



EPOCH 6LT

Ultrasonic Flaw Detector

User Interface Guide

DMTA-10084-01EN — Rev. 3
September 2022

This instruction manual contains essential information on how to use this Evident product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed. Keep this instruction manual in a safe, accessible location.

EVIDENT SCIENTIFIC INC., 48 Woerd Avenue, Waltham, MA 02453, USA

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This document was prepared with particular attention to usage to ensure the accuracy of the information contained therein, and corresponds to the version of the product manufactured prior to the date appearing on the title page. There could, however, be some differences between the manual and the product if the product was modified thereafter.

The information contained in this document is subject to change without notice.

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List of Abbreviations

AGC	automatic gain control
ASME	American Society of Mechanical Engineers
AVG	abstand verstärkung gröÙe
AWS	American Welding Society
BEA	back wall echo attenuator
CSC	curved surface correction
DAC	distance-amplitude correction
DGS	distance gain size
EFUP	environment-friendly use period
FSH	full-screen height
JIS	Japanese Industrial Standard
MEM	memory
NDT	ultrasonic nondestructive testing
OS	overshoot
PK	peak
PRF	pulse repetition frequency
SDH	side-drilled hole
TCG	time-corrected gain
TOF	time-of-flight
UI	software user interface

Important Information — Please Read Before Use

Intended Use

The EPOCH 6LT is designed to perform nondestructive inspections on industrial and commercial materials.



WARNING

Do not use the EPOCH 6LT for any purpose other than its intended use. It must never be used to inspect or examine human or animal body parts.

Instruction Manual

This instruction manual contains essential information on how to use this product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed. Keep this instruction manual in a safe, accessible location.

IMPORTANT

Some of the details of components illustrated in this manual may differ from the components installed on your device. However, the operating principles remain the same.

Device Compatibility

Only use this device with the approved ancillary equipment provided by Evident. Equipment provided by Evident and approved for use with this device is described later in this manual.



CAUTION

Always use equipment and accessories that meet Evident specifications. Using incompatible equipment could cause equipment malfunction and/or damage, or human injury.

Repair and Modification

This device does not contain any user-serviceable parts. Opening the device might void the warranty.



CAUTION

In order to prevent human injury and/or equipment damage, do not disassemble, modify, or attempt to repair the device.

Safety Symbols

The following safety symbols might appear on the device and in the instruction manual:



General warning symbol

This symbol is used to alert the user to potential hazards. All safety messages that follow this symbol shall be obeyed to avoid possible harm or material damage.



High voltage warning symbol

This symbol is used to alert the user to potential electric shock hazards greater than 1000 volts. All safety messages that follow this symbol shall be obeyed to avoid possible harm.

Safety Signal Words

The following safety symbols might appear in the documentation of the device:



DANGER

The DANGER signal word indicates an imminently hazardous situation. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, will result in death or serious personal injury. Do not proceed beyond a DANGER signal word until the indicated conditions are fully understood and met.



WARNING

The WARNING signal word indicates a potentially hazardous situation. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in death or serious personal injury. Do not proceed beyond a WARNING signal word until the indicated conditions are fully understood and met.



CAUTION

The CAUTION signal word indicates a potentially hazardous situation. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, may result in minor or moderate personal injury, material damage, particularly to the product, destruction of part or all of the product, or loss of data. Do not proceed beyond a CAUTION signal word until the indicated conditions are fully understood and met.

Note Signal Words

The following note signal words could appear in the documentation of the device:

IMPORTANT

The **IMPORTANT** signal word calls attention to a note that provides important information, or information essential to the completion of a task.

NOTE

The **NOTE** signal word calls attention to an operating procedure, practice, or the like, which requires special attention. A note also denotes related parenthetical information that is useful, but not imperative.

TIP

The **TIP** signal word calls attention to a type of note that helps you apply the techniques and procedures described in the manual to your specific needs, or provides hints on how to effectively use the capabilities of the product.

Safety

Before turning on the device, verify that the correct safety precautions have been taken (see the following warnings). In addition, note the external markings on the device, which are described under “Safety Symbols.”

Warnings



WARNING

General Warnings

- Carefully read the instructions contained in this instruction manual prior to turning on the device.
- Keep this instruction manual in a safe place for further reference.

- Follow the installation and operation procedures.
- It is imperative to respect the safety warnings on the device and in this instruction manual.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment could be impaired.
- Do not install substitute parts or perform any unauthorized modification to the device.
- Service instructions, when applicable, are for trained service personnel. To avoid the risk of electric shock, do not perform any work on the device unless qualified to do so. For any problem or question regarding this device, contact Evident or an authorized Evident representative.
- Do not touch the connectors directly by hand. Otherwise, a malfunction or electric shock may result.
- Do not allow metallic or foreign objects to enter the device through connectors or any other openings. Otherwise, a malfunction or electric shock may result.

**WARNING****Electrical Warning**

The device must only be connected to a power source corresponding to the type indicated on the rating label.

**CAUTION**

If a non-approved power supply cord not dedicated to Evident products is used, Evident will not be able to ensure the electrical safety of the equipment.

Battery Precautions**CAUTION**

- Before disposing of a battery, check your local laws, rules, and regulations, and follow them accordingly.

- Transportation of lithium-ion batteries is regulated by the United Nations under the United Nations Recommendations on the Transport of Dangerous Goods. It is expected that governments, intergovernmental organizations, and other international organizations shall conform to the principles laid down in these regulations, thus contributing to worldwide harmonization in this field. These international organizations include the International Civil Aviation organization (ICAO), the International Air Transport Association (IATA), the International Maritime Organization (IMO), the US Department of Transportation (USDOT), Transport Canada (TC), and others. Please contact the transporter and confirm current regulations before transportation of lithium-ion batteries.
- For California (USA) only:
The device may contain a CR battery. The CR battery contains perchlorate material, and special handling may be required. Refer to <http://www.dtsc.ca.gov/hazardouswaste/perchlorate>.
- Do not open, crush, or perforate batteries; doing so could cause injury.
- Do not incinerate batteries. Keep batteries away from fire and other sources of extreme heat. Exposing batteries to extreme heat (over 80 °C) could result in an explosion or personal injury.
- Do not drop, hit, or otherwise abuse a battery, as doing so could expose the cell contents, which are corrosive and explosive.
- Do not short-circuit the battery terminals. A short circuit could cause injury and severe damage to a battery making it unusable.
- Do not expose a battery to moisture or rain; doing so could cause an electric shock.
- Only use an external charger approved by Evident to charge the batteries.
- Only use batteries supplied by Evident.
- Do not store batteries that have less than 40 % remaining charge. Recharge batteries to between 40 % and 80 % capacity before storing them.
- During storage, keep the battery charge between 40 % and 80 %.
- Do not leave batteries in the EPOCH 6LT unit during device storage.

Regulations for Shipping Products with Lithium-Ion Batteries

IMPORTANT

When shipping a Li-ion battery or batteries, be sure to follow all local transportation regulations.



WARNING

Damaged batteries cannot be shipped through normal routes — DO NOT ship damaged batteries to Evident. Contact your local Evident representative or material disposal professionals.

Equipment Disposal

Before disposing of the EPOCH 6LT, check your local laws, rules, and regulations, and follow them accordingly.

BC (Battery Charger - California, USA Community)



The BC marking indicates that this product has been tested and complies with the Appliance Efficiency Regulations as stated in the California Code of Regulations Title 20, Sections 1601 through 1608 for Battery Charger Systems. The internal battery charger within this device has been tested and certified pursuant to the California Energy Commission's (CEC) requirements; this device is listed on the online CEC's (T20) database.

CE (European Community)



This device complies with the requirements of directive 2014/30/EU concerning electromagnetic compatibility, directive 2014/35/EU concerning low voltage, and directive 2015/863 which amends 2011/65/EU concerning restriction of hazardous substances (RoHS). The CE marking is a declaration that this product conforms to all the applicable directives of the European Community.

UKCA (United Kingdom)



This device complies with the requirements of the Electromagnetic Compatibility Regulations 2016, the Electrical Equipment (Safety) Regulations 2016, and the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012. The UKCA marking indicates compliance with the above regulations.

RCM (Australia)



The regulatory compliance mark (RCM) label indicates that the product complies with all applicable standards, and has been registered with the Australian Communications and Media Authority (ACMA) for placement on the Australian market.

WEEE Directive



In accordance with European Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), this symbol indicates that the product must not be disposed of as unsorted municipal waste, but should be collected separately. Refer to your local Evident distributor for return and/or collection systems available in your country.



China RoHS

China RoHS is the term used by industry generally to describe legislation implemented by the Ministry of Information Industry (MII) in the People’s Republic of China for the control of pollution by electronic information products (EIP).



The China RoHS mark indicates the product’s Environment-Friendly Use Period (EFUP). The EFUP is defined as the number of years for which listed controlled substances will not leak or chemically deteriorate while in the product. The EFUP for the EPOCH 6LT has been determined to be 15 years.

Note: The Environment-Friendly Use Period (EFUP) is not meant to be interpreted as the period assuring functionality and product performance.



电器电子产品有
害物质限制使用
标志

本标志是根据“电器电子产品有害物质限制使用管理办法”以及“电子电气产品有害物质限制使用标识要求”的规定，适用于在中国销售的电器电子产品上的电器电子产品有害物质使用限制标志。

（注意）电器电子产品有害物质限制使用标志内的数字为在正常的使用条件下有害物质等不泄漏的期限，不是保证产品功能性能的期间。

产品中有害物质的名称及含量

部件名称		有害物质					
		铅及其化合物 (Pb)	汞及其化合物 (Hg)	镉及其化合物 (Cd)	六价铬及其化合物 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
主体	机构部件	×	○	○	○	○	○
	光学部件	×	○	○	○	○	○
	电气部件	×	○	○	○	○	○

产品中有害物质的名称及含量

部件名称	有害物质					
	铅及其化合物 (Pb)	汞及其化合物 (Hg)	镉及其化合物 (Cd)	六价铬及其化合物 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
附件	×	○	○	○	○	○
本表格依据 SJ/T 11364 的规定编制。 ○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T26572 规定的限量要求以下。 ×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T26572 规定的限量要求。						

Korea Communications Commission (KCC)



Seller and user shall be noticed that this equipment is suitable for electromagnetic equipment for office work (class A) and it can be used outside the home. This device complies with the EMC requirements of Korea.

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

EMC Directive Compliance

This equipment generates and uses radio-frequency energy and, if not installed and used properly (that is, in strict accordance with the manufacturer’s instructions), may cause interference. The EPOCH 6LT has been tested and found to comply with the limits for an industrial device in accordance with the specifications of the EMC directive.

FCC (USA) Compliance

NOTE

This product has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the product is operated in a commercial environment. This product generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this product in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

IMPORTANT

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the product.

FCC Supplier's Declaration of Conformity

Hereby declares that the product,

Product name: EPOCH 6LT

Model: EPOCH 6LT-MR/EPOCH 6LT-CW

Conforms to the following specifications:

FCC Part 15, Subpart B, Section 15.107 and Section 15.109.

Supplementary information:

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

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

Responsible party name:

EVIDENT SCIENTIFIC INC.

Address:

48 Woerd Avenue, Waltham, MA 02453, USA

Phone number:

+1 781-419-3900

ICES-001 (Canada) Compliance

This Class A digital apparatus complies with Canadian ICES-001.

Cet appareil numérique de la classe A est conforme à la norme NMB-001 du Canada.

Warranty Information

Evident guarantees your Evident product to be free from defects in materials and workmanship for a specific period, and in accordance with conditions specified in the Terms and Conditions available at <https://www.olympus-ims.com/en/terms/>.

The Evident warranty only covers equipment that has been used in a proper manner, as described in this instruction manual, and that has not been subjected to excessive abuse, attempted unauthorized repair, or modification.

Inspect materials thoroughly on receipt for evidence of external or internal damage that might have occurred during shipment. Immediately notify the carrier making the delivery of any damage, because 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 Evident for assistance with the damage claim and equipment replacement, if necessary.

This instruction manual explains the proper operation of your Evident product. The information contained herein is intended solely as a teaching aid, and shall not be used in any particular application without independent testing and/or verification by the operator or the supervisor. Such independent verification of procedures becomes increasingly important as the criticality of the application increases. For this reason, Evident makes no warranty, expressed or implied, that the techniques, examples, or procedures described herein are consistent with industry standards, nor that they meet the requirements of any particular application.

Evident reserves the right to modify any product without incurring the responsibility for modifying previously manufactured products.

Technical Support

Evident is firmly committed to providing the highest level of customer service and product support. If you experience any difficulties when using our product, or if it fails to operate as described in the documentation, first consult the user's manual, and then, if you are still in need of assistance, contact our After-Sales Service. To locate the nearest service center, visit the Service Centers page on the Evident Scientific Web site.

Introduction

The EPOCH 6LT is a portable ultrasonic nondestructive testing (NDT) instrument designed primarily for inspections requiring high portability, such as rope access, and detection of flaw conditions in welds, pipes, turbine blades, and other structural and industrial materials. The instrument can be used both indoors and outdoors.

The EPOCH 6LT offers advanced conventional ultrasonic performance featuring a large dynamic range and superior measurement resolution. The full color liquid-crystal display provides a resolution of 640×480 pixels with transreflective technology for superior visibility. The software user interface (UI) provides an intuitive way to access the full functionality of the instrument.

1. Hardware User Interface Overview

The EPOCH 6LT hardware keys and adjustment knob are used to control the software user interface. The hardware keys are located on the front panel of the instrument. The adjustment knob is located on the left side of the instrument (see Figure 1-1 on page 27).

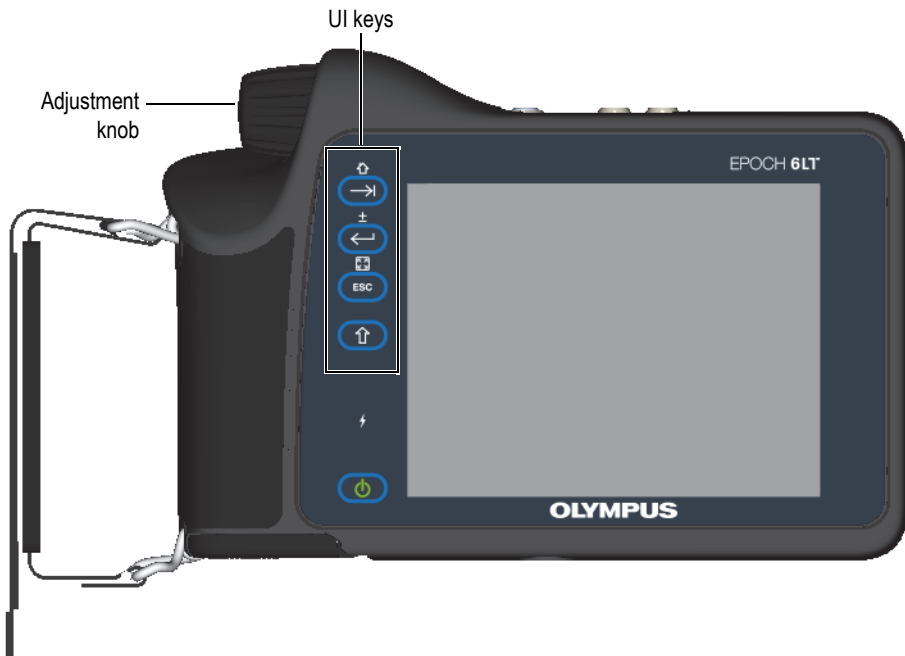


Figure 1-1 EPOCH 6LT front panel

1.1 Shift Key

The Shift key () is used to activate the second function, changing the way the ESC, Enter, and Tab keys function.

1.2 ESC Key

The ESC key () is used to move the focus to the previous menu in the user interface (UI). The Shift (), ESC () key sequence changes the display mode () of the UI.

1.3 Enter Key

The Enter key () is used to accept a highlighted parameter (selected with the adjustment knob). The Shift (), Enter () key sequence switches between coarse and fine adjustment () of the highlighted parameter with the adjustment knob.

1.4 Tab Key

The Tab key () moves the focus to and selects the next element in the UI for an action. In certain menus, the Tab key () moves the focus to the next icon or button. The Shift (), Tab () key sequence immediately returns to the live A-scan display from any level of menu, dialog box, or setup page.

1.5 Adjustment Knob

The adjustment knob increases or decreases the value of the highlighted adjustable parameter (see Figure 1-2 on page 29). The Shift (), Enter () key sequence switches the adjustment knob between coarse and fine adjustment of the highlighted parameter.

The adjustment knob can also be used to move the focus to the next icon, button, or data element.

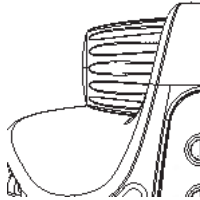


Figure 1-2 Adjustment knob

2. Software User Interface Overview

The EPOCH 6LT live A-scan display is shown in Figure 2-1 on page 31.

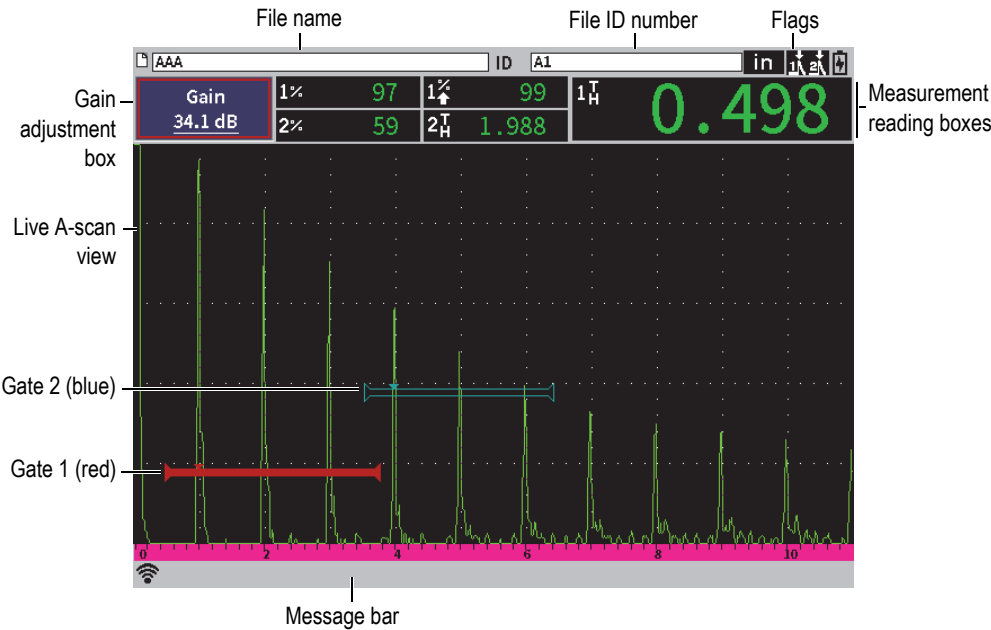


Figure 2-1 Live A-scan display elements

2.1 File Identifier Bar

The file identifier bar appears at the top of the live A-scan display and shows the name and the ID number of the currently opened file (see Figure 2-2 on page 32). The file identifier bar also displays status flags.

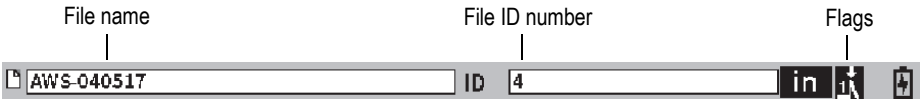


Figure 2-2 File identifier bar with ID example

2.2 Gain Adjustment Box

The **Gain** adjustment box is used to display and set the reference and scanning gain (see Figure 2-3 on page 32).

2.3 Measurement Reading Boxes

The measurement reading boxes at the top of the live A-scan display present the icons and digital values for up to five selectable measurements (see Figure 2-3 on page 32). See “Measurement Setup Page” on page 64 for a description of available measurements and details on how to select measurements.

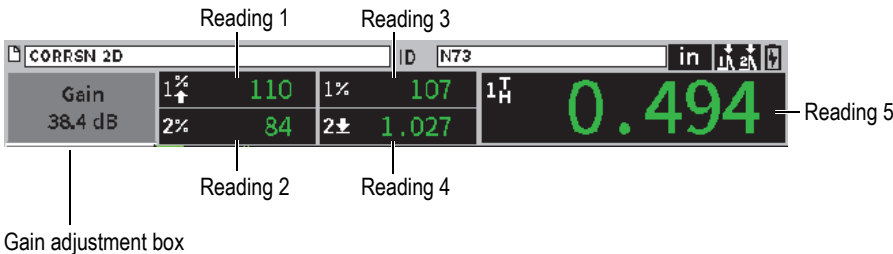


Figure 2-3 Measurement reading boxes example

2.4 Message Bar

The message bar at the bottom of the screen displays certain messages and notifications in response to your actions (see example in Figure 2-4 on page 33).



CORRSN-2D recalled, press any key to continue.

Figure 2-4 Message bar with a message example

The message bar also displays a flag or flags that indicate when particular functions are active. See “Flags” on page 227 for a list of the available flags.



Figure 2-5 Message bar with flags displayed

2.5 Live A-Scan

The live A-scan graphically displays the ultrasonic data (see Figure 2-6 on page 34).

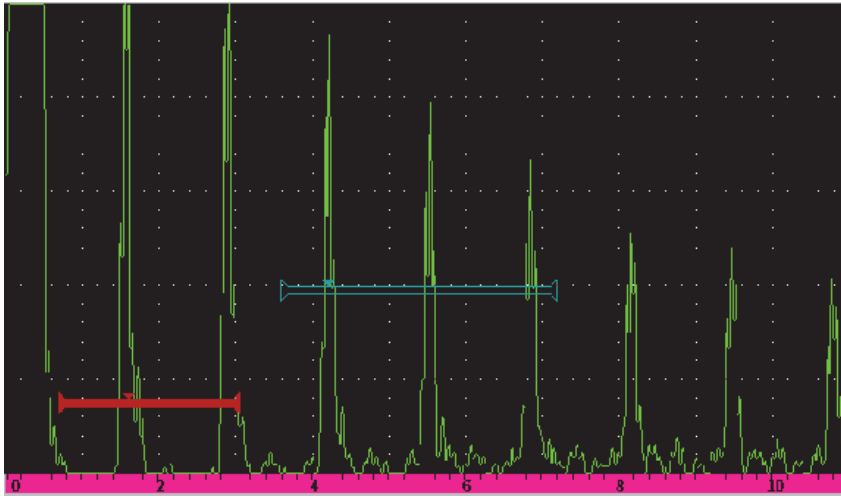


Figure 2-6 Example of an A-scan waveform with gates

2.6 Modes

The EPOCH 6LT software operates in two modes: setup mode and inspection mode. Each mode has a main menu. The menu in setup mode is called the setup menu. The menu in inspection mode is called the sidebar menu. The menus appear on the left side of the A-scan. The A-scan is compressed to make room for the displayed menu (see Figure 2-7 on page 35). For details on the setup and shortcut menus, see “Setup Mode” on page 37 and “Shortcut Menus” on page 48.



Figure 2-7 Setup menu (left) and sidebar menu (right)

A set of shortcut menus are also available while in inspection mode. The shortcut menus offer quick access to specific parameters (see Figure 2-8 on page 35). For details on shortcut menus, see “Shortcut Menus” on page 48.



Figure 2-8 Shortcut menu

3. Setup Mode

The EPOCH 6LT Setup mode enables you to set up the instrument before an inspection or change setup parameters during an inspection.

3.1 Setup Menu

The setup menu presents dialog boxes and setup pages that contain parameters relevant to instrument setup. The setup menu displays a series of icons that represent areas of instrument setup and control (see Figure 3-1 on page 37).

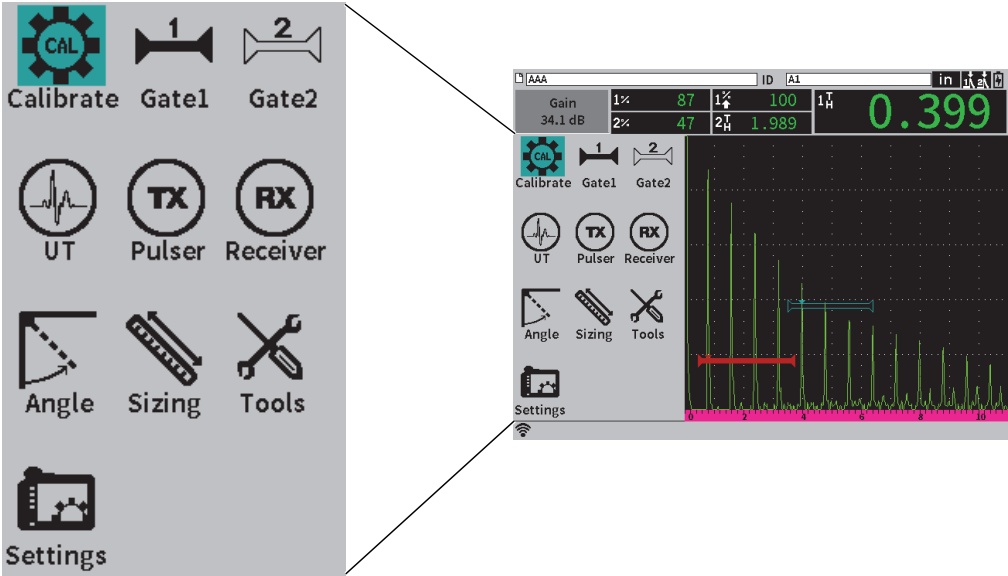


Figure 3-1 Setup menu

To display the Setup menu

- ◆ When on the live A-scan display, press Shift (), and then Escape ().

3.1.1 Setup Menu Icons

A setup menu icon opens a dialog box or submenu of icons (see Table 1 on page 38).

Table 1 Setup menu icon actions

Icon		Description
 		Opens a dialog box.
		
		
		
		Opens a submenu of icons. Each icon opens a related dialog box.
		Opens a submenu of icons. Each icon opens a related setup page. For detailed information on setup pages, see “Setup Pages” on page 53.

The difference between a dialog box and a setup page is as follows (see Figure 3-2 on page 39):

- A dialog box replaces the setup menu, but the live A-scan is still displayed and active. You can access the **Gain** adjustment box and its shortcut menu, but you

cannot access the file identifier shortcut menu or measurement reading shortcut menu (see “Shortcut Menus” on page 48).

- A setup page occupies the entire screen and an inspection is suspended until the setup page is dismissed.

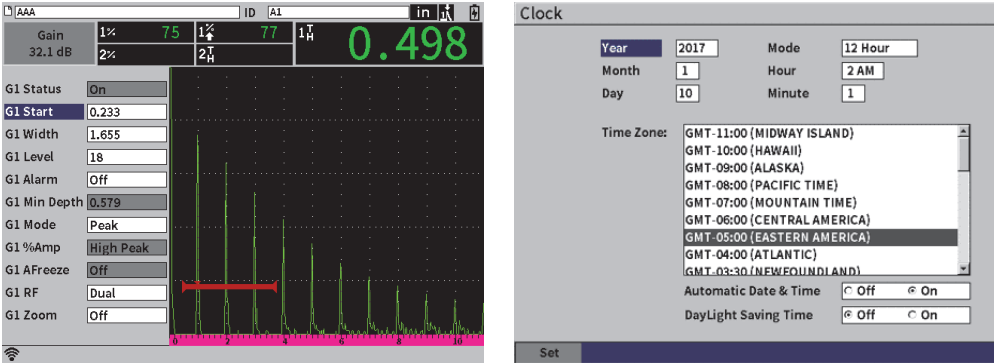


Figure 3-2 Dialog box (left) and setup page (right)

To scroll through the setup menu icons

- ◆ Turn the adjustment knob to scroll through the setup menu icons.

To select a setup menu icon for an action

- ◆ Press Enter () to open a dialog box or submenu of icons.
If the action opens a submenu of icons:
 - a) Turn the adjustment knob to select an icon.
 - b) Press Enter () to open a dialog box or setup page.

3.1.2 Navigating Dialog Boxes and Setup Pages

The procedure for navigating through dialog boxes and setup pages is the same for both. When you open a dialog box or setup page, the first parameter description is highlighted, but the parameter value is not highlighted (see Figure 3-3 on page 40). You must highlight the first parameter value before you can change it.

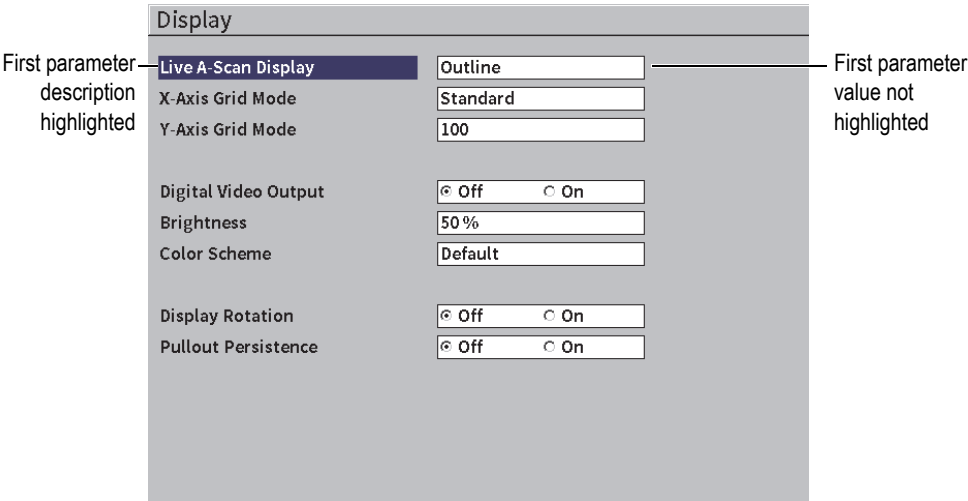


Figure 3-3 Setup page as initially displayed

To highlight (and select) the first parameter value on a dialog box or setup page

1. On the dialog box or setup page, press Enter () to highlight and select the first parameter value.
2. Turn the adjustment knob to choose a different parameter value.

To change other dialog box or setup page parameters

1. Press Tab () to move to a parameter value.
Pressing the Tab key confirms the current parameter value and then moves to and selects the next parameter value.

NOTE

A parameter is shaded if it cannot currently be changed.

2. Turn the adjustment knob to choose a different parameter value.
3. Repeat the two previous steps until you have changed all of the desired parameters.

4. Press the Shift (, Tab () key sequence to return to the live A-scan.

4. Inspection Mode

The EPOCH 6LT Inspection mode provides you full access to all of the inspection mode features, including a full-screen view of the live A-scan. The inspection mode menus include the sidebar menu (see Figure 4-1 on page 43) and the shortcut menus. The menus are designed to enable you to make quick adjustments or use advanced features during an inspection.

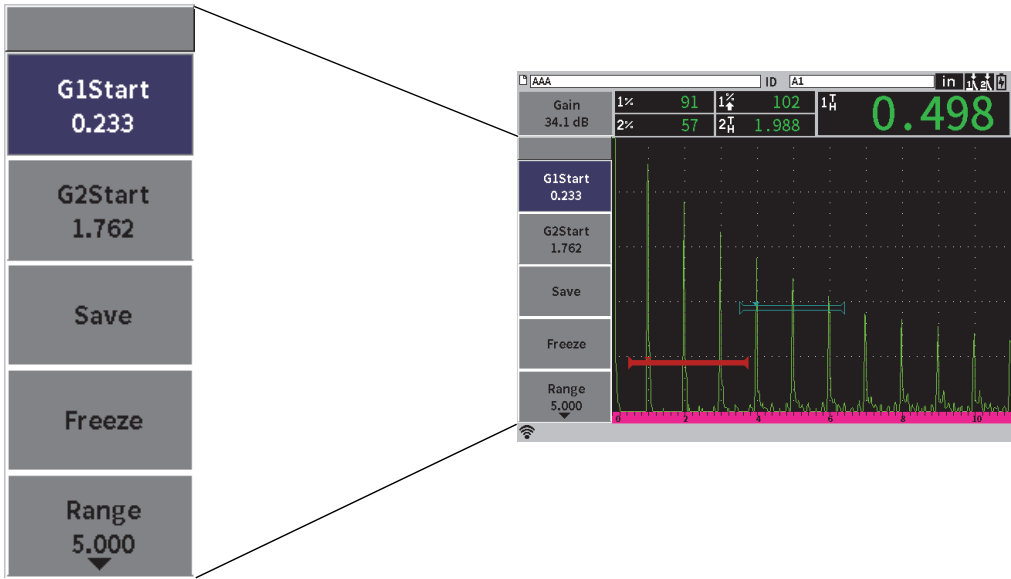


Figure 4-1 Sidebar menu

4.1 Sidebar Menu

The sidebar menu contains a set of buttons that immediately affect an ongoing inspection (see Figure 4-1 on page 43).

NOTE

You can change the persistence of the sidebar (pullout) menu in the **Display** setup page. See “Display Setup Page” on page 61 for more information.

To display the sidebar menu on the live A-scan display

- ◆ Press Tab () until the sidebar menu displays.

4.1.1 Sidebar Menu Button Actions

The number of buttons that appear in the sidebar menu depends on settings made in the setup menu.

Table 2 on page 44 shows the types of buttons found in the sidebar menu and describes the action associated with each button type.

Table 2 Button types

Type	Example	Description
Adjustable value		Button with an adjustable value. The value appears under the button name.
Function		Button that immediately initiates an action.

Table 2 Button types (*continued*)

Type	Example	Description
Menu open		Button that opens a submenu of adjustable parameters and/or function buttons. The pointer (►) identifies a submenu button.

4.1.2 Adjustable Value Buttons

Both the sidebar menu and submenus can have one or more buttons with an adjustable value. The value appears under the button name (see Figure 4-2 on page 45).

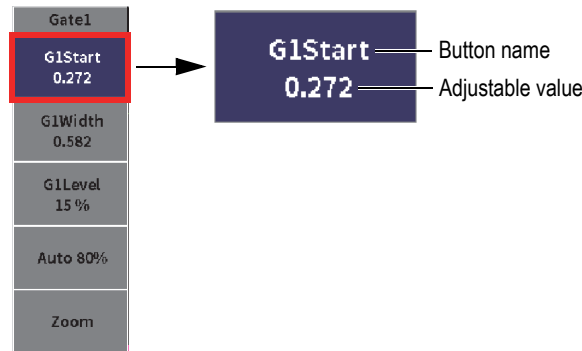


Figure 4-2 Submenu with highlighted adjustable value

Figure 4-2 on page 45 shows a button that is highlighted, but not selected. A button must be selected before you can change its value. When a button with an adjustable value is selected, an enhanced border surrounds the button (see Figure 4-3 on page 45). You can then change the value.



Figure 4-3 Enhanced border indicates selected adjustable value

The default behavior for the sidebar menu or sidebar submenu is that the first button is highlighted, but not selected, when you open the menu or submenu for the first time. If that button is an adjustable value button it must be selected before it can be adjusted.

To select the first adjustable value button in a menu or submenu

- ◆ Press Enter () to select the highlighted button (see “Using the Sidebar Menu and Submenus” on page 46 for details on adjusting the value).

4.1.3 Using the Sidebar Menu and Submenus

There are differences between the way you move through the sidebar menu and the way you move through a sidebar submenu.

4.1.3.1 Using the Sidebar Menu

When using the Sidebar menu, you can move the focus from button to button by turning the adjustment knob.

To use the sidebar menu buttons

1. Turn the adjustment knob to move through the sidebar menu buttons. Buttons are highlighted as you turn the knob.
2. Highlight the button of your choice.
3. Press Enter () to execute an action.
 - If the button has an adjustable parameter value, turn the adjustment knob to change the value, and then press Enter () to confirm the new value.

TIP

The Shift (), Enter () key sequence switches the adjustment knob between coarse and fine adjustment of the highlighted value. A line under the value indicates a coarse adjustment.

-
- If the button performs an immediate action, that action is executed.

- If the button opens a submenu, that submenu is opened (see “Using Sidebar Submenus” on page 47).
- 4. Repeat the first three steps of this procedure until you are finished making changes.
- 5. Press the Shift (), Tab () key sequence to dismiss the Sidebar menu.

4.1.3.2 Using Sidebar Submenus

When using a sidebar submenu, you can move the focus from button to button by pressing the Tab key.

To use the Sidebar submenu buttons

1. Press Tab () to move through the sidebar submenu buttons.
Buttons are highlighted and selected for action as you move through the submenu.
 - If the button you choose has an adjustable parameter value, turn the adjustment knob to change the value, and then press Tab ().

TIP

The Shift (), Enter () key sequence switches the adjustment knob between coarse and fine adjustment of the highlighted value. A line under the value indicates a coarse adjustment.

Pressing the Tab key confirms the adjusted parameter value, and then moves to and selects the next button.

- If the button performs an immediate action, press Enter () to execute that action.
2. Press ESC () to return to the Sidebar menu.

4.2 Shortcut Menus

Shortcut menus are available while in Inspection mode. Shortcut menus offer you quick access to the following:

- Setup pages in the data logger
- Measurement and display setup
- **Gain** adjustment box configuration

4.2.1 File Identifier Shortcut Menu

The file identifier shortcut menu contains buttons that open data logger setup pages (see Figure 4-4 on page 48).



Figure 4-4 File identifier shortcut menu

To use the file identifier shortcut menu

1. While on the live A-scan screen, press Tab () to highlight the file identifier bar, outlining it in red (see Figure 4-5 on page 49).



