

Revision 3 - 06.00

C.A.T and Genny User Guide

Troubleshooting

When reporting any problem to your Radiodetection Dealer/Supplier it is important to quote the Receiver Serial Number.



Warning:

Radiodetection Receivers detect almost all buried cables and most conductors, but there are some which do not radiate signals and which Radiodetection Receivers cannot detect.

Radiodetection Receivers do not indicate whether a signal is from a single cable, several buried side by side or one above another.

Live cables may not be detectable in the Power mode, IF the cable is not loaded OR the cable load is well balanced.

This equipment is NOT approved for use in areas where hazardous gases may be present.

Ensure the Receiver is switched on and the battery test 'beep' has sounded before attempting to use the loudspeaker as an earphone.

Ni-Cad batteries should be disposed of in accordance with your Company's work practice, and/or the relevant law or guidelines in your country.

CE Complies with European EMC Directive 89/336/EEC.

This instrument, or family of instruments, will not be permanently damaged by reasonable electrostatic discharge and has been tested in accordance with IEC 801-2. However, in extreme cases temporary malfunction may occur. If this happens, switch off, wait and switch on again. If the instrument still malfunctions, disconnect the batteries for a few seconds.

The Ten Golden Rules of Locating

- 1 Obtain Plans and walk the site to check for obvious signs of utilities.
- 2 Use safe digging practice.
- 3 Use the C.A.T upright - NEVER swing it!
- 4 Use Power and Radio to sweep the whole area.
- 5 Use the sensitivity control correctly to pinpoint the conductor.
- 6 Use the C.A.T again in the trench/hole once you have excavated approximately 0.3 m (1 ft) to locate deeper or smaller services not locatable from the surface.
- 7 Remove the speaker when using the C.A.T in noisy environments.
- 8 Remember the C.A.T alone cannot always locate every conductor including small services and street lighting - use the Genny.
- 9 Remember the C.A.T will only trace metallic conductors and not plastic pipes or fibre optic cables for example.
- 10 Maintain your C.A.T and Genny regularly to ensure continued trouble free performance

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C.A.T LOCATOR

1.1 FEATURES

The features of the C.A.T Locator (Figure 1) are as follows:

ON/OFF (1)

Press and hold to use the C.A.T.

LOUDSPEAKER (2)

To use in noisy environments, unscrew and hold to the ear. Always replace when not in use.

SENSITIVITY CONTROL (3)

Rotate clockwise if weak signal, anticlockwise if strong signal. On hearing a signal reduce the sensitivity for a narrow response to pinpoint the conductor.

FUNCTION SWITCH (4)

Selects three locating modes:



Power

Detects 50 - 60 Hz energy present on most buried conductors.



Radio

Detects re-radiated radio energy if present on buried conductors.



Genny

Detects conductors radiating the applied Genny Transmitter signal.

BATTERY COMPARTMENT (5)

Open the access cover (using screwdriver/coin) to replace 8 LR6 (AA) 1.5 V alkaline batteries.

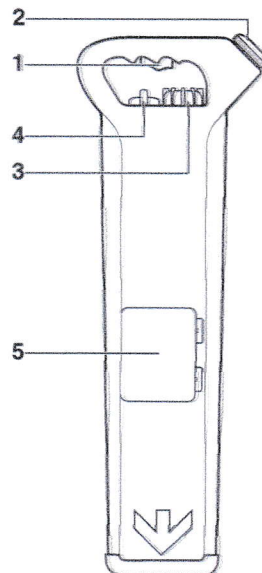


Figure 1 C.A.T Locator

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GENNY TRANSMITTER

2.1 FEATURES

The features of the Genny Transmitter (Figure 2) are as follows:

ON/OFF BUTTON (1)

When the On/Off button is pressed with no accessory connected to the Genny an induction signal is radiated.

CONNECTION SOCKET (2)

When an accessory is connected to the Genny Connection Socket the signal is applied via the accessory. Induction mode is automatically disabled.

LOUDSPEAKER (3)

To reduce the audio level press and hold the On/Off button at switch on.

BATTERY COMPARTMENT (4)

Open the access cover (using screwdriver/coin) to replace 4 LR20 (D) 1.5 V alkaline batteries.

STORAGE COMPARTMENT (5)

Opened by releasing the two end clips and contains a Connection Cable for connecting the Genny directly to a conductor, a Ground Cable on a reel and a Ground Stake for making ground connection (Figure 3). Connection Clips with magnets fitted provide an alternative means of connection.

