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CHAPTER ONE
INTRODUCTION

The Dakota Ultrasonics model **DFX-8** 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 DL+**, as well as our new **DFX-8** 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 **DFX-8** 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 an effort to avoid complexity issues and differential between gauges types, this manual focuses only on the flaw detector portion of the **DFX-8**.

Dakota Ultrasonics 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:

<table>
<thead>
<tr>
<th>Dakota Ultrasonics Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 Green Hills Road, #107</td>
</tr>
<tr>
<td>Scotts Valley, CA 95066 USA</td>
</tr>
<tr>
<td>Telephone: (831) 431-9722</td>
</tr>
<tr>
<td>Facsimile: (831) 431-9723</td>
</tr>
<tr>
<td><a href="http://www.dakotaultrasonics.com">www.dakotaultrasonics.com</a></td>
</tr>
</tbody>
</table>

1.1 General Disclaimer

The manual should be read and understood prior to using the **DFX-8**. This operating manual provides the user with all the general information necessary to use and operate the features of the **DFX-8**. 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 *DFX-8* 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 DFX-8 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 DFX-8, 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 DFX-8, use the UP/DOWN arrow keys to select “flaw detector”, followed by pressing the OK key start the DFX-8 in flaw mode. If this is the first time the gauge has been used, a general startup configuration will automatically be loaded and the DFX-8 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:

<table>
<thead>
<tr>
<th>PRB</th>
<th>CAL</th>
<th>DISP</th>
<th>TUNE</th>
<th>GT1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>Matl: Steel 1020</td>
<td>View: +Rect</td>
<td>Filters: Wide</td>
<td>Alarm: On</td>
</tr>
<tr>
<td>Single</td>
<td></td>
<td></td>
<td>Gate1: 0.484</td>
<td></td>
</tr>
<tr>
<td>Pulse:</td>
<td>Matl 1pt: Uncal</td>
<td>Delay: 0.000</td>
<td>Gain: 65</td>
<td></td>
</tr>
<tr>
<td>Thin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max PRF:</td>
<td>Matl 2pt: Uncal</td>
<td>Range: 5.011</td>
<td>Detect Mode: Z-Cross</td>
<td>Thresh1: 40%</td>
</tr>
<tr>
<td>66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damping:</td>
<td>Velocity: 0.2320</td>
<td>Units: inches</td>
<td>Width1: INF</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulser Volt:</td>
<td>200</td>
<td>Zero: 0.0</td>
<td>Brightness: 15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Detect: Above</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Polarity: Pos</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>View: Green 1</td>
</tr>
</tbody>
</table>
2.3 Top & Submenu Reference

The following table is a quick menu reference guide. The DFX-8 has 15 top level menu titles, and multiple submenu items as illustrated below. The DFX-8 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 LEFT and RIGHT arrow keys multiple times using the left button wheel, and pressing the UP and DOWN 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
DFX-8+ Only

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

<table>
<thead>
<tr>
<th>PRB</th>
<th>CAL</th>
<th>DISP</th>
<th>TUNE</th>
<th>GT1</th>
<th>GT2</th>
<th>TRIG</th>
<th>AWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>MAT</td>
<td>VIEW</td>
<td>FILTERS</td>
<td>ALARM</td>
<td>ALARM</td>
<td>TRIG</td>
<td>AWS</td>
</tr>
<tr>
<td>PULSE</td>
<td>MATL 1PT</td>
<td>DELAY</td>
<td>GAIN</td>
<td>DETECT</td>
<td>DETECT</td>
<td>THICKNESS</td>
<td>SET REF GAIN</td>
</tr>
<tr>
<td>MAX PRF</td>
<td>MATL 2PT</td>
<td>RANGE</td>
<td>GAIN STEP</td>
<td>GATE1</td>
<td>GATE2</td>
<td>ANGLE</td>
<td>SHOW CURVE</td>
</tr>
<tr>
<td>DAMPING</td>
<td>VELOCITY</td>
<td>UNITS</td>
<td>DETECT MODE</td>
<td>GATE1 WIDTH</td>
<td>GATE2 WIDTH</td>
<td>X-OFFSET</td>
<td>% SCRNR HEIGHT</td>
</tr>
<tr>
<td>PULSER VOLTAGE</td>
<td>ZERO</td>
<td>BRIGHTNESS</td>
<td></td>
<td>THRESHOLD1</td>
<td>THRESHOLD2</td>
<td>CSC O.D.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>COLORS</td>
<td>POLARITY</td>
<td>POLARITY</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DIM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECT WAVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DETECT MARK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WAVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVERAGING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.4 Loading the Default Setup

If the *DFX-8* 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 **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **ENTER** key to display the confirmation screen.

```
CONFIRM

LOAD DEFAULT SETTINGS

OK

ESC
```

4) Press the **OK** key to load the default setup and return to the measurement screen.
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

<table>
<thead>
<tr>
<th>SETUP OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B</strong></td>
</tr>
<tr>
<td>OPEN</td>
</tr>
<tr>
<td>SAVE</td>
</tr>
<tr>
<td>DELETE</td>
</tr>
<tr>
<td>DEFAULT SETUP</td>
</tr>
<tr>
<td><strong>A</strong></td>
</tr>
<tr>
<td>LANGUAGE</td>
</tr>
<tr>
<td>ENGLISH</td>
</tr>
<tr>
<td>GT1</td>
</tr>
</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** 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 **UP** and **DOWN** 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 **LEFT** and **RIGHT** arrow keys on the right button wheel to scroll the options, or the **ENTER** 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 DFX-8 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 88 for a further explanation. The DFX-8+ 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 88 for a further explanation.

**MAX PRF:** This feature controls the pulse repetition frequency of the DFX-8. The maximum frequency is 333 Hz. However, the DFX-8 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 90 for further info.

**PULSER VOLT:** The DFX-8 has an adjustable pulser voltage: 100, 150, and 200 volts. Refer to page 91 for a further explanation. The DFX-8+ has a special tone burst pulser: 100, 150, 200, 300, 400 volts. Refer to page 91 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 39 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 39 for further info.

VELOCITY: Function to calibrate the DFX-8 by setting the velocity to a known material velocity. Refer to page 94 for further info.

ZERO: Used to zero the transducer and calibrate the screen. The DFX-8 is zeroed in much the same way that a mechanical micrometer is zeroed. If the DFX-8 is not zeroed correctly, all of the measurements made using the DFX-8 may be in error by some fixed value. Refer to the section on page 39, 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.

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 97 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 98 for further info.

DIM: Allows the user to conserve battery life by dimming 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 99 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 100 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 DFX-8+ is equipped with wave averaging to eliminate noise for a clear waveform image. Not recommended for high speed scanning. Refer to page 103 for further info.
DFX-8 Series Ultrasonic Flaw Detectors

3.5 TUNE – Menu

**MEASURE MODE:** This menu item is only included in our DFX-8+. 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 104 for further info.

**FILTERS:** The DFX-8 is a wide band flaw detector with a frequency range of 1.8 to 19 MHz (-3dB). The DFX-8 is additionally equipped with selectable narrow band filters at; 2, 5 & 10 MHz. The DFX-8+ includes two additional filters at 0.5 kHz and 15 MHz. Refer to page 103 for further info.

**GAIN:** The DFX-8 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 UP or DOWN 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 DFX-8 is equipped with optional detection modes; PEAK, 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 109 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 33 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 33 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 33 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 33 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 33 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 DFX-8 will not display an amplitude percentage of full screen height. Refer to page 33 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 33 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 33 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 33 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 33 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 33 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 DFX-8 will not display an amplitude percentage of full screen height. Refer to page 33 for further info.

<table>
<thead>
<tr>
<th>TRIGONOMETRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRIG: ON</td>
</tr>
<tr>
<td>THICKNESS: 4.000</td>
</tr>
<tr>
<td>ANGLE: 0.0</td>
</tr>
<tr>
<td>X-OFFSET: 0.000</td>
</tr>
<tr>
<td>CSC O.D.: 0.000</td>
</tr>
<tr>
<td>GT1</td>
</tr>
</tbody>
</table>

### 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 (\(\Delta\)), Surface distance (\(\rightarrow\)), and Depth (\(\downarrow\)) from the index point of the transducer. Refer to page 54 for further info.

**THICKNESS:** Used to set the thickness of the test material. The thickness will be used to determine which skip/leg the DFX-8 is detecting on. Refer to page 54 for further info.

**ANGLE:** Used to set the angle of the transducer, and used in the calculations above. Refer to page 54 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 54 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 54 for further info.

<table>
<thead>
<tr>
<th>AWS SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS: ON</td>
</tr>
<tr>
<td>REFERENCE GAIN: OFF</td>
</tr>
<tr>
<td>SHOW CURVE: OFF</td>
</tr>
<tr>
<td>X SCRNN HEIGHT: 80</td>
</tr>
<tr>
<td>GT1</td>
</tr>
</tbody>
</table>

### 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 60 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 60 for further info.

**SHOW CURVE**: Toggles the AWS correction curve on/off. Refer to page 60 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 60 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 72 for further info.

