User's Guide

Ver:1.1B

Danatronics, Corp.

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."

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1 Getting Started

About the EHC-09 Wave series

The EHC-09C, EHC-09CW, and EHC-09DLCW are portable, digital, handheld thickness gages. The EHC series of ultrasonic thickness gages are specifically designed to measure the remaining wall thickness of primarily steel structures.

> ➢ Vibralarm (vibrates gage below/above minimum/maximum thickness value)
>
> ➢ Illuminating keypad for easy to view go-no go thickness values (patent pending)
>
> ➢ Automatic transducer replacement intelligence built in (patent pending)
>
> ➢ Unique, programmable left-hand/right-hand operation (patent pending)
>
> ➢ Up to 50 hour battery life with 2 AA batteries
>
> ➢ Small, easy to hold, ergonomic, custom molded, durable case with rubber keypad
>
> ➢ Automatic zero capability
>
> ➢ Gain boost
>
> ➢ Multiple dual and single element transducer options including high temperature

The EHC-09C is a base gage in the color family offering a simple user interface packaged in the same custom molded high-density plastic case with rubber keypad as the other more sophisticated models. This gage offers reliable, accurate thickness readings on mostly steel structures with access to only one side. The EHC-09C can be easily upgraded in the field to the EHC-09CW or EHC-09DLCW models to add the live color waveform (A-Scan).

The EHC-09W is a mid-range model consisting of the most commonly used features in a thickness gage not requiring a datalogger but with a live color A-Scan. This model offers gain adjustment, vibrating alarm and illuminating keypad conditions, and automated

transducer replacement notification feature. Like the EHC-09C, this model is field upgradeable to a datalogger version with color waveform, the EHC-09DLCW.

Our top of the line model, EHC-09DLCW, contains all the same features of the EHC-09C and EHC-09CW plus:

- ➢ Live Color Waveform with gain, range, rectify adjustments

- ➢ 50,000 (expandable to 100,000) reading (5,000 waveform) datalogger capacity with complete setup tracking

- ➢ Three pre-set files for linear, grid (row advance) and grid (column advance)

- ➢ Echo-to-Echo

- ➢ B-scan

- ➢ Custom molded carrying pouch with belt clip and elastic strap

Probe Zero

When turning on the EHC-09C, EHC-09CW, and EHC-09DL CW(for the sake of this manual, with the exception of the datalogger, B-scan, and Echo-to-Echo features, the three model numbers are interchangeable for the basic operation and calibration), the gage does an automatic zeroing of the transducer thus eliminating the need for an on-block zero. The EHC-09C, EHC-09CW, and EHC-09DLCW will electronically zero the transducer upon power up and at a particular time during normal operation. This feature ensures the transducer is working in accordance with electronic zeroing procedures. This feature is particularly important on high temperature materials and when the transducer becomes worn.

> **Important Notice:** Please make sure the transducer is not coupled to the test piece when the gage is first turned on and that there is no couplant on the end of the transducer. The transducer should also be at room temperature, clean without any noticeable wear.

For a more accurate "span" of calibration, Danatronics recommends a zero calibration and sound velocity calibration as well.

Upon first turning on the gage, you can match the transducer part number on the back of the transducer to the screen, wipe couplant off face and press **MENU OK**. Here is what the first screen will look like, see reset and backlight sections for additional details.

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```
         X  D  U  C  E  R
  DHT537          5.0MHZ
  DK718           7.5MHZ
  DK1025         10.0MHZ
  DC1025         10.0MHZ
  DK10125        10.0MHZ
  DK537EE         5.0MHZ
  DK718EE         7.5MHZ
  USER            5.0MHZ
  DC110           1.0MHZ
  DC175           1.0MHZ
  DK250           2.0MHZ
                            99%
    SETUP   |   RESET   |  BKLITE
```
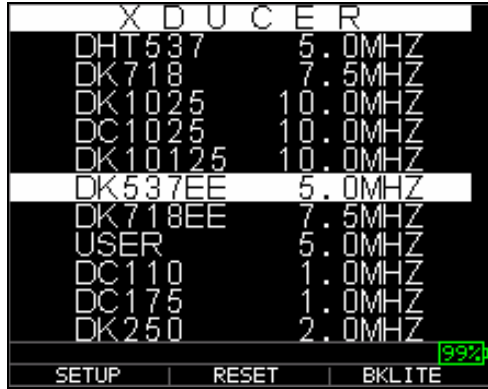
Keypad Functions

The figure below shows the full keypad of the EHC Series thickness gages. Refer to the following table that lists the function of each key on the keypad.

Key	Function
▲	Up arrow key
▼	Down arrow key
◄	Left arrow key
►	Right arrow key
⏻	On/Off symbol (under the F1 key)
OK	OK key
F1	F1 key
F2	F2 key
F3	F3 key

Function Keys

Function keys, or F keys, such as F1, F2, and F3 have various gage 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 (Dir).

Display Screen

The gage has a graphic style color TFT with 270x220 pixel density. Viewing the screen is best from straight above or slightly below the surface rather than from side to side. If external temperatures are below 32°F (0°C), the display may be slower to update information.

At the top right corner of the display screen is the "available key mode".

Color thickness of EHC-09C

Color Waveform in echo to echo, filename, id, minimum, large thickness value, echo to echo, range, echoes, blanking, gain, rectification, battery life, save, freeze and directory.

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RF in Zoom mode "Z"

| F1 | F2 | F3 |

The top part of the display screen for EHC-09DLCW model shows the File name, ID number, AA, and 0001 for grid column and row. The lower part of the display acts as an interactive tool that allows you to decide how you want to proceed with the information that is displayed on the screen. The middle part of the screen shows the thickness value, In, mm or usec, Echo-to-Echo symbol, LOS for loss of signal, Freeze, Fast Min or Max, Alarm indicator, Differential mode, Low, Med or High gain and percent remaining battery life.
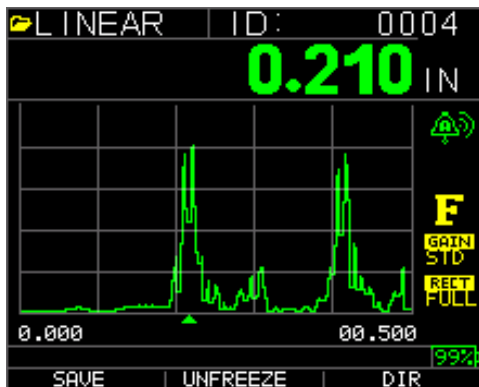
| F1 | F2 | F3 |

Using the Battery Pack

Monitoring the Battery Charge from the Display Screen

The EHC-09 Wave series constantly displays the percent battery life on the bottom right hand corner of the measurement display screen. When the gage gets below 10 %, the indicator will turn from green to red and a 5% it will flash.

> **Note:** You should power down the EHC-09 Wave to ensure any saved data is stored internally.

Replacing the Battery

To replace the battery pack, unscrew the battery door on the bottom of the gage and slide out the two "AA" batteries. Replace with two new "AA" batteries paying attention that both positive ends should be facing towards the top of the gage.

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2 Basic Gage Operations

Power on the Gage

To power on any of the EHC series thickness gages follow these steps:

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

Power symbol
under the F1 key

2. The following will appear on the display screen of the thickness gage:

3. The next screen that appears automatically is the *Xducer* (transducer) selection screen, also referred to as *Home* screen in the manual.

4. Use the up and down arrow keys to select a transducer and press **OK** key. (Please note, the transducer selection will automatically display the transducer last used prior to shut off.) The following default transducer choices are available:

```
USER  5.0MHz
DC110 1.0MHz
DC175 1.0MHz
DK250 2.0MHz
DC250 2.0MHz
DK525(s) 5.0MHz
DC525 5.0MHz
DK550 5.0MHz
DC550 5.0MHz
DK537 5.0MHz
DC537 5.0MHz
DHT537 5.0MHz
DK718 7.5MHz
DK1025 10.0MHz
DC1025 10.0MHz
```

5.   Press **F1** to select the **Setup** option.

6.   Press **F2** to select the **Reset** option.

7.   Press **F3** to select the **Bklite** option.

Performing a Reset

You can reset the gage settings back to the default settings by performing a gage reset.

Note: Performing a reset permanently deletes all of the saved parameters from the gage and replaces the settings with default values.
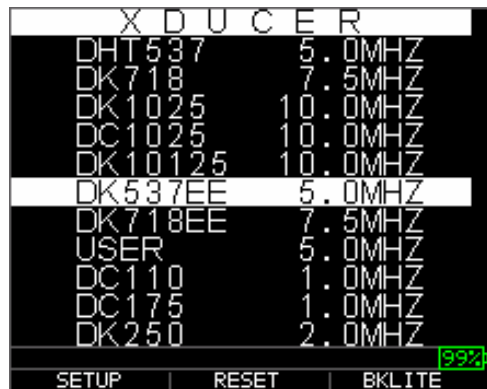
To perform a reset, follow these steps:

1.   From the *Home* screen, press the **F1 – Reset** key. The following Reset screen appears:

2.   Select the **Database**, **Parameter**, or **Database/Parameter** option by using the up and down arrow keys and press the **Menu Ok** key to make a selection. See the following sections to perform each of these reset options.

Database Reset

Performing a Database Reset clears all the files in the database and keeps the first three: Linear, Row increment and Col increment database files with cleared readings. All the user created files in the database will be cleared and deleted. To perform a Database Reset, follow these steps:

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1. From the H*ome* screen, press the **F1** – **Reset** key. The Reset screen appears.

2. Select the **Database** option and press the **OK** key. The following screen appears:

```
     R  E  S  E  T



  CLEAR  FILES/DEFAULT
  DATABASE/PARAMETER
  ARE  YOU  SURE?



                        99%
  EXIT   |    YES    |    NO
```
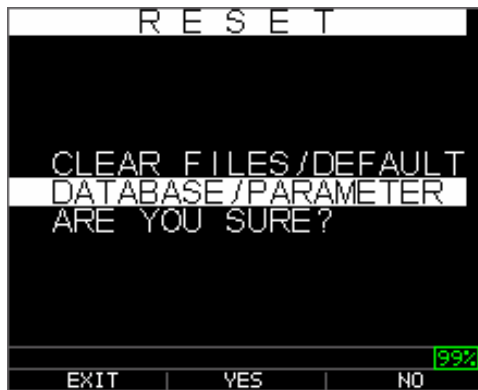
If you want to exit this screen press either the **F1 – Exit** key or **F3 – No** key to take no action and return to *Home* screen.

3. Press the **F2 – Yes** key to perform a Database reset.

After performing a Database Reset, the *Home* screen appears automatically.

Parameter Reset

Performing a Parameter Reset restores default parameters to the factory settings. To perform a Parameter Reset, follow these steps:

1. From the H*ome* screen, press the **F1** – **Reset** key. The *Reset* screen appears.

2. Select the **Parameter** option and press the **OK** key. The following screen appears:

```
     R  E  S  E  T



  DATABASE
  PARAMETER
  DATABASE/PARAMETER



  EXIT   |         |   ABOUT
```

If you want to exit this screen press either the **F1 – Exit** key or **F3 – No** key to take no action and return to *Home* screen.

3. Press the **F2 – Yes** key to perform a **Parameter** reset.

After performing a Parameter Reset, the *Home* screen appears automatically.

Database/Parameter Reset

Performing a Database/Parameter Reset clears all the files in the database and keeps the first three Linear, Row increment and Col increment database files with cleared readings. All the user created files in the database will be deleted and the default parameters will be restored at the same time. This selection is the equivalent of performing MASTER RESET on the instrument, restoring original factory setting. To perform a Database/Parameter Reset, follow these steps:

1. From the H*ome* screen, press the **F1 – Reset** key. The *Reset* screen appears.

2. Select the **Database** option and press the **OK** key. The following screen appears:
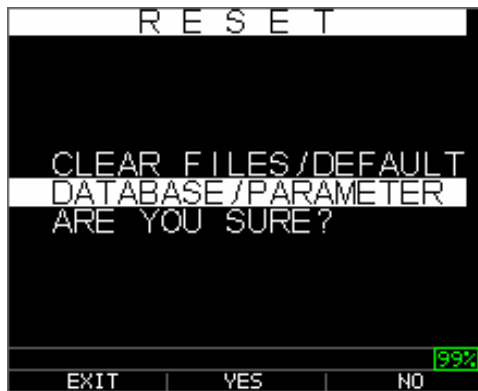
> If you want to exit this screen press either the **F1 – Exit** key or **F3 – No** key to take no action and return to *Home* screen.

3. Press the **F2 – Yes** key to perform a **Database/Parameter** reset.

> After performing a Database/Parameter Reset, the *Home* screen appears automatically.

Backlight

The backlight can be turned On or Off by pressing **F3 – Bklite**. Backlight can also be turned On, Off or set on Auto using the **Bklight** option in the Setup Menu/Display Menu. The Wave goes out with the Backlight automatically set to Auto to optimize viewing in various lighting while conserving battery life.

Note: Leaving the backlight on will reduce battery life.

If you set the backlight to Auto, the backlight will turn on during active readings and hold for 12 seconds or unless otherwise specified.

Note: If the backlight is set to Auto and you have the gage in Hold mode, the backlight will shut off after 12 seconds. If you would like the hold to remain lit, then you must enable the backlight on instead of using Auto.

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About Screen

You can find information about any of the EHC Wave series thickness gages such as the model number, version number and contact information from the gage's *About* screen. To go to the *About* Screen, follow these steps:

1. From the H*ome* screen, press the **F1 – Reset** key. The following *Reset* screen appears:

2. Press the **F3 – About** key. The following *About* screen appears.
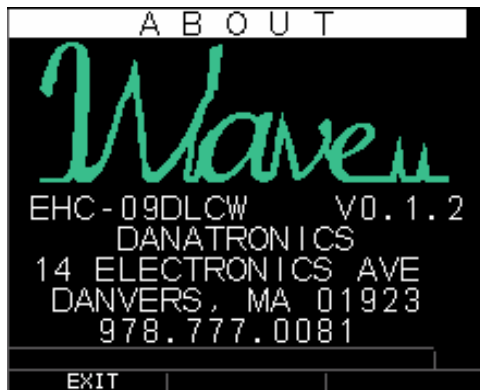
3. Press the **F1 – Exit** key to return back to *Reset* selection screen.

3 Calibrating the Gage and Making Measurements

Calibrating is the process of adjusting the gage for a specific material and transducer before testing material to make sure that all measurements are accurate. You must always calibrate before measuring material for standard accuracy.

To measure a thickness of unknown material you need to know the velocity of the sound in the unknown material. To find the velocity of the sound you can use one of the following methods:

- Velocity calibration only
- Velocity and zero calibration
- Zero calibration only
- Delay line calibration

Velocity Calibration Only

If you are working with a test piece of known thickness but unknown material, then you can calibrate the 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 any calibration, first go to the measure mode and press Menu/OK. Then go to the Cal option in the Menu screen and press OK. The following Cal mode screen should appear. To exit the cal screen without performing any calibration, press OK. To proceed to velocity cal, follow the following instructions.
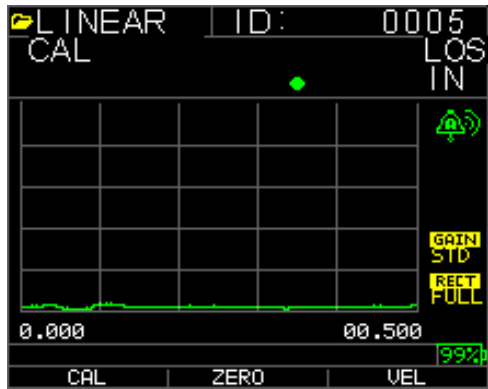
Cal screen for non-datalogger version

While measuring the thicker step, select VEL by pressing F3. After selecting VEL, 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. Press OK 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.

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Velocity and Zero Calibration

If you have a test step block of known thicknesses but unknown material, then you can calibrate the zero and velocity of the sound in the unknown material by measuring the time of flight from the main-bang to the first back echo for thinner step and thicker step.

To calibrate both: velocity and zero at the same time, first go to the Cal mode as shown in Velocity Calibration Only section. While measuring the thicker step, select VEL by pressing F3. After selecting VEL you can take the transducer off the test block. If the displayed value is different than the known value of the step, adjust the value by pressing up or down arrow keys and press F1/CAL. Then while measuring the thinner step select ZERO by pressing F2. After selecting ZERO you can take the transducer off the test block. If measured value is different than the known value of the step, adjust the measured value by pressing up or down arrow key and then press OK. The unit will briefly display the calibrated zero value and then return to Measure mode. Note that the order of Velocity and Zero calibration could be reversed. If Velocity calibration is performed after Zero calibration, the calibrated velocity value will be displayed at the end of the calibration process.

Zero Calibration Only

If you have a test step block of known thickness and known velocity of sound in the material, then you can calibrate the zero by measuring the time of flight from main-bang to the first back echo for the thinner step. The calibrated zero is the calculated zero minus the measured zero.

To accurately measure a thickness of unknown material you need to know the velocity of the sound in the unknown material and the errors introduced by the cable and electronics. This is called delay line and zero calibrated value for the transducer.

To perform a zero calibration, go to the Cal mode as shown in Velocity Calibration Only section. Then while measuring the thinner step, select ZERO by pressing F2. After selecting ZERO, 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. Press OK to perform the calibration. The unit will briefly display the calibrated zero value in the top of the screen and then return to measure mode.

Delay Line Calibration

Delay line calibration is done every time the thickness gage is powered on and a transducer is selected, or when a different transducer is selected during normal operation.

Delay line calibration is performed by measuring the echo of the transducer itself when it is not placed on any material and there is no couplant on the transducer surface.

Under normal usage, the surface of the transducer wears out over time, which reduces sensitivity of the transducer. When you power on any of the EHC series thickness gages and select a transducer, the gage performs automatic calculations and warns you (patent pending) if the sensitivity of the transducer is too low and whether the transducer should be replaced.

Automatic Zero

To perform an Automatic Zero or Auto Zero, you must first select a transducer option from the *Xducer* selection screen and press the **OK** key.
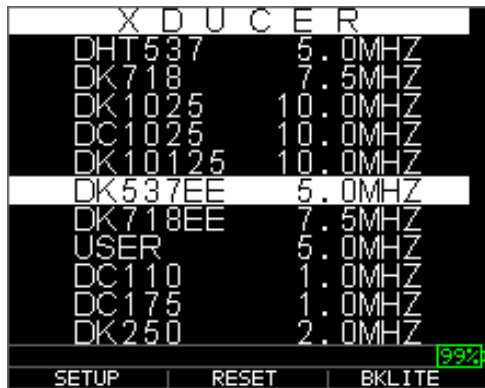
To continue the Auto Zero, follow these steps:

1. Follow the instructions given on each display screen; the first of which will prompt you to wipe off any couplant from the transducer and wait three seconds. The waiting time is shown in the changing pie-clock graphic on the display screen.
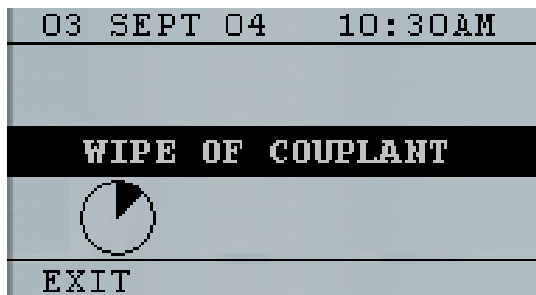
2. After three seconds the gage automatically begins to zero the transducer. During the delay line calibration a screen appears displaying the message "Performing Auto Zero".

3. A warning message will appear on the display screen if the delay line is below the acceptable limit for accurate thickness measurements. You will need to replace the transducer or select the **F1** key to acknowledge the warning message and continue using the same transducer, which may have a worn surface.

4. After three seconds or after acknowledging the warning message, the display shows the instrument parameters for 3 seconds before going to *Measurement* mode.

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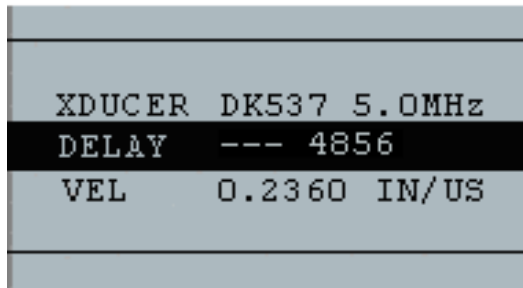
Measurement Mode with a Datalogger

If your EHC Wave series thickness gage is equipped with a datalogger, then the display screen in *Measurement* mode will look like the screen below:
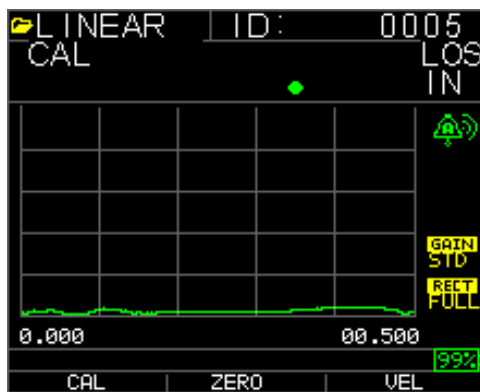
To continue in *Measurement* mode, follow these steps:

1. Press the **F1** key to select the **Save** option. (See: Save section for datalogger version.)

2. Press the **F2** key to select the **Freeze** option. (See: Freeze section.)

3. Press the **F3** key to select the **Dir** (Directory) option. (See: Directory section.)

4. Press the **Menu = OK** key to select the **Menu** option. (See: Menu section.)

Note: The available choices for F1, F2, F3 are different for the EHC series thickness gages without a datalogger. Also, the file symbol, filename, ID: xx,xxxx are not displayed in the non-datalogger version of the EHC series thickness gages.

To continue in *Measurement* mode **without a datalogger**, follow these steps:

1. Press the **F1** key to select the **Alarm** option. (See: Alarm section.)

2. Press the **F2** key to select the **Freeze** option. (See: Freeze section.)

3. Press the **F3** key to select the **Gain** option. (See: Gain section.)

4. Press the **Menu = OK** key to select the Menu option. (See: Menu section.)

4 Adjusting parameters in A-Scan mode:

In addition to changing parameters via the Menu OK key, you can also adjust the following parameters while in A-Scan:

Units (in, mm, usec)

Alarm (high, low, high-low, high vib, low vib, high-low vib, off)

Gain (AGC or manual in 1 db from 20 dB as min and 94 dB as Max)

Rectify (RF, Full Wave, Half + or Half -)

Range (.5,1,2,5,10 and 20 inch or 12.7, 25.5,50,127, 254, 508mm)

Blanking (MB for Main bang and IF for interface echo)

Echo to Echo (on or off)

To change a parameter use either the right or left arrow until the parameter to be adjusted is highlighted. Use the up or down arrow to adjust the parameter. You can also view the functions for each parameter by pressing the Menu OK key. When finished adjusting the parameter press the F1 done key (set up for left hand user), F3 for right hand user. For gain control, F2=AGC or Automatic Gain Conrol. When in AGC, the gage will use its sophisticated algorithms to automatically set the gain to the desired height. If echoes are not being detected but are somewhat visible, try increasing or decreasing the gain as described above.

Here are screen shots highlighting the various parameters that can be adjusted:
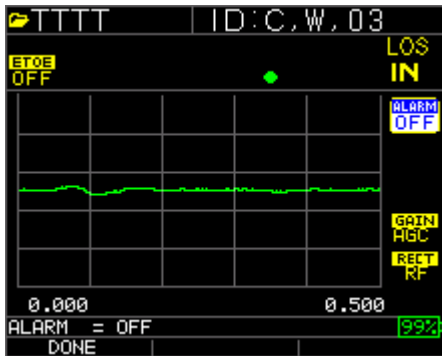
Alarm Highlighted
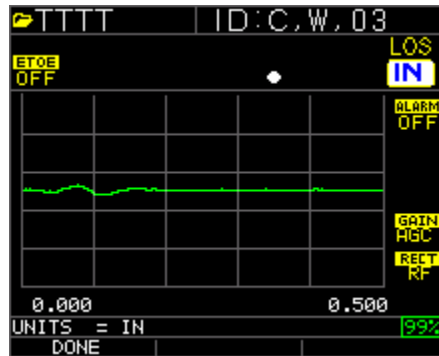
Units Highlighted

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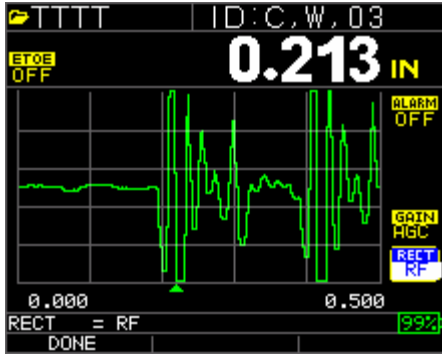
Rectify Highlighted
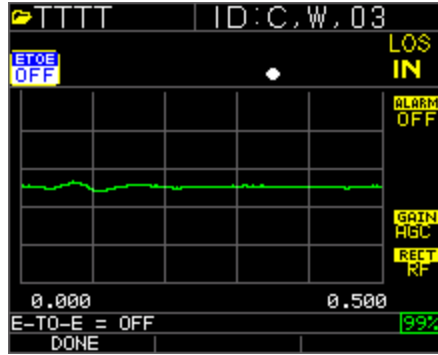
Echo to Echo Highlighted
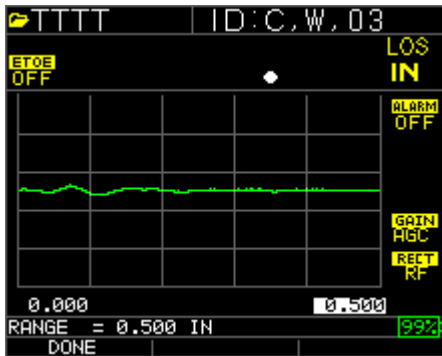
Range Highlighted
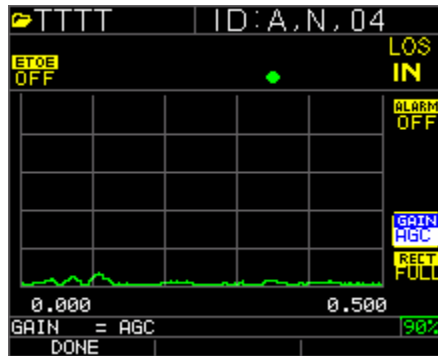
Gain Highlighted

NOTE:

Pay close attention when turning on echo to echo as thickness readings will not be accurate with echo to echo on versus off if you do not re-calibrate. You will also see an echo to echo cursor on the bottom of the screen to indicate where the measurements are being made.

5 Using Setup Mode on the Gage

The following modes are available (please note that in the non-datalogger version of the EHC series, the **Directory** mode is not available.)
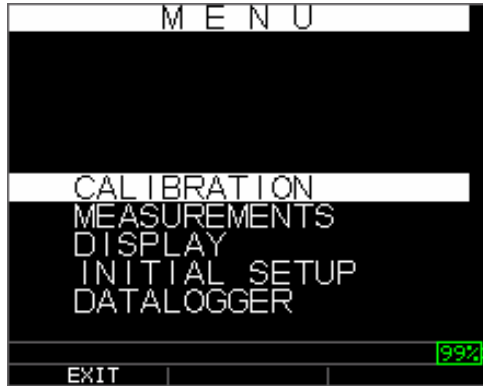
To select **Measurement** mode, follow these steps:

1. Press **Menu OK** to get to **Measurement** mode.

2. Use the up and down arrow keys to select the **Measurement** option and press the **OK** key.
   The following Setup choices are available:

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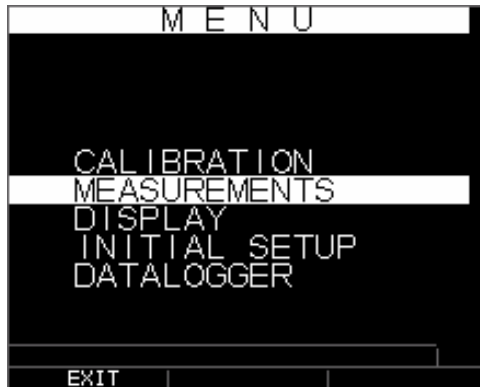
3. Use the up and down arrow keys to select any of the setup parameters available and press the **OK** key to change the setting. You can also change the setting using the "Quick Access mode". To do this, simply use the left and right key (indicated in the top right hand of the display screen) to change the setting of the highlighted parameter.
The entire list of available **Measurement** parameters are as follows:

```
          MEASUREMENTS
 RANGE    00.500
 RECT     FULL
 VEL      0.23300  IN/US
 XDUCER  DK537EE  5MH
 ZOOM     OFF
 ALARM    HIGH-LOW  VIB
 BSCAN    OFF
 DIFF     OFF
 E-TO-E   OFF
 FAST     OFF
 GAIN     STD  DB

     EXIT
```
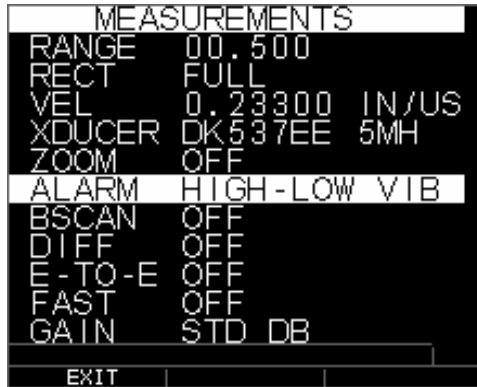
Note: Hold is off screen in the above image.

Here is a list of what is under the **Measurement** Screen:

RANGE	00.500
RECT	Full
VEL	0.23300 IN/US
XDUCER	DK537EE 5MH
ZOOM	OFF
ALARM	OFF
BSCAN	OFF
DIFF	OFF
E-TO-E	OFF
FAST	OFF
GAIN	32 dB
HOLD	OFF

Here is a list of what is under the **Display** screen:

