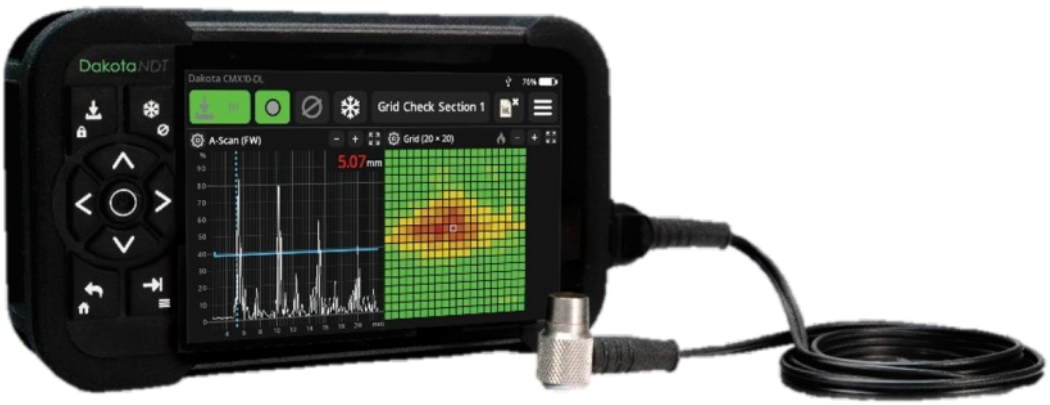
Dakota NDT
an Elcometer company

User Guide

Dakota CMX10-DL

Ultrasonic Full Wave Capture
A-Scan Thickness Gauge



CONTENTS

Section		Page
1	Introduction	en-3
1.1	About Your Gauge	en-3
1.2	Gauge Overview	en-4
1.3	Keypad Explained	en-6
1.4	Button Navigation	en-7
1.5	Control Centre	en-7
1.6	Overheating Protection	en-8
1.7	Box Contents	en-8
2	Getting Started	en-9
2.1	Fitting the Hand / Shoulder Strap	en-9
2.2	Fitting the Battery Pack	en-10
2.3	Switching On / Off	en-10
2.4	Initial Gauge Setup	en-10
2.5	Ensuring your Gauge has the Latest Firmware	en-11
3	Home Screen Layout Explained	en-11
3.1	Status Bar	en-12
3.2	Function Bar	en-12
3.3	Panel Reading Display	en-14
4	Connecting a Transducer	en-19
4.1	Connecting an ODU Intelligent Transducer	en-20
4.2	Connecting a Standard Lemo Transducer	en-21
5	Navigating the Gauge	en-22
5.1	Main Menu	en-22
5.2	Menu/Reading Setup	en-23
5.3	Menu/Transducer Library	en-32
5.4	Menu/Calibration Library	en-34
5.5	Menu/Limit Library	en-37
5.6	Menu/Data	en-38
5.7	Menu/Display Settings	en-41
5.8	Menu/Gauge Settings	en-42
6	A-Scan Recordings & B-Scans	en-44
6.1	Recording Mode	en-44
6.2	Generate B-Scan from Recording	en-45

CONTENTS (continued)

Section		Page
7	Introducing DakMaster™	en-46
8	Technical Specification	en-47
9	Warranty	en-48
10	Legal & Regulatory Information	en-49

For the avoidance of doubt, please refer to the original English language version. The most up-to-date version of this user guide is available to view and download via www.dakotandt.com.

© Elcometer Limited 2026. All rights reserved. No part of this document may be reproduced, transmitted, transcribed, stored (in a retrieval system or otherwise) or translated into any language, in any form or by any means (electronic, mechanical, magnetic, optical, manual or otherwise) without the prior written permission of Elcometer Limited.

1 INTRODUCTION

Thank you for purchasing this Dakota CMX10-DL Ultrasonic Full Wave Capture A-Scan Thickness Gauge. Welcome to DakotaNDT. With the purchase of this gauge you now have access to the worldwide service and support network of DakotaNDT. For more information visit our website at www.dakotandt.com

1.1 ABOUT YOUR GAUGE

The Dakota CMX10-DL is a powerful ultrasonic full wave thickness gauge designed for both corrosion surveys and high-precision measurements.

Based on operating principles similar to those of ultrasound, the gauge can measure the thickness of various materials with precision accuracy (accuracy is dependent on the material and transducer used).

The primary advantage of ultrasonic measurement over traditional methods is that it requires access to only one side of the material being measured.

The Dakota CMX10-DL also features a built-in data logging memory, allowing readings to be stored in data logs before being uploaded to a computer via Bluetooth® or USB.

The Dakota CMX10-DL is a measuring instrument for use in general industry. It is not a medical device and **MUST NOT BE USED FOR ANY MEDICAL APPLICATIONS.**

The gauge is supplied with a rechargeable lithium ion battery pack which can be re-charged either within the gauge or using an optional external battery charger.

IMPORTANT: LITHIUM ION RECHARGEABLE BATTERY PACK

- **ONLY** use battery packs recommended by DakotaNDT.
- **DO NOT** use unapproved battery packs.
- When transporting the gauge by air, check the carrier's requirements relating to the transport of products containing lithium ion batteries.
- When shipping a gauge with a battery pack, refer to the carrier's regulations relating to the carriage of lithium ion powered products and attach the appropriate UN3481 or UN3480 label to the packaging.
- When returning a gauge for service, calibration or repair, remove the battery pack and return the gauge without the battery pack.
- Never ship a battery that is damaged or suspected of being faulty.

If in doubt, contact DakotaNDT or your DakotaNDT supplier for guidance.

1 INTRODUCTION (continued)

Note: A Material Safety Data Sheet for the rechargeable lithium ion battery pack supplied with the Dakota CMX10-DL is available to download via our website: https://downloads.dakotandt.com/MSDS/DakotaNDT_CMX10-DL_Rechargeable Smart Battery Pack.pdf

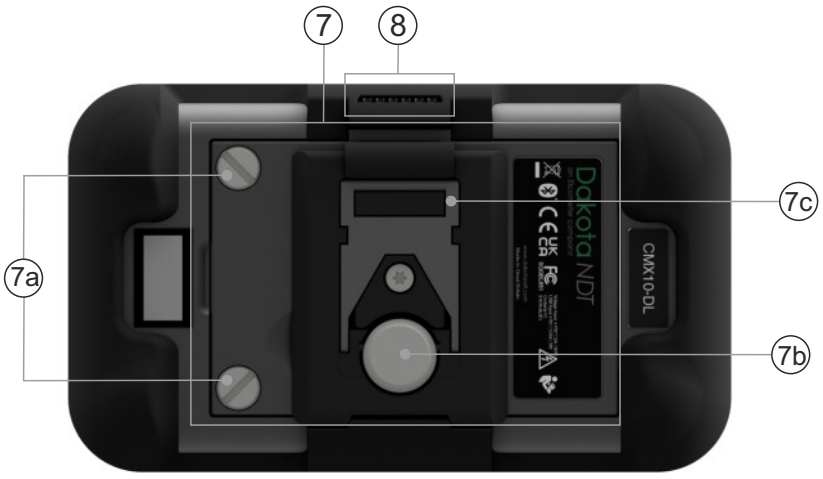
This user guide provides the reader with essential instructions on how to operate the Dakota CMX10-DL. Training in the use of any ultrasonic measuring device is recommended to ensure optimum measurement, accuracy and precision.