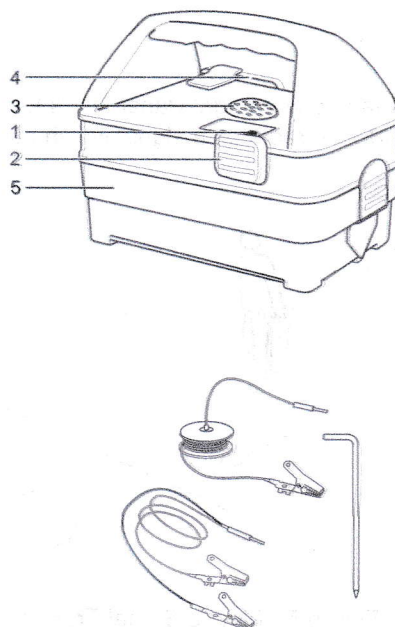


Figure 2 Genny Transmitter

Figure 3 Connection Cable, Ground Stake and Ground Cable

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2.2 OPTIONAL EXTRAS

2.2.1 Signal Clamp

The Signal Clamp (Figure 4), which fits into the Genny storage compartment, will apply a selective signal when connected to the Genny. The Signal Clamp can be fitted to extension rods 70 cm (28 in), if required.

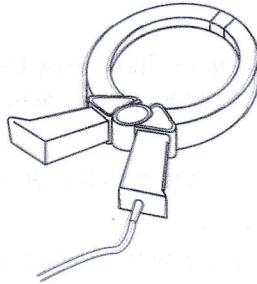


Figure 4 Signal Clamp

2.2.2 Live Plug Connector

The Live Plug Connector applies the Genny signal to mains cabling via a live domestic electric socket. The Genny has a safety circuit which protects the user and transmitter from the mains voltage.

2.2.3 Mouse Signal Transmitters

A range of small self-contained watertight transmitters for insertion into non-metallic pipes or sewers (Figure 5). The Mouse radiates a signal which can be pinpointed by the C.A.T in the Genny mode.

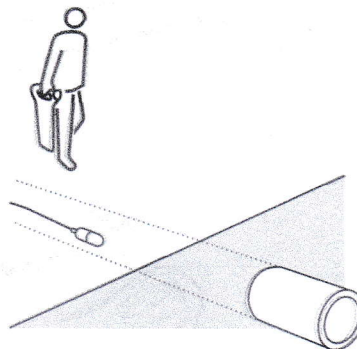


Figure 5 Mouse Signal Transmitter

Insert the battery into the Mouse. Attach the Mouse to the drain rod using the relevant connector (purchased separately).

Switch the C.A.T Function Switch to 'G' and squeeze the On/Off Trigger.

Place the Mouse on the ground and holding the C.A.T in line with it (not at right angles), check that the signal is being received.

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Insert the Mouse 1 m/yd into the duct/drain, and adjust the C.A.T sensitivity to receive the signal.

A ghost signal appears before and behind the main signal position (Figure 6). Reduce the C.A.T sensitivity to receive only the main signal.

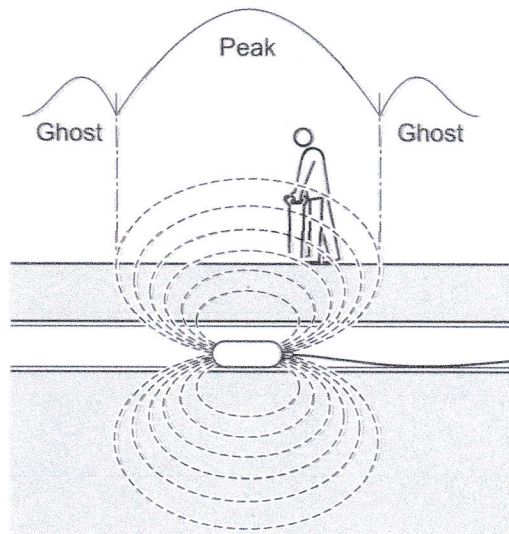


Figure 6 Mouse Transmitter Signal Peaks

Locate the Mouse at 2 m intervals

Equipment incorporating a Mouse is sometimes lost underground. It is important to locate it before the batteries are exhausted. Carry out a sweep with the C.A.T in the Genny mode at maximum sensitivity to locate the Mouse.

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3 FUNCTIONAL CHECKS

3.1 TEST AREA

Using the C.A.T in the Power and Radio modes find a site free of interference from buried cables, overhead lines, etc., and also clear of structural steel, reinforcing bars etc.

3.2 TEST PROCEDURE

Place the Genny on the ground and switch on.