**REFERENCE GAIN**: Toggles the DRAW mode on/off, and used to draw the TCG curve. Refer to page 72 for further info.

**CURVE**: Toggles the TCG correction curve on/off, and the curve is displayed on the screen. Refer to page 72 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 72 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 66 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 66 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 66 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 66 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 66 for further info.

**DPOLARITY:** Used to select the polarity of the DAC curves generated, either positive or negative. Refer to page 66 for further info.

**FIT:** Creates either a linear (straight line) or spline (nice curve) fit between calibrated reference points. Refer to page 66 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 77 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 80 for further info.

**TRIGGER CURVE:** Used to set the alarm to detect on either the DGS curve, or independent GATE. Refer to page 80 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 78 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 80 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 80 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 81 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 81 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 81 for further info.

**REFERENCE LOSS:** Used to compensate for the loss of sound in the reference standard. Refer to page 81 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 81 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 80 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 80 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 80 for further info.

---

**SETUP OPTIONS**

<table>
<thead>
<tr>
<th>OPEN</th>
<th>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 146 for further info.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAVE</td>
<td>Provides the user with the ability to save a custom setup that has been modified or created by the user. Refer to page 148 for further info.</td>
</tr>
<tr>
<td>DELETE</td>
<td>Provides the user with the ability to delete specific setups previously save in memory. Refer to page 148 for further info.</td>
</tr>
<tr>
<td>DEFAULT SETUP</td>
<td>Loads a basic default setup. Use only as a last resort when the setups in the DFX-8 have been corrupted and a computer is not accessible. Refer to page 153 for further info.</td>
</tr>
<tr>
<td>LANGUAGE</td>
<td>Provides the user the ability to select different languages for the DFX-8. Refer to page 155 for further info.</td>
</tr>
</tbody>
</table>

---

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 146 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 148 for further info.

**DELETE:** Provides the user with the ability to delete specific setups previously save in memory. Refer to page 148 for further info.

**DEFAULT SETUP:** Loads a basic default setup. Use only as a last resort when the setups in the DFX-8 have been corrupted and a computer is not accessible. Refer to page 153 for further info.

**LANGUAGE:** Provides the user the ability to select different languages for the DFX-8. Refer to page 155 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 123 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 140 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 140 for further info.

**CLOSE:** Provides the user the ability to close a currently opened grid or sequential log file. Refer to page 142 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 136 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 138 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 97 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 113 for further info.
**ANALOG OUTPUT:** *DFX-8*+ only. Proportional outputs (amplitude or distance), 0-10 volts. Speed is determined by the PRF setting. Refer to page 114 for further info.

**SET DATE:** Gives the user the ability to set the internal date and time stamp in the *DFX-8*. Refer to page 113 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 117 for further info.

**GAUGE:** Gives the user the ability to toggle the *DFX-8* gauge type to either a flaw detector, or a thickness gauge. Refer to page 3 for further info.

<table>
<thead>
<tr>
<th>DATA TRANSFER</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPY DATA</td>
</tr>
<tr>
<td>COPY SCREENS</td>
</tr>
<tr>
<td>UPGRADE GAUGE</td>
</tr>
<tr>
<td>CAPTURE TO FILE</td>
</tr>
<tr>
<td>STORAGE</td>
</tr>
<tr>
<td>ABOUT</td>
</tr>
<tr>
<td>DATA UTIL</td>
</tr>
</tbody>
</table>

### 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 158 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 158 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 158 for further info.

**UPGRADE GAUGE:** Enables the user the ability to upgrade the *DFX-8* to the most current firmware revision. Refer to page 160 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 157 for further info.

**ABOUT:** Provides the user with Dakota Ultrasonics contact information and the *DFX-8* firmware & FPGA versions. Refer the Dakota Ultrasonics web site for information on the latest firmware versions available for download.

### 3.17 CLR (clear) Key

![CLEAR]
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 MEAS (measurement mode) Key

The **MEAS** key puts the **DFX-8** 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 **DFX-8** 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 **MENU**, **MEAS**, and **EDIT** functions as a back or escape function. If the **DFX-8** is displaying a grid or sequential log, the **OK** 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 DFX-8.

### 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 to 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 DFX-8, 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 **DFX-8** 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 DFX-8 Overview

In order to understand how to operate the **DFX-8**, it’s best to start off with an understanding of what we’re looking at. The **DFX-8** 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 **DFX-8** 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 **MEAS** key at anytime. The **ESC** key is used in conjunction with **MEAS** 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 **CLR** 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 DFX-8. 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 LEFT and RIGHT arrow keys to scroll through the 9 individual Hot Menus, and the UP and DOWN
arrow keys to scroll through the **Hot Menu** items. Alternatively, the **MEAS & ESC** keys can be used to scroll through the **Hot Menu** items.

2) Press the LEFT and RIGHT 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 **ENTER** 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 **DFX-8**. 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 **DFX-8’s** top end cap. The transducer connectors are of type Lemo “00”. **Note:** There is no polarity associated with connecting the transducer to the **DFX-8**.

**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 **DFX-8**. **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 DFX-8 with the latest version of firmware (gauge software). The cable supplied with the DFX-8 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 DFX-8+ 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 DFX-8+ “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 DFX-8+ 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 DFX-8+ 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.
4.1 Selecting Display View

The DFX-8 includes a variety of viewing options for the waveform display. There are three primary options waveform options with selectable polarity. These are all outlined 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:

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times
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 **DFX-8**.

**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:

---

using the left button wheel. *For quick access and editing, refer to navigating the Hot Menus page 22.*

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

3) Use the **LEFT** and **RIGHT** 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 **MEAS** key to return to measurement mode.
1) Using the left button wheel, press the LEFT and RIGHT arrow keys to scroll through the 9 individual Hot Menus, and the UP and DOWN arrow keys to scroll through the Hot Menu items to highlight DELAY. Alternatively, the MEAS & ESC keys can be used to scroll through the Hot Menu items.

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

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

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

5) Press the LEFT and RIGHT 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:
1) Using the left button wheel, press the LEFT and RIGHT arrow keys to scroll through the 9 individual Hot Menus, and the UP and DOWN arrow keys to scroll through the Hot Menu items to highlight RANGE. Alternatively, the MEAS & ESC keys can be used to scroll through the Hot Menu items.

2) Press the UP, DOWN, LEFT, and RIGHT arrow keys to scroll the highlighted value.

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

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

5) Press the LEFT and RIGHT 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 OK key to return to the measurement screen, or ESC to cancel entering the RANGE.
4.3 Gain

The gain feature of the DFX-8 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 DFX-8 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 DFX-8 commands a 110dB gain range using 3 stages of amplification. The overall range makes the DFX-8 extremely versatile regarding a variety of applications and material types.

The Gain can be quickly adjusted at any time, as the DFX-8 has dedicated buttons on the keypad for this purpose. The procedure to adjust the Gain are outlined below:

1) Press the UP and DOWN arrow keys on the right button wheel to adjust the GAIN setting.
2) Additionally, the increment **GAIN STEP** size can be adjusted at any time by pressing the **GAIN** button and displaying the **Digits Edit Box**.

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

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

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

6) Press the **OK** key to return to the measurement screen, or **ESC** to cancel entering the **GAIN 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

![TUNE SIGNAL Table]

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>GAIN</th>
<th>GAIN STEP</th>
<th>DETECT</th>
<th>PRB</th>
<th>CAL</th>
<th>DISP</th>
<th>TUNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIDE</td>
<td>24.0</td>
<td>1.0</td>
<td>Z-CROSS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.
2) Use the **UP** and **DOWN** arrow keys on the left button wheel to scroll through the sub menu items until **GAIN** is highlighted.

3) Press the **LEFT** and **RIGHT** 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 **ENTER** key to display the **Digits Edit Box**.

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

6) Press the **UP** and **DOWN** 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 **OK** key to set the **Gain** and return to the menu screen, or **ESC** to cancel entering the **Gain**.

9) Finally, press the **MEAS** 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 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 DFX-8 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 22.
The following steps outline how to enable a gate as follows:

Activating a Gate

1) Press the MENU key once to activate the menu items tab. Press the MENU
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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the LEFT and RIGHT 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 UP and DOWN arrow keys on the left button wheel until DETECT is highlighted.

2) Press the LEFT and RIGHT 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 UP and DOWN arrow keys multiple times on the left button wheel until GATE1 is highlighted, followed by pressing the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.

3) Press the UP and DOWN arrow keys multiple times on the left button wheel to scroll the highlighted value.
4) Press the **LEFT** and **RIGHT** 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 **OK** key to set the **GATE1** start position and return to the menu screen, or **ESC** 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.

---

**Set Gate1 Width**

1) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until **GATE1 WIDTH** is highlighted, followed by pressing the **LEFT** and **RIGHT** 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 **ENTER** key to display the **Digits Edit Box**.

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

4) Press the **LEFT** and **RIGHT** 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 **OK** key to set the **GATE1 WIDTH** and return to the menu screen, or **ESC** 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.

---

**Set Threshold1 Level**
1) Press the UP and DOWN arrow keys multiple times on the left button wheel until THRESHOLD1 is highlighted, followed by pressing the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.

