Wave

User Manual

Contents

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1 Introduction

1.1 What is Wave?

Wave is a new generation, smart flaw detector. It has been designed to simplify the work of technicians and engineers. It is based on simple, custom-made applications that can be tailored to meet the specific requirements of different inspection procedures.

Wave also brings new tools to make the interpretation of A-Scans easier. A scan plan and complete 2-D view can be used to represent the part being inspected. A smart ray tracer then displays the ultrasonic beam path travelling within the piece of material, precisely showing the echoes, echo amplitude and gate positions.

As well, Wave allows using all the main sizing methods, including DAC and DGS to name a few.

1.2 Application Concept

Applications are a subset of the **Default** application that is pre-installed on all shipped Wave units. The **Default** app allows access to all functionalities and features, and you have the flexibility of setting all parameters to any possible value.

Applications are easily created using the Wave Companion Software. Once created, these new apps are transferred and installed on a Wave unit. They are then immediately available to the Wave user.

A custom app will greatly simplify the instrument usage by building a much simplified environment. This allows streamlining your task, as well as lowering the risk of misusing the instrument.

2 Wave Carry Case

The Wave carry case includes:

- Wave instrument;
- Smart Li-on battery pack;
- AC/DC battery charger;
- Ethernet to USB-C adapter;
- Ethernet cable;
- Quick Start Guide booklet;
- Couplant bottle.

Figure 1 – Wave Transport Case

3 Wave Physical Characteristics

3.1 The Screen

The seven-inch screen of Wave occupies most of the front area of the instrument. It is made of glass, which makes it very easy to clean, and is protected on all sides with a rubberised contour.

Figure 2 – Wave with the touch screen, power button, and LED indicator

The unit does not present any physical button apart from the power button. Operating the unit is done using the integrated touch panel. Using the latest projective capacitive (P-CAP) technology, the touch panel allows multi-touch as well as drag and pinch gestures. Using working gloves is not a problem as the touchscreen controller has been programmed to adapt to different circumstances. Moreover, water or couplant will not interfere or affect the behaviour of finger detection.

3.2 The Power Button

The power button is used to turn the unit on. Once the unit is turned on, it is possible to double-click the power button and disable the touchscreen. A lock screen icon appears in the top right corner of the screen. Double-click the power button again to enable the touchscreen.

Figure 3 - Lock screen icon

NOTE: Disabling the touch screen can be useful for cleaning the screen.

IMPORTANT: To turn the unit off, you must use the on-screen power-off button appearing at the bottom right of the Home screen. See Section 4 for more details.

3.3 LED Behaviours

The LED light, next to the power button, provides information on Wave's status.

3.3.1 The Device Is Turned off

- If Wave is not connected to the power supply, which means it is not charging, the LED light is turned off.
- If Wave is connected to the power supply, which means the device is charging, the LED will blink.
- If Wave is connected to the power supply and it is fully charged, a solid green LED light is displayed.

3.3.2 The Device Is Booting

- During the booting phase, the LED will blink for 5 seconds until the **Home** screen appears.

3.4 The UT Connectors

The UT connectors are located on top of the unit. There is one TX/RX connector and one RX connector. They are identified directly on the casing. These UT connectors can be LEMO or BNC.

When using the instrument in pulse-echo mode, only the TX/RX output is used. For pitch and catch, both TX/RX and RX must be hooked up to the probe.

Figure 4 – Wave connectors and the expansion ports

3.4.1 The UT Connector Pinouts

The following tables describe the pinouts of the UT connectors. Figure 5 and Figure 6 illustrate the localisation of the pinouts in the Lemo connector and BNC.

Table 1 – TX/RX connector pinouts

Pin number	I/O	I/O type	Description
1	In/Out	Analogue	Ultrasound pulse transmitter/receiver
2	Out	Power	Ground

Table 2 – RX connector pinouts

Pin number	I/O	I/O type	Description
1	In/Out	Analogue	Ultrasound pulse receiver
2	Out	Power	Ground

Figure 5 – Lemo ultrasound connector pinouts
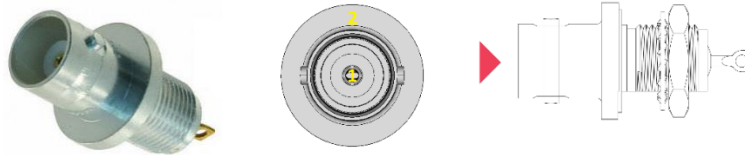
Figure 6 – BNC ultrasound connector pinouts

3.5 The GPIO Connector

An additional connector is present just beside the UT connectors. This is the GPIO connector for encoder inputs and digital outputs namely used for alarms.

NOTE: The UT and GPIO connectors, when not used, should always be hidden by their protective covers. Though these connectors are rugged and rated IP67, they can eventually become damaged by the accumulation of dirt, which may cause some contacts to fail.

3.5.1 GPIO Connector Pinout

The following table describes the pinouts of the GPIO connector. Figure 7 illustrates the localisation of these pinouts.

Table 3 – GPIO connector pinouts

Pin number	I/O	I/O type	Description
1	Out	Power	5V DC power supply (500 mA limit)
2	Out	Power	Ground
3	Out	TTL 5V	Alarm Output 1 / General Purpose Output 1
4	Out	TTL 5V	Alarm Output 2 / General Purpose Output 2
5	Out	TTL 5V	Alarm Output 3 / General Purpose Output 3
6	Out	TTL 5V	Alarm Output 4 / General Purpose Output 4
7	In	TTL 5V	Encoder 1 Phase A
8	In	TTL 5V	Encoder 1 Phase B
9	In	TTL 5V	Encoder 2 Phase A
10	In	TTL 5V	Encoder 2 Phase B
11	In	TTL 5V	External Trigger Input
12	In/Out	RS-485	Noninverting Receiver Input and Driver Output
13	In/Out	RS-485	Inverting Receiver Input and Driver Output
14	Out	Analogue	Proportional output
15	Out	Power	Ground
16	Out	Power	Ground

Figure 7 – GPIO connector pinouts

The following table presents information regarding the part number of the GPIO.

Table 4 – GPIO part number

Type	Part number	Description
Wave connector (Lemo)	HEG.1K.316.CLNP	K Series (1K), 16-pin, receptacle, centre key (G), watertight
Mating connector (Lemo)	FGG.1K.316.CLAC	K Series (1K), 16-pin, straight plug, centre key (G)

3.6 The Expansion Port

The expansion port is a Sonatest proprietary connection that will allow adding extra accessories. The protector cap over the expansion port must remain in place to protect the connector. It should only be removed when attaching an accessory.

3.7 The USB-C Connector

The USB-C connector can be found on the left side (front view) of the instrument. It is protected and lies behind a small door made of soft material.

Figure 8 – Wave from the left side

3.7.1 Charging Through USB-C

Wave's USB-C port is hence used to recharge the instrument's battery. The AC-DC power supply provided with the unit allows fast charging. Typically, a full recharge of a dead battery to 100% charge level will take just over 3 hours even if the unit is turned on during recharge.

USB-C hubs can be inserted between the power supply and the instrument, allowing extra connections (like being hooked-up to a wired network) at the same time as the instrument's battery is being recharged.

IMPORTANT: Sonatest recommends a few USB-C hubs. Please follow these recommendations as some manufacturers may not provide fully USB-C compliant devices. Go to Sonatest's website to view an updated list of these pre-tested hubs.

3.7.2 USB-C to Ethernet Adapter

The unit comes with a small USB-C to wired Ethernet adapter. This is used to connect your unit to your local network and allow you to exchange data between the instrument and a laptop computer, for example. For more information regarding the data transfers, including installing custom applications on your Wave unit, consult the "Wave Companion User Manual", where all information about creating custom apps as well as transferring them to a Wave unit is provided.

3.8 The Battery

Wave is powered by a 72 W/h battery, typically capable of providing 10 hours of continuous use. The battery compartment is located on the back of the unit, and it is accessible just behind the battery door. Note that to remove the battery, you have to pull on the battery tab that will push back the additional battery latch that secures the battery in order to prevent any disconnect in the event of a shock or a drop. Pulling on the tab will make the battery come out of its compartment.

Battery compartme

Figure 9 – Wave battery compartment door

NOTE: Always turn off the instrument before removing the battery. Doing differently may cause undesirable effects.

3.8.1 Battery Icon

The battery icon changes colour depending on the charge level of the device. In addition, if the device is at10% or less, it is recommended to save the configuration, turn off the device and replace the battery.

Figure 10 – Battery icon

3.9 The Unit's Stand

At the back of the Wave instrument, there is a stand providing a full 180º of adjustment, without any position limitation in between 0º and 180º. The stand, when fully extended, can serve as a handle to carry the unit. The anti-skid material of both the handle and around the instrument makes it easy to find a sturdy way to have the unit lay on pretty much any surface.

4 Powering Up and Shutting Down

The instrument is powered up by pressing the power-on button located at the bottom, just under the display.

Power button

Figure 11 – How to power up the Wave

4.1 Shutting Down the Unit

Shut down the unit from the **Home** screen. By pressing the red **On/Off** button, you will be presented with a confirmation screen where you can select between **Shutdown**, **Reboot**, or **Cancel**.
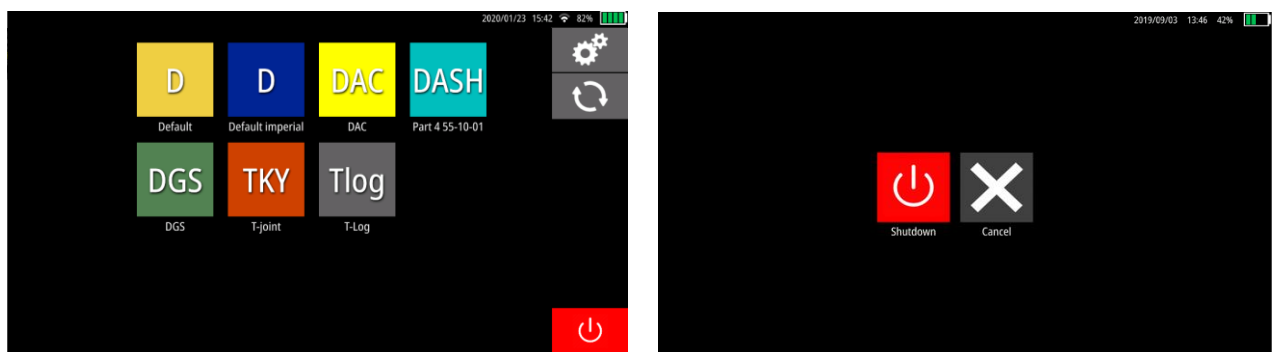
Figure 12 – Shutting down from the Home screen

5 Main Screen Overview

There are several screens available in Wave. This section highlights the main features of each screen. For more details, see the corresponding sections.

5.1 Home Screen

When powering up your instrument, you will be presented with the **Home** screen, where all the available applications appear. By default, Wave has seven (7) applications: **Default**, **Default imperial**, **DAC**, **DASH**, **DGS**, **TKY** and **Tlog**.
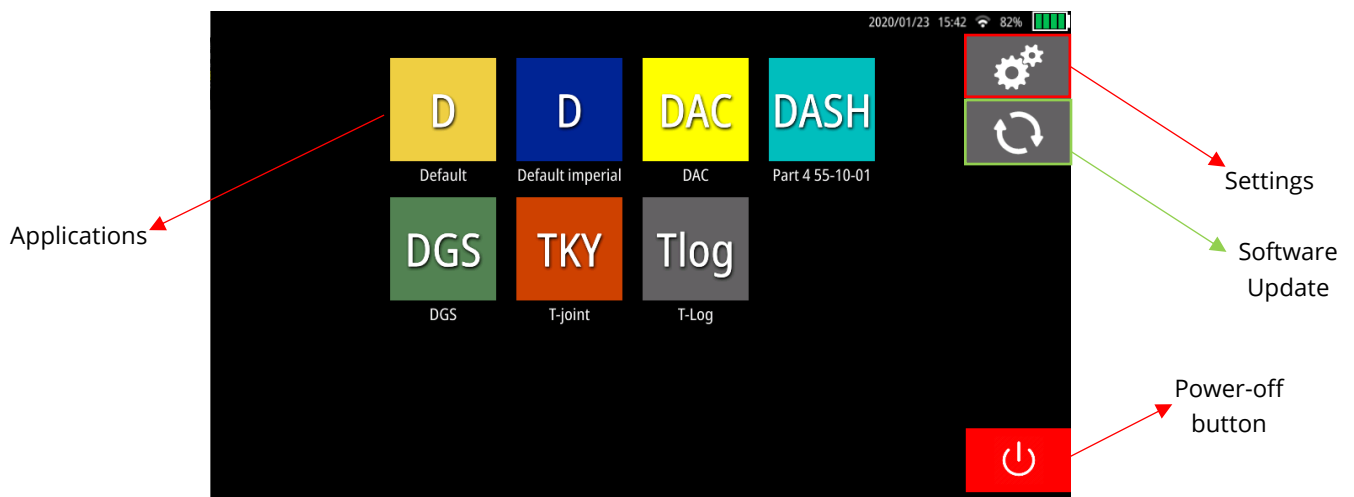
Figure 13 – Wave Home screen

From this screen, you can click on an application to access the **App Description** screen, **Settings, Software Update**. You can also close the device with the Power-off button.

5.2 App Description Screen

The **App Description** screen displays a short description of the app as well as a list of configurations and reports associated with this specific app. Moreover, for a configuration, a section to the right lists the main parameters of the highlighted configuration, which helps you to select the right one prior to launching the app.
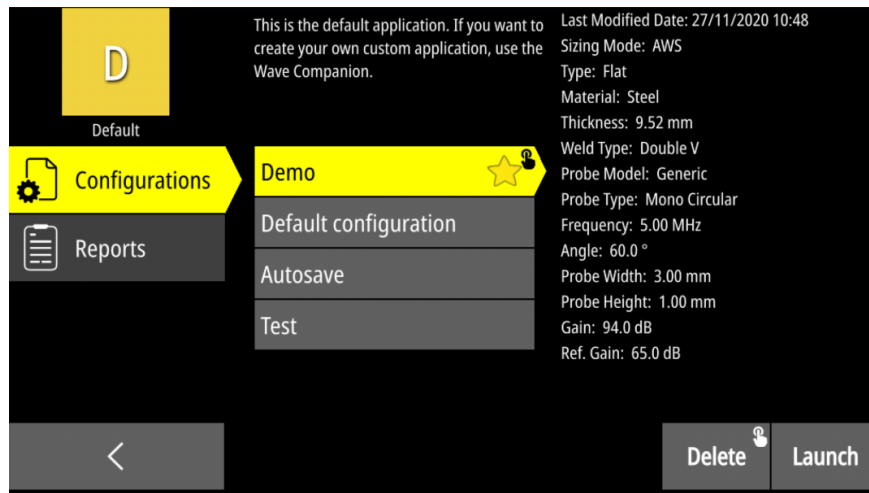
Figure 14 – App Description screen

NOTE: From the **App Description** screen, you can delete a configuration or a report by using the **Delete** button. This requires a long press, as indicated by the long press icon.

5.2.1 Preferred Configuration

A preferred configuration can be selected. This allows the preferred configuration to be located at the top of the list. Also, this will be the default configuration launched.

In order to create the preferred configuration, long press on the desired configuration. A star will appear on the chosen configuration. In order to remove the preferred status from a configuration, simply make another long press.

5.3 Inspection Screen

Once a configuration is chosen, the inspection will begin. From top to bottom, the on-screen action buttons are permanent buttons that are always displayed, even in full-screen mode (see Section 6.2). The **Freeze** button is used to freeze the signal on the screen (see Section 6.3). The **Screen Capture** button allows you to take a screenshot, name it, and add important information (see Section 6.4). The menu allows you to navigate through the menus. The parameters are dynamically linked to the selected menu.
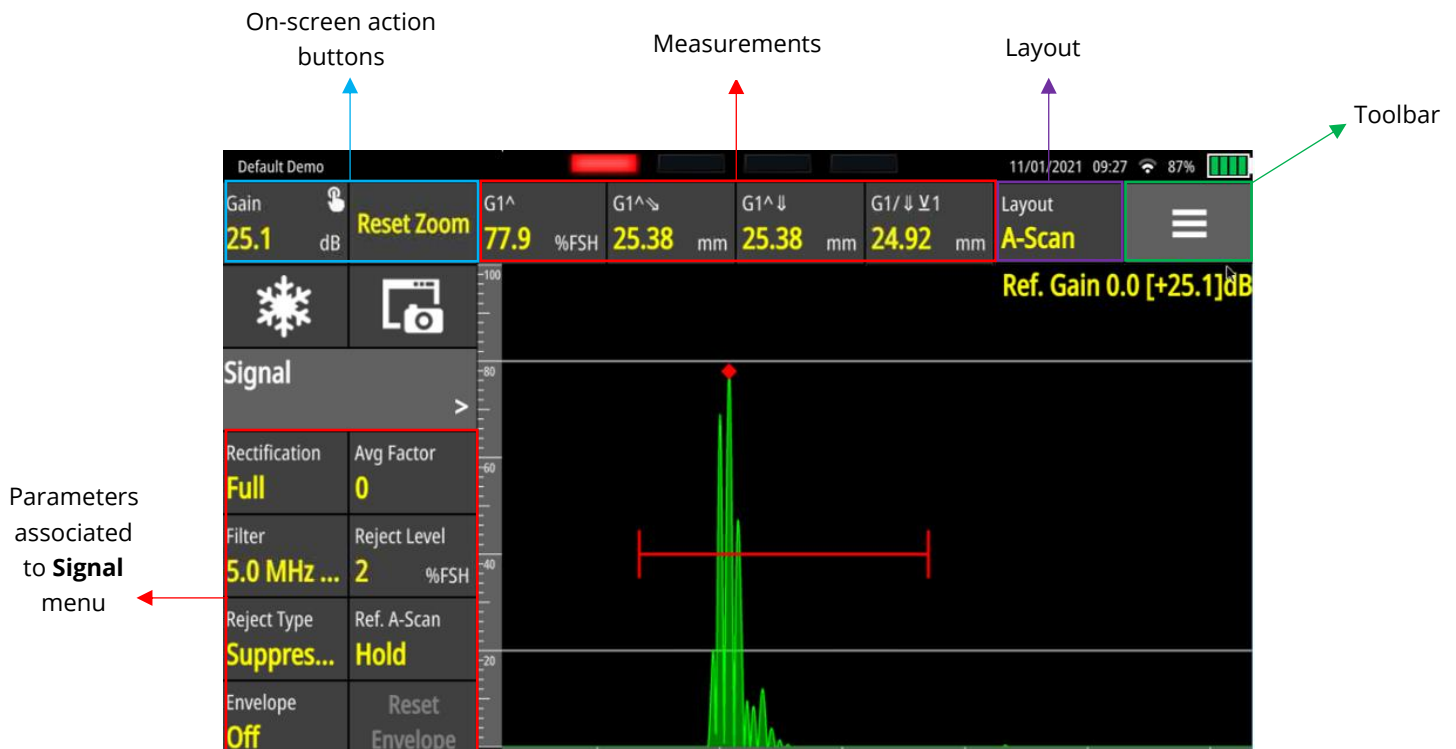
Figure 15 – Inspection screen

Starting from left to right, the **Inspection** screen always displays four measurements. The **Layout** button allows you to change views or groups of views (see Section 6.7). Finally, the **Toolbar** menu is a toggle menu (see Section 6.8).

5.4 Report Screen

This screen has six tabs on the left and filters at the top. The filters are used only for the selection of the **Source** and **Image**.
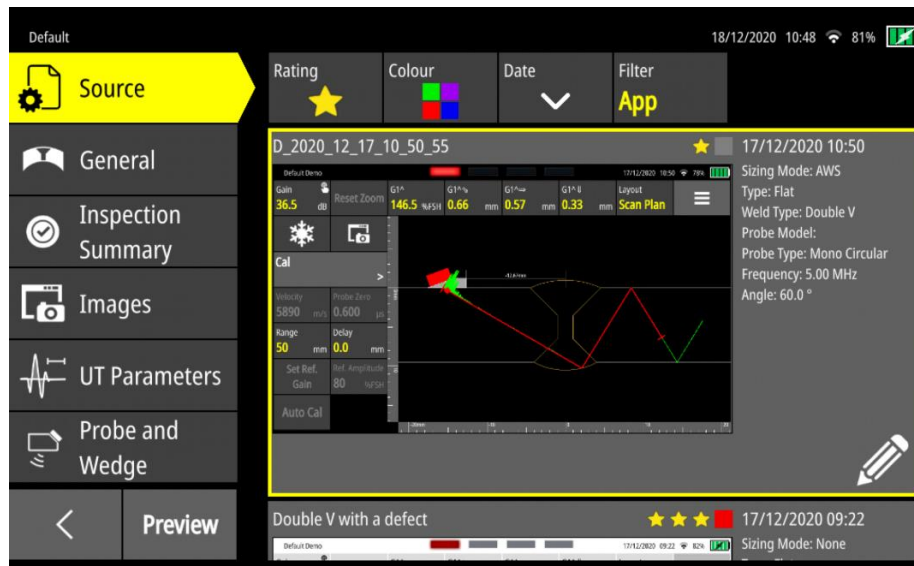
Figure 16 – Report screen

The **Source** is used to define the reference screenshot that will populate the report. The **General** tab allows you to add information about the customer and the inspected part. The **Inspection Summary** tab describes the inspection identifies the inspector. The **Images** tab allows you to select the images in the report. The **UT Parameters** tab displays the ultrasound information. Finally, as the name implies, the **Probe and Wedge** tab displays information related to the probe and wedge used during the inspection. Finally, the **Preview** button displayed the PDF report. For more details, please see Section 13.

6 The Basics – Inspection Screen

The Inspection Screen, among all the screens presented in the **Main Screen Overview** section, remains the one that will be the most used by the inspector. Therefore, this section presents the basics to know about the Inspection screen. For more detailed explanations of ultrasonic parameters, please refer to Section 8.

6.1 The Menu Items

In the **Inspection** screen, the menu item selected appears with its associated parameters. The **Default** and **Default imperial** apps have the following menus, which are considered as the basic menus:

- Cal
- Signal
- TX/RX
- Sizing
- Part
- Probe
- Display
- Alarms
- Gate 1
- Gate 2
- Gate 3
- Gate 4
- Scan Plan

If an app has different menus, it means that they have been modified by the Wave Companion.

To have access to a different menu (and its proper list of parameters), simply press the displayed menu item to make a list of menus appear. Select the desired menu from that list.

Figure 17 - List of Menu items

NOTE: A small hand and finger in the upper right corner of some buttons indicates that a long press will trigger a specific action. For example, on the **Gain** button, this will set the amplitude of the A-Scan under the selected gate to a predetermined FSH, usually 80%.

To change the value of a parameter, press it to see editing tools appear.
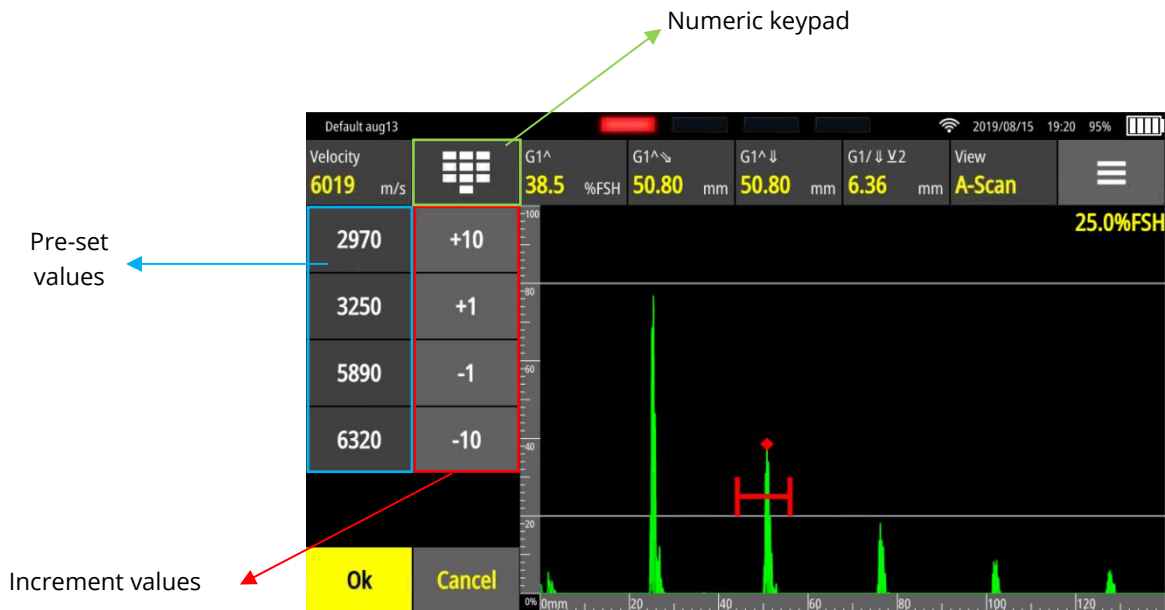
Figure 18 – Different ways to modify the value of a parameter

For example, in the above figure, simply select a new value for **Velocity** from the list of pre-set values. You can also change the **Velocity** value by increments of ±1 or ±10. Another option would be to make the on-screen keypad appear in order to then enter a specific value.

6.2 Permanent On-screen Action Buttons

At the top left of the Wave's screen, there are two (2) permanent action buttons, regardless if the unit is in full screen or not. These are described below.

