USER'S MANUAL

MG2, MG2-XT, MG2-DL

Ultrasonic Thickness Gages

Part No. 910-257C

PANAMETRICS-NDT™

Nondestructive Testing Products

In accordance with European Directive 2002/96/EC on Waste Electrical and Electronic Equipment, this symbol indicates that the product must not be disposed of as unsorted municipal waste, but should be collected separately. Refer to your local Olympus distributor for return and/or collection systems available in your country.

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Preface

MG2 Series Ultrasonic Gages (MG2, MG2-XT, MG2-DL) are designed and manufactured as precision instruments. Under normal working conditions, they will provide long, trouble-free service.

Damage in transit - Inspect the unit thoroughly immediately upon receipt for evidence of external or internal damage that may have occurred during shipment. Notify the carrier making the delivery immediately of any damage, since the carrier is normally liable for damage in shipment. Preserve packing materials, waybills, and other shipping documentation in order to establish damage claims. After notifying the carrier, contact Olympus NDT™ so that we may assist you in the damage claims, and provide replacement equipment, if necessary.

Warranty

Olympus NDT guarantees MG2 Series Ultrasonic Gages to be free from defects in materials and workmanship for a period of two years (twenty-four months) from date of shipment. The warranty covers only equipment that has been used in a proper manner as described in this instruction manual and has not been subject to excessive abuse, unauthorized repair, or modification. DURING THIS WARRANTY PERIOD, Olympus NDT LIABILITY IS STRICTLY LIMITED TO REPAIR OR REPLACEMENT OF A DEFECTIVE UNIT AT ITS OPTION. Olympus NDT does not warrant MG2 Series Ultrasonic Gages to be suitable for intended use, and assumes no responsibility for unsuitability for intended use. Olympus NDT accepts no liability for consequential or incidental damages including damage to property and/or personal injury.

This warranty does not include the transducer, transducer cable,

charger or battery. The customer will pay shipping expense to the Olympus NDT™ plant for warranty repair; Olympus NDT will pay for the return of the repaired equipment. For instruments not under warranty, the customer will pay shipping expenses both ways.

Olympus NDT offers an optional third year warranty coverage (at an additional cost), under the same terms, at the time of purchase.

Olympus NDT reserves the right to modify all products without incurring responsibility for modifying previously manufactured products. Olympus NDT does not assume liability for the results of particular installations, as these circumstances are not within our control.

1 GENERAL INFORMATION

Panametrics-NDT™ MG2 Series Ultrasonic Gages are designed for a wide range of applications including quick spot measurements to determine wall thickness of various structures and measurement of corroded metal. The MG2 series includes:

- MG2 - Features include: Automatic probe recognition, quick compensations for transducer temperature changes, fast scan min hold mode with 20 readings/sec and freeze function, selectable Hold or Blank display during loss of signal (LOS) conditions, LCD with selectable backlight or auto backlight for a highly readable display under all lighting conditions, selectable English/metric units, selectable calibration lockout functions to prevent accidental change to calibration, selectable resolutions .001" (.01mm) or .01" (.1mm), easy calibration for unknown material velocity and/or transducer zero, and automatic power off.
- MG2-XT - Features include: Automatic probe recognition, quick compensations for transducer temperature changes, fast scan min hold mode with 20-readings/sec and freeze function, freeze function that instantly freezes displayed measurement, differential mode that displays the difference between the actual thickness and a user set nominal reference value, THRU-COAT® that displays the thickness of the coating and the true metal thickness using a single backwall echo, Echo-to-Echo that displays the true metal thickness and ignores the thickness of the coating layer, High-Low Alarm that indicates out of tolerance measurements, Gain Adjustment to help enable measurements in difficult applications, Material Sensitivity Optimization, selectable Hold or Blank display during loss of signal (LOS) conditions, LCD with selectable backlight or auto backlight for a highly readable dis-

play under all lighting conditions, selectable calibration lockout functions to prevent accidental change to calibration, selectable resolutions .001" (.01mm) or .01" (.1mm), and easy calibration for unknown material velocity and/or transducer zero.

- MG2-DL - Features include: Quick compensations for transducer temperature changes, fast scan min hold mode with 20 readings/sec and freeze function, freeze function that instantly freezes displayed measurement, differential mode that displays the difference between the actual thickness and a user set nominal reference value, THRU-COAT® that displays the thickness of the coating and the true metal thickness using a single backwall echo, Echo-to-Echo that displays the true metal thickness and ignores the thickness of the coating layer, High-Low Alarm that indicates out of tolerance measurements, Gain Adjustment to help enable measurements in difficult applications, Material Sensitivity Optimization, On-Board Datalogger for storage of up to 8000 thickness readings, and USB output for computer interface.

Table 1 below lists MG2 Series features:

Table 1: MG2 Series Features

MG2 Series Features	MG2	MG2-XT	MG2-DL
Thickness Range 0.020"-25.00" (0.50-635.0 mm)	•	•	•
Compatible with Complete Line of Dual Element Transducers	•	•	•
Thickness Display Resolution up to 0.001" (0.01 mm)	•	•	•

Table 1: MG2 Series Features

MG2 Series Features	MG2	MG2-XT	MG2-DL
Electroluminescent Display Back Lighting	•	•	•
Automatic Probe Recognition	•	•	•
High Temperature Capabilities	•	•	•
Fast Measurement Rate of 20 per second	•	•	•
Fast Minimum Mode	•	•	•
Freeze Mode	•	•	•
Zero Compensation Mode	•	•	•
Display Hold/Blank	•	•	•
Inches/millimeter Mode	•	•	•
Low Battery Indicator	•	•	•
150-Hour Battery Operating Time	•	•	•
Battery Saver	•	•	•
Two Year Limited Warranty	•	•	•
Hazardous Area Operation as per MIL-STD 810E Method 511.3	•	•	•

Table 1: MG2 Series Features

MG2 Series Features	MG2	MG2-XT	MG2-DL
Gain Adjust		•	•
Auto Sensitivity Gain Optimization		•	•
Differential Mode		•	•
THRU-COAT®		•	•
Echo-to-Echo		•	•
Hi-Low Alarm		•	•
Internal Datalogger			•
Live Waveform Option		•	•
USB **Note:** The USB port on the MG2 and MG2-XT is used for internal software upgrade only.	•	•	•

The gages employ a full range of user-controlled display functions to measure the thickness of corroded, pitted, scaled, granular, and other difficult materials from one side only. A full line of transducers is available to measure materials between 0.020” (0.50mm) and 25” (635mm) thickness and between -20°C and +500°C in temperature.

The MG2 series makes full use of its microprocessor to offer selectable, advanced measurement features. Moreover, the MG2 Series continuously adjusts the receiver setup so that every

measurement is optimized for reliability, range, sensitivity, and accuracy.

The MG2-DL built-in datalogger allows a simple method for recording thickness readings and for labeling each point with an identification code, and can store up to 8000 thickness readings, providing an alternative to recording data manually.

2 BASIC OPERATION

This section demonstrates basic MG2 measurement techniques. The unit has been shipped from the factory set up with the following conditions.

STANDARD RESOLUTION:	**0.001 in. or 0.01mm**
SOUND VELOCITY:	**0.2260 in/µS or 5.740 mm/µS. (Approximate sound velocity for the carbon steel test bar provided with the gage.) See note below.**
BLANK MODE:	**Display is blank when not making a measurement.**

These conditions have been selected to demonstrate the instrument's ease of use. A further explanation of these default conditions can be found in later sections of this manual. These conditions may be changed after the operator becomes familiar with the advanced features of the gage.

Note: The default value for sound velocity is only an approximation of the sound velocity in the test block material. The sound velocity of low to medium carbon alloy steel is typically 0.2260 in/µS or 5.740 mm/µS. Therefore, if you find the default value gives inaccurate results on your material, refer to calibration instructions.

2.1 Initial Setup

Follow this procedure when operating the gage for the first time.

Step 1: Plug the transducer into the connector at the top end of the MG2 case.

Note: When unplugging a transducer, pull ONLY on the molded plug, NOT on the cable.

Step 2: Press the [ON/OFF] key to turn the gage on. The transducer should NOT be coupled to the test piece. After a power up screen, the display screen displays:

Figure 2-1: Transducer ZERO Compensation

This means that the gage requires the following transducer ZERO compensation step.

Step 3: Wipe couplant from the tip of the transducer.

Step 4: Press [2ndF], [Cal Zero] (Do-Zero).

The gage displays a zero value and then displays the measurement screen.:

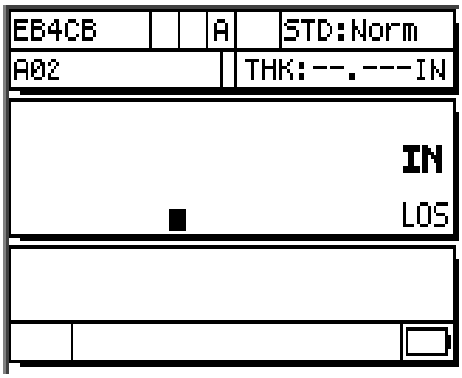


Figure 2-2: Zero Screen

Step 5: You are now ready to make measurements. The current units are indicated on the right of the display. Inches (IN) or millimeters (MM) may be changed to the alternate measurement units by pressing [2ndF], [↓](Setup), then pressing [↓] to highlight units and using [←, →] to select English (inches) or metric units.

Step 6: Press the [Meas] key.

Note: This is not a substitute for doing a standard calibration.

2.2 Making Measurements

Step 1: Apply couplant to the test block or material at the spot to be measured. In general, the smoother the material surface, the thinner the couplant may be. Rough surfaces require more viscous couplant such as gel or grease. Special couplants are required for high temperature applications.

Step 2: Press the tip of the transducer to the surface of the material to be measured. Use moderate to firm pressure and keep the transducer as flat as possible on the material surface.

Step 3: Read the material thickness on the gage display.

Note: For highest accuracy both a velocity and zero calibration must be done.

2.3 Low Battery

The gage will operate for at least 150 hours on one set of batteries under normal conditions (not in FAST mode and with backlight off). The battery symbol in the bottom right corner of the display indicates remaining battery life.

3 STANDARD CALIBRATION MEASUREMENT

3.1 Introduction

The MG2 calibration procedure adjusts the gage so that it measures accurately on a particular material, using a particular transducer at a particular temperature. Calibration procedures include:

1. **Transducer Zero Compensation–**Calibrates for the sound transit time in each of the dual transducer delay lines, which varies from unit to unit and with temperature. This simple "off-block" procedure must be done when the gage is turned on, when the transducer is changed, and whenever the transducer temperature changes significantly.
2. **Material Velocity Calibration or CAL VEL–**Done using a thick test block of the measured material with known thickness or by entering the previously determined material velocity manually. It must be performed for each new type of material.
3. **Zero Calibration or CAL ZERO–**Done using a thin test block of the measured material with known thickness. Unlike the first two calibrations, this procedure is not required unless the best absolute accuracy is demanded (better than ±0.004" or ±0.10mm). If required, it need only be done once for each new transducer and material combination. It does not have to be repeated when the transducer temperature changes. Transducer Zero

Compensation will adjust for temperature changes in the transducer.

3.2 Transducer Zero Compensation

This step must be done whenever the message “Do--” and the ZERO flag are displayed (do ZERO).

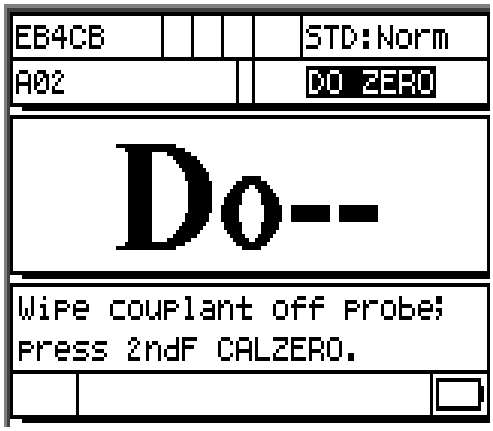


Figure 3-1: Do Screen

To do the Transducer Zero Compensation, wipe any couplant from the transducer face, and press [2ndF], [Cal Zero](Do Zero). The gage will momentarily display the zero calibration value and then go to the measure mode automatically. When measurements are being made on surfaces that are significantly above or below room temperature,

[2nd F], [Cal Zero](Do Zero) should be pressed to compensate for any temperature changes in the transducer.

3.3 Velocity and Zero Calibration

The Material Velocity and Zero Calibration procedures may be combined using a thick and a thin calibration block of the same material.

Step 1: Update the Transducer Zero Compensation by wiping the transducer face and pressing [2nd F], [Cal Zero](Do Zero).

Step 2: Couple the transducer to the thick calibration block.

Step 3: Press [CAL VEL].

Step 4: When the thickness reading is stable, press the [ENTER] key.

Step 5: Uncouple the transducer from the block and use the [↑, ↓, ←, and →] slewing keys to enter the thickness of the thick block.

Step 6: Couple the transducer to the thin block and press the [CAL ZERO] key.

Step 7: When the reading is stable, press the [ENTER] key.

Step 8: Uncouple the transducer from the block and use the [↑, ↓, ←, and →] slewing keys to enter the thickness of the thin block.

Step 9: Press the [MEAS] key to complete the calibration and go to the Measure mode.

Note: Cal Velocity should always be performed on the thick sample and Cal Zero should always be performed on the thin sample.

Note: Before calibrating, the measured thickness value while coupled to the thin calibration block should be within +/- 0.010 inch or +\- 0.20 mm of the correct thickness. If the indicated thickness is two or more times the actual thickness of the thin calibration block with a good approximate sound velocity, the gage is "doubling", that is, measuring to the 2nd or 3rd multiple echo. Do not attempt to do a Velocity and Zero calibration under this condition. Doing so will cause an error. Instead, correct the cause of the doubling. Either the calibration block is thinner than the specified capability of the transducer, the transducer is malfunctioning, or the gage is malfunctioning.

3.4 Material Velocity Calibration

3.4.1 When Material Sound Velocity Is Unknown

To do the Material Velocity Calibration, a calibration block made from the material to be measured must be used. The block should be approximately as thick as the thickest section to be measured and have flat, smooth, and parallel front and back surfaces. The thickness of the block must be known exactly.

Figure 3-2: Unknown Sound Material Do Screen

Step 1: Update the Transducer Zero Compensation by wiping the transducer face clean of all couplant and pressing [2ndF], [Cal Zero](Do Zero).

Step 2: Couple the transducer to the block.

Step 3: Press the [CAL VEL] key.