Check there is an audible sound from the speaker.

Place the C.A.T flat on the ground and pointing towards the Genny (Figure 7).

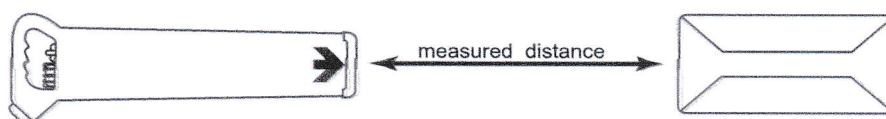


Figure 7 Test Configuration

With the C.A.T switched on and set to maximum sensitivity, check that the audio response (which should be synchronized with the Genny audio output) is as detailed in Table 1.

Table 1 Functional Check Audio Responses

MODE	TEST DISTANCE	AUDIO OUTPUT
Power	1 m (3 ft)	Pulsed, clearly audible.
Radio	6 m (20 ft)	Pulsed, clearly audible.
Genny	15 m (50 ft)	Pulsed, very high volume.
	26 m (85 ft)	Pulsed, clearly audible.

3.3 TROUBLESHOOTING

If any of the above Test Procedures give a poor result, check the battery orientation. Prove the fault with another C.A.T or Genny.

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4 LOCATING

4.1 SWEEPING

Turn the Function Switch to Power.

Note:

The Power signal is radiated by loaded electric power cables and often found on other nearby conductors.

Press and hold the On/Off trigger.

The battery test bleep will confirm the condition of the batteries. Replace the batteries if necessary.

Rotate the Sensitivity Control fully clockwise for maximum sensitivity, but reduce if there is a blanket signal across the site.

Define the area to be excavated and carry out a grid pattern sweep in the Power mode (Figure 8).

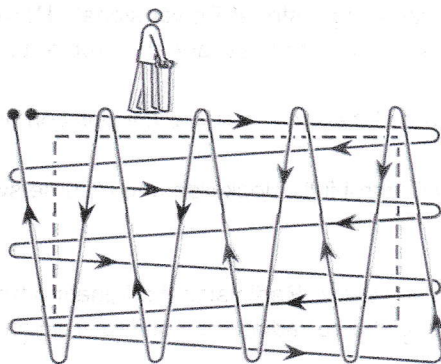


Figure 8 Sweep Grid Pattern

Sweep in two directions, as illustrated, holding the C.A.T upright and by your side.

Walk beyond the edges of the area to be excavated.

4.2 PINPOINTING

The presence of a buried conductor will be indicated by a tone emitted from the loudspeaker.

Keeping the blade vertical, slowly move the C.A.T backwards and forwards across the conductor reducing the sensitivity for a narrower response. Do not swing the C.A.T.

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When directly over the conductor and with the sensitivity level set for a narrow response, rotate the C.A.T on its axis (Figure 9) until the signal minimum is found, the blade is now in line with the conductor.

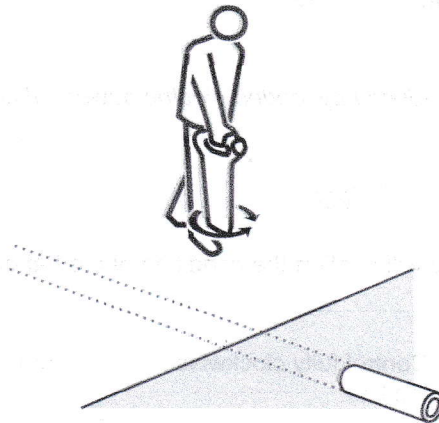


Figure 9 Finding Signal Minimum

Sometimes it is not possible to define a zero and a maximum signal over a buried conductor, particularly when it is radiating a strong Power signal. Raise the C.A.T to 0.5 m (20 in) from the ground, reducing the sensitivity if necessary, then rotate to find the minimum signal.

Trace the conductor out of the area, marking the position as required with chalk or paint.

Rotate the Sensitivity Control fully clockwise and resume sweeping the area following the grid pattern.

There is often, but not always, a Radio signal originating from distant radio transmitters that penetrates the ground and is re-radiated by buried conductors.

When the Power mode sweep has been completed, select the Radio mode and again sweep the area following the grid pattern.

Ensure that the ground is well marked where all buried conductors were located before excavation commences.

Local know-how, plans and knowledge about the presence of buried conductors will help when locating, as they indicate what to expect.

Moving the C.A.T steadily from side to side and adjusting the sensitivity as necessary, follow the line so that the audible signal is heard when over the conductor and not at either side.

