

GE
Measurement & Control Solutions

Ultrasonic

USM Go

Operator's Manual



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P/N 1259801 Rev. 5
October 2011

USM Go

Ultrasonic Flaw Detector

Operator's Manual

P/N 1259801 Rev. 5
October 2011



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Safety Information

Before powering up or operating this instrument, the safety information in this section should be read carefully. This *Operator's Manual* should be stored in a safe place for reference.

IMPORTANT: *This instrument is to be used only for testing materials in an industrial environment. Any use for medical applications or any other purpose is not permitted.*

IMPORTANT: *This instrument is waterproof according to IP 67. It can be operated either with batteries or with the power supply unit. The power supply unit meets the requirements of Electrical Safety Class II.*

Batteries

For battery operation of this instrument, GEIT only recommends the use of a lithium-ion battery. You should only use the battery recommended by GEIT for operation of this instrument. You can charge the lithium-ion battery either within the instrument itself or with the external battery charger.

IMPORTANT: *See “Battery Disposal” on page 189 for instructions on proper battery disposal procedures.*

Important Ultrasonic Testing Guidelines

Please read the information in this section before using your instrument. It is important that you understand and observe this information to avoid any operator errors that might lead to false test results. Such false results could result in personal injuries or property damage.

Using Ultrasonic Test Equipment

This *Operator's Manual* contains essential information on how to operate your test equipment. In addition, there are a number of factors that affect the test results, but a description of all these factors is beyond the scope of this manual. The three most important factors for safe and reliable ultrasonic inspection are:

- Operator training
- Knowledge of special technical test requirements and limits
- Choice of appropriate test equipment

Operator Training

The operation of an ultrasonic test device requires proper training in ultrasonic testing methods. Proper training comprises adequate knowledge of:

- The theory of sound propagation
- The effects of sound velocity in the test material
- The behavior of the sound waves at interfaces between different materials
- The shape of the sound beam
- The influence of sound attenuation in the test object and the influence of the surface quality of the test object

Lack of such knowledge could lead to false test results with unforeseeable consequences. You can contact GEIT or NDT societies or organizations in your country (DGZfP in Germany; ASNT in the USA) for information on opportunities for training on ultrasonic instruments that use time-of-flight measurements.

Accurate measurement results require a constant sound velocity in the test object. Steel test objects have only slight variations in sound velocity, thus affecting only high precision measurements. Test objects made of other materials (e.g., nonferrous metals or plastics) may have larger sound velocity variations, which could adversely affect the accuracy of the measurements.

Test Object Material Effects

If the material of the test object is not homogeneous, the sound waves may propagate at different velocities in different parts of the test object. An average sound velocity should then be used for the range calibration. This is achieved by using a reference block with a sound velocity equal to the average sound velocity of the test object.

If substantial sound velocity variations are expected, then the instrument calibration should be adjusted to the actual sound velocity values at shorter time intervals. Failure to do so may lead to false readings.

Test Object Temperature Effects

The sound velocity also varies as a function of the temperature of the test object. This can cause appreciable errors in measurements if the instrument has been calibrated with a reference block at one temperature, and the instrument is then used on a test object at a different temperature. Such measurement errors can be avoided either by ensuring that the reference block and the test object are at the same temperature, or by using a correction factor obtained from published tables.

Limited Warranty

For a period of two (2) years from the date of purchase, we warrant that the instrument will be free of any claim of ownership by third parties, (ii) when new, be free from defects in material and workmanship and perform in accordance with the Product's specifications under normal use and service for the applicable warranty period following the date of sale. The second year of this warranty is valid only if the instrument is calibrated to within the provided specifications, by us or one of our certified service providers after month twelve of ownership but before month fourteen begins. The duration of the warranty may be extended or modified by explicit service contracts.

This limited warranty shall not apply to any problems arising from (i) failure to follow the product instructions or failure to perform preventive maintenance, (ii) service, repair or modification by someone other than us or one of our authorized service representatives; or (iii) external causes, such as accident, abuse, misuse, or problems with electrical power.

This warranty does not cover parts identified as wear-and-tear parts or lamps, transducers, tubes, accessories, or optional equipment not manufactured by us, which items may be covered by separate manufacturers' warranties.

Our obligation under this warranty is limited to the repair or replacement of components determined by us to be defective within the warranty period at no cost to the original purchaser. Customer shall arrange for delivery to us in approved packing material. This warranty extends to the original purchaser and cannot be assigned or transferred to any other party.

EXCEPT FOR THE WARRANTY SET ABOVE, WE EXPRESSLY DISCLAIM ALL WARRANTIES AND REPRESENTATIONS OF ANY KIND WITH RESPECT TO OUR PRODUCTS, WHETHER EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, TITLE AND ANY WARRANTIES ARISING FROM COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

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Chapter 1. General Information

The *USM Go* is a portable ultrasonic flaw detector. In addition to its light-weight design, the USM Go includes a clean and simple user interface and a large, easy-to-read color WVGA (800x480) display. When operating in *Acquire Mode*, the instrument provides ultrasonic flaw detection and thickness measurements. In this mode, it is capable of storing A-Scans, operating parameters, and reports. Prior to using the *Acquire Mode*, the instrument display and operating parameters must be configured by using the *Setup Mode*. The following specific topics are discussed in this chapter:

- Supplying power to the instrument
- Powering the instrument ON and OFF
- Using the keypad
- Using the display

1.1 Supplying Power to the Instrument

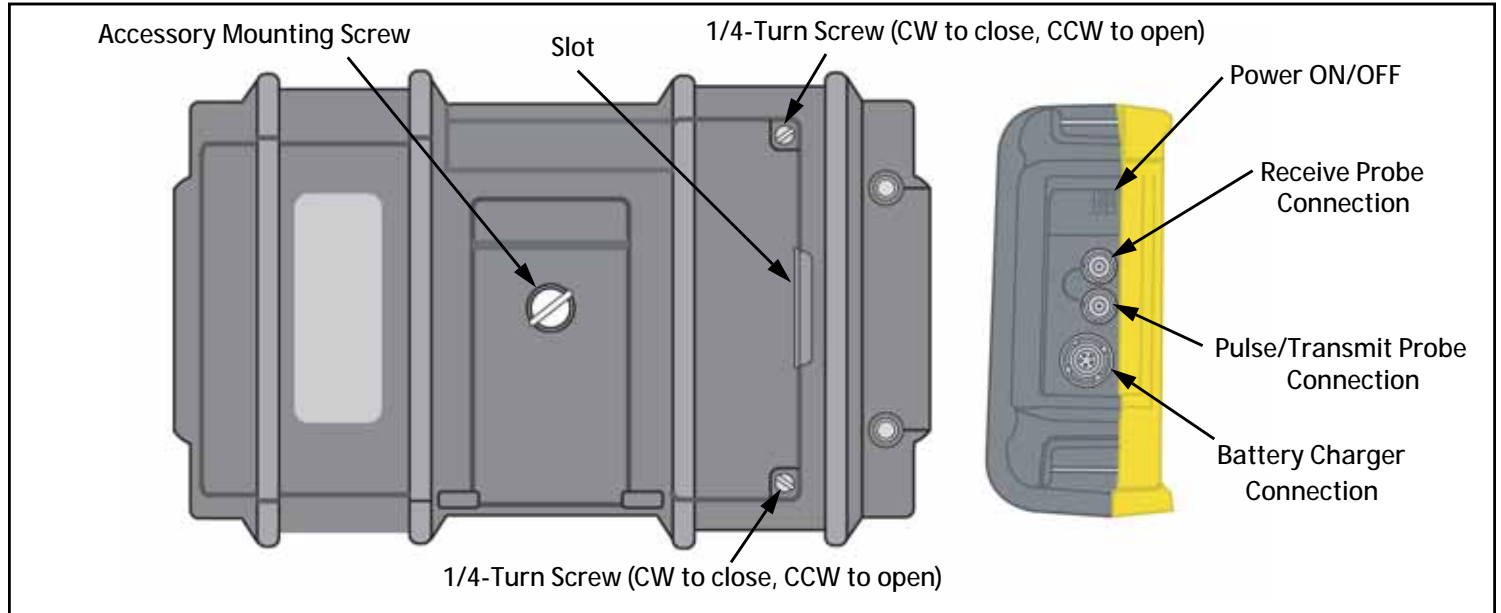


Figure 1: Rear and Side Views of the USM Go Case


1.1 Supplying Power to the Instrument (cont.)

The USM Go can be powered in either of two ways (see *Figure 1 on page 2*):

- A lithium battery pack that is installed in a compartment on the rear of the case, or
- An external power adapter plugged into the connector on the side of the case

CAUTION! Use only the GE Lithium battery pack in this instrument, and charge only this battery pack in the instrument or in the provided GE charger/adapter.

To remove the battery compartment cover, loosen the two 1/4-turn screws and then lift up on the slot between the screws. The standard GE Lithium battery pack is designed to provide maximum operating life between chargings.


The approximate level of remaining battery life is shown on the display (see *Figure 2 on page 5*) by the battery icon, , and the approximate “hours of charge” indication below the icon. When a fully-charged battery pack is installed, the icon will appear as “full,” and the icon will begin to “empty” as the battery life is depleted. When the battery indicator is down to one-quarter full, charge the battery pack as soon as possible.

Note: *The instrument automatically shuts OFF when the batteries are too weak for reliable operation. However, your settings are saved and then restored when the instrument is turned back ON. When testing in remote locations, always carry a spare battery pack.*

1.1 Supplying Power to the Instrument (cont.)

When the AC adapter is connected to the instrument, the icon in the upper right corner of the display indicates the percentage of full-charge of the battery pack. When removing the battery pack to install a charged spare, the instrument will automatically turn OFF if the AC adapter is not connected to the instrument. However, if the adapter is connected, the instrument will remain ON while you change battery packs.

1.2 Powering the Instrument ON and OFF

To power the USM Go ON or OFF, simply press the power button, , on the side of the case (see *Figure 1 on page 2*). As soon as the button press is recognized, you will hear the click of an internal relay. Then, after about 4 seconds, the display controller will be fully loaded and the display will become visible.

1.3 Using the Keypad

The USM Go is designed to provide the user quick access to all of the instrument's functions. Its easy-to-use menu system allows any function to be accessed with a minimum of effort. The functions typically used to collect ultrasonic data are located in the *Acquire Mode* menu, while those used to configure the instrument are found in the *Setup Mode* menu.

See *Figure 2 on page 5* for the locations of the front-panel components described in this chapter.

1.3 Using the Keypad (cont.)

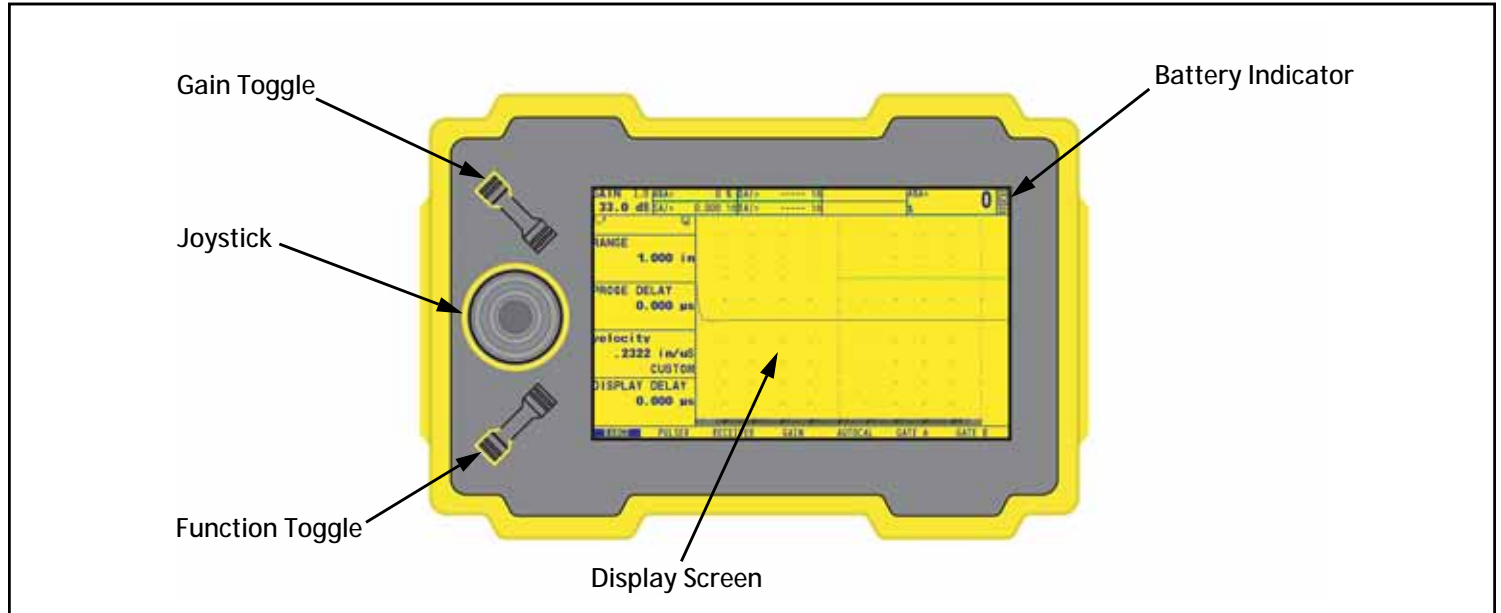


Figure 2: Front Panel of the USM Go

1.3.1 Instrument Orientation




One of the innovative features of the DMS Go is the user option to quickly and easily rotate the instrument 180° to accommodate either right-hand or left-hand operation, depending on which hand holds the probe. During this process, the display image is also rotated to allow proper viewing. Figure 3 below shows the instrument in both orientations: the photo on the left shows orientation if the right hand holds the probe, and the photo on the right shows orientation if the left hand holds the probe.



Figure 3: USM Go in Right-Hand and Left-Hand Probe Orientations

1.3.2 Keypad Components

The USM Go keypad includes the following items (see *Figure 2 on page 5*):




- **Center-press joystick** (): The joystick may be moved either “*left or right*” or “*up or down.*” In addition, the center of the joystick may either be “*pressed*” or “*pressed and held.*”
- **Gain toggle** (): The two ends of the gain toggle act as separate buttons. One end is the “*Gain DOWN*” button, while the other end is the “*Gain UP*” button. Either end of the gain toggle can either be “*pressed*” or “*pressed and held.*”
- **Function toggle** (): The two ends of the function toggle act as separate buttons. One end is the “*Function 1*” button, while the other end is the “*Function 2*” button. Either end of the function toggle can either be “*pressed*” or “*pressed and held.*”

Note: *The gain toggle is always at the top of the instrument, and the end of the function toggle closer to the display is always the “Function 1” button, regardless of the chosen instrument orientation.*



1.3.3 Joystick Functions

The effects of the joystick actions described on the previous page are as follows:

Joystick Center Press:

- When in *Acquire Mode*, a single press and release () toggles the A-Scan display between standard size and full screen mode.
- When in *Setup Mode*, a single press and release () activates or deactivates a parameter for adjustment.
- When in *Acquire or Setup Mode*, a 2-second press-and-hold () switches to the other mode.

Joystick Movement:

- When in *Acquire or Setup Mode*, moving up/down () scrolls between the available function options for the highlighted menu.
- When in *Acquire or Setup Mode*, moving left/right () highlights a menu option or adjusts the value of a selected parameter.

1.3.4 Multi-Key Functions

Note: *All multi-key functions are defined with the instrument in the left-hand orientation (see the left side of Figure 3 on page 6).*

- Power button + Function 2 button + Gain DOWN button

Pressing and holding these three buttons simultaneously causes the instrument to initiate a software upgrade.

Note: *A formatted SD card with a valid USM Go upgrade file in the root directory must be inserted prior to pressing these buttons.*

- Power button + Function 2 button + Gain UP button

Pressing and holding these three buttons simultaneously causes the instrument to ignore the last known setup and revert to the factory default settings.

Important: *The last known setup will be overwritten and lost during this process.*

- Gain UP button + Gain DOWN button

Pressing and holding the two *Gain Toggle* buttons simultaneously activates the AUTO80 function for the current *Evaluation Mode*.

1.4 Using the Display

Typical displays for the USM Go *Acquire Mode* and *Setup Mode* menus are illustrated in *Figure 4* below. See the following pages for step-by-step instructions on accessing these menus.

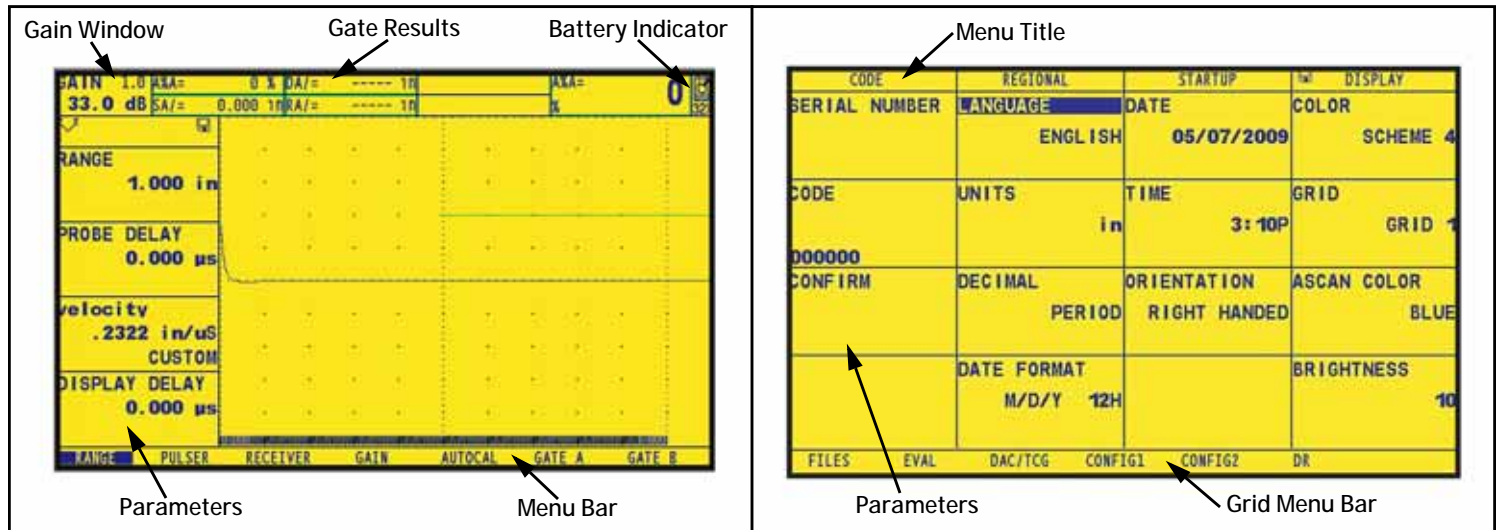




Figure 4: Acquire Mode (Left) and Setup Mode (Right) Displays





1.4.1 Accessing the Full-Screen A-Scan Display

When in *Acquire Mode*, a single press and release of the joystick () toggles the A-Scan display between standard-size and full-screen display mode. When viewing the A-Scan in full-screen mode, the joystick can be used to change the parameters of Gate A, as follows:

Note: *If the joystick lock function has been enabled (see “Locking the Gain Toggle and the Joystick” on page 94), any up-down and left-right joystick movements will have no effect on the instrument.*





- Moving the joystick left or right () will change the Gate A *range* in that direction.
- If AGT is OFF, moving the joystick up or down () will change the Gate A *threshold*, accordingly.

To disable full-screen Gate A control without effecting other instrument functions, activate the JOY CONTROL parameter as follows:

1. In the SETUP menu, activate the CONFIG1 submenu using the joystick ()
2. Use the joystick () to select the JOY CONTROL function, and press the center of the joystick () to activate it.
3. Use the joystick to select either the ON or OFF option, and press the center of the joystick () to deactivate the function.

1.4.2 Accessing the Acquire Mode Menu








To access the *Acquire Mode* menu, refer to the left side of *Figure 4 on page 10* while completing the following steps:

1. Move the joystick left or right () until the desired menu is highlighted on the menu bar. The function bar automatically shows the parameters available in the highlighted menu.
2. Move the joystick up or down () to highlight the desired parameter.
3. While the desired parameter is highlighted, change its value by moving the joystick to the left or right () or by pressing either end of the function toggle (). For parameters with continuous values, the function toggle acts as a course adjustment, while the joystick acts as a fine adjustment. For selecting a parameter value from a list, either the joystick or the function toggle may be used to step through the list one item at a time.

Note: *Pressing both ends of the function toggle simultaneously resets a highlighted parameter to its default value.*

1.4.3 Accessing the Setup Mode Menu

To access the *Setup Mode* menu, refer to the right side of *Figure 4 on page 10* while completing the following steps:

1. Press and hold the center of the joystick () to toggle between *Acquire Mode* and *Setup Mode*.
2. Move the joystick left or right () until the desired menu is highlighted on the menu bar. The function bar automatically shows the parameters available in the highlighted menu.
3. Move the joystick as required () to highlight the desired parameter.
4. Press the center of the joystick () to activate the highlighted parameter. The parameter value can now be changed either by moving the joystick () as a fine adjustment or by pressing either end of the function toggle () as a coarse adjustment. Press the center of the joystick () again to deactivate the highlighted parameter.

Note: *Step 4 above applies to the setting of all parameters, except for specifying the actions associated with the function toggle keys. For instructions on configuring these keys, see “Defining Function Toggle Actions” on page 47.*

To exit the Setup Menu, press any of the gain keys. (While in the Setup Mode, pressing the gain keys will have no effect on the gain setting.)

1.5 Using the SD Slot, USB Connector & I/O Connector

The USM Go uses a standard *SD memory card* for storing data set files and reports (see “*The FILES Menu*” on page 144) and for loading an instrument software upgrade (see “*Activating Instrument Upgrades*” on page 74). The SD card slot is located in a compartment on the top of the instrument, along with a USB connector and an I/O connector (see *Figure 5* below).

