MicroCALL+ User Manual

Palmer Environmental Ltd
Ty Coch House
Llantarnam Park Way
Cwmbran
NP44 3AW
United Kingdom

Tel: +44 (0) 1633 489479
Fax: +44 (0) 1633 877857
Email: info@palmer.co.uk
Web: www.palmer.co.uk

MicroCALL+ User Manual

MAN-066-0001

Issue A

Date 01/02/08

Written by JP

Contents

Introduction

The MicroCALL+ combines the power, graphics and ease of use of a PC based leak noise Correlator into a handheld unit. Featuring a high visibility LCD display with advanced detection features, the intelligent software includes automatic 3-outstation functionality for improved pinpointing results and reduced dry holes. Redesigned radio outstations offer more compact packaging and portability.
The system builds on the proven reputation of MicroCorr Correlators and includes advanced features only previously available in Palmer's DigiCALL PC based unit to maximise performance, ease of use and rugged compact packaging for daily deployment.

Headphones can be connected to the Basestation unit in listening mode to hear the leak noise detected by the Outstations. A database of filter options and presets are also available within the unit to increase accuracy when being used in areas with a high level of ambient noise. Digital sensors, radio transmission and intelligent processing ensure the highest level of performance.

The Basestation unit and Outstations are fully injection-moulded housings, providing maximum strength and durability. The Basestation unit incorporates an external antenna and a magmount antenna (optional extra) that may be connected that can provide longer correlation distances if the Basestation is vehicle-based. External antennae are used with the Outstations.

Connectors are to military specification and cables are fitted with strain relief to protect against fatigue damage and help eliminate external noise interference.

Principle of Correlation

In the "classic" correlation process, two sensors are deployed on pipe fittings ("dry" connection) or connected to hydrants ("wet" connection).

The sensors are positioned either side of the suspected leak position. Noise is created by the leak as it escapes from the pipe under pressure.

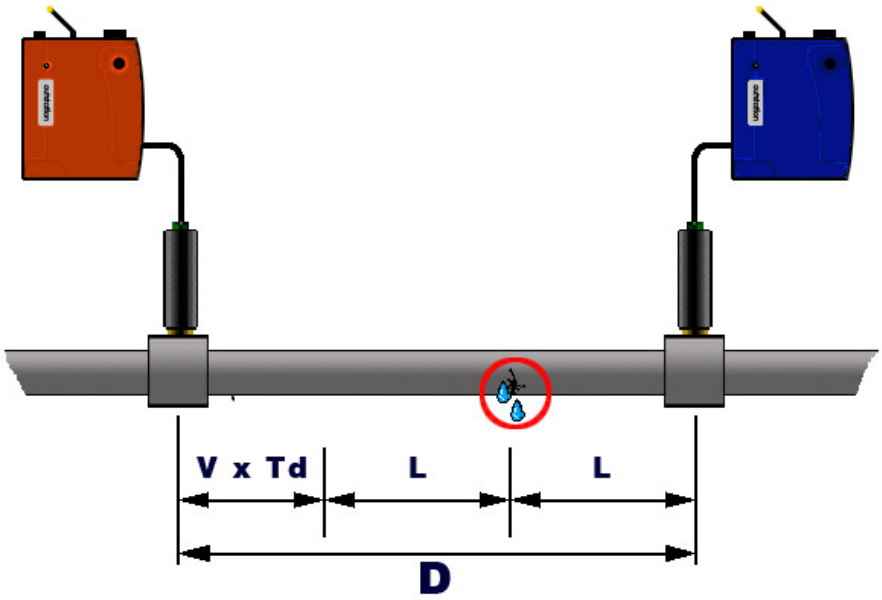
This noise is conducted in both directions away from the leak through the pipe wall (as minute vibrations) and through the water column (as a pressure wave).

The leak noise travels at a constant velocity (V), which depends on the material and diameter of the pipe, and arrives first at the sensor nearer the leak.

The arrival time at each sensor is registered. The difference (Td) between the two arrival times, combined with knowledge of the sound velocity which is provided by the pipe type and length, allows the leak position to be calculated by the correlator.

Depending on the environmental conditions, accuracy of leak pinpointing can be within centimetres.

Principle of correlation can be defined by: L = ½ (D-(VxTd)) and is shown graphically below:



Battery Installation and Charging

BATTERY WARNING

All batteries supplied are rechargeable lithium ion. Do not short-circuit these batteries. Any misuse may result in explosion or fire. They must not be used in any other application or used with any other equipment. Only batteries/battery-packs supplied by Palmer Environmental must be used.

The sealed battery packs contain circuitry to prevent overcharging and over-discharging.

NOTE: If the system is going to be stored for any length of time, to ensure long life of batteries it is recommended that they are charged to approx. 1/4 of capacity.

The battery packs for the Basestation and Outstations are supplied as separate items and will need to be installed and fully charged before use. Two battery chargers are supplied that are capable of charging all components of the system.

To charge the batteries they must be installed in the unit.

Unscrew the quick release screws on the underside of the Basestation and Outstations, remove the battery covers, connect the battery to the internal connector and fit the battery, ensuring the battery leads are fitted neatly inside the battery compartment.

Refit the cover and tighten the screws. Attach the battery charge lead to the headphone/charge connector on the top of the Basestation and Outstations. The units will turn themselves on to charge.

All Outstations may be charged simultaneously using the supplied Chargers. Only batteries with the correct specification and type must be used. These are available from Palmer Environmental should replacements be required.

