt disposable battery. The battery is located in the handle of the instrument and can be accessed by turning the screw counterclockwise. To remove the battery, simply tilt the unit so that the handle is pointing down, and the battery will slide out. When replacing the battery, look at the inside of the battery door for the proper battery orientation. As a safety measure the unit will not turn on if the battery is not inserted correctly. You should never have to force the battery door closed. If the battery does not seem to be going in all the way, remove the battery, reverse its orientation and then replace it.



Transmitter Battery

The battery is a custom rechargeable NiMH pack. It is recommended to first charge the batteries for at least 4 hours before the initial use. Replacement of the battery pack should not be attempted; if you suspect that the battery is malfunctioning, please contact Schonstedt Instrument Company.

Transmitter Battery Charger

The battery charger is especially designed to charge the internal NiMH battery pack that powers the transmitter. It will typically charge a fully discharged battery in under 4 hours, and it has smart safety features to monitor the charge process.

For all XTpc models except the XTpc+, the chargers are external to the transmitter, are powered by the AC power supply (included), and are then plugged into the transmitter. For the XTpc+ transmitter (the Tx5), the charger is built into the unit, and the AC power supply plugs directly into the transmitter (as shown in the figure to the right). The power supply is universal and will accept any AC input voltage in the 100 - 240 volt range, 50 or 60 Hz. A variety of power cords are available to accommodate different style plugs around the world.

The vehicle power supply, included with all XTpc models except the XTpc+, allows the battery to be recharged while driving from job to job. For the XTpc+ transmitter (the Tx5) an alternative for in-vehicle charging is to plug the AC power supply into one of the many commercially available vehicle DC-to-AC inverters capable of supplying at least 100 W of power.

Battery Charger Indicators

A) All transmitters **EXCLUDING** the XTpc+ (Tx5):

After plugging the charger into the XTpc transmitter and connecting the AC power to it, allow a few minutes for it to settle. The LED indicators are as follows:

FULL (Green): The charger has determined that the battery is fully charged

CHARGING (Yellow): The charger is charging the battery

FAULT (Red): See explanation below

Conditions Under Which the FAULT LED Will Come On:

The FAULT LED indicates that the battery charger is not charging the battery successfully. This can be for a number of reasons: the battery may be overcharged, the battery may not be taking a charge in a reasonable amount of time, the battery may be too warm to be charged without causing damage to its internal cells, or the battery charger may have an internal fault.

The FAULT LED may also come on if power is applied to the charger, but the charger is not connected to the transmitter. This is because the charger cannot distinguish between a missing battery and a battery that is not responding to charging correctly.

If the FAULT LED comes on, take the following steps to try to clear the condition:

1. Make sure that the charger is properly connected to the XTpc transmitter and wait a few minutes (2-5) to see if the FAULT LED turns off.
2. If the FAULT LED does not come off after a few minutes, remove the power connector from the charger and reconnect it to start the charger.
3. If the XTPC transmitter is warm, move it to a conditioned space and allow it to cool for several hours before attempting a charge again.
4. If the FAULT LED remains on after the steps above, contact Schonstedt Instrument Company for further instructions.

B) XTpc+ **ONLY** (the Tx5 transmitter):

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. If the power is OFF, the battery will still charge, but no indication of charging activity or battery status will be shown on the LCD.



If the battery charger is not charging the battery successfully, the following indication will be shown on the LCD:

This can be for a number of reasons: the battery may be overcharged, the battery may not be taking a charge in a reasonable amount of time, the battery may be too warm to be charged without causing damage to its internal cells, or the battery charger may have an internal fault.



If the error message comes on, take the following steps to try to clear the condition:

1. Remove the power connector from the charger, and reconnect it to start the charger.
2. If the transmitter is warm, move it to a conditioned space and allow it to cool for several hours before attempting a charge again.
3. If the error message remains on after the steps above, contact Schonstedt Instrument Company for further instructions.

Recommendations for Battery Charging and Storage

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

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 “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. In this case, only a small fraction of full charge will be reached after the normal 4-hours of charging time.

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, 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.

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.