Figure 4-5 Highlighted file identifier bar

2. Press Enter () to open the shortcut menu.
3. Turn the adjustment knob to choose a menu item, and then press Enter () to open the associated setup page.

For detailed information on the data logger setup pages, see “Data Logger Setup Pages” on page 124.

4.2.2 Measurement Reading Shortcut Menu

The measurement reading shortcut menu contains buttons that open the **Measurement** and **Display** setup pages (see Figure 4-6 on page 50).



Figure 4-6 Measurement reading shortcut menu

To use the measurement reading shortcut menu

1. While on the live A-scan display, press Tab (→|) to highlight the measurement reading bar, outlining it in red (see Figure 4-7 on page 50).



Figure 4-7 Highlighted measurement reading bar

2. Press Enter (←|) to open the shortcut menu.
3. Turn the adjustment knob to choose a menu item, and then press Enter (←|) to open the associated setup page.

For detailed information on the **Display** and **Measurement** setup pages, see “Display Setup Page” on page 61 and “Measurement Setup Page” on page 64.

4.2.3 Gain Adjustment Shortcut Menu

The gain adjustment shortcut menu contains buttons that enable you to set the reference and scanning gain values (see Figure 4-8 on page 51).

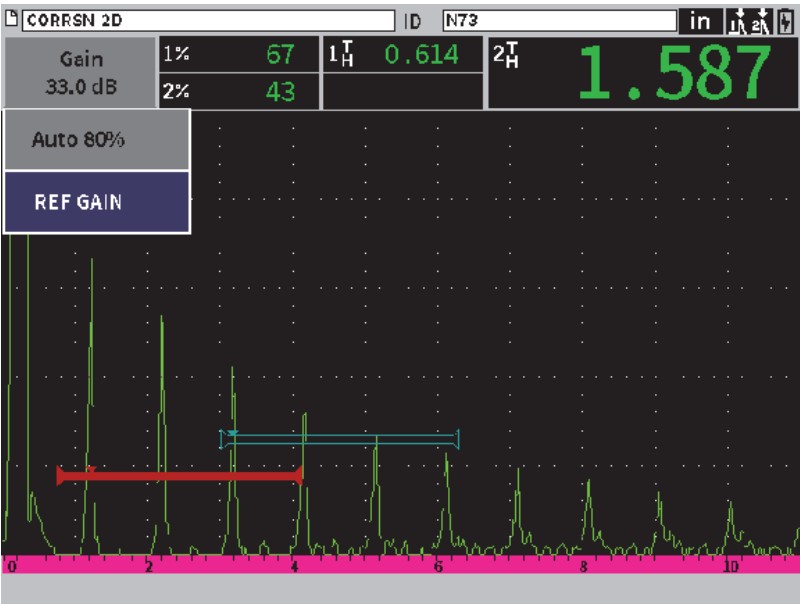


Figure 4-8 Gain adjustment shortcut menu

To use the gain adjustment shortcut menu

1. While on the live A-scan screen, press the Tab key (→) to highlight the **Gain** adjustment box, outlining it in red (see Figure 4-9 on page 51).



Figure 4-9 Highlighted Gain adjustment box

2. Press the Enter key () to open the shortcut menu.

For detailed information on making gain adjustments using the shortcut menu, see “Adjusting the Gain (System Sensitivity)” on page 79.

5. Setup Pages

The EPOCH 6LT software includes a number of setup pages for adjusting instrument features and parameters. An example setup page is shown in Figure 5-1 on page 53.

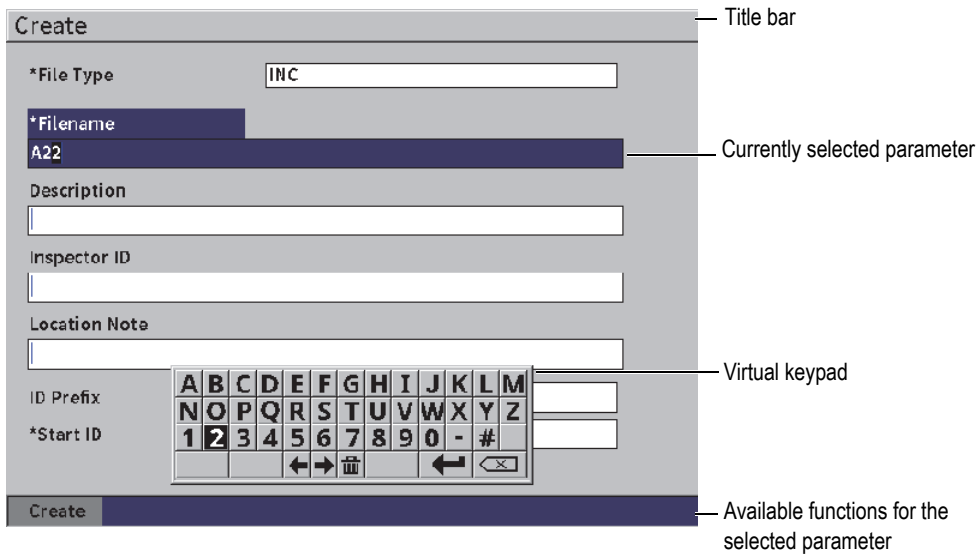


Figure 5-1 Create setup page and its elements

The title bar identifies the type of setup page. Parameters appear in the center area of the page. Buttons may appear at the bottom of the page to execute certain functions.

All setup pages are accessible through the **Settings** menu (see Figure 5-2 on page 54). Certain setup pages are available through the shortcut menus (see “Shortcut Menus” on page 48).

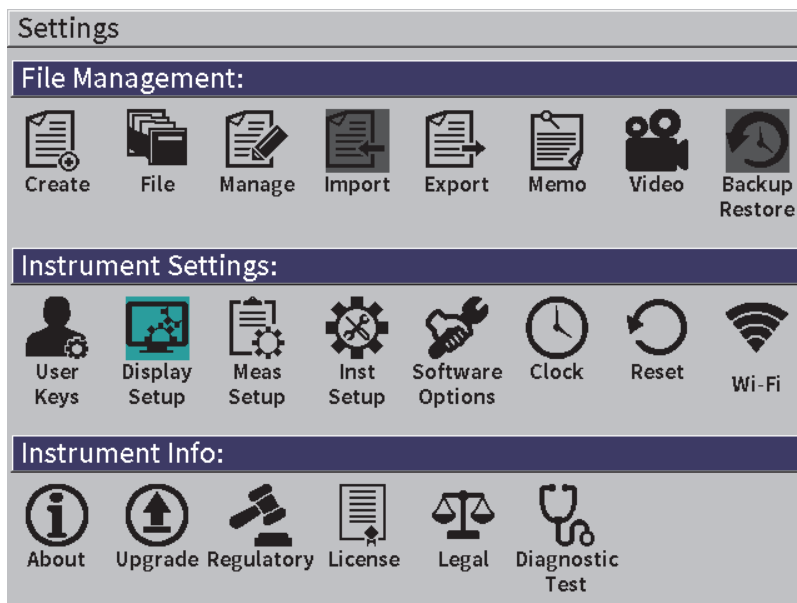


Figure 5-2 Settings menu

5.1 Opening a Setup Page

Opening a setup page requires opening and navigating through the setup menu, the **Settings** menu, and then opening one of the **Settings** menu setup pages.

To open a setup page

1. On the live A-scan screen, press the Shift (), Escape () key sequence to access the setup menu.
2. Turn the adjustment knob to move to and highlight the **Settings** icon ().
3. Press Enter () to open the **Settings** menu.
4. On the **Settings** menu, turn the adjustment knob to move to and highlight one of the **Settings** icons.

5. Press Enter () to open the selected setup page.

When you open a setup page, the first parameter description is highlighted, but the parameter value is not highlighted. You must highlight the first parameter value before you can change it. See “Navigating Dialog Boxes and Setup Pages” on page 39.

NOTE

A parameter is shaded if it cannot currently be changed.

5.2 Using the Virtual Keypad

A setup page containing one or more parameters with alphanumeric values also contains a virtual keypad. The virtual keypad enables you to enter alphanumeric characters.

A setup page containing parameters with alphanumeric values is shown in Figure 5-3 on page 56.

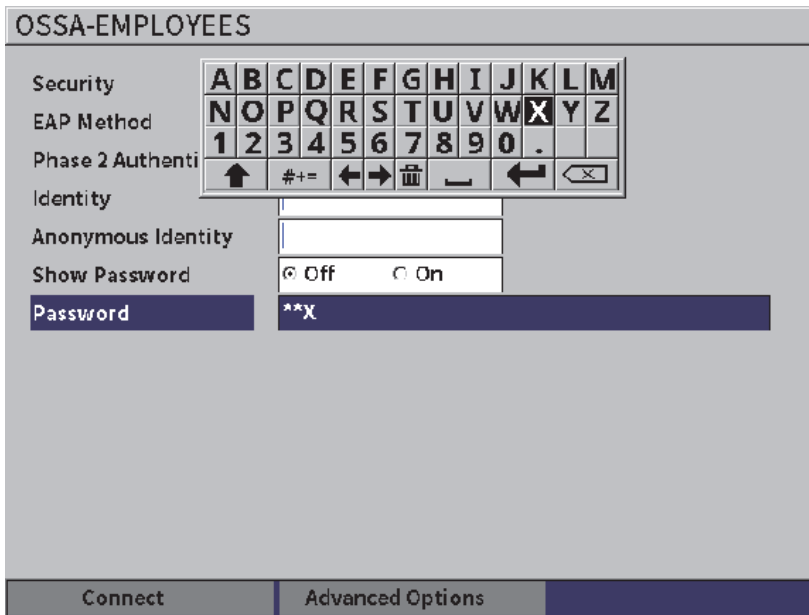


Figure 5-3 Edit page with virtual keypad

To enter an alphanumeric value using the virtual keypad

1. Press Tab () to select the box that you want to edit, and then press Enter ()
2. On the virtual keypad:
 - a) Turn the adjustment knob to move to and highlight the character to be added.
 - b) Press Enter ()
3. To delete an already entered character:
 - a) On the virtual keypad, select the left arrow () or right arrow () with the adjustment knob.
 - b) Press Enter () once for each move left or right.

- c) Turn the adjustment knob to select Delete () on the virtual keypad, then press Enter () to delete the character.
- 4. To save the entered data and exit the setup page, press Tab () until the **Apply** or **Create** button is selected, and then press Enter ().

5.3 File Management Pages

See “Data Logger Setup Pages” on page 124.

5.4 Instrument Settings Pages

The Instrument Settings setup pages are used to set up the general hardware aspects of the EPOCH 6LT.

5.4.1 User Keys Setup Page

Custom user keys affect the Inspection mode sidebar menu action that occurs when the Home (Shift [], Tab [] key) sequence is pressed.

The default action when you press the Shift, Tab key sequence is that the live A-scan (Home) screen is displayed (see Figure 5-4 on page 58).

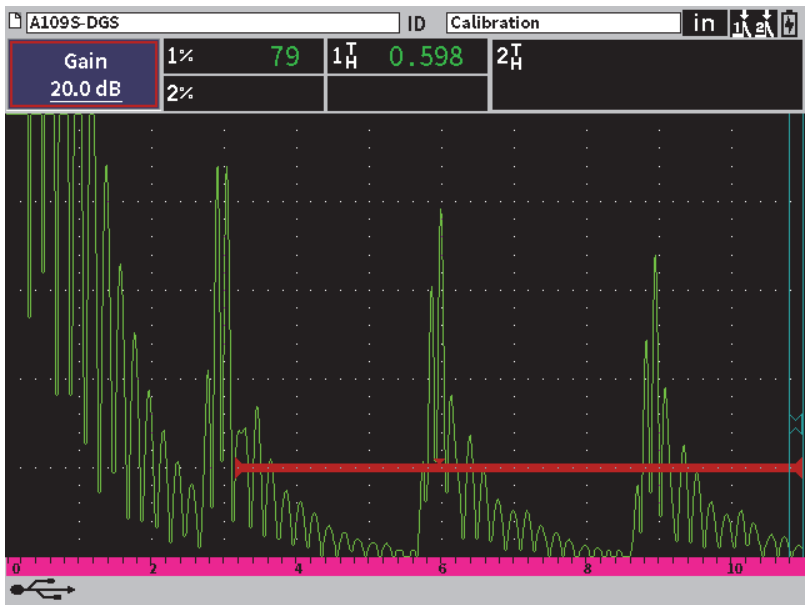


Figure 5-4 Default home screen (live A-scan)

You can change the action of the Shift, Tab key sequence in the **User Keys and Home Keys** setup page (see Figure 5-5 on page 59).

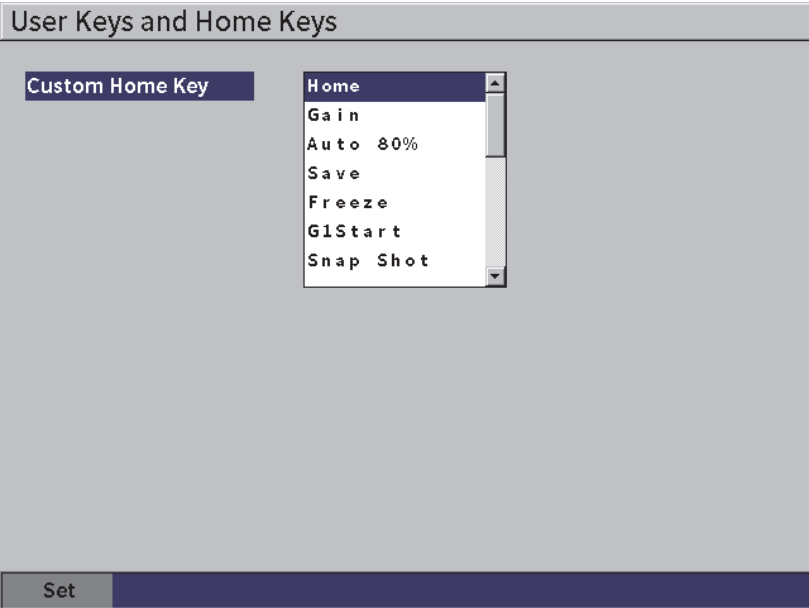


Figure 5-5 Custom User Key setup page

For example, if the **G1Start** parameter is selected, the result of pressing the Shift, Tab key sequence is that the **Gate1** Sidebar submenu is displayed with the **G1Start** button selected (see Figure 5-6 on page 60).

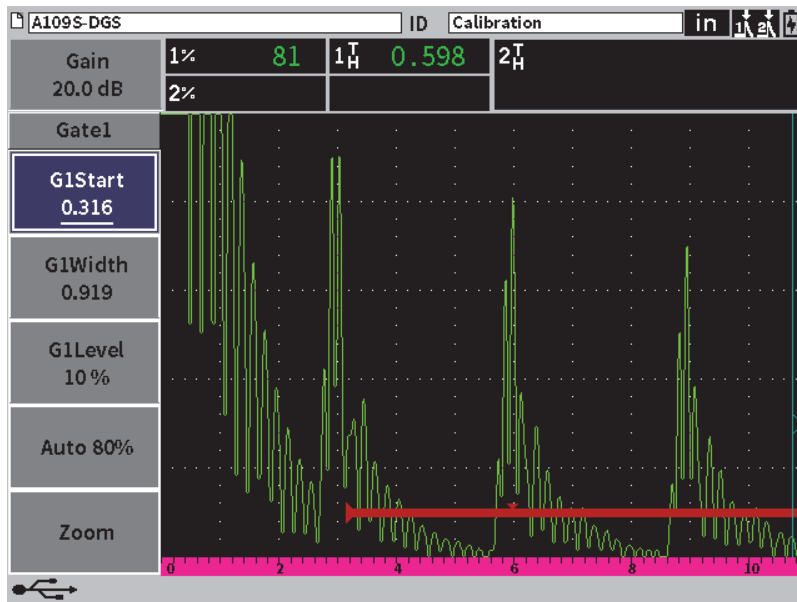


Figure 5-6 G1Start selected as Home location

To change the Home location

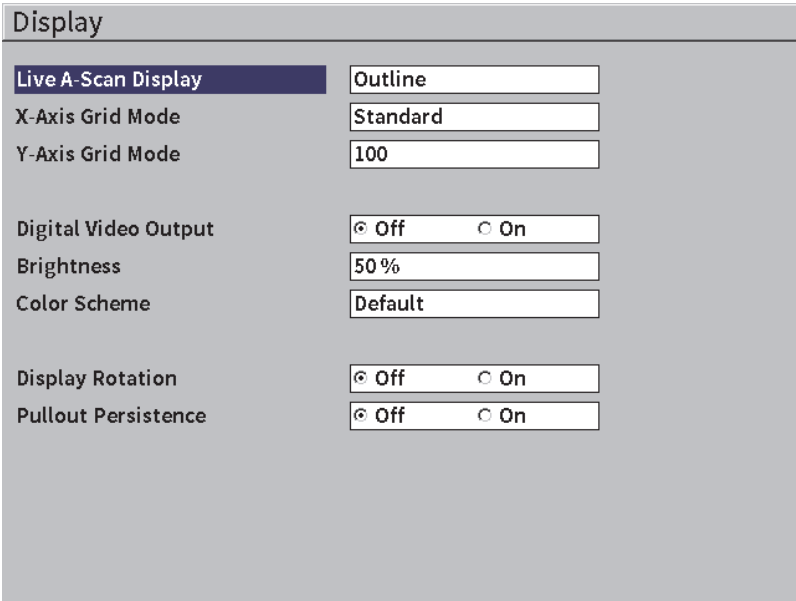
1. Open the **User Keys and Home Keys** setup page (see Figure 5-5 on page 59).
2. Press the Tab key to select the dialog box containing the following parameters:
 - **Home**
 - **Gain**
 - **Auto XX%**
 - **Save**
 - **Freeze**
 - **G1Start**
 - **Snap Shot**
3. Turn the adjustment knob to select one of the parameters.
4. Press the Tab key to highlight **Set**, and then press the Enter key to confirm.

5.4.2 Display Setup Page

The **Display** setup page enables you to set parameters that control aspects of the display.

To open the Display setup page

- ◆ Select the **Display Setup** icon () to open the **Display** setup page (see Figure 5-7 on page 61).



Display	
Live A-Scan Display	Outline
X-Axis Grid Mode	Standard
Y-Axis Grid Mode	100
Digital Video Output	☒ Off ☐ On
Brightness	50 %
Color Scheme	Default
Display Rotation	☒ Off ☐ On
Pullout Persistence	☒ Off ☐ On

Figure 5-7 Display setup page

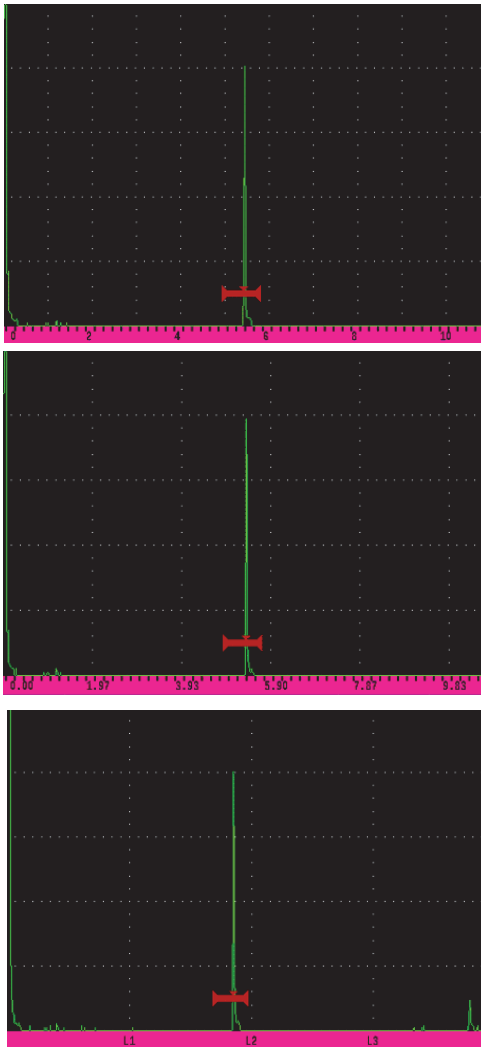
The available parameters are as follows:

- **Live A-Scan Display**
Sets the live A-scan drawing mode
 - **Outline**
 - **Filled**

- **X-Axis Grid Mode** (see Figure 5-8 on page 63)

Sets the horizontal x-axis grid display mode

- **Off:** no grid
- **Standard:** 10 divisions spaced evenly and labeled 1 to 10
- **Soundpath:** five divisions spaced evenly and labeled with corresponding sound path values
- **Leg:** up to four divisions representing half-skip distances in angle beam inspection mode, based on test piece thickness value, and labeled L1 to L4



Standard grid: traditional flaw detector view with 10 divisions equally spaced across the screen range, and the numbers 1–10 appearing below each division.

SoundPath grid: actual sound path measurements at equally spaced increments along the horizontal axis. This mode displays 5 divisions, each labeled with its corresponding sound path value (depending on the **Basic > Range**, **Basic > Delay**, and **Meas Setup > Units** settings).

Leg grid: vertical lines represent angle beam inspection legs. This mode displays up to 4 divisions, labeled **L1** to **L4**, each representing the half-skip distance of a test piece during an angle beam inspection. The spacing and number of divisions displayed depends on the **Basic > Range**, **Basic > Delay**, and **Trig > Thick** (material thickness) parameters.

Figure 5-8 X-Axis Grid Mode options

- **Y-Axis Grid Mode**
Sets the vertical y-axis grid display mode to 100 % or 110 % full-screen height.
- **Digital Video Output**
Controls the output to the digital video connector.

- **Off**
- **On**
- **Brightness**

Used to adjust the screen brightness by choosing one of the preset values (0 %, 25 %, 50 %, 75 %, or 100 %).
- **Color Scheme**

Sets the overall instrument color scheme.

 - **Default:** default multi color display
 - **Classic:** EPOCH 650 color scheme
 - **Outdoor (White):** white background, black text
 - **Outdoor (Yellow):** yellow background, black text
 - **Mono:** Black background, white text
- **Display Rotation**

Controls whether the display changes orientation when the instrument is rotated 90, 180, or 270 degrees.

 - **Off**
 - **On**
- **Pullout Persistence**

Controls whether or not the Sidebar menu is always displayed in Inspection mode.

 - **Off**
 - **On**

5.4.3 Measurement Setup Page

The **Measurement Setup** page (see Figure 5-9 on page 65) enables you to select which measurement appears in the measurement reading boxes at the top of the software live A-scan screen.

To open the Measurement Setup page

- ◆ Select the **Meas Setup** icon () to open the **Measurement Setup** page (see Figure 5-9 on page 65).

Measurement Setup

Reading Selection

Manual

Reading1

Gate1 Thickness

Reading2

Gate1 Minimum Amplitude

Reading3

Gate2 Thickness

Reading4

Gate2 Soundpath Distance

Reading5

Gate2 - Gate1

Units

in

Thickness Resolution

X.XXX

AscanMode

1% Max

Curve Connected to Zero

☒ Off ☐ On

Information displayed in the measurement reading boxes

Figure 5-9 Measurement Setup page

The available parameter selections are:

- Reading Selection**
Sets the measurement reading box mode.
 - Auto:** Automatically makes the selection based on instrument function
 - Manual:** Readings correspond to the manually defined selections
- Reading1 to Reading5**
Each measurement reading box is defined independently when in **Manual** mode. Figure 5-10 on page 66 shows an example of the measurement reading boxes. Each box displays an icon that indicates the type of measurement being displayed and the measurement value.

NOTE

The flags that appear in the upper-right corner of the display indicate units (see Units on page 69 and “Flags” on page 227), gate measurement modes (see “Gate Measurement Modes” on page 95 and “Flags” on page 227), and battery status (see “Flags” on page 227).

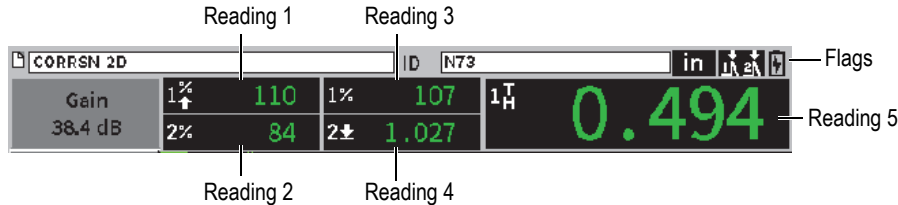


Figure 5-10 Example of measurement reading boxes with icons

Table 3 on page 66 describes the available measurement readings.

Table 3 Available measurement readings

Flag	Measurement reading	Description
1 ^T _H	Gate 1 Thickness	Thickness in gate 1. Not used with the Angle setting.
2 ^T _H	Gate 2 Thickness	Thickness in gate 2. Not used with the Angle setting.
1 [↘]	Gate 1 Soundpath Distance	Sound path (angular) distance in gate 1.
2 [↘]	Gate 2 Soundpath Distance	Sound path (angular) distance in gate 2.
1 [↓]	Gate 1 Depth to Reflector	Depth to reflector in gate 1. Used with the Angle setting.
2 [↓]	Gate 2 Depth to Reflector	Depth to reflector in gate 2. Used with the Angle setting.

Table 3 Available measurement readings (continued)

Flag	Measurement reading	Description
	Gate 1 Surface Distance	Horizontal distance to reflector in gate 1. Used with the Angle setting.
	Gate 2 Surface Distance	Horizontal distance to reflector in gate 2. Used with the Angle setting.
	Gate 1 Surface Dist — X Val	Horizontal distance minus the x value (distance from beam index point to front of wedge) in gate 1. Used with the Angle setting.
	Gate 2 Surface Dist — X Val	Horizontal distance minus the x value (distance from beam index point to front of wedge) in gate 2. Used with the Angle setting.
	Gate 1 Minimum Depth	Minimum depth in gate 1. Resets on gate adjustment and on most pulser/receiver adjustments.
	Gate 2 Minimum Depth	Minimum depth in gate 2. Resets on gate adjustment and on most pulser/receiver adjustments.
	Gate 1 Maximum Depth	Maximum depth in gate 1. Resets on gate adjustment and on most pulser/receiver adjustments.
	Gate 2 Maximum Depth	Maximum depth in gate 2. Resets on gate adjustment and on most pulser/receiver adjustments.
	Gate 1 Current Amplitude	Amplitude measurement in gate 1. Displays as % of full-screen height (FSH).
	Gate 2 Current Amplitude	Amplitude measurement in gate 2. Displays as % of full-screen height (FSH).
	Gate 1 Maximum Amplitude	Maximum amplitude in gate 1. Resets on gate adjustment and on most pulser/receiver adjustments.
	Gate 2 Maximum Amplitude	Maximum amplitude in gate 2. Resets on gate adjustment and on most pulser/receiver adjustments.

Table 3 Available measurement readings (*continued*)

Flag	Measurement reading	Description
1% 	Gate 1 Minimum Amplitude	Minimum amplitude in gate 1. Resets on gate adjustment and on most pulser/receiver adjustments.
2% 	Gate 2 Minimum Amplitude	Minimum amplitude in gate 2. Resets on gate adjustment and on most pulser/receiver adjustments.
1% C	Gate 1 Amplitude to Curve	Amplitude measurement in gate 1. Displays echo height as a percentage of DAC/TCG curve height.
2% C	Gate 2 Amplitude to Curve	Amplitude measurement in gate 2. Displays echo height as a percentage of DAC/TCG curve height.
dB 1 C	Gate 1 dB to Curve	Amplitude measurement in gate 1. Displays echo dB value compared to curve height where the curve equals 0 dB.
dB 2 C	Gate 2 dB to Curve	Amplitude measurement in gate 2. Displays echo dB value compared to curve height where the curve equals 0 dB.
2-1	Gate 2—Gate 1 (Echo-to-Echo)	Gate 2 thickness minus gate 1 thickness (echo-to-echo measurement).
D=	AWS D1.1/D1.5 Weld Rating (D)	D rating calculated for the gated echo.
E_S^R	Equivalent Reflector size	Equivalent reflector size (flat-bottom hole) for DGS/AVG evaluation
OS	Overshoot (OS)	Overshoot value in dB comparing echo height to DGS/AVG curve.
A=	AWS A	AWS defect indication value A.
B=	AWS B	AWS reference indication value B.
C=	AWS C	AWS sound path correction value C.

Table 3 Available measurement readings (continued)

Flag	Measurement reading	Description
R1	Gate1 Ref dB-Current Amp	Comparison value in dB measuring the difference between the gate 1 echo height and the reference gain.
R2	Gate2 Ref dB-Current Amp	Comparison value in dB measuring the difference between the gate 2 echo height and the reference gain.

- **Units**

Determines the unit of measurement.

- **μs**
- **mm**
- **in.**

- **Thickness Resolution**

Sets the displayed resolution of a thickness measurement.

- **X**
- **X.X**
- **X.XX**
- **X.XXX**

- **Ascan Mode**

Sets the A-scan mode.

- **Composite**
- **1% Max**
- **2% Max**
- **1D Min**
- **2D Min**

- **Curve Connected to Zero**

Creates a horizontal line connecting the left side of the A-scan to the first acquired point when building a DAC curve.

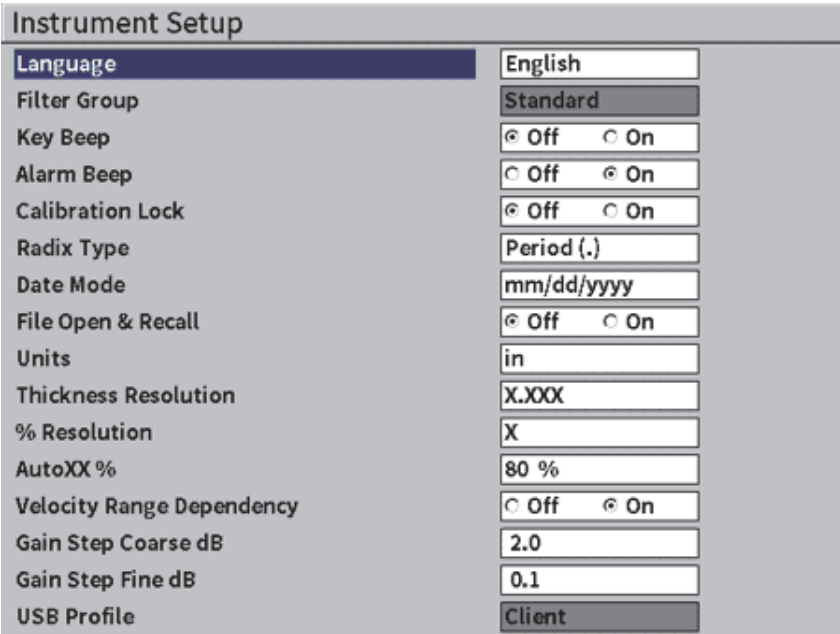
- **Off**
- **On**

5.4.4 Instrument Setup Page

The **Instrument Setup** page, shown in Figure 5-11 on page 70, enables you to configure general parameters such as the user interface language and the instrument date mode.

To open the Instrument Setup page

- ◆ Select the **Inst Setup** icon () to open the **Instrument Setup** page (see Figure 5-11 on page 70).



Instrument Setup	
Language	English
Filter Group	Standard
Key Beep	☒ Off ☐ On
Alarm Beep	☐ Off ☒ On
Calibration Lock	☒ Off ☐ On
Radix Type	Period (.)
Date Mode	mm/dd/yyyy
File Open & Recall	☒ Off ☐ On
Units	in
Thickness Resolution	X.XXX
% Resolution	X
AutoXX %	80 %
Velocity Range Dependency	☐ Off ☒ On
Gain Step Coarse dB	2.0
Gain Step Fine dB	0.1
USB Profile	Client

Figure 5-11 Instrument Setup page

The available parameter selections are as follows:

- **Language**
Selects the user interface language (**English, Japanese, German, French, Italian, Spanish, Portuguese, Russian, Chinese, Polish, or Custom**).

- **Filter Group**
Selects receiver filter group.
- **Key Beep**
Sounds an audible tone on every key press.
- **Alarm Beep**
Activates an audible tone when a gate alarm is triggered.
- **Calibration Lock**
Locks access to all functions affecting calibration/waveform data. These include **Basic**, **Pulser**, **Rcvr** (receiver), and **Trig** settings, as well as **Gain**, **Range**, and **Delay**. These parameters are crossed out when the **Calibration Lock** function is turned **On**.
- **Radix Type**
Used to select the format used by the instrument to display numeric values (radix) and the date.
- **Date Mode**
Used to set the date format. You can choose between the **dd/mm/yyyy** and **mm/dd/yyyy** formats.
- **File Open & Recall**
 - **On**
 - **Off**
- **% Resolution**
Sets the displayed resolution of an amplitude measurement.
 - **X**
 - **X.X**
 - **X.XX**
- **AutoXX %**
Quickly adjusts the instrument gain (dB) setting to bring the gated peak echo to XX %FSH (full-screen height). Auto XX% is especially useful for bringing the echo from a reference indication to XX % FSH to establish the instrument's reference gain level (see "Setting Reference Gain and Scanning Gain" on page 80 for further information). The default setting for **Auto XX%** is 80 % FSH.
- **Gain Step Coarse dB**
Changes the gain from 1 to 24 steps per adjustment knob notch.
- **Gain Step Fine dB**
Changes the gain from 0.1 to 0.9 steps per adjustment knob notch.

5.4.5 Software Options Setup Page

Use the **Software Options** page to enter an activation code for access to a software option not included with the standard instrument features. See “Defining Licensed and Unlicensed Software Features” on page 171 for details on software option activation.

5.4.6 Clock Setup Page

The **Clock** setup page, shown in Figure 5-12 on page 72, enables you to configure the date and time settings for the instrument internal clock.

To open the Clock setup page

- ◆ Select the **Clock** icon (🕒) to open the **Clock** setup page (see Figure 5-12 on page 72).

The screenshot shows the 'Clock' setup page with the following fields and options:

Field	Value
Year	2017
Month	1
Day	10
Mode	12 Hour
Hour	2 AM
Minute	1

Time Zone: A list box containing the following options (GMT-11:00 {MIDWAY ISLAND} through GMT-03:30 {NEWFOUNDLAND}). The option GMT-05:00 {EASTERN AMERICA} is currently selected.

Automatic Date & Time: ☐ Off ☒ On

DayLight Saving Time: ☒ Off ☐ On

At the bottom left is a 'Set' button.

Figure 5-12 Clock setup page

The available parameter selections are as follows:

- **Year**
Sets the year.
- **Month**
Sets the month.
- **Day**
Sets the day of the month.
- **Mode**
Sets the hour display mode (**12 Hour** or **24 Hour**).
- **Hour**
Sets the hour.
- **Minute**
Sets the minutes.
- **Time Zone**
Sets the time zone.
- **Automatic Date & Time**
Automatically sets the date and time when connected to a wireless LAN (Wi-Fi) network.
 - **On**
 - **Off**
- **Daylight Saving Time**
Sets daylight saving time.
 - **On**
 - **Off**

5.4.7 Resets Setup Page

This page is used to reset certain system parameters to the factory default condition (see Figure 5-13 on page 74). A warning is displayed to notify you that the data associated with the selection will be reset (erased).

To open the Resets setup page

- ◆ Select the **Reset** icon () to open the **Resets** setup page (see Figure 5-13 on page 74).

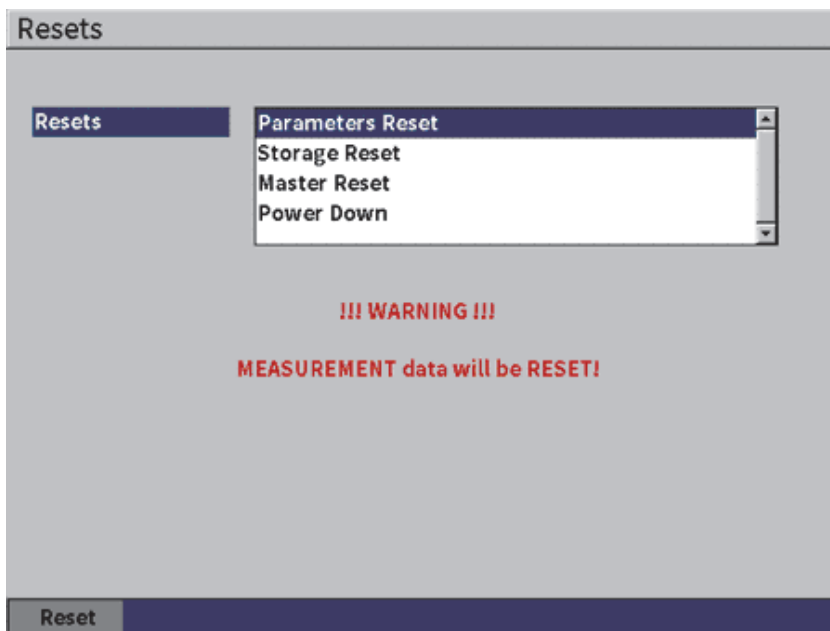


Figure 5-13 Resets setup page

5.4.8 Wi-Fi Networks Setup Page

This page is used to configure a wireless LAN connection. See “Wi-Fi Networks” on page 165 for details on using the **Wi-Fi Networks** setup page.

5.5 Instrument Info Setup Pages

These pages primarily provide information about the state of the instrument. The **Upgrade** and **Diagnostic Test** pages are more interactive.

