



# 38DL PLUS

## Ultrasonic Thickness Gage

User's Manual

DMTA-10004-01EN — Rev. D  
November 2016

This instruction manual contains essential information on how to use this Olympus product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed. Keep this instruction manual in a safe, accessible location.

Olympus Scientific Solutions Americas, 48 Woerd Avenue, Waltham, MA 02453, USA

Copyright © 2010, 2011, 2015, 2016 by Olympus. All rights reserved. No part of this publication may be reproduced, translated, or distributed without the express written permission of Olympus.

This document was prepared with particular attention to usage to ensure the accuracy of the information contained therein, and corresponds to the version of the product manufactured prior to the date appearing on the title page. There could, however, be some differences between the manual and the product if the product was modified thereafter.

The information contained in this document is subject to change without notice.

Part number: DMTA-10004-01EN

Rev. D

November 2016

Printed in the United States of America

All brands are trademarks or registered trademarks of their respective owners and third party entities.

---

---

# Table of Contents

---

<b>List of Abbreviations .....</b>	<b>xi</b>
<b>Labels and Symbols .....</b>	<b>1</b>
<b>Important Information – Please Read Before Use .....</b>	<b>5</b>
Intended Use .....	5
Instruction Manual .....	5
Instrument Compatibility .....	6
Repair and Modification .....	7
Safety Symbols .....	7
Safety Signal Words .....	7
Note Signal Words .....	8
Safety .....	9
Warnings .....	9
Battery Precautions .....	10
Equipment Disposal .....	11
CE (European Community) .....	11
WEEE Directive .....	12
China RoHS .....	12
EMC Directive Compliance .....	13
FCC (USA) Compliance .....	13
ICES-001 (Canada) Compliance .....	14
Regulatory Information .....	14
Warranty Information .....	14
Technical Support .....	15
<b>Introduction .....</b>	<b>17</b>
<b>1. Instrument Description .....</b>	<b>19</b>

---

1.1	Product Description .....	19
1.2	Environmental Ratings .....	22
1.3	Instrument Hardware Components .....	22
1.4	Connectors .....	23
1.5	Keypad Functions .....	25
<b>2.</b>	<b>Powering the 38DL PLUS .....</b>	<b>31</b>
2.1	Power Indicator .....	31
2.2	Using the AC Power .....	32
2.3	Using Battery Power .....	33
2.3.1	Battery Operating Time .....	34
2.3.2	Charging the Battery .....	34
2.3.3	Replacing the Battery .....	36
<b>3.</b>	<b>Software User Interface Elements .....</b>	<b>39</b>
3.1	Measurement Screen .....	39
3.2	Menus and Submenus .....	41
3.3	Parameter Screens .....	42
3.4	Selecting the Text Edit Mode .....	44
3.4.1	Editing Text Parameters Using the Virtual Keyboard .....	44
3.4.2	Editing Text Parameters Using the Traditional Method .....	46
<b>4.</b>	<b>Initial Setup .....</b>	<b>49</b>
4.1	Setting the User Interface Language and Other System Options .....	49
4.2	Selecting the Measurement Units .....	50
4.3	Setting the Clock .....	50
4.4	Changing Display Settings .....	51
4.4.1	Color Schemes .....	52
4.4.2	Display Brightness .....	53
4.4.3	Waveform Rectification .....	54
4.4.4	Waveform Trace .....	55
4.5	Range of the Waveform Display .....	56
4.5.1	Selecting the Range Value .....	57
4.5.2	Adjusting the Delay Value .....	58
4.5.3	Activating the Zoom Function .....	58
4.6	Adjusting the Measurement Update Rate .....	60
4.7	Changing the Thickness Resolution .....	61
<b>5.</b>	<b>Basic Operation .....</b>	<b>63</b>
5.1	Setting Up the Transducer .....	63
5.2	Calibration .....	66

5.2.1	Calibrating the Instrument .....	67
5.2.2	Test Blocks .....	70
5.2.3	Transducer Zero Compensation .....	70
5.2.4	Material Sound Velocity and the Zero Calibrations .....	71
5.2.5	Entering a Known Material Sound Velocity .....	72
5.2.6	Locked Calibrations .....	73
5.2.7	Factors Affecting the Performance and the Accuracy .....	73
5.3	Measuring Thicknesses .....	75
5.4	Saving Data .....	76
5.5	Measurements with THRU-COAT D7906 and D7908 Transducers .....	78
5.5.1	Enabling the THRU-COAT Function .....	78
5.5.2	Performing a THRU-COAT Calibration .....	79
5.6	Echo Detection Modes with Dual Element Transducers .....	80
5.6.1	Blanking Adjustments in Manual Echo-to-Echo Detection Mode .....	83
5.6.2	Dual Element Transducer Selection in Echo-to-Echo Modes .....	84
5.6.3	Echo-to-Echo Mode Datalogger Flags .....	85
5.7	Using the VGA Output .....	86
<b>6.</b>	<b>Using EMAT Transducers .....</b>	<b>87</b>
6.1	Connecting the E110-SB EMAT Transducer .....	88
6.2	Calibrating with the E110-SB EMAT Transducer .....	89
<b>7.</b>	<b>Software Options .....</b>	<b>91</b>
7.1	Activating Software Options .....	92
7.2	High Resolution Software Option .....	93
7.3	Oxide Layer Software Option .....	93
7.3.1	Steam Boiler Tube Scale .....	94
7.3.2	Setting Up for Oxide Layer Measurement .....	95
7.3.3	Calibrating for Oxide Layer Measurement .....	96
7.3.4	Measuring Boiler Tube and Oxide Layer Thicknesses .....	97
7.4	Multi-Measurement Software Option .....	99
7.4.1	Active Measurement .....	100
7.4.2	Using the Multi-Measurement Normal Mode .....	100
7.4.3	Using the Multi-Measurement with the Soft Contact Mode .....	102
7.4.4	Using the Multi-Measurement % Total Thickness Mode .....	104
7.5	Encoded B-Scan Option .....	105
7.6	High Penetration Software Option .....	111
<b>8.</b>	<b>Using Special Functions .....</b>	<b>113</b>
8.1	Activating and Configuring a Differential Mode .....	113
8.2	Using the Minimum, Maximum, or Min/Max Thickness Mode .....	115

8.3	Preventing False Minimum/Maximum Thickness Readings .....	117
8.4	Using Alarms .....	117
8.5	Locking the Instrument .....	124
8.6	Freezing Waveforms .....	126
<b>9.</b>	<b>Configuring the Instrument .....</b>	<b>127</b>
9.1	Configuring Measurement Parameters .....	127
9.2	Configuring System Parameters .....	129
9.3	Configuring Communications .....	131
<b>10.</b>	<b>Using Advanced Gaging Features .....</b>	<b>135</b>
10.1	Adjusting the Gain with Dual Element and E110 EMAT Transducers .....	135
10.2	Adjusting the Extended Blank with Dual Element Transducers .....	137
10.3	B-Scan .....	139
10.3.1	Using the B-Scan .....	144
10.3.2	Using the B-Scan Alarm Mode .....	144
10.3.3	Saving B-Scans, A-Scans, or Thickness Readings .....	145
10.4	DB Grid .....	147
10.4.1	Activating and Configuring the DB Grid .....	147
10.4.2	Changing the Highlighted Cell in the DB Grid .....	150
10.4.3	Saving Thickness Readings in the DB Grid .....	152
10.4.4	Viewing an Inserted or an Appended Cell in the DB Grid .....	152
10.5	Configuring AVG/MIN Measurements .....	153
10.6	Making AVG/MIN Measurements .....	154
10.7	Using Temperature Compensation .....	156
<b>11.</b>	<b>Using the Datalogger .....</b>	<b>159</b>
11.1	Datalogger .....	159
11.2	Creating a Data File .....	163
11.2.1	Data File Types .....	165
11.2.1.1	Incremental Data File Type .....	165
11.2.1.2	Sequential Data File Type .....	167
11.2.1.3	Sequential with Custom Points Data File Type .....	168
11.2.1.4	2-D Grid Data File Type .....	170
11.2.1.5	2-D Grid with Custom Points Data File Type .....	174
11.2.1.6	3-D Grid Data File Type .....	176
11.2.1.7	Boiler Data File Type .....	178
11.2.1.8	3-D Custom File Type .....	180
11.2.2	File Data Modes .....	182
11.3	Performing File Operations .....	183
11.3.1	Opening a File .....	184

11.3.2	Copying a File .....	185
11.3.3	Editing a File .....	186
11.3.4	Deleting a File or its Contents .....	188
11.3.5	Deleting a Range of IDs .....	190
11.3.6	Deleting All Data Files .....	190
11.4	Notes .....	192
11.4.1	Creating or Editing Notes .....	192
11.4.2	Associating a Note to an ID or to a Range of IDs .....	193
11.4.3	Deleting a Note from a File .....	194
11.4.4	Copying a Note Table .....	195
11.5	Setting the ID Overwrite Protection .....	196
11.6	ID Review Screen .....	197
11.6.1	Reviewing Stored Data and Changing the Active ID .....	199
11.6.2	Editing the ID .....	199
11.6.3	Erasing Data in the Active File .....	201
11.7	Generating Reports .....	202
<b>12.</b>	<b>Dual Element Transducer Setups .....</b>	<b>211</b>
12.1	Standard D79X and Other Dual Element Transducers .....	211
12.2	Creating a Setup for Nonstandard Dual Element Transducers .....	212
12.3	Recalling Stored Dual Element Transducer Setups .....	215
12.4	V-Path .....	215
12.4.1	Activating the V-Path Function .....	216
12.4.2	Building a V-Path Correction Curve for a Nonstandard Dual Element Transducer .....	216
<b>13.</b>	<b>Custom Setups for Single Element Transducers .....</b>	<b>221</b>
13.1	Creating a Custom Setup for a Single Element Transducer .....	221
13.2	Quickly Adjusting Waveform Parameters For Single Element Transducers .	224
13.3	Detection Modes .....	225
13.4	First Peak .....	227
13.5	Pulser Power .....	228
13.6	Time-Dependent Gain Curve .....	229
13.6.1	Maximum Gain .....	230
13.6.2	Initial Gain .....	231
13.6.3	TDG Slope .....	231
13.7	Main Bang Blank .....	232
13.8	Echo Window .....	233
13.8.1	Detection of Echo 1 and Echo 2 .....	235
13.8.2	Interface Blank .....	236
13.8.3	Mode 3 Echo Blank .....	238

13.9	Saving Setup Parameters .....	239
13.10	Quickly Recalling a Custom Setup for Single Element Transducers .....	240
<b>14.</b>	<b>Managing Communications and Data Transfer .....</b>	<b>243</b>
14.1	GageView .....	243
14.2	Setting Up USB Communication .....	244
14.3	Setting Up RS-232 Serial Communication .....	245
14.4	Exchanging Data with a Remote Device .....	248
14.4.1	Sending Entire Files (RS-232) .....	248
14.4.2	Sending an ID Range from a File (RS-232) .....	249
14.4.3	Sending the Currently Displayed Measurement (RS-232) .....	250
14.4.4	Exporting a File to the External Memory Card .....	251
14.4.5	Importing Survey Files from the External Memory Card .....	252
14.4.6	Receiving Files from a Computer .....	254
14.5	Capturing 38DL PLUS Screen Images .....	255
14.5.1	Sending a Screen Capture to GageView .....	255
14.5.2	Sending a Screen Capture to the External microSD Card .....	257
14.6	RS-232 Serial Data Output Formats .....	258
14.7	Resetting the Communication Parameters .....	260
<b>15.</b>	<b>Maintaining and Troubleshooting the 38DL PLUS .....</b>	<b>263</b>
15.1	Providing Routine Gage Maintenance .....	263
15.2	Cleaning the Instrument .....	264
15.3	Maintaining Transducers .....	264
15.4	Using Instrument Resets .....	264
15.5	Performing Hardware Diagnostic Tests .....	267
15.6	Performing the Software Diagnostic Test .....	269
15.7	Viewing the Instrument Status .....	270
15.8	Understanding Error Messages .....	271
15.9	Resolving Battery Pack and Charger Problems .....	271
15.10	Resolving Measurement Problems .....	272
<b>Appendix A:</b>	<b>Technical Specifications .....</b>	<b>275</b>
<b>Appendix B:</b>	<b>Sound Velocities .....</b>	<b>283</b>
<b>Appendix C:</b>	<b>Accessories and Replacement Parts .....</b>	<b>285</b>
<b>List of Figures</b>	<b>.....</b>	<b>289</b>
<b>List of Tables</b>	<b>.....</b>	<b>295</b>



**Index ..... 297**



---

## List of Abbreviations

---

2-D	two-dimensional
3-D	three-dimensional
AC	alternative current
AEtoE	automatic echo-to-echo
AGC	automatic gain control
ASCII	American standard code for information interchange
AVG	average
CSV	comma separated variables
DB	database
DC	direct current
DIA	diameter
DIAG	diagnostic
DIFF	differential
EFUP	environment-friendly use period
EMAT	electromagnetic acoustic transducer
ESS	electronic stress screening
EXT	extended
FRP	fiber reinforced polymer
GB	giga bytes
GRN	green
HDPE	high density polyethylene
HI	high
HR	high resolution
ID	identification

LDPE	low density polyethylene
Li-ion	lithium-ion
LOS	loss-of-signal
MAX	maximum
MB	main bang
MEtoE	manual echo-to-echo
MIL	military
MIN	minimum
MM	multi measurement
MTI	measured time interval
MULTI	multiple
NiMH	nickel metal hydride
P/N	part number
PDF	portable document format
PDSTL	pedestal
PRF	pulse repetition frequency
PVC	polyvinylchloride
SE	single element
SEC	second
SP	special
STD	standard
SW	software
SWC	shear wave couplant
TDG	time-dependent gain
TFT	thin film transistor (liquid crystal display technology)
TOF	time-of-flight
USB	universal serial bus
VAC	voltage alternative current
YEL	yellow





Table 1 Label contents








Serial number label	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>SERIAL <span style="border: 1px solid black; padding: 2px 10px;">yyynnnnmm</span></p>  </div> <p>Where:</p> <p><b>yy</b>: last two digits of the production year</p> <p><b>nnnnn</b>: 5-digit nonduplicated incrementing number representing the n<sup>th</sup> production unit of this product</p> <p><b>mm</b>: production month</p>
Instruction label	<div style="background-color: black; color: white; padding: 10px;"> <p style="text-align: center;"><b>OLYMPUS</b> <span style="float: right;"><b>38DL PLUS</b></span></p> <p style="text-align: center;"><b>Do-Zero Calibration (Dual element transducer)</b> Perform off test block - Must be done after power up and when changing dual element xdcr. Uncouple, wipe xdcr, and press [2nd F], [CAL ZERO] (Do ZERO).</p> <p style="text-align: center;"><b>Calibration Both Velocity and Zero</b> Couple xdcr to thick sample, after steady reading press [CAL VEL] then [ENTER]. Use [◀ ▶, ▼ ▲] to enter know thickness. Couple xdcr to thin sample, press [CAL ZERO] after steady reading press [ENTER]. Use [◀ ▶, ▼ ▲] to enter known thickness and press the [MEAS] key.</p> <p style="text-align: center;"><b>Recall Stored Transducer Setup</b> Recall transducer setup press [XDCR RECALL] then use [▼, ▲] to select xdcr list type and press [ENTER]. Use [▼, ▲] to highlight transducer setup and press [ENTER] to view/edit parameters or [MEAS] to recall and return to measure mode.</p> <p style="text-align: center;"><b>Display Range</b> Press the [Range] key to toggle through the available fixed ranges.</p> <p style="text-align: center;"><b>Display Delay</b> Press [2nd F], [Range] (Delay) then use the [◀ ▶] to adjust the delay.</p> <hr/> <div style="display: flex; justify-content: space-around; align-items: center;">      </div> <p style="text-align: center;">DC: 24V ---, 2.5A</p> <p style="text-align: center;">MADE IN U.S.A. <a href="http://www.olympus-ims.com">www.olympus-ims.com</a></p> </div>

Table 1 Label contents (*continued*)

Symbol	Description
	The CE marking is a declaration that this product conforms to all the applicable directives of the European Community. See the <i>Declaration of Conformity</i> for details. Contact your Olympus representative for more information.
	The regulatory compliance mark (RCM) label indicates that the product complies with all applicable standards, and has been registered with the Australian Communications and Media Authority (ACMA) for placement on the Australian market.
	This symbol indicates the location of the membrane vent.
	The WEEE symbol indicates that the product must not be disposed of as unsorted municipal waste, but should be collected separately.
	The China RoHS mark indicates the product's Environment-Friendly Use Period (EFUP). The EFUP is defined as the number of years for which listed controlled substances will not leak or chemically deteriorate while in the product. The EFUP for the 38DL PLUS has been determined to be 15 years. <b>Note:</b> The Environment-Friendly Use Period (EFUP) is not meant to be interpreted as the period assuring functionality and product performance.
	This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
	The direct current symbol.



---

## Important Information — Please Read Before Use

---

### Intended Use

The 38DL PLUS instrument has been designed to measure thicknesses of industrial and commercial materials.



#### **WARNING**

Do not use the 38DL PLUS for any purpose other than its intended use. It must never be used to inspect or examine human or animal body parts.

---

### Instruction Manual

This instruction manual contains complete and essential information on how to use this Olympus product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed.

Keep this instruction manual in a safe, accessible location.

---

**IMPORTANT**

Some of the details of components and/or software images in this manual may differ from your instrument's components or software display. However, the principles remain the same.

---

The other 38DL PLUS documents are:

*38DL PLUS Ultrasonic Thickness Gage — Getting Started* (P/N: DMTA-10010-01EN [U8778357])

A short leaflet containing essential information on how to quickly start operating the 38DL PLUS instrument.

*38DL PLUS Ultrasonic Thickness Gage — Basic Operation Manual* (P/N: DMTA-10009-01EN [U8778346])

A printed document containing a detailed description of the instrument as well as basic setup and operation procedures.

*GageView Interface Program — User's Manual* (P/N: 910-259-EN [U8778347])

The 38DL PLUS also works with the GageView interface program. Refer to this document for detailed information on GageView. The document is available in PDF format on the GageView CD and as online help in GageView.

## Instrument Compatibility

See "Accessories and Replacement Parts" on page 285 for information on accessories that are compatible with the 38DL PLUS.

---



**CAUTION**

Always use equipment and accessories that meet Olympus specifications. Using incompatible equipment could cause equipment malfunction and/or damage, or human injury.

---

## Repair and Modification

Apart from the battery, the 38DL PLUS does not contain any user-serviceable parts. Opening the instrument might void the warranty.



### CAUTION

In order to prevent human injury and/or equipment damage, do not disassemble, modify, or attempt to repair the instrument.

---

## Safety Symbols

The following safety symbols might appear on the instrument and in the instruction manual:



General warning symbol

This symbol is used to alert the user to potential hazards. All safety messages that follow this symbol shall be obeyed to avoid possible harm or material damage.



Shock hazard caution symbol

This symbol is used to alert the user to potential electric shock hazards. All safety messages that follow this symbol shall be obeyed to avoid possible harm.

## Safety Signal Words

The following safety symbols might appear in the documentation of the instrument:



**DANGER**

The DANGER signal word indicates an imminently hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to will result in death or serious personal injury. Do not proceed beyond a DANGER signal word until the indicated conditions are fully understood and met.



**WARNING**

The WARNING signal word indicates a potentially hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to could result in death or serious personal injury. Do not proceed beyond a WARNING signal word until the indicated conditions are fully understood and met.



**CAUTION**

The CAUTION signal word indicates a potentially hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to may result in minor or moderate personal injury, material damage, particularly to the product, destruction of part or all of the product, or loss of data. Do not proceed beyond a CAUTION signal word until the indicated conditions are fully understood and met.

## Note Signal Words

The following symbols could appear in the documentation of the instrument:

**IMPORTANT**

The IMPORTANT signal word calls attention to a note that provides important information, or information essential to the completion of a task.

**NOTE**

The NOTE signal word calls attention to an operating procedure, practice, or the like, which requires special attention. A note also denotes related parenthetical information that is useful, but not imperative.

**TIP**

The TIP signal word calls attention to a type of note that helps you apply the techniques and procedures described in the manual to your specific needs, or provides hints on how to effectively use the capabilities of the product.

## Safety

Before turning on the instrument, verify that the correct safety precautions have been taken (see the following warnings). In addition, note the external markings on the instrument, which are described under “Safety Symbols.”

## Warnings

**WARNING**

### General Warnings

- Carefully read the instructions contained in this instruction manual prior to turning on the instrument.
- Keep this instruction manual in a safe place for further reference.
- Follow the installation and operation procedures.
- It is imperative to respect the safety warnings on the instrument and in this instruction manual.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment could be impaired.
- Do not install substitute parts or perform any unauthorized modification to the instrument.
- Service instructions, when applicable, are for trained service personnel. To avoid the risk of electric shock, do not perform any work on the instrument unless qualified to do so. For any problem or question regarding this instrument, contact Olympus or an authorized Olympus representative.
- Do not touch the connectors directly by hand. Otherwise, a malfunction or electric shock may result.

- Do not allow metallic or foreign objects to enter the device through connectors or any other openings. Otherwise, a malfunction or electric shock may result.



## **WARNING**

### **Electrical Warnings**

- Before operating this instrument using mains electricity, you must connect the protective earth terminal of the instrument to the protective conductor (mains) of the power cord. The mains plug shall only be inserted into a socket outlet provided with a protective earth contact. Never negate the protective action by using an extension cord (power cable) without a protective conductor (grounding).
- If there is any possibility that the ground protection could be impaired, you must make the instrument inoperative and secure it against any unintended operation.
- The instrument must only be connected to a power source corresponding to the type indicated on the rating label.



## **CAUTION**

If an unauthorized power supply cord is used to power the instrument or charge the batteries, Olympus cannot guarantee the electrical safety of the equipment.

### **Battery Precautions**



## **CAUTION**

- Before disposing of a battery, check your local laws, rules, and regulations, and follow them accordingly.
- Transportation of lithium-ion batteries is regulated by the United Nations under the United Nations Recommendations on the Transport of Dangerous Goods. It is expected that governments, intergovernmental organizations, and other international organizations shall conform to the principles laid down in these regulations, thus contributing to worldwide harmonization in this field. These international organizations include the International Civil Aviation organization

(ICAO), the International Air Transport Association (IATA), the International Maritime Organization (IMO), the US Department of Transportation (USDOT), Transport Canada (TC), and others. Please contact the transporter and confirm current regulations before transportation of lithium-ion batteries.

- Do not open, crush, or perforate batteries; doing so could cause injury.
- Do not incinerate batteries. Keep batteries away from fire and other sources of extreme heat. Exposing batteries to extreme heat (over 80 °C) could result in an explosion or personal injury.
- Do not drop, hit, or otherwise abuse a battery, as doing so could expose the cell contents, which are corrosive and explosive.
- Do not short-circuit the battery terminals. A short circuit could cause injury and severe damage to a battery making it unusable.
- Do not expose a battery to moisture or rain; doing so could cause an electric shock.
- Only use the 38DL PLUS unit or an external charger approved by Olympus to charge the batteries.
- Only use batteries supplied by Olympus.
- Do not store batteries that have less than 40 % remaining charge. Recharge batteries to between 40 % and 80 % capacity before storing them.
- During storage, keep the battery charge between 40 % and 80 %.
- Do not leave batteries in the 38DL PLUS unit during instrument storage.

## Equipment Disposal

Before disposing of the 38DL PLUS, check your local laws, rules, and regulations, and follow them accordingly.

## CE (European Community)



This device complies with the requirements of both directive 2014/30/EU concerning electromagnetic compatibility and directive 2014/35/EC concerning low voltage. The CE marking indicates compliance with the above directives.

## WEEE Directive



In accordance with European Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), 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.

## China RoHS

*China RoHS* is the term used by industry generally to describe legislation implemented by the Ministry of Information Industry (MII) in the People's Republic of China for the control of pollution by electronic information products (EIP).



The China RoHS mark indicates the product's Environment-Friendly Use Period (EFUP). The EFUP is defined as the number of years for which listed controlled substances will not leak or chemically deteriorate while in the product. The EFUP for the 38DL PLUS has been determined to be 15 years.

**Note:** The Environment-Friendly Use Period (EFUP) is not meant to be interpreted as the period assuring functionality and product performance.

“中国 RoHS”是一个工业术语，一般用于描述中华人民共和国信息工业部（MII）针对控制电子信息产品（EIP）的污染所实行的法令。



电气电子产品  
有害物质  
限制使用标识

中国 RoHS 标识是根据“电器电子产品有害物质限制使用管理办法”以及“电子电气产品有害物质限制使用标识要求”的规定，适用于在中国销售的电气电子产品上的电气电子产品有害物质限制使用标识。

注意：电气电子产品有害物质限制使用标识内的数字为在正常的使用条件下有害物质不会泄漏的年限，不是保证产品功能性的年限。



产品中有害物质的名称及含量

部件名称		有害物质					
		铅及其化合物 (Pb)	汞及其化合物 (Hg)	镉及其化合物 (Cd)	六价铬及其化合物 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
主体	机构部件	×	○	○	○	○	○
	光学部件	×	○	○	○	○	○
	电气部件	×	○	○	○	○	○
附件		×	○	○	○	○	○
<p>本表格依据 SJ/T 11364 的规定编制。</p> <p>○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T26572 规定的限量要求以下。</p> <p>×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T26572 规定的限量要求。</p>							

## EMC Directive Compliance

This equipment generates and uses radio-frequency energy and, if not installed and used properly (that is, in strict accordance with the manufacturer's instructions), may cause interference. The 38DL PLUS has been tested and found to comply with the limits for an industrial device in accordance with the specifications of the EMC directive.

## FCC (USA) Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is

operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

## ICES-001 (Canada) Compliance

This Class A digital apparatus complies with Canadian ICES-001.

Cet appareil numérique de la classe A est conforme à la norme NMB-001 du Canada.

## Regulatory Information

The 38DL PLUS may display a regulatory screen that lists the specific regulation with which it complies.

### To view the REGULATORY screen

1. In the measurement screen, press **[2nd F]**, **[SETUP MENU]** (**SP MENU**).
2. In the **SP MENU**, select **REGULATORY** to display the **REGULATORY** screen.
3. Use the up and down arrow keys to scroll through the different **REGULATORY** screens.
4. Press **[MEAS]** to return to the measurement screen.

## Warranty Information

Olympus guarantees your Olympus product to be free from defects in materials and workmanship for a specific period, and in accordance with conditions specified in the *Olympus Scientific Solutions Americas Inc. Terms and Conditions* available at <http://www.olympus-ims.com/en/terms/>.

The Olympus warranty only covers equipment that has been used in a proper manner, as described in this instruction manual, and that has not been subjected to excessive abuse, attempted unauthorized repair, or modification.

Inspect materials thoroughly on receipt for evidence of external or internal damage that might have occurred during shipment. Immediately notify the carrier making the delivery of any damage, because the carrier is normally liable for damage during shipment. Retain packing materials, waybills, and other shipping documentation needed in order to file a damage claim. After notifying the carrier, contact Olympus for assistance with the damage claim and equipment replacement, if necessary.

This instruction manual explains the proper operation of your Olympus product. The information contained herein is intended solely as a teaching aid, and shall not be used in any particular application without independent testing and/or verification by the operator or the supervisor. Such independent verification of procedures becomes increasingly important as the criticality of the application increases. For this reason, Olympus makes no warranty, expressed or implied, that the techniques, examples, or procedures described herein are consistent with industry standards, nor that they meet the requirements of any particular application.

Olympus reserves the right to modify any product without incurring the responsibility for modifying previously manufactured products.

## **Technical Support**

Olympus is firmly committed to providing the highest level of customer service and product support. If you experience any difficulties when using our product, or if it fails to operate as described in the documentation, first consult the user's manual, and then, if you are still in need of assistance, contact our After-Sales Service. To locate the nearest service center, visit the Service Centers page at: <http://www.olympus-ims.com>.



---

# Introduction

---

This manual provides basic and advanced operating instructions for the 38DL PLUS ultrasonic thickness gage. The information in this manual is organized to explain the technology, safety details, hardware, and software. Practical measurement examples help the user become familiar with the instrument's capabilities.

---

<b>IMPORTANT</b>
------------------

The list of other 38DL PLUS documents is provided in "Instruction Manual" on page 5.

---



**Figure i-3 The 38DL PLUS instrument**



# 1. Instrument Description

---

This chapter describes the main features and the hardware components of the 38DL PLUS instrument.

## 1.1 Product Description

The 38DL PLUS by Olympus is a hand-held ultrasonic thickness gage designed for a wide variety of thickness measurement applications. With the 38DL PLUS, you only need access to one side of a part to measure, in a nondestructive manner, the thickness of corroded, pitted, scaled, granular, and other difficult materials (see Figure 1-1 on page 19).



**Figure 1-1 Measuring thicknesses with the 38DL PLUS**

The 38DL PLUS simultaneously displays a thickness readout and an A-scan view for waveform verification. The microprocessor of the 38DL PLUS continuously adjusts the receiver setup so that every measurement is optimized for reliability, range, sensitivity, and accuracy. An advanced internal datalogger can store up to 475000 thickness measurements and 20000 waveforms.

The 38DL PLUS operates with a full line of single element and dual element transducers to measure material thicknesses between 0.08 mm and 635 mm (0.003 in. and 25 in.). The temperature range of measured materials can be between  $-20\text{ }^{\circ}\text{C}$  and  $500\text{ }^{\circ}\text{C}$  ( $-4\text{ }^{\circ}\text{F}$  and  $932\text{ }^{\circ}\text{F}$ ) depending on the material characteristics, the transducer, and the measurement mode. You can also use single element or dual element transducers for echo-to-echo measurements.

You can connect the 38DL PLUS to a printer and to a computer using the bidirectional serial USB/RS-232 communication ports.

### **Advanced Measurement Features**

- THRU-COAT measurement
- Temperature-compensated measurement
- Min/Average mode
- EMAT transducer capability
- Measurement-related status flags and alarms
- Full VGA color transfective LED back-lite display
- Automatic probe recognition for the standard D79X and MTD705 series transducers
- Dynamic default gain optimization
- V-path calibration to build custom V-path correction tables for any dual element transducer
- Warning against calibration doubling
- Calibration for unknown material sound velocity and/or transducer zero
- Echo-to-echo measurements
- Fast scan mode with 30 readings per second
- Manual gain adjustment in 1-dB steps
- Hold or blank thickness display during loss-of-signal (LOS) conditions
- Hold minimum, maximum, or both minimum and maximum functions
- Differential thickness display relative to the set point in absolute or percentage ratio



- Selection of password-protected lockout functions
- Selectable resolution: low of 0.1 mm (0.01 in.), standard of 0.01 mm (0.001 in.), or high (optional) of 0.001 mm (0.0001 in.) [option not available for all transducers]

### **A-Scan and B-Scan Display Options**

- Real-time A-scan waveform display for verification of critical measurements
- Manual freeze mode with post processing
- Manual zoom and range control of waveform display
- Auto hold on LOS and auto zoom (measured echo centering)
- Extended blank
- Blank after first received echo in echo-to-echo mode
- Receiver gain readout
- Ability to capture and display waveform associated with minimum thickness during scanned measurements
- Display stored and downloaded waveforms

### **Internal Datalogger Functions**

- Internal data storage and possibility to export data to a removable microSD memory card
- Capacity to store 475000 fully-documented thickness readings or 20000 waveforms with thickness readings
- Database enhancements include 32-character file naming and 20-character ID naming
- Automatic ID number increments following a preset sequence, or manual ID numbering using the keypad
- Save reading/waveform to an ID number
- Simultaneously show ID number, stored comments, and stored reference thickness while displaying active thickness and waveform
- Nine file formats available
- Erase selected data or all stored data
- Save or send an held or frozen reading to the thickness display
- Transmit selected data or all stored data
- Keypad-programmable communication parameters
- Standard USB and RS-232 directional communication

## 1.2 Environmental Ratings

The 38DL PLUS is a rugged and durable instrument that you may use in harsh environments. The 38DL PLUS was designed to meet the requirement of the IP67 standard (Ingress Protection).



### CAUTION

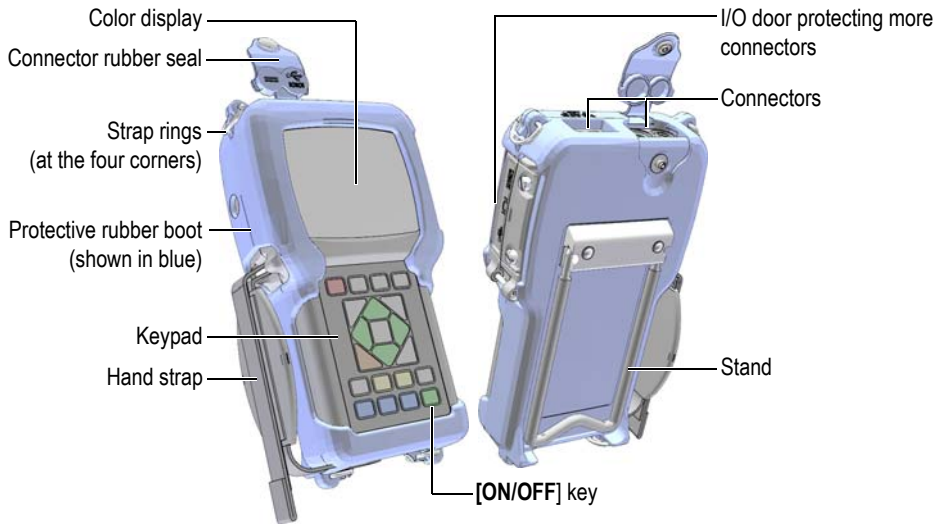
Olympus cannot guarantee any level of ingress protection performance once the instrument seals have been manipulated. You must use sound judgment and take proper precautions before exposing the instrument to harsh environments.

To maintain the original level of ingress protection, you are responsible for the proper care of all routinely exposed membrane seals. Additionally, you are responsible for returning the instrument to an authorized Olympus service center each year to ensure that the instrument seals are properly maintained.

---

## 1.3 Instrument Hardware Components

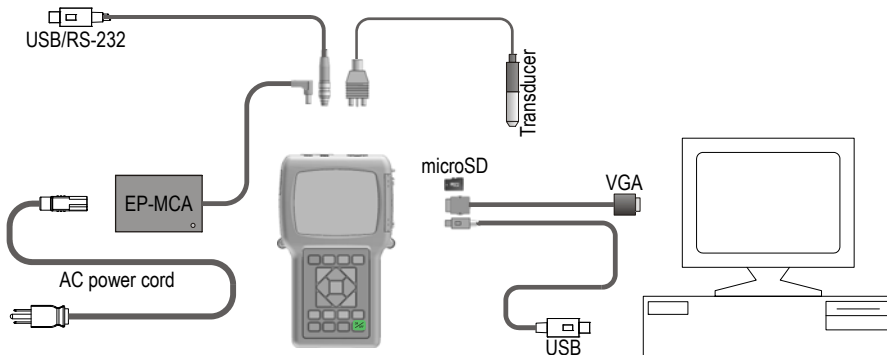
The 38DL PLUS front panel features a color display and a keypad. The instrument comes with a hand strap. A protective rubber boot includes a dust flap seal for the DC power and serial communication connectors, strap rings at the four corners, and a stand at the back (see Figure 1-2 on page 23).



**Figure 1-2 The 38DL PLUS hardware components**

## 1.4 Connectors

Figure 1-3 on page 23 illustrates the possible connections of the 38DL PLUS with external devices.



**Figure 1-3 The 38DL PLUS connections**

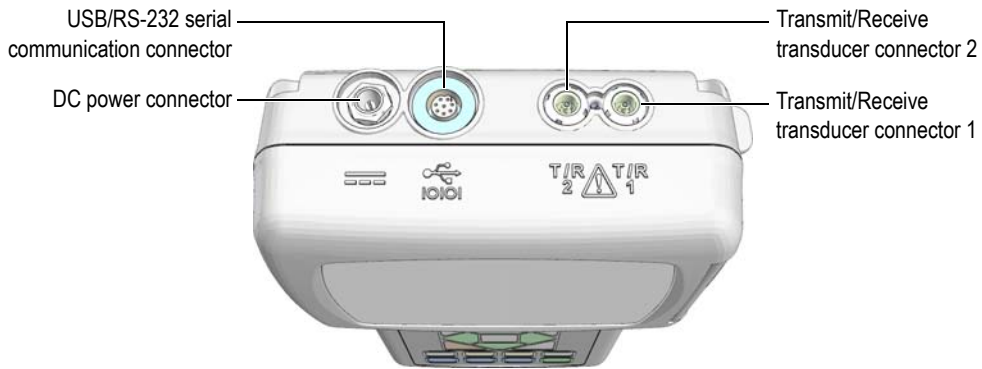


**CAUTION**

To avoid the risk of injuries or equipment damage, use only the AC power cord supplied with the 38DL PLUS. Do not use this AC power cord with other products.

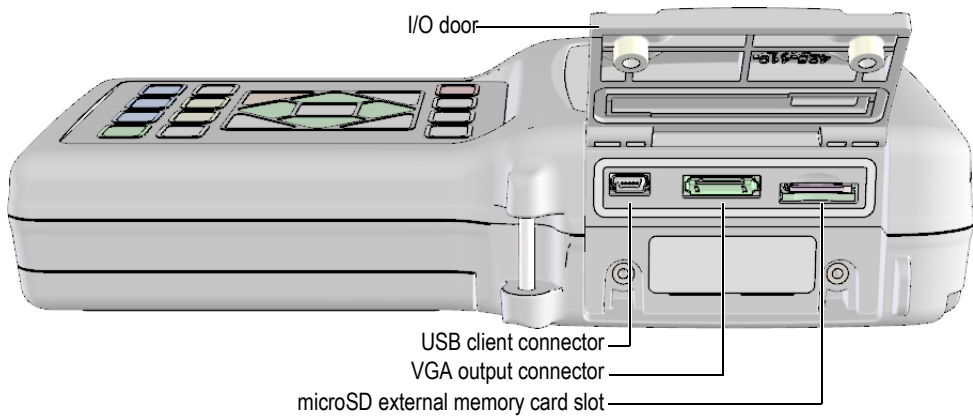
---

The DC power, USB/RS-232 communication, and Transmit/Receive probe connectors are located on the top end of the 38DL PLUS (see Figure 1-4 on page 24).



**Figure 1-4 The top end connectors**

The USB client connector, the VGA output connector, and the external microSD memory card slot are located on the right side of the instrument, hidden behind the I/O door (see Figure 1-5 on page 25).



**Figure 1-5 The connectors behind the I/O door**

## 1.5 Keypad Functions

The 38DL PLUS comes either with the English, international, Chinese, or Japanese keypad (see Figure 1-6 on page 26). The functions are the same for all keypads. On the international keypad, the text labels on many keys are replaced by pictograms. In this document, keypad keys are referred to using the English label in bold and within brackets (ex.: **[MEAS]**).

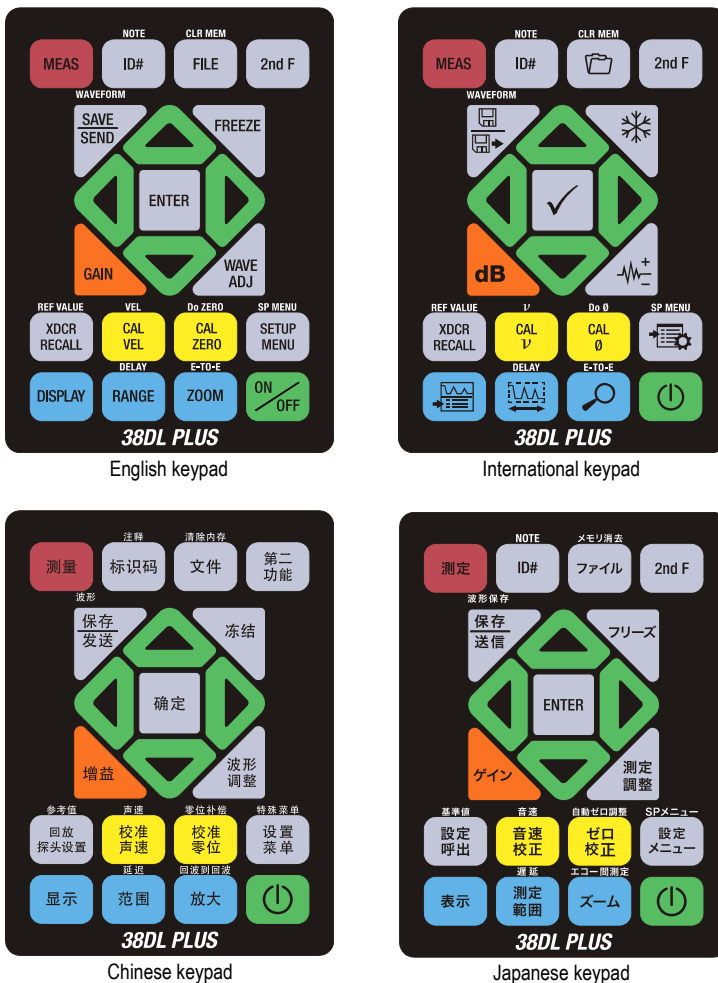


Figure 1-6 The 38DL PLUS keypads

Each key indicates its primary function. The area just above some of the keys indicates a secondary key function that you can activate by first pressing [2nd F]. Throughout this document, references to a secondary function are written as follows: [2nd F], [Primary] (Secondary). For example, the instruction to activate the clear memory function is written as follows: “Press [2nd F], [FILE] (CLR MEM)”.

The [**▲**], [**▼**], [**◀**], and [**▶**] keys, together with the [**ENTER**] key, are used to select menu items or screen parameters and to change parameter values. Use the [**MEAS**] key at any time to return to the measurement screen. The yellow keys are related to calibration. The blue keys are related to the display configuration.

Table 2 on page 27 lists the key functions available from the 38DL PLUS keypad.

**Table 2 Keypad functions**












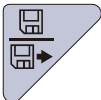


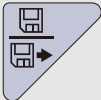
English	International	Functions
		Measurement — Completes the current operation and returns to the measurement screen.
		Identification number — Accesses several functions related to the ID numbers for the thickness measurement location.
 		Note — Allows you to create or select comments to store at an ID number location.
		File — Opens the file menu to access file commands (open, review, create, copy, edit, delete, send, import, export, note-copy, memory, and report).
 		Clear memory — Acts as an alternative method to erase an entire file. Also erases a range of data in a file or a single ID number location.
		Secondary function — Needs to be pressed prior to a key to activate the secondary function of the key.
		Save or send — Stores a measurement and optionally the corresponding waveform in the datalogger at the current ID number.
 		Save waveform — Stores a measurement and the corresponding waveform in the datalogger at the current ID number.

Table 2 Keypad functions (continued)













































English	International	Functions
		Freeze — Causes the displayed waveform to immediately hold until the key is pressed again.
		Gain — Initiates the adjustment of the gain value when using dual element transducers.
		Wave adjustment — Toggles the display of a selectable waveform parameter with an editable value.
		Enter — Selects an highlighted item or accepts an entered value.
		Up arrow <ul style="list-style-type: none"> <li>In a screen or a list, moves to the previous element.</li> <li>For some parameters (ex.: <b>Gain</b>), increases the value.</li> </ul>
		Down arrow <ul style="list-style-type: none"> <li>In a screen or a list, moves to the next element.</li> <li>For some parameters (ex.: <b>Gain</b>), decreases the value.</li> </ul>
		Left arrow <ul style="list-style-type: none"> <li>Selects the previous available value for the selected parameter.</li> <li>In text edit mode, moves the cursor one character position to the left.</li> </ul>
		Right arrow <ul style="list-style-type: none"> <li>Selects the next available value for the selected parameter.</li> <li>In text edit mode, moves the cursor one character position to the right.</li> </ul>



Table 2 Keypad functions (*continued*)

English	International	Functions
		Transducer recall — Recalls default or custom transducer (XDCR) setups.
 		Reference value — For some functions (ex.: differential mode or temperature compensation) opens a screen allowing you to enter a reference value.
		Velocity calibration <ul style="list-style-type: none"> <li>Switches to the semi-automatic step block calibration mode.</li> <li>When using THRU-COAT mode, press <b>[CAL VEL]</b> twice to view and set the coating velocity.</li> <li>With the traditional text edit mode only, deletes the character at the cursor position.</li> </ul>
 		Velocity <ul style="list-style-type: none"> <li>Opens a screen allowing you to view and manually change the sound velocity.</li> <li>In THRU-COAT mode or with the internal oxide option, pressing the keys a second time allows you to view/adjust the velocity for the coating or the oxide layer.</li> </ul>
		Zero calibration <ul style="list-style-type: none"> <li>Compensates for transducer zero or enables the step block zero calibration.</li> <li>With the traditional text edit mode only, inserts a character at the cursor position.</li> </ul>
 		Do zero — Compensates for transducer delay for dual element transducers and for the M2008 transducer.
		Setup menu — Provides access to instrument parameters (measurement, system, alarm, differential mode, communication, B-scan, DB grid, avg/min, temperature correction, multilayer [optional], oxide [optional], password set, instrument lock).

**Table 2 Keypad functions (continued)**

English	International	Functions
 		Special menu — Provides access to special gage parameters (clock, language, options, resets, tests, software diagnostics, instrument status).
		Display — Provides access to display parameters (color scheme, brightness, waveform rectification, waveform trace, and VGA output).
		Range — Changes the waveform display range to the next available value.
 		Delay — Allows editing the value for the beginning of the waveform display.
		Zoom — Dynamically changes the waveform display range so that the region immediately surrounding the measured echo is shown at maximum magnification.
 		Echo-to-Echo — With dual element transducers, opens a menu to select the measurement mode (standard, auto echo-to-echo, or manual echo-to-echo).
		On/Off — Turns the instrument power on or off.

## 2. Powering the 38DL PLUS

This chapter describes how to operate the 38DL PLUS using different power supply options.

### 2.1 Power Indicator

The power indicator is always present on the right side of the screen. It shows the level of the battery charge and on which type of power the instrument operates (see Figure 2-1 on page 31).

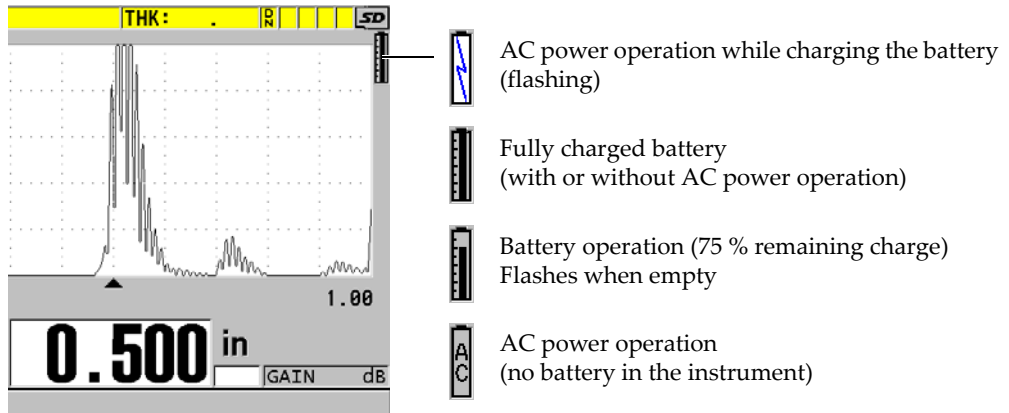


Figure 2-1 The power indicator for battery and AC operation

When the instrument operates on the battery, the vertical black bar in the power indicator indicates the remaining battery charge. Each graduation mark represents 12.5 % of the charge.

## 2.2 Using the AC Power

You can operate the 38DL PLUS with the AC power using the charger/adaptor (P/N: EP-MCA [U8767042]). The EP-MCA has a universal AC power input that operates with any line voltage from 100 VAC to 120 VAC or 200 VAC to 240 VAC and with 50 Hz to 60 Hz line frequency.

### To use AC power

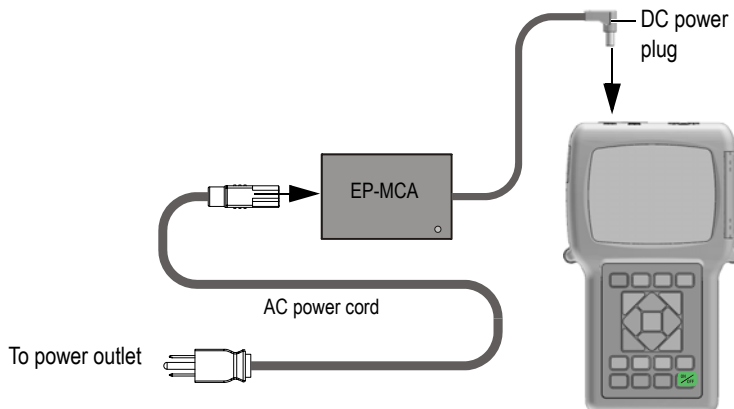
1. Connect the AC power cord to the charger/adaptor (P/N: EP-MCA [U8767042]), and to an appropriate power outlet (see Figure 2-2 on page 32).



### CAUTION

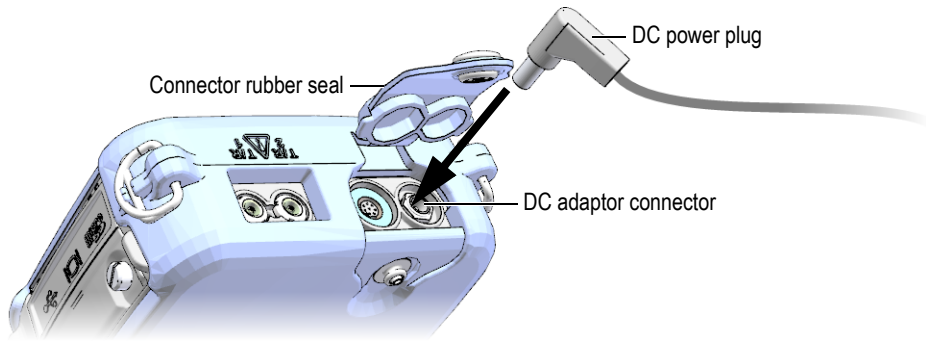
To avoid the risk of injuries or equipment damage, use only the AC power cord supplied with the 38DL PLUS. Do not use this AC power cord with other products.

---



**Figure 2-2 Connecting the charger/adaptor**

2. On the 38DL PLUS, lift the rubber seal covering the DC adaptor connector on top of the 38DL PLUS (see Figure 2-3 on page 33).



**Figure 2-3 Connecting the DC power plug**

3. Connect the DC power plug from the charger/adaptor to the DC adaptor connector (see Figure 2-3 on page 33).
4. Press [ON/OFF] to turn on the 38DL PLUS.

## 2.3 Using Battery Power

The 38DL PLUS comes with a rechargeable lithium-ion (Li-ion) battery (P/N: 38-BAT [U8760054]). The 38DL PLUS automatically recharges the 38-BAT battery when you connect the instrument to the AC power.

You can also operate the 38DL PLUS using four AA-size Alkaline or nickel metal hydride (NiMH) rechargeable batteries using the AA battery holder (P/N: 38DLP/AA [U8780290]). The 38DL PLUS does not recharge NiMH batteries. You must recharge AA batteries with an external battery charger (not included).

---

### NOTE

The 38DL PLUS battery is not fully charged when shipped. You must fully charge the battery before operating the instrument from the battery power.

---

## 2.3.1 Battery Operating Time

The battery operating time depends on the type of battery being used, the age of the battery, and the instrument settings. To provide realistic battery operating times, the 38DL PLUS has been tested with mid-level operating parameters (update rate set to 4 Hz and display brightness set to 50 %).

The nominal battery operating times for new batteries are:

- Rechargeable Li-ion: 12 to 14 hours
- AA NiMH: 4 to 5 hours (externally recharged)
- AA Alkaline: 2 to 3 hours (nonrechargeable)

## 2.3.2 Charging the Battery



### WARNING

The 38DL PLUS charger/adaptor (P/N: EP-MCA [U8767042]) is designed to charge 38DL PLUS batteries only (P/N: 38-BAT [U8760054]). Do not attempt to charge any other battery types (such as alkaline or NiMH) or use any other chargers/adaptors to charge the 38DL PLUS batteries (P/N: 38-BAT [U8760054]). Doing so may cause an explosion and injury.

---

---



### WARNING

Do not attempt to power or charge other electronic equipment with the 38DL PLUS charger/adaptor (P/N: EP-MCA [U8767042]) as this may cause death or serious personal injury as the result of the explosion while charging a battery.

---

### To charge the internal battery

- ◆ Connect the 38DL PLUS using the AC power (see “Using the AC Power” on page 32).  
The battery charges when the instrument is ON or OFF, but the rate of charge is slower when the instrument is ON.

---

**NOTE**

When the battery is fully charged, the battery charging symbol (lighting bolt) is replaced with a “full battery” symbol (battery with all bars full). This is the indication that the battery is fully charged (see “Power Indicator” on page 31). It takes approximately 2 to 3 hours to fully charge a battery depending on its initial conditions.

---

---

**NOTE**

It may take several cycles of complete charging and discharging of the battery to bring the battery to full capacity. This conditioning process is normal for this type of rechargeable batteries.

---

**Battery Usage Instructions**

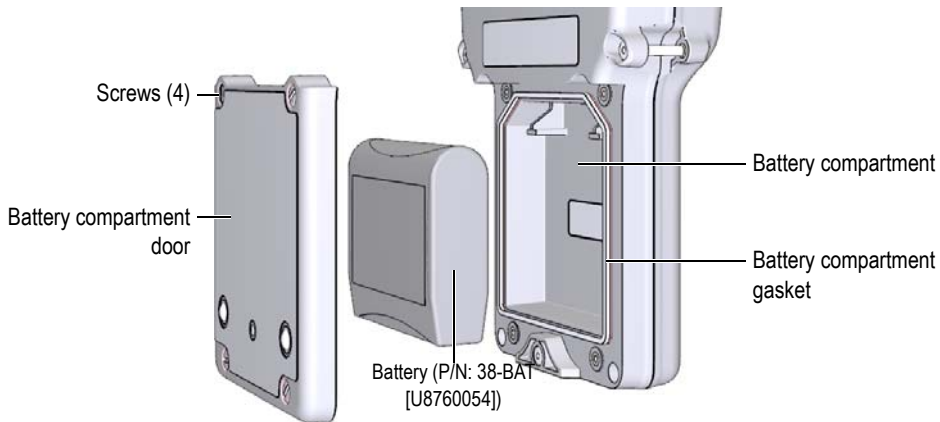
- If the battery is used daily (or frequently), connect the instrument to the charger/adaptor when not in use.
- Whenever possible, the instrument should remain connected to the EP-MCA charger/adaptor (overnight or over a weekend), so that the battery reaches a full charge.
- The battery must reach full charge on a regular basis for proper capacity and cycle-life maintenance.
- Fully recharge discharged batteries as soon as possible after use.

**Battery Storage Instructions**

- Never store discharged batteries without a full recharge.
- Store batteries in a cool, dry environment.
- Avoid long-term storage under sunlight or in other excessively hot places such as the trunk of an automobile.
- While in storage, fully recharge batteries at least once every two (2) months.

### 2.3.3 Replacing the Battery

The battery is located in a compartment that is accessible from the back of the 38DL PLUS (see Figure 2-4 on page 36).



**Figure 2-4 Opening the battery compartment**



#### **CAUTION**

Do not attempt to replace the battery while the instrument is ON and/or connected to charger/adaptor. Dispose of used battery promptly. Keep away from children. The battery used in this device may present a risk of fire or chemical burn if mishandled. Do not disassemble, heat above 50 °C, or incinerate the battery. Replace the battery only with an Olympus battery (P/N: 38-BAT [U8760054]).

---

#### **To replace the battery**

1. Disconnect the instrument from the charger/adaptor.
2. Ensure that the 38DL PLUS power is off.
3. Disconnect any other cable connected to the 38DL PLUS.
4. Remove the hand strap.
5. Remove the protective rubber boot.



6. At the back of the instrument, unscrew the four screws of the battery compartment cover (see Figure 2-4 on page 36).
7. Remove the battery compartment cover.
8. Remove the battery and carefully disconnect the battery connector.
9. Connect the new battery in the battery compartment.
10. Ensure that the gasket of the battery compartment cover is clean and in good condition.
11. Reinstall the battery compartment cover at the back of the instrument, and then tighten the four screws.
12. Reinstall the protective rubber boot and the hand strap.
13. Press **[ON/OFF]** to turn on the 38DL PLUS.
14. To answer the question appearing at the bottom of the screen (see Figure 2-5 on page 37):
  - ◆ Select **Li-ion** when using a 38-BAT battery.

OR

Select **NiMH** or **Alkaline** when using four NiMH AA batteries or four Alkaline AA batteries with the AA battery holder.



**Figure 2-5 Selecting the new battery type**

#### NOTE

When replacing the rechargeable 38-BAT battery, fully charge the battery to ensure the accuracy of the estimated remaining battery charge shown by the power indicator (see "Power Indicator" on page 31).



### 3. Software User Interface Elements

The following sections describe the main elements of the 38DL PLUS software screens and menus.

#### 3.1 Measurement Screen

The 38DL PLUS starts with the measurement screen where you can see the ultrasonic echo on the waveform display and read the measured thickness value (see Figure 3-1 on page 39). The measurement screen is the main screen of the 38DL PLUS software. From anywhere in the 38DL PLUS software, simply press [MEAS] to return to the measurement screen. The power indicator is always present on the right side of the 38DL PLUS screen (see “Using Battery Power” on page 33 for details).

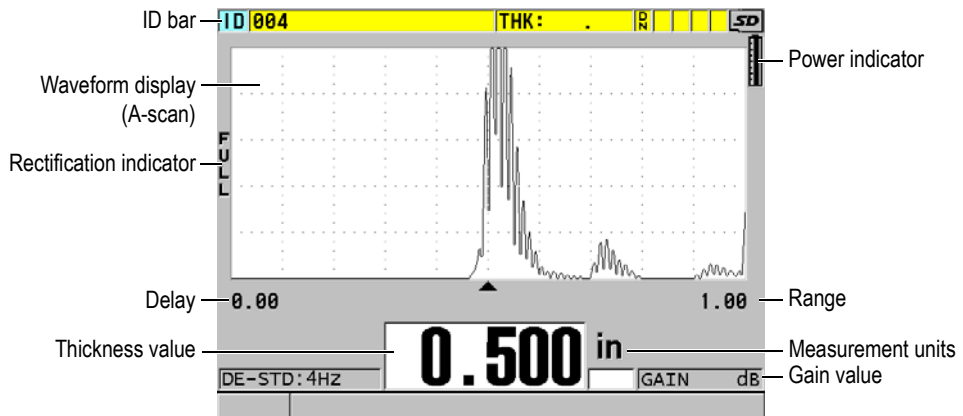
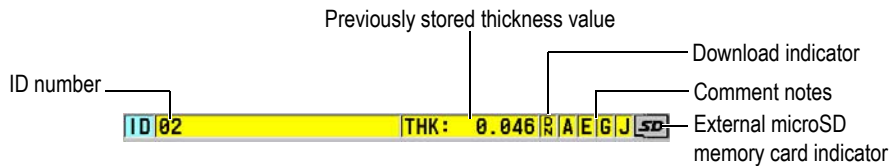


Figure 3-1 The main elements of the measurement screen

The waveform trace, called the A-scan, allows a skilled operator to verify that the signal used to make a thickness measurement is the correct back-wall echo and not noise, material anomaly, or the second multiple echo. The A-scan can also allow you to observe indications that may be too small to be measured by the instrument.

