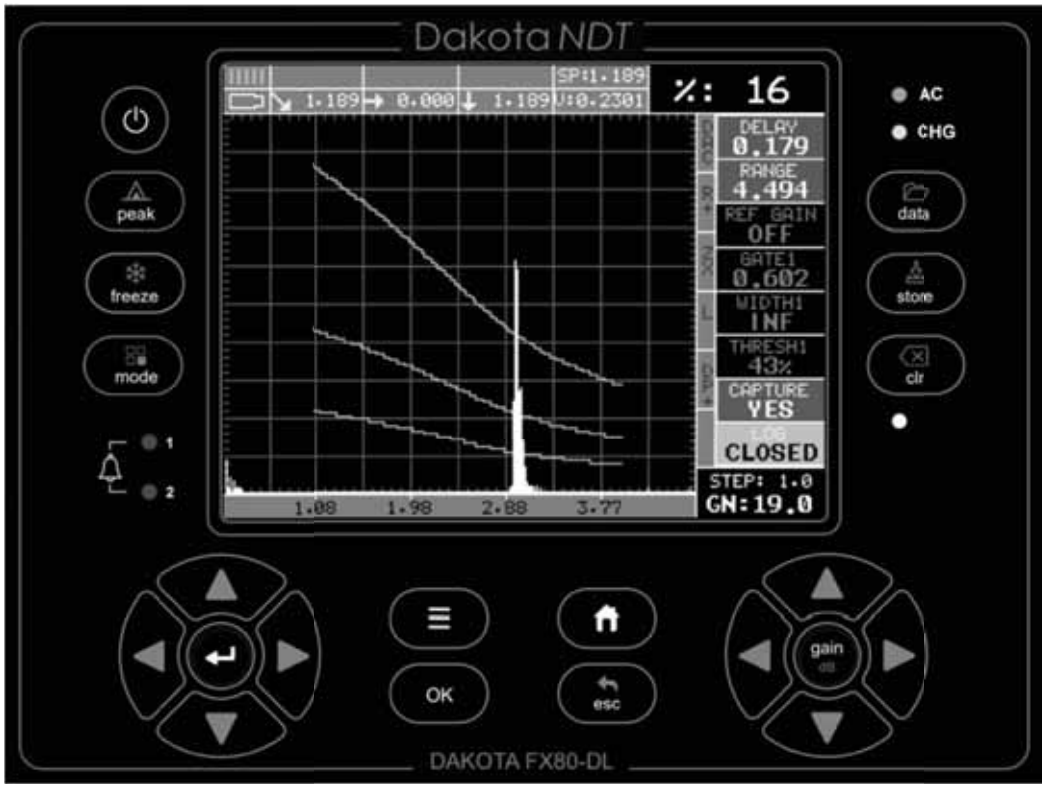
OPERATION MANUAL

Dakota NDT

FX80 Series

Ultrasonic Flaw Detectors

(Manual 2 of 2)



P/N P-250-0007

Rev 1.00, January 2024

CONTENTS

CHAPTER ONE INTRODUCTION 1

1.1 General Disclaimer 1
1.2 Electrical Warning 2

CHAPTER TWO QUICK START GUIDE 3

2.1 Gauge Type 3
2.2 Basic Flaw Setup Reference 3
2.3 Top & Submenu Reference 4
2.4 Loading the Default Setup 5

CHAPTER THREE KEYBOARD, MENU, & CONNECTOR REFERENCE 7

3.1 Menu Key (Operation & Sub Menus) 7
3.2 Probe – Menu 9
3.3 CAL – Menu 9
3.4 DISP (display) – Menu 10
3.5 TUNE – Menu 11
3.6 GT1 – Menu 12
3.7 GT2 – Menu 12
3.8 TRIG – Menu 13
3.9 AWS – Menu 14
3.10 TCG – Menu 14
3.11 DAC – Menu 15
3.12 DGS – Menu 15
3.13 SETUP – Menu 16
3.14 DATA – Menu 17
3.15 UTIL (Utilities) – Menu 18
3.16 XFER (transfer) – Menu 18
3.17 CLR (clear) Key 19
3.18 HOME (measurement mode) Key 19
3.19 OK Key 19
3.20 ESC Key 20
3.21 Wheel Keys 20
3.22 ENTER key 20
3.23 MULTI MODE Key 20
3.24 DATA Key 20
3.25 STORE Key 20
3.26 PEAK Key 21
3.27 FREEZE Key 21

3.28 ON/OFF KEY 21
3.29 FX80 OVERVIEW 21
3.30 NAVIGATING THE HOT MENUS 23
3.31 TOP & BOTTOM END CAPS 24

CHAPTER FOUR SETTING UP FOR MEASUREMENT 27

4.1 SELECTING DISPLAY VIEW 27
4.2 ADJUSTING THE DISPLAY 28
4.3 GAIN 31
4.4 GATES 34
4.5 ACTIVATING AND SETTING UP A GATE 35

CHAPTER FIVE CALIBRATION 40

5.1 SETTING UP FOR CALIBRATION 40
5.2 STRAIGHT BEAM CALIBRATION 46
5.3 ANGLE BEAM CALIBRATION 53

CHAPTER SIX TRIGONOMETRY MODE 57

6.1 INTRODUCTION TO TRIG 57
6.2 ADDITIONAL COMMENTS 57
6.3 SETUP TRIGONOMETRY MODE 58

CHAPTER SEVEN AWS – WELD INSPECTION 64

7.1 INTRODUCTION TO AWS 64
7.2 ADDITIONAL COMMENTS 64
7.3 SETUP AWS 64

CHAPTER EIGHT DISTANCE AMPLITUDE CORRECTION (DAC) 71

8.1 INTRODUCTION TO DAC 71
8.2 ADDITIONAL COMMENTS 71
8.3 CREATING A DAC CURVE 72

CHAPTER NINE TIME CORRECTED GAIN (TCG) 78

9.1 INTRODUCTION TO TCG 78
9.2 ADDITIONAL COMMENTS 78
9.3 CREATING A TCG CURVE 78

CHAPTER TEN DISTANCE, GAIN, SIZE (DGS) 84

10.1 INTRODUCTION TO DGS (AVG) 84
10.2 DGS DIAGRAM 85
10.3 ESTIMATING EFFECTIVE DIAMETER 85
10.4 PARAMETER DEFINITIONS DGS(AVG) 87
10.5 ATTENUATION PARAMETERS 88

10.6 CREATING A DGS CURVE 89

CHAPTER ELEVEN ADDITIONAL FEATURES OF THE FX80 96

11.1 PULSE WIDTH 96
11.2 PULSE REPETITION FREQUENCY (PRF) 97
11.3 DAMPING 98
11.4 PULSER VOLTAGE 100
11.5 MATERIAL VELOCITY CHARTS 101
11.6 MATERIAL VELOCITY 102
11.7 ZERO 104
11.8 BRIGHTNESS 106
11.9 COLOR SCHEME 107
11.10 DIM 108
11.11 GRAPHICS OPTION (LOOK & FEEL) 109
11.12 DETECT MARK 111
11.13 WAVE AVERAGING 112
11.14 PERSISTENCE 113
11.15 GRATICULE (A-SCAN BACKGROUND) 114
11.16 AUTO INTERFACE GATE – IMMERSION TESTING (IM) 116
11.17 FILTERS (WIDE & NARROW BANDS) 119
11.18 GAIN STEP SIZE 120
11.19 DETECT MODES 121
11.20 POLARITY 123
11.21 COMPARE 125
11.22 ANALOG OUTPUT 127
11.23 SERIAL OUTPUT 128
11.24 DIGITIZER 129
11.25 KEY CLICK 130
11.26 DATE & TIME 131
11.27 SHOW DATE & TIME 133
11.28 FREEZE & CAPTURE 134
11.29 CAPTURE VIEWER 135
11.30 PEAK HOLD 137
11.31 FREEZE WAVEFORM 138

CHAPTER TWELVE DATA STORAGE – SETUP, EDIT, & VIEW FILES 140

12.1 INTRODUCTION TO GRID AND SEQUENTIAL FILE FORMATS 140
12.2 CREATING A NEW GRID OR SEQUENTIAL LOG (FILE) 141
12.3 STORING A WAVEFORM 152
12.4 VIEWING STORED READINGS 153
12.5 DELETING GRIDS (FILES) 155
12.6 EDITING A GRID (FILE) 157

12.7 Changing the active File - Open **160**
12.8 Closing an active File - Close **162**

CHAPTER THIRTEEN SETUPS – CREATE, STORE, EDIT, & RECALL 164

13.1 Introduction to Setups **164**
13.2 Opening a Setup **164**
13.3 Saving a Setup **166**
13.4 Deleting a Saved Setup **169**
13.5 Using the Default Setup **171**
13.6 Selecting a Language **173**

CHAPTER FOURTEEN SOFTWARE, FILE TRANSFER, & UPGRADES.... 174

14.1 Computer System Requirements **174**
USB Type1 to Type 2 Cable 174
14.2 Installing DakView **174**
14.3 Communicating with FX80 ..... **174**
14.4 Using the XFER menu (*FX80*) **175**
14.5 Selecting Storage Device **175**
14.6 Copying Files (Setups, Data, & Screenshots) **176**
14.7 Upgrading the FX80 ..... **179**

APPENDIX A - VELOCITY TABLE **180**

APPENDIX B - SETUP LIBRARY **182**

CHAPTER ONE
INTRODUCTION

The Dakota NDT model ***FX80*** is both, an ultrasonic flaw detector, as well as an ultrasonic A/B Scan thickness scope, in a single unit. It's a combination of both our ***CMX Series***, as well as our new ***FX80*** flaw detector series. Why is this advantageous? Thickness gauge are specifically setup to very accurately measure thickness, locate pits, flaws and blind surface corrosion. All the linearity tables, correction curves for various types of longitudinal transducers and features are built with dimensional thickness as its primary focus. Flaw detectors are designed to detect, size, position, and differentiate between flaw types in various materials and welded joints. A flaw detector must be fast, in terms of its sample and screen refresh rate, as inspectors are generally scanning the surface of a part or test specimen at a relatively high speed, rather than looking for the thickness at a specific point or location. While flaw detectors can also measure material thickness with reasonable accuracy, they are not designed with precision thickness as their primary focus.

The ***FX80*** combines the two types of gauges into one powerful and full featured instrument, that's equipped with a number of comprehensive toolkits to provide the user the arsenal necessary to address a number of common field applications. In and effort to avoid complexity issues and differential between gauges types, this manual focuses only on the flaw detector portion of the ***FX80***.

Dakota NDT maintains a customer support resource in order to assist users with questions or difficulties not covered in this manual. Customer support may be reached at any of the following:

Dakota NDT
1500 Green Hills Road, #107
Scotts Valley, CA 95066 USA
Telephone: (831) 431-9722
Facsimile: (831) 431-9723
www.dakotandt.com

1.1 General Disclaimer

The manual should be read and understood prior to using the ***FX80***. This operating manual provides the user with all the general information necessary to use and operate the features of the ***FX80***. However, this manual is not a certified NDT training course, nor is it intended to be one. Ultrasonic training for sound wave theory, flaw detection and interpretation of defects is highly recommended, and will be required by most companies and contract services. Contact the local NDT society in your area to inquire about training available in your locality.

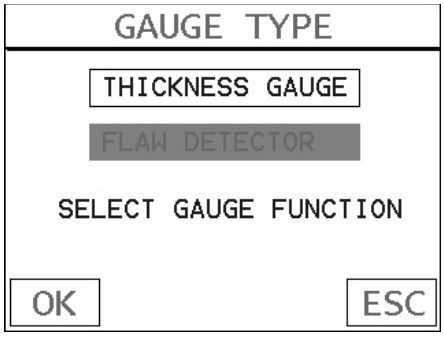
1.2 Electrical Warning

The ***FX80*** series gauges contain high voltage pulsers. It's recommended that the gauge be powered off prior to connecting or disconnecting your transducer, to avoid damaging the instrument.

CHAPTER TWO
QUICK START GUIDE

This section will cover a basic quick start guide to initially get up and running with the ***FX80*** for demonstration purposes only. However, in order to use the gauge and features for actual applications, a thorough review of this manual is recommended.

2.1 Gauge Type



Power up the ***FX80***, by pressing the on/off key located in the bottom right corner of the keypad. During initial boot up, a flash screen and lights will be displayed, followed by a **GAUGE TYPE** selection screen. Since this manual will focus on the flaw detector portion of the ***FX80***, use the / arrow keys to select "flaw detector", followed by pressing the OK key start the ***FX80*** in flaw mode. If this is the first time the gauge has been used, a general startup configuration will automatically be loaded and the ***FX80*** is ready for general inspections. If this is not the first time the gauge has been used, and the user would like to reload the basic default setup parameters, refer to section 13.5 for further info.

Note: *The default setup should only be considered as a basic setup. Proper calibration and parameter settings should be done prior to an actual inspection.*

2.2 Basic Flaw Setup Reference

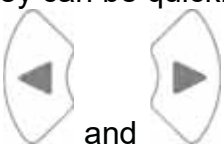
The following table lists all the settings for the basic flaw setup:

PRB	CAL	DISP	TUNE	GT1
Type: Single	Matl: Steel 1020	View: +Rect	Filters: Wide	Alarm: On
Pulse: Thin	Matl 1pt: Uncal	Delay: 0.000	Gain: 65	Gate1: 0.484
Max PRF: 66	Matl 2pt: Uncal	Range: 5.011	Detect Mode: Z-Cross	Thresh1: 40%
Damping: 600	Velocity: .2320	Units: inches		Width1: INF
Pulser Volt: 200	Zero: 0.0	Brightness: 15		Detect: Above

		Color: Green 1		Polarity: Pos
		Dim: Off		
		Rect Wave: Filled		
		Detect Mark: None		

Note: *The following features are set to off: GT2, TRIG, AWS, TCG, DAC, DGS.*

2.3 Top & Submenu Reference

The following table is a quick menu reference guide. The ***FX80*** has 15 top level menu titles, and multiple submenu items as illustrated below. The ***FX80*** also has 9 'hot menu' subsets of the same menu structure. These are the most commonly adjusted submenu items from each of the top level menus. They can be quickly accessed from the main measurement screen by pressing the  arrow keys multiple times using the left button wheel, and pressing the  and  arrow keys on the left button wheel to select the appropriate submenu item. Refer to Chapter Three for additional definitions and information on the keypad and menu items.

1st Main Hot Menu	
Additional Hot Menus	
FX-81 Only	

Note: *Gate1* & *Box* have been added to multiple Hot Menus for the purpose of quick adjustment.

Start >>

PRB	CAL	DISP	TUNE	GT1	GT2	TRIG	AWS
TYPE	MAT	VIEW	FILTERS	ALARM	ALARM	TRIG	AWS
PULSE	MATL 1PT	DELAY	GAIN	DETECT	DETECT	THICKNESS	SET REF GAIN
MAX PRF	MATL 2PT	RANGE	GAIN STEP	GATE1	GATE2	ANGLE	SHOW CURVE
DAMPING	VELOCITY	STEP	DETECT MODE	GATE1 WIDTH	GATE2 WIDTH	X-OFFSET	% SCRN HEIGHT
PULSER VOLTAGE	ZERO	UNITS		THRESHOLD1	THRESHOLD2	CSC O.D.	
		BRIGHTNESS		POLARITY1	POLARITY1	LEGS	
		COLORS					
		DIM					
		RECT WAVE					
		DETECT MARK					
		WAVE AVERAGING					
		PERSISTENCE					

		GRATICULE					

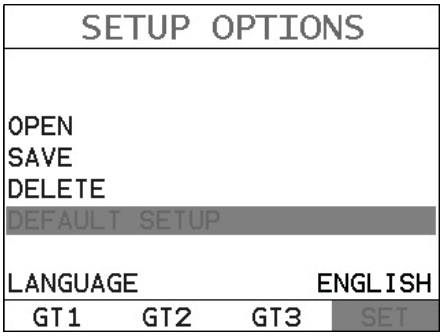
>> End

TCG	DAC	DGS	SET	DATA	UTIL	XFER
TCG	DAC	DGS	OPEN	NEW	COMPARE	BACKUP SETUPS
DRAW	DRAW	REF GAIN	SAVE	EDIT	ANALOG OUTPUT	COPY DATA
CURVE	HOME	TRIGGER CURVE	DELETE ONE FILE	OPEN	SERIAL OUTPUT	COPY SCREENS
% SCRN HEIGHT	CURVE	EFF PROBE DIAMETER	DEFAULT SETUP	CLOSE	DIGITIZER	UPGRADE GAUGE
	TRIGGER	PROBE FREQUENCY	LANGUAGE	DELETE ONE FILE	SET DATE	CAPTURE TO FILE
	DPOLARITY	CURVE SIZE (ERS)		DELETE ALL DATA	SHOW DATE	CAPTURE VIEWER
	FIT	ATTENUATION			KEY CLICK	STORAGE
		DELAY VELOCITY			GAUGE	ABOUT
		REFERENCE TYPE				

2.4 Loading the Default Setup

If the ***FX80*** has previously been used, the basic default settings can be reloaded at any time, as outlined below:

Load Default Setup



The following section assumes the gauge is powered up, the flaw detector option selected, and the main measurement screen is being displayed.

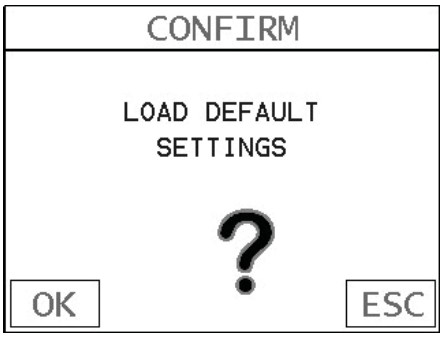
1) Press the ≡ key once to activate the menu items tab. Press the ≡ key multiple times to tab right and the esc key multiple times to

tab left until the **SET** menu is highlighted and displaying the submenu items.

Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys on the left button wheel to scroll through the sub menu items until **DEFAULT SETUP** is highlighted.

3) Press the  key to display the confirmation screen.



4) Press the 

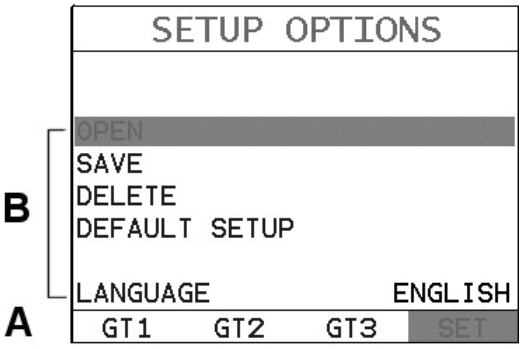
key to load the default setup and return to the measurement screen.

CHAPTER THREE
KEYBOARD, MENU, & CONNECTOR REFERENCE

3.1 Menu Key (Operation & Sub Menus)

The **Menu** key activates the primary menu structure containing 15 menu tab groups. These tab groups then contain sub menu items, or functions. The sub menu items have been organized in the tab groups according to how closely they are related to the individual tab group names. Let's first get familiar with how to move around in these tabs before continuing on to the sub menu functions. This procedure is outlined below:

Activating and Navigation of the Menu Items



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left until the desired tab group is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel. The tab groups are illustrated above **(A)**.

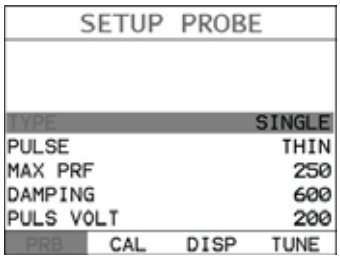
Now that you're familiar with activating and moving amongst the tab groups, let's have a look at how to move around in the sub menu items as follows:

2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until the desired function is highlighted. The sub menu items are illustrated in the diagram above **(B)**.

3) Depending on which function is highlighted, use the ◀ and ▶ arrow keys on the right button wheel to scroll the options, or the ↵ key to activate the **Digit Edit** and **List Box** options.

The sections to follow will provide the user with an explanation of the sub menu functions:

3.2 Probe – Menu



TYPE: Enables the user to select the type of transducer being used, either Single or Dual.

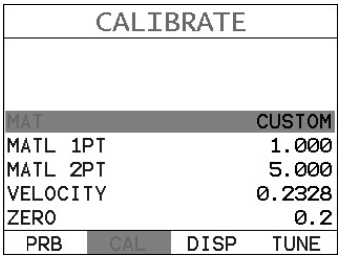
PULSE: The ***FX80*** has an adjustable pulse width for both high penetration and resolution applications. The pulse width refers to the duration of time the pulser is on. The options are **Spike**, **Thin**, and **Wide**. Refer to page 96 for a further explanation. ***The FX-81*** has a special tone burst style pulser with options Spike, Thin, Wide, HV Spike, HV Thin, HV Wide, TB 10MHz, TB 5MHz, TB 2MHz, and TB 1MHz. Refer to page 96 for a further explanation.

MAX PRF: This feature controls the pulse repetition frequency of the ***FX80***. The maximum frequency is 333 Hz. However, the ***FX80*** will automatically adjust the PRF according to what the current delay and range settings have been adjusted to. Larger the range, the slower the repetition frequency will automatically be set for.

DAMPING: The ability to control the amplifiers output impedance to match the impedance of the transducer, and optimize overall transducer performance. Adjustable at: 50, 100, 300, 600, 1500 ohms. Refer to page 98 for further info.

PULSER VOLT: The ***FX80*** has an adjustable pulser voltage: 100, 150, and 200 volts. Refer to page 100 for a further explanation. The ***FX-81*** has a special tone burst pulser: 100, 150, 200, 300, 400 volts. Refer to page 100 for a further explanation.

3.3 CAL – Menu



MAT: Select the material velocity from a chart of basic material types when a known sample thickness, or material velocity cannot be obtained.

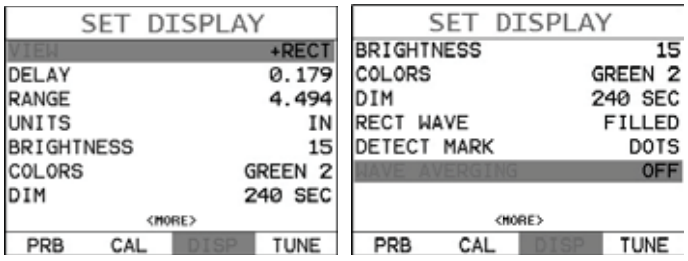
MATL 1PT: Performs a single point calibration. This calibration option is used in conjunction with the MATL 2PT option for the calibration process. Refer to page 40 for further info.

MATL 2PT: Performs a two-point calibration. This option allows the user to automatically calculate the velocity by entering a second known sample thickness. Refer to page 40 for further info.

VELOCITY: Function to calibrate the ***FX80*** by setting the velocity to a known material velocity. Refer to page 102 for further info.

ZERO: Used to zero the transducer and calibrate the screen. The **FX80** is zeroed in much the same way that a mechanical micrometer is zeroed. If the **FX80** is not zeroed correctly, all of the measurements made using the ***FX80*** may be in error by some fixed value. Refer to the section on page 40, for further info.

3.4 DISP (display) – Menu



VIEW: Selectable RF, +RECT, -RECT, RECTFW views. Refer to page 27 for further info.

DELAY: Provides the user the ability to change the start position of the A-SCAN views. Refer to page 28 for further info.

RANGE: Provides the user the ability to change the overall range/depth of the viewable measurement area. It functions a lot like a zoom on a camera. Refer to page 28 for further info.

STEP: When scrolling a range or value using the arrow keys, it can be done using the ‘coarse’ or ‘fine’ setting options for large or small adjustments.

UNITS: Toggle between English or Metric units. The readout will change from inches to millimeters.

BRIGHTNESS: TFT high speed color display. An arbitrary scale of 1-20 has been implemented, with the brightest setting at 20. Refer to page 106 for further info.

COLORS: Provides the user with a variety of different color schemes to select from. There are two schemes for each main color option. Refer to page 107 for further info.

DIM: Allows the user to conserve battery life by diming the display after idle for a specific amount of time – OFF, 30, 60, 90, 120 seconds. Once dimmed, a single press of any key will restore the screen brightness. Refer to page 108 for further info.

RECT WAVE: Provides the user an outlined or filled view option when the display setting is in RECT (rectified) wave mode only. Refer to page 109 for further info.

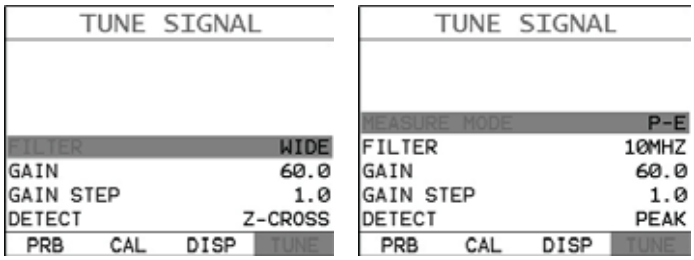
DETECT MARK: Selectable graphics option for the point of detection on the waveform: Line, Box, Dots, None. Offers the user a graphics preference on how they prefer to view the detection on the waveform.

WAVE AVERAGING: The ***FX-81*** is equipped with wave averaging to eliminate noise for a clear waveform image. Not recommended for high speed scanning. Refer to page 112 for further info.

PERSISTENCE: The ***FX-81*** is equipped with wave averaging to eliminate noise for a clear waveform image. Not recommended for high speed scanning. Refer to page 112 for further info.

GRATICULE: Selectable graphics option for the A-Scan background (grid/segments) used as references to depth/thickness versus amplitude. The options are: Point, Line, Dots, Mix. Offers the user a graphics preference on how they prefer to view the A-Scan waveform area. Refer to page 114 for further info.

3.5 TUNE – Menu

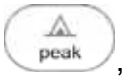


MEASURE MODE: This menu item is only included in our ***FX-81***. Toggles a variety of measurement modes for different application requirements: Currently pulse echo (P-E) and Immersion (IM) for water path correction. Refer to page 116 for further info.

FILTERS: The ***FX80 Series*** have both a wide band frequency range of 1.8 to 19 MHz (-3dB), as well as narrow band filter options at; 2, 5 & 10 MHz. The ***FX-81*** includes two additional filters at 0.5 kHz and 15 MHz. Refer to page 112 for further info.

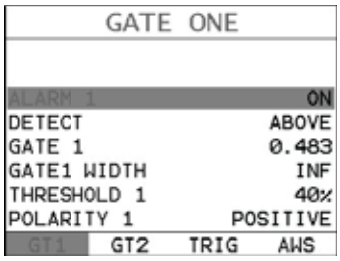
GAIN: The ***FX80*** has a 0-110dB gain range with 2dB resolution. This feature is used to increase/decrease the strength or amplitude of the signal. Similar to turning the volume up or down on a stereo receiver. Refer to page 31 for further info.

GAIN STEP: This feature allows the user to control the increment step size of the gain. Once the step size is set, each time the  or  button is pressed on the right button wheel, the gain is incremented or decremented by the gain step setting. Refer to page 31 for further info.

DETECT MODE: The ***FX80*** is equipped with optional detection modes; 

, FLANK, or Z-CROSS (zero crossing). This option allows the user to decide where the detection is acquired on the waveform echo. Refer to page 121 for further info.

3.6 GT1 – Menu



ALARM1: Toggles the alarm function of gate 1; on, off, audible. The audible feature sounds a beeper when the waveform breaks the threshold level either above or below depending on the current DETECT setting. Refer to page 34 for further info.

DETECT: Enables the user to set the alarm detection to occur either above or below the gates threshold level. Refer to page 34 for further info.

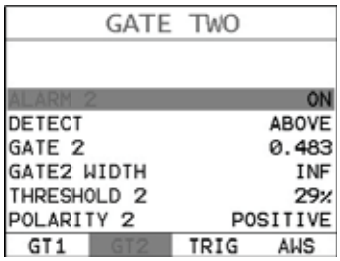
GATE1: Gates allow the user to view a specific inspection/measurement range, or specific regions of the waveform, while ignoring others. In order to detect on a waveform echo, and display the amplitude as a percentage of full screen height, the echo must be inside the boundaries of the gate settings. The **GATE1** feature adjusts where the gate begins, according to the depth/thickness. Refer to page 34 for further info.

GATE1 WIDTH: This feature allows the user to set the overall width of the gate, in terms of distance, from the **GATE1** setting. Refer to page 34 for further info.

THRESHOLD1: Enables the user to set the sensitivity level of Gate1 to a calibrated screen height percentage. The threshold level will act as a starting point for the alarm trigger, and is directly associated with the **DETECT** setting outlined above. Refer to page 34 for further info.

POLARITY1: The gates can be set to detect on either the positive or negative polarity, or stroke, of the half or full wave cycle. It should be noted that if the **VIEW** is set to positive, and the gate negative, the ***FX80*** will not display an amplitude percentage of full screen height. Refer to page 34 for further info.

3.7 GT2 – Menu



ALARM2: Toggles the alarm function of gate 2; on, off, audible. The audible feature sounds a beeper when the waveform breaks the threshold level, either above or below, depending on the current DETECT setting. Refer to page 34 for further info.

DETECT: Enables the user to set the alarm detection to occur either above or below the gates threshold level. Refer to page 34 for further info.

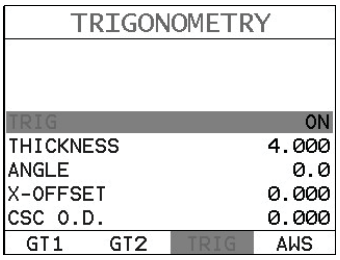
GATE2: Gates allow the user to view a specific inspection/measurement range, or specific regions of the waveform, while ignoring others. In order to detect on a waveform echo, and display the amplitude as a percentage of full screen height, the echo must be inside the boundaries of the gate settings. The GATE2 feature adjusts where the gate begins, according to the depth/thickness. Refer to page 34 for further info.

GATE2 WIDTH: This feature allows the user to set the overall width of the gate, in terms of distance, from the GATE2 setting. Refer to page 34 for further info.

THRESHOLD2: Enables the user to set the sensitivity level of Gate2 to a calibrated screen height percentage. The threshold level will act as a starting point for the alarm trigger, and is directly associated with the DETECT setting outlined above. Refer to page 34 for further info.

POLARITY2: The gates can be set to detect on either the positive or negative polarity, or stroke, of the half or full wave cycle. It should be noted that if the VIEW is set to positive, and the gate negative, the ***FX80*** will not display an amplitude percentage of full screen height. Refer to page 34 for further info.

3.8 TRIG – Menu



TRIG: This feature toggles trigonometry feature on/off. This feature is used with angle beam transducers for the inspection of welds, to calculate three measurements: Beam path distance (↘), Surface distance (→), and Depth (↓) from the index point of the transducer. Refer to page 57 for further info.

