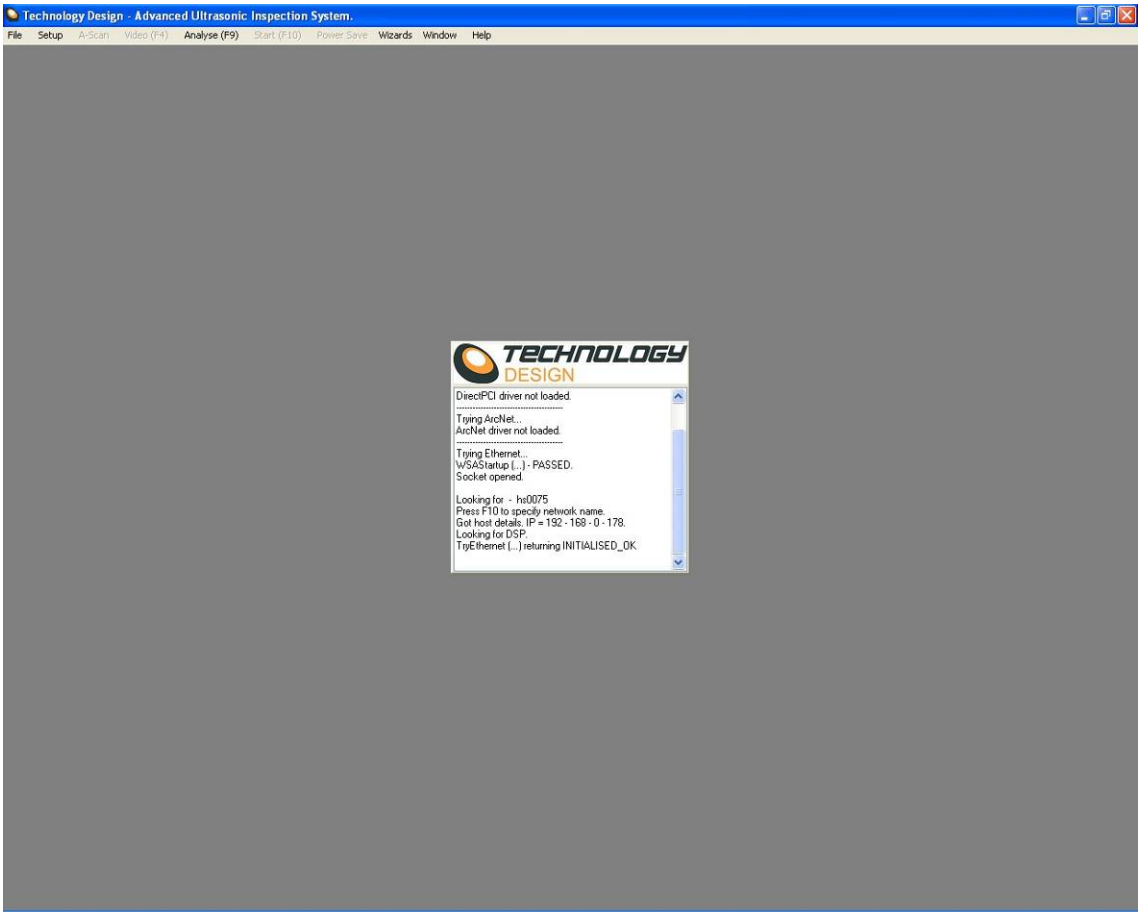
Starting the software

To start the TD-Scan software, double click the mouse left button on the TD-Scan icon on the Windows® desktop. The TECHNOLOGY DESIGN logo splash screen displays as the software starts. During start-up the previous set-up parameters are loaded from the PC's hard drive and downloaded to the remote unit (the ultrasonic circuitry). After a short time (1 – 3 seconds), the splash screen is replaced by the A-Scan display window.