The response from the conductor can suddenly reduce or disappear due to:

- (a) A curve.
- (b) A depth change.
- (c) A Tee connection.
- (d) A break in, or the end of, the conductor

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If the signal is lost, stop and locate in a circle 1 m/yd around the point where the signal was lost (Figure 10). The C.A.T gave a response where the conductor entered the circle, and if the conductor has curved, another response where it leaves the circle. If there is no second response, increase the sensitivity to check if the signal has divided into a tee or has weakened due to increased depth.

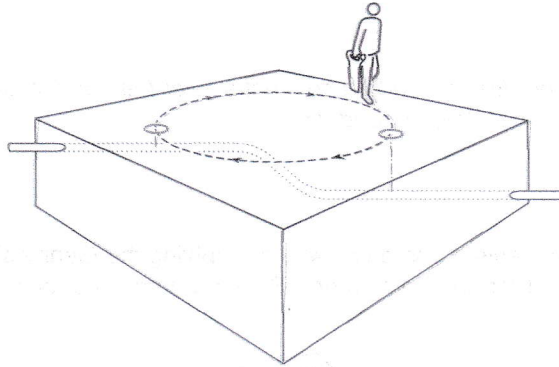


Figure 10 Lost Signal

Trace the conductor back to a point where it can be identified, i.e. valve, junction box, street lighting column etc.



Warning

The C.A.T will not locate some conductors, particularly those with small cross sections, or which are short, such as pot-ended conductors. Dig with great care or use the C.A.T with the Genny if unlocated conductors are suspected.

In a noisy environment the loudspeaker can be removed from the C.A.T and held to the ear. Always ensure the C.A.T is switched on and the battery test 'beep' has sounded before holding the loudspeaker to the ear.

4.3 LOCATING WITH C.A.T AND GENNY

Check the battery state by switching the Genny on, if there is no loudspeaker tone or it is very slow, replace the batteries.

There are several rules that always apply when using the Genny:

- Sweeping with the C.A.T in the Power and Radio modes indicates the position of buried conductors. Check their identity by applying then tracing the Genny signal.
- Where possible Direct Connection or using a Signal Clamp is preferable to Induction when applying the Genny signal.
- Whenever possible, apply the Genny signal at an access point where the conductor can be positively identified.
- For a further identity check, after normal location reverse the procedure by inducing the Genny signal on to the conductor and tracing it back to the original point of application.

Tracing and pinpointing the Genny signal with the C.A.T requires similar techniques to those used in the Power and Radio modes.

Adjust the C.A.T sensitivity in the Genny mode for a narrow response. Sensitivity will need a periodical increase as the signal strength reduces when tracing further away from the Genny.

Never assume a buried cable or pipe is straight and trace every part of the length to be certain.

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The Genny signal will sometimes transfer on to unwanted conductors, therefore never assume that the first response to a signal is the conductor to be traced. Increase the sensitivity to maximum and carry out a sweep in a circle around the Genny. Note the position of all conductors leaving the circle. Repeat the sweep reducing the sensitivity until the C.A.T is sensitive enough to locate only one conductor which is almost certainly the conductor with the applied signal.

Note:

A signal which has 'leaked' on to a conductor near the surface can appear to be stronger than the actual signal on a deeper conductor.

4.4 INDUCTION

Induction is a convenient and quick way of applying the Genny signal to a pipe or cable where access for using direct connection or a Signal Clamp is not possible (Figure 11).

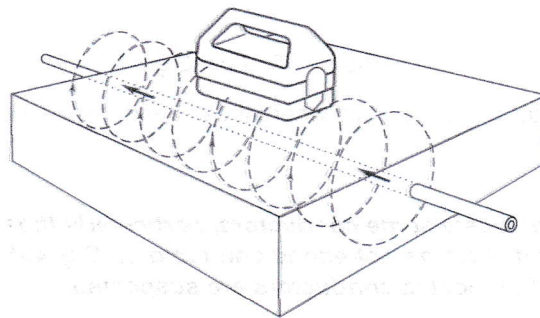


Figure 11 Signal Induction

The following illustrations are of a typical street situation comprising four parallel lines 1m (3 ft) apart and 0.5 m (1.5 ft) deep.

When the Genny is in the upright position it radiates a signal directly below.

Figure 12 shows the Genny upright over one of the lines inducing a signal of 100. Assuming all lines are identical, the other lines have signals of 20, 6 and 3 respectively.

