PDL-4 A.C.ID-M
System (with GPS)
User Guide

Rev 1 10/2002

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⚠ Safety Notes

The above Safety Alert Symbol is used throughout this User Guide to highlight critical information. Read this information carefully and follow any instructions that may be given.

FCC Statement

Radio Interference

Note: Relevant parts of this equipment have been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Caution: Any changes or modifications made to this product not expressly approved by Radiodetection Ltd could void the user's authority to operate the equipment.

VectorBar 20–Compliance statements

USA

The FCC identification number for the VectorBar 20 is K68AA2614.

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

If the equipment is used in a manner not specified by Radiodetection, the protection provided by the equipment may be impaired.

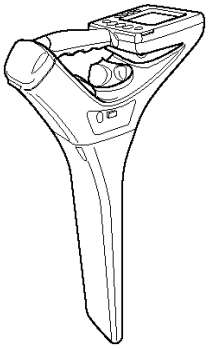
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Warning
The operation of any cable and pipe locator may be affected when used in close proximity to ferrous materials such as manhole covers and parked cars. Keep a one or two meter distance from these objects when taking critical measurements such as depth and current readings. Standing too close to the locator when wearing steel toe-capped boots may also affect the readings.

Radiodetection is committed to a policy of continual product improvement and development. Therefore, there may be slight differences between the screen displays on your equipment and those in this manual. However, the principles of operation will be the same.

PDL-4 A.C.ID-M System (with GPS) User Guide



Introduction

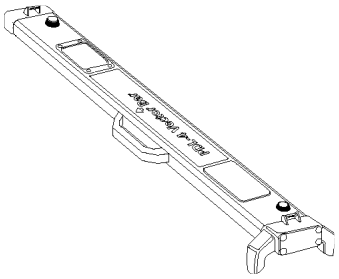
PDL-4 Receiver
The PDL-4 is a portable receiver used for locating and identifying underground cables.

The Global Positioning System (GPS) fitted to the receiver enables the position of cables to be accurately logged and mapped.

When used with the following equipment the PDL-4 will positively identify a cable that emits an A.C.ID-M (Absolute Current Identification-Multi) signal.

- VectorBar
- Extended Range VectorBar
- VectorBar 20
- SmartProbe-2
- Extended Range SmartProbe-2
- LMS-3 or PTx-3 transmitter

The A.C.ID-M signal is described in the LMS-3 Manual.

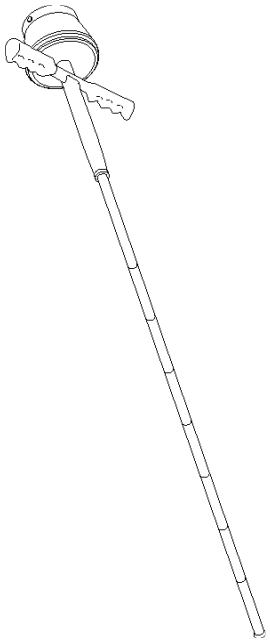


Refer to the LMS-3 Manual and PTx-3 User Guides for transmitter operating instructions.

VectorBar
When placed on the ground over the target cable, and activated, the VectorBar receives the applied A.C.ID-M signal and relays A.C.ID-M status information to the PDL-4 via a short-wave radio link.

Extended Range VectorBar
The extended range VectorBar is tripod mounted and is used to locate cables that are buried too deep to be located by the standard VectorBar. Once assembled the extended range VectorBar operates in the same way as the standard VectorBar.

VectorBar 20
The VectorBar 20 is used to locate cables that are buried too deep to be located by the standard VectorBar. The VectorBar 20 incorporates an extendable arm to enable cables that have been laid at a greater depth to be located. The VectorBar 20 can be used with the arm fully stowed or fully extended. The VectorBar 20 operates in the same way as the standard VectorBar.



SmartProbe-2
When pushed into the ground in close proximity to the target cable, and activated, the SmartProbe-2 receives the applied A.C.ID-M signal and relays A.C.ID-M status information to the PDL-4 via a short-wave radio link.

Extended Range SmartProbe-2
The extended range SmartProbe-2 is used to locate cables that are buried too deep to be located by the standard SmartProbe-2. The extended range SmartProbe-2 operates in the same way as the standard SmartProbe-2 except for an LED (Light Emitting Diode) that illuminates when the unit is activated.

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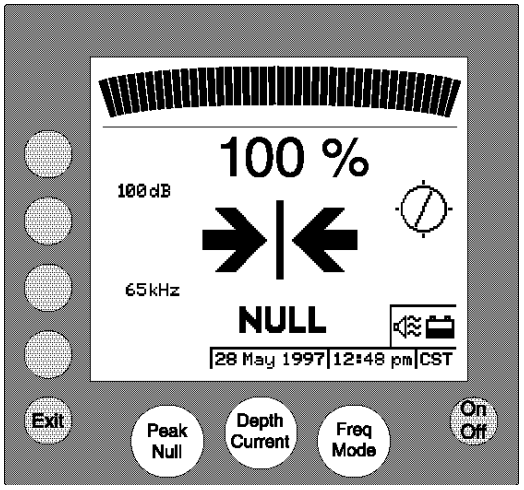


Global Positioning System (GPS)
When the green button on the VectorBar or SmartProbe 2 is pushed the GPS system will automatically calculate the position of the receiver.

PDL-4 Receiver Features

On/Off Key
Press and hold for one second to switch the PDL-4 receiver On or Off.
Display Contrast. With the PDL-4 switched off, press and hold the On/Off key. After a few seconds, the contrast will automatically cycle through its range. Release the On/Off key when a satisfactory display contrast is achieved.

The display contrast can also be set manually. Refer to the Contrast screen in the System Setup menu.

Peak/Null key
Toggles between Peak and Null modes, and indicates the selection on the LCD (Liquid Crystal Display).

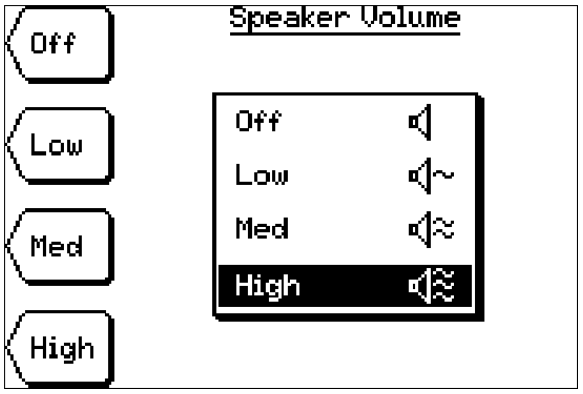
Depth/Current key
Simultaneously displays cable Depth and Current for five seconds. Depth/Current is not available in Power mode.

Freq./Mode key
Cycles through the receiver passive and active operating frequencies.

Menu keys
Pressing a Menu key accesses the Cable Locate Control menu (Perform CD Reset, Confirmation, Log Data options).

Note: When using some frequencies not all of the above options may be available.

Gain Control Paddle
If the signal strength is at maximum or less than 10%, a momentary flick of the control in the appropriate direction will cause the gain to be adjusted to give an approximate bar graph indication of 50%. If the signal strength is below maximum and greater than 10%, the control will adjust the gain in 1dB steps with each momentary flick or by rapid stepping if the control is held when rotated.



In Direct Selection mode, and when using other screens requiring selection from a list, rotate the Gain Control to move the highlight bar up or down. Rotate the gain control to adjust the contrast when the Contrast screen is displayed.

Speaker Sounds
The volume is controllable in four steps: Off, Low, Medium and High, via the menu system.

PDL-4
The speaker sounds are as follows:

1. At switch-on, the speaker will generate a continuous tone for 1 second, at the volume setting last used. If the volume is set to Off, the tone will still be generated, but at the lowest audible level.

2. Whenever a key is pressed, the speaker will generate a confirmation "beep". If the key has a secondary "press and hold" function a higher tone beep will also be generated as soon as the secondary function is initiated.

3. When locating a cable in Null (Left/Right) mode, the speaker will generate a pulsing tone when the cable is to the left of the PDL-4, and a continuous tone when the cable is to the right.

4. When locating a cable in Peak mode, the speaker volume will increase as the cable is neared.

5. When locating a cable in Power mode, the speaker will generate "Signal Sound" - derived from the signal detected, at amplitude proportional to the signal amplitude.

6. Whenever the PDL-4 detects an error condition during a self-test, or at any other time, the speaker will generate the standard low-frequency "Error" tone. This will be a short "beep" if a non-functional key is pressed, or will be for 2 seconds if an error condition is detected.

7. Whenever it is necessary to alert the user, the speaker will generate the standard "Alert" tone. This will be a repeating cycle of 5 rapid "beeps" followed by a four-second pause. The Alert tone will always be generated at the highest audible level, regardless of the speaker volume setting.