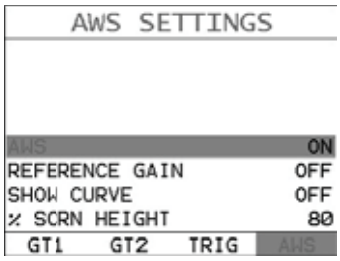
THICKNESS: Used to set the thickness of the test material. The thickness will be used to determine which skip/leg the ***FX80*** is detecting on. Refer to page 57 for further info.

ANGLE: Used to set the angle of the transducer, and used in the calculations above. Refer to page 57 for further info.

X-OFFSET: This feature is used to calculate the surface distance in the trigonometry function, as is a physical measurement from the index point of the probe to the front of the wedge/can/shoe/case. Refer to page 57 for further info.

CSC OD: Curved surface correction to compensate for changing sound path distance and angle. This feature is used in conjunction with 'thickness' in order to calculate a correction factor. Refer to page 57 for further info.

3.9 AWS – Menu



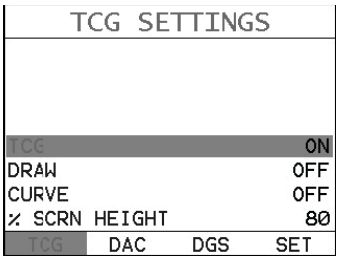
AWS: This feature toggles the AWS feature on/off. Used in the analysis of welds according to American Welding Society's structural welding code D1.1-94, to calculate the Indication Rating (IR). Refer to page 64 for further info.

REFERENCE GAIN: The gain (in dB) required to set the indication level to a specific percentage of full screen height (FSH). This value will typically be set somewhere between 20%–90%. Refer to page 64 for further info.

SHOW CURVE*:* Toggles the AWS correction curve on/off. Refer to page 64 for further info.

% SCRN HEIGHT: This feature enables the user to set the reference level of the TCG as a percentage of full screen height (FSH). Refer to page 64 for further info.

3.10 TCG – Menu



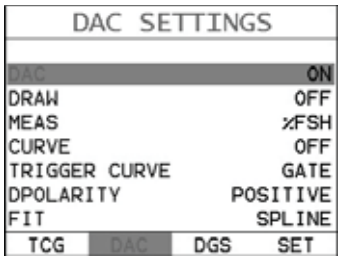
TCG: This feature toggles the TCG feature on/off. The Time Corrected Gain (TCG) feature displays reflectors of equal size at equal A-Scan amplitudes, regardless of the reflector's depth in the test material. Refer to page 78 for further info.

REFERENCE GAIN: Toggles the DRAW mode on/off, and used to draw the TCG curve. Refer to page 78 for further info.

CURVE: Toggles the TCG correction curve on/off, and the curve is displayed on the screen. Refer to page 78 for further info.

% SCRN HEIGHT: This feature enables the user to set the reference level of the TCG as a percentage of full screen height (FSH). Refer to page 78 for further info.

3.11 DAC – Menu



DAC: Toggles the DAC feature on/off/audible. A Distance Amplitude Correction (DAC) curve is used to configure a variable threshold for the gate, using the same size reflector at different distances. Refer to page 71 for further info.

DRAW: Toggles the DRAW mode on/off/audible, and used to draw the DAC curve. **Note:** TCG *curve cannot be drawn in RF view. Refer to page 71 for further info.*

MEAS: Toggles the units displayed as a relationship of either the signal amplitude and DAC curve, or just the signal according to screen height. The units are as: %FSH, %DAC, and dB. Refer to page 71 for further info.

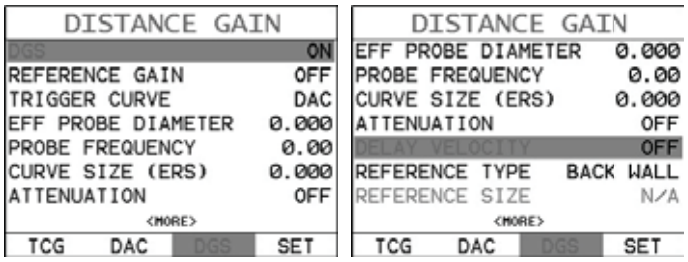
CURVE: Selectable signal or multi DAC curve options. The displayed curve options are: DAC, -2dB, -6dB, -10dB, (-6dB/-12dB), (-6dB/-14dB). Once the DAC curve has been generated, these options can be toggled at any time. Refer to page 71 for further info.

TRIGGER CURVE: Used to set the alarm threshold for the DAC curve. The options are; at DAC, -2dB, -6dB, -10dB, -12dB, -14dB, or using an independent gate. The list of trigger options will change according to which CURVE option has been selected. Refer to page 71 for further info.

DPOLARITY: Used to select the polarity of the DAC curves generated, either positive or negative. Refer to page 71 for further info.

FIT: Creates either a linear (straight line) or spline (nice curve) fit between calibrated reference points. Refer to page 71 for further info.

3.12 DGS – Menu



DGS: Toggles the DGS feature on/off. Distance Gain Size (DGS) curve is used to configure a variable threshold for the gate using a single reflector using an empirically derived set of curves. Refer to page 84 for further info.

REFERENCE GAIN: Toggles the DRAW mode on/off, and used to set the reference gain from a given reference standard. Refer to page 87 for further info.

TRIGGER CURVE: Used to set the alarm to detect on either the DGS curve, or independent GATE. Refer to page 87 for further info.

EFF PROBE DIAMETER: Used to set the effective probe diameter of either a round or square/rectangular crystal element, and used as a variable to calculate the near field length. Refer to page 85 for further info.

PROBE FREQUENCY: Used to set the center frequency of the probe/transducer. The frequency will either be scribed on the probe itself, and additionally listed on the transducer certificate. Refer to page 87 for further info.

CURVE SIZE (ERS): Used to select the Effective Reflector Size that will be used from the DGS/AVG chart. Refer to page 87 for further info.

ATTENUATION: Toggles the ATTENUATION on/off. The parameters in the sub menu are used to compensate for additional factors that affect the propagation of sound energy, based on the material, surface condition, and differences between the reference standards versus test material. Refer to page 88 for further info.

DVK: Used to correct for increases in gain based on a curved reference standard, to an actual back wall reflector. Refer to page 88 for further info.

MATERIAL LOSS: Used to correct for the loss of sound in attenuative materials and applications inspections where sound will travel long distances. Refer to page 88 for further info.

REFERENCE LOSS: Used to compensate for the loss of sound in the reference standard. Refer to page 88 for further info.

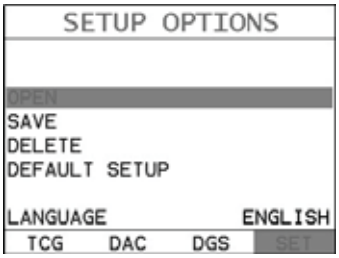
TRANSFER LOSS: Used to correct for the loss of sound based on the surface of the actual test material. Refer to page 88 for further info.

DELAY VELOCITY: Used to set the longitudinal velocity of the transducer delay line, for both angle & straight beam probes, to account for the proportion of the near field length in the delay line. Refer to page 87 for further info.

REFERENCE TYPE: This option is used to set the type of reflector that will be used during the setup and calibration process. The options are Back Wall, Side Drilled Hole (SDH), or Flat Bottom Hole (FBH). Refer to page 87 for further info.

REFERENCE SIZE: If the reference type was set to SDH or FBH, the size of the reflector must be entered. Refer to page 87 for further info.

3.13 SETUP – Menu



OPEN: Displays a list of factory and user defined setups currently stored in memory. These setups can be recalled and used at any time. Refer to page 164 for further info.

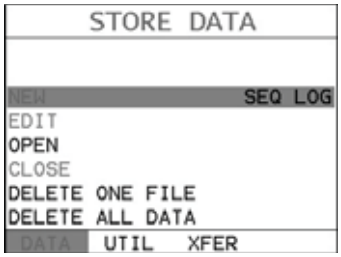
SAVE: Provides the user with the ability to save a custom setup that has been modified or created by the user. Refer to page 166 for further info.

DELETE: Provides the user with the ability to delete specific setups previously save in memory. Refer to page 166 for further info.

DEFAULT SETUP: Loads a basic default setup. Use only as a last resort when the setups in the ***FX80*** have been corrupted and a computer is not accessible. Refer to page 171 for further info.

LANGUAGE: Provides the user the ability to select different languages for the ***FX80***. Refer to page 173 for further info.

3.14 DATA – Menu



NEW: Allows the user the ability to create a new alpha numeric grid, or sequential log file with auto identifiers. It is equipped with custom parameters, rows, and columns depending on the user's application reporting requirements. Refer to page 141 for further info.

EDIT: Gives the user the ability to change parameters of grid or sequential file previously saved. **Note:** *Pre-defined coordinates cannot be changed once they have been created. Refer to page 157 for further info.*

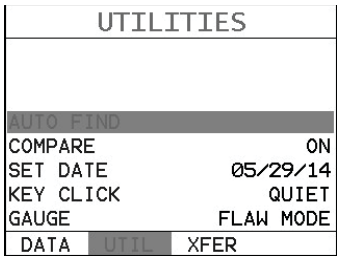
OPEN: This function provides the user with the ability to recall grids or sequential log files that currently exist in memory, from a list of grids. Refer to page 157 for further info.

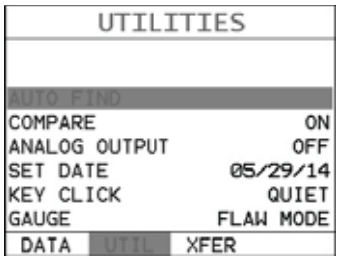
CLOSE: Provides the user the ability to close a currently opened grid or sequential log file. Refer to page 160 for further info.

DELETE ONE FILE: This function provides the user with the ability to delete one individual grid or sequential log file from a list of multiple grids/files previously saved in memory. Refer to page 154 for further info.

DELETE ALL DATA: This function provides the user with the ability to delete all files currently stored in memory. Refer to page 156 for further info.

3.15 UTIL (Utilities) – Menu





AUTO FIND: Automatically locates the detection point if the measurement is out of the viewable display area, and automatically sets up the gauges scope settings. Refer to page 106 for further info.

COMPARE: Enables the user to freeze and drop a reference reflector or defect into the background, to compare against a live wave scan in the foreground. Compare is a variation of the peak feature and used in conjunction with the PEAK key when enabled. Refer to page 125 for further info.

ANALOG OUTPUT: ***FX-81*** only. Proportional outputs (amplitude or distance), 0-10 volts. Speed is determined by the **PRF** setting. Refer to page 127 for further info.

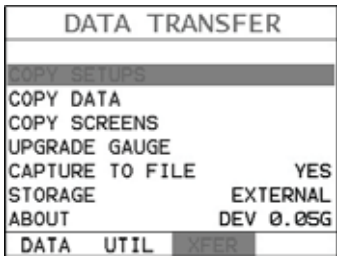
SET DATE: Gives the user the ability to set the internal date and time stamp in the ***FX80***. Refer to page 125 for further info.

SHOW DATE: Gives the user the ability to display the date and time in the waveform area of the ***FX80***. The options are OFF, DATE, TIME, BOTH. Refer to page 133 for further info.

KEY CLICK: Gives the user the ability to set the level of the key press beeper OFF, QUIET, or LOUD. Refer to page 133 for further info.

GAUGE: Gives the user the ability toggle the ***FX80*** gauge type to either a flaw detector, or a thickness gauge. Refer to page 3 for further info.

3.16 XFER (transfer) – Menu



COPY SETUPS: Copies setup files from either the internal or external SD memory card to the other memory card, depending on the current internal/external setting of **Storage** (current device being used to store data), located in the XFER menu. Refer to page 176 for further info.

COPY DATA: Enables the user to copy all, or individual grid/log files from either the internal or external SD memory card to the other memory card, depending on the

current internal/external setting of **Storage** (current device being used to store data), located in the XFER menu. Refer to page 176 for further info.

COPY SCREENS: Copies screen capture (.tif's) files from either the internal or external SD memory card to the other memory card, depending on the current internal/external setting of **Storage** (current device being used to store data), located in the XFER menu. Refer to page 176 for further info.

UPGRADE GAUGE: Enables the user the ability to upgrade the ***FX80*** to the most current firmware revision. Refer to page 179 for further info.

CAPTURE TO FILE: Enables the user the ability to enable screen captures to .tiff files, and used in conjunction with the Multi Mode key. Refer to page 134 for further info.

CAPTURE VIEWER: Enables the user the ability to enable screen captures to .tiff files, and used in conjunction with the Multi Mode key. Refer to page 135 for further info.

STORAGE: Enables the user to select which SD memory card to use for storage. **Note:** *if no card exists in the external reader slot, this option will be grayed out and inactive. Refer to page 175 for further info.*

ABOUT: Provides the user with Dakota NDT contact information and the ***FX80*** firmware & FPGA versions. Refer the Dakota NDT web site for information on the latest firmware versions available for download.

3.17 CLR (clear) Key

The primary functions of the **CLR** key, is to clear a measurement from a grid or sequential log files cell location or set obstruct, backspace in an **Alpha Edit Box,** or clear a DAC reference point used to generate a curve. Use this key to clear saved measurement & waveform.

3.18 HOME (measurement mode) Key

The **HOME** key puts the ***FX80*** into its primary mode of operation. In this mode, the user has a complete view of the LCD. When pressed multiple times, navigates the hot menu items.

3.19 OK Key

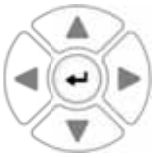
The primary function of the **OK** key is confirmation of a change or selection. The **OK** key also toggles the Hot Menu area, while in measurement mode, to a large digits display area. If the ***FX80*** is displaying a grid log, the **OK** key toggles an advance to row number option.

3.20 ESC Key

The **ESC** key is used in the  ,  , and **EDIT** functions as a back or escape function. If the ***FX80*** is displaying a grid or sequential log, the 

key toggles the display options: RF, +RECT, -RECT and RECTFW views.

3.21 Wheel Keys




The **Arrow Keys** are used to navigate through the menus, increase/decrease values, and toggle specific function keys.

3.22 ENTER key

The **ENTER** key is used in the overall menu selection process, to activate list and edit boxes, display and save measurements/waveforms to grid or sequential file locations.

3.23 MULTI MODE Key

The **MULTI MODE** key is only used in the thickness gauge portion of the ***FX80***.

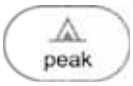
3.24 DATA Key

The **DATA** key opens the tabbed data menu, allowing a user to efficiently create a new log/grid file for storage.

3.25 STORE Key

The **STORE** key displays the current log/grid opened in split screen mode. If no log/grid file is open, the **STORE** key will open the tabbed data menu in order create a new, or open an existing log/grid file for storage.

3.26 PEAK Key



The **PEAK** key is a feature used in the flaw detector portion of the ***FX80***, and is not used in the thickness gauge. It is also used to activate the **COMPARE** feature located in the **UTIL** menu

3.27 FREEZE Key

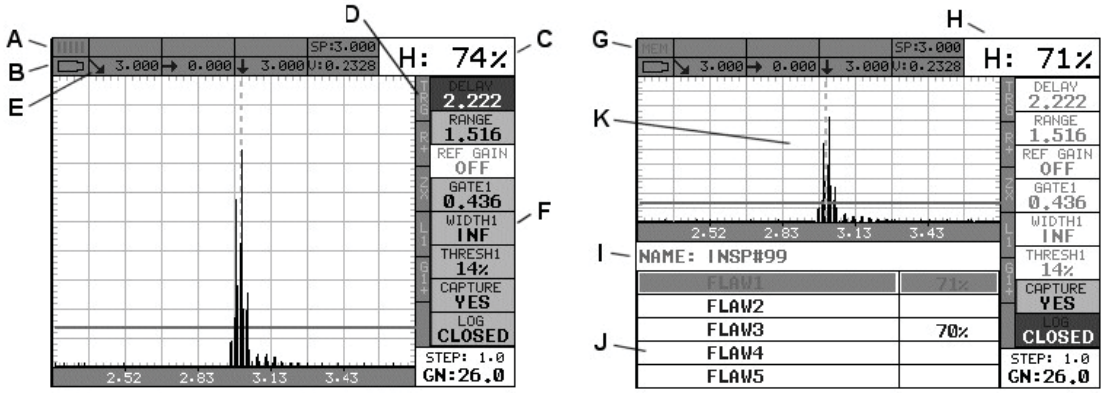
The FREEZE key is used to freeze the display for evaluation/review of what's currently on the display. It is also used in conjunction with the **CAPTURE** feature to save the current display to a .tif (tagged image) graphic file that can be opened using any graphics viewer.

3.28 ON/OFF Key

The **ON/OFF** key simply powers the unit either **ON** or **OFF**. **Note:** *Unit will automatically power off when idle for 5 minutes. All current settings are automatically saved prior to powering off.*

Note: *If the **FX80** fails and is in a state where none of the keys are responding, pressing the **ON/OFF** key continuously with repetition will force an auto system shutdown. The user can then power the unit back up.*

3.29 FX80 Overview



FX80 Screen Shots

In order to understand how to operate the ***FX80***, it's best to start off with an understanding of what we're looking at. The ***FX80*** has a lot of great features and tools that will prove to be a huge benefit for the variety of applications you're

constantly facing on a continual basis. Let's have a brief look at the screens you'll be looking at most often:

A. **Repeatability/Stability Indicator** – This indicator shows the stability/repeatability of the sound path signal. When all the vertical bars are fully illuminated, the repeatability of the sound path is stable.
B. **Battery Icon** – Indicates the amount of battery life the ***FX80*** has remaining.
C. **Height** – Shows the signal amplitude height as a percent of 100% full screen height.
D. **Feature Status Bar** – Indicates the features currently enabled and in use in the following order:
    - Feature Toolkits
        i. Trig – Trigonometry w/ Curved Surface Correction
        ii. AWS – American Welding Society
        iii. TCG – Time Corrected Gain
        iv. DAC – Distance Amplitude Correction
        v. DGS – Distance Gain Size
    - View
        i. RF: Radio Frequency.
        ii. R+: Rectified positive.
        iii. R- : Rectified negative
        iv. FW: Rectified full wave.
    - Detect
        i. Zero crossing (ZX)
        ii. Flank (FK)
        iii. Peak (PK)
    - Leg – Skip leg reference, (L1…L4…)
    - High Speed Scan Mode
    - Alarm Mode
    - Gain Setting
E. **Leg (skip leg)** – Indicates which skip/leg the detection in on. The thickness of the material is used to calculate the leg.
F. **Hot Menu items** – We call this menu section our "hot menu", as these items are the most commonly adjusted features, requiring quick access from the user. They can be displayed and scrolled by pressing the  key at anytime. The  key is used in conjunction with  key to reverse the direction scrolled.

G. **Memory** – Indicates that the currently displayed measurement screen and values have been previous stored in memory. When MEM is displayed, all measurement functions are disabled until the user advances to an empty storage location, or the current measurement is cleared by pressing the 

key.

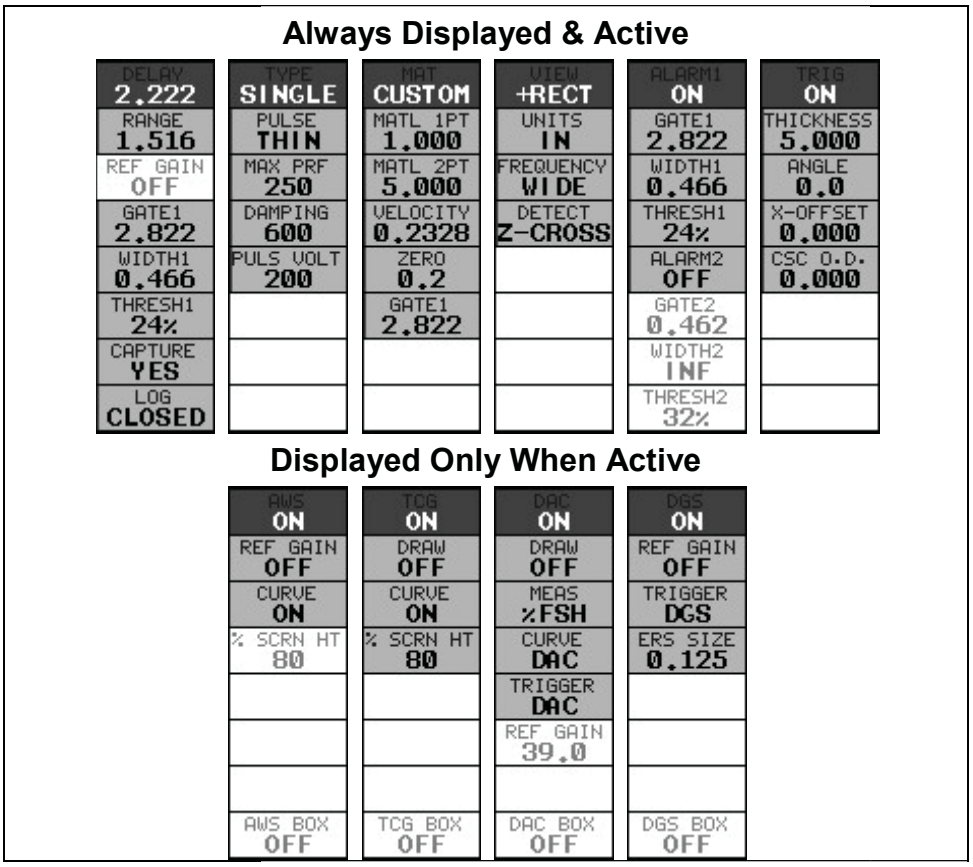
H. **Height** – Displays the amplitude of the signal as a percentage of full screen height. Depending on the quantity selected, this could also be displayed in dB, or D.

I. **Grid or Seq Log Name** – References the name of the log file currently open.

J. **Log File** – Shows the storage cells of the current log file open. Depending on the quantity currently selected, show either the %height or dB value stored.

K. **A-Scan Display** – The actual echo reflections returned from the backwall or defect.

3.30 Navigating the Hot Menus



The diagram above is a screenshot of all 10 “Hot Menus” in the **FX80**. The Hot Menu’s contain all the most regularly adjusted features from each tabbed menu, in

the exact order of the tabbed menus themselves. Some of the menus have been combined into a single Hot Menu, in order to reduce the number of Hot Menus (i.e. GT1 & GT2 have been combined into a single Hot Menu). Additionally, the toolboxes (AWS, TCG, DAC, DGS) will only appear as a Hot Menu when activated and only one toolbox can be active at a time. Therefore, a total of 6 Hot Menus will always be active, plus an optional toolbox. The primary purpose of the design was to provide the user with an efficient way to make adjustments on the fly, while continuing to have visibility of the A-Scan display. The following procedure outlines the steps to navigate and make adjustments as follows:

Navigating Hot Menus

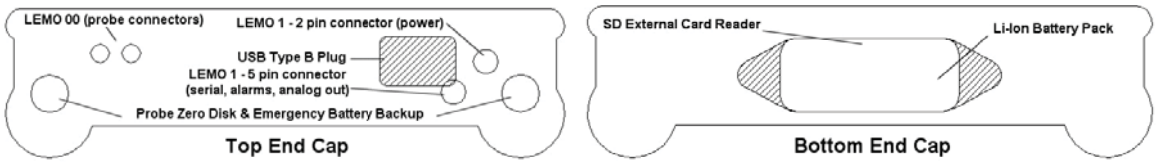
1) Using the left button wheel, press the  and  arrow keys to scroll through the 9 individual **Hot Menus**, and the  and  arrow keys to scroll through the **Hot Menu** items. Alternatively, the  **&**  keys can be used to scroll through the **Hot Menu** items.

2) Press the  and  arrow keys multiple times on the right button wheel to toggle the value or status.

Note: *This is a coarse adjustment. It's the fastest and easiest way to increment, decrement, or toggle the status, however it does so in coarse steps. Pressing the*  *key will allow the user to enter a specific target value.*

This procedure above is universal for navigating through and selecting all the features in the Hot Menus.

3.31 Top & Bottom End Caps



The top & bottom end panels are where all connections are made to the ***FX80***. The diagram above shows the layout and description of the connectors:

Transducer Connectors

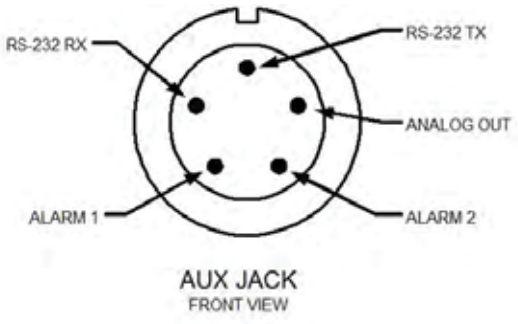
Refer to Diagram: The transducer connectors, emergency battery backup channels/probe zero disks, power connector and auxiliary connector are located on the ***FX80's*** top end cap. The transducer connectors are of type Lemo "00". **Note:** *There is no polarity associated with connecting the transducer to the* ***FX80****.*

Probe Zero Disk & Battery Cover

Refer to Diagram: The emergency battery backup disks are the large round disks shown in the diagram. **Note:** *This same disk is also used as a probe zero disk.* Simply remove the cover when replacing the batteries (3 AA cells) for each. When performing a manual probe zero function, simply place the transducer on disk making firm contact. **Important:** Be sure to follow the polarity label located on the back label of the ***FX80***. **Note:** *Rechargeable batteries can be used, however they must be recharged outside of the unit in a standalone battery charger.*

USB Type B Connector

Refer to Diagram: The **USB** connector is a common type B connector found on a variety of electronic devices. This port will be used to transfer stored grid/log files, captured screen shots, etc. This connector will also be used to upgrade the ***FX80*** with the latest version of firmware (gauge software). The cable supplied with the ***FX80*** is USB type A to USB type B.

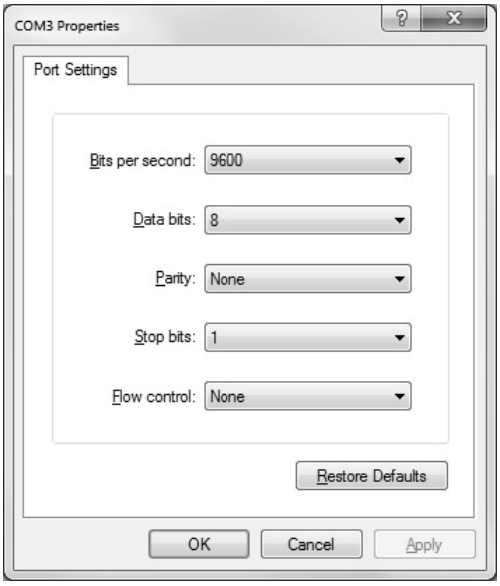


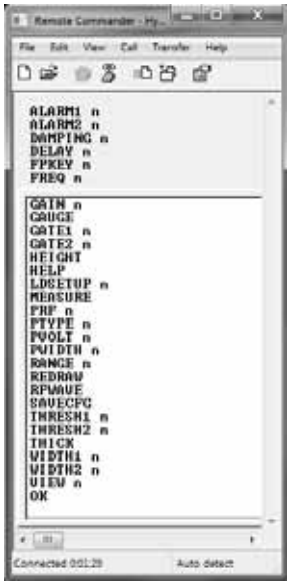
RS-232 Serial Connection (LEMO 1 – 5 pin)

Refer to Diagram: The **RS-232** connector is a 5 pin female Lemo 1 connector. It is designed to connect directly from the ***FX-81*** to a standard AT serial port on a PC, and works in conjunction with the integrated "remote commander" feature built for system

integration in the ***FX-81*** “only”. A standard terminal software program must be installed and configured, like HyperTerminal from Windows, in order to use this feature. Basic commands can be sent from a PC keyboard to the ***FX-81*** through the serial portion of the connector to remote control the gauge. An accessory 9 pin female serial to Lemo 1 - 5 pin male cable will be required to use this feature, and is not included in the standard kit.

Terminal settings for serial communication and a list of the current set of commands available in remote commander are shown in the diagrams below. They can be displayed at any time by typing ‘help’ in the PC terminal window, followed by pressing the enter key. You’ll notice that some of the commands have an ‘n’ next to them. These require either a number to change the value for the given parameter, or a ‘?’ to report back to the user the current value of the parameter.





Analog Output (LEMO 1 – 5 pin)

Refer to Diagram: The ***FX-81*** is also equipped with analog outputs 0-10volt, and is updated at the same rate as the PRF. There is 100 ohm output impedance which will vary the voltage slightly and should therefore be calibrated to the device connected.

Alarms Connection (LEMO 1 – 5 pin)

Refer to Diagram: This is used for connecting each alarm directly to an external source. The alarm pins are an open collector, 20 MA at 12v. Typically a 4.7K “pull up” resistor is required. An accessory 9 pin female serial to Lemo 1 - 5 pin male cable will be required to use this feature, and is not included in the standard kit.

Power Connector (LEMO 1 – 2 pin)

Refer to Diagram: The Lemo 1 2 pin connector is used for direct line power and charging the Li-Ion battery pack.

CHAPTER FOUR
SETTING UP FOR MEASUREMENT

4.1 Selecting Display View

The **FX80** includes a variety of viewing options for the waveform display. There are three primary options waveform options with selectable polarity. These are all outline below as follows:

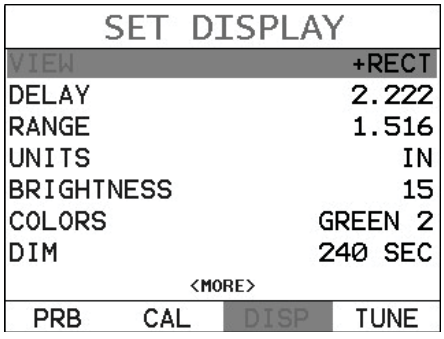
Radio Frequency (RF): Displays the entire sine wave signal, much like an oscilloscope, from a reflector or return echo. This view shows both the positive and negative peaks.

Rectified (RECT): Displays half sine wave signal, either positive or negative, from the reflector or return echo. The user can select the polarity or "phase" displayed. This is typically determined by first using **RF** view to select the most optimal polarity "phase", to fine tune the scopes settings. The **RECT** view is commonly used as the primary "flaw detection" view.

Full Wave (RECTFW): Display entire sine wave signal in a rectified view. There is no polarity.

The following procedure outlines the steps to select the view:

Display View



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **DISP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times

using the left button wheel. *For quick access and editing, refer to navigating the Hot Menus page 23.*

2) Use the  and  arrow keys on the left button wheel to scroll through the sub menu items until **VIEW** is highlighted.

3) Use the  and  arrow keys on the right button wheel to scroll the view options **(RF, +RECT, -RECT, RECTFW)**.

4) Once the desired view is displayed, press the  key to return to measurement mode.

