Operating Manual
for

Model UD800
Ultrasonic Flaw Detector

1 Introduction of the Instrument

1.1 Overview of the Instrument

The UD800 combines the powerful advantages of digital design with the detailed dynamic echo information that was previously only possible with an analog display. The high resolution color LCD display, 150 Hz update rate, and “single shot” measurement technique produce a fast, smooth response for immersion and critical weld testing. The quality, durability, dependability and ease of use remains on the UD800. From rugged field inspections to high resolution thin measurements, long acoustically clean materials, and immersion systems work, the UD800 extends the range of applications that a portable instrument can perform.

Rugged UD800 durability, 12 hours of battery use, easy keys operation, outstanding ultrasonic performance, and now “square wave pulser” and “color leg” combine to form a powerful portable ultrasonic inspection tool with powerful Lithium Ion battery pack.

1.2 Specifications

- **Range** 1 to 10,000 mm at steel velocity, range selectable in fixed steps or continuously variable
- **Material Velocity** Continuously adjustable from 100 to 20,000 m/s, 33 selectable material velocities
- **Display Delay** -5 to 3400 μs in steel (dependent on range)
- **Probe Delay (Zero Offset)** 0 to 100 μs
- **Damping** 50, 75, 150, 500 ohms
- **Gain** 0 to 110 dB adjustable in selectable steps 0.2, 0.5,1, 2, 6, 12dB, user definable, and locked
- **Pulse Repetition Frequency** 20 to 1K Hz
- **Bandwidth** 0.2 to 20 MHz with 3 selectable broadbands
- **A/D Sample Rate** 100MHz (Hardware Rate)
- **Probe Connections** BNC
- **Power adapter** 9VDC, 110-220VAC
- **Battery Power** 7.4V, 6600Ahr Lithium Ion Battery Pack
- **Battery Life** 12 hours on Li-Ion Battery Pack
- **Operating temperature** -10～60℃
- **Stored temperature** -25～70℃
- **Size** 230mm×150mm×45mm
- **Weight** 1.0kg with Li-ion battery pack
- **Horizontal Linearity Error** ≤0.1%
- **Vertical Linearity Error** ≤3%
- **Echoes Resolution** ＞30dB
- **Sensitivity Margin** ＞60dB (200mm,Φ2,flat bottom hole)
- **Dynamic Range** ＞30dB

1.3 Performance features

• Parameter Setups Files	Up to500 files stored instrument parameter setups.
• A-Scan Files	Up to 500 files including operation parameters plus A-scan, the stored datasets can be easily previewed, recalled and exported to a computer for edit and printing.
• Thickness Files	Up to 10,000 thickness values stored in single thickness file.
• PC Communication	Bi-directional RS232 or RS232-USB adaptor connected with PC.
• DAC/ TCG	DAC or TCG with a maximum of 16 reference echoes, 4 other curves can be displayed with variable dB intervals. DAC curves can be varied with variable dB or variable range.
• AVG/DGS	DGS curves can be displayed automatically, DGS curves can be varied with variable dB or variable range.
• Readings	Up to selectable 26 readings (Sound path, projection distance, depth, echo height, and ERS.)
• B-Scan	Selectable corrosion-featured B-scan and full-featured B-scan
• Square Wave Pulser	Square wave pulsers allow optimum probe matching by adjusting pulse width and voltage. Difficult to penetrate metallic applications and especially non- metals inspection like composite materials are optimized. Pulse width is tunable up to 1000 ns in 10 ns steps. Pulser voltage is adjustable from 20 to 500 V in 10 V steps.
• Rectification	Positive half-wave, negative half-wave, full-wave, RF
• Reject (suppression)	0 to 90% linear
• Units	Inch, millimeter, or microsecond selectable
• Languages	Selectable English, Chinese
• Gate Monitors	Two independent flaw gates controllable over entire sweep range
• Measurement Modes	Zero-to-first, multi-echo with selectable flank or peak detection
• TTL Output	Three independently assignable outputs, instantaneous, timed, latched with visual LED and audible horn alarms
• Alarm	Selectable positive logic, negative logic, upper limit thickness or lower limit thickness alarm mode
• Curved surface correction	Corrects sound path information when using an angle beam transducer to circumferentially inspect a curved surface for either tubular or bar inspections.
• Auto Calibration	Measurement and setting of sound velocity and probe delay using two known calibration echoes (2-point calibration)
• Auto Gain	Adjust automatically the system sensitivity to bring (increase or decrease) the measured echo to the suitable echo height. Echo height setting value from 10 % to 90 % of the screen height.
• Display Screen	5.7 inch LED backlight TFT_LCD, display resolution 320 x 240 pixels, selectable 4 scheme colors and 8 A Scan colors.
• A-Scan Resolution	Standard 200 x 220 pixels, or 100 x 220 pixels
• Display Update Rate	150Hz

2 Understanding the Keypad, Menu System, and Displays

The UD800 is an ultrasonic flaw detection and thickness measurement instrument. It's capable of storing A-Scans, operating parameters, and a variety of thickness measurement data in its data logger. This chapter of your manual will help you become more familiar with the menus and functions of the UD800. Closely reviewing the material in this chapter will help you make better use of the more detailed information found throughout the rest of this instruction manual.

After reviewing this chapter, you'll be able to

• Install Batteries in the instrument (section 2.1)

• Power up the instrument (section 2.2)

• Understand the function of each key on the keypad (section 2.3)

• Access each UD800 function using the built-in menu system (section 2.4)

• Interpret the symbols that most often appear on the display (section 2.5)

• List the features of the UD800 (section 2.6)

• Determine which optional features are installed in your instrument (section 2.6)

2.1 Battery Installation

The UD800's Li-ion battery pack locates in the rear of the housing. Remove the battery compartment cover, and then install the battery pack. The Li-ion battery pack is charging with the AC/DC adapter, while the UD800 can also be operated on the AC power with this adapter. The AC/DC power adapter is connected to the instrument though the Power Adapter Port shown in Figure 2-1.When connect the AC adapter to charge the empty battery pack, the red charging indicator become light. Charge the empty battery pack for about seven hours to be full, the red charging indicator becomes black. Pull out the AC adapter from the instrument

FIGURE 2-1—Note the location of the AC Power Adapter Port.

The approximate level of remaining battery life is visually displayed by the icon. The location of this icon is shown in Figure 1-4. When fresh batteries are installed, the icon will appear as "full". As the battery life is consumed, the icon will begin to "empty."

Note:

When the battery indicator is in the last quarter as indicated by the symbol , charge the batteries as soon as possible. The UD800 automatically shuts off when batteries are too weak for reliable operation. Settings are saved and restored when the UD800 is turned on again. When testing in remote locations, always carry spare battery pack.

2.2 Powering On and Off the Instrument

Press and hold for about two seconds to power the instrument on and off.

The instrument can be reset, in one of two ways, by using a combination of key presses. To reset the instrument do the following:

- Reset the instrument settings WITHOUT deleting all stored data files.

Press and hold the 2 ABC and ⏻ keys simultaneously to wait for the beep sound, release the 2 ABC and ⏻ keys after you heard the beep sound. The instrument settings are returned to the default factory values and instrument data memorys are not changed.

- Reset the instrument settings and DELETE all stored data files.

Press and hold the 3 DFE and ⏻ keys simultaneously to wait for the beep sound, release the 3 DFE and ⏻ keys after you heard the beep sound. The instrument settings are returned to the default factory values and instrument data memorys are formated.

NOTE:

When the instrument has been reset, the settings are returned to the default values and data files (when applicable) are deleted. The effects of resetting the instrument may not be reversed.

2.3 Keypad Features

The UD800 is designed to give the user quick access to all of the instrument's functions. Its easy-to-use menu system allows any function to be accessed quickly with no more than three key presses (Figure 2-2). To access any function:

- Press one of the five function keys Fx (**x=1,2,3,4,5**) to select a menu. The menus across the bottom of the display will immediately be replaced with the submenus contained in the selected menu.
- Press a function menu keys Fx (**x=1,2,3,4,5**) again to select the submenu containing the desired function. Up to four functions will be displayed in the function bar on the right side of the display
- Select the desired function, by pressing ▲ or ▼ key.
- Change the value listed in the function box, by pressing ◄ or ◄ key. Some values can also be adjusted with repeated presses of the ↵ key. The ↵ key also changes fine and coarse adjustment of some values.

You'll also find these keys on the instrument (Figure 2-2):

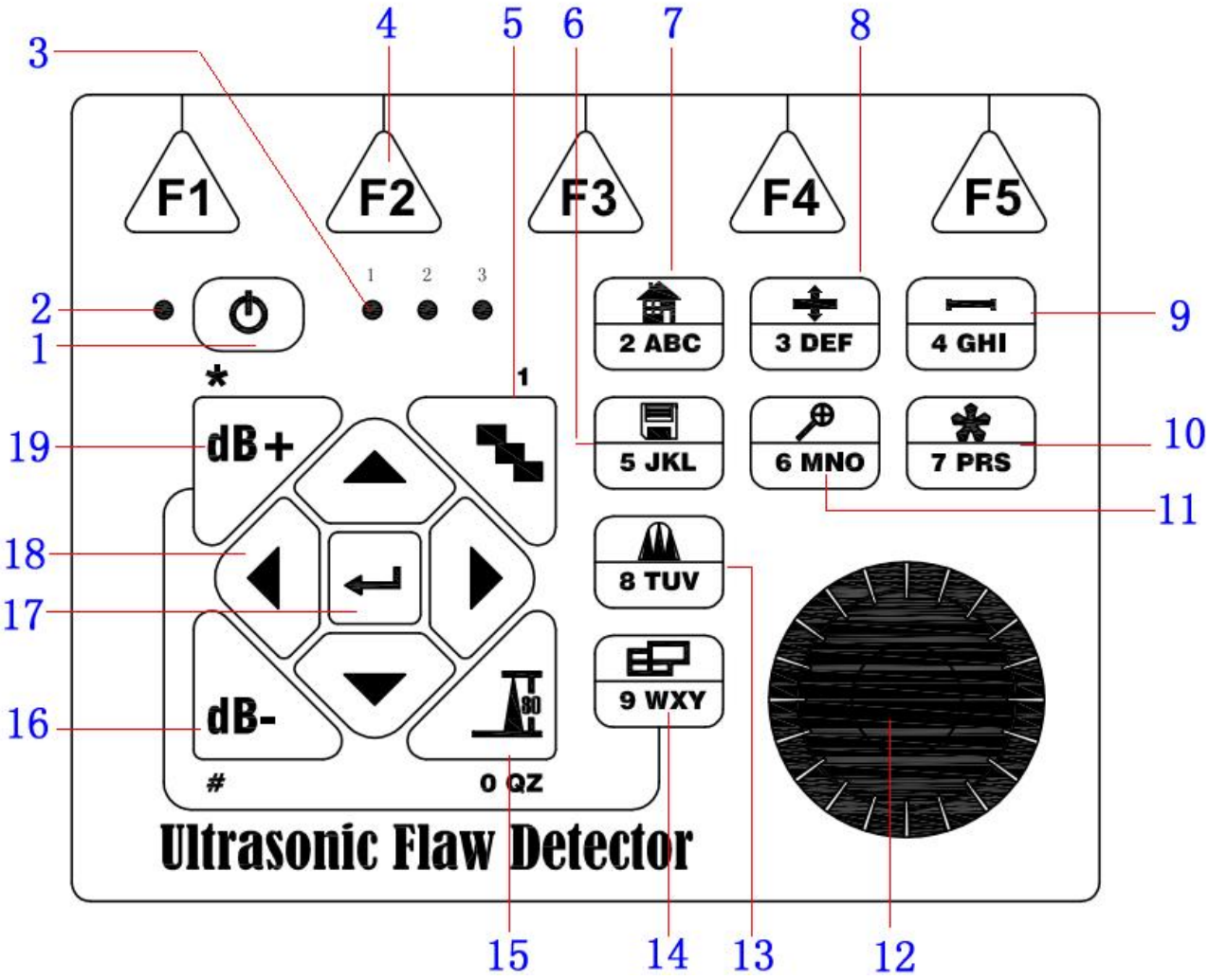


FIGURE 2-2—Some of the keypad and knob functions are shown here.

1 —Power Key turns the instrument on and off.
2 —Gate Shortcut Key adjusts A gate or B gate quickly.
3 —Charging status light.
4 —Save Shortcut Key performs a data-storage function quickly.
5 —Function Key select menu and submenu, select the edit menu and notes.
6 —Alarm lights corresponding to TTL 1,2,3.
7 —dB＋ key increases the instrument's gain.
8 —Direction key includes Up,Down,Left and Right.
9 —dB－ key decreases the instrument's gain.
10 —OK key.
11 —Gain step key changes the gain-adjustment increment.
12 —Auto Gain key automatically adjusts the instrument's gain.
13 —Home Key immediately returns the instrument to the Last Menu list as shown in Figure 2-3.
14 —Magnify key magnifies the A-scan contents of a gate.
15 —Test Menu Key switches from the Home Menu to the Status Bar. A first press displays the grid markers in the menu bar, a second press activates a bar identifying display delay and range, and a third press returns to the original menu position.
16 —Freeze Key freezes the A-Scan display in one of four user-defined modes.
17 —Development Key displays the development curve of A-Scan.
18 —Enlarge Shortcut Key enlarges to display the readings。

2.4 Menus and Functions

The UD800 menu system allows the operator to select and adjust various features and instrument settings. It includes several menus used to configure and calibrate the instrument prior to test. Also used to select pulser and receiver characteristics, position gates, set alarms, specify operating mode and screen appearance, adjust the A-Scan display, and control other significant measurement features

Note:

Figures 2-3 show the instrument's Home Menu structures. The information provided in the following two manual sections explains what each function does and shows how to access the function through the menu system. You'll also find operation-manual section references that tell you where to turn in this manual for more specific information on each function.

2.4.1 Home Menu System

The UD800's Home Menu System consists of several menus, submenus, and functions.

- Available menus are accessed via the Home Menu (Figure 2-3). Note that the menus visible on your particular instrument depend on which options are installed.
- Each menu contains several submenus.
- Menus and submenus are selected by pressing function menu key Fx (**x=1,2,3,4,5**) below the desired item.
- When a submenu is selected, the functions contained in that submenu are listed in the Function Bar down the right-hand side of the display screen.
- Functions are then selected by pressing ▲ or ▼ key
- Pressing ◀ or ▶ key, and in some cases continuing to press ↵ key, will change the value shown in the selected function's box.
- Pressing 2 ABC Key returns the instrument to the Last Menu list, repeatly pressing 2 ABC Key returns the instrument to the main Menu.

Note:

Some functions, like RANGE, have both coarse and fine adjustment modes. Coarse and fine modes are selected by pressing ↵ key more than once. When the function name, such as RANGE, appears in all capital letters, turning the function knob will produce large changes in the selected function's value. When the function name appears in all lower-case letters, turning the function knob will change the value by smaller amounts. Functions with coarse-and-fine adjustment capabilities are noted with a (*) in Figure 2-3.