Conditions resulting in the Alert tone include:

a) The battery becoming almost exhausted
b) The Inactivity Timer expiring.

When the volume is set to Off, the speaker will still generate key press confirmation "beeps" and the "Error" tone - but at the lowest audible level. When the unit is first switched on, it will select the volume setting last used.

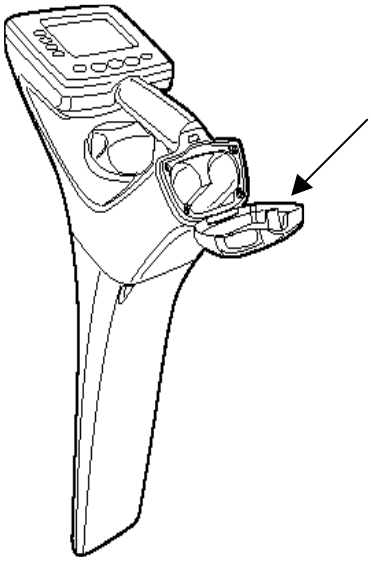
GPS

- When the location and GPS data have been acquired and logged, the sounder will generate a single confirmation “beep”.

Battery Replacement

PDL-4

Warning
Do not mutilate, puncture, or dispose of batteries by placing them in a fire. The batteries can burst or explode, releasing hazardous chemicals.
Discard used batteries in accordance with the manufacturer’s instructions and your local regulations.



Two types of battery can be used, either 4 D-cells, or a single, rechargeable, DR 15AA, Nickel Metal Hydride (NiMH) type. It is not possible to insert both types of battery at the same time.

When the LCD shows a low-battery warning it is necessary to replace the battery.

The battery housing is at the rear of the carrying handle (see illustration).
Before using the locator, ensure that a charged battery (or batteries) is installed and correctly fitted.

Note: When using D-cells replace them as a set. Replacement is the same for both types of battery.

To replace batteries proceed as follows:

- Release battery-housing cover by means of the release catch, situated under the carrying handle
- Remove battery or batteries
- Insert new battery or batteries, ensuring correct installation, as indicated on the label within the battery housing
- Close battery-housing cover.

VectorBar and Extended Range VectorBar
When activated the VectorBar, or extended range VectorBar, transmits its battery status to the PDL-4. If low battery-level is indicated on the PDL-4 display the batteries should be replaced.

Note: To ensure optimum performance of the equipment always replace batteries as a set.

There are two battery compartments, located under separate grey covers, one at each end of the bar. Each cover is attached by 2 quick-release screws and each compartment houses 2 D-cells.

To replace the batteries proceed as follows:
- Unscrew the quick-release screws a quarter of a turn, anti-clockwise
- Remove batteries
- Insert new batteries, ensuring that they are installed correctly, as indicated on the diagram within the battery housing
- Replace covers
- Screw in quick-release screws a quarter of a turn clockwise.

The battery compartment at the green button end of the VectorBar and extended range VectorBar also houses an RS232 socket for software download.

VectorBar 20
When activated, the VectorBar 20 transmits its battery-level status to the PDL-4. If low battery-level is indicated on the PDL-4 display the batteries in the VectorBar 20 should be replaced.

Note: To ensure optimum performance of the VectorBar 20 always replace batteries as a set.

There are two battery compartments, located under separate grey covers placed next to each other. Each cover is attached by 2 quick-release screws, and each compartment houses 2 D-cell batteries.

To replace the batteries proceed as follows:

- Unscrew the quick-release screws a quarter of a turn, anti-clockwise
- Remove batteries
- Insert new batteries, ensuring that they are installed correctly, as indicated on the diagram within the battery housing
- Replace covers
- Screw in quick-release screws a quarter of a turn clockwise.

One battery compartment at also houses an RS232 socket for software download.

SmartProbe-2 & Extended Range SmartProbe-2
When activated the SmartProbe-2, or extended range SmartProbe-2, transmits its battery status to the PDL-4. If low battery-level is indicated on the PDL-4 LCD the battery should be replaced.

The battery is a PP9 cell, located under the black cover on the head of the SmartProbe-2 or extended range SmartProbe-2. The cover is attached by 3 quick-release screw.

To replace the battery proceed as follows:

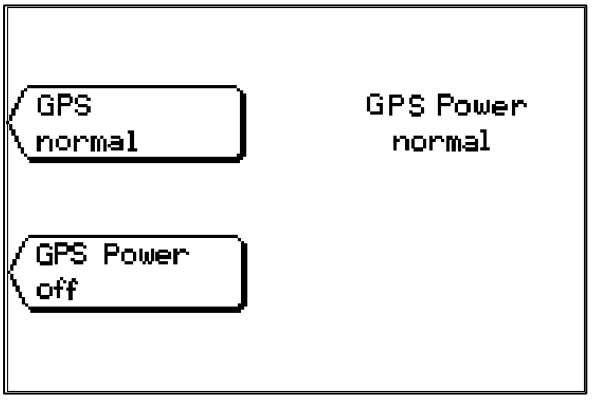
- Unscrew the 3 quick-release screws a quarter of a turn anti-clockwise
- Remove cover

- Remove battery
- Insert new battery, ensuring that it is installed correctly, as indicated on the diagram within the battery housing
- Replace cover
- Screw in the 3 quick-release screws a quarter of a turn clockwise.

The Battery Compartment also houses an RS232 socket for software download.

PDL-4 Operation

Power On/Off
Press and hold the On/Off key for one second. The speaker will emit a tone and the software revision number will be displayed for two seconds. The PDL-4 then enters Cable Locate mode.



Enabling GPS
GPS can be manually enabled or disabled. To change the setting proceed as follows:

- Switch the locator On
- Press the Exit Key
- Press System Menu
- Press User Preferences
- Press GPS Power Options key
- Select option

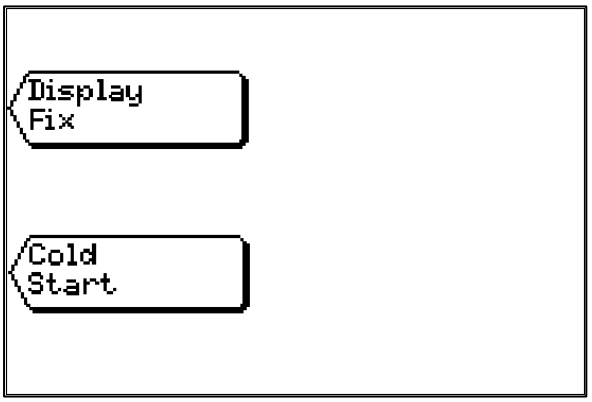
When the locator is switched off, it will remember the last GPS mode it was in.

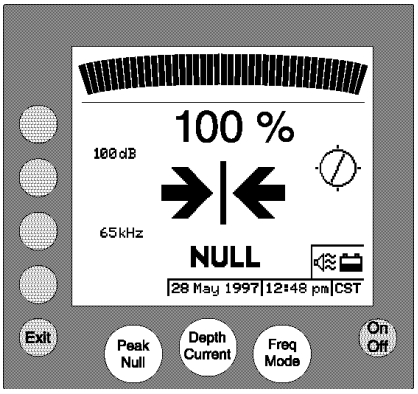
GPS Cold Start
Before using the locator for the first time after delivery from the manufacturer, or if the locator is moved from site to site (over 200 miles), it is necessary to re-align the locator with the GPS satellites. This is done by performing a cold start, as follows:

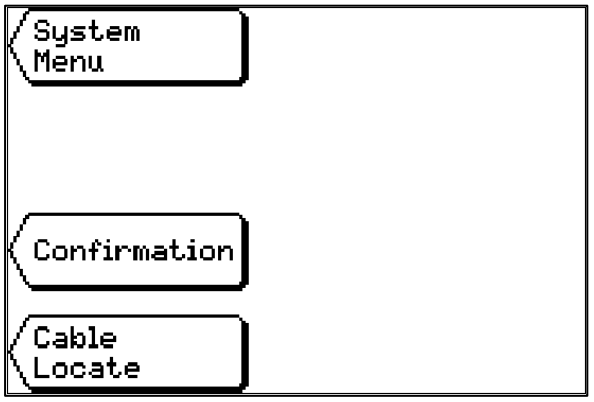
- Switch the locator on.
- Ensure GPS is selected ON (see above)
- A "GPS" icon will be displayed on the screen
- Press the key next to the arrow
- Press the key next to the Cold Start symbol.

Note: This process can take several minutes as the locator re-aligns itself with the position of the GPS satellites.

On successful re-alignment, a confirmation screen will be displayed.







On the screen, "SV's 5" (Solar Vehicles) refers to the number of satellites used to calculate the position during a Cold Start. This number will be 5 or more, depending on the number of satellites providing cover at the time of the fix.

