



XEO - User Guide



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Document Version

The following table tracks the published versions of the XEO User Manual.

Table 1 – XEO User Manual Versions

Document Version	Firmware Version	UTLab Version	Date
Version 1	V4.3.6.0	V1.2.0	August 2026

1 Introduction

This manual provides information for the XEO instrument; the information contained herein allows the XEO to be used to its full potential.

The user guide has been designed with the assumption that users already have a good knowledge of basic ultrasonic non-destructive testing. It is important that users understand the critical nature of ultrasonic non-destructive testing before operating this instrument. The user guide contains procedures on how to use the XEO, how to care for it, and explains the available functionalities and parameters according to the type of inspection to be performed.

2 Disclaimers and Notices

2.1 Copyright

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E-mail: sales@sonatest.com

Web: www.sonatest.com

2.2 Operating Conditions

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2.2.1 Temperature

Operating temperature: -10°C to 45°C (14°F to 113°F)

Storage temperature: -20°C to 60°C (-4°F to 140°F)

2.2.2 Environment Rating

IP65 certified

Equipment vibration rating: MIL-STD 810H Method 514.8 Cat.4

Drop test rating: MIL-STD 810H

WARNING

DO NOT OPERATE UNDER WATER

DO NOT OPERATE WITH FANS OBSTRUCTED



3 Instrument and Accessories

3.1 XEO Hardware Overview

3.1.1 Touchscreen

The screen is an 11.56-inch capacitive touchscreen with a 1920 × 1080 resolution and LED backlit touchscreen. The screen can be operated with and without gloves and is navigated using simple gestures. See Section 6 on the user interface for details.

3.1.2 Joystick

The 360° joystick features click control, allowing users to navigate the interface without using the touchscreen.

3.1.3 Back Button

The back button is a manual way of exiting certain menus in the UI.

3.1.4 Batteries

The XEO has 2 x 99.4Wh hot swappable batteries providing 5.2hr operating time under normal conditions. See section 4 maintenance for further information on how to swap out batteries.

3.1.5 Mini-docks

The XEO has multiple Mini-docks that provide a range of IPEX and UT Lemo connection options, depending on the users' requirements. The current options are:

	
ADAP-029 1 x I-PEX connectors (128 elements)	ADAP-030 2 x I-PEX connectors (64 elements)

Table 2 – Mini-dock Options

The mini-docks are easily swapped by loosening 4 screws and changing the required dock. See section 4 Maintenance for further information.

3.1.6 IPEX Connectors

The IPEX connectors on the mini-docks are standard IPEX (MHF) types with threaded holes for adaptors to connect all Quick IPEX type connectors.

3.1.7 UT/TOFD Connectors

The UT connections use Lemo 00 connectors and are all PR connections.

3.1.8 GPIO Connector

The XEO has GPIO (TTL) capabilities with start, stop, index reset, alarms and trigger, the GPIO pins are in the Lemo 1K connection shared with the encoder pins. See Table 3 - GPIO/Encoder Port External Mating Connector Pinout Information for the location.

3.1.9 Encoder Port

The XEO features a three-axis encoder input, with the encoder connected through the LEMO 1K connector shared with the GPIO. (See Table 3 - GPIO/Encoder Port External Mating Connector Pinout Information).

Pin Number	Signal Name	I/O	I/O Type	Description
1	VCC 5V	Out	Power	Reserved
2	VCC 5V	Out	Power	5V DC Power Supply (500mA limit)
3	GPI1	Out	TTL 5V	General Purpose Input 1
4	GPI2	Out	TTL 5V	General Purpose Input 2
5	Remote PWR	Out	TTL 5V	XEO Remote Power Button
6	GPO4	Out	TTL 5V	Output 4 (also WP2 remote learn)
7	GPO1	Out	TTL 5V	General Purpose Output 1
8	GPO2	Out	TTL 5V	General Purpose Output 2
9	ENC_A1_PHA	In	TTL 5V	Encoder 1 Phase A
10	ENC_A1_PHB	In	TTL 5V	Encoder 1 Phase B
11	ENC_A2_PHB	In	TTL 5V	Encoder 2 Phase B
12	ENC_A2_PHA	In	TTL 5V	Encoder 2 Phase A
13	GPO3	Out	TTL 5V	General Purpose Output 3
14	ENC_A3_PHA	In	TTL 5V	Encoder 3 Phase A
15	ENC_A3_PHB	In	TTL 5V	Encoder 13 Phase B
16	GROUND	Out	Power	Ground

Table 3 - GPIO/Encoder Port External Mating Connector Pinout Information

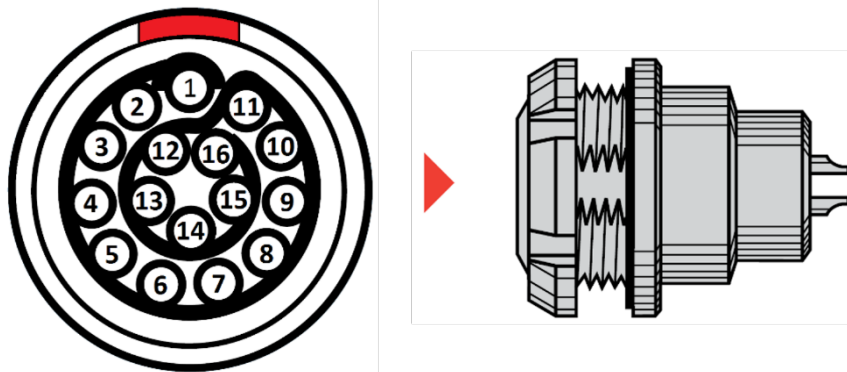


Figure 1 XEO GPIO connector pinout (external view)

Connector	Manufacturer	P/N	Description
XEO connector	Lemo	EGG.1K.316.CLL	K Series (1K), 16-pin, receptacle, center key (G), watertight
Mating connector	Lemo	FGG.1K.316.CLAC	K Series (1K), 16-pin, straight plug, center key (G)

Table 4 - XEO and mating GPIO connectors

3.1.10 USB-C Ports (Multi-Functional)

The XEO has 2 x multi-functional USB-C ports, These are used for:

- Power delivery via the charger (maximum of 7.5 Watts x2)
- Connecting second screens
- Ethernet connection (via adapter)
- HDMI connection (Via adapter)
- Data transfer using a USB-C drive (FAT32, NTFS, ext3 and ext4 formats)



Figure 2 – USB-C Connections

3.1.11 XEO compatible 100W USB-C Power Supply

XEO compatible 100W USB-C Power Supply				
Manufacturer	P/N	Description		
Sonatest	XEO-ACC-007	100W USB-C Power Supply with Power Delivery (20 V /5 A) - custom Sonatest label		
Globtek	TR9CZ5000USBCG2R6BF 2	100W USB-C Power Supply with Power Delivery (20 V /5 A)		
XP Power	PGD100PS20	100W USB-C Power Supply with Power Delivery (20 V /5 A)		
International Power Cords (3 conductors)				
Manufacturer	P/N	Region	Description	Overall Length (mm)
GlobTek	3021457F701(R)	N. American	Type B (NEMA 5-15P) to IEC 320/C13	2150
GlobTek	204B4272M5701(R)	Brazil	Type N to IEC 320/C13	2500
GlobTek	6023602M5701(R)	China	Type I (CCC GR2099) to IEC 320/C13	2500
GlobTek	23144272M5701-T(R)	Europe	Type E (CEE 7/7) to IEC320/C13	2500
GlobTek	208IN4272M5701(R)	India/South Africa	Type M to IEC 320/C13	2500
GlobTek	23024272M5701(R)	Italy	Type L (CEI 23-16/VII) to IEC 320/C13	2500
GlobTek	3003068F2701-HK(R) or 3003339F701(R)	Japan	Type B (JIS 8303 / 3 PINS) to IEC 320/C13	2500
GlobTek	23214272M5701(R)	Switzerland	Type J (SEV 1011 (EL 203)) to IEC 320/C13	2500
GlobTek	PZ0800100- 2M5BK13H(R)	United Kingdom, Hong Kong, Singapore, Gulf States	Type G (BS1363) to IEC320/C13	2500

Table 5 - Compatible USB-C Power Supply Examples

3.1.12 Stand

The XEO stand has 180° of motion, allowing the XEO to stand firmly at any angle, or be hung from a hook using the notch located at the centre of gravity.

3.1.13 Rugged Case and Handle

The XEO features a ruggedized case and carry handle designed for demanding environments.

4 Maintenance

This chapter presents what users should do to protect and maintain the XEO unit in good working condition as well as the procedure for replacing batteries and mini-docks.

4.1 General



- Do not use the XEO near a source of electromagnetic noise; this could disrupt data acquisition.
- Be careful about electrostatic discharges, especially if there is carpeting in the workplace.
- Clean the XEO often to ensure that oil, dust, or couplant do not damage the unit. To avoid damaging the unit's surface, do not use any abrasive or chemical cleaning agents.
- Avoid dusty places.
- Protect the unit from adverse weather conditions.

4.1.1 Replacing Batteries

To change a battery from either of the 2 ports, follow these steps:

- Press the bottom half of the yellow button to release the lid.
- Press the internal yellow tab; this will allow the battery to spring up.
- Using the tab on the battery, pull the battery out of the port.
- Place the new battery inside the port, ensuring the right orientation (use the guide notches).
- Push the battery down until the yellow tab clicks into place, holding the battery in the port.
- Push the lid closed until the yellow button clicks into place, holding the lid in place.



Figure 3 – Battery Change

4.1.2 Swapping Mini-docks

To remove and swap mini-docks, follow these steps:

- Unscrew the 4 x captive screws (see **Figure 4** below). NOTE: do NOT remove the screws fully; only unscrew until the user notices them become loose.
- Pull the mini-dock in the direction shown in **Figure 4** below.
- To attach the mini-dock, push the dock onto the XEO, ensuring the correct orientation and that the internal connector seats correctly.
- Tighten the 4 x screws to secure the mini-dock. NOTE: Do NOT over-tighten the screws; “hand tight” is adequate.



Figure 4 – Changing Mini-docks (Screw Locations)

4.2 Updating XEO

4.2.1 Automatic Updates

When an update is released, this will be automatically downloaded and installed onto the XEO unit when connected to the internet.

A tab at the top of the screen will inform the user of the download.

Once completed, the system will restart; this will complete the update.

To check if an update is available, ensure the XEO is connected to Wi-Fi and go to the “Software Update” tab in the settings app. Press the “Check Now” button in the top right of the screen. This will alert the user of an available update. If an update is available, press “Install Update” in the top right corner of the screen

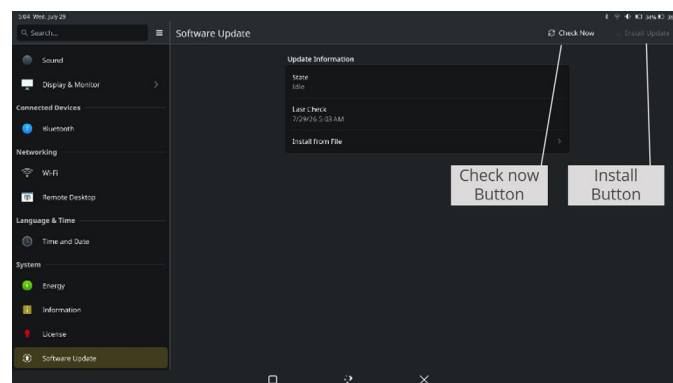


Figure 5 - Software Update Page



NOTE:

- Do not turn off or restart the XEO during an update.
- Please wait while the software displays that something is downloading. The downloading step also includes file updates.
- Never interrupt the update process during the downloading step.
- Updates may fail multiple times. If the automated update stops working, please install using the `MANUAL.MENDER` FILE. Check section 4.2.2 for more information.

4.2.2 Manual Updates

A manual update can be carried out for those systems with no access to the Internet, or with the Wi-Fi capabilities of the XEO removed.

Sonatest will notify users of an update and include a link to download the update file.

Place this file on an external hard drive, and connect to the XEO.

Using the File Manager, copy and paste the file into the “Home” folder

Once copied, open the “Settings” and select the “Firmware Update” section. On the screen, press the file button adjacent to the “Image:” button then select the update file. See Figure 6.

Once selected, the “Start Installation” button will be highlighted. Press this button and allow the installation process to complete.

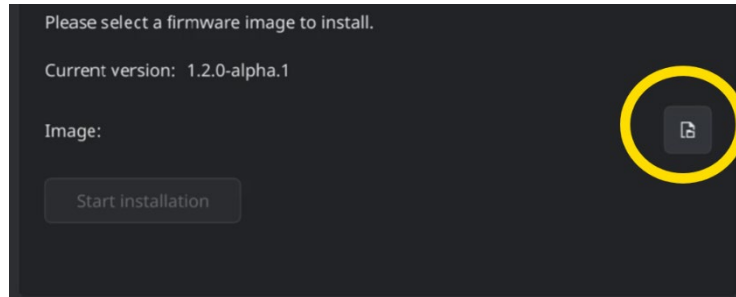


Figure 6 – Update File Button



NOTE: The system should restart on its own after an update; should this not happen, wait 1minute and perform a manual restart using the quick menu shortcut.



NOTE: In doubt, check if the version changed from previous version. In case the earlier version appears again, re-install the new version again.

4.3 Screen

The screen is an 11.56-inch capacitive touchscreen with a 1920 × 1080 resolution and LED backlighting.



- To clean the screen, use a clean lint-free cloth. Do not use an abrasive material or brush.
- Do not use a sharp object (pen, pencil) to navigate the touchscreen.
- Do not store or leave the unit where the display will be exposed to direct sunlight for long periods of time.
- We advise applying the supplied screen protector for additional protection.

4.4 Temperature



- Avoid putting the unit near a heat source.
- Never block the fan vents at the back of the unit.
- Always allow air flow between the instrument and its surroundings.
- The operating temperature is from -10°C to 45°C (14°F to 113°F).
- The storage temperature is from -20°C to 60°C (-4°F to 140°F).

4.5 Transportation



- Make sure that the unit is not submitted to excessive shocks or impacts during transportation.
- Ensure the battery is removed or at a charge level in accordance with any applicable flight requirements.
- Do not transport the unit with connections attached to the ports, e.g. probes, encoder cables, USB-C etc.

5 Powering up and Shutting Down

5.1 Powering up the Unit

Press and hold the power button for 2 seconds to turn on the unit, a green light will appear below the button and the XEO will start up.

5.2 Putting the Screen to Sleep

Click the power button to put the screen to sleep.



Figure 7 – Power Button

To awaken, press the power button again and swipe up on the screen to display a password prompt.. Enter the set password and press the > button to unlock the screen.

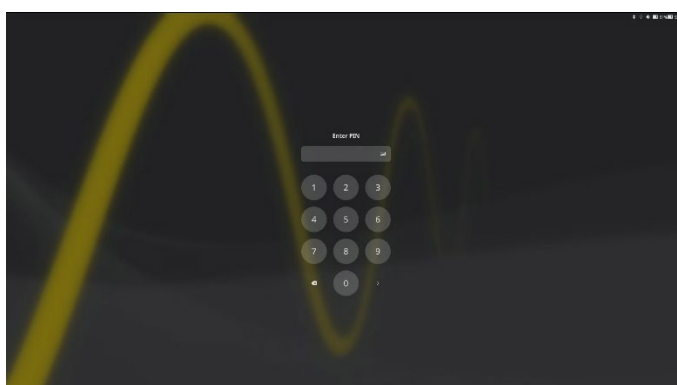


Figure 8 – Password Unlock Screen

5.3 Shutting Down the Unit

To power off the XEO, either press and hold the power button for 2 seconds or swipe down in the top right to show the quick settings menu, then select "Shut Down". Both will bring up the options to "restart"/"Shut down". Choose "Shut Down" to turn off the XEO.

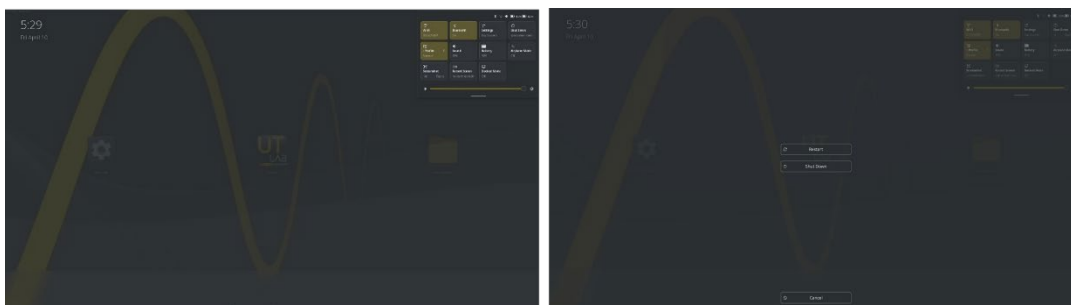


Figure 9 – Quick Settings Menu and Shut Down/Restart Option

6 User Interface

6.1 Graphical Interface

On the home screen, there are 3 icons:

Settings – Opens the settings menu.

UTLab – Opens the XEO inspection software.

File Manager – Opens the file management system.

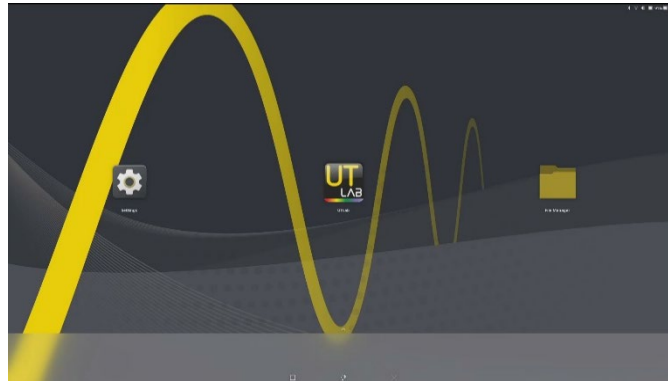


Figure 10 – Home Screen

6.2 Navigation

6.2.1 Touchscreen

The XEO touchscreen can be used to navigate all aspects of the user interface; the list of applicable gestures is as follows:

1. Tap (single Tap) – Quick touch to select an item or open an item.
2. Double tap – Two quick taps in succession, used to select gates and adjust size and location.
3. Long press – A press and brief hold, used for various actions.
4. Swipe/Drag – A smooth quick motion using one finger that touches and slides across the screen; used to navigate lists, and 3D views.
5. Two fingers drag – Used in navigation of 3D views.
6. Pinch to zoom/Spread to zoom out – Using two fingers, pinch together to zoom in and spread out to zoom out on applicable views.

6.2.2 Header “Quick Action” Menu

6.2.2.1 Access the quick action menu

To access the quick action menu, swipe down with one finger from the top right of the screen, this will cause the menu to appear.

6.2.2.2 Short Press/Long Press actions

Short press – A short press/Tap will:

- Toggle the setting on/off for “Wi-Fi”, “Bluetooth”, “Airplane mode” and “Docked mode” buttons.
- Start/Stop recording for the “Record Screen” button.
- Open the settings menus for the “Settings”, “Touchscreen Profile”, “Sound” and “Battery” buttons.
- Open the restart/shutdown option for the “Shutdown” button.

Long press will:

- Open the settings menu for the “Wi-Fi”, “Bluetooth” and “Sound” buttons.

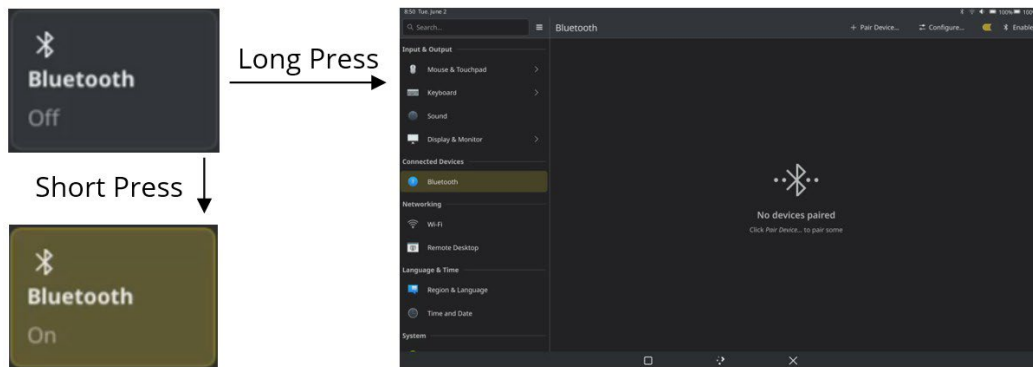


Figure 11 – Example of Short and Long Presses

6.2.3 Touchscreen Sensitivity

Open the touchscreen profiles button to access the sensitivity menu:

Normal mode – Fits most usages.

Glove mode – Higher sensitivity.

Rain mode – Lower sensitivity.



Figure 12 - Touchscreen Sensitivity Options: Normal, Higher, Lower

6.2.4 Joystick

Moving the joystick in any direction will switch to the nearest menus or tab in the direction moved. Pushing the joystick or 'clicking' it will select the highlighted menu or tab.

Using this method, the user can navigate the system without the need of the touchscreen

6.2.5 System Status Information Bar

The top bar of the screen shows the following information:

- Date and time
- Connection status of Bluetooth and Wi-Fi
- Battery charge level for both batteries and charging indicator



Figure 13 – Status Bar Information Example

6.3 Manipulating Cursors (Gate, Extractor, Cartesian, Angular, Hyperbolic)

It is possible to move or enlarge (gate) cursors in the view layout using a single finger or a mouse cursor.

A mouse can be connected via the USB-C ports or through the remote desktop connection.

Clicking and dragging will move the cursor/gate to a new location; lifting the finger/unclicking the mouse will drop the cursor/gate in the new location.

To resize a gate using touch or a mouse, single click the gate; this will produce white markers at each end of the gate, click and drag on either of these will extend/reduce the length of the gate. Removing the finger/unclicking will release the marker, setting the new length.

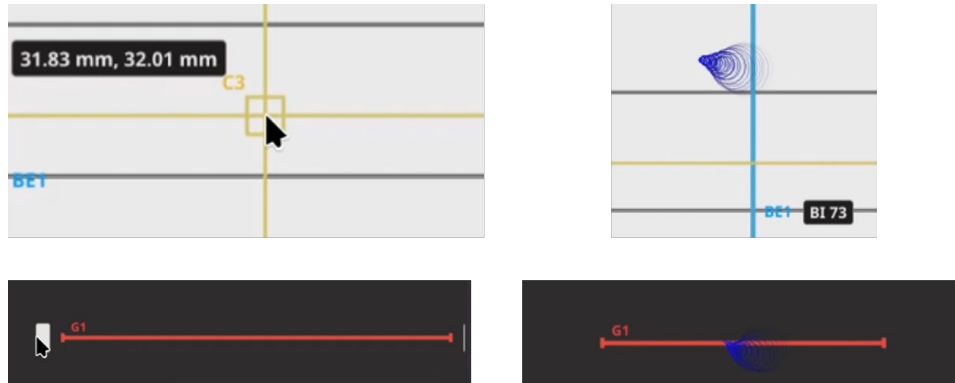


Figure 14 - Examples of Cursor Manipulations

Dragging items will leave a blue trace behind the fingertip while the mouse cursor does not.

6.4 View Definitions

A-Scan - Raw amplitude vs time/distance signal from a single beam/delay law.

B-Scan - A cross-sectional "slice" through the material depth along the scan length.

S-Scan - Sectorial scan view.

L-Scan - Linear scan view.

C-Scan - Top-down "plan view", scan aperture vs scan length, single scan or multi-scan views can be displayed in amplitude or depth.

Side View - Cumulated view slice from the material depth along the scan length.

Top View - Cumulated view slice from the top along the scan length.

TOFD View - TOFD scan display showing "slice" view along the scan length.

6.5 Colour Palettes

Colour pallets are selected in the view menu and are specific to the window Palettes are selected per view. To select and edit a colour pallet, select a view and click on the "pencil" button in the top right of the window.

From the Pallets window, the user can invert the pallet and change the active range in the depth/amplitude range.

For more information, check section 7.3.1.1.2.1

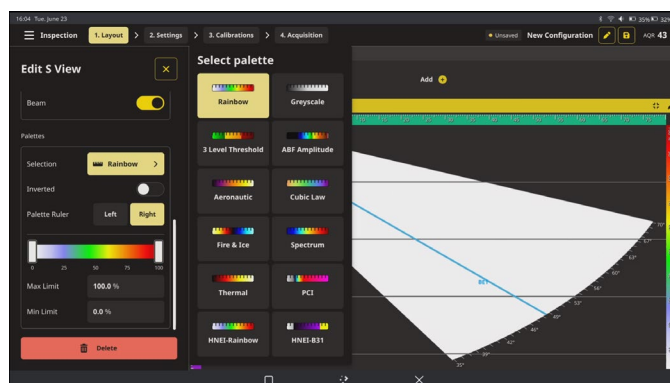


Figure 15 – Colour Palette Selection Menu

6.6 Rulers and Axis

Rulers and axes share the same colours to facilitate their identification. The table below shows the available axes for each type of view.

Setting	Description
A-Scan	0 mm 10 20 30 Depth
	0 mm 10 20 30 40 Sound Path
	100 % 50 Amplitude
B-Scan	0 mm 10 20 30 Scan Distance
	0 mm 50 Depth
	0 mm 10 20 30 40 Sound path
C-Scan	0 mm 10 20 30 Scan Distance
	-30 mm -20 -10 0 Index Distance
S-Scan L-Scan	-30 mm -20 -10 0 Index Distance
	0 mm 50 Depth
Top	0 mm 10 20 30 Scan Distance
	-30 mm -20 -10 0 Index
Side	0 mm 10 20 30 Scan Distance
	0 mm 50 Depth

When the inspection does not use an encoder, the scan ruler does not appear.

Table 6 – Available Rulers for Each View

6.7 Main Menus

UT Lab is split into four main sections, each with its own subcategories, each of these sections will be explored in detail in the following pages. The flowchart of menus is shown below:

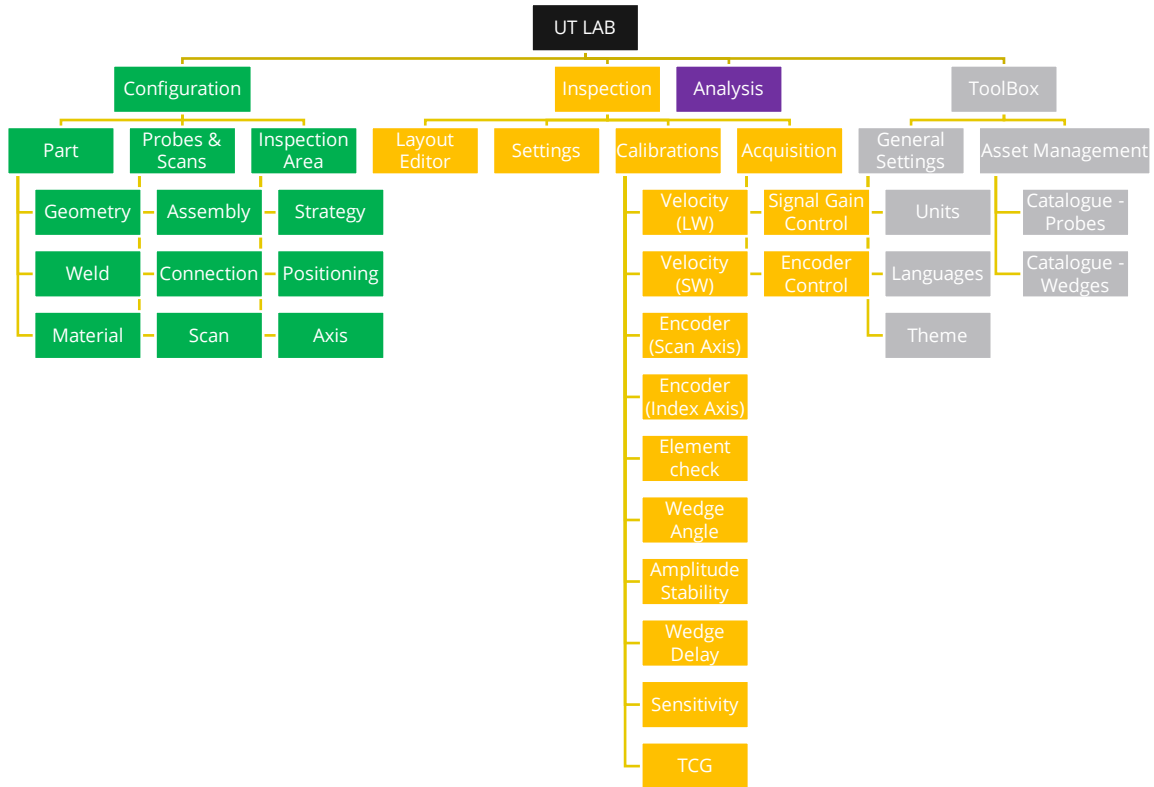


Figure 16 – UT Lab Menu Flowchart

6.8 Changing Numerical Values in Settings

To change numerical values throughout the XEO UT Lab application, the user must press the value they wish to change; this will highlight the value and in many cases the user will be presented with a list of quick incremental value buttons, which, when pressed, will change the highlighted value by a set amount for each press.

This will also present the user with several commonly used values for this particular field, selecting one of these will change the highlighted value to that number.

If the user wishes to manually input a value, they can press the “Open Numpad” button; this will open the number pad as seen in Figure 18.

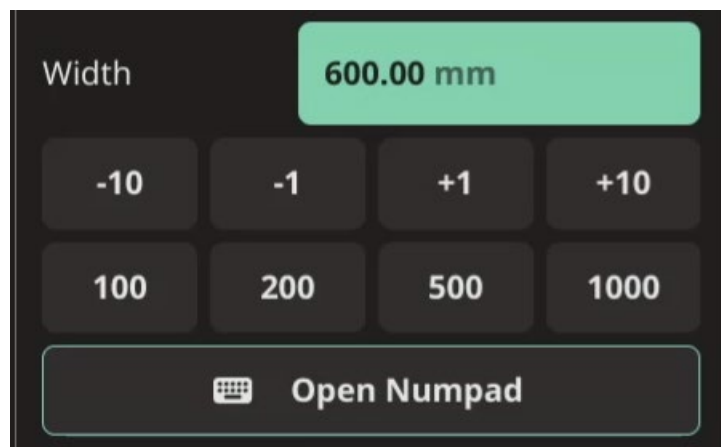


Figure 17 – Quick Increments, Quick Values and Open Number Pad Example

In the number pad, there is a full traditional keypad with the addition of the quick incremental buttons, if applicable.

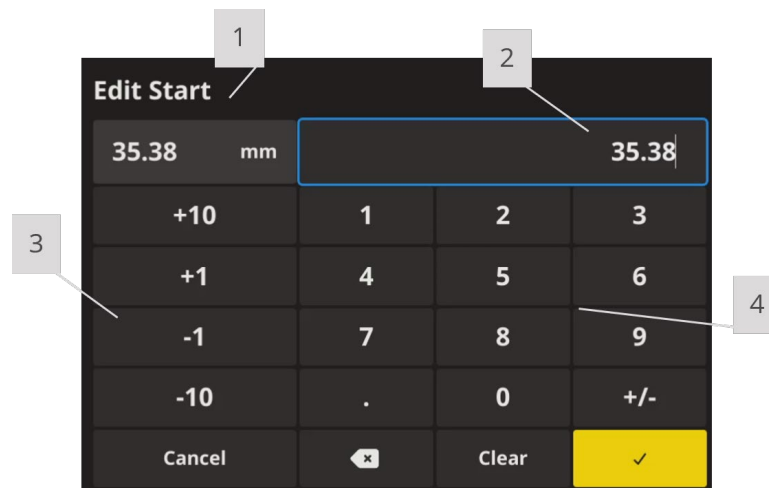


Figure 18 – Numerical Keypad

1. "Item name"
2. Entered value
3. Coarse and fine increment (varies depending on the parameter)
4. Classical numerical keypad

7 UT LAB

7.1 Navigation

7.1.1 Home Screen

Opening UT Lab will present the user with the home screen for the application, (see **Figure 19**). From here the user can launch one of four sections.

- Configuration – Part, Probe, Wedge, Scans, encoding settings are located here.
- Inspection – Layouts, UT settings, Acquisition
- Analysis – Review and modify data files, Report generation
- Tool Box – General app settings, Asset management (probe and wedge creator, colour pallets etc.)

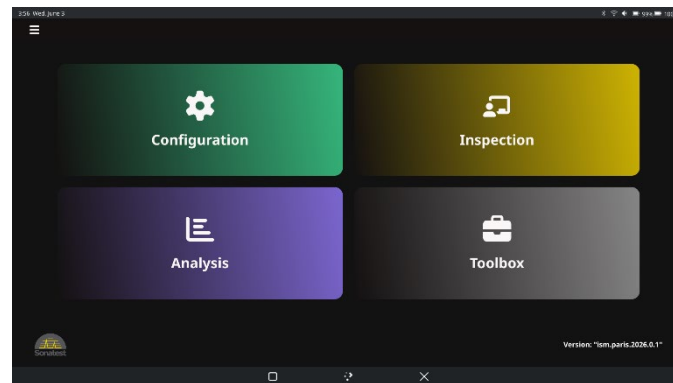


Figure 19 – UT Lab home screen



NOTE: the currently installed software version of UTLab can be found in the bottom right of the home screen.

7.1.2 Page Navigation

7.1.2.1 Burger Menu

Select the 'Burger menu' located in the top left of the screen for quick access to switch between UT LAB sections, and file saving options. See **Figure 20**.

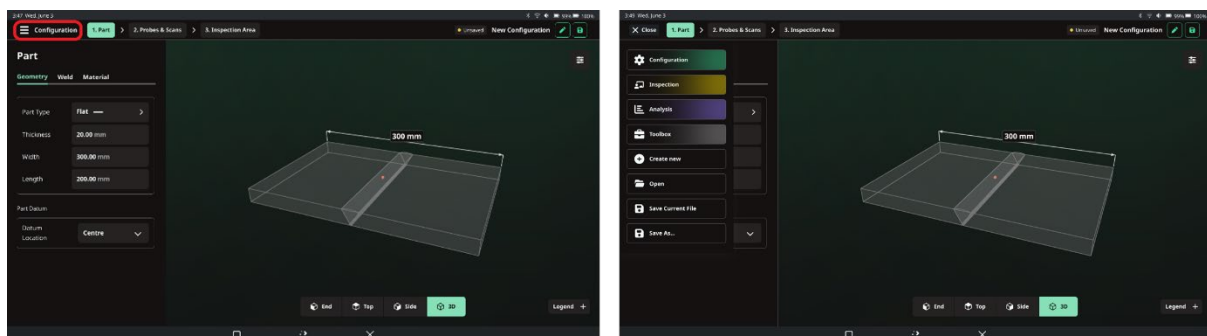


Figure 20 – Burger Menu

7.1.2.2 Tab Navigation

The XEO uses 'Tabs', 'Sub Tabs' and 'Setting buttons' to navigate the pages.

Tabs – Each section has tabs along the top bar of the screen (see **Figure 21**, red highlighted section). Selecting these will change the onscreen information to the settings that fall under this title. For example, selecting Part will show the geometry, weld and material settings needed to create a part.

Sub tabs – Each tab has sub sections of information, these are navigated by a list of sub tabs (see **Figure 21**, yellow highlighted area). Selecting these tabs will present the user with the specific settings associated that tab title.

Settings buttons – Under each sub tab, a list of applicable settings will be displayed (see **Figure 21**, green highlighted area). selecting one of these will pop up further setting and options to customise these values.

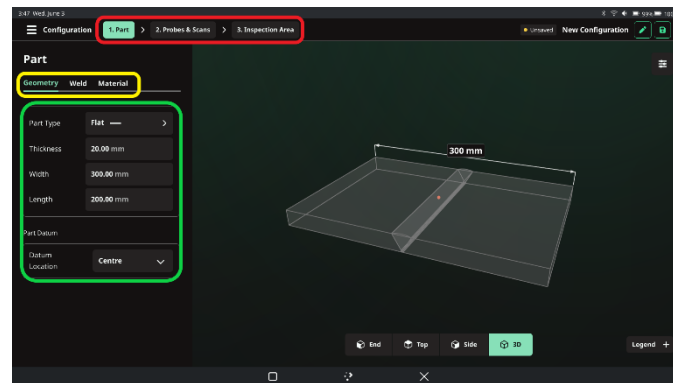


Figure 21 – Tab Navigation

Options menu pop-ups – selecting some settings will produce a pop-up window to either make a selection between options, or input a value (see **Figure 22**).