The ID bar, located at the top of the measurement screen, contains the ID for the actual thickness measurement location, the previously stored value, and comment notes indicators (see Figure 3-2 on page 40). The download indicator (R) appears when the previously stored thickness measurement comes from a file rather than from a newly acquired value.



**Figure 3-2 The ID bar**

The external microSD memory card indicator appears in the top-right corner of the screen when a microSD memory card is inserted in its slot under the I/O door on the right side of the instrument (see Figure 1-5 on page 25). The 38DL PLUS recognizes an external microSD memory card when you start the instrument.

Depending on the context and on the available functions and options, various indicators and numeric values appear around the waveform display and around the main measurement value (see Figure 3-3 on page 41). A help text bar, at the bottom of the screen, indicates the keys that you can use to navigate and make a selection in the menu structure.

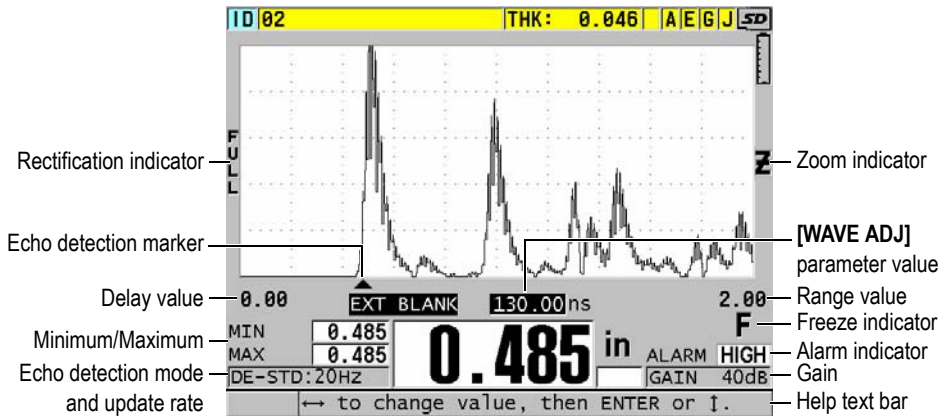


Figure 3-3 Example of other elements appearing on the measurement screen

The loss-of-signal (LOS) appears and the thickness value is cleared when the 38DL PLUS no longer detects ultrasonic echoes (see Figure 3-4 on page 41).

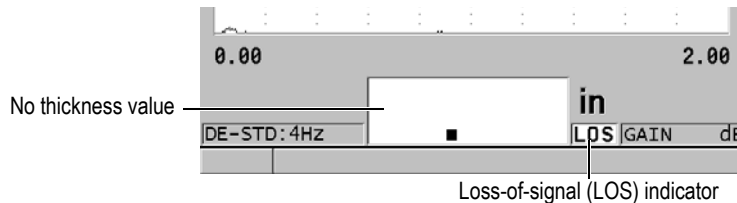


Figure 3-4 The loss-of-signal (LOS) indicator

## 3.2 Menus and Submenus

The 38DL PLUS displays menus and submenus when you press some of the front panel keys. The menu appears at the top-left corner of the screen (see Figure 3-5 on page 42). If applicable, a submenu also appears, conveniently showing the parameters available for the highlighted menu command.

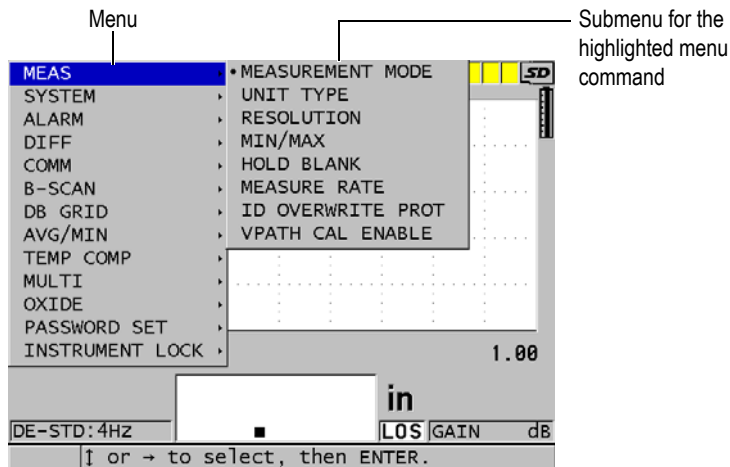


Figure 3-5 Menu and submenu example

### To select a menu or a submenu command

1. Press one of the front panel keys to display a menu.
2. Use the [▲] and [▼] keys to highlight the desired menu command.
3. If applicable and needed, use the [▶] key to move the highlight to the submenu, and then use the [▲] and [▼] keys to highlight the desired submenu command.
4. Press [ENTER] to select the highlighted menu, or submenu command.

#### NOTE

In the remainder of this document, the above procedure is summarized by simply stating to select a specific menu or submenu command. For example: "In the menu, select MEAS."

## 3.3 Parameter Screens

The 38DL PLUS parameters are logically grouped in parameter screens that you access using front panel keys or menu commands. Figure 3-6 on page 43 shows the MEAS parameter screen as an example.

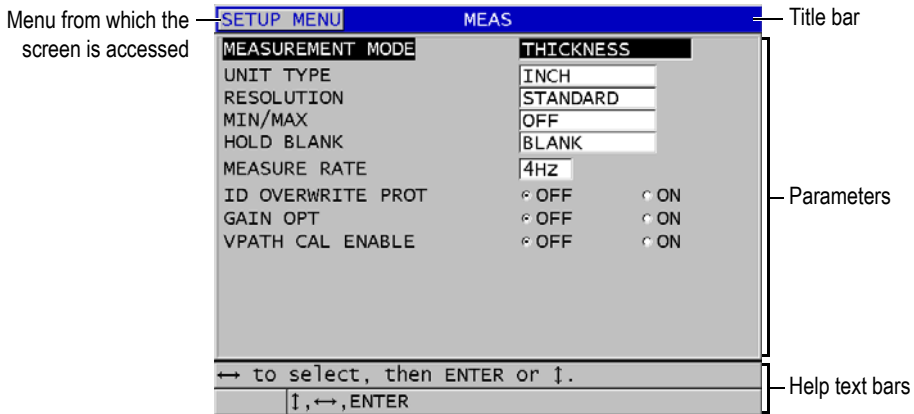


Figure 3-6 Parameter screen example

The title bar, located at the top of the parameter screen, indicates the parameter subject. When you access a parameter screen from a menu, a menu button appears on the left side of the title bar. You can select this menu button to easily return to the original menu. One or two help text bars, appearing at the bottom of the screen, indicate the keys to use to select a parameter and edit its value.

### To select a parameter and edit its value

1. Use the [▲] and [▼] keys to highlight the desired parameter.
2. For parameters with predefined values, use the [▶] and [◀] keys to select the desired value.
3. In parameter screens containing lists or alphanumeric parameters:
  - In a list, use the [▲] and [▼] keys to highlight the desired list item.
  - For an alphanumeric parameter, use the [▲] and [▼] keys to enter the desired characters (see “Selecting the Text Edit Mode” on page 44 for details).
  - Press [2nd F], [▼] or [2nd F], [▲] to leave a list or an alphanumeric parameter, and respectively go to the next or previous screen element.
4. To exit the parameter screen:
  - ◆ Press [MEAS] to return to the measurement screen.
  - OR
  - When a menu button appears in the left corner of the title bar, use the [▲] key to highlight the menu button, and then press [ENTER] to reopen the menu.

**NOTE**

In the remainder of this document, the above procedure is summarized by simply stating to select a specific parameter or list, and its value. For example: "In the **MEAS** screen, set **MEASUREMENT MODE** to **THICKNESS**."

---

### 3.4 Selecting the Text Edit Mode

The 38DL PLUS offers two methods to edit the value of alphanumeric parameters. You can either use the virtual keyboard or the traditional method. The virtual keyboard appears on the screen to show all the available characters that you can use (see "Editing Text Parameters Using the Virtual Keyboard" on page 44 for details). With the traditional method, you select each character from a hidden list of standard sorted letters, numbers, and special characters (see "Editing Text Parameters Using the Traditional Method" on page 46 for details).

#### To select the text edit mode

1. From the measurement screen, press [SETUP MENU].
2. In the menu, select **SYSTEM**.
3. In the **SYSTEM** parameter screen, highlight **TEXT EDIT MODE**, and then select the desired mode (**VIRTUAL** or **TRADITIONAL**).
4. Press [MEAS] to return to the measurement screen.

#### 3.4.1 Editing Text Parameters Using the Virtual Keyboard

When the text edit mode is set to **VIRTUAL**, the virtual keyboard appears when you select an alphanumeric parameter (see Figure 3-7 on page 45).



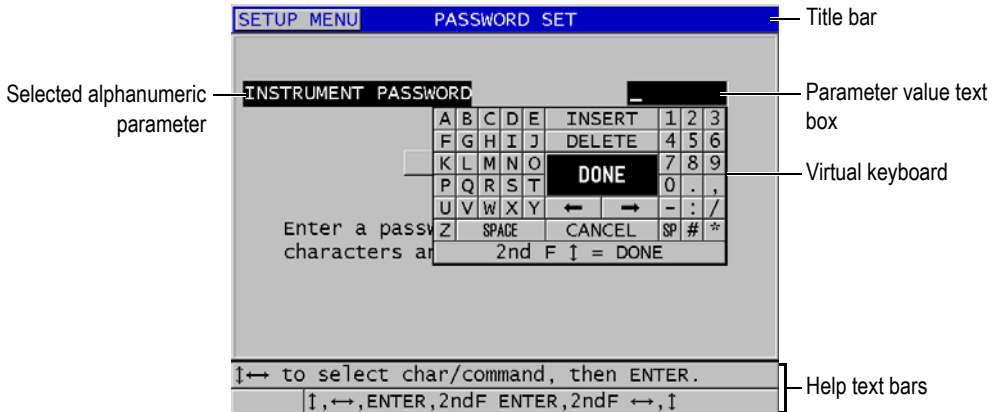


Figure 3-7 Example of the virtual keyboard

### To edit an alphanumeric parameter value using the virtual keyboard

1. Select an alphanumeric parameter.  
The virtual keyboard appears.
2. Use the [▲], [▼], [▶], and [◀] keys to highlight the character that you wish to enter, and then press [ENTER].  
The selected character appears in the parameter value text box and the cursor moves to the next character position.
3. Repeat the previous step to enter other characters.
4. If you need to move the position of the cursor in the value text box, on the virtual keyboard, highlight either the left or right arrow button (below **DONE**), and then press [ENTER].  
The cursor moves by one character position.
5. When you need to delete a character:
  - a) Move the cursor to the character you wish to delete.
  - b) On the virtual keyboard, highlight **DELETE**, and then press [ENTER].
6. When you need to insert a character:
  - a) Move the cursor to the character in front of which you wish to insert a character.
  - b) On the virtual keyboard, highlight **INSERT**, and then press [ENTER].
  - c) Enter the desired character in the inserted space.

7. If you want to cancel the editing operation and return to the original parameter value, on the virtual keyboard, highlight **CANCEL**, and then press **[ENTER]**.
8. To complete the editing of the parameter value, on the virtual keyboard, highlight **DONE**, and then press **[ENTER]**.

---

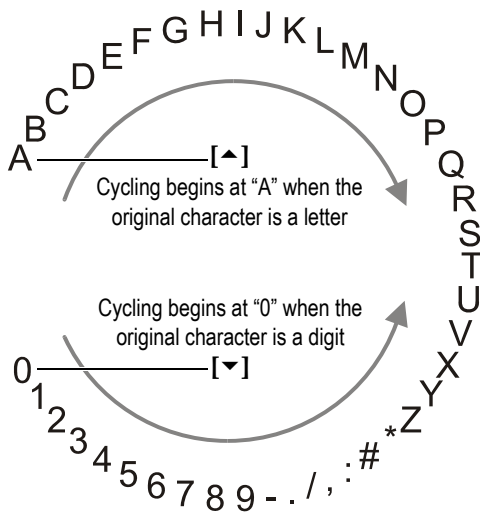
**NOTE**

When editing a multiple line parameter value, highlighting **DONE** and pressing **[ENTER]** moves the cursor to the next line. You can also press **[2nd F]**, **[▼]** to accept the text and move the cursor to the next line.

---

### 3.4.2 Editing Text Parameters Using the Traditional Method

When the text edit mode is set to **TRADITIONAL**, you select each character from a hidden circular list of standard sorted letters, numbers, and special characters (see Figure 3-8 on page 46). Only upper case letters are available.



**Figure 3-8 The character cycle of the traditional text edit method**

## To edit an alphanumeric parameter value using the traditional method

1. Select an alphanumeric parameter.
2. Use the [▲] and [▼] keys to select the character that you wish to enter. Hold down the key to quickly cycle through the letters, numbers, and special characters.
3. Use the [▶] keys to move to the next character.
4. Repeat the steps 2 and 3 to enter other characters.
5. If you need to move the position of the cursor in the value text box, use the [▶] or [◀] key.
6. To insert a character at the cursor position, press [CAL ZERO].  
The character at the cursor and all those to the right moves one position to the right, making a space for a new character.
7. To delete the character at the cursor position, press [CAL VEL].  
The character at the cursor is deleted and any characters to the right move to the left by one position.
8. Press [ENTER] to accept the character string and move to the next parameter.



---

## 4. Initial Setup

---

The following sections describe basic system configurations.

### 4.1 Setting the User Interface Language and Other System Options

You can configure the 38DL PLUS to present the user interface in the following languages: English, German, French, Spanish, Japanese, Chinese, Russian, Swedish, Italian, Norwegian, Portuguese, Czech, and a customized interface. You can also set the character delimiting the radix of a number.

The 38DL PLUS includes a beep tone generator to confirm when a key is pressed and to notify you of an alarm condition. You can set the beeper on or off.

To save battery while you do not use the instrument, you can enable the inactive time function so that the instrument automatically turns off when no key has been pressed and no measurement has been made within about six minutes.

#### To change the user interface language and other system options

1. Press [SETUP MENU].
2. In the menu, select **SYSTEM**.
3. In the **SYSTEM** screen (see Figure 4-1 on page 50):
  - a) Set **BEEPER** to **ON** or **OFF**.
  - b) Set **INACTIVE TIME** to **ON** or **OFF**.
  - c) Set **LANGUAGE** to the desired language.
  - d) Set **RADIX TYPE** to the desired character (period or comma) to separate the integer and the decimal digits.

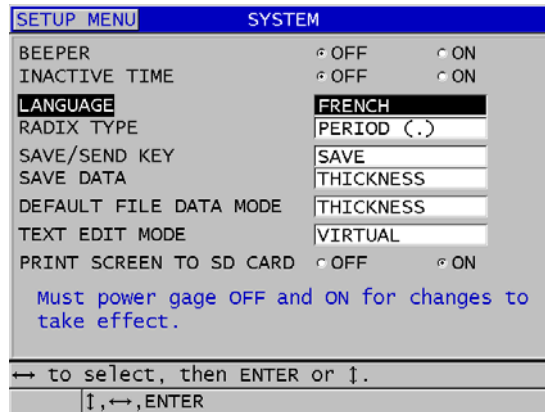


Figure 4-1 Selecting the user interface language

4. Press **[MEAS]** to return to the measurement screen.
5. Turn off the 38DL PLUS, and then turn it back on to activate the language change.

## 4.2 Selecting the Measurement Units

You can set the 38DL PLUS to show thickness measurements in inches or millimeters.

### To set the measurement units

1. Press **[SETUP MENU]**.
2. In the menu, select **MEAS**.
3. In the **MEAS** screen, set **UNIT TYPE** to **INCH** or **MILLIMETER**.
4. Press **[MEAS]** to return to the measurement screen.

## 4.3 Setting the Clock

The 38DL PLUS has a built-in date and time clock. You can set the date and the time and select their format. The 38DL PLUS saves all measurements value with their acquisition date.

## To set the clock

1. Press [2nd F], [SETUP MENU] (SP MENU).
2. In the menu, select **CLOCK**.
3. In the **CLOCK** screen (see Figure 4-2 on page 51):
  - a) Set parameters to the current date and time and to the desired date and hour modes.
  - b) Select **SET**.

The screenshot shows a terminal window with a blue header bar containing 'SP MENU' on the left and 'CLOCK' on the right. The main area is a light gray box with the following text and input fields:

MONTH	2
DAY	24
YEAR	2010
DATE MODE	MM/DD/YYYY
HOUR	2 PM
MINUTE	35
HOUR MODE	12 HOUR

Below the input fields are two buttons: 'SET' and 'CANCEL'. At the bottom of the screen, there is a status bar with the text: '↔ to change value, then ENTER or ↓.' and '↑, ↔, ENTER'.

Figure 4-2 Selecting clock parameters

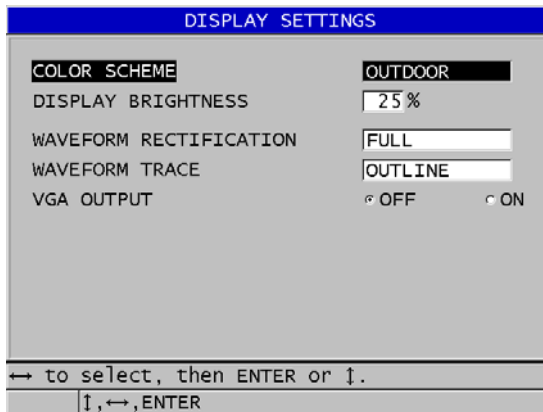
## 4.4 Changing Display Settings

You can change the appearance of some display elements such as colors, brightness, waveform rectification, and waveform trace.

### To change the display setting

1. From the measurement screen, press [DISPLAY].
2. In the **DISPLAY SETTINGS** screen (see Figure 4-3 on page 52), select the desired parameter and value for the following parameters:
  - **COLOR SCHEME** to either select the **INDOOR** or **OUTDOOR** optimized visibility (see “Color Schemes” on page 52 for details).

- **DISPLAY BRIGHTNESS** to select one of the predefined brightness levels (see “Display Brightness” on page 53 for details).
- **WAVEFORM RECTIFICATION** to select one of the rectification modes (see “Waveform Rectification” on page 54 for details).
- **WAVEFORM TRACE** to select one of the trace types (see “Waveform Trace” on page 55 for details).
- **VGA OUTPUT** to turn **ON** or **OFF**, the VGA signal for the VGA output (see “Using the VGA Output” on page 86 for details).



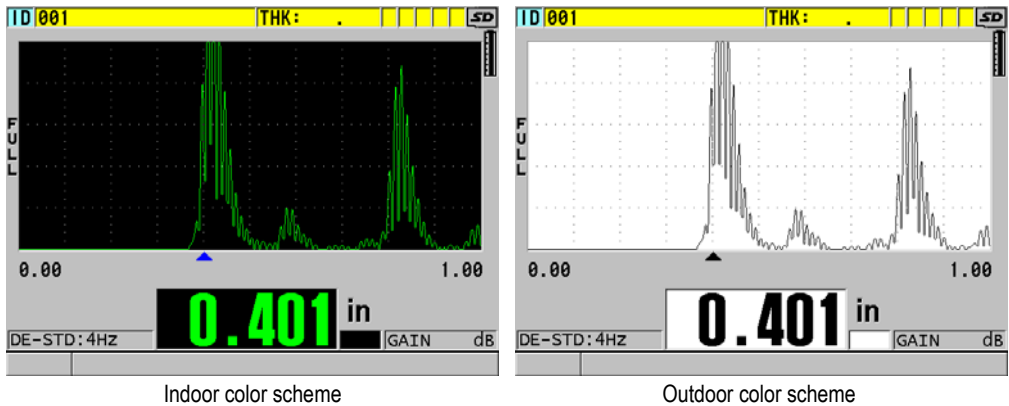
**Figure 4-3 The DISPLAY SETTINGS screen**

3. Press **[MEAS]** to return to the measurement screen.

#### 4.4.1 Color Schemes

The 38DL PLUS offers two standard color schemes designed to provide best display visibility in indoor or outdoor lighting conditions (see Figure 4-4 on page 53). From the measurement screen, press **[DISPLAY]** to access the **COLOR SCHEME** parameter.





**Figure 4-4 Example of the indoor and the outdoor color schemes**

The indoor scheme gives the best visibility when you use the instrument indoors or in low lighting conditions. The indoor scheme presents green characters and waveform trace on a black background.

The outdoor scheme gives best visibility when you use the instrument in direct sunlight. The outdoor mode presents black characters and waveform trace on a white background. For best readability, in this document, most screen captures are shown with the outdoor color scheme.

#### NOTE

Colored measurement values corresponding to specific alarm conditions only appear when the indoor color scheme is selected.

## 4.4.2 Display Brightness

You can adjust the 38DL PLUS display brightness by selecting the backlight intensity. The display brightness can be set at 0 %, 25 %, 50 %, 75 %, and 100 %. Choosing a high percentage increases the brightness of the display. By default, the display brightness is set to 25 %. From the measurement screen, press **[DISPLAY]** to access the **DISPLAY BRIGHTNESS** parameter.

The 38DL PLUS uses a transfective color display that reflects ambient light and becomes brighter in direct light. With brighter ambient conditions, you can set the display brightness to a lower percentage.

**NOTE**

Reducing the display brightness percentage increases the battery life. Battery life specifications are based on backlight brightness set to 50 %.

### 4.4.3 Waveform Rectification

The rectification mode is the way in which the ultrasonic echoes are represented on the waveform display (see Figure 4-5 on page 54). The rectification mode does not affect the thickness measurement in any way. The rectification indicator (**FULL**, **POS**, **NEG**, or **RF**) appears on the left edge of the waveform display. From the measurement screen, press **[DISPLAY]** to access the **WAVEFORM RECTIFICATION** parameter.

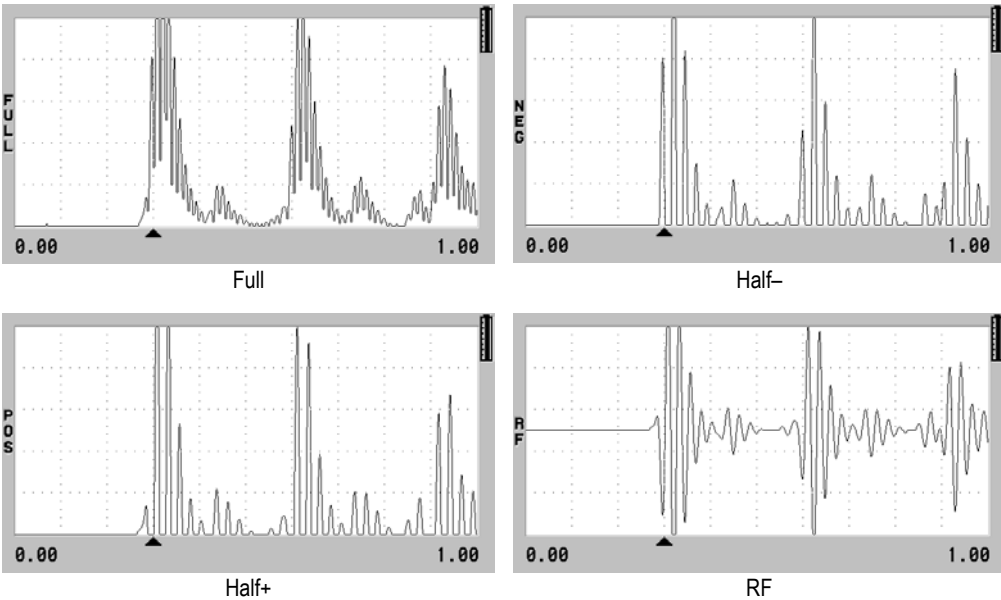


Figure 4-5 Examples of the rectification modes

The available rectification modes are:

**FULL**

Shows the negative portion of the echo folded around the baseline so that both positive and negative waveform lobes are displayed. Gives the best overall representation of position and magnitude for most thickness measurement applications. **FULL** is the default mode for dual element transducers.

**HALF-** (NEG indicator)

Shows negative waveform lobes as positive and does not show the positive lobes.

**HALF+** (POS indicator)

Shows positive waveform lobes and does not show the negative waveform lobes.

**RF**

Shows negative and positive lobes on either side of the baseline. **RF** is the default mode for single element transducers.

#### 4.4.4 Waveform Trace

The 38DL PLUS can display the waveform trace as a line (**OUTLINE**) or as a **FILLED** area (see Figure 4-6 on page 56). From the measurement screen, press **[DISPLAY]** to access the **WAVEFORM TRACE** parameter.

---

<b>NOTE</b>
-------------

A filled waveform trace is only possible when the waveform rectification is set to **FULL**, **HALF+**, or **HALF-**.

---

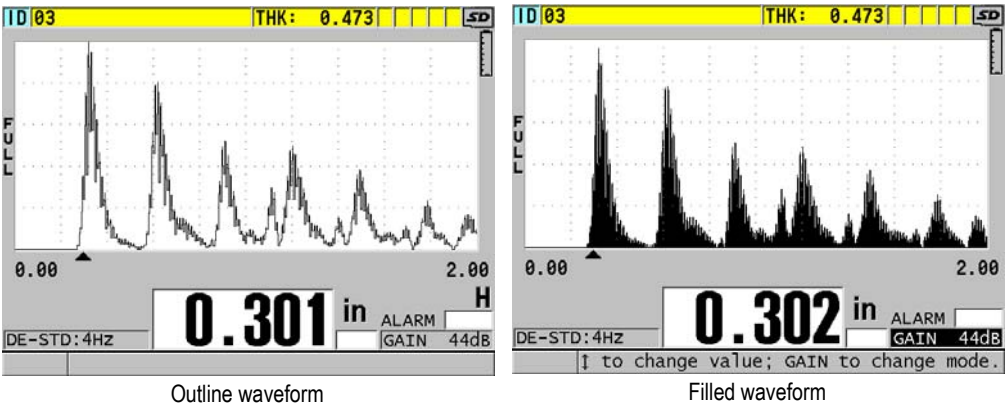


Figure 4-6 Examples of waveform trace modes

## 4.5 Range of the Waveform Display

The range of the waveform display is the distance spanned by the horizontal axis of the waveform display. The left end of the horizontal axis, the delay, is generally set to zero. You can manually adjust the delay value to change the starting point of the range (see “Adjusting the Delay Value” on page 58) and select the end point of the range (see “Selecting the Range Value” on page 57). You can also activate the zoom function to automatically set the delay and the range values to best see the echo (see “Activating the Zoom Function” on page 58).

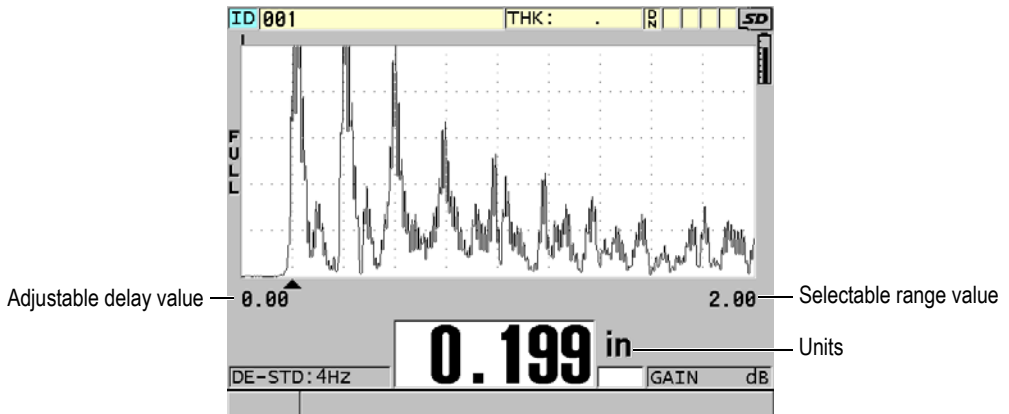


Figure 4-7 The range of the waveform display

#### 4.5.1 Selecting the Range Value

There are fixed ranges available for each transducer frequency. The available ranges are also dependent on material sound velocity. These selectable ranges let you adjust the thickness span of the waveform display to only show the thickness range being measured and thus, obtain maximum waveform resolution for each application. The range setting affects the waveform display only. You can still make measurements even when the display range does not show the detected echo from which the thickness is measured. You cannot manually set the range while the zoom is active.

##### To select the range value

1. From the measurement screen, press **[RANGE]**.  
The waveform range changes to the next higher available range.
2. Continue to press **[RANGE]** until you obtain the desired range.  
The range value recycles to the minimum range value following the maximum value.

## 4.5.2 Adjusting the Delay Value

The delay of the waveform display adjusts the beginning of the horizontal span. You can adjust the delay to display the waveform of interest in the center of the waveform display. This function is very useful when using delay line or immersion transducers, or when measuring thick material so that the measured echoes can be seen in greater detail.

### To adjust the delay value

1. Press **[2nd F]**, **[RANGE]** (**DELAY**).
2. Use the arrow keys to adjust the delay value.
3. Press **[2nd F]**, **[RANGE]** (**DELAY**) again to stop editing the delay value.

---

<b>TIP</b>
------------

Press and hold the **[RANGE]** key to reset the delay to zero.

---

## 4.5.3 Activating the Zoom Function

The zoom function automatically and dynamically sets the delay and the range values to optimally track and show the detected echo in the waveform display.

### To activate the zoom function

1. From the measurement screen, press **[ZOOM]**.  
The zoom flag (**Z**) appears on the right side of the waveform display, below the power indicator.
2. Press **[ZOOM]** again to turn off the zoom function.

The resulting zoomed waveform depends on the current measurement mode. The zoom for D79X dual element transducers and mode 1 single element transducers centers the first back-wall echo on the screen (see Figure 4-8 on page 59).

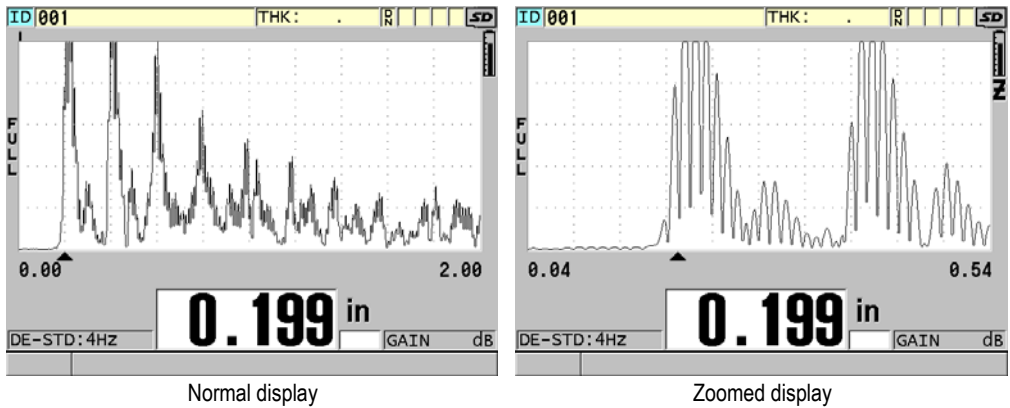


Figure 4-8 Comparing normal and zoomed display in mode 1

The zoom with single element transducers in mode 2 adjusts the waveform range and delay so that the interface echo and the first back-wall echo appear on the waveform display (see Figure 4-9 on page 59).

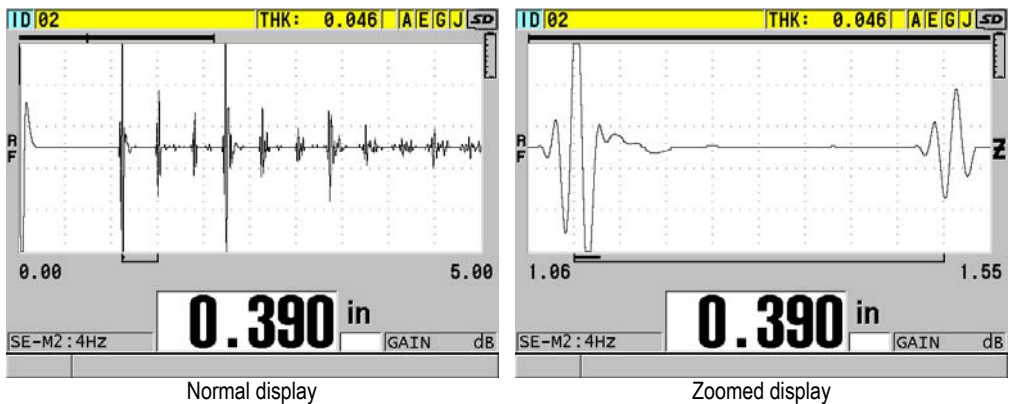


Figure 4-9 Comparing normal and zoomed display in mode 2

The zoom with single element transducers in mode 3 adjusts the waveform range and delay so that the interface echo and the second measured back-wall echo appear on the waveform display (see Figure 4-10 on page 60).

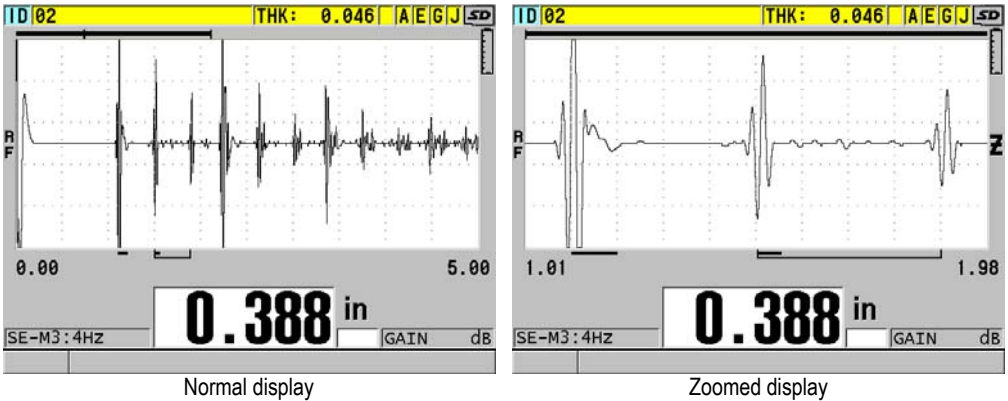


Figure 4-10 Comparing normal and zoomed display in mode 3

## 4.6 Adjusting the Measurement Update Rate

You can select a predefined measurement update rate (4 Hz, 8 Hz, 16 Hz, 20 Hz, or **MAX**). The measurement update rate indicator is always present on the left of the thickness measurement (see Figure 4-11 on page 60).



Figure 4-11 The measurement update rate indicator

The **MAX** update rate is up to 30 Hz and is dependent on measurement type. This option is useful when making high temperature thickness measurements to help limit the transducer contact time or for applications where you scan the transducer over an area to find the minimum thickness.



**NOTE**

The 38DL PLUS automatically uses the fastest update rate when entering the **Minimum** or **Maximum** mode (see “Using the Minimum, Maximum, or Min/Max Thickness Mode” on page 115).

---

**To adjust the measurement update rate**

1. From the measurement screen, press [SETUP MENU].
2. In the menu, select **MEAS**.
3. In the **MEAS** screen, set the **MEASURE RATE** to the desired value.
4. Press [MEAS] to return to the measurement screen.

## 4.7 Changing the Thickness Resolution

You can change the thickness measurement resolution, meaning the number of digits shown to the right of the decimal point. The resolution selection affects all displays and data output of values with thickness units. This includes measured thickness, differential reference value, and alarm set points. The highest thickness resolution with dual element transducer is 0.01 mm (0.001 in.). The velocity is always reported with full four-digit resolution.

You can reduce the resolution in some applications where the extra precision of the last digit is not required, or where extremely rough outside or inside surfaces make the last thickness display digit unreliable.

The high resolution software option (P/N: 38DLP-HR [U8147015]) allows to increase the resolution to 0.001 mm (0.0001 in.). The high resolution is available for measured thickness smaller than 102 mm (4 in.). The high resolution is not active with low-frequency transducers and when the high penetration software option is activated.

**To change the thickness measurement resolution**

1. Press [SETUP MENU].
2. In the menu, select **MEAS**.
3. In the **MEAS** screen, set **RESOLUTION** to the desired option:
  - **STANDARD**: 0.01 mm or 0.001 in. (default)

- **LOW**: 0.1 mm or 0.01 in.
  - Optional **HIGH**: 0.001 mm or 0.0001 in.
4. Press [**MEAS**] to return to the measurement screen.

---

## 5. Basic Operation

---

The following sections describe the basic operation for the 38DL PLUS ultrasonic thickness gage.

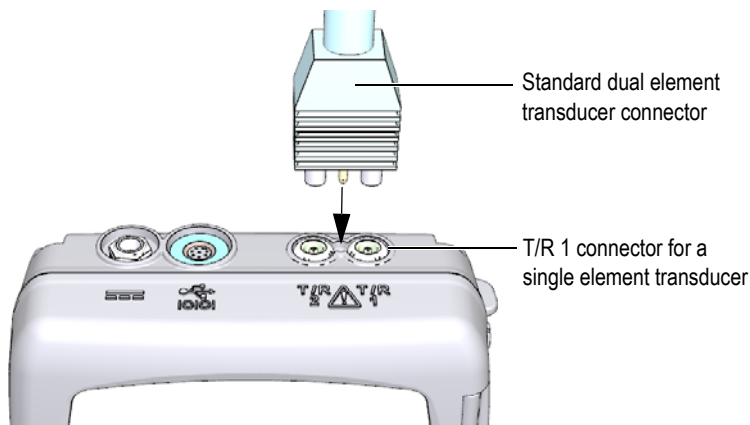
### 5.1 Setting Up the Transducer

The 38DL PLUS operates with a full line of single element and dual element transducers. The 38DL PLUS automatically recognizes standard D79X dual element transducers and automatically loads the appropriate predefined setup. The predefined setup contains ultrasonic velocity for the stainless steel step block supplied with the instrument. With dual element transducers, you need to perform a transducer zero compensation.

For a single element transducer, or other dual element transducers, you need to manually load an appropriate setup. The 38DL PLUS ships from the factory set up with default conditions for the purchased transducers using an approximate sound velocity for the stainless steel test block provided with the instrument. The default conditions are selected to facilitate instrument usage for your applications.

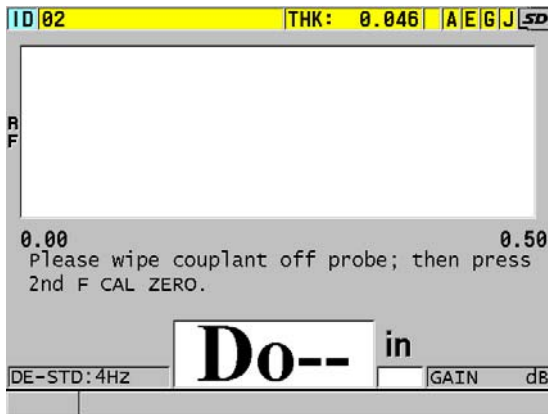
#### To set up the transducer

1. Plug the transducer into the transducer connector(s) at the top of the 38DL PLUS case (see Figure 5-1 on page 64). Use T/R 1 for a single element transducer.



**Figure 5-1 Plugging the transducer**

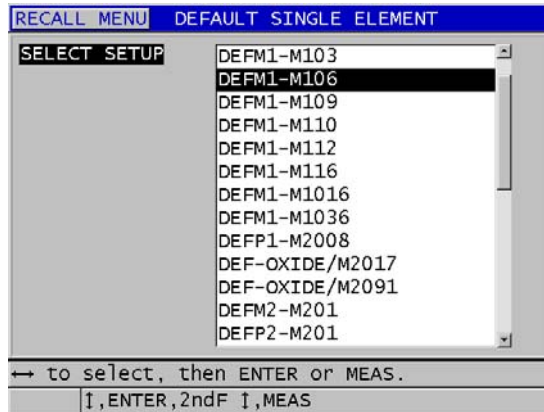
2. Press [ON/OFF] to start the instrument. The measurement screen appears. With a standard D79X dual element transducer, the “Do--” message appears in the measurement screen (see Figure 5-2 on page 64).



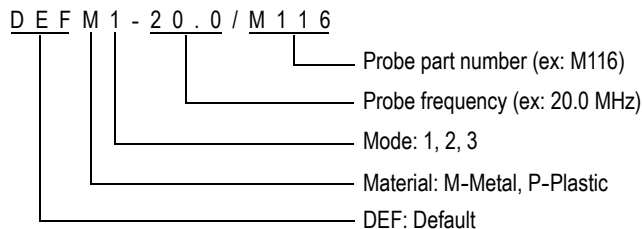
**Figure 5-2 Initial screen with a standard D79X dual element transducer**

3. For dual element transducers, perform the transducer zero compensation:
  - a) Wipe couplant off the tip of the transducer.

- b) Press **[2nd F]**, **[CAL ZERO]** (**Do ZERO**).
4. For a single element transducer, or other dual element transducers, load an appropriate setup:
  - a) Press **[XDCR RECALL]**.
  - b) In the menu, select the default choice for the probe type that you use (ex.: **DEFAULT SINGLE ELEMENT**).
  - c) In the **DEFAULT** screen for the type of probe that you are using (see the example shown in Figure 5-3 on page 65), in the list of available default setups, highlight the setup for the transducer that you are using.



**Default setup naming convention:**



**Figure 5-3 Selecting a default single element transducer setup**

**NOTE**

You can rename the setups listed as USER-1 through USER-35 for special applications. Refer to “Custom Setups for Single Element Transducers” on page 221 for more details on setups.

---

- d) Press **[MEAS]** to automatically recall the setup parameters for the chosen setup and return to the measurement screen.

## 5.2 Calibration

The calibration is the process of adjusting the instrument to accurately measure on a particular material, using a known transducer at a given temperature. Calibrating the instrument is always necessary before inspecting a specific material. The measurement accuracy is only as good as the calibration that you perform.

You need to perform the following three calibration types:

### Transducer zero compensation (**[Do ZERO]**)

For dual element transducer only, calibrate for the sound transit time in each of the dual transducer delay lines. This compensation varies in each transducer unit and with temperature. You must perform the transducer zero compensation procedure when the unit is powered on, when the transducer is changed, and when the transducer temperature changes significantly (see “Setting Up the Transducer” on page 63 and “Transducer Zero Compensation” on page 70).

### Material sound velocity calibration (**[CAL VEL]**)

Perform a velocity calibration using a thick test block of the measured material with known thickness or by manually entering a previously determined material sound velocity. You must perform this procedure for each new measured material (see “Calibrating the Instrument” on page 67 and “Material Sound Velocity and the Zero Calibrations” on page 71).

### Zero Calibration (**[CAL ZERO]**)

Perform a zero calibration using a thin test block of the measured material with known thickness. Unlike the transducer zero compensation and the material sound velocity calibration, this procedure is not required unless you need the best absolute accuracy (better than  $\pm 0.10$  mm or  $\pm 0.004$  in.). You only need to do it once for each new transducer and material combination. You do not have to repeat the zero calibration when the transducer temperature changes; Transducer

zero compensation is responsible for that task (see “Calibrating the Instrument” on page 67 and “Material Sound Velocity and the Zero Calibrations” on page 71).

## 5.2.1 Calibrating the Instrument

When you want to make accurate measurements, you need to perform the following calibrations:

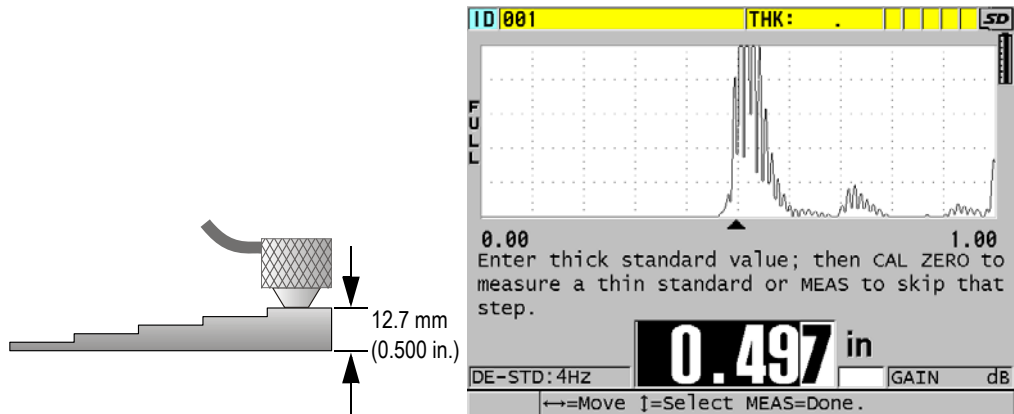
- Material sound velocity calibration
- Zero calibration

You must perform the calibrations using a thick and a thin sample of precisely known thicknesses. The sample must be made of the same material as the parts to be inspected (see “Test Blocks” on page 70 for details on test blocks).

The following procedure is illustrated using a dual element probe and a 5-step test block. Refer to “Calibration” on page 66 for more details on the calibration process.

### To calibrate the instrument

1. To perform the material sound velocity calibration (see Figure 5-4 on page 68):
  - a) Place a drop of couplant on the surface of the thick part of the test block.
  - b) Couple the transducer to the thick part of the test block using moderate to firm pressure.  
The waveform and the thickness reading appear on the screen.
  - c) Press **[CAL VEL]**.
  - d) When the thickness reading is stable, press **[ENTER]**.
  - e) Using the arrow keys, edit the thickness value to match the known thick thickness of the test block.



**Figure 5-4 Performing the material sound velocity calibration on a 5-step test block**

2. To perform the zero calibration (see Figure 5-5 on page 69):
  - a) Place a drop of couplant on the surface of the thin part of the test block.
  - b) Couple the transducer to the thin part of the test block, and then press **[CAL ZERO]**.
  - c) When the thickness reading is stable, press **[ENTER]**.
  - d) Using the arrow keys, edit the thickness value to match the known thin thickness of the test block.



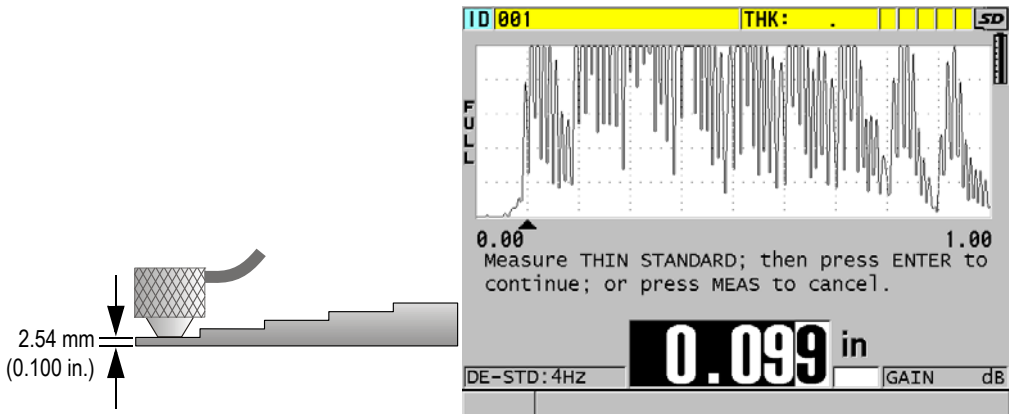


Figure 5-5 Performing the zero calibration on a 5-step test block

3. Press **[MEAS]** to complete the calibration and return to the measurement screen.

#### IMPORTANT

If you turn off the instrument before pressing **[MEAS]**, the velocity is not updated to the new value; instead the instrument retains the previous value.

#### NOTE

When the 38DL PLUS detects an error in the calibration procedure, it successively displays the following messages in the help text bar before returning to the measurement screen:

**“Potential wrong echo detected!”**

**“Invalid calibration results!”**

In this case, the velocity is not changed. The probable case is that an incorrect thickness value was entered.

## 5.2.2 Test Blocks

The 38DL PLUS comes with a cylindrical stainless steel test block with two thicknesses. You can use the two precisely known test block thicknesses to perform the material sound velocity and the zero calibrations.

Precision step test blocks are also often used when more than two known thicknesses are needed (see Figure 5-6 on page 70).



**Figure 5-6 Example of a 5-step test block**

When performing the material sound velocity and zero calibration, you must use a test block with the following characteristics:

- Made from the same material as the parts to be tested.
- Have two or more precisely known thicknesses
- Have one part as thin as the thinnest section of the parts to be tested to perform the zero calibration. The surface condition should be similar to that of the tested parts. Rough surfaces generally reduce the accuracy of measurements, but simulating actual surface conditions on the calibration block can help to improve results.
- Have one part as thick as the thickest section of the parts to be tested, to perform the material sound velocity calibration. The front and back surfaces should be smooth and parallel.
- Be at the same temperature as the samples to be measured.

## 5.2.3 Transducer Zero Compensation

Perform a transducer zero compensation by pressing **[2nd F]**, **[CAL ZERO]** (**Do ZERO**) whenever the message “**Do—**” or the zero indicator appear. You should also perform this procedure when the dual element transducer temperature has changed.

The frequency at which you perform a transducer zero compensation procedure depends on the rate of change of the internal temperature of the dual element transducer. This is related to the material surface temperature, frequency of transducer application, length of time the transducer is held in contact with the material, and the accuracy that you want to obtain.

---

<b>NOTE</b>
-------------

When measurements are made on surfaces that are significantly above room temperature, the zero should be recalibrated on a regular basis. This is less important for transducers part numbers D790-SM, D791-RM, D797-SM, and D798 than for other transducers that have various types of resin delay lines.

---

For high temperature measurements, Olympus recommends that you develop a transducer zero compensation schedule that takes these factors into account. For example, use the D790-SM, D791-RM, or D797-SM for high temperature applications, minimizing the frequency of the zero compensation. You can also use the D790-SM and D791-RM for general purpose applications.

## 5.2.4 Material Sound Velocity and the Zero Calibrations

The 38DL PLUS performs a material gain optimization during the velocity calibration procedure when this feature is activated (see “Configuring Measurement Parameters” on page 127).

For dual element transducers, the material gain optimization (**GAIN OPT** in the **MEAS** screen) evaluates the signal from the test block and automatically sets a starting default gain based on the transducer sensitivity and material noise levels. When the default gain required is outside of the allowable range, a message appears, specifying that the transducer may not be functioning correctly.

The 38DL PLUS performs a calibration doubling verification to help prevent mis-calibrating on thin samples. Doubling occurs when the instrument measures the time to the second back-wall echo rather than detecting the first back-wall echo. The 38DL PLUS compares the measured time of flight to the expected time of flight based on the current sound velocity. The 38DL PLUS displays a warning message if doubling is suspected. Doubling can occur when measuring a thickness that is below the minimum range of the transducer, or when a transducer is worn or low in sensitivity.

**NOTE**

You can also achieve a material sound velocity and zero calibration procedure by performing the operations in the reverse order, starting with the zero calibration, followed by the material sound velocity calibration.

---

## 5.2.5 Entering a Known Material Sound Velocity

When preparing to measure thicknesses on parts made of a different material, if you know the sound velocity for the material, you can directly enter the velocity without performing a material sound velocity calibration procedure.

### To enter a known material sound velocity

1. From the measurement screen, press [2nd F], [CAL VEL] (VEL).
2. In the **VELOCITY** screen (see Figure 5-7 on page 72), use the arrow keys to edit the velocity to the known value.

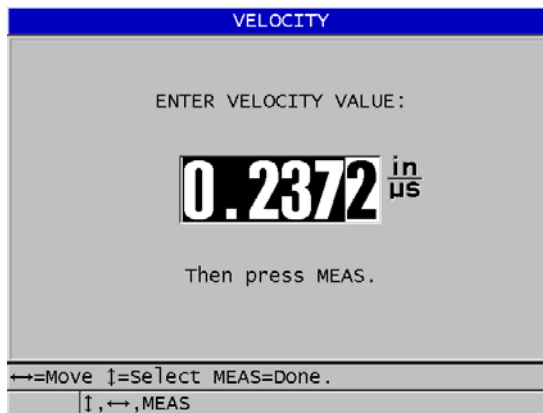


Figure 5-7 Entering a known material sound velocity

3. Press [MEAS] to return to the measurement screen.

## 5.2.6 Locked Calibrations

The 38DL PLUS includes a password-protected locking function to prevent changes to setups and prevent access to some functions. A change to the calibration is one action that you can lock. When this is the case, the message shown in Figure 5-8 on page 73 appears momentarily on the help text bar (see “Locking the Instrument” on page 124 for details).



Figure 5-8 The calibration lock message

## 5.2.7 Factors Affecting the Performance and the Accuracy

The following factors affect the performance of the instrument and the accuracy of the thickness measurements.

### Calibration

The accuracy of any ultrasonic measurement is only as good as the accuracy and care with which you calibrate the instrument. The 38DL PLUS ships from the factory with standard setups for a number of transducers and applications. In some cases, it may be desirable to optimize these setups for specific measurement situations. In all cases, it is essential that you perform the velocity and zero calibrations whenever the test material or transducer is changed. Periodic checks with samples of known thickness are recommended to verify that the gage is operating properly.

### Surface roughness of the test piece

The best measurement accuracy is obtained when both the front and back surfaces of the test piece are smooth. When the contact surface is rough, the minimum thickness that can be measured will be increased because of sound reverberating in the increased thickness of the couplant layer. Additionally, when the two test piece surfaces are rough, the slightly different multiple sound paths seen by the transducer may cause distortion in the returning echo, resulting in measurement inaccuracies.

### Coupling technique

In mode 1 (contact transducer) measurements, the couplant layer thickness is part of the measurement and is compensated by a portion of the zero offset. If

maximum accuracy is to be achieved, then the coupling technique must be consistent. In order to accomplish consistent measurements, use a couplant of reasonably low viscosity; employ only enough couplant to achieve a reasonable reading; and apply the transducer with uniform pressure. Practice will show the degree of moderate to firm pressure that produces repeatable readings. In general, smaller diameter transducers require less coupling force to squeeze out the excess couplant than larger diameter transducers. In all modes, tilting the transducer distorts echoes and causes inaccurate readings, as noted below.

#### Curvature of the test piece

A related issue to this section involves the alignment of the transducer with respect to the test piece. When measuring on curved surfaces, it is important that the transducer be placed approximately on the centerline of the part and held as steadily to the surface as possible. In some cases, a spring-loaded V-block holder may be helpful for maintaining this alignment. In general, as the radius of curvature decreases, the size of the transducer should be reduced, and the more critical transducer alignment will become. For very small radii, an immersion approach is necessary. In some cases it may be useful to observe the waveform display as an aid in maintaining optimum alignment. Practice the best way to hold a transducer with the aid of a waveform display. On curved surfaces, it is important to use only enough couplant to obtain a reading. Excess couplant forms a fillet between the transducer and the test surface where sound reverberates and possibly creates spurious signals that may trigger false readings.

#### Taper or eccentricity

If the contact surface or back surface of the test piece is tapered or eccentric with respect to the other, the return echo is distorted due to the variation in sound path across the width of the beam. The accuracy of the measurement is reduced. In severe cases, no measurement is possible.

#### Acoustic properties of the test material

There are several conditions found in certain engineering materials that can potentially limit the accuracy and range of ultrasonic thickness measurements:

- Sound scattering:

In materials such as cast stainless steel, cast iron, fiberglass, and composites, sound energy scatters from individual crystallites in the casting or boundaries of dissimilar materials within the fiberglass or composite. Porosity in any material can have the same effect. Adjust the instrument sensitivity to prevent detection of these spurious scatter echoes. This compensation can in turn limit the ability to discriminate a valid return echo from the back wall of the material, thereby restricting measurement range.

- Sound attenuation or absorption:  
In many organic materials such as low density plastics and rubbers, sound energy is attenuated very rapidly at the frequencies used for ultrasonic gaging. This attenuation typically increases with temperature. The maximum thickness that can be measured in these materials will often be limited by attenuation.
- Velocity variations:  
An ultrasonic thickness measurement is accurate only to the degree that material sound velocity is consistent with the instrument calibration. Some materials exhibit significant variations in sound velocity from point to point. This happens in certain cast metals due to the changes in grain structure that result from varied cooling rates, and the anisotropy of sound velocity with respect to grain structure. Fiberglass can show localized velocity variations due to changes in the resin/fiber ratio. Many plastics and rubbers show a rapid change in sound velocity with temperature, requiring that velocity calibration be performed at the temperature where measurements are made.

#### Phase reversal or phase distortion

The phase or polarity of a returning echo is determined by the relative acoustic impedances (density  $\times$  velocity) of the boundary materials. The 38DL PLUS assumes the customary situation where the test piece is backed by air or a liquid, both of which have a lower acoustic impedance than metals, ceramics, or plastics. However, in some specialized cases, such as measurement of glass or plastic liners over metal, or copper cladding over steel, this impedance relationship is reversed and the echo appears phase reversed. In these cases, it is necessary to change the appropriate echo detection polarity in order to maintain accuracy (see “Detection of Echo 1 and Echo 2” on page 235). A more complex situation can occur in anisotropic or inhomogeneous materials such as coarse-grain metal castings or certain composites, where material conditions result in the existence of multiple sound paths within the beam area. In these cases, phase distortion can create an echo that is neither cleanly positive nor negative. Careful experimentation with reference standards is necessary in these cases to determine effects on measurement accuracy.

## 5.3 Measuring Thicknesses

You can start measuring thicknesses once a transducer is connected (see “Setting Up the Transducer” on page 63) and once the instrument is calibrated (see “Calibrating the Instrument” on page 67).

## To measure thicknesses

1. Apply couplant to the test block or tested part at the measuring spot.

### NOTE

In general, use a thinner couplant such as propylene glycol, glycerin, or water for smooth material surfaces. Rough surfaces require a more viscous couplant such as gel or grease. Special couplants are required for high temperature applications.

2. Using moderate to firm pressure, couple the tip of the transducer to the surface of the test material, and keep the transducer as flat as possible on the material surface (see Figure 5-9 on page 76).