```
          DISPLAY




 BKLIGHT  ON
 COLOR
 USER      LEFT  HAND



     EXIT
```

Backlight   ON
USER   LEFT HAND
Color   Flags, Grid, Text, Waveform, Background

Some color changes are dynamic, meaning you will see the changes as you make the change; examples include Flag, File, ID. Others, such as waveform and background, can only be seen once the change is made and you return to the screen.

Note: the Wave will not allow the superimpose of two simultaneous colors.

To change a color, Press Menu/OK, scroll to Display, press Menu/OK, choose the item to change the color on using the up and down arrows, then use the left or right arrow to toggle through the color choices of:
Red, green, blue, yellow, white, black, grey, light grey. By varying the colors, you can optimize ease of visibility and improve contrast. The Wave is readable in direct sunlight as well as in-doors. It is highly recommended to use the back light set to on or auto when using the wave indoors. You can not make two colors be the same and the Wave will prompt you with a message such as wave and background not allowed and the gage will move to the next available color.

Using the Clock

The EHC Wave series thickness gages have an internal real-time clock that includes the year, month, day and time.

From the **Initial Setup** screen press menu/OK and scroll to clock and press Menu/OK.

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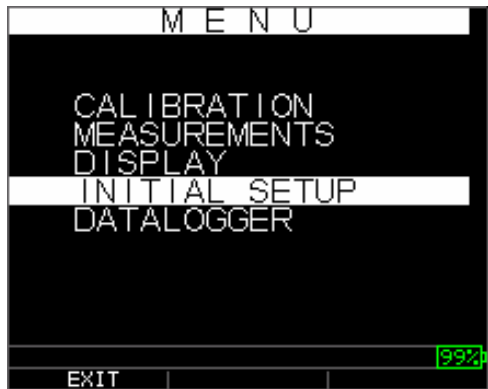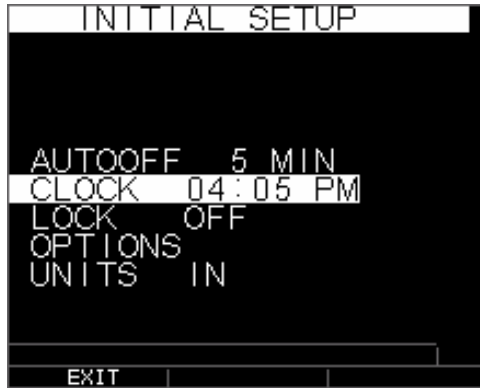
The entire list of available clock setup options are as follows:

TIME FMT   12 HR
DATE FMT   MM/DD
MINUTE   21
HOUR   01 PM
DAY   01
MONTH   01
YEAR   2005

To set the time and date, follow these steps:

    1. Select **Clock option** from the Initial *Setup* screen.

The following is an example of what the clock setup screen might look like depending on the previous setup.

To change the **Time Format**, select TIME FMT using up/down arrow keys. Use the left/right arrow keys to select between 12 HR and 24 HR options.

2. To change the **Date Format**, select DATE FMT using up/down arrow keys. Use the left/right arrow keys to select between MM/DD and DD/MM options.

3. To set **Minute**, select the MINUTE option using up/down arrow keys. Use left/right arrow keys to decrease/increase the minute value. You can set the minute value from 00 to 59.

4. To set the **Hour**, select the HOUR option using up/down arrow keys. Use left/right arrow keys to decrease/increase the hour value. If time is set in 12 HR format, the available hour values are from 00 AM to 11 PM. If time is set in 24 HR format, the available hour values are 00 to 23.

5. To set **Day**, select the DAY option using up/down arrow keys. Use left/right arrow keys to decrease/increase the day value. You can set the day value from 01 to 31.

6. To set **Month**, select the MONTH option using up/down arrow keys. Use left/right arrow keys to select a Month from JAN to DEC.

7. To set **Year**, select the YEAR option using the up/down arrow keys. Use left/right arrow keys to select the year value from 2005 to 2025.

Press F1 – EXIT to exit the clock setup and return to the setup screen. The real-time clock will automatically update the date and time once the clock parameters are selected.

Understanding a LOS Reading

LOS (Loss of Signal) occurs when the gage is not making a valid reading for a variety of reasons. This may be because there is not enough couplant, the surface is too rough or rusty, the transducer is low in sensitivity, the temperature is too high, there is a disbond between the coating and the steel or for a variety of other reasons. In the event you try to save a reading in LOS with the datalogger version, the *Notes* screen will automatically appear so that a reason is given for saving an LOS. You can scroll to the appropriate note and press the soft save key.

Using the Hold Option

From the **Initial Setup** screen, if a LOS occurs, the gage can continue to display the last measured thickness by "holding" the measurement. There are two **Hold** options, which include:

- *Hold On*: Continues to display the last measured thickness
- *Hold Off*: Does not continue to display the last measured thickness

Using the Fast Option

From the **Measurement** Screen, the **Fast** option is available in the **Setup** mode in both the Datalogger and Non-datalogger versions of the gage.

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To select the **Fast** option in **Measurements** mode, follow these steps:

```
         M  E  N  U


      CALIBRATION
      MEASUREMENTS
      DISPLAY
      INITIAL  SETUP
      DATALOGGER



      EXIT
```
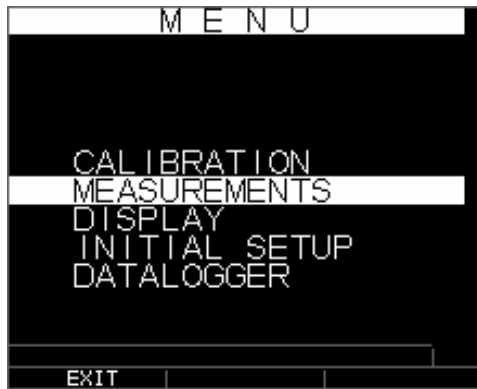
1. Use the up and down arrow keys to highlight the **Fast** option and press the **OK** key. Or once **Fast** is highlighted, use Quick Access mode by pressing left or right arrow key as indicated in the top right corner of the display screen.
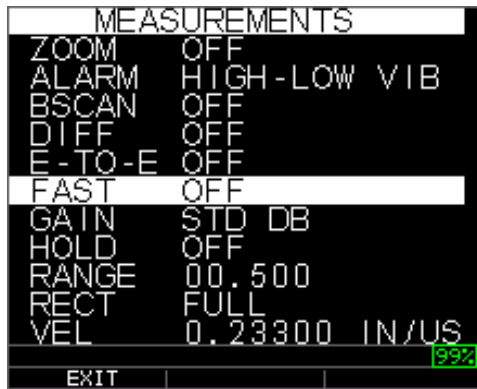
```
      MEASUREMENTS
   ZOOM      OFF
   ALARM     HIGH-LOW  VIB
   BSCAN     OFF
   DIFF      OFF
   E-TO-E    OFF
   FAST      OFF
   GAIN      STD  DB
   HOLD      OFF
   RANGE     00.500
   RECT      FULL
   VEL       0.23300  IN/US
                        [99%]
      EXIT
```

The following parameters are available:

```
         F  A  S  T





      OFF
      ON
      MIN
      MAX


                        [99%]
      EXIT
```
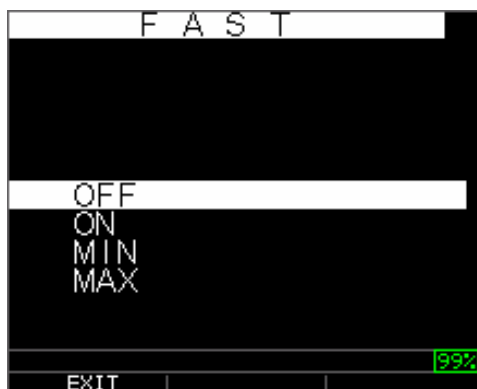
2. Use the up and down arrow keys to select the desired parameter and press the **OK** key.

3. Press **OK** key again to accept and return to **Measure** mode.

In the **Measure** mode in either the Datalogger or Non-datalogger version of the gage, the selected **Fast** option setting is displayed under the thickness reading as shown in the screens below:
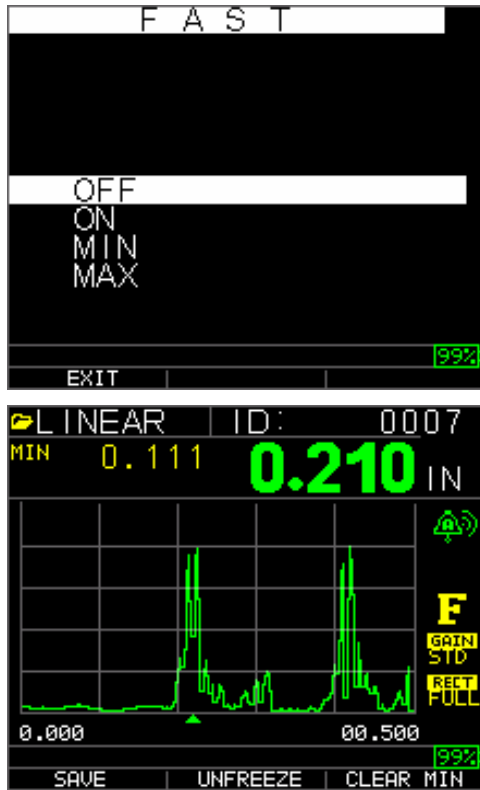

Helpful Hint: When using the FASTMIN mode, if you press the F2 key "Freeze" prior to LOS, the gage will display the last minimum prior to the LOS so that the actual couplant on the end of the transducer is not registered as a legitimate minimum reading.

The parameters that you selected in the **Fast** option are shown as follows in **Measure** mode:

FAST	when **On** is selected
FASTMIN	when **Min** is selected
FASTMAX	when **Max** is selected
<BLANK>	when **Off** is selected

The **Fast** option allows you to select fast updates of measurements at 20 Hz compared to 4 Hz. If you selected the **FastMax** option, the LOS will display the LAST MAX measured value, or if you selected the **FastMin** parameter the LOS will display the LAST MIN measured value. If you select the **On** parameter from the **Fast** option, the LOS will work normally and not show the measured reading.

The screens below reflect different parameters selected from the Fast option. For example, the top screen shows the FASTMAX with LAST MAX measurement on LOS, and the bottom screen shows the FASTMIN with LAST MIN measurement on LOS.

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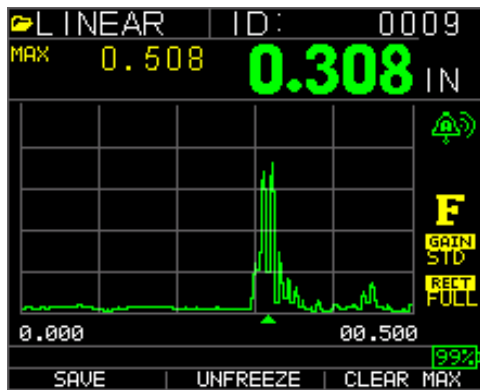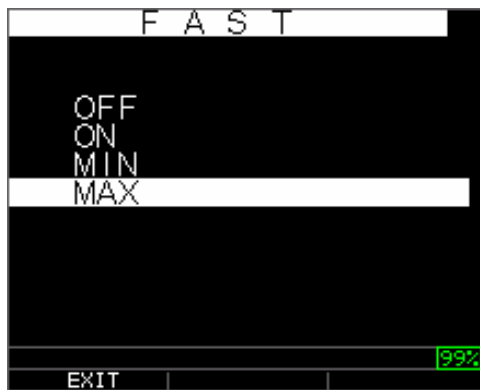
Note: The LOS flag indicates the LAST MAX or the LAST MIN value and is shown based on the *FastMax* or *FastMin* setting.

To reset the tracking of LAST MAX and LAST MIN measured value press the **OK** (Menu) key.

Using the Gain Option

From the **Measurement** Screen, gain refers to an increase in signal power (echo height) and is typically measured in decibels (dBs). The Gain function is useful for setting a reference level where by making it easier to add or subtract gain. There are two types of gain, one is Auto in three Gain options, which include: LOW dB, STD dB & HI dB (For

EHC-09C only) or in manual gain adjustment in 1dB step for EHC-09CW or EHC-09DL CW.

The Gain selection is available from the **Measurement** screen to either AGC (Auto Gain Control) or Manual (1dB step) for the waveform models. You can also adjust the gain for waveform gages from the live A-Scan. To adjust gain during a live A-Scan, press the right or left arrow until gain is highlighted, then use the up or down arrow or F2 to return to AGC and F1 when done. For the EHC-09C, you can adjust in the **Measurement** screen, low, standard and high.

In the non-datalogger version gage, the **F3** key allows you to select the **Gain** option directly without having to go to through the **Measurements Setup** mode. In the datalogger version, F3 becomes **Dir** (Directory).


1. For the datalogger version, use the up and down arrow keys in the **Measurement** screen to highlight the **Gain** option and press the **OK** key, or select the **F3** key if you are using the non-datalogger version.

    The following Gain parameters are available:
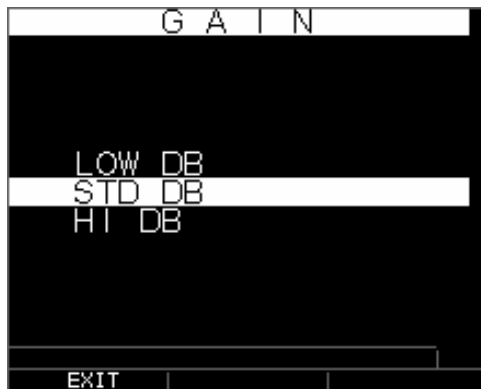
2. Use the up and down arrow keys to select the desired **Gain** option.

3. Press the **OK** key to accept the parameter and return to **Measure** mode.

In the **Measure** mode screen of the datalogger and non-datalogger versions of the gage, the **Gain** option that you select is displayed to the left of the battery indicator as shown below under the F for freeze flag on the bottom right:
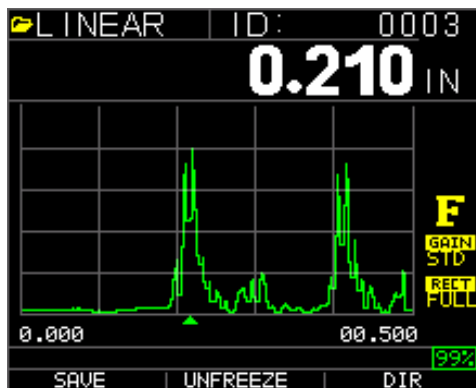
Using the Diff Option

From the **Measurement** screen, there are two Diff options, which include:

- *Diff ABS:* Absolute where the gage will display a thickness value as an absolute number of what has been entered. For example, diff abs = 0.500" and the real thickness is 1.000 inch, the display will show diff abs 0.500. If the real value is 0.300, the gage will display, -0.200"

- *Diff %:* When this mode is on, the displayed value will be listed as a percentage of the value entered into as the diff. For Example, if the operator set the diff to percentage at 0.500", a reading of 0.250" will result in 50%

Using the Alarm Option

From the **Measurement** Screen, the EHC Wave series thickness gages offers various alarm settings to alert you of low or high thresholds via audible sounds, display flashes, sensational vibrations (if on) and illuminating keypad. There are several; different alarms options, which include:

- *Alarm Off***:** Sets the audible alarm either off.

- *Low Alarm***:** Audible alarm will occur and display will flash when the displayed reading is less than the low alarm reference value.

- *High Alarm***:** Audible alarm will occur when the displayed reading is higher than the high alarm reference value.

- *High_Low Alarm:* Audible alarm will occur and display will flash when the displayed reading is less than the low alarm or greater than the High alarm reference value.

- *Low Alarm/Vibra***:** Vibration alarm will occur and display will flash when the displayed reading is less than the low alarm reference value.

- *High Alarm/Vibra***:** Vibration alarm will occur and display will flash when the displayed reading is higher than the high alarm reference value.

- *High_Low Alarm/Vibra:* Audible alarm will occur and display will flash as well as vibrate when the displayed reading is less than the low alarm or greater than the High alarm reference value.

- *High_Low Alarm/Vibra with Dynamic Waveform Adjust:* Audible alarm will occur and display will flash as well as vibrate when the displayed reading is less than the low alarm or greater than the High alarm reference value. In addition, the color of the A-Scan will dynamically change to red, yellow (caution…within an operators preset value of high or low alarm, i.e. 20%) or green corresponding to bad, caution or good readings.

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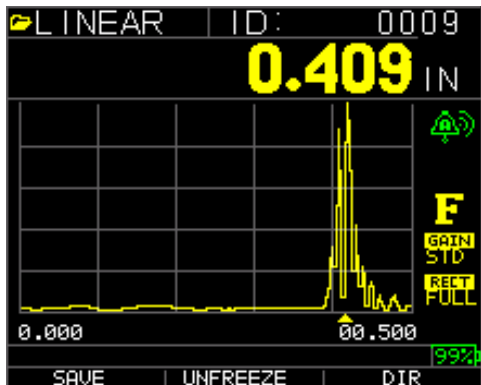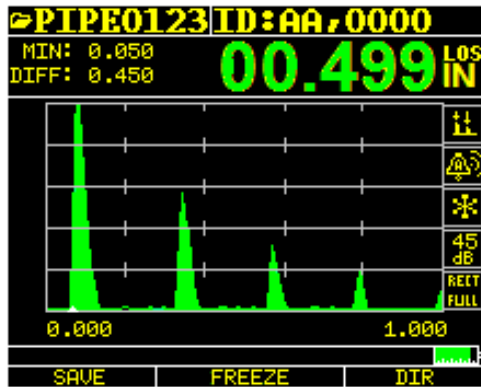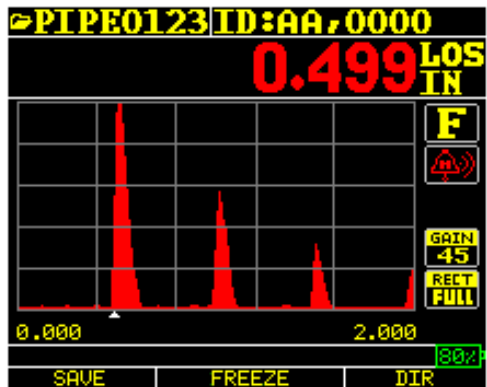
Green echoes=good   Red echoes = tripped alarm

The **Alarm** option is available from the **Measurement** screen.
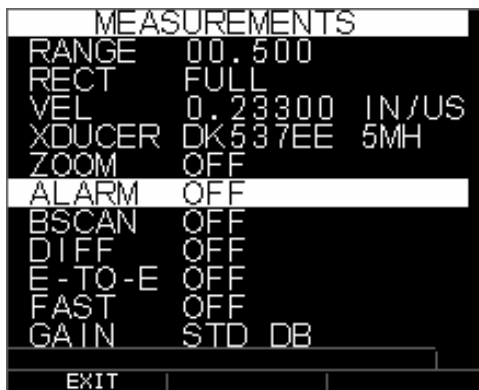
1. Use the up and down arrow keys to highlight the **Alarm** option and press the **OK** key or you can use Quick Access mode by using the right or left keys once **Alarm** is highlighted from the **Setup** mode. If you are using the non-datalogger version you can also press the **F1** (Alarm) key to go directly to the **Alarm** option without having to go through the **Setup** Mode.

    The following ALARM selections are available:

```
       A  L  A  R  M
LOW            VIB
HIGH-LOW
OFF
HIGH
LOW
HIGH-LOW  VIB
HIGH         VIB




                    99%
   EXIT
```
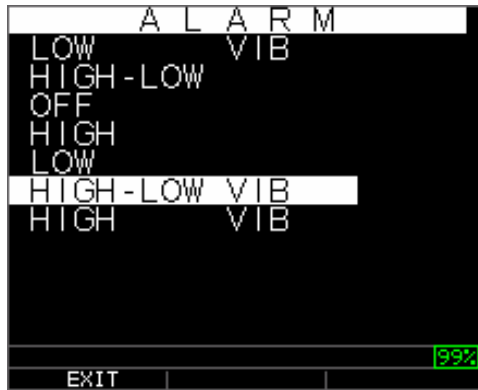
2. Use the up and down arrow keys to select the desired alarm parameters and press the **OK** key.

   For example, when you select the **High-Low** option the following screen below appears. Use the up and down arrow keys to change the Alarm High limits and press the **OK** key to continue.

```
       A  L  A  R  M




   HIGH    0.500



                    99%
   EXIT
```

3. Use the same steps from above to set the Alarm Low settings.

```
       A  L  A  R  M




   LOW     0.100



   EXIT
```
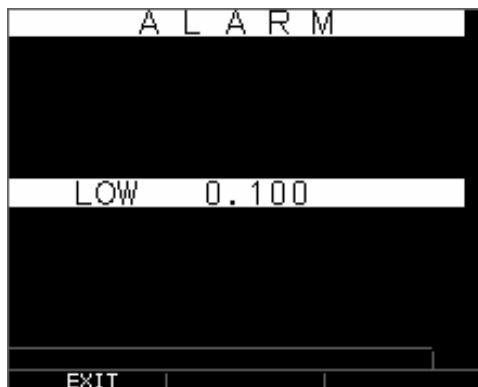
4. Setting the % for caution. In this mode, the % entered based on the high and low set points will cause the waveform and F2 to light up yellow:

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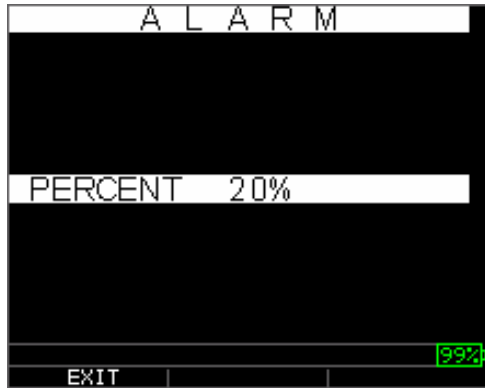
> **Note:** The Low Alarm limit will not go beyond the High Alarm limit.

5. When you are finished adjusting the setting, press the **OK** key to return to **Measure** mode.

Setting the Visual and Audible Alarm

The Visual Alarm conditions can be viewed from either a red, yellow or green LED that lights up under the **F1**, **F2,** or **F3** keys on the keypad.

As an example, when using the 5 step English test block with thicknesses of 0.100, 0.200, 0.300, 0.400 and 0.500 inches, if you enter alarm high-low you will first need to enter the high value. Enter 0.500 and press enter. Next you will need to enter the low value of 0.100 in. The display will ask you to enter the percent reading of the high low. The gage will default to 20% (this can be changed with the up or down keys), so any reading within 20% of the high value (approaching high, between 0.400 and 0.499 as 0.400 is within the 20% range of 0.500.) will result in the yellow keypad lighting up. Also, any reading above the low value of 0.101 and 0.120 will result in the yellow F2 keypad lighting up as you are approaching the minimum

So, in **Alarm** mode, choosing a non-zero percent value provides the user with warning for readings approaching the selected percent value of the high or low limits. For example, if the alarm value is 0.100" and 20% is entered as the "percent value", reading from 0.101" to 0.120" will result in the **F2** "yellow" key being illuminated. Also, reading less than 0.100" will result in the F1 key "Red" being illuminated and greater than 0.120" will result in the **F3** "Green" key being illuminated.

The Audible Alarm turns the beeper on the gage either on or off based on the same alarm conditions used for visual alarm stated above.

Setting the Vibra Alarm

The gage will physically vibrate when the Vibrating Alarm is active based on the same alarm condition used for visual alarm. The Vibrating Alarm, noted as **vib** on the gage display, can be enabled with varying alarms and alarm conditions as shown on the screens below:

Visual and Audible Alarm is enabled.
The letter **A** (Alarm) appears in the alarm icon
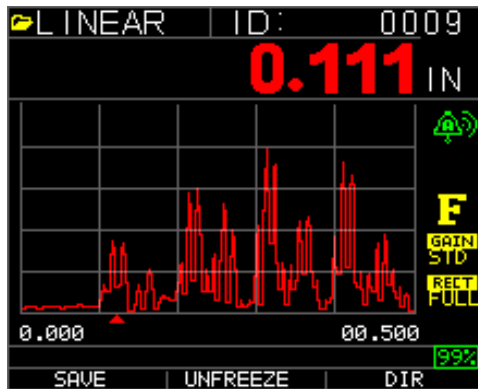
Visual, Audible, and Vibrating alarm enabled
.)) symbol appears next to the alarm icon. The letter **H** (High) appears in the alarm icon

Alarm condition has occurred meaning the measured reading is greater than the High Alarm limit. The letter **H** (High) appears in the alarm icon. The screen above has the Vibrating alarm enabled as the .)) symbol appears next to the alarm icon.

Alarm condition has occurred meaning the measurement reading is less than the Low Alarm limit. The letter **L** (Low) appears in the alarm icon. The screen above has the Vibrating alarm enabled as the .)) symbol appears next to the alarm icon.

Note: In the NON-DATALOGGER version the F1, F2, and F3 choices are different and the file symbol or the filename along with ID# are not shown.

Using the Echo-to-Echo Option

The **Echo-to-Echo** option allows you to make measurements between two consecutive backwall echoes. Therefore, a good usage of the **Echo-to-Echo** option is for measuring through coatings to measure only the true metal thickness. There are two Echo-to-Echo options you can select, which are as follows:

- *Echo-to-Echo On:* Enables the Echo-to-Echo function

- *Echo-to-Echo Off***:** Disables the Echo-to-Echo function

- *Blanking in Echo to Echo:* close attention should be paid when making readings in echo to echo as the blank after first receive echo may need to be adjusted to avoid "noise" or mode converted echoes. To adjust blanking on the first echo, see section 4: Adjusting parameters in A-Scan mode.

Note: Pay attention in A-Scan mode to ensure you are in the appropriate mode, echo to echo or normal mode as thickness readings and associated calibrations are mode specific.

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- *Manual Adjustment of Gain:* Again, sometimes gain will help to ensure you are reading on the correct echo. To adjust gain, see section 4: Adjusting parameters in A-Scan mode.

- *Rectification Mode Adjustments:* Lastly, in echo to echo, sometimes using various rectification modes can "clean up" the signals so you are reading the proper echoes.
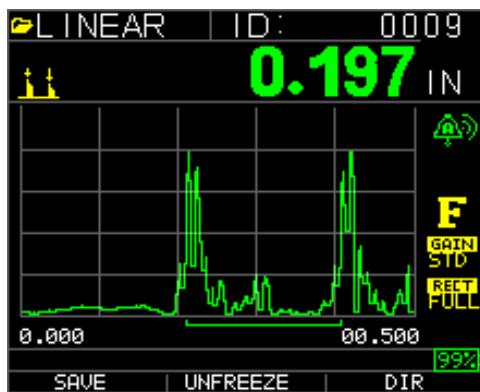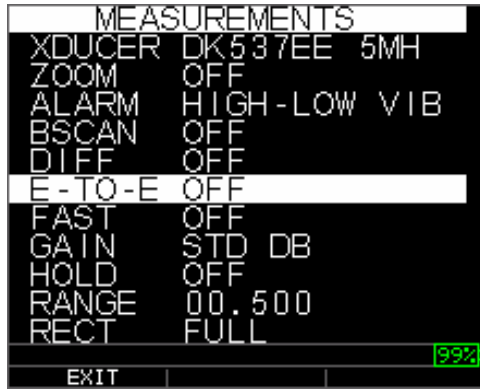
The first Read line on the baseline is referred to as the Main Bang Blank while the second red line is referred to as the Blank After First Received echo. The white line represents the measured time interval between the two correct echoes.

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6 Special Gage Functions

The EHC Wave series thickness gages have many special functions that go beyond the basics, mainly in the EHC-09CW and EHC-09DLCW models. This section will discuss these special gage functions in detail.

Using the Save Option

For the datalogger version only, you are able to save your data via the **Save** option. Please note, the save key can appear over either the F1 or F3 keys depending on how the user prefers to the gage. See section…

To use the **Save** option, follow this step:

1. From the **Measurement** mode screen, press **[F1] (Save)**. Please note, if the user has been set to righty under the **Display Screen**, the Save will appear over the F3 key.
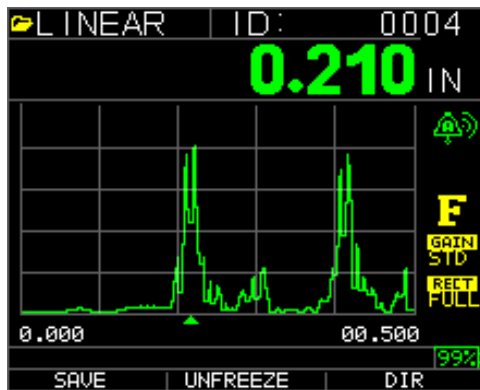
Note: Save is on the left.
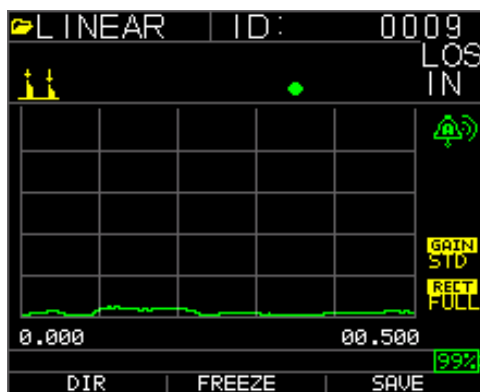
Note: Save is on the right.

The data saved will depend on your setup parameters, which are selected from the *Setup* screen. For example, if the **Notes** option is set to **Off** then saved thickness

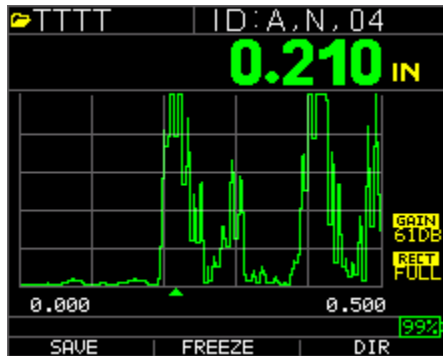reading will be stored at the ID location [Linear], [Row], [Col] without notes. (See: Directory selection for file type details.)
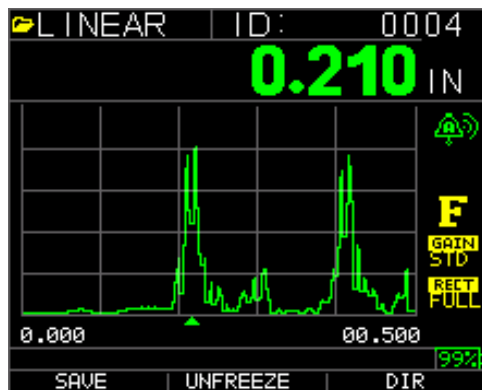
Using the Freeze Option

For the datalogger version and non-datalogger version thickness gages, you can freeze your data via the **Freeze** option.

To use the **Freeze** option, follow these steps:

1. From the **Measurement** mode screen, press **[F2] (Freeze)**.

The following screen comes up after pressing **[F2] (Freeze)** whereby showing the flag "**Freeze**" under the thickness reading. You are now in **Freeze** mode. The **[F2]** selection also changes from **Freeze** to **Unfreeze**.

2. Press **[F1] (Save)** to save the reading. (See Using the Save Option for more information.)

3. Press **[F2] (Unfreeze)** to disable the **Freeze** mode

4. Press **[F3] (Dir)** to perform file operations. (See Using the Directory Option for more information.)

5. While in **Freeze** mode the menu options are disabled. The display will prompt you to unfreeze the gage.

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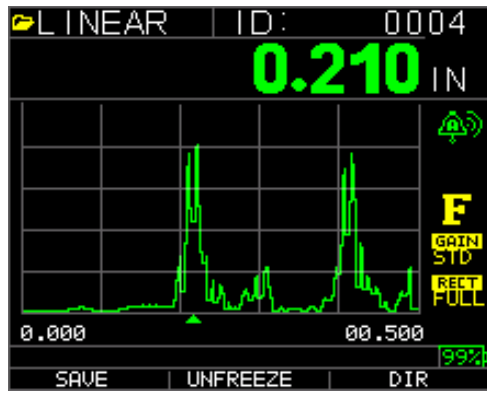
Datalogger version

7 Using the Datalogger Directory Mode

Note: This section applies only to the EHC-09DL Thickness Gage with a datalogger. If you do not have a datalogger, you may skip this section. Please note, the EHC-09B and EHC-09 gages are field upgradeable to the Datalogger version. Call the factory for installation instructions.

To use the datalogger **Directory** mode, follow these steps:

You can either press F3 if Min or Max clear is not present or press the Menu OK key and view this screen:

Then you will see this screen:
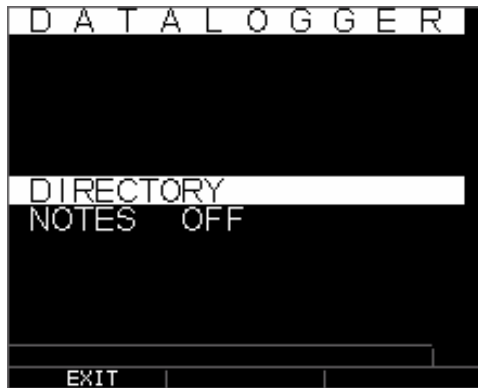
Choosing a file:

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Naming a file: type in name, press F3 when done

Next you will need to use the up and down keys to determine the file type and amount of readings stored per file. The many types are shown here:
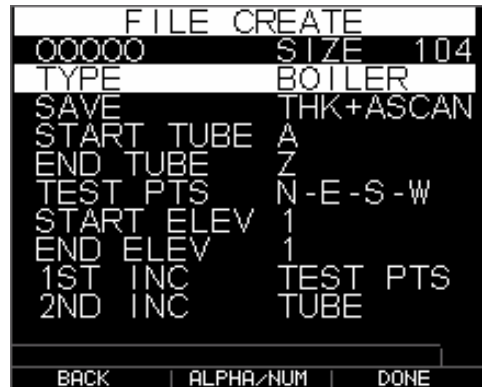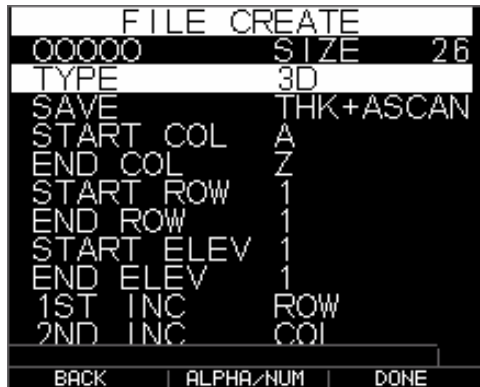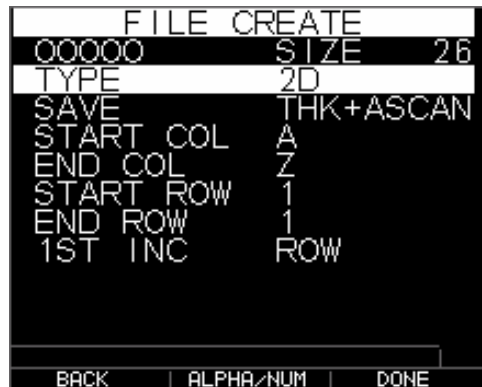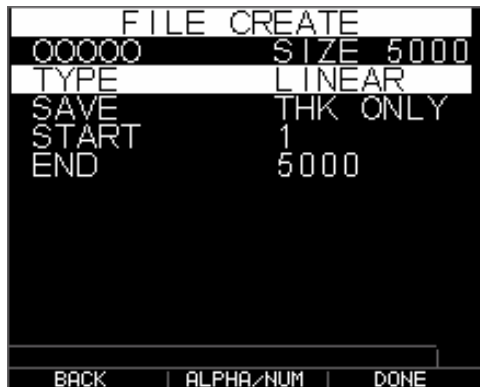
You will also need to decide per file if you want to save thickness and a-scan as per below screen:

Use the right arrow to change from linear to grid files, 2D, 3D and boiler files. Use the down arrow to select end row and/or end column. The Maximum number of readings per file is 5,000 and 160 A-Scan. The gage will dynamically re-calculate the size based on row end times column end. :
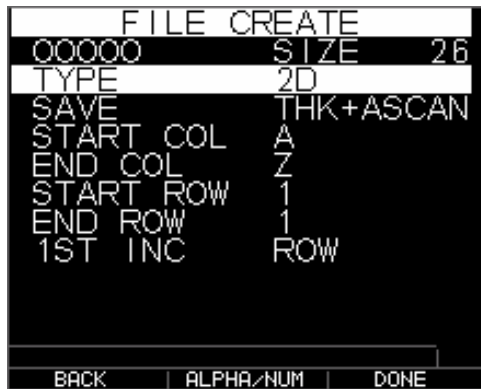
1. From the **Measurement** mode screen press **[F3] (Dir)** to select the **Directory** mode.
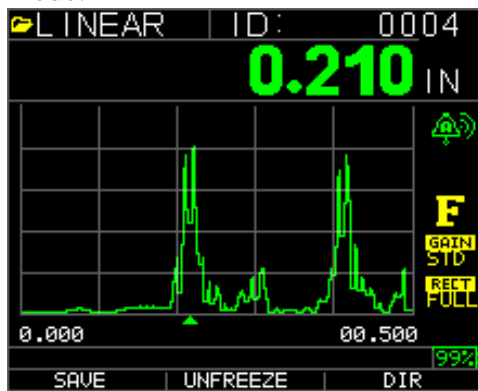
By pressing Menu/OK and choosing datalogger or **[F3] (Dir)** you will be able to review, create, delete, select, rename and clear stored thickness and copy.

2. Use the up and down arrow keys to view the list of files, and select which ever one is relevant.

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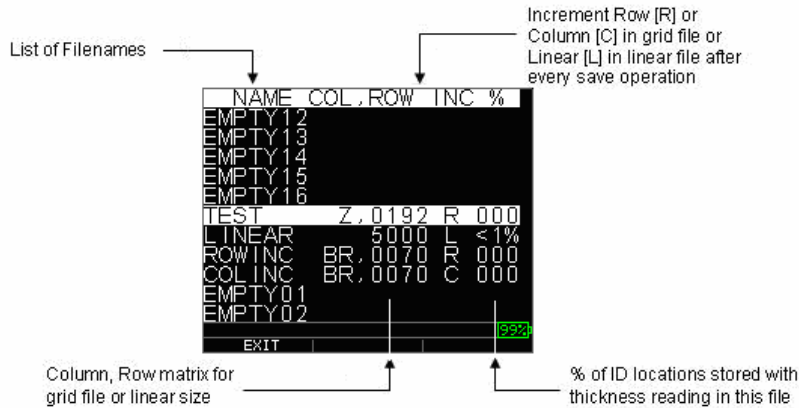
3. Press the **OK** key to select a file in the directory view.

4. To create a custom file see *Creating Custom Files* section.

5. To review thickness readings, see *Reviewing a File* section.

6. To rename custom file, see *Renaming a File* section.

7. To clear an entire file, see *Clearing a File* section.

8. To clear selected readings from a file, see *Reviewing a File* section.

9. To create copy of the existing file structures, see *Copying a File* section.

10. To delete a custom file, see *Deleting a File* section.

The first three files [LINEAR], [ROW INCREMENT] and [COLUMN INCREMENT] cannot be deleted or renamed. These files are factory default files available for you to start storing thickness reading or make a quick copy of the file structure (Linear or Grid [Col, Row]) in order to start saving data in the new file. (See File System for more information.)

Managing the Datalogger File System

The EHC-09DL supports the following two files types:

- *Linear file*: Consists of ID# from 0001 to 5000. The extended memory option consists of ID# from 1 to 500000.

- *Grid file*: Consists of ID# as COLUMN and ROW. The COLUMN is single or double digit capital alpha character from A to Z and AA to ZZ. The ROW is a four digit numbers based on the 5000 / COLUMN.

For example, when you create a new GRID file with END COLUMN = C, then the maximum ROW you can slew up to is limited to 1666 calculated by the instrument as follows:

- The total storage space per file is 5000 reading.

- For Columns ending at C means 3 columns are required and the maximum Row allowed is limited to 5000 / 3 = 1666.

If you create a new GRID file with END COLUMN = Z, then the maximum ROW you can slew up to is limited to 5000/26 = 192.

If you create a new GRID file with END COLUMN = AF, then the maximum ROW you can slew up to is limited to 5000/(26 for A to Z + 6 for AA to AF) = 156 the grids are created as shown below:

```
 A,1 to  A,156 then
 B,1 to  B,156 then
 :
 Z,1 to  Z,156 then
AA,1 to AA,156 then
AB,1 to AB,156 then
   :
AF,1 to AF,156
```

If a new GRID file with END COLUMN = ZZ, then the maximum ROW you can slew up to is limited to 5000/(26 for A to Z + 26*26 for AA to ZZ) = 7.

```
 A,1 to  A,7 then
 B,1 to  B,7 then
 :
 Z,1 to  Z,7 then
AA,1 to AA,7 then
AB,1 to AB,7 then
 :
AZ,1 to AZ,7 then
BA,1 to BA,7 then
BB,1 to BB,7 then
 :
 :
ZZ,1 to ZZ,7
```

Note: There are a few different types of Grid file: 2D, 3D and boiler. The above two examples show how the ID locations are incremented in ROWINC type file only. Here the Row value is incremented first, while updating ID location, whereas, in a COLINC type file, Column value is incremented first.

So for a COLINC file with END COLUMN value AF, the ID locations will increment as follows:

A,1 to AF,1 then

A,2 to AF,2 then

.

.

A,156 to AF,156

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A COLINC file with END COLUMN value ZZ will have ID increments as follows:

A,1 to ZZ,1 then

A,2 to ZZ,2 then

.

A,7 to ZZ,7

Creating a new File

To create a custom file in the datalogger, follow these steps:

1. Press **[F3] (Dir)** from the **Measurement** mode screen.

The following screen appears:

2. Use the up and down arrow keys to highlight the next **Empty** file in the list.

3. Press the **OK** key and the following screen appears:

4. Use the up, down, left, and right arrow keys to select the characters of the filename. Press the **OK** key to accept the selected characters. If you make an error, press **[F2] (Del)** to delete the last character of the entered filename.

5. Press **[F3] (Done)** when you are finished entering the filename. The following screen appears:

6. Use the left and right arrow keys to select a file type: LINEAR, ROWINC or COLINC**. See the next two sections for more information on selecting file type for the new file.**

Selecting a Custom Linear File

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When you select a LINEAR file format the following screen appears displaying the maximum reading you can store in the LINEAR file.
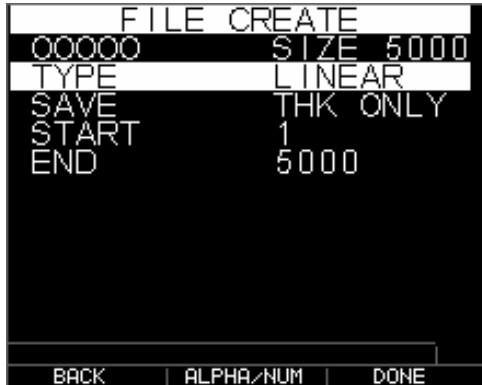
With the extended memory, you can store up to 100,000 readings allowing you more total files.

Pressing the **F3 (Done)** key again will take you to the **Measure** mode displaying the new filename in the top left corner and the next ID location in the top right corner.
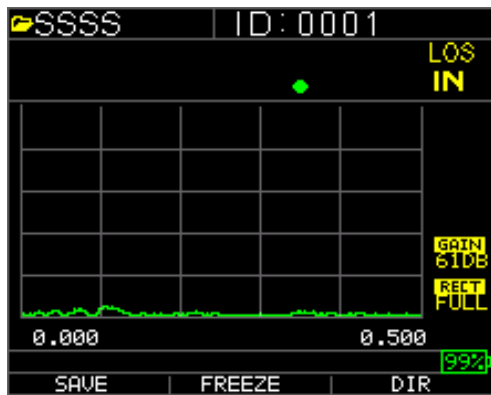
Selecting a Custom Grid File

When you select 2D file type, the display changes as shown below.

Select if you want to save THK only or THK + Ascan by highlighting SAVE and using left or right arrows.

Use the up and down arrow keys to highlight the Start Column . Now press left or right arrow key to change the value Note: the F2 key will toggle between alpha and numbers so if you want to change A to 1, press F2. Then press down arrow key to select END COL option. Press left or right arrow key to change the END COL value. Since the file size is limited to 5000, the END COL value is limited to 5000/END ROW. Note that the 'FILE SIZE' will change depending on the END ROW and END COL settings. You can select the number of rows and columns for your new file and if you want to first increment by row or column. In other words, what direction of your grid do you want to advance first (up or over).

```
        FILE  CREATE
OOOOO           SIZE     26
TYPE            2D
SAVE            THK+ASCAN
START COL       A
END COL         Z
START ROW       1
END ROW         1
1ST  INC        ROW


    BACK   | ALPHA/NUM |   DONE
```
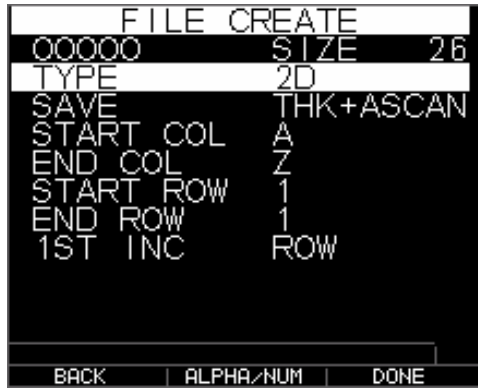
When you are finished selecting END ROW and END COL values, press F3 (Done). The display will go back to Measure mode, showing the new filename and next ID location in the top row as shown below.

```
⌾TEST01   ID:   A,0001
                        LOS
  ⓤⓤ          ◆        IN

                         ⓐ))



                        GAIN
                        STD
                        RECT
                        FULL
 0.000            00.500
                        99%
    SAVE   |  FREEZE  |   DIR
```
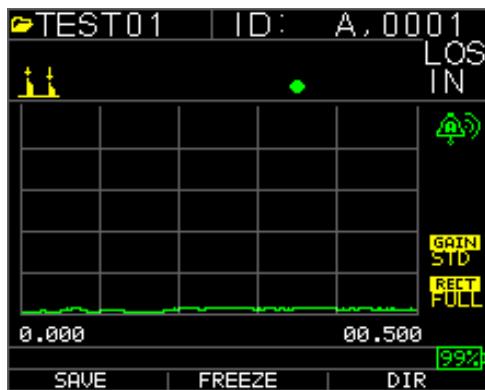
Reviewing a File

To review a file from the **Measurement** mode screen in datalogger version only, follow these steps:

1. Press **[F3] (Dir)** from the **Measurement** mode screen.

