Locators, Signal Generators and Transmitters
Instruction Manual

CXL4 Cable Avoidance Tool
DXL4 Depth Measuring Cable Avoidance Tool
SGA4 Signal Generator
SGV4 Signal Generator
SGV4-DB Signal Generator with Bluetooth®
MXL4 Precision Pipe & Cable Locator
MXT4 Transmitter
MXT4-DB12 12 Watt Transmitter with Bluetooth®



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General Warnings

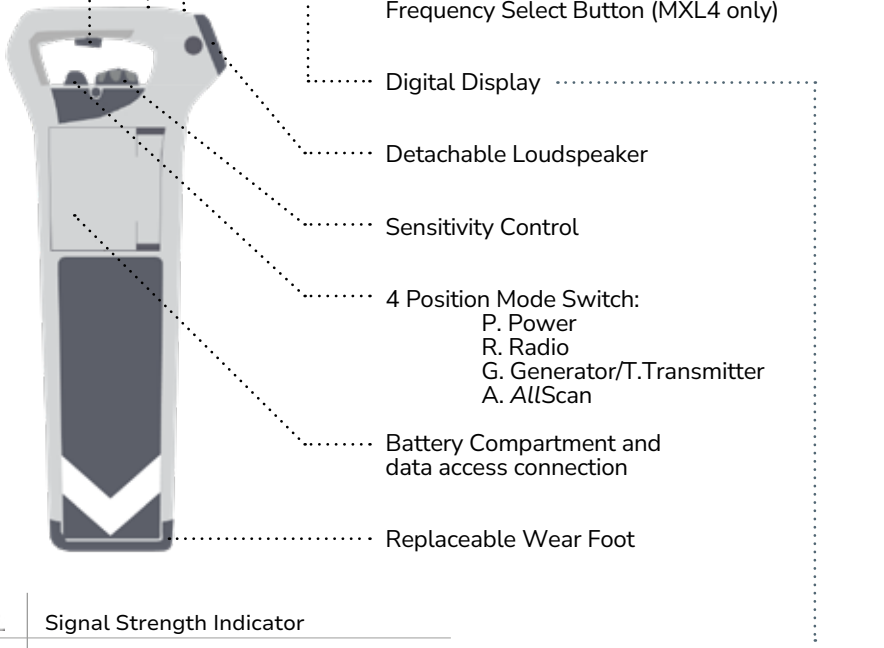
⚠ ALWAYS EXCAVATE WITH CARE

- Operators must be competent to use the equipment.
- The equipment is for professional use only. Keep it away from children and the general public.
- The Signal Generator/ Transmitter leads MUST NOT be connected directly to any live electrical service.
- The Signal Generator/Transmitter can produce potentially HAZARDOUS VOLTAGES in Connected Mode. NEVER TOUCH the metal parts of its crocodile clips or the service under test while in use. Keep others away from the equipment and the service. Consider risk factors such as wet/humid conditions which are worse, and the operator's medical history.
- NEVER TOUCH the Plastic Pipe Tracer or Flexible Tracer terminals when in use.
- Do not use the equipment in areas where hazardous gases may be present.
- Check for underground services before using the Earth Stake.
- The Locator detects services radiating a detectable signal. There may be some services that do not radiate a signal and cannot be located.
- The Locator alone will not always locate every service. Use a Signal Generator/ Transmitter wherever possible.
- Performance may be impaired by unusually strong electromagnetic fields.
- Do not use the equipment outside of the temperature range -10˚C to 50˚C (14˚F to 122˚F) if alkaline batteries are fitted and -20˚C to 50˚C (-4˚F to 122˚F) if rechargeable lithium-ion batteries are fitted.
- Beware of multiple services. The Locators will not always indicate services that are close together or one above the other.
- Always make sure that the Locator and Signal Generator/ Transmitter are set to the same frequency when used together.
- Do not hold the Locator Loudspeaker close to the ear for extended periods.
- Training on the safe use of the equipment is strongly advised.

It is recommended that the operation of the Locator and Signal Generator/Transmitter is regularly checked (see pages 63 - 66).

CXL4, DXL4 and MXL4 Locators

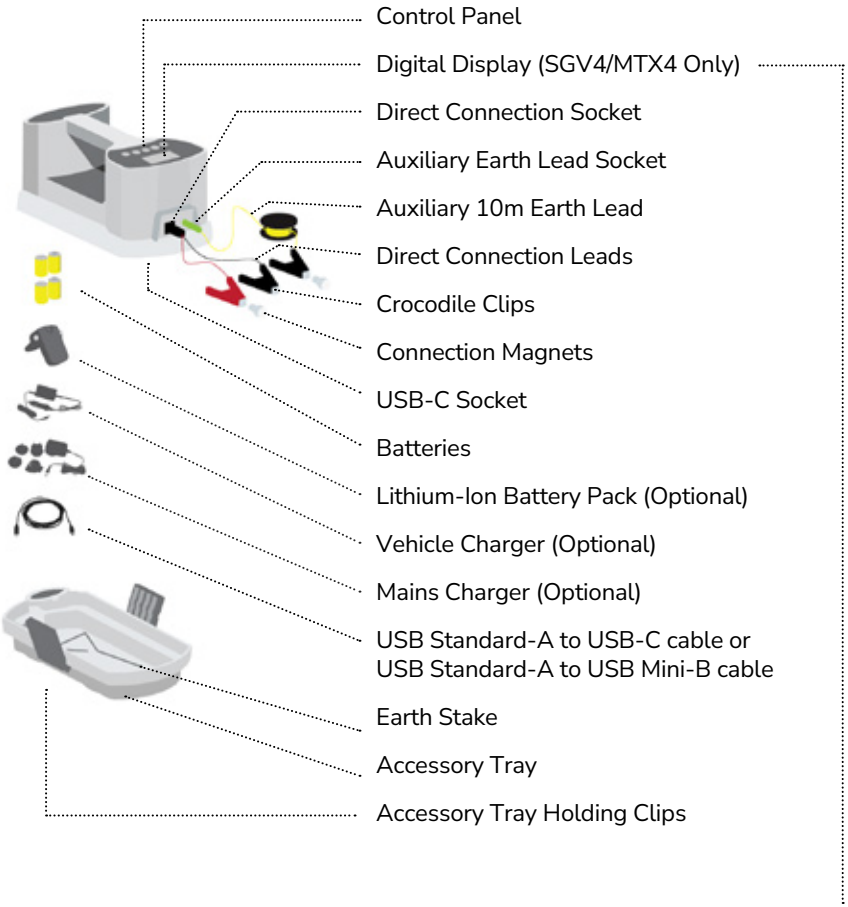
The CXL4, DXL4 and MXL4 can provide precise information about the position and depth (DXL4 and MXL4 only) of buried services.The combination of locating modes enables buried services to be detected quickly and reliably.



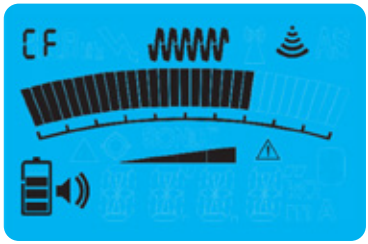
	Signal Strength Indicator
0415	Depth display (DXL4/MXL4 only)
	Mode selected:
	P Power
	R Radio
CF	G Generator (CXL4/DXL4 frequency)
	T Transmitter (MXL4 selected frequency)
AS	A *All*Scan
	Battery Condition Indicator
	Self Test Warning
	GPS
	Bluetooth



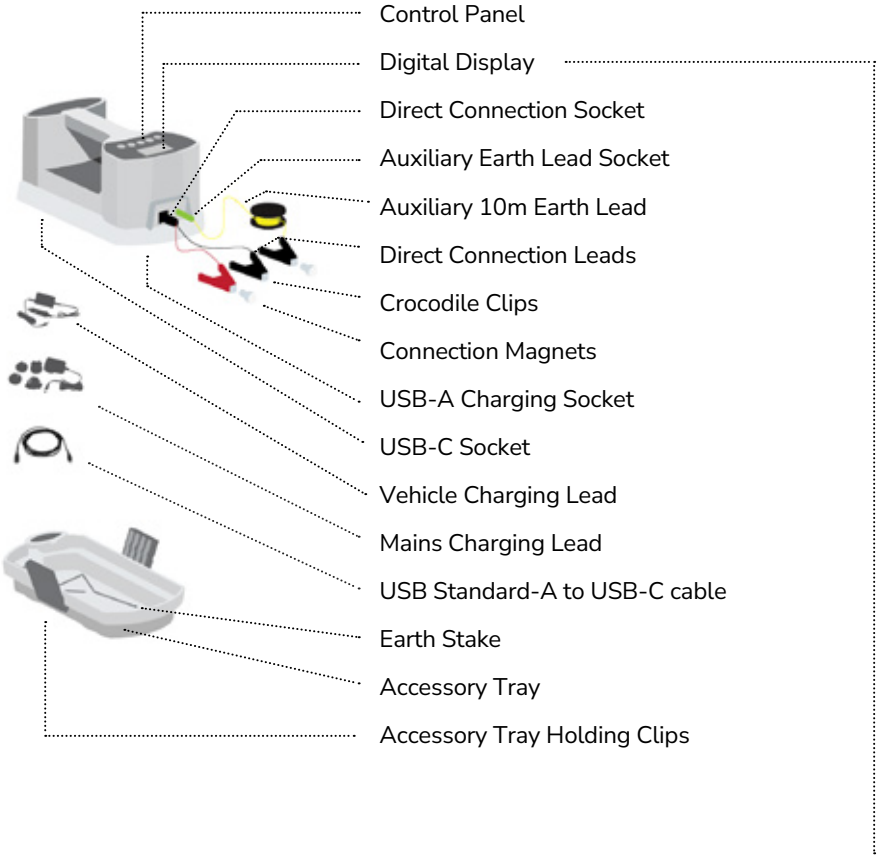
SGA4/SGV4 Signal Generator and MXT4 Transmitter



	Signal Strength Indicator
	Output Power Level
CF	Output Frequency Indicator. In CF this will show CF, 131kHz, and 33kHz sequentially
	Connected Mode Indicator. Flashes briefly if one Watt accessory is connected
	Induced Mode Indicator
	Battery Condition Indicator
	Audio Level Indicator
⚠	Self Test Warning



MXT4-DB12 12 Watt Transmitter and SGV4-DB Signal Generator



	Signal Strength Indicator
	Output Power Level
CF	Output Frequency Indicator
	Connected Mode Indicator
	Induced Mode Indicator
	Battery Condition Indicator
	Audio Level Indicator
⚠	Self Test Warning
0415	Output Meter Reading in Amps, Volts, Ohms or Watts (MXT4-DB12 only)
	Bluetooth Indicator



SGA4 and SGV4 Signal Generator

SGA4 Signal Generator

The SGA4 Signal Generator is designed for use with the CXL4 and DXL4 Locators.

- High (One Watt) and low Power Output settings.
- Pulsed or Continuous output signal.
- Loud or Muted audible output.
- Combined Frequency (CF) signal output (33kHz and 131kHz) applicable for Connected method of signal transfer only.



SGV4 Signal Generator

The SGV4 Signal Generator is designed for use with the CXL4 and DXL4 Locators.

- Automatic Daily Self Test.
- Data Logging of all Signal Generator activity.
- Automatic Back-light.
- Four Power Output settings up to One Watt.
- Pulsed or Continuous output signal.
- Loud, Muted or Silent audible output settings.
- Combined Frequency (CF) signal output (33kHz and 131kHz) applicable using both Connected and Induced methods of signal transfer.



SGV4-DB Signal Generator

The SGV4-DB Signal Generator is designed for use with the CXL4 and DXL4 Locators.

- Automatic Daily Self Test.
- Data Logging of all Signal Generator activity.
- Automatic Back-light.
- Five Power Output Settings up to One Watt.
- Pulsed or Continuous output signal.
- Four volume levels with Mute function.
- Combined Frequency (CF) signal output (33kHz and 131kHz) applicable using both Connected and Induced methods of signal transfer.
- Built in rechargeable Lithium-Ion batteries with mains and vehicle chargers.
- Bluetooth link for remote control, data download and configuration using the C.Scope Relay app for iOS and Android™ phones.
- USB-C socket for data download and configuration using C.Scope Desktop Relay for Microsoft Windows® PCs.



MXT4 Transmitter

The MXT4 Transmitter is designed for use with the MXL4 Locator.

- Automatic Daily Self Test.
- Data Logging of all Transmitter activity.
- Automatic Back-light.
- Four Power Output settings up to One Watt.
- Pulsed or Continuous output signal.
- Loud, Muted or Silent audible output settings.
- Six Frequency settings: 512Hz, 640Hz, 8kHz, 33kHz, CF (33kHz and 131kHz combined), 131kHz (HF).
- All Frequencies applicable using the Direct Connect method of signal transfer.
- 8kHz, 33kHz, CF (33kHz and 131kHz combined), 131kHz (HF) frequencies applicable using the Induced method of signal transfer.



MXT4-DB12 12 Watt Transmitter

The MXT4-DB12 12 Watt Transmitter is designed for use with the MXL4 Locator.

- Automatic Daily Self Test.
- Data Logging of all Transmitter activity.
- Automatic Back-light.
- Ten Power Output Settings up to Twelve Watts.
- Pulsed or Continuous output signal.
- Five volume levels with Mute function.
- Six Frequency settings: 512Hz, 640Hz, 8kHz, 33kHz, CF (33kHz and 131kHz combined), 131kHz (HF).
- All Frequencies applicable using the Direct Connect method of signal transfer.
- 8kHz, 33kHz, CF (33kHz and 131kHz combined), 131kHz (HF) frequencies applicable using the Induced method of signal transfer.
- Measurement of Output Current, Voltage, Resistance and Power.
- Built in rechargeable Lithium-Ion batteries with mains and vehicle chargers.
- Bluetooth link for remote control, data download and configuration using the C.Scope Relay app for iOS and Android™ phones.
- USB-C socket for data download and configuration using C.Scope Desktop Relay for Microsoft Windows® PCs.



ⓘ Note

Output Current, Voltage, Resistance and Power measurements are indicative.
For accurate measurements use a calibrated measurement device.

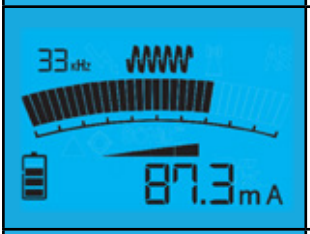
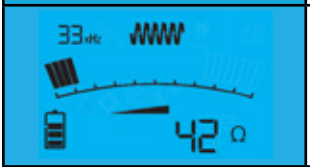
MXT4-DB12 Button Function Summary

Button Symbol			
Single Press	Frequency Up	Power Level	Volume Level
Long Press	Measurement Display (Voltage, Power, Current, Resistance)	Toggle Pulsed output	Toggle Mute

In addition, the following functions can be accessed by holding the following key combinations for a long press.