5.5.1 About Setup Page

The **About** page provides information about the instrument hardware, software identification data, and battery data.

To open the About setup page

- ◆ Select the **About** icon () to open the **About** setup page.

5.5.2 Upgrade Setup Page

This page is used to upgrade the EPOCH 6LT system software. You can upgrade via a wireless LAN network, a USB flash drive, or a USB connection to a computer.

To upgrade the system software

1. Select the **Upgrade** icon () to open the **Upgrade** setup page (see Figure 5-14 on page 76).
2. Press the Enter key to select the **Upgrade From** parameter box.
3. Turn the adjustment knob to select an upgrade source. The available upgrade sources are as follows:

Mass Storage

A USB flash drive

Wi-Fi

A wireless LAN network

PC

A USB connection to a PC

4. Make sure that the selected upgrade source is properly configured and connected to the instrument.
5. Press the Tab key to select the **Start** button, and then press the Enter key to begin the upgrade.

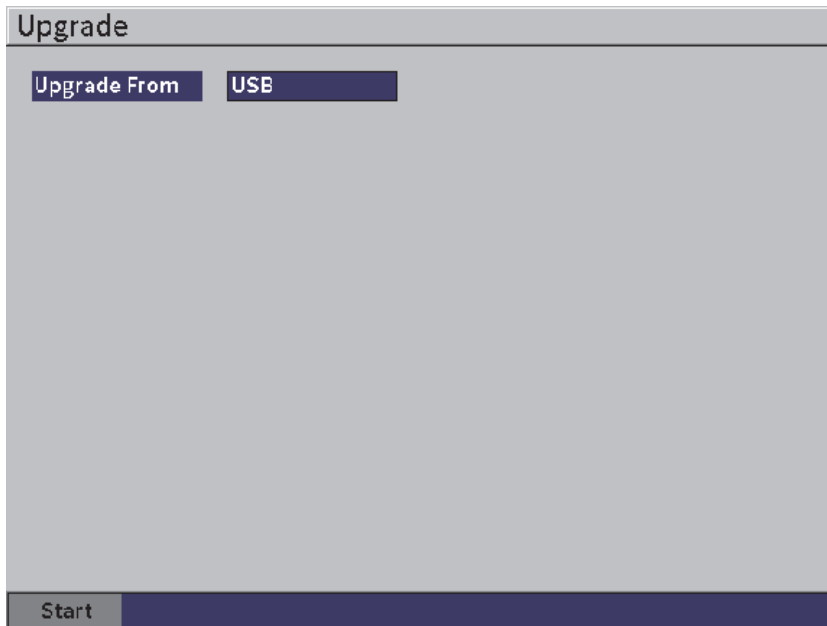


Figure 5-14 Upgrade setup page

5.5.3 Regulatory Setup Page

This page displays regulatory information and labels.

To open the Regulatory setup page

- ◆ Select the **Regulatory** icon () to open the **Regulatory** setup page.

5.5.4 License Setup Page

This page displays all the licensing information.

To open the License setup page

- ◆ Select the **License** icon () to open the **License** setup page.

5.5.5 Legal Setup Page

This page displays patent information.

To open the Legal setup page

- ◆ Select the **Legal** icon () to open the **Legal** setup page.

5.5.6 Diagnostic Test Setup Page

This page displays a list of diagnostic tests, and available test options. The **Start** button at the bottom of the page begins the test.

To run a Diagnostic Test

1. Select the **Diagnostic Test** icon () to open the **Diagnostic Test** setup page (see Figure 5-15 on page 78).
2. Turn the adjustment knob to select a test.
3. Press the Tab key to select the **Start** button, and then press the Enter key to begin the test.

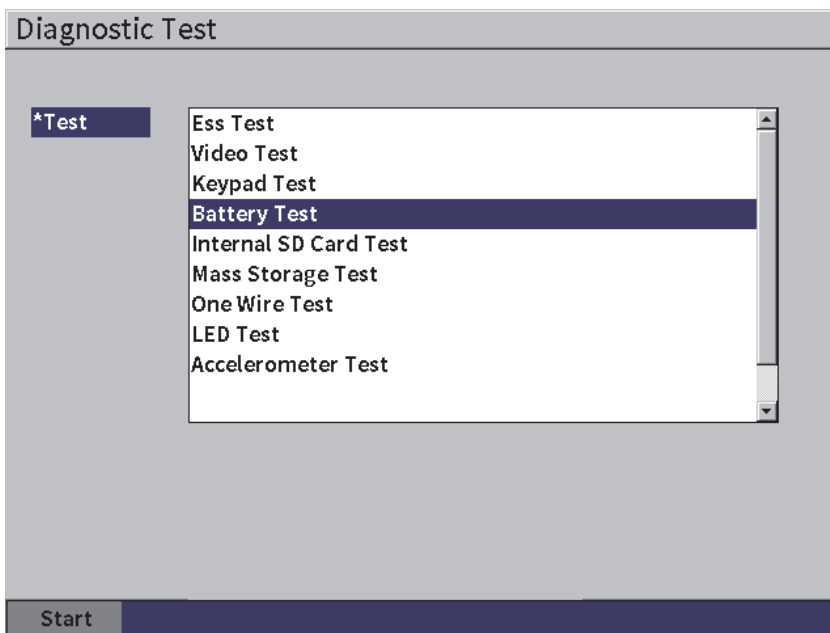


Figure 5-15 Diagnostic Test setup page

6. Pulser/Receiver Adjustments

This chapter describes how to adjust the EPOCH 6LT pulser/receiver.

6.1 Adjusting the Gain (System Sensitivity)

To adjust the gain

1. On the live A-scan screen, press the Tab key to select the **Gain** adjustment box (see Figure 6-1 on page 79).
2. Turn the adjustment knob to set the gain (system sensitivity).

NOTE

The total gain (system sensitivity) is 110 dB.



Figure 6-1 Highlighted Gain adjustment box

6.1.1 Using the Auto XX% Feature

The **Auto XX%** feature is used to quickly adjust the instrument gain (dB) setting to bring the gated peak echo to XX % FSH (full-screen height). **Auto XX%** is especially useful for bringing the echo from a reference indication to XX % FSH to establish the instrument's reference gain level (see "Setting Reference Gain and Scanning Gain" on page 80 for further information).

The default setting for **Auto XX%** is 80 % FSH. You can adjust the FSH target value to meet the demands of the application (see "Instrument Setup Page" on page 70).

You can use the **Auto XX%** feature to bring an echo to XX % FSH in any gate.

To use the Auto XX% feature

1. On the live A-scan screen, press the Tab key to select the **Gain** adjustment box (see Figure 6-1 on page 79).
2. Press the Enter key to open the shortcut menu.
The shortcut menu opens with **Auto XX%** highlighted.
3. Press the Enter key again to activate the **Auto XX%** feature.

NOTE

Auto XX% can be activated at any time during operation. If you do not actively select a gate, **Auto XX%** is applied to gate 1.

6.1.2 Setting Reference Gain and Scanning Gain

Establishing the current system gain as the reference (base) level is useful for inspections that require adding or subtracting scanning gain based on the relation to a fixed gain level.

To set reference gain and adjust scanning gain

1. On the live A-scan display, press the Tab key to select the **Gain** adjustment box (see Figure 6-1 on page 79).
2. Press the Enter key to open the shortcut menu.
3. Turn the adjustment knob to highlight **REF GAIN**.
4. Press the Enter key to activate the reference gain feature.

The gain display reads: **Ref XX.X + 0.0 dB**. Scanning gain can now be added or subtracted.

5. Turn the adjustment knob to adjust the scanning gain.
6. Press the Enter key to display the scanning gain buttons (see Figure 6-2 on page 82).
 - **Auto XX%**
Quickly adjusts the instrument gain (dB) setting to bring the gated peak echo to XX % FSH (full-screen height, default value is 80 %).
 - **Scan dB**
Toggles the scanning gain from the active level to 0.0 dB (reference level) allowing a direct amplitude comparison to the reference indication.
 - **+6 dB**
Adds 6 dB to the reference gain. You add 6 dB with each button press.
 - **-6 dB**
Subtracts 6 dB from the reference gain. You subtract 6 dB with each button press.
 - **Add**
Adds the current scanning gain to the current reference gain for “transfer correction.”
 - **Off**
Exits the reference gain function without adding the scanning gain to the base instrument gain.

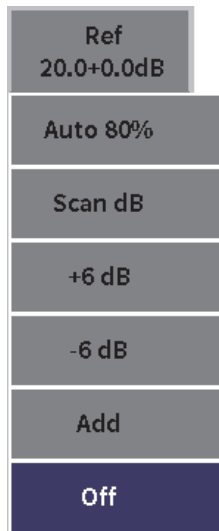


Figure 6-2 Scanning gain buttons

7. Turn the adjustment knob to highlight a button, and then press the Enter key to execute the function.

6.2 Selecting and Adjusting the Pulser

The pulser settings in the EPOCH 6LT are available in the **Pulser** dialog box.

To select the pulser

1. In the setup menu, turn the adjustment knob to navigate to the **Pulser** (**TX**). See “Setup Mode” on page 37 for details on using the setup menu and dialog boxes.
2. Press the Enter key to display the pulser dialog box (see Figure 6-3 on page 83).

Energy	400
Damp	50
Pulser	Tunable
Freq	10.0
Mode	P/E
PRF Mode	Auto
PRF	380

Figure 6-3 Pulser dialog box

6.2.1 Energy (Voltage)

The EPOCH 6LT can adjust the pulse energy from 0 V to 400 V in increments of 100 V. You can set the pulse energy to a minimum to extend the battery life, or set very high pulse energy for the most difficult materials.

To adjust the pulse energy

- 1. In the pulser dialog box, press the Enter key to highlight the **Energy** value.
 - 2. Turn the adjustment knob to vary the value (see “Navigating Dialog Boxes and Setup Pages” on page 39).
- In the **Energy** adjustment, coarse and fine steps are equal (100 V).

NOTE

To maximize instrument battery life and transducer life, use lower energy settings when the application permits. For most applications, the energy setting does not need to exceed 200 V.

6.2.2 Damping

The damping control enables you to optimize the waveform shape for high resolution measurements using an internal resistive circuit. There are two damping settings on the EPOCH 6LT ultrasonic flaw detector: **50 Ω** and **400 Ω** .

To adjust the damping

1. In the pulser dialog box, press the Tab key to select **Damp**.
2. Turn the adjustment knob to vary the value (see “Navigating Dialog Boxes and Setup Pages” on page 39).

TIP

Generally, the lowest resistance (Ω) setting increases the system damping and improves near-surface resolution, while the highest resistance setting decreases system damping and improves the instrument penetration power.

Selecting the correct damping setting fine-tunes the EPOCH 6LT in order to operate with a particular transducer selection. Depending on the transducer, the various damping settings either improve near-surface resolution or improve the instrument’s penetration power.

6.2.3 Pulser Type

The EPOCH 6LT has two pulser modes to choose from:

Tunable

Used to adjust the pulse width of the instrument square wave pulser for optimal response from the connected transducer.

Min

Sets the pulse width to its minimum square wave pulse value, mimicking the response of a traditional “spike” pulser.

NOTE

The EPOCH 6LT uses PerfectSquare technology to achieve optimum response from the tunable square wave pulser. The PerfectSquare technology maximizes the energy used to drive the connected transducer while providing excellent near-surface resolution.

To adjust the pulser waveform

- ◆ In the pulser dialog box, press the Tab key to select **Pulser**, and then turn the adjustment knob to change the setting (see “Navigating Dialog Boxes and Setup Pages” on page 39).

6.2.4 Pulser Frequency

When the pulser is set to **Tunable**, the pulser frequency selection sets the pulse width. The best performance is achieved by tuning the pulser frequency as close as possible to the center frequency of the transducer being used.

To adjust the pulser frequency

- ◆ With the pulser set to **Tunable**, press the Tab key to select **Freq**, and then turn the adjustment knob to change the setting (see “Navigating Dialog Boxes and Setup Pages” on page 39).

NOTE

Actual results could vary depending on the test material and/or variation in the transducer center frequency. Try various settings with a transducer and test piece to maximize ultrasonic performance.

6.2.5 Test Modes

The EPOCH 6LT can operate in three selectable test modes:

P/E

Used to select pulse-echo mode, where a single element transducer sends and receives the ultrasonic signal. You must use the red T/R transducer connector in pulse-echo mode.

Dual

Used to select pitch-catch mode, where a dual-element transducer has one element that transmits the ultrasonic signal and another element that receives the signal. Use the transducer connection labeled T/R as the transmit connector.

Thru

Used to select the thru-transmission mode, where two separate transducers are typically located on opposite sides of the test specimen. One transducer transmits the ultrasonic signal, the other receives. Use the transducer connection labeled T/R as the transmit connector.

NOTE

To compensate for the one-way sound path in thru-transmission (**Thru**) mode, the EPOCH 6LT does not divide transit time by two when calculating thickness measurements.

To select the test mode

- ◆ In the pulser dialog box, press the Tab key to select **Mode**, and then turn the adjustment knob to select and set a mode.

6.2.6 Pulse Repetition Frequency (PRF)

The EPOCH 6LT allows you to manually adjust the PRF from 10 Hz to 2000 Hz in 50 Hz (coarse) or 10 Hz (fine) increments. The instrument has an **Auto-PRF** mode to automatically adjust the PRF based on screen range.

To select a PRF adjustment method

1. In the pulser dialog box, press the Tab key to select **PRF Mode**.
2. Turn the adjustment knob to select **Auto** or **Manual**.
 - **Auto** is used to automatically set the PRF value based on the chosen screen range.

- **Manual** is used to manually set the PRF value.

To adjust the PRF value with PRF Mode set to Manual

- ◆ In the pulser dialog box, press the Tab key to select **PRF**, and then turn the adjustment knob to change the PRF value.

NOTE

The EPOCH 6LT is a *single-shot* instrument. This means that the instrument acquires, measures, and draws the complete A-scan with each pulse rather than using multiple acquisitions to construct a full waveform. The measurement rate in the EPOCH 6LT is always equal to the PRF rate unless you are using a multiplexer.

6.3 Adjusting the Receiver

The receiver settings are accessed in the **Receiver** dialog box.

To select the receiver

1. On the setup menu, turn the adjustment knob to select the **Receiver** ()
2. Press the Enter key to display the receiver dialog box (see Figure 6-4 on page 88).

Filter	2-21.5 MHz
Rect	Full
Reject	0

Figure 6-4 Receiver dialog box

6.3.1 Digital Receiver Filters

The EPOCH 6LT has a total instrument bandwidth of 0.2–26.5 MHz at –3 dB. The instrument offers 8 standard fixed digital filters designed to improve the signal-to-noise ratio by filtering out unwanted high and/or low frequency noise.

Because of the shifting frequency spectrum in most materials, you may need to adjust the filter settings. In most cases, you should select either a broadband filter or a narrow-band filter that covers the frequency of the transducer being used.

The EPOCH 6LT contains the following eight (8) standard filters.

- 0.2 MHz–1.2 MHz
- 0.2 MHz–10.0 MHz
- 0.5 MHz–4.0 MHz
- 1.5 MHz–8.5 MHz
- 2.0 MHz–21.5 MHz
- 5.0 MHz–15.0 MHz
- 8.0 MHz–26.5 MHz

- DC-10 MHz

NOTE

The DC-10 MHz filter is not compliant with EN12668-1:2010 testing standards. When the instrument is calibrated in accordance with EN12668-1:2010 Group 2, this filter is automatically disabled.

To adjust the Filter

- ◆ In the receiver dialog box, press the Enter key to select **Filter**, and then turn the adjustment knob to change the setting.

6.3.2 Waveform Rectification

The EPOCH 6LT can operate in one of four different rectification modes: **Full**, **Half+**, **Half-**, or **RF** (unrectified).

NOTE

RF mode is not active while operating in special software feature modes, such as **DAC** mode or **Peak Memory**.

To adjust the rectification

- ◆ In the receiver dialog box, press the Tab key to select **Rect**, and then turn the adjustment knob to change the setting.

6.3.3 Reject Parameter

The **Reject** parameter enables you to eliminate unwanted low-level signals from the display. The reject function is linear and adjustable from 0 % to 80 % FSH. Increasing the reject level does not affect the amplitude of the signals above the reject level.

NOTE

Reject can also be used in the unrectified **RF** mode.

To adjust the reject level

- ◆ In the receiver dialog box, press the Tab key to select **Reject**, and then turn the adjustment knob to change the setting.

The reject level is displayed as a blue horizontal line on the instrument display (see Figure 6-5 on page 90) or two lines in the case of the **Rect = RF** mode.

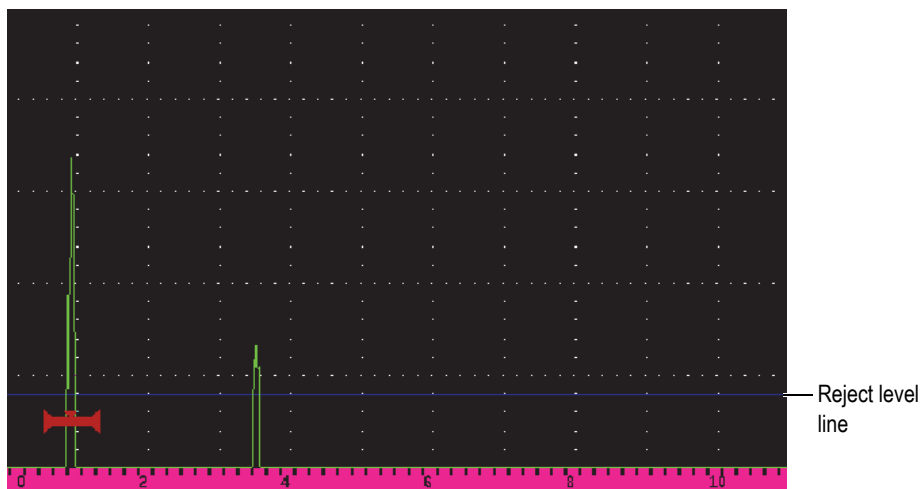


Figure 6-5 Horizontal line indicating the reject level

7. Gates

This chapter describes how to use the standard gates of the EPOCH 6LT ultrasonic flaw detector.

7.1 Activating the Gates

To activate the gates

1. On the setup menu, turn the adjustment knob to select the **Gate1** icon () or **Gate2** icon (). See “Setup Mode” on page 37 for details on opening the setup menu.
2. Press the Enter key to display the **Gate (1 or 2)** dialog box.
3. Press the Enter key, and then turn the adjustment knob to set the **G(1 or 2) Status** to **On** (see Figure 7-1 on page 92).

G1 Status	On
G1 Alarm	Off
G1 AFreeze	Off
G1 RF	Negative
G1 Mode	Peak
G1 Min Depth	0.634
G1 %Amp	High Peak
G1 Start	0.384
G1 Width	1.685
G1 Level	18

Figure 7-1 Gate (G1) status On

7.2 Measurement Gates 1 and 2

The EPOCH 6LT has two standard independent gates. In the A-scan, a gate is represented by a horizontal line with fixed start and end points. The length and horizontal position of the gate identifies the sound path range, while the vertical position of the gate line represents a threshold amplitude level for echoes of interest. Gate 1 appears as a solid red line, while gate 2 appears as a hollow blue line (see Figure 7-2 on page 93).

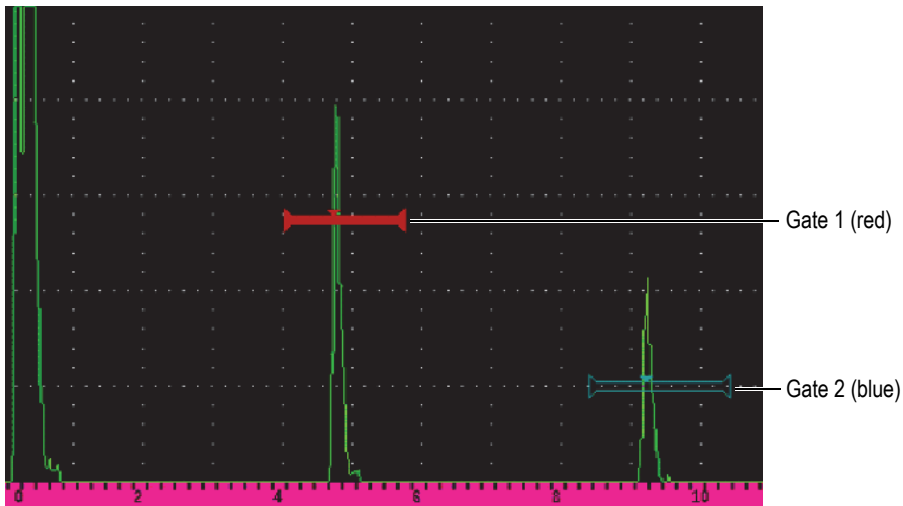


Figure 7-2 Gate 1 and gate 2 (with echo-to-echo turned on)

Both gates can be used to do the following:

- Measure thickness with straight-beam transducers
- Measure sound path and depth with angle beam transducers
- Measure signal amplitude
- Measure time-of-flight in microseconds
- Trigger threshold and minimum-depth alarms

The gates can also be used together to take echo-to-echo thickness measurements.

7.3 Quickly Adjusting Basic Gate Parameters

You can perform basic gate adjustments using the **Gate1** and **Gate2** sidebar submenus (see Figure 7-3 on page 94).

NOTE

Before you can access a gate menu, the gate must be activated. (see “Activating the Gates” on page 91).

Gate1
G1Start 0.272
G1Width 0.582
G1Level 15 %
Auto 80%
Zoom

Figure 7-3 Gate 1 submenu

The available gate parameters are as follows:

Start

Used to adjust the gate start position.

Width

Used to adjust the gate width.

Level

Used to adjust the vertical position of the gate.

To quickly adjust basic gate parameters

- 1. Open the sidebar menu, and then open the **Gate1** or **Gate2** submenu (see “Sidebar Menu” on page 44 for details on using menus and submenus).
- 2. Select a gate parameter.
- 3. Turn the adjustment knob to change the parameter.

You can also use the **Auto XX%** button to set the level of the pulse to 80 % (see “Using the Auto XX% Feature” on page 80 for details), or the **Zoom** button to zoom in on the gate (see “Zooming in on a Gate” on page 101 for details).

7.4 Gate Measurement Modes

The EPOCH 6LT ultrasonic flaw detector’s two gates provide measurements of a gated indication based on one of four possible measurements modes. You can select the measurement mode of a gate in the **Gate1** or **Gate2** dialog box (see Figure 7-4 on page 95).

G1 Status	On
G1 Alarm	Off
G1 AFreeze	Off
G1 RF	Positive
G1 Mode	Edge
G1 Min Depth	0.634
G1 %Amp	High Peak
G1 Start	0.400
G1 Width	1.685
G1 Level	18

Figure 7-4 Gate1 dialog box

When a measurement is in progress using one of the measurement gates, a small triangle appears on the gate to indicate from which echo/point the measurement is being acquired (see Figure 7-5 on page 96 and Figure 7-6 on page 97). This triangle is called the gate trigger indicator. The available parameters are as follows:

G(1 or 2) Mode

Each gate can make measurements using the following modes:

Edge

Acquires measurement readings based on the position of the first crossing point of a gated signal. The indication must break the threshold of the gate for a measurement to be acquired. **Edge** mode is also known as *flank* mode (see Figure 7-5 on page 96).

Peak

Acquires measurement readings based on the position of the highest peak within the gated screen range. The indication does not have to break the gate threshold for a measurement to be acquired (see Figure 7-5 on page 96).

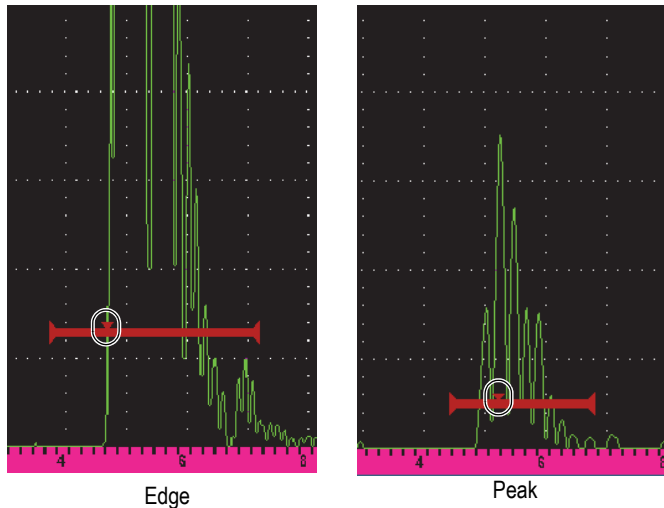


Figure 7-5 Gate trigger indicator in Edge (left) and Peak (right) modes

1stPeak

Acquires measurement readings based on the position of the first peak to break the threshold of the gate within the gated region (see Figure 7-6 on page 97).

J-Flank

Acquires thickness measurement readings based on the position of the first crossing point of a gated signal and amplitude measurement readings from the highest peak of the first echo in the gated region (see Figure 7-6 on page 97).

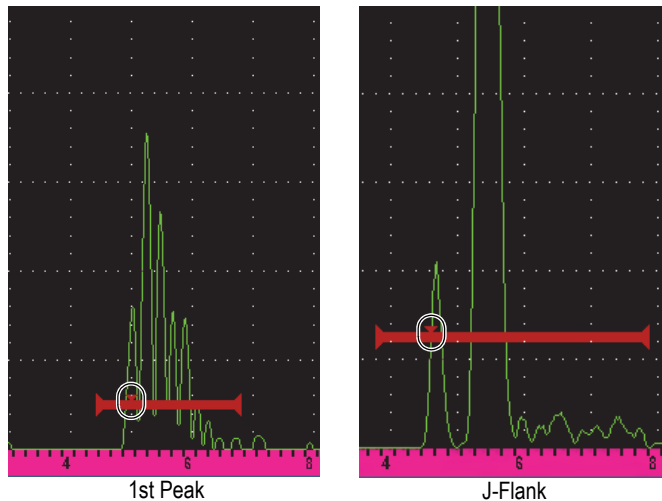


Figure 7-6 Gate trigger indicator in 1stPeak (left) and J-Flank (right) modes

G(1,2) RF

In unrectified (RF) mode, used to choose the polarity of the gate. These are the options:

Dual

The gate appears in the positive and negative side of the x-axis. Position and width are identical, and the gate level mirrors across the x-axis (for example: 25 % and -25 %).

Positive

The gate appears only on the positive side of the x-axis.

Negative

The gate appears only on the negative side of the x-axis.

G(1,2) %Amp

In **Edge** mode only, this selection allows you to define the method for measuring the amplitude of the gated indication:

High Peak

Acquires the amplitude measurement of the indication from the highest peak within the gate.

1stPeak

Acquires the amplitude measurement of the indication from the first peak within the gate. The peak must break the threshold of the gate to be measured. In this mode, two triangles appear on the gate. The solid triangle indicates the point from which thickness or sound path/depth measurements are being acquired. The hollow triangle indicates the point from which the amplitude measurement is being made.

NOTE

The EPOCH 6LT does not acquire measurement readings unless the indication of interest is within a gated region of the screen. You should be careful to adjust the **Start**, **Width**, and **Level** of a measurement gate so that only the indication of interest falls within the gated region, as per the measurement mode definitions above.

7.5 Viewing Measurement Readings

The EPOCH 6LT provides five measurement reading boxes to display acquired measurements. These measurement readings must be properly defined to view the desired information from a given indication.

For more information on defining measurement reading boxes, and for a full list of possible measurement readings, see “Measurement Setup Page” on page 64.

7.6 Gate Tracking and Echo-to-Echo Measurements

The gate tracking feature enables you to make echo-to-echo measurements whenever this feature is required by an application. Echo-to-echo measurements can be made between gate 2 and gate 1.

Gate tracking maintains a constant separation between the position of the indication in the first gate and the start position of the second gate. When gate tracking is active, the start position value of the tracking gate (the second gate involved in the measurement) defines the separation between the gates, not a fixed start position.

To make echo-to-echo measurements with gate 1 and gate 2

1. Open the setup menu, and then select and open the **Gate1** icon (). See “Setup Mode” on page 37 for details on using the setup menu.
2. Activate gate 1 by setting the **G1 Status** to **On**.
3. Using the **G1 Start** parameter, turn the adjustment knob to position gate 1 over the first echo you want to detect.
4. Press ESC to go back to the setup menu.
5. Select the **Gate2** icon () , and then set **G2 Status** to **On** (see Figure 7-7 on page 100).
6. Use the **G2 Start** parameter to position gate 2 over the second echo to detect. The **G2 Start** position defines the separation between the position of the indication in gate 1 and the start of gate 2.
7. Set gate 2 as the tracking gate by setting **G2 Tracks** to **Gate1**.

The echo-to-echo mode flag () appears in the message bar, indicating that the instrument is measuring the distance between positions of the indications in gate 1 and gate 2.vb

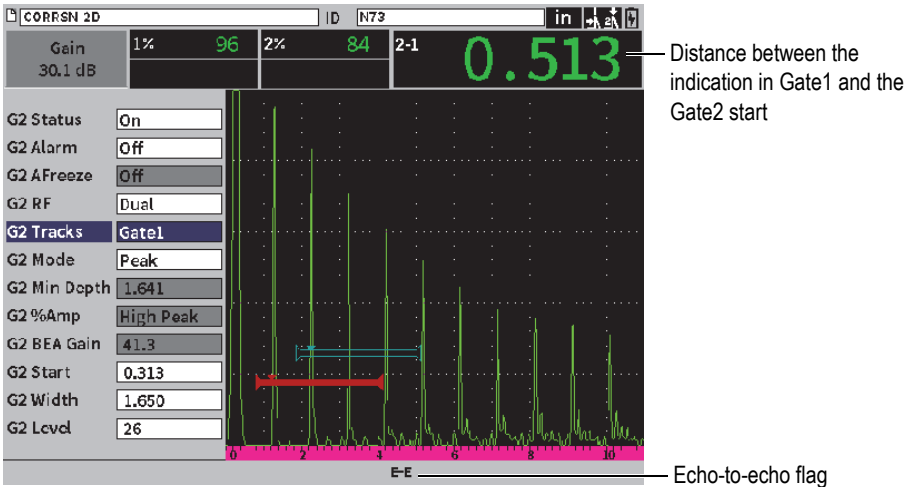


Figure 7-7 Echo-to-echo measurement example

7.7 Time-of-Flight Mode

The EPOCH 6LT is capable of displaying time-of-flight (TOF) sound path data for a gated indication. Time-of-flight is the location of the reflector in terms of microseconds.

The time-of-flight mode does not divide the measurement reading value by two. The entire time-of-flight through the test piece in both directions is displayed.

NOTE

When the instrument is set up to display distances in time-of-flight mode, the **Velocity** parameter (in the UT dialog box) becomes inactive. This is because time-of-flight mode does not use the material velocity to calculate sound path measurements.

To operate in time-of-flight mode

- 1. Open the setup menu, and then select the **Settings** icon (). See “Setup Mode” on page 37 for details on using the setup menu.
- 2. On the **Settings** menu, select the **Meas Setup** icon ().
- 3. On the **Measurement Setup** page, change the **Units** value to μs .
- 4. Press the Shift, Tab key sequence to return to the live A-scan display.

In time-of-flight mode, all distance measurements are displayed in microsecond values instead of inches or millimeters, as indicated above the measurement reading boxes (see Figure 7-8 on page 101).

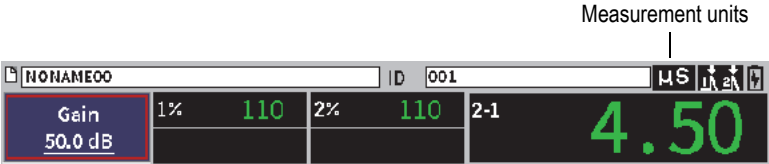


Figure 7-8 Time-of-flight measurement

7.8 Zooming in on a Gate

The EPOCH 6LT can quickly zoom in the screen range to provide fine resolution of a particular inspection zone. When the zoom is activated, the instrument automatically brings the point that corresponds to the gate start to the left side of the screen and adjusts the displayed range to match the gate width. The new range equals the normal gate width. The lowest achievable value of the expanded range is equivalent to the minimum range of the instrument at the current material-velocity setting. The zoom flag () appears on the right side of the display.

To zoom in on a gate

NOTE

The zoom function can only be active for one gate at a time.

1. From the setup menu, activate the gate (see “Activating the Gates” on page 91).
2. Position the gate using **G1 Start**, **G1 Width**, and **G1 Level** (see “Navigating Dialog Boxes and Setup Pages” on page 39 for details on using the gate dialog box).
3. Go to the sidebar menu and select **Gate1** or **Gate2** (see “Sidebar Menu” on page 44 for details on using the sidebar menu).
4. Select **Zoom** to zoom in.
5. Select **Zoom** again to zoom out (default view).

7.9 Gate Alarms

The EPOCH 6LT features a variety of alarm configurations for each measurement gate. In unrectified (**RF**) mode, gate alarms can be used in positive, negative, or dual gate modes.

By default, when an alarm condition is triggered, the EPOCH 6LT emits an audible beep. The instrument also illuminates the red indicator, above the display window, corresponding to the gate with which the alarm has been triggered. To toggle the audible alarm on and off, see “Instrument Setup Page” on page 70.

The three primary types of gate alarms are as follows:

- Positive threshold
- Negative threshold
- Minimum depth

7.9.1 Threshold Alarms

Threshold alarms can be set on gate 1 or gate 2.

A positive logic alarm is triggered when a signal exceeds the gate threshold. A negative logic alarm is triggered when a signal falls below the gate threshold.

When you set a threshold alarm, the appearance of the tick marks at the end of the gate changes (see Figure 7-9 on page 103).

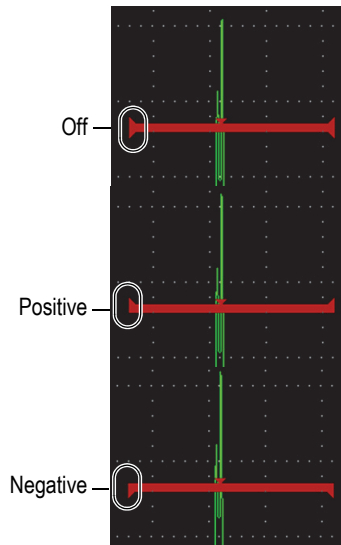


Figure 7-9 Gate tick marks indicating alarm threshold type

To set a threshold alarm

1. Activate the gate in the **Gate1** or **Gate2** dialog box (see “Navigating Dialog Boxes and Setup Pages” on page 39 for details on using the dialog boxes).
2. Use the **G(1 or 2) Start**, **Width**, or **Level** parameters to position the gate to cover the desired area.
3. Select **G(1 or 2) Alarm**, and then select either the **Positive** or **Negative** threshold alarm condition.

7.9.2 Minimum Depth Alarm

The minimum depth alarm is triggered whenever the current thickness measurement reading falls below an operator-defined level. The minimum depth alarm can be used either with a single gate or in echo-to-echo measurement mode.

7.9.2.1 Minimum Depth Alarm with a Single Gate

When the minimum depth alarm is activated, a marker appears on the gate to visually indicate the current setting (see Figure 7-10 on page 104). Any indication that exceeds the gate threshold to the left of the marker triggers the alarm.

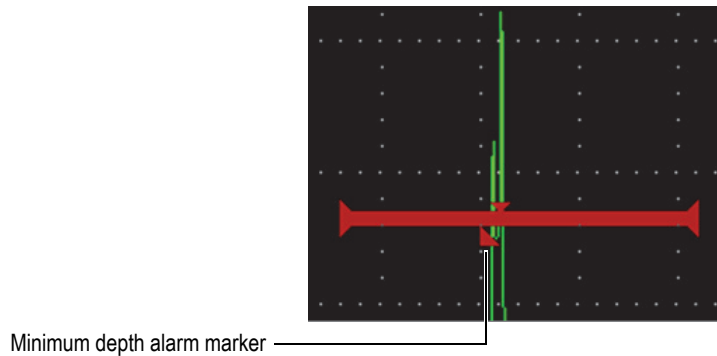


Figure 7-10 Minimum depth alarm marker

To set a minimum depth alarm

1. Activate the gate in the **Gate1** or **Gate2** dialog box (see “Navigating Dialog Boxes and Setup Pages” on page 39 for details on using the dialog boxes).
2. Use the **G(1 or 2) Start**, **Width**, or **Level** parameters to position the gate to cover the desired area.
3. Select **G(1 or 2) Alarm**, and then select the **Min Depth** alarm condition.
4. Turn the adjustment knob to set the **Min Depth** value.

The minimum depth alarm value must be greater than the gate start value and less than the gate width value.

NOTE

The minimum depth alarm is not available when certain special functions are enabled.

7.9.2.2 Minimum Depth Alarm with Gate Tracking

When gate tracking is active, the tracking gate moves side-to-side, tracking the position of the echo in the nontracking (first) gate. With gate tracking active, the **Min Depth** alarm threshold is relative to the position of the echo in the nontracking gate (first gate).

To set up a minimum depth alarm with gate tracking

- ◆ With the **G1 Alarm** set to **Min Depth**, press the Tab key to move to **G1 Min Depth**, and then adjust the setting.

