

Technology Design

ADVANCED ULTRASONIC HARDWARE

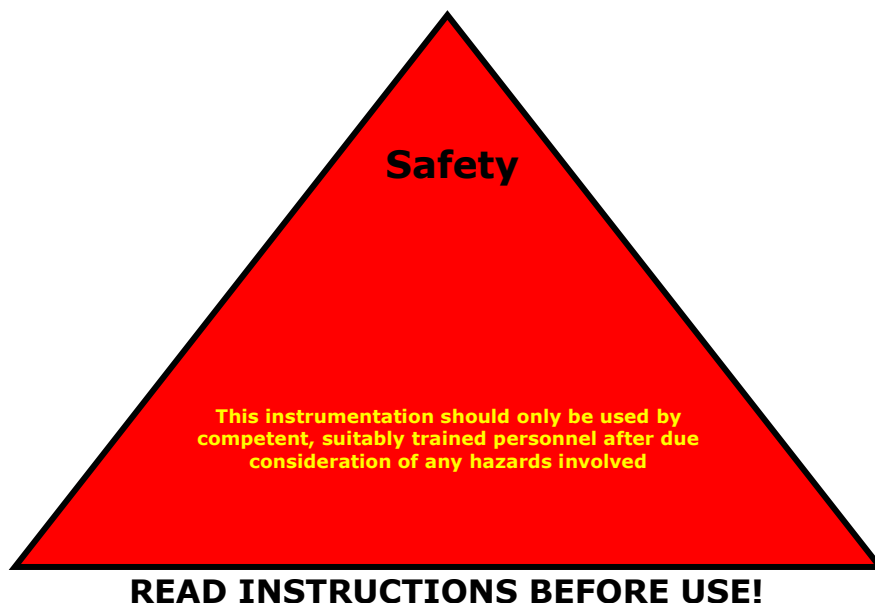
Corrosion Mapping Kit

USER GUIDE AND TECHNICAL REFERENCE MANUAL



TECHNOLOGYDESIGN.COM

Important Safety Information



Due to the potential hazards associated with any electrical equipment it is important that the user is familiar with the instructions covering the capabilities and operation of the instrument. The user should ensure that all reasonable safety precautions are followed and if in any doubt, should seek advice from a suitably qualified and trained person before proceeding.



NO attempt should be made to remove protective covers or access the internals of the system unless the equipment is isolated from the electrical supply and then only by a suitably trained and qualified technician. Failure to comply with these instructions may expose the user to electrical hazard.



All equipment supplied MUST only be used in dry conditions and is not suitable for operation in damp or wet environments.

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Corrosion Mapping with Video Tracking - Tutorial

1. Objectives

- The objectives of the tutorial are to:
- Provide an explanation of the setup procedures to achieve a corrosion mapping scan.
- Guide the user through the essential steps required to execute the procedures.

2. What is Corrosion Mapping?

- Corrosion Mapping is the use of ultrasonic data to generate colour-graphic images of the surface topography of a material. Although primarily used to determine the extent of material loss due to corrosion or erosion, the technique may also be used to detect and analyse other degradation mechanisms, for example; Hydrogen damage in metals and de-lamination in composites.
- Before any meaningful data can be collected the system parameters must be adjusted appropriately in the software for the type of ultrasonic procedure being carried out. This tutorial is restricted to the basic steps required to achieve a setup for a normal (0°) pulse echo transducer used with the TD Corrosion Mapping Kit (video tracking system).

3. How to set up the Corrosion Mapping Kit

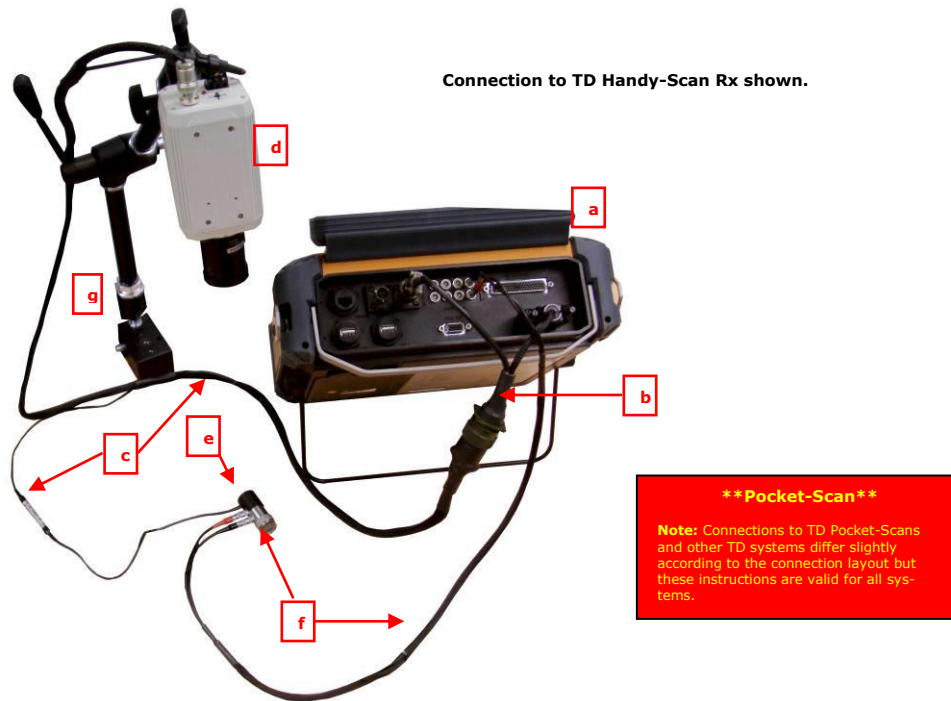
There are seven steps to complete the setup for data collection and analysis. Each step has an associated procedure:

- Equipment Setup
- Ultrasonic setup
- Probe calibration
- Colour/depth range setup
- Scanner setup
- Data Collection
- Data Analysis

4. Procedures

4.1. Equipment setup

- Connect the various components that make up the Corrosion Mapping Kit:
 - a. TD Advanced ultrasonic system
 - b. Connection adapter(Pocket-Scan, Pocket-Scan PS45 & Handy-Scan only)
 - c. Umbilical (for Focus-Scan & TD-Scan connect directly to Axis 1)
 - d. Video Camera with lenses and infrared filter
 - e. Infrared LED
 - f. Probe & leads
 - g. 'Magic' arm

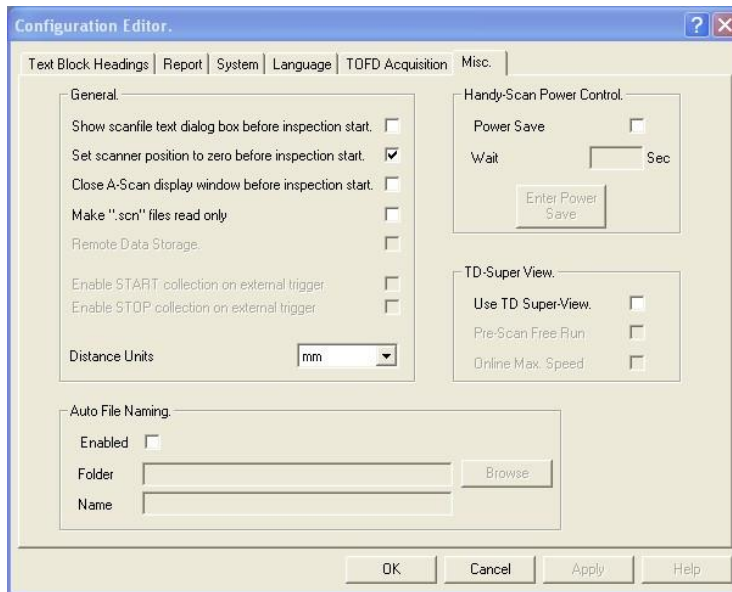


- Connect the probe and leads to the Lemo connectors. During scanner setup and scanning the Infrared LED cup is placed over the top of the probe.
- Attach the camera to the 'Magic arm' (g) and position it at a distance of approximately 500mm from the centre of the scan area. (This distance is arbitrary but keep it within a 5 centimetre range for each scan or the scanner will have to be re-calibrated)
- Switch the TD system on and start the TD Scan Advanced Ultrasonic Software. The Camera and infrared LED are powered from the TD unit. When using a TD Pocket-Scan, the PCMCIA card may be mains powered or powered directly from the Laptop PC depending on the configuration purchased.

4.2. Ultrasonic setup

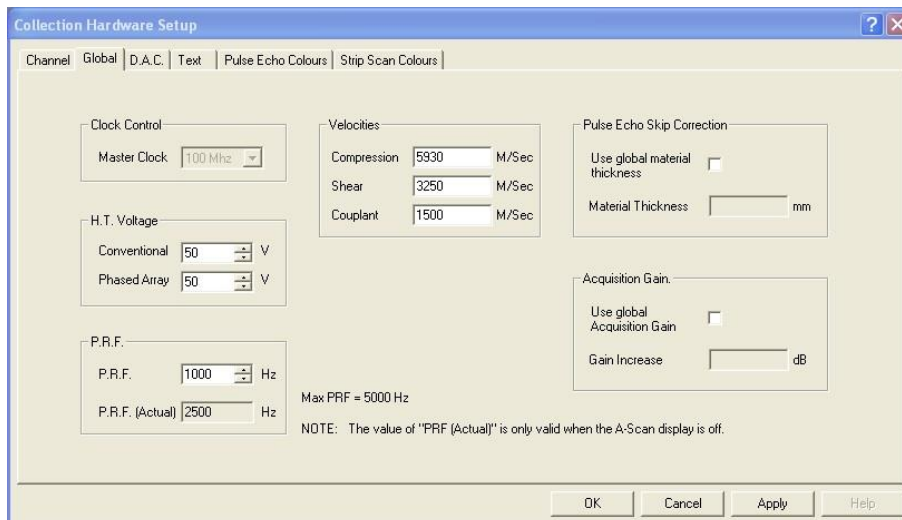
In the TD-Scan software follow the steps as described below:

- Select Setup – Configuration.
- Select the Misc. tab and enter the values as illustrated.



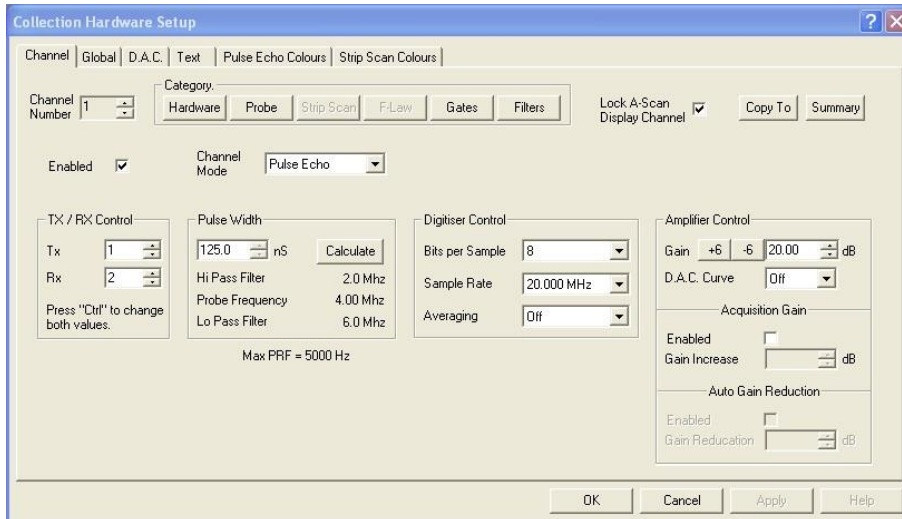
- Click **OK**.

