DigiCALL+ User Manual

DigiCALL+ User Manual

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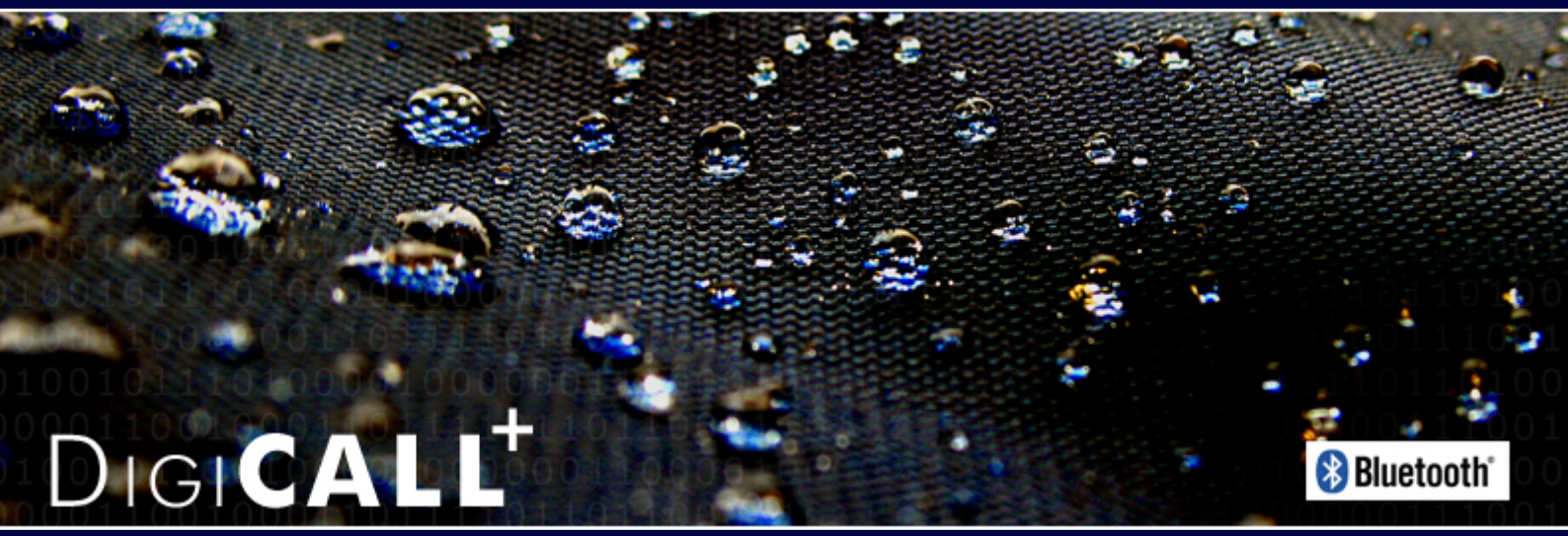
Introduction

The new DigiCALL+ (**D**igital **C**omputer **A**ssisted **L**eak **L**ocator) is the latest PC based fully digital correlator designed to pinpoint leaks while using the processing power of a laptop PC. Utilising Bluetooth® technology, DigiCALL+ is proving to be the most portable and reliable PC based correlator on the market.

The larger screen of the laptop PC allows for improved graphical presentation within the familiar intuitive Windows environment. The software also allows the user to easily export both the text data and graphic data to other applications to ease the compilation of reports and recorded data.

The system uses the same proven high performance fully digital sensors and transmitter Outstations as the MicroCorr® Digital + (over 4,000 MicroCorr® units in use worldwide).

Headphones can be connected to the DigiCALL+ Interface Unit in listening mode to hear the leak noise detected by the Outstations and a database of filter options and presets are also available within the software to increase accuracy when being used in areas with a high level of ambient noise.



The DigiCALL+ system is based on the proven technology used in the MicroCorr® Digital+ but harnesses the processing power of a PC and Bluetooth communications. This enables it to achieve performance levels well in excess of previous analogue-based systems, with important benefits to the user.

- Totally digital system
- Superior leak detection performance on all pipe materials and sizes
- Quick and easy to use, especially for less experienced operators
- Automatic parametric filtering (APF)
- Ergonomically designed – lightweight, compact system
- Software updates via web site
- Optional third Outstation for velocity measurement and rapid surveys
- Select dedicated or PC-based models
- Transceiver enables all system functions to be controlled centrally,
- Quicker deployment
- Expert system leak detection algorithms eliminate transient, non-leak effects
- Tricorrelation automatically calculates site specific velocity
- Data replay function allows immediate post-processing or off-line correlation

Leak detection staff require a high performance correlator in order to maximise their productivity (number of leaks found per hour) and minimise the incidence of "dry" holes, when excavation reveals no leak to be present. However, because it is used constantly in the field, the correlator must also be robustly designed.

The Interface Unit and Outstation are injection-moulded housings, providing maximum strength and durability. They are designed to IP65 protection and the Interface Unit incorporates an external antenna and a magmount antenna (optional extra) that may be connected for longer correlation distances if the Interface Unit is vehicle-based. External antennae are used with the Outstations.

All connectors are to military specification and cables are fitted with strain relief to protect against fatigue damage.

With safety in mind the Outstations have also been designed to be highly visible over typical correlation distances and allow back-to-back portability.

Operational Benefits

With the latest technology, it's easy to see why the MicroCorr® range of correlators are at the top of their class:

- Pinpoints a higher percentage of leaks
- New technology gives significantly higher percentage of "difficult" leaks (plastic pipes, trunk mains, low pressure situations) to be detected
- Fewer "dry" holes reduces excavation costs
- Improved productivity – more leaks found per hour
- Easier to use – less training required
- Improved reliability with less downtime
- Lightweight and robust
- Easily integrates into Company-specific reporting
- New software versions available from www.palmer.co.uk
- Designed for easy portability

Fully automatic

- Immediate correlation – switch on and go (enter pipe details later)
- Automatic parametric filtering (APF)
- Self diagnosis

Easier to Use

- Graphical user interface
- Intuitive display and operation
- Quick correlation
- Bluetooth communications

Reliability to inspire confidence

- All functions self-calibrated automatically on power-up
- In-built power management
- In-built diagnostics
- Increased battery life – batteries rechargeable and field replaceable

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.

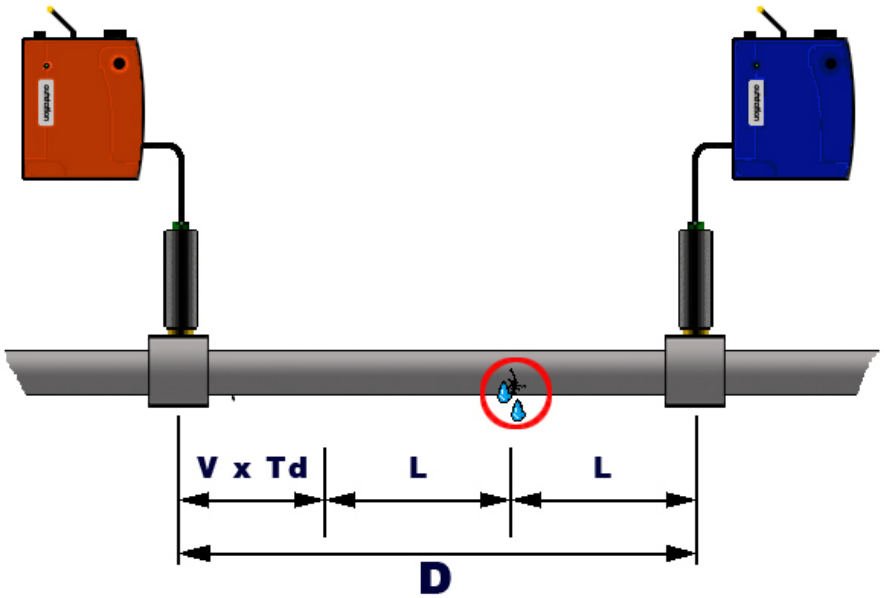
This noise is conducted in both directions away from the leak through the pipe wall (as minute vibrations) and through the water column (as a pressure wave).

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 pipe type and length, enables 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:



Full Digital Correlation

Digital sensor

New sensor with improved sensitivity to low frequency noise (for plastic and large diameter pipes and low pressure situations) - down to 1.0Hz

Wider dynamic range than any previous sensor - can distinguish leak noises much quieter than previous sensors over much greater distances

True 16 bit ΣΔADC

Immediate digitisation of the analogue leak noise so that the calculation of the correlation can be done with no loss or interference of data.

Low noise electronics with digital protocol eliminates interference

Longer sensor cables possible

High strength magnet

Quality rubber housing for sensor protection

Military specification amphenol connection

Full Digital Correlation

Digital Outstation

New compact Digital Outstation with improved communications

Two-way communication with Interface Unit using digital transceiver technology

Virtually no data loss, interference or distortion of the transmitted signal

Single radio frequency for all Outstations

Improved dynamic range over analogue radios

High speed data transmission using transform coding techniques

No directional restrictions

Interface Unit Features

1. Charger Connection
2. Antenna Connection
3. Sensor Connection
4. Status LED
5. On/Off Button
6. Carry Handle
7. IP65 Rated Housing
8. Battery Compartment

Outstation Features

Outstation general features

1: Injection Moulded Housing

2: LED

3: On/Off Switch

4: Carry Strap

Outstation rear view

1: Headphone/Charger Connection

2: Antenna Connection

3: Sensor Connection

Battery Installation

BATTERY WARNING

All three 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 Palmer 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, please ensure they are at least half charged when stored.

Installing and Charging the Batteries

The battery packs for the DigiCALL+ Interface Unit and the Outstations are supplied as separate items and will need to be fully charged before use.

Two dual battery chargers are supplied: This allows a complete system to be charged at the same time. A full system can comprise of 1 x Interface unit, 1 x Red Outstation, 1 x Blue Outstation and an optional third Yellow Outstation.

Batteries are interchangeable and can be charged simultaneously and in any order (i.e. you can charge the Interface unit and an Outstation on the same charger). Charging for all batteries takes up to 6 hours from flat, although an overnight charge is recommended for maximum performance.

To charge the batteries, they must first be fitted. To insert the battery pack, unscrew the two quick release screws underneath the units, remove the cover and packing foam and connect the battery pack. Carefully place the battery pack in the battery compartment, refit the packing foam, and then replace the cover.

Connect the charge lead from the charger to the headphone/battery charge connection on the top of the Interface Unit and Outstations. Plug the charger unit into the mains supply and switch on. The units will turn themselves on and start charging.

LED status during charge:

During a "fast" charge the LED will flash Red.
During a "slow" charge the LED will flash Yellow.
Once fully charged the LED will light up Green.

Outstation Deployment

Once the batteries have been installed and charged in the Basestation and the Outstations, connect the antenna, sensor cable and sensor to each Outstation.

Switch on each Outstation by pressing the On/Off button on the back, 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.

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 debris 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.

For best performance, it is recommended that the sensor is deployed in a vertical/ upright position as this gives the most effective reading.

LED Functions

The Outstations incorporate an LED which provides the user with the following information:

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 then Red. With the LED flashing Yellow, the battery is half charged. A Red flashing LED indicates the battery requires immediate charging.

The DigiCALL Software

Minimum Specification

- 500MHz Pentium® II or equivalent processor
- 128MB RAM
- CD-ROM Drive
- VGA monitor capable of 800x600 resolution with 256 colours
- Mouse or compatible pointing device
- RS232 Serial port or USB port (USB port will require an optional cable)
- Windows(R) 98/ME/2K/XP

Installation

To install the DigiCALL software from the supplied CD, please follow the procedure below:

With the Laptop turned on, insert the DigiCALL CD into your CD ROM drive. Your Operating System should automatically detect the disc and start the installation for you

Should AutoPlay not run, using Windows Explorer or My Computer, locate the CD Drive and double click on setup.exe

Follow the on-screen instructions and install the program to the default directory recommended by the installation.