BASIC MENU		PLSRCVR MENU		GATE MENU		TRIG MENU		AUTOCAL MENU	
RANGE	RANGE*	PULSER	PULSER TYPE	POSITION	GATE SELECT	SETUP	PROBE ANGLE*	CAL1	GATE A START*
	PROBE DELAY		VOLTAGE(SPIKE ENERGY)		GATE START*		PROBE K VALUE*		S-REF1*
	VELOCITY*		WIDTH		GATE WIDTH*		THICKNESS*		S-REF2*
	DISPLAY DELAY*		DAMPING		GATE THRESHOLD		X VALUE		RECORD
CONFIG	FREEZE MODE	RECEIVER	FREQUENCY	GATEMODE	GATE SELECT	CSC	DETECT SIDE	READING1	VELOCITY
	A-SCAN MODE		RECTIFY		DETECTION		O_DIAMETER*		PROBE_DELAY
	GRID SELECT		PROBE TYPE		START MODE				
	PEAK MEMORY		REJECT		MAGNIFY GATE				
DISPLAY	COLOR CONFIG	GAIN	dB STEP	ALARMS	GATE SELECT	AWS D1.1	A INDICATION	CAL2	REF SIZE*
	ITEM SELECT		dB VALUE		LOGIC		B REFERENCE		D-REF*
	COLOR SELECT		dB REF		ALARM CLEAR		C ATTENUATION		R-REF*
	BRIGHTNESS		USER GAIN STEP		HORN		D D1.1 RATING		RECORD
REGIONAL	LANGUAGE	SETUP	GATE A START*	LIMITS	LOW LIMIT*	A POS	GATE A START*	READING2	PROBE ANGLE
	UNITS		AUTO GAIN LEVER		HIGH LIMIT*		GATE A WIDTH*		PROBE K VALUE
	DATE						GATEATHRESHOLD		X VALUE
	TIME								
RESULTS	READING 1			TTL OUT	TTL1#	COLORING	COLOR LEG		
	READING 2				TTL2#				
	READING 3				TTL3#				
	READING 4				ALARM MODE				

FILE MENU		DAC MENU		DGS MENU		BSCAN MENU	
FileName	FILE TYPE(LINEAR)	RECORD	GATE A START*	SETUP	DGS MODE	SCAN	BSCAN MODE
	FILE NAME(GRID)		GETEA THRESHOLD		DGS CURVE		SCAN LENGTH
	ACTION(CUSTOM LINEAR)		RECORD		PROBE #		SCAN TIME
	CREAT NEW(STORE)		DELETE CURVE		PROBE NAME		OPRATION
FileHead	HEAD NUMBER	SETUP1	TCG/DAC MODE	DGSPROBE	XTAL FREQUENCY	RANGE	DEPTH RANGE
	EDIT		DAC/TCG DISPLAY		EFF DIAMETER		GATE A START*
					DELAY VELOCITY		GETE A WIDTH*
	ENTER		OFFSET AMOUNT		PROBE NAME		GATEA THRESHOLD
NOTES	NOTE NUMBER	SETUP2	DAC OFFSET #	REF ECHO	GETE A STERT*	SETUP	A-SCAN MODE
	EDIT		DAC OFFSET		REFERENCE TYPE		SCAN WAY
			DAC/TCG ATTEN		REF SIZE		SCAN TYPE
	ENTER		TRANSFER LOSS		RECORD REF		A SCAN DISPLAY
NTS EDIT	FILE NAME	EDIT1	POINT	REF CORR	REF ATTEN		
	SCROLL FILE		POINT TIME		AMPL CORRECT		
	NOTE ACTION		POINT GAIN				
	CLEAR NOTES		ENTER		DELETE REF		
DL EDIT	FILE NAME	EDIT2	POINT	MATATTEN	TEST ATTEN		
	SCROLL FILE		POINT DELETE		TRANSFER LOSS		
	ACTION		POINT RENEW				
	EDIT						

FIGURE 2-3—These menus, submenus, and functions are accessed through the Home Menu.

BASIC Menu

RANGE Submenu

- **RANGE**—Adjusts the range of the display screen from 1 mm to 10000 mm in steel.
- **PROBE DELAY**—Represents the time delay caused by sound-wave travel through a probe's wear

plate, membrane, delay line, or wedge.
- **VELOCITY**—Displays the velocity for the selected material and allows the user to input a velocity.
- **DISPLAY DELAY**—Shifts the A-Scan viewing window to the left or right.

CONFIG Submenu
- **FREEZE MODE**—Determines what is frozen when the Freeze Key is pressed.
- **A-SCAN MODE**—Changes the appearance of the A-Scan.
- **GRID SELECT**—Selects the display screen's grid markings.
- **PEAK MEMORY**——Dynamically records the highest peak value of the past A-scans in the gate.

DISPLAY Submenu
- **COLOR CONFIG**—Select predefined color configuration or user- defined color configuration
- **ITEM SELECT**—Selects the color configuration item.
- **COLOR SELECT**—configures the color of the selected item
- **BRIGHTNESS**—Adjusts the display's brightness

REGIONAL Submenu
- **LANGUAGE**—Sets the language displayed on the instrument's screen
- **UNITS**—Sets displayed units to inch, millimeter, or microsecond
- **DATE**—Sets the displayed date
- **TIME**—Sets the displayed time

RESULTS Submenu
- **READING 1 - READING 4**—Selects the measurement displayed in each of the four Reading Boxes.

PLSRCVR Menu

PULSER Submenu
- **PULSER TYPE**—Selects the pulser type. (Refer to section 2.3.5)
- **ENERGY**—Sets the emitted signal (pulser) to high , middle , or low power. (Refer to section 2.3.5)
- **VOLTAGE**—Sets the emitted pulse voltage amplitude. (Refer to section 2.3.5)
- **WIDTH**—Sets the emitted pulse voltage width. (Refer to section 2.3.5)
- **DAMPING**—Adjusts the damping level to match the installed probe. (Refer to section 2.2.2)

RECEIVER Submenu
- **FREQUENCY**—Selects the bandwidth of the instrument.
- **RECTIFY**—Selects the rectification-mode which effects how the A-Scan appears on the display.
- **DUAL**—Identifies whether one or two single-element probes, or a dual element probe, is installed.
- **REJECT**—Determines what percentage of the A-Scan height is displayed at 0% full screen height.

GAIN Submenu
- **dB STEP**—Defines increment of gain value change when knob is turned.
- **dB VALUE**—Adjusts the instrument's gain value.
- **dB REF**—Stores reference gain value and echo height.
- **USER GAIN STEP**—Specify a user-defined gain value increment to appear in the Test Menu's dB Step selections.

SETUP Submenu
- **GATE A START—**Sets A-Gate starting point.
- **AUTO GAIN LEVER—**Sets echo to percentage of screen height, the instrument automatically adjust the gain to lever the echo in the A gate to this screen height

GATES Menu

POSITION Submenu
- **GATE SELECT**—Select from two or more gates (depending on the installed options).
- **GATE START**—Sets the beginning position of the selected gate on the A-Scan.
- **GATE WIDTH**—Sets the width of the selected gate on the A-Scan.
- **GATE THRESHOLD**—Sets the height of the selected gate.

GATEMODE Submenu

- **GATE SELECT**—Select from two or more gates (depends on the installed options).
- **DETECTION**—Indicates whether an A-Scan echo's flank, or peak is evaluated by the gate.
- **START MODE**—Set to IP (initial pulse) in base-model KFD90.
- **MAGNIFY GATE**— Allows the user to select which gate is magnified to full screen width when the Magnify Key is pressed (depends on the installed options).

ALARMS Submenu

- **GATE SELECT**—Select from two or more gates (depends on the installed options).
- **LOGIC**—Determines whether the gate alarm is triggered when a signal crosses the gate or does not cross the gate.
- **ALARM CLEAR**—Clear TTL and analog outputs.
- **HORN**—Enables the audible warning alarm (horn).

LIMITS Submenu

- **LOW LIMIT**—Use to set the minimum thickness for alarm purposes.
- **HIGH LIMIT**—Use to set the maximum thickness for alarm purposes.

TTL OUT Submenu

- **TTL #1**—Identifies which event triggers TTL 1 / illuminates Warning Light 1.
- **TTL #2**—Identifies which event triggers TTL 2 / illuminates Warning Light 2.
- **TTL #3**—Identifies which event triggers TTL 3 / illuminates Warning Light 2.
- **MODE**—Specifies how the TTL Alarms are reset.

TRIG Menu

SETUP Submenu

- **PROBE ANGLE**—Inputs the angle of the connected angle beam probe.
- **PROBE K VALUE**—Inputs the K value of the connected angle beam probe.
- **THICKNESS**—Sets the test-piece material thickness for angle-beam measurements.
- **X VALUE**—Input the specified value from the angle beam probe's BIP to front edge.

CSC Submenu

- **DETECT SIDE**—Sets which side the probe on the curved test pieces.
- **O-DIAMETER**—Sets the outside diameter of curved test pieces.

AWS D1.1 Submenu

- **A INDICATION**—Gain representation of test-piece reflector.
- **B REFERENCE**—Gain representation of reference reflector.
- **C ATTENUATION**—Calculated gain representation of depth variation between reference and test-piece reflectors.
- **D D1.1 RATING**—Calculated weld rating for measured test piece.

A POS Submenu

- **GATE A START**—Sets A-Gate starting point.
- **GATE WIDTH**—Sets width of the A-Gate.
- **A THRESHOLD**—Sets A-Gate's height.

COLORING Submenu

- **COLOR LEG—**Selects color leg or grid background color band mode to display the A-scan.

AUTOCAL Menu

CAL1 Submenu

- **GATE A START—**Sets A-Gate starting point.
- **S-REF 1**—User-input thickness value of the thinner calibration standard.
- **S-REF 2**—User-input thickness value of the thicker calibration standard.
- **RECORD**—Identifies and progresses through each stage of the calibration procedure.

READING1 Submenu

- **VELOCITY**—Display's the instrument's default velocity for the specified material type as well as the calculated velocity after calibration.

- **PROBE DELAY**—Adjustment made as a result of the zeroing procedure. This represents the time delay caused by sound-wave travel through a probe's wear plate, membrane, delay line, or wedge (plastic).

CAL2 Submenu

- **REF SIZE—**User-input diameter of a known reflector (side drilled hole)
- **D-REF**—User-input depth value of t a known reflector (side drilled hole)
- **R-REF**—User-input horizontal distance value of a known reflector (side drilled hole)
- **RECORD**—Record and complete calibration procedure.

READING2 Submenu

- **PROBE ANGLE**—Output the angle of the connected angle beam probe.
- **PROBE K VALUE**—Output the K value of the connected angle beam probe.
- **X VALUE**—Output the specified value from the angle beam probe's BIP to front edge.

FILES Menu

FileName Submenu

- **FILETYPE**—Selects the file type
- **FILENAME**—Selects stored files.
- **ACTION**—Recalls or deletes the selected file and saves edits to alphanumeric and parameter settings.
- **CREATE NEW**—Pressing twice launches the file creation process.

File Head Submenu

- **HEADER NUMBER**—Selects the Header Line to edit.
- **EDIT**—Allows editing of the selected Header Line contents.
- **ENTER**—Saves the title

NOTES Submenu

- **NOTE NUMBER**—Selects the Note Line to edit.
- **EDIT**—Allows editing of the selected Note Line contents.
- **ENTER**—Save the notes

NTS EDIT Submenu

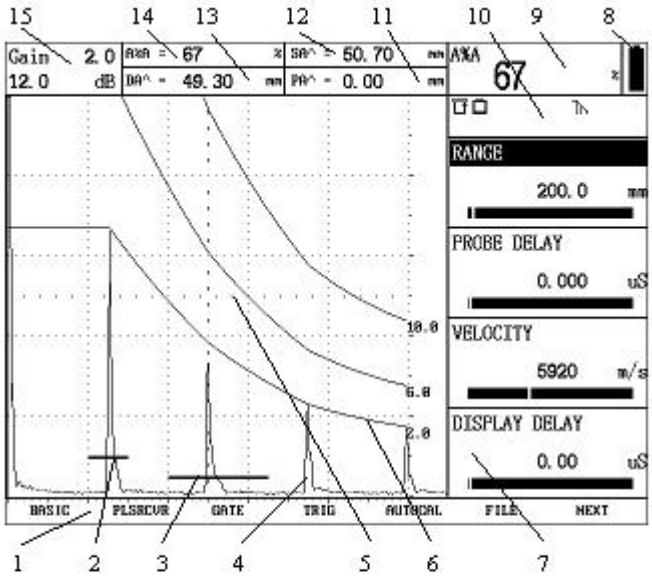
- **FILENAME**—Selects stored files.
- **SCROLL FILE**—Scrolls the contents of the selected file.
- **NOTE ACTION**—Presses key twice to modify the notes content, presses key again to return.
- **CLEAR NOTES**—Presses twice to clear the notes contents of the selected thickness.

DL EDIT Submenu

- **FILENAME**—Selects stored files.
- **SCROLL FILE**—Scrolls the contents of the selected file.
- **ACTION**—Presses twice to clear or save the contents of the selected thickness.
- **EDIT**—enable to edit the contents of the selected thickness.

2.5 Display Screen Features

The instrument displays are designed to be easy to interpret. In Figure 2-4 you'll find an example of the a display configuration. This specific display includes a data logger file navigation window (which allows you to navigate through and store thickness measurements in an existing data logger file), an active A-Scan, the GATES menu bar, and POSITION submenu. Refer to this Figure for an explanation of those screen features you'll most often encounter. You'll also find a reference to the manual section which explains the identified feature in more depth.



1 ——MEMU BAR
2 ——GATE A (RED)
3 ——GATE B (GREE)
4 ——A SCAN
5 ——GRID
6 ——DAC CURVE
7 ——FUNCTION/VALUE BAR
8 ——BATTERY LEVEL INDICATOR
9 ——LARGE READING BOX
10——STATUS BAR
11——READING 4
12——READING 2
13——READING 3
14——READING 1
15——GAIN

FIGURE 2-4—Screen areas and the contents

Definition of Display Icons

There are several graphical features (icons) which appear in the display screen's icon bar for various reasons. Figure 2-5 includes several of these icons along with an explanation of their significance.

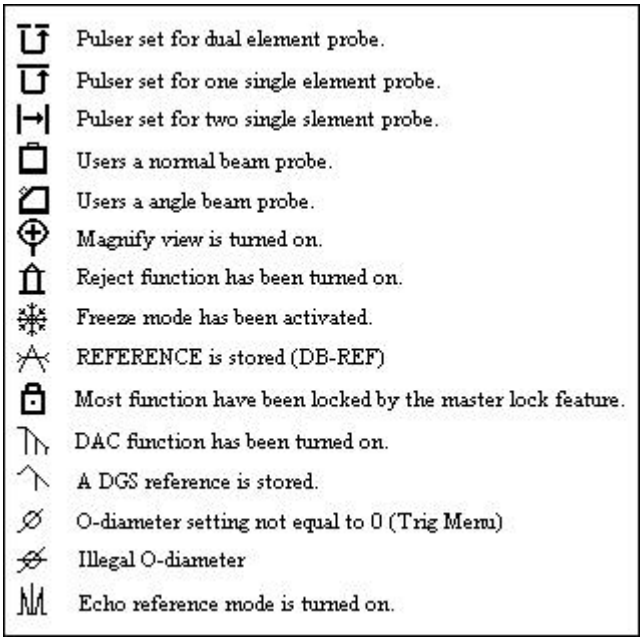


FIGURE 2-5—These icons appear in the Status Bar at various times.

2.6 Overview of Optional Features

Several options are available to be added to the base-model UD800. Options purchased with your instrument will be described in detail later in this manual. This section explains how to tell which options are installed in your instrument and includes a brief overview of the features available with each option. Any UD800 instrument can be retrofitted with available options.

2.6.1 Determining Which Optional Features are Installed in Your instrument

The instrument options:

- Square Wave Pulser

Square Wave Pulser is Selectable and tunable for optimum probe matching to satisfy a wide range of tough-to-penetrate applications. For low frequencies, square wave pulsers allow optimum probe matching by adjusting pulse width and voltage. Difficult to penetrate metallic applications and especially non-metals inspection like composite materials are optimized.

- DAC/TCG

The DAC (Distance Amplitude Curve) feature allows the user to collect up to 16 samesize- reflector echoes, representing various material depths, and generate a curve that fits the echo peaks. In this mode all echoes are represented at their true amplitude with no depth or attenuation compensation. Most ten additional curves, drawn at user-specified dB offsets from the original DAC curve, can be displayed at one time. The TCG (Time Corrected Gain) feature allows all equivalent echoes to be displayed at the same height, regardless of material depth related signal loss (caused by attenuation and beam spread). TCG works by adjusting gain over time to ensure that like-reflectors, located at different material depths, are represented by same-amplitude echoes.

- DGS

The DGS (Distance Gain Size)feature allows the user to display a curve which represents equivalent reflector- sizes, for a particular gain, as a function of the distance between the reflector and transducer. DGS assumes a vertical beam impingement. Flaw sizing evaluations can be done via dB to the DGS curve or ERS (Equivalent Reflector Size) methods.

2.6.2 How Options are Dealt with in This Manual

When an option is installed, several additional functions and, in some cases submenus, are available. These additional capabilities can only be accessed when the option is installed. Whenever these special features are discussed in this manual, they will be identified as being available only with one or more of the optional upgrades. If no reference to an option is made, assume that the feature is available with the base-model instrument

3 Set Up and Calibration of the instrument

This chapter explains how to prepare your instrument for use. In this chapter, you'll learn how to

- Set up the instrument's display and basic operating features (section 3.1)
- Install a probe and configure the Pulser/Receiver to match the probe type (section 3.2)
- Adjusting the A-Scan display screen's appearance (section 3.3)
- Calibrate the instrument (section 3.4) Most sections in this chapter describe steps that will be followed by every user of a new instrument. For this reason, we suggest that you proceed through each section in this chapter while configuring your instrument for the first time.

