

## Quick Start Guide for ECHO FD



**ECHO FD Ultrasonic Flaw Detector**



### **Liability**

Ultrasonic testing is a function of using the proper equipment (electronics, transducer, cable and couplant combination) for the inspection and a qualified operator who knows how to use this manual, the instruments and all calibration procedures. The improper use of this equipment, along with the improper calibration can cause serious damage to components, factories, facilities, personal injury, and even death. ALL DANATRONICS ULTRASONIC THICKNESS GAGES ARE NOT INTRINSICALLY SAFE AND SHOULD NOT BE USED IN ANY HAZEDOUS OR EXPLOSIVE AREAS.

It is understood that the operator of this equipment is a well trained inspector qualified by either their own company or another outside agency to issue Ultrasonic Level I, 40 hour class room training in Ultrasonic Theory. Danatronics, Corp. and any of its employees or representatives shall not be held responsible for improper use of this equipment for its intended use. Proper training, a complete understanding of Ultrasonic wave propagation, thorough reading of this manual, proper transducer selection, correct zeroing of the transducer, correct sound velocity, proper test blocks, proper cable length, proper couplant selection all play a factor in successful ultrasonic thickness gaging. Special care should be taken when test pieces have rough or painted surfaces, particularly those applications where the test piece is thin to begin with as doubling of the echoes is possible even if the transducer is capable of measuring the desired thickness. As transducers wear or heat up, results can be either too thin due to a lack of sensitivity as a result of wear or too thick due to heating up of the transducer, referred to as "drift."

## Table of Contents

|   |          |
|---|----------|
| <b>Liability.....</b>                                       | <b>2</b> |
| <b>1 Getting Started .....</b>                              | <b>5</b> |
| About the ECHO Series .....                                 | 5        |
| <b>2 Basic Operations .....</b>                             | <b>6</b> |
| Power On the Unit.....                                      | 6        |
| Keypad Functions .....                                      | 7        |
| Battery Pack .....  | 8        |
| Monitoring the Battery Charge from the Display Screen ..... | 8        |
| Re-charging the Battery.....                                | 9        |
| Using Non-rechargeable AA Batteries.....                    | 10       |
| Boot, Bail, and Strap Features .....                        | 10       |
| Placing the Boot on the Unit.....                           | 11       |
| Removing the Boot from the Unit.....                        | 11       |
| Using the Boot Strap and Bail .....                         | 11       |
| Other Unit Features.....                                    | 11       |
| Using the T/R 1 and T/R 2 Ports .....                       | 11       |
| Locating the USB Slot .....                                 | 11       |
| Using the Accessory Mount .....                             | 11       |
| Locating the Altitude Change Release Regulator .....        | 11       |
| ECHO FD User Interface .....                                | 11       |
| Parameter Overview .....                                    | 15       |
| Gain .....  | 15       |
| Frequency .....   | 15       |
| Measurement Mode .....                                      | 16       |
| Reject .....  | 16       |
| Rectification .....   | 16       |
| Gate 1 Start .....  | 17       |
| Gate 1 Width .....  | 17       |
| Gate 1 Level .....  | 18       |
| Gate 1 Alarm .....  | 18       |
| Gate 1 Auto 80 .....  | 18       |
| Gate 2 Start .....  | 19       |
| Gate 2 Width .....  | 19       |
| Gate 2 Level .....  | 20       |
| Gate 2 Alarm .....  | 20       |
| Gate 2 Auto 80 .....  | 20       |
| Zero .....  | 21       |
| Velocity .....  | 21       |
| Angle .....   | 22       |
| Thickness.....  | 22       |
| Energy .....  | 22       |
| DAC .....   | 23       |
| Curve.....  | 23       |
| DAC Gain .....  | 24       |
| Range .....   | 24       |

|  |           |
|--|-----------|
| Delay .....  | 24        |
| Gate 1 Detection .....   | 25        |
| Gate 2 Detection .....   | 25        |
| Measurement Box 2 .....  | 25        |
| Measurement Box 3 .....  | 26        |
| Measurement Box 1 .....  | 26        |
| ID .....   | 26        |
| Peak Memory .....  | 27        |
| <b>Display Screen .....</b>  | <b>27</b> |
| <b>Monitoring the Battery Charge from the Display Screen .....</b> | <b>29</b> |
| <b>3 Calibrating the ECHO FD for Contact Transducers .....</b>     | <b>30</b> |
| Velocity Calibration Only .....                                    | 31        |
| <b>4 ECHO FD Calibrations .....</b>                                | <b>32</b> |
| Angle Beam Calibration .....                                       | 34        |
| Setting Reference Gain .....                                       | 38        |
| Setting Ref Gain Step .....  | 39        |
| <b>5 Echo FD advanced software features .....</b>                  | <b>40</b> |
| AWS D-rating .....   | 40        |
| Setting Gate Alarms .....  | 41        |
| Positive Gate Alarm .....  | 41        |
| Negative Gate Alarm .....  | 42        |
| Minimum Depth Alarm .....  | 42        |
| Stored setups .....  | 43        |
| DAC (Distance Amplitude Correction Curves) GUI .....               | 45        |
| <b>6 Technical Assistance .....</b>                                | <b>47</b> |



## 1 Getting Started

### About the ECHO Series

ECHO FD is a portable ultrasonic flaw detector in the same field-proven case as our popular ECHO series, and it represents a breakthrough in terms of cost, size, ease of use, and versatility. ECHO FD can even toggle from an every day flaw detector to a corrosion or precision thickness gage making it the smallest and most affordable unit in the world to offer such a vast application set. Our new hand-held ultrasonic flaw detector is packed with many useful and practical features including:

- 3.5" sunlight readable display with color pallet
- Change color and vibrate on alarm
- 2 independent gates
- DAC
- AWS
- API-5UE
- Peak Memory
- 2GB, expandable to 32GB, micro SD card memory
- Datalogger including B-scan and export of reading to excel
- 13 hour battery life
- Custom rubber boot with padded wrist strap and bail
- Made and designed in the USA

## 2 Basic Operations

Make sure the connector is plugged into TR 2 when using a single element probe.

### Power On the Unit

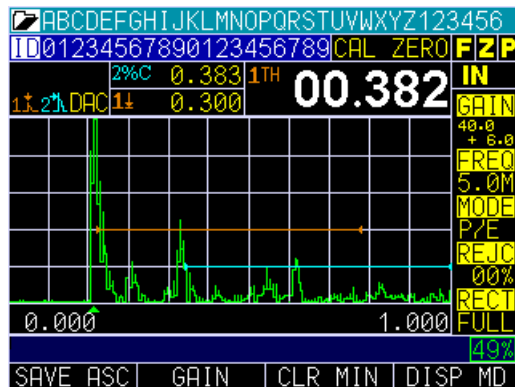
To power on any ECHO FD, follow these steps:

1. Press and hold the **F1** key for more than 3 seconds. The power symbol, as shown below, is under the **F1** key printed on the keypad.



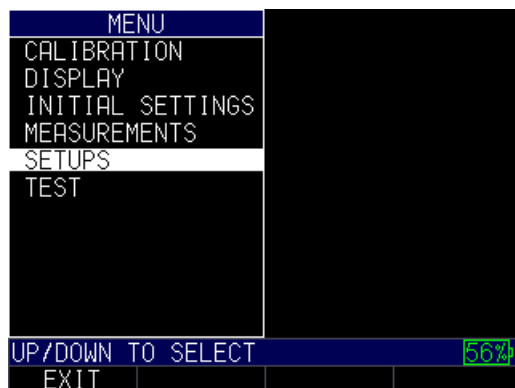
Power symbol  
under the F1 key

2. After powering on the ECHO FD, the unit will display the last instrument settings as well as the battery life in the bottom right corner. The image below shows the battery life at 49%.



**Note:** Set your parameters based on the type of probe you are using.

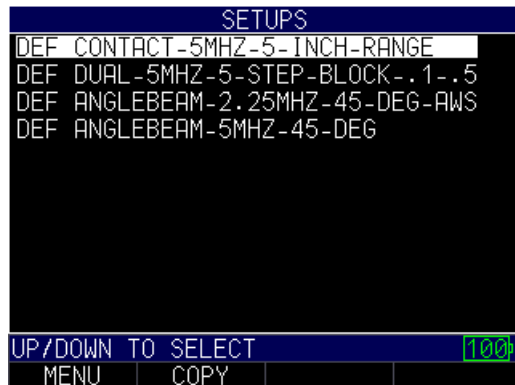
3. Press the **MENU/OK** key and use the up and down arrow keys to select the **Setups** option. Press the **MENU/OK** key again.



4. In the **Setups** menu, use the up and down arrow keys to select the probe closest to the one you will be using. If none of the options are close, then press the **F1 – Exit** key to set your own parameters.

ECHO FD has 4 default setup template files that cannot be deleted. They are as follows:

1. Straight beam contact probe 5 MHz, 5" range
2. Dual probe 5 MHz on a 0.100-0.500" (2.52-12.7mm) test block
3. Angle beam AWS type 2.25 with ref gain on
4. Angle beam quick change 5 MHz, 45 degree









To get started, we recommend that you choose a setup close to what you will be using. This will allow you to get echoes and make smaller adjustments when fine-tuning your setups and calibrations. As stated, the default setups cannot be deleted. Once a new custom setup is saved (1,800 max.), you can also use the included Data XL interface program to save them on your computer and even send the setups to additional ECHO FDs.

### Keypad Functions

The figure below shows the full keypad layout representative of each ECHO series unit.



The following table refers to each key or symbol shown on the keypad. Note, the F keys correspond to text above each key and prompts change depending on which screen you are adjusting.

| Key   | Function                         |
|---|----------------------------------|
|  | Up arrow key                     |
|  | Down arrow key                   |
|  | Left arrow key                   |
|  | Right arrow key                  |
|  | On/Off symbol (under the F1 key) |
|  | MENU/OK key                      |
| F1  | Varies                           |
| F2  | Varies                           |
| F3  | Varies                           |
| F4  | Varies                           |

Function keys, or F keys (e.g., F1, F2, F3, F4), have various unit functions and may change depending on the display screen. View the bottom of the display screen for the function that corresponds with the appropriate F key. For example, **F1** may correspond with the Save function, **F2** with the Freeze function, or **F3** with the Directory function

#### **Battery Pack**

To ensure the highest level of performance and protection, the battery compartment is separated from the electronic components of the unit.

