

Operators Manual

Model 2512 Mini Pipe Profiling Sonar

Issue 1.08
12 February 2013

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1.0 INTRODUCTION

1.1 Principle of operation

The use of colour video cameras is well established as a means for surveying underground pipes. The cameras are typically mounted on a small powered tractor which moves through the pipe with the camera looking forward. In a sewer pipe there is practically zero visibility if the pipe is full and so the camera survey would require the pipework to be drained for inspection. On the other hand the model 2512 mini pipe profiling sonar will only work when the transducer head is submerged in the water. Unlike a camera which looks forward the sonar looks sideways at right angles to the direction of motion through the pipe. The head of the sonar rotates rapidly and displays a cross-section through the pipe. The sonar uses colour to display the strength of the acoustic signal being returned from the pipe which gives an indication of the type of surface (hard or soft) that the beam has swept over. The default "rainbow" colour pattern uses red as an indicator of strong signals and blue as an indicator of weak signals, with the in-between colours scaled proportionately.

As the sonar head only takes one second to rotate through 360 degrees the normal method of surveying would be to move slowly through the pipe in the same manner as for a camera survey with the sonar beam prescribing a spiral over the inside surface of the pipe. The speed of movement is dictated by the diameter of the pipe and size of defect that it is required to detect i.e. How coarse the spacing of the spiral is. For a given range there will always be up to 1000 samples plotted and so the resolution is fixed to the range i.e. for 500mm range the pixel spacing on the screen will be 0.5mm. The size of the illuminated area on the internal surface of the pipe is dictated by the transducer beam width which is 1.8 degrees between the -3dB points. The diameter of the beam at 250mm range is 7.8mm whereas at 2m range the beam diameter is 62.8mm

1.2 The System hardware

The complete system comprises of an Underwater Scanner, Connecting Cable, USB Interface Unit, DC Power Supply and a Laptop or Desktop PC running windows. The connecting cable carries power to the Scanner, sonar information and serial communication to control the Scanner unit.

The cylindrical Scanner has a rotating transducer head enclosed in a protective plastic shell at one end and an underwater connector at the other. The unit may be either skid, float, tractor or ROV mounted to allow the Scanner to be moved through the pipe under inspection. The transducer head projects a narrow beam of acoustic energy and the receiver amplifies the echoes from the walls of the pipe. A total of up to 1000 samples are taken for each transmit/receive cycle and 400 cycles are implemented for each revolution of 360 degrees.

The USB Interface Unit collects raw acoustic data from the Underwater Scanner then digitizes and processes the signal before sending to the host PC via the USB port. A quadrature or Pearpoint style cable counter may also be connected to the USB Interface Unit to enable cable payout to be displayed.

DC power for the Underwater Scanner must be floating from any other supplies and preferably adjustable between +14v and +24v DC to allow for the cable resistance. The USB Interface Unit can be supplied incorporating an AC to variable DC supply. The main Sonar program is supplied on a CD and can be installed on the operating PC using the set up procedure.



Underwater Unit with Peek boot.



USB Interface Unit



USB Interface Unit with AC to variable DC supply

2.0 SPECIFICATION

2.1 UNDERWATER SCANNER UNIT

2.1.1 Mechanical & Environmental

(a) Overall Length	178mm
(b) Diameter	50mm
(c) Finish	Stainless Steel / Peek
(d) Maximum Operating Depth	100m
(e) Operating Temperature	0 to +40 deg C
(f) Storage Temperature	-20 to +70 deg C
(g) Weight in air	0.75kg
(h) Weight in water	0.4kg

2.1.2 Acoustical

(a) Acoustic Frequency	2MHz
(b) Beam Width	1.8 deg. (+/-3dB) (Conical beam)
(c) Range Resolution (0.125m range)	0.5mm
(d) Min /Max Range for echo returns	40mm to 2000mm
(e) Transmit Pulse Width	4 to 20usec
(f) Receiver Bandwidth	500kHz

2.1.3 Interface and Cable

(a) Number of conductors	1 Twisted pair or coaxial cable 2 Power Cores
(b) Computer control Baud Rate	9600 baud
(c) Maximum cable attenuation	40dB at 2MHz
(d) Power Requirements	15V dc (+/-1V) 0.5A continuous 1A peak floating.

2.2 USB INTERFACE UNIT

- | | | |
|----|-----------------------------|--|
| a) | Size:- USB only | 110 x 165 x 35mm |
| | USB with AC to DC Supply | 180 x 180 x 110mm |
| b) | Weight:- USB only | 0.2kg |
| | USB with AC to DC Supply | 3kg |
| c) | Protocols | USB 1.1 and USB2.0 |
| d) | Power Requirements USB only | +5V DC at 200ma typical (self-powered from USB port) |
| | With AC to DC supply | 110v / 240v ac 1 amp |

2.3 PC SPECIFICATIONS

- a) Minimum of 300MHz Pentium III processor with 32Mb RAM , 4MB of video memory, CD drive and at least 5Mb of hard disk space
- b) Spare USB 1.0 or 2.0 port for connection of 2512 USB Interface Unit.
- c) Spare RS232 serial port if using “White Line” profile output
- d) Windows 9x / ME / XP operating system

3.0 SYSTEM SETUP

3.1 Installing USB Interface Box

Before connecting the USB Interface box to an available USB port on the PC with the supplied USB cable, ensure that the installation CD is inserted into the CD drive. When it is connected, Windows will detect the interface box and inform the user that it has found a new device. Follow the instructions on screen and select “Have Disk” when prompted for the manufacturer’s drivers. If the operating system is Windows XP then a warning message will appear informing the user that the driver is not digitally signed, select “Continue Anyway”. This whole procedure will be repeated twice. Once the installation is finished, the 2512 software can be installed as described later in this document.

3.2 Software Installation

The 2512 software runs under the Windows operating system and is supplied on a CD. Insert the CD in the CD ROM drive, run the program “setup.exe” and follow the instructions on the screen.

The default installation will put a “PipeProf” icon on the desktop which may be double-clicked to start the program.

NOTE: The installation CD also contains a viewer program “PipeView” which may be freely distributed to clients for post-processing and viewing stored images. The PipeView program has the same look and feel as the main PipeProf program except that all hardware control of the sonar underwater unit is disabled.

3.3 System Connections

When installing the system take care to ensure that all connections are as described in appendix C. Failure to do so could cause damage to the electronics.

Take care when mounting the underwater scanner to position the engraved line on the body of the sonar looking downwards, i.e. towards the invert of the pipe otherwise the image will not be correctly orientated.



USB Interface Unit connectors, one with AC to variable DC supply.

4.0 OPERATING INSTRUCTIONS

4.1 TURNING THE SYSTEM ON

Before powering up the system for the first time, ensure that the appropriate mains supply voltage has been selected on the USB Interface Unit if an AC to DC variable supply is fitted. The AC supply voltage can be selected for either 110v or 240v on the IEC input connector.



The picture shows the voltage selection set to 240v ac. To change to 110v ac remove the fuse holder and re-insert with the 110v arrow pointing towards the white line.

Note:-

Failure to select the correct ac voltage may damage the power supply.

Check all interconnecting cables are wired correctly.

When the USB Interface Unit is connected to the operating PC (PC must be switched on and Windows running) using the cable supplied the five LED's on the front panel will all illuminate and then extinguish before illuminating one at a time in sequence. Once the LED's are off the Scanner supply can be switch on at which point the sonar transducer will rotate and locate.

4.2 RUNNING THE PC2512 PROGRAM

The program runs in the Windows operating system. It is recommended that you are familiar with using Windows before using the PC2512 system.