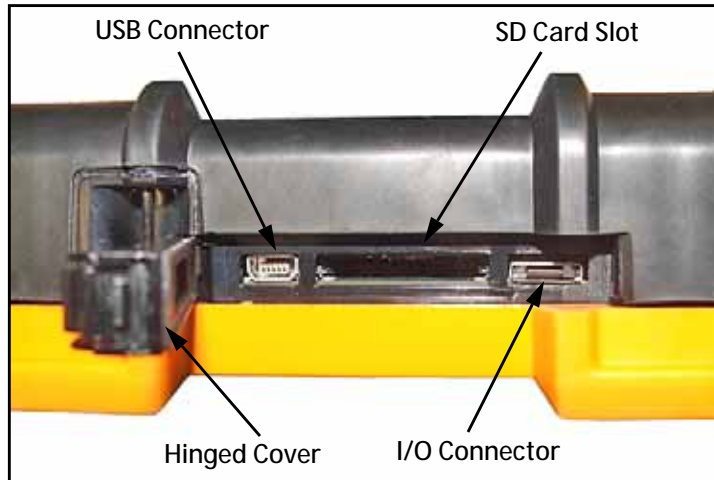


Figure 5: Top View of USM Go Case

1.5.1 Removing the SD Card

To remove the SD card from its slot, proceed as follows:

1. Access the SD card slot by pushing on the cover in the direction of the arrow and lifting the hinged cover.
2. Press down of the SD card with your finger and then remove your finger quickly. The SD card will be partially ejected, and you can then grasp it by the edge and slide it completely out of the slot.

1.5.2 Inserting the SD Card

To insert the SD card into its slot, proceed as follows:

CAUTION! Do not force the SD card into the slot if you feel significant resistance. If the card does not enter the slot freely, it is probably oriented incorrectly.

1. Access the SD card slot by pushing on the cover in the direction of the arrow and lifting the hinged cover.
2. Orient the SD card so that the label side faces the rear of the instrument and the blank side with the row of gold-colored electrical contacts faces the display side of the instrument. The edge of the card with the row of gold-colored electrical contacts must enter the slot first.
3. Slide the card fully into the slot and push gently until the card seats into its socket. Then, close the SD card slot cover.

1.5.3 Connecting the USB Port

The connector closest to the hinge of the top compartment cover (see *Figure 5 on page 14*) is a *Micro USB* port. If you use a standard USB cable to connect the USM Go to a PC (no special drivers are required), the installed SD card will be added to the list of active drives on the PC. You can then perform all normal drive activities, such as copying and deleting files, on the USM Go SD card.

Important: *While the USM Go is connected to a PC via the USB port, the instrument will not accept any user input from the keypad. Normal operation resumes as soon as the USB cable is disconnected.*

1.5.4 Connecting the I/O Port

The connector furthest from the hinge of the top compartment cover (see *Figure 5 on page 14*) is an I/O port. This port serves a dual role:

- *Serial port pins* - these are used strictly for factory service diagnostics.
- *Sync & Alarm pins* - these signals are accessible to the user via a special optional cable.

To use this connector you must order the optional USM Go cable, which is available as P/N 022-510-032. The pin designations for connecting the open end of this cable are listed in *Table 1* below:

Table 1: I/O Connector Pin Assignments

Pin #	Color	Signal
1	Brown	+5V
2	Red	SAP
3	Orange	Alarm
4	Yellow	RS232 CTS
5	Green	RS232 TX
6	Blue	RS232 RX
7	Purple	GND

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Chapter 2. Instrument Setup

2.1 Display Screen and Keypad Features

The USM Go user interface has been designed for clarity and ease of use. *Figure 6* below show the complete set of icons that may appear in the icon area of the screen, and *Figure 7 on page 20* shows the major components of the display and the keypad.
















 Freeze mode has been activated	 TCG MODE is turned on	 Trig settings indicate Curved Surface I-D reflection
 Reject function has been turned on	 A DGS reference is stored	 Trig settings indicate Curved Surface O-D reflection
 Pulsar set for dual element probe	 dB REF MODE is turned on	 Trig settings indicate Curved Surface Beam
 Pulsar set for single element probe	 AGT MODE is active	 Trig settings indicate Flat Angle reflection
 Battery level indicator (shown 1/4 full)	 SD Card installed (flashes when saving)	 Trig settings indicate Flat Surface Beam

Figure 6: Display Screen Icons

2.1 Display Screen Features (cont.)

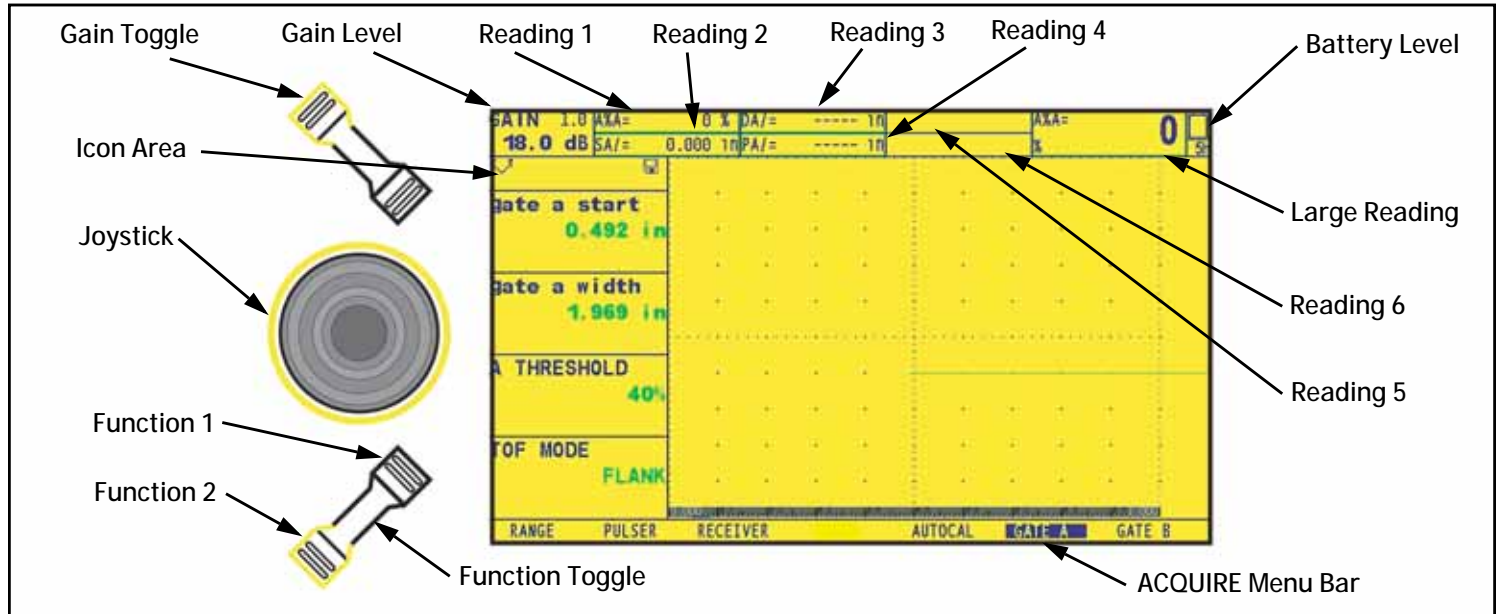


Figure 7: Display Screen Features

2.2 The Menu System

The USM Go menu system, as shown in *Figure 8 on page 22*, allows the operator to select and adjust various instrument features and settings. It includes:

- **Acquire Menu:** Consists of several submenus used to calibrate the instrument prior to a test, configure the instrument during a test, select the pulser and receiver characteristics, and configure the gates.
- **SETUP Menu:** Consists of several submenus used to configure the instrument prior to a test, including specifying the acquire mode and the screen appearance, adjusting the A-Scan display, setting the alarms, and controlling other significant measurement parameters.

The information provided in this chapter describes each menu function and shows how to access each function through the menu system.

The *EVALuation MODE Function*, which is located in the EVAL submenu of the SETUP menu, determines which submenu for evaluating results appears in the Acquire and SETUP menus (see the shaded cells in *Figure 8 on page 22*). See *Figure 9 on page 23* for the available *Evaluation Mode* options.

2.2 The Menu System (cont.)

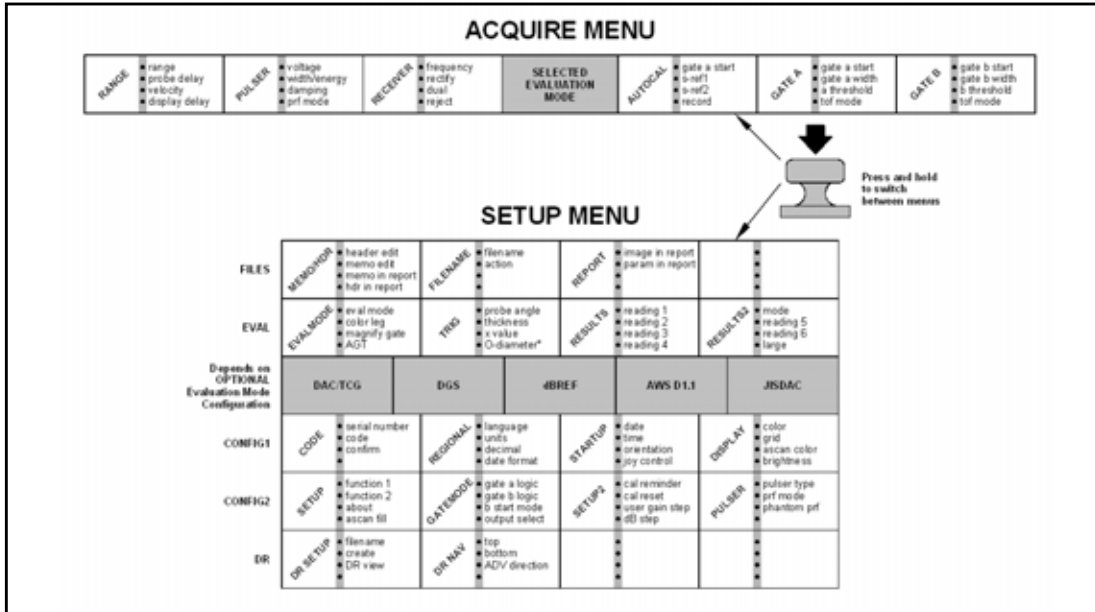


Figure 8: Acquire and Setup Menus


2.2 The Menu System (cont.)

EVALUATION MODE MENUS AVAILABLE				
DAC/TCG	DGS	dB REF	AWS D1.1	JISDAC
RECORD <ul style="list-style-type: none"> gate A start auto80 record finish 	SETUP <ul style="list-style-type: none"> dgs mode dgs curve probe # probe name 	SETUP <ul style="list-style-type: none"> mode reference record delete ref 	SETUP <ul style="list-style-type: none"> A indication B reference C attenuation D D1.1 rating 	RECORD <ul style="list-style-type: none"> gate A start auto80 record finish
GATE A <ul style="list-style-type: none"> gate A start gate A width A threshold tof mode 	DGS PROB <ul style="list-style-type: none"> probe name xial frequency eff diameter delay velocity 	GATE A <ul style="list-style-type: none"> gate A start gate A width A threshold tof mode 	GATE A <ul style="list-style-type: none"> gate A start gate A width A threshold tof mode 	GATE A <ul style="list-style-type: none"> gate A start gate A width A threshold tof mode
SETUP <ul style="list-style-type: none"> topdac mode log display dac type delete curve 	REF ECHO <ul style="list-style-type: none"> gate A start reference type ref size record ref 			SETUP <ul style="list-style-type: none"> JISDAC bold line delete curve
EDIT <ul style="list-style-type: none"> point point pos point gain enter 	REF CORR <ul style="list-style-type: none"> ref atten ampl correct delete ref 			MAT ATTN <ul style="list-style-type: none"> transfer corr
MAT ATTN <ul style="list-style-type: none"> transfer corr 	MAT ATTN <ul style="list-style-type: none"> best attn transfer corr 	<div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block;"> Use the EVAL MODE function to make one of these five menus active. </div>		
OFFSETS <ul style="list-style-type: none"> mode offset 	OFFSETS <ul style="list-style-type: none"> offset 1 offset 2 offset 3 offset 4 			
OFFSETS2 <ul style="list-style-type: none"> offset 1 offset 2 offset 3 offset 4 	GATE A <ul style="list-style-type: none"> gate A start gate A width A threshold tof mode 			

Figure 9: Available Evaluation Mode Menus

2.3 Initial Setup

In this section, you'll learn how to configure the USM Go display and operating features. Follow these procedures to turn the instrument ON and make initial adjustments to the control settings. Because the instrument can be set to save the control settings when it is turned OFF and restore them when it is turned back ON, you won't have to repeat these adjustments unless a change is required.

Power the instrument ON and note that the ACQUIRE menu is automatically activated. Activate the SETUP menu by pressing in and holding the center of the joystick ()

Note: *The entire menu structure is shown in Figure 8 on page 22 and Figure 9 on page 23.*

2.3.1 Language, Units of Measurement, Date, Time and Other Parameters

Use the procedures in this section to adjust the units of measurement, the date, the time, and the language that appears on the display screen and the data output. The adjustments require access to the REGIONAL and STARTUP function groups. These are accessed from the CONFIG1 and 3 submenus in the SETUP menu, as shown in *Figure 10 on page 25*.

2.3.1 Language, Units of Measurement, Date, Time and Other Parameters (cont.)

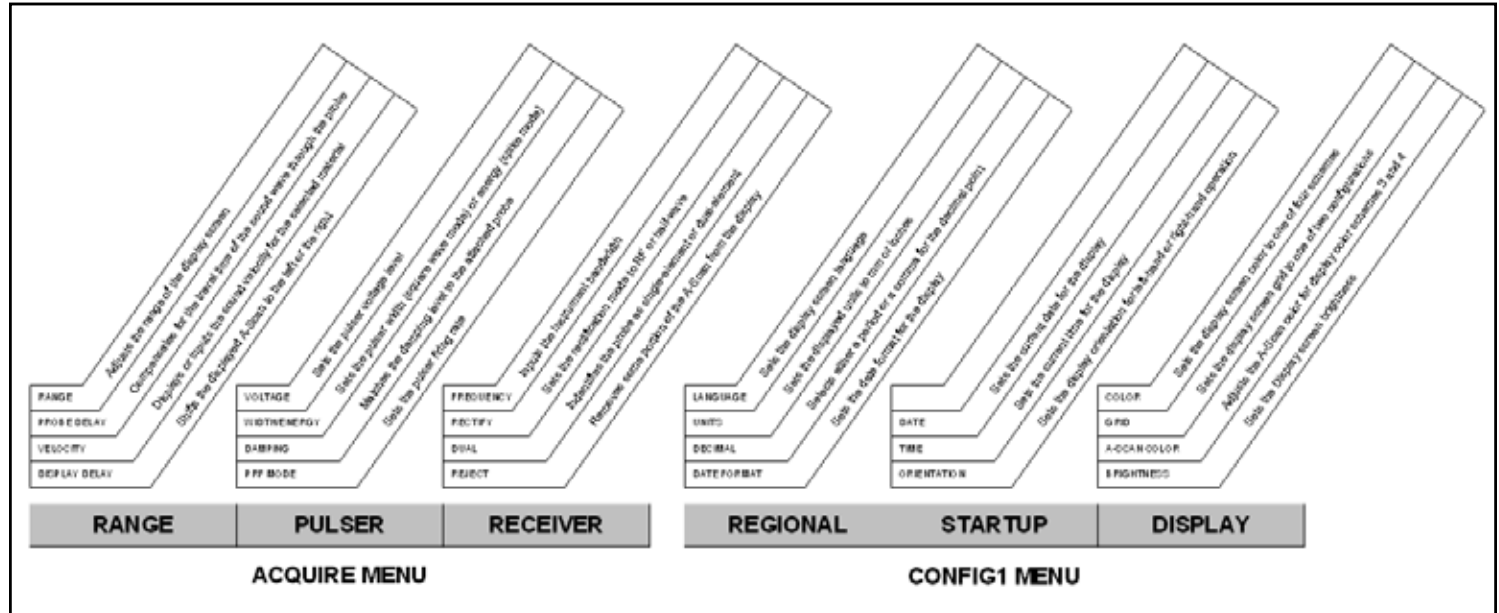









Figure 10: ACQUIRE Menu (Left) and CONFIG1 Menu (Right)



2.3.1a *Setting the Acquire Mode Language (SETUP-CONFIG1-LANGUAGE)*

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick () . Several functions are displayed on the screen.
2. Use the joystick () to select the **LANGUAGE** function, then press the center of the joystick () to activate the function. To change the selected language, either move the joystick or press the function toggle. You'll note that the options available are English, German, French, Spanish, Italian, Romanian, Polish, Czech, Russian, Japanese and Chinese. The default language is English.
3. Press the center of the joystick () to deactivate the function when complete. The display screen and report language are now set to the choice last selected.





2.3.1b Setting the Units of Measurement (SETUP-CONFIG1-UNITS)

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **UNITS**, then press the center of the joystick () to activate the function. The following options are available:
 - **mm** - default setting which displays values in millimeters
 - **in** - displays values in inches
 - **us** - displays values in microseconds





Note: *When unit is set as **us**, the **DR** menu and **VELOCITY** parameter will be hidden automatically. **DR** operation does not support the μ s unit option.*

3. Move the joystick left or right () to change the units of measurement.
4. After making your choice, press the center of the joystick () to save the setting.







2.3.1c *Setting the Decimal Convention* (SETUP-CONFIG1-DECIMAL)

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **DECIMAL**, then press the center of the joystick () to activate the function. The following options are available:
 - **PERIOD** - uses a period as a decimal point
 - **COMMA** - uses a comma as a decimal point
3. To change the decimal convention, either move the joystick or press the function toggle.
4. After making your choice, press the center of the joystick () to deactivate the function.







2.3.1d *Setting the Date and Time Formats* (SETUP-CONFIG1-DATE FORMAT)

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick () . Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **DATE FORMAT**, then press the center of the joystick () to activate the function.
3. To change the selected date and time format, either move the joystick or press the function toggle. Choose from the following date and time formats:
 - Y-M-D date format and 12 or 24 hour time format
 - M/D/Y date format and 12 or 24 hour time format
 - D.M.Y date format and 12 or 24 hour time format
4. After making your choice, press the center of the joystick () to deactivate the function. The date and time format shown on the display screen and in the out reports are now set to the choice last selected.

2.3.1e *Setting the Date* (SETUP-CONFIG1-DATE)





1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **DATE**, then press the center of the joystick () to activate the function. Note that the first character is highlighted.
3. Move the joystick up or down () to change the highlighted character. Then, move the joystick left or right () to select the other characters to be modified.
4. After making your choice, press the center of the joystick () to deactivate the function.

2.3.1f *Setting the Time* (SETUP-CONFIG1-TIME)

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **TIME**, then press the center of the joystick () to activate the function. Note that the first character is highlighted.
3. Move the joystick up or down () to change the highlighted character. Then, move the joystick left or right () to select the other characters to be modified.
4. After setting the correct time, press the center of the joystick () to deactivate the function.




Note: *Once set, the internal clock maintains the current date and time.*

2.3.1g *Setting Left-Hand or Right-Hand Orientation* (SETUP-CONFIG1-ORIENTATION)

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **ORIENTATION**, then press the center of the joystick () to activate the function. Select either **RIGHT** hand or **LEFT** hand control.
3. To change the display screen orientation, either move the joystick or press the function toggle.
4. After making your choice, press the center of the joystick () to deactivate the function.




2.3.1h *Setting the Current Working Directory*(FILE-FILENAME-DIRECTORY)

The user can set the current working directory. All the datasets and reports will be saved and loaded from this directory. The default directory is the USMGO folder under the root of the SD card.

1. In the FILE menu, activate FILENAME submenu.
2. Use the joystick () to select the DIRECTORY function, and then press the center of the joystick () to activate the function.
3. Use the joystick to browse the SD card and select the working directory.
4. Press the center of the joystick () to set the working directory.

2.3.1i *Setting the Power Saver Function (CONFIG3-FREEZE-POWER SAVER)*





The user can set a timer to save the battery power. When the time is out, the LCD is powered off. Any movement of the joystick or keys will reactivate the instrument.

1. In the CONFIG3 menu, activate the FREEZE submenu.
2. Use the joystick to select POWER SAVER function, and then press the center of joystick () to activate the function.
3. Move the joystick left/right() to select the time or turn off the Power Saver mode.
4. Press the center of the joystick () to set the setting.




2.3.1j *Setting a Yearly Calibration Reminder*

The user can set a date for a yearly calibration reminder. When the date is 3 months, 1 month, 2 weeks or 1 week before the reminder date, a warning message will be shown every day. The user can then reset this reminder when the yearly calibration is complete.


Set Reminder Date

1. In the CONFIG3 menu, activate the YEARLY CAL submenu.
2. Use the joystick to select the DATE function, and then press the center of the joystick () to activate the function.
3. Move the joystick left/right () to select MONTH and DATE.
4. Move the joystick up/down () to set the month or the date.
5. Press the center of the joystick () to set the setting.

Set Reminder



1. In the CONFIG3 menu, activate the YEARLY CAL submenu.
2. Use the joystick to select the CAL REMINDER function, and then press the center of the joystick () to activate the function.
3. Move the joystick left/right () to select the reminder time. The available options are 3 MONTHS, 1 MONTH, 2 WEEKS, or 1 WEEK.
4. Press the center of the joystick () to set the setting.

Reset Reminder

1. In the CONFIG3 menu, activate the YEARLY CAL submenu.
2. Use the joystick to select CAL RESET function, and then press the center of the joystick () to activate the function.
3. A warning message, “RESET YEARLY CALIBRATION REMINDER? DOUBLE KEY PRESS TO CONFIRM”, appears on the screen.
4. Press the function key 1 and 2 at the same time to confirm the reset action. (This is the only action necessary.)

2.3.1k Password

The user can set a password to protect the parameter mode settings.

1. In the CONFIG4 menu, activate the PARAM MODE submenu.
2. Use the joystick () to select the PASSWORD function, and then press the center of the joystick () to activate the function. A popup window is shown on the screen.
3. Follow the instruction on the screen to set the password.




Reset Password

A software reset will clear the password.

2.3.11 *Parameter Mode*


The user can change the parameter mode settings to avoid changing some parameter by wrong operation. This setting is protected by password if users have created a password.

Edit Parameter Mode Setting

1. In the CONFIG4 menu, activate the PARAM MODE submenu.
2. Use the joystick to select PARAM EDIT function, and then press the center of the joystick to activate the function.
3. If a password has been set, enter it to activate this function.
4. If the password is entered correctly, a parameter list appears on the screen.
5. Move the joystick up/down () to select the parameter.
6. Move the joystick left/right () to enable/disable the parameter.
7. Press the center of the joystick () to save the setting.

Disable/Enable Parameter Mode




Two different modes are available: EXPERT and INSPECTOR. When operating in EXPERT mode, users can access all parameters. When in INSPECTOR mode, users cannot change the disabled parameter. If the user tries to change these parameters, a warning message appears on the bottom of the screen.