Step 4: When the thickness reading is stable, press the [ENTER] key.

Step 5: Uncouple the transducer and use the [↑, ↓, ←, and →] slewing keys to enter the thickness of the standard.

Step 6: Press the [MEAS] key to complete the calibration and return to Measure mode.

If the gage double beeps before returning to the Measure mode, then an error has been made in the calibration procedure and the velocity has not been changed. The most likely problem is that the thickness value entered was not correct.

[2nd F], [CAL VEL](Vel) may be pressed following Velocity Calibration (or at any time from the Measure mode) in order to read and record the material velocity for this particular material. This velocity may be entered by means of the slewing keys in the future when measuring this material, without using the block.

Note: Sound velocity in all materials changes with temperature. For maximum accuracy the calibration block should be at approximately the same temperature as the samples to be measured.

3.4.2 When Material Sound Velocity Is Known

When preparing to measure a different material, of known sound velocity, the velocity may be entered directly without doing the CAL VEL procedure discussed above.

Step 1: From the Measure mode press [2nd F], [CAL VEL](Vel). The current velocity will be displayed.

Step 2: This number may then be changed to the desired value using the [↑, ↓, ←, and →] slewing keys.

Step 3: Press [MEAS] to complete the entry and return to the Measure mode. If the gage is turned off before the [MEAS] key is pressed, the velocity will not be updated to the new value, but instead will retain the previous value.

3.5 Zero Calibration

To do the Zero Calibration, a calibration block of the material to be measured must be used. The block should be approximately as thin as the thinnest section to be measured. If the surface of the material to be inspected is rough, the surface of the calibration block may be roughened to simulate the actual surface to be measured. Rough surfaces generally reduce the accuracy of measurements but simulating actual surface conditions on the calibration block can help to improve results. The exact thickness of the sample must be known.

Step 1: First update the Transducer Zero Compensation by wiping the transducer face clean of all couplant and pressing [2ndF], [CAL ZERO](Do Zero) while in the Measure mode.

Step 2: Couple the transducer to the standard.

Step 3: Press the [CAL ZERO] key.

Step 4: When the thickness reading is stable, press the [ENTER] key. The [ENTER] key will not be accepted if the LOS display flag is on.

Step 5: Uncouple the transducer and use the [↑, ↓, ←, and →] slewing key to enter the thickness of the standard.

Step 6: Press the [MEAS] key to complete the calibration and return to the Measure mode. If the gage is turned off before the [MEAS] key is pressed, the Zero value will not be updated to the new value but instead will retain the previous value.

If the gage sounds a long beep before returning to the Measure mode, an error has been made in the calibration procedure and the Zero value has not been changed. The most likely cause is that the entered thickness was not correct.

3.6 THRU-COAT® Calibration (MG2-XT and MG2-DL Only)

THRU-COAT is a special feature that measures the true metal thickness of coated or paint materials. This feature only requires a single backwall echo and is recommended for applications with heavy corrosion where the outside of the material is painted. The THRU-COAT feature is available with D7906 and D7908 transducers only.

When you power up the unit with a THRU-COAT transducer or change to one of the THRU-COAT transducers, the gage prompts you with a message “DO__”.

To setup THRU-COAT parameters, follow these steps:

Step 1:Wipe the couplant from the transducer face.

Step 2:Press [2nd F], [CAL ZERO](Do Zero). The THRU-COAT Setup dialog box displays.

Step 3:Press **[←]** or **[→]** to select **On** or **Off** from the **THRU-COAT Enable** option. Press **[ENTER]**.

Step 4:Press **[←]** or **[→]** to select **OK** or **Cancel**. Press **[ENTER]**.

3.6.1 THRU-COAT® (Metal Only) Calibration (MG2-XT and MG2-DL Only)

Perform this calibration to calibrate for the sound velocity and zero offset of the metal thickness. This calibration should be used when the user wishes to measure the true metal thickness of material that is coated or painted but on which the exact thickness of the coating is not important. Performing this calibration will use a default velocity for the coating.

To perform a THRU-COAT (Metal Only) calibration, follow these steps:

Step 1:Couple the transducer to a thick calibration block. Press **[CAL VEL]** while in the **THRU-COAT Measurement** mode.

Step 2:Press **[ENTER]** when the reading is stable.

Step 3:Uncouple the transducer from the material and enter the thickness of the block using the [↑, ↓, ←, and →] slewing keys.

Step 4:Couple the transducer to a thin calibration block. Press **[CAL ZERO]**.

Step 5:Press **[ENTER]** when the reading is stable.

Step 6:Uncouple the transducer from the material and enter the thickness of the block using the [↑, ↓, ←, and →] slewing keys.

Step 7:Press **[MEAS]** to complete the calibration.

3.6.2.THRU-COAT (Metal and Coating) Calibration

This calibration will calibrate for the velocity and zero offset of the

metal and the velocity of the coating.

Use the steps below to calibrate for the sound velocity of the steel and the coating.

Note: Unless absolute accuracy of the coating thickness is required, it is not necessary to perform this calibration. Not performing this calibration will not affect the accuracy of the steel thickness measurement, and will affect only the accuracy of the coating measurement.

Step 1: Couple the transducer to a thick calibration block. Press **[CAL VEL]** while in the **THRU-COAT Measurement** mode.

Step 2: Press **[ENTER]** when the reading is stable.

Step 3: Uncouple the transducer from the material and enter the thickness of the block using the [↑, ↓, ←, and →] slewing keys.

Step 4: Couple the transducer to a thin calibration block. Press **[CAL ZERO]**.

Step 5: Press **[ENTER]** when the reading is stable.

Step 6: Uncouple the transducer from the material and enter the thickness of the block using the [↑, ↓, ←, and →] slewing keys. Press **[CAL VEL]**.

Step 7: Couple the transducer to a sample with a known coating thickness when the reading is steady and press **[ENTER]**.

Step 8: Uncouple the transducer from the material and enter the thickness of the coating using the [↑, ↓, ←, and →]

slewing keys.

Step 9: Press [MEAS] to complete the calibration.

Note: The THRU-COAT feature can measure only coatings of 0.005” (0.12mm) or greater. If you are measuring coated steel and a value for the coating is not displayed, the coating thickness is below the minimum thickness reading capability of the THRU-COAT feature or cannot be otherwise resolved by the feature. In these cases, the thickness of the coating will be added to the thickness of the steel, causing an error. You may attempt the measurement using the Echo-to-Echo feature, or it may be necessary to remove the coating.

3.7 Echo-to-Echo Calibration

The Echo-to-Echo measurement feature allows the MG2-XT and MG2-DL to measure remaining wall thickness of painted metal while ignoring the coating thickness. Echo-to-Echo mode refers to measuring from one backwall echo to the next backwall echo. The time interval between these echoes does not include the time through any paint, resin, or organic coating that is present.

The Echo-to-Echo mode of the MG2-XT and MG2-DL can make thickness measurements in the range between 0.100” (2.5mm) and 0.500” (12.5mm). If you need to make thickness measurements on coated metal outside of this thickness range, the THRU-COAT feature is recommended.

To activate the Echo-to-Echo mode:

Step 1: From Measure mode, press [2nd F], [↓](SETUP).

Step 2: Use [↓] to highlight the **Meas Option** in the **Meas** tab.

Step 3: Use the **[←]** and **[→]** keys to change between Standard and Auto Echo-to-Echo mode.

Step 4: Press **[MEAS]** to return to the Echo-to-Echo Measure mode.

To calibrate the Echo-to-Echo feature:

Step 1: Zero the transducer by wiping the tip until dry and then pressing [2nd F], [CAL ZERO](DO ZERO).

Step 2: Couple the transducer to a thick calibration standard that does not exceed a thickness of 0.500" (12.5mm) and is thicker than 0.100" (2.5mm) and press [CAL VEL].

Step 3: When the reading is stabilized, press [ENTER].

Step 4: Uncouple the transducer from the material and enter the thickness of the block using the [↑, ↓, ←, and →] slewing keys.

Step 5: Couple the transducer to a thin calibration standard but one greater than 0.100" (2.5mm) and less than 0.500" (12.5mm), and press [**CAL ZERO**].

Step 6: When the reading is stabilized, press [ENTER].

Step 7: Uncouple the transducer from the material and enter the thickness of the block using the [↑, ↓, ←, and →] slewing keys.

Step 8: Press [MEAS] to complete the calibration.

Note: The Echo-to-Echo measurement mode operates only

within the thickness range of 0.100”- 0.500” (2.5 mm - 12.5 mm).

4 ADDITIONAL MG2 SERIES GAGING FEATURES

MG2 Series thickness gages have several additional convenient features. The use of these features is not required for basic operation. However, they make the gages more versatile instruments.

The following additional features may be accessed directly from the keypad:

Tables 4-1A & 4-1B:

MG2, MG2-XT, and MG2-DL	MG2-XT and MG2-DL Only	MG2-DL Only
Backlight	Gain Adjust	Datalogger
Freeze	Material Gain Sensitivity Optimization	

Additional features may be accessed in the setup mode. To access or change any of these functions, press [2nd F], [↓](SETUP).

These features include the following functions:

MG2 Series Gages	MG2-XT and MG2-DL Only	MG2-DL Only
• Inches/ Millimeters Conversion • Resolution • Min/Max • Hold/Blank • Measure Rate • CAL Lock • Beeper • Inactivity time • Radix • Backlight mode • LCD Contrast adjust • Resets • Diagnostics	• Alarm • Differential Mode	• Clock

4.1 Back Light

The display backlight feature internally illuminates the liquid crystal display with a bright, uniform light. This allows the display, which has excellent visibility in normal to high ambient light conditions, to be viewed in low to zero ambient light conditions.

To switch backlight On/Off:

- **MG2 and MG2-XT** - Press the [Light Bulb] key.
- **MG2-DL** - Press [2nd F],[Freeze](LIGHT/LCD).

Additionally, when the backlight is switched on, you may select a power-saver Auto Backlight mode, which turns the backlight on only when a reading is being made and turns it off five seconds after LOS.

To select Auto Backlight:

Step 1: Press [2nd F], [↓](SETUP).

Step 2: Use [→] to select the System Tab.

Step 3: Use the [↓] key to highlight Backlight Mode

Step 4: Use the [←] and [→] keys to change between Normal and Auto.

Step 5: Press [**MEAS**] to return to the measure mode with the new settings.

To adjust Contrast:

The Contrast adjustment feature allows the MG2 Series thickness gages to adjust the contrast (light or dark) of the display.

To adjust the display contrast for the Model MG2 and MG2-XT:

Step 1: From Measure Mode, press [2nd F][Light Bulb](LCD ADJ).

Step 2: Use the [↑] or [↓] key to adjust contrast.

Step 3: Press [ENTER] to exit Contrast Adjust Mode.

To adjust the display contrast for the Model MG2-DL:

Step 1: From Measure Mode, press [2nd F][FREEZE](LIGHT/ LCD) to turn on the back light and begin contrast adjustment.

Step 2: Use the [↑] or [↓] key to adjust contrast.

Step 3: Press [ENTER] to exit Contrast Adjust Mode.

Step 4: Press [2nd F][FREEZE](LIGHT/LCD) to turn the back light off.

4.2 Freeze Mode

The freeze function allows the operator to freeze the thickness display when the [FREEZE] key is pressed. The display is returned to an active status by pressing [FREEZE] a second time or by pressing [MEAS]. This function is useful in a situation when the user wishes to hold a displayed thickness reading. This is helpful for high temperature thickness measurement applications to limit the transducer contact time. The freeze can also be used in combination with the Min/Max function.

4.3 Gain Adjust (Model MG2-XT and MG2-DL Only) (Non-Live Waveform)

The gain adjust allows the normal measurement sensitivity to be increased or decreased by a fixed amount (approximately 10 dB Hi Gain and 6 dB Low Gain). This function is available for those applications in which more or less than the default sensitivity is required but in which the use of a fixed sensitivity increase rather than a sensitivity proportional to the measured noise is preferred. Use of the Gain Adjust Function is generally recommended for all high temperature measurements.

To adjust the Gain from the default Gain value:

From the Measure mode, press [2nd F],[←](GAIN) to toggle between Gain High to Gain Low to Default Gain.

4.4 Material Gain Sensitivity Optimization (Models MG2-XT and MG2-DL Only)

The Material Gain Sensitivity Optimization feature allows the normal measurement sensitivity to be increased or decreased by an amount related to the measured peak noise in a specific transducer and material combination. Normally, the MG2 Series gages adjust receiver gain and detection level depending on both the transducer type and the received echo characteristics. Also, each transducer type imposes its own maximum gain and detection threshold to prevent any transducer related or material related noise from being seen as a thickness echo. This works well in most corroded material gaging applications. However, in certain special cases, it is advantageous to modify those fixed limits on sensitivity.

The Material Gain Sensitivity Optimization feature of the MG2-XT and MG2-DL optimizes by using actual material noise level measurements rather than fixed gain boost or fixed attenuators. While the transducer is coupled to a thick sample of the material of interest, the gage measures the peak noise level up to a specified backwall thickness. Then the gain and detection threshold values are adjusted to produce the minimum backwall sensitivity without hanging up on noise.

Performing the sensitivity optimization procedure on different materials may yield different results. In the case of grainy materials

such as cast iron, or high surface noise materials such as aluminum, this procedure may result in a decrease in gain. In the case of hot materials with rough surfaces or other highly attenuating but low noise materials, this procedure may produce an increase in sensitivity.

To Perform Automatic Material Gain Sensitivity Optimization:

Step 1: From the Measure mode, press [2nd F],[ENTER](GAIN OPT). The gage will display 0.000.

Step 2: Use the [↑], [↓], [←, and →] keys to slew to the approximate wall thickness. It is best to guess low if you are uncertain.

Step 3: Couple the transducer to the material sample and press [MEAS]. Optimization will be performed and the gage will return to the Measure Mode. The gain flag will indicate that the gain is not at default gain by displaying "GO" (Gain Optimized).

Return to Default Gain:

Note: Return to Default Gain when the optional waveform is active. Default Gain may be restored directly by pressing [2nd F], [←](Gain) and then [2nd F], [←](Gain) again and then the [MEAS] key.

4.5 Measurement Setup

The measurement setup menu allows the user to turn on/off many of the additional measurement features of the MG2 Series gages.

Measurement setup features include:

- Meas Option (MG2-XT and MG2-DL only)

- Units
- Resolution
- Min/Max
- Hold Blank
- Measure rate
- Cal Lock
- ID Overwrite (MG2-DL only)

4.5.1 Meas Option (MG2-XT and MG2-DL Only)

The Meas Option allows the user to change among Standard Measurement Mode, Auto Echo-to-Echo Measurement Mode, and Manual Echo-to-Echo Mode (when Waveform Option is activated).