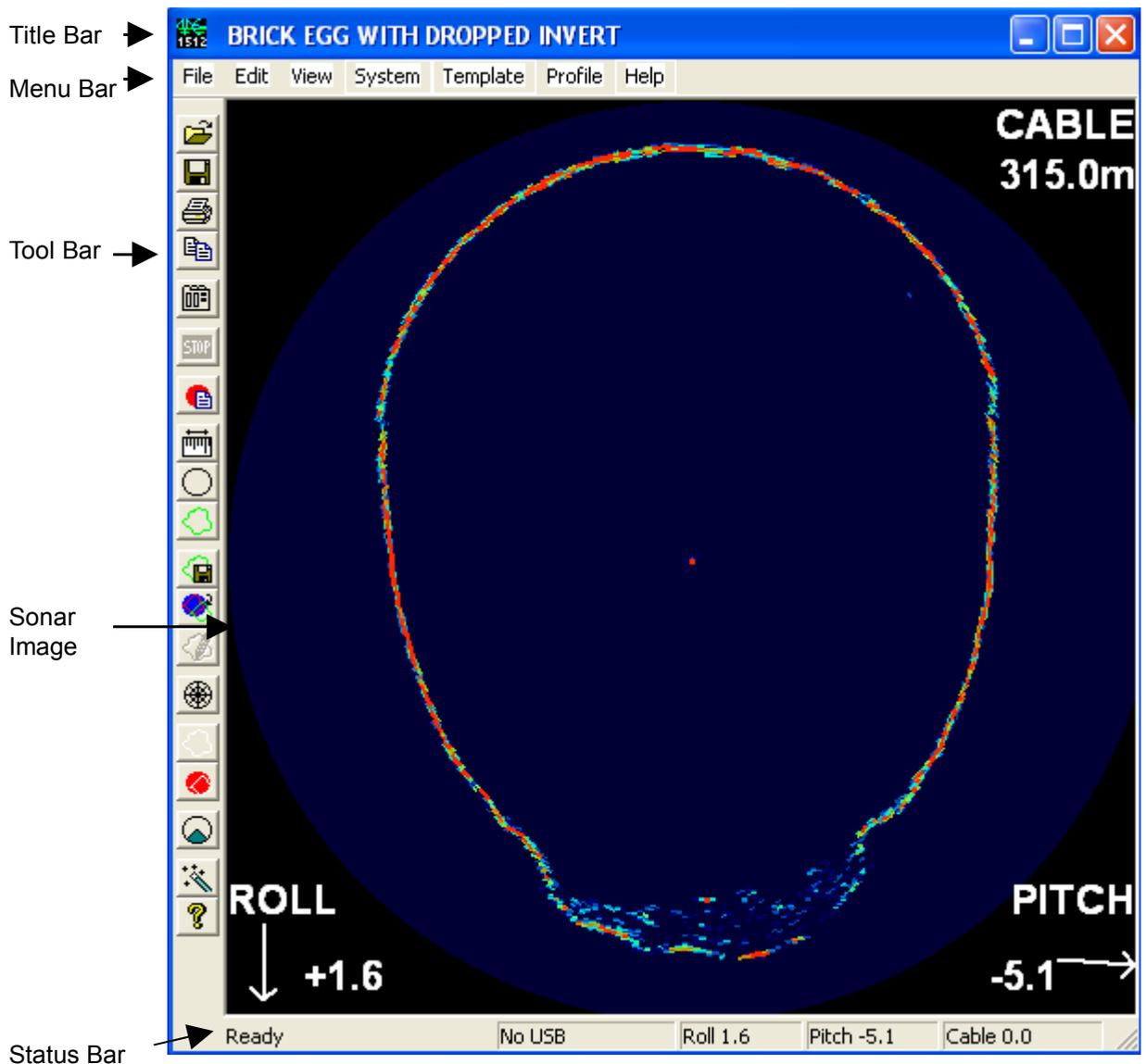
The program is started by either double clicking on the short cut icon with the left button on the mouse, or by selecting the program from the start-programs menu. The program will open up a square window which is the sonar display area and the Status Line will indicate that the scanner is on line.

If the message "NO USB" appears in the status line close the program, disconnect the lead to the USB Interface Unit and then reconnect. Restart the program and recheck the Status line message.

If the message "Scanner Not On Line" appears this may be caused by the DC supply to the underwater unit being too low. Increase the voltage supply and when "Scanner On Line" appears check the voltage as indicated in section 4.4.4 below.

4.3 DISPLAY INFORMATION AND LAYOUT

The main display contains the sonar image within a standard Windows window.



The title bar contains the survey title and may be edited from the system control panel.

The menu bar contains a set of drop down menus which provide the full set of system facilities.

The tool bar provides a set of buttons which give easy access to some of the menu facilities. The tool bar is locked to the left margin of the display. As the cursor pauses over each button in the toolbar, a text description of the button is displayed adjacent to the button, and a longer description appears in the status line.

The status bar at the bottom of the display window indicates the status of the scanner, the orientation (pitch and roll) and the cable payout. The text area to the left of the status bar is a help area. It contains simple descriptions of the button or menu option currently selected.

The sonar image is displayed as a polar plot with signal levels corresponding to the selected colour scale. The picture is orientated so that the top of the screen is always vertically up and is corrected for the roll of the tool if the roll correction option is selected on the Auxiliary tab of the System Control dialogue.

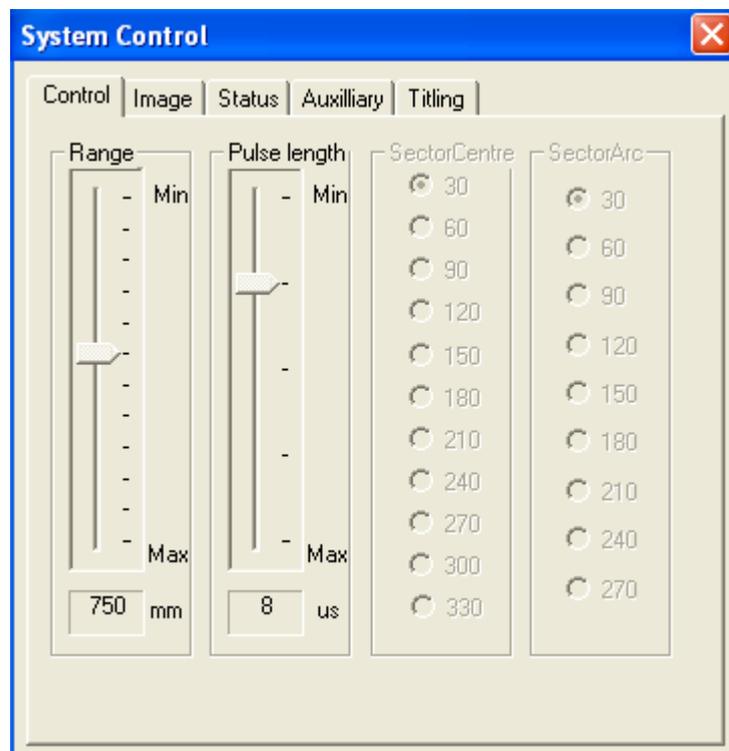


4.4 SYSTEM CONTROL PANEL (Menu - System - Control F9)

The system control panel provides most of the scanner control and monitoring functions. The control panel contains a set of 5 tabbed pages which provide the different functions.

4.4.1 Control

The control page contains sliders for the range, pulse length and Sector mode.



The range may be set from 125mm to 2000mm (5in to 80in) in the following settings:

125mm, 187mm, 250mm, 375mm, 500mm, 750mm, 1000mm, 1500mm, 2000mm
(5in, 7in, 10in, 15in, 20in, 30in, 40in, 60in, 80in)

The ranges correspond to the radius from the transducer head therefore a 900mm (36in) diameter pipe would best be displayed on the 500mm (20in) range

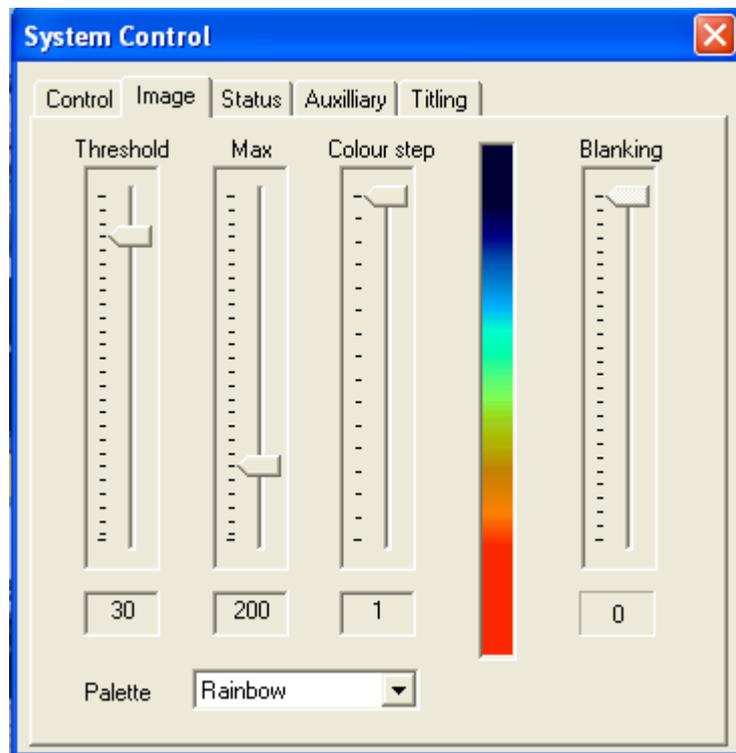
The pulse width is the width of the signal transmitted by the Scanner transducer, measured in microseconds. This lies in the range 4us to 20us in 4us steps. Typically the pulse width is adjusted according to the range as follows:

4us	125mm to 500mm
8us	500mm to 1000mm
12us	1000mm to 1500mm
16us	1500mm to 2000mm
20us	2000mm

The effect of using a large pulse width is to increase the sensitivity of the system i.e. more signals are displayed as red. The thickness of the image of the pipe wall is also affected by the pulse length, the smaller the pulse length the more detail is perceived. If the sector display mode has been selected from the tool bar then the sector centre and sector arc of scan can be selected otherwise they are greyed out (See section 4.12.7 for Sector mode selection).

4.4.2 Colour

The colour page contains controls to adjust the palette and colour scale used to display the sonar image. By adjusting the controls it is possible to remove background noise from the display and increase the sensitivity of received signals. The colour adjustment combines the features of both blanking and gain controls.



The acoustic data is collected using an 8-bit analogue to digital converter, which means raw signals are in the range 0 to 255. The colour bar to the right of the page shows the current colour scale being used, with the colour for 0 signal at the top, and that for full signal (255) at the bottom.

The Threshold setting defines the raw signal level at which the background colour is selected. Any signals at or below the Threshold setting are displayed in the background colour. If the Threshold is set to 0, a level of background noise will be visible on the sonar image. By increasing this setting, the background noise will disappear from view, effectively providing a blanking control.

The "Max" setting defines the raw signal level at which the peak colour is selected. Any signals at or above the "Max" setting are displayed in the peak colour. The "Max" setting in effect increases the gain or sensitivity of the system. By lowering this setting, it is possible to bring more of the lower level signals into view. The "Max" setting should be adjusted so that the strongest signals being detected are displayed in the peak colour.