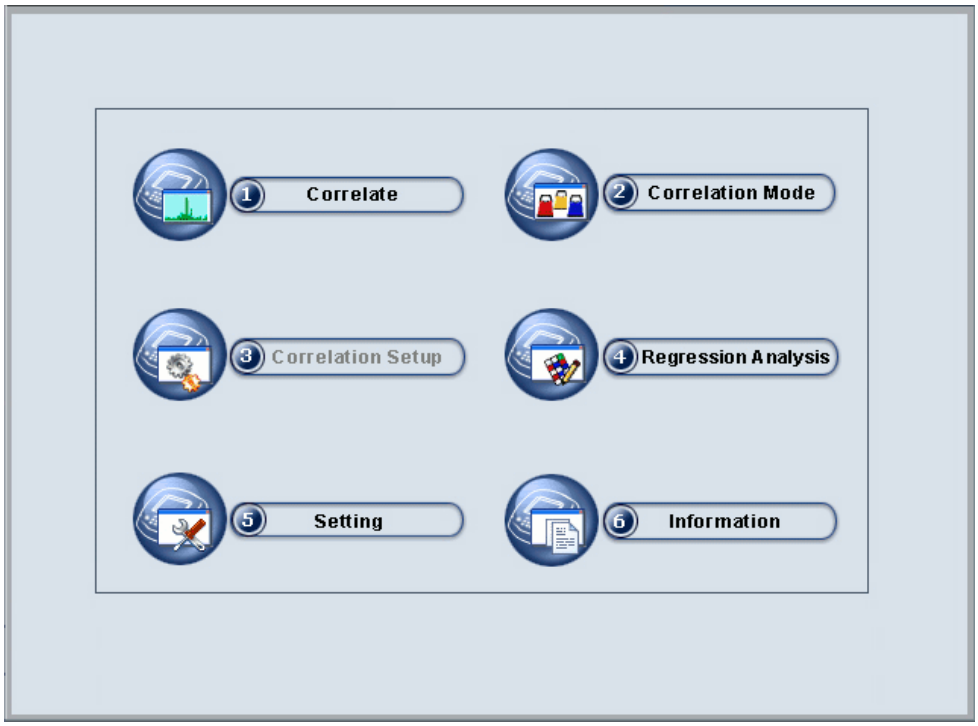
All batteries are identical and are interchangeable. Charging for all batteries takes up to 6 hours from flat, although an overnight charge is recommended for maximum performance.

Batteries should be removed from the units during extensive periods of storage.

Switching on the Basestation

Switch the Basestation on by pressing the On/Off key momentarily. A number of system tests and calibrations are carried out on power up to ensure the unit is fully functional.

After a few seconds the main screen will appear on the display as shown below:



From the main screen select the required menu/function by pressing the assigned key.

Press key 1 to enter the Correlate screen
Press key 2 to select Correlation Mode - two- or three-station correlation
Press key 3 to enter the Correlation Setup screen
Press key 4 to enter the Regression Analysis screen
Press key 5 to enter the Settings menu
Press key 6 to view Information menu.

Detailed information on each option is described on the following pages.

To turn the Basestation off, press and hold the On/Off key for 5 seconds until the backlight goes out.

Outstation Deployment

Once the batteries have been installed and charged in the Basestation and the Outstations, connect the antennas, sensor cables and sensors to each Outstation.

Switch on each Outstation by pressing the On/Off button. The LED will flash Orange then Green (or Yellow/Red depending on battery status) to indicate the unit is ready for use.

To turn the Outstations off, press and hold the On/Off button momentarily. The LED will light Red then go off. When the LED has gone off, the button can be released.

To check the sensors are working correctly, connect the headphones to the Outstation and listen while running your finger over the sensor magnet. A clear crisp noise should be heard.

Deploy each sensor on a water pipe fitting either side of the suspected leak position. The sensor has a strong magnet that will enable it to remain in position on steel/iron fittings.

Always ensure the contact point is free from dirt so that the magnet makes a good contact. We recommend the use of a wire brush to clean the pipe/valve/hydrant fitting prior to attaching the sensor.

Outstation LED Functions:

The Outstation incorporates an LED, which provides the following information:

During charge:

The LED flashes red at the start of charging. When the charging current starts to fall, the LED indication changes to a yellow flash. When charging is complete, the LED will flash green.

During deployment:

When the unit is on and performing normally, the LED flashes Green briefly once a second. To indicate battery status the LED will change from Green to Yellow and Red. With the LED flashing Yellow, the battery is OK. A Red flashing LED indicates the battery requires immediate charging.

If the Outstation is off and the system is not on charge, the LED is off.

Operating the Basestation

The Basestation has an alpha-numeric keypad, similar to that of a mobile phone. Keys include a full stop, cancel, enter and up/down arrows. Navigation through the menus uses combinations of these keys. Most functions can be selected by the number displayed on screen.

Moving around the system is done via the numeric keys. Each page, function and menu has a corresponding key to select that page, function or menu. The relevant key to select is displayed on the screen.

- The up/down arrows select items within a list and move the cursor on the graph.
- Numbers 0—9 are used to select the required menu or function.
- Enter accepts any changes or saves current settings
- Cancel disregards any changes and moves to previous page or menu.

Text Mode:

Entering text is similar to enter text on a mobile phone. Pressing key 2 several times toggles between 2, A, B and C. Key 3 toggles through 3, D, E and F and so forth. Key 0 enters a space and . enters a full stop. The arrow keys enter a < or > respectively. Key 1 only enters the number 1, there is no text function.

Function Keys:

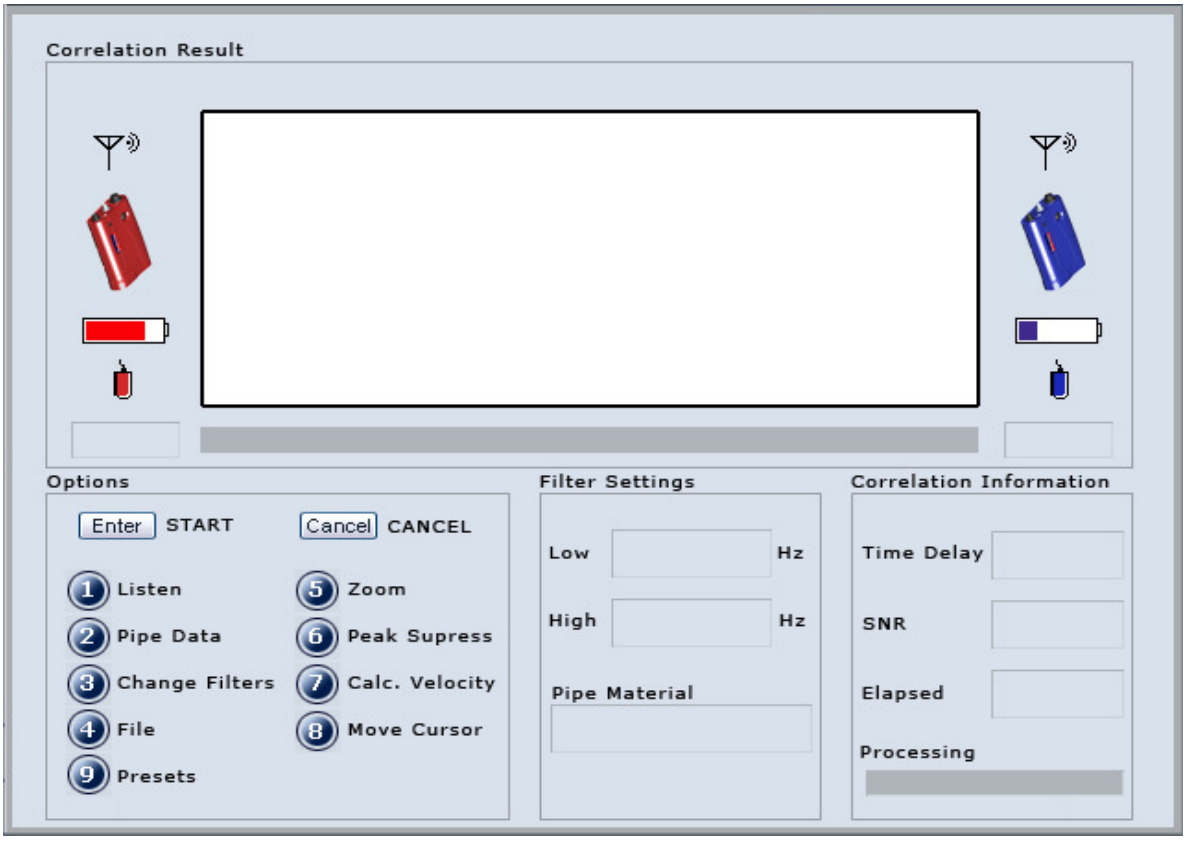
On / Off Key

Arrow Keys

Enter Key

Correlate

Selecting Correlate (key 1) from the main screen opens the correlation screen. With the Outstations deployed and turned on, press the Enter key to start the correlation. Correlation can be stopped at any time by pressing the Enter key a second time.



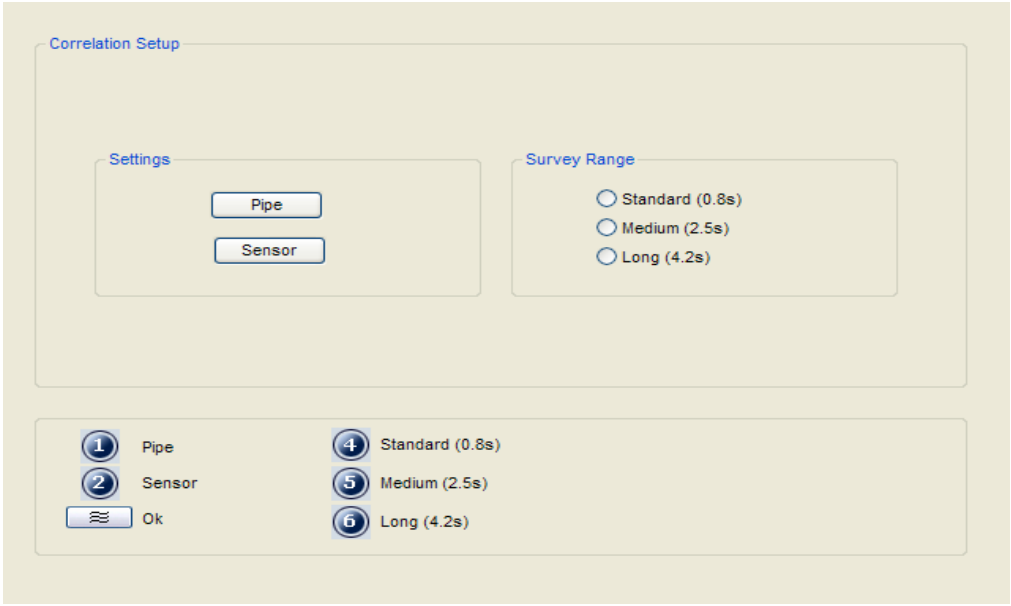
Press Enter key for Correlation Set-up

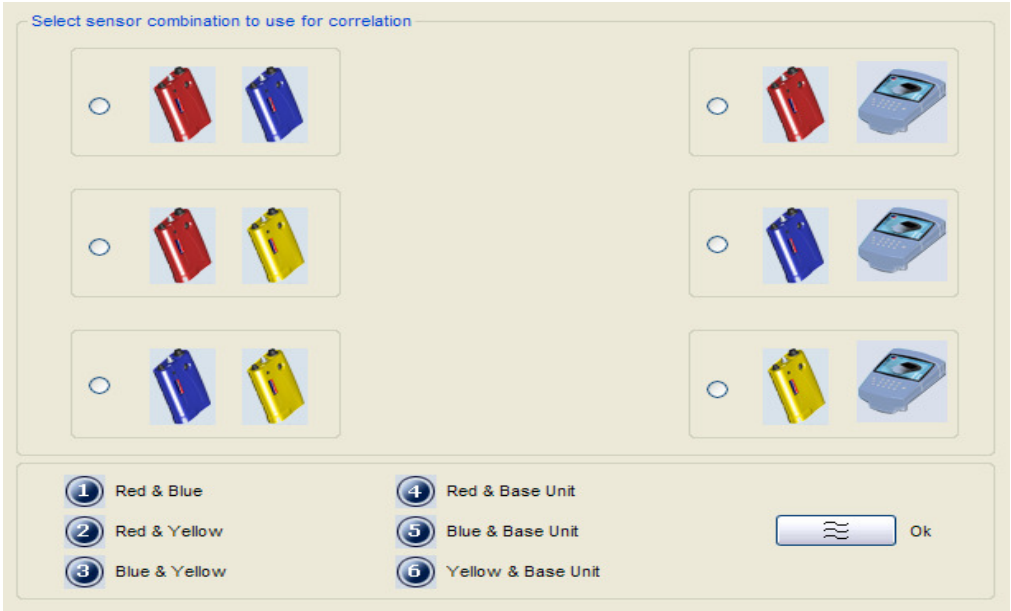
Press Enter again to start Correlation

Press Enter a third time to stop Correlation.