1. In the CONFIG4 menu, activate the PARAM MODE submenu.
2. Use the joystick to select the PARAM MODE function, and then press the center of joystick to activate the function.
3. Move the joystick left/right () to select parameter mode.
4. If a password has been set, selecting the EXPERT mode requires a password confirmation.

2.3.1m TOF in Layer




When TOF in LAYER is enabled, the measurement can be shown in the layer number.

Enable/Disable TOF in Layer





1. In the CONFIG3 menu, activate the TOF in LAYER submenu.
2. Use the joystick to select the TOF in LAYER function, and then press the center of the joystick () to activate the function.
3. Move the joystick left/right () to enable/disable the function.
4. Press the center of the joystick () to save the setting.

Set Layer Type

Two types of layers are available. In the standard type, all layers have the same thickness value. In the custom type, each layer has its own thickness.

1. In the CONFIG3 menu, activate the TOF in LAYER submenu.
2. Use the joystick to select the LAYER TYPE function, and then press the center of the joystick () to activate the function.
3. Move the joystick left/right () to select layer type.
4. Press the center of the joystick () to save the setting.





Edit Layer Thickness

1. In the CONFIG3 menu, activate the TOF in LAYER submenu.
2. Use the joystick to select the LAYER EDIT function, and then press the center of the joystick () to activate the function. A layer's thickness list is shown on the screen.
3. Move the joystick up/down () to select different layers; one layer is available for the STANDARD type, and 10 for the CUSTOM type.
4. Move the joystick left/right () to set the layer's thickness.
5. Press the center of the joystick () to save the setting.





2.3.2 Display Appearance

Follow the procedures in this section to adjust the display appearance. The adjustments require access to the **CONFIG1** submenu, which is accessed from the **SETUP** menu (see *Figure 10 on page 25*).





2.3.2a Setting the Display Color (*SETUP-CONFIG1-COLOR*)

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **COLOR**, then press the center of the joystick () to activate the function. There are four preset color schemes.
3. To change the display color scheme, either move the joystick or press the function toggle.
4. After making your choice, press the center of the joystick () to deactivate the function.





2.3.2b *Selecting a Display Grid* (SETUP-CONFIG1-GRID)

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **GRID**, then press the center of the joystick () to activate the function.
3. To change the display grid type, either move the joystick or press the function toggle. The selected grid style will be shown in the A-Scan window on the display screen, after you return to *Acquire Mode*.
4. After making your choice, press the center of the joystick () to deactivate the function.


2.3.2c *Setting the A-Scan Color* (SETUP-CONFIG1-ASCAN COLOR)




1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **ASCAN COLOR**, then press the center of the joystick () to activate the function. There are six A-Scan color options.
3. To change the A-Scan color, either move the joystick or press the function toggle.
4. After making your choice, press the center of the joystick () to deactivate the function.

2.3.2d *Setting the Display Brightness* (SETUP-CONFIG1-BRIGHTNES)


1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select the function titled **BRIGHTNESS**, then press the center of the joystick () to activate the function. The available settings range from 1 to 10.
3. To change the brightness level, either move the joystick or press the function toggle.
4. After making your choice, press the center of the joystick () to deactivate the function.

2.3.3 Defining Function Toggle Actions

The user can specify a desired action to occur when either end of the *Function Toggle* () is pressed or pressed-and-held. The user-specified function action is ignored, however, whenever a parameter is selected and its value is being edited.


1. In the **SETUP** menu, activate the **CONFIG2** submenu using the joystick (). Several functions are displayed on the screen.
2. Use the joystick () to select either the function titled **FUNCTION1**, for the end of the toggle closer to the display screen, or the function titled **FUNCTION2**, for the end of the toggle further from the display screen. Then, press the center of the joystick () to activate the function.


Note: *There are two values for each function. The **upper** parameter determines the action taken when the corresponding toggle end is momentarily pressed. The **lower** parameter defines the action taken when the toggle end is pressed and held.*

3. To change the **upper** parameter, move the joystick left or right ()

2.3.3 Defining Function Toggle Actions (cont.)

4. To change the *lower* parameter, press the function toggle to scroll through the options. The available options include:

- NONE – no action is assigned.
- FREEZE – Freezes the A-Scan and displays the *Freeze* icon (see *Figure 6 on page 19*) in the status bar.
- JOYSTICK LOCK – Prevents *up-down* and *left-right* adjustments using the joystick () and displays the *Lock* icon (see *Figure 6 on page 19*) on the display screen. However, *center-press* operations with the joystick are *not* disabled.
- COPY – Performs the task specified by the ACTION function, which is located in the FILE submenu.
- AUTO80 – Adjusts the gain to place the Gate A triggering echo peak at 80% of full-screen height.
- MAGNIFY GATE – Zoom the A-Scan so that the displayed screen width matches the user-specified gate width.
- BEA Gain – Two functions are available, + and -.
- ANGLE - Two functions are available, + and -.
- HOME – Selects the RANGE (i.e. HOME) menu in *Evaluation Mode*.

5. After making your choice, press the center of the joystick () to deactivate the function.

2.4 Installing a Probe

Follow the instructions in this section to install a probe on your USM Go.

2.4.1 Connecting the Probe

When connecting a probe to the instrument, the following steps must be taken:

- Properly complete the physical connection of the probe to the instrument.
- Properly configure the instrument to work with the connected probe.

The USM Go accepts either a *single-element* probe or a *dual-element* probe.

To install a *single-element* probe, connect the probe cable to either of the two ports on the side of the instrument (see *Figure 11* to the right). When a *dual-element* probe is connected to the instrument, the key between and below the ports ensures proper orientation of the transmit and receive connectors.

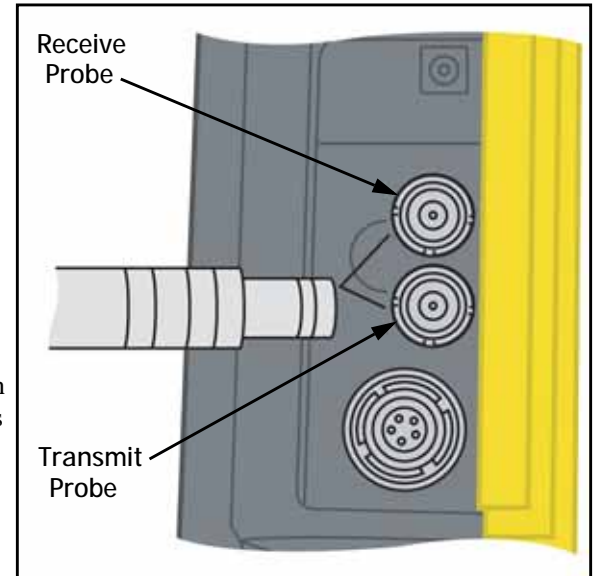





Figure 11: Probe Connector Locations

2.4.2 Configuring the Instrument


Three instrument settings are directly dependent on the type of probe installed. These settings must be adjusted any time a probe of a different type is installed, by following the instructions in the following sections.

2.4.2a Selecting the Probe Type (RECEIVER-DUAL)





1. In the ACQUIRE menu, activate the RECEIVER submenu using the joystick () .
2. Use the joystick () to select the function titled DUAL.
3. To change the probe type, move the joystick () or press the function toggle. Each available probe type is represented by an icon in the *Icon Bar*, near the upper left corner of the display, whenever that probe type is highlighted. The following options are available:
 - ON - Use for *dual-element* probes. If this option is selected, the *Dual* icon (see *Figure 6 on page 19*) is displayed.
 - OFF - Use for *single-element* probes. If this option is selected, the *Single* icon (see *Figure 6 on page 19*) is displayed.
 - THROUGH - Use for 2 separate probes. If this option is selected, the *Through* icon is displayed.

2.4.2a Selecting the Probe Type (RECEIVER-DUAL) (cont.)





Note: *THROUGH mode is used with two separate probes when the sound attenuation in the tested material is too strong. One probe will be on one side of the material to be tested, the other probe will be on the opposite side. As the sound will not travel twice in the material (one way only), the thickness (or time of flight) is calculated accordingly.*

4. After completing your selection, move the joystick up or down () to navigate away from this function.

2.4.2b *Specifying the Probe Frequency* (RECEIVER-FREQUENCY)



1. In the ACQUIRE menu, activate the RECEIVER submenu using the joystick () .
2. Use the joystick () to select the function titled FREQUENCY .
3. To change the specified frequency, move the joystick () or press the function toggle. The following options are available:
 - 1, 2, 2.25, 4, 5, 10, 13, 15 MHz - Choose the frequency that matches the frequency of your probe.
 - BROADBAND - Select this option to use the built-in broadband filter.
4. After completing your selection, move the joystick up or down () to navigate away from this function.

2.4.2c Changing Damping Level to modify the Signal to Noise Ratio (PULSER-DAMPING)


1. In the ACQUIRE menu, activate the PULSER submenu using the joystick () .
2. Use the joystick () to select the function titled DAMPING.
3. To change the specified damping level and optimize the A-Scan signal appearance, move the joystick () or press the function toggle. The following options are available:
 - 50 Ω
 - 1000 Ω
4. After completing your selection, move the joystick up or down () to navigate away from this function.

2.4.3 Adjusting the Pulser Repetition Frequency (PRF)

The *Pulser* fires at a frequency which can be set either *automatically* or *manually*. To set the PRF mode and frequency level:

1. In the ACQUIRE menu, activate the PULSER submenu using the joystick ().
2. Use the joystick () to select the function titled PRF MODE.
3. Press the function toggle to see the available choices:
 - **AUTO HIGH** - The instrument calculates and sets the pulser firing rate at 75% of the maximum frequency possible, based on the range and the material velocity.
 - **AUTO MED** - The instrument calculates and sets the pulser firing rate at 50% of the maximum frequency possible, based on the range and the material velocity.
 - **AUTO LOW** - The instrument calculates and sets the pulser firing rate at 20% of the maximum frequency possible, based on the range and the material velocity.
 - **MANUAL** - Allows the user to set the pulser frequency. However, unacceptable PRF settings will cause a display prompt to appear.





2.4.3 Adjusting the Pulser Repetition Frequency (PRF) (cont.)

- If PRF MODE is set to AUTO HIGH, AUTO MED or AUTO LOW, the automatically calculated value is displayed in the function box. If you selected the MANUAL option, you may now adjust the PRF value by moving the joystick left or right ()

Note: *The PRF setting may be limited based on the user-selected pulser voltage setting. This feature acts to limit signal dissipation.*






2.4.4 Setting the Pulser Voltage

The relative energy with which the pulser fires is adjusted by changing the VOLTAGE setting. To set the pulser voltage level:


- In the ACQUIRE menu, activate the PULSER submenu using the joystick ()
- Use the joystick () to select the function titled VOLTAGE. Press the function toggle or move the joystick () to:
 - Set the voltage level to HIGH or LOW, for a standard PULSER TYPE setting of SPIKE, or
 - Specify the actual VOLTAGE value, for an optional PULSER TYPE setting of SQUARE
- After completing your selection, move the joystick up or down () to navigate away from this function.

2.4.5 Selecting the Pulser Type (OPTIONAL)

The standard pulser shape is a spike, and there is also an optional square pulser shape available. If the PULSER TYPE option is activated, choose between the spike and square options as follows:

1. In the **SETUP** menu, activate the **CONFIG2** submenu using the joystick (.
2. Use the joystick () to select the function titled **PULSER TYPE**. Then, press the center of the joystick () to activate the function.
3. Press the function toggle or move the joystick () to select **SPIKE** or **SQUARE**. Then, press the center of the joystick () to activate the function.

Note: *This selection influences the **VOLTAGE** settings available and determines if a **PULSER WIDTH** function (**SQUARE** wave mode) or a **PULSER ENERGY** function (**SPIKE** mode) is available.*

4. After making your choice, press the center of the joystick () to deactivate the function.

2.4.6 Selecting the Pulser Energy or Width (OPTIONAL)

After activating the PULSER TYPE option, either SQUARE wave mode or SPIKE mode may be chosen (see the previous page). Depending on your choice, proceed to the appropriate section below to specify either the pulser *width* (*square wave* mode) or the pulser *energy* (*spike* mode).

2.4.6a Selecting Pulser Width in Square Wave Mode

The pulser width generally varies from 30 to 500 nanoseconds. A recommended starting point from which the width setting can be adjusted is found with the following equation:





$$\text{PULSE WIDTH (nanoseconds)} = \frac{1000}{2f} (\text{with } f \text{ in MHz})$$

For example, if a 2 MHz probe is used, the equation becomes:

$$\text{PULSE WIDTH (nanoseconds)} = \frac{1000}{2 \bullet 2} = 250$$





2.4.6a *Selecting Pulser Width in Square Wave Mode (cont.)*

To set the pulser width:

1. In the ACQUIRE menu, activate the PULSER submenu using the joystick () .
2. Use the joystick () to select the function titled WIDTH, which is only available if the PULSER TYPE function is set to SQUARE. Press the function toggle or move the joystick () to set the width of the pulser.
3. After completing your selection, move the joystick up or down () to navigate away from this function.






2.4.6b *Selecting Pulser Energy in Spike Mode*

To set the pulser energy:

1. In the ACQUIRE menu, activate the PULSER submenu using the joystick () .
2. Use the joystick () to select the function titled ENERGY, which is only available if the PULSER TYPE function is set to SPIKE. Press the function toggle or move the joystick () to set the energy of the pulser to either HIGH or LOW.
3. After completing your selection, move the joystick up or down () to navigate away from this function.

2.4.7 Using the Phantom PRF Feature

When activated, this diagnostic feature varies the PRF to identify any wrap-around signals, which are phantom echoes caused by a PRF setting that is too high. When this feature is activated, the time-based position of the phantom echoes varies while the true echoes remain stationary on the display screen.

1. In the **SETUP** menu, activate the **CONFIG2** submenu using the joystick () .
2. Use the joystick () to select the function titled **PHANTOM PRF**. Press the joystick () to activate this function.
3. Press the function toggle or move the joystick () to choose either **ON** or **OFF**.
4. After making your choice, press the center of the joystick () to deactivate the function.

2.4.8 Selecting a Rectification Mode

Rectification effects the orientation of the A-scan on the display screen. The A-scan represents the sound pulse (i.e. echo) that is returned to the instrument from the material being tested. The series of echoes looks like the *Radio Frequency (RF)* signal shown in *Figure 12* below. Note that the RF signal has both a negative component below the axis and a positive component above the axis. In RF mode, Gate A and Gate B can be positioned either above or below the axis, to be triggered by either a positive-heading echo or a negative-heading echo.

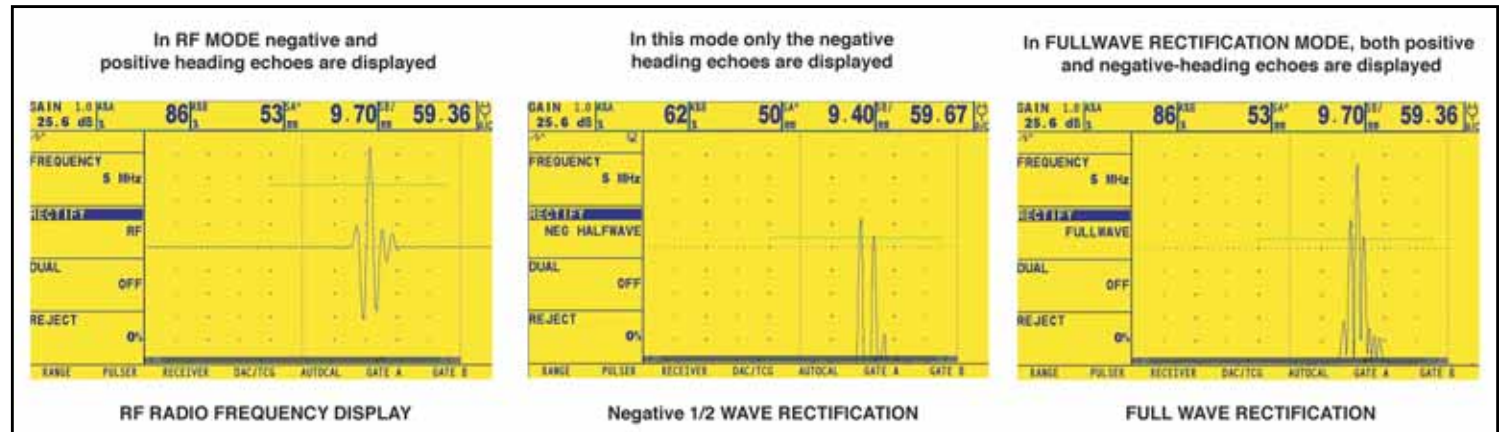






Figure 12: Typical RF and Rectified Signals

2.4.8 Selecting a Rectification Mode (cont.)

- *Positive Half Rectification* means that only the upper (i.e. positive) half of the RF signal is displayed.
- *Negative Half Rectification* means that only the bottom (i.e. negative) half of the RF signal is displayed (see *Figure 12 on page 61*). Note that although only the negative half of the RF signal is displayed, it is shown in the same orientation as a positive component to simplify viewing.
- *Full-Wave Rectification* combines the positive- and negative-rectified signals together, and displays both of them in a positive orientation (see *Figure 12 on page 61*).




Use the procedure on the next page to select a rectification mode.

2.4.8 Selecting a Rectification Mode (cont.)

1. In the ACQUIRE menu, activate the RECEIVER submenu using the joystick () .
2. Use the joystick () to select the function titled RECTIFY. The following options are available:
 - NEG HALFWAVE - Shows the negative component of the RF signal but displays it in a positive orientation.
 - POS HALFWAVE - Shows the positive component of the RF signal.
 - FULLWAVE - Shows the positive and negative halves of the RF wave, but both are oriented in the positive direction.
 - RF - Shows the echo with no rectification.
3. Press the function toggle or move the joystick () to select the desired rectification method.
4. After completing your selection, move the joystick up or down () to navigate away from this function.

2.4.9 Setting the A-Scan REJECT Level

A portion of the A-Scan can be omitted from the display screen, by defining the percentage of the full-screen height you wish to omit. To set a reject percentage:

1. In the ACQUIRE menu, activate the RECEIVER submenu using the joystick () .
2. Use the joystick () to select the function titled REJECT.
3. To change the amount of the A-Scan you wish to omit from the display, as a percentage of the full-screen height, either move the joystick () or press the *function toggle*. You may omit a portion of the A-Scan up to 80% of the full-screen height.

Note: *Whenever REJECT is set to a value greater than 0%, the reject icon (see Figure 6 on page 19) is displayed in the status bar.*

2.5 Adjusting the A-Scan

To configure the USM Go A-Scan, follow the instructions in this section.

2.5.1 Setting the A-Scan Range

Calibration of the USM Go requires the use of two calibrated standards. These standards must be of different thicknesses, and they must be made of the same material as the test piece. Prior to calibrating the instrument/probe combination, the A-Scan display range, which is the material thickness value represented by the full horizontal width of the screen, is normally set to a value equal to or slightly larger than the thicker calibrated standard (see *Figure 13* below).

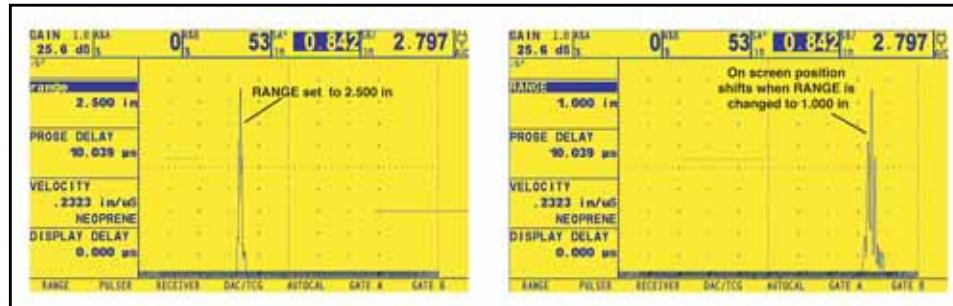






Figure 13: Effects of the A-Scan Range Adjustment




2.5.1 Setting the A-Scan Range (cont.)

To set the A-Scan range:


1. In the ACQUIRE menu, activate the RANGE submenu using the joystick () .
 2. Use the joystick () to select the function titled RANGE, which has both coarse and fine adjustment modes. Coarse adjustments are made with the *function toggle*, while fine adjustments are made with the *joystick*. When “RANGE” appears in all capital letters, coarse adjustments are being made, while fine adjustments occur when “range” appears in all lower-case letters.
 3. Press the function toggle or move the joystick () to change the range setting. Values from 0.040 to 1100 in. are allowed.
- Note:** *Pressing both buttons on the Function Toggle simultaneously resets the RANGE to the default value of 10.000 in.*
4. After completing your selection, move the joystick up or down () to navigate away from this function.

2.5.2 Setting the Display Delay

The display delay function shifts the displayed A-Scan to the left or the right in the viewing window. To set the display delay:

1. In the ACQUIRE menu, activate the RANGE submenu using the joystick () .
2. Use the joystick () to select the function titled DISPLAY DELAY.
3. Press the function toggle or move the joystick () to change the display delay. As you change the value, you should see the displayed echoes shift to the left or the right.

Note: *Pressing both buttons on the Function Toggle simultaneously resets the DELAY to the default value of 0.*

4. After completing your selection, move the joystick up or down () to navigate away from this function.

2.6 Calibrating the Instrument

To calibrate the USM Go, follow the instructions in this section.







2.6.1 Pre-Calibration Check List

To improve the accuracy and quality of your calibration, be sure that the following steps have been taken before beginning the calibration:

- Install the probe
- Adjust the DUAL (RECEIVER) setting to match probe
- Set the material type
- Set the DISPLAY DELAY to 0 (recommended)
- Set the PRF to AUTO LOW
- Set TCG to OFF
- Set REJECT to 0 (recommended).

2.6.2 Using AUTOCAL

Note: *While following the instructions in this section, refer to Figure 14 on page 70.*

1. In the ACQUIRE menu, activate the AUTOCAL submenu using the joystick (.
2. Use the joystick () to select the function titled S-REF1. Then, press the function toggle or move the joystick () to change the value to match the thickness of the **thinner** calibration standard. The S-REF1 function has both coarse and fine adjustment modes. Coarse adjustments are made with the function toggle, while fine adjustments are made with the joystick.
3. Use the joystick () to select the function titled S-REF2. Then, press the function toggle or move the joystick () to change the value to match the thickness of the **thicker** calibration standard. The S-REF2 function has both coarse and fine adjustment modes. Coarse adjustments are made with the function toggle, while fine adjustments are made with the joystick.
4. Apply couplant and couple the probe to the **thinner** calibration standard. With the A START function highlighted, press the function toggle or move the joystick () to shift the starting point of Gate A until Gate A lies over the echo corresponding to the thickness of the thinner standard (see *Figure 14 on page 70*). Coarse adjustments are made with the function toggle, while fine adjustments are made with the joystick.

