

OPERATION MANUAL

DAKOTA ULTRASONICS

MX

Visual A / B Scan Thickness Gauge



| | |
|---|-----|
| CHAPTER ONE INTRODUCTION | 1 |
| CHAPTER TWO QUICK STARTUP GUIDE | 2 |
| CHAPTER THREE KEYBOARD, MENU, & CONNECTOR REFERENCE..... | 13 |
| CHAPTER FOUR PRINCIPALS OF ULTRASONIC MEASUREMENT | 23 |
| CHAPTER FIVE SELECTING THE MEASUREMENT MODE | 28 |
| CHAPTER SIX MAKING MEASUREMENTS | 31 |
| CHAPTER SEVEN USING THE A-SCAN & B-SCAN DISPLAYS | 45 |
| CHAPTER EIGHT THRU PAINT MEASUREMENT TECHNIQUE | 70 |
| CHAPTER NINE ADDITIONAL FEATURES OF THE MVX..... | 73 |
| CHAPTER TEN DATA STORAGE – SETUP, EDIT, & VIEW GRIDS | 82 |
| CHAPTER ELEVEN SETUPS – CREATE, STORE, EDIT, & RECALL | 100 |
| CHAPTER TWELVE USING THE FLAW MODE FEATURE..... | 107 |
| CHAPTER THIRTEEN USING THE UTILITY SOFTWARE..... | 111 |
| APPENDIX A - VELOCITY TABLE..... | 112 |
| APPENDIX B - SETUP LIBRARY..... | 114 |

CHAPTER ONE INTRODUCTION

The Dakota Ultrasonics model **MVX** is a visual A / B scan ultrasonic thickness gauge. Based on the same operating principles as SONAR, the **MVX** 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 Ultrasonics maintains a customer support resource in order to assist users with questions or difficulties not covered in this manual. Customer support may be reached at any of the following:

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

CHAPTER TWO QUICK STARTUP GUIDE

Turn the **MVX** on and off using the switch located on the bottom right corner of the keypad. When **MVX** 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 Selecting The Transducer Type

The first step in using the **MVX** is to select the transducer type according to frequency and diameter. By selecting the transducer type from a predefined list, the **MVX** can recall specific properties about the transducer. **Note:** Once the transducer has been selected, the **MVX** will store and recall this transducer type every time the **MVX** 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. Therefore, if you have previously gone through this section and selected the transducer you are using, proceed to the next section. Use the following steps to select your transducer type:

Selecting the Transducer Type

| | | | | |
|-----------|------------|------|-----------|-------|
| 1. | 3/16IN | - | 5.0MHZ | |
| 2. | 3/16IN | - | 7.5MHZ | |
| 3. | 3/16IN | - | 10.0MHZ | |
| 4. | 1/4IN | - | 1.0MHZ | |
| 5. | 1/4IN | - | 2.25MHZ | |
| 6. | 1/4IN | - | 5.0MHZ | |
| 7. | 1/4IN | - | 5.0MHZ HD | |
| 8. | 1/4IN | - | 7.5MHZ | |
| PROBE | CAL | DISP | TUNE | GATE |
| ZERO | TRANSDUCER | | | |
| PULSE | | | | SPIKE |
| TYPE | | | | 1 |
| FLAW MODE | | | | OFF |

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

- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **TYPE** is highlighted.
- 3) Press the **ENTER** key to display the list of transducer types.
- 4) Press the **UP** and **DOWN** arrow keys to scroll through the transducer list until the appropriate type is highlighted.
- 5) Press the **ENTER** key to display the confirmation screen.
- 6) Press the **OK** key to select the transducer and return to the menu screen, or **ESC** to cancel the selecting the transducer.

2.2 Probe Zero & Calibration

The next step is to calibrate the **MVX** to the material and transducer being used. If a sound velocity is not known, the **MVX** can be calibrated to a known thickness sample. This demo will briefly explain both of these techniques.

In either case, the transducer **MUST** be zeroed on the probe zero disk (battery cover located on the top of the unit as follows:

Performing a Probe Zero

| PROBE | CAL | DISP | TUNE | GATE |
|------------------------|-----|------|------|-------|
| ZERO TRANSDUCER | | | | |
| PULSE | | | | SPIKE |
| TYPE | | | | 1 |
| FLAW MODE | | | | OFF |

- 1) Apply a drop of couplant on the transducer and place the transducer in steady contact with the probe zero disk, and obtain a steady reading.

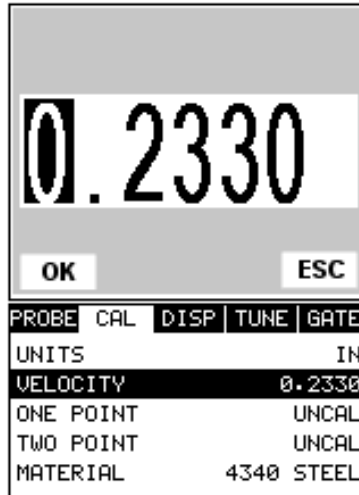
- 2) Assuming the probe menu is still displayed from the previous type selection, use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **ZERO TRANSDUCER** is highlighted.
- 3) Press the **ENTER** key to display the confirmation screen.
- 4) Press the **OK** key to complete the probe zero function, or **ESC** key to cancel the probe zero function.
- 5) 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 **MVX**. 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.

Known Velocity

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

Using a Known Material Velocity

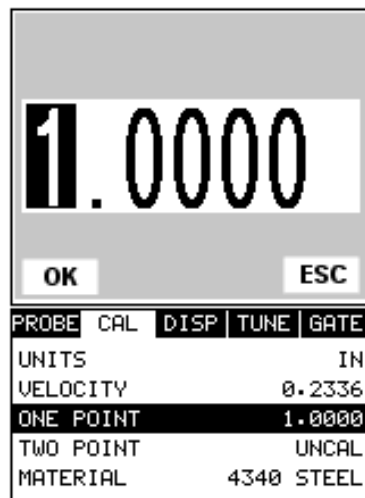


- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **VELOCITY** is highlighted.
- 3) Press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps **4 & 5** until the velocity number is correctly displayed.
- 7) Press the **OK** key to set the velocity and return to the menu screen, or **ESC** to cancel entering the velocity.
- 8) Finally, press the **MEAS** key to return to the measurement screen and begin taking readings.

Known Thickness

Sometimes the sound velocity of a material is not known. In this case a sample with a known thickness can be used to determine the sound velocity. It would be very handy to carry a set of mechanical calipers to use in conjunction with the **MVX** for calibration in the field:

Using a Known Thickness



Note: Be sure that the probe zero procedure has been performed prior to performing this calibration 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 **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.

- 3) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **ONE POINT** is highlighted.
- 4) Press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** 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 entering the velocity.
- 9) Finally, press the **MEAS** 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 numbers. 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

| PROBE | CAL | DISP | TUNE | GATE |
|-----------|-----|------|------|--------|
| UNITS | | | | IN |
| VELOCITY | | | | 0.2330 |
| ONE POINT | | | | UNCAL |
| TWO POINT | | | | UNCAL |
| MATERIAL | | 4340 | | STEEL |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **MATERIAL** is highlighted.
- 3) Press the **ENTER** key to display the list of material types.
- 4) Press the **UP** and **DOWN** arrow keys to scroll through the material list until the appropriate material is highlighted.
- 5) Press the **ENTER** key to display the confirmation screen.
- 6) Press the **OK** key to select the material and return to the menu screen, or **ESC** to cancel the material selection.
- 7) Finally, press the **MEAS** key to return to the measurement screen and begin taking readings.

2.3 Measure

The **MVX** is now ready to measure. There are four different measurement view options, each with a specific purpose. The steps below outline how to toggle between the different view mode options:

Selecting the Measurement View Option

| PROBE | CAL | DISP | TUNE | GATE |
|-----------|-----|------|------|------|
| VIEW | | | | RF |
| BACKLIGHT | | | | OFF |
| CONTRAST | | | | 10 |
| DELAY | | | | 0.00 |
| WIDTH | | | | 2.06 |

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

RF: Is useful to see exactly what the signal looks like directly around the detect point. Use this view only when viewing smaller ranges (zoomed in) around the detection point. This can be done manually by adjusting the delay and width settings.

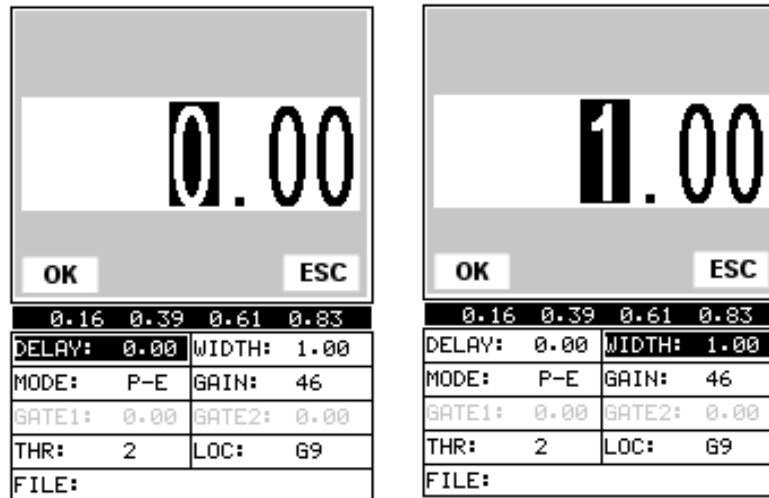
RECTIFIED (RECT): Displays the entire range being scanned. This screen is useful to “get the big picture” when viewing wide ranges (zoomed out). The point which is triggering the digital thickness reading (called the detect) is displayed as a vertical dashed line.

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.

DIGITS: Displays the digital thickness value using a larger font size. This view is useful when the MVX is being used as a basic thickness gauge.

Once the view has been selected according to the application requirements, the **delay** and **width** of the screen will potentially need to be adjusted, if the view has been set to **RF**, **RECT**, or **BSCAN**. Use the following steps to adjust these settings directly from the measurement screen as follows:

Adjusting the Delay & Width



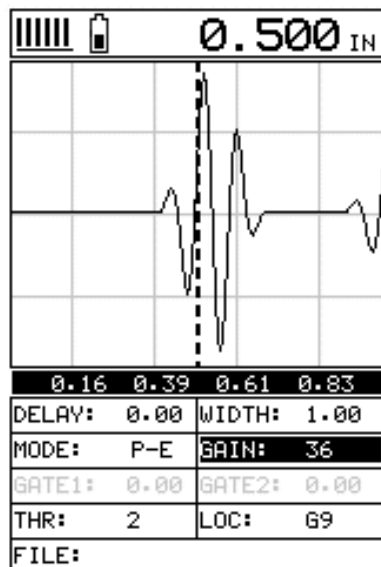
- 1) Press the **MEAS** key once to activate the measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left, until the either the **DELAY** or **WIDTH** cell is highlighted.
- 2) Use the **UP**, **DOWN**, **LEFT**, or **RIGHT** arrow keys to scroll the **DELAY** and **WIDTH** values.
- 3) Repeat steps 1 & 2 until the range is correctly being displayed.

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

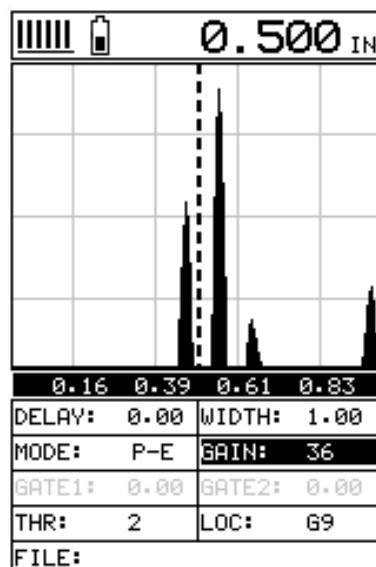
- 1) Press the **MEAS** key once to activate measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left, until the either the **DELAY** or **WIDTH** cell is highlighted.

- 2) Press the **ENTER** key to display the digits edit box.
- 3) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 4) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 5) Repeat steps 3 & 4 until the **DELAY** or **WIDTH** value is correctly displayed.
- 6) Press the **OK** key to set the **DELAY** and **WIDTH** value and return to the measure screen, or **ESC** to cancel entering the **DELAY** or **WIDTH** value.
- 7) Finally, press the **MEAS** key to return to the measurement screen and begin taking readings.

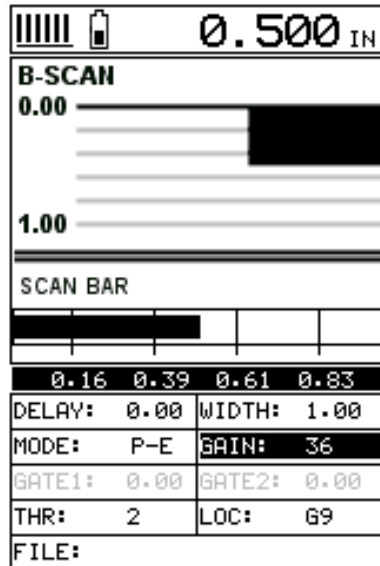
Note: The **DELAY** & **WIDTH** can also be adjusted from the menu tab items. However, using the hot menu keys is the easiest method.



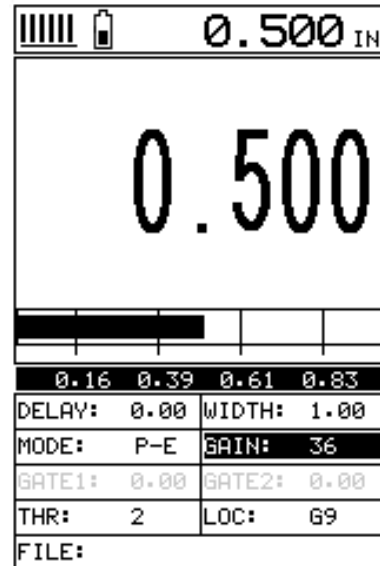
RF



RECTIFIED



B-SCAN



DIGITS

In the upper left corner of each of the mode photos above, is the repeatability indicator. The repeatability indicator is represented by six vertical bars and represents how repeatable the measurements are. In regular measurement mode, the **MX** makes 4 measurements a second. In scan mode, the **MX** makes 32 measurements a second. When the **MX** is idle, only the left vertical bar and the underline will be displayed. However, when the **MX** is making a measurement, five or six of the bars should be displayed on the repeatability indicator. If fewer than five bars are showing, the **MX** is having difficulty achieving a stable measurement and the thickness value displayed is potentially be unstable. Another thing to note is the vertical broken line in the **RF** and **RECTIFIED** photos above. This line represents the actual point of detection. The **MX** uses a zero crossing or flank detection method, and presents the actual point of measurement on the display.

CHAPTER THREE KEYBOARD, MENU, & CONNECTOR REFERENCE



3.1 Menu Key (Operation & Sub Menus)

The **Menu** key activates the primary menu structure containing 9 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

| PROBE | CAL | DISP | TUNE | GATE |
|-----------------|-----|-------|------|------|
| ZERO TRANSDUCER | | | | |
| PULSE | | SPIKE | | |
| TYPE | | 1 | | |
| FLAW MODE | | OFF | | |

1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left until the desired tab group is highlighted and displaying the submenu items.

Now that your 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 **UP** and **DOWN** arrow keys to scroll through the sub menu items until the desired function is highlighted.

2) Depending on which function is highlighted, use the **LEFT**, **RIGHT**, and **Enter** 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:

| | | | | |
|-----------------|-----|------|------|-------|
| PROBE | CAL | DISP | TUNE | GATE |
| ZERO TRANSDUCER | | | | |
| PULSE | | | | SPIKE |
| TYPE | | | | 1 |
| FLAW MODE | | | | OFF |

3.2 Probe – Menu

Zero: The **MVX** is zeroed in much the same way that a mechanical micrometer is zeroed. If the **MVX** is not zeroed correctly, all of the measurements made using the **MVX** may be in error by some fixed value. Refer to the section on page 35, for an explanation of this important procedure.

Pulse: The **MVX** has an adjustable pulse width for both high penetration and resolution applications. The pulse width refers to the duration of time the pulser is on. The options are **Spike**, **Thin**, and **Wide**. Refer to page 73 for a further explanation.

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 31 for a further explanation.

Flaw Mode: Activates the flaw detection mode and view. This feature is for use with single element angle beam transducers and used as a general prove-up flaw inspection mode. Refer to page 107 for a further explanation.

| PROBE | CAL | DISP | TUNE | GATE |
|-----------|-----|------|------|------------|
| UNITS | | | | IN |
| VELOCITY | | | | 0.2330 |
| ONE POINT | | | | UNCAL |
| TWO POINT | | | | UNCAL |
| MATERIAL | | | | 4340 STEEL |

3.3 CAL – Menu

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

Velocity: Function to calibrate the MVX by setting the velocity to a known material velocity. Refer to page 37 for further info.

One Point: Performs a single point calibration. This option allows the user to automatically calculate the velocity by entering a known sample thickness. Refer to page 39 for further info.

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

Material: 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 44 for further info.

| PROBE | CAL | DISP | TUNE | GATE |
|-----------|-----|------|------|------|
| VIEW | | | | RF |
| BACKLIGHT | | | | OFF |
| CONTRAST | | | | 10 |
| DELAY | | | | 0.00 |
| WIDTH | | | | 2.06 |

3.4 DISP (display) – Menu

View: Selectable RF wave, RECT (rectified) wave, BSCAN (cross section), and DIGITS (large digits) views. Refer to page 46 for further info.

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

Contrast: Adjustable display contrast for variable light conditions.

Delay: Provides the user the ability to change where the left side of the display window starts according to thickness, in inches or millimeters. Refer to page 55 for further info.

