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Web: https://www.abqindustrial.net **E-mail:** info@abqindustrial.net

OPERATION MANUAL

Dakota NDT

RX8-DL

Sonic Thickness Tester



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CHAPTER ONE
INTRODUCTION

The Dakota NDT model ***RX8-DL*** is a digital ultrasonic sonic thickness tester with time based B-Scan and alpha numeric data logger. Based on the same operating principles as SONAR, the ***RX8-DL*** is capable of measuring the thickness of various materials with accuracy as high as ± 0.001 inches, or ± 0.01 millimeters. The principle advantage of ultrasonic measurement over traditional methods is that ultrasonic measurements can be performed with access to only one side of the material being measured.

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

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

1.1 Disclaimer

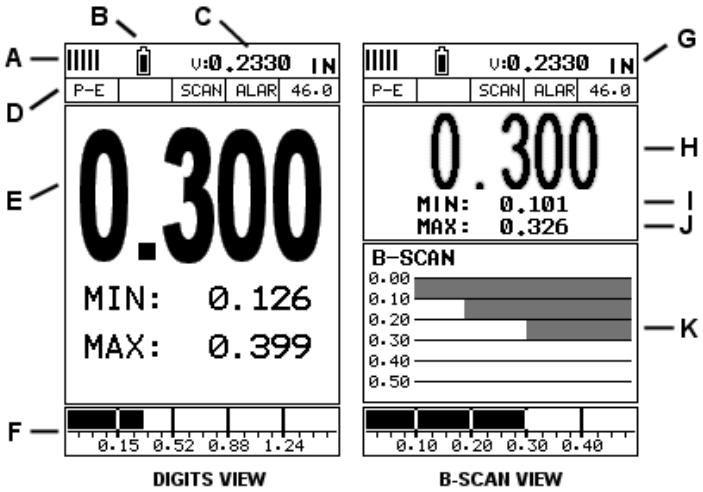
Inherent in ultrasonic thickness measurement is the possibility that the instrument will use the second rather than the first echo from the back surface of the material being measured. This may result in a thickness reading that is TWICE what it should be. Responsibility for proper use of the instrument and recognition of this phenomenon rest solely with the user of the instrument. Other errors may occur from measuring coated materials where the coating is insufficiently bonded to the material surface. Irregular and inaccurate readings may result. Again, the user is responsible for proper use and interpretation of the measurements acquired.

CHAPTER TWO
QUICK STARTUP GUIDE

Turn the ***RX8-DL*** on and off using the switch located on the bottom right corner of the keypad. When ***RX8-DL*** is initially turned on, a flash logo and blinking lights will be displayed prior to entering into the main measurement screen.

Note: *This section is primarily written as a basic startup guide only.*

2.1 RX8-DL Overview



PR-8V SCREEN SHOTS (MENUS OFF)

In order to understand how to operate the ***RX8-DL***, it's best to start off with an understanding of what it is we're looking at exactly. The ***RX8-DL*** has a lot of great features and tools that will prove to be a huge benefit for the variety of applications you're constantly facing on a continual basis. Let's have a brief look at the screens you'll be looking at most often:

A. **Repeatability/Stability Indicator** – This indicator should be commonly used in conjunction with the digital thickness values displayed. When all the vertical bars are fully illuminated and the last digit on the digital thickness value is stable, the ***RX8-DL*** is reliably measuring the same value 250 times per second (250 Hz).
B. **Battery Icon** – Indicates the amount of battery life the ***RX8-DL*** has remaining.
C. **Velocity** – The material velocity value the ***RX8-DL*** is currently using or calibrated for. Displayed in both English or Metric units, depending on what units the gauge is set for.

D. **Feature Status Bar** – Indicates the features currently enabled and in use in the following order:
    - Measurement Mode
    - Differential Mode
    - High Speed Scan Mode
    - Alarm Mode
    - Gain Setting
E. **Digital Material Thickness Value** – Extra large font size for viewing ease.
F. **Scan Bar** – Another view of material thickness in a deflection style horizontal bar. This is a visual tool that would enable the user the ability to see thickness changes during high speed scans from flaws and pits.
G. **Units** – The current measurement units being used (English, Metric).
H. **Digital Material Thickness Value** – Smaller font size when the B-Scan display view is enabled.
I. **Minimum Material Thickness** – Part of the scan feature. Displays the minimum thickness value found during a scan.
J. **Maximum Material Thickness** – Part of the scan feature. Displays the maximum thickness value found during a scan.
K. **B-Scan Display** – Cross section view of the material. Provides the user with graphical view of the opposite/blind surface (i.e. inside engine block surface), to give the user some idea of the condition, or integrity of the material being tested.

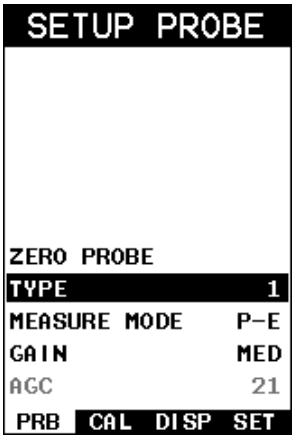
2.2 Selecting the Transducer Type

The ***RX8-DL*** is equipped with a transducer list of all of the dual element transducer options that can be connected to the gauge. These are dual element transducers with different diameters and frequencies, depending on the material and application requirements. Transducers with an HD (high damped) designation are commonly used in conjunction with E-E (echo-echo) through paint modes, while CPZT (composite) are used for additional output with materials that are difficult to pass sound through. Finally, the majority of the transducers listed in the table are standard diameter/frequency transducers used in P-E (pulse-echo) mode. By selecting the transducer type from a predefined list, the ***RX8-DL*** can recall specific properties about the transducer.

Note: *Once the transducer has been selected, the **RX8-DL** will store and recall this transducer type every time the **RX8-DL** is powered on/off. The type will only change if the user physically selects another transducer type from the list, or selects a previously saved setup. You'll notice that the probe type previously selected will be highlighted every time the probe type screen is displayed.*

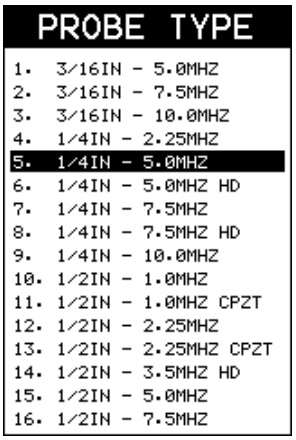
Use the following steps to select your transducer type:

Selecting the Transducer Type



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

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



3) Press the ↵ key to display the table/list of transducers.

4) Use the ▲ and ▼ arrow keys to highlight the transducer type currently connected to the gauge.

5) Press the ↵ key to load the transducer type and display the confirmation screen.



6) Press the OK key to overwrite the existing probe type, or esc to cancel.

2.3 Probe Zero & Calibration

The next steps are to perform a probe zero and calibrate the ***RX8-DL*** to the material and transducer selected. If the sound velocity is unknown, the ***RX8-DL*** can be calibrated to a known thickness sample. The procedures are outlined as follows:

Performing a Probe Zero



Note: *The probe zero disk (battery cap) is located on the top end cap of the gauge. The warning screen will be displayed following the selection and overwrite of a new transducer.*

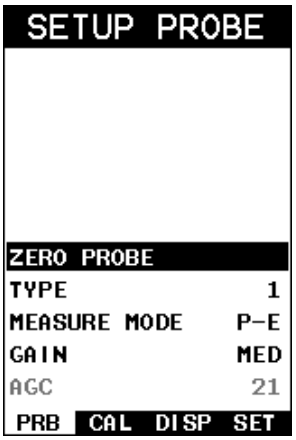
1) Press the OK key to enter the main measurement screen and begin the manual zero process.

2) Apply a drop of couplant on the transducer and place the transducer in steady contact with the probe zero disk.

ZERO PROBE:	SCAN: ON
START: 0.000	DEPTH: 1.000
MODE: P-E	GAIN: MED
VIEW: DIGITS	LOG: A001

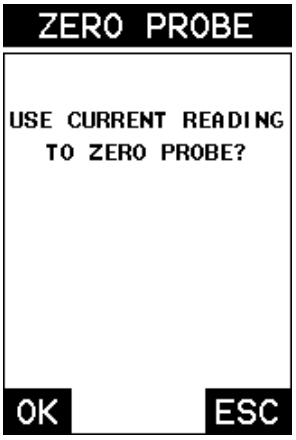
3) With the “zero probe” hot menu cell highlighted by default, press the ↵ key to display the confirmation screen, followed by pressing the OK key to perform the zero.

Note: *If the "zero probe" cell is not highlighted, press the*  *or*  *keys to highlight.*



4) Alternatively, press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **PRB** menu is highlighted and displaying the submenu items.

5) Press the  and  arrow keys to scroll through the sub menu items until **ZERO PROBE** is highlighted.



6) Press the  key to display the confirmation screen.

7) Press the OK key to complete the probe zero process, or esc key to cancel zeroing.

8) Remove the transducer from the probe zero disk, and proceed to the calibration section.

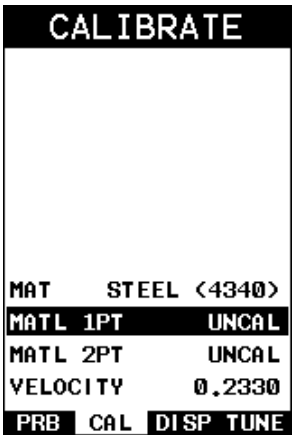
Note: *The value that is displayed will change depending on the current velocity setting in the **RX8-DL**. Disregard the number that is displayed. **It is not important**. What is important is accurately performing the steps outlined above to insure reliability of the probe zero calculation.*

One Point Material Calibration

For the purposes of this quick start section, the most common single point calibration option will covered in this section.

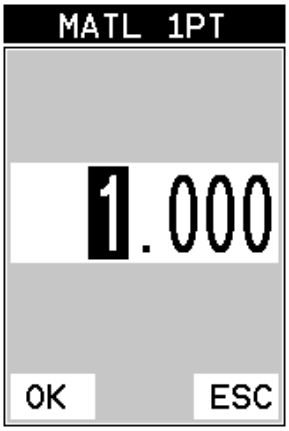
Note: *It would be very handy to carry a set of mechanical calipers to use in conjunction with the **RX8-DL** for calibration in the field.*

Known Thickness



Note: *Be sure a probe zero has been performed prior to calibration.*

1) Physically measure an exact sample of the material, or a specific location directly on the material using a set of calipers or a digital micrometer.
2) Apply a drop of couplant on the transducer and place the transducer in steady contact with the sample or actual test material measured. Be sure the measurement is stable and the repeatability indicator, in the top left corner of the display, is fully lit and stable. Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.
3) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **MATL 1PT** is highlighted.



4) Press the ↵ key to display the **Digits Edit Box**.
5) Press the ▲ and ▼ arrow keys to scroll the highlighted value.
6) Press the ◀ and ▶ arrow keys to scroll the digit locations.
7) Repeat steps **5 & 6** until the known thickness value is correctly displayed.

8) Press the OK key to calculate the velocity and return to the menu screen, or esc to cancel the one point calibration.

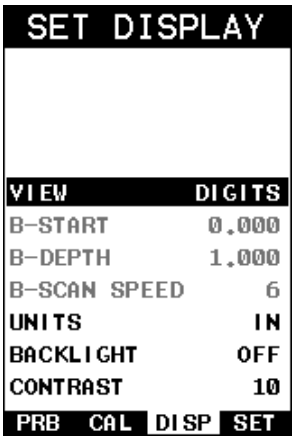
9) Finally, press the key to return to the measurement screen and begin taking readings.

Note: ***CHECK YOUR CALIBRATION!*** *Place the transducer back on the calibration point. The thickness reading should now match the known thickness. If the thickness is not correct, repeat the steps above.*

2.4 Measure

The ***RX8-DL*** is now ready to measure. There are two different measurement view options each with a specific purpose – Digits & B-Scan. The steps below outline how to toggle between the different view mode options:

Selecting the Measurement View Option



1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right and the  key multiple times to tab left until the **DISP** menu is highlighted and displaying the submenu items.
2) Use the  and  arrow keys to scroll through the sub menu items until **VIEW** is highlighted.
3) Use the  and  arrow keys to scroll the view options.
4) Once the view is displayed, press the  key to return to measurement mode.

DIGITS: Displays the digital thickness value using a large font size. This view is useful when the ***RX8-DL*** is being used as a basic sonic thickness tester.

BSCAN: The Time Based B-Scan provides the user with a cross sectional view of the material being tested. This mode is useful when there is concern regarding the profile of the blind surface. This can also be a useful view when scanning for pits and flaws.

Once the view has been selected according to the application requirements, the **B-Scan Start** and **Depth** will potentially need adjustment in order to optimize the zoom if the ***RX8-DL*** has been set to **B-Scan**.

Use the following steps to adjust these settings directly from the measurement screen as follows:

Note: *The **Start** and **Depth** are also used to adjust the parameters of **Scan Bar**.*

Adjusting Start & Depth

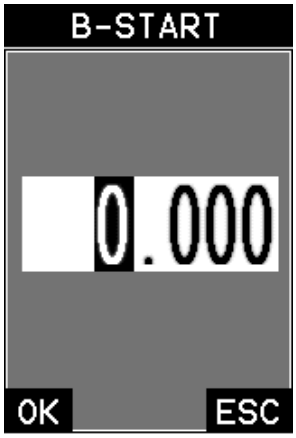
ZERO PROBE:	SCAN: ON
START: 0.000	DEPTH: 0.300
MODE: P-E	GAIN: MED
VIEW: BSCAN	LOG: A001

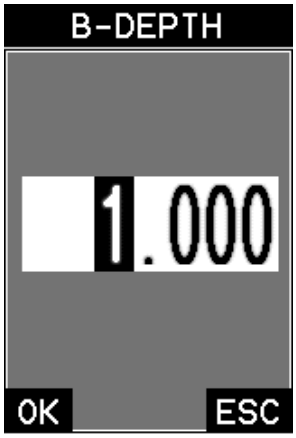
ZERO PROBE:	SCAN: ON
START: 0.000	DEPTH: 0.300
MODE: P-E	GAIN: MED
VIEW: BSCAN	LOG: A001

1) Press the key once to activate the measure menu items. Press the key multiple times to move right and the esc key multiple times to move left, until the either the **START** or **DEPTH** cell is highlighted.
2) Use the , , , or arrow keys to scroll the **START** and **DEPTH** values.
3) Repeat steps **1 & 2** until the range is correctly being displayed.