2.6.2 Using AUTOCAL (cont.)

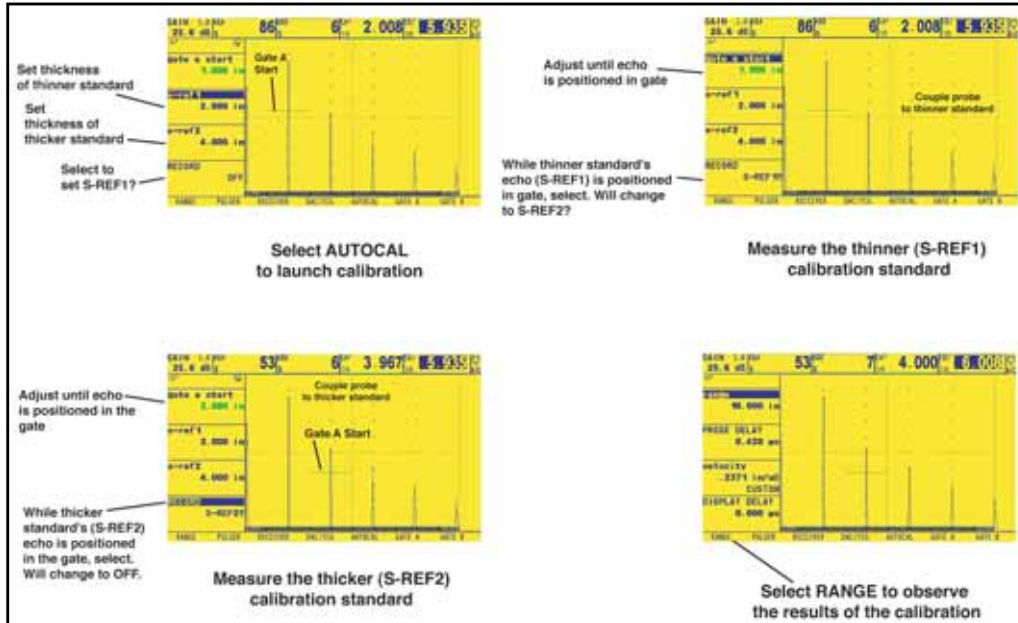








Figure 14: Auto Calibration Procedures



2.6.2 Using AUTOCAL (cont.)

Note: During the following steps, pressing both buttons on the Gain Toggle simultaneously activates the AUTO80 function.

5. Use the joystick () to select the function titled RECORD. The value in the function box changes from "OFF" to "S-REF1?".
While maintaining the signal in Gate A, move the joystick right or left () to record the reference echo. The value in the function box now reads "S-REF2?".
6. Apply couplant and couple the probe to the *thicker* calibration standard. Then, use the joystick () to select the function titled A START. Press the function toggle or move the joystick () to shift the starting point of Gate A until Gate A lies over the echo corresponding to the thickness of the thicker standard (see *Figure 14 on page 70*). Coarse adjustments are made with the function toggle, while fine adjustments are made with the joystick.
7. Use the joystick () to select the function titled RECORD. While maintaining the signal in Gate A, move the joystick right or left () to record the reference echo. The value in the function box now reads "OFF".





2.6.3 Checking the Calibration Results

Following the calibration procedure, the calculated acoustical velocity and probe delay are displayed. To view these calculated values:

1. In the ACQUIRE menu, activate the RANGE submenu using the joystick () .
2. Press the function toggle or move the joystick () to view the following selections:
 - PROBE DELAY - The adjustment made as a result of the AUTOCAL (zeroing) procedure is shown. This represents the time delay caused by sound-wave traveling through the probe membrane, wear plate, or delay line.
 - VELOCITY - The calculated velocity after the calibration is shown. The *material type* is listed as “*custom*”.

2.7 Using the Calibration Reminder Alarm






The USM Go incorporates a timed alarm feature that causes an icon to appear on user-defined input intervals between 0.5 and 4.0 hours. To use this alarm:

1. In the **SETUP** menu, activate the **CONFIG2** submenu using the joystick () .
2. Use the joystick () to select the function titled **CAL REMINDER**, then press the center of the joystick () to activate the function. Input the intervals at which the reminder alarm will trigger (between 0.5 and 4.0 hours). Setting this value automatically resets the alarm to trigger on the specified intervals. This function also allows the alarm to be disabled.
3. Press the function toggle or move the joystick () to change the alarm interval.
4. Select and activate **CAL RESET** to acknowledge the triggered alarm and reset it to resume normal operation.

Note: *The selection of the PROBE DELAY or VELOCITY functions also resets the alarm.*




2.8 Activating Instrument Upgrades

When provided, activation codes matched to your USM Go serial number can be input via the **CODE** submenu, which is located in the **CONFIG** menu. This submenu also lists the serial number assigned to your instrument. To input an activation code:

1. In the **SETUP** menu, activate the **CONFIG1** submenu using the joystick () .
2. Use the joystick () to select the function titled **CODE**, and then press the center of the joystick () to activate the function. Note that the first character of the current code value is highlighted.
3. Use the joystick () to change the highlighted character to match the value provided by GE. Then, move the joystick () to select the next character, and continue modifying the values until they all match the code provided by GE.

Note: *Holding either end of the Function Toggle down for three seconds resets all values in the code to 0.*

2.8 Activating Instrument Upgrades (cont.)

4. After completing the code entry, press the center of the joystick () to deactivate the function.
5. Use the joystick () to select the function titled **CONFIRM**, and then press the center of the joystick () to acknowledge that the new code is correct.
6. Be sure to follow on-screen instructions to successfully complete the activation.

[no content intended for this page - proceed to next page]

Chapter 3. Making Measurements

This chapter explains how to configure the USM Go flaw detection and thickness measurement capabilities. It then explains how to make ultrasonic measurements.

3.1 Configuring Gate A and Gate B

Setting the position and the characteristics of Gate A and Gate B is the first step in configuring the instrument for flaw detection or material thickness measurements. The GATE A and GATE B submenus control the location of Gate A and Gate B, while the EVAL and CONFIG2 submenus in the SETUP menu control the operating characteristics for the gates.





3.1.1 Activating Automatic Gate Threshold (AGT)

When Automatic Gate Threshold (AGT) is activated, the corresponding gate's threshold is set automatically.

Note: An icon is displayed in the Symbol Area when the AGT mode is activated.

3.1.1 Activating Automatic Gate Threshold (AGT) (cont.)

To configure the *Automatic Gate Threshold* (AGT) function, follow this procedure:


1. In the **SETUP** menu, activate the **EVAL** submenu using the joystick () , and then the **EVALMODE** option.
2. Use the joystick () to select the function titled **AGT**. Then press the center of the joystick () to activate the function.
3. Move the joystick to select the particular **AGT** mode:
 - **GATE A**
 - **GATE B**
 - **GATE A/GATE B**
4. Press the center of the joystick () to set the setting.

3.1.2 Positioning the Gates




Use the procedures in this section to set the vertical and horizontal position of Gate A and Gate B. Remember that gate position has the following effects on instrument performance:

- A-Scan echoes on the right side of the display screen represent features that occur at a greater depth from the test-material surface than those on the left side of the display screen. Therefore, moving a gate to the right means that the gate is evaluating a deeper portion of the test material.
- A wider gate setting means that the gate is evaluating a thicker portion of the test material.
- Increasing the vertical height, called the threshold, of a gate means that only reflected signals of sufficiently large amplitude will cross the gate.

To configure the gate parameters, complete the following steps and then proceed to the appropriate section:


1. In the ACQUIRE menu, activate the Gate A or Gate B submenu using the joystick ()
2. Choose the desired function from the available options.

3.1.2a *Setting the Gate Starting Point* (GATE A or GATE B-GATE START)




1. In the ACQUIRE menu, activate the GATE A or GATE B submenu using the joystick () .
2. Use the joystick () to select the GATE A START (or GATE B START) function.
3. To change the gate starting point, either move the joystick () or press the function toggle.

Increasing and decreasing the value of the starting point moves the gate to the right and left, respectively. The gate starting point remains as set here, even when width adjustments are made.


Note: *The GATE A START and GATE B START functions have both coarse and fine adjustment modes. Coarse adjustments are made with the function toggle, while fine adjustments are made with the joystick. When the function name appears in all capital letters, coarse adjustments are being made, while fine adjustments occur when the function name appears in all lower-case letters.*

4. After completing your selection, move the joystick up or down () to navigate away from this function.



3.1.2b Adjusting the Gate Width (GATE A WIDTH or GATE B-GATE WIDTH)

1. In the ACQUIRE menu, activate the GATE A or GATE B submenu using the joystick () .
2. Use the joystick () to select the GATE A WIDTH (or GATE B WIDTH) function.
3. To change the gate width, either move the joystick () or press the function toggle.



Note: *This function has both coarse and fine adjustment modes. Coarse adjustments are made with the function toggle, while fine adjustments are made with the joystick.*

4. After completing your selection, move the joystick up or down () to navigate away from this function.

3.1.2c *Setting the Gate Threshold (Vertical Position)* (A THRESHOLD or B THRESHOLD)




1. In the ACQUIRE menu, activate the GATE A or GATE B submenu using the joystick () .
2. Use the joystick () to select the A THRESHOLD (or B THRESHOLD) function.

IMPORTANT: *If the AGT function has been activated (see “Activating Automatic Gate Threshold (AGT)” on page 77), the A THRESHOLD menu parameter is replaced with the AGT Scale Value. The scale value is displayed in the form of $\pm\text{AGT} = \text{ss}\%$, where ss represents the AGT scale value. The user can modify the AGT scale value using the joystick and/or the function keys.*


3. To change the gate height, either move the joystick () or press the function toggle. Increasing or decreasing the value of the threshold moves the gate up or down, respectively.
4. After completing your selection, move the joystick up or down () to navigate away from this function.

3.1.3 Selecting the TOF-Detection Method

A-Scan signals crossing either Gate A or Gate B are evaluated for the purposes of flaw detection and material thickness evaluation. When the signal crosses Gate A or Gate B, either the gate-crossing point (i.e. the flank) of the signal, or the maximum point (i.e. the peak) of the signal in that specific gate is used for evaluation purposes. The TOF MODE function allows the user to specify which A-Scan feature (FLANK or PEAK or JFLANK) is used to evaluate the signal in each gate.

1. In the ACQUIRE menu, activate the GATE A or GATE B submenu using the joystick () .
2. Use the joystick () to select the TOF MODE function.
3. To change the gate detection mode, either move the joystick () or press the function toggle. The following options are available:
 - **PEAK** - All detection, whether time-based and peak height, is based on the **HIGHEST** triggering echo in the gate.
 - **FLANK** - The time-based triggering point is the first flank to cross the gate, and amplitude-based results are based on the **HIGHEST** peak of any echo crossing the gate. This is not necessarily the peak of the same echo whose flank triggered the gate.
 - **JFLANK** - The time-based triggering point is the first flank to cross the gate, and the amplitude-based results are based on the peak of this first echo to cross the gate. This is not necessarily the highest echo in the gate.

3.1.3 Selecting the TOF-Detection Method (cont.)

4. After completing your selection, move the joystick up or down () to navigate away from this function.





Note: *The detection method chosen is indicated by a small icon. This icon is displayed in the display box containing the measured reading, and in the options offered in the **READING 1** through **6** and **LARGE** function boxes.*

3.1.4 Setting Gate Alarms and Outputs


An alarm can be set for either one or both of the gates. This is accomplished by configuring either *Reading Box 4* (in **LARGE** mode) or the single *Large Reading Box* (in **SMALL** mode) to act as a virtual LED that mimics an indicator light. When so configured, the virtual LED reading box is green when there is no fault condition and red when the alarm has been triggered.

3.1.4a Defining Gate-Alarm Logic (SETUP-CONFIG2-GATE A or B LOGIC)

Each gate alarm can be triggered by one of two circumstances: either when an A-Scan echo crosses the gate or when no A-Scan echo crosses the gate. Use the following procedure to specify the gate LOGIC settings:






1. In the **SETUP** menu, activate the **CONFIG2** submenu using the joystick () .
2. Use the joystick () to select the function titled **GATE A** (or **GATE B**) **LOGIC**. Press the center of the joystick () to activate the function.
3. To choose the gate-alarm triggering logic, move the joystick up or down () . The following options are available:
 - **POSITIVE** - An A-Scan signal crosses the gate
 - **NEGATIVE** - No A-Scan signal crosses the gate
 - **OFF** - No alarm is connected to the selected gate

Note: *Gate A and Gate B can be configured so that either gate triggers the alarm.*

4. After making your choice, press the center of the joystick () to deactivate the function.





3.1.4b Assigning Alarm Output Indicator Lights (SETUP-CONFIG2-OUTPUT SELECT)

As an option, one reading box may be configured as a virtual LED (see “Setting Gate Alarms and Outputs” on page 84), which is green when there is no fault condition and red when the alarm has been triggered. This virtual LED corresponds to an OUTPUT, which is in-turn assigned to a gate alarm. When an alarm is triggered, the virtual LED is illuminated (except when the GATE LOGIC is set to OFF). Use the following procedure to indicate which gate activates the virtual LED:


1. In the **SETUP** menu, activate the **CONFIG2** submenu using the joystick () .
2. Use the joystick () to select the function titled **OUTPUT SELECT**. Press the center of the joystick () to activate the function.
3. To configure the gate-alarm virtual LED operation, move the joystick up or down () . The following options are available:
 - **A(+), A(-)** - the virtual LED indicates the Gate A alarm is triggered (see previous page for description of + and - alarms)
 - **B(+), B(-)** - the virtual LED indicates the B Gate alarm is triggered (see previous page for description of + and - alarms)
 - **A or B(+), A or B (-)** - the virtual LED indicates either Gate alarm is triggered (see previous page for description of + and - alarms)
4. After making your choice, press the center of the joystick () to deactivate the function.

3.1.4c *Select Gate to Be Magnified When Function Toggle Is Pressed* (SETUP-EVAL-MAGNIFY GATE)

The user can indicate the action to be taken when either end of the *Function Toggle* is pressed. One option magnifies the A-Scan display, so the assigned gate spans the entire displayed range. To specify the gate that should be magnified on demand:

1. In the **SETUP** menu, activate the **EVAL** submenu using the joystick ().
2. Use the joystick () to select the function titled **MAGNIFY GATE**. Press the center of the joystick () to activate the function.
3. To select **Gate A** or the **Gate B**, move the joystick up or down ().

Note: *Pressing the assigned end of Function Toggle, when **FUNCTION1** or **FUNCTION 2** is set to **MAGNIFY GATE**, magnifies the display so the selected gate spans the entire displayed range.*

4. After making your choice, press the center of the joystick () to deactivate the function.



3.2 Using Angle Beam Probes

When connecting an angle beam probe to the instrument, adjustments must be made for probe characteristics as well as test piece geometry. These adjustments include:

- Probe angle
- Probe X value = the distance from the probe Beam Index Point (BIP) to the front edge of its wedge
- Test piece thickness
- O-Diameter




3.2.1 Setting the Angle Beam Probe Parameters

To configure the instrument for an angle-beam probe, follow this procedure:

1. In the **SETUP** menu, activate the **EVAL** submenu using the joystick () .
2. Use the joystick () to select the function titled **PROBE ANGLE**. Input the angle for the installed probe. Surface evaluation is performed by installing the correct probe/wedge and setting this value to $> 89^\circ$.

Note: *This function has both coarse and fine adjustment modes. Coarse adjustments are made with the function toggle, while fine adjustments are made with the joystick.*

3.2.1 Setting the Angle Beam Probe Parameters (cont.)

3. Use the joystick () to select the **THICKNESS** function, and input the thickness of the test piece. The thickness of a solid rod should be input as 1/2 of its diameter.
4. Use the joystick () to select the **X VALUE** function, and input the user-determined X value for the probe. This compensates for the distance from the BIP to the front of the probe wedge.
5. Use the joystick () to select the **O DIAMETER** function, and input the outside diameter (from 50 to 2000 mm) of a curved test piece. When set to **FLAT**, curvature correction is not applied.

Note: *Based on the values input for the **PROBE ANGLE**, **THICKNESS**, **X VALUE**, and **O DIAMETER** parameters, the instrument operates in one of five modes. Each of these modes is represented by an icon in the icon area at the upper left corner of the screen. See Figure 6 on page 19 for an illustration of these icons.*

3.2.2 Indicating Leg with Color

The leg in which a reflector is encountered, can be visually indicated on the instrument display using color. Setting the **COLOR LEG** function, located in the **EVAL** submenu of the **SETUP** menu, to **ON** causes each ultrasonic time region to be displayed in a unique color.

3.3 Displaying Measured Results

The instrument is capable of displaying up to seven measured readings at one time. The displayed readings are selected using the **EVAL** submenu located in the **SETUP** menu. The parameters available for display, which depends on the instrument configuration and the evaluation mode, include the following:

- **A%A** - Amplitude, as a % of full-screen height, of the highest echo falling within the width of Gate A
- **A%B** - Amplitude, as a % of full-screen height, of the highest echo falling within the width of Gate B

Note: *When S, D, P, or R readings are displayed, the Gate-Detection Mode setting for the referenced gate (A or B) is indicated by a ^ for Peak Mode or a / for Flank Mode.*

- **SA** - Sound-Path distance or duration, represented by the highest echo or the first flank to cross Gate A
- **SB** - Sound-Path distance or duration, represented by the highest echo or the first flank to cross Gate B
- **SBA** - Sound-Path distance or duration, from the highest echo or the first flank in Gate A to the echo in Gate B. The reading is only available if Gate A and Gate B are set to **ON**.

3.3 Displaying Measured Results (cont.)

- DA - Material-thickness depth from the probe-contacted side of the test-piece surface to the reflector, represented by the Gate A echo.
- DB - Material-thickness depth from the probe-contacted side of the test-piece surface to the reflector, represented by the Gate B echo.
- LA - Leg number of the reflector, represented by the Gate A echo.
- LB - Leg number of the reflector, represented by the Gate B echo.
- PA - Projection distance from the probe BIP to the reflector, represented by the Gate A echo.
- PB - Projection distance from the probe BIP to the reflector, represented by the Gate B echo.
- RA - Projection distance from the probe BIP to the reflector, represented by the Gate A echo, minus the current X-VALUE.
- RB - Projection distance from the probe BIP to the reflector, represented by the Gate B echo, minus the current X-VALUE.
- A%rA - Amplitude of the signal crossing Gate A, as a percentage of the active EVAL MODE reference amplitude.
- A%rB - Amplitude of the signal crossing Gate B, as a percentage of the active EVAL MODE reference amplitude.
- dBrA - dB equivalent height difference between the signal crossing Gate A and the active EVAL MODE reference height.
- dBrB - dB equivalent height difference between the signal crossing Gate B and the active EVAL MODE reference height.

3.3 Displaying Measured Results (cont.)


Note: Reference results (*identified with “r”*) behavior based on EVAL MODE are as follows:

- DAC - % Amplitude or dB compared to corresponding DAC curve point
- TCG - % Amplitude or dB compared to TCG reference level
- dB REF - % Amplitude or dB compared to reference level
- DGS - % Amplitude or dB compared to curve/size selected
- JISDAC - % Amplitude or dB compared to JIS LINE (H, M, or L) set to BOLD
- NONE - % Amplitude or dB compared to gate threshold height
- CLS - JIS CLASS (I, II, III, or IV). Available only when JISDAC evaluation mode is active.
- ERS - Evaluates the reflected echo in DGS Mode, and calculates the *Equivalent Reflector Size*
- GT - DGS test gain, which initializes the DGS curve maximum height at 80% FSH.
- GR - DGS reference gain, which represents the instrument gain at which the reference echo peak reaches 80% FSH.
- VIRTUAL LED - Reading box color changes from green to red when a gate alarm is triggered.

3.3 Displaying Measured Results (cont.)

- SLA - dB equivalent height difference between the signal crossing Gate A and the SL reference height (for CNDAC evaluation mode only).
- SLB - dB equivalent height difference between the signal crossing Gate B and the SL reference height (for CNDAC evaluation mode only).
- OFF - No reading is displayed in the reading box.






The measured readings can be displayed at the top of the display screen either in six small reading boxes and one large reading box or in four large reading boxes. To set the reading box configuration:

1. In the **SETUP** menu, activate the **RESULTS2** submenu using the joystick .
2. Determine the configuration of the reading boxes by setting the **MODE** function to either **LARGE** (four parameters displayed) or **SMALL** (six parameters displayed in small boxes and a seventh parameter displayed in a large box).
3. In the **RESULTS** and **RESULTS2** submenus, access and set the **READING 1** through **READING 6** functions to select the desired result to be displayed. When time or thickness readings are displayed, the detection method selected for that gate is indicated with a ^ (representing **PEAK**) or / (representing **FLANK** or **JFLANK**).

Note: *Under certain conditions, while TCG reference points are being recorded, two measurement results boxes are automatically set (if not so configured already) to display SA and A%A values.*

3.4 Locking the Gain Toggle and the Joystick

The gain toggle can be locked so that pressing it has no effect on the instrument.

1. In the **SETUP** menu, activate the **CONFIG2** submenu using the joystick () .
2. Use the joystick () to select the function titled **dB STEP**. Press the center of the joystick () to activate the function.
3. Move the joystick left or right () to change the value of **dB STEP** until the word **LOCK** appears as the **dB STEP** value. The gain toggle is now locked.
4. To unlock the gain toggle, change the setting of **dB STEP** to any value other than **LOCK**.
5. After making your choice, press the center of the joystick () to deactivate the function.

Joystick operation is disabled by assigning either **FUNCTION1** or **FUNCTION2** to a value of **JOYSTICK LOCK**, then pressing that end of the *Function Toggle*. When the joystick is locked, the *Lock icon* (see *Figure 6 on page 19*) appears on the display. To unlock the joystick, simply press the assigned end of the *Function Toggle* a second time.

IMPORTANT: *When the joystick is locked, the center-press function still works.*






3.5 Setting the Gain

Instrument gain, which increases and decreases the height of a displayed A-Scan, is adjusted with the *Gain Toggle*. The instrument gain can be adjusted while in any menu location, except when the dB STEP feature is set to LOCK.