Display Fix
Selecting Display Fix will give a read-out of the current GPS position of the locator. Performing a Display Fix is similar to the procedure for a Cold Start. Instead of pressing the key next to the Cold Start icon, press the key next to the Display Fix icon. The screens will look similar to those of the Cold Start.

Cable Locate Mode
The Cable Locate screen displays the following:

- Bar Graph - Received signal strength, Peak or Null.
- Percentage representation of Bar Graph selection Indication
- Selected gain
- CD arrow - Forward or Reverse
- Cable Orientation Indicator
- Left/Right arrows - Null only
- Selected frequency
- Peak/Null indication
- Battery level indication - five levels
- Speaker Volume - four levels including Off.
- Date, Time and Time Zone
- GPS icon.

Menus
To access the top-level menu screen whilst in Cable Locate Mode press the exit key.

The top-level menu screen displays the following options:
- System Menu.
- Confirmation Mode.
- Cable Locate.

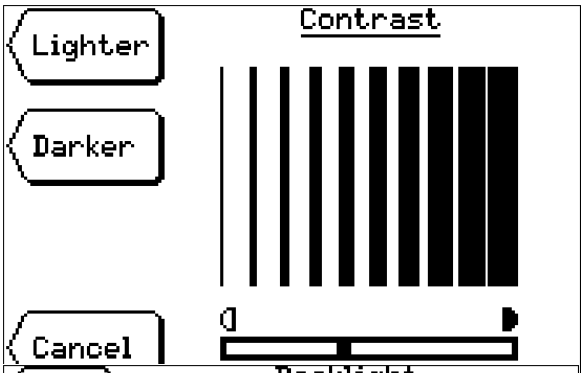
<u>System Menu</u>
To select the System menu press the key next to the System Menu arrow.

System menu options are displayed as follows:

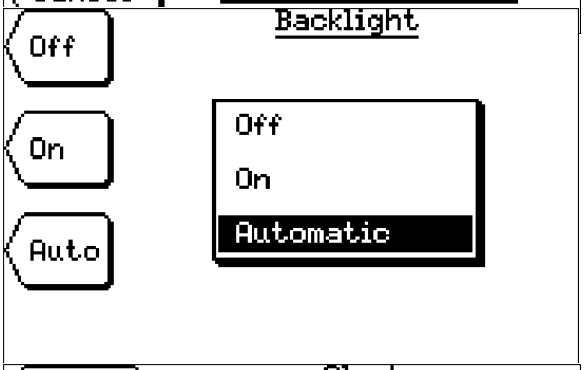
- Volume, Contrast, Backlight, Clock (System Setup).
- Upload, Download, Defaults, Test (System Utilities).
- User Preferences.
- PDL-4 Information.

Options are:

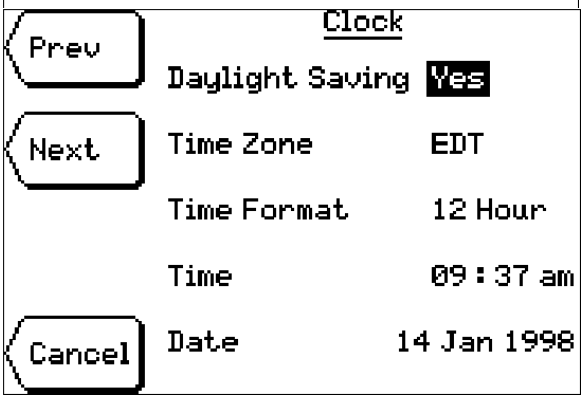
- Volume -
  Off, Low, Med, High.



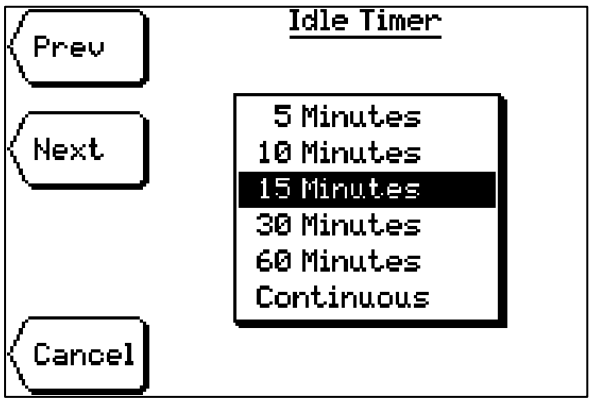
• Contrast –
On screen slider adjusted by Lighter/Darker keys Gain Control.



• Backlight -
Off, On, Auto.

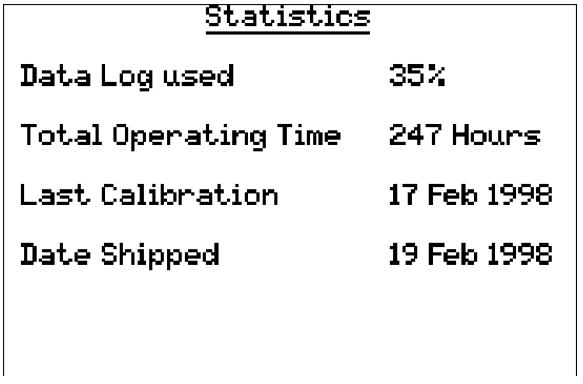


- Clock -Daylight Saving, Time Zone, Time Format, Time, Date.
- Upload, Download, Defaults, Test
  Upload Data Log -
  Start, Cancel.
  Download S/W Upgrade -
  Start, Cancel.
- Restore System Defaults -
  Confirm Restore, Cancel.
- Self-Test –
  Automated tests and results followed by further manual test options.



User Preferences Screen
The User Preferences screen displays the following options:

- GPS power options
- Idle Timer Switch-Off -
  5, 10, 15, 30, 60 Minutes, or Continuous.
- Auto gain-
  Enabled-Disabled



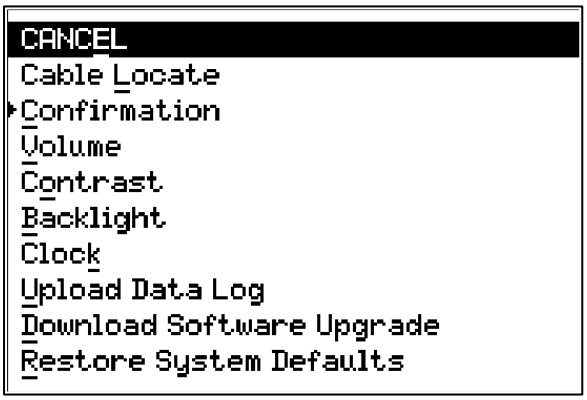
options:
• VectorBar -
VectorBar screen prompts for the green button to be pressed.
• SmartProbe -
SmartProbe screen prompts for the green button to be pressed.
▪ A.C.ID Clamp
• Non A.C.ID Confirmation -
Pot Hole, Confirmation Other options.

Cable Locate
Pressing the cable locate menu key takes the PDL-4 into the cable locate screen.

▪ Feature Configuration-
This feature is for Radiodetection use only.

PDL-4 Information Screen
The PDL-4 Information screen displays the following options:
• Version Status.
Statistics -
Calibration, Date Shipped.
▪ Review A.C.ID Data.

Confirmation Mode
The Confirmation mode screens display the following



Direct Selection

Direct Selection allows quick selection of any menu item from a list, without having to use the menu structure.

Press and hold the Exit key for one second to display the Direct Selection screen.

Select the function required by rotating the Gain Control to move the highlight bar down (clockwise) or up (anti-clockwise) then access that function by pressing the Select key.

VectorBar Operation

Green Button

Press and release to activate the VectorBar - the adjacent LED will illuminate.

To select a specific A.C.ID-M code press the green button until the correct code is displayed on the PDL-4.

To de-activate the VectorBar press and hold the green button for approximately 5 seconds or until the red LED extinguishes.

Graduations

Graduations are provided as a guide to the exact location of the cable or pipe.

VectorBar 20 Operation

Green Button

Press and release to activate the VectorBar 20 - the adjacent red LED will illuminate.

To select a specific A.C.ID-M code press an release the green button until the correct code is displayed on the PDL-4.

To de-activate the VectorBar 20 press and hold the green button for approximately 5 seconds or until the red LED extinguishes.

Arm

The VectorBar 20 must only be used with the arm fully stowed or fully deployed. Do not use the VectorBar 20 if the arm is not in one of these two positions.

To deploy the arm, release the catch on the carrying handle and lift the arm at the green button end of the VectorBar 20. Continue lifting the arm until it is fully extended and locks into the fully deployed position. When the arm is fully deployed, the green LED next to the swivel mechanism will illuminate. To stow the arm lift it at the free end until it swings back into the fully stowed position. Engage the catch in the carrying handle.