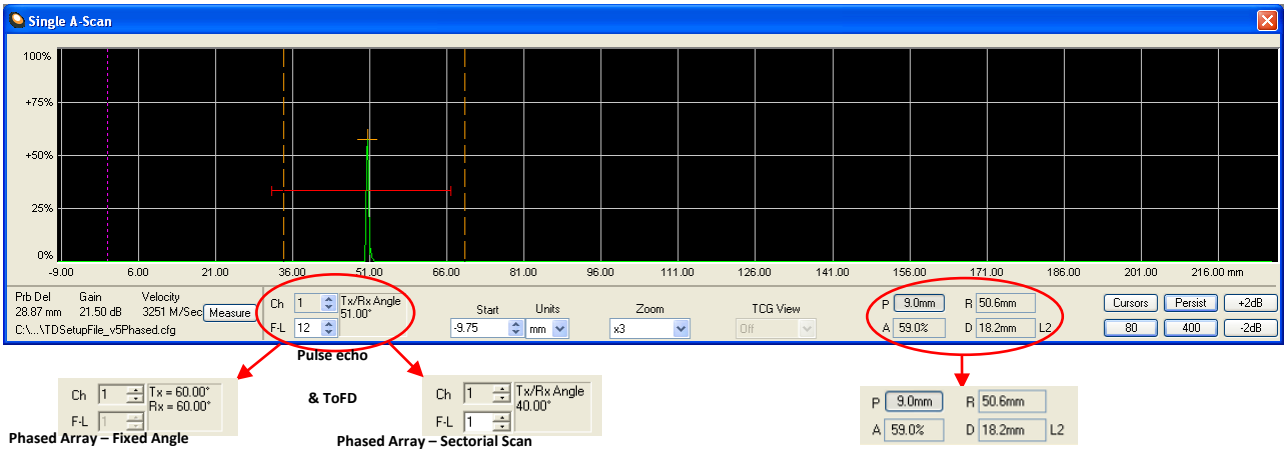


Running the software for the first time

On a - TD Focus-Scan, TD-Scan, TD Handy-Scan Rx & TD Pocket-Scan PS45

When running the software for the first time on a **TD Handy-Scan**, **TD-Scan** or **TD Focus-Scan** the software will start normally and display the A-Scan window.

The A-Scan display window



The A-Scan display window shows the digitised ultrasonic signal received by the transducer.

The RED line in the A-Scan display area is a graphical representation of data collection gate 1. When enabled, Gate 2 is drawn in BLUE, and gate 3 is drawn in YELLOW (See *Gates* category).

Prb Del	The probe delay for the displayed channel.	
Gain	This field shows the gain setting for the selected channel.	
Velocity	This field shows the programmed ultrasonic velocity for the selected channel.	The value will change depending on the wave mode selected: Shear or Compression.
Measure	Activates the A-scan velocity measurement procedure	Use this procedure to determine the test material velocity and enter it automatically.
Ch	The channel number of the A-Scan currently displayed. This value may be changed by clicking the Up/Down arrows to the right of the text using the left mouse button or by using the Up/Down arrow keys.	**Note:** using this control will change the channel being viewed as an A-Scan but will **not** change the channel in the *Collection Hardware Setup* window. (see *Channel Page – Channel)*
F-L	The focal law number of the A-scan currently displayed. This value may be changed by clicking the Up/Down arrows to the right of the text using the left mouse button or by using the Up/Down arrow keys.	**Phased Array Only.** The box will be greyed out in ToFD and Pulse Echo channels
TX	Transmit transducer number.	**Pulse echo, ToFD & Phased array (fixed angle)**
RX	Receive transducer number.	
Tx/Rx Angle	Transmit/Receive angle of a sectorial scan	**Phased Array only** – only one angle at a time can be displayed in the A-scan window.
Start	The time or distance at the left edge of the A-Scan display. Changing this value scrolls the A-Scan **Left/Right**. Values may be entered via the **keyboard** (the **Enter** key must be pressed for the software to use the value), or the **Up/Down** - **Arrow/Page** keys. The **shift** key may be used in conjunction with the **Up/Down** –**Arrow/Page** keys to scroll faster. An alternative method of scrolling the A-scan is: **Left Click**, **Hold** & **Drag** the mouse.	
Units	Choose mm or µS (Microseconds) from the **drop-down menu.**	Changing the **Units** will change the displayed values on the A-Scan time base accordingly and will also change the positional displays in the **Cursors** window.
Zoom	Controls the amount of data displayed in the A-Scan display window. Values of 1:1, x2, x3, x4, x5, x6, and FULL are available.	
TCG view	This list controls the display of the Amplitude Correction curve on the A-Scan display. (Only available for Pulse Echo & Phased array channels).	The system displays a **TCG** curve (Time Corrected Gain). The menu items zoom the TCG view vertically for ease of viewing. **See** *Manual Time Corrected Gain (TCG)* in Appendix A for guidance on setting up TCG (theoretical).
Show	Activates the Peak Search Gates and real-time Surface Projection (P), Amplitude (A), Range (R) & Depth (D) value boxes. The current active skip leg is also shown.	**Drag** the **orange vertical dashed delimiters** to encompass the area of interest. The highest amplitude signal between the delimiters is identified by an **orange cross** at the apex of the signal.