Table 5 - On-screen action button

Button	Action
Gain	Change gain, from 0 dB to 110 dB
Reset Zoom	Resets A-Scan to normal ("zoom out") mode. The button is enabled (non-greyed out) when the A-Scan is zoomed. The A-Scan will be zoomed after zooming in on a gate (by double-tapping on the gate) or after zooming in part of the A-Scan.

6.3 Freeze

The table below describes the behaviour of the **Freeze** button.

Table 6 - Freeze button behaviour

Button	Action
❄	Freezes the A-Scan. Once frozen, all gates remain active and can be moved around. All measurements show live values according to new gate positions and different measurements can be selected.

NOTE: When the screen is frozen, the button appears like this , indicating the frozen status.

6.4 Screen Capture

The table below describes the behaviour of the **Screen Capture** button. For more details see Section 13.2.

Table 7 - Screen capture button behaviour

Button	Action
	Takes a complete screenshot of the entire screen, in PNG file format. An XML file with all settings and measurements will also be created. In addition, you can name your screenshot, add comments and use a rating system to identify it. All parameters related to the screenshot will be saved for use when a report is created.

6.5 Gates

Wave supports four (4) gates. All can be used simultaneously and all offering all measurements.

NOTE: The gate to gate measurements are possible between **Gate 1** and **Gate 2** (G1-G2), and between **Gate 3** and **Gate 4** (G3-G4).

6.5.1 Enabling a Gate

There are two distinct ways to enable and to set the gates. It is directly related to the selected mode view in the instrument. They are detailed below.

6.5.1.1 From Menu

To enable a gate, simply select the gate from the menu. Note that **Gate X** stands for **Gate 1**, **Gate 2**, **Gate 3**, or **Gate 4**. Press **GX Enabled** to change its value to **Yes**.

Figure 19 – Gate colours

NOTE: Gates are easily differentiated by their unique colour. **Gate 1** is red; **Gate 2** is blue; **Gate 3** is yellow; and **Gate 4** is pink.

6.5.1.2 Directly Clicking on the Gate of Interest

While on the A-Scan view mode, you can set a gate by directly clicking on the gate of interest. Once you click on the gate, it will appear a double arrow on each corner of the gate and a cross in the centre. At the same time, it will enable the corresponding gate in the Menu. You can set the starting point and the length of the gate by clicking on the arrows, respectively. By clicking on the centre cross, you can set the height and the position (X-axis) of the gate.

While in Scan Plan view mode, you can set a gate by directly clicking on the gate of interest. Once you click on the gate, the Menu will change to the corresponding gate; you can then set gate parameters (gate enabling, gate start, gate width, gate level and gate polarity) according to their needs.

6.5.2 Moving Gates and Changing Gate Properties

Each gate has properties: **Gate Start**, **Gate Width**, **Gate Level** and **Gate Polarity**. To change any gate related parameter, first select the desired gate from the **Gate** menu then simply modify the parameter values.

You can press a gate and move it around by dragging it to a new position. When you do so, the gate is "selected" and appears bold. Also, the proper gate menu is then automatically selected, allowing to easily change gate parameters.

Alternatively, you can also press on a gate. After doing so, the gate will appear with handles.
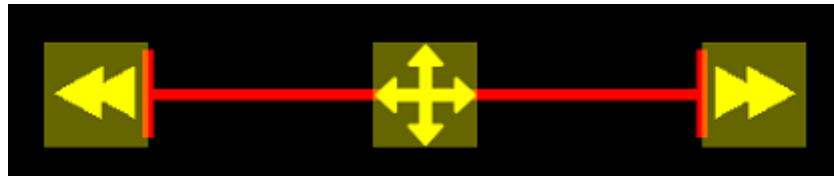
Figure 20 - Gate handles

The left arrow, when dragged left or right, will change the starting point of the gate and its length. The right arrow will allow changing the gate length without changing the gate starting point. Finally, the cross-arrow handle is used to move the gate with useful constraints. Move up or down without changing the gate position, or move right and left, without changing its level.

NOTE: When a gate is selected, the upper right corner of the A-Scan view always shows the gate level in FSH percentage

NOTE: When moving a gate with your fingers, i.e. when you drag it, the value of the gate level (FSH) is displayed live. This value is rounded to the nearest 5%. Use the **Gate Level** parameter if you want to set a gate to any specific level.

6.5.3 Setting a Gate on a Scan Plan View

When you are set to the Scan Plan view, you can still set the gates that are available. To set a gate, you must go to the **Gate** menu (1, 2, 3 or 4) to have access to the desired gate. While in the **Gate** menu, you can set the following parameters, as seen at Table 8.

Table 8 – Gate options

Option	Meaning
Gx Enabled	Unable or disable a gate (Yes or No)
Gx Start	It sets the starting point of a gate (in mm or µs).
Gx Width	It sets the width of a gate (in mm or inches).
Gx Level	It sets the level of the gate (in %FSH).
Gx Polarity	It sets the polarity of a gate (positive or negative).
Gx Adaptive Triggering	It sets an echo-to-echo (E-E) or flank-to-flank (F-F) adaptive triggering mode. Present in G2 and G4 only.
Gx Blanking	It prevents the current gate from triggering from previous gate. Present in G2 and G4 only.

6.6 Alarms
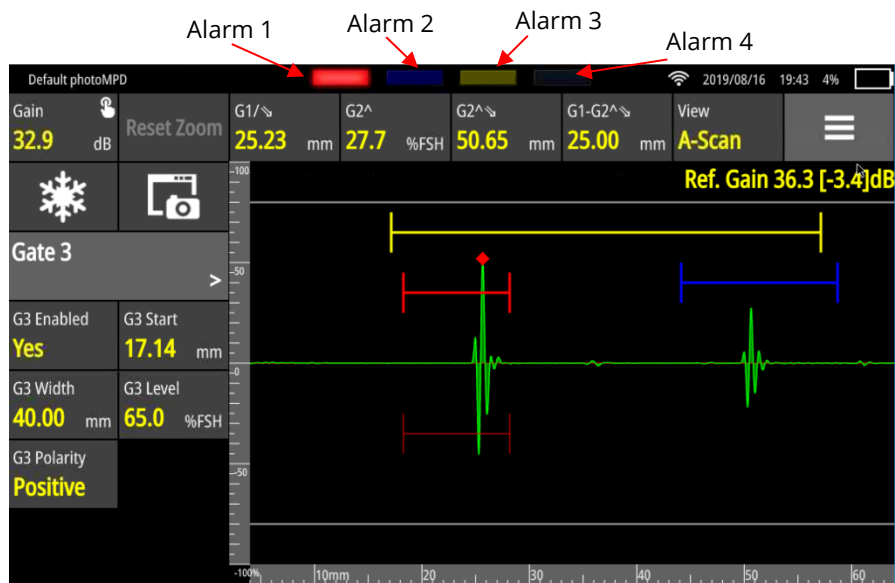
Figure 21 – Alarm position

There are four alarms, simply named **Alarm 1** to **Alarm 4**. They all appear at the top of the Wave display. If an alarm is not active, it will not be visible. If it is enabled but not triggered, it will appear dimmed, like a turned-off LED. When enabled and triggered, the alarm will appear bright, like a turned-on LED.

In the above table, we can see the status of each of the four (4) alarms.

Table 9 - Alarms

Alarm	Enabled	Status	Display
Alarm 1	Yes	Triggered (on)	Bright
Alarm 2	Yes	Not triggered (off)	Dimmed
Alarm 3	Yes	Not triggered (off)	Dimmed
Alarm 4	No	-	Invisible

NOTE: Pressing the alarms at the top bar of the Wave is a direct short cut to the **Alarms** menu.

6.6.1 Alarm On-Screen LED Colours

Alarms 1 to **4** will have the same colours as their corresponding gate. This is their default colour.

Figure 22 - Alarm default colours

The above figure shows the default alarm colours. It is possible to override the default source of each alarm. That is, you can decide that **Alarm 1** will be triggered by **Gate 2**. This is accomplished in the **Alarms** menu. Moreover, the alarm LED will take the colour of its source gate. So, as an example, if **Alarm 1** is triggered by **Gate 2**, **Alarm 1** will appear blue (instead of its default red colour).

> **NOTE:** When enabling a gate, its corresponding alarm is automatically enabled as well. By default, the source for **Alarm 1** is **Gate 1**, the source for **Alarm 2** is **Gate 2**, and so on.

6.6.2 Complex Alarms

Wave allows to generate alarms based on complex events. For example, **Alarm 1** could be triggered by conditions from **Gate 1 or Gate 2**.

When an alarm is triggered by a complex condition, it will appear differently, as shown below.

Figure 23 - Complex alarms

In the example above, we had **G1 or G2** as the source of **Alarm 1**, and **G1 and G2** as the source of **Alarm 2**.

6.7 Layout

The **Layout** allows you to switch between views or groups of views. This feature gives different perspectives of the current inspection. The following figure shows all the available views.

A-Scan

Scan Plan

A+Plan
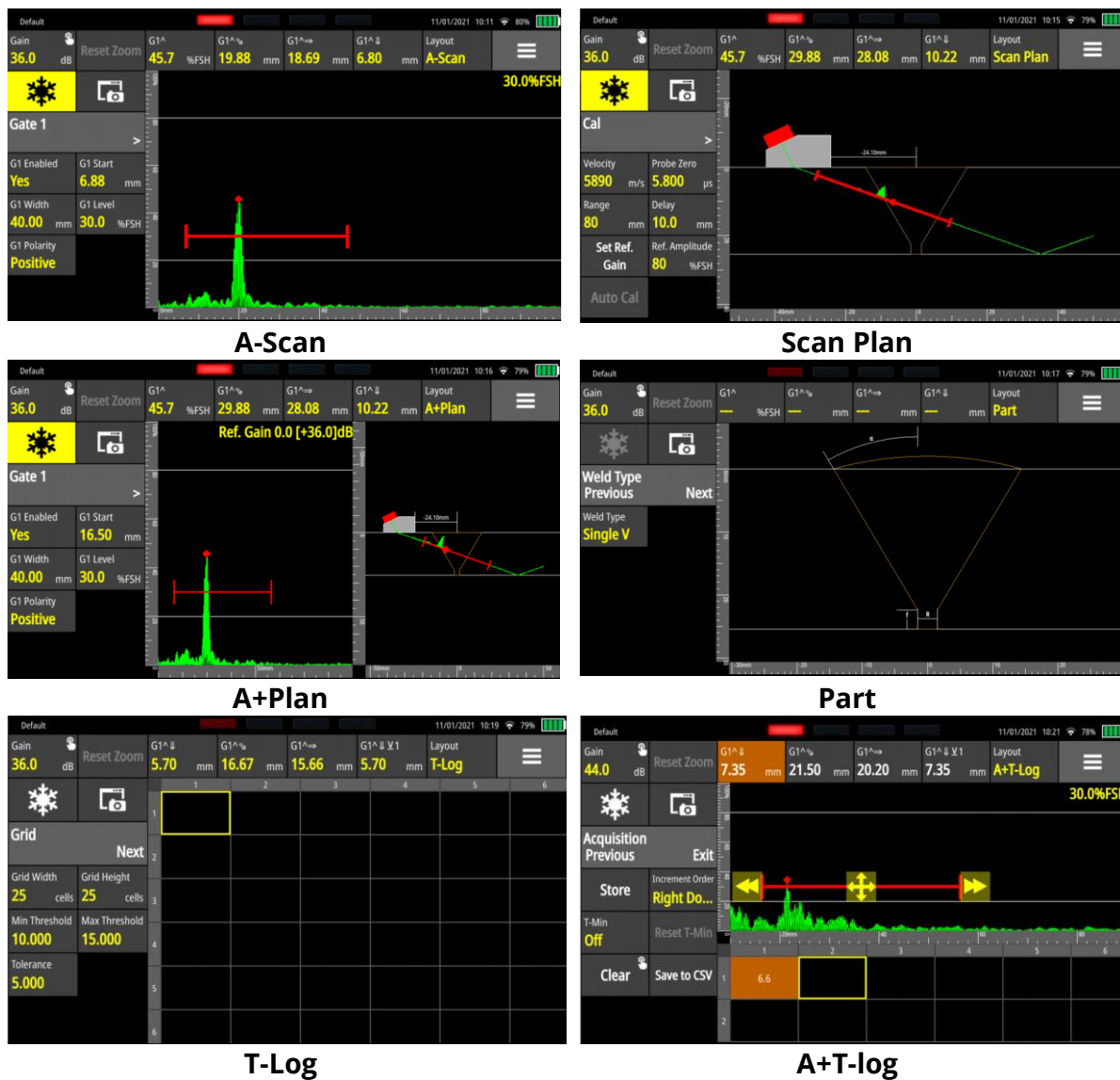
Part

T-Log

A+T-log

Figure 24 – All views or groups of views available

NOTE: The **T-Log** and **A+Tlog** views are only available when you select **T-Log** in the **Sizing** menu. Similarly, the **Part** view is only available in the **Part** menu.

6.8 Toolbar

The toolbar appears at the top right corner. It is represented by the common drop-down menu icon. It includes the following buttons: **Full Screen**, **Save**, **Report** and **Exit.**

Figure 25 – Toolbar menu

6.8.1 Full Screen Mode

This drop-down menu is where you can get access to the full-screen display where only the **Gain**, **Reset Zoom** and measurements remain displayed, allowing the A-Scan to extend to the full width of the screen.
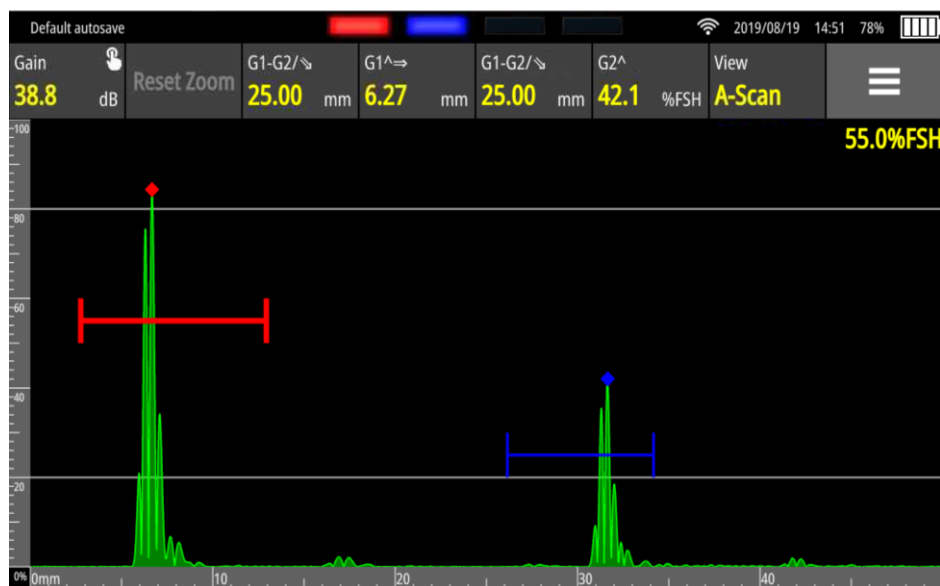
Figure 26 - Full-screen mode

6.8.2 Save a Configuration

This is where you can save a configuration, that is the complete set up of all parameters. It is important to understand that configurations are associated with applications. This means a configuration saved when using App A will only be available when using App A. It will not be visible when using another application.

When saving a configuration, you will be presented with the following screen, allowing you to enter a file name under which the file content will be saved.
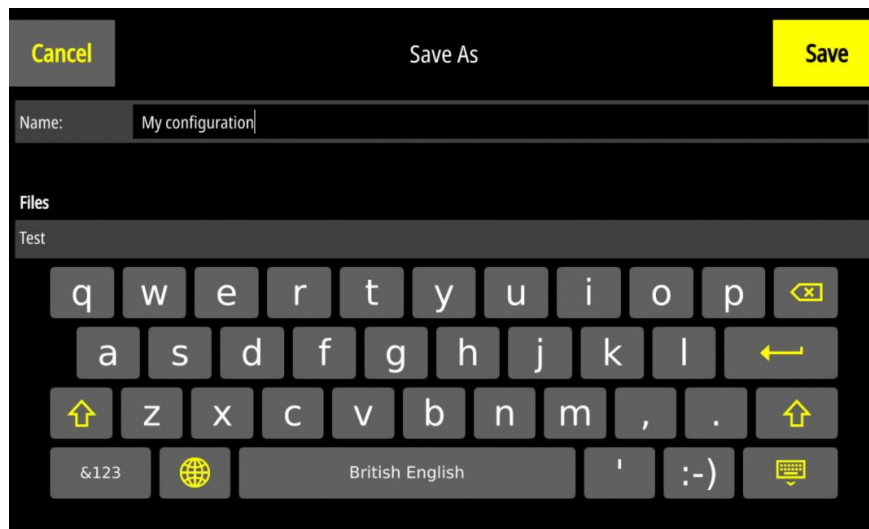
Figure 27 – Save a configuration

6.8.3 Create a Report

This button allows you to create a report directly from an inspection. For more details on how to create reports, see Section 13.

6.8.4 Quit an Application

This button brings you back to the actual **App Description** screen where the list of configurations and existing reports are shown.

NOTE: When you exit an application, the configuration is always automatically saved in the **Autosave** file. Since each application possesses its own list on configuration files, a different autosave file is created for each application.

7 Measurements

The measurement bar is displayed at the top of the screen. There are four measurements, each one showing any possible measurement, depending on the gates used.

As an example, the above figure shows measurements that can be displayed when only **Gate 1** is enabled. The choice of measurements is then dynamic, making it easier to choose from depending on the application running on the instrument and also depending on the number of gates enabled.
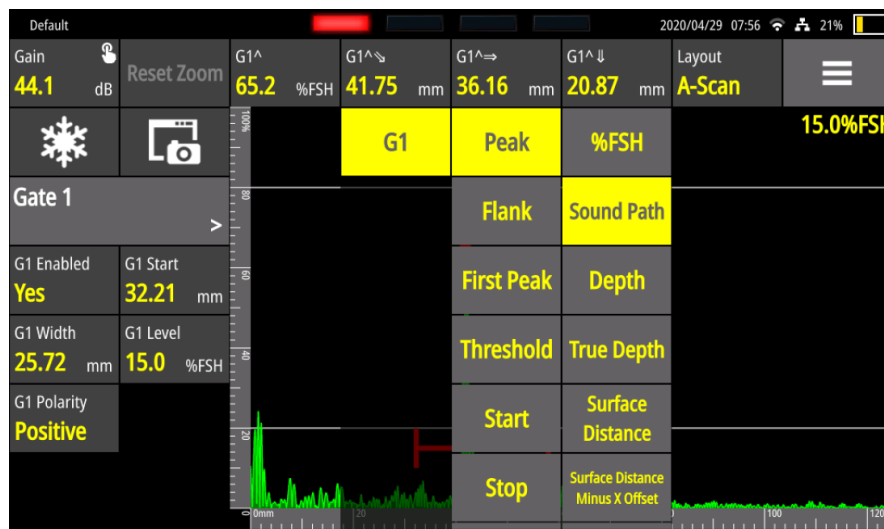
Figure 28 - Measurement choices (only Gate 1 is enabled)

Gate to gate measurements are grouped in pairs. That is, **GX-GY** measurements are offered between **Gate 1** and **Gate 2** or between **Gate 3** and **Gate 4**. The example below shows this.
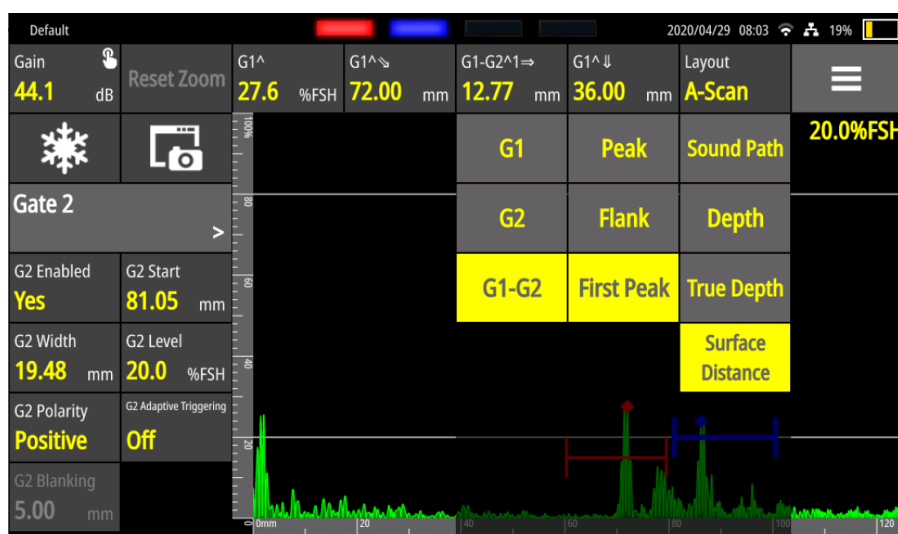
Figure 29 - Measurements available with more than one gate enabled

The following table shows the various measurement choices for different gates.

Table 10 - Measurement choices versus gates

Source Gate	Measurement Basis	Measurement
Gate 1 to Gate 4	Peak	%FSH, Sound Path, Depth, True Depth, Surface Distance, Surface Distance Minus X Offset, %Ref, dB Ref
Gate 1 to Gate 4	Flank	Sound Path, Depth, True Depth, Surface Distance, Surface Distance Minus X Offset
Gate 1 to Gate 4	First Peak	%FSH, Sound Path, Depth, True Depth, Surface Distance, Surface Distance Minus X Offset, %Ref, dB Ref
Gate 1 to Gate 4	Threshold	%FSH (that is the gate level)
Gate 1 to Gate 4	Start	Sound Path, Depth, True Depth, Surface Distance
Gate 1 to Gate 4	Stop	Sound Path, Depth, True Depth, Surface Distance
Gate 1 to Gate 4	Length	The length of the gate
G1-G2 / G3-G4	Peak	Sound Path, Depth, True Depth, Surface Distance
G1-G2 / G3-G4	Flank	Sound Path, Depth, True Depth, Surface Distance, Surface Distance Minus X Offset
G1-G2 / G3-G4	First Peak	Sound Path, Depth, True Depth, Surface Distance, Surface Distance

NOTE: The **Gate Start** and **Gate Stop** positions in the table above can be expressed in a number of different ways. The usual way of representing theses positions is based on the sound path. It might also be useful to express them relative to the depth, the true depth or the surface distance. This allows you to better understand which part of the piece being expected is covered by the gate.

View the following video for how to change the measurements.

7.1 Measurement Definitions

Here are some additional information regarding the peak, first peak and flank:

Peak: The highest value inside the gate.

Flank: The first positive flank to cross the gate (the first value higher than the gate threshold that crosses the gate).

First Peak: The highest value between the first two gate crossings (full positive flank and full negative flank), with the first gate crossing being the flank.

The following figure shows the aforementioned definitions in graphical form. The peak corresponds to B. The flank is represented by A. The first peak is B.
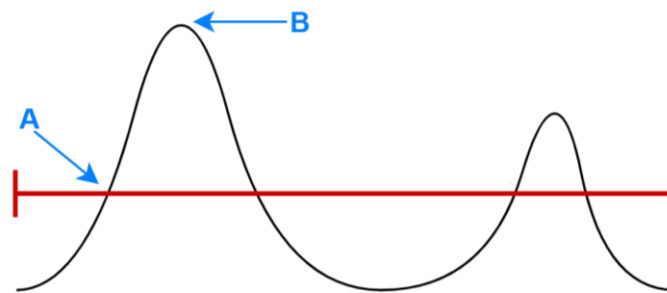
Figure 30 – Graphical representation of the plank, first peak and flank

There is also a difference between the depth and true depth. Depth is considered as the depth without taking into account multiple half skips.
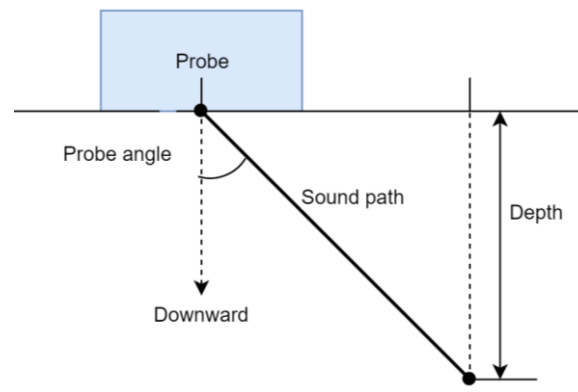
Figure 31 – Visual representation of depth measurement

True depth is considered as the depth in which multiple haft skips are taken into account. True depth is less or equal to the thickness of the part.