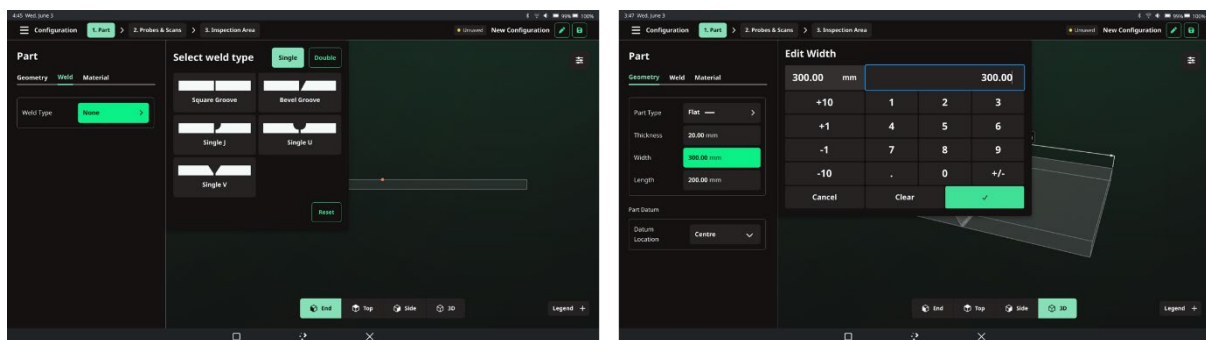


Figure 22 – Pop-up Settings Window Examples

7.2 Configuration

7.2.1 Configuration File Creation/Loading Screen

Pressing the configuration button on the home screen will open the file creation/loading screen (see **Figure 23**) from here the user can:

- Create a new config by pressing the “Create New” button.
- Search for an existing config file by inserting key words into the search bar.
- Select and load an existing config file from the list and pressing the “load configuration” button at the bottom of the screen.

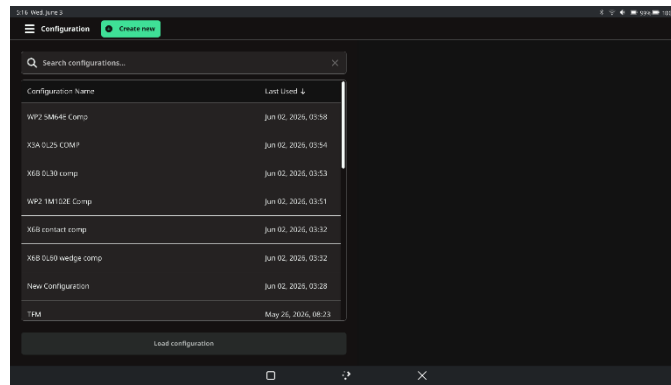


Figure 23 –File Creation/Loading Screen

Selecting an existing configuration file opens pop-up that give the user information about the configuration file details, allowing the user to ensure this is the correct file to load prior to actually loading the file (see Figure 24).

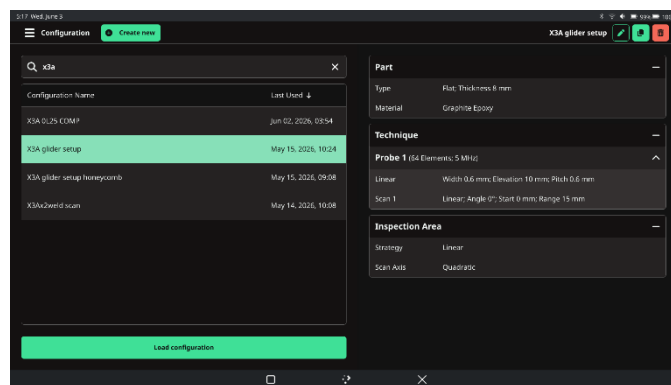


Figure 24 – Configuration File Page and Additional File Information Pop-ups

7.2.2 Saving a New Configuration File

To save a new configuration file, either:

- Open the burger menu and select “Save Current File” or “Save As.”
- Select the Save icon in the top right of the screen.

Both will open the save file pop-up; enter the name of the file and press “Save As.”

7.2.3 Saving an Existing Configuration File

To save an existing configuration file, open the burger menu and select “Save Current File”, or press the Save icon I the top right of the screen; these options will save over the existing file with the current config settings.

To save an existing file as a new name without overwriting the original, open the burger menu and select “Save As.” This will open a pop-up, prompting the user to input a new name then press the green “Save As” button; this will create a new saved configuration file with the new name.

7.2.4 Renaming an Existing Configuration File

To rename an existing configuration file while in the configuration menu, select the pencil icon in the top right of the screen; this will show a pop-up prompting the user to input the required name. Select “Rename” and this file will be saved with the new name. NOTE: This action will replace the existing file; if this is not the intention, use the “save As” option detailed in Section 7.2.3.

7.2.5 PART

7.2.5.1 Part Windows Navigation and Tools

The Part tab contains the “Geometry”, “Weld” and “Material” sub tabs to create a range of Inspection items and welds. In this section we will detail the navigation of the screen and the list of parameters that can be changed and their functions.



NOTE: Changing the numerical values in settings throughout the Part section is detailed in Section 6.8

7.2.5.1.1 Part Manipulation and Views

On the right side of the screen, a “live” view of the created part is shown, different views can be displayed by selecting the options at the bottom of the section. These are “End”, “Top”, “Side” and “3D.”

- Using one finger swipe motions on any of these views will move the part in the direction of motion.
- Using pinch zoom and spread motions on any view will zoom in and out on the image
- Using two finger swipe motions on the 3D view will rotate the part around the centre point of the view.

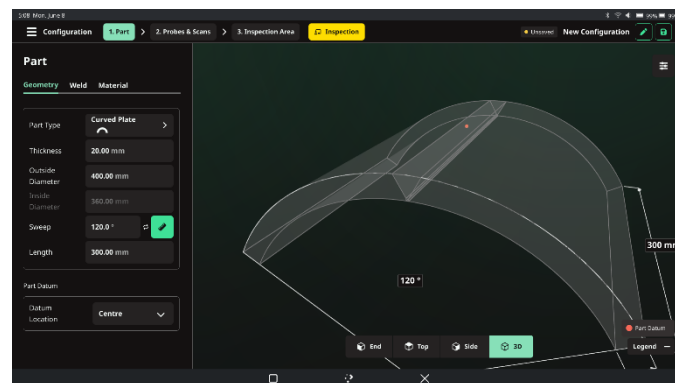


Figure 25 – Part Live View

7.2.5.1.2 Legend

The Legend is in the bottom right of the live view. Pressing the “+” icon will open the list of available icons.

The Legend is live and will show only the available information for the active scan.

The information available is: “Wedge reference”, “Encoding Datum” and Scan Coverage.” See Figure 26 for an example of the full legend.

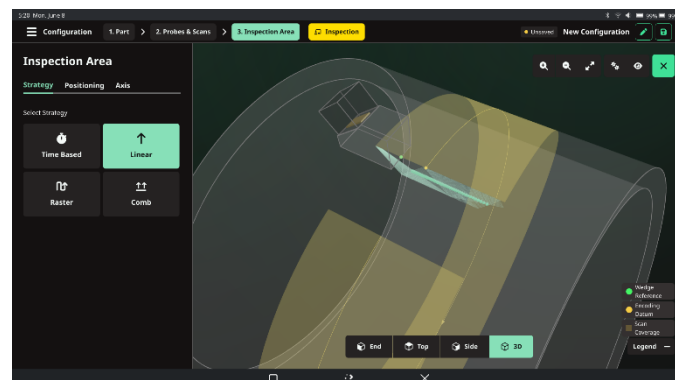


Figure 26 – Part View Legend

7.2.5.1.3 Part and Weld Measurements

All the measurements for the part and weld are displayed on the live view.

When in the “Geometry” tab, single pressing on the part or weld will zoom to the selected information and show the relevant dimensional information.

Changing the view type from “End”, “Top”, “Side” and “3D” will show different part measurements as required.

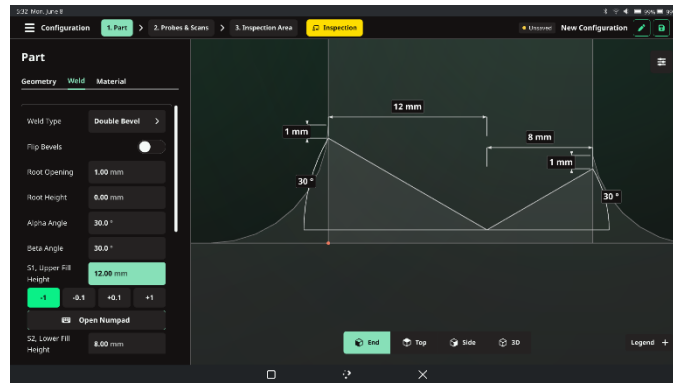


Figure 27 – Live View Part and Weld Measurements

7.2.5.1.4 Zoom/Resize Buttons

There are on screen buttons to zoom in, out and auto zoom. These are in the top right of the live view in the settings button. Pressing this button opens the zoom options (see Figure 28).

Pressing the magnifying glasses will incrementally zoom into and out of the part.

Pressing the double arrow button will auto zoom the part to a full screen view. NOTE: Very large parts may be larger than the view can display at once.

The gear button is used in the scan section of the configuration and will be explained in the “Scan” section of this manual.

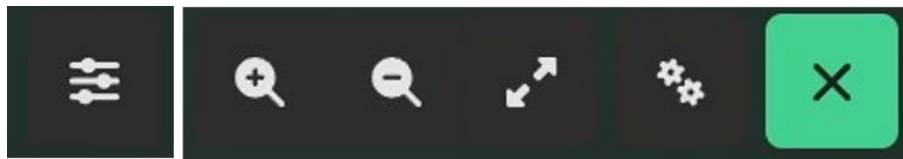


Figure 28 – Zoom Options, Settings Button (left), Zoom Options (Right)

7.2.5.2 Geometry

The “Geometry” tab provides the part options and dimension settings for the range of part types on the XEO.

The specific dimension options shown are related to the part type that has been selected. See Figure 29.

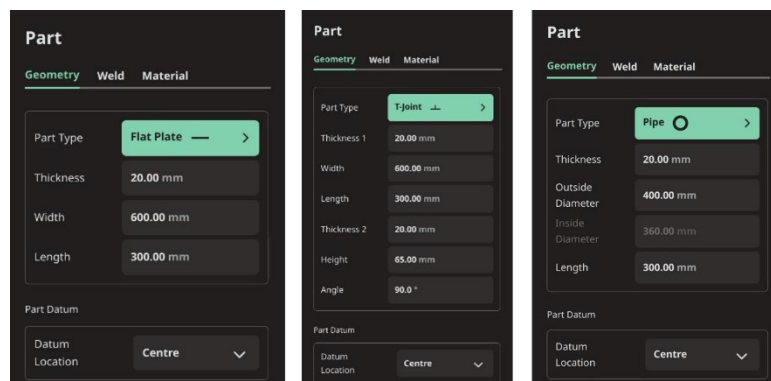


Figure 29 - Geometry Options Based on the Part Type Selected

7.2.5.3 Part Type

Selecting the “Part Type” option will pop up a list of available base part types. Choose the required option to bring up the dimensional information for that part.

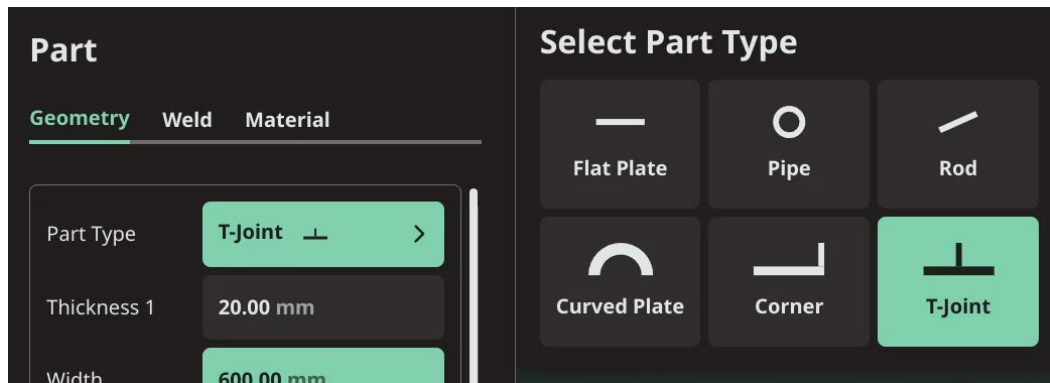


Figure 30 – Part Type Selection

The full list of the geometry options is in the below table.

Setting	Applicable Part Types	Description
Thickness	Flat Plate, Pipe, Curved Part	Thickness of the part
Thickness 1	Corner, T-Joint	Thickness of the bottom plate
Thickness 2	Corner, T-Joint	Thickness of the upper plate
Width	Flat Plate, Corner, T-Joint	Width of the part in the index axis
Length	ALL	Length of the part in the scan axis
Height	Corner, T-Joint	Height/(Length) of the upper plate
Outside Diameter	Pipe, Curved Plate	Outside diameter of the part
Inside Diameter	Pipe, Curved Plate	Inside diameter of the part (calculated value only)
Diameter	Rod	Diameter of the part
Sweep	Curved Plate	Length of the curved plate in the index axis in distance or degrees
Angle	T-Joint	Angle of the T plate relative to the bottom plate
Datum Location	ALL	Datum location on the part for the scan start position

Table 7 – Part Geometry Options

7.2.5.4 Weld

The “Weld” tab includes all the weld type, and dimensional options for the parts in the XEO.

Select the “Weld Type” button to open the available options. These are split into single and double weld lists; press the “Single” or “Double” buttons at the top of the options menu to change between lists.

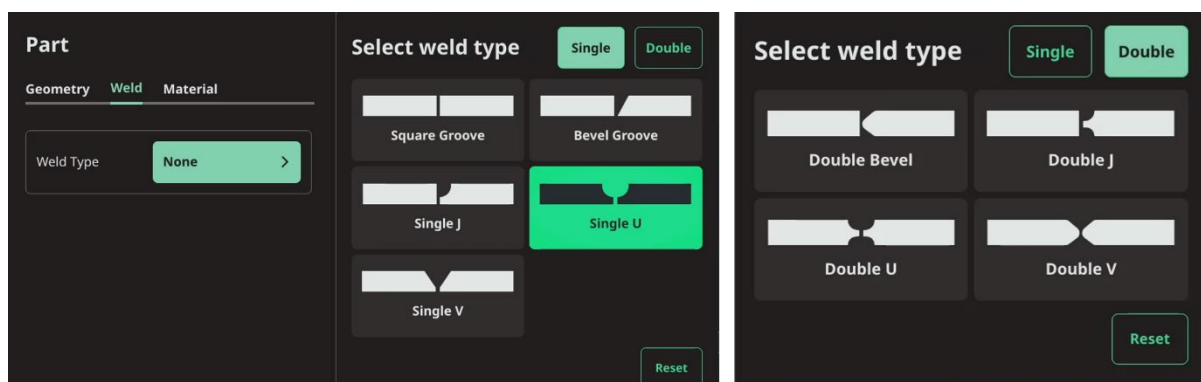


Figure 31 – Weld Type Lists

The weld types shown will depend on the part selected. See the below table for a list.

Part Type	Single Weld Options	Double Weld Options
Flat Plate	Square groove, Bevel Groove, Single J, Single U, Single V	Double Bevel, Double J, Double U, Double V
Pipe	Square groove, Bevel Groove, Single J, Single U, Single V	Double Bevel, Double J, Double U, Double V
Rod	None	None
Curved Plate	Square groove, Bevel Groove, Single J, Single U, Single V	Double Bevel, Double J, Double U, Double V
Corner	Square groove, Bevel Groove	Double Bevel
T-joint	Square groove, Bevel Groove	Double Bevel

Table 8 – Weld Types per Part

The full list of the weld type options is in the below table.

Setting	Applicable Weld Types	Description
Root Opening	Square Groove, Bevel Groove, Single J, Single V, Double Bevel, Double J, Double V	Defines the gap at the root between both sides of the weld.
Root Height	Bevel Groove, Single J, Single U, Single V, Double Bevel, Double J, Double U, Double V	Defines the through wall height of the root face from the ID in single welds or the central root in double welds.
Angle	Bevel Groove, Single J, Single U, Single V, Double J	Defines the bevel angle of the weld face; NOTE: this is not the “Included Angle.”
Groove Radius	Single J, Single U	Defines the radius of the curvature in J and U prep welds.
Alpha Angle	Double Bevel, Double J, Double U, Double V	Defines the bevel angle of the weld face on the OD weld face in double welds; NOTE: This is not the “Included Angle.”
Beta Angle	Double Bevel, Double J, Double U, Double V	Defines the bevel angle of the weld face on the ID weld face in double welds; NOTE: This is not the “Included Angle.”
S1, Upper Fill Height	Double Bevel, Double J, Double U, Double V	Defines the through wall height of the OD bevel in double welds.
S2 Lower Fill Height	Double Bevel, Double J, Double U, Double V	Defines the through wall height of the ID bevel in double welds.
Groove Radius 1	Double J, Double U,	Defines the radius of the curvature in the OD bevel of double J and U prep welds.
Groove radius 2	Double J, Double U,	Defines the radius of the curvature in the ID bevel of double J and U prep welds.
Flip Bevels	Bevel Groove, Single J, Single U, Single V, Double Bevel, Double J, Double U, Double V	Inverts the current weld parameters.
Cap Height (both)	All	Defines the height of the weld cap from the surface of the OD and ID of the part.
Cap Overlap (both)	All	Defines the amount of overlap from the bevel edge of the weld cap.

Table 9 – Weld Settings List

7.2.5.5 Material

The Material tab contains a list of pre-loaded material velocities that can be selected.

Selecting the “Material Type” will open a list of materials that can be scrolled through and selected, or use the search bar to find specific materials quickly. See Figure 32.

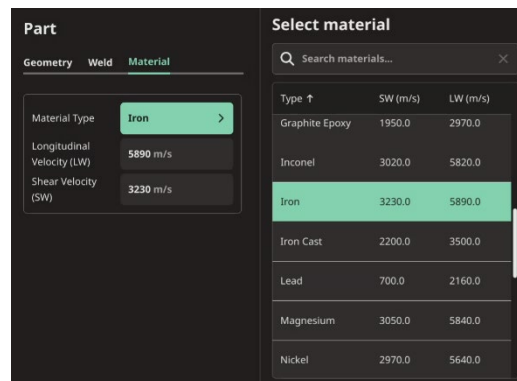


Figure 32 - Material List

Selecting the “Longitudinal Velocity (LW)” or “Shear Velocity (SW)” sections allows the user to input custom velocities if known.

7.2.6 PROBES & SCANS

7.2.6.1 Probe and Scan Page Navigation



NOTE: The scan page navigation shares general actions that can be found in Section 7.2.5.1 Part Window and Navigation Tools. The following information is specific to the Probe & Scan page navigation.

Visibility Controls

When in the Scan tab with an active scan, the user can hide individual scans and full probes to aid in scan plan creation. This option is in the settings menu in the top right of the live view, when pressed, this will now show a “eye” button. Pressing the eye button will show a pop-up where the user can select “Hide All” to hide a probe and its associated scans or hide individual scans by pressing the “eye” button next to the scan name. See Figure 33 for an example.

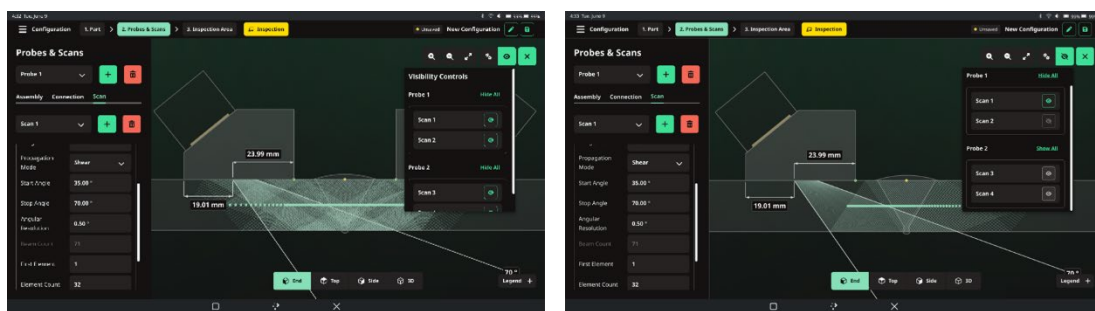


Figure 33 – Scan and probe visibility controls



NOTE: Changing the numerical values in settings throughout the Probe & Scans section is detailed in Section 6.8

Ray Tracing

The XEO automatically has ray tracing turned on. To turn ray tracing off select the settings button in the top right of the live view, select the gears button, which shows a pop-up with the ray tracing activation button. Press this button to toggle the ray tracing on and off.

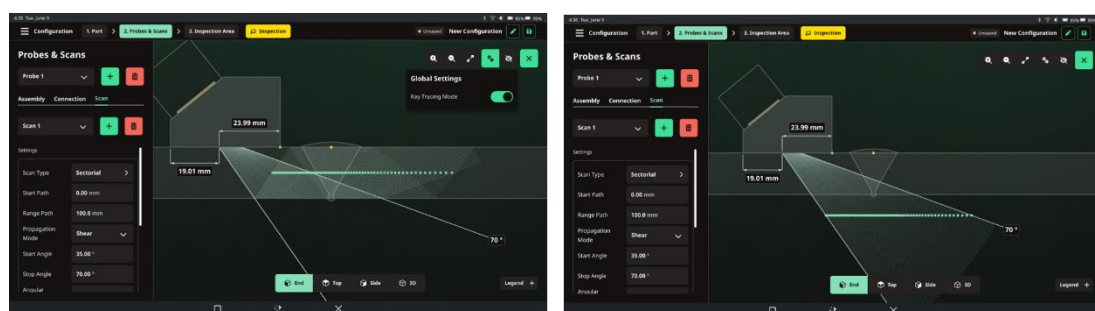


Figure 34 – Ray Tracing On/Off Example

7.2.6.2 Probe Selection

Adding the First Probe

Selecting the “Probes and Scans” tab will take the user to the starting screen, where they are prompted to add a probe by pressing the “+ Add Probe” button. See Figure 35

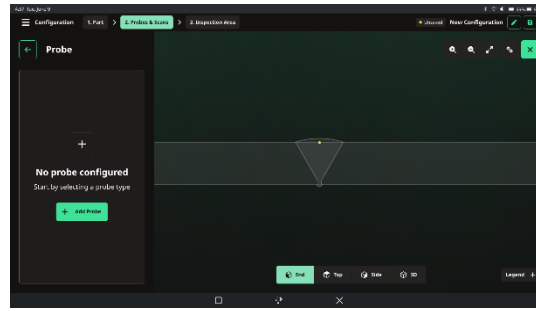


Figure 35 – Probe and Scans Home Screen

Choosing a Probe

The probe library shows a full list of loaded and user-created probes to locate and choose a probe to load. There are three methods of navigation:

- Scroll through the list using a one finger swipe up/down.
- Use the search bar to input key words, this will reduce the list of available probes in accordance with the words searched.
- Use the drop-down lists to narrow the probe list, these bars are: Manufacturer (Manufacturer of the probe), Type (Linear, Wheel etc.), Elements (number of elements in the array) and Frequency (frequency of the probe).

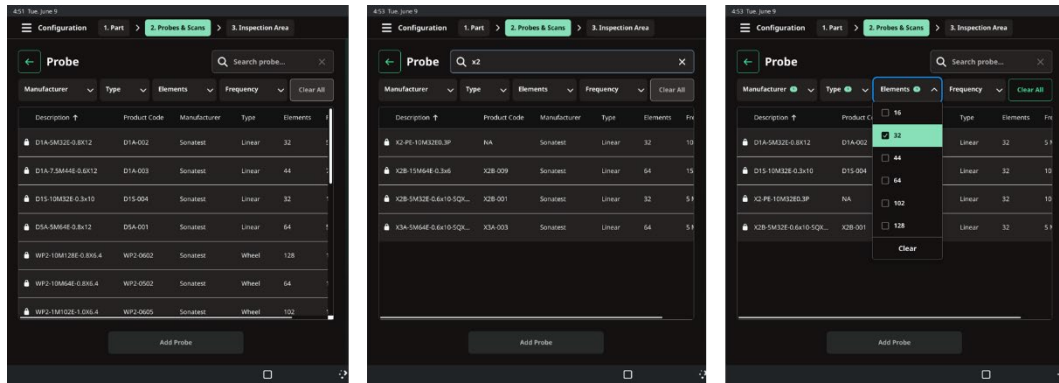


Figure 36 – Probe List Navigation, Scrolling, Search Bar and Drop-Down Lists

Single pressing a probe in the list will highlight that row and present the user with extra details in the right side of the screen; these detail the transducer parameters, and if applicable, integrated wedge and integrated encoder parameters. See Figure 37.

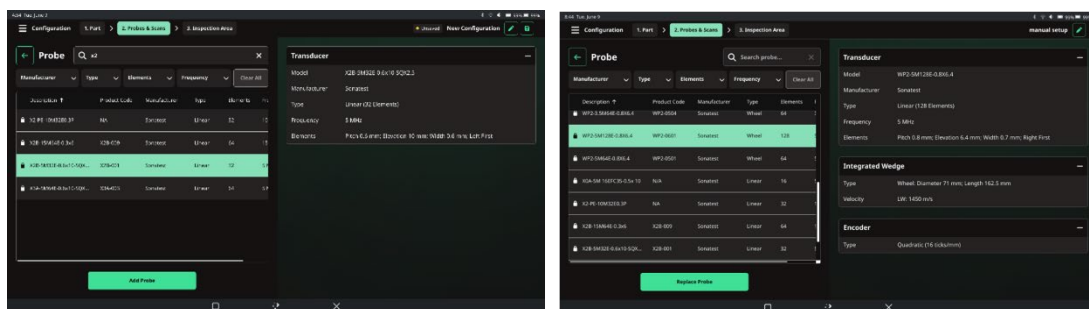


Figure 37 – Probe Selection Additional Information Examples

To add the probe to the scan plan, press the “Add Probe” button at the bottom of the list; this will add the probe and take the user to the wedge selection page.

Changing a Chosen Probe

To change a probe once selected, go to the “Assembly” tab. Then press the pencil button next to the probe details; this will take the user back to the probe selection menu to select a replacement probe. See Figure 38.

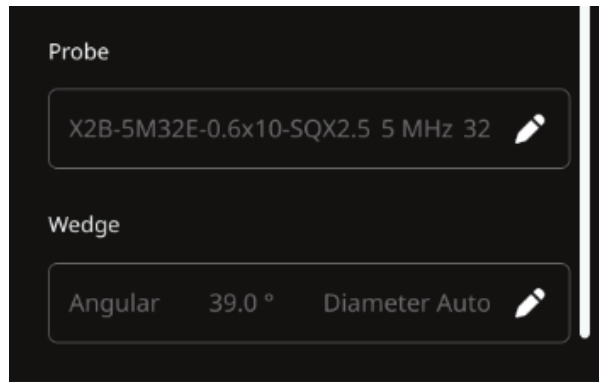


Figure 38 – Probe and Wedge Replacement Button Locations

7.2.6.3 Wedge Selection

Choosing a Wedge

The wedge library shows a full list of loaded and user created wedges. To locate and choose a wedge to load, there are three methods of navigation:

- Scroll through the list using a one finger swipe up/down.
- Use the search bar to input key words; this will reduce the list of available wedges in accordance with the words searched.
- Use the drop-down lists to narrow the wedge list; these bars are Manufacturer (Manufacturer of the wedge), Type (Angular, Flat) and the Cut Angle (the cut angle of the wedge).

Single pressing a wedge in the list will highlight that row and present the user with extra details in the right side of the screen; these detail the wedge parameters.

To add the wedge to the scan plan, press the “Add Wedge” button at the bottom of the list; this will add the wedge and take the user to the Probe and Scans home page.

To use the probe in contact with the surface, select “Continue without wedge” button at the bottom of the list.

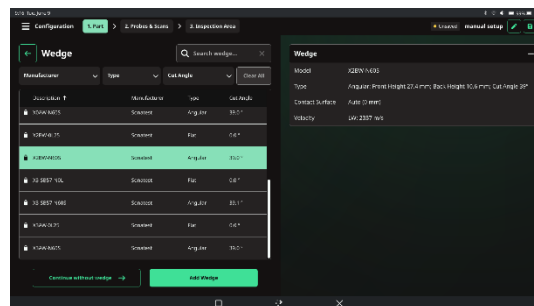


Figure 39 – Wedge Selection Screen

Changing a Chosen Wedge

To change a wedge once selected, go to the “Assembly” tab, then press the pencil button next to the wedge details. this will take the user back to the wedge selection menu to select a replacement wedge. See Figure 38.

7.2.6.4 Adding Another Probe and Wedge

To add an additional probe and wedge to the setup, Press the “+” button next to the probe list; this will take the user to the probe library to add a new probe. See Figure 40.

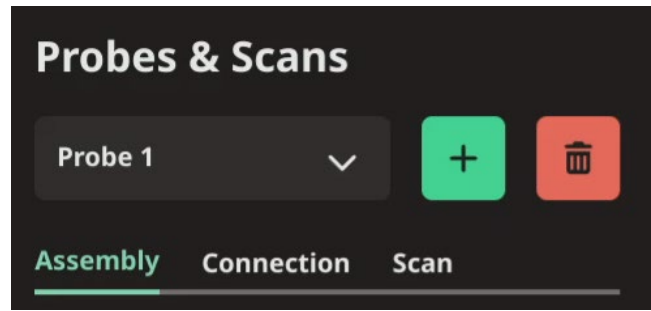


Figure 40 – Probe Add and Delete Button Location

7.2.6.5 Deleting a Probe and Wedge

To delete a probe and wedge, select the probe from the drop-down list, then press the “Bin” button to delete the probe and wedge. See Figure 40.



NOTE: Deleting a probe will also delete any scans that were assigned to that probe.

7.2.6.6 Assembly

The Assembly tab includes the settings required to correctly position and orient the selected probe. The “Position” section settings can be adjusted as per Section 6.8. See Table 10 for setting descriptions.

Scan Offset	Defines the position of the probe and wedge on the Scan Axis in relation to the datum location. Location is set from the centre of the wedge width measurement.
Index Offset	Defines the position of the probe and wedge on the Index Axis in relation to the datum location. Location is set from the front of the wedge.
Skew Angle	Defines the orientation of the probe and wedge to the direction of scan. 0° in this setting, sets the probe facing the scan direction.

Table 10 – Assembly Page Position Settings List

The probe and wedge information is shown beneath the position section, these detail the selected probe and wedge details, and the pencil button can be used to replace the active probe and wedge as per Section 7.2.6.5.

7.2.6.7 Connection

The Connection tab includes the settings for the mini-dock, probe connection and pin assignment.

Mini-dock selection can be changed to setup a scan plan based on a different mini-dock than the one installed, to select a different mini-dock, press the dropdown menu next to the “Mini-dock” section and choose the required mini-dock.

When using mini-docks with multiple IPEX connectors, the user can define the connector a selected probe is connected to. To change the connection, press the drop-down list next to the “Slot” wording and choose either PA 1 or PA 2.

Setting pin locations for external splitters can be done using the “first Pin” and “Last Pin” settings.

Mini-dock	Choose the mini-dock for the configuration being created.
Slot	Choose the slot for the selected probe
First Pin	Set the 1 st pin location for the selected probe.
Last Pin	Set the last pin location for the selected probe

Table 11 – Connection Settings List

7.2.6.8 Scan

The Scan tab contains all the settings required to add/remove and configure scans, for the inspection.

This section covers the functionality and location of each setting for the different types of scans, for example setups for each scan see Section 10 of this document.

7.2.6.9 Adding a Scan

If not scan has been configured, pressing “Scan” will present the user with the “Add Scan” button, as shown in Figure 41.

Pressing “Add Scan” will present the user with a choice of scan types; choose one of these scan types to create the scan.



NOTE: The created scan will automatically be assigned to the probe currently selected.

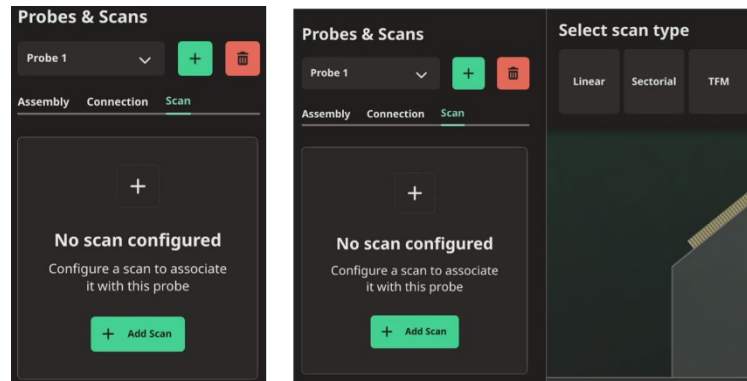


Figure 41 – Adding a Scan

7.2.6.10 Adding a New Scan

To add a new scan to a setup, press the green “+” button next to the scan section (highlighted in yellow in Figure 42).

7.2.6.11 Deleting Scans

To delete an existing scan, ensure it is selected in the scan drop down list; then press the trash can button (highlighted in red in Figure 42).

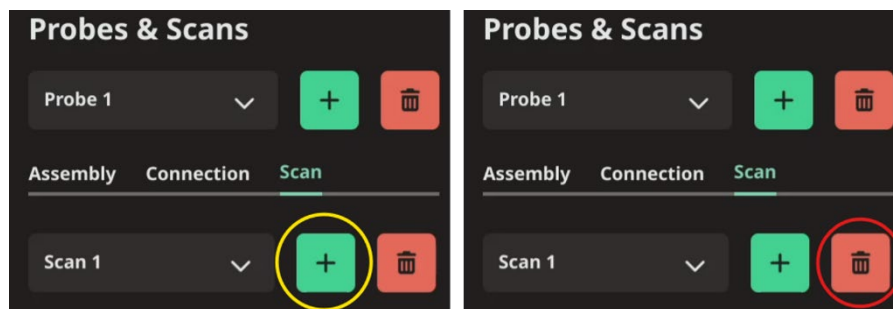


Figure 42 - Adding a New Scan and Deleting Scans

7.2.6.12 Linear Scan Settings List

The linear scan settings list is below.

Setting	Description
Scan Type	Change the scan type, choices are Linear, Sectorial and TFM.
Start Path	Define the start of the recorded scan length; measurement is taken from the surface of the test part.
Range Path	Defines the length of the recorded scan; the length is taken from the start path setting. E.g. start path 20 mm, range path 100 mm the recorded area would be from 20 mm to 120 mm.
Propagation Mode	Define the ultrasonic propagation mode in the part; choice of Shear and Longitudinal modes.
Angle	Define the propagation angle of the linear scan into the part.
Aperture	Define the number of elements used in the virtual probe aperture in the electronic scan.
Step	Define the element step required for the electronic raster scan.
First Element	Define the start element in the array to be used in the electronic raster scan.
Element Count	Defines the number of elements in the array to be used in the linear scan.
Focusing	Choose the focal mode for the linear scan; choices are Depth and Natural (Unfocused).
Depth	Active only when Focusing is set to "Depth;" defines the focal depth of the linear scan.

Table 12 – Linear Scan Settings List

7.2.6.13 Sectorial Scan Settings List

The Sectorial scan settings list is below.

Setting	Description
Scan Type	Change the scan type, choices are Linear, Sectorial and TFM.
Start Path	Define the start of the recorded scan length; measurement is taken from the surface of the test part.
Range Path	Defines the length of the recorded scan; the length is taken from the start path setting. E.g. start path 20 mm, range path 100 mm the recorded area would be from 20 mm to 120 mm.
Propagation Mode	Define the ultrasonic propagation mode in the part; choice of Shear and Longitudinal modes.
Start Angle	Define the lowest angle of the sectorial scan.
Stop Angle	Define the highest and last angle of the sectorial scan.
Angular Resolution	Define the angular step between each beam.
Beam Count	Indicate the number of beams forming the scan the S-Scan.
First Element	Define the start element in the array to be used in the electronic raster scan.
Element Count	Defines the number of elements in the array to be used in the linear scan.
Focusing	Choose the focal mode for the Sectorial scan; choices are Depth, Offset, Path and Natural (Unfocused).
Depth, Offset, Path	Active only when Focusing is set to "Depth", "Offset" or "Path;" defines the focal point of the sectorial scan.