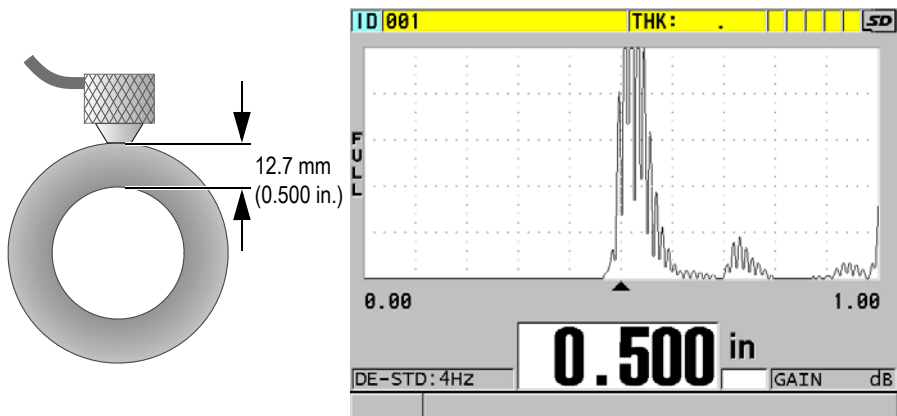


Figure 5-9 Coupling dual element transducer and reading the measured thickness

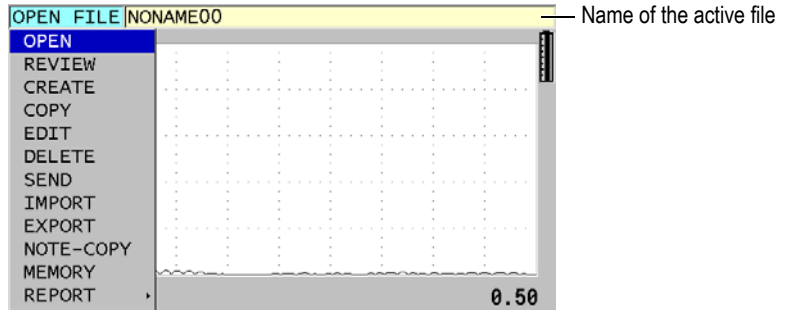
3. Read the measured thickness value for the tested part.

## 5.4 Saving Data

The 38DL PLUS datalogger is a file based system where one file is opened at a time. The active file stores a measurement at a thickness measurement location ID. Each time you press [SAVE/SEND], the displayed value is saved to the active file at the



current ID. The ID is automatically incremented for the next measurement. When you press [FILE], the name of the active file appears in the ID bar above the menu (see Figure 5-10 on page 77).



**Figure 5-10 The active file name appearing in the ID bar**

The NONAME00 increment type file, starting with the 001 ID, is the active file by default when you first use the 38DL PLUS or after resetting the instrument memory. You can create various types of files and define IDs to represent various 1-D, 2-D, or 3-D thickness measurement locations. When restarting, the instrument automatically opens the last file that was used.

The following special cases may occur:

- When the thickness value is blank, “— —” is saved rather than a value.
- When a measurement is already stored at the current ID, the new value overwrites the old thickness reading unless the overwrite protection is enabled (see “Setting the ID Overwrite Protection” on page 196).
- When the ID increment reaches the end of a sequence and cannot be updated, **Last ID** appears on the help text bar, a long beep sound is emitted (when the beeper is active), and the ID on the display remains unchanged.

Refer to “Using the Datalogger” on page 159 for more information on the datalogger.

#### To save data at the current ID in the active file

- ◆ While the desired thickness value and waveform are displayed, press [SAVE/SEND] to save the measured thickness value.
- OR

Press **[2nd F]**, **[SAVE/SEND]** (**WAVEFORM**) to save the measured thickness value and the waveform.

### TIP

If you want to always save both the thickness and the waveform when you press **[SAVE/SEND]**, in the **SYSTEM** screen, set **SAVE DATA** to **THK+WF** (see “Configuring System Parameters” on page 129).

## 5.5 Measurements with THRU-COAT D7906 and D7908 Transducers

THRU-COAT is a function that measures the true metal thickness of coated or painted parts. This function only requires a single back-wall echo and is recommended for heavy corrosion applications where the outside of the material is coated or painted. If needed, you can also calibrate the measurement of the coating/paint layer to precisely measure the thickness of the coating/paint.

### 5.5.1 Enabling the THRU-COAT Function

The THRU-COAT function is only available when you connect a THRU-COAT transducer (P/N: D7906 [U8450005] or D7908 [U8450008]) to the 38DL PLUS.

#### To enable the THRU-COAT function

1. Connect a THRU-COAT transducer to the 38DL PLUS.
2. Start the instrument.
3. Wipe the couplant off the transducer tip.
4. Press **[2nd F]**, **[CAL ZERO]** (**Do ZERO**).

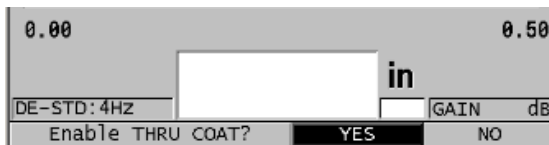


Figure 5-11 Opening the THRU COAT SETUP dialog box

5. Select **YES** to answer the **Enable THRU COAT?** prompt.

## 5.5.2 Performing a THRU-COAT Calibration

The calibration procedure for a THRU-COAT probe is similar to the procedure for other probes. As for a normal calibration, you need two uncoated samples with accurately known thin and thick thicknesses to perform the following calibration procedure. The difference is that towards the end of the procedure, you can press **[CAL VEL]** a second time to calibrate the coating thickness measurement on a sample with an accurately known coating thickness.

### To perform a THRU-COAT calibration

1. Ensure that the THRU-COAT function is enabled (see “Enabling the THRU-COAT Function” on page 78).
2. Couple the transducer to the thick sample.
3. Press **[CAL VEL]**.
4. When the reading is stable, press **[ENTER]**.
5. Using the arrow keys, edit the thickness value to match the known thickness of the sample.
6. Couple the transducer to the thin sample.
7. Press **[CAL ZERO]**.
8. When the reading is stable, press **[ENTER]**.
9. Using the arrow keys, edit the thickness value to match the known thickness of the sample.
10. If the coating thickness measurement accuracy is important for your application, perform the following actions (omitting this step does not affect the accuracy of the metal thickness measurement):
  - a) Press **[CAL VEL]** again.
  - b) Couple the transducer to the coated sample.
  - c) When the reading is stable, press **[ENTER]**.
  - d) Using the arrow keys, edit the thickness value to match the known coating thickness of the coated sample.
11. Press **[MEAS]** to complete the calibration.

**NOTE**

Pressing [2nd F], [CAL VEL] (VEL) opens the VELOCITY screen where you can see and edit the calibrated metal sound velocity. Pressing [2nd F], [CAL VEL] (VEL) again opens the VELOCITY screen for the calibrated sound velocity through the coating.

## 5.6 Echo Detection Modes with Dual Element Transducers

With dual element transducers, the 38DL PLUS offers three echo detection modes allowing you to measure thicknesses in various material conditions. A description of each of the three echo detection modes (STANDARD, AUTO E-TO-E, and MANUAL E-TO-E) follows:

### STANDARD

The standard echo detection mode measures the thickness based on the time of flight between the main bang to the first back-wall echo. Use this mode for uncoated materials with good echo waveforms.

The DE-STD indicator appears to the left of the thickness reading and a triangular echo detection marker appears at the back-wall echo below the waveform display (see Figure 5-12 on page 80).

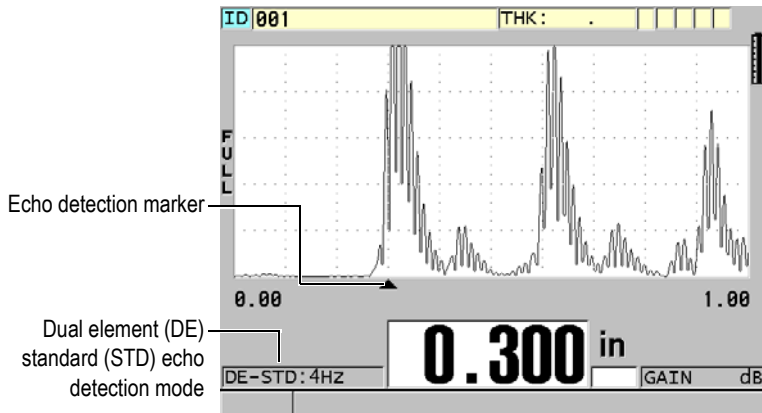
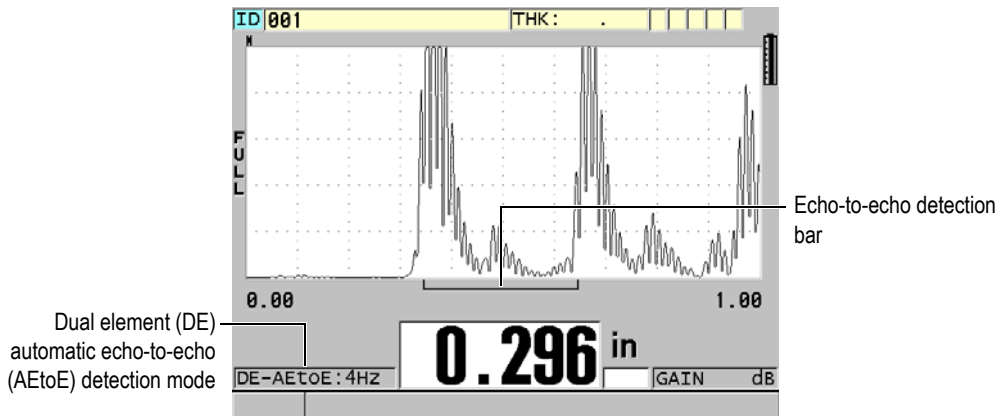


Figure 5-12 Measuring with the standard echo detection mode

## AUTO E-TO-E

The automatic echo-to-echo detection mode measures the thickness using the time of flight between two consecutive back-wall echoes. Use this mode for painted or coated materials since the time interval between consecutive layer back-wall echoes excludes the time of flight through a paint, resin, or coating layer. The **DE-AEtoE** indicator appears to the left of the thickness reading. The triangular marker is replaced by an echo-to-echo detection bar to indicate the exact pair of back-wall echoes used to determine the thickness (see Figure 5-13 on page 81). The echo height is automatically adjusted to a preset level.

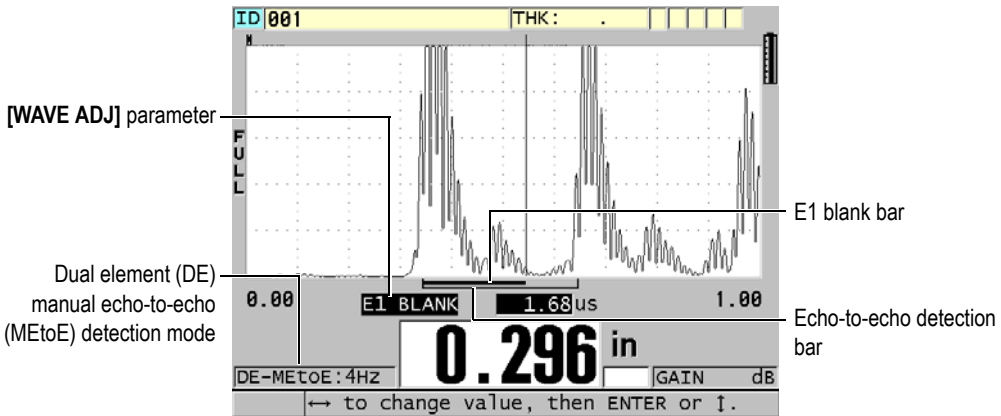


**Figure 5-13 Measuring with the automatic echo-to-echo detection mode**

## MANUAL E-TO-E

The manual echo-to-echo detection mode also measures the thickness using the time of flight between two consecutive back-wall echoes. In this mode, you can however also manually adjust the gain and the blanking parameters. Use this mode when material conditions produce noisy signals where the automatic mode may be less effective.

The **DE-MEtoE** indicator appears to the left of the thickness reading. The echo-to-echo detection bar is similar to the automatic echo-to-echo mode but includes the adjustable E1 blank bar that indicates the area to exclude for echo detection (see Figure 5-14 on page 82). Following the E1 blank, the instrument detects the next echo with an amplitude of at least 20 % of the waveform display height. In this mode, press **[WAVE ADJ]**, and then use the arrow keys to adjust the **EXT BLANK**, the **E1 BLANK**, and the **GAIN** parameters.



**Figure 5-14 Measuring with the manual echo-to-echo detection mode**

#### NOTE

In severe corrosion situations where valid multiple echoes are not present, you must use the standard mode to be able to measure thicknesses.

You can use dual element transducers in all three modes. You can use all measurement, display, and datalogger functions with the echo-to-echo modes. The internal datalogger recognizes and saves all necessary echo-to-echo information to upload and download thickness, waveform, and setup data.

#### TIP

You do not have to switch between echo detection modes when measuring both coated and uncoated areas because you can measure uncoated wall thicknesses using an echo-to-echo mode.

### To change the echo detection mode

1. Press [2nd F], [ZOOM] (E-TO-E).

2. In the menu, select the desired echo detection mode (**STANDARD**, **AUTO E-TO-E**, or **MANUAL E-TO-E**).
3. To perform the zero calibration again:
  - a) Place a drop of couplant on the surface of the thin part of the test block.
  - b) Couple the transducer to the thin part of the test block, and then press **[CAL ZERO]**.
  - c) When the thickness reading is stable, press **[ENTER]**.
  - d) Using the arrow keys, edit the thickness value to match the known thin thickness of the test block.

### 5.6.1 Blanking Adjustments in Manual Echo-to-Echo Detection Mode

The 38DL PLUS offers two blanking functions to help detect valid echoes in situations where material conditions generate unwanted signals:

#### EXT BLANK

The extended blank creates a blanked zone that begins at the left edge of the waveform display and in which no signals are detected. In situations where the second or third pair of back-wall echoes are stronger or cleaner than the first pair, use the extended blank to control which pair of echoes to use for measurement.

#### E1 BLANK

The echo 1 (E1) blank runs for a selected interval following the first detected echo. Use the E1 blank to exclude any unwanted peaks occurring between the first and the second back-wall echoes. Unwanted peaks may be trailing edges of a large first echo, or shear wave reflections on thick test pieces. The E1 blank parameter is only available in the manual echo-to-echo detection mode.

#### To adjust the extended and the E1 blank parameters

1. Select the manual echo-to-echo mode:
  - a) Press **[2nd F]**, **[ZOOM]** (**E-TO-E**).
  - b) In the menu, select **MANUAL E-TO-E**.
2. Press **[WAVE ADJ]**.

The wave adjustment parameter appears (see Figure 5-15 on page 84).

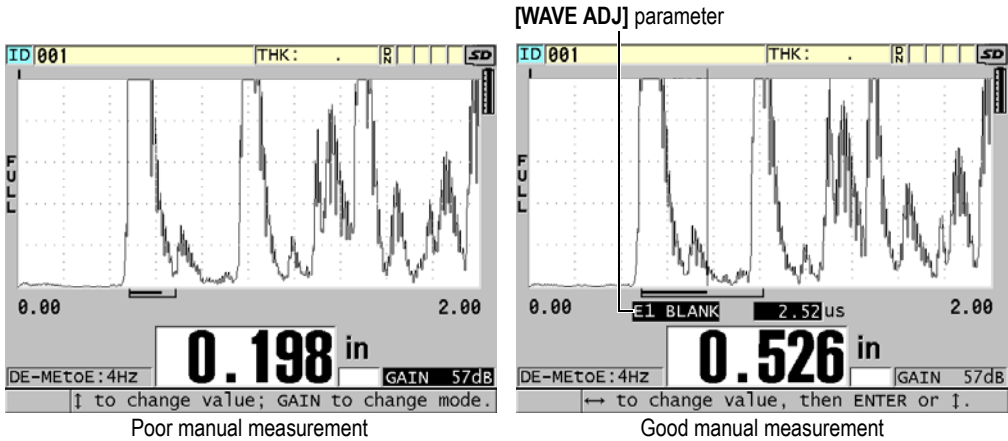


Figure 5-15 Comparing manual measurements

3. Use the [▲] and [▼] keys to select either the EXT BLANK or the E1 BLANK parameter.
4. Use the [▶] and [◀] keys to adjust the value to exclude unwanted peaks and detect the desired echoes.

## 5.6.2 Dual Element Transducer Selection in Echo-to-Echo Modes

Although the echo-to-echo modes work with all of the 38DL PLUS dual element transducers, Olympus recommends using particular transducers for specific thickness ranges in steel parts (see Table 3 on page 84).

Table 3 Recommended transducers for various steel thickness ranges

Transducer type	Thickness range <sup>a</sup>
D798	1.5 mm to 7.6 mm (0.060 in. to 0.300 in.)
D790/791	2.5 mm to 51 mm (0.100 in. to 2.00 in.)
D797	12.7 mm to 127 mm (0.500 in. to 5.00 in.)
D7906	2.5 mm to 51 mm (0.100 in. to 2.00 in.)

- a. Thickness ranges are dependent on transducer type, material conditions, and temperature.



In some cases, an error can occur if you are using a D790 transducer to measure thicknesses above 18 mm (0.7 in.). Typically, this error is due to a mode-converted shear-wave echo that may appear before the second back-wall echo. If this unwanted echo is larger than the second back-wall echo, the gage measures to it, which produces a thinner reading.

You can usually distinguish the unwanted shear-wave echo from the correct back-wall echo by examining the waveform display. The distance between the first and the second back-wall echoes is the same as the distance between the zero thickness point and the first back-wall echo. If there is an echo between the first two back-wall echoes, it is probably a mode-converted shear-wave echo. Use the manual echo-to-echo detection mode techniques and manually adjust the E1 blank to eliminate this error (see “Blanking Adjustments in Manual Echo-to-Echo Detection Mode” on page 83). Using the D797 transducer beyond 18 mm (0.7 in.) helps to eliminate the possibility of this error.

In some cases, the second or third back-wall echo is smaller in amplitude than subsequent echoes. This causes the instrument to give a double or triple reading. If you are using a D790 transducer, this effect may occur around 5 mm (0.2 in.) on flat smooth steel samples. If this occurs, it is clearly visible on the waveform display and you can work around it using the manual echo-to-echo detection mode, or moving the extended blank beyond the previously detected first echo.

When the 38DL PLUS cannot make an echo-to-echo reading, the LOS flag appears on the screen. In this case, the waveform display shows that either no echoes are large enough to be detected or that only one echo is detectable. In this last case, the echo-to-echo detection bar begins at the detected echo but extends indefinitely to the right. Increase the gain value to make a good echo-to-echo reading. If this does not help, you can still obtain an approximate measurement by returning to the standard echo detection mode.

### 5.6.3 Echo-to-Echo Mode Datalogger Flags

The following flags are used in the echo-to-echo modes in the first flag field of the uploaded thickness table and in the comment note box at the top right corner of the measurement screen:

- **E**: Automatic echo-to-echo detection mode
- **e**: Manual echo-to-echo detection mode
- **M**: Standard detection mode
- **I**: LOS in automatic echo-to-echo detection mode

- **n**: LOS in manual echo-to-echo detection mode
- **L**: LOS in standard echo detection mode

## 5.7 Using the VGA Output

You can connect the 38DL PLUS to an external screen or projector to more easily show the content of the 38DL PLUS screen to other people. This feature is particularly useful when you need to train other 38DL PLUS users.

When you activate the VGA output, the 38DL PLUS screen becomes blank and its contents appears only on the connected external screen. The VGA output is always turned off when you restart the 38DL PLUS.

### To use the VGA output

1. Turn off the 38DL PLUS.
2. Connect the optional VGA output cable (P/N: EPLTC-C-VGA-6 [U8840035]) to the VGA output connector, located under the I/O door on the right side of the 38DL PLUS (see Figure 1-5 on page 25).
3. Connect the other end of the VGA output cable to the external screen or projector.
4. Turn on the 38DL PLUS.
5. Turn on the external screen or projector.
6. Press **[DISPLAY]**.
7. In the **DISPLAY SETTINGS** screen (see Figure 4-3 on page 52), set **VGA OUTPUT** to **ON**.  
The 38DL PLUS screen becomes blank and the 38DL PLUS screen contents appears on the external screen.
8. Turn the instrument off and then back on if you need to restore the contents on the 38DL PLUS screen.

---

## 6. Using EMAT Transducers

---

This section provides background information regarding EMAT transducers and how to make basic thickness measurements using the 38DL PLUS and the E110-SB transducer.

An electromagnetic acoustic transducer (EMAT) uses the magnetostrictive principle to generate shear wave sound energy in ferrous metals that are externally coated with high temperature oxide scale. The E110-SB [U8471001] transducer does not work on nonferrous metal or in cases where the external surface is not coated with oxide scale. The EMAT transducer uses the external scale to generate shear wave sound energy and does not require the use of ultrasonic couplant. When the scale is not fully bonded to the surface of the steel, the shear wave sound energy is not transmitted to the steel.

The EMAT transducer is an effective way to estimate the remaining thickness of steel boiler tubes since you do not have to remove the external scale to perform the measurement. The EMAT transducer creates a nonfocused signal and is designed to give a good estimate of the remaining ( $\pm 0.25$  mm or  $\pm 0.010$  in.) wall thickness. Because of the nonfocused nature of the transducer, it is relatively insensitive to small internal pits. The minimum thickness measurement capability of the 38DL PLUS and EMAT transducer is approximately 2.0 mm (0.080 in.) depending on material properties.

---

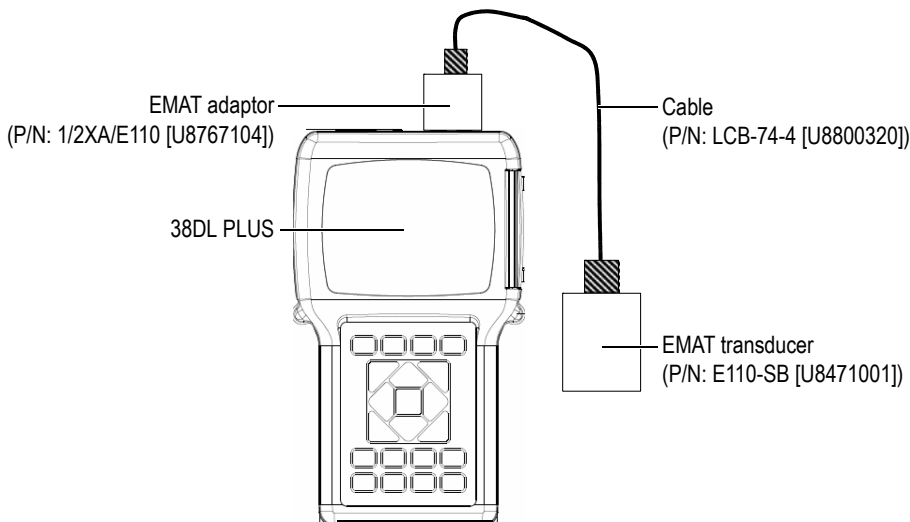
<b>NOTE</b>
-------------

Remove the external oxide and use a standard single or dual element transducer for a more accurate thickness measurement of remaining metal. Focused dual element transducers are also more sensitive to any internal pitting.

---

## 6.1 Connecting the E110-SB EMAT Transducer

You can use the E110-SB [U8471001] EMAT transducer with the 38DL PLUS. You need to use the EMAT 1/2XA/E110 [U8767104] filter adaptor and a standard LEMO-to-BNC cable (P/N: LCB-74-4 [U8800320]) as shown in Figure 6-1 on page 88.



**Figure 6-1 EMAT transducer and filter adaptor connection**

The 38DL PLUS automatically detects the E110-SB and 1/2XA/E110 filter adaptor and automatically recalls the default **DEF-EMAT/E110** setup from the **DEFAULT SINGLE ELEMENT** transducer list. Like for standard transducers, you may need to adjust the gain and the extended blank to make proper thickness measurements. Experienced technicians familiar with the basic theory of ultrasonic gaging and the interpretation of ultrasonic waveforms can also press [**WAVE ADJ**] to adjust other transducer parameters.

## 6.2 Calibrating with the E110-SB EMAT Transducer

Calibration is the adjustment of the gage so that it measures accurately on a particular material. The default velocity and zero offset for the E110-SB EMAT transducer are designed to provide a good estimate of the ferrous metal thickness underneath an external oxide scale coating.

To achieve the best accuracy, use calibration samples with external oxide scale made from the material to be tested. These samples should have a metal of known thickness (not including external oxide scale) and should represent the minimum and maximum thickness of your measurement range.

The calibration procedure is the same as for a standard transducer except that you do not need to use couplant to couple the transducer to the material. Refer to “Calibrating the Instrument” on page 67 for the calibration procedure.

---

<b>NOTE</b>
-------------

The EMAT transducer generates shear wave sound energy. Consequently, the velocity calculated by the gage is the shear sound velocity of the material.

---



## 7. Software Options

You can increase the capability of the already versatile 38DL PLUS using the available software options (see Table 4 on page 91).

**Table 4 38DL PLUS software options**

Option	Description
<b>HIGH RESOLUTION</b> (see “High Resolution Software Option” on page 93)	Increases the thickness resolution to 0.001 mm or 0.0001 in. for single element transducers with a frequency $\geq 2.25$ MHz.
<b>OXIDE LAYER</b> (see “Oxide Layer Software Option” on page 93)	Allows the 38DL PLUS to measure the thickness of both the boiler tube and its internal oxide.
<b>MULTI-MEASUREMENT</b> (see “Multi-Measurement Software Option” on page 99)	Allows the 38DL PLUS to measure and display up to four different layer thicknesses at the same time using single element transducers.
<b>HIGH PENETRATION</b> (see “High Penetration Software Option” on page 111)	Allows the 38DL PLUS to use low-frequency single element transducers (as low as 0.5 MHz) for thickness measurement in attenuating and sound scattering materials.

When you purchase a software option with the original 38DL PLUS order, the option is already activated. You can also purchase software options later. You can activate the software options without having to return the instrument to the factory, by entering an activation code in the instrument (see “Activating Software Options” on page 92).

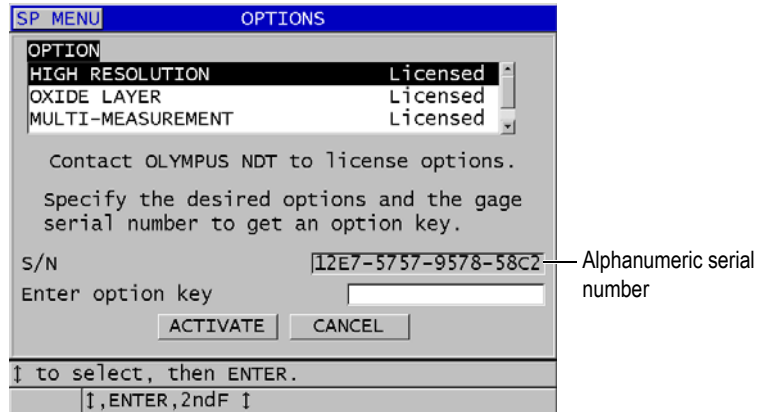
Contact your local Olympus representative for more information regarding ordering software options. Refer to Table 42 on page 285 for the software option part numbers.

## 7.1 Activating Software Options

Each 38DL PLUS has a unique serial number code. An option key provided for a specific 38DL PLUS activates the purchased software options only on that specific 38DL PLUS unit. A single option key can activate one, several, or all software options.

### To activate a software option

1. Press [2nd F], [SETUP MENU] (SP MENU).
2. In the menu, select **OPTIONS**.
3. In the **OPTIONS** screen (see Figure 7-1 on page 92), note the 16-digit alphanumeric serial number appearing in the **S/N** field.  
The **OPTION** list indicates the actual status of the software options where **Licensed** means that the option is activated.



**Figure 7-1 The OPTIONS screen to activate software options**

4. Contact your local Olympus representative to purchase one or more software options and provide the alphanumeric serial number.  
Your Olympus representative will provide you the corresponding option key.
5. In the **OPTIONS** screen (see Figure 7-1 on page 92):
  - a) In **Enter option key**, enter the option key that you received from the Olympus representative.
  - b) Select **ACTIVATE**.



- Restart the instrument to complete the activation.

## 7.2 High Resolution Software Option

The 38DL PLUS has the ability to display thickness values with its standard resolution of 0.01 mm (0.001 in.) and low resolution of 0.1 mm (0.01 in.). These resolutions are adequate for most ultrasonic thickness measurement applications.

For single element transducers, the high resolution software option adds the ability to display thickness readings with a high resolution of 0.001 mm (0.0001 in.). High resolution is not available for all transducers or measurement screens and is also limited by maximum thickness. Even though the 38DL PLUS has the ability to display thickness readings in high resolution, the measurement accuracy is highly dependent on material, geometry, surface condition, temperature, and needs to be determined on a case-by-case sample evaluation.

High resolution is available for the following transducers and measurement conditions:

- Single element transducer in the frequency range of 2.25 MHz to 30.0 MHz
- Thickness measurement below 100 mm (4.00 in.)

High resolution is not available for the following transducer or measurement conditions:

- Dual element transducers
- Low-frequency transducers with frequency below 2.25 MHz
- Thickness ranges over 100 mm (4.00 in.)

Once activated the high resolution selection appears in the resolution selection list (see “Changing the Thickness Resolution” on page 61).

## 7.3 Oxide Layer Software Option

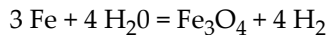
The oxide layer software option allows the 38DL PLUS to measure the thickness of both the boiler tube and its internal oxide at the same time. When the oxide layer option is activated, the **OXIDE** item appears in the menu when you press [SETUP MENU]. Table 5 on page 94 indicates the transducer to use when using the oxide layer software option.

**Table 5 Oxide layer transducers**

Transducer	Minimum internal scale thickness
M2017 [U8415002]	0.254 mm (0.010 in.)
M2091 [U8415018] normal incident shear	0.152 mm (0.006 in.)

### 7.3.1 Steam Boiler Tube Scale

The very high temperatures found inside steam boilers (over 500 °C or 1000 °F) can cause the formation of magnetite (a specific type of hard and brittle iron oxide), on the inside and outside surfaces of steel boiler tubes. At very high temperatures, water vapor reacts with the iron in the steel to form magnetite and hydrogen, according to the following formula:



The speed of this reaction increases with temperature. Oxygen atoms diffuse inward through the magnetite layer, and iron atoms diffuse outward, so that scale continues to grow even after the tube surface is completely covered.

Magnetite scale acts as a thermal insulation on the pipe, since the thermal conductivity of the scale is approximately 3 % of that of steel. When heat no longer radiates efficiently from the flame through the tube and into the steam within, the tube wall heats to temperatures beyond intended operating range. Long term exposure to overly high temperatures, combined with the very high pressure inside the tube, leads to intergranular micro-cracking in the metal and to creep deformation (slow swelling or bulging of the metal). This eventually leads to tube failure.

The growth of magnetite scale and associated metal damage are primary limiting factors for boiler tube service life. The process begins slowly and then accelerates. As the scale grows thicker, the tube wall becomes hotter, which in turn increases the rate of both scale growth and metal damage. Studies in the power generation industry indicate that the effect of scale is relatively insignificant up to thicknesses of approximately 0.3 mm (0.012 in.). Beyond that thickness, the negative effects of scale increase rapidly. Measurement of scale thickness allows a plant operator to estimate remaining tube service life and to identify and replace tubes that are approaching the failure point. Ultrasonic testing with the 38DL PLUS provides a quick and nondestructive method for measuring scale.

## 7.3.2 Setting Up for Oxide Layer Measurement

You need to connect an appropriate transducer, select the corresponding default setup, and configure the oxide and material measurement parameters.

### To set up for oxide layer measurement

1. Connect the M2017 or M2091 transducer to an LCM-74-4 cable.
2. Connect the cable to the T/R 1 single-element transducer connector at the top of the 38DL PLUS.
3. Press **[ON/OFF]** to start the instrument.
4. While in the measurement screen, press **[XDCR RECALL]**.
5. In the **DEFAULT SINGLE ELEMENT** screen, highlight **DEF-OXIDE/M2017** or **DEF-OXIDE/M2091** depending on which transducer you are using.
6. Press **[MEAS]**.
7. Press **[SETUP MENU]**.
8. In the menu, select **OXIDE**.
9. In the **OXIDE** screen (see Figure 7-2 on page 95):
  - a) In **OXIDE MEAS TYPE**, select the type of measurement for the oxide layer (**THICKNESS** or **TIME OF FLIGHT**).
  - b) In **MATERIAL MEAS TYPE**, select the type of measurement for the material layer.

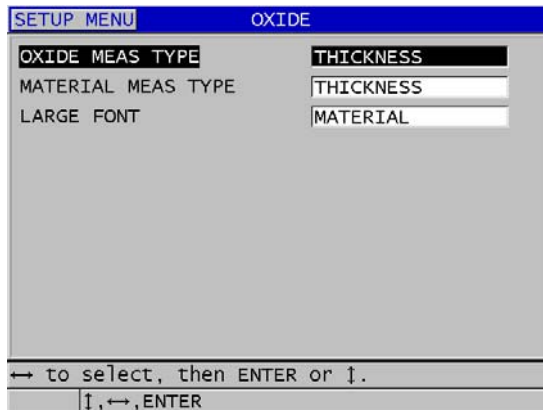
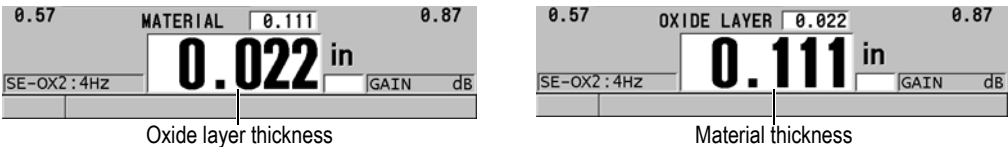


Figure 7-2 The OXIDE screen

- c) In **LARGE FONT**, select which measurement appears in the larger font in the measurement screen (see Figure 7-3 on page 96).



**Figure 7-3 Selecting which measurement appears with the larger font**

10. Press **[MEAS]** to return to the measurement screen that is now showing both the **MATERIAL** and the **OXIDE LAYER** measurements.

### 7.3.3 Calibrating for Oxide Layer Measurement

For the best accuracy, perform the material sound velocity and zero calibrations on oxide-free samples with known boiler tube thickness and on a sample with known internal oxide scale thickness.

#### To calibrate for oxide layer measurements

1. Couple the transducer to the thick oxide-free boiler tube sample.

---

**NOTE**

When using the M2091 normal incident shear transducer, you must use shear wave couplant (SWC) between the delay line and the surface of the material

---

2. Press **[CAL VEL]**.
  3. When the reading is stable, press **[ENTER]**.
  4. Using the arrow keys, edit the thickness value to match the known thickness of the thick sample.
  5. Couple the transducer to the thin oxide-free boiler tube sample.
  6. Press **[CAL ZERO]**.
  7. When the reading is stable, press **[ENTER]**.
  8. Using the arrow keys, edit the thickness value to match the known thickness of the thin sample.
-

9. Press [CAL VEL] again.
10. Couple the transducer to the sample with known internal oxide thickness.
11. When the reading is stable, press [ENTER].
12. Using the arrow keys, edit the thickness value to match the known internal oxide thickness.
13. Press [MEAS] to complete the calibration.

### 7.3.4 Measuring Boiler Tube and Oxide Layer Thicknesses

With the oxide layer software option, the 38DL PLUS simultaneously measures the thickness of the boiler tube metal and the thickness of oxide scale that has built up inside the tube.

Figure 7-4 on page 97 shows the correct ultrasonic signals using the single element transducer default setup DEF-OXIDE/M2017. The 38DL PLUS makes a standard mode 2 measurement from the delay line echo (surface of the boiler tube) to the echo from the inside of the oxide layer (total back-wall echo). The instrument centers the data window on the detected total back-wall echo and then searches for the steel/oxide interface echo in the data window. An oxide echo marker indicates the detected steel/oxide interface echo.

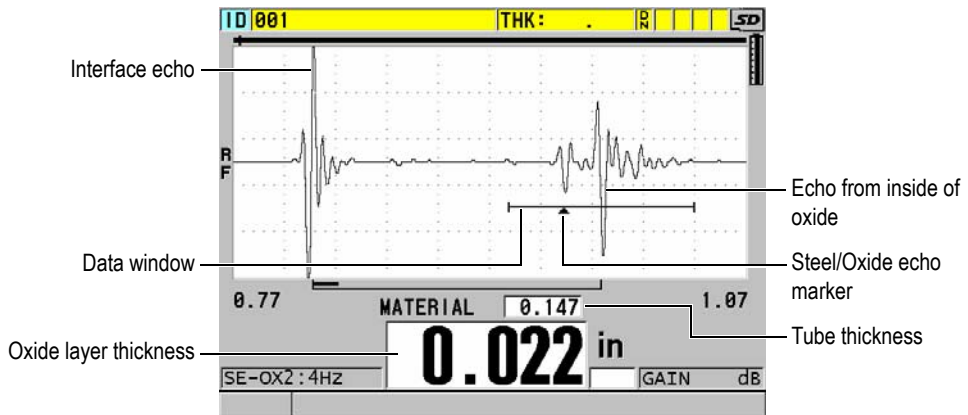


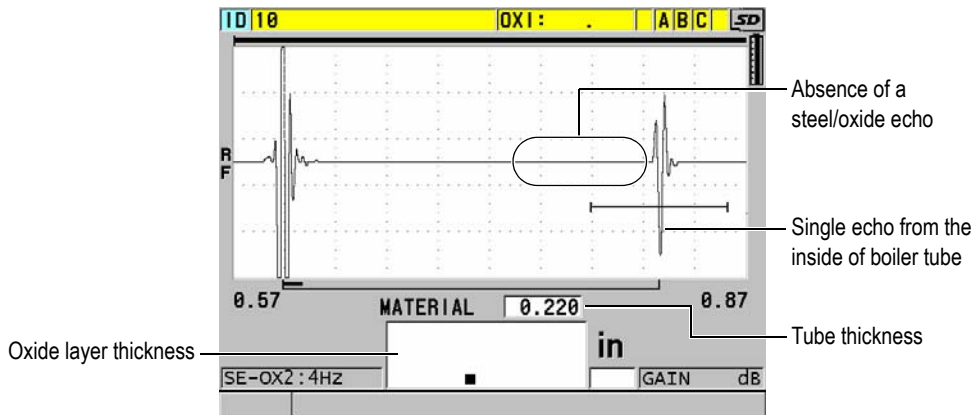
Figure 7-4 Measurement screen with the oxide layer software option

**NOTE**

To achieve accurate boiler tube and internal oxide scale thickness readings, remove any oxide scale or coating from the external surface of the boiler tube.

The minimum internal oxide thickness that the 38DL PLUS can measure depends on the material sound velocity but is approximately 0.254 mm (0.010 in.) with the M2017 transducer or 0.152 mm (0.006 in.) with the M2091 transducer. The 38DL PLUS only displays the thickness of the steel boiler tube when the internal oxide scale thickness is below the minimum measurement capability or when it is exfoliated (disbonded) from the inside of the boiler tube.

Figure 7-5 on page 98 shows a waveform from a sample in which the internal oxide layer is disbonded from the boiler tube. Because the oxide is disbonded, sound energy does not travel into the internal oxide layer, and only a single reflected echo from the inside of the boiler tube appears. When the internal oxide is thinner than 0.25 mm (0.010 in.), the waveform looks almost identical. The steel/oxide interface is so close in time to the echo from the inside of the oxide that it cannot be separated from the total back-wall echo and will produce a single echo.



**Figure 7-5 Measurement screen for a disbonded oxide layer**

## 7.4 Multi-Measurement Software Option

The multi-measurement software option allows the 38DL PLUS to measure and display the individual thickness of up to four layers of multilayer materials. You can combine this function with the barrier layer thickness mode to measure the thickness of barrier layers in multilayer plastic containers. You can save the measured values to the internal datalogger or send them to a computer.

Multi-measurement common applications are:

- Multilayer plastic fuel tanks
- Multilayer plastic bottle preforms
- Multilayer aircraft windows
- Contact lenses: radius of curvature and thickness calculation
- Co-extruded plastic
- Two-layer hot tubs and spas

The 38DL PLUS has three different multi-measurement modes:

### **NORMAL**

Measures and displays up to four different thickness layers or three layers and the sum of any selected layers.

### **SOFT CONTACT**

Displays sagittal height and lens thickness, and calculates the radius of curvature of soft contact lenses. This mode is designed specifically for the measurement of soft contact lenses.

### **% TOTAL THK**

Displays the thickness of any layer as a percentage of the total thickness. Use this mode for barrier layer measurement applications.

---

<b>IMPORTANT</b>
------------------

Before you can use the multi-measurement function with the **NORMAL** and the **% TOTAL THK** modes, you must create and save a custom setup for each thickness layer that you want to include in the multi-measurement. Refer to “Dual Element

Transducer Setups” on page 211 for information about creating custom setups. All custom setups included in the multi-measurement configuration must use the same **PROBE TYPE**.

## 7.4.1 Active Measurement

With the multi-measurement, one of the displayed measurement is the active measurement. The value of the active measurement is highlighted and is repeated at the bottom of the screen. The corresponding waveform appears in the waveform display (see Figure 7-6 on page 100).

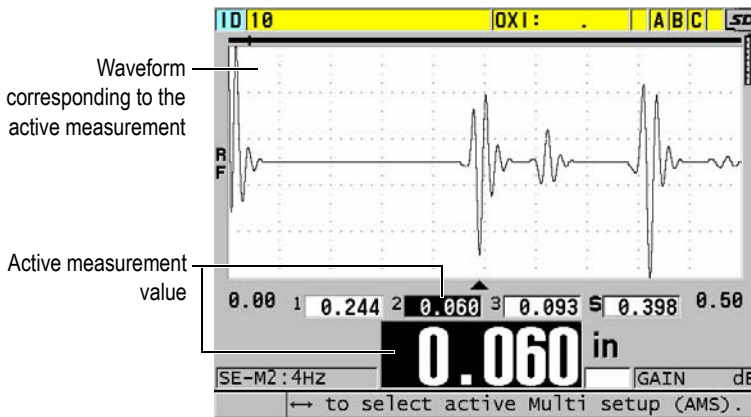


Figure 7-6 Waveform display screen

### To change the active measurement

1. Enable the multi-measurement mode (see “Using the Multi-Measurement with the Soft Contact Mode” on page 102).
2. Use the arrows keys to change the active measurement.

## 7.4.2 Using the Multi-Measurement Normal Mode

Use the multi-measurement normal mode unless you want to show thickness values as a percentage of the total thickness or when you want to inspect soft contact lenses.



## To use the multi-measurement normal mode

1. Create and store a custom setup to measure the thickness of each individual layer (see “Dual Element Transducer Setups” on page 211).
2. Ensure that the multi-measurement software option is activated (see “Activating Software Options” on page 92).
3. Press [SETUP MENU].
4. In the menu, select **MULTI**.
5. In the **MULTI** screen (see Figure 7-7 on page 101):
  - a) Set **MULTI ENABLE** to **ON**.

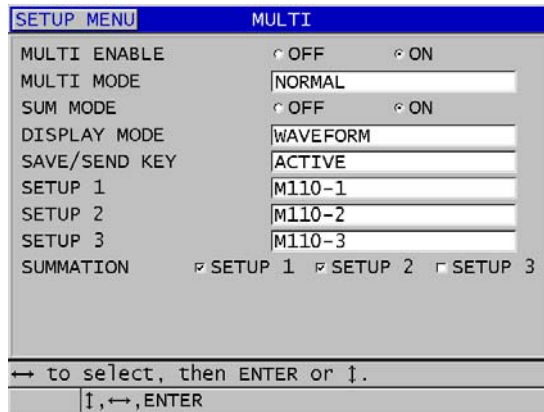
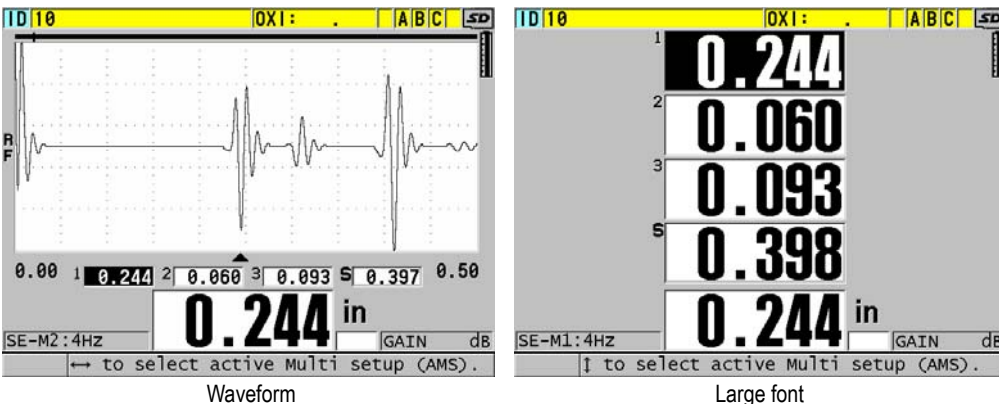


Figure 7-7 Setting multi-measurement parameters in the normal mode

- b) Set **MULTI MODE** to **NORMAL**.
- c) Set **SUM MODE** to one of the following options:
  - **ON**: Measures and displays up to three individual layer thicknesses and calculates and displays the sum of thicknesses for selected layers.
  - **OFF**: Measures and displays up to four individual layer thicknesses.
- d) Set **DISPLAY MODE** to (see Figure 7-8 on page 102):
  - **WAVEFORM** to display the multiple measurements horizontally below the waveform display.
  - **LARGE FONT** to display the multiple measurements vertically using large fonts.



**Figure 7-8 Multi-measurement display modes with three layers and the sum**

- e) Set **SAVE/SEND KEY** to one of the following options to determine the operation when you press **[SAVE/SEND]**:
  - **ACTIVE**: Saves only the active measurement (the highlighted thickness) to the datalogger.
  - **AUTO-INCR ACTIVE**: Saves the active measurement to the datalogger, and then changes the active setup to the next setup in the multi-measurement list. This option allows you to easily save all multilayer measurement by repeatedly pressing **[SAVE/SEND]**.
- f) For **SETUP 1**, **SETUP 2**, **SETUP 3**, and **SETUP 4**, select the custom setups that you created in step 1 for each of the layers. Selecting **NONE** shows no thickness at the location.
- g) When **SUM MODE** is set to **ON**, in **SUMMATION**, select the setups for which you want to sum the thickness measurements.
- h) Press **[MEAS]** to return to the measurement screen with the multi-measurement function active in the normal mode.

### 7.4.3 Using the Multi-Measurement with the Soft Contact Mode

Before you can use the multi-measurement function, you must create and save custom setups for the sagittal height and the lens thickness measurement. The 38DL PLUS calculates the radius of curvature using the sagittal height value and the diameter of the pedestal that you enter.

---

## To use the multi-measurement with the soft contact mode

1. Create and store custom setups for the sagittal height and lens thickness measurements (see “Creating a Setup for Nonstandard Dual Element Transducers” on page 212).
2. Ensure that the multi-measurement software option is activated (see “Activating Software Options” on page 92).
3. Press **[SETUP MENU]**.
4. In the menu, select **MULTI**.
5. In the **MULTI** screen (see Figure 7-9 on page 104):
  - a) Set **MULTI ENABLE** to **ON**.
  - b) Set **MULTI MODE** to **SOFT CONTACT**.
  - c) Set **DISPLAY MODE** to **WAVEFORM** or **LARGE FONT** (see Figure 7-8 on page 102).
  - d) Set **SAVE/SEND KEY** to one of the following options to determine the operation when you press **[SAVE/SEND]**:
    - **ACTIVE**: Saves only the active measurement (the highlighted thickness) to the datalogger.
    - **AUTO-INCR ACTIVE**: Saves the active measurement to the datalogger, and then changes the active setup to the next setup in the multi-measurement list. This option allows you to easily save all multilayer measurement by repeatedly pressing **[SAVE/SEND]**.
  - e) In **SGTTL HT**, select the custom setup for the sagittal height measurement.
  - f) In **LENS THK**, select the custom setup for the lens thickness measurement.
  - g) In **PDSTL DIA**, enter the diameter of the pedestal being used.
  - h) Press **[MEAS]** to return to the measurement screen with the multi-measurement function active in the soft contact mode.

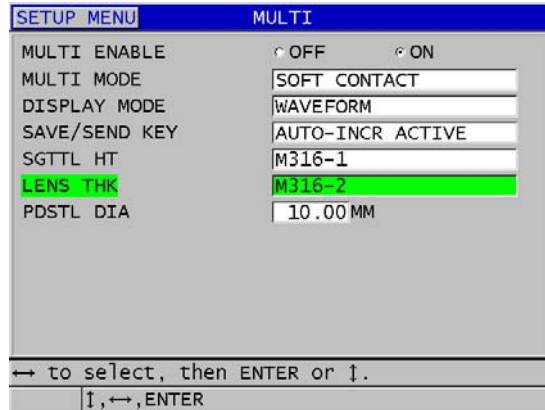


Figure 7-9 Setting multi-measurement parameters in the soft contact mode

#### 7.4.4 Using the Multi-Measurement % Total Thickness Mode

The multi-measurement % total thickness mode is very similar to the normal mode. The difference is that it can measure the thickness of up to three layers and show the thickness of one layer as a percentage of the sum of selected layers.

##### To use the multi-measurement % total thickness mode

1. Follow the procedure to use the multi-measurement normal mode (see “Using the Multi-Measurement Normal Mode” on page 100) except that you set **MULTI MODE** to **% TOTAL THICKNESS**.
2. In the **MULTI** screen (Figure 7-10 on page 105):
  - a) In **TOTAL**, select the setups for which you want to sum the thickness measurements.
  - b) In **SHOW TOTAL**, select **YES** to show the calculated total thickness on the display while the multi-measurement is active.
  - c) In **SHOW AS %**, select the setups for which you want to show the thickness measurement as a percentage of the total thickness.
  - d) Press **[MEAS]** to return to the measurement screen with the multi-measurement function active in the % total thickness mode.

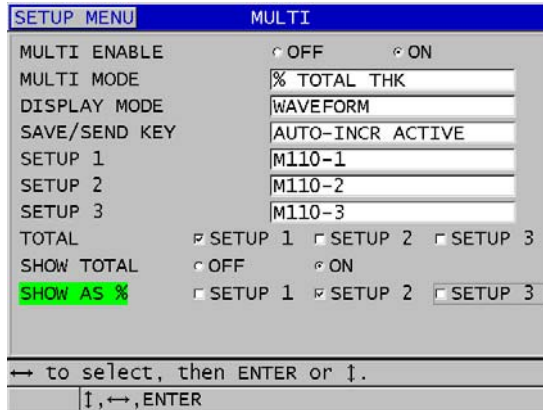


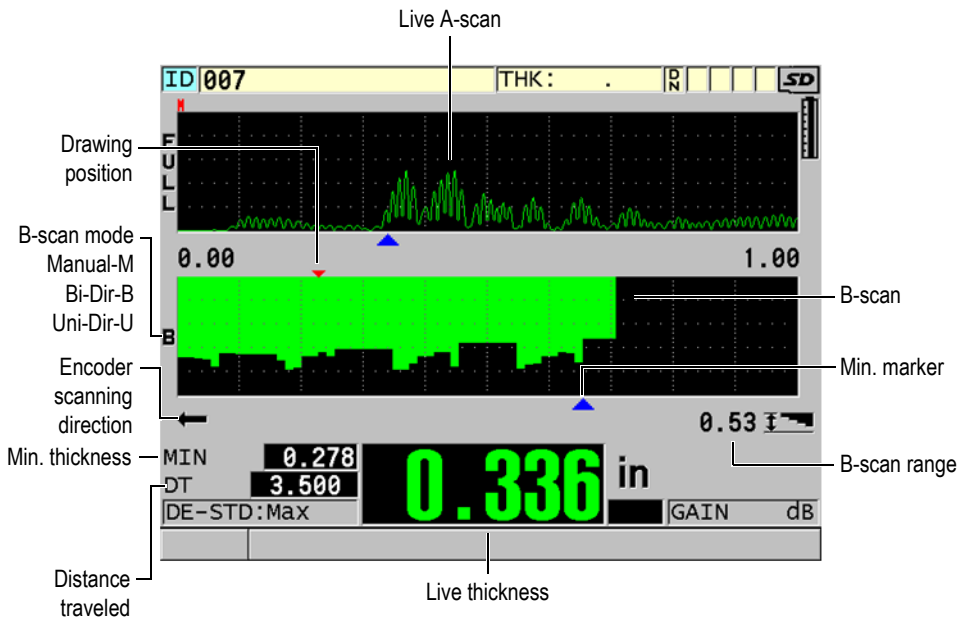
Figure 7-10 Setting multi-measurement parameters in the % total thickness mode

## 7.5 Encoded B-Scan Option

The 38DL PLUS standard software has the capability to save non-encoded B-scans. Non-encoded B-scans run at a fixed rate, and do not capture the distance traveled information with the scan. The Encoded B-Scan software option allows the 38DL PLUS to be connected to a linear encoder so that an encoded B-scan can be generated that captures the thickness and distance traveled in a linear B-scan. B-scans can be saved to the internal data logger, and uploaded to the GageView interface program.

The Encoded B-Scan option is designed to work with the Olympus B-Scan Encoder Buggy (part number EP4/ENC [U8780018]), but it can be connected to other linear encoders. Please contact Olympus for more information about connecting the 38DL PLUS encoded B-Scan to other encoders.

A maximum of 10000 thickness readings with distance traveled (DT) can be saved in a single B-scan. The B-scan also captures the minimum thickness location, in addition to the associated waveform for the minimum thickness. Saved B-scans can be reviewed on the 38DL PLUS, or transferred to the GageView interface program for review. The thickness and distance traveled data can be exported to Excel. The maximum number of B-scans that can be stored in the 38DL PLUS's internal memory is approximately 47 (10000 readings per scan).



**Figure 7-11 Encoded B-scan main screen**

The optional B-scan feature can be activated using a software key. Please contact Olympus to purchase the encoded B-scan feature.

In order to use the encoded B-scan feature you will need the following:

1. Encoded B-Scan software code (P/N: 38DLP-EBSCAN [U8147018])
2. B-Scan Encoder Buggy (P/N: EP4/ENC [U8780018])

#### NOTE

The EP4/ENC is designed to work with the D790 and D790-SM dual element transducers when the bell housing is not in place.

The D790 and D790-SM are not included with the EP4/ENC.

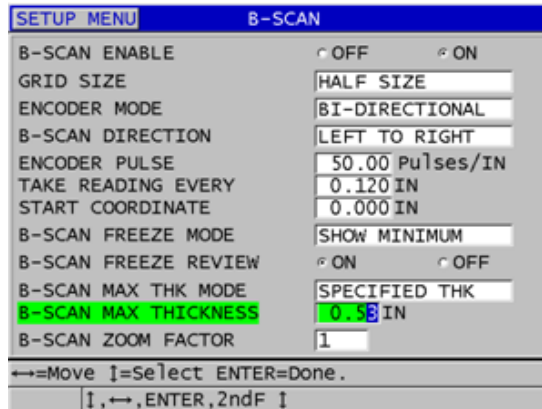
3. D790 or D790-SM transducer. Please contact Olympus for pricing on longer cables for the D790-SM transducer.

4. Encoder cable; this cable connects the EP4/ENC B-Scan Encoder Buggy to the combination 11 pin USB/RS-232/B-scan connector located on the top of the 38DL PLUS.

Select one of the following:

- 3.05 m (10 foot) encoder cable (P/N: 38DLP-ENC-CBL-10 [U8840168])
- 7.62 m (25 foot) encoder cable (P/N: 38DLP-ENC-CBL-25 [U8840169])
- 15.24 m (50 foot) encoder cable (P/N: 38DLP-ENC-CBL-50 [U8840170])
- 30.48 m (100 foot) encoder cable (P/N: 38DLP-ENC-CBL-100 [U8840171])

The Encoded B-scan can be activated and configured from the **B-SCAN** screen (see Figure 7-12 on page 107) by pressing **[SETUP MENU]**, and then selecting **B-SCAN** in the menu. Most of the controls for the encoded B-scan are the same as those for the standard non-encoded B-scan. Please refer to “B-Scan” on page 139 for more information concerning B-scan configuration.



**Figure 7-12 Changing B-scan parameters**

Additional configuration parameters for the Encoded B-Scan option are listed below.

#### ENCODER MODE

**MANUAL:** Time based no encoder.

**B-DIRECTIONAL:** The B-scan moves forward or backward with the encoder.

**UNI-DIRECTIONAL:** The B-scan moves forward only, regardless of whether the encoder moves forward or backward.

## ENCODER PULSE

The encoder pulse must be set in accordance with the encoder being used and its specifications. The Olympus EP4/ENC Encoder Buggy is always set to 1.97 pulses/mm or 50 pulses/in..

## TAKE READING EVERY

This indicates the spacing between measurements. There is fixed spacing based on the number of pulses per inch or per millimeter of the encoder.

---

<b>NOTE</b>
-------------

The smaller the spacing, the slower the maximum scan speed. Maximum scanning speed can be calculated as follows:

$$\text{Maximum scan speed} = 20 \times \text{Reading spacing}$$


---

Table 6 on page 108 provides sample scan-speed calculations.

**Table 6 Sample scan-speed calculations<sup>a</sup>**

Spacing (in.)	Max. scan speed (in./sec)	Spacing (mm)	Max. scan rate (mm/sec)
0.040 (min. spacing)	0.80	1.016 (min. spacing)	20
0.100	2.00	1.524	30
0.200	4.00	2.032	40
0.500	10.00	12.70	254

a. Maximum reading spacing is 595.38 mm (25 in.)

Maximum B-scan distance is also dependent on the reading spacing setting. The maximum B-scan length can be calculated as follows:

$$\text{Maximum scan distance} = \text{Reading spacing} \times 10000$$

Table 7 on page 109 provides sample maximum-distance calculations.



**Table 7 Sample maximum-distance calculations**

Spacing (in.)	Max. scan distance (ft)	Spacing (mm)	Max. scan distance (m)
0.040 (min. spacing)	33.3	1.016 (min. spacing)	10.1
0.060	50	1.524	15.2
0.100	83	2.032	20.3
0.200	166.6	2.540	25.4
0.500	416.6	12.70	127.0

**START COORDINATES**

Used to set the starting point for the distance traveled by the scan. This is generally set to 0.00, but can be used to define the start point for multiple B-scans.

**ZOOM FACTOR**

Used to set the number of vertical lines on the B-scan representing a single thickness reading.

A zoom factor of 1 indicated that every vertical line in the B-scan represents a single thickness reading. Setting the zoom factor to 1 yields a very compressed B-scan image (see Figure 7-13 on page 110).

A zoom factor of 10 indicates that 10 vertical lines in the B-scan represent a thickness reading. Setting the zoom factor to 10 yields an expanded B-scan (see Figure 7-14 on page 110 and Figure 7-15 on page 111).

