

MicroCorr[®] Digital Users Guide



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
Internet: www.palmer.co.uk
Mcorr Dig UG

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MicroCorr[®] Digital Users Guide

Introduction and Features

MicroCorr[®] DIGITAL is the latest model of the world's leading correlator brand (over 4,000 MicroCorr[®] units in use worldwide) but is the first fully digital system. 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
- 1/4 VGA colour display
- *Software upgrades via Internet web site*
- *Optional third Out Station for velocity measurement and rapid survey*
- *Select dedicated or PC-based models*

New features

- Transceiver communication enables all system functions to be controlled centrally, enabling quicker deployment
- Expert system leak detection algorithms eliminate transient, non-leak effects
- *Tricorrelation (optional third Out Station/sensor) automatically calculates site-specific velocity*
- Data replay function allows immediate post-processing or off-line correlation
- *Software upgrades downloaded directly from www.palmer.co.uk*
- *Results transferable into Windows PC for post-processing or export*

Best in the field

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 Control Unit and Out Station are injection-moulded housings, providing maximum strength and durability. They are designed to IP65 protection and to survive a 1 metre drop. The Control Unit incorporates an external antenna and a magmount antenna (optional extra) may be connected for longer correlation distances if the Control Unit is vehicle-based. External antennae are used with the Out Stations.

All connectors are military specification and cables are fitted with strain relief to protect against fatigue damage. The complete system, comprising control unit with two Out Stations and sensors, is easily carried by one person. The Out Stations have been designed to be visible over typical correlation distances and allow back-to-back portability.

Operational Benefits

- Pinpoints a higher percentage of leaks...
- ...and a significantly higher percentage of “difficult” leaks (plastic pipes, trunk mains, low pressure situations)
- 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*
- *Ground microphone “foot” option to improve versatility*
- *Permalog “Patroller link” option to improve versatility*
- Designed for easy portability

Fully automatic

- Immediate correlation – switch on and go (enter pipe details later)
- Automatic parametric filtering (APF)
- *Velocity measurement using (optional) third Out Station/sensor*

Easier to Use

- Colour graphical user interface
- Intuitive display and operation
- Quick correlation
- Batteries field-changeable

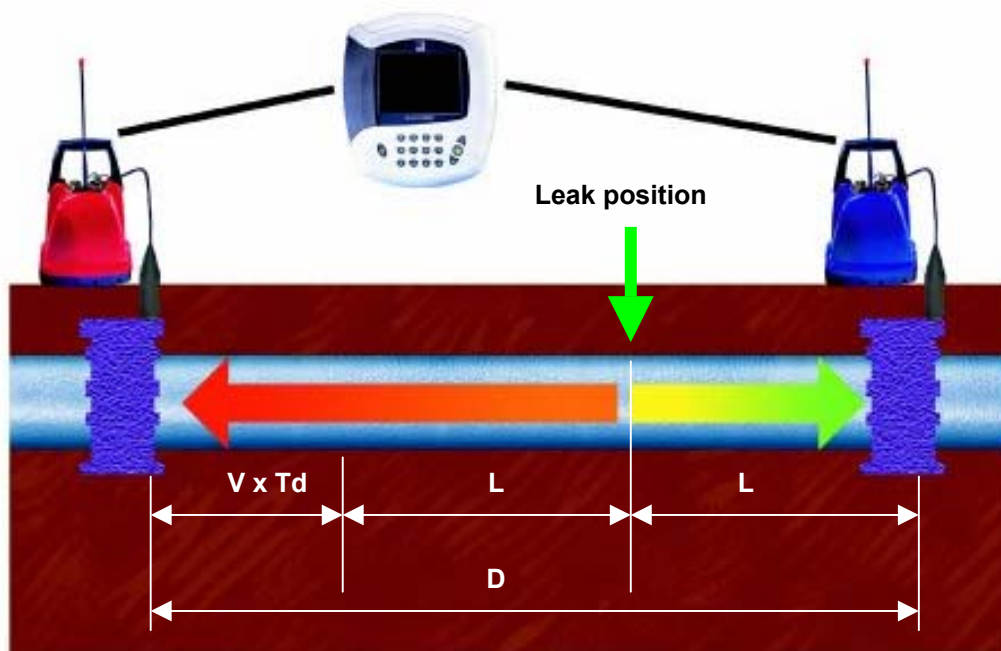
Reliability to inspire confidence

- All functions self-calibrated automatically on power-up
- In-built power management
- 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 (T_d) 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 to within centimetres.

Principle of correlation: $L = \frac{1}{2} (D - (V \times T_d))$



System Overview

Standard system configuration

The standard MicroCorr Digital system comprises the following equipment:-

1. Control Unit
2. External Antenna for C.U.
3. Carry strap for C.U.
4. Red Out Station
5. Blue Out Station
6. 2 x External Antennae for O/S
7. 2 x Digital Sensors with cables
8. Headphones (for use with C.U. or O/S)
9. MicroCorr Digital PC communications cable
10. Mains power supply/charger for 2 Out Stations
11. Mains power supply/charger for Control Unit
12. 12V DC power/charge lead for C.U. or O/S
13. Operating manual