- Standard Measure Mode makes thickness measurements to the first backwall echo. This mode is used for most applications in which the material is not coated or painted. If this Measure Mode is used on painted material, the thickness of the paint will be added to the thickness reading.
- Auto Echo-to-Echo Mode makes thickness measurements between two successive backwall echoes and is used to ignore paint or coatings and to give true metal thickness readings. The thickness range for this mode is limited to 0.100-0.500" (2.5-12.5 mm) in steel.
- Manual Echo-to-Echo Mode is an advanced version of the Auto Echo-toEcho Mode and also makes measurements between two successive backwall echoes to ignore paint or coatings on metal. Manual Echo-to-Echo Mode is available only when the Optional

Waveform has been activated and the Waveform function has been turned on. This feature allows the user to adjust the Gain, Extended Blank and E1 (Echo 1) blank to select which pair of backwall echoes is to be used for the measurement. For more details, refer to Section 4.13.3.

To activate the Meas Option:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] to highlight the MEAS tab.

Step 3: Use the [↓] key to highlight Meas Option and [←, →] to select Standard, Auto Echo-to-Echo, or Manual Echo-to-Echo (Waveform Mode only).

Step 4: Press [MEAS] to return to the Measure Mode.

4.5.2 Units

Changing units allows the user to change from inch measurement units to millimeter measurement units.

To change units:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←,→] keys to highlight the MEAS tab.

Step 3: Use the [↓] key to highlight Units and the [←,→] keys to select English (") or metric (mm).

Step 4: Press [MEAS] to return to the Measure Mode.

4.5.3 Resolution

Resolution allows the user to change the number of decimal points displayed in the thickness display.

The user can select between Standard (0.001" or 0.01 mm) and Low (0.01" or 0.1 mm).

To changing resolution:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the MEAS tab.

Step 3: Use the [↓] key to highlight Resolution and the [←, →] keys to select Standard or Low.

Step 4: Press [MEAS] to return to the Measure Mode.

4.5.4 Min/Max

Min/Max allows the user to put the gage in Min or Max scanning mode. This feature allows the user to scan over an area and quickly determine the minimum or maximum thickness.

Min Mode displays live thickness values and recalls the minimum thickness when a LOS (loss of signal) occurs. Live thickness values are displayed in filled-in form, and recalled min values are displayed in outlined form. The minimum values are retained in a temporary memory until new minimum thickness values replace them or until the [Meas] key is pressed to reset the minimum. When Min Mode is selected, the MG2 automatically changes to 20 Hz fast update mode.

Max Mode displays live thickness value and recalls the maximum thickness when a LOS (loss of signal) occurs. Live thickness values

are displayed in filled-in form, and recalled max values are displayed in outlined form. The maximum value is retained in a temporary memory until a new maximum thickness value replaces it or until the [Meas] key is pressed to reset the maximum. When Max Mode is selected, the MG2 automatically changes to a 20 Hz fast update mode.

To select Min/Max:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the MEAS tab.

Step 3: Use the [↓] key to highlight Min/Max and the [←, →] keys to select among Off, Min, or Max.

Step 4: Press [MEAS] to return to the Measure Mode.

4.5.5 Hold/Blank

Hold/Blank controls:

- Hold: The gage holds the last measurement when no measurements (LOS) are being made.
- Blank: The display blanks out the thickness value when no measurements (LOS) are being made.

The MG2 Series is set by default to blank out the measurement display when no measurements are being made. When Hold mode is selected, live (active) thickness readings are displayed with filled-in numbers and held measurements are displayed with outlined numbers.

To change Hold/Blank:

Step 1: Press [2ndF],[↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] to highlight the MEAS tab.

Step 3: Use the [↓] key to highlight Hold/Blank and [←, →] to select between Blank and Hold.

Step 4: Press [MEAS] to return to the Measure Mode.

4.5.6 Measure Rate

Measure Rate allows the user to display the measurement update rate. The user can select between Normal (4 Hz) and Fast (20 Hz).

Note: Changing to the fast update rate will greatly affect the battery life of the MG2 Series thickness gages.

To change Measure Rate:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the MEAS tab.

Step 3: Use the [↓] key to highlight Measure Rate and the [←, →] keys to select between Normal (4 Hz) and Fast (20 Hz).

Step 4: Press [MEAS] to return to the Measure Mode.

4.5.7 CAL Lock

CAL Lock allows the user to lock the calibration so that it cannot be changed while CAL Lock is enabled. If the user tries to change the calibration while the lock is activated, the gage displays a CAL Lock message.

To activate CAL Lock:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←,→] keys to highlight the MEAS tab.

Step 3: Use the [↓] key to highlight CAL Lock and [←,→] to select between Off and On.

Step 4: Press [MEAS] to return to the Measure Mode.

4.5.8 ID Overwrite (MG2-DL Only)

ID Overwrite allows the user to lock ID locations so that once a thickness reading is saved at the ID# location, users will be prompted with a message asking if they wish to overwrite the stored thickness value.

To activate ID Overwrite:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←,→] keys to highlight the MEAS tab.

Step 3: Use the [↓] key to highlight ID Overwrite and [←,→] to select between Off and On.

Step 4: Press [MEAS] to return to the Measure Mode.

4.6 System Setup

The System Setup menu allows the user to turn on/off many MG2 Series gage configurations.

Features include:

- Beeper
- Inactive Time
- Radix
- Backlight Mode
- 36DL PLUS Output

4.6.1 Beeper

Beeper allows the user to turn the audio beeper of the MG2 Series gages on and off. The Beeper is set to On by default and will generate an audio beep when any key is pressed or when an alarm condition has been detected.

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the System tab.

Step 3: Use the [↓] key to highlight Beeper and [←, →] to select between Off and On.

Step 4: Press [MEAS] to return to the Measure Mode.

4.6.2 Inactive Time

Inactive Time allows the user to set the Auto Power Off feature to either On or Off. When Inactive Time is set to On, the MG2 Series gage powers off after approximately six (6) minutes during which no thickness measurements or key presses have occurred. When Inactive Time is set to Off, the MG2 Series unit remains powered up until the user turns the unit Off or the battery voltage becomes low.

To change Inactive Time:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the System tab.

Step 3: Use the [↓] key to highlight Inactive Time and [←, →] to select between Off and On.

Step 4: Press [MEAS] to return to the Measure Mode.

4.6.3 Radix

Radix allows the user to select the display of the radix character (the character that separates the whole and decimal part of the thickness value). In the United States, the period (.) is used as radix (Example: 0.123"). In many other countries, the comma (,) is used (Example: 1,25 mm).

To change radix:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the System tab.

Step 3: Use the [↓] key to highlight Radix and [←, →] to select between Period and Comma.

Step 4: Press [MEAS] to return to the Measure Mode.

4.6.4 Backlight Mode

Backlight Mode allows the user to determine how the backlight works once it has been turned on. When Backlight Mode is set to Normal, the backlight will stay on until it is turned off. When Backlight Mode is set to Auto and the backlight is turned on, it will stay on while a thickness measurement is being displayed and automatically turn off five (5) seconds after a LOS (Loss of Signal) has occurred.

To Change Backlight Mode:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the System tab.

Step 3: Use the [↓] key to highlight Backlight Mode and [←, →] to select between Normal and Auto.

Step 4: Press [MEAS] to return to the Measure Mode.

4.6.5 36DLP Output (MG2-DL Only)

36DLP Output allows the user to choose to output the thickness data in a special 36DL PLUS output format. This will allow the MG2-DL to communicate with software programs that communicates with the 36DL PLUS. The MG2-DL will mimic the output format of the 36DL PLUS when the 36DLP Output is set to On.

To Activate 36DLP Output:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←,→] keys to highlight the System tab.

Step 3: Use the [↓] key to highlight 36DLP Output and [←,→] to select between On and Off.

Step 4: Press [MEAS] to return to the Measure Mode.

4.7 High/Low Alarms (MG2-XT and MG2-DL Only)

The High/Low alarm allows the user to establish high and low alarm set points. When a thickness is displayed below the Low Alarm set point or above the High Alarm set point, an audio beep is sounded and an alarm flag is displayed.

When the alarm is active but not above or below set points, the gage displays an “A”. The gage displays an “L” to indicate a Low Alarm condition and an “H” to indicate a High Alarm condition only when set points have been violated.

Note: The Alarm Mode and the Diff Mode are mutually exclusive (cannot be used at the same time). If one of these functions is activated, it will be automatically turned off when the other function is turned on.

To activate the High/Low Alarm:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the Alarm tab.

Step 3: Use the [↓] key to highlight Enable and [←, →] to select On or Off.

Step 4: Press the [↓] key to highlight Lo-Alarm and then press [→] key and use the [← , → , ↓, and ↑] keys to edit the low alarm set point.

Step 5: Press the [ENTER] key to highlight Hi-Alarm, then press [→] and the [←, →, ↓, and ↑] keys to slew to the high alarm set point.

Step 6: Press [MEAS] to return to the Measure Mode.

4.8 Diff Mode (MG2-XT and MG2-DL Only)

Diff Mode allows the user to set a differential set point. When Diff Mode is activated, the gage displays the difference between the Diff set point and the actual thickness value. The gage displays a “D” to indicate that Diff Mode is active.

Note: The Alarm Mode and the Diff Mode are mutually exclusive (cannot be used at the same time). If one of these function is activated, it will be automatically turned off if the other function is turned on.

To activate Diff Mode:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the Diff tab.

Step 3: Use the [↓] key to highlight Enable and [←, →] to select On or Off.

Step 4: Press the [ENTER] key and then use the [→] key to highlight Diff Value. Use the [←, →, ↓, and ↑] keys to slew to the Diff set point.

Step 5: Press [MEAS] to return to the Measure Mode.

4.9 Clock Setup (MG2-DL Only)

The clock is used to set the internal date and time for the MG2-DL, so that a time and date stamp can be given to a data file. The time and date stamp indicates when data was last stored in a file.

To set the internal date and clock:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the Clock tab.

Step 3: Use the [↓] key to highlight Hour and [←, →] to set the hour.

Step 4: Press the [↓] key to highlight Minute and use the [←, →] keys to set the minute.

Step 5: Press the [↓] key to highlight Year and use the [←, →] keys to set the year.

Step 6: Press the [↓] key to highlight Month and use the [←, →] keys to set the month.

Step 7: Press the [↓] key to highlight Day and use the [←, →] keys to set the day.

Step 8: Press the [↓] key to highlight Set/Cancel and use the [←, →] keys to select Set or Cancel.

Step 9: Press [Enter] when Set is highlighted to set the clock and press [MEAS] to return to the Measure Mode.

4.10 Resets

Resets are used to reset the operating software of the MG2 Series gages to their factory default settings. Three resets can be performed: Measurement, Master, and Database (MG2-DL only).

4.10.1 Measurement Reset

Measurement Reset resets the measurement parameters to their default values.

The parameters that are reset and their reset values are:

- Material Velocity (0.2260 in/µsec)
- Transducer Zero
- Measure Option (Standard)
- Unit (Inches)
- Resolution (Standard)
- Min/Max (Off)
- Hold/Blank (Blank)
- Measure Rate (Normal)
- CAL Lock (Off)
- ID Overwrite (Off) MG2-DL only
- Beeper (On)
- Inactive Time (On)
- Radix (Period)
- Backlight Mode (Normal)
- 36DLP Output (Off) (MG2-DL only)
- Alarm (Off). Default Values: Low 0.000; High 25.000
- Diff (Off). Default Value 0.000

To perform Measurement Resets:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the Reset tab.

Step 3: Use the [↓] key to highlight Measurement Reset and press [ENTER].

Step 4: Use the [←, →] keys to highlight Reset or Cancel and press [ENTER].

Step 5: Press [MEAS] to return to the Measure Mode.

4.10.2 Master Reset

Master Reset resets the entire instrument to it's default values and also deletes the database on the MG2-DL.

Note: Caution should be used when performing a Master Reset because it will cause the gage to delete all stored thickness readings. Once a master reset has been performed, the thickness data cannot be retrieved.

To perform Master Resets:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the Reset tab.

Step 3: Use the [↓] key to highlight Master Reset and press [ENTER].

Step 4: Use the [←, →] keys to highlight Reset or Cancel and press [ENTER].

Step 5: Press [MEAS] to return to the Measure Mode.

4.10.3 Database Reset (MG2-DL Only)

Database Reset (MG2-DL only) resets and clears the entire database.

Note: Caution should be used when performing a Database Reset because it will cause the gage to delete all stored thickness readings. Once a database reset has been performed, the thickness data cannot be retrieved.

To perform Database Resets:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the Reset tab.

Step 3: Use the [↓] key to highlight Database Reset and press [ENTER].

Step 4: Use the [←, →] keys to highlight Reset or Cancel and press [ENTER].

Step 5: Press [MEAS] to return to the Measure Mode.

4.11 Activating Waveform Option (MG2-XT and MG2-DL Only)

An optional Live Waveform can be added to any MG2-XT or MG2-DL gage. The Live Waveform option adds many measurement

features to the MG2-XT and MG2-DL gages and enhances overall performance for difficult measurement applications.

The following advanced capabilities are available when the Live Waveform feature is added:

- Manual Gain adjustment in 1 dB increments
- Extended Blank (Material Sound Entry Blank)
- Manual Echo-to-Echo
- E1 Blank (for Manual Echo-to-Echo only)
- Range
- Delay

Note: These features are available only when the Waveform Mode is activated and are not available when the gage is operating in standard Thickness Mode.

If the Live Waveform Option has been purchased, then the optional software will already have been loaded and activated. When this feature is activated, a Waveform tab appears in the Setup menu.

If the Live Waveform software was purchased after the unit was initially supplied, then the Waveform Option must be activated using a unique license name and license name code system.

Each MG2-XT and MG2-DL Series gage generates a unique license name. To activate the internal Live Waveform feature, the user must enter a valid license code. Contact Panametrics-NDT™ or our local Panametrics-NDT representative to obtain a valid license code for the license name. This license code is not valid for any other MG2-XT

and MG2-DL Series unit.

Activate the Live Waveform software through the following procedure:

Step 1: Press [2nd F], [↓] (SETUP).

Step 2: Use the [→] key to select the License tab.

Step 3: Press [ENTER] twice. The gage displays a license name.

Step 4: Enter the License Code provided by Panametrics-NDT using the [↑, ↓, ←, →] keys and then press [ENTER].