Note: *Pressing both buttons on the Gain Toggle simultaneously activates the AUTO80 function.*






3.5.1 Changing the Gain-Adjustment Increment (dB STEP)

When adjusting the A-Scan gain, each press of the *Gain Toggle* increases or decreases the gain level by a dB increment equal to the dB STEP value. Several values can be specified for dB STEP, including: a user-specified value known as the USER GAIN STEP. There is also a *Gain Toggle* adjustment LOCK which prevents any gain adjustment by the user. To select one of the existing dB STEP values:

1. In the SETUP menu, activate the CONFIG2 submenu using the joystick (.
2. Use the joystick () to select the function titled dB STEP. Press the center of the joystick () to activate the function.
3. Move the joystick left or right () to change the value of dB STEP. Available increments include: 0.2 dB, 0.6 dB, 1.0 dB, 2.0 dB, 6 dB, a user-defined *Gain Step* (if one has been defined), and LOCK.
4. After making your choice, press the center of the joystick () to deactivate the function.


3.5.2 Setting the User-Defined Gain Step (SETUP-GAIN-USER GAIN STEP)

When adjusting the A-Scan gain, each press of the *Gain Toggle* increases or decreases the gain level by the amount of the dB STEP. To enter a user-specified gain step, known as USER GAIN STEP, complete the following steps:




1. In the SETUP menu, activate the CONFIG2 submenu using the joystick () .
2. Use the joystick () to select the function titled USER GAIN STEP. Press the center of the joystick () to activate the function.
3. Move the joystick left or right () to change the value of USER GAIN STEP. This value is now available as an option whenever the dB STEP function is activated.
4. After making your choice, press the center of the joystick () to deactivate the function.

3.6 Auto Gain Control




The Auto Gain Control option enables the operator to set the minimum and maximum amplitude for the echo which passes through Gate A. When the echo's amplitude is lower than the minimum value or higher than the maximum value, the gain will be adjusted automatically to make the echo's amplitude at the middle of the minimum value and maximum value. To enable auto gain control:

1. In the CONFIG4 menu, select the Auto Gain Ctrl submenu.
2. Set the CTRL MODE setting as ON.
3. Press the center of the joystick () to save the setting.

3.6.1 Setting Maximum Amplitude




1. In the CONFIG4 menu, select the Auto Gain Ctrl submenu
2. Move the joystick to select the MAX AMP.% function, and press the center of joystick () to activate the function.
3. Move the joystick left/right () to set the value.
4. Press the center of the joystick () to deactivate the function and save the setting.

3.6.2 Setting Minimum Amplitude

1. In the CONFIG4 menu, select the Auto Gain Ctrl submenu.
2. Move the joystick to select the MIN AMP.% function, and press the center of the joystick () to activate the function.
3. Move the joystick left/right () to set the value.
4. Press the center of the joystick () to deactivate the function and save the setting.

3.6.3 Setting Noise Level

When the echo's amplitude is lower than the noise level, it will be ignored as a noise.

1. In the CONFIG4 menu, select the Auto Gain Ctrl submenu.
2. Move the joystick to select the NOISE LEVEL.% function, and press the center of the joystick () to activate the function.
3. Move the joystick left/right () to set the value.
4. Press the center of the joystick () to deactivate the function and save the setting.

Note: *The maximum amplitude must be higher than the minimum amplitude, and the minimum amplitude must be higher than the noise level.*

3.7 Freezing the A-Scan Display




By using the FUNCTION1 or FUNCTION2 functions in the SETUP menu, you can program one end of the *Function Toggle* to FREEZE the display. Then, whenever an A-Scan is active, pressing that end of the *Function Toggle* freezes the A-Scan display. The active A-Scan will remain as it appeared when the toggle was pressed and the display will remain frozen until it is pressed again. While the display is frozen, the displayed readings are based on the frozen echoes.

Once in frozen mode, the user can change the settings of Gate A and Gate B to obtain the new measured results. While the display is frozen, the settings of Gate A and Gate B still can be changed. The measured results are updated when the settings are changed.




Note: *When the acquisition time is longer than twice the quotient of range and velocity, the precision of measured results will be reduced.*

3.8 Freeze on A-Scan Operation




When this feature is enabled, if an echo passes through the gate, the A-Scan curve will be frozen automatically.

1. In the CONFIG3 menu, activate the FREEZE submenu.
2. Move the joystick to select FREEZE MODE function, and then press the center of joystick() to activate the function.
3. Move the joystick left/right () to select the option.
 - STANDARD - Normal setting. Pressing the function key to freeze the A-Scan display.
 - AFREEZE - If an echo passes through Gate A, A-Scan display will be frozen automatically.
 - BFREEZE - If an echo passes through Gate B, A-Scan display will be frozen automatically.
 - AB-FREEZE - If an echo passes through Gate A or Gate B, A-Scan display will be frozen automatically.
 - COMPARE - A-Scan comparison. The current A-Scan display can be compared with an A-Scan curve stored before or a frozen A-Scan curve.
4. Press the center of the joystick () to deactivate the function and save the setting.

3.9 Echo Envelope

1. In the CONFIG3 menu, activate the FREEZE submenu.
2. Use the joystick to select the ENVELOPE function, and then press the center of the joystick () to activate the function.
3. Move the joystick left/right () to turn on/off the ENVELOPE option.
4. Press the center of the joystick () again to deactivate the function and save the setting.


3.9.1 Envelope Color

1. In the CONFIG3 menu, activate the FREEZE submenu.
2. Use the joystick to select the ENVELOPE COLOR parameter, and then press the center of joystick () to activate the function.
3. Move the joystick left/right () to select the color for ENVELOPE curve.
4. Press the center of the joystick () again to deactivate the function and save the setting.

3.10 Comparison Mode

When the Comparison mode is turned **ON**, an A-Scan curve from a dataset file or a frozen A-Scan is displayed on the screen as a reference curve. If the envelope mode is **ON**, the envelope curve is displayed as a reference curve.

To enable the Comparison mode:

1. In the **CONFIG3** menu, select the **FREEZE** submenu.
2. Activate the **FREEZE MODE** function, and select the option, **COMPARE**.
3. Press the center of the joystick () to deactivate the function and save the setting.

3.11 DAC/TCG Evaluation Mode (Optional)

Note: *Optional evaluation features, such as DAC/TCG, are selected via the EVAL MODE function in the EVAL menu. The functions for the selected evaluation mode then appears in the ACQUIRE menu.*

Conventional measurements can be made using the *Time Corrected Gain* (TCG) and *Distance Amplitude Correction* (DAC) modes. The functions for these modes are accessed through the DAC/TCG menu on the ACQUIRE menu bar. The DAC and TCG modes operate based on a set of user-recorded data points. These points are recorded from the DAC/TCG menu as described below.

The TCG mode displays reflectors of equal size at equal A-Scan amplitudes, regardless of the depth of the reflector in the test material. This is accomplished by adjusting the gain at different locations in the A-scan display, corresponding to different material depths, to compensate for signal loss (or variation) due to attenuation, beam spread, or other factors.

The DAC mode displays all echoes at their true amplitude, without depth compensation. However, when operating in DAC mode, a *Distance Amplitude Correction* curve is superimposed on the A-Scan display. The curve represents the constant reflector size at varying material depth.

3.12 Using DAC Mode (Optional)


When displayed, the DAC curve visually represents a line of constant reflector peaks over a range of material depths. Remember that in DAC mode, the only deviation from traditional display and operation is the appearance of the DAC curve. All A-Scan echoes are displayed at their non-compensated height. A DAC curve can be based on up to 16 data points (material depths).

A DAC curve is programmed using a series of same-reflector echoes at various depths, covering the range of depths to be inspected in the test material. Because near field and beam spread vary according to transducer size and frequency, and materials vary in attenuation and velocity, DAC must be programmed differently for different applications.



The minimum time difference between successive points is 60 ns. This corresponds to a distance of 0.18 mm (0.007 in.) at a velocity of 5900 m/s (.2323 in./ μ s). Successive data points do not have to progressively decrease in amplitude. That is, the DAC/TCG curve does not have to have a constantly descending slope.

3.12.1 Recording the DAC Curve

DAC Curve points are typically recorded from a standard with equally-sized reflectors (holes) located at various material depths. The primary echo from each of these points, for a total of up to 16 echoes, are recorded. When DAC mode is active, the instrument displays a line that represents echo peaks for constant reflectors at varying material depth. This line is drawn as either a curved, linear in gain, line based on a series of collected DAC points or a series of straight line segments that join these DAC points. Only one DAC curve can be stored at a time. To program the DAC curve proceed as follows:



1. In the ACQUIRE menu, activate the DAC/TCG submenu using the joystick ().
2. Couple the probe to the first reference point and use the GATE A START function to adjust Gate A so that it is broken by the primary echo. If necessary, use the *Gain Toggle* to adjust the gain so that the echo crosses Gate A, and the highest peak in Gate A is at approximately 80% of full-screen height. The highest peak must not be higher than 100% full-screen height.

Note: *The AUTO 80 function allows for automatic application of gain to set the Gate A triggering echo to 80% of full screen height.*

3. While Gate A is lined up over the first reference echo, use the joystick () to select the function titled RECORD. Press the center of the joystick () to activate the function. When the value of the RECORD function changes from 0 to 1, you have recorded the first *DAC Curve* point, which is then treated as the reference echo. The amplitude value at which this point is recorded becomes the “reference amplitude” value. However, the “reference amplitude” is updated if a new point is recorded with an earlier TOF.

3.12.1 Recording the DAC Curve (cont.)

Note: *If the Gate Detection Mode is set to PEAK, after the first DAC reference point is stored, two measurement result boxes are automatically set, if not already configured, to display SA and A%A values.*

4. Repeat steps 2 and 3 to record additional *DAC Curve* points, up to a maximum of 16 points. A minimum of two *DAC Curve* points are required to define the curve.
5. After entering all of your points, press the center of the joystick () to deactivate the function. The TCG/DAC data is stored, using the amplitude of the earliest TOF as the reference amplitude.
6. In the **SETUP** menu, activate the **DAC TYPE** function using the joystick (). Then, select one of the following options:
 - **STRAIGHT:** The DAC curve is displayed as a series of straight line segments that join the stored DAC points.
 - **CURVED:** The DAC curve is displayed as a curved line that is linear in gain, based on the stored DAC points.

Note: *DAC curve points and status are stored with a data set. When recalled, the curve status is the same as when it was stored.*

3.12.1 Working with DAC Mode

In DAC mode the instrument uses the user-input reference points to create a curve representing the amplitudes of echoes representing same-size reflectors at varying material depth. The recorded point data is stored until replaced or edited. To create a DAC curve and operate in DAC mode:

1. With the DAC/TCG menu accessed, select the **SETUP** submenu.
2. Use the **TCG/DAC MODE** menu to activate the DAC function. The DAC Curve appears whenever operating in DAC mode.
3. The DAC curve can appear either as a series of straight line segments joining the stored DAC points or as a curved (linear in gain) line based on these points. Access the **DAC TYPE** function in the **SETUP** submenu to display the desired DAC curve type.

Note: *To operate in TCG/DAC mode, a DAC curve must first be generated. After the DAC curve has been generated, the TCG mode can be accessed by setting the TCG/DAC function value to TCG.*

Note: *When rectification is set to RF, reference lines are not displayed.*

3.13 Using TCG Mode (Optional)

When the optional TCG mode is in use, echoes from equally sized reflectors are shown at the same height on the A-Scan display. Before using the TCG mode do the following:

1. Make sure that the instrument/probe combination has been properly calibrated and that all instrument settings (PULSER, RECEIVER, etc.) have been properly configured. Changing these settings after the TCG reference points have been entered will affect the accuracy of your measurements.
2. Up to 16 TCG points may be recorded, but a minimum of two points are required to define the curve. This process allows the instrument to calculate and compensate for the effect of material depth on reflector echo height. Successive data points do not have to progressively decrease in amplitude. That is, the DAC/TCG curve does not have to have a constantly descending slope.

3.13.1 Generating the TCG Reference Curve

TCG reference points are derived from the points used to create the DAC curve. Points are typically taken from a standard with equally sized reflectors (holes) located at various material depths. The primary echo from each of these points, for a total of up to 16 echoes, are recorded. When TCG is active, the instrument compensates for different material thickness by applying a varying gain level to echoes at material depths other than the baseline depth.

Note: TCG reference points, curve, and status are stored with a data set. When recalled, curve status is the same as when it was stored.

3.13.2 Working with TCG

In TCG mode the instrument uses the recorded reference points to calculate an amount of gain correction required to display each echo from same-size reflectors at the same amplitude. The recorded reference point data is stored until replaced or edited. To use the stored reference points and operate in TCG mode:

1. Enter the **SETUP** menu, and then select the **TCG/DAC MODE** function.
2. Activate the **TCG/DAC MODE** function, and select the **TCG** option.
3. Select the **TCG DISPLAY** function, and turn this feature **ON** or **OFF**.

Note: *The TCG curve begins at the first reference point recorded. It then proceeds horizontally from the amplitude of this first reference point to the depth (i.e. time position) of the last reference point recorded.*

Note: *When rectification is set to **RF**, reference lines are not displayed.*

3.14 Adjusting DAC or TCG Display and Adding Offsets

After the DAC or TCG curves are displayed, the addition of guidelines offset from the reference line by a fixed or variable dB value provides enhanced evaluating capabilities. Similarly, the TRANSFER CORR function applies dB compensation for the difference in coupling conditions between the known standard and the test piece.

3.14.1 Defining DAC or TCG Curve Offsets (DAC/TCG-OFFSETS-MODE)

To add a series of guidelines, offset from the DAC or TCG curve by a definable dB increment (but not exceeding ± 24 dB from the reference curve):

1. Access the OFFSETS submenu in the DAC/TCG menu.
2. Set the MODE function to FIXED for evenly spaced offset lines or to CUSTOM for user-controlled offset line placement. Set this function to OFF to remove offset lines from the display.
3. If FIXED offset MODE is selected, set the OFFSET function to the dB increment at which offset lines are drawn above and below the DAC or TCG line.
4. If CUSTOM offset MODE is selected, access the OFFSETS2 submenu and input the positive or negative offset at which each of up to four guidelines are drawn.

3.14.2 Setting Transfer Correction (DAC/TCG-MAT ATTN-TRANSFER CORR)

To adjust the dB compensation for differences in ultrasonic coupling between the standard and the test piece:

1. Access the MAT ATTN submenu in the DAC/TCG menu.
2. Adjust the TRANSFER CORR function as required to compensate for coupling differences.

Note: *When TRANSFER CORR is set to any value other than 0, the displayed gain value appears in a contrasting color, indicating that the amount of applied gain differs from the listed “instrument” gain.*

3.15 Editing and Deleting DAC and TCG Reference Points

After your reference points are recorded, they may be individually deleted, their values may be manually adjusted, or new points may be manually entered (as long as the total number does not exceed 16 points). To edit points or input additional points:

1. With the DAC/TCG menu accessed, select the EDIT submenu.
2. Activate the POINT function and select the desired point number (or NEW if adding a new point).
3. Activate the POINT POS. function and adjust (or input for NEW points) the horizontal position of the point.
4. Activate the POINT GAIN function to adjust (or input for NEW points) the applied gain (i.e. the vertical position) of the point. Note that this adjustment applies regardless of whether the point is used for TCG reference or a DAC curve.
5. Activate the ENTER function to confirm the adjusted point values (or the position of a new point). The DAC curve or the TCG reference function is adjusted to match the edited input.
6. To delete any single DAC point, press and hold the center of the joystick for the POINT, POINT POS, or POINT GAIN function while the point to be deleted is active. When prompted, confirm the deletion. Note that the first point cannot be deleted, and that all DAC curves must contain at least two points. Therefore, if a curve has only two points stored, neither can be deleted.

3.16 Deleting a DAC Curve or TCG Reference Points

To delete a stored DAC curve or stored TCG reference points:

1. With the DAC/TCG menu activated, select the SETUP submenu.
2. Activate the DELETE CURVE function.
3. Activate the DELETE CURVE function a second time, then confirm your selection.
4. The statement in the function box changes to TCG/DAC MODE OFF.

3.17 DGS Evaluation Mode

Note: Evaluation features, such as DGS mode, are first selected by the user via the EVAL MODE function in the EVAL menu. The menu for the selected evaluation mode is then available in the ACQUIRE menu bar.

The USM Go *Distance Gain Sizing* (DGS) feature is accessed through the DGS menu, which is located in the ACQUIRE menu bar. DGS mode allows the user to use a particular probe to compare a reflector in a test piece with a known standard reflector. The DGS mode relies on a reference curve based on a recorded reference point. The procedure for recording a reference point using the DGS Menu is described on the next page.

3.17 DGS Evaluation Mode (cont.)

Using the DGS mode (*Distance Gain Size*), you can compare the reflecting power of a natural flaw in the test object with that of a theoretical flaw (e.g. a circular, disk-shaped equivalent reflector) at the same depth.

CAUTION! You are comparing the reflecting power of a natural flaw with that of a theoretical flaw. No definitive conclusions may be drawn about the natural flaw (roughness, inclined position, etc.).

The DGS diagram forms the basis for this comparison of the reflecting power. This diagram consists of a set of curves showing the connection of three influencing variables:

- Distance (D) between the probe and circular, disk-shaped equivalent reflector
- Difference in gain (G) between various large circular, disk-shaped equivalent reflectors and an infinitely large backwall
- Size (S) of the circular, disk-shaped equivalent reflector. The influencing variable S remains constant for one curve in a set

The advantage of the DGS method lies in the fact that you can carry out reproducible evaluations of small discontinuities. This reproducibility is most important whenever you carry out an acceptance test.

3.17 DGS Evaluation Mode (cont.)

In addition to the influencing variables already mentioned, these other factors affect the curve shape:

- sound attenuation
- transfer losses
- amplitude correction value
- probe

Also, the following probe parameters affect the curve shape:

- element or crystal diameter
- frequency
- delay length
- delay velocity

You can adjust these parameters in such a way that you can use the DGS method with many different probes and on various materials.

3.17 DGS Evaluation Mode (cont.)

When the DGS mode is in use, echoes from equally-sized reflectors located at varying depths appear to lie along the *DGS Reference Curve*. When operating in DGS mode, the *DGS Reference Curve* is shown on the display screen. Before using the DGS mode, do the following:

- Calibrate the instrument/probe combination
- Make all required instrument settings related to the pulser, receiver, and material velocity functions

The instrument prevents changes to certain settings after the *DGS Reference Echo* has been recorded and DGS is turned ON.

3.17.1 Specifying a Probe and Preparing to Record the Reference Echo

Before using the DGS mode to evaluate reflectors in test pieces, the characteristics of the attached probe must be specified, certain characteristics of the reference standard must be input, and a reference echo must be stored. To specify the probe characteristics:

1. Select the DGS menu on the ACQUIRE menu bar.
2. Select the SETUP submenu, then the PROBE # function. Once activated, this function allows you to choose from a list of available probe types . These are probes for which probe characteristics are already stored in the instrument, with the exception of the user-defined probe (PROBE # 0).

3.17 Specifying a Probe and Preparing to Record the Reference Echo (cont.)

Note: *The DGS option supports these True DGS probes:*

- *MWB 45-2 tD*
 - *MWB 60-2 tD*
 - *MWB 70-2 tD*
 - *MWB 45-4 tD*
 - *MWB 60-4 tD*
 - *MWB 70-4 tD*
3. If the user-defined probe type (PROBE #0) is selected, you can then select the PROBE NAME function. Then use the *Gain Toggle* and the *Function Toggle* to input a new name. Note that selecting any PROBE # value other than 0 will prevent you from modifying the PROBE NAME or any of the other settings described in this section.

3.17 Specifying a Probe and Preparing to Record the Reference Echo (cont.)

4. If the user-defined probe type (PROBE #0) is selected, you must then select the DGS PROBE submenu and input the characteristics for the connected probe:
 - XTAL FREQUENCY - The frequency rating of the probe
 - EFF. DIAMETER - The effective diameter rating of the probe element
 - DELAY VELOCITY - User-determined delay-line velocity

Note: *These characteristics cannot be changed for any probes other than PROBE #0.*

3.17.1 Record the Reference Echo that Defines the DGS Curve

Prior to generating the DGS curve, a test standard with a known reflector must be used to define a reference point. Acceptable test standards include these reference types:

- **BW** - Backwall echo with reference defect size defined as infinity
- **SDH** - Side-drilled hole with a reference defect size defined as the diameter of the hole
- **FBH** - Flat-bottom hole with a reference defect size equal to the facial diameter of the hole

Follow these steps to record a reference echo:

1. Select the **REF ECHO** submenu, then the **REFERENCE TYPE** function. Once activated, this function allows you to select one of the three reference types described above, and to specify the size of the known standard reference flaw.
2. Couple the probe to the known standard, capture the reference flaw so that it's reflected echo is displayed on the instrument A-Scan, and adjust the **Gate A** starting point to ensure that the resulting echo triggers the gate.
3. Adjust the *Gain Toggle* until the reference flaw A-Scan peak measures 80% of FSH ($A\%A = 80\%$).
4. With the probe coupled to the standard, and the reference flaw echo captured by **Gate A**, use the **RECORD REF** function to store a DGS reference echo.

3.17.1 Record the Reference Echo that Defines the DGS Curve (cont.)

Note: *The AUTO 80 function automatically sets the Gate A triggering echo to 80% of full screen height.*

Note: *Only one DGS reference echo can be stored at a time. To delete the currently stored reference, access the REF CORR submenu, select DELETE REF, and follow the on-screen prompts.*

Note: *When a DGS reference echo is stored, two measurement result boxes are automatically set, if not already configured, to display SA and A%A values.*

IMPORTANT: *The following two adjustments should be made prior to recording a reference echo. Changing these values after the DGS curve is generated will cause the curve to be deleted.*

- **REF ATTEN** (found in the REF CORR submenu) - Specify a sound attenuation value, in dB per inch or mm of material thickness, for the material from which the known standard is made.
- **AMPL CORRECT** (found in the REF CORR submenu) - Correction required when using an angle-beam type probe. This value is specified on the probe data sheet.