4.2 Adjusting the display

This section will cover the procedures for adjusting the viewable range, or area, of the display, in terms of thickness. A basic overview example for this section would be as follows: Suppose we had a 50” widescreen television set. The left side of the television screen is considered the **Delay** for all view options. The right side of the television screen is the **Range + Delay**. By adjusting the left and right side of the television screen, to control the viewable area/range, we can zoom in and out of any part of the 50” screen we’d like, and focus on only the specific areas of the screen necessary.

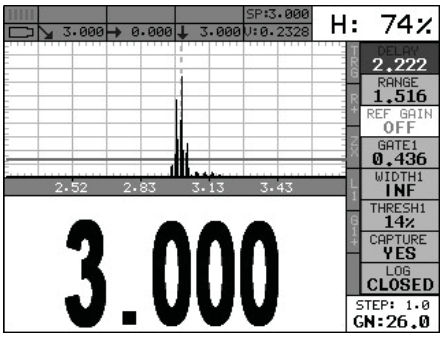
Setting Delay

The Delay represents the left side of the display, and can be adjusted to start at any thickness value within the overall range of the ***FX80***.

Note: *Once the delay is set, it will remain the same for the views:* ***RF***, ***+RECT, -RECT***, ***RECTFW***.

The procedures to adjust the **Delay** are outlined below:

Setting Delay



1) Using the left button wheel, press the  and  arrow keys to scroll through the 9 individual Hot Menus, and the  and  arrow keys to scroll through the Hot Menu items to highlight **DELAY**. Alternatively, the  **&**  keys can be used to scroll through the Hot Menu items.

2) Press the  and  arrow keys multiple times on the right button wheel to scroll the highlighted value.

3) **Alternatively**, press the  key to display the **Digits Edit Box**.

4) Press the  and  arrow keys on the left button wheel to scroll the highlighted value.

5) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

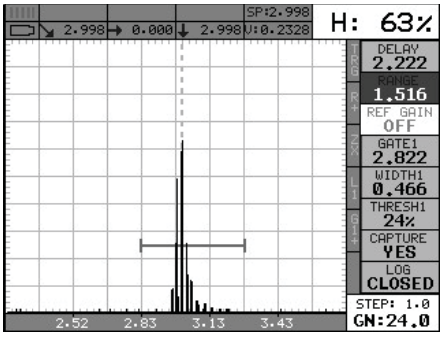
6) Repeat steps **4 & 5** until the **DELAY** value is correctly displayed.

7) Press the OK key to return to the measurement screen, or esc to cancel entering the **DELAY**.

Setting Range

The **Range** is the distance from the delay that will be viewable on the screen. It can be adjusted to any value greater than the **Delay**. The procedures to adjust the range are outlined below:

Setting Range



1) Using the left button wheel, press the ◀ and ▶ arrow keys to scroll through the 9 individual Hot Menus, and the ▲ and ▼ arrow keys to scroll through the Hot Menu items to highlight **RANGE**.
   Alternatively, the 🏠 **&** esc keys can be used to scroll through the Hot Menu items.

2) Press the ▲, ▼, ◀, and ▶ arrow keys to scroll the highlighted value.

3) **Alternatively**, press the ↵ key to display the **Digits Edit Box**.

4) Press the  and  arrow keys on the left button wheel to scroll the highlighted value.

5) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

6) Repeat steps **4 & 5** until the **RANGE** value is correctly displayed.

7) Press the  key to return to the measurement screen, or  to cancel entering the **RANGE**.

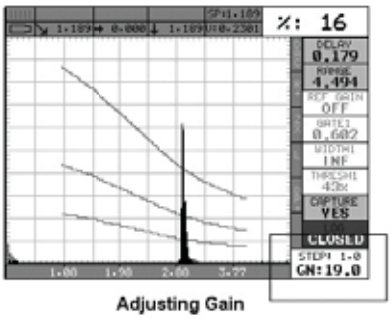
4.3 Gain

The gain feature of the **FX80** is used to adjust the signal amplitude to a predetermined reference height for the inspection process. The higher the gain the more the sound is amplified. The gain, or amplification of the return echoes, can be adjusted in the **FX80** to accommodate a variety of applications. The setting of the gain is crucial in order to obtain valid readings during the inspection process.

Too much gain may result in erroneous measurements, by detecting on noise rather than the actual reflector or defect. Not enough gain may result in intermittent detection. It may also result in lack of detection on internal flaws, pits, or porosity. The gain can easily be compared to the volume control of a home stereo system. If you turn it up too much, you can't hear the music clearly. If it's turned down too much, you can't hear it at all. The ***FX80*** commands a 110dB gain range using 3 stages of amplification. The overall range makes the FX80 extremely versatile regarding a variety of applications and material types.

The **Gain** can be quickly adjusted at any time, as the ***FX80*** has dedicated buttons on the keypad for this purpose. The procedure to adjust the **Gain** are outlined below:

Gain



Adjusting Gain

1) Press the  and  arrow keys on the right button wheel to adjust the  setting.

2) Additionally, the increment **GAIN STEP** size can be adjusted at any time by pressing the  button and displaying the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

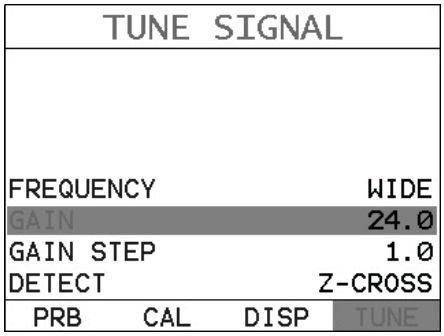
4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the  value is correctly displayed.

6) Press the  key to return to the measurement screen, or  to cancel entering the  **STEP**.

The user can also access and adjust the gain from the tabbed menus. However, this method is more tedious than making the adjustments using the **Hot Menus**. The procedure using the tabbed menus is outlined below:

Adjusting the Gain using the Tabbed Menus



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **TUNE** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until gain is highlighted.

3) Press the ◀ and ▶ arrow keys on the right button wheel to scroll the value. When the correct **Gain** is displayed, **proceed to step 8**.

4) **Alternatively**, press the ↵ key to display the **Digits Edit Box**.

5) Press the  and  arrow keys multiple times using the left button wheel to scroll the highlighted value.

6) Press the  and  arrow keys multiple times on the left button wheel to scroll the digit locations.

7) Repeat steps **5 & 6** until the **Gain** value is correctly displayed.

8) Press the 

key to set the **Gain** and return to the menu screen, or 

to cancel entering the **Gain**.

9) Finally, press the  key to return to the measurement screen.

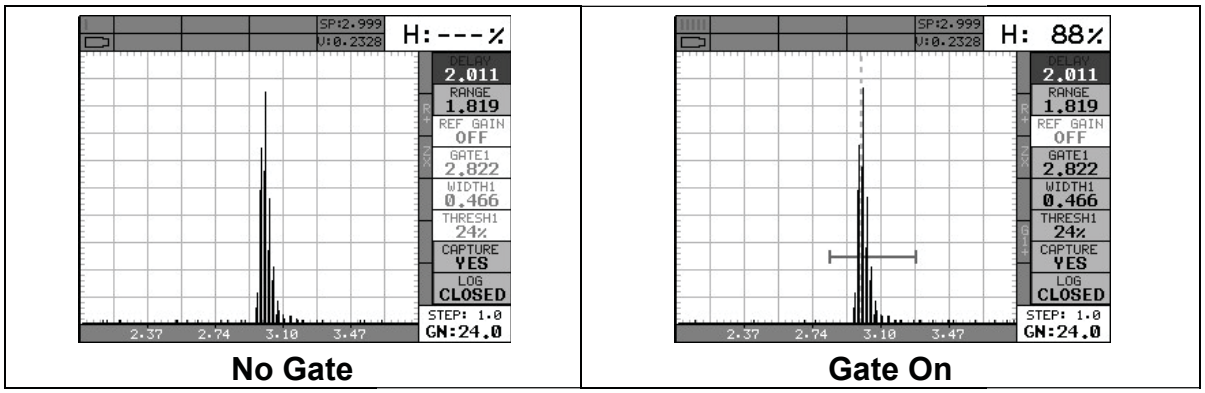
4.4 Gates

The gates are an important part of any ultrasonic device, in this case a flaw detector. The primary purpose of using a flaw detector is to “detect” and estimate the “size” of of flaws according to calibrated reference standards or simulated defects. The gates play an important role in this process, as without them a detection/measurement isn’t possible. The height of a gate is also a threshold, or controls the level of sensitivity. They can be adjusted to a specific reference height, based a predetermined reflector, and set to act as an alarm during the inspection process.

The more flexible a gate is, the better the possibilities for the user to setup an application. For example, a test block with a target size and depth is optimized on the A-Scan display with a signal amplitude at 70% full screen height. The inspector wants to know of any defects during the inspection that are greater than or equal in size to the calibrated test specimen. A gate is then enabled and set to a reference height of 70%. The width and range are adjusted to cover the range tested, and the inspection is underway.

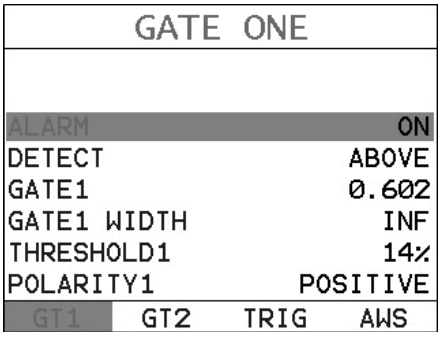
The ***FX80*** is equipped with 2 fully independent gates. Each gate has a start and stop or width, a threshold, a polarity switch, and a detect option. A gate can only detect on reflections that occur inside the boundaries of the gate. Anything outside of the start and range/width of the gate will be ignored. Both gates can be enabled and set for different detects, polarities, and positioned anywhere on the A-Scan display independent of one another. The following sections cover enabling and setting up gates:

4.5 Activating and Setting Up a Gate



The screenshots above show a rectified waveform with and without a gate enabled. The commonly adjusted features of the gates can also be accessed using the Hot Menus. *For quick access and editing, refer to navigating the Hot Menus page 23.* The following steps outline how to enable a gate as follows:

Activating a Gate



Gate1

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **GT1** menu is highlighted and displaying the submenu

items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **ALARM** is highlighted.

3) Press the  and  arrow keys on the right button wheel to toggle **ALARM** to **ON**. The menu items should now become active and adjustable, as the gate is now activated.

Set Detect

1) Press the  and  arrow keys on the left button wheel until **DETECT** is highlighted.

2) Press the  and  arrow keys on the right button wheel to toggle the **ABOVE** or **BELOW**.

Note: *Above will trigger the alarm when a signal meets or exceeds the height of the gate, and below will detect on anything that meets or is below the height of the gate.*

Set Gate1 Start

1) Press the  and  arrow keys multiple times on the left button wheel until **GATE1** is highlighted, followed by pressing the  and

 arrow keys on the right button wheel to scroll the value. When the correct start position is displayed, proceed to the next menu item setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the start position is correctly displayed.

6) Press the  key to set the **GATE1** start position and return to the menu screen, or  to cancel entering the **GATE1** start position.

Note: *This is where the gate first turns on relative to the horizontal axis or depth. Sets the left boundary of the gate, or where it turns on.*

<u>Set Gate1 Width</u>

1) Press the  and  arrow keys multiple times on the left button wheel until **GATE1 WIDTH** is highlighted, followed by pressing the  and  arrow keys multiple times using the left button wheel to scroll the value. When the correct width is displayed, proceed to the next menu item setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the **Width** is correctly displayed.

6) Press the  key to set the **GATE1 WIDTH** and return to the menu screen, or  to cancel entering the **GATE1 WIDTH**.

Note: *This sets the overall width of the gate in terms of the horizontal axis or depth. Sets the right boundary of the gate, or where it turns off.*

<u>Set Threshold1 Level</u>

1) Press the  and  arrow keys multiple times on the left button wheel until **THRESHOLD1** is highlighted, followed by pressing the  and  arrow keys multiple times using the left button wheel to scroll the value. When the correct threshold level is displayed, proceed to the next menu item setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the threshold level is correctly displayed.

6) Press the 

key to set the **THRESHOLD1** level and return to the menu screen, or 

to cancel entering the **THRESHOLD1** level.

Note: *This sets the overall sensitivity level of the gate which is the threshold.*

<u>Select Gate Polarity</u>

1) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **POLARITY1** is highlighted.

2) Press the  and  arrow keys multiple times using the left button wheel to toggle the **POLARITY** feature positive or negative.

3) Press the  key to return to the measurement screen.

Note: *The **GATE1** and **WIDTH1** values can now be adjusted or tuned directly from the Hot Menus on the main measurement screen.*

Note: *Sets where the detection will occur, on the negative or positive going echoes.*

CHAPTER FIVE
CALIBRATION

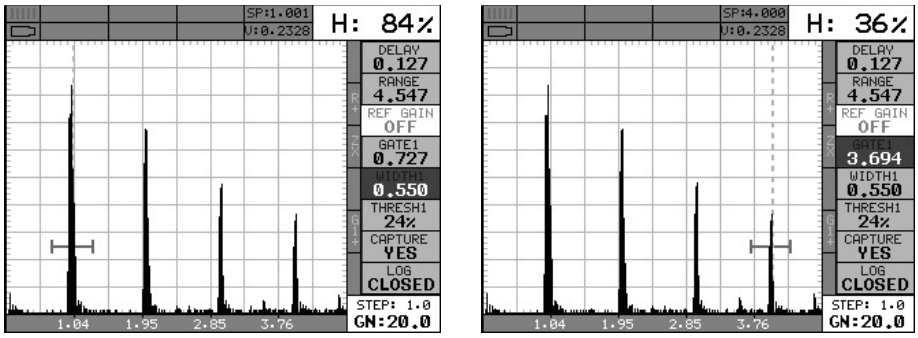
In this section we'll focus on calibrating the ***FX80***. There are a number of ways to go about performing a calibration, but we'll be focusing on the simplest and most accurate method, which is performing a two point calibration. This method is very convenient, as it will automatically calculate the material velocity and zero using a minimum and maximum calibration standard of know thickness and material type. The ***FX80*** can certainly be manually calibrated by adjusting the velocity and zero features, but this is a tedious and redundant process overall.

The two point calibration method can be used for both straight and angle beam transducers. A number of certified calibration standards are available to address inspection code requirements, specifications, and applications. It should be noted again that the ***FX80*** has virtually 2 gauges built into a single gauge; a flaw detector, and a thickness gauge. Therefore, while the flaw detector option can be calibrated for straight beam contact and angle beam style transducers, the thickness gauge option contains a number of tools for using single and dual element style transducers with linearity tables and v-path correction curves. In addition, it should also be noted that the thickness gauge option has a fully functional scope with the same precision linearity as the flaw detector option. Therefore, the user should consider the current application to determine which gauge option will produce the best results. The following sections outline how to setup and calibrate your ***FX80*** for field use, given a specific range and material type.

5.1 Setting Up For Calibration

This section covers performing a two point automatic calibration using a single element straight beam contact transducer with a range from 1 to 4 inches. In order to accomplish this, a set of calibration standards covering range is required. The steps are outlined as follows:

FX80 Setup



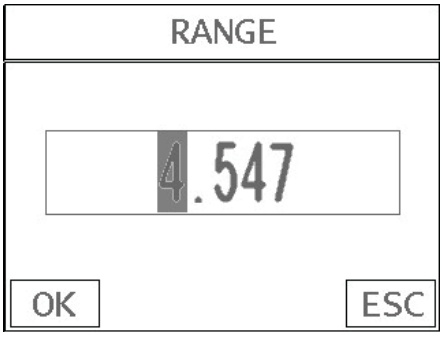
The gauge will require a few basic adjustments in order to get underway with the calibration process. For this example, in order to avoid multiple steps for setting the gauge features/options, the default setup will be loaded as a starting point. However, the user should invest the necessary time getting to know the features and options included in the ***FX80***, as well as gaining a good understanding of their function:

Loading Default Setup

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **SEUTP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **DEFAULT SETUP** is highlighted.
3) Press the ↵ key to display the **CONFIRM** screen.
4) Press the OK key to load the **DEFAULT SETUP**.

Setting the Range

1) Using the left button wheel, press the  and  arrow keys to scroll through the 8 individual Hot Menus, and the  and  arrow keys to scroll through the Hot Menu items, until the RANGE cell is highlighted. Alternatively, the  **&**  keys can be used to scroll through the Hot Menu items.



2) Press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the desired range value is displayed.

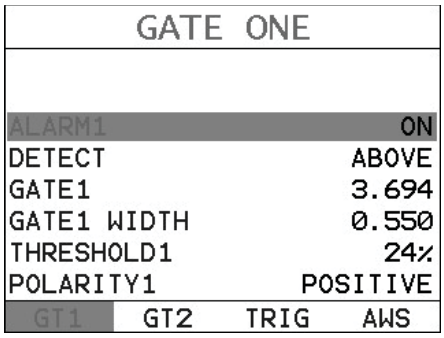
6) Press the 

key to set the value and return to the measure screen.

Note: *Our range calibration range for this example is 4 inches. Therefore setting a range great than 4 inches will enable the user to view the entire range on the display.*

<u>Enabling and Setting Up a Gate</u>

Refer to the illustrations above. In order to measure, a gate is required. The width of the gate should be small enough, in terms of its width, in order to select specific reflections to measure. The screenshot above shows a gate enabled to select the 1 inch calibration standard, and in the second the 4 inch calibration standard. *For quick access and editing, refer to navigating the Hot Menus page 23.*



Activating a Gate

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **GT1** menu is highlighted and displaying the submenu items.

   Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **ALARM1** is highlighted.

3) Press the ◀ and ▶ arrow keys on the right button wheel to toggle the gate **ON**.

Setting the Detect

1) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **DETECT** is highlighted.

2) Press the  and  arrow keys on the right button wheel to toggle the option **ABOVE**.

Gate1 Start

1) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **GATE1** is highlighted.

2) Press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the desired **GATE1** value is displayed.

Note: *In our example, a value less than 1 inch should be selected.*

6) Press the 

key to set the value and return to the **GT1** menu.

Gate1 Width

1) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **GATE1 WIDTH** is highlighted.

2) Press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the desired **GATE1 WIDTH** value is displayed.

Note: *In our example, a value greater than 1 inch should be selected.*

6) Press the  key to set the value and return to the **GT1** menu.

<u>Threshold Level</u>

1) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **THRESHOLD1** is highlighted.

2) Press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the desired **THRESHOLD1** value is displayed.

Note: *In our example, a value of 20% has been selected. However, the user should set a value that will be close enough to the baseline to avoid a "Peak Jump", or missing the first cycle.*

6) Press the OK key to set the value and return to the **GT1** menu.

Setting Polarity

1) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **POLARITY1** is highlighted.

2) Press the ◀ and ▶ arrow keys multiple times using the left button wheel to toggle the polarity **POSITIVE**.

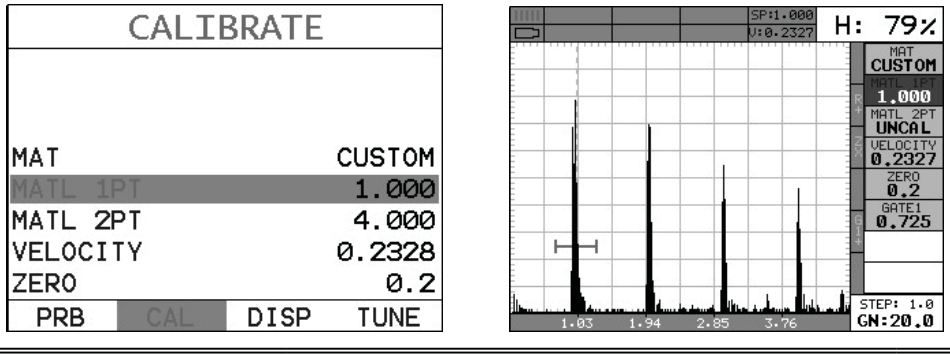
3) Press the 🏠 key to return to the measurement screen and get started with the two point calibration.

5.2 Straight Beam Calibration

Now that the ***FX80*** is setup with a valid range and a gate enabled, we're ready to perform a two point calibration using a single element contact style transducer, as follows:

For quick access and editing, refer to navigating the Hot Menus page 23. In the screenshot below, notice the Hot Menu representing the CAL menu is being displayed on the right side of the display.

Two Point Calibration – Straight Beam



Note: *Calibration standards representing the minimum and maximum thickness of the overall inspection range intended are required. They must also be of the same material type as the intended application. For our example, we'll be using a 1 and 4 inch standard for calibration.*

Coupling to the 1" Cal Standard (1st Point)

Apply a drop of couplant on the transducer and place the transducer in steady contact with the 1" calibration standard. Be sure that the reading is stable and the repeatability indicator, in the top left corner of the display, is fully lit and stable. Also, be sure there is sufficient signal amplitude in order to avoid 'peak jumping' or missing the first cycle.

Adjusting the Gate

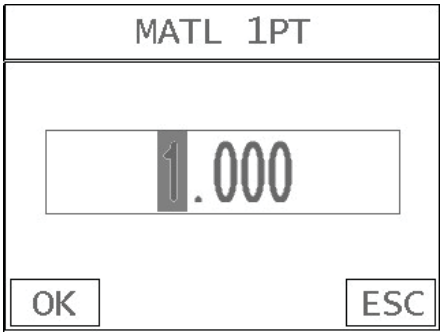
1) Using the left button wheel, press the  and  arrow keys to scroll through the 9 individual Hot Menus, and the  and  arrow keys to scroll through the Hot Menu items, until the **GATE1** cell is highlighted. Alternatively, the  **&**  keys can be used to scroll through the Hot Menu items.

2) Press the  and  arrow keys on the right button wheel to move the gate over the waveform to be measured, as demonstrated in the screen shot above.

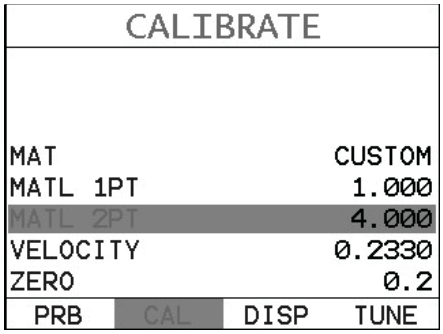
Note: *In order to trigger on a signal, the waveform must be inside the boundaries of the gate.*

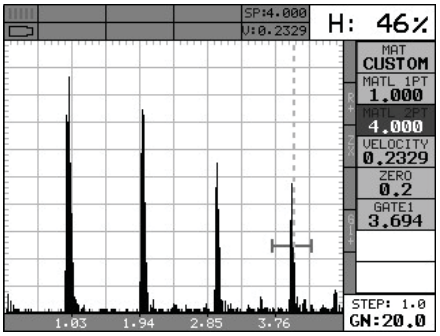
Calibrating the First Point

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items, as shown in the screenshot above. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **MATL 1PT** is highlighted.



3) Press the ↵ key to display the **Digits Edit Box**.
4) Press the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll the highlighted value.
5) Press the ◀ and ▶ arrow keys multiple times using the left button wheel to scroll the digit locations.
6) Repeat steps **4 & 5** until the known thickness value is correctly displayed.
7) Press the OK key to calculate the velocity and return to the menu screen, or esc to cancel the one point calibration.
8) Finally, press the ⌂ key to return to the Measurement screen.





Apply a drop of couplant on the transducer and place the transducer in steady contact with the 4" calibration standard. Be sure that the reading is stable and the repeatability indicator, in the top left corner of the display, is fully lit and stable. Also, be sure there is sufficient signal amplitude in order to avoid 'peak jumping' or missing the first cycle.

Adjusting the Gate

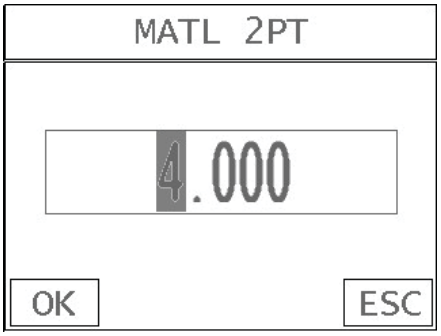
1) Press the key once to activate the measure menu items. Press the key multiple times to move right and the esc key multiple times to move left, until the **GATE1** cell is highlighted. Alternatively, press the and arrow keys multiple times using the left button wheel.

2) Press the and arrow keys on the right button wheel to move the gate over the waveform to be measured, as demonstrated in the screen shot above.

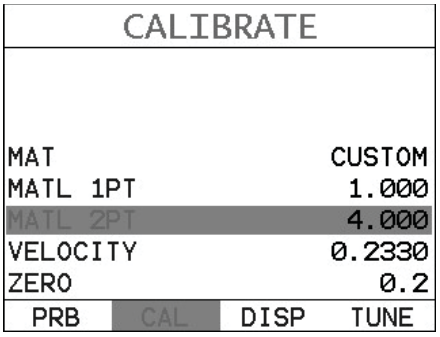
Note: *In order to trigger on a signal, the waveform must be inside the boundaries of the gate.*

Calibrating the Second Point

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items, as shown in the screenshot above. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **MATL 2PT** is highlighted.



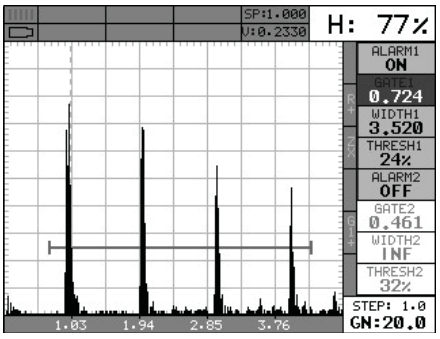
3) Press the ↵ key to display the **Digits Edit Box**.
4) Press the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll the highlighted value.
5) Press the ◀ and ▶ arrow keys multiple times using the left button wheel to scroll the digit locations.
6) Repeat steps **4 & 5** until the known thickness value is correctly displayed.
7) Press the OK key to calculate the velocity and return to the menu screen, or esc to cancel the one point calibration.



Note: *A velocity and zero value will be calculated and displayed in the fields a shown above.*

8) Finally, press the  key to return to the measurement screen.

In order to trigger on anything that's detected in the calibrated range, the boundaries of the gate must be adjusted to include the entire range. **Caution:** in both z-cross & flank detection settings, the first signal to cross the gate will be triggered on. However, if the **peak** detection setting has been enabled, the signal with the most amplitude will be detected.

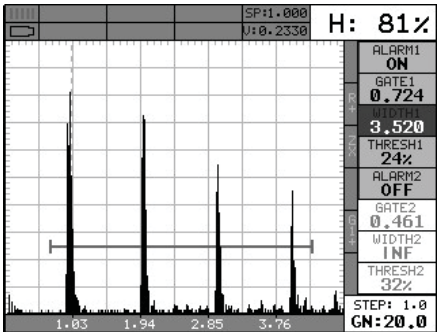


<u>Adjusting the Gate to Calibrated Range</u>

1) Using the left button wheel, press the  and  arrow keys to scroll through the 9 individual Hot Menus, and the  and  arrow keys to scroll through the Hot Menu items until the **GATE1** cell is

highlighted. Alternatively, the  **&**  keys can be used to scroll through the Hot Menu items.

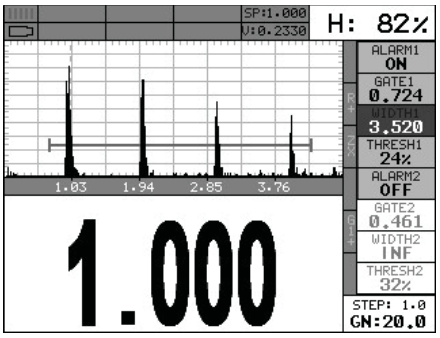
2) Press the  and  arrow keys on the right button wheel to move the gate start to a position less than 1 inch.



3) Press the  key once to highlight the **WIDTH1** cell. Alternatively, use the  and  arrow keys on the left button wheel

4) Press the  and  arrow keys on the right button wheel to move the gate start to a position greater than 4 inches.

Note: ***CHECK YOUR CALIBRATION!*** *Place the transducer back on the one inch point, and any others in the given range, to confirm linearity. If the velocity and zero values we calculated correctly, the thickness reading will match the known thickness of the calibration standards. If the thickness is not correct, repeat the steps above.*



5) Press the OK key once to display the split screen with the thickness value.

5.3 Angle Beam Calibration

In the first example we demonstrated how to perform a two point calibration using a single element straight beam contact transducer. With the exception of a handful of additional comments, calibration using an angle beam transducer is virtually identical in the scope of the overall step by step process. To avoid copying the procedures from the previous section, we'll focus only on the additional comments. Refer to section 5.1 and 5.2, regarding the procedures to setup and calibrate the ***FX80***. The following are a list of additional items to consider when using an angle beam transducer, as follows:

Calibration Standards:

There are a number of calibration block options available in a variety of common material types, and according to specific code requirements. The user should consider the application, codes applicable, and purchase the necessary calibration standards.

Shear versus Longitudinal Velocity:

Unlike the previous straight beam calibration, which uses a longitudinal wave, an angle beam transducer uses a shear wave. The following is a brief review of the waves:

- **Longitudinal –**
  - Particle motion is parallel to the direction of wave travel.
  - Travels in solids, liquids, and gasses.
  - Fastest mode of vibration.
- **Shear –**
  - Particle motion is perpendicular to the direction of wave travel.
  - Travels only in solids.

- Is approximately ½ the velocity of longitudinal waves.
- Has a shorter wavelength than a longitudinal at the same frequency.

Therefore, a two point calibration using an angle beam transducer will result in a velocity approximately ½ the speed of the velocity calculated from the straight beam calibration in the previous section.

Gain and Amplitude Ratio:

During an angle beam calibration the overall amplitude height of the waveform is critical for "peaking up". Therefore the maximum amplitude of the waveform must be visible on the display in order to correctly position the transducer on the calibration standard. The user should select a screen height and gain level that will enable the entire waveform to be visible on the display.

Peaking Up the Signal Amplitude:

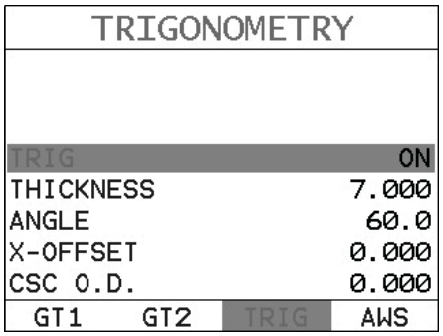
During an angle beam calibration, it's important to peak up the overall amplitude of the waveform to its maximum potential. The primary purpose is to be sure the transducer is positioned properly on the calibration standard, that's producing return echoes at different distances. **For example:** If the operator is using a DSC block to calibrate the velocity and zero, a DSC block will produce echoes at 1 & 5, or 3 & 7 inches. The operator then positions the transducer on an index point, moves the transducer in both directions forward and backward, rotates it side to side, and watches the signal amplitude to find the maximum potential. At the maximum potential, the transducer is correctly positioned to measure both multiple echoes at the correct distances, and ready to proceed with the calibration.