Here are visualisations of true depth measurements for different parts that available on Wave:

Flat part   **T-joint part**

Curved part
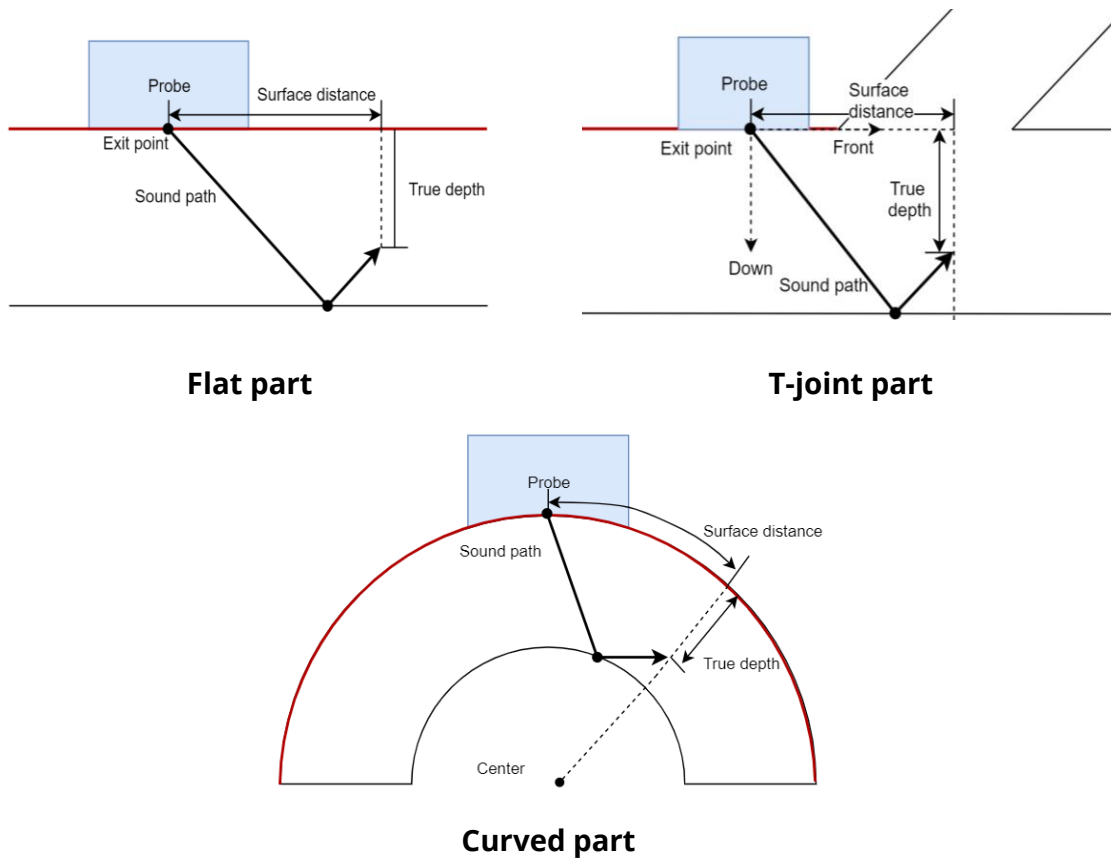
Figure 32 – Visual representation of true depth measurement

7.2 Measurements Reference Table

Following is a complete table of measurements and their associated symbols, where X is the gate number.

Table 11 - Measurement reference

Gate	Ref	Measurement	Symbol	Meaning
GX	Peak	%FSH	GX^	Amplitude of the highest peak in gate. Shown even if peak below the gate, but peak greater than 5%FSH
GX	Peak	Sound Path	GX^↘	Sound path distance measured at peak
GX	Peak	Depth	GX^⇓	Depth at peak position
GX	Peak	True Depth	GX^⇓∨	True depth at peak position (takes skips into account)
GX	Peak	Surface Distance	GX^⇒	Distance from the exit point of the probe to position of peak relative to the surface

Gate	Ref	Measurement	Symbol	Meaning
GX	Peak	Surface Distance minus X-offset	GX^⇒-X	Distance from front of the probe to position of peak relative to the surface
GX	Peak	%Ref	GX^%REF	Amplitude referred to the curve (DAC, TCG and DGS) or to the reference amplitude (Ref. Amplitude)
GX	Peak	dB Ref	GX^dBREF	Amplitude referred to the reference dB. This is the difference between the Ref dB and the actual dB amplitude.
GX	Peak	AWS A	GX^AWS an	AWS Indication level (A)
GX	Peak	AWS C	GX^AWS C	AWS Attenuation factor (C)
GX	Peak	AWS D	GX^AWS D	AWS Indication rating (D)
GX	First Peak	%FSH	GX^1	Amplitude of the first peak in gate. Shown even if the peak is below the gate and if the peak is greater than 5%FSH
GX	First Peak	Sound Path	GX^1↘	Sound path distance measured at the first peak
GX	First Peak	Depth	GX^1⇓	Depth at the first peak position
GX	First Peak	True Depth	GX^1⇓∨	True depth at the first peak position (takes skips into account)
GX	First Peak	Surface Distance	GX^1⇒	Distance from the exit point of the probe to the position of first peak relative to the surface
GX	First Peak	Surface Distance Minus X-offset	GX^1⇒-X	Distance from front of the probe to the position of first peak relative to the surface
GX	First Peak	%Ref	GX^1%REF	Amplitude referred to the curve (DAC, TCG and DGS) or to the reference amplitude (Ref. Amplitude)
GX	First Peak	dB Ref	GX^1dBREF	Amplitude referred to the reference dB. This is the difference between the Ref dB and the actual dB amplitude.

Gate	Ref	Measurement	Symbol	Meaning
GX	Flank	Sound Path	GX/↘	Sound path distance measured at flank
GX	Flank	Depth	GX/⇓	Depth at flank position
GX	Flank	True Depth	GX/⇓⌄	True depth at flank position (takes skips into account)
GX	Flank	Surface Distance	GX/⇒	Distance from the exit point of the probe to position of flank relative to the surface
GX	Flank	Surface Distance minus X-offset	GX/⇒-X	Distance from front of the probe to position of flank relative to the surface
GX	Threshold	---	GX threshold	This is the gate level
GX	Start	Sound Path	GX↘start	Gate start position relative to sound path
GX	Start	Depth	GX⇓start	Gate start position relative to depth
GX	Start	True Depth	GX⇓⌄start	Gate start position relative to true depth
GX	Start	Surface Distance	GX⇒start	Gate start position relative to the surface distance
GX	Stop	Sound Path	GX↘stop	Gate stop position relative to sound path
GX	Stop	Depth	GX⇓stop	Gate stop position relative to depth
GX	Stop	True Depth	GX⇓⌄stop	Gate stop position relative to true depth
GX	Stop	Surface Distance	GX⇒stop	Gate stop position relative to the surface distance
GX	Length	---	GX↘length	Gate length (always relative to sound path)
DAC	Peak	%DAC(C)	DAC^%(C)	Peak measurement, in %, relative to DAC curve. Corrected if the gain changed

Gate	Ref	Measurement	Symbol	Meaning
DAC	Peak	%DAC(U)	DAC^%(U)	Peak measurement, in %, relative to DAC curve. Uncorrected if the gain changed. Use with care
DAC	Peak	dB DAC(C)	DAC^dB(C)	Peak measurement, in dB, relative to DAC curve. Corrected if the gain changed
DAC	Peak	dB DAC(U)	DAC^dB(U)	Peak measurement, in dB, relative to DAC curve. Uncorrected if the gain changed. Use with care
DGS	Peak	%DGS(C)	DGS^%(C)	Peak measurement, in %, relative to DGS curve. Corrected if the gain changed
DGS	Peak	%DGS(U)	DGS^%(U)	Peak measurement, in %, relative to DGS curve. Uncorrected if the gain changed. Use with care
DGS	Peak	dB DGS(C)	DGS^dB(C)	Peak measurement, in dB, relative to DGS curve. Corrected if the gain changed
DGS	Peak	dB DGS(U)	DGS^dB(U)	Peak measurement, in dB, relative to DGS curve. Uncorrected if the gain changed. Use with care
DGS	Peak	ERS	GX^ ERS	Peak Measurement, in ERS (Equivalent Reflector Size), relative to DGS curve. Corrected if gain changes.
G1-G2	Peak	Sound Path	G1-G2^↘	Difference, in sound path distance, between gate 1 peak and gate 2 peak measurements
G1-G2	Peak	Depth	G1-G2^⇓	Difference, in depth, between gate 1 peak and gate 2 peak measurements
G1-G2	Peak	True Depth	G1-G2⇓⌄	Difference, in true depth, between gate 1 peak and gate 2 peak measurements
G1-G2	Peak	Surface Distance	G1-G2^⇒	Difference, in surface distance, between gate 1 peak and gate 2 peak measurements
G3-G4	Peak	Sound Path	G3-G4^↘	Difference, in sound path distance, between gate 3 peak and gate 3 peak measurements

Gate	Ref	Measurement	Symbol	Meaning
G3-G4	Peak	Depth	G3-G4^⇓	Difference, in depth, between gate 3 peak and gate 4 peak measurements
G3-G4	Peak	True Depth	G3-G4⇓∨	Difference, in true depth, between gate 3 peak and gate 4 peak measurements
G3-G4	Peak	Surface Distance	G3-G4^⇒	Difference, in surface distance, between gate 3 peak and gate 4 peak measurements

7.3 Measurement Values

Measurements are displayed as numbers. Usually these represent the FSH % or a distance. There are exceptions though. Sometimes, a proper measurement cannot be displayed. See below regarding the occurrences and reasons for not being able to see a number of one of the measurement areas.

Table 12 - Measurement values

Value displayed	Meaning
N/A	The value cannot be calculated because at least one of the required conditions to compute it is missing.
---	Nothing is being measured (below 5% FSH)
*****	A saturated reading, i.e. over 160% FSH
Number	The normal condition: this is the value of the measurement

7.4 Measurement Coordinates References

Wave adds quite a few new capabilities for the inspection of complex parts. For example, when inspecting T joints with fillet welds, the ray tracer will show the beam path travelling everywhere in the part.
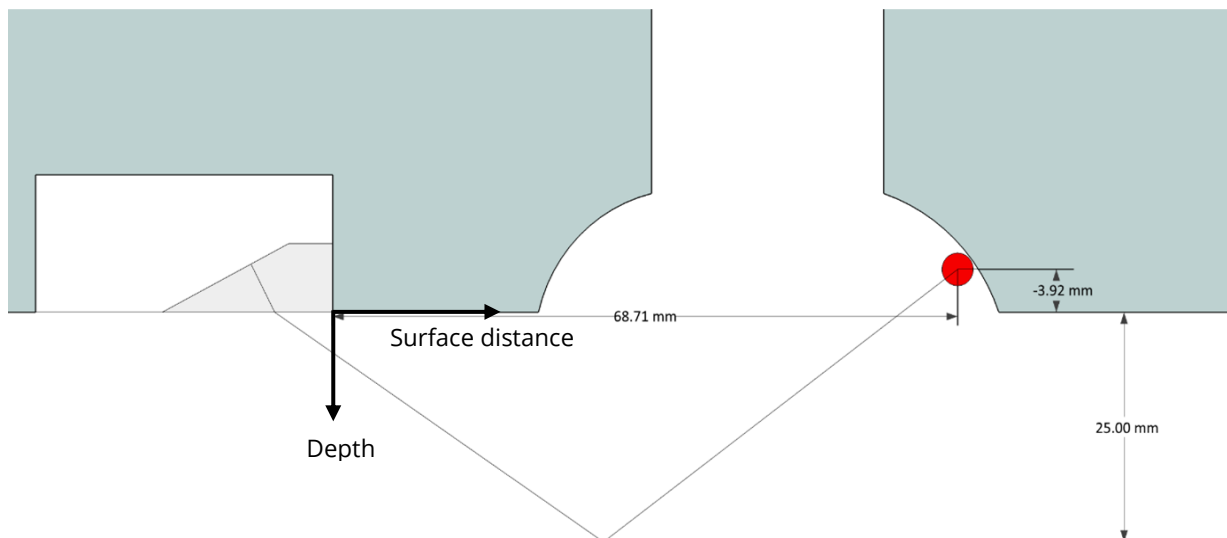
Figure 33 – Measurements in complex shapes

Let's say that the red dot in the above figure represents the position of a flaw, as it would be indicated in the measurement of a gate. The red dot is positioned over the horizontal line where the probe lies. As depth is usually represented as a positive number, referencing the red dot's position requires using a negative number.

Hence, we need to make sure we have a unique reference system for positioning, both in terms of surface distance and in depth.

7.5 Measurements Units

To modify the measurement units, click on **Display** menu and click on **Units**. It will switch from **SI** to **Imperial** and vice versa.

7.6 FSH% Measurement in Gates

The Full Screen Height (FSH) in a gate will provide a measurement from 0% up to 160% FSH. Above that number, the signal is saturated, and you will need to lower the gain in order to have a good reading.

Note that even if a signal peak amplitude is lower than a gate, the gate will display the FSH% if this is the measurement selected. The exception being for a signal below 5% FSH.

8 Ultrasonic Parameters – Advanced Notions

This section informs you about more advanced notions regarding Wave's ultrasonic parameters. It is assumed that the concepts in Section 6 have already been understood.

8.1 The A-Scan View

The A-Scan appearance and background can be adjusted in numerous ways. The following table describes all the actions offered that can change the A-Scan.

Table 13 - A-Scan signal modification

Menu	Parameter	Possible values
Display	Line Appearance	Thin, Thick, Filled
Signal	Envelope	Off, Trail, Peak
Signal	Reset Envelope	*No value – this is a direct action*
Display	Trail Duration	0 to 60 seconds
Display	Trail Speed	Slow, Medium, Fast
Display	Rulers	None, Horizontal, Vertical, Both
Display	Ruler Mode	Distance, Time
Display	Overlay Mode	None, Line, Band
Display	Grid Type	None, Plain, Dash, Dot, Cross
Display	Grid Alignment	Aligned, Fixed

NOTE: The A-Scan grid can be aligned with the main tick mark of the horizontal ruler. On the other hand, the grid can be fixed, displaying the traditional 10 vertical lines.

View the following [video](#) for more details about the envelope.

View the following [video](#) for more details about grid types and overlays.

8.1.1 Reference A-Scan

The reference A-Scan is a fixed A-Scan view of a signal of your choice to be displayed in the **A-Scan View** background to be used as a reference signal.

Click on **Signal** menu and then on **Ref. A-Scan** to activate it.

8.1.2 A-Scan Zoom

It is possible to zoom an A-Scan in a couple of different ways. The first one requires having a gate displayed then zooming over the region covered by the gate. This is accomplished

by double-tapping on the gate. Exit this "zoom in gate" mode by using the **Reset Zoom** on-screen button (top left of display).

The alternate way of zooming in an A-Scan is simply by using the same zoom gesture you use on your smartphone, that is by using 2 fingers and spreading them apart. It is then possible to zoom out by simply pinching your fingers or use the **Reset Zoom** button.

When zoomed, you can pan through the entire range of the A-Scan by using the usual pan action, that is dragging the screen with one finger.

View the following video for more details about zooming the A-Scan.

8.1.3 Auto 80% FSH

Setting a peak to 80% FSH automatically is easily achieved in the following way. Position a gate so it covers the peak you want to adjust to 80%. Then do a long press of the **Gain** button. This will automatically set the gain level such that the peak covered by the selected gate will be adjusted to 80% FSH.

The reference level 80% can be set to any FSH percentage by using the **Ref. Amplitude** parameter found in the **Cal** menu.

View the following video for more details auto 80% FSH.

8.2 TX/RX Menu

The **TX/RX** menu is used to set the ultrasound pulser to the required needs. This is where you can set the **RX Mode**, the **Voltage**, the **Pulse type** as well as the **Pulse Width** and the **PRF**.

Table 14 - TX/RX menu parameters

Parameter	Possible values
RX Mode	Pulse-Echo, Pitch-Catch, Through Transmission
Voltage	100 V, 150 V, 200 V, 250 V, 300 V, 350 V, 400 V, 450 V and 500 V
Pulse Type	Spike, Square
Pulse Width	50 ns to 1 µs (steps of 4 ns)
PRF	Up to 1500 Hz

NOTE: The pulse width is automatically set when setting the probe frequency. Although this parameter is calculated automatically, it corresponds to 0.5/frequency in square mode. In spike mode, it is equal to 50 ns.

8.3 Signal Menu

The A-Scan view can be modified in different ways. The signal itself can be changed by applying different filters or by choosing a rejection mode and rejection level.

Table 15 - A-Scan signal appearance

Menu	Parameter	Possible values			
Signal	Rectification	Full, +Half, -Half, RF			
Signal	Avg Factor	0, 2, 4, 8, 16, 32			
Signal	Filter	0.5 MHz Wide	0.5 MHz Narrow	1 MHz Wide	1 MHz Narrow
		1.25 MHz Wide	1.25 MHz Narrow	2 MHz Wide	2 MHz Narrow
		2.25 MHz Wide	2.25 MHz Narrow	3.5 MHz Wide	3.5 MHz Narrow
		4 MHz Wide	4 MHz Narrow	4.5 MHz Wide	4.5 MHz Narrow
		5 MHz Wide	5 MHz Narrow	7.5 MHz Wide	7.5 MHz Narrow
		10 MHz Wide	10 MHz Narrow	15 MHz Wide	15 MHz Narrow
		20 MHz Wide	20 MHz Narrow	Broadband High	Broadband Low
Signal	Reject Type	None, Suppressive, Linear			
Signal	Reject Level	0% to 100%			

NOTE: Some parameters can only take two (2) different values. When changing the value of such binary type parameters, hitting the on-screen button will immediately toggle the parameter value. The **Ruler Mode** parameter is one of these parameters as it can only take one of two values: Distance or Time.

View the following video for more details about the A-Scan rectification.

8.3.1 Filter Reference Table

Following is the list of these filters available on the Wave. For each frequency, you have its centre frequency as well as their low and high pass frequencies.

Table 16 – Filter Reference Table

Filter Name	Centre Frequency (MHz)	High Pass Freq. (MHz)	Low Pass Freq. (MHz)
0.5 MHz Narrow	0.5	0.38	0.63
0.5 MHz Wide	0.5	0.25	0.75
1 MHz Narrow	1	0.75	1.25
1 MHz Wide	1	0.5	1.5
1.25 MHz Narrow	1.25	0.94	1.56
1.25 MHz Wide	1.25	0.63	1.88
2 MHz Narrow	2	1.5	2.5
2 MHz Wide	2	1	3
2.25 MHz Narrow	2.25	1.69	2.81
2.25 MHz Wide	2.25	1.13	3.38
3.5 MHz Narrow	3.5	2.63	4.38
3.5 MHz Wide	3.5	1.75	5.25
4 MHz Narrow	4	3	5
4 MHz Wide	4	2	6
4.5 MHz Narrow	4.5	3.38	5.63
4.5 MHz Wide	4.5	2.25	6.75
5 MHz Narrow	5	3.75	6.25
5 MHz Wide	5	2.5	7.5
7.5 MHz Narrow	7.5	5.63	9.38
7.5 MHz Wide	7.5	3.75	11.3
10 MHz Narrow	10	7.5	12.5
10 MHz Wide	10	5	15
15 MHz Narrow	15	11.3	18.8
20 MHz Narrow	20	15	25
20 MHz Wide	20	10	30
Broadband Low	2.25 to 5	1	6
Broadband High	7.5 to 10	2	15

NOTE: A new filter is automatically selected when a new probe is loaded or if the probe frequency is changed. The filter automatically selected matches the new probe's frequency, using a wide type filter. This filter selection can then be manually overridden if desired.

View the following video for how to choose a filter.

8.4 Gate Advanced Settings

This section presents slightly more advanced features for the gates.

8.4.1 Gate Polarity

The **Gate Polarity** parameter may take the following values: absolute, positive or negative. Here is a brief description of each:

- **Absolute**: Considers all signal for evaluation (available only with non-rectified signal)
- **Positive**: Considers only the positive signal for evaluation (available with non-rectified or rectified or positive only signal)
- **Negative**: Considers only the negative signal for evaluation (available only with non-rectified or negative only signal)

View the following video for how to use the gates.

8.4.2 Setting up an Adaptive Gate in Gate Mode

Gate 2 and **Gate 4** have an adaptive triggering feature. This feature adapts the gate with respect to the start function (**Gx Start**) of **G1^** peak position. In the example below, **G1 Start** is set at 12 mm. The **G1^** sound path is 25.4 mm. The blanking value is the minimum offset between **G1^** and **G2 Start**. In this case, the **G2 Blanking** is set to 15 mm. Hence, the **G2 Start** will automatically be set to (12 mm + 25.4 mm +15 mm = 40.4 mm).
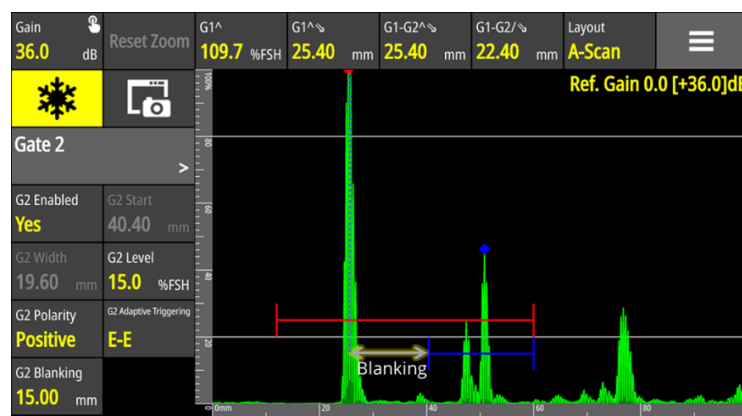

Figure 34 – Adaptative gate

For a gate adaptive triggering set to **F-F,** it has the same described behaviour. However, but the flank is the new source of position.

In echo to echo mode, this prevents **Gate 2** to trigger the same peak as **Gate 1.** Consequently, a **G2-G1** measurements would have been set to 0 mm.

9 The Probe Selection

The **Probe** menu allows you to choose a probe in a probe list and to generate a probe, called **Generic**, based on some ultrasonic parameters.

Figure 35 – Access to Probe Selection

IMPORTANT: It is not possible to save a **Generic** probe file. On the other hand, you can save these parameters by saving the configuration as it is.

By pressing the **Probe Model** menu parameter, the **Probe Selection** screen appears.

Figure 36 – Probe Selection

The left columns include fields (**Manufacturer**, **Frequency**, **Type**, **Angle**, **DGS Only**, **Show Recent**) to help you search for a probe. The table on the right shows the list of available probes according to the fields chosen. In the probe list, it is possible to sort them by clicking **Model**, **Manufacturer**, **Frequency**, **Angle** or **Size**.

Once a probe is loaded, it is possible to modify the **Probe Model**, the **Angle**, the **Wedge Velocity**, the **Probe Zero**, the **Frequency**, the **Probe Width** and the **Probe Type**. **Probe Height** will always remain greyed and **X-Offset** is only available for angular probes.

NOTE: DGS probes are identified with a small DGS logo next to the manufacturer's name. DGS probes are the only probes that can be used to make a DGS sizing method. Once a DGS probe is loaded all the menu parameters are greyed out except **Probe Model** and **Probe Zero**.

View the following video for instructions on how to choose a probe in the **Probe Selection**.

View the following video how to choose a DGS probe.

10 The Part Wizard

The part wizard allows you to define the dimensions of the chosen part as well as the chosen weld. It should be noted that this wizard includes dynamic tiles. Thus, according to the choices made concerning the part or the weld types, specific tiles will appear, and others will disappear. This is one of the special characteristics of this menu.

10.1 Part Types
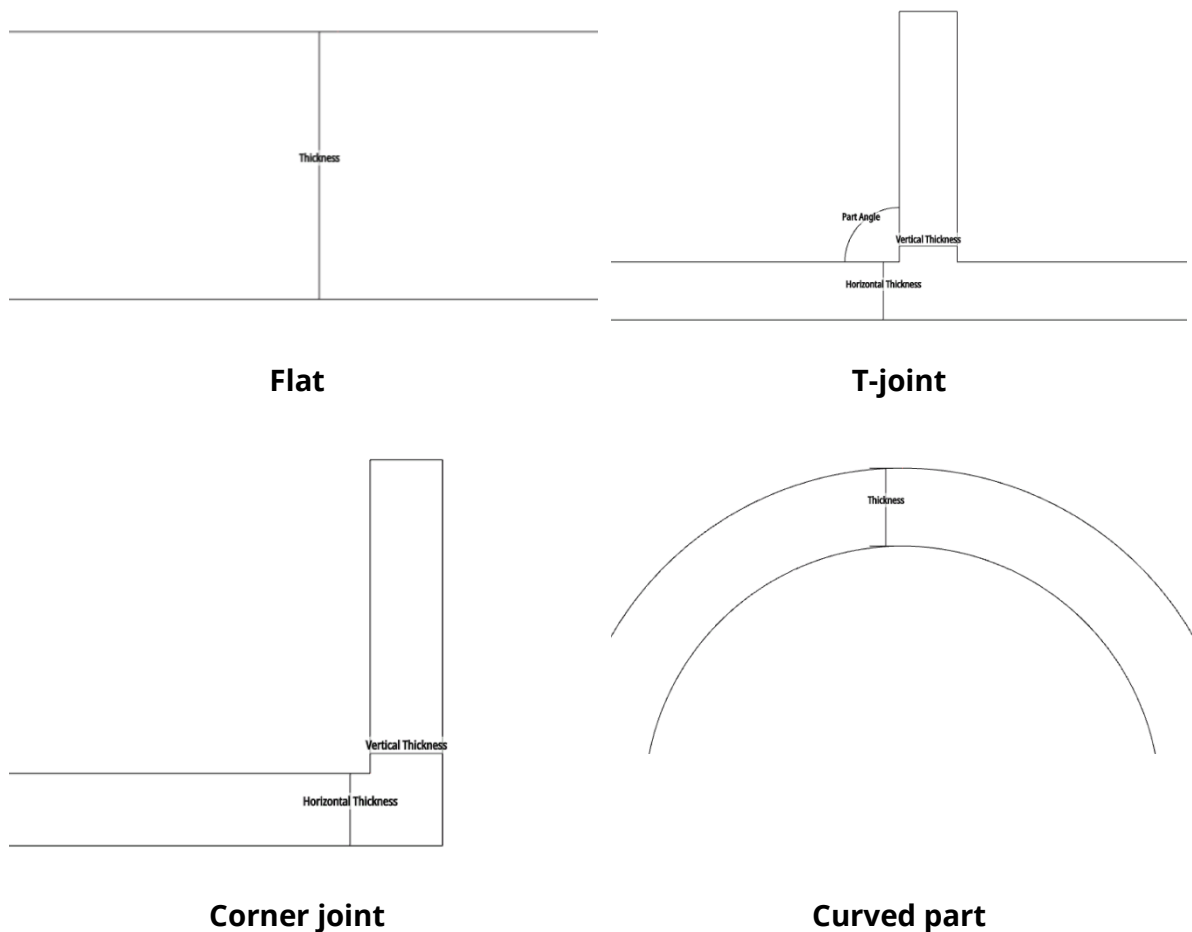
There are four (4) part types:

Flat   **T-joint**

Corner joint   **Curved part**

Figure 37 – Part types available on Wave

NOTE: The part type choice influences the weld types. Thus, not all weld types will be available depending on the chosen part.