1.2 GAUGE OVERVIEW

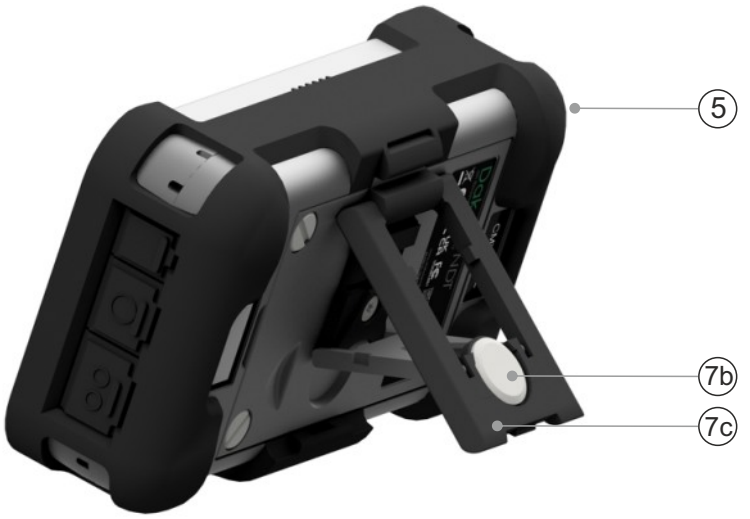


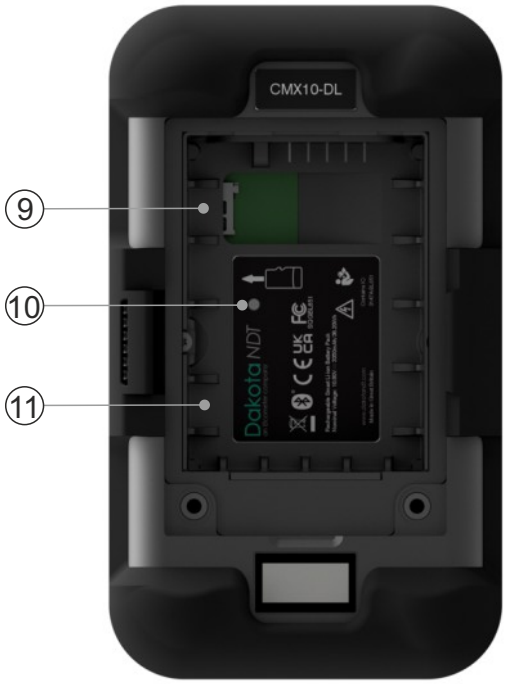
Item	Description
1	Hand Strap / Shoulder Strap Connection Points, x4 2 on each side of the gauge, suitable for left or right handed use
2	Keypad - see Section 1.3 for further details
3	LCD Touchscreen
4	Transducer Connection Points 4a - not used 4b - for ODU 'intelligent' transducers 4c - for standard single & dual element lemo transducers
5	Protective Rubber Boot - surrounds the whole gauge, not removeable
6	Data & Power Points 6a: USB Port - for data transfer only 6b: AC Power Port - for power and recharging the battery in the gauge

1 INTRODUCTION (continued)



Battery Door Assembly Fitted





Battery Door Assembly Removed

Item	Description
5	Protective Rubber Boot - surrounds the whole gauge, not removable
7	Battery Compartment Door Assembly - complete with 7a - Battery door retaining screws, x2 7b - Integrated Zero Disc ` 7c - Integrated Gauge Stand
8	Waterproof Speaker
9	External Memory Card Slot - supports 'SD Type' cards, 32GB maximum
10	Gauge Reset Button
11	Battery Compartment

1 INTRODUCTION (continued)

1.3 KEYPAD EXPLAINED



The Dakota CMX10-DL can be operated entirely via the touchscreen LCD and/or the 9 button keypad. For more information on button navigation, see Section 1.4.

Some keypad buttons have dual use;

Primary function: indicated by the ***large*** icon, only requires a short press to activate

Secondary function: indicated by the ***small*** icon, requires a longer press to activate (approximately 2 seconds).

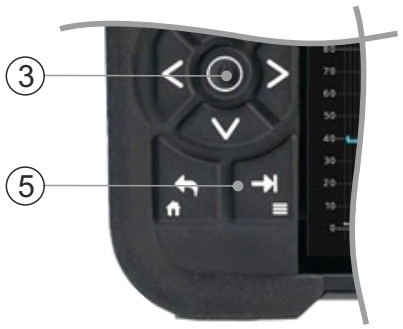
Button	Primary Function	Secondary Function
1	Freeze / unfreeze A-Scan display	Record an obstruction in the gauge memory
2	Save readings in the gauge memory	Disable/enable touchscreen LCD lock
3	Select, OK or Toggle on/off	Power on/off
4	Back button - returns to the previous screen	Return to the home reading screen
5	Tab button - returns the cursor to the next LCD window or button	Menu button - opens the main menu selection screen
Navigation Buttons		
Up	Navigate up / Home reading screen gain increase quick key[a]	
Down	Navigate down / Home reading screen gain decrease quick key[a]	
Right	Navigate right / Home reading screen gain 'Auto-80' trigger[a] 'adjusts the gain so that the highest peak within the gate is 80% of full screen height	
Left	Navigate left	

Should the user wish to operate the gauge using the touchscreen LCD **only,** the button keypad can be locked / disabled via the 'Keypad Lock' option in the Control Centre, see Section 1.5. Similarly, for operation using the button keypad only, the touchscreen can be locked / disabled by selecting 'Touch Lock'.

[a] When enable via Menu/Gauge Settings/Input Functions.

1 INTRODUCTION (continued)

1.4 BUTTON NAVIGATION



The Dakota CMX10-DL is intended to be used with both touchscreen and button controls, but it can be operated entirely using the buttons if required by the user.

When the Tab button is pressed (#5), a yellow highlight will appear around the top left option on the screen.



Touchscreen Operation | Tab Button Pressed

The highlight indicates the currently selected option, which can be accessed by pressing the central button.

When the highlighted option is a numerical entry button, the value can be adjusted by using the arrow buttons.



Note: Holding down the button will gradually increase the rate of adjustment.

1.5 CONTROL CENTRE

The Control Centre, which is accessed by swiping down from the top of the display, provides quick access to various gauge settings, see Section 5.8 for more information on gauge settings, plus the following additional functions:



Touch Lock: disables / enables touchscreen operation.

Keypad Lock: disables / enables button keypad operation.

1 INTRODUCTION (continued)

1.6 OVERHEATING PROTECTION

The Dakota CMX10-DL is equipped with three internal temperature sensors to protect the gauge from overheating and potential damage. These sensors continuously monitor the temperature of the measurement system, the main processor and the battery.

If any of these components exceed their normal operating temperature, the Overheat Warning icon ‘  ’ will be displayed on the status bar. Should the temperature continue to rise, the gauge will automatically shut down to prevent damage.

When the battery is charging, it may heat up more quickly than other components. During charging, the battery has a lower temperature limit. As a result, the overheat warning icon may be displayed while measurements are being taken if the gauge has been charging at the same time, particularly after prolonged charging.

If the overheat warning icon is displayed disconnect the mains power supply if the gauge is charging or alternatively, switch the gauge off and allow it to cool.

1.7 BOX CONTENTS

Each gauge is supplied with the following:

Description	Part Number
Power Supply with UK, EU and US Adapters For recharging the battery inside the gauge or for powering the gauge without the battery	T92033671
Li-Ion Rechargeable Smart Battery Pack 10.8V, 3.35Ah, 36.2Wh	T92033672
Ultrasonic Couplant, 120ml/4fl oz	T92015701
Hand Strap (x1) with Extension Pieces (x2) Extension pieces convert the hand strap to a shoulder strap	T92033670
Screen Protector (x1)	T92033669 (Pack of 5)
DakMaster™ Download Card For data transfer to and from the gauge. For more information on DakMaster™, see Section 7.	n/a
USB-C Cable	T92033668
Transit Case	T92033673
Calibration Certificate	n/a
User Guide	n/a

1 INTRODUCTION (continued)

Note: Battery packs must be disposed of carefully to avoid environmental contamination. Please consult your local Environmental Authority for information on disposal in your region. **Do not dispose of any batteries in fire.**

Note: Material Safety Data Sheets for the ultrasonic couplant and rechargeable lithium ion battery pack supplied with the Dakota CMX10-DL are available to download via our website:

https://downloads.dakotandt.com/MSDS/Elcometer_Ultrasonic_Couplant_Blue.pdf
https://downloads.dakotandt.com/MSDS/Elcometer_Ultrasonic_Couplant_Blue_EU Version.pdf
https://downloads.dakotandt.com/MSDS/DakotaNDT_CMX10-DL_Rechargeable Smart Battery Pack.pdf

2 GETTING STARTED

2.1 FITTING THE HAND / SHOULDER STRAP

Each gauge has four attachment points for the hand / shoulder strap; two on the left and two on the right, making it suitable for both left or right handed operation.



1 Attach a hand strap quick-release clip to each attachment point on the left or right side of the gauge, as required, by feeding the cord through the attachment slot.
2 Rotate the quick-release clip onto its side, then pass the cord loop over the clip and pull the clip back through the loop to secure it in place.
3 Attach the hand strap to the quick-release clips.
4 Separate the VELCRO® fastening and adjust the strap until it fits comfortably around the hand. Secure the fastening once the desired fit has been achieved.



To convert the hand strap into a shoulder strap:

1 Attach an extension piece to each hand strap quick release clip (two extension pieces are supplied with each gauge).
2 Connect the hand strap to the extension pieces to form the shoulder strap.