Table 13 – Linear Scan Settings List

7.2.6.14 TFM/TFMi Scan Settings List

Setting	Description
Scan Type	Change the scan type; choices are Linear, Sectorial and TFM.
Min Index	Defines the start position of the ROI relevant to the front of the wedge in the Index axis.
Max Index	Defines the end position of the ROI relevant to the front of the wedge in the Index axis.
Min Depth	Defines the start/Top position of the ROI relevant to the inspection surface in the depth axis.
Max Depth	Defines the end/bottom position of the ROI position of the ROI relevant to the inspection surface in the depth axis.
Index Resolution	Defines the resolution of the ROI in the index axis.
Depth Resolution	Defines the resolution of the ROI in the depth axis.
Element Start	Define the start element in the array to be used in the TFM scan.
Element Count	Defines the number of elements in the array to be used in the TFM scan.
Sensitivity Level	Defines the level of image saturation applied to the TFM scan.
TFMi Operation	Activates the TFMi modes, provides a choice of Product or Keep max.
Propagation Mode	Defines the propagation mode to be used for the TFM scan; in TFMi mode, up to 4 modes can be selected at once.
Baseline Correction	Appears only with TFMi Propagation mode is active. Defines the value of additional amplitude amplification required when using TFMi Propagation mode.

Table 14 – TFM/TFMi Scan Settings List

7.2.6.15 Scan Settings Further Detail

In this section, we will explore the scan settings in more detail.

7.2.6.15.1 Scan Type

Changing the scan type will alter the current selected scan to the new type and change the settings options to reflect the new scan. To add a scan, follow the steps in Section 31.

7.2.6.15.2 Start Path and Range Path

The Start Path and Range Path items allow the user to define the sampling window in Sectorial and Linear scans. They tell the unit when to start sampling the A-Scans and for what scan length for all beams in the scan.

7.2.6.15.3 Propagation Mode

The Propagation Mode item allows the user to specify which wave mode will be generated in the inspected material: longitudinal waves (LW) or shear waves (SW). Selecting the proper wave mode is required to calculate the proper refraction, attenuation, and delay.

The XEO will automatically set this value based on the wedge type and scan type, but this can be set by the user if a different mode is required than the one assumed.



NOTE: The angles supplied are theoretical. When the resulting beams (focal laws) are programmed in a phased array system, the effective angles might be altered because of system delay resolution or velocity variation. Steering the angle too far away from the 0-degree mark will result in weaker signals.

7.2.6.15.1 Start Angle, Stop Angle and Angular Resolution

The Start and Stop angle settings define the range of angles to be used in the S-Scan; the start angle setting the lower limit and the stop angle defining the upper limit of the area.

When using 0° wedges or contact methods, it is possible to create start angles with a negative value; this is common in bolt applications, for example.



NOTE: When using wedges to create an S-Scan, consideration must be made to the beam strength of the focal laws created. As a rule of thumb, the upper and lower limits of the S-Scan are $\pm 15^\circ$ – 20° from the main beam angle of the wedge. E.g. for an N55S wedge, the range will be 40° – 70° . This is dependent on a range of factors, so refer to the procedure for the correct settings.

The Angular Resolution item allows the user to define the angular step between each beam in the S-Scan. An angular resolution of 0.5° means that 0.5° separate each beam. More beams can give more resolving power; however, it also creates larger scan file sizes and slower scans.

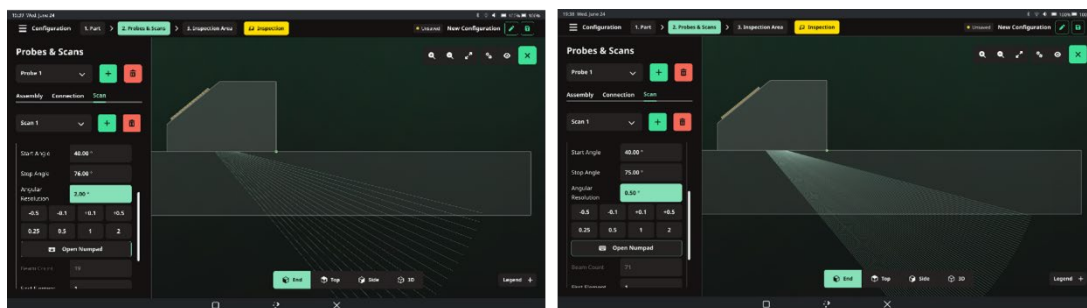


Figure 43 – Angular Resolution Examples

7.2.6.15.2 Angle

The Angle setting defines the direction of propagation of the L-Scan within the part.

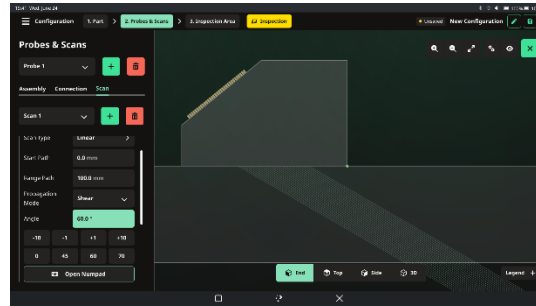


Figure 44 – Angle Setting Example

7.2.6.15.3 First Element and Element Count

The First Element and Element Count settings define which elements to activate to perform sectorial or TFM scans.

- The First Element defines the starting element to be used for the group.
- The Element Count defines the number of elements to be used in the group.

For example, to create a group using elements 10-32 of a probe, the First Element = 10, and Element Count = 23,

In Linear Scans, the First Element and Element Count are used to define the range of elements to be used in the L-Scan electronic raster pattern.

7.2.6.15.4 Aperture and Step

The Aperture and Step settings are used in the creation of L-Scans otherwise known as Electronic Raster scans.

The Aperture defines the number of elements to be used to form the PA beam, also known as the “Active Aperture” or “Virtual Probe Aperture”. In Linear scans, the aim is to fire the beam from several elements. Then move along the array by a defined number of elements, and fire again. This repeats until the full array has been covered.

The Step setting defines the number of elements the group moves along the array before firing again.

7.2.6.15.5 Focusing

In Phased Array sectorial and linear scanning, the user can set focal points along the length of the beam. The XEO offers the user multiple focusing types for different applications; these are Natural (unfocused), Depth, Offset and Path.

7.2.6.15.5.1 Depth

Depth defines a focal point that remains at a constant set depth across the beam width. Depth focusing is possible in both S-Scans and L-Scans

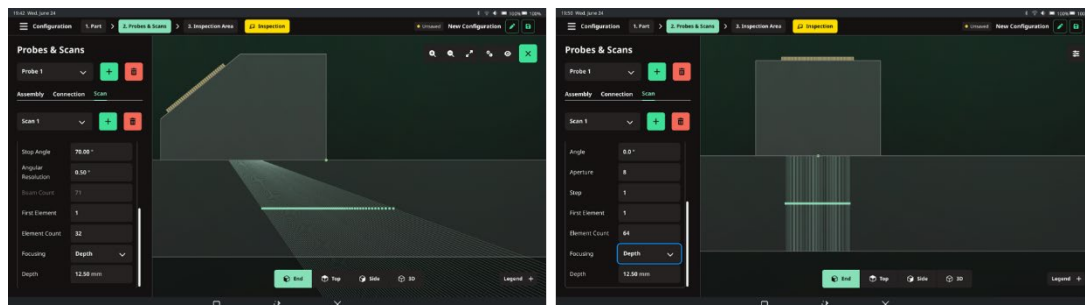


Figure 45 – Depth Focusing Examples

7.2.6.15.5.2 Offset

Offset defines a focal point that remains at a constant distance in the index axis, across the full height of the scan. This setting reference is the front of the wedge, and is only available for sectorial scans.

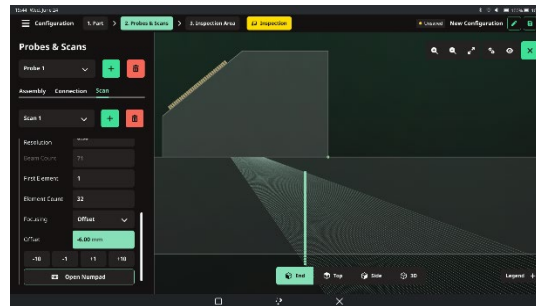


Figure 46 – Offset Focusing Example

7.2.6.15.5.3 Path

Path, otherwise known as Constant Path Focusing, defines the focal point at a set beam path on each individual beam across the beam width. This is only available on sectorial scans.

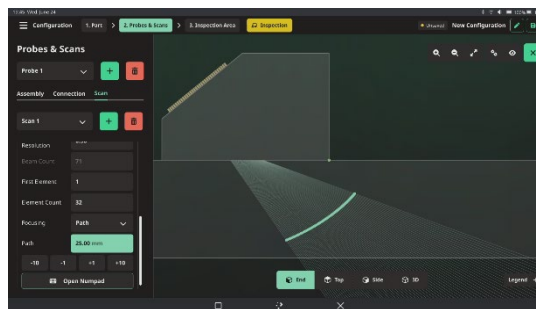


Figure 47 – Path Focusing Example

7.2.6.15.5.4 Natural

Natural or Unfocused sets the scans to apply no focusing methods for the scan.



NOTE: For curved surfaces sectorial scanning, the user can choose between Path and Depth. The focusing points may be affected by all additional geometry of the part.

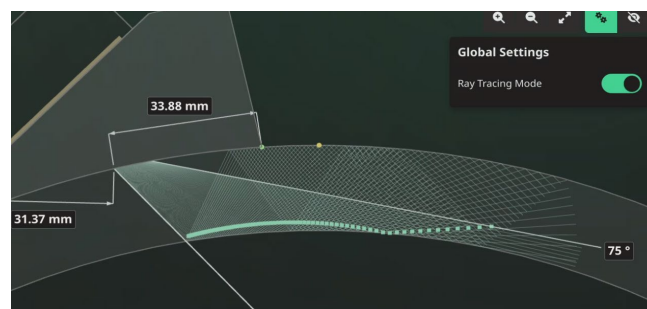


Figure 48 Ray Tracing Mode and Focusing Points Offset by an Inner Pipe Geometry

7.2.6.16 TFM/TFMi: Specific Settings

7.2.6.16.1 Min. Index and Max. Index

The min. and max. index settings define where the ROI starts and stops in the index axis in relation to the front of the wedge.

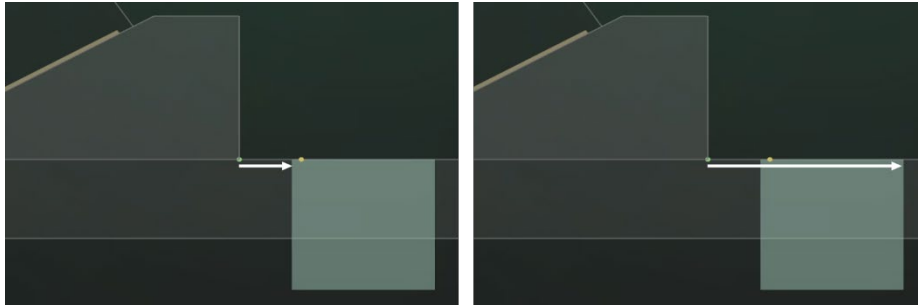


Figure 49 – Min. Index (Left), Max. Index (Right)

7.2.6.16.2 Min. Depth and Max. Depth

The min. and max. depth settings define where the ROI starts and stops in the depth axis in relation to the inspection surface.

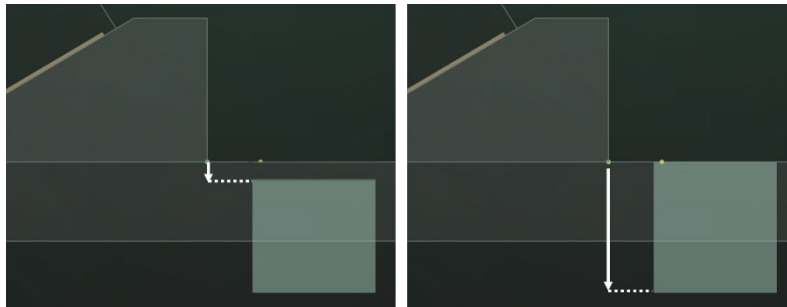


Figure 50 – Min. Depth (Left), Max. Depth (Right)

7.2.6.16.3 Index Resolution and Depth Resolution

The index and depth resolution settings define the resolution of the ROI.

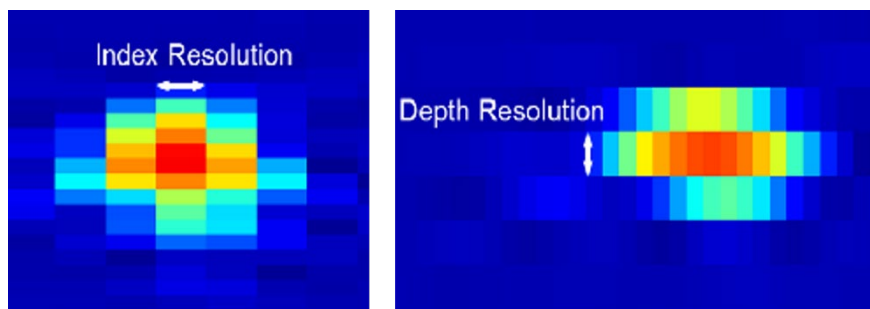


Figure 51 – Index and Depth Resolution Examples

7.2.6.16.4 Sensitivity Level

The **Sensitivity Level** item allows the users to define customised levels of imaging saturation. For example, in the TFM algorithm, this imagery saturation level can rescale the dynamic input range to increase the TFM scan's sensitivity.



NOTE: All the amplitude rulers remain at 100% full-screen height even if the saturation threshold limit may be different. The scale is defined in the **A-Scan Height** parameter.

7.2.6.16.5 TFMi Operation

The TFMi Operation setting activates and deactivates the TFMi functionality within a TFM scan. TFMi allows the user to combine up to four propagation modes in a single scan window, TFMi has two modes: Product and Keep Max. For examples of setups using TFMi. See section 10 in this document.

7.2.6.16.5.1 Disable

Deactivates the TFMi mode and sets the scan as a single mode TFM scan.

7.2.6.16.5.2 Product

Product combines up to four propagation modes, an algorithm is applied to create a new high-fidelity image. See Figure 52 for a comparison between Product and Keep Max. modes.

7.2.6.16.5.3 Keep Max.

Keep Max. combines up to four propagation modes in a single image. Only the maximum values from each mode are kept and displayed in the new image. See Figure 52 for a comparison between Keep Max. and Product modes.

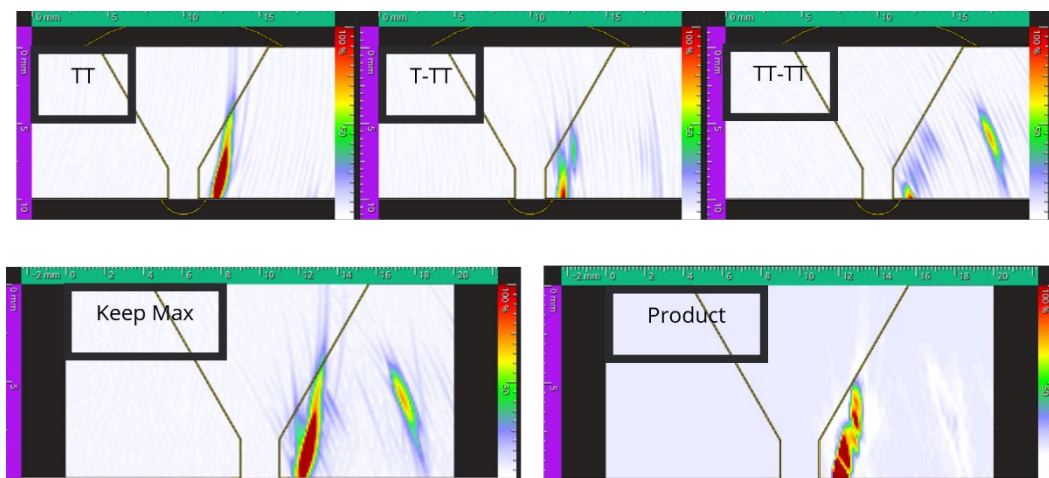


Figure 52 – TFMi Keep Max. and Product Result Comparison

7.2.6.16.6 Propagation Mode

The “Propagation Mode” setting defines the propagation mode used in the TFM scan.

When selected, a table of options is generated showing all the propagation mode options. Simply select the option required and press “Apply” to activate it.

When using TFMi, up to four modes can be selected at once; the modes selected will be highlighted in green as shown in Figure 53.

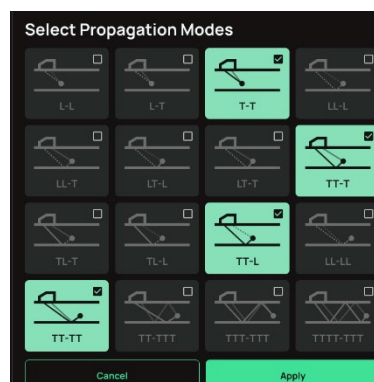


Figure 53 – Available Propagation Modes; Selected Modes Are Highlighted in Green

7.2.6.16.7 Baseline Correction

“Baseline Correction” is a setting option that is present for TFMi “Product” mode only.

The Baseline Correction item offers an additional amplitude amplification for a Product operation TFMi scan.



NOTE: We suggest the following “Baseline Correction” settings; these suggestions should not be taken as absolute values. They are only good starting points for finer adjustments by the user.

- Two TFMi modes used = BC at 10%.
- Three TFMi modes used = BC at 20%.
- Four TFMi modes used = BC at 30%.

7.2.7 Inspection Area

The “Inspection Area” section covers the scanning and encoding options available to the XEO. Currently the options are as follows:

Strategy	Description
Time Based	A free running non-encoded scan based on a fixed acquisition speed and recording duration.
Linear	A single line encoded scan used primarily for weld scanning or single line L-Scans. See Figure 56 .
Raster	An area scan utilising 2 axis and 1 or 2 encoders. Scans in a ‘back and forth’ motion where index axis progression is made at either end of the scans axis. See Figure 57 .
Comb	An area scan utilising 2 axis and 1 or 2 encoders. Scans in a ‘Comb’ pattern where each scan line in the index axis is positioned at the start point of the scan axis See Figure 58 .

Table 15 - Inspection Strategy List

7.2.7.1 Strategy

When the “Inspection Area” is selected, the user will be presented with the “Strategy” menu. By default, the “Time Based” option is selected, the user must choose the scanning strategy required then progress on to the “Positioning” Tab.

On selecting an option, the scan plan on the right of the screen will show a mock-up of the current plot; see the following sections for details on the scanning strategies and examples of the scan plan mock-ups that will be displayed.

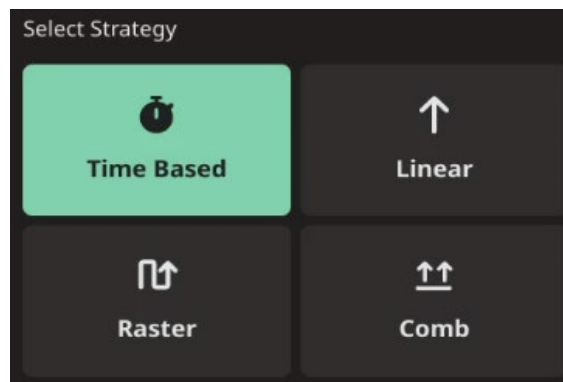


Figure 54 - Inspection Strategy

7.2.7.1.1 Time Based

The **Timed Based** frame flow is not determined on the part geometry. This is a free running option, and its frame rate (AQR) is determined by the entire configuration speed.



NOTE: If “Time Based” is selected, the “Axis” tab will not be accessible.

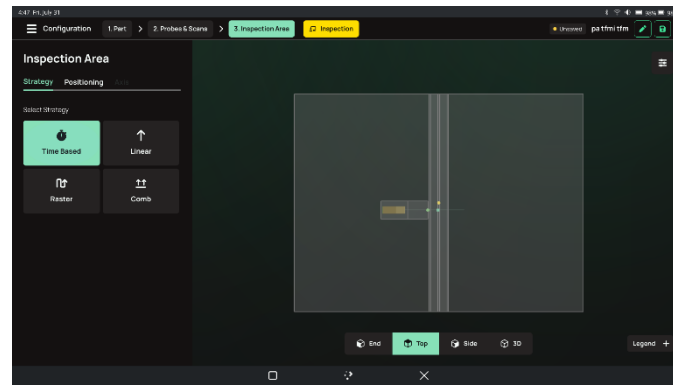


Figure 55 - Time Based Selection

7.2.7.1.2 Linear

The **Linear** scanning item adds a linear trajectory across the pre-defined part. If the part is defined a pipe and the line follow the circumference, the line will follow the pipe outside surface.

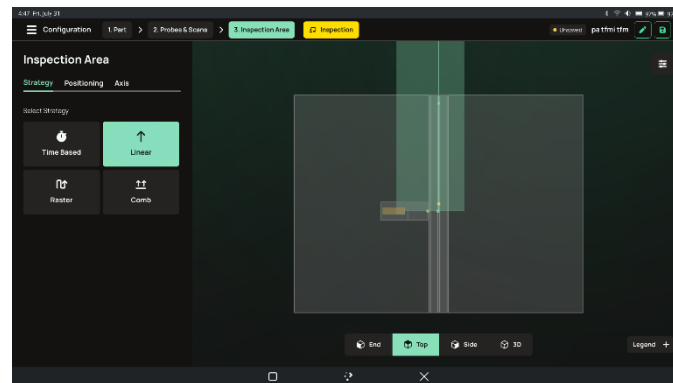


Figure 56 - Linear Scanning Strategy

7.2.7.1.3 Raster

The **Raster** scanning item adds a back-and-forth trajectory across the pre-defined part. If the part is defined a pipe and the line follow the circumference, the line will follow the pipe outside surface.

The probe assemble must alternately run along the scan axis; however, the index then moves back along the scan axis again until the entire region is covered.

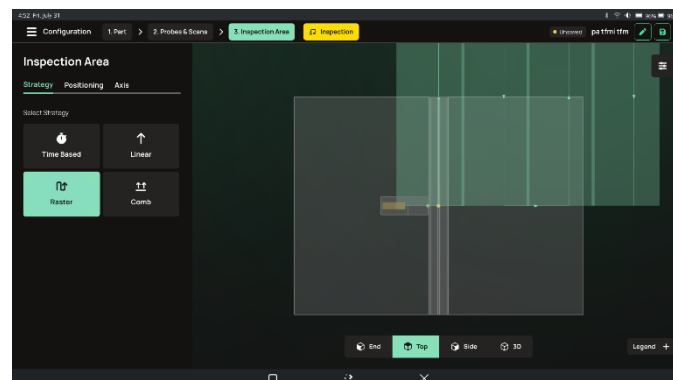


Figure 57 - Raster Scan Strategy

The above figure shows the coverage of the scan and its probe trajectory using the arrows.

7.2.7.1.4 Comb

The Comb scanning item adds a linear and indexing trajectory across the pre-defined part. If the part is defined a pipe and the line follow the circumference, the line will follow the pipe outside surface.

The probe assembly moves along the scan axis for the full length of the scan, the probe is then returned to the start position and incremented to the next point on the Index axis, then scan along the length of the scan axis in this new position. Positioning in the index axis can be carried out with an encoder or the manual positioning of the probe on the next position. These steps are repeated till the entire region is covered.

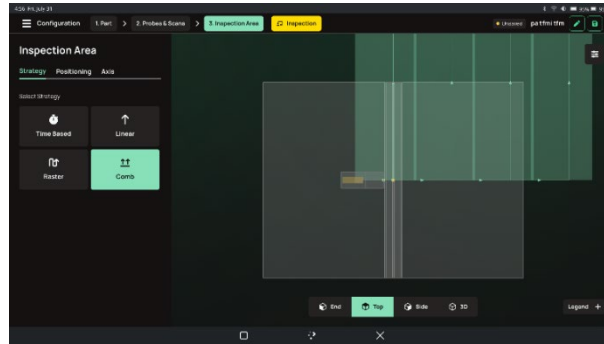


Figure 58 - Comb Strategy

The above figure shows the yellow (from scan items) coverage and its probe trajectory using the arrows.

7.2.7.2 Positioning

The "Positioning" tab defines the location and direction of the "Scanner." In multiple probe setups, changes to position in this menu will apply the changes to all the probes at the same time.

The options in the "Positioning" tab are dependent on the part geometry selected. See the below table for the full list of options and applicable parts.

Setting	Applicable parts	Description
Surface	All	Defines the test surface the probe is located on; the options are part-specific. See section 7.2.7.2.1 for details.
Length Offset (L)	Plate, Corner, T-joint	Defines the scanner offset in the scan axis from the 0 point.
Width Offset (W)	Plate, Corner, T-joint	Defines the scanner offset in the index axis from the 0 point.
Rotation	All	Defines the angular direction of the scan from the 0° point; see Section 7.2.7.2.2 for further details.
Axial Offset (A)	Pipe, Rod, Curved Plate,	Defines the scanner offset in the scan axis from the 0 point on curved parts.
Circumferential Offset (C)	Pipe, Rod, Curved Plate,	Defines the scanner offset in the Index axis from the 0 point on curved parts.
Datum Location	All	Defines the datum point location on the part.

Table 16 - Positioning Tab Settings List

7.2.7.2.1 Surface

The "Surface" setting defines the location of the probe on the part; the default setting is "Top" or "Outside" depending on the part type selected. The available options are part-specific, see the below table for the list of available surface settings for each part:

Part Type	Available Options	Comments
Flat	Top, Bottom	-
Pipe	Outside, Inside	-
Rod	Outside, Back, Front	-
Curved Plate	Top, Bottom	-
Corner	Top, Bottom, Vertical Left, Vertical Right	"Vertical" options place the probe on the upper section of the part.
T-Joint	Top Left, Bottom, Top Right, Vertical Left, Vertical Right	"Vertical" options place the probe on the upper section of the part.

Table 17 - Surface Setting Options

See below for an example of probe position options for a T-Joint:

- Top Left (1)
- Bottom (2)
- Top Right (5)
- Vertical Left (3)
- Vertical Right (4)

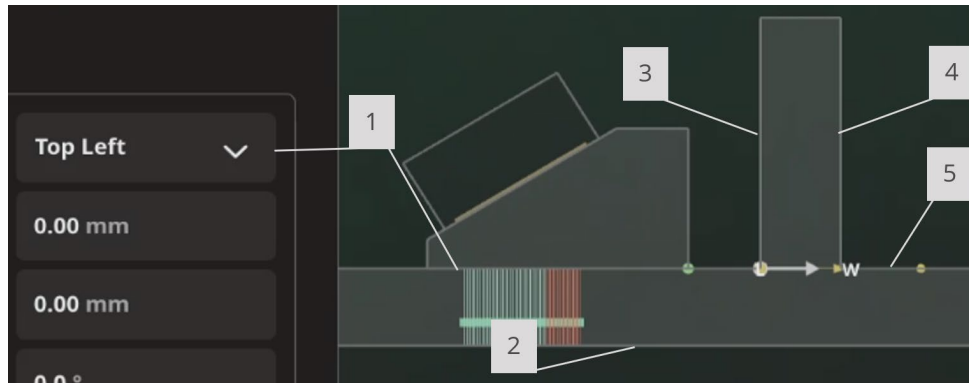


Figure 59 - T-joint Surface Options Example

7.2.7.2.2 Rotation

The “Rotation” setting allows the user to orient the scan direction at an angle in relation to the Scan axis. The scan plan shows the new scan direction and coverage.

NOTE: Rotating scans can cause probes to be positioned off the part, please be aware of the probe position when changing the rotation settings.

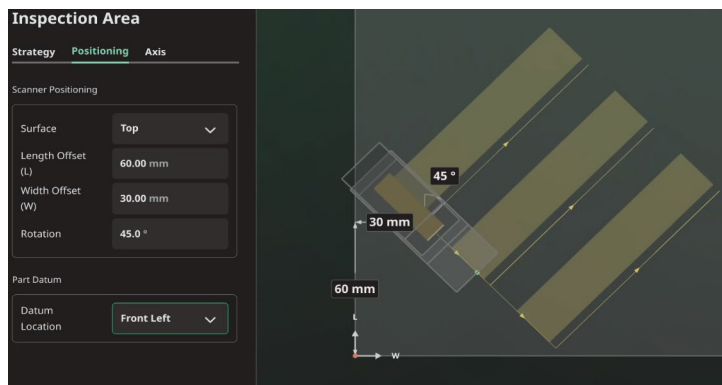


Figure 60 - Scanner Positioning

7.2.7.3 Axis

The **Axis** tab contains the menus for both the Scan Axis and Index Axis. Select either button to show the options for that axis.

NOTE: The Axis menu will not be available when “Timed” is selected as a strategy.

NOTE: The Index Axis will only be available when “Raster” or “Comb” scan strategies are selected.

7.2.7.3.1 Scan Axis and Index Axis

The Scan and Index Axis menus control the settings around the scan start position, scan length and resolution. When active, the Index Axis has some unique settings; these are detailed in the following sections.

Setting	Description
Type	Defines the encoder type used; the Scan axis is set at "Quadratic." Index Axis allows for "Quadratic" or "Manual" options,
Start	Defines the starting point of the scan on the scan axis, in relation to the datum 0 point.
Range	Defines the length of the scan from the starting point.
Step	Defines the distance between each recorded data point along the scan axis for encoded scans. Defines the distance between each position in the index axis for "Manual" scans.
Resolution	Defines the "Step/mm" setting of the encoder and includes a calibration button that takes the user to the encoder calibration space; the calibration will automatically set the resolution value when completed.
Invert Scan direction	A toggle switch that inverts the direction of the encoder. When in "Manual" scans, this will not appear in the Index Axis
Overlap (Index Axis Only)	Unique to the Index Axis settings, this defines the overlap distance of area scans; this setting can be set in mm or % by selecting the button to the right of the value. This setting is also linked to the "Step" setting; changing either of these values will automatically update the other with a calculated value.

Table 18 - Scan and Index Axis Settings List

7.2.7.3.1.1 Type

When in Scan Axis, this setting is fixed as "Quadratic."

When in Index Axis, press the value to choose between "Quadratic" and "Manual":

- Quadratic types are single axis encoders; two encoders can be used together to scan areas.
- Manual types set the index axis as a manual positioning of the probe at set intervals by the user.

7.2.7.3.1.2 Start

The "Start" setting sets the beginning point of the recorded data. The location is in relation to the zero point/datum of the part. See Figure 60 for an example.

7.2.7.3.1.3 Range

The "Range" setting defines the length of scan to be recorded from the Start point; this is NOT the scan end point.

E.g. A Range of 100 mm from a start point of 50 mm will record a scan from the 50 mm -150 mm position.

7.2.7.3.1.4 Step

The encoding **Step** item allows the user to define the distance between each acquisition point on an axis. It is the acquisition resolution of that axis. For example, if the scan step is set to 1 millimetre, the unit will acquire a new scan every 1 millimetre.

7.2.7.3.1.5 Overlap

The **Overlap** parameter can be expressed in mm or in % based the index pass width. The **Overlap** parameter will override the **Step** parameter when the user updates it and vice-versa.

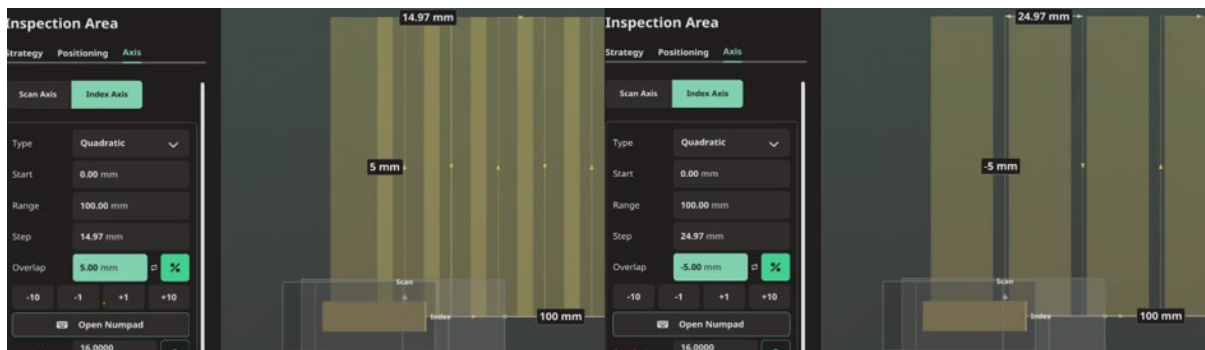


Figure 61 - Overlap Examples of 5 mm on the Left, -5 mm on the Right

7.2.7.3.1.6 Resolution

The scan encoding **Resolution** setting allows the user to set the encoder resolution specific to each axis. The encoder resolution is defined by the number of ticks triggered per millimetre (or inch). The encoder resolution can be found in the encoder specification sheet or occasionally written on the encoder.

The ticks/mm metric can be calibrated manually when the encoder resolution is not specified. This can be carried out in the calibration tab in the Inspection section, or by using the target button next to the value to take the user straight to the Encoder calibration section. For details on the encoder calibration see Section 7.3.3.2.2

7.2.7.3.1.7 Invert Scan Direction

The **Invert Scan Direction** item allows the user to reverse the encoder count on the scan or index axis. This parameter is a toggling button; the direction given by that encoder will be considered as positive when the encoder reports a negative position and vice-versa.

7.3 Inspection

The **Inspection** step follows the completion of the **Configuration** section. To access the Inspection section, press the tab at the top of the screen, or access the tab from the burger menu in the top left of the screen.

When in this mode, the user works with live views to complete the ultrasonic and calibration steps before moving to data acquisition.



NOTE: It is possible to go back to the configuration section to make changes if required; simply press the burger menu and select the Configuration tab.

NOTE: Changing certain settings in Configuration may invalidate some completed calibrations; the user will be presented with a warning before proceeding with the change.

The Inspection section includes four main tabs; these are as follows:

- Layout – Creates the scan layout and add gates/cursors, measurement bar.
- Settings – Defines the ultrasonic settings, filters, PRF etc. Gates and cursors, Scan parameters, IFT gates.
- Calibrations – Contains the calibration dashboard and accesses all calibrations.
- Acquisition – Gathers and saves inspection data.

7.3.1 Layout

7.3.1.1 Layout Editor

The layout editor is fully customizable. For each new configuration, the layout starts empty and must be set up before live data can be displayed in the **Acquisition** step. It is not necessary to display every scan in the layout; all scan data is retained regardless of which views are shown.



NOTE: The user can delete the source view of an extracted view without interrupting the live data. For example, displaying an L-Scan A-Scan requires a beam extraction. After both views have been created, the L-Scan view can be removed and the A-Scan will continue to update normally.

7.3.1.1.1 Creating a Layout

To create a layout, choose the scan from the dropdown list, from which a view needs to be extracted; this will show the user the applicable views for each scan type. See **Figure 62** for examples.

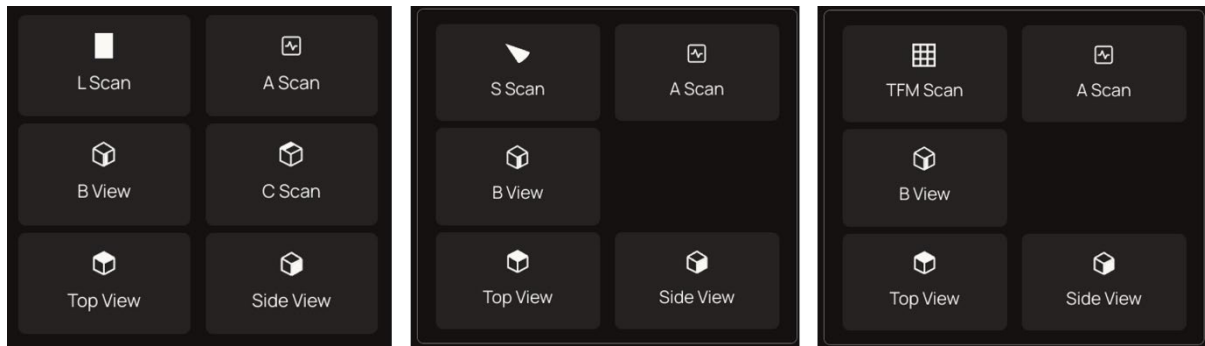


Figure 62 - Layout Options for Each Scan Type

To extract a view, press, drag and drop the view to the layout window (see Figure 63).

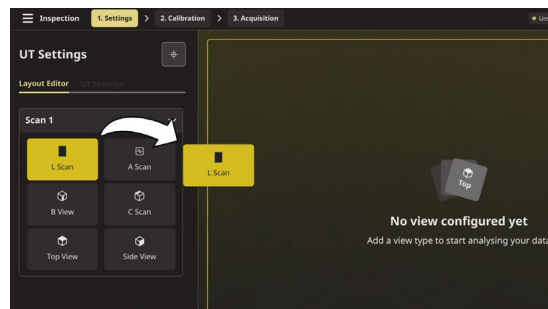


Figure 63 - Drag and Drop from the Scan Items

The first view added will fill the layout screen, to add further views and build the desired layout, additional views will show a gray box where the window will appear if dropped, this can be to the top, bottom, left or right of an existing window (see Figure 64), to the top, bottom, left or right of a group of windows (see Figure 65, or to 'share' a window (see Figure 66).