```
⌾LINEAR    ID:    0004
            0.210 IN

                        ⓐ))



                        F
                        GAIN
                        STD
                        RECT
                        FULL
 0.000    ▲       00.500
                        99%
    SAVE   | UNFREEZE |   DIR
```

The following screen appears:

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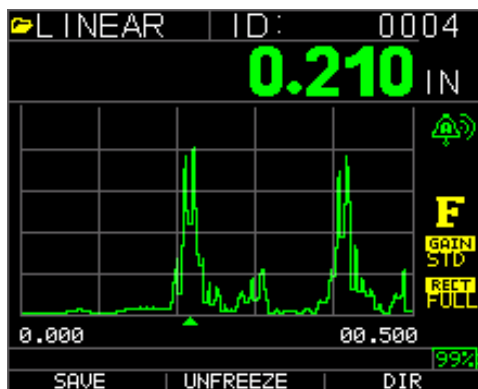
2. Select the file you would like to review using the up and down arrow keys and press the **OK** key. Based on the type of file you select, one of the following screens will appear:
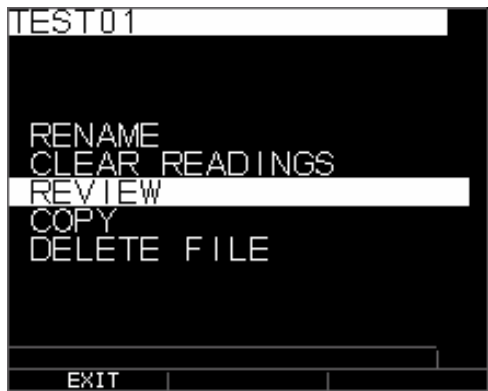
Factory default file Row Incremental (**Rename** and **Delete** options are not available)

The three factory default files have only 3 options: Clear File, Review and Copy. Custom files have 5 options: Rename, Clear File, Review, Copy, and Delete. Select the **Review** option and press the **OK** key to review the file.

Reviewing a Linear File

The linear file shows the ID# and the stored readings along with the units. You can browse the readings by pressing the up or down arrow key. You can also press **F3** (**Beg/End**) to go to the beginning or end of the file. The left side is the i.d., the stored thickness reading, and units.

To clear a reading from the file, select the reading to be cleared by pressing up or down arrow key and then press **F2** (**Clear**). Note that once a reading is cleared, it cannot be restored. To store another reading in the file location that has been emptied by the **Clear** operation, highlight that location by pressing up or down arrow key. Then press **OK** to go to the measure mode. When you have the new reading to be stored in the emptied file location, press **F1** (**Save**). The new reading will be saved in that location and the display will show the next empty file location in the top right corner.

Reviewing a Grid File

The grid file shows the ID# as COL, ROW and the stored reading with the units.

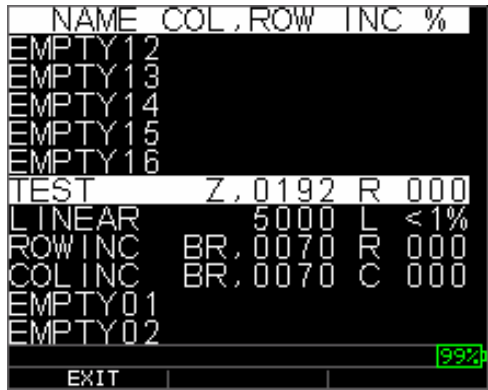F2 and F3 function keys operate in the same way as discussed in *Reviewing a Linear File* section.

Renaming a File

To rename a file from the **Measurement** mode screen in datalogger version only, follow these steps:

1. Press **[F3] (Dir)** for the **Directory** mode.

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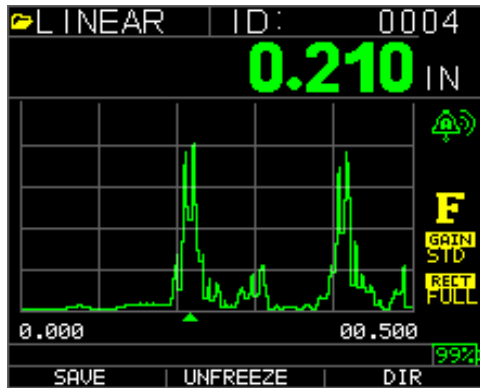
The following screen appears:

2. Use the up and down arrow keys to select the file you would like to rename and press the **OK** key.

Note: The Rename option is not available for the first three factory default files.

The following screen appears:
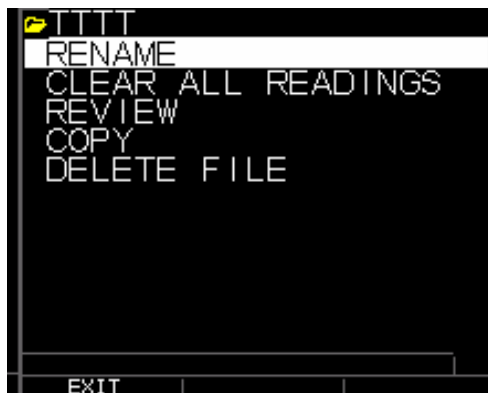
3. Use the up and down arrow keys to select the **Rename** option and press the **OK** key to rename the file.

4. Use the up, down, left, and right arrow keys to select the characters of the filename. Press the **OK** key to accept the selected characters. If you make an error, press **[F2] (Del)** to delete the last character of the entered filename.

5. Press **[F3] (Done)** when you are finished entering the filename. The old filename will be updated with the new filename in the directory as shown in the example **below.**

Note: Press [F1] (Exit) to exit the screen <u>without</u> renaming the file**.**

Example:
A user erases a file named ABCD by pressing **[F2] (Del)** and selects XYZ as the new filename and presses **[F3] (Done)** to accept the entered new filename.

The old filename in the directory is updated with the new filename as shown.

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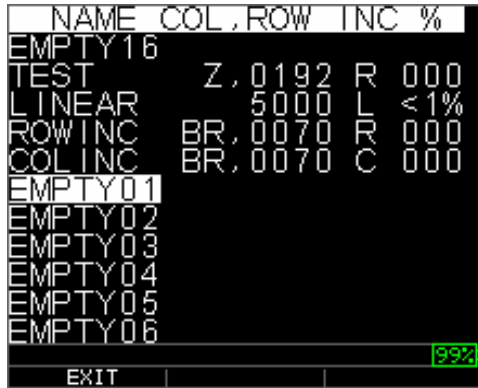
Clearing all readings within a File

To clear (or delete) a single thickness reading at a time from a file, see *Reviewing a File*
section. To clear all the readings from a file but keep the file structure with id still
available, use the clear all readings. To do this, from measurement mode, press **[F3] (Dir)**
for the **Directory** mode.
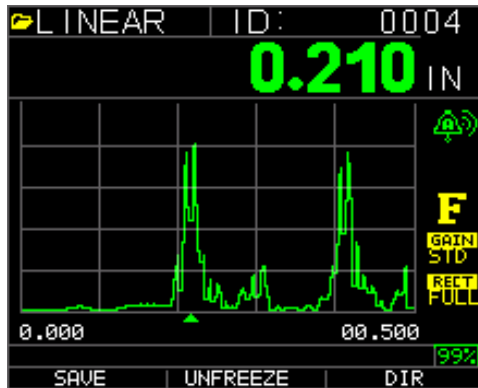
The following screen appears:
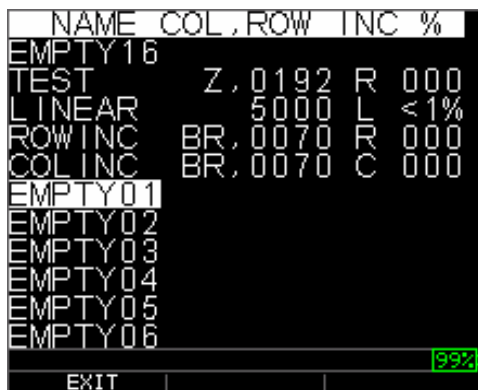
1. Use the up and down arrow keys to select the file you want to clear and press the
   OK key. The following screen appears:
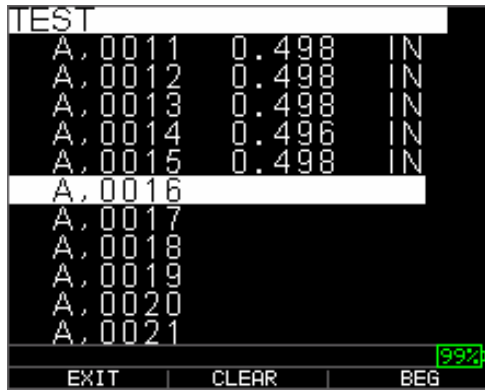
2. Use the up and down arrow keys to select the **Clear File** option and press the **OK** key to clear all the stored thickness readings in that file. The following confirmation prompt appears:
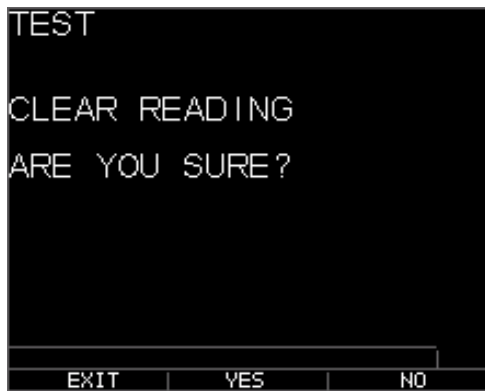
Press [**F1**] (**Exit**) to exit <u>without</u> clearing the thickness readings.

Press [**F2**] (**Yes**) to clear the stored thickness from the entire file.

Press [**F3**] (**No**) to exit <u>without</u> clearing the thickness readings.

If the file is already clear, the unit will show 'NO READINGS TO CLEAR.' message.

Copying a File

To copy a file, from the **Measurement** mode screen in datalogger version only, follow these steps:

1. Press [**F3**] (**Dir**) for the **Directory** mode.

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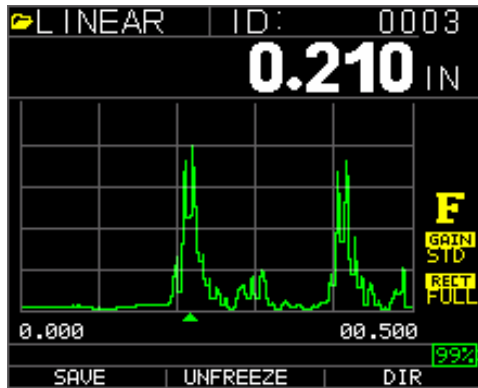
The following screen appears:
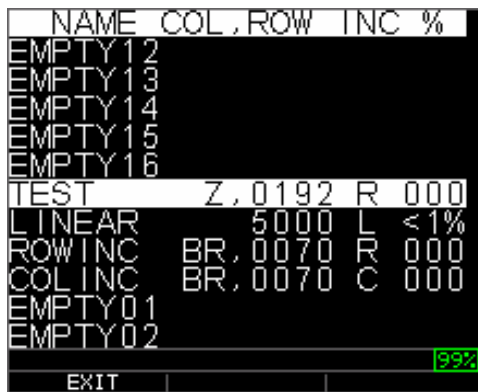
2. Use the up and down arrow keys to select a file and press the **OK** key. Any file structure (factory default or custom) can be copied.

Note: When you copy a file only the structure of the file ID# is copied and not the associated file readings.
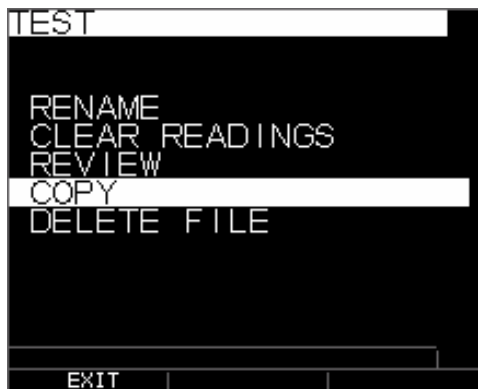
3. Use the up and down arrow keys to select the **Copy** option and press the **OK** key. The following confirmation prompt appears with the next Empty file highlighted as the default choice.

```
PICK FILE TO COPY TO
LINEAR        5000  L  <1%
ROWINC    BR,0070  R  000
COLINC    BR,0070  C  000
TEST01     Z,0192  C  000
PIPE          5000  L  <1%
EMPTY03
EMPTY04
EMPTY05
EMPTY06
EMPTY07
EMPTY08                 99%
      EXIT   |       |
```
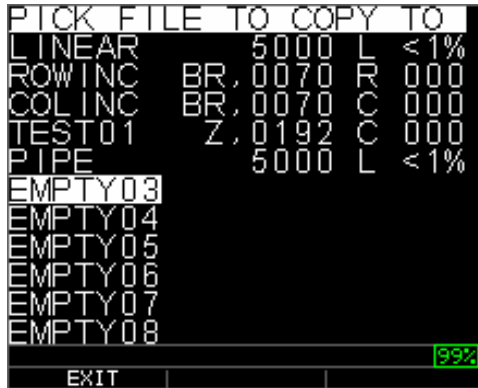
Press up or down to select an Empty file and press **OK** to assign it a new filename. The following screen appears.

```
📁TEST_


  1  2  3  4  5  6  7  8  9  0
  A  B  C  D  E  F  G  H  I  J
  K  L  M  N  O  P  Q  R  S  T
  U  V  W  X  Y  Z     -  ,  +




      EXIT   |   DEL   |   DONE
```

4. Use the up, down, left, right arrow keys to select the characters of the filename and press the **OK** key to accept the selected characters. If you make an error, press **[F2] (Del)** to erase last character before the cursor.

5. Press **[F1] (Exit)** to exit without copying the file.

6. Press **[F3] (Done)** when you are finished entering the filename. A new file with the selected name will be added in the directory with the file structure of the original file **ABCD.**

Deleting a File

To delete a file, from the **Measurement** mode screen in the datalogger version only, follow these steps:

1. Press **[F3] (Dir)** for the **Directory** mode.
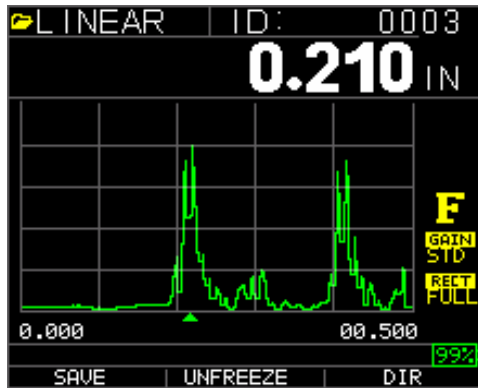
The following screen appears:
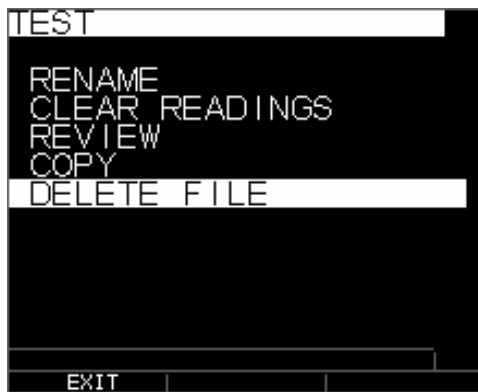
2. Use the up and down arrow keys to select the file to be deleted and press the **OK** key.

Note: Only custom files can be deleted. The factory default files cannot be deleted.
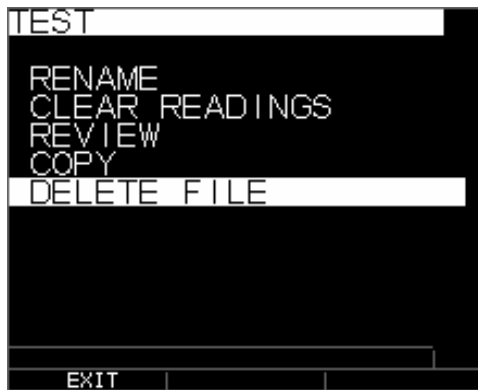
3. Use the up and down arrow keys to select the **Delete** option and press the **OK** key. The following confirmation prompt appears:

```
TEST

DELETE FILE
ARE YOU SURE?