2 GETTING STARTED (continued)

2.2 FITTING THE BATTERY PACK

Each gauge is supplied with a rechargeable lithium ion battery pack

To insert or replace the battery pack:

1 Using a screwdriver or coin, unscrew the battery compartment assembly (turning anti-clockwise).
2 Check the battery is charged by pressing the integrated battery status indicator *(a)*.
3 Insert the battery ensuring the battery status indicator is facing outwards.
4 Refit the battery compartment assembly.



Only use battery packs recommended by DakotaNDT.
DO NOT use unapproved battery packs.

2.3 SWITCHING ON / OFF

To switch on: Press and hold the power button *(b)* until the welcome screen is displayed. Once the welcome screen is displayed release the power button.



To switch off: Press and hold the power button *(b)* until the gauge beeps four times.

2.4 INITIAL GAUGE SETUP

When switching on the gauge for the first time, after the regulatory information is displayed, the user will be asked to set up the generic settings of the gauge, which include:

Setting the Language: Select the language required from the list using the touch screen or gauge buttons.

Time and Date: The user can set up the time format, date format, current time and date by using the touch screen or buttons. Once adjusted the user can choose to display the time and date on the status bar.

Screen Brightness: The user can manually select a screen display brightness or select “Auto adjust” which allows the gauge to adjust the screen brightness in line with the ambient light conditions optimizing battery life.

Setup Display Layout: The user will be asked to set up the layout of the panel display or select the default settings - see Section 5.7 or further details.

2 GETTING STARTED (continued)

Select Transducer: The user will now be asked to select the transducer to be used or connect an ODU “intelligent” transducer - see Section 4 for further details.

For details of the full range of transducers available from DakotaNDT, scan the QR code or visit www.dakotandt.com

Single Element

Dual Element

2.5 ENSURING YOUR GAUGE HAS THE LATEST FIRMWARE

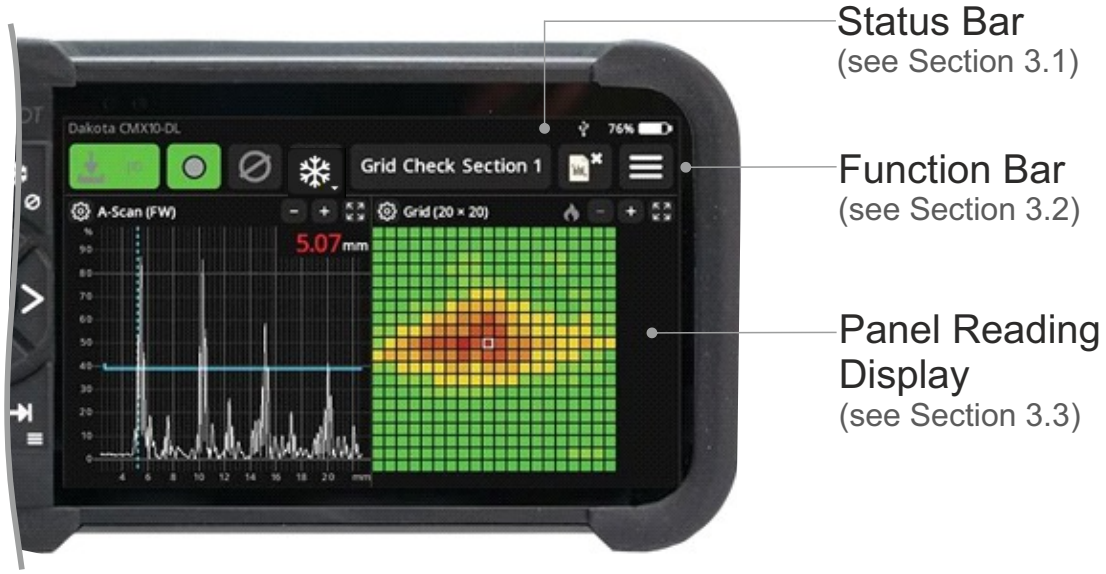
To ensure that your gauge has the most up-to-date gauge firmware, allowing you to benefit from the latest features and functionality, we recommend it is connected to DakMaster™ on a regular basis and before first use.

Simply connect the gauge via USB to an internet connected computer running DakMaster™ and use the ‘Connect Gauge’ feature. If a later version of the gauge firmware is available, ‘Update Gauge’ will be displayed to the right of the gauge details. Click ‘Update Gauge’ to install the latest firmware.

DakMaster™

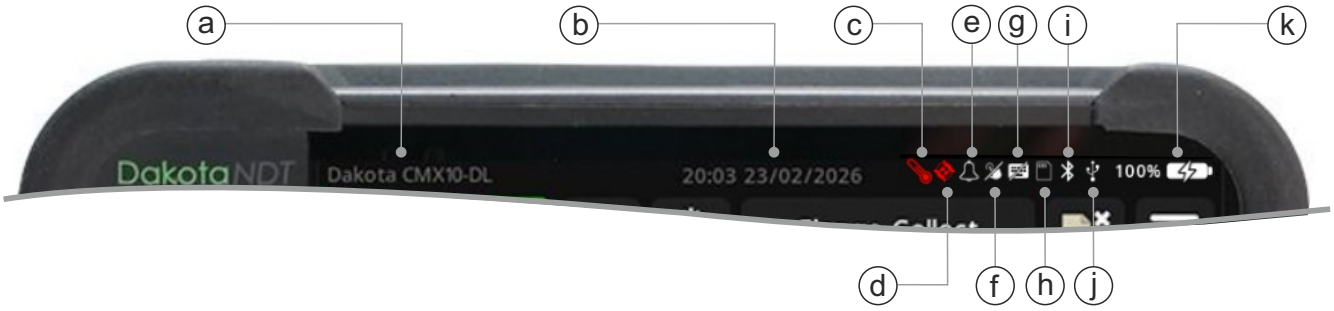
For more information on DakMaster™, see Section 7, scan the QR code or visit www.dakotandt.com

3 HOME SCREEN LAYOUT EXPLAINED



3 HOME SCREEN LAYOUT EXPLAINED

3.1 STATUS BAR



a	Gauge model identification
b	Time & Date - if enabled via Menu/Gauge Settings
c	Overheat Warning - see Section 1.6 for further details.
d	Calibration Warning - active calibration not valid for transducer connected
e	Limits Alarm Enabled
f	Touchscreen LCD locked / disabled
g	Keypad buttons locked / disabled
h	External ‘SD Card’ fitted
i	Bluetooth® - Grey = non connected; Orange = connected
j	USB Connected
k	Power: ‘78%’ - Battery power with % charge remaining; ‘100%’ - Mains power / battery % charge remaining

3.2 FUNCTION BAR

The function bar will change depending on whether a data log file is open.

3.2.1 When not in data logging:



3 HOME SCREEN LAYOUT EXPLAINED (continued)

l	Reading set up: allows the user to set up all the measurement parameters of the reading - see Section 5.2 for further details.
m	Customisable button - allows several different functions to be enabled, see Section 3.2.3 for further details.
n	Create a new data log, open or edit an existing data log - see Section 5.6 for further details.
o	Menu button

3.2.2 When a data log file is open:

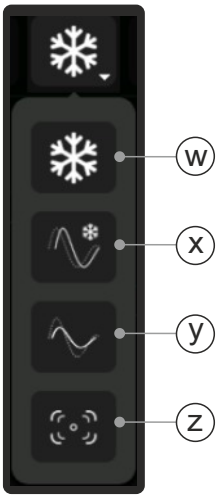


p	Save / log reading into data log a reading location # - see Section 5.6 for further details.
q	Record up to 10 seconds of scanning into data log at reading location # - see Section 6 for further details.
r	Record an obstruction at reading location # - the user can enter an optional comment for information
s	Customisable button - allows several different functions to be enabled, see Section 3.2.3 for further details.
t	The data log file path and name - when selected the gauge displays additional data log file information.
u	Close the current data log file
v	Menu button

3 HOME SCREEN LAYOUT EXPLAINED (continued)

3.2.3 Customisable Button

Press and hold to display the drop down selection menu.



w	Freeze / unfreeze the A-Scan display - when the transducer is lifted, the A-Scan remains on screen for review and analysis.
x	Ghost Scan (Fig. 1) - a snapshot is taken of the current waveform, which is then overlaid on the A-Scan in green.
y	Peak Hold (Fig. 2) - the A-Scan will keep track of the maximum amplitude seen at each time step and overlay this on the A-Scan in green.
z	Focus to detection - this adjusts the delay and range so that the waveform 'zooms in' to the gate violation (if there is one). Pressing the button again will zoom back out.