Width: Provides the user the ability to change the overall size of the viewable measurement area. It functions a lot like a zoom on a camera. Refer to page 52 for further info.

| PROBE | CAL | DISP | TUNE | GATE |
|---------------|-----|------|----------|--------|
| GAIN | | | | 46 |
| AGC | | | | 1 |
| THRESHOLD | | | | 2 |
| POLARITY | | | NEGATIVE | |
| RECT WAVEFORM | | | | FILLED |

3.5 TUNE – Menu

Gain: Increases or decreases the overall amplitude of the signal. Much like turning the volume up or down on a stereo receiver. Refer to page 57 for further info.

AGC: The *MVX* is equipped with an automatic gain control when operating in echo-echo mode only. This is much like turning the volume up or down on a stereo receiver. However, the *MVX* will automatically control how much the volume is turned up or down. Alternatively, the AGC can be manually controlled using the same procedures as GAIN described above. Refer to page 57 for further info.

Threshold: Enables the user to set the sensitivity level of the *MVX*. The amplitude of the signal must reach and exceed the threshold level before a measurement is detected. Refer to page 60 for further info.

Polarity: The *MVX* operates on a zero crossing detection principle. This feature toggles which stroke of the cycle the crossing detection uses, either positive or negative. Refer to page 78 for further info.

Rect Waveform: This option provides the user an outlined or filled view option when the display setting is in RECT (rectified) wave mode only. Refer to page 80 for further info.

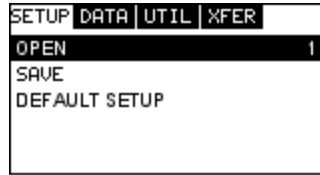
| PROBE | CAL | DISP | TUNE | GATE |
|--------------|-----|------|------|------|
| MEASURE MODE | | | | E-E |
| GATE 1 | | | | 0.00 |
| GATE 2 | | | | 0.00 |

3.6 GATE – Menu

Measure Mode: Used to select the measurement mode for different application requirements. The modes are P-E (pulse-echo), P-E GT(pulse-echo w/gate), and E-E(echo-echo). Refer to page 24 for further info.

Gate 1: Gates allow the user to view areas or sections of the waveform and ignore others. Gate 1 can be used in both pulse-echo and echo-echo measurement modes. Refer to page 63 for further info.

Gate 2: Gates allow the user to view areas or sections of the waveform and ignore others. Gate 2 is only used in echo-echo measurement mode. Refer to page 67 for further info.

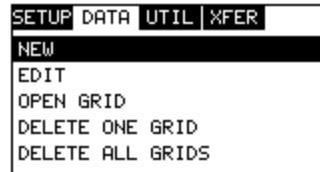


3.7 SETUP – Menu

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 100 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 102 for further info.

Default Setup: Loads a basic default setup. Use only as a last resort when the setups in the MVX have been corrupted and a computer is not accessible. Refer to page 105 for further info.



3.8 DATA – Menu

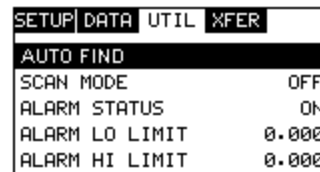
New: Allows the user the ability to create a new alpha numeric grid with custom parameters, rows, and columns depending on their application reporting requirements. Refer to page 82 for further info.

Edit: Gives the user the ability to change parameters of grid that have been previously saved. Note: Pre-defined coordinates cannot be changed once they have been created. Refer to page 95 for further info.

Open: This function provides the user with the ability to recall grids that currently exist in memory from a list of grids. Refer to page 97 for further info.

Delete One Grid: This function provides the user with the ability to delete one individual grid from a list of multiple grids previously saved in memory. Refer to page 93 for further info.

Delete All Grids: This function provides the user with the ability to delete all grids currently stored in memory. Refer to page 93 for further info.



3.9 UTIL (utilities) – Menu

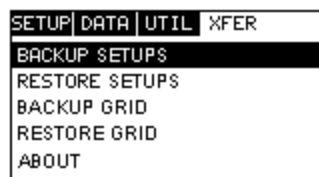
Auto Find: Automatically locates the detection point if the measurement is out of the viewable display area. Refer to page 74 for further info.

Scan Mode: This function enables a hi speed scan mode that increases the overall sample rate from the standard 4 measurements a second to 32 measurements a second. Refer to page 75 for further info.

Alarm Status: Toggles alarm mode on or off. Refer to page 76 for further info.

Alarm LO Limit: 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 77 for further info.

Alarm HI Limit: 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 78 for further info.



3.10 XFER (transfer) – Menu

Backup Setups: Enables the user the ability to backup the setups currently stored in the *MVX* to a PC via RS232 port. Refer the help section of the **DakView 3** or **MVXview** software for a complete electronic manual.

Restore Setups: Enables the user the ability to restore the setups currently saved on a PC to an *MVX* via RS232 port. Refer the help section of the **DakView 3** or **MVXview** software for a complete electronic manual.

Backup Grid: Enables the user the ability to backup grids currently stored in the *MVX* to a PC via RS232 port. Refer the help section of the **DakView 3** or **MVXview** software for a complete electronic manual.

Restore Grid: Enables the user the ability to restore grids currently saved on a PC to an *MVX* via RS232 port. Refer the help section of the **DakView 3** or **MVXview** software for a complete electronic manual.

About: Provides the user with Dakota Ultrasonics contact information and the *MVX* software version. Refer the help section of the **DakView 3** or **MVXview** software for a complete electronic manual.



3.11 CLR (clear) Key

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



3.12 MEAS (measurement mode) Key

The **MEAS** key puts the **MVX** into it's primary mode of operation. In this mode, the user has a complete view of the LCD, as well as control of the **Hot Menu Functions**. These hot functions provide the user with the ability to make crucial adjustments to the display, waveform settings, and grid storage locations without having to search through the menu and sub menu items. It's important to first get familiar with moving around in the hot functions as follows:

Getting Around in the Hot Menus

| | |
|-------------|-------------|
| DELAY: 0.00 | WIDTH: 2.06 |
| MODE: P-E | GAIN: 46 |
| GATE1: 0.00 | GATE2: 0.00 |
| THR: 2 | LOC: 69 |
| FILE: | |

- 1) Press the **MEAS** key at any time to return to the primarily measurement mode.
- 2) Press the **MEAS** key multiple times to tab right through the menu fields, and the **ESC** key multiple times to tab left through the menu fields, until the desired hot function is highlighted.

Now that you're familiar with activating and moving amongst the hot function fields, let's have a look at how to adjust or change the values of these fields:

Adjusting the Values of the Hot Menus

- 1) Use the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to increase and decrease the values of the hot function fields.
- 2) **Repeat step 1** until the desired value has been achieved.

Alternatively, the delay, width, gain, and threshold hot function fields can be changed using the **Digit Edit Box** as follows:

- 1) Press the **ENTER** key to display the **Digits Edit Box**.
- 2) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 3) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 4) Repeat steps **2 & 3** until the delay, width, gain, or threshold number is correctly displayed.
- 5) Press the **OK** key to set and return to the measure screen, or **ESC** to cancel entering the delay, width, gain, or threshold value.



3.13 OK Key

The primary function of the **OK** key is confirmation of a change or selection. This key also has a secondary function: pressing the OK key while in the main measurement screen, toggles large digits to be displayed in place of the hot menu items. This will provide the user with a larger digital readout of the measurement, while in RF or RECT display modes.



3.14 ESC Key

The **ESC** key is used in the **MENU**, **MEAS**, and **EDIT** functions as a back or escape function. This key also has a secondary function: pressing the ESC key, while in the main measurement screen, toggles between all of the possible display view options – RF, RECT, B-SCAN, and DIGITS.



3.15 Arrow Keys

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



3.16 ENTER key

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



3.17 MULTI MODE Key

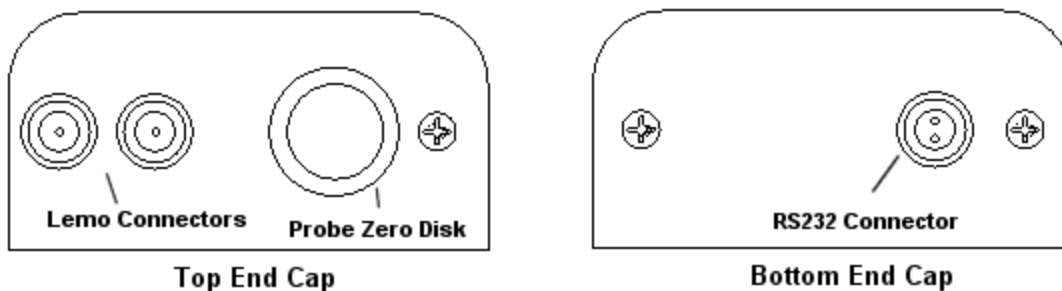
The **MULTI MODE** key toggles the measurement mode of the **MVX**, from pulse-echo (flaw mode), to echo-echo (thru paint) mode. This is a quick automatic preset mode that enables the user to change modes without having to manually adjust the view and gate parameters. Both modes have been configured for use with any transducer type selected.



3.18 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 saved prior to powering off.

3.19 Top & Bottom End Caps



The top & bottom end panels are where all connections are made to the **MVX**. 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 **MVX's** top end cap. The transducer connectors are of type Lemo "00". Note: There is no polarity associated with connecting the transducer to the **MVX**.

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

RS-232 Connector

Refer to Diagram: The **RS-232** connector, located on the bottom end cap, is a 2 pin female Lemo connector. It is designed to connect directly from the **MVX** to a standard AT serial port on a PC. The cable supplied with the **MVX** is a Lemo to 9 pin serial cable. **Note:** This connector is also used to upgrade the **MVX** 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 mode has larger errors due to changes in temperature of the delay line. However, multi-echo techniques help to minimize these errors.

4.6 Measurement Modes

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

Pulse-Echo Mode (Flaw & Pit detection)

Pulse-echo mode measures from the initial pulse (sometimes referred to as an artificial zero) to the first echo (reflection). In this mode, the transducer is placed on a reference disk, located on top of the *MVX*, and a key is pressed to establish a zero point for the particular transducer.

In this mode errors result from surface coatings and temperature variations.

Since pulse-echo only requires one reflection, it is the most sensitive mode for measuring weak reflections (flaws) typically found when measuring heavily corroded metals.

V-Path Correction

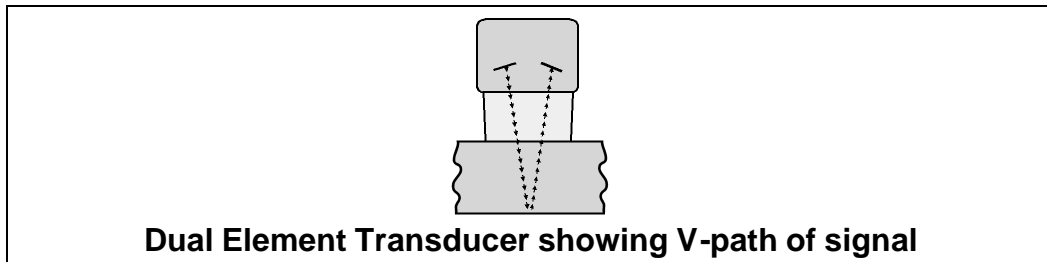
Dual element delay line transducers have two piezoelectric elements mounted at an angle on one end of the delay line. One element is used for transmitting sound, while the other element only receives sound. The two elements and their delay lines are packaged in a single housing but acoustically isolated 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.

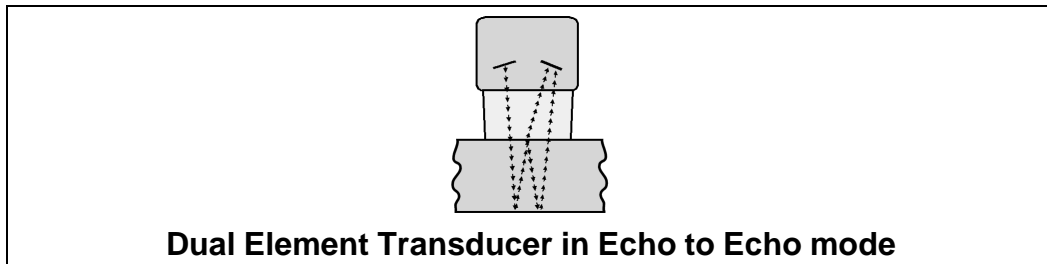
Dual element delay line transducers are usable over a range of 0.025 inches to 20 inches depending on the material, frequency, and diameter.

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.



Echo-Echo Mode

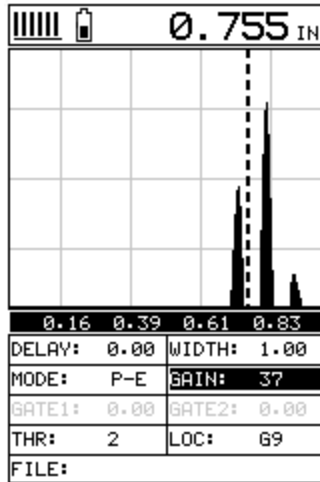
The echo-echo mode measures between two reflections. This technique is commonly used to eliminate errors from surface coatings and also to make measurements in multiple layered materials. The disadvantage is that two echoes are needed which requires a much stronger echo (reflection).



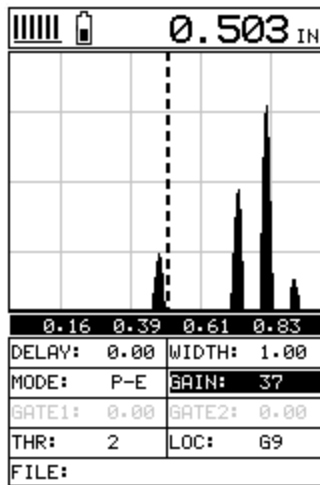
Searching for small defects

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. The A-Scan display of the **MVX** can be used to see the defect and optimize the transducer placement.

Sometimes a grain particle or air bubble will cause a reflection. Without the A-Scan display it is impossible to know if this is a thin area or just a harmless defect. The A-Scan allows the user to see the backwall as well as the defect similar to a flaw detector.



Waveform showing echo from corroded backwall



Waveform showing flaw with solid backwall

4.7 Glossary of terms

Repetition Rate & Display Update

The repetition rate is how often the **MVX** generates a burst of ultrasound.

The **MVX** has a fixed repetition rate of 1 kHz, or 1000 times per second. The **MVX** updates the display 4 times per second in regular measurement mode and 32 times a second in hi speed scan mode. Therefore, the scan mode is most suitable for fast scans of a test piece at a lower resolution.

Variable Pulser Width

Transducers have a center frequency where they are most efficient at transmitting sound (i.e. they are resonant). The **MVX** has a variable width pulser with three setting options (**spike, thin, wide**). These settings determine the period of time the pulser turned is on. High frequency applications, where resolution is a requirement, may require the spike or thin settings to achieve optimal results. Low frequency applications, where more penetration is a needed, may require the thin or wide settings, offering increased penetration. The variety of transducer frequencies and diameters used in conjunction with the pulser settings, enable users to fine tune the **MVX** for their application needs.

Gates

Gates control the time measurement process. They enable the user to select measurement regions and threshold levels (sensitivity). The **MVX** is equipped with two gates. In pulse-echo mode a single gate can be used to eliminate noise. In echo-echo mode both gates are used. In this mode the second gate starts automatically after a signal is detected during the gates region, and after a user adjustable delay, sometimes called a hold-off.

CHAPTER FIVE

SELECTING THE MEASUREMENT MODE

5.1 The setup library

The *MVX* contains 64 user configurable preset locations to store custom setups for easy recall. These setups can be optimized for the user's specific application needs and can also be stored on a PC and transferred bi-directionally using Dakota's PC interface software included with the instrument.

The setups supplied with the instrument cover some of the more typical applications commonly used with this type of instrument. These setups can be recalled, modified, and overwritten to one of 64 setup locations. Therefore, these factory setups can also be considered a good starting point to be modified for custom applications. The PC software includes a default setup file that can be uploaded to the gauge at any time to restore factory settings. However, it is recommended that the user consider saving modified setups to an empty location rather than overwriting the factory setups in the *MVX*. Once again, these factory settings are excellent starting points for custom setups.

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. Select a low frequency transducer. Depending on the thickness of the material, use a 2.25MHz or lower frequency transducer. Larger diameters offer greater penetration power because of the crystal size, for difficult to measure materials.

Corrosion & Pit Detection in steel

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. Alternatively, enable a single gate to block this noise. See the section **Gate 1** on page 63 for more information.

Restricted access

In order to measure materials with lots of curvature or restricted access, use and select higher frequencies with smaller diameters. The smallest diameter uses 3/16" crystals with a contact area of .250".

CHAPTER SIX MAKING MEASUREMENTS

The steps involved in making measurements are detailed in this section. The following sections outline how to setup and prepare your **MVX** for field use.

In pulse-echo modes, the probe zero must be measured on the reference disk (battery disk) attached to the top of the instrument. This compensates for variation in the transducer. In all modes the sound velocity must be determined. The sound velocity is used to convert the transit time to a physical length. The sound velocity can be selected from a material chart in the manual, selected from a material list in the **MVX**, or for greater precision, determined from a sample of the test material that has been mechanically measured. To enter the velocity from a table, look up the material on the chart in the appendix of this manual and refer to the section below on Calibration to a Known Velocity. To determine the velocity of a single sample, refer to the Material Calibration section on page 39.

When measuring curved materials, it is more accurate to calibrate from two test points, one at the minimum limit of the target thickness and one at the maximum limit. In this case the reference disk mounted to the **MVX** is not used. This is called two-point calibration and is described on page 40.