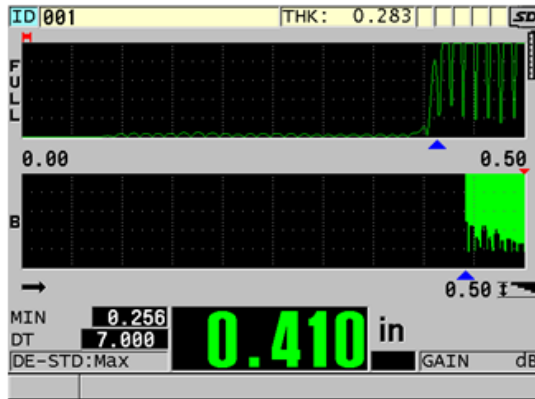


Figure 7-13 7 inch scan zoom set to 1



Figure 7-14 7 inch scan zoom set to 5

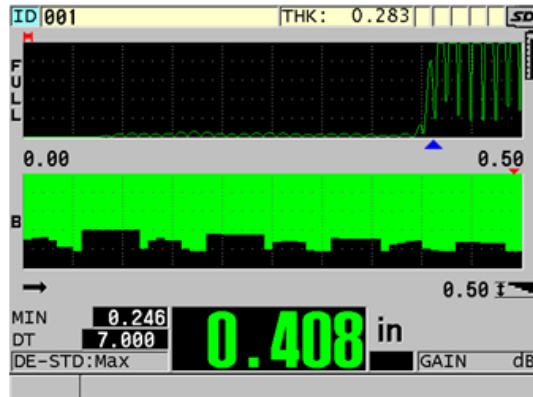


Figure 7-15 7 inch scan zoom set to 10

## 7.6 High Penetration Software Option

The 38DL PLUS high penetration software option coupled with low-frequency single element transducers (down to 0.5 MHz) allows you to make thickness, material sound velocity, and time of flight measurements, on materials such as composites, fiberglass, plastic, rubber, and cast metals that are difficult or impossible to measure using standard ultrasonic instruments. The M2008 [U8415001] transducer is a special low-frequency transducer used to measure the thickness of thick fiber reinforced polymer (FRP) and composite materials.

### NOTE

With a M2008 transducer only, press [2nd F], [CAL ZERO] (Do ZERO) at any time to auto-adjust the zero offset and compensate for temperature changes in the delay line.

### To use the high penetration software option with the M2008 transducer

1. Ensure that the high penetration software option is activated (see “Activating Software Options” on page 92 for details).
2. Connect the M2008 transducer to the T/R 1 and T/R 2 connectors at the top of the 38DL PLUS.

3. Press [**XDCR RECALL**].
4. In the menu, select **DEFAULT HP SINGLE ELEMENT**.
5. In the **DEFAULT HP SINGLE ELEMENT** screen, highlight the default transducer setup for the M2008 (**DEFP1-0.5-M2008**) or any custom setup that uses the M2008 transducer.
6. Press [**MEAS**] to return to the measurement screen with the recalled transducer setup.
7. Wipe couplant off the transducer tip.
8. Press [**2nd F**], [**CAL ZERO**] (**Do ZERO**).
9. Perform the material sound velocity and zero calibration (see “Calibrating the Instrument” on page 67).

## 8. Using Special Functions

This chapter describes how to use special 38DL PLUS functions and modes. The 38DL PLUS has many thickness measurement features. Although the features outlined in this section are not required for basic thickness operation, they can make the gage a more versatile instrument.

### 8.1 Activating and Configuring a Differential Mode

The 38DL PLUS includes differential modes to easily compare the actual measurement with a reference value that you enter. The actual thickness measurement appears on the thickness display and the differential value appears in the differential display area (see Figure 8-1 on page 113).

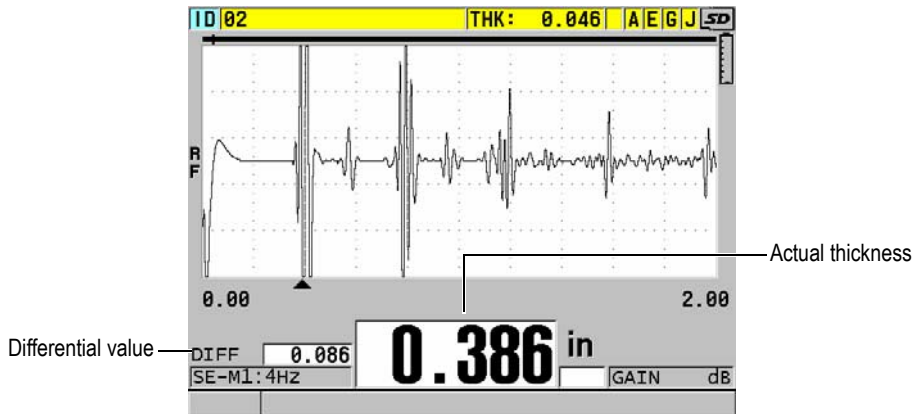


Figure 8-1 Normal differential mode

The units and resolution of the differential thickness are the same as those selected for the thickness measurement.

When you press [SAVE/SEND] while in **NORMAL** or **% RATIO** differential modes, the 38DL PLUS saves the actual thickness value along with the “D” flag, indicating that the **Differential** mode is active.

### To activate and configure a differential mode

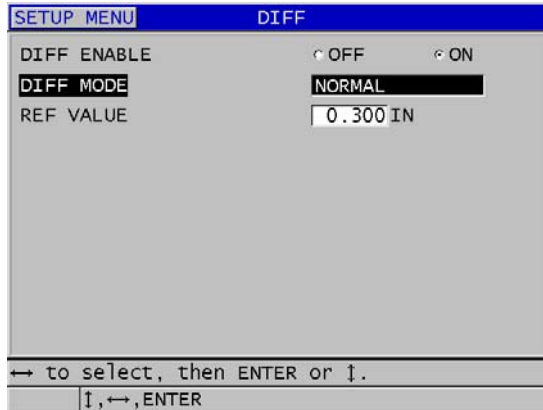
1. While in the measurement screen, press [SETUP MENU].
2. In the menu, select **DIFF**.
3. In the **DIFF** screen (see Figure 8-2 on page 115):
  - a) Set **DIFF ENABLE** to **ON** to activate the differential function.
  - b) In **DIFF MODE**, select one of the three differential modes:
    - **NORMAL**: Shows the actual thickness along with the difference between the actual thickness measurement and the **REF VALUE** that you entered.

$$\text{Differential}_{Normal} = \text{Current thickness} - \text{Reference value}$$

- **% RATIO**: Shows the actual thickness along with the percent difference from the **REF VALUE** that you entered.

$$\text{Differential}_{\% \text{ Ratio}} = \frac{\text{Current thickness} - \text{Reference value}}{\text{Reference value}} \times 100$$

- **REDUCTION RT**: Shows the actual thickness as well as the percent difference between the actual thickness and the former value. The former value is the thickness of the metal prior to the bending process. Use this mode for metal bending or other application in which you need to track the percentage of wall thinning.
- c) When **DIFF MODE** is set to **NORMAL** or **% RATIO**, in **REF VALUE**, enter the reference value.



**Figure 8-2 The DIFF screen**

When **DIFF MODE** is set to **REDUCTION RT** only:

- d) In **FORMER THICKNESS**, enter the original thickness value, as measured before bending the metal.
  - e) In **LARGE FONT**, select which measurement appears at the bottom of the measurement screen with the large font (**THICKNESS** or **REDUCTION RT**).
4. Press **[MEAS]** to return to the measurement screen with the displayed differential value.

## 8.2 Using the Minimum, Maximum, or Min/Max Thickness Mode

You can activate the minimum, maximum, or min/max thickness mode to also display retained minimum and/or maximum thickness values. The **MIN** and/or **MAX** values appear on the left side of the main thickness reading (see Figure 8-3 on page 116). The minimum or maximum thickness value replaces the main thickness display when the transducer is uncoupled or when a loss-of-signal (LOS) occurs. The replacing value appears with outlined digits.

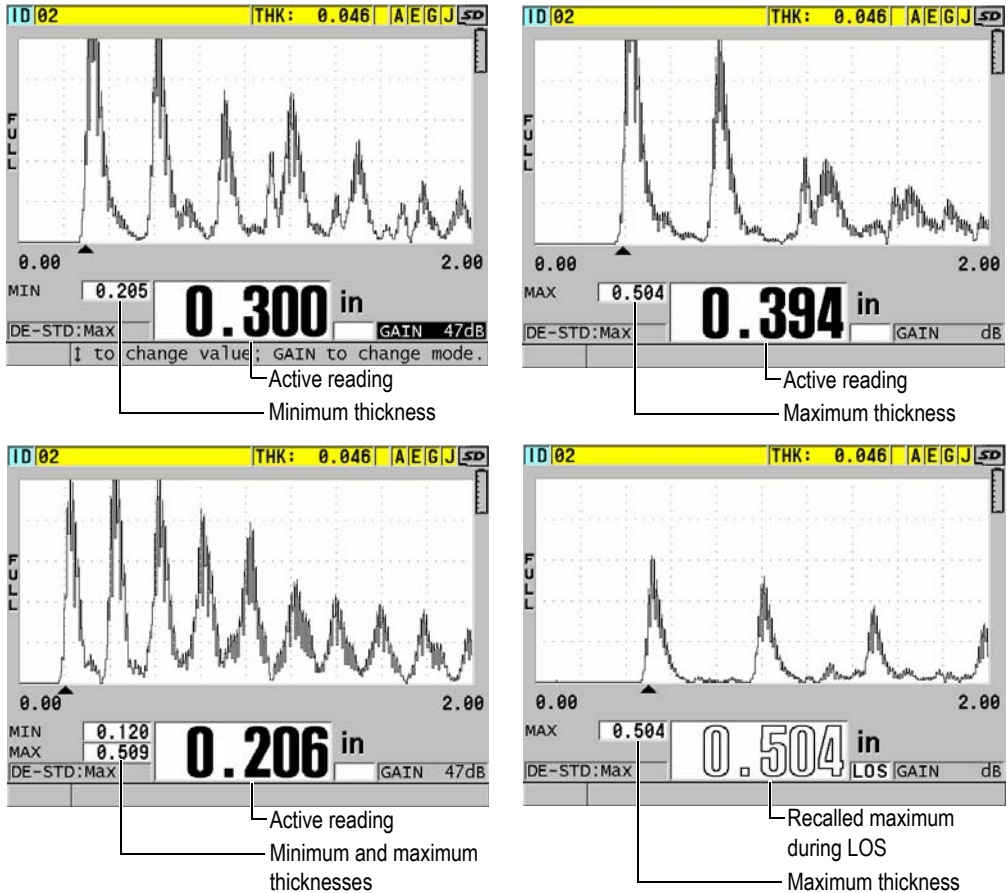


Figure 8-3 Displaying the minimum and/or maximum thickness

**NOTE**

The fastest display update rate is automatically activated when entering the minimum or maximum thickness mode. When leaving the mode, the display update rate is restored to its previous state.



The minimum and maximum thickness modes respectively display the smallest and largest thickness measured value from the time you activate the minimum mode or from the time you reset it. The modes are useful when it is important to determine the thinnest/thickest reading obtained while making a series of readings on a test piece.

### To activate the minimum, maximum, or min/max mode

1. From the measurement screen, press **[SETUP MENU]**.
2. In the menu, select **MEAS**.
3. In the **MEAS** screen, set **MIN/MAX** to the desired mode (**OFF**, **MIN**, **MAX**, or **BOTH**).
4. Press **[MEAS]** to return to the measurement screen.
5. In the measurement screen, press **[MEAS]** again to reset the held minimum, maximum, or min/max values.  
The thickness display will blank indicating that the old **MIN/MAX** value is reset. Saving or sending a **MIN/MAX** reading also resets the value.

## 8.3 Preventing False Minimum/Maximum Thickness Readings

A false minimum or maximum reading can occur when you lift the transducer from the test piece. This is due to excess couplant, particularly on smooth surfaces, which causes the instrument to read the thickness of a couplant drop when you lift the transducer.

### To prevent false minimum/maximum thickness readings

1. Activate the minimum or maximum thickness mode (see “Using the Minimum, Maximum, or Min/Max Thickness Mode” on page 115).
2. Before uncoupling the transducer, press **[FREEZE]** to freeze the waveform.
3. Once the transducer is uncoupled, press **[FREEZE]** again to unfreeze the display and recall the minimum thickness and waveform.

## 8.4 Using Alarms

You can activate one of the 38DL PLUS alarm modes to help you identify when the actual thickness measurement is above or below editable reference values.

When an alarm condition occurs, the 38DL PLUS warns you as follows:

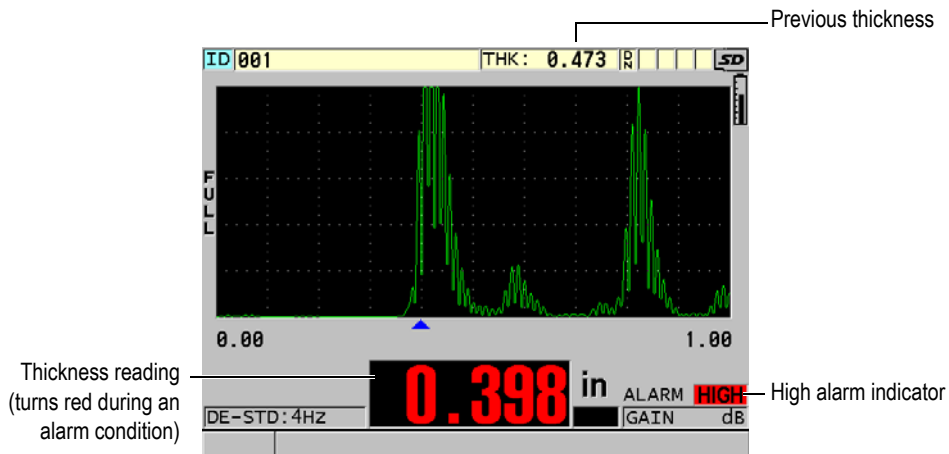
- The **HIGH** or **LOW** alarm indicator flashes with a red background at the bottom right corner of the measurement screen (see Figure 8-4 on page 118).
- The thickness value appears in red.
- When the beeper is active (see “Setting the User Interface Language and Other System Options” on page 49), the 38DL PLUS emits a long beep.

---

**NOTE**

The thickness value and alarm indicator appear in color only when the indoor color scheme is active (see “Color Schemes” on page 52 to change the color scheme).

---



**Figure 8-4 Example of a HIGH alarm indicator**

The datalogger records an alarm condition in the second status box for all stored measurements. An **A** indicates the alarm mode, an **L** indicates a low alarm condition, and an **H** indicates a high alarm condition.

There are four different alarm modes (**STANDARD**, **PREVIOUS THK**, **B-SCAN**, and **REDUCTION RT**):

## STANDARD

The standard alarm warns you when the actual measured thickness is below a low reference value or above a high reference value. The reference values are thickness set points using the current instrument units and resolution.

## PREVIOUS THK

To use this function, you must first open a previously stored inspection file. The alarm uses the previous thickness value as its reference when determining if the actual thickness is in a high or low alarm condition. The previous thickness alarm warns you when the actual measured thickness is outside the alarm reference values when compared to the previous thickness value at each ID location within the file.

You can choose the **ABSOLUTE DIFF** (differential) mode to set the following parameters:

- When the thickness differential is smaller than or equal to the **ABSOLUTE LOSS** value, a low alarm is indicated.
- When the thickness differential is greater than the **ABSOLUTE GROWTH** value, a high alarm is indicated.

Table 8 on page 119 shows the result for an example where both **ABSOLUTE LOSS** and **ABSOLUTE GROWTH** are set to **1.27 mm (0.05 in.)**.

**Table 8 Alarm calculation example with the ABSOLUTE DIFF mode**

Previous values	Actual thickness	Low alarm	High alarm	Calculations
7.62 mm (0.300 in.)	6.07 mm (0.239 in.)	Yes	No	$7.62 - 6.07 > 1.27$ mm ( $0.300 - 0.239 > 0.050$ in.)
7.62 mm (0.300 in.)	8.03 mm (0.316 in.)	No	Yes	$8.03 - 7.62 > 0.127$ mm ( $0.316 - 0.300 > 0.005$ in.)
7.62 mm (0.300 in.)	7.24 mm (0.285 in.)	No	No	$7.62 - 7.24 < 0.127$ mm ( $0.300 - 0.285 < 0.050$ in.)
7.62 mm (0.300 in.)	7.67 mm (0.302 in.)	No	No	$7.67 - 7.62 < 0.127$ mm ( $0.302 - 0.300 < 0.005$ in.)

You can also choose the **% DIFF** (differential) mode to set the following parameters:

- When the thickness differential is smaller than or equal to the **% LOSS** value, a low alarm is indicated.

- When the thickness differential is greater than the % **GROWTH** value, a high alarm is indicated.

Table 9 on page 120 shows the result for an example where both % **LOSS** is set to 20 % and % **GROWTH** is set to 5 %.

**Table 9 Alarm calculation example with the % DIFF mode**

Previous values	Actual thickness	Low alarm	High alarm	Calculations
7.62 mm (0.300 in.)	6.07 mm (0.239 in.)	Yes	No	$\frac{7.62 - 6.07}{7.62} \times 100 > 20\%$ <p>or in inches:</p> $\frac{0.300 - 0.239}{0.300} \times 100 > 20\%$
7.62 mm (0.300 in.)	8.03 mm (0.316 in.)	No	Yes	$\frac{8.03 - 7.62}{7.62} \times 100 > 5\%$ <p>or in inches:</p> $\frac{0.316 - 0.300}{0.300} \times 100 > 5\%$
7.62 mm (0.300 in.)	7.24 mm (0.285 in.)	No	No	$\frac{7.62 - 7.24}{7.62} \times 100 < 20\%$ <p>or in inches:</p> $\frac{0.300 - 0.285}{0.300} \times 100 < 20\%$
7.62 mm (0.300 in.)	7.67 mm (0.302 in.)	No	No	$\frac{7.67 - 7.62}{7.62} \times 100 < 5\%$ <p>or in inches:</p> $\frac{0.302 - 0.300}{0.300} \times 100 < 5\%$

## B-SCAN

The B-scan alarm mode is similar to the standard alarm mode except that in the B-scan alarm mode, lines are shown in the B-scan grid when the reference values fall within the B-scan thickness range (see Figure 8-5 on page 121). In addition, the alarms are operational as you review B-scan thicknesses in B-scan freeze review mode.

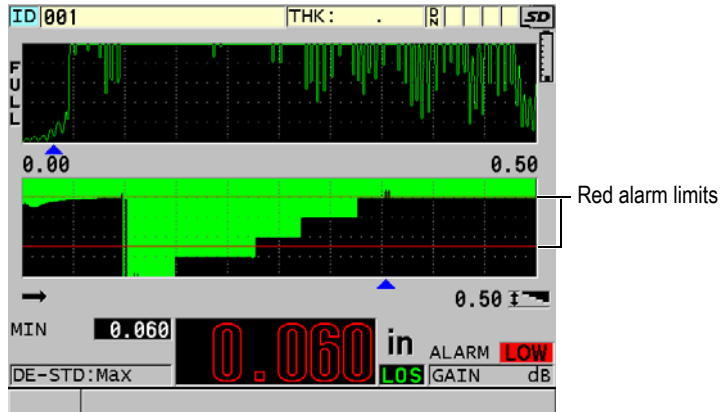


Figure 8-5 Example of a B-scan alarm mode

#### NOTE

The thickness value and the alarm indicator appear in color only when the indoor color scheme is active (see “Color Schemes” on page 52 to change the color scheme).

#### REDUCTION RT

The **REDUCTION RT** option appears only when the active file is configured with **FILE DATA MODE** set to **REDUCTION RT**. You set the reduction percentage for a low (**YELLOW ALARM**) and high (**RED ALARM**) limits, and the instrument displays (see Figure 8-6 on page 122):

- The **RED** indicator for reduction rates that are greater than or equal to the **RED ALARM** value.
- The **YEL** indicator for reduction rates that are between the **YELLOW ALARM** and the **RED ALARM** values.
- The **GRN** indicator for reduction rates that are below the **YELLOW ALARM** value.

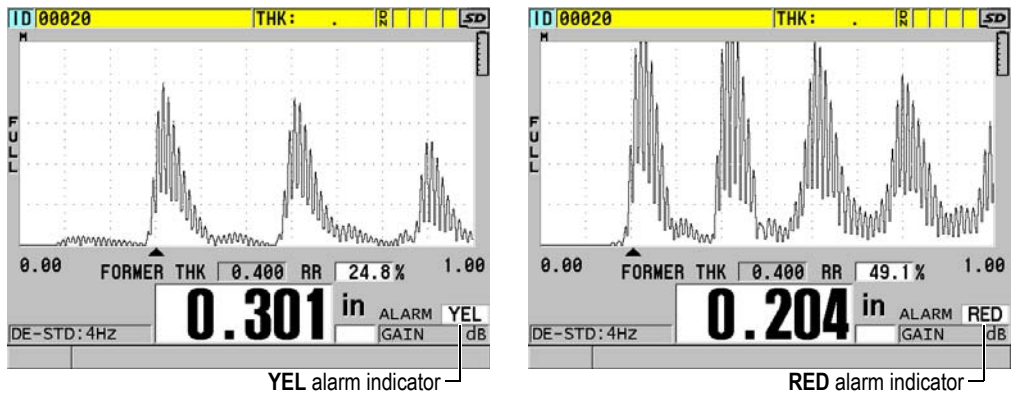


Figure 8-6 YEL (yellow) and RED alarm indicators

### To set the alarm

1. From the measurement screen, press [SETUP MENU].
2. In the menu, select **ALARM**.
3. In the **ALARM** screen (see Figure 8-7 on page 123):
  - a) Set **ALARM ENABLE** to **ON** to activate the alarm function.
  - b) In **ALARM MODE**, select the desired alarm mode (**STANDARD**, **PREVIOUS THK** [previous thickness], **B-SCAN**, or **REDUCTION RT** [reduction rate]).  
The other parameters vary depending on the alarm mode selection.

#### NOTE

The **B-SCAN** option appears only when the B-scan mode is active (see “Using the B-Scan” on page 144).

The **REDUCTION RT** option appears only when the active file is configured with the **FILE DATA MODE** parameter set to **REDUCTION RT** (see “File Data Modes” on page 182).

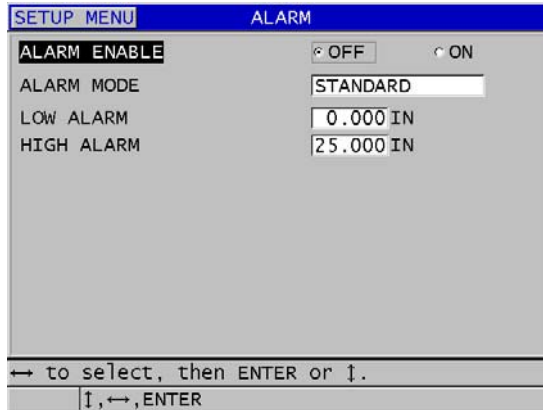


Figure 8-7 Setting up the STANDARD alarm

4. When **ALARM MODE** is set to **STANDARD** or **B-SCAN**, set the **LOW ALARM** and the **HIGH ALARM** values.

OR

When **ALARM MODE** is set to **PREVIOUS THK**:

- a) With **PREVIOUS THK MODE** set to **ABSOLUTE DIFF** [absolute differential], set the **ABSOLUTE LOSS** and the **ABSOLUTE GROWTH** values.
- b) With **PREVIOUS THK MODE** set to **% DIFF** [percent differential], set the **% LOSS** and the **% GROWTH** values.

OR

When **ALARM MODE** is set to **REDUCTION RT**, set the **YELLOW ALARM** and the **RED ALARM** values.

5. Press **[MEAS]** to return to the measurement screen.

#### NOTE

Alarm reference values that were entered in one unit system are displayed as the equivalent value when the alternate units are selected.

## 8.5 Locking the Instrument

The 38DL PLUS offers an instrument lock allowing a supervisor to restrict access to selected functions. The supervisor can also enter a password to prevent other users from unlocking the functions. Once a password has been set, you must reenter the password before you can lock or unlock any function.

You can lock the following functions:

- Calibration with [CAL VEL] and [CAL ZERO] ([2nd F], [CAL ZERO] (Do ZERO) still available)
- Setup menus accessed with [SETUP MENU] and [SP MENU]
- Transducer setup recall with [XDCR RECALL]
- Datalogger operations (except [SAVE/SEND])
- Gain adjustment with [GAIN]
- Waveform adjustment with [WAVE ADJ]

Locking the calibration prevents changes to calibration values so that no parameters can affect the value of the measurement; these include material velocity and test block zero calibration. However, you can still view these values, use the measurement screen, and use the datalogger functions.

Anytime a user attempts to use a locked function, a message appears in the help bar to indicate that the function is locked (see Figure 8-8 on page 124).



**Figure 8-8 Example of a locked function message in the help bar**

### To set the password

1. From the measurement screen, press [SETUP MENU].
2. In the menu, select **PASSWORD SET**.
3. In the **PASSWORD SET** screen, in **INSTRUMENT PASSWORD**, enter your password using up to eight alphanumeric characters.



**IMPORTANT**

If you forget the password, you can unlock the instrument and deactivate the password by entering the master password "OLY38DLP".

When you want to change the password, you must first use the master password to deactivate the password, and then set a new password.

4. Select **SET** to set the password and return to the measurement screen.

**To lock and unlock instrument functions**

1. From the measurement screen, press **[SETUP MENU]**.
2. In the menu, select **INSTRUMENT LOCK**.
3. In the **INSTRUMENT LOCK** screen (see Figure 8-9 on page 125):
  - a) If a password was set, enter the password in **PASSWORD**.
  - b) Set the functions you want to lock to **ON** and the ones you want to unlock to **OFF**.
  - c) Select **SET** to activate the instrument lock and return to the measurement screen.

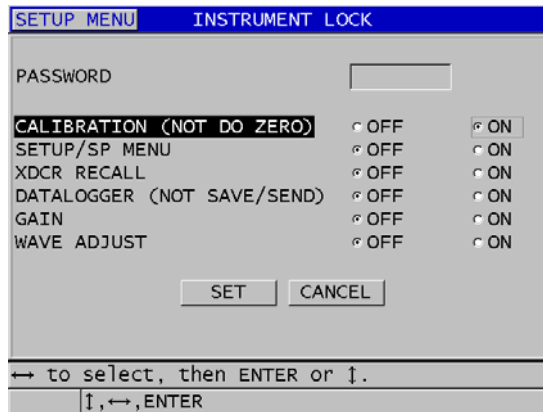


Figure 8-9 The INSTRUMENT LOCK screen

## 8.6 Freezing Waveforms

Pressing **[FREEZE]** stops updating the displayed waveform and keeps the waveform and thickness on the display even if you move or uncouple the transducer. The freeze indicator (**F**) appears on the right side of the waveform display when the freeze function is active.

The freeze function is convenient to easily set the gain parameters, review a B-scan, or perform a high temperature measurement, without having to maintain the transducer coupled to the test piece.

You may also want to use the freeze function to pause measurements before uncoupling the transducer from the test piece, to prevent recording wrong minimum or maximum values.

### To freeze the waveform and thickness display

1. Press **[FREEZE]** while making a measurement.
2. Press **[FREEZE]** again to unfreeze the waveform and thickness display.

---

<b>NOTE</b>
-------------

Pressing **[MEAS]** or **[SAVE/SEND]** also unfreezes the display.

---

## 9. Configuring the Instrument

This chapter describes how to configure various instrument parameters.

### 9.1 Configuring Measurement Parameters

The **MEAS** setup is the most commonly used setup menu screen where you access global parameters concerning the instrument measurement features.

#### To configure measurement parameters

1. From the measurement screen, press **[SETUP MENU]**.
2. In the menu, select **MEAS**.  
The **MEAS** screen appears. The last parameters differ depending if a single or dual element transducer is connected (see Figure 9-1 on page 127).

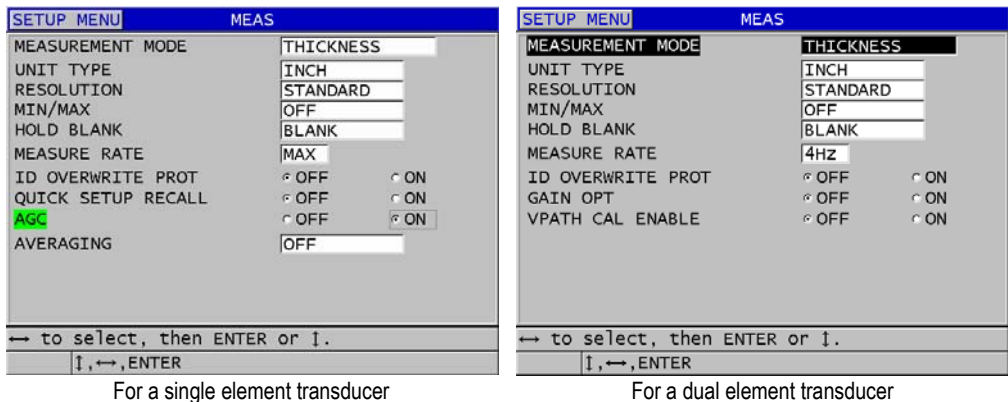


Figure 9-1 The MEAS screen

3. In **MEASUREMENT MODE**, select what the instrument measures and displays among the following options:
  - **THICKNESS**: the thickness of the inspected part
  - **VELOCIMETER**: the sound velocity in the material of the inspected part
  - **TIME OF FLIGHT**: the round trip time-of-flight (TOF) of the sound in the inspected part
4. In **UNIT TYPE**, select between the **INCH** (English) or **MILLIMETER** (metric) units.  
Time-of-flight measurements are always expressed in microseconds.
5. In **RESOLUTION**, select between **STANDARD**, **LOW**, or **HIGH** (see “Changing the Thickness Resolution” on page 61 for details).
6. In **MIN/MAX**, select to activate either the **MIN** (minimum), **MAX** (maximum), or **BOTH** modes (see “Using the Minimum, Maximum, or Min/Max Thickness Mode” on page 115 for details).
7. In **HOLD BLANK**, configure the instrument to either continue to show (**HOLD**) or not hold (**BLANK**) the last measured thickness and waveform while a loss-of-signal (LOS) occurs.

---

<b>NOTE</b>
-------------

The **MIN/MAX** and **HOLD BLANK** functions are mutually exclusive. You must set **MIN/MAX** to **OFF** to be able to change the **HOLD BLANK** function. Similarly, you must set **HOLD BLANK** to **BLANK** to be able to change the **MIN/MAX** function.

---

8. In **MEASURE RATE**, adjust the measurement update rate (see “Adjusting the Measurement Update Rate” on page 60 for details).
9. Set **ID OVERWRITE PROT** to **ON** if you want to see a confirmation message in the help bar when attempting to save a measurement reading in an ID that already contains a value (see “Setting the ID Overwrite Protection” on page 196 for details).
10. For single element transducers only, set **QUICK SETUP RECALL** to **ON** to activate the quick recall of the first four custom setups using the combination of **[2nd F]** and the arrow keys (see “Quickly Recalling a Custom Setup for Single Element Transducers” on page 240 for details).
11. For single element transducers only, set **AGC** to **ON** to set the automatic gain control (AGC) function to automatically bring all measured back-wall echoes to the same amplitude.

---

**TIP**

The **AGC** function works well for most standard thickness gage applications and is by default turned on. In some thickness applications, the receiver gain is set at or near its maximum value. In such cases, turn off the AGC function to prevent reading instability.

---

12. For single element transducers only, set **AVERAGING** to **OFF** to turn thickness averaging off, set **AVERAGING** to **ON** to perform a running average of the last 5 thickness readings, or set **AVERAGING** to **On-QBar** to display a quality measurement Q-bar below the measurement screen indicating the stability of the averaged reading.
13. For dual element transducers only, set **GAIN OPT** to **ON** to activate the gain optimization during the zero and material velocity calibrations (see “Material Sound Velocity and the Zero Calibrations” on page 71 for details).
14. For dual element transducers only, set **VPATH CAL ENABLE** to **ON** to activate the V-Path calibration option when you press **[CAL VEL]** (see “Building a V-Path Correction Curve for a Nonstandard Dual Element Transducer” on page 216 for details).
15. Press **[MEAS]** to return to the measurement screen.

## 9.2 Configuring System Parameters

The **SYSTEM** screen, allows you to configure many 38DL PLUS system parameters.

### To configure system parameters

1. From the measurement screen, press **[SETUP MENU]**.
2. In the menu, select **SYSTEM**.  
The **SYSTEM** screen appears (see Figure 9-2 on page 130).

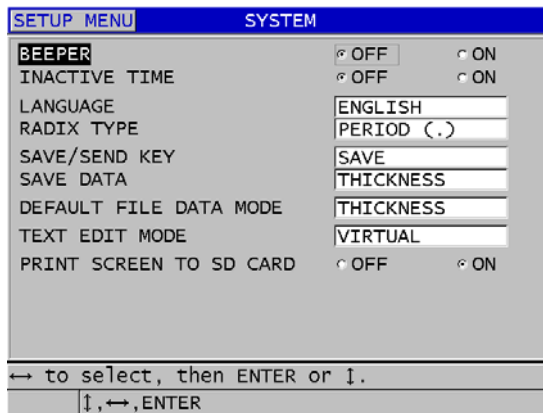


Figure 9-2 The SYSTEM screen

3. Set **BEEPER** to **ON** or **OFF** (see “Setting the User Interface Language and Other System Options” on page 49 for details).
4. Set **INACTIVE TIME** to **ON** or **OFF** (see “Setting the User Interface Language and Other System Options” on page 49 for details).
5. In **LANGUAGE**, select the desired user interface language (see “Setting the User Interface Language and Other System Options” on page 49 for details).
6. Set **RADIX TYPE** to the desired character (period or comma) to separate the integer and the decimal numbers.
7. Set **SAVE/SEND KEY** to configure what happens to the actual data (as set in **SAVE DATA**) when you press [**SAVE/SEND**]. The options are:
  - **SAVE**: saves the actual data to the internal datalogger.
  - **SEND**: sends the actual data to the RS-232 port (see “Setting Up RS-232 Serial Communication” on page 245 for details on RS-232 data communication).

#### NOTE

The **SAVE/SEND KEY** parameter also affects the save/send operation triggered using the optional foot switch. The 38DL PLUS cannot send a single thickness value through the USB communication port.

8. Set **SAVE DATA** to save only the thickness measurement (**THICKNESS**) or both the thickness and the waveform (**THK+WF**).

**NOTE**

The calibration and setup parameters are also always saved/sent along with the thickness measurement.

---

9. Set **DEFAULT FILE DATA MODE** to the desired default file data mode when you create a file (see “File Data Modes” on page 182 for details).
10. Set **TEXT EDIT MODE** to choose how to enter alphanumeric values using either the virtual keyboard (**VIRTUAL**) or the legacy character wheel selection (**TRADITIONAL**) [see “Selecting the Text Edit Mode” on page 44 for details].
11. Set **PRINT SCREEN TO SD CARD** to **ON** to enable the 38DL PLUS to create a BMP image file on the external microSD card for the actual screen shot, when you press [**2nd F**], [**DISPLAY**] (see “Sending a Screen Capture to the External microSD Card” on page 257 for details).
12. Press [**MEAS**] to return to the measurement screen.

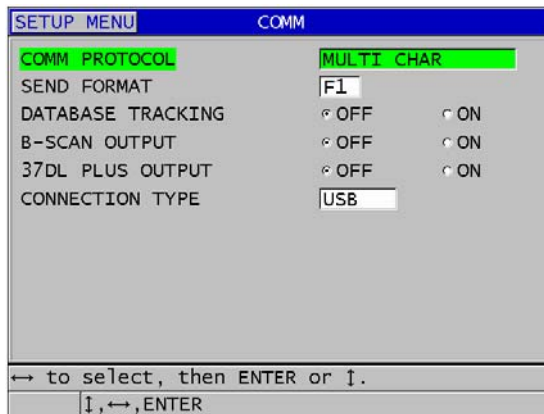
### 9.3 Configuring Communications

The 38DL PLUS features a RS-232 and a USB port allowing you to connect the instrument to a computer, a printer, or optional accessories such as a caliper. When connected to a computer, the 38DL PLUS can send and receive data, or can be remotely controlled by the computer.

The instrument is set to use USB communication by default. You can select which type of communication you wish to use along with other communication parameters.

#### To configure the communication parameters

1. From the measurement screen, press [**SETUP MENU**].
2. In the menu, select **COMM**.
3. In the **COMM** screen (see Figure 9-3 on page 132):



**Figure 9-3 Changing the communication parameters**

- a) In **COMM PROTOCOL**, select which remote command set the instrument uses for communication:
  - **MULTI CHAR**: Multi character commands used for communication with a computer running the GageView interface program.
  - **SINGLE CHAR**: Single character command normally used when an external program is controlling the instrument by remotely sending commands to mimic keystroke.
- b) In **OUTPUT FORMAT**, select the format of the data being output (**F1, F2, F3,...F10**). Refer to Table 24 on page 258 and Table 25 on page 259 for the description of available output formats.

---

**NOTE**

Contact Olympus for more information on the following communication parameters:

- Multi and single character remote commands.
- Send formats (F1, F2, F3, F4, F5, F6, F7, F8, F9, and F10).

- c) Set **DATABASE TRACKING** to **ON** to allow the instrument to track the measurement parameters (calibration settings, transducer type, gain etc.) that were used in a previous inspection. In order for this feature to be implemented, you must load the previous inspected file to the 38DL PLUS



and overwrite the old readings with the new inspection data.

When database tracking is selected, the following measurement related parameters are automatically adjusted to match those stored at the current ID number:

- Alarm mode (on/off)
- Alarm set points
- Differential mode (on/off)
- Differential reference value
- Min/max mode (min/max/off)
- Extended blank value
- Resolution
- Units
- Gain
- Velocity
- Transducer type (user prompt only)

When database tracking is selected and a waveform is stored at the current ID number, the following additional waveform related parameters are automatically adjusted to match those stored with that waveform:

- Range
- Zoom (on/off)
- Extended blank position
- Rectification mode (full wave, half wave negative, half wave positive, RF)

If the database does not have any data stored at the current ID number, then the setup remains unchanged.

---

<b>NOTE</b>
-------------

Even if database tracking is activated, you can override the settings for the current ID number by manually changing any setup parameter.

---

- d)* Set **B-SCAN OUTPUT** to **ON** to output the B-scan data when communicating with the GageView interface program. Set it to **OFF** when communicating with other interface programs that do not support the B-scan data. This parameter only applies to files that have stored B-scan images.

- e) Set **37DL PLUS OUTPUT** to **ON** to have the 38DL PLUS send data in the same format as the 37DL PLUS to communicate with external software programs that were written for the 37DL PLUS.
- f) In **CONNECTION TYPE**, choose which communication format the instrument uses:
  - **USB**: Universal serial bus used to communicate with a computer running the GageView interface program (default) [see “Setting Up USB Communication” on page 244].
  - **RS-232**: Used for communication with serial port printers, digital calipers, and other RS-232 communication devices.

The following parameters only appear when **CONNECTION TYPE** is set to **RS-232** (see “Setting Up RS-232 Serial Communication” on page 245):

- g) In **RS-232 DEVICE**, select what type of device the 38DL PLUS communicates with:
  - **PRINTER**: for communicating with serial port printers.
  - **TERMINAL**: for communicating with computers.
  - **CALIPER**: to receive reference thickness data from the optional digital caliper.
  - **FISHER**: to receive data from a Fisher coating instrument.
- h) In **BAUD RATE**, set the RS-232 data transfer rate to match that of the device with which the 38DL PLUS communicates.
- i) In **CONTINUOUS OUTPUT**, select the rate at which the 38DL PLUS sends measurement data through the RS-232 communication port:
  - **OFF**: No continuous output.
  - **ON**: The output rate is controlled by the **MEASURE RATE** setting in the **MEAS** setup menu (see “Adjusting the Measurement Update Rate” on page 60).
  - **5 SEC AVERAGE**: Outputs one averaged thickness reading every 5 seconds.
  - **10 SEC AVERAGE**: Outputs one averaged thickness reading every 10 seconds.

---

<b>NOTE</b>
-------------

The other RS-232 parameters are fixed (Word length = 8, Stop bits = 1, Parity = None).

---

- 4. Press **[MEAS]** to return to the measurement screen.

---

## 10. Using Advanced Gaging Features

---

The 38DL PLUS has many advanced thickness measurement features that assist in making the gage a more versatile instrument. This chapter describes how to use these advanced features.

### 10.1 Adjusting the Gain with Dual Element and E110 EMAT Transducers

By default, the 38DL PLUS automatically sets the gain to an optimum value to obtain the most accurate measurement. This works well for most corrosion measurement applications.

In special circumstances, you may need to manually adjust the gain to get a correct thickness measurement. For example, in high temperature measurements, increasing the gain is generally recommended.

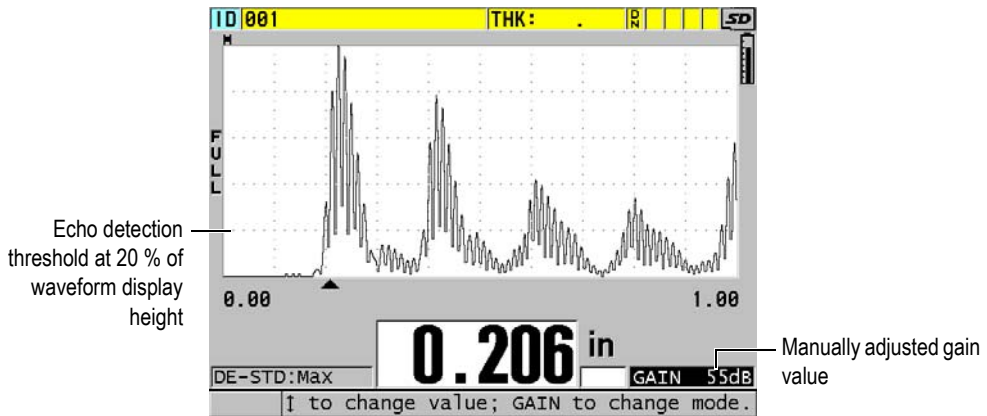
---

<b>NOTE</b>
-------------

Olympus recommends to manually adjust the gain only when you are an experienced operator who can analyze and understand the waveform display.

---

With D79X series dual element and E110 EMAT transducers, you can manually adjust the gain by pressing **[GAIN]**. The gain value, expressed in decibels (dB), appears near the lower-right corner of the display (see Figure 10-1 on page 136).



**Figure 10-1 Manually adjusting the gain**

When activated, the manual gain adjustment also modifies the way in which echoes are shown on the waveform display. With the default automatic gain, the measured echo peak is visible on the display so that you can readily observe the measured echo position, independently of its strength or of the gain. When you manually adjust the gain, the displayed echo height changes to be proportional to the actual echo amplitude at the receiver output, allowing you to readily observe gain changes.

The peak detection threshold for thickness calculation is at 20 % of the waveform display height, the first graticule line above the baseline in Figure 10-1 on page 136. The peak amplitude of measured echoes must be at or above the threshold to be processed for thickness calculation.

### To view, restore, or change the gain value

1. Press [**GAIN**] to view the current automatic gain value.  
The gain value appears near the lower-right corner of the display. The waveform display changes to the amplitude proportional to gain mode.
2. Press [**▲**] or [**▼**] to adjust the gain in steps of  $\pm 1$  dB.  
The gain value and the height of the echoes change accordingly.
  - Increase the gain value when the peak amplitude of the echo that should be detected is below 20 % of the waveform display height.  
This prevents the gage from reading a too high value when skipping one back-wall echo, measuring twice the correct thickness (doubling).

- Reduce the gain value when noise peaks are above 20 % of the waveform display height.  
This prevents the gage from detecting a noise peak rather than the correct back-wall echo.
- 3. Press **[GAIN]** again to restore the last previously set gain.
- 4. Press **[GAIN]** again to return to the automatically adjusted echo height mode.  
The default automatic gain mode is indicated by a blank **Gain** field.

## 10.2 Adjusting the Extended Blank with Dual Element Transducers



### CAUTION

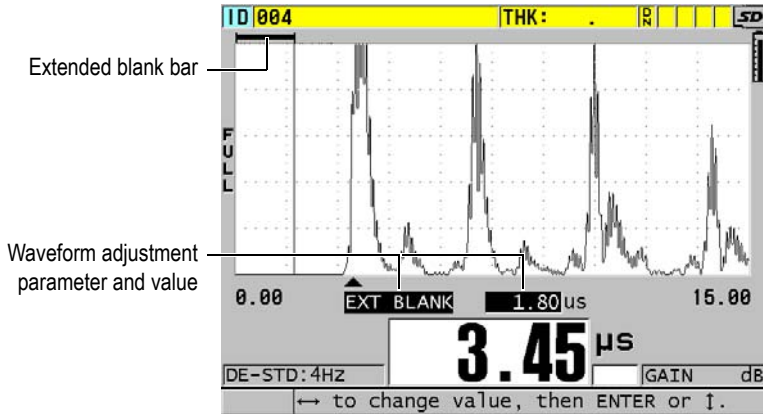
Olympus recommends using the extended blank parameter only when you are an experienced operator who thoroughly understands the acoustic properties of the material being measured. Incorrect use of the extended blank can cause the gage to misread areas of thin material.

Normally, the 38DL PLUS searches for echoes down to nearly zero thickness. However, some special circumstances such as a high degree of near surface corrosion, aluminum material, enclosed flaws, or laminations can generate echoes that the instrument may falsely detect as the low thickness. When these echoes are larger than the sought after back-wall echo, the manual gain adjustment (see “Adjusting the Gain with Dual Element and E110 EMAT Transducers” on page 135) cannot prevent this false detection. However, the extended blank parameter allows you to define an early period in which the 38DL PLUS will not perform echo detection, and therefore, prevent erroneous measurements.

### To use the extended blank

1. Press **[WAVE ADJ]**.  
The waveform adjustment parameter and its value appear on the measurement screen (see Figure 10-2 on page 138).
2. If needed, use the **[▲]** and **[▼]** keys to select **EXT BLANK**.  
The extended blank becomes active, but initially, its value is zero. The gage remains in the measurement screen.

- Use the [▶] or [◀] keys to respectively increase or decrease the blank value until you exclude early unwanted echoes from detection.  
The extended blank horizontal bar just above the waveform display indicates the extended blank length (see Figure 10-2 on page 138).



**Figure 10-2 Adjusting the extended blank length**

- To turn off the extended blank, use the [◀] key to decrease the extended blank value back to zero.

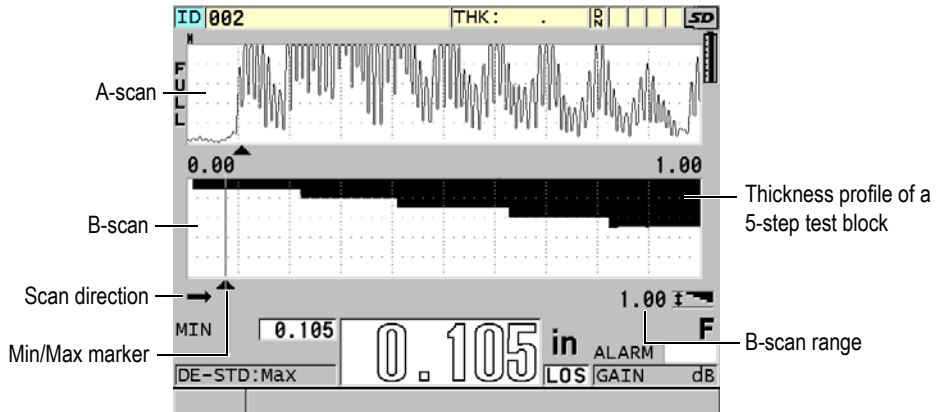
#### NOTE

If the measurement point changes when the extended blank is moved, echoes can change in height. This is because in the normal waveform display mode, the 38DL PLUS attempts to adjust the height.

The instrument also attempts to make the most accurate measurement by identifying the beginning of an echo. When the extended blank is positioned within an echo instead of to its left, the gage is unable to make an accurate detection.

## 10.3 B-Scan

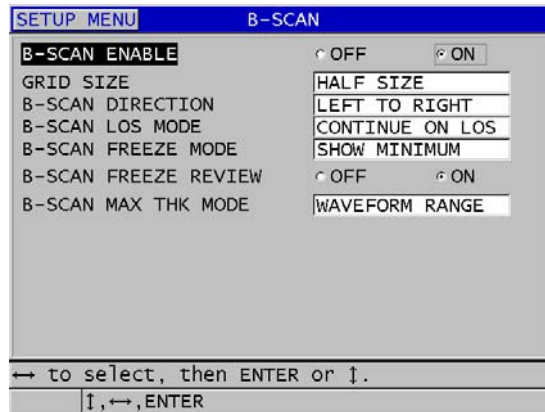
A B-scan is a cross-sectional image of thickness readings. The 38DL PLUS can acquire and display B-scan data (see Figure 10-3 on page 139). When you activate the B-scan, the thickness reading profile builds up and scrolls on the screen. Once a B-scan is acquired, you can freeze the screen and review the recorded thickness values.



**Figure 10-3 B-scan example for a 5-step test block**

While the B-scan is running, you can save individual thickness readings, save the current B-scan screen (with all thickness values), or the entire scan (up to 10000 readings) [see “Saving B-Scans, A-Scans, or Thickness Readings” on page 145].

You can activate and configure the B-scan from the **B-SCAN** screen (see Figure 10-4 on page 140), accessible by pressing **[SETUP MENU]**, and then selecting **B-SCAN** in the menu.



**Figure 10-4 Changing B-scan parameters**

The **B-SCAN** screen contains the following parameters:

#### **GRID SIZE**

Determines the size of the B-scan with the following two options (see Figure 10-5 on page 141):

#### **HALF SIZE**

Displays a half-height A-scan waveform and a half-height B-scan.

#### **FULL SIZE**

Displays the B-scan over the entire waveform display area.



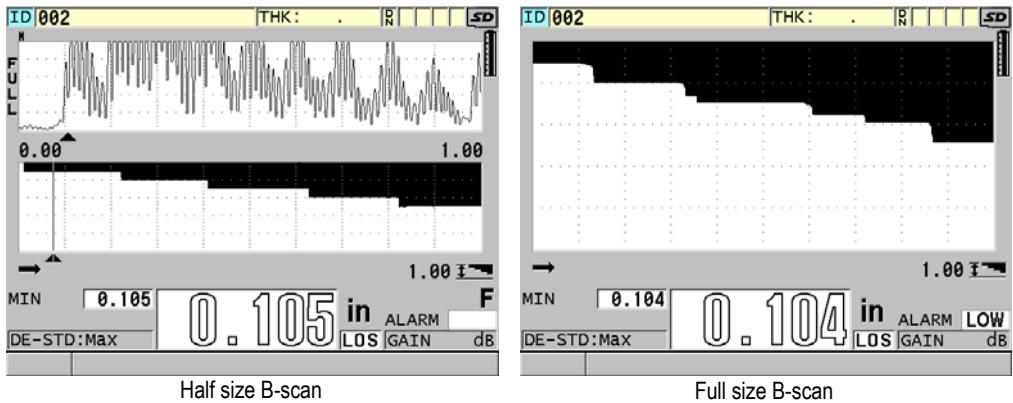


Figure 10-5 The half-size and full-size B-scans

### B-SCAN DIRECTION:

Choose the B-scan direction to match the direction of transducer movement. A scan direction arrow appears below the left corner of the B-scan display to indicate the transducer scan direction (see Figure 10-6 on page 141). The data starts appearing on the screen in the opposite direction.

#### LEFT TO RIGHT

The transducer scans the part from left to right and the data starts appearing at the right of the screen and scrolls to the left.

#### RIGHT TO LEFT

The transducer scans the part from right to left and the data starts appearing at the left of the screen and scrolls to the right.

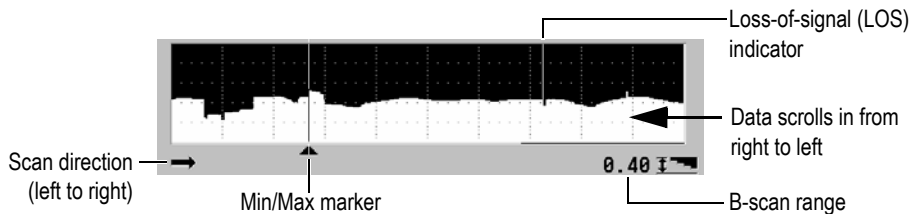


Figure 10-6 B-scan elements

## **B-SCAN LOS MODE**

Determines how the B-scan behaves when a loss-of-signal (LOS) occurs.

### **STOP ON LOS**

The B-scan stops scrolling when a LOS occurs. When the instrument regains measurements, a thin blank vertical line is inserted into the B-scan as a marker showing that a LOS has occurred (see Figure 10-6 on page 141).

### **CONTINUE ON LOS**

The B-scan continues scrolling when a LOS occurs.

## **B-SCAN FREEZE MODE**

Determines which A-scan waveform and thickness reading are displayed when you press **[FREEZE]** while a B-scan is active.

### **SHOW MINIMUM**

Displays the waveform and thickness reading for the minimum reading collected during the scan.

### **SHOW MAXIMUM**

Displays the waveform and thickness reading for the maximum reading collected during the scan.

### **SHOW CURRENT**

Displays the last thickness reading made before pressing **[FREEZE]**.

## **B-SCAN FREEZE REVIEW**

When this feature is enabled and a B-scan is active, pressing **[FREEZE]** freezes the B-scan image in review mode. In this mode, a vertical line, the review marker, appears to indicate the location of the displayed thickness (see Figure 10-7 on page 143). The displayed thickness is either the minimum, maximum, or current thickness depending on which **B-SCAN FREEZE MODE** option is selected. The 38DL PLUS displays both the thickness value and the corresponding waveform. Use the **[◀]** and **[▶]** keys to move the review marker and read the thickness at the review marker location.

---

<b>TIP</b>
------------

If the minimum or maximum value moves off the B-scan screen, press **[FREEZE]** to center the B-scan and the review marker on the minimum or maximum thickness.

---

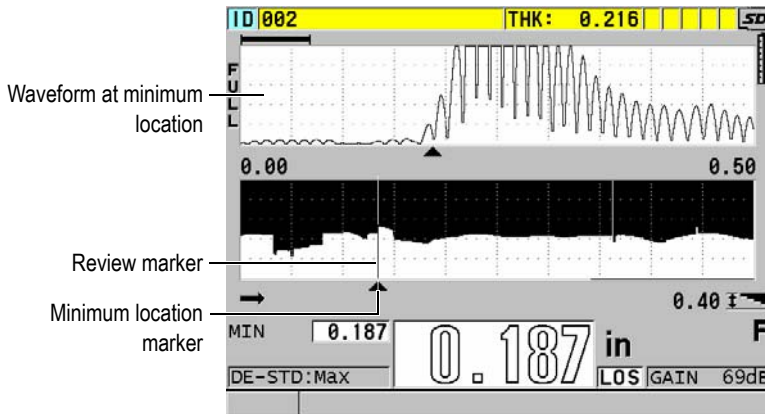


Figure 10-7 B-scan freeze review elements

#### B-SCAN MAX THK MODE:

Determines the vertical scale of the B-scan with the following two options:

##### A-SCAN RANGE

The top and bottom of the vertical scale correspond to the start and end of the A-scan display range.

##### SPECIFIED THK

The top of the vertical scale represents the zero value and the bottom of the scale is the value that you enter in the **B-SCAN MAX THICKNESS** parameter that appears. The allowed range is 0.00 mm to 635.00 mm (0.000 in. to 25.000 in.).

#### NOTE

Olympus does not recommend using the A-scan zoom feature when **B-SCAN MAX THICKNESS** is set to **A-SCAN RANGE**. The zoom constantly adjusts the start and the end points of the A-scan range, resulting in a B-scan image where the scale changes as the thickness changes.

### 10.3.1 Using the B-Scan

The following procedure describes how to activate and use the B-scan.

#### To use the B-scan

1. While in the measurement screen, press [SETUP MENU].
2. In the menu, select **B-SCAN**.
3. In the **B-SCAN** screen, set **B-SCAN ENABLE** to **ON**, and configure the other B-scan parameter as desired (see “B-Scan” on page 139).
4. Press [MEAS] to return to measurement screen with the B-scan active.  
The B-scan begins drawing the cross section of the material as soon as the first non-LOS reading is collected.
5. To stop the collection of B-scan data:  
Press [FREEZE].  
OR  
With **B-SCAN LOS MODE** set to **STOP ON LOS**, simply uncouple the transducer from the test material.
6. While the B-scan is frozen, if **B-SCAN FREEZE REVIEW** is set to **ON**, use the [◀] and [▶] keys to move the review marker and read the thickness value corresponding to the marker position.
7. Press [MEAS] again to reset the B-scan and begin a new B-scan.
8. Refer to “Saving B-Scans, A-Scans, or Thickness Readings” on page 145 for details on how to save B-scan data.

### 10.3.2 Using the B-Scan Alarm Mode

You can specify B-scan low and high alarm reference values and turn the visual and audible alarm functions **ON** and **OFF**. The B-scan alarm mode is similar to the standard alarm mode (see “Using Alarms” on page 117) except that the alarm lines are shown in the B-scan grid, as long as the alarm reference values fall within the B-scan thickness range. The alarms are also operational as you review B-scan thicknesses in review mode, in a frozen B-scan.

#### To use the B-scan alarm mode

1. Activate and configure the B-scan (see “Using the B-Scan” on page 144).
2. While in the measurement screen, press [SETUP MENU].

3. In the menu, select **ALARM**.
4. In the **ALARM** screen:
  - a) Set **ALARM ENABLE** to **ON**.
  - b) Set **ALARM MODE** to **B-SCAN**.
  - c) Enter the desired **LOW ALARM** and **HIGH ALARM** values.
5. Press **[MEAS]** to return to the measurement screen.
6. The horizontal red alarm lines appear on the B-scan (see Figure 8-5 on page 121).

### 10.3.3 Saving B-Scans, A-Scans, or Thickness Readings

The 38DL PLUS can do the following tasks while using the B-scan:

- Save a live thickness reading while the B-scan is running.
- Save any reviewed thickness reading on a frozen B-scan.
- Save all thickness readings for one B-scan screen (600 readings) along with the minimum or maximum thickness readings for a held B-scan.
- Save all thickness readings for one B-scan screen (600 readings), the minimum or maximum thickness reading and waveform for a held B-scan.
- Save an entire B-scan history up to 10000 thickness readings, the minimum or maximum thickness readings and waveform, and the held B-scan.

#### To save a live thickness reading while the B-scan is running

- ◆ Press **[SAVE/SEND]**.