7.10 Peak Memory

The peak memory function enables on-screen capture and storage in memory of the amplitude of each A-scan acquisition. When you scan the transducer over a reflector, the peak memory signal envelope (echo dynamic as a function of transducer position) is retained on the screen in blue (see Figure 7-11 on page 105). The display updates whenever a signal of greater amplitude is acquired. In addition, the current, live waveform is displayed at the appropriate place within the signal envelope.

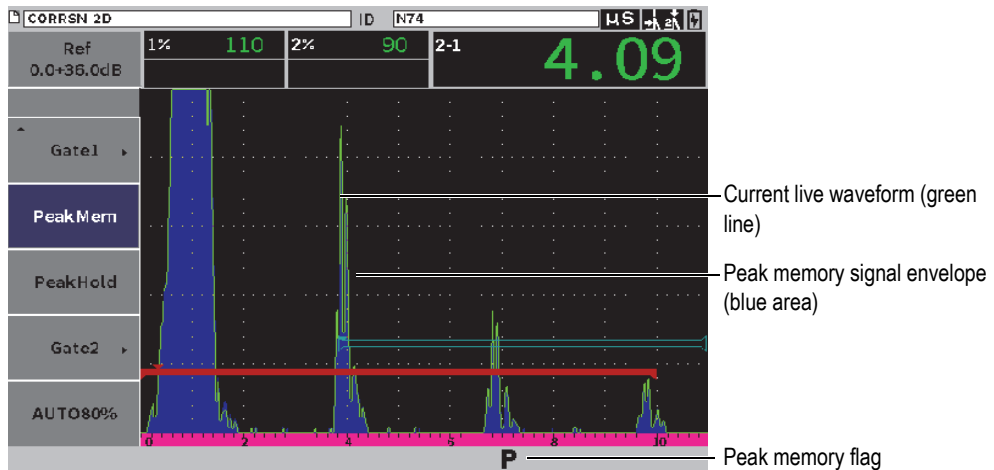


Figure 7-11 Peak memory signal envelope example

This function is useful for finding the peak from an indication during an angle beam inspection.

NOTE

You cannot activate the peak memory function in the unrectified **Rect = RF** mode.

To activate the peak memory function

1. With a gate active and the sidebar menu displayed, turn the adjustment knob to select the **PeakMem** button (see Figure 7-11 on page 105).
2. Press the Enter key to activate the peak memory function.

The **P** flag appears to indicate that the function is active.

3. Scan over a reflector to acquire the echo envelope.
4. Press the Enter key again to deactivate the peak memory function.

7.11 Peak Hold

The peak hold function is similar to the peak memory function as both capture the current screen when they are activated. The difference is that with peak hold, the captured waveform is frozen on the screen and does not update even if the live waveform exceeds the frozen waveform's amplitude.

Peak hold is useful when you want to obtain a waveform from a known sample and compare it to a waveform from an unknown test piece.

To activate peak hold

1. Obtain an echo on the screen.
2. On the sidebar menu, select **PeakHold**.

This captures the screen yet still allows viewing of the live waveform. The **P_H** flag appears to indicate that the function is active.

3. Select **PeakHold** again to deactivate the peak hold function.

7.12 Freeze

The freeze function holds, or freezes, the information on the screen at the moment it is activated, and the EPOCH 6LT pulser/receiver becomes inactive. No further data is acquired. A freeze (**F**) flag appears, indicating that the function is active.

There are two ways to activate the freeze function: manual and automatic. Manual freeze requires you select the **Freeze** button in the sidebar menu to activate the function. Automatic freeze (**AFreeze**) enables you to automatically activate the freeze function based on any triggered gate alarm.

When the display is frozen, you can use a variety of instrument functions, including the following:

- Gate movement
- Gain
- Range and delay
- Rectification
- Data logging

When the freeze function is active, the following parameters cannot be changed/accessed:

- Zero offset
- Range (cannot be increased)
- Pulser/receiver settings such as **PRF**, **Energy**, **Mode**, pulser waveform, and **Filter**

To activate the freeze function manually

- ◆ On the sidebar menu, select and activate **Freeze**.

To activate the freeze function automatically

1. Select the **Gate(1 or 2)** icon, and then activate a gate (see “Activating the Gates” on page 91).
2. On the selected gate, set an alarm (see “Gate Alarms” on page 102).
3. Set **G(1 or 2) AFREEZE** to **On**.

To deactivate the freeze function

- ◆ On the sidebar menu, select and activate **Freeze** to deactivate a manual or automatic freeze.

8. Calibration

Calibrating the EPOCH 6LT is the process of adjusting the unit so that it measures accurately on a particular material, using a particular transducer at a particular temperature.

In calibrating the instrument, you set the zero offset and velocity parameters. The zero offset (sometimes referred to as probe delay) is set to compensate for the dead time between the firing of the main pulse and the entry of the sound into the test piece. The velocity is set so it matches the material velocity of the test piece.

The EPOCH 6LT features advanced auto-calibration that provides for a fast and easy calibration process. This section details the example procedures to calibrate the EPOCH 6LT using the two basic transducer configurations: straight beam and angle beam.

8.1 Basic Setup

Until you are completely comfortable operating the EPOCH 6LT ultrasonic flaw detector, we recommend using a basic setup procedure before starting the actual calibration.

To setup the EPOCH 6LT before calibrating

1. In the **Gain** adjustment box, set an initial gain value that is appropriate for the calibration (see “Adjusting the Gain (System Sensitivity)” on page 79 for instructions on using the **Gain** adjustment box).

If the appropriate gain level is unknown, set the initial gain to **20 dB** and adjust it as necessary during calibration.

2. On the setup menu, select the **UT** icon () , and then press the Enter key to open the UT dialog box (see Figure 8-1 on page 111).
3. Press the Enter key to select **Range**, and then turn the adjustment knob to set the range based on the sound path range within the selected calibration block.

TIP

Use a greater range than necessary to ensure all calibration echoes appear on the screen.

4. Press the Tab key to move to **Velocity**, and then turn the adjustment knob to set an approximate velocity for the test material.
Note that the **Velocity** parameter is disabled when the instrument is in time-of-flight (μs) mode.
5. Press the Tab key to move to **Zero**, and then adjust the zero offset of the instrument to **0.700** (μs).
6. Press the Tab key to move to **Delay**, then adjust the screen delay to **0.000**.
7. Press the ESC key twice to return to the setup menu.

Range	1.000
Velocity	0.2272
Zero	0.700
Delay	0.000

Figure 8-1 UT dialog box

8. If you are using an angle beam transducer, select the Angle icon () , and then press the Enter key to open the angle dialog box (see Figure 8-2 on page 112):
 - a) Select **Angle**, and then use the adjustment knob to set the correct refracted angle for the probe (0 for a straight beam probe, **45** for a 45° probe, etc.).
 - b) Press the Tab key to move to **Thick**, and then adjust the material thickness to **0.000**.
9. Press the ESC key twice to return to the setup menu.

Angle	45.0
Thick	0.000
X Value	0.000
CSC	Off
Diameter	25.000

Figure 8-2 Angle dialog box

8.2 Calibration Modes

The EPOCH 6LT features multiple calibration modes to accurately meet the requirements of the selected transducer, calibration test block, and application. These calibration modes can be set in the calibration dialog box. There are two modes for straight beam transducers and two modes for angle beam transducers.

8.2.1 Straight Beam Modes

Straight beam calibrations can be performed using one of two modes. For the purposes of the EPOCH 6LT calibration, *straight beam* refers to all zero-degree probes, including contact, dual, delay line, immersion, etc. The two straight beam calibration modes are as follows:

- Thickness

This standard straight beam calibration mode requires you to provide two different, known material thicknesses to properly calibrate the instrument. The

thin material thickness allows for zero offset calibration, and the thick material thickness allows for velocity calibration.

- Echo-to-echo

This calibration mode allows you to use any echo-to-echo measurement to calibrate for material velocity only. In echo-to-echo calibration, the effects that cause zero offset are eliminated by gating a particular indication that represents the start point of the measurement. A second gate is set to track that gated indication to acquire a measurement. This means that you must only calibrate for the material velocity of the sample to acquire accurate echo-to-echo measurements. You can perform echo-to-echo measurements between gate 2 and gate 1 (**G2–G1**), and this calibration mode will only be available if gate 2 tracking is turned on (see “Gate Tracking and Echo-to-Echo Measurements” on page 99).

8.2.2 Angle Beam Modes

Angle beam calibrations can be performed using one of two modes:

- Sound path

This standard angle beam calibration mode uses the sound path measurement of two different known material thicknesses to properly calibrate the instrument. Typically, these sound path measurements are made from the radius of a calibration test block. The smaller (thin) sound path measurement allows for zero offset calibration, and the larger (thick) sound path measurement allows for velocity calibration.

- Depth

This angle beam calibration mode uses the known depth of two different reflectors to properly calibrate the instrument. Typically, these depth measurements are made from side-drilled holes of equal size. For accurate measurements, you must first verify the refracted angle of the transducer, since the EPOCH 6LT calculates depth values based on sound path and known refracted angle. The shallow reflector depth allows for zero offset calibration, and the deep reflector depth allows for velocity calibration.

8.3 Calibration Procedure

The calibration described in this section is for a straight beam thickness calibration. The calibration requires a test block with two known thicknesses, made from the material to be measured. Ideally, the two thicknesses should represent thicknesses

that are below and above the expected thickness of the material being inspected. For this example, the 0.200 in. and 0.400 in. steps of an Evident standard 5-step steel calibration test block are used.

NOTE

If the EPOCH 6LT is set to work in metric units, the calibration process is exactly the same, except the entries are in millimeters rather than inches.

To calibrate using a straight beam transducer

1. Couple the transducer to the 0.200 in. step of the calibration test block.
2. Adjust the **Pulser** and **Receiver** settings to create a clean A-scan.
For more information on pulser and receiver adjustments, see “Pulser/Receiver Adjustments” on page 79.
3. On the setup menu, select the **Calibrate** icon () to open the calibration dialog box (see Figure 8-3 on page 115).
4. Set the **Type** to **Depth-2pts**.
5. Adjust **Cal-Zero** to **0.200** (to match the 0.200 in. step of the calibration test block).
6. Adjust **Cal-Vel** to **0.400** (to match the 0.400 in. step of the calibration test block).

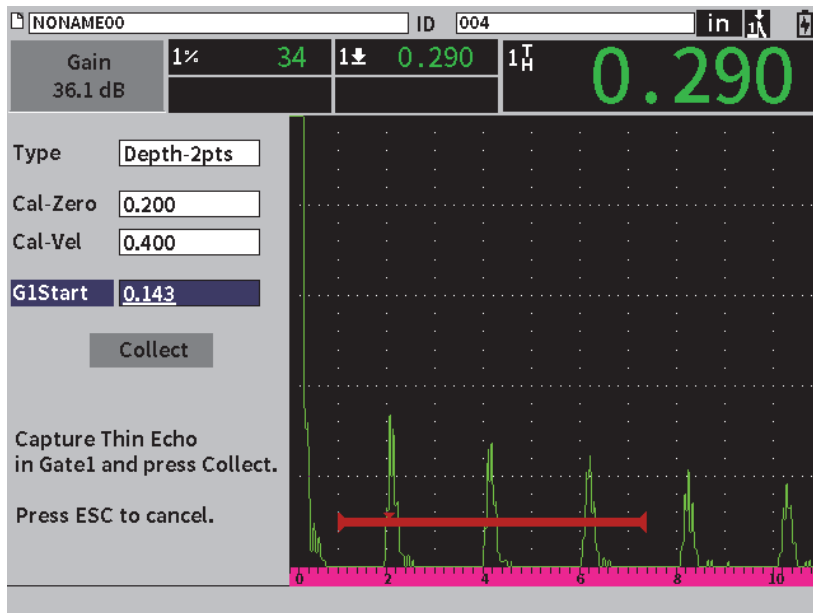


Figure 8-3 Calibration — Dialog box initial setup

7. Adjust **G1Start** until the gate is over the first back wall echo.
8. Press the Tab key to highlight the **Gain** adjustment box, and then complete the **Auto 80%** procedure (see Figure 8-4 on page 116). See “Using the Auto XX% Feature” on page 80 for details on the **Auto XX%** procedure.

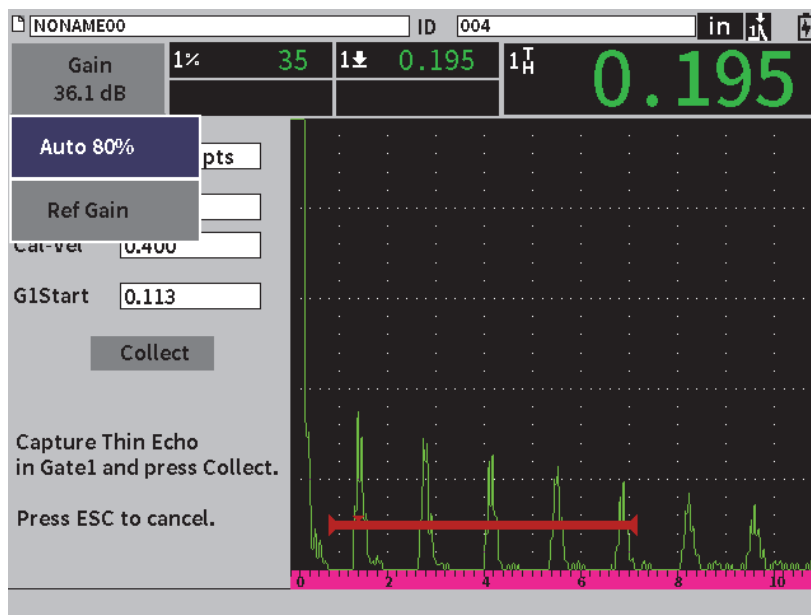


Figure 8-4 Calibration — Ready to Auto 80% on thin echo

9. Press the Tab key to highlight the **Collect** button, and then press the Enter key to capture the thin echo (see Figure 8-6 on page 118).

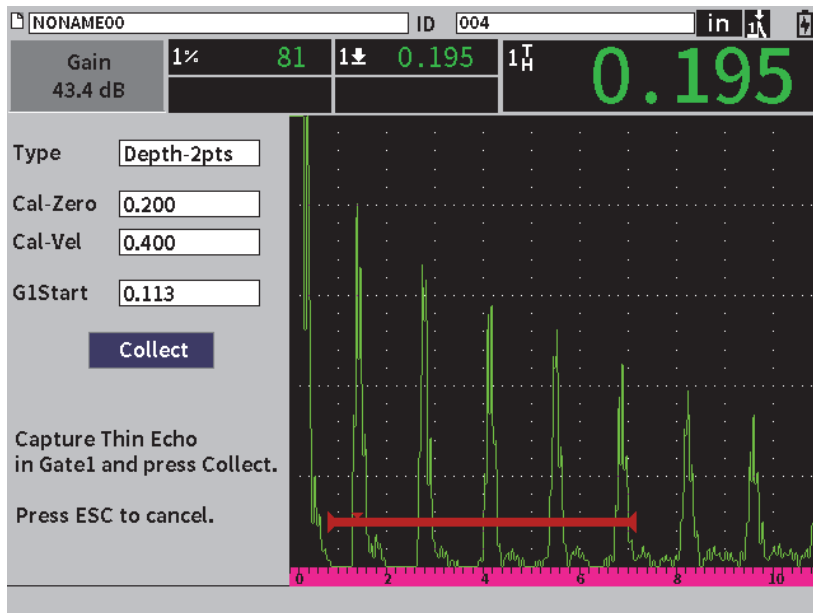


Figure 8-5 Calibration — Ready to collect thin echo

10. Couple the transducer to the 0.400 in. step of the calibration test block.
11. Repeat the **Auto 80%** procedure for this step of the calibration test block.
12. Press the Tab key to highlight the **Collect** button (see Figure 8-6 on page 118).

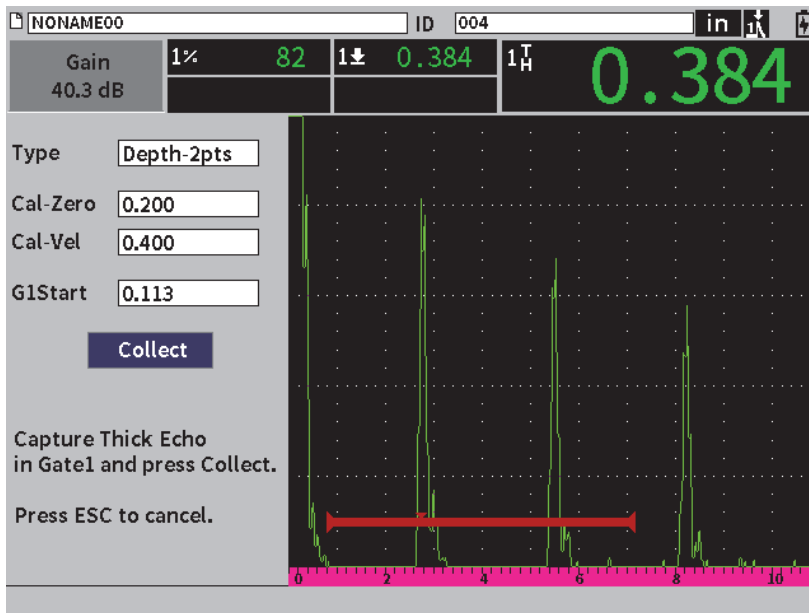


Figure 8-6 Calibration — Ready to collect thick echo

13. Press the Enter key to capture the thick echo.

When the calibration is complete, the following message is briefly displayed at the bottom of the calibration dialog box: **SUCCESS!** Then the calibration dialog box is replaced by the setup menu. On the live A-scan, measurement reading box five displays the calibrated value of the 0.400 in. step (see Figure 8-7 on page 119).

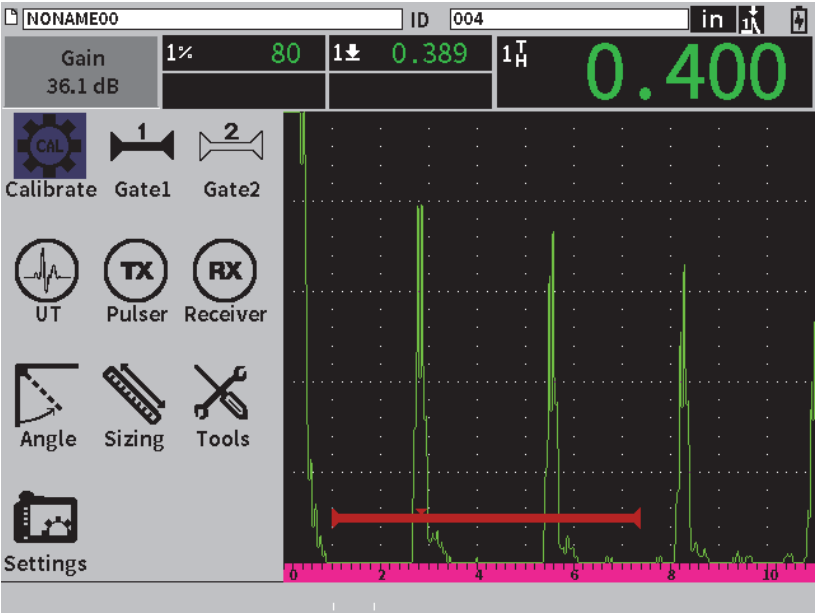


Figure 8-7 Calibration — Successfully completed

9. Data Logger

Evident has designed the data logger for ease of use, with a wide range of features. The data logger serves two basic purposes:

- To manage test and setup data
- To display certain data in a graphical format, as a screen snapshot, or as full-motion video.

The data logger includes the following features:

- Data is organized by alphanumeric filenames and identifier (ID) codes
- File description, inspector ID, and location note data elements exist in every file
- Data capture to standard or advanced file types
- Ability to edit files, rename files, clear file contents, and delete files
- On-screen review of all file contents including snapshot and grid view
- File summary screen (without images and setup info) for measurement review to visually inspect and monitor the measurements saved in multiple IDs of the active file
- Video record and playback
- Ability to transfer data between the EPOCH 6LT and a computer
- Ability to export files, images, and data to removable memory

Most of the data logger setup functions can be accessed through the **Settings** icon

() in the setup menu. The **Settings** icon opens the **Settings** menu. The specific data logging icons are in the **File Management** section (see Figure 9-1 on page 122).

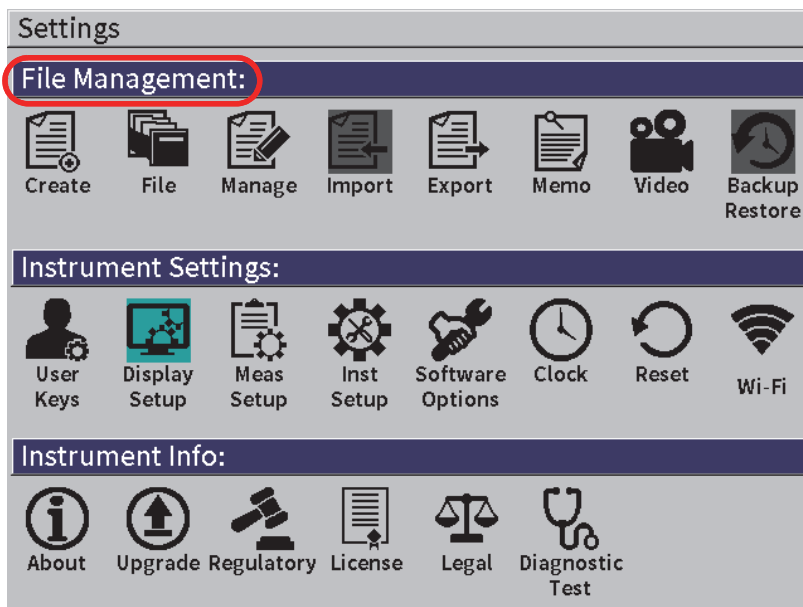


Figure 9-1 Settings menu

All of the icons in the **Settings** menu open setup pages. See “Navigating Dialog Boxes and Setup Pages” on page 39 for instructions on using the setup pages.

9.1 Data File Types

EPOCH 6LT ultrasonic flaw detectors enable you to create several types of files based on application requirements. There are two standard file types, calibration and incremental, and one advanced file type, 2D.

9.1.1 Incremental File Type

Incremental (INC) files are designed for general inspection data storage, and they can contain more than one ID for storing file data. Each time the file is saved, the ID increments. If an ID number cannot increment, an error beep sounds and the momentary message “Cannot Increment ID” is displayed above the parameter keys. Subsequent saves overwrite measurement readings if you do not manually change the ID number first.

9.1.2 Calibration File Type

A calibration (CAL) file is designed specifically for storing calibration setups. Calibration files have space to store one single ID with its corresponding waveform and data. Separate calibration files are created for the different transducers, materials, or test parts being used. The advantage to storing setup data in calibration files is that the data can be quickly recalled to the live A-scan display (see “Recalling a File ID” on page 133).

9.1.3 2-D Matrix Grid File Type

A two-dimensional (2-D) file sequence begins with the ID number that refers to the first column and the first row. Then the column (or row) increments one value at a time until the sequence reaches the last column (or row) value while the other dimension stays constant. At this point, the other dimension increases from its first to its next value. This continues until the ID number that refers to the last column and last row is reached.

9.2 Data Logger Storage Capacity

The EPOCH 6LT data logger can store over 100000 IDs on 2 GB of available internal memory.

9.3 Saving Data to Active Files

The EPOCH 6LT allows you to save data whenever there is an active file open with an active ID. If there is no active ID and you try to save the data, the instrument displays the error message “No active ID” at the top of the display.

There is no save button on the **File** menu because data is usually captured and saved on the live A-scan screen.

To save data to an active file

- ◆ Select and activate the **Save** button on the sidebar menu to save data.
The following information is saved:
 - File name
 - ID code

- Alarm conditions
- Gate measurement modes
- Sound path leg for each gate
- Up to five measurement reading box values (all active user-selected measurements on the instrument screen)
- A-scan waveform
- Peak memory envelope or peak hold waveform, if active
- Complete setup parameters
- Flag status (Freeze, Zoom, PeakMem, etc.)
- Active software features: DAC/TCG, DGS/AVG, AWS D1.1/D1.5
- Software feature/option setups

9.4 Data Logger Setup Pages

The available setup pages are as follows:

- **Create**
Create different types of files.
- **File**
View file data in multiple formats and with varying detail.
- **Manage**
Edit certain file information, copy files, and delete files.
- **Import**
Import files from a USB flash drive.
- **Export**
Export files to a USB flash drive.
- **Memo**
Create memos within existing files.
- **Video**
Review recordings and export and import video files.
- **Backup/Restore**
Back up and restore files.

The functionality of the **File Management** setup pages is explained in the following sections.

9.4.1 Create

The **Create** setup page is used to create files (a default file: NONAME00, is created by the EPOCH 6LT). Files can be created on the instrument or in the GageView Pro software and transferred to the instrument.

Each time you save file data, it is linked to a file identifier (ID). The number of IDs in a file depends on the file type selected and the number of data sets that you have saved. On the live A-scan display of the EPOCH 6LT, the currently opened file ID is displayed in the file identifier bar.

To create CAL or INC files

NOTE

Required boxes in the **Create** setup page are marked with an asterisk (*).

The screenshot shows a 'Create' dialog box with a light gray background. At the top, the title 'Create' is displayed in a darker gray bar. Below the title, there are six labeled input fields arranged vertically. The first field is labeled '*File Type' and contains the text 'CAL'. The second field is labeled '*Filename' and is empty. The third field is labeled 'Description' and is empty. The fourth field is labeled 'Inspector ID' and is empty. The fifth field is labeled 'Location Note' and is empty. The sixth field is labeled '*Calibration ID' and contains the text 'Calibration'. At the bottom left of the dialog, there is a dark blue button labeled 'Create'.

Figure 9-2 Create setup page

1. In the **Create** setup page, press the Enter key to select the file type value, and then turn the adjustment knob to choose **INC** or **CAL**.
2. Press the Tab key to highlight the **Filename** box.
3. Enter characters (up to 32) using the virtual keypad, adjustment knob, and Enter key (see Figure 9-3 on page 126).

The screenshot shows a 'Create' setup page with the following fields and controls:

- *File Type**: A text box containing 'INC'.
- *Filename**: A text box containing 'A22', which is highlighted with a dark blue background.
- Description**: An empty text box.
- Inspector ID**: An empty text box.
- Location Note**: An empty text box.
- ID Prefix**: A text box.
- *Start ID**: A text box.
- Virtual Keypad**: A grid of buttons for letters (A-M, N-Z), numbers (1-0), and symbols (-, #). It also includes navigation arrows and a delete key.
- Create**: A button at the bottom left.

Figure 9-3 File name edit

NOTE

Special characters such as spaces, decimals, slashes, and punctuation are not permitted in the **Filename** box.

4. For each of the next three optional boxes (**Description**, **Inspector ID**, **Location Note**) press the Tab key, and then repeat step 3 to enter information.
5. If the **File Type** is **INC**:
 - a) Press the Tab key, and then enter an optional **ID Prefix**.

This prefix will save as part of the ID but will not increment.

- b) Enter a **Start ID** for the INC file.
6. If the **File Type** is **CAL**, press the Tab key, and then enter a calibration ID.
7. After you have completed the file setup, press the Tab key to highlight the **Create** button.
8. Press the Enter key to create the file and exit the setup page.

NOTE

After a file is created, you must use the **Manage** setup page to open and edit the file. See “Selecting a File as the Active Storage Location” on page 128 for instructions on how to open a file.

9.4.2 File

The **File** setup page enables you to perform multiple actions for saved files:

- Select a file as the active storage location
- View details about a specific file
- View setup and waveform data for saved IDs in a file
- Recall a file ID to bring saved data to the live screen
- View a summary of all saved data in a file
- View memos

To select a file

1. On the **Settings** menu, select the File icon to open the **File** setup page (see Figure 9-4 on page 128).
2. Turn the adjustment knob, and then press the Enter key to select the specific file that you want to work with.

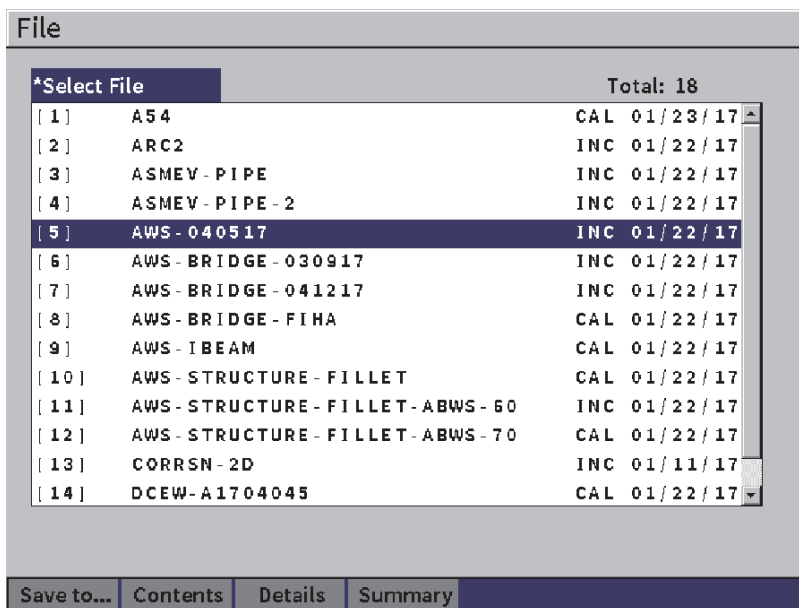


Figure 9-4 File setup page

9.4.2.1 Selecting a File as the Active Storage Location

The EPOCH 6LT maintains a list of all files on the instrument. To save information to a file, you must first select that file and then set it as the active storage location.

The **File** setup page enables you to use calibration files and inspection storage files at the same time within a procedure while minimizing required button presses. For example, a particular inspection may require the use of three separate transducers and therefore three calibrations, but you may want to store all inspection data in one inspection file. In such a situation, you should open that inspection file first.

To select a file as the active storage location

1. With the selected file highlighted, press the Enter key, and then press the Tab key to highlight the **Save to...** button (see Figure 9-4 on page 128).
2. Press the Enter key to confirm the **Save to...** action.

The file name and file ID of the opened file are displayed in the file identifier bar on the live A-scan display (see Figure 9-5 on page 129).

When you select **Save** on the sidebar menu, on-screen data and settings are saved to the currently opened file ID.



Figure 9-5 Name and ID of open file on the live A-scan display

9.4.2.2 Viewing File Contents

After you have saved data to a file, you can view the saved setup and waveform data. The waveform and basic setup parameters are displayed on one screen (see Figure 9-6 on page 130), and the complete setup information on another screen (see Figure 9-7 on page 131).

To view saved data

1. In the **File** setup page, turn the adjustment knob, and then press the Enter key to select the file that you want to use.
2. Press the Tab key to select the **Contents** button.
3. Press the Enter key to view the saved waveform and the basic setup data (see Figure 9-6 on page 130).

The ID of the file being viewed is displayed in the file identifier bar.

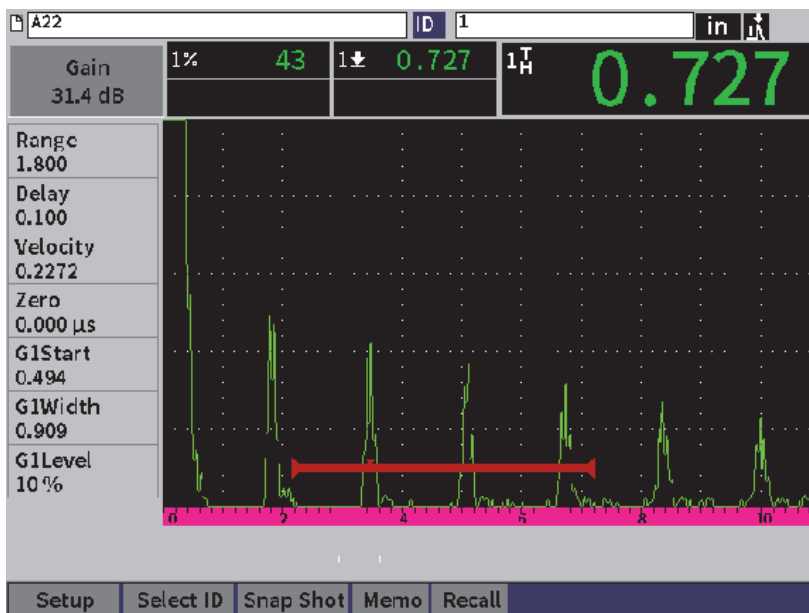


Figure 9-6 Saved file waveform

4. Press the Tab key to select the **Setup** button.
5. Press the Enter key to view the complete setup parameters for the current ID (see Figure 9-7 on page 131).

ID	1		
G1Start	0.494	G2Start	Off
Width	0.909	Width	Off
Level	10%	Level	Off
Alarm	Off	Alarm	Off
Velocity	0.2272 in/ μ s	Zero	0.000 μ s
Range	1.800	Gain	31.4 dB
Angle	0.0	Delay	0.100
CSC	Off	Thick	0.000
PRF	390 Hz	CSC Diameter	25.000
Node	P/E	Damp	50
Freq	5.0 MHz	Energy	100 v
Filter	2-21.5 MHz	Reject	0 %
Pulser	Tunable	Rect	Full
Waveform Recall Select ID			

Figure 9-7 Saved file data

To switch to a different file ID

NOTE

Calibration (CAL) files only contain a single ID.

1. Press the Enter key to highlight the ID value.
2. Turn the adjustment knob to scroll through the saved IDs in the file.
As you scroll to the next ID, the corresponding information is displayed.

To choose from a large number of IDs

NOTE

Calibration (CAL) files only contain a single ID.

1. While on the setup parameters page (see Figure 9-7 on page 131), press the Tab key to highlight the **Select ID** button, and then press the Enter key to open the **Select ID** setup page (see Figure 9-8 on page 132).
2. Turn the adjustment knob to choose an ID.
3. Press the Tab key to select the ID and highlight the **Select** button.
4. Press the Enter key to view the data for the selected ID.

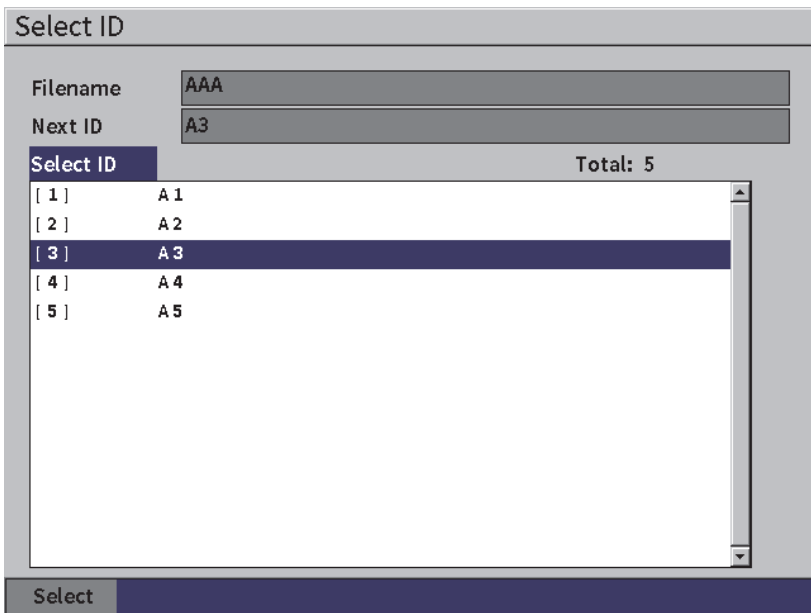


Figure 9-8 Viewing all the IDs in a file

9.4.2.3 Taking a Snap Shot of the Waveform

You can take a snap shot (screen shot) of the waveform data screen.

To take a snap shot of the waveform

1. With the waveform data page displayed, turn the adjustment knob to highlight the **Snap Shot** button (see Figure 9-9 on page 133).
2. Press the Enter key to save the snap shot to the cloud or a USB flash drive as a bitmap (.bmp) image file.

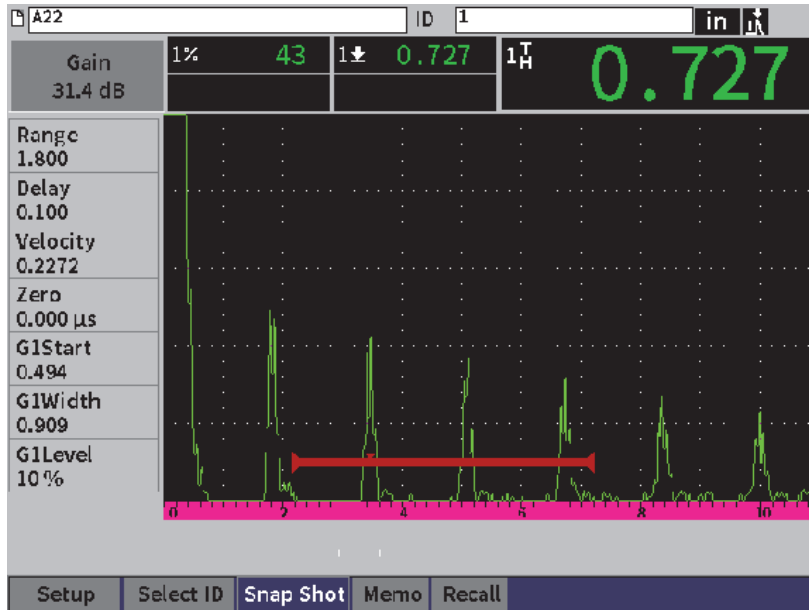


Figure 9-9 Saved file waveform and data

9.4.2.4 Recalling a File ID

To bring saved data to the live A-scan display, you must recall that particular file ID. For incremental (INC) files, you must select the specific ID to be recalled. For calibration (CAL) files, recalling the file automatically recalls the parameters of the single ID saved in that file.