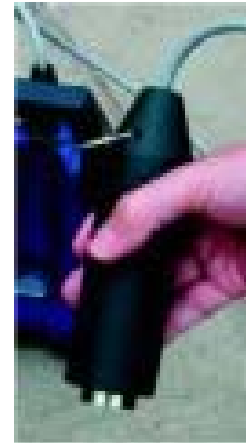
Optional accessories

1. PC software (for upgrades, diagnostics, PC interface)
2. Spare battery pack with charge lead
3. Vehicle magmount antenna with cable
4. Digital hydrophones with cables (set of 2)
5. Leak noise CD
6. Digital microphone foot
7. Tripod or ground plate for accelerometer (magnetically attached)
8. Printer cable to standard Epson/HP printer
9. Rechargeable colour printer with batteries
10. "Tricorrelation" 3rd (yellow) Out Station and digital sensor, with antenna and charge lead
11. Measuring Wheel
12. Soft carry bags for control unit and Out Station(s)
13. Hard transit case for all system components.
14. Permalog Patroller radio unit

Fully 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
- True 16 bit $\Sigma\Delta$ ADC with 10kHz sampling
- Immediate digitisation of received signal
- Low noise electronics with digital protocol eliminates interference
- Longer sensor cables possible



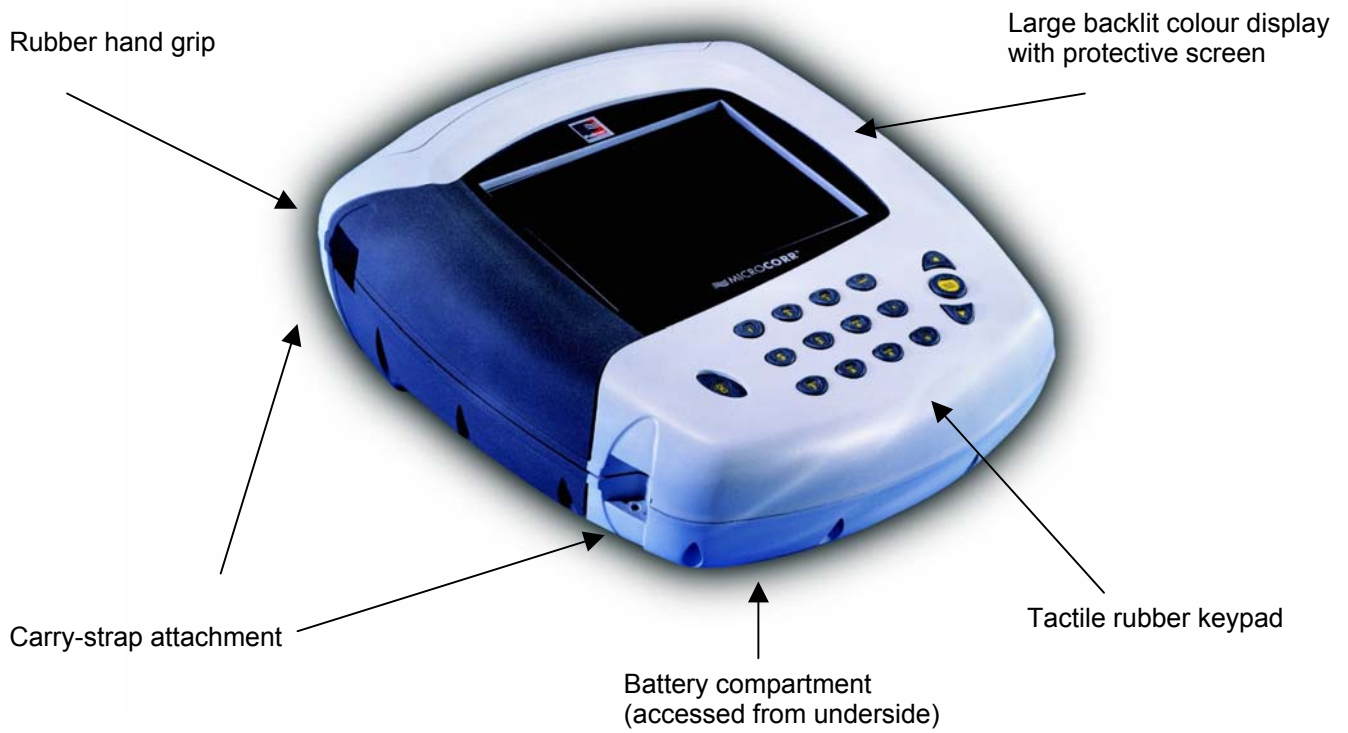
Digital radio Out Station

- Two-way communication with control unit using transceiver technology
- Virtually no data loss, interference or distortion of the transmitted signal
- Single radio frequency for all Out Stations
- Improved dynamic range over analogue radios
- High speed data transmission using transform coding techniques
- No directional restrictions