#### **Monitoring the Battery Charge from the Display Screen**

The ECHO unit continuously displays the percentage of battery life remaining on the bottom right corner of the measurement display screen. When the battery life is below 10%, the battery indicator will turn from green to red. When the battery life is below 5%, the indicator will flash.

|   |
|---|
| <b>Note:</b> Power off the ECHO unit to ensure any saved data is stored internally. |
|---|

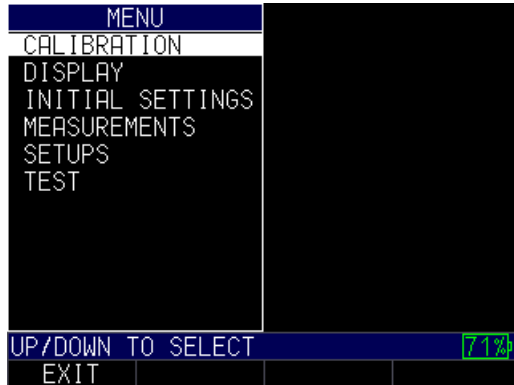
### Re-charging the Battery



To re-charge the battery, simply plug in the charger to an AC outlet (between 100-240V) and plug the other end into the USB connector on the top of the ECHO series unit. The **F4** key will light up with a blue LED when charging, and the light will go out when fully charged. Allow several hours (up to 10 hours) to fully charge. We recommend using the charger and high-quality USB cable that is supplied with the ECHO unit. Using lower quality USB cables can result in little or no charge.

**Note:** It is possible to use a computer to charge the unit, but this will take significantly more time than using an AC outlet and we do not recommend it; however, if you decide to charge the flaw detector using this method, make sure the unit is powered off before you connect the USB to the computer and to the flaw detector itself.

When charging is complete, the **F4** key will appear translucent in color. Power off the flaw detector, and unplug the charger from the USB connector on the top of the unit. Keep in mind, there is a battery indication monitor on the bottom right of the screen that displays the percentage of battery life, as shown in the image below at 71%.



### Using Non-rechargeable AA Batteries

A non-rechargeable alkaline AA pack is also available. This option requires a spare tray and 3 AA batteries. Follow these steps to insert non-rechargeable batteries:

1. Un-screw the battery door.
2. Disconnect the Li-Ion battery connector.
3. Plug in the AA tray connector.
4. Replace the battery door and tighten screws.



**Note:** When using the 3 AA battery tray, batteries cannot be re-charged.

### Boot, Bail, and Strap Features

The custom rubber boot with built in bail and 4-point chest harness is an accessory for all ECHO series units. Not only does the boot help to protect the unit from the elements, but the functional bail and strap also offers a variety of positioning options.

### Placing the Boot on the Unit

To insert the unit into the rubber boot, follow these steps:

1. Guide the unit strap through the hole at the top of the boot (either right or left side).
2. Slide the unit into the top of the boot.
3. Gently apply pressure to the bottom of the unit until it fully pops into the boot.

### Removing the Boot from the Unit

Be sure that the bail is set in the open position before attempting to remove the boot. Follow these steps:

1. Apply pressure to the bottom two corners of the boot until the unit pops out.
2. Wiggle the top section of the unit out of the boot.
3. Guide the unit strap through the hole at the top of the boot.

### Using the Boot Strap and Bail

The boot strap is attached to the bail on the back of the boot. It can be used as a right- or left-handed strap, or a finger strap. You can also connect the strap to a 4-point chest harness for hands-free use.

The bail, including the straps, can be removed from the boot. This is useful when adding accessories or locating the unit's serial number. Simply open the bail and apply gentle pressure to one side of the connector, which is located at the top of the bail. The piece will pop off exposing the accessory mount (see below) and unit serial number.

### Other Unit Features

#### Using the T/R 1 and T/R 2 Ports

On the top of the ECHO series units are two ports for transducer connectivity.

If you are using a dual element transducer, you may use either port—T/R 1 or T/R 2—interchangeably. However, if you are using a single element transducer, plug the connector into the T/R 1 port only.

#### Locating the USB Slot

The ECHO series units are furnished with a USB 2.0 slot on the top of the unit. Use the USB slot to connect AC chargers or to connect to a computer for cross-functionality.

#### Using the Accessory Mount

On the back of the unit is a ¼ x 20 accessory mount. This connector point is compatible with a multitude of accessories including a magnetic pipe attachment and a Gorilla Pod.

#### Locating the Altitude Change Release Regulator

At the bottom of the unit is a circular outline with small holes. This feature regulates pressure due to altitude change. Any pressure built up inside the unit will be automatically released.

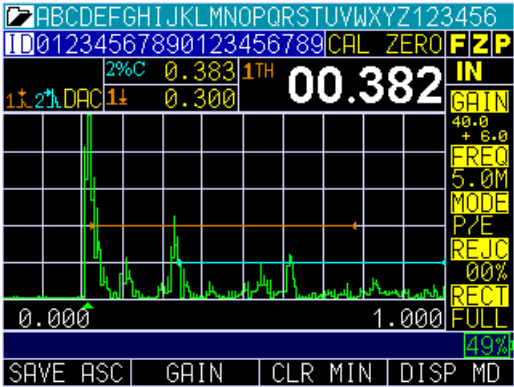
### ECHO FD User Interface

Press and hold the **F1** key to power on the unit. The following *Display* screen will appear for 5 seconds.

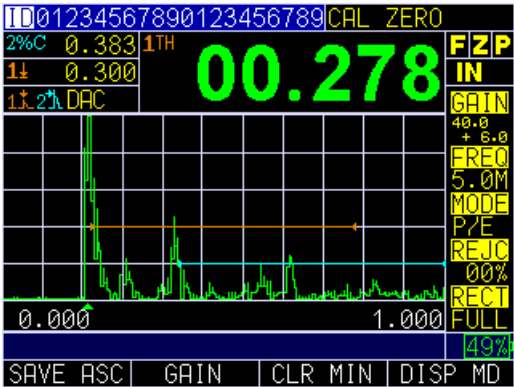


Display screen shows remaining battery life

The *Measurement* screen will appear following the *Display* screen. There are five *Measurement* screens as shown below. Use the **F4 – DISP MD** key to toggle the screen between display modes.

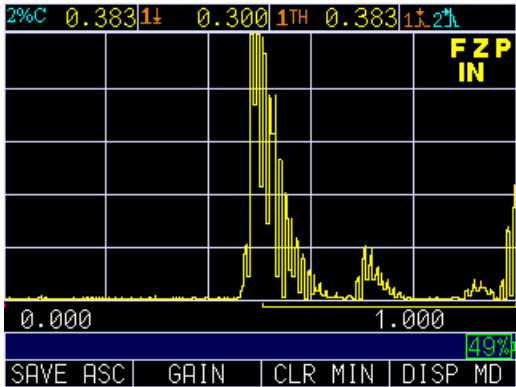


Display Mode 1

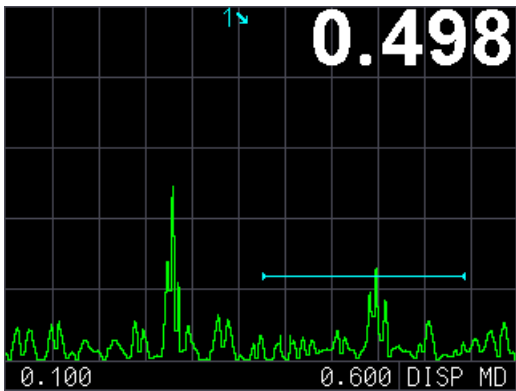


Display Mode 2



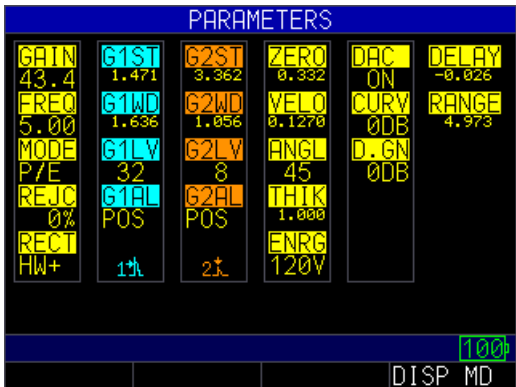


Display Mode 3



Display Mode 4 (Scan Mode)

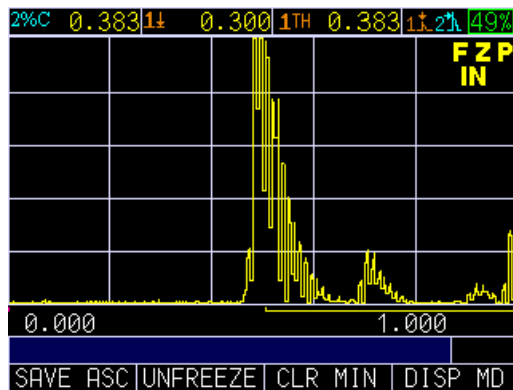
**Note:** You cannot use the left or right arrow keys to edit any parameter in the scanning mode screen. The parameter in the large measurement box (e.g., soundpath measurement of 0.498" shown above) will be displayed in the top right corner of the screen. To change a parameter, press the **F4 – DISP MD** key.



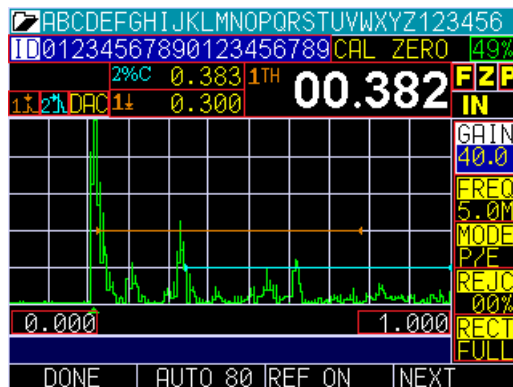
Display Mode 5

Similar to ECHO 9 and ECHO 7, the left and right arrow keys will activate editing of the parameters. A parameter that is highlighted will be active to edit by using the up and down arrow keys. The right arrow key will select parameters in a clockwise direction and

the left arrow key will select parameters in a counter clockwise direction. Red-circled parameters, shown below, will be editable. This screen also represents the default screen because it allows full instrument operation while showing the largest A-scan. This screen will appear 10 seconds after the *Parameter* screen is displayed upon powering on the unit. To change the Display mode, simply press the **F4 – DISP MD** key.



Color Waveform in Echo-to-Echo mode, filename, ID, thickness value, gain, rectification, battery life, alarm, freeze, backlight, and display mode.



Press the left or right arrow key to activate the Parameter Edit mode. Once active, you can scroll through the list using the left or right arrow key and then use the up and down arrow keys to make adjustments. When finished, press the **F1 – Done** key to end editing or the **F4** key to select the next set of parameters. The list will toggle the right side parameter list in following order:



## Parameter Overview

ECHO FD Ultrasonic Flaw Detector has many parameters that can be edited by using the functions keys. Note, the function keys will vary depending on the current screen in use. Below is an overview of editable parameters for ECHO FD and how the function keys work for each relevant screen.