6.1 Selecting The Transducer Type

The first step in using the **MVX** is to select the transducer type from the transducer list located in the tabbed menu items by frequency and diameter. By selecting the transducer type from a predefined list, the **MVX** can recall specific properties about the transducer. **Note:** Once the transducer has been selected, the **MVX** will store and recall this transducer type every time the **MVX** is powered on/off. The type will only change if the user physically selects another type from the list, or selects a previously saved setup. Therefore, if you have previously gone through this section and selected the transducer you are using, proceed to the next section. Use the following steps to select your transducer type. **Note:** Be sure the transducer type selected is the same as the transducer plugged into the **MVX**. **Failure to do this will result in erroneous measurements:**

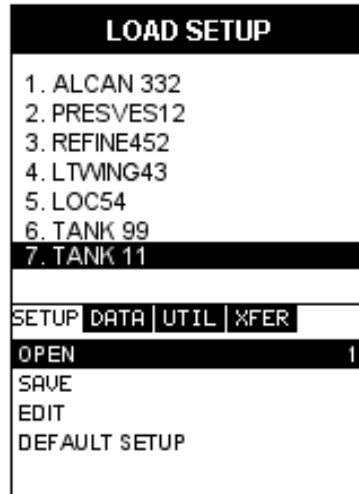
Selecting the Transducer Type

| | | | |
|---|--------|-------|-----------|
| 1. | 3/16IN | - | 5.0MHZ |
| 2. | 3/16IN | - | 7.5MHZ |
| 3. | 3/16IN | - | 10.0MHZ |
| 4. | 1/4IN | - | 1.0MHZ |
| 5. | 1/4IN | - | 2.25MHZ |
| 6. | 1/4IN | - | 5.0MHZ |
| 7. | 1/4IN | - | 5.0MHZ HD |
| 8. | 1/4IN | - | 7.5MHZ |
| PROBE CAL DISP TUNE GATE | | | |
| ZERO TRANSDUCER | | | |
| PULSE | | SPIKE | |
| TYPE | | | 1 |
| FLAW MODE | | | OFF |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **PROBE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **TYPE** is highlighted.
- 3) Press the **ENTER** key to display the list of transducer types.
- 4) Press the **UP** and **DOWN** arrow keys to scroll through the transducer list until the appropriate type is highlighted.
- 5) Press the **ENTER** key to display the confirmation screen.
- 6) Press the **OK** key to select the transducer and return to the menu screen, or **ESC** to cancel the material selection.

Now that the proper transducer has been selected and connected to the **MVX**, the measurement mode must be chosen according to the type of application. Following the recommendations in the prior chapter, there are three different ways to select the measurement mode as follows:

Selected from a Setup



Important Note: Stored setups will save all the parameters of the *MVX*. Therefore, if a transducer was selected in the previous section and a setup is now being recalled, the transducer saved in the setup will overwrite the transducer previously selected. Be sure the transducer saved with the setup is the same as the transducer currently being used. Alternatively, you can select a transducer again after recalling a setup. This will override the transducer saved with the setup.

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **OPEN** is highlighted.
- 3) Press the **ENTER** key to display the list of stored setups.
- 4) Press the **UP** and **DOWN** arrow keys to scroll through the list of setups until the appropriate setup is highlighted.
- 5) Press the **ENTER** key to display the confirmation screen.

- 6) Press the **OK** key to select the setup and return to the menu screen, or **ESC** to cancel the selection process.
- 7) Press the **MEAS** key to return to the measurement screen.

Alternatively, the measurement mode can be simply selected from **the Hot Menu Items** or selected from a sub menu feature as follows:

Hot Menu Selection

| | |
|------------------|-------------|
| DELAY: 0.00 | WIDTH: 2.00 |
| MODE: P-E | GAIN: 46 |
| GATE1: 0.00 | GATE2: 0.00 |
| THR: 4 | LOC: 69 |
| FILE: | |

- 1) Press the **MEAS** key once to activate measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left, until the **MODE** cell is highlighted.
- 2) Use the **UP**, **DOWN**, **LEFT**, or **RIGHT** arrow keys to scroll the modes **P-E** (pulse-echo flaws and pits), **P-E GT** (pulse-echo flaws and pits w/gate), and **E-E** (echo-echo thru paint w/2 gates) until the target mode is selected.

Finally, the measurement mode can be selected from the menu items as follows:

Selected Using The Tabbed Submenu Items

| PROBE | CAL | DISP | TUNE | GATE |
|--------------|-----|------|------|------|
| MEASURE MODE | | | | E-E |
| GATE 1 | | | | 0.00 |
| GATE 2 | | | | 0.00 |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **GATE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **MEASURE MODE** is highlighted.
- 3) Use the **LEFT** and **RIGHT** arrow keys to scroll the mode options. Once the mode is displayed, press the **MEAS** key to return to the measurement mode screen.

6.2 Probe zero

As noted in chapter 3, the probe zero function is a very important and necessary function that must be done prior to calibration. It should also be done on a regular basis. If the **MVX** is not zeroed correctly, all of the measurements taken, may be in error by some fixed value. In order to perform a probe zero, the **MVX** must be in pulse-echo mode. If echo-echo mode was previously selected in the last section, skip this section and continue on to the next. **Note:** If you intend to switch between measurement modes simultaneously, temporarily select the pulse-echo mode using the hot menu option, perform the probe zero function, and switch back to echo-echo measurement mode after zeroing. The following steps outline the procedure for performing a probe zero:

Performing a Probe Zero

| | | | | |
|-----------------|-----|-------|------|------|
| PROBE | CAL | DISP | TUNE | GATE |
| ZERO TRANSDUCER | | | | |
| PULSE | | SPIKE | | |
| TYPE | | 17 | | |

- 1) Clean the surface of the **Probe Zero Disk**, located on top of the **MVX** (battery cover).
- 2) Apply a drop of couplant to the end of the transducer, or probe disk, and hold the transducer in steady contact with the reference disk.
- 3) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **PROBE** menu is highlighted and displaying the submenu items.
- 4) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **ZERO TRANSDUCER** is highlighted.
- 5) Press the **ENTER** key to display the confirmation screen.
- 6) Press the **OK** key to zero the transducer and return to the menu screen, or **ESC** to cancel the zeroing process.
- 7) Remove the transducer from the probe zero disk.
- 8) Press the **MEAS** key to return to the measurement screen.

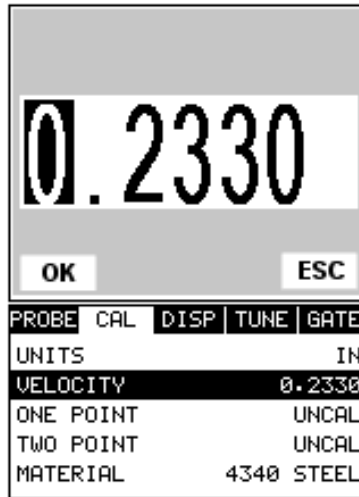
6.3 Material Calibration

In order for the **MVX** to make accurate measurements, it must be set to the correct sound velocity of the material being measured. Different types of materials have different inherent sound velocities. 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.

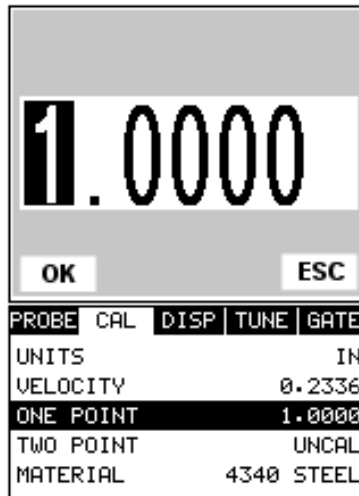
The **One Point** calibration is the simplest and most commonly used calibration method - optimizing linearity over large ranges. The **Two Point** calibration allows for greater accuracy over small ranges by calculating the probe zero and velocity. The **MXV** provides four simple methods for setting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

Calibration to a known velocity



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **CAL** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **VELOCITY** is highlighted.
- 3) Press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps **4 & 5** until the velocity number is correctly displayed.
- 7) Press the **OK** key to set the velocity and return to the menu screen, or **ESC** to cancel entering the velocity.

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

One Point Calibration

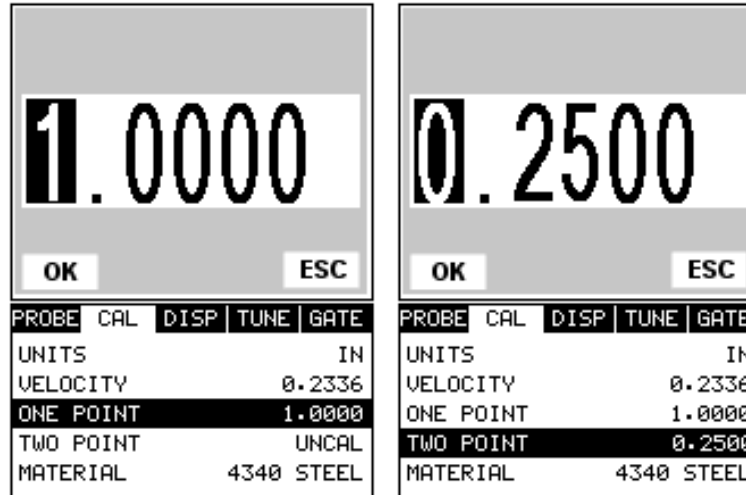
Note: Be sure that a probe zero has been done prior to performing this calibration procedure.

- 1) **Physically measure** a location on the sample to be measured using a set of calipers or a digital micrometer. Note: It's always best to calibrate on thickest location on the sample, rather than on the thinnest location, as the percentage error is much less with respect to the **MVX's** resolution of +/- .001" (0.01mm).
- 2) Apply a drop of couplant on the transducer. Place the transducer in steady contact on the known thickness location. Be sure that the reading is stable and the repeatability indicator, located in the top left corner of the display, is fully lit and stable. Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **CAL** menu is highlighted and displaying the submenu items.

- 3) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **ONE POINT** is highlighted.
- 4) Press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** 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 entering the velocity.
- 9) Finally, press the **MEAS** 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.

Two Point Calibration



Note: Be sure that a probe zero has been done prior to performing this calibration procedure.

- 1) Using a set of calipers, physically measure two known thickness locations on the sample of material. **Note:** The two locations should represent the desired thickness range being measured. If the range is from .250" - 1.000", then the two known locations should represent this range, or be slightly outside or inside of this range. A typical example would be to find two locations at .236" and the other at 1.047". These thickness points will satisfy the required thickness range noted above.
- 2) Apply a drop of couplant on the transducer. Place the transducer in steady contact on thickest known location first. Be sure that the reading is stable and the repeatability indicator, located in the top left corner of the display, is fully lit and stable. Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **CAL** menu is highlighted and displaying the submenu items.

- 3) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **ONE POINT** is highlighted.
- 4) Press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** 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 for the **ONE POINT** calibration and return to the **CAL** menu screen, or press **ESC** to cancel entering the velocity.
- 9) Apply a drop of couplant on the transducer and place the transducer in steady contact with the sample or actual test material on the thinnest, or second known thickness location. Be sure that the reading is stable and the repeatability indicator, located in the top left corner of the display, is fully lit and stable.
- 10) Use the **UP** and **DOWN** arrow keys to highlight the **TWO POINT** calibration submenu item.
- 11) Press the **ENTER** key to display the **Digits Edit Box**.
- 12) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 13) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 14) Repeat steps **12 & 13** until the known thickness value is correctly displayed.
- 15) Press the **OK** key to calculate the velocity for the **TWO POINT** calibration and return to the **CAL** menu screen, or press **ESC** to cancel entering the velocity.

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

Note: CHECK YOUR CALIBRATION! Place the transducer back on both calibration points. The thickness readings should now match the known thickness locations. If they are not correct, repeat the steps above.

Built in Material Selection

| SELECT MATERIAL | |
|--------------------------|------------|
| 25. QUARTZ GLASS | 0.2260 |
| 26. RUBBER, VULCAN | 0.0910 |
| 27. SILVER | 0.1420 |
| 28. STEEL (1020) | 0.2320 |
| 29. STEEL (4340) | 0.2330 |
| 30. STEEL, STAIN. | 0.2230 |
| 31. TEFLON | 0.0540 |
| 32. TIN | 0.1310 |
| PROBE CAL DISP TUNE GATE | |
| UNITS | IN |
| VELOCITY | 0.2330 |
| ONE POINT | UNCAL |
| TWO POINT | UNCAL |
| MATERIAL | 4340 STEEL |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **CAL** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **MATERIAL** is highlighted.
- 3) Press the **ENTER** key to display the list of **Material Types**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll through the material list until the appropriate material is highlighted.
- 5) Press the **ENTER** key to display the confirmation screen.
- 6) Press the **OK** key to select the material and return to the menu screen, or press **ESC** to cancel the material selection.
- 7) Finally, press the **MEAS** key to return to the measurement screen and begin taking readings.

CHAPTER SEVEN USING THE A-SCAN & B-SCAN DISPLAYS

A key feature of the *MVX* is the waveform display. The waveform is a graphical representation of the sound reflections returning to the transducer. Consider standing at the base of a canyon and screaming “Hello There”. After a brief delay, you will here multiple echoes, “Hello There’s” repeated back to you. The waveform display shows the amplitude of the signal received on the vertical (Y) axis and time (shown in units of thickness) on the horizontal (X) axis.

The waveform display is very useful for viewing and adjusting the location of the gates. The gates are typically used to eliminate potential surface noise by adjusting the starting point in single echo modes, for multi echo measurement modes, as well as to adjust the threshold (sensitivity) in either mode. The waveform display is also very useful for locating pits and internal flaws in materials.

The B-Scan display is also very useful when scanning surfaces and viewing the cross section of the test material. It provides a convenient way of profiling 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 *MVX*. The *MVX* has four different display options (**RF A-Scan, Rectified A-Scan, B-Scan, and Large Digits**). 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 *MVX* 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 100 for more information on setups.

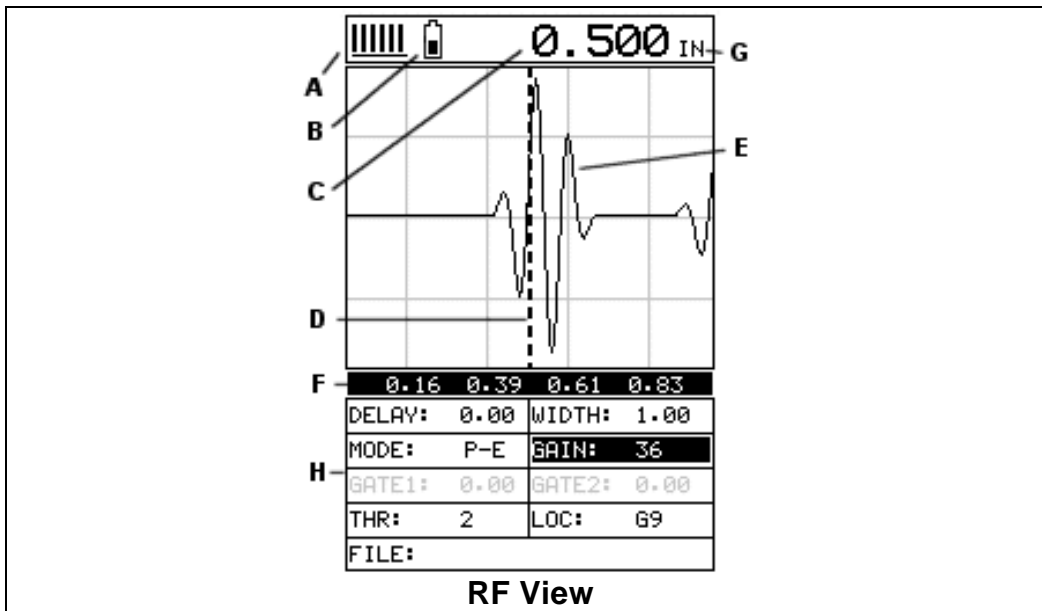
7.1 Selecting a Display Option

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

| Changing Display Options | | | | |
|---------------------------------|-----|------|------|------|
| PROBE | CAL | DISP | TUNE | GATE |
| VIEW | | | | RF |
| BACKLIGHT | | | | OFF |
| CONTRAST | | | | 10 |
| DELAY | | | | 0.00 |
| WIDTH | | | | 2.06 |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **DISP** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **VIEW** is highlighted.
- 3) Use the **LEFT** and **RIGHT** arrow keys to scroll the view options. Once the appropriate view is displayed, press the **MEAS** key to return to the measurement screen.

7.2 Display Views



RF

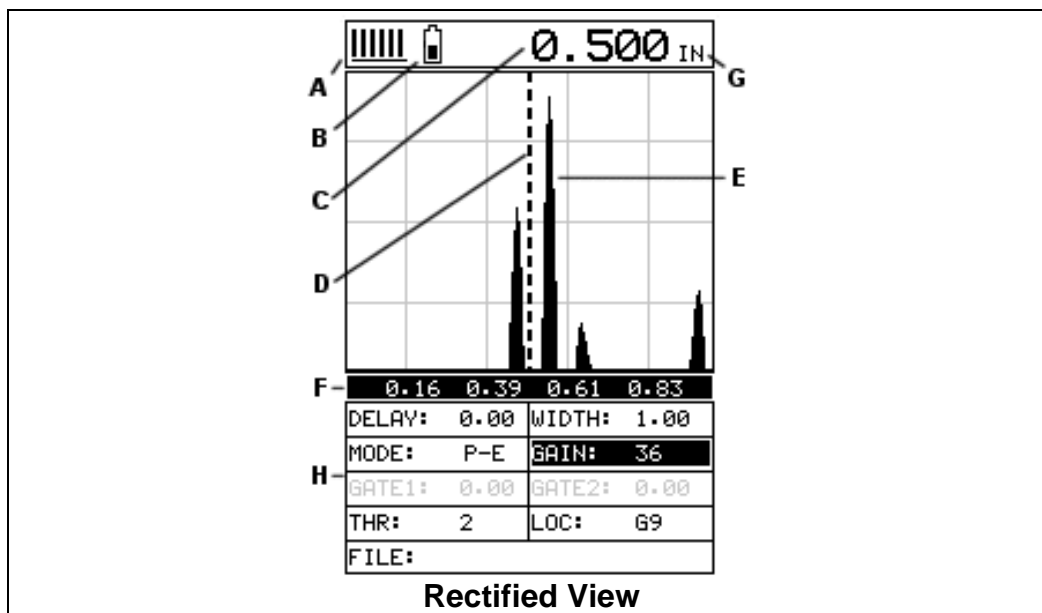
The RF mode shows the waveform in a similar fashion to an oscilloscope. It shows both the positive and the negative peaks. The peak (either positive or negative) selected for measurement is shown in upper portion of the display.