3.1 Initial Instrument Setup

In this part of the manual, you'll learn how to configure the instrument display and operating features. Follow these procedures to turn on the instrument and make initial adjustments to the instrument control settings. Because the instrument saves the control settings when it's turned off and restores them when it's turned on, you won't have to repeat these adjustments unless a change is required.

Turn on the instrument by pressing . The Home Menu will be activated. This menu's structure was shown in Figure 2-3. Activate the Basic Menu by pressing Fx (**x=1,2,3,4,5**) key.

3.1.1 Regional Settings—Language, Units of Measurement, Date, and Time

Use the procedures below to adjust the unit of measurement, the date, the time, and the language that appears on the instrument's display screens and data output. The adjustments will require access to the REGIONAL submenu. This is accessed from the Basic Menu.
Setting the Operating Language (BASIC-REGIONAL-LANGUAGE)

Step 1: Activate the REGIONAL submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled LANGUAGE. To change the selected language, continue pressing ◀ or ▶ key, or continue pressing ↵ key. You'll note that the options available are English, Chinese. The default language is English.

Step 3: The display-screen and report language will be set to the choice last selected.

Setting the Date (BASIC-REGIONAL-DATE)

Step 1: Activate the REGIONAL submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled DATE. The date is displayed in Day/Month/Year format. Note that the first time you press ↵ key, the day character is highlighted. The next time you press ↵ key, the month character is highlighted. Finally, pressing ↵ key again will cause the year character to be highlighted.

Step 3: To change the month, days, or year, press ◀ or ▶ key while the desired character is highlighted.

Step 4: When complete, press ↵ key one more time. The current date will be set to the date displayed.

Setting the Time (BASIC-REGIONAL-TIME)

Step 1: Activate the REGIONAL submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled TIME. Time is displayed in 24-hour format. Note that the first time you press ↵ key, the hours character is highlighted. The next time you press ↵ key, the minutes character is highlighted. Finally, pressing ↵ key again will cause the seconds character to be highlighted.

Step 3: To change the hours, minutes, or seconds setting, press ◀ or ▶ key while the desired character is highlighted.

Step 4: When complete, press key one more time. The current time will be set to the time displayed.

Note:

Once set, the internal clock of the UD800 will maintain the current date and time.

Setting the Units of Measurement (BASIC-REGIONAL-UNITS)

Step 1: Activate the REGIONAL submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press or key to highlight the selection titled UNITS. You'll note that the following options are available:

- INCH default setting which displays values in inches
- MM displays values in millimeters

Step 3: To change the units of measurement, pressing or key, or continue pressing key.

Step 4: The unit of measurement will be set to the choice last displayed.

3.1.2 Display Appearance

Use the procedures in this section to adjust display appearance. The adjustments will require access to the DISPLAY and CONFIG submenus, which are each accessed from the BASIC Menu.

Setting the Display Brightness (BASIC-DISPLAY-BRIGHTNESS)

Step 1: Activate the DISPLAY submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press or key to highlight the selection titled BRIGHTNESS. Settings range from 40 to 255.

Step 3: To change the brightness level, pressing or key, or continue pressing key..

Step 4: The display brightness will remain at the level last displayed.

Selecting a Display Grid (BASIC-DISPLAY-GRID)

Step 1: Activate the DISPLAY submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press or key to highlight the selection titled GRID.

Step 3: To change the grid type, pressing or key, or continue pressing key. Each grid style is shown in the display screen's A-Scan window as it is selected. You'll note that the following styles are available:

- GRID 1 Five major horizontal and vertical divisions.
- GRID 2 Ten major horizontal and vertical divisions.
- GRID 3 No on-screen grid. Only display marks are visible.

Step 4: The grid style will be set to the last one displayed.

Setting the Display Color (BASIC-DISPLAY-COLOR CONFIG)

Step 1: Activate the DISPLAY submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled COLOR CONFIG. Six are four preset color schemes.

Step 3: To change the display's color scheme, pressing ◀ or ▶ key, or continue pressing ↵ key.

Step 4: The display color will remain at the scheme last displayed.

☞ **Note:**

All color schemes are recommended for indoor operation while schemes 2 and 3 are best suited for outdoor operation. Custom 1 and 2 are user-defined schemes.

Setting the User-defined Scheme Color

Step 1: Activate the DISPLAY submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled COLOR CONFIG. To change the display's color scheme, pressing ◀ or ▶ key, or continue pressing ↵ key until CUSTOM 1 or 2 is display.

Step 3: Press ▲ or ▼ key to highlight the selection titled ITEM SELECT. There are 5 item options.

- WINDOW Selects the background color of the menu and parameters display areas.
- BACKGOUND Selects the background color of the coordinate grid.
- GRID Selects the grid color of the coordinate grid and menu.
- PARA ADJUST Selects the words color of the fine adjusted menu parameters.
- A SCAN Selects the A-scan color.

Step 4: To change the item options, pressing ◀ or ▶ key, or continue pressing ↵ key.

Step 5: Press ▲ or ▼ key to highlight the selection titled COLOR SELECT. There are 16 color options. To change the color options, pressing ◀ or ▶ key, or continue pressing ↵ key.

Step 6: The color of the selected item options will remain the color last displayed.

Setting the A-Scan Style (BASIC-CONFIG-ASCAN MODE)

Step 1: Activate the CONFIG submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled A-SCAN MODE. The following are available:

- HOLLOW Only the A-Scan's outline appears on the display screen.
- FILLED A solid A-Scan appears on the display screen.

Step 3: To change the A-Scan's style, pressing ◀ or ▶ key, or continue pressing ↵ key.

Step 4: The A-Scan style will remain as last displayed.

3.2 Installing a Probe

3.2.1 Connecting a Probe

When connecting a probe to the instrument, it's not only important that the probe's physical connection be properly made. It's also important that the instrument is properly configured to work with the installed probe.

To install a single-element probe, connect the probe cable to either of the two ports on the front of the instrument (Figure 3-1). When two probes, or a dual-element probe is connected to the instrument, the "RECEIVE" probe connector should be installed in the left port and the "TRANSMIT" probe connector in the right port.

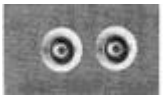


FIGURE 3-1—Probe Attachment Locations

3.2.2 Configuring the Instrument to Match the Probe Type

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.

Selecting Probe Type (PLSRCVR-RECEIVER-PROBE TYPE)

Step 1: Activate the RECEIVER submenu (located in the PLSRCVR Menu) by pressing Fx (**x=1,2,3,4,5**) key.

Step 2: Press ▲ or ▼ key to highlight the selection titled PROBE TYPE.

Step 3: To change the probe type, pressing ◀ or ▶ key, or continue pressing ↵ key. Each available probe type is represented by an icon that is displayed in the Icon Bar (near the upper right corner of the display) whenever that probe type is indicated. The following types are available:

- SINGLE For single-element probe (will be displayed)
- DUAL For dual-element probes (will be displayed)
- THROUGH For two single-element probes used on opposing surfaces of the test piece (will be displayed)

Step 4: The probe type will be set to the last one displayed.

Specifying the Probe Frequency (PLSRCVR-RECEIVER-FREQUENCY)

Step 1: Activate the RECEIVER submenu (located in the PLSRCVR Menu) by pressing Fx (**x=1,2,3,4,5**) key.

Step 2: Press ▲ or ▼ key to highlight the selection titled FREQUENCY.

Step 3: To change the specified frequency, pressing ◀ or ▶ key, or continue pressing ↵ key. You'll note that the following frequency settings are available:

- 0.2-1 MHz Select to utilize a built-in lowpass (LP) filter with probes in the specified range

- 0.5-5 MHz Select to utilize a built-in highpass (HP) filter with probes in the specified range
- 2-20 MHz Select to utilize a built-in broadband (BB) filter with probes in the specified range

Step 4: The probe frequency level will be set to the last one displayed.

Modifying the Signal Ratio to Noise by Changing the Damping Level (PLSRCVR-PULSER-DAMPING)

Step 1: Activate the PULSER submenu (located in the PLSRCVR Menu) by pressing Fx (**x=1,2,3,4,5**) key.

Step 2: Press ▲ or ▼ key to highlight the selection titled DAMPING.

Step 3: To change the specified damping level and optimize the A-Scan signal appearance, pressing ◄ or ► key, or continue pressing ↵ key. You'll note that the following damping levels are available:

- 50, 75, 150, 500 Ω

Step 4: The damping level will be set to the one last displayed.

3.3 Adjusting the A-Scan

3.3.1 Setting the A-Scan Range

Calibration requires the use of two calibrated standards, of different thickness, made of the same material as the test piece. Prior to calibrating the instrument/probe combination, the A-Scan display-screen range (the material thickness value represented by the full horizontal width of the screen) will normally be set to a value equal to or slightly larger than the thicker calibrated standard.

Setting The A-Scan Range

Step 1: Activate the RANGE submenu (located in the BASIC Menu) by pressing Fx (**x=1,2,3,4,5**) key. Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled RANGE. You'll note that RANGE has both coarse and fine adjustment modes. Coarse and fine modes are selected by pressing ↵ key. When "RANGE" appears in all capital letters, pressing ◄ or ► key will produce large changes in the range value. When "range" appears in all lower-case letters, pressing ◄ or ► key will change the value by smaller amounts.

Step 3: To change the range, pressing ◄ or ► key. You'll note that the range can vary from 1mm to 10'000 mm.

Step 4: The display's horizontal range will remain as set.

3.3.2 Setting the Display Delay

The display delay function shifts the displayed A-Scan to the left or right. This function is used to set the instrument viewing window. To set the display delay

Step 1: Activate the RANGE submenu (located in the BASIC Menu). Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled DISPLAY DELAY. Display delay has two adjustment modes: coarse adjustment and fine adjustment. Press ↵ key to change the adjustment mode.

Step 3: To change the display delay, press ◀ or ▶ key to adjust the display delay. You'll note that the displayed echoes shift to the left or right. Display delay adjustment range is from -5us to 3400us.

3.3.3 Defining the Display Starting Point

The display starting point is the reference from which all display features are set

Step 1: Activate the BASE Menu (located in the HOME Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the CONFIG submenu by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 3: Press ▲ or ▼ key to highlight the selection titled DISPLAY START. Press ◀ or ▶ key, or continue pressing ↵ key to change display start. You'll note that there are two options:

IP —— Initial pulse.

IF —— The first IF Gate flank crossing, or the IF Gate starting point when no IF Gate crossing occurs.

3.3.4 Selecting a Rectification Mode

Use the following procedure to select a rectification mode

Step 1: Activate the PLSRCVR Menu (located in the HOME Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the RECEIVER submenu by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 3: Press ▲ or ▼ key to highlight the function titled RECTIFY. Press ◀ or ▶ key or continue pressing ↵ key to change rectification mode. You'll note that there are four options:

- NEG HALF WAVE — Shows the negative component of the RF signal but displays it in a positive orientation
- POS HALF WAVE — Shows the positive component of the RF signal
- FULL WAVE — 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

Step 4: Select the desired rectification method.

3.3.5 Setting the Pulser

The instrument has the square wave pulser option, you can choose spike pulser or square wave pulser to excite the ultrasound.

Selecting the Pulser Type

To select pulser type does the following:

Step 1: Activate the PULSER submenu (located in the PLSRCVR Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Press ▲ or ▼ key to highlight the selection titled PULSER TYPE.

Step 3: To select the desired pulser type and optimize the A-Scan signal appearance, pressing ◀ or ▶ key, or continue pressing ↵ key. You'll note that the following pulser types are available:

- spike — negative spike pulse excition
- square wave — square wave pulse excition with voltage amplitude and voltage width that can be adjusted.

Setting Spike Pulser Energy

The relative energy of the spike pulser can be set to high, mid or low. To set the spike pulser energy does the following:

Step 1: Activate the PLSRCVR Menu (located in the HOME Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the PULSER submenu by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 3: Press ▲ or ▼ key to highlight the function titled SPIKE ENERGY. Select HIGH, MID or LOW by pressing ◀ or ▶ key, or continue pressing ↵ key.

Setting the Square Wave Pulser Energy

The voltage amplitude and width of the square wave pulser can be adjusted. To set the square wave pulser energy does the following:

Step 1: Activate the PLSRCVR Menu (located in the HOME Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the PULSER submenu by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 3: Press ▲ or ▼ key to highlight the function titled VOLTAGE. Press ◀ or ▶ key, or continue pressing ↵ key to change voltage amplitude. You can adjust square wave voltage amplitude from 20V to 500V in steps of 10V.

Step 4: Press ▲ or ▼ key to highlight the function titled WIDTH. Press ◀ or ▶ key, or continue pressing ↵ key to change voltage width. You can adjust square wave voltage width from 20ns to 1000ns in steps of 10ns.

3.3.6 Setting the A-Scan REJECT Level

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

Step 1: Activate the PLSRCVR menu (located in the HOME Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the REJECT submenu by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 3: Press ▲ or ▼ key to highlight the function titled REJECT.

Step 4: To change the amount of A-Scan you wish to omit from the display screen (as a percentage of screen height), press ◀ or ▶ key or continue pressing ↵ key. You may omit A-Scans up to 90% of the screen height. Whenever REJECT is set to a value greater then 0%, the will appear in the status bar.

3.4 Calibrating the Instrument

3.4.1 Pre-calibration Check List

To improve the accuracy and quality of your calibration, be sure that the following conditions are met before launching the calibration function:

• Probe installed

• Dual (Receiver) setting must match probe

• Recommended that PROBE DELAY and DISPLAY DELAY be set to 0

• DAC, DGS—Turned OFF

• Master Lock—Turned OFF

• FREEZE—Turned OFF

• Recommended that REJECT be set to 0.

3.4.2 Using AUTOCAL to Calibrate the VELOCITY and PROBE DELAY

☞ **Note:**
Peak memory function in BASIC-CONFIGURE menu can help user to capture quickly and memory the highest peak of echo. Prior to calibration, turns on this function to be able to simply the calibration process.

To calibrate the instrument (for straight beam probe or angle beam probe)

Step 1: From the Home Menu, activate the AUTOCAL Menu by pressing Fx (**x=1,2,3,4,5**) below it. The CAL1 submenu will be highlighted and four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled S-REF1 and press ◀ or ▶ key until the value of S-REF1 matches the thickness of the *thinner* calibration standard.

Step 3: Press ▲ or ▼ key to highlight the selection titled S-REF2 and press ◀ or ▶ key until the value of S-REF2 matches the thickness of the *thicker* calibration standard.

Step 4: Press ▲ or ▼ key to highlight the selection titled RECORD. The value in the function box will change from “OFF” to “S-REF1?” by pressing ↵ key.

Step 5: Press ▲ or ▼ key to highlight the selection titled A GATE START. Press ◀ or ▶ key (this will shift the starting point of the A-Gate) until the A-Gate lies over the echo corresponding to the thinner standard’s thickness. Apply couplant and couple the probe to the thinner calibration standard, find the highest echo and holding the probe.

Step 6: Press ▲ or ▼ key to highlight the selection titled RECORD. The value in the function box will change from “S-REF1?” to “S-REF2?” by pressing ↵ key.

Step 7: Press ▲ or ▼ key to highlight the selection titled A GATE START. Press ◀ or ▶ (this will shift the starting point of the A-Gate) until the A-Gate lies over the echo corresponding to the thicker standard’s thickness. Apply couplant and couple the probe to the thicker calibration standard, find the highest echo and holding the probe..

Step 8: Press ▲ or ▼ key to highlight the selection titled RECORD. The value in the function box will change from “S-REF2?” to “OFF” by pressing ↵ key. The instrument will automatically calculate the material’s velocity and the probe delay.

☞ Note:

In the calibration process, pressing 2 ABC key or pressing ◀ or ▶ key will cancel the instrument calibration.

Checking Calibration Results

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

Step 1: Access the READING1 Menu (located in the AUTOCAL Menu) or RANGE submenu (located in the BASIC Menu).