Correlation Setup

The Stations to be used for Correlation are selectable.





Correlation Mode

Either 2 station or 3 station.

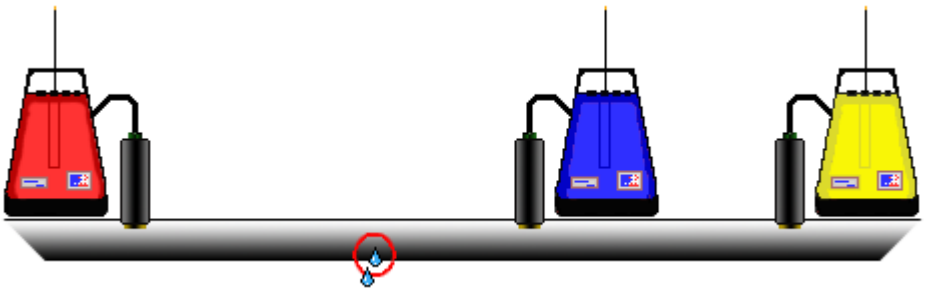
2 Station is standard mode at power-up when using it the Correlator estimates the velocity of sounds in the pipe work from user selected pipe material and diameter. This mode is also used in stations that contain more than one pipe material, results from this mode can be combined in a linear regression calculation to improve on the accuracy of the velocity calculation.
A more accurate velocity ensures more accurate reporting of the leak position.

3 Station requires red, blue and yellow (optional) outstations, this can be used in situations where the pipe material is the same throughout the run. The velocity is automatically determined when using this mode.

To set up the software for three-station correlation (Tri-Correlation), each of the Out-stations must be positioned relative to each other as shown below.

The sensors must always be placed in the same order on the pipe being surveyed.

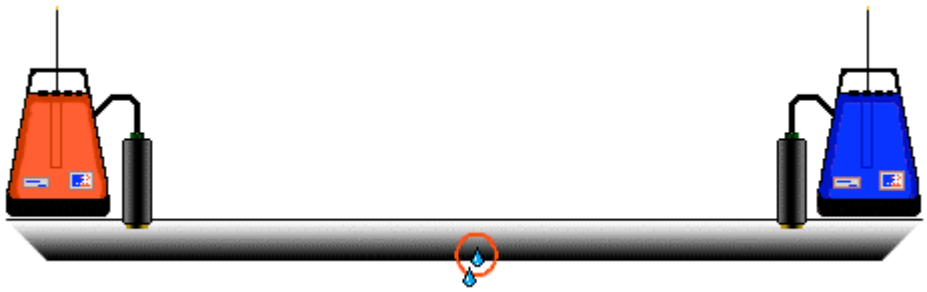
i.e. left-to-right - red, then blue, then yellow, as shown below.



Calculate Velocity

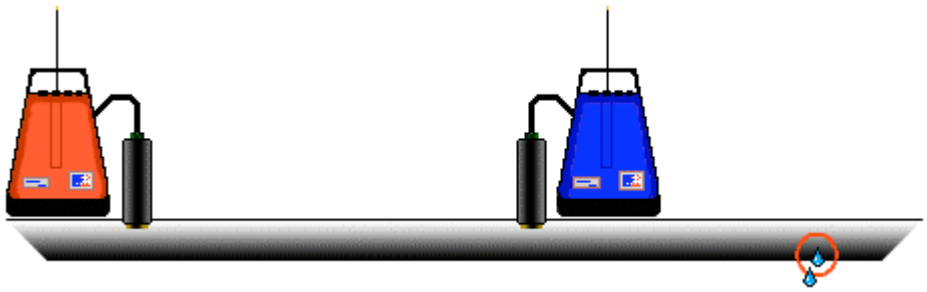
A velocity check gives a more accurate velocity of the pipe to be correlated instead of using the default velocity value. In some circumstances the default velocity may be slightly off due to adverse conditions, therefore it may be required that a manual velocity check be performed to ensure a correct correlation.

To calculate the velocity a leak must be present, either real or induced. The leak can either be between the sensors called an "In Bracket" check, see below:



In Bracket – Leak is between Sensor

Or outside of the sensors called an "Out of Bracket" check, shown below.



Out of Bracket – Leak is outside of Sensors

Unlike correlation, where the more central the leak is positioned between the sensors, the more accurate the result, a velocity check requires the leak to be positioned closer to one of the sensors to create a larger time delay.

The procedure for a velocity check is to position your sensors as described above. Induce your leak or use the real leak. Correlate as normal entering the correct pipe data. After a good correlation peak, stop correlating and select "Velocity Calculation" from the "Settings" menu.

It is worth noting that a velocity calculation is not required for 3 station correlation.

Peak Suppression Screen

Press 6(Peak Suppression) To suppress a section of the time delay range from the current correlation. This may be used to remove known leaks or demand usage that may be hiding unknown leaks.

Move the dashed cursor line to the start point of the data to be removed and press 1 to select a start point. A small arrow will appear below the correlation graph. Move the dashed cursor line along the data to select the stop point. Press 1 again and the section of the data to be suppressed will disappear from the correlation graph as shown below.

Press Enter to accept the data and a new correlation can be carried out without the suppressed data. To replace the removed data press 2 delete.