Alternatively, the **START** and **DEPTH** values can be changed using the **Digit Edit Box** as follows:

1) Press the key once to activate measure menu items. Press the key multiple times to move right and the esc key multiple times to move left, until the either the **START** or **DEPTH** cell is highlighted.





2) Press the key to display the digits edit box.
3) Press the and arrow keys to scroll the highlighted value.

4) Press the  and  arrow keys to scroll the digit locations.

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

6) Press the 

key to set the **START** and **DEPTH** value and return to the measure screen, or 

to cancel entering the **START** or **DEPTH** value.

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

Note: *The **START** & **DEPTH** can also be adjusted from the tabbed menu item **DISP**. However, using the hot menu keys is the most convenient method.*

CHAPTER THREE
KEYBOARD, MENU, & CONNECTOR REFERENCE

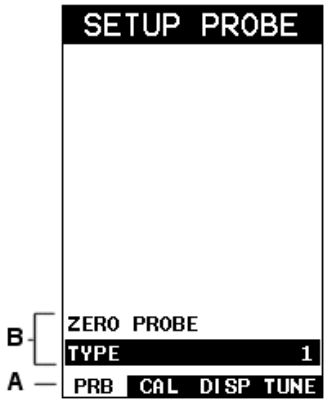


3.1 Menu Key (Operation & Sub Menus)



The **Menu** key activates the primary menu structure containing 8 menu tab groups. These tab groups then contain sub menu items, or functions. The sub menu items have been organized in tab groups according to how closely they are related to the individual tab group names. Let's first get familiar with how to move around in these tabs before continuing on to the sub menu functions. This procedure is outlined below:

Activating and Getting Around in the Menu Items



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left until the desired tab group is highlighted and displaying the submenu items. The tab groups are illustrated above **(A)**.

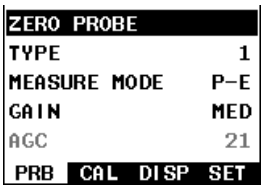
Now that you're familiar with activating and moving amongst the tab groups, let's have a look at how to move around in the sub menu items as follows:

Getting Around in the Sub Menu Items

1) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until the desired function is highlighted. The sub menu items are illustrated in the diagram above **(B)**.
2) Depending on which function is highlighted, use the ◀, ▶, and ↵ keys to scroll the options or activate the **Digit Edit** and **List Box** options.

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

3.2 Probe – Menu



ZERO PROBE: The ***RX8-DL*** is zeroed in much the same way that a mechanical micrometer is zeroed. If the ***RX8-DL*** is not zeroed correctly, all of the measurements made using the ***RX8-DL*** may be in error by some fixed value. The ***RX8-DL*** is equipped with an optional automatic or manual zero feature. Refer to the section on page 30, for an explanation of this important procedure.

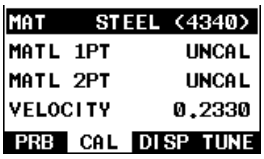
TYPE: Enables the user to select the type of transducer being used from a chart of transducer types. This provides increased linearity between transducers. Refer to page 4 for a further explanation.

MEASURE MODE: Toggles between the measurement modes; pulse-echo (P-E) and echo-echo (E-E). Refer to page 24 for further info.

GAIN: Active only if the measure mode is set to pulse-echo (P-E), and is used to increase/decrease the overall amplitude of the signal. The gain can be adjusted using a three position switch with LOW, MED, HI settings. MED is set to 46 dB, with a 3 dB cut or boost. Consider it as similar to turning the volume up or down on a stereo receiver. Refer to page 48 for further info.

AGC: Active only if the measure mode is set to echo-echo (E-E), and is used to increase/decrease the over amplitude of the signal. The gain can be adjusted using a three position switch with LOW, MED, HI settings. The AGC target is defined as MED, with a 3 dB cut/boost. Refer to page 48 for further info.

3.3 CAL – Menu



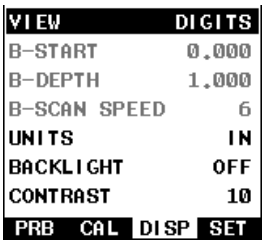
MAT: Select the material velocity from a chart of basic material types when a known sample thickness, or material velocity cannot be obtained. Refer to page 38 for further info.

MATL 1PT: Performs a single point calibration. This option allows the user to automatically calculate the velocity by entering a known sample thickness. Refer to page 34 for further info.

MATL 2PT: Performs a two-point calibration. This option allows the user to automatically calculate the velocity by entering a second known sample thickness. Refer to page 37 for further info.

VELOCITY: Function to calibrate the ***RX8-DL*** by setting the velocity to a known material velocity. Refer to page 33 for further info.

3.4 DISP (display) – Menu



VIEW: Selectable BSCAN (cross section), and DIGITS (large digits) views. Refer to page 42 for further info.

B-START: Provides the user the ability to change the start position of the B-SCAN view. Adjusts the range of the scan bar in digits view. Refer to page 43 for further info.

B-DEPTH: Provides the user the ability to change the overall depth of the viewable measurement area. Adjusts the range of the scan bar in digits view. Refer to page 47 for further info.

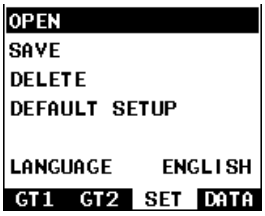
B-SCAN SPEED: Controls the speed of the time based B-Scan with an arbitrary scale of 0-10, with 10 being the fastest scrolling speed. Default speed set at 6. Refer to page 47 for further info.

UNITS: Toggle between English or Metric units. The readout will change from inches to millimeters (0.001” / 0.01mm).

BACKLIGHT: Selectable OFF, ON, AUTO, or INVERT backlight option.

CONTRAST: Adjustable display contrast for variable light conditions.

3.5 SETUP – Menu



OPEN: Displays a list of factory and user defined setups currently stored in memory. These setups can be recalled and used at any time. Refer to page 84 for further info.

SAVE: Provides the user with the ability to save a custom setup that has been modified or created by the user. Refer to page 86 for further info.

DELETE: Provides the user with the ability to delete specific setups previously save in memory. Refer to page 89 for further info.

DEFAULT SETUP: Loads a basic default setup. Use only as a last resort when the setups in the ***RX8-DL*** have been corrupted and a computer is not accessible. Refer to page 91 for further info.

LANGUAGE: Provides the user the ability to select different languages for the ***RX8-DL***. Refer to page 92 for further info.

3.6 DATA – Menu



NEW: Allows the user the ability to create a new alpha numeric grid, or engine log file with auto identifiers. It is equipped with custom parameters, rows, and columns depending on the user's application reporting requirements. Refer to page 64 for further info.

EDIT: Gives the user the ability to change parameters of grid or sequential file previously saved. Note: Pre-defined coordinates cannot be changed once they have been created. Refer to page 77 for further info.

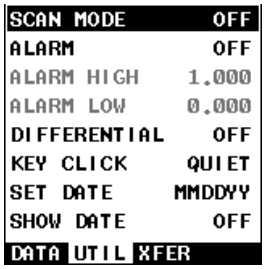
OPEN: This function provides the user with the ability to recall grids or sequential log files that currently exist in memory, from a list of grids. Refer to page 80 for further info.

CLOSE: Provides the user the ability to close a currently opened grid or sequential log file. Refer to page 82 for further info.

DELETE ONE FILE: This function provides the user with the ability to delete one individual grid or sequential log file from a list of multiple grids/files previously saved in memory. Refer to page 75 for further info.

DELETE ALL DATA: This function provides the user with the ability to delete all files currently stored in memory. Refer to page 76 for further info.

3.7 UTIL (utilities) – Menu



SCAN MODE: This function enables a high speed scan mode that increases the overall sample rate from 65 to 200 measurements per second, depending on the current measurement mode used. Refer to page 52 for further info.

ALARM: Toggles alarm mode on, off, or audible. Refer to page 53 for further info.

ALARM HIGH: Gives the user the ability to set the HI limit parameter. If the measurement exceeds this value, a red light will illuminate and sound the internal beeper. Refer to page 53 for further info.

ALARM LOW: Gives the user the ability to set the LO limit parameter. If the measurement falls below this value, a red light will illuminate and sound the internal beeper. Refer to page 53 for further info.

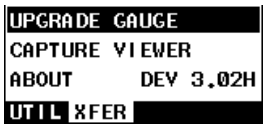
DIFFERENTIAL: Gives the user the ability to set a nominal value and the ***RX8-DL*** will display +/- the difference from the nominal value entered. Refer to page 55 for further info.

KEY CLICK: Give the user the ability to set the level of the key press beeper, OFF, QUIET, or LOUD. Refer to page 57 for further info.

SET DATE: Gives the user the ability to set the internal date and time stamp in the ***RX8-DL***. Refer to page 58 for further info.

SHOW DATE: Gives the user the ability to display the date and time in the waveform area of the ***RX8-DL***. The options are OFF, DATE, TIME, BOTH. Refer to page 59 for further info.

3.8 XFER (transfer) – Menu



UPGRADE GAUGE: Enables the user the ability to upgrade the ***RX8-DL*** to the most current firmware revision. Latest version posted on www.dakotandt.com.

CAPTURE VIEWER: Enables the user to view all the captured (.tif) files stored in the ***RX8-DL*** on the gauge display. Refer to page 61 for further info.

ABOUT: Provides the user with Dakota NDT contact information and the ***RX8-DL*** firmware version. Refer to the Dakota NDT web site for information on the latest firmware versions available for download.

3.9 CLR (clear) Key



The primary functions of the **CLR** key is to clear a measurement from a grid file cell location, set an obstruct, or backspace in an **Alpha Edit Box**. If a user has already saved a measurement and B-Scan to a cell location, use this key to clear the measurement at any time.

3.10 HOME (measurement mode) Key



The **HOME** key returns the ***RX8-DL*** to the primary measurement screen/view. Press at any time to view the main screen.

3.11 OK Key 

The primary function of the **OK** key is confirmation of a change or selection. Additionally, the **OK** key also toggles the **Hot Menu** area to a **large digits** display while in measurement mode. If the ***RX8-DL*** is displaying a grid log, the **OK** key toggles an advance to row number option.

3.12 ESC Key 

The **ESC** key is used in the , , and **EDIT** functions as a back or escape function. If the ***RX8-DL*** is displaying a grid or sequential log, the **ESC** key toggles the display options: Digits or B-Scan views.

3.13 Arrow Keys 

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

3.14 ENTER key 

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

3.15 MULTI MODE Key 

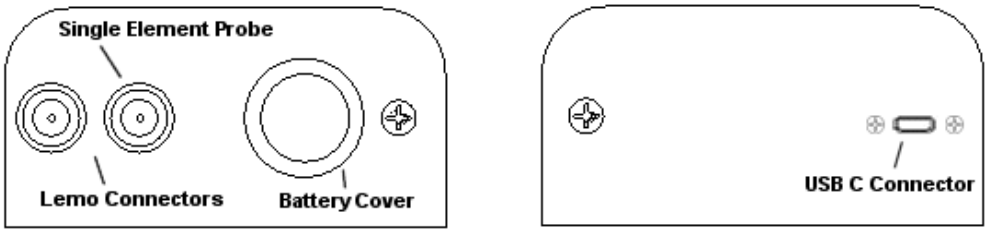
The **MULTI MODE** key opens a measurement mode screen that lists all the modes available for the transducer selected. The two modes available are pulse-echo (P-E) and echo-echo (E-E). The high damped transducers will offer both modes, while the majority will only offer pulse-echo. An additional menu item **"capture To File"** is also available when pressing the **MULTIMODE** key. This allows a user to capture a screenshot of any measurement screen, menu, or list to a .tif file stored on the internal SD card.

3.16 ON/OFF Key 

The **ON/OFF** key simply powers the unit either **ON** or **OFF**.

Note: *Unit will automatically power off when idle for 5 minutes. All current settings are automatically saved prior to powering off.*

3.17 Top & Bottom End Caps



Top End Cap Bottom End Cap

The top & bottom end panels are where all connections are made to the ***RX8-DL***. The diagram above shows the layout and description of the connectors:

Transducer Connectors

Refer to Diagram: The transducer connectors and battery cover/probe zero disk are located on the ***RX8-DL*** top end cap. The transducer connectors are of type Lemo "00".

Note: *There is no polarity associated with connecting the transducer to the* ***RX8-DL****.*

Probe Zero Disk & Battery Cover

Refer to Diagram: The Battery cover is the large round disk shown in the diagram. **Note:** This same disk is also used as a probe zero disk. Simply remove the cover when replacing the batteries (3 AA cells). When performing a manual probe zero function, simply place the transducer on disk making firm contact. **Important:** Be sure to follow the polarity labels located on the back label of the ***RX8-DL***.

Note: *Rechargeable batteries can be used however they must be recharged outside of the unit in a stand-alone battery charger.*

USB-C Connector

Refer to Diagram: The **USB-C** connector, located on the bottom end cap, is a mini type C female connector. It is designed to connect directly from the ***RX8-DL*** to a standard USB type A port on a PC. The cable supplied with the ***RX8-DL*** is a USB type C to a USB type A (pt# N-003-0330).

Note: *This connector is also used to upgrade the* ***RX8-DL*** *with the latest version of firmware.*

CHAPTER FOUR
PRINCIPALS OF ULTRASONIC MEASUREMENT

4.1 Time versus thickness relationship

Ultrasonic thickness measurements depend on measuring the length of time it takes for sound to travel through the material being tested. The ratio of the thickness versus the time is known as the sound velocity. In order to make accurate measurements, a sound velocity must be determined and entered into the instrument.

The accuracy of a thickness measurement therefore depends on having a consistent sound velocity. Some materials are not as consistent as others and accuracy will be marginal. For example, some cast materials are very granular and porous and as a result have inconsistent sound velocities.