NOTE

Calibration (CAL) files only contain a single ID.

To recall a file ID from the Contents page

1. With the **Contents** setup page displayed, turn the adjustment knob to highlight the **Recall** button.
2. Press the Enter key to bring the saved data to the live A-scan display (see Figure 9-10 on page 134).

The file name and ID of the file being viewed is displayed in the file identifier bar. The notification "<filename> recalled, press any key to continue" is displayed in the message bar.

3. Press any key on the instrument to continue.

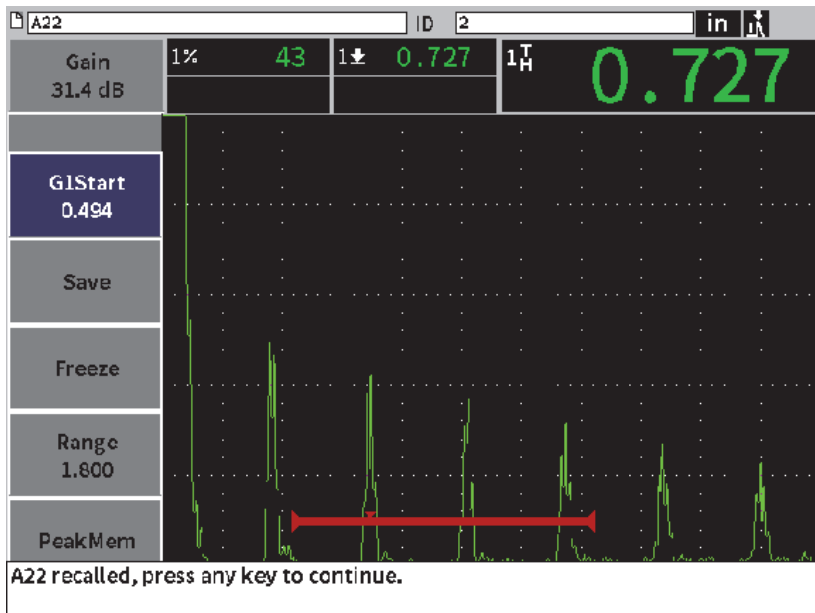


Figure 9-10 Recalled file data

To recall a file ID from the File setup page

1. In the **File** setup page, turn the adjustment knob, and then press the Enter key to select the file that you want to recall.
2. Press the Tab key to select the **Contents** button.
3. Press the Enter key to view the file contents.
4. Press the Tab key to select the **Recall** button.
5. Press the Enter key to bring the saved data to the live A-scan display.
The ID being viewed is displayed in the file identifier bar. The notification "<filename> recalled, press any key to continue" is displayed in the message bar (see Figure 9-10 on page 134).
6. Press any key on the instrument to continue.

9.4.2.5 Viewing File Details

You can view the file setup and creation information.

To view the file details

1. In the **File** setup page, turn the adjustment knob, and then press the Enter key to select the file that you want to use.
2. Press the Tab key to select the **Details** button.
3. Press the Enter key to view the **Details** page (see Figure 9-11 on page 136).

Details

Filename

AWS-IBEAM

Description

Inspector ID

Location Note

File Type

CAL

Date Created

01/22/17

11:51 PM

Date Modified

01/22/17

11:51 PM

Total ID Count

1

Figure 9-11 Details setup page

9.4.2.6 Viewing a Summary of All Saved Data

After you have completed saving data to a file, you may want to view a summary of the different measurements saved in the different IDs within the file.

To view a summary of all saved data in a file

1. In the **File** setup page, turn the adjustment knob, and then press the Enter key to select the file that you want to view.
2. Press the Tab key to select the **Summary** button.
3. Press the Enter key to view the file summary (see Figure 9-12 on page 137).
4. Use the **First Page**, **Prev Page**, **Next Page**, and **Last Page** buttons to navigate through a large summary file.

Summary					
Filename		ASMEV-PIPE			Total: 9
#1	1			in	
1%	0.692	1%	72	1%	10.7
#2	2			in	
1%	110	1%	0.148	1%	0.148
#3	3			in	
1%	110	1%	0.068	1%	0.068
#4	4			in	
1%	50	1%	0.068	1%	0.085
#5	5			in	
1%	110	1%	0.068	1%	0.068
#6	6			in	
1%	110	1%	0.068	1%	0.069
#7	7			in	
1%	110	1%	0.070	1%	0.149
#8	8			in	
1%	110	1%	0.068	1%	0.068
#9	9			in	
1%	43	1%	0.083	1%	0.083
First Page		Prev Page		Next Page	
Last Page					

Figure 9-12 Summary setup page

9.4.3 Manage

The **Manage** setup page can accomplish the following tasks in files (see Figure 9-13 on page 138):

- Edit
- Copy
- Delete
- Clear
- Select ID

To select a file in the Manage setup page

- ◆ In the **Manage** setup page, turn the adjustment knob, and then press the Enter key to select the file that you want to use.

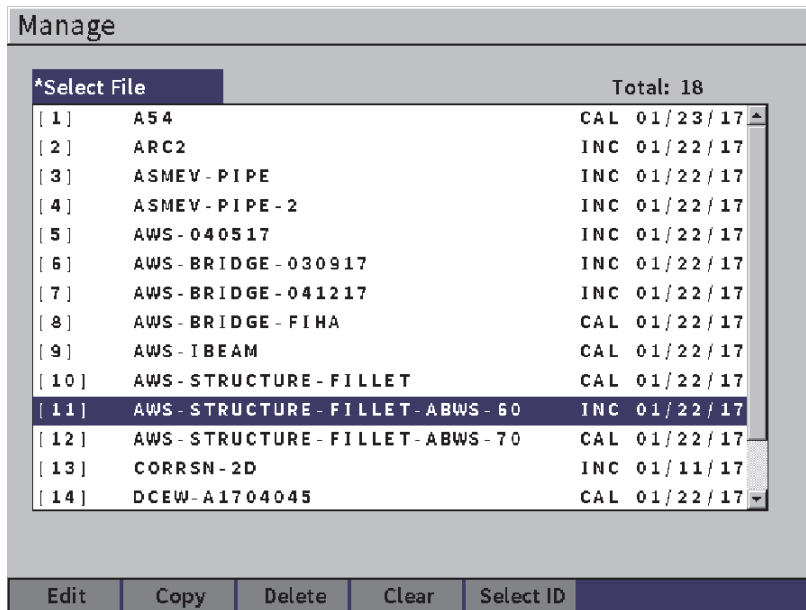


Figure 9-13 Manage setup page

9.4.3.1 Edit

The **Edit** button is used to edit information within saved files.

To edit file information

1. In the **Manage** page, turn the adjustment knob to highlight a file.
1. Press the Tab key to select the **Edit** button.
2. Press the Enter key to view the file contents (see Figure 9-14 on page 139).
3. Press the Tab key to highlight the box you want to edit.
4. Enter characters (up to 32) using the virtual keypad, adjustment knob, and the Enter key (see Figure 9-14 on page 139).
5. Press the Tab key to select **Apply**.
6. Press the Enter key to apply the changes.

Edit

*Filename
AWS-STRUCTURE-FILLET

Description

Inspector ID

Location Note

Apply

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	0	-	#	
						←	→	🗑️		⬅️	⬅️X	

Figure 9-14 Edit setup page

9.4.3.2 Copy

The **Copy** button is used to make a duplicate copy of a file saved on the instrument.

To copy a file

1. In the **Manage** page, turn the adjustment knob to highlight a file.
1. Press the Tab key to select the **Copy** button.
2. Press the Enter key to open the **Copy** page (see Figure 9-15 on page 140).
3. Press the Enter key to highlight the **To Filename** box.
4. Enter characters (up to 32) using the virtual keypad, adjustment knob, and the Enter key.
5. On the virtual keypad, select **Done** when finished.
6. Press the Enter key to confirm.
7. Press the Tab key to select **Copy**.
8. Press the Enter key to complete the copy.

Copy

*From Filename
ACUM-CO

*To Filename

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	0	-	#	
						←	→	🗑️		←	⌫	

Copy

Figure 9-15 Copy setup page

9.4.3.3 Delete

The **Delete** button is used to delete a saved file from the instrument. The file name and all the saved data and IDs contained within it are deleted.

To delete a file

1. Press the Tab key to select the **Delete** button.
2. Press the Enter key.

The **Delete** dialog box appears (see Figure 9-16 on page 141).

3. Follow the instructions in the dialog box to confirm or cancel the delete.



Figure 9-16 Delete dialog box

9.4.3.4 Clear

The **Clear** button is used to delete all of the data from a saved file, but it does not delete the file from the instrument.

To clear a file of data

1. Press the Tab key to select the **Clear** button.
2. Press the Enter key.

The **Clear** dialog box appears (see Figure 9-17 on page 141).

3. Follow the instructions in the dialog box to confirm or cancel the delete.



Figure 9-17 Clear dialog box

9.4.3.5 Selecting a File ID

See “Recalling a File ID” on page 133.

NOTE

Calibration (CAL) files only contain a single ID.

To select an ID within a file

1. In the **Manage** page, turn the adjustment knob to highlight a file.
2. Press the Tab key to highlight the **Select ID** button, and then press the Enter key to select the highlighted file and open the **Select ID** setup page.
3. Turn the adjustment knob to scroll through the saved IDs in the file, and then press the Tab key to select an ID and select the **Select** button (see Figure 9-8 on page 132).
4. Press the Enter key to confirm your ID selection.

Select ID		Total: 5
[1]	A 1	
[2]	A 2	
[3]	A 3	
[4]	A 4	
[5]	A 5	

Figure 9-18 Select ID setup page

9.4.4 Memo

The **Memo** setup page enables you to enter descriptive comments to include with stored data. Memos can be used to provide further details about a measurement condition or calibration. Memos can only be entered into the currently open file (see “Selecting a File as the Active Storage Location” on page 128). To add a memo to a

particular data file, open that file before creating the memo. To place a memo in the file with a specific reading, enter the memo before saving the reading. To place a memo in the file after saving an ID, enter the memo after that ID is saved.

To add a memo

1. On the **Settings** menu, select the **Memo** icon and open the **Memo** setup page. (see Figure 9-4 on page 128).
2. Press the Tab key to select **Edit**.
3. Enter characters (up to 32) using the virtual keypad, adjustment knob, and the Enter key.
4. Press the Tab key to select the **Update** button, and then press the Enter key.
5. Use the adjustment knob to select the **Save** button, and then press the Enter key.

The screenshot shows the 'Memo' setup interface. The title bar at the top is labeled 'Memo'. On the left side, there is a vertical menu with three items: 'Filename', 'ID', and 'Memo'. The 'Memo' item is currently selected, indicated by a dark blue background. To the right of this menu, there are three input fields. The first field, labeled 'Filename', contains the text 'DISBOND-170404'. The second field, labeled 'ID', contains the number '2'. The third field is a large, empty text area for entering the memo content. Below this text area is a button labeled 'Edit'. At the bottom of the screen, there is a dark blue horizontal bar containing four buttons: 'Update', 'Dictionary', 'Clear', and 'Save'.

Figure 9-19 Memo setup page

To add a memo using the dictionary

1. Press the Tab key to select the **Dictionary** button.

2. Press the Enter key to open the **Dictionary** setup page.
3. Press the Tab key to select **Custom**, then turn the adjustment knob to select one of the custom labels (see Figure 9-20 on page 144).
4. Press the Tab key to select the **Insert** button

The screenshot displays the 'Memo Dictionary' interface. On the left, a vertical menu has 'Memo' at the top and 'Custom' highlighted in blue. The main area on the right is divided into two sections. The top section, titled 'Preset', contains a large empty text box. The bottom section, titled 'Remark Code:', contains a list of labels: 'Position:', 'Surface Condition:', 'Comment:', 'Inspector:', and 'Work Pack ID:'. The 'Position:' label is highlighted in blue. Below this list is an 'Edit' section with a text box labeled 'Position:'. At the bottom of the screen is a dark blue bar with five buttons: 'Delete', 'Update', 'Insert', 'Clear', and 'Save'.

Figure 9-20 Memo Dictionary page

5. Press the Enter key to insert the custom label into the memo and return to the Memo setup page.
6. Press the Tab key to highlight the **Edit** box to associate text with the selected custom label.
7. Enter characters (up to 32) using the virtual keypad, adjustment knob, and the Enter key (see Figure 9-21 on page 145).

The screenshot shows a 'Dictionary' window with two main sections: 'Memo' and 'Custom'. The 'Memo' section contains a virtual keyboard with letters A-M, N-Z, numbers 1-0, and symbols like hyphen, hash, left arrow, right arrow, and delete. The 'Custom' section contains a form with fields for 'Remark Code:', 'Position:', 'Surface Condition:', 'Comment:', 'Inspector:', and 'Work Pack ID:'. Below the form is an 'Edit' button and a 'Position:A3' field. At the bottom of the window are buttons for 'Delete', 'Update', 'Insert', 'Clear', and 'Save'.

Figure 9-21 Memo Dictionary page — Editing a label

8. Press the Tab key to move down to the **Update** button, and then press the Enter key.

To associate more custom label information

1. In the Memo page, press the Tab key to highlight **Memo**, and then press the Enter key.
2. Turn the adjustment knob to scroll down to the first empty space (see Figure 9-22 on page 146).

The screenshot shows a software interface titled "Memo". On the left is a vertical menu with "Filename", "ID", and "Memo" (highlighted in dark blue). To the right of the menu are input fields: "Filename" with the text "DISBOND-170404", "ID" with the text "2", and a larger "Memo" field. The "Memo" field contains the text "Position: V15" and "Surface Condition: POOR" on separate lines. Below this text is a dark blue horizontal bar, which is the "First empty space" indicated by a callout line from the right. Below the "Memo" field is an "Edit" field. At the bottom of the screen is a dark blue bar with four buttons: "Update", "Dictionary", "Clear", and "Save".

Figure 9-22 Memo Dictionary page — Inserting label info

3. Press the Tab key to highlight **Dictionary**, and then press the Enter key.
4. Press the Tab key to select **Custom**, and then turn the adjustment knob to select one of the custom labels.
5. Press the Tab key to select the **Insert** button to insert the custom label into the empty memo space and return to the **Memo** setup page.
6. Press the Tab key to highlight **Edit** to associate information with the selected custom label.
7. Enter characters (up to 32) using the virtual keypad, adjustment knob, and the Enter key (see Figure 9-23 on page 147).

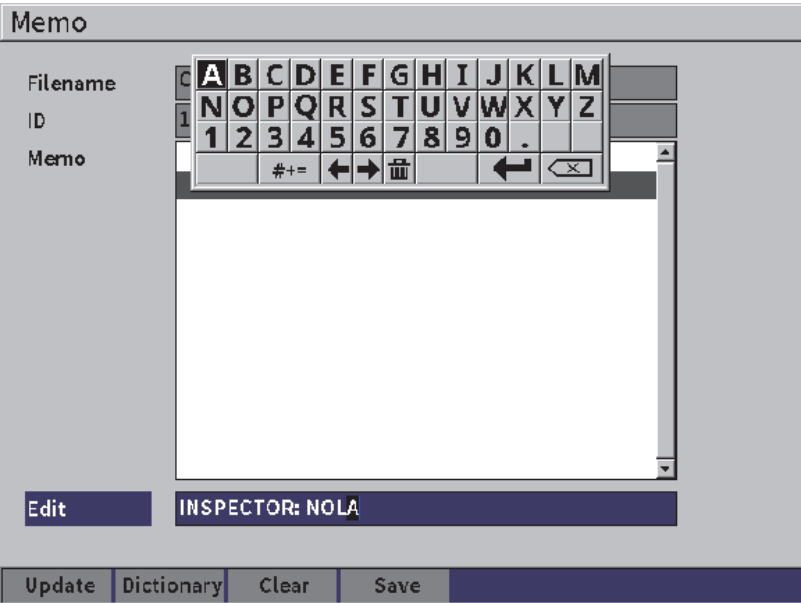


Figure 9-23 Memo Dictionary page — Inserted info

- 8. Press the Tab key to highlight **Update**, and press the Enter key.
- 9. When you are finished creating your memo. press the Tab key to highlight **Save**, then press Enter to return to the **Settings** menu.

To erase all the editable text in the Memo setup page

- 1. In the **Memo** setup page, press the Tab key to highlight **Clear**.
- 2. Press the Enter key to remove all of the data associated with custom labels.

9.4.5 Backup|Restore

NOTE

A USB flash drive must be connected to the HOST connector to access the **Backup|Restore** setup page.

The **Backup|Restore** setup page enables you to do the following:

- Copy language support files to or from a USB flash drive
- Copy DGS/AVG custom probe files to or from a USB flash drive
- Copy XML schema files to or from a USB flash drive
- Copy all database files to or from a USB flash drive
- Copy the entire data logger content to or from a USB flash drive.

To use the Backup|Restore page

1. Open the **Backup|Restore** setup page (see Figure 9-24 on page 148).
2. Turn the adjustment knob to select an action.

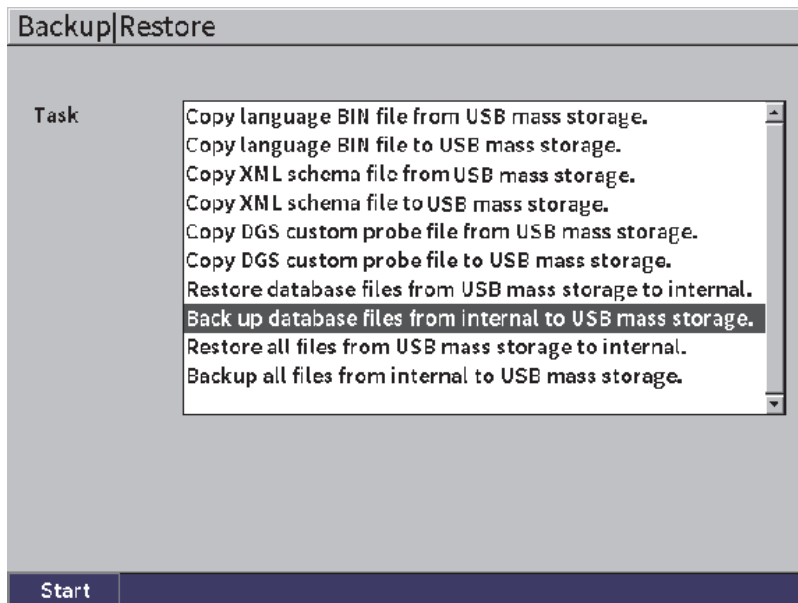


Figure 9-24 Backup|Restore setup page

The available actions include the following:

— **Copy language BIN file from USB mass storage**

Imports a language file from the USB flash drive to the internal memory to update user interface translations.

- **Copy language BIN file to USB mass storage**
Exports current language file from the internal memory to the USB flash drive.
 - **Copy XML Schema File from USB mass storage**
Imports an XML Schema file from the USB flash drive to the internal memory to support file exports in the XML format.
 - **Copy XML Schema File to USB mass storage**
Exports the current XML Schema file from the internal memory to the USB flash drive.
 - **Copy DGS Custom Probe File from USB mass storage**
Imports new custom DGS/AVG probe library from the USB flash drive to the internal memory.
 - **Copy DGS Custom Probe File to USB mass storage**
Exports current DGS/AVG custom probe library from the internal memory to the USB flash drive.
 - **Restore database files from USB mass storage to internal**
Restores all data logger files and live instrument settings from the USB flash drive to the internal memory from a previously backed up file.
 - **Backup database files from internal to USB mass storage**
Backs up all data logger files and live instrument settings from the internal memory to a USB flash drive.
 - **Restore all files from USB mass storage to internal**
Restores all data logger files and live instrument settings from the USB flash drive to the internal memory from a previously backed up file.
 - **Backup all files from internal to USB mass storage**
Backs up all data logger files and live instrument settings to a single file on the USB flash drive for data archiving or instrument cloning.
3. Press the Tab key to highlight **Start**, and then press the Enter key to begin the transfer.
A dialog box appears, asking you to confirm the transfer.
 4. Press the Enter key to confirm the transfer.

IMPORTANT

Restore permanently overwrites all existing data on the EPOCH 6LT with data from a USB flash drive.

9.5 Grid View

Using the grid view enables you to observe the measurements saved in multiple IDs of the active file displayed on the live A-scan display. This feature can be used for any file or file type, but it is most often used when conducting a thickness survey using a predefined inspection pattern. When used in a thickness survey, the grid view provides a partial or full-screen grid of thickness measurements arranged by columns and rows. When you save data to an ID in the file, the saved thickness reading appears in the corresponding cell in the grid. The grid can also be color coded to enable you to rapidly identify an area of critical thinning.

9.5.1 Activating the Grid View

The grid view must be activated before it is visible on the screen.

To activate the grid view

1. When on the live A-scan display, press Shift, Escape key sequence to display the setup menu.
2. Turn the adjustment knob to scroll the **Tools** icon ().
3. Press the Enter key to open the submenu of icons, then turn the adjustment knob to select the **Grid** icon ( icon).
4. Press the Enter key to open the **Grid** dialog box (see Figure 9-25 on page 151).
5. Press the Enter key, and then turn the adjustment knob to set **Grid Enable** to **On**.

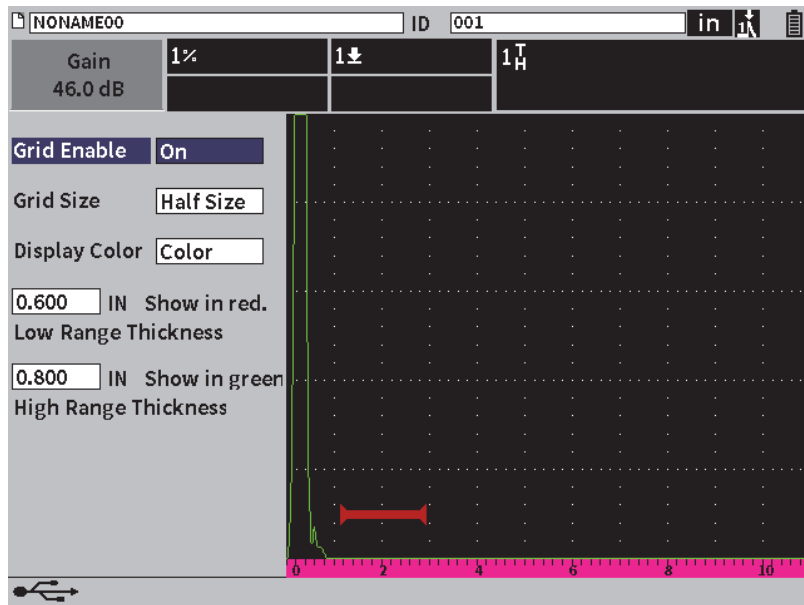


Figure 9-25 Grid dialog box

9.5.2 Configuring the Grid

Use the grid dialog box to configure the grid display options.

- **Grid Size**

Controls the amount of the live A-scan display dedicated to displaying the grid. **Half Size** splits the live display area. The top half displays the live A-scan. The bottom half displays the grid. **Full Size** uses the entire active screen area to display the grid (no A-scan is visible).

- **Display Color**

Controls the cell color coding of the live grid. **Mono** always applies the same text and background color to all cells in the grid.

Color applies either red, yellow, or green text or background to each cell, depending on the value of the measurement.

- **Low Range Thickness**

All measurements below this value are colored red.

- **High Range Thickness**

All measurements above this value are colored green.

All measurements between the **Low Range Thickness** value and the **High Range Thickness** value are colored yellow.

To configure the grid size and color

1. In the grid dialog box, press the Tab key to highlight the **Grid Size** box.
2. Turn the adjustment knob to select **Half Size** or **Full Size**.
3. Press the Tab key to highlight the **Display Color** box.
4. Turn the adjustment knob to select **Mono** or **Color**.
If you select **Color**, the **Low Range Thickness** and **High Range Thickness** boxes appear. Then complete the following steps:
 - a) Press the Tab key to select **Low Range Thickness**.
 - b) Turn the adjustment knob to change the low range thickness value.
 - c) Press the Tab key to select **High Range Thickness**.
 - d) Turn the adjustment knob to change the high range thickness value.

9.5.3 Using the Grid

Before using the grid, you must first activate it (see “Activating the Grid View” on page 150). If you set **Grid Enable** to **On**, and then press the ESC key to dismiss the grid dialog box, the grid view appears on the screen, including the grid and the **Grid** controls. If you press the ESC key while in grid view, the sidebar menu replaces the **Grid** controls.

The grid controls include the arrow buttons and **Save** button.

To save data in the grid on the live A-scan display

1. To immediately begin populating the grid with data, make a measurement, turn the adjustment knob to highlight **Save**, and press the Enter key.
The file ID is incremented, the data is saved to that location, and a new row in the grid is created and displayed to show the newly saved data.

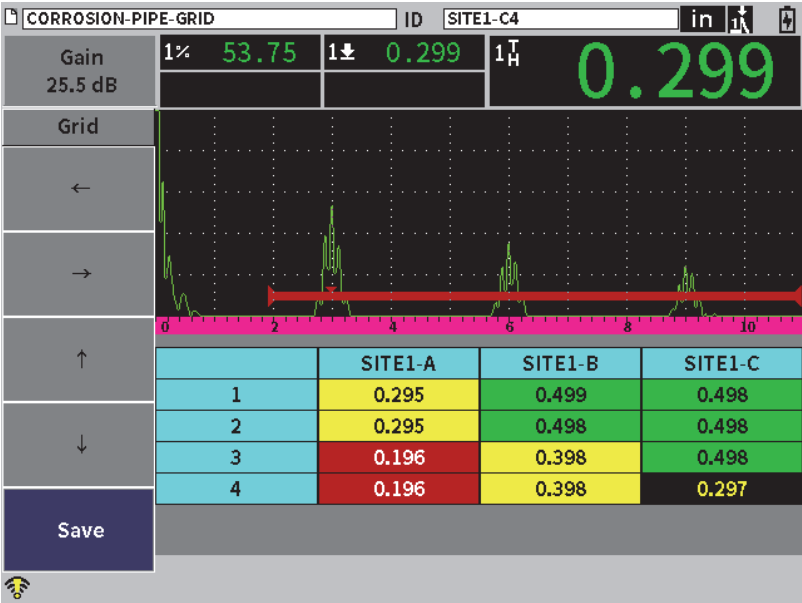


Figure 9-26 Grid view on the live A-scan display

To use the arrow buttons

1. Press the Tab key to move the selection from one arrow button to the next.
2. On the selected arrow button, press the Enter key to execute the desired function as described below.

NOTE

The selected cell is highlighted with a black background.

- The Left Arrow () button moves the selection to the cell on the left of the currently selected cell and changes the active file ID to that of the newly selected cell.
- The Right Arrow () button moves the selection to the cell on the right of the currently selected cell and changes the active file ID to that of the newly selected cell.

- The Up Arrow () button moves the selection to the cell above the currently selected cell and changes the active file ID to that of the newly selected cell.
- The Down Arrow () button moves the selection to the cell below the currently selected cell and changes the active file ID that of to the newly selected cell.

To overwrite grid data in a live screen

1. Use the arrow buttons to navigate to the cell to overwrite.
2. Make a measurement.
3. Turn the adjustment knob to highlight **Save**, and press the Enter key.
A dialog box appears asking if you want to overwrite the ID.
4. Press the Enter key to overwrite the data.

To use a grid when viewing a saved file

1. On the **Settings** menu, select the **File** icon to open the **File** setup page.
2. Turn the adjustment knob to select the specific file that you want to work with, and then press the Enter key.
3. Press the Tab key to highlight the **Contents** button.
4. Use the arrow buttons to navigate through the grid.
5. Press the Tab key to move to the **Select ID** button to highlight and select a specific ID for viewing (see Figure 9-27 on page 155).

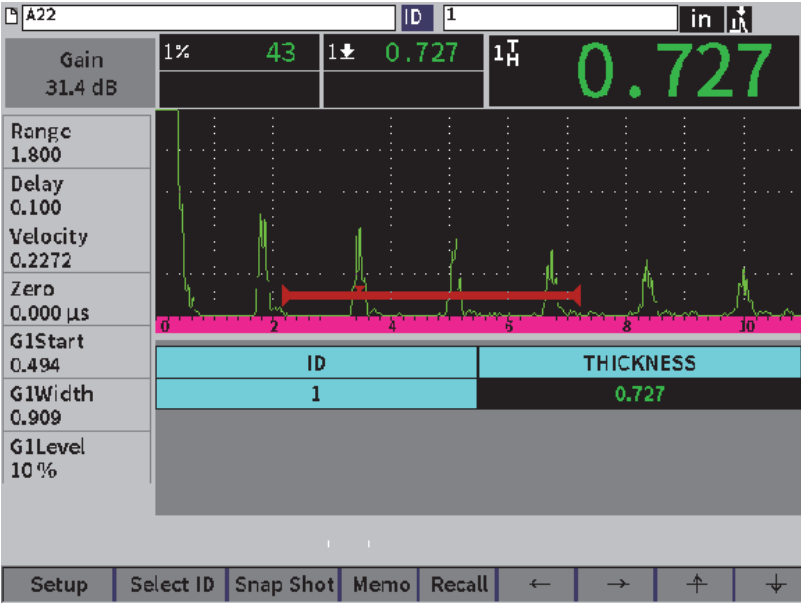


Figure 9-27 Grid controls in a saved file

9.6 Video Recorder

The video recorder enables you to record, save, delete, and play back live A-scan video. You can also export video to or import from other EPOCH series ultrasonic flaw detectors. Because the video information is stored in files, it is considered part of the data logger. However, components of the video recording system are found in the sidebar menu in addition to the setup menu.

9.6.1 Activating the Video Recorder

Before activating the video recorder, set up the EPOCH 6LT to display the events you want to record.

To activate the video recorder

1. In the setup menu, turn the adjustment knob to highlight the **Tools** icon () , and then press Enter to open the **Tools** submenu.
2. Turn the adjustment knob to highlight the **Video** icon () .
3. Press the Enter key to open the **Video** dialog box, and then press the Enter key again to highlight the **Video** parameter.
4. Turn the adjustment knob to set the parameter value to **On**.
5. Press the Shift, Tab key sequence to open the **Video** sidebar submenu (see Figure 9-28 on page 156).



Figure 9-28 Video sidebar submenu

9.6.2 Recording and Saving Video

Using the video recorder includes recording, saving, and clearing video files from memory.

To record video

NOTE

While recording a live video, gate and gain adjustments are available. No other parameters can be adjusted during live recording.

1. Activate the video recorder (see “To activate the video recorder” on page 156).
2. Press the Enter key to begin recording.

While you are recording, the menu includes the **Pause** and **Flag** buttons. The screen displays a counter that tracks the recording time (see “Recording in progress” on page 157).

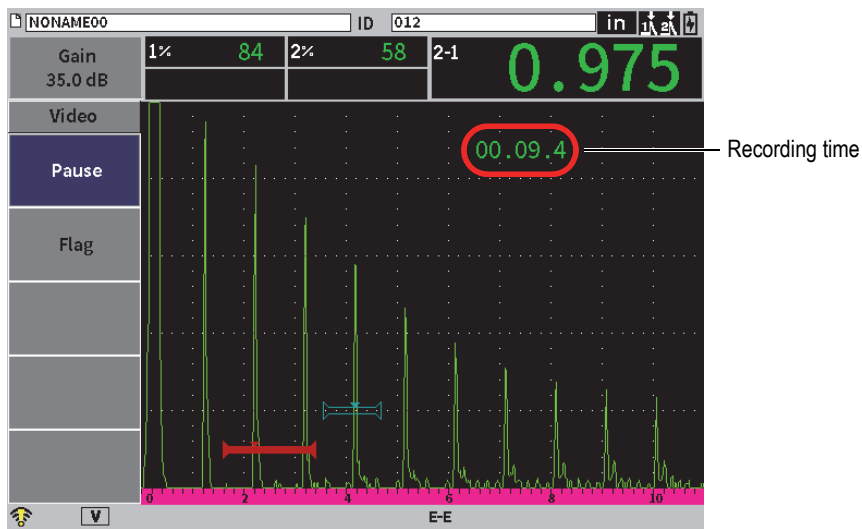


Figure 9-29 Recording in progress

3. To pause the recording, select the **Pause** button, and then press the Enter key. When you pause the recording, the **Record**, **Save**, and **Clear** buttons are displayed:
 - To resume recording, select **Record**.

- To finish recording and save the video to a file, select **Save** (see “To save a recording” on page 158 for details).
 - To erase the current video, select **Clear**.
4. To flag (or mark) a point in the video, select the **Flag** button, and then press the Enter key.

When reviewing the video, you can quickly jump from flag to flag.

To save a recording

1. Select **Save** to finish recording and display the **Create** (video file) setup page.
2. Press the Enter key to enter a **Filename**.
3. Enter characters (up to 32) using the virtual keypad, adjustment knob, and the Enter key (see Figure 9-30 on page 158).

The screenshot shows the 'Create' video file setup page. At the top is a title bar labeled 'Create'. Below it is a form with several input fields: '*File Type' (set to 'Video'), '*Filename' (containing 'AB'), 'Description', 'Inspector ID', and 'Location Note'. A virtual keypad is displayed at the bottom of the form, showing letters A-M, N-Z, numbers 1-0, and symbols -, #, and navigation arrows. The keypad is currently open over the 'Location Note' field. At the bottom of the page is a dark blue bar with a 'Create' button.

Figure 9-30 Create video file setup page

4. For each of the next three optional boxes (**Description**, **Inspector ID**, **Location Note**) press the Tab key, and then repeat step 3 to enter information.

- When you have completed the file setup, highlight the **Create** button, and then press the Enter key.
While the instrument is saving the file the following message is displayed:
"Creating file. Please wait."

To clear video from the memory

- ◆ Press the Tab key to move to and select the **Clear** button, and then press the Enter key to clear the current video recording from the internal memory.
The **Record** counter is reset to zero (0).

9.6.3 Working with Video Files

The data logger enables you to do the following:

- Review video recorded of the live A-scan display.
- Export video files via USB or the cloud.
- Import video files from other EPOCH 6LT ultrasonic flaw detectors.

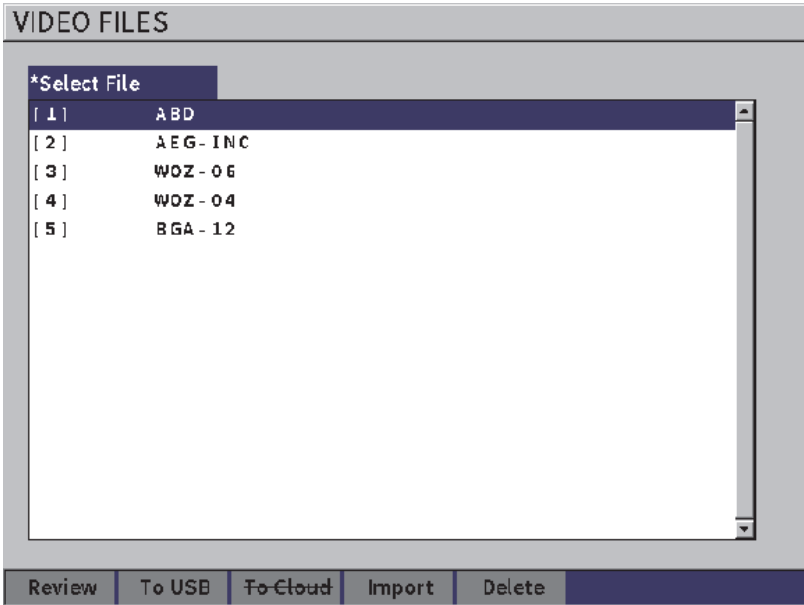


Figure 9-31 Video Files setup page

To open the Video settings

- ◆ Select the Video icon (📹) in the **Settings** menu to open the **Video Files** setup page. See “Navigating Dialog Boxes and Setup Pages” on page 39 for instructions on using the setup pages.

To review a recording

1. Turn the adjustment knob to select a file.
2. Press the Tab key to highlight the **Review** button.
3. Press the Enter key to display the reviewing page (see Figure 9-32 on page 160).