Step 2: You’ll find these selections:

- VELOCITY — Display’s the calculated velocity after calibration.
- PROBE DELAY — Adjustment made as a result of the AUTOCAL (zeroing) procedure. This represents the time delay caused by sound-wave travel through a probe’s membrane, wear plate, or delay line.

3.4.3 Using AUTOCAL to Calibrate the PROBE ANGLE and X VALUE

☞ Note:
Peak memory function in BASIC-CONFIGURE menu can help user to capture quickly and memory the highest peak of echo. Prior to calibration, turns on this function to be able to simply the calibration process.

To calibrate the instrument (for angle beam probe)

Step 1: From the Home Menu, activate the AUTOCAL Menu by pressing Fx (**x=1,2,3,4,5**) below it. The CAL2 submenu will be highlighted and four functions will appear down the right side of the

display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled REF SIZE and press ◀ or ▶ key until the value of REF SIZE matches the diameter of the reference.

Step 3: Press ▲ or ▼ key to highlight the selection titled D-REF and press ◀ or ▶ key until the value of D-REF matches the *d value* of the reference.

Step 4: Press ▲ or ▼ key to highlight the selection titled RECORD. The value in the function box will change from "OFF" to "RECORD?" by pressing ↵ key.

Step 5: Press ▲ or ▼ key to highlight the selection titled A GATE START (located in the CAL1 submenu). Press ◀ or ▶ key (this will shift the starting point of the A-Gate) until the A-Gate lies over the echo of the reference. Apply couplant and couple the probe to the standard calibration block, find the highest echo and holding the probe. Press ▲ or ▼ key to highlight the selection titled RECORD. The value in the function box will change from "RECORD?" to "CALIBRATE?" by pressing ↵ key.

Step 6: keep to hold the probe, use ruler to measure the horizontal distance p between the front edge of the probe wedge and the reflector.

Step 7: Press ▲ or ▼ key to highlight the selection titled P-REF and press ◀ or ▶ key until the value of P-REF matches the *p value* of the reference.

Step 8: Press ▲ or ▼ key to highlight the selection titled RECORD. By pressing ↵ key, the value in the function box will change from "CALIBRATE?" to "OFF" and the instrument will automatically calculate the probe angle and the x value.

☞ Note:

In the calibration process, pressing 2 ABC key or pressing ◀ or ▶ key will cancel the instrument calibration.

Checking Calibration Results

Following the calibration procedure, the calculated probe angle and the x value are displayed. To view these calculated values:

Step 1: Access the READING2 Menu (located in the AUTOCAL Menu) or TRIG submenu (located in the BASIC Menu).

Step 2: You'll find these selections:

- PROBE ANGLE
- X VALUE

4 Configuring Your Instrument for Measurement

This chapter explains how to configure your instrument's flaw detection and thickness measurement capabilities. In this chapter, you'll learn how to

• Adjust the A and B-Gates, alarms, and TTL outputs (section 4.1.1)

• Choose a GATE-DETECTION MODE (peak or flank) (section 4.1.2)

• Specify the action taken by the MAGNIFY MODE (section 4.1.3)

• Setting and clearing TTL Outputs and Alarms (sections 4.1.4 and 4.1.5)

• Select the maximum and minimum material-thickness limits (section 4.2)

• Specify the action taken by the FREEZE MODE (section 4.3)

• Configure the instrument for use of ANGLE BEAM probes (section 4.4)

• Identify which measured data to display in the four RESULTS boxes (section 4.5)

• Saving the instrument's settings as a data set (section 4.6)

• Lock the instrument to prevent further adjustment of settings (section 4.7)

• Using the Text-Entry feature (section 4.8)

4.1 Configuring the A and B Gates

Setting the position and characteristics of the A and B Gates is the first step to configuring the instrument for flaw detecting or material-thickness measurement. The GATES menu controls not only the location of the A and B Gates, but also the alarms and other features activated when an A-Scan signal crosses a specific gate. From the Home Menu, activate the Gates Menu by pressing 

(**x=1,2,3,4,5**) below it.

4.1.1 Positioning Gates

Use the following procedures to set the vertical and horizontal position of the A and B-Gates. The effect of each gate-positioning function is shown in Figure 1-4. Remember that gate position has the following effects on instrument performance:

- A-Scan echos 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 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 will simply span the equivalent of more test-material depth
- Increasing the vertical height (called threshold) of a gate means that only reflected signals of sufficiently large amplitude will cross the gate

Setting a Gate's Starting Point (GATE-POSITION-GATE START)

Step 1: Activate the POSITION submenu (located in the GATE Menu) by pressing 

(**x=1,2,3,4,5**) below it.

Step 2: Select the gate to be positioned using the GATE SELECT function.

Step 3: Select the GATE START function and adjust the starting point by pressing  or  key. Increasing and decreasing the value of the starting point moves the gate to the right and left, respectively.

Step 4: The gate starting point will remain as set, even when width adjustments are made.

Note:

The position of Gate B can be linked to Gate A's starting point (using the START MODE function located in the GATEMODE submenu). In this case, Gate B's GATE START position is measured from Gate A's starting point. This facilitates multi-echo measurement. See section 3.5 to display the gate-to-gate thickness measurement, SBA.

Adjusting a Gate's Width (GATE-POSITION-GATE WIDTH)

Step 1: Activate the POSITION submenu (located in the GATE Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the gate to be positioned using the GATE SELECT function.

Step 3: Select the GATE WIDTH function and adjust by pressing ◀ or ▶ key.

Setting a Gate's Threshold (Vertical Position) (GATE-POSITION-GATE THRESHOLD)

Step 1: Activate the POSITION submenu (located in the GATE Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the gate to be positioned using the GATE SELECT function.

Step 3: Select the GATE THRESHOLD function and adjust the vertical height by pressing ◀ or ▶ key. Increasing and decreasing the value of the threshold moves the gate up and down, respectively.

☞ **Note:**
Use the GATE short-cut key on the panel to position gates quickly. How to operate the GATE short-cut key refers to section 5.5.

4.1.2 Selecting the Gate Detection Method

A-Scan signals crossing the A or B Gate are evaluated for the purposes of flaw detection and material-thickness evaluation. When the signal crosses the A or B Gate, either the gate-crossing point (flank) of the signal, or the maximum point (peak) of the signal (in the specific gate) is used for evaluation purposes. The DETECTION function allows the user to specify which A-Scan feature (FLANK or PEAK) is used to evaluate the signal in each gate. Refer to figure 4-1.

Setting the A-Scan Signal-Detection Method

Step 1: Activate the GATE MODE submenu (located in the GATES Menu).

Step 2: Select the gate to be positioned (A and B Gates in the base model UD800) using the GATE SELECT function.

Step 3: Select the DETECTION function and choose between FLANK and PEAK methods.

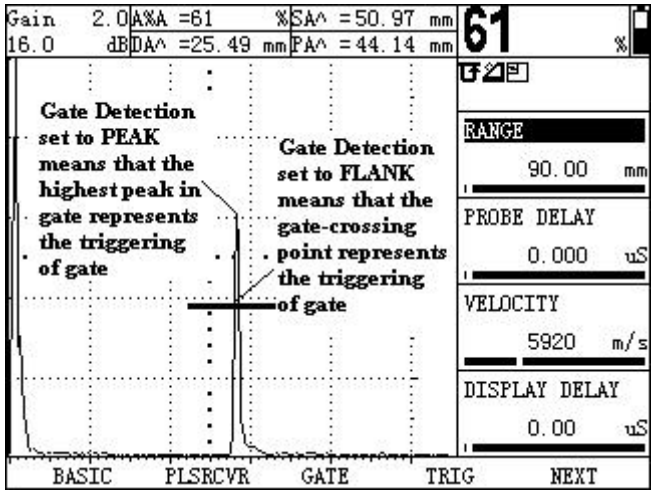


Figure 4-1 Setting gate detection method

☞ **Note:**
That the detection method chosen will be reflected 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 4 function

boxes (see Figure 4-2)

4.1.3 Selecting the Gate to be Magnified

Whenever an A-Scan is active and pressing the 

key enlarges the displayed portion of the A-Scan contained in the specified gate. Any of the available gates may be specified. The width of the magnified gate determines the level of magnification since the display is magnified until the gate width equals the full-screen width. The display will contain the magnified view until the 

key is pressed again.

To specify the magnified gate:

Step 1: Activate the GATEMODE submenu (located in the GATES Menu).

Step 2: Select the MAGNIFY GATE function and specify the desired gate.

4.1.4 Setting Gate Alarms and TTL Outputs

An alarm can be set for each of the instrument gates. When a gate alarm is activated, one or more of the following will occur:

- An alarm indication light on the front of the instrument will illuminate
- An audible alarm (HORN) will sound
- A TTL alarm signal will be output

Defining Gate-Alarm Logic (GATE-ALARMS-LOGIC)

Each gate's alarm can be triggered under one of two circumstances. Gate alarms can be set to trigger when an A-Scan echo crosses the gate or when no echo crosses the gate. Use the following procedure to specify GATE LOGIC settings:

Step 1: Activate the ALARMS submenu (in the GATES Menu).

Step 2: Select the gate whose logic you wish to specify.

Step 3: Select the LOGIC function and choose the gate alarm triggering logic:

- POSITIVE — An A-Scan signal crosses the gate
- NEGATIVE — No A-Scan signal crosses the gate
- MEASURE — An A-Scan signal crosses the gate but in this mode no warning light illuminates
- OFF — No alarm will be connected to the selected gate

Turning the Audible Alarm On or Off (GATE-ALARMS-HORN)

When any gate's alarm is triggered, an audible horn will sound. Use the following procedure to turn this horn off or on:

Step 1: Activate the ALARMS submenu (in the GATES Menu).

Step 2: Select the HORN function and turn the audible alarm ON or OFF.

Assigning TTL Outputs / Alarm Indication Lights to Gates and/or Limits (GATE-TTL OUT-TTL #1,2,3)

Three warning lights appear on the front of the instrument (see Figure 1-1for light location). These lights are labeled 1, 2, 3. Each light corresponds to a TTL Output, which is in-turn assigned to a gate alarm or a user-inputted minimum or maximum material thickness limit. When a gate alarm is triggered, or a limit is violated, the corresponding TTL is activated. This produces a TTL output signal to be sent to the REAL TIME I/O port and causes the matching warning light to illuminate (except when the GATE LOGIC is set to MEASURE). Use the following procedure to assign each TTL to a gate alarm or limit:

Step 1: Activate the TTL OUT submenu (in the GATES Menu).

Step 2: Select the TTL (#1, 2, or 3) you wish to assign.

Step 3: Assign each TTL value to one of the following selections:

- A-GATE selected TTL and alarm light indicate when A-Gate's alarm triggers
- B-GATE selected TTL and alarm light indicate when B-Gate's alarm triggers
- LOW LIMIT selected TTL and alarm light indicate when material thickness (DA) is less than the low limit setting
- HIGH LIMIT selected TTL and matched alarm light indicate when material thickness (DA) is greater than the high limit setting
- OFF selected TTL and alarm indication light will not function

4.1.5 Clearing TTL Outputs and/or Warning Lights (GATES-TTL OUT-MODE)

When a TTL output and the corresponding alarm indication light are activated, the warning may remain set only as long as the alarm condition exists, or the alarm may continue to be active for some longer period of time. Use the following procedure to adjust the TTL Output Mode:

Step 1: Activate the TTL OUT submenu (in the GATES Menu).

Step 2: Assign the MODE function to one of the following selections:

- INSTANTANEOUS One warning signal is tripped for each instrument cycle. Alarm sounds for as long as the alarm condition exists
- TIMED Warning triggered when on the first instrument cycle in which a violation exists. Warning continues to signal for 0.25, 0.5, 1, or 2 seconds after the first cycle in which the alarm condition no long exists
- LATCHED Warning signals until reset by either selecting ALRM RST (in the ALARMS Menu).

4.2 Setting the Minimum and Maximum Material-Thickness Limits

The user can specify minimum and maximum expected material-thickness limits. Depending on the alarm configuration (see 4.1.4 for setting alarms), an alarm can be triggered anytime a detected thickness violates these limits.

Setting the Minimum and Maximum Thickness Limits (GATE-LIMITS-HIGH OR LOW LIMIT)

The user can specify minimum and maximum material-thickness limits. Anytime a measured material thickness (displayed in the large reading box) violates these limits, an alarm and TTL output can be triggered (See 3.1.4 for setting alarms). To set the expected minimum and maximum material thickness:

Step 1: Activate the GATES menu.

Step 2: Activate the LIMITS submenu.

Step 3: Select the HIGH LIMIT function and input the value of the maximum material thickness.

Step 4: Select the LOW LIMIT function and input the value of the minimum material thickness.

4.3 Setting the Freeze-Mode Action

Whenever an A-Scan is active, pressing 

freezes the A-Scan display. The active A-Scan will

remain as it appeared when 7 PRS was pressed and the display will remain frozen until 7 PRS is pressed again. There are several frozen-display configurations that allow subsequent A-Scans to be displayed and evaluated against the frozen A-Scan. The configuration of the frozen display is determined by the FREEZE MODE setting. There are four freeze configurations.

Selecting the Freeze-Mode Action (BASIC-CONFIG-FREEZE MODE)

Pressing 7 PRS freezes the currently displayed A-Scan. To select the desired configuration of the frozen A-Scan display:

Step 1: Activate the BASIC menu.

Step 2: Activate the CONFIG submenu.

Step 3: Select the FREEZE MODE function and choose from the following selections:

- ALL — Freezes the currently active A-Scan. No additional A-Scans are displayed until the display is unfrozen. (See following NOTE regarding Behind the Freeze Mode)
- PEAK STD — The frozen A-Scan is displayed and adjusted to match subsequent echoes whenever higher-amplitude echoes are measured. This has the effect of "building" onto the frozen A-Scan whenever a higher-amplitude echo is encountered.
- COMPARE — Freezes the currently active A-Scan on the display screen, then displays subsequent live AScans. Frozen A-Scan is cleared by selecting an alternative FREEZE MODE
- ENVELOPE (PEAK, .5S, 1S, 2S)

  The frozen AScan is displayed and adjusted (just as in PEAK STD) except that the frozen A-Scan persists for the specified time. Depending on the ENVELOPE mode (.5S, 1S, 2S) selected, the points in the Frozen A-Scan are automatically replaced by live readings at .5, 1, or 2 second intervals. When Envelope PEAK is selected, each point remains until another of greater amplitude occurs. (Simultaneously, subsequent live echoes are also displayed in the selected A-Scan color.)

Note:

Behind the Freeze Mode is a special feature which allows for limited dynamic time-base adjustment of frozen echoes. This mode is only available when FREEZE MODE is set to ALL. In this mode, the A-Scan display delay and range, as well as the gate start, width, and threshold can all be adjusted after an A-Scan is frozen. Adjusting these settings will cause the related measurements to change.

Pressing 7 PRS key releases the freeze status, the adjustment of setting parameters also releases automatically the freeze status.

4.4 Using Angle Beam Probes and the TRIG Menu

When connecting an angle beam probe to the instrument, adjustments must be made for probe characteristics as well as test-piece geometry. These features are shown in Figure 4-3 and include

- Probe Angle
- Probe's X value (distance from the probe's Beam Index Point (BIP) to the front edge of its wedge.) Certain test-piece features must also be input when conducting angle beam probe measurements, including
- Material Thickness

- Outside Diameter for Curved Test Pieces (set to infinity for flat test pieces)

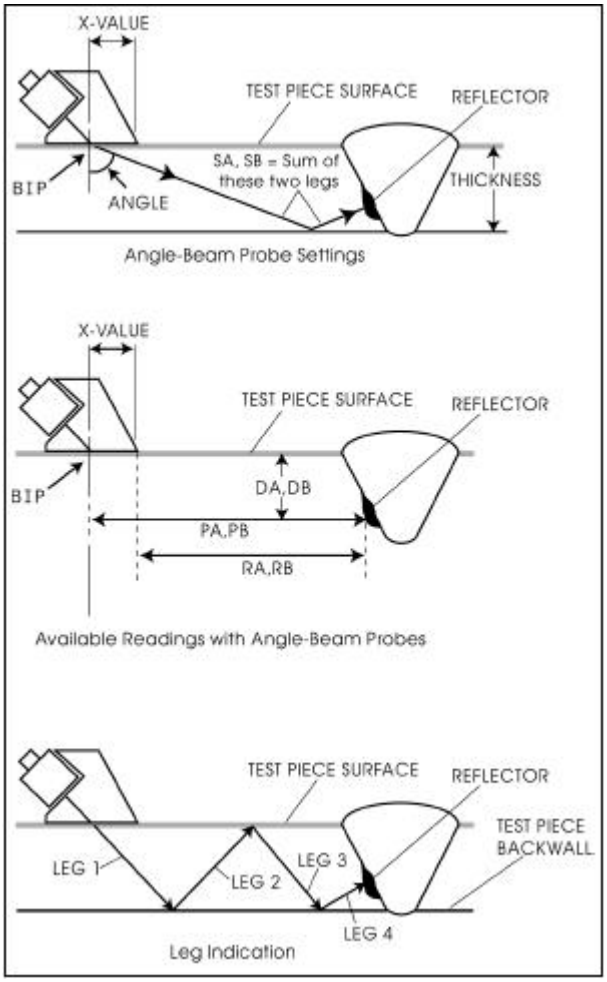


FIGURE 4-3—Angle Beam Flaw Detection

4.4.1 Setting Angle Beam Probe Characteristics

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

Step 1: Activate the Setup submenu located in the TRIG menu.