While there are many different ultrasonic techniques to measure thickness, which will be discussed below, all of them rely on using the sound velocity to convert from time to thickness.

4.2 Suitability of materials

Ultrasonic thickness measurements rely on passing a sound wave through the material being measured. Not all materials are good at transmitting sound. Ultrasonic thickness measurement is practical in a wide variety of materials including metals, plastics, and glass. Materials that are difficult include some cast materials, concrete, wood, fiberglass, and some rubber.

4.3 Range of measurement and accuracy

The overall measurement capabilities, based on the wide variety of materials, is determined by the consistency of the material being measured

The range of thickness that can be measured ultrasonically depends on the material as well as the technique being used and the type of transducer. Thickness measurements can be made from a minimum of 0.010 inch to 9.999” in steel. However, the maximum attainable thickness is much less for more attenuative materials (materials that absorb sound).

Accuracy, is determined by how consistent the sound velocity is through the sound path being measured, and is a function of the overall thickness of the material. For example, the velocity in steel is typically within 0.5% while the velocity in cast iron can vary by 4%.

4.4 Couplant

All ultrasonic applications require some medium to couple the sound from the transducer to the test piece. Typically a high viscosity liquid is used as the medium. The sound frequencies used in ultrasonic thickness measurement do not travel through air efficiently. By using a liquid couplant between the transducer and test piece the amount of ultrasound entering the test piece is much greater.

4.5 Temperature

Temperature has an effect on sound velocity. The higher the temperature, the slower sound travels in a material. High temperatures can also damage transducers and present a problem for various liquid couplants.

Since the sound velocity varies with temperature it is important to calibrate at the same temperature as the material being measured.

Normal temperature range

Most standard transducers will operate from 0°F to 180°F.

High temperature measurements

Special transducers and couplants are available for temperatures above 180°F up to 650°F with intermittent contact. It is necessary to cool the transducer, by submerging the transducer in water between readings, when measuring high temperatures.

Modes and temperature errors

In addition to errors caused by velocity changing with temperature, some modes (measurement techniques) are affected more than others. For example, dual element pulse-echo mode has larger errors due to changes in the temperature of the delay line. However, multi-echo techniques offer temperature compensation help to minimize these errors.

4.6 Measurement Modes

In this section we will discuss the different measurements modes the ***RX8-DL*** is capable of operating in, the transducers required, and the reasons for using specific modes:

Pulse-Echo Mode (Flaw & Pit detection) – (P-E)

Pulse-echo mode measures from the initial pulse (sometimes referred to as an artificial zero) to the first echo (reflection). A manual probe zero can be performed while in this mode by placing the transducer on the reference disk located at the top end cap of the ***RX8-DL*** and selecting the ‘zero transducer’ option in the “PRB” menu, or the ‘zero probe’ option in the hot menu items.

Errors can result from surface coatings and temperature gradients in pulse-echo mode. Therefore, the zero process should be performed on a frequent basis.

This mode is commonly used to detect flaws and pits, as it only requires one reflection and adjustable gate to improve sensitivity when measuring heavily corroded metals.

V-Path Correction

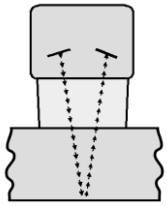
Dual element delay line transducers have two piezoelectric elements mounted at an angle on one end of the delay line. One element is used for transmitting sound, while the other element only receives sound. The two elements and their delay lines are packaged in a single housing but acoustically isolated from each other with a sound barrier. This allows the transducer the ability to achieve very high sensitivity for

detecting small defects. Also, the surface of the test material does not have to be as flat in order to obtain good measurements.

Dual element transducers are normally used in pulse-echo mode for finding defects, and in echo-echo mode for through coating measurements.

Dual element delay line transducers are usable over a range of 0.025 inches to 20 inches depending on the material, frequency, and diameter.

A limitation of dual element delay-line transducers is the V shaped sound path. Because the sound travels from one element to another, the time versus thickness relationship is non-linear. Therefore, a correction table in the instruments software is used to compensate for this error.



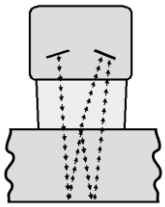
Dual Element Transducer showing V-path of signal

Searching for small defects

Dual element delay line transducers are especially useful in searching for small defects. In the pulse-echo mode with high amplifier gain, very small defects can be measured, and is useful during corrosion inspections to locate pits, porosity and cracks during tank and pipeline inspections, for example.

Echo-Echo Mode – Thru Coat (E-E)

The echo-echo mode measures between two reflections. This technique is commonly used to eliminate errors from surface coatings and applications with temperature gradients. The disadvantage is that two echoes are required for measurement. Certain materials can be difficult to pass sound through, making it hard to successfully achieve multiple echoes.



Dual Element Transducer in Echo to Echo mode

CHAPTER FIVE
SELECTING THE MEASUREMENT MODE

5.1 The setup library

The ***RX8-DL*** contains 64 user configurable preset locations to store custom setups for easy recall. These setups can be optimized for common application requirements, and bi-directionally transferred to the gauge and computer using Dakota's PC or OSX interface software, included with the instrument.

5.2 Which mode & transducer do I use for my application?

High penetration plastics and castings

The most common mode for these types of applications is pulse-echo. The ***RX8-DL*** has been optimized for cast materials. Cast iron applications require 1 - 5MHz frequencies, and cast aluminum requires a 10MHz frequency. Plastics typically require lower frequencies depending on the thickness and make-up of the material. Larger diameters offer greater penetration power because of the crystal size, for difficult to measure materials.

Corrosion & Pit Detection in steel and cast materials

Use pulse-echo mode whenever attempting to locate pits and flaws. Typically a 5MHz transducer, or higher, will be used for these types of applications. Use low frequencies for greater penetration and use higher frequencies for better resolution.

Thru Paint & Coatings

Often times, users will be faced with applications where the material will be coated with paint or some other type of epoxy material. Since the velocity of the coating is approximately 2.5 times slower than that of steel, pulse-echo mode will induce error if the coating or paint is not completely removed. By using echo-echo mode, the user is able to successfully measure through both, the coating and steel, and completely eliminate the thickness of the paint or coating. Therefore, the steel can be measured without having to remove the coating prior to measuring. Users will often use pulse-echo mode and echo-echo mode in conjunction when performing inspections on coated materials.

Thru coating measurements require special high damped transducers. The most common transducers are the 3.5, 5, and 7.5MHz hi damped transducers. These transducers are suitable for use in both pulse-echo and echo-echo modes. This conveniently enables the user to accurately measure overall material thickness using the thru Coating mode, and then conveniently switch to pit detection mode without changing transducers.

Thin materials

Use pulse echo mode and a high frequency transducer for these types of applications. The most common transducers are the 7.5MHz and 10MHz models

with extra resolution. The higher frequencies provide greater resolution and a lower minimum thickness rating overall.

High temperature

Use and select a special 2.25MHz and 5 MHz High temperature transducer for these types of applications. Both pulse-echo and echo-echo modes will also work for these applications. However, echo-echo mode will eliminate error caused by temperature variations in the delay line of the transducer.

Noisy Material

Materials such as titanium, stainless steel, and aluminum may have inherent surface noise issues. This is a signal that appears at the surface of the material when using a dual element delay line probe. Select a higher frequency transducer to reduce this noise – 7.5MHz and higher for better resolution.

Restricted access

Measuring materials with extreme curvatures or restricted access, higher frequencies with smaller diameters should be considered. The smallest diameter uses 3/16" crystals with a contact area of .250". Custom transducers are available on request.

5.3 Factory Setup Chart

Num	Name	Comment 1	Gn/AGC	Velocity
1	Enter Custom Name			
2	…			
3	…			
4	…			
5	…			
6	…			
…	…			

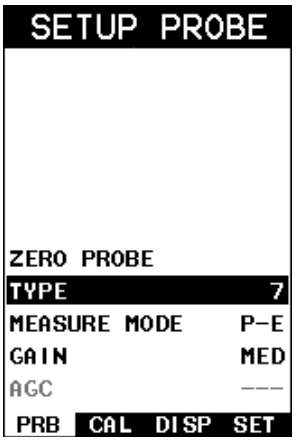
CHAPTER SIX
MAKING MEASUREMENTS

6.1 Selecting the Transducer Type

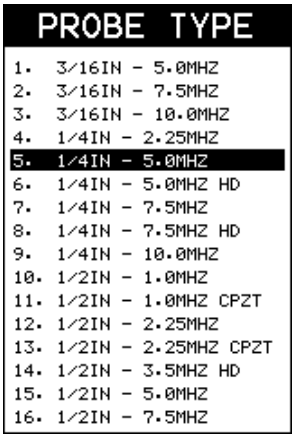
The first step in using the ***RX8-DL*** is to plug the transducer into the gauge and power up the unit to display the main measurement screen. The diameter and frequency should be noted in order to select a transducer from the list of probes in the gauge. The steps to select a transducer are outlined below:

Note: *Once the transducer has been selected, the **RX8-DL** will store and recall this transducer type every time the **RX8-DL** is powered on/off. The type will only change if the user physically selects another type from the list, or selects a previously stored setup. Therefore, if you have previously gone through this section and selected the transducer you are using, proceed to the next section.*

Selecting the Transducer

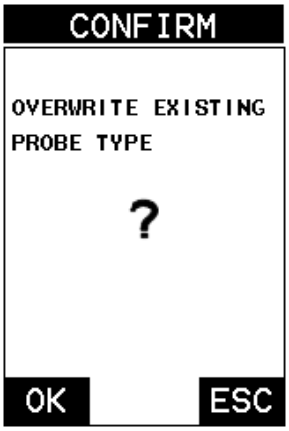


1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **PRB** menu is highlighted and displaying the submenu items.
2) Press the ▲ and ▼ arrow keys to scroll through the sub menu items until **TYPE** is highlighted.



3) Press the ↵ key to display the list of transducer options.

4) Press the ▲ and ▼ arrow keys to scroll through the transducer list until the appropriate type is highlighted.



5) Press the ↵ key to select the transducer type and display overwrite confirmation screen.

6) Press the OK key to overwrite the existing probe type with the newly selected type.



7) The zero probe warning screen will be displayed. Press the OK key, followed by pressing the key to return to the main measurement screen and proceed to the probe zero section that follows.

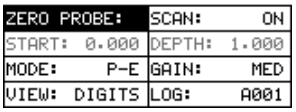
6.2 Probe zero

The next step is to perform a probe zero. This must be done prior to calibration, and periodically performed during an inspection to account for temperature variations. If the ***RX8-DL*** is not zeroed correctly, all measurements may be in error by some fixed value. In order to perform a zero, the gauge must be set to pulse-echo measurement mode. If the ***RX8-DL*** is currently set to echo-echo mode, the menu item "transducer zero" will be grayed out and inactive.

The procedure to perform a zero is outlined below:

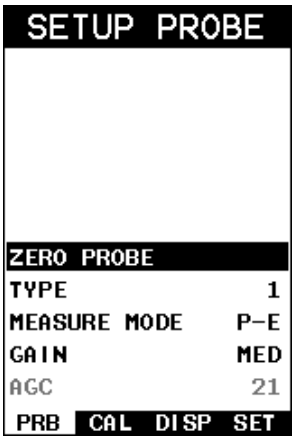
Probe Zero

1) Apply a drop of couplant on the transducer and place the transducer in steady contact with the probe zero disk at the top of the gauge.



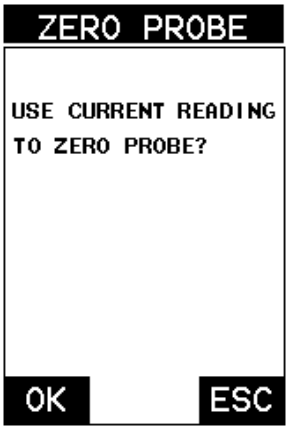
2) With the “zero probe” hot menu cell highlighted by default, press the ↵ OK key to display the confirmation screen, followed by pressing the key to perform the zero.

Note: *If the “zero probe” cell is not highlighted, press the* *or* esc *keys to highlight.*



3) Alternatively, press the ≡ key once to activate the menu items tab. Press the ≡ key multiple times to tab right and the esc key multiple times to tab left until the **PRB** menu is highlighted and displaying the submenu items.

4) Press the ▲ and ▼ arrow keys to scroll through the sub menu items until **ZERO PROBE** is highlighted.



5) Press the ↵ key to display the confirmation screen.

6) Press the OK key to perform the zero, or esc key to cancel the probe zero process.

7) Proceed to the calibration section.

Note: *The value that is displayed will change depending on the current velocity setting in the **RX8-DL**. Disregard the number that is displayed. **It is not important**. What is important is accurately performing the steps outlined above to insure reliability of the probe zero calculation.*

6.3 Material Calibration

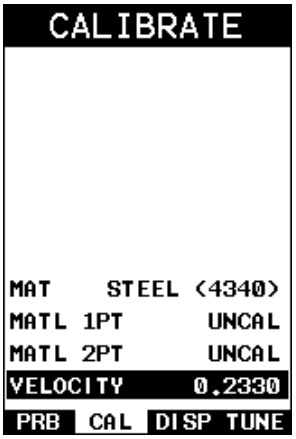
In order for the ***RX8-DL*** to make accurate measurements, it must be set to the correct sound velocity of the material being measured. Sound will travel at different speeds in different material types. For example, the velocity of sound through steel is about 0.233 inches per microsecond, versus that of aluminum, which is about 0.248 inches per microsecond. If the gauge is not set to the correct sound velocity, all of the measurements the gauge makes will be erroneous by some fixed percentage.

The **One Point** calibration is the simplest and most commonly used calibration method - optimizing linearity over large ranges. The **Two Point** calibration allows for greater accuracy over small ranges by calculating the probe zero and velocity. The ***RX8-DL*** provides four simple methods for setting the sound-velocity outlined below:

Known Velocity

If the material velocity is known, the user may wish to simply enter the velocity number into the ***RX8-DL***, rather than have the ***RX8-DL*** calculate the velocity value using a known thickness on a material sample. The steps for entering the velocity are outlined below:

Using a Known Material Velocity



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **VELOCITY** is highlighted.