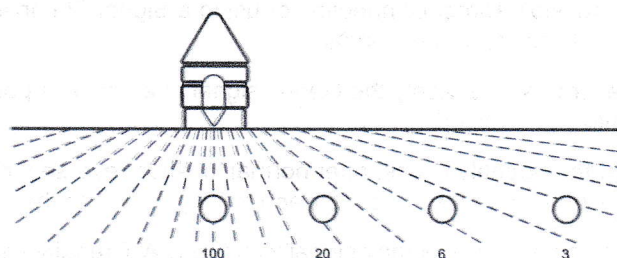


Figure 12 Genny Induction Signal Radiation - Upright Position

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When the Genny is placed on its side with the Connection Socket Cover uppermost the signal covers a wider area with no signal directly below.

Figure 13 shows the Genny on its side and above a target line. The lines, have signals of 0, 50, 30 and 19.

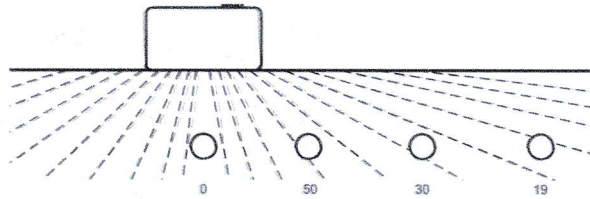


Figure 13 Genny Induction Signal Radiation - Horizontal Position

4.4.1 Procedure

Note

Always carry out the following procedure as precisely as possible.

Place the Genny on the ground in line with the suspected route of the target lines.

Switch the Genny on.

Switch the C.A.T to 'G' and squeeze the On/Off trigger.

Hold the C.A.T upright and at right angles to the suspected route.

Using the C.A.T at approximately 10 paces away from the Genny, pinpoint the position of the target line.

The Genny signal can sometimes be received directly by the C.A.T causing incorrect pinpointing information. To eliminate this unwanted signal reduce the C.A.T sensitivity. If difficulty isolating this direct signal from the signal on the target line continues, move a further 10 paces away from the Genny and resume pinpointing.

It is possible, with practice and by carefully reducing the C.A.T sensitivity, to pinpoint a target line radiating the Genny signal, when the C.A.T is only 5 paces from the Genny.

It is usually possible to induce a signal on to a line at the base of a street light, beside a meter or where the cable or pipe enters the ground. Adjust the Genny position for the best signal application.

Always place the Genny over the cable or pipe before it enters or after it leaves the chamber, *never* on a cover.

In congested areas the precise positioning of the C.A.T and Genny is important. To help discriminate between two adjacent lines keep the C.A.T stationary and inch the Genny sideways

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4.5 ACTIVE SEARCH

This technique can be used to check for the presence of lines not radiating Power or Radio signals (Figure 14).

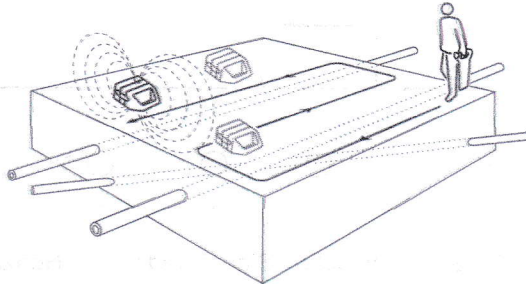


Figure 14 Active Search

Place the Genny on its side with the Connection Socket Cover uppermost. The Genny will energize all lines to either side but not lines running directly below.

Carry out a search with the C.A.T at least 10 paces from the Genny. Pinpoint and mark any lines that are located.

Reposition the Genny at 5 pace intervals around the site searching each time with the C.A.T. Pinpoint and mark any lines that are located.

Another type of search is for two operators 20 paces apart, one with the Genny and one with the C.A.T on maximum sensitivity (Figure 15).

Move around the search area maintaining the 20 pace distance between operators.

The C.A.T must always be at right angles to the line of the Genny to receive the signal.

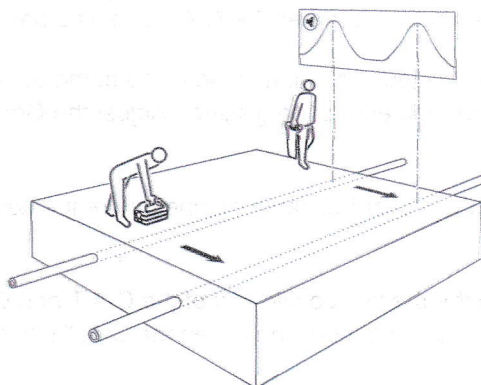


Figure 15 Dual Operator Active Search

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5 USEFUL TECHNIQUES

5.1 PIPES

Apply the Genny signal by direct connection at a meter or a tap/spigot and trace with the C.A.T.