**Note:** Some of the below F1, F2, F3 and F4 screen shots are subject to change with software updates.

### Gain



- **F1:** Done (exit edit mode)
- **F2:** Gate 1 Auto 80 – set signal within Gate 1 amplitude to 80% by adjusting gain automatic
- **F3:** Toggle Ref Gain On/Off. If Ref Gain is active, then Ref Gain and Scanning Gain will appear as follows:

R.GN  
40.0  
+ 6.0

- Also **F2** will become **ADD**. In this situation when **F2** is pressed, Ref Gain and Scanning Gain will be added and Scanning Gain will be deactivated.
- **F4:** Next page of Gate 1 parameters
- **Up/Down Arrow:** Slew gain from 0.0 dB to 90.0 dB, and if Ref Gain is active, the Up/Down arrow keys will slew Scanning Gain
- **Right Arrow:** Select Scanning Gain if Ref Gain is selected, or select Freq to edit if Scanning Gain is selected
- **Left Arrow:** Select Peak to edit if you are in Gain or Ref Gain and if Scanning Gain is selected
- **MENU/OK:** Go to Menu to set the Gain parameters

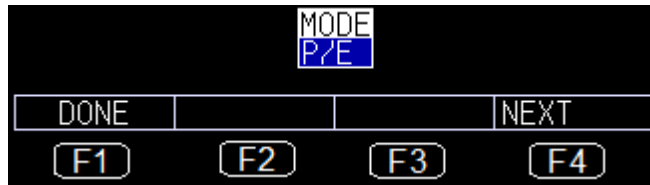
### Frequency



- **F1:** Done (exit edit mode)
- **F2:** Cycle through fixed list of frequencies: 1.0M, 2.2M, 5.0M, 7.5M, 10.0M, 12.0M
- **F3:** None
- **F4:** Next page of Gate 1 parameters

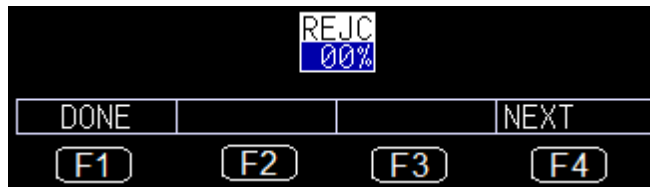
- **Up/down Arrow:** Slew frequency from 1.0MHz to 12.0 MHz
- **Right Arrows:** Select Measurement mode to edit
- **Left Arrows:** If Ref Gain is on, then select Scanning Gain or else select Gain to edit
- **MENU/OK:** Go to Menu to set the Frequency parameters

#### **Measurement Mode**



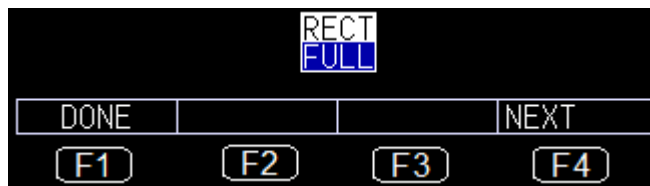
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of Gate 1 parameters
- **Up/Down Arrow:** Cycle thru P/E, THRU, DUAL
- **Right Arrow:** Select Reject to edit
- **Left Arrow:** Select Frequency to edit
- **MENU/OK:** Go to Menu to set Measurement mode parameters

#### **Reject**



- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of Gate 1 parameters
- **Up/Down Arrow:** Slew 0 to 85%
- **Right Arrow:** Select Rectification to edit
- **Left Arrow:** Select Mode to edit
- **MENU/OK:** Go to Menu to set Reject parameters

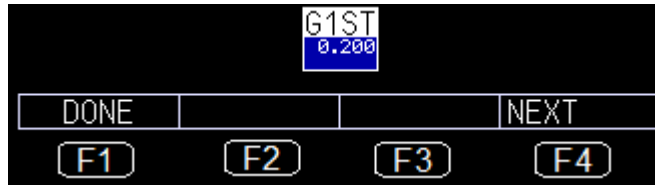
#### **Rectification**



- **F1:** Done (exit edit mode)

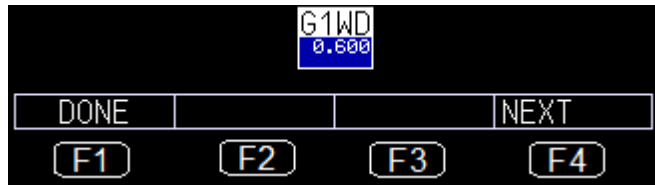
- **F2:** None
- **F3:** None
- **F4:** Next page of Gate 1 parameters
- **Up/Down Arrow:** Cycle thru FULL, HW+, HW-, RF
- **Right Arrow:** Select Range to edit
- **Left Arrow:** Select Reject to edit
- **MENU/OK:** Go to Menu to set Rectification parameters

#### Gate 1 Start



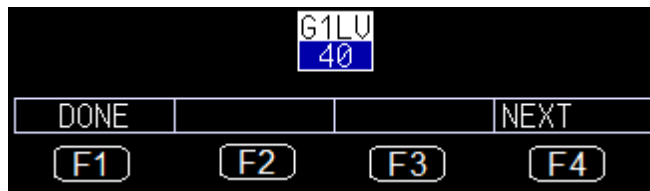
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of Gate 2 parameters
- **Up/Down Arrow:** Slew Gate 1 Start value from Delay up to (Delay + Current Range)
- **Right Arrow:** Select Gate 1 Width to edit
- **Left Arrow:** Select Peak to edit
- **MENU/OK:** Go to Menu to set Gate 1 Start parameters

#### Gate 1 Width



- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of Gate 2 parameters
- **Up/Down Arrow:** Slew Gate 1 Width value from 0.010" to (Delay + Current Range)
- **Right Arrow:** Select Gate 1 Level to edit
- **Left Arrow:** Select Gate 1 Start to edit
- **MENU/OK:** Go to Menu to set Gate 1 Width parameters

### Gate 1 Level



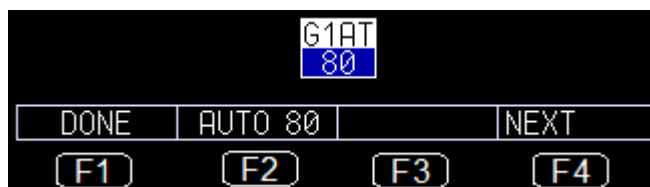
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of Gate 1 parameters
- **Up/Down Arrow:** Slew Gate 1 Level value from 2% to 95%
- **Right Arrow:** Select Gate 1 Alarm to edit
- **Left Arrow:** Select Gate 1 Width to edit
- **MENU/OK:** Go to Menu to set Gate 1 Level parameters

### Gate 1 Alarm



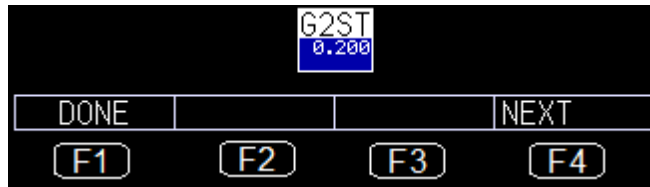
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of Gate 2 parameters
- **Up/Down Arrow:** Toggle options: OFF, POS, NEG, MIN DEPTH if DAC is inactive  
OFF, POS, NEG, MIN DEPTH, ASME if DAC = ASME  
OFF, POS, NEG, MIN DEPTH, 0 dB, -6 dB, -14 dB if DAC = ASME3  
OFF, POS, NEG, MIN DEPTH, RL, SL, EL if DAC = CUSTOM
- **Right Arrow:** Select Gate 1 Auto 80 to set
- **Left Arrow:** Select Gate 1 Level to edit
- **MENU/OK:** Go to Menu to set Gate 1 Alarm parameters

### Gate 1 Auto 80



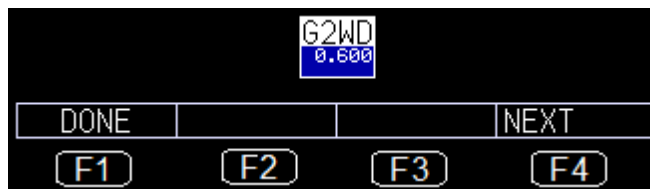
- **F1:** Done (exit edit mode)
- **F2:** Perform Auto 80
- **F3:** None
- **F4:** Next page of Gate 2 parameters
- **Up/Down Arrow:** None
- **Right Arrow:** Select Range to set
- **Left Arrow:** Select Gate 1 Alarm to edit
- **MENU/OK:** None

#### Gate 2 Start



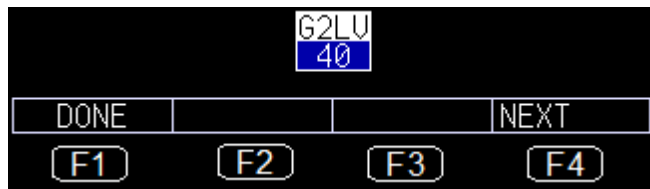
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** G2 OFF or ON
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew Gate 2 Start value from Delay up to (Delay + Current Range)
- **Right Arrow:** Select Gate 2 Width to edit
- **Left Arrow:** Select Peak to edit
- **MENU/OK:** Go to Menu to set Gate 2 Start parameters

#### Gate 2 Width



- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** G2 OFF or ON
- **F4:** Next page of Parameters
- **Up/Down Arrow:** Slew Gate 2 Width value from 0.010" to (Delay + Current Range)
- **Right Arrow:** Select Gate 2 Level to edit
- **Left Arrow:** Select Gate 2 Start to edit
- **MENU/OK:** Go to Menu to set Gate 2 Width parameters

### Gate 2 Level



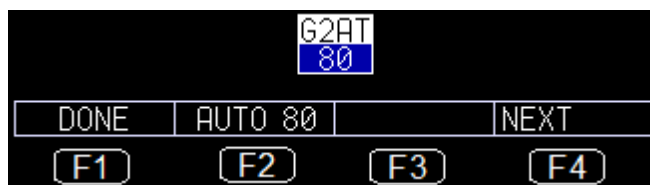
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** G2 OFF or ON
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew Gate 2 Level value from 2% to 95%
- **Right Arrow:** Select Gate 2 Alarm to edit
- **Left Arrow:** Select Gate 2 Width to edit
- **MENU/OK:** Go to Menu to set Gate 2 Level parameters

### Gate 2 Alarm



- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** G2 OFF or ON
- **F4:** Next page of parameters
- **Up/Down Arrow:** Toggle options: OFF, POS, NEG, MIN DEPTH if DAC is OFF  
OFF, POS, NEG, MIN DEPTH, ASME if DAC = ASME  
OFF, POS, NEG, MIN DEPTH, 0 dB, -6 dB, -14 dB if DAC = ASME3  
OFF, POS, NEG, MIN DEPTH, RL, SL, EL if DAC = CUSTOM
- **Right Arrow:** Select Gate 2 Auto 80 to set
- **Left Arrow:** Select Gate 2 Level to edit
- **MENU/OK:** Go to Menu to set Gate 1 Alarm parameters