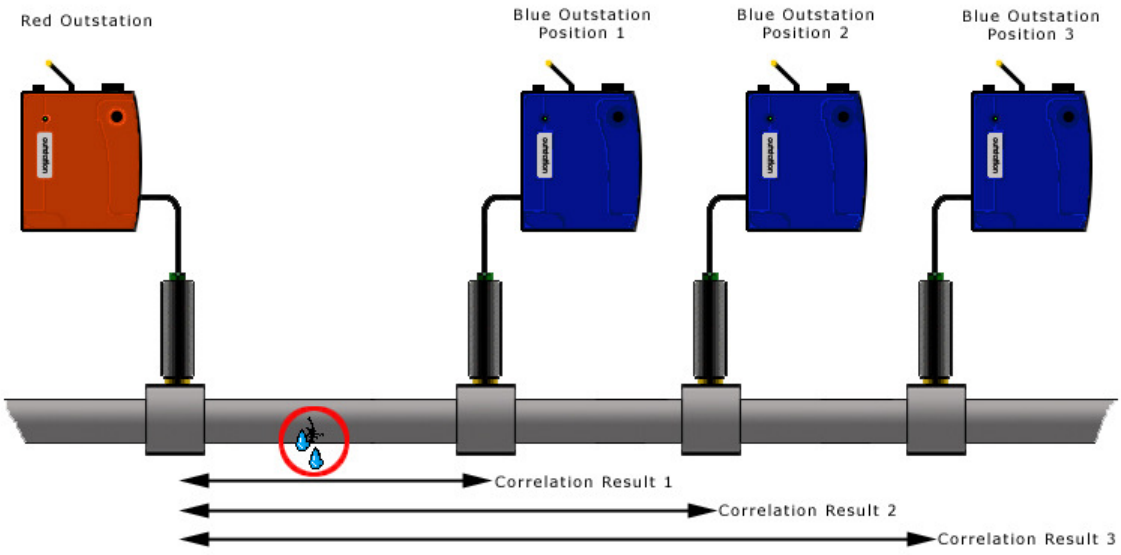
Regression Analysis

Regression Analysis provides an additional way of pinpointing leak positions by using a set of correlation results, rather than an individual correlation result. This also provides a way of measuring an accurate velocity.

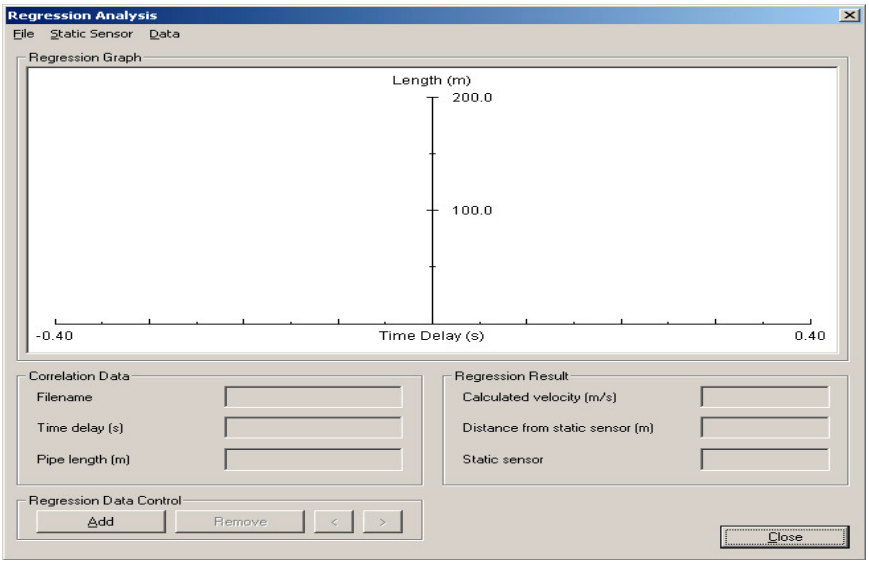
Where the same pipe material and diameter are used within the network, the time delay / distance relationship of the correlation is theoretically linear. As the distance between a sensor and the leak noise increases, the time taken for the sound to reach the sensor increases proportionally with the distance. For example, if you move the sensor twice as far away, the sound will take twice as long to reach it. It is this linear relationship that makes it possible to determine the sound speed and therefore the leak point automatically when using a set of correlation results.

Before the regression analysis feature can be used, correlations must have been saved on the control unit. For an accurate result it is recommended to save three or more correlations, but obeying the following rule :-

One of the sensors must remain static during the collection of data. Which of the sensors does not matter.

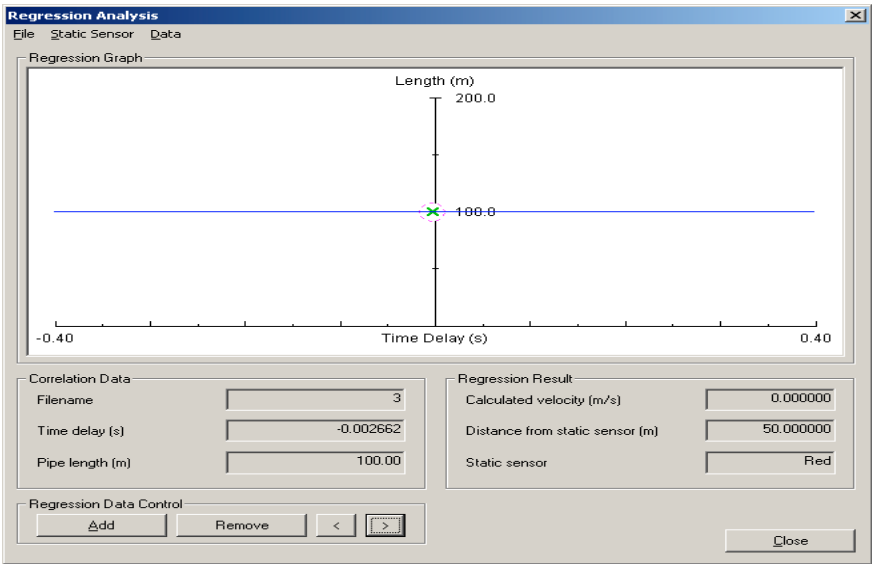


After at least two correlation results have been saved, from the main screen, press 4 (Regression Analysis). Press 1 to add the first result. At this point the file screen will appear. Select one of the saved correlations.



The control unit will then ask for the "Static Outstation" colour. (This is the outstation that was not moved during the correlations.) The control unit will store the material and diameter of the first correlation result and compare with the next result(s) to be added, this ensures these details remain constant.

A regression analysis graph will appear showing time delay and distance. A cross will appear on the graph showing the length of pipework between the sensors and the measured time delay.



Press 1 to add the second correlation result. A second cross will appear and a line will pass through both. The distance from the static sensor to the leak and the calculated velocity will be shown. We highly recommend the user add a third result for a more confident result.

If you have taken a third correlation result, press 1 again to add it. A third cross will appear and a best fit line will pass through or near the three crosses. The distance from the static sensor to the leak and the calculated velocity will be improved.
Note that it is possible to add further correlation results taken at different distances from the leak, which will further refine the results.