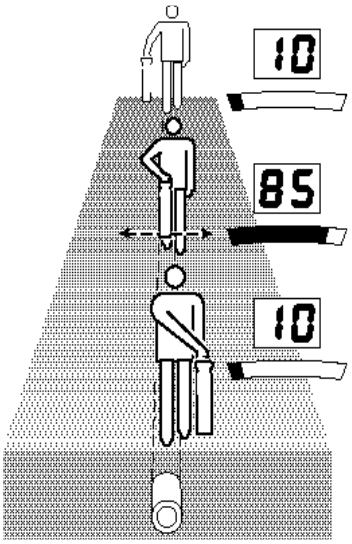
Graduations
Graduations are provided on the side and top of the VectorBar 20 as a guide to the exact location of the cable or pipe.

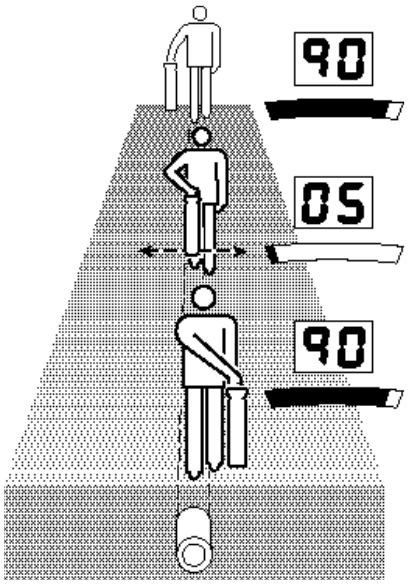
SmartProbe-2 Operation

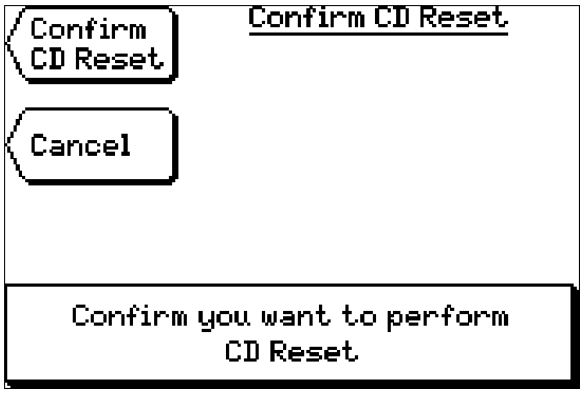
Green Button
Press and release to activate the SmartProbe-2. When the extended range SmartProbe-2 is activated a red LED, located on the head of the unit, will illuminate to indicate activation.

To select a specific A.C.ID-M code press the green button until the correct code is displayed on the PDL-4.

Depth Graduations
Graduations are provided as a guide to the depth of ground penetration.







Tracing Procedure

Tracing the cable between confirmation locations is carried out using both Peak and Null modes. Peak mode is preferred as, in null mode, the signal is easily distorted.

Peak
Rotate the PDL-4 until the orientation line in the centre of the Cable Orientation Indicator is aligned with the North/South marks.

Whilst moving the PDL-4 steadily from side to side, follow the line of maximum response, keeping the blade vertical and maintaining Cable Orientation Indicator alignment.

Null
If required, press the Peak/Null key to select Null mode and follow the path of the target cable. Minimum response, with an increased response on each side, indicates the position of the target cable.

Press the Peak/Null key again to return to Peak mode.

Locate Procedure

Ensure the LMS-3 transmitter is set to CD mode and is energising the correct cable.

If a PTx-3 transmitter is generating the signal, ensure that the LMS-3 is not also energising the cable.

Locate the target cable using Peak mode then check using Null mode.

Ensure that the PDL-4 is in Peak mode before taking measurements.

Current Direction (CD)

CD - Reset
Before using Current Direction information a CD Reset must be carried out.

Set the PDL-4 to CD mode, by pressing the Freq. Mode key until CD is displayed. With your back to the transmitter (facing end ground), hold the receiver blade vertical and across the target cable.

Press the menu key located next to the CD Reset key.

Select 'Perform CD Reset' and when prompted confirm that a CD Reset is required.

'CD Reset Successful' is displayed when the CD Reset is successfully completed. The CD arrow will point away from the transmitter (towards end ground) when the PDL-4 is over the target cable.

Depth/Current
Rest the end of the PDL-4 blade on the ground, centre the level bubble and select Cable Locate Mode, and then press the Depth/Current key to display the target cable depth and current.

Confirmation Procedure

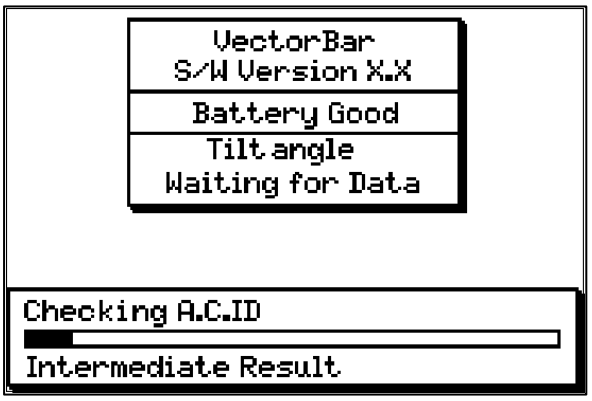
Confirmation mode is used for positive identification of the target cable, and requires an LMS-3 or PTx-3 transmitter to generate the A.C.ID-M signal. Depending on the transmitter being used apply the signal as follows:

LMS-3
- Select CD and A.C.ID-M and apply the signal to the target cable.
- Locate the target cable with the PDL-4 as previously described.

PTX-3
- Select CD or LF and apply the signal to the target cable.
- Locate the cable, with the PDL-4, and mark the approximate position with a suitable marking fluid.
- Select A.C.ID-M on the PTx-3

Cable Identification

VectorBar, VectorBar 20 and Extended Range VectorBar
Place the VectorBar on the ground above the cable, at 90^0 to the cable direction, and with no more than 40^0 tilt from the horizontal on the VectorBar and 30^0 on the Extended Range VectorBar. Ensure that the CD arrow on the VectorBar points away from the transmitter (towards the end ground point). If the VectorBar is placed with the arrow pointing towards the transmitter a “A.C.ID Current Wrong Direction” screen is displayed.
When the LMS-3 or PTx-3 is set to generate the A.C.ID-M signal, press the green button on the VectorBar - the LED will illuminate and remain on. The VectorBar is now searching for the A.C.ID-M signal. For customers with more than one A.C.ID-M code press the button repeatedly until the required A.C.ID-M code is displayed.



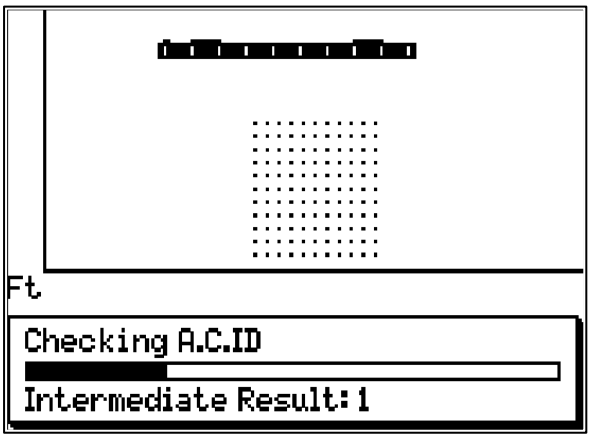
Note: Do not move or touch the VectorBar while it is calculating.

The VectorBar can be deactivated by pressing and holding the green button, until the LED extinguishes.

When the green button is pressed on the VectorBar the PDL-4 will automatically switch to VectorBar mode and display the following information:

VectorBar software version.
VectorBar battery condition.
Tilt angle of bar.
'Waiting for Data'.
'Checking A.C.ID-Mx' progress bar (where x is the customer unique code)
GPS icon.

After approximately 20 seconds (depending on signal strength), the VectorBar will normally transmit initial location data to the PDL-4.



If a GPS position has been fixed the GPS icon will extinguish.

A 'Checking A.C.ID-Mx' progress bar is displayed and as each intermediate result is received from the VectorBar, the PDL-4 increments the Intermediate Result number by one.

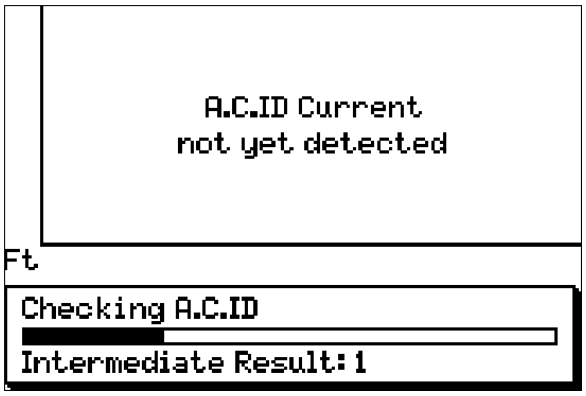
The dotted area represents the region within which the cable has been detected. The size of this area indicates the accuracy achieved by this stage of the measurement cycle.