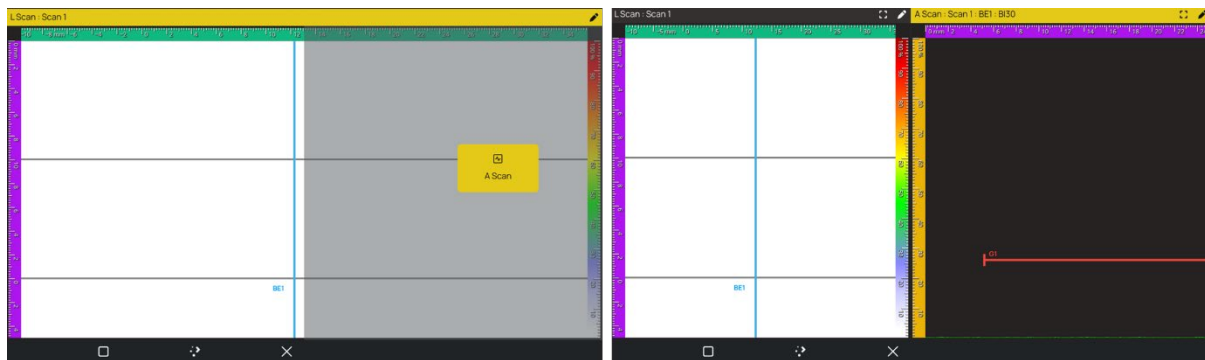


Figure 64 - 'Split' a Window Example

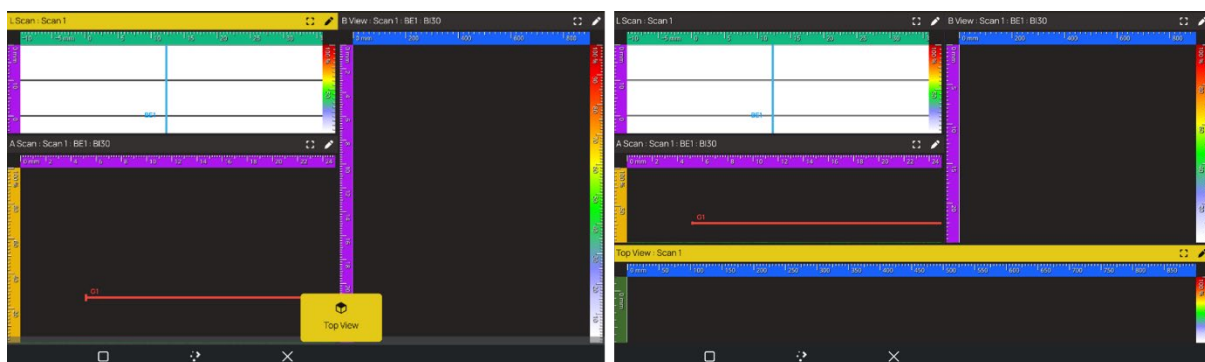


Figure 65 - Placing a Window to the Edge of a Group Example

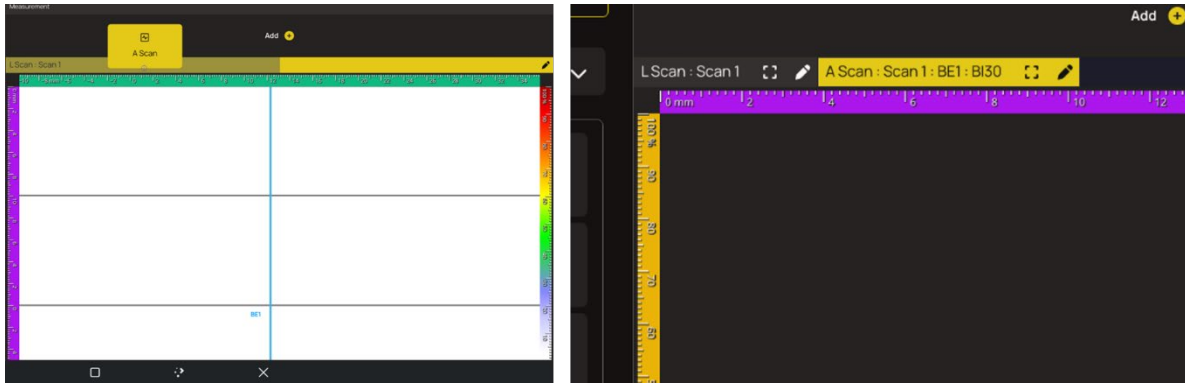


Figure 66 - Placing a View into a Shared Window

7.3.1.1.1 Delete an Existing Window

To delete a view, press the 'Pencil' button in the top bar, then select "Delete" from the Edit View options.

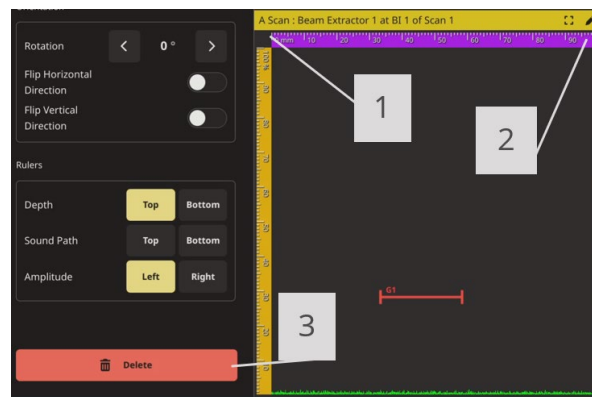


Figure 67 Delete View Process; Select the View, Click on the Edit (Pencil) Button and Delete It.

7.3.1.1.2 Moving Windows

To relocate an existing window, tap near the top bar and drag it to the new location using the same rules as detailed in the above sections.

7.3.1.1.2 Window Information

Each window shows the ultrasonic view selected, along with a set of default rulers and colour pallets.

The top bar of the window gives information on the type of scan and the scan number. , In the case of TFM and TFMi scans, it lists the applied propagations modes.

If a window is 'shared,' each window details will be shown in the top bar. See the area marked in blue in Figure 68.

A window can be enlarged to full screen by pressing the enlarge button in the top bar; it is highlighted in red in Figure 68.

View options can be accessed by pressing the 'Pencil' button in the top bar; see the green highlighted section in Figure 68. The following section covers all the options available for the user in the "Edit View" settings.

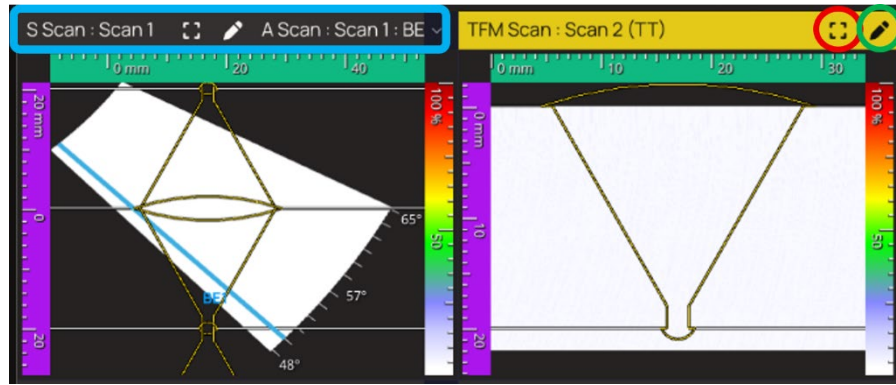


Figure 68 - Window Information

7.3.1.1.2.1 Edit View Options

Pressing the 'pencil' button for a window will reveal the "Edit View" options.



NOTE: The Edit View options are specific to the selected window; some settings are universal to all views, such as Orientation. Others, like Overlay, Visible are only applicable to certain views.

The full list of view options and their functions can be found in Table 19.

Section	Edit view settings	Description
Overlay	Overlay	Display part/weld over in the view. (if available).
Orientation	Rotation	Rotates the view in 90° increments: 0°, 90°, 180°, or 270°. This setting can be combined with the Flip options.
	Flip Horizontal Direction	Applies a symmetry in the vertical axis; the index ruler will be flipped from its default position. This setting can be combined with the Rotation options.
	Flip Vertical Direction	Applies a symmetry in the horizontal axis; the depth ruler will be flipped from its default position. This setting can be combined with the Rotation options.
Rulers	Fixed Aspect Ration	Fulfil the entire view area with data if disabled. Fulfil the view area with 1 to 1 orthogonal ratio data if enabled.
	Surface Distance	Enables the surface distance ruler on Top and/or Bottom .
	Depth	Enables the depth distance ruler on Left and/or Right .
	Sound Path	Enables the sound path ruler on Left and/or Right .
Palettes	Selection	Choice of Rainbow , Greyscale , 3 Level Threshold , ABF Amplitude , Aeronautic , Cubic law , Fire & Ice , Spectrum , Thermal , PCI , HNEI-Rainbow , HNEI-16-80 .
	Inverted	Inverts palette order based on the palette Selection .
	Palette Ruler	Enables the palette ruler on Left and/or Right.
		Live cursor of min. and max. handles.
	Max. Limit	Manual entry for the maximum palette colour position.
	Min Limit	Manual entry for the minimum palette colour position.

Table 19 - Edit View Options List

7.3.1.1.3 Adding Gates and Cursors

To add a gate or cursor to a window, the user has two options:

- Long press within the window; this will show a box with the gate and cursor options available for that view.
- Press the 'Target' button in the left settings area; this will show the available gate and cursor options for the selected window.

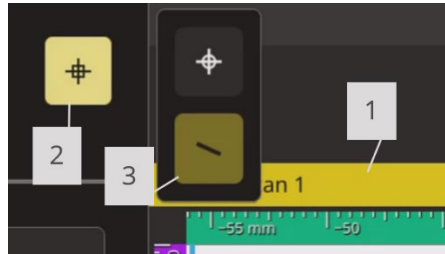


Figure 69 3-click Step to Add Cursor: Select "Add Cursor" button; Then Select the Cursor Type

7.3.1.1.4 Measurements Bar

The Measurements bar provides the user with a customisable list of extracted live values from the data.

To add a value, press the "Add" button at the top of the screen; select the window to extract a measurement.

Select the gate or cursor to extract a measurement from.

For an A-Scan, choose the point of the signal to use for extraction; the options are 'Peak', 'First Peak' and 'Flank.' See Figure 70 for examples.

Next choose the measurement type; the options are Distance or Amplitude. then choose the measurement to extract.

The full list of measurement options can be found in Table 20.

Measurement Symbols/Acronyms	Description
Peak	Readings will be taken from the highest amplitude signal value crossing the gate.
First Peak	Readings will be taken from the first peak crossing the gate, even if it has a lower amplitude than successive peaks.
Flank	Readings will be taken from the flank of the first peak that crosses the gate.
Distance Measurements	
Depth	The total depth of the signal in relation to the scanning surface (does not account for multiple skips).
True Depth	True Depth of the signal in relation to the scanning surface (considers multiple skips).
Surface Distance	Surface Distance to the indication from the front of the wedge.
True Surface Distance	Surface Distance to the indication from the index point.
Sound Path	Distance to the indication along the beam from the wedge.
Amplitude Measurements	
% Reference Gain	Amplitude difference between the measured indication and the set reference value in %.
Reference Gain (dB)	Amplitude difference between the measured indication and the set reference value in dB.
% FSH	Amplitude of the measured signal in % of full screen height.

Table 20 - Measurement Bar Options

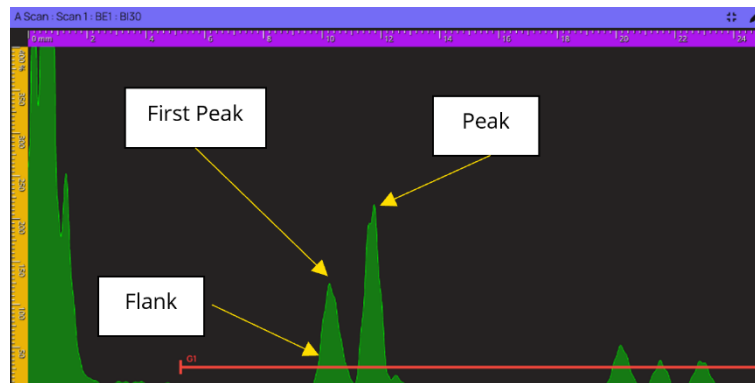


Figure 70 – Example of the A-Scan Measurement Point Locations

Some examples of the depth measurement options are shown in Figure - 71 and Figure 72.

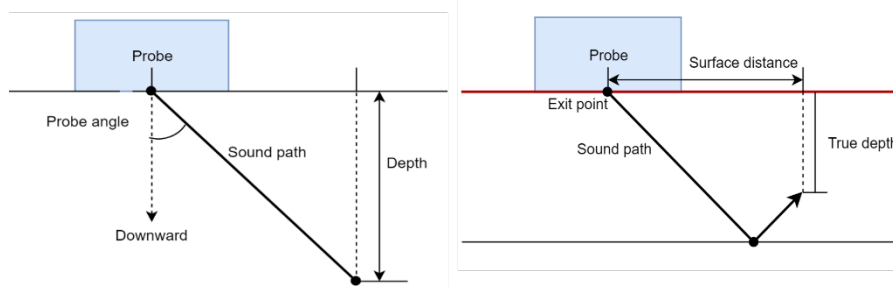


Figure - 71 Measurement Diagrams

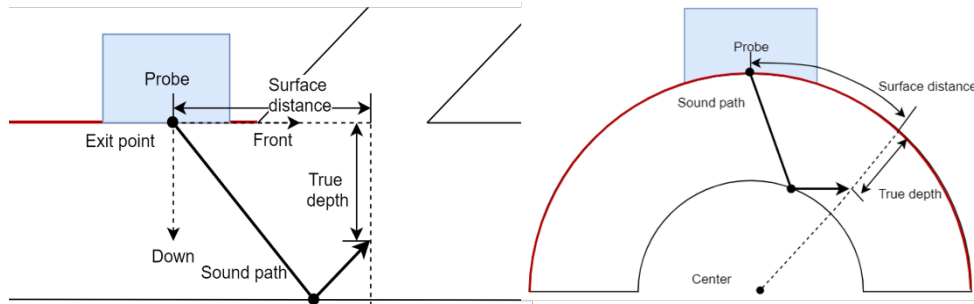


Figure 72 - Complex Part Measurement Diagrams

7.3.2 Settings

The Settings menu contains the UT settings options for the scan setup, this includes several grouped settings; these are: **Gain Settings, Gates, Cursors Management, Signal, Scan Parameters** and **IFT**.

7.3.2.1 Gain Settings

The gain settings allows the user to alter the gain level, set the reference gain value, and set the 'Auto FSH' levels for gates.

NOTE: The gain setting options are specific to the scan group the user currently has highlighted; in multi group setups, the user must select a window for that group to access the gain settings for that scan.



Edit settings	Description
Gain	Defines the gain level applied to a scan in dB
Ref Gain	Defines the reference gain level to be used for a scan. Pressing the "Set Ref Gain" button will set the current gain level as the reference level. Once set, all measurements using reference gain will use this value as it base for comparison.
Auto FSH	Defines the %FSH value a signal will be adjusted to when "Auto FSH" is applied

Table 21 - Gain Settings List

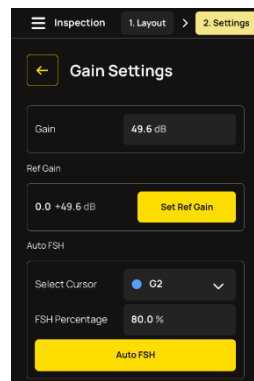


Figure 73 - Gain Settings

7.3.2.2 Gates

Edit Settings	Description
Gate Selector	Defines which gate is being edited. This drop-down list shows only the gates in the selected view; to change the settings of other gates, the user must select the view that contains the target gate .
Start	Defines the start point of the gate in the depth axis of the A-Scan in mm/in.
Width	Defines the gate Width of the gate from the start position.
Level	Defines the height of the gate in the amplitude axis of the A-Scan in % FSH.
Polarity	Defines the polarity of a peak to be used for measurements. Positive – Only uses + peaks for measurements. Negative – Only uses negative peaks for measurements (only available for Rectification modes “None” and “Negative”) Absolute – Uses the maximum amplitude peak from + or – peaks for the measurements (only available for the Rectification mode “None”).

Table 22 - Gate Settings List

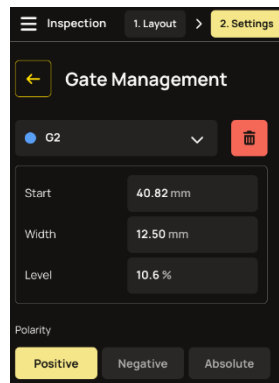


Figure 74 - Gates Settings Menu

7.3.2.3 Cursor Management

Edit Settings	Description
Cursor Selection	Defines which cartesian (C_n) or beam extractor (BE_n) is being edited. This drop-down list does not contain all gates; the user must select the view first to access to a specific gate. On the right, the red trash button deletes the current gate. A pop-up prevents to delete it right away.
Beam Angle	Defines the Beam Angle of a BE type cursor for S-Scans, or the group in L-Scans.
Surface Distance	Defines the position of C type cursors in the horizontal distance axis, position is taken from the front of the wedge set as 0 mm.
Scan Axis	Defines the Scan Axis item allows the user to set the position of the cursor on the scan axis.
Depth	Defines the Depth item allows the user to set the cursor position, in the view, regarding the part surface. The depth does not consider the multiple half skips. For a true depth measurement, one measurement can be added in the measurement bar.

Table 23 - Cursor Management Settings List

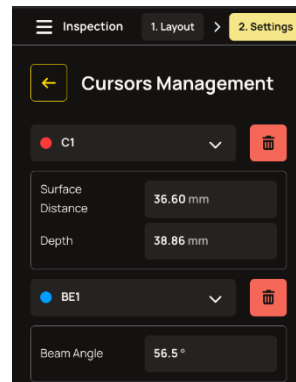


Figure 75 - Cursors Setting Menu

7.3.2.4 Signal

7.3.2.4.1 Signal Settings

Setting	Definition
Rectification	Defines the rectification setting for the scan; options are: None, Full, Positive and Negative.
Smoothing	Defines the smoothing level for the scan; options are: None, Low, Medium and high.
Rejection	Defines the Rejection level for the scan, options are: None, Linear and suppressive.
Rejection Threshold	Defines the rejection threshold for the scan; appears only when either "Linear" or "Suppressive" are chosen in the "Rejection" setting. User sets the level as a %.
Filter	Defines the filter setting for the scan; the default is "Auto" and the full list of available filters can be found in Table 25.
Filter Width	Defines the filter width between Wide and Narrow when the Filter setting is changed from "Auto."
Voltage	Defines the voltage for the scan using preset values, user-defined values or the quick tabs.

Table 24 - Signal Settings List

7.3.2.4.1.1 Signal Rectification

The Signal Rectification item allows the user to change the signal display in the A-Scan. This is set by default to "Full."



NOTE: Signal rectification has an impact on the full screen height (FSH) display. If the rectification is set to Full, the amplitude will vary from 0 to 100 % FSH. If the rectification is set to None, the amplitude will vary from -100 to 100% FSH.

To set the signal rectification, select the drop-down menu and choose from the available options:

- **None:** Non-rectified waveform (RF waveform)
- **Full:** Fully rectified waveform
- **Unipolar+:** Positive half-wave rectification
- **Unipolar-:** Negative half-wave rectification

7.3.2.4.1.2 Smoothing

The **Smoothing** item allows the user to pre-filter the signal with a low-pass filter during signal processing. This setting is set to "None" by default.

To set the smoothing filter, select the drop-down list and choose from the available options:

- **None:** No smoothing filters are applied to the raw signal.
- **Low:** The lowest level of smoothing is applied to the raw signal.
- **Medium:** A medium level of smoothing is applied to the raw signal.
- **High:** The highest level of smoothing is applied to the raw signal.



Note: Smoothing, affects the A-Scan signals and all imaging views extracted from the A-Scan. Therefore, the user must be aware when selecting the smoothing mode. Weak signals such as tip diffractions can be lost when applying high smoothing to a signal.

No smoothing can be applied when the rectification is set to None (RF Waveform), Unipolar+ or Unipolar-.

7.3.2.4.1.3 Rejection

The Rejection setting allows the user to suppress or remove unwanted noise caused by grain structure or electrical noise. To set the rejection level, select the drop-down list and choose from the following options:

- **None:** No rejection filters are applied.
- **Linear:** Signals below the set level are reduced to 0%FSH leaving the remaining signals in place.
- **Suppressive:** All A-Scan signals below the set level are removed; the remaining signals are reduced by the set level.



NOTE: Rejection of samples affects the A-Scan signals and all the imaging in a destructive manner. Therefore, the user must be careful when selecting the Rejection mode to keep in mind that data has been suppressed.

7.3.2.4.1.4 Filter

The **Filter** item offers a list of band-pass filters that can be applied to the signal to improve the overall signal quality by reducing or expanding the frequency range used to create the A-Scans. The filters are set by default to “Auto,” which allows all available frequencies to be used for the scan.

To change the filter settings, select the drop-down list and choose the centre frequency from the available options; once selected, a new setting for “Filter Width” will appear, choose from the new dropdown list for Narrow or Wide. See **Table 25** for a full list of the selection options and the actual filter bands applied.



NOTE: Using filters has pros and cons. They provide a smoother signal variation because they clean some background noise from the A-Scan signals, but the drawback is that they can eliminate weak signals related to defects. Therefore, they must be used with caution.

Filter at 125 MSPS	Centre Frequency (MHz)	High Pass Freq. (MHz)	Low Pass Freq. (MHz)
0.5 MHz Narrow	0.5	0.19	0.82
0.5 MHz Wide	0.5	0.35	0.66
1 MHz Narrow	1	0.37	1.65
1 MHz Wide	1	0.70	1.31
1.5 MHz Narrow	1.5	0.55	2.47
1.5 MHz Wide	1.5	1.03	1.95
2.25 MHz Narrow	2.25	0.81	3.69
2.25 MHz Wide	2.25	1.58	2.96
3.5 MHz Narrow	3.5	1.25	5.74
3.5 MHz Wide	3.5	2.41	4.57
4 MHz Narrow	4	1.47	6.46
4 MHz Wide	4	2.75	5.20
5 MHz Narrow	5	1.76	8.18
5 MHz Wide	5	3.47	6.57
7.5 MHz Narrow	7.5	2.76	12.38
7.5 MHz Wide	7.5	5.09	9.72
10 MHz Narrow	10	3.48	16.32
10 MHz Wide	10	6.90	13.05
15 MHz Narrow	15	5.92	24.50
15 MHz Wide	15	10.29	19.45
20 MHz Narrow	20	9.69	25.11
20 MHz Wide	20	10.69	21.96
Wide Low	3.5	0.95	6.10
Wide High	7.5 to 10	1.83	15.22
Filter at 250 MSPS	Centre Frequency (MHz)	High Pass Freq. (MHz)	Low Pass Freq. (MHz)
0.5 MHz Narrow	0.5	0.19	0.82
0.5 MHz Wide	0.5	0.35	0.65
1 MHz Narrow	1	0.39	1.63
1 MHz Wide	1	0.70	1.31
1.5 MHz Narrow	1.5	0.57	2.47
1.5 MHz Wide	1.5	1.04	1.95
2.25 MHz Narrow	2.25	0.83	3.71
2.25 MHz Wide	2.25	1.57	2.95
3.5 MHz Narrow	3.5	1.28	5.78
3.5 MHz Wide	3.5	2.44	4.58
4 MHz Narrow	4	1.46	6.55
4 MHz Wide	4	2.78	5.23
5 MHz Narrow	5	1.89	7.99
5 MHz Wide	5	3.41	6.48
7.5 MHz Narrow	7.5	2.70	12.17
7.5 MHz Wide	7.5	5.14	9.75
10 MHz Narrow	10	3.70	16.58
10 MHz Wide	10	6.84	13.03
15 MHz Narrow	15	5.31	24.22
15 MHz Wide	15	10.42	19.67
20 MHz Narrow	20	9.90	24.41
20 MHz Wide	20	10.76	21.99
Wide Low	3.5	0.99	6.10
Wide High	7.5 to 10	1.74	15.09

Table 25 – Filter Table

7.3.2.4.1.5 Voltage

The Voltage setting allows the user to alter the voltage applied for the scans. The PA and UT voltage on the XEO ranges from 25 to 90V. A list of recommended maximum voltages for different frequencies is offered in **Table 26**. Please check the probe data sheet and the procedure for actual settings as required.



NOTE: The voltage is applied universally across all focal laws in the scan setup, and not per individual group.

NOTE: A higher voltage value allows deeper sound penetration into the material but increases power consumption and reduces battery life. It is important to make sure that the transducer being used supports the applied voltage. We recommend that the user read the transducer data sheet before using a voltage higher than 100 V.

PA Probe Frequency (MHz)	Instrument Max. Voltage
3.5	90 (180 Vpp)
5	70 (140 Vpp)
7.5	45 (95 Vpp)
10	35 (75 Vpp)
15	25 (50 Vpp)
20	25 (50 Vpp at low PRF)

Table 26 – Maximum Voltage Recommendations

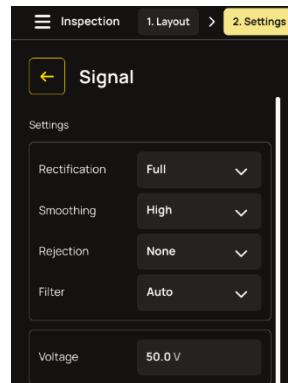


Figure 76 - Signal Settings Options

7.3.2.4.2 Scan Height

The Scan Height settings can be used to ensure that signals do not become saturated, losing peak data in the process.

The XEO allows users to select the FSH level to be recorded; it also allows users to define the height of the A-Scan window during the scan.

7.3.2.4.2.1 Full Scan Height

To set the **Full Scan Height**, select the drop-down list and choose from the following available options:

- 100%
- 200%
- 400%
- 800%
- 1600%
- 3200%

7.3.2.4.2.2 A-Scan Height

The **A-Scan Height** defines the maximum amplitude displayed in the view. The default FSH is 100%; changing the value rescales the signal between 0% and the selected value.

To change the setting, select the drop-down list and chose from the available options.



NOTE: The options that will be available depend on the selected value in the full scan height setting. The A-Scan height cannot exceed the Full Scan Height setting; only the value set in Full Scan Height and those lower will be available for selection.

E.g. For a Full Scan Height setting of 400%, the available options in the A-Scan Height setting will be: 100%, 200% and 400%.

7.3.2.4.3 PRF

The PRF (Pulse Repetition Frequency) controls the number of ultrasonic pulses the XEO transmits per second; this can be set by the user to increase scanning speeds, or remove ghost echoes from a scan.

7.3.2.4.3.1 Mode

The Mode setting allows the user to choose between three set PRF values and one manual PRF selection.

To change the PRF setting, select the drop-down list and choose from the available options:

- **Manual:** Allows the user to input their own value for the PRF up to a calculated safe maximum.
- **Quality:** Sets the PRF to a calculated conservative PRF value, aimed at data quality over speed.
- **Speed /2:** Sets the PRF to a calculated medium value, aimed at a medium data quality and speed setting.
- **Speed:** Sets the PRF to a calculated safe maximum value, aimed at higher speeds.

7.3.2.4.3.2 Value

When "Manual" has been selected, the "Value" box can be selected, and the user can input their own value.

NOTE: The manual value cannot exceed the highest setting as calculated in the "Speed" option.

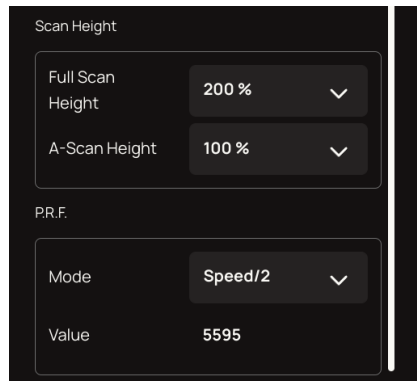



Figure 77 - Scan Height and PRF Settings

7.3.2.5 Scan Parameters

The Scan Parameters section gives the user full access to the scan settings without the need to return to the configuration menus.

The Scan Parameters options are specific to the scan selected in the layout; to change the visible options, simply select a window from the desired scan.

The parameters available are the same as described in the scan setup section of this document.

7.3.2.6 IFT

Edit settings	Description
Enable IFT	Enables the IFT gate settings.
Start	Defines the start point of the gate in the depth axis of the A-Scan in mm/in.
Width	Defines the length of the gate in the depth axis of the A-Scan from the Start point in mm/in.
Level	Defines the height of the gate in the amplitude axis of the A-Scan in % FSH.
Trigger	The Trigger item allows the user to determine which part of the specified signal measures the depth. Measuring to the flank of a peak is often more accurate than measuring to the summit. Three options are available for measuring to the Flank , First Peak or the highest Peak .
Active	Activate the IFT gate using the defined settings.

Table 27 - IFT Gate Settings List

The interface triggering (IFT) gate is used to set a zero point on the depth scale, using a signal trigger instead of a zero set by the wedge delay.

To set the IFT gate, open the menu and toggle on the gate. This will create a white gate on the A-Scan labelled "I1" Position the gate crossing the desired signal using the Start, Width and Level settings or by dragging and resizing the gate using the touchscreen.

Once positions, chose the trigger option from the list:

- **FLANK:** Zero will be set at the first flank of the crossing signal.
- **PEAK:** Zero will be set as the highest peak of the signals that cross the gate.
- **First Peak:** Zero will be set on the first peak position to cross the gate.

Once the correct trigger has been chosen, toggle the "Active" button to turn on the gate; the gate will disappear. The A-Scan will adjust the position of the interface signal to the 0 mm position on the depth axis.

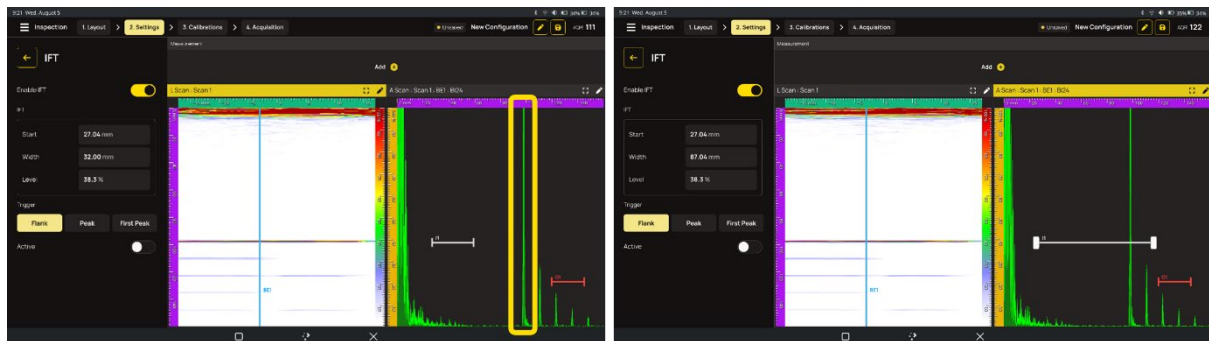


Figure 78 - IFT Example Showing the Desired Interface Signal (Left) and Correct IFT Gate Positioning (Right)

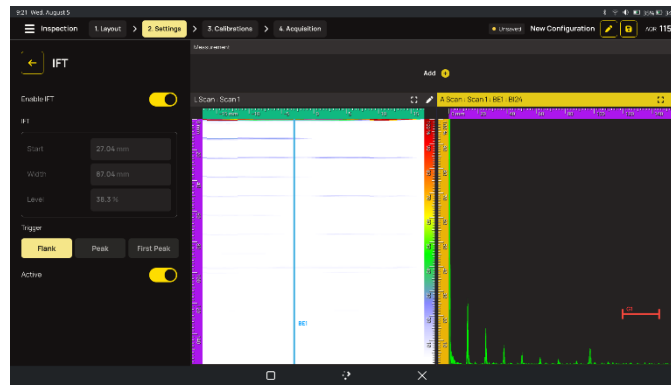


Figure 79 - Active IFT Gate Showing the New Zero Position of the Signal



Figure 80 - IFT Gate Settings Window

7.3.3 Calibration

The Calibration tab contains the calibration dashboard and access to each of the calibrations for the scans that have been created. This section presents the calibration menus, parameters and workflow examples for each calibration type.

The XEO has the following calibrations available across all scan types:

- **Velocity (SW or LW):** Calibration to determine test item velocity using two reflectors of known depth/beam path.
- **Element Check:** Calibration to detect dead/underperforming elements and deactivate them from use.
- **Wedge Angle:** Calibration to determine the actual wedge angle of the wedge being used.
- **Amplitude Stability:** Calibration to determine the amplitude fidelity value of a TFM scan.
- **Wedge Delay:** Calibration used to determine the wedge delay for all delay laws within a single focal law.
- **Sensitivity:** Calibration used to set the sensitivity level of a focal law by using a known reflector and evening out the amplitude across all delay laws within a single focal law.
- **TCG:** Calibration used to set the gain at increasing depths to a set FSH value.
- **Encoder:** Calibration used to determine the tick/mm of an encoder for accurate scan tracking.

7.3.3.1 Calibration Dashboard

The Calibration Dashboard allows the user to see the status of all calibrations across each generated scan group. The user can then access the calibration wizards for each in turn.

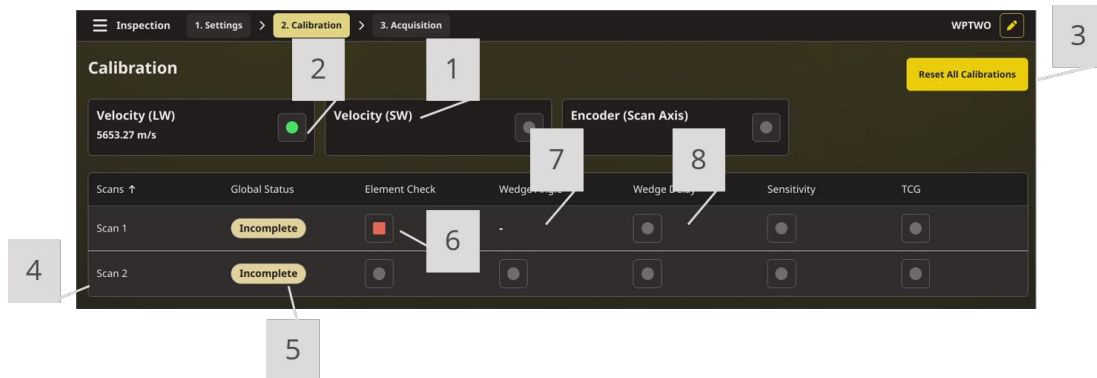


Figure 81 - Calibration Dashboard Overview

Calibration dashboard items:

1. **Velocity (SW or LW): Separate calibration.**
2. **Green Valid status:** The calibration has passed and active.
3. **Reset All Calibration button.**
4. **Scan:** Each row will have its calibration status.
5. **Global status:** Incomplete or complete. Complete must have all green status.
6. **Invalid status:** The calibration invalid status. The calibration and configuration mismatch.
7. **"-" Not Available status:** The calibration type cannot be applied to this scan.
8. **Grey status:** The calibration has not been attempted.



NOTE: Clicking on invalid and valid status will prompt the two choices of resetting the calibration or redoing it.

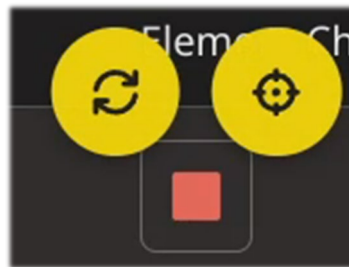


Figure 82 - Reset and Calibrate Button

7.3.3.2 Calibrations Parameters

The following section details the settings associated with each calibration and provides a workflow example for each calibration.



NOTE: The workflow for the calibrations is the same regardless of scan type; however, they may differ visually due to the different scan type and part geometry.