Toggle Bluetooth On/Off			
Self Test			
Show Date and Time			
Show Software Version Number			

MXT4-DB12 Display

	Display showing Self Test in progress. Bar graph shows progress of test. When complete, “TEST” changes to “PASS” or “FAIL” with a failure code displayed in top left corner.
	Display showing software version number.
	Display showing charge indicator. Battery symbol on bottom left is animated to show current state of charge.
	Display showing connected mode, in highest power level setting (100%). The (connected mode) flashes briefly if standard (low-power) accessories are connected. It flashes regularly to indicate pulsed mode. When set to CF, the frequency indicator alternates showing 33kHz, 131kHz and CF.
	Connected mode display with units changed to show ground impedance in Ohms by using a long press on the button: Here a resistance of 42 Ohms is indicated.
	Display showing induced mode, in lowest power setting.
	This Bluetooth symbol will appear when the C-Scope App is connected to the MXT4DB-12 transmitter. It disappears when the operator has moved out of range of the MXT4-DB12.
	Indicates MXT4-DB12 is connected to a computer via a USB-C cable.

Locator Operating Modes
Power Mode

In Power Mode the Locator detects power signals. These power signals are present on all current carrying electricity cables although not all are detectable. Power signals may also flow along other conductors such as metal gas and water pipes, telecom cables, metal fences and railway tracks.

Limitations of Power Mode

Not all electricity cables can be found using the Power Mode.
Here are the most important examples of electricity cables that may not be detectable in the Power Mode:

- Cables supplying equipment which is not always active (e.g. street lighting) . When the power is off, no current flows and so no power signal is created.
- Supplies to buildings or plant using very little or no electricity may not have a detectable power signal.
- Pot-ended or capped cables. These will never have any current flowing through them but are possibly still live.
- Disused or abandoned cables.
- A few high voltage electricity cables. These can be 'well balanced', electrically and therefore radiate little or no power signal.
- Direct Current cables (such as those found on railway systems, and some solar panels or wind turbines). These do not create their own Power signals.
- Cables more than 3m (9'9") deep.

ⓘ Note

Generally these services should be detectable using the Radio or Generator/Transmitter Modes.

⚠ WARNING

- Locators can only detect services radiating a detectable electromagnetic signal. There may be some services that do not radiate these signals and cannot be located.
- The absence of a power signal does not mean the service is not live.

Locator Operating Modes
Radio Mode

In Radio Mode, the Locator detects signals from various radio transmitters. These signals flow through the ground and will tend to follow the line of least resistance such as a buried metallic service. When this happens the service can often be detected by using the Locator in Radio Mode.

Limitations of Radio Mode

Not all services will be detectable in Radio Mode.

- A strong radio signal present on one service may be masking a weaker radio signal present on an adjacent service.
- It is not normally possible to determine the identity of the utility in Radio Mode, only its position.
- Radio signals do not favour one utility over another.
- The depth of the buried service cannot be judged by the strength of the radio signal alone.
- Normally it is only possible to detect radio signals present on services up to 2 m (6'6") deep.
- A short service may not have enough signal to be detected.
- Geographical conditions such as nearby hills and mountains may prevent a detectable radio signal being present on a buried pipe or cable.

ⓘ Note

Most buried metallic services not found in Radio Mode should be detectable by using Generator/ Transmitter Mode with the Signal Generator/ Transmitter

⚠ WARNING

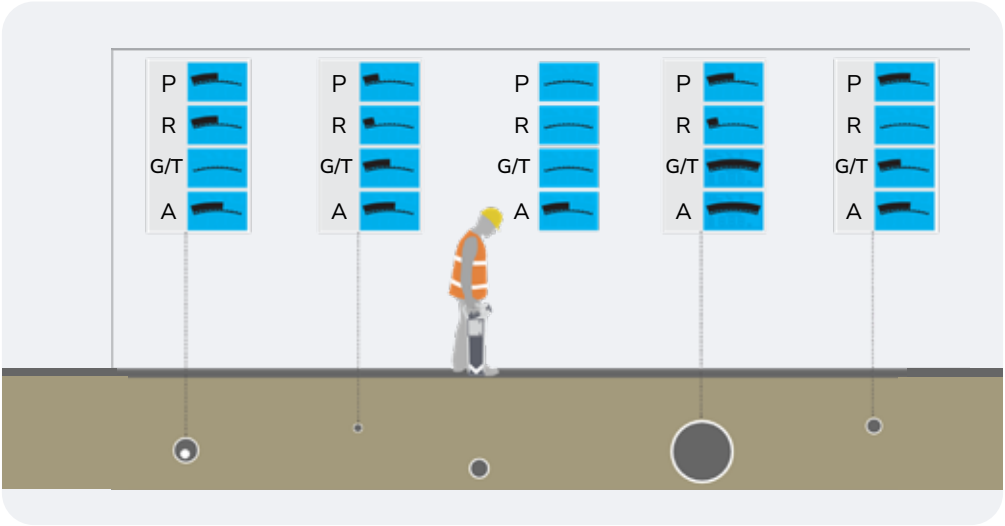
Locators can only detect services radiating a detectable electromagnetic signal. There may be some services that do not radiate these signals and cannot be located.

Locator Operating Modes
*All*Scan Mode

In *All*Scan Mode, the Locator detects at ALL frequencies in a wide band. Sometimes a signal that is outside of the frequency range of the other search modes (Power, Radio, and Generator/ Transmitter) will be present on a buried metallic service.

*All*Scan Mode is a useful additional search mode to employ as it may detect these 'extra' signals as well as the Power, Radio and Generator/ Transmitter signals.

Using the *All*Scan Mode is also a good way to confirm the accuracy of the marking of metal pipes and cables previously detected using the Power, Radio and Generator/ Transmitter modes of detection.



Limitations of *All*Scan Mode

AllScan Mode has the same limitations as those listed for the Power and Radio Modes:

- Cables when the supply is switched off (e.g. street lighting), cables to buildings or plant using little or no electricity, pot-ended or capped cables, well balanced high voltage cables and direct current cables may all be missed on the *All*Scan Mode.
- A strong *All*Scan signal present on one service may mask a weaker *All*Scan signal present on an adjacent service.
- It is not normally possible to determine the identity of the utility in *All*Scan Mode, only its position.
- *All*Scan signals do not favour one utility over another.
- The depth of the buried service cannot be judged by the strength of the *All*Scan signal alone.
- Normally it is only possible to detect *All*Scan signals present on services up to 2 m (6'6") deep.
- A short service may not have enough signal to be detected.

⚠ WARNING

Using the Power and Radio Modes may be more effective in areas where there are many services radiating an *All*Scan signal.

Locator Operating Modes
Generator/Transmitter Mode

In Generator/ Transmitter Mode the Locator detects conductors radiating a signal applied by the Signal Generator/ Transmitter or the signal radiated by a Sonde.

The Signal Generator/ Transmitter provides a way of sending a known signal along buried metallic services which can then be detected using the Locator. By detecting this signal it is possible to locate, trace and identify the pipes or cables that may be carrying it.

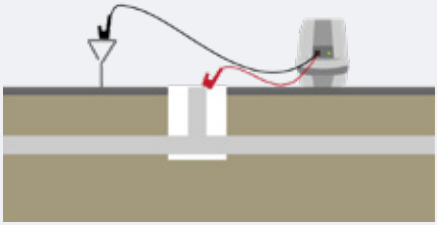
There are **TWO** basic methods by which the Signal Generator/ Transmitter signal can be applied to buried services:

Direct Connection - The Signal Generator/ Transmitter is attached directly to the service using either the Direct Connection Leads or one of the accessories available for use with the Signal Generator/ Transmitter such as the Signal Clamp or Signal Injector.

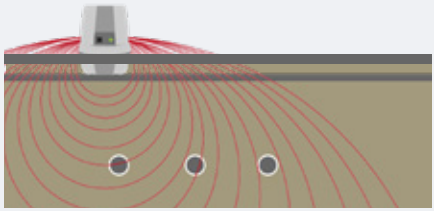
Induction - The Signal Generator/ Transmitter can induce a signal onto a buried metallic service remotely from the surface without the need to physically connect to that service.

Limitations of Generator/ Transmitter Mode are covered in the '***Using the Signal Generator/ Transmitter***' section of this Manual.

Direct Connection



Induction



⚠ WARNING

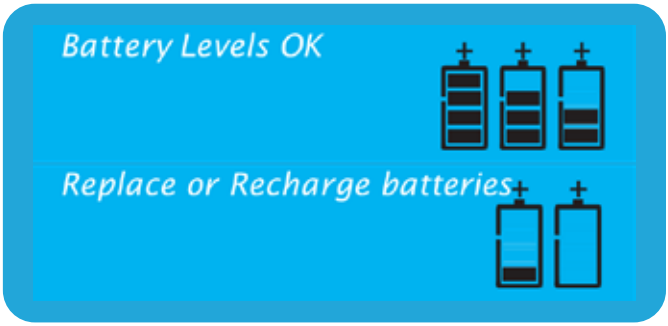
Locators can only detect services radiating a detectable electromagnetic signal. There may be some services that do not radiate these signals and cannot be located.

C.Scope Locators can be powered by either eight standard Alkaline or Nickel-Metal Hydride rechargeable (NiMH) AA (LR6) size batteries or with an optional Lithium-Ion battery pack.

Locator Battery Check

Switch the Locator on by pulling up on the On/Off trigger positioned on the underside of the handle. The Locator should emit a clear audible battery check tone for one second and the display should come on.

Check the battery level indicator in the bottom left hand corner of the display.
If there is only one segment or no segments of the indicator filled in then the batteries will need to be replaced or recharged before locating work can begin.



ⓘ Note

The Locator will carry out an automatic daily Self Test when it is switched on for the first time each day ***(see pages 21-22 for full details).***

Charging Lithium-Ion Battery Pack

The C.Scope Lithium-Ion battery packs can be charged by releasing the Battery Compartment door and connecting the correct charger. Remove the charger once the battery is fully charged and close the Battery Compartment door securely.

Changing Alkaline or Nickel-Metal Hydride batteries

- Push the two clips back to release the Battery Compartment door.
- Remove ALL EIGHT used batteries and replace with new or recharged ones and be careful to insert the new batteries the correct way round in the holder.
- Replace the holder or battery pack in the Battery Compartment making sure that the two terminals on the holder make contact with the two terminals within the Battery Compartment.
- Close the Battery Compartment door securely.

ⓘ Note

Only use Alkaline or Nickel-Metal Hydride rechargeable (NiMH) AA (LR6) size batteries or C.Scope Lithium-Ion battery packs.

⚠ WARNING

- **DO NOT** change batteries in confined spaces where gas may be present.
- **DO NOT** mix old and new or different types of batteries.
- Use only the supplied C.Scope charger with C.Scope Lithium-Ion battery packs. Take care to use the appropriate charger. Use only a certified external power supply. The power supply/charger must comply with local (e.g. UK/EU/US/AUS) safety requirements for electrical equipment. Disconnect the charger when charging is complete.
- Avoid disassembling, crushing, or puncturing battery packs.
- Don't expose the battery packs to temperatures above 60˚C (140˚F), or extreme shocks or vibration.
- Keep the batteries away from children and do not use the battery if it is damaged.
- Dispose of all exhausted batteries and battery packs in accordance with local regulations.
- If a battery or battery pack leaks, do not touch the fluids and dispose of it. Batteries and battery packs should be recycled at permitted facilities and not thrown away in household waste or recycling bins. Lithium-Ion battery packs contain chemicals that can catch fire and explode.

Using the Locator
Automatic Daily Self Test

The CXL4, DXL4 and MXL4 Locators have a built-in automatic Daily Self Test function. This tests the Locator's circuits and receiving aerials for correct performance.

The Self Test is automatically performed the first time the Locator is switched on each day and takes approximately four seconds.

ⓘ Note

- When turning the Locator on for the first time it is important that no other Locator is situated within 30 cm (1') and that no Signal Generators, Transmitters or Sondes are operating within 5m (16').
- Try not to switch the Locator on for the first time in an area with unusually high Power signals such as next to an electricity transformer.

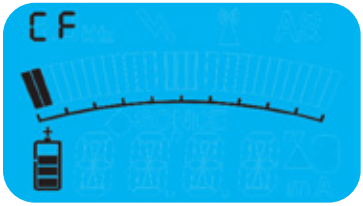
The Self Test process is indicated by 'TEST' appearing on the display. In the top left hand corner of the screen a countdown timer shows the progress of the test.



ⓘ Note

The Locator records every Automatic Daily Self Test.
The Test results can be retrieved from the Locator to produce a System Validation Certificate by using Desktop Relay and cscope.info ***(see page 66).***

After the Locator has successfully completed the Self Test, the Locator is ready for use. It will not do another Self Test that day.



If the Locator has failed the Self Test the Warning symbol will appear in the bottom right hand corner of the screen.



If the error code 'OVER' is displayed alongside the Warning symbol this indicates that there is a significant external signal present that has corrupted the actual Self Test process.



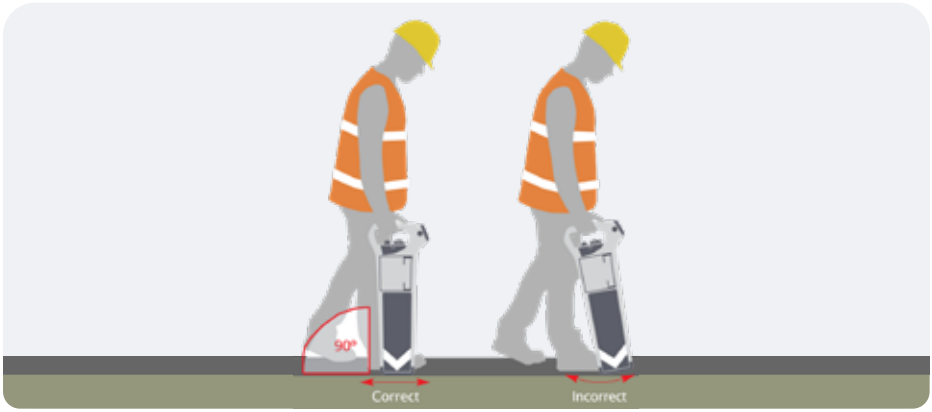
The source could be an active Signal Generator, Transmitter, Sonde or a nearby transformer or other power source emitting a strong Power mode signal.

In this situation make sure all nearby Signal Generators, Transmitters and Sondes are switched off or move a few metres/ feet to a different location. The Locator will automatically initiate a new Self Test when it is next switched on and will continue to do this until a successful Self Test has been achieved.

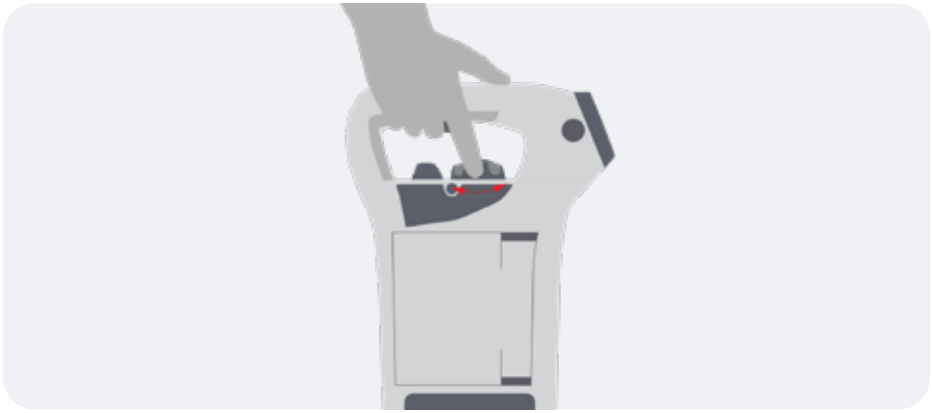
If the Locator still fails a Self Test then this is indicating that there is a fault and the Locator should be withdrawn from service. Contact C.Scope or a C.Scope Authorised Service Centre for advice.