-
- Select **Setup – Collection hardware**.
 - Select the **Global** tab and enter the values as illustrated. (velocity may differ according to test material).
 - PRF will be re-adjusted automatically.



- Click **Apply**.

-
- Select the **Channel** tab.
 - Click the **Hardware** button and enter the values as illustrated.



Collection Hardware Setup

Channel | Global | D.A.C. | Text | **Pulse Echo Colours** | Strip Scan Colours

Channel Number: 1

Category: Hardware | **Probe** | Strip Scan | F-Law | Gates | Filters

Lock A-Scan Display Channel: ☒ Copy To: Summary

Enabled: ☒ Channel Mode: Pulse Echo

TX / RX Control

Tx: 1 Rx: 2

Press "Ctrl" to change both values.

Pulse Width

Pulse Width: 125.0 nS Calculate

Hi Pass Filter: 2.0 Mhz

Probe Frequency: 4.00 Mhz

Lo Pass Filter: 6.0 Mhz

Max PRF = 5000 Hz

Digitiser Control

Bits per Sample: 8

Sample Rate: 20.000 MHz

Averaging: Off

Amplifier Control

Gain: +6 -6 20.00 dB

D.A.C. Curve: Off

Acquisition Gain

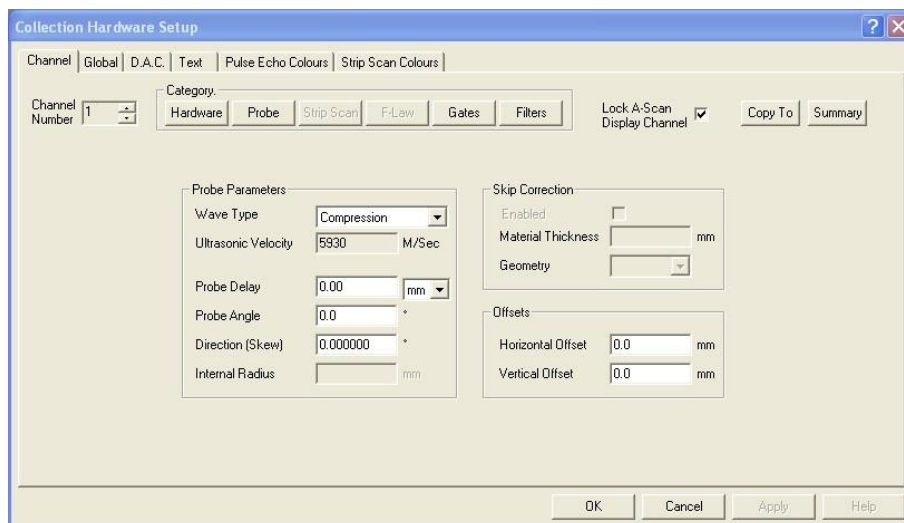
Enabled: ☐ Gain Increase: dB

Auto Gain Reduction

Enabled: ☐ Gain Reduction: dB

OK Cancel Apply Help

- **Note** – Ensure that the **TX/Rx** controls are set to the same values as the sockets that the UT leads are plugged into.
 - The **Gain** may be adjusted as required.
 - Click **Apply** if active.
-
- Click the **Probe** button and enter the values as illustrated.



Collection Hardware Setup

Channel | Global | D.A.C. | Text | **Pulse Echo Colours** | Strip Scan Colours

Channel Number: 1

Category: Hardware | **Probe** | Strip Scan | F-Law | Gates | Filters

Lock A-Scan Display Channel: ☒ Copy To: Summary

Probe Parameters

Wave Type: Compression

Ultrasonic Velocity: 5930 M/Sec

Probe Delay: 0.00 mm

Probe Angle: 0.0 °

Direction (Skew): 0.000000 °

Internal Radius: mm

Skip Correction

Enabled: ☐

Material Thickness: mm

Geometry:

Offsets

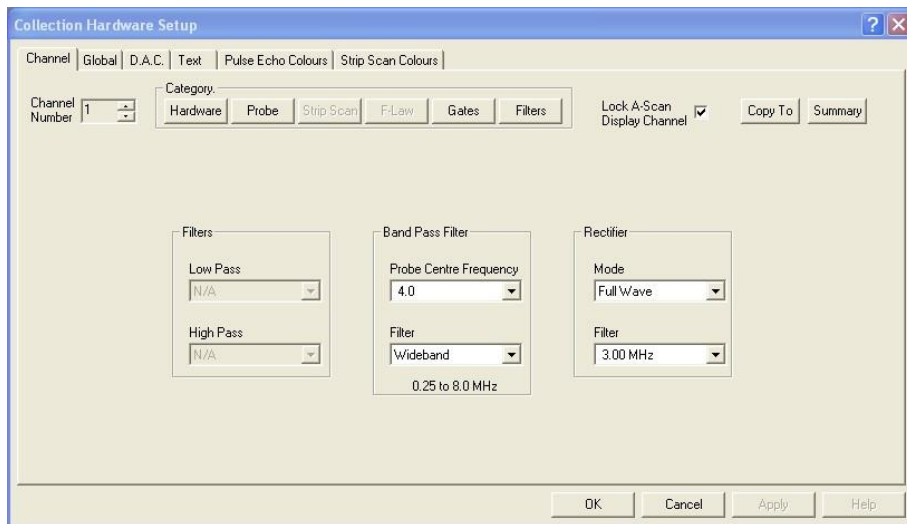
Horizontal Offset: 0.0 mm

Vertical Offset: 0.0 mm

OK Cancel Apply Help

- **Note** – Ensure that the probe delay is set to **zero (0)** by clearing any values in the **Probe Delay** box and clicking **Apply**. This is essential for calibration with conventional probes.
-

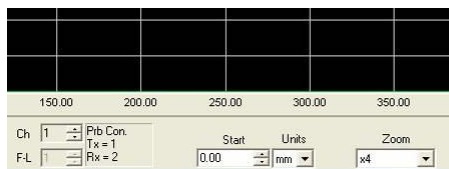
- Click the **Filters** button and enter the values as illustrated. (Note that the illustration below is for the TD Handy-Scan that uses band pass filters, other TD systems have full low & high pass filter control).