Step 2: Select the PROBE ANGLE function and input the angle for the probe you've installed. If the probe angle equal to zero degree, the straight-beam probe icon appears in the display screen's icon status bar to indicate that the straight-beam probe is connected to the instrument. If the probe angle don't equal to zero degree, the angle-beam probe icon appears in the display screen's icon status bar to indicate that the angle-beam probe is connected to the instrument.

Step 3: Select the THICKNESS function and input the thickness of the test piece.

Step 4: Select the X VALUE function and input the user determined X value for the probe. When desired, this compensates for the distance from the BIP to the front of the probe's wedge.

Step 5: Select the O-DIAMETER function and input the outside diameter of a curved test piece (when using angle beam probes only). Note that this value should be set to FLAT when evaluating flat (non-curved) test pieces. Also, note that when O-DIAMETER is set to any value other then FLAT, the icon will appear in the icon bar near the top right-hand corner of the instrument display. If the defined geometry is outside of the instrument's curved test piece capability, the icon will be displayed.

Note:

Probe angle and X-value are able to be calculated with the automatic calibration procedure. （Refer to section 3.4.4）。

4.5 Displaying Measured Readings

The instrument is capable of displaying up to four measured readings at one time. Parameters available for display include the following (availability depends on instrument configuration and operating mode):

- A%A Amplitude (as a % of full-screen height) of the highest echo to cross A-Gate
- A%B Amplitude (as a % of full-screen height) of the highest echo to cross B-Gate
- dBtA dB difference between the height of A-Gate and the height of the highest echo in A-Gate.
- dBtB dB difference between the height of B-Gate and the height of the highest echo in B-Gate.
- dBrA dB difference between the reference echo and the height of the highest echo in A-Gate. (available when dB REF is ON)
- dBrB dB difference between the reference echo and the height of the highest echo in B-Gate. (available when dB REF is ON)
- A%cA The percentage of the echo amplitude in the A-gate to DGS curve height. (available when DGS is ON)
- A%cB The percentage of the echo amplitude in the B-gate to DGS curve height. (available when DGS is ON)
- dBcA dB difference between the echo amplitude in the A-gate and DGS curve height . (available when DGS is ON)
- dBcB dB difference between the echo amplitude in the B-gate and DGS curve height .（available when DGS is ON）
- ERSA ERS (equivalent reflector size) evaluated with the echo amplitude in the A-gate. (DGS is On)
- ERSB ERS (equivalent reflector size) evaluated with the echo amplitude in the B-gate. (DGS is ON)
- SA Sound-Path distance or duration represented by the highest echo to cross A-Gate
- SB Sound-Path distance or duration represented by the highest echo to cross B-Gate
- SBA Sound-Path distance or duration from the highest echo in A-Gate to the echo in B-Gate Reading is only available if B-Gate's START Mode is set to A-Gate. (see 3.1.1 to set START Mode)
- DA Material-thickness depth from the testpiece surface (the probe-contacted side) to the reflector represented by the echo in A-Gate. (see Figure 3-5)
- DB Material-thickness depth from the testpiece surface (the probe-contacted side) to the reflector represented by the echo in B-Gate. (see Figure 3-5)
- DBA Material-thickness depth from the highest echo in A-Gate to the echo in B-Gate
- PA Projection distance from the probe's BIP to the reflector represented by the echo in A-Gate. (see Figure 3-5)
- PB Projection distance from the probe's BIP to the reflector represented by the echo in B-Gate. (see Figure 3-5)
- PBA Projection distance from the highest echo in A-Gate to the echo in B-Gate
- RA Projection distance from the probe's BIP to the reflector represented by the echo in A-Gate, minus the inputted X-VALUE. (see Figure 3-5)
- RB Projection distance from the probe's BIP to the reflector represented by the echo in B-Gate,

minus the inputted X-VALUE. (see Figure 3-5)

- LA Leg Indicator identifies on which leg the reflector represented by the echo in A-Gate was detected (Legs 1 through 5). (see Figure 3-5)
- LB Leg Indicator identifies on which leg the reflector represented by the echo in B-Gate was detected (Legs 1 through 5). (see Figure 3-5)
- LBA Leg Indicator identifies on which leg the reflector represented by the echo in A-Gate to echo in B-Gate was detected (Legs 1 through 5). (see Figure 3-5)
- DACr dB difference between the echo amplitude in the A-gate and DAC curve height. (available when DAC is ON).
- OFF No reading will be displayed in the reading box.

The four measured readings can be displayed in any of the four small reading boxes at the top of the display screen. In addition, the result displayed in one of the four small boxes can be shown in the large reading box.

Note:

When S, D, P, or R readings are displayed, the Gate-Detection Mode (4.1.2) setting for the referenced gate (A or B) is indicated by a ^ (Peak Mode) or a / (Flank Mode).

Assigning Measured Readings to the Displayed Reading Boxes (BASIC-RESULTS-READING #)

The display includes a total of five boxes where measured values can be displayed. Four “small” reading boxes can each contain one of four measured values. A “large” reading box can display, in a larger format, any one of the values shown in the small boxes. To define the reading-box contents:

Step 1: Activate the BASIC menu.

Step 2: Select the RESULTS submenu.

Step 3: Select the READING box location you wish to specify and choose from several of the selections listed above (available readings depend on designated operating mode).

To define the large display box contents:

Press 

key on the panel to specify and choose from one of four “small” reading boxes until the large reading box contains the desired value. The icon appears in the display screen’s icon status bar to indicate which “small” reading boxe is selected to connect with “large” reading box.

4.6 Saving the Instrument Configuration in a Data Set

Instrument settings can be stored as Data Sets. When a stored data set is later recalled, all active functional settings are replaced with those settings contained in the data set. Once a data set is recalled, the newly active functional settings may be modified. Anytime that data set is recalled, the functional settings will be returned to their initially stored values.

See section 6.2.1 to create a data set file.

4.7 Using the Master Lock Function to Prevent Setting Adjustment

To prevent modification of settings (except for the Gain setting), the instrument may be locked using the MASTER LOCK function. To lock the instrument:

Pressing MENU LOCK function will cause the to appear in the upper right corner of the display screen and will prevent further adjustment of most instrument settings. Pressing MENU LOCK function again will unlock the instrument.

4.8 Using the Text-Entry feature

Some menu parameters need text input. There are character keys (multiplexing function keys) on the instrument panel. In the text edit status, the menu bar will be replaced by the edit menu, press Fx (**x=1,2,3,4,5**) key to select edit operation.

Edit menu includes edit operations: PREVIOUS, NEXT, BACKSPACE, INSERT and DELETE keys are the corresponding Fx (**x=1,2,3,4,5**) keys on the instrument panel.

- PREVIOUS: Moves cursor to the previous line when more than one lines are available.
- NEXT: Moves cursor to the next line when more than one lines are available.
- BACKSPACE: moves cursor backwards and deletes previous character, automatically moves characters behinds to the left.
- INSERT: inserts one space on the cursor's location, automatically moves cursor and characters behinds to the right.
- DELETE: deletes the character on the cursor's location.

In the text edit status, ◀ or ▶ key doesn't adjust parameters, only operates the character selected by cursor. Character is selected circularly in ASCII code table sequence.

In the text edit status, some keys also have the edit function on the instrument panel.

- ◀ key: Moves cursor to the left.
- ▶ key: Moves cursor to the right.

Pressing character input keys (multiplexing function) Inputs one character on the cursor's location.

- * dB+ key:

This key has increase dB and Alphabet/Numbers selection multiplexing function.

By default, character input keys input corresponding numbers. By pressing * dB+ key first time, character input keys input corresponding capital characters. By pressing * dB+ key second time, character input keys input corresponding lowercase characters. By pressing * dB+ key again, character input keys return to the default status of input corresponding numbers.

- Character input keys:

2 ABC, 3 DFE, 4 GHI, 5 JKL, 6 MNO, 7 PRS, 8 TUV and 9 WXY keys are multiplexing function keys. Input corresponding numbers, capital characters and lowercase characters.

- # dB- key:

This key has decrease dB and input other ASCII code characters multiplexing function. Input the other ASCII code characters (Does not include numbers and characters.) in ASCII code table sequence.

5 Using the shortcut key

This chapter explains how to use the shortcut key, how to freeze a displayed A-Scan, and how to use the full range of gain-adjustments. In this chapter, you'll learn how to

- Adjust the A-Scan gain using the Gain key and the dB STEP key (section 5.1)
- Use the dB REFERENCE feature (section 5.2)
- MAGNIFY the contents of a selected gate (section 5.3)
- FREEZE and unfreeze the A-Scan and work in the Behind the Freeze Mode (section 5.4)
- Position A or B gate using the Gain key (section 5.5)
- Automatically adjust the A-Scan gain using Auto Gain key (section 5.6)
- Other shortcut key. (section 5.7)

5.1 Setting the Gain

Instrument gain, which increases and decreases the height of a displayed A-Scan, is adjusted with the dB+ and dB- keys. The instrument's gain can be adjusted while in any menu location except when the dB STEP feature is set to LOCK. Note that pressing MENU LOCK key, which causes to appear in the icon bar, does not prevent gain adjustment.
User can adjust the Instrument gain in the menu. To adjust Instrument gain in the menu does the following:

Step 1: Activate the PLSRCVR Menu (located in the HOME Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the GAIN submenu by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 3: Press ▲ or ▼ key to select the function titled USER GAIN. Press ◀ or ▶ key to increase and decrease the Instrument gain.

5.1.1 Changing the Gain-Adjustment Increment (dB STEP)

When adjusting the A-Scan gain, each click of the gain-adjustment key increases or decreases the gain level by a dB increment equal to the dB STEP. Several values can be specified for dB STEP, including a user-specified gain step, known as the USER GAIN STEP, and a gain key adjustment LOCK, which prevents any gain adjustment and any changes using the keys.

Continue pressing key to set eight dB step values circularly. You also can set the dB STEP in the menu. To select one of the existing dB STEP values in the menu:

Step 1: Activate the PLSRCVR Menu (located in the HOME Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the GAIN submenu by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 3: Press ▲ or ▼ key to highlight the selection titled GAIN STEP. Press ◀ or ▶ key to set the GAIN STEP value. Available increments include: 0.2 dB, 0.5 dB, 1.0 dB, 2.0 dB, 6 dB,

12.0 dB, a user-defined Gain Step, and LOCK. To specify a user-defined dB STEP value, see the next manual procedure. Note that setting the dB STEP to LOCK prevents adjustment of the instrument gain and prevents any changes using the ◀ or ▶ key. Also note that the dB STEP setting can be changed by pressing ▀ key.

Step 4: Once a dB STEP value has been selected, each click of the dB+ or dB- will increase or decrease the instrument's gain by the dB STEP increment.

☞ **Note:**

Setting dB STEP to LOCK prevents any adjustment using either dB+ and dB- keys or ◀ and ▶ keys.

5.1.2 Setting the User-Defined Gain Step (PLSRCVR-GAIN-USER GAIN)

When adjusting the A-Scan gain, each click of the gain-adjustment key increases or decreases the gain level by the amount of the dB STEP (see above for adjusting the dB STEP). Several values can be specified for dB STEP, including a user-specified gain step, known as USER GAIN STEP. To input a user-specified gain step:

Step 1: Activate the PLSRCVR Menu (located in the HOME Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Select the GAIN submenu by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 3: Press ▲ or ▼ key to highlight the selection titled USER GAIN STEP. To set the USER GAIN STEP size, continue pressing ◀ or ▶ key.

User-specified gain step can be adjusted from 0.0dB to 24.0dB. User-specified gain step can be the same to fixed gain step, and can also be lock (0.0 dB).

5.2 Using the dB Reference Feature

When dB REF is activated, the instrument gain changes to X.XX±X.XX dB format. The fist part of instrument gain is the Reference Gain and the latter part of instrument gain is the Incremental Gain. The amplitude of the highest echo in A-Gate becomes the reference echo against which subsequent echo amplitudes are evaluated. At the time of dB REF activation, the gain setting also becomes a reference against which subsequent gain values are compared. It's important to remember that the highest echo in A-Gate and GAIN setting, when dB REF is selected, will become the reference amplitude and gain value for as long as dB REF is activated. Note that dB REF can also be turned on from the GAIN Submenu found in the PLSRCVR Menu.

☞ **Note:**

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

Once dB REF is activated, the Gain-Display Block lists both the Reference Gain and Incremental Gain levels. Also, the icon will appear. The Reference Gain remains constant throughout the dB REF

session while the Incremental Gain value changes as the dB+ or dB- Key is pressed.

After dB REF is activated, any amplitude measurements are stated in relation to the reference echo amplitude. Available amplitude readings (see section 4.5 to change display-box reading values) when operating in dB REF mode are

- dBrA – dB difference between the reference echo and the highest echo to cross A-Gate.
- dBrB – dB difference between the reference echo and the highest echo to cross B-Gate.

5.3 Magnifying the Contents of a Gate

Whenever an A-Scan is active, pressing 6 MNO feature enlarges the displayed portion of the A-Scan contained in a specified gate. Any available gate may be specified. The width of the magnified gate determines the level of magnification. This is because the display is magnified until the gate width equals 100% full-screen width. The display will contain the magnified view until 6 MNO is again pressed.

Selecting the Gate to Be Magnified (GATES-GATEMODE-MAGNIFY GATE)

To specify the magnified gate:

Step 1: Activate the GATEMODE submenu.

Step 2: Select the MAGNIFY GATE function and specify the desired gate.

5.4 Freezing the A-Scan Display

Whenever an A-Scan is active, pressing the freeze key (7 PRS) freezes the A-Scan display. The active A-Scan will remain as it appeared when 7 PRS key was pressed and the display will remain frozen until 7 PRS key is pressed again. There are several frozen-display configurations, however, that allow subsequent A-Scans to be displayed and evaluated against the frozen A-Scan (compare) or that adjust the frozen A-Scan whenever an active echo is higher in amplitude (PEAK STD and ENVELOPE PEAK, .5S, 1S, 2S). The configuration of the frozen display is determined by the FREEZE MODE setting (see section 4.3 to adjust this setting).

5.5 Positioning Gate by Using the Shortcut Key

Use the following procedures to set the vertical and horizontal position of the A and B-Gates by pressing 4 GHI shortcut key.

By pressing 4 GHI key first time, select the GATE START function and adjust the starting point by pressing ◀ or ▶ key. Increasing and decreasing the value of the starting point moves the gate to the right and left, respectively.

By pressing 4 GHI key second time, select the GATE WIDTH function and adjust by pressing ◀ or ▶ key.

By pressing 4 GHI key third time, select the GATE THRESHOLD function and adjust the vertical height

by pressing ◀ or ▶ key. Increasing and decreasing the value of the threshold moves the gate up and down, respectively.

By pressing 4 GHI key again, close Gate quick adjustment function.

Note:
Icon will appears in the display screen's icon bar for various Gate function selection.

Attention:

After you start the 4 GHI key, DO NOT adjust the current selected function parameter by pressing ◀ or ▶ key. Once you complete to position the gate by using the 4 GHI shortcut key, you MUST close Gate quick adjustment function by repeatly pressing the 4 GHI shortcut key.