7.3.3.2.1 Velocity (SW)/(LW)

Step Section	Settings	Description
Settings	Gain	Defines the gain setting for the calibration; d; defaults to the currently set gain level.
	Select Reflector	Acquisition cursor that will apply the AUTO FSH below.
	FSH Percentage/AUTO FSH	Set the FSH percentage to get a signal amplitude at the desired full screen height. The Auto FSH% item automatically adjust the gain so that the signal peak amplitude reaches the gate position.
	Beam Index/Beam Angle	Selects the beam to a specific angle or focal law.
	Start Path	Defines the start point for the scan along the beam length; d; defaults to the current scan setting.
	Range Path	Defines the range of the area from the start point along the beam length; defaults to the current scan setting.
Reflector	Depth or Radius	Apply reflector type: Radius or Depth depending on the calibration block.
	Reflector 1	Defines the reflector #1 depth or radius distance.
	Reflector 2	Defines the reflector #2 depth or radius distance.
	Reflector 1 & 2 Start	Defines the box for reflector #1 and #2 cursor start position.
	Reflector 1 & 2 Width	Defines the box for reflector #1 and #2 cursor width.
Calibrate	1 st Peak (Set Point)	Gather first acquisition cursor peak distance. The Set Point tile is an action button to record the #1 reflector position.
	2 nd Peak (Set Point)	Gather second acquisition cursor peak distance. The Set Point tile is an action button to record the #2 reflector position.
	Calibrated velocity	Provides the resulting velocity once the two reflectors are recorded and calibrated (see below).
	Calibrate (button)	Action button to confirm the two reflectors' positions and it will apply the new velocity based on them.
Validate*	1 st Peak (Set Point)	Result of the 1st Peak distance using the newly calibrated velocity.
	2 nd Peak (Set Point)	Result of the 2nd Peak distance using the newly calibrated velocity.
	Calibrated Velocity	Velocity output based in this current calibration.
	Theoretical Distance	Reflector distance 1 - Reflector distance 2 = Theoretical Distance .
	Results/ Distance	Set points and validate the theoretical distance. Recorded Reflector distance 1 – Recorded Reflector distance 2 = Distance .

* Grayed out until the **Calibrate** step is done.

Table 28 - Velocity (LW) and (SW) Settings List

7.3.3.2.1.1 Workflow Example

7.3.3.2.1.1.1 Objective

Velocity calibration establishes the correct sound velocity for the inspection material so that sound path calculations, reflector locations, and measurements are displayed accurately. Separate velocity calibrations may be required for different wave modes. When multiple wave modes are used within a configuration, XEO maintains independent velocity calibrations for each mode.

NOTE: The images in this section show both the Depth and Radius versions of each step



7.3.3.2.1.1.2 Workflow

Begin by selecting a calibration block containing two reflectors at known locations. The two reflector locations should be clearly separated so the instrument can determine the difference in sound path between them.

In the **Settings** tab, adjust the gain and scan parameters as required to clearly display both reflector responses. The scan range should be sufficient to display both reflectors within the active inspection zone. Move the probe on the calibration block as needed to obtain stable, repeatable signals from both reflectors.

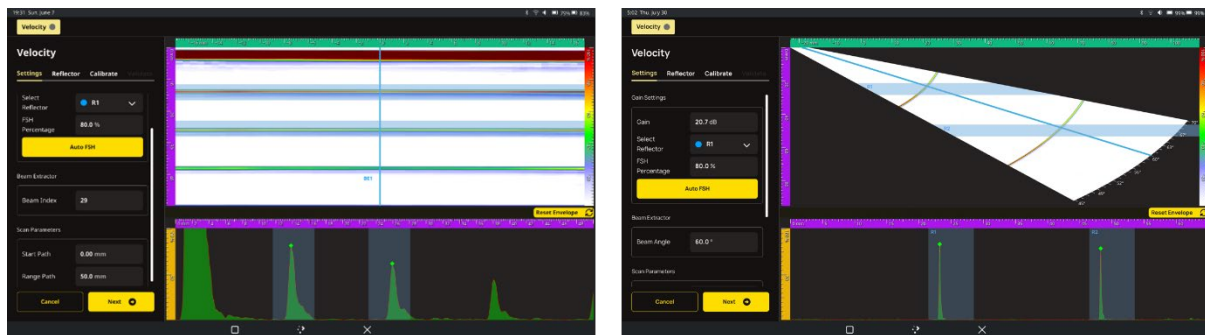


Figure 83 - Velocity Calibration Settings Configured to Display Both Calibration Reflectors

In the **Reflector** tab, define the type and known location of each reflector. Reflectors may be defined using either Depth or Radius, depending on the calibration block being used.

Use **Depth** when the reflectors are located at known depths or thickness positions, such as back wall reflections, side-drilled holes, flat-bottom holes, or notches. Use **Radius** when the reflectors are based on a known curved surface or radius, such as an IIW-type calibration block.

Position the reflector zones so they fully cover the reflector responses being used for calibration. The zones may be adjusted numerically or directly from the scan display by selecting and moving the reflector boxes. Proper zone placement ensures the instrument evaluates the intended signals.

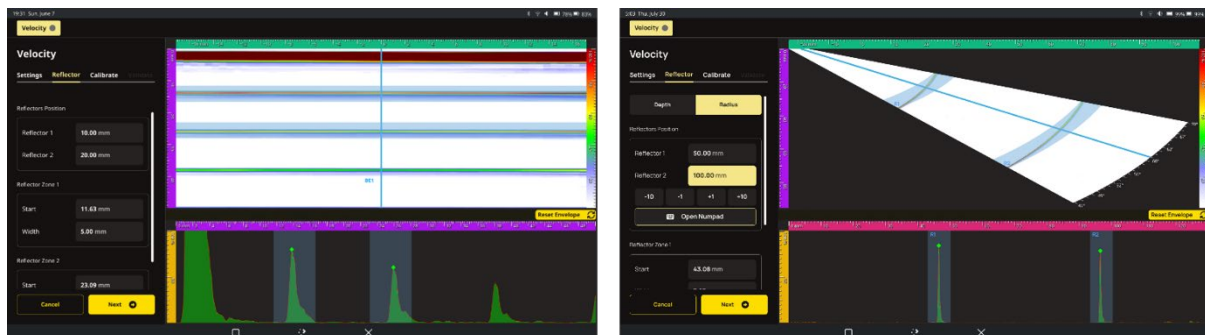


Figure 84 - Reflector Definitions and Reflector Gates Positioned Over the Calibration Targets.

In the **Calibrate** tab, assign the first and second calibration points to the appropriate reflector responses; the first point should be the shallowest reflector. The instrument uses the known spacing between the reflectors and the measured spacing between the detected responses to calculate the material velocity.

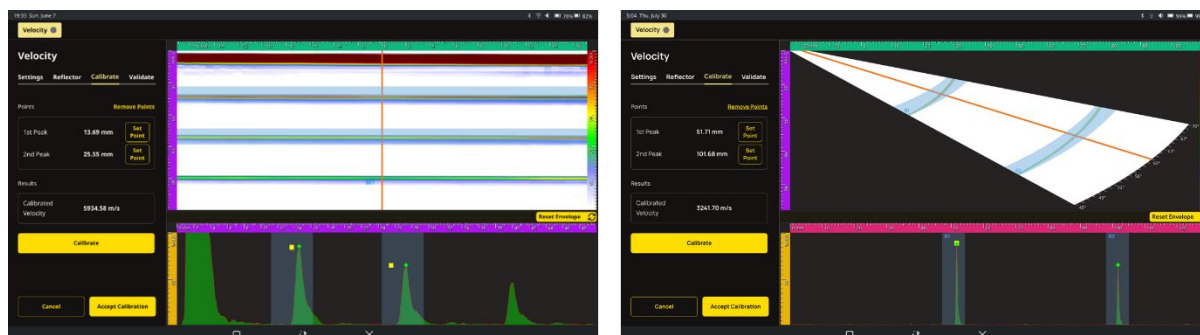


Figure 85 - Velocity Calibration Using Two Known Reflector Responses.

In the **Validate** tab, review the calculated velocity and verify that the spacing between the reflector responses corresponds to the known spacing between the calibration reflectors.

NOTE: Velocity calibration establishes the correct sound velocity but does not compensate for probe, wedge, or system delays. As a result, reflector locations may still appear offset after calibration. For example, a reflector located at 10 mm depth may display at 12 mm and a reflector located at 20 mm depth may display at 22 mm. Although the displayed positions are offset, the 10 mm spacing between the reflectors is correct, indicating that the material velocity has been calibrated successfully.



7.3.3.2.1.3 Verification

- Verify the following before proceeding to the next calibration.
- The calculated velocity is reasonable for the material being inspected.
- The reflector responses are stable and repeatable.
- The displayed spacing between the calibration reflectors matches the known spacing between the reflectors.
- The calibration result is accepted and stored for the active wave mode.

If the displayed spacing does not match the known spacing between the calibration reflectors, review the reflector locations, reflector zone placement, and probe position before repeating the calibration

7.3.3.2.2 Encoder

Step Section	Settings	Description
Calibrate	Length	Defines the distance the encoder will be moved for the calibration .
	Ticks	Total of ticks during the Calibrate step.
	Start Calibration	Starts the calibration and resets the ticks count to 0.
Validate	Resolution	Provides the result of the past Calibrate step in ticks/mm.
	Invert Direction	Inverts the direction of the encoder.
	Distance	Calculated distance based on the real travelled rolling distance.
	Restart Calibration	Reset the distance if it does not match the targeted length.

Table 29 - Encoder Calibration Settings List

7.3.3.2.2.1 Workflow Example

7.3.3.2.2.1.1 Objective

Encoder calibration establishes the relationship between encoder counts (ticks) and actual travel distance. This relationship allows encoded scan data to be displayed with accurate positional information during acquisition.

The calibration determines the encoder resolution used by the instrument, typically expressed as ticks per millimetre. Accurate encoder calibration is essential for dimensional measurements, encoded B-Scans, C-Scans, corrosion mapping, and other position-dependent inspections.

7.3.3.2.2.1.2 Workflow

Select a known calibration distance and enter the value into the **Length** field.

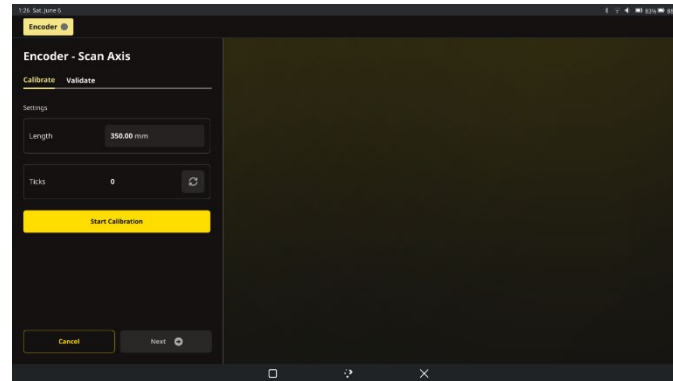


Figure 86 - Encoder Calibration Settings Showing the Known Calibration Distance.

Position the scanner or encoder at the start of the measured distance and reset the encoder count if necessary. Move the scanner through the full calibration distance while the instrument records the encoder counts.

The total number of encoder ticks accumulated over the known distance is displayed in the **Ticks** field. The instrument uses these values to calculate the encoder resolution.

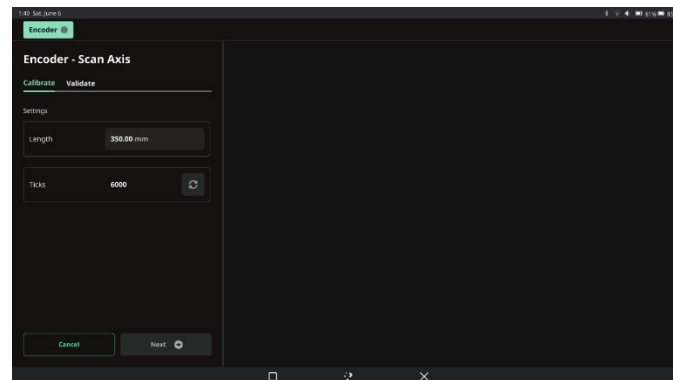


Figure 87 - Encoder Counts Recorded Over the Known Calibration Distance.

After the calibration is completed, proceed to the **Validate** tab. The calculated encoder resolution is displayed, and the instrument continuously converts encoder counts into displayed travel distance.

Move the scanner through a known distance and compare the displayed travel distance to the actual movement. If the displayed direction is opposite to the scanner movement, enable **Invert Direction**.

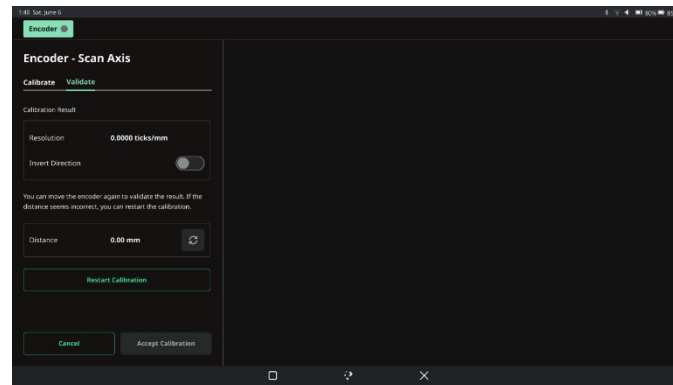


Figure 88 - Encoder Validation Showing the Calculated Resolution and Measured Travel Distance.

If the displayed distance does not correspond to the actual travel distance, repeat the calibration using a carefully measured reference length.

7.3.3.2.2.1.3 Verification

Verify the following before proceeding to inspection:

- The calibration distance was measured accurately.
- The scanner travelled through the full calibration distance during calibration.
- The encoder maintained consistent contact throughout the movement.
- The displayed distance corresponds to the actual travel distance.
- Encoder direction matches scanner movement.
- The calculated encoder resolution is reasonable for the encoder being used.
- The calibration has been accepted and stored.

Unlike ultrasonic calibrations, encoder calibration does not affect sound path measurements or focal law performance. It establishes the positional accuracy used to display and record encoded scan data.

7.3.3.2.3 Element Check

Step Section	Settings	Description
Settings	Gain	Defines the gain setting for the calibration; d; defaults to the currently set gain level.
	Beam Index	Selects the beam to a specific angle or focal law.
	Start Path	Defines the start point for the scan along the beam length; defaults to the current scan setting.
	Range Path	Defines the range of the area from the start point along the beam length; d; defaults to the current scan setting.
Reflector	Start Zone	Defines the gate start point.
	Range Zone	Defines the gate range.
Elements	Activation Table of Elements	A list of element buttons; press to deactivate an element.
Calibrate	Threshold Level	Defines the acceptance level of the element signal response.
	Maximum Dead Count	Defines the maximum number of allowed dead elements across the array.
	Maximum Consecutive Dead Count	Defines the maximum number of consecutive dead elements across the array.
	Dead Count (Output)	Total number of dead elements deactivated by the user.
	Consecutive Dead Count (Output)	Total number of consecutive dead elements deactivated by the user
	Status (Output)	Pass/Fail result.

Table 30 - Element Check Calibration Settings List

7.3.3.2.3.1 Workflow Example

7.3.3.2.3.1.1 Objective

Element Check is used to evaluate probe operability by verifying that all active elements are responding as expected. This calibration is typically performed before other calibrations to confirm that the probe is suitable for inspection use.

7.3.3.2.3.1.2 Workflow

Begin by selecting a suitable reference reflector that provides a consistent re the probe's active aperture of the probe.

In the **Settings** tab, adjust the gain and scan parameters as required to clearly display the reflector response. The signal should be stable, repeatable, and easily distinguishable from background noise.

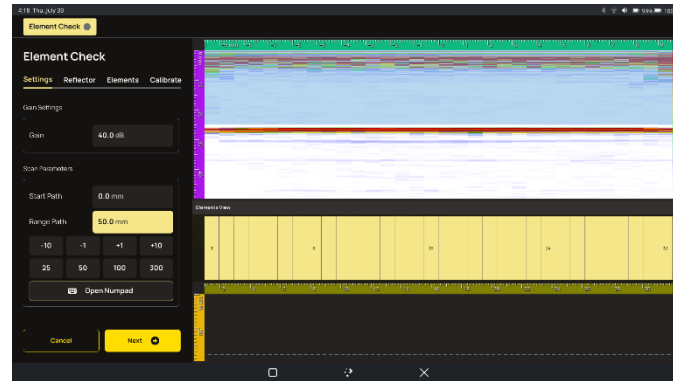


Figure 89 - Element Check Settings configured for the Evaluation of Probe Element Responses

In the **Reflector** tab, position the reflector zone so that it completely encompasses the signal being evaluated. For contact inspections, this is typically the initial pulse or interface reflection. Proper placement of the reflector zone ensures the instrument collects data from the intended signal during the evaluation.

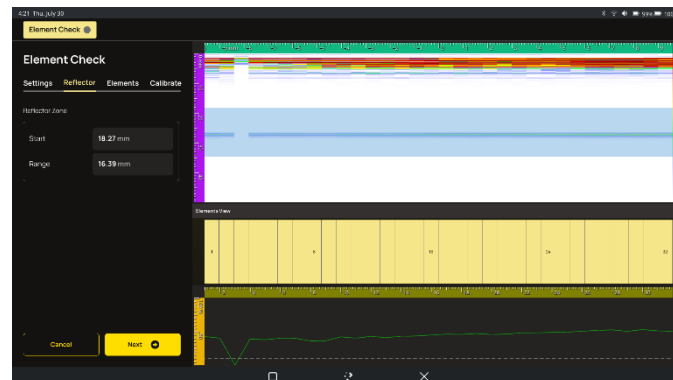


Figure 90 - Reflector Zone Positioned Over the Signal Used for Element Evaluations

In the **Elements** tab, review the active aperture and identify any disabled or inactive elements before running the evaluation. Individual elements may be disabled if required by the inspection procedure or when working with a probe containing known defective elements.

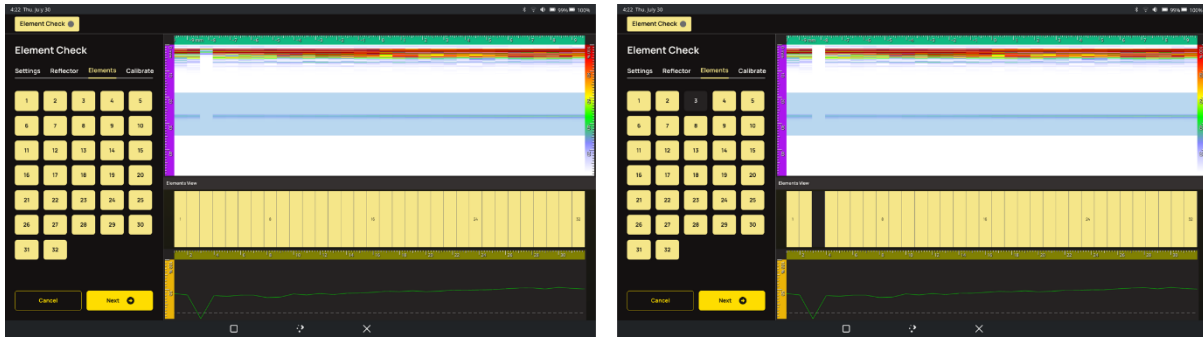


Figure 91 - Active Probe Aperture Showing Poor-performing Element 3 and then Disabled Elements

In the **Calibrate** tab, review the acceptance criteria used to determine probe operability. Typical acceptance criteria may include minimum element response levels, maximum allowable inactive elements, and limits on consecutive inactive elements. These values should be established by the applicable inspection procedure, code requirements, or company practices.

Run the Element Check and review the results. The wizard automatically compares the measured element responses against the defined acceptance criteria and reports a Pass or Fail result.

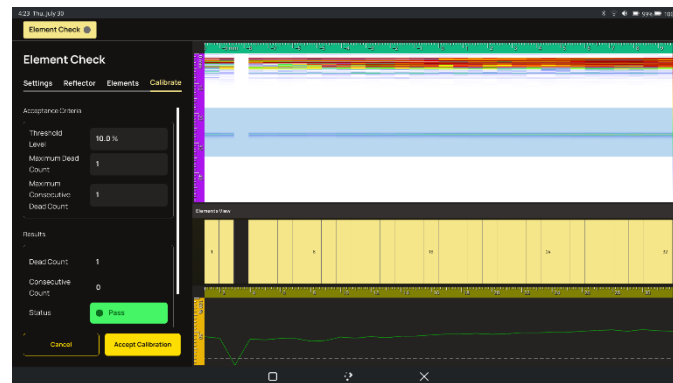


Figure 92 - Element Check Results Compared Against the Defined Acceptance Criteria

The example below shows a failed Element Check result. In this example, the measured dead element count and consecutive dead element count exceed the defined acceptance criteria, resulting in a failed operability check.

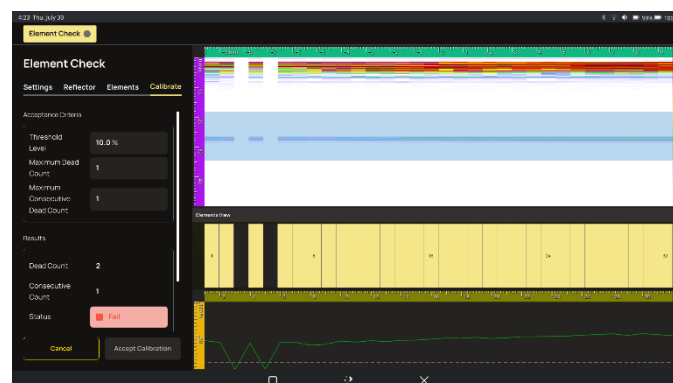


Figure 93 - Failed Element Check Result Caused by Acceptance Criteria not Being Met

7.3.3.2.3.1.3 Verification

Verify the following before proceeding to the next calibration:

- The calibration status indicates Pass.
- The reported dead element count is within the defined acceptance criteria.
- The reported consecutive dead element count is within the defined acceptance criteria.
- The probe meets the operability requirements established for the inspection.

If the calibration result indicates Fail, review the reported element status and acceptance criteria. Inspect the probe, cable, and connections before repeating the evaluation or replacing the probe if necessary.

7.3.3.2.4 Wedge Angle

Step Section	Settings	Description
Settings	Gain	Defines the gain setting for the calibration; d; defaults to the currently set gain level.
	Start Path	Defines the start point for the scan along the beam length; ; defaults to the current scan setting.
	Range Path	Defines the range of the area from the start point along the beam length; defaults to the current scan setting.
Reflector	Start Path	Defines the start location of the acquisition gate on the L-Scan
	Range Path	Defines the range of the acquisition gate on the L-Scan
	First Beam	Defines the starting beam included the calibration scan.
	Last Beam	Defines the final beam included in the calibration scan.
Calibrate	Initial Angle	For information only field displaying the cut angle based on the wedge XEO database.
	Calibrated Angle (Output)	Initially shows "N/A", when Calibrate is pressed; this displays the calculated actual wedge angle.

Table 31 - Wedge Angle Calibration Settings List

7.3.3.2.4.1 Workflow Example

7.3.3.2.4.1.1 Objective

Wedge Angle calibration measures the actual wedge cut angle and updates the focal law calculations to match the probe and wedge assembly being used. This calibration compensates for variations caused by wedge manufacturing tolerances and wedge, wear that may affect beam calculations.

7.3.3.2.4.1.2 Workflow

Wedge Angle calibration is typically performed with the probe removed from the calibration block and free of couplant. The calibration uses the reflection from the wedge itself to determine the actual wedge geometry.

In the **Settings** tab, adjust the gain and scan parameters as required to obtain a strong, repeatable wedge reflection. The reflected signal should be stable and clearly distinguishable from background noise; ensure the full wedge reflection can be identified in the window.

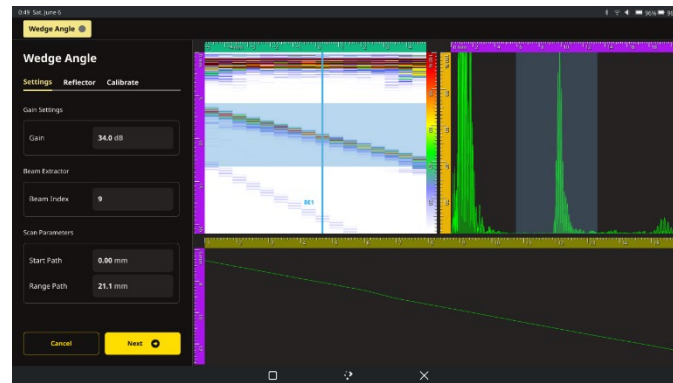


Figure 94 - Wedge Angle Calibration Setup Configured to Display the Wedge Reflection

In the **Reflector** tab, position the reflector zone so that it fully encompasses the wedge reflection used for the calibration. Proper reflector zone placement ensures the instrument evaluates the correct signal when determining the wedge angle.

The reflector zone should be sized to capture the wedge reflection while excluding any additional reflections that could affect the calculation. Reducing the reflector zone width or limiting the number of active elements may help isolate the desired signal and improve calibration accuracy.

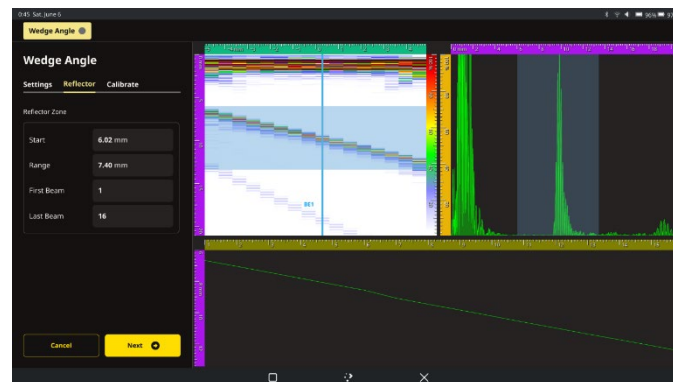


Figure 95 - Reflector Zone Positioned over the Wedge Reflection Used for Angle Calibration

In the **Calibrate** tab, perform the calibration. The instrument uses the measured wedge reflection to determine the actual wedge cut angle and update the focal law calculations. Review the calculated angle and verify that the result is reasonable for the wedge being used.

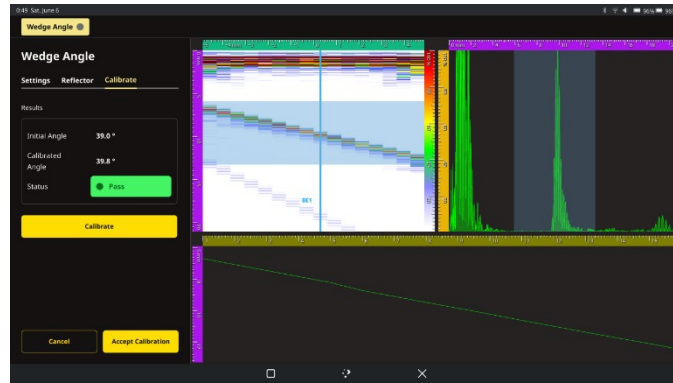


Figure 96 - Wedge Angle Calibration Results Showing the Measured Wedge Angle

7.3.3.2.4.1.3 Verification

Verify the following before proceeding to the next calibration:

- The wedge reflection is stable and repeatable.
- The reflector zone fully encompasses the desired wedge reflection while excluding unwanted signals.
- The calculated wedge angle is reasonable for the wedge being used.
- The calibration result has been accepted and stored.

Wedge Angle calibration updates the wedge geometry used for focal law calculations but does not compensate for probe, wedge, or system delays. Delay-related offsets are addressed during subsequent delay calibrations.

If the calculated wedge angle differs significantly from the expected wedge geometry, verify the wedge condition, probe assembly, and calibration setup before repeating the calibration

7.3.3.2.5 Wedge Delay

Step Section	Edit view settings	Description
Settings	Gain	Defines the gain setting for the calibration; defaults to the currently set gain level.
	Beam Index	Selects the beam to a specific angle or focal law.
	Start Path	Defines the start point for the scan along the beam length; defaults to the current scan setting.
	Range Path	Defines the range of the area from the start point along the beam length; defaults to the current scan setting.
Reflector	Reflector Choices	Reflector type choice. Depth, Radius or SDH buttons
	Tolerance	Defines the acceptable deviation from inputted reflector value (in mm or in).
	Reflector	Defines the reflector depth, radii distance or centre point of the SDH.
	Diameter	Setting only appears when SDH is selected as the reflector type; defines the diameter of the SDH to be used for the calibration.
	Start Zone	Defines the reflector #1 and #2 cursor start position.
	Range Zone	Defines the reflector #1 and #2 cursor width.
Calibrate	Status	Displays the live pass/fail result based on the defined tolerance zone. The recorded red line must remain within this zone for the calibration to pass.
	Calibrate (Button)	After the reflector has been swept across all angles or focal laws, click Calibrate . The system applies updated focal delays to align the measured reflector position as closely as possible with the target reference line.
	Reset All Calibrations	Resets calibration to default.

Table 32 - Wedge Delay Calibration Settings List

7.3.3.2.5.1 Workflow Example

7.3.3.2.5.1.1 Objective

Wedge Delay calibration compensates for the sound travel time through the wedge and probe assembly before the sound enters the test material. This correction allows reflector locations to be displayed accurately and ensures measurements, such as sound path, depth, and position, are calculated correctly.

Wedge Delay calibration is typically performed after Velocity and Wedge Angle calibrations are completed.

NOTE: The images in this section show both the Depth and Radius versions of each step.



7.3.3.2.5.1.2 Workflow

Select a suitable calibration reflector with a known location. The reflector may be a radius, side-drilled hole (SDH), notch, or other reference reflector that produces a strong and repeatable response.

In the **Settings** tab, adjust the gain and scan range as required to clearly display the reflector response. The selected reflector should be easily identifiable and free from interference caused by neighbouring indications.

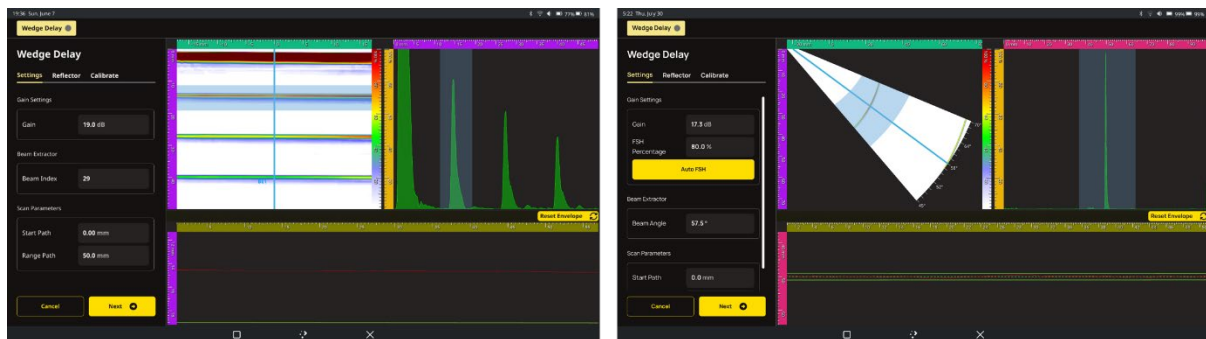


Figure 97 - Wedge Delay Calibration Settings Configured for a Known Reference Reflector

In the **Reflector** tab, select the appropriate reflector type and enter the known reflector dimensions. Position the reflector zone so it fully encompasses the reflector response used for calibration.

The reflector zone should isolate the intended reflector from surrounding echoes. If multiple reflectors or geometric indications are present within the zone, the calibration may produce inaccurate results.

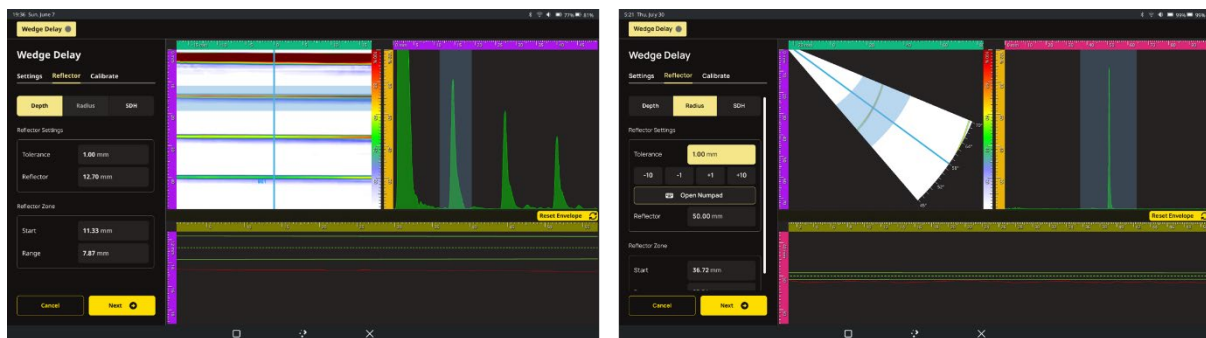


Figure 98 - Reflector Zone Positioned over the Selected Calibration Reflector.

In the **Calibrate** tab, perform the calibration. The instrument compares the measured reflector position to the known reflector location and calculates the delay correction required for the probe and wedge assembly.

Unlike Velocity calibration, which determines the material sound velocity using the distance between reflectors, Wedge Delay calibration uses a single known reflector to establish the timing offset introduced by the wedge and probe assembly.

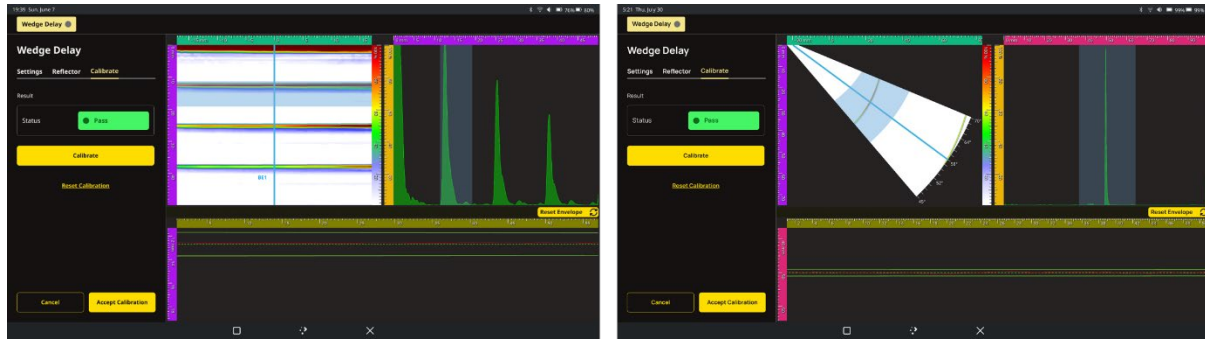


Figure 99 - Wedge Delay Calibration Result

7.3.3.2.5.1.3 Verification

Verify the following before proceeding to the next calibration:

- The reflector response is stable and repeatable.
- The reflector type and reference dimensions are entered correctly.
- The reflector zone fully encompasses the intended reflector response.
- No unwanted reflectors or geometric indications are included within the reflector zone.
- The calibration status indicates **Pass**.
- The reflector is displayed at the expected location after calibration.

If the calibration does not pass, review the reflector selection, reflector dimensions, reflector zone placement, coupling, and probe position before repeating the calibration.

7.3.3.2.6 Sensitivity

Step Section	Edit View Settings	Description
Settings	Gain	Defines the gain setting for the calibration; defaults to the currently set gain level.
	Beam Index	Selects the beam to a specific angle or focal law.
	Start Path	Defines the start point for the scan along the beam length; defaults to the current scan setting.
	Range Path	Defines the range of the area from the start point along the beam length; defaults to the current scan setting.
Reflector	Reflector Type	Reflector type choice: Depth, Radius or SDH.
	Reflector	The reference is the targeted sound path or depth of the reflector. It is represented by a dashed green line.
	Start Zone	Defines the reflector cursor start position.
	Range Zone	Defines the reflector cursor width.
Calibrate	Threshold Level	Targeted amplitude for a uniform signal for each focal law for a given reflector.
	Tolerance	The Tolerance is the acceptable amplitude deviation from the reference level. The default value is $\pm 5\%$.
	Status	Displays the live pass/fail result based on the defined amplitude tolerance. The recorded red line must remain within this zone for the calibration to pass.
	Calibrate (Button)	After the reflector has been swept across all angles or focal laws, click Calibrate . The system applies updated scanning gain to each focal laws to align the measured reflector height as closely as possible with the target reference line.
	Reset All Calibrations	Resets calibration to the initial flat scanning gain.

Table 33 - Sensitivity Calibration Settings List

7.3.3.2.6.1 Workflow Example

7.3.3.2.6.1.1 Objective

Sensitivity calibration adjusts the gain response across the focal laws so that a selected reflector produces a consistent amplitude response. This calibration helps compensate for amplitude variation caused by beam angle, wedge effects, material path, and probe response.

Sensitivity calibration is typically performed after Velocity, Wedge Angle, and Wedge Delay calibrations have been completed.