It's important to note that a measurement must fall inside the displays viewable range in order to see the waveform. However, even if the waveform is outside of the viewable range of the display, a measurement can be taken and viewed on the digital

readout. If the wave is outside of the display range, you can manually change the range by adjusting the **Delay** and **Width** values, or you can use the **Auto Find** feature located in the **UTIL** menu of the tabbed menu items. Refer to page 74 for additional information on the **Auto Find** feature.

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

- A) **Stability of Reading Indicator** – Indicates the stability of the return echo on a scale of 1 to 6 – the solid bars displayed in the figure above indicate a repeatable signal. If the **MVX** is displaying a reading from memory, the repeatability indicator will be replaced by the text “**MEM**”.
- B) **Battery life Indicator** – Fully charged batteries will appear filled in solid. Note: The diagram shows the batteries at approximately 50%.
- C) **Thickness Reading** – Digital readout of thickness (inches or millimeters).
- D) **Detect Indicator** – The broken vertical line displays the zero crossing (flank) detection point on the waveform where the measurement has been obtained. Notice that the digital thickness readout is the same as the location of the detect indicator according to the measurements labels F, also in the diagram.
- E) **Echo Signal** – Graphical full waveform representation of the echo signal displayed as an amplitude (vertical or “Y” axis) plotted against time (horizontal or “X” axis), this time is then converted to a physical measurement and displayed according.
- F) **Measurement Labels** – The measurement labels are calculated and displayed based on where the left side of the display has been set (**Delay**), and the overall viewable area (**Width**) of the display. Note: The gray hash marks break the display up into 5 segments, or quadrants. The measurement labels correspond to the measurement at each hash mark.
- G) **Units Label** - Displays the current units of measurement (inches or millimeters).
- H) **Hot Menus** - Each of the fields located under the waveform display are called the **Hot Menu Fields**. These fields allow quick control of some of the fine adjustments needed to control the display settings, measurement modes, and grid memory control. All of these fields can be adjusted without having to activate the tabbed menu items and searching through a variety of menus to make adjustments.



Rectified

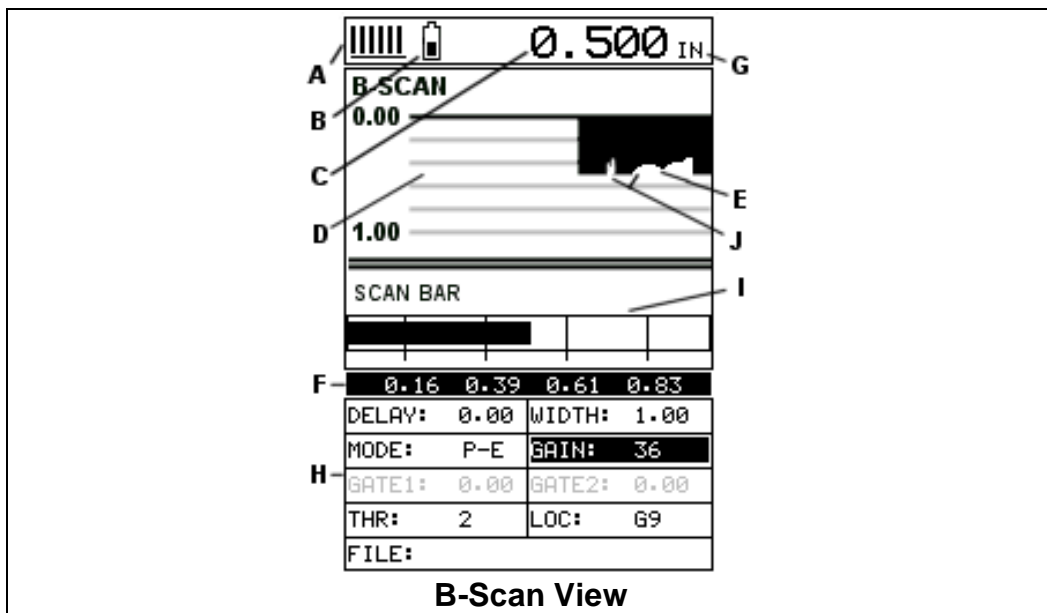
The rectified A-Scan mode shows half of the waveform. Either the positive or negative peaks are displayed, depending on the polarity selected. This is the preferred display view for flaw and pit detection applications.

It's important to note that a measurement must fall inside the viewable display range in order to see the waveform. However, even if the waveform is outside of the viewable area, a measurement can be taken and viewed on the digital readout. If the waveform is outside of the display range, you can manually change the range by adjusting the **Delay** and **Width** values, or you can use the **Auto Find** feature located in the **UTIL** menu in the tabbed menu items. Refer to page 74 for additional information on the **Auto Find** feature.

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

- A) **Stability of Reading Indicator** – Indicates the stability of the return echo on a scale of 1 to 6 – the solid bars displayed in the figure above indicate a repeatable signal. If the **MVX** is displaying a reading from memory, the repeatability indicator will be replaced by the text “**MEM**”.
- B) **Battery life indicator** – Fully charged batteries will appear filled in solid. Note: The diagram shows the batteries at approximately 50%.
- C) **Thickness reading** – Digital readout of thickness (inches or millimeters).
- D) **Detect Indicator** – The broken vertical line displays the zero crossing (flank) detection point on the waveform where the measurement has been obtained. Notice that the digital thickness readout is the same as the location of the detect indicator according to the measurements labels F, also in the diagram.

- E) **Echo Signal** – Graphical full waveform representation of the return echo displayed as an amplitude (vertical or “Y” axis) plotted against time (horizontal or “X” axis), this time is then converted to a physical measurement.
- F) **Measurement Labels** – The measurement labels are calculated and displayed according to where the left side of the display has been set (**Delay**), and the overall viewable area (**Width**) of the display. Note: The gray hash marks break the display up into 5 segments, or quadrants. The measurement labels correspond to the measurement at each hash mark.
- G) **Units Label** - Displays the current units of measurement (inches or millimeters).
- H) **Hot Menus** - Each of the fields located under the waveform display are called the **Hot Menu Fields**. These fields allow quick control of some of the fine adjustments needed to control the display settings, measurement modes, and grid memory control. All of these fields can be adjusted without having to activate the tabbed menu items and searching through a variety of menus to make adjustments.



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 E represents the cross section, or side view of the material. You will notice that the overall thickness of the material is .500”, and the display range is 0.00” to 1.00” respectively. The B-Scan view draws at a rate of 15 seconds per

screen from right to left. Also notice at location J, the pits and corroded bottom surface of the material.

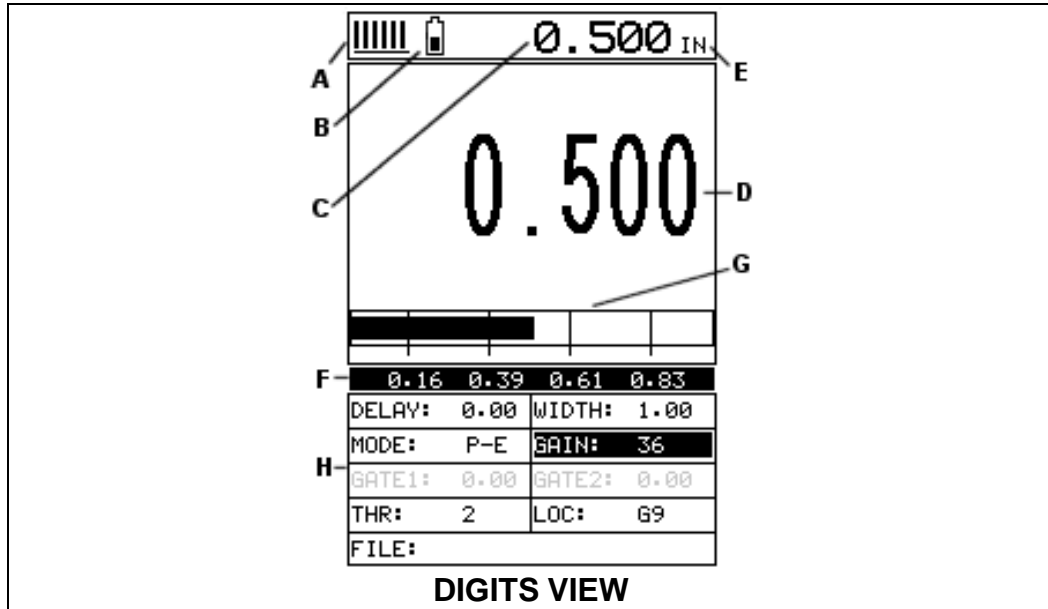
It's important to note that the measurement range on the display be set wide enough, so that the maximum thickness of the material can be viewed on the display. Using the diagram above, if the material thickness was actually 1.75", the underside of the material would not be viewable according to the 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) **Stability of Reading Indicator** – Indicates the stability of the echo signal on a scale of 1 to 6 – the solid bars displayed in the figure above indicate a repeatable signal. If the *MVX* is displaying a reading from memory, the repeatability indicator will be replaced by the text "**MEM**".
- B) **Battery life indicator** – Fully charged batteries will appear filled in solid. Note: The diagram shows the batteries at approximately 50%.
- C) **Thickness reading** – Digital readout of thickness (inches or millimeters).
- D) **B-Scan Display Area** – This is the area representing where the B-Scan will be drawn. Notice the range of the area in the diagram at 0.00" – 1.0" respectively.
- E) **Displayed B-Scan** – Graphical presentation of the cross section, or side view of the test material. The top, or accessible side of the material represented as 0.00", and the bottom, or blind surface at .500". You will notice the contour in the B-Scan, indicating a very corroded bottom surface. The B-Scan is displayed from right to left at a rate of 15 screens per second.
- F) **Measurement Labels** – The measurement labels are calculated and displayed based on where the left side of the display has been set (**Delay**), and the overall viewable area (**Width**) of the display. Note: The gray hash marks break the display up into 5 segments, or quadrants. The measurement labels correspond to the measurement at each hash mark.
- G) **Units Label** - Display's the current unit of measurement (inches or millimeters).
- H) **Hot Menu** - Each of the fields located under the B-Scan display are called the **Hot Menu Fields**. These fields allow quick control of some of the fine adjustments needed to control the display settings, measurement modes, and grid memory control. All of these fields can be adjusted without having to activate the tabbed menu items and searching through a variety of menus to make adjustments.
- I) **Scan Bar** – The scan bar corresponds directly with thickness represented by the horizontal labels on the on the display. As you can see from the diagram above, the filled horizontal bar is displayed at .500". This display can be very useful when scanning materials in either B-Scan or Digits display views. It is much easier to watch and notice deflections for flaws and pits using the scan bar, rather than trying to notice changes in digital values. If the user is scanning a pipe, for

instance, and passes over a pit in the process, the scan bar will quickly deflect and alarm the user to go back and search for the defect.

- J) Contour (blind surface)** – A view of the B-Scan displaying the blind side surface contour of the material.



DIGITS

The Digits view is a basic digital thickness gauge 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) **Stability of Reading Indicator** – Indicates the stability of the return echo on a scale of 1 to 6 – the solid bars displayed in the figure above indicate a repeatable signal. If the *MVX* is displaying a reading from memory, the repeatability indicator will be replaced by the text “MEM”.
- B) **Battery life indicator** – Fully charged batteries will appear filled in solid. Note: The diagram shows the batteries at approximately 50%.
- C) **Thickness reading** – Digital readout of thickness (inches or millimeters).
- D) **Large Digits** – Large readout of thickness (inches or millimeters).
- E) **Units Label** – Display's the current unit of measurement (inches or millimeters).
- F) **Measurement Labels** – The measurement labels are calculated and displayed based on where the left side of the display has been set (**Delay**), and the overall viewable area (**Width**) of the display. Note: The gray hash marks break the

display up into 5 segments, or quadrants. The measurement labels correspond to the measurement at each hash mark.

G) Scan Bar – The scan bar corresponds directly with thickness represented by the horizontal labels on the on the display. As you can see from the diagram above, the filled horizontal bar is displayed at .500”. This display can be very useful when scanning materials in either B-Scan or Digits display views. It is much easier to watch and notice deflections for flaws and pits using the scan bar, rather than trying to notice changes in the digital value. If the user is scanning a pipe, for instance, and passes over a pit during the process, the scan bar will quickly deflect and alarm the user to go back and search for the defect.

H) Hot Menu - Each of the fields located under the display are called the **Hot Menu Fields**. These fields allow quick control of some of the fine adjustments needed to control the display settings, measurement modes, and grid memory control. All of these fields can be adjusted without having to activate the tabbed menu items and searching through a variety of menus to make adjustments.

7.3 Adjusting the screen

The width refers to the overall viewable range, with respect to depth, being displayed on the screen. The starting depth is displayed at the lower left side of the screen, and the ending depth is shown at the lower right hand side of the screen. The difference between these values is called the **Width**. The procedures to adjust the **Width** are outlined below:

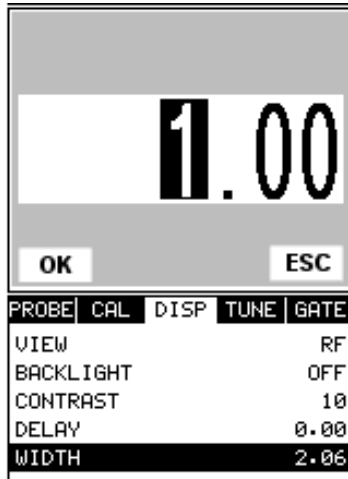
Adjusting the Width using the Hot Menu

| | |
|---------------------|-------------|
| 1.00 | |
| OK | ESC |
| 0.16 0.39 0.61 0.83 | |
| DELAY: 0.00 | WIDTH: 1.00 |
| MODE: P-E | GAIN: 46 |
| GATE1: 0.00 | GATE2: 0.00 |
| THR: 2 | LOC: 69 |
| FILE: | |

- 1) Press the **MEAS** key once to activate measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left, until the **WIDTH** cell is highlighted.
- 2) Press the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll the highlighted value.
- 3) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps **4 & 5** until the **WIDTH** value is correctly displayed.
- 7) Press the **OK** key to return to the measurement screen, or **ESC** to cancel entering the **WIDTH**.

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

Adjusting the Width using the Tabbed Menu



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **DISP** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **WIDTH** is highlighted.
- 3) Press the **LEFT** and **RIGHT** arrow keys to scroll the value. When the correct width is being displayed, **proceed to step 8**.
- 4) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 7) Repeat steps **5 & 6** until the **Width** value is correctly displayed.
- 8) Press the **OK** key to set the **Width** and return to the menu screen, or **ESC** to cancel entering the **Width**.

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

Starting delay

The starting **DELAY**, or starting depth, is the value displayed on the bottom lower left side of the display in both **RF** and **RECT** (Rectified) views. The **DELAY** will also be represented in both the **BSCAN** and **DIGITS** (Scan Bar) views, as the starting thickness depth. The starting depth is the minimum thickness value that can be viewed on the display. In **DIGITS** view, the delay will only affect the starting depth of the **Scan Bar**.

Note: Once the range is set, it will remain the same for all the views respectively.

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

Adjusting the Delay using the Hot Menu

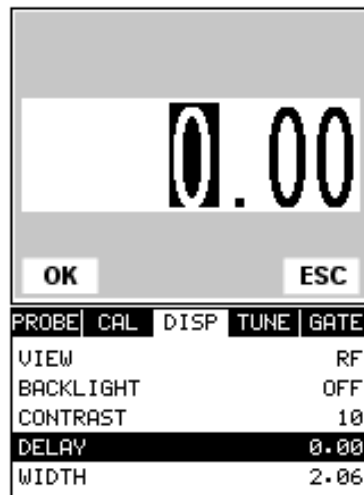
| | |
|---------------------|-------------|
| 0.16 0.39 0.61 0.83 | |
| DELAY: 0.00 | WIDTH: 1.00 |
| MODE: P-E | GAIN: 46 |
| GATE1: 0.00 | GATE2: 0.00 |
| THR: 2 | LOC: 69 |
| FILE: | |

- 1) Press the **MEAS** key once to activate measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left, until the **DELAY** cell is highlighted.
- 2) Press the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll the highlighted value.
- 3) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.

- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps **4 & 5** until the **DELAY** value is correctly displayed.
- 7) Press the **OK** key to return to the measurement screen, or **ESC** to cancel entering the **DELAY**.

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

Adjusting the Delay using the Tabbed Menus



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **DISP** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **DELAY** is highlighted.
- 3) Press the **LEFT** and **RIGHT** arrow keys to scroll the value. When the correct **Delay** is being displayed, **proceed to step 8**.

- 4) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 7) Repeat steps **5 & 6** until the **Delay** number is correctly displayed.
- 8) Press the **OK** key to set the **Delay** and return to the menu screen, or **ESC** to cancel entering the **Delay**.
- 9) Finally, press the **MEAS** key to return to the measurement screen and begin taking readings.