SECTION VII: SPECIFICATIONS

(Specifications are subject to change without notice)

Receiver

Operating Frequency:	Active and passive frequencies depending on model (see Model Comparison Chart)
Battery:	9V Alkaline single battery
Battery Life:	12 hours (intermittent use)
Audio Output:	10 - 1500 Hz (determined by signal strength) 0 - 70 db SPL (Sound Pressure Level), volume controlled
Weight (incl. batteries):	Under 2.8 lbs
Operating Temp.:	-4°F to 140°F (-20°C to 70°C)
Water and Dust Resistance	Rated IP54, when operated with earphone jack plug (provided)
Overall Dimensions:	Closed: 17.5 in x 3 in x 8.5 in (44 cm x 7.6 cm x 21.5 cm) Extended: 27.7 in x 3 in x 8.5 in (70 cm x 7.6 cm x 21.5 cm)
Max. Depth Capability:	Approximately 19' (5.8 m) Sonde mode approximately 5'- 8' (1.5 m - 2.5 m)

Transmitter

A) All models **EXCLUDING** the XTpc+ (Tx5) and XT-512:

Operating Frequency:	33 kHz or 82 kHz, depending on model (see Model Comparison Chart)
Operating Modes:	Conductive Inductive (optional) Inductive Clamp (optional)
Output Power: (conductive mode max, load dependent)	33 kHz - 1.8 W maximum 82 kHz - 1.0 W maximum (FCC limited)
Max. Output Voltage:	100 V RMS
Resistance Meas. Range:	N/A
Voltage Meas. Rang:	N/A

Battery Type:	Rechargeable NiMH pack (7.2V)
Battery Life:	8 hours (intermittent usage @ 70° F)
Charging:	External smart charger powered by AC/DC power adapter (100-240 V - 0.8 A), or vehicle supply
Outputs/Inputs:	Circular "smart" connector to: <ul style="list-style-type: none"> 1) Inductive antenna (output) 2) Inductive clamp (output) 3) Conductive clips (output) 4) Battery charger (input)
Dimensions:	7.2" W x 2.2" D x 1.5" H (18.3 cm x 5.6 cm x 3.8 cm)
Weight:	1.5 lbs. (0.68 kg)
Operating Temp.:	-4°F to 140°F (-20°C to 70°C)
Backlighting:	N/A

B) XTpc+ **ONLY** (the Tx5 transmitter):

Operating Frequency:	512 Hz, 33 kHz or 82 kHz
Operating Modes:	Conductive, all frequencies Inductive, 82 kHz only Inductive Clamp (optional), 33 and 82 kHz only
Output Power: (conductive mode max, load dependent)	33 kHz - 1/2, 1, 2 or 5 W 33 kHz - 1/2, 1, 2 or 5 W 82 kHz - 1/2 or 1 (FCC limited)
Max. Output Voltage:	100 V RMS
Resistance Meas. Range:	500 Ω to 5 MΩ
Voltage Meas. Range:	0-260 VAC and 0-60 VDC
Battery Type:	Rechargeable NiMH pack (12V)
Battery Life:	8 hours (intermittent usage @ 70° F)
Charging:	Internal smart charger powered by AC/DC power adapter (100-240 V - 0.8 A), or by 22-30 VDC, 1.5 A supply

Outputs/Inputs:	a) Phono plug output connector to: 1) Inductive clamp 2) Conductive clips b) 5.5 mm x 2.1 mm DC jack input connector, center positive, from: 1) AC/DC power adapter (100-240 V -0.8 A) 2) 22-30 VDC, 1.5 A supply
Dimensions:	14" W x 10.5" D x 6" H (35.5 cm x 27 cm x 15 cm)
Weight:	9.1 lbs. (4.1 kg)
Operating Temp.:	-4°F to 140°F (-20°C to 70°C)
Backlighting:	White LED array, ambient light sensing
Environmental:	IP56 per ANSI/IEC 60529-2004 MIL-STD-810 F

SECTION VIII: OPERATING RECOMMENDATIONS

Follow these tips and recommendations to operate your XTpc Pipe and Cable Locator:

- 1) Whenever possible, use the conductive mode. It provides the strongest and best-coupled signal.
- 2) When operating in conductive mode:
 - The ground stake should be buried on a line perpendicular to the utility to be traced and as far from it as possible.
 - Verify that a good circuit has been established by checking the output current from the transmitter.
 - If necessary, make adjustments to the ground stake or clips to improve the connection.
 - You can also manually adjust the output power to affect the output current.
- 3) When operating in the inductive mode, place the antenna (an additional accessory for the XTpc model but is built into the transmitter of the XTpc+ model) over the buried cable or pipe in the direction indicated by the label. (This application does not apply to XT-512, which is a receiver only device.)
- 4) If using the inductive clamp mode, place the clamp so that it completely encircles the desired cable or pipe. Make sure the clamp can fully close so that both ends touch.
- 5) When operating in the passive mode or the passive cathodic mode, be aware of your surroundings and possible interference from overhead power lines, other buried cables carrying 50 or 60 Hz signals, and nearby transformers or substations.
- 6) In all operating modes, always set the gain at the minimum setting that shows a clear "peak" over the target. Optimum results will most likely be obtained with a signal strength reading between 200 and 800. A consistent reading of 995 or higher indicates the signal is too strong and the gain and/or transmitter power should be reduced.
- 7) Searching for a sonde:

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, the signal strength is the only indication available, and it will be "null" (very close to zero) 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. As the receiver gets closer to the sonde, the signal strength increases. It reaches a maximum when the receiver is directly over the sonde (if the plane of the sensors is parallel to the axis of the sonde by approaching from a direction that is perpendicular to the direction of the pipe). A rotation of 90 degrees from this position should produce a null. 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. The achievable depth depends on a number of factors, but typically it is possible to read depth up to 5 to 8 feet (1.5 to 2.4 m).

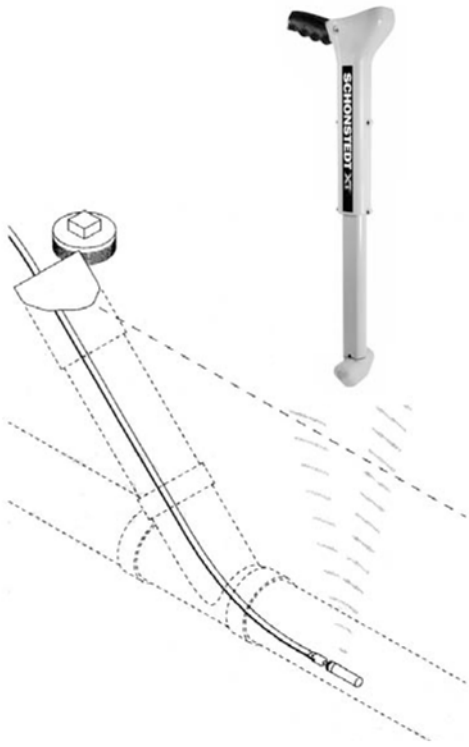


Figure 1: Showing receiver orientation in "NULL" or lowest signal strength detection.

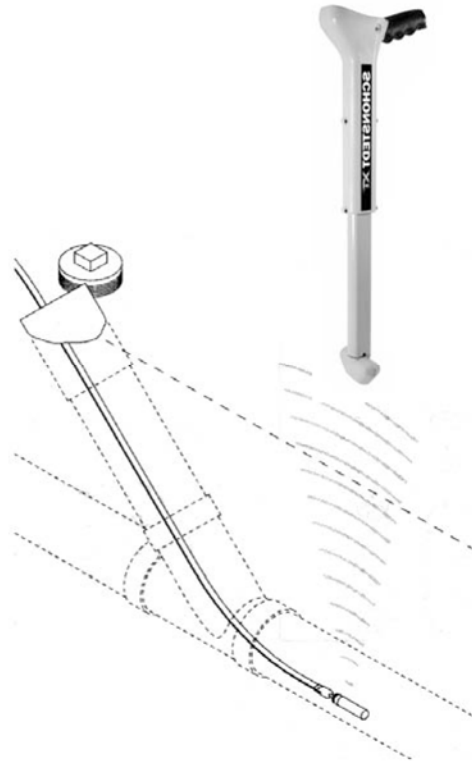


Figure 2: Showing receiver orientation in "Peak" or maximum signal strength detection. (Orientation needed for depth measurement)

SECTION IX: TECHNICAL SUPPORT

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

FOR SERVICE OR REPAIR

Please ship unit to:

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

SECTION X: WARRANTY INFORMATION

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. Please complete the warranty registration card and send back to Schonstedt Instrument Company.

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 a description of the defect in writing. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed. Specifically, this warranty does not cover product that has been subject to inundation by fire, water or other liquid intrusion, or units that have been damaged or compromised due to repair, alteration or modification by anyone other than an authorized repair representative. Prior to a repair being performed by Schonstedt, a cost estimate will be submitted and no work will be completed until authorized by the customer. Batteries are specifically excluded under the warranty and should be addressed to the manufacturer of batteries in question.

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.