Removal

To remove the DigiCALL software from your computer, please follow the procedure below:

Go into Windows Control Panel

Win 95/98/Me = "Start – Settings – Control Panel"

Win 2000 = "Start – Settings – Control Panel"

Win XP = "Start – Control Panel"

Double click the icon "Add/Remove Programs"

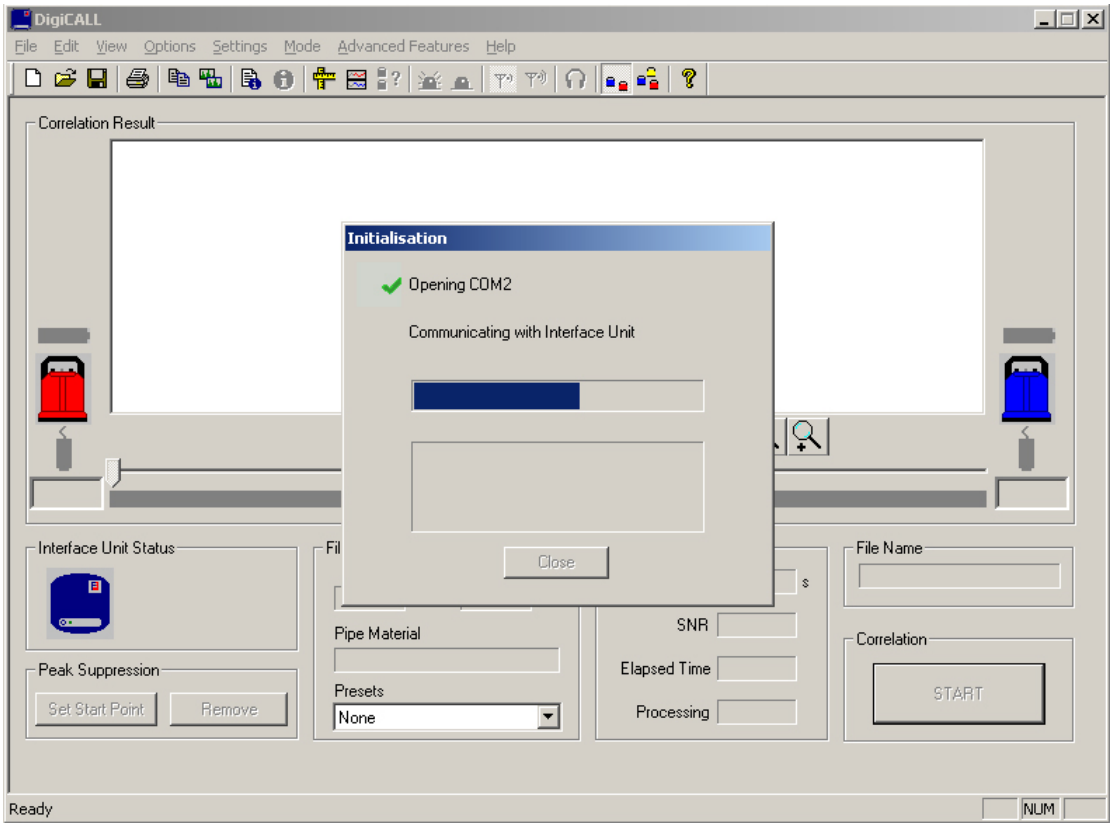
In the list of installed applications showing, locate "DigiCALL" and click "Remove"

Click "Yes" or "OK" to any warnings advising about removal.

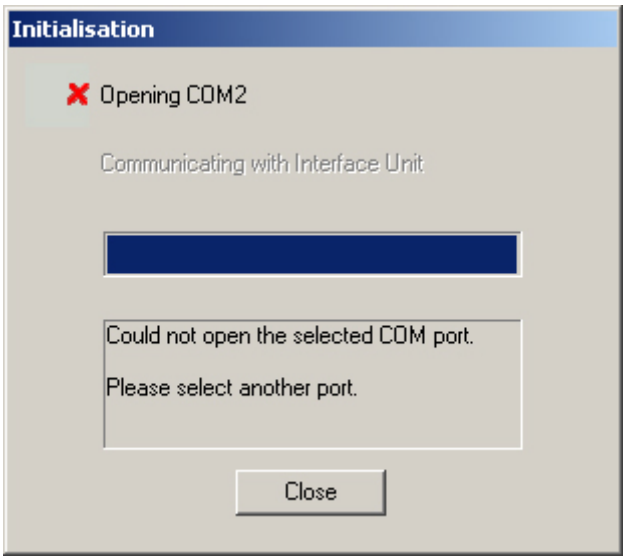
Starting the application

To start the DigiCALL application, click "Start – Programs – Palmer Environmental – DigiCALL"

Upon starting, the program will attempt to communicate with the Interface Unit; you will be presented with the following screen:

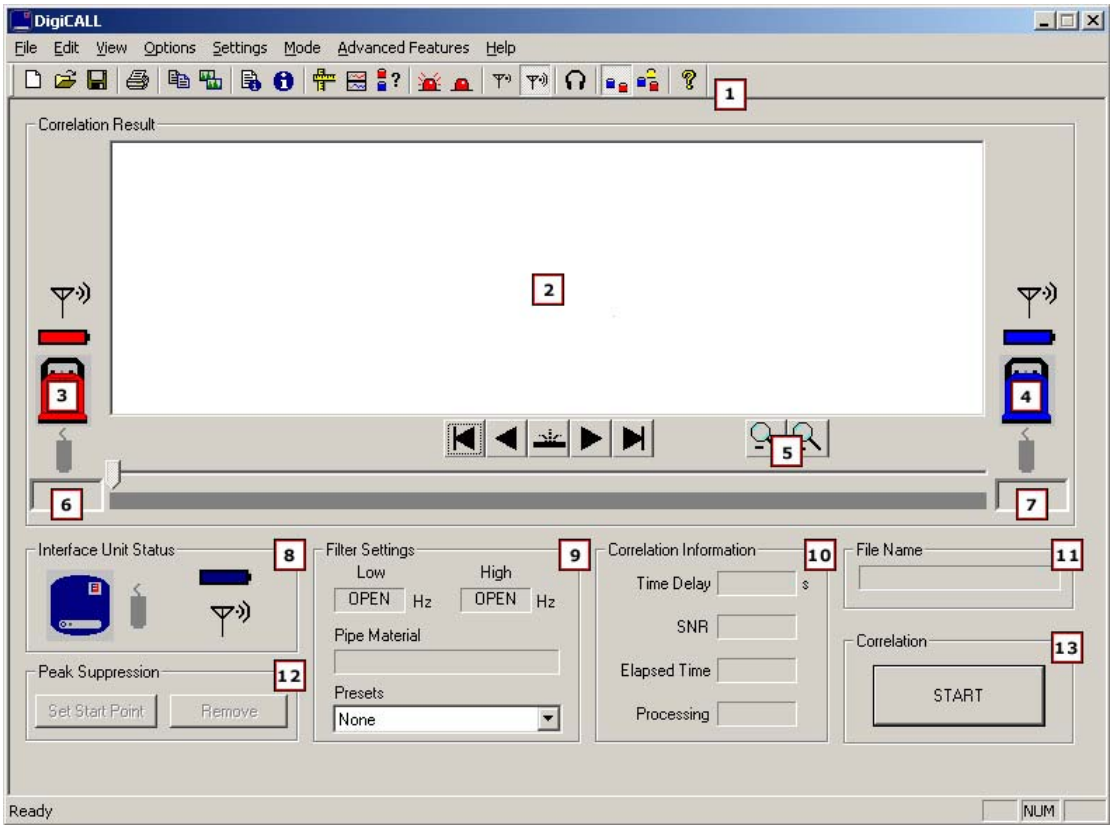


Should there be any problem in communicating with the selected communication port, the following message will appear:



Main screen

The DigiCALL main screen is shown below:



1: Tool Bar

2: Correlation Graph Display Area

3: Red Outstation Status

4: Blue Outstation Status

5: Zoom Correlation Graph In/Out

6: Distance from Red Sensor to Leak

7: Distance from Blue Sensor to Leak

8: Interface Unit Status

9: Filter Settings

10: Correlation Information

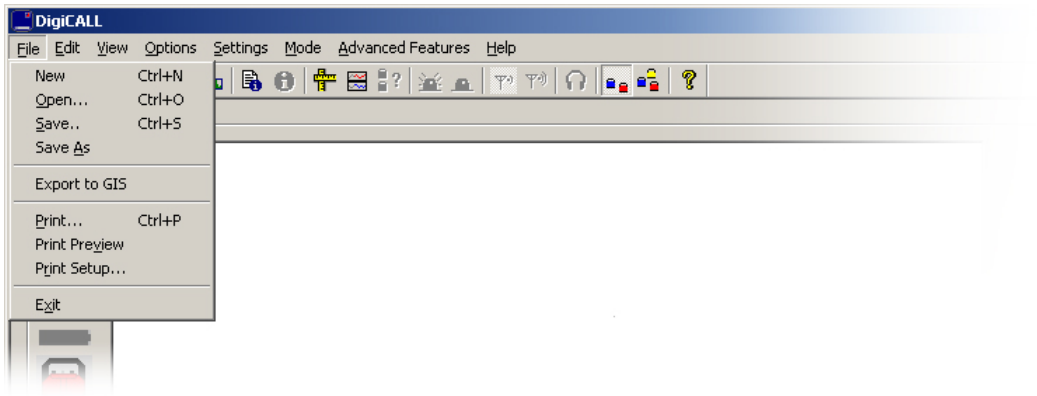
11: Correlation File Name

12: Peak Suppression Options

13: Start/Stop Correlation

DigiCALL Menu Options

File Menu



New - Creates new ".dcd" DigiCALL file

Open - Opens ".dcd" DigiCALL file

Save - Saves current ".dcd" DigiCALL file

Save as - Saves ".dcd" DigiCALL file under a new name

Export to GIS - This option is used to create a bitmap and data file to be used in conjunction with GIS systems

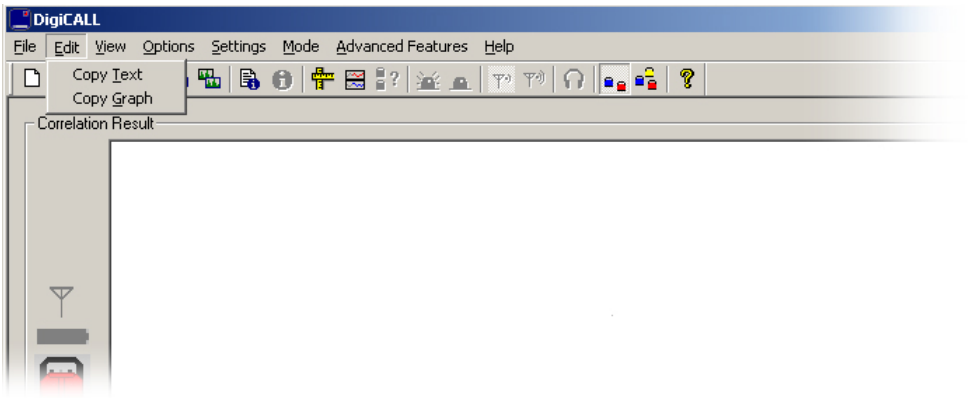
Print - Prints the current ".dcd" DigiCALL file

Print Preview - Shows the screen to be printed

Print Setup - Printer Options

Exit - Exits the application

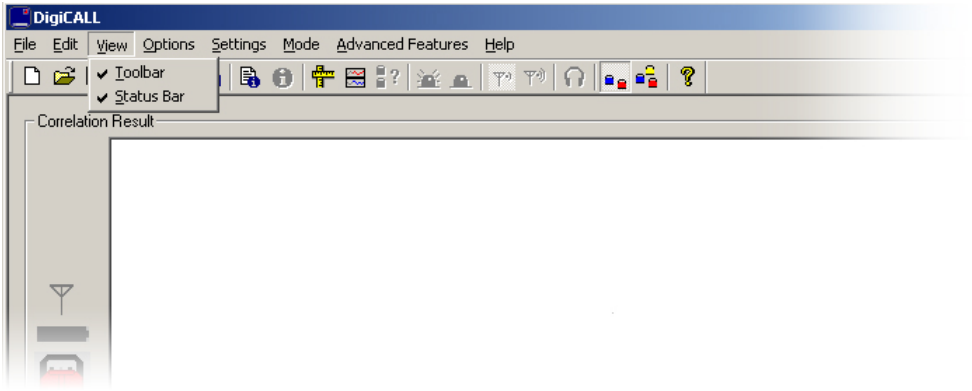
Edit Menu



Copy Text - This feature copies the text associated with the current DigiCALL file to the clipboard for pasting into other applications (e.g. Microsoft Word).