10.1.1   Part Type Dimensions

Table 17 shows the available dimensions according to the chosen part. It should be noted that all dimensions are available in the SI system as well as the imperial

system (see Section 7.5). A checkbox indicates that this part dimension is visible for a given part.

Table 17 - Part types and their dimensions available

|	Flat part	Curved part	T-joint	Corner joint
Thickness	X	X		
Horizontal thickness			X	X
Vertical thickness			X	X
Joint height			X	X
Part angle			X	
Curved base				X
Outside diameter		X		
Inside diameter		X		

NOTE: For the **Curved** type, the **Inside Diameter** is automatically calculated. It is therefore impossible for you to modify it. It is a read-only parameter. That is why it is always greyed out.
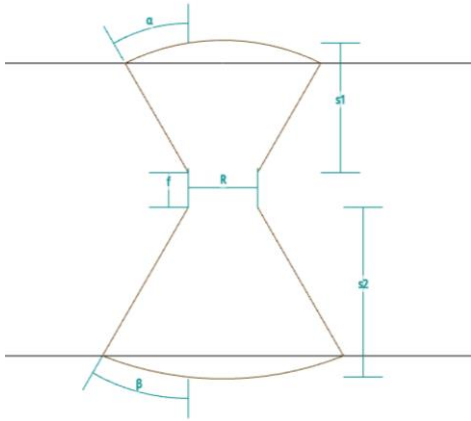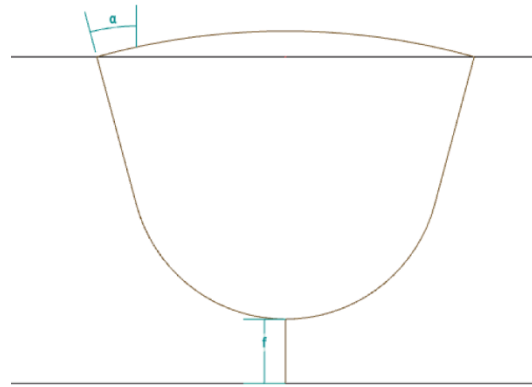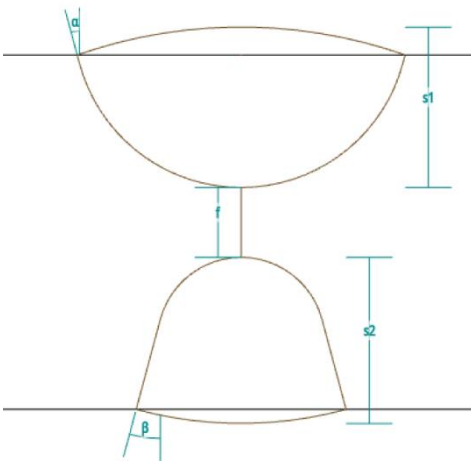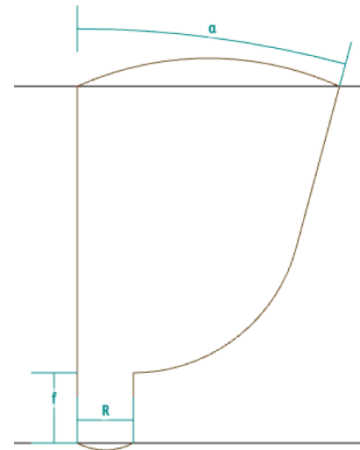
10.2 Weld Types

There are twelve (12) weld types, including **None**:
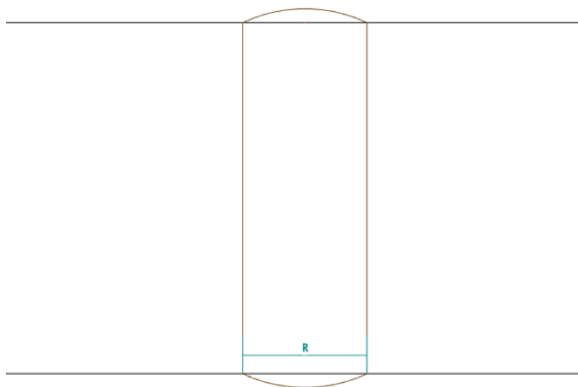
Square Groove
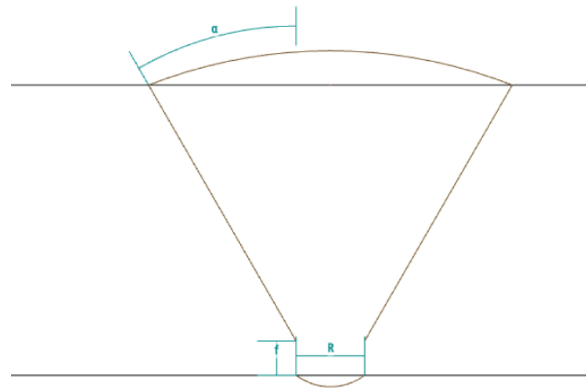
Single V

Double V

Single U

Double U

Single J
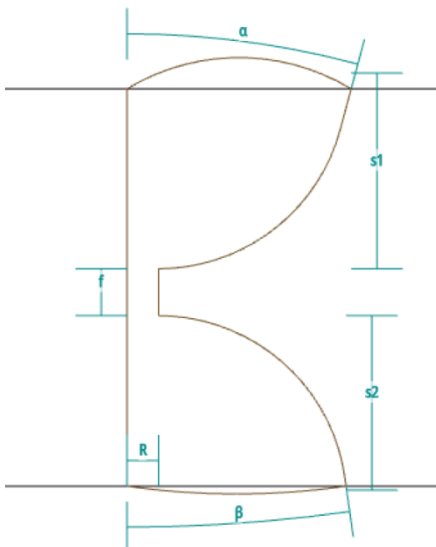
Double J
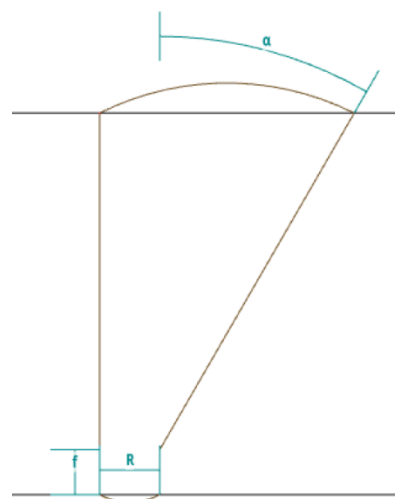
Bevel Groove
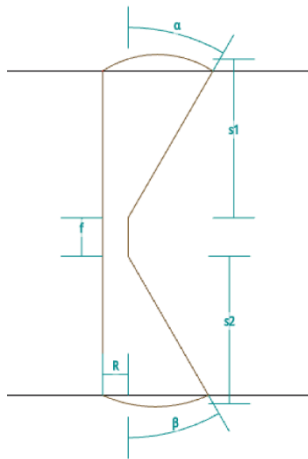
Double Bevel
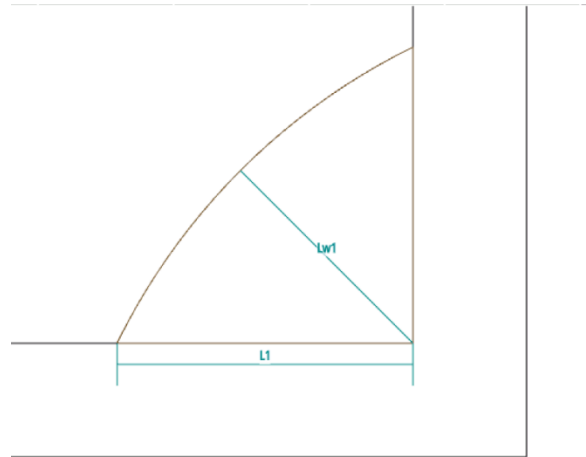
Single Fillet Weld
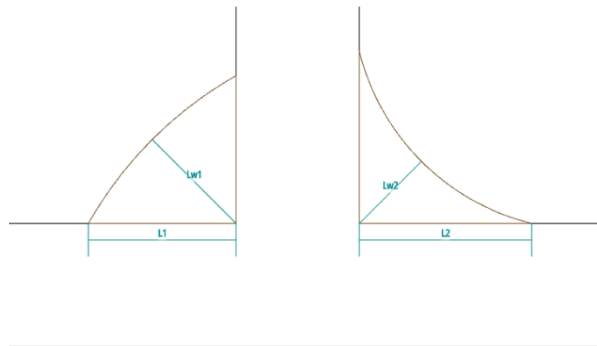
Double Fillet Welds

Figure 38 – Welds available with Wave

The availability of these welds depends on the type of part chosen beforehand. Table 18 illustrates these possibilities. A checkbox indicates that the weld is visible for a given part.

Table 18 - Part types vs welds

	Flat part	Curved part	T-joint	Corner joint
None	X	X	X	X
Square Groove	X	X	X	X
Single V	X	X		
Double V	X	X		
Single U	X			
Double U	X			
Single J	X			
Double J	X			
Bevel Groove	X		X	X
Double Bevel	X		X	
Single Fillet Weld			X	X
Double Fillet Welds			X	

10.2.1 Weld Dimensions

You have the possibility to modify as desired all the dimensions of a weld. Again, the tiles are dynamic. Thus, depending on the type of weld chosen, the visibility of the available dimensions will be modified. It should be noted that all dimensions are available in the SI system as well as in the imperial system (see Section 7.5)

Table 19 shows the dimensions according to the type of weld chosen. An X indicates that the parameter is visible for a given weld.

Table 19 - Weld types and their dimensions

	R	α	β	f	S1	S2	r1	r2	Top Cap	Bottom Cap	L1	L2	Lw1	Lw2
None														
Square Groove	X								X	X				
Single V	X	X		X					X	X				
Double V	X	X	X	X	X	X			X	X				
Single U		X		X			X		X					
Double U		X	X	X	X	X	X	X	X	X				
Single J	X	X		X			X		X	X				
Double J	X	X	X	X	X	X	X	X	X	X				
Bevel Groove	X	X		X					X	X				
Double Bevel	X	X	X	X	X	X			X	X				
Single Fillet Weld											X		X	
Double Fillet Welds											X	X	X	X

NOTE: For **Single U** and **Double U** welds, the root opening (**R**) is equal to zero. Since the parameter cannot be modified, it is not visible.

Here are the meanings of each weld symbol parameters:

- **R**: Root opening
- **α**: Bevel angle α
- **β**: Bevel angle β
- **f**: Root face
- **S1**: Weld depth of the bevel #1
- **S2**: Weld depth of the bevel #2
- **r1**: Groove radius #1
- **r2**: Groove radius #2
- **L1**: Length of the left-side fillet weld
- **L2**: Length of the right-side fillet weld

- **Lw1**: Effective throat of the left-side fillet weld
- **Lw2**: Effective throat of the right-side fillet weld

10.3 Wizard

The goal of the wizard is to quickly and simply guide you to define the part to be inspected and the weld, if any. Here is a summary of the steps to follow:

1. Choose the desired part
2. Define the part according to the part parameters
3. Choose the weld type. If you want a fillet weld, choose the fillet weld localisation.
4. Define the weld (if any) according to the weld parameters

View the following video for how to define a **Flat** part with a **Single V** weld.

View the following video for how to define a **T-joint** with **Fillet Welds.**

10.3.1 Part View

The **Part View** is a view only accessible in the **Part** menu. It allows to focus on the part and its dimensions. Thus, it is not possible to see a probe or an A-Scan. These interactions are reserved for the **Scan Plan view** or the **A-Scan view**.
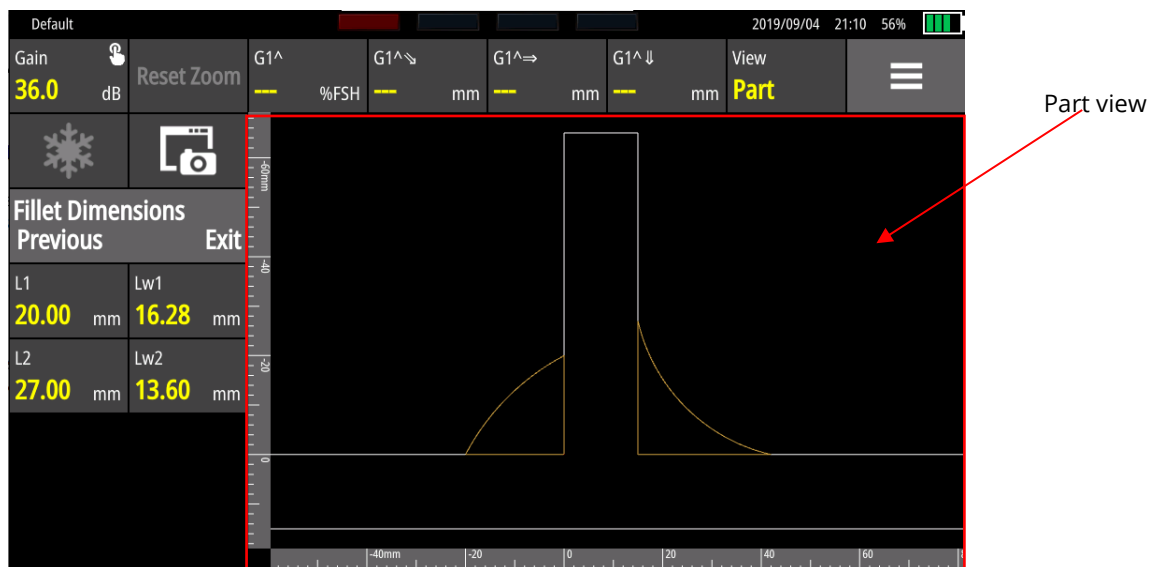

Figure 39 – Part view

The **Part View** always includes vertical and horizontal rulers. The units of the rules are in SI or imperial system depending on user preferences (see Section 7.5).

11 The Scan Plan View

The **Scan Plan View** allows you to see the part with the probe and the distances. Of course, it is possible to add visual elements such as welds, real A-scan ray tracer and grids. The **Scan Plan View** is the visual tool that allows a better understanding of defects in an inspected part.

11.1 Scan Plan Menu

The following options are available in the **Scan Plan** menu.

Table 20 – Scan Plan parameters and their meanings

Button	Choices	Action
Beam Exit Point	*Read-only*	For **T-joint** or **Corner joint**: The linear distance from the vertical wall thickness to the point where the beam exits the wedge. For **Flat** and **Curved** parts: The linear distance from point 0 to the point where the beam exits the wedge. By default, this distance is set as -20.00 mm for all geometries.
Ruler	Both, None	Rulers are located on the left and on the bottom axis and can show metric/imperial values depending on the unit system.
Grid Type	None, Plain, Cross	By default, the dimensions are 10x10mm (1″x1″),but can change as you zoom in or out. Grid lines may help you on sizing and distance evaluation.
Weld Visible	Yes, No	This feature allows you to see the weld overlay. It helps you to be more confident with defects location and evaluation.
Signal Visible	Yes, No	This feature allows you to have the A-scan displayed over the ray tracer, in real time. It helps you to be more confident with defects location and evaluation.
Distance Visible	Yes, No	It allows you to show or hide the distance.

NOTE: Distances located on the left side of the vertical reference point (Y axis origin) are set by default as negative values. Distances located on the right side of the vertical reference point (Y axis origin) are set by default as positive values.

11.2 Moving a Probe

To virtually move the probe over the test piece image, you just need to click the probe and move it to the desired position. All geometric parameters are then automatically adjusted.

View the following [video](#) for how to move a probe into the **Scan Plan View**.

12 Auto Cal and Sizing Methods

Conventional ultrasonic techniques have a wide variety of methods for flaw sizing Wave offers all of the most popular methods: **DAC**, **TCG**, **AWS**, **DGS**, **AWS**, **API, T-log** and **Auto Cal**.

12.1 Auto Cal

Auto Cal provides automatic calibration of sound velocity and transducer zero. In order to achieve a proper calibration, two factors must be known: the velocity of sound in the material under inspection, and the offset of the transducer caused by wear face and phase shifts.

The **Auto Cal** automates this process so that only two readings are required, one on the thin sample and one on the thick sample. The Wave then sets the **Velocity** and **Probe Zero**. This **Auto Cal** operation must be repeated any time the test material is changed (velocity) or the transducer is changed (zero).

View the following video for how to use **Auto Cal**.

12.2 DAC

One of the many ways to perform echo evaluation is by means of the *distance-amplitude correction* (DAC). DAC curves use a series of reference echoes from a reference block having artificial flaws. Due to sound attenuation on materials and beam spread while using angle probes, echo heights of same-sized reflectors are different at distinct depths (sound path).

12.2.1   Create a DAC Curve

With the help of a calibration block, you can set a DAC curve by clicking on the **Sizing** menu. Then, click on **DAC**. Before creating a new DAC curve, you can set the Reference Amplitude (% of FSH), configure the range size (in mm/in) and enable or disable the **Split DAC** function.

Couple your probe with your standard block and try to maximise the echo from the first reflector. Depending on your range size and the sound path associated with your reflector, the refracted echo can be located outside of the reference window. You can move the reference window (forward/backward) through the A-Scan until it encompasses the echo; simply click on the touch panel. You can also enlarge or reduce the window width by directly clicking on the window and then adjusting it according to your needs.
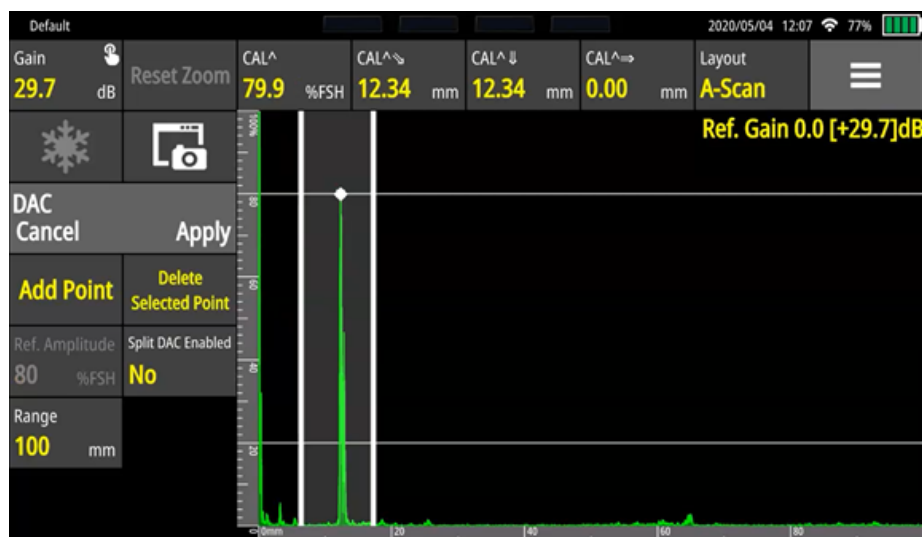
Figure 40 – Creating a DAC curve

At this point, you do not need to be aware of echo amplitude (gain level). You just need to make sure that the first echo corresponds to your reference reflector to maximise its amplitude. When the first echo is recorded, Wave automatically sets the **Gain** at 80% FSH by default. You can change the reference amplitude to other values with the **Ref. Amplitude** button and according to your requirements. The gain is locked and set as the reference gain. To record an echo, you should click on **Add Point**. Once the reference gain is set and the first echo is recorded, you can randomly record the other points to create a DAC curve. You can also delete or replace another point as much as necessary if they consider that the point was not properly taken. To delete or replace a point on a DAC curve, move the reference window over the point and then click on the **Delete Selected Point** option.

If an echo amplitude falls below 20% FSH, click **Split DAC Enabled**. Once this option is switched on, continue recording points. Wave will automatically set the gain so that echo amplitude will reach the level of amplitude set by you.

Figure 41 – Split DAC function enabled

You can add up to 16 points to a DAC curve and also have four Split DACs, depending on their needs.

View the following video for how to create a DAC curve.

12.2.2 DAC Sizing Options

Once a DAC curve is created, these are the following sizing options available for the **DAC** sizing method.

Table 21 – DAC sizing options

Option	Meaning
Transfer Loss	The transfer loss is the gain to compensate for the difference of attenuation between a reference standard and the part to be inspected.
DAC Trigger	It sets the trigger of the alarm when DAC curve is on (DAC, G1, 6 dB, 0 dB, -2 dB, -6 dB, -10 dB, -12 dB and -14 dB). Options are directly dependent on DAC sub curves.
Gain Mode	Absolute or relative
Split DAC Enabled	Turns on/off Split DAC option
DAC Subcurves	-2/-6/-10, -6/-14, JIS and Custom

12.2.3 Absolute and Relative DAC Gain Mode

Under sizing options, the DAC curve height can be displayed in two different ways. To dynamically adjust its height, set the **Gain Mode** to **Relative**.
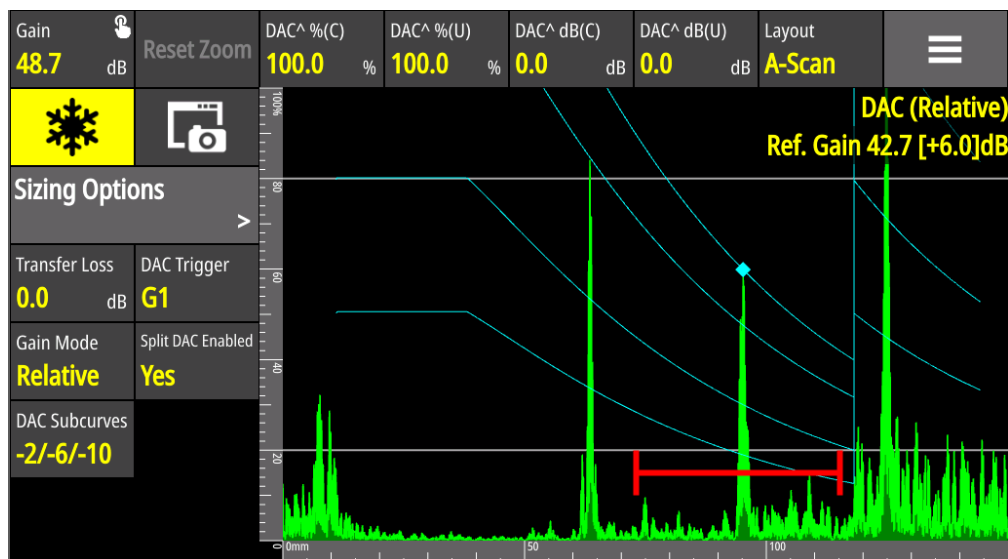

Figure 42 – Gain mode set to Relative and 6 dB of scanning gain has been added

In the figure above, 6 dB of scanning gain has been added. All the DAC curves have also been increased by 6 dB. Please noted that all relative amplitude measurements have not changed (+0 dB).