Step 5: Use the [←, →] keys to select Done and press [ENTER].

Step 6: Press [ENTER] to accept.

Step 7: Power the unit Off, then On again to complete the Live Waveform activation.

4.12 Optional Waveform (MG2-XT and MG2-DL Only)

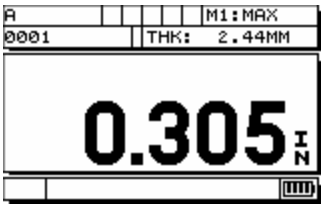
The Live Waveform option for MG2-XT and MG2-DL Series gages allows the user to view the live ultrasonic waveform to help align the transducer for difficult applications. When this feature is added, the user can change between the standard thickness display and the optional live waveform display.

Other Waveform setup features include:

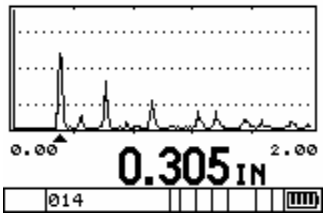
- **Zoom Option:** This mode automatically adjusts the ranges and delay so the measured echoes will always be displayed on the waveform.

- **Save Key:** A Save Key designation is also set in the Waveform setup (MG2-DL) to allow the user to define the function of the Save Key. Setting the Save Key to “THK ONLY” will save only the thickness value when the Save Key is pressed, while setting the Save Key to “THK + WF” will save the thickness and waveform when the Save Key is pressed. Note that the MG2-DL can save approximately 8000 thickness readings or 350 waveforms with thickness.
- **Rectification:** Allows the user to select the rectification of the displayed waveform. Selections are Full Wave, Half Neg, Half Pos, and RF.
- **Waveform Fill:** Allows the user to show the waveform filled in. This feature is not available in RF rectification mode.

Note: The WAVEFORM tab is available only if the Waveform option has been activated on the gage. Please contact Panametrics-NDT for more information concerning activating the optional Waveform feature.



Standard Thickness Display



Waveform Display

To activate the optional Waveform, use the following procedure:

Step 1: Press [2nd F], [↓] (Setup) to display the Setup tabs.

Step 2: Use the [←, →] keys to select the Waveform tab.

Step 3: Press [↑] or [↓] to scroll to Enable.

Step 4: Press [←, →] to choose On or Off.

Step 5: Press [↓] or [ENTER] to scroll to Zoom.

Step 6: Press [←, →] to choose On or Off.

Step 7: Press [↓] or [ENTER] to scroll to Save Key (MG2-DL only).

Step 8: Press [←, →] to choose THK ONLY or THK + WF.

Step 9: Press [↓] or [ENTER] to scroll to Rectification.

Step 10: Press [←, →] to choose among Full, Half Neg, Half Pos, and RF.

Step 11: Press [↓] or [ENTER] to scroll to Waveform Fill.

Step 12: Press [←, →] to choose between Off and On.

Step 13: Press [MEAS/RESET].

Note: When the Waveform has been enabled and the Zoom feature is turned off, the user can adjust the range and delay of the waveform by using the [↑] or [↓] key to change the range to the next higher or lower range set point or the [←, →] keys to increase or decrease the waveform delay.

4.13 Waveform Adjust Mode (MG2-XT and MG2-DL Only)

The Waveform Adjust Mode feature allows the user to make Setup adjustments that are not available in the Standard Mode.

Additional measurement capabilities include:

- Manual Gain adjustment in 1 dB increments
- Extended Blank
- Echo Blank (Manual Echo-to-Echo only)
- Range
- Delay

Note: These features can be activated only while the optional

Waveform is enabled. These additional features are not available when the Waveform is turned off.

Note: These adjustments can affect the measurement capability of the instrument and should be undertaken only by a person with extensive knowledge of ultrasonic theory.

To activate Waveform Adjust Mode while Waveform is enabled:

Step 1: Press [2nd F], [←](Gain).

Step 2: Press [↑] or [↓] to select the waveform setup parameter.

Step 3: Press [←, →] to adjust the parameter.

Step 4: Press [2nd F] (Gain) while viewing the Gain parameter to set the Gain back to its default value.

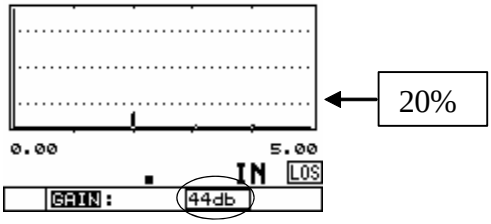
Step 5: Press [MEAS] to exit the Waveform Adjust Mode with the parameters at their adjusted values.

4.13.1 Manual Gain Adjust (MG2-XT and MG2-DL Only)

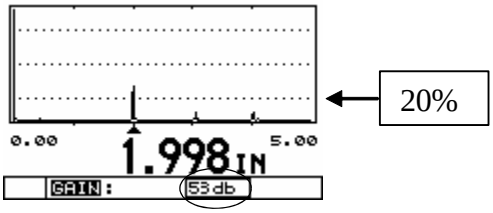
When the waveform is not activated or if the waveform option was not purchased, pressing [2nd F],[←] (Gain) will move through Gain Hi, Low, and Standard.

While the live waveform is active, pressing [2nd F],[←] (Gain) will place the gage in Waveform Adjust Mode. The user can use the [↑] or [↓] key to select Gain and the [←, →] keys to increase or decrease the gain. The gain can be adjusted in 1 dB increments from 21 dB to 77 dB. Note that echoes that are higher in amplitude than the

first gradicules (20% screen height) will be detected by the gage. The detection threshold is not the measurement point. Measurements are made using algorithms and DSP and are amplitude independent.



Echo Below the 20% Screen Gradicule



Echo Detection, Echo Above the 20% Gradicule

Note: Normally, when the gain is set to its default value the waveform is ADC'd (Automatic Display Controlled). This feature automatically adjusts the amplitude of the detected backwall echo to try to keep the echo peak on screen. Once the gain has been changed from the default

gain, the displayed waveform will be not be ADC'd and will be shown at an amplitude proportional to the gain setting.

To return to default ADC'D gain:

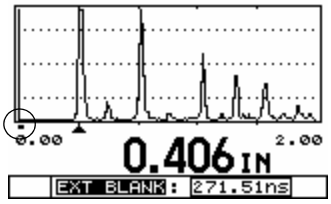
Step 1: While in Waveform Adjust Mode, use the [↑] or [↓] key to highlight Gain.

Step 2: Press [2nd F],[←] (Gain). The gain will be changed to its default ADC'd condition.

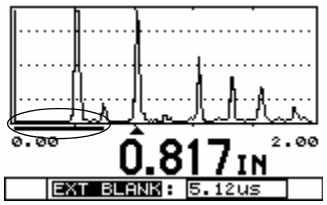
4.13.2 Extended Blank

Extended Blank allows the operator to extend a blank from the sound entry point to the maximum of the displayed range. When the extended blank is set, the gage measures to the first valid echo after the end of the blank.

While the Live Waveform is active, pressing [2nd F],[←] (Gain) places the gage in Waveform Adjust Mode. The user can use the [↑] or [↓] key to select Extended Blank and the [←, →] keys to increase or decrease the blank position. When the blank is set, the gage measures to the first echo after the end of the blank that is higher in amplitude than the first gradicule's 20% screen height.



Blank Set at Default



Gage Measuring First Echo Over the 20% Gradicule After the End of the Extended Blank

4.13.3 E1 (Echo1) Blank

The E1 blank adjustment is only selectable when the gage measurement type is set to Manual Echo-to-Echo. This Blank is used to block out the trailing edge of the first detected backwall echo and any noise signals that may appear between backwall echoes in Manual Echo-to Echo mode.

E1 Blank is used in Manual Echo-to-Echo along with Gain Adjust and

Extended Blank to manually select which echoes will be used for the Echo-to-Echo measurements. In Manaual Echo-to-Echo, the gage detects the first backwall echo past the Extended Blank with an amplitude greater than 20% screen height. It then measures to the next echo past the E1 blank with an amplitude greater than 20% screen height. The user can adjust the Extended Blank and E1 blank to make proper detection on two successive backwall echoes.

To activate Manual Echo-to-Echo:

Step 1: Press [2nd F],[↓] (SETUP) to enter the Setup Menu.

Step 2: Use the [←, →] keys to select the MEAS tab.

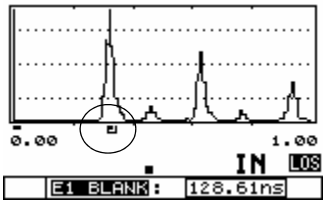
Step 3: Use the [↓] key to select MEAS OPTION.

Step 4: Use the [←, →] keys to select MAN E-to-E.

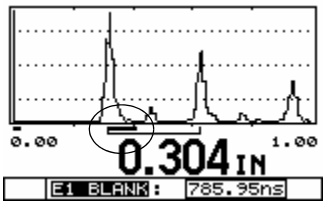
Step 5: Press the [MEAS] key to return to the Measurement Mode in Manual Echo-to-Echo Mode.

Note: Manual Echo-to-Echo is only available if the waveform is activated.

While the live waveform is active, pressing [2nd F],[←] (Gain) places the gage in Waveform Adjust Mode. The user can use the [↑] or [↓] key to select E1 Blank and the [←, →] keys to increase or decrease the blank position. When E1 Blank is set, the gage measures to the next echo after the end of the E1 Blank that is higher in amplitude than the first gradicule (20% screen height).



Echo Blank Set Too Small; Gage Reading Trailing Edge of First Backwall Echo

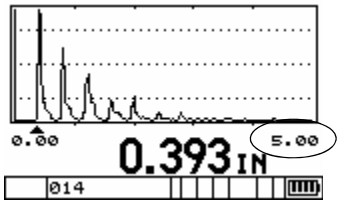


E1 (Echo1) Blank Set Properly; Gage Making Proper Detection Between Successive Backwall Echoes

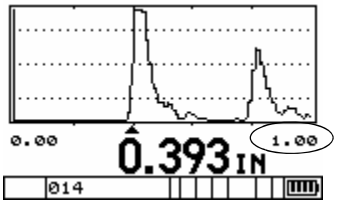
4.13.4 Range

Range Adjust allows the user to adjust the range of the waveform so that the measured echoes appear on screen. Range Adjust is not available if the Waveform Zoom Option is turned on.

To adjusting the range when in Live Waveform Mode, press the [↑] or [↓] key to adjust the range to the next higher/lower range. The available ranges on the MG2-XT and MG2-DL Series gages are fixed based on the transducer being used.



Waveform Showing 5.00" Range



Press [↓] to Change Range to 1.00"

To adjust the range in Waveform Adjust Mode:

Step 1: Press [2nd F], [←] (Gain).

Step 2: Press [↑] or [↓] to select the Range Setup parameter.

Step 3: Press [←, →] to adjust the range.

Step 4: Press [MEAS] to exit the Waveform Adjust Mode with the Range set at the adjusted values.

4.13.5 Delay

Delay Adjust allows the user to adjust the waveform delay so that the measured echoes appear on screen. Delay Adjust is not available if the waveform Zoom Options is turned on.

To adjusting the range when in Live Waveform Mode, press the [←, →] keys to increase or decrease the Waveform Delay.

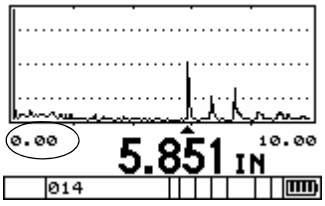
To adjust the delay in Waveform Adjust Mode:

Step 1: Press [2nd F],[←] (Gain).

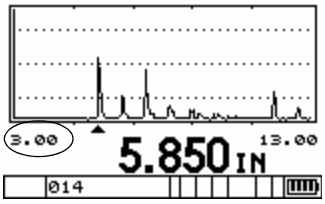
Step 2: Press [↑] or [↓] to select the Delay Setup parameter.

Step 3: Press [←, →] to adjust the Delay.

Step 4: Press [MEAS] to exit Waveform Adjust Mode with the Delay set at adjusted values.



Delay Set to 0.00"

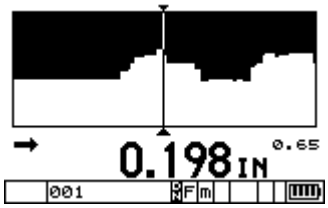


Delay Set to 3.00

4.14 B-scan

B-scan converts thickness readings to cross-sectional image profiles. The B-scan function is used to scan over an area and look at how the cross sectional thickness is changing. The B-scan, DB Grid, and Optional Waveform are mutually exclusive features. Only one of these functions can be active at a time. Activation of one of these functions will automatically deactivate any of the others. You can save these images (datalogger versions only) in the gage internal

datalogger in order to review them later or download them to a computer (GageView) or printer at a later time. A maximum of 350 B-scan images can be stored to the internal datalogger.



The follow are definitions of the available B-Scan options and parameters.

Enable: Allows the user to turn the function On or Off.

B-Scan Direction: Determines the direction in which data is updated or drawn on the screen. Choose the B-Scan direction based on the direction of transducer movement.

- Left to right: Causes the data to start at the right of the screen and scroll to the left and produces a B-Scan that is properly orientated based on transducer movement.
- Right to left: Causes the data to start at the left of the screen and scroll to the right and produces a B-Scan that is properly orientated based on transducer movement.

Save Key: Determines what gets saved when the Save key is pressed. Saving B-scan images can only be done with the Datalogger version (DL) of the gages.

- THK ONLY: Will save only the current thickness reading when the Save key is pressed.
- THK + B-scan: Will Save the Thickness and the B-scan image when the Save key is pressed.

B-Scan Freeze Mode: Determines which thickness readings are displayed when the [FREEZE] key is pressed during a scan.

- Show Minimum: Will recall the minimum thickness in the scan to the center of the screen, even if the minimum has scrolled off the current B-scan screen.
- Show Current: Will stop the B-scan at its current position when the [FREEZE] key is pressed.

Max Thickness: Allows the user to set the thickness range for the B-scan image. This should be set slightly larger than the maximum thickness that will be encountered. The maximum value for Max Thickness is 25.00" (635.00 mm).

4.14.1 Using the B-scan Function

To activate the B-scan feature:

Step 1: Press the [2nd F],[↓](SETUP) key to display the Setup Tabs.

Step 2: Use the [→] key to highlight the B-scan Tab.

Step 3: Use the [↓] Key to enter the B-scan Setup menu.

Step 4: Use [↓ and ↑] to select a parameter and [← and →] to adjust the setting.