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

4) Press the LEFT and RIGHT 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 OK key to set the THRESHOLD1 level and return to the menu screen, or ESC to cancel entering the THRESHOLD1 level.

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

**Select Gate Polarity**

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

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

3) Press the MEAS 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 DFX-8. 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 DFX-8 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 DFX-8 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 DFX-8 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:

DFX-8 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 \textit{DFX-8}, as well as gaining a good understanding of their function:

**Loading Default Setup**

1) Press the \textbf{MENU} key once to activate the menu items tab. Press the \textbf{MENU} key multiple times to tab right and the \textbf{ESC} key multiple times to tab left until the \textbf{SEUTP} menu is highlighted and displaying the submenu items. Alternatively, press the \textbf{LEFT} and \textbf{RIGHT} arrow keys multiple times using the left button wheel.

2) Use the \textbf{UP} and \textbf{DOWN} arrow keys multiple times on the left button wheel to scroll through the sub menu items until \textbf{DEFAULT SETUP} is highlighted.

3) Press the \textbf{ENTER} key to display the \textbf{CONFIRM} screen.

4) Press the \textbf{OK} key to load the \textbf{DEFAULT SETUP}.

**Setting the Range**

1) Using the left button wheel, press the \textbf{LEFT} and \textbf{RIGHT} arrow keys to scroll through the 9 individual Hot Menus, and the \textbf{UP} and \textbf{DOWN} arrow keys to scroll through the Hot Menu items, until the RANGE cell is highlighted. Alternatively, the \textbf{MEAS & ESC} keys can be used to scroll through the Hot Menu items.
2) Press the ENTER key to display the Digits Edit Box.

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

4) Press the LEFT and RIGHT 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 OK 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 greater than 4 inches will enable the user to view the entire range on the display.

Enabling and Setting Up a Gate

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 22.
Activating a Gate

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

Setting the Detect

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

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

Gate1 Start

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

2) Press the **ENTER** key to display the **Digits Edit Box**.
3) Press the UP and DOWN arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the LEFT and RIGHT 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 OK key to set the value and return to the GT1 menu.

**Gate1 Width**

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

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

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

4) Press the LEFT and RIGHT 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 OK key to set the value and return to the GT1 menu.

**Threshold Level**

1) Use the UP and DOWN arrow keys multiple times on the left button wheel to scroll through the sub menu items until THRESHOLD1 is highlighted.
2) Press the **ENTER** key to display the **Digits Edit Box**.

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

4) Press the **LEFT** and **RIGHT** 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 **UP** and **DOWN** arrow keys multiple times on the left button wheel to scroll through the sub menu items until **POLARITY1** is highlighted.

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

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

---

### 5.2 Straight Beam Calibration

Now that the **DFX-8** 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 22.* 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 ℡ LEFT and RIGHT arrow keys to scroll through the 9 individual Hot Menus, and the ℡ UP and DOWN arrow keys to scroll through the Hot Menu items, until the GATE1 cell is highlighted. Alternatively, the MEAS & ESC keys can be used to scroll through the Hot Menu items.
2) Press the \textbf{LEFT} and \textbf{RIGHT} arrow keys on the right button wheel to move the gate over the waveform to be measured, as demonstrated in the screen shot above.

\textbf{Note:} In order to trigger on a signal, the waveform must be inside the boundaries of the gate.

\textbf{Calibrating the First Point}

1) Press the \textbf{MENU} key once to activate the menu items tab. Press the \textbf{MENU} key multiple times to tab right and the \textbf{ESC} key multiple times to tab left until the \textbf{CAL} menu is highlighted and displaying the submenu items, as shown in the screenshot above. Alternatively, press the \textbf{LEFT} and \textbf{RIGHT} arrow keys multiple times using the left button wheel.

2) Use the \textbf{UP} and \textbf{DOWN} arrow keys multiple times on the left button wheel to scroll through the sub menu items until \textbf{MATL 1PT} is highlighted.

<table>
<thead>
<tr>
<th>MATL 1PT</th>
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<tbody>
<tr>
<td>1.000</td>
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</table>

3) Press the \textbf{ENTER} key to display the \textbf{Digits Edit Box}.

4) Press the \textbf{UP} and \textbf{DOWN} arrow keys multiple times on the left button wheel to scroll the highlighted value.

5) Press the \textbf{LEFT} and \textbf{RIGHT} 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 **MEAS** 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 **MEAS** key once to activate the measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left, until the **GATE1** cell is highlighted. Alternatively, press the **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

2) Press the **LEFT** and **RIGHT** 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 **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

4) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel to scroll the highlighted value.

5) Press the **LEFT** and **RIGHT** 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 as shown above.

8) Finally, press the **MEAS** 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.

![Diagram](image)

**Adjusting the Gate to Calibrated Range**

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

2) Press the **LEFT** and **RIGHT** arrow keys on the right button wheel to move the gate start to a position less than 1 inch.
3) Press the **MEAS** key once to highlight the **WIDTH1** cell. Alternatively, use the **UP** and **DOWN** arrow keys on the left button wheel.

4) Press the **LEFT** and **RIGHT** 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 DFX-8. 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 *DFX-8* 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 22.*

**Selecting the Material Type**

1. Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

2. Press the LEFT and RIGHT arrow keys on the right button wheel to toggle TRIG mode **ON**.
3) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

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

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

8) Press the **OK** key to confirm the material selection, or **ESC** key to cancel changing the material type.
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:

Refer to the Angle Beam Transducer diagram above:

<table>
<thead>
<tr>
<th>SP – Sound Path</th>
<th>X-Offset – Front of wedge less Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle – Transducer Angle</td>
<td>SD – Surface Distance</td>
</tr>
<tr>
<td>Thickness – Material Thickness</td>
<td>Depth – Depth of flaw from surface</td>
</tr>
</tbody>
</table>

**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 DFX-8 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 DFX-8.

### 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 22.*
Activating & Setting the Parameters

**TRIGONOMETRY**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>TRIG</td>
<td>ON</td>
<td>THICKNESS</td>
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</tr>
<tr>
<td>ANGLE</td>
<td>60.0</td>
<td>ANGLE</td>
<td>60.0</td>
</tr>
<tr>
<td>X-OFFSET</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSC O.D.</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GT1</td>
<td>GT2</td>
<td>TRIG</td>
<td>AHS</td>
</tr>
</tbody>
</table>

**Activate Trig Mode**

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the LEFT and RIGHT 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 UP and DOWN arrow keys multiple times on the left button wheel until THICKNESS is highlighted, followed by pressing the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.
3) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the **LEFT** and **RIGHT** 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 **OK** key to set the **THICKNESS** and return to the menu screen, or **ESC** to cancel entering the **THICKNESS**.

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

**Transducer Angle**

1) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until **ANGLE** is highlighted, followed by pressing the **LEFT** and **RIGHT** 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 **ENTER** key to display the **Digits Edit Box**.

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

4) Press the **LEFT** and **RIGHT** 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 **OK** key to set the **ANGLE** and return to the menu screen, or **ESC** to cancel entering the **ANGLE**.

**X-Offset**

1) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until **X-OFFSET** is highlighted, followed by pressing the **LEFT**
and RIGHT 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 ENTER key to display the Digits Edit Box.

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

4) Press the LEFT and RIGHT 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 OK key to set the X-OFFSET and return to the menu screen, or ESC 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 UP and DOWN arrow keys multiple times on the left button wheel until CSC OD is highlighted, followed by pressing the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.

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

4) Press the LEFT and RIGHT 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 **OK** key to set the **CSC OD** and return to the menu screen, or **ESC** to cancel entering the **CSC OD**.

**Note:** The **CSC OD** value is only used for curved surfaces of longitudinally welded pipes.
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 DFX-8 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 22.

### Activating & Setting AWS

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<thead>
<tr>
<th>AWS SETTINGS</th>
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</thead>
<tbody>
<tr>
<td>AWS</td>
</tr>
<tr>
<td>REFERENCE GAIN</td>
</tr>
<tr>
<td>CURVE</td>
</tr>
<tr>
<td>* SCRN HEIGHT</td>
</tr>
<tr>
<td>GT1</td>
</tr>
</tbody>
</table>

**Activate Trig Mode**

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **LEFT** and **RIGHT** 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 **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

**Enter % Screen Height**

1) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until **% SCRN HEIGHT** is highlighted, followed by pressing the **LEFT** and **RIGHT** 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 **ENTER** key to display the **Digits Edit Box**.

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

4) Press the **LEFT** and **RIGHT** 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 **OK** key to set the **% SCRN HEIGHT** and return to the menu screen, or **ESC** 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 **UP** and **DOWN** arrow keys multiple times on the left button wheel until **SET REF HEIGHT** is highlighted, followed by pressing the **LEFT** and **RIGHT** arrow keys on the right button wheel to toggle the feature **ON**.