The figure below is based on the same previous example; however, the **Gain Mode** is set to **Absolute** instead. The A-scan is indeed +6 dB higher, while the DAC curves have not moved. Please note that corrected (C) measurements provide a compensated amplitude reading. It is the advised assessment method to use for DAC amplitude measurements. Uncorrected (U) measurements are not compensated with respect to the DAC calibration.
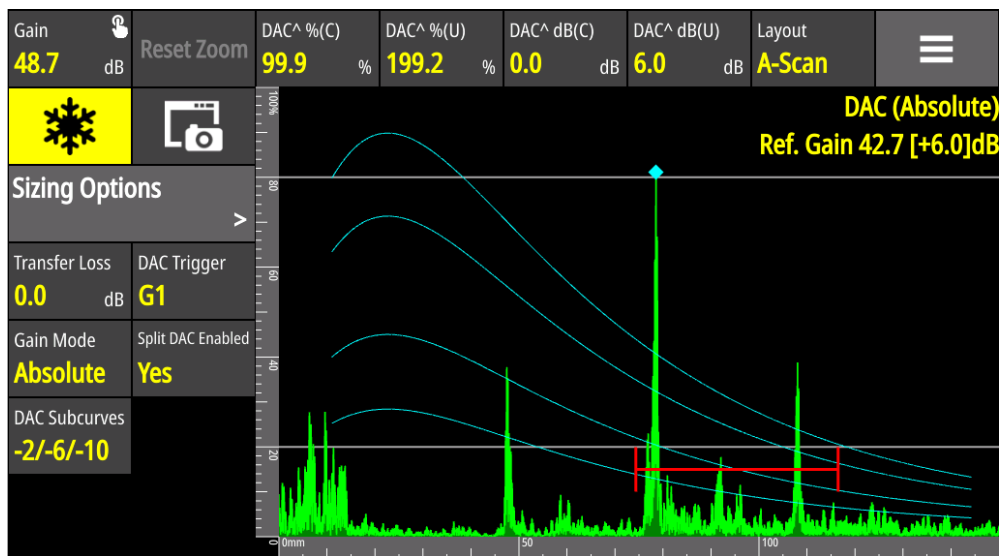

Figure 43 – Gain Mode is set to Absolute and 6 dB of scanning gain has been added

12.2.4   Amplitude Corrected and Uncorrected Measurements

You may choose corrected and uncorrected measurements for the amplitude DAC. They appear as (C) and (U) in the top measurement bar, within a drop-down list.
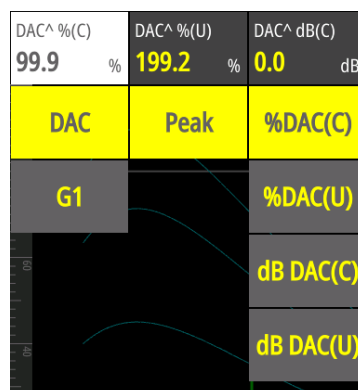

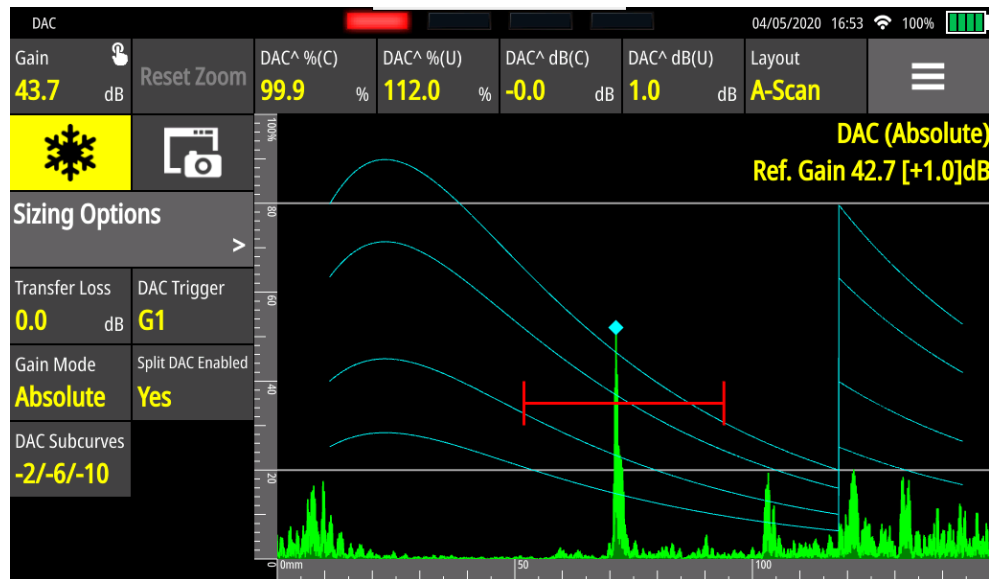Figure 44 – Corrected and uncorrected DAC measurements in a drop-down list

Figure 45 Corrected and uncorrected measurements when +1 dB is applied

Corrected measurements, such as the screenshot above, is the recommended way to use DAC measurements. Regardless of the **Gain Mode**, the scanning gain is 1 dB stronger than the current reference gain (42.7 dB+ 1.0 dB = 43.7 dB). The calibration has not been changed, so the corrected readings are also 100.0% FSH and 0.0 dB. The uncorrected readings are 112.0% FSH and 1.0 dB. This would mean a larger reflector. It also breaks the current calibration because a higher A-scan echo from the same reflector should give the same DAC gain difference.

12.3 TCG

Another alternative to perform echo evaluation is by the *time correction gain* (TCG). TCG uses a series of reference echoes from a calibration block with artificial flaws. This sizing method is a way to compensate material attenuation and beam characteristics so that reflectors of equal size at distinct depths into a piece will provide the same amplitude response on A-Scan.

12.3.1 Create a TCG Curve

With the help of a calibration block, you can set a DAC curve by clicking on the **Sizing** menu. Then, click on **TCG**. Before creating a new TCG curve, you can set the Reference Amplitude (% of FSH), configure the range size (in mm/in) and, enable/disable the function to lock points.

Couple your probe with your standard block and try to maximise the echo from the first reflector. Depending on your range size and the sound path associated to your reflector, the refracted echo can be located outside of the reference window. You can move the reference window (forward/backward) through the A-Scan until it encompasses the echo by just clicking on the touch panel. You can also enlarge or reduce the window width by directly clicking on the window and then adjusting it according to your needs.

At this point, you do not need to be aware of echo amplitude (Gain level). You just need to make sure that the first echo corresponds to your reference reflector to maximise its amplitude. When the first echo is recorded, Wave automatically sets the **Gain** at 80% FSH by default. You can change the refence amplitude to other values on **Ref. Amplitude** button based on your requirements. The gain is locked; it is set as the reference gain. To record an echo, you should click on **Add Point**. Once the reference gain is set and the first echo is recorded, you can randomly record the other points to create a TCG curve. You can also delete or replace another point as many times as necessary if they consider the point was not properly taken. To delete or replace a point on your TCG curve, you need to move your reference window over the point and then click on the **Delete Selected Point** option.

Figure 46 – Creating a TGC curve

Here is some additional information on the buttons found in the wizard.

Table 22 – Buttons in the TCG wizard

Option	Meaning
Lock Points	It allows you to lock or unlock (yes or no) the points on TCG curve.
Range	It allows you to set the range according to their needs.
Delete Selected Point	It allows you to delete selected points on the TCG curve.

View the following video for how to create a TCG curve.

12.3.2   TCG Sizing Options

After creating a TCG curve, you can easily switch from TCG to DAC and back, via the **DAC to TCG** button. Once the **TCG** curve is created, you can still set the **Transfer Loss** making the curve visible, as shown on the following figure.

Figure 47 – TCG sizing options available

12.4 DGS

Distance-gain-size diagram is a theoretical model for discontinuity sizing evaluation. This model allows technicians to correlate discontinuity size between natural flaws and theoretical reflectors in terms of distance compensation, and without requiring a large range of reference standards in order to establish an evaluation curve.

DGS flaw sizing shows the sound response from "equivalent reflectors" of different sizes at distinct depths, by performing mathematical predictions in terms of probe effective diameter, frequency and near-field length.

When performing DGS evaluation, keep in mind that this defect sizing method shows some limitations and it may lead to no definitive conclusions in some cases. As far as discussed above, it is a predictive method and it tends to work better on standard configurations, circular probe elements and narrow band.

12.4.1   Performing a DGS Calibration

Prior to generating the DGS evaluation curve, you must be in possession of a standard test block with a reference reflector in order to define a reference point. A standard test block must have one of the following reflectors:

- Side-drilled hole – SDH

- Flat bottom hole – FBH
- Backwall – BW

NOTE: To perform DGS evaluation, click the **Probe** menu and choose a proper DGS probe from the probe list. Otherwise, the DGS sizing option will remain greyed out on Wave.

Couple your probe with your standard block and try to maximise the echo from the first reflector. Depending on your range size and the sound path associated to your reflector, the refracted echo can be located outside of the reference window. You can move the reference window (forward/backward) through the A-Scan until it encompasses the echo by just clicking on the touch panel. You can also enlarge or reduce the window width by directly clicking on the window and then adjusting it according to your needs.

Press **Calibrate** once the echo is correctly located in the calibration window. Wave will automatically set the gain as the Reference Gain. Wave will then apply it to finalise the calibration procedure.

Figure 48 – Performing a DGS calibration

Once a DGS probe is selected, you may set some additional parameters.

Table 23 – Additional parameters for DGS sizing options

Option	Meaning
Ref. Attenuation	Attenuation finds the attenuation losses at the calibration step.
Material Att.	Material attenuation of the test piece. Once the DGS calibration is done, it applies the attenuation effect on all DGS curves.
Ref. Type	Reference echo can be a side-drilled hole, flat bottom hole or the infinite reflector size, also known as the backwall echo.
Ref. Type	Reference echo can be a side-drilled hole, flat bottom hole or the infinite reflector size, also known as the backwall echo.
Ref. Size	Reference size during the calibration, its type is defined in the **Ref. Type** tile
Ref. Block Velocity	The velocity of the reference block

View the following [video](#) for how to create a DGS curve.

12.4.2   DGS Sizing Options

Once a DGS curve is created, there are the following options available on **DGS** sizing options menu.

Table 24 – Information regarding the DGS sizing options

Option	Meaning
Transfer Loss	The Transfer Loss is the gain to compensate for the difference of attenuation between a reference standard and the part to be inspected.
DGS Trigger	It sets the trigger of the alarm when DGS curve is on (DGS or G1).
Gain Mode	Absolute or relative
ERS	Equivalent Reflector Size
DGS Subcurves	Ref, ERS or dB

12.5 AWS

You can evaluate discontinuities according to AWS D1.1 *(American Welding Society)*. This evaluation is based on signal amplitude comparison. The echo amplitude from a discontinuity is compared to the echo amplitude of a known reflector. It is defined as an indication rating according to the code. Sound attenuation in test part is also taken into account for evaluation.

12.5.1   Performing an AWS Calibration

Couple your probe with your standard block and try to maximise the echo from the reference reflector. Depending on your range size and the sound path associated to your reflector, the refracted echo can be located outside of the reference window. You can move the reference window (forward/backward) through the A-Scan until it encompasses the echo, by just clicking on the touch panel. You can also enlarge or reduce the window width by directly clicking on the window and then adjusting it according to your needs.

At this point, you do not need to be aware of echo amplitude (Gain level). You just need to make sure that the echo corresponds to your reference reflector and maximise its amplitude. When the echo is recorded, Wave automatically sets the **Gain** at 80% FSH by default. You can change the refence amplitude to other values on **Ref. Amplitude** button based on your requirements. Since the reference level is taken (dB level), it is no longer possible to make adjustments on the reference gain; however you can still set the range. For calibration, echoes must reach the gate at a proper amplitude level.

Figure 49 – AWS calibration has been performed on this echo

 View the following video for how to perform an AWS calibration.

12.5.2   AWS Sizing Options

Once AWS is set and calibrated, the following sizing options are available in the **AWS** menu.

Table 25 – AWS sizing options

Option	Meaning
Transfer Loss	The Transfer Loss is the gain (dB) to compensate for the difference of attenuation between a reference standard and the part to be inspected.
AWS C Rounded	It allows you to choose the rounding method for the C parameter (0.1 dB or 1 dB precision).

The AWS C rounded parameter is a material attenuation factor. It is expressed in terms of dB. It relates the sound attenuation. It can assume positive or negative values depending on sound path length (in inches). These values can be rounded to the unit or decimal according to customer needs.

12.6 API

You are able to perform discontinuity evaluation according to American Petroleum Institute (API) *Recommended Practice for Ultrasonic Evaluation of Pipe Imperfections by using the Amplitude Distance Differential Method (ADDM)*, also known as API Recommended Practice 5UE.

This evaluation method is a combination of amplitude comparison and a 6 dB drop in echo amplitude to determine the radial depth of a discontinuity. It assumes that radial depth of a discontinuity affects either the amplitude of the received echo signal and the differential time of flight of the incident ultrasonic wave as it passes through the discontinuity.

12.6.1   Perform an API Calibration

To perform calibration, you must have a calibration block with a reference reflector such as a notch or a side-drilled hole. Couple your probe with your standard block and try to maximise the echo from the reference reflector. Depending on your range size and the sound path associated to your reflector, the refracted echo can be located outside of the reference window. You can move the reference window (forward/backward) through the A-Scan until it encompasses the echo by just clicking on the touch panel. You can also enlarge or reduce the window width by directly clicking on the window and then adjusting it according to your needs. At that point, amplitude echo must show a value between 5%FSH and 100%FSH, and a proper gain setting may take place if necessary. You must also set the **dr** (the reference reflector diameter) to perform calibration. When the gate is correctly placed, and the echo amplitude reaches the appropriate value, press **Calibrate**. Wave will automatically calculate the **API k** factor (a derived factor for calculating depth). Set the trigger (Gate or API) and then go to the measurements bar to set which values will be displayed in the top of the screen.

Figure 50 – API K factor calculated after the calibration

 View the following video for how to perform an API calibration.

12.6.2   API Sizing Option

To calibrate the API, only one sizing option is available.

Table 26 – API sizing option

Option	Meaning
Transfer Loss	The transfer loss is the gain to compensate for the difference of attenuation between a reference standard and the part to be inspected

12.7 T-log

The method to log thickness data, the T-log (also known as Thickness logging), enables you to log several thickness measurements in a table. These values are colour-coded based on different thresholds (**Min Threshold**, **Max Threshold**, **Tolerance**).

The T-log is built using a wizard. The first step enables you to define the grid. The second step allows you to record thickness measurements.

 View the following video for how to use T-log.

12.7.1   Parameter descriptions

The following table describes the grid's parameters.

Table 27 – Grid parameters

Button	Choices	Action
Grid Width	1 to 200 cells	Determines the width of the grid
Grid Height	1 to 200 cells	Determines the height of the grid
Min Threshold	*Depends on the selected measurement*	Determines the cell's colour
Max Threshold	*Depends on the selected measurement*	Determines the cell's colour
Tolerance	*Depends on the selected measurement*	Determines the cell's colour

The following table describes the parameters with respect to data acquisition.

Table 28 – Data acquisition parameters

Button	Choices	Action
Store	*No option available*	Save the first measurement in the *measurement bar* from the left-hand side
Increment Order	Right Down, Left Down, Right Up, Left Up, Down Right, Down Left	How to move into the grid
T-min	On or Off	This keeps a record of the first minimum value (using the left-hand side of the measurement bar, this mode will only be used on the first measurement).
Reset T-min	*No option available*	Enables you to reset the T-min value
Clear	*No option available*	Deletes all values in the grid. Important: You need to perform a *long press* to activate the button.
Save to CSV	*No option available*	To save the grid in .csv format as well as other measurements in the measurement bar.

As indicated in Table 22, the measurement that will be logged in the grid is the first one in the measurement bar from the left-hand side.
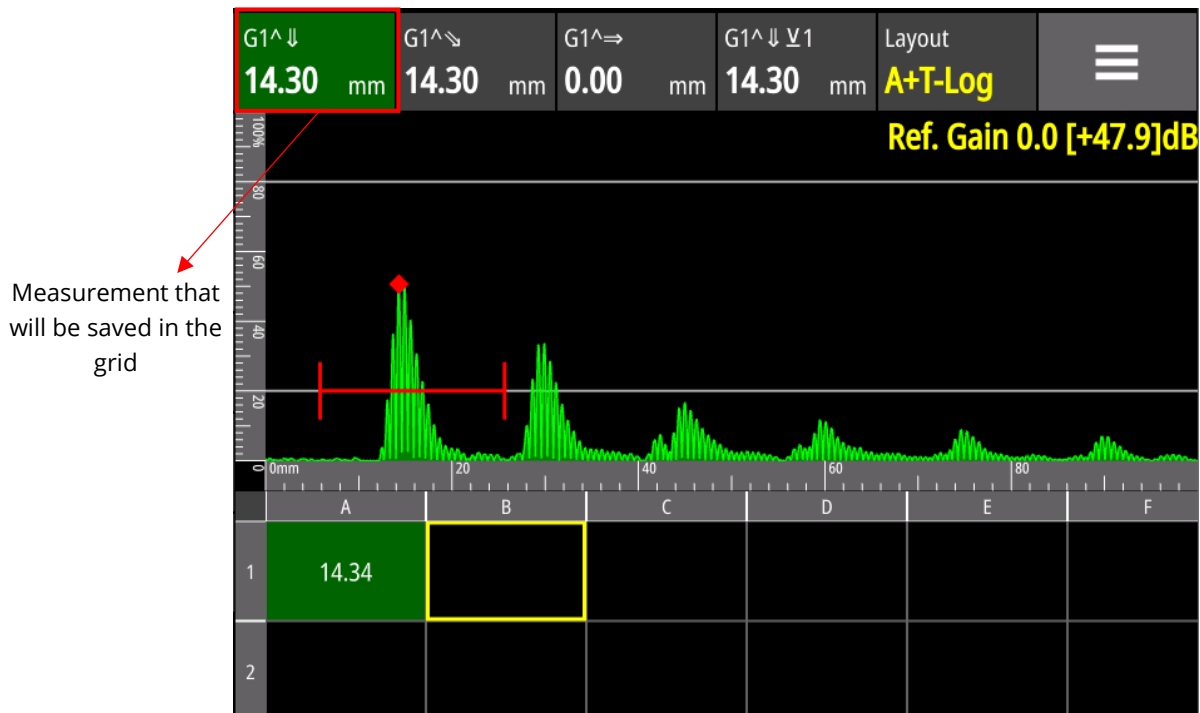

Figure 51 – The first measurement that is saved in the grid

12.7.2   Colour Palette

A cell can have up to six colour palettes. The following table features the colours based on the Wave's contrasts. The extreme values of each colour are identified.

Table 29 – Colour palette for the T-log

Normal contrast	High contrast	Bornes
		$[Min\ threshold + tolerence, infinite]$
		$[Min\ threshold, Min\ threshold + tolerence]$
		$[Min\ threshold, Max\ threshold]$
		$[Max\ threshold, Max\ threshold + tolerence]$
		$[Max\ threshold + tolerence, infinite]$
		No logged valued

12.7.3   T-min function

The T-min function is available to you when conducting thickness measurements. To activate/deactivate this function, you need to click on the T-Min button, as shown in the figure below. The symbol ⬇ is added to the measurement field at the top of the screen in order to highlight that the T-Min function is enabled.
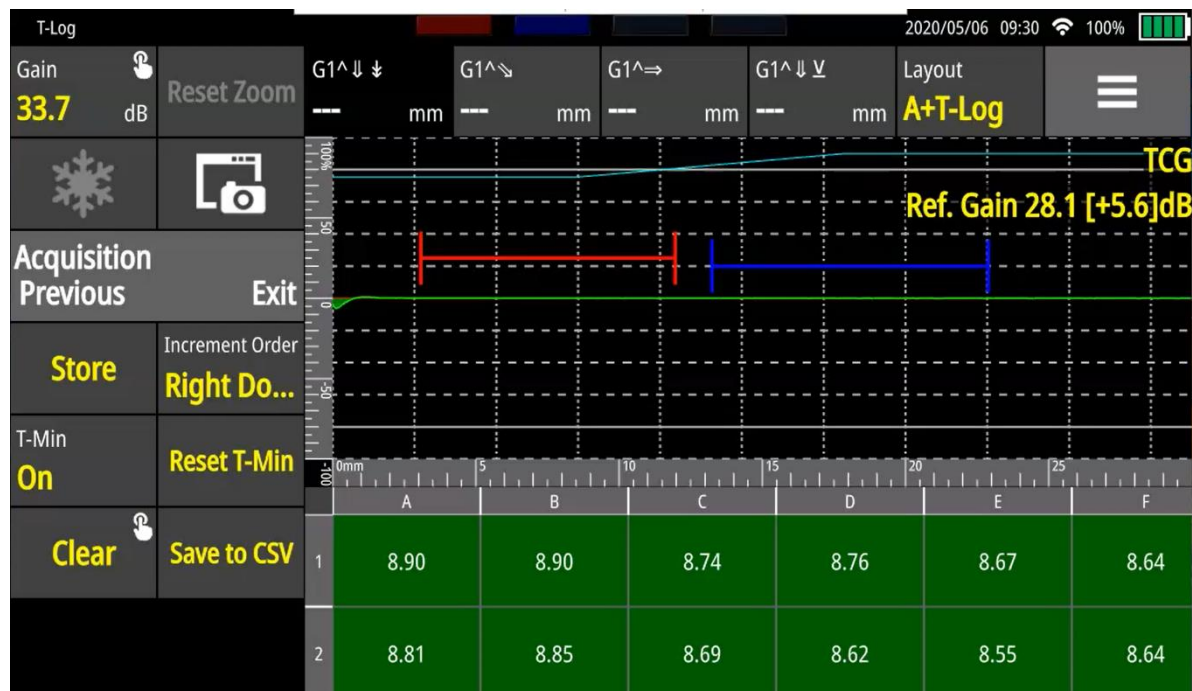

Figure 52 – T-Min function is enabled

This function allows you to set the minimum thickness value as a reference while taking measurements, depending on the values previously established for the minimum threshold, maximum threshold, and tolerance (mm / in /%).

Once the T-Min function is enabled, a new button is also enabled, the Reset T-Min. This button allows you to reset a new reference value for the minimum thickness, starting from the active cell. Once activated, all measures taken after enabling this function will be taken as a reference for the minimum thickness, which represents the new value established.

This function can be very interesting for you when they perform measurements with significant variations in thickness. It allows you to perform all the necessary measurements without the need to save them in separate files.

12.7.4   CSV Files

You can export all stored values to a .csv file. All they need to do is click on Save to CSV button. Wave will then automatically generate four .csv files. Each file will include one of the measurements recorded in the data table. The names of the files will be automatically generated with the time stamp, the name of the application used to record the

measurements, and an indicative at the end that related to each type of measurement (M1, M2, M3 and M4).

To access the files, you must connect to the device through the Wave Companion software. Once connected, they will be able to select the desired files and transfer them to their computers. View the figure below for more details.
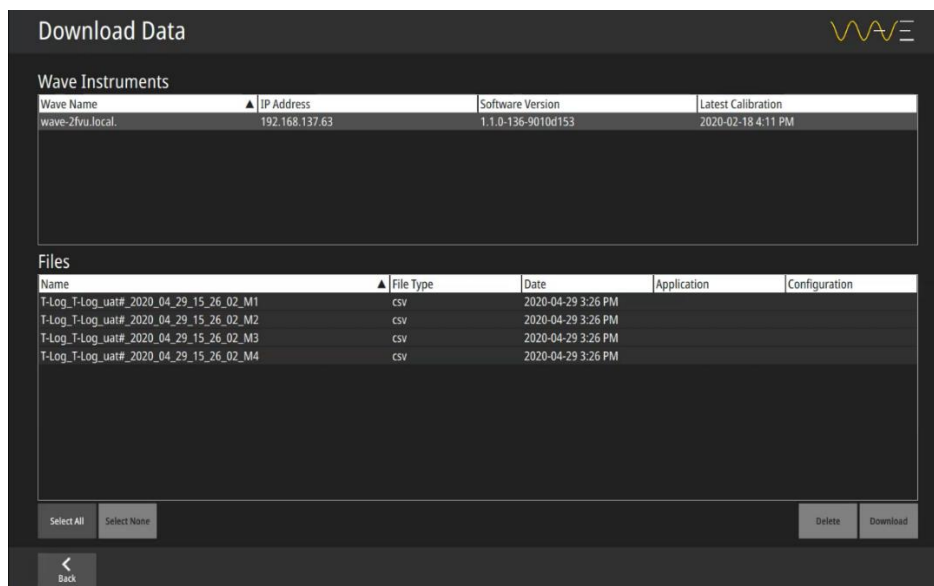

Figure 53 – Companion interface that shows stored CSV files in the instrument

The headers and the measurement relative to each file will be present at the top of the file's data table. Values will be shown in the table as a function of measurements taken by you and the table size (columns x lines). View the details in the figures below.

Figure 54 – Automated generated CSV files

Figure 55 – Example of a CSV file

13 Report

The Wave reporting tool has been designed to generate a report based on a source. This source is in fact a screenshot that includes all the information from the configuration. Therefore, once the source is selected, the report data is automatically filled in. However, you are free to modify some of the information. This allows you to add complementary information to the report. In addition, you can preview the report at any time before saving it. Once saved, the report is available in PDF format. Finally, it is possible to send the PDF formatted report by email or to retrieve it through the Wave Companion.

13.1 Workflow

Creating a report is typically done through a few simple steps. These are:

1. Save relevant screenshots during inspection (flaws or any other noteworthy information)
2. Initiate the creation of a report
   a. Select the main screenshot, called the Source; it is used to namely populate the report with the UT parameters.
   b. Add additional information to complete the report (customer name, code or procedure, inspector qualification, etc.)
   c. Add additional complementary screenshots
3. Preview the report
4. Save the report
5. Send the report via email

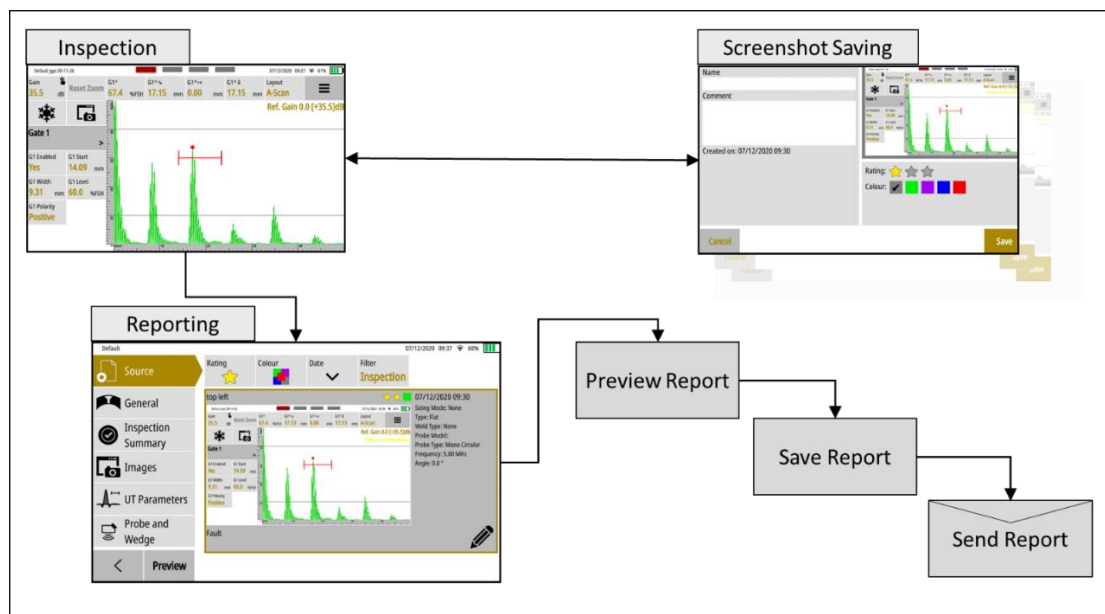Below is a diagram that shows the steps described above.