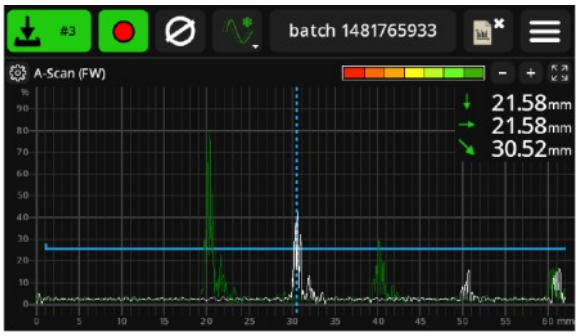


Fig. 1: Ghost Scan

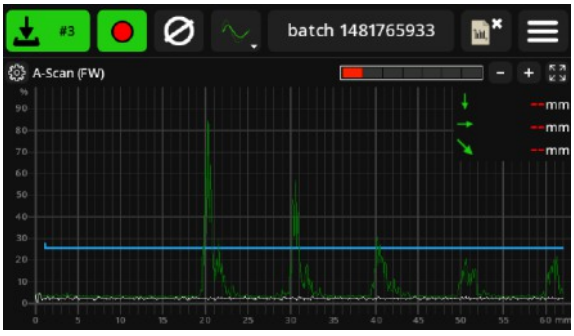


Fig. 2: Peak Hold

3.3 PANEL READING DISPLAY

The Dakota CMX10-DL display can be set up to meet the specific requirements of the user. This can be changed at any time via the Display Settings menu.

There are 5 panel layouts to choose from and once the layout has been chosen, the user can then select the content to be displayed in each panel; A-Scan, Statistics, Live Reading, Grid, Image Collect, Beam Path Display (relates to TRIG measurement mode only) or DAC (Distance Amplitude Correction) Curve (Fig. 3: four panel display example; Fig. 4: three panel display example). See Section 5.7 for further information on display settings.

3 HOME SCREEN LAYOUT EXPLAINED (continued)



Fig. 3: Four Panel Display



Fig. 4: Three Panel Display

Within each panel, there are various options to configure the display further:

Icon	Function
	Allows the user to set up or select functions for that specific display. See following sections for details of each reading panel type specific settings.
	Zooms out or in the display. Pinching in and out on the touch screen also zooms in and out respectively.
	Toggles between maximising the panel display with function bar; maximises the panel display without the function bar and return to user defined panel display layout.
	Allows user to quickly toggle between the measurement modes without going through Menu/Reading Setup. **Note:** The icon shown will vary depending on the measurement mode currently in use.

3.3.1 PANEL READING SETTINGS: A-SCAN SPECIFIC

Firstly, the user can choose to view the gates as a ‘Bar’ (Fig. 5) or ‘Box’ (Fig. 6).

The user can then also choose to toggle on / off any of the additional options listed.



3 HOME SCREEN LAYOUT EXPLAINED (continued)

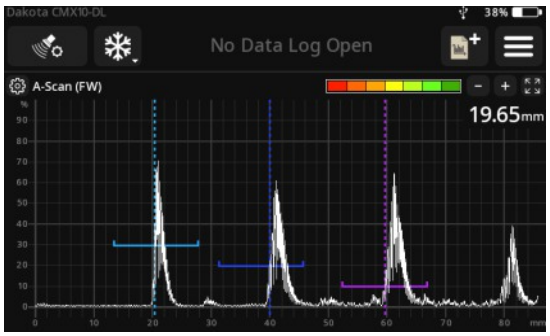


Fig. 5: Gates Display Mode: Bar

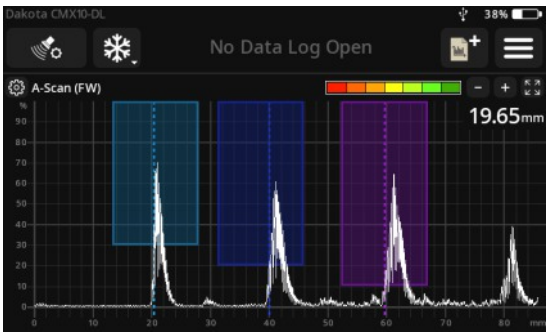
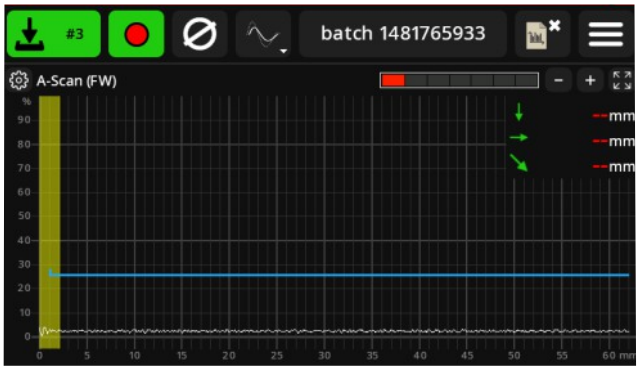


Fig. 6: Gates Display Mode: Box

Option	Function
Enable Zoom	Switches on or off the "Pinch to Zoom" touch screen function.
Lock Amplitude	Locks the scale of the amplitude so that pin to zoom only affects the x-axis (time)
Invert Scan	Changes the scan background from black to white.
Show TCG Overlays	Allows the user to display the Time Corrected Gain (TCG) on the A-Scan.
Show Trig Legs	When using TRIG mode, this shows coloured bands in the background of the A-Scan to indicate each "leg", calculated from the probe angle and the part thickness. Each leg is a single "bounce" between the front and back walls of the piece. The same colour banding is always shown on the beam path display panel. **Note:** This is a new feature available on gauges with gauge firmware version 2.0 and later. Gauges with earlier firmware versions should be updated to the latest version via DakMaster™ to benefit from this feature - see Section 7.
Show Near Field	The near-field is the region of the waveform immediately after the sound beam enters the material under test, where interference is strongest and therefore echo amplitudes are less predictable and less reliable. The size of the near-field depends on the material velocity, the transducer frequency, and the transducer diameter. The near-field is the region of the waveform immediately after the sound beam enters the material under test, where interference is strongest and therefore echo amplitudes are less predictable and less reliable.

3 HOME SCREEN LAYOUT EXPLAINED (continued)

Option	Function
Show Near Field (cont.)	The size of the near-field depends on the material velocity, the transducer frequency, and the transducer diameter. Displaying the extent of the near-field on the A-Scan (Fig. 7) helps to determine whether the current setup is suitable for the test being performed. This is particularly useful for flaw sizing, since within the near-field the amplitudes do not drop off predictably, which could affect how echoes are interpreted in respect to a DAC curve.  Fig. 7: Show Near Field Enabled The near field is not displayed when a delay line transducer is in use, as the delay line is designed to counteract the near field effect. **Note:** This is a new features available on gauges with gauge firmware version 2.0 and later. Gauges with earlier firmware versions should be updated to the latest version via DakMaster™ to benefit from this feature - see Section 7.

3.3.2 PANEL READING SETTINGS: LIVE READING SPECIFIC

The user can choose to set the Live Reading Mode to ‘Actual’ or ‘Differential’ and also set limit alarms.

Option	Function
Live Reading Mode	***Actual:*** Display the actual reading. ***Differential:*** Displays the difference between the actual reading and the nominal value (if set).
Limit Alarm	***Off:*** Readings will be displayed as follows: *Green*: within limits *Yellow*: within limits but within warning threshold *Red*: outside limits *White*: no active limits

3 HOME SCREEN LAYOUT EXPLAINED (continued)

Option	Function
Limit Alarm (cont.)	***Visual:*** As above plus when the reading is outside limits, the LED goes red; when inside limits it goes green. **Note:** LED is only active when the reading stability bar is full. ***Visual & Audible:*** As per Visual setting but with also with an audible alarm if the reading is outside set limits.

3.3.3 PANEL READING SETTINGS: GRID SPECIFIC

Whether the user chose to store measurements sequentially or as a grid in the current data logo file, see Section 5.6 for further details, they have the option to display Data Log Limits or a Heatmap.

Option	Function
Data Log Limits	Cells are coloured based on the limits configured (Fig. 8): *Green*: within limits *Yellow*: within limits but within warning threshold *Red*: outside limits *White*: no active limits
Heatmap	Each grid cell is coloured based upon a gauge wide heat map reading range (Fig. 9). The maximum & minimum reading heat map range can be setup within this settings screen.