7.3.3.2.6.1.2 Workflow

Select a suitable calibration reflector that produces a clear response across the focal laws being calibrated. The reflector may be a side-drilled hole (SDH), notch, radius, or other reference reflector specified by the inspection procedure.

In the **Settings** tab, adjust the gain and scan range as required to clearly display the reflector response. The response should be stable and repeatable across the focal laws being evaluated.

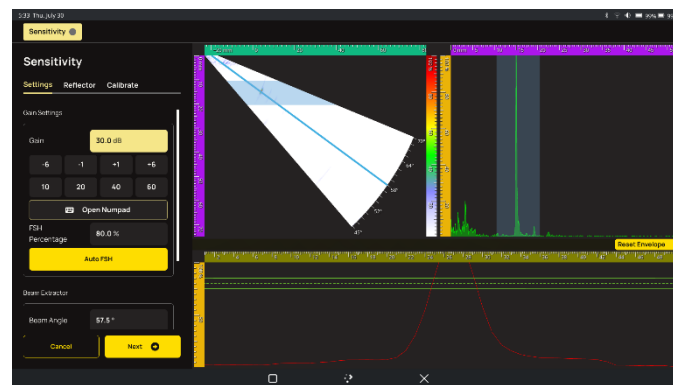


Figure 100 - Sensitivity Calibration Settings Configured to Display the Selected Reflector Response

In the **Reflector** tab, select the appropriate reflector type and position the reflector zone over the intended reflector response. The reflector zone should include the response from the calibration reflector while excluding unwanted indications that could affect the amplitude measurement.

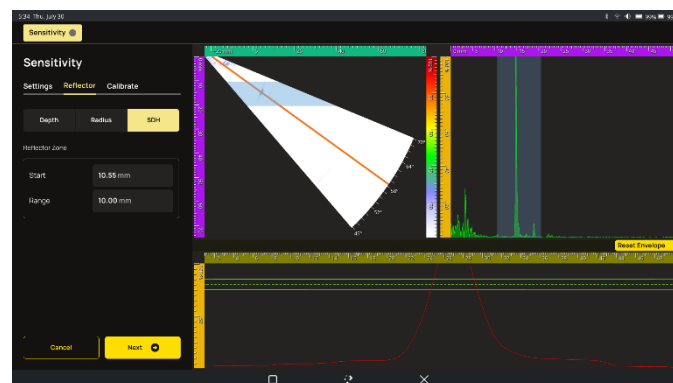


Figure 101 - Reflector Zone Positioned over the Selected Reflector Response for Sensitivity Calibration

In the **Calibrate** tab, define the target amplitude and tolerance used for the calibration. The wizard evaluates the reflector response across the focal laws and applies the required gain correction, so the reflector response is brought within the defined amplitude tolerance.

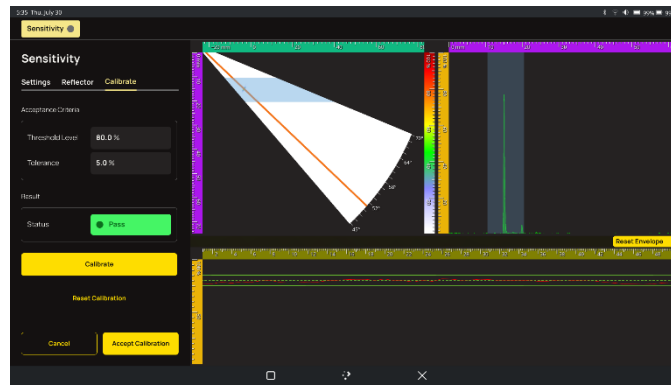


Figure 102 - Sensitivity Calibration Result Showing Amplitude Response Compared with the Defined Tolerance

7.3.3.2.6.1.3 Verification

Verify the following before proceeding to the next calibration:

- The reflector response is stable and repeatable.
- The reflector zone isolates the intended reflector response.
- The target amplitude and tolerance are appropriate for the inspection procedure.
- The amplitude response across the focal laws is within the defined tolerance.
- The calibration status indicates **Pass**.
- The calibration result has been accepted and stored.

If the calibration does not pass, review the reflector selection, reflector zone placement, coupling, probe position, gain level, and acceptance criteria before repeating the calibration.

7.3.3.2.7 TCG

Step Section	Edit View Settings	Description
Settings	Gain	Defines the gain setting for the calibration; defaults to the currently set gain level.
	Beam Index	Selects the beam to a specific angle or focal law.
	Start Path	Defines the start point for the scan along the beam length; defaults to the current scan setting.
	Range Path	Defines the range of the area from the start point along the beam length; defaults to the current scan setting.
Calibrate	Threshold Level	Targeted amplitude for a uniform signal for each focal law and time of flight for a series of reflector.
	Tolerance	The Tolerance is the acceptable amplitude deviation from the reference level. The default value is $\pm 10\%$.
	Start Zone	Defines the reflector cursor start position.
	Range Zone	Defines the reflector cursor width. TCG points are replaced within that zone when user adds a new TCG point.
	Add Point	Adds TCG point at the reflector zone highest peak.

Table 34 - TCG Calibration Settings List

7.3.3.2.7.1 Workflow Example

7.3.3.2.7.1.1 Objective

Time Corrected Gain (TCG) compensates for the reduction in signal amplitude that occurs as sound travels through a material. Factors, such as beam spread, attenuation, and sound path length, can cause identical reflectors to produce different amplitudes at different distances.

TCG applies distance-based gain correction so that reflectors of similar size produce a consistent response throughout the inspection range.

TCG is typically performed after Velocity, Wedge Angle, Wedge Delay, and Sensitivity calibrations have been completed.

7.3.3.2.7.1.2 Workflow

Select a calibration block containing multiple reflectors of the same size located at different sound paths. Common examples include side-drilled holes (SDHs), notches, or other reference reflectors specified by the inspection procedure.

In the **Settings** tab, define the target amplitude and tolerance used for the TCG calibration. Position the reflector zone so it encompasses the reflector response being used to create each TCG point.

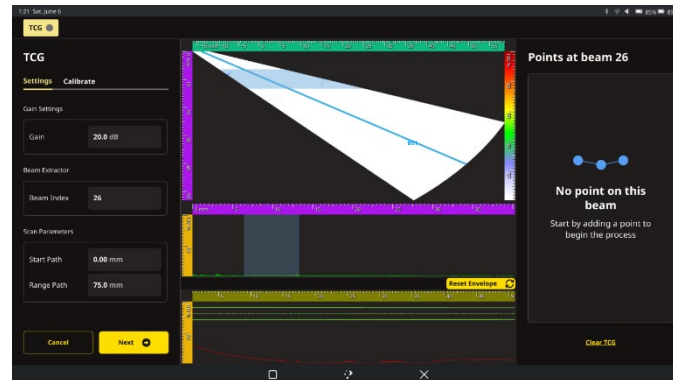


Figure 103 - TCG Calibration Settings Showing the Target Amplitude, Tolerance, and Reflector Zone

In the **Calibrate** tab, locate the selected calibration reflector and adjust probe position as necessary to obtain a clear response. When the reflector is captured within the active focal laws, add a TCG point. The instrument evaluates the reflector response and determines the gain correction required to achieve the target amplitude.

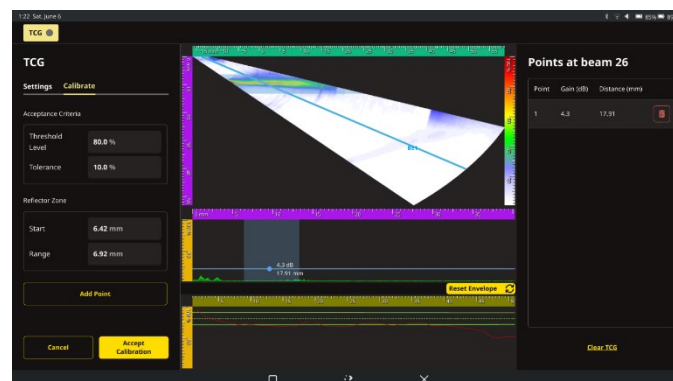


Figure 104 - First TCG Point Collected from the Calibration Reflector

Repeat the process for additional reflectors at increasing sound paths. Depending on the calibration block and scan configuration, probe movement may be required to capture each reflector response. For each point, the instrument evaluates the reflector response and records the gain correction required to achieve the target amplitude.

Each point therefore represents the gain compensation required at a specific sound path, allowing the instrument to compensate for attenuation and beam spread throughout the inspection range.

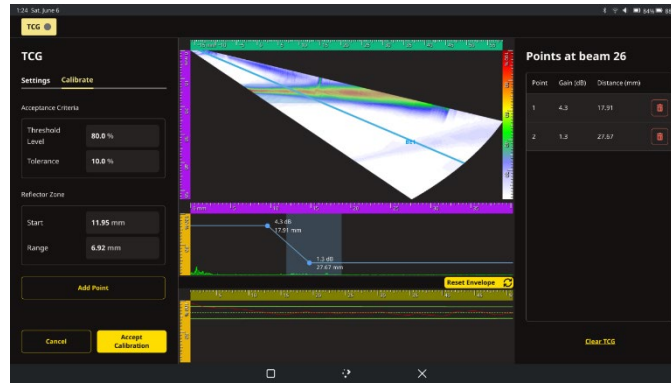


Figure 105 - Additional TCG Points Collected at Increasing Sound Paths

As additional points are added, the instrument generates a TCG curve by interpolating between the collected points. This curve is then used to compensate for amplitude loss with increasing sound path.

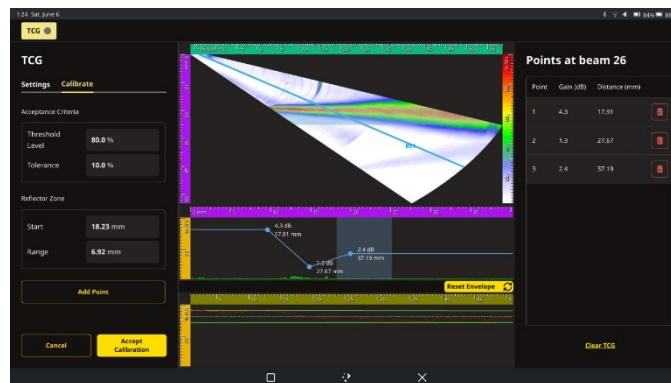


Figure 106 - Completed TCG Curve Generated from Multiple Calibration Points

7.3.3.2.7.1.3 Verification

Verify the following before proceeding to inspection:

- Each TCG point was collected from the intended calibration reflector.
- The calibration reflectors are of known and consistent size.
- The collected points span the inspection range of interest.
- The reflector responses achieve the specified target amplitude within the defined tolerance.
- The resulting TCG curve is smooth and representative of the calibration data.
- The calibration has been accepted and stored.

Unlike Sensitivity calibration, which equalizes amplitude response between focal laws, TCG applies gain correction as a function of sound path distance. This allows similar reflectors to produce a consistent response throughout the calibrated inspection range.

7.3.3.2.8 Amplitude Fidelity

Step Section	Step Section	Settings
Settings	Gain	Defines the gain setting for the calibration; defaults to the currently set gain level.
	FSH Percentage	Defines the amplitude level to which the Auto FSH will bring a signal.
	Auto FSH	Automatically adjusts the gain level to peak the signal in the box to the FSH level defined in the FSH Percentage setting.
	Min. Index	Defines the start of the TFM area in the Index axis in relation to the front of the wedge.
	Max. Index	Defines the end of the TFM area in the Index axis in relation to the front of the wedge.
	Min. Depth	Defines the start of the TFM area in the Depth axis in relation to the inspection surface.
	Max. Depth	Defines the end of the TFM area in the Depth axis in relation to the inspection surface.
	Sensitivity Level	Defines the sensitivity level applied to the TFM scan.
Reflector	Index Start	Defines the start of the acquisition box area in the Index axis in relation to the front of the wedge.
	Index range	Defines the end of the acquisition box area in the Index axis in relation to the front of the wedge.
	Depth Start	Defines the start of the acquisition box area in the Depth axis in relation to the inspection surface.
	Depth Range	Defines the end of the acquisition box area in the Depth axis in relation to the inspection surface.
Calibrate	Amplitude Stability Ref.	Defines the acceptable amplitude stability level, default is 2.0dB.
	Index Resolution	Defines the resolution of the TFM area in the Index axis, this defaults to the currently set resolution for the scan.
	Depth Resolution	Defines the resolution of the TFM area in the Depth axis, this defaults to the currently set resolution for the scan.
	Calibrate	Pressing the calibrate button with carry out the calibration and then display the results.
Calibrate (Results)	Amplitude Stability	Displays the amplitude stability achieved by the current setup.
	Index Resolution	Displays the minimum resolution required to achieve the amplitude fidelity reference value in the Index axis. It also displays the pixels per wavelength achieved. Pressing the Set button will apply the recommended setting.
	Depth Resolution	Displays the minimum resolution required to achieve the amplitude fidelity reference value in the Depth axis. It also displays the pixels per wavelength achieved. Pressing the Set button will apply the recommended setting.
	Status	Pass or Fail status

Table 35 - Amplitude Stability Calibration Settings List

7.3.3.2.8.1 Workflow Example

7.3.3.2.8.1.1 Objective

Amplitude Stability (a.k.a. Amplitude Fidelity) verifies that the selected TFM image resolution provides a stable amplitude response for a reflector within the TFM image. This check is used to confirm that the image grid is fine enough to represent the reflector response without excessive amplitude variation caused by pixel spacing.

Amplitude Stability is not a gain calibration. It does not equalize focal laws or compensate for sound path. It verifies whether the selected index and depth resolution are suitable for the TFM configuration.

7.3.3.2.8.1.2 Workflow

In the **Settings** tab, select the TFM scan to be checked. The scan parameters should match the inspection configuration, including the TFM imaging area, sensitivity level, and propagation mode.

Set the gain and FSH percentage so the reflector response is clearly visible and at a usable amplitude. The reflector response should be stable and separated from surrounding noise or geometry.

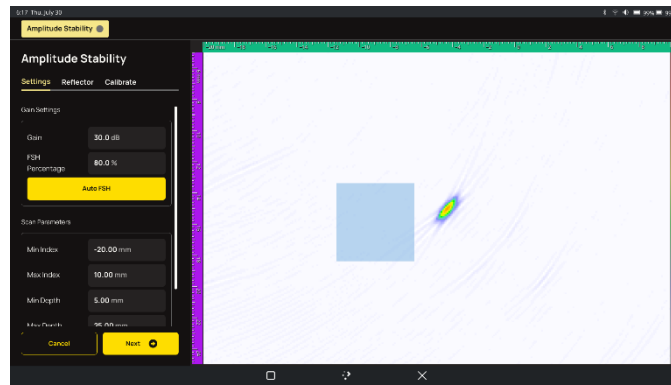


Figure 107 - Amplitude Stability Settings Configured for the Selected TFM Scan

In the **Reflector** tab, position the reflector zone around the reflector response. The zone should include the reflector being checked without including unnecessary background noise or adjacent responses. The wizard uses this area to evaluate the amplitude stability of the selected TFM image.

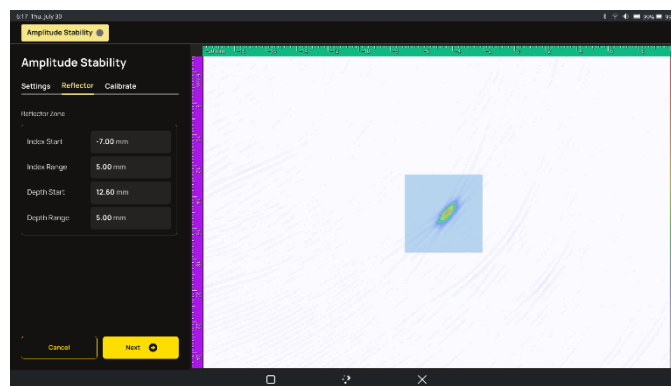


Figure 108 - Reflector Zone Positioned Around the TFM Response

Open the **Calibrate** tab and define the allowable amplitude stability reference. In this example, the acceptance reference is set to 2.0dB. The index and depth resolution values define the TFM image pixel spacing used for the check.

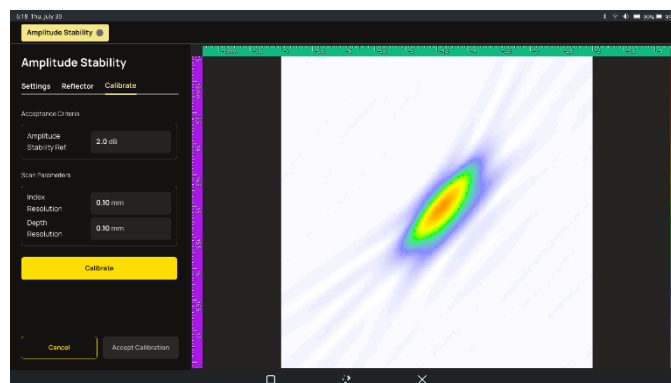


Figure 109 - Amplitude Stability Calibration Settings Showing Acceptance Reference and Image Resolution.

Run the calibration. The wizard evaluates the amplitude variation of the reflector response for the selected image resolution and displays the calculated amplitude stability result.

If the result meets the acceptance reference, the wizard displays a Pass status and allows the calibration to be accepted.

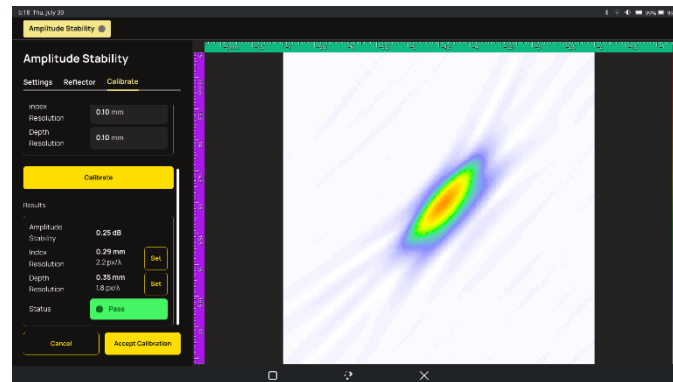


Figure 110 - Amplitude Stability Result Showing a Passing Result

If the result does not meet the acceptance reference, the wizard displays a Fail status. A failed result indicates that the current image resolution may be too coarse for the selected TFM configuration.

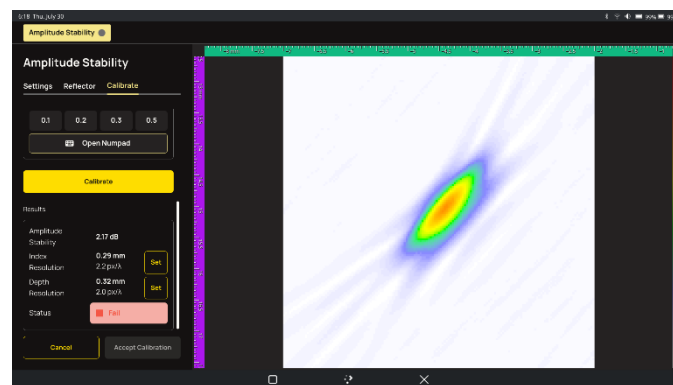


Figure 111 - Amplitude Stability Result Showing a Failed Result Due to Insufficient Image Resolution

When required, use the resolution adjustment controls to apply the calculated index and depth resolution values. Reducing the pixel size generally improves amplitude stability but may increase processing demand. The selected resolution should provide acceptable amplitude stability while maintaining usable inspection performance.

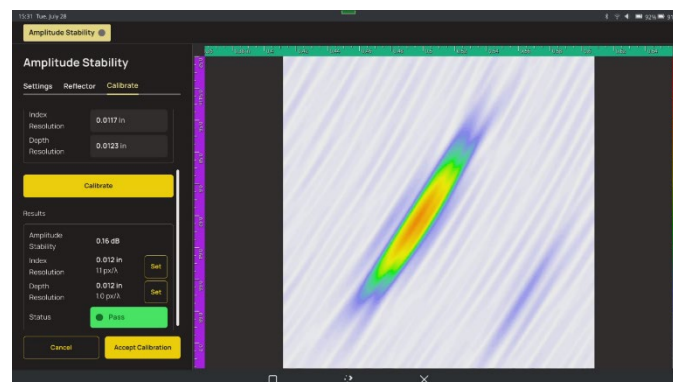


Figure 112 - Optimized Index and Depth Resolution Applied after the Amplitude Stability Check

After the resolution has been adjusted, repeat the calibration. When the result meets the acceptance reference, accept the calibration.

7.3.3.2.8.1.3 Verification

Verify the following before proceeding:

- The correct TFM scan was selected.
- The reflector zone includes the intended reflector response.
- The reflector response is stable and suitable for the check.
- The amplitude stability reference matches the required tolerance.
- The index and depth resolution values are appropriate for the TFM configuration.
- The Amplitude Stability result meets the required tolerance.
- The calibration has been accepted

7.3.4 Acquisition

The Acquisition tab is where the user performs the scan and saves the scan data.

Pressing the Acquisition button on the top tab will take the user to the acquisition screen.

NOTE: In **Acquisition**, the system is automatically recording the moment button is enabled.

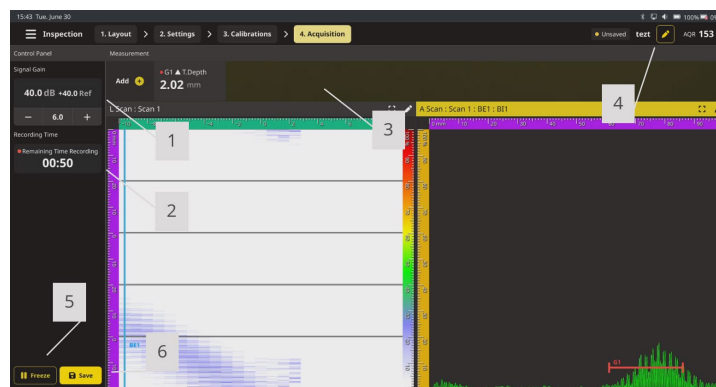


Figure 113 - Acquisition Screen

Acquisition:

1. **Gain:** Adjust the gain with the available controls. Click + or – to increase or decrease the gain. Click the gain value to open the numerical pad and set the increment between 0.1 and 20.0 dB.
2. **Recording Time:** Time Based inspection uses a timer of 1 minute by default. Freeze will pause the timer. This zone is also where the encoder positions will appear. See below for more details.
3. **Add Cursor zone to measurement bar:** See section 7.3.1.1.4.
4. **Acquisition information:** In order: Save status, file name, edit name, AQR (Acquisition rate in frame per second) See section **Error! Reference source not found..**
5. **View layout area:** Freeze acquisition button.
6. **Save:** Save and stop the acquisition. A pop-up “Save As...” window prompts every time.

Settings	Description
Scan Axis	Indicates the scan axis position in mm or inch.
Index Axis	Indicates the scan axis position in mm or inch.
Reset All	Resets position and data of all encoders.
Next & Prev Index (Manual Index only)	Next sets next position index to the index axis encoder. Prev (Previous) sets previous position index to the index axis encoder.

Table 36 - Acquisition screen encoder controls list



Figure 114 - Configuration information in Acquisition

Setting	Description
Unsaved status	The Type item allows the user to specify the type of encoder used for each axis. The XEO supports quadrature single ended encoders and offers a manual entry mode for index axis.
Filename	White text line which was defined earlier by the user.
Edit Name	Pencil button: click to edit its filename.
Save Button	If the configuration is modified during the Acquisition step, the save button appears. Click it to save the current configuration; once saved, the button disappears.
AQR	Acquisition rate in frame per second. That number is determined by the entire configuration speed. Parameters that make an impact on speed especially are the PRF, scan range, total of pixels in TFM, and the number of scans. Example of an AQR speed scenario: Manual PRF is at 1200 Hz for 60 sectorial beams; the maximum AQR is technically 20 Hz. NOTE: A steady or disconnected encoder will pace the AQR to 3 Hz.

Table 37 - Acquisition Screen File Options

7.4 ANALYSIS

The Analysis section allows the user to review saved data files, gather measurements and screenshots. It also lets the user review the configuration and calibration settings to ensure procedures have been adhered to.

The Analysis section consists of three tabs:

- **Layout Editor:** Allows the user to add or remove view windows from the “as scanned” layout.
- **Calibrations:** Allows the user to view the status of each calibration for all scans in the setup.
- **Analysis:** Allows the user to review saved data files, adjust software gain, add and remove cursors and measurements.

7.4.1 Layout Editor

The Layout Editor loads the “as scanned” layout used to acquire the data; from here, the user can add new windows and remove unwanted views.

The operation of this is identical to the Layout Editor in the Inspection section; for details, see Section 7.3.1.1 of this document.

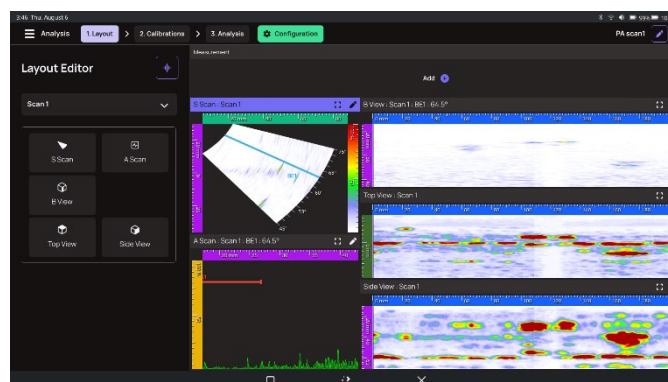


Figure 115 - Analysis Layout Editor Screen

7.4.2 Calibrations

The calibrations tab allows the user to see the status of the calibrations carried out for the inspection; this is a read-only screen. The user cannot click into the calibrations to see details or alter settings.

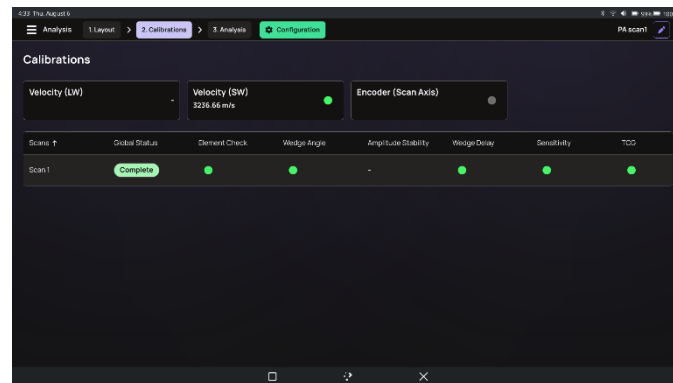


Figure 116 - Analysis Calibrations Screen

7.4.3 Analysis

The analysis tab presents the user with tools for the review of the data file and menus with read only information and settings that can be changed in post analysis.

The menus available in the analysis page are the same as the Acquisition page; some are read only and some have analysis specific settings. See the following table for information.

Menu	Setting	Description
Gain settings	Digital gain	Adds/subtracts electronic gain from the selected scan. Note: The user cannot recover the peak from a saturated signal by reducing the digital gain.
	Gain	Read only information on the as scanned gain level.
	Ref Gain	Read only information on the as scanned reference gain settings.
Gates	Gate Selector	Defines which gate is being edited. This drop-down list shows only the gates in the selected view; to change the settings of other gates, the user must select the view that contains the target gate.
	Start	Defines the start point of the gate in the depth axis of the A-Scan in mm/in.
	Width	Defines the gate Width of the gate from the start position.
	Level	Defines the height of the gate in the amplitude axis of the A-Scan in %FSH
	Polarity	Defines the polarity of a peak to be used for measurements. Positive – Only uses positive peaks for measurements. Negative – Only uses negative peaks for measurements (only available for Rectification modes “None” and “Negative”). Absolute – Uses the maximum amplitude peak from positive or negative peaks for the measurements (only available for Rectification mode “None”).
Cursor Management	Cursor Selection	Defines which cartesian (C_n) or beam extractor (BE_n) is being edited. This drop-down list does not contain all gates; the user must select the view first to access to a specific gate. On the right, the red trash button deletes the current gate. A pop-up prevents to delete it right away.
	Beam Angle	Defines the Beam Angle of a BE type cursor for S-Scans, or the group in L-Scans.
	Surface Distance	Defines the position of C type cursors in the horizontal distance axis, position is taken from the front of the wedge set as 0 mm
	Scan Axis	Defines the Scan Axis item allows the user to set the position of the cursor on the scan axis.
	Depth	Defines the Depth item; allows the user to set the cursor position, in the view, regarding the part surface. The depth does not consider the multiple half skips. For a true depth measurement, one measurement can be added in the measurement bar.
Signal	Rectification	Read only information showing the rectification setting used for the scan.
	Smoothing	Read only information showing the Smoothing setting used for the scan.
	Rejection	Read only information showing the Rejection setting used for the scan.
	Rejection Threshold	Read only information showing the Rejection threshold setting used for the scan.
	Filter	Read only information showing the Filter setting used for the scan.
	Filter Width	Read only information showing the Filter Width setting used for the scan.
	Voltage	Read only information showing the Voltage setting used for the scan.
	Full Scan Height	Read only information showing the Full Scan Height setting used for the scan.
	A-Scan Height	Defines the A-Scan Height Setting, can be altered in analysis step.
	PRF Mode	Read only information showing the PRF Mode setting used for the scan.
Scan Parameters	PRF Value	Read only information showing the PRF Value setting used for the scan.
	As per Section 7.3.2.5	Read only information showing the Scan Parameter settings used for the scan.
IFT	As per Section 7.3.2.6	Read only information showing the IFT setting used for the scan.

Table 38 - Analysis Menu Options List



NOTE: The menu section can be reduced to increase the room on the screen for analysis by pressing the Reduce button at the top of the menu section.

7.4.4 Configuration Information

A read-only version of the configuration section can be accessed by the burger menu in the top left of the screen; this will show all the configuration sections as a read only format.

7.4.4.1 Analysis Tools

7.4.4.1.1 Scroll Bar

To scroll through an encoded scan, the user can grab and drag the scroll bar at the bottom of the screen or the scan bar on the window.

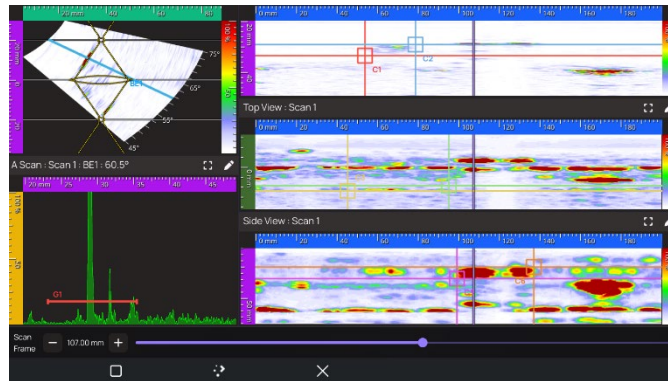


Figure 117 - Analysis Scroll Bar

7.4.4.1.2 Add and Remove Gates and Cursors

To add a gate or cursor to a window, the user has two options:

- Long press within the window: This will show a box with the gate and cursor options available for that view.
- Press the 'Target' button in the left settings area: This will show the available gate and cursor options for the selected window.

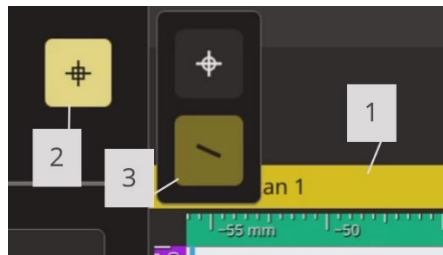


Figure 118 - Analysis Add and Remove Gates and Cursors

7.4.4.2 Analysis Measurements Bar

The user can add new measurements to the measurements bar as required, for the options and process. See section 7.3.1.1.4.

7.5 TOOLBOX

The Toolbox section controls the UTLAB universal settings, and the library of probes and wedges.

To access the toolbox, press the burger menu on the top-left hand side of the screen and click Toolbox (in gray).

The welcome screen of the UTLab application contains a gray Toolbox tile as well to launch it.

7.5.1 GENERAL SETTINGS

7.5.1.1 Units

Unit preference for the UTLab parameters. Choices are metric or imperial. Measurements will also be updated.

7.5.1.2 Languages

7.5.1.2.1 Follow Browser Language

Choosing this will set the UTLab language to use the language set in the system settings of the unit.

7.5.1.2.2 Use Different Language

Choosing this setting will allow the user to select a language from the drop-down menu.

7.5.1.3 Theme

The user can choose between two colour themes to improved visibility. The **Light** option can be useful when the sunlight conditions are too strong.

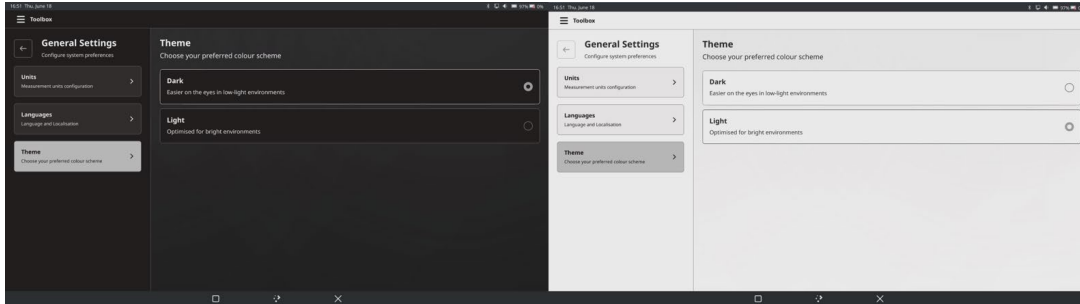


Figure 119 Dark and Light Modes

7.5.2 ASSET MANAGEMENT

The Asset Management contains the probe and wedge instrument inventory.

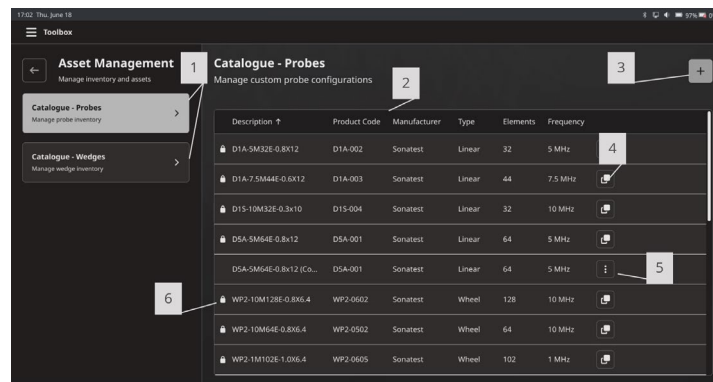


Figure 120 - Asset Management Screen

Asset Management content:

1. **Probe and Wedge** internal libraries.
2. **Probe and Wedge** metadata columns.
3. **Create new Probe** (or wedge, in the wedge inventory).
4. **Duplicate** button.
5. **Duplicate/Edit/Delete** button.
6. **Locked item:** Probe and wedge items that are part of the default system.

7.5.2.1 Catalogue – Probes

7.5.2.1.1 Finding a Probe

The user can locate a probe file by:

- Searching for key words in the search bar.
- Using the drop-down filters to narrow the on-screen list.
- Scrolling through the list.

7.5.2.1.2 Create New Probe

To create a new probe there are two starting options:

- Select the “+” icon in the top right corner, this will open the probe creator for a new probe.

- Choose an existing probe from the list, press the button on the right of the probe and select duplicate. This creates a duplicate of that probe in the list; this probe can be edited. This has the advantage of only needing to adjust settings rather than create from new.

Section	Setting	Description
General	Description	Model or name on the probe datasheet. This field is mandatory.
	Product Code	Probe part number. This field is mandatory.
	Manufacturer	Manufacturer name. This field is mandatory.
	Frequency	Defines the probe centre frequency in MHz
	Pulse Width	Define the pulse width in ns.
	Type	Define the Type of probe options are "Normal" or "Integrated Wedge."
Element	Numbers of Elements	Defines the number of elements in the array .
	Pitch	Defines the centre-to-centre distance from one element to the next.
	Element Width	Defines the element width.
	Gap Width	Displays the calculated gap width between elements based on the pitch and element with settings.
	Aperture	Displays the calculated aperture length based on the number of elements, element width and pitch settings.
	Elevation	Defines the elevation (passive width).
	First Element Position	Defines the position of the 1 st element within the case.
Casing	Width	Defines the probe casing width.
	Length	Defines the probe casing length.
	Height	Defines the probe casing height.

Table 39 - Probe Creation Settings List

7.5.2.2 Catalogue – Wedges

7.5.2.2.1 Finding a Wedge

The user can locate a wedge file by:

- Searching for key words in the search bar.
- Using the drop-down filters to narrow the on-screen list
- Scrolling through the list.