7.4 Gain

The gain, or amplification of the return echoes, can be adjusted over a wide range. 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. Too little gain may result in detection on an undesirable section of the waveform. It may also result in lack of detection on internal flaws or pits. 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 procedures to adjust the **Gain** are outlined below:

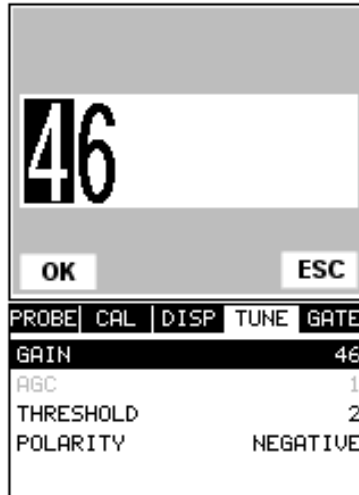
Adjusting the Gain using the Hot Menus

| | |
|---------------------|-----------------|
| 46 | |
| OK | ESC |
| 0.33 0.77 1.22 1.66 | |
| DELAY: 0.00 | WIDTH: 2.00 |
| MODE: P-E | GAIN: 46 |
| GATE1: 0.00 | GATE2: 0.00 |
| THR: 2 | LOC: 69 |
| FILE: | |

- 1) Press the **MEAS** key once to activate measure menu items. Press the **MEAS** key multiple times to move right, and the **ESC** key multiple times to move left until the **GAIN** cell is highlighted.
- 2) Press the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll the highlighted value.
- 3) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps **4 & 5** until the **GAIN** value is correctly displayed.
- 7) Press the **OK** key to return to the measurement screen, or **ESC** to cancel entering the **GAIN**.

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 Menu**. The procedure using the tabbed menu is outlined below:

Adjusting the Gain using the Tabbed Menu



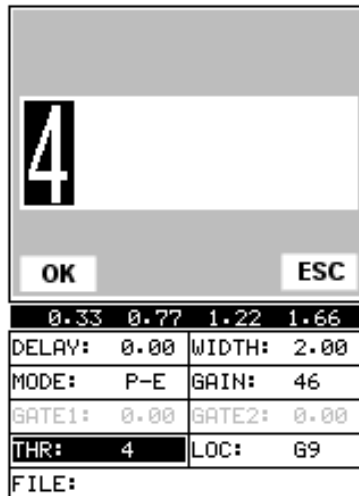
- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **TUNE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **GAIN** is highlighted.
- 3) Press the **LEFT** and **RIGHT** arrow keys to scroll the value. When the correct **Gain** is being displayed, **proceed to step 8**.
- 4) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 7) Repeat steps **5 & 6** until the **Gain** value is correctly displayed.
- 8) Press the **OK** key to set the **Gain** and return to the menu screen, or **ESC** to cancel entering the **Gain**.
- 9) Finally, press the **MEAS** key to return to the measurement screen and begin taking readings.

7.5 Threshold

The **Threshold** is the level (sensitivity) of the signal amplitude required to trigger the thickness reading. This level can be used in conjunction with the gain. Example: suppose the user can visually see a potential flaw on the display, but the **MVX** is not detecting on the flaw because the **Gain** is too low, or the **Threshold** too high. The **Threshold** level can be decreased (lower sensitivity) in order to detect signals with lower amplitudes. This will allow the amplitude from the reflection of the flaw to reach and exceed the **Threshold** level, and enable the **MVX** to detect on the flaw or defect. This can also be accomplished by increasing the **Gain**, allowing the signal to exceed the current **Threshold** level. Lowering the **Threshold** (increases sensitivity), and raising the **Threshold** decreases the sensitivity respectively.

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

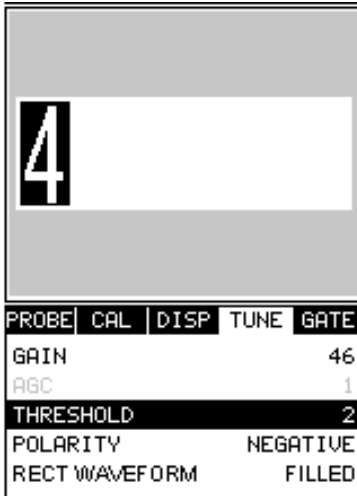
Adjusting the Threshold using the Hot Menu



- 1) Press the **MEAS** key once to activate measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left, until the **THR** (threshold) cell is highlighted.
- 2) Press the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll the highlighted value.
- 3) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps 4 & 5 until the **THR** value is correctly displayed.
- 7) Press the **OK** key to return to the measurement screen, or **ESC** to cancel entering the **THR**.

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

Adjusting the Threshold using the Tabbed Menus



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **TUNE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **THRESHOLD** is highlighted.
- 3) Press the **LEFT** and **RIGHT** arrow keys to scroll the value. When the correct threshold is being displayed, **proceed to step 8**.
- 4) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 7) Repeat steps **5 & 6** until the **Threshold** number is correctly displayed.
- 8) Press the **OK** key to set the **Threshold** and return to the menu screen, or **ESC** to cancel entering the **Threshold**.
- 9) Finally, press the **MEAS** key to return to the measurement screen and begin taking readings.

7.6 Gates

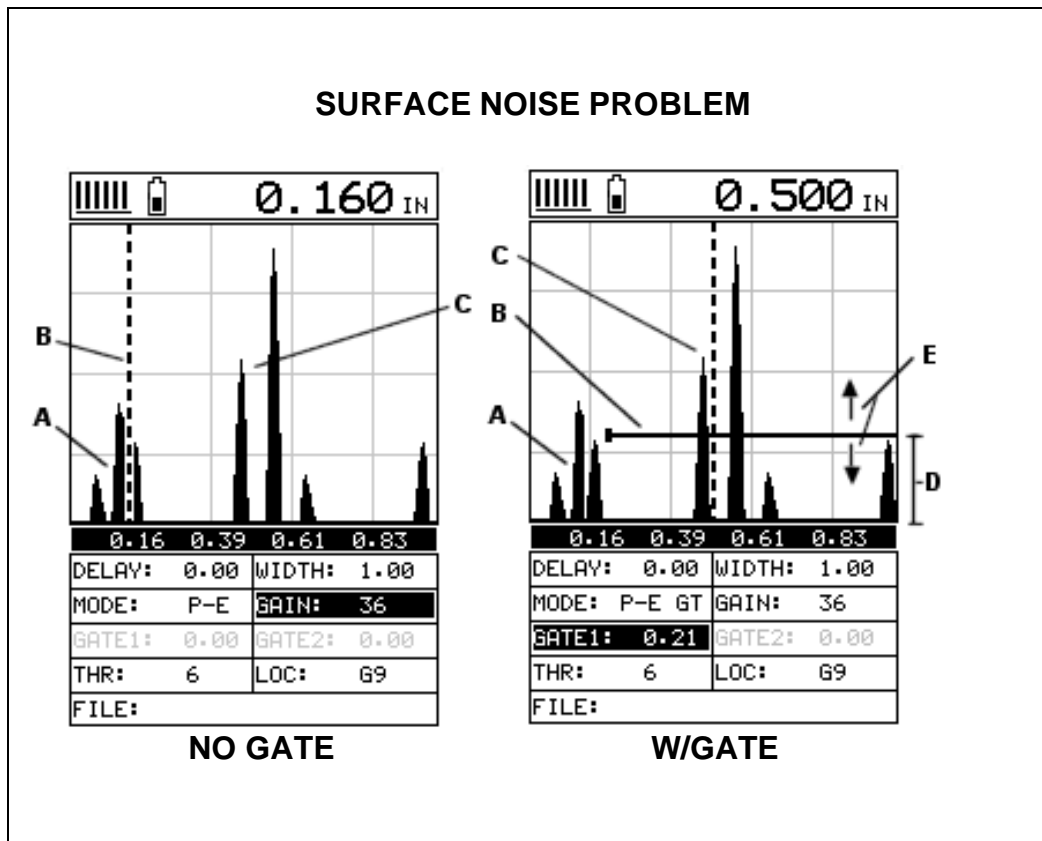
The **MVX** is equipped with two gates that can be adjusted by the user to measure a specific region or area on and between waveforms. In pulse - echo, only a single gate can be used. The single gate has a threshold and a start point. In echo - echo mode, two gates are used. The same threshold level is associated with both gates. The first gate has a starting point and threshold, and the second gate has a start time that is determined by adding an adjustable **HOLD OFF**, or delay, to the return echo measured by the first gate. These features are described in more detail below:

Note: In order to adjust the gates they must be activated. The gates will only be active if the measurement mode is set to P-E GT (pulse – echo w/gate1), or E-E (echo – echo w/ gates 1&2). If the gates are not active, they will be grayed out in the hot and tabbed menus. The explanations that follow assume that the proper measurement mode has been selected. Refer to page 28 for additional information on selecting the measurement mode.

Gate 1

GATE 1 is used in both pulse-echo and echo-echo modes. It has a threshold and a start time. The purpose of **GATE 1** is to prevent the **MVX** from measuring unwanted surface noise. This is accomplished by changing the start time of **GATE 1**. It may be advantageous to activate a gate when measuring aluminum, titanium, and stainless steel using lower frequency transducers. However, if a high frequency transducer is being used, the gate may not be necessary. Aluminum sometimes has an inherent surface noise problem that can cause erroneous readings from the noise just following the initial pulse. By blocking the surface noise with **GATE 1** this error is eliminated. **GATE 1** is also used in echo - echo mode to force the **MVX** to measure between the first and second back wall echoes, by moving the start to the first back wall reflection of the test material.

The procedures to adjust **Gate 1** are outlined below:



The diagrams above illustrate a typical surface noise condition. Refer to the **NO GATE** diagram: **(A)** refers to the noise in front of the actual back wall signal **(C)**. Notice that without a gate activated, the **MVX** is detecting on the noise **(A)** as shown at point **(B)**. However, the true measurement should be taken at point **(C)**. Given the threshold and gain levels the **MVX** is currently set to in the **NO GATE** diagram, the amplitude from the noise is sufficient enough to cause the **MVX** to detect, or measure the noise rather than the true back wall thickness **(C)**. Therefore, the **MVX** is making an incorrect reading at point **(B)**.

Now refer to the **W/GATE** diagram. The horizontal line at the top of **(D)**, is **GATE1**. The start point of **GATE1** has been adjusted to just beyond the noise **(A)** so that the **MVX** ignores the noise and detects the true back wall **(C)**. Note: the **MVX** will only detect on signals that are located inside the dimensions of **GATE1** **(B)**. Therefore, the **MVX** cannot see **(A)** at all, with respect to the starting point of **(B)**. Also notice, the **THR** (threshold) level is the height of the distance **(D)** from the baseline. Zero threshold is indicated by the bottom of the range **(D)**, and **THR: 6** (threshold) is indicated at the top of the range at **(D)**. Therefore, the vertical height of **GATE1** is the **THR** (threshold) level. The threshold level can be increased to decrease sensitivity, or decreased to increase sensitivity.

If the threshold level was increased in the **NO GATE** diagram, so that the level was higher than the amplitude of the noise **(A)**, the **MVX** would have detected on the true back wall **(C)**. Alternatively, if the gain level was decreased, the signal amplitude of the noise **(A)** would have decreased below the threshold level, and the **MVX** would

have also detected the true back wall (C). This example brings all the fine adjustments into consideration, and demonstrates the versatility of having fully functional scope rather than a basic digital thickness gauge.

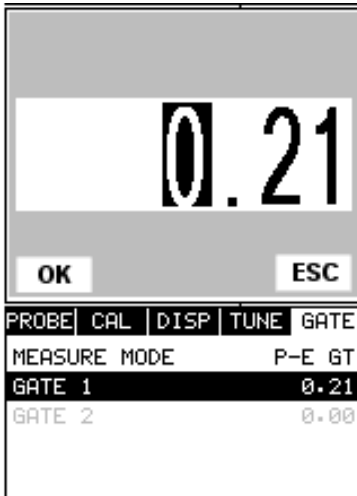
Adjusting Gate1 using the Hot Menus

| | |
|---------------------|-------------|
| 0.21 | |
| OK | ESC |
| 0.16 0.39 0.61 0.83 | |
| DELAY: 0.00 | WIDTH: 1.00 |
| MODE: P-E GT | GAIN: 36 |
| GATE1: 0.21 | GATE2: 0.00 |
| THR: 6 | LOC: 69 |
| FILE: | |

- 1) Press the **MEAS** key once to activate measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left until the **GATE 1** cell is highlighted.
- 2) Press the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll the highlighted value.
- 3) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps **4 & 5** until the **GATE 1** value is correctly displayed.
- 7) Press the **OK** key to return to the measurement screen, or **ESC** to cancel entering the **GATE 1** value.

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

Adjusting Gate1 using the Tabbed menus



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **GATE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **GATE** is highlighted.
- 3) Press the **LEFT** and **RIGHT** arrow keys to scroll the value. When the correct gate is being displayed, **proceed to step 8**.
- 4) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 7) Repeat steps **5 & 6** until the gain number is correctly displayed.
- 8) Press the **OK** key to set the **Gate 1** value and return to the menu screen, or **ESC** to cancel entering the **Gate 1** value.

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

Gate 2

The **GATE 2 HOLDOFF** is only used in the echo-echo mode. Note: The **MVX** must be in **E-E** (echo-echo) mode to be activated. **GATE 2** is sometimes called a **Hold-Off** or **Delay**. The function of the **GATE HOLDOFF** is to prevent the second gate from triggering on noise associated with ring down of the first echo. The **GATE 2 HOLDOFF** is visible as the distance from the end of **GATE 1** at the first detect, to the start of **GATE 2** as display by the horizontal bars on the display. A further explanation suggests the **HOLDOFF** is a time delay that simply extends the end of **GATE 1** further out in time to prevent **GATE 2** from starting. This is commonly used to avoid detecting interface noise or transducer ring down. The diagrams below provide a visual example of the gates, followed by the procedures to adjust the gates for different applications:

Adjusting Gate2 using the Hot Menu

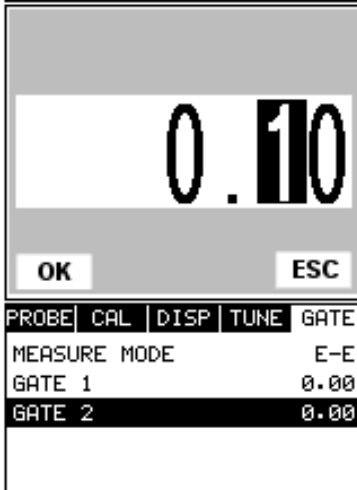
| | |
|---------------------|--------------------|
| 0.34 0.80 1.25 1.71 | |
| DELAY: 0.00 | WIDTH: 2.06 |
| MODE: E-E | AGC: 1 |
| GATE1: 0.00 | GATE2: 0.00 |
| THR: 15 | LOC: 69 |
| FILE: | |

- 1) Press the **MEAS** key once to activate measure menu items. Press the **MEAS** key multiple times to move right and the **ESC** key multiple times to move left, until the **GATE2** cell is highlighted.

- 2) Press the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll the highlighted value.
- 3) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps 4 & 5 until the **GATE2** value is correctly displayed.
- 7) Press the **OK** key to return to the measurement screen, or **ESC** to cancel entering the **GATE 2** value.

Alternatively, **Gate 2** can be selected from the menus and adjusted as follows:

Adjusting the Gate 2 from the Menu Items



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **GATE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **GATE 2** is highlighted.

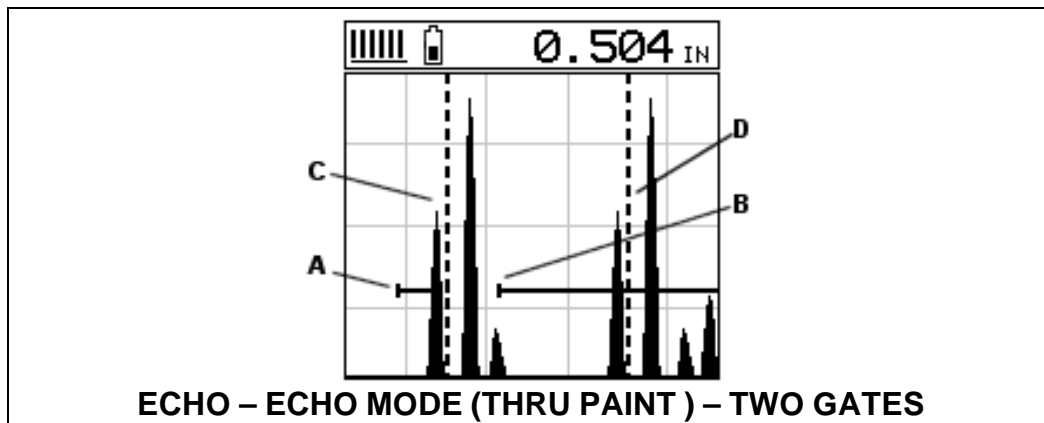
- 3) Press the **LEFT** and **RIGHT** arrow keys to scroll the value. When the correct gate value is being displayed, **proceed to step 8**.
- 4) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 5) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 6) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 7) Repeat steps **5 & 6** until the **GATE 2** value is correctly displayed.
- 8) Press the **OK** key to set the gate and return to the menu screen, or **ESC** to cancel entering the gate value.
- 9) Finally, press the **MEAS** 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 backwall echoes returning from the test material. Since both of these backwall echoes travel the same path through the paint or coating, the thickness of the coating is subtracted out of the measurement so that only the actual material thickness can be measured. This feature saves the user a great deal of time scraping and removing the coating from tanks and pipes during the inspection process.

The primary purpose of thru paint measurement is to determine actual or overall material thickness by eliminating the coating thickness. Thru paint mode cannot be used for flaw or pit detection. Therefore, inspectors will use this echo-echo thru paint mode in conjunction with a standard pulse-echo flaw detection mode. The combination of using both modes is ideal for the advanced inspectors needs.