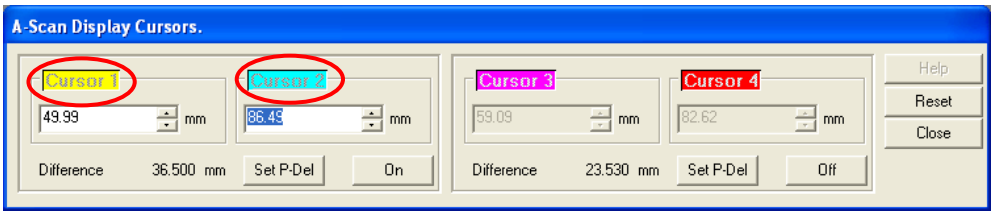
Cursors	Opens the cursor control dialog box.	See **A-Scan Display Cursors** for an explanation of the cursors.
Persist	Activates a coloured fill-in on the A-scan display that remains on-screen after the A-scan peak has moved.	Useful during calibration or measurement because once the signal is maximised the probe may be removed and the persistent image used for measurement.
80	Sets the vertical scale to show 80% full scale, with –6dB steps.	
400	Sets the visible A-scan scale to 400%	Only useful when **14 bits per sample** is enabled
+2dB / -2dB	Increases / Decreases gain in 2dB steps	

A-Scan Display Cursors

To open the *A-Scan Display Cursors* dialogue box, click the *Cursors* button on the A-Scan display window. Coloured vertical cursors corresponding to the cursor controls are displayed in the A-scan window.

The purpose of the A-Scan Display Cursors is to measure precisely any point on the A-Scan. The cursors may be used for calibration procedures. Usually only two cursors are displayed however an extra pair of cursors may be activated by clicking the **OFF** button.

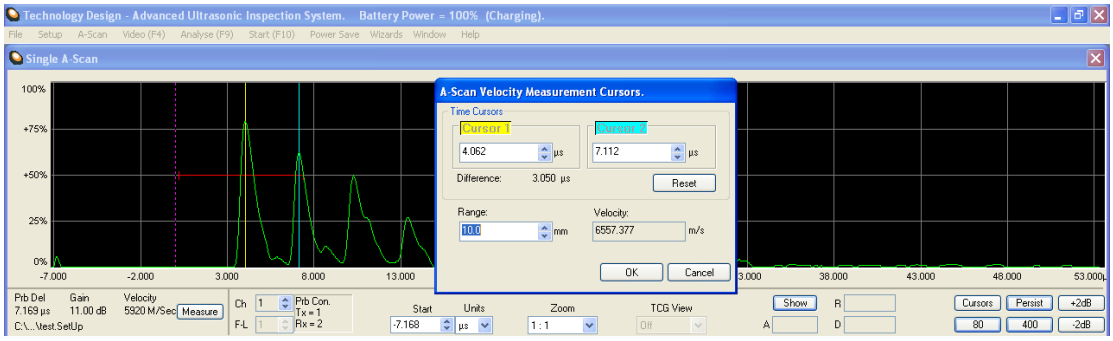
Cursors may be moved by dragging with the mouse pointer or adjusting the values in the *A-Scan Display Cursors* window.



How to Measure Velocity

Automated Method

a. Close all open windows leaving only the **A-Scan** window open.
b. Set the system up with an appropriate basic setup.
c. Click the **Measure** button on the A-Scan window. The **A-Scan Velocity Measurement Cursors** window appears.
d. Place the probe on a calibration block or defect free area of the test piece. Adjust the A-Scan window so that two BWE's are displayed or the signals from two known thicknesses can be displayed ensuring that the peaks are not saturated.
e. Adjust Cursor1 and Cursor2 to the peaks of two subsequent BWE's.
f. Adjust the **Range** control to the known thickness of the material. The velocity of the material in metres per second will be displayed in the **Velocity** text box.
g. Tap **OK**. Notice the velocity value changes on the A-Scan window and may also be viewed in the **Compression** velocity text box on the **Global** tab in the **Collection Hardware Setup** window.