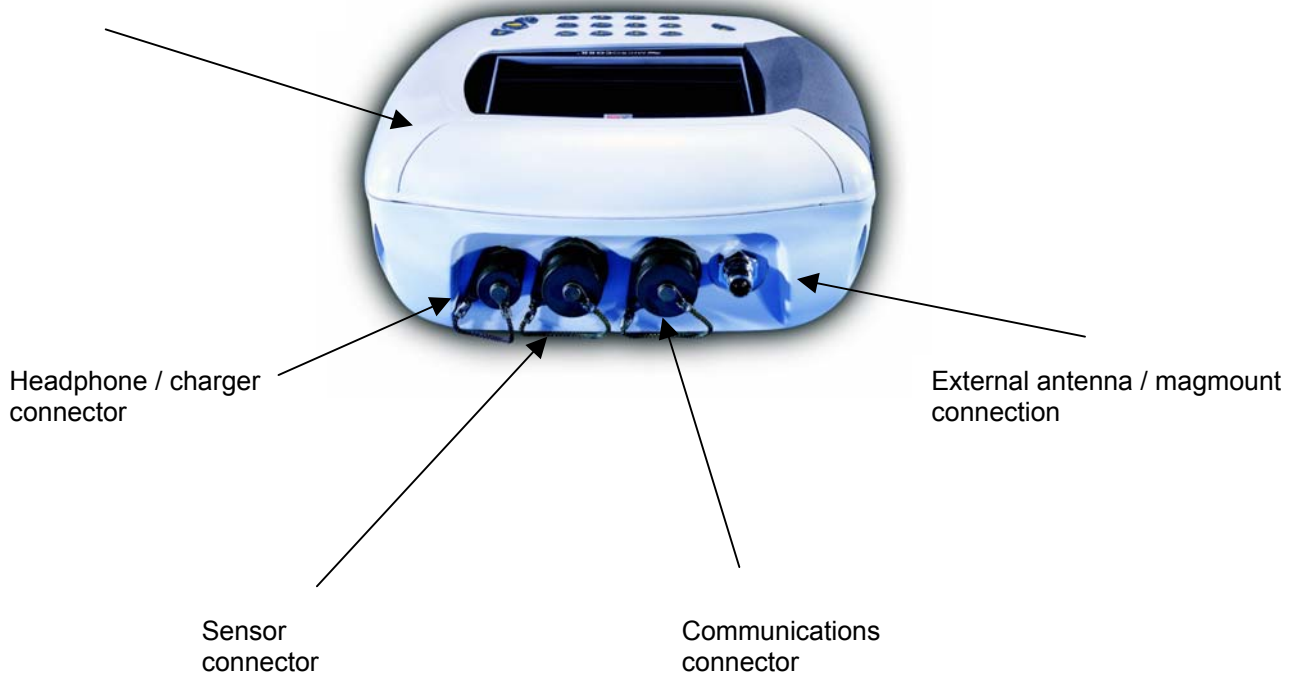
New digital sensor with enhanced low frequency sensitivity