5.6 Using the Auto Gain High Feature

AUTO GAIN HIGH function can automatically bring (increase or decrease) the measured echo to the setting screen height. To use the AUTO GAIN HIGH function in the following steps:

Step 1: Activate the SETUP submenu (located in the PLSRCVR Menu) by pressing Fx (**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 2: Press ▲ or ▼ key to highlight the selection titled AUTO GAIN HIGH, press ◀ or ▶ key to set the required echo height for your measurement.

Step 3: Press ▲ or ▼ key to highlight the selection titled GATE A START, press ◀ or ▶ key to move gate A so that the selected echo is within the gate rang.

Step 4: Press the shortcut key. The instrument automatically adjust the system gain to bring the measured echo in gate A to the setting screen height.

5.7 Other shortcut keys

Instrument front panel has other shortcut keys, their functions will be introduced in other chapter. Their location follows

- 2 ABC —See section 2.4
- 3 DFE —See section 2.3
- 5 JKL —See section 6.2.2
- 8 TUV —See section 4.3
- 9 WXY —See section 4.5

6 Storing and Outputting Data

Your instrument is equipped with a data-storage system. Instrument settings, A-Scans, thickness readings and notes can be stored in data files for later retrieval. Information can be contained in report headers. Files are created, modified, recalled, and deleted by using the FILES MENU.

In this chapter, you'll learn how to work with all FILES MENU functions including:

- FILE TYPE (section 6.1)
- CREATE, SAVE, DELETE (CLEAR), RECALL, PREVIEW and Input HEADER information (section 6.2)
- Instrument parameter settings files (section 6.3)
- A-Scan files (section 6.4)
- Thickness values file (section 6.5)
- Edit NOTES to be attached to stored readings (section 6.5.4)
- Configure the instrument to output data to a personal computer via the RS-232 serial port. (section 6.6)

6.1 Selecting file type

Your instrument supports the file-storage system. The file type includes:
- Instrument parameter settings file (.SET)
- A-scan file (.WAV)
- Thickness data logger file (.THK)

Files are saved dynamically up to 500 files. File name can be created with 8 ASCII code characters. User can input several lines file information (test piece name, company name, operator and so on.) to the stored file. Thickness data logger file has three selected file type. User can attaché notes to the stored thickness measurement, memory and analyze easily the stored data later.

6.2 Operating file

You will learn how to create, save, delete file and edit the file information.

6.2.1 Creating Files

Step 1: Activate the FILES MENU (located in the HOME MENU), select FILENAME submenu.

Step 2: Press ▲ or ▼ key to highlight the selection titled FILE TYPE.

Step 3: Press ◀ or ▶ key, or press ↵ key to select one file type from three file types.

Step 4: Press ▲ or ▼ key to highlight the selection titled CREATE NEW. Press ↵ key, creating file dialog box is opened, edit menu appears at the menu bar, and four functions on the right side of the display screen change from

- FILE TYPE
- FILE NAME
- ACTION

• CREAT NEW

to

• LINEAR

• GRID

• CUSTOM LINEAR

• STORE

If the created file type is instrument settings or A-scan type, the function titled STORE is automatically selected at the same time. If the created file type is thickness data logger type, the default function titled LINEAR is automatically selected at the same time.

Step 5: Note that the creating file dialog box of the display screen contains a default file name (the word "FILE" followed by a numeral). This name can be adjusted using the instrument Text-Entry feature. If the thickness data logger file is created, the data logger store format information also need be input in the creating file dialog box. Press ▲ or ▼ key to select a file store format (the default LINEAR, GRID or CUSTOM LINEAR).

Note:

Do not select a file store format (LINEAR, GRID, CUSTOM LINEAR) for instrument settings or A-scan type files because these only apply to thickness data logger files which contain stored thickness measurements.

Step 6: Once the desired file name is entered on the screen, press ↵ key to creat the new file. The new file has been saved in the data-storage system. The screen returns to FILE NAME submenu after a new file is created successfully, and the new file name is displayed at the FILE NAME function on the right side of the display screen.

Note:

The thickness data logger file only select a store format (LINEAR, GRID or CUSTOM LINEAR) and then directly press ↵ key to creat the new file. DO NOT select STORE.

The file name of the same file type is exclusive, if a existing file name is created, file creation will be fail.

6.2.2 Saving in Active Files

Step 1: Activate the FILES MENU (located in the HOME MENU), select FILENAME submenu.

Step 2: Select file type and file name.

Step 3: Press ▲ or ▼ key to highlight the selection titled ACTION, Press ◀ or ▶ key until the SAVE is appears. ACTION function includes PREVIEW, DELETE, SAVE, RECALL and CLEAR.

Step 4: Press ↵ key to save the content into the file. If the instrument's menu is not on the file menu, presses the 5 JKL shortcut key to also finish saving file operation. When presses the 5 JKL shortcut key to save A-scan type file, system automatically creates a new file named current date to save A-scan file, the A-scan file is not saved in the current selected file.

Note:

The saved file will be added "*" indication before the file name. The saved file will be not saved again. The thickness file can be saved many times, saved one or four thickness measurements every time (refer to 6.2.2) up to the defined upper limit measurement amounts.

6.2.3 Deleting (CLEARING) Existing Data Files

Existing files are deleted using this procedure:

Step 1: Activate the FILENAME submenu (in the FILES menu).

Step 2: Press ▲ or ▼ key to select the FILE TYPE function. Press ◀ or ▶ key until the desired function type appears.

Step 3: Press ▲ or ▼ key to select the FILENAME function. Press ◀ or ▶ key until the desired function name appears.

Step 4: Press ▲ or ▼ key to select the ACTION function, then press ◀ or ▶ key until DELETE appears. Now press ↵ key, "HOME key = DELETE" appears in the instrument menu bar. Follow the display-screen prompting and press 2 ABC key to confirm the file-delete command.

Note:

You must press 2 ABC key to delete the file before the display-screen prompting disappears, otherwise you can not delete the selected file.
The deleted file may not be retrieved.

6.2.4 Creating a Report Header

Report Headers are attached to data logger and 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:

Step 1: Activate the FileHead submenu (in the FILES menu). Open the file header information dialog box.

Step 2: Press ▲ or ▼ key to select the HEAD NUMBER function. Press ◀ or ▶ key, or repeatly press ↵ key to select the edited line number. In the edit status, the file header line number also is selected by using the "PREVIOUS" or "NEXT" operation in the edit menu.

Step 3: Press ▲ or ▼ key to select EDIT function. Press ◀ or ▶ key, or press ↵ key to set the EDIT function to ON. Edit menu appears at the menu bar. This allows you to create or edit a Header.

Step 4: Note that the display screen contains a nine-entry report header. Use Character input keys and edit menu to complete the file header information input.

Step 5: Press ▲ or ▼ key to select ENTER function, then press ↵ key to save the edited file header information.

Step 6: Press ▲ or ▼ key to select EDIT function, then press ↵ key to set the EDIT function to OFF.

Note:
When exits the FILES menu, the file header information content will be lost if the file header information is not saved.

6.2.5 Previewing Existing Data Files

Existing data files can be PREVIEWED rather than RECALLED. Previewing only allows the user to view the report header and A-Scan stored with the file settings. To preview an existing file:

Step 1: Activate the FILES MENU (located in the HOME MENU), select FILENAME submenu.

Step 2: Select file type and file name

Step 4: Press ▲ or ▼ key to select ACTION function, then press ◀ or ▶ key until the PREVIEW appears.

Step 5: Press ↵ key, the file is previewed. The selected file can only be previewed. If preview the parameter settings file, parameter name and setting values will be displayed. If preview the A-scan file, report header, A-Scan stored with parameter settings will be displayed. If preview the thickness data logger file, thickness values with notes will be displayed.

Step 6: Press ↵ key again to exit previewing status.

6.2.6 Recalling Existing Data Files

Existing data files are typically accessed for the following purposes:

- DATA SET FILES — these are instrument parameter settings files. Accessing an existing file resets the current instrument setting to the stored parameter settings
- DATA WAVE FILES — these are A-scan files. Accessing an existing file resets the current instrument setting to the stored parameter settings. At the same time the stored A-scan is displayed on the screen background to compare with the active A-scan, the icon will appear in the Status Bar. Refer to section 6.4 for a explanation of how to delete the compare A-scan.
- DATA LOGGER FILES — these are thickness values files. Accessing an existing file allows stored thickness measurements to be replaced and/or new thickness values to be stored. It also resets the current instrument setting to the stored data-logger-file settings.

To access an existing file:

Step 1: Activate the FILENAME submenu (in the FILES menu).

Step 2: Press ▲ or ▼ key to select the FILE TYPE function. Press ◀ or ▶ key until the desired function type appears.

Step 3: Press ▲ or ▼ key to select the FILENAME function. Press ◀ or ▶ key until the desired function name appears.

Step 4: Press ▲ or ▼ key to select the ACTION function, then press ◀ or ▶ key until RECALL appears. Then press ↵ key, “HOME key = DELETE” appears in the instrument menu bar. Follow the display-screen prompting and press 2 ABC key to confirm the file-delete

command.

Step 5: The selected file is now active. The instrument settings will be configured to those stored in the file. Thickness measurements may be stored in data logger files as discussed in section 6.5.2.

6.3 Instrument Parameter Settings (Data Set) Files

Data set files are instrument parameter settings files, they are used to store a specific instrument setup configuration. When the data set file is recalled, all instrument settings are modified to match the settings stored in the data set file.

Data set files can be created, saved, reviewed, recalled, and deleted. Data set files also can be transmitted via RS-232 to PC, then analyzed and printed with the PC software.

6.4 A-Scan (Data Wave) Files

Data set files are A-scan files. they are used to store the A-scan (the flaw echo and its measurements) with current instrument parameter settings. After finishing the flaw inspection, User can review and analyze the flaw echo and its measurements, prints the inspection report with the PC software. Refer to section 6.2 how to create, save, review, recall, delete A-scan files, and edit the file header information. To recall the A-scan file can modify the instrument settings, also can output a compare echo in the screen background with the A-scan saved in the file. After output the compare echo, the instrument settings can not be modifed until the compare echo is deleted.

To delete the compare curve

Step 1: Activate the FILENAME submenu (in the FILES menu).

Step 2: Press ▲ or ▼ key to select the FILE TYPE function. Press ◀ or ▶ key until the desired function type appears.

Step 3: Press ▲ or ▼ key to select the FILENAME function. Press ◀ or ▶ key until the desired function name appears.

Step 4: Press ▲ or ▼ key to select the ACTION function, then press ◀ or ▶ key until CLEAR appears. Then press ↵ key to clear the compare curve.

6.5 Thickness values (Data Logger) files

Data logger files are thickness values files. They are used to store thickness measurements, along with the current instrument parameter settings. Data logger files can be arranged into one of three file types:

- LINEAR a series of 1 to 10,000 consecutive data points
- GRID a matrix of data points up to N x N
- CUSTOM LINEAR up to 10,000 data points stored in up to N locations

After a data logger file is created, thickness data can be stored, erased, and modified in that file. Once creates the logger file, the instrument settings can not be modified. (Table 6-1)

NAME	MENU	SUBMENU
VELOCITY	BASIC	RANGE
PROBE DELAY	BASIC	RANGE

PROBE ANGLE	TRIG	SETUP
THICKNESS	TRIG	SETUP
O_DIAMETER	TRIG	CSC

Table 6-1—Parameter settings that are not modified

6.5.1 Creating Data Logger Files

To store thickness readings and instrument settings in a new data logger file follow the following procedure:

Step 1: Activate the FILES MENU (located in the HOME MENU).

Step 2: Press ▲ or ▼ key to select the FILE TYPE function, then press ◀ or ▶ key until THK appears.

Step 3: Press ▲ or ▼ key to select the CREATE NEW function, then press ↵ key to open the crearing file dialog box.

Step 4: Note that the display screen contains a default file name (the word “FILE” followed by a numeral). This name can be adjusted using the character input keys and edit menu.

Step 5: Select a desired logger store format by pressing ◀ or ▶ key:

- LINEAR contains up to 10,000 consecutive thickness measurements
- GRID stores thickness measurements in a matrix format (up to N rows and N columns)
- CUSTOM LINEAR stores data in up to 10,000 locations, each containing from up to 10,000 points

Step 6: Set characteristics as shown in Figure 6-1.

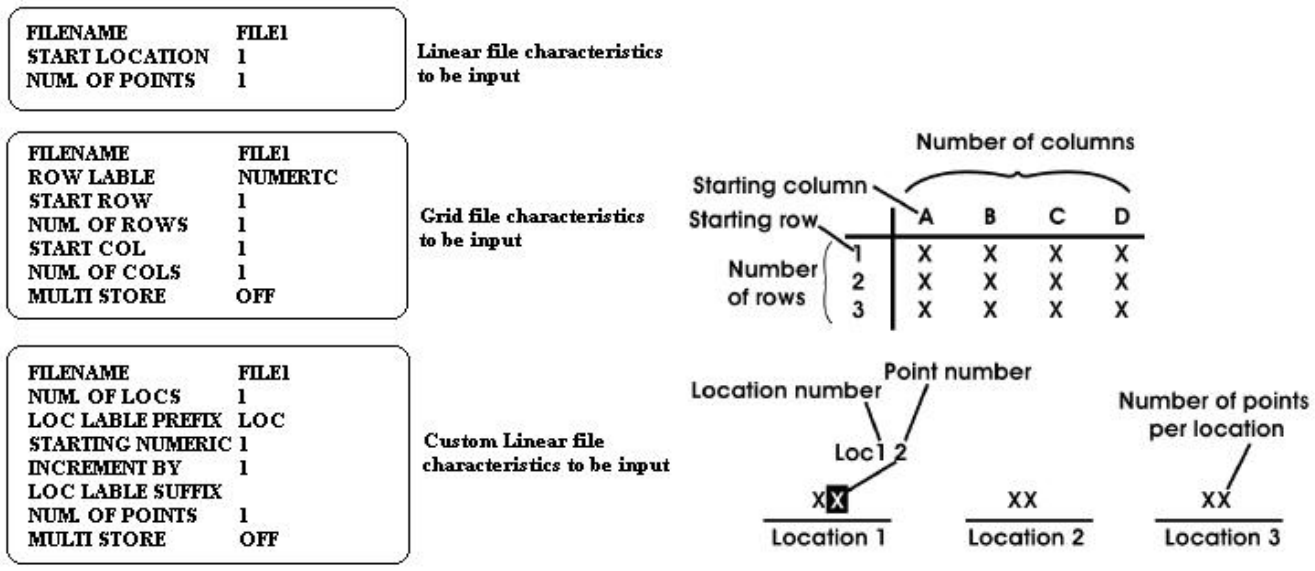


FIGURE 6-1—After selecting file type (LINEAR, GRID, or CUSTOM LINEAR) you must specify the applicable group of file characteristics.

☞ **Note:**

When a grid file is active, turning MULTI STORE ON allows 2, 3, or 4 thickness readings (from each of the RESULTS boxes) to be simultaneously stored in an equal number of grid positions by pressing 5 JKL shortcut key. For this feature to operate, a grid store format must be active, the file must have MULTI STORE turned ON.

Step 7: Once the desired file name and characteristics are entered, press ↵ key to complete the creating of the data logger file. Screen display returns to the FILE NAME submenu.

6.5.2 Storing Thickness Measurements in Data Logger Files

Thickness measurements can be stored in active (newly created or recalled) data logger files using as follows:

Step 1: Activate the FileName submenu (in the FILES menu).

Step 2: Press ▲ or ▼ key to select the FILE TYPE function, then press ◀ or ▶ key until THK appears.

Step 3: Press ▲ or ▼ key to select the FILENAME function, then press ◀ or ▶ key until the desired function name appears.

Step 4: Press ▲ or ▼ key to select the ACTION function, then press ◀ or ▶ key until SAVE appears.

Step 5: Couple the probe to the test piece.

Step 6: Press ↵ key (in the FILES menu) or press 5 JKL shortcut key (in the other menu). The thickness measurement in the Large Display Window will be stored in the next available file location of the active data logger file.

6.5.3 Restoring Instrument Parameter Settings from Thickness Values File

If the current instrument parameter settings are inconsistent with the parameter settings stored in the active thickness values file, the thickness measurements are not saved in the active thickness values file. Then the relevant parameters (Table 6-1) need to be modified:

Step 1: Activate the FILENAME submenu (in the FILES menu).