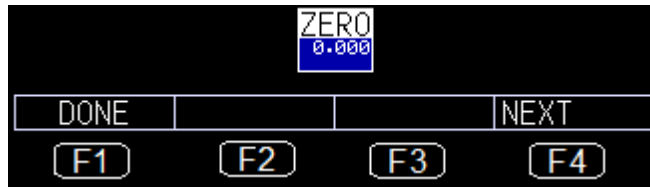
### Gate 2 Auto 80





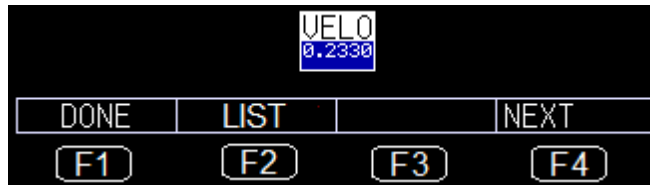
- **F1:** Done (exit edit mode)
- **F2:** Perform Auto 80
- **F3:** G2 OFF or ON
- **F4:** Next page of parameters
- **Up/Down Arrow:** None
- **Right Arrow:** Select Range to set
- **Left Arrow:** Select Gate 2 Alarm to edit
- **MENU/OK:** None

### Zero



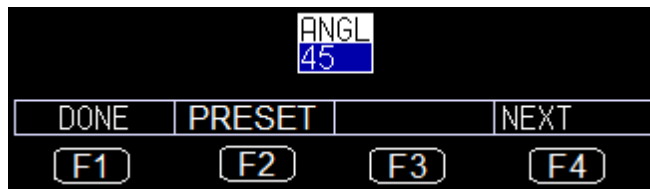
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew Zero from 0.000" to 20.000"
- **Right Arrow:** Select Velocity to set
- **Left Arrow:** Select Peak to edit
- **MENU/OK:** Go to Menu to set Zero parameters

### Velocity



- **F1:** Done (exit edit mode)
- **F2:** Display list of material to pick a material velocity
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew Velocity from 0.0800 in/us to .3000 in/us
- **Right Arrow:** Select Angle to set
- **Left Arrow:** Select Zero to edit
- **MENU/OK:** Go to Menu to set Velocity parameters

### Angle



- **F1:** Done (exit edit mode)
- **F2:** Toggle through preset values 30, 45, and 60 degrees
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew Angle from 0 to 85 degrees
- **Right Arrow:** Select Thickness to set
- **Left Arrow:** Select Velocity to edit
- **MENU/OK:** Go to Menu to set Angle parameters

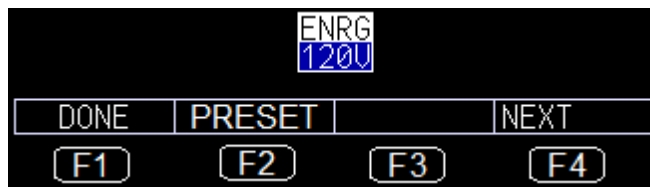
**Note:** When angle is other than Zero, ECHO FD will automatically set the acoustic velocity to shear wave at 0.1270 in/usec and set the 3 measurement screens for Gate 1 as follows: Large box is soundpath, other boxes will be depth and surface distance. When angle is re-set to 0 degrees, velocity will revert back to Longitudinal or 0.2330 in/usec and the large measurement box will be set to thickness.

### Thickness



- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew Thickness from 0.020" to 20.000"
- **Right Arrow:** Select Energy to set
- **Left Arrow:** Select Angle to edit
- **MENU/OK:** Go to Menu to set Thickness parameters

### Energy



- **F1:** Done (exit edit mode)
- **F2:** Toggle through preset values 30, 60, 90, and 120 Volts

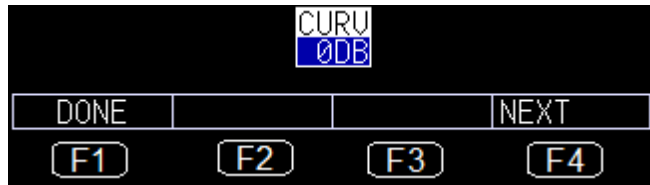
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Toggle thru preset values 30, 60, 90, and 120 Volts
- **Right Arrow:** Select Range to set
- **Left Arrow:** Select Thickness to edit
- **MENU/OK:** Go to Menu to set Energy parameters

### DAC



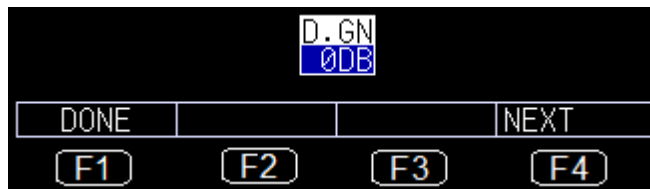
- **F1:** Done (exit edit mode)
- **F2:** Turn Off DAC
- **F3:** Erase DAC curve(s)
- **F4:** Next page of parameters
- **Up/Down Arrow:** Toggle between ON and OFF
- **Right Arrow:** Select DAC curve to set
- **Left Arrow:** Select PEAK mem to edit
- **MENU/OK:** Go to Menu to set DAC parameters

### Curve



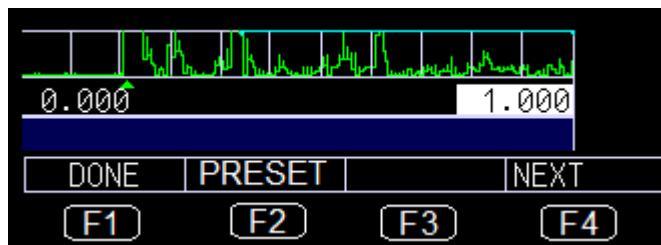
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Toggle between Curve for ASME-3 and Custom
- **Right Arrow:** Select DAC Gain to set
- **Left Arrow:** Select DAC On/Off to edit
- **MENU/OK:** Go to Menu to select DAC Curve parameters

### DAC Gain



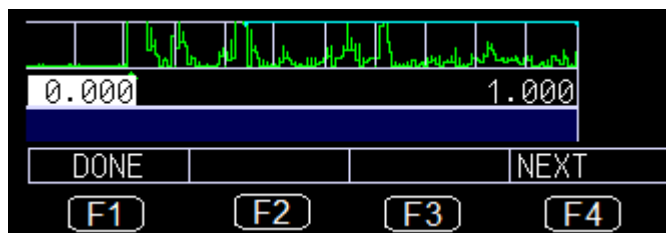
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew DAC gain
- **Right Arrow:** Select Range to edit
- **Left Arrow:** Select DAC Curve to edit
- **MENU/OK:** Go to Menu to edit DAC Gain parameters

### Range



- **F1:** Done (exit edit mode)
- **F2:** Preset – IT will toggle through preset values 0.100", 0.200", 0.500", 1.000", 2.000", 5.000", 10.000", 20.000" and equivalent in mm and uSec mode
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew Range from 0.100" to 23" in 0.001" resolution and equivalent in mm and uSec mode
- **Right Arrow:** Select Delay to edit
- **Left Arrow:** Select last parameter of current Parameter page to edit
- **MENU/OK:** Go to Menu to edit Range parameters

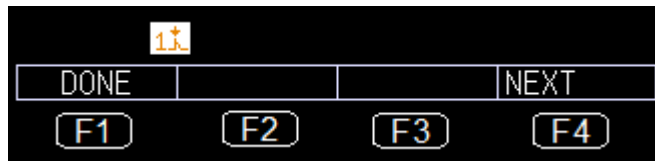
### Delay



- **F1:** Done (exit edit mode)

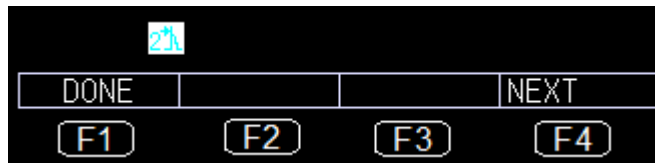
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Slew Delay from 0.0" to 20" in 0.001" resolution and equivalent in mm and uSec mode
- **Right Arrow:** Select Gate 1 Detection mode to edit
- **Left Arrow:** Select Range to edit
- **MENU/OK:** Go to Menu to edit Delay parameters

#### Gate 1 Detection



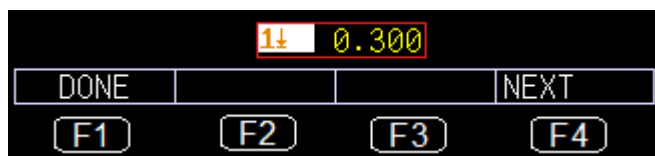
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Toggle between Edge and Peak
- **Right Arrow:** Select Gate 2 Detection mode to edit
- **Left Arrow:** Select Delay to edit
- **MENU/OK:** Go to Menu to edit Gate 1 Detection mode parameters

#### Gate 2 Detection



- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Toggle between Edge and Peak
- **Right Arrow:** Select Measurement Box 2 to edit
- **Left Arrow:** Select Gate 1 Detection mode to edit
- **MENU/OK:** Go to Menu to edit Gate 2 Detection mode parameters

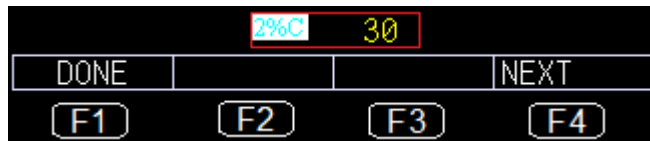
#### Measurement Box 2



- **F:** Done (exit edit mode)

- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Cycle through list of measurements
- **Right Arrow:** Select Measurement Box 3 to edit
- **Left Arrow:** Select Gate 2 Detection mode to edit
- **MENU/OK:** Go to Menu to edit Measurement Box 2 parameters

#### **Measurement Box 3**



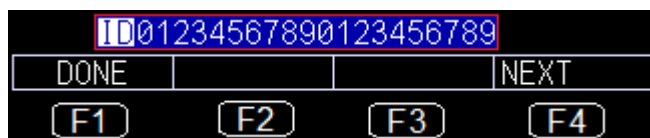
- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Cycle through list of measurements
- **Right Arrow:** Select Measurement Box 1 to edit
- **Left Arrow:** Select Measurement Box 2 to edit
- **MENU/OK:** Go to Menu to edit Measurement Box 3 parameters

#### **Measurement Box 1**



- **F1:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Cycle through list of measurements
- **Right Arrow:** Select ID to edit
- **Left Arrow:** Select Measurement Box 3 to edit
- **MENU/OK:** Go to Menu to edit Measurement Box 1 parameters

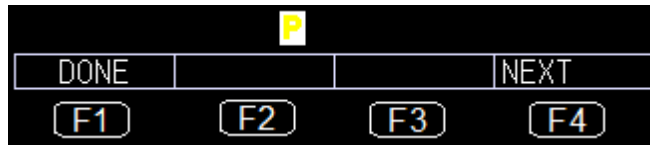
#### **ID**



- **F1:** Done (exit edit mode)
- **F2:** None

- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Cycle through IDs
- **Right Arrow:** Select Peak Memory to edit
- **Left Arrow:** Select Measurement Box 1 to edit
- **MENU/OK:** Go to Menu to edit ID parameters