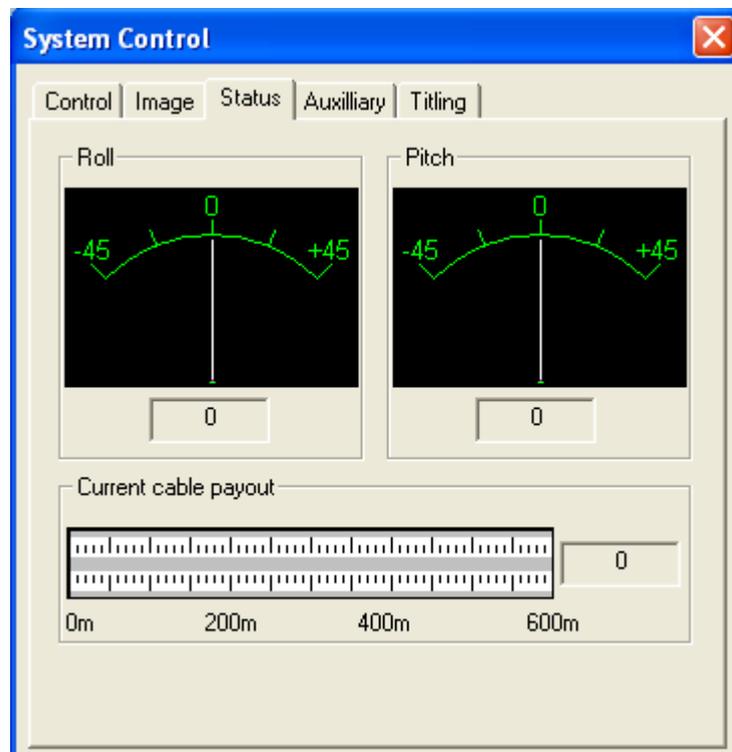
The "Colour step" setting defines the width of the colour bands in the colour scale. A step size of 1 gives a smooth transition between colours. A step size of 16 (maximum) gives an abrupt change of colours.

The "Palette" defines the actual colours used to display the image. The palette is chosen from a list. There are several internal palettes as well as palettes loaded from file. The file based palettes are described by their file name. The palette file format is described in the appendices.

When the Show Profile is selected from the tool menu the Blanking slider controls a minimum exclusion zone, in which an outline can not be detected. This blanking zone is shown on the screen as a grey crosshatch. Increase this slider to exclude nearer targets.

4.4.3 Status

The status page shows a graphical representation of the readings provided on the status line of the main display window. i.e. pitch, roll and cable payout.



The pitch is displayed in degrees, with positive pitch indicating the sonar is pointing up.

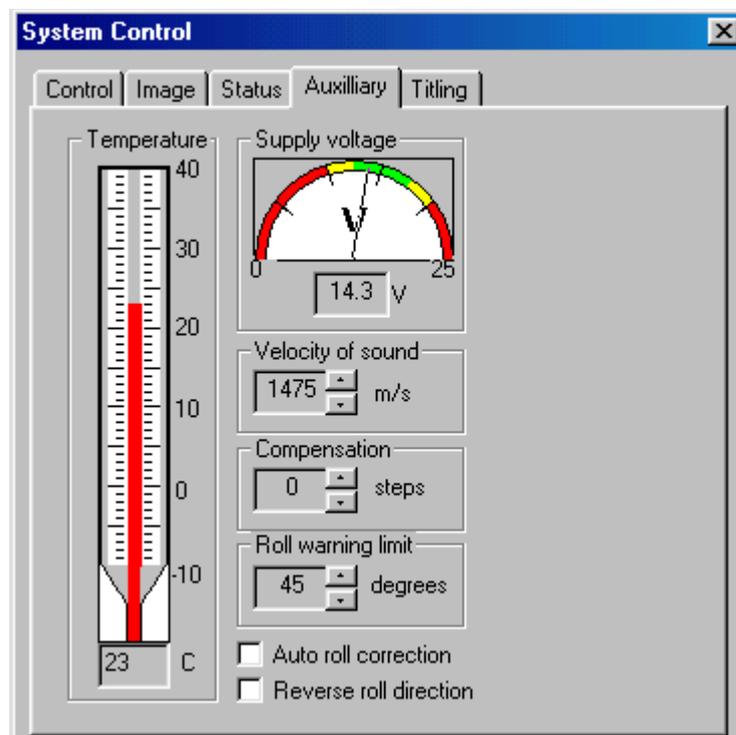
The roll is displayed in degrees, with positive roll indicating the sonar is tilted over to the right (clockwise).

The pitch and roll sensors are only displayed within the range +/- 45 degrees. If the tool should be positioned outside this range then the readings should be taken from the sonar screen indicators. Take care when mounting the sonar to position the engraved line on the body of the sonar looking downwards, i.e. towards the invert of the pipe otherwise the image will not be correctly orientated.

The cable payout shows the horizontal distance travelled by the Scanner, with reference to the point at which the cable length counter was last reset. The cable payout is displayed in metres or feet, depending on the measurement system currently selected in the regional settings of Windows.

4.4.4 Auxiliary

The auxiliary page displays data from the secondary sensors in the sonar, and provides some of the minor system controls.



The temperature inside the sonar tool is displayed in degrees Celsius.

The supply voltage is the voltage measured in the sonar unit. The recommended setting is 15V. The unit will work satisfactorily with a setting of between 14V and 24V.(The green area on the voltage gauge).

The velocity of sound (VOS) in water is nominally 1500m/s (4921ft/s). The true VOS is dependant on a number of factors, including the temperature, pressure and salinity of the water. If accuracies within 3% of full scale are sufficient, the velocity of sound may be set and left at 1500m/s. If better accuracy is required the system needs to be calibrated against a known target using the cursor measurement tool. If the VOS is increased, the image will stretch. If the VOS is decreased, the image will shrink. An easy way to calibrate the system is to use a vertical sided round bucket of around 12" (300mm) diameter. Put around 6" (150mm) of water from the pipe to be surveyed into the bucket then stand the scanner on end with the grey transducer end in the water in the centre of the bucket. Enable the circle overlay and set its diameter to match the actual diameter of the bucket (measure this as accurately as you can using a ruler). Set the system scanning and call up the Auxiliary tab of the System Control dialogue. Now adjust the velocity of sound figure whilst positioning the circle over the sonar image until the inside edge of the sonar image is co-incident with the circle overlay. Remember that it is the inside edge of the sonar image that represents the distance to the pipe wall. The thickness of the image is dictated by the transmit pulse width.

The sonar collects images by rotating clockwise, then anticlockwise. When the sensor reverses direction the image will appear to rock slightly from side to side with each successive sweep. This is due to the mechanical backlash in the system and depends on the precise mechanical alignment of the transducer. It can be corrected using the compensation setting, which adjusts the number of steps the image is corrected for. The normal setting is just 1 compensation step, however, it may be necessary to adjust this by 1 or 2 steps.

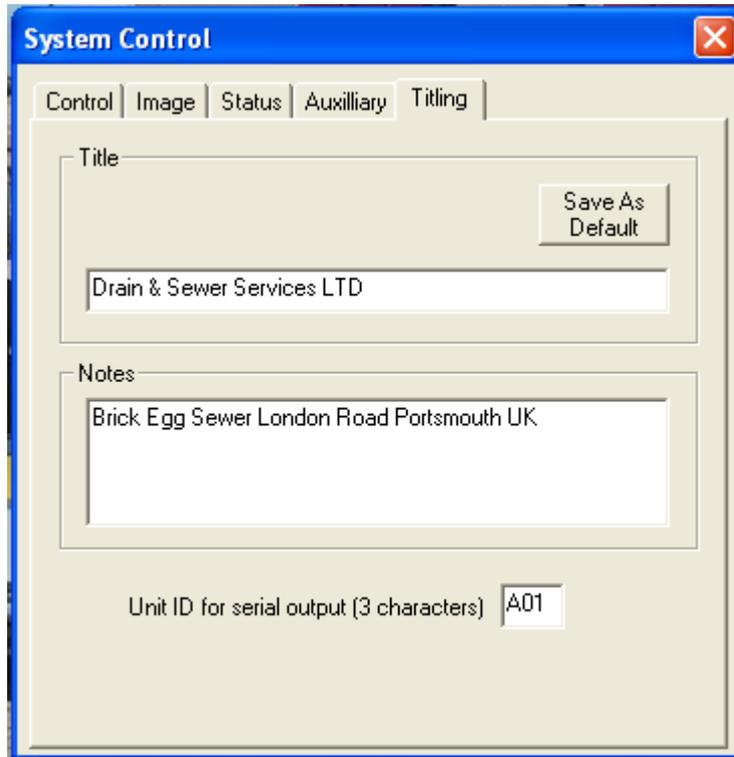
If the Roll warning limit is exceeded an alarm will sound if sound is enabled on the PC.

The sonar tool is engraved with a mark which indicates the bottom of the sonar. In normal operation, acoustic data from this position is displayed at the bottom of the screen. If auto roll correction is enabled, (the box is ticked) the sonar image is rotated to allow for the roll of the sonar tool, and data displayed at the bottom of the screen comes from the bottom of the pipe. If Manual rotate is selected then the operator can manually rotate the picture clockwise or anti-clockwise using the arrow keys. Note that the Manual rotate option will only appear when the Auto rotate is selected. If the roll reading falls outside +/-45degrees, roll compensation is automatically disabled until the reading returns to the +/-45degree range.