3.17.2 Display and Adjust the DGS Curve

After a reference echo has been recorded, the DGS curve is displayed simply by selecting the **SETUP** submenu in the **DGS** menu, then setting the **DGS MODE** function to **ON**. Note that switching this value to **OFF** does not delete the curve - it simply removes the curve from the display and disables the DGS mode. After the DGS curve is displayed, it can be adjusted using one of these three functions:

- **TEST ATTEN** (found in the **MAT ATTN** submenu) - Specify a sound attenuation value, in dB per inch or mm of material thickness, for the material from which the test piece is made.
- **TRANSFER CORR.** (found in the **MAT ATTN** Submenu) - dB compensation for difference in coupling conditions between the known standard and the test piece. Setting this to values other than zero causes a “T” to be added to the **DGS** icon and the displayed gain value to appear in a contrasting color, indicating that the amount of applied gain differs from the listed instrument gain.
- **DGS CURVE** (found in the **SETUP** submenu) - Positions the probe DGS curve based on the size of the reflector (flaw) being tested. The setting usually depends on the largest acceptable flaw size.

3.17.3 Evaluating Results in DGS Mode

After the DGS curve is recorded and displayed, by turning DGS mode ON, echoes are automatically compared to the recorded reference. There are three ways this comparison can be made and two additional DGS-related results that can be displayed:

- **A%rA** - Amplitude of the signal crossing Gate A as a percentage of the corresponding DGS curve amplitude.
- **dBrA** - dB equivalent height difference between the signal crossing Gate A and the corresponding DGS curve height.
- **ERS** - Evaluates the reflected echo and calculates the *Equivalent Reflector Size*.
- **Gt** - DGS test gain, which initializes the DGS curve maximum height at 80% FSH.
- **Gr** - DGS reference gain, which represents the instrument gain at which the reference echo peak reaches 80% FSH.

To aid in interpreting the DGS mode display, the instrument displays up to four curves representing fixed-gain offsets from the DGS curve. These curves are enabled and positioned, by specifying the dB-equivalent amount they are offset above or below the DGS curve, by accessing the OFFSETS submenu in the DGS menu.

3.17.4 Locks and Error Messages

As long as a valid reference echo is stored, no functions can be changed which could cause an incorrect DGS evaluation. If an attempt is made to change such a function, the following error message appears:

- “Function Locked - DGS Reference has been recorded”

Likewise, the DGS evaluation must be switched OFF and the reference echo deleted when selecting a new probe (e.g. for a new test application).

3.17.5 Validity of the DGS Method

Echo amplitude evaluations according to the DGS method are only reliable and reproducible in cases when:

- The reference echo is received from the test object if possible. If this is not possible, it should be verified that the reference block is made of the same material as the test object.
- The evaluation is carried out using the same probe which was also used for recording the reference echo. Another probe of the same type can be used only after recording a new reference echo.
- Echo amplitudes for reflector distances smaller than half of the probe near-field length are subject to extreme variation, for physical reasons due to interference phenomena effecting the area. Thus, evaluation results may fluctuate more than the usually permissible ± 2 dB. An evaluation according to the DGS method is possible, but it is not recommended in such a case.

3.18 dB REF Evaluation Mode

Note: *Evaluation modes, such as dB REF, are selected via the EVAL MODE function in the EVAL menu. The selected evaluation mode menu then appears in the ACQUIRE menu bar.*

When dB REF is activated, the amplitude of the highest echo in A-Gate becomes the reference echo against which subsequent echo amplitudes are evaluated. At the time of the dB REF activation, the gain setting also becomes a reference against which subsequent gain values are compared.

1. Access the **SETUP** submenu in the dB REF menu.
2. Locate the reference echo in Gate A and adjust the gain as required. Then, use the **RECORD** function to record the reference echo. The function box now indicates that a reference has been stored. Also note the following:
 - The instrument gain and the reference echo amplitude are now shown in the function box titled **REFERENCE**.
 - The instrument automatically switches the **dB REF MODE** function to **ON**, as indicated on the display.
 - Setting **MODE** to **OFF** allows you to disable the dB REF mode without deleting the reference echo.
 - Use **DELETE REF** function to delete the current reference.

3.18 dB REF Evaluation Mode (cont.)

IMPORTANT: *Remember that the highest echo in Gate A and the GAIN setting, when dB REF is selected, become the reference amplitude and gain values for as long as dB REF is activated.*

Note: *The reference echo amplitude must not exceed 100% of full-screen height.*

After dB REF has been activated, the *Gain-Display Window* lists both the *Reference Gain* and *Incremental Gain* levels.

The *Reference Gain* remains constant throughout the dB REF session while the *Incremental Gain* value changes with the *Gain Toggle*.

After dB REF has been activated, any amplitude measurements are stated in relation to the reference echo amplitude. Available amplitude readings when operating in dB REF mode are:

- dBrA - dB difference between the reference echo and the highest echo to cross Gate A.
- A%rA - Amplitude of the signal crossing Gate A, as a percentage of the reference amplitude.
- dBrB - dB difference between the reference echo and the highest echo to cross Gate B.
- A%rB - Amplitude of the signal crossing Gate B, as a percentage of the reference amplitude.

3.19 AWS D1.1 Weld Rating Evaluation Mode

Note: *Evaluating modes, such as AWS D1.1 / D1.5, are selected in the EVAL MODE function in the EVAL menu. The selected evaluation mode menu then appears in the ACQUIRE menu bar.*

This mode allows the analysis of welds according to AWS specifications D1.1 or D1.5 and provides a D1.1 or D1.5 rating. The AWS D1.1 mode is accessed via the ACQUIRE menu. The mode utilizes four AWS-specified variables, including:

- **A INDICATION** - Gain (in dB) required to position an A-Scan echoes peak from the measured reflector) at an amplitude equal to the reference amplitude (between 10 and 90% of full-screen height)
- **B REFERENCE** - Gain (in dB) required to position an A-Scan echo peak from the reference reflector at the user-selected amplitude (between 10 and 90% of FSH).
- **C ATTENUATION** - Determined by subtracting 1 inch from the sound-path distance to the discontinuity, using the equation (inch units): $C = (SA - 1) \times 2$. This compensates for sound loss from material attenuation along the sound path to the discontinuity.
- **D D1.1 RATING** - Calculated based on the AWS formula: $D = A - B - C$.

Note: *The dB value of A-Indication is automatically adjusted to match the amplitude of the B-Ref upon performing the dB rating calculation.*

3.19 AWS D1.1 Weld Rating Evaluation Mode (cont.)

Before activating the AWS D1.1/D1.5 weld rating mode, be sure that all instrument settings are properly adjusted for the specific measurement application. Then access the AWS D1.1 submenu in the ACQUIRE menu, and follow this procedure:

1. Apply couplant and couple the probe to a suitable reference test standard.
2. Ensure that Gate A is positioned over the desired echo. Then, adjust the gain until the peak of the desired reference echo reaches the desired amplitude. Note that if the echo peak amplitude (A%A) does not fall between 10% and 90% of FSH, the point will not be accepted.
3. Use the B REFERENCE function to define the reference dB level.
4. To evaluate a reflector in a test piece, couple the probe to the test piece. Now adjust the Gate A position, if required, so that it is over the desired echo.
5. Adjust the gain until the peak of the test-piece echo reaches the desired screen height.

Note: *The dB value recorded for A-Indication is automatically adjusted based on the amplitude difference between it and the value recorded for B-REF. It will usually not match the instrument dB gain setting.*

6. With the AWS D1.1 SETUP submenu displayed, note that the A, C, and D parameters automatically update to match the Gate A triggering echo. Use the A INDICATION function to HOLD the current parameters. Note that the displayed RESULTS continue to update while the A, C, and D parameters are held.

3.20 JISDAC Evaluation Mode

Note: *Evaluation modes, such as JISDAC, are selected in the EVAL MODE function in the EVAL menu. The selected evaluation mode menu then appears in the ACQUIRE menu bar. While operating in JISDAC mode, the Gate A TOF MODE must be set to PEAK or JFLANK.*

Conventional measurements can be made using the *JIS Distance Amplitude Correction (JISDAC)* mode. This mode operates based on a set of user-recorded data points. These points are recorded from the JIS/DAC menu, as described below.

The JISDAC mode displays all echoes at their true amplitude. However, when operating in JISDAC mode, a *Distance Amplitude Correction* curve is superimposed on the A-Scan display. The curve represents constant reflector size at varying material depth.

When displayed, the JISDAC curve visually represents a line of constant reflector peaks over a range of material depths. Remember that in JISDAC mode, the only deviation from traditional display and operation is the appearance of the JISDAC curve and a series of OFFSET curves. All A-Scan echoes are displayed at their non-compensated height. A JISDAC curve can be based on up to 15 data points (i.e. material depths). A JISDAC curve is programmed using a series of same-reflector echoes at various depths, covering the range of depths to be inspected in the test material. Because near field and beam spread vary according to transducer size and frequency, and materials vary in attenuation and velocity, JISDAC must be programmed differently for different applications.

The dynamic range of the JISDAC function is 60 dB, and the maximum curve slope is 12 dB per microsecond. Successive data points do not have to progressively decrease in amplitude. That is, the JISDAC curve does not have to have a constantly descending slope.

3.20.1 Recording the JISDAC Curve

JISDAC Curve points are typically taken from a standard with equally-sized reflectors (holes) located at various material depths. The primary echo from each of these points, for a total of up to 15 echoes, are recorded. When JISDAC is active, the instrument displays a line that represents echo peaks for constant reflectors at varying material depth. This line is drawn as either a curved (linear in gain) line based on a series of collected JISDAC points or a series of straight line segments that join these JISDAC points. Only one JISDAC curve can be stored at a time. To program the JISDAC Curve:

1. Access the JISDAC menu, and select the RECORD submenu .
2. Couple the probe to the first reference point and adjust Gate A so that it is broken by the primary echo. If necessary, use the *Gain Toggle* to adjust the gain so that the echo crosses Gate A and the highest peak in Gate A is at approximately 80% of full-screen height. The highest peak must not be higher than 100% full-screen height.

Note: *The AUTO 80 function automatically adjusts the gain to set the Gate A triggering echo to 80% of full screen height. If desired, select the AUTO 80 function in the RECORD submenu.*

3. While the Gate is lined up over the first reference echo, activate the RECORD function. When the value of the RECORD function changes from 0 to 1, you have recorded the first JISDAC Curve point. Note that the first JISDAC point is treated as the reference echo. The amplitude value at which this point is recorded becomes the “*reference amplitude*” value.

3.20.1 Recording the JISDAC Curve (cont.)

Note: *When the first JISDAC reference point is stored, two measurement result boxes will be automatically set (if not already configured) to display SA and A%A values.*

4. Continue to record additional curve points, up to a maximum of 15 points (note that at least two JISDAC Curve points are required).
5. When all of your points have been entered, select the FINISH function.

3.20.2 Working with JISDAC

In JISDAC mode, the instrument uses the user-input reference points to create a curve representing the amplitudes of echoes representing same-size reflectors at varying material depth. To turn JISDAC evaluation mode ON or OFF:

1. With the JISDAC menu accessed, select the SETUP submenu.
2. Use the JISDAC function to select ON or OFF. The JISDAC Curve is displayed whenever the feature is turned ON.

3.20.2a Interpreting JISDAC Lines and Classes

The JISDAC display contains a recorded reference line and five fixed offset lines. Three of the lines are labeled as follows:

- **H Line** – Connects the recorded reference points
- **M Line** – Fixed offset positioned 6 dB below the H line
- **L Line** – Fixed offset positioned 12 dB below the H line

Any one of these three lines can be identified as the reference from which measurements are based (see the **BOLD LINE** function below). In addition, the remaining three offset lines are drawn at 6, 12, and 18 dB above the H line.

The regions of the A-Scan display bordered by the H, M, and L lines are identified with JIS Class numbers. These identifying numbers can also be displayed as results. CLS reports the region that contains the peak of the Gate A triggering echo.

3.20.2b *Defining a BOLD LINE Measurement Reference (JISDAC-SETUP-BOLD LINE)*

The user-defined measurement reference is selected as follows:

1. Access the **SETUP** submenu in the **JISDAC** menu.
2. Use the **BOLD LINE** function to select the H, M, or L line.
3. Note that the selected line is now shown in bold on the A-Scan display. This line now serves as the reference level from which all reference measurements (such as A%rA or dBrB) are made.

3.20.2c *Setting TRANSFER CORREction (JISDAC-MAT ATTN-TRANSFER CORR)*

The **TRANSFER CORR** function applies dB compensation for the difference in coupling conditions between the known standard and the test piece.

1. Access the **MAT ATTN** submenu in the **JISDAC** menu.
2. Adjust the **TRANSFER CORR** function as required to compensate for coupling differences.

Note: *When TRANSFER CORR is set to any value other than 0, the displayed gain value appears in a contrasting color, indicating that the amount of applied gain differs from the listed “instrument” gain.*

3.20.3 Deleting a JISDAC Curve

To delete a stored JISDAC curve:

1. With the JISDAC menu activated, select the **SETUP** submenu.
2. Activate the **DELETE CURVE** function, and then confirm your selection.
3. The entry in the JISDAC function box changes to **OFF**.

3.21 CNDAC Evaluation Mode

Note: *Evaluation modes, such as CNDAC, are selected in the EVAL MODE function in the EVAL menu. The selected evaluation mode menu appears in the ACQUIRE menu bar. While operating in CNDAC mode, the Gate A TOF MODE must be set to PEAK.*

Conventional measurement can be made using the CN Distance Amplitude Correction (CNDAC) mode. This mode operates based on a set of user-recorded data points. These points are recorded from the CNDAC menu, as described below.

The CNDAC mode displays all echoes at their true amplitude. However, when operating in CNDAC mode, three additional lines, RL, SL, and EL, are superimposed on the A-Scan display. These curves represent constant reflector size at varying material depth.

3.21.1 Recording the CNDAC Curve

CNDAC Curve points are typically recorded from a standard with equally-sized reflectors (holes) located at the various material depths. The primary echoes from each of these points, for a total of up to 16 echoes, are recorded. Only one CNDAC curve can be stored at a time. To program the DAC curve, proceed as follows:

1. Access the CNDAC menu, and select the RECORD submenu.
2. Couple the probe to the first reference point and adjust Gate A so that the primary echo passes through it. If necessary, use the Gain Toggle to adjust the gain so that the echo passes through Gate A and the highest peak in Gate A is at approximately 80% of full-screen height. The highest peak must not be higher than 100% full-screen height.

3.21.1 Recording the CNDAC Curve (cont.)

Note: *The AUTO80 function automatically adjusts the gain to set the Gate A triggering echo to 80% of full-screen height. If desired, select the AUTO80 function in the RECORD submenu.*

3. While the Gate is lined up over the first reference echo, activate the RECORD function. When the value of the RECORD function changes from 0 to 1, you have recorded the first CNDAC curve point. Note that the first CNDAC point is treated as the reference echo. The amplitude value at which this point is recorded becomes the “reference amplitude” value.
4. Continue to record additional curve points, up to the maximum of 16 points. Note that at least two CNDAC curve points are required.
5. When all of your points have been entered, activate the FINISH function.

3.21.2 Working with CNDAC Curves

To turn CNDAC evaluation mode ON or OFF:

1. Access the CNDAC menu, and select the SETUP submenu.
2. Use the CNDAC MODE function to select ON or OFF. Three addition lines appear when the feature is turned on.

3.21.2a Showing CNDAC Curve

By default, the CNDAC curve is hidden after the curve is recorded. To show the line:

1. Access the **CNDAC** menu, and select the **SETUP** submenu.
2. Use the **CNDAC DISPLAY** function to select **ON** or **OFF**. The CNDAC curve is displayed when the feature is turned on.

3.21.2b Setting Three Addition Lines: RL, SL, EL

Three addition lines are displayed after the CNDAC curve is recorded. To adjust the offset of these three lines:

1. Access the **CNDAC** menu, and select the **LINE** submenu.
2. Adjust **RL**, **SL**, and **EL** parameters to set the offset of the line.

3.21.2c *Setting Transfer Correction (CNDAC-LINE-TRANSFER CORR)*

The TRANSFER CORR function applies dB compensation for the difference in coupling conditions between the known standard and the test piece.

1. Access the CNDAC menu, and select the LINE submenu.
2. Adjust the TRANSFER CORR function as required to compensate for coupling differences.

Note: *When TRANSFER CORR is set to any value other than 0, the displayed gain value appears in a contrasting color, indicating that the amount of applied gain differs from the listed “instrument” gain.*

3.21.2d *Deleting a CNDAC Curve*

To delete a CNDAC curve:

1. Access the CNDAC menu, and select the SETUP submenu.
2. Activate the DELTE CURVE function, and then confirm your selection.

3.22 Backwall Echo Attenuation

The Backwall Echo Attenuation option enables the operator to set a separate gain for the gate range of gate B. This gain is independent of the gain for the rest of the test range. The Backwall Echo Attenuation therefore enables a selective attenuation or peaking of the echoes in the B gate. A typical application case for the Backwall Echo Attenuation is forging testing. In this application case, the gain is reduced in gate B until the backwall echo is completely displayed in the A-scan. The user can then selectively integrate the backwall echo into the flaw evaluation.

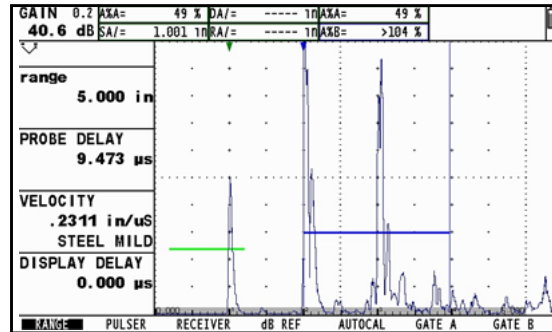


Figure 15: Backwall Echo Attenuation

3.22 Backwall Echo Attenuation (cont.)

However, the Backwall Echo Attenuation option also allows to systematically increase the gain. In this way, the operator can, for example, only increase the gain within the flaw expectancy range in order to peak the echo in this range.

Note: *The Backwall Echo Attenuation has no effect on the evaluation of the echoes in the B gate. The echo evaluation continues to refer to the actually measured signals. All other gate-related functions, such as gate alarm or TTL assignment remain unaffected as well.*

3.22.1 BEA

1. In the CONFIG3 menu, activate the BEA submenu.
2. Use the joystick to select the BEA function, and then press the center of the joystick to activate the function.
3. Move the joystick left/right to turn on/off the BEA option.
4. Press the center of the joystick again to save the setting.

FREEZE	YEARLY CAL	TOF 1n LAYER	BEA
AFREEZE OFF	DATE 01/01	TOF in LAYER OFF	BEA ON
BFREEZE OFF	CAL REMINDER OFF	LAYER TYPE STANDARD	BW GAIN 55.6dB
POWER SAVER OFF	CAL RESET	LAYER EDIT EDIT	
PARAM MODE EXPERT	PARAM EDIT ENTER	PASSWORD ENTER	
FILES	EVAL	dB REF	CONFIG1
			CONFIG2
			CONFIG3
			DR

Figure 16: CONFIG3 Menu with BEA Activated

3.22.2 BW Gain

You can set the separate gain for the echoes in gate B in this function. The gain may be situated both above and below the gain in the rest of the test range. The setting range for the gain is between 0.0 and 110.0 dB.

1. In the **CONFIG3** menu, activate the **BEA** submenu.
2. Use the joystick to select **BW GAIN** function, and then press the center of joystick to activate the function.
3. Move the joystick left/right to set the gain for gate B.
4. Press the center of the joystick again to save the setting.

Chapter 4. Data Sets & Reports

The USM Go can store data set files and generate reports. To perform these functions, see *Figure 17* below and proceed with this chapter.

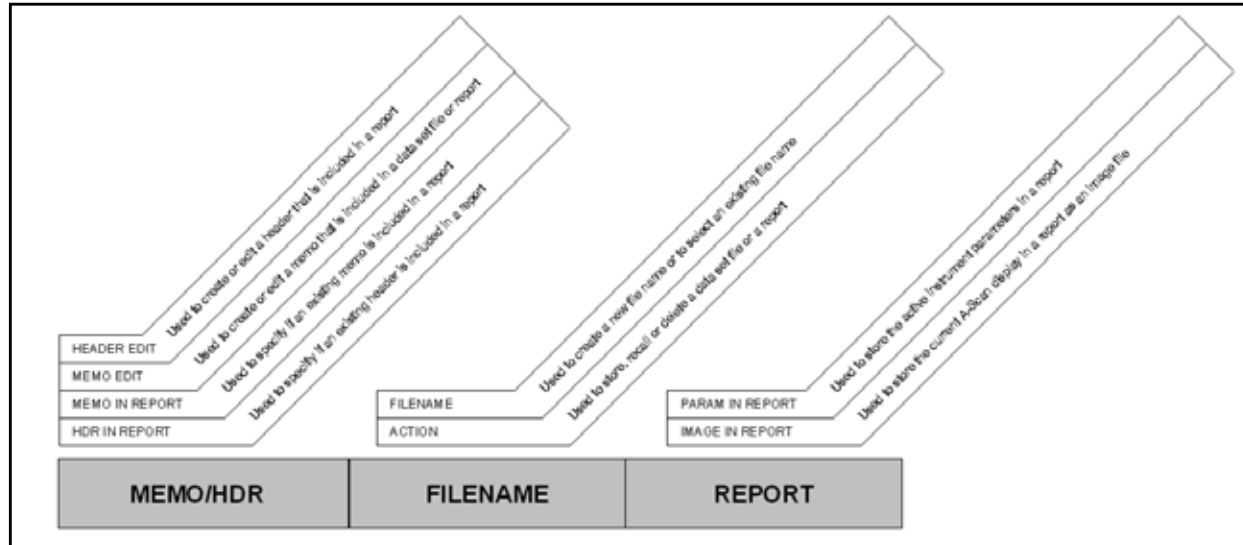







Figure 17: The FILES Menu

4.1 The FILES Menu

To access the FILES menu and select the desired function, refer to *Figure 17 on page 143* and complete the following steps:

1. In the SETUP menu, activate the FILES submenu using the joystick () .
2. Use the joystick () to select the function titled ACTION. Press the center of the joystick () to activate the function.
3. Move the joystick left or right () to select one of the following actions:
 - STORE DATASET - see “*Storing a New Data Set File*” on page 145
 - RECALL DATASET - see “*Recalling a Data Set File*” on page 147
 - DELETE DATASET - see “*Deleting a Data Set File*” on page 148
 - STORE REPORT - see “*Storing a Report*” on page 156
 - FAST REPORT - see “*Fast Report*” on page 157
4. After making your choice, press the center of the joystick () to deactivate the function.