2) Using the left button wheel, press the **LEFT** and **RIGHT** arrow keys to scroll through the 9 individual Hot Menus, and the **UP** and **DOWN** arrow keys to scroll through the Hot Menu items until the **GATE1** cell is highlighted. Alternatively, the **MEAS & ESC** 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 **DFX-8** 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 **LEFT** and **RIGHT** 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 **LEFT** and **RIGHT** arrow keys to scroll through the 9 individual Hot Menus, and the **UP** and **DOWN** arrow keys to scroll through the Hot Menu items until the **WIDTH1** cell is highlighted. Alternatively, the **MEAS & ESC** keys can be used to scroll through the Hot Menu items.
4) Press the \textbf{LEFT} and \textbf{RIGHT} arrow keys multiple times on the right button wheel to adjust the size or width of \textbf{GATE1}.

\textbf{Note}: When the signal is in the gate, the height indicator will detect and display the \% full screen height.

\textbf{Setting the Level}

1) Press the left button wheel, press the \textbf{LEFT} and \textbf{RIGHT} arrow keys to scroll through the 9 individual Hot Menus, and the \textbf{UP} and \textbf{DOWN} arrow keys to scroll through the Hot Menu items until the \textbf{AWS BOX}: cell is highlighted. Alternatively, the \textbf{MEAS} \& \textbf{ESC} keys can be used to scroll through the Hot Menu items.

2) Press the \textbf{LEFT} and \textbf{RIGHT} arrow keys multiple times on the right button wheel, to position the cursor box over the waveform.

3) Press the \textbf{ENTER} key to set the \textbf{REFGN} (reference gain).

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

4) Press the \textbf{MENU} key once to activate the menu items tab. Press the \textbf{MENU} key multiple times to tab right, and the \textbf{ESC} key multiple times to tab left, until the \textbf{AWS} menu is highlighted and displaying the submenu items. Alternatively, press the \textbf{LEFT} and \textbf{RIGHT} arrow keys multiple times using the left button wheel.

5) Press the \textbf{UP} and \textbf{DOWN} arrow keys multiple times on the left button wheel until \textbf{SET REF GAIN} is highlighted, followed by pressing the \textbf{LEFT} and \textbf{RIGHT} arrow keys to toggle \textbf{OFF}.

6) Finally, press the \textbf{MEAS} key to return to the main measurement screen.
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 be 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 DFX-8, 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 22.

Activating & Setting the Parameters

<table>
<thead>
<tr>
<th>DAC SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAC</td>
</tr>
<tr>
<td>DRAW</td>
</tr>
<tr>
<td>MEAS</td>
</tr>
<tr>
<td>CURVE</td>
</tr>
<tr>
<td>TRIGGER CURVE</td>
</tr>
<tr>
<td>DPOLARITY</td>
</tr>
<tr>
<td>FIT</td>
</tr>
<tr>
<td>TCG</td>
</tr>
</tbody>
</table>

Activating DAC

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the LEFT and RIGHT 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 UP and DOWN arrow keys multiple times on the left button wheel until DRAW is highlighted, followed by pressing the LEFT and RIGHT arrow keys on the right button wheel until ON is displayed.

**Quantity Displayed**

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

**Selecting the Curve(s)**

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

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

**Drawing the DAC**

<table>
<thead>
<tr>
<th>DAC SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAC</td>
</tr>
<tr>
<td>SAM</td>
</tr>
<tr>
<td>MEAS</td>
</tr>
<tr>
<td>CURVE</td>
</tr>
<tr>
<td>TRIGGER CURVE</td>
</tr>
<tr>
<td>DPOLARITY</td>
</tr>
<tr>
<td>FIT</td>
</tr>
<tr>
<td>TCG</td>
</tr>
</tbody>
</table>

1) With all the parameters set in the previous section, press the MEAS 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.
2) Press the left button wheel, press the **LEFT** and **RIGHT** arrow keys to scroll through the 9 individual Hot Menus, and the **UP** and **DOWN** 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 **LEFT** and **RIGHT** 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 **LEFT** and **RIGHT** 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 **ENTER** 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 **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

7) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until **DRAW** is highlighted, followed by pressing the **LEFT** and **RIGHT** arrow keys on the right button wheel until **OFF** is displayed. The **DAC** curves are now set and ready to be used for inspection.
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 DAC 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 22.
Setting TCG Parameters

<table>
<thead>
<tr>
<th>TCG SETTINGS</th>
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</thead>
<tbody>
<tr>
<td>TCG</td>
</tr>
<tr>
<td>DRAW</td>
</tr>
<tr>
<td>CURVE</td>
</tr>
<tr>
<td>X SCRN HEIGHT</td>
</tr>
<tr>
<td>TCG</td>
</tr>
</tbody>
</table>

Activating TCG

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the LEFT and RIGHT 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 UP and DOWN arrow keys multiple times on the left button wheel until % SCRN HEIGHT is highlighted, followed by pressing the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.
3) Press the UP and DOWN arrow keys multiple times on the left button wheel to scroll the highlighted value.

4) Press the LEFT and RIGHT 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 OK key to set the % SCRN HEIGHT and return to the menu screen, or ESC to cancel entering the % SCRN HEIGHT.

**Activating Draw Mode**

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

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

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

**Drawing the TCG**

<table>
<thead>
<tr>
<th>TCG SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCG</td>
</tr>
<tr>
<td>DRAW</td>
</tr>
<tr>
<td>CURVE</td>
</tr>
<tr>
<td>% SCRN HEIGHT</td>
</tr>
<tr>
<td>TCG</td>
</tr>
</tbody>
</table>
1) With all the parameters set in the previous section, press the MEAS 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.

2) Press the left button wheel, press the LEFT and RIGHT arrow keys to scroll through the 9 individual Hot Menus, and the UP and DOWN 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 LEFT and RIGHT 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 LEFT and RIGHT 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 ENTER 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 **CLR** key when **DRAW** is active.

6) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

7) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until **DRAW** is highlighted, followed by pressing the **LEFT** and **RIGHT** 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 **UP** and **DOWN** arrow keys multiple times on the left button wheel until **CURVE** is highlighted, followed by pressing the **LEFT** and **RIGHT** arrow keys on the right button wheel toggle **ON**.

9) Press the **MEAS** key to display the main measurement screen, and the **TCG** curve will be displayed.
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/reflectator 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% (1/10th = 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 DFX-8. 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).

\[
N = \frac{D_{EFF}^2 - \lambda^2}{4 \lambda}
\]
Where:
N = Near Field Length
\(D_{\text{EFF}}\) = Effective Diameter
\(\lambda\) = 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 (\(D_{\text{EFF}}\))**

\[
D_{\text{EFF}} = (\text{Dia.})(0.97)
\]

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

**Square/Rectangle (\(D_{\text{EFF}}\))**

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

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

\[
D_{\text{EFF}} = 0.97(\sqrt{K})(A)
\]

Where:
**D**<sub>EFF</sub> = Effective Diameter  
**K** = Aspect Ratio  
**A** = Largest Dimension  
0.97 = Fixed Ratio

Calculated results can also be compared to the following table:

<table>
<thead>
<tr>
<th>B/A</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>1.37</td>
</tr>
<tr>
<td>0.9</td>
<td>1.25</td>
</tr>
<tr>
<td>0.8</td>
<td>1.15</td>
</tr>
<tr>
<td>0.7</td>
<td>1.09</td>
</tr>
<tr>
<td>0.6</td>
<td>1.04</td>
</tr>
<tr>
<td>0.5</td>
<td>1.01</td>
</tr>
<tr>
<td>0.4</td>
<td>1.00</td>
</tr>
<tr>
<td>0.3</td>
<td>0.99</td>
</tr>
<tr>
<td>0.2</td>
<td>0.99</td>
</tr>
<tr>
<td>0.1</td>
<td>0.99</td>
</tr>
</tbody>
</table>

### 10.4 Parameter Definitions DGS(AVG)

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

<table>
<thead>
<tr>
<th>DISTANCE GAIN</th>
<th>DISTANCE GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>DGS</td>
<td>EFF PROBE DIAMETER 0.000</td>
</tr>
<tr>
<td></td>
<td>PROBE FREQUENCY 0.00</td>
</tr>
<tr>
<td>REFERENCE GAIN</td>
<td>CURVE SIZE (ERS) 0.000</td>
</tr>
<tr>
<td>TRIGGER CURVE</td>
<td>ATTENUATION OFF</td>
</tr>
<tr>
<td>EFF PROBE DIAMETER</td>
<td>DGS OFF</td>
</tr>
<tr>
<td>PROBE FREQUENCY</td>
<td>DAC OFF</td>
</tr>
<tr>
<td>CURVE SIZE (ERS)</td>
<td>TCG</td>
</tr>
<tr>
<td>ATTENUATION</td>
<td>DAC</td>
</tr>
<tr>
<td>&lt;MORE&gt;</td>
<td>DGS</td>
</tr>
<tr>
<td>TCG</td>
<td>SET</td>
</tr>
</tbody>
</table>

**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 DFX-8 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:

<table>
<thead>
<tr>
<th>DGS ATTENUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>VK</td>
</tr>
<tr>
<td>MATERIAL LOSS</td>
</tr>
<tr>
<td>REFERENCE LOSS</td>
</tr>
<tr>
<td>TRANS LOSS</td>
</tr>
</tbody>
</table>

**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 correction 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 22.*

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#### Setting DGS Parameters

**Activating DGS**

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **LEFT** and **RIGHT** 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 **UP** and **DOWN** arrow keys multiple times on the left button wheel until **TRIGGER CURVE** is highlighted, followed by pressing the **LEFT** and **RIGHT** 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 **UP** and **DOWN** arrow keys multiple times on the left button wheel until **EFF PROBE DIAMETER** is highlighted, followed by pressing the **LEFT** and **RIGHT** 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 **ENTER** key to display the **Digits Edit Box**.