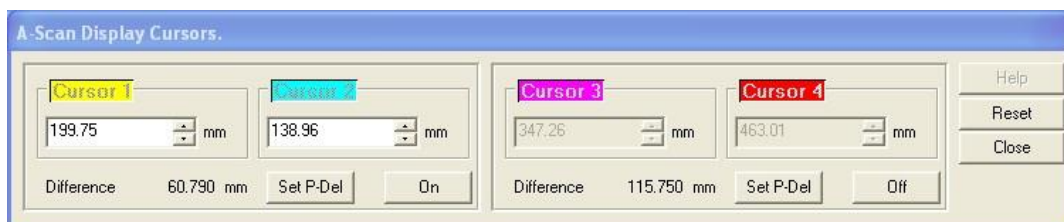
- Click **Apply** if active.

4.3. Probe Calibration

- Ensure that the Units are set to **mm** (millimetres) on the A-scan window.



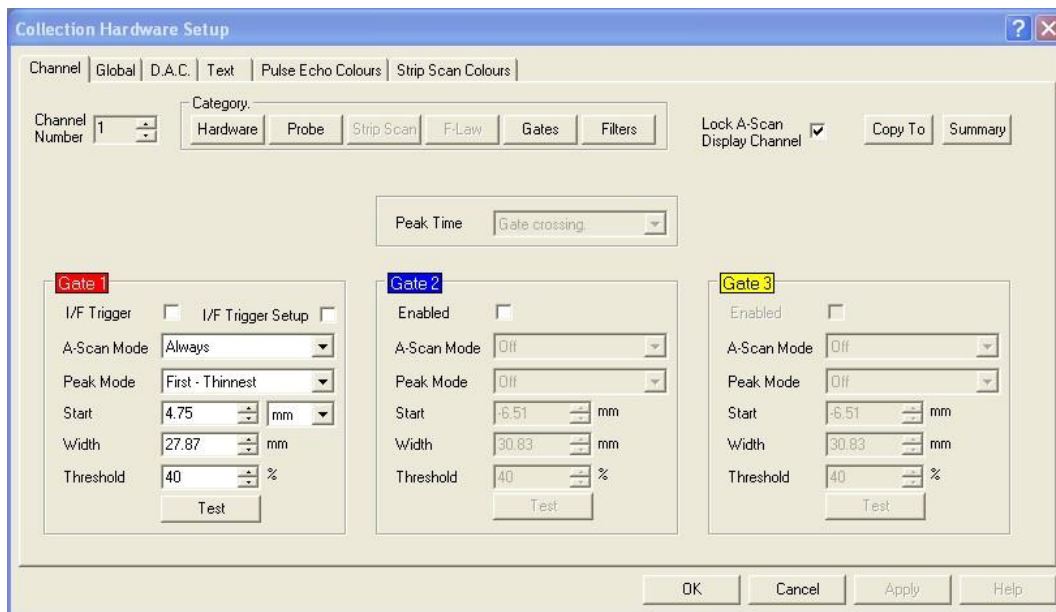
- Select Setup - **Collection Hardware – Probe**.
- Clear the **Probe Delay** & click **Apply**.
- Click the Cursors button on the A-scan window (button may display as C only depending on screen resolution). The **A-scan Display Cursors** window opens.



- Couple the probe to a calibration block & maximise the signal.
- Adjust the gain. We recommend the following gain setting as a guide: Backwall signal at 100% FSH + 6dB. This usually ensures a good signal, even from corroded/eroded areas, but of course the gain must be set by the user to optimise the application.
- The collection **Gate** height (threshold) may now be set by selecting **Setup - Collection Hardware – Gates**. Move the gate along the time-base so that it crosses

the calibration signal. The gate Threshold (height) is a matter of preference but should be adjusted such that the base line noise (grass) does not cross the gate **threshold**.

- Move **Cursor 1** to the flank of the calibration signal where it crosses the gate. This ensures accurate depth readings and colour slicing.
- Type the calibration block thickness into the **Cursor 2** text box & press **ENTER** (*very important*).
- Click the **Set P-Del** button to transfer the delay to the **Probe Delay** text box on the **Probe** page.
- Cross check the calibration by moving a cursor to one of the multiple echoes and the beam path distance should read correctly. If the cross check is incorrect, your velocity is probably incorrect & we suggest you check the material velocity.