Using the Locator
Holding the Locator

When in use the Locator should always be held upright.
Never swing the Locator such that it moves away from the vertical.
The Locator will emit an audio warning if the Locator is being swung excessively.



Your middle or little finger should be used to squeeze, and hold on, the On/Off trigger. Your index finger will then be free to adjust the Sensitivity Control.



Using the Locator
Searching

There are three stages to the locating process; searching, pinpointing and tracing.

1. Turn the Mode Switch to the appropriate mode.

2. Hold in the On/ Off trigger. The Locator should emit the audible battery test tone and the digital display should come on.
Check the battery level indicator to confirm the batteries are usable.

3. Rotate the Sensitivity Control fully clockwise to its maximum setting as indicated by the arrow on the control.

4. Carry out the search using a grid pattern as shown in the diagram. Walk slowly and keep the Locator upright at all times and stationary by your side.

5. As you approach the area in which there is a signal the Locator will emit an audible response and show a visual response on the display.

6. Keep walking until the audible and visual responses disappear.



ⓘ Note

- This search technique applies only to the Power, Radio and *All*Scan Modes. See 'Using the Signal Generator/ Transmitter' for the correct search pattern when using Generator/ Transmitter Mode.
- If the Locator gives a maximum audible and visual signal across the entire area, slightly reduce the sensitivity and repeat the grid search.

Having found a signal the next step is to pinpoint the source.
The closer the Locator is to the signal source the stronger the response.

To Pinpoint a Signal

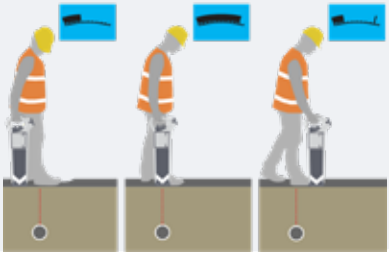
1. Keeping the Locator vertical, walk through the area of the signal response. If the visual response goes off the scale then stop and reduce the sensitivity of the Locator slightly before continuing.

2. The width of the signal response will shrink as the sensitivity is reduced. Once it is reduced enough then a clear peak response will be seen on the display as the Locator traverses the service. The Locator is positioned directly above the buried service when the display is at its highest (peak) reading.

ⓘ Note

Each time the Locator response reaches its peak position, a single 'Peak Hold' line will remain showing on the bar graph for two seconds to assist you to return to the correct peak position.

3. Carefully rotate the Locator over the peak reading until the visual response falls to a minimum. The Locator will now be roughly IN LINE with the direction of the buried service.



ⓘ Note

The presence of other signals in the immediate vicinity may result in the visual response not always reducing to a minimum level when the Locator is rotated over the peak response.

4. Mark the position of the buried service.

ⓘ Note

- The amount of sensitivity adjustment needed to pinpoint a service can vary depending on the mode being used, the signal strength and the service depth.
- The word 'OVER' will appear on the display if the Locator is detecting a signal that is too strong. This is irrespective of which mode of detection is being used and can also be caused if the Power Output setting on the Signal Generator/ Transmitter is too high.

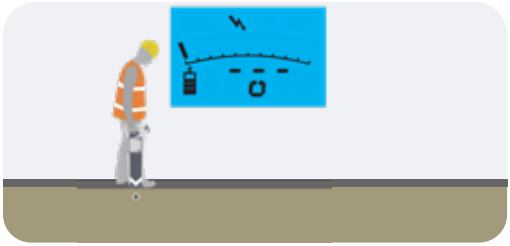
Using the Locator
AlarmZone™

The CXL4, DXL4 and MXL4 Locators feature an Alarm Zone™ which is a form of automated depth measurement intended to alert the user to the presence of unusually shallow pipes or cables.

The Alarm Zone™ warning will be triggered if the Locator measures a Power, Generator/ Transmitter or *All*Scan signal as being less than 0.3 m (12 ”) away. The Locator will give an audible alert and the Alarm Zone™ warning symbol will flash on the display of the Locator.

ⓘ Note

The Locator is measuring the distance from the base of the Locator to the source of the signal (the centre line of the metal pipe or cable). If the Locator is held a significant distance above the ground surface then it may not trigger an Alarm Zone™ warning because the Locator is now too far away from that shallow service.



The Alarm Zone™ depth setting is shown each time the Locator is switched on.

The Alarm Zone™ is factory set to be triggered at 0.3 m (12”). This distance can be altered using Desktop Relay.

The Alarm Zone™ feature can be temporarily disabled by switching between the Generator/ Transmitter mode and *All*Scan mode three times in quick succession. If you have disabled the Alarm Zone™ feature, each time the Locator is switched on the display will read ‘OFF’.

Alarm Zone™ will be temporarily disabled for 30 minutes, then automatically reactivated.



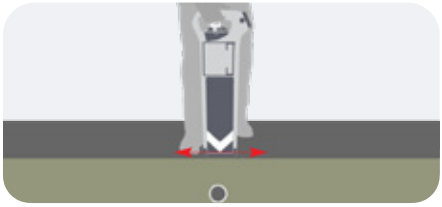
⚠ WARNING

There may be some pipes and cables that are not radiating a signal so the Alarm Zone™ warning will not appear. **NEVER** presume there are no shallow pipes or cables present simply because Alarm Zone™ has not been triggered.

Having pinpointed a service it should now be possible to trace its route.

1. Carefully follow the direction of the signal holding the Locator at right angles to the line of the signal. It is necessary to constantly 'slice' the Locator from side to side in order to be sure of still being over the peak signal response.

2. Stop and mark the position of the signal at regular intervals. As more marks are recorded the precise direction of the service will become more apparent.



ⓘ Note

- It may be necessary to readjust the sensitivity to maintain the optimum response.
- After tracing, return to the original search grid to search for further buried services.

⚠ WARNING

NEVER rush the tracing process. Small and unexpected changes in the service's route will be missed if care is not taken to follow the signal's path every step of the way.

Lost Signals

This can be because of a curve, or bend in the route, change in depth of the service, a T connection or the end of the service.

Finding Lost Signals

1. Walk in a circle at least 1 m (3'3") around the point where the signal was lost. This should locate the service if the signal has been lost because of a curve or bend in the route of the service, or a T connection into another service.

2. If you find nothing then increase the sensitivity and repeat the circle. This should find the service if it has continued but at a greater depth.



Using the Signal Generator/ Transmitter

Using the Locator in Power and Radio Modes will only allow you to locate and mark the position of buried services that are producing a Power signal or re-radiating a Radio signal.

Use of the Signal Generator/ Transmitter should enable most, if not all, of the remaining buried metallic services to be detected and traced.

This section explains the various ways in which the Signal Generator/ Transmitter can be used. It also shows how to use those accessories that allow the Signal Generator/ Transmitter to be directly connected to specific services.

Direct Connection

Physically connecting the Signal Generator/ Transmitter to a service is the most effective way to transfer the signal onto that service and the best way to trace the route of that service.

Signal Clamp

The Signal Clamp is an accessory that allows the Signal Generator/ Transmitter signal to be applied to a specific cable without having to make electrical contact with that cable.

Although the Signal Clamp is not physically fixed to the cable we still consider it as a Connection method because it is using the Signal Generator/ Transmitter in Connection Mode.

Signal Injector

The Signal Injector is an accessory that allows the Signal Generator/ Transmitter signal to be safely applied to an electrical system via a conventional power socket

Induction

Induction is a method of applying a signal to a service to which there is no direct access.

ⓘ Note

- The Locator should always be handled and operated according to the instructions shown in the ‘Using the Locator’ section unless specifically shown otherwise in this section.
- SGA4 Signal Generators will always switch on at higher power output, continuous signal and loud audio setting.
- SGV4 Signal Generators and MXT4 Transmitters will switch on to the last used settings.
- The SGV4-DB and MXT4-DB12 will switch on to the last used settings or to user configurable defaults which can be set using Desktop Relay or the C.Scope Relay App.
- The SGV4, SGV4-DB MXT4, and MXT4-DB12 have a display backlight that is activated each time any control button is pressed. The display will remain illuminated for 15 seconds.

The SGA4, SGV4 and MXT4 can be powered by either four standard Alkaline, by four standard Nickel-Metal Hydride rechargeable (NiMH) D (LR20) size batteries or by an optional Lithium-Ion battery pack.

The MXT4-DB12 and SGV4-DB have a built in Lithium-Ion battery pack and charger. The battery pack can be charged using the mains or vehicle charging leads.

Signal Generator/ Transmitter Battery Check

SGA4 Signal Generator

Switch the SGA4 on by pressing the On/Off Control.
The SGA4 should emit a loud continuous tone. An interrupted tone will be heard if the batteries need replacing or recharging immediately.

If the batteries need replacing or recharging during use, the same interrupted tone will be heard, and the signal output will also be interrupted.

SGV4/SGV4-DB Signal Generators and MXT4/MXT4-DB12 Transmitters

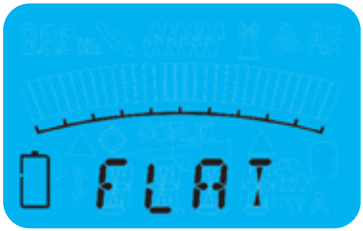
Switch the Signal Generator/ Transmitter on by pressing the On/Off Control.

Check the battery level indicator in the bottom left hand corner of the display.

If there is only one segment or no segments of the indicator filled in it is advisable to replace or recharge the batteries before locating work begins.



If 'FLAT' appears on the display, the unit will cease to transmit any signals and the batteries must be replaced or recharged.



Charging Lithium-Ion Battery Pack

ⓘ Note

- Charging the MXT4-DB12 and SGV4-DB is internally restricted below 0˚C (32˚F) and above 45˚C (113˚F).

The MXT4-DB12, SGV4-DB and C.Scope Lithium-Ion battery packs can be charged by removing the accessory tray and connecting the correct charging lead. Remove the charging lead once the battery pack is fully charged.

Changing Alkaline or Nickel-Metal Hydride batteries

- Remove the Accessory Tray.
- Undo the two round knurled battery cover retaining screws situated on the underside of the Signal Generator/ Transmitter.
- Remove ALL FOUR used batteries and replace with new or recharged ones and be careful to insert the new batteries the correct way round in the compartment as indicated on the case.
- Replace the Battery Cover or battery pack, being careful to not over tighten the retaining screws.
- Replace the Accessory Tray.

ⓘ Note

- Only use Alkaline, or Nickel-Metal Hydride rechargeable (NiMH) AA (LR6) size batteries, or C.Scope Lithium-Ion battery packs.

⚠ WARNING

- **DO NOT** change batteries in confined spaces where gas may be present.
- **DO NOT** mix old and new or different types of batteries.
- Use only the supplied C.Scope charger with C.Scope Lithium-Ion battery packs.
- For charging the MXT4-DB12 and SGV4-DB built in Lithium-Ion battery packs always use the appropriate charging lead and a certified external power supply. The power supply/charger must comply with local (e.g. UK/EU/US/AUS) safety requirements for electrical equipment. Disconnect the charging lead when charging is complete.
- The MXT4-DB12 and SGV4-DB batteries can be charged between the temperature ranges of 0 to 45˚C (32 to 113˚F) only.
- Avoid disassembling, crushing, or puncturing battery packs.
- Don't expose the MXT4-DB12 or SGV4-DB battery packs to temperatures below -20˚C or above 50˚C (-4˚F to 122˚F).
- Keep the batteries away from children and do not use the battery if it is damaged.
- Dispose of all exhausted batteries and battery packs in accordance with local regulations.
- If a battery or battery pack leaks, do not touch the fluids and dispose of it. Batteries and battery packs should be recycled at permitted facilities and not thrown away in household waste or recycling bins. Lithium-Ion battery packs contain chemicals that can catch fire and explode.

Output Power Level

The SGA4 Signal Generator has two selectable output power levels. The SGV4 Signal Generator and the MXT4 Transmitter have four selectable output power levels. The SGV4-DB Signal Generator has five selectable output power levels. The MXT4-DB12 Transmitter has ten selectable output power levels.

For long distance tracing or for detecting deep services it is always best to use the highest power setting of the Signal Generator/ Transmitter. Please note, however, that higher power settings will drain the batteries more quickly than lower power settings.

For tracing work close to the signal application point, the lower power settings are better.

ⓘ Note

- When using the Signal Clamp it is normally best to use the highest power setting. When using the Signal Injector, it is best to start with a lower power setting and only increase the power setting if the signal needs to be traced for a greater distance.
- When using Plastic Pipe Tracers or Flexible Tracers with the SGA4, SGV4, SGV4-DB, or MXT4, use the highest power setting. With the MXT4-DB12, keep the output to less than 50%.

Pulsed/Continuous Output

For most locating work a Continuous signal output is best and MUST be used for any Depth or Signal Current Measurements.

A Pulsed signal output can be useful when it has become difficult to distinguish the Signal Generator/ Transmitter signal from unwanted interference, for example, when tracing services over long distances or at greater depths. On the MXT4-DB12 pulse output is enabled and disabled by holding down the Power level button.

Using the Signal Generator/ Transmitter
Frequency Selection *(MXT4 and MXT4-DB12)*

Select the frequency on the Transmitter and the MXL4 Locator by pressing the Frequency (f) buttons. The Frequency (f) buttons will scroll through the various frequency options in order.

Generally, the Combined Frequency (CF) is the best frequency setting to use as it performs well in many applications. CF is a combination of 33kHz and 131kHz.

The lower frequency signals 512Hz, 640Hz and 8kHz should travel further along a metallic service although they may be more difficult to successfully apply in the first place. There should also be less 'coupling' of these lower frequency signals onto adjacent services.

The highest frequency setting, 131kHz (HF), is likely to be most successful when attempting to detect and trace short length or poorly earthed cables.

There can be exceptions to these general rules, and so often the best option is to try each frequency setting and then utilise the one that is giving the best results for that particular service. This is irrespective of the method of signal application; Direct Connection, Signal Clamp, Signal Injector or Induction Mode, and of the service being traced.

ⓘ Note

The 512Hz and 640Hz frequency signals can only be applied using the Direct Connection Leads.

⚠ WARNING

The Locator frequency MUST always be set to the same frequency setting as the Transmitter.

Using the Signal Generator/ Transmitter

Automatic Daily Self Test *(SGV4, SGV4-DB, MXT4 and MXT4-DB12)*

The SGV4, SGV4-DB, MXT4 and MXT4-DB12 have a built-in automatic Daily Self Test function. This tests the Signal Generator/ Transmitter circuits and transmitting aerials for correct performance.

The Self Test is automatically performed the first time the Signal Generator/ Transmitter is switched on each day and takes approximately twelve seconds.

The Self Test process is indicated by 'TEST' appearing on the display.



ⓘ Note

- On the SGV4, SGV4-DB and MXT4 a Self Test can be initiated manually by holding down the Pulse/ Continuous button while the Signal Generator/ Transmitter is switched on. On the MXT4-DB12 a Self Test can be initiated manually by holding down the Frequency up and down buttons while the Transmitter is switched on.