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

4) Press the  and  arrow keys to scroll the highlighted value.

5) Press the  and  arrow keys to scroll the digit locations.

6) Repeat steps **4 & 5** until the velocity number is correctly displayed.

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

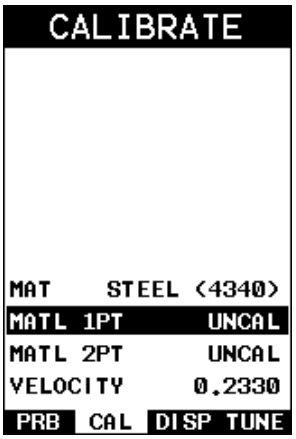
8) Finally, press the  key to return to the measurement screen and begin taking readings.

Known Thickness

Often times the sound velocity of a material is unknown. In this case a sample with one or two known thicknesses can be used to determine the sound velocity. As previously discussed, the ***RX8-DL*** has a one or two point calibration option. The one point calibration option is most suited for linearity over large ranges, as noted above. The user should also consider calibrating on high side of the intended measurement range, when using the one point option, minimize overall error. For example, if the measurement range is .100” (2.54mm) to 1.0” (25.4mm), the user should calibrate on a known thickness sample close to 1.0” (25.4mm).

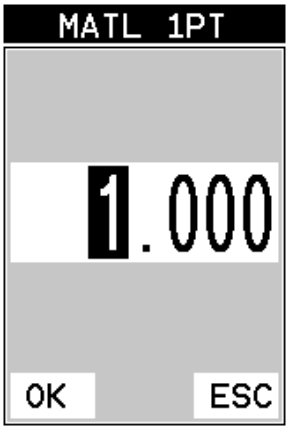
Note: *It’s always handy to carry a set of mechanical calipers to use in conjunction with the **RX8-DL** for calibration in the field.*

<u>One Point Calibration</u>



Note: *Be sure that the probe zero has been performed prior to performing this procedure.*

1) Physically measure an exact sample of the material, or a location directly on the material, to be measured using a set of calipers or a digital micrometer.
2) Apply a drop of couplant on the transducer and place the transducer in steady contact with the sample or actual test material. Be sure that the reading is stable and the repeatability indicator, in the top left corner of the display, is fully lit and stable. Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.
3) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **MATL 1PT** is highlighted.



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

5) Press the ▲ and ▼ arrow keys to scroll the highlighted value.

6) Press the ◀ and ▶ arrow keys to scroll the digit locations.

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

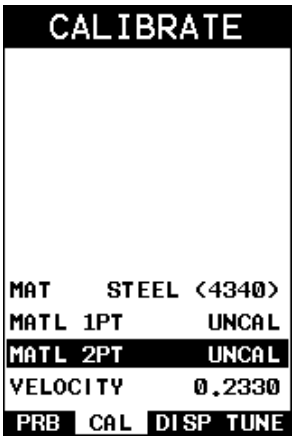
8) Press the OK key to calculate the velocity and return to the menu screen, or esc to cancel the one point calibration.

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

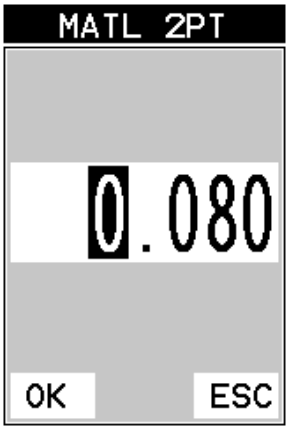
Note: ***CHECK YOUR CALIBRATION!*** *Place the transducer back on the calibration point. The thickness reading should now match the known thickness. If the thickness is not correct, repeat the steps above.*

At some point there may become a requirement for improved accuracy over a smaller measurement range. In this case, a two point calibration would be most suited for the job. For example, if the measurement range was .080” (2.03mm) to .250” (6.35mm), the user would perform a one point calibration on a known thickness sample close to .250” (6.35mm), followed by a two point calibration close to .080” (2.03mm). When a two point calibration is performed, the ***RX8-DL*** calculates the zero and the velocity. The following steps outline this procedure:

Two Point Calibration



1) Physically measure an exact sample of the material or a location directly on the material to be measured using a set of calipers or a digital micrometer.
2) Apply a drop of couplant on the transducer and place the transducer in steady contact with the sample or actual test material. Be sure that the reading is stable and the repeatability indicator, in the top left corner of the display, is fully lit and stable. Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.
3) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **MATL 2PT** is highlighted.



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

5) Press the ▲ and ▼ arrow keys to scroll the highlighted value.

6) Press the ◀ and ▶ arrow keys to scroll the digit locations.

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

8) Press the OK key to calculate the velocity and return to the menu screen, or esc to cancel the one point calibration.

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

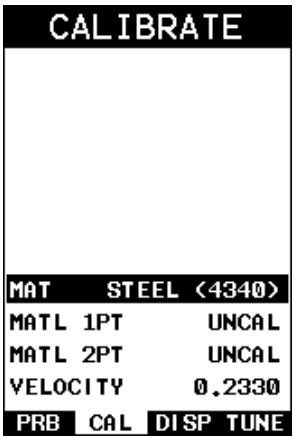
Note: ***CHECK YOUR CALIBRATION!*** *Place the transducer back on the calibration point. The thickness reading should now match the known thickness. If the thickness is not correct, repeat the steps above.*

Basic Material Type

If the material velocity is unknown, and a sample thickness cannot be taken from the material, the user may opt to choose a basic material type from a list with approximate velocity values according to various material types. It's important to note that these velocities will not always be an exact representation of the material

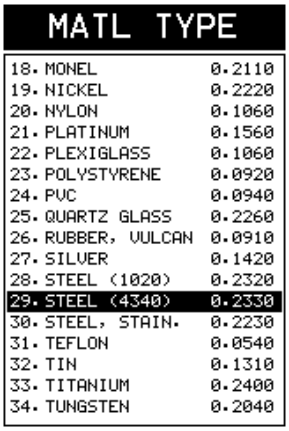
being tested. Use these values only if a close approximation is acceptable. Follow the steps below to select a basic material type:

Selecting a Basic Material Type



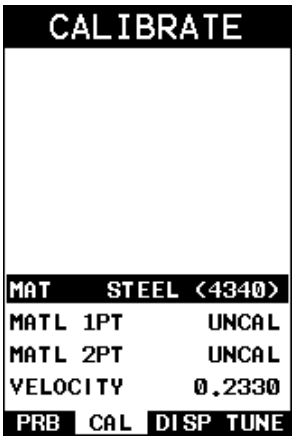
1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.

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



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

4) Press the  and  arrow keys to scroll through the material list until the appropriate material is highlighted.



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

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

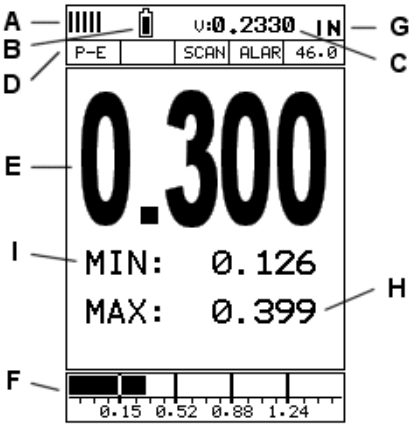
CHAPTER SEVEN
USING THE DISPLAY OPTIONS

A key feature of the ***RX8-DL*** is the ability to toggle between two different display options; Digits & B-Scan. All views provide a digital readout of the base material thickness measurement, while also displaying the min/max values if scan is enabled. The B-Scan display is useful when scanning surfaces and viewing the cross section of the test material. It provides a convenient way of visually profiling, or drawing a picture of, the blind surfaces during a scan. The B-Scan display is also equipped with a scan bar representing the overall thickness. The scan bar gives the user a visual indication when a flaw or defect passed over during the scan process. The scan bar will deflect off of the defect and return back to the overall thickness. Visually, this is much easier to notice than watching for changes in the digital value displayed. The scan bar has also been included in the large digits display mode for the same purpose.

Note: *The following chapter outlines some of the fine adjustment features of the* ***RX8-DL****. The* ***RX8-DL*** *has two different display options* ***(Large Digits and B-Scan)****. We'll take a better look at these options in this chapter.*

Note: *In order to recall and use the new adjustments made to the* ***RX8-DL*** *at a later time, the user must save the modified settings in one of the setup locations prior to powering off the unit.* *Refer page 84 for more information on setups.*

7.1 Display Views



Digits View

Digits

The Digits view is a basic digital sonic thickness tester look and feel. The larger digits make it much easier for the operator to monitor the thickness readings. The Scan Bar has also been added to the Digits view to provide the user with yet another visual tool for easily monitoring changes in thickness readings due to internal flaws or defects.

The following is a list of the viewable features on the display:

A. **Repeatability/Stability Indicator** – This indicator should be commonly used in conjunction with the digital thickness values displayed. When all the vertical bars are fully illuminated and the last digit on the digital thickness value is stable, the ***RX8-DL*** is reliably measuring the same value 250 times per second, depending on which measurement mode and features are enabled.

B. **Battery Icon** – Indicates the amount of battery life the ***RX8-DL*** has remaining.

C. **Velocity** – The material velocity value the ***RX8-DL*** is currently using or calibrated for. Displayed in English or Metric units, depending on what units the gauge is set for.

D. **Feature Status Bar** – Indicates the features currently enabled and in use in the following order:
   - Measurement Mode (P-E, E-E)
   - Differential Mode (ON/OFF)
   - High Speed Scan Mode (ON/OFF)
   - Alarm Mode (ON/OFF/AUDIBLE)
   - Gain Setting (VLOW, LOW, MED, HI, VHI)

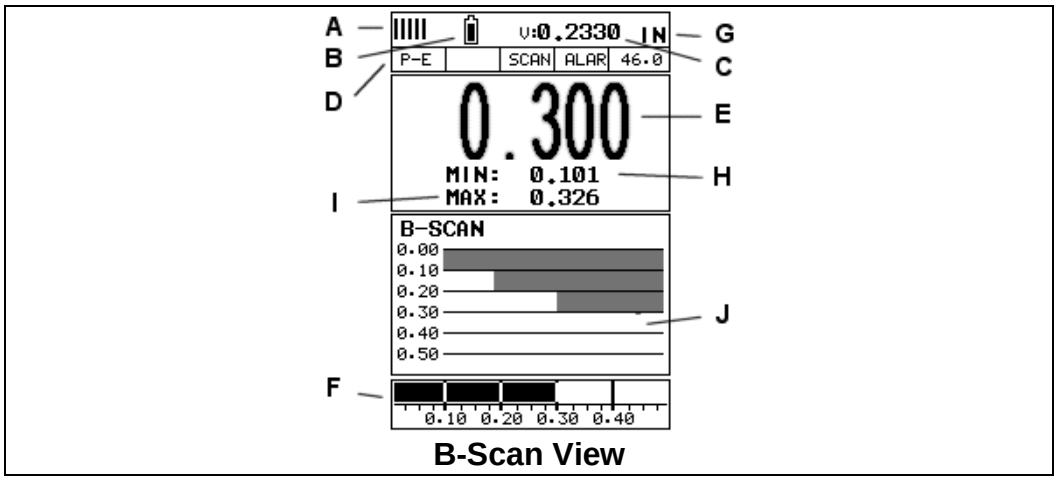
E. **Digital Material Thickness Value** – Extra large font size for viewing ease.

F. **Scan Bar** – Another view of material thickness in a deflection style horizontal bar. This is another visual tool that would enable the user the ability to see thickness changes during high speed scans from flaws and pits.

G. **Units** – The current measurement units being used (English, Metric).

H. **Minimum Material Thickness** – Part of the scan feature. Displays the minimum thickness value found during a scan.

I. **Maximum Material Thickness** – Part of the scan feature. Displays the maximum thickness value found during a scan.



B-Scan View

B-Scan

The B-Scan displays a time based cross section view of test material. This view is commonly used to display the contour of the blind, or underside, surface of a pipe or tank application. It is very similar to a fish finder. If a flaw or pit is located during a scan, the B-Scan will draw the pit on the screen. The solid black rectangle in the diagram at location K represents the cross section, or side view of the material. The B-Scan view draws at a rate of 7 seconds per screen from right to left. Also notice at location K, the pits and corroded bottom surface of the material.

It's important to note that the measurement range on the display be set wide enough, so that the maximum thickness of the material can be viewed on the display. Using the diagram above, if the material thickness was actually 1.75", the underside of the material would not be viewable according to the current range at 0.00" – 1.00". All the user would see is a black screen from 0.00" – 1.00" with no view of the bottom contour at 1.75".

The following is a list of the viewable features on the display:

A. **Repeatability/Stability Indicator** – This indicator should be commonly used in conjunction with the digital thickness values displayed. When all the vertical

bars are fully illuminated and the last digit on the digital thickness value is stable, the ***RX8-DL*** is reliably measuring the same value 250 times per second, depending on which measurement mode and features are enabled.

B. **Battery Icon** – Indicates the amount of battery life the ***RX8-DL*** has remaining.

C. **Velocity** – The material velocity value the ***RX8-DL*** is currently using or calibrated for. Displayed in either English or Metric units, depending on what units the gauge is set for.

D. **Feature Status Bar** – Indicates the features currently enabled and in use in the following order:
   - Measurement Mode (P-E, E-E)
   - Differential Mode (ON/OFF)
   - High Speed Scan Mode (ON/OFF)
   - Alarm Mode (ON/OFF/AUDIBLE)
   - Gain Setting (VLOW, LOW, MED, HI, VHI)

E. **Digital Material Thickness Value** – Smaller font size when the B-Scan display view is enabled.

F. **Scan Bar** – Another view of material thickness in a deflection style horizontal bar. This is another visual tool that would enable the user the ability to see thickness changes during high speed scans from flaws and pits.