Further linear regression options are as follows:

Pressing 2 allows you to remove a suspicious correlation—one that does not appear to be accurate in comparison to the other data points. Those that are accurate should lie close to the plotted straight line. Use Up/Down to select the inaccurate result, then press 2 to remove it.
Pressing 3 (File info) shows any information that pertains to the currently-selected result.
Pressing 4 (New) clears the results and allows you to start a new linear regression calculation.

Settings

Options **1,2** and **3** allow the setting of length units both Metric and Imperial and the time units selectable are seconds or milliseconds, radio power can be low or high. High—gives greater range but shortens battery life.

Option **4**, this allows access to the pipe material database where you can define your own materials also velocities for specific diameters.

Option **5,** system setting sub-menu:

Press key 1 to set-up time intervals after which the specified period of inactivity switches the backlight off.

Press key 2 to adjust of backlight level and brightness.

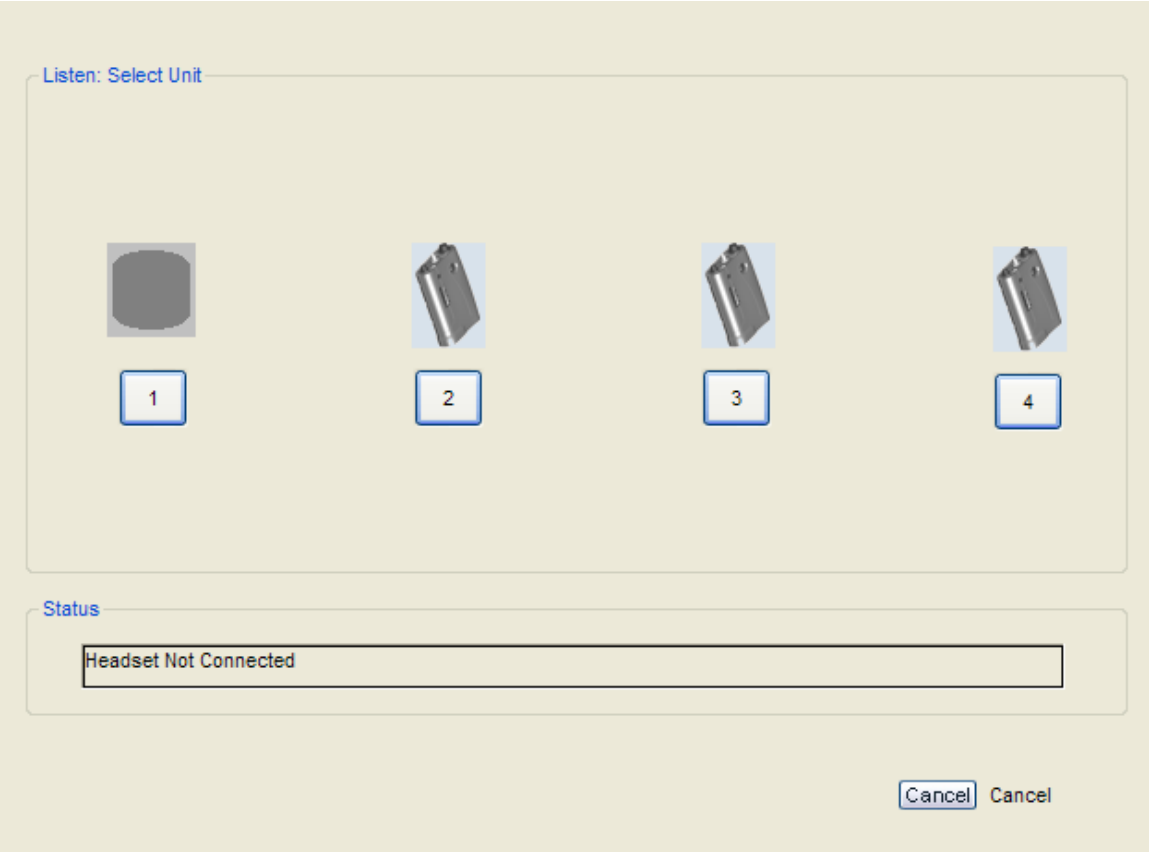
Press key 3 to enter /adjust Time and Date setting.

Press key 4 to control beacons on suitably equipped outstations.

Settings

Listening Mode

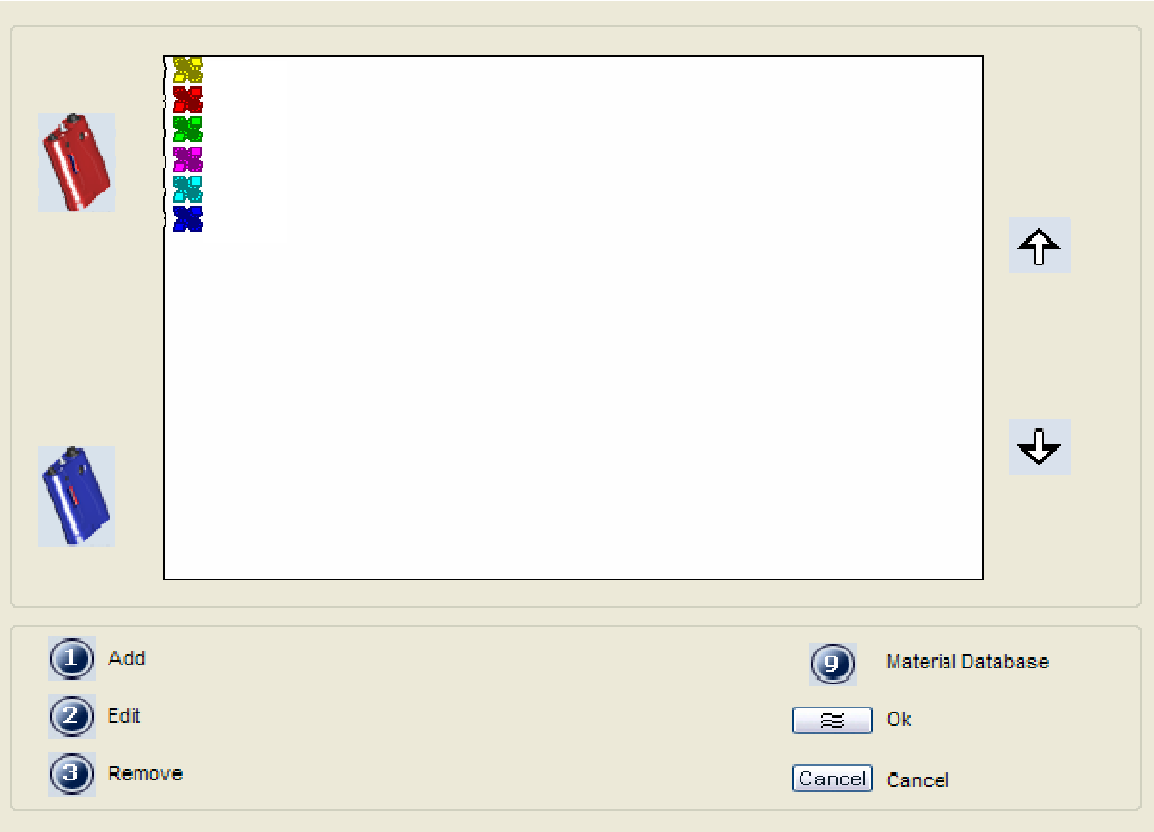
When listening to an Outsatation the transmission will occur in fifteen second blocks. This is due to the system using a single radio frequency, it then allows listening mode to finish according to the user's wishes. See below for screenshot.