Selecting Reverse roll direction will change the roll reading displayed from positive to negative or vice versa.

4.4.5 Titling

The titling page allows text to be associated with the sonar display.



The Title text appears on the title bar of the sonar image.

The notes text does not appear on the main display, but is stored when images are saved.

4.5 Running the Sonar



To start the sonar scanning, press the GO button on the toolbar, or select **System** then **Scan** from the menu bar. The scanning will start, and data will be updated automatically on the main display. Each scan takes about a second to be collected and displayed. At long ranges each scan may take up to 3 seconds.



To pause scanning, press the STOP button on the toolbar, or select **System** then **Pause** from the menu bar.

4.6 Image storage facilities



4.6.1 Open (Menu Bar - File – Open)

This option opens up the file selection window. A previously saved image or outline file may then be selected and loaded.

The loaded data is displayed on the main display.



4.6.2 Save (Menu Bar - File – Save)

This option saves the current image to a file. The image is saved in the current default format, to the current default directory. The directory may be changed using the Change Directory option. The format may be changed by using the save as option. The file name is automatically generated from a sequence number. This means that successive images may be saved by just clicking the save button, and the system will provide different file names.

4.6.3 Save As (Menu Bar - File - Save As)

This option opens up the file selection dialog. Files may be saved either as a 256 colour image, or a 16 colour image.

256 colour images contain 8 bits of data for each scan point. The images can be reloaded and contain all the information available when the data was originally collected. This should be the setting that is normally used.

16 colour images contain 4 bits of data for each scan point. The format is only provided so that images can be saved in a format compatible with the previous pipe profiling system. 16 colour images can be reloaded into the system.

The file format selected to save the image, will be used as the default for later image saves.

4.7 Cursor tools (Menu Bar - View - Cursor Tools)



4.7.1 Measure (Menu Bar - View - Cursor Tools - Measure F4)

The measuring line provides the facility to measure the distance between features on an image. The distance between the end points of the line is displayed adjacent to the moving position.

The moving position may be changed by pressing the left mouse button. The reference position may be changed by pressing the right mouse button.

The positions may be moved to the centre of the image by holding down the shift key and pressing the relevant mouse button.

To remove the measuring line from the screen either press the Icon button or F4 or select **View** then **Cursor Tools** then **Measure** from the Menu Bar.

The measuring line may be used with the circle or outline facilities.



4.7.2 Circle (Menu Bar - View - Cursor Tools - Circle F3)

The circle tool provides the facility to measure the diameter of pipes on an image. The diameter of the circle is displayed on the edge of the circle nearest to the image centre. The circle can also be used as an aid in identifying deformations in round pipes.

The circle is moved by the mouse when the left button is held down. The circle centre can be reset to the centre of the image by holding down the shift key on the keyboard and pressing the left button on the mouse.

The circle size is adjusted by the mouse when the right button is held down.

To remove the circle from the screen either press the Icon button or F3 or select **View** then **Cursor Tools** then **Circle** from the Menu Bar.

Note that the circle and the outline are mutually exclusive, for reasons of clarity, and displaying one causes the other to be erased.



4.7.3 Template (Menu Bar – View – Cursor Tools – Outline F5)

The template tool provides the facility to take a snapshot of a sewer and overlay it on the image as the survey proceeds. This makes it easy to identify deformations of the sewer.

The template is moved by the mouse when the left button is held down. The template can be reset to its original position by holding down the shift key on the keyboard and pressing the left button on the mouse.

The template size is adjusted by the mouse when the right button is held down. The template can be rotated by holding down the shift key on the keyboard and pressing the right button on the mouse. The template can then be dragged clockwise or anticlockwise.

Other template functions are detailed in the template tools section below.

To remove the template from the screen either press the Icon button or F5 or select **View** then **Cursor Tools** then **Outline** from the Menu Bar.

Note that the template and the circle are mutually exclusive, for reasons of clarity, and displaying one causes the other to be erased.

4.8 Template tools (Menu Bar – Template)



4.8.1 Save Template (Menu Bar - Template – Save)

This option saves the current template to a file. The file name is automatically generated from a sequence number. This means that successive templates may be saved by just clicking the template save button, and the system will provide different file names.

4.8.2 Save Template As (Menu Bar - Template - Save As)

This option opens up the file selection dialog to select the storage directory.

4.8.3 Open Template (Menu Bar - Template –Open)

This option opens up the file selection dialog to select a saved Template from file.



4.8.4 Capture Template (Menu Bar -Template - Capture F8)

This option causes the currently displayed image to be captured as a template. The template is produced from the strongest signal along each path. Irregularities in the template, produced for example by a deformed pipe, may be corrected and smoothed out using the template editing function.



4.8.5 Edit Template (Menu Bar - Template - Edit F7)

This option enables the template overlay to be edited. This function is provided so that templates may be traced from screen images, or captured templates may be touched up.

When the edit template mode is enabled, the left mouse button is used for editing the template. While the button is pressed, the template may be redrawn using the cursor.

To return to normal mode the option should be selected again.

4.9 Profile tools (Menu Bar – Profile)



4.9.1 Show Profile (Menu Bar - Profile – Show)

Selecting Show Profile captures the white line output of each live scan. The target coordinates will be transferred in an ASCII format to a serial port.

The **Blanking** slider on the **Image** tab of the **System Control** dialog controls a minimum exclusion zone in which no image can be outlined. This blanking zone is shown on the screen as a grey crosshatch. Increase this slider to exclude nearer targets.

The **Threshold** slider on the **Image** tab of the **System Control** dialog controls the colour representation of the signal strengths and also the minimum level of a valid signal. Increase this slider to exclude weaker targets.

A 3 character identifier for the underwater scanner or the system can be set in the **Unit Id** box on the **Titling** tab of the **System Control** dialog.

To remove the profile from the screen either press the Icon button again or select **Profile** then **Show** from the Menu Bar.

See appendix A for serial output format and port selection.



4.9.2 Record Profile (Menu Bar - Profile – Record to File)

This option opens up the file selection dialog to allow selection of the file name and storage directory.

4.9.3 File Format (Menu Bar - Profile – File Format)

Selects the file format for the RS232 serial output as detailed in appendix A.

4.9.4 Detection Algorithm (Menu Bar - Profile –Detection Algorithm)

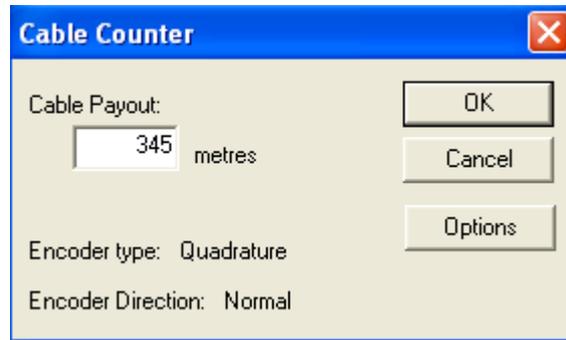
Sets the detection algorithm for the profile capture
Maximum - works on the highest intensity.

3/4 Max - similar to maximum except it finds the maximum intensity and then works back to a the point that has an intensity of approx 3/4 of the max.

Area1 - Chooses the peak that has the highest total energy. A peak starts when the signal intensity goes above the threshold and ends when the intensity goes beneath the threshold.

4.10 Cable Counter (Menu Bar - System - Cable Counter- Setup)

The cable counter dialog provides the facilities for setting up the cable counter.



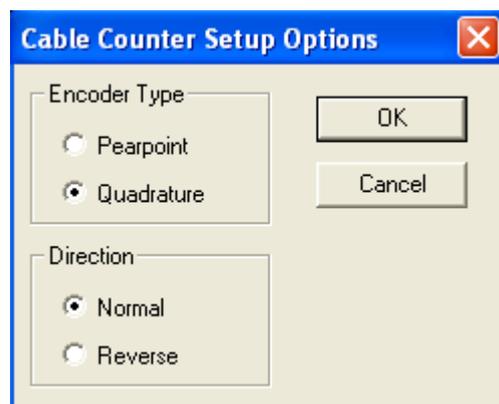
The system can operate with either a Pearpoint or Quadrature cable counter, operating in either direction. The cable counter is calibrated by running off a known length of cable. Once calibration has been performed, the system records the results and re-calibration should not be necessary. (see section 4.10)

When the system starts up the actual cable payout may need to be reset to a known value. This could be due to the cable being wound or unwound while the system is off. Once set, the system monitors the cable counter, and the length is displayed on the status line of the main screen.

To reset the cable counter reading, just enter the cable payout in the box and press enter.

To set the type of cable counter click the options button.