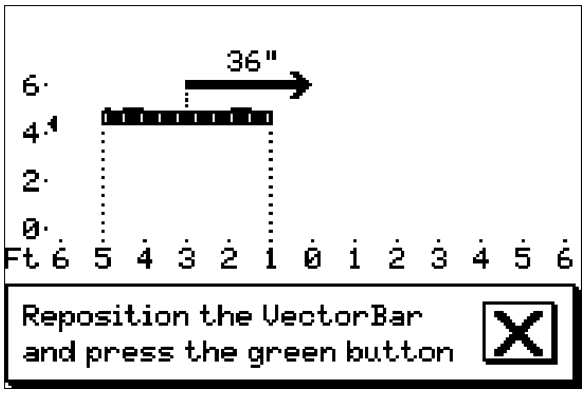
A number of "Intermediate Result" screens may be displayed (at intervals of up to 16 seconds) before the Final Result is displayed. The sequence of Intermediate Result screens may show increasing accuracy (i.e., the size of the dotted region may reduce with each Intermediate Result). It is also possible that the accuracy may not improve with each Intermediate Result, or could even deteriorate, e.g. due to a passing vehicle.

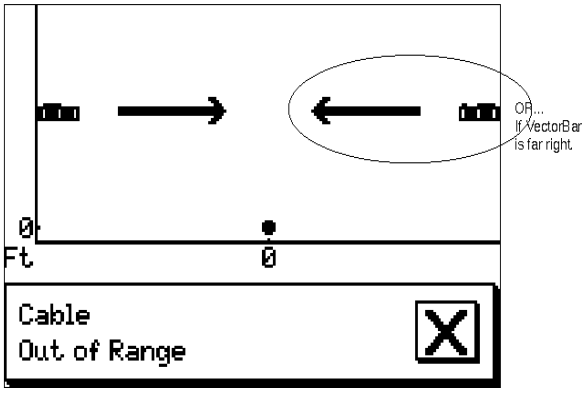
If the VectorBar reports an error, “Error” and a number are displayed on the wake-up screen.
The numbers and corresponding errors are:

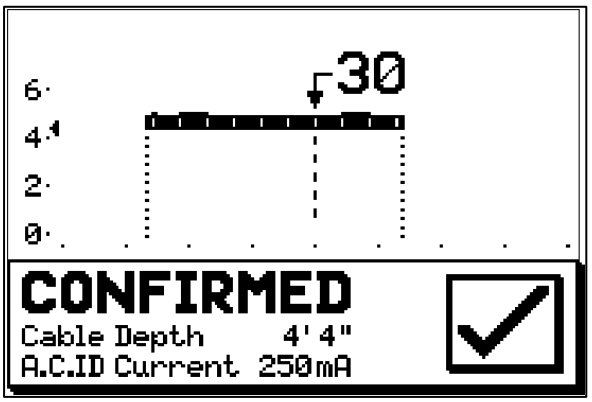
16 Invalid Software Version
32 Invalid Checksum
48 Invalid Calibration

In case of one of these error codes being displayed, contact your local Radiodetection office.
The PDL-4 will report "A.C.ID-M Current not yet detected" if the VectorBar does not detect the









A.C.ID-M signal, and the VectorBar will continue looking.

If the VectorBar is tilted, but by less than 45^0, the Intermediate Result screen is displayed.
If the VectorBar has not been placed above the target cable the 'Reposition the VectorBar' screen will be displayed indicating the distance and direction that the VectorBar must be moved.

If the VectorBar has been placed too far away from the target cable the “Cable out of range” screen will be displayed indicating direction and approximate position of the cable.

If the VectorBar is not correctly aligned at 90^0 to the target cable a Plan View screen is displayed indicating the direction in which the VectorBar
If A.C.ID-M confirmation is not achieved the PDL-4 will display 'Not Confirmed'.

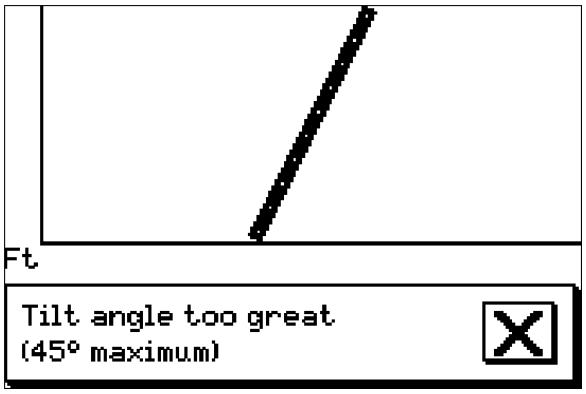
When the A.C.ID-M data has been processed the 'CONFIRMED' screen, possibly the first of several will be displayed. The dotted box represents the region within which the cable is confirmed - the size of the box indicates the accuracy achieved.

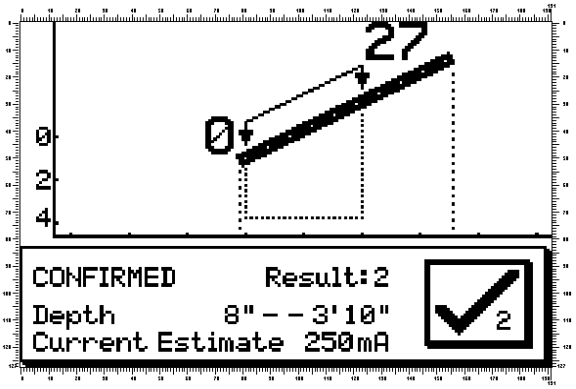
 Indicates A.C.ID-M Confirmation.

A number of Confirmation screens may be displayed (at intervals of up to 16 seconds) before the Final Result is displayed. The sequence of Confirmation screens may show increasing accuracy (i.e. the size of the box may reduce with each Confirmation Result). The Final Result is displayed either when the confirmation box is 6" wide (accuracy +/-3") or the VectorBar times-out after 5 minutes.

If a GPS position fix has been obtained "GPS OK" will be displayed in the bottom left-hand side of the screen.

If "no GPS" is displayed the locator is still obtaining a GPS position fix. Once the fix has been obtained, "GPS OK" is displayed.
When GPS data is not immediately available and the confirm signal from the VectorBar has been received the display will show "Searching for GPS". After a 10 second delay the display will show "Searching for GPS. Press 'EXIT' to log without GPS".





If the EXIT button is pressed depth and current will be logged without GPS data.

If the VectorBar is tilted at an angle of more than 45^0 the 'Tilt angle too great (45^0 maximum)' screen is displayed.

Successful confirmation cannot be achieved until the tilt angle is reduced to less than 45^0.

If the VectorBar is tilted, but at an angle of less than 45^0 the Confirmation screens will be similar to that shown opposite, which shows a Final Confirmation, achieved with A.C.ID-M.

SmartProbe-2 or Extended SmartProbe-2

DANGER
Before pushing the SmartProbe-2 into the ground you must:

Check that the insulating handle grips are not damaged - Do not use a probe with damaged insulation.

Perform a Power mode sweep of the area to check for, and locate, power cables.

Always wear electrically insulating rubber gloves when handling the SmartProbe-2 in the ground.

Use an electrically insulating rubber mat for extra protection.

Depending on transmitter being used apply the signal as follows:

LMS-3

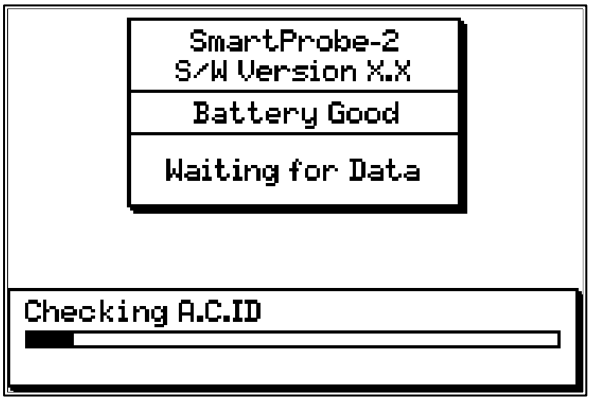
- Select CD and A.C.ID-M and apply the signal to the target cable.
- Locate the target cable with the PDL-4 as previously described.