Features of the correlator unit

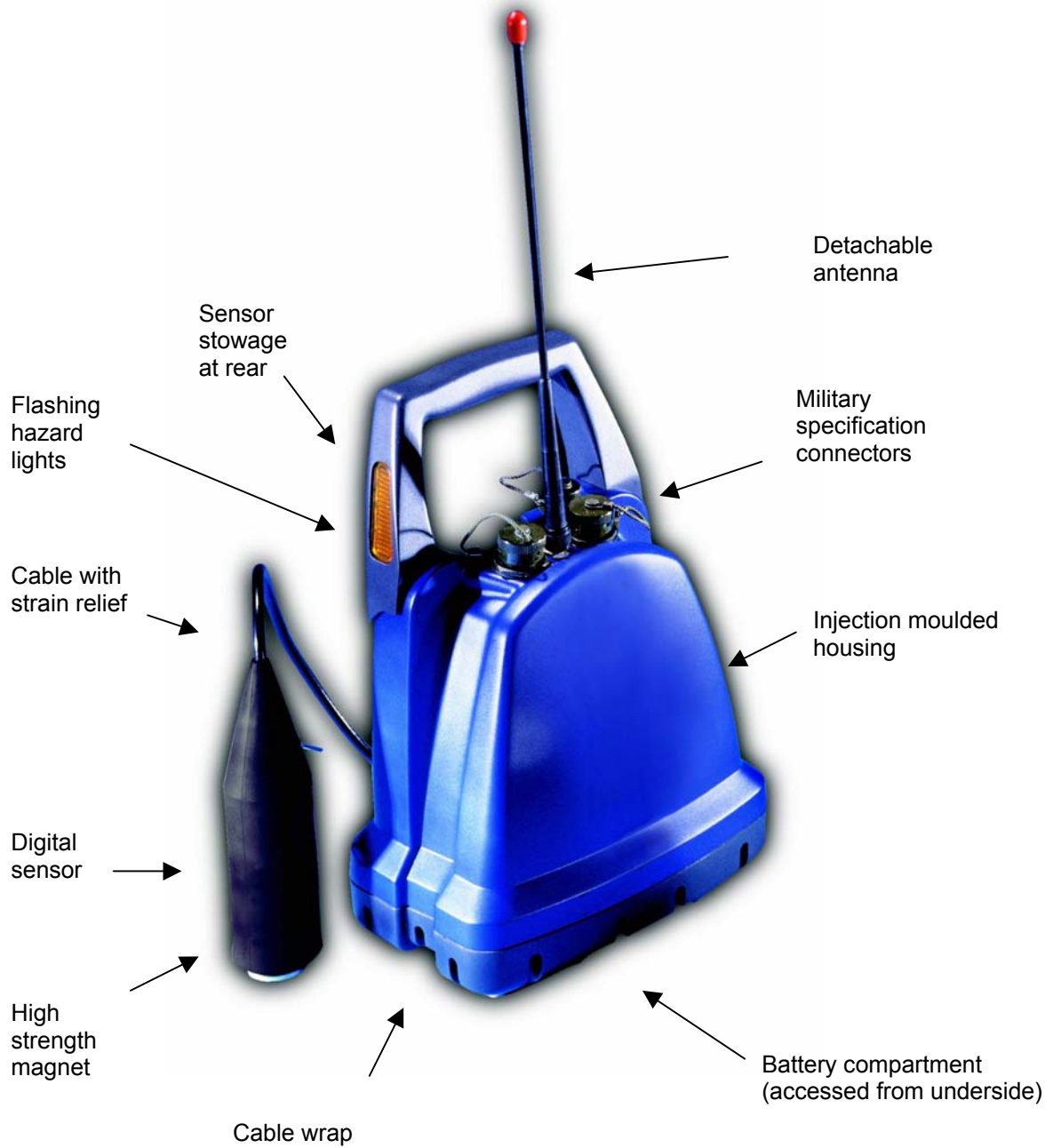


Injection moulded housing



Features of the Out Stations

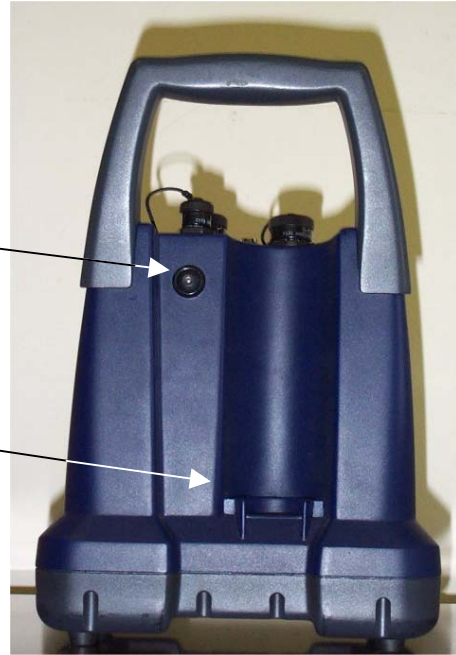
The Out Station consists of a transmitter unit (red, blue – or optionally yellow) and a digital sensor unit complete with cable to connect to the transmitter. Its design incorporates sensor stowage and cable wrap.



Rear of transmitter

On/Off switch with integral flashing LED

Sensor stowage



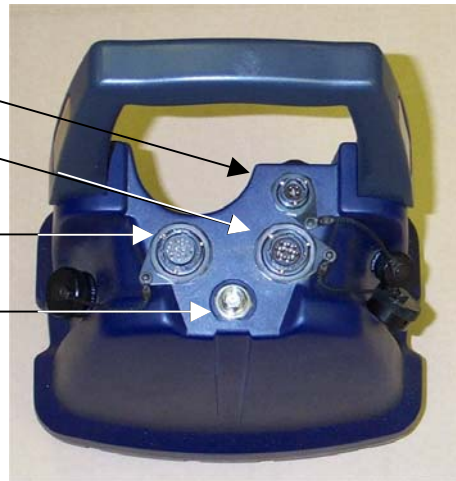
Top view of transmitter – connector covers removed

Headphones / charger connector

Communications connector

Sensor connector

Antenna connector



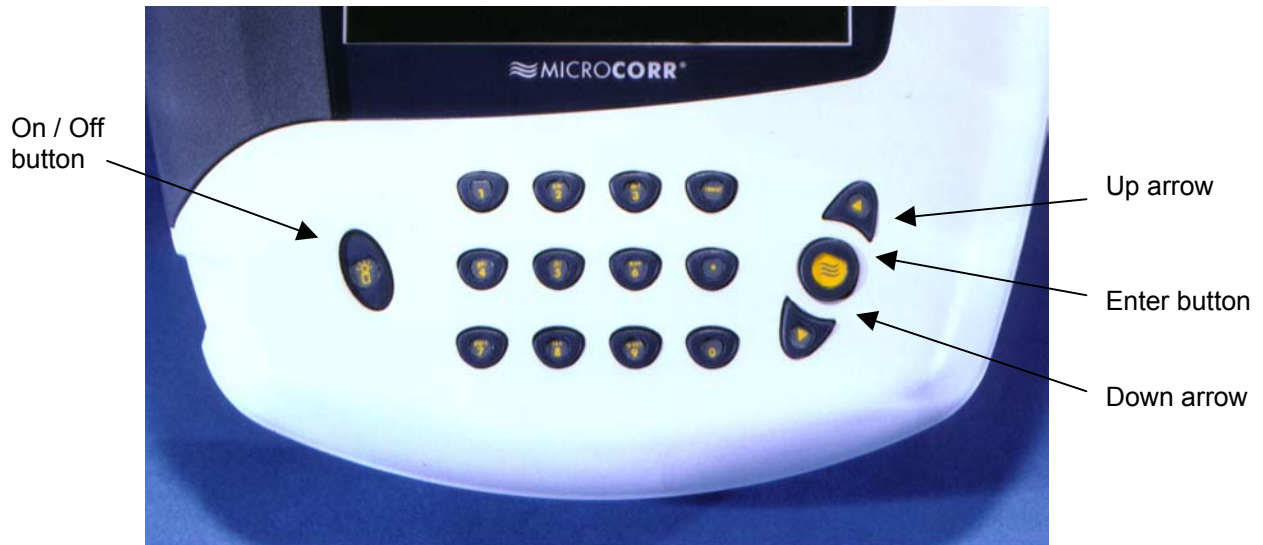
Top view of transmitter – connector covers fitted



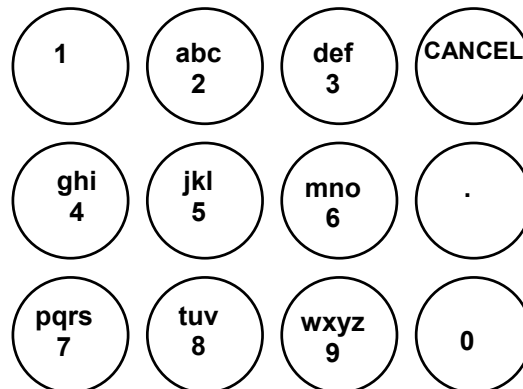
MicroCorr[®] DIGITAL correlator unit operational features

The unit performs accurate leak noise correlations for leak positioning and velocity measurement. It has listening and surveying facilities and its stored information can be downloaded to a computer or printer.