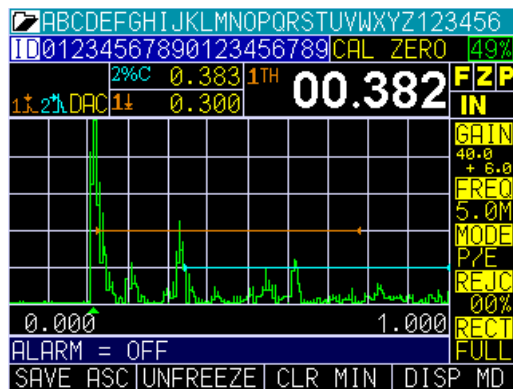
### Peak Memory



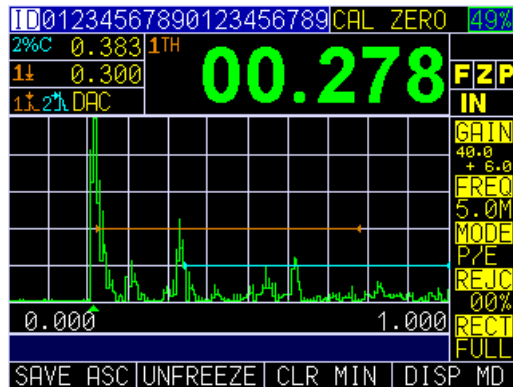
- **F:** Done (exit edit mode)
- **F2:** None
- **F3:** None
- **F4:** Next page of parameters
- **Up/Down Arrow:** Toggle between Peak, Peak Hold, and OFF
- **Right Arrow:** Select 1st parameter of current Parameter page to edit
- **Left Arrow:** Select ID to edit
- **MENU/OK:** Go to Menu to edit Peak Memory parameters

### Display Screen

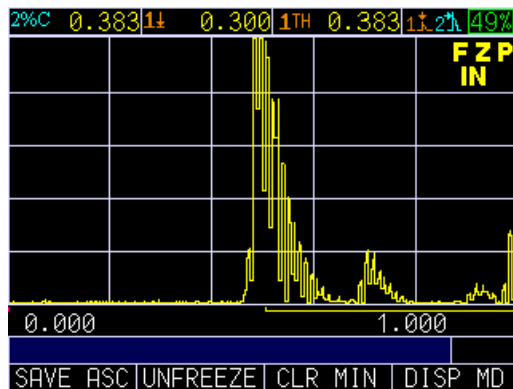
ECHO FD has a graphic-style color display with 320 x 240 (1/4 VGA) pixel density. Viewing the screen is best from straight above or slightly below the surface rather than from side to side. If external temperature is below 32°F (0°C), the display may be slower to update information.



Color thickness reading only on ECHO 9



Color Waveform in Echo-to-Echo mode, filename, ID, thickness value, gain, rectification, battery life, alarm, freeze, backlight, and display mode. This screen represents the default screen because it allows full instrument operation while showing the largest A-scan. Ten seconds after the parameter screen is displayed upon power up, this screen will appear. To change it, simply press **F4 – Disp MD** for Display mode.

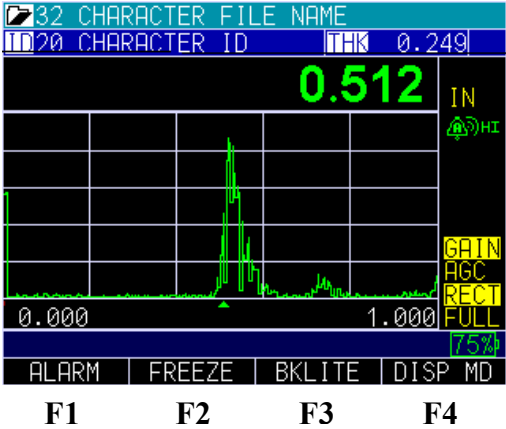


Transducer screen, menu, reset, backlight

The screen has three distinct areas:

1. Top part of the display screen: Shows the File Name, ID Number, AA, and 0001 for grid column and row.
2. Lower part of the display screen: Acts as an interactive tool that allows you to decide how you want to proceed with the information that is displayed on the screen.
3. Middle part of the display screen: Shows the following: thickness value; In, mm or usec; Echo-to-Echo symbol; LOS (loss of signal); Freeze; Fast Min or Max; Alarm indicator; Differential mode; Low, Med or High gain; and percent remaining battery life.





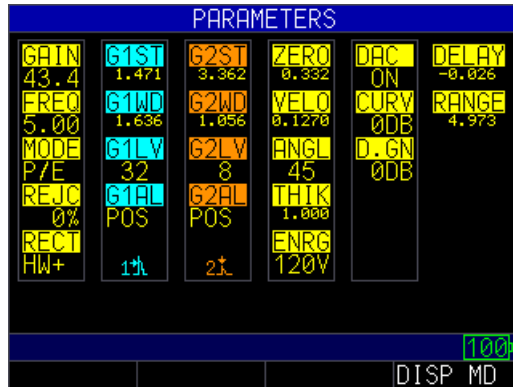
**Monitoring the Battery Charge from the Display Screen**

The ECHO series continuously displays the percentage of battery life remaining on the bottom right corner of the measurement display screen. When the battery life is below 10%, the battery indicator will turn from green to red. When the battery life is below 5%, the indicator will flash.

**Note:** Power off the ECHO series unit to ensure any saved data is stored internally.

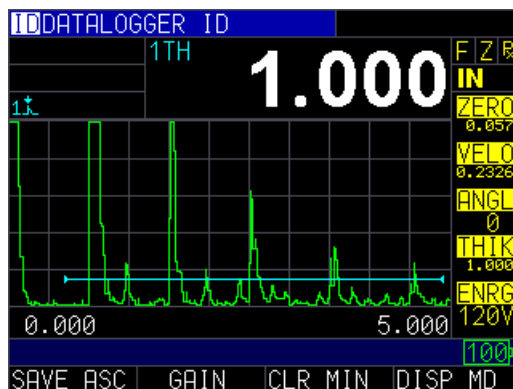
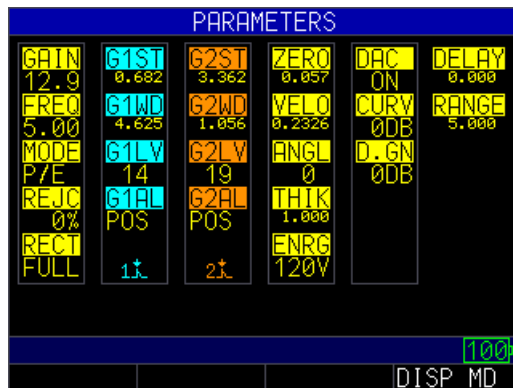
### 3 Calibrating the ECHO FD for Contact Transducers

Calibrating is the process of adjusting the unit for a specific material and transducer before testing material to ensure that all of the data are accurate. You must always calibrate before testing material for standard accuracy. It is always a good idea to start with the *Parameter* screen so you can set your basic adjustments such as range, material velocity, zero angle, etc.



Use the left or right arrow key to begin Edit mode. There are two ways to enter Edit mode: (1) hold down the left or right arrow key to scroll to the desired parameter and adjust by using the up or down arrow keys; or (2) press the **F4 – Next** key to move to the next set of parameters. Press the **F1** key when done.

In the case of contact transducers, the parameters should appear very similar to the ones shown below:



The example shown above is a contact probe on a 1" test piece on a 5" range. To choose parameters using the left or right arrow key, the peak or edge icon will be displayed in the top left for each gate. The above image shows Gate 1 set to peak.

### Velocity Calibration Only

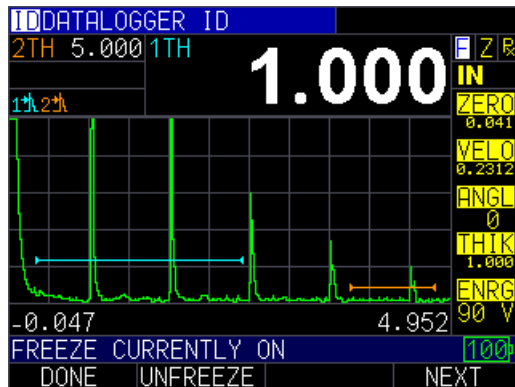
If you are working with a test piece of known thickness but unknown material, then you can calibrate velocity of the sound in the unknown material by measuring the time of flight from main-bang to the first back echo. By using the known thickness you can calculate velocity of the sound for the unknown material.

To perform a Velocity calibration only, follow these steps:

1. Power on the unit.
2. Make sure the range is set so that you can see the proper echoes
3. Adjust gate to cover the thickness echo, either slew the echo to the known depth or use the auto cal and enter the known thickness of the detected echo.
4. Press **F1 – Menu** key.
5. Use the up and down arrow keys to select the **Calibration** option.
6. Press the **MENU/OK** key.
7. Verify your transducer selection and press the **MENU/OK** key.

To proceed with Velocity calibration, follow the instructions below:

1. Place couplant on the surface of a 5-step test block.
2. Couple the transducer to the material. A similar screen to the one shown below will appear:



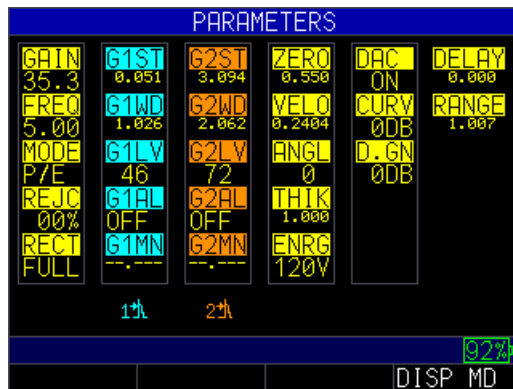
The above screen shows gate one measuring 1.000" and gate 2 measuring 5.000" after adjusting the zero for the thin (1.000") and velocity for the thick (5.000")

3. While measuring the thickest step, select **F3 - VEL** key.
4. After pressing the **F3** key, you can take the transducer off the test block. If the displayed measurement is different than the known value of the step, use the up or down arrow key to adjust the displayed value to the known value of the step.
5. Press the **MENU/OK** key to perform the calibration.

The unit will briefly display the calibrated velocity value in the top of the screen and then return to **Measure** mode.