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

4) Press the **LEFT** and **RIGHT** 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 **OK** key to set the **EFF PROBE DIAMETER** and return to the menu screen, or **ESC** to cancel entering the **EFF PROBE DIAMETER**.
**Probe Frequency**

1) Press the UP and DOWN arrow keys multiple times on the left button wheel until **PROBE FREQUENCY** is highlighted, followed by pressing the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.

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

4) Press the LEFT and RIGHT 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 OK key to set the **PROBE FREQUENCY** and return to the menu screen, or ESC to cancel entering the **PROBE FREQUENCY**.

**Curve Size (ERS)**

2) Press the UP and DOWN arrow keys multiple times on the left button wheel until **ERS** is highlighted, followed by pressing the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.

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

4) Press the LEFT and RIGHT 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 **OK** key to set the **ERS** and return to the menu screen, or **ESC** to cancel entering the **ERS**.

**Attenuation (All Parameters)**

1) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until **ATTENUATION** is highlighted, followed by pressing the **ENTER** key on the left button wheel to enter the **ATTENUATION** sub menu.

2) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel to scroll the correct attenuation parameter is highlighted.

3) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until the desire attenuation parameter is highlighted, followed by pressing the **LEFT** and **RIGHT** 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 **ENTER** key to display the **Digits Edit Box**.

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

6) Press the **LEFT** and **RIGHT** 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 **OK** key to set the value and return to the **ATTENUATION** sub menu screen, or **ESC** to cancel entering the parameter value.

---

**Drawing the DGS Curve**
1) Press the UP and DOWN arrow keys multiple times on the left button wheel until REFERENCE GAIN is highlighted, followed by pressing the LEFT and RIGHT arrow keys on the right button wheel to toggle on. With all the parameters set in the previous section, press the MEAS 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 LEFT and RIGHT arrow keys on the right button wheel to move the cursor over the waveform that will be used to set the REFERENCE GAIN and draw the DGS curve.
**Note:** The DGS curve uses 16 points to plot the curve.

4) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

5) Press the **UP** and **DOWN** arrow keys multiple times on the left button wheel until **REFERENCE GAIN** is highlighted, followed by pressing the **LEFT** and **RIGHT** 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 DFX-8

11.1 Pulse Width

The DFX-8 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 DFX-8+ 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 DFX-8+ 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 22.

---

**Selecting the Pulse Width**

<table>
<thead>
<tr>
<th>SETUP PROBE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
</tr>
<tr>
<td>PULSE</td>
</tr>
<tr>
<td>MAX PRF</td>
</tr>
<tr>
<td>DAMPING</td>
</tr>
<tr>
<td>PULS VOLT</td>
</tr>
<tr>
<td>PRB</td>
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<td></td>
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<td></td>
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</tbody>
</table>
1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

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

### 11.2 Pulse Repetition Frequency (PRF)

The **DFX-8** 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 22.*
1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

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

### 11.3 Damping

The *DFX-8* 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 22.*
Selecting the Damping

<table>
<thead>
<tr>
<th>SETUP PROBE</th>
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</thead>
<tbody>
<tr>
<td>TYPE</td>
</tr>
<tr>
<td>PULSE</td>
</tr>
<tr>
<td>MAX PRF</td>
</tr>
<tr>
<td>DAMPING</td>
</tr>
<tr>
<td>PULS VOLT</td>
</tr>
<tr>
<td>PRB</td>
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<tr>
<td></td>
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<td></td>
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</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

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

### 11.4 Pulser Voltage

The **DFX-8** 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 **DFX-8** to offer greater penetration for difficult material types, or increased resolution on noisy materials.

The **DFX-8+** 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 DFX-8+ 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 22.

### Changing the Pulser Voltage

<table>
<thead>
<tr>
<th>SETUP PROBE</th>
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</thead>
<tbody>
<tr>
<td>TYPE</td>
</tr>
<tr>
<td>PULSE</td>
</tr>
<tr>
<td>MAX PRF</td>
</tr>
<tr>
<td>DAMPING</td>
</tr>
<tr>
<td>PULSER VOLT</td>
</tr>
<tr>
<td>PRB, CAL, DISP, TUNE</td>
</tr>
</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Use the **LEFT** and **RIGHT** arrow keys on the right button wheel to scroll the **PULSER VOLT** options.
4) Once the desired **Pulser Voltage** is displayed, press the **MEAS** key to return to the measurement screen.

### 11.5 Material Velocity Charts

The **DFX-8** 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

<table>
<thead>
<tr>
<th>CALIBRATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATL 1PT</td>
</tr>
<tr>
<td>MATL 2PT</td>
</tr>
<tr>
<td>VELOCITY</td>
</tr>
<tr>
<td>ZERO</td>
</tr>
<tr>
<td>PRB</td>
</tr>
</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

2) Use the **UP** and **DOWN** arrow keys multiple times on the left button wheel to scroll through the sub menu items until **MAT** is highlighted.
3) Press the **ENTER** key to display the list of material types.

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

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

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

### 11.6 Material Velocity

The *DFX-8* has a built-in feature to manually adjust the material velocity to a known value in the calibration section of the *DFX-8*. 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 22.

#### Adjusting Velocity

<table>
<thead>
<tr>
<th>MATL_TYPE</th>
<th>VEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>25. QUARTZ CLASS</td>
<td>0.2260</td>
</tr>
<tr>
<td>26. RUBBER, VULCAN</td>
<td>0.0910</td>
</tr>
<tr>
<td>27. SILVER</td>
<td>0.1420</td>
</tr>
<tr>
<td>29. STEEL (4340)</td>
<td>0.2230</td>
</tr>
<tr>
<td>30. STEEL, STAIN.</td>
<td>0.2250</td>
</tr>
<tr>
<td>31. TEFLOW</td>
<td>0.0540</td>
</tr>
<tr>
<td>32. TIN</td>
<td>0.1310</td>
</tr>
<tr>
<td>33. TITANIUM</td>
<td>0.2400</td>
</tr>
<tr>
<td>34. TUNGSTEN</td>
<td>0.2840</td>
</tr>
<tr>
<td>35. URANIUM</td>
<td>0.1380</td>
</tr>
<tr>
<td>36. WATER</td>
<td>0.0500</td>
</tr>
</tbody>
</table>
1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the LEFT and RIGHT 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 **ENTER** key to display the **Digits Edit Box**.

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

6) Press the LEFT and RIGHT 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 **OK** key to set the velocity and return to the menu screen, or **ESC** to cancel entering the velocity.

9) Finally, press the **MEAS** key to return to the measurement screen.
11.7 Zero

The DFX-8 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:

<table>
<thead>
<tr>
<th>CALIBRATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT</td>
</tr>
<tr>
<td>MATL 1PT</td>
</tr>
<tr>
<td>MATL 2PT</td>
</tr>
<tr>
<td>VELOCITY</td>
</tr>
<tr>
<td>ZERO</td>
</tr>
</tbody>
</table>

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.

5) Press the UP and DOWN arrow keys multiple times on the left button wheel to scroll the highlighted value.
6) Press the LEFT and RIGHT 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 OK key to set the zero and return to the menu screen, or ESC to cancel entering the zero.

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

11.8 Brightness

The DFX-8 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:

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.
2) Use the \textbf{UP} and \textbf{DOWN} arrow keys multiple times on the left button wheel to scroll through the sub menu items until \textbf{BRIGHTNESS} is highlighted.

3) Press the \textbf{LEFT} and \textbf{RIGHT} arrow keys on the right button wheel to scroll the value.

4) Press the \textbf{MEAS} key to return to the measurement screen and begin taking readings.

11.9 Color Scheme

The \textit{DFX-8} 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 \textbf{VIEW}, are outlined below:

- **Selecting a Color Scheme**

<table>
<thead>
<tr>
<th>SET DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIEW</td>
</tr>
<tr>
<td>DELAY</td>
</tr>
<tr>
<td>RANGE</td>
</tr>
<tr>
<td>UNITS</td>
</tr>
<tr>
<td>BRIGHTNESS</td>
</tr>
<tr>
<td>COLORS</td>
</tr>
<tr>
<td>DIM</td>
</tr>
<tr>
<td>PRB</td>
</tr>
<tr>
<td>DISP</td>
</tr>
</tbody>
</table>

1) Press the \textbf{MENU} key once to activate the menu items tab. Press the \textbf{MENU} key multiple times to tab right and the \textbf{ESC} key multiple times to tab left until the \textbf{DISP} menu is highlighted and displaying the submenu items. Alternatively, press the \textbf{LEFT} and \textbf{RIGHT} arrow keys multiple times using the left button wheel.