    EXIT   |   YES   |   NO
```
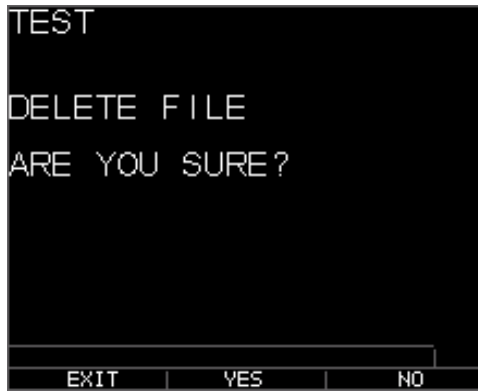
Press **[F1]** (**Exit**) to exit the screen <u>without</u> deleting the file.

Press **[F3]** (**No**) to exit the screen <u>without</u> deleting the file.

4. Press **[F2]** (**Yes**) to delete the file and remove the file from the directory.

File Compare

Comparing a file, requires V2.0 or higher. The file compare feature allows the operator to compare 2 files to one another. As an example, a file taken 6 months ago can be compared to the same file taken today. First set up a new file or if available copy the file to be compared to and assign a new name. Clear out the readings of the old file (prev.) while in the new file (curr.). Press Menu OK then Diff for differential as the new file will be a differential to the old file, choose file compare, press Menu OK. The gage will list any files with like characteristics to the current file.

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```
        D I F F                      FILE  COMPARE
      OFF                        CURR.FILE  2
      ABSOLUTE                   PREV.FILE  1
      PERCENT                    TYPE        ABSOLUTE
        FILE  COMPARE




UP/DOWN TO SELECT
     BACK                          BACK
```
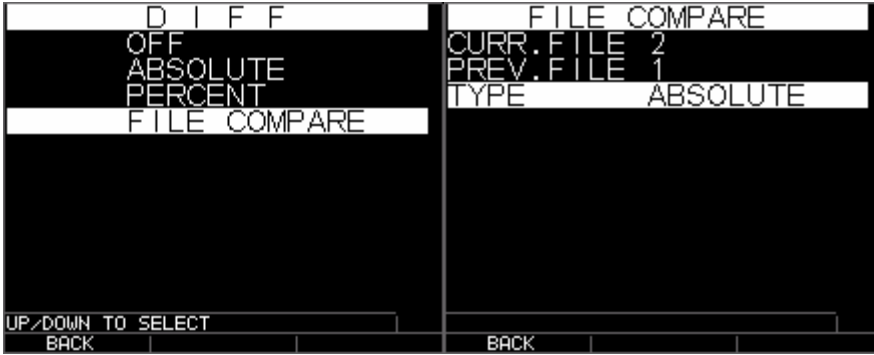
File compare with absolute   once chosen, files of like structure appear

```
        FILE  COMPARE
CURR.FILE  2
PREV.FILE  1
TYPE        PERCENT




                           99%
     BACK
```

File compare %

You will see curr. for current file and prev. for the previous file. You can also choose if you want to display the differential value as an absolute reading or as a percent %. Under the Menu OK, measurement screen you can also go to alarm and choose to alarm on compared file where the gage will prompt you to enter either a % or absolute reading for wall loss or growth based on the change at the same id of the current file to the previous file. Growth, although not very common can mean either a bad previous reading, scale build up or temp. change affecting sound velocity on a previous reading. In the alarm file compare screen, you can even enable the vibrate feature.

```
        A  L  A  R  M              A  L  A  R  M
   OFF                        TYPE      ABSOLUTE
   FILE  COMPARE              LOSS       0.004  IN
   HIGH                       GROWTH     0.004  IN
   LOW                        VIBRATE  OFF
   HIGH-LOW
   HIGH  VIBRATE
   LOW  VIBRATE
   HIGH-LOW  VIB



 <-CHANGE VALUE->           <-CHANGE VALUE->
      BACK                       BACK
```
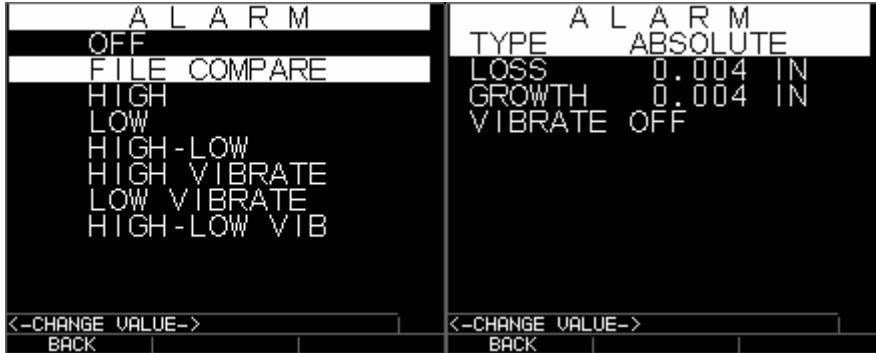
Alarm file compare   Alarm Absolute loss and growth

```
        A  L  A  R  M
   TYPE      PERCENT
   LOSS          5
   GROWTH        5
   VIBRATE  OFF




 <-CHANGE VALUE->            99%
      BACK
```
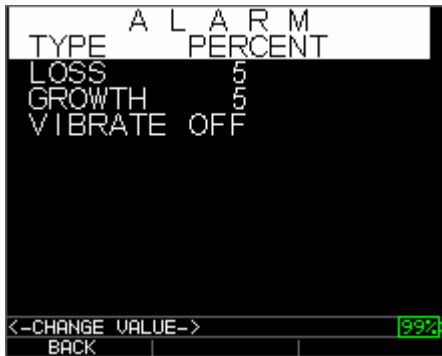
Alarm % loss and growth

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Below is a picture of the file compare screen showing the old value in the top left, differential either as a percent or absolute as well as the current reading. The file compare is based on the same i.d. as the previous reading.
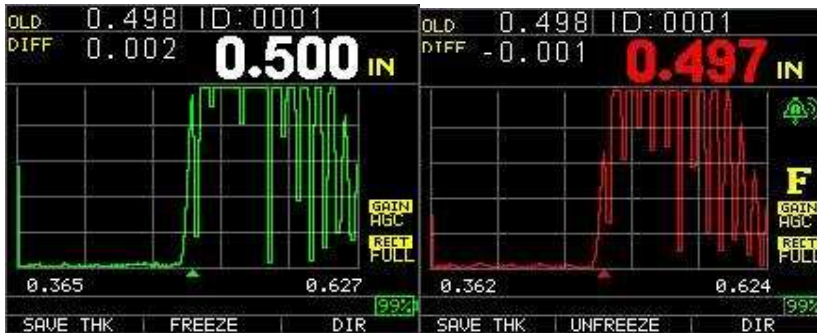
File compare showing all vaules   File compare with alarm on

If the **Notes** option is set to **On** from the datalogger screen, then the thickness reading is stored at the ID location [Linear], [Row], [Col] with notes. To change the Notes settings, select the Notes option from the *Datalogger* screen. In versions 1.7 or higher, notes can be set to the following, Off, Always or LOS or loss of signal. Off is always off when save is pressed, no notes appear. Always is always on therefore when save is pressed, the list of notes appears. On LOS, only when save is pressed without a valid reading will the notes appear. Specific to boiler files, when notes are set to LOS on a center point L-C-R of a boiler, Rib appears and the wave will prompt the user for the end of tubes where the center reading can be resumed.

Notes are set up in the Datalogger screen, here are the three choices:

    5.

```
 D A T A   L O G G E R      D A T A   L O G G E R
DIRECTORY                  DIRECTORY
NOTES            OFF       NOTES            LOS
OUTPUT  FORMAT  DETAIL     OUTPUT  FORMAT  DETAIL




                    99%
  BACK                       BACK
 D A T A   L O G G E R
DIRECTORY
NOTES          ALWAYS
OUTPUT  FORMAT  DETAIL




                    99%
  BACK
```

6. Use the up and down arrow keys to select a note for the reading and press the **OK** key. The selected note will be stored at the ID location, and based on the file type, [Linear], [Row], or [Col] is incremented. (See: Directory selection for file type details.) When save is pressed with notes on, the gage will display the following pick list and save a note with the i.d. currently on the screen. After downloading the file to data xl interface program, the note will appear with a particular set up number at the end of a file.

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The following notes are available:

0. NO COMMENTS
1. Not Sand Blasted (NTSB)
2. PITTING
3. TOO HOT
4. BROKEN INSULATION
5. Couldn't read Scaffold (CNSR)
6. NEEDS PAINTING
7. BROKEN/MISSED PLUG

8. Obstruction (OBST)

9. Port (PORT)

10. Burner (BRNR)

11. Metalized (METL)

12. Overlay (OVLY)

13. Already cut out (ARCO)

14. Padweld (PWLD)

15. Ribbed tube (RIBB)

Waveform Adjustments

To adjust any of the above settings, from the main measurement screen, simply use the left, right, up or down arrow until the desired parameter is highlighted. In other words the arrow keys will act as a mouse or cursor to highlight the desired parameter. As an example, use the right arrow unit Rectify is highlighted, then press Menu/OK to adjust the rectification mode by again using the right or left key to except, press F1=exit. You can follow the same procedure for Gain, Blanking and Range. Units shipped after Jan.

2008 have a hardware change for Zoom auto tracking. This feature is under the range key and can be enabled by pressing using the up or down arrow until zoom appears in the bottom left hand corner. When enabled, the zoom will display any measured echo in the center of the screen independent of the thickness without ever having to adjust range. The approximate range of the screen is .250" full screen at a steel velocity. Here are a couple of pictures at .100 and 4.000 inches:
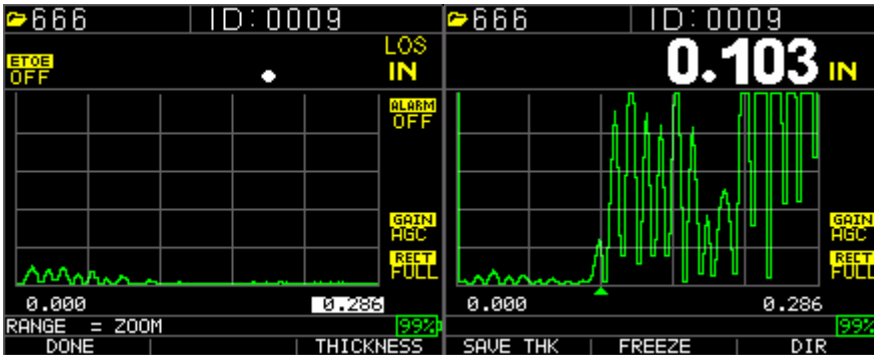
Zoom prompt, rangle at .286"   .100" echo centered on screen
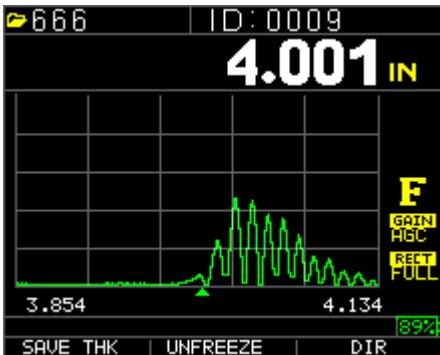
   4.00   inch echo centered on screen,

right of screen minus left of screen equals

range .28"

The EHC-09CW and EHC-09DLCW have a live Color Waveform with Adjustments. Only operators familiar with detailed Ultrasonic knowledge and training should adjust waveform related function, see liability statement in the beginning of this manual. Waveform adjustments are used in applications and industries requiring such. For example, echo to echo is very helpful when using echo to echo and RF. Below are examples of echo to echo with blanking and RF.
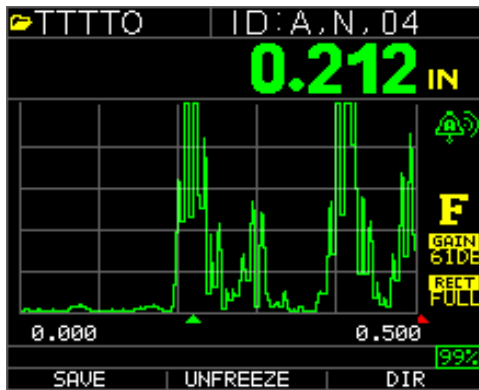
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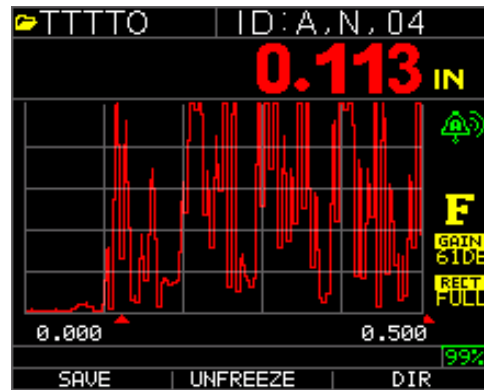

Example of echo to echo with blanking

RF signal with cursor upside down "V" indicating where the measurement is being made

The color waveform is also ideal to alert the operator of an alarm condition as such:

Good readings in green

Tripped alarm in Red
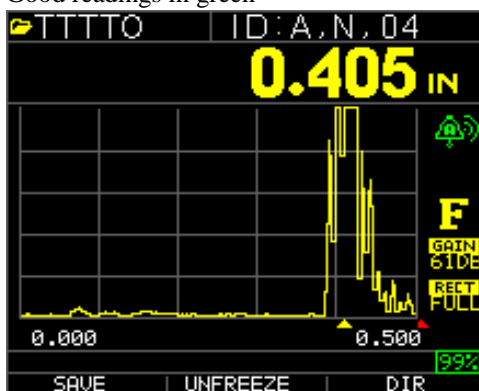
Caution, % of high or low detected
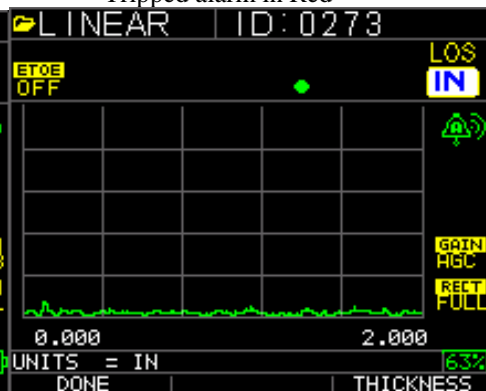
Large Thickness Reading (F3)
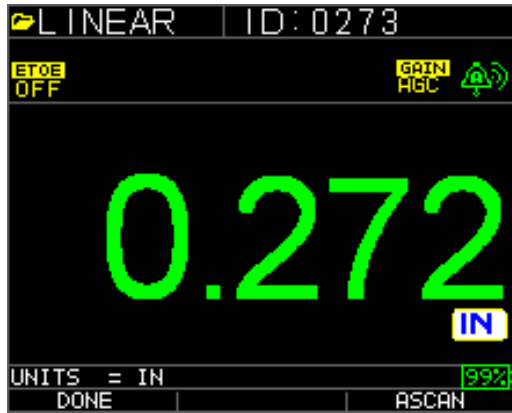
Large Thickness F3= return to A-Scan

Range-pre-set or Auto Zoom tracking to center echoes in the middle of the screen independent of test range thus allowing the operator not to fuss with the range control. Fixed ranges are Zoom, .5, 1, 2, 5, 10 and 20 inches or 12.7, 25.4, 125, 254 and 500 mm. To select the Auto Zoom tracking, use the left or right arrow key until range (bottom right is hightlighted) and then the up and down arrow keys to select the desired range. You can also enable zoom from the Menu OK key, choose **Measurement**, range and adjust to zoom.
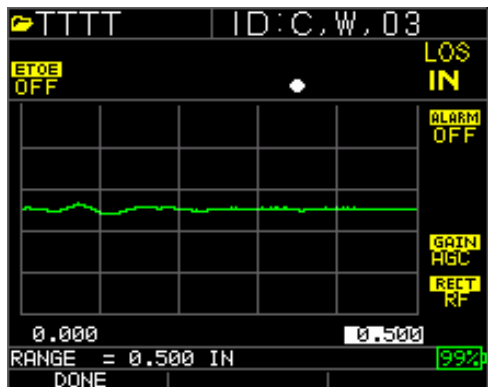
Note: if you are measuring a 2 inch part with a 1" range, no echoes will be visible. Please adjust range accordingly. The Wave is defaulted to a 2 inch range as a factory setting.