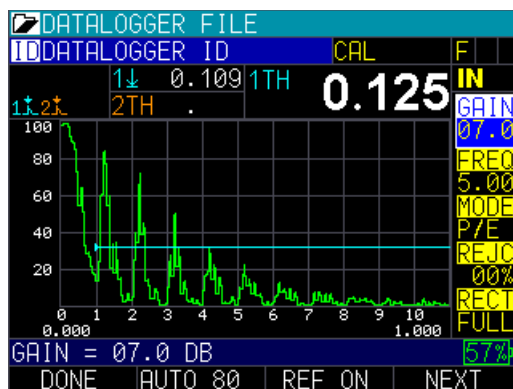
#### 4 ECHO FD Calibrations

Before performing a straight beam calibration on a 5-step test block (0.100" – 0.500" or 2.54mm-12.70mm) it is important to check your initial settings from the *Parameter* screen. For a straight beam probe, 5.0 MHz, your initial settings should look like the parameters shown in the image below:



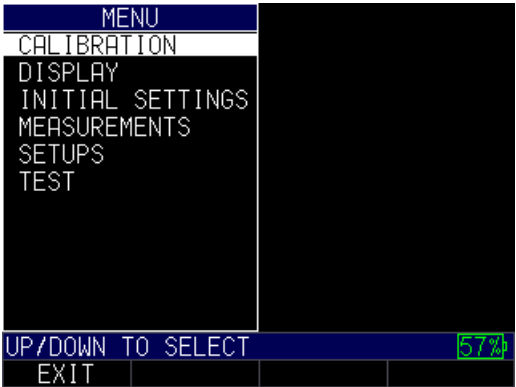
Press the **F4 – DISP MD** key for Display mode and you will see a following screen after coupled to the 0.100" block. It is recommended that you adjust Gate 1 (light blue) to cover the first echo and the Gate Width to cover the last echo at 0.500". You can also press the **F2** key for Auto 80 after detecting the first echo at 0.100" to automatically adjust the amplitude to 80% FSH (full screen height).

Note, when 0 angle is plugged in, ECHO FD will automatically put the large thickness box in the top right to Thickness. You can choose between edge depth or peak depth by using the right or left arrow key until you stop at this setting. Consequently, when an angle other than 0 is chosen, the top left measurement bar sets Soundpath as the proper setting.

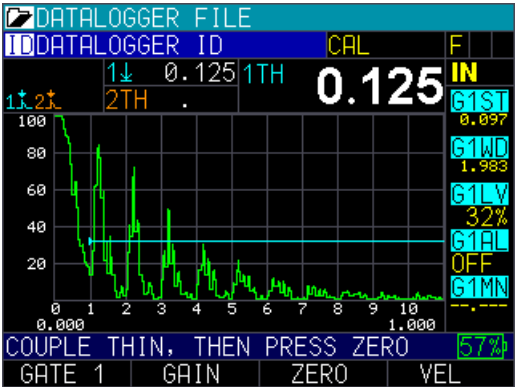


To begin calibrating the ECHO FD, follow these steps:

1. Press the **MENU/OK** key. Use the arrow keys to scroll to the **Calibration** option and press the **MENU/OK** key again.

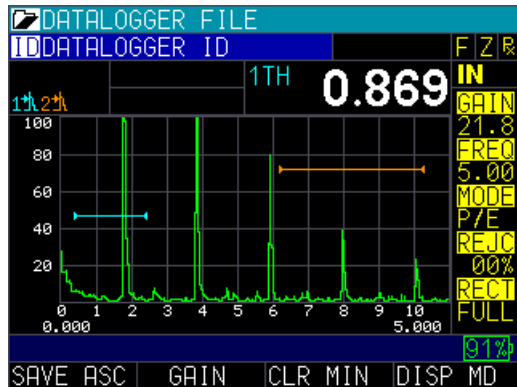


2. Couple to the 0.100", then press the **F3 – Zero** key. The number in the top right of the screen will be frozen and you can remove the probe from the test block surface. Hold the up arrow key until it reaches the known thickness of 0.100", and then press the **F1 – Cal** key. If the frozen number in the top right is above 0.100" then use the down arrow to scroll to the known thickness.



3. Couple to the 0.500" (you may need to press the **F2 – Gain** key if the signal is too low to get the echo in the gate), and then press the **F4 – Vel** key. The reading on the screen will be frozen. Use the up or down arrow key to scroll to the known thickness of 0.500" and then press the **MENU/OK** key. ECHO FD will briefly display the calibrated acoustic sound speed. For steel, the speed should be around 0.2300 in/usec.

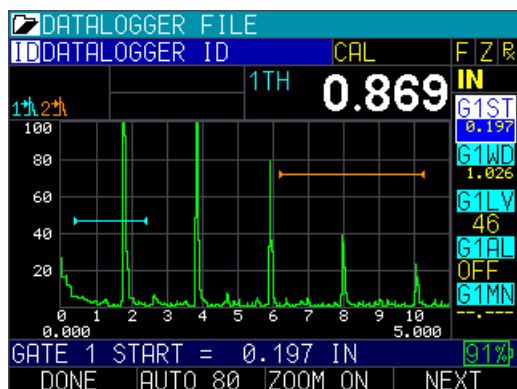
You will need to use a different procedure for calibration when using multiple echoes across the display as shown below:



This procedure will require you to move the gate one start after you have performed a Calibrate Zero. In this scenario, use a 5" range and a 1" calibration block.

To calibrate when using multiple echos across the display, follow the steps below:

1. Couple the transducer to the test block, and adjust Gate 1 covering the 1.000" echo.
2. Press the **MENU/OK** key and use the arrow keys to scroll to the Calibration option. Press the **MENU/OK** key again.
3. Press the **F3** key and adjust the frozen thickness in the top right to 1.000". Press the **F1 – Cal** key.
4. Use the left or right arrow key, which will highlight Gate 1 Start. Next, use the up arrow key to increase the Gate 1 Start until the 5<sup>th</sup> echo at 5.000" is gated. (Note, you may need to press the **F2 – Gain** key or lower the Gate 1 level to make sure the echo is in the gate.)
5. Press the **F1 – Done** key.
6. Press the **F4** key again for **VEL** and slew the gated 5<sup>th</sup> echo to 5.000", and then press the **MENU/OK** key.



### Angle Beam Calibration

The calibration process for an angle beam is much like a straight beam calibration in the sense that you will need to move the gate in the middle of the calibration process.

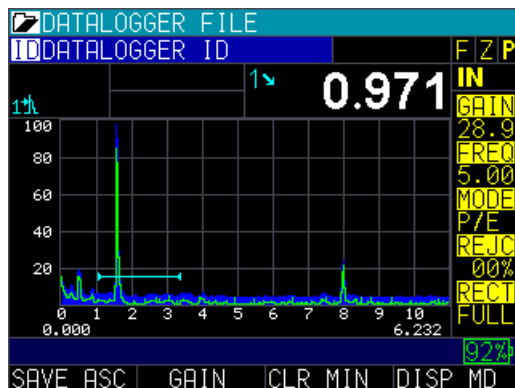
Depending on the frequency and angle, you can start with parameters close to the ones shown in the image below. The probe used in this calibration is a 5.0MHz at 0.5" with a

60 degree angle and a IIW, type 2 block with reflectors at 2" and 4". Another common test block is a IIW, type 1 or DSC block.

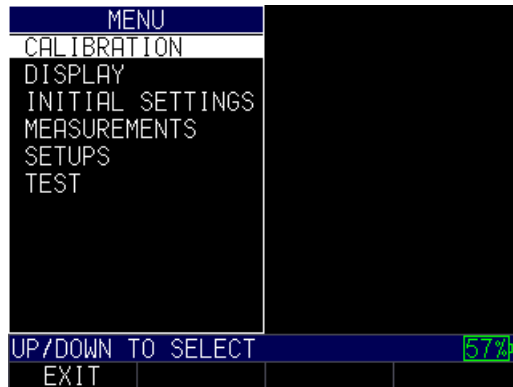


To perform an angle beam calibration, follow the steps:

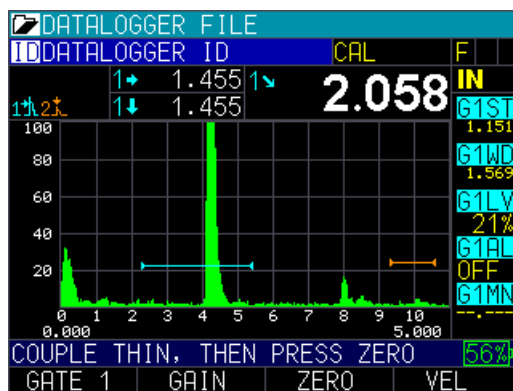
1. It is recommended that you first turn on Peak Memory by highlighting the “P” in the top right corner of the display by using the left or right arrow key. You will see an “echo envelope” in dark blue, which represents the maximum amplitude recorded.
2. Move the angle beam probe back and peak the signal. You may want to use Gain or Auto 80 to achieve this peak.



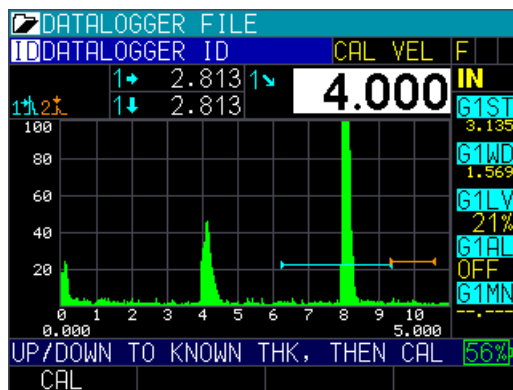
3. Once the echo is peak, verify that the angle is correct by looking at the Beam Index Point (BIP) on the wedge as it corresponds with the marking on the test block. Enter the correct angle, for example, 61 degrees.
4. Do not move the probe at this point. Press the **MENU/OK** key and scroll to the Calibration option.
5. Press the **MENU/OK** key again.



- Gate first echo and press the **F3 – Zero** key. Adjust the angular distance in the top right of the screen to 2.000", and then press the **F1 – Cal** key.



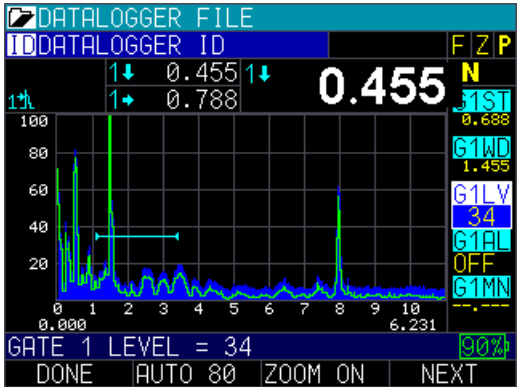
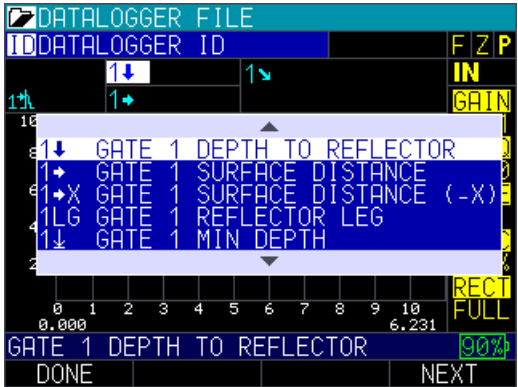
- Use the **F1** key to move Gate 1 Start to 2<sup>nd</sup> echo (4.000") using the right arrow key in this case, and then press the **F1 – Done** key.



- Press the **F4 – Vel** key and adjust the angular distance in top right to 4.000". Press the **MENU/OK** key. ECHO FD will display the shear wave velocity of approximately 0.1270 in/usec.