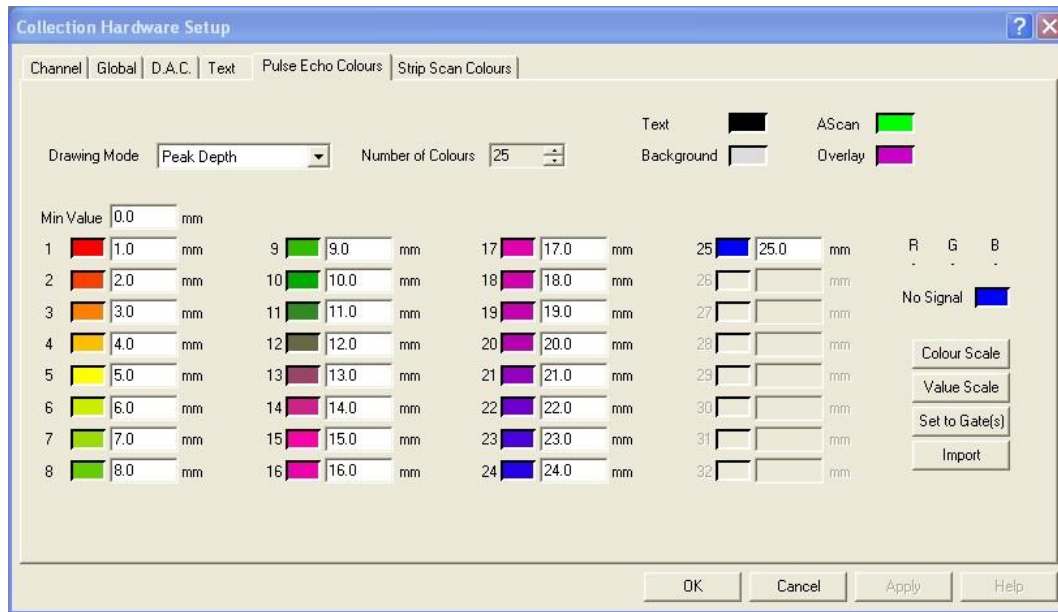


- The collection **Gate** position and width may now be adjusted by selecting **Setup - Collection Hardware - Gates**. Enter the **A-scan Mode** and **Peak Mode** values as illustrated. The **Start** and **Width** and values must be adjusted to suite the test thickness.

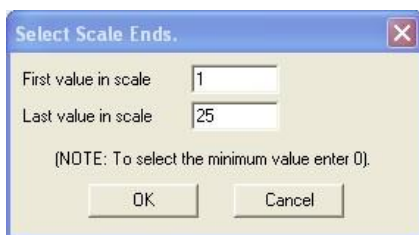
4.4. Colour/Depth Range Setup

- Select **Setup - Collection Hardware - Pulse Echo Colours**.
- Select or enter the values for **Drawing Mode** and **Min Value** as illustrated then click **Apply**.

- Select the **Number of colours** desired using the arrows.

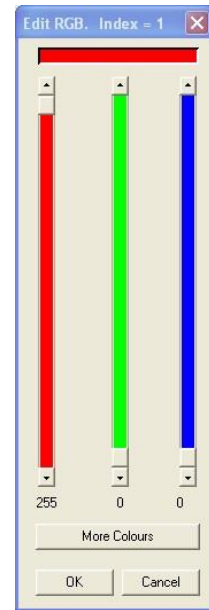


- Set the depth scale values as follows:
 - Enter the lowest value to record into the text box at the first position on the scale (our illustration shows 1mm at position **1**).
 - Enter the highest value to record into the text box at the last position on the scale (our illustration shows 25mm at position **25**). We suggest that you use a value slightly larger than the thickness being tested to accommodate variations in nominal thickness.
- Click the **Value Scale** button. The **Select Scale Ends** window appears.



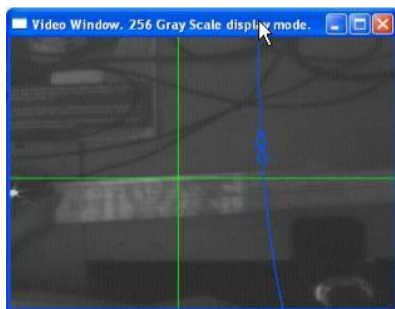
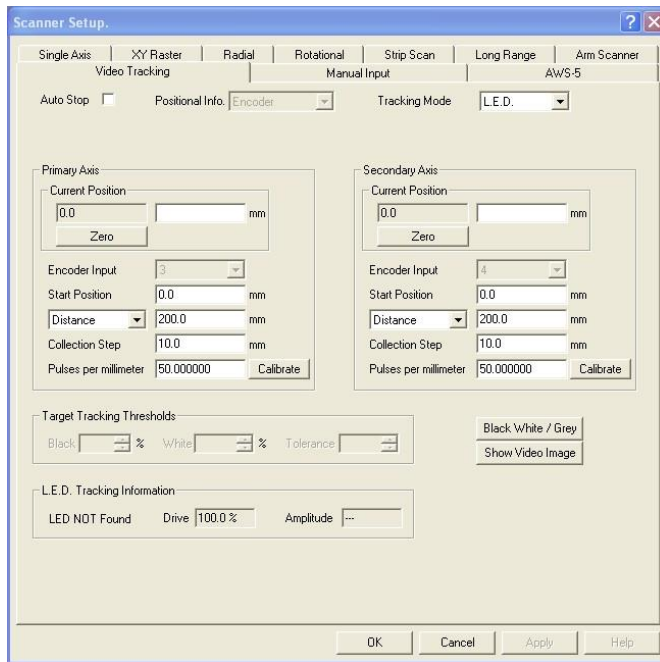
- Enter the number of the first position in the **First value in scale** box.
- Enter the number of the last position in the **Last value in scale** box.
- Click **OK** or press **Enter**. The scale is automatically adjusted into even steps across the entire scale.