Key functions



Keypad functions



MicroCorr Digital has an alpha-numeric keypad, similar to that of a mobile phone including a full stop, cancel, enter and up/down arrows. Navigation through the menus uses combinations of these keys.

- UP/DOWN arrows will select items from within a list
- Numeric to select menu item
- Enter to accept input
- Cancel to move back a menu level.

Using the MicroCorr[®] Digital Correlator

BATTERY WARNING

All three batteries supplied are rechargeable lithium ion. Do not short circuit these batteries. Any misuse of these batteries 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 overdischarging.

Step 1: Charging and installing batteries

The battery packs for the correlator and the Out Stations are supplied as separate items and will need to be fully charged although they are supplied quarter charged.

Two different battery chargers are supplied: one for the correlator and one for both Out Stations to be charged simultaneously. All three batteries are identical and are interchangeable. Charging for all batteries takes up to 4 hours from flat.

Charging the Correlator

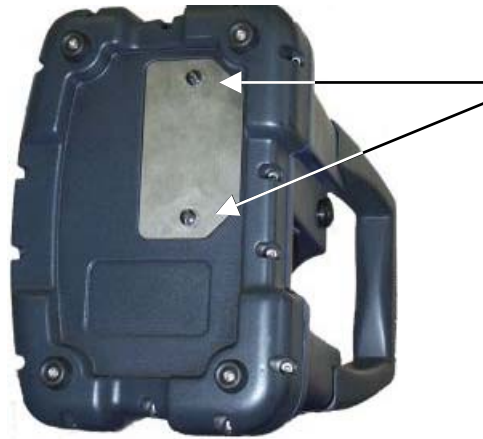
1. To charge the correlator battery, the battery must first be fitted inside the correlator.



Unscrew these 3 quick-release screws to remove battery compartment panel.

2. To insert the battery pack into the correlator unscrew the three screws underneath the unit, remove the cover and packing foam and connect the battery pack, place in the battery compartment, refit the packing foam, and then replace the cover with the three screws.
3. Connect the charge lead from the correlator charger to the headphone / battery charge connector on the back of the correlator. Plug the charger unit into the mains supply and switch on. The correlator will turn itself on and display the battery indicator as charging on the correlation screen.

4. To charge the Out Station batteries they must first be installed. To do this remove the screws from the battery compartment on the bottom of each Out Station, connect the battery lead to the connector and insert the battery. Refit the screws and attach the battery charge lead to the headphone / charge connector on the top of the transmitter. The Out Stations will turn themselves on to charge.



Unscrew these 2 quick-release screws to remove battery compartment panel.

Remember to turn control unit and Out Stations off after disconnecting charger cables.

Although the batteries are rechargeable, they may eventually need to be replaced. Only batteries configured to the correct specification and type must be used. These are available from Palmer Environmental.

TWO OUT STATIONS CONNECTED VIA CHARGER TO MAINS



Step 2: Set up and deployment of Out Stations

1. Once the batteries have been charged and installed in the correlator and the Out Stations, connect the antennae, connect a sensor cable and sensor to each Out Station. Switch on each transmitter by pressing the On / Off button on the back.

2. Transmitter switch functions

To switch the transmitter on, press the switch on the rear of the transmitter once momentarily. The beacons will flash once.

To switch the flashing beacons on, press the switch momentarily again.

To switch the flashing beacons off, press the switch momentarily once more.

To switch the transmitter off, press the switch and hold it in for at least 2 seconds. The beacons will flash three times before the Out Station turns off.

3. Green LED functions

The switch incorporates a green LED, which provides the following functions:-

When lit constantly the transmitter is charging.

When flashing rapidly, the transmitter battery is almost fully charged.

When flashing steadily, the transmitter is switched on and performing normally.

When there is a long flash this indicates the battery is discharged and requires charging.

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 try to make a debris free contact between sensor and fitting for the best possible results.