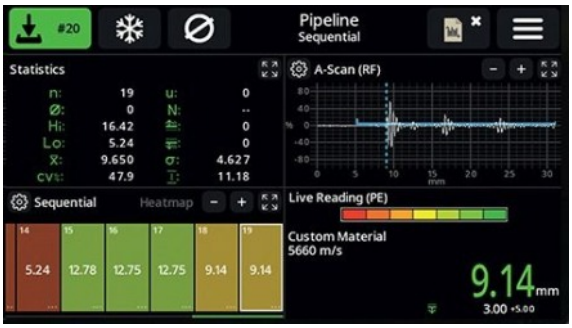


Fig. 8: Data Log Limits Option Enabled

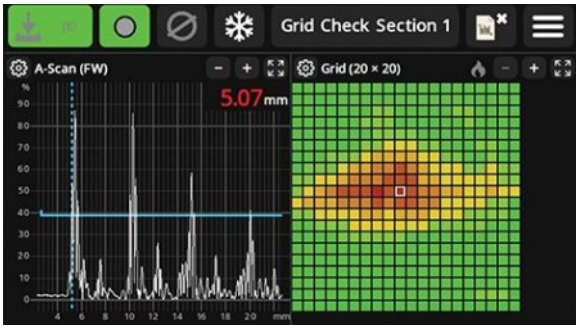


Fig. 9: Heatmap Option Enabled

3.3.4 PANEL READING SETTINGS: BEAM PATH DISPLAY SPECIFIC

This panel displays a cross-section of the part showing the path of the sound beam within the part (Fig 10.). The length of the beam visualised depends on the configured range of the gauge (as well as the delay).



Fig. 10: Beam Path Display

[b] Only available when using TRIG Measurement Mode.

3 HOME SCREEN LAYOUT EXPLAINED (continUed)

The user can then choose to toggle on / off the options listed.

Note: This is a new feature available on gauges with gauge firmware version 2.0 and later. Gauges with earlier firmware versions should be updated to the latest version via DakMaster™ to benefit from this feature - see Section 7.

Option	Function
Beam Direction	Controls the direction of the beam, either left-to-right or right-to-left. The direction is shown with an arrow on the beam.
Waveform Overlay	Shows an overlay of the waveform on the beam to more clearly indicate where flaws are.
Gate Overlay	Shows where the gate is located within the beam.
Labels	Shows standoff and depth labels over the part

4 CONNECTING A TRANSDUCER

The Dakota CMX10-DL is designed to operate with a wide range of single and dual element transducers fitted with either intelligent **ODU** connectors or standard **Lemo** connectors.

ODU 'Intelligent' Transducers:
Manufactured by Dakota and available in both single and dual element configurations, these transducers are automatically recognised by the gauge when connected. When a dual element transducer is detected, the gauge automatically applies the appropriate V-Path correction.



Standard Lemo Transducers:
Single and dual element transducers fitted with standard lemo connectors can also be used with the gauge. For Dakota manufactured dual element transducers, the appropriate V-Path correction is automatically applied by the gauge. However, for transducers manufactured by other equipment manufacturers (OEMs), V-Path correction values vary according to the transducer type and manufacturer hence the gauge cannot automatically apply these corrections.



4 CONNECTING A TRANSDUCER (continued)

V-Path Correction:

Dual element transducers contain two separate crystals: one crystal transmits the ultrasonic pulse and the other receives the returning echo. Due to the physical arrangement of these crystals, the sound beam travels in a 'V'-shaped path through the test material rather than a direct path. As a result, the sound path is slightly longer than the actual material thickness, which can introduce measurement errors if not compensated for.

For Dakota transducers connected to Dakota gauges, the appropriate V-Path correction is applied automatically. When using transducers not manufactured by Dakota, V-Path correction values may differ depending on the transducer design and manufacturer. In these cases, the effect of V-Path on measurement accuracy can be minimised by carefully calibrating the gauge using calibration step blocks.

Single Element

During calibration, select two reference thicknesses that bracket the expected thickness range of the material being inspected.

For details of the full range of transducers available from DakotaNDT, scan the QR code or visit www.dakotandt.com

Dual Element

4.1 CONNECTING AN ODU INTELLIGENT TRANSDUCER

When connected, 'intelligent' transducers are automatically recognised by the gauge. The gauge identifies the transducer frequency, crystal diameter, serial number and element type (single or dual element).



1 Locate the ODU transducer port on the right-hand side of the gauge.
2 Align the red positioning dot on the ODU connector with the top of the transducer port then push in the connector until it locks into position with an audible click.
3 The gauge will automatically identify the connected transducer and display the transducer part number, serial number, element type (single or dual element), frequency and crystal diameter.
4 Verify that the displayed transducer information is correct, then select 'Continue'.

The gauge will now prompt the user to calibrate or zero the connected transducer. Although it is possible to skip this step by selecting 'No', calibrating the transducer is recommended to achieve the highest measurement accuracy. Select 'Yes' and follow the on-screen instructions to complete the calibration procedure. Once complete, the gauge is ready to take readings.

4 CONNECTING A TRANSDUCER (continued)

To disconnect the transducer, pull back on the knurled locking collar on the ODU connector. **DO NOT** pull on the transducer cable as this may damage the cable and/or connector assembly.

4.2 CONNECTING A STANDARD LEMO TRANSDUCER

1 Locate the lemo transducer port on the right-hand side of the gauge. There are two lemo sockets identified as Rx (Receive) and Tx (Transmit):



Single element transducers: insert the lemo plug into the socket marked **Tx**.

Dual element transducers: insert the dual lemo plugs into the **Rx and Tx** sockets.

2 When connected, press '+' to create a new transducer.

3 Using the keyboard, enter the transducer ID or serial number, then select 'Single Element' or 'Dual Element'. If single is selected also identify the delay line type; standard Delay Line or Contact. Press '✓' to confirm and progress to the next screen.

- If not using a delay line with a single element transducer, select 'Contact'.

A delay line is a small component that is attached to a single element transducer to increase the accuracy of measurements, especially on thin materials or materials with a high 'ring'.

Delay lines increase the time between the ultrasonic transmission pulse and the echo received, allowing the gauge to accurately measure the thickness of thin materials (where the signal returns very quickly). Delay lines can also slow down the sound pulse helping to reduce noise (ring), improving signal clarity of the return echoes.

Delay lines are made from a wide range of materials and are chosen based on the type of material being measured. Acrylic is used for steel, aluminum & titanium; graphite is used for thin plastics, for example.

5 Select the manufacturer; DakotaNDT or OEM, select the frequency, diameter and type from the drop down lists followed by '✓' to confirm.

- 'Type' applies to dual element transducer only and refers to the transducer's damping and wearface; Standard (STD), Highly Damped (HD) or Coating (CT). If the specific type is unknown, select Standard (STD).
- If DakotaNDT is selected as the manufacturer and the transducer frequency, diameter and type do not match those of a DakotaNDT transducer, a message will be displayed advising that no matching transducer could be found and prompting the user to verify and correct the transducer details.

4 CONNECTING A TRANSDUCER (continued)

The gauge will now prompt the user to calibrate or zero the connected transducer. Although it is possible to skip this step by selecting 'No', calibrating the transducer is recommended to achieve the highest measurement accuracy. Select 'Yes' and follow the on-screen instructions to complete the calibration procedure. Once complete, the gauge is ready to take readings.

As the maximum pulser voltage is determined by the transducer frequency, incorrect transducer identification may result in inappropriate pulser voltage levels being applied. This could damage the transducer if the output voltage exceeds its specified operating limits.

To disconnect the transducer, pull back on the lemo transducer plug. **DO NOT** pull on the transducer cable as this may damage the cable and/or connector assembly.

5 NAVIGATING THE GAUGE

5.1 MAIN MENU

The Dakota CMX10-DL has been designed to be incredibly user friendly. All functions and features of the gauge can be selected via the Menu icon '☰'.

When pressed, the selection screen is displayed (Fig. 11).

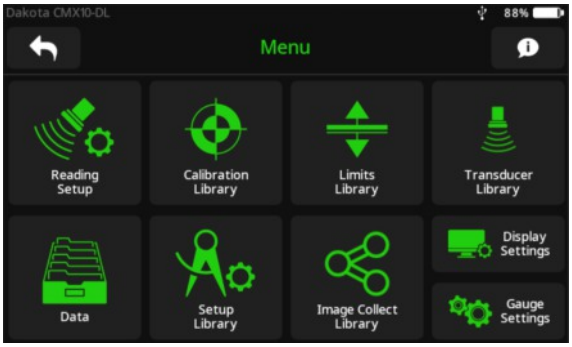


Fig. 11: Menu Selection

Icon	Function
	Returns to the previous screen
	Provides detailed information including; • Gauge model, serial number and firmware version • Measurement system details • ODU transducer information (if connected) • Storage memory - % free / % used • DakotaNDT contact information • Legal information including regulatory information and licensing

Refer to the following sections for detailed information on each of the menu options.