Step 5: When the Max thickness is highlighted, press [← or →] to adjust the Max thickness (range for the B-scan) value

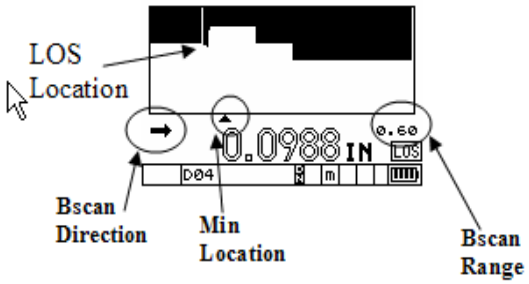
with the [↓, ↑, ←, →] keys and then press [ENTER].

Step 6: Press the [MEAS] key to return to the Measure mode and save the adjusted settings.

Once the B-scan function has been enabled, the B-scan starts drawing the cross-sectional thickness when the transducer make contact with the material and the first thickness reading is displayed. The B-scan will continue to draw while displaying the live thickness at the transducer location until one of the following events occurs:

- The gage encounters a LOS condition (Loss of Signal), no thickness value. When an LOS occurs, the B-scan stops updating and will start up again if a new thickness reading is acquired. A vertical blank line will be inserted into the B-scan image to indicate that a LOS condition has occurred.
- The user presses the Freeze key and stops the B-scan update. The gage will either recall the minimum thickness (Freeze Min) or freeze at the current location (Freeze Current). This will also display the B-scan Review screen. The user can use the [← and →] keys to review the thickness readings on the frozen B-scan. A triangle marks the location of the minimum thickness in the B-scan.

- The user presses the [MEAS] key. The B-scan is reset and blanked out allowing the user to start another scan.

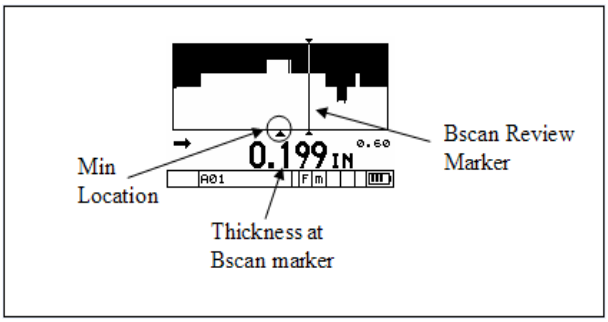


Live B-scan Screen

4.14.2 B-scan Freeze

Freezing the B-scan allows the user to review all the thickness values of the current B-scan. When the [FREEZE] key is pressed, a vertical line (Review Marker) appears to indicate the location of the displayed thickness. This is either the Minimum or Current thickness location of the B-scan, depending on the Freeze option selected. The unit displays the thickness and the location of the minimum. Pressing [←] and [→] moves the Review Marker to the left or the right of the scan. During review, the gage always displays the thickness at the Review Marker location.

Tip: Set the B-scan to Freeze Min if you wishes to recall the Minimum thickness to the center of the B-scan screen even if the minimum value moved off the B-scan screen.



B-scan Review Screen

4.14.3 Saving B-scan to the Internal Datalogger (DL Models Only)

B-scan images can be saved to the internal datalogger and recalled to the screen or uploaded to the optional GageView interface program. Only one thickness value is saved with the B-scan image. This value can be the current thickness, minimum thickness, or the thickness at the Review Marker on a frozen B-scan. The Datalogger can store a maximum of 350 B-scan images.

To save the B-scan image to the internal datalogger:

Step 1: In the B-scan setup tab, set the Save Key option to “THK + B-scan”.

Step 2: Press the Save key.

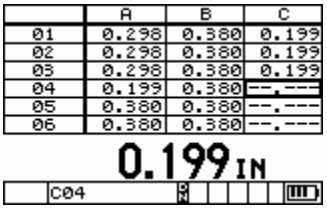
A. Pressing the Save key while the B-scan is live (currently scrolling) saves the B-scan image and the thickness at

the current update position.

B. Pressing the Save key on a frozen B-scan saves the B-scan image and the thickness at the position of the review marker. The user can move the review marker to any location on the frozen B-scan.

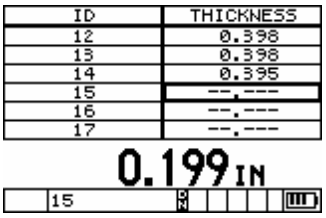
4.15 DB Grid (DL Models Only)

The DB Grid feature allows the user to view the open data file in a Grid or Expanded Liner format. 2D Grid files display the rows and columns of the grid file. This allows the user to easily see the thickness data being saved to the grid file at the current position. Incremental and Sequential files are displayed in an Expanded Liner format, showing the last six (6) ID# locations in a linear file list. DB Grid, B-scan, and the Optional Waveform are mutually exclusive features and cannot be used at the same time. Turning one of these functions on will turn any of the other functions off.



DB Grid of a 2D Grid type File

DB Grid of a 2D Grid Type File



DB Grid of an incremental file

DB Grid of Incremental File

DB Grid allows the user to easily navigate through grids by simultaneously displaying the grid positions with the current thickness reading. This gives the user the ability to move in any direction on the grid file rather than following a pre-set list of ID's. Instead of automatically incrementing to the next ID location, the user may press the ID# key and use the arrow keys to move to any row or column in the grid file.

The following are definitions of the available DB Grid options and parameters:

Enable: Allows the user to turn the DB Grid function On or Off.

Transpose Grid: Allows the user to switch the position of the Row and Columns of a 2D Grid file. This parameter has no affect on incremental or sequential files.

4.15.1 Using the DB Grid Function

To activate the DB Grid feature:

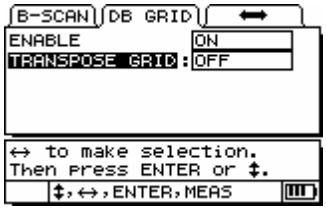
Step 1: Press the [2nd F],[↓](SETUP) key to display the Setup Tabs.

Step 2: Use the [→] key to highlight the DB GRID Tab.

Step 3: Use the [↓] Key to enter the DB GRID Setup menu.

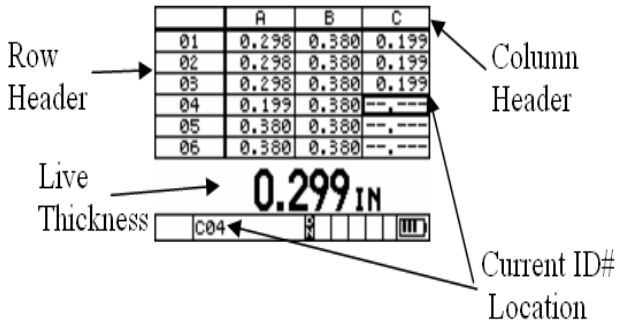
Step 4: Use the [↓ and ↑] to select a parameter and the [← and ←] to adjust the setting.

Step 5: Press the [MEAS] key to return to the Measure mode and save the adjusted settings.



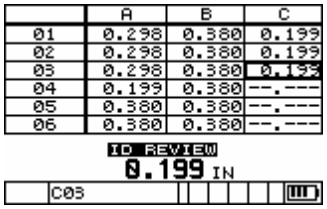
4.15.2 Saving Data While DB Grid Is Active

Once DB Grid is activated, press the Save key to store the current thickness reading in the Current ID# location.



4.15.3 Reviewing Stored Thickness Data While DB Grid Is Active

Step 1: From Measure mode, press the [2nd F], [→] (ID#) key. The gage displays the ID REVIEW screen.



Step 2: Use [↑, ↓, ←, →] to move to a new grid or ID# location. For incremental or sequential files, only the [↑, ↓] keys can be used.

Note: The user can jump to the beginning of the file by press-

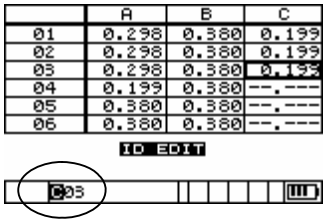
ing [2nd F], [↓] or to the end of the file by pressing [2nd F], [↑].

Step 3: Press the [MEAS] key to go back to the Measure mode at the new ID# location. The gage increments from this new ID# location.

4.15.4 Editing and Moving Directly to Any ID# Location in the Active File

Step 1: From Measure mode, press the [2nd F], [→] (ID#) key. The gage displays the ID REVIEW screen.

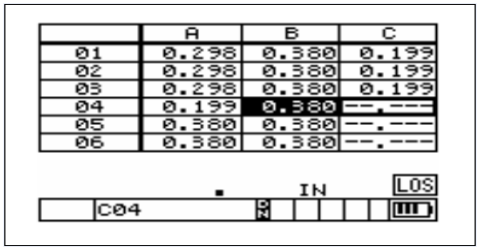
Step 2: Press the [2nd F], [→] (ID#) again to enter the ID# EDIT screen. A cursor appears in the current ID# and the [↑, ↓, ←, →] keys can be used to edit to any location in the active file.



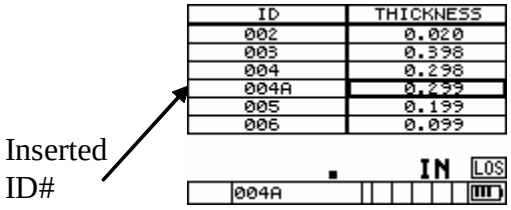
Step 3: Press the Measure key to return to the Measure screen at the new ID# location or press [2nd F], [→] (ID#) to go back to Review mode at the edited ID# location.

4.15.5 Inserted ID# Location in Grid Files

ID# locations can be inserted into or appended to 2D Grid files. If the user adds an additional ID# location in a grid file, the Row and Column cell is displayed in reverse video indicating that there are additional ID#s stored at the current Row and Column locations. Inserted points in incremental or sequential files are shown as added ID#s in the current file list.



To view the inserted or appended ID# location in a file, enter the ID# Review screen by pressing [2nd F], [→] (ID#). Use the [↑, ↓, ←, →] keys to highlight the reverse video cell. Press [ENTER]. The grid will be displayed in an Expanded Linear format, and the inserted ID# can be viewed. Press [Enter] again to switch back to the normal DB Gird view.



5 DATALOGGER

Two important features of the MG2-DL are the internal datalogger and USB communication. The operation of the datalogger and data transmission are discussed in this section.

Topics include:

- Datalogger Overview
- Organizing the Datalogger
- Creating Data Files
- Opening a File
- Saving Data
- Using ID# Review Mode
- Using ID# Edit Mode
- Deleting a File
- Receiving Files and Using the GageView Interface Program
- Statistics Reports

5.1 Datalogger Overview

The MG2-DL datalogger has a built-in file and data management system. Each thickness reading is stored and tagged with an alphanumeric identification number and file name with descriptive fields. A complete description of the measurement type, gage calibration and setup parameters is stored along with each reading. Datalogger functions include:

- Store thickness measurements
- Recall stored data to the gage displays

- Receive previously transmitted thickness data back from a computer
- View current datalogger settings while simultaneously taking measurements.

You can store thickness measurements. When each measurement is stored, the gage also stores a complete description of the measurement conditions. The additional data stored with each thickness value includes:

- File Name
- Identifier
- Units (in or mm)
- LOS (Loss of Signal)
- Differential Mode
- Differential Reference Value
- Alarm Mode
- Alarm Status
- Alarm Set Points
- Minimum or Maximum Mode
- Minimum or Maximum Reading
- Velocity
- Resolution
- Transducer Setup Number and Information
- Coating Thickness (when THRU-COAT® is active)

You can store a maximum of 8,000 thickness values at any one time in the MG2-DL.

5.2 Organizing the Datalogger

The MG2-DL datalogger is a flexible, file-based system. Every measurement stored into the datalogger is tagged with a file name and identification number (ID number). The file name and ID number may be thought of as the place in the gage memory where the measurement data is stored. This description usually corresponds to the physical location numbers of each measurement point in the actual application.

When stored data is loaded into a computer and later recalled back to the gage, each measurement is always uniquely identified by the file name and ID number where it was initially stored.

5.2.1 File Name Structure

File names consist of up to eight (8) alphanumeric characters. Allowable characters are as follows:

0 1 2 3 4 5 6 7 8 9

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

space - . / , : # *

The total number of files is only limited by the number of ID numbers. The file name is limited to eight (8) characters.

5.2.2 Identifier (ID Number) Structure

ID numbers consist of up to 10 alphanumeric characters. Allowable characters are as follows:

0 1 2 3 4 5 6 7 8 9

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

space - . / , : # *

The allowable number of ID numbers within a file is dependent on the total number of identifiers in the datalogger. There are no restrictions on the use of any allowed character at any position in an ID number except that you cannot use a space as either the first or last character of the ID number.

5.3 Creating Data Files

You can create data files for the MG2-DL datalogger from within the gage.

Throughout this section there are references to the use of the MG2-DL Standard Editing Commands. These commands are described in the section below.

5.3.1 Standard Editing Commands

To enter a character or a symbol at any character location, follow these steps:

Step 1: Press **[↑]** or **[↓]** to select a letter, number, or punctuation mark.

Step 2: Press and quickly release a slewing key to change the character by one value.

Hold down an arrow key to continuously cycle through the letters, numbers, and punctuation marks until the desired character is displayed.

The [↑] key moves forward from A to Z then *****, **#**, **:**, **,**, /, **.**, **-**, blank, 9, 8, 7, 6, 5, 4, 3, 2, 1, A, and so forth.

The [↓] key moves backward from 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, **-**, **.**, /, **,** **:**, **#**, *****, Z to A blank - and so forth.

After selecting an alpha character, press [←] or [→] to move the cursor position to another character.

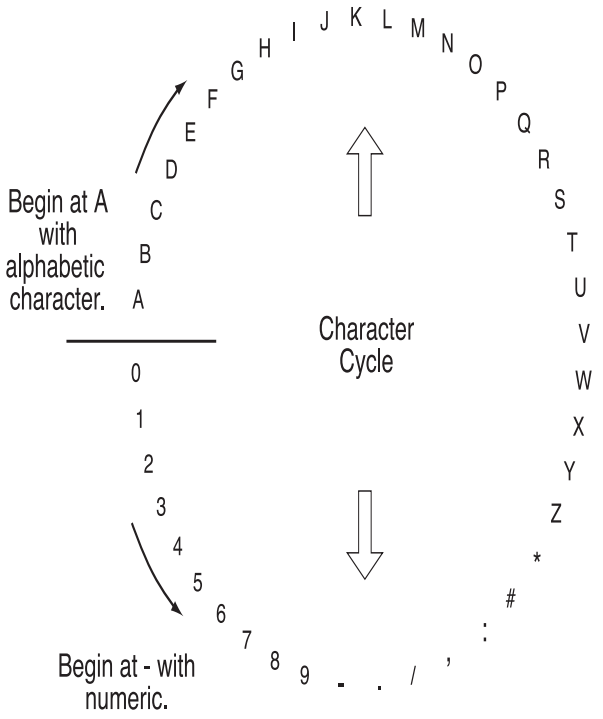


Figure 5-1: Organization of Character Cycle

To insert a character at the cursor position, do the following:

Press **[CAL ZERO]**. The character at the cursor and all those to the right move one position to the right, making a space for a new character.