Figure 56 - Reporting workflow

As will be explained in the following sections, the reporting module is not limited to the specific workflow described above. For example, once a report is created and saved, it is very possible to suspend the process at this point and only send the report at a later time, for example once someone would be near a Wi-Fi access point.

13.2 Screenshot

Taking screenshots during the inspection process allows to capture images of A-Scans, Scan Plans, or both, as well as the 4 measurements displayed on the screen. This is done using the **Screen Capture** button.

Figure 57 - Using the screenshot button (highlighted in red)

Once the **Screen Capture** button is hit, you are presented with the following screen:

Figure 58 - Entering more information associated with a screenshot

As shown in Figure 58, it is then possible to add basic information to the screenshot just taken.

13.2.1 Name and Comment

- Name: Used to enter any name that will help identify the screenshot. For example, useful and significant names could simply be: "Weld Nb 32"
- Comment: Used to add additional information that relates to the screenshot. For example, one may enter short but meaningful comment, such as "Lack of fusion."

Note that these fields can be left blank. In the case a custom name is not entered, a default name will be used to uniquely identify the screenshot. The format of that default name:

"Application Short Name" + YYYY-MM-DD HH:MM:SS

where:

- YYYYY: Year
- MM: Month
- DD: Day
- HH: hour
- MM: minute
- SS: seconds

13.2.2 Rating and Colour

Additionally, Wave allows to classify screenshots using 2 useful properties: the rating and the colour. The rating is 1, 2 or 3 stars. A good way to use ratings would be, for example, to set all screenshots that need to be part of a report with 3 stars, as they indicate a flaw.

The colour is a second characteristic that could be used to categorise screenshots. Whether it is to help classify the type of defect, differentiate screenshots taken in the morning from those taken in the afternoon, or categorise as per the position (e.g., top, bottom, left side and right side), you can choose the category you need.

Of course, neither a rating nor colour need to be used. They can be left at their default values.

When saving the screenshot, the image of the screen saved, and all the UT inspection parameters are also recorded. This additional information is what we call the metadata. What is saved is a perfect snapshot of the screen content and all the inspection parameters at the exact time the screenshot was taken.

13.2.3 Cancel and Save

By clicking the **Cancel** button, the screenshot is discarded, and you are brought back to the inspection screen.

Clicking on the **Save** button saves the screenshot, name, comment section, time stamp, rating and choice of colours. Note that all these parameters can be modified later, except for the time stamp, which remains unchanged.

13.3 Create a Report

There are two ways to create a report, either from the **App description** screen or directly from the current **Inspection** screen. Although they both produce a similar result, each has its own specific details.

NOTE: The screenshot does not have to be an A-Scan. The **Layout** menu allows you to switch between **A-Scan**, **Scan Plan** and **A+ Plan** (i.e. A-Scan and Scan Plan side by side) views. The **Screen Capture** button can be pressed at any time from these views.

13.3.1 From the Inspection Screen

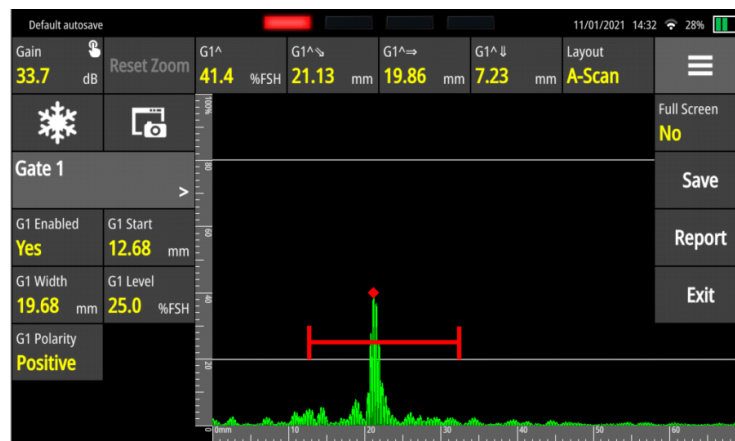From the Toolbar menu, press the **Report** button.

Figure 59 - Report creation from within the application

From there, the screenshots related to the current inspection will be displayed first, which is an advantage of this workflow.
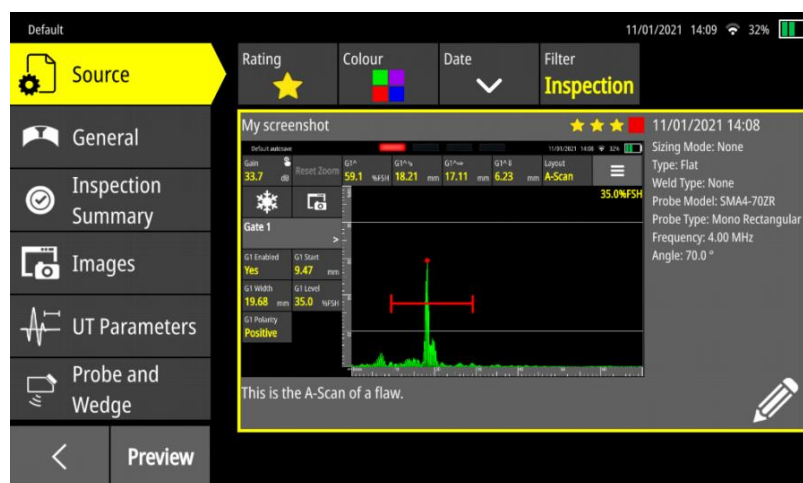

Figure 60 - Report creation first step

The screenshots are by default ordered with the most recent ones first.

13.3.2 From the App Description Screen

In the **App Description** screen, click on the **Reports** tab. Then, click on the **Create** button.
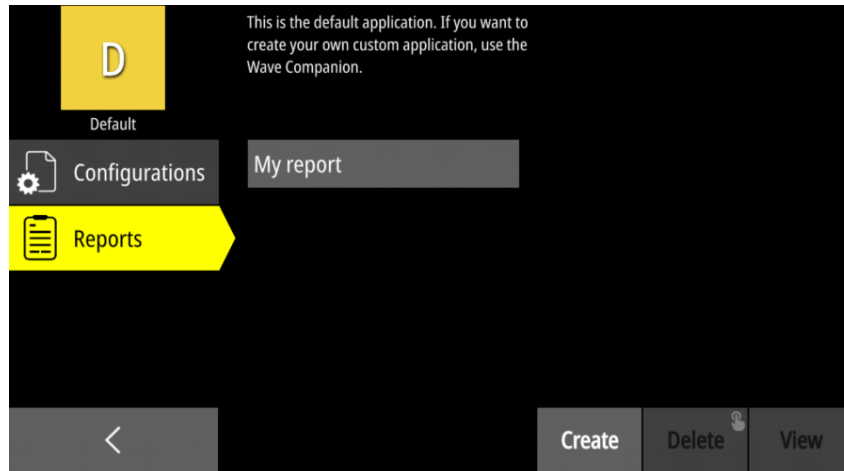

Figure 61 - Launching report creation from the App Description screen

13.4 Report Creating Screen

Creating a report is quite quick and easy. There are a few key concepts to keep in mind and make sure they are properly understood. These are explained in the following sections.

13.4.1 Source

As can be seen in the **Error! Reference source not found.**, the first tab on the left is called the **Source**. This first tab is selected by default when you start to generate the report. The source means the screenshot that will be used as the main one in the report. That will be the screenshot from which the UT parameters will be fetched from. Later on, you can add additional screenshots. These will be secondary or additional screenshots. This will be done when the **Images** tab will be selected.

There are quite a few tools and filters to help when selecting a source screenshot. We will explore each of them. Again, refer to **Error! Reference source not found.**.

13.4.1.1 Selecting the Source Screenshot
To select which screenshot will be the source of the report, simply press on one of the screenshots that appears in the list. The selected screenshot will then be highlighted with a bold rectangle. The selection can be modified by simply pressing on a different screenshot.

13.4.1.2 Editing the Source Screenshot
Once highlighted, the screenshot also displays an **Edit** icon in the bottom right corner. By pressing this icon, you will then have the opportunity to edit the screenshot name and comment as well as its rating and colour properties.
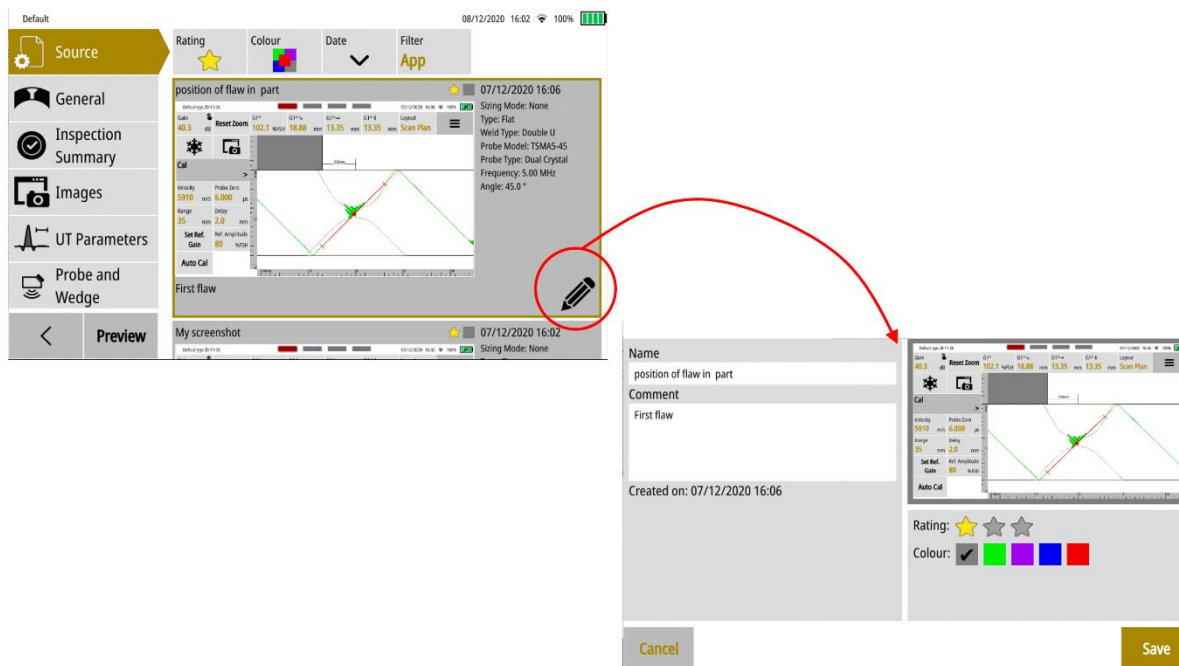
Figure 62 - Editing a screenshot during when generating a report

Once the edit is completed, exit with the **Save** button. The system will bring you back to the Source tab of the report. The same happens if you hit cancel to ignore all changes to the screenshot.

13.4.1.3 Rating Filtre

This filter allows you to limit the screenshots in the list to only those having a star rating of at least the number of stars selected. That is, by selecting a filter of 2-star rating, only these screenshots having a rating of 2 or 3 stars will appear in the list.

13.4.1.4 Colour Filtre

The colour filter is an exclusive one. Only screenshots having the colour property selected in the filter will appear in the list. To select all files whatever their colour property, simply select the 5 colour icon in the colour filter drop-down list.
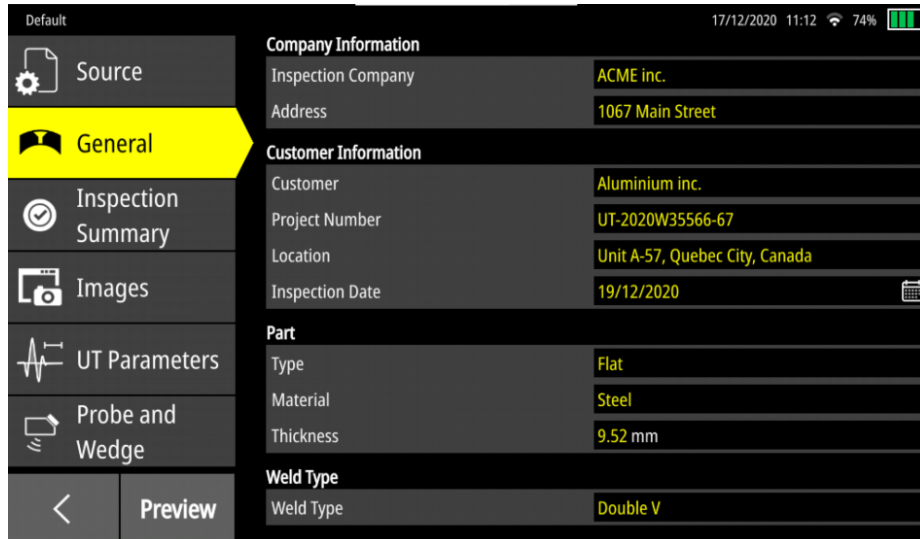
13.4.1.5 Date

Date is not a filter; it is a means to put screenshots into order. By default, screenshots are presented by reverse chronological order. You can change this to chronological order by pressing on Date. This is a simple toggle.

13.4.1.6 Filtre

Filtre allows you to choose all screenshots or only screenshots related to the specific application. When launching the report from within the application, a third choice appears in the drop-down menu, which is "Inspection." This last choice will limit the screenshot listing to those created in the actual inspection session—that is, since the last time the inspection application was launched.

13.4.2 General

This tab presents general information of the report. There are four sections: **Customer Information, Part**, **Weld Type** and **Weld Dimensions**. Note that the last category is only present if the weld type is different from **None**. Each category includes parameters that are specific to it.

Figure 63 – Part of the section presented in the General tab.

NOTE: Some sections might be hidden when you glance at the screen. Do not hesitate to scroll the screen with your finger.

By default, some fields are empty, although a **Source** is selected. In fact, these are the few parameters that need to be written manually in the report. To do this, all you have to do is click on the parameter to be modified. A yellow box will appear to indicate the parameter being modified. In addition, the virtual keyboard will be displayed in the lower half of the screen. Enter the information you want.

Figure 64 – Some fields need to be filled in manually using a virtual keyboard

13.4.2.1 Company Information

This section allows you to enter your company information, such as the name and the address. This information will be visible in the header of the report once it is generated.

13.4.2.2 Customer Information

The parameters of this category are **Customer**, **Project Number**, **Location** and **Inspection Date**. By default, the fields are empty; they have to be entered manually.

Regarding the date, there are two ways to change it. It is possible to write the date in text form, e.g., December 19, 2020, or use the date picker. If the date picker method is chosen, the date format will be linked to the language choice in **Settings** (see Section 14 for more information). To use the date picker method, click on the **Calendar** icon.

Figure 65 – Scroll down to choose the date

13.4.2.3 Part and Weld Dimensions

All the parameters of this category are intrinsically linked to the **Source**. For example, if the part from the **Source** is a T-joint, only the parameters related to the T-joint are displayed. However, it is still possible to modify them. Parts and welds can be edited; they will follow the same behaviours as in the **Inspection** screen. Changing the type of each one will show only their respective parameters and possible choices.

> **NOTE**: If the **Weld Type** is set to **None**, the **Weld Dimensions** section will not be displayed.

13.4.3   Inspection Summary

This tab, as its name suggests, provides a global summary of the inspection. There are three sections: **Description**, **Inspected by** and **Approved by.**
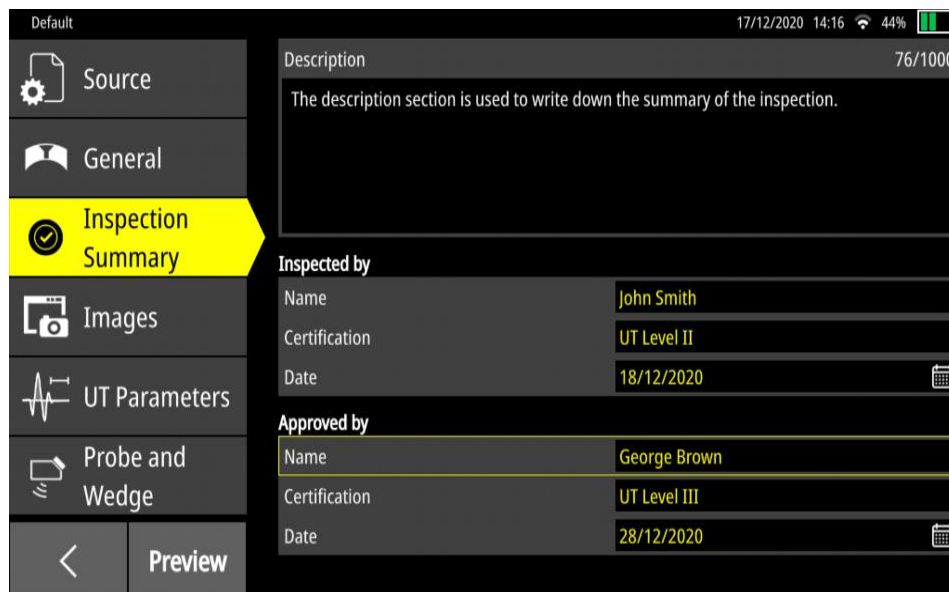
Figure 66 – The sections for the Inspection Summary tab

By default, the fields are empty; they have to be entered manually.

13.4.3.1 Description

This field is designed to allow you to write down a summary of the inspection. You have a limit of 1000 characters, including line breaks. If the limit is reached, it will not be possible to add more text.

Note that line breaks may affect the layout even if the number of characters is not reached. If this is the case, by clicking on the **Preview** button, a pop-up appears on the screen indicating that the text is too long and will be truncated in the PDF report.
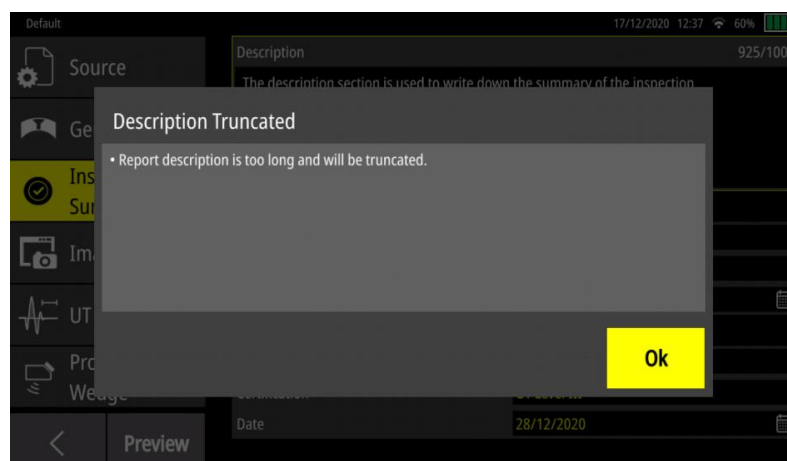

Figure 67 – The pop-up that warns the description will be truncated.

13.4.3.2 Inspected by and Approved by

The purpose of this section is to identify the people who inspected and approved the report.

Regarding the date, there are two ways to change it. It is possible to write the date in text form, e.g., December 19, 2020, or using the date picker. If the date picker method is chosen, the date format will be linked to the language choice in **Settings (**see Section 14 for more information). To use the date picker method, click on the **Calendar** icon.

Figure 68 – Scroll down to choose the date

13.4.4   Images

The **Images** tab presents a list of screenshots in a very similar way as the **Source** tab (see above). Here, multiple selection can be made. All selected screenshots will be added to the report. Note that the screenshot selected in the **Source** tab remains the main one, meaning that it will be used to determine the UT parameters that will appear in the report.

Selected images will appear with a large checkmark. To unselect, just hit again the screenshot. An alternative way of unselecting images consists of selecting the name of the screenshot that appears in the right-hand side of the window and dragging it to the left.
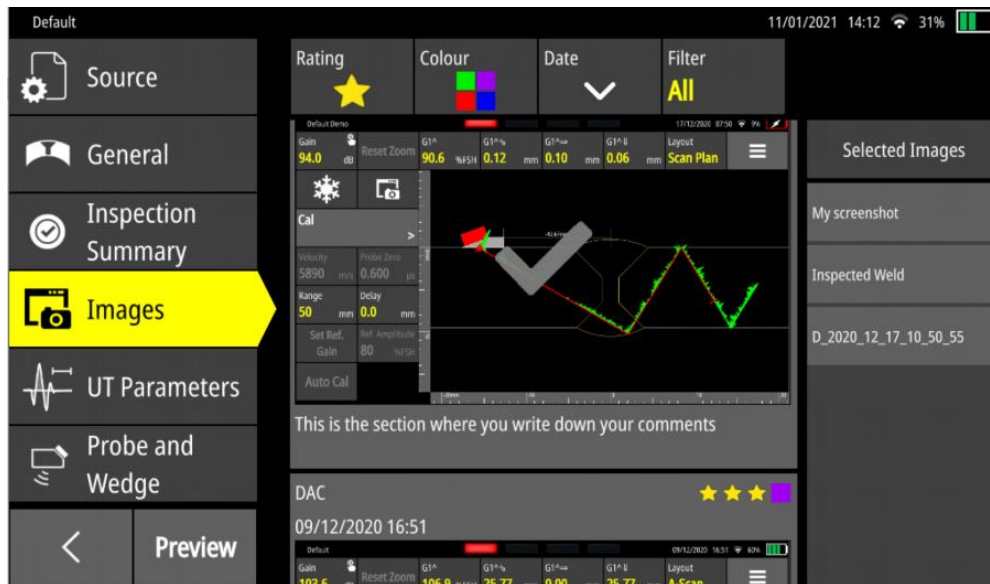
Figure 69 - Additional screenshots to add to the report

The list of selected screenshots can be easily reordered by simply dragging and dropping a specific screenshot appearing in the list on the right-hand side of the screen. Therefore, you can have the screenshots appear in any order in the report that will be created later.

13.4.5 UT Parameters

This tab gathers, in a single place, the parameters directly related to the inspection, excluding those with respect to the probe and wedge. There are four sections: **Code**, **Calibration Block**, **Gain and Amplitude,** and **Calibration**.
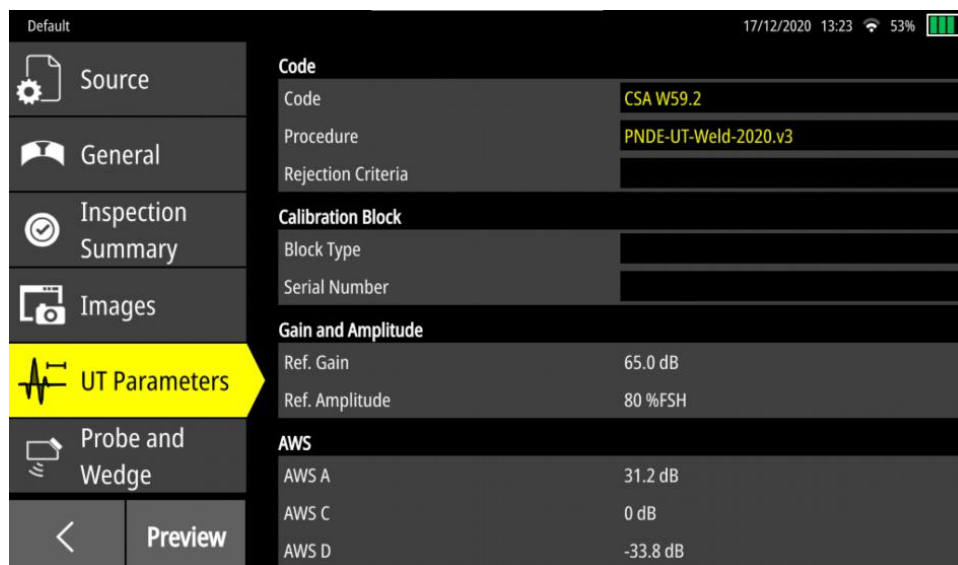

Figure 70 – The sections that are usually displayed for the UT Parameters tab

NOTE: Some parameters might be hidden when you look at the screen. Do not hesitate to scroll with your finger.

13.4.5.1 Code and Calibration

This section is used to identify the procedure and calibration block used for the inspection. By default, the fields are empty; they have to be entered manually.

13.4.5.2 Gain and Amplitude

This section presents the parameters **Ref.Gain** and **Ref. Amplitude**, which are related to the source. Note that these parameters cannot be changed: they are read-only. This avoids any errors that could have important repercussions on report quality.

13.4.5.3 Sizing Mode

This section presents the parameters related to the calibration. They are dynamically displayed, depending on the calibration and the selected source. It is not possible to modify them.

Table 30 shows the parameters according to the calibration selected

Table 30 – Calibration parameters displayed in the report

DAC	API	AWS	DGS	TCG
• Split DAC • Transfer Loss • DAC subcurves • DAC trigger	• dr • API K • Transfer Loss	• AWS A • AWS B • AWS C • AWS C Rounded • Transfer Loss	• Near field • Ref. attenuation • Mat. Attenuation • Ref. type • Ref. size • Ref. block velocity • Delta Vk • ERS • PED • Gain mode • DGS subcurves • DGS trigger • Transfer Loss	• Transfer Loss

NOTE: If the selected source does not provide any calibration, this section will not be displayed.