G. **Units** – The current measurement units being used (English, Metric).

H. **Minimum Material Thickness** – Part of the scan feature. Displays the minimum thickness value found during a scan.

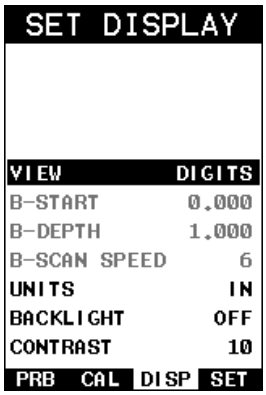
I. **Maximum Material Thickness** – Part of the scan feature. Displays the maximum thickness value found during a scan.

J. **B-Scan Display** – Cross section view of the material. Provides the user with graphical view of the opposite/blind surface (i.e. inside engine block surface), to give the user some idea of the condition, or integrity of the material being tested.

7.2 Changing Display Options

The following procedure outlines how to select or toggle display options:

Display Views



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **DISP** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **VIEW** is highlighted.
3) Use the ◀ and ▶ arrow keys to scroll the view options. Once the appropriate view is displayed, press the ⌂ key to return to the measurement screen and begin taking measurements.

Note: *The view can also quickly be changed from the hot menu.*

7.3 Adjusting the display

This section will cover the procedures for adjusting the viewable range of the 'scan bar', in terms of thickness. The START (B-START) and DEPTH (B-DEPTH) are used for both views to adjust the thickness scale. The scan bar displays the viewable thickness range using a starting value and an overall depth. Therefore, if the measuring range is 0.500" to 1.00", the start will be 0.500" and the depth 1.00".

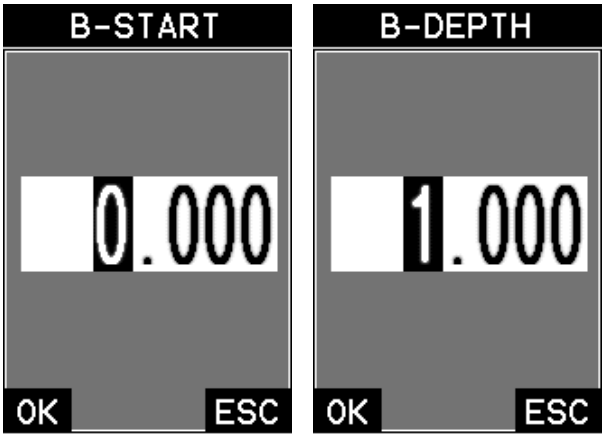
The procedures to adjust the **START & DEPTH** are outlined below:

Start & Depth

ZERO PROBE:	SCAN: ON
START: 0.000	DEPTH: 0.300
MODE: P-E	GAIN: MED
VIEW: BSCAN	LOG: A001

ZERO PROBE:	SCAN: ON
START: 0.000	DEPTH: 0.300
MODE: P-E	GAIN: MED
VIEW: BSCAN	LOG: A001

1) Press the  key once to activate measure menu items. Press the  key multiple times to move right and the  key multiple times to move left, until the **START** cell is highlighted.
2) Press the , , , and  arrow keys to scroll the highlighted value.



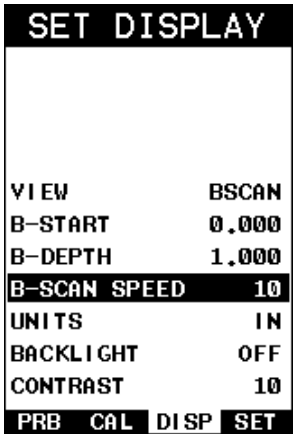
3) **Alternatively**, press the  key to display the **Digits Edit Box**.
4) Press the  and  arrow keys to scroll the highlighted value.
5) Press the  and  arrow keys to scroll the digit locations.
6) Repeat steps **4 & 5** until the **B-START** value is correctly displayed.
7) Press the  key to return to the measurement screen, or  to cancel entering the **B-START**.

8) Finally, repeat the steps above to adjust the **B-DEPTH**.

Adjusting the B-Scan Speed

The ***RX8-DL*** has the capability to adjust the the scrolling speed of the time based B-Scan displayed in the gauge. The procedures to adjust the speed are outlined below:

Adjusting the B-Scan Speed



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **DISP** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **B-SCAN SPEED** is highlighted.
3) Use the ◀ and ▶ arrow keys to scroll the speed from 0-10. Note: 10 representing the fastest scroll time. Once the appropriate speed is

displayed, press the  key to return to the measurement screen and begin the B-Scan process.

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

5) Press the  and  arrow keys to scroll the highlighted value.

6) Press the  and  arrow keys to scroll the digit locations.

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

8) Press the 

key to set the speed and return to the **DISP** menu., followed by pressing the  key to begin the B-Scan process.

9) Finally, press the  key to return to the measurement screen and begin the scanning process.

7.4 Gain

The gain, or amplification of the return echoes, can be adjusted in the **RX8-DL** to accommodate a variety of applications. The setting of the gain is crucial in order to obtain valid readings during the measurement process. Too much gain may result in erroneous measurements by detecting on noise rather than the actual material back wall itself. Not enough gain may result in intermittent detection. It may also result in lack of detection on internal flaws, pits, or porosity. The gain can easily be compared to the volume control of a home stereo system. If you turn it up too much, you can't hear the music clearly. If it's turned down too much, you can't hear it at all.

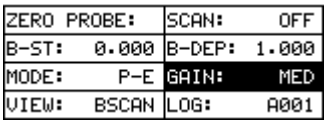
The ***RX8-DL*** has a five position gain switch (vlow, low, med, hi, vhi), with Med gain set at 46dB, with an overall cut/boost of 6dB in 3dB increments. The gain can be adjusted to accommodate a variety of material types, and offers the user flexibility. Some applications may require the lower or higher gain settings. When? The low settings may be necessary for noisy or granular cast materials. How do I know when to lower the gain? If the reading becomes sporadic and won't settle down or resolve on a thickness value, the user can assume that the material is either very noisy aluminum, or granular cast iron. This would be a good time to change the ***RX8-DL*** to lower gain setting and see if the reading settles down and becomes stable.

How do I know when to increase the gain? Often times the user will be trying to measure a material that is hard to penetrate or pass sound through. This may be due to the material type, or overall thickness of the material. When a material is hard to pass sound through because of the thickness or general make-up, it would be a good time to consider increasing the ***RX8-DL*** to a higher gain setting. Another example might be the need to increase overall sensitivity for locating fine pits or flaws. In any case, the adjustable gain feature offers the user some additional options to resolve and overcome application issues.

Note: *When the echo-echo thru-paint measurement mode is selected, the manual gain feature is disabled and grayed out in the menu items. In echo-echo mode the* ***RX8-DL*** *switches to an automatic gain mode* ***(AGC)*** *to optimize the gain setting automatically, and can be overridden by adjusting the dynamic range (Low, Med, Hi).*

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

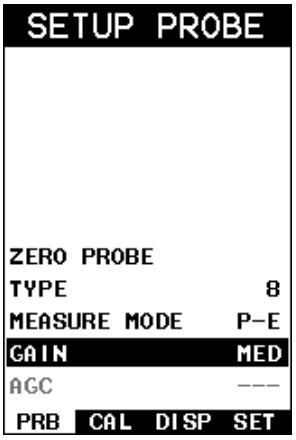
Gain Adjust Hot Menu



1) Press the  key once to activate measure menu items. Press the  key multiple times to move right, and the  key multiple times to move left until the **GAIN** cell is highlighted.
2) Press the , , , and  arrow keys to scroll (vlow, low, med, hi, vhi) in pulse-echo mode, or (low, med, hi) in echo-echo mode.

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

Gain Adjust Tabbed Menus



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

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

3) Press the ◀ and ▶ arrow keys to scroll the steps.

4) When the target gain step is displayed, press the ⌂ key to return to the measurement screen and begin taking readings.

CHAPTER EIGHT
THRU PAINT MEASUREMENT TECHNIQUE

8.1 Introduction to Thru Paint Measurement

The principle behind thru paint measurement is by measuring the time between two back wall echoes returning from the test material. Since both of these back wall echoes travel the same path through the paint or coating, the thickness of the coating is subtracted out of the measurement, measuring only the base material. This avoids the time to remove existing coating from the test material during the inspection process.

Thru paint mode cannot be used for flaw or pit detection. Therefore, inspectors may need to use echo-echo thru paint mode in conjunction with the standard pulse-echo flaw detection mode for some applications. The combination of using both modes is ideal for achieving the nominal base material thickness, as well as for finding defects or pitting in materials.

8.2 Using Thru Paint Mode

By selecting the transducer type from the list of probes stored in the ***RX8-DL***, a basic echo-echo thru paint configuration is recalled from memory. Each of the 'high damped' transducers in the list contain pre-configured echo-echo settings. However, fine adjustments may be necessary in order to be suitable for your specific applications. These configurations are general setups only. Once the transducer type has been selected, and the appropriate calibration procedure completed, the ***RX8-DL*** can be toggled between **pulse-echo** (flaw & pits), and **echo-echo** (thru-paint) modes by simply pressing the 

key located on the keypad. The standard transducer that will be used for common steel applications is a ¼" 5MHz high damped transducer **(1/4IN – 5.0MHZ HD)**. However, any of the transducers with the **HD** label have been optimized for echo-echo thru paint applications.

Note: *When a transducer is selected for use, all of the measurement modes available for use with this transducer can easily be determined by pressing the multi-mode button on the keypad. The **RX8-DL** has been programmed to identify the modes available to a specific transducer.*

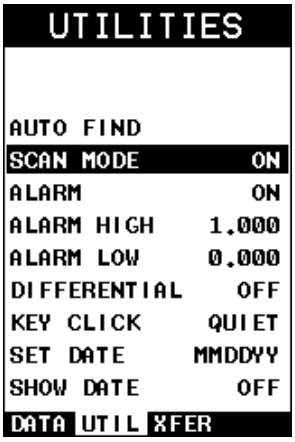
CHAPTER NINE
ADDITIONAL FEATURES OF THE RX8-DL

9.1 High Speed Scan

The High Speed Scan feature of the ***RX8-DL*** increases the overall repetition rate to a maximum of 250Hz with a high speed screen refresh rate of 25 times a second. This feature enables a user to make scanned passes over an arbitrary length of the test material, while still maintaining a reasonable representation of thickness over the scanned area or region. This feature can be used in conjunction with High and Low alarm limits features to dynamically keep track of both values. The feature is typically used to provide a better representation of the area scanned, by taking more readings at a faster rate repetition rate.

The procedure to use the **SCAN MODE** feature is outlined below:

Using the Scan Mode



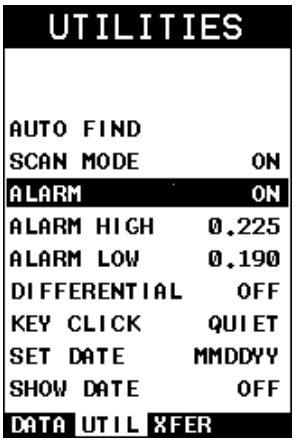
1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **SCAN MODE** is highlighted.
3) Use the ◀ and ▶ arrow keys to toggle the **SCAN MODE** on/off.

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

9.2 Alarm Mode

The **Alarm Mode** feature of the ***RX8-DL*** provides the user with a method of setting tolerances, or limits, for a particular application requirement. This feature may be used for a variety of applications to verify the material is within the manufacturer specifications. There are two limits, or alarm values, that can be setup in the ***RX8-DL*** – **ALARM LOW** and **ALARM HIGH** limits. However, the user may choose to activate and utilize only one of the limit values, depending on their specific application requirements. The procedures to use the **ALARM MODE** feature are outlined below:

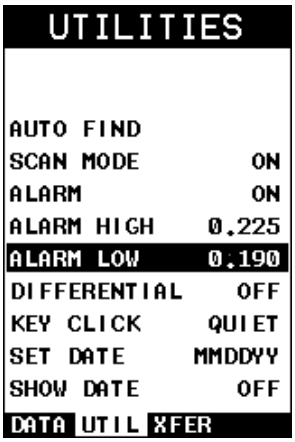
Toggle Alarm (on/off)

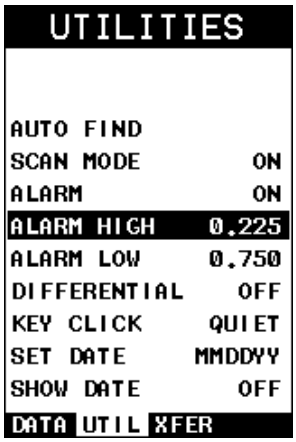


1) Press the  key once to activate the menu items tab. Press the  key multiple times to tab right, and the  key multiple times to tab left, until the **UTIL** menu is highlighted and displaying the submenu items.
2) Use the  and  arrow keys to scroll through the sub menu items until **ALARM** is highlighted.
3) Use the  and  arrow keys to toggle the **ALARM** on/off/audible.

4) Continue on to the next section **"Setting the Alarm Low Limit"**.

Setting the Alarm Low Limit





1) Assuming the **ALARM** is **ON**, use the ▲ and ▼ arrow keys to scroll through the sub menu items until **ALARM LOW** is highlighted.

2) Press the ◀ and ▶ arrow keys to scroll the value. When the correct alarm value is being displayed, **proceed to step 7**.





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

4) Press the  and  arrow keys to scroll the highlighted value.

5) Press the  and  arrow keys to scroll the digit locations.

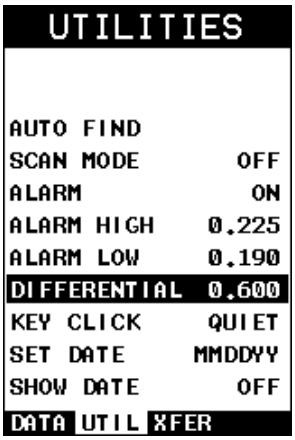
6) Repeat steps **4 & 5** until the **ALARM LOW** value is correctly displayed.

7) If only one limit will be used, press the  key to return to the measurement screen and begin taking readings. Otherwise, continue on to set the **ALARM HIGH** limit using the same procedures.