To delete the character at the cursor position, do the following:

Press **[CAL VEL]**. The character at the cursor is deleted and any characters to the right moves left one position to fill-in the empty space.

5.3.2 Create Files From a Computer (Using GageView)

See the GageView Interface Program Instruction Manual.

5.3.3 Create Files from the MG2-DL

To create files from the MG2-DL, follow these steps:

Step 1:Press **[2nd F],[↑](FILE)**. The File Tab menu opens.

Step 2:Press [←] and [→] to highlight the **Create** option.

Step 3:Press **[↓]**.

5.3.3.1 Incremental

After a starting ID number (up to 10 alphanumeric characters) has been entered, the gage automatically increments to the subsequent ID numbers using the following incrementing rules:

- Only that portion of an ID number consisting of digits and letters (no punctuation marks) beginning with the right-most character

and extending leftward to the first punctuation mark or to the left-most character (whichever is first) can increment.

- Digits are cycled 0, 1, 2, ..., 9. The 9 to 0 transition is done only after incrementing the character to the left. Letters are cycled A, B, C, ..., Z, A, etc. The Z to A transition is done only after incrementing the character to the left. In either case, if there is no character to the left, or if the character to the left is a punctuation mark, then the ID number cannot increment.
- If an ID number cannot increment, after a reading is saved, a long error beep sounds and the momentary message "CANNOT INCREMENT" is shown on the display.

Note: **To make the gage increment through a range of numbers several digits wide while beginning with a single digit ID number, the maximum number of digit positions must be entered initially using leading zeroes.**

Some examples of automatically generated incremented ID number series include:

Table 5-1: Five Examples of Automatically Generated Incremented ID Number Series

1:	
Initial	1
	2
	3
	.
	.
	.
Limit	9

Table 5-1: Five Examples of Automatically Generated Incremented ID Number Series

2:	
Initial	ABC ABD ABE . . . ABZ ACA ACB . . .
Limit	ZZZ
3:	
Initial	ABC*12*34 ABC*12*35 ABC*12*36 . . .
Limit	ABC*12*99
4:	
Initial	001 002 003 . . . 009 010 . . .
Limit	999

Table 5-1: Five Examples of Automatically Generated Incremented ID Number Series

5:
Initial 1A
1B
1C
.
.
.
1Z
2A
2B
.
.
.
Limit 9Z

To create an Incremental File, follow these steps:

Step 1: Press [2nd F][↑](File) to display the File Tabs.

Step 2: Use the [←] and [→] keys to select the Create Tab.

Step 3: Use the [↓] key to highlight the file name and press [→] to enter a file name using the [↑, ↓, ←, →] editing function. Press [ENTER].

Step 4: Use the [← and →] keys to select Incremental. Press [ENTER].

Step 5: Use the [← and →] keys to select Normal or THRU COAT® and press [ENTER]. Normal is for standard files. THRU COAT is used when storing thru-coat thickness readings.

Step 6: Use the [← and →] keys to select Continue and then press [ENTER].

Step 7: Use the [→] key to enter the start ID number using the editing function keys [↑, ↓, ←, →]. Press [ENTER].

Step 8: Use the [←, →] to select Done or Cancel. Press [ENTER].

5.3.3.2 Sequential

A Sequential File is defined by a starting and an ending ID number. The resulting file is inclusive of the starting and ending points and all points in between.

Example: Start ID# = ABC123
End ID# = ABC135
The resulting file would contain the following list of ID numbers:
ABC123
ABC124
ABC125
.
.
.
ABC135

Example: Start ID# = XY-GY
End ID# = XY-IB
The resulting file would contain the following list of ID numbers:
XY-GY
XY-GZ
XY-HA
.
.
.
XY-IB

To create a Sequential File, follow these steps:

Step 1: Press [2nd F][↑](File) to display the File Tabs.

Step 2: Use the [← and →] keys to select the Create Tab.

Step 3: Use the [↓] key to highlight the file name. Press the [→]

key to enter a file name using the [↑, ↓, ←, →] editing function. Press [ENTER].

Step 4: Use the [← and →] keys to select Sequential. Press [ENTER].

Step 5: Use the [← and →] keys to select Normal or THRU COAT®. Press [ENTER]. Normal is for standard files. THRU COAT is used when storing THRU COAT thickness readings.

Step 6: Use the [← and →] keys to select Continue. Press [ENTER].

Step 7: Use the [→] key to enter the Start ID# using the [↑, ↓, ←, →] editing function. Press [ENTER].

Step 8: Use the [→] key to enter the End ID# using the [↑, ↓, ←, →] editing function. Press [ENTER].

Step 9: Use the [← and →] keys to select Done or Cancel. Press [ENTER].

5.3.3.3 2-D Grid File

A 2-D grid is a sequence of ID numbers arranged to describe a path through a two-dimensional matrix. Each part of the ID number corresponds to a particular matrix dimension.

A 2-D (two-dimensional) sequence begins with the ID number that refers to the first column and the first row. Then the column (or row) increments one value at a time until the sequence reaches the last column (or row) value while the other dimension value stays constant. At this point the other dimension increments from its first to its last value. This

continues until the ID number that refers to the last column and last row is reached.

Note: Either the columns or the rows can be selected to increment first. Refer to the following figure.

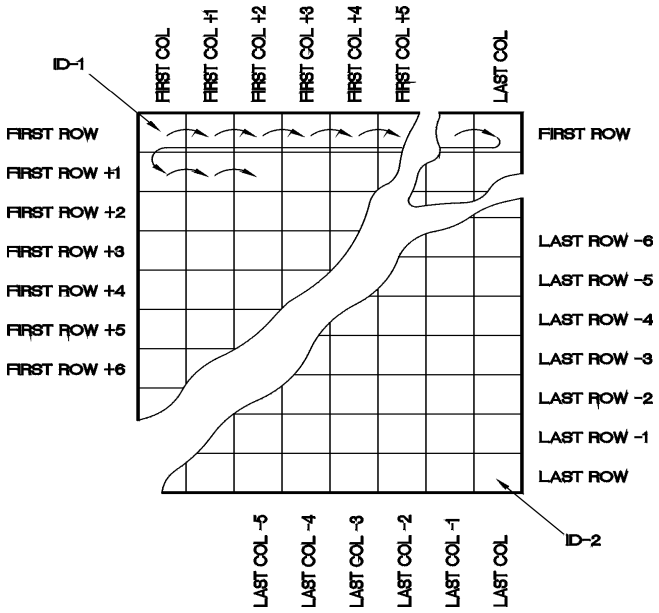


Figure 2 General Grid Database

How is a grid used? A grid structure may associate one dimension of the grid (for example, the columns) with the physical parts whose wall thickness is to be measured. The particular measurement points on each part are then associated with the other dimension of the grid (that is, the rows).

Alternatively, the rows and columns of a grid may refer to a two dimensional map of measurement points on the surface of one part. In this case, a different grid is made for each part.

To create a 2-D Grid file, follow these steps:

Step 1: Press [2nd F][↑](File) to display the File Tabs.

Step 2: Use the [← and →] keys to select the Create Tab.

Step 3: Use the [↓] key to highlight the file name. Press [→] to enter a file name using the [↑, ↓, ←, →] editing function. Press [ENTER].

Step 4: Use the [← and →] keys to select 2D Grid. Press [ENTER].

Step 5: Use the [← and →] keys to select Normal or THRU COAT® Press [ENTER]. Normal is for standard files.THRU COAT is used when storing THRU COAT thickness readings.

Step 6: Use the [← and →] keys to select Continue. Press [ENTER].

Step 7: Use the [→] key to enter the Start COL using the [↑, ↓, ←, →] editing function. Press [ENTER].

Step 8: Use the [→] key to enter the End COL using the [↑, ↓,

←, →] editing function. Press [ENTER].

Step 9: Use the [→] key to enter the Start ROW using the [↑, ↓, ←, →] editing function. Press [ENTER].

Step 10: Use the [→] key to enter the END ROW using the [↑ ↓ ← →] editing function. Press [ENTER].

Step 11: Use the [← and →] keys to select Standard or EPRI. Press [ENTER]. In Standard mode, the columns after Z increment [AA, AB, AC, …]. In EPRI mode, the columns after Z will increment [AA, BB, CC…].

Step 12: Use the [← and →] keys to select to increment first by Row or Column. Press [ENTER].

Step 13: Use the [← and →] keys to select Done or Cancel. Press [ENTER].

5.4 Opening a File

Use the File Open function to retrieve a file stored in the datalogger and mark it as the active file in the Measure Mode.

To open a File, follow these steps:

Step 1: Press [2nd F][↑](FILE) to go to the File Tabs.

Step 2: Press [→] to scroll to the Open tab.

Step 3: Press [↓] to enter the Open tab.

Step 4: Use [↑] or [↓] to scroll files.

Step 5: Press [ENTER] to select the file.

Step 6: Use [←] or [→] to choose Open or Cancel.

Step 7: Press [ENTER].

5.5 Saving Data

To store displayed thickness values in the datalogger, press **[SAVE]**. All appropriate calibration and setup parameters are also stored simultaneously.

If a measurement is already stored at the current ID number, pressing **[SAVE]** overwrites the old thickness reading with the current thickness reading, unless ID Overwrite Protection is enabled in Meas Setup.

If you do not want to save a measurement at a specific ID, press **[SAVE]** while no measurement is taken. The gage will store an LOS condition and _.___ at the specific ID number.

To save a thickness reading, do the following:

While the thickness value is being displayed, press **[SAVE]**.

An audible beep indicates that the reading is saved. The displayed thickness value and setup information is stored at the current ID number in the current file. If the thickness display is blank when **[SAVE]** is pressed, then "_.___" is saved in place of a value.

The ID number is automatically updated to the next ID number in the sequence. The new ID number is indicated on the display. If the ID number cannot be updated, a long beep sounds and the gage displays a message explaining why the ID was unable to update. In this case, the ID number on the display remains unchanged.

Some of the special features of the MG2-DL allow the gage to store more than one thickness value at an ID location. For this reason, the gage has two file types for saving data:

- **Normal:** Standard one thickness saved.
- **THRU COAT®*:*** Thickness of coating and thickness of steel saved.

The gage will not store different file type data in a single file.

5.6 Using the Review ID Mode

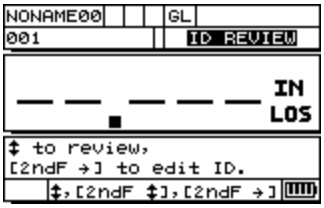
The review ID mode has two purposes:

- Review datalogger contents by scanning through stored ID locations in the active file.
- Move within the file and change the current ID location to any location that already exists in the file.

To review stored thickness values or move to an existing ID location, follow these steps:

Step 1: Press [2nd F][→](ID#).

Step 2: Use [↑] or [↓] to change ID.



5.7 Using Edit ID Mode

The ID Edit mode is generally used for one of two purposes:

- To change the current ID Location to a different ID Location already in the database. This mode is useful when you are using a large database and it would take too long to locate the desired ID by pressing **[↑]** and **[↓]**.
- To change the current ID Location to a new ID, which does not yet exist in the database. This mode is useful when you want to include additional measurement points to the active file. Additional ID locations can be added anywhere in the file.

Note: **No stored data is shown while in ID Edit mode and no measurements can be made.**

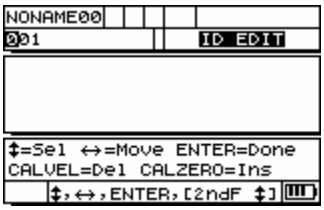
To use the **ID Edit** mode, follow these steps:

Step 1: Press [2nd F][→](ID#).

Step 2: Press [2nd F][→](ID#) again.

Step 3: Use [↑, ↓, ←, →] to make changes.

Step 4: Press [2nd F][→](ID#) to view the content of the new ID#, or press [MEAS] to return to Measure mode at the new ID# location.



5.8 Delete

5.8.1 Delete a Range of ID#s in a File

Note: When deleting a range of ID's in an incremental file, both the ID# and the stored value will be deleted.

Note: When deleting a range of ID's in a sequential or 2-D grid file, only the thickness values will be deleted. The ID# structure will remain.

Step 1: Press [2nd F][↑](FILE) to go to the File Tabs.

Step 2: Press [→] to scroll to the Delete tab.

Step 3: Press [↓] to enter the Delete tab.

Step 4: Press [←] or [→] to select ID Range.

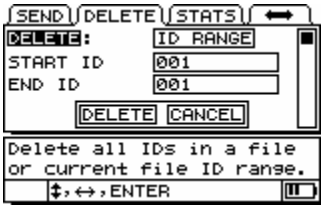
Step 5: Press [↓] to select the starting ID#.

Step 6: Use [→] to edit the Start ID# using the [↑,↓,←,→] editing function keys. Press [ENTER].

Step 7: Press [→] to edit the End ID# number using the [↑,↓,←,→] editing function keys. Press [ENTER].

Step 8: Use [←] or [→] to choose Delete or Cancel. Press [ENTER].

Step 9: Press [MEAS] to return to Measurement Mode.



5.8.2 Delete Selected Files

Step 1: Press [2nd F][↑](FILE) to go to the File Tabs.

Step 2: Press [→] to scroll to the Delete tab.

Step 3: Press [↓] to enter the Delete tab.

Step 4: Press [←] or [→] to select Delete File. Press [ENTER].

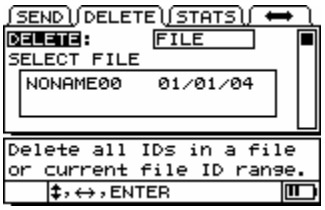
Step 5: Press [↑] or [↓] to highlight the file.

Step 6: Press [ENTER] to select the file for deletion.

Step 7: Use [←] or [→] to choose Delete or Cancel.

Step 8: Press [ENTER].

Step 9: Press [MEAS] to return to Measurement Mode.



5.8.3 Delete Stored Value

You may erase the current stored value at a specified ID location by overwriting the value with new data or a LOS value. You may enable ID# Overwrite, and the gage will display a message that states whether data already exists at an ID location.