#### To save any reviewed thickness reading on a frozen B-scan

1. While the B-scan is running, press **[FREEZE]** to enter the review mode.
2. Use the **[◀]** and **[▶]** keys to review any thickness on the frozen B-scan.
3. Press **[SAVE/SEND]** to save to the datalogger, the thickness value for the review marker position.

#### To save the minimum or maximum thickness reading for a frozen B-scan

1. Set **B-SCAN FREEZE MODE** to **SHOW MINIMUM** or **SHOW MAXIMUM**.  
The gage displays the minimum or maximum thickness reading with the corresponding waveform.
2. While the B-scan is running, press **[FREEZE]** to enter the review mode.

3. Press **[SAVE/SEND]** while the minimum or maximum thickness reading is displayed.

### To save the minimum or maximum A-scan along with the frozen B-scan

1. Set **B-SCAN FREEZE MODE** to **SHOW MINIMUM** or **SHOW MAXIMUM**. The gage displays the minimum or maximum thickness reading with the corresponding waveform.
2. While the B-scan is running, press **[FREEZE]** to enter the review mode.
3. Press **[2nd F]**, **[SAVE/SEND]** (**WAVEFORM**) while the minimum or maximum thickness reading is displayed.

### To save the entire B-scan (B-scan history)

1. While the B-scan is running or when it is frozen, press **[2nd F]**, **[SAVE/SEND]** (**WAVEFORM**).

The **Save B-Scan history?** message appears on the help text bar.

2. Select **Yes** or **No**:

#### **Yes**

Saves the entire B-scan history including the Minimum or Maximum thickness with corresponding waveforms.

#### **No**

Saves the current B-scan screen and the waveform.

---

#### **NOTE**

When a B-scan screen is saved to the datalogger, the gage saves the thickness values for the 600 data points appearing on the display. All thickness values on a saved B-scan can be reviewed during ID Review. Recall the saved B-scan and use the **[◀]** and **[▶]** keys to review each thickness reading.

---

---

#### **NOTE**

You can save a maximum of 10000 thickness readings to a B-scan. When the maximum number of thickness points reaches 10000, the gage prompts you to save the B-scan history or to reset the B-scan without saving.

---

## 10.4 DB Grid

The database grid (DB grid) is a table representation of 2-D data. This representation gives you the ability to move freely in any direction on a grid rather than follow a preset list of IDs. Instead of automatically incrementing to the next ID location, you can use the arrow keys to move to a location that is more convenient. You can simultaneously display the A-scan, the DB grid, and the thickness reading (see Figure 10-8 on page 147). You can configure the grid cells to show a data cell flag and a background color corresponding to the range in which their thickness reading falls.

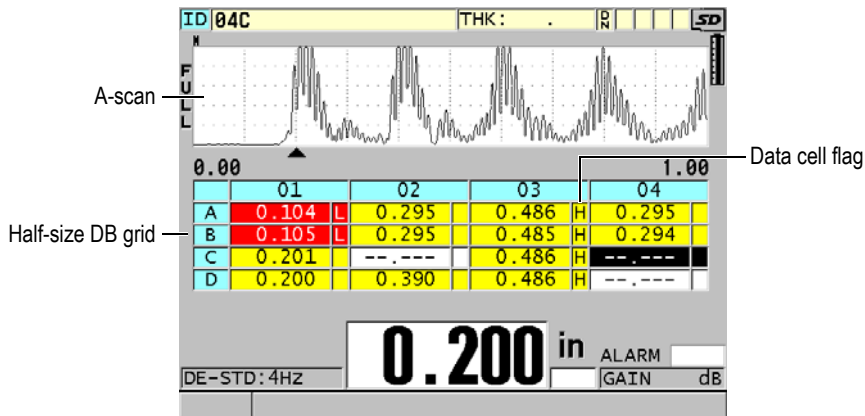


Figure 10-8 Example of the half-size DB grid

### 10.4.1 Activating and Configuring the DB Grid

You activate and configure the DB grid options from the **DB GRID** screen.

#### To activate and configure the DB grid

1. From the measurement screen, press **[SETUP MENU]**.
2. In the menu, select **DB GRID**.
3. In the **DB GRID** screen (see Figure 10-9 on page 148), perform the following steps.

SETUP MENU		DB GRID	
DB GRID ENABLE	<input type="radio"/> OFF	<input checked="" type="radio"/> ON	
GRID SIZE	HALF SIZE		
TRANSPOSE GRID	<input type="radio"/> OFF	<input type="radio"/> ON	
LINEARIZE GRID	<input type="radio"/> OFF	<input type="radio"/> ON	
DATA CELL FLAG	NONE		
GRID COLOR OPTION	<input type="radio"/> OFF	<input checked="" type="radio"/> ON	
LO RANGE COLOR	RED		
LO RANGE VALUE	0.000		
MID RANGE COLOR	YELLOW		
HI RANGE COLOR	GREEN		
HI RANGE VALUE	0.000		
↔ to select, then ENTER or ↓.			
↑, ↔, ENTER			

Figure 10-9 Changing DB grid parameters

- Set **DB GRID ENABLE** to **ON** to activate the DB grid.
- Set **GRID SIZE** to one of the desired database grid size options (see Figure 10-10 on page 149):

#### **HALF SIZE**

Displays a half-screen A-scan waveform and a half-screen database grid. Up to five grid rows are shown.

#### **FULL SIZE**

Displays the database grid on the entire screen. Up to 11 grid rows are shown.

---

#### NOTE

With both options, the number of grid columns shown varies, depending on the length of column labels and whether or not a database flag is displayed with each data cell.

---



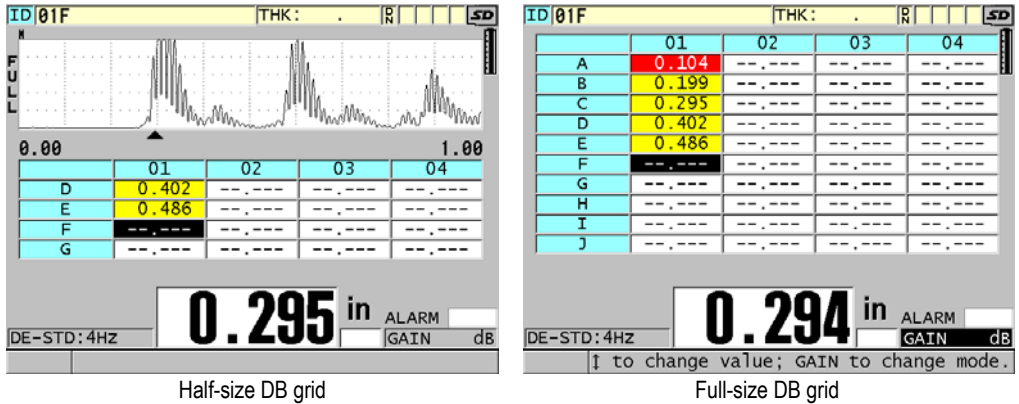


Figure 10-10 Example of half-size and full-size DB grids

6. Set **TRANSPOSE GRID** to **ON** to interchange the rows and columns in a grid (see Figure 10-11 on page 149).

TRANSPOSE GRID set to OFF					TRANSPOSE GRID set to ON				
01	A	B	C	D	A	01	02	03	04
02	---	---	---	---	B	---	---	---	---
03	---	---	---	---	C	---	---	---	---
04	---	---	---	---	D	---	---	---	---

Figure 10-11 Grid transposition example

#### NOTE

The ID number increments in the order assigned when the file was originally set up independently of the **TRANSPOSE GRID** value.

7. Set **LINEARIZE GRID** to **ON** to display the grid IDs in the linear form (see Figure 10-12 on page 150).

ID	THICKNESS
A01	--,---
A02	--,---
A03	--,---
A04	--,---

**Figure 10-12 Example of a linearized DB grid**

8. Set **DATA CELL FLAG** to one of the available options to display a single data flag with each data cell in the DB grid. The data cell flag is a letter that appears in a small box to the right of the thickness value in the data cell (see Figure 10-8 on page 147). The available options are:

**NONE**

No data cell flag appears.

**MIN/MAX**

“m” indicates a minimum thickness.

“M” indicates a maximum thickness.

**ALARM**

“L” indicates any kind of low alarm condition including a standard low alarm condition or a previous thickness alarm.

“H” indicates any high alarm condition.

**A-SCAN**

“W” indicates that a waveform is stored with the thickness.

9. Set **GRID COLOR OPTION** to **ON** to activate usage of low, mid, and high range colors for the grid cell background.
10. Set **LO RANGE COLOR** to the desired cell background color (**RED**, **YELLOW**, or **GREEN**) when the cell thickness value is smaller than the **LO RANGE VALUE**.
11. Set **MID RANGE COLOR** to the desired cell background color (**RED**, **YELLOW**, or **GREEN**) when the cell thickness value is between the **LO RANGE VALUE** and the **HI RANGE VALUE**.
12. Set **HI RANGE VALUE** to the desired cell background color (**RED**, **YELLOW**, or **GREEN**) when the cell thickness value is higher than the **HI RANGE VALUE**.

## 10.4.2 Changing the Highlighted Cell in the DB Grid

You can easily move the selected cell in the DB grid using the arrow keys.

## To change the highlighted cell in the DB grid

1. Activate and configure the DB grid (see “Activating and Configuring the DB Grid” on page 147).
2. From the measurement screen, press [ID#].
3. In the ID review screen (see Figure 10-13 on page 151):
  - a) Use the [▲], [▼], [◀], and [▶] keys to highlight the desired grid cell.
  - b) Press [2nd F], [▲] to jump to the last ID location in the file.
  - c) Press [2nd F], [▼] to jump to the first ID location in the file.
  - d) Press [ID#] at any time to edit the displayed ID location.

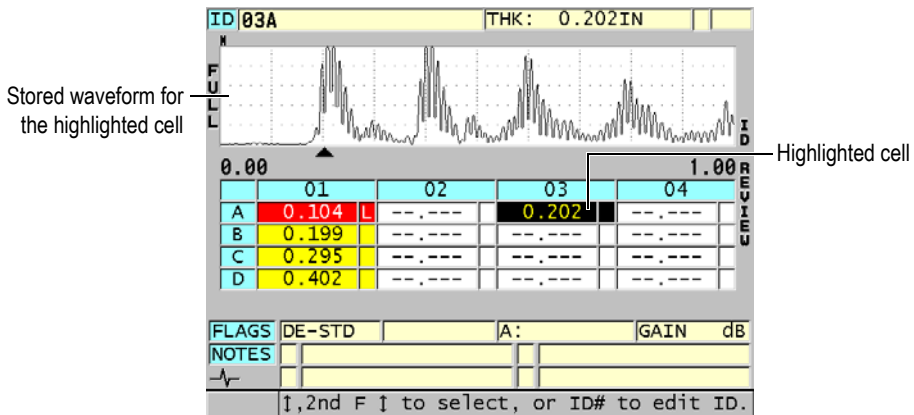


Figure 10-13 The highlighted DB grid cell in the ID review screen

4. Press [MEAS] to return to the measurement screen with the current ID number changed to the ID location selected in the ID review screen.

OR

Press [2nd F], [MEAS] to return to measurement screen with the current ID number unchanged. The current ID location is the last active ID location in the measurement screen.

## 10.4.3 Saving Thickness Readings in the DB Grid

### To save thickness readings in the DB grid

1. Activate and configure the DB grid (see “Activating and Configuring the DB Grid” on page 147).
2. Move to the desired DB grid cell (see “Changing the Highlighted Cell in the DB Grid” on page 150).
3. In the measurement screen, while the thickness value is displayed, press **[SAVE/SEND]** to save the thickness.

OR

Press **[2nd F]**, **[SAVE/SEND]** (**WAVEFORM**) to save the thickness and the waveform.

The displayed thickness value and setup information are stored at the current ID location identified by the highlighted cell in the grid. If the thickness display is blank when you press **[SAVE/SEND]**, 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 ID bar and its cell is highlighted in the grid. If the ID number cannot be updated, a long beep sound is emitted and the instrument displays a message pertaining to the reason the ID was unable to update. In this case, the ID number on the display remains unchanged.

## 10.4.4 Viewing an Inserted or an Appended Cell in the DB Grid

You can insert or append a cell in the DB grid. To maintain the format of the grid, the inserted or appended cell does not appear in the grid. However, the cell after which it is inserted or to which it is appended appears shaded with a grey background (see Figure 10-14 on page 152).

Cell with an inserted or appended cell

	01	02	03	04
A	0.104	--.--	0.202	--.--
B	0.199	--.--	--.--	--.--
C	0.295	--.--	--.--	--.--
D	0.402	--.--	--.--	--.--

Figure 10-14 Example of an inserted cell

## To view an inserted or an appended cell in the DB grid

1. Activate and configure the DB grid (see “Activating and Configuring the DB Grid” on page 147).
2. Press [ID#], and then use the arrow keys to move to the desired shaded grid cell.
3. Press [ZOOM].  
The grid changes to a linear view and the inserted or appended ID number is displayed (see Figure 10-15 on page 153).

ID	THICKNESS	
01A	0.104	L
01B	0.199	
01BB	0.200	
01C	0.295	

Inserted cell —

Figure 10-15 Example of a zoomed inserted cell

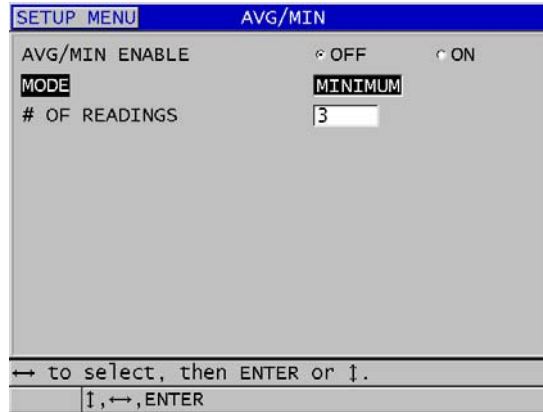
4. Press [ZOOM] again to return to the normal DB grid view.

## 10.5 Configuring AVG/MIN Measurements

You can use the AVG/MIN measurement function to store the average or the minimum measurement of several successive thickness readings to the datalogger.

### To configure the AVG/MIN measurement option

1. From the measurement screen, press [SETUP MENU].
2. In the menu, select **AVG/MIN**.
3. In **AVG/MIN** screen (see Figure 10-16 on page 154):
  - a) Set **AVG/MIN ENABLE** to **ON** to activate the average/minimum measurement function.
  - b) Set **MODE** to **AVERAGE** to calculate the average of the sequential thickness readings or **MINIMUM** to calculate the minimum of the sequential thickness readings.
  - c) Set **# OF READINGS** to set the number of thickness values in the sequence (**2**, **3**, or **4**).

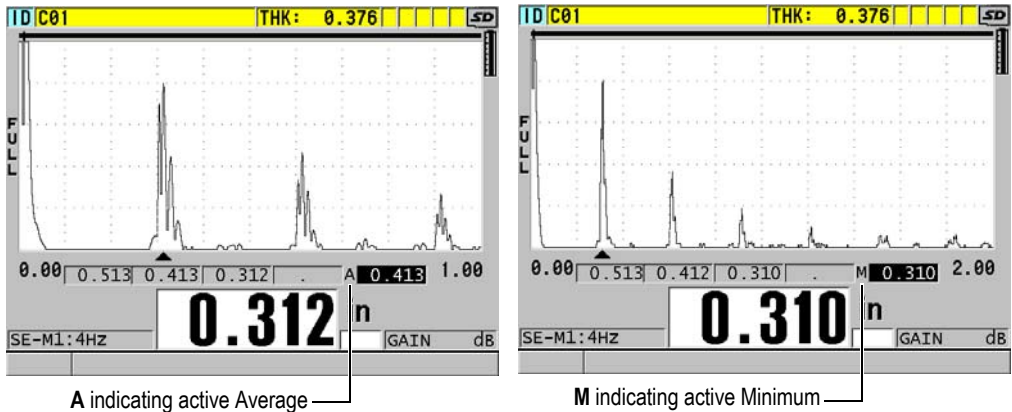


**Figure 10-16** Opening the Avg/Min measure dialog box

4. Press [MEAS] to return to measurement screen.

## 10.6 Making AVG/MIN Measurements

When you are in the measurement screen and the AVG/MIN measurement is active, the last measured thickness values (up to four) appear above the current thickness value together with the average or minimum value (see Figure 10-17 on page 155).



**Figure 10-17 Examples of the measurement screen with the AVG/MIN measurement active**

### To make thickness readings using the AVG/MIN measurement

1. Activate and configure the **AVG/MIN** function (see “Configuring AVG/MIN Measurements” on page 153).
2. Couple your transducer to the material.  
The thickness appears on the display.
3. Press **[SAVE/SEND]** to display the thickness in the left most thickness box. Each time you press **[SAVE/SEND]** the actual thickness reading appears in the next shaded box moving to the right while the minimum or average of the thickness readings is automatically calculated and placed in the right most box.
4. If you want to replace a reading, use the **[◀]** and **[▶]** keys to switch from one highlighted box to another, and press **[SAVE/SEND]** to save the new reading.
5. When the minimum or average box is highlighted, press **[SAVE/SEND]** a last time to store that value in the datalogger at the current ID# location, and clear all the boxes.

OR

Press **[MEAS]** to clear all the boxes without saving to the datalogger.

## 10.7 Using Temperature Compensation

The 38DL PLUS can compensate for changes in sound velocity due to temperature variations. This function is useful for example when the test block may be at room temperature while the actual material can be at an elevated temperature.

Using the temperature compensation function, you can input the temperature of the calibration standard in °F or °C units. You can manually enter a fixed elevated temperature, manually enter a temperature for the current ID location, or automatically read the temperature from an optional temperature probe.

The sound velocity of most steel changes about 1 % for every 55 °C (100 °F) change in temperature. The following equation is used to compensate for the change in sound velocity due to temperature.

$$\text{Temperature corrected thickness} = MTI \times V_0 \times (1 + (k \times (T_1 - T_0)))$$

Where:

MTI = Measured time interval

$V_0$  = Calibrated test block velocity

$T_1$  = Actual material temperature

$T_0$  = Temperature at calibration

k = Temperature coefficient (normally -0.00018 for °C or -0.0001 for °F)

A temperature coefficient of 0.00018 for °C (or 0.0001 for °F) assumes a 1 % change in velocity per 55 °C (100 °F) change in temperature.

### To use the temperature compensation

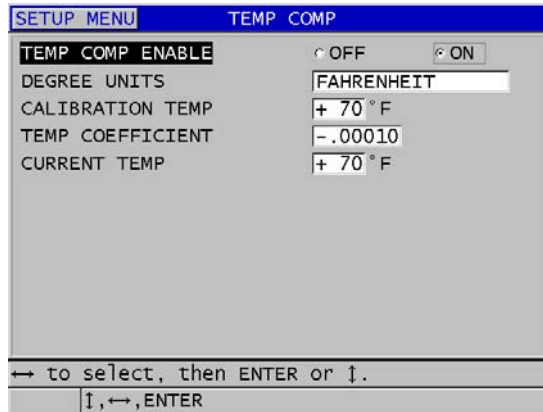
1. Press **[SETUP MENU]**.
2. In the menu, select the **TEMP COMP**.
3. In the **TEMP COMP** screen (see Figure 10-18 on page 157):
  - a) Set **TEMP COMP ENABLE** to **ON** to activate the temperature compensation function.
  - b) Set **DEGREE UNITS** to the desired temperature units (**FAHRENHEIT** or **CELSIUS**).
  - c) Set **CALIBRATION TEMP** to the temperature of the test block used to perform the calibration. The allowable range is -10 °C to 500 °C or 14 °F to 932 °F.



- d) Set **TEMP COEFFICIENT** to the desired value (typically  $-0.00018$  for  $^{\circ}\text{C}$  or  $-0.00010$  for  $^{\circ}\text{F}$ ) for steel.
- e) Set **CURRENT TEMP** to the temperature of the actual test piece.

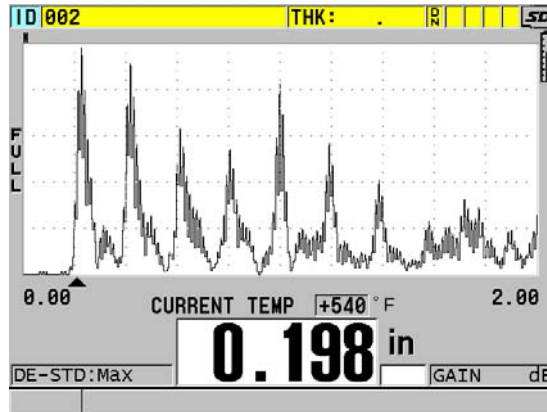
### NOTE

You can specify a negative sign using the [**▶**] or [**◀**] keys to move the cursor over the “+” or “-”, and then using the [**▲**] and [**▼**] keys to change the sign.



**Figure 10-18 The TEMP COMP screen**

4. Press [**MEAS**] to return to the measurement screen with the activated temperature compensation (see Figure 10-19 on page 158). The measured thickness is temperature-compensated based on the **CALIBRATION TEMP**, the **CURRENT TEMP**, and the **TEMP COEFFICIENT** parameter values.



**Figure 10-19** Displaying temperature compensation data

5. While the temperature compensation function is active, if the temperature of the test piece changes, you can quickly change the **CURRENT TEMP** as follows:
  - a) Press [2nd F], [XDCR RECALL] (REF VALUE).
  - b) In the **CURRENT TEMPERATURE** screen, enter the new current temperature value.

---

<b>NOTE</b>
-------------

Both the thickness and current temperature values are saved to the internal datalogger.

---

---

## 11. Using the Datalogger

---

This chapter describes how to use the 38DL PLUS internal datalogger to organize your data.

### 11.1 Datalogger

The 38DL PLUS datalogger is a file-based system where one file is opened at a time. The active file stores a measurement at a thickness measurement location ID. Each time you press [SAVE/SEND], the displayed value is saved to the active file at the current ID. The ID is automatically incremented for the next measurement. When you press [FILE], the name of the active file appears in the ID bar above the menu (see Figure 11-1 on page 159).

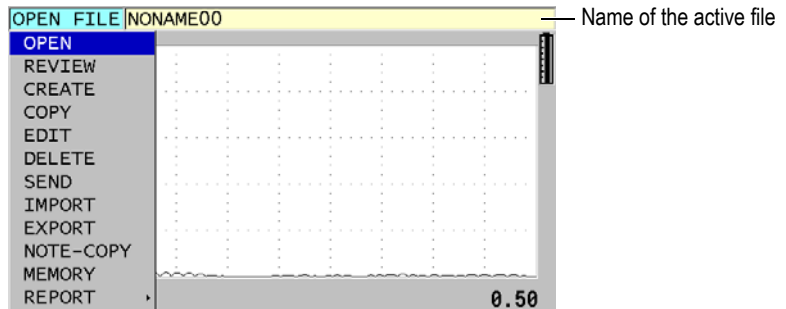


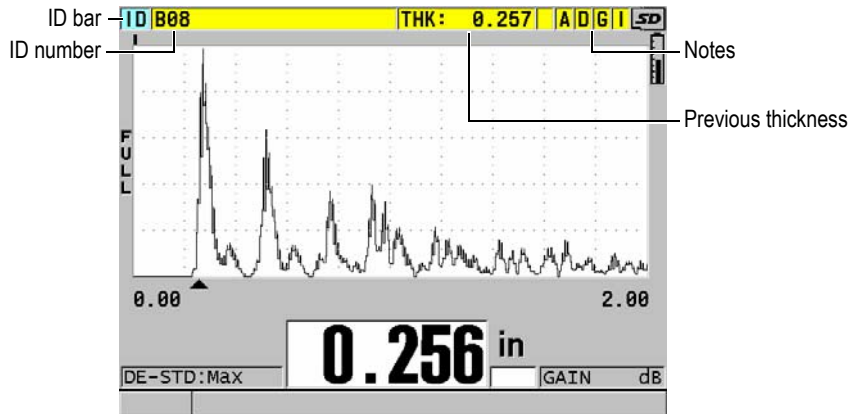
Figure 11-1 The active file name appearing in the ID bar

A file also contains header parameters that you can define to better describe the content of the file. You can define notes in the file, and associate up to four notes to an ID or to a range of IDs. In the file, you can organize the ID range, select the data format, and select the saved data. Table 10 on page 160 summarizes the contents of a file and indicates where you can find more information.

**Table 10 File contents summary**

Contents	Description	See section
Header	Extra parameters to describe the contents and the context of the data	“Creating a Data File” on page 163
Measurement data	Organized by predefined IDs arranged by file types	“Data File Types” on page 165
	Data format defined by the file data mode	“File Data Modes” on page 182
	Saved data (thickness measurement with or without the waveform) configured using the setup menu	“Saving Data” on page 76
Notes	Centralized in a note table	“Notes” on page 192
	Associated to an ID or to a range of IDs	“Associating a Note to an ID or to a Range of IDs” on page 193

You can identify the datalogger parameters in the ID bar at the top of the measurement screen (see Figure 11-2 on page 161).



**Figure 11-2 Identifying datalogger parameters**

With each measurement, the 38DL PLUS also stores a complete description of the measurement conditions. Table 11 on page 162 describes the additional data stored with each thickness measurement and with each waveform.

**Table 11 Additional information stored with the data**

For a measurement	For a waveform
File name File header data 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) Temperature (when temperature compensation is active) Oxide thickness (when Oxide Measurement is active)	Zoom status Horizontal axis limits Detection marker position Delay Range Rectification mode

You can store approximately 475000 thickness values without waveforms in the internal memory or approximately 20000 thickness values with waveforms. You can double the storage capacity by using an optional external microSD memory card. The maximum size of the external microSD card that can be used on the 38DL PLUS is 2 GB.

With the datalogger, you can easily create a data file (see “Creating a Data File” on page 163), perform a number of file operations (see “Performing File Operations” on page 183), add notes (see “Notes” on page 192), and perform data operations (see “Setting the ID Overwrite Protection” on page 196).

## 11.2 Creating a Data File

The following procedure describes how to create a data file in the 38DL PLUS.

---

<b>NOTE</b>
-------------

You can also create a 38DL PLUS data file from a computer using the GageView interface program. Refer to the *GageView Interface Program – User’s Manual* (P/N: 910-259-EN [U8778347]) for details.

---

### To create a data file

1. From the measurement screen, press **[FILE]**.
2. In the menu, select **CREATE**.
3. In the **CREATE** screen (see Figure 11-3 on page 164):
  - a) In the **FILE NAME** parameter, enter the desired file name using up to 32 characters.
  - b) In the **DESCRIPTION** parameter, optionally enter a description of the contents of the file.
  - c) In the **INSPECTOR ID**, optionally enter an identification of the inspector.
  - d) In the **LOCATION NOTE** parameter, optionally enter an identification of where the measurement are performed.
  - e) Select the appropriate **DATA FILE TYPE** for your application (see “Data File Types” on page 165 for details).
  - f) Select the appropriate **FILE DATA MODE** for your application (see “File Data Modes” on page 182 for details).
  - g) Set the **DELETE PROTECTION** mode **ON** or **OFF**.  
Delete protection locks the file so it cannot be deleted. You can unlock the file for deletion using the file edit function.
  - h) Depending on the selected **FILE TYPE**, refer to the following sections for the remaining steps of this procedure:
    - **INCREMENTAL**                    see “Incremental Data File Type” on page 165
    - **SEQUENTIAL**                    see “Sequential Data File Type” on page 167

- **SEQ+CUSTOM PT** see “Sequential with Custom Points Data File Type” on page 168
- **2D GRID** see “2-D Grid Data File Type” on page 170
- **2D+CUSTOM PT** see “2-D Grid with Custom Points Data File Type” on page 174
- **3D GRID** see “3-D Grid Data File Type” on page 176
- **BOILER** see “Boiler Data File Type” on page 178
- **3D CUSTOM** see “3-D Custom File Type” on page 180

FILE MENU		CREATE								
FILE NAME										
DESCRIPT	A	B	C	D	E	INSERT	1	2	3	
	F	G	H	I	J	DELETE	4	5	6	
INSPECTO	K	L	M	N	O	DONE	7	8	9	
	P	Q	R	S	T		0	.		
LOCATION	U	V	W	X	Y	←	→	-	:	/
	Z	SPACE				CANCEL	SP	#	*	
FILE TYPE	INCREMENTAL									
FILE DATA MODE	THICKNESS									
DELETE PROTECTION	<input type="radio"/> OFF <input type="radio"/> ON									
START ID										
CREATE					CANCEL					
↑↔ to select char/command, then ENTER.										
↑, ↔, ENTER, 2ndF ENTER, 2ndF ↔, ↓										

**Figure 11-3 Example of the CREATE screen**

**TIP**

At any time, you can press [2nd F], [▲] or [2nd F], [▼] to scroll between parameters on the screen.



## 11.2.1 Data File Types

You can create a data file using one of the following eight data file types:

- Incremental
- Sequential
- Sequential with Custom Point
- 2-D Matrix Grid
- 2-D Matrix Grid with Custom Point
- 3-D Matrix Grid
- Boiler
- 3-D Custom

### 11.2.1.1 Incremental Data File Type

The incremental data file type uses the alphanumeric start ID value (up to 20 characters) and automatically increments to the subsequent ID value using the following incrementing rules:

- Increments only digits and letters, not punctuation or other special characters.
- Begins incrementing with the right-most character.
- Extends leftward until reaching the first punctuation or special character, or the left-most character, whichever comes first.
- Increments digits from 0, 1, 2,..., 9. Makes the 9 to 0 transition only after incrementing the character to the left.
- Increments letters from A, B, C,..., Z. Makes the Z to A transition only after incrementing the character to the left.
- When an ID cannot be incremented after saving a reading, the **Cannot increment ID!** message momentarily appears in the help text bar. Subsequent saves overwrite the reading of the last possible ID until you change the ID value range.

---

<b>NOTE</b>
-------------

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 (see examples in Table 12 on page 166).

---

**Table 12 Resulting ID examples for the INCREMENTAL file type**

START ID	Resulting IDs	
1	1, 2, 3,..., 9	
0001	0001 0002 0003 ... 0009	0010 ... 9999
ABC	ABC ABD ABE ... ABZ	ACA ACB ACC ... ZZZ
1A	1A 1B 1C ... 1Z	2A 2B ... 9Z
ABC*12*34	ABC*12*34 ABC*12*35 ABC*12*36 ... ABC*12*99	

**To create an incremental data file**

1. From the measurement screen, press **[FILE]**, and then select **CREATE** in the menu (see "Creating a Data File" on page 163 for details on the first parameters).
2. In the **CREATE** screen (see Figure 11-4 on page 167):
  - a) Enter the **START ID** value.
  - b) Select **CREATE**.

FILE MENU		CREATE								
FILE NAME										
DESCRIPT	A	B	C	D	E	INSERT	1	2	3	
	F	G	H	I	J	DELETE	4	5	6	
INSPECTO	K	L	M	N	O	<b>DONE</b>	7	8	9	
	P	Q	R	S	T		0	.		
LOCATION	U	V	W	X	Y	←	→	-	:	/
	Z	SPACE				CANCEL	SP	#	*	
FILE TYPE	INCREMENTAL									
FILE DATA MODE	THICKNESS									
DELETE PROTECTION	<input type="radio"/> OFF <input type="radio"/> ON									
START ID										
<input type="button" value="CREATE"/> <input type="button" value="CANCEL"/>										
↑↔ to select char/command, then ENTER.										
↑, ↔, ENTER, 2ndF ENTER, 2ndF ↔, ↓										

Figure 11-4 The CREATE screen for the incremental data file type

### 11.2.1.2 Sequential Data File Type

The sequential data file type is similar to the incremental type but you can define both a starting and ending ID numbers. The resulting file is inclusive of the starting and ending points and all incremental points in between (see examples in Table 13 on page 167).

Table 13 Resulting ID examples for the SEQUENTIAL file type

START ID	END ID	Resulting IDs
ABC123	ABC135	ABC123 ABC124 ABC125 ... ABC135
XY-GY	XY-IB	XY-GY XY-GZ XY-HA ... XY-IB

## To create a sequential data file

1. From the measurement screen, press **[FILE]**, and then select **CREATE** in the menu (see "Creating a Data File" on page 163 for details on the first parameters).
2. At the bottom of the **CREATE** screen, select **CONTINUE**.
3. In the second page of the **CREATE** screen (see Figure 11-5 on page 168):
  - a) Enter the **START ID** and **END ID** values.
  - b) Select **CREATE**.

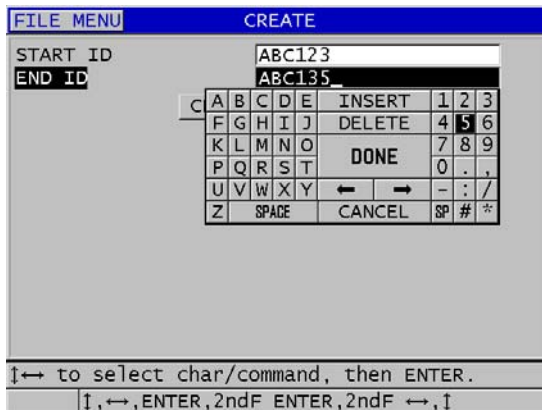


Figure 11-5 Selecting the ID range for the sequential file type

### 11.2.1.3 Sequential with Custom Points Data File Type

The sequential with custom point (**SEQ+CUSTOM PT**) data file type is defined by a starting and an ending ID number plus a series of custom points. The resulting file is inclusive of the start and end points and all points in between. In addition, multiple thickness readings per ID number location are assigned using the assigned custom points.

Use the sequential with custom point data file type for example when you want to measure along a pipe or tube, where at each ID number location, you can take measurements at the top, bottom, left, and right of the pipe (see an example in Table 14 on page 169).

**Table 14 Resulting ID example for the SEQ+CUSTOM PT file type**

START ID	END ID	Custom points	Resulting IDs
XYZ1267	XYZ1393	TOP BOTTOM LEFT RIGHT	XYZ1267TOP XYZ1267BOTTOM XYZ1267LEFT XYZ1267RIGHT XYZ1268TOP XYZ1268BOTTOM XYZ1268LEFT ... XYZ1393RIGHT

The allowable number of characters for each custom point depends on the ID number of characters defined in the start and end ID values. The total number of characters of the ID value plus the custom points cannot exceed 20 characters. For example, when the start and end ID values are seven characters long, as in the example in Table 14 on page 169, the maximum allowable length for each custom point is thirteen ( $20 - 7 = 13$ ).

### To create a sequential data file with custom points

1. From the measurement screen, press **[FILE]**, and then select **CREATE** in the menu (see "Creating a Data File" on page 163 for details on the first parameters).
2. At the bottom of the **CREATE** screen, select **CONTINUE**.
3. In the second page of the **CREATE** screen (see Figure 11-6 on page 170):
  - a) Enter the **START ID** and **END ID** values.
  - b) Enter two or more **CUSTOM POINTS** values.
  - c) Press **[2nd F]**, **[▼]** to finish entering **CUSTOM POINTS** values.
  - d) Select **CREATE**.

FILE MENU		CREATE							
START ID	XYZ1267								
END ID	XYZ1393								
CUSTOM POINTS	BOTTOM								
	LEFT								
	RIGHT								
	A	B	C	D	E	INSERT	1	2	3
	F	G	H	I	J	DELETE	4	5	6
	K	L	M	N	O	DONE	7	8	9
	P	Q	R	S	T		0	.	/
	U	V	W	X	Y	←	→	-	:
	Z	SPACE	CANCEL	SP	#	*			
↑↔ to select char/command, then ENTER.									
↑, ↔, ENTER, 2ndF ENTER, 2ndF ↔, ↓									

Figure 11-6 Configuring the ID range for a sequential with custom points data file type

#### 11.2.1.4 2-D Grid Data File Type

A grid is a sequence of ID numbers arranged to describe a path through a two-dimensional. 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 (see Figure 11-7 on page 171). 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 the last row is reached. You can select to first increment either the columns or the rows.

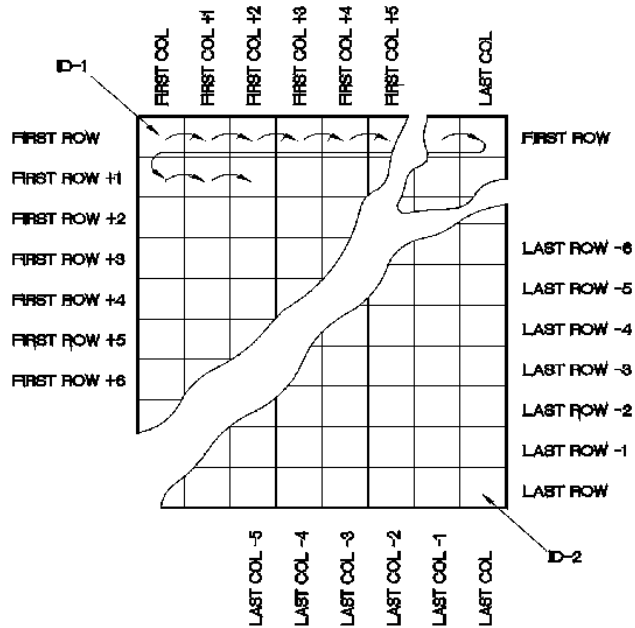
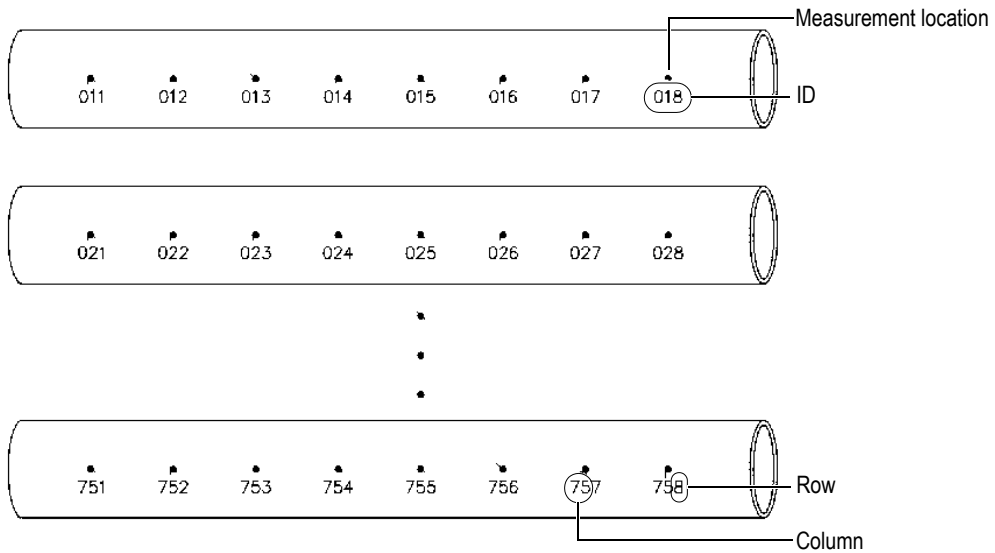


Figure 11-7 General 2-D grid example

A grid structure may associate one dimension of the grid 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 (see the example in Figure 11-8 on page 172).



**Figure 11-8 One grid for 75 identical parts**

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 (see the examples in Figure 11-9 on page 173).



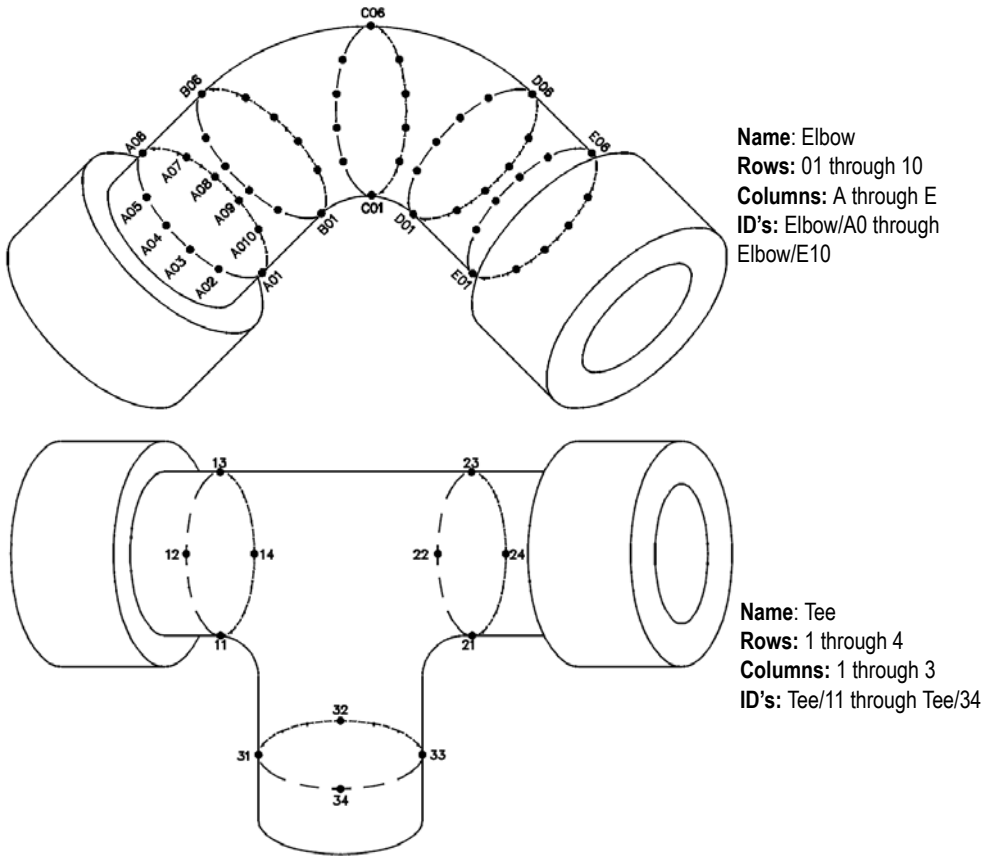
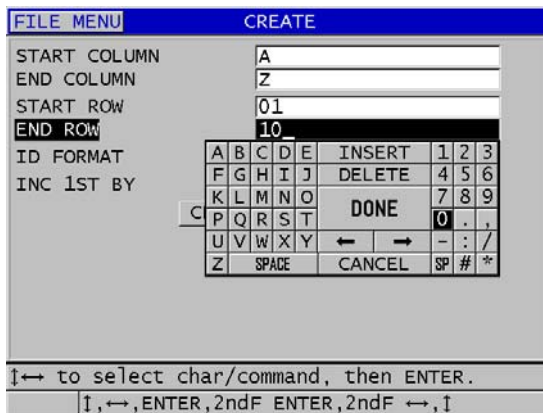


Figure 11-9 Different named grid for each part

### To create a 2-D grid data file

1. From the measurement screen, press **[FILE]**, and then select **CREATE** in the menu (see "Creating a Data File" on page 163 for details on the first parameters).
2. At the bottom of the **CREATE** screen, select **CONTINUE**.
3. In the second page of the **CREATE** screen (see Figure 11-10 on page 174):
  - a) Enter the **START COLUMN**, **END COLUMN**, **START ROW**, and **END ROW** values.

- b) Select the **ID FORMAT** to determine how letters are incremented after Z:  
**STANDARD:** A, B, C... Z, AA, AB, AC... ZZ.  
**EPRI:** A, B, C... Z, AA, BB, CC... ZZ.
- c) In **INC 1ST BY**, select which parameter increments the first (**ROW** or **COLUMN**).
- d) Select **CREATE**.



**Figure 11-10 Configuring the ID range for a 2-D grid data file type**

#### NOTE

The 38DL PLUS has the ability to add a row, add a column, and change the incrementing direction after a grid file is created (see “Editing a File” on page 186 for details).

### 11.2.1.5 2-D Grid with Custom Points Data File Type

The 2-D grid with custom points data file type is similar to the 2-D grid data file type (see “2-D Grid Data File Type” on page 170), except that you can add custom points. Custom points to record multiple readings with each grid ID number (see an example in Table 15 on page 175).

**Table 15 Resulting ID example for the 2D+CUSTOM PT file type**

Parameters	Values	CUSTOM POINTS	Resulting IDs
START COLUMN	A	LEFT	A01LEFT
END COLUMN	J	CENTER	A01CENTER
START ROW	01	RIGHT	A01RIGHT
END ROW	17		A02LEFT
			...
			J17RIGHT

**To create a 2-D grid with custom points data file**

1. From the measurement screen, press **[FILE]**, and then select **CREATE** in the menu (see “Creating a Data File” on page 163 for details on the first parameters).
2. At the bottom of the **CREATE** screen, select **CONTINUE**.
3. In the second page of the **CREATE** screen (see Figure 11-11 on page 176):
  - a) Enter the **START COLUMN**, **END COLUMN**, **START ROW**, and **END ROW** values.
  - b) Enter two or more **CUSTOM POINTS** values.
  - c) Press **[2nd F]**, **[▼]** to finish entering **CUSTOM POINTS** values.
  - d) In **INC 1ST BY**, select which parameter increments first (**POINT**, **ROW**, or **COLUMN**).
  - e) In **INC 2ND BY**, select which parameter increments second (**POINT**, **ROW**, or **COLUMN**).
  - f) Select **CREATE**.

FILE MENU		CREATE	
START COLUMN	A		
END COLUMN	J		
START ROW	01		
END ROW	17		
CUSTOM POINTS	LEFT		
	CENTER		
	RIGHT		
INC 1ST BY	A B C D E	INSERT	1 2 3
INC 2ND BY	F G H I J	DELETE	4 5 6
	K L M N O	DONE	7 8 9
	P Q R S T		0 . ,
	U V W X Y	← →	- : /
	Z SPACE	CANCEL	SP # *
↑↔ to select char/command, then ENTER.			
↑, ↔, ENTER, 2ndF ENTER, 2ndF ↔, ↓			

**Figure 11-11** Configuring the ID range for a 2-D grid with custom points data file type

#### NOTE

The columns of the 38DL PLUS can increment past Z. For example: Start Column: A; End Column: AC; Column Result: A, B, C,...Z, AA, AB, AC.

### 11.2.1.6 3-D Grid Data File Type

A 3-D grid is a sequence of multipart ID numbers arranged to describe a path through a three-dimensional matrix. Each part of the ID number corresponds to a particular matrix dimension.

A 3-D (three-dimensional) sequence begins with the ID number that refers to the first column, the first row, and the first point. Each time you press [SAVE/SEND], the value for the first dimension increments by one while the values for the other two dimensions remain unchanged. When the sequence reaches the last value of the first dimension, the value for the second dimension increments by one. This continues until the ID number that refers to the last column, last row and last point is reached. You can select either the columns, rows, or points to increment first.

A three-dimensional grid structure may associate two dimensions of the grid (for example, the columns and rows) with the physical coordinates on the part whose wall thickness is to be measured. The particular measurement points on each part are then

associated with the third dimension of the grid (for example, the points). This scenario allows multiple readings to be stored at each grid coordinate. The example shown in Table 15 on page 175 assumes that you chose to increment the point first, the row second and the column third.

**Table 16 Resulting ID example for the 3-D GRID file type**

Parameters	Values	Resulting IDs
Start column	A	A1X
End column	F	A1Y
Start row	1	A1Z
End row	4	A2X
Start point	X	...
End point	Z	A4Z
		B1X
		B1Y
		...
		AF4Z

### To create a 3-D grid data file

1. From the measurement screen, press **[FILE]**, and then select **CREATE** in the menu (see “Creating a Data File” on page 163 for details on the first parameters).
2. At the bottom of the **CREATE** screen, select **CONTINUE**.
3. In the second page of the **CREATE** screen (see Figure 11-12 on page 178):
  - a) Enter the **START COLUMN**, **END COLUMN**, **START ROW**, **END ROW**, **START POINT**, and **END POINT** values.
  - b) In **INC 1ST BY**, select which parameter increments first (**POINT**, **ROW**, or **COLUMN**).
  - c) In **INC 2ND BY**, select which parameter increments second (**POINT**, **ROW**, or **COLUMN**).
  - d) Select **CREATE**.

FILE MENU		CREATE
START COLUMN	A	
END COLUMN	F	
START ROW	1	
END ROW	4	
START POINT	X	
END POINT	Y	
<b>INC 1ST BY</b>	<b>POINT</b>	
INC 2ND BY	ROW	
		CREATE CANCEL
↔ to select, then ENTER or ↓.		
↓, ↔, ENTER		

Figure 11-12 Configuring the ID range for a 3-D grid data file type

### 11.2.1.7 Boiler Data File Type

A boiler file is a special file type designed specifically for boiler applications. A common method for identifying a thickness measurement location is using the following three dimensional approach:

#### Elevation

The first dimension refers to the physical distance from the bottom of the boiler toward the top.

#### Tube number

The second dimension refers to the number of the specific boiler tube to be inspected.

#### Custom points

The third dimension refers to the actual thickness reading location at the specified elevation on the specified tube.

The three dimensions are combined in a single ID number to precisely identify the exact location of each thickness reading. Table 17 on page 179 shows an example where you chose to increment the custom points first, the tube number second, and the elevation third.

**Table 17 Resulting ID example for the BOILER file type**

ELEVATIONS	START TUBE	END TUBE	CUSTOM POINTS	Resulting IDs
10FT 20FT 45FT 100FT	01	73	L (left) C (center) R (right)	10FT-01L 10FT-01C 10FT-01R 10FT-02L ... 10FT-73R 20FT-01L ... 100FT-73R

**To create a boiler data file**

1. From the measurement screen, press **[FILE]**, and then select **CREATE** in the menu (see “Creating a Data File” on page 163 for details on the first parameters).
2. At the bottom of the **CREATE** screen, select **CONTINUE**.
3. In the second page of the **CREATE** screen (see Figure 11-13 on page 180):
  - a) Enter the **START TUBE** and **END TUBE** values.
  - b) Enter two or more **CUSTOM POINTS** values.
  - c) Press **[2nd F]**, **[▼]** to finish entering **CUSTOM POINTS** values.
  - d) Enter two or more **ELEVATIONS** values.
  - e) Press **[2nd F]**, **[▼]** to finish entering **ELEVATIONS** values.
  - f) In **INC 1ST BY**, select which parameter increments first (**POINT**, **TUBE**, or **ELEVATIONS**).
  - g) In **INC 2ND BY**, select which parameter increments second (**POINT**, **TUBE**, or **ELEVATIONS**).
  - h) Select **CREATE**.

FILE MENU		CREATE
START TUBE		01
END TUBE		73
CUSTOM POINTS		C
		R
ELEVATIONS		45FT-
		100FT-
INC 1ST BY		POINT
INC 2ND BY		TUBE
		CREATE CANCEL
↔ to select, then ENTER or ↓.		
↑, ↔, ENTER		

Figure 11-13 Configuring the ID range for a boiler data file type

### 11.2.1.8 3-D Custom File Type

The 3-D custom file type is very similar to a standard 3-D Grid except that the point parameter can be a custom list of points.

Table 18 on page 180 shows an example where the custom point increments first, the custom row second, and the column third.

Table 18 Resulting ID example for the 3-D CUSTOM file type

Parameters	Value	CUSTOM ROWS	CUSTOM POINTS	Resulting IDs
START COLUMN END COLUMN	A F	-TOP- -MIDDLE- -BOTTOM-	LEFT RIGHT	A-TOP-LEFT A-TOP-RIGHT A-MIDDLE-LEFT A-MIDDLE-RIGHT ... F-BOTTOM-LEFT F-BOTTOM-RIGHT

#### To create a 3-D custom data file

- From the measurement screen, press **[FILE]**, and then select **CREATE** in the menu (see “Creating a Data File” on page 163 for details on the first parameters).



2. At the bottom of the **CREATE** screen, select **CONTINUE**.
3. In the second page of the **CREATE** screen (see Figure 11-14 on page 181):
  - a) Enter the **START COLUMN**, and **END COLUMN** values.
  - b) Enter two or more **CUSTOM ROWS** values.
  - c) Press [**2nd F**], [**▼**] to finish entering **CUSTOM ROWS** values.
  - d) Enter two or more **CUSTOM POINTS** values.
  - e) Press [**2nd F**], [**▼**] to finish entering **CUSTOM POINTS** values.
  - f) In **INC 1ST BY**, select which parameter increments first (**POINT**, **ROW**, or **COLUMN**).
  - g) In **INC 2ND BY**, select which parameter increments second (**POINT**, **ROW**, or **COLUMN**).
  - h) Select **CREATE**.

FILE MENU		CREATE
START COLUMN		A
END COLUMN		F
CUSTOM ROWS		MIDDLE
		BOTTOM
CUSTOM POINTS		LEFT
		RIGHT
INC 1ST BY		POINT
INC 2ND BY		ROW
		<b>CREATE</b> CANCEL
← to select, then ENTER.		
I, ←, ENTER		

**Figure 11-14** Configuring the ID range for a 3-D custom data file type

#### NOTE

The columns of the 38DL PLUS can increment past Z. For example:  
 Start Column: A;  
 End Column: AC;  
 Column Result: A, B, C,...Z, AA, AB, AC.

## 11.2.2 File Data Modes

When you create a data file on the 38DL PLUS, you must select the file data mode to determine which measured values to store in the file (see step 3.f in “Creating a Data File” on page 163). Table 19 on page 182 describes the available file data mode options. You can only store one type of data in a file.

**Table 19 File data mode stored measurements**

File data mode	Stored measurements	When to use
THICKNESS	Standard thickness Echo-to-echo thicknesses	When basic thickness measurement functions
THRU COAT	Coating thickness Material thicknesses	When using THRU-COAT (see “Measurements with THRU-COAT D7906 and D7908 Transducers” on page 78)
TEMP COMP	Material temperature Material thickness	When using temperature compensation (see “Using Temperature Compensation” on page 156)
OXIDE LAYER	Oxide thickness Material thickness	When using the optional oxide software (see “Oxide Layer Software Option” on page 93)
VELOCITY	Velocity	When performing velocity measurements
MIN/MAX	Minimum thickness Maximum thickness	When using the MIN/MAX mode (see “Using the Minimum, Maximum, or Min/Max Thickness Mode” on page 115)
TIME OF FLT	Time of flight	When measuring time of flight
REDUCTION RT	Material thickness Reduction rate	When the reduction rate differential mode is activated (see REDUCTION RT in “Using Alarms” on page 117)

**Table 19 File data mode stored measurements (continued)**

File data mode	Stored measurements	When to use
SOFT CONTACT	Sagittal height Radius of curvature Lenses thickness	When using the multilayer software option (see “Using the Multi-Measurement with the Soft Contact Mode” on page 102)
% TOTAL THK	Thickness Percent total thickness	When using the multilayer software option (see “Using the Multi-Measurement % Total Thickness Mode” on page 104)

You can set the default file data mode to the option you use most frequently.

### To change the default file data mode

1. From the measurement screen, press [SETUP MENU].
2. In the menu, select **SYSTEM**.
3. In the **SYSTEM** screen, set **DEFAULT FILE DATA MODE** to the desired option (see Table 19 on page 182 for details).
4. Press [MEAS] to return to the measurement screen.

## 11.3 Performing File Operations

Pressing [FILE] opens a menu from which you can perform numerous file operations (see Figure 11-15 on page 184). The following sections describe how to perform the operations. Datalogger files are stored in the internal microSD memory card. You can import/export files from/to an external microSD memory card.

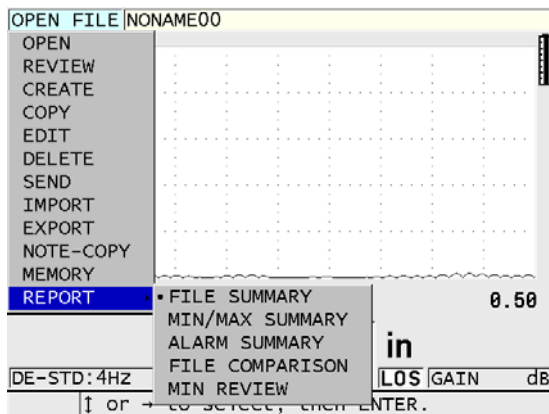


Figure 11-15 The file menu and report submenu

### 11.3.1 Opening a File

You can open an existing file to make it the active file to which new measurements will be saved.

#### To open a file

1. Press **[FILE]**.
2. In the menu, select **OPEN**.
3. In the **OPEN** screen (see Figure 11-16 on page 185):
  - a) In **SORT BY**, select how files appearing on the screen are sorted (by **NAME** or by **DATE CREATED**).
  - b) In the list of files, select the file that you wish to open.  
The descriptive header for the highlighted file name appears on the lower section of the display.
  - c) Select **OPEN** to return to the measurement screen with the selected file as the active file and the ID number set to the first ID number in the file.

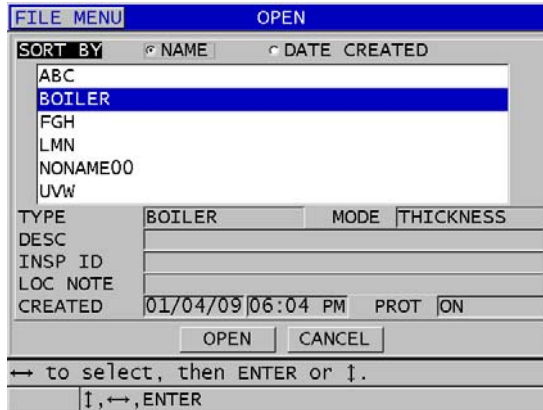


Figure 11-16 Opening a file

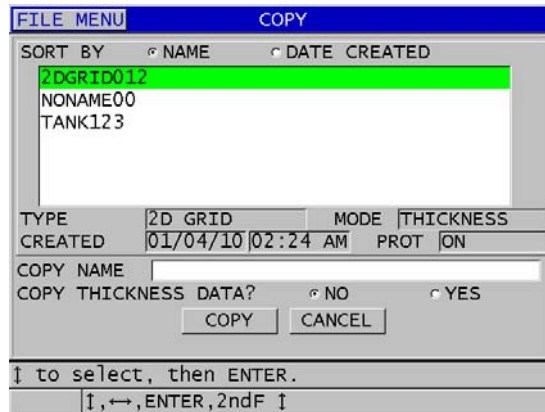
### 11.3.2 Copying a File

You can duplicate a file that already exists in the datalogger. The file copy function is useful when you need to create a new file with the exact same ID number structure as a previously created file. You can also choose to copy the thickness data.

The file copy only allows you to copy an existing file in the internal memory to the internal memory. Use the file import and export functions to copy data between the internal memory and the external microSD card.

#### To copy a file

1. From the measurement screen, press **[FILE]**.
2. In the menu, select **COPY**.
3. In the **COPY** screen (see Figure 11-17 on page 186):
  - a) In the list, select the source file.
  - b) In **COPY NAME**, enter the file name for the destination file.
  - c) Set **COPY THICKNESS DATA** to **YES** when you want to also copy the thickness readings from the original file into the new file.
  - d) Select **COPY**.