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Gain-Manual or Automatic, Gain can be adjusted automatically where the gage will set the optimum range or manually, where the operator changes the range in 1dB steps. To select Auto, use the left or right arrow keys and highlight gain on the bottom right side of the display, use the up and down arrows to select Manual for desired setting or F2 for AGC. The Wave is defaulted to Auto gain where Automatic Gain Control (AGC) is on.
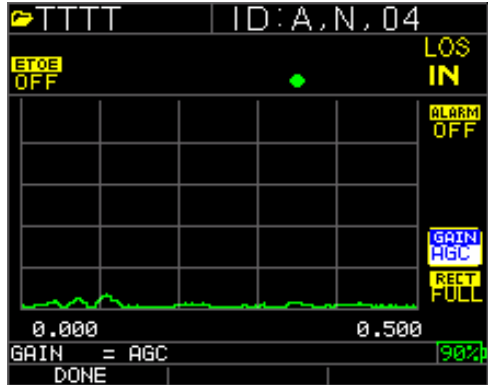
Rectify-RF, Full Wave, Half+ and Half – Use the left or right arrow keys to highlight RECT. for rectify the up or down arrows to select between RF, Full Wave, Half Wave + or Half Wave -. The default setting is Full Wave Rectified.
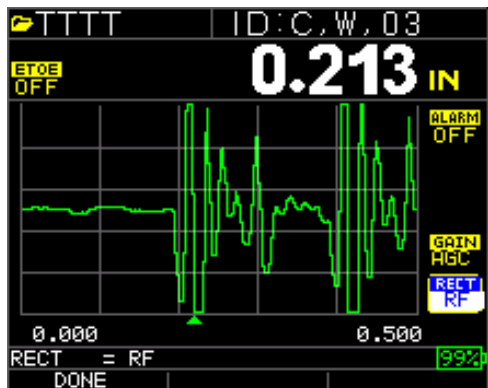
Blanking

To adjust for main bang blank or blank after first received echo. Use the arrow keys to highlight "Blanking", select main bang blank or blank after first received echo (in echo to echo mode only), press Menu/OK. Use the left or right arrows to adjust the blanking accordingly to eliminate noise or mode converted echoes. The Default setting is Main Bang Blank on. Blank after first received echo is only enabled once Echo To Echo is turned on.
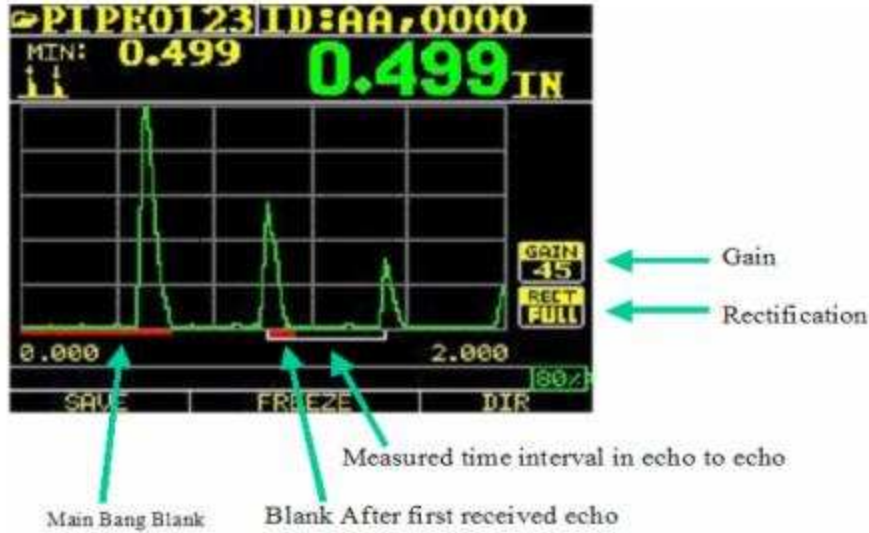
The first Read line on the baseline is referred to as the Main Bang Blank while the second red line is referred to as the Blank After First Received echo. The white line represents the measured time interval between the two correct echoes.

To adjust any of the above settings, from the main measurement screen, simply use the left, right, up or down arrow until the desired parameter is highlighted. In other words the arrow keys will act as a mouse or cursor to highlight the desired parameter. As an example, use the right arrow unit Rectify is highlighted, then press Menu/OK to adjust the rectification mode by again using the right or left key to except, press F1=exit. You can follow the same procedure for Gain, Blanking and Range. A newer feature in versions 1.7 or higher is the ability to show the thickness value in large numbers. When in A-scan mode and using the left or right arrow, F3 will display Thickness, see below. When this is press, the gage will not show the A-Scan but rather the thickness in large numerals. To go back to Waveform, press F3.
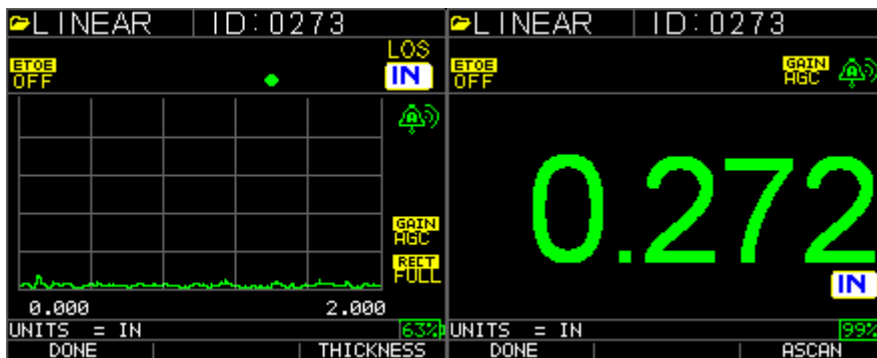
| F1 | F3 | F1 | F3 |

F1   F3

8 Technical Specifications

Specifications for the EHC-09C/EHC-09CW/ECH-DLCW Ultrasonic Thickness Gage with Live Color Waveform
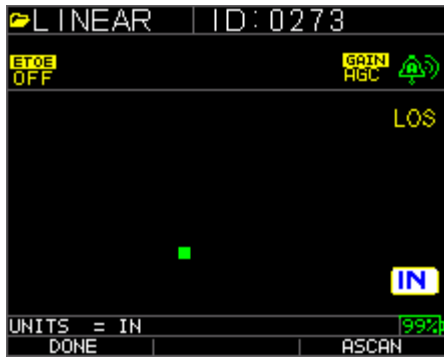
Size: 5" (127 mm) (L) x 3" (76.2 mm) (W) x 1.25" (31.75 mm) (H)

Weight: 8 OZ (.23 kg)

Thickness range: 0.008 - 20 inches (0.20 mm - 508 mm), depending on material, temperature and transducer selection

Material velocity calibration range: 0.200-0.7362 in/µS (0.508-18.699 mm/µS)

Temperature: Gage Operating: -4° F to 122° F (-20° C to 50° C)

Surface temperature of material: Depending on probe used, from -5° F to 1000° F (-20° C to 537° C)

Battery life: Up to 50 hours (20 hours with backlight on)

Battery type: 2 "AA" Alkaline

Display: 220 X 170 Graphics Color TFT with Live Color Waveform

Information displays: LOS, min, max, large reading while displaying min at the same time, velocity, zero, calibration, units, freeze, unfreeze, % battery life remaining, gain - low, std, high, echo-to-echo symbol

Resolution: 0.001" (0.01 mm), 0.01" (0.1mm)

Probe recognition: Via pick list from a menu

Delay line zero measurement: Auto at power up with listed numeric value. Ideal for correcting delay line wear/curvature and for transducer acoustic drift at elevated temperatures

Package: Custom, splash-proof, high-impact plastic with rubber, illuminating keypad for go/no-go testing

Bandwidth: 0.5-20 MHz (-3dB)

Units: English/Metric/Microseconds

WaveForm: Live Color Waveform with Dynamic color change on alarm, large thickness reading, super-impose thickness over top right of A-Scan.

Rectify: RF, Full Wave, Half Wave+, Half Wave -

Blanking: Main Bang Blank and Blank After First Received Echo

Gain: Auto or Manual in 1 dB steps for varying test conditions

Echo to Echo: used to ignore coatings and measure substrate only

B-Scan: Cross sectional representation of test piece

Measurement rate: 4/sec and 20/sec in fast mode

Differential Mode: Displays the difference from the actual
thickness measurement and a user entered reference value

Alarms: Minimum/Maximum depth, vibralarm (vibration on alarm-patent pending), beeps and display flashes as well as keypad illumination and dynamic waveform color change

Illuminating keypad: F1 = Red, F2 = Yellow and F3 = Green for easy, go/no-go testing (Patent Pending)

Automatic probe wear indicator (Transducer attendant): Automatically informs the operator to replace the transducer (Patent Pending)

Ergonomics: User selectable lefty or righty display changes via keypad (Patent Pending)

Backlight: Light Emitting Diode, On/Off or Auto On based on
valid readings or last key press

Shut off: Auto, time out (after 1-31 minutes user programmable after no reading, loss or no key press or "never")

Scan mode: Simultaneously Displays minimum or maximum thickness value at 20 measurements per second (ideal for high temperature thickness reading and tracking the minimum depth alarm). Press Freeze to capture last valid minimum thickness readings prior to Loss of Signal (LOS), without reading the couplant upon lifting probe off the test piece

Carrying case: Custom molded pouch with wrist strap for either left-handed or right-handed operators.

Shipping case: Hard plastic with high-density molded cut out for all accessories

Freeze mode: Freezes display (ideal for high temp. measurements)

Hold mode: Holds display to retain last thickness reading in reverse video display

Standard EHC-09 Wave series includes: Ultrasonic thickness gage, DK-537potted, 5 MHz 0.375 inch diameter, operational manual, USB cable, couplant, protective pouch, transport case, data XL interface program. (Pouch not included with EHC-09C)

Warranty: Limited 2 year warranty on parts and labor

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9 Software Options for EHC-09C

Echo to Echo

The Echo to Echo feature should and can be used within the thickness range of the chart listed below. It is best to use the transducers designated with a –EE part number such as DK 537EE and DK 718EE. These transducers have greater damping allowing more stable readings in Echo to Echo mode. To calibrate in Echo to Echo, first press MENU OK, scroll to set up, press MENU OK and find where E to E is displayed. Either use the right arrow to turn on or press MENU OK and scroll to on. You will see a symbol in the top right looking like Echo to Echo. Next, press MENU OK, turn on calibration and perform CAL VEL on the thick part with the coating and CAL ZERO on the think part with coating, then MENU OK.

B-Scan

The B-Scan represents a cross sectional view on the test piece. The simplest example is to show a 5 step test block. To turn on the option B-Scan for EHC-09 serires press MENU/OK, go to **Measurement**, find B-scan and press MENU/OK. First enter the maximum thickness you expect to scan using the up, down, left and right keys, then turn on the B-Scan scrolling down and right arrow (left arrow for off). Press F3 in lefty or F1 in Righty mode when **done**. The bottom of the display will read SAVE, START or STOP and CLEAR. To Start a B-Scan, couple to the test block and press F2 [START]. If you uncouple the transducer, B-Scan will stop due to LOS. If you press F2 [STOP] the minimum thickness will be displayed in the center of the screen while a vertical cursor allows you to review readings. During review the thickness value is updated in the top right of the display. To save all the readings, press F1 [SAVE]. The amount of saved

readings up to the file size of 5,000 readings or what was pre-determined in the current file (See Datalogging) set up. Here is a picture of the B-Scan on a test block.
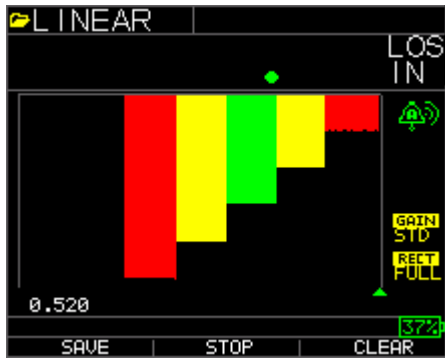
Saving a B-Scan to memory.

When saving images to a B-Scan file, first set up a file name, save as a linear file and Thickness only…Thickness only is very important as one B-Scan screen represents approximately 200 data points and a thickness and waveform file would be full before one B-Scan full screen is complete. Press done, press F2 start and F1 Save. You can now press menu OK, scroll to Datalogger, choose the B-Scan file to review, Menu OK, Review, Menu OK, scroll over where an id and reading are present and press Menu OK, the B-scan will appear. F2 will center the minimum (min) in the middle of the screen. F3 will show either Beg or End to go to the beginning or end of file. You can also use the left or right keys to move the cursor (triangle) to show the thickness in the top right above the triangle.

Angle Beam Software

Once version 1.9 or higher is downloaded to the WAVE gage, operators can add the Angle Beam software. When Angle beam software is added, you can display the soundpath components of the detected echo to calculate, angular distance, surface distance and depth. The WAVE can even correct for which leg the echo is detected in. Upon powering up the gage, simply choose one of the two angle beam probes, 2.25 Mhz. or 5.0 Hhz., press menu OK. The next screen will allow you to enter the angle of the wedge such as 30, 45 , 60 or 70 degrees as the most popular. You can enter these to 1 degree. Also to be entered is the material thickness which is important for the WAVE to correct for which leg the echo is detected in. This applies only to the depth component. After these two values have been entered using the up and down arrows to adjust between the two values and the left and right arrows to change the value, press Menu OK. Once the angle beam is chosen, the WAVE automatically sets the sound velocity in inches to .1270 in/usec and metric equivalent. In addition, the gage automatically is set to fast mode, main bang blanking enabled and B-Scan shut off. We also shut off other parameters no useful in angle beam testing. Below is a picture of an angle beam screen showing the Angular distance with the large value, depth indicated by a down arrow and surface distance indicated by a right arrow.

Note: The Angle Beam Software does not mean the WAVE is an Ultrasonic Flaw Detector and is not code compliant in terms of scan speed, vertical linearity or any detection and sizing. It should only be used by qualified, trained ultrasonic personnel familiar with weld inspections and general ultrasonic testing. Danatronics Corp. is not responsible for any other un-intended use of this function.

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10 Technical Assistance

Call Danatronics, Corp. at 978-777-0081 or email us at sales@danatronics.com for specific technical assistance or troubleshooting questions.