Copy Graph - This feature copies the graph associated with the current DigiCALL file to the clipboard for pasting into other applications.

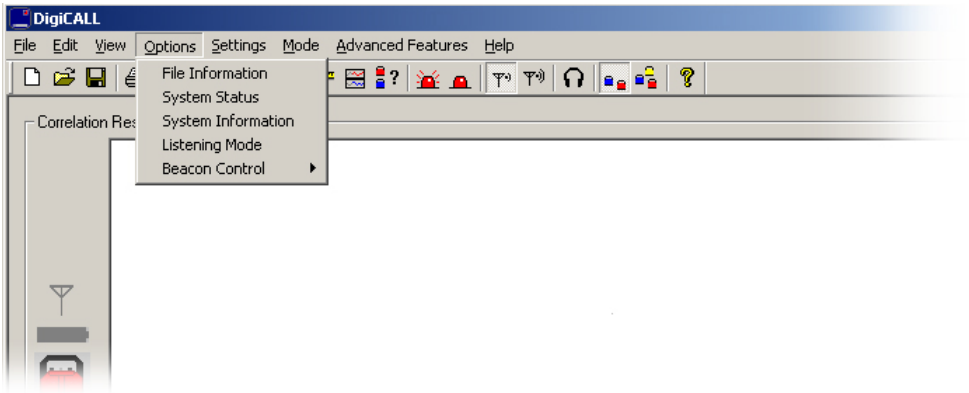
View Menu



Toolbar - Adds or removes the toolbar at the top of the application screen

Status bar - Adds or removes the status bar at the bottom of the application screen

Options Menu



File Information - Allows user to add a title and notes for the current file

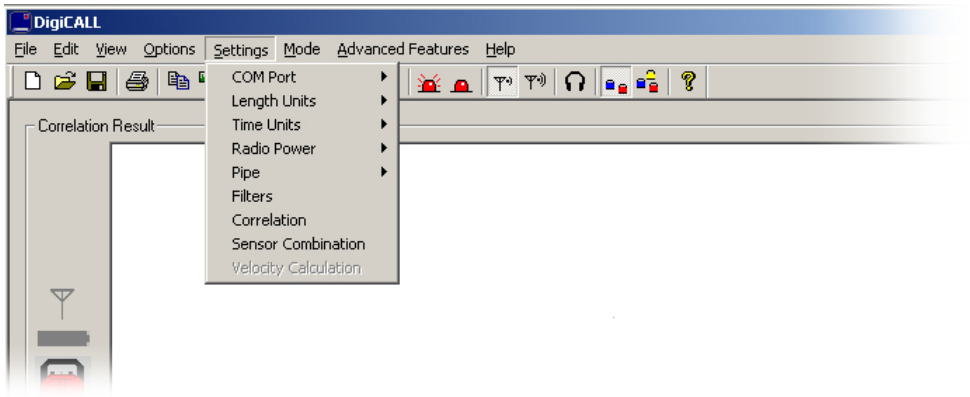
System Status - Displays various status information for the Interface Unit and any Outstations

System Information - Displays the firmware version number of all units within the system

Listening Mode - Enables the user to connect headphones to the Interface Unit and listen to the leak noise from any Outstations or the Interface Unit

Beacon Control - Remotely set the beacons on the Outstations to flash ON or OFF

Settings Menu



COM Port - Allows user to select different COM Ports

Length Units - Metric or imperial units can be selected

Time Units - Seconds or milliseconds can be selected

Radio Power - Set to HIGH or LOW

Pipe—Pipe Parameters - Allows a pipe containing up to ten segments to be defined

Materials Database - Allows up to 20 pipe materials to be defined

Restore Default Materials Database - Restores the default material database

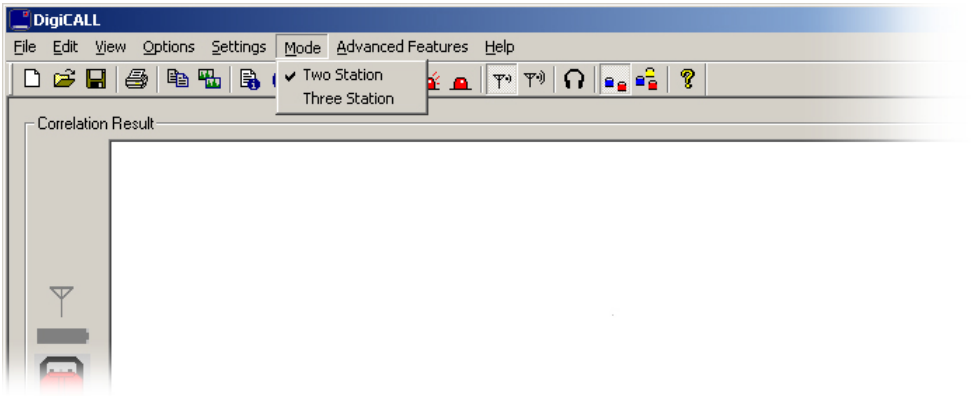
Filters - Allows user to apply filters to the correlation

Correlation - Allows user to change pipe and sensor settings for the correlation

Sensor Combination - Allows user to change a combination of sensors for correlation

Velocity Calculation - Allows user to calculate the velocity of the pipe

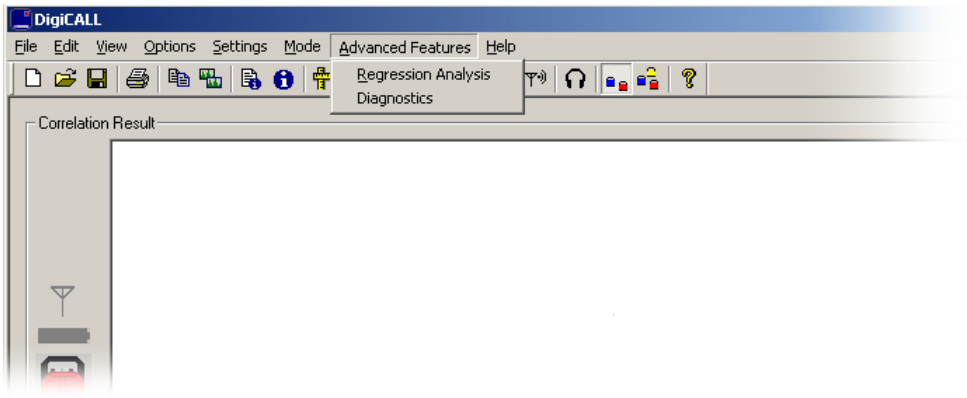
Mode Menu



Two Station - Sets the screen for a 2 station correlation session

Three Station - Sets the screen for a 3 station correlation session

Advanced Features Menu

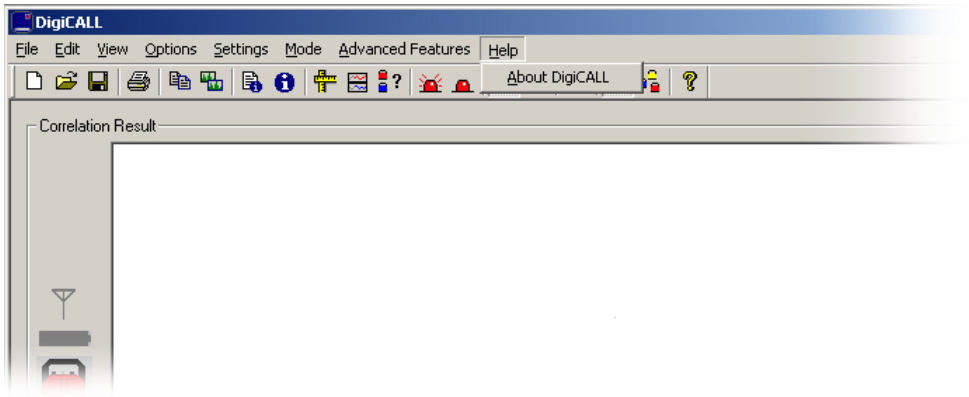


Regression Analysis - Opens the Regression Analysis window

Diagnostics - Opens the Diagnostics window

NB: Diagnostics window is only used for Palmer Service Engineers

Help Menu

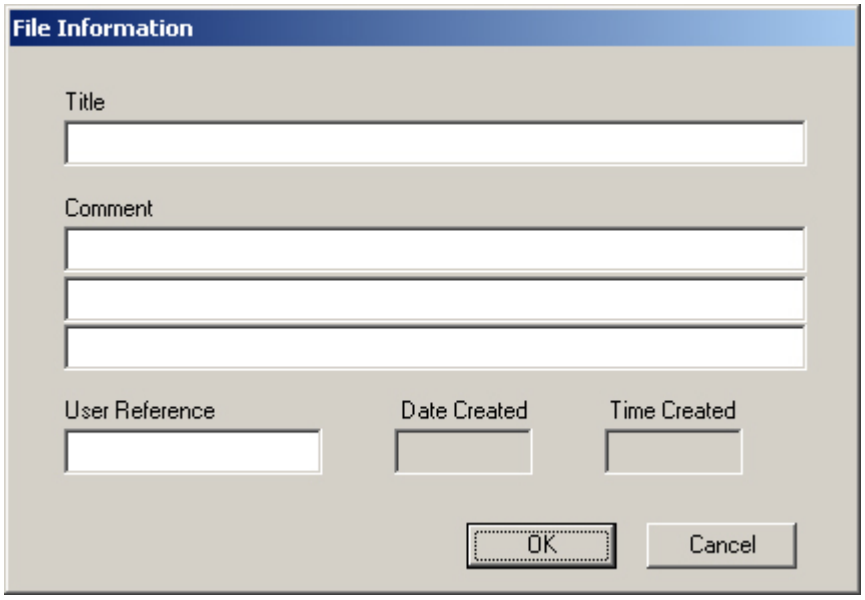


About DigiCALL - Displays current version of the DigiCALL application as shown below

DigiCALL Menu Operations

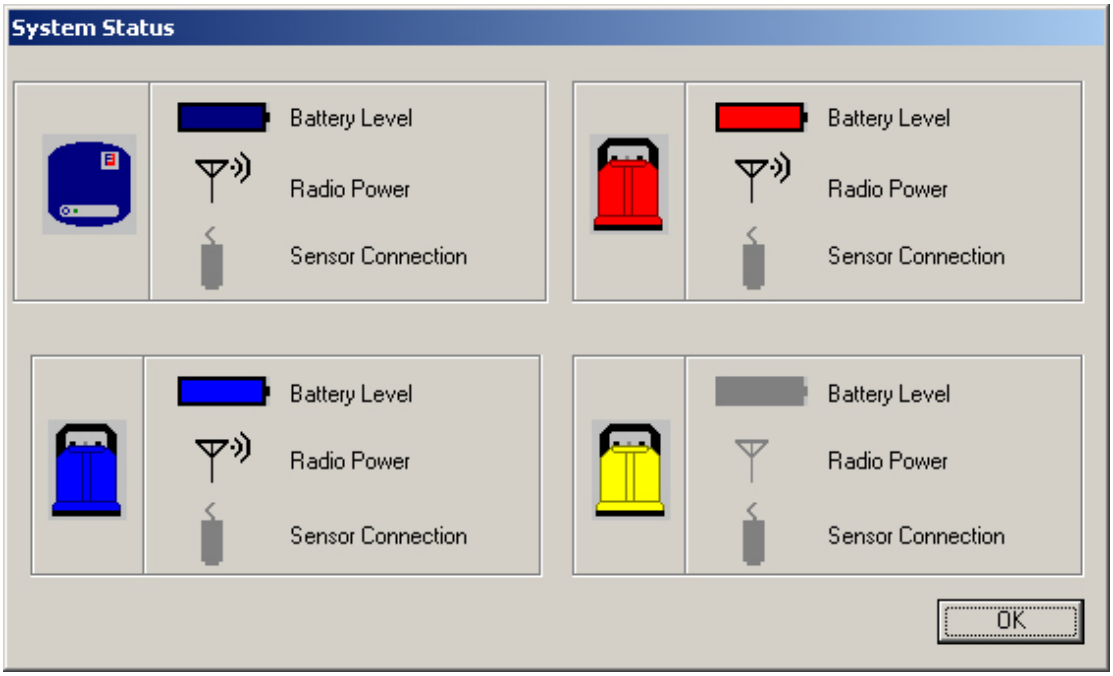
The following screen shots explain the extra windows that appear for the features found on the menu:

Options – File Information



Displays the window above that enables the user to add a title and any comments to the correlation file.