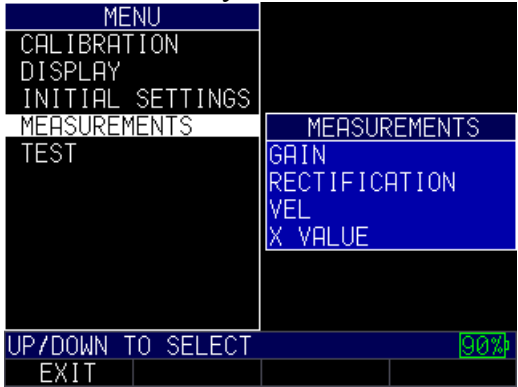
You can also set the other two measurement boxes for **depth** to reflector and **surface distance** to reflector as shown in the images below:



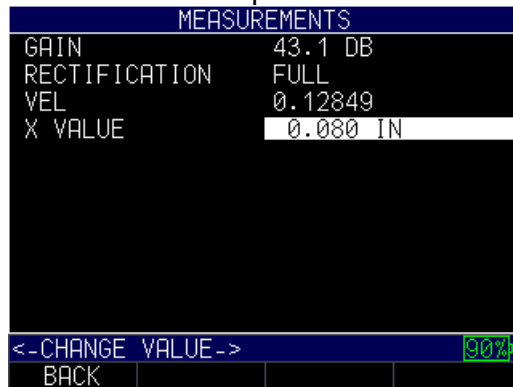


Setting the X-value physically marks the distance from the front of the wedge to the BIP. To enter this value into the unit, follow these steps:

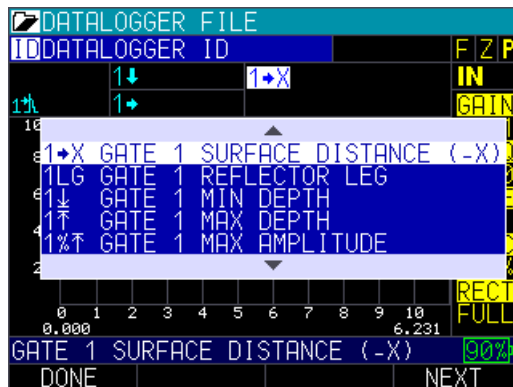
1. Press the **MENU/OK** key and use the arrow keys to select the **Measurement** option.
2. Use the arrow keys to select the X-value parameter.



3. Enter the X-Value parameter.

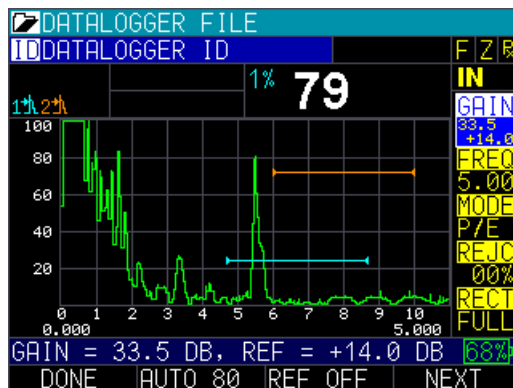


4. In the pull down menu of the measurement box, you can then choose Gate 1 Surface Distance (-X) as shown below:



### Setting Reference Gain

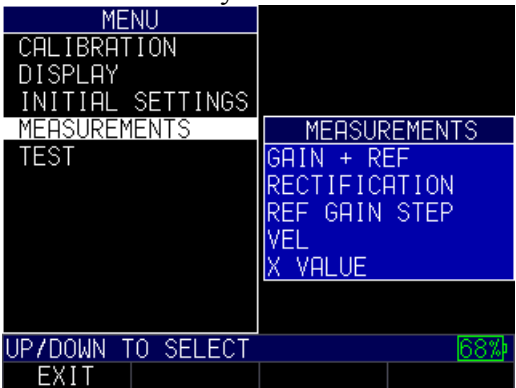
Some procedures require you peak a signal on a given reflector by peaking the signal to 80 full screen height (FSH), for example. This is easy to do by gating the signal and pressing the **F2 – Auto 80** key. Once this done, some codes will dictate how much scanning gain should then be added for inspecting parts in the field to account for attenuation, scattering, and surface condition. If your code and procedure stated to add +14 dB of scanning gain, this can also be done by pressing the function key for **REF ON** and using the up arrow key to +14 dB as shown in the image below:



Setting Ref Gain Step

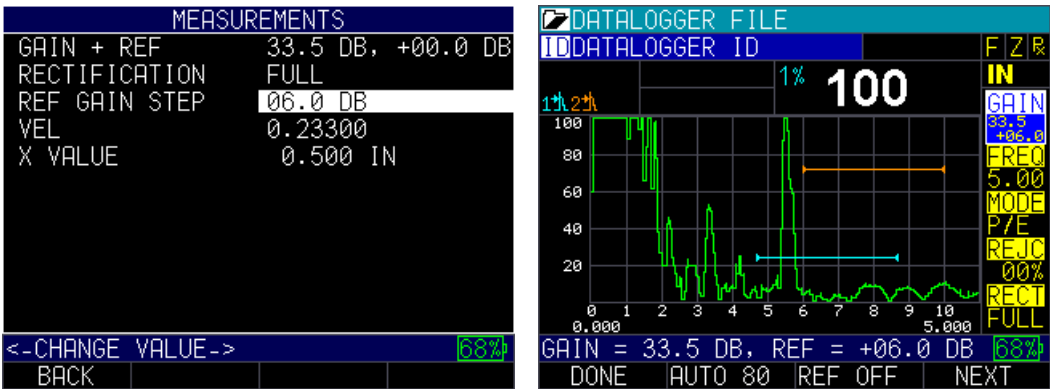
Setting the Ref Gain Step can be achieved by following these steps:

- 1. Press the **MENU/OK** key and use the arrow keys to select the **Measurement** option.
- 2. Use the arrow keys to select the Ref Gain Step option.



- 3. Set the Ref Gain Step from 0.1 dB to the total system gain (Ref Gain plus Scan Gain).

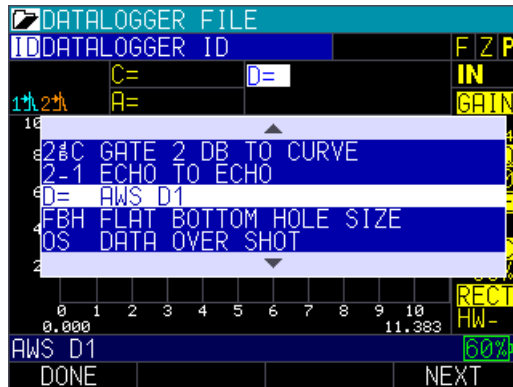
In the example below, the Ref Gain Step parameter was turned on after the dB step was set to 6 dB. This means that after pressing gain, each up or down setting to gain, the gain will change by the step size of 6 dB.



## 5 Echo FD advanced software features

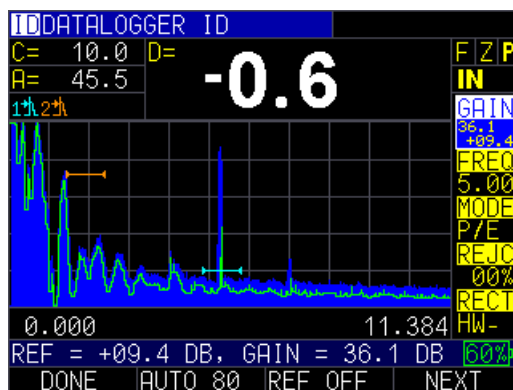
### AWS D-rating

When ECHO FD has an entered angle and an active reference gain, the AWS D1 rating is available in the large pull down menu as shown here:



To use the AWS D1 rating, follow these steps:

1. Calibrate ECHO FD using your angle beam probe and a IIW block.
2. Use peak memory and find the 0.060" side drilled hole, and bring this signal to a preset and known full screen height percentage. Because Auto 80 is available as a direct access key, we suggest 80%.
3. Hold the probe steady and use the right or left arrow key to toggle to the largest top right measurement box.
4. Select D = AWS D1.
5. Once the **F1 – Done** key or **MENU/OK** key is selected, the other 2 smaller measurement boxes will automatically populate to A and C values as shown in the image below:

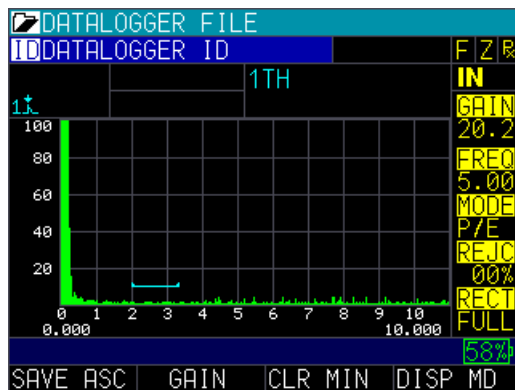
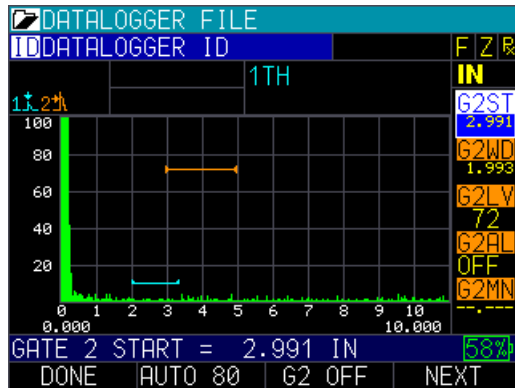


Consult with the AWS code for specific values and calculations.

- A = Total of system gain, base gain plus reference gain
- B = Base system gain
- C = Soundpath minus 1 times 2
- D = A-B-C

### Setting Gate Alarms

ECHO FD has 2 independent color-coded gates. Gate 1 is light blue and Gate 2 is tan. You can make Gate 2 inactive, but never Gate 1. To make Gate 2 inactive, simply use the right or left arrow key and press the **F4 – Next** key until the tan colored Gate 2 prompts are on the right side of the screen. Press the **F3** key to activate this option again.

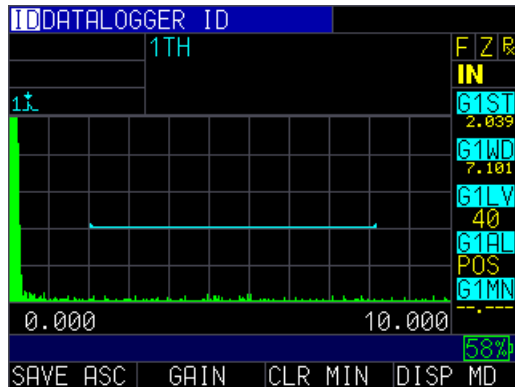


There are several options to choose from when using the gates to set alarms. Each gate can be set to the following parameters:

- OFF
- Positive
- Negative
- Minimum depth alarm

### Positive Gate Alarm

To set a Positive Gate Alarm, highlight G1AL. The arrows on the start and end of the gate will be positive facing line as shown in the image below:

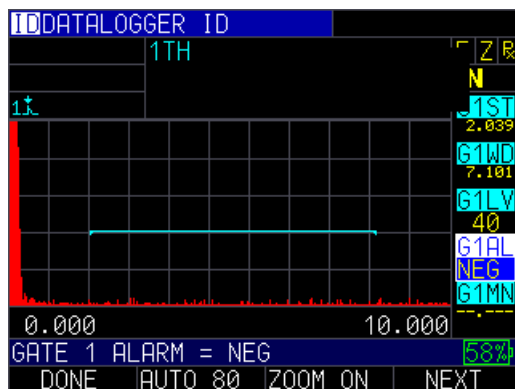


When an echo breaks into the gate, it will cause the waveform to light up red. Note, this color red is independent of A-Scan colors. **Alarm colors take priority over other colors as well as the F1 key, which lights up red.**

Also, if the vibrate or beeper parameters were set to ON, the unit will also beep and vibrate if an alarm occurs. Setting the vibrate option to ON is a good choice for loud environments.