Step 2: Press ▲ or ▼ key to select the FILE TYPE function. Press ◀ or ▶ key until the desired function type appears.

Step 3: Press ▲ or ▼ key to select the FILENAME function. Press ◀ or ▶ key until the desired function name appears.

Step 4: Press ▲ or ▼ key to select the ACTION function, then press ◀ or ▶ key until RECALL appears. Then press ↵ key, “HOME key = RECALL” appears in the instrument menu bar. Follow the display-screen prompting and press 2 ABC key to confirm the file-recall command. The current instrument parameter settings will be replaced by the parameter settings stored in the active thickness values file. You can continue saving the thickness measurements into the active thickness values file.

Note:
If user do not want to modified the relevant parameters (see Table 6-1), creat a new thickness values file to save the thickness measurements.

6.5.4 Entering and Editing Notes for Attachment to Thickness Measurements

Notes can be attached to data logger thickness measurements when the file is active. The contents of five available notes must be modified prior to the time the file is stored. After a note is attached to a thickness reading, suggests that note cannot be modified. To create or edit a file's notes:

Step 1: Activate the NOTES submenu (in the FILES menu). Open notes information dialog box.

Step 2: Press ▲ or ▼ key to select the EDIT function, then press ◀ or ▶ key, or press ↵ key to set the EDIT function to ON. The edit menu appears at the menu bar. This allows you to create or edit notes.

Step 3: Press ▲ or ▼ key to select the NOTE NUMBER function. Press ◀ or ▶ key, or press ↵ key to select the edited line number. In the edit status, the note line number also is selected by using the "PREVIOUS" or "NEXT" operation in the edit menu.

Step 4: Note that the display screen contains five notes (NOTE A through E). One or more notes can be inputed or edited using character input keys and edit menu.

Step 5: Press ▲ or ▼ key to select the ENTER function, then press ↵ key to save the edited notes.

Step 6: Press ▲ or ▼ key to select the EDIT function, then press ↵ key to set the EDIT function to OFF.

Note:

When exits the NOTES submenu, the notes content will be lost if the notes is not saved. To edit and save the notes are valid in the thickness logger file, these actions are invalid in the other type files.

6.5.5 Attaching notes to thickness measurements

User can attach one or more than one notes to the thickness measurement. To attach the notes do the following:

Step 1: Activate the NTS EDIT submenu (in the FILES menu).

Step 2: Press ▲ or ▼ key to select the FILE NAME function, then press ◀ or ▶ key until the desired function name appears.

Step 3: Press ▲ or ▼ key to select the SCROLL function. Press ◀ or ▶ key to select the thickness value that need be added notes. Press ↵ key to go to the next page.

Step 4: Press ▲ or ▼ key to select the NOTE ACTION function. Note numbers appear the Menu Bar, select the note number by the corresponding function key Fx (**x=1,2,3,4,5**). Add

notes by pressing Fx (**x=1,2,3,4,5**) below it, view the notes content by pressing ↵ key to enter the notes information dialog box.

Step 5: Selected note numbers are automatically attached to the thickness measurement. To delete the note numbers from the thickness measurement is the same as to add the note numbers to the thickness measurement.

Step 6: Press ▲ or ▼ key to select the CLEAR NOTES function，then press ↵ key to delete all note numbers attached to the thickness measurement.

6.5.6 Editing the stored thickness measurements

User can edit or delete the thickness values stored in the data logger file. To edit the thickness values do the following:

Step 1: Activate the DL EDIT submenu (in the FILES menu).

Step 2: Press ▲ or ▼ key to select the FILE NAME function, then press ◀ or ▶ key until the desired function name appears.

Step 3: Press ▲ or ▼ key to select the SCROLL function. Press ◀ or ▶ key to select the thickness value that will be edited. Press ↵ key to go to the next page.

Step 4: Press ▲ or ▼ key to select the EDIT function, then press ◀ or ▶ key, or press ↵ key to set the EDIT function to ON.

Step 5: Press ◀ or ▶ key to change the thickness value.

Step 6: Press UP or DOWN key to select the ACTION function, then press ◀ or ▶ key to set the ACTION function. Set the ACTION function to SAVE, then press ↵ key to update thickness value. Set the ACTION function to REMOVE, then press ↵ key to delete thickness value.

☞ **Note:**
When exits the DL EDIT submenu, the edited content will be lost if the edited thickness measurement is not saved.

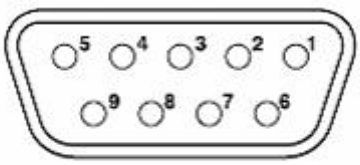
6.6 Outputting to a Computer via the RS-232 Serial Port

The instrument is equipped with the serial interface RS-232 for bi-directional data communication with a PC.
When you connect the instrument with a PC you can:

- transfer A-scans for documentation,
- transfer instrument settings in ASCII format,
- transfer reports from stored datasets,
- read and write datasets in binary format.

6.6.1 RS-232 interface

The instrument has a RS-232 interface for communication with PC.



View of the 9-way Sub-D socket

Contact assignment of the Sub-D socket

Contact	Designation	Signal direction	Level
1, 4, 6, 7, 8, 9	unassigned	–	–
2	RXD	input	RS 232
3	TXD	output	RS 232
5	ground	–	RS 232

Note:
Switch off the instrument before connecting a cable to the RS 232 socket or before withdrawing any plugs.

6.6.2 Connecting a PC

You can connect the instrument to a PC using the special cables.
Please refer to chapter 8.

6.6.3 Activation of serial communication

After connecting the instrument to the PC you must run a software that opens the serial port. This can either be a commercial terminal program (e.g. Microsoft Hyper Terminal) or a customised program like DU DataPro. Make sure that the serial communication parameters on the PC are identical to those of the instrument.

The data transmission parameters are as follows:
- Baud rate: 38400
- Word length: 8 data bits (fixed)
- Parity: none (fixed)
- Stop bits: 2 (fixed)

The baud rate can be fixed in the instrument.
The settings on the instrument apply to most of the PCs. To ensure a perfect communication, please check the settings of the connected PCs and adjust them to the parameters of the instrument.

7 DAC/TCG Option

The instrument is available with optional Time Corrected Gain (TCG) and Multi-Curve Distance Amplitude Correction (DAC) functions. These functions are accessed through the DAC Menu. Both the DAC and TCG functions operate based on a set of user-recorded data points. These points are recorded from the DAC menu as described below.
The DAC function displays all echoes at their true amplitude (without depth compensation). when operating in DAC mode, several Distance Amplitude Correction curves are superimposed on the A-Scan display. The original recorded curve and other curves are displayed in deffrent color. Each curve, like the one shown in Figure 7-1, represents constant reflector size at varying material depth.

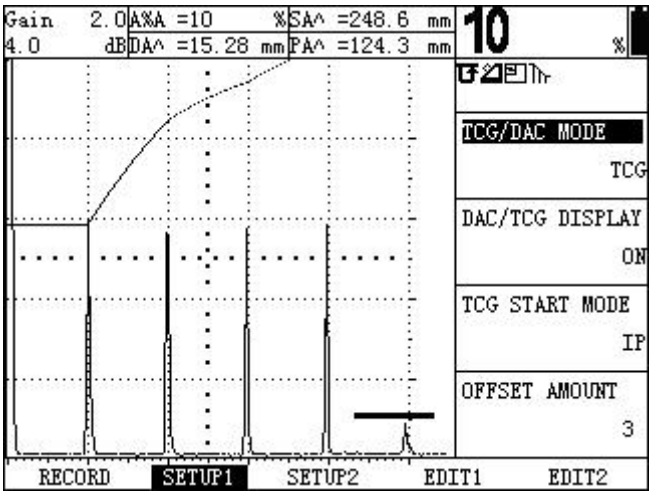


FIGURE 6-1 TCG Curve

The TCG function displays reflectors of equal size at equal A-Scan amplitudes, regardless of the reflector's depth in the test material. The instrument accomplishes this 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. When TCG is activated, appears in the status bar near the top right-hand corner of the display.

7.1 Recording the DAC/TCG Reference Points

When the DAC function is in use, echoes from equally sized reflectors appear as the same height on the A-Scan display. When operating in DAC/TCG mode, will appear on the display screen. Before using the TCG function do the following:

Step 1: The instrument and probe combination has been calibrated and all instrument settings (PULSER, RECEIVER, MATERIAL, etc.) have been made. Changing these settings after the DAC/TCG reference points are input will effect the accuracy of measurement.

Step 2: DAC/TCG reference points (up to 16) must be recorded. This process allows the instrument to calculate and compensate for the effect on material depth on reflector-echo height. The dynamic range of the DAC/TCG function is 40 dB. Maximum curve slope is 12 dB per microsecond. Successive data points do not have to decrease in amplitude. That is, the DAC/TCG curve does not have to have a constantly descending slope.

DAC/TCG reference 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 up to a total of 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. Either one set of TCG reference points or one DAC curve can be stored at a time. To program TCG reference points:

Step 1: Access the DAC menu by pressing Fx (**x=1,2,3,4,5**) below the NEXT selection (on the HOME Menu bar). Activate the SETUP1 submenu by pressing Fx (**x=1,2,3,4,5**) below it. Press ▲ or ▼ key to select DAC/TCG DISPLAY function, then press ↵ key to set DAC/TCG DISPLAY function to ON.

Step 2: Activate the RECORD submenu by pressing Fx (**x=1,2,3,4,5**) below it. Couple the probe to the first reference point and, using ▲ or ▼ key to select GATE A START and GATE A THRESHOLD, adjust the A-Gate so that it is broken by the primary echo. If necessary, use the

dB+ and dB- Keys to adjust the gain so that the echo crosses the A-Gate 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:

Peak memory function in BASIC-CONFIGURE menu can help user to capture quickly and memory the highest peak of echo.

Step 3: While the Gate is lined up over the first reference echo, Press ▲ or ▼ key to select the RECORD function, then press ↵ key to record the reference echo. When the value of the RECORD function changes from 0 to 1, you have recorded the first DAC/TCG reference point.

Step 4: Continue to take additional reference points, following steps 2 and 3, up to a maximum of 16 points (note that at least two reference points are required).

Step 5: Note that stored DAC/TCG reference points can be edited as described in Section 7.4

Note:

DAC/TCG reference points, curve, and status (OFF, TCG, OR DAC) will be stored with data set. When recalled, curve status will be the same as when it was stored. For example, if TCG is active when a data set is stored, it will be active when that data set is recalled.

7.2 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 (Figure 6-1). The recorded reference point data is stored until replaced or edited. To use the stored reference points and operate in TCG mode:

Step 1: Access the DAC Menu, active the SETUP1 submenu.

Step 2: Press ▲ or ▼ key to select the DAC/TCG MODE function, then press ◀ or ▶ key, or press ↵ key to set the DAC/TCG MODE function until TCG appears. (will appear)

Step 3: Press ▲ or ▼ key to select the DAC/TCG DIS function, then turn this feature ON or OFF.

Note:

The TCG CURVE graphically represents the level of gain applied at each of the user-input reference points. This compensating gain is represented by the height of the TCG curve while the material depth of each reference point is represented by its horizontal position on the display screen.

Using TCG ATTENUATION

When TCG reference points are measured from a standard of material different from the test material, a dB adjustment can be applied to each reference point by using the DAC/TCG ATTEN function. Note that this adjustment is automatically applied to the dB level of all reference points.

Step 1: Access the DAC Menu, active the SETUP2 submenu.

Step 2: Press ▲ or ▼ key to select the TCG ATTEN function, then adjust its value from –700.00 dB/m to +500.00 dB/m.

Step 3: Note that this adjustment is applied to all TCG reference points.

7.3 Using DAC

When displayed, the DAC curve visually represents a line of constant reflector peaks over a range of material depths. A new feature of the instrument is a multiple-curve option that displays the recorded DAC curve plus offset DAC curves simultaneously. 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 is programmed using a series of samereflector 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.

7.4 Working with DAC

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 (Figure 6-2). The recorded reference point data is stored until replaced or edited. To create a DAC curve and operate in DAC mode:

Step 1: Access the DAC Menu, active the SETUP1 submenu.

Step 2: Press ▲ or ▼ key to select the DAC/TCG MODE function, then press ◀ or ▶ key, or press ↵ key to set the DAC/TCG MODE function until DAC appears. The DAC Curve will appear whenever operating in DAC mode.

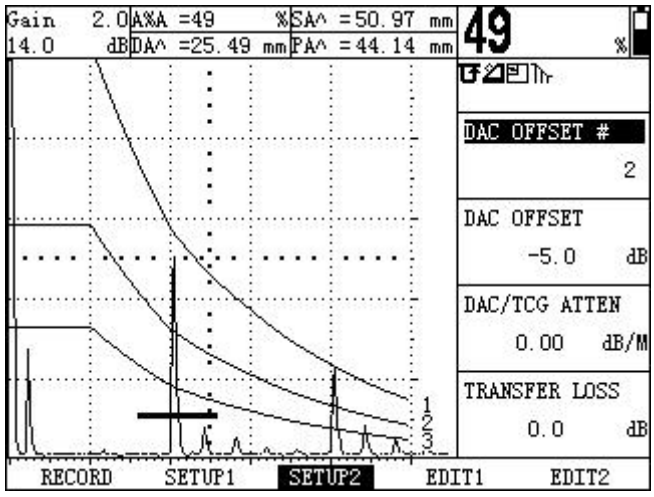


FIGURE 6-2—DAC Curve

Creating DAC Offset Curves

When operating with DAC turned on, the DAC curve is typically displayed. Additional curves can also be offset from the original DAC curve by a user-inputted amount. The DAC offset amount can range from -50 dB to 50 dB. When DAC OFFSET is set to any value other than zero, most ten offset curves will appear in addition to the original DAC curve. To turn the DAC OFFSET feature on

Step 1: Access the DAC Menu, active the SETUP1 submenu.

Step 2: Press ▲ or ▼ key to select the OFFSET AMOUNT function. Selects the DAC offset curve amount.

Step 3: Access the DAC Menu, active the SETUP2 submenu.

Step 4: Press ▲ or ▼ key to select the DAC OFFSET # function. Selects which DAC offset

curve will be configured.

Step 5: Press ▲ or ▼ key to select the DAC OFFSET function. Adjust the value as required. Setting the value to zero eliminates the offset curves.

Adjusting the Applied Gain Using TRANSFER CORRECTION

When DAC is active, adjusting the instrument gain setting will result in a equal adjustment of the DAC curve position. To increase the instrument gain without changing the DAC curve position, use the TRANSFER CORR function to compensate for varying coupling/surface conditions.

Step 1: Access the DAC Menu, active the SETUP2 submenu.

Step 2: Press ▲ or ▼ key to select the TRANSFER LOSS function. Adjust the gain value as required. This gain adjustment will only apply to the echo height, not the DAC curve position.

7.5 Editing DAC Curve and TCG Reference Points

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

Step 1: Access the DAC Menu, active the SETUP1 submenu.

Step 2: Press ▲ or ▼ key to select the POINT function, then press ◀ or ▶ key to set the POINT function until the desired point number (or NEW if adding an new point) appears.

Step 3: Press ▲ or ▼ key to select the POINT TIME function, adjust (input for NEW points) the point's horizontal position

Step 4: Press ▲ or ▼ key to select the POINT GAIN function, adjust (input for NEW points) the point's applied gain (vertical position). Note that this adjustment applies regardless of whether the point is used for TCG reference or a DAC Curve.

Step 5: Press ▲ or ▼ key to select the ENTER function, input the adjusted point values (or new point's position). The DAC Curve or TCG reference function will be adjusted to match this edited input.

To renew a point

Step 1: Access the DAC Menu, active the EDIT2 submenu.

Step 2: Press ▲ or ▼ key to select the POINT function, then press ◀ or ▶ key to set the POINT function until the desired point number (OFF or blank in POINT function indicates that no edit point is selected and NEW POINT function is invalid.) appears.

Step 3: Couple the probe to the reference point and, using ▲ or ▼ key to select GATE A START and GATE A THRESHOLD, adjust the A-Gate so that it is broken by the primary echo. If necessary, use the Gain Key to adjust the gain so that the echo crosses the A-Gate 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.