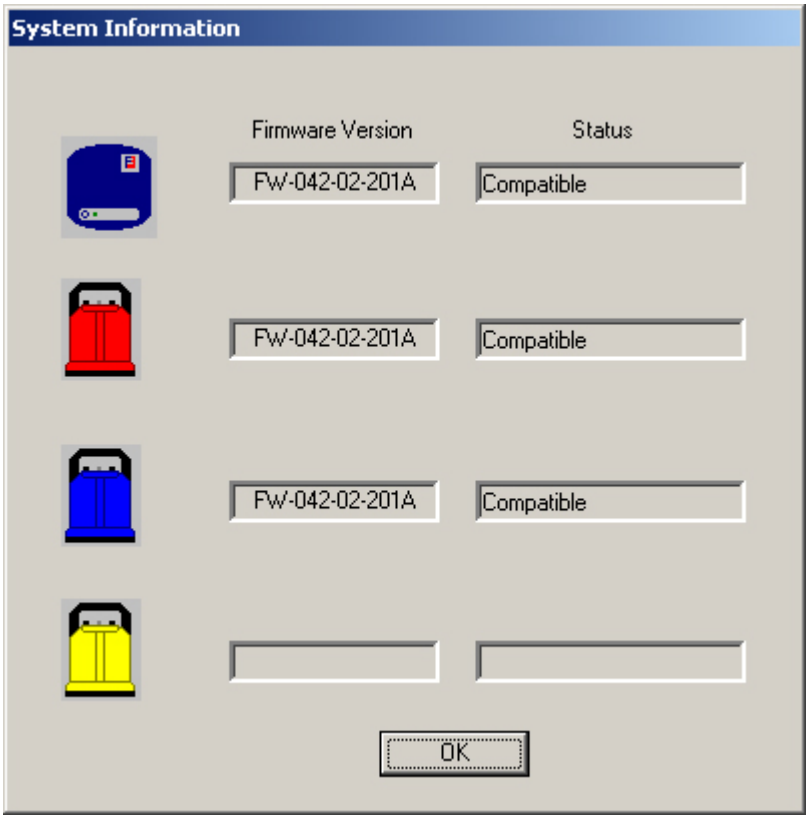
Options – System Status



Displays various status information for the Interface Unit and any Outstations.

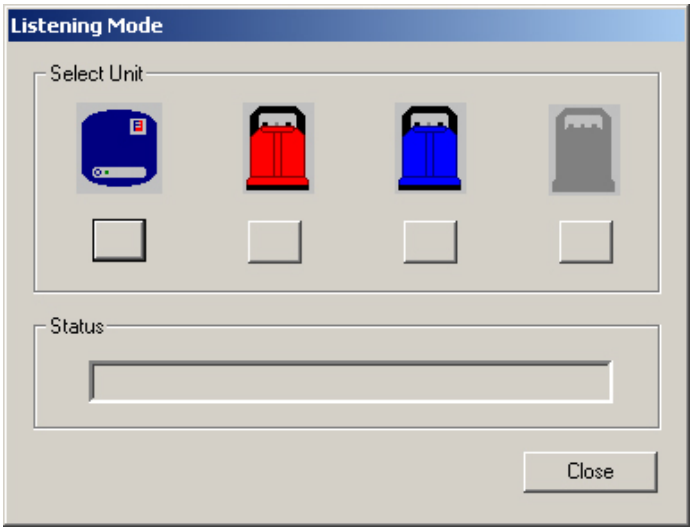
Options – System Information

Displays details of the version of firmware each unit is running.



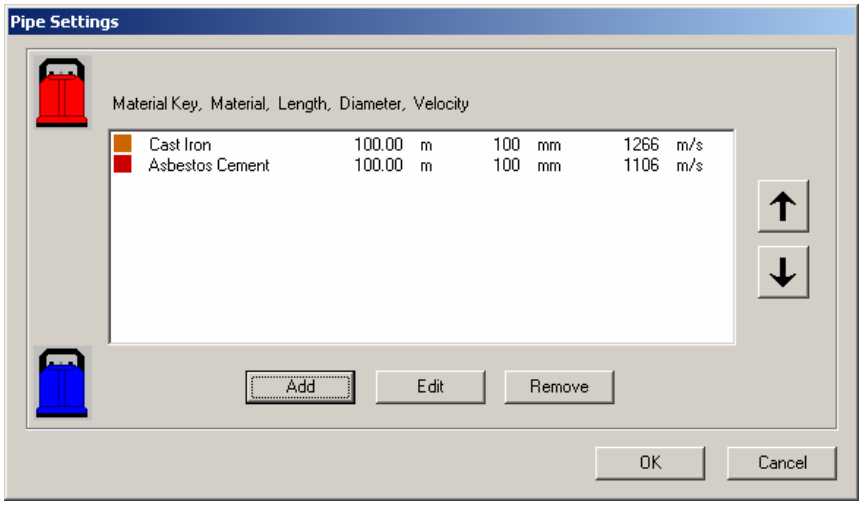
NB: It is very important that all Outstations and the Interface Unit are running the same version of Firmware.

Options – Listening Mode



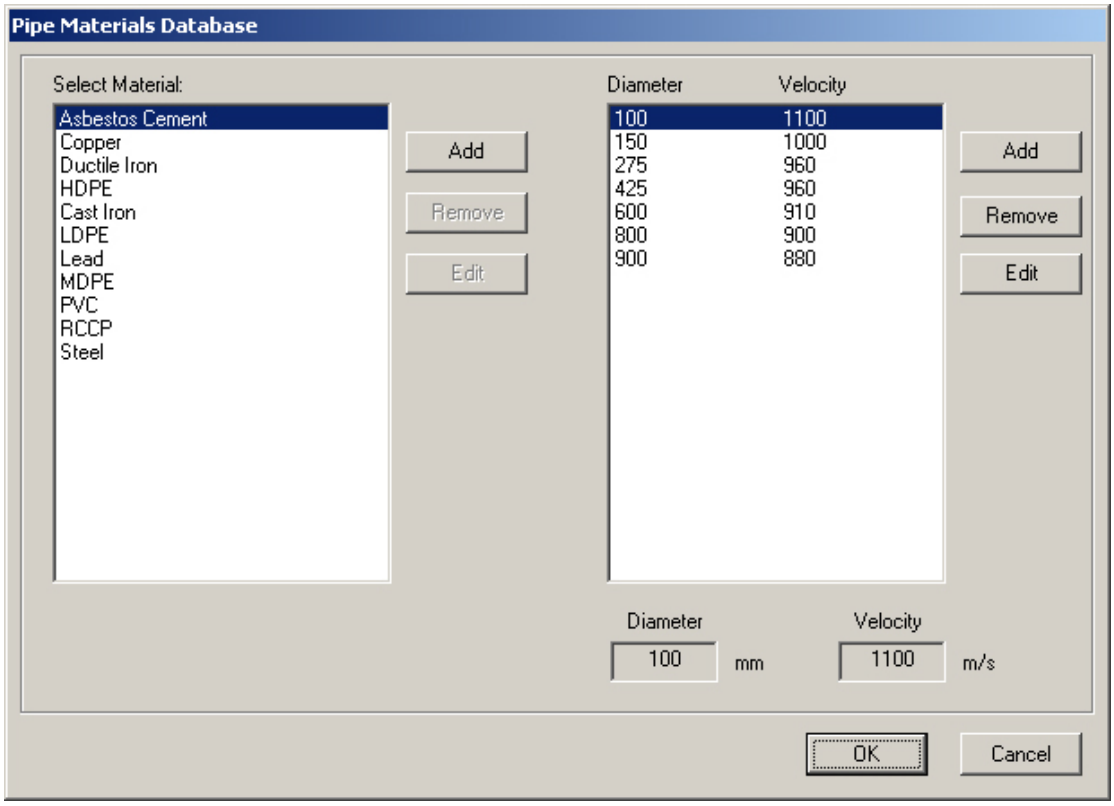
Allows the user to connect headphones to the Interface Unit and select which unit to listen to the leak noise from.

Settings – Pipe – Parameters



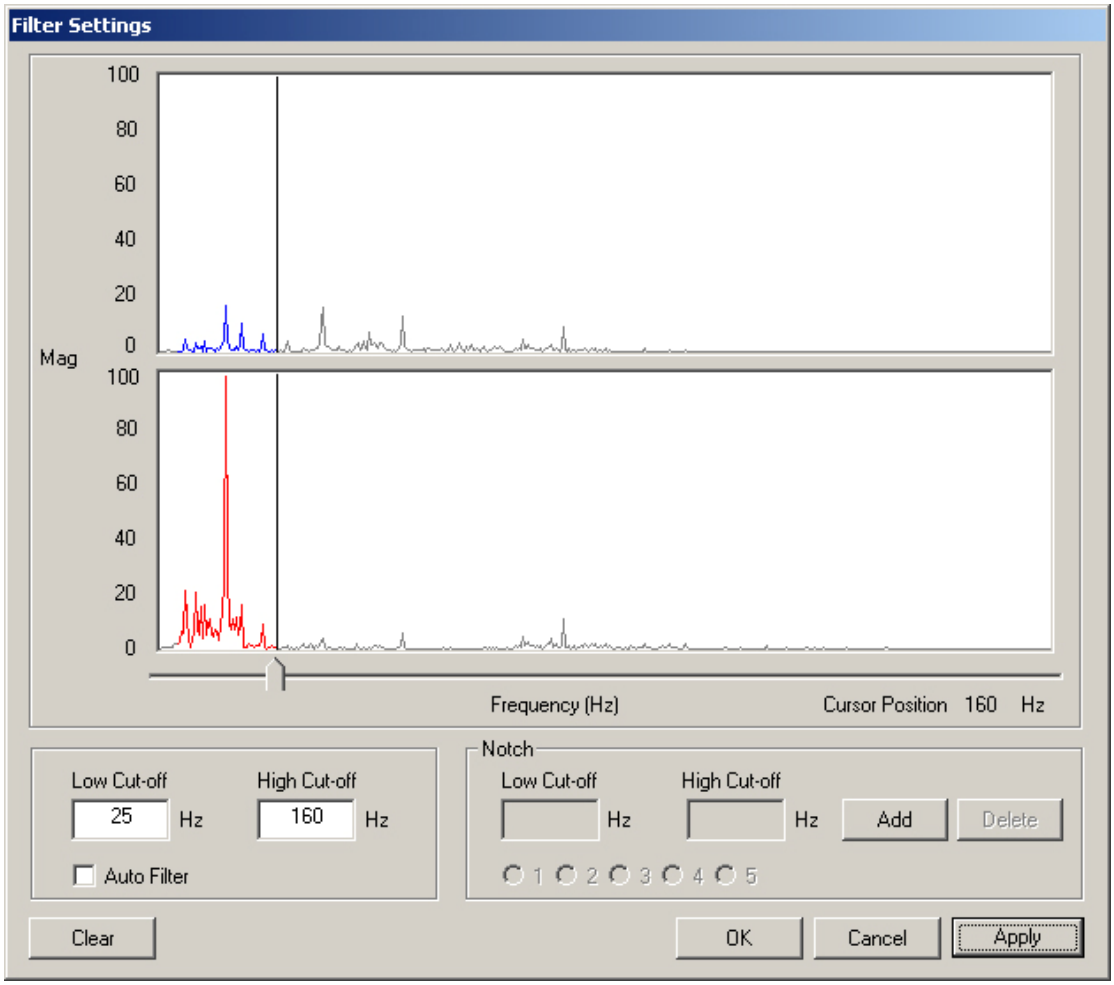
Enables the user to define a pipe containing up to 10 segments.