13.4.6   Probe and Wedge

As indicated by the name, this section presents the parameters related to the probe and wedge. By default, **Couplant** is the only field left empty; it must be filled in manually. This means that all other parameters are intrinsically linked to the **Source**. Nevertheless, all of them can be modified by a visual keyboard or a numerical keypad.

Figure 71 – Parameters related to the Probe and Wedge tab

13.5 Report Preview

At any time, you can visualise a preview of the report by pressing the **Preview** button.

Figure 72 The Preview button is available at any time in order to visualise the report

At this point, the report is not saved. Adjustments are still possible. All you have to do is click on the back arrow to make the changes.

The following table shows the sections displayed according to the pagination of the report.

Table 31 – Breaking down sections of a typical report

	Content	Note
Header	• Company Information	
First page	• Customer • Equipment Specifications[1] • Material • Description[2] • Certification	1. This section is automatically generated with the information intrinsically linked to the device, such as the serial number or the software version. 2. If the description is too long, it will automatically appear on the second page.
Second page[3]	• Screenshot(s)[3] • Caption(s)[4]	3. If there are several images selected, other pages will be created. However, the screenshot will never be on the first or last page of the report. 4. The caption corresponds to the title of the screenshot.
Last page	• Code • Gain and Amplitude • Sizing Method[5] • Transducer and Wedge • Calibration Block	5. If the source does not have an associated sizing method, this section will not be displayed.

13.5.1   Navigation in the PDF Report

Navigating within the report is easy thanks to the touch screen. In order to zoom in or zoom out, you simply have to pinch in or pinch out the screen. Use your fingertip to navigate anywhere on the screen.

More traditional methods can also be used. You can enter the page number of the page you want to access directly or simply use the navigation arrows, as shown inFigure 73Figure 73.
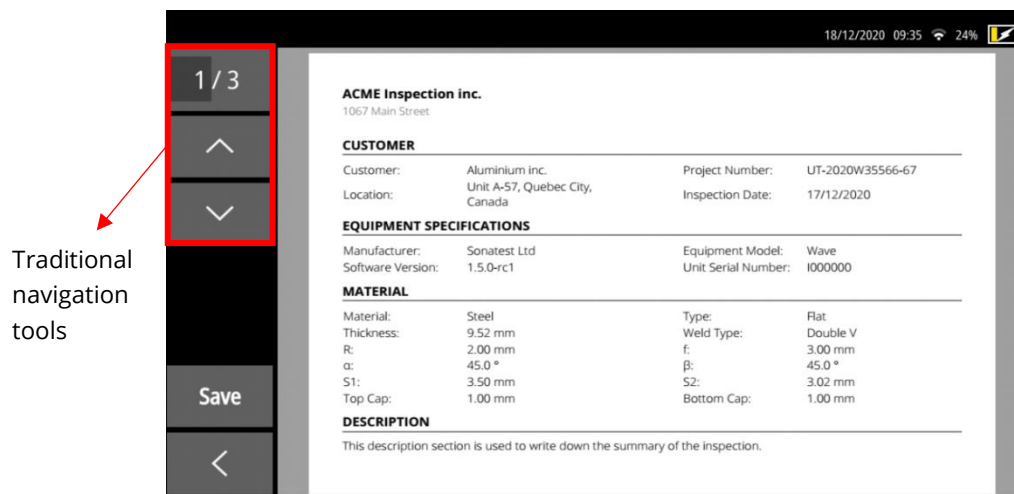

Figure 73 – There are several ways to navigate through the report

13.6 Save and Name a Report

In order to save a report, you must press the **Preview** button in the **Report** screen. Once the report preview is visible, click on the **Save** button.
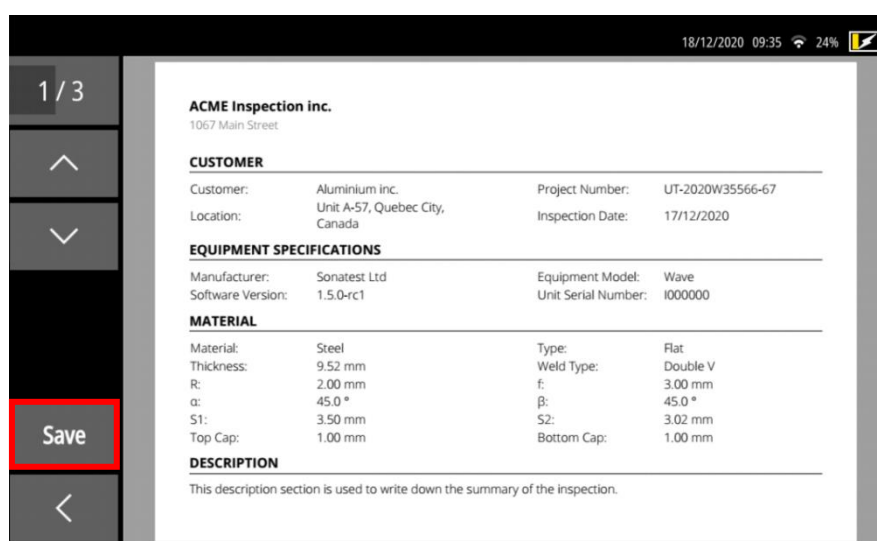
Figure 74 – It is from the report preview that it is possible to save it.

From here, you will be required to write the name of the report. It is mandatory for you to give a name to the report in order to save it.
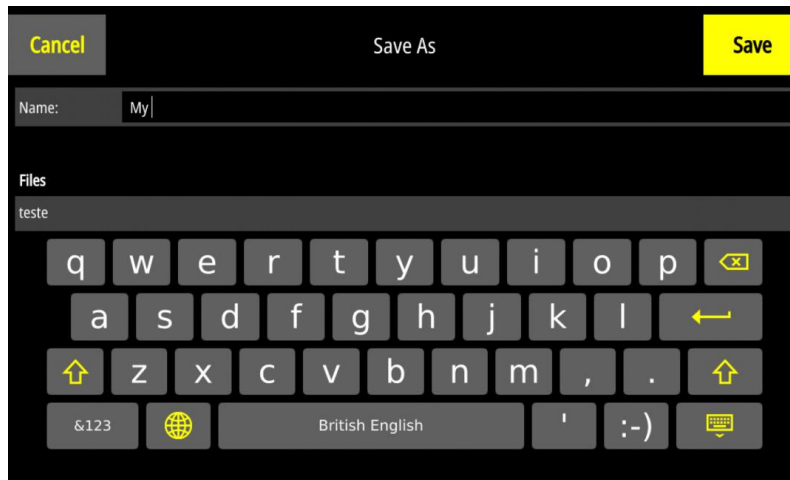
Figure 75 The virtual keyboard is displayed in order to save the report

At any time, you can press the **Cancel** button to go backwards.

NOTE: It is not possible to overwrite an existing report. This means that each report must have a unique file name.

13.7 View an Existing Report

Once a report has been saved, it can be viewed again. From the **App Description** screen, click on the **Report** tab. The reports saved in the application appear as a list. Once the report name is selected, simply click on the **View** button.

Figure 76 – List of existing report available in App Description

13.7.1 Delete an Existing Report

You can delete one report at a time from the unit. Once the file name is highlighted, long press the **Delete** button. It will delete the selected report. It is also possible to delete any type of file from the Wave Companion.

13.8 Retrieve a Report

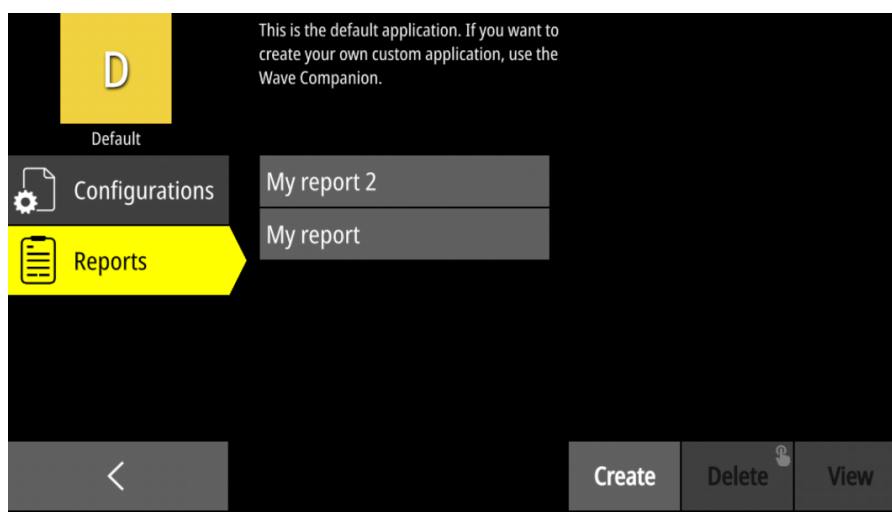The purpose of creating a report is to make it accessible to the client. Therefore, there are two ways to retrieve a saved report: either by email (which requires an Internet connection) or by the Wave Companion

13.8.1 With Wave Companion.

The Wave Companion allows you to retrieve any files, including reports. Of course, the Wave and the Wave Companion must be on the same network (Internet or not). For more information on downloading files, please refer to the Wave Companion User Manual

13.8.2 By Email

IMPORTANT: Wave must be connected to the Internet to be able to send an email.

To access the email function, you must view a saved report. This can be done through the **App Description** screen or simply after the report is named. In both cases, the workflow will be the same.

Once you view the PDF report, click on the email icon in the left sidebar.
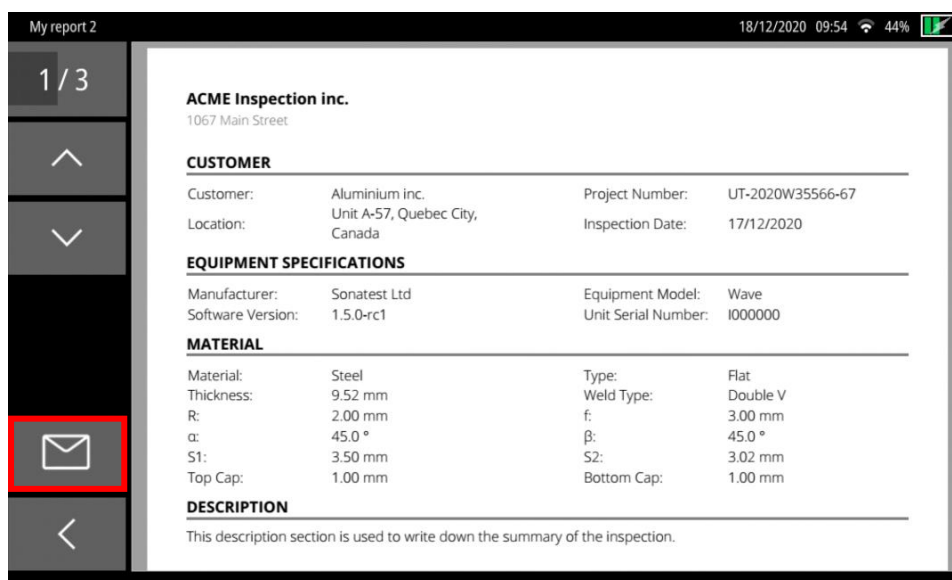

Figure 77 – Email is a quick and easy way to send a report

The **Compose Email** screen allows you to enter the necessary information to send an email.
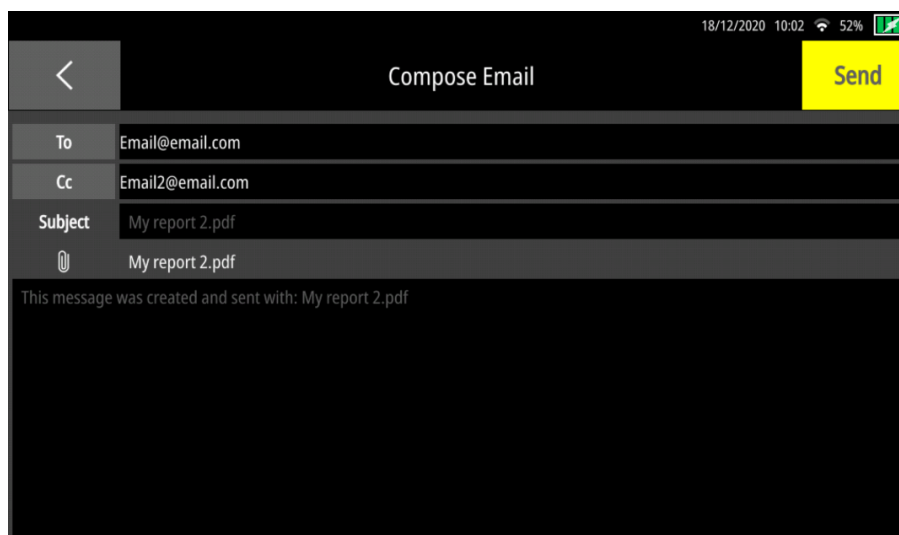
Figure 78 – Compose Email screen

13.8.2.1 To and Cc

These are the fields for entering an email address. The Wave is able to store up to 10 email addresses. If an eleventh is added, the least used address will be removed from the list.

NOTE: In order to see the emails included in the list, simply press the To or Cc button.

NOTE: In order to send an email, at least one valid email address must be entered in the To: and Cc: fields.

13.8.2.2 Subject

By default, the subject of the email is the report name and its extension. It is possible to modify this field by clicking on it. A virtual keypad will appear to make the modification.

13.8.2.3 Attachment

Automatically, the selected report is added as an attachment. Please note that only one PDF report can be attached. It is not possible to change this field.

13.8.2.4 Message

By default, a message is already displayed. However, you can change it at any time by clicking on the field. A virtual keyboard will appear.

14 Settings

Wave settings are available by clicking the gear wheel located in the top right corner of the **Home** screen.
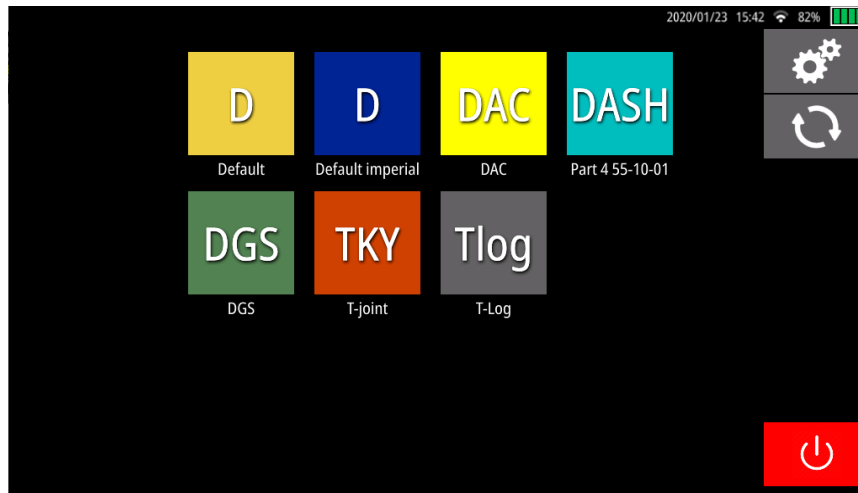
Figure 79 - Access to the Settings via the Home screen

14.1 General

The **General** includes three sub-menus, which include the brightness, contrast, and date and time.
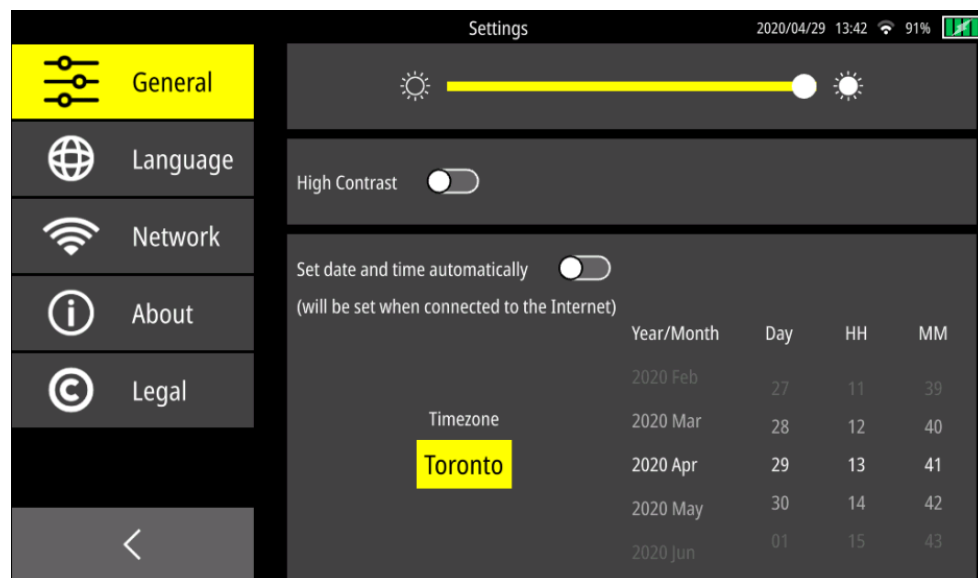
Figure 80 –The General sub-menus

14.1.1   Brightness

You can change the brightness of the screen by moving your finger on the slider.

14.1.2 High Contrast

You can toggle between two contrasts. The **High Contrast** is useful when Wave is used outside.
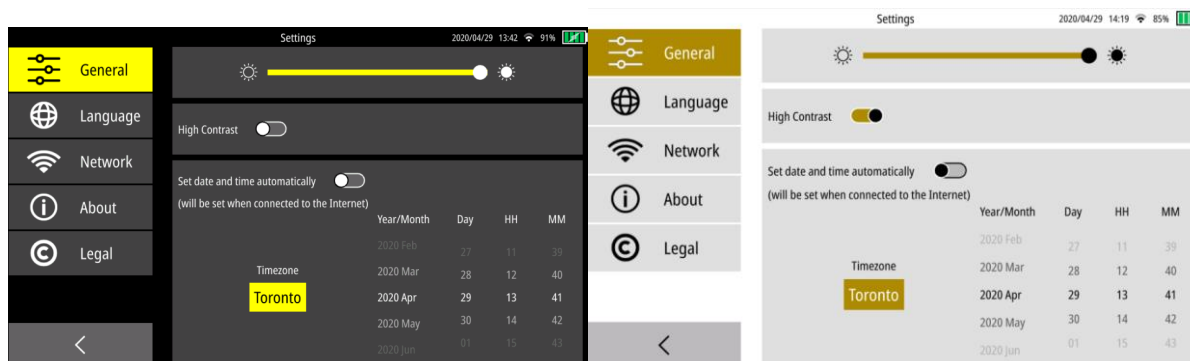
Figure 81 – Normal contrast (black background) versus high contrast (white contrast)

14.1.3 Date and Time

You can automatically or manually choose the date and time. To automatically configure the date and time settings, you must be connected to the Internet.

14.2 Language

You can choose the language of the instrument from the list of available languages. The changes are done automatically. In short, the instrument does not need to be rebooted.

14.3 Network

The device can be connected to a network either by a wire or by Wi-Fi.
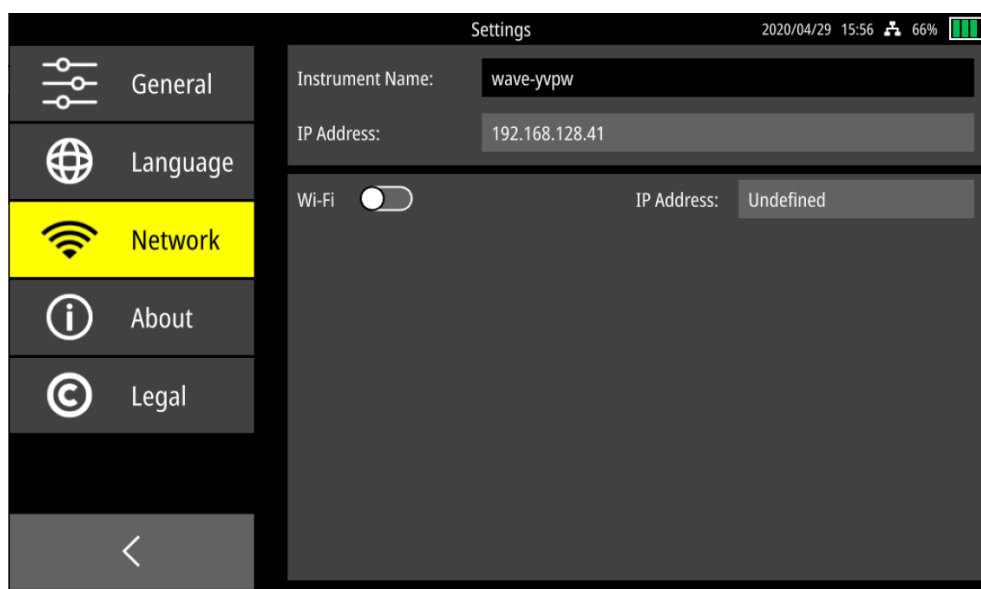
Figure 82 – Network

14.3.1   Wired Network Connection

In order to connect Wave to an Ethernet wire, you must use a USB-C/Ethernet adapter.

Figure 83 – USB-C/Ethernet adapter plugged into the Wave USB-C connector

IMPORTANT: Properly connect the USB-C/Ethernet adapter into the Wave USB-C connector. This reduces the risk of damaging the connector pins.

No matter how Wave is connected to a network (wire or Wi-Fi), an IP address will be assigned to the device. In the case of a wire connection, the IP address is visible in the **Network** section, under the **Instrument Name.**
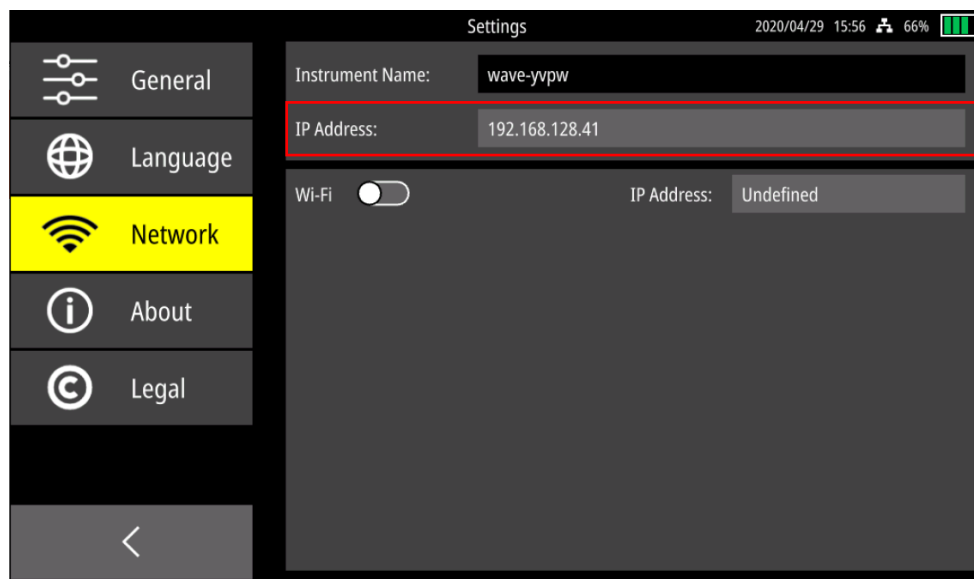
Figure 84 – The IP address of a Wave unit when it is connected to a network via a wire.

In addition, an icon, which represents a wired network connection, will appear at the top upper right-hand corner, next to **Time**.
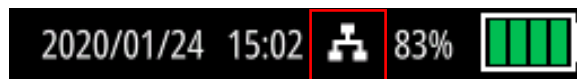
Figure 85 – Icon when the device is connected to network via a wire

14.3.2 Network Connection via Wi-Fi

In order to connect Wave to Wi-Fi, toggle the Wi-Fi button.