5 NAVIGATING THE GAUGE (continued)

5.2 MENU/READING SETUP

The screen provides the necessary controls to configure the gauge's measurement settings.

Via this screen which comprises of a Main Tool Bar and Control Tab Groups (Fig. 12), the user can set / adjust parameters such as gain, range, delay and rectification mode; manage measurement setups (save, load and create) and access Transducer and Calibration libraries.

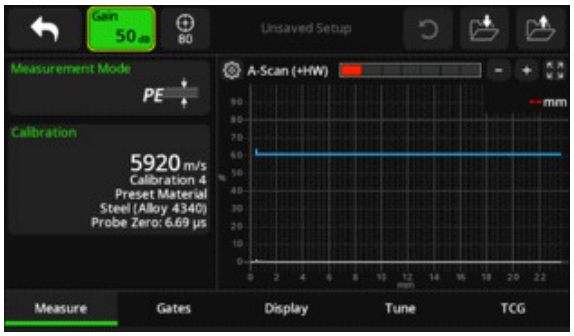
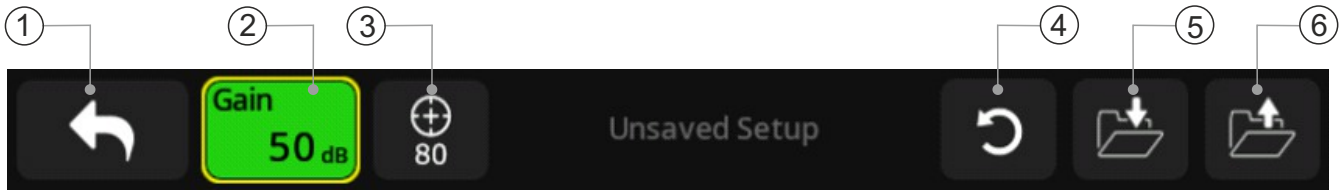


Fig. 12: Reading Setup

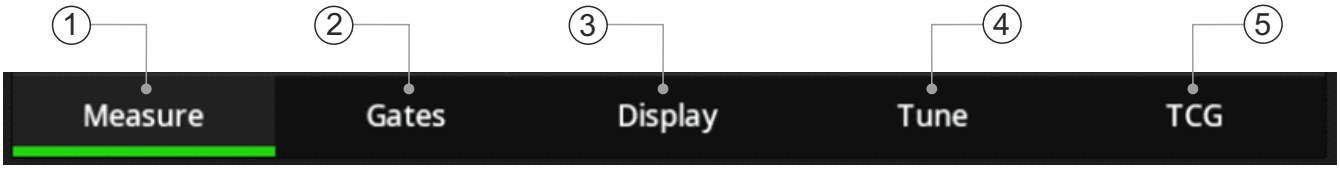
5.2.1 READING SETUP: MAIN TOOL BAR



Button		Function
1	**Back**	Returns to the previous menu or screen.
2	**Gain Adjust**	Adjusts the amplification (gain) of the received ultrasonic signal. The value is given in decibels (dB).
3	**Auto 80**	Automatically adjusts the gain to set the current signal within the gate to 80% of the Full Screen Height (if possible).
n/a	**Setup Name**	If a saved setup is loaded, this area will display the name of that setup file. Displays 'Unsaved Setup' otherwise.
4	**Restore Setup**	When a named setup is loaded, this button discards any subsequent changes and restores the setup to its last saved state.
5	**Save Setup**	Saves the current settings as a new setup or allows the current setup to be overwritten
6	**Load Setup**	Opens the Setup Library to load a previously saved setup or restore the factory default setup.

5 NAVIGATING THE GAUGE (continued)

5.2.2 READING SETUP: CONTROL TAB GROUPS



Tab		Function
1	**Measure**	Change the measurement mode and selected calibration.
2	**Gates**	Controls responsible for the position, mode and polarity of measurement gates.
3	**Display**	Controls responsible for the A-Scan display parameters, such as the X-Axis quantity and rectification mode.
4	**Tune**	Adjust the pulser / receiver settings and choose the currently connected transducer.
5	**Time Corrected Gain (TCG)**	Apply Ramp, Time Corrected Gain (TCG) Curve or Distance Amplitude Correction (DAC) Curve to the A-Scan, as well as Backwall Suppression.

5.2.3 READING SETUP: CONTROL TAB GROUPS / MEASURE TAB

Via the measure tab, the user can select the measurement mode and select the calibration.

a) Measurement Modes

Option		Function
PE	**Material Thickness**	Uses a *single* gate to measure the first echo received back from a material. This is the most common measurement mode, used for basic material thickness testing.
EE	**Material Thickness ThruPaint™**	Uses *two* gates to measure between the first and second echoes, or successive backwall echoes. Used for measuring the thickness of materials through a paint coating.
EEV	**Echo-Echo Verify**	Uses *three* gates to add an additional verification to ensure that echo-echo measurements are reasonable. Used to verify measurements on ThruPaint™ when signals are hard to interpret.

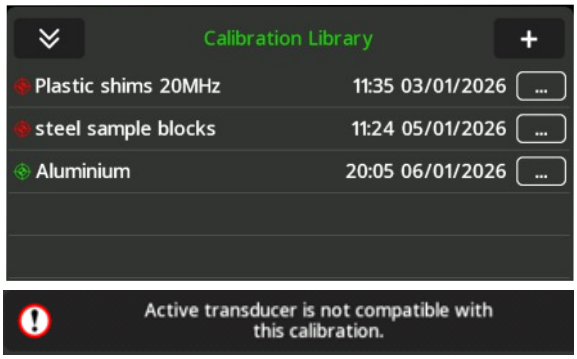
5 NAVIGATING THE GAUGE (continued)

Option		Function
PE2	**2nd Layer Thickness**	Measure total thickness based on known material velocity in both layers, and one known layer thickness.
Ee2	**2nd Layer Thickness ThruPaint™**	As per PE2 but for painted materials.
TRIG	**Trigonometry**	For use with angled transducers where the sound wave travels at an angle, the horizontal distance (standoff) and vertical distance (depth) from the transducer is determined using trigonometry. **Note:** This is a new measurement mode available on gauges with gauge firmware version 2.0 and later. Gauges with earlier firmware versions should be updated to the latest version via DakMaster™ to benefit from this feature, see Section 7.

Note: The measurement mode used will depend on the specific inspection being performed and is at the discretion of the operator or any specified work instructions.

b) Calibration Selection

Pressing the Calibration button opens the Calibration Library. The user can choose to select a previously saved calibration or create a new calibration.



The green and red icons to the left of the calibration name indicate whether the calibration is compatible with the transducer currently in use; green if compatible, red if not.

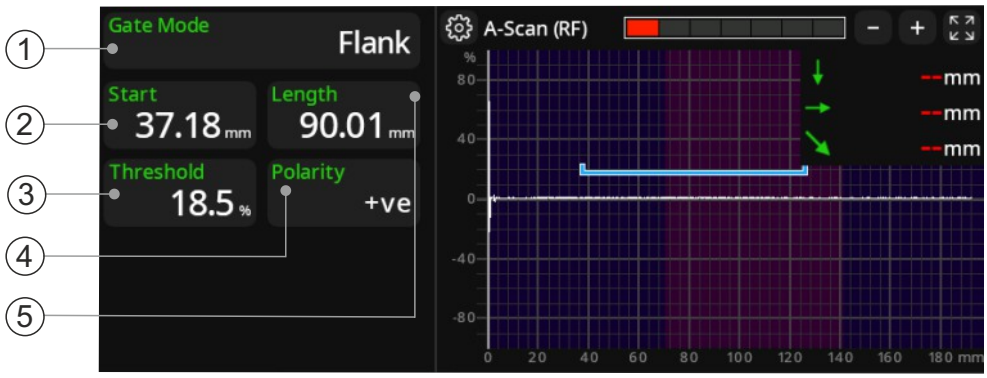
If a pre-saved calibration is however selected which does not match the transducer connected, a warning appears to alert the user that the calibration is not compatible.

5.2.4 READING SETUP: CONTROL TAB GROUPS / GATES TAB

The contents of the Gates tab changes depending on the measurement mode selected via the Measure tab, as this setting determines the total number of active gates.