2) Use the \textbf{UP} and \textbf{DOWN} arrow keys multiple times on the left button wheel to scroll through the sub menu items until \textbf{VIEW} is highlighted.
3) Press the ENTER key to display a list of the color scheme options.

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

5) Press the ENTER key, followed by pressing the OK key, to overwrite the current color scheme with the selected scheme.

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

### 11.10 DIM

The **DFX-8** 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 **DFX-8** 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 22.*
1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **LEFT** and **RIGHT** arrow keys on the right button wheel to scroll the **DIM** time.

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

---

### 11.11 Graphics Option (look & feel)

The **DFX-8** 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 **DFX-8** 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:

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

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

### 11.12 Detect Mark

Another look and feel option of the **DFX-8** 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 DFX-8+ 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

<table>
<thead>
<tr>
<th>SET DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNITS</td>
</tr>
<tr>
<td>BRIGHTNESS</td>
</tr>
<tr>
<td>COLORS</td>
</tr>
<tr>
<td>DIM</td>
</tr>
<tr>
<td>RECT WAVE</td>
</tr>
<tr>
<td>DETECT MARK</td>
</tr>
<tr>
<td>WAVE AVERAGING</td>
</tr>
</tbody>
</table>

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 ![LEFT](image) and ![RIGHT](image) arrow keys multiple times using the left button wheel.

2) Use the ![UP](image) and ![DOWN](image) arrow keys multiple times on the left button wheel to scroll through the sub menu items until **WAVE AVERAGING** is highlighted.

3) Use the ![LEFT](image) and ![RIGHT](image) arrow keys on the right button wheel to scroll the **WAVE AVERAGING** options.

4) Once the desired **WAVE AVERAGING** value is displayed, press the **MEAS** key to return to the measurement screen.

### 11.14 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 **DFX-8+** 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 DFX-8+ 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**

<table>
<thead>
<tr>
<th>TUNE SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEASURE MODE</td>
</tr>
<tr>
<td>FILTER</td>
</tr>
<tr>
<td>GAIN</td>
</tr>
<tr>
<td>GAIN STEP</td>
</tr>
<tr>
<td>DETECT</td>
</tr>
<tr>
<td>PRB</td>
</tr>
</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Use the **LEFT** and **RIGHT** arrow keys on the right button wheel to toggle the **MEASURE MODE**.

4) Once the desired **MEASURE MODE** is displayed, press the **MEAS** 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 position of the gates.
11.15 Filters (Wide & Narrow Bands)

The DFX-8 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 DFX-8+ 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 22.

### Selecting the Filter

<table>
<thead>
<tr>
<th>TUNE SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILTER: 2MHz</td>
</tr>
<tr>
<td>GAIN: 45.0</td>
</tr>
<tr>
<td>GAIN STEP: 1.0</td>
</tr>
<tr>
<td>DETECT: Z-CROSS</td>
</tr>
<tr>
<td>PRB</td>
</tr>
</tbody>
</table>

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

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

4) Once the desired FILTER is displayed, press the MEAS key to return to the measurement screen.
11.16 Gain Step Size

Adjusting Gain Step Size

<table>
<thead>
<tr>
<th>TUNE SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILTER</td>
</tr>
<tr>
<td>GAIN</td>
</tr>
<tr>
<td>GAIN STEP</td>
</tr>
<tr>
<td>DETECT</td>
</tr>
<tr>
<td>PRB</td>
</tr>
</tbody>
</table>

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the LEFT and RIGHT 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 ENTER key to display the Digits Edit Box.

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

6) Press the LEFT and RIGHT 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 **OK** key to set the gain step and return to the menu screen, or **ESC** to cancel entering the gain step.

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

### 11.17 Detect Modes

The *DFX-8* 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 22.*

**Selecting the Detect**
1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

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

### 11.18 Polarity

The **DFX-8** 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:
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 22.
**Note:** The screenshots above show where all the possible locations for polarity selection are found in the *DFX-8*. For more information on the above, refer to the sections on VIEW, DAC, GT1, & GT2.

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

2) Use the **UP** and **DOWN** 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 **LEFT** and **RIGHT** arrow keys on the right button wheel to toggle the **VIEW, DPOLARITY, POLARITY1, or POLARITY2** negative or positive.

4) Press the **MEAS** key to return to the measurement screen and begin taking readings.

11.19 Auto Find

The *DFX-8* is equipped with a very handy feature for locating the detection point of a return echo that is not currently in the viewable region of the display. The **AUTO FIND** feature is a convenient way to automatically bring the detected echo into view on the display. Once the echo is in the viewable area, the user can then make small adjustments to the delay and range accordingly. The procedure to use the **AUTO FIND** feature is outlined below:

**Using Auto Find**
1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Place the transducer on the test material and obtain a reading.

4) Press the **ENTER** key to automatically adjust the display settings and bring the waveform into view.

5) Once the signal is displayed, press the **MEAS** key to return to measurement mode.

### 11.20 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

<table>
<thead>
<tr>
<th>UTILITIES</th>
<th>UTILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO FIND</td>
<td>AUTO FIND</td>
</tr>
<tr>
<td>COMPARE</td>
<td>ON</td>
</tr>
<tr>
<td>SET DATE</td>
<td>07/14/14</td>
</tr>
<tr>
<td>KEY CLICK</td>
<td>QUIET</td>
</tr>
<tr>
<td>GAUGE</td>
<td>FLAW MODE</td>
</tr>
<tr>
<td>DATA XFER</td>
<td>DATA XFER</td>
</tr>
</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Use the **LEFT** and **RIGHT** 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 **MEAS** 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.

### 11.21 Analog Output
The **DFX-8+** 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

<table>
<thead>
<tr>
<th>UTILITIES</th>
<th>UTILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO FIND</td>
<td>AUTO FIND</td>
</tr>
<tr>
<td>COMPARE</td>
<td>COMPARE</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>SET DATE</td>
<td>SET DATE</td>
</tr>
<tr>
<td>07/14/14</td>
<td>07/14/14</td>
</tr>
<tr>
<td>KEY CLICK</td>
<td>KEY CLICK</td>
</tr>
<tr>
<td>QUIET</td>
<td>QUIET</td>
</tr>
<tr>
<td>GAUGE</td>
<td>GAUGE</td>
</tr>
<tr>
<td>FLAW MODE</td>
<td>FLAW MODE</td>
</tr>
<tr>
<td>DATA</td>
<td>DATA</td>
</tr>
<tr>
<td>UTIL</td>
<td>UTIL</td>
</tr>
<tr>
<td>XFER</td>
<td>XFER</td>
</tr>
</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

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

### 11.22 Date & Time
The DFX-8 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:

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

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

4) Press the **UP, DOWN, LEFT, & RIGHT** arrow keys on the left button wheel, to scroll the field locations.
5) Press the LEFT and RIGHT 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 OK key to set the **Time & Date** and return to the menu screen, or ESC to cancel entering the **Time & Date**.

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

---

**11.23 Key Click**

---

**Selecting the Detect**

<table>
<thead>
<tr>
<th>UTILITIES</th>
<th>UTILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO FIND</td>
<td>AUTO FIND</td>
</tr>
<tr>
<td>COMPARE</td>
<td>COMPARE</td>
</tr>
<tr>
<td>SET DATE</td>
<td>SET DATE</td>
</tr>
<tr>
<td>07/15/14</td>
<td>07/15/14</td>
</tr>
<tr>
<td>KEY CLICK</td>
<td>KEY CLICK</td>
</tr>
<tr>
<td>QUIET</td>
<td>QUIET</td>
</tr>
<tr>
<td>GAUGE</td>
<td>GAUGE</td>
</tr>
<tr>
<td>FLAW MODE</td>
<td>FLAW MODE</td>
</tr>
<tr>
<td>DATA</td>
<td>DATA</td>
</tr>
<tr>
<td>UTIL</td>
<td>UTIL</td>
</tr>
<tr>
<td>XFER</td>
<td>XFER</td>
</tr>
</tbody>
</table>

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

2) Use the UP and DOWN arrow keys multiple times on the left button wheel to scroll through the sub menu items until KEY CLICK is highlighted.
3) Use the LEFT and RIGHT 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 MEAS key to return to the measurement screen.

11.24 Freeze & Capture

The DFX-8 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 DFX-8, 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

<table>
<thead>
<tr>
<th>DATA TRANSFER</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPY SETUPS</td>
</tr>
<tr>
<td>COPY DATA</td>
</tr>
<tr>
<td>COPY SCREENS</td>
</tr>
<tr>
<td>UPGRADE GAUGE</td>
</tr>
<tr>
<td>STORAGE FILE</td>
</tr>
<tr>
<td>ABOUT</td>
</tr>
<tr>
<td>DATA UTIL</td>
</tr>
</tbody>
</table>

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.
2) Use the UP and DOWN 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 LEFT and RIGHT 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 MEAS key to return to the measurement screen.

5) To capture a file, press the FREEZE 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 FREEZE key toggles freeze on/off.

11.25 Peak Hold

The DFX-8 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 PEAK hold feature:

---

**Activating Peak**

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

2) Press the PEAK 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 CLEAR 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.