Figure 86 – Network connection via Wi-Fi

The available networks are displayed. Some icons may appear next to a Wi-Fi network:

- A lock indicates it is a private network. A password is required.
- A Wi-Fi icon indicates the network's signal strength.
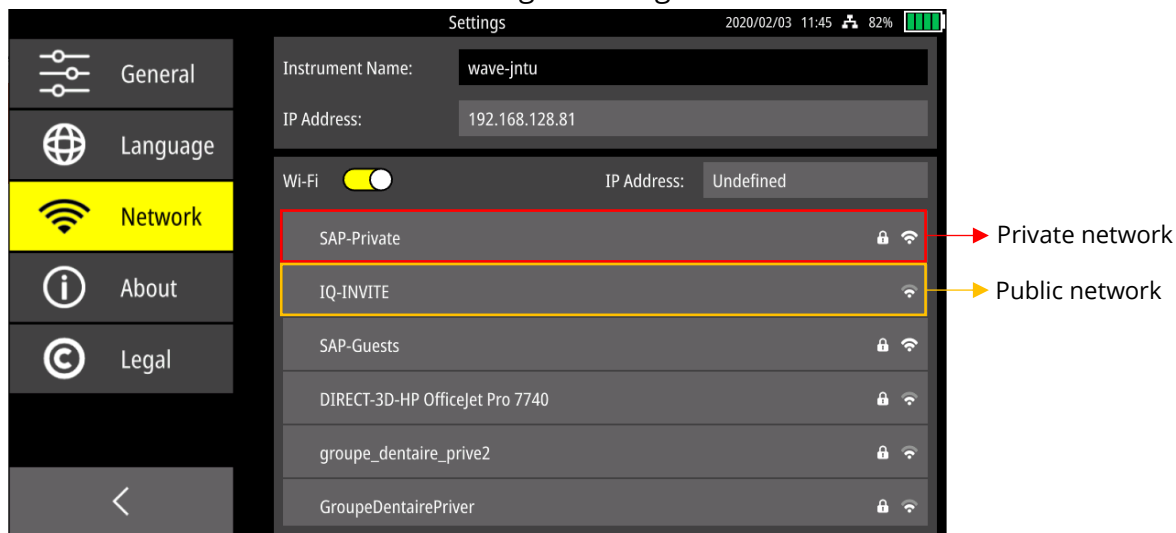
Figure 87 – Example of private and public Wi-Fi networks

By clicking on a private network, a window will open in order to enter the password.
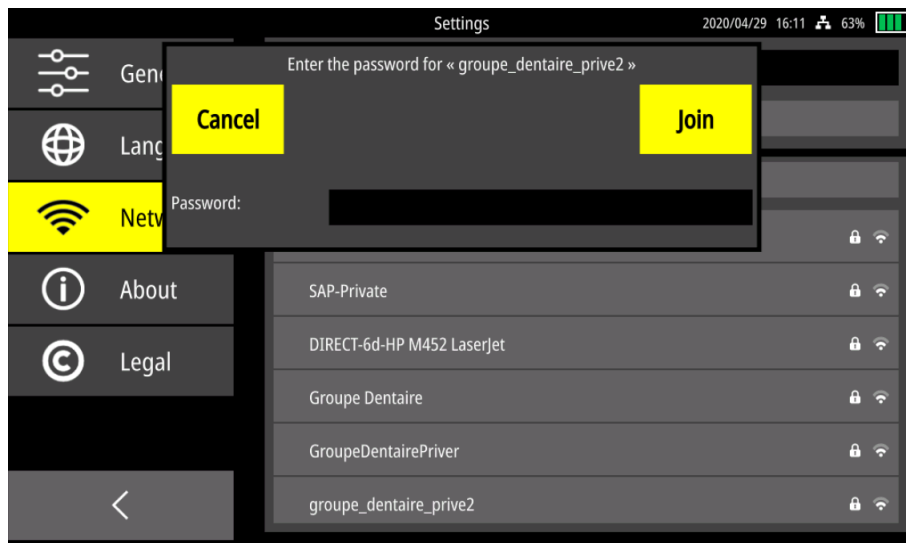
Figure 88 – A password is required for a private network

Once the Wave is connected to Wi-Fi, an IP address is assigned to it.

NOTE: If the Wave is connected to a network by a wire and Wi-Fi at the same time, the wire network will take precedence over the Wi-Fi network.

14.4 About

This section gives you some basic information about your Wave, like the date of the **Last Calibration**, the **Software Version**, the **Firmware Version** and the **Serial Number**.

14.5 Legal

Wave was designed to be ultrasonic inspection equipment. It has been extensively tested before leaving the manufacturer. However, operating software may experience untoward issues.

The instrument must be used only for industrial applications and material testing. Any other use than that prescribed in this manual is strictly prohibited.

If you face any operating issues, please contact Sonatest's customer service or our nearest representative in your home country.

15 Updates

The **Software Update** is available by clicking on the circular arrows displayed on the **Home** screen.
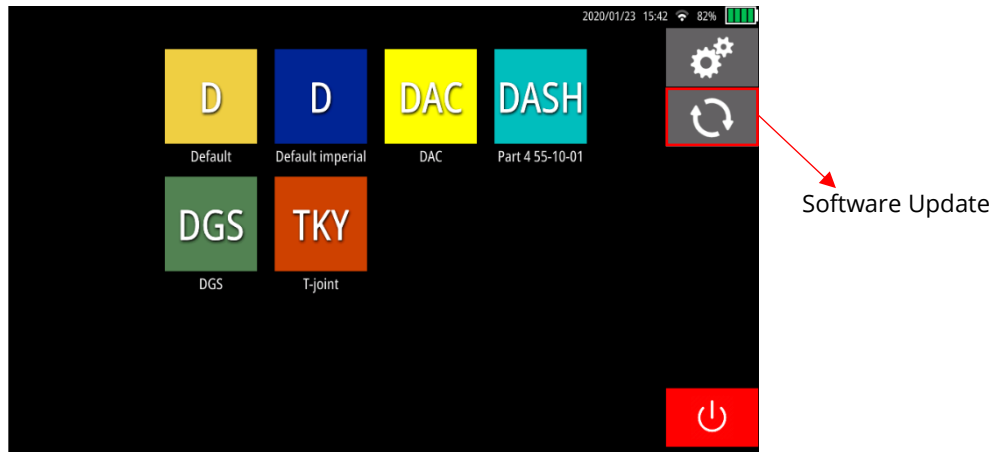
Figure 89 – Home screen with Software Update menu

15.1 Internet Update

The **Software Update** screen allows you to update the device via the Internet. If an update is available, you will be able to click on the **Update** button. Release notes are available for each update.

> ⚠️ **IMPORTANT:** Wave must be connected to the Internet to be able to update.

15.2 USB-C Update

If the Internet connection is not available, it is still possible to update the Wave. Simply put the update file on a USB-C stick and reach the **Software Update** screen. From there, click on the **USB tab** and the corresponding update file will be displayed. Then, just press the **Update** button.

16 Remote Connection and VNC

This section will explain how to set a remote connection to your Wave. This feature will help technicians, professors, and service providers to share the screen of the instrument while giving a presentation or discussion with a customer.

You must keep in mind that by setting up a remote connection with your Wave will not allow you to "virtually" manipulate/operate the instrument from its own laptop. It means that there will be no interaction with your instrument; it will remain as like as a screen-sharing tool.

There are three ways to set a remote connection. They are detailed right below.

16.1 Connection to a Network

Make sure your laptop has a good network connection (stable and high-speed connection). Once your laptop is connected to a network, you have two different ways to connect your Wave: by cable or Wi-Fi (see Section 14.3 for more details). Once you are connected to a network, an IP address will be automatically set to your instrument.

Sonatest suggests downloading and installing a VNC viewer on your laptop that allows you to set a remote connection to your instrument. This will allow you to share your screen on your laptop's screen. For the majority of VNC viewer applications, you just need to set the IP address from your instrument to get access to it.

For the majority of VNC viewers' applications, you just need to set the IP address from your instrument to get access to it.

16.2 Sharing your Internet Connection from your Laptop

Your laptop should be connected to a network (Wi-Fi or cable) before you can set up a mobile hotspot.

To set a mobile hotspot from your laptop, go to the **Start Menu** (if your laptop is Windows-based) and then **Settings**. In the **Settings** home page, go down to Mobile Hotspot, which features the list of available options and click on it. Once you click in that option, you will see the screen below.
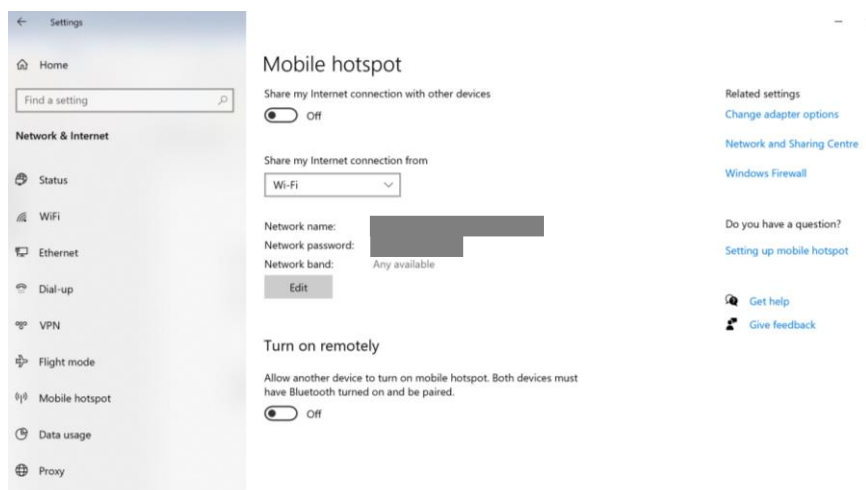
Figure 90 – Laptop hotspot

If your mobile hotspot option is set to off, set the option to ON. You must also set the option Wi-Fi for Internet sharing. Once you have set the option to ON, the network name and password will be available, as shown in the image above.

Launch your instrument and then, in the Home screen, click on the **Settings** button. In Settings, click on the **Network** button. Once you are connected to the mobile hotspot network, an IP address will be automatically set to your instrument.

Sonatest suggest downloading and installing a VNC viewer on your laptop that allows you to set a remote connection to your instrument. This will allow you to share your screen on your laptop's screen.

For the majority of VNC viewers' applications, you just need to set the IP address from your instrument to get access to it.

16.3 Sharing your Internet Connection from your Mobile Phone

Your mobile phone should be connected to a mobile network before you start to set up a mobile hotspot.

To set a mobile hotspot from your mobile phone, go to **Settings** (if your mobile is Android-based). In the Settings home page, go down to **Portable Hotspot** which features the list of available. Activate the portable hotspot.

Launch your instrument and then, in the Home screen, click on the **Settings** button. In Settings, click on the **Network** button. Once you are connected to the portable hotspot network, an IP address will be automatically set to your instrument.

Sonatest suggest downloading and installing a VNC viewer on your laptop that allows you to set a remote connection to your instrument. This will allow you to share your screen on your laptop's screen.

17 Menus and Parameters Reference

Cal	Signal	Signal (continued)
- Velocity - Probe Zero - Range - Delay - Set Ref. Gain - Ref. Amplitude - Auto Cal	- Rectification - Full +Half -Half - RF - Avg Factor - Disable 2 4 8 16 32 - Filter 0.5 MHz narrow 0.5 MHz wide 1 MHz narrow 1 MHz wide 1.25 MHz narrow 1.25 MHz wide 2 MHz narrow 2 MHz wide 2.25 MHz narrow 2.25 MHz wide 3.5 MHz narrow 3.5 MHz wide 4 MHz narrow 4 MHz wide	4.5 MHz narrow 4.5 MHz wide 5 MHz narrow 5 MHz wide 7.5 MHz narrow 7.5 MHz wide 10 MHz narrow 10 MHz wide 15 MHz narrow 20 MHz narrow 20 MHz wide - Broadband low - Broadband high Reject Level - Reject Type - None - Suppressive - Linear - Ref. A-Scan - Hold - Reset Envelope - Off - Peak - Trail Reset Envelope

TX/RX	Sizing	Sizing (continued)
- RX Mode - Pitch-Catch - Pulse-Echo - Through Transmission - Voltage 100 V 150 V 200 V 250 V 300 V 350 V 400 V 450V 500V - Pulse Type - Spike - Square - Frequency - PRF	- DAC - TCG - DGS - API - AWS - DAC to TCG - T-Log **Sizing Options** - Transfer Loss - DAC Trigger - DAC - G1 0 dB - Gain Mode - Relative - Absolute - Split DAC Enabled - Yes - No - DAC Sub curves - DAC - JIS -2/-6/-10 -6/-14 - Custom - Nb of DAC Curves 0 1 2 3 - DAC Curve 1 - DAC Curve 2 - DAC Curve 3	- TCG Visible - Yes - No - AWS C Rounded 0.1 1 - ABCD Visible - Yes - No - ERS - Gain Mode - Relative - Absolute - DGS Trigger - DGS - G1 - DGS Sub curves - Ref. - dB - ERS - Nb of DGS Curves 0 1 2 3 - DGS Curve 1 - DGS Curve 2 - DGS Curve 3 - ERS Curve 1 - ERS Curve 2 - ERS Curve 3

Part	Probe
Part menu is a wizard in fact. See Section 9 for more details.	- Probe Model - Probe Selection - Angle - X-offset - Wedge Velocity - Probe Zero - Frequency - Probe Width - Probe Height - Probe Type - Mono Circular - Mono Rectangular - Dual Crystal - Probe Serial Number

Display	Display (continued)	Alarms

● Units
  ○ SI
  ○ Imperial
● Line Appearance
  ○ Thin
  ○ Thick
  ○ Filled
● Trail Speed
  ○ Slow
  ○ Medium
  ○ Fast
● Trail Duration
● Rulers
  ○ None
  ○ Horizontal
  ○ Vertical
  ○ Both
	● Ruler Mode
	  ○ Distance
	  ○ Time
	● Overlay Mode
	  ○ None
	  ○ Line
	  ○ Band
	● Grid Type
	  ○ None
	  ○ Plain
	  ○ Dash
	  ○ Dot
	  ○ Cross
	● Grid Alignment
	  ○ Fixed
	  ○ Aligned
		● Alarm 1 Enabled
		  ○ Yes
		  ○ No
		● Alarm 1 Source
		  ○ G1
		  ○ G2
		  ○ G3
		  ○ G4
		  ○ DAC
		  ○ DGS
		  ○ not G1
		  ○ G1 and G2
		  ○ G1 or G2

Alarms (continued)	**Alarms (continued)**	**Alarms (continued)**

● Alarm 2 Enabled
  ○ Yes
  ○ No
● Alarm 2 Source
  ○ G1
  ○ G2
  ○ G3
  ○ G4
  ○ DAC
  ○ DGS
  ○ not G2
  ○ G1 and G2
  ○ G1 or G2
	● Alarm 3 Enabled
	  ○ Yes
	  ○ No
	● Alarm 3 Source
	  ○ G1
	  ○ G2
	  ○ G3
	  ○ G4
	  ○ DAC
	  ○ DGS
	  ○ not G3
	  ○ G3 and G4
	  ○ G3 or G4
		● Alarm 4 Enabled
		  ○ Yes
		  ○ No
		● Alarm 4 Source
		  ○ G1
		  ○ G2
		  ○ G3
		  ○ G4
		  ○ DAC
		  ○ DGS
		  ○ not G4
		  ○ G3 and G4
		  ○ G3 or G4

Alarms (continued)	Alarms (continued)
- Alarm 1 GPO - None 0 1 2 3 - Alarm 2 GPO - None 0 1 2 3	- Alarm 3 GPO - None 0 1 2 3 - Alarm 4 GPO - None 0 1 2 3

Gate 1	Gate 2	Gate 3
- G1 Enabled - Yes - No - G1 Start - G1 Width - G1 Level - G1 Polarity - Absolute - Positive - Negative	- G2 Enabled - Yes - No - G2 Start - G2 Width - G2 Level - G2 Polarity - Absolute - Positive - Negative - G2 Adaptive Triggering - On - Off - G2 Blanking	- G3 Enabled - Yes - No - G3 Start - G3 Width - G3 Level - G3 Polarity - Absolute - Positive - Negative

Gate 4	Scan Plan
- G4 Enabled - Yes - No - G4 Start - G4 Width - G4 Level - G4 Polarity - Absolute - Positive - Negative - G2 Adaptive Triggering - On - Off - G2 Blanking	- Beam Exit Point - Probe Distance - Rulers - Both - None - Grid Type - None - Plain - Cross - Weld Visible - Yes - No - Signal Visible - Yes - No - Distance Visible - Yes - No

18 Wave Companion

Wave Companion is the desktop application that accompanies **Wave**. It offers an environment in which dedicated applications can be designed and uploaded to **Wave** units as well as a way to download files.

> **NOTE:** For more information about Wave Companion, please refer to the Wave Companion User Guide.

18.1 Connect Wave to the Wave Companion

In order to take advantage of all the features available in Wave Companion, the unit and application must be connected to the same network. Please refer to Section 14.3 to learn how to connect Wave to a network.

18.2 Version Compatibility

Here is some important information regarding the compatibility between different application versions, Wave and Wave Companion:

- Wave Companion can manage several applications that are based on the current version or older versions. However, these applications should not be corrupted.
- Wave Companion will transfer an application if its version is not as recent as the version of Wave. Once exception is version 1.0.X of Wave Companion.
- When an application based on an old version is transferred to Wave, a clock icon will appear on the application. This helps you distinguish old from current applications.

Figure 91 – Old application

- When Wave is updated, default applications (**Default imperial**, **T-joint**, **Default**, **DGS**, **DAC** and **DASH)** are also updated. For all other applications, you must update them in Wave Companion or leave them as is.

> **NOTE:** The numbers of the application versions are accessible in Wave Companion.

19 Quality Assurance

Wave was designed to meet and to surpass several international standards. All Wave units are tested for quality assurance before delivery to customers.

The following list shows the standards that Wave has been tested for:

- EN 12668
- EN 61326-1
- FCC Part 15
- ICES 003
- CISPR11
- IEC 61000-4

20 Maintenance

Wave requires basically no maintenance, only a few procedures for cleaning.

Do not leave the equipment close to electromagnetic sources because it may lead to electronic interference. Likewise, keep it away from carpets that can provide electrostatic shocks.

To clean the instrument and its accessories use a soft cloth and ordinary liquid soap. Try to clean Wave as often as possible to avoid any accumulation of dust, oil, grease, or couplant. Special attention needs to be given to the battery door. Make sure the battery door gasket is properly clean and free of particles.

IMPORTANT: Do not use any methyl alcohol or solvents for dye penetrant to clean the equipment. It may damage some parts or brittle plastic components.

20.1 Temperatures

Wave's operating temperatures (when the fan is working) are from -10°C to 45°C (14°F to 113°F).

20.2 Screen

For the Wave screen, we recommend the following advice:

- Do not use an abrasive cloth or brush to clean the screen.
- Do not use a sharp object to point functions on the screens.
- Do not leave or store the unit where the screen will be directly exposed to sunlight for a long period of time.

20.3 Connectors

We strongly recommend you to protect all connectors to avoid contact with dust, oil, grease, and water. All connectors come with a rubber cover which just needs to be put back in the right place when the connector is not in use.

This procedure will avoid major damages to connectors and further issues related to pin corrosion.

20.4 Battery and Power Supply

Use and charge only the specified Sonatest battery pack with Wave. Using third-party or counterfeit battery packs may cause fire, smoke, or make the battery burst.

Do not use the battery if it has been severely impacted or dropped, or if the battery has been exposed to heavy pressure. Some damage may not be visible on the outside of the case, thus the cells inside the battery may rupture or catch fire.

Do not expose the battery to seawater, rain, snow, drop in water or any other liquids. Do not charge or use a wet battery. If the battery gets wet, make sure to wipe it dry before using.

If the equipment is going to be stored for more than 30 continuous days with no utilisation, we recommend fully recharging the battery, no matter of the battery level. This procedure will avoid premature mortality of the battery.

The approximate level of remaining battery life is shown on the top right corner display by the battery icon and the percentage level. When the battery indicator is down to one-quarter full, charge the battery as soon as possible.

NOTE: The instrument automatically shuts off when the battery is too weak for reliable operations. However, current settings are saved and then restored when the instrument is turned on. For long work journeys on remote locations or if you are unable to have access to main power supply, always carry a spare battery.

When the AC adapter is connected to the instrument, the battery icon indicates a percentage of full charge of the battery. If the AC adapter is not connected to the instrument when removing the battery to install a spare, the instrument will automatically turn off. However, if the adapter is connected, the instrument will remain on.

20.5 USB-C Connector

You can recharge electronic devices with the USB-C connector available, but it may affect the durability of the battery.

20.6 Travelling

When travelling, Wave should be placed in its transportation case to avoid any major damages and mechanical impacts.

21 Additional Resources

21.1 Probes

Before operating the Wave, connect it to a probe. Probes can be connected to sockets on the top of the instrument. Make sure to use appropriate cables and to properly connect them to the probes. Otherwise, it may lead to considerable power losses or to echo waveform perturbation.

Wave can either work with single or double element probes. Single element probes need to be connected to the proper socket as indicated on the following picture.

Figure 92 – Connectors and the expansion

21.2 Accessories

IMPORTANT: It is recommended that the instrument should be switched off, or at least the pulser stopped, for the probe installation. If the Wave is not turned off, you may cause some damage to the electronic circuits.

For options availability and quotations, please contact with one of our distributors.

21.3 Sonatest Website

For further information and additional support, please visit the Sonatest website: www.sonatest.com

22 Warranty and Disclaimers

22.1 Warranty

Sonatest Limited guarantees your Sonatest Limited product to be free from defects in materials and workmanship for 1 year.

The Sonatest warranty only covers equipment that has been used in a proper manner, as described in this document and that has not been subjected to excessive abuse, attempted unauthorised repairs, or modification.

Inspect materials thoroughly on reception for evidence of external or internal damage that might have occurred during shipment. Immediately notify the carrier making the delivery of any damage, since the carrier is normally liable for damage during shipment. Retain packing materials, waybills, and other shipping documentation needed in order to file a damage claim. After notifying the carrier, contact Sonatest Limited for assistance with the damage claim and equipment replacement if necessary.

22.2 Disclaimer of Liability

All statements, technical information and recommendations contained in this manual or any other information supplied by Sonatest Limited in connection with the use, features and qualifications of the Wave are based on tests believed to be reliable, but the accuracy or completeness thereof is not guaranteed. Before using the product, you should determine its suitability for your intended use based on your knowledge of ultrasonic testing and the characteristics of materials. You bear all risks in connection with the use of the product. You are reminded that all warranties as to merchantability and fitness for purpose are excluded from the contract under which the product and this manual have been supplied to you. The Seller's only obligation in this respect is to replace such quantity of the product proved to be defective.

Neither the seller nor the manufacturer shall be liable either in contract or in tort for any direct or indirect loss or damage (whether for loss of profit or otherwise), costs, expenses or other claims for consequential or indirect compensation whatsoever (and whether caused by the negligence of the company, its employees or agents or otherwise).

23 Troubleshooting

23.1 Battery

Wave does not start when press I press the power-on button.

- Make sure the battery is fully charged and connected to the Wave.
- If the battery is flat or not fully charged, connect the charger which came with the unit.
- Remove and reinsert the battery then try to turning Wave on again.
- If the above does not work send it back for repairs.

My battery life is very short despite having charged it for 3-4 hours.

- When you received the unit for the first time, it is strongly recommended to complete a full charge and discharge cycle.
- If possible, try charging the battery with another certified charger.
- If you do not have a spare charger, try with another battery. If the battery life is longer, the battery is faulty.

23.2 USB-C Connector

Which USB-C adapter should I use?

- Have a look at the Sonatest website (sonatest.com) to see all the adapters compatible with Wave.

Can I use a USB-C adapter which is not in the adapter list?

- Yes. However Sonatest does not guarantee the compatibility of the adapter.

23.3 System Status

Where can I get access to the system status?

- By long pressing on the battery icon.

23.4 Hard Shutdown

Wave is not responding. Everything seems to be frozen.

- Make sure you did not click the Freeze button or double-clicked the power-on to lock the screen.
- If nothing is working with Wave, you can do a hard shutdown by long pressing and holding the power-on button for 10 seconds. This action should be considered as a last resort.

23.5 Application

I have transferred an application and it is not working.

- Make sure you have not transferred a corrupted application. A corrupted application features a logo with a crossed-out circle. You cannot open this application. You must replace the application with one that is not corrupted or simply deleted the corrupted application.
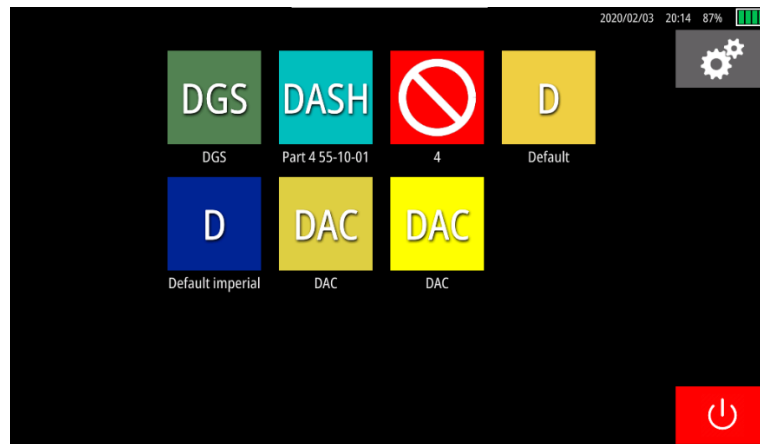

Figure 93 – A corrupted application

24 Glossary

α (degree): Bevel angle α

β (degree): Bevel angle β

Angle (degree): Angle of the ultrasound beam exiting the probe

API: American Petroleum Institute

AWS: American welding Society

DAC: Distance amplitude gain

Delay (mm or in): Offset of the left side of the A-scan.

DGS: Distance gain size. Also known as AVG in German

ERS (mm or in): Equivalent reflector size

f (mm or in): Root face

First peak: The highest value between the first two gates crossing (full positive flank and full negative flank), the first gate crossing being the flank.

Flank: The first positive flank to cross the gate (the first value higher than the gate threshold that crosses the gate).

L1 (mm or in): Length of the left-side fillet weld

L2 (mm or in): Length of the right-side fillet weld

Lw1 (mm or in): Effective throat of the left-side fillet weld

Lw2 (mm or in): Effective throat of the right-side fillet weld

Overlay mode: Skip overlay mode

Peak: The highest value inside the gate.

PED (mm or in): Probe effective diameter

PRF: Pulse repetition frequency

Probe zero (µs): Time which the sound spends in the wedge.

R (mm or in): Root opening

r1 (mm or in): Groove radius #1

r2 (mm or in): Groove radius #2

Reference amplitude (%FSH): Reference amplitude for sensitivity calibrations.

Reject type: Signal rejection criteria. It removes noise from the A-Scan.

RX Mode: Pulsing Mode

S1 (mm or in): Weld depth of the bevel #1

S2 (mm or in): Weld depth of the bevel #2

TCG: Time corrected gain

Transfer loss (dB): dB loss due to surface conditions, poor coupling, etc.

X-Offset (mm or in): Distance between the front of the probe and the exit point.