Manually

a. Connect a probe to the system. No calibration is required.
b. Ensure the measurement units on the A-Scan display window are set to microseconds (µS).
c. Place the probe on a defect-free area of the material and ensure that at least two repeat signals from a reflector at a known range are visible on the A-Scan.
d. Activate the cursors and place one cursor on each of the peaks of the two signals.
e. To calculate the velocity in *metres per second*, calculate the following:

$$\frac{Range \times 2}{Difference} \times 1000$$

Example:
Range=100mm
Difference between repeat signals = 61.47 µS

$$\frac{200}{61.47} \times 1000 = 3253 m/s$$

Probe Calibration

There are three methods to calibrate the system. In **Phased array mode** all 3 are available, in **Pulse Echo** mode only manual calibration is available.

a. **Manually (PA & PE)** by physically determining the probe delay of a single focal law. For phased array the system then calculates the probe delay for all other focal laws theoretically.
b. **Theoretically (PA)** where the system calculates all the probe delays (for each focal law) without any physical action by the operator.
c. **Wizard (angled PA only)**. The delay for each focal law is determined experimentally by passing the probe (therefore each focal law) over a calibration reflector *(see Appendix C for detailed tutorials)*. **NOTE**: A special procedure to calibrate a multi-focal law **Pitch/Catch** channel is activated when **Probe Delay – Manual - Calibrate** is selected in the phased array wizard.

Manual Method

This method uses one focal law to calibrate and then corrects all the other focal laws mathematically.
f. Enter all values for a basic system setup.
g. Change the measurement units from microseconds (µs) to millimetres (mm).
h. *Click* **Setup** – **Collection Hardware** – **Probe**.
i. Clear the value in the **Delay** text box then click **Apply**.
j. *Click* the **Cursors** button on the **A-scan** window (the button may display as **C** only depending on screen resolution).
k. *Couple* the probe to a calibration piece and *maximise* the signal.
l. *Move* Cursor 1 to the peak *or* flank of the calibration signal.
m. *Enter* the range to the calibration reflector into the Cursor 2 text box and *press* **ENTER**. The **Difference** (delay) between the cursors is displayed below the cursor controls.
n. *Click* the **Set P-Del** button to transfer the delay to the **Probe Delay** text box on the **Probe Page**.
o. Cross check the calibration by moving any cursor to a signal with known range & check that the range is correct. Alternatively, *click* the **Show** button on the **A-Scan** window and *move* the vertical dashed markers on the A-Scan to encompass the signal. The depth is displayed in the **D** text box.
p. **Note**: If the cross check is incorrect, the velocity is probably incorrect. We suggest you measure the velocity (see 'How to Measure Velocity' in Appendix B).

Theoretical Method

a. Enter all values for a basic system setup.
b. Simply *click* the **Theoretical Delay** button in **Setup – Collection Hardware – Probe**. The system will calculate and delay values of all focal laws for the channel and display the value of the first focal law in the **Probe Delay** text box.

Wizard (see Appendix C for detailed instructions on how to use the wizard)
The phased array wizard may be activated from three different locations within the software:

a. *Click* the **Wizards** menu and select one of the **PA wizard** options.
  i. **PA Wizard** – Starts the wizard at the *equipment setup* section. Complete this section to proceed to the *calibration* and *TCG* section.
  ii. **PA Calibration Wizard – Channel *x*** – Allows the user to re-enter the wizard at the *calibration* and *TCG* section, by-passing the setup section. These menu items will only be displayed for channels that have already been calibrated.
b. *Click* **Setup** – **Collection Hardware** – **Probe – Calibration Wizard**. Enters the phased array wizard at the *calibration* and *TCG* section by-passing the setup section.
c. *Click* **Setup** – **Collection Hardware** – **TCG – Calibration Wizard**. Enters the phased array wizard at the *calibration* and *TCG* section by-passing the setup section.