Step 4: Press ▲ or ▼ key to select the POINT RENEW function, renew the point by pressing ↵ key.

7.6 Deleting a DAC/TCG Reference Points

To delete a stored DAC/TCG reference points

Step 1: Access the DAC Menu, active the EDIT2 submenu.

Step 2: Press ▲ or ▼ key to select the POINT function, then press ◀ or ▶ key to set the POINT function until the desired point number (OFF or blank in POINT function indicates that no edit point is selected and NEW POINT function is invalid.) appears.

Step 3: Press ▲ or ▼ key to select the POINT DELETE function, delete the point by pressing ↵ key.

7.7 Deleting a DAC/TCG Curve

To delete a stored DAC or TCG curve

Step 1: Access the DAC Menu, active the RECORD submenu.

Step 2: Press ▲ or ▼ key to select the DELETE CURVE Function, then delete the curve by pressing ↵ key.

Step 3: The statement in the function box will change to NO VALID CURVE.

☞ **Note:**
The recorded reference points and curve settings are saved in and recalled from DATA SET FILE. Also they are saved with the instrument setup configuration when the instrument shut down and are recalled with the instrument setup configuration when the instrument start up. To delete curve only delete the curve on the screen, don't change the recorded reference points and curve settings stored in DATA SET FILE.

8 DGS Option

The instrument is available with an optional Distance Gain Sizing (DGS) feature. This feature is accessed through the DGS menu, which is located by pressing Fx (**x=1,2,3,4,5**) below the NEXT selection on the HOME menu bar. The DGS feature allows the user to use a particular probe to compare a reflector in a test piece with a known standard reflector.

The DGS feature relies on a reference curve based on a recorded reference point. The procedure for recording a reference point using the DGS Menu is described below.

8.1 Using DGS

When the DGS function 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 appears on the display screen. Before using the DGS function, do the following:

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

When the DGS function is in use, forbid to make the instrument calibration and instrument settings.

8.1.1 Specifying a Probe and Preparing to Record the Reference Echo

Before using the DGS feature 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:

Step 1: Access the DGS menu by pressing Fx (**x=1,2,3,4,5**) below the NEXT selection (on the HOME Menu bar).

Step 2: Select the SETUP submenu, then the PROBE # function. Once activated, this function allows you to choose the stored probe types. These are probes for which probe characteristics are already input in the instrument (this function is only in some version instrument), with the exception of the user-defined probe (PROBE # 1):

Step 3: If the user-defined probe type (PROBE #1) is selected, you can then select the PROBE NAME function. Then press ▲ or ▼ key to select the PROBE NAME function and press ◀ or ▶ key (press ◀ or ▶ to select location within the name, the characters input keys changes the character value) to input a new name. Note that selecting any PROBE # value other than 1 will prevent you from modifying the PROBE NAME or any of the other settings described in Step 4.

Step 4: If the user-defined probe type (PROBE #1) is selected, you must then select the DGS PROBE submenu and input the characteristics for the probe you've connected including:

XTAL FREQUENCY—The probe's frequency rating

EFF. DIAMETER—The probe element's effective diameter rating

DELAY VELOCITY—User determined delay-line velocity

☞ **Note:**
These characteristics can't be changed for any probes other than PROBE #1.

8.1.2 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 hole's diameter

• FBH Flat Bottom Hole with a reference defect size equal to the hole's facial diameter

Follow these steps to record a reference echo:

Step 1: Select the REF ECHO submenu, then select the REFERENCE TYPE function. Once activated, this function allows you to select one of the three reference types described above. Select the REFERENCE SIZE function, specify the size of the known standard's reference flaw.

Step 2: Couple the probe to the known standard, capture the reference flaw so that it's reflected echo is displayed on the instrument's A-Scan, and adjust the A Gate's starting point to ensure that the resulting echo triggers the gate.

Step 3: Adjust the gain key until the reference flaw's A-Scan peak measures 80% of FSH (A%A = 80%).

Step 4: With the probe coupled to the standard, and the reference flaw's echo captured by the A-Gate, select the RECORD REF function, then press ↵ key to store a DGS reference echo.

☞ **NOTE:**
When a DGS reference echo is stored, the ↑ will appear in the display's status bar (upper right corner). Note that 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.
The recorded DGS reference echo and curve settings are saved in and recalled from DATA SET FILE. Also they are saved with the instrument setup configuration when the instrument shut down and are recalled with the instrument setup configuration when the instrument start up.

8.1.3 Display and Adjust the DGS Curve

Once 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. Once the DGS Curve is displayed, it can be adjusted using one of these five functions:

REF ATTEN (found in the REF CORR submenu)

Specify a sound attenuation value (in dB per m 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's data sheet.

TEST ATTEN (found in the MAT ATTN submenu)

Specify a sound attenuation value (in dB per m 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.

DGS CURVE (found in the SETUP submenus)
Positions the probe's DGS Curve based on the size of the reflector (flaw) being tested. The setting will usually depend on the largest acceptable flaw size.

8.1.4 Adjusting DGS Curve

DGS curve for Side Drilled Hole or Flat Bottom Hole can be adjusted. To adjust the DGS curve does the following:

Step 1: Access the DGS menu by pressing Fx (**x=1,2,3,4,5**) below the NEXT selection (on the HOME Menu bar). Select the SETUP submenu by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Press ▲ or ▼ key to select the DGS CURVE function, and then press ◀ or ▶ key to set the hole size.

8.2 Evaluating Test Samples in DGS Mode

Once the curve is recorded and displayed (by turning DGS MODE on), echoes are automatically compared to the DGS curve and evaluated based on the recorded reference. There are two ways in which this comparison can be made:

A%cA and A%cB Amplitude of the signal crossing the A-Gate and B-Gate as a percentage of the corresponding DGS Curve amplitude.

dBcA and dBcB Equivalent height of the signal above or below the corresponding DGS Curve amplitude.

ERS Equivalent Reflector Size evaluates the reflected echo and calculates the equivalent reflector size.

8.3 Deleting a DGS Curve

To delete a stored DGS curve
Access the REF CORR submenu, select DELETE REF, and follow the on-screen prompts.

9 B-Scan option

The B-Scan software option allows you to generate an easy to understand cross sectional profile of test material. This view can be used to verify acquired corrosion thickness measurements, and also to provide a visual reference showing areas on the test material with critical flaws. The thickness mode B-Scan is used to verify the corrosion measurement. The full wave mode B-Scan is used to analyze and evaluate the flaws of the test material.
The B-Scan has only the manual mode. This mode does not keep track of location information and does not require the use of an encoder. This mode provides a continuous scan of thickness data with no correlation to its location along the scan. Readings are not related to transducer movement.
This chapter explains how to the functions of B-Scan menu. In this chapter, you'll learn how to

- Setup the parameters of the B-Scan (section 9.1)
- Use the functions of the B-Scan (section 9.2)
- Review the B-Scan (section 9.3)

9.1 Setup B-Scan Parameters

9.1.1 Setup B-Scan Depth Range

In the B-Scan process, the screen height is defined as the depth of test material. For best inspection resolution, setup correctly the depth of test material.

To setup the depth range, follow these steps:

Step 1: Activate the RANGE submenu (located in the BSCAN Menu) by pressing 

(**x=1,2,3,4,5**) below it. Four functions will appear down the right side of the display screen.

Step 2: Press  or  key to highlight the selection titled DEPTH RANGE. To change the selected display range type, press  or  key or press  key. You'll note that the following options are available:

- RANGE The vertical scale of the B-Scan is determined by RANGE, D-DELAY and P-DELAY functions.
- A GATE The vertical scale of the B-Scan is determined by GATE START and GATE WIDTH functions.

Step 3: Use RANGE, D-DELAY and P-DELAY functions or use GATE START and GATE WIDTH functions to adjust the vertical scale (the depth of test material) of the B-Scan.

9.1.2 Setup A Gate Height

In the thickness mode B-Scan process, the echo must break the gate for the instrument to capture automatically it and display the B-Scan data point. Through selecting appropriate setting of the A gate height, the instrument will detect valid echo and filter noise. To setup A Gate Height, refer to section 4.1.1, also use A GATE HEIGHT function (accessing the RANGE submenu located in the B-SCAN menu).

9.1.3 Setup Horizontal Length Range

In the B-Scan process, the screen horizontal length is defined as the scan length of test material. The scan length is only used to indicate the reference location of test material flaws, and is not used to indicate the accurate location of test material flaws. To setup the scan length range, follow these steps:

Step 1: Activate the SCAN submenu (located in the B-SCAN Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Press ▲ or ▼ key to highlight the selection titled SCAN LENGTH. To change the selected scan length range, press ◀ or ▶ key. Adjust the range of scan length from 1 mm to 1000 mm in steel.

9.1.4 Setup Scan Time

Scan time is the time of a complete B-Scan process in an appropriate scan length(if use video record function, the scan time is the time length of a video record file). To setup the scan time, follow these steps:

Step 1: Activate the SCAN submenu (located in the B-SCAN Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Press ▲ or ▼ key to highlight the selection titled SCAN TIME. To change the selected scan time, press ◀ or ▶ key. Adjust the range of scan time from 4s to 100s.

9.1.5 Setup Scan Direction

Set the correct scan direction can directly display the location of defects, avoid the location errors. To setup the scan time, follow these steps:

Step 1: Activate the SETUP submenu (located in the B-SCAN Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Press ▲ or ▼ key to highlight the selection titled SCAN DIRECTION. To change the selected scan direction, press ◀ or ▶ key or continue pressing ↵ key. Selectable scan direction is as follows:

→ —— B Scan direction from left to right.

← —— B Scan direction from right to left.

9.1.6 Setup Record Type

Record type can be selected the single records or duplicate records of B Scan. To setup the scan record type, follow these steps:

Step 1: Activate the SETUP submenu (located in the B-SCAN Menu) by pressing Fx (**x=1,2,3,4,5**) below it.

Step 2: Press ▲ or ▼ key to highlight the selection titled SCAN TYPE. To change the selected B-Scan recode type, press ◀ or ▶ key or continue pressing ↵ key. Selectable recode

type is as follows:

SINGLE —— B Scan complete a screen and stop.

REPEAT —— B Scan complete a screen, clear the screen and restart the scan.

9.1.7 Setup A Scan Monitor Window

When B Scan is working, A Scan can also be displayed in other window at the same time. User can observe the echo changes of A Scan to analyze the test results. To switch the A Scan window, follow these steps:

Step 1: Activate the SETUP submenu (located in the B-SCAN Menu) by pressing  (**x=1,2,3,4,5**) below it.

Step 2: Press  or  key to highlight the selection titled A SCAN DISPLAY. To switch the A Scan window, press  or  key or continue pressing  key. Under the B Scan mode, B Scan is only displayed on the screen if A SCAN DISPLAY function is closed. A Scan is displayed on the upper half screen and B Scan is displayed on the lower half screen if A SCAN DISPLAY function is opened.

9.1.8 Setup Scan Filling Mode

Under the corrosion thickness mode B Scan, Users can select filled B Scan. To select B Scan filling function, follow these steps:

Step 1: Activate the SETUP submenu (located in the B-SCAN Menu) by pressing  (**x=1,2,3,4,5**) below it.

Step 2: Press  or  key to highlight the selection titled A SCAN MODE. To setup the wave display mode, press  or  key or continue pressing  key. Users also setup this function in the SET submenu of the BASE menu. Selectable wave display mode is as follows:

FILL —— A Scan and B Scan are draw with the fill block.

HOLLOW —— A Scan and B Scan are draw with the line.

9.2 Useing B-Scan

Under the B-Scan mode, B-Scan images are updated in real time, at the same time A-Scan also can be displayed. To start B-Scan, follow these steps:

Step 1: Activate the SCAN submenu (located in the B-SCAN Menu) by pressing  (**x=1,2,3,4,5**) below it.

Step 2: Press  or  key to highlight the selection titled BSCAN MODE. To select the scan mode, press  or  key or continue pressing  key:

OFF B-Scan mode is closed. The instrument is working under the A Scan mode.

THICKNESS corrosion-featured B-Scan is Activated. The instrument captures the echo in A gate to calculate the thickness value and draws the corrosion thickness image.

FULL full-featured B-Scan is Activated. The instrument draws the full-featured

image including amplitude and location information of echoes in the measurement range.

If RECORD TYPE is set the SINGLE records, the operator can start and stop B-Scan. Stop the B Scan, the image data on the screen is no longer updated. To start again the B-Scan will clear the last the image data and start a new B-Scan. To start and stop B-Scan, follow these steps:

Step 1: Activate the SCAN submenu (located in the B-SCAN Menu) by pressing ◘ below it.

Step 2: Press ▲ or ▼ key to highlight the selection titled OPERATION. Press ◄ or ► key to select START, Press OK ↵ to start the B-Scan.

Step 3: Press ◄ or ► key to select STOP, Press ↵ key to stop the B-Scan.

☞ **NOTE:**

If SCAN TYPE is set the REPEAT records, to start or stop B-Scan will restart a new B-Scan.

In the running process of B-Scan, press ✱ 7 PRS (Freeze) short-cut key to pause the B-Scan, and press again ✱ 7 PRS (Freeze) short-cut key to continue the B-Scan from the paused position.

10 AWS option

10.1 AWS D1.1 Weld Rating Feature

This feature allows analysis of welds according to AWS specification D1.1 and provides a D1.1 rating. The AWS D1.1 feature is accessed via the TRIG Menu. The feature utilizes four AWS-specified variables including:

A INDICATION—Gain (in dB) required to position an A-Scan echo's peak (from the measured reflector) at 50% of full screen height (FSH)

B REFERENCE—Gain (in dB) required to position an A-Scan echo's peak (from the reference reflector) at 50% of FSH

C ATTENUATION—Determined by subtracting 1 inch from the sound-path distance to the discontinuity, using the equation: C = (SA -1) 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

Before activating the AWS D1.1 weld rating feature, be sure that all instrument settings are properly adjusted for the specific measurement application. Then access the AWS D1.1 Submenu (via the TRIG Menu) and follow this procedure:

Step 1: Apply couplant and couple the probe to a suitable reference test standard.

Step 2: Ensure that the A-Gate is positioned over the desired echo. Then adjust the gain until the peak of the desired reference echo reaches 50% of full screen height (FSH). Note that if the echo's peak amplitude (A%A) does not fall between 45% and 55%, the inputted point will not be accepted.

Step 3: Press ▲ or ▼ key to highlight the selection titled B REFERENCE function and Press OK ↵ (then 2 ABC to confirm) to define the reference dB level.

Step 4: To evaluate a reflector in a test piece, couple the probe to the test piece and press ◘ to select the A POS Submenu. Now adjust the A-Gate position so that it is over the desired echo.

Step 5: Adjust the again until the peak of the test-piece's echo reaches 50% of full screen height (FSH). Note that if the echo's peak amplitude (A%A) does not fall between 45% and 55%, the inputted point will not be accepted.

Step 6: Return to the AWS D1.1 Submenu and press ▲ or ▼ key to highlight the selection titled A INDICATION function and Press OK ↵. This will record the current dB setting and will automatically calculate and display values for the AWS variables C and D. Rating D can then be applied to the appropriate acceptance criteria found in AWS D1.1. To evaluate additional reflectors against the recorded reference, simply repeat Steps 4 to 6.

11 Maintenance and care

11.1 Care of the instrument

Clean the instrument and its accessories using a moist cloth. Only use the following recommended instrument cleaners:

- water,
- a mild household cleaner or
- alcohol (no methyl alcohol).

⚠ **Attention:**
Do not use any methyl alcohol, solvents, or dye penetrant cleaners!
The plastic parts can be damaged or embrittled by this.

11.2 Care of the batteries

11.2.1 Care of the batteries

Capacity and life of batteries mainly depend on the correct handling. Please therefore observe the tips below.

You should charge the batteries in the following cases:
- before the initial startup
- after a storage time of 3 months or longer
- after frequent partial discharge

11.2.2 Charging the batteries

You can charge the lithium-ion battery pack directly in the instrument by connecting the battery charger recommended by us.

⚠ **Attention:**
You should only use the battery pack recommended by us and the corresponding battery charger. An improper handling of the battery pack and of the battery charger may cause explosion hazard.

11.3 Maintenance

The instrument requires basically no maintenance.

⚠ **Attention:**
Repair work may only be carried out by members of authorized Service staff.