11.26 Freeze Waveform

The DFX-8 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

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 screenshot will be captured as a “tagged interface format” (.tif), which can be opened directly with any graphics file viewer.
12.1 Introduction to Grid and Sequential file formats

The DFX-8 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 DFX-8 and the log created, the DFX-8 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 DFX-8’s memory is full. If the user attempts to store a new file in the DFX-8 and the size of the file exceeds the capacity of memory, the DFX-8 will respond with an error message indicating that the memory is unable to store the new file.

The DFX-8 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 DFX-8 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:
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:
**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.

<table>
<thead>
<tr>
<th>STORE DATA</th>
<th>STORE DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW GRID LOG</td>
<td>NEW SEQ LOG</td>
</tr>
<tr>
<td>EDIT</td>
<td>EDIT</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN</td>
</tr>
<tr>
<td>CLOSE</td>
<td>CLOSE</td>
</tr>
<tr>
<td>DELETE ONE ENTRY</td>
<td>DELETE ONE ENTRY</td>
</tr>
<tr>
<td>DELETE ALL DATA</td>
<td>DELETE ALL DATA</td>
</tr>
<tr>
<td>SET DATA</td>
<td>SET DATA</td>
</tr>
<tr>
<td>UTIL XFER</td>
<td>UTIL XFER</td>
</tr>
</tbody>
</table>

**Grid Log**  
**Sequential Log**

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **LEFT** and **RIGHT** arrow keys multiple times on the right button wheel to toggle the data formats – **GRIG LOG & SEQ LOG**.
4) Press the **ENTER** key to display the new **Grid** or **Seq Log**.

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

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

7) Use the **UP, DOWN, LEFT, & RIGHT** arrow keys on the left button wheel to highlight the appropriate alpha characters.

8) Press the **ENTER** 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.

<table>
<thead>
<tr>
<th>NEW GRID LOG</th>
<th>NEW SEQ LOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAME: BOILER 34</td>
<td>NAME: BOILER 34</td>
</tr>
<tr>
<td>NOTE: INSPE#99</td>
<td>NOTE: INSPE#99</td>
</tr>
<tr>
<td>TOP LEFT: A001</td>
<td>START: B001</td>
</tr>
<tr>
<td>LOWER RIGHT: A001</td>
<td>END ID: 01</td>
</tr>
<tr>
<td>INCR. DIR: NONE</td>
<td>DIRECTION: NONE</td>
</tr>
<tr>
<td>SAVE GRAPHICS: NO</td>
<td>SAVE GRAPHICS: NO</td>
</tr>
<tr>
<td>CREATE GRID?:</td>
<td>CREATE LOG</td>
</tr>
<tr>
<td>GRID SIZE: 1</td>
<td>LOG SIZE: 0</td>
</tr>
</tbody>
</table>

**Grid Log**

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

2) Press the **ENTER** key to activate the **Alpha Edit Box**.
3) Use the UP, DOWN, LEFT, & RIGHT arrow keys on the left button wheel to highlight the appropriate alpha characters.

4) Press the ENTER 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 DFX-8 and the log created, the DFX-8 will automatically generate all the identifiers within that range.

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

<table>
<thead>
<tr>
<th>NEW GRID LOG</th>
<th>NEW SEQ LOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAME: BOILER 34</td>
<td>NAME: BOILER 34</td>
</tr>
<tr>
<td>NOTE: INSPE#99</td>
<td>NOTE:</td>
</tr>
<tr>
<td>TOP LEFT: A001</td>
<td>START: B001</td>
</tr>
<tr>
<td>LOWER RIGHT: A001</td>
<td>END ID: 01</td>
</tr>
<tr>
<td>INCR. DIR: NONE</td>
<td>DIRECTION: NONE</td>
</tr>
<tr>
<td>SAVE GRAPHICS: NO</td>
<td>SAVE GRAPHICS: NO</td>
</tr>
<tr>
<td>CREATE GRID?</td>
<td>CREATE LOG</td>
</tr>
<tr>
<td>GRID SIZE: 1</td>
<td>LOG SIZE: 0</td>
</tr>
</tbody>
</table>

Grid Log          Sequential Log

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

2) Press the ENTER key to activate the Coordinate or Start ID Edit Box.
3) **GRID LOG:** Use the **LEFT, & RIGHT** arrow keys on the left button wheel to scroll the **Columns**, and the **UP, DOWN** arrow keys on the left button wheel to scroll the **Rows**.

**SEQ LOG:** Use the **UP, DOWN, LEFT, & RIGHT** arrow on the left button wheel keys to highlight the appropriate alpha characters. Press the **ENTER** key to select 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 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)**
1) Use the **UP** and **DOWN** arrow keys on the left button wheel to scroll through the new **Grid** or **Seq List Items** until **LOWER RIGHT** or **END ID** is highlighted.

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

3) **GRID LOG**: Use the **LEFT**, **& RIGHT** arrow keys on the left button wheel to scroll the **Columns**, and the **UP**, **DOWN** arrow keys to scroll the **Rows**.
**SEQ LOG:** Use the UP, DOWN, LEFT, & RIGHT arrow keys on the left button wheel to highlight the appropriate alpha characters. Press the ENTER 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 DFX-8 at this time. Refer to page 136 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

NEW GRID LOG                  NEW SEQ LOG
NAME: BOILER 34               NAME: BOILER 34
NOTE: INS#99                  NOTE: INS#99
TOP LEFT: A001                START: B001
LOWER RIGHT C050             END ID: B150
INCR. DIR: EAST              DIRECTION: INC
SAVE GRAPHICS NO             SAVE GRAPHICS NO
CREATE GRID?                  CREATE LOG
GRID SIZE: 150               LOG SIZE: 150

5) Use the UP and DOWN 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 LEFT & RIGHT 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”.

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## Saving a Grid

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

### NEW GRID LOG

- **NAME:** BOILER 34
- **NOTE:** INSPE#99
- **TOP LEFT:** A001
- **LOWER RIGHT:** C050
- **INCR. DIR:** EAST
- **SAVE GRAPHICS:** NO

### NEW SEQ LOG

- **NAME:** BOILER 34
- **NOTE:** INSPE#99
- **START:** B001
- **END ID:** B150
- **DIRECTION:** INC
- **SAVE GRAPHICS:** NO

### CREATE GRID?

- **GRID SIZE:** 150

### CREATE LOG

- **LOG SIZE:** 150

#### Grid Log

1) Use the **UP** and **DOWN** 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 **ENTER** key to accept the grid or seq log parameters and activate the confirmation screen.
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 **MEAS** 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 grid 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 DFX-8 is displaying a “grid log”, pressing the OK key will initiate an advance to row number option. Use the Left, Right, UP, and DOWN 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 DFX-8 is displaying a “grid log”, pressing the ESC key multiple times, will toggle through the display options: DIGITS, RF, RECT, and B-SCAN views.

<table>
<thead>
<tr>
<th>NAME: EX#1</th>
<th>NAME: EX#2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Grid Log                             Sequential Log

1) Press the UP, DOWN, LEFT, and RIGHT arrow keys on the left button wheel to scroll the target cell cursor to the desired storage location.

2) Press the ENTER key to save the current reading in the highlighted cell location. It’s as simple as that!

3) Press the MEAS key to hide the GRID/SEQ View Box, or ENTER 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 DFX-8 will automatically open the file when powered on. Simply press the ENTER 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 **DFX-8** without a PC. The following procedures outline this process:

1) Press the MEAS key once to activate measure menu items. Press the MEAS key multiple times to move right and the ESC key multiple times to move left until the LOG cell is highlighted. Alternatively, press the LEFT and RIGHT arrow keys multiple times using the left button wheel.

2) Press the ENTER key to display the Grid Log Box.

3) Press the UP, DOWN, LEFT, and RIGHT 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 CLR key in the appropriate cell location to clear the reading, take a new measurement, and press the ENTER key to save the new reading.

5) Abort the Grid/Seq Log View Box by pressing the MEAS key at any time.

12.5 Deleting Grids (Files)

Deleting One or All Files from Memory

Deleting One File

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

2) Use the UP and DOWN arrow keys on the left button wheel to scroll through the sub menu items until DELETE ONE FILE is highlighted.
3) Press the ENTER key to display the File List Box.

4) Use the UP and DOWN arrow keys on the left button wheel to scroll through the stored Files until the target File to delete is highlighted.

5) Press the OK key to delete the File.

6) Press the MEAS key to return to the measurement screen.

Deleting All Data

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

2) Use the UP and DOWN arrow keys on the left button wheel to scroll through the sub menu items until DELETE ALL DATA is highlighted.
<table>
<thead>
<tr>
<th>CONFIRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELETE ALL READINGS</td>
</tr>
<tr>
<td>?</td>
</tr>
<tr>
<td>OK</td>
</tr>
</tbody>
</table>

3) Press the **ENTER** key to activate the confirmation screen.

4) Press the **OK** key to delete **All Files** from memory, or the **ESC** key to abort.

5) Press the **MEAS** 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:

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the ENTER key to display the Edit List Box.