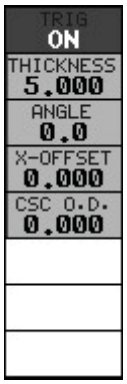
Selecting the Material Type:

The user can also select a material type directly from a table built into the ***FX80*** with shear wave values. This would only get the user close, in terms of velocity, to the calibration standards material type. In order to display the material chart with shear wave values, the **TRIG** mode must be enabled. The following outlines the steps to enable the shear wave velocity table and select a material type from the chart:

For quick access and editing, refer to navigating the Hot Menus page 23.

Selecting the Material Type





1) Press the ≡ key once to activate the menu items tab. Press the ≡ key multiple times to tab right and the esc key multiple times to tab left until the **TRIG** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Press the ◀ and ▶ arrow keys on the right button wheel to toggle **TRIG** mode **ON**.

3) Press the ≡ key once to activate the menu items tab. Press the ≡ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

4) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **MAT** is highlighted.

5) Press the  key to display the list of material types.

6) Press the  and  arrow keys multiple times on the left button wheel to scroll through the material list until the appropriate material is highlighted.

7) Press the  key to select the material type and initiate the overwrite confirmation screen.

8) Press the 

key to confirm the material selection, or 

key to cancel changing the material type.

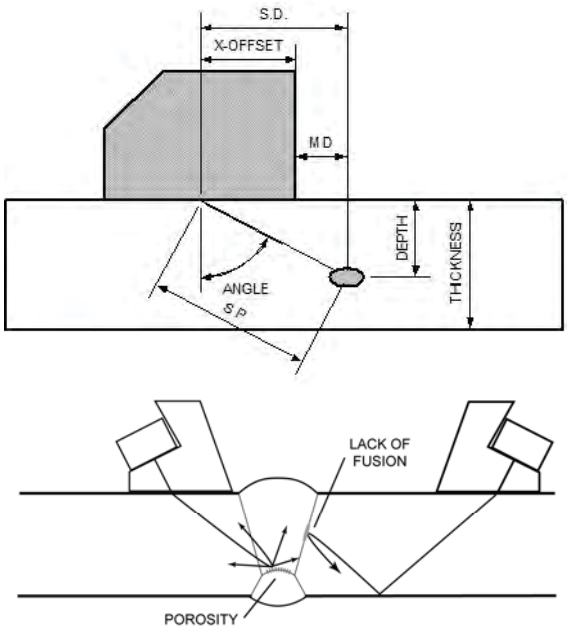
CHAPTER SIX
TRIGONOMETRY MODE

6.1 Introduction to TRIG

Trig mode is most commonly used for inspecting welded joints using an angle beam transducer. Based on the location, orientation, and geometry of the weld, a straight beam transducer is typically not suitable for inspection. As a result, a transducer emitting sound at a given angle will allow the operator to position the transducer away from the actual weld, and "skip" into the weld at a given angle. Therefore, in order to determine the location of a defect, given a specific angle, the trigonometry mode is used. This section will cover the steps to setup and utilize trigonometry mode.

6.2 Additional Comments

Prior to proceeding on to the next section outlining how to enable and setup the **TRIG** mode, a few additional items should be clarified:

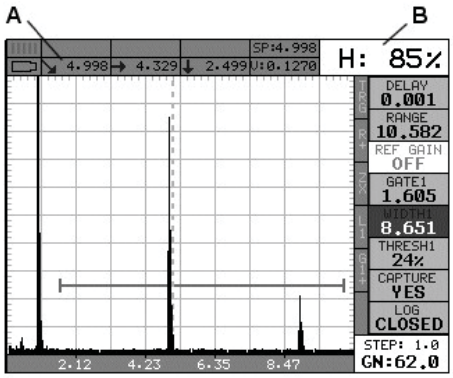


Angle Beam Transducer **Weld Inspection**

Refer to the Angle Beam Transducer diagram above:

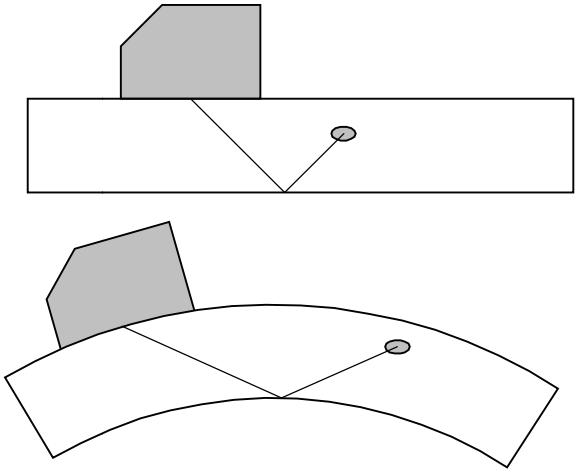
SP – Sound Path	X-Offset – Front of wedge less Index
Angle – Transducer Angle	SD – Surface Distance
Thickness – Material Thickness	Depth – Depth of flaw from surface

Screenshot Trig mode:



When **TRIG** mode is enabled, the calculated measurements will be displayed below the waveform display area at (A), and the signal amplitude as a percentage of full screen height at (B).

Curved Surface Correction:



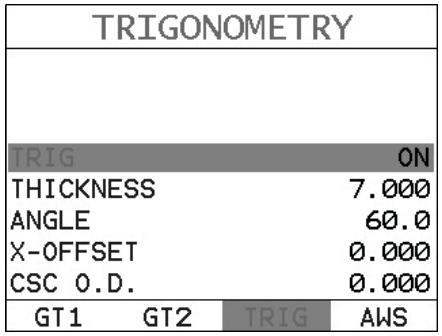
The ***FX80*** will also compensate for convex curved surfaces of longitudinally welded pipes. A curved surface will produce a greater sound path than a flat surface will, using a transducer with a given angle. The user should consider the angle used on curved surfaces, with respect to the material thickness, in order to be sure a reflection will occur from the opposite surface of the test material. In order to utilize the curved surface compensation, the outside diameter must be entered into the ***FX80***.

6.3 Setup Trigonometry Mode

This section provides a step by step procedure to enable and setup the **TRIG** mode.
Note: *A two point calibration should be done prior to proceeding. Refer to Chapter Five for the calibration procedures.*

For quick access and editing, refer to navigating the Hot Menus page 23.

Activating & Setting the Parameters



Activate Trig Mode

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **TRIG** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **TRIG** is highlighted.
3) Press the ◀ and ▶ arrow keys on the right button wheel to toggle the **TRIG** feature **ON**. The menu items should now become active and adjustable, as illustrated above.

Enter Material Thickness

1) Press the  and  arrow keys multiple times on the left button wheel until **THICKNESS** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to scroll the value. When the correct thickness is displayed, proceed to the next setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the thickness is correctly displayed.

6) Press the  key to set the **THICKNESS** and return to the menu screen, or  to cancel entering the **THICKNESS**.

Note: *Thickness is used to calculate the depth.*

<u>Transducer Angle</u>

1) Press the  and  arrow keys multiple times on the left button wheel until **ANGLE** is highlighted, followed by pressing the  and  arrow keys multiple times using the left button wheel to scroll the value. When the correct angle is displayed, proceed to the next setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the angle is correctly displayed.

6) Press the  key to set the **ANGLE** and return to the menu screen, or  to cancel entering the **ANGLE**.

X-Offset

1) Press the  and  arrow keys multiple times on the left button wheel until **X-OFFSET** is highlighted, followed by pressing the  and  arrow keys multiple times using the left button wheel to scroll the value. When the correct X-Offset is displayed, proceed to the next setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the X-Offset is correctly displayed.

6) Press the 

key to set the **X-OFFSET** and return to the menu screen, or 

to cancel entering the **X-OFFSET**.

Note: *The **X-Offset** is used for purposes of marking, and is physically measured with a ruler from the index point to the front edge of the transducer.*

Curved Surface Outside Diameter

1) Press the  and  arrow keys multiple times on the left button wheel until **CSC OD** is highlighted, followed by pressing the  and  arrow keys multiple times using the left button wheel to scroll the value. When the correct **CSC OD** is displayed, proceed to the next setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the **CSC OD** is correctly displayed.

6) Press the 

key to set the **CSC OD** and return to the menu screen, or 

to cancel entering the **CSC OD**.

Note: *The **CSC OD** value is only used for curved surfaces of longitudinally welded pipes.*

CHAPTER SEVEN
AWS – WELD INSPECTION

7.1 Introduction to AWS

AWS provides a toolkit for evaluating defects according to the American Welding Society D1.1 welding code. The code offers inspectors a method to classify discontinuities by calculating an Indication Rating (IR) using ultrasonics. This toolkit can be used in conjunction with **TRIG** mode, outlined in the previous chapter, to simultaneously display the sound path (SP), surface distance (SD), and depth (D). The following sections provide an outline for using the **AWS** feature.

7.2 Additional Comments

Since the ***FX80*** is a gain controlled instrument, the following formula applies:

A – B – C = D

Where:

A = Discontinuity Indication Rating (DI)

B = Reference Indication Level (IL)

C = Attenuation Factor (AF); or 2(SP – 1)

SP = sound path in inches (2dB loss per inch of material thickness)

D = Indication Rating (IR)

Note: *all values are in dB.*

Calibration Standards & Calibration:

In order to use the **AWS** feature, the operator must have calibration standards made with the same size reflector at different distances within the testing range. The standards should also be made of the same material type as the material to be inspected.

AWS D1.1 Standard:

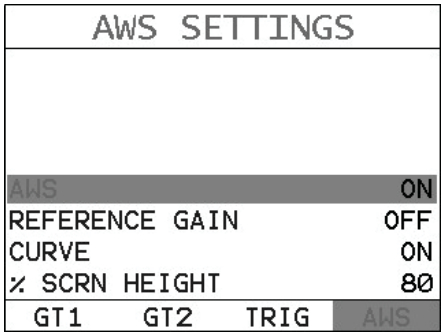
There are specific transducers that are required by the D1.1 standard. The frequency specified by the standard is 2-2.5MHz. The user should refer to the standard for further information.

7.3 Setup AWS

This section provides a step by step procedure to enable and setup the **AWS** feature.
Note: *A two point calibration should be done prior to proceeding. Refer to* ***Chapter Five*** *for the calibration procedures. The* ***TRIG*** *mode will also be used for weld inspection, and should additionally be setup prior to enabling the* ***AWS*** *feature. Refer to* ***Chapter Six*** *for instructions on setting up* ***TRIG*** *mode.*

For quick access and editing, refer to navigating the Hot Menus page 23.

Activating & Setting AWS



Activate Trig Mode

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **AWS** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **AWS** is highlighted.
3) Press the ◀ and ▶ arrow keys on the right button wheel to toggle the **AWS** feature **ON**. The menu items should now become active and adjustable, as illustrated above.

Toggle Curve On/Off

1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right, and the  key multiple times to tab left, until the **AWS** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **CURVE** is highlighted.

3) Press the  and  arrow keys on the right button wheel to toggle the **CURVE** feature  . The menu items should now become active and adjustable, as illustrated above.

<u>Enter % Screen Height</u>

1) Press the  and  arrow keys multiple times on the left button wheel until **% SCRN HEIGHT** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to scroll the value. When the correct height is displayed, proceed to the next setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the height is correctly displayed.

6) Press the  key to set the **% SCRN HEIGHT** and return to the menu screen, or  to cancel entering the **% SCRN HEIGHT**.

Note: *% Screen Height is an arbitrary level, and is not specified by the AWS D1.1. The user should set a value that will optimize viewing defects that are larger and smaller than the reference level. Typically this level is set between 50%-80% full screen height.*

Setting the Reference Gain

1) Press the  and  arrow keys multiple times on the left button wheel until **SET REF HEIGHT** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to toggle the feature **ON**.

2) Using the left button wheel, press the  and  arrow keys to scroll through the 9 individual Hot Menus, and the  and  arrow keys to scroll through the Hot Menu items until the **GATE1** cell is highlighted. Alternatively, the  **&**  keys can be used to scroll through the Hot Menu items.

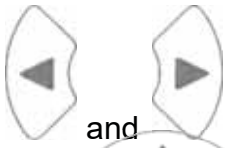
Note: *A gray cursor should be visible in the waveform area of the display. Also, since the **FX80** has been previous calibrated and the **TRIG** feature has been setup, a gate should be enabled and active.*

Peak Up on the Reflector

1) Apply couplant on the calibration standard, place the transducer in the correct area in position with the reflector, and slide the transducer around to locate the maximum amplitude.
2) Press the  and  arrow keys on the right button wheel to position the start of **GATE1** to trigger on the waveform.
3) Optionally, press the left button wheel, press the  and  arrow keys to scroll through the 9 individual Hot Menus, and the  and  arrow keys to scroll through the Hot Menu items until the **WIDTH1** cell is highlighted. Alternatively, the  **&**  keys can be used to scroll through the Hot Menu items.
4) Press the  and  arrow keys multiple times on the right button wheel to adjust the size or width of **GATE1.**

Note: *When the signal is in the gate, the height indicator will detect and display the % full screen height.*

Setting the Level

1) Press the left button wheel, press the  and  arrow keys to scroll through the 9 individual Hot Menus, and the  and   arrow keys to scroll through the Hot Menu items until the **AWS BOX:** cell is highlighted. Alternatively, the **&** keys can be used to scroll through the Hot Menu items.

2) Press the  and  arrow keys multiple times on the right button wheel, to position the cursor box over the waveform.

3) Press the  key to set the **REFGN** (reference gain).

Note: *This process can be repeated and reset multiple times, or until the **SET REF GAIN** feature is toggled **OFF**.*

4) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right, and the  key multiple times to tab left, until the **AWS** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

5) Press the  and  arrow keys multiple times on the left button wheel until **SET REF**  is highlighted, followed by pressing the  and  arrow keys to toggle **OFF**.

6) Finally, press the  key to return to the main measurement screen.

CHAPTER EIGHT
DISTANCE AMPLITUDE CORRECTION (DAC)

8.1 Introduction to DAC

A **DAC** curve is a gate with a variable threshold to compensate for a given reflector type and size measured at different depths. Unlike a standard gate, which typically has a fixed threshold level regardless of the depth, the **DAC** curve is more representative of the reflector size at different depths. In order to generate a **DAC** curve, calibration standards must made with the same material being inspected, the representative reflector size, and over a given thickness range. The **DAC** curve is then used as an alarm to inform the user about the size of any given reflector at any depth during the inspection process.

Once the **DAC** curve has been established, the user can display; -2dB, -6dB, -10dB, -12dB, -6/-12dB, -6/-14dB, DAC or GATE at any time. The initial **DAC** curve generated is always displayed in conjunction with any of the above **CURVE** options. Additionally, the alarm can be set to **TRIGGER** on any of the curve options displayed. Therefore, if the -6/-12dB curve option has been selected, the user can toggle the **TRIGGER** options: GATE, DAC, -6dB, or -12dB.

Note: *Based on the screen resolution of the **FX80**, the dynamic range of the **DAC** is approximately 18dB. As a result, inspection of any materials that attenuate more than 18dB over the inspection range, the **DAC** feature should not be used, and **TCG** (Time Corrected Gain) should optionally be considered.*

8.2 Additional Comments

Prior to proceeding onto the next section to create a **DAC** curve, a few additional items will help with the users selection process in the menu items:

- Up to 16 points can be used to generate a **DAC** curve.
- 3 or more points must be used in order to draw a **DAC** curve.
- All the **DAC** curve or gate combinations only detect when the amplitude of the signal is ‘at’ or ‘above’ the selected trigger option.
- Any of the **DAC** curves or gate displayed, can be set as the trigger alarm option.
- The measure (meas) options are as follows:

  dB –

  %DAC – At the **DAC** curve represents 100%. Any signal generating an amplitude below the **DAC** curve is less than 100%, and any above greater than 100%.

  %FSH – The top of the waveform display represents 100% full screen height. Any waveform amplitudes generated greater than 100% full

screen height will not be displayed. 100% is the greatest value that can be displayed.

Note: *The **MEAS** option selected is overridden with %FSH while the **DAC** curve is in **DRAW** mode. Once the **DRAW** mode is turned off, the select **MEAS** option will be displayed.*

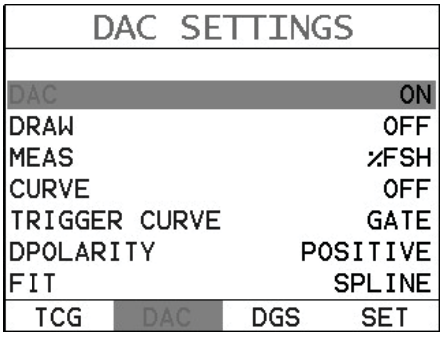
- The **MEAS**, **CURVE**, and **TRIGGER** options can be changed at any time once the **DAC** curve has been created.
- In order to move the highlighted cursor over a waveform to use as a point in generating the **DAC** curve, the **"DAC BOX:"** hot menu item in the main measurement screen must be highlighted.

8.3 Creating a DAC Curve

This section provides a step by step procedure to create a **DAC** curve. **Note:** *A two point calibration should be done prior to proceeding. Refer to Chapter Five for the calibration procedures. Also, if the **TRIG** function will be used, it should be setup prior to proceeding. Refer to **Chapter Six** for the setup procedure.*

For quick access and editing, refer to navigating the Hot Menus page 23.

Activating & Setting the Parameters



Activating DAC

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **DAC** menu is highlighted and displaying the submenu

items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **DAC** is highlighted.

3) Press the  and  arrow keys on the right button wheel to toggle the **DAC** feature **ON** or **AUDIBLE**. The menu items should now become active and adjustable, as illustrated above.

Activating Draw Mode

1) Press the  and  arrow keys multiple times on the left button wheel until **DRAW** is highlighted, followed by pressing the  and  arrow keys on the right button wheel until **ON** is displayed.

Quantity Displayed

1) Press the  and  arrow keys multiple times on the left button wheel until  is highlighted, followed by pressing the  and  arrow keys on the right button wheel to toggle and select **dB**, **%FSH**, or **%DAC**.

Selecting the Curve(s)

1) Press the  and  arrow keys multiple times on the left button wheel until **CURVE** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to toggle and select **DAC**, **-2**, **-4**, **-6**, **-10**, **(-6/-12)**, or **(-6/-14)** curve options. The **CURVE** option can be changed at any time after the **DAC** curve has been created.

Setting the Curve(s) Trigger

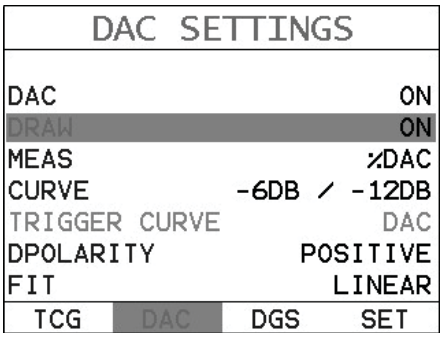
1) Press the  and  arrow keys multiple times on the left button wheel until **TRIGGER** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to toggle and select which curve or gate to use as the alarm trigger. The options displayed will vary according to which **CURVE** option has been selected above: **DAC**, **-2**, **-4**, **-6**, **-10**, **(-6/-12)**, or **(-6/-14)** curve options. The Trigger option can be changed at any time after the **DAC** curve has been created.

Selecting the Fit

1) Press the  and  arrow keys multiple times on the left button wheel until **FIT** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to select **SPLINE** or **LINEAR**.

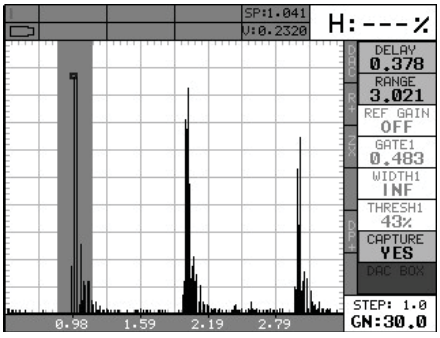
2) Proceed to the next section – Drawing the **DAC**.

Drawing the DAC

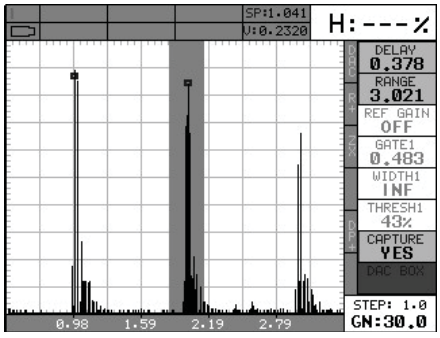


1) With all the parameters set in the previous section, press the  key to return to the main measurement screen.

Note: *The user should now see a highlighted cursor displayed in the waveform area, starting at the left most side of the display.*



ex. 1



ex. 2

2) Press the left button wheel, press the  and  arrow keys to scroll through the 9 individual Hot Menus, and the  and  arrow keys to scroll through the Hot Menu items until the **DAC BOX** cell is

highlighted. Now that the **DAC BOX** cell is highlighted, the cursor can be controlled by moving the  and  arrow keys on the right button wheel.

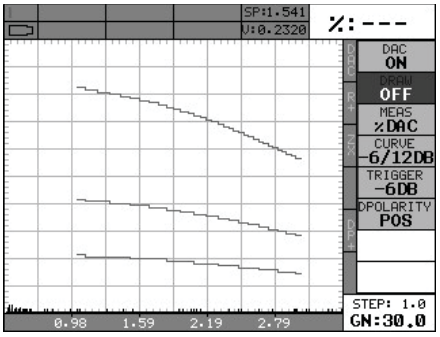
3) Couple the transducer to the first calibration standard, and peak up on the reflector, adjusting the gain to keep the signal height within the boundaries of the waveform display area, and at a suitable height to allow for attenuation at greater depths in the overall range to be tested.

4) Press the  and  arrow keys on the right button wheel to move the cursor over the waveform to be used as the first point in the **DAC** curve, and press the  key to set the first point. Illustrated in ex.1 above.

5) **Repeat steps 3 & 4** to set multiple points as is necessary. Illustrated in ex.2 above.

Note: *The **DAC** curve will be displayed after 3 points have been set/recorded, and will continue to be redrawn/updated for each additional point added, with a maximum of 16 points allowed.*

6) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right, and the  key multiple times to tab left, until the **DAC** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.



7) Press the  and  arrow keys multiple times on the left button wheel until **DRAW** is highlighted, followed by pressing the  and  arrow keys on the right button wheel until **OFF** is displayed. The **DAC** curves are now set and ready to be used for inspection.

CHAPTER NINE
TIME CORRECTED GAIN (TCG)

9.1 Introduction to TCG

The **TCG** feature increases gain as distance increases, in order to achieve an overall level of sensitivity for the same reflector at different distances. It is very similar to the **DAC** feature noted in a previous chapter. However, while a **DAC** curve plots points at given amplitudes and distances, generating a variable threshold, the **TCG** feature increases the gain at various distances to adjust the signal amplitude to a predetermined level of full screen height. Therefore, the amplitude of all signals at various distances will be displayed at the same reference level.

Note: *One of the advantages of the **TCG** feature over the **DAC** option is the dynamic range. The **TCG** feature has a maximum dynamic range of 50dB, while the **DAC** option is approximately 18dB. Therefore the **TCG** feature is a better solution for any materials that attenuate more than 18dB over the inspection range, and should be considered.*

9.2 Additional Comments

Prior to proceeding onto the next section to create a **TCG** curve, a few additional items will help with the user selection process in the menu items:

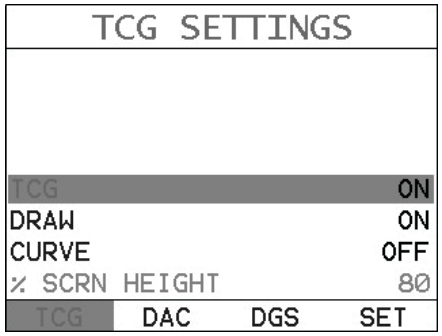
- Up to 16 points can be used to generate a **TCG** curve.
- 3 or more points must be used in order to draw a **TCG** curve.
- The gain will be adjusted at each point to display the signal amplitude at a predetermined reference level.
- In order to move the highlighted cursor over a waveform to use as a point in generating the **TCG** curve, the **"TCG BOX:"** hot menu item in the main measurement screen must be highlighted.

9.3 Creating a TCG Curve

This section provides a step by step procedure to create a **TCG** curve. **Note:** *A two point calibration should be done prior to proceeding. Refer to **Chapter Five** for the calibration procedures. Also, if the **TRIG** function will be used, it should be setup prior to proceeding. Refer to **Chapter Six** for the setup procedure.*

For quick access and editing, refer to navigating the Hot Menus page 23.

Setting TCG Parameters



Activating TCG

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **TCG** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **TCG** is highlighted.
3) Press the ◀ and ▶ arrow keys on the right button wheel to toggle the **TCG** feature **ON**. The menu items should now become active and adjustable, as illustrated above.

Enter % Screen Height

1) Press the ▲ and ▼ arrow keys multiple times on the left button wheel until **% SCRN HEIGHT** is highlighted, followed by pressing the

 and  arrow keys on the right button wheel to scroll the value. When the correct height is displayed, proceed to the next setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the height is correctly displayed.

6) Press the  key to set the **% SCRN HEIGHT** and return to the menu screen, or  to cancel entering the **% SCRN HEIGHT**.

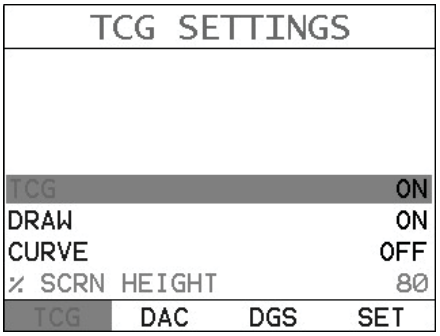
<u>Activating Draw Mode</u>

4) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **DRAW** is highlighted.

5) Press the  and  arrow keys on the right button wheel to toggle the **DRAW** feature **ON**.

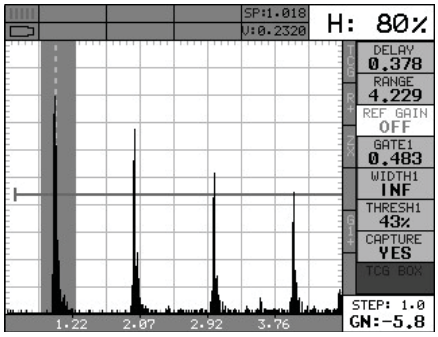
6) Proceed to the next section – Drawing the **TCG** curve.

<u>Drawing the TCG</u>

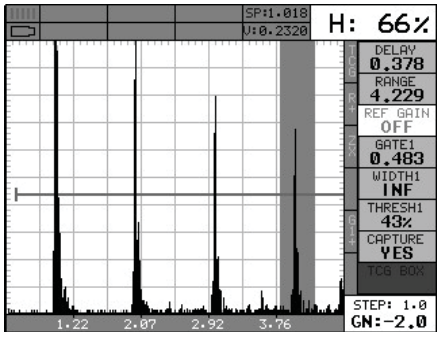


1) With all the parameters set in the previous section, press the key once to return to the main measurement screen.

Note: *The user should now see a highlighted cursor displayed in the waveform area, starting at the left most side of the display area.*



ex. 1



ex. 2

2) Press the left button wheel, press the and arrow keys to scroll through the 9 individual Hot Menus, and the and arrow keys to scroll through the Hot Menu items until the **TCG BOX:** cell is highlighted. Now that the **TCG BOX:** cell is highlighted, the cursor can be controlled by moving the and arrow keys on the right button wheel.

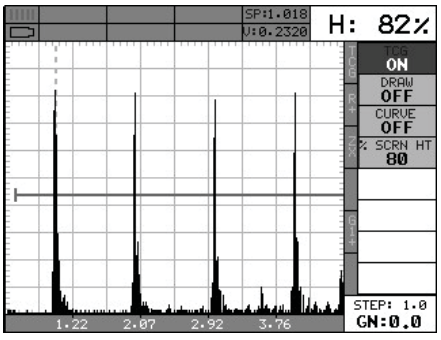
3) Couple the transducer to the first calibration standard, and peak up on the reflector to achieve maximum signal amplitude.

4) Press the  and  arrow keys on the right button wheel to move the cursor over the waveform to be used as the first point in the **TCG** curve, and press the  key to set the first point. Illustrated in ex.1 above.

5) **Repeat steps 3 & 4** to set multiple points as is necessary. Illustrated in ex.2 above.

Note: *You must set 3 points to draw a **TCG** curve, and a total of 16 points can be set. Any point can be cleared by pressing the*  *key when **DRAW** is active.*

6) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right, and the  key multiple times to tab left, until the **TCG** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.



7) Press the  and  arrow keys multiple times on the left button wheel until **DRAW** is highlighted, followed by pressing the  and  arrow keys on the right button wheel until **OFF** is displayed. The **TCG** curve is now set.

8) Optionally, the **TCG** curve can be displayed by pressing the  and  arrow keys multiple times on the left button wheel until **CURVE** is highlighted, followed by pressing the  and  arrow keys on the right button wheel toggle **ON**.

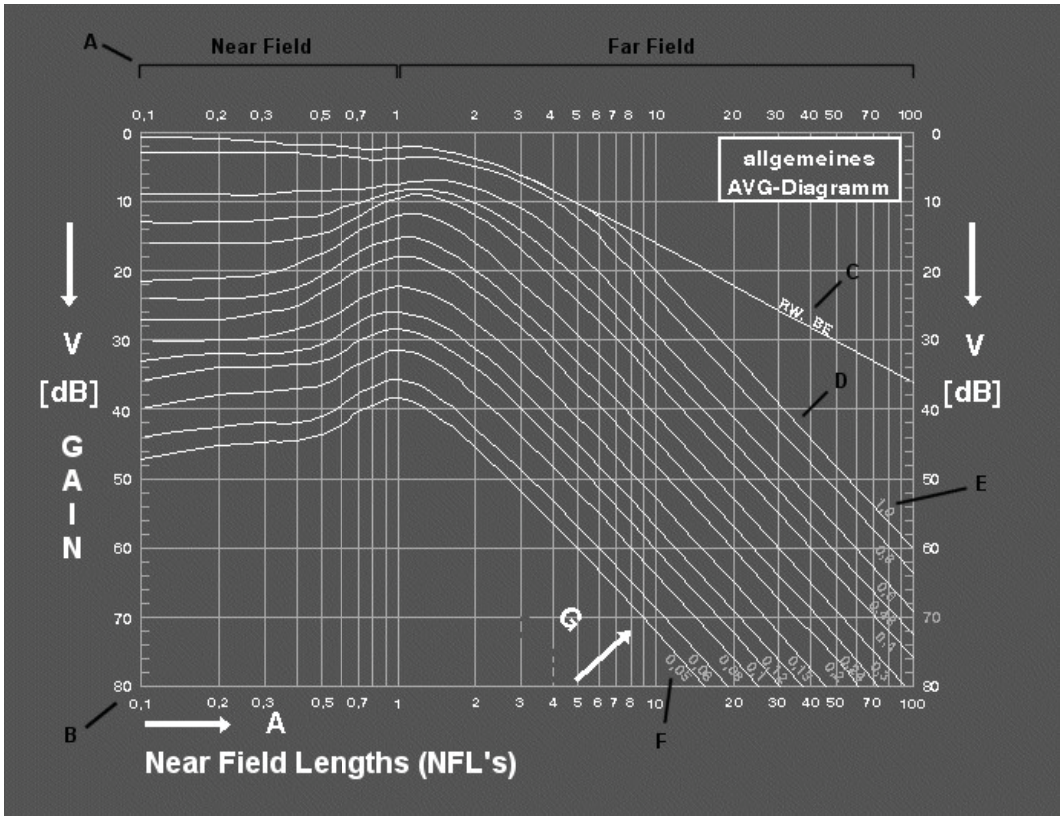
9) Press the  key to display the main measurement screen, and the **TCG** curve will be displayed.