**Figure 11-17 Copying a file**

4. Open the newly created file when you want to make it the active file (see “Opening a File” on page 184.)

### 11.3.3 Editing a File

Once a file is created, you can use the edit function to change the following file parameters:

- File name
- File description
- Inspector ID
- Location note
- Delete protection (on/off)
- End row, column, or point of a grid file
- Incrementing order of a grid file
- Incrementing direction (forwards or reverse) for rows, columns, points, tube numbers, and elevations

The edit function does not let you edit the file type and cannot be used to edit individual measurement identifiers (ID) or actual thickness readings.

## To edit an existing file

1. From the measurement screen, press **[FILE]**.
2. In the menu, select **EDIT**.
3. In the **EDIT** screen (see Figure 11-18 on page 187):
  - a) In the list, select the file to edit.

### NOTE

When scrolling through the file names, a descriptive header for the highlighted file name appears on the lower section of the display. This information can assist in selecting the proper file if you are uncertain of the exact file name.

- b) To rename the file, edit the **NAME** value.
- c) Edit the file description (**DESC**), the inspector identification (**INSP ID**), and the location note (**LOC NOTE**) values as needed.
- d) To change the file lock state, set **DELETE PROTECTION** to **ON** or **OFF**.
- e) For a nongrid file, select **UPDATE**.

The screenshot shows the 'EDIT' screen with the following fields and controls:

- FILE MENU** and **EDIT** headers.
- SORT BY**: NAME (selected), DATE CREATED.
- File list: ABC, **BOILER** (highlighted), FGH.
- TYPE**: BOILER, **MODE**: THICKNESS.
- CREATED**: 01/04/09 06:04 PM, **PROT**: ON.
- NAME**: BOILER01
- DESC**: A B C D E INSERT 1 2 3
- INSP ID**: F G H I J DELETE 4 5 6
- LOC NOTE**: K L M N O DONE 7 8 9
- DELETE PROT**: P Q R S T 0 . ,
- U V W X Y ← → - : / N
- Z SPACE CANCEL SP # \*

Instructions at the bottom:
   
↑↔ to select char/command, then ENTER.
   
↑, ↔, ENTER, 2ndF ENTER, 2ndF ↔, ↓

Figure 11-18 Entering new file information

4. For a grid file, select **CONTINUE**, and then in the second page of the **EDIT** screen (see Figure 11-19 on page 188):

- a) Increase the **END COLUMN** and **END ROW** values as needed. You cannot decrease the values.
- b) If needed, change the **INC 1ST BY** value.
- c) Change the incrementing direction of rows, columns, points, tubes, and elevations.

**FORWARD** increments in the direction specified when the file was created, and **REVERSE** increments in the opposite direction of that which was specified during file creation.

- d) Select **UPDATE**.

The screenshot shows a dialog box titled "EDIT" with a menu bar containing "FILE MENU". The dialog contains the following fields and controls:

- END COLUMN:** Text input field containing "2".
- END ROW:** Text input field containing "15".
- INC 1ST BY:** Text input field containing "ROW".
- COL INC DIRECTION:** Text input field containing "FORWARD", highlighted in green.
- ROW INC DIRECTION:** Text input field containing "FORWARD".
- Buttons:** "UPDATE" and "CANCEL" buttons.

At the bottom of the dialog, there is a status bar with the text: "→ to select, then ENTER or ↓." and "↓, ←, ENTER".

Figure 11-19 Displaying the grid edit screen

### 11.3.4 Deleting a File or its Contents

You can use the file delete function to completely erase the file from the datalogger memory or to erase the contents of a file. Files that are delete-protected cannot be deleted until the delete protection is disabled (see "Editing a File" on page 186.)



#### CAUTION

Once you delete a file, you cannot recover any information that was once contained in that file.



## To delete a file stored in the 38DL PLUS

1. From the measurement screen, press **[FILE]**.
2. In the menu, select **DELETE**.
3. In the **DELETE** screen (see Figure 11-20 on page 189):
  - a) In the list, select one or more files to delete.  
A check mark appears on the right on the line of files that you selected.
  - b) Press **[2nd F]**, **[▼]** to leave the list.
  - c) Select the desired **Delete Stored Data** or **Entire File** option.
  - d) Set **DELETE MODE** to **DATA** to only delete the contents of the file.  
OR  
Set **DELETE MODE** to **FILE** to completely erase the file from the memory.
  - e) Select **DELETE** to perform the operation.

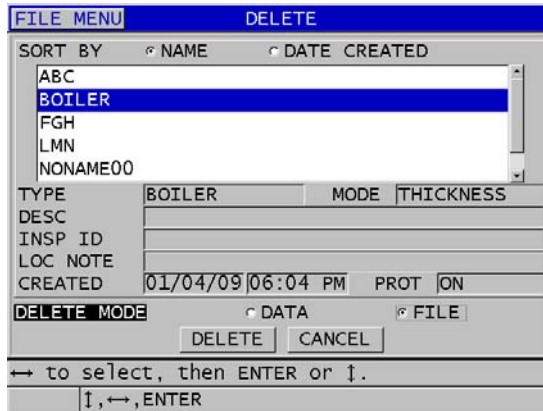


Figure 11-20 Deleting a file

### NOTE

When you select to delete multiple files, and some files are delete-protected, the 38DL PLUS will only delete the files that are not delete-protected.

### 11.3.5 Deleting a Range of IDs

You can delete a range of IDs in the active file using the clear memory function. This function deletes both the data and the ID number locations for incremental and manual (built in GageView) data files. For other data file types only the data is deleted, not the ID number locations.

#### To delete a range of IDs in a file

1. Open the file from which you wish to delete the data of a range of IDs (see “Opening a File” on page 184).
2. Press [2nd F], [FILE] (CLR MEM).
3. In the **CLEAR ID RANGE**, screen (see Figure 11-21 on page 190):
  - a) Edit the **STARTING ID** and the **ENDING ID** values to define the range of IDs that you wish to delete from the file.
  - b) Select **CLEAR**.

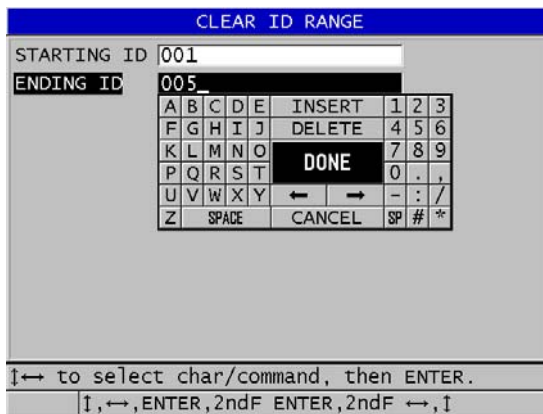


Figure 11-21 Deleting the data of an ID range in the active file

### 11.3.6 Deleting All Data Files

You can use the reset function to quickly erase all the files stored in the 38DL PLUS.



## CAUTION

Using the measurement reset erases all files and data contained in those files. The deleted files and the data they contain cannot be recovered. The datalogger will be completely empty after this procedure.

### To delete all files

1. Press [2nd F], [SETUP MENU] (SP MENU).
2. In the menu, select **RESETS**.
3. In the **RESETS** screen (see Figure 11-22 on page 191):
  - a) In the **RESETS** list, select **INTERNAL MEMORY RESET** to delete all files on the internal microSD memory card.
  - b) Select **RESET** to delete all the files.

OR

Select **CANCEL** or press [MEAS] to abort the operation.

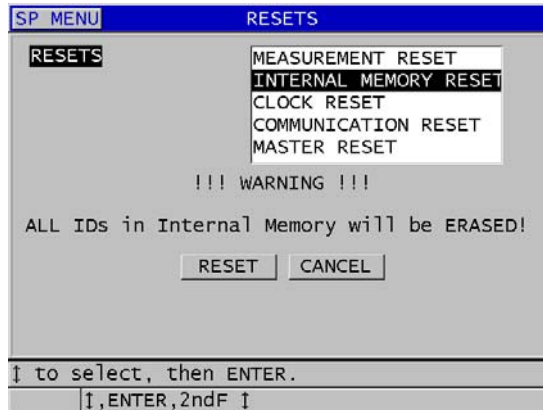


Figure 11-22 Warning message when resetting measurements

## 11.4 Notes

A note is an annotation that you can record with a particular measurement, for example to identify an unusual measurement condition. With the 38DL PLUS, you can define a list of text notes saved with the data file (see Figure 11-23 on page 192).

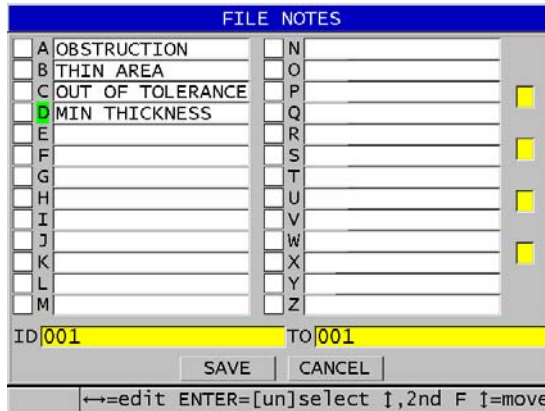


Figure 11-23 The FILE NOTES screen

A note is made of up to 16 characters. In the **FILE NOTES** screen, you can enter up to 26 notes per file. Each note is uniquely identified by a letter code. You can select up to four notes in the list, and then associate them to an ID or to a range of IDs.

When a note is associated to the current ID, the letter code of the note appears in the ID bar at the top of the measurement screen (see Figure 11-2 on page 161).

### 11.4.1 Creating or Editing Notes

You create or edit the text notes in the note table that is saved with a file.

**NOTE**

You can also quickly and easily create a note table on a computer using the GageView interface program. Refer to the *GageView Interface Program – User’s Manual* (P/N: 910-259-EN [U8778347]) for details.

---

**To create or edit notes**

1. Open the file in which you want to create or edit the notes (see “Opening a File” on page 184).
  2. Press **[2nd F], [ID#] (NOTE)**.
  3. In the **FILE NOTES** screen:
    - a) Select the letter code for the note that you wish to create or edit.
    - b) Press the **[▶]** key to enter the edit mode.
    - c) Create or edit the note text.
    - d) Repeat steps 3.a to 3.c to create or edit other notes.
    - e) Select **SAVE** to save the note list to the file.
- 

**NOTE**

If there are any previous notes, the **FILE NOTES** screen may show these notes.

---

**11.4.2 Associating a Note to an ID or to a Range of IDs**

You can associate up to four notes to each measurement ID within a file. You can also select to use up to four notes and save them to a range of IDs in a file. Notes can be saved to an ID with or without a thickness reading. Notes can be added to an ID or a range of IDs without overwriting the stored thickness readings.

**To associate a note to an ID or to a range of IDs**

1. From the measurement screen, press **[2nd F], [ID#] (NOTE)**.
  2. In the **FILE NOTES** screen (see Figure 11-24 on page 194):
    - a) Select the letter code for the note that you wish to associate.
-

- b) Press **[ENTER]**.  
A checkmark appears in the check box to the left of the letter code.
- c) Repeat steps 2.a to 2.b when you want to associate other notes (up to four).
- d) In **ID**, enter the ID or the start ID of the range to which you want to associate the note(s).
- e) In **TO**, enter the ID or the end ID of the range to which you want to associate the note(s).
- f) Select **SAVE** to save the note list to the file.  
The letter codes for the checked notes are assigned to the selected ID range.

FILE NOTES	
<input type="checkbox"/>	A OBSTRUCTION
<input checked="" type="checkbox"/>	B HIGH TEMP
<input checked="" type="checkbox"/>	C ROUGH SURFACE
<input type="checkbox"/>	D
<input type="checkbox"/>	E
<input type="checkbox"/>	F
<input type="checkbox"/>	G
<input type="checkbox"/>	H
<input type="checkbox"/>	I
<input type="checkbox"/>	J
<input type="checkbox"/>	K
<input type="checkbox"/>	L
<input type="checkbox"/>	M
<input type="checkbox"/>	N
<input type="checkbox"/>	O
<input type="checkbox"/>	P
<input type="checkbox"/>	Q
<input type="checkbox"/>	R
<input type="checkbox"/>	S
<input type="checkbox"/>	T
<input type="checkbox"/>	U
<input type="checkbox"/>	V
<input type="checkbox"/>	W
<input type="checkbox"/>	X
<input type="checkbox"/>	Y
<input type="checkbox"/>	Z

ID **10FT-01L** TO **10FT-01L**

SAVE | CANCEL

↔=edit ENTER=[un]select ↑,2nd F ↑=move

Figure 11-24 Selecting a note from the notes table

### NOTE

The letter codes are automatically untagged every time you press **[SAVE/SEND]**. Therefore, you must select the desired comment code before using the **[SAVE/SEND]** key.

## 11.4.3 Deleting a Note from a File

You can delete a note from a file.

**CAUTION**

To prevent loss of data, do not delete notes of letter codes that have already been associated with an ID or with a range of IDs. This would destroy the meaning of the letter codes stored with IDs.

---

**To delete a note from a file**

1. Open the file in which you want to delete a note (see “Opening a File” on page 184).
2. Press **[2nd F], [ID#] (NOTE)**.
3. In the **FILE NOTES** screen:
  - a) Select the letter code for the note that you wish to delete.
  - b) Press the **[▶]** key to enter the edit mode.
  - c) Delete all the characters of the note text.
  - d) Select **SAVE** to save the edited note list to the file.

**11.4.4 Copying a Note Table**

You can easily copy notes from one file to another file in the 38DL PLUS. This is very useful when you are creating files from the 38DL PLUS and want to use a common note table.

**CAUTION**

To prevent loss of data, do not copy a note table to a file that has existing stored letter codes. Copying would redefine the meaning of existing stored notes.

For example, if A = HOT SURFACES in the original note table, and you copy a note table where A = PAINTED SURFACES, this changes the definition of A, and thus changes the meaning of any previously stored A notes.

---

## To copy a note table

1. Press **[FILE]**.
2. In the menu, select **NOTE-COPY**.
3. In the **NOTE-COPY** screen (see Figure 11-25 on page 196):
  - a) Select the **SOURCE FILE**, the file from which you want to copy the note table.
  - b) Select the **DESTINATION FILE**, the file to which you want to copy the note table.
  - c) Select **COPY**.

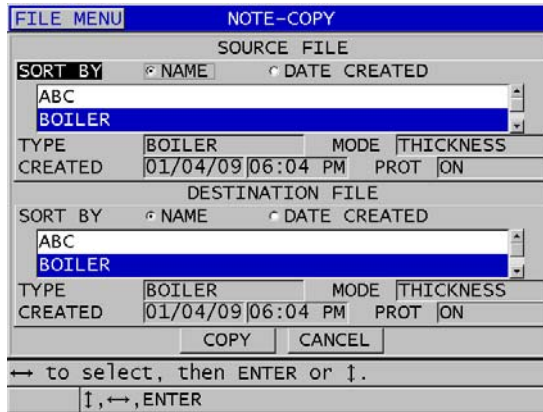


Figure 11-25 Copying a note table from one file to another

## 11.5 Setting the ID Overwrite Protection

You can activate the ID overwrite protection to warn you every time that you attempt to overwrite an existing measurement in a file. You can enable this function at any time.

When the ID overwrite protection is enabled, a message appears on the help text bar when you attempt to save data over existing thickness readings/waveforms. Select **YES** to replace the previous reading with the new one, or **NO** to leave the original value.





Figure 11-26 The ID overwrite protection message

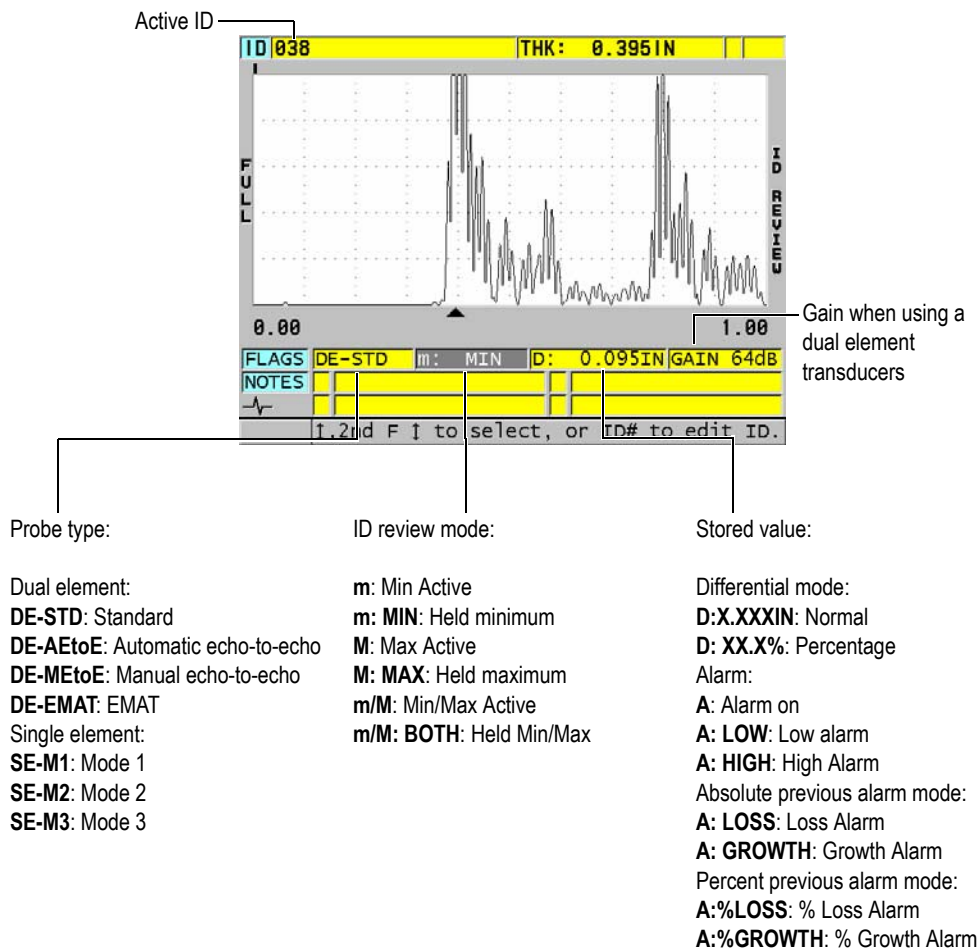
### To set the ID overwrite protection

1. From the measurement screen, press **[SETUP MENU]**.
2. In the menu, select **MEAS**.
3. In the **MEAS** screen, set **ID OVERWRITE PROTECTION** to **ON** or **OFF**.
4. Press **[MEAS]** to return to the measurement screen.

## 11.6 ID Review Screen

You can review the data stored in the active file using the ID review screen. You toggle the state of the ID review screen by pressing **[ID#]**. The ID review screen shows the waveform and the data for the active ID.

Figure 11-27 on page 198 shows an example of ID review screen and describes its contents. The area under the waveform is reserved for status flags describing the displayed stored thickness values. The flags are the same single letter abbreviations for status words that are transmitted by the gage using the send commands (see “Managing Communications and Data Transfer” on page 243).



**Figure 11-27 Identifying the ID review screen**

The ID review screen has three purposes:

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

- Change the current ID location to any location that already exists in the data file for the purposes of editing that ID location.

## 11.6.1 Reviewing Stored Data and Changing the Active ID

You use the ID review screen to review the data in the active file.

### To review stored data and change the active ID

1. Open the file that you wish to review (see “Opening a File” on page 184).
2. From the measurement screen, press **[ID#]**.
3. While in the ID review screen (see Figure 11-27 on page 198):
  - a) Review the waveform, status flags, notes, and measured values for the active ID.
  - b) Press **[▲]** to display the data for the next ID in the file.
  - c) Press **[▼]** to display the data for the previous ID in the file.
  - d) Press **[2nd F]**, **[▲]** and **[2nd F]**, **[▼]** to respectively jump to the last ID and to the first ID in the file.
  - e) Press **[ID#]** to edit the ID (see “Editing the ID” on page 199).
4. Press **[MEAS]** to return to the measurement screen with the new active ID.

## 11.6.2 Editing the ID

You can edit the ID for one of two following purposes:

- Change the active ID to quickly jump to an existing ID. This is useful when you are using a large database and it would take too long to locate the desired ID using the arrow keys.
- Change the active ID to a new ID, which does not yet exist in the file. This mode is useful when you want to include additional measurement points to the active file. Additional IDs can be added anywhere in the database (beginning, middle, end).

---

<b>NOTE</b>
-------------

No stored data is shown while editing the ID.

---

## To use the ID edit mode

1. Open the file in which you wish to edit an ID (see “Opening a File” on page 184).
2. From the measurement screen, press **[ID#]**.
3. Select the ID you wish to edit (see “Reviewing Stored Data and Changing the Active ID” on page 199).
4. Press **[ID#]** again, and edit the ID value (see Figure 11-28 on page 200).

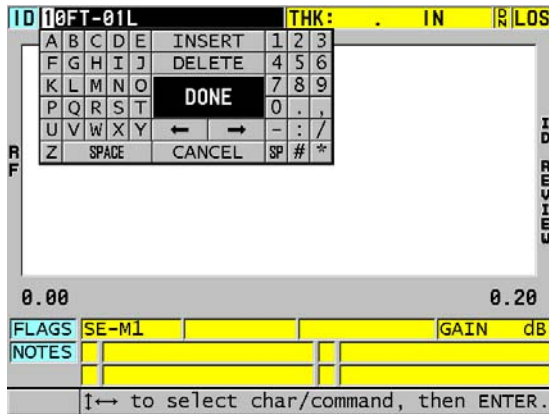


Figure 11-28 Editing the ID # edit mode

5. Press **[MEAS]** to return to the measurement screen with the new active ID.
6. When the edited ID is not in the database, the help text bar message shown in Figure 11-29 on page 201 appears, select **INSERT** to insert the new ID before the active ID.

OR

Select **APPEND** to add the new ID at the end of the file.

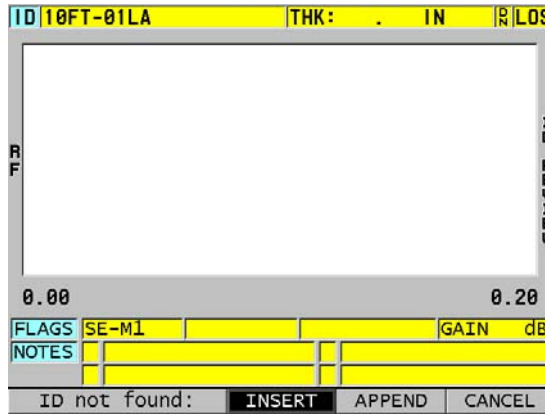


Figure 11-29 The message when the edited ID is not in the database

7. Press [SAVE/SEND] with or without an active measurement in order for the edited ID to become a permanent part of the database.  
The sequence resumes at the previous active ID.

### 11.6.3 Erasing Data in the Active File



#### CAUTION

Data erased by the following techniques **CANNOT** be recovered.

#### To erase a single measurement

1. From the measurement screen, press [ID#].  
The ID review screen appears and shows the active ID with its stored data.
2. Select the ID to be erased (see “Reviewing Stored Data and Changing the Active ID” on page 199).
3. Press [2nd F], [FILE] (CLR MEM) to erase the data at the displayed ID.  
The displayed ID changes to the next ID in the sequence.

**TIP**

To replace a thickness reading, it is easier to save a new measurement at the desired ID from the measurement screen. If you do not want to save a measurement at a specific ID, press **[SAVE/SEND]** from the measurement screen when you are not taking a measurement. This stores an LOS condition and --.-- at the specific ID number.

---

4. Press **[MEAS]** to return to the measurement screen.
- 

**NOTE**

When deleting the measurement stored in an ID, the ID is also deleted. In all other file types, only the thickness and waveform data is deleted.

---

## 11.7 Generating Reports

The 38DL PLUS can generate inspection data reports without having to connect to a computer or printer. The following reports are available:

### File summary

Shows basic statistics for the file (minimum thickness and location, maximum thickness and location, high and low alarm conditions along with the mean, median, and standard deviation).

### Minimum/Maximum summary

Shows a list of ID number location that have the minimum and maximum thickness in a file.

### Alarm summary

Shows a list of all the ID number locations where a low alarm and high alarm occurred.

### File comparison

Allows you to select two files and compare them. The first file contains the previous inspection data and the second file contains the current inspection data. The report indicates the maximum wall loss and any area of greater wall thickness (growth) and their ID number locations.

---

## Minimum Review

Allows you to select a file and then review all minimum thickness locations in the file. You can verify the thickness at all minimum location and replace them if needed.

### To generate a report

1. From the measurement screen, press **[FILE]**.
2. In the menu, select **REPORT**.
3. In the submenu, select the desired type of report. When you select:
  - **FILE SUMMARY**, go to step 4
  - **MIN/MAX SUMMARY**, go to step 5
  - **FILE COMPARISON**, go to step 6
  - **ALARM SUMMARY**, go to step 7
  - **MIN REVIEW**, go to step 8
4. In the **FILE SUMMARY** screen (see Figure 11-30 on page 203):
  - a) Select the file for which you want to create the report.
  - b) Select **REPORT**.

The **FILE SUMMARY** report result screen opens (see Figure 11-31 on page 204).

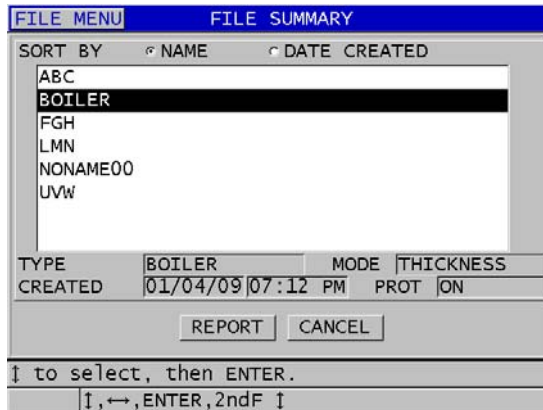


Figure 11-30 The FILE SUMMARY report screen

FILE SUMMARY			
START ID	10FT-01L		
END ID	100FT-73R		
TOTAL ID COUNT	876		
#MINS:	34	MIN VAL:	0.398
#MAXS:	34	MAX VAL:	0.494
#HI ALARMS:	0	%HI:	0.000%
#LO ALARMS:	0	%LOW:	0.000%
MEAN:	0.446		
MEDIAN:	0.446		
STD DEV:	0.048		
<b>CANCEL</b>		NEW REPORT	

Figure 11-31 The FILE SUMMARY report result screen

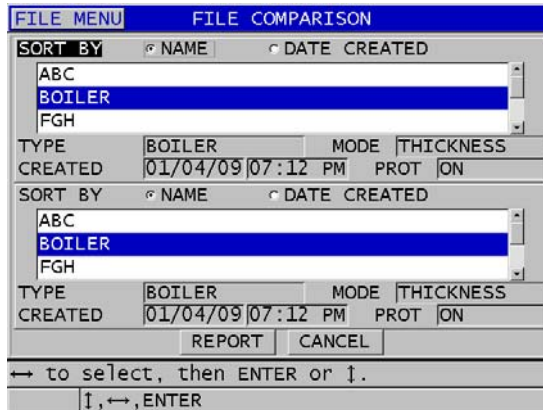
- c) Select **CANCEL** to return to the measurement screen or **NEW REPORT** to generate another report.
5. In the **MIN/MAX SUMMARY** screen:
- a) Select the file for which you want to create the report.
  - b) Select **REPORT**.
- The **MIN/MAX SUMMARY** report result screen opens with the first min ID # highlighted (see Figure 11-32 on page 204).

MIN/MAX SUMMARY	
MIN VAL :	0.398
MAX VAL :	0.494
#MINS:	34
	10FT-12C
	10FT-12R
	10FT-13L
	10FT-13C
#MAXS:	34
	10FT-01L
	10FT-01C
	10FT-01R
	10FT-02L
<b>CANCEL</b>	
NEW REPORT	

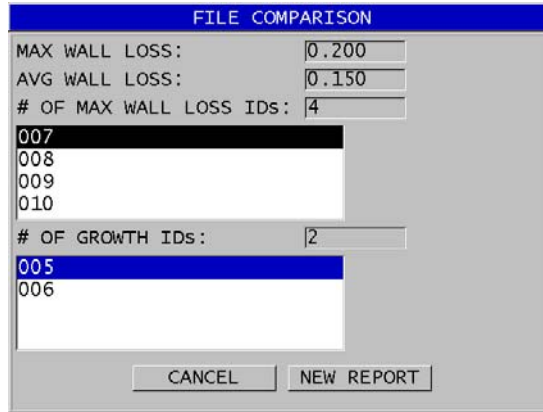
Figure 11-32 The MIN/MAX SUMMARY report screen



- c) Press **[2nd F], [▲]** or **[2nd F], [▼]** to move between the **#MINS** and **#MAXS** lists.
  - d) Select **CANCEL** to return to the measurement screen or **NEW REPORT** to generate another report.
6. In the **FILE COMPARISON** screen (see Figure 11-33 on page 205):
- a) In the upper list, select the reference file that you want to use in the comparison.
  - b) In the lower list, select the comparison file (containing newer data for the same measurement points).
  - c) Select **REPORT**.  
The **FILE COMPARISON** report result screen opens with the first maximum wall loss ID highlighted (see Figure 11-34 on page 206).

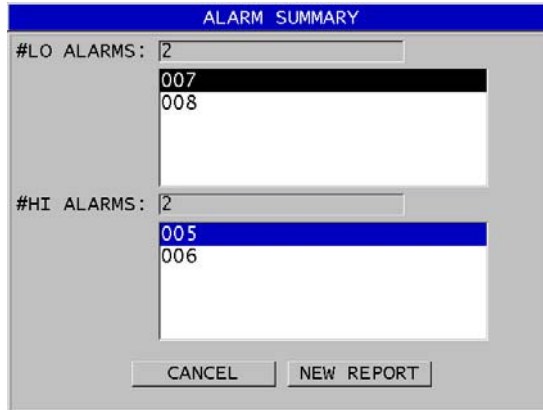


**Figure 11-33 The FILE COMPARISON report screen**



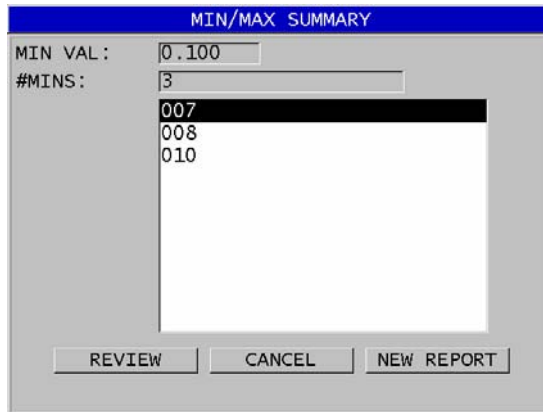
**Figure 11-34 The FILE COMPARISON report result screen**

- d) Review the maximum wall loss location list and the maximum wall growth location list.
  - e) Select **CANCEL** to return to the measurement screen or **NEW REPORT** to generate another report.
7. In the **ALARM SUMMARY** screen:
- a) Select the file for which you want to generate the report.
  - b) Select **REPORT**.  
The report page of the **ALARM SUMMARY** screen opens with the first low alarm location ID highlighted (see Figure 11-35 on page 207).



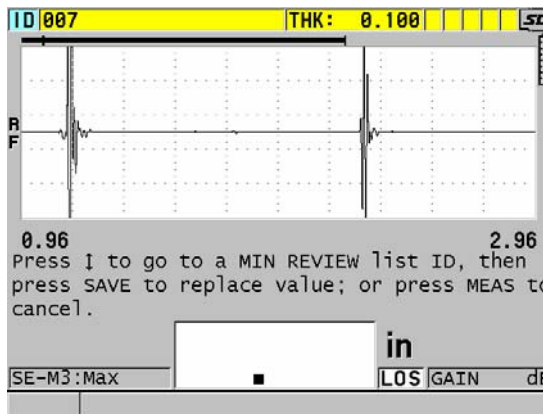
**Figure 11-35 The ALARM SUMMARY report result screen**

- c) Review the low and the high alarm location lists.
  - d) Select **CANCEL** to return to the measurement screen or **NEW REPORT** to generate another report.
8. In the **MIN REVIEW** screen:
- a) Select the file for which you want to generate the report.
  - b) Select **REPORT**.
- The **MIN/MAX SUMMARY** report result screen opens with the minimum thickness ID highlighted (see Figure 11-36 on page 208).



**Figure 11-36 The MIN/MAX SUMMARY report result screen**

- c) In the list, select an ID.  
 The 38DL PLUS returns to the live measurement screen at the selected minimum ID in the file (see Figure 11-37 on page 208).



**Figure 11-37 Returning to the measurement screen**

- d) You can couple the probe back to the minimum ID location to verify the thickness, and then press [SAVE/SEND] to store the new measurement.  
 e) Use the [▲] and [▼] keys to move to other minimum review list IDs.

f) Press **[MEAS]** to exit the minimum review.



## 12. Dual Element Transducer Setups

You can use a wide variety of transducers with the 38DL PLUS. You can create, store, and quickly recall setups in the instrument for the transducers that you use and for specific applications.

The 38DL PLUS comes with predefined setups that always remain in the instrument as defaults and cannot be removed (see Table 20 on page 211). The default conditions are selected to easily get you started with your applications. You can however easily change existing setups and create up to 35 user-defined application setups, providing flexibility for a wide range of applications.

**Table 20 Predefined setups**

Quantity	Setup type	Application
22	Predefined	Standard single and dual element probes
7	Predefined	High penetration option
2	Predefined	Internal oxide software option
35	User-defined	Custom applications

### 12.1 Standard D79X and Other Dual Element Transducers

The 38DL PLUS is compatible with a full line of Olympus dual element thickness gage transducers (see Table 21 on page 213). The 38DL PLUS automatically recognizes a D79X transducer when you plug one and automatically requests you to perform a transducer zero compensation ([Do ZERO]).

The 38DL PLUS recognizes the transducer through the identification pin located in the molded plug of the cable. Transducer recognition allows the 38DL PLUS to automatically recall setup parameters for the transducer along with a corresponding V-path correction. This generally provides the highest degree of accuracy and repeatability. For best performance, Olympus recommends using an Olympus dual element transducer. Olympus cannot guarantee proper performance with other dual element transducers or transducers that are not designed for use with the 38DL PLUS.

If a dual element transducer without a recognition pin is plugged into a 38DL PLUS, the instrument prompts you to select a generic transducer setup or one of the previously created custom stored transducer setup. The 38DL PLUS has the ability to build and store a custom transducer setup for nonrecognized dual element transducers in the frequency range of 1 MHz to 10 MHz.

## 12.2 Creating a Setup for Nonstandard Dual Element Transducers

The 38DL PLUS automatically detects standard D79X series dual element transducers and automatically loads the appropriate setup. When you use a nonstandard dual element transducer, you need to create a custom setup.

### To create a setup for a nonstandard dual element transducer

1. Connect the nonstandard dual element transducer to the 38DL PLUS.
2. In the **GENERIC SETUP SELECTION** screen that appears (see Figure 12-1 on page 213):
  - a) In the **SETUP TYPE** list, select **DEFAULT**.
  - b) In the **SELECT SETUP** list, select the setup that best matches the frequency of the connected transducer.



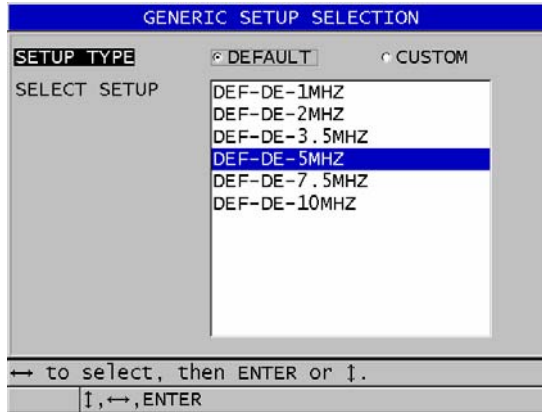


Figure 12-1 The GENERIC SETUP SELECTION screen

3. Press **[MEAS]** to return to the measurement screen.
4. Press **[XDCR RECALL]**.
5. In the menu, select **DEFAULT DUAL ELEMENT**.
6. In the **DEFAULT DUAL ELEMENT** screen, among the default transducer list, select the transducer that best matches the frequency and the diameter of the dual element transducer that you are using (see Table 21 on page 213).

Table 21 Default transducers

Default transducer	Frequency	Tip diameter
D790/791/D799	5 MHz	11.0 mm (0.434 in.)
D792/D793	5 MHz	7.2 mm (0.283 in.)
D794/D795	10 MHz	7.2 mm (0.283 in.)
D797	2 MHz	22.9 mm (0.900 in.)
D798/D7226	7.5 MHz	7.2 mm (0.283 in.)
D7912/D7913	10 MHz	7.5 mm (0.295 in.)
MTD705	5 MHz	5.1 mm (0.200 in.)
D7906 (THRU-COAT)	5 MHz	11.0 mm (0.434 in.)
D7908	7.5 MHz	7.2 mm (0.283 in.)
Generic setups for dual element transducers:		
DEF-DE-2MHZ	2 MHz	

Table 21 Default transducers (continued)

Default transducer	Frequency	Tip diameter
DEF-DE-3.5MHZ	3.5 MHz	
DEF-DE-5MHZ	5 MHz	
DEF-DE-7.5MHZ	7.5 MHz	
DEF-DE-10MHZ	10 MHz	

7. In the **ACTIVE** screen (see Figure 12-2 on page 214):
  - a) Set **MEAS OPTION** to the desired echo detection mode to use with this transducer (see “Echo Detection Modes with Dual Element Transducers” on page 80 for details).
  - b) In **SETUP NAME**, enter a setup name that describes the transducer and the application for which the setup will be used.
  - c) Set **VELOCITY** to the sound velocity in the material to be tested.
  - d) If needed, adjust the **MAX GAIN** value (see “Maximum Gain” on page 230).
  - e) If needed, adjust the **EXT BLANK** value (see “Adjusting the Extended Blank with Dual Element Transducers” on page 137).
  - f) Press **[SAVE/SEND]** to save the changes to the setup.

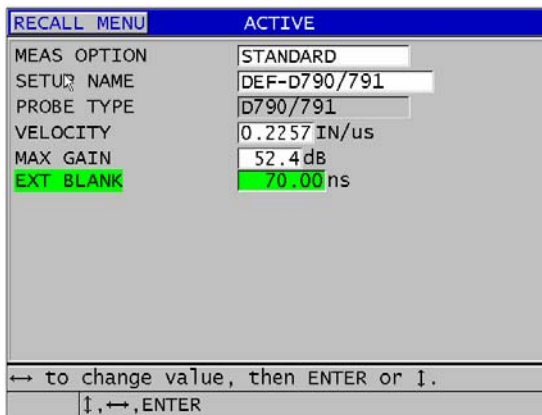


Figure 12-2 Example of the ACTIVE screen

8. In the **SAVE SETUP** screen:
  - a) If needed, highlight **SAVE AS**, and then modify the setup name.

- b) In the **SAVE TO** list, select the custom setup location where to save the setup.
  - c) Select **SAVE**.
9. Back in the **ACTIVE** screen, press **[MEAS]** to return to the measurement screen.

## 12.3 Recalling Stored Dual Element Transducer Setups

The 38DL PLUS allows you to store and recall setups for dual element transducers. Stored dual element transducer setups can also include calibration information like the velocity, the zero offset, the V-path, and the default gain. This feature makes it easy to change between different transducer setups designed for different applications.



### CAUTION

Unsaved data will be lost when a different application setup is recalled. Save all changes made to the active setup before recalling another setup.

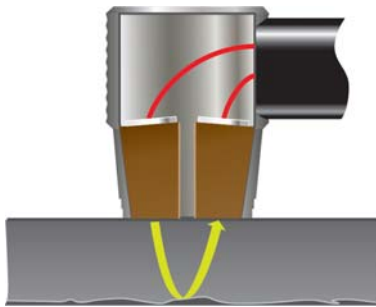
---

### To recall a custom dual element transducer setup

1. Press **[XDCR RECALL]**.
2. In the menu, select **CUSTOM DUAL ELEMENT**.
3. In the **CUSTOM DUAL ELEMENT** screen, select the desired custom setup.
4. In the **ACTIVE** screen, review the setup parameters.
5. Press **[MEAS]** to return to the measurement screen with the recalled setup active.

## 12.4 V-Path

The V-path is the path along which the ultrasonic wave travels from one element to the other when using a dual element transducer. Since the V-path is slightly longer than twice the thickness, the instrument must calculate a compensation to measure the true thickness. Using a V-path correction allows the 38DL PLUS to measure thicknesses with the highest degree of accuracy and repeatability.



**Figure 12-3 Illustration of the V-path**

When you connect an Olympus standard D79X series dual element transducer, the 38DL PLUS automatically recognizes it and recalls the appropriate default setup and V-path correction. The 38DL PLUS also includes a function to build a custom V-path compensation for almost any other dual element transducer. This compensation curve is saved and recalled along with a custom setup.

### **12.4.1 Activating the V-Path Function**

You need to activate the V-path function to be able to build a V-path correction curve.

#### **To activate the V-path function**

1. Press [SETUP MENU].
2. In the menu select **MEAS**.
3. In the **MEAS** screen, set **VPATH CAL ENABLE** to **ON**.
4. Press [MEAS] to return to the measurement screen.

### **12.4.2 Building a V-Path Correction Curve for a Nonstandard Dual Element Transducer**

Creating a custom V-path requires a multi-step test block representing the thickness range and material to be tested (minimum and maximum thicknesses). You need to measure on at least three test block steps. You can use up to ten known thicknesses to generate a V-path correction curve. Using more V-path calibration points improves the accuracy of the measurements.

**IMPORTANT**

When using generic dual element transducers, you need to determine the exact thickness range over which you will measure. The minimum and maximum thicknesses are highly dependent on:

- Frequency of the transducer
  - Material being tested
  - Roof angle of the transducer
  - Delay material in the transducer
  - Signal noise in the transducer
- 

**CAUTION**

Olympus cannot guarantee the accuracy or performance with non-D79X transducers. The user assumes all responsibility for assuring that the generic dual element transducer is performing properly and is suitable for the application.

---

**To build a V-path correction for a nonstandard dual element transducer**

1. Ensure that the transducer is not coupled to the test material and that there is no couplant on the tip to the transducer.
2. Press [**2nd F**], [**CAL ZERO**] (**Do ZERO**) to perform the transducer zero calibration.
3. To ensure that the instrument properly detects echoes:
  - a) Press [**RANGE**] until the range value is higher than the maximum thickness of the test block.
  - b) Couple the transducer to the thickest test block step, and then press [**GAIN**] to adjust the gain so that the instrument properly detects the back-wall echo, and then ensure that there are no noise signals above 20 % of the screen height.

**NOTE**

The thickness readings at this point may not be accurate because a proper zero offset for the transducer has not yet been set.

- c) Couple the transducer to the thinnest test block step.
  - d) If necessary, press **[GAIN]** to adjust the gain so that the instrument properly detects the back-wall echo.
  - e) If necessary, adjust the extend blank so that the gage is making proper detection on the back-wall signal (see “Blanking Adjustments in Manual Echo-to-Echo Detection Mode” on page 83).
  - f) Ensure that the instrument properly detects echoes on all test block steps.
4. Activate the V-path function (see “Activating the V-Path Function” on page 216 for details).
  5. Couple the transducer to a thick sample representing the thickest material that you will measure.
  6. Press **[CAL VEL]**.
  7. In the help text bar, select **YES** to the **VPath Calibration?** prompt (see Figure 12-4 on page 218).



**Figure 12-4 Answering YES at the V-path calibration prompt**

8. While the transducer is coupled to the thick sample and getting a steady thickness reading, press **[ENTER]**.
9. In the **V-PATH CALIBRATION** screen, edit the point **1** value to match the known thickness (see Figure 12-5 on page 219).

V-PATH CALIBRATION				
ENTER VALUE FOR TEST BLOCK POINT 1				
1	2	3	4	5
0.500	---	---	---	---
6	7	8	9	10
---	---	---	---	---
NEXT TEST BLOCK POINT 2				
Then CAL VEL to measure next selected test block point or MEAS if done.				
←=Move ↓=Select MEAS or ENTER=Done.				
↑, ←, ENTER, MEAS, CAL VEL				

Figure 12-5 Editing point 1 of the V-path calibration

10. Press [CAL VEL].
11. Couple the transducer to the next thickest sample to get a steady thickness reading, and then press [ENTER].
12. In the **V-PATH CALIBRATION** screen, edit the value for the next point to match the known thickness.
13. Repeat steps 10 to 12 for the other thicknesses. You need a minimum of three points and a maximum of ten V-path calibration points.
14. When all known thickness values from all calibration points have been entered, press [MEAS].
15. At this point you can either press [CAL VEL] to view the V-path Calibration table.  
OR  
Save the V-path calibration as a custom dual element transducer setup:
  - a) Press [SAVE/SEND].
  - b) In the **SAVE SETUP** screen, enter the desired custom setup file name (see Figure 12-6 on page 220).

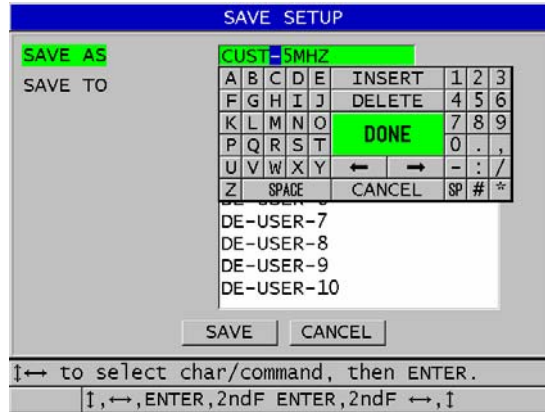


Figure 12-6 Saving the setup

- c) In the **SAVE TO** list, select a storage location.



### CAUTION

**DE-USER-X** (where X = 1 to 10) represents an empty location. Selecting a custom setup location that already has a stored custom setup deletes and replaces the contents with the new custom dual element transducer setup.

- d) Select **SAVE** to save the custom setup.
- e) In the **ACTIVE** screen, review the parameters.
- f) Press **[MEAS]** to return to the measurement screen.  
The new custom transducer is now the active setup and can be recalled from the list of custom dual element transducer setups.



---

## 13. Custom Setups for Single Element Transducers

---

The 38DL PLUS includes predefined setups for standard single element transducers. In some cases, a 38DL PLUS ships from the factory preprogrammed with one or more custom setups to meet special customer requirements. You can create your own custom setups to meet the need of a particular single element transducer or for a particular application. With predefined and custom setups you can quickly change between transducer and application setups by selecting a previously saved setup.

### 13.1 Creating a Custom Setup for a Single Element Transducer

You should create a custom setup when the measurement requirements of a particular application are not optimally met by one of the standard setups. Once adjustments are made, you can name and store this setup in one of the 35 user-defined setup locations.



#### **CAUTION**

The adjustments described in the following procedure and subsections should be made only by a qualified technician who is familiar with the basic theory of ultrasonic gaging and the interpretation of ultrasonic waveforms.

---

Many of the adjustments that you can make in a setup are interactive. All of them have an effect on the measurement range and/or measurement accuracy of the 38DL PLUS. In most cases, do not attempt adjustments without monitoring the waveform. Additionally, when establishing a custom setup for a specific application, it is essential to verify the performance on reference standards representing the materials and thickness range to measure.

## To create a custom setup for a single element transducer

1. Connect the single element transducer to the 38DL PLUS (see “Setting Up the Transducer” on page 63).
2. Press [XDCR RECALL].
3. In the menu, select the **CUSTOM SINGLE ELEMENT**.
4. In the **CUSTOM SINGLE ELEMENT** screen, select the desired custom setup location (**SE-USER-n**) in which you wish to save the custom setup.

### TIP

To reduce the number of changes to make to parameter values, you can also select an existing single element setup with parameter values that are close to the desired setup.

5. In the **ACTIVE** screen (see Figure 13-1 on page 222):
  - a) Set **DET MODE** to the desired detection mode (see “Detection Modes” on page 225 for details).

RECALL MENU	ACTIVE
DET MODE	MODE 1
SETUP NAME	SE-USER-1
MEAS TYPE	STANDARD
PROBE TYPE	M112
VELOCITY	0.2260 IN/us
ZERO VALUE	643.0
PULSER POWER	200 VOLTS
MAX GAIN	53.9 dB
INIT GAIN	35.9 dB
TDG SLOPE	1.07 dB/us
MB BLANK	0.25 us
ECHO WINDOW	199.65 us
ECHO 1 DETECT	-SLOPE
↔ to select, then ENTER or ↓.	
↑, ↔, ENTER	

Figure 13-1 The **ACTIVE** screen for the setup of a single element transducer

- b) Enter a **SETUP NAME** that describes the transducer and/or the application for which you create the setup.
- c) Set **MEAS TYPE** to the desired measurement type. The available choices are:

- **STANDARD:** For normal mode 1, 2, or 3 positive or negative peak measurement.
  - **OXIDE LAYER** (optional): For simultaneous measurement of the thickness of a boiler tube and of its internal oxide layer with the oxide layer software option (see “Oxide Layer Software Option” on page 93 for details).
  - **BARRIER LAYER** (optional): For thickness measurement of thin barrier layer materials in multilayer plastic with the multi-measurement software option (see “Multi-Measurement Software Option” on page 99 for details).
  - **FIRST PEAK:** For the detection of the first of several peaks of similar amplitudes (see “First Peak” on page 227 for details).
- d) Set **PROBE TYPE** to indicate the transducer type to be used with this setup. The selected probe type must match the frequency of the transducer being used for proper pulser/receiver performance.
  - e) Set **VELOCITY** to the value of the sound velocity in the material to be tested with this setup (see “Material Sound Velocity and the Zero Calibrations” on page 71).
  - f) Set **ZERO VALUE** to the calibrated zero offset value (time of flight of the echo that is not traveling through the material) for this transducer (see “Calibrating the Instrument” on page 67).
  - g) If needed, increase the **PULSER POWER** to increase the ultrasound wave penetration in the material. Reduce the value for better near surface resolution (see “Pulser Power” on page 228 for details).
  - h) Set **MAX GAIN** to the desired maximum gain value (see “Maximum Gain” on page 230 for details).
  - i) Set **INIT GAIN** to the desired initial gain value (see “Initial Gain” on page 231 for details).
  - j) Set **TDG SLOPE** to the desired time-dependent gain slope value (see “TDG Slope” on page 231 for details).
  - k) Set **MB BLANK** to the desired main bang blank time interval (see “Main Bang Blank” on page 232 for details).
  - l) Set **ECHO WINDOW** to the desired time interval (see “Echo Window” on page 233 for details).
  - m) Set **ECHO 1 DETECT** to **-SLOPE** to detect the negative peak of the first echo, or **+SLOPE** to detect the positive peak of the first echo (see “Detection of Echo 1 and Echo 2” on page 235 for details).
6. Press [SAVE/SEND].

7. In the **SAVE SETUP** screen:
  - a) If needed, in **SAVE AS**, edit the setup name.
  - b) In the **SAVE TO** list, select the desired custom setup location where you want to save the setup.
  - c) Select **SAVE**.
8. Press **[MEAS]** to return to the measurement screen.  
The saved setup becomes the active setup.

## 13.2 Quickly Adjusting Waveform Parameters For Single Element Transducers

With single element transducers, you can quickly adjust individual waveform parameters using the **[WAVE ADJ]** key.

### To quickly adjust individual waveform parameters

1. Ensure that a single element transducer is connected to the 38DL PLUS.
2. From the measurement screen, press **[WAVE ADJ]**.  
The waveform adjustment parameter appears on the measurement screen above the thickness value (see Figure 13-2 on page 224).

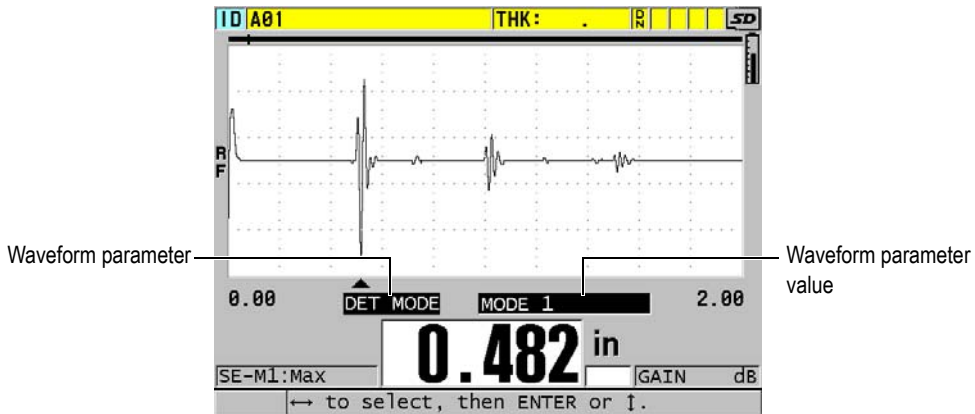


Figure 13-2 Adjusting the waveform parameters

3. Use the [▲] or [▼] key to select the parameter that you wish to adjust among the following:
  - **DET MODE** (see “Detection Modes” on page 225 for details)
  - **M3 BLANK** in mode 3 only (see “Mode 3 Echo Blank” on page 238 for details)
  - **IF BLANK** in mode 2 and 3 only (see “Interface Blank” on page 236 for details)
  - **ECHO 2 DETECT** in mode 2 and 3 only (see “Detection of Echo 1 and Echo 2” on page 235 for details)
  - **ECHO 1 DETECT** (see “Detection of Echo 1 and Echo 2” on page 235 for details)
  - **ECHO WINDOW** (see “Detection of Echo 1 and Echo 2” on page 235 for details)
  - **MB BLANK** (see “Main Bang Blank” on page 232 for details)
  - **TDG SLOPE** (see “TDG Slope” on page 231 for details)
  - **INIT GAIN** (see “Initial Gain” on page 231 for details)
  - **MAX GAIN** (see “Maximum Gain” on page 230 for details)
  - **PULSER POWER** (see “Pulser Power” on page 228 for details)
  - **PROBE TYPE**
  - **MEAS TYPE** (see step 5.c in “Creating a Custom Setup for a Single Element Transducer” on page 221 for details)
4. Use the [◀] or [▶] keys to select the value for the selected parameter.
5. Repeat steps 3 and 4 to adjust other parameters.
6. Press [WAVE ADJ] again to hide the waveform adjustment parameter.

### 13.3 Detection Modes

There are three detection modes (**Mode 1**, **Mode 2**, and **Mode 3**):

#### Mode 1

Measures the time of flight between the main bang and the first back-wall echo using a direct contact transducer (see Figure 13-3 on page 226).

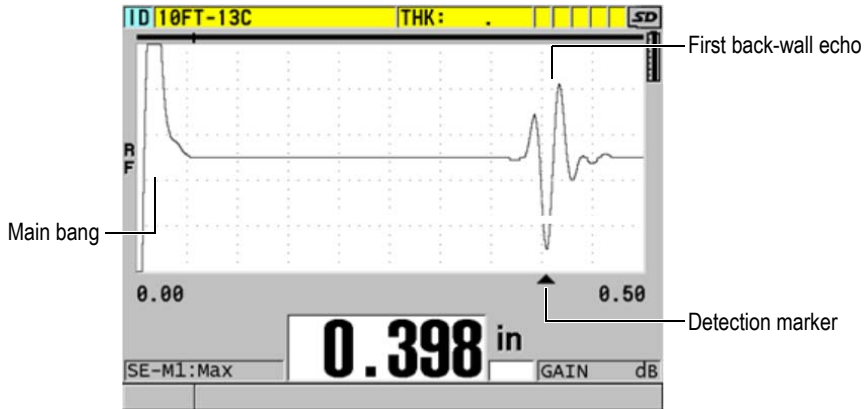


Figure 13-3 Mode 1 detection example

## Mode 2

Measures the time of flight between the interface (or delay line) echo and the first back-wall echo using a delay line or an immersion transducer (see Figure 13-4 on page 226).

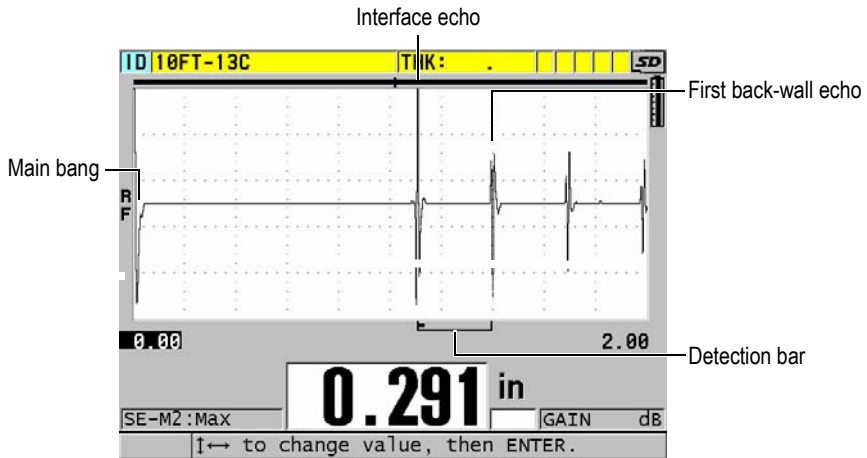


Figure 13-4 Mode 2 detection example

### Mode 3

Measures the time of flight between one back-wall echo to the next back-wall echo using a delay line or an immersion transducer (see Figure 13-5 on page 227).

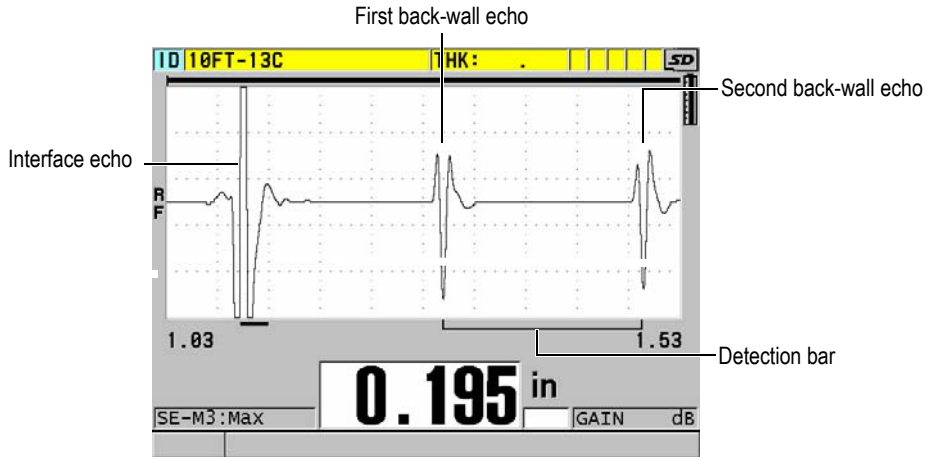


Figure 13-5 Mode 3 detection example

#### NOTE

Refer to “Echo Window” on page 233 for information on the modes in relation with the echo window.