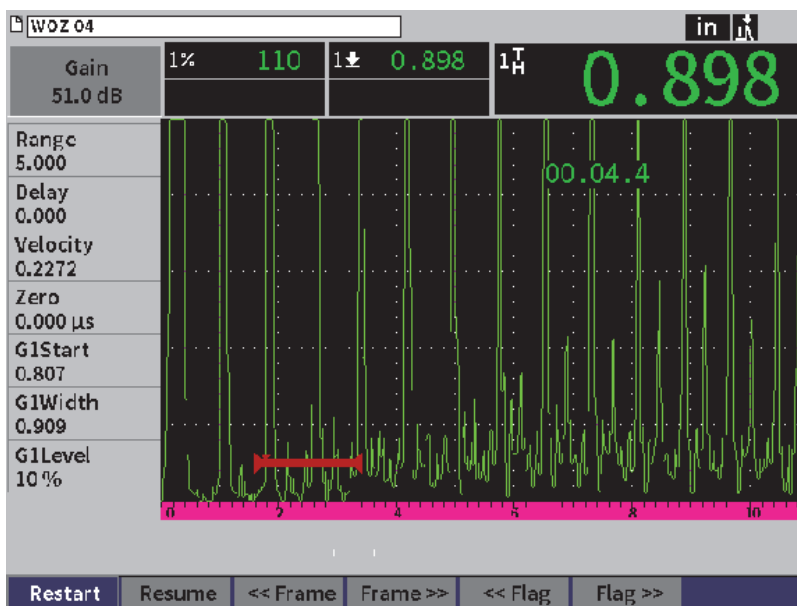


Figure 9-32 Video review setup page

4. Press the Tab key to move the selection from one button to the next at the bottom of the page.
5. On a selected button, press the Enter key to execute the desired function as described below:
 - **Restart** begins video playback from the start of the recording.

- **Pause** pauses video playback.
- **Resume** continues the video playback from the pause point.
- **<< Frame** or **Frame >>** moves back or forward one frame at time.
- **<< Flag** or **Flag >>** moves back or forward to the previous or next flag in the video (see “To record video” on page 157).

To export a video file

NOTE

Before exporting to the cloud, check to ensure that your wireless LAN (Wi-Fi) connection is properly set up.

NOTE

The HOST connector accommodates either a USB flash drive or a wireless LAN (Wi-Fi) adaptor. Depending on which device is connected to the HOST connector, either the **USB Flash** or **Cloud** button is disabled.

1. In the **Video Files** setup page, select a file, and then select the **USB Flash** or **Cloud** button.
2. Press the Enter key to begin the transfer.

To import a video file

NOTE

Before importing from the cloud, check to ensure that your wireless LAN (Wi-Fi) connection is properly set up.

NOTE

The HOST connector accommodates either a USB flash drive or a wireless LAN (Wi-Fi) adaptor. The instrument will import a file through or from the device connected to the HOST connector.

1. In the **Video Files** setup page, select the **Import** button.
2. Press the Enter key to open the **Import** setup page.
3. Turn the adjustment knob to highlight the file you want to import.
4. Press the Tab key to select the file and move the focus to the **Filename** box.
5. To import the selected file under a different name, enter a new file name (up to 32 characters) using the virtual keypad, adjustment knob, and the Enter key (see Figure 9-33 on page 162).

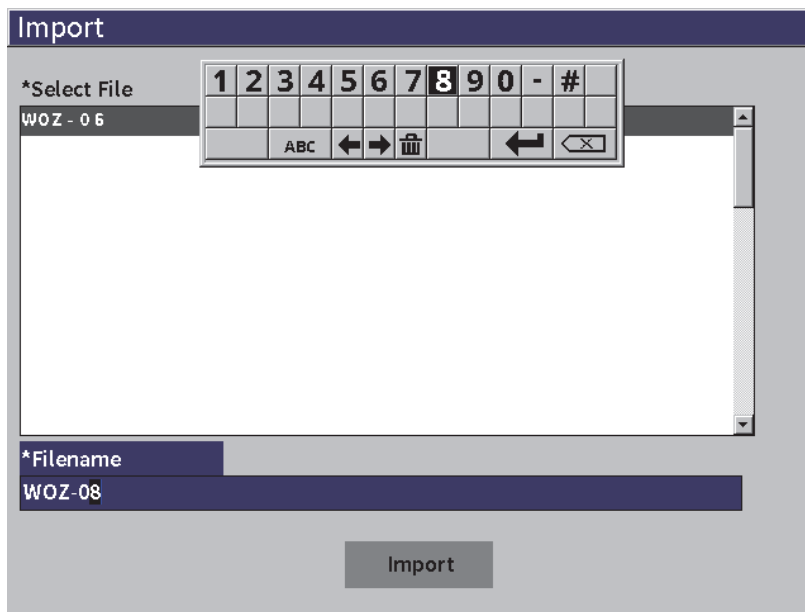


Figure 9-33 Import (video file) setup page

6. Press the Tab key to highlight the **Import** button.
7. Press the Enter key to begin the transfer.

To delete a video file

1. In the **Video Files** setup page, turn the adjustment knob to select a file.
2. Press the Tab key to highlight the **Delete** button.
3. Press the Enter key to delete the selected file.

10. Wi-Fi Networks

The wireless LAN (Wi-Fi) setup pages are used to set up the instrument to connect to a wireless LAN (Wi-Fi) network through a wireless LAN adaptor.

NOTE

You can connect to the cloud through Wi-Fi. See your network administrator about configuring your instrument to connect to the cloud.

10.1 Connecting to a Wireless LAN (Wi-Fi) Network

You can check the status of or connect to a wireless LAN (Wi-Fi) network in the **Wi-Fi Networks** setup page.

To check the status of available wireless LAN (Wi-Fi) networks

1. On the setup menu, select the **Settings** icon to open the **Settings** submenu (see “Setup Mode” on page 37 for details on selecting icons and navigating Setup menus).
2. Select the **Wi-Fi** icon () to open the **Wi-Fi Networks** setup page (see Figure 10-1 on page 166).
The available networks and their security and connection statuses are displayed.

To connect to a wireless LAN (Wi-Fi) network

1. If the **Enable** parameter is set to **Off**, perform the following steps:

- a) Press the Tab key to select the **Enable** parameter.
 - b) Turn the adjustment knob to set the **Enable** parameter to **On**.
 - c) Press the Tab key to move to the list of available networks.
2. Turn the adjustment knob to select a network, and then press the Enter key to confirm your selection.

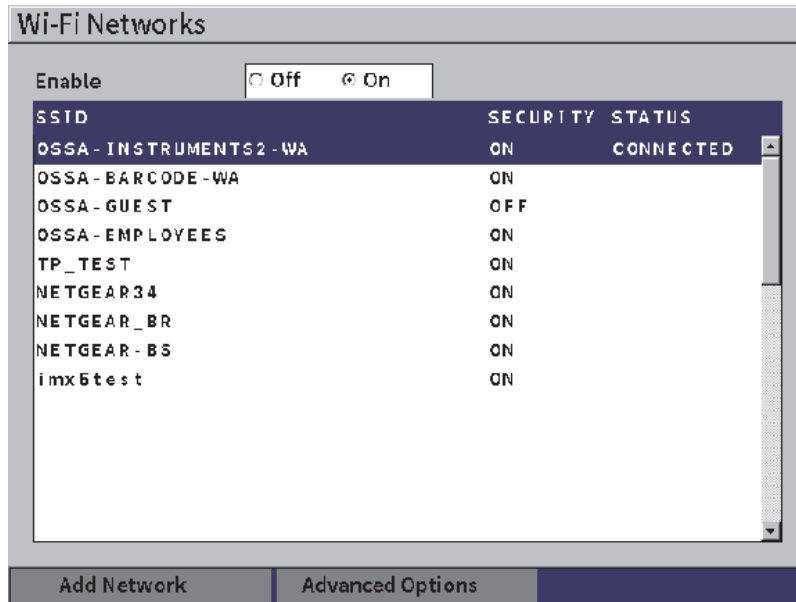


Figure 10-1 Wi-Fi Networks setup page

- a) If the network you select requires a password, the log on page for that network is displayed (see Figure 10-2 on page 167):
 - (1) Select and fill in the **Password** box, and then highlight **Connect**.
 - (2) Press the Enter key to make the connection.

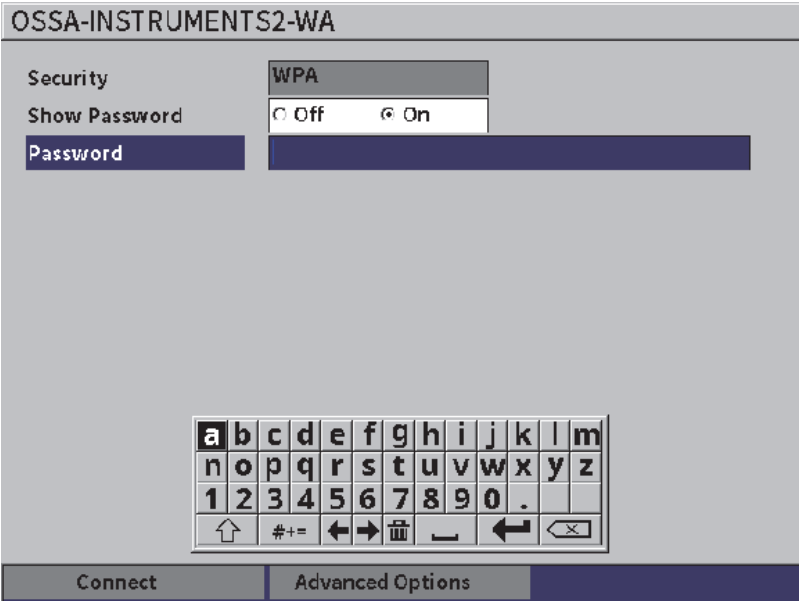


Figure 10-2 Wi-Fi secure logon page

After the network connection is made, a page displays to show the status, strength, security, and IP address of the connection (see Figure 10-4 on page 169).

- b) If the network you select does not require a password, press the Enter key to connect to the selected network (see Figure 10-3 on page 168).

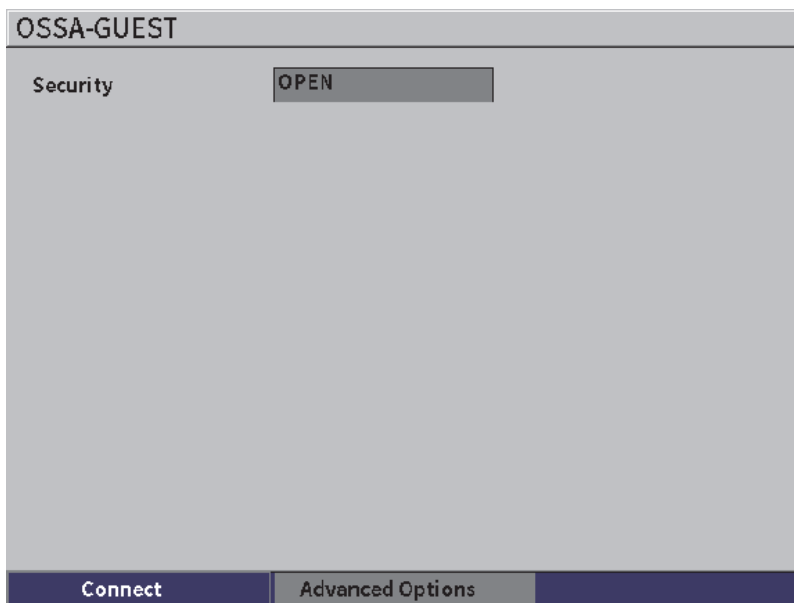


Figure 10-3 Wi-Fi unsecured logon page

A page displays to show the status, strength, security, and IP address of the connection (see Figure 10-4 on page 169).

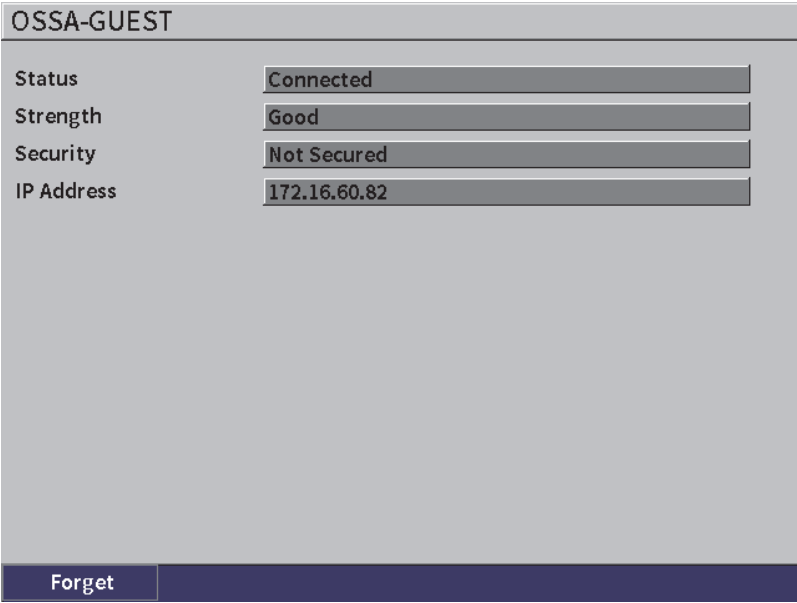


Figure 10-4 Wi-Fi connection status page

10.2 Adding a Wireless LAN (Wi-Fi) Network

If a wireless LAN (Wi-Fi) network that you want to connect to is not listed in the networks list on the **Wi-Fi Networks** setup page. You can manually enter the necessary information to connect to that network.

To add a wireless LAN (Wi-Fi) network

1. In the **Wi-Fi Networks** setup page, highlight the **Add Network** button.
2. Press the Enter key to open the **Add Network** setup page (see Figure 10-5 on page 170).
3. Press the Enter key to select the **Security** parameter, and then turn the adjustment knob to select a security type.
4. Press the Tab key to select the **Network Name (SSID)** parameter and display the virtual keypad.
5. Enter the network SSID (see “Using the Virtual Keypad” on page 55).
6. Press the Tab key to move to the **Password** box.

Other parameters may be displayed on the page, depending on the security type.

7. Enter a password, and then press the Tab key to select the **Connect** button.
8. Press the Enter key to connect to the newly added network.

If there is a problem connecting to the added network, the following message is displayed in the message bar: "Error on Network Setting."

Add Network	
Security	WPA2
*Network Name (SSID)	
Show Password	☒ Off ☐ On
Password	
Connect Advanced Options	

Figure 10-5 Add Network setup page

11. Software Features and Options

This chapter explains the activation and operation of software features and options for the EPOCH 6LT ultrasonic flaw detector.

11.1 Defining Licensed and Unlicensed Software Features

The EPOCH 6LT comes standard with many software features that expand the instrument's capabilities beyond standard flaw detection.

The following software features are standard components of the EPOCH 6LT:

- Dynamic DAC/TCG
- AWS D1.1/D1.5

The following software features are optional components of the EPOCH 6LT, which you can purchase to add to the instrument:

- Back Wall Echo Attenuator (BEA)
- Corrosion Module

The optional software features can be activated at the time of purchase of the instrument, or they can be activated remotely after purchase of the instrument.

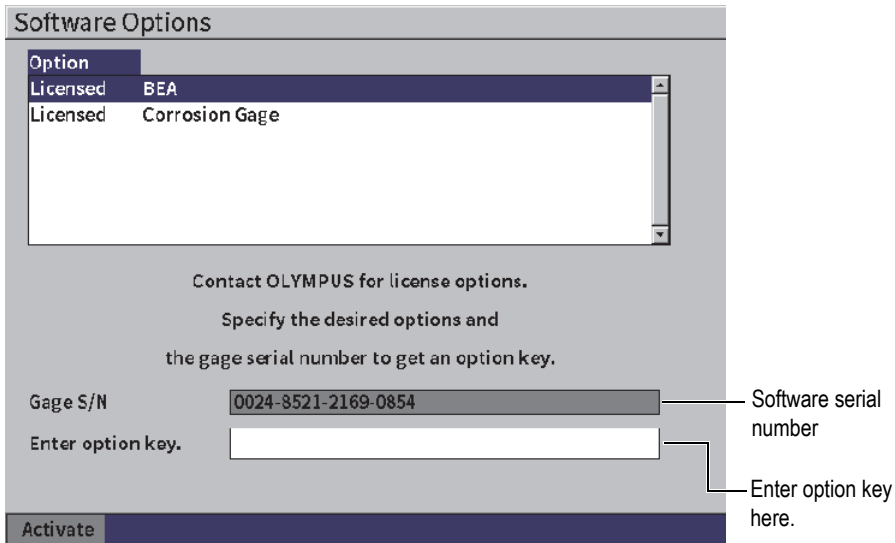
If an optional software feature is not activated, you cannot access that feature in the **Software Options** dialog box (see “Activating Software Options” on page 172). Evident can provide you with an activation code that grants access to the option so you do not have to return the instrument to a service center.

11.2 Activating Software Options

Software options are activated in the **Software Options** setup page.

To activate a software option

1. On the setup menu, select the **Settings** icon () , and then press the Enter key to open the **Settings** submenu.
2. Select the **Software Options** icon () , and then press the Enter key to open the **Software Options** setup page (see “Software Options setup page” on page 172). See “To scroll through the setup menu icons” on page 39 for details on using setup pages.



Option
Licensed BEA
Licensed Corrosion Gage

Contact OLYMPUS for license options.
Specify the desired options and
the gage serial number to get an option key.

Gage S/N 0024-8521-2169-0854

Enter option key.

Activate

Software serial number

Enter option key here.

Figure 11-1 Software Options setup page

NOTE

You can only select unlicensed options. All licensed options are shaded and cannot be selected.

3. Select an **Unlicensed** option and note the 16-character software serial number for your instrument that appears in the **Gage S/N** parameter.
4. Contact Evident to purchase the software option, using the software serial number to identify your instrument.
5. After Evident provides you with the remote activation code, open the **Software Options** setup page.
6. Press the Tab key to move to the **Enter Option Key** box, and then press the Enter key to display the virtual keypad.
7. Using the virtual keypad, adjustment knob, and Enter key, enter the activation code in the **Enter Option Key** box.
8. Press the Tab key to select **Activate**.
9. Press the Enter key to activate the option and return to the live A-scan display.

11.3 Dynamic DAC/TCG

A distance-amplitude correction (DAC) curve is used to plot amplitude variations of signals from reflectors of the same size, but at different distances from the transducer. Normally, these reflectors produce echoes of varying amplitude due to material attenuation and beam spreading as the sound beam travels through the part. The purpose of the DAC curve is to graphically compensate for material attenuation, near-field effects, beam spreading, and surface roughness.

After plotting a DAC curve, reflectors of the same size as those used for creation of the curve produce echoes that peak along the curve despite their different locations within the test piece. Similarly, reflectors that are smaller than those used to create the curve fall below the level, while larger reflectors exceed the curve level.

When a DAC curve is created in the EPOCH 6LT ultrasonic flaw detector, the instrument also creates a time-corrected gain (TCG) setup. TCG is used to compensate for the same factors as DAC, but the presentation is different. Instead of drawing a curve across the display that follows the reference-reflector peaks downward as sound is attenuated, the TCG setup amplifies the gain as a function of time (distance) to bring the reference reflectors to the same screen height (80 % FSH).

The EPOCH 6LT DAC/TCG feature allows you to quickly and easily toggle between DAC and TCG views, giving you the freedom to use both techniques during a single inspection. When you switch from DAC view to TCG view, the DAC curves are displayed as TCG lines across the screen. The time-varied gain effectively amplifies the signals across the time base to make the DAC curves appear as straight lines across the screen.

You can customize DAC/TCG setups to your unique application requirements using the flexible DAC/TCG software feature. The DAC/TCG feature incorporates several DAC/TCG modes that adhere to ASME, ASME III, and JIS, and JBT 4730 sizing codes. The software provides direct control of gain, range, zero offset, and delay, as well as scanning gain and transfer correction. In addition, the DAC/TCG option provides a 20 % to 80 % DAC view, customizable DAC curves, and a user-defined TCG table to meet advanced and unique inspection needs.

On the live A-scan display, the **DAC/TCG** dialog box contains the various setup and adjustment parameters. These parameters provide access to several important functions that control DAC/TCG setup and operation.

In the following sections, all DAC/TCG modes are covered. The DAC/TCG setup procedure is the same for all modes. The setup is covered in detail in the ASME/ASME-III section to follow. Any differences in the procedure to set up other DAC/TCG modes are discussed in the pertinent section for that particular mode.

11.3.1 Enabling the DAC/TCG Feature

Before any options associated with DAC/TCG are activated, the EPOCH 6LT must be properly calibrated to the material being inspected (see “Calibration” on page 109).

To enable the DAC/TCG feature

1. On the setup menu, select the **Sizing** icon () , and then press the Enter key to open the **Sizing** submenu (see “Setup Mode” on page 37 for details on icons and submenus).
2. Select the **DAC** icon () , and then press the Enter key to open the DAC/TCG dialog box (see Figure 11-2 on page 176). See “Navigating Dialog Boxes and Setup Pages” on page 39 for details on using dialog boxes.
3. Press the Enter key to highlight the **DAC/TCG Mode** parameter box.
4. Turn the adjustment knob to select a mode.

The available active modes are: **Standard** (see “Building a DAC Curve in Standard or ASME III Mode” on page 176), **ASME-3** (see “Building a DAC Curve in Standard or ASME III Mode” on page 176), **JIS** (see “JIS DAC” on page 189), and **Custom** (see “Custom DAC Curves” on page 190).

11.3.2 Applying Reference Correction

You can apply reference correction to the digital analysis of the live A-scan and DAC/TCG mode. Reference correction allows full gain manipulation of either the live echo peaks or the DAC curve while providing the percentage of amplitude or dB comparison of the actual peak-to-curve ratio. In this way, you can use scanning gain while maintaining an accurate measurement reading of the ratio of the gated peak to the DAC curve for sizing purposes. The gated echo amplitude is corrected back to the reference gain level for amplitude evaluation compared to the DAC curve.

To apply reference correction

1. In the DAC/TCG dialog box, press the Tab key to move to the **Ref Correct** parameter.
2. Turn the adjustment knob to select **On**.
3. Press the Tab key to move to the **20-80 DAC View** parameter.
4. Turn the adjustment knob to select **On** or **Off**.
5. Press the Tab key to move to the **Curve Type** parameter.
6. Turn the adjustment knob to select **Straight** or **Curve**.
7. If you have selected the **Custom** DAC/TCG mode, move to the **Curve No.** parameter as follows:
 - a) Turn the adjustment knob to enable curves 1–6.
 - b) Press the Tab key to move to each enabled curve, and then turn the adjustment knob to select a **dB** value.
8. Press the Shift, Tab key sequence to return to the live A-scan display and begin the DAC/TCG setup.

DAC/TCG Mode	ASME-3
Ref Correct	On
20-80 DAC View	On
Curve Type	Curve
Curve no.	0
Curve 1 dB	+ 0 dB
Curve 2 dB	+ 0 dB
Curve 3 dB	+ 0 dB
Curve 4 dB	+ 0 dB
Curve 5 dB	+ 0 dB
Curve 6 dB	+ 0 dB

Figure 11-2 DAC/TCG dialog box

11.3.3 Building a DAC Curve in Standard or ASME III Mode

Building a DAC curve in Standard or ASME III mode involves the same series of steps, but the modes produce different visual results:

- The **Standard** DAC mode draws a single DAC curve from peak-to-peak on reference reflectors.
- The ASME III (or **ASME-3**) mode draws three DAC curves: one main curve from peak-to-peak on the reference reflectors and two warning curves at -6 dB and -14 dB compared to the main curve.

The example used in this section to set up and build a DAC curve assumes the instrument is in **ASME-3** mode.

To set up ASME-3 DAC mode

1. Activate the DAC/TCG feature (see “Enabling the DAC/TCG Feature” on page 174).
2. Turn the adjustment knob to set the **DAC/TCG Mode** to **ASME-3**.
3. Press the Shift, Tab key sequence to return to the live A-scan display.

The DAC/TCG submenu should be displayed (see Figure 11-3 on page 177). If it is not displayed, do the following:

- a) Press the Tab key to display the sidebar menu.
- b) Press the Tab key to highlight the **DAC/TCG** button, and then press the Enter key to open the **DAC/TCG** submenu.

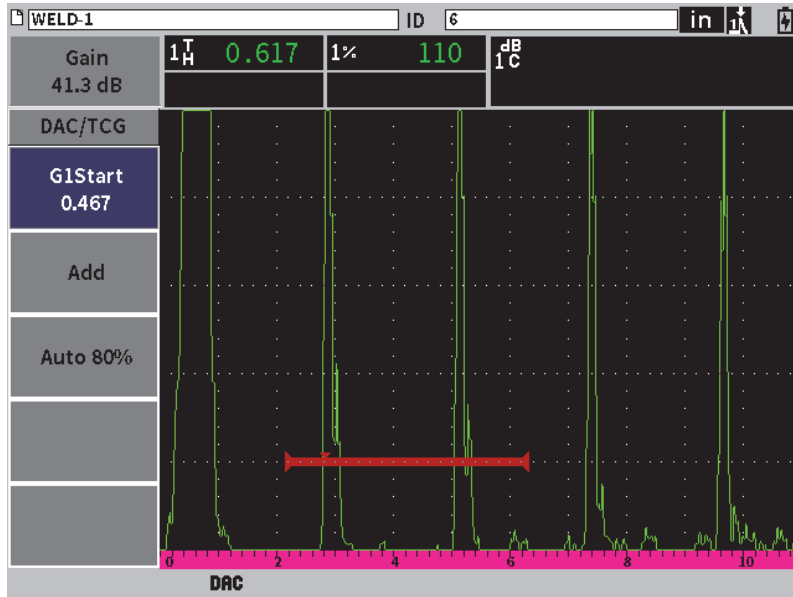


Figure 11-3 DAC/TCG sidebar submenu

To build a DAC curve

1. With the DAC/TCG submenu displayed, press the Enter key to select **G1 Start**, and then turn the adjustment knob to center gate 1 over the first echo.
2. Press the Tab key to highlight **Add**, and then press the Enter key to add the first point (see Figure 11-4 on page 178).

The **G1Start** button should now be highlighted.

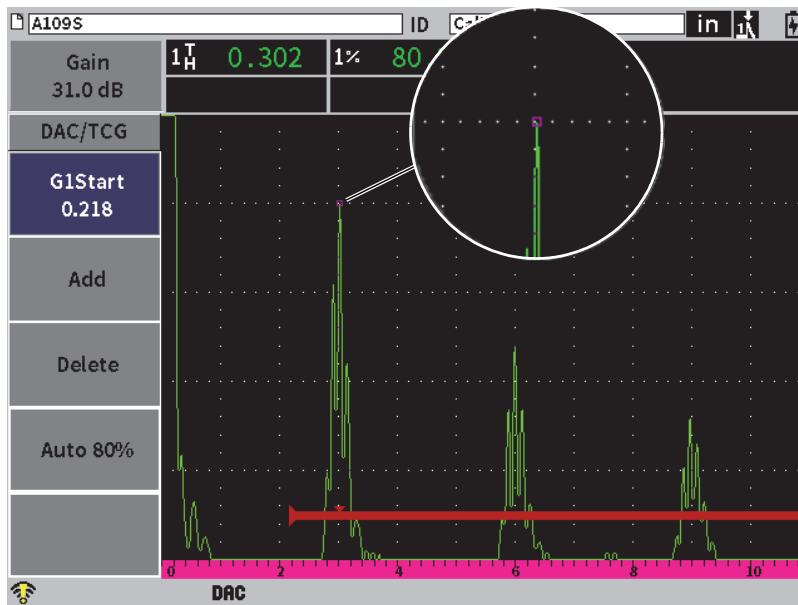


Figure 11-4 First DAC point

3. Turn the adjustment knob to move the gate trigger indicator to the next echo.
4. Press the Tab key to highlight **AUTO 80%**, and then press the Enter key to bring the second echo to 80 % full-screen height. While building the DAC curve:
 - The **Delete** button deletes the most recently captured DAC point
 - The **Erase** button deletes all captured DAC points (the entire curve).
5. Press the Tab key to highlight the **Add** button, and then press the Enter key to add the second point (see Figure 11-5 on page 179).

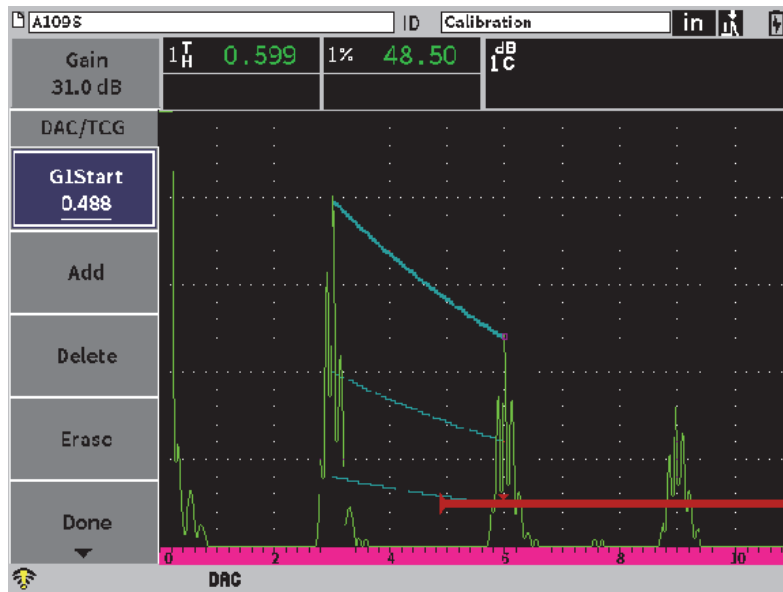


Figure 11-5 Second DAC point

6. Turn the adjustment knob to move the gate trigger indicator to the next echo.
7. Press the Tab key to highlight **AUTO 80%**, and then press the Enter key to bring the selected point to 80 % full-screen height.
8. Press the Tab key to highlight the **Add** button, and then press the Enter key to add another point (see Figure 11-5 on page 179).
9. Repeat steps 6, 7, and 8 until you are finished building your curve (see Figure 11-6 on page 180).

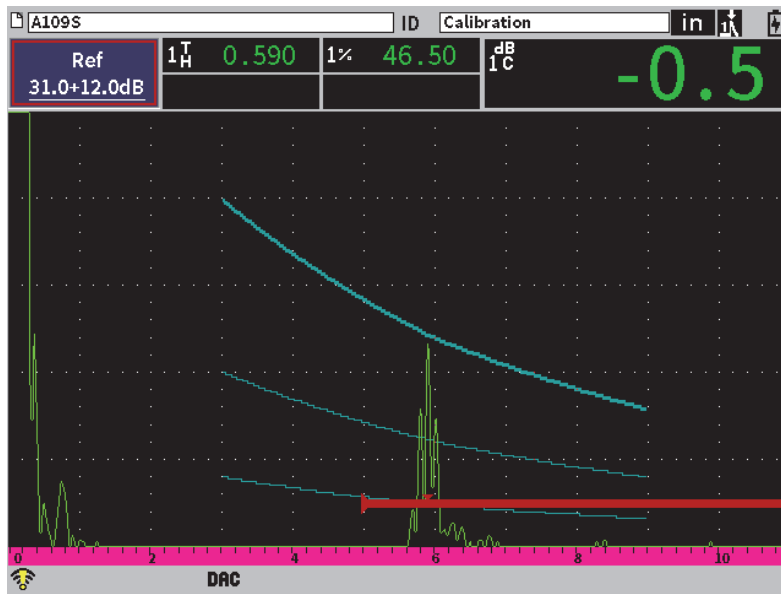


Figure 11-6 Completed DAC curve

10. Select the **Done** button to end curve acquisition and switch to DAC inspection mode.

In Figure 11-7 on page 181, the instrument has drawn a DAC curve with three levels from the first point to the second. The AUTO 80% function has brought the second point to 80 % full-screen height. This ensures that the point is captured accurately because amplitude resolution is better at greater echo heights. This also pushes the first captured echo over 110 % full-screen height so the main DAC curve and the -6 dB warning curve extend downward to the second point from off-screen.

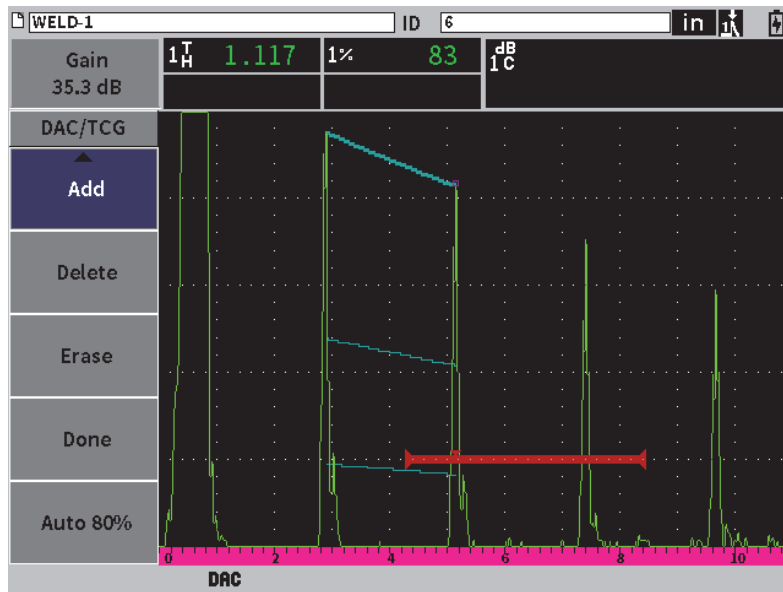


Figure 11-7 Partial DAC curve with each echo set to 80 % FSH

11.3.3.1 Other Adjustments for Building a DAC Curve

You can increase the instrument range or increase the display delay to increase the number of echoes that you can see.

To adjust the Range, Delay, or Zero while detecting the echo

1. On the DAC/TCG submenu, press the ESC key to go to the sidebar menu.
2. Turn the adjustment knob to select the **UT** button, and then press the Enter key to display the **UT** submenu.
3. Adjust the **Range**, **Delay**, or **Zero** parameters while detecting the echo.

To adjust the Angle, Thickness, and Curved Surface Correction values

1. On the sidebar menu, press the Shift key, and then press the ESC key to go to the setup menu.
2. Turn the adjustment knob to select the **Angle** icon, and then press the Enter key to open the Angle dialog box.

3. Adjust the **Angle**, **Thick**, **X Value**, and **CSC** parameters as desired.

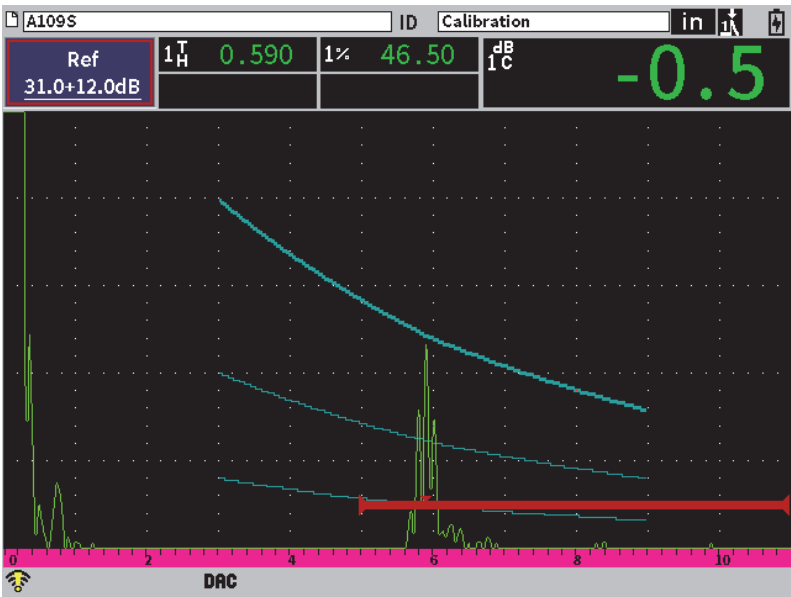


Figure 11-8 Completed DAC curve

11.3.4 DAC Inspection Mode

When the DAC curve is complete and the instrument is in inspection mode, the DAC/TCG submenu displays a new set of parameters:

G1Start

The start position of gate 1 can be adjusted on the DAC/TCG submenu or the Gate1 submenu.

DAC Gain

This adjustment enables you to manipulate the screen height/gain of both the DAC/TCG curve and the echoes on screen. This allows for amplitude-to-curve comparison at code compliant screen levels across the time base.

View

This parameter enables you to toggle between the DAC curve acquired and the corresponding TCG setup based on the DAC curve information (see Figure 11-9 on page 183).

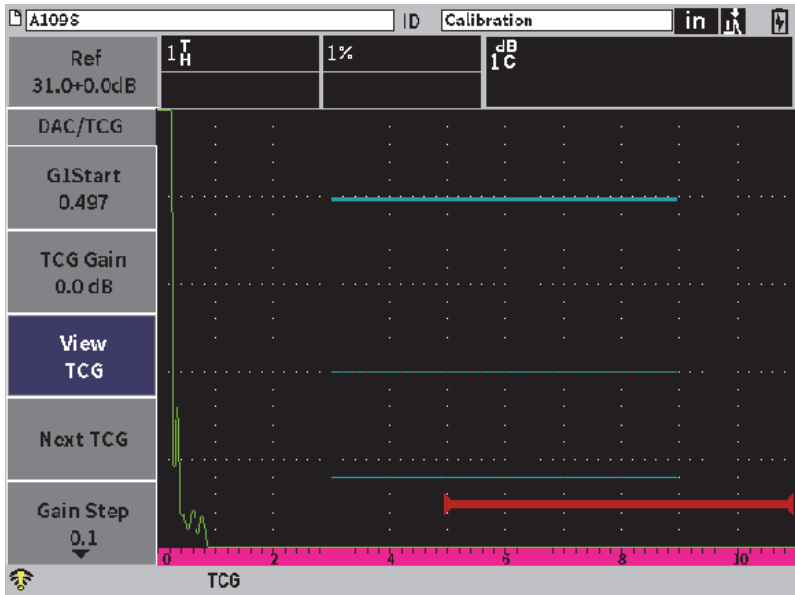


Figure 11-9 Completed DAC curves in TCG view mode

Next DAC

This parameter cycles through the available DAC curves (if more than one is available) for amplitude comparison with on-screen echoes.