CHAPTER TEN
DISTANCE, GAIN, SIZE (DGS)

10.1 Introduction to DGS (AVG)

The **DGS** (Distance, Gain, Size) method was introduced in 1958 as a way to standardize the process of evaluating and sizing defects, also referred to by the German acronym **AVG**. This method uses a combined empirical and mathematical model to eliminate the need for a large range of reference standards, generally required when using the **DAC** or **TCG** methods. **DGS** can be thought of as a mathematically derived **DAC** curve, and used as an alternative replacement for **DAC**.

The concept of the **DGS** method is to compare the amplitude/gain of similar reflectors at different distances and sizes, to mathematically approximate the size of the defect using the effective probe diameter, frequency and near field length (NFL). The reference to 'similar reflectors' assumes that the orientation of the reflector is the same for all sizes, which is unrealistic to assume during actual field testing. The diagram below illustrates the mathematically derived set of curves used for **DGS**:



Considerations:

- Should only be used with single element probes.
- The effective diameter must be estimated for standard transducers not certified for **DGS**.
- Center frequency clarity is required. Highly damped transducers can sometimes produce a broadband frequency range, and should not be used.

10.2 DGS Diagram

In order to get familiar with the **DGS** diagram, let's take a look at some of the general concepts. The near and far fields are referenced at point **(A)**. In the near field the wave front is not as uniform or consistent as the far field. As a result, the evaluation of flaws/defects are optimized in the far field when the wave front becomes uniform. Evaluating defects less than .7 NFL's is marginal at best.

The **DGS** diagram uses a logarithmic scale for both the Gain (dB) y axis, and near field length (NFL) distance at **(B)**. The curve at **(C)** is the back wall reflector. It's important to note that when the distance is doubled, the sound energy decreases by 1/2 (-6dB). However, a defect/reflector that's less than or equal to the effective diameter of the transducer, doubling the distance decreases the sound energy by 1/4 (-12dB), at **(D)**.

The curve at **(E)** represents a defect that is equal to 100% the effective diameter of the transducer, while 5% the effective diameter at **(F)**. As an example for using this diagram to determine a reflector size, consider the following: If I set my gauge for 80% screen height on a back wall reflector at 5 NFL's, and found a defect also at 5 NFL's, but at 80% ($1/10^{th}$ = 20dB), the ERS would be 30% of the effective diameter.

10.3 Estimating Effective Diameter

There are a number of transducers that are specially documented as ***DGS/AVG*** transducers. What this typically infers is that the effective diameter, near field length, and center frequency have been determined and documented on the transducer certificate. If **DGS/AVG** transducers are being used, the values for effective diameter and frequency can simply be entered into the ***FX80***. However, if a standard transducer will be used and has a standard transducer certificate, the effective diameter must be estimated in order to determine the near field length (NFL).

Calculating NFL

$$N = \frac{D_{EFF-\lambda^2}^2}{(4\lambda)}$$

Where:
N = Near Field Length
D_{EFF} = Effective Diameter
λ = Wave Length (velocity/frequency)

In order to approximate the effective diameter, the shape of the crystal must be taken into account. Transducers are either round or square/rectangular in shape, and can be approximated as follows:

Round Crystal (D_{EFF})

$$D_{EFF} = (Dia.)(.97)$$

Where:
D_{EFF} = Effective Diameter
Dia. = Diameter of the crystal
0.97 = Fixed ratio

Square/Rectangle (D_{EFF})

$$K = 0.6935\left(\frac{B}{A}\right)^3 - 0.3753\left(\frac{B}{A}\right)^2 + 0.0661\left(\frac{B}{A}\right) + 0.9863$$

Where:
K = Aspect Ratio
A = Largest Dimension
B = Smallest Dimension

$$D_{EFF} = 0.97\left(\sqrt{K}\right)(A)$$

Where:
D_{EFF} = Effective Diameter
K = Aspect Ratio

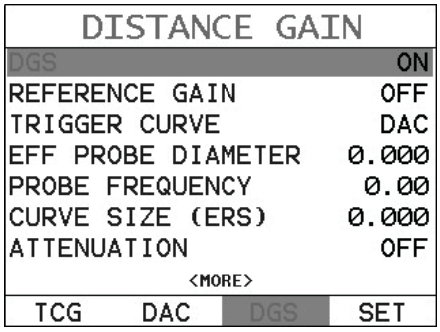
A = Largest Dimension
0.97 = Fixed Ratio

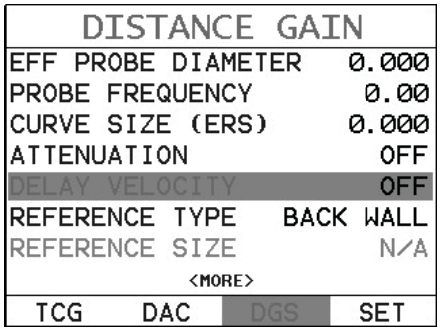
Calculated results can also be compared to the following table:

Ratio of the sides	
B/A	**K**
1.0	1.37
0.9	1.25
0.8	1.15
0.7	1.09
0.6	1.04
0.5	1.01
0.4	1.00
0.3	0.99
0.2	0.99
0.1	0.99

10.4 Parameter Definitions DGS(AVG)

This section outlines the parameters in the DGS/AVG toolbox, and provides a brief definition of each parameter:





DGS: Activate the DGS on/off.

Reference Gain: Activated to set the reference gain using a given reflector from a calibration standard.

Trigger Curve: Enables the user to set the detection curve to either **DGS** or **GATE**. This will be the curve used to trigger the alarms and display the effective reflector size (ERS) during the inspection process.

Effective Probe Diameter: A variable used to calculate the near field length of a given transducer, and determine the defect size. The effective diameter will be noted on the transducer calibration certificate for a standard DGS transducer. However, this can be estimated using the formulas outlined in section 10.3.

Probe Frequency: Refers to the center frequency of the transducer being used, and used in the calculation of the near field length.

Curve Size (ERS): Used to select which curve will be used, based on the reflector size, from the DGS(AVG) chart in section 10.1. If the value entered is not an exact curve value represented in the diagram, the ***FX80*** will compare and interpolate between the two closest curves, and mathematically derive a curve for that value.

Attenuation: Used to additionally compensate other factors leading to the loss of sound/energy. Refer to section 10.5 for more information on the attenuation parameters. If all the attenuation values are set to zero, the attenuation feature will display off.

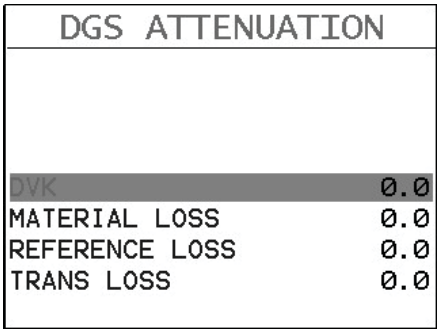
Delay Velocity: The longitudinal velocity of the delay line, most commonly used with angle beam style probes, but also used with 90 degree compression probes. It's important to note that in order for this to be accurate, the 'probe zero' must be accurate. This is easily accomplished performing a two point calibration (auto cal).

Reference Type: This option enables the user to select the type of reflector that will be used during calibration and setup. The options are Back Wall, Flat Bottom Hole (FBH), or Side Drilled Hole (SDH).

Reference Size: Assuming the reference type selected is either FBH or SDH, the user will be required to enter the size of the reference reflector.

10.5 Attenuation Parameters

The attenuation section is setup to accommodate additional factors that can affect the accuracy of the amplitude or sound energy, considering different application scenarios. The following parameters are outline below:



DVK (Curvature Correction): If a V1/K1 or V2/K2 (A2/A4, IIW/Kidney) calibration standard is used as a reference reflector, the curved surface offers additional focus

normally resulting in greater signal output. **DVK** is a correction to the gain, in order to simulate the amplitude generated from a flat back wall. This will typically result in an overall gain increase.

Material Loss: Used to correct for the attenuation (loss) of sound energy in the test material; in units of dB/in. or dB/meter. Should be considered during inspections where the sound has to travel long distances, or the material is very attenuative.

Reference Loss: Used to correct for the attenuation (loss) of sound energy in the calibration/reference standard; in units of dB/in. or dB/meter.

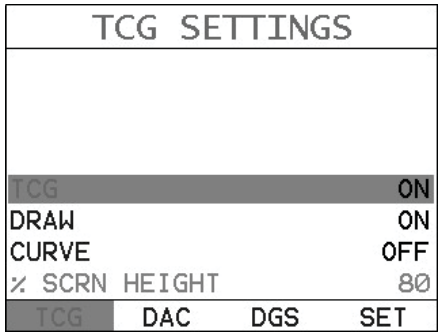
Transfer Loss: Correction factor to account for the loss of sound energy from surface condition/roughness or inadequate coupling between the transducer and test specimen. The surface condition of calibration/reference standards and actual material being tested in the field will typically vary. This is generally approximated based on the inspectors experience in the field. Units are dB/in., or dB/meter.

10.6 Creating a DGS Curve

This section provides a step by step procedure to create a **TCG** curve. **Note:** *a two point calibration should be done prior to proceeding. Refer to* ***Chapter Five*** *for the calibration procedures. Also, if the* ***TRIG*** *function will be used, it should be setup prior to proceeding. Refer to* ***Chapter Six*** *for the setup procedure.*

For quick access and editing, refer to navigating the Hot Menus page 23.

Setting DGS Parameters



Activating DGS

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times

to tab left, until the **DGS** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **DGS** is highlighted.

3) Press the  and  arrow keys on the right button wheel to toggle the **DGS** feature **ON**. The menu items should now become active and adjustable, as illustrated above.

Trigger Curve

1) Press the  and  arrow keys multiple times on the left button wheel until **TRIGGER CURVE** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to scroll the curve options. When the correct curve is displayed, proceed to the next setting.

Effective Diameter

1) Press the  and  arrow keys multiple times on the left button wheel until **EFF PROBE DIAMETER** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to scroll the value. When the correct diameter is displayed, proceed to the next setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the diameter is correctly displayed.

7) Press the 

key to set the **EFF PROBE DIAMETER** and return to the menu screen, or 

to cancel entering the **EFF PROBE DIAMETER**.

<u>Probe Frequency</u>

1) Press the  and  arrow keys multiple times on the left button wheel until **PROBE FREQUENCY** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to scroll the value. When the correct frequency is displayed, proceed to the next setting.

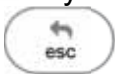
2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the frequency is correctly displayed.

6) Press the 

key to set the **PROBE FREQUENCY** and return to the menu screen, or 

to cancel entering the **PROBE FREQUENCY**.

Curve Size (ERS)

2) Press the  and  arrow keys multiple times on the left button wheel until **ERS** is highlighted, followed by pressing the  and  arrow keys on the right button wheel to scroll the value. When the correct **ERS** is displayed, proceed to the next setting.

2) **Alternatively**, press the  key to display the **Digits Edit Box**.

3) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

5) Repeat steps **3 & 4** until the **ERS** is correctly displayed.

6) Press the 

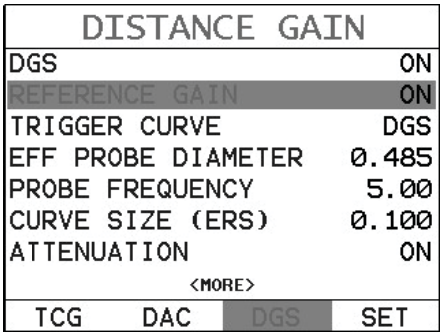
key to set the **ERS** and return to the menu screen, or 

to cancel entering the **ERS**.

Attenuation (All Parameters)

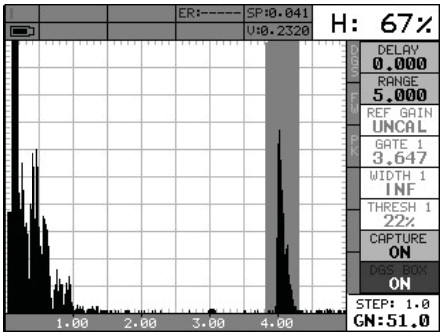
1) Press the  and  arrow keys multiple times on the left button wheel until **ATTENUATION** is highlighted, followed by pressing the  key on the left button wheel to enter the **ATTENUATION** sub menu.
2) Press the  and  arrow keys multiple times on the left button wheel to scroll the correct attenuation parameter is highlighted.
3) Press the  and  arrow keys multiple times on the left button wheel until the desire attenuation parameter is highlighted, followed by pressing the  and  arrow keys on the right button wheel to scroll the value. When the correct value is displayed, proceed to the next parameter.
4) **Alternatively**, press the  key to display the **Digits Edit Box**.
5) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.
6) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.
7) Repeat steps **5 & 6** until the parameter value is correctly displayed.
8) Press the  key to set the value and return to the **ATTENUATION** sub menu screen, or  to cancel entering the parameter value.

Drawing the DGS Curve



1) Press the  and  arrow keys multiple times on the left button wheel until **REFERENCE**  is highlighted, followed by pressing the  and  arrow keys on the right button wheel to toggle on. With all the parameters set in the previous section, press the  key to return to the main measurement screen.

Note: *The user should now see a highlighted cursor displayed in the waveform area, starting at the left most side of the display. Also note that the* ***DGS BOX*** *will be highlighted in the hot menus on the right of the display.*

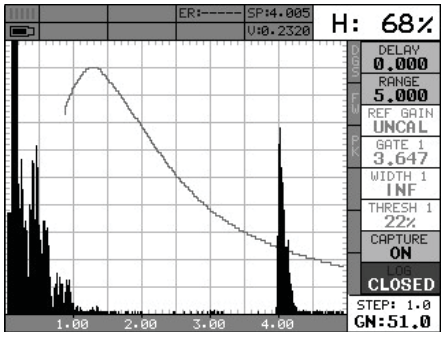


2) Couple the transducer to the first calibration standard, and peak up on the reflector, adjusting the gain to keep the signal height within the boundaries of the waveform display area, and at a suitable height to allow for attenuation at greater depths in the overall range to be tested.

3) Press the and arrow keys on the right button wheel to move the cursor over the waveform that will be used to set the **REFERENCE** and draw the **DGS** curve.

Note: *The **DGS** curve uses 16 points to plot the curve.*

4) Press the key once to activate the menu items tab. Press the key multiple times to tab right, and the key multiple times to tab left, until the **DGS** menu is highlighted and displaying the submenu items. Alternatively, press the and arrow keys multiple times using the left button wheel.



5) Press the and arrow keys multiple times on the left button wheel until **REFERENCE** is highlighted, followed by pressing the and arrow keys on the right button wheel to toggle **OFF**. The **DGS** curve is now set and ready to be used for inspection.

CHAPTER ELEVEN
ADDITIONAL FEATURES OF THE FX80

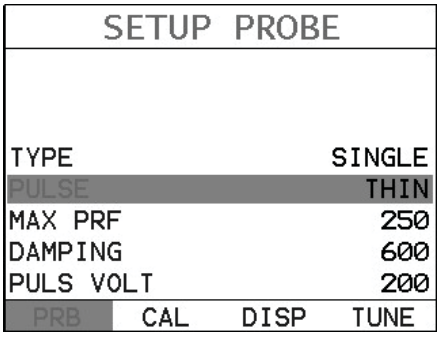
11.1 Pulse Width

The ***FX80*** has a square wave pulser with adjustable pulse width option. Pulse width, refers to the duration of time the pulser is left on. This time results in increased energy sent into the test material. There are three width options (**SPIKE, THIN,** and **WIDE**). The **SPIKE** setting may be desirable for high resolution and general applications to decrease the overall noise. When additional energy is needed, more penetration, the **THIN** and **WIDE** options may be necessary. The standard setting is **THIN**.

The ***FX80+*** is equipped with a "Tone Burst" style pulser, and supplies a constant amplitude pulse to the transducer for a set amount of time, which is adjustable. The key advantage using this type of pulser is that the frequency of the generated pulse can be tuned to the frequency of the transducer, the bursts can be adjusted/optimized, a clean narrow band ultrasonic wave produced, and exceptional output at a given voltage. Therefore, the output of a general square wave pulser at 400V is approximately 12dB less than a tuned 400V tone burst style pulser. The options for the ***FX80+*** pulse width settings are; **Spike, Thin, Wide, HV Spike, HV Thin, HV Wide, TB 10MHz, TB 5MHz, TB 2MHz, and TB 1MHz**. Depending on the setting selected, the pulser voltage options will include the applicable settings/options (i.e. if Thin is selected, the max output voltage option is 200V. However if HV Thin is selected, the max output voltage option is 400V – HV or high voltage, etc.). Once the pulse width option has been selected, refer to the pulser voltage menu option to adjust the desired voltage. The procedure to change the pulse width is outlined below:

For quick access and editing, refer to navigating the Hot Menus page 23.

Selecting the Pulse Width



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **TUNE** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.
2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **PULSE** is highlighted.
3) Use the  and  arrow keys on the right button wheel to scroll the **Pulse** options.
4) Once the **Pulse** is displayed, press the  key to return to the measurement screen.

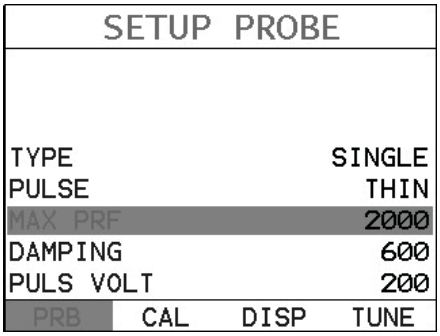
11.2 Pulse Repetition Frequency (PRF)

The ***FX80*** is equipped an adjustable pulse repetition rate, with adjustable settings of 8, 16, 32, 66, 125, 250, and 333Hz. The primary purpose is to control how fast the pulser is firing. The repetition rate is tied into the alarm LEDS. Therefore, when scanning at higher speeds, a higher repetition rate will make the alarm trigger more responsive. It's important to note that since the screen has a maximum refresh rate of 60Hz, or draws at 60 times a second, any **PRF** settings over this maximum will not be visible on the display. In fact, the human eye has a response rate of less than 60Hz.

The **PRF** setting will automatically be overridden according to the range set by the user. Long range settings will slow the **PRF** down automatically. Slower **PRF** settings will save on battery life. Therefore, if your current application doesn't call for fast scanning speeds, you can save battery life by selecting a slower **PRF**. The procedure to change the **MAX PRF** setting is outlined below:

For quick access and editing, refer to navigating the Hot Menus page 23.

Setting the Max PRF



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **PRB** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **MAX PRF** is highlighted.
3) Use the ◀ and ▶ arrow keys on the right button wheel to scroll the **PRF** options.
4) Once the desired **PRF** is displayed, press the ⌂ key to return to the measurement screen.

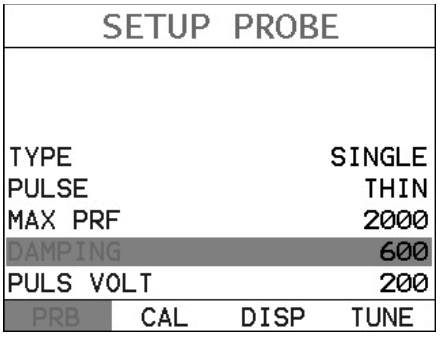
11.3 Damping

The ***FX80*** has an adjustable damping feature, enabling the user to select from a variety of settings according the transducer frequency and overall output. The range of the damping feature is 50-1500 ohms. The available steps are 50, 75, 100, 300, 600 and 1500 ohms. Lower frequency transducers require less damping because

they typically have higher impedance and distort. The reverse is true for higher frequency transducers. Nevertheless, trial and error with this feature will enable you to find the optimal signal response and setting for your transducer. The procedure to change the **DAMPING** is outlined below:

For quick access and editing, refer to navigating the Hot Menus page 23.

Selecting the Damping



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **PRB** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **DAMPING** is highlighted.
3) Use the ◀ and ▶ arrow keys on the right button wheel to scroll the **DAMPING** options.
4) Once the desired **DAMPING** is displayed, press the 🏠 key to return to the measurement screen.

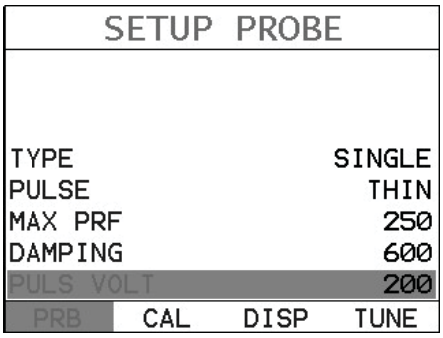
11.4 Pulser Voltage

The ***FX80*** has a 200 volt square wave pulser that can be adjusted for specific applications and transducers. The Pulser Volt feature offers a 50 volt cut/boost option to the user. The standard setting is 200 volts. This enables the ***FX80*** to offer greater penetration for difficult material types, or increased resolution on noisy materials.

The ***FX80+*** is equipped with a "Tone Burst" style pulser, and supplies a constant amplitude pulse to the transducer for a set amount of time, which is adjustable. The key advantage using this type of pulser is that the frequency of the generated pulse can be tuned to the frequency of the transducer, the bursts can be adjusted/optimized, a clean narrow band ultrasonic wave produced, and exceptional output at a given voltage. Therefore, the output of a general square wave pulser at 400V is approximately 12dB less than a tuned 400V tone burst style pulser. The options for the ***FX80+*** pulse width settings are; Spike, Thin, Wide, HV Spike, HV Thin, HV Wide, TB 10MHz, TB 5MHz, TB 2MHz, and TB 1MHz. Depending on the setting selected, the pulser voltage options will include the applicable settings/options (i.e. if Thin is selected, the max output voltage option is 200V. However if HV Thin is selected, the max output voltage option is 400V – HV or high voltage, etc.). **Note:** *The Pulser Voltage menu option is used in conjunction with the Pulse Width menu option. Refer to the Pulse Width menu options to select the desired voltages intended.* The procedure to change the pulser voltage is outlined below:

For quick access and editing, refer to navigating the Hot Menus page 23.

Changing the Pulser Voltage



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to

tab left until the **TUNE** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **PULSER VOLT** is highlighted.

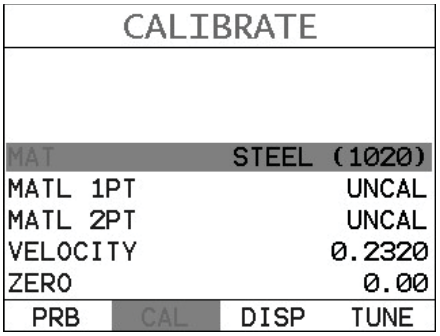
3) Use the  and  arrow keys on the right button wheel to scroll the **PULSER VOLT** options.

4) Once the desired **Pulser Voltage** is displayed, press the  key to return to the measurement screen.

11.5 Material Velocity Charts

The ***FX80*** has two material velocity charts built into the gauge with both longitudinal and shear material velocities. It should be noted that in order to display the chart containing the shear wave velocities the **TRIG** mode must be activated, as we've assumed an angle beam transducer will be used for the inspection process. The procedure is listed below:

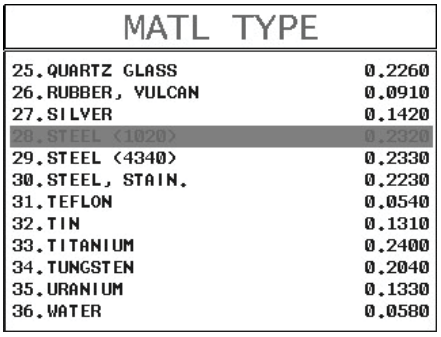
Selecting a Basic Material Type



1) Press the key once to activate the menu items tab. Press the key multiple times to tab right and the key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.

   Alternatively, press the and arrow keys multiple times using the left button wheel.

2) Use the and arrow keys multiple times on the left button wheel to scroll through the sub menu items until **MAT** is highlighted.



3) Press the key to display the list of material types.

4) Press the and arrow keys multiple times on the left button wheel to scroll through the material list until the appropriate material is highlighted.

5) Press the key to overwrite the material type and display the menu items with the new material type selected.

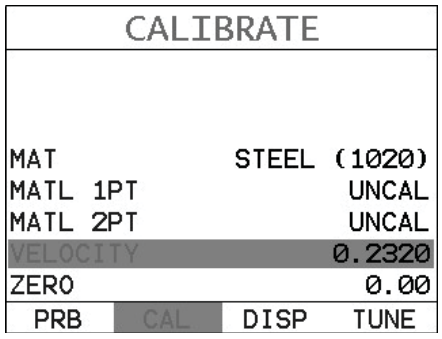
6) Finally, press the key to return to the measurement screen and begin taking readings.

11.6 Material Velocity

The ***FX80*** has a built in feature to manually adjust the material velocity to a known value in the calibration section of the ***FX80***. It should be noted that this does not calculate the zero value like the two point calibration option does. Therefore, if the material velocity is changed you should check the calibration. The procedures for adjusting the velocity are outlined below:

For quick access and editing, refer to navigating the Hot Menus page 23.

Adjusting Velocity



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **VELOCITY** is highlighted.
3) Press the ◀ and ▶ arrow keys on the right button wheel to scroll the value. When the correct velocity value is being displayed, **proceed to step 8**.

4) **Alternatively**, press the  key to display the **Digits Edit Box**.

5) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

6) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

7) Repeat steps **5 & 6** until the velocity value is correctly displayed.

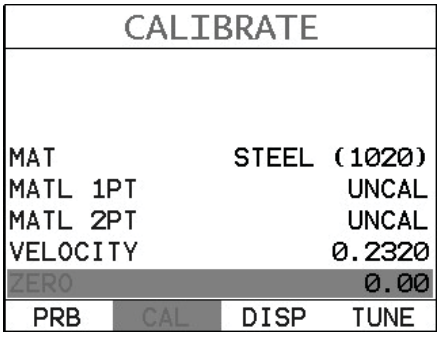
8) Press the  key to set the velocity and return to the menu screen, or  to cancel entering the velocity.

9) Finally, press the  key to return to the measurement screen.

11.7 Zero

The ***FX80*** has a feature to manually adjust the electronic zero. This feature used in conjunction with manually adjusting the velocity, are the primary features necessary to perform a 'crude' manual screen calibration. The procedure for adjusting the zero is listed below:

Adjusting Zero



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.

   Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **ZERO** is highlighted.

3) Press the  and  arrow keys multiple times using the left button wheel to scroll the value. When the correct zero value is being displayed, **proceed to step 8**.

4) **Alternatively**, press the  key to display the **Digits Edit Box**.

5) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

6) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

7) Repeat steps **5 & 6** until the zero value is correctly displayed.

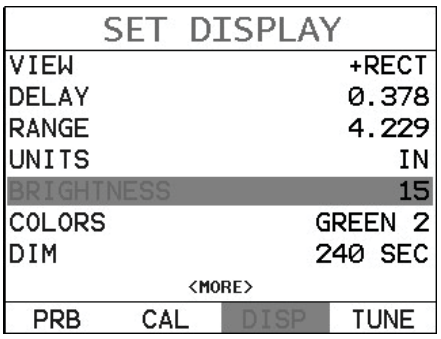
8) Press the  key to set the zero and return to the menu screen, or  to cancel entering the zero.

9) Finally, press the  key to return to the measurement screen.

11.8 Brightness

The ***FX80*** is equipped with a brightness feature to adjust the display visibility and optimize battery life. It has an arbitrary scale with values from 1-20, with 20 representing the brightest setting. The procedures for adjusting the brightness are outlined below:

Adjusting Brightness

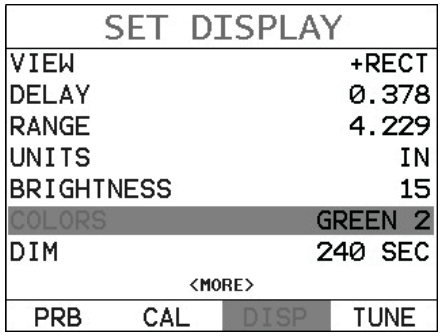


1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **DISP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **BRIGHTNESS** is highlighted.
3) Press the ◀ and ▶ arrow keys on the right button wheel to scroll the value.
4) Press the ⌂ key to return to the measurement screen and begin taking readings.

11.9 Color Scheme

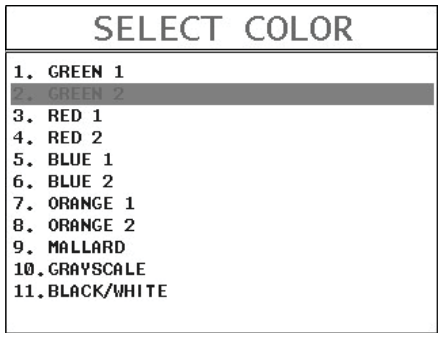
The ***FX80*** has a variety of display color options to select from. These will change the look and feel of the according to the users preference. The procedures for changing the **VIEW**, are outlined below:

Selecting a Color Scheme



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **DISP** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **VIEW** is highlighted.



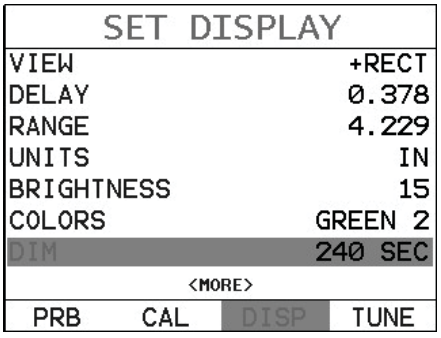
3) Press the ↵ key to display a list of the color scheme options.
4) Press the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the material list until the appropriate material is highlighted.
5) Press the ↵ key, followed by pressing the OK key, to overwrite the current color scheme with the selected scheme.
6) Finally, press the ⌂ key to return to the measurement screen and begin taking readings.