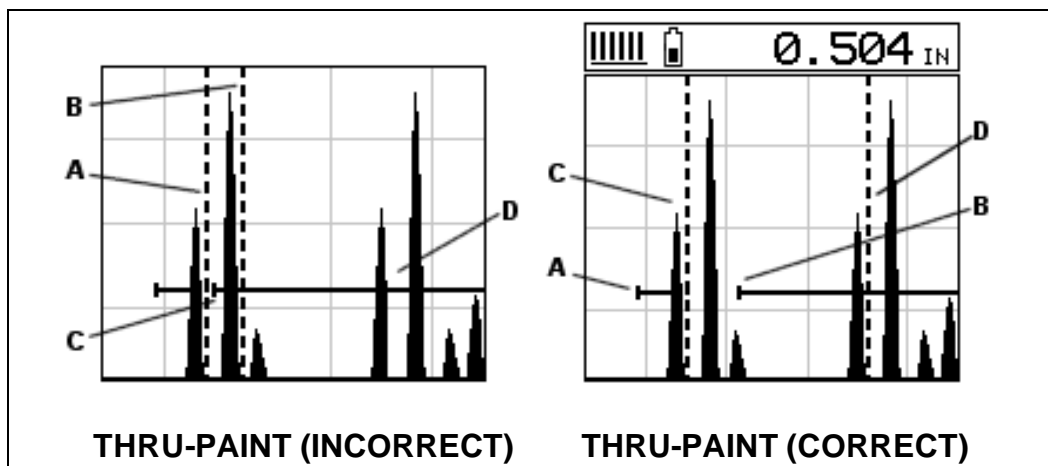
Refer to the diagram above. This is a typical example of an echo-echo mode setup commonly used for a through paint or coatings application. Once again, the definition of an echo-echo measurement, is a measurement taken between two return echoes, rather than from the initial pulse to a single echo. Therefore, the measurement is taken between the first and second echo reflections. Point **(C)** represents the detection on the back wall of the first reflection. Notice that **GATE1** has been set up so that the **MVX** can only see the first back wall reflection **(C)**, and cannot see anything before the first reflection. Remember that the **MVX** can only see those signals inside the dimensions of the gate.

GATE2 (hold-off) has been set at point **(B)**, so that the transducer ring down noise following the first detection **(C)** can't interfere with the second back wall reflection **(D)**. The distance from point **(C)**, which is the end of the first gate **(A)**, to the start of **GATE2** **(B)**, is the hold-off time or delay. This type of setup allows the user to eliminate the paint or coating, and measure only the metal thickness of the metal.

8.2 Setting Up Thru Paint Mode

The first thing to note in this section, is that by selecting the transducer type from the list of probes stored in the *MVX*, a basic echo-echo thru paint configuration is recalled from memory. Each of the 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 *MVX* can toggle between **pulse-echo** (flaws & pits), and **echo-echo** (thru paint) modes by simply pressing the **MULTI MODE** key located on the keypad. Refer to page 31 for additional information.

When configuring the *MVX* for specific thru paint applications, all of the scope parameters will potentially be needed. The delay, width, gain, threshold, gate1, and gate2 features will be subject to change. For this reason, they have all been added to **Hot Menu** fields located directly beneath the A-Scan display for quick and easy access. **Note:** Once the values of the fields have been changed or modified, these changes must be saved to a setup location prior to powering the *MVX* off. **Failure to do so will result in losing your changes.**



Refer to the incorrect diagram above. Point **(A)** represents the detection on the first back wall echo. The true, second back wall, reflection should be detecting at point **(D)**. However, the hold-off **(C)** is setup incorrectly and the *MVX* is detecting the ring down noise of the transducer, on the first reflection, rather than the true second back wall reflection shown at **(D)**.

Before we look at the diagram with the correct configuration, let's consider all of our options on how to fix the problem beforehand. Our **delay** and **width** will simply change the view options of the screen – not needed in this example. Will a **gain** or **threshold** adjustment fix the problem? Unfortunately, not. Why? Notice the

amplitude of the cycle just to the left of **(B)**. If we tried to increase the threshold level above the height of the cycle, we would lose our detection for both echoes resulting in no reading at all. If we decrease our **gain**, reducing the signal amplitudes, we would also lose our detection of both back wall echoes.

Notice that the amplitude of the cycle just to the left of **(C)**. The amplitude of the cycle, at **(C)**, is less than the amplitude of the cycle at **(B)**, in terms of overall height. If we decreased our **gain**, we would lose the first cycle **(C)** long before losing the second cycle **(B)**. Therefore, adjusting the **gain** or **threshold** levels will not help us in this example. Our final option is adjusting the **GATE2** hold-off, shown at point **(C)** in the incorrect diagram, to point **(B)** in the correct diagram. If we adjust the **GATE2** hold-off further to the right of the first reflection, the ring down noise from the first back wall echo no longer interferes with the true detection **(D)**, shown in the correct diagram.

The adjustment considerations in the example above will typically be used for all thru paint applications respectively. In some applications the hold-off may be sufficient, while a **gain** or **threshold** adjustment will solve the problem. A similar process of elimination should be considered for all thru paint applications.

CHAPTER NINE ADDITIONAL FEATURES OF THE MVX

9.1 Pulse Width

The **MVX** has an adjustable pulse width option, located as a submenu item in the **PROBE** tab group. Pulse width, refers to the duration of time the pulser is left on. This time results in increased energy sent into the test material. There are three width options (**SPIKE**, **THIN**, and **WIDE**). The **SPIKE** setting may be desirable for high resolution and general applications to decrease the overall noise. This can be considered the normal or standard setting. When additional energy is needed, more penetration, the **THIN** and **WIDE** options may be necessary. The procedure to change the pulse width is outlined below:

Selecting the Pulse Width

| | | | | |
|-----------------|-----|-------|------|------|
| PROBE | CAL | DISP | TUNE | GATE |
| ZERO TRANSDUCER | | | | |
| PULSE | | SPIKE | | |
| TYPE | | | | 1 |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **PROBE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **PULSE** is highlighted.
- 3) Use the **LEFT** and **RIGHT** arrow keys to scroll the **Pulse** options.
- 4) Once the **Pulse** is displayed, press the **MEAS** key to return to measurement screen.

9.2 Auto Find

The **MVX** is equipped with a very handy feature for locating the detection point of a back wall echo that is not currently in the viewable region of the display. Suppose the **MVX** is currently setup with a delay of 0.0" and a width of 1.0", and the user is measuring material thickness of 2.5". The **MVX** will make the correct measurement and display it digitally. However, the waveform will not show up at all in both A-Scan views, and incorrectly in the B-Scan view without adjusting the range of the **Delay** and **Width** accordingly.

The **AUTO FIND** feature is a convenient way to let the **MVX** find the detection point and bring the waveform signal into view automatically. The user can then make small adjustments to the range once the signal is displayed on the screen. The procedure to use the **AUTO FIND** feature is outlined below:

Using Auto Find

| SETUP | DATA | UTIL | XFER |
|------------------|------|------|-------|
| AUTO FIND | | | |
| SCAN MODE | | | OFF |
| ALARM STATUS | | | ON |
| ALARM LO LIMIT | | | 0.000 |
| ALARM HI LIMIT | | | 0.000 |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **UTIL** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **AUTO FIND** is highlighted.
- 3) Place the transducer on the test material and obtain a reading.
- 4) Press the **ENTER** key to automatically adjust the display settings and bring the waveform into view.
- 5) Once the signal is displayed, press the **MEAS** key to return to measurement mode.

9.3 High Speed Scan

The High Speed Scan feature of the *MVX* increases the overall sample rate from the standard 4 measurements a second to 32 measurements 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. The display will continue to be updated during the scan process, and when the transducer is removed, the *MVX* will display the minimum reading found. The procedure to use the **SCAN MODE** feature is outlined below:

Using the Scan Mode

| | | | |
|----------------|------|------|-------|
| SETUP | DATA | UTIL | XFER |
| AUTO FIND | | | |
| SCAN MODE | | | OFF |
| ALARM STATUS | | | ON |
| ALARM LO LIMIT | | | 0.000 |
| ALARM HI LIMIT | | | 0.000 |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **UTIL** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **SCAN MODE** is highlighted.
- 3) Use the **LEFT** and **RIGHT** arrow keys to toggle the **SCAN MODE** on/off.
- 4) Press the **MEAS** key to return to the measurement screen.

9.4 Alarm Mode

The **Alarm Mode** feature of the *MVX* provides the user with a method of setting tolerances, or limits, for a particular application requirement. This feature may be used for incoming material inspections to verify the material received is within the manufacturer specifications. There are two limits, or alarm values, that can be setup in the *MVX* – **ALARM LO LIMIT** and **ALARM HI LIMIT**. 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:

| SETUP | DATA | UTIL | XFER |
|----------------|------|------|-------|
| AUTO FIND | | | |
| SCAN MODE | | | OFF |
| ALARM STATUS | | | ON |
| ALARM LO LIMIT | | | 0.000 |
| ALARM HI LIMIT | | | 0.000 |

| SETUP | DATA | UTIL | XFER |
|----------------|------|------|-------|
| AUTO FIND | | | |
| SCAN MODE | | | OFF |
| ALARM STATUS | | | ON |
| ALARM LO LIMIT | | | 0.000 |
| ALARM HI LIMIT | | | 0.000 |

| SETUP | DATA | UTIL | XFER |
|----------------|------|------|-------|
| AUTO FIND | | | |
| SCAN MODE | | | OFF |
| ALARM STATUS | | | ON |
| ALARM LO LIMIT | | | 0.000 |
| ALARM HI LIMIT | | | 0.000 |

UTIL MENU – ALARM MODE

Toggle Alarm Status (on/off)

| SETUP | DATA | UTIL | XFER |
|----------------|------|------|-------|
| AUTO FIND | | | |
| SCAN MODE | | | OFF |
| ALARM STATUS | | | ON |
| ALARM LO LIMIT | | | 0.000 |
| ALARM HI LIMIT | | | 0.000 |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **UTIL** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **ALARM STATUS** is highlighted.
- 3) Use the **LEFT** and **RIGHT** arrow keys to toggle the **ALARM STATUS** on/off.
- 4) Continue on to the next section “**Setting the Alarm Lo Limit**”.

Setting the Alarm LO Limit

| | | | |
|----------------|------|------|-------|
| SETUP | DATA | UTIL | XFER |
| AUTO FIND | | | |
| SCAN MODE | | | OFF |
| ALARM STATUS | | | ON |
| ALARM LO LIMIT | | | 0.000 |
| ALARM HI LIMIT | | | 0.000 |

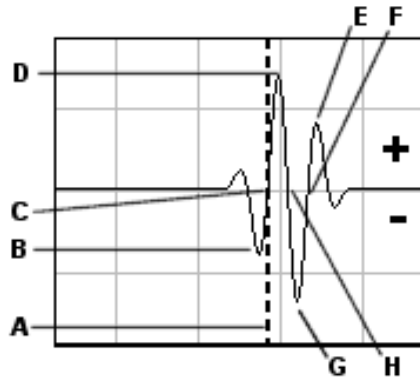
- 1) Assuming the **ALARM STATUS** is **ON**, use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **ALARM LO LIMIT** is highlighted.
- 2) Press the **LEFT** and **RIGHT** arrow keys to scroll the value. When the correct alarm value is being displayed, **proceed to step 7**.
- 3) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps **4 & 5** until the **ALARM LO** value is correctly displayed.
- 7) If only one limit will be used, press the **MEAS** key to return to the measurement screen and begin taking readings. Otherwise, continue on to set the **ALARM HI LIMIT**.

Setting the Alarm HI Limit

- 1) Assuming the **ALARM STATUS** is **ON**, use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **ALARM HI LIMIT** is highlighted.
- 2) Press the **LEFT** and **RIGHT** arrow keys to scroll the value. When the correct alarm value is being displayed, **proceed to step 8**.
- 3) **Alternatively**, press the **ENTER** key to display the **Digits Edit Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the highlighted value.
- 5) Press the **LEFT** and **RIGHT** arrow keys to scroll the digit locations.
- 6) Repeat steps **4 & 5** until the **ALARM HI** value is correctly displayed.
- 7) Press the **OK** key to set the **ALARM HI** value and return to the menu screen, or **ESC** to cancel entering the **ALARM HI** value.
- 8) Press the **MEAS** key to return to the measurement screen and begin taking readings.

9.5 Polarity

The **MVX** is equipped with an option to select the polarity, or phase +/-, for the purpose of detection. The phase can be a very valuable feature to have when the signal returning from the test material is marginal, a low frequency transducer is being used, and the user has a very weak positive or negative cycle, while trying to measure very thick materials. There is a possibility that signal will become so weak that it falls below the threshold, and peak jumps to the next cycle altogether. This peak jump represents a shift of the detection further out in time, resulting in incorrect measurements. The material being measured will appear thicker than it actually is. Refer to the diagram below:



Notice the +/- positions in the diagram. The positive phase is everything above the horizontal center line, and the negative everything below the center line. The **MVX** uses a **zero crossing (flank) method for detection**. Therefore, the detect line (**A**) is represented by the broken vertical dotted line, and is currently detecting on the negative portion of the waveform (**B**) at the zero crossing (**C**). The signal amplitude (**B**) is shown as the negative vertical height at (**B**) in the diagram. Refer to the height of the second negative peak at (**G**). It's clear that the amplitude of (**G**) is much greater than that of (**B**). Therefore, if the user was measuring thick attenuative material, and the amplitude of (**B**) decreased substantially, the **MVX** would lose the first cycle (**B**) and peak jump to the second cycle (**F**). The detect (**A**), would move to (**F**), resulting in incorrect measurements.

If the user were to select the positive phase in the diagram above, the detect would measure at (**H**). (**A**) would move to (**H**). Notice the height of (**D**) with respect to the height of (**E**) in the diagram. If the user was measuring thick attenuative material using this phase, the signal (**E**) will certainly be lost long before (**D**). Therefore, the positive phase is a much better choice in the diagram above.

Toggle Polarity (+/-)

| PROBE | CAL | DISP | TUNE | GATE |
|---------------|-----|------|------|----------|
| GAIN | | | | 46 |
| AGC | | | | 1 |
| THRESHOLD | | | | 2 |
| POLARITY | | | | NEGATIVE |
| RECT WAVEFORM | | | | FILLED |

Note: Before toggling the **Polarity**, the **MVX** should be set to the **RF** display view option. The **RF** view will give the user the best opportunity to correctly

view the positive and negative cycles of the waveform. Please refer to page 46 for information on selecting the **Display Views**.

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **TUNE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **POLARITY** is highlighted.
- 3) Use the **LEFT** and **RIGHT** arrow keys to toggle the **POLARITY** negative or positive.
- 4) Press the **MEAS** key to return to the measurement screen and begin taking readings.

Important: Be sure to do a Probe Zero after change the polarity!

9.6 Rectified Waveform (Filled/unfilled)

The **MVX** has yet another feature primarily included for user personal viewing preference. When the **MVX** is in the **Rectified Display View**, the waveform can be completely filled in black, or simply outlined. The procedures to toggle this feature, are outlined below:

Toggle Rect Wave (filled / Unfilled)

| PROBE | CAL | DISP | TUNE | GATE |
|---------------|-----|------|------|----------|
| GAIN | | | | 46 |
| AGC | | | | 1 |
| THRESHOLD | | | | 2 |
| POLARITY | | | | NEGATIVE |
| RECT WAVEFORM | | | | FILLED |

Note: Before toggling the **Rect Wave**, the **MVX** should be set to the **RECT** display view option. Please refer to page 46 for information on selecting the **Display Views**.

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **TUNE** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **RECT WAVEFORM** is highlighted.
- 3) Use the **LEFT** and **RIGHT** arrow keys to toggle the **RECT WAVEFORM** filled or unfilled.
- 4) Press the **MEAS** key to return to the measurement screen and begin taking readings.

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

10.1 Introduction to Grid (spreadsheet) format

Data is stored in the *MVX* in a spreadsheet like format called a **GRID**. A **GRID** is simply a table of readings. The location in a grid is specified by giving a row and column coordinate. The rows are numbered from 1 to 99 and the columns are labeled from A to Z, then AA to ZZ giving a maximum of 52 possible columns.

The largest grid that can be held in the *MVX* is limited by the total memory of the *MVX*. Multiple grids can be created and stored until the *MVX*'s memory is full. If the user attempts to store a grid in the *MVX* when the memory is full, the *MVX* will respond with an error message indicating that the memory is unable to store the new grid.

The *MVX* can store a total of **12,000 readings** with a corresponding waveform stored with every reading. The waveform stored with the reading will depend on what view the *MVX* was in at the time it was saved. For example, If the view is **RECT**, then a rectified waveform will be saved with the reading.

10.2 Creating a new Grid

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

Creating a Grid Name

| NEW GRID | |
|------------------|----------------|
| NAME: | |
| NOTE: | |
| TOP LEFT: | A01 |
| LOWER RIGHT: | D3 |
| INCR. DIR: | EAST |
| CREATE NEW GRID? | |
| SETUP | DATA UTIL XFER |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right, and the **ESC** key multiple times to tab left, until the **DATA** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **NEW** is highlighted.
- 3) Press the **ENTER** key to display the new **Grid Edit Box**.
- 4) Use the **UP** and **DOWN** arrow keys to scroll through the new **Grid List Items** until **NAME** is highlighted.
- 5) Press the **ENTER** key to activate the **Alpha Edit Box**.



- 6) Use the **UP, DOWN, LEFT, & RIGHT** arrow keys to highlight the appropriate alpha characters.
- 7) Press the **ENTER** 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 - 8** until the **Grid Name** is completed.

- 10) Press the **OK** key to save the **Grid Name** and return to the **Grid List Items** menu, or **ESC** to cancel entering the **Grid Name**.