4.2 Working With Data Set Files

The current instrument settings, which includes most of the functional settings, can be stored as a *data set file*. When a stored data set file is later recalled, all active function settings are modified to match those contained in the data set file. Also, if the A-Scan was stored in the data set file, it is displayed and frozen on the display screen. After a data set is recalled, the newly active functional settings may then be modified if desired. To perform data set operations:





After a data set file is recalled, the instrument settings may then be modified, but these changes only affect the stored data set file if the new settings are stored with the same file name as the original data set file.

Note: *The USM Go data set files can be recognized by the ".UGO" extension on the filenames.*






4.2.1 Storing a New Data Set File

After selecting the **STORE DATASET** action (see "*The FILES Menu*" on page 144), proceed to the appropriate section on the following page to either create a new file name or select an existing file name.

4.2.1a File Selection Mode





1. Use the joystick () to select the function titled **FILENAME**. Press the center of the joystick once () to activate the function in *File Selection* mode.
2. Move the joystick up or down () to select the desired file name from the list of SD card files.
3. Press the center of the joystick () to deactivate the function.

4.2.1b File Naming Mode

1. Use the joystick () to select the function titled **FILENAME**. Press the center of the joystick twice () to activate the function in *File Naming* mode.
2. Move the joystick up or down () to choose the first character in the desired file name. Then, move the joystick left or right () to move the cursor to another character position in the text string. Repeat the process until you have entered the entire file name.
3. Press the center of the joystick () to deactivate the function.






4.2.2 Recalling a Data Set File

After selecting the RECALL DATASET action (see “*The FILES Menu*” on page 144), continue as follows:

1. Use the joystick () to select the function titled FILENAME. Press the center of the joystick () to activate the function in *File Selection* mode.
2. After the list of data set files available on the SD card is displayed, move the joystick up or down () to select the desired data set file name from the list.
3. After selecting the desired data set file, press the center of the joystick () to deactivate the function.

4.2.3 Deleting a Data Set File

After selecting the DELETE DATASET action (see “*The FILES Menu*” on page 144), continue as follows:

1. Use the joystick () to select the function titled FILENAME. Press the center of the joystick () to activate the function.
2. Move the joystick up or down () to choose the first character in the desired filename. Then, move the joystick left or right () to move the cursor to a different character position in the text string.
3. Repeat step 2 until you have entered the entire file name. Then, press the center of the joystick () to deactivate the function.

4.2.4 Editing a Data Set File








Editing an existing data set file, requires a simple combination of the procedures described in the previous sections:

1. Recall the data set file that you wish to edit (see “*Recalling a Data Set File*” on page 147).
2. Using the methods described in previous chapters, modify the active functional settings as desired.
3. Store the modified settings as a data set file (see “*Storing a New Data Set File*” on page 145). When choosing a filename, overwrite the original data set file by choosing the same filename for the modified settings.




4.3 Creating a Memo (Smart Notes)

The USM Go places a folder, “MEMO”, at the current working directory. The user can load a memo text file from this folder. In addition, the user can create a new memo text file and save the file in this folder, for future editing on a PC. Each file contains 5 lines and each line has 31 characters.






Memos may be attached to *Data Set Files* at the time the files are stored or to *Reports* at the time they are generated. After a file is stored, the attached memo may be modified. To create or edit a memo:

1. In the **SETUP** menu, activate the **FILES** submenu using the joystick (.
2. Use the joystick () to select the function titled **MEMO EDIT**. Press the center of the joystick () to activate the function.
3. Use the joystick to browse the SD card and select a memo text file.
4. Select **NEW MEMO**, and press the center of the joystick () to create a new memo text file.
5. Use the joystick () to enter the memo text file's name.
6. Move the joystick left/right () to move the cursor position and up/down () to change the character.

4.3 Creating a Memo (Smart Notes) (cont.)






7. Once you have entered the file name, press the center of the joystick to enter the Edit mode. An empty memo file is created. Now the user can modify the content.
8. To modify the content, move joystick left/right () to move the cursor and up/down () to change the character.
9. Press the center of the joystick again to exit the Edit mode. Then, press the center of the joystick () to deactivate the function.

To edit an existing memo file:

10. Move the joystick up/down () to select a stored memo text file.
11. Press the center of the joystick () to enter edit mode. The content of the selected memo text file appears on the screen.
12. To modify the content, move the joystick left/right () to move the cursor and up/down () to change the character.
13. Press the center of joystick again to exit Edit mode. The modification will be saved automatically, and the selected memo text file's name appears on the screen.
14. Press the center of the joystick () to deactivate the function.

4.4 Including a Memo in a Report







After creating a memo, you can specify whether that memo is included in a report. To add or remove a memo from a report:

1. In the **SETUP** menu, activate the **FILES** submenu using the joystick ().
2. Use the joystick () to select the function titled **MEMO IN REPORT**. Press the center of the joystick () to activate the function.
3. Move the joystick left or right () to select one of the following options:
 - **YES** - the memo is included with a report
 - **NO** - the memo is not included with a report
4. After making your choice, press the center of the joystick () to deactivate the function.

4.5 Creating a Report Header






The USM Go places a folder, “MEMO”, at the current working directory. The user can load a memo text file from this folder. In addition, the user can create a new memo text file and save the file in this folder, for future editing on a PC. Each file contains 5 lines and each line has 31 characters. Memos may be attached to *Data Set Files* at the time the files are stored or to *Reports* at the time they are generated. After a file is stored, the attached memo may be modified.

Report Headers are attached to data set files at the time the files are stored. After a file is stored, the attached *Report Header* may be edited. To create or edit a *Report Header*:

1. In the **SETUP** menu, activate the **FILES** submenu using the joystick ().
2. Use the joystick () to select the function titled **HEADER EDIT**. Press the center of the joystick () to activate the function.
3. A text area for the header is now available on the display, with the cursor positioned for the first character. Move the joystick up or down () to enter the first character in the header. Then, move the joystick left or right () to move the cursor to a different character position in the text string.
4. Repeat step 3 until you have entered the entire header (nine characters maximum). Then, press the center of the joystick () to deactivate the function.

4.6 Including a Header in a Report

After creating a header, you can specify whether that header is included in a report. To add or remove a header from a report:

1. In the **SETUP** menu, activate the **FILES** submenu using the joystick ().
2. Use the joystick () to select the function titled **HDR IN REPORT**. Press the center of the joystick () to activate the function.
3. Move the joystick left or right () to select one of the following options:
 - **YES** - the header is included with a report
 - **NO** - the header is not included with a report
4. After making your choice, press the center of the joystick () to deactivate the function.

4.7 Creating a Report

IMPORTANT: *Before proceeding be sure an SD card is installed in the instrument (see “Using the SD Slot, USB Connector & I/O Connector” on page 14).*

A report, with contents specified by the user, can be generated and stored on the USM Go SD card. The following features of the active data set file can either be omitted from or included in the report:






- Header (use the HDR IN REPORT function)
- Memo (use the MEMO IN REPORT function)
- A-Scan Image (use the IMAGE IN REPORT function)
- Instrument parameters (use the PARAM IN REPORT function)

After configuring the report as desired, proceed to the next page to store the report.

4.8 Storing a Report






To store the report specified in the previous section:

Note: *If you have chosen to store the A-Scan image with the report, the image will be saved as a JPG file.*

1. Use the joystick () to select the function titled **FILENAME**. Press the center of the joystick () to activate the function.
2. Move the joystick up or down () to choose the first character in the desired filename. Then, move the joystick left or right () to move the cursor to a different character position in the text string.
3. Repeat step 2 until you have entered the entire file name. Then, press the center of the joystick () to deactivate the function.
4. If you have not already done so, assign the **COPY** function to one of the *Function Toggle* buttons (see “*Defining Function Toggle Actions*” on page 47). Your report can now be saved by pressing the assigned toggle button, whenever you are in *Acquisition Mode* and the cursor is in the menu bar or the full-screen display is active.



4.9 Fast Report

The *Fast Report* option performs the same basic function as the *Store Report* option. The difference is that, if you save the A-Scan screen image along with the report, the image is saved as a bitmap file. This permits the save operation to be completed significantly faster, but you should be aware that some SD card printers may not recognize the bitmap file. To use the Fast Report option:

1. Use the joystick () to select the function titled FILENAME. Press the center of the joystick () to activate the function.
2. Move the joystick up or down () to choose the first character in the desired filename. Then, move the joystick left or right () to move the cursor to a different character position in the text string.
3. Repeat step 2 until you have entered the entire file name. Then, press the center of the joystick () to deactivate the function.
4. If you have not already done so, assign the COPY function to one of the *Function Toggle* buttons (see “*Defining Function Toggle Actions*” on page 47). Your report can now be saved by pressing the assigned toggle button, whenever you are in *Acquisition Mode* and the cursor is in the menu bar or the full-screen display is active.

4.10 Parameters Summary

The user can browse all the parameters setting in the summary report.

1. In the **FILE** menu, activate the **REPORT** submenu.
2. Use the joystick to select the **PARAMETERS SUMMARY** function, and then press the center of joystick () to activate the function.
3. All the parameters are listed on the screen. Move the joystick up/down () to see other pages.
4. Press the Function 2 key to save the report to the SD card.

Chapter 5. Data Recorder Files

The *Data Recorder (DR)* menu functions are shown in *Figure 18* below.







DR SETUP	DR NAV				
FILENAME DR#1	TOP 1A				
CREATE	BOTTOM 10B				
DR VIEW OFF	ADV DIRECTION DOWN				
FILES	EVAL	DAC/TCG	CONFIG1	CONFIG2	DR

Figure 18: The DR Menu






5.1 Naming the Data Recorder File

In the **SETUP** menu, use the joystick () to activate the **DR** menu (see *Figure 18 on page 159*). Then, proceed to the appropriate section below to either create a new file name or select an existing file name.

5.1.1 File Selection Mode

1. Use the joystick () to select the function titled **FILENAME** in the **DR SETUP** submenu. Press the center of the joystick once () to activate the function in *File Selection* mode.
2. Move the joystick up or down () to select the desired file name from the list of SD card files.
3. Press the center of the joystick () to deactivate the function.

5.1.2 File Naming Mode

1. Use the joystick () to select the function titled FILENAME in the DR SETUP submenu. Press the center of the joystick twice () to activate the function in *File Naming* mode.
2. Move the joystick up or down () to choose the first character in the desired file name. Then, move the joystick left or right () to move the cursor to another character position in the text string. Repeat the process until you have entered the entire file name.
3. Press the center of the joystick () to deactivate the function.



5.2 Configuring the Data Recorder File

After entering a name for the data recorder file, the following parameters must be specified:

- **TOP** - the coordinates of the first cell in the file, using a row number and an column letter (e.g. 1A).
- **BOTTOM** - the coordinates of the last cell in the file, using a row number and an column letter (e.g. 10B).
- **ADV DIRECTION** - specifies the direction (**DOWN** or **RIGHT**) in which the DR advances after each thickness reading is recorded.

Use the usual joystick methods to select each of the above functions and program the desired values.








5.3 Creating the Data Recorder File

1. After naming and configuring the DR file, use the joystick () to select the function titled **CREATE**.
2. Press the center of the joystick () to create and activate a DR file that uses your previous selections.

IMPORTANT: *After the DR file is created, the **TOP** and **BOTTOM** parameters cannot be changed. In fact, these functions are replaced on the menu with listings of the **NUM OF COLS** and **NUM OF ROWS**, respectively.*

5.4 Viewing the Data Recorder File

To view the DR file that you have just activated, you must complete the following steps:

1. In the **SETUP** menu, activate the **DR** submenu using the joystick ().
2. Use the joystick () to select the function titled **DR VIEW**. Then, press the center of the joystick () to activate the function.
3. Move the joystick left or right () to select the **ON** option. Then, press the center of the joystick () to deactivate the function.
4. Press and hold the center of the joystick () to switch to the *Acquire Menu*.
5. When in *Acquire Mode*, press the center of the joystick () to enter the full-screen display mode.

As shown in *Figure 19 on page 164*, the DR file is displayed on the right side of the display screen.

5.4 Viewing the Data Recorder File (cont.)

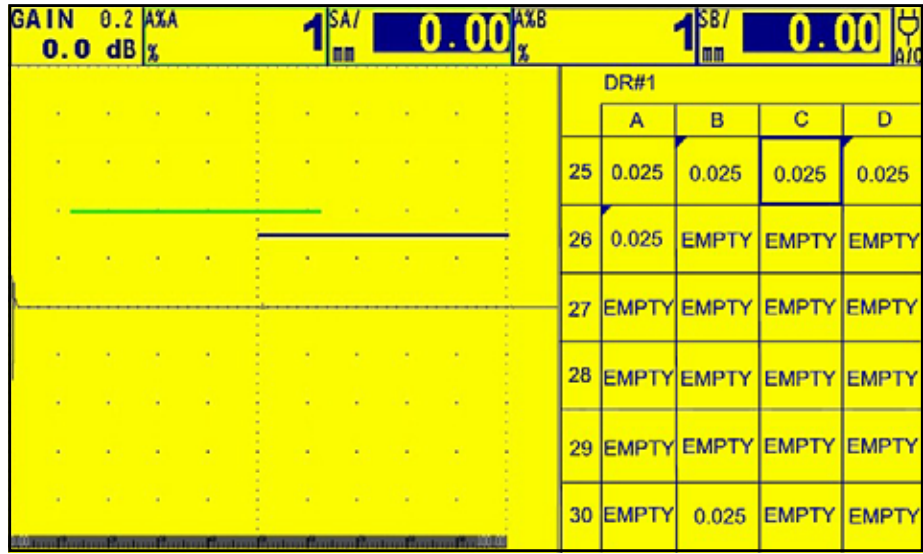





Figure 19: The DR File Display

5.5 Using the Data Recorder File


5.5.1 Adding Data and A-Scan Images to a Cell

When the DR file is displayed (see *Figure 19 on page 164*), the name of the DR file is shown at the top of the grid and the currently selected cell is highlighted. To add data or data plus an A-Scan image to a cell, proceed as follows:

IMPORTANT: *You must delete any existing data from a cell before using the two SEND functions described below.*

- Move the joystick as required () to highlight any desired cell in the grid.
- Use the *Function 1* end of the function toggle () to send the current thickness data to the highlighted cell.
- Use the *Function 2* end of the function toggle () to send the current thickness data and the A-Scan image to the highlighted cell.

Note: *A flag in the upper left corner of a cell (see *Figure 19 on page 164*) indicates that an A-Scan image is attached to the data.*

- Press both ends of the function toggle () simultaneously to delete the contents of the highlighted cell.

Note: *In DR mode, the function keys behave as described above, regardless of any previous user-defined actions. However, if the user-defined HOLD functions have been assigned to these keys, those functions are still available.*

5.5.2 Previewing A-Scan Images in a Cell

When you select a cell in the DR file that has an A-Scan image attached, the attached image is loaded and the instrument displays a frozen preview of the saved image with the corresponding gate positions (see *Figure 20 on page 167*).

While a frozen A-Scan image is displayed, no new data is taken until you resume live data input by one of the following actions:

- Delete both the stored data and the attached A-Scan image from selected the cell
- Navigate to an empty cell

As soon as one of the above actions is taken, the instrument unfreezes and resumes taking data in the manner specified by the current setup configuration.

5.5.2 Previewing A-Scan Images in a Cell (cont.)

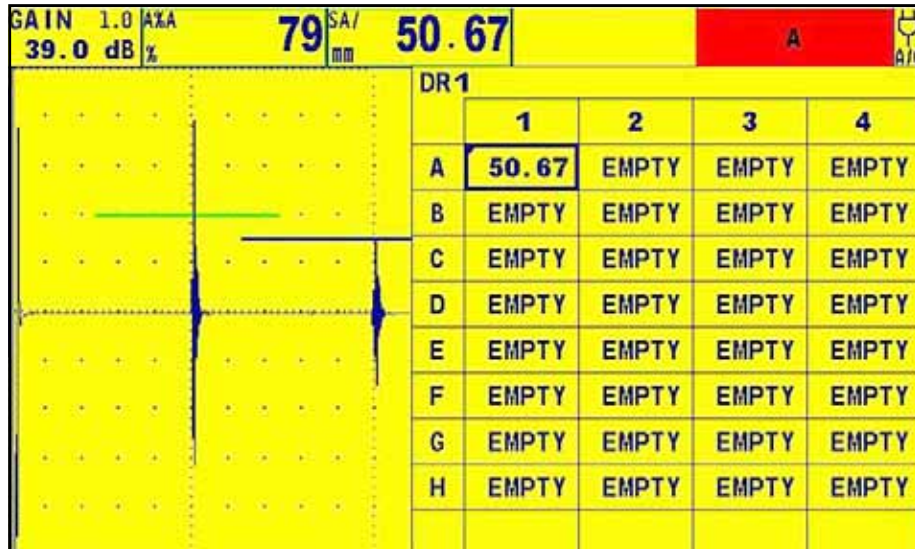




Figure 20: Frozen A-Scan Image Attached to Selected Cell

5.6 Live Video Record Files


5.6.1 Video Record Temporary Source and Destination

The user can set the source and destination of a video record temporary file. The options are memory and the SD card. If the memory is selected, the recording frequency is 50 Hz. If the SD card is selected, the recording frequency is 10 Hz.

1. In the **FILE** menu, activate **VIDEO** submenu.




2. Use the joystick () to select **SOURCE/DEST** function, and then press the center of the joystick () to activate the function.

3. Move the joystick to choose **MEMORY** or **SD CARD**.

4. Press the center of the joystick () to save the setting.

5.6.2 Video Record Mode

Users can select two different modes, RECORD and REPLAY, for live video recording.



1. In the FILE menu, activate the VIDEO submenu.
2. Use the joystick () to select the MODE function, and then press the center of the joystick () to activate the function.
3. Move the joystick to choose RECORD or REPLAY.
4. Press the center of the joystick () to save the setting.

5.6.3 Video Record Filename


When in record mode, the user can select the existing file on the SD card or enter a new filename. When in replay mode, the user can only select the existing file on the SD card.


5.6.3a Record Mode

1. In the FILE menu, activate the VIDEO submenu.

2. Use the joystick () to select the FILENAME function, and then press the center of the joystick () to activate the function.




3. Move the joystick up/down to select the existing file on SD card.

4. When the filename shows “<NEW FILE>”, press the center of the joystick () to enter a new filename.

5. When an existing file is selected, press the center of the joystick () to modify the filename.


6. Press the center of the joystick () to exit the FILENAME edit mode.

5.6.3b *Replay Mode*


1. In the **FILE** menu, activate the **VIDEO** submenu.
2. Use the joystick to select the **FILENAME** function, and then press the center of the joystick () to activate the function.
3. Move the joystick up/down () to select the existing file on SD card.
4. Press the center of the joystick () to select the file.

5.6.4 Live Video Record File Record Mode

Enter Record Mode


1. In the FILE menu, activate the VIDEO submenu.
2. Set the MODE as RECORD and FILENAME.
3. Use the joystick to select ENTER function, and then press the center of the joystick () to enter the record mode.

Start/Pause Recording

1. In the RECORD menu, use the joystick to select the RECORD function.
2. Move the joystick left/right () to start or pause recording.

During the recording, the user can change only the gain value and gate. All these changes will be saved at the same time.

Stop Recording


1. In the RECORD menu, use the joystick to select the STOP function.
2. Move the joystick left/right () to exit RECORD mode.

Add a Flag

The live video record file supports a flag feature. The user can set a flag during recording. Then, when replaying a record file, the user can get the flagged frame directly.


1. In the RECORD menu, use the joystick to select the FLAG function during recording.
2. Move the joystick to set the current frame flagged.

Exit Record Mode


1. Move the joystick to select the menu bar.
2. Press the center of the joystick () to exit RECORD mode.

5.6.5 Live Video Record File Replay Mode


5.6.5a Enter Replay Mode

1. In the **FILE** menu, activate the **VIDEO** submenu.
2. Set the **MODE** as **REPLAY** and **FILENAME**.
3. Use the joystick to select the **ENTER** function, and then press the center of the joystick () to enter the **REPLAY** mode.


5.6.5b Start/Pause Replaying

1. In the **REPLAY** menu, use the joystick to select the **PLAY** parameter.
2. Move the joystick left/right () to start or pause replaying.

5.6.5c Stop Replaying


1. In the **REPLAY** menu, use the joystick to select the **STOP** parameter.
2. Move the joystick left/right () to exit the **REPLAY** mode.

5.6.5d *Change Replay Speed*

1. In the **REPLAY** menu, use the joystick to select the **SPEED** parameter.
2. Move the joystick left/right () to select **SPEED**.


5.6.5e *Browse the Record File by Time*

The user can browse the record file by changing the time.

1. In the **REPLAY** menu, use the joystick to select the **TIME** parameter.
2. Move the joystick left/right () to change **TIME**. The corresponding frame will be replayed on the screen.

5.6.5f *Browse the Record File by Frame*

The user can browse the record file by changing the frame.


1. In the **REPLAY** menu, use the joystick to select the **FRAME** parameter.
2. Move the joystick left/right () to change **FRAME**. The corresponding frame will be replayed on the screen.

5.6.5g *Browse the Record File's Flag*

The user can browse the flag stored in the record file.

In the **FLAG** menu, use the joystick to select the **FLAG** parameter. The flagged frame will be replayed on the screen automatically.

5.6.5h *Exit Replay Mode*

1. Move the joystick () to select the menu bar.
2. Press the center of the joystick to exit the **REPLAY** mode.

Appendix A. Specifications

Note: All instrument specifications listed in this appendix are subject to change without prior notice. Also, see “EN 12668 Specifications” on page 191.

A.1 LCD Display

Active Area: 108.0 mm (W) x 64.8 mm (H), 5.0” Diagonal

Size: 5.0”

Resolution: 800 (W) x 480 (H) pixel

Contrast Ratio: ≥ 300

Brightness: ≥ 200 cd/m²

A.2 Connectors

<i>Probe Connectors:</i>	2, LEMO-00
<i>UT Output Connector:</i>	SAP output, with an added ALARM pin
<i>USB Interface:</i>	Micro USB connector
<i>SD-Card Connector:</i>	Full-size SD card slot, accommodates all standard SD cards
<i>Range:</i>	14,016 mm (552") for longitudinal wave in steel
<i>Display Delay:</i>	-15 μ s to 3500 μ s
<i>Probe Delay:</i>	0 to 1000 μ s
<i>Sound Velocity:</i>	1000 to 16,000 m/s
<i>PRF:</i>	Manually adjusted from 15 to 2000 Hz or automatically optimized, 3 <i>automatic adjustment modes</i> : Auto Low, Auto Med, Auto High

A.3 Pulser

Note: All pulser measurements were taken according to EN12668 specifications.