Connect the Genny signal to a valve at the junction of the branch and main and trace with the C.A.T.

Connect the Genny signal to the tracer wire on plastic water pipes.

Using a Signal Clamp is possible if the end of the pipe is grounded.

If there is no access point to the pipe, carry out a C.A.T sweep in the Power and Radio modes; if this fails to give any response carry out a C.A.T and Genny sweep, obtain a response then induce the Genny signal and trace the conductor with the C.A.T.

5.2 CABLES

Apply the Genny signal to the cable with a Signal Clamp, at the meter.

If possible use the Signal Clamp around cables in a chamber, at a distribution box or in a sub station.

Apply the Genny signal with a Live Plug Connector if there is access to a live electric socket in a nearby building.

If there is no access point to the cable, carry out a C.A.T sweep in the Power and Radio modes; when a conductor is located induce the Genny signal and trace the conductor to a point where it can be identified. Reverse the process to confirm the cable identity.

5.3 STREET LIGHTING

If the cable cannot be found with the Power and Radio sweep, carry out a C.A.T and Genny sweep, obtain a response then induce the Genny signal and trace the conductor with the C.A.T.

Metal street lamp columns are normally bonded to cable sheaths. Using a Connection Clip with a magnet fitted provides a quick and safe street lamp column connection method without the need to involve the lighting department. This method is also useful for locating cables to/from distribution cabinets, Keep Left bollards, No Entry signs, traffic lights etc.

Concrete columns may have the cable sheath bonded to the inspection door frame. If not, the lighting department must make the Transmitter connection to the cable sheath. Use this opportunity to gain knowledge about the position and depth of lighting cables, plus feeds to other street furniture on the same system. One connection point will energize cables over a considerable area.

Induction can be used by placing the Genny at the base of the column.

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5.4 ELIMINATION

If it is not possible to identify the conductor being searched for, carry out either a C.A.T Power and Radio sweep or a C.A.T and Genny sweep across the area and mark the position of all conductors that are located. Trace them back to a point where they can be identified and mark each line with its identity (telecom, power, water etc.).

The procedures just described are some of the more common methods for obtaining results with the C.A.T and Genny but there are many others.

5.5 CONCRETE REINFORCING BARS

Any longitudinal piece of metal in the ground will re-radiate ac signals such as Power, Radio and Genny.

In the case of reinforcing bars or lengths of discarded cable the signals are virtually undetectable at normal depths (50 cm [20 in]) at which cable and pipes are buried. When near the surface they are easily detected and form unwanted interference when tracing a deeper conductor.

The solution is to lift the C.A.T approx. 30 cm (12 in) above the ground. The distance to the shallow reinforcing bars is increased by a factor of around ten so their effective signal is reduced by the same and they are no longer detected by the C.A.T.

5.6 LOCATING TEE CONNECTIONS

Apply the Genny signal to the conductor. Using the C.A.T trace the conductor with the sensitivity adjusted to give a very narrow response. Moving away from the application point the signal will gradually reduce as the Genny signal leaks off the conductor making it necessary to periodically increase the sensitivity to compensate.

If the response suddenly reduces or disappears check (with increased sensitivity if necessary) that the conductor has not curved or gone deeper. If not, there is probably either a Tee connection (Figure 16) or an insulation fault, if insulated.

The actual point of the junction is generally midway between the point where the signal starts decreasing and the where it levels out.

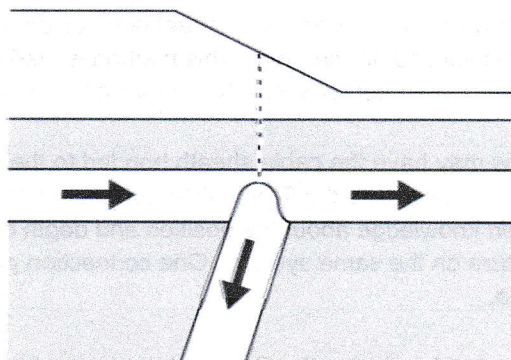


Figure 16 Tee Connection Response

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5.7 CONGESTED AREAS

A wide response from the C.A.T usually indicates the presence of two or three conductors buried close together. The limit of obtaining separate responses from close together conductors radiating the same signal is normally limited to a distance apart marginally more than 85% of their depth.

Usually the position of the two close together conductors can be defined by using the C.A.T in its two passive modes. A telecom cable radiates a stronger Radio signal than an energized power cable and careful pinpointing over the area first in Power mode then in Radio mode will define separate responses very close to each other.