Creating a Grid Note

| NEW GRID | |
|------------------|----------------|
| NAME: | |
| NOTE: | |
| TOP LEFT: | A01 |
| LOWER RIGHT: | D3 |
| INCR. DIR: | EAST |
| CREATE NEW GRID? | |
| SETUP | DATA UTIL %FER |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 1) Use the **UP** and **DOWN** arrow keys to scroll through the new **Grid List Items** until **NOTE** is highlighted.
- 2) Press the **ENTER** key to activate the **Alpha Edit Box**.

| |
|----------------------|
| 0123456789 |
| ! " # \$ % & ' () |
| ABCDEFGHIJ |
| KLMNOPQRST |
| UVWXYZ |
| <input type="text"/> |
| SETUP DATA UTIL %FER |
| NEW |
| EDIT |
| OPEN |
| DELETE ONE GRID |
| DELETE ALL GRIDS |

- 3) Use the **UP, DOWN, LEFT, & RIGHT** arrow keys to highlight the appropriate alpha characters.
- 4) Press the **ENTER** key to select a character and advance to the next field of the **Grid Note**.
- 5) Use the **CLR** key to backspace if necessary.
- 6) Repeat steps **3** through **5** until the **Grid Note** is completed.
- 7) Press the **OK** key to save the **Grid Note** and return to the **Grid List Items** menu, or **ESC** to cancel entering the **Grid Note**.

Setting the Coordinates of the Grid

Note: 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.

Setting the Top Left Coordinate

| NEW GRID | |
|----------------------|------|
| NAME: | |
| NOTE: | |
| TOP LEFT: | A01 |
| LOWER RIGHT: | D3 |
| INCR. DIR: | EAST |
| CREATE NEW GRID? | |
| SETUP DATA UTIL XFER | |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 1) Use the **UP** and **DOWN** arrow keys to scroll through the new **Grid List Items** until **TOP LEFT** is highlighted.
- 2) Press the **ENTER** key to activate the **Coordinate Edit Box**.

| PICK UPPER LEFT | |
|----------------------|-----|
| A01 | |
| OK | ESC |
| SETUP DATA UTIL XFER | |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 3) Use the **LEFT, & RIGHT** arrow keys to scroll the **Columns**, and the **UP, DOWN** arrow keys to scroll the **Rows**.
- 4) Press the **OK** key to select the coordinate and return to the **Grid List Items** screen, or **ESC** to cancel the selection and return to the **Grid List Items** menu.

Setting the Lower Right Coordinate

| NEW GRID | |
|------------------|----------------|
| NAME: | |
| NOTE: | |
| TOP LEFT: | A01 |
| LOWER RIGHT: | D03 |
| INCR. DIR: | EAST |
| CREATE NEW GRID? | |
| SETUP | DATA UTIL XFER |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 1) Use the **UP** and **DOWN** arrow keys to scroll through the new **Grid List Items** until **LOWER RIGHT** is highlighted.
- 2) Press the **ENTER** key to activate the **Coordinate Edit Box**.

| PICK LOWER RIGHT | |
|------------------|----------------|
| D03 | |
| OK | ESC |
| SETUP | DATA UTIL XFER |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 3) Use the **LEFT, & RIGHT** arrow keys to scroll the **Columns**, and the **UP, & DOWN** arrow keys to scroll the **Rows**.
- 4) Press the **OK** key to select the coordinate and return to the **Grid List Items** screen, or **ESC** to cancel the selection and return to the **Grid List Items** menu.

Note: If there is not enough memory available to create the grid, an error message box “**NOT ENOUGH MEMORY**” will be displayed. Press the **OK** or **ESC** key to return to the **Grid List Items** menu. It may be necessary to free some memory in the **MVX** at this time. Refer to page 93 for more information on **Deleting a Grid**.

Selecting the Auto Increment Direction

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

| NEW GRID | |
|------------------|----------------|
| NAME: | |
| NOTE: | |
| TOP LEFT: | A01 |
| LOWER RIGHT: | D3 |
| INCR. DIR: | WEST |
| CREATE NEW GRID? | |
| SETUP | DATA UTIL XFER |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 5) Use the **UP** and **DOWN** arrow keys to scroll through the new **Grid List Items** until **INCR. DIR** is highlighted.
- 6) Use the **LEFT & RIGHT** arrow keys to toggle the **Increment** direction **NONE, NORTH, EAST, SOUTH, or WEST**.
- 7) When the correct **Increment** direction is displayed, continue on to the next section "**Saving the Grid**".

Saving the Grid

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

| NEW GRID | |
|----------------------|------|
| NAME: | |
| NOTE: | |
| TOP LEFT: | A01 |
| LOWER RIGHT: | D3 |
| INCR. DIR: | EAST |
| CREATE NEW GRID? | |
| | |
| SETUP DATA UTIL XFER | |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 1) Use the **UP** and **DOWN** arrow keys to scroll through the new **Grid List Items** until **CREATE NEW GRID?** is highlighted.
- 2) Press the **ENTER** key to accept the grid parameters, and activate the confirmation screen.

| CONFIRM | |
|----------------------|-----|
| CREATE | |
| NEW | ? |
| GRID? | |
| OK | ESC |
| SETUP DATA UTIL XFER | |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 3) Press the **OK** key to save the **New Grid**, or the **ESC** key to cancel the **New Grid** setup and return to the **DATA** menu.
- 4) Press the **MEAS** key to return to the measurement screen and begin storing readings.

10.3 Storing a reading

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

Storing a Reading

| | |
|-------------|----------------|
| DELAY: 0.00 | WIDTH: 2.06 |
| MODE: P-E | GAIN: 46 |
| GATE1: 0.00 | GATE2: 0.00 |
| THR: 2 | LOC: A1 |
| FILE: | |

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

| | A | B | C |
|---|--------------|-------|-------|
| 1 | 0.027 | 0.027 | 0.027 |
| 2 | 0.027 | 0.999 | 0.027 |
| 3 | 0.027 | 0.027 | 0.196 |
| 4 | 0.027 | 0.027 | 0.027 |

- 2) Press the **ENTER** key to display the **Grid View Box**.

- 3) Press the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll the target cell cursor to the desired storage location.
- 5) Press the **ENTER** key to save the current reading in the highlighted cell location.
- 6) Abort the **Grid View Box** by pressing the **MEAS** key at any time.

Note: Every time a reading is saved to memory, a picture of the display is automatically saved with the reading.

10.4 Viewing stored readings and waveforms

It is sometimes necessary to go back and view the stored readings and waveforms using the **MVX** without a PC. The following procedures outline this process:

Viewing Stored Readings & Waveforms

| | | | |
|--------|------|--------|------|
| DELAY: | 0.00 | WIDTH: | 2.06 |
| MODE: | P-E | GAIN: | 46 |
| GATE1: | 0.00 | GATE2: | 0.00 |
| THR: | 2 | LOC: | A1 |
| FILE: | | | |

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

| | A | B | C |
|---|-------|-------|-------|
| 1 | 0.027 | 0.027 | 0.027 |
| 2 | 0.027 | 0.999 | 0.027 |
| 3 | 0.027 | 0.027 | 0.196 |
| 4 | 0.027 | 0.027 | 0.027 |

- 2) Press the **ENTER** key to display the **Grid View Box**.
- 3) Press the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll the stored readings and corresponding display view. Notice as the cursor is moved to a different cell, the display will be updated with the display view saved with the reading.
- 4) The user may opt to clear a specific reading and save a new one at any time. Press the **CLR** key in the appropriate cell location to clear the reading, take a new measurement, and press the **OK** key to save the new reading.
- 5) Abort the **Grid View Box** by pressing the **MEAS** key at any time.

10.5 Deleting a grid

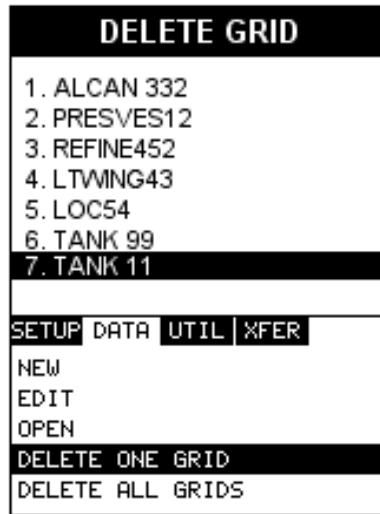
Deleting One or All Grids from Memory

Deleting One Grid

```

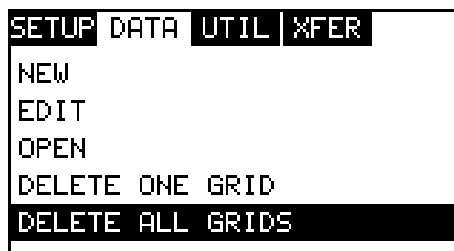
SETUP DATA UTIL XFER
NEW
EDIT
OPEN
DELETE ONE GRID
DELETE ALL GRIDS
    
```

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **DATA** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **DELETE ONE GRID** is highlighted.

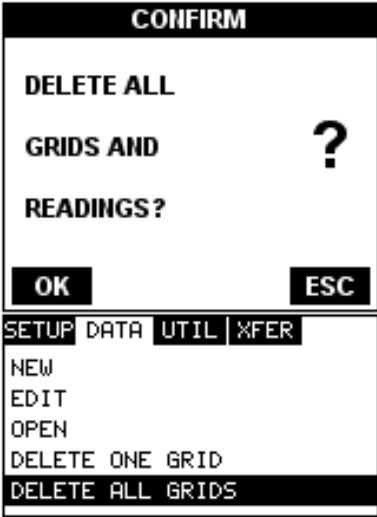


- 3) Press the **ENTER** key to display the **Grid List Box**.
- 4) Use the **UP** and **DOWN** arrow keys to scroll through the stored **Grids** until the target **Grid** to delete is highlighted.
- 5) Press the **OK** key to delete the **Grid**.
- 6) Press the **MEAS** key to return to the measurement screen.

Deleting All Grids



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **DATA** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **DELETE ALL GRIDS** is highlighted.



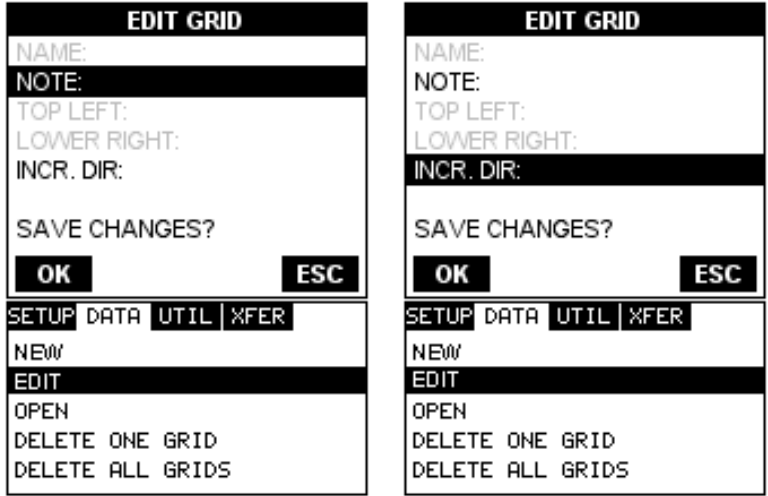
The screenshot shows a confirmation screen titled "CONFIRM". The main text reads "DELETE ALL GRIDS AND READINGS?" with a large question mark to the right. At the bottom of the screen are two buttons: "OK" on the left and "ESC" on the right. Below the main screen is a menu bar with "SETUP DATA UTIL XFER" and a list of options: "NEW", "EDIT", "OPEN", "DELETE ONE GRID", and "DELETE ALL GRIDS".

- 3) Press the **ENTER** key to activate the confirmation screen.
- 4) Press the **OK** key to delete **All Grids** from memory, or the **ESC** key to abort.
- 5) Press the **MEAS** key to return to the measurement screen.

10.6 Editing a grid

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

Editing a Grid



The image shows two side-by-side screenshots of the "EDIT GRID" screen. Both screens have a menu bar at the top with "SETUP DATA UTIL XFER" and a list of options: "NEW", "EDIT", "OPEN", "DELETE ONE GRID", and "DELETE ALL GRIDS".

The left screenshot shows the following fields: "NAME:", "NOTE:", "TOP LEFT:", "LOWER RIGHT:", "INCR. DIR:", and "SAVE CHANGES?". There are "OK" and "ESC" buttons at the bottom.

The right screenshot shows the same fields, but the "INCR. DIR:" field is highlighted with a black background, indicating it is the current selection.

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **DATA** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **EDIT** is highlighted.
- 3) Press the **ENTER** key to display the **Edit List Box**.
- 4) Use the **UP** and **DOWN** arrow keys to scroll through the **Edit** options until **NOTE** or **INCR. DIR** is highlighted.

Note: If editing the **INCR. DIR**, simply use the **LEFT** or **RIGHT** arrow keys to scroll **NONE**, **NORTH**, **EAST**, **SOUTH**, or **WEST**. **Proceed to step 10.**



- 5) Press the **ENTER** key to activate the **Alpha Edit box** – **Only used when editing the NOTE.**
- 6) Use the **UP**, **DOWN**, **LEFT**, & **RIGHT** arrow keys to highlight the appropriate alpha characters.
- 7) Press the **ENTER** key to select a character and advance to the next field of the **Comments**.

- 8) Use the **CLR** key to backspace if necessary.
- 9) Repeat steps **6 - 8** until the **Comments** are completed.

| EDIT GRID | |
|------------------|----------------|
| NAME: | |
| NOTE: | |
| TOP LEFT: | |
| LOWER RIGHT: | |
| INCR. DIR: | |
| SAVE CHANGES? | |
| OK | ESC |
| SETUP | DATA UTIL XFER |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 10) Press the **UP** or **DOWN** arrow key to highlight **SAVE CHANGES**, and the **OK** key to activate the confirmation screen.

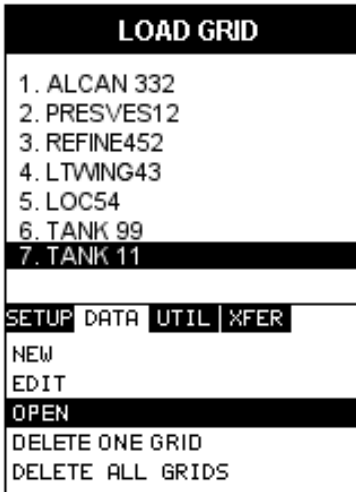
| CONFIRM | |
|------------------|----------------|
| OVERWRITE | |
| CURRENT | ? |
| GRID? | |
| OK | ESC |
| SETUP | DATA UTIL XFER |
| NEW | |
| EDIT | |
| OPEN | |
| DELETE ONE GRID | |
| DELETE ALL GRIDS | |

- 11) Press the **OK** to save the changes or the **ESC** key to cancel editing the grid parameters.
- 12) Press the **MEAS** key to return to the measurement screen.

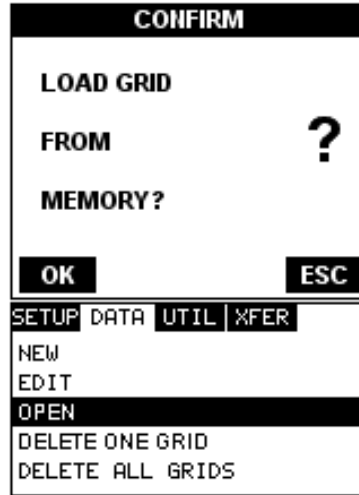
10.7 Changing the active grid (Open)

The user may have transferred grid templates from a PC to the **MVX**, or setup grids using the **MVX** at an earlier time. The name of the currently active grid is always displayed at the bottom of the **Hot Menu Items** in measurement mode. It's not only important to recognize what grid is currently active, but also be able to change the active grid at any time. The following procedures outline this process:

Changing the Active Grid



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **DATA** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **OPEN** is highlighted.
- 3) Press the **ENTER** key to display the **Grid List Box**.
- 4) Use the **UP** and **DOWN** arrow keys to scroll through the grids until the target grid is highlighted.



- 5) Press the **ENTER** key to activate the confirmation screen.
- 6) Press the **OK** key to load the grid from memory.
- 7) Press the **MEAS** key to return to the measure screen.

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

11.1 Introduction to Setups

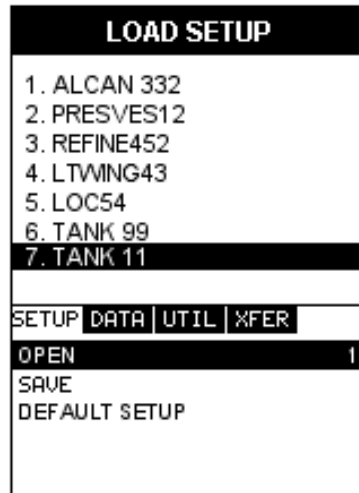
Often times, users are faced with a variety of tasks and applications that are sometimes similar, but often times very different. With a standard thickness gauge, the user would have to recalibrate for each individual application respectively. With all the features of the **MVX**, the number of potential applications also increases based on ability alone. This is primarily in reference to the addition of those very difficult applications, where a standard thickness gauge would not be feasible, or capable of accomplishing the tasks.

The increased number of features and parameters also adds to the overall setup time, or amount of time to set up marginal applications with perfection and understanding. Because of the additional time involved, the **MVX** has been equipped with the ability to save these setups to memory and be recalled at any time. The **MVX** can store **64 custom setups**. These setups can be bi-directionally transferred to and from a PC. Therefore, the user can save as many setups as necessary for all of the individual applications. This saves a great deal of time and knowledge for future inspections of the same job or project. This feature also eliminates error between two or more users during the setup and calibration process.