Gain Step

This parameter controls the steps by which **Curve Gain** is adjusted. Possible steps are 0.1, 1.0, 2.0, 3.0, 6.0, and 12.0 dB.

Edit

This parameter enables you to return to DAC acquisition mode, providing access to the **Add**, **Delete**, **Erase**, and **Done** functions. (**Edit** is not available in TCG mode.)

Save

This parameter saves the DAC curve to internal memory.

Auto XX%

This parameter allows you to return to DAC acquisition mode, providing access to the **Add**, **Delete**, **Erase**, and **Done** functions. (**Edit** is not available in the TCG view.)

While DAC/TCG is active, you have full control of the **Range**, **Delay**, and **Zoom** settings. With this control, you can focus on areas of interest within the DAC setup. Figure 11-10 on page 184 shows a reduced range with delay.

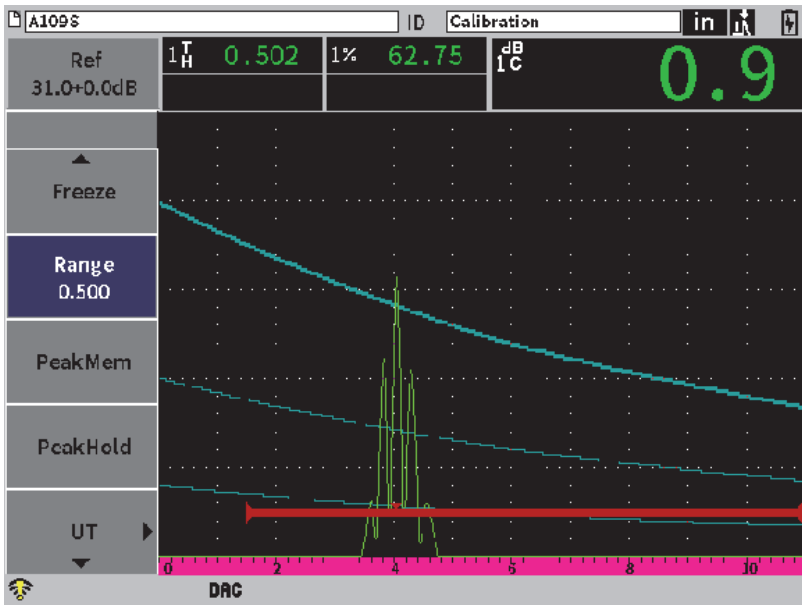


Figure 11-10 A small range DAC

11.3.5 Gain Adjustment Options

The DAC/TCG mode includes three separate types of gain adjustment for each DAC/TCG setup. These gain adjustments allow for better inspection precision, easy manipulation of curves and live peak information, and transfer correction.

11.3.5.1 Scanning Gain

To quickly find and identify potential defects, it is commonly required by code to increase the gain (scanning gain) on the EPOCH 6LT from the reference (calibration) gain for scanning purposes. However, after a potential defect is identified, this gain is usually removed to view the reflector at **Ref** gain level, set at calibration. The DAC/TCG mode is fully capable of adding temporary scanning gain for inspection purposes. This scanning gain only affects the live A-scan and does not adjust the level of the DAC curve(s) set up on screen.

To add temporary scanning gain

1. Open the gain adjustment shortcut menu (see “Gain adjustment shortcut menu” on page 51 for instructions on opening and using the shortcut).
2. Adjust the gain in either coarse or fine increments, or use the **+6 dB** or **−6 dB** buttons to increase or decrease the scanning gain (see Figure 11-11 on page 185).

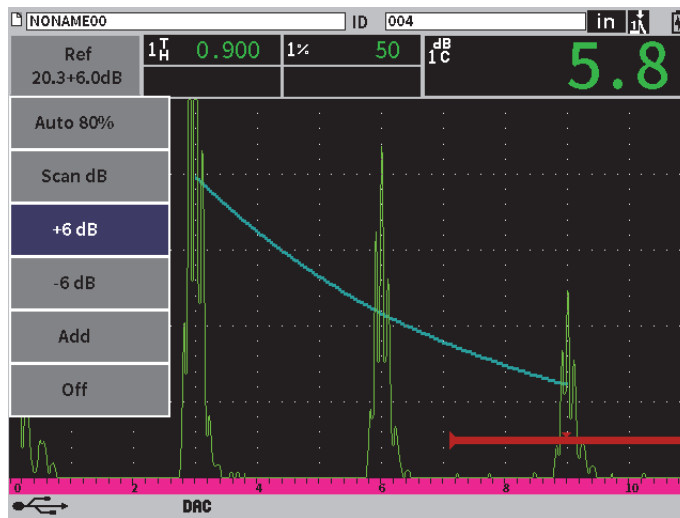


Figure 11-11 Standard DAC with 6 dB scanning gain

3. Use the **Scan dB** button to toggle between the base (reference) gain and the adjusted scanning gain.

For example, select the **+6 dB** button, and then highlight **Scan dB** and press the Enter key to toggle between **+6.0 dB** and **+0.0 dB**.

4. Select the **Off** button to turn the scanning gain off completely.

Figure 11-12 on page 186 shows a **Standard** DAC setup with 6 dB of scanning gain added.

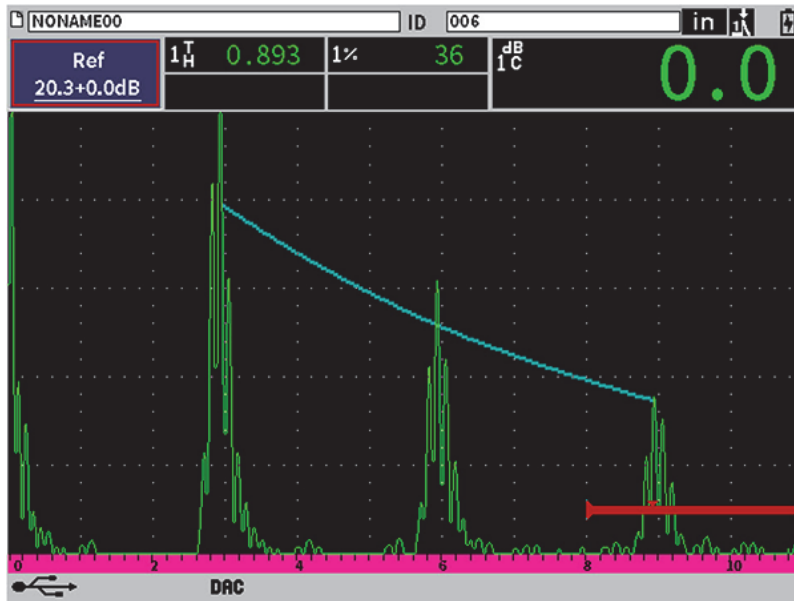


Figure 11-12 Standard DAC with scanning gain off

When reference correction is active, the digital comparison between a captured reflector and the DAC curve is accurate even with the scanning gain applied to the inspection, provided that the gated echo is not saturated. Figure 11-13 on page 187 shows the same setup as above but with reference correction active. Notice that the scanning gain has been removed from the dB-to-curve measurement in the measurement reading 5 box. The instrument compares the echo height to the DAC curve, compensates for the added scanning gain, and reports the true-amplitude comparison.

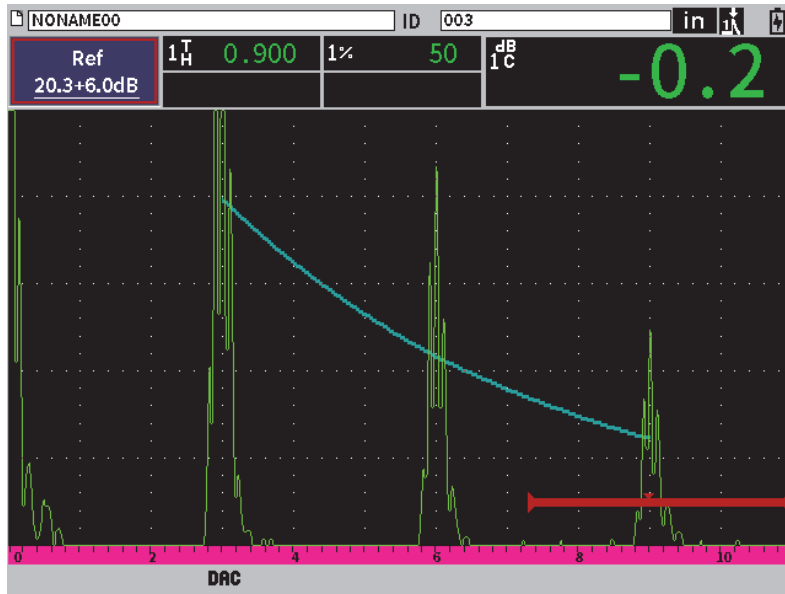


Figure 11-13 DAC with 6 dB scan gain — Reference correction active

11.3.5.2 Curve-Adjustment Gain (DAC Gain or TCG Gain)

The overall gain level of the entire DAC curve and TCG line setup can be adjusted higher or lower from the reference gain (**Ref**). Most inspection codes do not permit reflectors to be sized below 20 % FSH. Therefore, to inspect beyond a certain depth/sound path time within a part, it is necessary to raise the gain of both the live A-scan and the DAC curve to continue the inspection. This is accomplished on the EPOCH 6LT using the curve gain (DAC curve-adjustment gain).

To adjust the curve gain

1. In the **DAC/TCG** submenu, press the Tab key to select **Gain Step**.
2. Turn the adjustment knob to select the desired increment of the gain adjustment.
3. Press the Tab key to highlight **DAC Gain**, and then turn the adjustment knob to adjust the curve gain.

Figure 11-14 on page 188 shows a DAC setup with DAC gain in use to provide accurate echo amplitude measurement by placing the echo close to 80 % FSH.

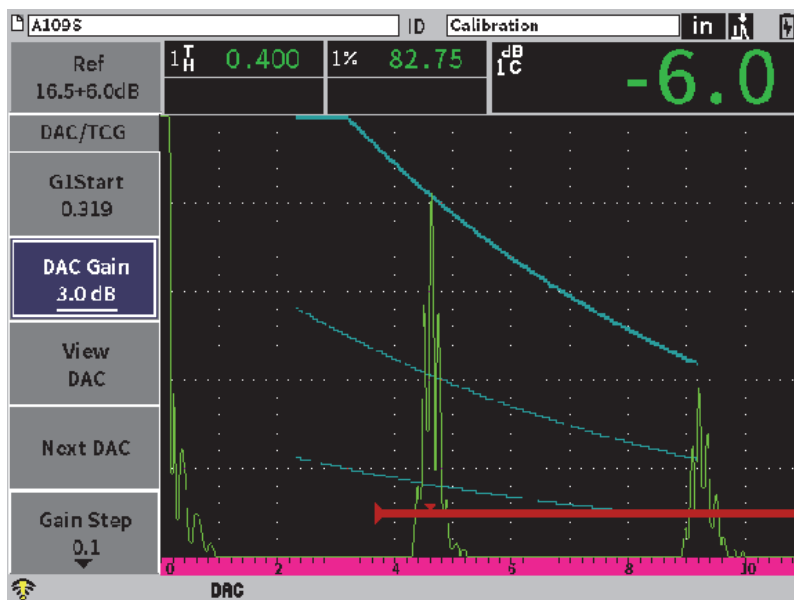


Figure 11-14 DAC curves with adjusted gain

11.3.5.3 Transfer Correction

Transfer correction is an adjustment in the reference gain setting during calibration of the instrument, and it is typically added when the surface conditions of a calibration block and test piece are different. The coupling conditions on the test surface can often cause signal loss after calibrating a DAC curve, which results in inaccurate comparisons of the test reflectors with the calibrated DAC curve. The EPOCH 6LT can be easily adjusted for this potential difference by adding transfer correction to the calibrated base gain after completing the DAC curve setup.

To add transfer correction to a completed DAC curve

1. Highlight the gain adjustment box.
2. Turn the adjustment knob to bring the scanning gain to the desired level for transfer correction.
3. Press the Enter key to open the gain adjustment shortcut menu (see “Gain adjustment shortcut menu” on page 51 for instructions on opening and using the shortcut).

- Turn the adjustment knob to highlight the **Add** button, and then press the Enter key to add the scanning gain to the base gain and to apply the transfer correction.

11.3.6 JIS DAC

The Japanese Industrial Standard (JIS) DAC mode meets the requirements of JIS Z3060. The JIS DAC curve setup is nearly identical to the standard DAC/TCG setup. However, any of the six curves can be used to trigger the alarm when in the JIS DAC mode. Additionally, you can set the alarm to positive or negative.

To select the curve to be used as the alarm reference level

- Activate the DAC/TCG feature (see “Enabling the DAC/TCG Feature” on page 174).
- In the DAC/TCG dialog box, turn the adjustment knob to set the **DAC/TCG Mode** to **JIS** (see Figure 11-15 on page 189).

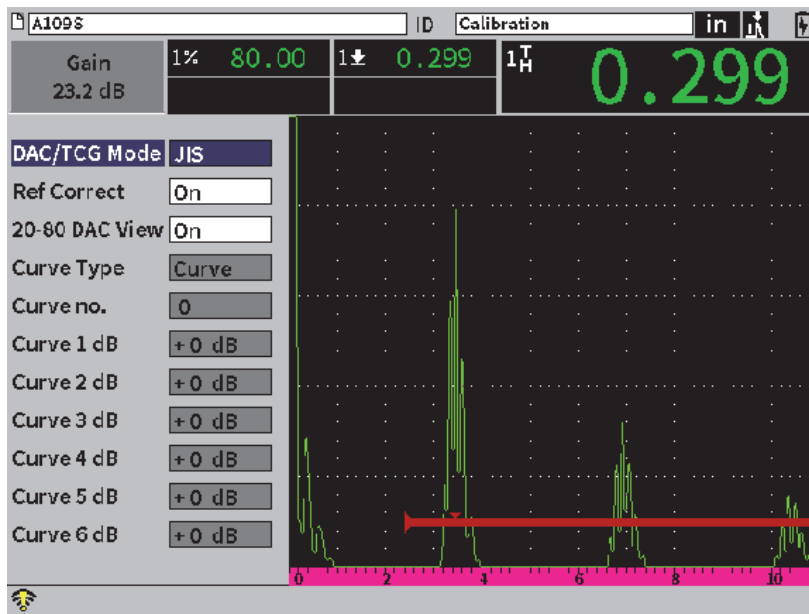


Figure 11-15 JIS mode

- Press the Shift, Tab key sequence to return to the live A-scan display.

4. Adjust the G1 Start value and use the **Add** button to add points and build the desired DAC curve (see Figure 11-16 on page 190).

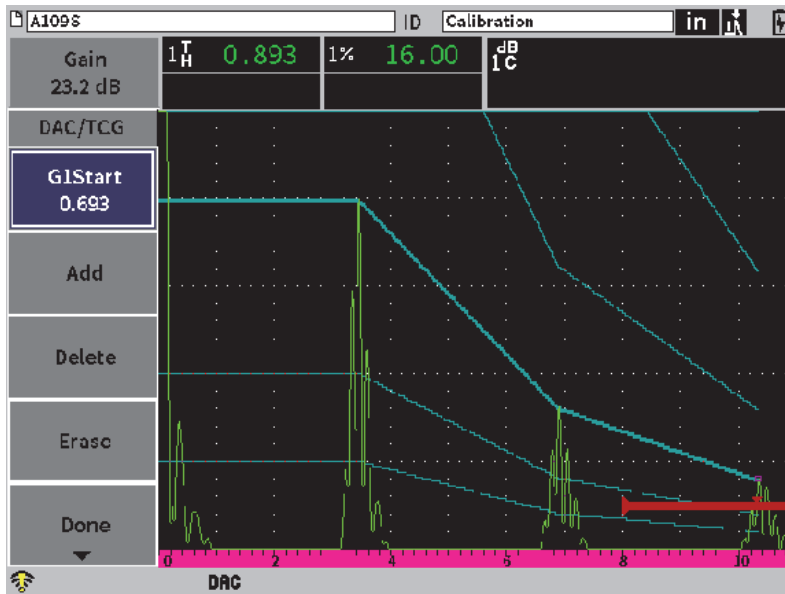


Figure 11-16 JIS curves

5. When the curve is complete, select **Done**, then press the Enter key.
6. Use the adjustment knob to highlight **Next DAC** and press the Enter key to cycle through the available DAC curves.

11.3.7 Custom DAC Curves

The DAC/TCG software option features a DAC curve setup that allows you to define up to six additional reference curves from the primary curve at varying levels from -24 dB to +24 dB. The **Custom** DAC mode option is ideal for unique sizing inspections and procedure development. **Custom** DAC mode also enables you to choose between a straight-line connection or a curved, polynomial connection of each point on the DAC curve to meet various international or customer-specific requirements.

To activate and set up the customized curves

1. Activate the DAC/TCG feature (see “Enabling the DAC/TCG Feature” on page 174).
2. In the DAC/TCG dialog box, turn the adjustment knob to set the **DAC/TCG Mode** to **Custom**.
3. Set the **Curve Type** to either **Curve** or **Straight** (polynomial or straight-line segments).
4. Select the **Curve no.** to be used in addition to the main curve (see Figure 11-17 on page 191).
5. For each warning curve, choose **Curve <1–6> dB**, and set the value compared to the main curve.

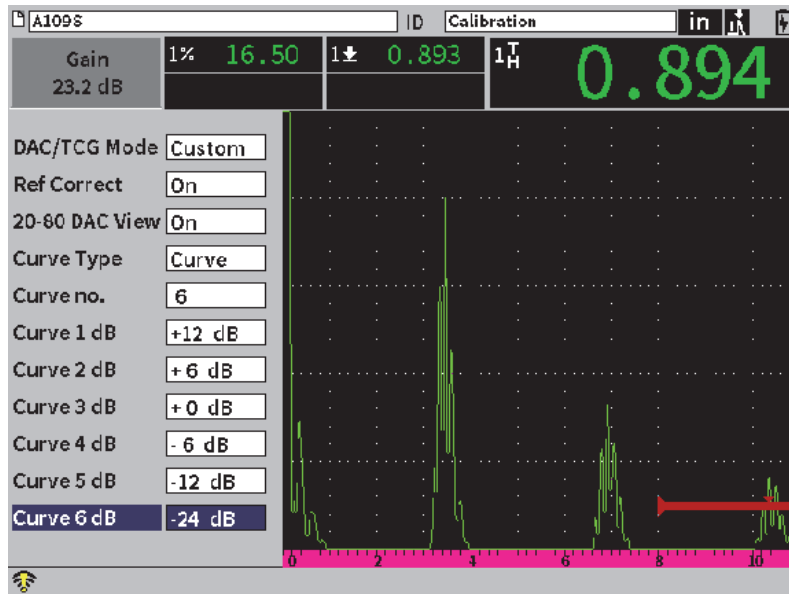


Figure 11-17 Custom DAC setup

The **Custom** DAC setup and functionality are the same as the Standard and ASME III modes discussed earlier in this section. Figure 11-18 on page 192 shows a completed **Custom** DAC setup.

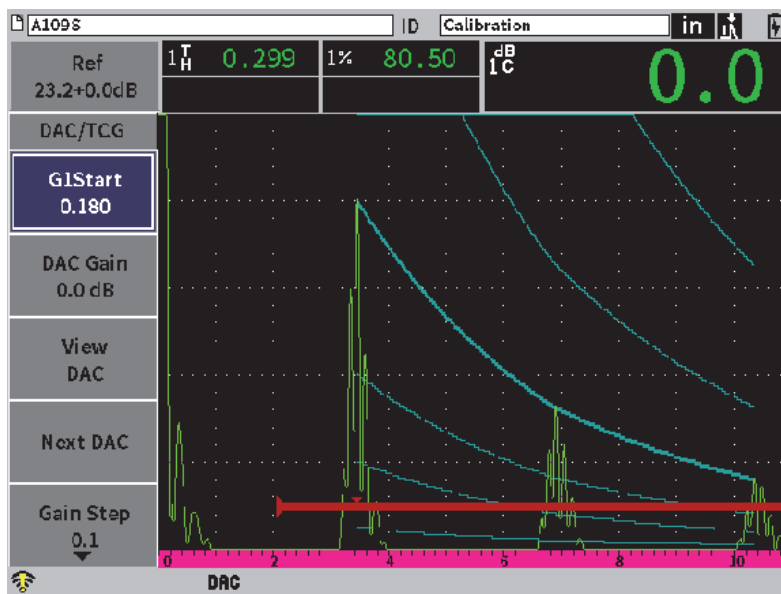


Figure 11-18 Completed Custom DAC

When the customized DAC curve points have been captured and completed, you have full capability to toggle between DAC and TCG views, to manipulate **Range**, **Delay**, **CAL Zero**, and **Angle**, and to add necessary scanning gain, curve gain adjustment or transfer correction. The TCG view of any custom DAC curve includes the user-defined reference curves as well as the primary DAC curve. The **Custom** DAC curve also incorporates the reference correction functionality, if desired.

11.4 DGS/AVG

The DGS/AVG option permits complete DGS/AVG setups to be performed on the instrument. With the onboard DGS/AVG method, you can size defects based on a calculated DGS/AVG curve for a given transducer, material, and reflector size. This method requires that you only have one reference reflector to create a DGS curve for flaw sizing. This is much different than the DAC or TCG method, which requires that you have representative defects at various depths within a part in order to create a curve for flaw sizing.

To setup DGS/AVG curves on the instrument rapidly, Evident has developed a transducer library that is stored in the instrument's memory. This library contains the entire Atlas Series European specification conventional transducers as well as several other transducers that are commonly used by inspectors. The library includes three categories:

- **Straight Beam** contact (includes protected face)
- **Angle Beam** transducers
- **Dual Probe** transducers

All required data for building DGS/AVG curves is stored in the instrument memory for each transducer in the library. If you want to use a probe that is not in the default library, you can enter the required transducer characteristics in the GageView Pro computer interface program and download them to the EPOCH 6LT. Probes that are downloaded to the instrument appear in the custom transducers section of the transducer library.

The onboard DGS/AVG option provides you with rapid setup times and easy flaw-size evaluation. This software option has been designed to meet ISO 16811:2014 requirements. It is extremely important that you be familiar with this specification and others, and be qualified according to local standards to properly use this instrument function. Since the calculations for curves used in defect sizing are based on many variables, a proper instrument setup is required for accurate results.

11.4.1 Enabling the DGS/AVG Option

Before you enable the DGS/AVG option, the instrument must be properly calibrated to the material being inspected (see "Calibration" on page 109).

To enable the DGS/AVG option

1. On the setup menu, select the **Sizing** icon () to display the **Sizing** submenu (see "Setup Mode" on page 37 for details on icons and submenus).
2. Select the **DGS** icon () to open the DGS/AVG dialog box (see Figure 11-19 on page 194). See "Navigating Dialog Boxes and Setup Pages" on page 39 for details on using dialog boxes.

DGS/AVG	On	
Probe Type	Straight Beam	
Name	CN4R-10	
Refl. Type	SDH	
Refl. Dia.	0.100	IN
Delta VT	0.0	dB
Reg Level	0.125	IN
Warning 1	-6.0	dB
Warning 2	-12.0	dB
Warning 3	0.0	dB
ACV Spec.	0.0	dB/IN
ACV Cal.	0.0	dB/IN

Figure 11-19 DGS/AVG dialog box

3. Press the Enter key to highlight the **DGS/AVG** parameter box.
4. Turn the adjustment knob to set the **DGS/AVG Mode** to **On**.

The **DGS/AVG** dialog box enables you to define the exact probe being used for the inspection, and to set up the DGS/AVG curve to be drawn. The adjustments that can be made are as follows:

— **Probe Type**

Selects the type of probe to be used (**Straight Beam**, **Angle Beam**, or **Dual Probe**).

— **Name**

Selects the actual probe to be used.

— **Refl. Type**

Defines the type of reflector to be used to acquire a reference indication to build the DGS/AVG curve. For straight beam and dual probes, the available reflectors are as follows:

- Back wall
- Side-drilled hole (SDH)
- Flat-bottom hole (FBH)

For angle beam probes, the available reflectors are as follows:

- Side-drilled hole (SDH)
- K1-IIW block arc
- K2-DSC block
- Flat-bottom hole (FBH)

— **Refl. Dia.**

Used for angle beam inspections only. This allows you to define the diameter of the flat-bottom hole (FBH) or side-drilled hole (SDH) used as a reference reflector. This size is required to properly position the DGS/AVG curve.

— **DeltaVT**

Transfer correction value used to compensate for amplitude differences as a result of coupling variation (surface condition) from the calibration block to the test piece. EN 583-2:2001 provides methods for calculating transfer correction.

— **Reg. Level**

The height of the main DGS/AVG curve. The curve represents the amplitude from a flat-bottom hole with a diameter of the registration level at different depths. This is usually equal to the critical flaw size for the application.

— **Warning 1, 2, 3**

These are the positions of up to three secondary DGS/AVG “warning” curves compared to the position of the main DGS/AVG curve. If any of these values is set to zero, the warning curve is turned off.

— **ACV Spec**

This is the attenuation value in dB/m for the test piece (specimen). In some cases, it is necessary to calculate the relative attenuation within the test piece and enter the value here.

— **ACV Cal**

This is the attenuation value in dB/m for the calibration block. In some cases, it is necessary to calculate the relative attenuation within the calibration block and enter the value here.

5. When you have completed the selections in the DGS/AVG dialog box, press the Shift, Tab key sequence to display the **DGS/AVG** submenu on the live A-scan display.

To complete the DGS/AVG curve setup

1. Couple the transducer to the calibration block and obtain a reflection from the selected reference reflector.

2. Press the Enter key, and then turn the adjustment knob to adjust the **G1Start** until the gate is over the reference indication.
3. Press the Tab key to highlight the **Auto 80%** button.
4. Press the Enter key to bring the reference reflector to 80 % FSH.
5. Press the Tab key to select **Ref**, and then press Enter to capture the reference reflector and build the DGS/AVG curve.



Figure 11-20 Reference reflector before capture

After capturing the reference reflector, the EPOCH 6LT automatically calculates the DGS/AVG curve(s) and displays them at the correct registration level amplitude on the screen (see Figure 11-21 on page 197).

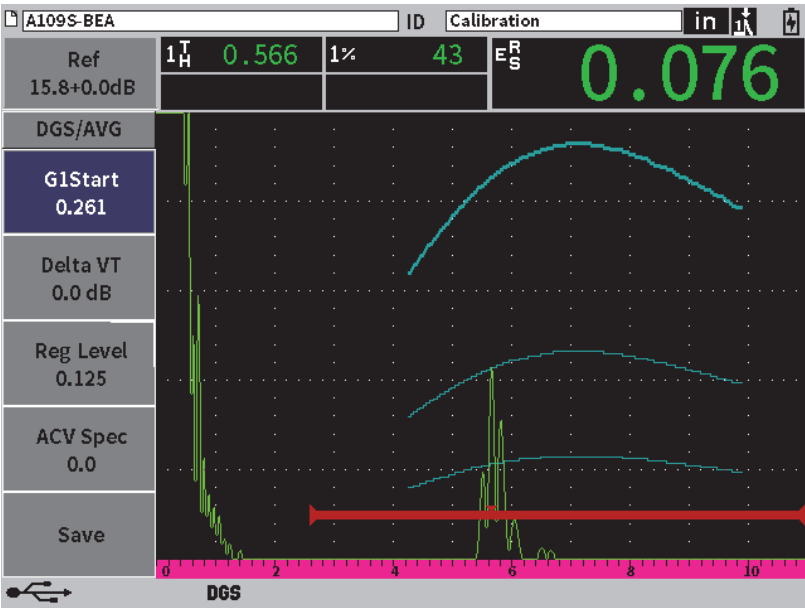


Figure 11-21 DGS/AVG curves on the screen

11.4.2 Curve-Adjustment Options

After a DGS/AVG curve has been calculated on the EPOCH 6LT, you can make adjustments to that curve during an inspection. These adjustments include gain adjustments allowing proper defect scanning and code-compliant defect sizing, as well as reference-reflector adjustments.

11.4.3 Transfer Correction

Transfer correction is an adjustment in the reference gain setting during calibration of the instrument. It is typically added when the surface conditions of a calibration block and test piece are different. The coupling conditions on the test surface can often cause signal loss after calibrating a DGS/AVG curve, which results in inaccurate comparisons of the test reflectors with the calibrated DGS/AVG curve. The EPOCH 6LT allows you to adjust for this difference by adding transfer correction to the calibrated base gain after completing the DGS/AVG curve setup.

The transfer correction can be added during initial setup of the DGS/AVG curve (**DeltaVt** value), but typically this factor is unknown until after the setup is completed.

To add transfer correction to a completed DGS/AVG curve

1. On the DGS/AVG submenu, press the Tab key to select **Delta VT** (see Figure 11-21 on page 197).
2. Turn the adjustment knob, and then press the Enter key to set the value of the transfer correction.
3. Press the ESC key.

NOTE

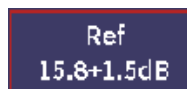
When you adjust the transfer correction, the curve height should remain constant, and the echo height should change.

11.4.4 DGS/AVG Curve Gain

The overall gain level of the entire DGS/AVG curve can be adjusted higher or lower than the reference gain. Most inspection codes do not permit reflectors to be sized below 20 % FSH. Therefore, to inspect beyond a certain depth/sound path time within a part, it is necessary to raise the gain of both the live A-scan and the DGS/AVG curve to continue the inspection. This is accomplished on the EPOCH 6LT using the DGS/AVG curve-adjustment gain.

To adjust the DGS/AVG curve gain

1. Press the Tab key to highlight the reference gain (Ref) adjustment box (see Figure 11-22 on page 198).
2. Turn the adjustment knob to adjust the curve gain.
The curve-gain difference is added to or subtracted from the instrument base (reference) gain.



Ref
15.8+1.5dB

Figure 11-22 (Ref) Gain adjustment box

NOTE

DGS/AVG curve gain adjustments are applied to both the echo height and curve height to maintain the amplitude ratio and, therefore, the sizing comparisons.

Figure 11-23 on page 199 shows a DGS/AVG setup with curve gain in use to provide accurate echo-amplitude measurement by placing the echo close to 80 % FSH.

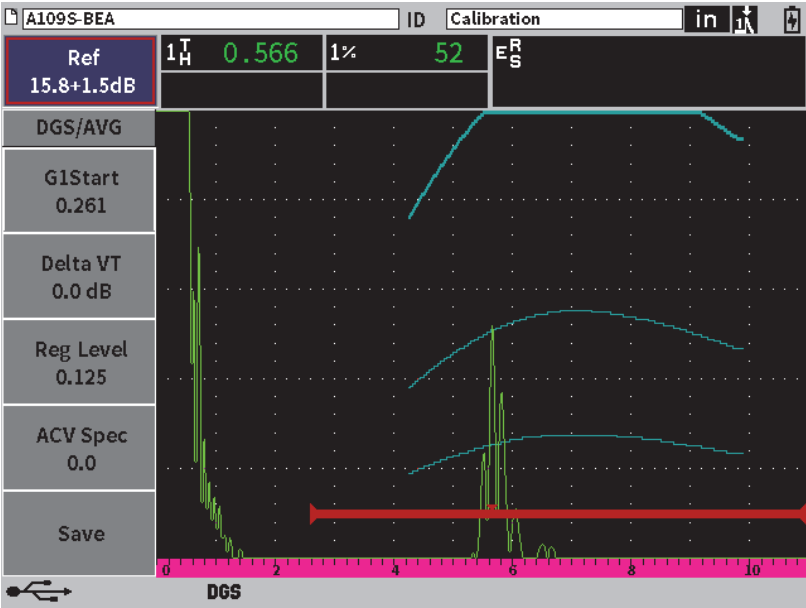


Figure 11-23 Gain curve adjusted DGS

11.4.5 Registration Level Adjustment

The registration level of the DGS/AVG curve defines the height of the main curve. The curve height represents the amplitude from a flat-bottom hole with a diameter of the registration level at different depths. This is usually equal to the critical flaw size for the application. The EPOCH 6LT allows you to adjust this registration level during a live inspection.

NOTE

This curve-height adjustment is possible because the DGS/AVG curves are calculated based on a captured reference reflector and mathematical probe data. This allows the EPOCH 6LT to plot the attenuation curve (in steel) for a particular reflector size without having to acquire individual data points, as is required in a DAC/TCG setup. This is one of the key advantages of the DGS/AVG sizing technique over the DAC/TCG sizing technique.

To adjust the registration level

1. Open the **DGS/AVG** submenu, and then press the Tab key to select **Reg Level**.
2. Turn the adjustment knob, and then press the Enter key to adjust the current registration-level value.

11.4.6 Relative Attenuation Measurement

There are several methods for measuring the ultrasonic attenuation within a material. Often the procedure measures absolute attenuation in a material. This usually requires an immersion test setup and a time-consuming set of measurements. For the purpose of flaw sizing with the DGS/AVG method, it might be suitable in many cases to measure relative attenuation in the test piece or calibration block as needed. This section outlines one simple method of relative attenuation measurement, which is generally effective. There may be a more suitable method available. You must decide the most appropriate method to arrive at the values for ACV Specimen and ACV Cal Block based on the application and local requirements.

Measurements:

ΔVg = Gain difference between two successive back wall echoes (d and 2d)

ΔVe = Gain difference on back wall curve from d to 2d

Calculations:

$$\Delta Vs = \Delta Vg - \Delta Ve \text{ [dB]}$$

Sound attenuation coefficient:

$$\alpha = \Delta V_s / 2d * 1000 \text{ [dB/m]}$$

11.5 AWS D1.1/D1.5 Weld Rating Software

The AWS D1.1 software feature for the EPOCH 6LT has been created to assist you in performing inspections covered under the American Welding Society D1.1 (or D1.5) Structural Welding code for steel. This code provides inspectors with a method to classify discontinuities found in welds using ultrasonic inspection. This code uses the following formula to develop an indication rating for a reflector found during an inspection:

$$A - B - C = D$$

where:

A = Discontinuity indication level (dB)

B = Reference indication level (dB)

C = Attenuation factor: $2 * (\text{sound path} - 25.4 \text{ mm})$ (dB)

D = Indication rating (dB)

The AWS D1.1 inspector must take the indication rating (D) that is calculated based on A, B, and C to an “Ultrasonic Acceptance — Rejection Criteria” table produced by the AWS in order to classify the severity of the discontinuity that has been located. As an inspection is performed, you are required to develop an AWS report that lists the values for all variables listed above as well as transducer information, discontinuity length and location, and your overall evaluation of the discontinuity.

For further details regarding the test equipment, methods, interpretation, and classification requirements for these inspections, refer to the AWS D1.1 Code Book.

The goal of the AWS D1.1 software feature is to simplify inspector tasks and lower the overall inspection time. The EPOCH 6LT does this by automatically performing required calculations. It also enables the inspector to document discontinuities in the data logger for reporting purposes.

The EPOCH 6LT can transfer inspection data to your PC through the GageView Pro software to aid in report generation. GageView Pro enables you to view the instrument’s setup parameters, the waveform generated by a discontinuity, the sound path and location information of the discontinuity, and all values for the AWS D1.1 formula variables.

11.5.1 Enabling the AWS D1.1 Option

The first step in operating the EPOCH 6LT for AWS D1.1 inspections is to calibrate the instrument for the transducer and test conditions. For information on the angle beam calibration of the EPOCH 6LT, see “Calibration” on page 109, or follow the appropriate guidelines from the American Welding Society.

To enable the AWS D1.1 option

1. On the setup menu, select the **Sizing** icon () to open the **Sizing** submenu (see “Setup Mode” on page 37 for details on icons and submenus).
2. Select the **AWS** icon () to open the AWS dialog box (see Figure 11-24 on page 202). See “Navigating Dialog Boxes and Setup Pages” on page 39 for details on using dialog boxes.
3. Press the Enter key to highlight the **AWS** parameter box.
4. Turn the adjustment knob to set the **AWS** mode to **On**.

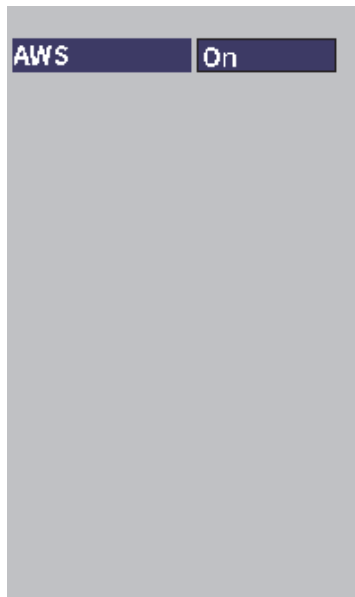


Figure 11-24 AWS dialog box

5. Press the ESC key to close the **AWS** dialog box and display the **AWS** menu in inspection mode.
6. Press the Enter key to select **G1Start**, and then turn the adjustment knob to center gate 1 over the echo.
7. Press the Tab key to highlight **Ref Level**, and then set the level to what you desire (default value is 50 %)

The EPOCH 6LT enables you to define the reference level to adhere to best practices and procedures. The reference reflector is often a side-drilled hole in the calibration block used for the angle beam calibration. Other reference reflectors can be used provided that they meet AWS requirements for these inspections.