- The SGV4, SGV4-DB, MXT4 and MXT4-DB12 record every Automatic Daily Self Test and any manual Self Test. The Test results can be retrieved from the Signal Generator/ Transmitter to produce a System Validation Certificate by using Desktop Relay or the C.Scope Relay App and cscope.info.

If the Signal Generator/ Transmitter has failed the Self Test, 'FAIL' will appear on the display and the Self Test warning symbol will flash.
The Self Test warning symbol will then remain on the display.

After any Self Test fail, the Signal Generator/ Transmitter will automatically initiate a new Self Test when it is next switched on.

If the Signal Generator/ Transmitter fails a Self Test it should be withdrawn from service. Contact C.Scope or a C.Scope Authorised Service Centre for advice.



If the Signal Generator/ Transmitter has successfully completed the Self Test, 'PASS' will appear on the display.

The Signal Generator/ Transmitter is ready for use as per normal.
It will not undertake another automatic daily Self Test that day.



Using the Signal Generator/ Transmitter
Direct Connection

⚠ WARNING

- **NEVER** connect directly to electrical services.
- You may need to seek permission from the service owners before connecting to some buried services.
- The Signal Generator/Transmitter can produce potentially HAZARDOUS VOLTAGES in Connected Mode. NEVER TOUCH the metal parts of its crocodile clips or the service under test while in use. Keep others away from the equipment and the service. Consider risk factors e.g. wet/humid conditions which are worse, and the operator's medical history.

The Direct Connection Leads and Earth Stake that are supplied with the Signal Generator/ Transmitter are used to apply a signal to any metal pipe at a suitable access point such as a valve, hydrant point, stop cock or exposed pipe length.

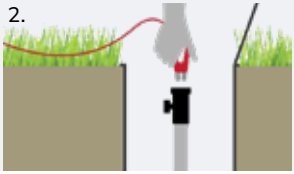
1. Plug the Direct Connection Leads into the Signal Generator/ Transmitter Connection Socket.
2. Attach the red lead to the pipe at your point of access using the Crocodile Clip. Ensure that you have a secure and clean grip on the pipe with the Crocodile Clip.
3. Turn the Signal Generator/ Transmitter on.

For MXT4 and MXT4-DB12, select frequency to be used;
512Hz, 640Hz, 8kHz, 33kHz, CF, 131kHz (HF).

1.



2.



ⓘ Note

- The type of metal that the pipe is constructed from or its use will have little effect on its traceability.
- If it is not possible to get the Crocodile Clip to grip the pipe then use the Magnet supplied.
- SGV4 Signal Generators and MXT4 Transmitters will switch on to the last used settings.
- MXT4-DB12 Transmitters and SGV4-DB Signal Generators will switch on to the last used settings or to user defined defaults.
- MXT4-DB12 Transmitters will limit output to one Watt unless they are used with leads with a purple connection plug.

4. Place the Earth Stake in the ground (having first searched the area for buried services with the Locator). The ideal position for the Earth Stake is at right angles to the assumed line of the pipe and the full length of the Direct Connection Leads away from the pipe access point.

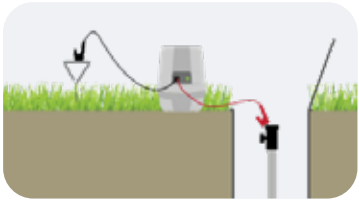
5. Connect the black Earth Lead to the Earth Stake (or an alternative earth point). If your earth point is too far away from the pipe access point for the black Earth Lead to reach then use the yellow 10 metre Auxiliary Earth Lead instead.

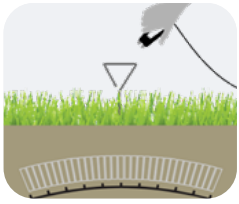
6. As the Earth Lead is connected to the Earth Stake the audible signal from the Signal Generator/ Transmitter should change in pitch. The lower the pitch, the better the signal will be on the metal pipe.

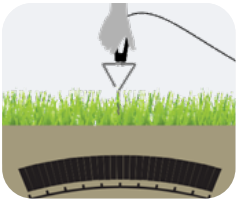
If there is no change in pitch it may be that some dirt, rust or paint on the pipe is preventing the Crocodile Clip or Magnet from making a good contact with the pipe. Alternatively it may be that your earth point is at fault. Change the position of the Earth Stake or use an alternative earth point.

For SGV4, SGV4-DB, MXT4 and MXT4-DB12, there will be a visual representation of the quality of the connection in addition to the audible pitch change. The greater the response on the bar graph display, the better the signal will be on the pipe. Using the MXT4-DB12 only, you can measure the voltage, current, resistance and power output by the Transmitter. By default, the Transmitter will show the current, holding down the Frequency up button will switch between the available measurements. You can mute the audible feedback by holding down the Volume button. ***See page 38 for further information.***

7. Adjust the Output Power Level to suit.







ⓘ Note

- If it is not possible to use the Earth Stake use a nearby metal fence post, or the frame of a manhole cover or gully cover.
- If the Earth Stake cannot be inserted into the ground then simply laying it flat on the ground can sometimes provide a successful earth connection (especially if the ground is wet).

  DO NOT use something that may have another metallic service attached to it, such as a metal street lighting column.
- If the Signal Generator/ Transmitter pitch does not change then there is no signal being transferred onto the service.

Using the Signal Generator/ Transmitter
Direct Connection with the MXT4-DB12

⚠ WARNING

- **NEVER** connect directly to electrical services.
- You may need to seek permission from the service owners before connecting to some buried services.
- The Signal Generator/Transmitter can produce potentially HAZARDOUS VOLTAGES in Connected Mode. NEVER TOUCH the metal parts of its crocodile clips or the service under test while in use. Keep others away from the equipment and the service. Consider risk factors e.g. wet/humid conditions which are worse, and the operator's medical history.

The MXT4-DB12 is a high power Transmitter which allows the MXL4 Locator to successfully detect metal pipes and cables that are unusually deep, or metal pipes that are extremely large, or to allow for much longer distance tracing of metal pipes and cables than is normally possible.

The display of the MXT4-DB12 automatically shows the amount of current flowing into the metal pipe or cable in milliamps, as this is the most useful measure of the actual signal strength on the buried metal pipe or cable.



By successive long presses of the MXT4-DB12's middle button (f up) the display will also show ground resistance, output voltage and power output. Knowing these values can help to achieve the maximum possible amount of current flow into the metal pipe or cable. These quantities will also be shown in the App.





Interpretation and best use of the Current (mA), Voltage (V) and Resistance (Ohms) readings

Current (mA) reading: Achieving the highest possible mA reading will enable maximum detection depths and distances to be achieved.

Voltage (V) reading: When the MXT4-DB12 reaches its maximum output voltage of 40 Volts rms, the applied signal current (mA) to the metal pipe or cable cannot be increased any further unless the ground resistance (Ohms) is lowered.

Resistance (Ohms): This indicates the resistance or impedance of the applied signal through the circuit of the buried utility and returning through the ground itself.

Lowering this resistance will allow a higher signal current to be applied to the utility creating a stronger signal.

How to reduce the total resistance figure to achieve the strongest applied signal

There are several steps that can be taken to reduce the overall resistance figure.

- Check there is a clean metal to metal connection between the metal of the pipe and the crocodile clip.
- If possible, ground the utility at its far end to achieve a better return path for the signal through the soil.
- Place the Earth Stake in the ground at 90 degrees to the line of the pipe and as far away as possible.
- If the ground is dry, use water to wet the ground where the Earth Stake is positioned to improve conductivity.
- Consider using an alternative to the Earth Stake such as a metal fence post or the frame of a manhole cover or a metal signpost as these can often provide a stronger earth point.

ⓘ Note

A Transmitters maximum allowable power output is governed by international regulations. The exact amounts vary depending upon the frequency of signal being applied. More power is allowed for lower frequency signals and less power for higher frequency signals. The MXT4-DB12 is designed to only allow the internationally permissible output powers to be used for each frequency selected.

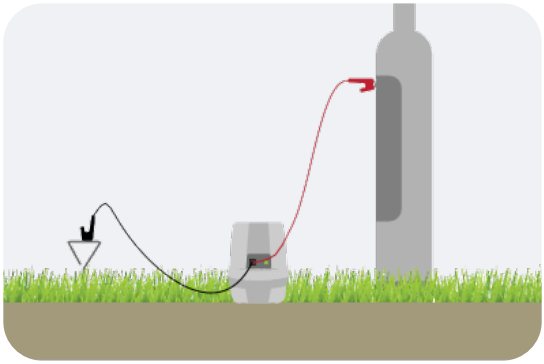
⚠ WARNING

See WARNINGS on page 36.

Direct Connection to a Street Lighting Column or other Street Furniture

The best method to determine the position and route of street lighting, car park lighting cables or any other item of street furniture with a power supply is by using a Signal Generator/ Transmitter and the pipe connection method of signal application.

Follow the same rules as for connecting the Signal Generator/ Transmitter to a metal pipe except attach the red Direct Connection Lead to a metal part of the OUTSIDE of the lamp column/ street furniture.



ⓘ Note

- Make sure that the Direct Connection Crocodile Clip or Magnet is not insulated from the metal of the column by paint.
- If the column is concrete attach the Crocodile Clip or Magnet to the metal surround of the access door.

⚠ WARNING

NEVER open the lamp column door to gain access to the cables, this is potentially dangerous and is not necessary.

⚠ WARNING

See WARNINGS on page 36.

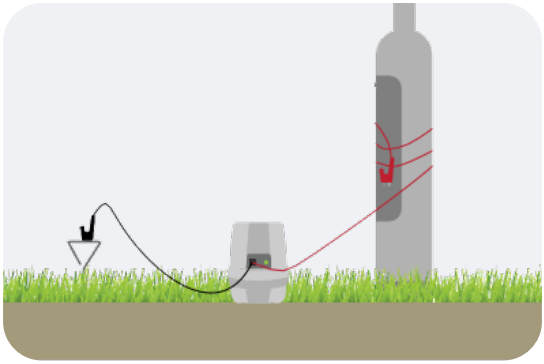
Signal Hopping using Direct Connection Leads

If it is difficult or inconvenient to use the Direct Connection method of signal application then an alternative technique called Signal Hopping can be utilised to successfully energise a street lighting or car park lighting cable with the Signal Generator/ Transmitter signal.

Wrap the red Direct Connection lead around the street lighting column (two or three times if possible). This is particularly useful if it is difficult to get a good metal to metal connection between the Crocodile Clip or Magnet and the column.

The black Direct Connection lead is connected to the Earth Stake positioned away from the column.

For MXT4 and MXT4-DB12 Transmitters, ensure 131kHz (HF) or CF frequency setting is selected.



ⓘ Note

If the Earth Stake cannot be inserted into the ground then simply laying it flat on the ground will often provide a successful earth connection when using the Signal Hopping technique.

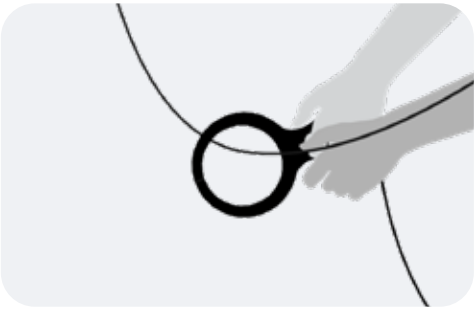
Signal Clamp

1. Plug the Signal Clamp into the Connection Socket on the Signal Generator/ Transmitter.

2. Turn the Signal Generator/ Transmitter on.

For the MXT4 or MXT4-DB12 with a standard Signal Clamp, choose 8kHz, 33kHz, or CF. If you are using the Multi Frequency Signal Clamp, 131kHz is also available.

3. Check that the jaws of the Signal Clamp are clean.
   Place the Signal Clamp AROUND the cable making sure that the jaws are able to fully close. The audible signal from the Signal Generator/ Transmitter should drop in pitch indicating that the jaws have closed correctly.



ⓘ Note

- The Signal Clamp cannot apply a signal to a cable that is not earthed at both ends such as abandoned cables that have been cut off where they appear above ground or cables supplying unearthed equipment.

- MXT4-DB12 transmitters automatically limit power to one Watt when using a standard Signal Clamp. Using the Multi-Frequency Signal Clamp allows higher power output.

⚠ WARNING

NEVER attempt to place the Signal Clamp around electricity cables that are deliberately suspended out of reach. They may be unsheathed or unprotected cables.

Signal Injector

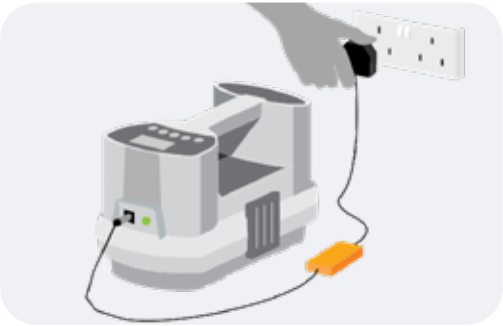
1. Plug the Signal Injector into the Connection Socket on the Signal Generator/ Transmitter and an electric outlet.

2. Turn the Signal Generator/ Transmitter on and set it to the lowest power setting.

For MXT4 and MXT4-DB12, select either 8kHz, 33kHz or CF frequency.

3. Turn the socket on. The audible tone from the Signal Generator/ Transmitter will drop in pitch to indicate a successful connection.

4. If no signal is detected, progressively increase the power output of the Signal Generator/Transmitter.



ⓘ Note

- On two wire Protective Multiple Earth (PME) systems it may be necessary to also provide an external earth using the yellow 10 metre Auxiliary Earth Lead and Earth Stake.
- Using Signal Injector may cause the electrical installation protection circuit to trip.
- Always check with the owners that it is acceptable to interrupt the supply before connecting the Signal Injector.

⚠ WARNING

DO NOT use the Signal Injector on systems with voltages in excess of 240 volts AC. Domestic systems will normally be below this voltage.

⚠ WARNING

See WARNINGS on page 36.

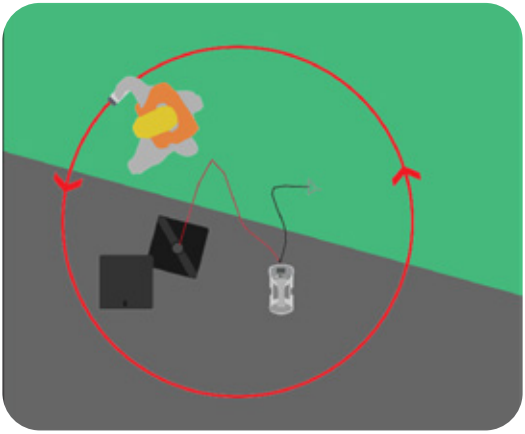
The search pattern used to find the Signal Generator/ Transmitter signal when applied by a direct connection method (Direct Connection Leads, Signal Clamp or Signal Injector) is different to the normal search pattern used on Power, Radio or *All*Scan Modes.