- Set the colour scale as follows:
 - Click the colour box at position **1**. A colour selection window appears.
 - Select a colour by moving the **RGB** slider controls then click **OK**.
 - Repeat this process using different colours at even position intervals (in our illustration above the colours were set at positions **1, 5, 10, 15, 20** and **25**)
 - Click the **Colour Scale** button. The **Select Scale Ends** window appears.
 - Enter the number of the first position in the **First value in scale** box.
 - Enter the number of the last position in the **Last value in scale** box – we have used position **5** in our illustration. (**Note** – in our illustration we created five smaller colour scales to make up the complete scale).
 - Click **OK** or press **Enter**. The scale is automatically adjusted into even colour steps across the scale from positions **1** to **5**.
 - Repeat this process to create colour scales between the positions where the individual colours were previously entered in 4.4.5.3. (i.e. **1-5, 5-10, 10-15, 15-20, 20-25**).
-
- Click **OK** on the **Collection Hardware Setup** window.
-

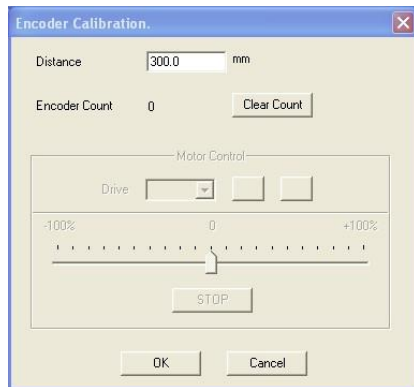


4.5. Scanner Setup

- Select **Setup – Scanner**. The Scanner Setup window appears.
- Select the **Video Tracking** tab.



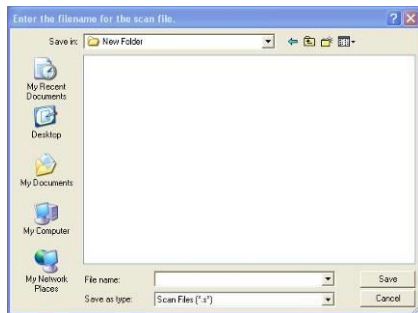
- Select **L.E.D.** in the Tracking Mode box.
- Click the Show Video Image button. A live video window opens. Adjust the focus and aperture on the camera lenses manually. Note: Depending on the CCTV unit supplied, adjustment of the video configuration may be necessary before a usable video image can be displayed. See Note 1 at the end of this tutorial for details.
- Click the **Calibrate** button in the **Primary Axis** area. The **Encoder Calibration** window appears.
- Enter the measured calibration distance to be used in the Distance box.



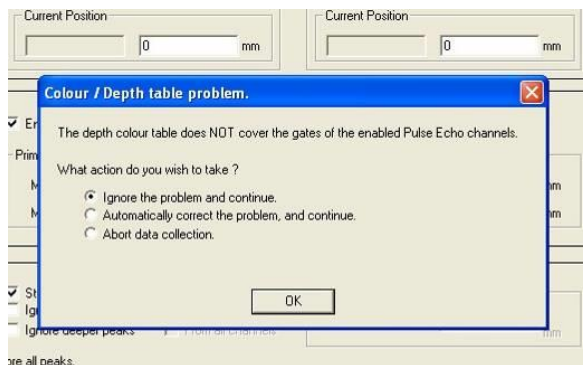
- Place the infrared LED at the beginning of the measured calibration area.
Note – the LED must be in line-of-sight of the camera. This is determined by ensuring the LED image (white spot) is visible in the Video window. Adjust the focus and aperture on the camera lenses if required, the white spot should follow the movement of the LED. If the aperture is too large then the white spot may 'jump' to a brighter area on the screen.
- Click the **Clear Count** button.
- Move the LED the measured calibration distance ensuring that line-of-sight is maintained between LED and camera and the white spot follows the led movement constantly. At the end of the movement keep the LED still.
- Click the **OK** button. The calibration window closes automatically and the correctly calibrated value is automatically entered into the **Counts per millimetre** box. The **Primary Axis** is now calibrated.
- Repeat the process from 4.5.5 in the **Secondary Axis** area.
- The values for **Start Position**, **Distance** and **Collection Step** may be entered as required. We recommend that you start with a collection step of 10mm for large areas and re-scan smaller areas of interest with a smaller collection step. **Note** – smaller collection steps may increase the time to complete a scan significantly.
- Close the live **Video Window** if it is open.
- Click **OK** on the **Scanner Setup** window.

4.6. Data Collection

- Click the **Start** menu.
- The **Enter the filename for the scan file** window opens.

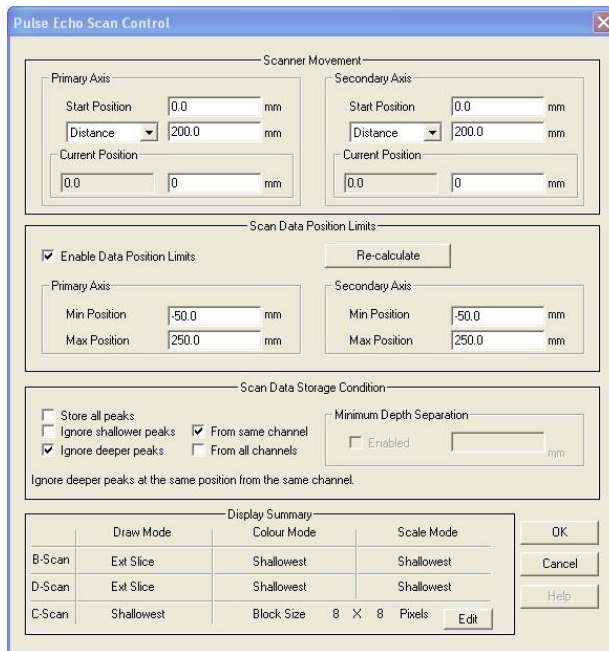


- Enter a file name into the **File Name box**.
- Click **Save**.
- The **Pulse Echo Scan Control** window appears, however the **Colour/Depth table problem window** may also appear.



- If the above dialogue appears Select **Automatically correct the problem and continue** then click **OK**. The dialogue is simply telling you that the gate and depth scale are not identical.