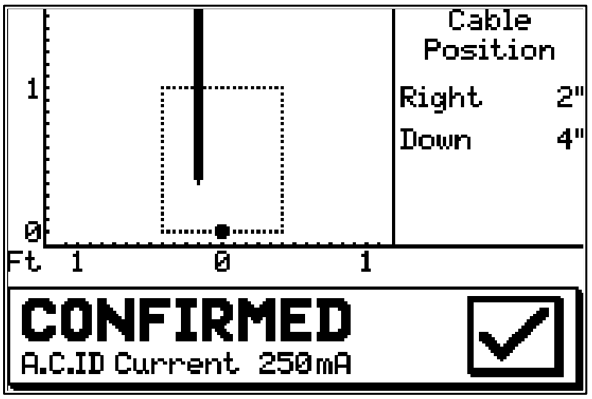
PTX-3

- Select CD or LF and apply the signal to the target cable.
- Locate the cable, with the PDL-4, and mark the approximate position with a suitable marking fluid.
- Select A.C.ID-M on the PTx-3

Push the SmartProbe-2 into the ground so that the tip enters the Confirmation Zone (within 5 inches either side of, and 12 inches above, the target cable) - use the graduations on the probe as a guide.

PDL-4 A.C.ID-M System (with GPS) User Guide





The arrow on the top of the SmartProbe-2 must be pointing along the line of the cable, away from the LMS-3 transmitter (towards the end ground point).

If the ground is hard, it may be necessary to start spade, potholer or MED.

Press the SmartProbe-2 green button. For customers with more than one A.C.ID-M code the button should be pressed repeatedly until the required A.C.ID-M code is displayed.

The PDL-4 will automatically switch to SmartProbe-2 mode and display the following information:

SmartProbe-2 software version.
SmartProbe-2 battery condition.
'Waiting for Data'.
'Checking A.C.ID-M' progress bar

If the SmartProbe-2 reports an error, 'SmartProbe-2 Error' replaces the 'Checking A.C.ID-M' progress bar and 'Error Code' followed by a number replaces 'Waiting for Data'.

SmartProbe-2 Error Codes are:

16	Invalid Software Version
32	Invalid Checksum
48	Invalid Calibration

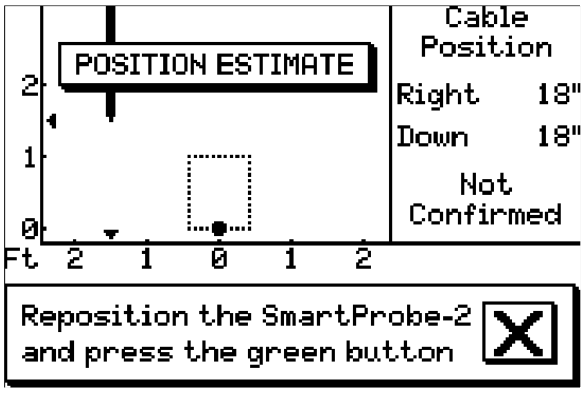
In case of one of these error codes being displayed, contact your local Radiodetection office.

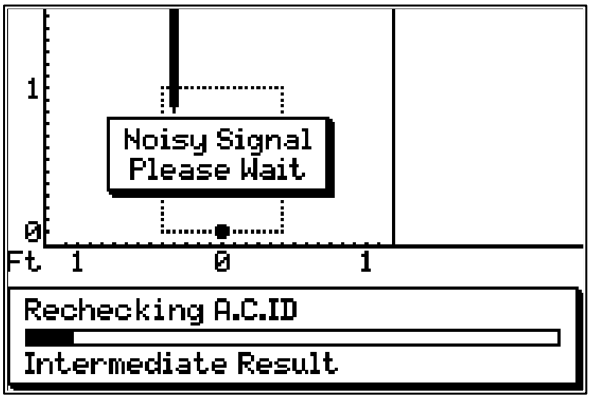
If the tip of the SmartProbe-2 is within the Confirmation Zone, and A.C.ID-M current of a sufficient level is detected, the 'CONFIRMED' ( ) screen is displayed.

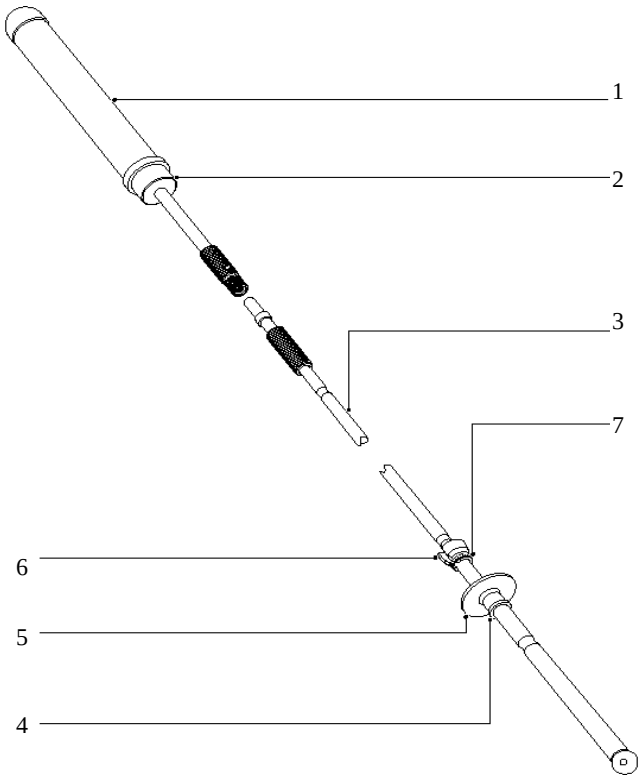
If a GPS position fix has been obtained "GPS OK" will be displayed in the bottom left-hand side of the screen.

If "no GPS" is displayed the locator is still obtaining a GPS position fix. Once the fix has been obtained, "GPS OK" is displayed.

When GPS data is not immediately available and the confirm signal from the SmartProbe 2 has been received the display will show "Searching for GPS". After a 10 second delay the display will show "Searching for GPS. Press 'EXIT' to log without GPS". If the EXIT button is pressed, depth and current will be logged without GPS data.







If the tip of the SmartProbe-2 is outside the Confirmation Zone, but not further than 4 ft from the target cable, the 'Reposition the SmartProbe-2' screen is displayed at one of two zoom levels (maximum horizontal displacements of 2 ft or 4 ft). 'Position Estimate' is displayed across the screen.

If the probe tip is close to or within the Confirmation Zone, and the A.C.ID-M signal is noisy, the SmartProbe-2 will transmit an intermediate result and continue measurement. The PDL-4 displays 'Rechecking A.C.ID-M' and a progress bar.

If the SmartProbe 2 has been placed too far away from the target cable the “Cable out of range” screen will be displayed indicating direction and approximate position of the cable.

If the tip of the SmartProbe-2 is within the confirmation box but at 180^0 to the cable the PDL-4 display will show “Current Direction Wrong".

If A.C.ID-M confirmation is not achieved the PDL-4 will display a 'Not Confirmed'.

Penetration Bar

Assembly
Handle and Penetration Rod
Holding the Handle/Safety Lock assembly (1) with the handle uppermost, ensure that the Safety Lock (2) is turned fully anti-clockwise. This locks the upper part of the rod to the handle.

Screw the Penetration Rod (3) to the Handle/Safety Lock assembly and tighten using two $^7/_8$" AF spanners.

Depth Indicator
Place the Outer Sleeve (4) on a hard surface with the wider inner diameter uppermost then place the Disc (5) on top of the Outer Sleeve. Press down firmly and evenly on the Disc, forcing it to fit into the groove around the Outer Sleeve.

With their wider ends uppermost, place the two Collets (6) on the Penetration Bar and locate them in the desired depth groove. Fit the 'O' ring (7) over the Collets ensuring it is correctly seated in the grooves provided.

With the Disc end uppermost, pass the Outer Sleeve/Disc assembly up the Penetration Bar. Push the Outer Sleeve/Disc assembly over the Collets/'O' ring until the Disc end of the Outer Sleeve is flush with the upper end of the Collets.

Operation
Safety Lock
To release the Safety Lock, rest the tip of the Penetration Bar on the ground and, holding the handle, rotate the Safety Lock $^1/_4$ turn clockwise.

Depth Warning
Raise and lower the handle forcefully to penetrate the ground until the Disc reaches ground level.

Note: If the Disc jumps off the Outer Sleeve this indicates that penetration has exceeded the desired depth.

Further Penetration
Should further penetration be required, remove the Outer Sleeve and Disc, reposition the Collets/'O' ring to the desired depth groove, then carry out the Depth Indicator assembly procedure previously described.

Non A.C.ID Confirmation

Pothole
If it is not possible to use the VectorBar or SmartProbe-2, or if confirmation could not be achieved, it may be necessary to dig a pothole for visual confirmation. Select Pothole then answer 'Yes' or 'No'.

Note: Information will be logged without GPS

Confirmation Other
If it is not possible to confirm the cable's identity using the VectorBar, Smart Probe-2 or by Potholing, confirmation must be achieved by other means, e.g. by referring to plans. Select 'Confirmation Other' then answer 'Yes' or 'No'.