1. Move a few paces away from where the Signal Generator/ Transmitter has been connected to the service. Turn the Mode Switch to Generator/ Transmitter Mode. Hold the Locator so that the side of the Locator is facing towards the Signal Generator/ Transmitter. *For MXT4 or MXT4-DB12, ensure that the Transmitter and Locator are set to the same frequency.*

2. Adjust the Locator sensitivity so it shows a minimal visual response and emits a minimal audible response.

3. If possible walk in a complete circle around the connection point trying to keep the same distance from this point at all times. When a signal is detected, 'pinpoint' that signal as shown in the 'Using the Locator' section.

4. Having pinpointed the first signal, do not adjust the Sensitivity Control but continue with the circle to see if any other signals are detected. If more signals are detected compare the strength of each signal by observing the bar display. The strongest signal will usually be coming from the service that the Signal Generator/ Transmitter is connected to.

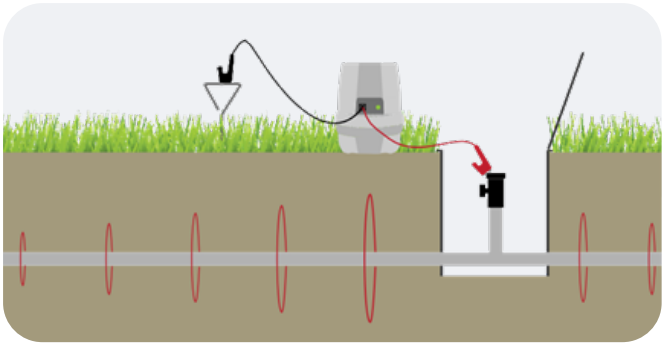


⚠ WARNING

See WARNINGS on page 36.

The tracing technique used to follow the Signal Generator/ Transmitter signal when applied by a direct connection method (Direct Connection Leads, Signal Clamp or Signal Injector) is almost exactly the same as the normal tracing technique used on Power, Radio or *All*Scan Modes, except the signal the Locator is detecting will get weaker the further away from the Signal Generator/ Transmitter that you go. It will be necessary to regularly increase the Locator Sensitivity Control to compensate for this.

For MXT4 or MXT4-DB12, having traced the signal for a short distance it may be worthwhile switching the Transmitter to alternative frequencies to see if they give a stronger response. Choose the frequency that gives the strongest response and continue with the trace.



ⓘ Note

It is not possible to search for the signal above any leads connecting the Signal Generator/ Transmitter to the service or above the Earth Lead connected to the Earth Stake.

Using the Signal Generator/ Transmitter
Induction

This is the standard method for inducing signals onto buried metallic services. It produces a strong signal directly below the Signal Generator/ Transmitter but the signal strength drops off quite quickly either side of the Signal Generator/ Transmitter.

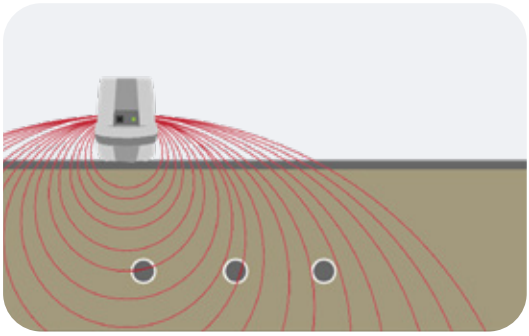
1. Check that there are no accessories plugged into the Connection Socket. The Signal Generator/ Transmitter switches automatically to Induction Mode when the socket is unused.

2. Place the Signal Generator/ Transmitter upright on the ground where you suspect the services are buried. Make sure the Signal Generator/ Transmitter is in line with the expected route of these services.

3. Turn the Signal Generator/ Transmitter on and check that the batteries are OK.

For MXT4 and MXT4-DB12, select 8kHz, 33kHz, CF or 131kHz (HF). It is not possible to induce a 512Hz or 640Hz signal onto buried services.

4. The signal will be radiated into the ground immediately below and for approximately 3 m (10') either side of the Signal Generator/ Transmitter.



ⓘ Note

- The closer the Signal Generator/ Transmitter is to the position of the buried service then the stronger the signal will be on that service.

- Only metallic services that are approximately in line with the Signal Generator/ Transmitter orientation will be energised with a signal. Metallic services that are crossing the line of the Signal Generator/ Transmitter will NOT be energised.

Using the Signal Generator/ Transmitter
Searching for an Induced Signal

The search pattern used to find the Signal Generator/ Transmitter signal when applied by Induction Mode is slightly different to the search pattern used on other modes.

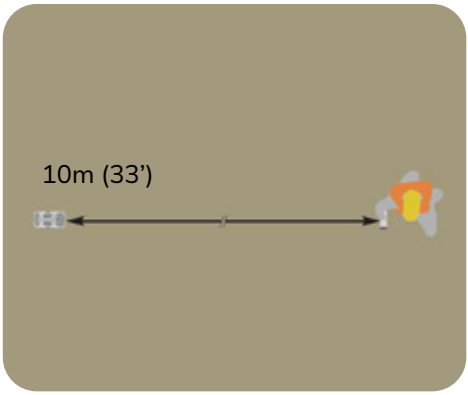
1. Move AT LEAST 10 m (33') away from the Signal Generator/ Transmitter position with your Locator. This is to avoid the Locator picking up the airborne signal rather than the signal induced onto the buried service.

2. Stand so that you are roughly in line with the end of the Signal Generator/ Transmitter and hold the Locator so that the side of the Locator is facing towards the Signal Generator/ Transmitter.

3. Select Generator/ Transmitter Mode.

The MXL4 Locator must be set to the same frequency as the MXT4 or MXT4-DB12 Transmitter.

4. Adjust the sensitivity so that the Locator shows a minimal visual response and emits a minimal audible response.



ⓘ Note

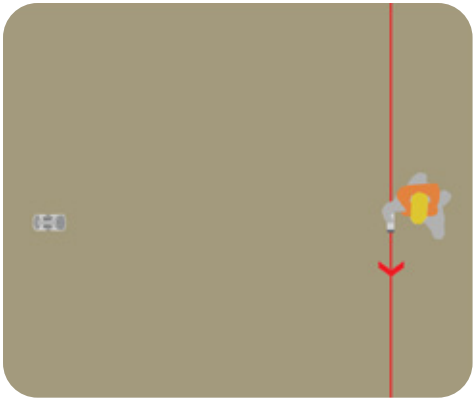
- A Signal Generator/ Transmitter will transmit a significant amount of signal into the air as well as into the ground.
- Keep the Locator upright at all times to reduce the risk of picking up the airborne signal.

5. Walk in a straight line across the end line of the Signal Generator/ Transmitter. When a signal is detected 'pinpoint' that signal as shown in the '***Using the Locator***' section.

If no signal is found move the Signal Generator/ Transmitter 5 m (16') and try again. Continue this procedure moving the Signal Generator/ Transmitter in 5 m (16') steps, following a grid pattern, until a signal can be found.

6. It may be possible to increase the strength of the induced signal on the buried service by improving the positioning of the Signal Generator/ Transmitter. Once the buried service has been pinpointed, moving the position of the Signal Generator/ Transmitter from side to side will give an increase or decrease in the Locator response.

Remember, the closer the Signal Generator/ Transmitter is to the position of the buried service then the stronger the signal will be on that service.



ⓘ Note

The Signal Generator/ Transmitter signal that the Locator is detecting will get weaker the further away from the Signal Generator/ Transmitter that you go. It will be necessary to regularly increase the sensitivity to compensate for this.

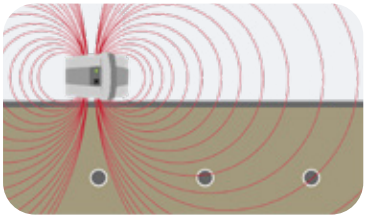
Using the Signal Generator/ Transmitter
Induction: Multiple Services

It is important to check for the presence of adjacent services running close, or parallel, to the service that you have already located.

1. Check that there are no accessories plugged into the Connection Socket.
2. Turn the Signal Generator/ Transmitter on and check that the batteries are OK.
3. Place the Signal Generator/ Transmitter on the ground on one side over the previously located service. That service will not have a signal induced onto it.
4. Re-scan the area looking for another peak signal close to where the original signal was found. This operation should be repeated until you are satisfied that no further services can be located.

ⓘ Note

The signal will be radiated up to 3 m (9'9") either side of the Signal Generator/ Transmitter but NOT directly below when the Signal Generator/ Transmitter is on its side.



Limitations of Induction Method

There are limitations concerning what can be achieved when using a Signal Generator/ Transmitter on the Induction Mode compared to the Connected Mode. It is not normally possible to identify what the service is that has been detected with an induced signal. If the signal can be followed far enough, a visible feature such as a valve cover or cable pit cover may be found that can indicate the identity of the service.

Cables with a very small cross section may not have enough signal induced onto them to make them detectable. It is often not possible to apply an induced signal onto just ONE specific buried service, in order to trace it alone, when other services are positioned in a close proximity.

ⓘ Note

An induced signal cannot be applied to a buried service that lies beneath reinforced concrete. The reinforcing bars will re-radiate the induced signal masking any signal that has been induced onto the buried service below.

Using the Signal Generator/ Transmitter
Inductive Sweep

If a large area needs to be searched for buried services then an 'Inductive Sweep' could be used. It is an ideal method for detecting the position of buried services as they cross the boundary of a large site.

An Inductive Sweep requires two people; one to operate the Locator and one to position the Signal Generator/ Transmitter.

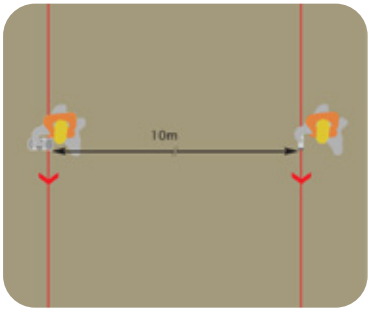
1. Stand about 10 m (33') apart.

2. The first person holds the Signal Generator/ Transmitter, switched to its lowest Output Power Level, close to the ground and 'end on' (see diagram) whilst the other holds the Locator switched to Generator/ Transmitter Mode.

3. Adjust the sensitivity so that the Locator shows a minimal visual response and emits a minimal audible response.

4. Together, slowly walk across the site, staying the same distance apart and being careful to keep in line with each other. When the Signal Generator/ Transmitter gets close to a buried metallic service the signal will be induced onto it and you should see this in the increased response on the Locator.

5. Immediately tell your colleague to stop and place the Signal Generator/ Transmitter on the ground at that point. Now you can pinpoint the service and trace out its route. Continue the sweep across the length and width of search area.



ⓘ Note

- It is important to maintain the same distance and between the Locator and Signal Generator/ Transmitter at all times.
- Only metallic services that are approximately in line with the Signal Generator/ Transmitter orientation will be energised with a signal. Metallic services that are crossing the line of the Signal Generator/ Transmitter will NOT be energised.

Non-Metallic Pipe Tracing

Non-metallic pipes such as sewers or drains, service ducts, plastic gas and water pipes are not electrically conductive and so will not be detectable using a Locator on Power, Radio or *All*Scan Modes. It is also impossible to apply a detectable Signal Generator/ Transmitter signal to the non-metallic pipe or, for that matter, to the water or gas within that pipe.

If access can be gained into the pipe then a C.Scope Sonde, Plastic Pipe Tracer or Flexible Tracer should make it possible to determine the pipes position and route.

Sondes

The C.Scope 8kHz and 33kHz General Purpose Sondes and the Duct Sonde are small, battery powered, waterproof transmitters that can be inserted into a pipe, such as a sewer, drain or cable duct. The position of the Sonde (and therefore the location of the pipe) can be pinpointed by using the Locator switched to Generator/ Transmitter Mode.

The Sonde is inserted into and then moved along the pipe to the point at which the pipe needs to be located. This is normally done by fitting the Sonde to drain rods. Alternatively, the Sonde can be attached to a continuous fibreglass duct rodder, jetter hose or camera inspection system.

- The 33kHz General Purpose Sonde can be used in pipes as small as 50 mm (2”) in diameter and up to 7 m (23’) deep.
- The 33kHz Duct Sonde can be used in pipes as small as 30 mm (1.1”) in diameter and up to 5 m (16’) deep.
- The 512Hz and 640Hz Metal Pipe Sondes are able to transmit a signal from within a metal pipe. They can be used in pipes as small as 50 mm (2”) in diameter. The maximum depth the Metal Pipe Sonde can be detected will depend on the pipe material and wall thickness.

ⓘ Note

An 8kHz or 33kHz Sonde will NOT transmit a signal through a metal pipe.

General Purpose Sonde and Metal Pipe Sonde

The General Purpose Sonde is available in two frequencies; 33kHz (orange casing) or 8kHz (green casing) and is powered by a single standard Alkaline or Nickel-Metal Hydride rechargeable (NiMH) AA (LR6) size battery.

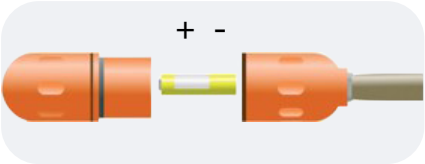
The Metal Pipe Sonde (red casing) is available in two frequencies; 512Hz and 640Hz, and is powered by a single Alkaline or Nickel-Metal Hydride rechargeable (NiMH) AA (LR6) size battery. The frequency of the Sonde is indicated on the label within the battery compartment.

The 8kHz General Purpose Sonde and 512Hz or 640Hz Metal Pipe Sondes can only be used with the MXL4 Locator.

1. To turn the Sonde on, separate the two halves of the Sonde casing. Insert a new battery into the battery compartment with the positive end down.

2. Screw the two halves of the Sonde together being careful not to over tighten them. The Sonde is now transmitting a signal.

3. To turn the Sonde off the battery must be removed or reversed.



ⓘ Note

- Only use an Alkaline or Nickel-Metal Hydride rechargeable (NiMH) AA (LR6) size battery.
- Dispose of the used battery safely in accordance with local regulations.
- Always use a new battery in a Sonde if you expect to take a long time to trace the pipe or duct route.

⚠ WARNING

- The Locator must always be set to Generator/ Transmitter Mode when using the Sonde.
- For the MXL4 Locator, the correct frequency must also be selected.

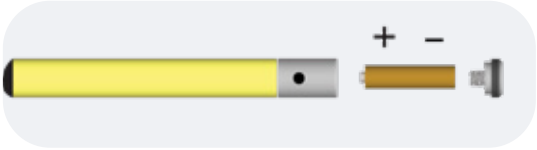
33kHz Duct Sonde

The Duct Sonde (yellow casing) transmits at 33kHz and is powered by a single AAA (LR03) size Alkaline battery. Rechargeable batteries are not recommended for this product.

1. To turn the Duct Sonde on, use a large flat bladed screwdriver to unscrew the battery cover located within the hollow end of the Sonde casing. Insert a new battery into the battery compartment with the positive end down.

2. Replace the battery cover fully using the screwdriver to secure. The Duct Sonde is now transmitting a signal.

3. To turn the Sonde off the battery must be removed.



ⓘ Note

- Only use an Alkaline battery.
- Dispose of the used battery safely in accordance with local regulations.
- Always use a new battery in a Sonde if you expect to take a long time to trace the pipe or duct route.

⚠ WARNING

- The Locator must always be set to Generator/ Transmitter Mode when using the Sonde.
- For the MXL4 Locator, the correct frequency must also be selected.

The technique used to determine the position of a Sonde is always the same irrespective of which Sonde is being used.