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

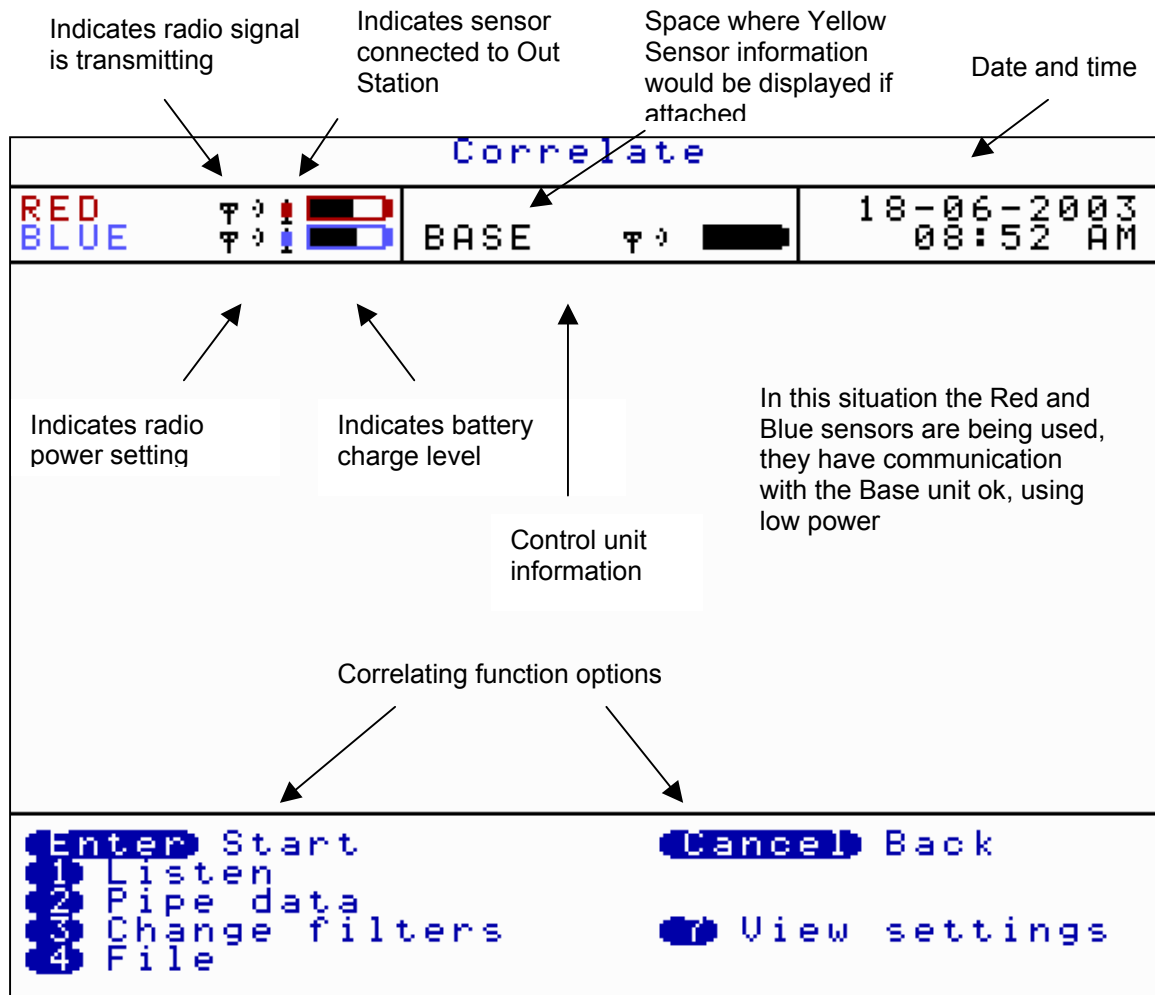
Step 3: Switching on the Correlator

Switch the correlator on by pressing the On/Off switch momentarily. A number of system tests are carried out on power up to ensure the correlator is fully functional. After a few seconds the main correlation screen will appear on the display as shown below. Note, this is the default screen on start-up to enable the operator to start correlating immediately. The Main Menu screen is accessed by pressing Cancel.

To switch the correlator off, press the On/Off button and select 2, to switch off

To turn off the display only, press the On/Off button and select 1, to put into standby. (If the correlator is not then used for 2 hours it will switch off). To reactivate the screen, press the On/Off button again.

The top menu bar on the correlate screen shows information for each sensor by displaying in the relevant colour (except Yellow appears black)



Correlating

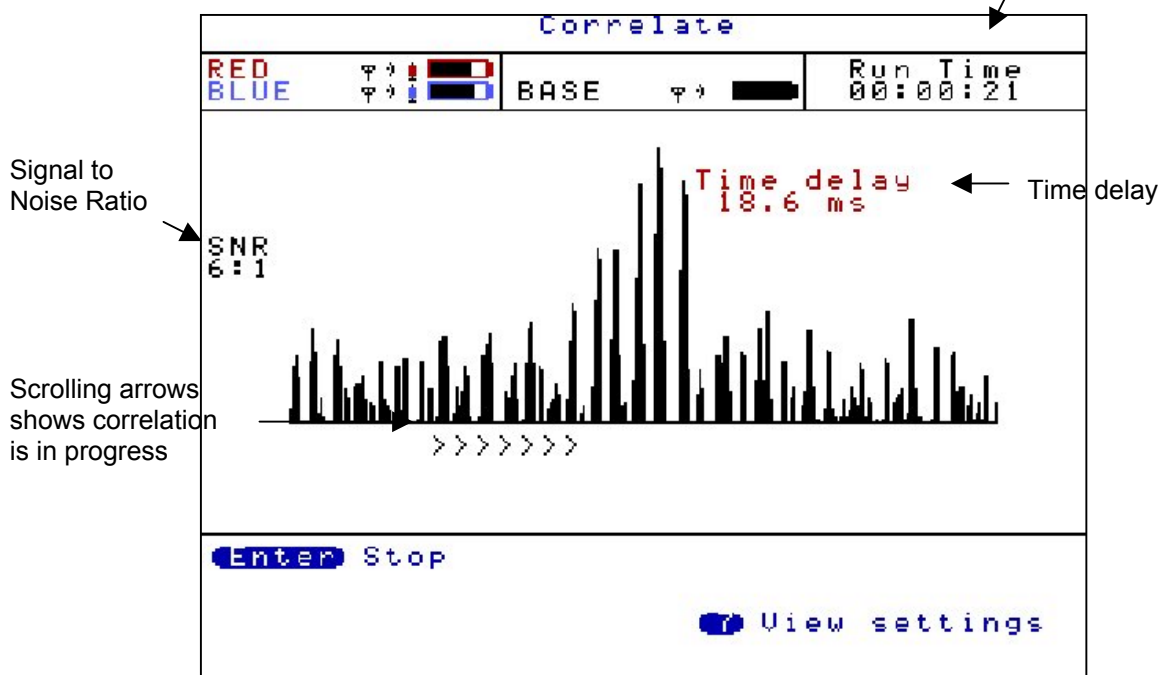
The screen shown on page 15 is the first screen that appears on the control unit when it is switched on. Once the ENTER key is pressed the system will begin to correlate. Correlation can be stopped by pressing the ENTER key again.