7.5.2.2.2 Create New Wedge

To create a new wedge there are two starting options:

- Select the "+" icon in the top right corner, this will open the wedge creator for a new wedge.
- Choose an existing wedge from the list, press the button on the right of the wedge and select duplicate. This creates a duplicate of that wedge in the list; this probe can be edited. This has the advantage of only needing to adjust settings rather than create from new.

Setting	Description
Description	Model or name on the probe datasheet. This field is mandatory.
Manufacturer	Manufacturer name. This field is mandatory.
Velocity	Define the wedge Velocity item allows the user to set the longitudinal wave velocity in the wedge. See Table 41 for some common wedge materials.
Type	The wedge Type item allows the user to specify the type of wedge used if any. Select either Angular or Flat.
Cut Angle	Define the cut angle of the wedge.
Length	Define the length of the wedge.
Width	Define the width of the wedge.
Front Height	Define the front height of the wedge.
Back Height	Define the back height of the wedge.
X	Define the distance between the front of the wedge and the first element.
Xt	Define the distance between the back of the wedge and the first element.
Inset	Recessed distance inside the wedge to sit the transducer. E.g.: X1B wedge design uses a set screw and the wedge inset to fix the transducer.
Z	Define the height between to bottom of the wedge to the first element.
Contact Surface Type	Auto: Wedge contact surface automatically matched the part as per the probe and wedge positioning. See section 7.2.7.2 for probe assemble positioning.
Contact Surface Type	Axial Outside: A curved contact-surface wedge designed for use on the outside diameter of a pipe in the longitudinal direction. This configuration is also known as an AOD wedge.
Contact Surface Type	Axial Inside: A curved contact-surface wedge designed for use on the inside diameter of a pipe in the longitudinal direction. This configuration is also known as an AID wedge.
Contact Surface Type	Circumferential Outside: A curved contact-surface wedge designed for use on the outside diameter of a pipe in the circumferential axis. This configuration is also known as an COD wedge.
Contact Surface Type	Circumferential Inside: A curved contact-surface wedge designed for use on the outside diameter of a pipe in the circumferential axis. This configuration is also known as an COD wedge.
Diameter	Set the AOD, AID, COD, CID wedge contouring dimension.

Table 40 - Wedge Creation Settings List



NOTE: For more curved contouring dimension recommendations, please find the [Curved Wedges and Long Seam Weld Pipe Inspection](#) section in our probe and wedge catalogue.

Material	LW Velocity (mm/μs)	LW Velocity (in./μs)
Water	1.48	0.0583
Rexolite (Cross-linked Polystyrene)	2.33	0.0929
Lucite	2.68	0.1055
Plexiglass	2.76	0.1087
Polystyrene	2.67	0.1051
Glycerine	1.92	0.0756

Table 41 - Common Wedge Material Details

8 FILE MANAGER

The File Manager is a space for the user to store, move, delete and transfer their files.

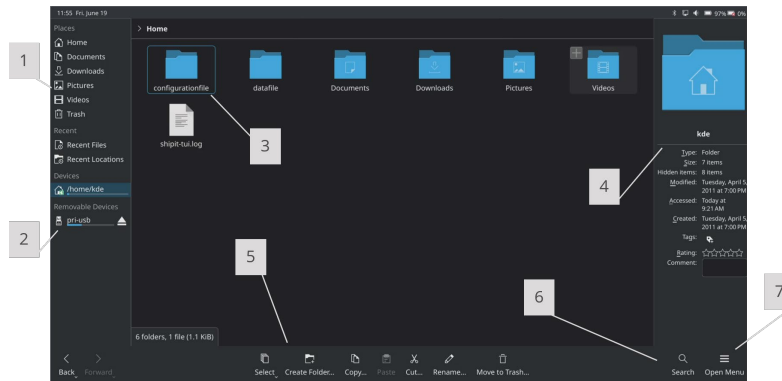


Figure 121 File Manager Application Screen

- **Home and folders (1):** The default file location for configurations, data files, documents, downloads, pictures, and videos. The **Pictures** and **Videos** folders are used to store screenshots and screen recordings captured on the XEO.
- **Documents:** General user documents folder. When a file is selected, a thumbnail appears with its metadata (4).
 - Hint: double-click outside a folder will select all folders and files at once.
- **Downloads:** Default location where saves files comes from the internet.
- **Pictures:** Default location where screenshots are saved (/Pictures/Screenshots).
- **Videos:** Default location where video screenshots are saved (/Videos/).
- **Removable devices:** USB disks like USB-A drives will appear here. If the device doesn't appear, check if the drive is FAT32, NTFS, ext3 & ext4 formatted.
- **Quick interaction access bar (5):** Quick interactions with folder or files: Select, Create Folder, Copy, Paste, Cut, Rename and move to Trash.
- **Search bar (6):** Click and type words to find items in the current files or everywhere in the instrument.
- **Open Menu quick access (7):** More quick access buttons are available to create new tabs, sort by, etc.



NOTE: Some items are intentionally disabled to help prevent unintended changes or disruption to the XEO system.

8.1 Supported Devices

Supported Removable Devices

The XEO can access removable storage devices, such as SSD hard drives and USB flash drives, when they are connected through a USB-C port or a USB-A adaptor.

Before transferring files, make sure the device uses one of the supported file formats listed below.

- FAT32
- NTFS
- Ext3 and Ext4

It is recommended to save and close files to **eject** the drive before the user unplugs it.

9 SETTINGS

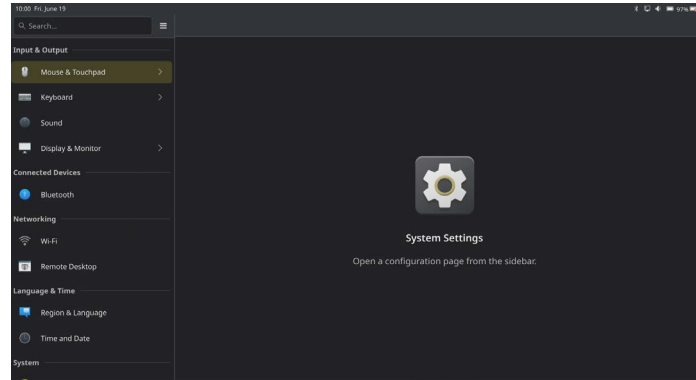


Figure 122 Settings Application Screen

9.1 Settings Content

The Settings application provides access to system-level options like those found on a conventional PC. Available settings may vary by software version or system configuration. Sonatest reserves the right to add, remove, or modify settings in this application.

Setting	Description
Mouse and Touchpad	External mouse and touch pad settings. The user can set its pointer speed, scrolling for example. Some pointers or touchpad features might not be fully supported by the XEO. Extra drivers must be installed. For more information, contact sales@sonatest.com
Keyboard	External Keyboard and On-screen Keyboard. Extra languages can be opt-in. Check for Keyboard/On-screen Keyboard/Language. Select the language that will appear when a typing field is active. Click on the planet Earth icon to select it.
Sound	Built-in Stereo output settings. Recording devices settings. Notification sounds.
Display Configuration	Resolution (1920X1080 is recommended). Scale to zoom out or zoom the interface (150% is the default and recommended option). Orientation (0- and 180-degree flip work fine). Refresh rate. Overscan (Determine how much padding is put around the image sent to the display to compensate for part of the content being cut off around the edges. This is sometimes needed when using a TV as a screen). Colour profile: None (default and recommended), iCC profile and built in. Colour accuracy. Brightness. Extended Dynamic Range: Enabled (default and recommended). Legacy applications (X11). Screen tearing: Allow in full screen windows is default and recommended.
Bluetooth	Settings to pair Bluetooth devices. Check for the upper right screen items to add, configure and enable the power status.
Wi-Fi	Disable/Enable Wi-Fi option. Available and connected network list. Hidden network connection is supported. Extra securities are not yet configurable. IP settings should be set to automatic (manual static IP is not recommended unless an IT support sets it for the XEO user).
Remote Desktop	Remote Desktop Access settings. RDP server can be enabled or disabled. Host name and IP address information Username settings for connection
Region & Language	Language setting (can be synchronised in the UTLab/Toolbox/General Settings/Languages). Time settings should not be changed in this section. Check for Time and Date below.
Time and Date	12-24h hour format. Time Zone: Search and pick the desired time zone. Automatic Time Synchronisation setting to yes. (recommended setting).
Energy	The two batteries status (click on each to access more information). Screen dimming and off mode after a period of inactivity (Never is default and recommended).
Factory Reset	Reset to Factory Settings. The Erase all Data button deletes all user or personal data that are present in the instrument. This procedure cannot be undone; please make sure the user has backed up the data before.
Software Update	Current version information. Update through internet when it is available and the XEO is connected. Offline update using a .mender image from a USB disk is possible by clicking to this button on the far right of the screen.
Information	System Information
License	Software options to build to order the XEO instrument: This list is subject to change. To buy an option, contact sales@sonatest.com to add them.

Table 42 - Settings Space Available Settings List

10 SETUP EXAMPLES

This section provides examples of common inspection setup workflows using XEO. The examples demonstrate the typical sequence of task for configuring an inspection, performing calibrations, verifying the system setup, and preparing for data acquisition.

The examples in this section include:

10.1 Phased Array Weld Inspection with Linear Probe and S-Scan

10.2 Phased Array C-Scan Inspection with Wheel Probe, L-Scan, and IFT Gate

10.3 FMC/TFM Weld Inspection

These examples focus on workflow and application. Detailed information regarding individual settings, controls, and functions can be found in Section 7 – UT Lab.

Actual inspection requirements may vary depending on the inspection procedure, equipment configuration, and application.

10.1 Phased Array Weld Inspection with Linear Probe and S-Scan

10.1.1 Objective

This example demonstrates the workflow for performing a phased array weld inspection using a linear array probe and a sectorial scan.

10.1.2 Workflow

Configure the part geometry and weld profile for the inspection. The part and weld details should match the component being inspected and provide the correct visual reference for beam coverage and indication location.

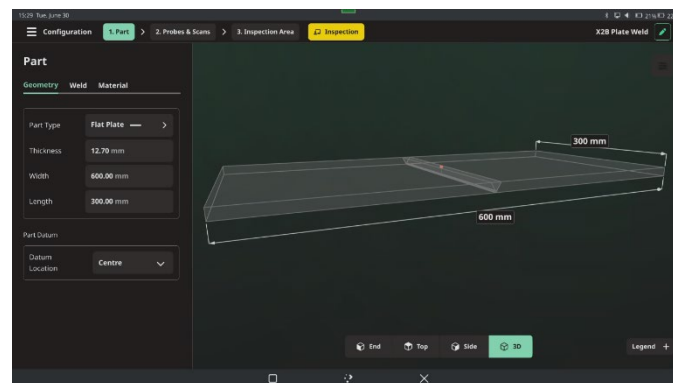


Figure 123 - Part Geometry Configured for the Weld Inspection

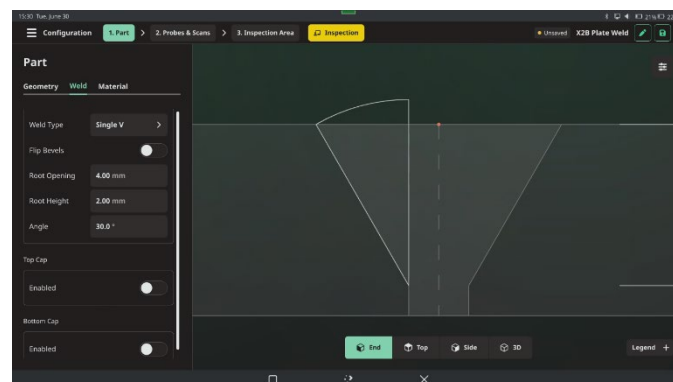


Figure 124 - Weld Profile Configured for the Inspection

Add the probe and wedge assembly. If the required probe or wedge is not available in the library, create it using the **Toolbox** before continuing.

Set the probe location for the inspection by confirming the **index offset**, **scan offset**, and **skew angle**.

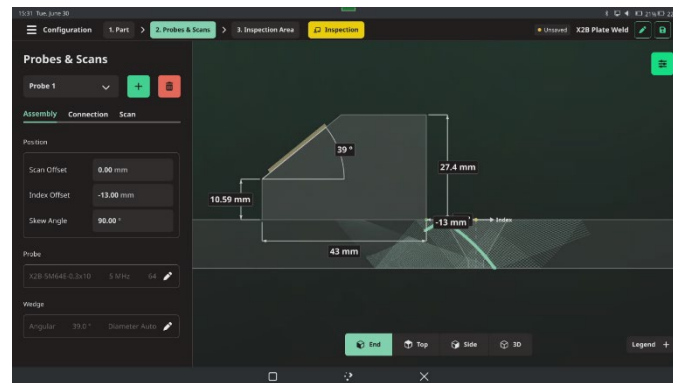


Figure 125 - Linear Array Probe and Wedge Assembly Configured with the Required Probe Position and Orientation

Add a sectorial scan and configure the scan parameters for the application. The scan range, angle range and resolution should provide adequate coverage of the weld volume required by the inspection procedure.

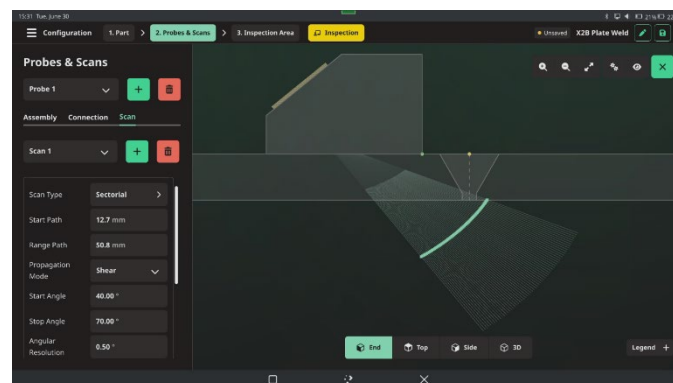


Figure 126 - Sectorial Scan Configured for the Inspection

Configure the inspection area. Verify that the probe position, scan direction, and beam coverage are appropriate for the weld being inspected.

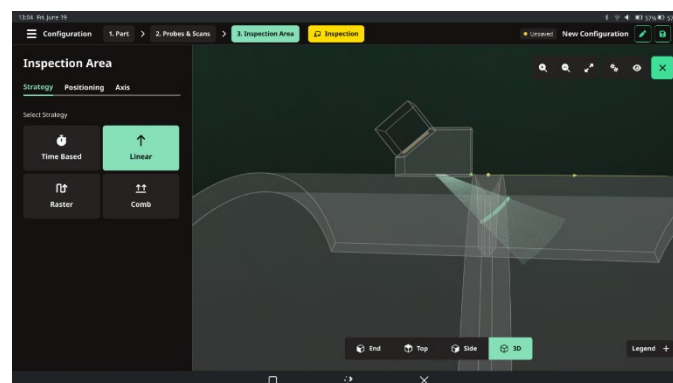


Figure 127 - Inspection Strategy Configured for the Weld

Open the **Inspection** workspace and configure the layout by dragging the required views into the desired display areas. Select views that support the inspection workflow, such as the S-Scan, A-Scan, Top View, and Side View. The layout should provide enough information to monitor the live ultrasonic response and confirm encoded scan coverage during acquisition.

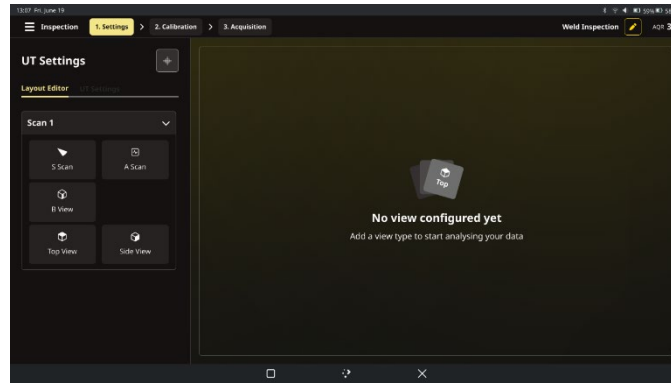


Figure 128 - Layout Editor Before Inspection Views Have Been Added

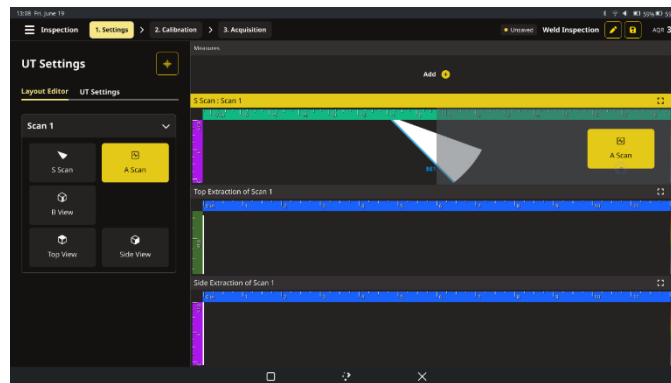


Figure 129 - Drag Desired View into Layout Editor; View Will Reorganize Layout Accordingly

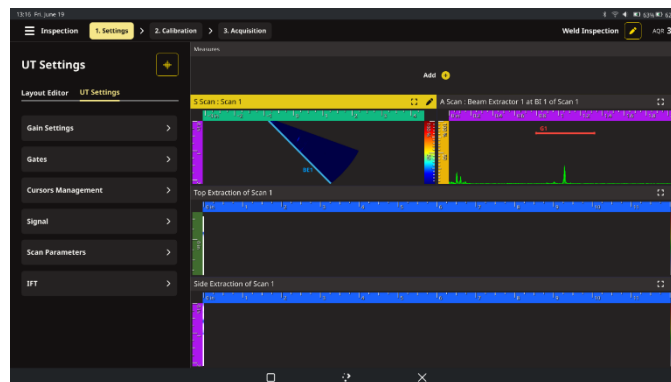


Figure 130 - Inspection Layout Configured with the Required Views Open the **Settings** tab and verify the inspection settings before acquisition. Typical settings include gain, signal processing, scan parameters, gates, and measurements. These settings should be appropriate for the inspection procedure and the type of data being collected.

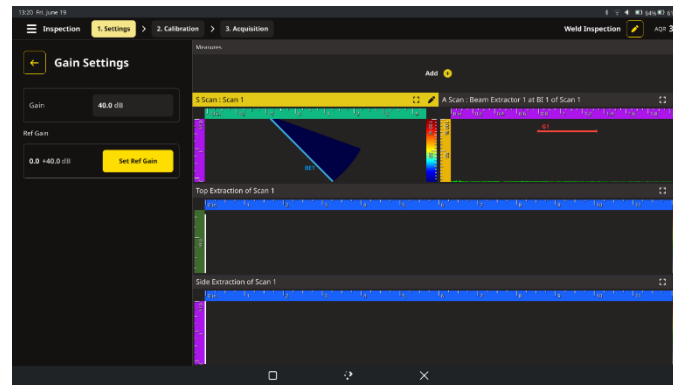


Figure 131 - Gain Settings Configured for the Inspection

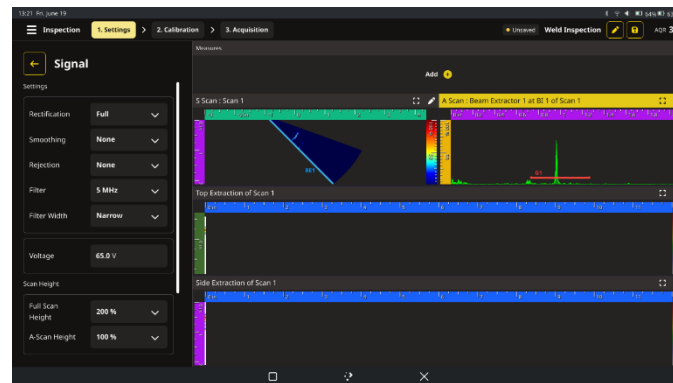


Figure 132 - Signal Settings Configured for the Inspection

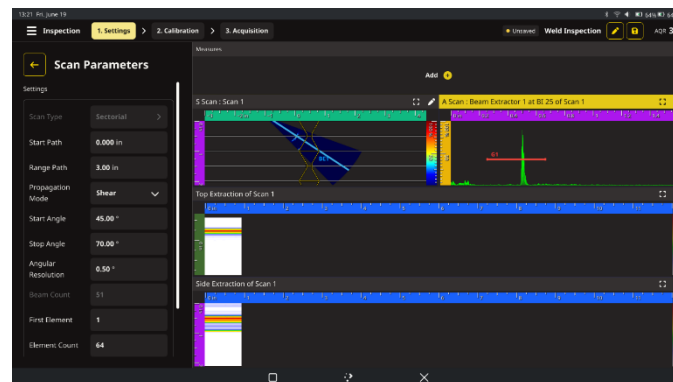


Figure 133 - Sectorial Scan Parameters Configured for the Inspection

Configure the inspection gate so that it covers the region of interest. The gate should be positioned to capture relevant responses from the weld volume without including unnecessary noise or geometry where possible.

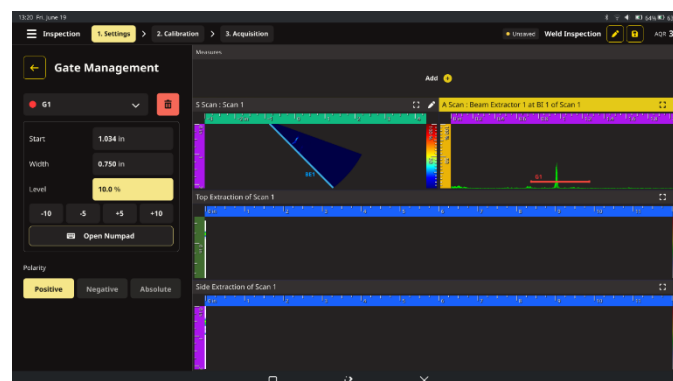


Figure 134 - Gate Configured for the Weld Inspection

Configure the required measurements. Common weld inspection measurements include amplitude, depth, surface distance, sound path, and other values required for indication location or evaluation.

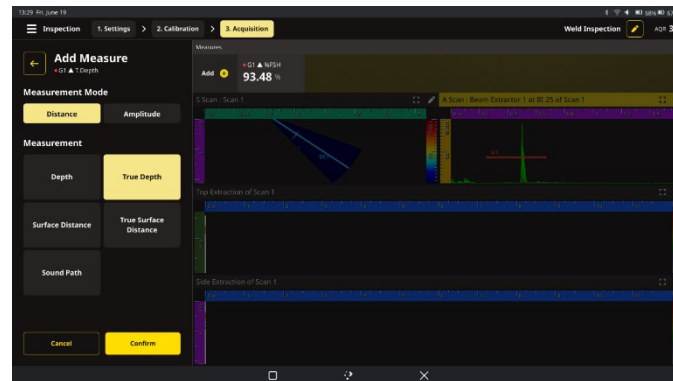


Figure 135 - Measurement Configuration for Indication Location and Sizing

Note: The layout, gates, and measurement displays are used to support live monitoring during acquisition. Recorded inspection data can be reviewed later in the **Analysis** workspace, where views, gates, cursors, and measurements may be adjusted as required for evaluation.

Open the **Calibrations** tab and verify that all required calibrations have been completed before beginning acquisition. Typical calibrations include velocity, wedge angle, wedge delay, sensitivity, and TCG when required.

Refer to **Section 10.1 – Calibration Workflows** for detailed calibration guidance.

Open the **Acquisition** tab. Position the probe at the start of the weld and verify that the encoder position has been zeroed before beginning the scan. Confirm adequate coupling and verify that the live S-Scan and A-Scan responses are stable.

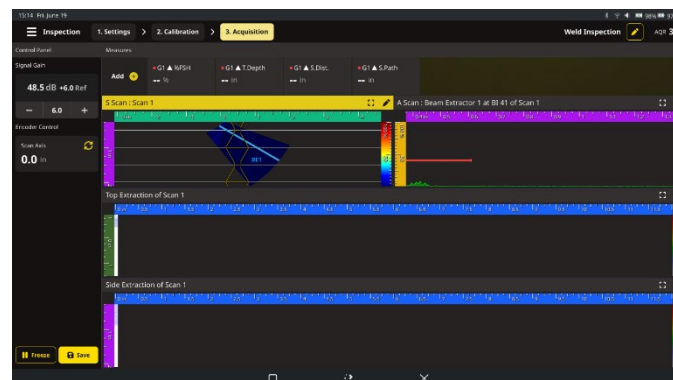


Figure 136 - Acquisition Page Ready Before Scanning

Begin scanning along the weld while maintaining consistent probe pressure, couplant coverage, and encoder movement. Monitor the S-Scan, A-Scan, Top View, and Side View during acquisition. As encoded data is collected, the Top View and Side View populate to show scan coverage along the inspection length.

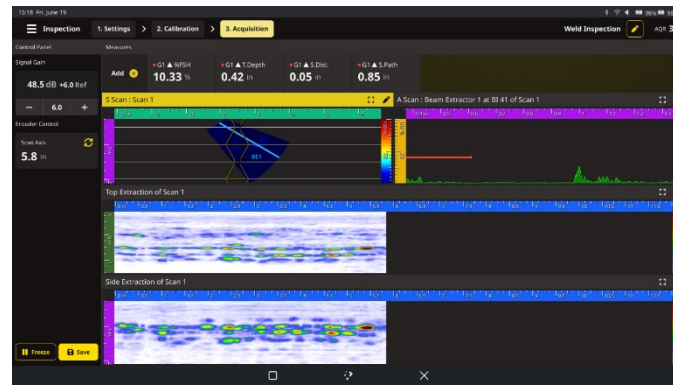


Figure 137 - Inspection in Progress with Encoded Data Collection

Continue scanning until the required inspection length has been completed. If an indication is observed during acquisition, confirm that the response is captured by the gate and that the selected measurements update as expected.

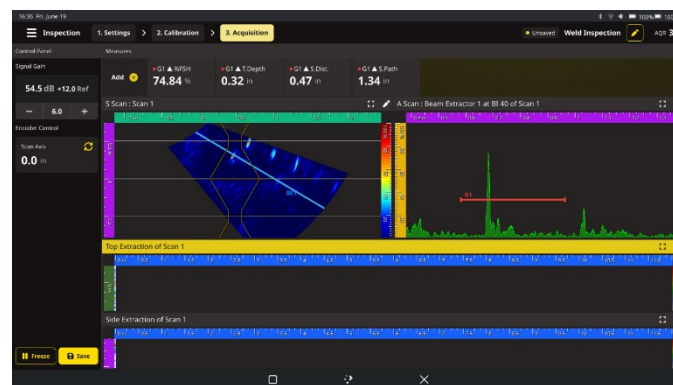


Figure 138 - **Example Indication Displayed in the S-Scan During Acquisition**

When the scan is complete, freeze the acquisition if required and review the recorded data for coverage before saving.

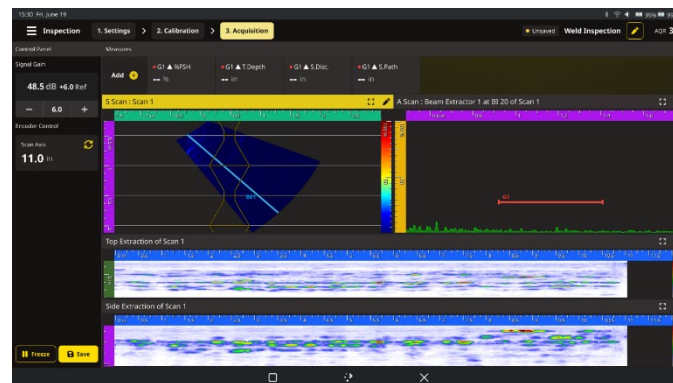


Figure 139 - Completed Encoded Inspection Data

Save the scan using a file name that identifies the inspection or component. The saved data can then be opened in the **Analysis** workspace for detailed review, evaluation, and reporting.

10.1.3 Verification

Verify the following before proceeding to analysis:

- The scan file was saved successfully.
- The required scan length was completed.
- Encoded data appears continuous and representative of the inspection area.
- No missed steps, gaps, or data discontinuities are visible that would prevent acceptance of the scan.

- Coupling was maintained sufficiently throughout the scan.
- Indications or areas of interest are visible in the recorded data for further review.

The completed scan is now ready for review and evaluation in the **Analysis** workspace.

10.2 Phased Array C-Scan Inspection with Wheel Probe and L-Scan and IFT Gate

10.2.1 Objective

This example demonstrates a corrosion mapping workflow using a wheel probe, L-Scan, C-Scan, B-View, encoded scan axis, and stepped index axis.

The workflow is intended to show the practical sequence used to configure the setup, prepare the inspection layout, acquire encoded scan strips, advance the index position, and save the completed data file. Evaluation and reporting should be performed later in the **Analysis** workspace.

10.2.2 Workflow

Configure the part geometry and material for the inspection. The part settings define the inspection surface and inspection area size. The material settings define the sound velocity used by the instrument for thickness and depth calculations.

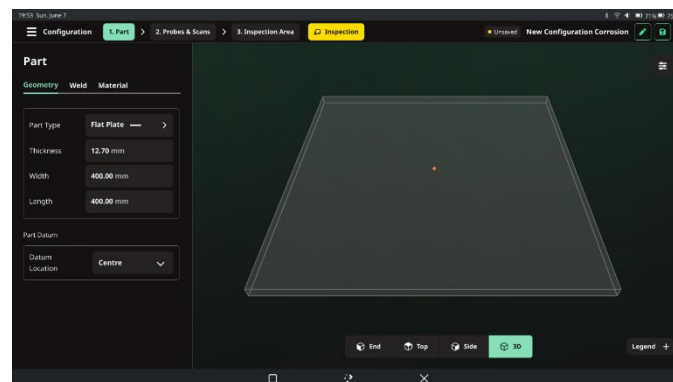


Figure 140 - Part Geometry Configured for the Corrosion Scan

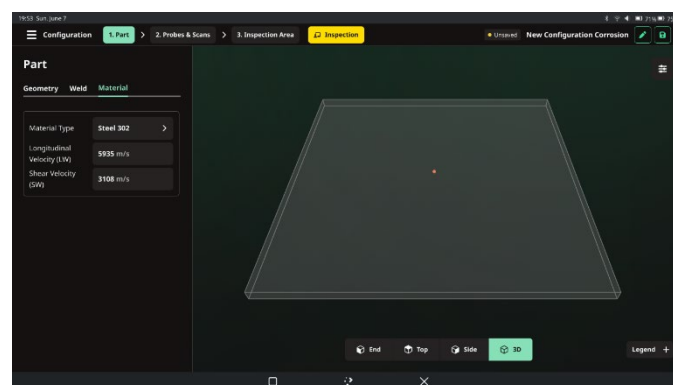


Figure 141 - Material Velocity Configured for the Inspection

Add the wheel probe and confirm the probe, wedge, scan offset, index offset, and skew angle are appropriate for the inspection setup. These values define where the probe is positioned relative to the part and how scan data will be placed in the encoded inspection area.

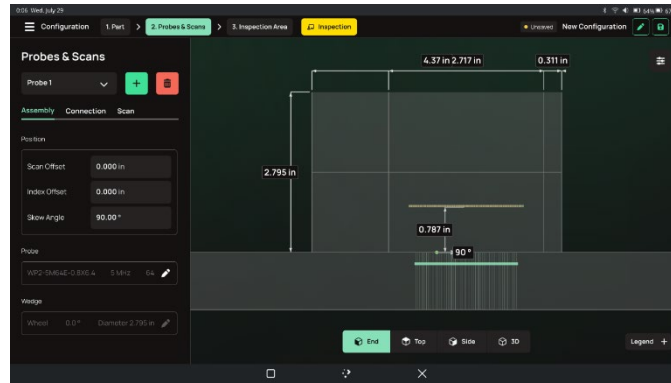


Figure 142 - Wheel Probe Assembly and Probe Position Configured for the Inspection

Configure the inspection area strategy. For corrosion mapping, a comb or raster-style strategy may be used to define repeated scan strips across the inspection area.

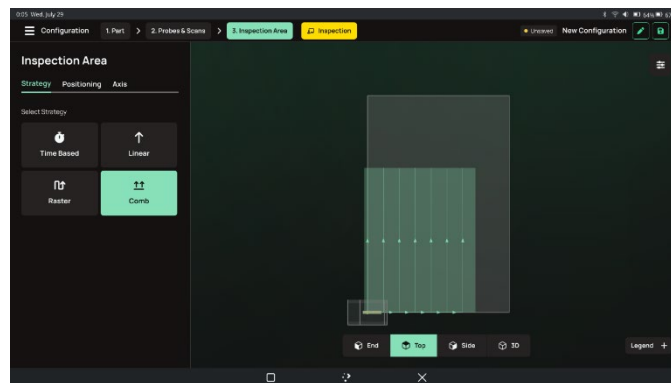


Figure 143 - Comb Inspection Strategy Selected for the Corrosion Scan

Configure the scan axis. The scan axis is the encoded direction of travel during each individual scan strip. The axis settings should match the encoder direction, scan length, and encoder resolution used for the inspection.

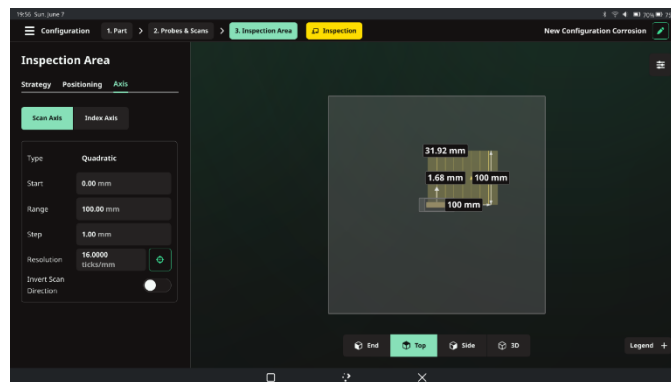


Figure 144 - Scan Axis Configured for Encoded Wheel Probe Movement

Configure the index axis. The index axis defines how the probe is moved between scan strips. The index step should provide the required coverage and overlap between adjacent strips. The step may be entered directly or calculated automatically by entering the required overlap as a length or percentage.

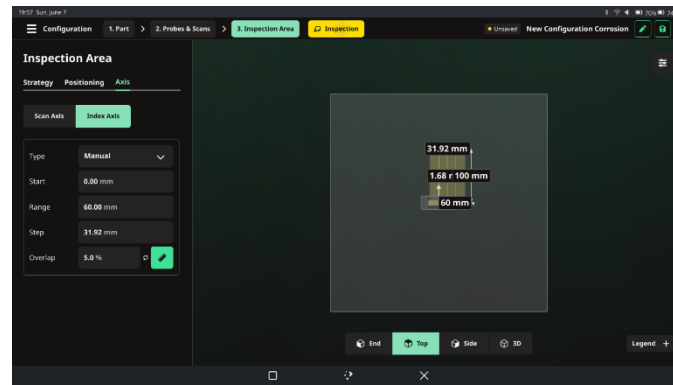


Figure 145 - Index Axis Configured with Scan-Strip Spacing and Overlap for the Corrosion Scan

Open the **Inspection** workspace and configure the layout by dragging the desired views into the layout where they are needed. A typical corrosion scan layout may include an L-Scan, A-Scan, C-Scan, and B-View. The layout is used to monitor acquisition, but the recorded data can still be reviewed and adjusted later in the **Analysis** workspace.

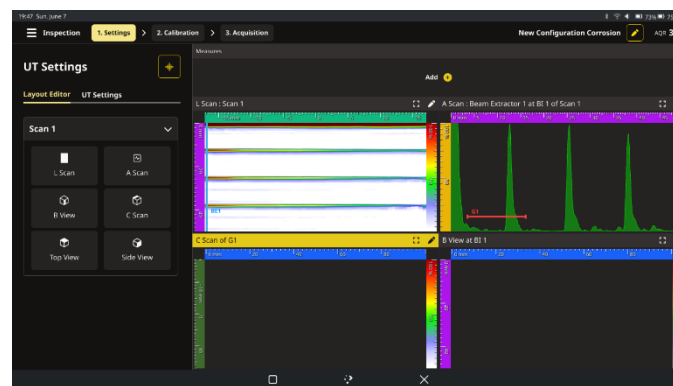


Figure 146 - Inspection Layout Configured with L-Scan, A-Scan, C-Scan, and B-View

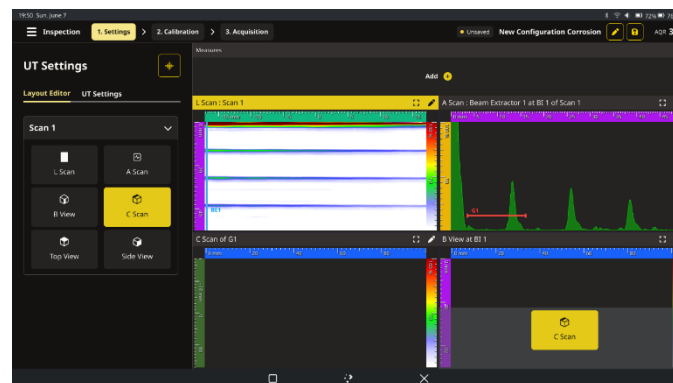


Figure 147 - Adding a C-Scan View to Existing layout

Add the measurement values required for acquisition monitoring. For corrosion scanning, a depth or thickness-related measurement is commonly displayed so the operator can monitor the gated response during acquisition.