When using **Pulse Echo Mode (PE)** measurement mode, a single gate is selected and the following controls are available:

5 NAVIGATING THE GAUGE (continued)



Button		Function
1	**Gate Mode**	Determines where the gate places the measurement point after being triggered by a signal. Each gate mode will change the measured value on the same waveform, so it's important to be consistent and to select the right one for the task. Options available are: **Flank:** Triggers at the exact point a signal crosses the gate. Used widely, considered the classic or standard gate mode. **Peak:** Triggers on the highest signal that crosses the gate. **Zero Cross:** Triggers at the position after the flank detection point where the signal crosses the X axis at 0. Used to compensate for measurement error caused by large amplitude variance.
2	**Start**	The start position of the gate is the earliest point a detection can be made.
3	**Threshold**	The height a signal must exceed to trigger the gate
4	**Polarity**	Determines whether the gate is on the positive or negative side of the amplitude graph; disabled when rectification is enabled in the Display tab.
5	**Length**	The overall length of the gate along the X axis.

If **Echo-Echo (EE)** or **Echo-Echo-Verify (EEV)** measurement mode is selected, the gates tab is modified to allow for each of the active gates to be selected and adjusted individually; selecting one of the gates displays the adjustment controls.

5 NAVIGATING THE GAUGE (continued)

For gates 2 and 3, a ‘holdoff’ value can also be configured. The ‘holdoff’ is a user-defined dead time applied immediately after the detection of a preceding gate. This prevents multiple gates from being triggered by the same echo or signal, helping to ensure accurate and reliable gate detection.

The A-Scan panel will also highlight the selected gate with a white border to make it easier to see which one is currently being adjusted (Fig. 13).

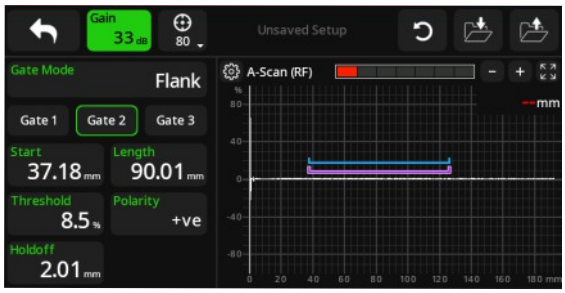


Fig. 13: Gate 2 Selected

While the Gates tab is selected, the user can drag their finger across the A-Scan to reposition the gates without having to enter specific values in the control fields.

5.2.5 READING SETUP: CONTROL TAB GROUPS / DISPLAY TAB

Option	Function
Rectify	Determines the rectification mode of the A-Scan display. Rectification is the process of converting the raw radio frequency (RF) signal into a more easily interpretable waveform by displaying either the full (FW) or half (HW) positive or negative portion of the signal amplitude against time. The selected mode is displayed on the top left (Fig. 14 to 17).
X-Axis	Determines whether the X-axis is displayed in terms of Time or Distance.
Delay	Determines the start position of the X-axis on the A-Scan display, allowing the user to shift the viewing window and focus on signals that appear later in time, effectively zooming in on a specific area of interest (Fig. 18 & 19).
Range	Determines the total width of the A-Scan display, corresponding to a specific time or distance within the material (Fig. 20 & 21). **Note:** Using Delay & Range together, the user can focus in or zoom out on areas of interest to make it easier to see wave echodynamics or gain variance over time.
Ghost Scan	A snapshot is taken of the current waveform, which is then overlaid on the A-Scan in green.

5 NAVIGATING THE GAUGE (continued)

Option	Function
Peak Hold	The A-Scan will keep track of the maximum amplitude seen at each time step and overlay this on the A-Scan in green.
Focus to Detection	This adjusts the delay and range so that the waveform ‘zooms in’ to the gate violation (if there is one). Pressing the button again will zoom back out.

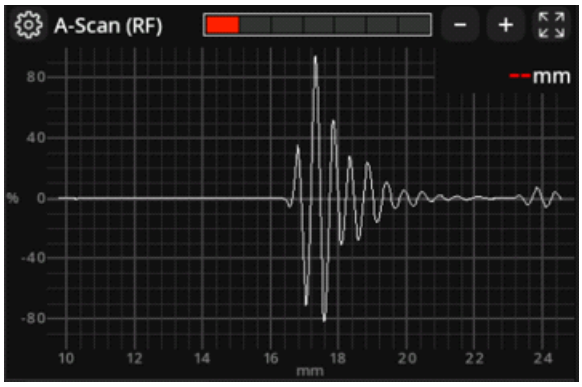


Fig. 14: Radio Frequency (RF)

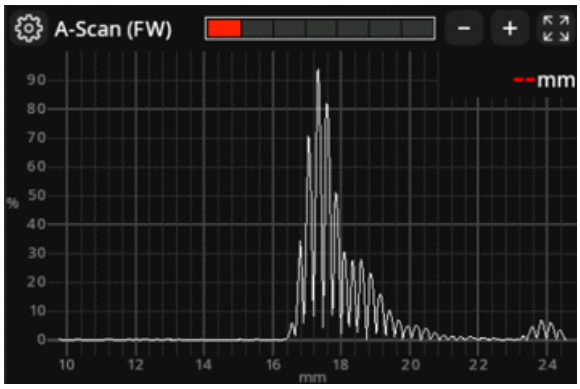


Fig. 15:Full Wave (FW)

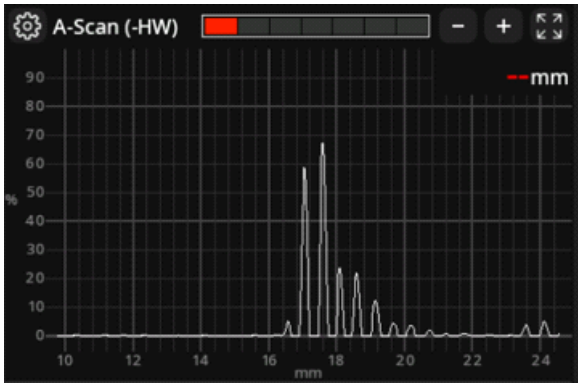


Fig. 16: Half Wave Negative (-HW)

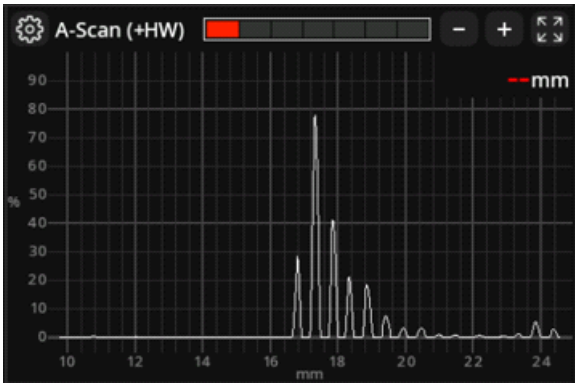


Fig. 17: Half Wave Positive (+HW)