This can be used for quick surveys without having to input any pipe data.

If the Enter key is pressed the control unit will start to correlate as shown below.

Date and time changes to the run time of the correlation

Press ENTER to stop correlation, to return to correlator function options



There is an option to select either the Correlate screen or the Main Menu screen as the first screen to appear after turning on. This can be selected by using the Set-up screen (option 4) from the Main Menu.

Main Menu



Correlate

See previous page for quick correlation instructions or Correlation Screen section for more in depth instructions.

File

Enables the user to load previously saved files or save a current correlation. The control unit can store approximately 30 files.



Press 1(Save) The following screen is displayed. The current correlation information details can be typed and saved.

```

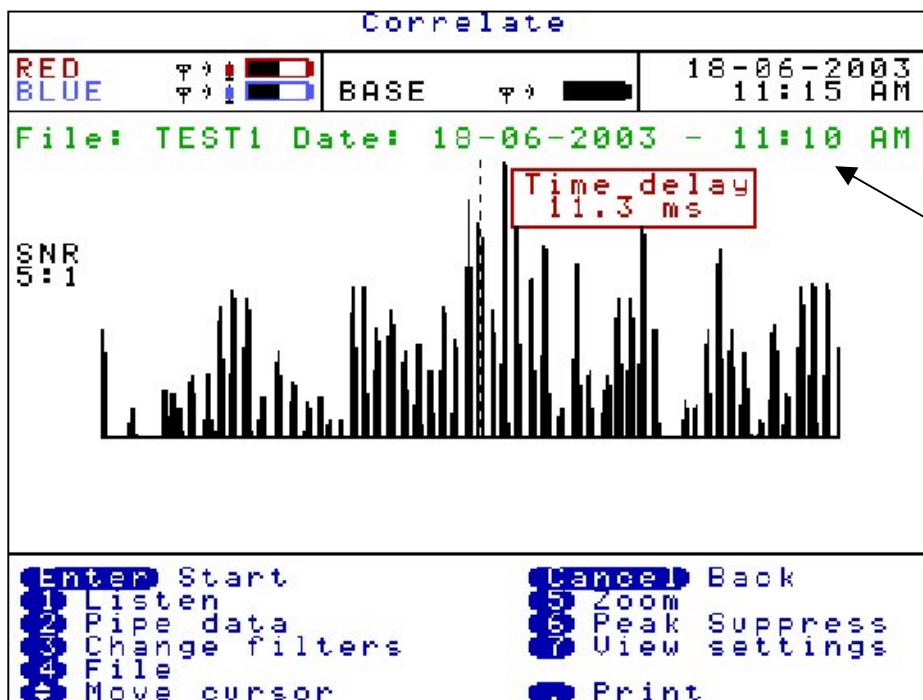
Save Correlation Data

File name  TEST1
Title      HIGH STREET
Date
Time

Comment 1  ■
Comment 2
Comment 3
Reference

0-9  Insert          Next line
      Space          Accept data
      Backspace      Cancel
Enter
Cancel
  
```

Press 2(Load) The saved correlation will be displayed. Arrow over the required saved file and press 2.



From a loaded file the control unit can undertake post correlation. Correlating functions such as pipe data, filters and peak suppression can be changed on the loaded data without having to return to site to re-correlate. Using new information may correlate a different result.

Press 3(Delete) Deletes a previously saved file. Use the arrow keys to highlight the file for deletion and press 3.

Press 4(Properties) Displays file information and comments, when the file was saved. Use the arrow keys to highlight the file to view and press 4.

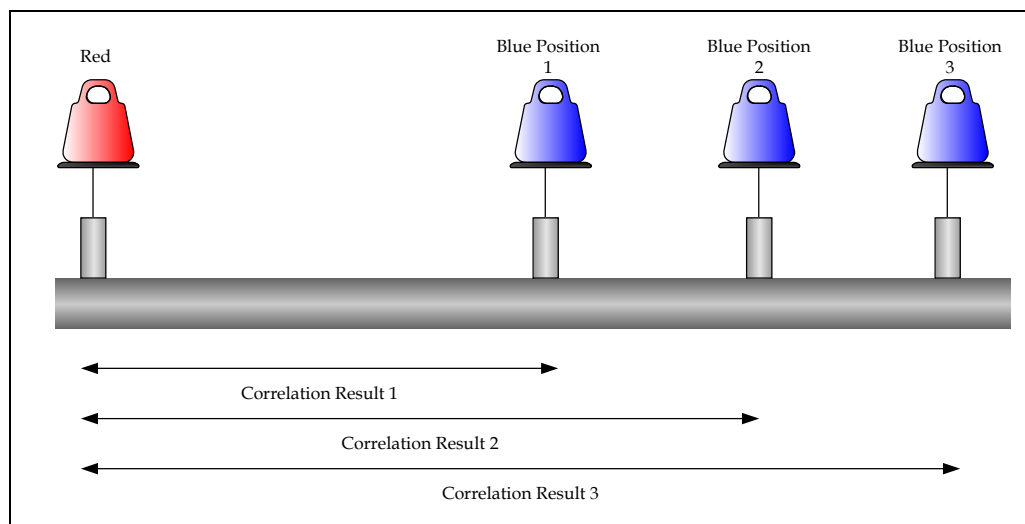
Regression Analysis

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 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, correlation's must have been saved on the control unit. For an accurate result it is recommended to save three correlation's, but obeying the following two rules :-