11.10 DIM

The ***FX80*** has a built-in **DIM** feature to manage power more effectively. This feature has adjustable time durations, until the power of the display is dimmed and current draw reduced. The timer is constantly reset while the user is making measurements, and is only activated when the gauge is idle for the duration of time the **DIM** value is set for. This feature does not override the preset 5 min idle power off feature in any way. However, if the gauge is turned on, set for a DIM of 120sec, and then left idle for 5 minutes, the ***FX80*** will dim in 2 minutes, then power off in 5 minutes. The procedures for adjusting the **DIM** time are outlined below:

For quick access and editing, refer to navigating the Hot Menus page 23.

Setting a DIM time



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **DISP** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.
2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **DIM** is highlighted.
3) Press the  and  arrow keys on the right button wheel to scroll the **DIM** time.
4) Finally, press the  key to return to the measurement screen and begin taking readings.

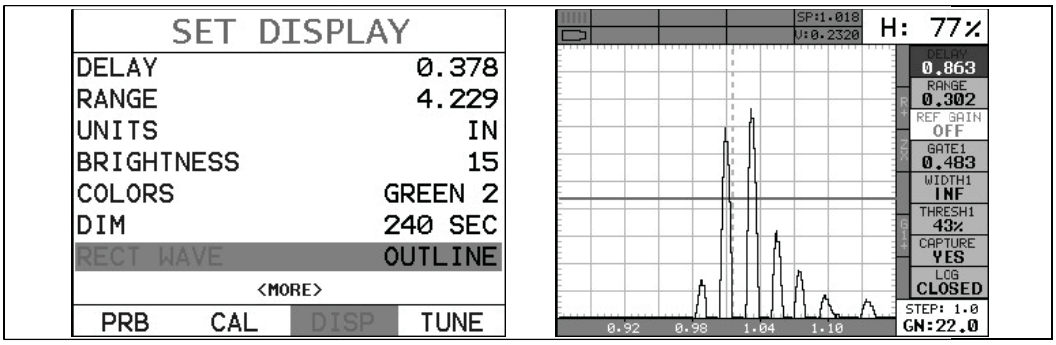
11.11 Graphics Option (look & feel)

The ***FX80*** includes a couple of cosmetic features for user preference when viewing the waveform. These features only serve as cosmetic items, and do not change the functionality of the ***FX80*** in any way.

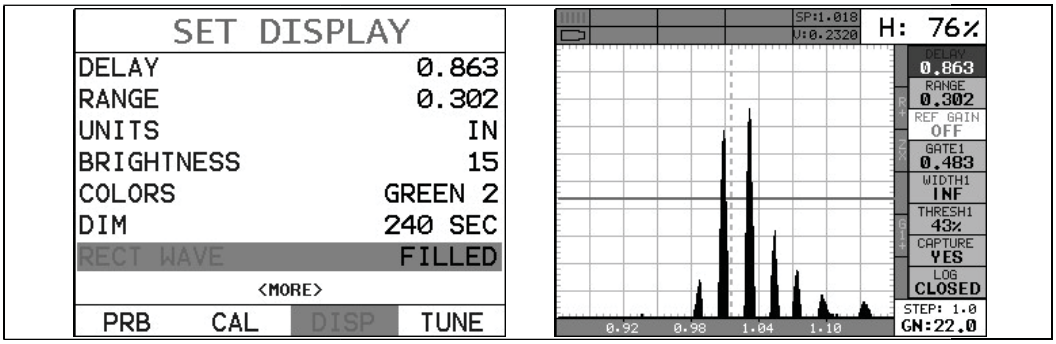
RECT Wave:

The rectified wave feature, is only functional when using **RECT** wave view, and provides the user the following display options:

Outline – Draws the unfilled outline of the waveform.

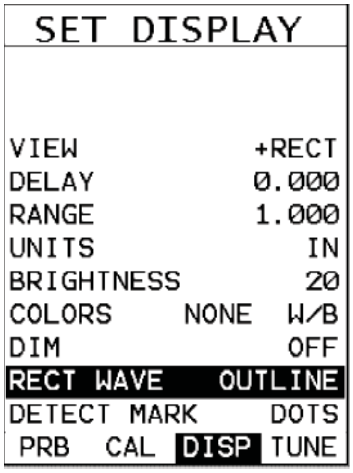


Filled – Draws a filled version of the waveform.



The procedure to select the look and feel option is outlined below:

Setting the Look & Feel



1) Press the ≡ key once to activate the menu items tab. Press the ≡ key multiple times to tab right and the esc key multiple times to

tab left until the **DISP** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

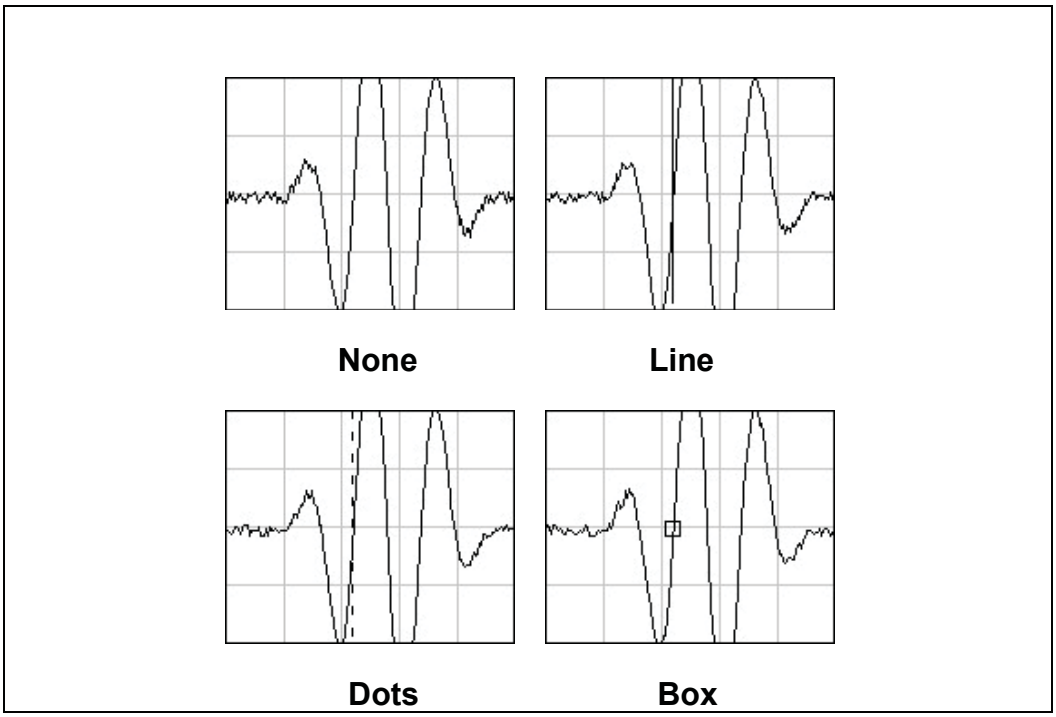
2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **RECT WAVE** is highlighted.

3) Use the  and  arrow keys on the right button wheel to scroll the **RECT WAVE** options.

4) Once the **RECT WAVE** is displayed, press the  key to return to the measurement screen.

11.12 Detect Mark

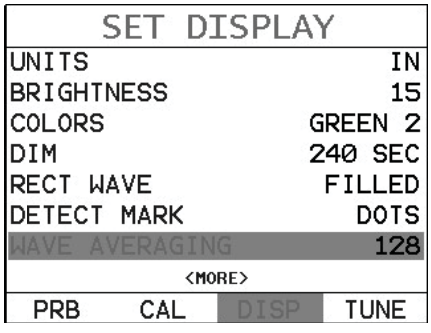
Another look and feel option of the ***FX80*** is the **DETECT MARK** feature. The detect mark give the user the option to select: **none**, **line**, **dots**, or **box**. Depending on the select made, an indication will be displayed on the waveform, showing where the detection is occurring. It should be noted that the “box” option will only be visible in **RF** view. The following screenshots illustrate the above selection options:



11.13 Wave Averaging

The ***FX-81*** has a wave averaging feature to improve the resolution or clarity of the waveform by averaging multiple shots/bangs and eliminating random noise. This feature is 'not' recommended for high speed scanning, as it slows down the screen redraw speed based on the number of averaging shots/bangs selected (OFF, 2, 4, 8, 16, 32, 64, 128). The procedure to change the averaging is outlined below:

Setting Wave Averaging



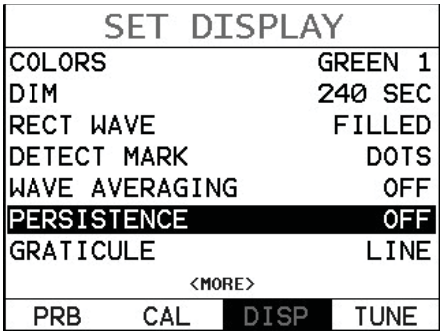
1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **DISP** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.
2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **WAVE AVERAGING** is highlighted.
3) Use the  and  arrow keys on the right button wheel to scroll the **WAVE AVERAGING** options.
4) Once the desired **WAVE AVERAGING** value is displayed, press the  key to return to the measurement screen.

11.14 Persistence

The ***FX-81*** has a persistence feature that is specifically used when connected to a multiple channel multiplexor and in Rectified display setting. The display is cleared based on the option selected, representing the overall number of bangs, to control the screen jitter. The setting options are (OFF, 15, 60, 240).

The procedures for selecting persistence are outlined below:

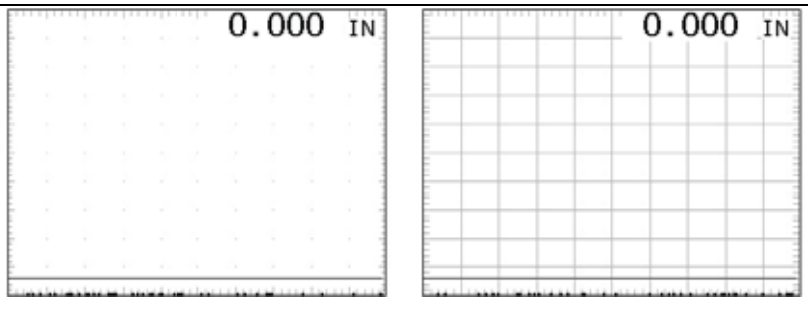
Persistence



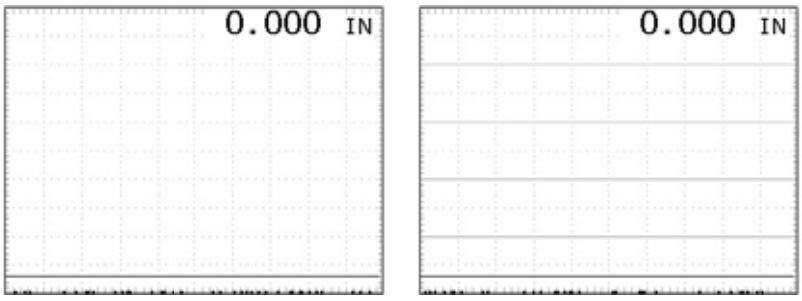
1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **DISP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times using the left button wheel to scroll through the sub menu items until **PERSISTENCE** is highlighted.
3) Use the ◀ and ▶ arrow keys multiple times on the right button wheel to toggle **PERSISTENCE** (Off, 15, 60, 240).
4) Press the ⌂ key to return to the measurement screen.

11.15 Graticule (A-Scan Background)

The graticule markers in the background of the A-Scan waveform area provide measurement references for depth/thickness versus amplitude. There are multiple options for the user to select an A-Scan background grid/segments to satisfy their graphics preference or 'look and feel'. The procedure to select one of the options is outline below:

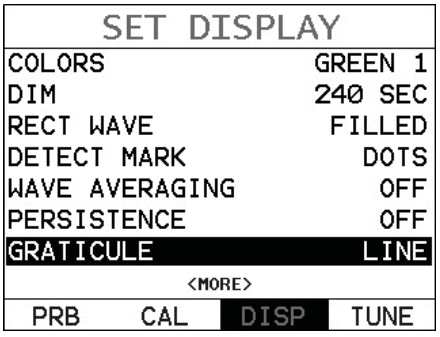


Points **Line**



Dots **Mix**

Selecting Graticule Option



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **DISP** menu is highlighted and displaying the submenu items.

2) Use the  and  arrow keys to scroll through the sub menu items until **GRATICULE** is highlighted.

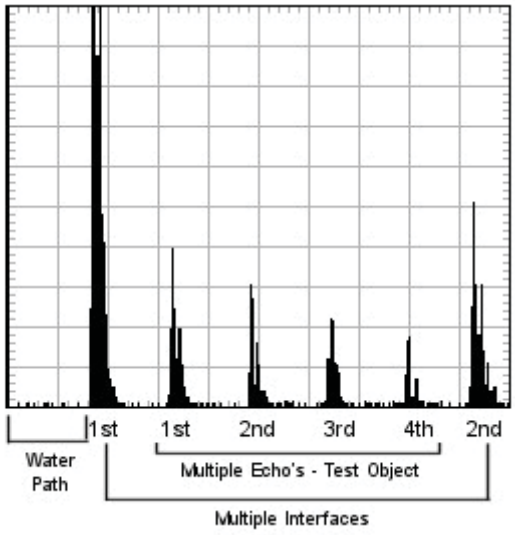
3) Use the  and  arrow keys to scroll the **GRATICULE** options.

4) Once the desired “look & feel” is displayed, press the  key to return to the measurement screen.

11.16 Auto Interface Gate – Immersion Testing (IM)

Immersion testing generally consists of a tank of water with the test object and transducers submerged in the tank with the transducer focused on the object, or using a “bubbler” with a constant water source and path. This procedure is advantageous in achieving a constant coupling during the scanning process, unlike standard manual contact scanning methods, and provides better control over amplitude fluctuations while attempting to estimate the size of a given reflector/flaw.

The ***FX-81*** is equipped with an additional gate to detect/trigger on the water path interface during the immersion inspection process. The start position, width and threshold of the gate can be configured for the interface echo to allow for deviations in the water path distance due to the surface condition, position and unwanted interface detections from the test object. The **IM** measure mode is similar to the standard interface-echo (I-E) mode generally found in precision thickness gauges to account for the length of the acrylic delay line material, when using a delay line style transducer.



Immersion Testing

Considerations:

- There is a significant difference between sound traveling in water versus steel, for example. The longitudinal velocity of sound traveling through water is approximately 0.058 in/µs, while 0.2320 in/µs in steel. Since the ***FX80+*** has been setup and calibrated for a steel test object, this would find the water path interface at approximately 4", considering an actual 1" water path, or 4 times the depth/distance on the calibrated display.

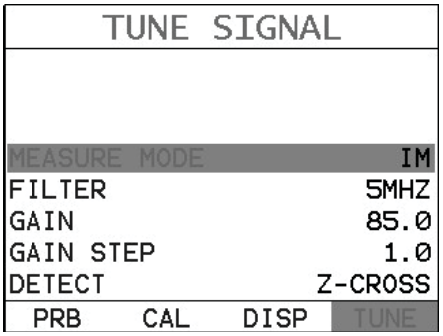
- It is recommended that the water path be greater than 25% of the thickness of the test object, and that the water path is long enough to keep the flaw evaluation process beyond the "near zone" and entirely in the "far zone" where sound has achieved the most uniform wave front (near zone will be contained in the water path).

- Additionally, any movements of the transducer or test object that change the water path distance are then compounded by a factor of 4x. Therefore, a mechanical fixture or carriage is typically used on the top side of the tank in order to maintain the positioning of the transducer to the test object.

- Changes in the targets angle and water path distance will reduce the amplitude/output, and should be considered during the evaluation of a flaw. Obviously, the optimal evaluation would be a perfectly fixed transducer position with a perfectly parallel reflector and water path distance.

The procedures for enabling and adjusting the IM measurement mode are outlined below:

Activating the (IM) Mode



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **TUNE** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **MEASURE MODE** is highlighted.
3) Use the ◀ and ▶ arrow keys on the right button wheel to toggle the **MEASURE MODE**.
4) Once the desired **MEASURE MODE** is displayed , press the ⌂ key to return to the measurement screen.

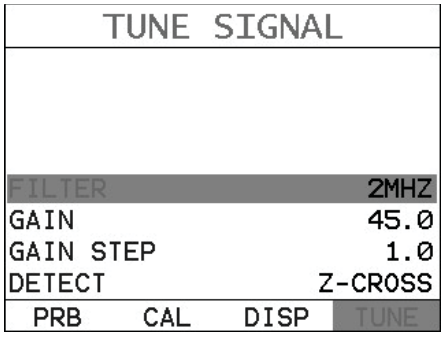
Note: *Two gates will be enabled and can be adjusted using the Hot or Tabbed Gate menu items. Refer to section 4.4 to adjust and configure the postion of the gates.*

11.17 Filters (Wide & Narrow Bands)

The ***FX80*** includes a wide band filter with a range of **1.8MHz** to **19MHz**, as well as narrow band filters at **1MHz**, **2MHz**, **5MHz** and **10MHz**. The ***FX80+*** has two additional narrow band filter at **0.5MHz** and **15MHz**. The wide band option is responsive to all signals within the given frequency range. However, narrow band filters eliminate signals outside of the target filter frequency, and focus on the output of the transducer at the specified frequency. The procedure to change the **FILTER** is outlined below:

For quick access and editing, refer to navigating the Hot Menus page 23.

Selecting the Filter



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **TUNE** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

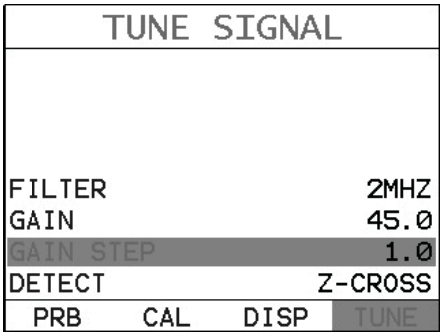
2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **FILTER** is highlighted.

3) Use the  and  arrow keys on the right button wheel to scroll the **FILTER** options.

4) Once the desired **FILTER** is displayed, press the  key to return to the measurement screen.

11.18 Gain Step Size

Adjusting Gain Step Size



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **TUNE** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until  **STEP** is highlighted.

3) Press the  and  arrow keys multiple times using the left button wheel to scroll the value. When the correct step size is being displayed, **proceed to step 8**.

4) **Alternatively**, press the  key to display the **Digits Edit Box**.

5) Press the  and  arrow keys multiple times on the left button wheel to scroll the highlighted value.

6) Press the  and  arrow keys multiple times using the left button wheel to scroll the digit locations.

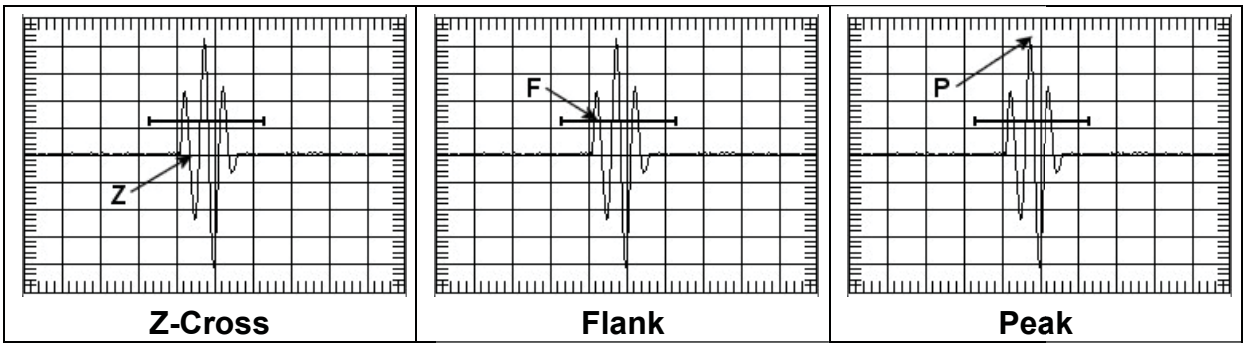
7) Repeat steps **5 & 6** until the zero value is correctly displayed.

8) Press the  key to set the gain step and return to the menu screen, or  to cancel entering the gain step.

9) Finally, press the  key to return to the measurement screen.

11.19 Detect Modes

The ***FX80*** has three selectable modes of detection: Z-Cross, Flank, and Peak. The following diagram illustrates the difference between the options:



Refer to the diagrams above. The current polarity is positive, as shown by the position of the gate above the baseline:

Z-Cross: The detection occurs as the first positive half cycle crosses the baseline and goes negative.

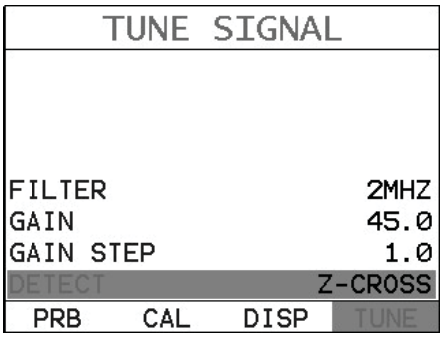
Flank: The detection occurs as the first half cycle left edge rises and breaks the threshold.

Peak: The detection occurs at the highest peak in the gate.

The procedure to select the **DETECT MODE** is outlined below:

For quick access and editing, refer to navigating the Hot Menus page 23.

Selecting the Detect



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **TUNE** menu is highlighted and displaying the submenu

items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

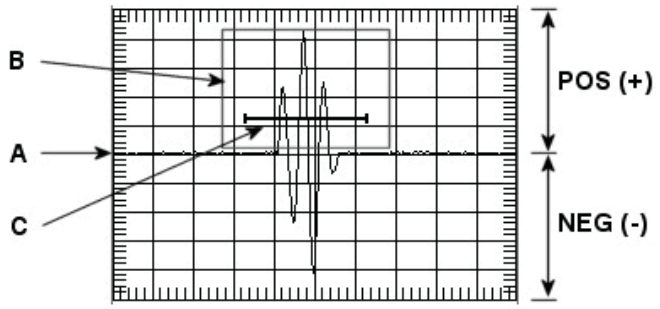
2) Use the  and  arrow keys multiple times on the left button wheel to scroll through the sub menu items until **DETECT MODE** is highlighted.

3) Use the  and  arrow keys multiple times using the left button wheel to scroll the **DETECT** options.

4) Once the **DETECT** is displayed, press the  key to return to the measurement screen.

11.20 Polarity

The ***FX80*** has a number of features and views that offer selectable polarity. The important thing to note is the polarity view is entirely different than the polarity selection of a gate. If a polarity view of **+RECT** is selected, only the positive portion of the waveform will be shown on the screen. If a positive polarity is then selected for **GT1**, not only will the gate be displayed on the screen, it will only detect on the positive going cycles of the waveform. Polarity is selectable according to the **VIEW**, **GT1**, **GT2**, and **DAC**. Again, view corresponds only to what portion of the waveform is displayed, positive or negative, and the other three options are primarily associated with where the detect occurs. Finally, if the view is set to **RF**, the entire waveform cycle will be displayed, both positive and negative. Refer to the diagram below:



Polarity

The diagram above is an **RF** view, showing both the positive and negative going cycles for purposes of explanation. Notice the +/- positions in the diagram. The positive phase is everything above the horizontal center line, and the negative everything below the center line. The baseline is found at position **(A)**, and considered zero dB. If **+RECT** was selected as the view, only the positive portion of the waveform would be displayed. Equally, if the gate polarity was set to positive, as in the diagram at **(C)**, it would also appear on the display. However, if it was set to negative, would not appear on the display. In the example above, the gate is set to positive and will detect on the positive going waveform cycles shown in the box **(B)**.

For quick access and editing, refer to navigating the Hot Menus page 23.

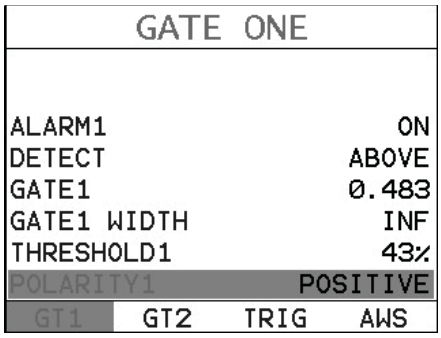
Toggle Polarity (+/-)

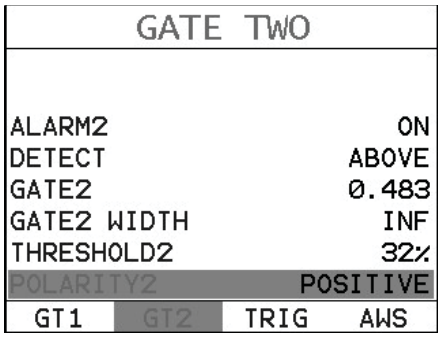
SET DISPLAY	
VIEW	+RECT
DELAY	2.222
RANGE	1.516
UNITS	IN
BRIGHTNESS	15
COLORS	GREEN 2
DIM	240 SEC
<MORE>	

PRB CAL DISP TUNE

DAC SETTINGS	
DAC	ON
DRAW	OFF
MEAS	%DAC
CURVE	DAC
TRIGGER	DAC
DPOLARITY	POSITIVE

TCG DAC DGS SET





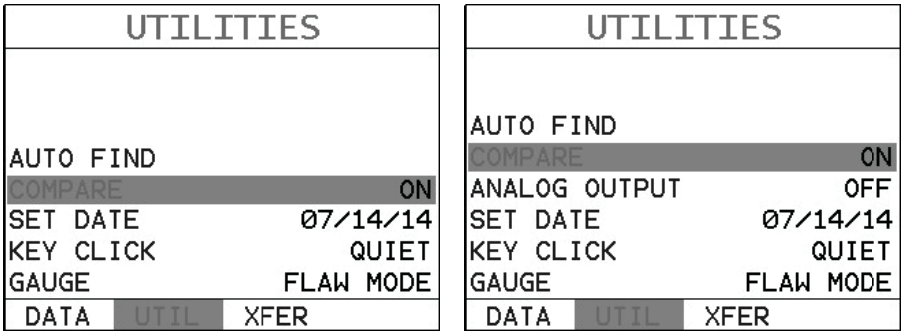
Note: *The screenshots above show where all the possible locations for polarity selection are found in the **FX80**. For more information on the above, refer to the sections on **VIEW**, **DAC**, **GT1**, & **GT2**.*

1) Press the ≡ key once to activate the menu items tab. Press the ≡ key multiple times to tab right, and the esc key multiple times to tab left, until the **DISP**, **DAC**, **GT1**, or **GT2** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **VIEW**, **DPOLARITY**, **POLARITY1,** or **POLARITY2** is highlighted.
3) Use the ◀ and ▶ arrow keys on the right button wheel to toggle the **VIEW**, **DPOLARITY**, **POLARITY1,** or **POLARITY2** negative or positive.
4) Press the ⌂ key to return to the measurement screen and begin taking readings.

11.21 Compare

The compare feature enables an operator the ability to locate and establish a reference waveform from a flaw in an existing or manufactured sample and send it to the background on the display in a color other than the active waveform color. The reference waveform will remain in the background for the duration of inspection process, or until cleared. This feature can be useful when inspecting for a common flaw in a specific object, location, and position. The procedures for activating and using the compare feature are outlined below:

Activating and Using Compare



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times using the left button wheel to scroll through the sub menu items until **COMPARE** is highlighted.
3) Use the ◀ and ▶ arrow keys multiple times on the right button wheel to toggle **COMPARE** on/off. **Note:** *The **COMPARE** feature now overrides the* peak *key and its functions while activated.*

4) Press the key to return to the measurement screen.

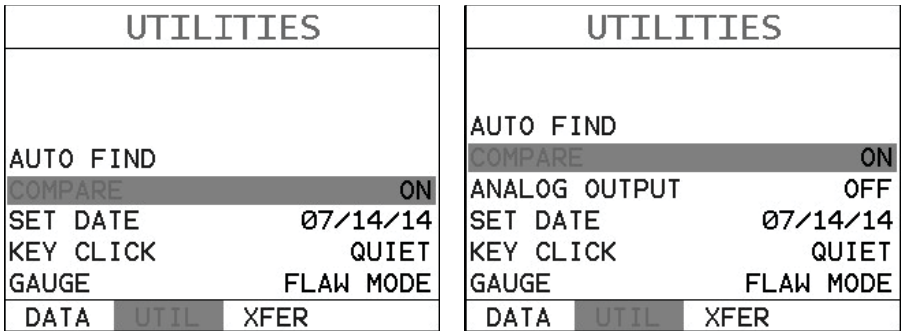
5) Acquire the waveform of the sample flaw on the display, and press the peak key to freeze and send it into the background on the display in another color. Pressing the peak key a second time to will clear the waveform.

6) Finally, repeat steps **1 – 3** to disable the **COMPARE** feature.

11.22 Analog Output

The ***FX-81*** is also equipped with an analog outputs to send a 0-10 volt electrical signal to an external device to control a system process to respond in a different manner considering the voltage measured. The outputs are updated at the same rate as the PRF (pulse repetition frequency) setting. There is 100 ohm output impedance which will vary the voltage slightly and should therefore be calibrated to the device connected. The output options are amplitude or distance. Refer to the Top & Bottom end caps or connections on page 24 for further info on the pins used on the Lemo 1 5 pin connector. The procedures for activating and selecting amplitude or distance are outlined below:

Activating Analog Out



5) Press the key once to activate the menu items tab. Press the key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items.

Alternatively, press the  and  arrow keys multiple times using the left button wheel.

6) Use the  and  arrow keys multiple times using the left button wheel to scroll through the sub menu items until **ANALOG OUTPUT** is highlighted.

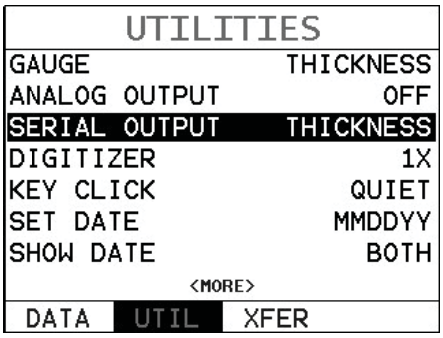
7) Use the  and  arrow keys multiple times on the right button wheel to toggle **ANALOG OUTPUT** thickness/amplitude.

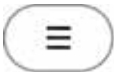
8) Press the  key to return to the measurement screen.

11.23 Serial Output

The ***FX-81*** is also equipped with a serial output that continuously sends the measurements to serial output port at a baud rate of 9600.
The procedure for activating the serial output are outlined below:

Activating Serial Out



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to

tab left until the **UTIL** menu is highlighted and displaying the submenu items.

Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times using the left button wheel to scroll through the sub menu items until **SERIAL OUTPUT** is highlighted.