- The Pulse Echo Scan Control window remains open.



Pulse Echo Scan Control

Scanner Movement

Primary Axis: Start Position 0.0 mm, Distance 200.0 mm, Current Position 0.0 mm

Secondary Axis: Start Position 0.0 mm, Distance 200.0 mm, Current Position 0.0 mm

Scan Data Position Limits

☒ Enable Data Position Limits Re-calculate

Primary Axis: Min Position -50.0 mm, Max Position 250.0 mm

Secondary Axis: Min Position -50.0 mm, Max Position 250.0 mm

Scan Data Storage Condition

☐ Store all peaks
☐ Ignore shallower peaks
☒ Ignore deeper peaks

☒ From same channel
☐ From all channels

Minimum Depth Separation: ☐ Enabled mm

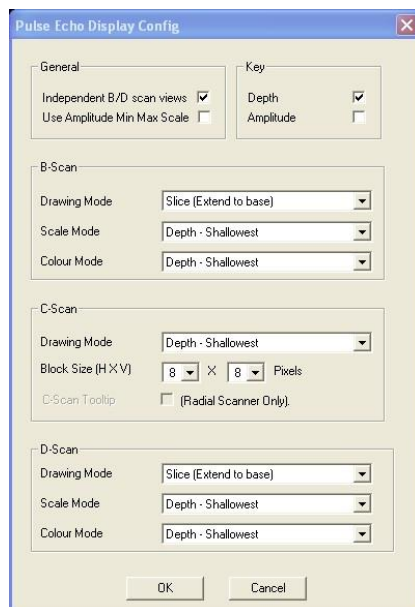
Ignore deeper peaks at the same position from the same channel.

Display Summary

	Draw Mode	Colour Mode	Scale Mode
B-Scan	Ext Slice	Shallowest	Shallowest
D-Scan	Ext Slice	Shallowest	Shallowest
C-Scan	Shallowest	Block Size 8 X 8 Pixels	Edit

OK Cancel Help

- Enter the values as above and then click **Edit** in the **Display Summary** area.
- The **Pulse Echo Display Config** window opens.



Pulse Echo Display Config

General

Independent B/D scan views ☒
 Use Amplitude Min Max Scale ☐

Key

Depth ☒
 Amplitude ☐

B-Scan

Drawing Mode: Slice (Extend to base)
 Scale Mode: Depth - Shallowest
 Colour Mode: Depth - Shallowest

C-Scan

Drawing Mode: Depth - Shallowest
 Block Size (H X V): 8 X 8 Pixels
☐ C-Scan Tooltip (Radial Scanner Only)

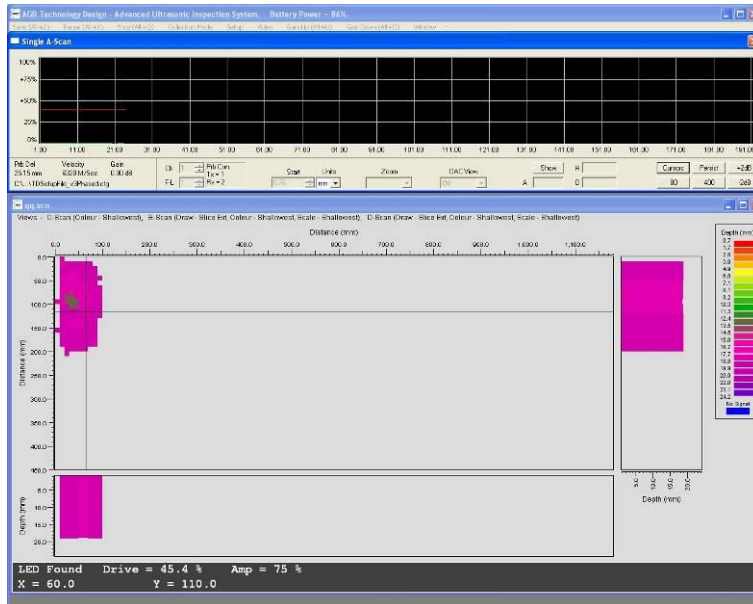
D-Scan

Drawing Mode: Slice (Extend to base)
 Scale Mode: Depth - Shallowest
 Colour Mode: Depth - Shallowest

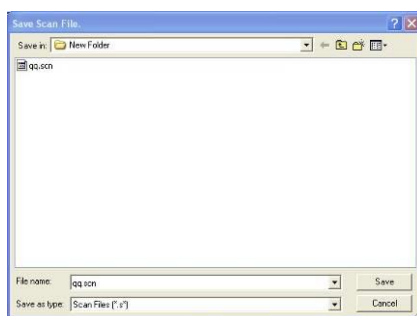
OK Cancel

- Enter the values as above.
- Click **OK**

- Place the probe and LED at the 0/0 position (top left) of the scan area. This ensures that the position of the probe is registered correctly when the scan starts.
Important – keep line-of-sight between LED and camera.
- Click **OK** on the **Pulse Echo Display Config** window.
- The scan starts.



- Move the probe/LED to record data. The cross-hair should follow the movement of the probe/LED. **Note** – if the cross-hair does not move, then gently adjust the aperture ring on the camera lenses until the cross-hair moves.
- To end the scan, click the **Stop** menu item.
- The **Save Scan file** window opens.