9.3 Differential Mode

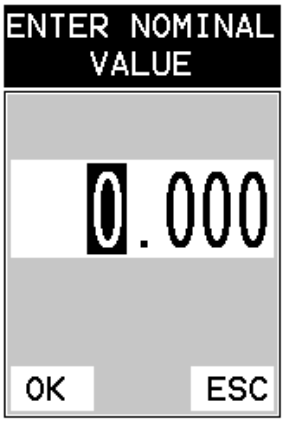
The **Differential Mode** of the ***RX8-DL*** provides the user with the ability to set a nominal value, according to what the expected thickness should be, and measure the +/- difference from the nominal value entered. This feature is typically used in QA incoming inspections on pipes, plate stock, coils, etc. The steps below outline how to enable and enter the nominal value to use this feature:

<u>Toggle Differential (on/off)</u>



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **UTIL** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **DIFFERENTIAL** is highlighted.
3) Use the ◀ and ▶ arrow keys to toggle the **DIFFERENTIAL** on. A value will appear to the right of **DIFFERENTIAL**.
4) Continue on to the next section **"Setting the Differential Value"**.

Setting the Differential Value



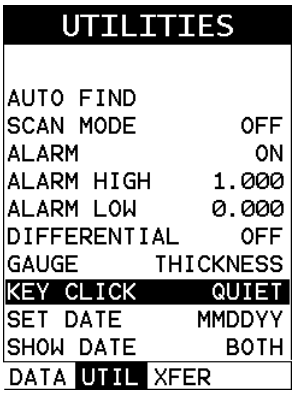
1) Assuming **DIFFERENTIAL** has been enabled and a value is being displayed to the right of the **DIFFERENTIAL** label, press the ↵ key to display the **Digits Edit Box**.
2) Press the ▲ and ▼ arrow keys to scroll the highlighted value.

3) Press the ◀ and ▶ arrow keys to scroll the digit locations.
4) Repeat steps **2 & 3** until the **DIFFERENTIAL** value is correctly displayed.
5) Press the OK key to set the **DIFFERENTIAL** value and return to the menu screen.
6) Finally, press the 🏠 key to return to the measurement screen and begin taking readings.

9.4 Key Click

When a key is pressed on the ***RX8-DL*** keypad, the user can control whether or not an audible beep is sounded and at what volume level, if any. The procedure for this feature/preference is outlined below:

Setting the Key Click



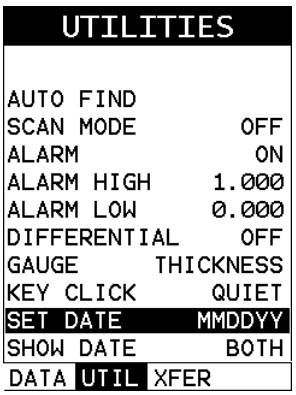
1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items.

2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **KEY CLICK** is highlighted.
3) Use the ◀ and ▶ arrow keys to toggle the **KEY CLICK** loud/quiet/off.
4) Press the ⌂ key to return to the measurement screen.

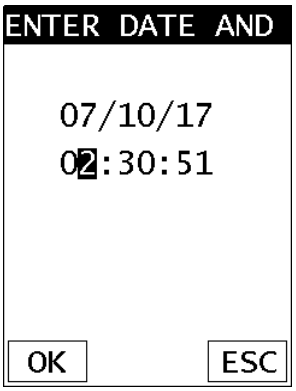
9.5 Set Date & Time

The ***RX8-DL*** is equipped with an internal clock to time and date stamp the log, setup and screen capture files for reporting/documentation purposes. The procedures for setting the time and date are outlined below:

Setting Date & Time



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **SET DATE** is highlighted.

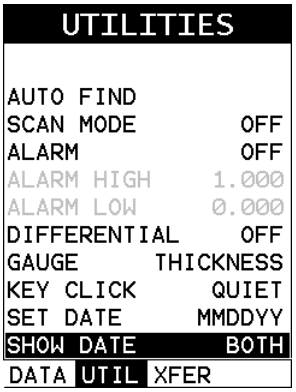


3) Press the ↵ key to display the **Digits Edit Box**.
4) Press the ▲, ▼, ◀, & ▶ arrow keys to scroll the field locations.
5) Press the ◀ and ▶ arrow keys multiple times to scroll the value.
6) Repeat steps **4 & 5** until the **Time & Date** is correctly displayed.
7) Press the OK key to set the **Time & Date** and return to the menu screen, or esc to cancel entering the **Time & Date**.
8) Finally, press the ⌂ key to return to the measurement screen and begin taking readings.

9.6 Show Date & Time

The ***RX8-DL*** can be configured to show the date & time in the active A-Scan window as needed or preferred (off/date/time/both). The procedure for activating and displaying the above options are outlined below:

Live Time & Date

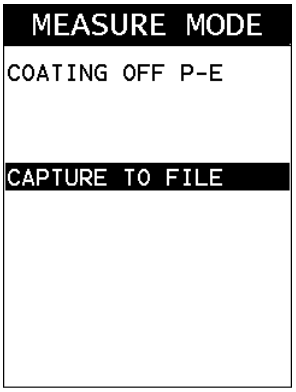


1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **SHOW DATE** is highlighted.
3) Press the ◀ and ▶ arrow keys multiple times to scroll the options (Date, Time, Both, Off).
4) Finally, press the ⌂ key to return to the measurement screen and begin taking readings.

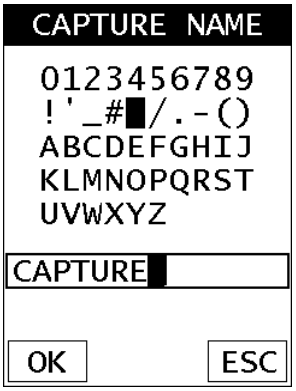
9.7 Freeze & Capture

The ***RX8-DL*** freeze feature enables a user to immediately freeze what's currently being displayed on the screen for further review or analysis. The freeze feature used in conjunction with the capture feature enables a user to save the entire screen shot directly to a **.tif** (tagged image) file format that can be opened using any graphics viewer. With the storage capacity of the ***RX8-DL*** the user can store as many screens shots as needed. It should also be mentioned that this feature is immediately activated on boot up. Therefore all the menus items, list boxes and edit screens can also be captured for presentation or training purposes. The procedure to freeze and capture the display is outlined below:

Capturing Screen Shots



1) To capture a file, press the **MULT MODE** key to freeze the screen and enter the measure mode menu.
2) Press the ▲ and ▼ arrow keys multiple times until **CAPTURE TO FILE** is highlighted.



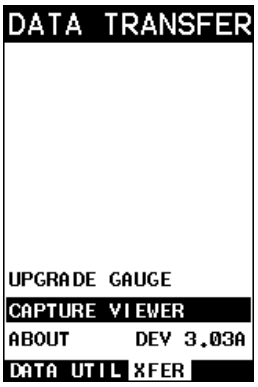
3) Press the ↵ key to display the alpha numeric edit box to name and save the screen shot.
4) Press the ⌂ key to return to the measurement screen.

9.8 Capture Viewer

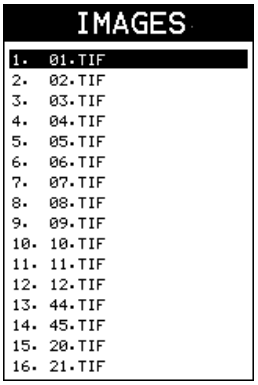
The capture viewer enables a user to view any of the saved screen captures on the SD card, using the ***MiniMax***. This is handy if a PC isn't available, but the user has a need to review the screen shots captured.

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

Using the Viewer



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **XFER** menu is highlighted and displaying the submenu items.
2) Press the ▲ and ▼ arrow keys until **CAPTURE VIEWER** is highlighted.



3) Press the  key to display the list of images saved on the SD card.

4) Use the  and  arrow keys to scroll through the list until the desired image name is highlighted.

5) Press the  key to display the image.

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

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

10.1 Introduction to File Formats

The **GRID** file format is very similar to a spreadsheet format found in popular software programs like Excel. A **GRID** is simply a table of readings. A specific location in a grid is specified by giving a row and column coordinate. The rows are numbered from 1 to 999 and the columns are labeled from A to ZZ (999 Rows & 52 Columns).

The **ENGINE** file format is also a standard grid style customized for mapping out an engine block in terms of labels. The columns are labeled as cylinders, and the rows are considered as clock positions. The maximum number of selectable cylinders is 16, and the maximum number of clock positions is 12.

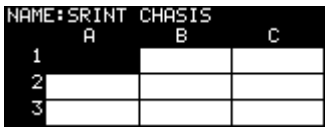
The following character set below can be used when creating a name or note as follows:

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

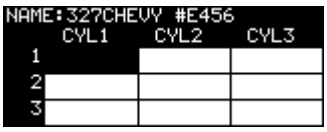
Note: *The name and note fields are 20 characters in length using any combination of the above.*

The ***RX8-DL*** has a 4gb SD memory card for virtually unlimited storage capacity. Along with every measurement stored, is a corresponding screenshot of the **DIGITS** or **B-SCAN** views, as well as all the ***RX8-DL*** settings for every individual measurement. The screenshot stored with the reading will depend on what view the ***RX8-DL*** was in at the time it was saved.

The sections that follow are a guide for creating a grid:



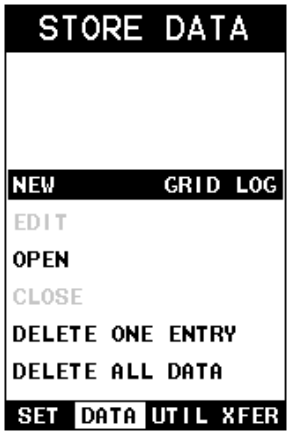
Grid Log



Engine Log

10.2 Creating a New Grid Log

Log Name



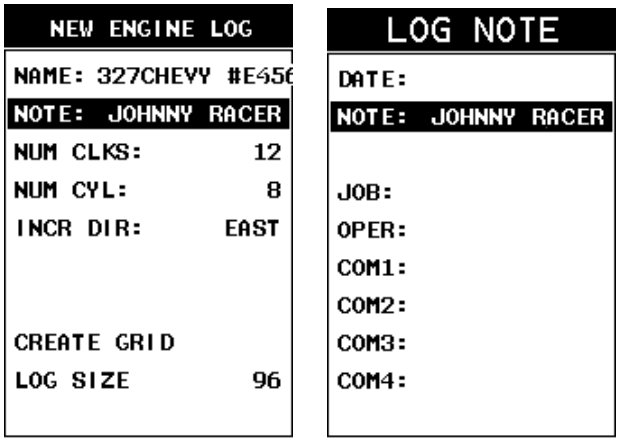


1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right, and the esc key multiple times to tab left, until the **DATA** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **NEW** is highlighted.
3) Press the ↵ key to display the new grid setup box.
4) Use the ▲ and ▼ arrow keys to scroll through the new grid options until **NAME** is highlighted.



5) Press the ↵ key to activate the **Alpha Edit Box**.
6) Use the ▲, ▼, ◀, & ▶ arrow keys to highlight the appropriate alpha characters.
7) Press the ↵ key to select a character and advance to the next field of the grid name.
8) Use the clr key to backspace if necessary.
9) Repeat steps **6 - 9** until the grid name is complete.
10) Press the OK key to save the grid and return to the grid setup list, or esc to cancel creating a **NAME**.

Creating a Note



1) Use the ▲ and ▼ arrow keys to scroll through the setup options until **NOTE** is highlighted.

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



3) Use the ▲, ▼, ◀, & ▶ arrow keys to highlight the appropriate alpha characters.

4) Press the ↵ key to select a character and advance to the next field.

5) Use the clr key to backspace if necessary.

6) Repeat steps **3** through **5** until the **Note** is complete.

7) Press the OK key to save the **Grid** and return to the setup list, or esc to cancel entering a **Note**.

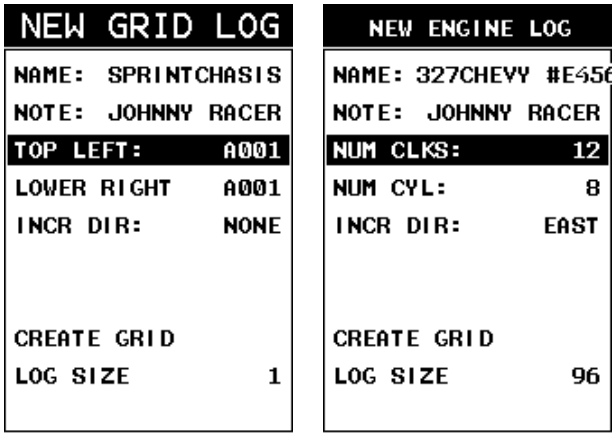
Setting the Coordinates or Start & Stop ID's

A grid is defined by using coordinates to define the **Top Left** and the **Bottom Right** corners of the grid. Alpha coordinates are horizontal across the top, and numeric coordinates are vertical down the side. Therefore, to define the top left corner of the grid, there will be an (X,Y) coordinate. Where X is an alpha column location across the top and Y is a numeric row location down the side.

Use the same logic when choosing the lower right corner. An individual grid can be up to 999 rows and 52 columns.

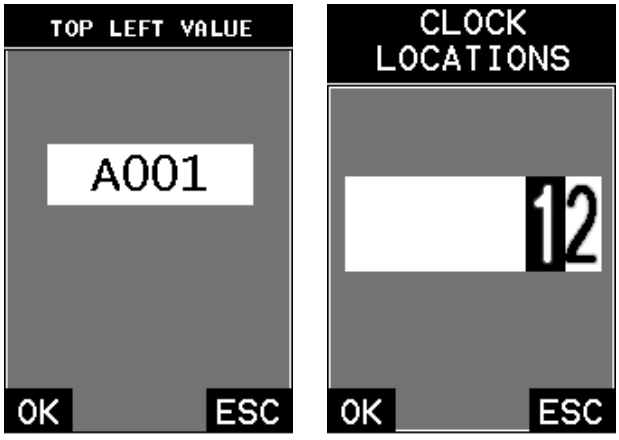
Note: *If the "Engine" format is selected, the X refers to cylinder #, and Y to clock positions.*

Grid Coordinates – Top Left



1) Use the  and  arrow keys to scroll through the setup list until **TOP LEFT** is highlighted.