3) Use the  and  arrow keys multiple times on the right button wheel to toggle **SERIAL OUTPUT** – off/thickness.

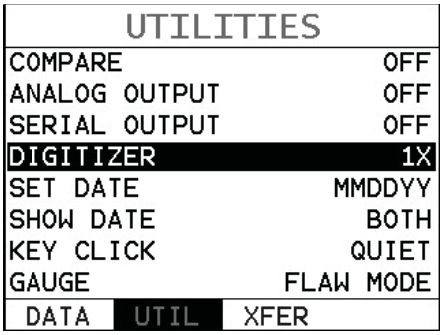
4) Press the  key to return to the measurement screen.

11.24 Digitizer

The ***FX-81*** is equipped with a selectable digitizer for additional resolution options. The 1x setting has the fastest update rate and lowest resolution, while the 4x option has 4 times the resolution and the slowest update rate.

The procedure for selecting the digitizer setting is outlined below:

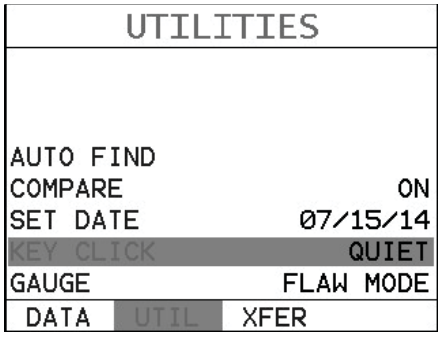
Selecting Digitizer Rate

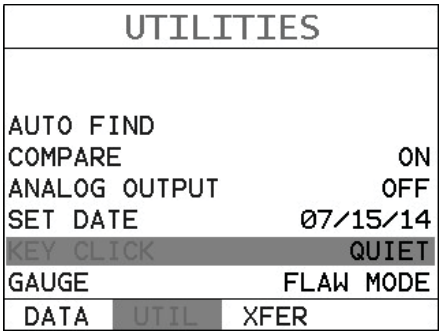


1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times using the left button wheel to scroll through the sub menu items until **DIGITIZER** is highlighted.
3) Use the ◀ and ▶ arrow keys multiple times on the right button wheel to toggle the **DIGITIZER** (1x, 2x, 4x).
4) Press the ⌂ key to return to the measurement screen.

11.25 Key Click

Selecting the Detect





1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items.

   Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **KEY CLICK** is highlighted.

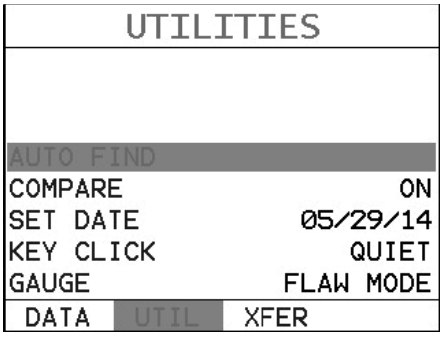
3) Use the ◀ and ▶ arrow keys multiple times using the left button wheel to scroll the **KEY CLICK** options.

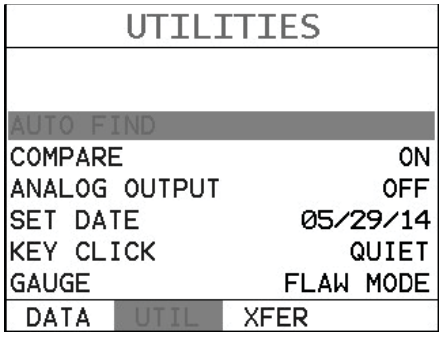
4) Once the desired **KEY CLICK** is displayed, press the ⌂ key to return to the measurement screen.

11.26 Date & Time

The ***FX80*** is equipped with an internal clock to time and date stamp the log, setup and screen capture files for reporting/documentation purposes. The procedures for setting the time and date are outlined below:

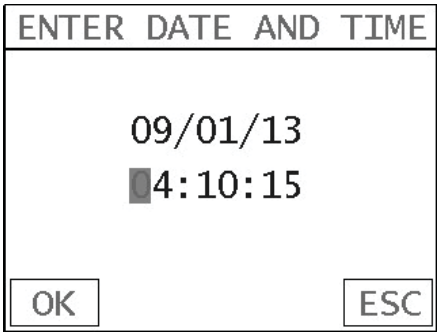
Setting Date & Time





1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys multiple times on the left button wheel to scroll through the sub menu items until **SET DATE** is highlighted.



3) Press the ↵ key to display the **Digits Edit Box**.

4) Press the ▲, ▼, ◀, **&** ▶ arrow keys on the left button wheel, to scroll the field locations.

5) Press the  and  arrow keys multiple times on the right button wheel to scroll the value.

6) Repeat steps **4 & 5** until the **Time & Date** is correctly displayed.

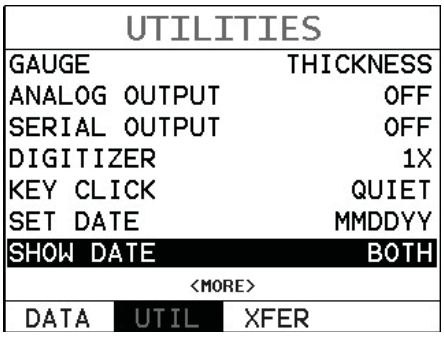
7) Press the  key to set the **Time & Date** and return to the menu screen, or  to cancel entering the **Time & Date**.

8) Finally, press the  key to return to the measurement screen and begin taking readings.

11.27 Show Date & Time

The ***FX80*** can be configured to show the date & time in the active A-Scan window as needed or preferred (off/date/time/both). The procedure for activating and displaying the above options are outlined below:

Live Time & Date



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items.

2) Use the  and  arrow keys to scroll through the sub menu items until **SHOW DATE** is highlighted.

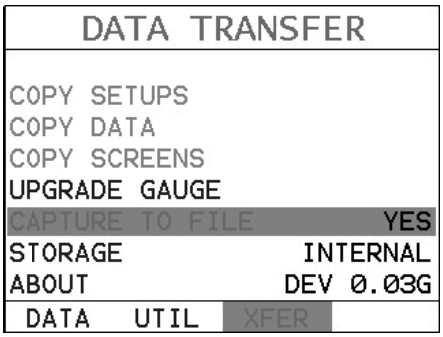
3) Press the  and  arrow keys multiple times to scroll the options (Date, Time, Both, Off).

4) Finally, press the  key to return to the measurement screen and begin taking readings.

11.28 Freeze & Capture

The ***FX80*** freeze feature enables a user to immediately freeze what's currently being displayed on the screen for further review or analysis. The freeze feature used in conjunction with the capture feature enables a user to save the entire screen shot directly to a **.tif** (tagged image) file format that can be opened using any graphics viewer. With the storage capacity of the ***FX80***, and additional external SD card reader, the user can store as many screens shots as needed. It should also be mentioned that this feature is immediately activated on boot up, therefore all the menus items, list boxes and edit screens can also be captured for presentation or training purposes. The procedure to freeze and capture the display is outlined below:

Capturing Screen Shots



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to

tab left until the **XFER** menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

2) Use the  and  arrow keys multiple times using the left button wheel to scroll through the sub menu items until **CAPTURE TO FILE** is highlighted.

3) Use the  and  arrow keys multiple times on the right button wheel to toggle the **CAPTURE** on/off. **Note:** *Capture will be displayed in a toolbar cell on the active display, indicating the feature is enabled.*

4) Press the  key to return to the measurement screen.

5) To capture a file, press the 

key to freeze the screen, followed by pressing it a second time to display the alpha numeric edit box to name and save the screen shot. **Note:** *if capture is not enabled, the* 

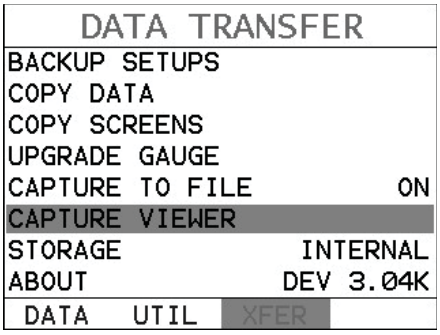
key toggles freeze on/off.

11.29 Capture Viewer

The capture viewer enables a user to view any of the saved screen captures on the SD card, using the ***FX80***. This is handy if a PC isn't available, but the user has a need to review the screen shots captured.

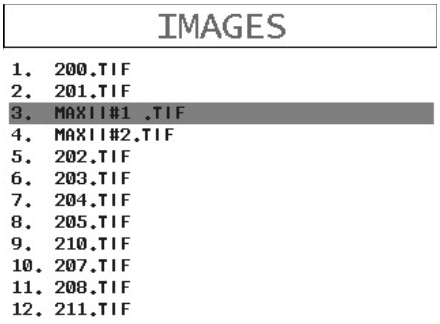
The procedure to capture the last screen displayed is outlined below:

<u>Capturing Screen Shots</u>



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **XFER** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys multiple times using the left button wheel to scroll through the sub menu items until **CAPTURE VIEWER** is highlighted.



3) Press the ↵ key to display the list of images (.tif) currently stored on the internal or external SD card.

4) Use the ▲ and ▼ arrow keys multiple times using the left button wheel to scroll through the list of images until the desired image is highlighted.

5) Press the  key to display the highlighted image, and the  key to close the image and return to the list of images.

6) Repeat steps 4-5 as needed.

7) Finally, press the  key to close the **VIEWER** and return the measurement screen.

11.30 Peak Hold

The ***FX80*** includes a peak hold feature that draws and saves the maximum waveform amplitude on the screen. This allows an inspector to move the transducer in all directions, in an effort to "peak up" on a signal, and locate the maximum amplitude.

The following procure outlines the steps to activate and use the  hold feature:

Activating Peak

1) Press the  key located in the upper left corner of the keypad to activate the feature.

2) Press the  key again at any time to toggle this feature OFF.

Clearing Current Wave Draw

Note: *At any point during a **PEAK** scan the operator may opt to clear the wave drawing and start over.*

1) Press the  key at any time to clear the currently displayed waveform, and continue the scanning process.

Disabling PEAK

1) Press the peak key at any time to disable the feature.

Note: *The peak key is also used in conjunction with the **COMPARE** feature. When the compare feature is enabled, it takes control over the normal **PEAK** functionality.*

11.31 Freeze Waveform

The ***FX80*** also includes a **FREEZE** mode that allows an operator the ability to freeze a the current waveform being display on the screen at anytime. Once the operator freezes the waveform, the transducer can be removed from the test material. The following procure outlines the steps to activate and use the FREEZE feature:

Activating Freeze

freeze

Note: *Assuming the operator currently has a waveform on the display that they'd like to freeze and have a closer look.*

1) Press the freeze key located in the upper left corner of the keypad to activate the feature.
2) Press the freeze key again at any time to toggle this feature OFF.

Note: *If the **CAPTURE** feature has been activated, pressing the freeze key a second time will capture the screenshot, and display the **File Edit Box** enabling the user to name the captured file. The screen shot will be captured as a "tagged interface format" (.tif), which can be opened directly with any graphics file viewer.*

CHAPTER TWELVE
DATA STORAGE – SETUP, EDIT, & VIEW FILES

12.1 Introduction to Grid and Sequential file formats

The ***FX80*** is equipped with two data file format options, **GRID LOG** and **SEQ LOG**. The **GRID** file format is very similar to a spreadsheet format found in popular software programs like Excel. A **GRID** is simply a table of readings. A location in a grid is specified by giving a row and column coordinate. The rows are numbered from 1 to 999 and the columns are labeled from A to ZZ (999 Rows & 52 Columns). The sequential file format can be viewed as a file as a single column of up to 512 possible rows (readings), and a column of corresponding identifiers associated with each individual reading. The identifier can be a combination of up to 10 numeric, alpha, or special characters listed above, while the file name can consist of a combination of up to 20 of the same character set. **Note:** *The identifier cannot start or end with a special character.* Once a start and end ID are entered into the ***FX80*** and the log created, the ***FX80*** will automatically generate all the identifiers within that range.

The following character set listed below are all the allowable characters that will be used for both file formats: **GRID** & **SEQ LOG**. Any combination of these characters can be used for creating a Name and Note regardless of the selected format. The allowable characters are as follows:

Numeric characters: 0 – 9 **Alpha Characters:** A – Z
Special Characters: ! ‘ _ # space / . – ( )

Multiple grids can be created and stored until the ***FX80***’s memory is full. If the user attempts to store a new file in the ***FX80*** and the size of the file exceeds the capacity of memory, the ***FX80*** will respond with an error message indicating that the memory is unable to store the new file.

The ***FX80*** has a very large potential storage capacity, and depending on the configuration of SD card sizes versus data, setups and screen capture images, can store limitless amount of data. The ***FX80*** has an internal SD of 4 gigabytes, and an external slot reader that has been successfully tested with a 64 gigabyte card. Therefore, available memory will not be an issue.

In the sections that follow, the procedures for creating, using, and editing **GRID’s** and **SEQ LOG’s** have been combined together for the purpose of similarity in overall functionality and structure. The illustrations below are snapshots of typical **GRID** and **SEQ LOG** file formats:

Grid File Formats

NAME: EX#1			
	A	B	C
1			
2			
3			
4			

NAME: EX#2			
	D	E	F
6			
7			
8			
9			

Sequential Log Formats

NAME: EX#1	
AA	
AB	
AC	
AD	
AE	

NAME: EX#2	
01	
02	
03	
04	
05	

NAME: EX#3	
3A	
3B	
3C	
3D	
3E	

NAME: EX#4	
BCD-4-01	
BCD-4-02	
BCD-4-03	
BCD-4-04	
BCD-4-05	

Important Note: *For the duration of this chapter, all references to* ***GRIDS*** *and* ***SEQ LOGS*** *should be considered synonymous with references to* ***FILES****.*

12.2 Creating a new Grid or Sequential Log (File)

Important Note: *This entire section is a step by step guide to successfully create a grid or sequential log.* The instructions must be used in the sequential order specified, as follows:

<u>Creating a Name</u>

Grid/Seq Log Name : Can contain a combination of up to 20 numeric, alpha, or special characters listed in the first section of this chapter.

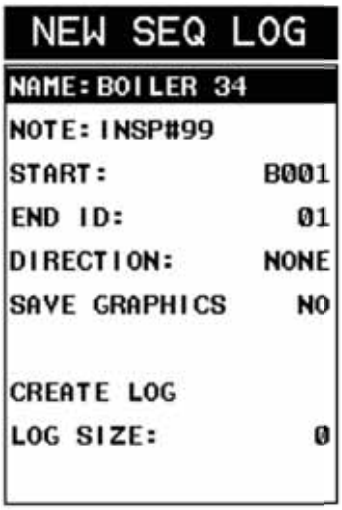
Grid Log

Sequential Log

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the data menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys multiple times using the left button wheel to scroll through the sub menu items until **NEW** is highlighted.

3) Press the ◀ and ▶ arrow keys multiple times on the right button wheel to toggle the data formats – **GRIG LOG** & **SEQ LOG**.



Grid Log **Sequential Log**

4) Press the ↵ key to display the new **Grid** or **Seq Edit Box**.

5) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the new **Grid** or **Seq List Items** until **NAME** is highlighted.

6) Press the ↵ key to activate the **Alpha Edit Box**.

7) Use the ▲, ▼, ◀, & ▶ arrow keys on the left button wheel to highlight the appropriate alpha characters.

8) Press the ↵ key to select a character and advance to the next field of the **Grid** or **Seq Name**.

9) Use the clr key to backspace if necessary.

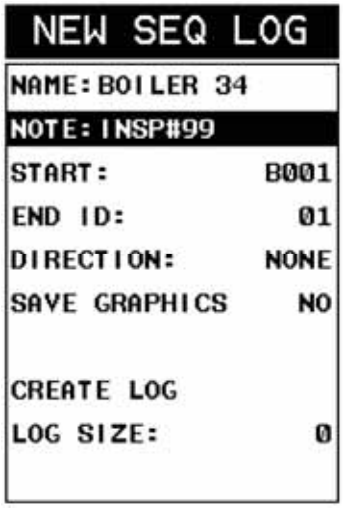
10) Repeat steps **6 - 9** until the **Grid** or **Seq Name (File Name)** is completed.

11) Press the OK key to save the **Grid** or **Seq Name** and return to the **Grid** or **Seq List Items** menu, or esc to cancel entering the **Grid** or **Seq Name (File Name)**.

Creating a Note

Grid/Seq Log Note: *Can contain a combination of up to 20 numeric, alpha, or special characters listed in the first section of this chapter.*

Grid Log



Sequential Log

1) Assuming the **Grid** or **Seq** List Items are displayed, use the ▲ and ▼ arrow keys using the left button wheel to scroll through the new **Grid** or **Seq List Items** until **NOTE** is highlighted.

2) Press the key to activate the **Alpha Edit Box**.

3) Use the , , , & arrow keys on the left button wheel to highlight the appropriate alpha characters.

4) Press the key to select a character and advance to the next field of the **Grid** or **Seq Note**.

5) Use the clr key to backspace if necessary.

6) Repeat steps **3** through **5** until the **Grid** or **Seq Note** is completed.

7) Press the OK key to save the **Grid** or **Seq Note** and return to the **Grid** or **Seq List Items** menu, or esc to cancel entering the **Grid** or **Seq Note**.

Setting the Coordinates or Start & Stop ID's

Grid: A grid is defined by using coordinates to define the **Top Left** and the **Bottom Right** corners of the grid. Alpha coordinates are horizontal across the

top, and numeric coordinates are vertical down the side. Therefore, to define the top left corner of the grid, there will be an (X,Y) coordinate. Where X is an alpha column location across the top and Y is a numeric row location down the side. Use the same logic when choosing the lower right corner. An individual grid can be up to 999 rows and 52 columns.

Sequential: The sequential file format can be viewed as a file as a single column of up to 512 possible rows (readings), and a column of corresponding identifiers associated with each individual reading. The identifier can be a combination of up to 10 numeric, alpha, or special characters listed above, while the file name can consist of a combination of up to 20 of the same character set. **Note:** *The identifier cannot start or end with a special character.* Once a start and end ID are entered into the ***FX80*** and the log created, the ***FX80*** will automatically generate all the identifiers within that range.

Setting the Top Left(Grid) or Start ID(Seq)

Grid Log

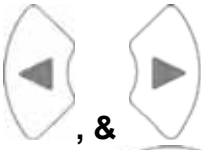
Sequential Log

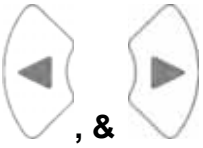
1) Use the  and  arrow keys on the left button wheel to scroll through the new **Grid** or **Seq List Items** until **TOP**  or **START ID** is highlighted.

2) Press the  key to activate the **Coordinate** or **Start ID Edit Box**.

Grid Log

Sequential Log

3) **<u>GRID LOG:</u>** Use the  **, &** arrow keys on the left button wheel to scroll the **Columns**, and the  **,**  arrow keys on the left button wheel to scroll the **Rows**.

<u>SEQ LOG:</u> Use the  **,**  **,**  **, &** arrow on the left button wheel keys to highlight the appropriate alpha characters. Press the  key to select character and advance to the next character field, in conjunction with using the  key to backspace if necessary.

4) Press the OK key to select the coordinate or start ID and return to the **Grid** or **Seq List Items** screen, or esc to cancel the selection and return to the **Grid** or **Seq List Items** menu.

Setting the Bottom Right(Grid) or End ID(Seq)

Grid Log

Sequential Log

1) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the new **Grid** or **Seq List Items** until **LOWER** ▶ or **END ID** is highlighted.

2) Press the ↵ key to activate the **Coordinate** or **End ID Edit Box**.

Grid Log **Sequential Log**

3) **GRID LOG:** Use the , & arrow keys on the left button wheel to scroll the **Columns**, and the , arrow keys to scroll the **Rows**.

SEQ LOG: Use the , , , & arrow keys on the left button wheel to highlight the appropriate alpha characters. Press the key to select a character and advance to the next character field, in conjunction with using the clr key to backspace if necessary.

4) Press the OK key to select the coordinate or end ID and return to the **Grid** or **Seq List Items** screen, or esc to cancel the selection and return to the **Grid** or **Seq List Items** menu.

Note: *If there is not enough memory available to create the grid or sequential log, an error message box* ***"NOT ENOUGH MEMORY"*** *will be displayed. Press the OK or esc key to return to the* ***Grid*** *or* ***Seq List Items*** *menu. It*

*may be necessary to free some memory in the **FX80** at this time. Refer to page 154 for more information on **Deleting a File**.*

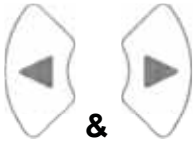
Selecting the Auto Increment Direction

The **Auto Increment** feature gives the user the ability to specify which direction to advance the cursor after storing a reading.

Grid Log

Sequential Log

5) Use the  and  arrow keys on the left button wheel to scroll through the new **Grid** or **Seq List Items** until **INCR. DIR** or **DIRECTION** is highlighted.

6) Use the  **&** arrow keys on the left button wheel to toggle the **Increment** direction **NONE, NORTH, EAST, SOUTH, or WEST** for a grid, or **INC, DEC** for a sequential log.

7) When the correct **Increment** direction is displayed, continue on to the next section **"Graphics"**.

Saving a Grid

Once all the parameters are set, the user has the option of saving or canceling the new grid.

Grid Log

Sequential Log

1) Use the  and  arrow keys on the left button wheel to scroll through the new **Grid** or **Seq List Items** until **CREATE GRID or LOG?** is highlighted.

2) Press the  key to accept the grid or seq log parameters and activate the confirmation screen.

Grid Log **Sequential Log**

3) Press the OK key to save the **New Grid** or **Seq Log**, or the esc key to cancel **the New Grid or Seq Log** setup and return to the data menu.

4) Press the key to return to the measurement screen and begin storing readings.

12.3 Storing a waveform

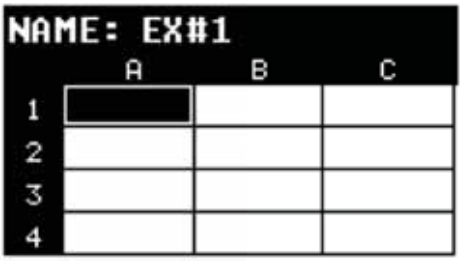
Now that a grid or sequential log has been created, it's time to make some measurements and store the readings. The following procedures outline this process:

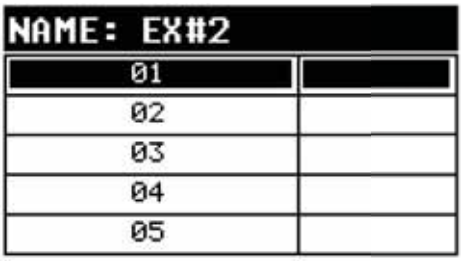
Storing a Reading

Note: *Once the gird or sequential log has been created it will automatically be displayed following the create confirmation screen. It is located at the bottom of the measurement screen, and can be left open for the duration of the inspection process. This section assumes the grid or sequential log was just created. Refer to the section on "opening a grid or seq log" if the file was created at another time.*

Key Feature: When the **FX80** is displaying a **"grid log"**, pressing the OK key will initiate an advance to row number option. Use the **Left, Right,** , and arrow keys on the left button wheel to enter the row number. Once the row number is correctly displayed, press the OK key to advance directly to that row number in the grid log.

Key Feature: When the **FX80** is displaying a **"grid log"**, pressing the esc key multiple times, will toggle through the display options: **DIGITS, RF, RECT,** and **B-SCAN** views.





Grid Log **Sequential Log**

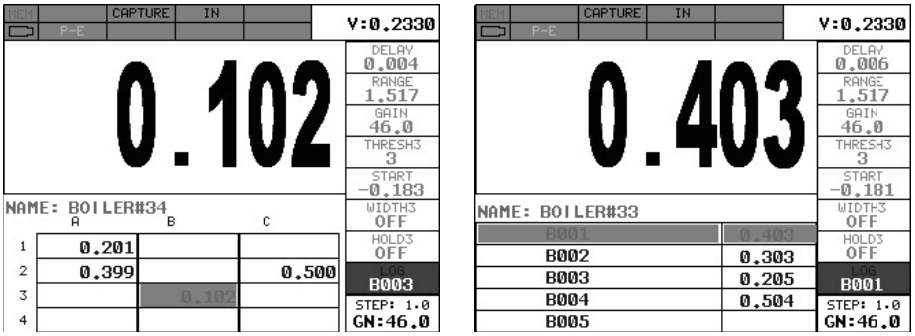
1) Press the  ,  ,  , and  arrow keys on the left button wheel to scroll the target cell cursor to the desired storage location.
2) Press the  key to save the current reading in the highlighted cell location. It's as simple as that!
3) Press the  key to hide the **GRID/SEQ View Box**, or  to display it as necessary.

Note: *Once the file is open, it will remain open until it's closed or another file is opened by the user. If the gauge is powered off, the* ***FX80*** *will automatically open the file when powered on. Simply press the*  *key to display the file from the measurement screen.*

12.4 Viewing stored readings

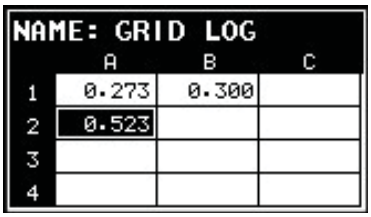
It is sometimes necessary to go back and view the stored readings and B-Scans using the ***FX80*** without a PC. The following procedures outline this process:

Viewing Stored Readings & A/B Scans



Grid Log **Sequential Log**

1) Press the  key once to activate measure menu items. Press the  key multiple times to move right and the  key multiple times to move left until the **LOG** cell is highlighted. Alternatively, press the  and  arrow keys multiple times using the left button wheel.



2) Press the  key to display the **Grid Log Box**.

3) Press the  ,  ,  , and  arrow keys on the left button wheel to scroll the stored readings and corresponding display view.

Notice as the cursor is moved to a different cell, the display will be updated with the display view saved with the reading. Readings stored in memory are indicated by displaying a **MEM** in the top left corner of the measurement screen.

4) The user may opt to clear a specific reading and save a new one at any time. Press the 

key in the appropriate cell location to clear the reading, take a new measurement, and press the  key to save the new reading.

5) Abort the **Grid/Seq Log View Box** by pressing the  key at any time.

12.5 Deleting Grids (Files)

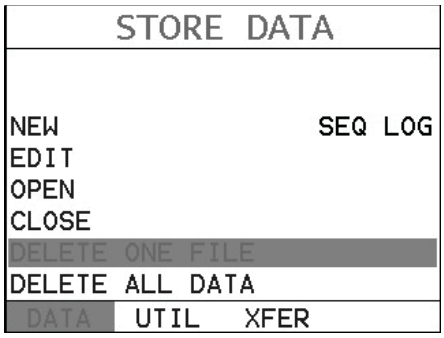
Deleting One or All Files from Memory

Deleting One File

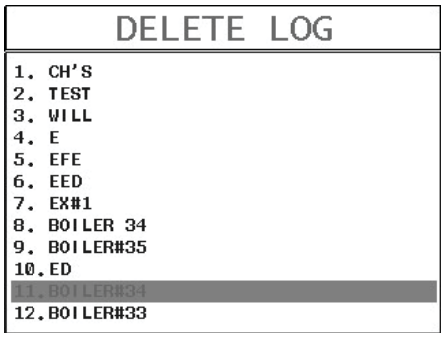
1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the 

key multiple times to tab left until the 

menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.



2) Use the  and  arrow keys on the left button wheel to scroll through the sub menu items until **DELETE ONE FILE** is highlighted.



3) Press the  key to display the **File List Box**.

4) Use the   and  arrow keys on the left button wheel to scroll through the stored **Files** until the target **File** to delete is highlighted.

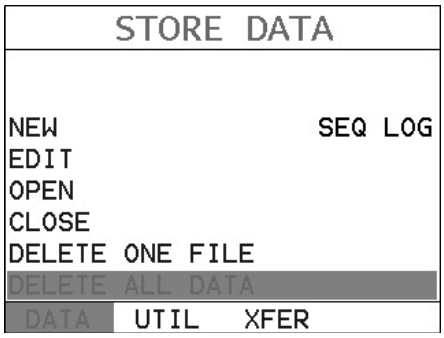
5) Press the  key to delete the **File**.

6) Press the  key to return to the measurement screen.

Deleting All Data

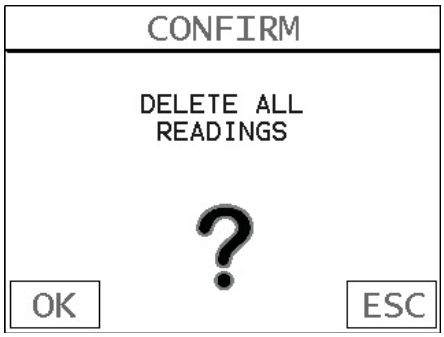
1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the  menu is highlighted and displaying the submenu

items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.



2) Use the  and  arrow keys on the left button wheel to scroll through the sub menu items until **DELETE ALL** 

is highlighted.



3) Press the  key to activate the confirmation screen.

4) Press the 

key to delete **All Files** from memory, or the 

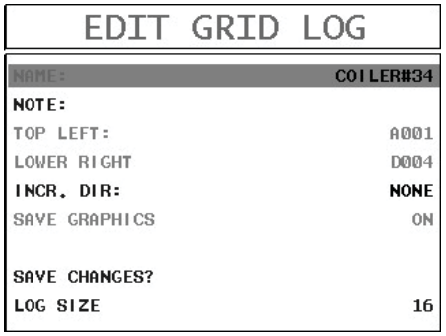
key to abort.

5) Press the  key to return to the measurement screen.

12.6 Editing a Grid (File)

Once a grid has been created and saved to memory, the user can edit the **Name**, **Comments**, or **Increment Direction** at a later time. The following procedures outline this process:

Editing a Grid



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the data menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until **EDIT** is highlighted.
3) Press the ↵ key to display the **Edit List Box**.
4) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the **Edit** options until **NAME**, **NOTE** or **INCR. DIR** is highlighted.

Note: *If editing the **INCR. DIR**, simply press the ◀ and ▶ arrow keys using the left button wheel to scroll **NONE, NORTH, EAST, SOUTH, WEST** for a Grid, or **INC, DEC** for a Seq Log. **Proceed to step 10**.*

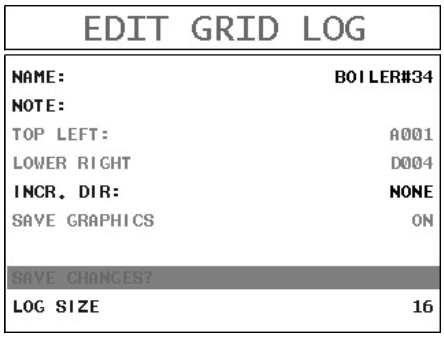
5) Press the ↵ key to activate the **Alpha Edit box – Only used when editing the NOTE**.