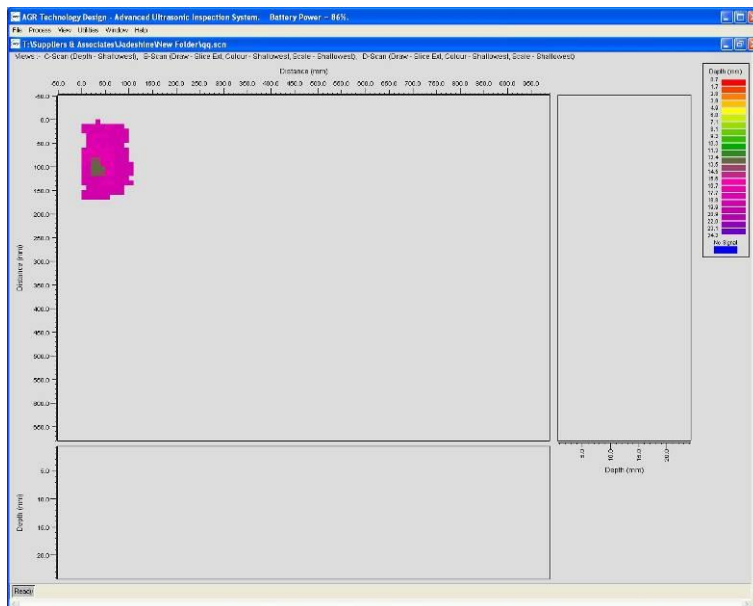
- Click **Save**.
 - The data collection is now complete.
-

4.7. Data Analysis

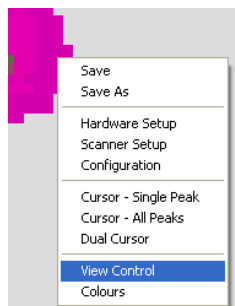
- Click the **Analyse** menu.
- The **Select Scan file(s)** window opens. The scan that was saved immediately prior to clicking Analyse is displayed in the **File name** box.



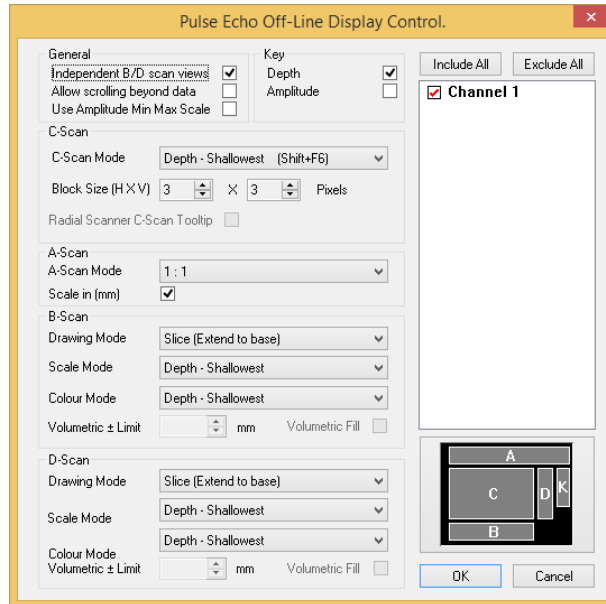
- Click **Open** or select other files to open for analysis.
- The file opens



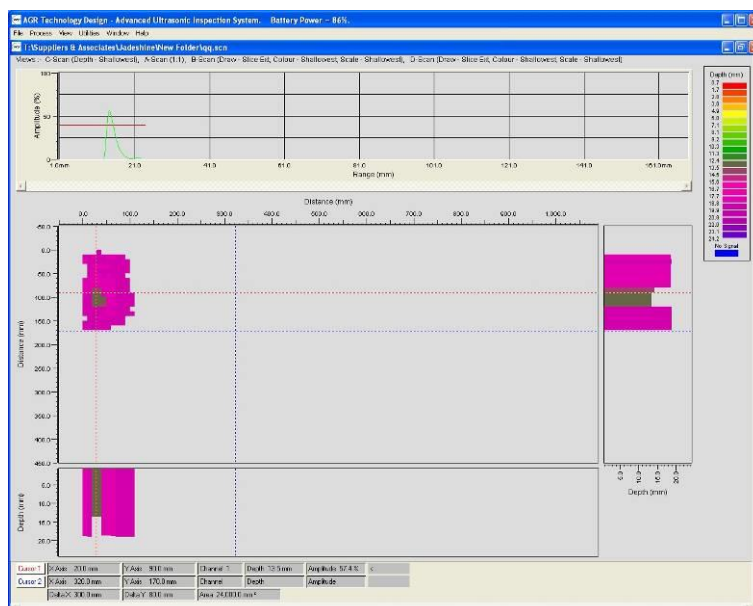
- Place the Windows® pointer in the data area and right click.
- A context menu appears.



- Select the **View Control** menu item.
- The **Pulse Echo Off-Line Display Control** window opens.
- Enter the values as illustrated below and click **OK**.



- The **A-scan** window is now displayed above the graphic data.
- Re-open the context menu as above in 4.7.5 and select the **Dual Cursor** menu item.
- **Blue** and **Red** cross-hair cursors appear in the data area. Move a cursor over the data to activate the **A-scan** and **numeric** data area at the bottom of the window.



5. Conclusion

This user guide provides the basic steps to achieve a corrosion mapping scan. Users may get additional information from Technology Design Ltd. directly or through their local distributor.

Note 1 – CCTV video settings

Depending on the CCTV unit supplied, adjustment of the video configuration may be necessary before a usable video image can be displayed. This adjustment will only need to be made once. The image below illustrates the type of CCTV unit that may need adjustment.



With CCTV unit connected to the TD acquisition unit, press the **Menu** button on the camera to display the adjustment menu. Move the button left, right, up or down to highlight items and press the button to select an item. Select the following settings:

Lense	Manual	
Exposure	Shutter	ESC
	AGC	Off
	Sens	- - -
White Bal	AWC	SET
Backlight	- - -	
DNR	- - -	
Day/Night	B/W	

Trouble Shooting

If the video image displays regular 'lines' that distort the image, restart the TD-Scan software.