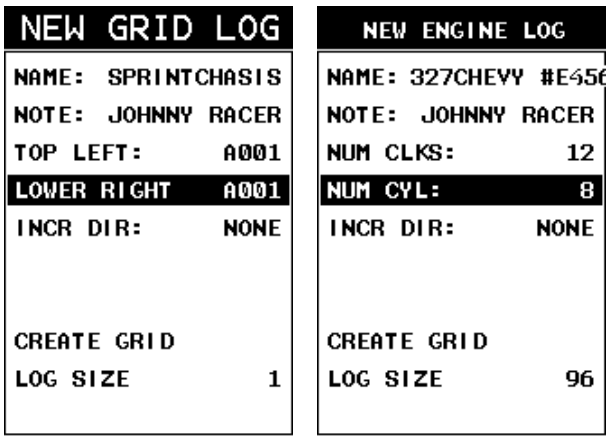
2) Press the  key to activate the **Coordinate Edit Box**.



3) Use the and arrow keys to scroll the **Columns**, and the and arrow keys to scroll the **Rows**.

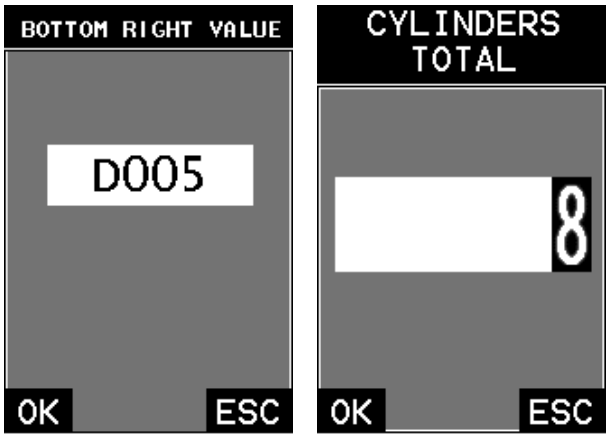
4) Press the OK key to select the coordinate and return to the setup list, or esc to cancel setting the coordinate.

Grid Coordinates – Lower Right



1) Use the and arrow keys to scroll through the setup list until **LOWER RIGHT** is highlighted.

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

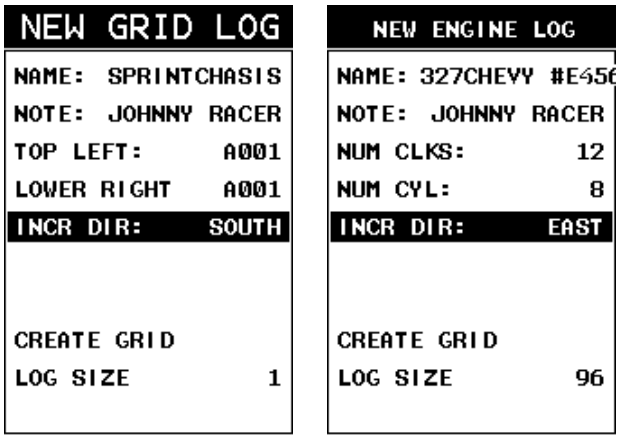


3) Use the **, &** arrow keys to scroll the **Columns**, and the and arrow keys to scroll the **Rows**.

4) Press the OK key to select the coordinate and return to the setup list, or esc to cancel the selection and return to the setup list.

Auto Increment Direction

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



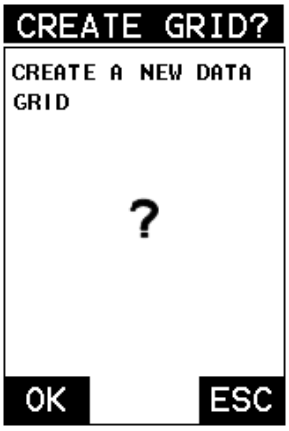
1) Use the  and  arrow keys to scroll through the setup list until **INCR. DIR** is highlighted.
2) Use the  and  arrow keys to toggle the **Increment** direction **NONE, NORTH, EAST, SOUTH,** or **WEST**.
3) Continue on to the next section **"Saving a Grid** or **Seq File"**.

Saving a Grid

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



1) Use the  and  arrow keys to scroll through the setup list until **CREATE GRID** is highlighted.
2) Press the  key to save the grid display the confirmation screen.



3) Press the OK key to save the **Grid**, or the esc key to cancel the setup and return to the **DATA** menu.

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

10.3 Storing a reading

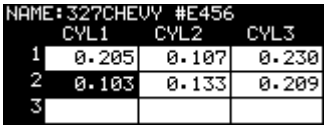
Now that a grid or sequential log has been created, it's time to make some measurements and store the readings. The following procedures outline this process:

Storing Data

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

Key Feature: When the **RX8-DL** is displaying a grid in the measurement screen, pressing the OK key will initiate an advance to row number option. Use the , , , and arrow keys to enter the row number. Once the row number is correctly displayed, press the OK key to advance directly to that row in the grid.

Key Feature: When the **RX8-DL** is displaying a grid in the measurement screen, pressing the esc key multiple times will toggle through the display options: **Digits** and **B-SCAN** views.



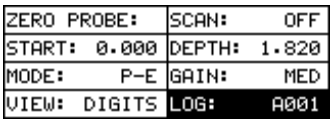
1) Press the , , , and arrow keys to scroll the target cell cursor to the desired storage location.
2) Press the key to save the current reading in the highlighted cell location.
3) Press the key to hide the **GRID** and display the **Hot Menu**.
4) To display the **GRID**, press the or esc keys multiple times until **LOG** is highlighted.
5) Press the to display the **GRID**.

Note: *Once the file is open, it will remain open until it's closed or another file is opened by the user. If the gauge is powered off, the **RX8-DL** will automatically open the file when powered on.*

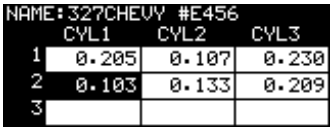
10.4 Viewing stored readings

It is sometimes necessary to go back and view the stored readings and B-Scans using the ***RX8-DL*** without a PC. The following procedures outline this process:

Viewing Stored Readings & A/B Scans



1) Press the  key once to activate measure menu items. Press the  key multiple times to move right and the  key multiple times to move left until the **LOG** cell is highlighted.



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

3) Press the , , , and  arrow keys to scroll the stored readings and corresponding display view.

Note: *As the cursor is moved to a different cell the display will be updated with the display view saved with the reading. Readings stored in memory are indicated by displaying a* ***MEM*** *in the top left corner of the measurement screen.*

4) The user may opt to clear a specific reading and save a new one at any time. Press the  key in the appropriate cell location to clear the reading, take a new measurement, and press the  key to save the new reading.

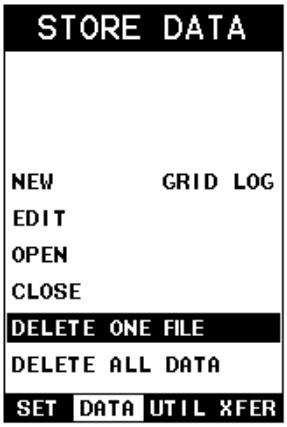
5) Abort displaying the **Grid** at any time by pressing the key.

10.5 Deleting Grids (Files)

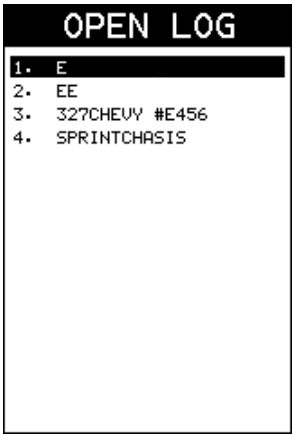
Deleting Files

One File

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



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



3) Press the ↵ key to display the **File List Box**.

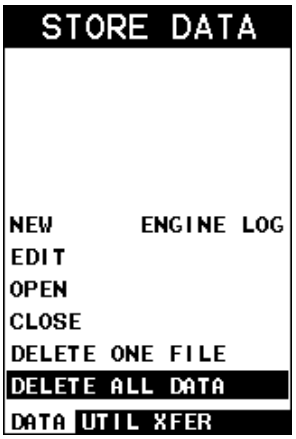
4) Use the ▲ and ▼ arrow keys to scroll through the stored **Files** until the target **File** to delete is highlighted.

5) Press the OK key to delete the **File**.

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

All Data

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



2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **DELETE ALL DATA** is highlighted.



3) Press the ↵ key to activate the confirmation screen.

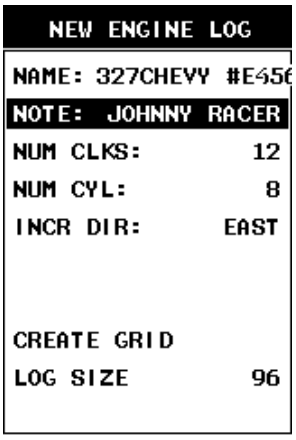
4) Press the OK key to delete **All Files** from memory, or the esc key to abort.

5) Press the ⌂ key to return to the measurement screen.

10.6 Editing a Grid (File)

Once a grid has been created and saved to memory, the user can edit the **Name**, **Notes**, or **Increment Direction** at a later time. The following procedures outline this process:

Editing a Grid



Note: *This section assumes the file to edit is already open.*

1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **DATA** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **EDIT** is highlighted.
3) Press the ↵ key to display the **Edit List Box**.
4) Use the ▲ and ▼ arrow keys to scroll through the **Edit** options until **NAME, NOTE** or **INCR. DIR** is highlighted.

Note: *If editing the **INCR. DIR**, simply use the ◀ or ▶ arrow keys to scroll **NONE, NORTH, EAST, SOUTH, WEST** for a Grid. **Proceed to step 10**.*



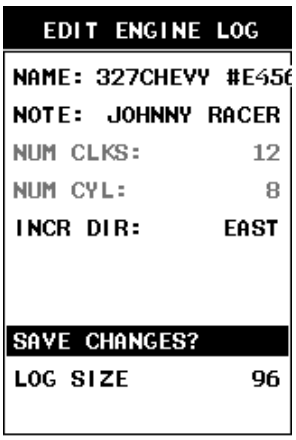
5) Press the ↵ key to activate the **Alpha Edit box** – Only used when editing the **NAME** or **NOTE**.

6) Use the ▲, ▼, ◀, & ▶ arrow keys to highlight the appropriate alpha characters.

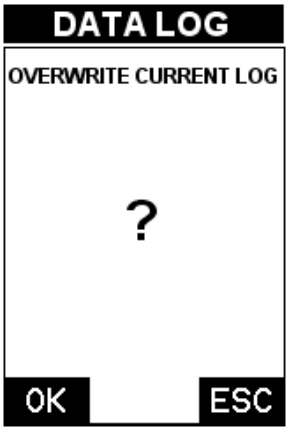
7) Press the ↵ key to select a character and advance to the next field of the note.

8) Use the clr key to backspace if necessary.

9) Repeat steps **6 - 8** until the note is completed.



10) Press the ▲ or ▼ arrow key to highlight **SAVE CHANGES**, and the OK key to activate the confirmation screen.



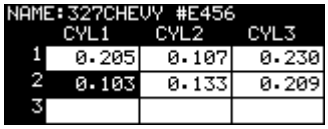
11) Press the OK key to save the changes or the esc key to cancel editing the file parameters.

12) Press the 🏠 key to return to the measurement screen.

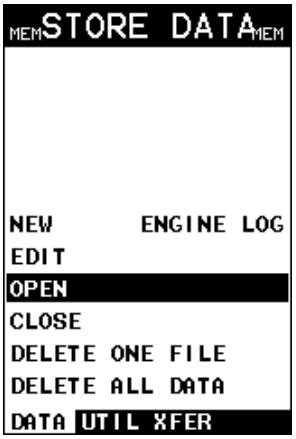
10.7 Changing the active File - Open

The user may have transferred grid templates from a PC to the ***RX8-DL***, or setup grids using the ***RX8-DL*** at an earlier time. The name of the currently active file is always displayed at the top of the **Grid Box** in measurement mode (refer to photo below). It's not only important to recognize what file is currently active, but also be able to change the active file at any time. The following procedures outline this process:

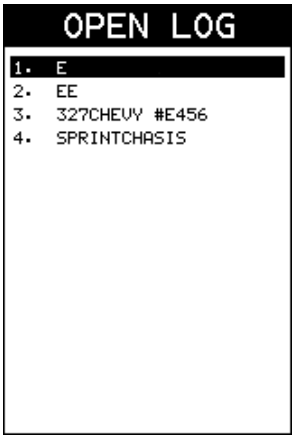
Active File



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

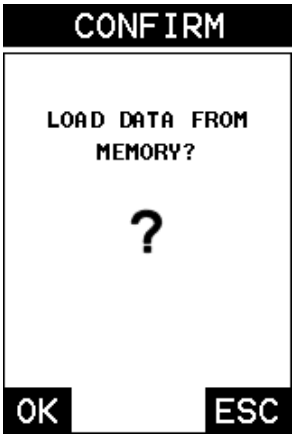


2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **OPEN** is highlighted.



3) Press the ↵ key to display the **Grid List Box**.

4) Use the ▲ and ▼ arrow keys to scroll through the grids until the target grid is highlighted.



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

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

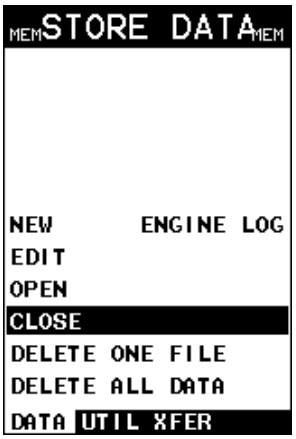
7) Press the ⌂ key to return to the measure screen.