Settings – Pipe – Material Database



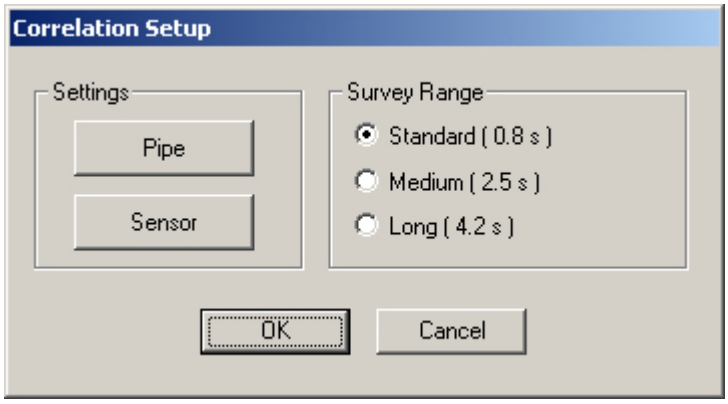
Enables the user to manually define up to 20 pipe materials for use on the current correlation.

Settings – Filters



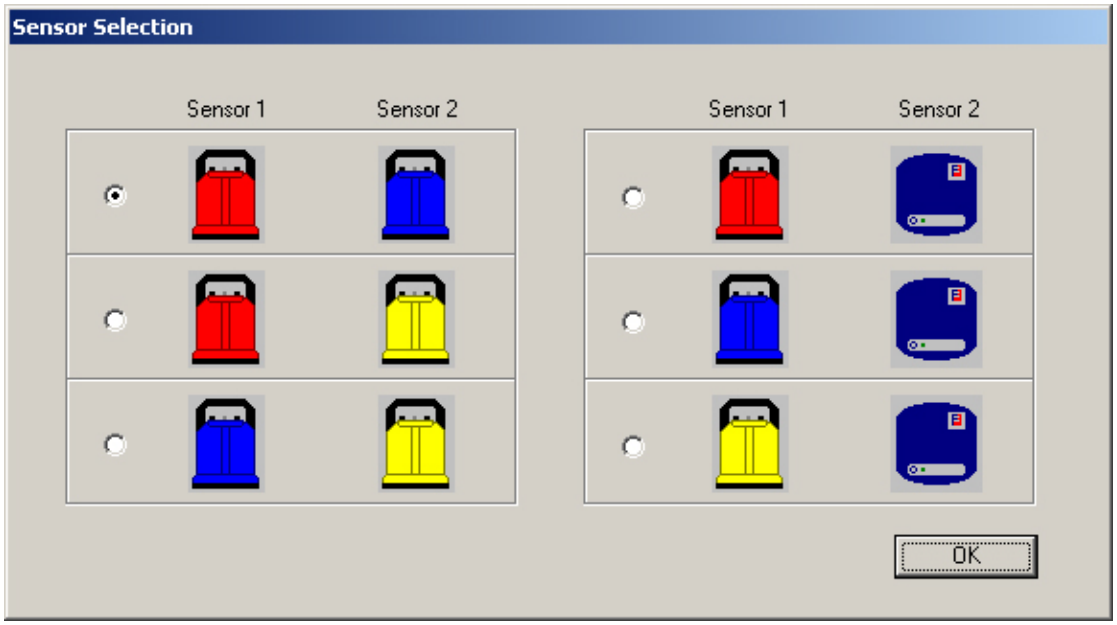
Enables the user to apply filters to the correlation.

Correlation – Setup



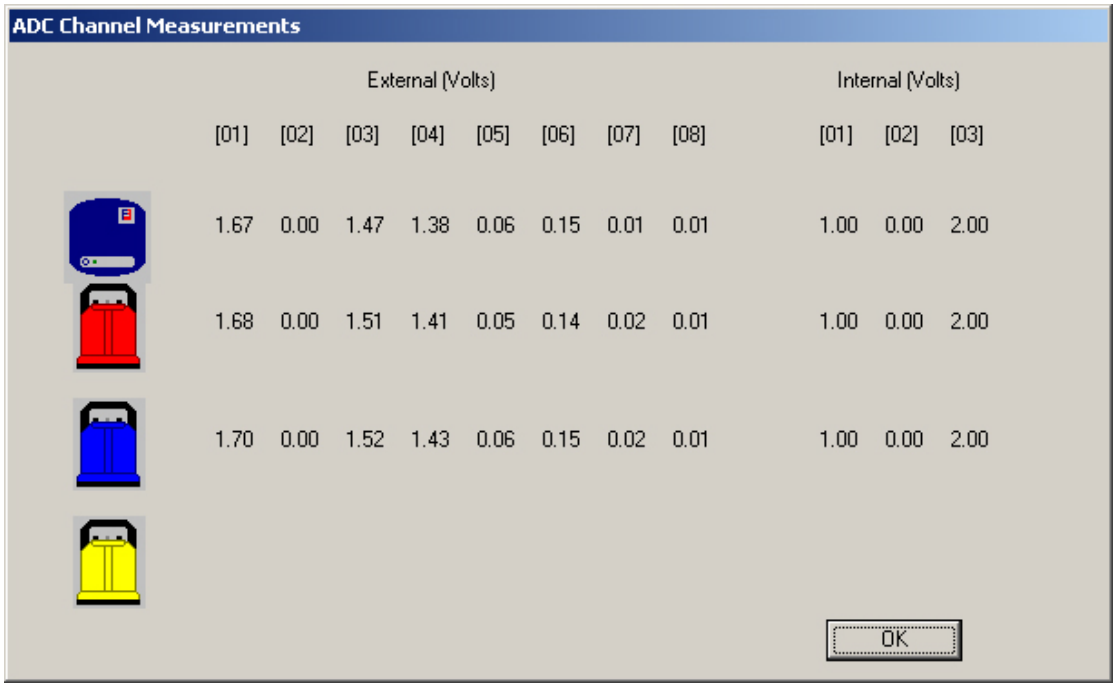
Enables the user to configure the correlation parameters.

Settings – Sensor Combination



Displays the window above that enables the user to change the combination of sensors used for the correlation.

Service - Diagnostics



Displays internal system parameters for advanced fault finding.

Additional Information

Copy Text

This feature copies the text associated with the current DigiCALL file to the clipboard for pasting into other applications (e.g. Microsoft Word). When pasted, the text will look similar to the following:

File: Example.dcd
Time Delay: -0.0118 s
SNR: 51:1
Elapsed Time: 00:06:00
Distance From Sensor 1: 5.4 m
Distance From Sensor 2: 20.9 m
Segment: 1
Material: Ductile Iron
Length: 26.30 m
Diameter: 80.00 mm
Velocity: 1320.00 m/s

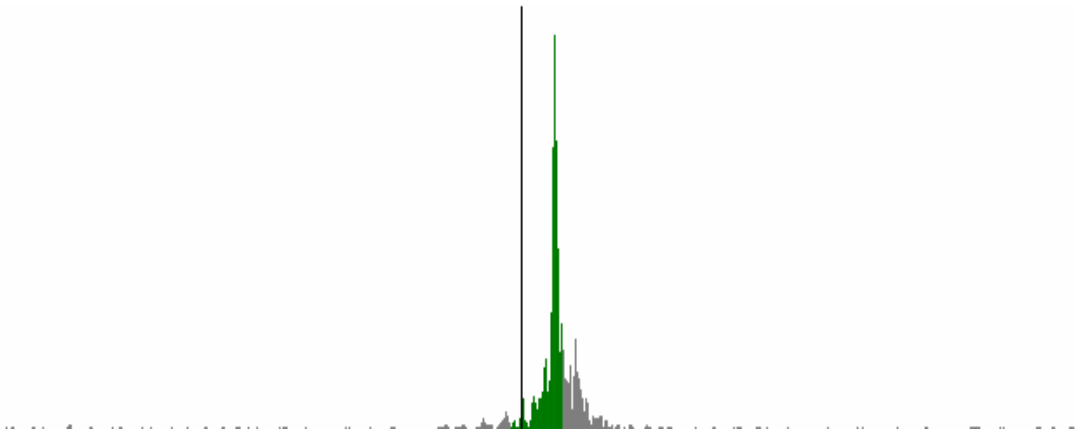
Low Cut-off: OPEN
High Cut-off: OPEN

Auto Filter: OFF

Notch Filter: OFF

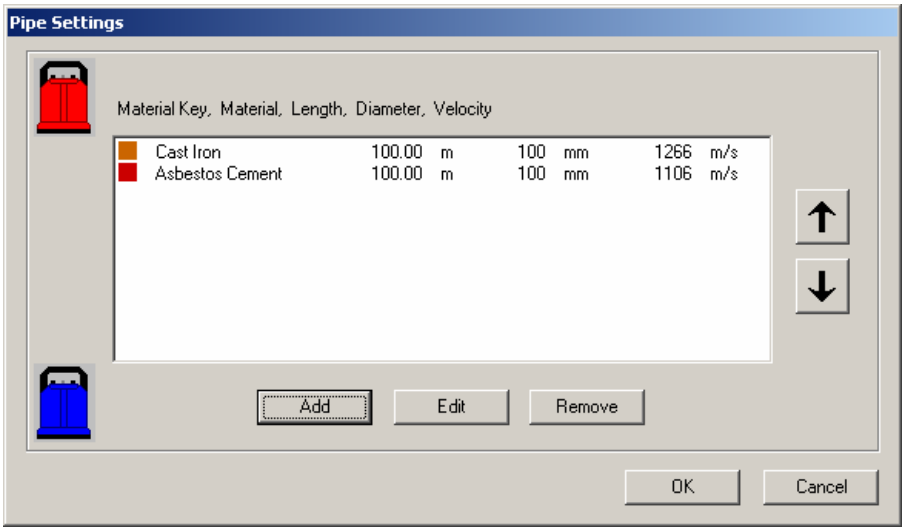
Copy Graph

This feature copies the graph of the current DigiCALL file to the clipboard for pasting into other applications. When pasted, the graph will look similar to the following:



Pipe Parameters

Selecting this option produces the following screen:



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

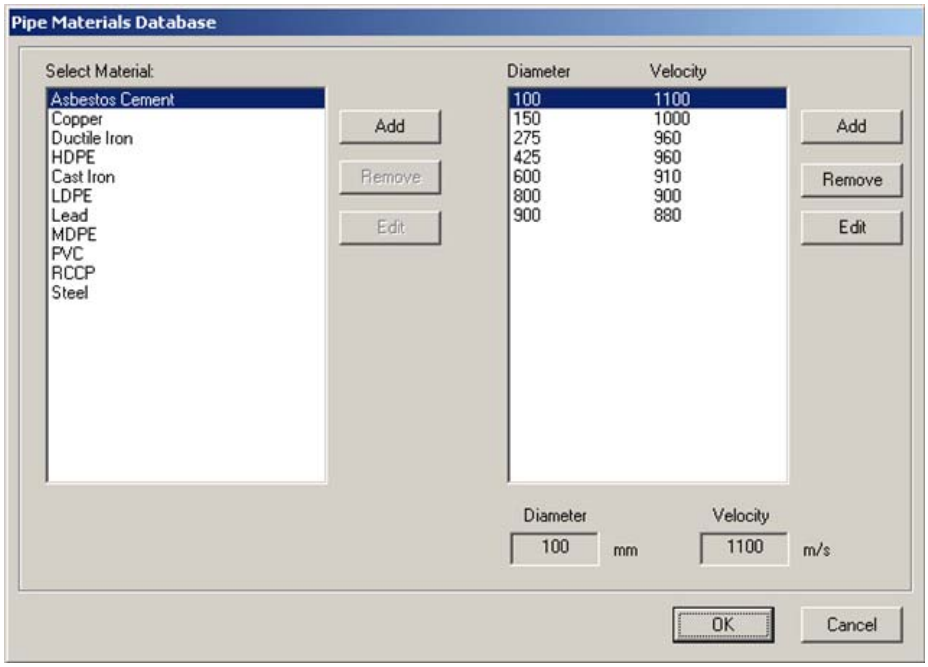
To add a new pipe segment, click the "Add" button and the "Enter Pipe Segment" box will be displayed. Enter the segment's details and press "OK".

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.

Pipe Materials Database



The pipe materials database stores up to twenty materials (twelve are pre-defined) with diameter/velocity information associated with each material.