Close together conductors can also be defined using the Genny. If two close together conductors are running parallel the Genny can be positioned across each of them enabling the C.A.T to pinpoint the other.

The Genny should be used horizontally with the Connection Socket Cover uppermost and be placed symmetrically across the route of the conductors (Figure 17).

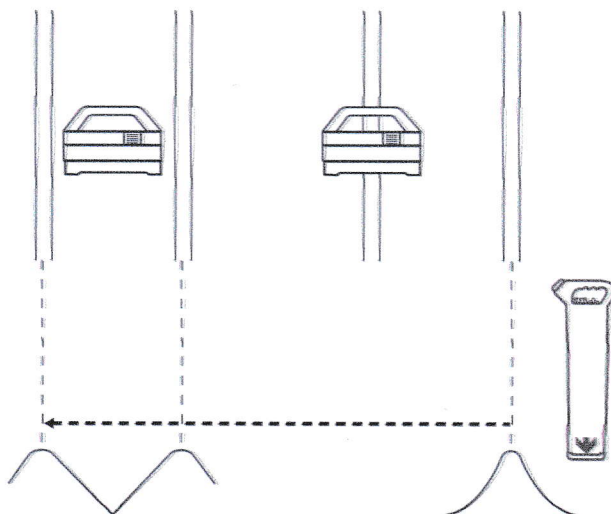


Figure 17 Induction Signal Application - Close Parallel Conductors

An extension of this technique is to edge the Genny sideways until it is directly over one of the conductors. This will now carry no signal and the other can be traced. This technique is very effective if the two conductors are different types or at different depths

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6 SIGNAL APPLICATION

6.1 DIRECT CONNECTION

Direct connection is the most effective form of signal application and is suitable for connecting the Genny to a valve, meter, junction box or other access point.



Warning

Should only be used on a power cable sheath by qualified personnel.

6.1.1 Procedure

Plug the Connection Cable into the Genny Connection Socket and attach the red lead to the target line (Figure 18).

If necessary clean off paint, rust or scale to ensure a good connection.

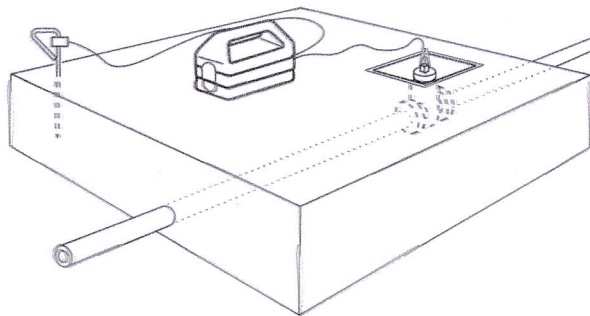


Figure 18 Direct Connection Configuration

Clip the black ground lead to the Earth Stake which should be placed in the ground 3-4 paces away from, and at right angles to, the target line.

Alternatively the ground lead can be clipped to the rim of a valve box cover, drain cover or manhole cover.

The earth lead can be extended using the extension cable connected to the earth clip.

To reduce the possibility of adjacent lines being energized, decrease the signal output level by either pulling the Earth Stake partly out of the ground or laying it on the ground.

A good connection is indicated by a change in loudspeaker tone. If there is no tone change, check the electrical contact and the earth point. If necessary change the position of the earth point or tip water over it, if placed in dry soil or sand.

Ground connections may sometimes apply the signal to other conductors or buried concrete reinforcing bars. These unwanted signals can be eliminated by using the C.A.T 30 cm (12 in) from the ground.

Consider the possibility of other paths the signal can take when connected to a pipe in a buried chamber for instance. If the pipe is feeding machinery that has electric and water supplies the signal may feed back through these other lines. Little can be done about this but always be aware of all possible paths a signal can take.

Tracing of the target line is normally possible from the point of connection.



Warning

There are potential dangers when connecting to a power cable. The cable may have sheath insulation damage which could mean an accessible part of the cable may be live, or may become live, should a fault occur. Moving the power cable to make space around it for clamping could cause stress to the insulation or conductors which could in turn cause a potentially dangerous defect either instantly or in the future. In either situation the cable is inherently dangerous and not to be touched, with or without a Signal Clamp.

7.1

SIGNAL CLAMP

The Signal Clamp safely applies a transmitter signal to a pipe or a live cable of up to 76 mm (3 in) diameter, without interrupting the supply, in situations where direct connection is not effective.