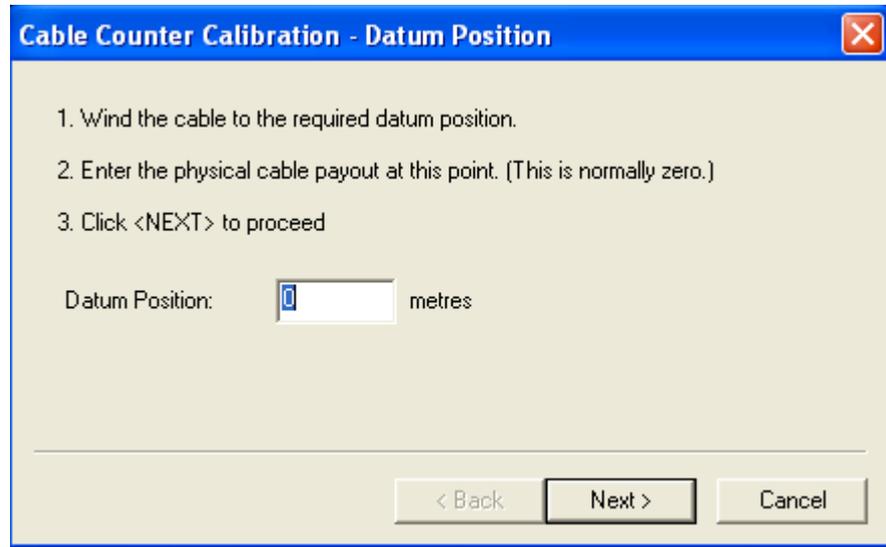
The system can operate with either a Pearpoint or Quadrature cable counter, operating in either direction. This dialog is used to select the type.



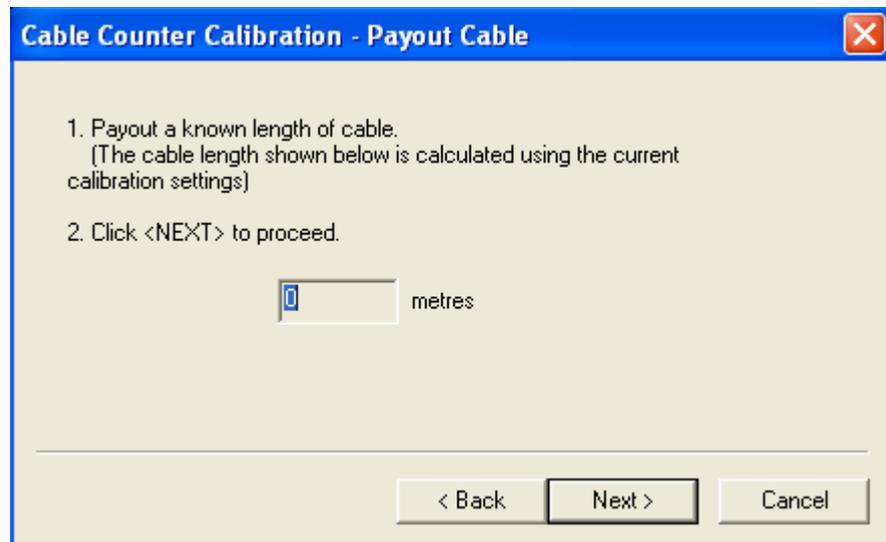
When the type has been set-up, click the OK button. The cable counter should normally be calibrated after this.

4.11 Cable Counter Calibrate (Menu Bar - System - Cable Counter – Calibrate)

The cable counter is calibrated by running off a known length of cable. Once calibration has been performed, the system records the results and re-calibration should not be necessary.



Enter the current cable payout, then click the next button (normally zero).



Payout a known length of cable. The cable payout should update in the dialog window. Stop paying out the cable, and click the next button.

Cable Counter Calibration - Correct Reading

1. Enter the known length of cable payed out in the box below.
(The uncalibrated reading is shown for information.)

2. Click <NEXT> to proceed.

Uncalibrated Payout metres

Actual Payout metres

< Back Next > Cancel

The uncalibrated payout shows the length measured by the system. Enter the actual payout position and click the next button.

Cable Counter Calibration - Results

Start (Datum) Position: metres

Payed out: metres

Final Position: metres

Encoder count: ticks

Calibration: ticks per metre

< Back Finish Cancel

The final window in the calibration procedure shows the start and end measurements, the number of ticks counted by the cable counter, and the calibration value calculated for the cable counter.

If the results are satisfactory, click the finish button. Items can be changed by using the back button to go back to earlier screens.

To abandon the calibration, and keep the old calibration settings, click the cancel button.

4.12 Miscellaneous Controls



4.12.1 Graticule (Menu Bar - View – Graticule)

This option enables/disables the annotated graticule overlay.



4.12.2 Record Images (Menu Bar - File – Record Images)

This option allows images to be stored to the Hard Drive automatically each time the cable payout has changed value (minimum of every 0.1m). Images can be played back from the Hard Drive by selecting File – Playback images.

If the “Save All Files” option is selected then all displayed images will be saved and the cable count ignored.



4.12.3 Copy (Menu Bar - Edit – Copy)

This option copies the window to the clipboard. This can then be pasted to other applications, such as paint.



4.12.4 Print (Menu Bar - Image – Print)

This option requires that a printer has been previously set-up on the system. The preferred printer is a colour ink-jet so that the shades of the image may be reproduced more faithfully.

4.12.5 Print Preview (Menu Bar - Image – Print Preview)

The print preview option from the menu may be used to view the formatting of the printed output prior to performing a print. The print preview window also supports a zoom mode and so could be used to examine features of the current image. Note that the zoom is only a pixel magnification and cannot reveal more data than is in the original image.

4.12.6 Print Setup (Menu Bar - Image – Print Setup)

The print setup option from the menu may be used to configure the printing characteristics of the currently selected printer or to select a different printer from the current default.



4.12.7 Sector

Traditionally the Pipe Profiler scanning head will rotate through a full 360 degree arc. To enable quicker scanning and a visual 2x zoom mode the software allows a choice of scan angles.

A circle / sector choice button allows easy switching between the complete circle view, and the smaller sector view. To change the angle of the sector view, radio buttons on the Control tab of the System Control dialog enable easy angle selection.

To take advantage of this new scan facility, you must have software version 2 or above in the underwater unit firmware and the P.C. software. Earlier scanners will still work with version 2 P.C. software, but will only run in 360 degree mode, and the circle / sector choice button will be disabled.



4.12.8 Default Setup (Menu Bar - System – Default Set Up)

The default setup will reset all the variable parameters such as range, transmit pulse length etc to known values.



4.12.9 About (Help F1)

The about icon or Help menu will display the version of software running.

4.12.10 Autostart (Menu Bar - System –Autostart)

If **Autostart**, on the **System** menu, is selected the program will endeavour to talk to its underwater scanner unit and gather data from it, whenever possible. If **autostart** is enabled when the program closes down, the software will go into play mode as soon as the program starts.

4.12.11 View (Menu Bar – View)

The **view** menu offers a choice of control reports on the main view screen. If the underwater scanner unit has internal pitch and roll sensors, or a cable counter is fitted, the figures from these instruments can be reported onscreen. If these instruments are not fitted to the attached scanner, or not required, these onscreen options can be removed from the display.

When viewing a saved image, the onscreen controls will report the condition at the time of the file save. Current feedback from these instruments is always reported on the status bar below the main screen.

The view menu also offers options to enable the graticule or cursor tools, and the useful **Annotation Off** allows speedy removal off all onscreen reports when that elusive target needs uncluttered examination.

Appendix A – Serial Output Format

Serial Output Format

There are three types of file outputs that can be selected from the drop down menu as listed below.

File types MEPPA, B & D are saved to disc or output for each image displayed.
File type MEPPC is only saved or output when the cable counter changes.

Serial link:- 115200 Baud, no parity, 8 data bits, 1 stop bit, no handshake

MEPPA:- \$MEPPA, UNITCODE, +XXXX, -YYY, +X, +YY.....-....XXX, +YYYY,
*[CS][CR][LF]

\$, Specifies start of a new message

MEPPA, Marine Electronics Pipe Profiler, message type A

UNITCODE, 3 “ASCII” characters, unit identifier e.g. A2Z

+X,-YY, +/-x , +/-y co-ords of an "outline" first character '-' or '+'
1-4 characters representing distance (measured in mm
from head at centre origin 0,0) +X,+Y are xy coordinate
pairs repeated as necessary

* terminator – signals end of message

[CS] 2 hexadecimal ASCII character checksum, being the 8 bit
sum (modulo 256) of the characters between \$ and *
inclusive

[CR][LF] carriage return, line feed for terminal formatting

MEPPB:- \$MEPPB, UNITCODE, PITCH, ROLL, +XXXX, -YYY, +X, +YY.....-XX,
+YYYY, *[CS][CR][LF]

MEPPB, Marine Electronics Pipe Profiler, message type B

UNITCODE, 3 “ASCII” characters, unit identifier e.g. A2Z

PITCH, up to 4 characters representing a pitch angle in tenths of
degrees.

ROLL, up to 4 characters representing a roll angle in tenths of
degrees.

+X,-YY, +/-x, +/-y co-ords of an "outline" first character '-' or '+'
1-4 characters representing distance (measured in mm
from head at centre origin 0,0) +X,+Y are xy coordinate
pairs repeated as necessary

* terminator – signals end of message

[CS] 2 hexadecimal ASCII character checksum, being the 8 bit sum (modulo 256) of the characters between \$ and * inclusive

[CR][LF] carriage return, line feed for terminal formatting

MEPPC:- \$MEPPC, UNITCODE, TIMESTAMP, PITCH,ROLL, +XXXX, -YYY, INTENSITY, +X, +YY, INTENSITY,-XX, +YYYY, INTENSITY, *[CS][CR][LF]

MEPPC, Marine Electronics Pipe Profiler, message type C

UNITCODE, 3 "ASCII" characters, unit identifier e.g. A2Z

TIMESTAMP Number of seconds since 00:00:00 on January 1 1970

PITCH, up to 4 characters representing a pitch angle in tenths of degrees.

ROLL, up to 4 characters representing a roll angle in tenths of degrees.