Time Corrected Gain (TCG)

Manual Method

Select the desired curve number from the **T.C.G. Curve** drop-down menu *(**Setup - Collection Hardware – Channel – Hardware**)*. Only one curve per channel may be selected but a single curve may be referenced by multiple channels.Select the zoom factor from **TCG View** on the A-Scan window.
Click the **T.C.G.** tab in the **Collection Hardware** window.
Select the curve to view from the DAC curve drop-down menu. Any values already in the dialogue may be removed by clicking the **Clear All** button.
Select the units (mm or µs).
Click the position **1** check box. A marker appears (usually in the bottom left corner of the A-Scan). It appears as a small yellow square identified by the position number.
Maximise the 1st reference signal and move the first marker across the base of the signal by clicking on the **mm / µs** up/down arrow control.
Adjust the gain using the **Gain (dB)** up/down arrow control to position the apex of the signal at the reference amplitude.
Click the position **2** check box. The second marker appears on the baseline below the previous marker.
Repeat the process with subsequent markers until the range through the material has been covered.
To disable the TCG/DAC for any single channel, select **Off** from the **T.C.G. Curve** drop-down menu mentioned in point *a* above.

Phased Array Wizard

The TCG wizard is activated after a valid calibration has been completed. The phased array wizard may be activated from three different points within the software:

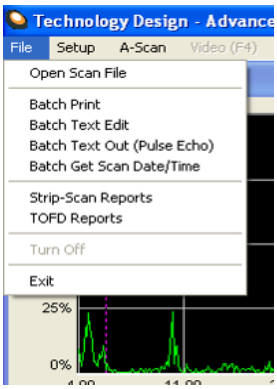
a. *Click* the **Wizards** menu and select one of the **PA wizard** options.
   i. **PA Wizard** – Starts the wizard at the equipment setup section. Complete this section to proceed to the *calibration* and *TCG* section.
   ii. **PA Calibration Wizard – Channel *x*** – Allows the user to re-enter the wizard at the *calibration* and *TCG* section by-passing the setup section. These menu items will only be displayed for channels that have already been calibrated.

b. *Click* **Setup** – **Collection Hardware** – **Probe – Calibration Wizard**. Enters the phased array wizard at the *calibration* and *TCG* section by-passing the setup section.

c. *Click* **Setup** – **Collection Hardware** – **TCG – Calibration Wizard**. Enters the phased array wizard at the *calibration* and *TCG* section by-passing the setup section

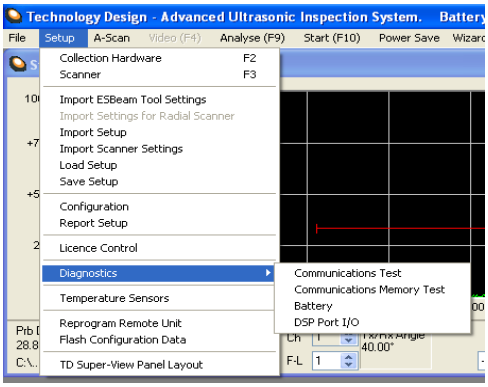
   a. *Click* **Setup** – **Collection Hardware** – **TCG – Calibration Wizard**. Enters the phased array wizard at the *calibration* and *TCG* section by-passing the setup section.

File Menu



File		
Open Scan File	Opens the *Select Scan File(s)* dialogue.	Select data files to open with a .SCN or .S00 (.s01, .s02, etc) file extension.
Batch Print	Opens *Printer* dialogue and *Select Scan File(s)* dialogue.	Allows selection of multiple data files for unattended printing.
Batch Text Edit	Opens the *Batch Text Edit* dialogue.	Allows user defined header text to be edited in multiple data files simultaneously.
Batch Text Out (Pulse Echo)	Currently inactive	
Strip-Scan Reports	Opens the *Strip-Scan Reports* dialogue.	Allows selection of template file and generation of automated reports for the Strip-Scan software.
TOFD Reports	Opens the *TOFD Reports* dialogue.	Allows selection of template file and generation of automated reports for the TOFD software.
Turn Off	Shuts TD-Scan Software down	
Exit	Shuts down the TD-Scan software	Clicking the ☒ in the top right-hand corner has the same effect.