In Figure 19, A, B, C and D are four conductors from a common source. When a signal is directly connected to D the other three share the signal proportionally according to the line impedance causing A to have a greater signal strength than D.

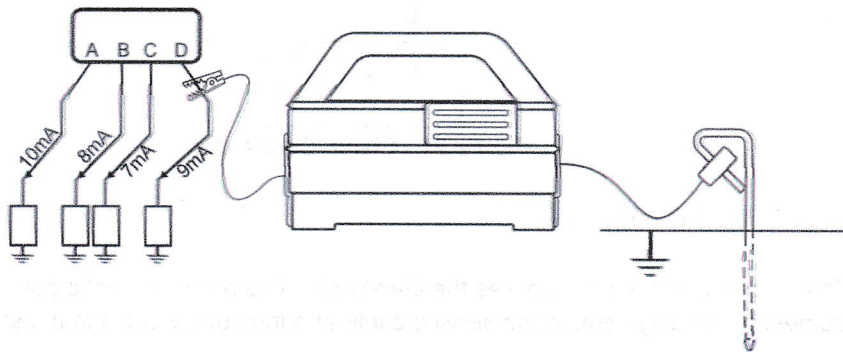


Figure 19 Direct Connection Current Comparison

If conductor D is energized with a Signal Clamp (Figure 20) all the current is through D and then divided among the others. D is clearly identifiable as the conductor with the strongest signal.

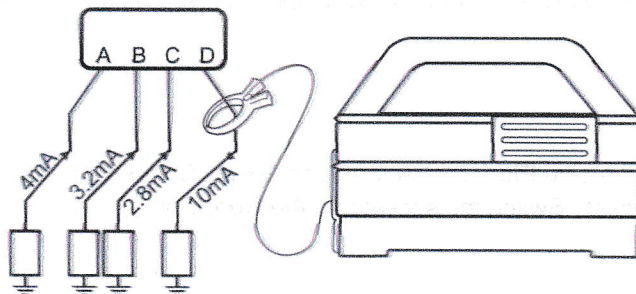


Figure 20 Clamp Connection Current Comparison

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Note:

Two conductors would have equal signal currents.

The conductor must be grounded at both ends. Do not use the Signal Clamp at the end of a pipe or cable unless the end is grounded.

Do not make a ground connection from the Genny when using the Signal Clamp.

7.1.1 Procedure

Plug the Signal Clamp into the Genny Connection Socket.

Place the Signal Clamp around the pipe or cable, ensuring the jaws are closed (Figure 21). Switch the Genny on.

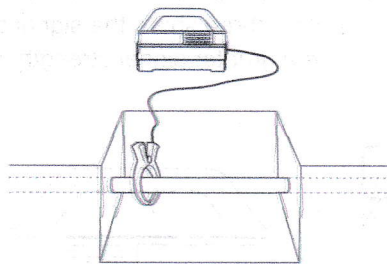


Figure 21 Clamp Connection

7.2 LIVE PLUG CONNECTOR

The Live Plug Connector applies the Genny signal to a live domestic power socket and, via the domestic wiring system, to the service cable and the supply cable in the street.

The signal is applied between the live and ground conductors on a 3-pin plug. The connector can also be fitted with a 2-pin plug with the signal applied between the live and neutral conductors.

The current does not affect domestic appliances. Suitable for system up to 250 V rms from dc to 400 Hz.

7.2.1 Procedure

Connect the Live Plug Connector to the Genny Connection Socket and to the live domestic power socket. Switch the socket and the Genny on.

Note

Live Plug Connector contains a protection unit to protect the user and the Genny from mains voltage up to 250 V

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8

CABLE AVOIDANCE

The Power and Radio sweeps should locate the main conductors, however, some house connections, streetlight cables or metal pipes may not have been detected.

If it is suspected that an unlocated conductor crosses the excavation site, apply the Genny signal at a point where it surfaces.

If there is a metal street light or illuminated sign use the magnet to connect the Genny to the metal support. If this is not possible induce a Genny signal and trace with the C.A.T.

At a nearby building, if possible, apply the Genny signal to an electricity supply cable using a Clamp, or where applicable, a Live Plug Connector.

Connect the Genny to any pipes at a nearby valve or where the pipe is accessible and trace with the C.A.T to check if the cable crosses the excavation site.

Induce the Genny signal either side of any nearby covers and trace with the C.A.T.

Carry out a C.A.T and Genny sweep if the presence of unlocated conductors is still suspected.

If a conductor radiating the Genny signal is located, pinpoint it, then trace it across the excavation site.