+X,-YY, +/-x, +/-y co-ords of an "outline" first character '-' or '+'
1-4 characters representing distance (measured in mm from head at centre origin 0,0) +X,+Y are xy coordinate pairs repeated as necessary

INTENSITY, Signal intensity at that point ranging from 0 - 255

* terminator – signals end of message

[CS] 2 hexadecimal ASCII character checksum, being the 8 bit sum (modulo 256) of the characters between \$ and * inclusive

[CR][LF] carriage return, line feed for terminal formatting

MEPPD:- \$MEPPD, UNITCODE, TIMESTAMP, CABLE COUNT, PITCH,ROLL, +XXXX, -YYY, INTENSITY, +X, +YY, INTENSITY,-XX, +YYYY, INTENSITY, *[CS][CR][LF]

MEPPD, Marine Electronics Pipe Profiler, message type D

UNITCODE, 3 "ASCII" characters, unit identifier e.g. A2Z

TIMESTAMP Microsoft time_t format.

CABLE COUNT Up to 2 decimal places in feet or meters.

PITCH, up to 4 characters representing a pitch angle in tenths of degrees.

ROLL, up to 4 characters representing a roll angle in tenths of degrees.

+X,-YY, +/-x, +/-y co-ords of an "outline" first character '-' or '+'
1-4 characters representing distance (measured in mm from head at centre origin 0,0) +X,+Y are xy coordinate pairs repeated as necessary

INTENSITY, Signal intensity at that point ranging from 0 - 255

* terminator – signals end of message

[CS] 2 hexadecimal ASCII character checksum, being the 8 bit sum (modulo 256) of the characters between \$ and * inclusive

[CR][LF] carriage return, line feed for terminal formatting

Appendix B - Summary of Cursor Tool Controls

	Left Button	Right Button	Shift+Left Button	Shift+Right Button
Measure	Move end point	Move Reference point	Move end point to image centre	Move reference point to image centre
Circle	Move circle	Adjust circle size	Move circle centre to image centre	na
Template (Normal mode)	Move outline	Adjust outline size	Move outline to image centre	Rotate outline
Template (Edit mode)	Edit outline	Adjust outline size	Move outline to image centre	Rotate outline

Appendix C - Connections

D.1 - 2512 Sonar Cable Connection.

Connection details between the sonar USB Interface Unit and the Underwater Scanner are listed below. The connector used to mate to the Scanner is an Amphenol Pattern 105 shell size 14-19 socket female. The connection to the USB Interface Unit can be either through an Amphenol pattern 105 shell size 12-10 pin male if an AC to DC variable supply is fitted or a 9-way D-type connector if not.

The sonar telemetry should be connected to the USB Interface Box with the Data +ve to the Data +ve and the Data -ve to the Data -ve. If a coaxial cable is used then the Data +ve should be connected to the inner and the Data -ve to the outer of the coax. If a twisted pair cable is used the Data +ve should be connected to both conductors of the pair in parallel and the Data -ve to the shield/foil/drain wire.

NOTE:- The +15v and 0v power connections to the sonar must be fully floating (isolated) from any other ground connections. No other system connections should be connected to the scanner power supply otherwise damage to the scanner can result.

The manufacturers will not be responsible for the cost of any damage resulting from incorrect connection of the sonar system.



Pattern 105 19 Way



**Cable Connector
Exploded View**



Cable Connector
Assembled

To connect the cable, disassemble the connector as shown above. Pass the cable through the connector body components and solder the wires to the relevant pins. Once soldered and checked for short circuits between pins screw the connector into the body and then assemble the cable gland remembering to lubricate the o-ring seal and then tighten the back nut to seal the gland to the cable.

The hole in the body must now be used to back fill the connector with a potting compound to ensure a water tight seal.

Note failure to back fill the connector will result in damage to the sonar head due to water ingress.

U/W Scanner Pattern 105-19 Pin	USB Interface Unit Pattern 105-10 pin	USB Interface Unit 9 way D-type	Function
B & C	E	N/C	+ 15 volts (floating)
M	B	4	Data -
	No Connection		
L	C	5	Data +
A & N	D	N/C	0 volts (floating)

D.2 - Cable Counter Connection.

Connections for installing a cable counter to the USB Interface Unit using either an Amphenol connector if an AC to DC variable supply is fitted or a 9-way D-type connector if not.

Pattern 105-10 Pin	9 Way D-Type	Function
F	2	Ch A Input Quadrature Counter
H	1	Ch B Input Quadrature Counter
		No Connection
K	8,9	0v
		No Connection
J	6,7	+5v
	3	Pearpoint Input *

* Note this pin may be used as a Synchronization Pulse output to indicate when the sonar is collecting data.