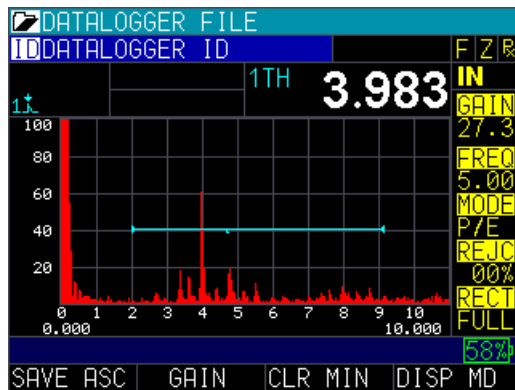
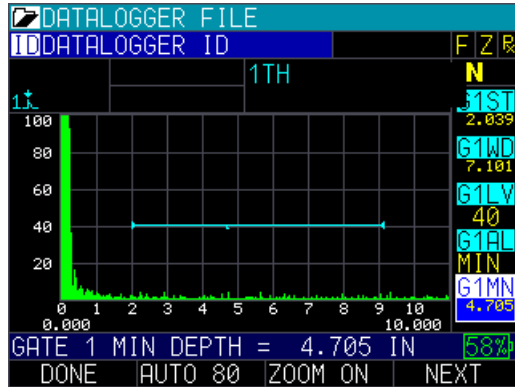
### Negative Gate Alarm

Set a Negative Gate Alarm to monitor when an echo has dropped out of a gate. Typically you would set Gate 1 Positive to look for a flaw and Gate 2 Negative to monitor a back wall echo.

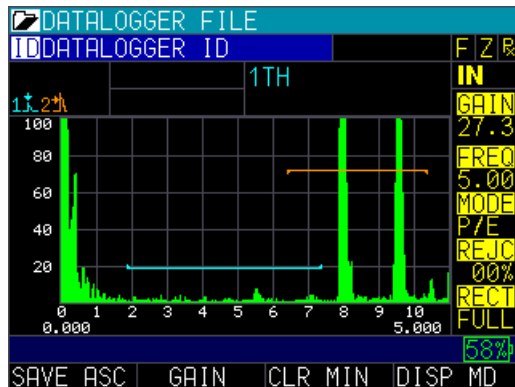


### Minimum Depth Alarm

When the minimum depth alarm is set, you can see a small triangle of where the alarm is and the G1 MIN value of 4.705 INCH, as shown in the image below:



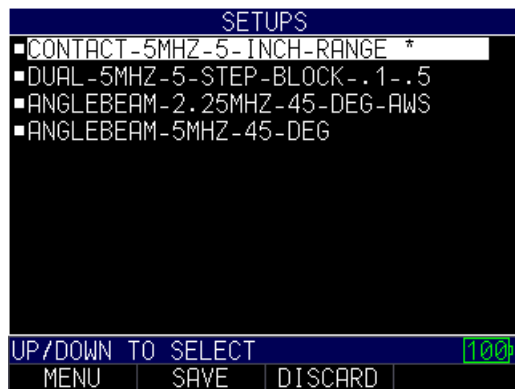
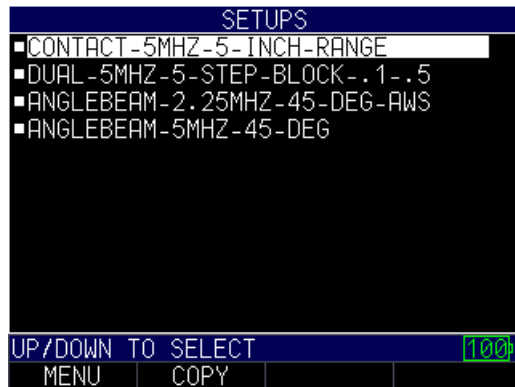
Below is an example of Gate 1 Positive and Gate 2 Negative:



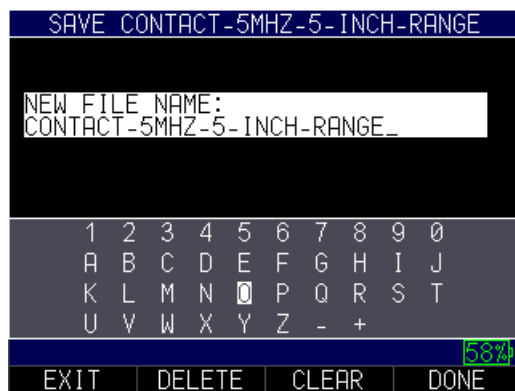
### Stored setups

Up to 1,800 setups can be stored in ECHO FD, which can keep track of calibration and instrument settings upon file creation. In addition, ECHO FD has 4 default template files denoted by a square to the left of the file name. None of the default files can be deleted. They are as follows:

- 1 Square Straight beam contact probe 5 MHz, 5" range
- 2 Square Dual probe 5 MHz.
- 3 Square Angle beam AWS type 2.25 with ref gain on
- 4 Square Angle beam quick change 5 MHz, 45 degree

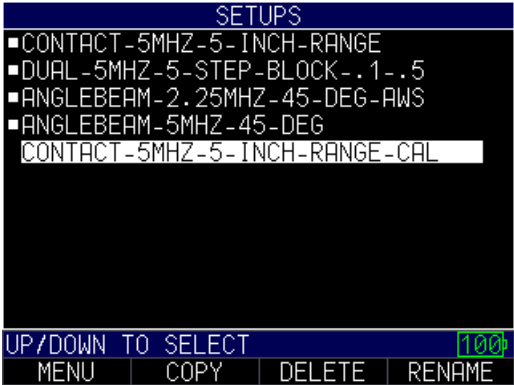


If any default parameter is altered, such as changing the Gain or Range, an asterisk will appear next to the file denoting the change (as shown in the image above). If you press the **F3 – Discard** key, then any changes made will be discarded. Pressing the **F2 – Save** key will allow you to save the setups, and the following screen will appear:





Press the **F4 – Rename** key when you are done and the new file name will populate at the end of the selection in the *Setups* screen.



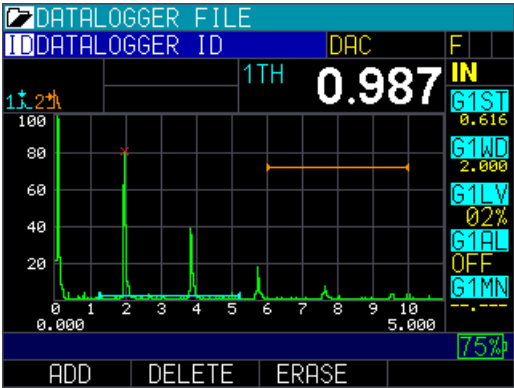
**DAC (Distance Amplitude Correction Curves) GUI**

To enable the DAC feature, follow these steps:

- 1. Press the **MENU/OK** key and use the up and down arrow keys to select the **Measurement** option.
- 2. From the **Measurement** menu, use the up and down arrow keys to select **DAC Curve**. The following parameters are available:

DAC > OFF  
ASME  
ASME-3  
CUSTOM  
JIS

- 3. Once DAC Curve is selected, press the **MENU/OK** key to return to the *Measurement* screen. The unit will be in **DAC Curve Creation** mode and the right side of the display will show GATE 1 panel with G1ST highlighted. “DAC” will be displayed at the “CAL” location to indicate **DAC** mode is active (see image below).

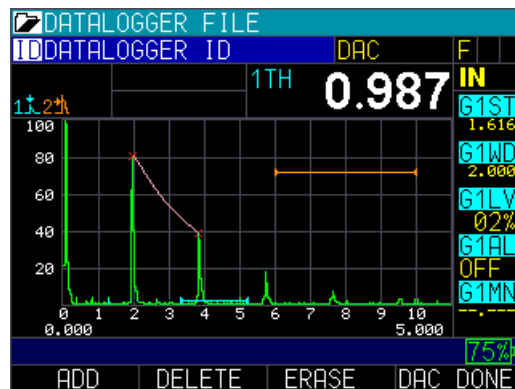


Until DAC Curve is done, the right side panel navigation will not be available; however, you can still navigate parameters by using the left and right arrow keys.

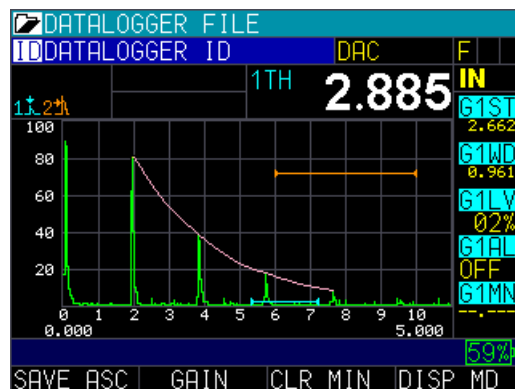
4. Press the **F1 – Add** key to add DAC point to the curve. An “X” will appear on the peak point to indicate the DAC point (see image above). After at least one point is added, the **F2 – Delete** key and **F3 – Erase** key will become available.

You can select different parameters using the right and left arrow keys, and adjust parameter values by using the up and down arrow keys, which will allow you to move the Gate and to add different points. Note, when a parameter is highlighted, the Function (F) keys will be available for editing that specific parameter, but after **DONE** is pressed, the F keys will return to **DAC Creation** mode.

5. After adding the 2<sup>nd</sup> point, the **F4 – DAC DONE** key will appear as an option.



Press the **F4 – DAC DONE** key after adding points to finish DAC Creation. You will notice that the “X” marks will disappear from the screen (shown below).



Once DAC curve is created, the DAC panel will be available for DAC gain adjustment, DAC curve selection (for the ASME-3 parameter), and custom curves. When DAC is created, DAC alarm options will become available in the Gate Alarm.

When the DAC feature is disabled, DAC points will be erased from the DAC table and you must create a new DAC when the feature is enabled again; however, DAC will be stored you can recall it from **Setup** mode and Datalogger.

## **6 Technical Assistance**

Call Danatronics, Corp. at 978-777-0081 or email us at [sales@danatronics.com](mailto:sales@danatronics.com) for specific technical assistance or troubleshooting questions.