Note: Information will be logged without GPS

Manually logging Data
Although information is automatically logged whenever the locator is used, it is possible to log data manually, as follows:

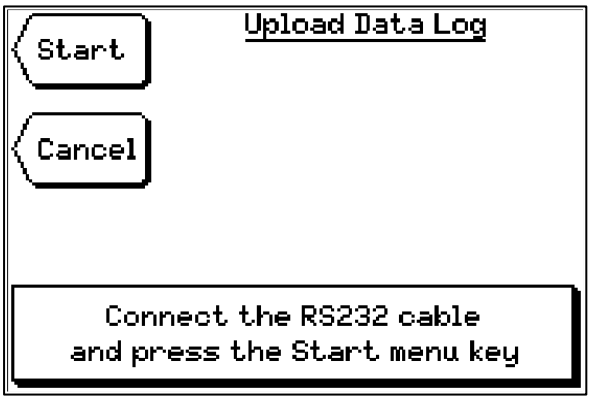
- Switch on locator
- Press and hold down second key from the top (on the left-hand side of the screen
- Select 'Log Data'

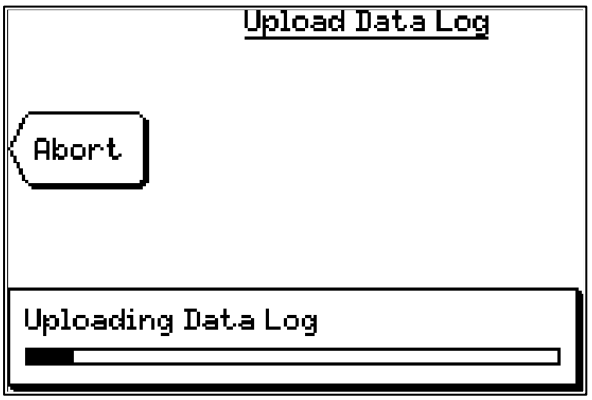
The display returns to the locate screen

If EXIT is pressed, data is logged without logging GPS data.

To log GPS data do not press the EXIT key. GPS information will be logged.

System Utilities
System Utilities are found in the System Menu and provide the following options: Upload Data Log, Download S/W Upgrade, Restore System Defaults and Self-Test.





Note:
Before connecting the PDL-4 to a PC or Laptop PC the following precautions must be taken.

- *To reduce the effect of static electricity, wipe the PDL-4 with a damp cloth.*
- *Wear an earthed wrist strap.*

Upload Data Log
The Upload Data Log option allows the contents of the PDL-4 Data Log, including GPS information, to be uploaded to a PC or LMS-3.

Two methods of upload are available:

- RD Upload-compatible with LMS-3 and PC upload program
- Terminal upload-compatible with Windows HyperTerminal

Connect the PDL-4 to the PC or LMS-3 using an RS232 cable.

Press the Cancel menu key or the Exit key to return to the System Utilities menu screen (without performing an upload).

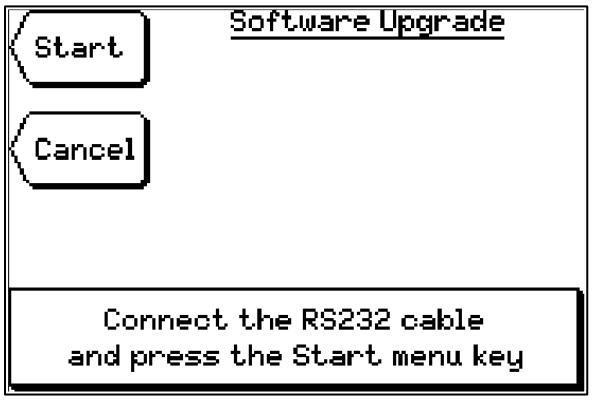
Press the Start menu key to initiate data transfer. The 'Uploading Data Log' progress bar is displayed.

If necessary, press the Abort menu key to terminate the download. 'Upload Aborted!' and 'Press any key' is displayed for five seconds, unless a key is pressed or the Gain Control is operated.

After the Data Log is uploaded to the PC or LMS-3 'Upload Successful Press any key' is displayed.

The Data Log is never deleted; the most recent entry overwrites the oldest.

If the Upload cannot be completed for any reason, 'ERROR' and 'Upload Failed Press any key' is displayed.

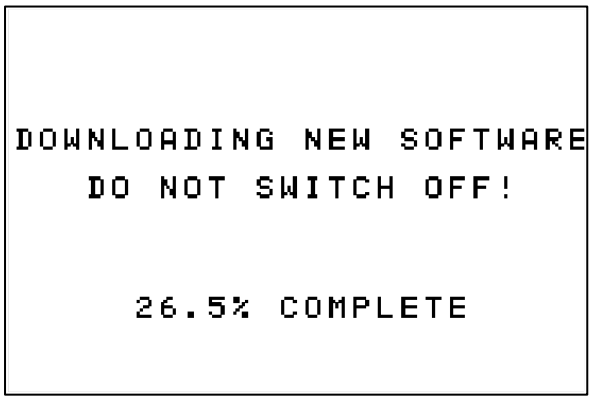


Download Software Upgrade
The Download Software Upgrade option allows new PDL-4 software to be downloaded from a PC or LMS-3.

Connect the PDL-4 to the PC using an RS232 cable.

Press the Cancel menu key or the Exit key to return to the System Utilities menu screen (without performing a download).

Press the Start menu key to initiate data transfer.

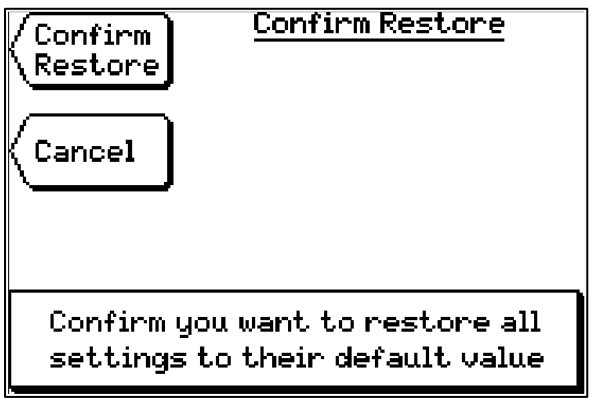


During the download, 'DOWNLOADING NEW SOFTWARE DO NOT SWITCH OFF!' and the data transfer percentage completed is displayed.

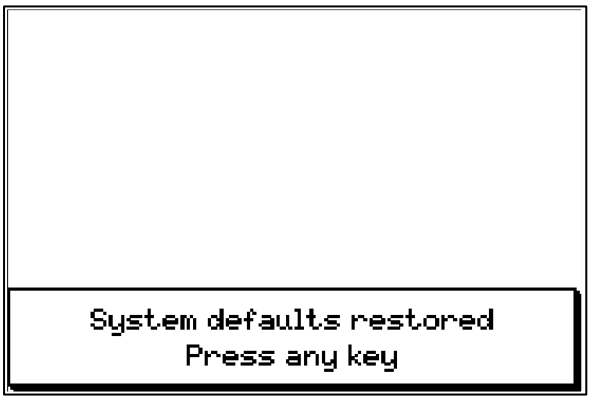
If the download completes successfully, the PDL-4 will reboot with the new software.

If the download fails for any reason, 'DOWNLOAD FAILURE!' is displayed.

If the PDL-4 is switched on when there is no valid software installed 'WAITING FOR SOFTWARE' is displayed.

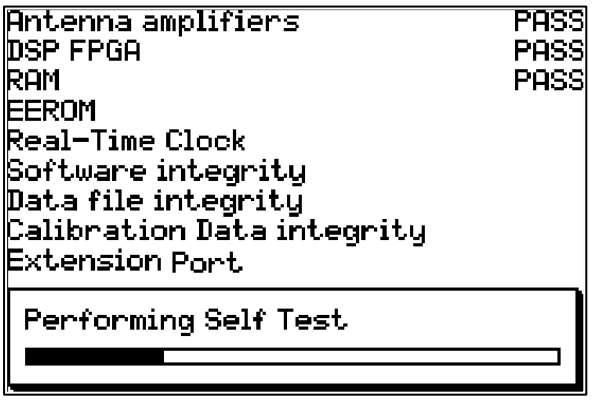


Restore System Defaults
The Restore System Defaults option allows the configuration of the PDL-4 to be set to pre-defined defaults.
Press the Confirm Restore menu key to confirm and initiate the request.



Press the Cancel menu key or the Exit key to return to the System Utilities menu screen (without restoring defaults).

After the defaults are restored 'System defaults restored' is displayed for five seconds (unless any key is pressed or the gain control is operated) and the receiver enters the operating mode last used.



Self-Test
To initiate a Self-Test, press and hold the On/Off key for four seconds or select it from the System Utilities menu.

If the Self-Test was initiated at Power-up the PDL-4 will enter Cable Locate mode on completion of the Self-Test.

If the Self-Test was initiated from the System Utilities menu, control returns to that menu on completion of the Self-Test.

During the Self-Test a list of the automated tests performed and their results are displayed. The 'Performing Self-Test' progress bar is displayed.