Before inserting the Sonde into the pipe it is best to set up the Locator so that the Sensitivity is correctly adjusted to suit the pipe depth. This is much easier to do when the Sonde is visible at the bottom of the manhole rather than already some distance up the pipe.

The blade of the Locator must be held IN LINE with the Sonde at all times.



ⓘ Note

This is at 90° to the way in which the Locator is held for most other locating tasks.

1. Turn the Locator to Generator/ Transmitter Mode and switch on. For the MXL4 Locator, the correct frequency must also be selected. Check the Battery Level Indicator to confirm the Locator batteries are usable. Replace or recharge if necessary.

2. Keeping the blade of the Locator in line with the Sonde, move the Locator backwards and forwards over the length of the Sonde. Adjust the Sensitivity until a clear peak response is shown on the display as the Locator passes directly over the position of the Sonde.

Still keeping the blade of the Locator in line with the Sonde, now move the Locator from side to side over the position of the Sonde. A similar peak response should be seen on the display as the Locator passes directly over the position of the Sonde. The Locator is now set up ready for tracing the Sonde.

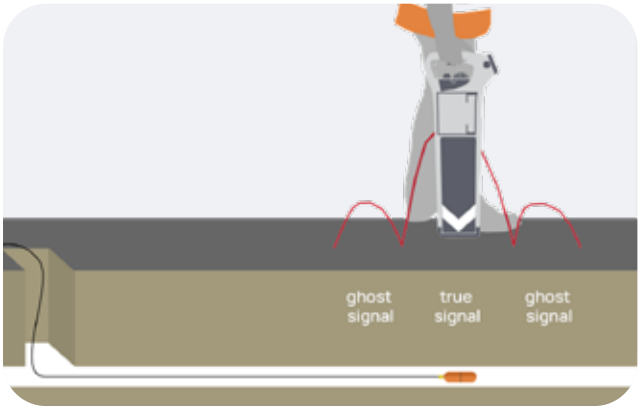
3. Push the Sonde up the pipe.

4. With the Locator turned on, walk from the pipe access point in the direction that the Sonde was pushed. A strong peak signal directly over the Sonde should be detected with two lesser 'ghost' signals found, one in front of and one behind the Sonde's true position. These ghost signals are always weaker than the main signal and should not be mistaken for the true Sonde signal.

5. Pinpoint the Sonde's exact position by moving the Locator first backwards and forwards and then from side to side to get the peak response on both occasions.

6. Push the Sonde further up the pipe and repeat the pinpointing process.

See page 60 for depth measurement using a Sonde.



ⓘ Note

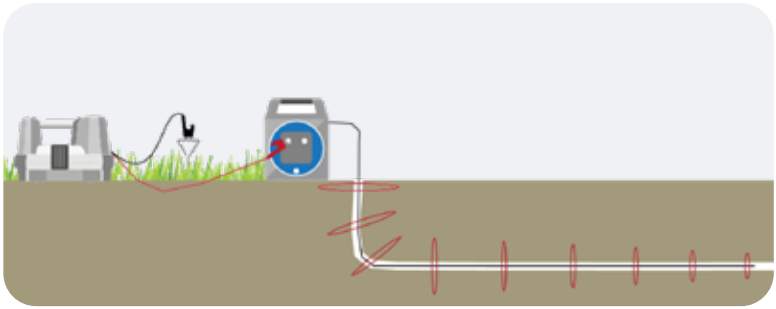
When a Locator is used with a Sonde in a non-metallic pipe at a depth less than 1 metre (3'3"), Alarm Zone™ is likely to be triggered. ***See page 26*** for instructions on disabling Alarm Zone™

Non-Metallic Pipe Tracing
Plastic Pipe Tracers/ Flexible Tracer

The Plastic Pipe Tracers and Flexible Tracer can be used in small diameter non-metallic pipes that normal Sondes cannot fit into. Two methods of detecting and tracing can be used: line tracing and end tracing.

For Line Tracing, the Plastic Pipe Tracer needs to be inserted into the pipe before a signal from the Signal Generator/ Transmitter is applied to the length of the Tracer. The slip-ring mechanism of the Flexible Tracer allows the Signal Generator/ Transmitter to be connected before it is inserted into the pipe.

The 33kHz, CF or HF Signal Generator/ Transmitter signal is applied using the 'Direct Connection to a metal pipe' method. Connect the red Direct Connection Lead to the red terminal of the Plastic Pipe Tracer/ Flexible Tracer. Connect the black lead to the Earth Stake. Leave the other terminal of the Plastic Pipe Tracer/ Flexible Tracer unconnected.



ⓘ Note

- It is important that a change of pitch is heard when making the connections to ensure that there is a detectable signal present on the Tracer.
- The Signal Generator / Transmitter signal is unlikely to travel the entire length of the Tracer within the pipe. Never assume that you have located the end of the Tracer on Line Tracing Mode. Use End Tracing if required.
- The Plastic Pipe Tracer and Flexible Tracer can be used inside a metal pipe or duct but the signal will transfer onto the pipe or duct itself.
- When using Plastic Pipe Tracers or Flexible Tracers with the SGA4, SGV4, SGV4-DB, or MXT4, use the highest power setting. With the MXT4-DB12, keep the output to less than 50%.

⚠ WARNING

Authorisation may be required before using the Plastic Pipe Tracer/ Flexible Tracer on some pipes or ducts.

End Tracing

The very tip of the Plastic Pipe Tracer/ Flexible Tracer can be energised with the signal from a Signal Generator/ Transmitter. It is acting much like a Sonde and offers a very reliable way of pinpointing the position of the tip. Pipes and ducts up to 4 m (13') deep can be traced.

The Signal Generator/ Transmitter signal is applied by connecting the red Direct Connection Lead to the red terminal on the Tracer and the black Earth Lead to the other terminal. As the second connection is made a change of pitch should be heard from the Signal Generator/ Transmitter signal indicating successful connection.

For MXT4 or MXT4-DB12, select 33kHz or CF frequency.
When using the MXT4-DB12 always keep the power output to less than 50%.

The tip of the Plastic Pipe Tracer/ Flexible Tracer is then pinpointed using the same technique as for Sonde tracing with the Locator blade always in line with the Tracer.



ⓘ Note

- It is important that a change of pitch is heard when making the connections to ensure that there is a detectable signal present on the Tracer.
- End Tracing is the ideal method to determine where the end of the pipe is but does not give the route of the pipe.
- The Plastic Pipe Tracers and Flexible Tracer do not work on End Tracing mode when inside a metal pipe or duct.
- When using Plastic Pipe Tracers or Flexible Tracers with the SGA4, SGV4, SGV4-DB, or MXT4, use the highest power setting. With the MXT4-DB12, keep the output to less than 50%

⚠ WARNING

Authorisation may be required before using the Plastic Pipe Tracer/ Flexible Tracer on some services.

Depth Measurement
Metallic Services *(DXL4 and MXL4 Locators only)*

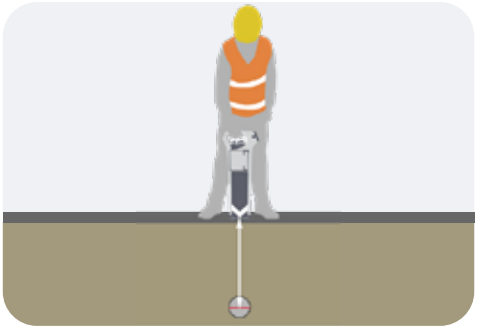
The DXL4 and MXL4 Locators can be used in conjunction with the Signal Generator/ Transmitter, Sonde, Plastic Pipe Tracer or Flexible Tracer to indicate the depth of a buried service.

Depth cannot be measured on the Power, Radio or *All*Scan Modes.
For the MXL4 Locator, depth measurements can be taken from a 512Hz, 640Hz, 8kHz, 33kHz, CF or HF (131kHz) signal.

⚠ WARNING

- The depth indication MUST NOT be used to decide if mechanical digging over the buried service is appropriate.
- If the following procedure for Depth Measurement is not followed then an inaccurate depth may be indicated. This is worse than having no depth information at all.

1. The Signal Generator/ Transmitter must be set to 'Continuous' signal output, not 'Pulsed' output.
2. It is vital that the signal being measured is a good quality signal. This is best achieved by using the Signal Generator/ Transmitter in Connected Mode rather than Induced Mode.
3. Set the Locator to Generator/ Transmitter Mode and pinpoint the position of the buried service. Make sure the Locator is directly over, and at right angles to the route of, the buried service. Rest the Locator on the ground with the body vertical.



ⓘ Note

A poor quality signal is indicated by an unstable visual response on the Locator. Depth Measurement may be inaccurate in these circumstances.

⚠ WARNING

If the pinpointing of the service is inaccurate then the Depth Measurement will be inaccurate.

4. Press and hold down the depth button. The depth will be shown on the display.

5. The depth can be verified by lifting up the Locator whilst keeping the depth button depressed. The depth indication should increase by the same amount that the Locator has been raised.

Limitations of Depth Measurement

There are some situations where it is not possible to gain accurate depth information:

- A curve or bend in the route of the service.
- Close to where the service changes in depth.
- Near to a 'T' junction in the service.
- At the very end point of a service.
- At any point where the signal has coupled onto an adjacent service.
- Close to any large metallic objects such as metal fences or vehicles.
- Within 25 m (82') of the position of the Signal Generator/ Transmitter if used on Induction Mode.
- Under reinforced concrete.
- The signal is of poor quality.
- Too close to the Signal Generator/ Transmitter or leads if used in Connected Mode.

Depth Measurement: Error Readings of Metallic Services

The Locator may show the following error codes when attempting a Depth Measurement:

Metric MXL4 pictured



1. **000** - The metallic service is too shallow for the Locator to obtain an accurate depth, less than 0.1m (4"). It should be possible to calculate the depth by raising the Locator a set amount and then carrying out the Depth Measurement again. The '000' Error will also display if the signal is not strong enough for the Locator to give a reliable depth measurement.

2. **888** - The metallic service is too deep for the Locator to measure its depth or there is no signal present.

3. **OVER** - Overload. The signal is too strong for the Locator to give a reliable depth measurement.

ⓘ Note

- The depth shown will be to the centre of the service and is not the depth of cover. This is of greater significance on large diameter pipes. Reading is to the nearest 0.01m.
- Alarm Zone™ will activate if the service is too close to the Locator. To measure shallow depths turn Alarm Zone™ off temporarily as described ***on page 26***.

Depth Measurement Non-Metallic Pipes using Sondes/ Plastic Pipe Tracers/ Flexible Tracer *(DXL4 & MXL4 Locators Only)*

ⓘ Note

The following instructions apply equally to all Sondes, Plastic Pipe Tracers and the Flexible Tracer in End Tracing Mode.

1. Pinpoint the exact position of the Sonde or Plastic Pipe Tracer/ Flexible Tracer tip. Take care to ensure that you are not over one of the two 'ghost' signals in front of and behind the true position.

2. Rest the Locator on the ground, keeping it vertical and IN LINE with the Sonde or Tracer tip.

3. ***IMPORTANT***. Push the depth button TWICE and hold on the second push, to select Sonde Depth Mode. The word 'SONDE' will flash on the display and the depth will then be displayed (see picture). If the word 'SONDE' is not displayed then the depth reading will be inaccurate.



ⓘ Note

The depth shown is that of the Sonde and **NOT** of the pipe.

Depth Measurement: Error Readings of Non-Metallic Pipes using Sondes/ Plastic Pipe Tracers/ Flexible Tracer

The Locator may show the following error codes when attempting a Depth Measurement to a Sonde or the tip of a Plastic Pipe Tracer or Flexible Tracer:

1. **000** - The Sonde/ Plastic Pipe Tracer/ Flexible Tracer is too shallow for the Locator to obtain an accurate depth, less than 0.1m (4"). It should be possible to calculate the depth by raising the Locator a set amount and then carrying out the Depth Measurement again. The '000' Error will also display if the signal from the Sonde/ Plastic Pipe Tracer/ Flexible Tracer is not strong enough for the Locator to give a reliable depth measurement.

2. **888** - The Sonde/ Plastic Pipe Tracer/ Flexible Tracer is too deep for the Locator to measure its depth or there is no signal at all present.

3. **OVER** - Overload. The signal from the Sonde/ Plastic Pipe Tracer/ Flexible Tracer is too strong for the Locator to give a reliable depth measurement.



Metric MXL4 pictured

ⓘ Note

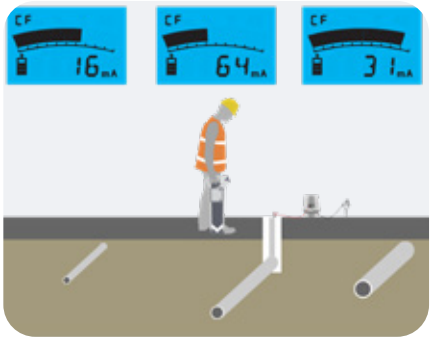
Alarm Zone™ will activate if the Sonde/ Plastic Pipe Tracer/ Flexible Tracer is too close to the Locator. To measure shallow depths turn Alarm Zone™ off temporarily as described ***on page 26***.

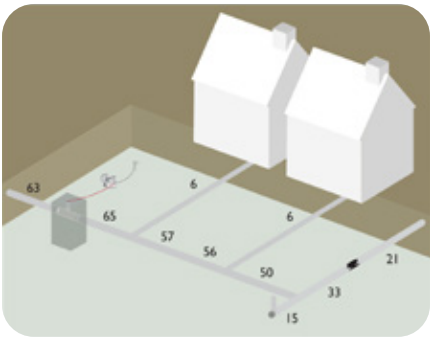
Signal Current Measurement
(MXL4 Locator only)

For MXL4 Locator only, Signal Current Measurement is a feature by which it is possible to measure the TRUE strength of the MXT4 or MXT4-DB12 Transmitter signal on a buried metal pipe or cable irrespective of depth. This is a useful aid for the correct identification of specific pipes and cables and may also help to determine the layout and condition of a pipe or cable network.

When the Transmitter has been connected to a particular 'target' service, the Locator may not always show the strongest response over that service. If the target pipe or cable happens to be much deeper than other services, which have picked up some of the Transmitter signal, these other services may show similar responses.

However, the Signal Current reading will invariably be highest on the target pipe or cable therefore aiding correct identification.





Signal Current Measurement can also help to identify the layout of pipe and cable networks as the main line after a 'T' will have most of the Signal Current remaining on it whereas the shorter connection will have correspondingly less.

The Signal Current reading should also reduce at a uniform rate as the distance from the Transmitter increases. A sudden drop in Signal Current, in a short distance, indicates a change to that service such as an unknown connection, an insulated joint or a break in the pipe or cable.

ⓘ Note

The Signal Current figure alone does not provide any useful information. It is how this figure compares to other Signal Current readings taken on other services or at different points along the target service that can indicate the layout and identity of the network.

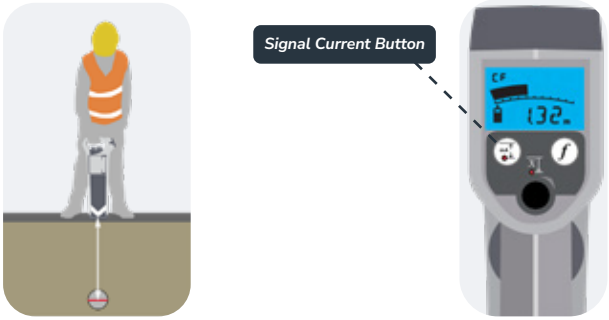
To ensure reliable Signal Current readings it is vital to adhere to the same best practises as are used to give accurate Depth Measurement readings.