To add a new material, click the "Add" button located in the left half of the window, type in a name for the new material when prompted and click "OK". The new material will appear in the list.

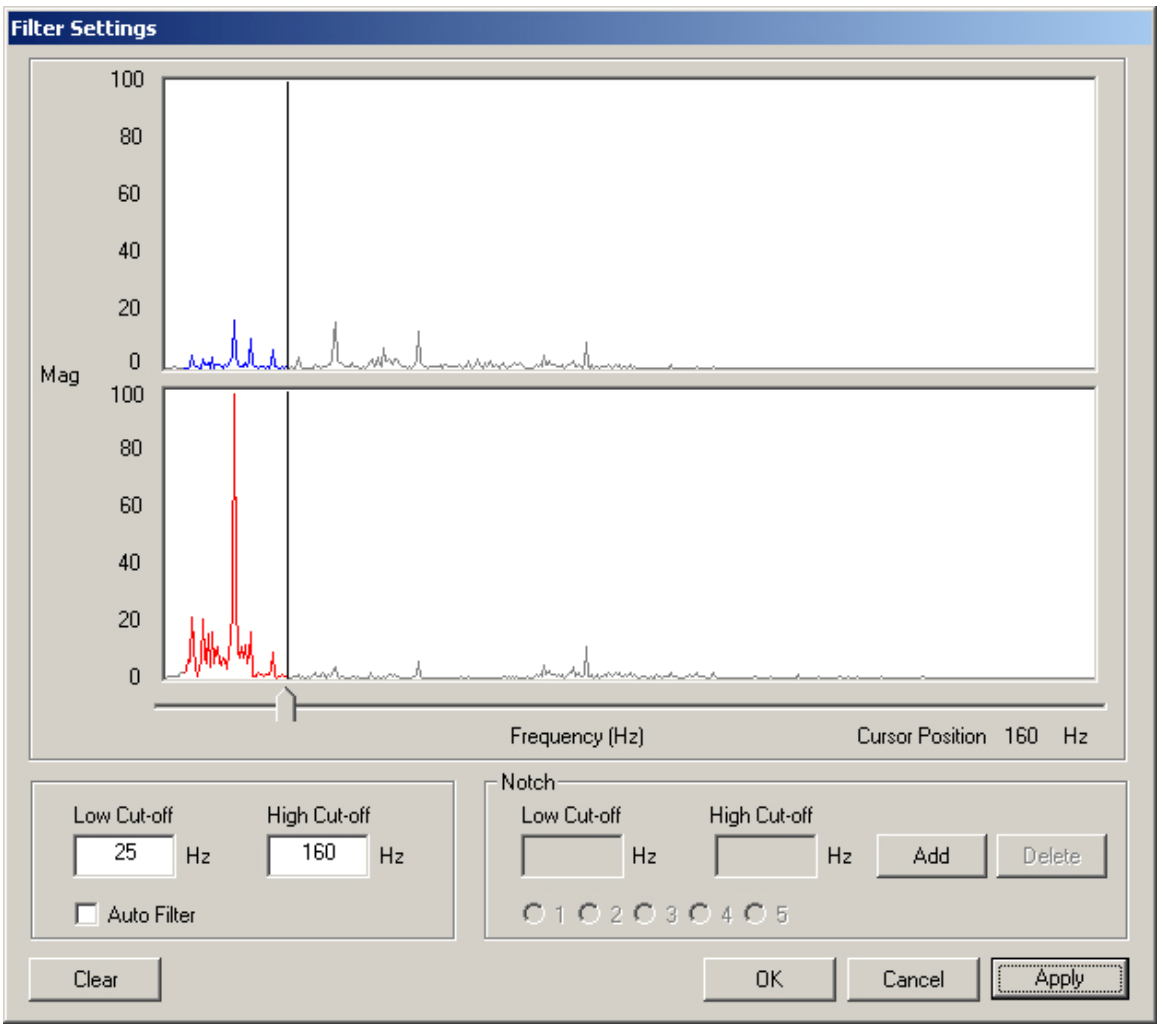
With the new material highlighted, click "Edit" on the right side of the window and when prompted enter the diameter/velocity in the corresponding boxes. The new diameter/velocity element will appear in the table. You may add up to twenty diameter/velocity elements per material.

To remove a material completely, highlight the material and click the "Remove" button.

To remove a diameter/velocity element associated with a material, highlight the material and then highlight the diameter/velocity element you wish to remove from the table and press the "Remove" button.

Note: At least one diameter/velocity element must be defined for each material.
Selecting the "Restore Default Materials Database" option from the "Pipe" menu will restore the default database of pre-defined materials.

Filter Settings



The low cut-off filter is used to filter out all frequencies below the set frequency. To set the low cut-off filter, type the frequency for cut-off in the relevant box. The graphs will update to show the filtered areas in grey.

The high cut-off filter is used to filter out all frequencies above the set frequency. To set the high cut-off filter, type in the frequency for cut-off in the relevant box. The graphs will then be updated to show the filtered areas in grey.

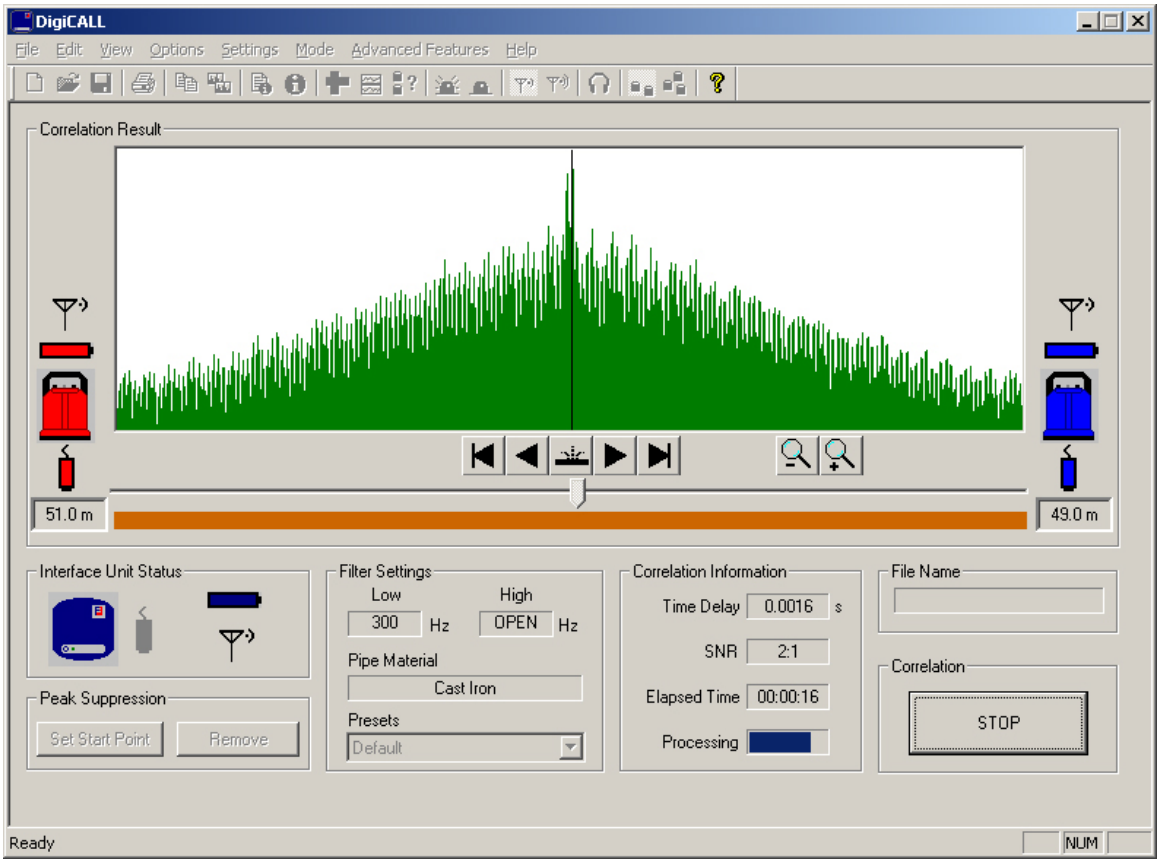
The notch filters can be used to filter out specific frequencies. Up to five notch filters can be defined. To define a notch filter, click the "Add" button and then set the corresponding high and low cut-off values. When more than one notch filter has been defined, each notch filter can be selected by selecting the corresponding radio buttons. Ticking the "Auto Filter" box applies an automatic filter for the reading based on the strongest signal.

Pressing the "Clear All" button, clears all the filter settings.

2 Station Correlation

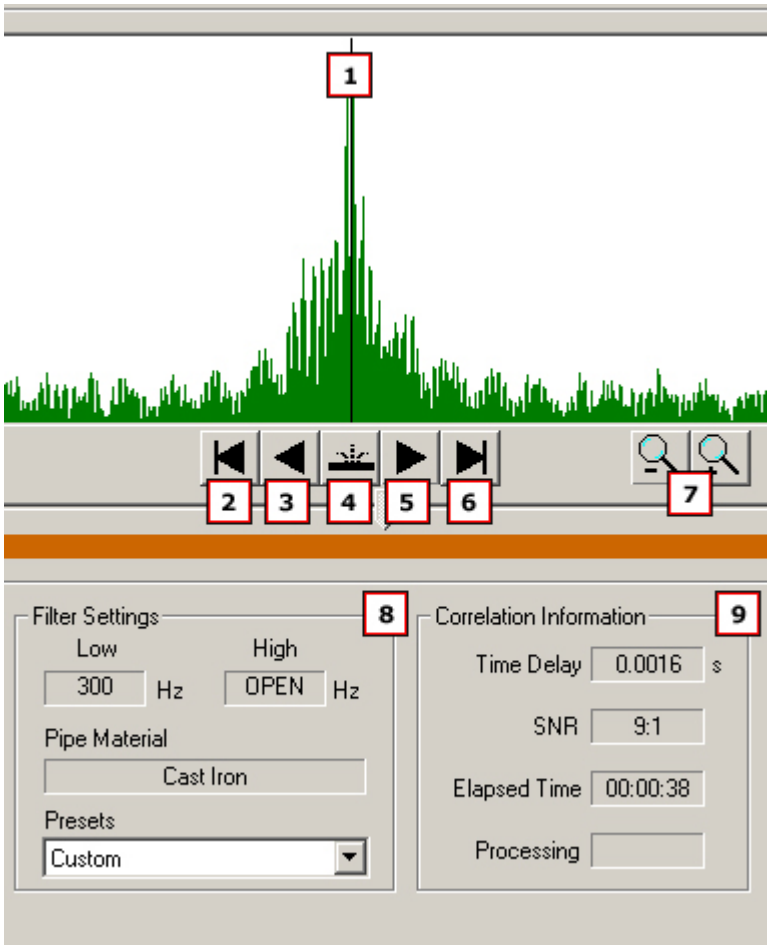
In a 2-station correlation the sensors and Outstations should be deployed on either side of the suspected leak as shown below:

Once you have deployed the Outstations, connected the Interface Unit to the laptop and have configured all the desired parameters, click the "START" button from the main screen. The following screen will appear:



If you have not pre-configured the parameters for the correlation and you click "START" you will be prompted to configure the pipe and sensor parameters before the correlation begins. Once all the required parameters have been configured, correlation will begin.

The "Processing" bar at the bottom of the main screen shows the data is being received by the Interface Unit and is indicated by the blue bar going from left to right. Once you have sufficient data (graph showing a nice sharp peak), press the "STOP" button to stop correlating.