To enable ID# Overwrite:

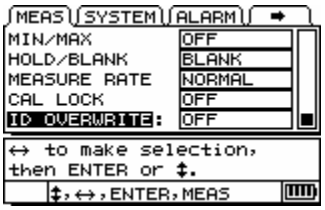
Step 1: Press [2nd F][↓](SETUP) to go to the Setup Tabs.

Step 2: Press [↓] to enter the MEAS tab.

Step 3: Press [↑] or [↓] to scroll to ID Overwrite.

Step 4: Use [←] or [→] to choose ON or OFF.

Step 5: Press [MEAS] to end.



5.9 Receiving Files and Using the GageView Interface Program

5.9.1 Receiving (Downloading) Files From a Computer

Datalogger information can be downloaded from a computer into the gage. This has two benefits:

1. Thickness survey data previously saved with ID#s and stored in a computer file may be retrieved to the gage at a later date to guide you through the measurement sequence using ID#s or to compare current values with previous thickness values.
2. You may create ID# sequences in a computer and then download them to the gage. This externally created sequence can guide you through the prescribed

measurement location path. The ID sequence created in the computer must have setup information.

Data downloaded to the MG2-DL gage must be in the same format in which data is transmitted. Panametrics-NDT™ recommends using the GageView Interface Program to manage all functions of interfacing, storing, and creating MG2-DL data.

5.9.2 Using the Optional GageView Interface Program

GageView is the interface program for the MG2-DL. GageView is a Windows®-based program compatible with Windows 2000® and XP®. It can create inspection database files, load data files, and generate reports. GageView is compatible with MG2-DL data files and offers advanced ODBC compatibility and enhanced OLE features.

For more information on GageView, refer to the GageView Instruction Manual.

5.10 Statistics Reports

The MG2-DL can generate statistic reports from within the gage without having to connect to a computer.

5.10.1 Statistics Report for an Entire File

Step 1: Press [2nd F][↑](FILE) to go to the File tabs.

Step 2: Press [→] to scroll to Stats tab.

Step 3: Press [↓] to enter the Stats tab.

Step 4: Press [←] or [→] to select Report on File. Press [ENTER].

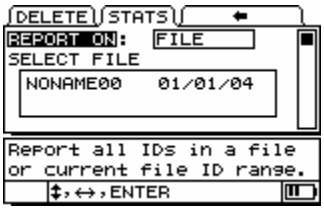
Step 5: Use [↑] and [↓] to scroll to files.

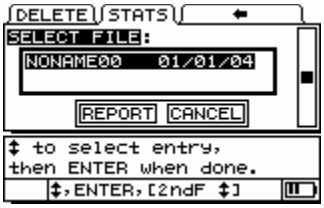
Step 6: Press [ENTER] to select the file.

Step 7: Use [←] or [→] to choose Report or Cancel.

Step 8: Press [ENTER].

Step 9: Press [ENTER] again to view the next screen.





5.10.2 Statistics Report for a Range of ID#s in a File

Use the following procedure to read statistics for a range of ID#s in a file:

Step 1: Press [2nd F][↑](FILE) to go to the File tabs.

Step 2: Press [→] to scroll to the Stats tab.

Step 3: Press [↓] to enter the Stats tab.

Step 4: From Report On, press [←] or [→] to select Report on ID# Range. Press [ENTER].

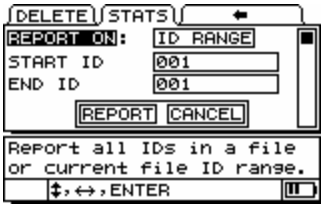
Step 5: Use [→] to edit Start ID# using the [↑, ↓, ←, →] editing function keys. Press [ENTER].

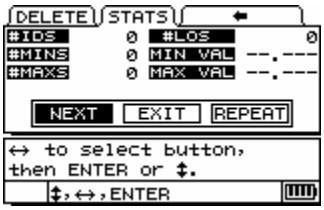
Step 6: Use [→] to edit the ID# using the [↑, ↓, ←, →] editing function keys. Press [ENTER].

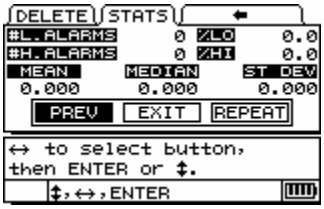
Step 7: Use [←] or [→] to choose Report or Cancel.

Step 8: Press [ENTER].

Step 9: Press [ENTER] again to view the next screen.


DELETE
STATS
REPORT ON:
ID RANGE
START ID
001
END ID
001
REPORT
CANCEL
Report all IDs in a file
or current file ID range.
↕,↔,ENTER


DELETE
STATS
#IDS
0
#LOS
0
#MINS
0
MIN VAL
--.---
#MAXS
0
MAX VAL
--.---
NEXT
EXIT
REPEAT
↔ to select button,
then ENTER or ↕.
↕,↔,ENTER


DELETE
STATS
#L.ALARMS
0
%LO
0.0
#H.ALARMS
0
%HI
0.0
MEAN
MEDIAN
ST DEV
0.000
0.000
0.000
PREV
EXIT
REPEAT
↔ to select button,
then ENTER or ↕.
↕,↔,ENTER

6 SPECIFICATIONS

THICKNESS MEASUREMENT RANGE:	0.020 to 25.000 inches or 0.50 to 635.0 mm (typical in steel)

NOTE: Thickness range depends on material, transducer type, surface condition, surface preparation, and temperature.

		Standard	Low
THICKNESS DISPLAY RESOLUTION:	• Millimeters:	0.01	0.1
	• Inches:	0.001	0.01
MEASUREMENT RATE:	Standard Mode - 4 measurements per second Fast Min Mode - 20 measurements per second		
MATERIAL VELOCITY RANGE:	0.0200 - 0.7362 in/µS 0.508 - 18.699 mm/µS		
TRANSDUCER ZERO COMPENSATION:	Provides zero and temperature compensation for different transducers.		

DISPLAY:	5-digit Liquid Crystal Display (LCD), 0.425” (10.8 mm) numerals, 160X100 pixel resolution.

DISPLAY UNITS, SYMBOLS, and FLAGS:

1. File Name (C)
2. Freeze Flag: F, _
3. Min/Max Flags: M, m,_
4. Diff/Alarm Flags: D, A, H, L, _ (B,C)
5. Gain Flag: GL, GH, GO, _
6. Measure Mode Flags: STD, THRU, AEtoE
7. Measure Rate: Normal, Fast
8. Stored Thickness (C)
9. Units: IN, MM
10. LOS Flag: LOS, _
11. Help Text
12. Battery Life Indicator
13. Key Press Guide
14. 2^{nd} Function Key Press Indicator: 2^{nd} F
15. Current Measurement Box
16. Coating Measurement (B, C)
17. ID Box (C)
18. DN Flag: DN, _ (C)

RECEIVER BANDWIDTH:	1 - 18MHz (-3dB)

MEASUREMENT MODE:	Standard time interval from a precision delay after the excitation to the first echo using a dual element transducer. MG2-XT and MG2-DL: • THRU-COAT® - Measurement of both metal and coating thickness using a single backwall echo (with D7906-SM and D7908 transducers) • Thru-Paint Echo-to-Echo - Time interval between two successive backwall echoes for elimination of paint and coating
METRIC/ENGLISH MODES:	Allows selection between English and metric units via the keypad
BATTERY:	Three (3) AA alkaline batteries
BATTERY LIFE:	150 hours minimum (Measure Mode) 30 hours minimum (Backlight On)
OPERATING TEMP. RANGE (ELECTRONICS):	-10° C to +50° C

SIZE:	6.0” L x 3.31” W x 1.50” H 152mm L x 84mm W x 38mm H
WEIGHT:	8.5 oz. (0.24Kg)
TRANSDUCERS:	D790, D790-SM, D790-RL, D790-SL, D791, D791-RM, D792, D793, D794, D795, D797, D797-SM, D798, D798-LF, D798-SM, D7226, D799, and MTD705 MG2-XT and MG2-DL models use the transducers listed above and D7906-SM and D7908.
DATALOGGER	MG2-DL only
STORAGE CAPACITY:	8000 thickness measurements or 350 waveforms with thickness with the Wavform option.
INFORMATION STORED:	ID Number, File Name, Thickness Value, Units, LOS Condition, Differential Mode, Differential Reference Value, Alarm Mode, High Alarm Setpoint, Low Alarm Setpoint, Minimum Reading Flag, Gain Mode Velocity Value, Transducer Type.

DATALOGGER FILES	8-character alphanumeric file names
IDENTIFICATION NUMBERS:	10 alphanumeric characters, character set A-Z, 0-9, and the special characters -, ., /, „ :, #, *
FILE FORMATS	Incremental, sequential, 2-dimension grid
DATALOGGER FEATURES:	Save Reading at ID# Review Stored Contents of Data Erase a File or Files Move to specific ID#'s in a file
COMMUNICATION	USB 2.0 Full Speed

7 THEORY OF OPERATION

MG2 Series Gages operate on the dual transducer "pulse-echo" principal, timing the reflection of high frequency sound waves from the far wall of the test piece. This technique, derived from sonar, has been widely applied to nondestructive testing.The frequency range used by the gage does not travel well through air, so a coupling liquid such as glycerine or gel is used between the face of the transducer and the test piece. The sound waves generated by the transmit side of the transducer are coupled into the test piece, travel through it, and are reflected back from the opposite side. The reflected sound waves or echoes are coupled into the receive side of the transducer where they are converted back into electrical signals. The gage precisely measures the time interval between the excitation pulse and the first echo signal and subtracts a zero offset value representing transducer delay. The result is multiplied by the velocity of sound in the test material, V, and divided by two to compensate for the two-way sound path. The final result, X, is the thickness of the test material.

$$X = \frac{(t)V}{2}$$

The microprocessor performs the arithmetic described above to produce the thickness value. This value along with various gage status indicators is sent to the LCD display.

The microprocessor also directs the Receiver/Detector to identify the transducer type using the I.D. pin of the transducer. Calibration values and gage setups are saved in non-volatile RAM (Random Access Memory). The keyboard informs the microprocessor of user-entered changes of mode, values, and so on.

8 APPLICATION NOTES

8.1 Factors Affecting Performance And Accuracy

a. Surface Condition

Severe pitting on the outside surface of a pipe or tank can be a problem. On some rough surfaces, the use of a gel or grease rather than a liquid couplant will help transmit sound energy into the test piece. In extreme cases it will be necessary to file or grind the surface sufficiently flat to permit contact with the face of the transducer. In applications where deep pitting occurs on the outside of a pipe or tank it is usually necessary to measure remaining metal thickness from the base of the pits to the inside wall. The conventional technique is to measure unpitted metal thickness ultrasonically, measure pit depth mechanically, and subtract the pit depth from the measured wall thickness. Alternately, one can file or grind the surface down to the base of the pits and measure normally. As with any difficult application, experimentation with actual product samples is the best way to determine the limits of a particular gage/transducer combination on a given surface.

b. Transducer Positioning/Alignment

For proper sound coupling the transducer must be pressed firmly against the test surface. On small diameter cylindrical surfaces such as pipes, hold the transducer so that the sound barrier material visible on the probe face is aligned perpendicular to the center axis of the pipe. See the illustration below.

It is possible that on some severely corroded or pitted materials there will be spots where readings cannot be obtained. This can happen when the inside surface of the material is so irregular that the sound energy is scattered rather than being reflected back to the transducer. The lack of a reading may also indicate a thickness outside the range of the transducer and instrument being used. Generally, an inability to obtain a valid thickness reading at a particular point on a test specimen could be a sign of a seriously degraded wall, which may warrant investigation by other means.

c. Calibration

The accuracy of measurements is only as good as the accuracy and care with which the gage has been calibrated. It is essential that the velocity and zero calibrations be performed whenever the test material or transducer is changed. Periodic checks with samples of known thicknesses are recommended to verify that the gage is operating properly.

d. Taper or Eccentricity

If the contact surface and the back surface are tapered or eccentric with respect to each other, the return echo becomes distorted and the accuracy of measurement is diminished.

e. Acoustic Properties of the Material

There are several conditions found in engineering materials that can severely limit the accuracy and thickness range that can be measured.

1. Sound Scattering

   Sound scattering in some materials (notably certain types of cast stainless steel, cast irons, and composites) occurs when sound energy is scattered from individual crystallites in the casting or from dissimilar materials within the composite. This effect reduces the ability to discriminate a valid return echo from the back side of the material and limits the ability to gauge the material ultrasonically.

2. Velocity Variations

   A number of materials exhibit significant variations in sound velocity from point-to-point within the material. Certain types of cast stainless steels and brass exhibit this effect due to a relatively large grain size and the anisotropy of sound velocity with respect to grain orientation. Other materials show a rapid change in sound velocity with temperature. This is characteristic of plastic materials where temperature must be controlled in order to obtain maximum precision in the measurement.

3. Sound Attenuation

Sound attenuation or absorption in many organic materials, such as low density plastics and rubber, occurs when sound is attenuated very rapidly at the frequencies used in normal ultrasonic thickness gauging. Therefore, the maximum thickness that can be measured in these materials is often limited.

8.2 Transducer Selection

For any ultrasonic measurement system (transducer plus thickness gage) there will be a minimum material thickness below which valid measurements will not be possible.

Normally this minimum range will be specified in the manufacturer's literature. As transducer frequency increases, the minimum measurable thickness decreases. In corrosion applications, where minimum remaining wall thickness is normally the parameter to be measured, it is particularly important to be aware of the specified range of the transducer being used. If a dual is used to measure a test piece that is below its designed minimum range, the gage may detect invalid echoes and display an incorrectly high thickness reading. The table below lists approximate minimum measurable thicknesses in steel for the standard transducers used with the Panametrics-NDT™ MG2 gage. Note that these numbers are approximate. The exact measurable minimum in a given application depends on material velocity, surface condition, temperature and geometry, and it should be determined experimentally by the user.