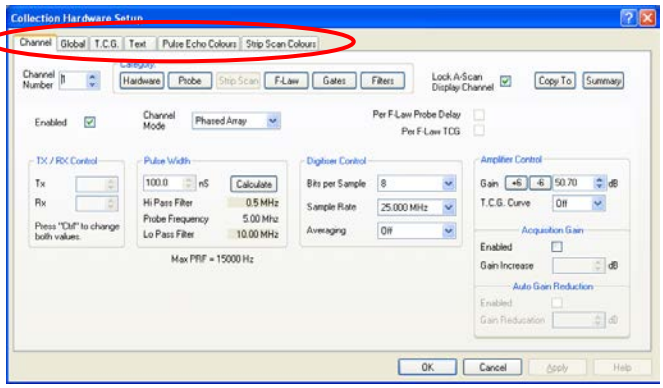
Setup Menu



Setup		
Collection Hardware F2	Opens the *Collection Hardware Setup* window (see *Collection Hardware* sections below).	Controls to configure UT hardware, Probe, Focal Laws, Gates, Filters, Zone Discrimination, Colours & TCG are contained in this window.
Scanner F3	Opens the *Scanner Setup* window (see *Scanner Setup* sections below).	Controls to configure sereral different scanner interfaces are contained in this window.
Import ESBeam Tool Settings	Opens the *Select Scan File(s)* dialogue.	Phased Array scan plans developed in ESBeamTool® can be imported into the TD-Scan software for convenient automated system configuration.
Import Settings for Radial Scanner	Not currently used	
Import Setup	Opens the *Select Scan File(s)* dialogue.	Configure the system by selecting an existing data file.
Import Scanner Settings	Opens the *Select Scan File(s)* dialogue.	Configure the system scanner without affecting the current UT setup by selecting an existing data file.
Load Setup	Opens the *Select Scan File(s)* dialogue.	Configure the system by selecting a previously saved setup file.
Save Setup	Opens the *Save Setup File* dialogue.	Setup files may be saved from the current system configuration. The file, with a .SETUP file extension contains setup data from all channels.
Configuration	Opens the *Configuration Editor* window. (See *Configuration Editor* section)	System configuration may be edited in this window.
LicenceControl	Opens the *LicenceControl* dialogue. (See *Licencing* section)	Licencing schemes are configured in this window. The licencing procedure is interactive and requires communication with an TECHNOLOGY DESIGN operator.
Diagnostics	Opens a sub-menu with options to run system diagnostic procedures.	Usually used under the direction of an Technology Design service engineer.
Temperature Sensors	Opens the *Temperature Sensors* window.	Project specific – not currently used.
Reprogram Remote Unit	Opens the *Select the Program ".PRG" file to download* dialogue.	Allows the user to reprogram the ultrasonic circuitry with new firmware. When a new version of the TD-Scan software is installed The following warning message may be encountered each time the software starts: *"The remote unit has version x.xx software, this release of the P.C. software was tested with version y.yy. This may cause incorrect system operation."* To remove the message, see *Reprogramming the Remote Unit* in Appendix A for detailed instructions for the procedure.

Collection Hardware Set-up

To open the *Collection Hardware Set-up* dialog box, from the *Setup* menu select *Collection Hardware*. (F2 hot key).

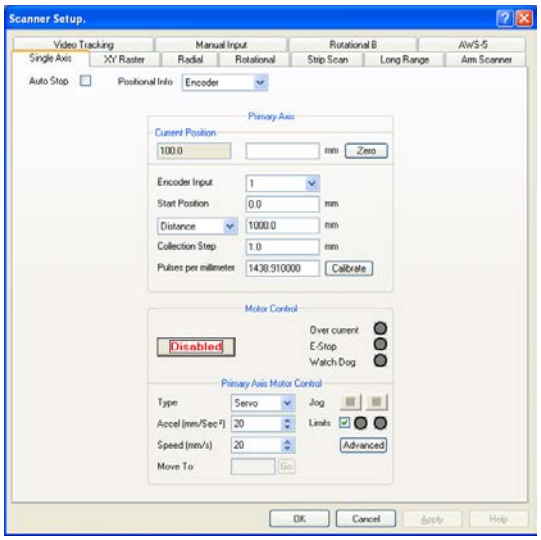


The **tabs** at the top of the dialog box control the viewed PAGE. They are:

Channel	The parameters that are programmable channel by channel	
Global	The parameters that are common to all channels	
D.A.C.	Depth Amplitude Correction curve configuration	The amplitude correction is displayed as a Time Corrected Gain curve (TCG). **See**: *Time Corrected Gain (TCG)* in Appendix A for guidance on setting up TCG.
Text	The text parameters that are saved in the ultrasonic data files	
Pulse Echo Colours	Set-up of the Pulse Echo Depth/Amplitude colour tables	
Strip Scan Colours	Set-up of Strip Scan / Long Range colours	

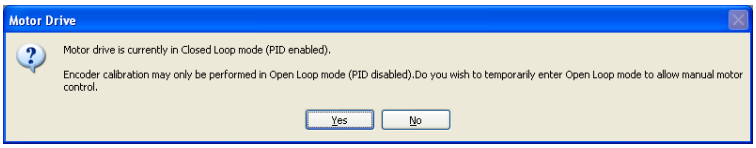
Scanner Set-up

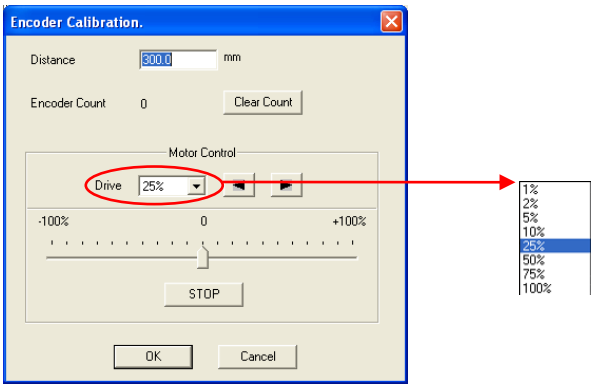
The tabs at the top of the dialog box allow the selection of different scanner types. The scanner interfaces are all variations on the basic single or dual axis setup.



Scanner Set-up - Encoder Calibration

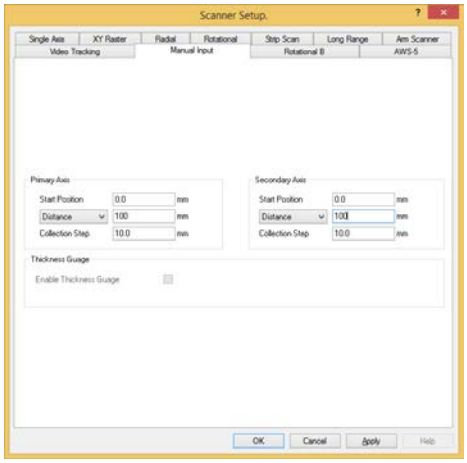
Click the ***Calibrate*** button for either the ***Primary Axis*** or ***Secondary Axis*** to activate the ***Encoder Calibration*** dialogue box. If the PID has been enabled, a dialogue box will appear as follows, warning that the PID will be disabled during calibration.





Distance	An arbitrary, measured distance selected by the operator.	The longer the calibration distance, the more accurate the calibration. 300mm is a reasonable distance.
Encoder Count	Displays the pulse count as the encoder wheel is turned	
Clear Count	Sets the encoder pulse counter to zero	Set this value to zero before moving the encoder for calibration.
OK	Ends the calibration procedure and closes the dialogue.	The pulses/mm will then be set in the system.
Motor Control:		
Drive	Applied percentage drive.	There are two methods to manually drive the motor in order to move the encoder for calibration: • Select the % drive from the dropdown list and click the left or right arrow buttons. • Move the slider either left or right. As the slider moves further from the centre (0) the % drive increases. A combination of both methods may be used if desired.
-100%...0...+100%	Applied percentage drive.	
Stop	Cuts power to the motor and brings the slider to the zero position abruptly.	

Scanner Set-up – Manual Input.



When the **Manual Input** tab is selected there is no encoder feedback therefore multiple A-scans are not recorded. Use this mode for manual 'free-hand' scanning with imaging when a record (snapshot) of the currently displayed data may be required. When the scan is terminated, only the data currently displayed is saved.