## 13.4 First Peak

With single element transducers, the 38DL PLUS normally detects peaks on either the highest positive or highest negative peak of the RF waveform. This feature works well for most precision thickness applications.

This normal peak detection can be unstable for applications in which the back-wall echo is irregular and contains several negative or positive peaks that are close in amplitude. In these cases, the thickness reading can fluctuate as the gage switches detection from one peak to another. This can happen for example in applications

measuring the length of bolts or the thickness of gel coat over fiberglass (see Figure 13-6 on page 228). In these cases, to help stabilize the echo detection and thickness measurements, select the first peak algorithm to detect the first of several peaks of similar amplitudes (see step 5.c in “Creating a Custom Setup for a Single Element Transducer” on page 221).

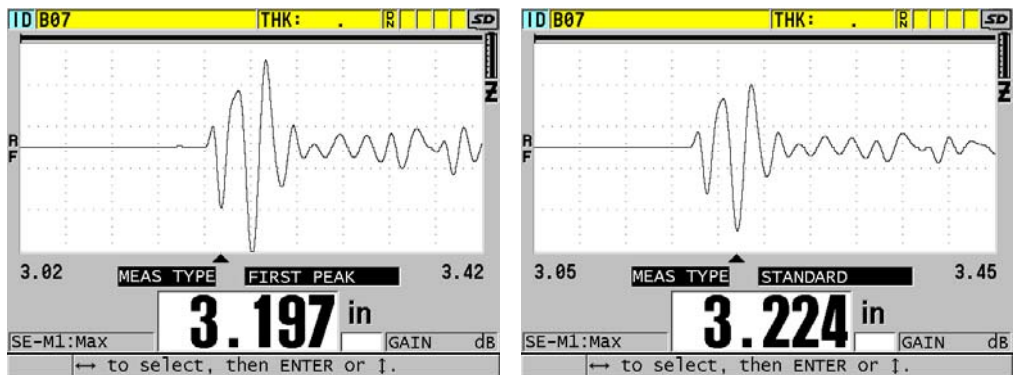


Figure 13-6 Detection of the first or the second negative peak

## 13.5 Pulsar Power

You can set the excitation pulse (main bang) voltage to one of the following values: 60 V, 110 V, 150 V, and 200 V.

Higher voltages may provide greater penetration at the expense of a lower near-surface resolution, especially in mode 1. Inversely, lower voltages may provide better near-surface resolution at the expense of a lower penetration.

For most applications, the 110 V value provides the best signal-to-noise ratio for returning echoes. The pulser power indicates the voltage used to excite the transducer and therefore, affects the size of the initial pulse (see Figure 13-7 on page 229) and the amount of energy going into the material.



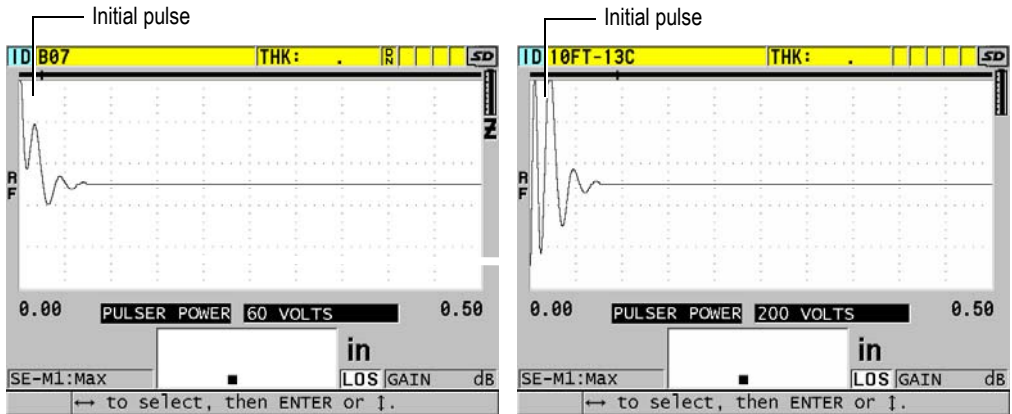
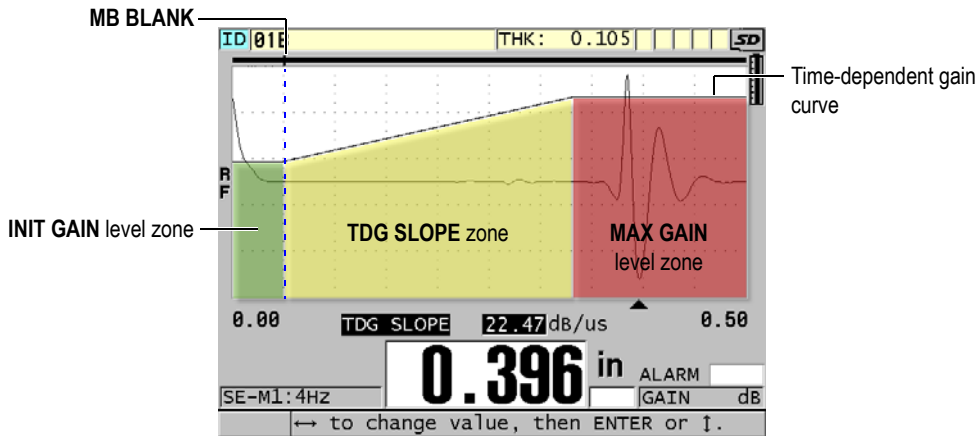


Figure 13-7 Comparing pulser power set to 60 V and 200 V

## 13.6 Time-Dependent Gain Curve

With single element transducers, the 38DL PLUS either uses the automatic gain control (AGC) [see “Configuring Measurement Parameters” on page 127 for details on how to activate the AGC] or the time-dependent gain (TDG) functions to automatically adjust receiver gain to an optimum level when an echo is detected.

The 38DL PLUS offers three parameters to draw a time-dependent gain curve: **INIT GAIN**, **TDG SLOPE**, and **MAX GAIN** (see Figure 13-8 on page 230). From the initial gain level, receiver gain slopes up to the maximum gain level at the rate determined by the **TDG SLOPE** setting. When you adjust any of the received gain parameters, a black time-dependent gain curve is displayed so that you can clearly see the zones of initial gain, slope, and maximum gain.



**Figure 13-8 The TDG zones and parameters**

You can use the TDG curve to optimize near-surface resolution while providing a higher maximum gain for thicker samples. You can also use the TDG curve in measurements of highly scattering materials, such as cast metals and fiberglass, to minimize detection of scattered echoes occurring ahead of the back-wall echo.

### 13.6.1 Maximum Gain

The maximum gain indicates the maximum (time-dependent) receiver gain possible. The maximum gain is used to amplify echoes that are further out in time. In general for a given application, you should set the maximum gain high enough so that all echoes of interest are detected.

You can adjust the maximum available receiver gain from 0.0 dB to 99.0 dB. When no echo is detected (LOS prompt), the gain rises to the maximum level set by the initial gain, slope, and maximum gain. When the maximum gain is set too high, the gage may hang up on transducer noise or other spurious signals; when it is set too low, returning echoes may not be high enough for detection.

**NOTE**

The max gain can never be lower than the initial gain and has a maximum value of 99.0 dB.

---

### 13.6.2 Initial Gain

The initial gain sets an upper limit on receiver gain in the vicinity of the excitation pulse (mode 1) or of the interface echo (modes 2 and 3). By effectively making the excitation pulse or interface echo smaller, the TDG curve allows detection of echoes occurring close to the pulse. You can adjust the initial gain from 0 dB to the maximum defined by the **MAX GAIN** setting.

The **INIT GAIN** setting is most critical in applications where minimum thickness measurements must be optimized. It should always be set with the aid of a reference standard representing that minimum. In cases where the minimum thickness capability is less important than penetration and scatter echoes are not a problem, you can set the initial gain equal to the maximum gain.

The initial gain does the following:

- Indicates the initial (time-dependent) receiver gain currently selected
- Amplifies echoes that are close to the Main Bang or interface echoes
- Starts at time zero and extends to:
  - the main bang blank in mode 1
  - the end of the interface blank in modes 2 and 3

### 13.6.3 TDG Slope

The TDG slope controls the rate at which the receiver gain slopes up from the initial gain level to the maximum gain level. The TDG slope starts at the position of the **MB BLANK** parameter in mode 1 and at the end of the **IF BLANK** parameter in mode 2 and mode 3. The TDG slope helps suppress reflections from grain structure or fibers. Generally, you should set the TDG slope as high as possible to reach the maximum gain as quickly as possible without having the gage hang up on spurious signals. You can set the slope from 0.0 dB/ $\mu$ s to 39.95 dB/ $\mu$ s.

## 13.7 Main Bang Blank

The main bang blank is effectively a blank zone that protects the receiver from false readings generated by the main bang. This blank or dead zone (up to 18 microseconds) prevents the detection of the trailing edge echoes of the excitation pulse as if they were back-wall or interface echoes. The end of the main bang blank indicates the point in time where the gage begins to search for echoes.

In general, set the main bang blank just beyond the point where the gage hangs up, and then test with the transducer both coupled to and uncoupled from the test material to ensure accurate measurements.

In mode 1, however, the length of the main bang blank determines the minimum thickness that can be measured, and it must be positioned with care after selecting the initial gain level (see Figure 13-9 on page 232). When the main bang blank is too short, the instrument hangs up on the excitation pulse and readings are not possible. When the main bang blank is too long, the minimum measurable thickness is unnecessarily restricted. When using immersion transducers, ensure that the main bang blank is always set before the interface echo from the shortest water path.

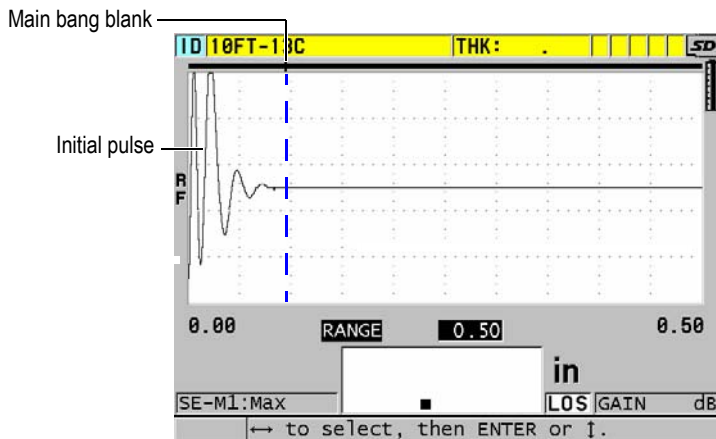


Figure 13-9 Main bang blank position for mode 1

In mode 2 and mode 3, the setting of the main bang blank is not critical when set at some point between the end of the excitation pulse and the interface echo (see Figure 13-10 on page 233).

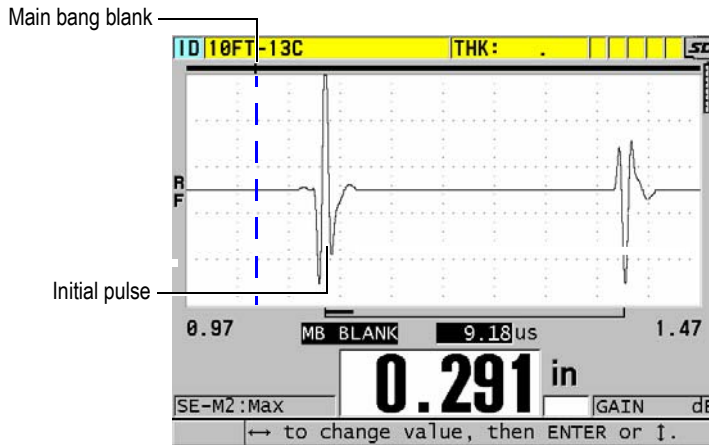


Figure 13-10 Main bang blank position for mode 2 and mode 3

## 13.8 Echo Window

The echo window is the time interval after each main bang during which the instrument is enabled to detect echoes. The echo window interval begins at the end of the main bang blank. The echo window ends  $x \mu\text{s}$  following the main bang in mode 1, or  $x \mu\text{s}$  following the interface blank in mode 2 and mode 3.

In mode 1, you can usually set the echo window to any value greater than the round-trip pulse transit time in the thickest or slowest piece of material to be measured (see Figure 13-11 on page 234). The exact setting is not critical as long as it is long enough to include the farthest echo of interest.

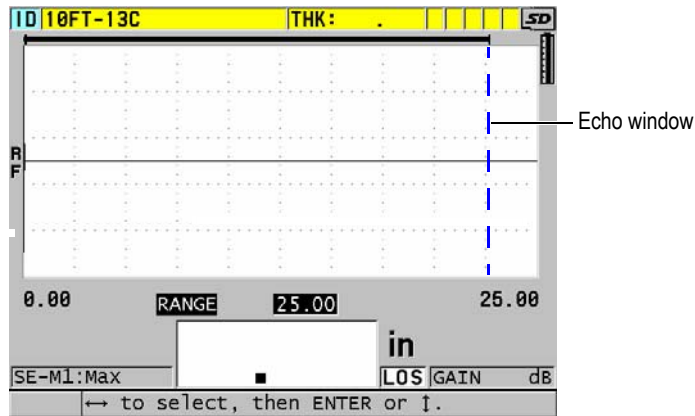


Figure 13-11 Echo window setting for mode 1

In mode 2 and mode 3, the echo window is limited to the time interval between successive interface echoes (see Figure 13-12 on page 234). The end of the echo window must be set ahead of the second interface echo to prevent an incorrect detection, which in turn determines a maximum measurable thickness. In applications involving mode 2 and mode 3 immersion measurements, the echo window placement must apply throughout the range of the water paths to be used.

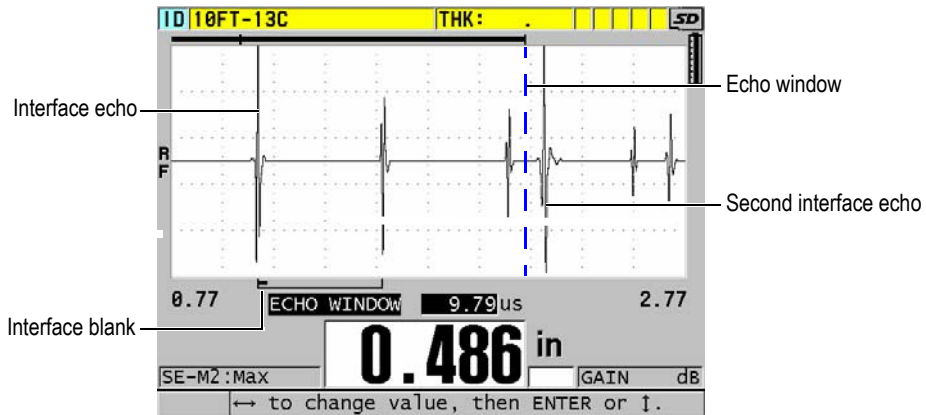
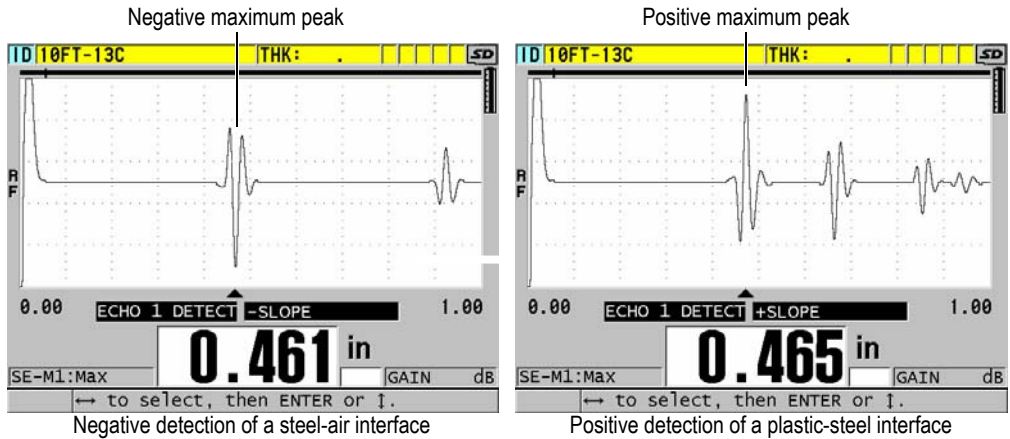


Figure 13-12 Echo window setting for mode 2 and mode 3

### 13.8.1 Detection of Echo 1 and Echo 2

You can select the detection polarity (positive or negative) for the first and second echoes. Depending on the measurement mode and on the type of test material, the maximum amplitude in an echo can either be a positive or negative peak. Positive and negative polarity refer to processed echoes displayed on the waveform display (see Figure 13-13 on page 235). To measure thicknesses with the highest accuracy, it is important that the 38DL PLUS detects the maximum amplitude peak in an echo.



**Figure 13-13 Negative and positive echo detection examples**

Refer to Table 22 on page 236 to help you decide which detection polarity to select for a given application.

**Table 22 Polarity of echoes**

Measurement mode	Echo 1	Echo 2
Mode 1 using contact transducer	Back-wall echo normally negative except when measuring material of low acoustic impedance bonded to a material of high impedance (such as plastic or rubber over metal), where the echo is phase-reversed.	Not applicable
Mode 2 using delay line or immersion transducers	Interface echo normally positive for high-impedance materials such as metals and ceramics, and negative for low-impedance materials such as most plastics.	Back-wall echo normally negative unless the back-wall echo represents the sort of low-to-high impedance boundary.
Mode 3 using delay line or immersion transducers	Interface echo normally positive for high-impedance materials.	Back-wall echo normally negative except in some special cases involving difficult geometries where phase distortion may cause the positive side of the back-wall echo to be better defined than the negative side.

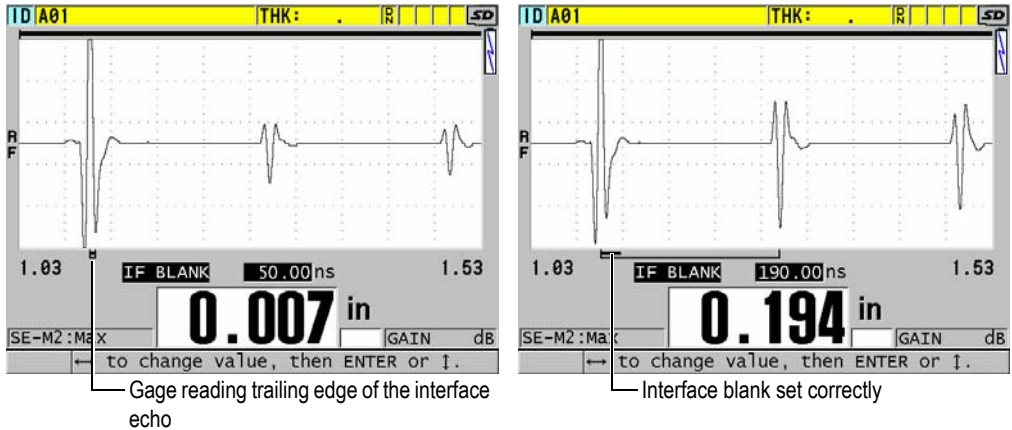
### 13.8.2 Interface Blank

The interface blank represents a blank or dead zone up to 20  $\mu\text{s}$  long that follows the leading edge of the interface echo. The interface blank is only available in mode 2 and mode 3.

In mode 2, the interface blank prevents the detection of trailing lobes or cycles of the interface echo, which might otherwise be detected as back-wall echoes, resulting in a hang-up condition (see Figure 13-14 on page 237). The interface blank should be set as short as possible to avoid unnecessarily restricting minimum measurable thicknesses.



The initial gain parameter often helps reduce the interface echo amplitude and permits the use of a shorter interface blank. Check the interface blank settings with the transducer both coupled to and uncoupled from the test material.



**Figure 13-14 Examples of the interface blank in mode 2**

In mode 3, the interface blank selects which pair of back-wall echoes are measured (see Figure 13-15 on page 238). In most conditions, the interface blank would be set just short of the first back-wall echo. However, as a practical matter, the first back-wall echo from thin materials is often distorted or lost in the interface echo. With some challenging geometries (such as tight radii), later pairs of back-wall echoes may be cleaner than early ones. In these cases, set the interface blank to a length that ensures detection of a clean and well-defined pair of back-wall echoes, even if echoes are not the first two.

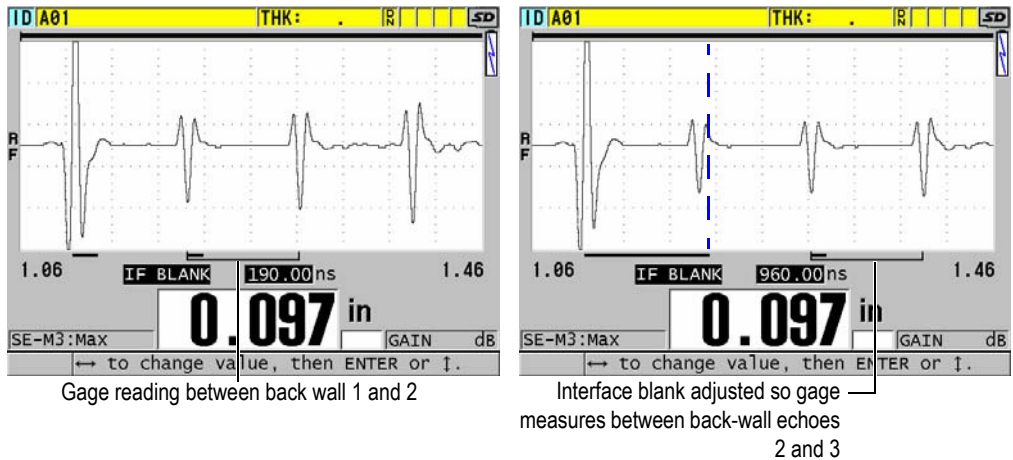


Figure 13-15 Examples of the interface blank in mode 3

### 13.8.3 Mode 3 Echo Blank

The echo blank in mode 3 (**M3 BLANK**) is similar to the interface blank in mode 2 or to the main bang blank in mode 1. This function creates a blank or dead zone up to 20  $\mu$ s long following the leading edge of the first detected back-wall echo, to prevent detection of trailing lobes or cycles of that echo and the resulting gage hang-up (see Figure 13-16 on page 239).

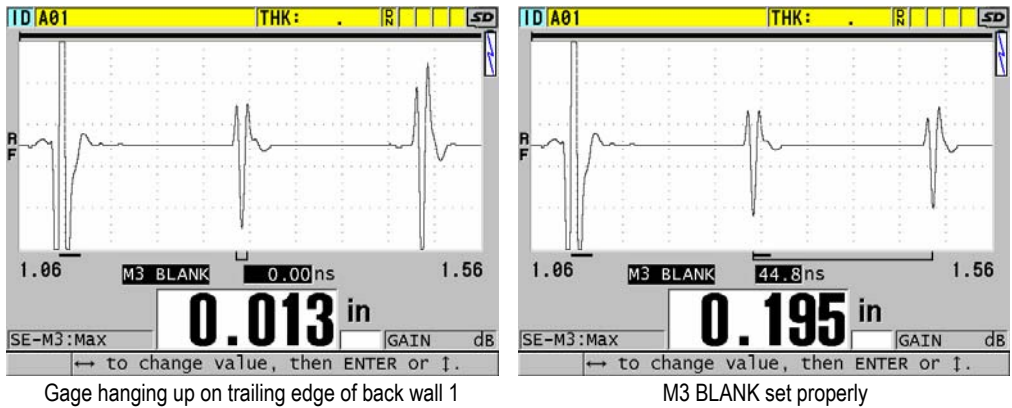


Figure 13-16 Examples of M3 Blank adjustment

Because the mode 3 echo blank limits minimum measurable thicknesses, set the controls as short as possible; typically no longer than a few hundred nanoseconds. Special cases may be an exception where mode conversion effects on curved samples cause significant spurious signals between legitimate echo peaks; in such cases set the mode 3 echo blank as long as necessary to prevent detection of the spurious signals.

## 13.9 Saving Setup Parameters

After adjusting selected waveform parameters, you can store the settings for a quick and easy recall. The 38DL PLUS can store up to 35 custom setups in its internal memory.

### To save setup parameters

1. Make the appropriate changes to the waveform parameters.
2. Press [XDCR RECALL].  
In the menu, ensure that **ACTIVE** is highlighted. The changes that you made are located in the active setup.
3. Press [SAVE/SEND].
4. In the **SAVE SETUP** screen (see Figure 13-17 on page 240):
  - a) In **SAVE AS**, enter a name for the custom setup.

- b) In the **SAVE TO** list, select one of the 35 available custom setup location.



### CAUTION

Setups named **SE-USER-1** through **SE-USER-35** are empty locations. Use caution when selecting a location that already contains a custom setup because the new setup will replace the old information.

- c) Select **SAVE** to save the custom setup.

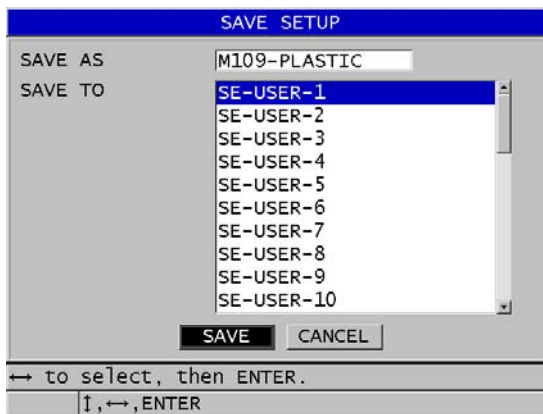


Figure 13-17 Saving custom setups

5. In the **ACTIVE** screen, review the setup parameters.
6. Press **[MEAS]** to return to the measurement screen.

## 13.10 Quickly Recalling a Custom Setup for Single Element Transducers

Normally, you can change the setup for a custom application by pressing **[RECALL XDCCR]** to select the appropriate setup in the list of available setups, and then press **[MEAS]**. This process is adequate for typical setups that are changed infrequently. However, when it is necessary to frequently change between two or more custom setups, rather use the quick setup recall function.

When the quick setup recall function is activated, you can use a simple keypad shortcut to quickly switch to any of the first four custom setups for single element transducers.

### To activate the quick setup recall function

1. From the measurement screen, press **[SETUP MENU]**.
2. In the menu, select **MEAS**.
3. In the **MEAS** screen, set **QUICK SETUP RECALL** to **ON**.
4. Press **[MEAS]** to return to the measurement screen.

### To quickly recall one of the four first custom setups

- ◆ While in measurement screen with the quick setup recall function activated, press **[2nd F], [▲]** to recall the first custom single element transducer setup.  
OR  
Press **[2nd F], [▶]** to recall the second custom single element transducer setup.  
OR  
Press **[2nd F], [▼]** to recall the third custom single element transducer setup.  
OR  
Press **[2nd F], [◀]** to recall the fourth custom single element transducer setup.

---

<b>NOTE</b>
-------------

This feature only works when a single element transducer is plugged into the 38DL PLUS.

---



---

## 14. Managing Communications and Data Transfer

---

This section describes how the 38DL PLUS can communicate with a computer or a printer to send, receive, import, and export files. The 38DL PLUS has two communication ports: USB and RS-232.

The 38DL PLUS comes standard with a USB cable for communicating using the USB 2.0 protocol. You must purchase an optional RS-232 cable (see Table 23 on page 246) to use RS-232 communication. The 38DL PLUS can send data to any device capable of receiving ASCII-formatted data using the RS-232C/D protocol. This includes personal computers, minicomputers, dataloggers, and printers. The data cable must be compatible with the 38DL PLUS output connector and the serial input connector of the receiving device. Olympus supplies cables for computers and serial printers and provides assistance with connecting to any other equipment.

---

<b>NOTE</b>
-------------

When communicating directly to a printer, the 38DL PLUS will only work with RS-232 serial printers.

---

### 14.1 GageView

GageView is the Olympus interface program designed to communicate with instruments such as the 38DL PLUS. GageView provides the capability to create inspection database files, upload and download data files, and generate reports. Olympus recommends to use GageView to communicate with the 38DL PLUS and to manage 38DL PLUS data.

GageView is compatible with Windows 2000, XP, Vista, and Windows 7. For more details, refer to the *GageView Interface Program – User’s Manual* (P/N: 910-259-EN [U8778347]).

## 14.2 Setting Up USB Communication

The default communication protocol for the 38DL PLUS is USB 2.0. The 38DL PLUS can also be set to use RS-232 serial communication (see “Setting Up RS-232 Serial Communication” on page 245).

### To set up the USB communication

1. Ensure that the 38DL PLUS driver is installed on the computer.  
This driver is installed when you install the GageView interface program.

---

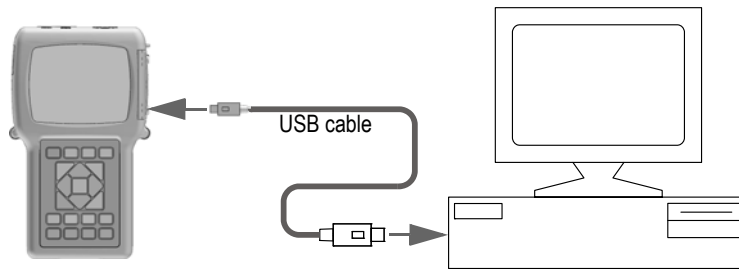
<b>NOTE</b>
-------------

For more information on installing GageView, refer to the *GageView Interface Program – User’s Manual* (P/N: 910-259-EN [U8778347]).

---

2. If you use a communication program other than GageView, refer to the program documentation to properly configure the program for USB communication.
3. Turn the 38DL PLUS on.
4. From the measurement screen, press **[SETUP MENU]**.
5. In the menu, select **COMM**.
6. In **COMM** screen, set **CONNECTION TYPE** to **USB**.
7. Press **[MEAS]** to return to the measurement screen.
8. Connect one end of a USB cable to the USB client connector under the I/O door of the 38DL PLUS, and the other end to a USB port of the computer (see Figure 14-1 on page 245).





**Figure 14-1 Connecting the 38DL PLUS to a computer**

The first time that you connect the 38DL PLUS to this computer, the computer prompts you that a new hardware device has been detected and asks if you would like to install the driver. Refer to the *GageView Interface Program — User’s Manual* (P/N: 910-259-EN [U8778347]) for more information.

The driver loads, and then you can start to use a program such as GageView to communicate with the 38DL PLUS.

---

**TIP**

If you experience problem to establish the communication between the 38DL PLUS and a remote device, consider using the 38DL PLUS communication reset function to return all communication parameters to the default values (see “Resetting the Communication Parameters” on page 260), and then reconfigure only needed communication parameters.

---

### 14.3 Setting Up RS-232 Serial Communication

The 38DL PLUS can transmit stored data and displayed readings over its input/output (I/O) RS-232 cable to any device with a RS-232 serial interface. The 38DL PLUS can also receive and execute commands sent from any device with a serial interface. Such devices include personal computers and printers.

To enable the 38DL PLUS to communicate with another RS-232 serial device, you must use the correct cable. Since all computers do not have the same serial port connector, the correct cable must be ordered from Olympus. The RS-232 cable is an option for the 38DL PLUS, which you can specify at the time of order (see Table 23 on page 246).

**Table 23 Optional RS-232 cables**

I/O cable part number	Computer serial port connector	Cable length	Typical device
36DLP-9F6	"D" Type, 9-pin male	2 m (6 ft)	Windows computer
36DLP-PR6	"D" Type, 25-pin female	2 m (6 ft)	Serial printer

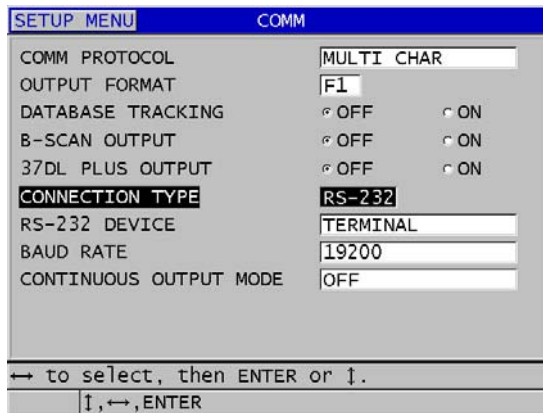
The serial communication parameter configuration must be the same in both the 38DL PLUS and the other device. In the 38DL PLUS, the baud rate is selectable (1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200) while the other RS-232 parameter are fixed:

- Word length = 8 characters
- Stop Bits = 1
- Parity = None

### To set up the RS-232 serial communication

1. Refer to the receiving device hardware and software documentation, and set the receiving device serial communication parameters to values supported by the 38DL PLUS:
  - a) Set the baud rate to 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200.
  - b) Set the stop bits to 1.
  - c) Set the parity to none.
2. On the 38DL PLUS, from the measurement screen, press **[SETUP MENU]**.
3. In the menu, select **SYSTEM**.
4. In **SYSTEM** screen, set **SAVE/SEND KEY** to **SEND**.
5. Press **[SETUP MENU]**.
6. In the menu, select **COMM**.
7. In the **COMM** screen (see Figure 14-2 on page 247):
  - a) Set **CONNECTION TYPE** to **RS-232**.  
The RS-232 parameters appear.

- b) Set **RS-232 DEVICE** to match the type of device to which you connect the 38DL PLUS:
- **PRINTER**: when connecting to serial printers.
  - **TERMINAL**: when connecting to computers.
  - **CALIPER**: when connecting to the Olympus caliper (P/N: HPV/C [U8780124]).
  - **FISCHER**: when connecting to the Fischer coating gage.
- c) Set **BAUD RATE** to the same value selected in step 1.a.
- d) Set **CONTINUOUS OUTPUT MODE** to one of the following options:
- **OFF**: Continuous output is off (default value).
  - **ON**: Continuously sends data at the selected measurement rate (see “Adjusting the Measurement Update Rate” on page 60).
  - **5 SEC AVERAGE**: Sends one averaged thickness reading every 5 seconds.
  - **10 SEC AVERAGE**: Sends one averaged thickness reading every 10 seconds.



**Figure 14-2 Viewing communication parameters**

8. Using the appropriate RS-232 cable (see Table 23 on page 246), connect the 38DL PLUS to the remote serial communication device.
9. If needed, on the remote serial communication device, start the serial communication program.
10. Press **[MEAS]** to return to the measurement screen.

**TIP**

If you experience a problem to establish the communication between the 38DL PLUS and a remote device, consider using the 38DL PLUS communication reset function to return all communication parameters to the default values (see “Resetting the Communication Parameters” on page 260) and reconfigure only needed communication parameters.

---

## 14.4 Exchanging Data with a Remote Device

You can exchange 38DL PLUS data with a remote device such as a computer or a printer.

**NOTE**

Data transmitted from the 38DL PLUS remains in the 38DL PLUS internal memory.

---

### 14.4.1 Sending Entire Files (RS-232)

You can send a single or multiple files from the 38DL PLUS to a computer or printer. The data that is transmitted includes the file name, the file header, ID numbers, thickness data, flags, calibration setups, and notes.

#### To send entire files from the 38DL PLUS to a computer or printer

1. Ensure that the RS-232 communication parameters are configured correctly (see “Setting Up RS-232 Serial Communication” on page 245).
2. From the measurement screen, press **[FILE]**.
3. In the menu, select **SEND**.
4. In the **SEND** screen (see Figure 14-3 on page 249):
  - a) Use the **[◀]** and **[▶]** keys to select to send **ALL** files or only **SELECTED** files. When you select **ALL**, in the file list, a check mark appears on the right of all files.
  - b) When you select **SELECTED**, you can individually select the files to send:

- (1) Set **SORT BY** to the desired sort option (**NAME** or **DATE CREATED**).
  - (2) In the file list, highlight each file, and then press **[ENTER]** to toggle the file transfer check mark so that only files you wish to send have a check mark on the right.
  - (3) Press **[2nd F]**, **[▼]** to leave the file list.
- c) Select the **SEND** button at the bottom of the screen.
- The **Accessing storage. Please wait** message appears on the help text bar while the data is transferred.

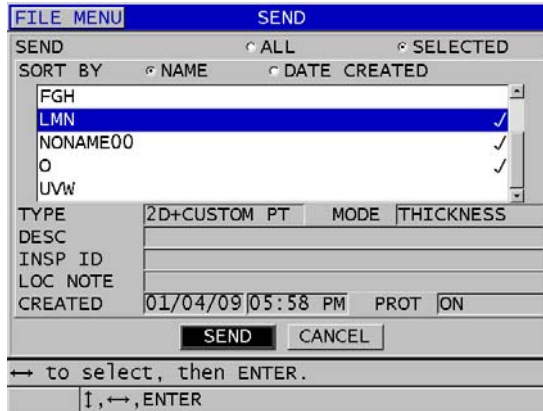


Figure 14-3 Selecting a file to send

## 14.4.2 Sending an ID Range from a File (RS-232)

The 38DL PLUS allows you to only transmit a portion of a given file to a computer or to a printer.

### To send a specific range of ID numbers from a specific file

1. Ensure that the RS-232 communication is configured correctly (see “Setting Up RS-232 Serial Communication” on page 245).
2. Open the file that contains the data to be transmitted, if the desired file is not already the active file (see “Opening a File” on page 184).
3. From the measurement screen, press and hold **[SAVE/SEND]**, until the **ID - RANGE SEND** screen opens.

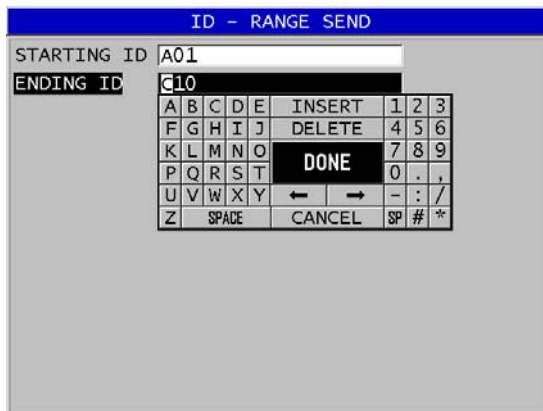


Figure 14-4 Identifying a range of ID numbers to send

4. Enter the **STARTING ID** and the **ENDING ID** of the desired range of ID numbers that you want to transmit.
5. Select **SEND**.  
The gage transmits the data for the specified range.

### 14.4.3 Sending the Currently Displayed Measurement (RS-232)

You can transmit the current displayed measurement data only. This function is useful when the 38DL PLUS is continuously connected to an external device (printer, data collector, or computer) and you need to collect only data on command.

#### To perform a single send

1. Ensure that the RS-232 communication is configured correctly (see “Setting Up RS-232 Serial Communication” on page 245).
2. Setup the desired measurement screen on the 38DL PLUS.
3. Make a thickness reading.
4. Press **[SAVE/SEND]** briefly (release in less than one second).

The displayed measurement data with its appropriate setup flags is transmitted and the instrument returns to the original measurement screen.

**NOTE**

The specific data transmitted depends on the datalogger output format. Pressing **[SAVE/SEND]** while the thickness display is blank sends “-.--” and the displayed flags.

---

**NOTE**

Sending a displayed reading blanks a held reading, resets the minimum or maximum function, and releases a frozen waveform.

---

#### 14.4.4 Exporting a File to the External Memory Card

The 38DL PLUS has the ability to export files from the internal memory to the external microSD memory card. You can export the files in CSV (comma separated variables), text (space delimited), or in survey (used by the GageView interface program) format. Using a microSD card reader, you can then open these files directly on your computer in Microsoft Excel, or any other program. You can import survey files in GageView from the microSD card reader.

You can send your user-defined transducer setups to the GageView interface program to save a copy of these setups on a computer. You can also send these transducer setups back to the 38DL PLUS (see “Importing Survey Files from the External Memory Card” on page 252). This procedure allows you to easily set up multiple 38DL PLUS instruments with the same custom transducer setup.

##### To export files to the external memory card

1. Ensure that a microSD memory card is inserted in its slot under the I/O door on the right side of the 38DL PLUS (see Figure 1-5 on page 25).
2. If you inserted the microSD memory card while the 38DL PLUS was turned on, turn the 38DL PLUS off, and then back on so that it recognizes the presence of the memory card.
3. From the measurement screen, press **[FILE]**.
4. In the menu, select **EXPORT**.

5. In the **EXPORT** screen (see Figure 14-5 on page 252):
  - a) If needed, change the **SORT BY** parameter to change how files are sorted in the file list.
  - b) In the file list, highlight the file that you want to export.
  - c) Set **FILE** to the desired file format:
    - **SURVEY FILE**: to be imported in GageView
    - **EXCEL CSV**: to be opened in Microsoft Excel
    - **TEXT FILE**: to be opened in many Windows-based programs
6. Select **EXPORT**.  
 The selected file is created in the following folder on the external microSD memory card: \OlympusNDT\38DLP\Transfer.  
 The instrument automatically returns to the measurement screen.

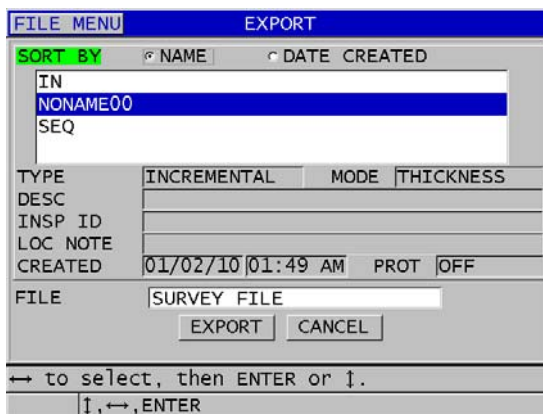


Figure 14-5 The EXPORT screen

### 14.4.5 Importing Survey Files from the External Memory Card

You can import a survey file from the external microSD memory card to the 38DL PLUS internal memory. You can use this function in conjunction with the GageView interface program to import survey files that have been exported from GageView to a microSD card. This feature allows you to import files in the 38DL PLUS while the instrument is in the field and cannot be connected to a computer.



## To import survey files from the external memory card

1. Ensure that the \OlympusNDT\38DLP\Transfer folder on your external microSD memory card contains the file that you wish to import in the 38DL PLUS internal memory.
2. Insert the microSD memory card in its slot under the I/O door on the right side of the 38DL PLUS (see Figure 1-5 on page 25).
3. If you inserted the microSD memory card while the 38DL PLUS was turned on, turn the 38DL PLUS off, and then back on so that it recognizes the presence of the memory card.
4. From the measurement screen, press **[FILE]**.
5. In the menu, select **IMPORT**.
6. In the **IMPORT** screen (see Figure 14-6 on page 253):
  - a) Select the file to import in the list of available files.  
The listed files are those found in the \OlympusNDT\38DLP\Transfer folder on the external microSD memory card.
  - b) Select **IMPORT**.
  - c) When a file with the same name already exists in the 38DL PLUS, the **Overwrite existing file?** message appears. When you still want to import the file, select **YES**.  
A beep confirms the end of the file transfer and the instrument returns to the measurement screen.

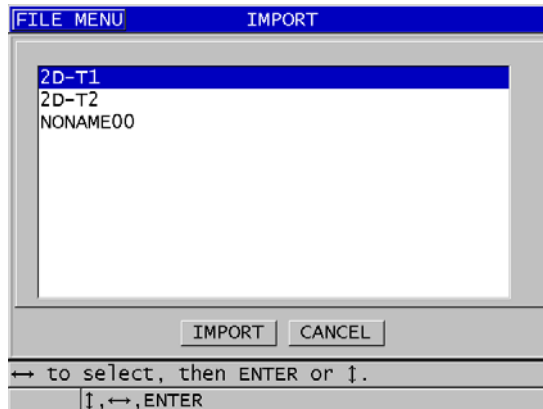


Figure 14-6 Example of the IMPORT screen

## 14.4.6 Receiving Files from a Computer

The same type of datalogger information, which you can send to a computer, can also be received or downloaded from a computer into the instrument. There are two benefits:

- At the next survey date, months, or years later, retrieve to the gage previously saved thickness survey data stored in a computer file with ID numbers. You can use this retrieved data for the following purposes:
  - To guide you through the measurement sequence using the ID numbers.
  - To compare current values, at the measurement site, with previously measured thickness values.
  - To manually or automatically verify that the current measurement setup is identical to the previously used setup.
- Create ID number sequences in a computer, and then download them to the instrument. This externally created sequence can guide you through the prescribed measurement location path. The ID sequence created in the computer must have setup information. The setup can be the gage default setups or any other desired sequence of setups.

The data downloaded to the 38DL PLUS must be in the same precise format in which data is transmitted. Olympus recommends using the GageView interface program to handle all functions of interfacing, storing, and creating 38DL PLUS data. Please contact Olympus for information on additional software data management programs.

### To receive a data file from a computer

1. When using GageView or another program to send the file from the computer using the USB port, set the USB communication parameters and connect the 38DL PLUS to the computer (see “Setting Up USB Communication” on page 244).
2. When using a program to send the file from the computer using the RS-232 port, set the RS-232 communication parameters and connect the 38DL PLUS to the computer (see “Setting Up RS-232 Serial Communication” on page 245).
3. Turn on the 38DL PLUS and ensure that the measurement screen is active.
4. On the computer, begin sending formatted data.  
The 38DL PLUS displays a **RECEIVING DATA** screen while the data is sent, and then returns to the measurement screen.

## 14.5 Capturing 38DL PLUS Screen Images

You can save a snapshot of the full 38DL PLUS screen contents to an image file. This function is useful when you need an exact replica of the display for reporting or documentation purposes. You can do this using one of the following two methods:

- Sending a Screen Capture to GageView (see section 14.5.1 on page 255)
- Sending a Screen Capture to the External microSD Card (see section 14.5.2 on page 257)

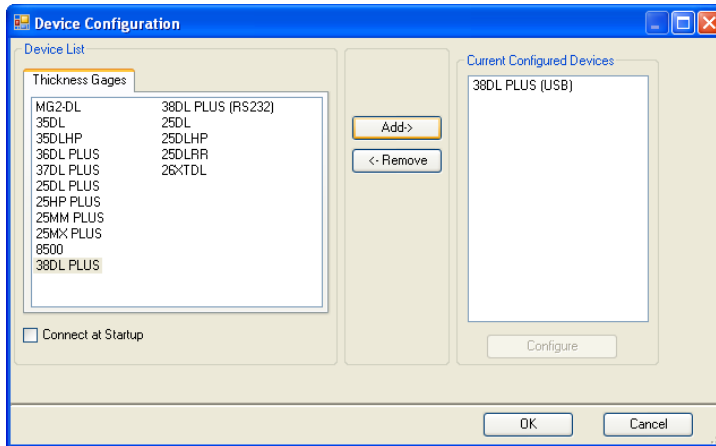
### 14.5.1 Sending a Screen Capture to GageView

You can send the full 38DL PLUS screen contents to the GageView interface program.

Refer to the *GageView Interface Program — User's Manual* (P/N: 910-259-EN [U8778347]) for information on how to install and use GageView.

#### To send a screen capture to GageView

1. Set the USB communication parameters, and then connect the 38DL PLUS to the computer (see “Setting Up USB Communication” on page 244).
2. On the 38DL PLUS, select the screen that you wish to capture.
3. On the computer, start GageView.
4. In GageView, perform the following tasks only the first time that you connect the 38DL PLUS to GageView on this computer:
  - a) On the GageView menu, select **Device > Config**.
  - b) In the **Device Configuration** dialog box (see Figure 14-7 on page 256):
    - (1) In the **Device List**, select 38DL PLUS, and then click **Add**.  
38DL PLUS (USB) appears in the **Current Configured Devices** list.
    - (2) Select the **Connect at Startup** check box so that GageView automatically attempts to connect to the 38DL PLUS when it starts.
    - (3) Click **OK**.



**Figure 14-7 The Device Configuration dialog box**

5. In GageView, perform the following tasks:
  - a) On the menu, select **Device > Tools**.
  - b) In the **Device Tools** dialog box (see Figure 14-8 on page 257), select **Screen Capture**, and then click **Receive**.  
The screen image appears when the data transfer completes.
  - c) Click **Copy** to copy the screen capture to the Windows clipboard.  
OR  
Click **Save** to save the image as a BMP file to a folder and file name of your choice.

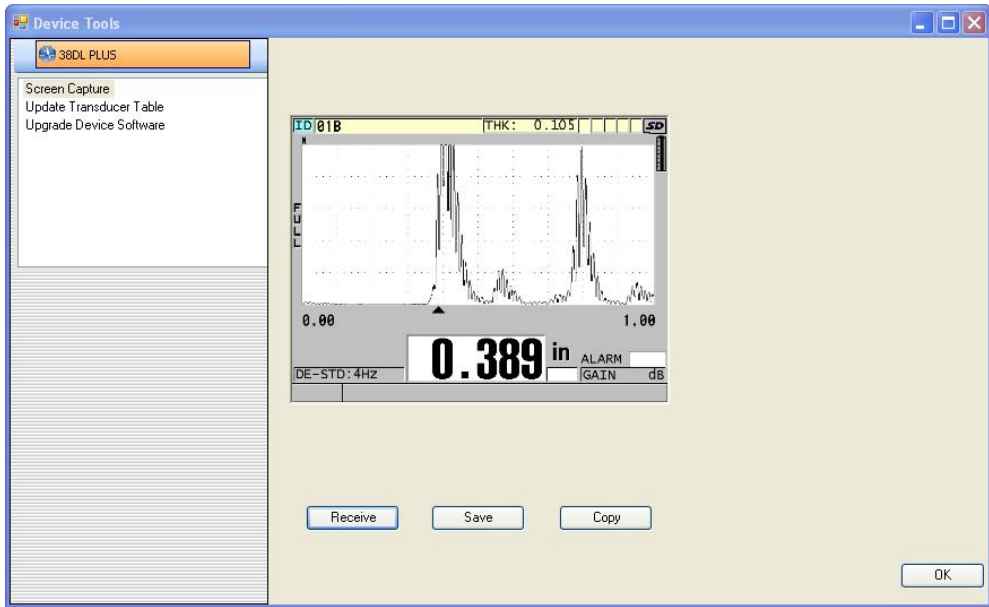


Figure 14-8 The Device Tools dialog box with a screen capture

## 14.5.2 Sending a Screen Capture to the External microSD Card

The 38DL PLUS has the ability to copy the contents of the current screen to the external microSD card. The screen shot is saved as a bitmap (.bmp) file. You can then connect the microSD card to a computer and open the file in any program that can view bitmap (.bmp) files.

### To send a screen capture to the external microSD card

1. Ensure that a microSD memory card is inserted in its slot under the I/O door on the right side of the 38DL PLUS (see Figure 1-5 on page 25).
2. If you inserted the microSD memory card while the 38DL PLUS was turned on, turn the 38DL PLUS off, and then back on so that it recognizes the presence of the memory card.
3. Ensure that the function to save a screen capture to the microSD card is enabled:
  - a) From the measurement screen, press [SETUP MENU].
  - b) In the menu, select **SYSTEM**.

- c) Set **PRINT SCREEN TO SD CARD** to **ON**.
4. Select the screen that you wish to capture.
5. Press **[2nd F]**, **[DISPLAY]**.  
The screen freezes for about 20 seconds as the file is being sent to the following folder on the external memory card: \OlympusNDT\38DLP\Snapshot.  
The screen shots are automatically named BMP*n*.bmp where *n* starts at 0 and is incremented by one each time a new screen shot is added.
6. To transfer the image file:
  - a) Remove the microSD memory card from its slot in the 38DL PLUS.
  - b) Using a microSD card reader, connect the memory card to a computer.
  - c) Copy the file from the \OlympusNDT\38DLP\Snapshot folder on the card to the desired folder on the computer.

## 14.6 RS-232 Serial Data Output Formats

The 38DL PLUS supports 10 output formats for RS-232 transmitted data. Output formats vary depending whether you are using a dual element transducer or a single element transducer. Table 24 on page 258 and Table 25 on page 259 describe the contents of each format for dual element transducers or a single element transducers respectively.

---

### NOTE

For USB communications, the output format is normally set to F1.

---

**Table 24 Serial data output format for dual element transducers**

Format	File header	ID header	Thickness table	Wave-forms	Setup table	Note table
F1	✓	✓	✓	✓	✓	✓
F2	✓	✓	✓		✓	✓
F4				✓		
F5		✓	✓	✓	✓	✓
F6		✓	✓		✓	✓
F7		✓	✓	✓	✓	

**Table 24 Serial data output format for dual element transducers (continued)**

Format	File header	ID header	Thickness table	Wave-forms	Setup table	Note table
F8		✓	✓		✓	
F9		✓	✓	✓	✓	✓
F10		✓	✓		✓	✓

**Table 25 Serial data output format for single element transducers**

Format	File header	ID header	Thickness table	Wave-forms	Setup table	Note table
F1	✓	✓	✓	✓	✓	✓
F2	✓	✓	✓		✓	
F4				✓		
F5		✓	✓	✓	✓	
F6		✓	✓		✓	
F7		✓	✓	✓	✓	
F8		✓	✓		✓	
F9		✓	✓	✓	✓	✓
F10		✓	✓		✓	

**To view or change the current output file format**

1. From the measurement screen, press [SETUP MENU].
2. In the menu, select **COMM**.
3. In **COMM** screen, view or change the **OUTPUT FORMAT** value (see Table 24 on page 258 and Table 25 on page 259 for a description of the formats).

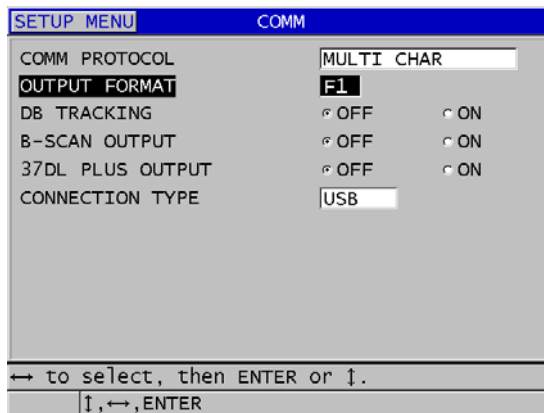


Figure 14-9 Viewing or changing the file output format

4. Press [MEAS] to return to the measurement screen.

## 14.7 Resetting the Communication Parameters

The communication reset function quickly returns communication parameters to the factory default values. This function may be useful when you experience difficulties to establish the communication with a remote device. Table 26 on page 260 gives the default values for the communication parameters.

Table 26 Default communication parameter values

Parameter	Value
COMM PROTOCOL	MULTI CHAR
OUTPUT FORMAT	F1
DATABASE TRACKING	OFF
B-SCAN OUTPUT	OFF
37DL OUTPUT	OFF
CONNECTION TYPE	USB



**To reset the communication parameters**

1. Press [2nd F], [SETUP MENU] (SP MENU).
2. In the menu, select **RESETS**.
3. In the **RESETS** screen (see Figure 14-10 on page 261):
  - a) In the **RESETS** list, select **COMMUNICATION RESET**.
  - b) Select **RESET**.

**Figure 14-10 Selecting the COMMUNICATION RESET**



---

## 15. Maintaining and Troubleshooting the 38DL PLUS

---

This section describes how to maintain your 38DL PLUS by applying routine care and maintenance.

### 15.1 Providing Routine Gage Maintenance

The 38DL PLUS case is sealed to prevent intrusion of environmental liquids and dust when the I/O door is closed. However, the instrument should never be immersed in any fluid.

The 38DL PLUS case is designed to withstand normal field use. However, as with any electronic instrument, damage is possible if not handled with some care. Observe the following instructions in particular:

- Never press a key with a hard or sharp object.
- When connecting cables to the instrument, first align the connector with the mating receptacle on the instrument (dual element D79X series transducer center pin is down, and the RS-232 I/O cable key tab facing down), then carefully insert the connector straight into the receptacle.
- When disconnecting cables from the instrument, first grasp the connector (not the cable), and then gently pull it out.
- Do not throw or drop the instrument.
- Do not use strong solvents or abrasives to clean the rubber boot, case, keypad, and display screen.

## 15.2 Cleaning the Instrument

First, clean the instrument with a dry damp cloth. If necessary, after closing the I/O door and the connector dust flap, use a wet damp cloth with a mild detergent to wash the instrument. Dry the instrument before using it.

## 15.3 Maintaining Transducers

The ultrasonic transducers used with the 38DL PLUS are rugged devices that need little care. However, they are not indestructible, and some attention to the following items result in the longer life span.

- Make high-temperature measurements only with suitable high temperature transducers. Standard transducers can be damaged or destroyed if put in contact with surfaces hotter than approximately 52 °C (125 °F).
- Cutting, pinching, or pulling the cables causes damage to the cables. Be careful 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 only. Never tie a knot in the transducer cable. Do not twist or pull the cable at the point where it connects to the transducer.
- Excessive wear at the tip of the Transducer degrades its performance. To minimize wear, do not scrape or drag the transducer across rough surfaces. Operating the transducer may become erratic or impossible when a transducer tip becomes rough or cracked. Although some wear is normal, severe wear limits transducer life. Take particular care with plastic delay line transducers; replace worn delay lines.

## 15.4 Using Instrument Resets

The 38DL PLUS includes reset functions to quickly restore the gage to its default parameters. Resets are useful shortcuts to known configurations. The reset functions are:

### **MEASUREMENT RESET**

Changes the measurement parameters to the default factory values listed in Table 27 on page 265.

**Table 27 Measurement default settings**

Parameter	Default value
Measurement mode with differential	Fast, min, max, and alarms turned off
Material sound velocity	5.969 mm/s or 0.2350 in./s (approximate velocity of the included test blocks)
Differential reference value	0.0 mm or 0.0 in.
Low alarm reference value	0.0 mm or 0.0 in.
High alarm reference value	635.0 mm or 25.0 in.
Display update rate	4 per second
Zoom	Off
Range	Minimum range
LOS condition	Blank thickness display
Resolution	0.01 mm or 0.001 in.

**INTERNAL MEMORY RESET**

Deletes all stored data on the internal microSD memory card and reformats the card.

**CAUTION**

The internal memory reset permanently deletes all stored thickness readings/waveforms that are stored in the memory card. However, this reset does not delete any stored transducer setups.

**CLOCK RESET**

Resets the date to 01/01/2010 in the MM/DD/YYYY format and the time to 12:00AM in the 12-hour format.

**COMMUNICATION RESET**

Changes the communication settings to the default factory values listed in Table 28 on page 266.

**Table 28 Default communication settings**

Parameter	Default value
COMM PROTOCOL	Multi Character
OUTPUT FORMAT:	F1
DATABASE TRACKING	Off
B-SCAN OUTPUT	Off
37DL PLUS OUTPUT	Off
CONNECTION TYPE	USB

**MASTER RESET**

Performs the measurement reset and the internal memory reset in one step.