10.8 Closing an active File - Close

A user might not have a current requirement to store measurements, but a file is currently open or active and needs to be closed. The following procedures outline how to close an open or active file:

Close an Active File

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



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



3) Press the ↵ key to close the active file. **Note:** *Following the key press, the **CLOSE** text will be grayed out indicating the file has been close and is no longer active.*

CHAPTER ELEVEN
SETUPS – CREATE, STORE, EDIT, & RECALL

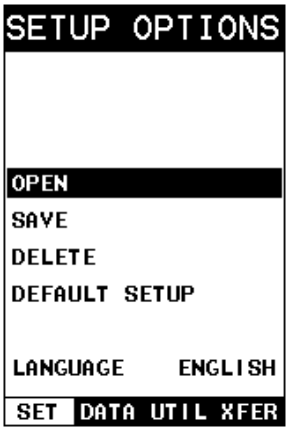
11.1 Introduction to Setups

Often times users are faced with a variety of tasks and applications that are sometimes similar, but very different. The ***RX8-DL*** offers a custom setup feature to store a variety of setup configurations or calibrations for recall at any time. The ***RX8-DL*** can store a total of 64 custom setups that can be backed up and restored to and from a PC and gauge. The feature offers convenience and efficiency by avoiding continuous calibration and setup for those common applications being performed on a constant basis.

11.2 Opening a Setup

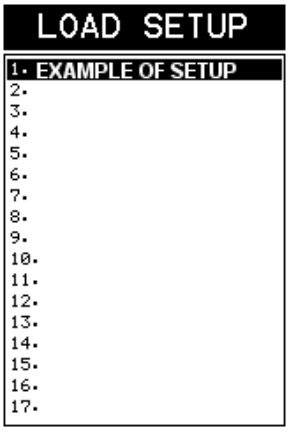
The following procedures outline how to open factory and custom setups:

Open



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

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



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

4) Use the ▲ and ▼ arrow keys to scroll through the setups until the target setup is highlighted.



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

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

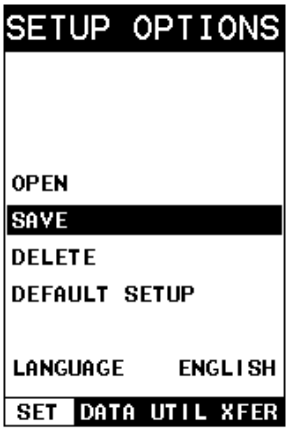
7) Press the ⌂ key to return to the measure screen.

11.3 Saving a Setup

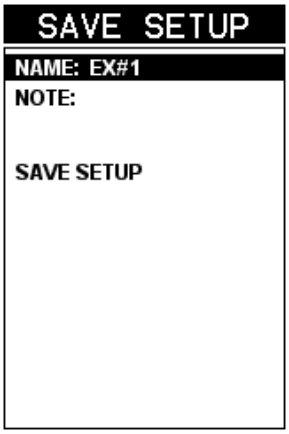
Once the ***RX8-DL*** parameters and features have be adjusted for a given application, the user may elect to save these setting to a specific setup location for future use. This can potentially save time and reduce error between users.

It is sometimes necessary to rename a previously saved setup, or add additional comments about a particular setup. The setup name may have been entered incorrectly, or the user needs to use the setup for a completely different project. An inspector's name or other comments about the project may also be required for additional documentation purposes. The following procedures outline the necessary steps for saving and editing a setup:

Save Setup



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **SAVE** is highlighted.



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

4) Press the ▲ and ▼ arrow keys to scroll the **Name** and **Note** parameters.

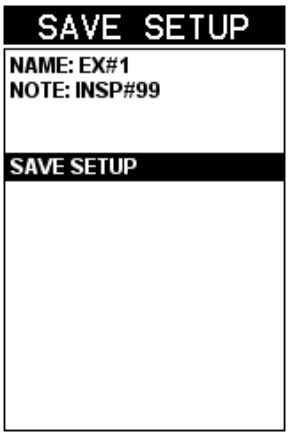


5) When the parameter to edit is highlighted, press the ↵ key to activate the **Alpha Edit Box**.

6) Use the ▲, ▼, ◀, and ▶ arrow keys to scroll through the characters, the ↵ key to select characters, and the clr key to backspace through the characters, until the **Name** or **Note** fields have been edited.

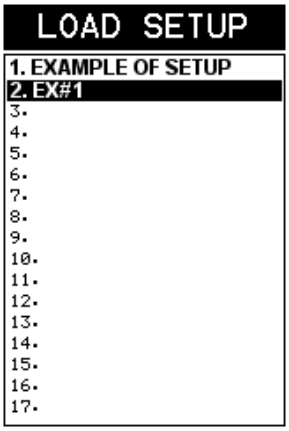
7) Press the OK key to return to the **Save Setup Parameters List Box**.

8) If both parameters will be edited, **repeat steps 4 – 7**.



9) Use the  and  arrow keys to scroll to and highlight **SAVE SETUP**.

10) Press the  key to activate the **Setup List Box**.



11) Use the  and  arrow keys to scroll through the setups until the target location to save the **Setup** is highlighted.



12) Press the OK key to activate the confirmation screen.

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

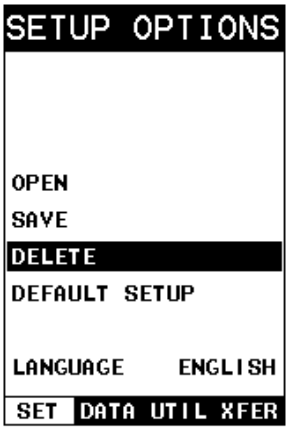
14) Finally, press the key to return to the measurement screen.

Note: *The **Name** and **Comments** of the **Setup** can be edited at any time by simply repeating the **Save Setup** routine described above. Therefore, **the Save Setup** function can also be considered an **Edit Function**.*

11.4 Deleting a Saved Setup

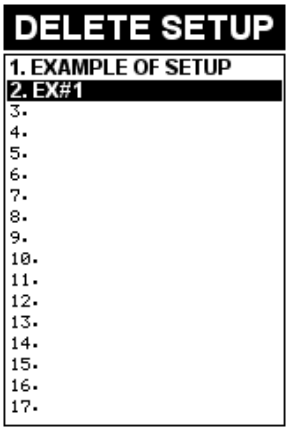
The following option allows a user to delete setup files that were previously saved and no longer needed (clean up).

Delete Setup



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

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



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

4) Press the ▲ and ▼ arrow keys to scroll to the **Setup Name**.

5) When the **Setup Name** is highlighted, press the ↵ key to display the confirmation screen.



6) Press the OK key to delete the **Setup File**.

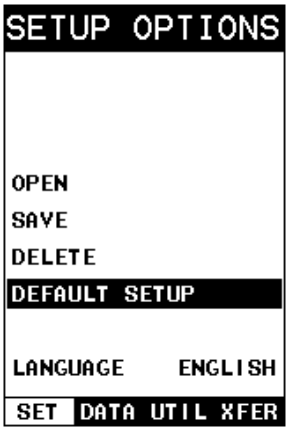
7) Finally, press the key to return to the measurement screen.

11.5 Loading the Default Setup

The default setup feature loads factory settings. If the RX8-DL isn't functioning properly or a parameter appears corrupt, loading the defaults will return the gauge back to factory settings. The procedure to load defaults is outlined below:

Note: *The default file contains no probe zero data. Therefore, a probe zero followed by calibration must be performed after loading the defaults.*

Default Setup



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items.
2) Use the ▲ and ▼ arrow keys to scroll through the sub menu items until **DEFAULT SETUP** is highlighted.
3) Finally, press the ⌂ key to return to the measurement screen.

11.6 Selecting a Language

The ***RX8-DL*** is equipped with a language option. Currently, the only languages supported are English, Spanish, German, French, Hungarian, Czech, however the list continues to grow. Check with Dakota for an updated list. The steps to select one of these languages are outlined below:

Language



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

key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items.

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

3) Press the  and  arrow keys to toggle the language options.

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

CHAPTER TWELVE
USING THE UTILITY SOFTWARE

12.1 Computer System Requirements

DakView will run on many different operating systems: Windows XP, Windows 2000 Professional, Windows 2000 Server, Windows 2000, Vista, Windows 7, 8, 10, or advanced Server operating systems running on Intel or AMD hardware. Additionally there is a version for the Mac OSX platform.

A Pentium 166MHz or faster processor with at least 32 megabytes of physical RAM is required. You should have 40 megabytes of free disk space before attempting to install **DakView**.

File transfer is standard USB connectivity, using a USB-C to USB transfer cable (pt# N-003-0330).

12.2 Installing DakView

DakView is available directly from our website for download free of charge. Stay current by periodically checking the website for the latest version. Simply download the .exe file from our website to your computer, and double click the icon to begin installation. Refer to the online help section in **DakView** for operating instructions.

12.3 Communicating with the *RX8-DL*

DakView will not directly communicate with the ***RX8-DL*** series gauges. The ***RX8-DL*** is equipped with USB, acting as a Thumb Drive (external storage device) when connected to a computer and powered on. Therefore, the SD memory card can be opened as a drive with *directory structure, similar to the C: on your computer. The files stored on the internal S*D can be simply copied (dragged) into any folder on your PC and opened using **DakView**. The PC software will function as a file viewer for the ***RX8-DL*** series gauges.

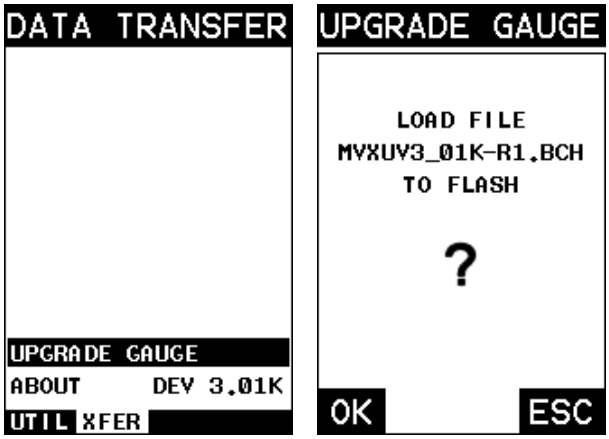
12.4 Line Power

The ***RX8-DL*** can be powered using the standard USB-C to USB-A data cable (N-003-0330), by connecting directly to a USB port on your computer, or using a standard cell phone power adapter directly to an outlet. This is a convenient way to power the gauge for specific bench top applications in a factory line environment.

12.5 Upgrading the *RX8-DL*

The ***RX8-DL*** can be upgraded to the latest revision of firmware at any time. Simply download the latest version posted on the Dakota NDT website, copy the upgrade file to the main drive directory ***RX8-DL***, and use the upgrade utility located in the **XFER** menu. The process is very easy and convenient, allowing our users to stay current with updated feature additions and bug fixes. The procedure to upgrade your ***RX8-DL*** is outlined below:

Upgrading the Firmware



1) Press the ☰ key once to activate the menu items tab. Press the ☰ key multiple times to tab right and the esc key multiple times to tab left until the **XFER** menu is highlighted and displaying the submenu items. Alternatively, press the ◀ and ▶ arrow keys multiple times using the left button wheel.
2) Press the ↵ key to display the upgrade confirmation screen, followed by pressing OK key to start the upgrade process.

Note: *The **RX8-DL** will power down and the alarm lights will flash during the upgrade process.*

APPENDIX A -
VELOCITY TABLE

Material	sound velocity in/us		sound velocity m/s
Aluminum	0.2510		6375
Beryllium	0.5080		12903
Brass	0.1730		4394
Bronze	0.1390		3531
Cadmium	0.1090		2769
Columbium	0.1940		4928
Copper	0.1830		4648
Glass (plate)	0.2270		5766
Glycerine	0.0760		1930
Gold	0.1280		3251
Inconel	0.2290		5817
Iron	0.2320		5893
Cast Iron	0.1800	(approx)	4572
Lead	0.0850		2159
Magnesium	0.2300		5842
Mercury	0.0570		1448
Molybdenum	0.2460		6248
Monel	0.2110		5359
Nickel	0.2220		5639
Nylon	0.1060	(approx)	2692
Platinum	0.1560		3962
Plexiglas	0.1060		2692
Polystyrene	0.0920		2337
PVC	0.0940		2388
Quartz glass	0.2260		5740
Rubber vulcanized	0.0910		2311
Silver	0.1420		3607
Steel (1020)	0.2320		5893
Steel (4340)	0.2330		5918
Steel Stainless"	0.2230		5664
Teflon	0.0540		1372

Tin	**0.1310**		**3327**
Titanium	**0.2400**		**6096**
Tungsten	**0.2040**		**5182**
Uranium	**0.1330**		**3378**
Water	**0.0580**		**1473**
Zinc	**0.1660**		**4216**
Zirconium	**0.1830**		**4648**

APPENDIX B -
SETUP LIBRARY

Num	Name	Comment 1	Gn/AGC	Velocity
1	Enter Custom Name			
2	…			
3	…			
4	…			
5	…			
6	…			
…	…			

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WARRANTY INFORMATION

• Warranty Statement •

Dakota NDT warrants the ***RX8-DL*** against defects in materials and workmanship for a period of two years from receipt by the end user. Additionally, Dakota NDT warrants transducers and accessories against such defects for a period of 90 days from receipt by the end user. If Dakota NDT receives notice of such defects during the warranty period, Dakota NDT will either, at its option, repair or replace products that prove to be defective.

Should Dakota NDT be unable to repair or replace the product within a reasonable amount of time, the customer's alternative exclusive remedy shall be refund of the purchase price upon return of the product.

• Exclusions •

The above warranty shall not apply to defects resulting from: improper or inadequate maintenance by the customer; unauthorized modification or misuse; or operation outside the environmental specifications for the product.

Dakota NDT makes no other warranty, either express or implied, with respect to this product. Dakota NDT specifically disclaims any implied warranties of merchantability or fitness for a particular purpose. Some states or provinces do not allow limitations on the duration of an implied warranty, so the above limitation or exclusion may not apply to you. However, any implied warranty of merchantability or fitness is limited to the five-year duration of this written warranty.

This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state or province to province.

• Obtaining Service During Warranty Period •

If your hardware should fail during the warranty period, contact Dakota NDT and arrange for servicing of the product. Retain proof of purchase in order to obtain warranty service.

For products that require servicing, Dakota NDT may use one of the following methods:

- Repair the product
- Replace the product with a re-manufactured unit
- Replace the product with a product of equal or greater performance
- Refund the purchase price.

• After the Warranty Period •

If your hardware should fail after the warranty period, contact Dakota NDT for details of the services available, and to arrange for non-warranty service.

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