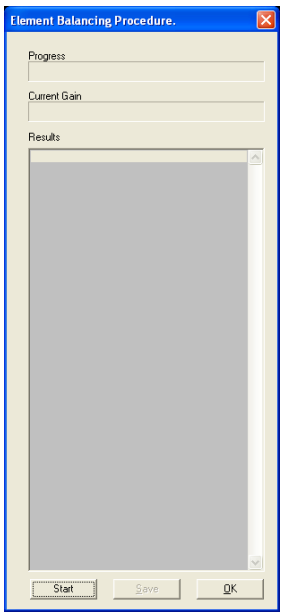
Manual Input may also be used to manually record a series of thickness gauge points on a grid matrix to produce a corrosion map similar in appearance to an X/Y encoded corrosion map. The grid mapping function is only available in the corrosion mapping software, i.e. SuperView disabled (see Appendix B, item xxiii for detailed instructions).

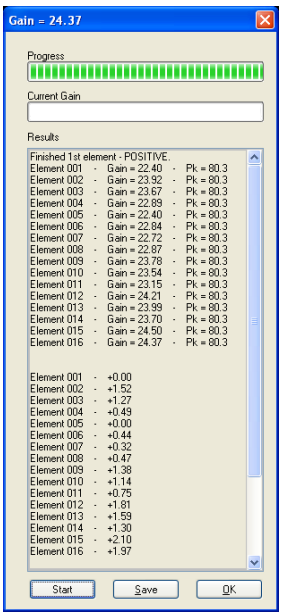
Primary and Secondary Axes		
Start Position	Allows the operator to specify the start position of the data collection grid.	This value is usually 0
Distance	Specifies the length of the data collection area in the given axis. There are two choices: • **Distance** • **End Position**	• **End Position** is useful if the operator does not want to calculate the actual length of the scan. But knows the desired end position.
Collection Step	The size of each block or gauge point on the data collection grid.	The operator places the probe manually in each block to record the thickness

xii. Encoder Calibration

a. This procedure is similar for all the scanner interfaces that allow positional encoding.
b. *Click* the **Calibrate** button.
c. The **Encoder Calibration** dialogue opens.
d. Enter a measured distance in the **Distance** text box. (e.g. 300mm)
e. Hold the encoder still at the beginning of the measured distance and *Click* the **Clear Count** button. The **Encoder Count** value is set to zero.
f. *Move* the encoder the length of the measured distance and hold the encoder still.
g. *Click* the **OK** button.
h. The **Encoder Calibration** dialogue closes automatically.
i. The value in the **Pulses per millimetre** text box is automatically corrected. If the correct pulses per millimetre value for the encoder being used is known then this value may be entered manually without using the calibration procedure. Note if the encoder is measuring in a negative direction after calibration, the sign (+ or -) of the pulses per millimetre value may be changed to reverse the measurement direction.
j. Calibration may be verified by *clicking* the *Zero* button and observing the **Current Position** value while moving the encoder a measured distance.
k. For a **two axis (XY) scanner**, the above procedure is repeated for both axes.

Channel Page – Probe Category - Phased Array – Balance Elements





Start	Starts the *Element Balancing* procedure.	**See** – *'Element Balancing'* in Appendix A for procedure.
Save	Saves the *Element Balancing* data to a delimited text file	The data can be converted into a spreadsheet or other format and used to generate a graphical record of probe performance.
OK	Closes the *Element Balancing Procedure* dialogue box	

vi. Element Balancing

a. Before enabling Element Balancing do the following:

i. Place the transducer without a wedge on a calibration block with parallel near and far sides and no intermediate reflectors.
ii. Set the number of elements within the transducer (*Geometry Page*).
iii. Set the number of Tx/Rx active elements to any arbitrary value, say 16 (*Focal Law Page*).
iv. Set the gain so a backwall signal can be clearly seen (*Hardware Page or A-scan Display* window).
v. Set gate 1 start/width to cover the backwall signal (*Gates Page*).

b. Now enable *Element Balancing*.

i. The *Element Balancing Procedure* dialog box opens,
ii. Click the *Start* button. The gain on each element is automatically adjusted so that an 80% full scale signal is achieved in the gate. Once gain values for each element have been determined, the gain differences for each element are calculated and stored and displayed in a table.
iii. The table may be saved as a delimited text file by clicking the *Save* button. Values in the saved file may be imported into a spreadsheet and displayed as a graph.