1: Cursor automatically centres on the leak position

2: Moves cursor to the far left of display

3: Moves cursor to the left

4: Centres the cursor on the leak position

5: Moves the cursor to the right

6: Moves cursor to the far right of display

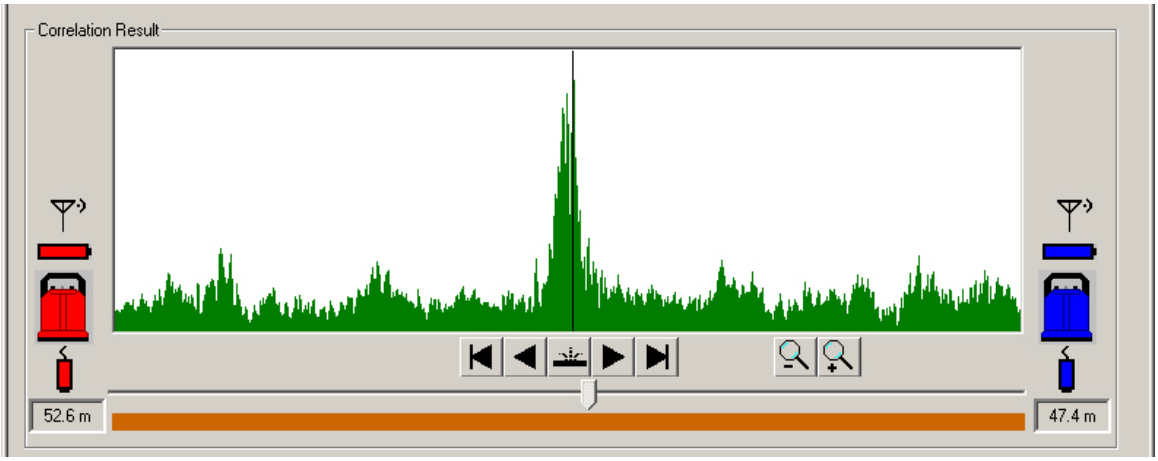
7: Zoom graph functions

8: Current filter settings

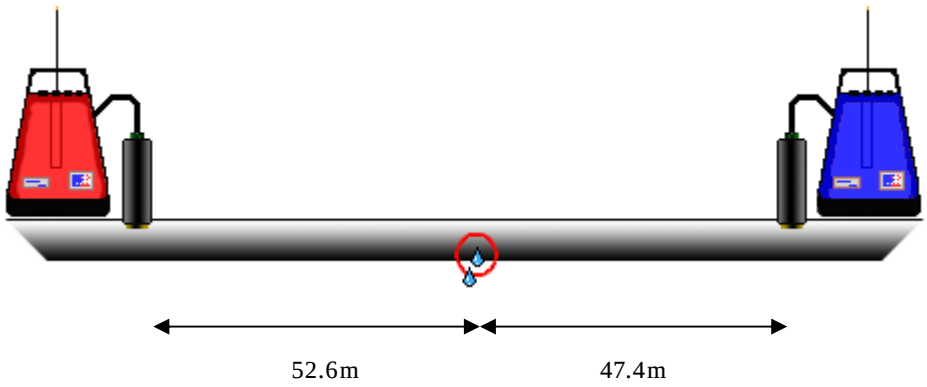
9: Correlation information

NB: Cursor cannot be moved whilst correlation is in progress

Once the correlation has completed you will be left with an accurate account of where the leak is in relation to each sensor.



In our example above, we can see the leak has been located 52.6m from the Red Sensor and 47.4m from the Blue Sensor.

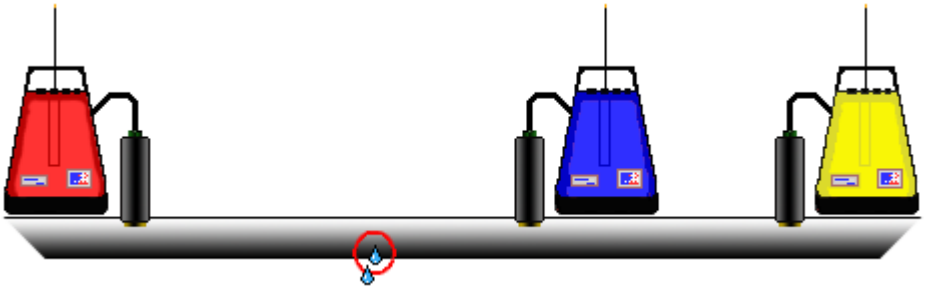


As the system has full post processing the user can edit on-site or off-site and make full use of the export features in the software.

The text and graph data may be used in documenting reports and in certain applications users may make use of the exported GIS information.

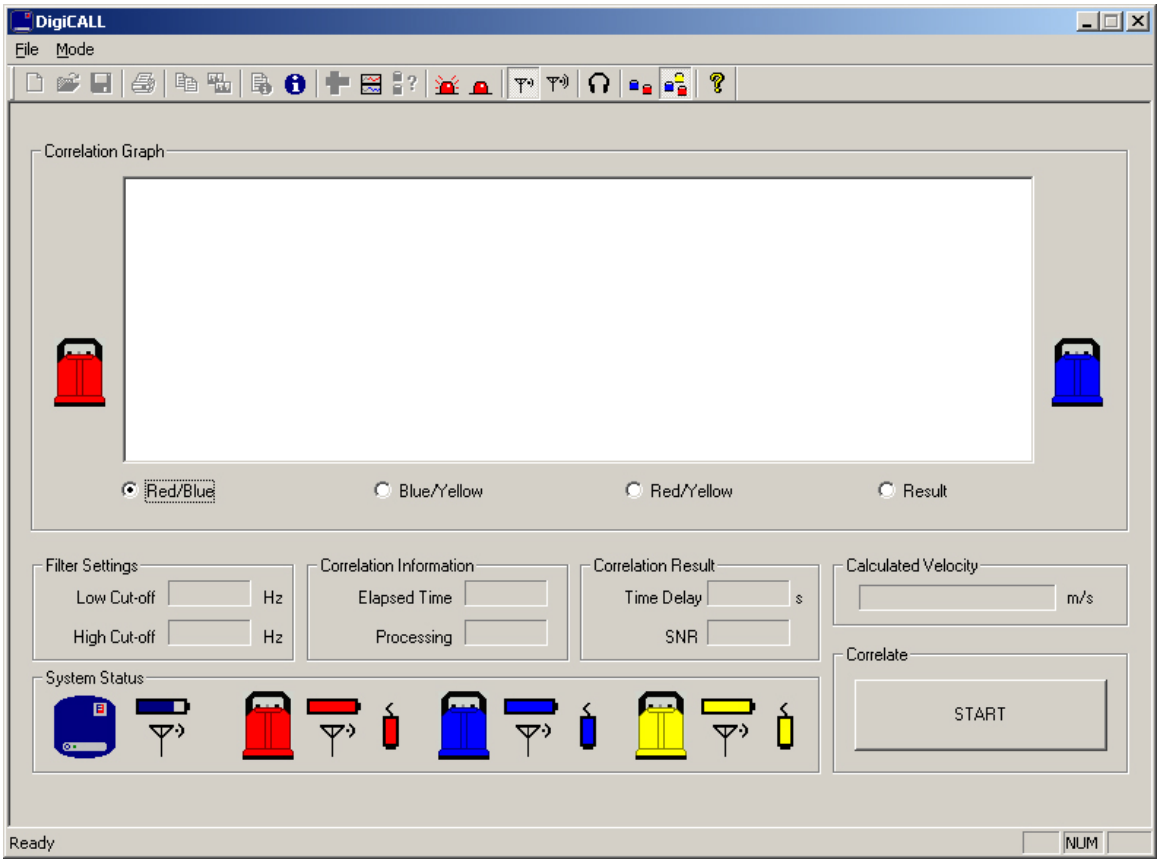
Tri-Correlation

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.



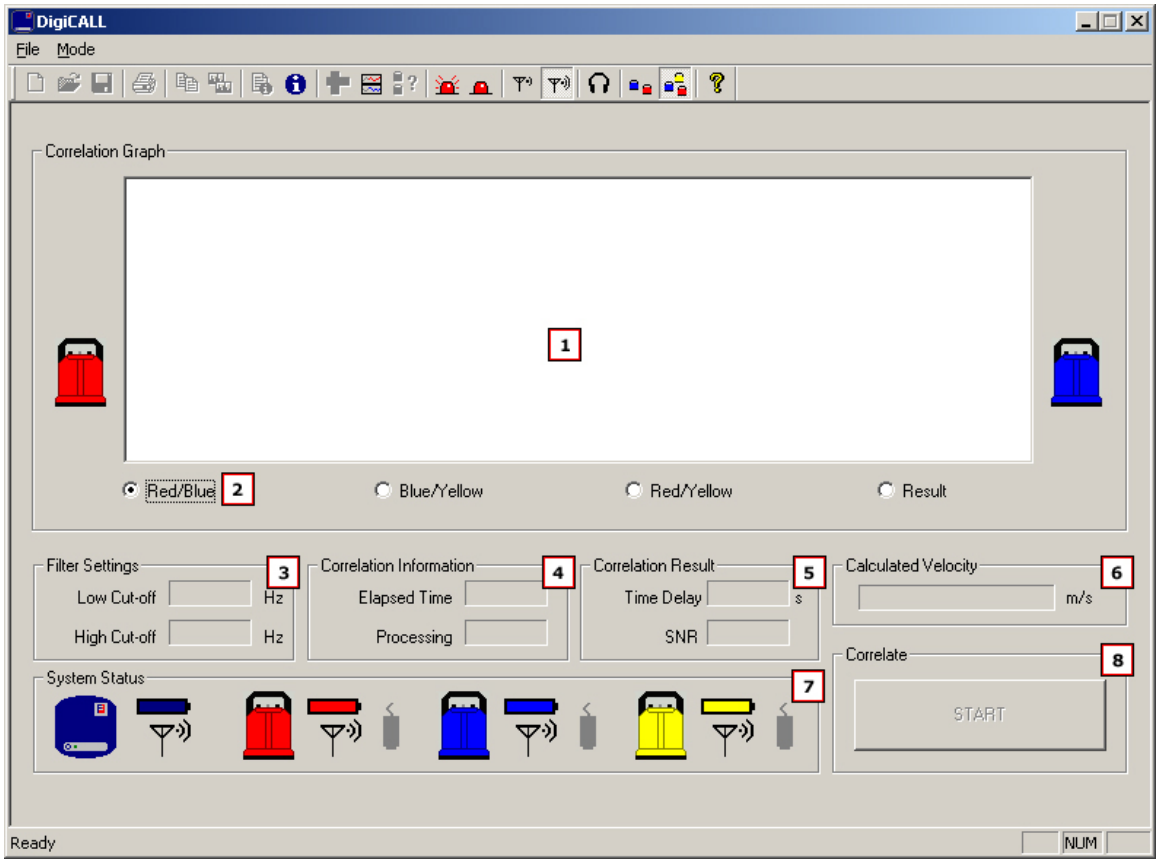
The sensors must always be placed in the same order on the pipe being surveyed.
i.e. left-to-right - red, then blue, then yellow, as shown above.

Once you have deployed the Outstations and connected the Interface Unit to the lap-top you will need to configure the DigiCALL application for a 3-station correlation ses-sion. To do this, click Mode from the top menu and select Three Station. You will be presented with the following screen.



Although the screen is very similar to the 2 Station Correlation screen there are some differences.

The image below explains the main features:



1: Correlation Graph Display Area

2: Sensor Select

3: Current Filter Settings

4: Correlation Session Information

5: Current Correlation Result

6: Calculated Velocity for Correlation

7: System Status

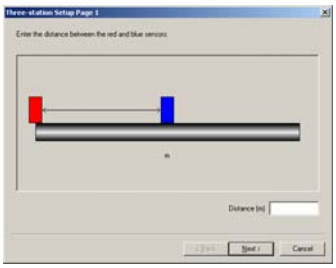
8: Start and Stop Correlation

9: Correlation Information

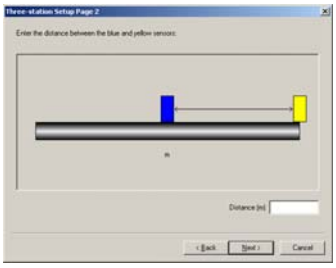
Click the “START” button in the bottom right corner of the screen.

You will now be prompted to enter the details for the correlation.

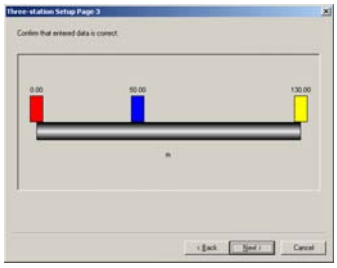
In the first window, enter the distance between the Red Outstation and the Blue Outstation.