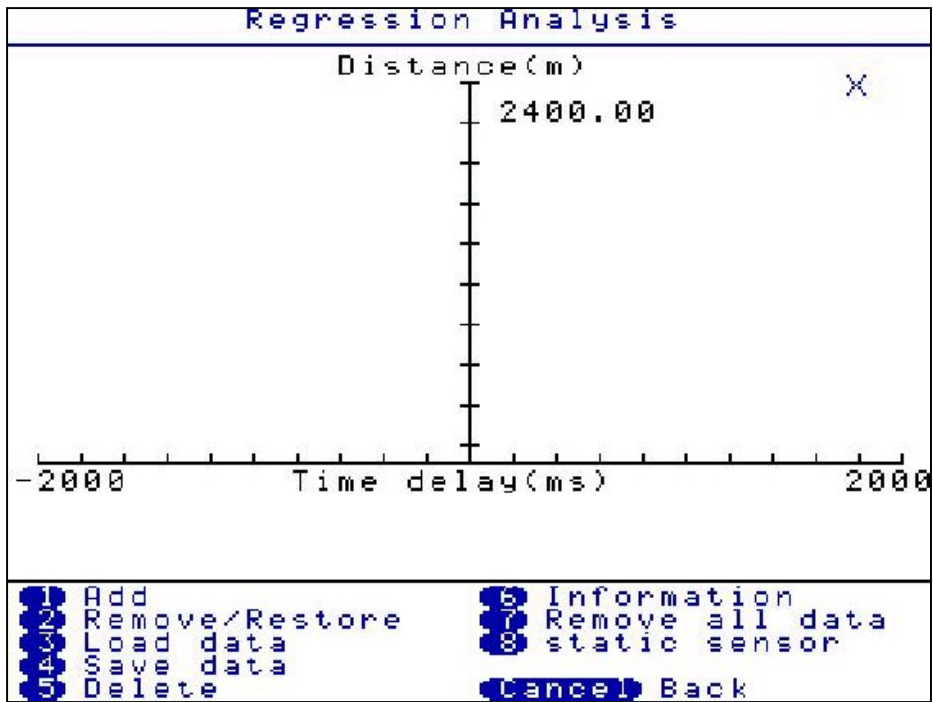
- One of the sensors must remain static during the collection of data. Which of the sensors does not matter.
- The pipe material and diameter must be constant for each of the correlation results. This is validated by the control unit.



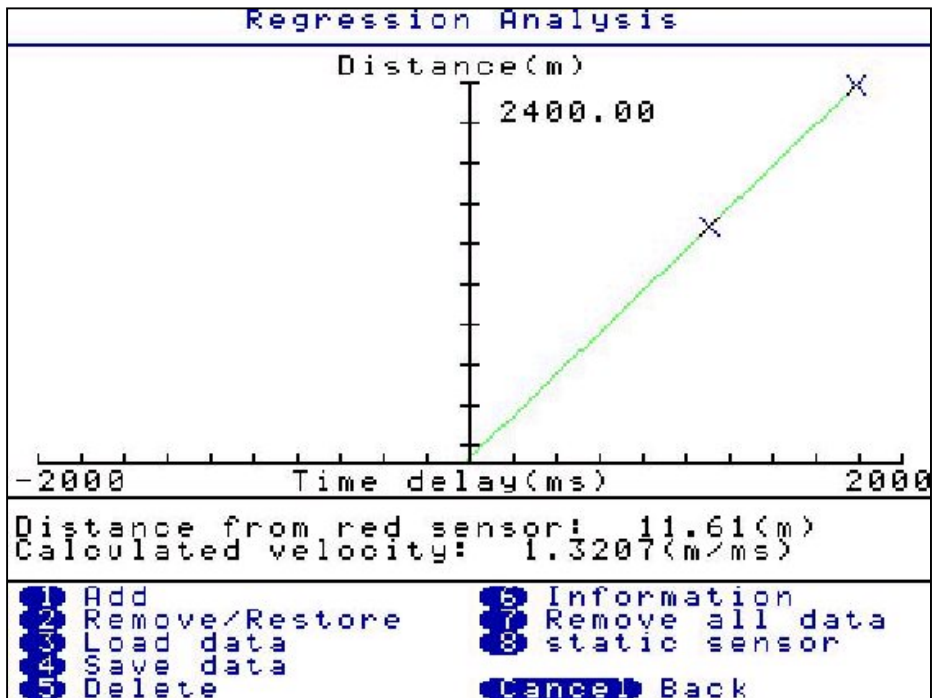
Press 3 (Regression Analysis) After correlation results have been saved. Press 1 to Add a result, the file screen will appear, select the first correlation result saved.

The control unit will then ask for the "Static Out Station" colour. The control unit will store the material and diameter of the first correlation result and compare with the next results 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 plotting the first correlation result.



Then press 1 to add the second correlation result. A second cross will appear and a line will pass through both. A result will be given on the leak position and velocity, but we recommend the user add a third result for a more confident result.



Then press 1 to add the third correlation result. A third cross will appear and a best fit line will pass through or near the three crosses. The result of the leak position and velocity will be displayed under the graph.