6) Use the ▲, ▼, ◀, & ▶ arrow keys on the left button wheel to highlight the appropriate alpha characters.

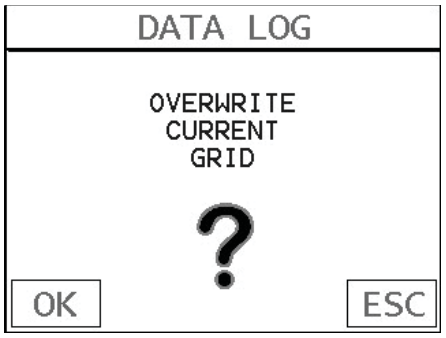
7) Press the ↵ key to select a character and advance to the next field of the **Comments**.

8) Use the clr key to backspace if necessary.

9) Repeat steps **6 - 8** until the **Comments** are completed.



10) Press the ▲ or ▼ arrow key to highlight **SAVE CHANGES**, and the OK key to activate the confirmation screen.



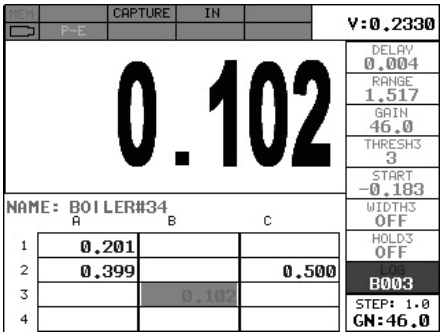
11)Press the OK key to save the changes or the esc key to cancel editing the file parameters.

12)Press the key to return to the measurement screen.

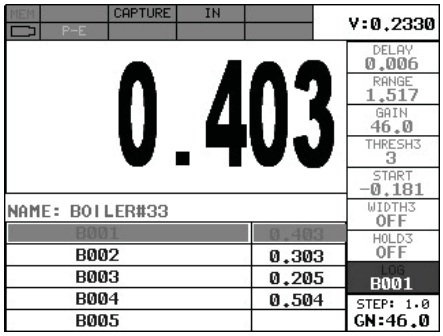
12.7 Changing the active File - Open

The user may have transferred grid/seq templates from a PC to the ***FX80***, or setup grids/seq using the ***FX80*** at an earlier time. The name of the currently active file is always displayed at the top of the **Grid/Seq Box** in measurement mode (refer to photo below). It's not only important to recognize what file is currently active, but also be able to change the active file at any time. The following procedures outline this process:

Changing the Active File



Grid Log

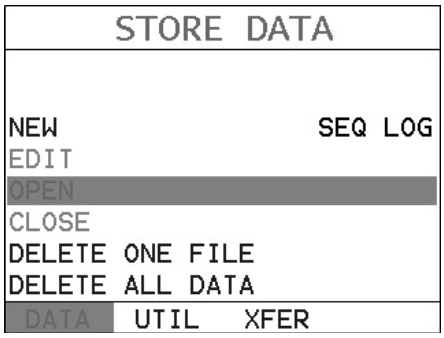


Sequential Log

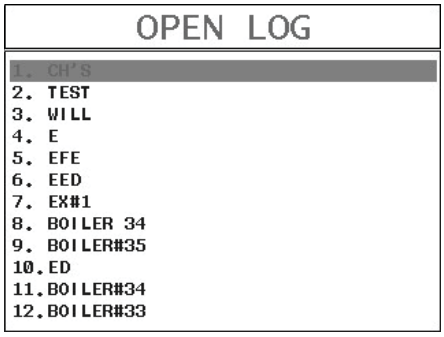
1) Press the key once to activate the menu items tab. Press the key multiple times to tab right and the esc key multiple times to

tab left until the 

menu is highlighted and displaying the submenu items. Alternatively, press the  and  arrow keys multiple times using the left button wheel.

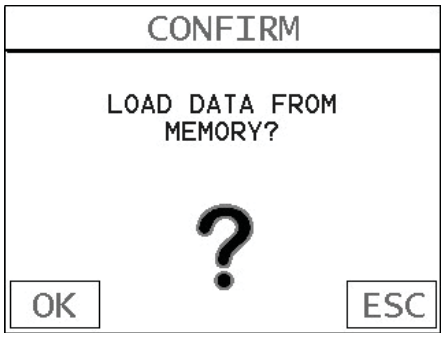


2) Use the  and  arrow keys on the left button wheel to scroll through the sub menu items until **OPEN** is highlighted.



3) Press the  key to display the **Grid/Seq List Box**.

4) Use the  and  arrow keys on the left button wheel to scroll through the grids until the target grid is highlighted.



5) Press the ↵ key to activate the confirmation screen.

6) Press the OK key to load the file from memory.

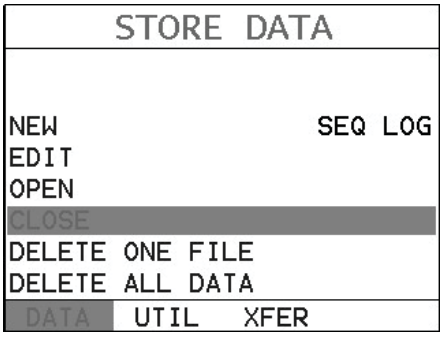
7) Press the ⌂ key to return to the measure screen.

12.8 Closing an active File - Close

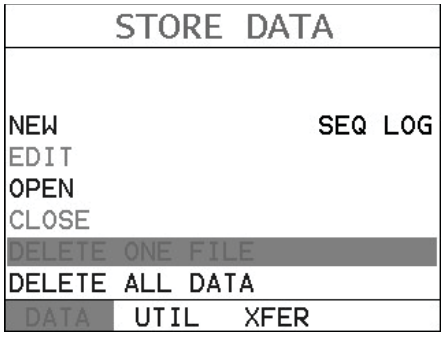
A user might not have a current requirement to store measurements, but a file is currently open or active and needs to be closed. The following procedures outline how to close an open or active file:

Closing an Active File

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **DATA** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.



2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until **CLOSE** is highlighted.



3) Press the ↵ key to close the active file. **Note:** *Following the key press, the **CLOSE** text will be grayed out indicating the file has been closed and is no longer active.*

CHAPTER THIRTEEN
SETUPS – CREATE, STORE, EDIT, & RECALL

13.1 Introduction to Setups

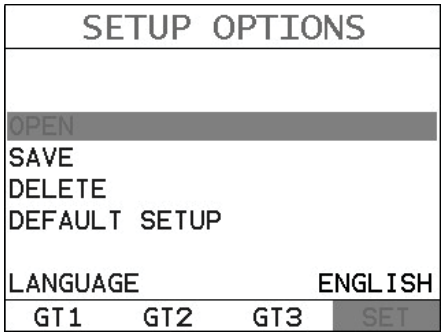
Often times, users are faced with a variety of tasks and applications that are sometimes similar, but can also be very different. Without the ability to save the individual calibrations and setups, the user would have to repeat the setup process on a regular basis for each individual application. This would become tedious rather quickly, especially considering the number of applications and potential calibration requirements for setup.

The increased number of features and parameters also adds to the overall setup time, or amount of time to set up marginal applications with perfection and understanding. Because of the additional time involved, the ***FX80*** has been equipped with the ability to save these setups to memory and be recalled at any time. The ***FX80*** can store up to **64 custom setups**. These setups can be bi-directionally transferred to and from a PC. Therefore, the user can save as many setups as necessary for all their individual applications requirements. This saves a great deal of time and knowledge for future inspections of the same job or project. This feature also eliminates error between two or more users during the setup and calibration process.

13.2 Opening a Setup

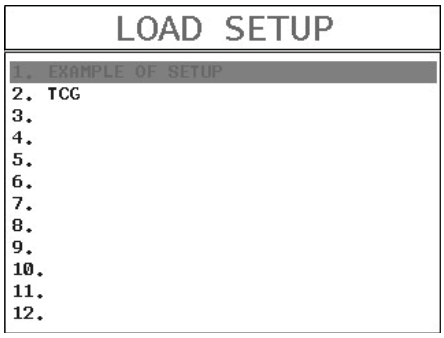
The ***FX80*** is loaded with a number of setups from the factory. These setups can be opened, edited, and saved to any one of **64 setup locations**. If a factory setup is written over, the user can simply reload the default factory setups at anytime using the utility software included with the ***FX80***. The factory setups are general setups **Only**. However, they may serve as an excellent starting point, requiring only minor adjustments to work for custom applications. It is recommended that user customized setups be saved to an empty location, and save the factory setups for the purpose of a general starting point. The following procedures outline how to open factory and custom setups:

Opening a Setup



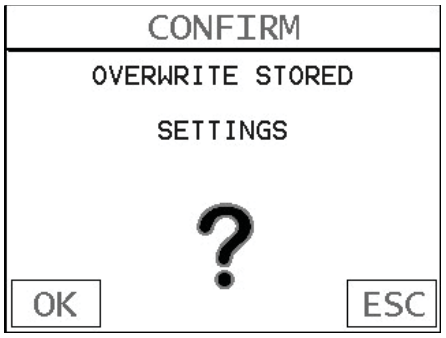
1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until **OPEN** is highlighted.



3) Press the ↵ key to display the **Setup List Box**.

4) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the setups until the target setup is highlighted.



5) Press the ↵ key to activate the confirmation screen.

6) Press the OK key to load the setup from memory.

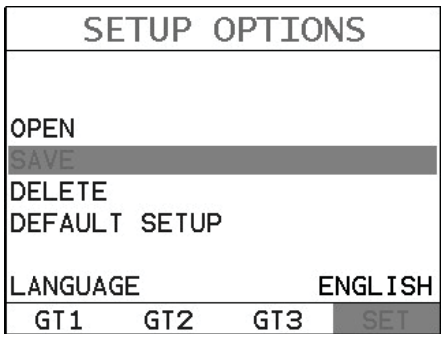
7) Press the ⌂ key to return to the measure screen.

13.3 Saving a Setup

Once the ***FX80*** parameters and features have be adjusted for an application, the user may elect to save these setting to a specific setup location for future use. This can potentially save time and reduce error between users.

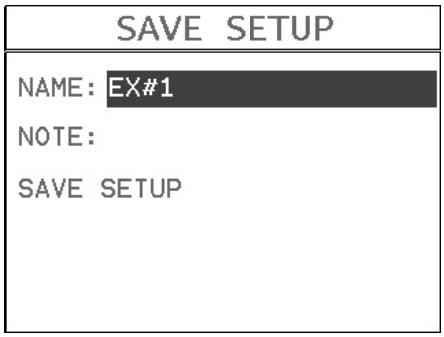
It is sometimes necessary to rename a previously saved setup, or add additional comments about a particular setup. The setup name may have been entered incorrectly, or the user needs to use the setup for a completely different project. An inspector's name or other comments about the project may also be required for additional documentation purposes. The following procedures outline the necessary steps for saving and editing a setup:

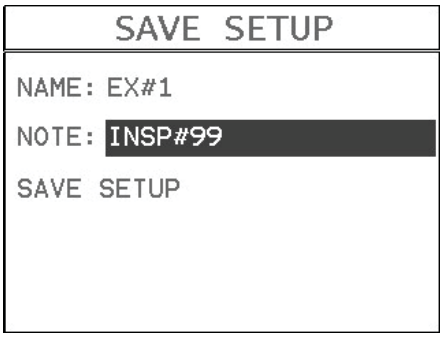
Saving a Setup



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until **SAVE** is highlighted.





3) Press the ↵ key to display the **Save Setup Parameters List Box**.

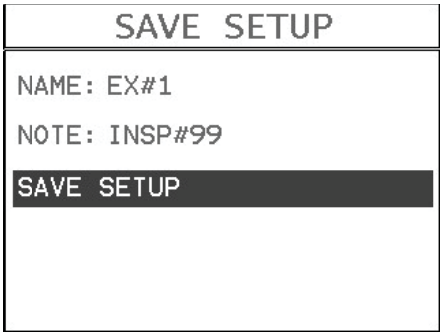
4) Press the ▲ and ▼ arrow keys on the left button wheel to scroll the **Name** and **Note** parameters.

5) When the parameter to edit is highlighted, press the key to activate the **Alpha Edit Box**.

6) Use the , , , & arrow keys on the left button wheel to scroll through the characters, the key to select characters, and the clr key to backspace through the characters, until the **Name** or **Note** fields have been edited.

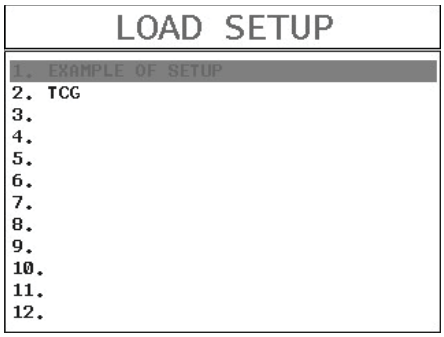
7) Press the OK key to return to the **Save Setup Parameters List Box**.

8) If both parameters will be edited, **repeat steps 4 – 7**.

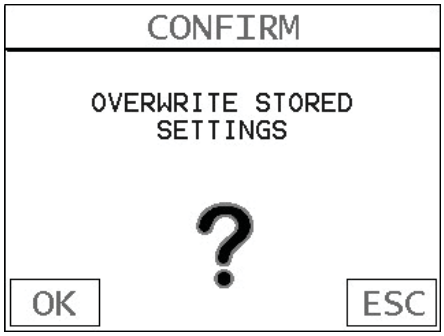


9) Use the and arrow keys on the left button wheel to scroll to and highlight **SAVE SETUP**.

10)Press the  key to activate the **Setup List Box**.



11)Use the  and  arrow keys on the left button wheel to scroll through the setups until the target location to save the **Setup** is highlighted.



12)Press the 

key to activate the confirmation screen.

13)Press the 

key to save the **Setup**, or 

to cancel saving the **Setup**.

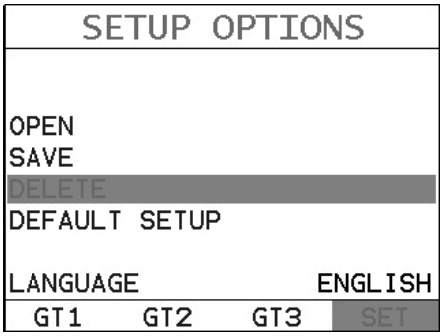
14)Finally, press the  key to return to the measurement screen.

Note: *The **Name** and **Comments** of the **Setup** can be edited at any time by simply repeating the **Save Setup** routine described above. Therefore, **the Save Setup** function can also be considered an **Edit Function**.*

13.4 Deleting a Saved Setup

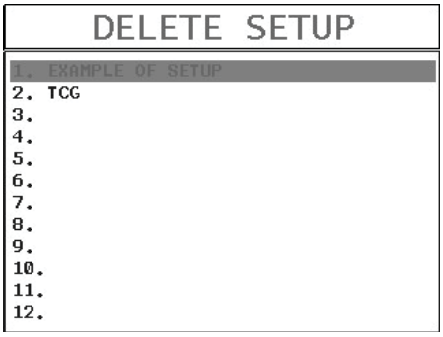
This option allows a user to delete setup files that were previously saved and no longer needed. It's a simple feature to allow the user to do a bit of "house cleaning".

Deleting a Setup



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

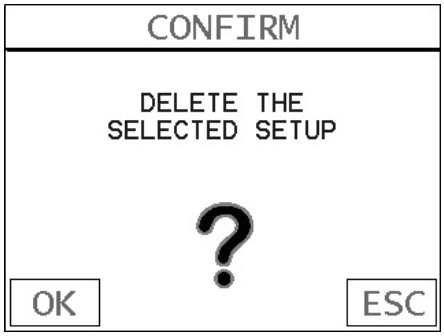
2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until **DELETE** is highlighted.



3) Press the ↵ key to display the **Setups List**.

4) Press the ▲ and ▼ arrow keys on the left button wheel to scroll to the **Setup Name**.

5) When the **Setup Name** is highlighted, press the ↵ key to display the confirmation screen.



6) Press the OK key to delete the **Setup File**.

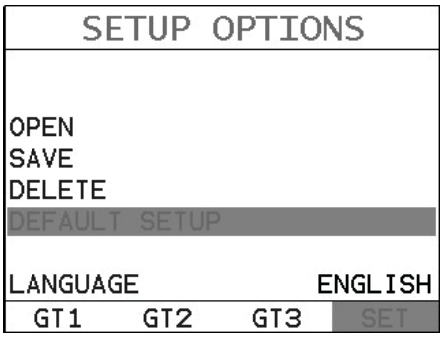
7) Finally, press the ⌂ key to return to the measurement screen.

13.5 Using the Default Setup

The default setup feature was added to the ***FX80*** to use, as a last resort, if there are no setups stored in the gauge –factory or otherwise. The only time this might possibly occur is if the setup file in the ***FX80*** was somehow corrupted, and the user does not have access to a computer to re-load the factory setups back into the ***FX80***. This gives the user the ability to load and modify a basic setup as follows:

Note: *The default file contains no probe zero data. Therefore, a zero must be performed after loading. Also, the default setup can be loaded when using the flaw mode feature, to eliminate the probe zero delay value, and start at the initial pulse or zero.*

Using the Default Setup

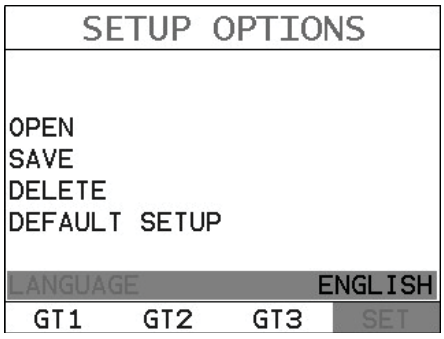


1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until **DEFAULT SETUP** is highlighted.
3) Press the ↵ key to load default **DEFAULT SETUP**.
4) Finally, press the ⌂ key to return to the measurement screen.

13.6 Selecting a Language

The ***FX80*** is equipped with a language option. Currently, only a few languages supported. However, be sure to update your gauge firmware often, to check for language additions. The steps to select a language are outlined as follows:

Selecting a Language



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until **LANGUAGE** is highlighted.

3) Press the ◀ and ▶ arrow keys multiple times on the right button wheel to toggle the language options.

4) Once the desired language is displayed, press the ⌂ key to return to the measurement screen.

CHAPTER FOURTEEN
SOFTWARE, FILE TRANSFER, & UPGRADES

14.1 Computer System Requirements

DakView will run on many different operating systems: Windows XP, Windows 2000 Professional, Windows 2000 Server, Windows 2000, Vista, Windows 7, or Windows 8 Advanced Server operating systems running on Intel or AMD hardware.

A Pentium 166MHz or faster processor with at least 32 megabytes of physical RAM is required. You should have 40 megabytes of free disk space before attempting to install **DakView**.

USB Type1 to Type 2 Cable

If a replacement cable is needed, contact Dakota NDT (pt# N-606-0530).

14.2 Installing DakView

DakView comes on a CD-ROM with an automatic installer program. Place the CD in your computer's CD tray and close the door. Open the CD-ROM by double clicking on the My Computer ICON, then double click on the CD. Finally, double click on the **SETUP** icon to begin the installation.Refer to the help section in **DakView** software for the complete operating manual, setup, and operation.

14.3 Communicating with FX80

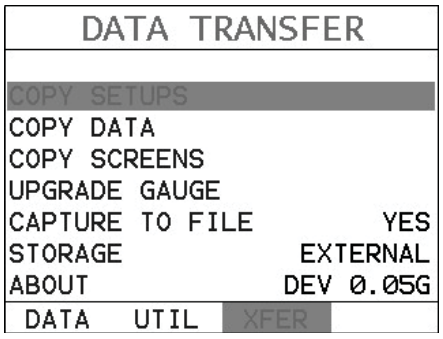
DakView will not directly communicate with the ***FX80*** series gauges. The ***FX80*** is equipped with USB, acting as a Thumb Drive (external storage device) when connected to a computer and powered on. Therefore, the SD memory card(s) can be opened as a drive with *directory structure, similar to the C: on your computer. The files stored on the internal S*D, or external SD reader, can be simply copied (dragged) into any folder on your PC and opened using **DakView**. The PC software will function on as a file viewer for the ***FX80*** series gauges.

Refer to the help section in **DakView** software for the complete operating manual, setup, and operation.

14.4 Using the XFER menu (*FX80*)

The **XFER** menu of the ***FX80*** will be used in conjunction with the **DakView** PC software. The steps below outline the procedure for accessing the **XFER** menu and basic operation as follows:

Accessing and Using the XFER Menu



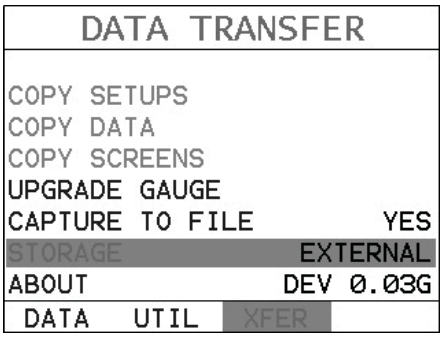
1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **XFER** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until the desire option is highlighted.
3) Press the ↵ key to activate the option selected.

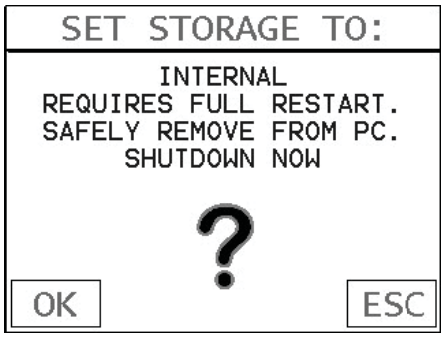
14.5 Selecting Storage Device

The ***FX80*** has two storage device options available. The ***FX80*** is shipped from the factory with a 4 gig internal SD memory card on the board itself, and additionally has an external SD card reader. The SD reader is located above the Li-Ion battery pack, under the battery cover. The **STORAGE** utility simply selects which card is currently being used as the primary storage device. This storage switch is also used in conjunction with all the copy utilities found in the **XFER** menu. For example; if the

storage switch is set to internal as the primary storage device, all the copy routines will copy from the internal to the external reader, or visa versa. The procedure to set the storage device is outlined below:

Selecting Storage Device



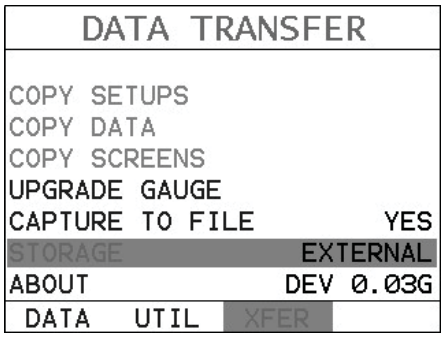


1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **XFER** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys multiple times using the left button wheel to scroll through the sub menu items until **STORAGE** is highlighted.
3) Use the ◀ and ▶ arrow keys multiple times on the right button wheel to toggle **STORAGE** internal/external. **Note:** *Capture will be displayed in a toolbar cell on the active display, indicating the feature is enabled.*

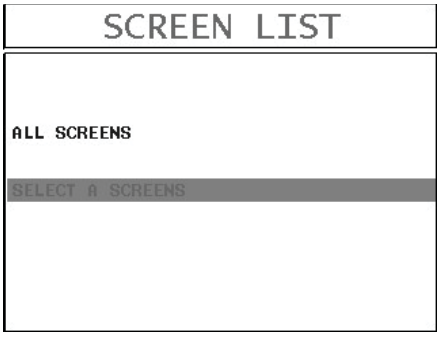
14.6 Copying Files (Setups, Data, & Screenshots)

The ***FX80*** can store a number of setup, data and screenshot files to either the internal or external SD memory cards. All the copy routines will copy files from the currently selected storage device to the other. Therefore, if the current storage device is set to 'internal', the copy routines will transfer files directly to the external device. Note: *If the **FX80** is powered up without an external SD card inserted in the slot, the copy routines in the **XFER** menu will be inactive.* The steps below outline the procedure for copying files from one storage device to the other as follows:

Copying Files Between Storage Devices

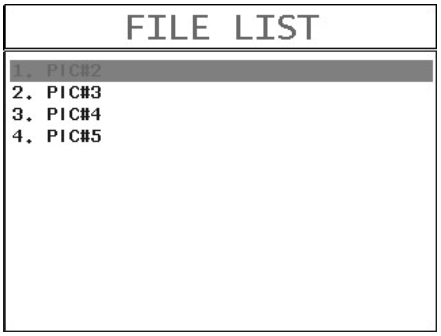


1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **XFER** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the sub menu items until the desired **COPY** option is highlighted.



3) Press the ↵ key to display the **Setups/Data/Sceens List**.

4) Use the ▲ and ▼ arrow keys on the left button wheel to highlight the desired **List Box** option.



5) Press the ↵ key to either transfer **ALL** files, or display the **Individual List** of files.

6) Use the ▲ and ▼ arrow keys on the left button wheel to scroll through the list of files and select the specific file to copy.

7) Press the ↵ key to complete the **Copy** process, followed by pressing the OK key to display the **List Box**.

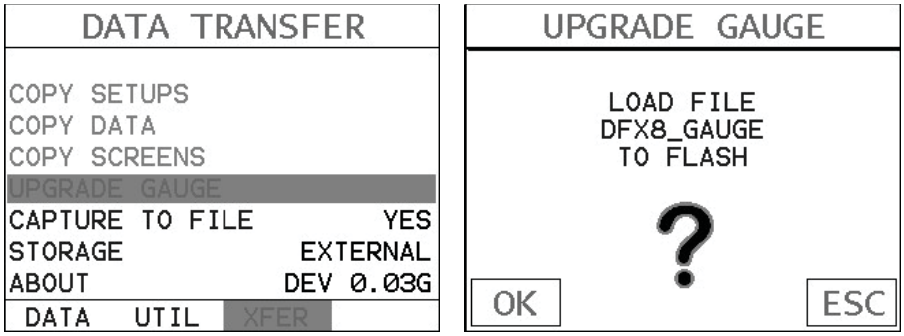
8) Repeat steps **6 & 7** to copying additional individual files.

9) Finally, press the ⌂ key to return to the measurement screen.

14.7 Upgrading the FX80

The ***FX80*** can be upgraded to the latest revision of firmware at any time. Simply download the latest version posted on the Dakota NDT website, copy the upgrade file to the main drive directory ***FX80***, and use the upgrade utility located in the **XFER** menu. The process is very easy and convenient, allowing our users to stay current with updated feature additions and bug fixes. The procedure to upgrade your ***FX80*** is outlined below:

Upgrading the Firmware



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **XFER** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.

2) Press the ↵ key to display the upgrade confirmation screen, followed by pressing OK key to start the upgrade process. **Note:** *The **FX80** will power down during the upgrade process, and restart when completed.*

APPENDIX A - VELOCITY TABLE

Material	L-Wave velocity in/µs	L-Wave velocity m/s	S-Wave Velocity in/µs	S-Wave Velocity in/µs
Aluminum	0.2510	6375	.1240	3130
Beryllium	0.5080	12903	.3500	8880
Brass	0.1730	4394	.0830	2120
Bronze	0.1390	3531	.0880	2235
Cadmium	0.1090	2769	.0590	1500
Columbium	0.1940	4928	.0830	2100
Copper	0.1830	4648	.0890	2260
Glass (plate)	0.2270	5766	.1350	3430
Glycerine	0.0760	1930	-	-
Gold	0.1280	3251	.0470	1194
Inconel	0.2290	5817	.1190	3020
Iron	0.2320	5893	.1270	3230
Cast Iron	0.1800	4572	.0870-.1260	2200-3220
Lead	0.0850	2159	.0280	700
Magnesium	0.2300	5842	.1200	3050
Mercury	0.0570	1448	-	-
Molybdenum	0.2460	6248	.1320	3350
Monel	0.2110	5359	.1070	2720
Nickel	0.2220	5639	.1170	2970
Nylon	0.1060	2692	.0430	1090
Platinum	0.1560	3962	.0660	1670
Plexiglas	0.1060	2692	.0500	1270
Polystyrene	0.0920	2337	-	-
PVC	0.0940	2388	.0420	1060
Quartz glass	0.2260	5740	.0870	2210
Rubber vulcanized	0.0910	2311	-	-
Silver	0.1420	3607	.0360	1590
Steel (1020)	0.2320	5893	.1280	3240
Steel (4340)	0.2330	5918	.1280	3240

Steel Stainless"	**0.2230**	**5664**	**.1230**	**3120**
Teflon	**0.0540**	**1372**	**.2500**	**6350**
Tin	**0.1310**	**3327**	**.0660**	**1670**
Titanium	**0.2400**	**6096**	**.1230**	**3120**
Tungsten	**0.2040**	**5182**	**.1130**	**2870**
Uranium	**0.1330**	**3378**	**.0780**	**1980**
Water	**0.0580**	**1473**	**-**	**-**
Zinc	**0.1660**	**4216**	**.0950**	**2410**
Zirconium	**0.1830**	**4648**	**.0890**	**2250**

APPENDIX B -
SETUP LIBRARY

Num	Name	Comment 1	Gn/AGC	Velocity
1	Enter Custom Name			
2	…			
3	…			
4	…			
5	…			
6	…			
…	…			

WARRANTY INFORMATION

• Warranty Statement •

Dakota NDT warrants the ***FX80*** against defects in materials and workmanship for a period of two years from receipt by the end user. Additionally, Dakota NDT warrants transducers and accessories against such defects for a period of 90 days from receipt by the end user. If Dakota NDT receives notice of such defects during the warranty period, Dakota NDT will either, at its option, repair or replace products that prove to be defective.

Should Dakota NDT be unable to repair or replace the product within a reasonable amount of time, the customer's alternative exclusive remedy shall be refund of the purchase price upon return of the product.

• Exclusions •

The above warranty shall not apply to defects resulting from: improper or inadequate maintenance by the customer; unauthorized modification or misuse; or operation outside the environmental specifications for the product.

Dakota NDT makes no other warranty, either express or implied, with respect to this product. Dakota NDT specifically disclaims any implied warranties of merchantability or fitness for a particular purpose. Some states or provinces do not allow limitations on the duration of an implied warranty, so the above limitation or exclusion may not apply to you. However, any implied warranty of merchantability or fitness is limited to the five-year duration of this written warranty.

This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state or province to province.

• Obtaining Service During Warranty Period •

If your hardware should fail during the warranty period, contact Dakota NDT and arrange for servicing of the product. Retain proof of purchase in order to obtain warranty service.

For products that require servicing, Dakota NDT may use one of the following methods:

- Repair the product
- Replace the product with a re-manufactured unit
- Replace the product with a product of equal or greater performance
- Refund the purchase price.

• After the Warranty Period •

If your hardware should fail after the warranty period, contact Dakota NDT for details of the services available, and to arrange for non-warranty service.