Transducer Selection

Probe	MHZ	Conn	Tip Dia	Range (Steel)	Temp Range
D790 D790-SM D790-RL D790-SL	5.0	Straight Straight Rt. Angle Straight	0.434" (11.0 mm)	0.040" - 20" (1-500 mm)	-5° - 932°F (-20° - 500°C)
D791	5.0	Rt. Angle	0.434" (11.0 mm)	0.040" - 20" (1-500 mm)	-5° - 932°F (-20° - 500°C)
D791-RM	5.0	Rt. Angle	0.434" (11.0 mm)	0.040" - 20" (1-500 mm)	-5° - 752°F (-20° - 400°C)
D792 D793	10	Straight Rt. Angle	0.283" (7.2 mm)	0.020" - 1" (0.5-25 mm)	32° - 122°F (0° - 50°C)
D794 D795	5.0	Straight Rt. Angle	0.283" (7.2 mm)	0.030" - 2" (0.75-50 mm)	32° - 122°F (0° - 50°C)
D797 D797-SM	2.0	Rt. Angle Straight	0.900" (22.9 mm)	0.150" - 25" (3.8-635 mm)	-5° - 752°F (-20° - 400°C)
D7226 D798-LF	7.5	Rt. Angle	0.350" (8.9 mm)	0.028" - 4" (0.71-100 mm)	-5° - 300°F (-20° - 150°C)
D798 D798-SM	7.5	Rt. Angle Straight	0.283" (7.2 mm)	0.028" - 4" (0.71-100 mm)	-5° - 300°F (-20° - 150°C)
D799	5.0	Rt. Angle	0.434" (11.0 mm)	0.040" - 20" (1-500 mm)	-5° - 300°F (-20° - 150°C)
D7906-SM D7908	5.0 7.5	Straight Rt. Angle	0.434" (11.0 mm) 0.283" (7.2 mm)	0.040" - 2.0" (1-50 mm) 0.028" - 1.5" (0.71-38 mm)	32° - 122°F (0° - 50°C)
MTD705	5.0	Rt. Angle	0.200" (5.1 mm)	0.040" - 0.75" (1.0-19 mm)	32° - 122°F (0° - 50°C)

In selecting a transducer for a corrosion application it is also necessary to consider the temperature of the material to be measured. Not all duals are designed for high temperature measurements. The chart above lists recommended temperature ranges for the Panametrics-NDT™ duals used with the MG2 gage. For other transducers, consult the manufacturer. Using a transducer on materials whose temperature is beyond the specified range can damage or destroy the transducer.

8.3 High Temperature Measurements

Corrosion measurements at elevated temperatures require special consideration. Keep in mind the following points:

a. Be sure that the surface temperature of the test piece does not exceed the maximum specified temperature for the transducer and couplant that you are using. Some duals are designed for room temperature measurements only.

b. Use a couplant rated for the temperature where you will be working. All high temperature couplants will boil off at some temperature, leaving a hard residue that is not able to transmit sound energy. Panametrics-NDT™ Couplant E (Ultratherm) can be used at temperatures up to 1000ºF/ 540ºC, although it will boil as the upper limit is reached. Maximum recommended temperatures for Panametrics-

NDT™ couplants are as follows:

Couplant Selection

Couplant	Type	Maximum Recommended Temperature
A	Propylene Glycol	200ºF/90ºC
B	Glycerine	200ºF/90ºC
C	Gel	200ºF/90ºC
E	High Temperature	1000ºF/540ºC
F	Medium Temperature	540ºF/280ºC

c. Make measurements quickly and allow the transducer body to cool between readings. High temperature duals have delay lines made of thermally tolerant material, but with continuous exposure to very high temperatures the inside of the probe will heat to a point where the transducer will be permanently damaged.

d. Remember that both material sound velocity and transducer zero offset will change with temperature. For maximum accuracy at high temperatures, velocity calibration should be performed using a section of the test bar of known thickness heated to the temperature where measurements are to be performed. The Panametrics-NDT™ MG2 gage has a semiautomatic zero function that can be employed to adjust zero setting at high temperatures.

e. Using the Fast mode with the Freeze function may help in obtaining measurements as quickly as possible.

f. Note that a corrosion gage is not designed for flaw or crack detection, and cannot be relied upon to detect material discontinuities. A proper evaluation of material discontinuities requires an ultrasonic flaw detector such as the Panametrics-NDT™ Epoch series used by a properly trained operator. In general, unexplained readings by a corrosion gage merit further testing with a flaw detector.

g. For further information on the use of dual element transducers in corrosion gaging, or for information on any aspect of ultrasonic testing, contact Panametrics-NDT.

h. Often, performance on hot, corroded materials will be considerably improved by the use of the Gain Adjust procedure or the Material Sensitivity Optimization procedure. High temperature couplants are generally less efficient than those used at lower temperatures, so the MG2 will work better when sensitivity is adjusted or optimized to accommodate high temperature conditions.

9 MAINTENANCE AND TROUBLESHOOTING

9.1 Routine Care And Maintenance

The MG2 case is sealed to prevent intrusion of environmental liquids and dust. However, it is not completely waterproof. Therefore, the unit should never be immersed in any fluid.

The case, keypad and display window may be cleaned with a damp cloth and mild detergent if necessary. Do not use strong solvents or abrasives.

9.2 Transducers

The ultrasonic transducers or probes used with the MG2 are rugged devices that need little care. They are not indestructible, however, and a little attention to the following items will result in the longest transducer life:

The cables can be damaged by cutting, pinching, or pulling. Care must be taken to prevent mechanical abuse to the cables. Never leave a transducer where a heavy object can be placed on the cable. Never remove a transducer from the gage by pulling on the cable. Pull on the molded connector housing only. Never tie a knot in a transducer cable.

Do not twist or pull the cable at the point where it connects to the transducer. These precautions are particularly important for all transducers other than the models that have field-replaceable cables.

Transducer performance will be degraded by excessive wear at the tip. To minimize wear, do not scrape or drag the transducer across rough surfaces. When a transducer tip becomes too rough, concave, or otherwise non-flat, operation may become erratic or impossible. Although some wear is normal in corrosion gaging applications, severe wear will limit transducer life. A transducer resurfacing procedure can be performed to improve performance of worn transducers. Contact Panametrics-NDT for details.

9.3 Error Messages

During the normal operation of the gage, certain special error messages may be displayed. Usually these indicate a problem with the operating procedure but some may indicate a physical problem with the gage itself. Consult Panametrics-NDT for further information.

9.4 Turn On And Low Battery Problems

The bars on the batteries symbol show operating time remaining. If the gage turns off immediately after turn-on, or if it does not turn on at all, then the battery is probably completely discharged. The batteries should be replaced. If, after replacing the batteries, the unit still does not turn on, there has probably been a component failure within the gage, which should be serviced.

SETUP ("Do--") PROBLEMS

If the message "Do--" will not go away when the [ZERO] key is pressed, make sure a Panametrics-NDT transducer is plugged in. If so, the transducer may be defective. Try another one if possible, or try a different cable. If no transducers will permit the "Do--" message to be removed, there is probably a problem in the pulser/receiver assembly of the gage.

9.5 Measurement Problems

If measurements cannot be made and the "MEAS" and "LOS" flags are on, there is either a problem with the transducer, the pulser/ receiver assembly, or there is not a large enough echo being returned from the far wall of the material. In order to further diagnose the problem, perform the following procedure:

Step 1: Wipe off any couplant from the transducer and press [2nd F],[CAL ZERO]. If a number between 3000 and 7500 is displayed along with the "Zero" flag, both the transducer and pulser/receiver assembly are working. Go to Step 2. Otherwise go to Step 6.

Step 2: Make sure you have sufficient couplant especially on rough or curved surfaces.

Step 3: Try the same transducer on a smooth, flat surfaced test sample.

Step 4: If the tests above all pass, but measurements still cannot be made, try Gain Adjust or Material Sensitivity (MG2-XT and MG2-DL). If measurements still cannot be made, try a different type of transducer with greater sensitivity in the thickness range in which you are working.

Step 5: If another transducer of the same type is available, use it to make measurements and to do Step 1. If this works, then the original transducer is defective. Otherwise, the pulser/ receiver assembly is probably defective.

Step 6: If the above tests indicate that there is a problem with the gage or transducer, then the unit(s) may be returned to Panametrics-NDT™ for repair or replacement. If the above tests indicate that the gage and transducer are good, the test

material itself probably cannot be measured due to:

- Extreme near side or far side surface roughness
- Extremely high sound attenuation or scattering due to graininess, inclusions, voids or, other material properties
- Extreme non-parallelism
- Excessively sharp curvature

9.6 Self Diagnostics

MG2 Series corrosion thickness gages include two self-diagnostic screens that permit the user to identify hardware or software problems.

To view the Diagnostic 1 screen and see internal self-test results:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the DIAG1 tab.

The following results are displayed:

Gain	Internal Calibration
BLK, DET, SMP	Internal Blank, Detector and Sampler Test
Thresh Cal (RCVR1)	Threshold Calibration Test Receiver 1
Thresh Cal (RCVR2)	Threshold Calibration Test Receiver 2

Table 9-1: DIAG1 Results

Note: Highlighted parameters indicate that the specific self-test failed based on the expected values.

To view the Diagnostic 2 screen, which shows information about your MG2 series gage:

Step 1: Press [2ndF][↓](Setup) to display the setup tabs.

Step 2: Use the [←, →] keys to highlight the DIAG2 tab.

The following results are displayed:

SW REV	Reports software version (1.00/1.00G)
Battery	Indicates current battery voltage
Probe	Indicates current attached probe
PR TX	Indicates the time of flight for the transmit delay line
PR RX	Indicates the time of flight for the receiver delay line

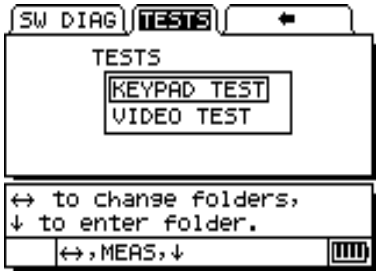
Table 9-2: DIAG2 Results

Note: If PR TX displays N/A, then either the cable is broken or there is a problem with the transducer.

9.7 Tests

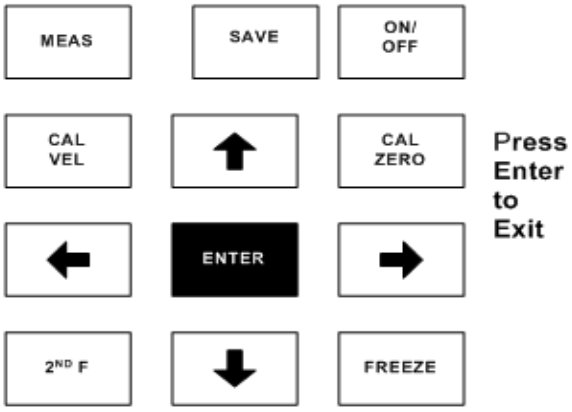
The MG2 Series TESTS screen, shown below, includes two tests of gage performance:

- **KEYPAD** - Tests keypad keys.
- **VIDEO** - Tests to assure that pixel locations are functional.



9.7.1 KEYPAD TEST

The KEYPAD TEST tests to assure that keypad keys are functional. The KEYPAD TEST displays an image of the keypad on the display. To test each key, press the key on the keypad. The image of the key will be highlighted. Where mismatches occur, keys are not functional.



To test the keypad, use the following procedure:

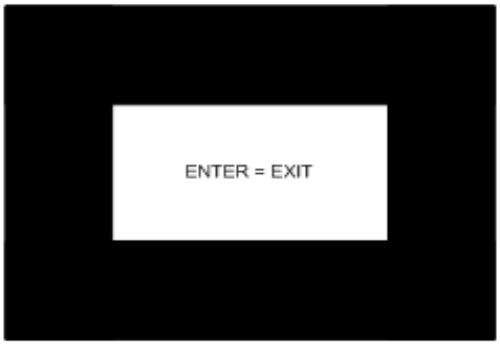
Step 1: From the Main screen, press [2ndF][↓] and use the [→] arrow to move across the top of the screen to the TESTS tab.

Step 2: Press the [↓] arrow to select KEYPAD TEST and then press ENTER or [2ndF][↑] to abort the test. Determine visually that the keypad keys are functional.

Step 3: Press ENTER to Exit to the TESTS screen.

9.7.2 VIDEO TEST

The VIDEO TEST tests to assure that individual pixels are functional. Non-functional pixels display in white when the VIDEO TEST is run.



To test the video display, use the following procedure:

Step 1: From the Main screen, press [2ndF][↓] and use the [→] arrow to move across the top of the screen to the TESTS tab.

Step 2: Press the [↓] arrow to select VIDEO TEST and then press ENTER or [2ndF][↑] to abort the test. Determine visually that video pixels are functional by observing if white spots occur in the screen test display.

Step 3: Press ENTER to Exit to the TESTS screen.

9.8 Repair Service

Panametrics-NDT™ will repair any MG2 gage at its Waltham, Massachusetts, USA factory. In addition, some local Panametrics-NDT dealers can perform repairs.

9.9 Replacement Parts And Optional Parts And Equipment

Replacement parts for the MG2 as well as additional related equipment are available from Panametrics-NDT™.

APPENDIX I: SOUND VELOCITIES

The following table presents a tabulation of the ultrasonic velocity in a variety of common materials. It is provided only as a guide. The actual velocity in these materials may vary significantly for a variety of reasons, such as: composition, preferred crystallographic orientation, porosity, and temperature. Therefore, for maximum accuracy, establish the sound velocity in a given material by first testing a sample of the material.

Material	V(in./µsec)	V(m/sec)
Acrylic resin (Perspex)	0.107	2730
Aluminum	0.249	6320
Beryllium	0.508	12900
Brass, naval	0.174	4430
Copper	0.183	4660
Diamond	0.709	18000
Glycerin	0.076	1920
Inconel®	0.229	5820
Iron, Cast (slow)	0.138	3500
Iron, Cast (fast)	0.220	5600
Iron oxide (magnetite)	0.232	5890

Material	V(in./µsec)	V(m/sec)
Lead	0.085	2160
Lucite®	0.106	2680
Molybdenum	0.246	6250
Motor oil (SAE 20/30)	0.069	1740
Nickel, pure	0.222	5630
Polyamide (slow)	0.087	2200
Nylon, fast	0.102	2600
Polyethylene, high density (HDPE)	0.097	2460
Polyethylene, low density (LDPE)	0.082	2080
Polystyrene	0.092	2340
Polyvinylchloride, (PVC, hard)	0.094	2395
Rubber (polybutadiene)	0.063	1610
Silicon	0.379	9620
Silicone	0.058	1485
Steel, 1020	0.232	5890
Steel, 4340	0.230	5850
Steel, 302 austenitic stainless	0.223	5660

Material	V(in./µsec)	V(m/sec)
Steel, 347 austenitic stainless	0.226	5740
Tin	0.131	3320
Titanium, Ti 150A	0.240	6100
Tungsten	0.204	5180
Water (20°C)	0.0580	1480
Zinc	0.164	4170
Zirconium	0.183	4650

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