On completion of the automated Self-Test, a Pass or Fail screen is displayed with the prompt 'Press any key'.

Pressing any key displays the Optional Tests screen which allows selection of additional manual tests or 'Exit' to stop further testing.

PDL-4 A.C.ID-M System (with GPS) User Guide

GPS User Guidelines

Buildings, foliage, and people can block signals from GPS positioning satellites. The ideal location using GPS is a wide-open space, with an unobstructed view of the sky in all directions. Make sure the unit has an unobstructed view of the sky before trying to obtain a fix.

Trying to obtain GPS readings in poor coverage areas may result in longer fix times and reduced PDL-4 battery life. To maintain battery life when locating in an inner city area, or any other area where poor coverage is to be expected, always select the GPS OFF option from the user preferences menu.

Do not leave the unit idling (waiting for a fix to be displayed) in the Display Fix mode for more than two minutes, as this will drain the battery.

Because GPS positioning satellites orbit the globe the actual number available for position fixing varies during the day. Long term testing has shown that occasional signal dropouts can occur where no coverage is available, regardless of location. As satellites appear over the horizon at least every 30 minutes, it is worth trying to obtain a position fix in difficult GPS locations at different times of the day.

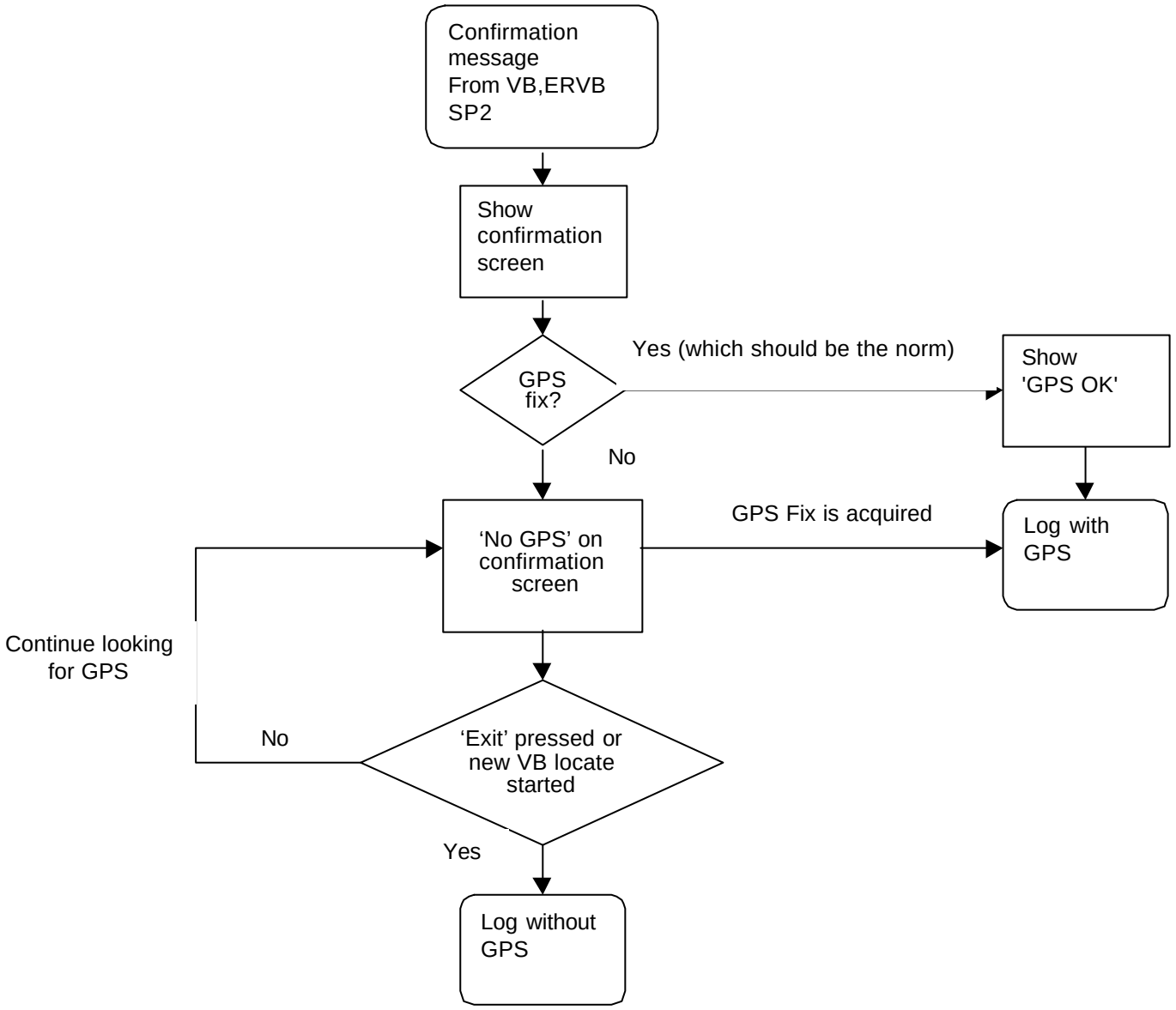
The following guidelines will help in establishing consistent PDL-4 GPS performance.

- Avoid having people crowd around the GPS antenna during a fix.
- Hold the unit away from the body with the face of the GPS antenna flat to the sky.
- Keep the receiver stationary during a fix, as even slight movements will affect the signal levels from the satellites reaching the antenna.
- Poor or non-existent coverage is to be expected when locating in built-up inner city locations.
- Keep cell telephones, hand held radios and laptop computers away from the GPS antenna during use.
- If the receiver is transported several hundred miles or more it will require a manual cold start command to re-acquire its new position; this may take several minutes.
- The cold start key can be used to reset the GPS receiver at any time, but frequent use is to be avoided as fix times are extended and battery life reduced.
- PDL-4 GPS performance is comparable with commercial hand held units, but varying satellite patterns in the sky will favour different types of GPS antenna so direct comparison may be misleading.

The GPS performance is not affected by cloud cover, rain, or temperature.

The GPS will not work indoors.

Flowchart Showing When GPS Data is Logged on Locate Confirmation



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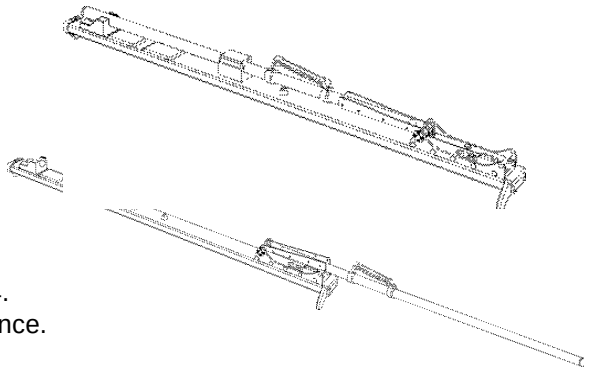
VectorBar 20 Technical Specification



Description: VB20 VectorBar.

Part No: 10/AA2614.

Physical:

Construction: Aluminium Extrusion weatherproof to IP54.
Extending arm to improve depth performance.

Ruggedness: Withstands 0.6 metre (2 ft) drops onto concrete (BS EN 60068-2).

Dimensions
(with arm stowed): 19(H) x 186(W) x 19(D) cm.
7.5(H) x 73(W) x 7.5(D) in.

(with arm deployed): 27(H) X 292(W) X 19(D) cm.
10.5(H) X 115(W) X 7.5(D) in.

Shipping Box Size: 25(H) x 200(W) x 30(D) cm.
10(H) x 79(W) x 12(D) in.

Weight: 8 kg (17.6 lb).

Shipping Weight: 11kg (24 lb).

Operating Modes:

Frequency	Sensitivity @ 2.7m	Max. Locating Depth (m)
A.C.ID 1	100 mA	2.7m
A.C.ID 2	100 mA	6m
A.C.ID M	100 mA	6m

Locate Accuracy: Better than 5% of depth on an undistorted signal and with no adjacent signals.

Search Sensors: Six Magnetometers.

Batteries: 4 x LR20 (D) 1.5 V alkaline. 8 hours life, nominal @ 20 °C (68 °F) intermittent use.

PDL-4 A.C.ID-M System (with GPS) User Guide

Operating Temperature Range: - 20 °C to +50 °C (- 4 °F to +122 °F).

Environmental Protection:

Shock	BS EN 60068-2-29.
Vibration	BS EN 60068-2-6.
Freefall	BS EN 60068-2-32.
Dust and Water Resistance	BS EN 60529 (IP 54).

Miscellaneous:

Options	Tilt Sensor.
Compatibility	Radiodetection PDL-4 Locator, Handheld Data Viewer.
Quality Control	BS5750/ISO 9001/EN29001.
Compliance	Part 15 FCC.
Warranty	12 months.