Settings

Pipe Parameters

This enables a user to define a pipe containing up to 10 segments.



This screen allows a pipe containing up to ten segments to be defined.

To add a new pipe segment, click the “Add” button and the “Enter Pipe Segment” box will be displayed. Enter the segment’s details and press “OK”.

To edit an existing pipe segment, select the segment in the table and press the “Edit” button. “The Enter Pipe Segment” box will be displayed allowing the user to change the segment’s settings.

Change the segment’s settings and press “OK”.

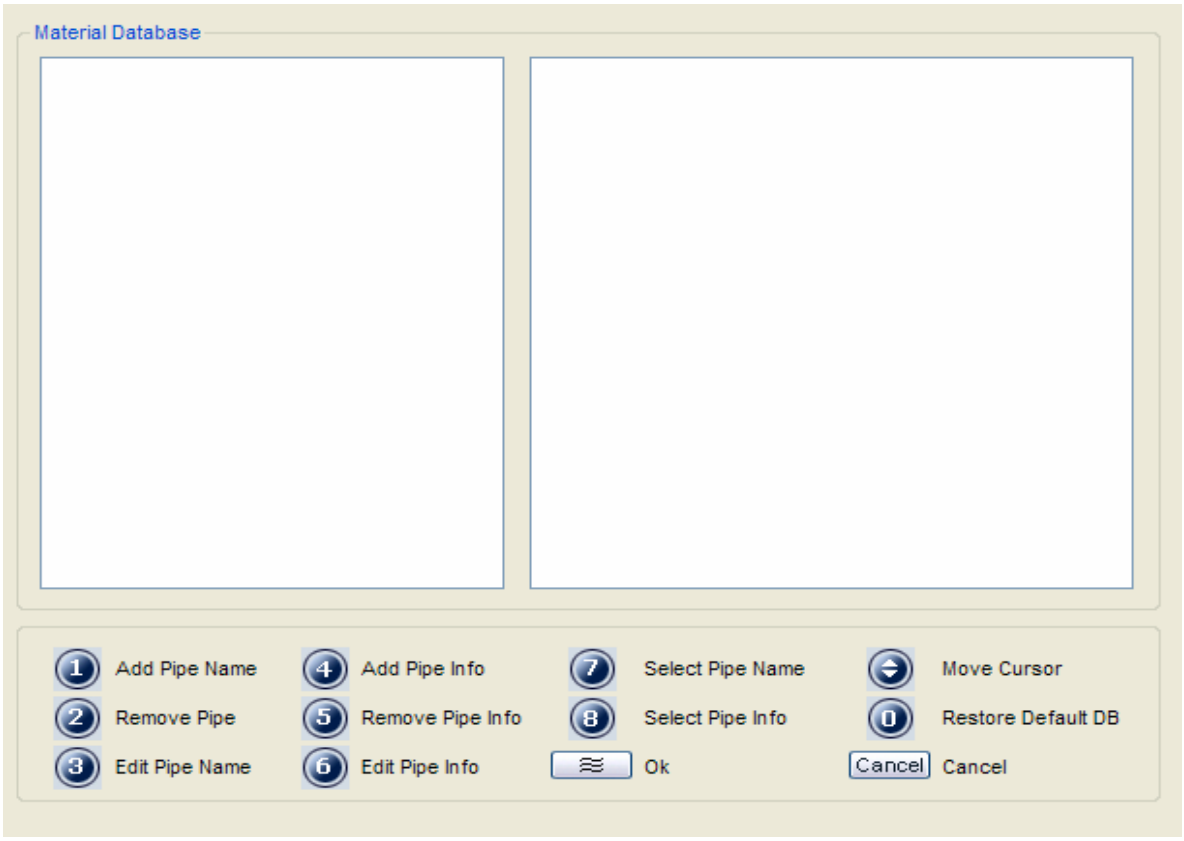
To remove a segment, select the segment to remove from the table and press the “Remove” button. The segment will be removed from the table.

To change the order of the pipe segments select the segment and click on the up/ down arrows accordingly.

Settings

Pipe Materials Database

Enables the user to manually define up to 20 pipe materials for use on the current correlation.



Information

Select the required menu/function by pressing the assigned key.

Press key 1 to enter editing of specific information of the current Correlation.

Press key 2 to show system status— battery power, radio signal and sensor to unit connection.

Press key 3 to display current version of Firmware and software.

Press key 4 to enter the Factory service diagnostics.

Filters

If correlating with pipe data entered, the default filter settings will be used depending on the properties of the pipe. Some times this may not be accurate enough to filter out unwanted frequencies, so the user may wish to alter the filer settings to remove certain frequencies that are influencing the current correlation.