1. Only apply the signal by a Connection method (Direct Connection, Signal Clamp or Signal Injector) to the target service.

2. The Transmitter must be set to Continuous signal output, NOT Pulsed output.

3. Set the Locator to Transmitter Mode, select the correct frequency and pinpoint the position of the buried service. Make sure the Locator is directly over the buried service and at right angles to its route. Rest the Locator on the ground with the body vertical.

4. Press and hold down the Signal Current button. The Signal Current reading will be shown on the display, measured in mA. Allow the Signal Current reading to stabilise.



Limitations of Signal Current Measurement

There are some situations where it may not be possible to gain an accurate Signal Current Measurement reading:

- At a sharp curve or bend in the route of the service.
- At a T junction in the service.
- At the very end point of the service.
- Close to any large metallic objects such as metal fences or vehicles.
- Within 25 m (82') of the position of the Transmitter.
- If the signal is of poor quality.

Locator
Function Checks

The CXL4, DXL4 and MXL4 Locators have a built-in Self Test feature that automatically tests the Locator's circuits and receiving aerials for correct performance each day ***(see pages 21-22)***.

If you wish to carry out additional checks or to test the Locator's functionality more than once a day then the following procedures can be used:

Battery Condition

Check the Locator battery condition by depressing the On/ Off Switch beneath the handle. The display will show at least two solid segments if the batteries are OK. Ensure power on tone is heard.

Power Mode

Select Power Mode. Set sensitivity fully clockwise and point the base of the Locator at a fluorescent light from a distance of 1 m (3'). Switch the light on. A loud tone should be heard and the display should read greater than 50% full scale. Reducing the sensitivity should cause the displayed reading to reduce and the tone to cut out.

Radio Mode

Select Radio Mode. Set the sensitivity fully clockwise and, from a distance of less than 0.25 m (10"), point the base of the Locator at a metal conductor of length greater than 100 m (330'), for example a metal pipe or cable. A warbling tone should be heard. The display should read greater than 50% full scale.

AllScan Mode

Select *All*Scan Mode. Repeat the same tests that were used to function check the Power and Radio Modes.

Generator/ Transmitter Mode

Locate an outdoor test area that is free from overhead and underground cables and metal pipes. The area should also not be near fences, steel framed buildings, or on reinforced concrete. Place the Signal Generator/ Transmitter on the ground and switch on - a tone should be heard. Set to Continuous and ensure lowest Output Power is selected.

For the MXT4 or MXT4-DB12 Transmitter, set to CF frequency.

With the Locator in the orientation shown, select Generator/ Transmitter Mode. For the MXL4 Locator, set to CF frequency. Rotate sensitivity fully clockwise. The results in the table below should be indicated. Reducing the sensitivity should cause the displayed reading to reduce and the tone to cut out.

For the MXL4 Locator only, repeat with both Transmitter and Locator set to 8kHz. The results should be the same.

Generator/ Transmitter Mode Check



Distance	Mode	Audio	Meter
6m (20')	Generator/Transmitter	Present	Full Scale
24m (80')	Generator/Transmitter	Less than at 6m (20')	Less than Full Scale

ⓘ Note

These Function Checks are approximate only. If a deterioration in performance is suspected for any reason, the equipment should not be used. It should be returned to C.Scope or a C.Scope Authorised Service Centre for more thorough investigation.

The SGV4, SGV4-DB, MXT4 and MXT4-DB12 Transmitters have a built-in Self Test feature that automatically tests the electronics and transmitting aerials for correct performance each day ***(see pages 34-35)***. On the SGV4 and MXT4, a Self Test can also be initiated manually by holding down the Pulse/ Continuous button while the Signal Generator/ Transmitter is switched on. On the SGV4-DB a Self Test can also be initiated manually by holding down the Pulse/ Continuous button. On the MXT4-DB12 a Self Test is initiated by holding down Frequency Down and Frequency Up buttons.

If you wish to carry out additional checks or to test the Signal Generator/ Transmitter functionality more than once a day then the following procedures can be used:

Battery Condition

Turn the Signal Generator/ Transmitter on and check batteries are in good condition ***(see pages 29-31)***. Replace or recharge batteries if necessary.

Induced Mode

This can only be checked in conjunction with a Locator as described on the previous page. If the unit does not meet the performance expected, repeat the test with another Locator to determine whether the Signal Generator/ Transmitter is at fault.

Connected Mode

Set the minimum Output Power Level, insert the Direct Connection Lead and the 10 metre Auxiliary Earth Lead and then connect the red lead Crocodile Clip to the Auxiliary Earth Lead Crocodile Clip. The pitch should change to a low tone.

The leads should be arranged to create an open loop on the ground of approximately 1m (3') in diameter. Check that a signal can be detected by the Locator in Generator/ Transmitter Mode when pointed closely at the loop.

ⓘ Note

These Function Checks are approximate only. If a deterioration in performance is suspected for any reason, the equipment should not be used. It should be returned to C.Scope or a C.Scope Authorised Service Centre for more thorough investigation.

Locators
Depth Measurement Function Checks *(DXL4 and MXL4 only)*

An area clear of services and metal structures should be chosen (beware of reinforced concrete car parks). A search with the DXL4 or MXL4 in all modes will help confirm the absence of other services. An insulated cable or wire (not supplied) over 20 m (70') long is laid out on the ground and the far end connected to a ground stake and earthed. The near end is connected to the red Direct Connection Lead.

The black Earth Lead should be laid at right angles to the 20 m (70') cable and earthed at the far end with the Earth Stake. The plug should be inserted in the Direct Connection Socket of the Signal Generator/ Transmitter.

The Signal Generator/ Transmitter is turned on to the lowest Output Power Level and Continuous Mode. The Locator should then be held vertically above the longer cable, approximately midway along it and the depth can then be measured. It is best to make a few readings at different depths.

For MXL4 Locators only, this procedure can then be repeated using 512Hz, 640Hz or 8kHz.



ⓘ Note

These Function Checks are approximate only. If a deterioration in performance is suspected for any reason, the equipment should not be used. It should be returned to C.Scope or a C.Scope Authorised Service Centre for more thorough investigation.

Data Logging

All CXL4, DXL4 and MXL4 Locators automatically record and store how they are being operated. Over 12 months of data (in normal use) can be stored before being overwritten. This data records when and how the Locator has been used.

All models also record every automatic Daily Self Test undertaken. It is therefore possible to keep a full audit trail of both the activity of the Locator, and its functionality.

This data can be transferred to cscope.info for analysis and storage, using a Windows® computer and a USB cable connected to the on-board data connection socket, situated inside the Battery Compartment. After data transfer, always replace the protective cover over the connection socket.

The CXL4-DBG, DXL4-DBG and MXL4-DBG models also have additional Bluetooth technology allowing this data to be wirelessly transferred to a smartphone or tablet and then uploaded to cscope.info for analysis. More detailed information on Data Logging is available at **cscopelocators.com**

Data Analysis using cscope.info

Using cscope.info you can store and analyse data from a single Locator, or from a fleet. Cscope.info produces maps, charts and tables to summarise activity patterns. This can help to quickly identify correct or incorrect usage patterns and any potential training requirements.

Data Transfer and Analysis using the C.Scope Relay App

To transfer data from a Bluetooth enabled Locator, using an iOS or Android device, use the C.Scope Relay App. The app provides maps, charts and tables and uploads data to cscope.info. The app is available free from Google Play and the App Store. Open the appropriate app store on a smartphone or tablet and search for 'C.Scope Relay'. The User Guide for C.Scope Relay App is available in the app and from **cscopelocators.com**

Data Transfer and Analysis using Desktop Relay

To transfer data from any Locator, using a Microsoft Windows computer, use Desktop Relay. Desktop Relay uploads data to cscope.info. Desktop Relay and supporting documentation is free-to-download from **cscopelocators.com**

ⓘ Note

We recommend that you regularly use Desktop Relay with your Locator to get the latest features and improvements from C.Scope. Desktop Relay automatically checks and updates the firmware on your Locator each time you use it. Download Desktop Relay from **cscopelocators.com**.

Data Logging

The SGV4 and SGV4-DB Signal Generators, MXT4 and MXT4-DB12 Transmitters automatically record and store how they are being operated. Over 12 months of data (in normal use) can be stored before being overwritten. This data records when and how the Signal Generator, or Transmitter, has been used.

The SGV4, SGV4-DB, MXT4 and MXT4-DB12 also record every automatic Daily Self Test undertaken. It is therefore possible to keep a full audit trail of both the activity of the Signal Generator/ Transmitter, and its functionality. This data can be transferred to a PC, for immediate analysis and storage, using a USB cable connected to the on-board data connection socket, situated on the underside of the Signal Generator/ Transmitter. This socket is easily accessible by removing the Accessory Tray. After data transfer, always replace the protective cover over the connection socket.

The SGV4-DB, and MXT4-DB12 models also have additional Bluetooth technology allowing this data to be wirelessly transferred to a smartphone or tablet and then uploaded to cscope.info for analysis. More detailed information on Data Logging is available at **cscopelocators.com**

Data Analysis using cscope.info

Using cscope.info you can store and analyse data from a single Signal Generator/ Transmitter or from a fleet. Cscope.info produces maps, charts and tables to summarise activity patterns. This can help to quickly identify correct or incorrect usage patterns and any potential training requirements.

Data Transfer and Analysis using the C.Scope Relay App

To transfer data from a Bluetooth enabled Signal Generator/ Transmitter, using an iOS or Android device, use the C.Scope Relay App. The app provides maps, charts and tables and uploads data to cscope.info. The app is available free from Google Play and the App Store. Open the appropriate app store on a smartphone or tablet and search for ‘C.Scope Relay’. The User Guide for C.Scope Relay App is available in the app and from **cscopelocators.com**

Data Transfer and Analysis using Desktop Relay

To transfer data from any Signal Generator or Transmitter, using a Microsoft Windows® computer, use Desktop Relay. Desktop Relay uploads data to cscope.info. Desktop Relay and supporting documentation is free to download from **cscopelocators.com**

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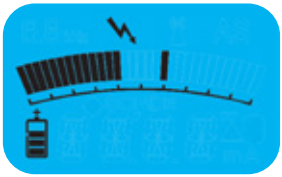
The CXL4-DBG, DXL4-DBG and MXL4-DBG Locators have built-in GPS and Bluetooth technology.

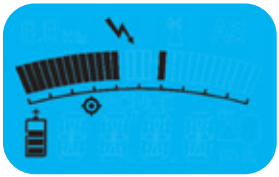
Built-in GPS

The GPS technology allows the geographical position of the Locator to be recorded. To allow this to happen the Locator will first need to detect and then lock on to a signal from a suitable satellite. This process can sometimes take a little time to complete but will not interfere with the Locator's ability to detect underground pipes and cables.

If the GPS symbol does not appear on the Locator display then the Locator is in the process of acquiring a GPS signal.

When the Locator has acquired a GPS signal, the GPS symbol will flash on the Locator display.





External GPS

Locators with Bluetooth can be connected to external GPS units. Consult the external GPS unit manufacturer for further instruction.

The Bluetooth symbol will appear on the display when the Locator has Bluetooth connectivity.

More detailed information on GPS is available from the C.Scope website at: **cscopelocators.com/gps/**

ⓘ Note

- GPS data is logged by the Locator and can be transferred to a PC via USB or to a smartphone via Bluetooth.
- To acquire a GPS signal, place the Locator somewhere with a clear view of the sky and leave it turned on until the Locator display indicates that a GPS signal has been acquired. When the Locator is used for the first time or at a significant distance from the place it last received a GPS signal it could take appreciably longer to identify a location accurately.

Bluetooth
Transmitters

The MXT4-DB12 Transmitter and SGV4-DB have built-in Bluetooth technology.

The Bluetooth symbol will appear on the display when the MXT4-DB12 or SGV4-DB is connected to a phone. The symbol will flash when the Transmitter is searching for a phone to connect to. The symbol will not show when Bluetooth is disabled.

On the MXT4-DB12, Bluetooth can be enabled and disabled by holding down the Frequency Down and Power Level buttons. On the SGV4-DB, Bluetooth can be enabled and disabled by holding down the Power Down and Pulse buttons.

ⓘ Note

Data logged by the Transmitter can be transferred to a PC via USB or to a smartphone via Bluetooth.

General Symbols

Warning - Refer to Manual



Waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Check with your local authority or retailer for recycling advice. In the UK visit **www.recycle-more.co.uk**



Conforms to UK & EU safety requirements.



Double Insulated.



CXL4 and DXL4 Locators
Technical Specifications

Controls	On/Off Switch: Spring loaded trigger switch under handle Function Select Switch (FOUR position): P. Power Mode; R. Radio Mode; G. Generator Mode; A. *All*Scan Mode Sensitivity Control For DXL4 only Depth Button. Push button for live display of depth
Audio Indication	Removable and user replaceable loudspeaker module
Visual Indication	Multi-segment Liquid Crystal Display indicating: Signal Strength; Mode selected; AlarmZone™; Battery Condition; Self Test Indicator For CXL4-DBG and DXL4-DBG only, GPS signal detected, Bluetooth activated For DXL4 only in Generator Mode, Depth Measurement
Data Logging	Internal capacity for storing over 12 months of data (in normal use) logged once per second Data logged includes Time/Date, Mode, Sensitivity Level, Received Signal Level, Frequency, Depth, Self Test Result, Swing Indicator For CXL4-DBG and DXL4-DBG only, GPS position
Bluetooth	Bluetooth 2.1
GPS	GPS/QZSS/GLONASS/SBAS
Data Connector	Standard USB Mini B or USB-C connector in battery compartment. USB 2.0 Compatible
Self Test	Automatic Daily Self Test
Swing Indicator	Audio beep to indicate incorrect use of the Locator
Generator Mode Frequencies	Simultaneous 131,072Hz and 32,768Hz
Construction	Case moulded from high impact plastic. Designed to withstand 1m (3'3") drop onto a hard surface
Weight (including batteries)	2.65kg (5 lb 13 oz)
Dimensions	720mm x 280mm x 65mm (28.3" x 11" x 2.5")
Performance	Locate Accuracy: better than 10% of depth Depth Accuracy: ±5% @ 1m (3'3") Line Depth Measurement Range: 0.1m to 9.99m (4" to 32') Line Depth Resolution: 0.01m (0.4") Sonde Depth Measurement Range: 0.1m to 9.99m (4" to 32') depending on Sonde type Sonde Depth Resolution: 0.01m (0.4")
Battery Type	Internal 8 x 'AA' (LR6) cells (either Alkaline non-rechargeable or NiMH rechargeable) or C.Scope Lithium-Ion battery pack
Battery Life	40 hours intermittent use at 20°C (68°F) using Alkaline cells
IP Rating	65

Notes: Performance figures stated can be affected by site parameters such as ground conditions, temperature, and strong electromagnetic fields. Specification may be subject to change.