USB Interface 9 Way D-Type

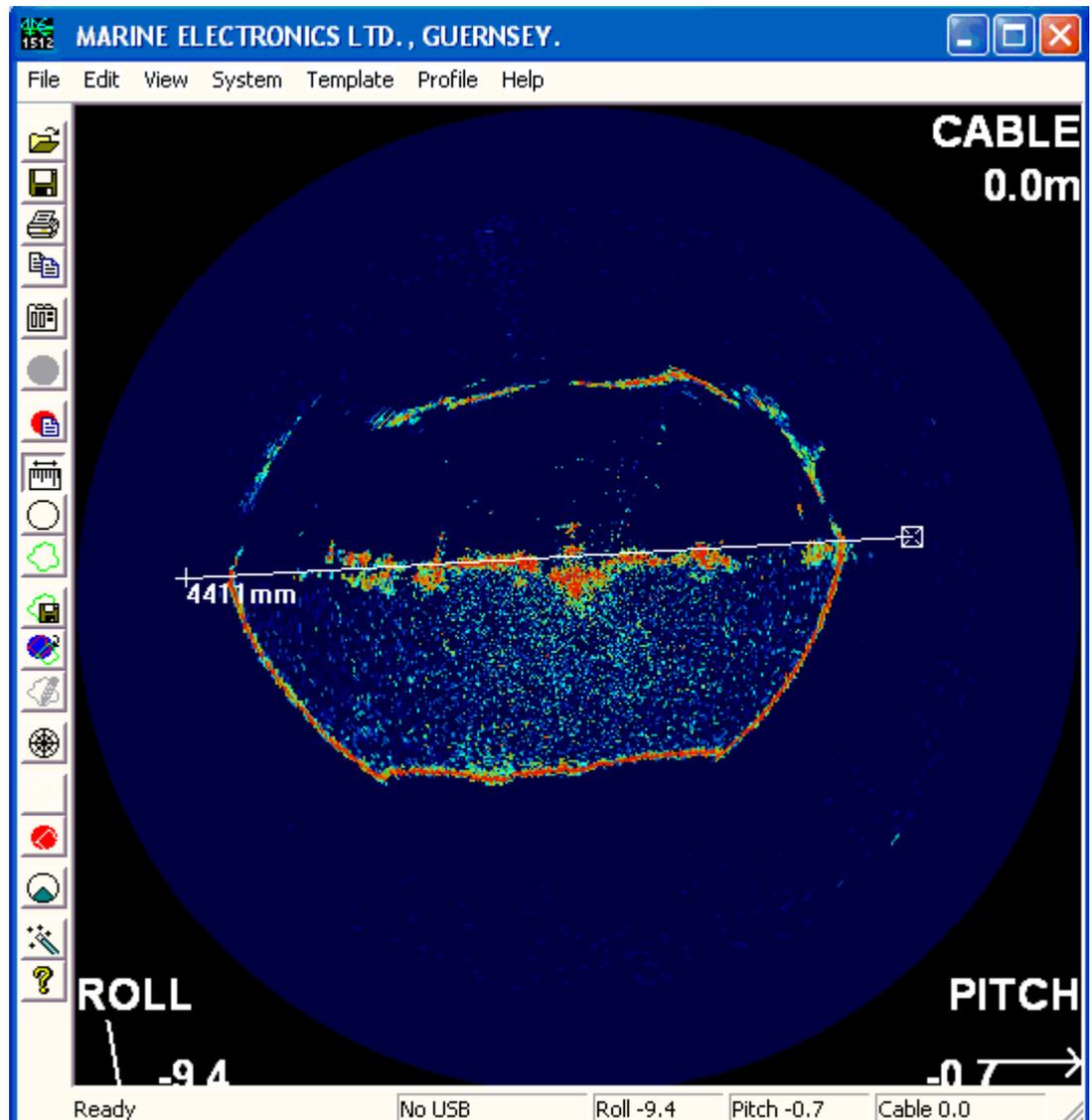


USB Interface Pattern 105

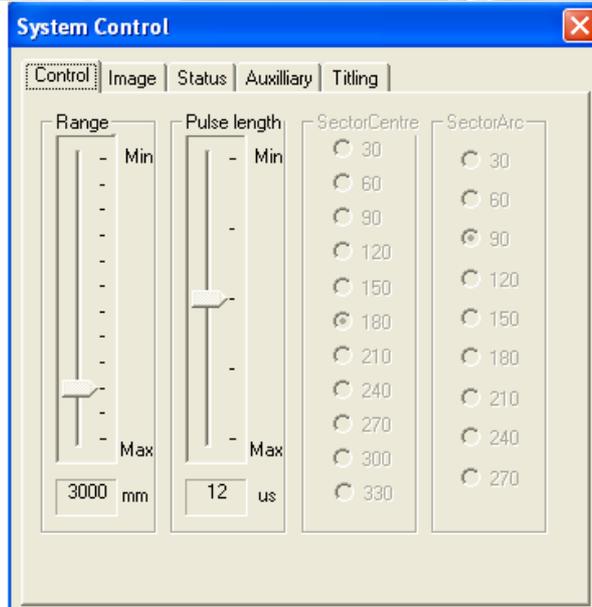
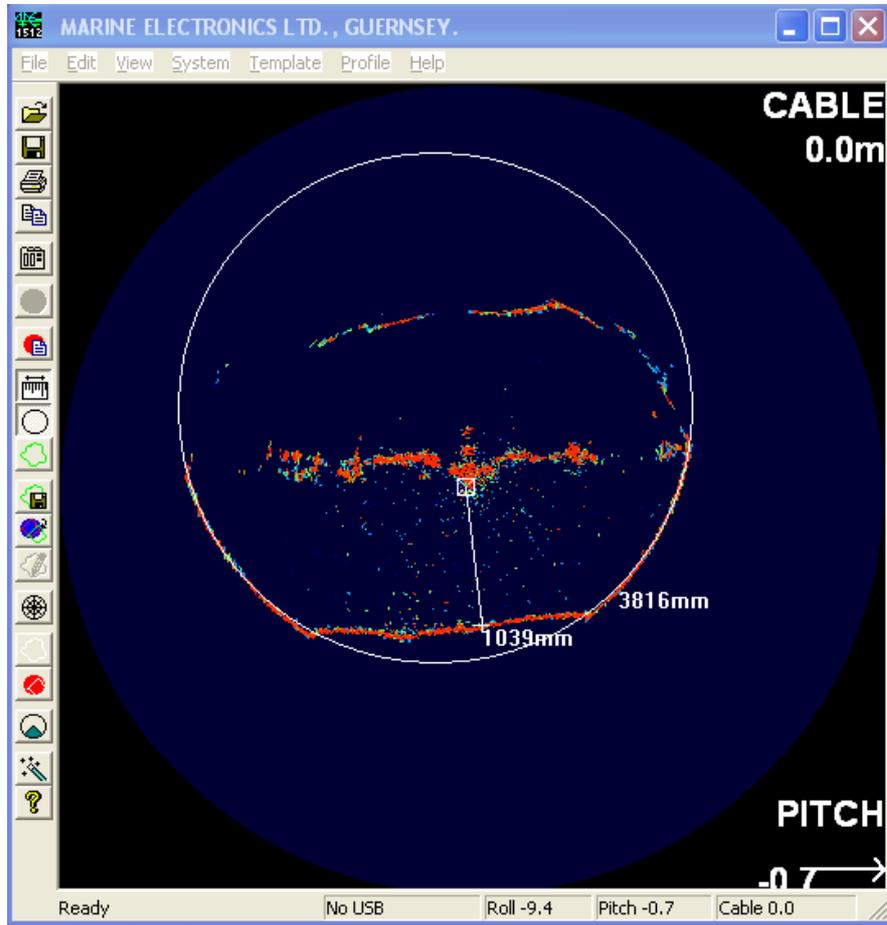
Appendix D – Sonar Interpretation

The Sonar transducer emits a 1.8° conical beam of sound that covers part of the pipe wall. The greater the distance from the sonar head the larger the area of reflection becomes. All echo's are received, amplified and displayed on the screen with the strongest targets in red and weaker one's in blue.

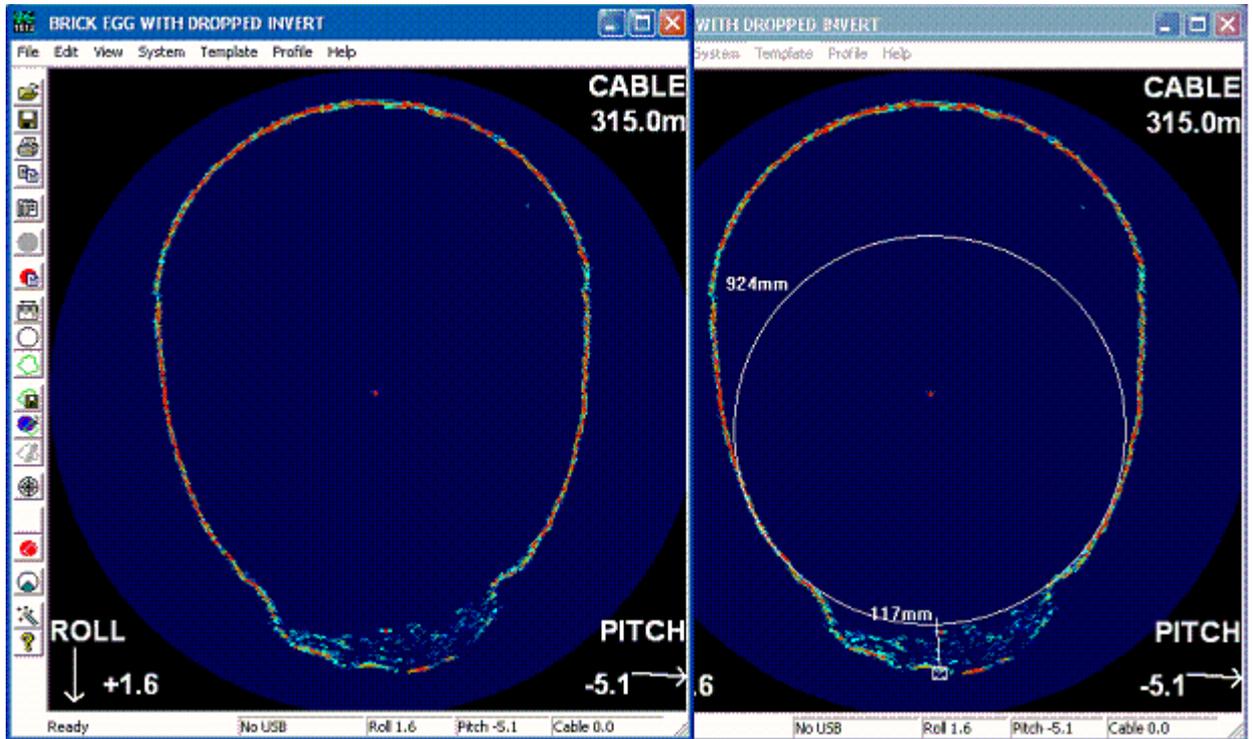
If the pipe is not full of water then it is possible to have a reflection of the pipe above the water line as shown below. The measuring cursor indicates the water line level. Also the flow is very turbulent with much aeration and debris being displayed in light blue colours. The sonar is mounted on a float with outriggers that are displayed in red on the image.



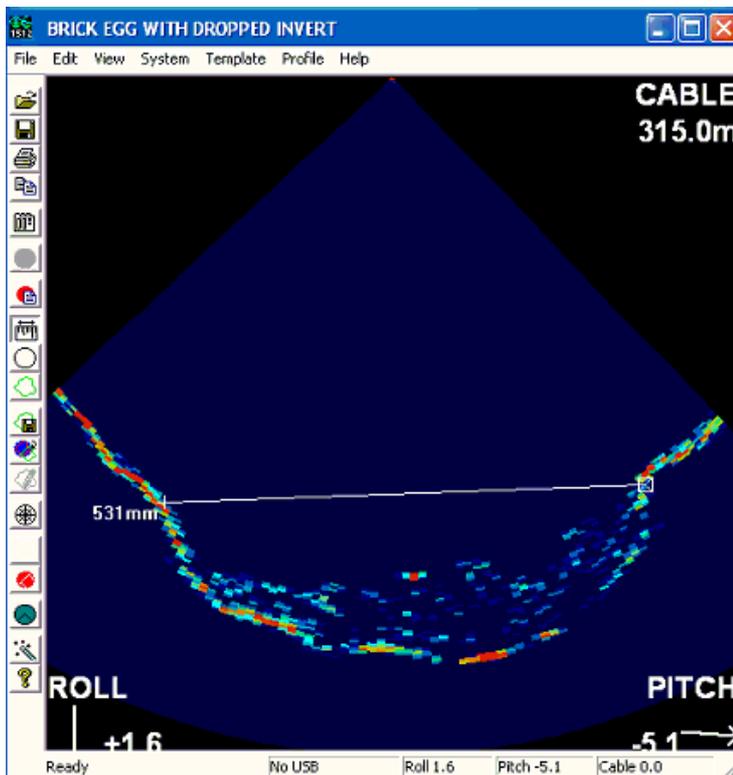
The previous image now has all the clutter removed from the screen by increasing the threshold control. This has the effect of a gain control and removes the weaker targets. The overlay circle shows the pipe diameter and the cursor tool the depth of water below the sonar head.