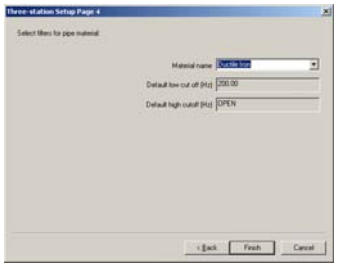
In the second window, enter the distance between the Blue Outstation and the Yellow Outstation.



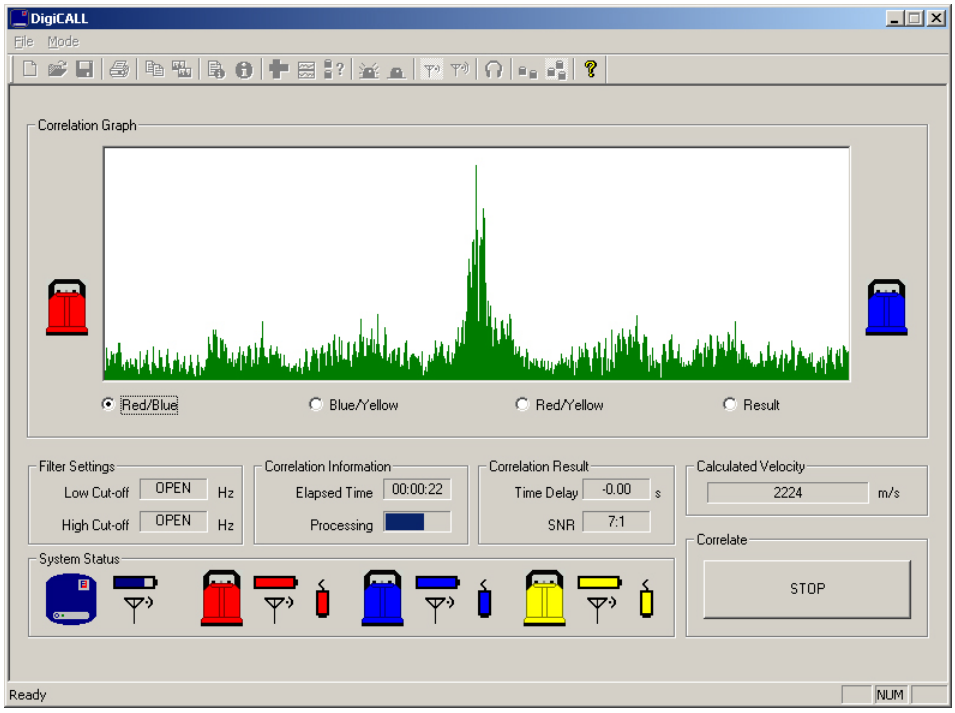
The third window shows a graphical representation of the distances between the Outstations.



In the forth and final window, select the material of the pipe using the drop down menu.



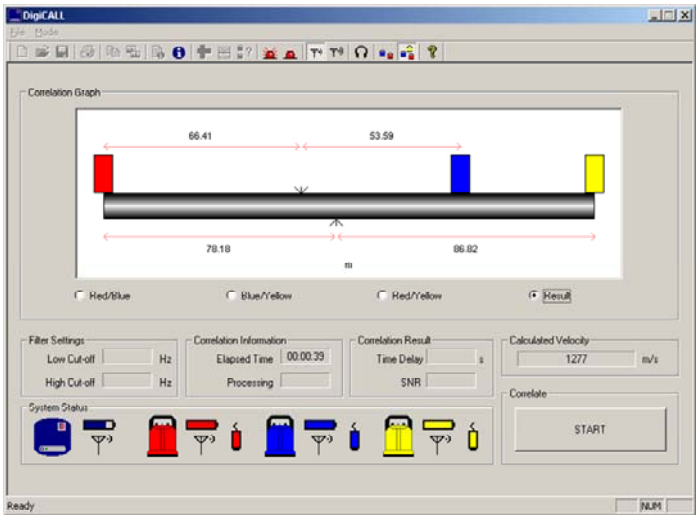
Upon clicking Finish, correlation will begin.



By clicking the radio buttons for the associated sensors you can see the results between sensors.

Once you have a nice peak on the graph, click the "STOP" button to stop the correlation.

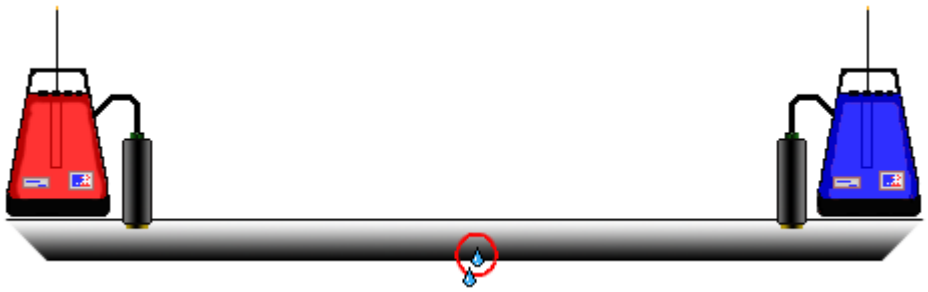
Clicking the radio button "Result" will display a screen similar to the one below displaying the leaks position in relation to each sensor.



Calculate Velocity

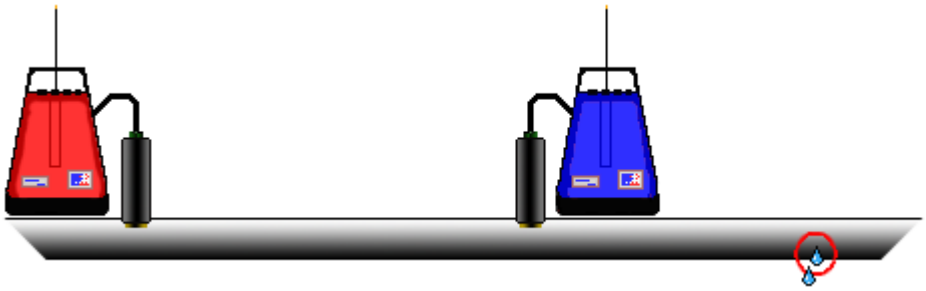
A velocity check gives a more accurate velocity of the pipe to be correlated instead of using the default velocity value. In some circumstances the default velocity may be slightly off due to adverse conditions, therefore it may be required that a manual velocity check be performed to ensure a correct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

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.

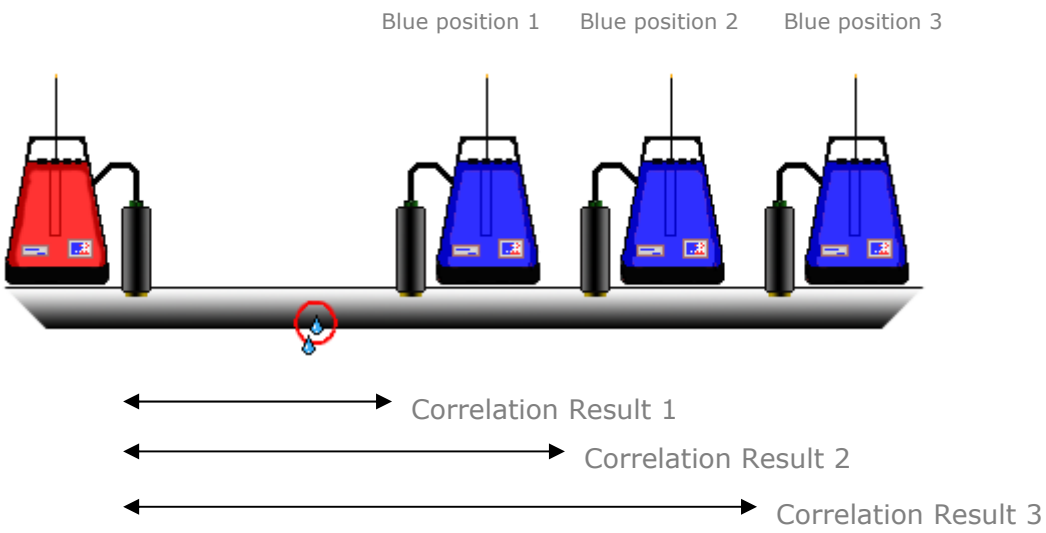
The time delay / distance relationship of the correlation is linear, as the distance between a sensor and the leak noise increases, the time taken for the sound to reach the sensor increases proportionally with the distance.

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 predict values for varying time delays / distances when using a set of correlation results.

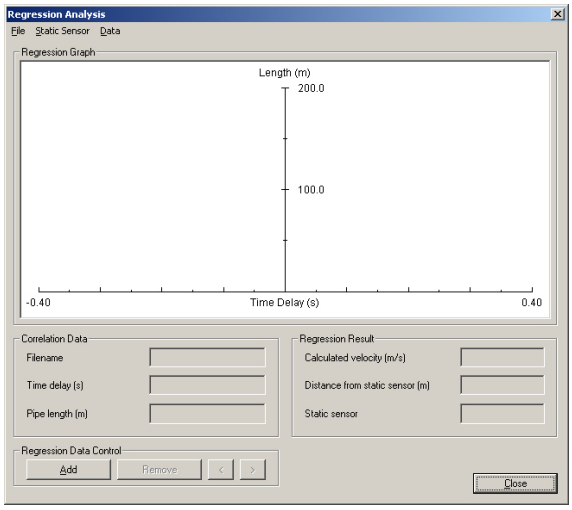
Before the regression analysis feature can be used, at least 2 correlation's must have been saved. For an accurate result it is recommended to save three correlation's, but obeying the following two rules:-

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

2) The pipe material and diameter must be constant for each of the correlation results. This is validated by the system.



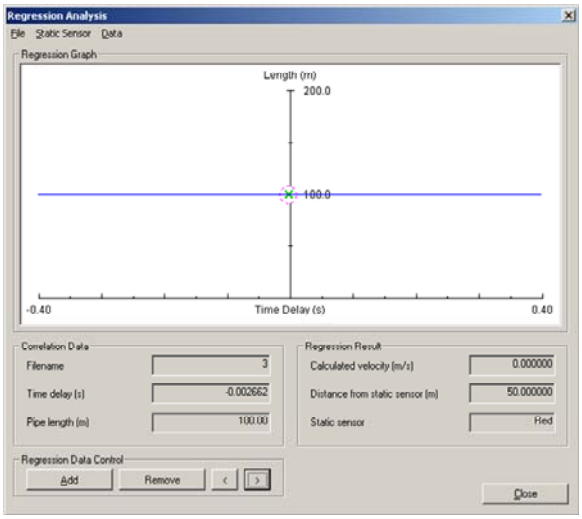
After at least 2 correlation results have been saved, select “Regression Analysis” from the “Advanced Features” menu. The following screen will appear.



Click the “Add” button and load the first correlation file, when prompted, select the “static” sensor. The system will store the material and diameter of the first correlation result and compare with the next result to be added this ensures these details remain constant. Load the second and third correlation files.

By selecting “Information” from the “Data” menu the user can add a title and comments for the regression analysis. This makes it easier in distinguishing different files.

The regression analysis graph will appear showing time delay and distance. A cross will appear on the graph plotting the combined correlation result.



Appendix A — Bluetooth Information

NOTE:

Only certain Bluetooth modules are compatible with the DigiCALL+ system. Please seek advise from your representative prior to ordering.

If you are using the supplied USB Bluetooth dongle, please see below for details.

Once the Bluetooth software and dongle have been successfully installed.

Ensure the Bluetooth dongle is connected and enabled.

Turn DigiCALL+ Interface Unit ON

Open the Bluetooth management software and search for devices

When you have found "DigiCALL XX:XX" select the option to "PAIR" the device. If asked use "0000" (four zeros) as the passkey.

Once paired, start the Bluetooth Serial Port, making a note of the serial port number.

Open the DigiCALL+ application by clicking:

Start—Programs– Palmer Environmental-DigiCALL

Click "Settings-COM Port" and select the communications port setup via the Bluetooth software.

Once selected the software will store the selected Com Port as default.

Should you get any errors in opening the selected com port please ensure the Bluetooth serial port is running by checking in the Bluetooth software.

If you have any problems configuring your Bluetooth device, please seek assistance from your local IT administrator. Palmer Environmental cannot offer any support on the configuration of Bluetooth devices.

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Note

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