All C.Scope Locators are in compliance with the essential requirements and other relevant provisions of Radio Equipment Directive (RED 2014/53/EU). Compliance has been demonstrated by testing representative samples to the relevant harmonised standards. All C.Scope Locators comply with the essential requirements and other provisions of Council Directive 2011/65/EU (RoHS).

MXL4 Locator
Technical Specifications

Controls	On/Off Switch: Spring loaded trigger switch under handle Function Select Switch (FOUR position): P. Power Mode; R. Radio Mode; T. Transmitter Mode; A. *All*Scan Mode Sensitivity Control Depth Measurement Button. Push button for live display of depth Current Measurement Button. Push button for live display of Transmitter current Frequency Select Button. Push button for Transmitter Mode frequency selection
Audio Indication	Removable and user replaceable loudspeaker module
Visual Indication	Multi-segment Liquid Crystal Display indicating: Signal Strength; Mode selected; AlarmZone™; Battery Condition; Self Test Indicator In Transmitter Mode, Frequency selected; Depth Measurement; Signal Current Measurement For MXL4-DBG only, GPS signal detected, Bluetooth activated
Data Logging	Internal capacity for storing over 12 months of data (in normal use) logged once per second Data logged includes Time/Date, Mode, Sensitivity Level, Received Signal Level, Frequency, Depth, Self Test Result, Swing Indicator For MXL4-DBG, GPS position
Bluetooth	Bluetooth 2.1
GPS	GPS/QZSS/GLONASS/SBAS
Data Connector	Standard USB Mini B or USB-C connector in battery compartment. USB 2.0 Compatible
Self Test	Automatic Daily Self Test
Swing Indicator	Audio beep to indicate incorrect use of the Locator
Transmitter Mode Frequencies	Simultaneous 131,072Hz and 32,768Hz; 131,072Hz, 32,768Hz; 8,192Hz; 640 and 512Hz
Construction	Case moulded from high impact plastic. Designed to withstand 1m (3'3") drop onto a hard surface
Weight (including batteries)	2.65kg (5 lb 13 oz)
Dimensions	720mm x 280mm x 65mm (28.3" x 11" x 2.5")
Performance	Locate Accuracy: better than 10% of depth Depth Accuracy: ±5% @ 1m (3'3") Line Depth Measurement Range: 0.1m to 9.99m (4" to 32') Line Depth Resolution: 0.01m (0.4") Sonde Depth Measurement Range: 0.1m to 9.99m (4" to 32') depending on Sonde type Sonde Depth Resolution: 0.01m (0.4") Current Measurement: 0.01mA to 100mA
Battery Type	Internal 8 x 'AA' (LR6) cells (either Alkaline non-rechargeable or NiMH rechargeable) or C.Scope Lithium-Ion battery pack
Battery Life	40 hours intermittent use at 20°C (68°F) using Alkaline cells
IP Rating	65

Notes: Performance figures stated can be affected by site parameters such as ground conditions, temperature, and strong electromagnetic fields. Specification may be subject to change.

All C.Scope Locators are in compliance with the essential requirements and other relevant provisions of Radio Equipment Directive (RED 2014/53/EU). Compliance has been demonstrated by testing representative samples to the relevant harmonised standards. All C.Scope Locators comply with the essential requirements and other provisions of Council Directive 2011/65/EU (RoHS).

SGA4/ SGV4/ SGV4-DB Signal Generators
Technical Specifications

Controls	Operation is by push button control as follows: On/Off. Power Level: For SGA4, 2 available power levels via High and Low Power buttons. The SGV4 has four available power levels, adjustable via the Increase and Decrease Power buttons. The SGV4-DB has five available power levels, adjustable via the Increase and Decrease Power buttons. Pulse/Continuous Output: toggles between pulse or continuous output using one push button. Audio/Mute: toggles between loud or muted audio output using one push button. Audio Output: SGA4 and SGV4 toggles between loud, muted and silent audio output using one push button. The SGAV4-DB has 4 volume levels. The SGV4-DB can also be controlled remotely from the C.Scope Relay app
Audio Indications	Audio Feedback on button push; Audio pitch drops with increasing load current in Connected Mode; Audio pitch changes with power level in Induced Mode; Audio output pulses to indicate Pulsed Mode; Low battery indicated by interrupted Audio and output signal
Visual Indication (for SGV4 and SGV4-DB)	Multi-segment Liquid Crystal Display indicating: Output Frequency; Pulse Mode; Continuous Mode; Battery Condition; Output Level (bar graph); Speaker Mute, Self Test Result and Bluetooth status (SGV4-DB only)
Bluetooth (SGV4-DB only)	Bluetooth Low Energy (BLE) 5.4
Data Connector (for SGV4 and SGV4-DB)	SGV4 has USB Mini B or USB-C connector. USB 2.0 Compatible SGV4-DB has USB-C connector. USB 2.0 Compatible
Power Connector (SGV4-DB only)	5.5mm barrel, 2.1mm centre pin, centre positive. Input range 10 to 24V. Maximum current draw 3A. Can simultaneously charge battery and power transmitter from 12V vehicle battery or mains adaptor.
Self Test (for SGV4 and SGV4-DB only)	Automatic Daily Self Test and manual Self Test function
Output	Induced: For SGA4 = 32,768Hz. For SGV4 and SGV4-DB = 131,072Hz and 32,768Hz Connected = 131,072Hz and 32,768Hz. Carrier Pulse Frequency: 7.5Hz (pulsed mode)
Connected Mode	Connection Mode automatically selected when lead is plugged into socket. On the SGV4-DB this can also be set from the C.Scope Relay app. Maximum Output Voltage (open circuit): SGA4 28V rms @ 33kHZ; SGV4 30V rms @ 33 kHz; SGV4-DB 40V rms @ 33 kHz. Maximum Output Current (short circuit): 65mA rms. Maximum Power: 1W into 400Ω load
Construction	Case moulded from high impact plastic. Designed to withstand 1m (3'3") drop onto a hard surface. Incorporates clip on accessory storage compartment
Built-in Rechargeable Battery	Built-in Lithium-Ion Rechargeable Battery with self-limiting charging protection -0˚C to 45˚C (32˚F to 113˚F) and self-limiting operational safety protection -20˚C to 50˚C (-4˚F to 122˚F).
Weight (including batteries, Connection Leads, Connection Magnets and Earth Stake)	3.4kg (7lb 7 oz) for SGV4 and SGA4. 2.7kg (5lb 15oz) for SGV4-DB
Dimensions (with Accessory Tray fitted)	720mm x 280mm x 65mm (28.3" x 11" x 2.5")
Battery Type	SGA4 and SGV4 use 4 x 'D' (LR20) cells (either Alkaline non-rechargeable or NiMH rechargeable) or C.Scope Lithium-Ion battery pack. SGV4-DB has an internal Lithium-Ion battery
Battery Life	up to 40 hours intermittent use at 20ºC (68ºF)
IP Rating	65

Notes: Performance figures stated can be affected by site parameters such as ground conditions, temperature, and strong electromagnetic fields. Specification may be subject to change. All C.Scope Signal Generators are in compliance with the essential requirements and other relevant provisions of Radio Equipment Directive (RED 2014/53/EU). Compliance has been demonstrated by testing representative samples to the harmonised standards EN300-330 and EN301-489.
The essential radio test suites have been carried out and the equipment is in conformity with all applicable directives. All C.Scope Signal Generators comply with the essential requirements and other provisions of Council Directive 2011/65/EU (RoHS).

MXT4 Transmitter
Technical Specifications

Controls	All operation is by push button control as follows: On/Off Power Level: Cycles through four available power levels Frequency: cycles through six available output frequencies Pulse/Continuous Output: toggles between pulse or continuous output using one push button Audio Output: toggles between loud, muted and silent audio output using one push button
Audio Indications	Audio Feedback on button push Audio pitch drops with increasing load current in Connected Mode Audio pitch changes with power level in Induced Mode Audio output pulses to indicate Pulsed Mode Low battery indicated by interrupted Audio and output signal
Visual Indication	Multi-segment Liquid Crystal Display indicating: Output Frequency; Pulse Mode; Continuous Mode; Battery Condition; Output Level (bar graph); Speaker Mute, Self Test Result
Data Connector	Standard USB Mini B or USB-C connector. USB 2.0 Compatible
Self Test	Automatic Daily Self Test and manual Self Test function
Output	Induced = 131,072Hz and 32,768Hz; 131,072Hz, 32,768Hz and 8,192Hz Connected = 131,072Hz and 32,768Hz; 131,072Hz, 32,768Hz; 8,192Hz; 640 and 512Hz Carrier Pulse Frequency: 7.5Hz (pulsed mode)
Connected Mode	Connection Mode automatically selected when lead is plugged into socket Maximum Output Voltage (open circuit): 30 V rms @ 33 kHz Maximum Output Current (short circuit): 65mA rms Maximum Power: 1W into 400 Ω load
Construction	Case moulded from high impact plastic. Designed to withstand 1m (3'3") drop onto a hard surface Incorporates clip on accessory storage compartment
Weight (including batteries, Connection Leads, Connection Magnets and Earth Stake)	3.4kg (7 lb 7 oz)
Dimensions (with Accessory Tray fitted)	360mm x 180mm x 230mm (14.1" x 7" x 9")
Battery Type	Internal 4 x 'D' (LR20) cells (either Alkaline non-rechargeable or NiMH rechargeable) or C.Scope Lithium-Ion battery pack
Battery Life	up to 40 hours intermittent use at 20°C (68°F) using Alkaline cells
IP Rating	65

Notes: Performance figures stated can be affected by site parameters such as ground conditions, temperature, and strong electromagnetic fields. Specification may be subject to change.

All C.Scope Transmitters are in compliance with the essential requirements and other relevant provisions of Radio Equipment Directive (RED 2014/53/EU). Compliance has been demonstrated by testing representative samples to the harmonised standards EN300-330 and EN301-489.

The essential radio test suites have been carried out and the equipment is in conformity with all applicable directives. All C.Scope Transmitters comply with the essential requirements and other provisions of Council Directive 2011/65/EU (RoHS).

MXT4-DB12 Transmitter
Technical Specifications

Controls	Operation is by push button control as follows: On/Off Frequency Down: step down through six available output frequencies Frequency Up: step up through six available output frequencies. Holding down this button changes the reading on the screen between Volts, Amps and Ohms Power Level: Cycles through ten available power levels. Holding down this button switches between pulse and continuous output Audio Output: toggles between five audio output levels using one push button. Holding down this button mutes and unmutes the audio The MXT4-DB12 can also be controlled remotely from the C.Scope Relay app
Audio Indications	Audio Feedback on button push Audio pitch drops with increasing load current in Connected Mode Audio pitch changes with power level in Induced Mode Audio output pulses to indicate Pulsed Mode Low battery indicated by interrupted Audio and output signal
Visual Indication	Multi-segment Liquid Crystal Display indicating: Output Frequency; Pulse Mode; Continuous Mode; Battery Condition; Output Level (bar graph); Voltage, Current, Resistance or Power Output measurement, Speaker Mute, Self Test Result, Bluetooth status
Bluetooth	Bluetooth Low Energy (BLE) 5.4
Data Connector	Standard USB-C connector. USB 2.0 Compatible
Power Connector	5.5mm barrel, 2.1mm centre pin, centre positive. Input range 10 to 24V. maximum current draw of 3A. Can simultaneously charge battery and power transmitter from 12V vehicle battery or mains adaptor.
Self Test	Automatic Daily Self Test and manual Self Test function
Output	Induced = 131,072Hz and 32,768Hz; 131,072Hz, 32,768Hz and 8,192Hz Connected = 131,072Hz and 32,768Hz; 131,072Hz, 32,768Hz; 8,192Hz; 640 and 512Hz Carrier Pulse Frequency: 7.5Hz (pulsed mode)
Connected Mode	Connection Mode automatically selected when lead is plugged into socket and can be changed remotely Maximum Output Voltage (open circuit): 40V rms Maximum Output Current (short circuit): 1A rms Maximum Power: 12W
Construction	Case moulded from high impact plastic. Designed to withstand 1m (3'3") drop onto a hard surface Incorporates clip on accessory storage compartment
Built-in Rechargeable Battery	Built-in Lithium-Ion Rechargeable Battery with self-limiting charging protection -0˚C to 45˚C (32˚F to 113˚F) and self-limiting operational safety protection -20˚C to 50˚C (-4˚F to 122˚F).
Weight (including batteries, Connection Leads, Connection Magnets and Earth Stake)	2.9kg, (6 lb 6oz)
Dimensions (with Accessory Tray fitted)	360mm x 180mm x 230mm (14.1" x 7" x 9")
Battery Type	Internal Lithium-Ion rechargeable
Battery Life	up to 40 hours intermittent use at 20°C (68°F)
IP Rating	65

Notes: Performance figures stated can be affected by site parameters such as ground conditions, temperature, and strong electromagnetic fields. Specification may be subject to change. All C.Scope Transmitters are in compliance with the essential requirements and other relevant provisions of Radio Equipment Directive (RED 2014/53/EU). Compliance has been demonstrated by testing representative samples to the harmonised standards EN300-330 and EN301-489.
The essential radio test suites have been carried out and the equipment is in conformity with all applicable directives. All C.Scope Transmitters comply with the essential requirements and other provisions of Council Directive 2011/65/EU (RoHS).

Maintenance

Handling

C.Scope Locators and Signal Generators are rugged instruments designed for the rigours of every day use. However, to ensure that the specified accuracy is maintained, it is essential to treat the instruments with care by avoiding shocks, vibration and excesses of temperature.

The construction of C.Scope Locators and Signal Generators incorporate weather proof seals, however, they are not guaranteed to prevent water ingress if the equipment is immersed.

Cleaning

- The equipment can be cleaned with a sponge dampened with warm water. A mild soap may be used if required.

  The use of solvents should be avoided.

- Do not allow moisture in the battery compartments or near the connectors.

Storage

- The equipment should be stored in a clean and dry environment.
- The temperature should not exceed -10˚C to 60˚C (14˚F to 140˚F). For optimum rechargeable battery life and performance storage in the temperature range 10˚C to 25˚C (50˚F to 77˚F) is strongly recommended.
- If stored for long periods, Alkaline or NiMH batteries should be removed.

Training

This Instruction Manual is comprehensive but cannot fully replace expert tuition. Excellent training is available directly from C.Scope and via authorised C.Scope agents, cost effectively, at your chosen location.

C.Scope recommend operators are trained before using the equipment.

Warranty

Details of the C.Scope Warranty Terms and Conditions and how to register the warranty for your C.Scope product are available from the C.Scope website **cscopelocators.com/warranty/**

Calibration

The C.Scope CXL4, DXL4 and MXL4 and SGA4, SGV4, SGV4-DB, MXT4 and MXT4-DB12 do not require periodic calibration. Where independent validation and certification is a requirement, this is available from C.Scope and C.Scope Authorised Service Centres.

Servicing

Routine servicing is available from C.Scope and C.Scope Authorised Service Centres.

Repairs

If you suspect equipment is faulty, please check it carefully with a fresh set of batteries. Check the battery connections and rotate the batteries in the holder. Refer to the section in this manual on Function Checks and if possible compare performance with equipment known to be in good working order.

If the problem persists then contact the company from whom you purchased the equipment, or contact C.Scope indicating the nature of the fault. Advice on the best course of action can then be given.

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