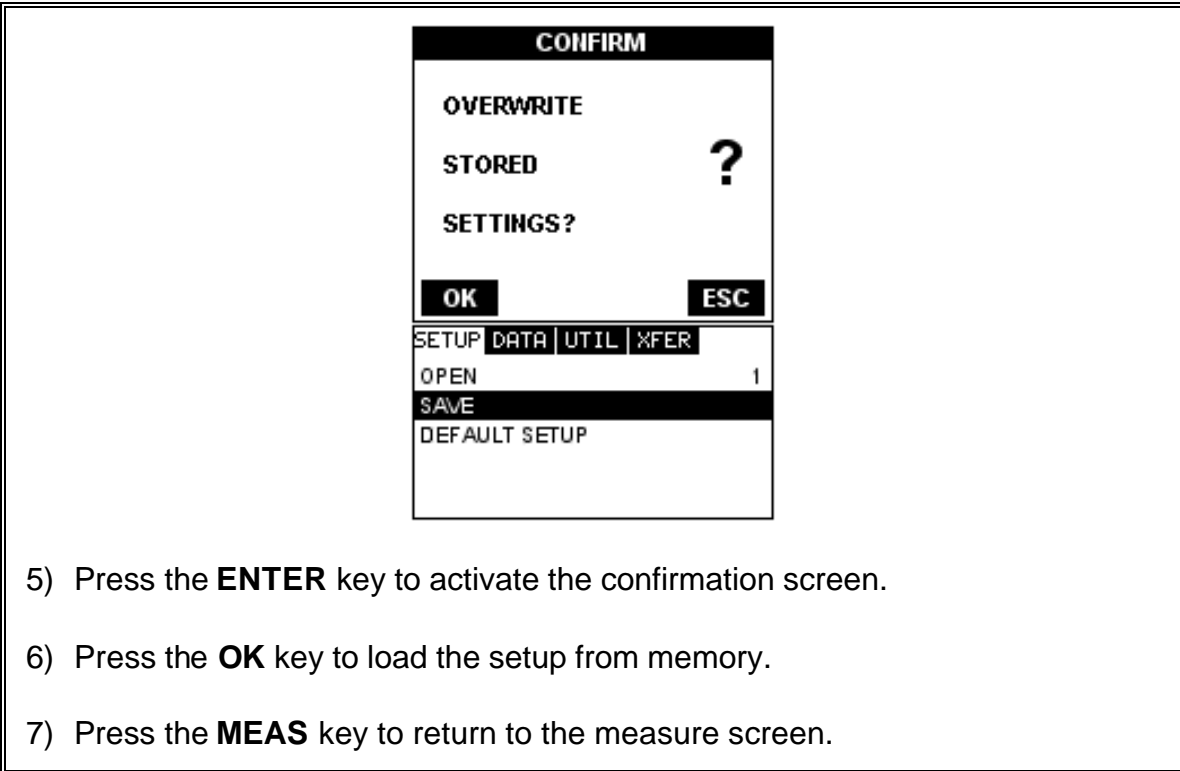
11.2 Opening a Setup

The **MVX** is loaded with a number of setups from the factory. These setups can be opened, edited, and saved to any one of **64 setup locations**. If a factory setup is written over, the user can simply reload the default factory setups at anytime using the utility software included with the **MVX**. The factory setups are general setups **Only**. However, they may serve as an excellent starting point, requiring only minor adjustments to work for custom applications. It is recommended that user customized setups be saved to an empty location, and save the factory setups for the purpose of a general starting point. The following procedures outline how to open factory and custom setups:

Opening a Setup



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **OPEN** is highlighted.
- 3) Press the **ENTER** key to display the **Setup List Box**.
- 4) Use the **UP** and **DOWN** arrow keys to scroll through the setups until the target setup is highlighted.



11.3 Saving a Setup

Once the **MVX** parameters and features have been adjusted for an application, the user may elect to save these settings to a specific setup location for future use. This can potentially save time and reduce error between users.

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

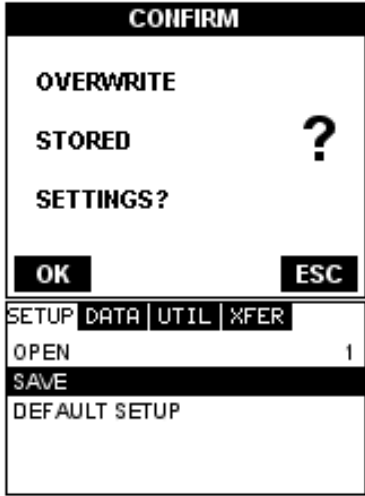
Saving the Setup

| SAVE SETUP | |
|---------------|--------------------|
| NAME: | |
| NOTE: | |
| SAVE SETUP? | |
| SETUP | DATA UTIL XFER |
| OPEN | 1 |
| SAVE | |
| DEFAULT SETUP | |

- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **SAVE** is highlighted.
- 3) Press the **ENTER** key to display the **Save Setup Parameters List Box**.
- 4) Press the **UP** and **DOWN** arrow keys to scroll the **Name** and **Note** parameters.



- 5) When the parameter to edit is highlighted, press the **ENTER** key to activate the **Alpha Edit Box**.
- 6) Use the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrow keys to scroll through the characters, the **ENTER** key to select characters, and the **CLR** key to backspace through the characters, until the **Name** or **Note** fields have been edited.
- 7) Press the **OK** key to return to the **Save Setup Parameters List Box**.
- 8) If both parameters will be edited, **repeat steps 4 – 7**.
- 9) Use the **UP** and **DOWN** arrow keys to scroll to and highlight **SAVE SETUP**.
- 10) Press the **ENTER** key to activate the **Setup List Box**.
- 11) Use the **UP** and **DOWN** arrow keys to scroll through the setups until the target location to save the **Setup** is highlighted.



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

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

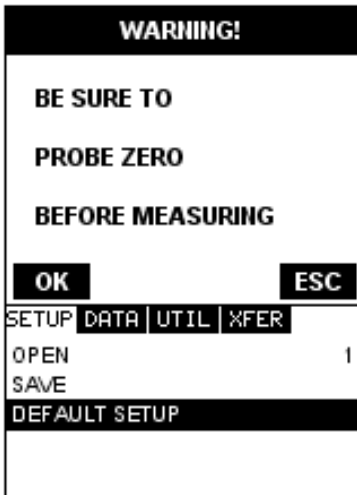
14) Finally, press the **MEAS** key to return to the measurement screen.

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

11.4 Using the Default Setup

The default setup feature was added to the *MVX* to use, as a last resort, if there are no setups stored in the gauge –factory or otherwise. The only time this might possibly occur is if the setup file in the *MVX* was somehow corrupted, and the user does not have access to a computer to re-load the factory setups back into the *MVX*. This gives the user the ability to load and modify a basic setup as follows:

Using the Default Setup



- 1) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **SETUP** menu is highlighted and displaying the submenu items.
- 2) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **DEFAULT SETUP** is highlighted.
- 3) Press the **ENTER** key to load the Default Setup and display the **Warning Message Box**.

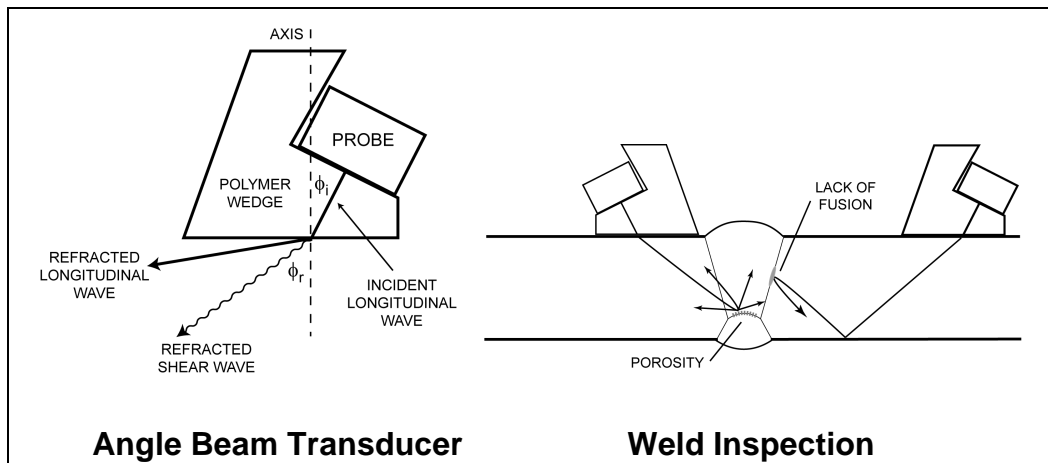
Important Note: Remember to perform a probe zero function prior to measuring. The default setup clears the probe zero value.

- 4) Press the **OK** key to return to the measurement screen.

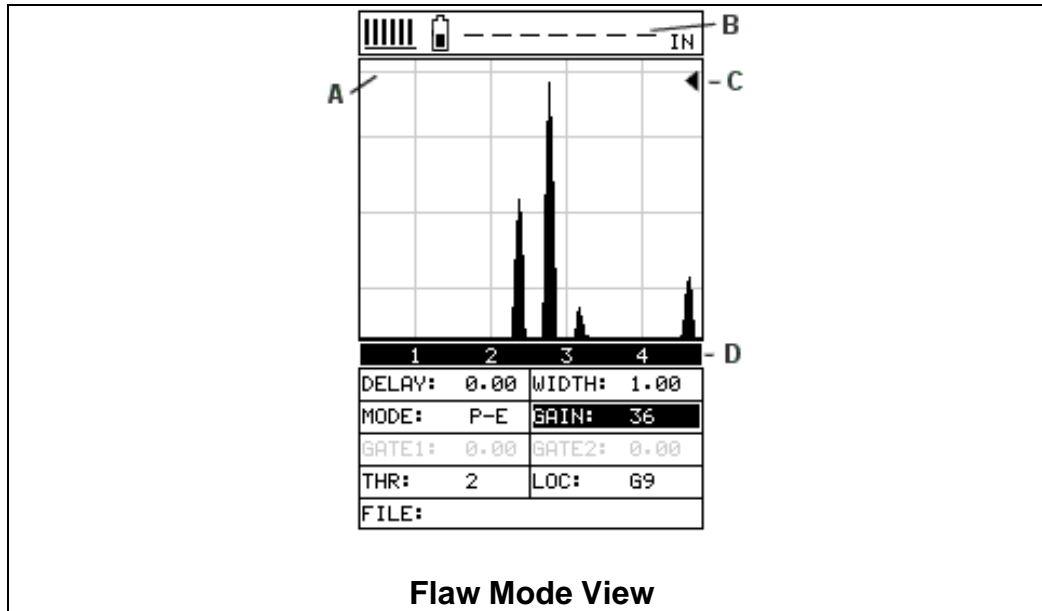
CHAPTER TWELVE USING THE FLAW MODE FEATURE

12.1 Introduction to Flaw Mode

The **Flaw Mode** feature was added to the **MXV** to provide inspectors with a basic prove-up flaw detection mode using an angle beam transducer. This mode enables inspectors to locate porosity, defects, inclusions, and cracks in a variety of test materials. Angle beam transducers, are transducers attached to a delay line wedge at specific angles. Some of the more common angles are 45°, 60°, and 70°. The sound wave is introduced into the test material at a specific angle, and converted from a longitudinal wave into a shear wave. The introduction at specific angles enables inspectors to steer the sound wave in a specific direction according to the position and location of specific types of defects.



12.2 Flaw Mode View



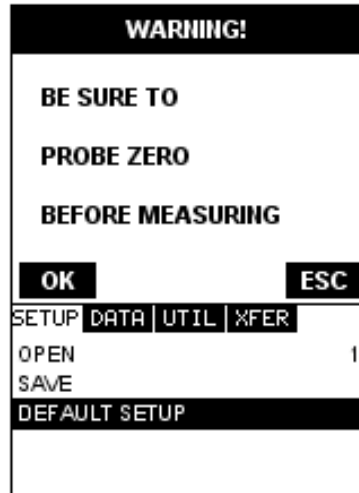
Refer to the diagram above. The grey grid line, **point (A)**, corresponds to 100% FSH (Full Screen Height). The other grid lines correspond to 25% amplitude increments, in order to calibrate the *MVX* in this mode. The digital thickness value has been replaced by dashed lines at **point (B)**. The digital thickness value is not applicable while operating in this mode. Notice at **point (D)**, the vertical grid lines have simply been given quadrant numbers. Again, this is because the grid lines do not correspond to a thickness value based on the delay and width of the screen. Finally, **point (C)** is the peak hold symbol - carrot. The carrot is only displayed if the flaw mode is set to “peak”. The peak hold position represents the highest amplitude obtained during the scan. Pressing the **CLR** key will reset the peak hold position to zero.

12.3 Enabling Flaw Mode

Note: This mode is only available in firmware version 1.5 forward. Gauges that were purchased prior to this version will need to be flash programmed with the latest revision firmware. Upgrades are available on our website at no charge. However, gauges purchased prior to this revision will also need a slight hardware modification. Please contact Dakota Ultrasonics for additional information regarding the

modification. Also, an accessory dual lemo to single microdot cable is available from the factory. The procedures to use the **FLAW MODE** feature are outlined below:

Using the Default Setup



- 1) Attach the special dual lemo to microdot cable and angle beam transducer to the **MVX**.
- 2) Press the **MENU** key once to activate the menu items tab. Press the **MENU** key multiple times to tab right and the **ESC** key multiple times to tab left until the **PROBE** menu is highlighted and displaying the submenu items.
- 3) Use the **UP** and **DOWN** arrow keys to scroll through the sub menu items until **FLAW MODE** is highlighted.
- 4) Use the **LEFT** and **RIGHT** arrow keys to scroll the flaw mode options (off, on, peak).

Off: Disables the Flaw Mode option.

On: Enables the Flaw Mode option and view.

Peak: Enables the Flaw Mode and Peak Hold options and view. When this option is enabled, a carrot will appear on the right side of the display. The position of the carrot corresponds to the highest waveform amplitude value

detected. In order to clear the peak hold carrot location and start another scan, the **CLR** key must be pressed. When pressed, the carrot will be displayed at the baseline, or at zero amplitude.

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

Note: All the features previously discussed in this manual can be used to adjust and fine tune the **MVX** while in Flaw Mode.

CHAPTER THIRTEEN USING THE UTILITY SOFTWARE

13.1 Computer System Requirements

DakView 3 will run on many different operating systems: Windows 95, Windows 98 (1st or 2nd edition), Windows NT 4.0 with Service Pack 5, Windows ME, Windows XP, Windows 2000 Professional, Windows 2000 Server, or Windows 2000 Advanced Server operating systems running on Intel or AMD hardware.

A Pentium 166MHz or faster processor with at least 32 megabytes of physical RAM is required. You should have 40 megabytes of free disk space before attempting to install **DakView 3**.

DakView 3 requires an available communications port in order to transfer data to and from the *MOVX*. **DakView 3** supports COM1, COM2, COM3, and COM4.

USB to Serial Converter

Some newer laptop computers do not have standard serial ports. In this case it is possible to use a USB to Serial converter. If a serial to USB cable is needed, Contact Dakota Ultrasonics (pt# N-402-0510).

13.2 Installing **DakView 2.X**

DakView 3 comes on a CD-ROM with an automatic installer program. Place the CD in your computer's CD tray and close the door. Open the CD-ROM by double clicking on the My Computer ICON, then double click on the CD. Finally, double click on the **SETUP** icon to begin the installation.

Refer to the help section in **DakView 3**, for the complete operating manual, setup, and operation.

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 |

MVX High Performance Thickness Gauge

| | | | |
|------------------|---------------|--|-------------|
| 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 |

MATERIAL SAFETY DATA SHEET

N/A = not applicable or not available

(To comply with 29 CFR 1910.1200)

SECTION 1 – PRODUCT IDENTIFICATION

Product Name: **SOUNDSAFE®**
Generic Name: Ultrasonic Couplant
Manufacturer: Sonotech, Inc.
774 Marine Dr., Bellingham, WA 98225
(360) 671-9121

NFPA Hazardous Materials
Identification System (est)
Health.....0
Flammability.....0
Reactivity.....0

SECTION 2 – HAZARDOUS INGREDIENTS

This material does not contain any ingredients having known health hazards in concentrations greater than 1%.

This material does not contain any known or suspected carcinogens.

SECTION 3 – PHYSICAL DATA (nominal)

Boiling Point: >220°F pH: 7.35 – 7.9
Freezing Point: <20°F Acoustic Imp.: 1.726x10⁶
Vapor Pressure: N/A Vapor Density: N/A
Evaporation Rate: N/A Specific Gravity: >1.02
Solubility in Water: complete
Appearance and Odor: water white, opaque gel;
bland odor

SECTION 4 – FIRE AND EXPLOSION HAZARD DATA

Flash Point: none
Upper Exposure Limit: none
Lower Exposure Limit: none
Special Fire Fighting Procedures: N/A
Extinguishing media: N/A
Unusual Fire and Explosion Hazards: none

SECTION 5 – REACTIVITY DATA

Stability: Stable
Conditions to Avoid: none
Incompatibility (Materials to Avoid): none known
Hazardous Polymerization: will not occur
Hazardous Decomposition or Byproducts: none known

SECTION 6 – HEALTH HAZARD AND FIRST AID DATA

Routes of Entry:¹
Skin: not likely Ingestion: not normally
Eyes: not normally Inhalation: no
Effects of Overexposure: *Acute:* May cause temporary
eye irritation
Chronic: none expected

First Aid Procedures:
Skin: Remove with water if desired.
Eyes: Flush with water for 15 minutes.
Ingestion: For large quantities, induce vomiting and
call a physician.
Inhalation: N/A

SECTION 7 – STORAGE AND HANDLING INFORMATION

Precautions to be taken in handling and storage: Store
between 20°F and 120°F. Spills are slippery and should
be cleaned up immediately.
Steps to be taken in case material is released or spilled:
Pick up excess for disposal. Clean with water.
Waste disposal method: Dispose of in accordance with
federal, state, and local regulations.

SECTION 8 – CONTROL MEASURES

Respiratory Protection: not required
Ventilation: not required
Protective Gloves: on individuals demonstrating
sensitivity to SOUNDSAFE®
Eye Protection: as required by working conditions
Other Protective Equipment: not required

¹SOUNDSAFE® contains only food grade and cosmetic grade ingredients.

SONOTECH, INC.

774 Marine Dr., Bellingham, WA 98225
Telephone: (360) 671-9121

Toll Free: 1-800-458-4254

Fax: (360) 671-9024