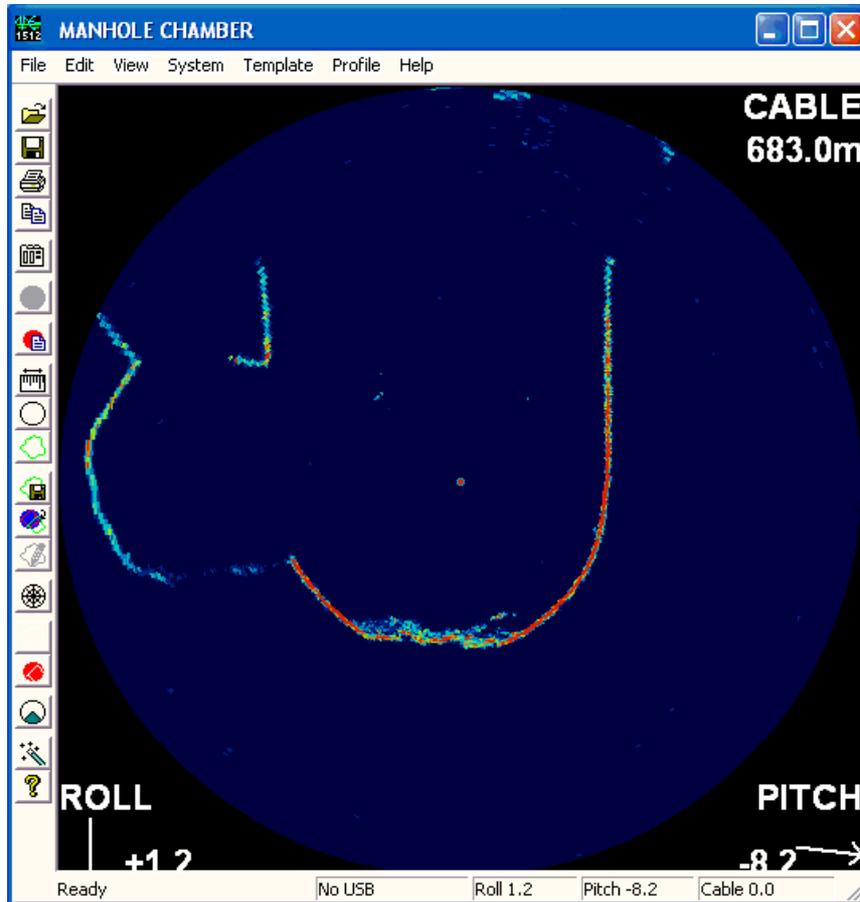
These 2 identical pictures show a fully surcharged Victorian brick sewer in which the invert has collapsed and filled with silt. The overlay circle shows where the pipe invert should be and the cursor tool the depth of collapse.



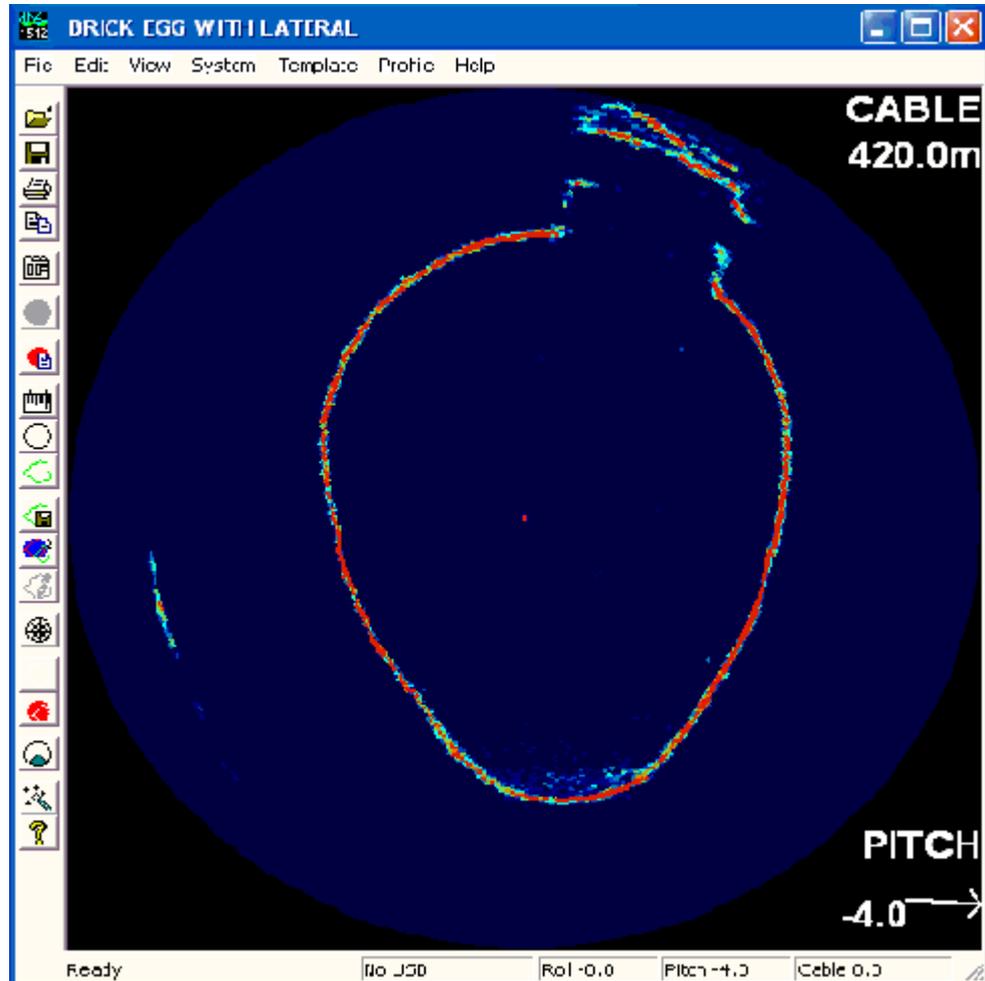
The same image below has the sector mode Icon selected and displays a 90° sector which results in a 2:1 zoom on the area of interest.



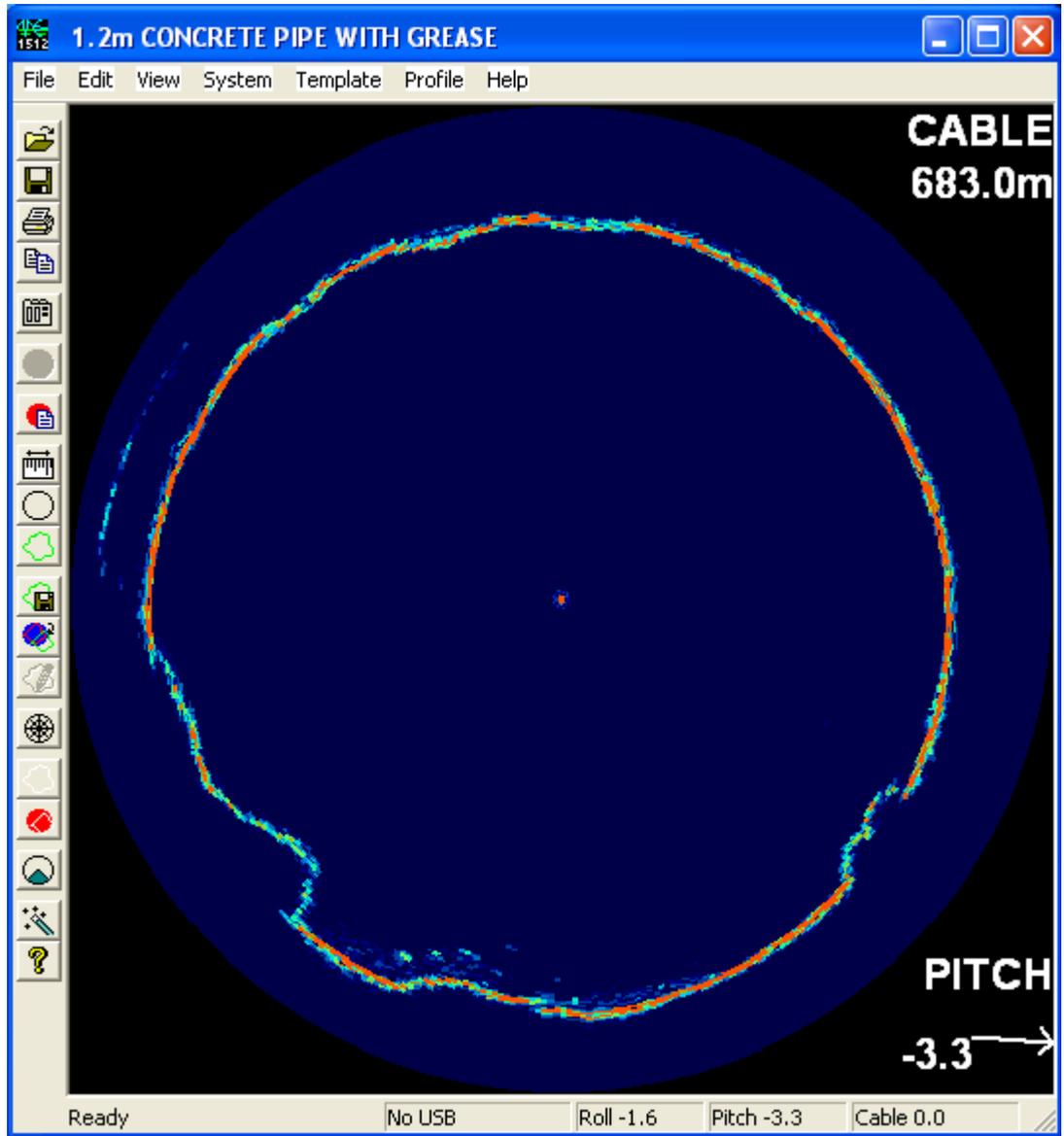
The image below shows a manhole chamber with a lateral entering from the left hand side.



The image below of a fully surcharged brick egg shaped sewer shows a lateral entering at the top right hand side. The signal to the left, appearing outside of the pipe, is a reflection and should be ignored.



The image below shows a concrete pipe that has a build up of material on the pipe walls. It can be seen from the image that the signal strength of the reflected signal (light blue) from the material build up is much less than the pipe wall.



The image below shows a concrete pipe where the crown has collapsed into the invert.