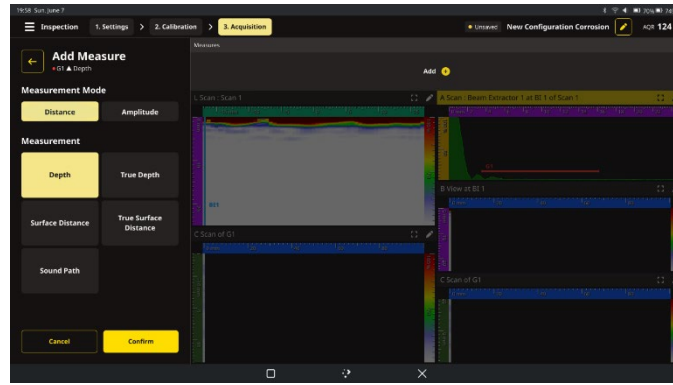


Figure 148 - Depth Measurement Added for Corrosion Scan Monitoring

Enable the IFT gate and set the gate position, width, level, trigger, and active status as required for the inspection. The IFT gate is used to track the selected interface or response used for the C-Scan and measurement output.

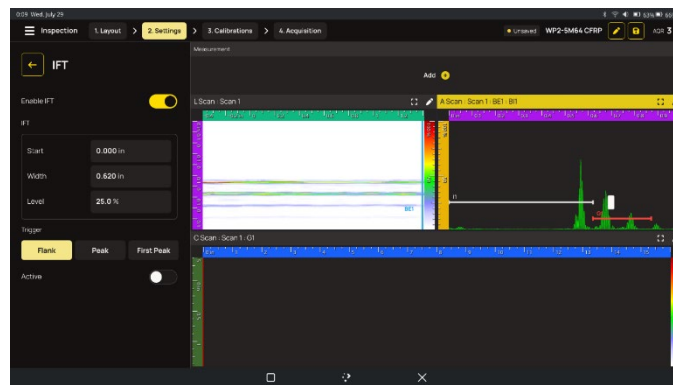


Figure 149 - IFT Gate Enabled and Configured for the Corrosion Scan

Set the reference gain as required by the inspection setup. Reference gain establishes the gain condition used during acquisition and helps maintain a consistent basis for the recorded scan data.

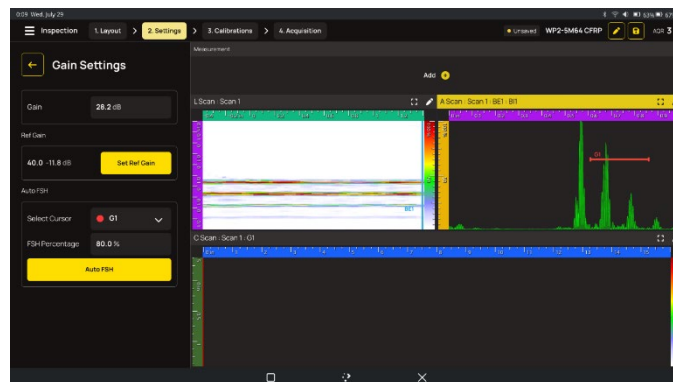


Figure 150 - Reference Gain Configured for the Corrosion Scan

Open the **Calibration** dashboard and confirm the required calibrations have been completed before acquisition. For this workflow, this may include velocity, encoder calibration, element check, sensitivity, TCG, or other calibrations required by the procedure and setup. Refer to **Section 10.1 – Calibration Workflows** for detailed calibration guidance.

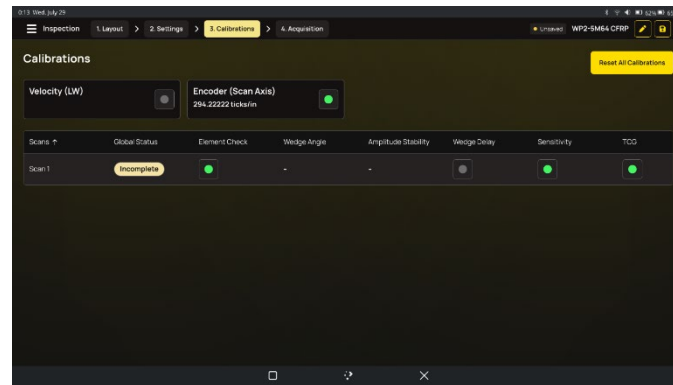


Figure 151 - Calibration Dashboard Showing Completed Calibration Status

Configure the C-View display. The C-View may be displayed by amplitude or depth depending on the purpose of the scan. For corrosion mapping, depth or thickness-based display is commonly used to show material loss or thickness variation. Palette selection, palette direction, ruler position, palette range, and multi-strip display may be adjusted from the C-View settings.

Multi-strip display can show accumulated scan strips together, while single-strip display can be used to focus on the current scan strip.

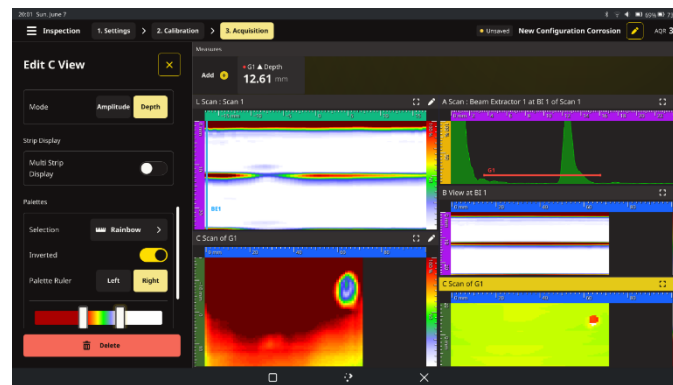


Figure 152 - C-View Settings Configured for Display Mode, Palette, and Multi-Strip Display

Reset the encoder positions before beginning acquisition. Confirm that the scan axis and index axis positions correspond to the intended starting location.

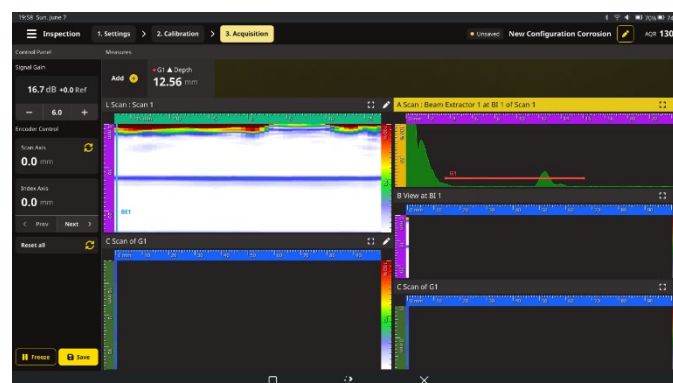


Figure 153 - Encoder Positions Reset at the Start of Acquisition

Start the first scan strip and move the wheel probe along the scan axis. Monitor coupling, scan progression, and the C-Scan/B-View response during acquisition.

At the end of the scan strip, stop the scan and advance the index position to the next strip. The index step moves the probe to the next scan position, so the next strip is placed correctly within the inspection area.

Continue acquiring scan strips until the required inspection area has been covered. During acquisition, monitor the C-Scan for gaps, missed strips, or uneven coverage. If the recorded data does not confirm the required coverage, reacquire the affected area as required by the inspection procedure.

When the scan is complete, stop acquisition and save the inspection file.

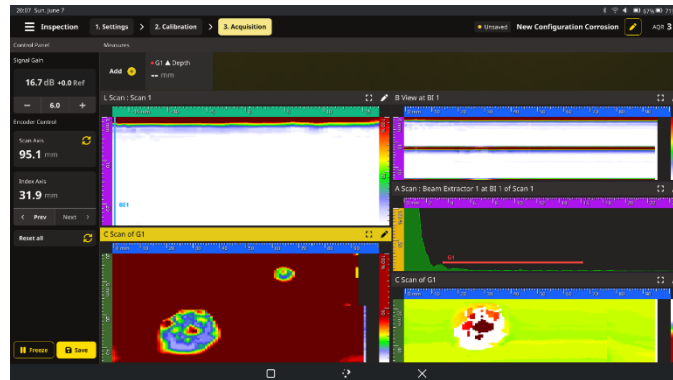


Figure 154 - Completed Corrosion Scan Ready to Be Saved

10.2.3 Verification

After acquisition, confirm the recorded scan data is ready for analysis.

Verify that the required scan length and index coverage were captured. Review the C-Scan and supporting views for missed strips, gaps, or areas where coupling was not maintained.

Confirm that the scan axis and index axis data were recorded as expected. The encoded data should represent the intended scan direction and strip spacing.

Confirm that the required measurement and C-View data were recorded. Display settings, measurements, gates, and palettes may be adjusted later in the **Analysis** workspace, but the required data must be present in the saved file.

Confirm that the inspection file was saved successfully.

The completed corrosion scan is now ready for review and evaluation in the **Analysis** workspace.

10.3 FMC TFM Weld Inspection

10.3.1 Objective

This example demonstrates the workflow for performing a weld inspection using FMC acquisition and TFM imaging.

10.3.2 Workflow

Configure the part geometry and weld profile for the inspection. The part and weld details should match the component being inspected and provide the correct visual reference for the TFM imaging area and indication location.

Add the probe and wedge assembly. If the required probe or wedge is not available in the library, create it using the **Toolbox** before continuing.

Add a TFM scan and configure the TFM imaging area for the application. The imaging area should cover the weld volume or region of interest required by the inspection procedure.

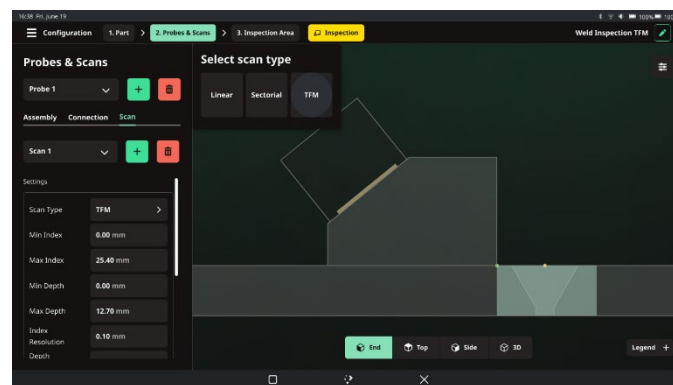


Figure 155 - TFM Scan Type Selected for the Weld Inspection

Configure the TFM scan settings. Typical settings include the index range, depth range, image resolution, element start, element count, sensitivity level, TFMi operation, and propagation mode.

The selected imaging area and propagation mode should be appropriate for the expected reflector orientation and inspection objective.

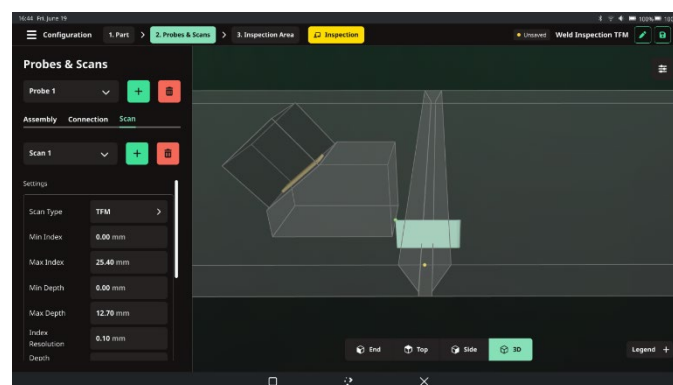


Figure 156 - TFM Scan Area Configured for the Weld Inspection

Select the propagation mode required for the inspection. Multiple propagation modes may be configured by adding separate TFM scans or by enabling TFMi when supported by the inspection configuration. Separate TFM scans allow each propagation mode to be displayed independently. TFMi combines multiple modes into a single image to simplify viewing when multiple propagation paths are required.

When TFMi is enabled, select the TFMi operation required for the inspection. **Keep Max.** displays the highest amplitude response from the available modes at each image location. **Product** emphasizes areas where multiple modes produce a response at the same location. The selected operation should match the inspection objective and applicable procedure.

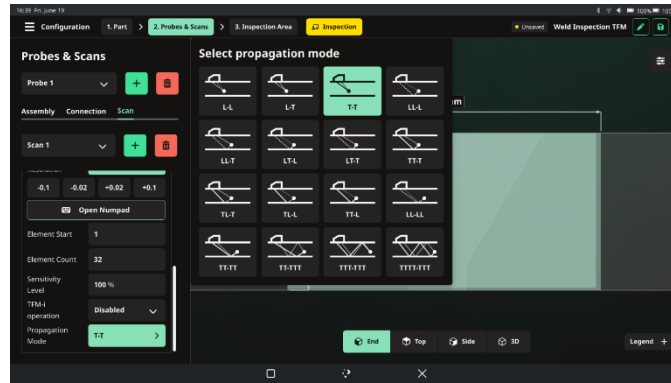


Figure 157 - Propagation Mode Selected for TFM Imaging

Configure the inspection area. Verify that the probe position, scan direction, TFM imaging area, and weld overlay are appropriate for the weld being inspected.

Open the **Inspection** workspace and configure the layout. A typical TFM weld inspection layout may include one or more TFM Scan views and a supporting Side View or Top View. When multiple propagation modes are used, displaying multiple TFM Scan views can help the operator monitor the response from each mode during acquisition.

Open the **Settings** tab and verify the inspection settings before acquisition. Typical settings include gain, signal processing, scan parameters, gates, and measurements. These settings should support live monitoring during acquisition.

Saved data can be reviewed later in the **Analysis** workspace, where views, gates, cursors, and measurements may be adjusted as required for evaluation.

Open the **Calibrations** tab and verify that all required calibrations have been completed before beginning acquisition. Calibration requirements depend on the inspection procedure and configuration.

Refer to **Section 10.1 – Calibration Workflows** for detailed calibration guidance.

Open the **Acquisition** tab. Position the probe at the start of the weld and verify that the encoder position has been zeroed before beginning the scan. Confirm adequate coupling and verify that the live TFM or TFMi views are stable.

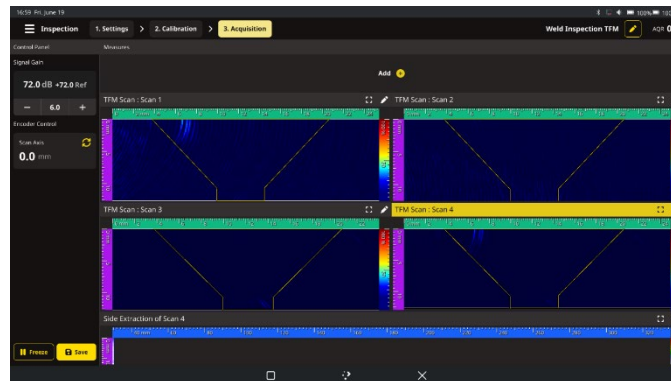


Figure 158 - Acquisition Page Ready Before Scanning

Begin scanning along the weld while maintaining consistent probe pressure, couplant coverage, and encoder movement. Monitor the TFM or TFMi views during acquisition. As encoded data is collected, the encoded view populates to show scan coverage along the inspection length.

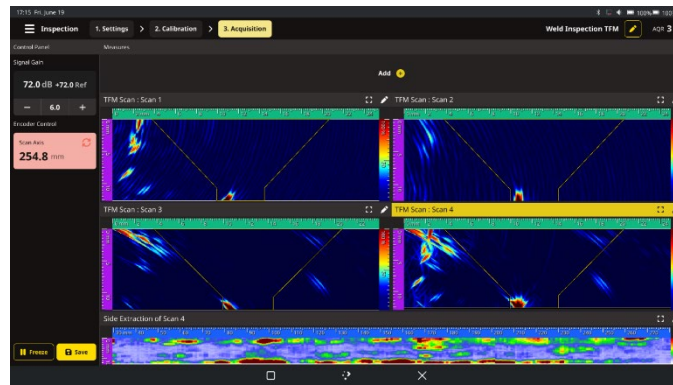


Figure 159 - TFM Weld Inspection in Progress

During encoded acquisition, monitor the encoded views for missed steps, gaps, or uneven scan progression. A missed step may appear as a break, skipped position, or discontinuity in the encoded data. If this occurs, verify whether the affected area has been adequately covered before accepting the scan. Acceptance of incomplete or corrected scan data should be based on the applicable inspection procedure.

Not all propagation modes will produce a response from every indication. The displayed response depends on indication position, orientation, geometry, and the selected sound path. During acquisition, monitor the applicable TFM or TFMi views for the modes required by the inspection procedure.

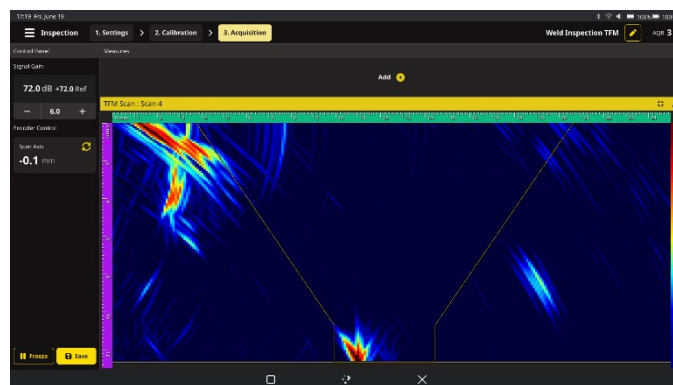


Figure 160 - Example Indication Displayed in a TFM Scan View

When multiple TFM or TFMi views are used, monitor the required views during acquisition to confirm that usable data is being recorded. Detailed comparison and interpretation should be performed in the **Analysis** workspace after acquisition.

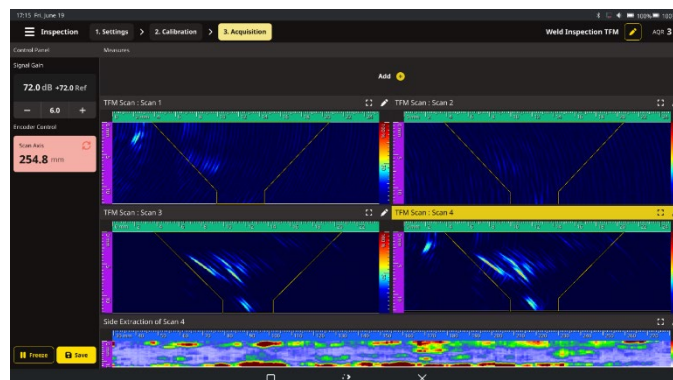


Figure 161 - Example Indication Displayed Across Multiple TFM Views

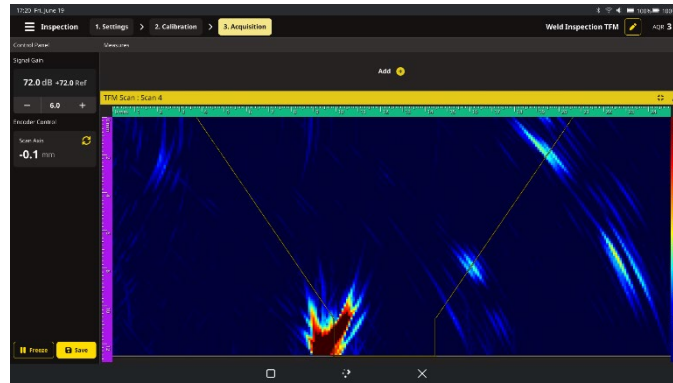


Figure 162 - Example Indication Displayed Using TFMi

When the scan is complete, freeze the acquisition if required and review the recorded data for coverage before saving.

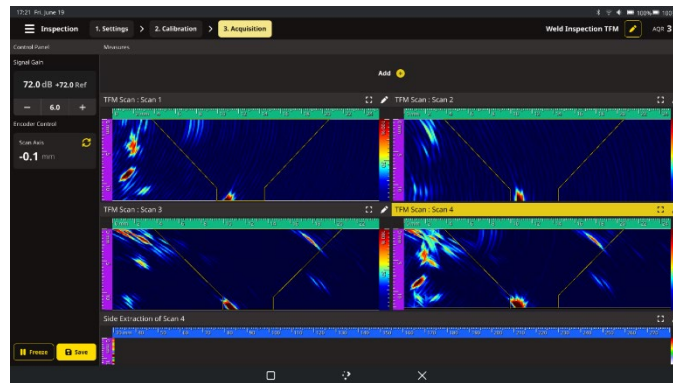


Figure 163 - Completed Encoded TFM Inspection Data

Save the scan using a file name that identifies the inspection or component. The saved data can then be opened in the **Analysis** workspace for detailed review, evaluation, and reporting.

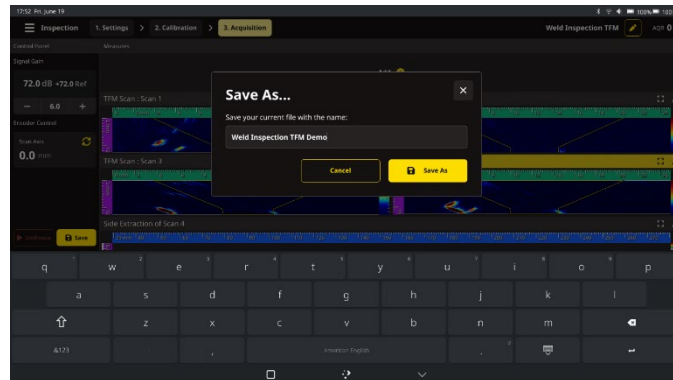


Figure 164 - Saving the Completed TFM Inspection

10.3.3 Verification

Verify the following before proceeding to analysis:

- The scan file was saved successfully.
- The required scan length was completed.
- Encoded data appears continuous and representative of the inspection area.
- No missed steps, gaps, or data discontinuities are visible that would prevent acceptance of the scan.

- Coupling was maintained sufficiently throughout the scan.
- The TFM or TFMi views contain usable data for the required inspection region.
- Indications or areas of interest are visible in the recorded data for further review.

The completed scan is now ready for review and evaluation in the **Analysis** workspace.

11 Product Specifications

GENERAL	PHASED ARRAY (64:128 PR)	UT-TOFD (2PR)	FMC-TFM (128 Elements)
Multi-scan Quantity	Up to 10 PA scans	Up to 8 UT Up to 4 TOFD/Pitch and Catch	Up to 8 TFM scans Up to 8 TFMi, with up to 4 modes each
Pulsers/Receivers	64:128PR (Option 32:128PR)	0, 6 or 8 (Depends on mini-docking options)	Up to 128 elements probe
PA-UT Mini-docks [1 PA] ; [2 PA] ; [1 PA + 8 UT] ; [2 PA + 6 UT]	Via 1 or 2 I-PEX depending on the module dock	0, 6 or 8	Via 1 or 2 I-PEX
Gain Range	80dB	80dB	80 dB
Sampling Frequency	Up to 250 MHz FPGA @ 16-Bit (16-Bit processing with max. dynamic FSH 100 to 3200% - Inspection app max.)		
System Bandwidth	0.2 to 24 MHz	0.2 to 23 MHz	0.2 to 24 MHz
Max Pulse Rate Frequency	50 000 Hz	50 000 Hz	50 000 Hz
Pulse Voltage	Bipolar from ± 25 to $\pm 90V$ (up to 180 V peak to peak)	Bipolar from ± 25 to $\pm 90V$ (up to 180 V peak to peak)	Bipolar from ± 25 to $\pm 90V$ (up to 180 V peak to peak)
Focusing Mode	Natural or Constant Depth/Path/Offset/Resolution	N/A	Up to 128 Elem. TFM & product and keep max TFMi™ methods
Resolution	Up to 0.01°	N/A	4 Megapixels* *(Maximum number of Pixel)
L-Scan Resolution	1 element, double resolution, or custom element steps	N/A	TFM and TFMi resolution up to 0.1mm
Max. PA Beams	PA or TFM focal laws up to 16 384 beams	N/A	FMC -> TFM: 2048 pixel ² PWL: Later included PCI: Later included
Measurement tools	EXTRACTION BOX, 4 gates/ A-Scan, TCG, DAC, Cartesian cursors, Indication table	4 gates/A-Scan, TCG, DAC, Indication table	EXTRACTION BOX and all the standard PA tools, Cartesian cursors, Indication table
General Phased Array		General FMC/TFM Technique	
Max Points per A-Scan	Up to 16 384 points per A-Scan	Propagation mode	16 TFM algorithms, up to 4 modes per TFMi™
Data Storage & File Size	500 GB SSD PCIe Gen 3x4 No file size limits	Fast TFM	Sparse matrix Capture (SMC) and hardware accelerated
Ultrasound Ray Tracing	PA-TFM Compatible with all geometries	Envelope/TFM	Hilbert Smoothing (default)
Advanced Focal Law Calculator	Sectorial Pulse-Echo, Sectorial Pitch & Catch, Linear Pulse-Echo, Linear Pitch & Catch, Curve surface solution.	TFM Calibration Wizard	Velocity, Time Corrected Gain, Amplitude Fidelity – Coming soon

All above specifications subject to change without notice

Table 43 - Product Specifications

OPERATING SYSTEM			
Onboard Reporting Tools	Export C-Scan data to CSV file Save Screenshots Anytime Save Audio File Indication table export to CSV	Multi-task File Browser	Ability to load and read: • PDF • Images files (jpeg, png, gif) • Audio files
Onboard Scan Plan Tools	Onboard 3D live rendering on flat welds, curved and pipelines, T-joints, corners joints	Calibration Standards	ISO18563-1
Integrated Online Help	Embedded manual and quick start guide	Remote Control	Powered by RDP
USER INTERFACE & PORTS	PHASED ARRAY (64:128 PR)	UT-TOFD	
Mini-dock PA and UT Connectors' options	IX 128 channels		Dual IX 64-64 channels
	IX 128 channels + 8x Lemo 00		Dual IX 64-64 channels + 6x Lemo 00
Instrument Display	11.56" Diagonal 1920 x 1080 LED Backlight Screen, Projective Capacitive Touch Panel Anti-glare replaceable film, Hardness of cover surface 6H Duplicated and extended display		
Encoder Ports	3 axes (16-pin LEMO 1K)		
GPIO Port (TTL)	Start, Stop, Index, Reset, Alarm(s), Trigger, LEMO 1K)		
Communication Ports	Wi-Fi 6 – (802.11ax 2.4 GHz and 5 GHz) 2 USB-C with Power Delivery and DisplayPort Alternate Mode Multiport adapter included (HDMI, Ethernet, USB)		
Remote Display Ports	Wi-Fi, Ethernet, HDMI or USB-C screen		
Data Transfer Ports	Wi-Fi, Ethernet or USB-C Drive (FAT32, NTFS, ext3 and ext4 formats)		
OPERATING TIME, ENCLOSURE & ENVIRONMENTAL			
Operating Temperature	- 10°C to 45°C (14°F to 113°F) ; storage -20°C to 60°C (-4°F to 140°F) without batteries		
Operating Time	5.2h (2x 99.4Wh swappable batteries) using ISO18563-1:2022, section 8.2 standard setup parameters		
Power Input	AC 110V/240V @ 50Hz/60Hz to USB-C 100W at 20V/5A		
Power Output (USB-C)	5V/1.5A (7.5W per port, total 15 W)		
Unit Dimensions	380 mm x 240 mm x 105 mm (15 x 9.45 x 4.10 inches)		
Weight	5.2 kg (11.5 lb) with batteries, 0.46kg (1 lb)/battery)		
Environmental Rating	IP65 certified Vibration Tested: MIL-STD 810H Method 514.8 Cat.4		
Safety and Cybersecurity	Compliant with EN 18031-1 cybersecurity requirements under the Radio Equipment Directive (RED) 2014/53/EU		

All above specifications subject to change without notice

Table 44 - Product Specifications Continued

12 Troubleshooting and Support

General System Error:

When the XEO system stops working, the user may get this warning message. Restarting UTLab is the only way to recover from it.

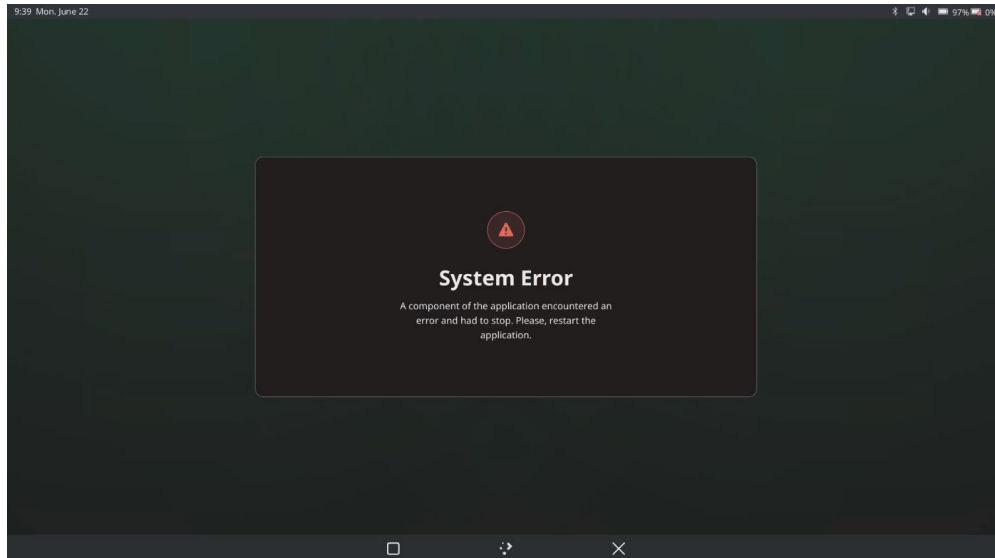


Figure 165 - General System Error

Remote Desktop issue: Copy and paste might not work properly in the connected PC to XEO. Please check the RDP preferences and disable them.

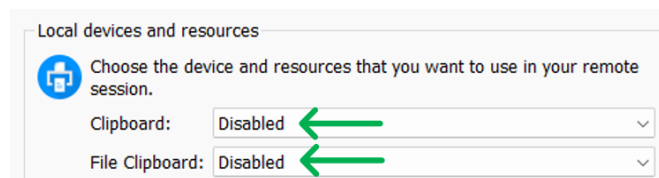


Figure 166 - Example of RDP Preferences to Disable

Remote Desktop usual troubleshooting:

- Use a PC client software, not a server version
- Username is not blank; it is **kde**.
- Password is 147147.

Power Supply: If the batteries are not charging while plugging a USB-C power supply, check if it is a true 20 Volts 5 Amps power delivery. Sonatest recommends using the official power supply part number: **XEO-ACC-007**.

Updates:

The instrument may be in a state where updates cannot be completed successfully. Updates may fail multiple times. If the automated update process stops working, please install the software manually using the .mender file.

Never interrupt the update process during the downloading step.

Check Section 4.2.2 for more information.

13 XEO Regulatory Information and Approvals

13.1 EU (RED Compliance)

European Union Compliance

This equipment complies with the essential requirements and other relevant provisions of Directive 2014/53/EU (Radio Equipment Directive).

The following harmonized standards have been applied:

Safety:

- EN IEC 61010-1:2010 + A1:2019 – Safety requirements for electrical equipment for measurement, control and laboratory use [TO COMPLETE]

EMC:

- EN IEC 61326-1:2021 – EMC requirements for electrical equipment for measurement, control and laboratory use

- ETSI EN 301 489-17 V3.3.1 (2024-09) – EMC standard for radio equipment

Radio:

- ETSI EN 300 328 V2.2.2 (2019-07) – Wideband transmission systems operating in the 2.4 GHz ISM band

- ETSI EN 301 893 V2.2.1 (2024-11) – 5 GHz RLAN; harmonized standard covering essential requirements of article 3.2 of RED

RF Exposure:

- EN 62311:2008 – Assessment of electronic and electrical equipment related to human exposure to electromagnetic fields [MPE calculation TO COMPLETE]

Power Quality:

- EN IEC 61000-3-2:2019 + A2:2024 – Limits for harmonic current emissions (Class A equipment)

- EN IEC 61000-3-3:2013 + A2:2021 – Limitation of voltage changes, voltage fluctuations and flicker

Cybersecurity:

- EN 18031-1:2024 – Common security requirements for radio equipment [TO COMPLETE]

This equipment is designed to support the cybersecurity requirements of EN 18031-1:2024 under the Radio Equipment Directive (RED) 2014/53/EU.

A copy of the EU Declaration of Conformity is available at:

[URL]

13.2 EU Class A Warning

EMC Warning

This is a Class A product. In a residential environment this product may cause radio interference, in which case the user may be required to take adequate measures.

13.3 FCC Compliance (Class A + Radio)

FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15, Subpart B of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

Operation of this equipment in a residential area is likely to cause harmful interference.

This device contains transmitters operating under:

- 47 CFR Part 15 §15.247
- 47 CFR Part 15 §15.407

13.4 RF Exposure

RF Exposure Statement

This equipment complies with radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and the user.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter except as authorized.

13.5 Canada (ISED)

13.5.1 English

This device complies with ISED licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference.

Complies with:

- ICES-003 Issue 7 (Class A)
 - RSS-247 Issue 3
- CAN ICES-003 (A)/NMB-003 (A)

13.5.2 French

Le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables.

L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage;
- (2) l'utilisateur doit accepter tout brouillage.

Conforme aux normes suivantes :

- ICES-003, publication 7 (classe A)
- CNR-247, 3e édition

CAN ICES-003 (A)/NMB-003 (A)

13.6 GHz Restriction

5 GHz Band Usage

Operation in the 5150–5350 MHz band is restricted to indoor use only.

Radar systems are given priority and may cause interference to this device; in rare cases, strong radar signals could affect device operation.

13.7 Safety (61010-1)

This equipment has been evaluated in accordance with IEC/EN/CSA/UL 61010-1 safety standards.

To maintain compliance:

- Use the equipment only as specified.
- Do not modify the device.
- Ensure proper installation and use in accordance with the instructions provided.
- Use only certified accessories and power supplies.

13.8 Cybersecurity (EN 18031-1/RED)

This equipment is designed to support cybersecurity requirements under the Radio Equipment Directive (RED) 2014/53/EU.

Compliance has been assessed against EN 18031-1:2024.

This equipment incorporates cybersecurity measures including secure boot, controlled access, and secure software update mechanisms (OTA and offline), helping protect software integrity, data and network interfaces.

Development follows industry cybersecurity best practices and key principles of IEC 62443-4-1.

13.9 Cyber Resilience

This equipment has been developed with consideration of the cybersecurity objectives of the Cyber Resilience Act (CRA).

The manufacturer applies secure development and maintenance practices aimed at improving the product's resilience to cybersecurity risks throughout its lifecycle.

13.10 Environmental Protection (IP Rating)

The product has been tested in accordance with IEC 60529 and meets the requirements for ingress protection rating IP65.

IP65 indicates:

- Complete protection against dust ingress
- Protection against low-pressure water jets from any direction

This rating applies when the product is installed according to the instructions provided.

13.11 Mechanical and Environmental Robustness

The product has been tested for resistance to mechanical vibration in accordance with the following standards:

- MIL-STD-810G, Method 514.6, Category 4 (Terrestrial environments)
- MIL-STD-810H, Method 514.8, Category 7 (Aerial environments)

These tests demonstrate the robustness of the product under vibration conditions representative of ground and airborne transportation environments, including operation during exposure.

13.12 Ultrasound Standards

The system supports ultrasonic testing functionalities in accordance with the following standards, depending on the installed configuration and accessories:

- Phased Array (PA) operation: in accordance with ISO 18563-1:2022
- Conventional Ultrasonic Testing (UT): in accordance with ISO 22232-1:2020

UT functionality is available only when the system is used with mini-dock modules enabling UT operation.

The applicable standard compliance depends on the final system configuration used during operation.

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UK

Sonatest (HQ)
Dickens Road
Old Wolverton, Milton Keynes
MK12 5QQ
United Kingdom

t: +44 (0) 1908 316345

e: sales@sonatest.com

USA

Sonatest (North America)
12775 Cogburn
San Antonio, Texas
78249
United States

t: +1 (210) 697 0335

e: sales@sonatestinc.com



sonatest.com