Press 3 (Change Filters) Displays a pop up box with four options :-

Quick set-metallic

Quick set-non metallic

Clear all

Manual settings

By using the arrow keys highlight the required option and press ENTER

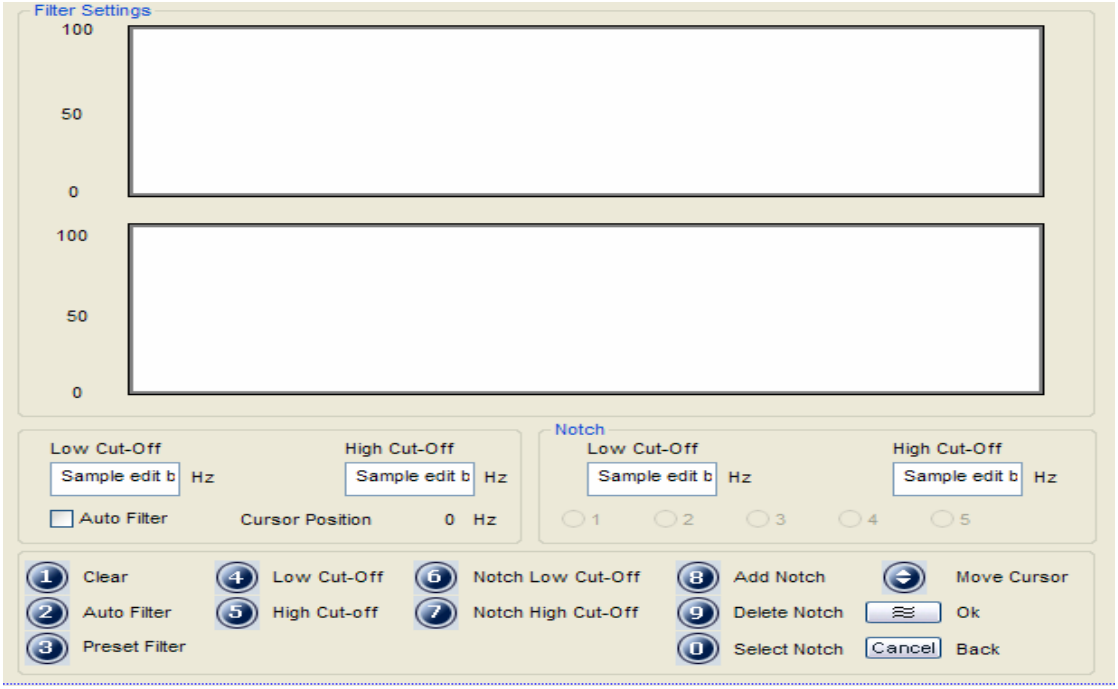
Quick set-metallic removes all frequencies from 0Hz to 405Hz. So the sensors will only listen to frequencies of 406Hz and above.

Quick set-non metallic removes all frequencies from 696Hz and above. So the sensors will only listen to frequencies of 695Hz and below.

Clear all removes any filter settings set and will listen to all frequencies.

Manual settings allow the user to view the frequencies and set to the user preference.

The filter screen displays the frequencies heard at the two sensors in use. The bottom axis of each graph displays the frequency level starting at 0Hz to the left. Two cursor lines are displayed on each graph and are move by using the arrow keys. The longer dashed cursor line is the current line selected to move. The lines on each graph will not cross. The position of the current cursor line is displayed under the second graph, in this example 160Hz.



Press 1 (Select cursor) This toggles between the two cursor lines. Only the longer dashed cursor line can be moved.

Press 2 (Low cut-off) When the left cursor line has be selected the low cut off option is displayed. Move the left cursor to the required position and press 2. This will remove all frequencies to the left of the cursor line. Removed frequencies are displayed in a cyan colour. In this example the cursor was moved to 257Hz and a low cut off was selected, so all frequencies from 0Hz to 257Hz will be removed.

Press 2 (High cut-off) When the right cursor line is selected the high cut off option is displayed. Move the right cursor to the required position and press 2. This will remove all frequencies to the right of the cursor line. Removed frequencies are displayed in a cyan colour. In this example the cursor was moved to 505Hz and high cut off was selected, so all frequencies from 505Hz and above will be removed. By pressing ENTER to accept the data would mean frequencies between 258Hz and 504Hz only are being used to process the current correlation.

Technical Specification

Basestation

Process	**Full digital correlation**
Frequency response	**1Hz to 1250Hz**
Filter selection	**Automatic parametric filtering** **Manual setting if required** **optional preset filters**
Resolution	**±0.1m**
Display	**VGA TFT LCD**
Antenna	**External antenna/magmount**
Mixed material	**10 sections**
Battery level indication	**For all system units**
Battery type	**Rechargeable Lithium ion batteries, field replaceable**
Firmware	**User upgradeable from www.palmer.co.uk**
Dimensions	**261mm x 185 x 88mm**
Weight	**1Kg**
Operating temperature	**-15°C to +50°C**
Enclosure	**Plastic moulded case**
Connectors	**Military specification Amphenol**

Technical Specification

Outstation

Radio communication	**Single frequency digital transceiver**
Radio frequency	**UHF (local regulations apply)**
Controls	**ON/OFF with LED status light**
Connections	**Headphones**
	External antenna
	Sensor
	PSU
Battery type	**Rechargeable Lithium ion batteries, field replaceable**
Battery life	**>18 hours**
Antenna	**External antenna**
Dimensions	**203mm x 136 x 51mm**
Weight	**0.826kg**
Housing	**Fully injection-moulded ABS**
Connectors	**Military specification Amphenol**

Sensor

Type	**Digital sensor with integral high strength magnet**
Frequency range	**1Hz to 5KHz**
Dynamic range	**>90dB**
Dimensions	**143mm x 52.5mm diameter**
Weight	**0.613kg**
Environmental	**IP68, rubber shroud for shock protection**
Connection to Outstation	**Cable with strain relief**
	Military specification connector

Contact

Palmer Environmental Ltd

Ty Coch House

Llantarnam Park Way

Cwmbran

Gwent

NP44 3AW

United Kingdom

Tel: +44 (0) 1633 489479

Fax: +44 (0) 1633 877857

General Enquires: information@palmer.co.uk

Technical support: support@palmer.co.uk

Web: http://www.palmer.co.uk

Note

Palmer Environmental reserves the right to change products, services or specifications without notice.