---

**CAUTION**

The master reset permanently deletes all stored thickness readings/waveforms that are stored in the internal memory card of the 38DL PLUS.

---

**To activate a reset function**

1. Press **[2nd F]**, **[SETUP MENU]** (SP MENU).
2. In the menu, select **RESETS**.
3. In the **RESETS** screen (see Figure 15-1 on page 267):
  - a) In the **RESETS** list, highlight the desired reset function.  
A warning message appears, indicating the type of data that will be reset.
  - b) Select **RESET**.

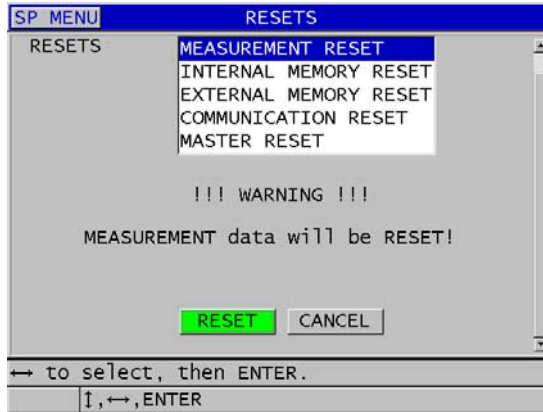


Figure 15-1 Activating a reset function

## 15.5 Performing Hardware Diagnostic Tests

The 38DL PLUS includes a function to perform several diagnostic self tests. The tests can help in localizing a suspected hardware problem or to verify correct hardware operation. Some tests are designed for Olympus internal testing procedures during the manufacturing process.

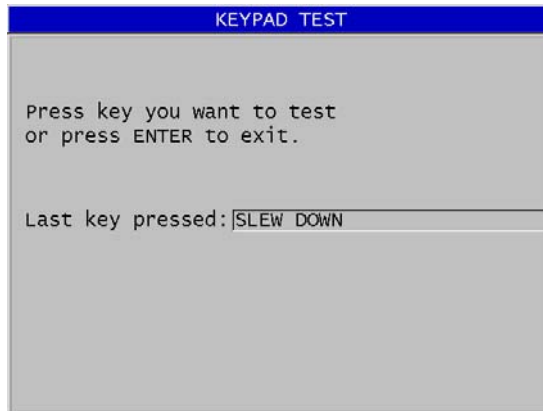
The available tests are:

- Keypad test
- Video test
- Internal microSD card test (Pass or Fail)
- External microSD card test (Pass or Fail)
- Dual element transducer test
- ESS Test (Electronic Stress Screening) [for Olympus internal use only]
- B-scan Test (for Olympus internal use only)
- Battery Test (for Olympus internal use only)
- One-wire test (for Olympus internal use only)

### To perform a diagnostic test

1. Press [2nd F], [SETUP MENU] (SP MENU).

2. In the menu, select **TESTS**.
3. In the **TESTS** screen, select the desired test, and then press **[ENTER]**.
4. When **KEYPAD TEST** is selected, in the **KEYPAD TEST** screen (see Figure 15-2 on page 268):
  - a) Test any key by pressing it on the keypad.  
When that specific key is working correctly, the instrument displays the name of the key in the last key pressed box.
  - b) Press **[ENTER]** to terminate the keypad test.



**Figure 15-2 The KEYPAD TEST screen**

5. When **VIDEO TEST** is selected:
  - a) In the **VIDEO TEST** screen, press **[DISPLAY]** to start the video test.  
The display shows three vertical color strips that darken to black. Any problems with the display show up as a disruption of the pattern.
  - b) Press **[ENTER]** to terminate the video test.
6. When **INTERNAL SD CARD TEST** or **EXTERNAL SD CARD TEST** is selected, in the **INTERNAL SD CARD TEST** or **EXTERNAL SD CARD TEST** screen:
  - a) Press **[DISPLAY]** to start the test.  
The test result appears in **SD Card Test Status**. The possible results are:
    - **PASS**: indicates that the card is functioning properly.
    - **FAIL**: indicates that there is a problem with the memory card. When the external card fails, re-install or replace the card, and then restart the instrument. When the internal card fails, contact Olympus for service.



- b) Press **[ENTER]** to terminate the **SD CARD** test.
7. When **DUAL XDCR TEST** is selected, in the **DUAL XDCR TEST** screen (see Figure 15-3 on page 269):
  - a) Press **[DISPLAY]** to start the test which measures the time of flight through each side of a dual element transducer.  
The measured parameter values appear.
  - b) Interpret the **Tx** and the **Rx** values as follows:
    - Similar values indicate a normal dual element transducer.
    - A difference between the values indicates that the delay line wear is not the same for each element.
    - A missing value indicates that a cable is broken or that the element is not functioning.
  - c) You can note the calculated **ZERO VALUE**.
  - d) Press **[ENTER]** to terminate the dual element transducer test.

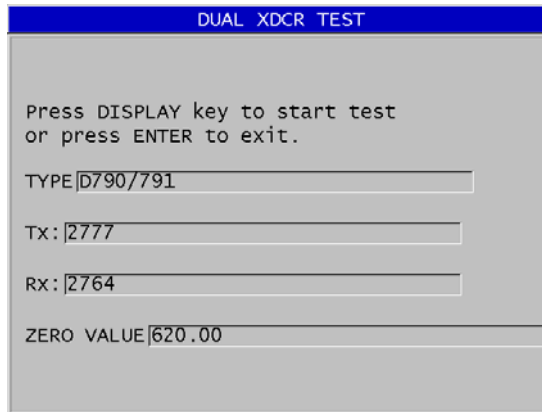


Figure 15-3 The DUAL XDCR TEST screen

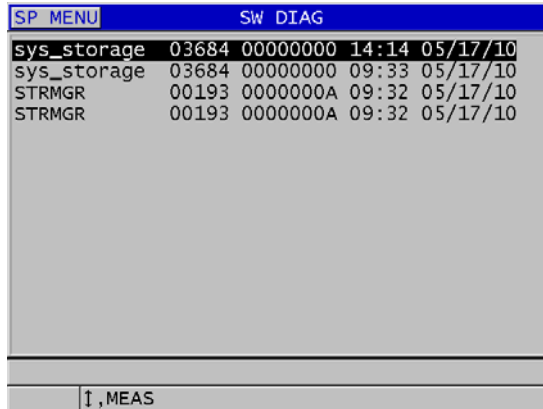
## 15.6 Performing the Software Diagnostic Test

The software diagnostic (**SW DIAG**) function presents a log of errors that occurred during instrument operation. Olympus uses this information to troubleshoot the operating software.

## To assess the software diagnostic

1. Press [2nd F], [SETUP MENU] (SP MENU).
2. In the menu, select **SW DIAG**.

The **SW DIAG** screen appears, showing the log of errors (see Figure 15-4 on page 270).



**Figure 15-4 Example of the SW DIAG screen**

3. Press [MEAS] to return to the measurement screen.

## 15.7 Viewing the Instrument Status

The **STATUS** screen lists important information about the instrument. The status screen shows the following information:

- Current instrument internal temperature
- Current battery charge level
- Instrument model
- Software release date (build date)
- Software version
- Hardware version
- Options code (S/N) to be communicated to Olympus for software option activation

## To view the instrument status

1. Press [2nd F], [SETUP MENU] (SP MENU).
2. In the menu, select **STATUS** (see Figure 15-5 on page 271).

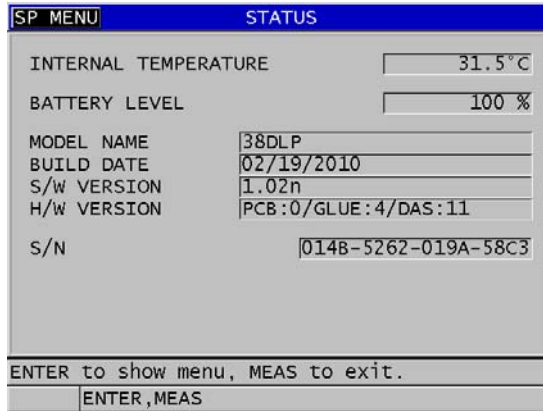


Figure 15-5 Example of the STATUS screen

3. Press [MEAS] to return to the measurement screen.

## 15.8 Understanding Error Messages

When operating the gage, certain error messages may appear. Usually these messages indicate a problem with the operating procedure, but some might indicate a physical problem with the gage itself. If you do not understand an error message, contact Olympus for assistance.

## 15.9 Resolving Battery Pack and Charger Problems

The power indicator (in the upper-right corner of the display) shows bars that indicate the percentage of remaining battery charge level. When the charge level becomes low, the gage automatically turns off. If the gage turns off immediately after you turn it on or if you cannot turn it on, the battery pack is probably depleted.

After recharging the battery pack (see “Charging the Battery” on page 34), you may need to replace the battery if the instrument only operates when the charger is connected.

---

<b>NOTE</b>
-------------

The battery is designed to withstand several hundred discharge-recharge cycles before failing.

---

The power indicator only shows the remaining charge level when the charger is not connected to the instrument.

If you are still unable to turn on the instrument after the charger is connected for several minutes, the instrument or the charger may be at fault.

## 15.10 Resolving Measurement Problems

**Table 29 Measurement troubleshooting**

Symptom	Possible explanation
No or weak echoes, no measurement (LOS)	<ul style="list-style-type: none"> <li>• Insufficient couplant, especially on rough or curved surfaces</li> <li>• Gain set too low</li> <li>• Material is too attenuating or surfaces are not parallel or are too rough.</li> <li>• Gage requires service, try the master reset.</li> <li>• The echo is too low in amplitude to be detected. Try increasing the gain.</li> </ul>
Strong echoes, no measurements	<ul style="list-style-type: none"> <li>• The echo may be in a blank area of the waveform and cannot be detected.</li> <li>• The echo is outside of the echo window.</li> </ul>

**Table 29 Measurement troubleshooting (continued)**

Symptom	Possible explanation
Strong echoes, incorrect measurements	<ul style="list-style-type: none"><li>• Out of calibration; perform calibration.</li><li>• <b>Differential</b> mode — check <b>DIFF</b> flag.</li><li>• <b>Min</b> or <b>Max</b> mode — see “Using the Minimum, Maximum, or Min/Max Thickness Mode” on page 115.</li><li>• Material is too grainy, has flaws, inclusions or laminations, or very high surface noise; try manual gain adjustment or extended blank.</li></ul>



## Appendix A: Technical Specifications

**Table 30 General EN15317 specifications**

Parameter	Value
Size	Height × Width × Depth Without protective boot: 211.6 mm × 128.1 mm × 46.2 mm (8.33 in. × 5.04 in. × 1.82 in.) With the rubber protective boot: 236.2 mm × 130.6 mm × 66.5 mm (9.30 in. × 5.14 in. × 2.62 in.)
Weight	816.5 g (1.80 lb)
Power supply types	AC-DC adaptor 24 V Lithium-ion battery 24.42 Wh Five AA auxiliary batteries
Probe sockets types	Dual LEMO with center pin IP67
Battery operating time Lithium-ion	12.6 hours minimum 14 hours typical 14.7 hours maximum
Operating temperature	With lithium-ion battery: -10 °C to 50 °C (14 °F to 122 °F)
Battery storage temperature	-20 °C to 40 °C (-4 °F to 104 °F)
Battery indicator	8-step battery charge level indication Flashing low-battery warning
Pulse repetition frequency (PRF)	1 kHz burst Measurement rates: 4 Hz, 8 Hz, 16 Hz, 20 Hz, and 30 Hz
Alarm indicators	Visual high-alarm and low- alarm indicators with audio tone
Thru coating	Echo-to-echo measurement and THRU-COAT

**Table 30 General EN15317 specifications (continued)**

Parameter	Value
Minimum and maximum thickness	Single element: 0.1 mm to 635.0 mm (0.004 in. to 25 in.) Dual element: 0.5 mm to 635.0 mm (0.020 in. to 25 in.)

**Table 31 Display EN15317 specifications**

Parameter	Value
Type	Color graphical TFT, LCD, 640 × 480 pixels
Size	[Height] × [Width], [Diagonal] 56.16 mm × 74.88 mm, 93.6 mm (2.21 in. × 2.94 in., 3.68 in)

**Table 32 Transmitter EN15317 specifications**

Parameter	Value
Transmitter pulse	Adjustable square wave pulser
Pulser voltage	Pulse voltages: 60 V, 110 V, 150 V, and 200 V
Pulse rise time	Damping in: 5 ns typical Damping out: 3.5 ns typical (pulse width dependent)
Pulse duration	Adjustable to probe frequency

**Table 33 Receiver EN15317 specifications**

Parameter	Value
Gain control	Automatic or manual: 0 dB to 99 dB
Frequency range	0.5 MHz to 24 MHz typical (filter dependent)

**Table 34 Other EN15317 specifications**

Parameter	Value
Data storage	Internal and external 2 GB microSD memory cards. Each card: 475000 thickness readings or 20000 waveforms with thickness readings



**Table 34 Other EN15317 specifications (continued)**

Parameter	Value
Data output types	2.0 USB client RS-232 Removable microSD memory card
Calibration setting storage	Default single and dual element transducer setups 35 custom single element and 10 custom dual element storage locations
Calibration	Single or two-point calibration test block Velocity can be entered manually. Multi-points for custom V-path calibration with dual element transducers
Display response time	Adjustable 4 Hz, 8 Hz, 16 Hz, 20 Hz, and 30 Hz
Number of pixels to display a waveform	640 × 480 pixels
Printer output	RS-232 serial

**Table 35 Environmental rating specifications**

Parameter	Value
IP rating	Designed for IP67
Explosive atmosphere	MIL-STD-810F, Section 511.4, Procedure I
Shock test	MIL-STD-810F, Section 516.5, Procedure I
Vibration test	MIL-STD-810F, Section 514.5, Procedure I
Drop test	MIL-STD-810F, Section 516.5, Procedure IV- Transit Drop

**Table 36 Measurement specifications**

Parameter	Value
Measurement modes	<p><b>Standard dual element:</b> Time between excitation pulse and first back-wall echo using dual element transducer.</p> <p><b>Dual echo-to-echo:</b> Time between successive back-wall echoes using dual element transducers.</p> <p><b>Thru-coat:</b> Time between excitation pulse and first back-wall echo while ignoring or displaying a coating thickness.</p> <p><b>Mode 1:</b> Time between excitation pulse and first echo following blank period using contact transducers.</p> <p><b>Mode 2:</b> Time between the interface echo and the first back-wall echo. Normally used with delay line or immersion transducers.</p> <p><b>Mode 3:</b> Time between a pair of back-wall echoes following the interface echo. Normally used with delay line or immersion transducers.</p>
V-path correction	Automatic or manually created, dependent on transducer type
Measurement resolution	<p>Selectable from the keypad:</p> <p><b>LOW:</b> 0.1 mm (0.01 in.)</p> <p><b>STD:</b> 0.01 mm (0.001 in.)</p> <p><b>HI:</b> 0.001 mm (0.0001 in.) with high resolution option.</p> <p>Not all resolutions are available for all measurement modes</p>
Material sound velocity range	0.762 mm/ $\mu$ s to 13.999 mm/ $\mu$ s (0.0300 in./ $\mu$ s to 0.5511 in./ $\mu$ s)
Material sound velocity resolution	0.001 mm/ $\mu$ s (0.0001 in./ $\mu$ s)
Alarm set points range	0.00 mm to 635.00 mm (0.00 in. to 25.00 in.)

**Table 37 Datalogger specifications**

Parameter	Value
Storage capacity	475000 thickness readings or 20000 waveforms with thickness readings
ID number length	1 to 20 characters
File name length	1 to 32 characters

**Table 37 Datalogger specifications (continued)**

Parameter	Value
File formats	Incremental Sequential (defined by starting and ending ID number) Sequential with custom points 2-D grid 2-D grid with custom points 3-D grid 3-D custom Boiler
External memory card	microSD memory card 2 GB maximum capacity

**Table 38 Typical measurement ranges and default setups for a single element transducer<sup>a</sup>**

Setup name	Transducer	Typical measurement range
DEFM1-20.0-M116	M116	Steel: 0.250 mm to 8.000 mm (0.020 in. to 1.500 in.)
DEFM1-10.0-M112	M112	Steel: 0.760 mm to 250.000 mm (0.030 in. to 10.000 in.)
DEFM1-10.0-M1016	M1016	Steel: 0.760 mm to 250.00 mm (0.030 in. to 10.000 in.)
DEFM1-5.0-M110	M110	Steel: 1.00 mm to 380.00 mm (0.040 in. to 15.000 in.)
DEFM1-5.0-M109	M109	Steel: 1.00 mm to 500.00 mm (0.050 in. to 20.000 in.)
DEFM1-2.25-M106	M106	Steel: 2.00 mm to 635.00 mm (0.080 in. to 25.000 in.)
DEFM1-2.25-M1036	M1036	Steel: 2.00 mm to 635.00 mm (0.080 in. to 25.000 in.)
DEFM3-20.0-M208	M208	Steel: 0.25 mm to 5.00 mm (0.008 in. to 0.200 in.)
DEFP2-20.0-M208	M208	Plastic: 0.12 mm to 5 mm (0.005 in. to 0.200 in.)
DEFM3-10.0-M202	M202	Steel: 0.25 mm to 12.00 mm (0.010 in. to 0.500 in.)
DEFM2-10.0-M202	M202	Steel: 0.75 mm to 12.00 mm (0.030 in. to 0.500 in.)
DEFP2-10.0-M202	M202	Plastic: 0.6 mm to 6 mm (0.025 in. to 0.25 in.)
DEFM3-15.0-V260	V260	Steel: 0.25 mm to 5.00 mm (0.010 in. to 0.200 in.)
DEFM2-15.0-V260	V260	Steel: 0.75 mm to 12.50 mm (0.030 in. to 0.500 in.)
DEFP2-15.0-V260	V260	Plastic: 0.25 mm to 3 mm (0.010 in. to 0.120 in.)
DEFM2-5.0-M201	M201	Steel: 1.50 mm to 25.40 mm (0.050 in. to 1.000 in.)
DEFP2-5.0-M201	M201	Plastic: 0.62 mm to 12.5 mm (0.025 in. to 0.500 in.)
DEFM2-5.0-M206	M206	Steel: 1.25 mm to 19.00 mm (0.050 in. to 0.750 in.)
DEFP2-5.0-M206	M206	Plastic: 1 mm to 12.5 mm (0.040 in. to 0.500 in.)

**Table 38 Typical measurement ranges and default setups for a single element transducer<sup>a</sup> (continued)**

Setup name	Transducer	Typical measurement range
DEFM2-2.25-M207	M207	Steel: 2.00 mm to 19.00 mm (0.080 in. to 0.750 in.)
DEFP2-2.25-M207	M207	Plastic: 2 mm to 12.5 mm (0.080 in. to 0.500 in.)
DEFM2-20.0-M208	M208	Steel: 0.50 mm to 10.00 mm (0.020 in. to 0.200 in.)
DEFM1-0.5-M101	M101	Steel: 12.5 mm to 635 mm (0.500 in. to 25.00 in.)
DEFM1-1.0-M102	M102	Steel: 5.0 mm to 635 mm (0.200 in. to 25.00 in.)
DEFM1-1.0-M103	M103	Steel: 2.5 mm to 635 mm (0.100 in. to 25.00 in.)
DEFP1-0.5-M2008	M2008	Fiberglass: 5.0 mm to 75 mm (0.200 in. to 3.00 in.)

- a. The maximum thickness measuring capability depends on transducer type, material conditions, and temperature.

**Table 39 Setup parameter description**

Name	Description	Units/Resolutions/Range
<b>MEAS OPTION</b>	Echo detect mode	Standard dual Dual echo-to-echo Thru-Coat Mode 1 Mode 2 Mode 3
<b>MEAS TYPE</b>	Special measurement modes	Standard or Oxide (optional) Barrier Layer (optional) First Peak
<b>PROBE TYPE</b>	Transducer types	Dual element Direct contact Delay line Immersion EMAT
<b>PULSER POWER</b>	Pulser power	60 V, 110 V, 150 V, or 200 V
<b>MAX GAIN</b>	Maximum receiver gain	0.0 dB to 99.8 dB, 0.3 dB steps
<b>INIT GAIN</b>	Initial TDG gain	0 to MaxGain, 1 dB steps.
<b>TDG SLOPE</b>	Time Gain slope (default)	0.0 dB/s to 39.9 dB/s
<b>MB BLANK</b>	Main Bang Blank	0 ns to 225 $\mu$ s

**Table 39 Setup parameter description (continued)**

Name	Description	Units/Resolutions/Range
<b>ECHO WINDOW</b>	Echo detect gate which begins at end of MB (main bang) blank in mode 1 or interface echo in modes 2 and 3. The value reported for the end of echo window is relative to the main bang.	0 ns to 224.71 $\mu$ s. 55 ns or MB blank time interval, whichever is less.
<b>ECHO 1 DETECT</b>	Detection polarity of first echo	+ or -
<b>ECHO 2 DETECT</b>	Detection polarity of second echo	+ or -
<b>IF BLANK</b>	Blank after interface echo	0 $\mu$ s to 20 $\mu$ s
<b>M3 BLANK</b>	Blank after first measured back-wall echo in mode 3	0 $\mu$ s to 20 $\mu$ s
<b>VELOCITY</b>	Ultrasonic sound velocity of material to be measured	0.508 mm/ $\mu$ s to 18.699 mm/ $\mu$ s (0.0200 in./ $\mu$ s to 0.7362 in./ $\mu$ s)
<b>ZERO</b>	Zero calibration factor	0.00 to 999.99

**Table 40 General specifications**

Element	Description
<b>Keypad</b>	Sealed and embossed membrane surface Tactile and audible feedback, color-coded graphics, 21 keys
<b>Dual element transducers</b>	Automatically identifies the transducer type and optimizes the gage for that transducer. Non-Olympus transducers might work, but performance is not guaranteed. Following transducers are supported: D790, D790-SM, D791, D791-RM, D792, D793, D794, D795, D797, D798, D7906-SM, D7908, D799, D7912, D7913, and MTD705
<b>Single element transducers</b>	Can be used with contact, delay line, and immersion transducers from 2 MHz to 30 MHz. High precision software option expands the frequency range to 0.5 MHz to 30.0 MHz



## Appendix B: Sound Velocities

Table 41 on page 283 consists of the sound velocities in a variety of common materials. Use this table only as a guide. The actual velocity in these materials may vary significantly due to a variety of causes, 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.

**Table 41 Sound velocities in common materials**

Material	V (in./ $\mu$ s)	V (m/s)
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
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

**Table 41 Sound velocities in common materials (continued)**

Material	V (in./ $\mu$ s)	V (m/s)
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
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

## References

Folds, D. L. "Experimental Determination of Ultrasonic Wave Velocities in Plastics, Elastomers, and Syntactic Foam as a Function of Temperature," Naval Research and Development Laboratory, Panama City, Florida, 1971.

Fredericks, J. R. *Ultrasonic Engineering*, John Wiley & Sons, Inc., New York, 1965.

*Handbook of Chemistry and Physics*. Chemical Rubber Co., Cleveland, Ohio, 1963.

Mason, W. P. *Physical Acoustics and the Properties of Solids*, D. Van Nostrand Co., New York, 1958.

Papadakis, E. P. Panametrics – unpublished notes, 1972.



## Appendix C: Accessories and Replacement Parts

**Table 42 Software options**

Description	Part number
Optional Oxide software (installed in units via activation code)	38DLP-OXIDE [U8147014]
Optional High Resolution software (installed in units via activation code)	38DLP-HR [U8147015]
Optional Multi-Measurement Software (installed in units via activation code)	38DLP-MM [U8147016]
Optional High Penetration software (installed in units via activation code)	38DLP-HP [U8147017]

**Table 43 Accessories and replacement parts**

Description	Part number
Carrying case	38-CC [U8764099]
Protective rubber boot with chest harness	38DLP/RPC [U8779306]
Gage stand	EPLTC-PS [U8780044]
Chest harness	441-087 [U8902895]
Rectangular rubber boot rings	412-1061LF [U8907259]
38DL PLUS User's Manual	DMTA-10004-01EN
Interface program CD-ROM (standard)	GageView [U8147006]
Batteries	Rechargeable lithium-ion battery: 38-BAT [U8760054] AA battery holder: 38DLP/AA [U8780290] Alkaline and NiMH
Remote save/send foot switch	38DLP/RFS [U8780288]

**Table 43 Accessories and replacement parts (continued)**

Description	Part number
Extended warranty — 1 year	38DLP-EW [U8778348]

**Table 44 Interface cables and power accessories**

Description	Part number
1.83 m (6 ft), 9-pin female “D” (top connector)	38-9F6 [U8840167]
1.83 m (6 ft) top USB cable	38-C-USB-IP67 [U8800998]
1.83 m (6 ft) USB cable (connects under I/O door)	EPLTC-C-USB-A-6 [U8840031]
VGA output cable 1.83 m (6 ft)	EPLTC-C-VGA-6 [U8840035]
2 GB external microSD memory card	MICROSD-ADP-2GB [U8779307]
Cable for portable printers	38DLP-PR6 [U8780287]
Universal charger/AC adaptor	EP-MCA-X where X denotes power cord type: <ul style="list-style-type: none"> <li>• U for North America, Japan, and Korea [U8050397]</li> <li>• A for Australia [U8767330]</li> <li>• K for United Kingdom [U8767287]</li> <li>• I for Italy [U8767289]</li> <li>• D for Denmark [U8767290]</li> <li>• P for Pakistan, India, South Africa, and Hong Kong [U8767291]</li> <li>• E for Europe [U8767288]</li> </ul>
AC/adaptor power cord for: North America, South America, Japan, and Korea	2111 [U8840015]
AC/adaptor power cord for: European—Austria, Belgium, Finland, France, Germany, Netherlands, Sweden, Norway, Israel, and Greece	1514 [U8840003]
AC/adaptor power cord for Australia	1515 [U8840005]
AC/adaptor power cord for United Kingdom	1516 [U8840007]

**Table 44 Interface cables and power accessories (continued)**

Description	Part number
AC/adaptor power cord for Italy	1517 [U8840009]
AC/adaptor power cord for Denmark	1518 [U8840011]
AC/adaptor power cord for India, Pakistan, South Africa, and Hong-Kong	1519 [U8840013]

**Table 45 Couplants**

Description	Part number
Glycerin, 0.06 l (2 oz.)	Couplant B-2 [U8770023]
Gel type, 0.35 l (12 oz.)	Couplant D-12 [U8770026]
High temperature couplant up to 398 °C (750 °F), 0.06 l (2 oz.)	Couplant H-2 [Q7700002]

**Table 46 Test blocks**

Description	Part number
5-step, 1018 steel English units; 0.100 in., 0.200 in., 0.300 in., 0.400 in., 0.500 in.	2214E [U8880014]
5-step, 1018 steel Metric units; 2.5 mm, 5.0 mm, 7.5 mm, 10.0 mm, 12.5 mm	2214M [U8880016]
5-step, aluminum English units; 0.100 in., 0.200 in., 0.300 in., 0.400 in., 0.500 in.	2213E [U8880010]
4-step, 1018 steel English units; 0.250 in., 0.500 in., 0.750 in., 1.500 in.	2212E [U8880008]
2-step, 303 stainless steel English units; 0.050 in., 0.150 in.	2218E [U8880022]
2-step, 303 stainless steel Metric units; 1 mm, 15 mm	2218M [U8880024]
2-step, 303 stainless steel, English units; 0.200 in., 1.500 in.	2219E [U8880026]
2-step, 303 stainless steel, Metric units; 5 mm, 30 mm	2219M [U8880028]



---

## List of Figures

---

Figure i-1	The warning symbol between the T/R connectors .....	1
Figure i-2	Labels and symbols are attached to the instrument .....	2
Figure i-3	The 38DL PLUS instrument .....	17
Figure 1-1	Measuring thicknesses with the 38DL PLUS .....	19
Figure 1-2	The 38DL PLUS hardware components .....	23
Figure 1-3	The 38DL PLUS connections .....	23
Figure 1-4	The top end connectors .....	24
Figure 1-5	The connectors behind the I/O door .....	25
Figure 1-6	The 38DL PLUS keypads .....	26
Figure 2-1	The power indicator for battery and AC operation .....	31
Figure 2-2	Connecting the charger/adaptor .....	32
Figure 2-3	Connecting the DC power plug .....	33
Figure 2-4	Opening the battery compartment .....	36
Figure 2-5	Selecting the new battery type .....	37
Figure 3-1	The main elements of the measurement screen .....	39
Figure 3-2	The ID bar .....	40
Figure 3-3	Example of other elements appearing on the measurement screen .....	41
Figure 3-4	The loss-of-signal (LOS) indicator .....	41
Figure 3-5	Menu and submenu example .....	42
Figure 3-6	Parameter screen example .....	43
Figure 3-7	Example of the virtual keyboard .....	45
Figure 3-8	The character cycle of the traditional text edit method .....	46
Figure 4-1	Selecting the user interface language .....	50
Figure 4-2	Selecting clock parameters .....	51
Figure 4-3	The DISPLAY SETTINGS screen .....	52
Figure 4-4	Example of the indoor and the outdoor color schemes .....	53
Figure 4-5	Examples of the rectification modes .....	54
Figure 4-6	Examples of waveform trace modes .....	56
Figure 4-7	The range of the waveform display .....	57
Figure 4-8	Comparing normal and zoomed display in mode 1 .....	59

Figure 4-9	Comparing normal and zoomed display in mode 2 .....	59
Figure 4-10	Comparing normal and zoomed display in mode 3 .....	60
Figure 4-11	The measurement update rate indicator .....	60
Figure 5-1	Plugging the transducer .....	64
Figure 5-2	Initial screen with a standard D79X dual element transducer .....	64
Figure 5-3	Selecting a default single element transducer setup .....	65
Figure 5-4	Performing the material sound velocity calibration on a 5-step test block .....	68
Figure 5-5	Performing the zero calibration on a 5-step test block .....	69
Figure 5-6	Example of a 5-step test block .....	70
Figure 5-7	Entering a known material sound velocity .....	72
Figure 5-8	The calibration lock message .....	73
Figure 5-9	Coupling dual element transducer and reading the measured thickness .....	76
Figure 5-10	The active file name appearing in the ID bar .....	77
Figure 5-11	Opening the THRU COAT SETUP dialog box .....	78
Figure 5-12	Measuring with the standard echo detection mode .....	80
Figure 5-13	Measuring with the automatic echo-to-echo detection mode .....	81
Figure 5-14	Measuring with the manual echo-to-echo detection mode .....	82
Figure 5-15	Comparing manual measurements .....	84
Figure 6-1	EMAT transducer and filter adaptor connection .....	88
Figure 7-1	The OPTIONS screen to activate software options .....	92
Figure 7-2	The OXIDE screen .....	95
Figure 7-3	Selecting which measurement appears with the larger font .....	96
Figure 7-4	Measurement screen with the oxide layer software option .....	97
Figure 7-5	Measurement screen for a disbanded oxide layer .....	98
Figure 7-6	Waveform display screen .....	100
Figure 7-7	Setting multi-measurement parameters in the normal mode .....	101
Figure 7-8	Multi-measurement display modes with three layers and the sum .....	102
Figure 7-9	Setting multi-measurement parameters in the soft contact mode .....	104
Figure 7-10	Setting multi-measurement parameters in the % total thickness mode ..	105
Figure 7-11	Encoded B-scan main screen .....	106
Figure 7-12	Changing B-scan parameters .....	107
Figure 7-13	7 inch scan zoom set to 1 .....	110
Figure 7-14	7 inch scan zoom set to 5 .....	110
Figure 7-15	7 inch scan zoom set to 10 .....	111
Figure 8-1	Normal differential mode .....	113
Figure 8-2	The DIFF screen .....	115
Figure 8-3	Displaying the minimum and/or maximum thickness .....	116
Figure 8-4	Example of a HIGH alarm indicator .....	118
Figure 8-5	Example of a B-scan alarm mode .....	121
Figure 8-6	YEL (yellow) and RED alarm indicators .....	122
Figure 8-7	Setting up the STANDARD alarm .....	123
Figure 8-8	Example of a locked function message in the help bar .....	124

Figure 8-9	The INSTRUMENT LOCK screen .....	125
Figure 9-1	The MEAS screen .....	127
Figure 9-2	The SYSTEM screen .....	130
Figure 9-3	Changing the communication parameters .....	132
Figure 10-1	Manually adjusting the gain .....	136
Figure 10-2	Adjusting the extended blank length .....	138
Figure 10-3	B-scan example for a 5-step test block .....	139
Figure 10-4	Changing B-scan parameters .....	140
Figure 10-5	The half-size and full-size B-scans .....	141
Figure 10-6	B-scan elements .....	141
Figure 10-7	B-scan freeze review elements .....	143
Figure 10-8	Example of the half-size DB grid .....	147
Figure 10-9	Changing DB grid parameters .....	148
Figure 10-10	Example of half-size and full-size DB grids .....	149
Figure 10-11	Grid transposition example .....	149
Figure 10-12	Example of a linearized DB grid .....	150
Figure 10-13	The highlighted DB grid cell in the ID review screen .....	151
Figure 10-14	Example of an inserted cell .....	152
Figure 10-15	Example of a zoomed inserted cell .....	153
Figure 10-16	Opening the Avg/Min measure dialog box .....	154
Figure 10-17	Examples of the measurement screen with the AVG/MIN measurement active .....	155
Figure 10-18	The TEMP COMP screen .....	157
Figure 10-19	Displaying temperature compensation data .....	158
Figure 11-1	The active file name appearing in the ID bar .....	159
Figure 11-2	Identifying datalogger parameters .....	161
Figure 11-3	Example of the CREATE screen .....	164
Figure 11-4	The CREATE screen for the incremental data file type .....	167
Figure 11-5	Selecting the ID range for the sequential file type .....	168
Figure 11-6	Configuring the ID range for a sequential with custom points data file type .....	170
Figure 11-7	General 2-D grid example .....	171
Figure 11-8	One grid for 75 identical parts .....	172
Figure 11-9	Different named grid for each part .....	173
Figure 11-10	Configuring the ID range for a 2-D grid data file type .....	174
Figure 11-11	Configuring the ID range for a 2-D grid with custom points data file type .....	176
Figure 11-12	Configuring the ID range for a 3-D grid data file type .....	178
Figure 11-13	Configuring the ID range for a boiler data file type .....	180
Figure 11-14	Configuring the ID range for a 3-D custom data file type .....	181
Figure 11-15	The file menu and report submenu .....	184
Figure 11-16	Opening a file .....	185

Figure 11-17	Copying a file .....	186
Figure 11-18	Entering new file information .....	187
Figure 11-19	Displaying the grid edit screen .....	188
Figure 11-20	Deleting a file .....	189
Figure 11-21	Deleting the data of an ID range in the active file .....	190
Figure 11-22	Warning message when resetting measurements .....	191
Figure 11-23	The FILE NOTES screen .....	192
Figure 11-24	Selecting a note from the notes table .....	194
Figure 11-25	Copying a note table from one file to another .....	196
Figure 11-26	The ID overwrite protection message .....	197
Figure 11-27	Identifying the ID review screen .....	198
Figure 11-28	Editing the ID # edit mode .....	200
Figure 11-29	The message when the edited ID is not in the database .....	201
Figure 11-30	The FILE SUMMARY report screen .....	203
Figure 11-31	The FILE SUMMARY report result screen .....	204
Figure 11-32	The MIN/MAX SUMMARY report screen .....	204
Figure 11-33	The FILE COMPARISON report screen .....	205
Figure 11-34	The FILE COMPARISON report result screen .....	206
Figure 11-35	The ALARM SUMMARY report result screen .....	207
Figure 11-36	The MIN/MAX SUMMARY report result screen .....	208
Figure 11-37	Returning to the measurement screen .....	208
Figure 12-1	The GENERIC SETUP SELECTION screen .....	213
Figure 12-2	Example of the ACTIVE screen .....	214
Figure 12-3	Illustration of the V-path .....	216
Figure 12-4	Answering YES at the V-path calibration prompt .....	218
Figure 12-5	Editing point 1 of the V-path calibration .....	219
Figure 12-6	Saving the setup .....	220
Figure 13-1	The ACTIVE screen for the setup of a single element transducer .....	222
Figure 13-2	Adjusting the waveform parameters .....	224
Figure 13-3	Mode 1 detection example .....	226
Figure 13-4	Mode 2 detection example .....	226
Figure 13-5	Mode 3 detection example .....	227
Figure 13-6	Detection of the first or the second negative peak .....	228
Figure 13-7	Comparing pulser power set to 60 V and 200 V .....	229
Figure 13-8	The TDG zones and parameters .....	230
Figure 13-9	Main bang blank position for mode 1 .....	232
Figure 13-10	Main bang blank position for mode 2 and mode 3 .....	233
Figure 13-11	Echo window setting for mode 1 .....	234
Figure 13-12	Echo window setting for mode 2 and mode 3 .....	234
Figure 13-13	Negative and positive echo detection examples .....	235
Figure 13-14	Examples of the interface blank in mode 2 .....	237
Figure 13-15	Examples of the interface blank in mode 3 .....	238



---

Figure 13-16	Examples of M3 Blank adjustment .....	239
Figure 13-17	Saving custom setups .....	240
Figure 14-1	Connecting the 38DL PLUS to a computer .....	245
Figure 14-2	Viewing communication parameters .....	247
Figure 14-3	Selecting a file to send .....	249
Figure 14-4	Identifying a range of ID numbers to send .....	250
Figure 14-5	The EXPORT screen .....	252
Figure 14-6	Example of the IMPORT screen .....	253
Figure 14-7	The Device Configuration dialog box .....	256
Figure 14-8	The Device Tools dialog box with a screen capture .....	257
Figure 14-9	Viewing or changing the file output format .....	260
Figure 14-10	Selecting the COMMUNICATION RESET .....	261
Figure 15-1	Activating a reset function .....	267
Figure 15-2	The KEYPAD TEST screen .....	268
Figure 15-3	The DUAL XDCR TEST screen .....	269
Figure 15-4	Example of the SW DIAG screen .....	270
Figure 15-5	Example of the STATUS screen .....	271



---

## List of Tables

---

Table 1	Label contents .....	3
Table 2	Keypad functions .....	27
Table 3	Recommended transducers for various steel thickness ranges .....	84
Table 4	38DL PLUS software options .....	91
Table 5	Oxide layer transducers .....	94
Table 6	Sample scan-speed calculations .....	108
Table 7	Sample maximum-distance calculations .....	109
Table 8	Alarm calculation example with the ABSOLUTE DIFF mode .....	119
Table 9	Alarm calculation example with the % DIFF mode .....	120
Table 10	File contents summary .....	160
Table 11	Additional information stored with the data .....	162
Table 12	Resulting ID examples for the INCREMENTAL file type .....	166
Table 13	Resulting ID examples for the SEQUENTIAL file type .....	167
Table 14	Resulting ID example for the SEQ+CUSTOM PT file type .....	169
Table 15	Resulting ID example for the 2D+CUSTOM PT file type .....	175
Table 16	Resulting ID example for the 3-D GRID file type .....	177
Table 17	Resulting ID example for the BOILER file type .....	179
Table 18	Resulting ID example for the 3-D CUSTOM file type .....	180
Table 19	File data mode stored measurements .....	182
Table 20	Predefined setups .....	211
Table 21	Default transducers .....	213
Table 22	Polarity of echoes .....	236
Table 23	Optional RS-232 cables .....	246
Table 24	Serial data output format for dual element transducers .....	258
Table 25	Serial data output format for single element transducers .....	259
Table 26	Default communication parameter values .....	260
Table 27	Measurement default settings .....	265
Table 28	Default communication settings .....	266
Table 29	Measurement troubleshooting .....	272
Table 30	General EN15317 specifications .....	275

Table 31	Display EN15317 specifications .....	276
Table 32	Transmitter EN15317 specifications .....	276
Table 33	Receiver EN15317 specifications .....	276
Table 34	Other EN15317 specifications .....	276
Table 35	Environmental rating specifications .....	277
Table 36	Measurement specifications .....	278
Table 37	Datalogger specifications .....	278
Table 38	Typical measurement ranges and default setups for a single element transducer .....	279
Table 39	Setup parameter description .....	280
Table 40	General specifications .....	281
Table 41	Sound velocities in common materials .....	283
Table 42	Software options .....	285
Table 43	Accessories and replacement parts .....	285
Table 44	Interface cables and power accessories .....	286
Table 45	Couplants .....	287
Table 46	Test blocks .....	287

---

# Index

---

## Symbols

% total mode, multi-measurement 104

## Numerics

2-D grid data file 170  
 2-D grid with custom points data file 174  
 3-D grid custom data file 180  
 3-D grid data file 176

## A

AA battery holder 33  
 AC power 32  
   cord 23  
   using 32  
 accessories and replacement parts 285  
 acoustic properties of test material 74  
 activating  
   DB grid 147  
   differential mode 114  
   min/max mode 117  
   quick setup recall 241  
   resets 266  
   software options 92  
   V-path 216  
   zoom 58  
 active file name 77, 159  
 active ID, changing 199  
 active measurement 100  
 adjusting  
   delay value 58  
   extended and E1 blanks 83  
   extended blank with D79X series transducers  
     137

  gain with DE and EMAT transducers 135  
   update rate 61  
   waveform parameters 224  
 advanced gaging functions 135  
 alarm  
   setting 122  
 alarm indicator 41  
 alarms 117  
 Alkaline batteries  
   operating time 34  
   using 33  
 arrow keys 27  
 A-scan 40  
 associating note to IDs 193  
 Australia, RCM compliance 4  
 AUTO E-TO-E 81  
 AVG/MIN  
   configuring 153  
   measuring thickness 155  
 Avg/Min measurements 153

## B

basic operation 63  
   manual 6  
 battery  
   charge 31  
   charging 34  
   compartment door 36  
   full capacity 35  
   operating time 34  
   power 33  
   precautions 10  
   rechargeable 33

- replacement 36
- resolving problems 271
- storage instructions 35
- usage instructions 35
- beeper 49, 130
- blank
  - adjusting 83
  - interface 236
  - main bang 232
  - mode 3 echo 238
  - thickness value 77
- boiler data file 178
- boiler tube 94
  - thickness measurement 97
- brightness, display 52
- B-scan
  - about the 139
  - alarm 120
  - freeze mode 142
  - max THK mode 143
  - saving 145
  - scan direction 141
  - using 144
  - using the alarm mode 144
- building V-path for DE transducers 217
- C**
- calibrating
  - EMAT transducer 89
  - oxide layer measurements 96
- calibration 66, 73
  - instrument 67
  - locked 73
  - material sound velocity 71
  - test block 70
  - THRU-COAT 79
  - transducer zero compensation 70
- capturing screen with GageView 255
- caution notes
  - AC power cord 24, 32
  - battery replacement 36
  - cannot guarantee accuracy and performance with non-D79X transducers 217
  - cannot recover data after measurement reset 191
  - cannot recover deleted file content 188
  - cannot recover erased data 201
  - do not delete existing notes 195
  - experienced operator only 137, 221
  - ingress protection guarantee 22
  - internal memory reset deletes all data 265
  - master reset deletes all data 266
  - overwriting notes with copied note table 195
  - replacing setup deletes original data 220, 240
  - unsaved data lost 215
- CAUTION signal word 8
- cautions
  - electric shock 1
  - instrument compatibility 6
  - modification prohibited 7
- CE (European Community) 11
- CE marking 4
- changing
  - active ID 199
  - active measurement 100
  - display settings 51
  - echo detection mode 82
  - file data mode 183
  - highlighted cell in DB grid 151
  - language 49
  - RS-232 output file format 259
  - thickness measurement resolution 61
- character
  - cycle in traditional method 46
  - deleting 47
  - inserting 47
- charging batteries 34
- China RoHS 4, 12
- Chinese keypad 26
- cleaning, instrument 264
- clock
  - reset 265
  - setting 51
- coated material 78
- color scheme 52
  - changing 51
- comment notes 40, 85
- communication
  - configuring 131
  - reset 261, 265
- compensation, temperature 156
- compliance

- EMC directive 13
- FCC (USA) 13
- ICES-001 (Canada) 14
- RCM (Australia) 4
- configuring
  - AVG/MIN 153
  - beeper 49
  - communications 131
  - DB grid 147
  - differential mode 114
  - inactive time 49
  - instrument 127
  - measurement parameters 127
  - radix type 49
  - system parameters 129
- connecting
  - EMAT transducer 88
- connections 23
- copying
  - file 185
  - note table 196
- corrosion applications 78
- couplant types 76
- coupling technique 73
- creating
  - custom setups for SE transducers 222
  - data file 163
  - notes 193
  - setup for nonstandard DE transducers 212
- curvature of test piece 74
- curvature, soft contact 99
- custom setups 221
- D**
- D79X standard transducers 211
- DANGER signal word 8
- data
  - erasing in active file 201
  - exchange 248
  - output formats 258
  - saving 77
- data file
  - 2-D grid 170
  - 2-D grid with custom points 174
  - 3-D grid 176
  - 3-D grid custom 180
  - boiler 178
  - creating 163
  - incremental 165
  - sequential 167
  - sequential with custom points 168
- datalogger
  - about the 159
  - echo-to-echo flags 85
  - file based system 76, 159
  - functions 21
- date, setting 51
- DB grid
  - about the 147
  - activating and configuring 147
  - changing the highlighted cell 151
  - saving readings 152
  - viewing inserted cell 153
- DC power connector 24
- DE-AEtoE indicator 81
- default file 77
- delay 56
  - adjusting value 58
- deleting
  - a character 47
  - all files 191
  - file or content 189
  - notes from a file 195
  - range of IDs 190
- DE-MEtoE indicator 81
- DE-STD indicator 80
- detection modes 225
- detection of echo 1 and 2 235
- diagnostic test 267
- differential mode 113
- direct current symbol 4
- display
  - brightness 52, 53
  - changing settings 51
  - options 21
- disposal, equipment 11
- doubling 85
- download indicator 40
- dual element transducer
  - connector 23
  - selection for echo-to-echo modes 84
  - zero compensation 66, 70

**E**

- E1 blank
  - adjusting 83
  - description 83
- E110-SB EMAT transducer 89
- eccentricity or taper 74
- echo detection mode 80
  - changing 82
- echo window 233
- echo-to-echo mode
  - blanking adjustments 83
  - flags 85
- editing
  - file 187
  - ID 200
  - notes 193
  - value with traditional method 47
  - value with virtual keyboard 45
- electric shock, caution 1
- electromagnetic acoustic transducer 87
- EMAT transducer 87
- EMC directive compliance 13
- EN15317 specifications 275
- enabling THRU-COAT 78
- English keypad 26
- entering known material sound velocity 72
- environmental rating 22
- EPRI 174
- equipment disposal 11
- erasing data in active file 201
- error messages 271
  - calibration 69
- European Community (CE) 11
- exchanging data 248
- exporting files to memory card 251
- extended blank 137
  - adjusting 83
  - using 137

**F**

- fast mode 60
- FCC (USA) compliance 13
- FCC symbol 4
- file
  - copying 185
  - deleting 189

- deleting all 191
- editing 187
- opening 184
- renaming 187
- file data modes 182
- file name 77, 159
- filled waveform 56
- first peak 227
- flags, echo-to-echo 85
- freeze indicator 41
- freezing
  - waveform 126
  - waveforms 126
- full rectification 54

**G**

- GageView
  - about 243
  - installation 244
  - manual 6
- gain
  - adjustments (DE and EMAT transducers) 135
  - initial 231
  - maximum 230
  - time dependent 229
- generating
  - report 203
- getting started manual 6

**H**

- half- rectification 54
- half+ rectification 54
- hand strap 22
- help text bar 41
- high penetration software option 91, 111
- high resolution software option 61, 91, 93
- high temperature measurements 71

**I**

- I/O door 24
- ICES-001 (Canada) compliance 14
- ID bar 39, 40
- ID number 40
- ID overwrite protection 196
- ID review screen 197
- ID, editing 200



- important information 5
- important notes
  - determine thickness range 217
  - forgotten password 125
  - setups for each multi-measurement layer 99
  - turning off before procedure completion 69
- IMPORTANT signal word 8
- importing survey files from memory card 253
- inactive time 49
- incremental data file 165
- indicators
  - alarm 41
  - DE-AEtoE 81
  - DE-MEtoE 81
  - DE-STD 80
  - download 40
  - freeze 41
  - LOS 41
  - microSD card 40
  - power 31, 39
  - rectification 39
  - zoom 41
- indoor color scheme 53
- initial gain 231
- initial screen 64
- inserting a character 47
- instruction label
  - content 3
  - location 2
- instruction manual 5
- instrument
  - calibrating 67
  - cleaning 264
  - configuring 127
  - locking 124
  - status 271
- interface blank 236
- internal memory reset 265
- internal oxide 98
- international keypad 26
- IP67 ingress protection 22
- J**
- Japanese keypad 26
- K**
- keypad 25
  - functions 25, 27
  - secondary function 26
- known material sound velocity 72
- L**
- labels
  - instructions 2, 3
  - safety 1
- language, changing 49
- last ID 77
- lenses, soft contact 99
- loading, setup 65
- locked calibration 73
- locking
  - instrument 124
- loss-of-signal indicator 41
- M**
- magnetite 94
- main bang blank 232
- maintenance 263
  - gage 263
  - transducer 264
  - transducers 264
- MANUAL E-TO-E 81
- manual gain adjust with D79X series transducer 135, 136
- manual, instruction 5
- master reset 266
- material
  - coated or painted 78
  - entering sound velocity 72
  - sound velocity calibration 66, 68, 71
- maximum gain 230
- maximum mode 115
- measurement
  - features 20
  - parameters, configuring 127
  - reset 264
  - troubleshooting 272
  - update rate 60
- measurement mode
  - ID overwrite protection 196
  - supervisor lock 124

- measurement screen 39
- measuring thickness 76
- membrane vent 4
- memory card
  - exporting files to 251
  - importing survey files from 253
  - indicators 40
  - microSD 23
  - screen capture 257
  - slot 24
- menus 41
  - selecting a ~ command 42
- messages, error 271
- min/max
  - mode 115
  - preventing false readings 117
- minimum mode 115
- mode 1 59
- mode 2 59
- mode 3 60
- mode 3 echo blank 238
- modification, instrument 7
- multi-measurement software option 91, 99

## N

- negative detection 235
- NiMH rechargeable batteries 33
  - operating time 34
- NONAME00 default file 77
- normal mode, multi-measurement 101
- NOTE signal word 8
- notes
  - about 192
  - adding row or column 174
  - alarm colors only with indoor color scheme 53
  - alarm indicator and color 118, 121
  - alarm reference values and units 123
  - also saving temperature value 158
  - A-scan zoom not recommended 143
  - battery charge cycles 35
  - battery not initially fully charged 33
  - battery withstands several hundred discharge-recharge cycles 272
  - B-scan appears only when enabled 122
  - calibration error 69
  - copying table 196
  - couplant types 76
  - couplant with M2091 shear transducer 96
  - creating data file in GageView 163
  - creating note table in GageView 193
  - creating or editing 193
  - data saved with a B-scan 146
  - database tracking and setting overwriting 133
  - deleting an ID 202
  - deleting and delete protection 189
  - deleting from a file 195
  - display brightness and battery life 54
  - display update rate and min/max mode 116
  - displaying file header 187
  - entering + and – signs 157
  - entering known material sound velocity 80
  - experienced operator only 135
  - extended blank effects 138
  - F1 format in USB communications 258
  - filled waveform trace condition 55
  - fixed RS-232 parameters 134
  - freeze to center the B-scan 142
  - fully charge battery after replacement 37
  - fully charged battery 35
  - GageView installation 244
  - grid transposition and ID increments 149
  - high temperature measurement 71
  - ID increment number of digit 165
  - incrementing passed Z 176, 181
  - max gain always higher than initial gain 231
  - menu selection writing convention 42
  - modes and echo window 227
  - move to the next line in text edit 46
  - mutually exclusive MIN/MAX and HOLD BLANK functions 128
  - no stored data shown while editing ID 199
  - optional foot switch 130
  - output format details 132
  - parameter selection writing convention 44
  - previously created notes 193
  - quick setup recall only for single element transducers 241
  - redo zero with M2008 transducer 111
  - remove external oxide 87
  - remove oxide scale for accurate measure-

- ment 98
- RS-232 printers only 243
- saving calibration and setup parameters 131
- sending blank reading resets min/max and freeze functions 251
- shear wave with EMAT 89
- thickness readings not accurate 218
- transmitted data depends on output format 251
- transmitted data remains in 38DL PLUS 248
- unfreezing display 126
- untagged letter codes when sending data 194
- user defined setups 66
- varying number of DB grid columns 148
- notes, information
  - signal words 8
- O**
- Olympus technical support 15
- opening
  - file 184
- options, software 91
- outdoor color scheme 53
- outline waveform 56
- overwrite protection 197
- oxide layer
  - measurement calibration 96
  - measurement setup 94, 95
  - software option 91, 93
  - thickness measurement 97
- P**
- painted material 78
- parameter
  - screens 42
  - selecting 43
- password
  - setting 124
- patent label 2
- performing
  - diagnostic tests 267
  - THRU-COAT calibration 79
- phase
  - distortion 75
  - reversal 75
- polarity of detection 235
- positive detection 235
- power
  - AC 32
  - battery 33
  - indicator 31, 39
- precautions
  - battery 10
  - safety 9
- preventing false min/max readings 117
- printer 248
- product description 19
- protective rubber boot 22
- pulse power 228
- Q**
- quick setup recall, activating 241
- R**
- radius of curvature 99
- radix type 49
- range 56
  - deleting 190
  - selecting value 57
- RCM mark 4
- recalling
  - custom DE transducer setup 215
  - quick setup 241
- receiving
  - files from a computer 254
- rectification
  - changing setting 52
  - indicator 39
  - mode 54
- renaming a file 187
- repair, instrument 7
- replacing the battery 36
- report, generating 203
- reports 202
- resets 264
- resetting
  - communication 261
- resolution, changing 61
- review screen 197
- reviewing stored data 199
- RF rectification 54
- RoHS symbol 4, 12

- RS-232 communications 246
  - serial data output formats 258
  - setting 246
- S**
- safety
  - instrument compatibility 6
  - labels and symbols 1
  - misuse of instrument 5
  - precautions 9
  - signal words 7
  - symbols 7
- sagittal height 99
- saving
  - B-scan 145
  - data 77
  - DB grid readings 152
  - setup parameters 239
- scale, boiler tube 94
- secondary key function 26
- selecting
  - menu command 42
  - parameter and value 43
  - range value 57
  - text edit mode 44
- sending
  - entire files to a computer 248
  - range of IDs 249
  - screen capture to GageView 255
  - screen capture to memory card 257
- sequential data file 167
- sequential with custom points data file 168
- serial communication connector 24
- serial number
  - label content 3
  - label location 2
- setting 246
  - alarms 122
  - clock 51
  - ID overwrite protection 197
  - oxide layer 94
  - oxide layer measurement 95
  - password 124
  - transducer 63
  - units 50
  - USB communications 244
- setups
  - creating for nonstandard DE transducers 212
  - creating for SE transducers 222
  - custom for SE transducers 221
  - dual element transducer 211
  - loading 65
  - recalling custom DE transducer 215
  - saving parameters 239
- shear-wave, unwanted 85
- signal words
  - information notes 8
    - IMPORTANT 8
    - NOTE 8
    - TIP 9
  - safety 7
    - CAUTION 8
    - DANGER 8
    - WARNING 8
- single send 250
- slope, TDG 231
- soft contact lenses 99
- soft contact mode, multi-measurement 103
- software diagnostic 270
- software options 91, 285
  - activating 92
  - high resolution 61, 93
  - multi-measurement 99
  - oxide layer 93
- sound
  - attenuation or absorption 75
  - scattering 74
  - velocities 283
  - velocity calibration 66, 71
- special functions 113
- stand 22
- standard echo detection mode 80
- status, instrument 271
- steam, boiler tube 94
- step test block 70
- stored data review 199
- strap rings 22
- submenus 41
- supervisor lock 124
- support information, technical 15
- surface roughness of test piece 73
- symbols

CE 4  
 direct current 4  
 FCC 4  
 RCM (Australia) 4  
 RoHS 4, 12  
 safety 1, 7  
 WEEE 4  
 system parameters, configuring 129

## T

T/R transducer connector 24  
 taper or eccentricity 74  
 TDG slope 231  
 technical specifications 275  
 technical support 15  
 temperature compensation 156  
 test block 70  
 test piece, curvature of 74  
 text edit  
   mode selection 44  
   traditional method 46  
   virtual keyboard 44  
 thickness  
   measuring 76  
   resolution 61  
 THRU-COAT  
   enabling 78  
   measurement 78  
   performing calibration 79  
 time, setting 51  
 time-dependent gain 229  
 tip notes  
   replacing a thickness reading 202  
   save both thickness value and waveform 78  
   scroll between parameters 164  
   start with existing setup to create a new one  
     222  
   switching between echo detection modes 82  
   try communication reset to solve communi-  
     cation problems 245, 248  
   when to turn off AGC 129  
 TIP signal word 9  
 title bar 43  
 traditional text edit method 46, 47  
 transducer  
   maintenance 264

setting 63  
 transmitting data 248  
 troubleshooting 263

## U

units, setting 50  
 unlocking, instrument 125  
 unwanted shear-wave echo 85  
 update rate 60  
   adjusting 61  
 USB  
   client connector 24  
   communications, setting 244  
   connector 23  
 USB/RS-232 connector 23, 24  
 use, intended 5  
 user interface language 49  
 using  
   AC power 32  
   AVG/MIN measurement 155  
   B-scan 144  
   B-scan alarm mode 144  
   extended blank 137  
   high penetration with M2008 transducer 111  
   multi-measurement % total mode 104  
   multi-measurement normal mode 101  
   multi-measurement soft contact mode 103  
   temperature compensation 156  
   VGA output 86

## V

velocity  
   calibration 66, 71  
   variations 75  
 VGA output  
   activating 52  
   connector 23, 24  
   using 86  
 viewing  
   inserted DB grid cell 153  
   instrument status 271  
 virtual keyboard 44  
   editing value 45  
 V-path  
   about the 215  
   activating 216

building for DE transducers 217

## **W**

warning notes

charger/adapter usage 34

WARNING signal word 8

warning symbols

general 7

shock hazard 7

warnings

electrical 10

general 9

misuse of instrument 5

warranty information 14

waste electrical and electronic equipment 12

waveform

delay 56

display 39

freezing 126

parameters adjusting 224

range 56

rectification 54

rectification, changing 52

trace 40, 55

trace, changing 52

WEEE directive 12

symbol 4

## **Z**

zero calibration 66, 69

zero compensation 66

zoom

activating 58

indicator 41

zoomed display 59