4) Use the UP and DOWN 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 LEFT and RIGHT 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 ENTER key to activate the Alpha Edit box – Only used when editing the NOTE.

6) Use the UP, DOWN, LEFT, & RIGHT arrow keys on the left button wheel to highlight the appropriate alpha characters.

7) Press the ENTER 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 UP or DOWN 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 MEAS 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 DFX-8, or setup grids/seq using the DFX-8 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:

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the ENTER key to display the Grid/Seq List Box.

4) Use the UP and DOWN arrow keys on the left button wheel to scroll through the grids until the target grid is highlighted.

5) Press the ENTER key to activate the confirmation screen.

6) Press the OK key to load the file from memory.
7) Press the MEAS 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 MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

<table>
<thead>
<tr>
<th>STORE DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW</td>
</tr>
<tr>
<td>EDIT</td>
</tr>
<tr>
<td>OPEN</td>
</tr>
<tr>
<td>CLOSE</td>
</tr>
<tr>
<td>DELETE ONE FILE</td>
</tr>
<tr>
<td>DELETE ALL DATA</td>
</tr>
<tr>
<td>DATA UTIL XFER</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>STORE DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW</td>
</tr>
<tr>
<td>EDIT</td>
</tr>
<tr>
<td>OPEN</td>
</tr>
<tr>
<td>CLOSE</td>
</tr>
<tr>
<td>DELETE ONE FILE</td>
</tr>
<tr>
<td>DELETE ALL DATA</td>
</tr>
<tr>
<td>DATA UTIL XFER</td>
</tr>
</tbody>
</table>
3) Press the **ENTER** 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.
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 DFX-8 has been equipped with the ability to save these setups to memory and be recalled at any time. The DFX-8 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 DFX-8 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 DFX-8. 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 **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **ENTER** key to display the **Setup List Box**.

4) Use the **UP** and **DOWN** arrow keys on the left button wheel to scroll through the setups until the target setup is highlighted.
5) Press the ENTER key to activate the confirmation screen.

6) Press the OK key to load the setup from memory.

7) Press the MEAS key to return to the measure screen.

### 13.3 Saving a Setup

Once the DFX-8 parameters and features have been adjusted for an application, the user may elect to save these settings 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

<table>
<thead>
<tr>
<th>SETUP OPTIONS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEN</td>
<td></td>
</tr>
<tr>
<td>SAVE</td>
<td></td>
</tr>
<tr>
<td>DELETE</td>
<td></td>
</tr>
<tr>
<td>DEFAULT SETUP</td>
<td></td>
</tr>
<tr>
<td>LANGUAGE</td>
<td>ENGLISH</td>
</tr>
<tr>
<td>GT1</td>
<td>GT2</td>
</tr>
</tbody>
</table>

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **ENTER** key to display the **Save Setup Parameters List Box**.

4) Press the **UP** and **DOWN** arrow keys on the left button wheel to scroll the **Name** and **Note** parameters.
5) When the parameter to edit is highlighted, press the ENTER key to activate the Alpha Edit Box.

6) Use the UP, DOWN, LEFT, & RIGHT arrow keys on the left button wheel to scroll through the characters, the ENTER 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 UP and DOWN arrow keys on the left button wheel to scroll to and highlight SAVE SETUP.

10) Press the ENTER key to activate the Setup List Box.
11) Use the UP and DOWN 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 OK key to activate the confirmation screen.

13) Press the OK key to save the Setup, or ESC to cancel saving the Setup.

14) Finally, press the MEAS 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 **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **ENTER** key to display the **Setups List**.

4) Press the **UP** and **DOWN** arrow keys on the left button wheel to scroll to the **Setup Name**.

5) When the **Setup Name** is highlighted, press the **ENTER** key to display the confirmation screen.
6) Press the **OK** key to delete the **Setup File**.

7) Finally, press the **MEAS** key to return to the measurement screen.

### 13.5 Using the Default Setup

The default setup feature was added to the **DFX-8** 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 **DFX-8** was somehow corrupted, and the user does not have access to a computer to re-load the factory setups back into the **DFX-8**. 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

<table>
<thead>
<tr>
<th>SETUP OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEN</td>
</tr>
<tr>
<td>DEFAULT SETUP</td>
</tr>
<tr>
<td>LANGUAGE</td>
</tr>
<tr>
<td>GT1</td>
</tr>
</tbody>
</table>

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

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

3) Press the ENTER key to load default DEFAULT SETUP.

4) Finally, press the MEAS key to return to the measurement screen.
13.6 Selecting a Language

The DFX-8 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:

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Press the **LEFT** and **RIGHT** arrow keys multiple times on the right button wheel to toggle the language options.

4) Once the desired language is displayed, press the **MEAS** key to return to the measurement screen.
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 Ultrasonics (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 DFX-8

**DakView** will not directly communicate with the **DFX-8** series gauges. The **DFX-8** 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 SD, 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 **DFX-8** series gauges.

Refer to the help section in **DakView** software for the complete operating manual, setup, and operation.
14.4 Using the XFER menu (DFX-8)

The XFER menu of the DFX-8 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:

<table>
<thead>
<tr>
<th>DATA TRANSFER</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPY SETUPS</td>
</tr>
<tr>
<td>COPY DATA</td>
</tr>
<tr>
<td>COPY SCREENS</td>
</tr>
<tr>
<td>UPGRADE GAUGE</td>
</tr>
<tr>
<td>CAPTURE TO FILE</td>
</tr>
<tr>
<td>STORAGE</td>
</tr>
<tr>
<td>ABOUT</td>
</tr>
<tr>
<td>DATA UTIL</td>
</tr>
</tbody>
</table>

1) Press the MENU key once to activate the menu items tab. Press the MENU 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 LEFT and RIGHT arrow keys multiple times using the left button wheel.

2) Use the UP and DOWN arrow keys on the left button wheel to scroll through the sub menu items until the desire option is highlighted.

3) Press the ENTER key to activate the option selected.

14.5 Selecting Storage Device

The DFX-8 has two storage device options available. The DFX-8 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 **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

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

3) Use the **LEFT** and **RIGHT** 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 **DFX-8** 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 **DFX-8** 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 **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

2) Use the **UP** and **DOWN** arrow keys on the left button wheel to scroll through the sub menu items until the desired **COPY** option is highlighted.

3) Press the **ENTER** key to display the **Setups/Data/Screens List**.

4) Use the **UP** and **DOWN** arrow keys on the left button wheel to highlight the desired **List Box** option.
5) Press the ENTER key to either transfer ALL files, or display the Individual List of files.

6) Use the UP and DOWN arrow keys on the left button wheel to scroll through the list of files and select the specific file to copy.

7) Press the ENTER 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 MEAS key to return to the measurement screen.

14.7 Upgrading the DFX-8

The DFX-8 can be upgraded to the latest revision of firmware at any time. Simply download the latest version posted on the Dakota Ultrasonics website, copy the upgrade file to the main drive directory DFX-8, 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 DFX-8 is outlined below:
1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** 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 **LEFT** and **RIGHT** arrow keys multiple times using the left button wheel.

2) Press the **ENTER** key to display the upgrade confirmation screen, followed by pressing **OK** key to start the upgrade process. Note: The **DFX-8** will power down during the upgrade process, and restart when completed.
# APPENDIX A - VELOCITY TABLE

<table>
<thead>
<tr>
<th>Material</th>
<th>L-Wave velocity in/µs</th>
<th>L-Wave velocity m/s</th>
<th>S-Wave Velocity in/µs</th>
<th>S-Wave Velocity in/µs</th>
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</thead>
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<td>Aluminum</td>
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<td>3130</td>
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<tr>
<td>Beryllium</td>
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<td>12903</td>
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<td>8880</td>
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<td>Brass</td>
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<td>4394</td>
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<td>2120</td>
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<td>2235</td>
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<td>1500</td>
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<td>2100</td>
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<tr>
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<td>0.1830</td>
<td>4648</td>
<td>.0890</td>
<td>2260</td>
</tr>
<tr>
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<td>3430</td>
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<td>-</td>
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## APPENDIX B - SETUP LIBRARY

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<td></td>
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</tbody>
</table>
WARRANTY INFORMATION

- **Warranty Statement**

Dakota Ultrasonics warrants the **DFX-8** against defects in materials and workmanship for a period of two years from receipt by the end user. Additionally, Dakota Ultrasonics warrants transducers and accessories against such defects for a period of 90 days from receipt by the end user. If Dakota Ultrasonics receives notice of such defects during the warranty period, Dakota Ultrasonics will either, at its option, repair or replace products that prove to be defective.

Should Dakota Ultrasonics 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 Ultrasonics makes no other warranty, either express or implied, with respect to this product. Dakota Ultrasonics 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 Ultrasonics and arrange for servicing of the product. Retain proof of purchase in order to obtain warranty service.

For products that require servicing, Dakota Ultrasonics 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 Ultrasonics for details of the services available, and to arrange for non-warranty service.
<table>
<thead>
<tr>
<th>PC Software &amp; Firmware</th>
</tr>
</thead>
</table>

**Note:** All software downloads and upgrades are available on our website at no additional charge. Take advantage and stay current.

www.dakotaultrasonics.com