<i>Pulser Mode:</i>	<i>Standard:</i> simulated spike <i>Optional:</i> uni-polar square wave via software control
<i>Pulser Voltage (SQ Mode):</i>	120 V to 300 V, with a 10 V step and tolerance of 10%
<i>Pulser Falling/Rising Time:</i>	10 ns maximum
<i>Pulser Width (SQ Mode):</i>	30 ns to 500 ns, with a 10 ns step and a tolerance of 10%
<i>Pulser Amplitude (SQ Mode):</i>	<i>Low:</i> 120 V <i>High:</i> 300 V
<i>Pulser Energy (Spike Mode):</i>	<i>Low:</i> 30 nS <i>High:</i> 100 nS
<i>Damping:</i>	50 ohms or 1000 ohms

A.4 Receiver

<i>Digital Gain:</i>	Dynamic range of 110 dB, with a 0.2 dB step
<i>Analog Bandwidth:</i>	0.9 to 20 MHz
<i>Equivalent Input Noise:</i>	$<80 \text{ nV}/\sqrt{\text{Hz}}$, across the full bandwidth
<i>Recovery Time:</i>	$< 10 \text{ us}$, according to EN12668 8.5.3 test
<i>Input Linearity:</i>	5% by method E317, for output data on all 4 ADCs
<i>Filters:</i>	<i>Broad Band: 1.1 to 20.44 MHz</i> <i>1-5 MHz: 0.9 to 5.14 MHz</i> <i>2, 2.25 MHz: 1.0 to 3.85 MHz</i> <i>4, 5 MHz: 2.43 to 7.92 MHz</i> <i>10 MHz: 6.27 to 13.6 MHz</i> <i>13, 15 MHz: 10.43 to 17.96 MHz</i>

A.5 Gates

Independent Gates: 2 Gates (A and B), Gate B supports triggering by Gate A

Rectification: POS (positive)
NEG (negative)
FW (full wave)
RF

Measurement: Peak
Flank
J-Flank

A.6 Memory

Capacity: 2 GB, SD card

Data Sets:

Reports: jpg or bmp A-Scan images

A.7 Environmental

<i>Battery:</i>	<i>Life:</i> 6 hr per full charge <i>Charging (standard):</i> Internal <i>Charging (optional):</i> External adapter <i>Level:</i> proportional battery gauge
<i>Battery Charger:</i>	Universal AC input (100 to 240 VAC, 50-60 Hz); meets CCC, CE, UL, CSA and PSE requirements
<i>Size:</i>	175 mm (W) x 111 mm (H) x 50 mm (D)
<i>Weight:</i>	1 kg with battery
<i>Languages:</i>	English, German, French, Spanish, Chinese, Japanese

A.8 Protection

<i>Damp Heat & Humidity (Storage):</i>	<i>10 Cycles:</i> 10 hr at +60°C down to +30°C, 10 hr at +30°C up to +60°C, Transition within 2 hr (507.4)
<i>Temperature Shock (Storage):</i>	<i>3 Cycles:</i> 4 hr at -20°C up to +60°C, 4 hr at +60°C, Transition within 5 minutes (503.4 Procedure II)
<i>Vibration:</i>	<i>General Exposure:</i> 1 hr each axis, 514.5-5 Procedure I, Annex C, Figure 6
<i>Shock:</i>	<i>6 Cycles each axis,</i> 15 g, 11 ms, half-sine (516.5 Procedure I)
<i>Loose Cargo (in Shipping Container):</i>	514.5 Procedure II
<i>Transit Drop (Packaged for Shipment):</i>	<i>26 Drops,</i> 516.5 Procedure IV
<i>Dust Proof/Dripping Water Proof:</i>	As per the IEC 529 specification for IP67 classification
<i>Operating Temperature Range:</i>	0 to 55°C
<i>Storage Temperature Range:</i>	-20 to +60°C, 24 hr with battery

A.8 Protection (cont.)

Compliance:

EMC/EMI: EN 55011
EN 61000-6-2:2001

Ultrasound: EN 12668
ASTM E1324
E317
ANSI/NCSL Z 540-1-1994
MIL STD 45662A
MIL STD 2154

A.9 USM Go Options

AWS Option:

AWS sizing tool, according to AWS D1.1 structural welding code

DAC Option:

DAC sizing tool, 16 points,
Complaint with: EN 1712 - EN 1713 - EN1714
ASTM E164
ASME & ASME III
JIS Z3060
TCG: 120 dB Dynamic
110 dB/ μ s slope

A.9 USM Go Options (cont.)

<i>DGS Option:</i>	DGS sizing tool, <i>Complaint with:</i> EN 1712 - EN 1713 - EN1714 ASTM E164
<i>Embedded Data Logger Option:</i>	Grid file creation
<i>Square Wave Pulser Option:</i>	Allows fine-tuning of pulser parameters, Voltage adjustment from 120 to 300 V per 10 V steps, pulse width adjustment from 30 to 500 ns per 10 ns steps
<i>BEA:</i>	Backwall Echo Attenuation.
<i>Phantom Option:</i>	Phantom PRF will help to identify a ghost echo caused by multiple reflections in low-attenuation materials

[no content intended for this page - proceed to next page]

Appendix B. Environmental Compliance

This appendix contains information on the following topics:

- WEEE Directive (see *Section B.1 on page 188*)
- Battery disposal (see *Section B.2 on page 189*)

B.1 Waste Electrical and Electronic Equipment (WEEE) Directive

GE Sensing & Inspection Technologies is an active participant in Europe's Waste Electrical and Electronic Equipment (WEEE) take-back initiative, directive 2002/96/EC.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Visit www.ge.com/inspectiontechnologies for take-back instructions and more information about this initiative.

B.2 Battery Disposal



This product contains a battery that cannot be disposed of as unsorted municipal waste in the European Union. See the product documentation for specific battery information. The battery is marked with this symbol, which may include lettering to indicate cadmium (Cd), lead (Pb), or mercury (Hg). For proper recycling return the battery to your supplier or to a designated collection point.

B.2.1 What do the Markings Mean?

Batteries and accumulators must be marked (either on the battery or accumulator or on its packaging, depending on size) with the [separate collection symbol](#). In addition, the marking must include the chemical symbols of specific levels of toxic metals as follows:

- Cadmium (Cd) over 0.002%
- Lead (Pb) over 0.004%
- Mercury (Hg) over 0.0005%

B.2.2 The Risks and Your Role in Reducing Them

Your participation is an important part of the effort to minimize the impact of batteries and accumulators on the environment and on human health. For proper recycling you can return this product or the batteries or accumulators it contains to your supplier or to a designated collection point.

Some batteries or accumulators contain toxic metals that pose serious risks to human health and to the environment. When required, the product marking includes chemical symbols that indicate the presence toxic metals: Pb for lead, Hg for mercury, and Cd for cadmium.

- **Cadmium** poisoning can result in cancer of the lungs and prostate gland. Chronic effects include kidney damage, pulmonary emphysema, and bone diseases such as osteomalacia and osteoporosis. Cadmium may also cause anemia, discoloration of the teeth, and loss of smell (anosmia).
- **Lead** is poisonous in all forms. It accumulates in the body, so each exposure is significant. Ingestion and inhalation of lead can cause severe damage to human health. Risks include brain damage, convulsions, malnutrition, and sterility.
- **Mercury** creates hazardous vapors at room temperature. Exposure to high concentrations of mercury vapor can cause a variety of severe symptoms. Risks include chronic inflammation of mouth and gums, personality change, nervousness, fever, and rashes.

Appendix C. EN 12668 Specifications

The EN 12668 specifications for the USM Go are listed in *Table 2* below.

Table 2: EN 12668-1:2000 Specifications

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
8.2	Timebase Stability Against Temperature	-1	0	1	%FS/C	After 30 minute warm-up
	Amplitude Stability Against Temperature	-5	0	5	%FS/C	After 30 minute warm-up
9.3.2	Timebase Stability After Warm Up	-1	0	1	%FS	After 30 minute warm-up
	Amplitude Stability After Warm Up	-2	1	2	%FS	After 30 minute warm-up
9.3.3	Timebase Display Jitter	-1	0	1	%FS	After 30 minute warm-up
	Amplitude Display Jitter	-2	1	2	%FS	After 30 minute warm-up
9.3.4	Timebase Stability Against Voltage Variation	-1	0	1	%FS	
	Amplitude Stability Against Voltage Variation	-2	0	2	%FS	
8.3.2	Pulse Repetition Frequency Error	-20	0	20	% Err	
8.3.3	Pulser Output Impedance		10		Ohm	
8.3.4	*Pulser Spectrum		See Chart			

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.4.2	Loaded Pulse Voltage	-130	-118	-106	V	Damping = 50, Voltage = Low, Energy = Low, RepRate = 15
		-129	-117	-105	V	Damping = 50, Voltage = Low, Energy = Low, RepRate = 1500
		-131	-119	-107	V	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 15
		-131	-119	-107	V	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 1500
		-130	-118	-106	V	Damping = 50, Voltage = Low, Energy = High, RepRate = 15
		-129	-117	-105	V	Damping = 50, Voltage = Low, Energy = High, RepRate = 1500
		-131	-119	-107	V	Damping =1000, Voltage = Low, Energy = High, RepRate =15
		-131	-119	-107	V	Damping =1000, Voltage = Low, Energy = High, RepRate =1500
		-321	-292	-263	V	Damping =50, Voltage = High, Energy = Low, RepRate =15
		-319	-290	-261	V	Damping =50, Voltage = High, Energy = Low, RepRate =1500
		-329	-299	-269	V	Damping =1000, Voltage = High, Energy = Low, RepRate =15
		-327	-297	-267	V	Damping =1000, Voltage = High, Energy = Low, RepRate =1500
		-321	-292	-263	V	Damping =50, Voltage = High, Energy = High, RepRate =15
		-319	-290	-261	V	Damping =50, Voltage = High, Energy = High, RepRate =1500
-329	-299	-269	V	Damping =1000, Voltage = High, Energy = High, RepRate =15		
-327	-297	-267	V	Damping =1000, Voltage = High, Energy = High, RepRate =2000		

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.4.2	Pulse Rise Time		3.7	10	nSec	Damping = 50, Voltage = Low, Energy = Low, RepRate = 15
			3.5	10	nSec	Damping = 50, Voltage = Low, Energy = Low, RepRate = 1500
			3.4	10	nSec	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 15
			3.2	10	nSec	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 1500
			3.7	10	nSec	Damping = 50, Voltage = Low, Energy = High, RepRate = 15
			3.5	10	nSec	Damping = 50, Voltage = Low, Energy = High, RepRate = 1500
			3.4	10	nSec	Damping =1000, Voltage = Low, Energy = High, RepRate =15
			3.2	10	nSec	Damping =1000, Voltage = Low, Energy = High, RepRate =1500
			6.6	10	nSec	Damping =50, Voltage = High, Energy = Low, RepRate =15
			6.4	10	nSec	Damping =50, Voltage = High, Energy = Low, RepRate =1500
			6.1	10	nSec	Damping =1000, Voltage = High, Energy = Low, RepRate =15
			5.9	10	nSec	Damping =1000, Voltage = High, Energy = Low, RepRate =1500
			6.6	10	nSec	Damping =50, Voltage = High, Energy = High, RepRate =15
			6.4	10	nSec	Damping =50, Voltage = High, Energy = High, RepRate =1500
	6.1	10	nSec	Damping =1000, Voltage = High, Energy = High, RepRate =15		
	5.9	10	nSec	Damping =1000, Voltage = High, Energy = High, RepRate =1500		

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.4.2	Pulse Duration SN starting with "0" in last four digits	45	50	55	nSec	Damping = 50, Voltage = Low, Energy = Low, RepRate = 15
		44	49	54	nSec	Damping = 50, Voltage = Low, Energy = Low, RepRate = 1500
		61	68	75	nSec	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 15
		59	66	73	nSec	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 1500
		109	121	133	nSec	Damping = 50, Voltage = Low, Energy = High, RepRate = 15
		109	121	133	nSec	Damping = 50, Voltage = Low, Energy = High, RepRate = 1500
		125	139	153	nSec	Damping =1000, Voltage = Low, Energy = High, RepRate =15
		125	139	153	nSec	Damping =1000, Voltage = Low, Energy = High, RepRate =1500
		29	32	35	nSec	Damping =50, Voltage = High, Energy = Low, RepRate =15
		27	30	33	nSec	Damping =50, Voltage = High, Energy = Low, RepRate =1500
		39	43	47	nSec	Damping =1000, Voltage = High, Energy = Low, RepRate =15
		37	41	45	nSec	Damping =1000, Voltage = High, Energy = Low, RepRate =1500
		94	104	124	nSec	Damping =50, Voltage = High, Energy = High, RepRate =15
		92	102	112	nSec	Damping =50, Voltage = High, Energy = High, RepRate =1500
104	115	127	nSec	Damping =1000, Voltage = High, Energy = High, RepRate =15		
104	115	127	nSec	Damping =1000, Voltage = High, Energy = High, RepRate =1500		

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.4.2	Pulse Duration SN starting with "5" in last four digits	53	59	65	nSec	Damping = 50, Voltage = Low, Energy = Low, RepRate = 15
		52	58	64	nSec	Damping = 50, Voltage = Low, Energy = Low, RepRate = 1500
		72	81	89	nSec	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 15
		71	79	87	nSec	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 1500
		121	134	148	nSec	Damping = 50, Voltage = Low, Energy = High, RepRate = 15
		119	133	146	nSec	Damping = 50, Voltage = Low, Energy = High, RepRate = 1500
		141	157	172	nSec	Damping =1000, Voltage = Low, Energy = High, RepRate =15
		139	155	170	nSec	Damping =1000, Voltage = Low, Energy = High, RepRate =1500
		32	36	39	nSec	Damping =50, Voltage = High, Energy = Low, RepRate =15
		31	34	38	nSec	Damping =50, Voltage = High, Energy = Low, RepRate =1500
		43	47	52	nSec	Damping =1000, Voltage = High, Energy = Low, RepRate =15
		41	46	51	nSec	Damping =1000, Voltage = High, Energy = Low, RepRate =1500
		98	109	120	nSec	Damping =50, Voltage = High, Energy = High, RepRate =15
		97	107	118	nSec	Damping =50, Voltage = High, Energy = High, RepRate =1500
109	121	133	nSec	Damping =1000, Voltage = High, Energy = High, RepRate =15		
109	120	132	nSec	Damping =1000, Voltage = High, Energy = High, RepRate =1500		

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.4.2	Pulse Reverberation		0	4	V	Damping = 50, Voltage = Low, Energy = Low, RepRate = 15
			0	4	V	Damping = 50, Voltage = Low, Energy = Low, RepRate = 1500
			0	4	V	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 15
			0	4	V	Damping = 1000, Voltage = Low, Energy = Low, RepRate = 1500
			0	4	V	Damping = 50, Voltage = Low, Energy = High, RepRate = 15
			0	4	V	Damping = 50, Voltage = Low, Energy = High, RepRate = 1500
			0	4	V	Damping =1000, Voltage = Low, Energy = High, RepRate =15
			0	4	V	Damping =1000, Voltage = Low, Energy = High, RepRate =1500
			0	4	V	Damping =50, Voltage = High, Energy = Low, RepRate =15
			0	4	V	Damping =50, Voltage = High, Energy = Low, RepRate =1500
			0	4	V	Damping =1000, Voltage = High, Energy = Low, RepRate =15
			0	4	V	Damping =1000, Voltage = High, Energy = Low, RepRate =1500
	0	4	V	Damping =50, Voltage = High, Energy = High, RepRate =15		

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.4.2	Pulse Reverberation		0	4	V	Damping =50, Voltage = High, Energy = High, RepRate =1500
			0	4	V	Damping =1000, Voltage = High, Energy = High, RepRate =15
			0	4	V	Damping =1000, Voltage = High, Energy = High, RepRate =1500
8.4.2	Crosstalk Pulser to Receiver	80	80	-	dB	
8.4.3	Dead Time After Transmitter Pulse			10	uSec	Measured in worst case frequency setting
8.4.4	Dynamic Range	100	100	-	dB	Measured in worst case frequency setting
8.4.5	Receiver Input Impedance		160		Ohm	Real Impedance at 4MHz
			0	0.1		$(R_{\max \text{ gain}} - R_{\min \text{ gain}})/R_{\max \text{ gain}}$
			40		Ohm	Imaginary Impedance at 4MHz
			358		pF	Input Capacitance
			0	0.15		$(C_{\max \text{ gain}} - C_{\min \text{ gain}})/C_{\max \text{ gain}}$
8.4.6	Distance Amplitude Correction	-1.5	0	1.5	dB	Maximum error between TCG curve and actual TCG correction

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.5.2	Amplifier Frequency Response	2.05	2.16	2.27	MHz	Center Frequency (Geometric Mean), 1-5 MHz selected
		3.81	4.23	4.65	MHz	Bandwidth, 1-5 MHz selected
		1.86	1.96	2.06	MHz	Center Frequency (Geometric Mean), 2 or 2.25 MHz selected
		2.57	2.85	3.14	MHz	Bandwidth, 2 or 2.25 MHz selected
		4.18	4.4	4.62	MHz	Center Frequency (Geometric Mean), 4 or 5 MHz selected
		4.95	5.5	6.05	MHz	Bandwidth, 4 or 5 MHz selected
		8.76	9.22	9.68	MHz	Center Frequency (Geometric Mean), 10 MHz selected
		6.6	7.33	8.06	MHz	Bandwidth, 10 MHz selected
		13	13.68	14.36	MHz	Center Frequency (Geometric Mean), 13 or 15 MHz selected
		6.78	7.53	8.28	MHz	Bandwidth, 13 or 15 MHz selected
		4.5	4.74	5	MHz	Center Frequency (Geometric Mean), BroadBand selected
17.41	19.34	21.27	MHz	Bandwidth, BroadBand selected		

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.5.3	Equivalent Input Noise	-	70	80	nV/ sqrt Hz	1-5 MHz selected
			70	80	nV/ sqrt Hz	2 or 2.25 MHz selected
		-	43	80	nV/ sqrt Hz	4 or 5 MHz selected
		-	34	80	nV/ sqrt Hz	10 MHz selected
		-	35	80	nV/ sqrt Hz	13 or 15 MHz selected
		-	38	80	nV/ sqrt Hz	BroadBand selected
9.5.4	Accuracy of Calibrated Attenuator	-1	0.7	1	dB	Cumulative Error over 20dB Range
		-2	0.7	2	dB	Cumulative Error over 60dB Range

Table 2: EN 12668-1:2000 Specifications (cont.)

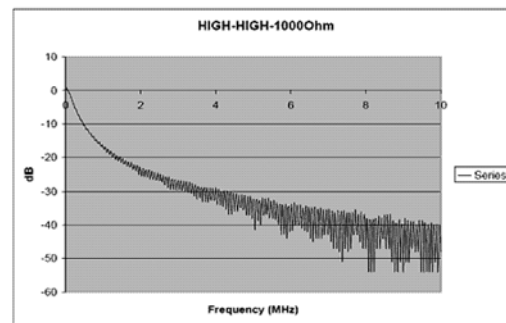
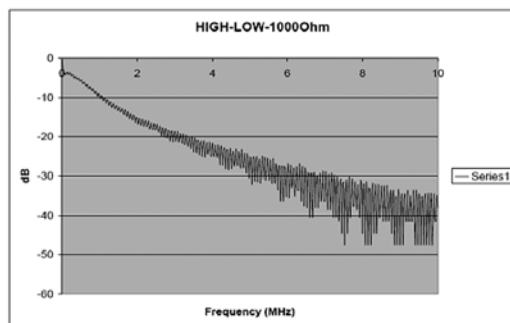
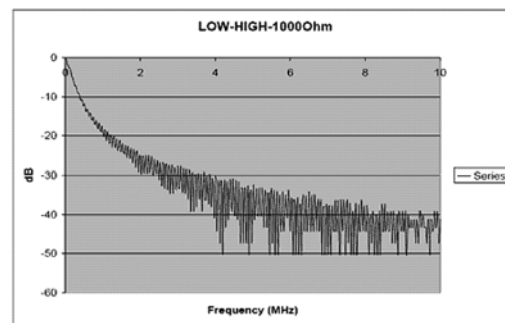
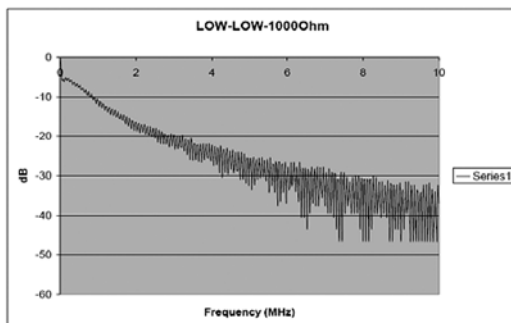
Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
9.5.5	Linearity of Vertical Display	-2	0.6	2	%FSH	1, 2 or 2,25 MHz selected
		-2	0.6	2	%FSH	4 or 5 MHz selected
		-2	-0.9	2	%FSH	10 MHz selected
		-2	-1.25	2	%FSH	13 or 15 MHz selected
		-2	0.18	2	%FSH	BroadBand selected
8.7.2	Linearity of Timebase	-	0.03	0.5	%FSW	
8.7.3	Digitization Sampling Error	-5	-4	5	%FSH	
	Dimensions	11.1			CM	Height
		17.5			CM	Width
		5			CM	Depth
<1			KG	Weight (With Battery)		

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
8.7.3	Battery Life		6		Hr	Instrument will automatically shut down when batteries are too low for reliable operation
	Operating Temperature Range	0	-	55	DegC	
	Rectification Modes	FW				
		HWP				
		HWN				
		RF				
	Pulse Repetition Frequency	15		2000	Hz	Continuously Variable
	Display Dimensions	12.6			CM	Diagonal
		800 x 480				Pixels
	Number of Pixels to Display an A-Scan	512				
	A-Scan Graticule Major Divisions	None, 5 or 10				Vertical and Horizontal, User selectable
	A-Scan Graticule Minor Horizontal Divisions	50				Displayed along the baseline
A-Scan Graticule Minor Vertical Divisions	50				Displayed on the center vertical	

Table 2: EN 12668-1:2000 Specifications (cont.)

Paragraph	Parameter	LSL	Typ.	USL	Units	Test Conditions
8.7.3	Velocity Range	0.0098	-	0.6299	in/uS	
		250	-	16000	M/S	
	Display Delay Range	-15	-	3500	uS	
	TCG Range	110			dB	
	TCG Maximum Slope	100			dB/uS	
	TCG Maximum Number of Points	15				



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