8. Press the Tab key to highlight **Auto XX%** (default value is 50 %), and then press the Enter key (see Figure 11-25 on page 203).

NOTE

In AWS mode, the **Ref Level** value determines the actual **Auto XX%** value.

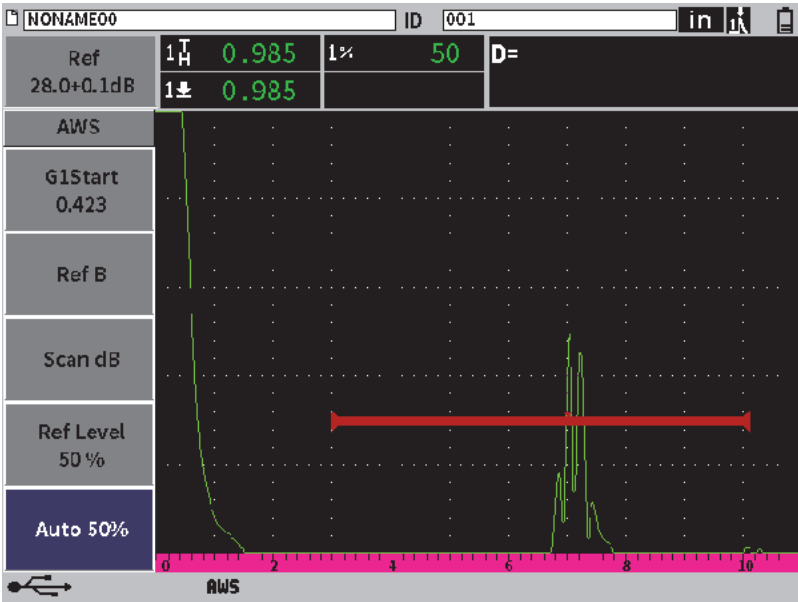


Figure 11-25 Active AWS with a Ref Level of 50 %

9. Press the Tab key to highlight **Ref B**, and then press Enter to set a **Ref B** value to begin the AWS inspection (see Figure 11-26 on page 204).
10. Press Enter again to store the **Ref B** value.

The **Ref B** value represents the gain level necessary to bring the echo from a reference reflector to a user defined full-screen height (FSH).

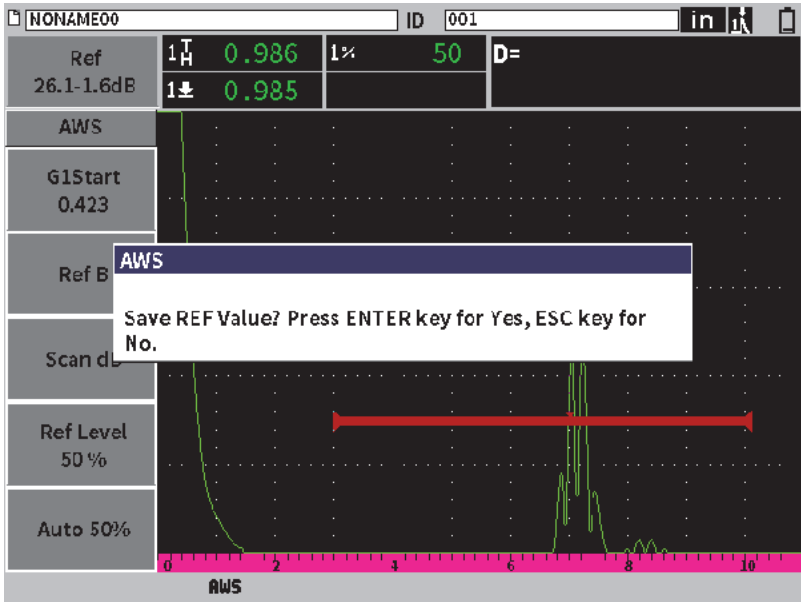


Figure 11-26 AWS Ref B value dialog box

After the **Ref B** value is stored, the instrument displays a live D rating of any gated indication (see Figure 11-27 on page 205). This live D value, which represents the defect indication rating used with the published “AWS Acceptance - Rejection Criteria” tables, can be viewed in measurement reading box five (by default). You can set this measurement reading to display in any of the five boxes. For details on viewing and changing the measurement display setup, see “Measurement Setup Page” on page 64.

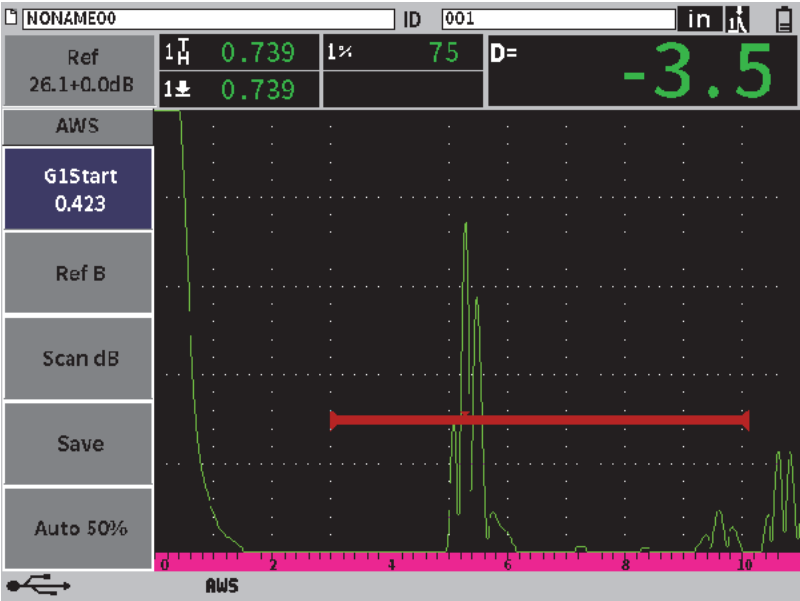


Figure 11-27 Active AWS with D rating

11.5.2 Scanning Gain

AWS codes require that you apply a certain amount of scanning gain to the **Ref B** gain value. This allows you to locate flaws that might be smaller or deeper in the test piece than the reference flaw.

To add scanning gain

- ◆ Use the **Gain** adjustment box to adjust the gain as necessary (see “Adjusting the Gain (System Sensitivity)” on page 79 for instructions on using the **Gain** adjustment box).

NOTE

To display a D indication rating value, the gated echo must peak at an amplitude less than 110 % FSH (full-screen height). You may need to turn off the scanning gain, and even make further gain adjustments, to bring the echo peak on screen.

11.5.3 Calculating A and C Values

When a gated echo whose peak is below 100 % FSH is present, the EPOCH 6LT automatically calculates the A and C values necessary to provide a D indication rating value. For the A value, the EPOCH 6LT automatically calculates the required dB value to bring the gated echo to reference height. To calculate C, the EPOCH 6LT uses the data in the sound path calculator to generate an attenuation factor.

NOTE

For this calculation to be accurate, you must enter the correct thickness for the test piece.

You can save the data for this discontinuity in the EPOCH 6LT data logger. For general data logger information, see “Data Logger” on page 121.

At the bottom of an ID saved with the AWS D1.1 feature activated, you can see the values for A, B, C, and D. This data can be viewed in the file review window.

You can also choose to see live A, B, and C values displayed in the reading measurement boxes at the top of the screen.

NOTE

While using the EPOCH 6LT and the AWS D1.1 software feature, you must account for any inspection conditions that could cause variations in the displayed indication rating (D value), and properly interpret the meaning of echo indications and reported D values corresponding to these indications.

11.6 Back Wall Echo Attenuator

The back wall echo attenuator (BEA) option enables you to apply an independent gain level to the A-scan defined by the gate 2 start position and width. Using the BEA, you can reduce the amplitude of the back wall echo when high gain levels are used to find small flaws.

The BEA option is commonly used with two specific forms of inspection:

- The first is an inspection where potential defects may not be oriented parallel to the direction of sound from the transducer. Sound will still reflect from these defects, but the reflection may be directed away from the transducer. In this situation, little or no signal is returned to the instrument for direct measurement. Generally, these defects are instead detected by monitoring for back wall signal loss or attenuation. This back wall amplitude change can be missed entirely if the back wall signal is saturated. The BEA allows you to monitor the back wall for any signal loss at a lower gain setting, while still scanning the remainder of the test piece at a high gain level for small defects.
- The second is an inspection for porosity. Porosity tends to scatter sound instead of returning a clear echo. In this situation, back wall amplitude may be the only way to positively differentiate porosity from material grain structure. The BEA is used to display the entire back wall signal on the screen so that it can be closely monitored.

Both inspection forms are useful when detecting very small defects.

11.6.1 Enabling the BEA Option

The BEA is enabled in the **Gate2** dialog box.

To enable the BEA

1. On the setup menu, turn the adjustment knob to select the **Gate2** icon ()². See “Setup Mode” on page 37 for details on opening the setup menu.
2. Press the Enter key to open the gate 2 dialog box.
3. Press the Enter key and turn the adjustment knob to set the **G2 Status** to **BEA** (see Figure 11-28 on page 208).

When the BEA is activated, gate 2 is on and displayed in its previous position.

G2 Status	BEA
G2 Start	1.494
G2 Width	0.574
G2 Level	20
G2 Alarm	Off
G2 Min Depth	1.494
G2 Mode	Peak
G2 %Amp	High Peak
G2 AFreeze	Off
G2 RF	Dual
G2 Tracks	Off
G2 BEA Gain	8.8
G2 Zoom	Off

Figure 11-28 Activating the BEA

11.6.2 Operating the BEA

The BEA option displays an independent back wall gain in the **G2 BEA Gain** parameter of the gate 2 dialog box. This control replaces the **G2 Min Depth** parameter while BEA is active. This gain is applied within the screen range of gate 2.

Initially, this base gain level is activated to show the same gain level as the primary gain control. If the primary gain control consists of a reference gain setting and scanning dB, the base gain level of the BEA will be the sum of the reference and scanning gain levels. You can adjust the BEA gain independently to suppress the back wall echo. Measurements and alarms under gate 2 are based on the attenuated echo.

To adjust back wall gain

1. In the gate 2 dialog box, press the Tab key to select **G2 BEA Gain** (see Figure 11-29 on page 209).
2. Turn the adjustment knob to set the gain.
3. Press the Tab key, turn the adjustment knob, and press the Enter key to select and adjust the **G2 Start**, **G2 Width**, and **G2 Level** parameters to change the BEA gate position.

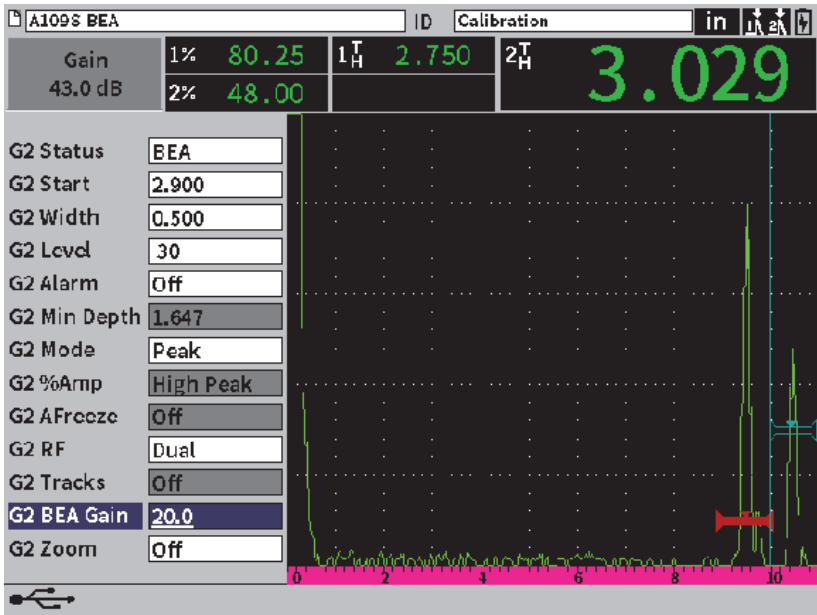


Figure 11-29 Adjusting back wall gain

4. Use Tab key and adjustment knob to set **G2 Zoom** to **On** to expand the signal display while adjusting parameters.

When BEA is active, gate 2 can be positioned anywhere on the visible screen range, to the extent of overlapping gate 1.

11.7 Corrosion Module

The EPOCH 6LT corrosion module provides a rapid and simple solution for flaw detector users to perform basic corrosion inspections. This feature simplifies instrument operation for corrosion applications, reduces set up time, and enables more efficient data collection. The corrosion module leverages many of the inspection features used in dedicated corrosion thickness gages while maintaining a close connection to standard flaw detector operation.

Once an Evident thickness gage dual transducer has been connected, the EPOCH 6LT uses center-pin transducer ID technology to identify the connected transducer. Then it automatically adjusts the pulser and receiver settings to optimize the ultrasonic setup. The EPOCH 6LT also automatically adjusts measurement thresholds and gain to allow immediate thickness measurements with minimal operator intervention.

11.7.1 Key Features

Several key features included in the EPOCH 6LT corrosion module vary from standard flaw detector operation.

- Automatic Do-Zero

Automatic do-zero corrects for internal electronic delays, cabling delays and transducer delays to the end of the delay line. Automatic do-zero calculates the zero offset of the system by measuring the time-of-flight of sound through the end of the delay line material of the connected dual probe. The EPOCH 6LT uses two pulsing channels to calculate the zero offset for each transducer element and delay line. While this measurement does not correct for couplant variation or surface conditions of the test piece, it calculates the majority of the zero offset value required for accurate material measurements before you couple the transducer to the test piece.

- Thickness Gage Measurement Algorithm

The corrosion module uses the measurement algorithm developed for the 38DL Plus ultrasonic thickness gage. This measurement mode, unlike peak, edge, or first peak mode, uses positive and negative minimum measurement thresholds to make the measurement. In this way, the measurement is less affected by variations in amplitude—a major source of inaccuracy in traditional flaw detection corrosion applications. To ensure prominent echoes are correctly measured, automatic gain control (AGC) is used to maintain dynamically optimized amplification of the A-scan.

- Automatic Gain Control

Automatic gain control (AGC) enables the EPOCH 6LT to acquire consistent measurements. AGC continuously optimizes the first detected echo to maintain a consistent echo height and shape by adjusting the gain level of the system to a predetermined screen height based on the selected probe.

- V-Path Correction

The EPOCH 6LT corrosion module includes V-path correction for all dual probes in its standard probe library. Dual transducers are typically constructed with a small angle of incidence in both the transmit and receive elements, known as the “roof angle.” Because of the roof angle, sound is introduced to a test piece at a

small refracted angle. Therefore, the actual depth of a given reflector is slightly smaller than the measured depth unless the measurement includes a correction (V-path correction) for this roof angle.

- Grid View

Grid view simplifies the reporting process by enabling the user to save thickness readings into a customizable grid (see Figure 11-30 on page 211). See “Grid View” on page 150.

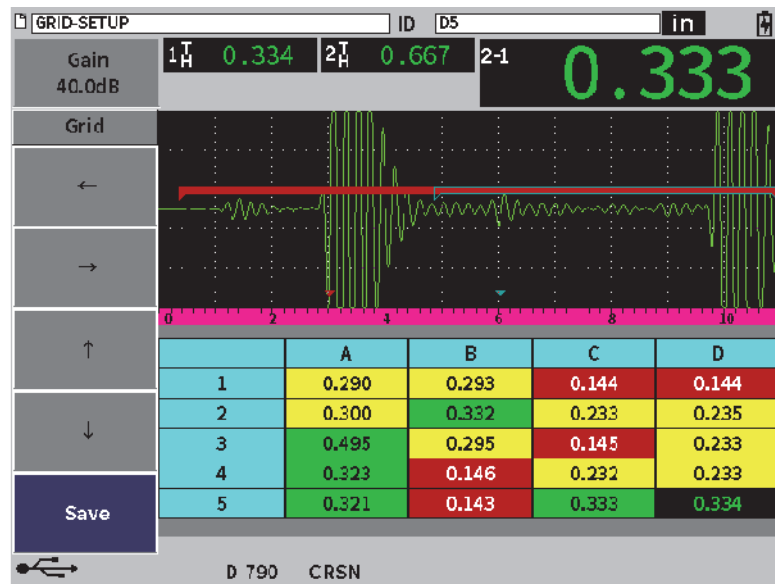


Figure 11-30 Corrosion module grid view

11.7.2 Corrosion Module Modes

The EPOCH 6LT ultrasonic flaw detector corrosion module uses two modes of operation: scanning (flaw detector, or FD) mode and precision (corrosion, or CRSN) mode. You can easily switch between measurement modes. When the corrosion module is active the current mode is indicated in the message bar, and some features are not available, including the Pulser, Angle, Sizing menus, and receiver filters.

11.7.2.1 Scanning (FD) Mode

Scanning (flaw detector) mode enables you to scan for corrosion, and detect and size corrosion-related defects. Scanning mode has the following attributes:

- A 60 Hz screen update rate
- Fully adjustable measurement gates
- Flaw detector gate measurement modes
- Traditional flaw detector gain linearity
- Supports automatic probe recognition for efficient instrument configuration.

Scanning Mode is similar to standard instrument operation, except that the measurement boxes are fixed to more limited selections applicable to corrosion measurement.

Scanning Mode Screen

The EPOCH 6LT screen in scanning mode is similar to the standard flaw detector screen. The current mode and connected transducer are indicated in the message bar at the bottom of the screen (see Figure 11-31 on page 212).



Figure 11-31 Scanning mode screen

11.7.2.2 Precision (CRSN) Mode

Precision (corrosion) mode enables you to record precise spot measurements of the remaining part thickness and evaluate areas of corrosion located during scanning. Precision mode utilizes the thickness gage measurement algorithm, V-path correction and do-zero for precise thickness measurements using dual element transducers. Automatic gain control (AGC) helps to ensure consistent measurements. Grid view can save readings and simplify the reporting process (see “Grid View” on page 150).

Precision Mode Screen

The EPOCH 6LT screen in precision mode has a modified screen layout compared to the standard flaw detector screen. Some flaw detector functions are limited or unavailable when the instrument is in precision mode (see Figure 11-32 on page 213).

- **Measurement Region**
Defined by the gate at the top of the A-scan.
- **Measurement Indicator**
The triangle along the bottom of the A-scan to indicate the point at which the measurement is being acquired.

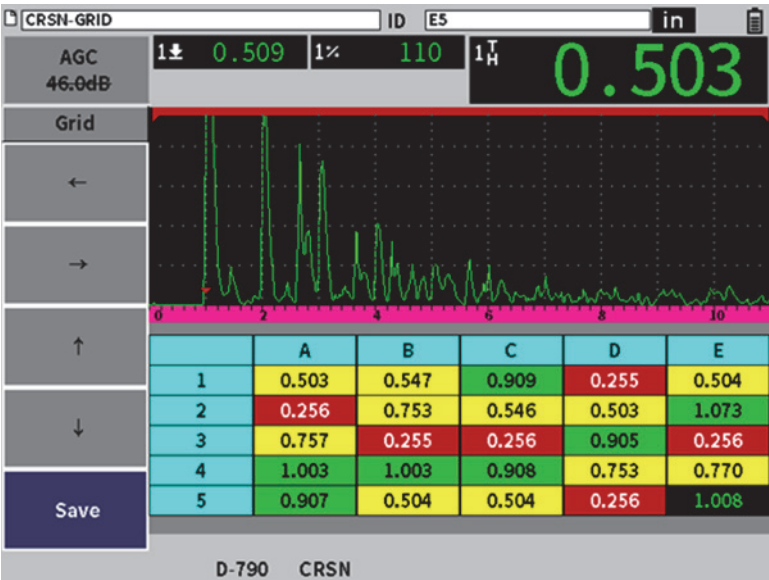


Figure 11-32 Precision mode screen

- Gate Control

Gate 1 and 2 parameter adjustments are limited to gate start. Because the precision mode measurement algorithm is not dependent on gate level, the gates are fixed at the top of the A-scan. G1 Start acts as a blanking function to help detect valid echoes when material conditions generate unwanted signals.

- Grid View

When grid view is active, the grid displays in precision mode, and navigation arrows are located in the sidebar menu.

11.7.3 Corrosion Module Activation and Setup

If an Evident thickness gage dual transducer is connected to the instrument when the corrosion module is first activated, the transducer parameters load automatically, and the identified transducer is indicated at the bottom of the screen.

If an Evident thickness gage dual transducer is *not* connected to the instrument when the corrosion module is first activated, the Transducer Setup page is displayed. With this page, you select the dual transducer you want to use for the inspection. Then the key parameters for the transducers are loaded with default values.

To activate the Corrosion Module

1. Connect an appropriate transducer to the EPOCH 6LT.

If an Evident thickness gage dual transducer is connected to the EPOCH 6LT, a dialog box will prompt you to press the Enter key to continue (see Figure 11-33 on page 214).

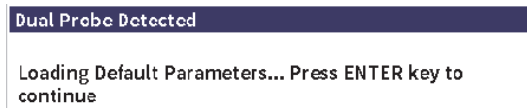


Figure 11-33 Probe detected dialog box

2. On the setup menu, select the **Tools** icon () to open the **Tools** submenu (see “Setup Mode” on page 37 for details on icons and submenus).

3. Select the **Corrosn** icon () to open the **Corrosion** dialog box (see Figure 11-24 on page 202). See “Navigating Dialog Boxes and Setup Pages” on page 39 for details on using dialog boxes.

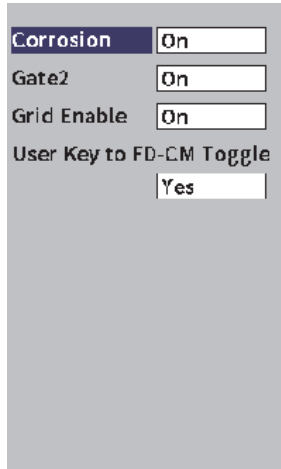


Figure 11-34 Corrosion dialog box

4. Press the Enter key to highlight the **Corrosion** parameter box.
5. Turn the adjustment knob to set **Corrosion** mode to **On**.
6. Set **Gate2** and **Grid Enable** to **On**.
7. Set **User Key to FD-CM Toggle** to **Yes** if needed
8. Press ESC twice to finish the activation and exit to Precision Mode.
9. If using a transducer without the center pin, select a probe on the **Transducer Setup** page after activating the Corrosion Module (see Figure 11-33 on page 214).

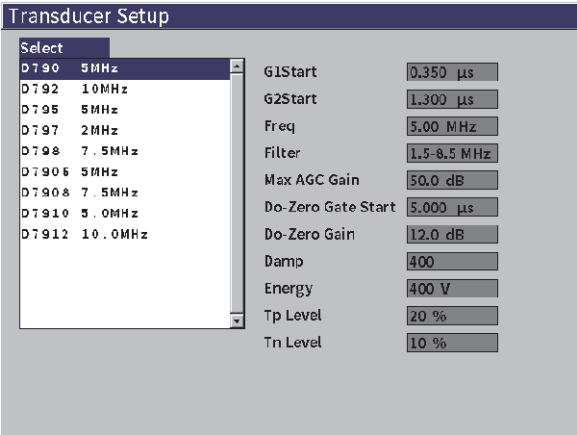


Figure 11-35 Transducer Setup page

10. Press ESC twice to dismiss the **Transducer Setup** page and display the **Do-Zero** dialog box (see Figure 11-36 on page 216).

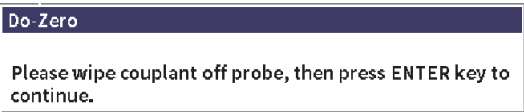


Figure 11-36 Do-Zero dialog box

11. Press the Enter key to perform a Do-Zero and begin the calibration.

11.7.3.1 Improving Measurement Accuracy

The combination of default settings from the automatic probe recognition and the do-zero function enable you to immediately begin measuring with a reasonable amount of accuracy.

You can improve upon the do-zero measurement accuracy by performing a straight beam thickness calibration while the corrosion module is active. For best results, Evident recommends that you perform a separate calibration in both modes

(precision and scanning), as each mode uses a separate set of calibration data. Also, the calibration must be performed using an Evident thickness gage dual transducer. See “Calibration” on page 109 for instructions on performing a thickness calibration.

11.7.3.2 Basic Measurement Adjustments

Common basic adjustments in both the scanning mode and the precision mode include rectification and manual gain adjustment. The precision mode also incorporates extended blanking control.

- **Rectification**

All rectification views are available in the corrosion module, including full wave and RF (the most common selections).

- **Gain Adjustment**

Gain is adjusted manually in scanning mode. Automatic gain control (AGC) is the default (and recommended) in precision mode, but some applications may require manual gain adjustment while in precision mode to achieve optimal results. Often this requirement is related to transducer sensitivity. If the transducer sensitivity is low, the default initial gain for the transducer may not be sufficient to allow measurements while AGC is on. If the transducer is overly sensitive, or the test material is highly transmissive, the default initial gain may be too great and result in amplified noise or cross talk, causing incorrect measurements.

- **Extended Blanking Control**

Based on the material and (or) the transducer, the corrosion module detection algorithm may incorrectly trigger measurements from a signal before the first back wall. This signal can be caused by surface conditions, transducer cross talk, or other factors. If a measurement is incorrectly triggered (see Figure 11-37 on page 218), you can adjust the start position of the measurement window.



Figure 11-37 Incorrectly triggered measurement

To manually adjust the gain in precision mode

1. In the precision corrosion mode sidebar menu, press the Tab key to select the **ACG** menu item.
2. Turn the adjustment knob to set **AGC** to **Off** (see Figure 11-38 on page 219).

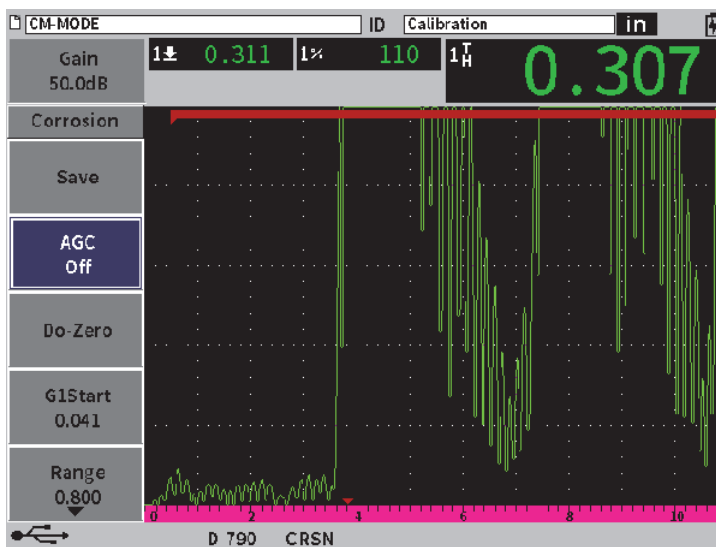


Figure 11-38 AGC Off in precision mode

3. Select **Gain** and turn the adjustment knob to adjust the gain value (see Figure 11-39 on page 220).

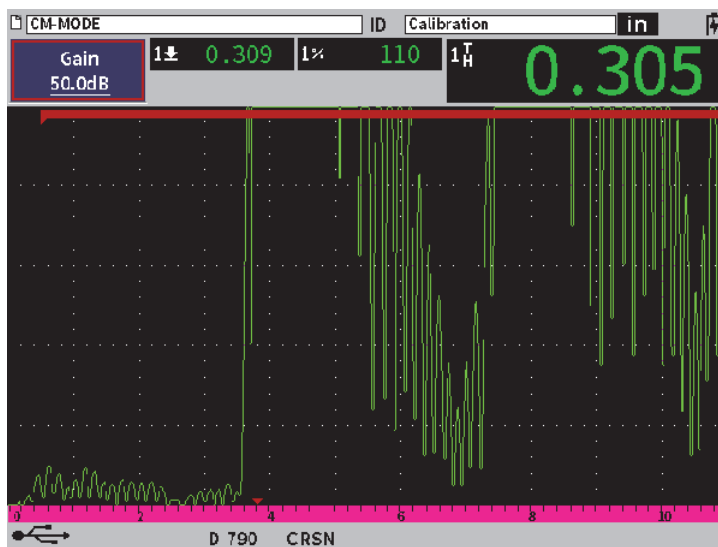


Figure 11-39 Adjust gain value in precision mode

To control extended blanking (gate 1 start position)

- ◆ Select **G1Start** from the Sidebar menu and turn the adjustment knob to increase or decrease the gate 1 start position until the measurement is correctly triggered (see Figure 11-40 on page 221).

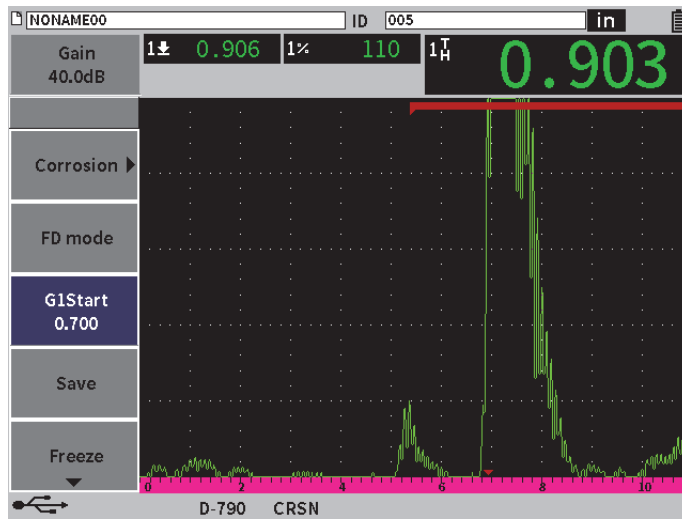


Figure 11-40 Correctly triggered measurement

11.7.3.3 Echo-to-Echo Measurements

The corrosion module echo-to-echo mode measures the distance between an echo in Gate 2 and an echo in Gate 1. Echo-to-echo measurements are most commonly used to determine the thickness of coated materials, since the first back wall measurement includes the thickness of the coating. Measuring the distance between the second successive back wall and the first back wall provides a more accurate measurement of the base material, so you can ignore the coating layer.

To make an echo-to-echo measurement

1. In the corrosion module () **Corrosion** dialog box, set **Gate2** to **On** (see Figure 11-41 on page 222).
Measurement reading 5 displays the measurement from Gate 2 to Gate 1 (2-1).

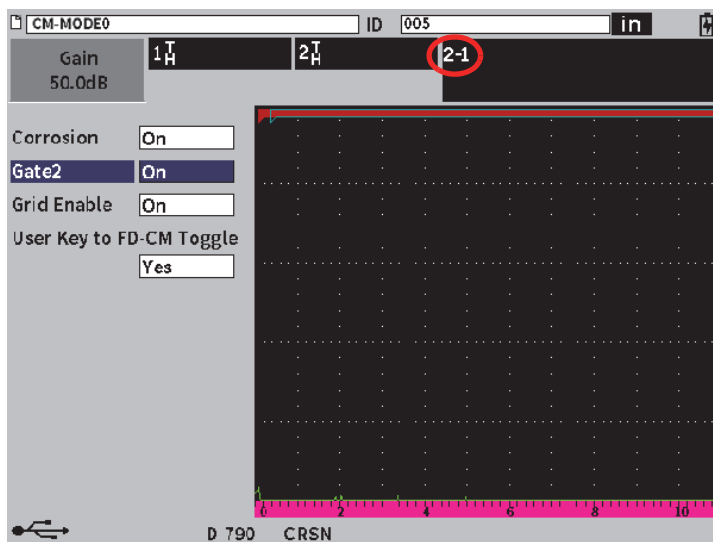


Figure 11-41 Corrosion dialog box

2. In the receiver (**RX**) dialog box, set **Rect** to **RF** (see Figure 11-42 on page 223).
The **Rect** setting enables you to view the positive and negative amplitude values.

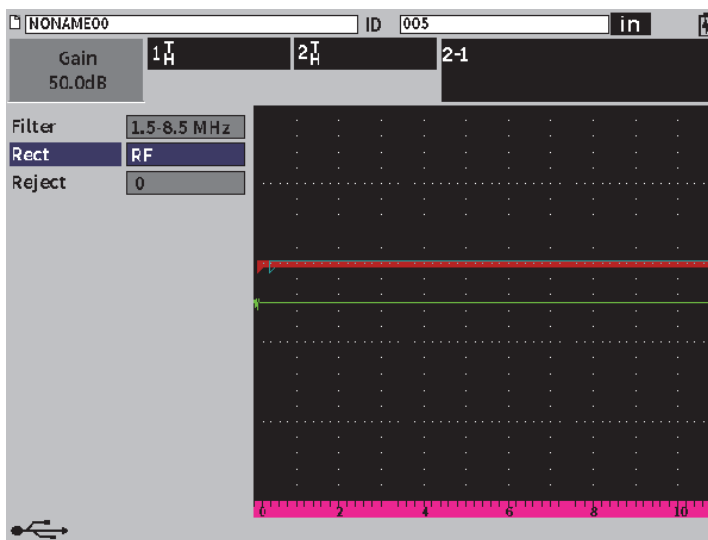


Figure 11-42 Receiver dialog box

3. Press ESC twice to dismiss the setup menu and view the echo-to-echo measurement in the live A-scan (see Figure 11-42 on page 223).



Figure 11-43 Echo-to-echo measurement

Shear wave errors in echo-to-echo mode

During a corrosion module inspection in echo-to-echo mode using a dual transducer, an unwanted shear wave often occurs because of the dual transducer roof angle. Shear wave velocity is slower than that of a longitudinal wave, so the shear component is displayed after the first back wall echo. If the shear component crosses the measurement threshold it can trigger a false measurement from the gate 2 region, causing a measurement error (see Figure 11-44 on page 225). You can eliminate a shear wave error by adjusting the start position of the second back wall measurement.

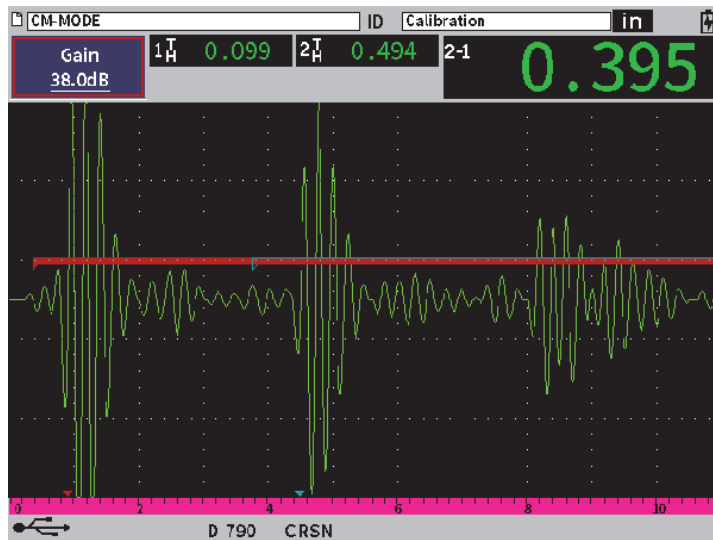


Figure 11-44 Shear wave measurement error

To adjust the measurement window start position

1. On the Corrosion sidebar menu, highlight **G2Start** (see Figure 11-45 on page 226).
2. Turn the adjustment knob to change the measurement window start position.

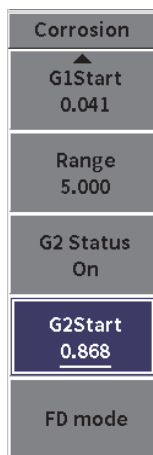


Figure 11-45 Corrosion sidebar menu (G2Start)

Appendix: Flags

Table 4 on page 227 provides a description of the possible flags.

Table 4 Flag descriptions

Flag	Description
	Length units are inches.
	Length units are millimeters.
	Length units are microseconds.
	Indicates that the Shift (2 ND Function) key has been pressed.
	Gate 1 is in peak measurement mode.
	Gate 2 is in peak measurement mode.
	Gate 1 is in edge (or flank) measurement mode.
	Gate 2 is in edge (or flank) measurement mode.

Table 4 Flag descriptions (*continued*)

Flag	Description
	Gate 1 is in first peak measurement mode.
	Gate 2 is in first peak measurement mode.
	Gate 1 is in J-Flank measurement mode.
	Gate 2 is in J-Flank measurement mode.
	DAC is active.
	DGS is active.
	AWS is active.
	Curved surface correction (CSC) is active.
	Gate tracking (echo-to-echo) is active.
	Zoom is active.
	FREEZE is active.
	Auto FREEZE is active.
	PEAK MEM is active.

Table 4 Flag descriptions (continued)

Flag	Description
	Peak Hold reference echo is active.
	Indicates that a USB flash drive is installed.
	A wireless LAN (Wi-Fi) network is connected.
	Wireless LAN (Wi-Fi) network connection error.
	Indicates that video record mode is actively acquiring a video.
	Indicates that the gated signal occurs within Leg 1 during an angle beam inspection.
	Indicates that the gated signal occurs within Leg 2 during an angle beam inspection.
	Indicates that the gated signal occurs within Leg 3 during an angle beam inspection.
	Indicates that the gated signal occurs beyond Leg 3 during an angle beam inspection.
	Current settings are restricting the waveform update rate below 60 Hz.
	Indicates that the charger is connected and charging the battery.
	Indicates that the instrument is running on battery power.

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