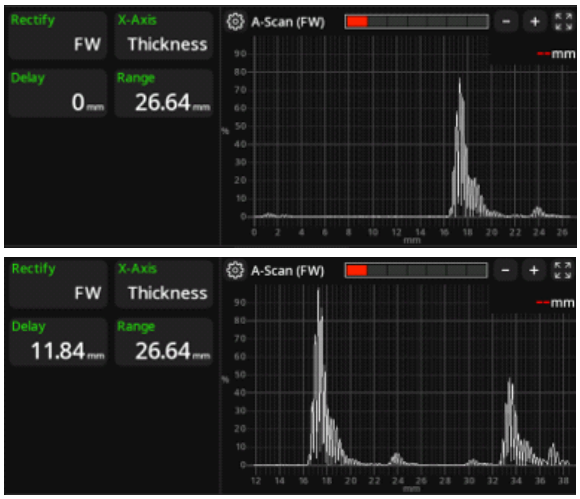


Fig. 18 & 19: Delay Examples

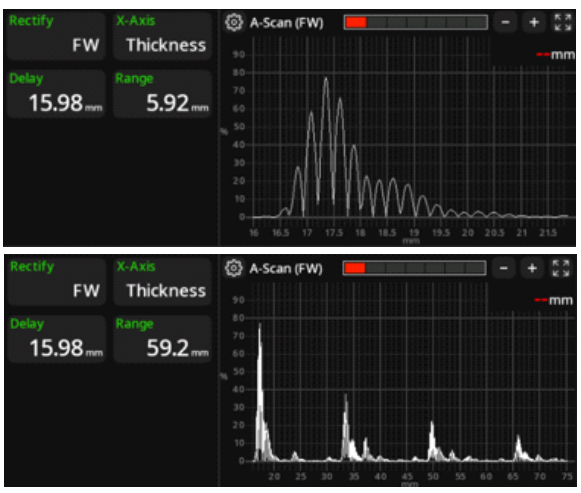


Fig. 20 & 21: Range Examples

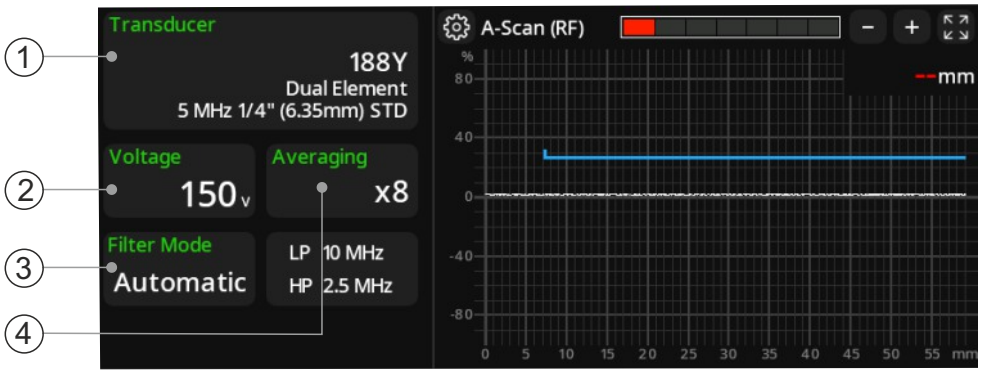
5 NAVIGATING THE GAUGE (continued)

5.2.6 READING SETUP: CONTROL TAB GROUPS / TUNE TAB

Use the Tune tab to fine-tune the instrument's signal path for the selected transducer and application.

Adjusting the pulser **Voltage** and receiver **Filter Mode** is critical for maximising sensitivity and achieving a clean signal response.

These settings must be considered together, as the ideal configuration depends directly on the transducer being used.



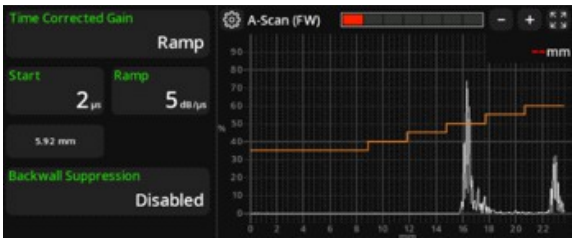
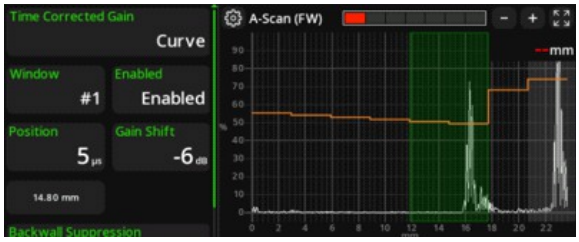
Button		Function
1	**Transducer**	Determines the currently selected transducer; if using an ODU intelligent transducer this field is locked while the transducer is connected.
2	**Voltage**	Determines the voltage of the pulse used to energise the transducer; higher frequency transducers have their max voltage limited to certain values to prevent damage.
3	**Filter Mode**	Determines the high and low pass filters to optimise signal to noise ratio. This is set automatically after a transducer is selected but can be adjusted later. Filtering can be an important tool for increasing signal to noise ratio when performing an ultrasonic inspection. By default, the gauge automatically applies a high and low pass filter with a window around the transducer's central frequency. This filtering can be disabled, or the individual bands can be configured using Advanced mode.
4	**Averaging**	Determines how many samples are averaged together before being displayed on the A-Scan. Increasing this value reduces grass and noise but can also decrease how responsive the gauge feels.

5 NAVIGATING THE GAUGE (continued)

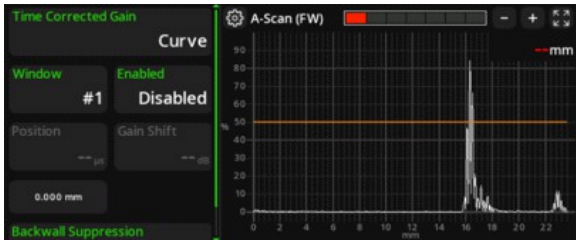
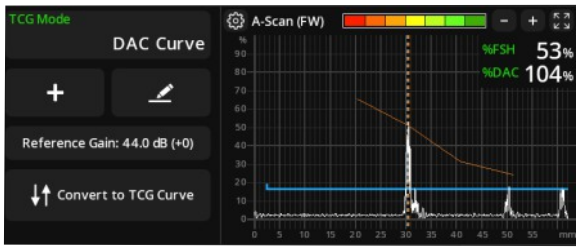
5.2.7 READING SETUP: CONTROL TAB GROUPS / TCG TAB

Time Corrected Gain (TCG) is a technique in ultrasonic testing that allows the gain to be altered along the time axis of the trace; typically 'correcting' for the natural attenuation of the ultrasonic signal in the test material. The Dakota CMX10-DL also allows the user to configure more complex zonal TCGs, which can raise or lower the gain in selected positions.

The TCG tab allows the user to enable and configure this behaviour, which can be useful when working with attenuative or complex materials. By default, TCG is disabled.

Option	Function
TCG Ramp	Ramp is the simpler of the two TCG modes and simply increases the gain linearly at the *Ramp* rate starting from the *Start* point. These settings are visually represented by the TCG overlay, represented by an orange line on A-Scan, which is automatically enabled while in the TCG tab (Fig. 22). To see the TCG overlay outside of this tab, it can be enabled in the A-Scan settings.  Fig. 22: TCG Ramp
TCG Curve	Curve extends the capability of TCG to allow *Windows* to be configured that adjust the gain either up or down. This can be useful when performing inspections on composite parts, or other complex materials that have specific zones of interest where higher sensitivity is needed (Fig. 23).  Fig. 23: TCG Curve

5 NAVIGATING THE GAUGE (continued)

Option	Function
TCG Curve (cont.)	The parameters available for selection / setup within TCG Curve are: ***Window***: 16 available windows to select from, if required. Windows are added or removed using the + / - buttons; and only enabled windows are shown in the "window" dropdown. ***Position:*** The position of the Window in microseconds. For reasons related to the gain switching circuitry, this is only adjustable in set microsecond intervals. The position is also reported in terms of calibrated length underneath. **Note:** The position of the windows can also be moved and adjusted by dragging on the A-Scan screen. ***Gain Shift:*** The amount of gain to add or subtract from the set's overall gain level. In the example (Fig. 24), Window #1 has been used to reduce the gain around the first back wall echo and Window #2, to increase the gain for the echo afterwards. This is reflected in the height of the peaks and represented in the orange TCG overlay.  Fig. 24: TCG Curve - Window #1 & #1 Enabled
DAC Curve	Distance Amplitude Correction (DAC) curves are used to determine the relative size of a flaw compared to a calibration sample (Fig. 25)  Fig. 25: DAC Curve

5 NAVIGATING THE GAUGE (continued)

Option	Function
DAC Curve (cont.)	The calibration sample will have several holes at various depths, all of which are the same size. The user will take a set of readings over these holes to construct a curve showing the reflection amplitude for each hole. This curve will be displayed over the A-Scan as the user takes readings on the test piece. Any flaw ***larger*** than the holes in the calibration sample will produce a higher-amplitude reflection; any ***smaller*** flaws will produce a smaller reflection. This difference in amplitude will then be displayed to provide an estimate of the flaw size. **Note:** This is a new function available on gauges with gauge firmware version 2.0 and later. Gauges with earlier firmware versions should be updated to the latest version via DakMaster™ to benefit from this feature, see Section 7.
Backwall Supression	The Backwall Suppression feature makes it easier to perform a Backwall Echo Attenuation style inspection for castings and composites. Backwall Suppression allows the user to dramatically ramp down the gain at the specified position; this allows a high scanning gain in the volumetric region prior to the backwall echo, while maintaining the ability to see the change in amplitude of that signal.

5.3 MENU/TRANSDUCER LIBRARY

Up to 50 standard lemo transducers can be stored in the Transducer Library for quick and easy selection.



Standard lemo transducers must be configured and saved to the library before first use.

ODU ‘intelligent’ transducers are automatically recognised by the gauge when connected and therefore do not need to be added to the library.

5 NAVIGATING THE GAUGE (continued)

5.3.1 Adding a New Transducer to the Library[c]

1 Press Menu/Transducer Library followed by '+' to open the transducer creation wizard.

2 Using the keyboard, enter the transducer ID or serial number, then select 'Single Element' or 'Dual Element'. If single is selected also identify the delay line type; standard Delay Line or Contact. Press '✓' to confirm and progress to the next screen.



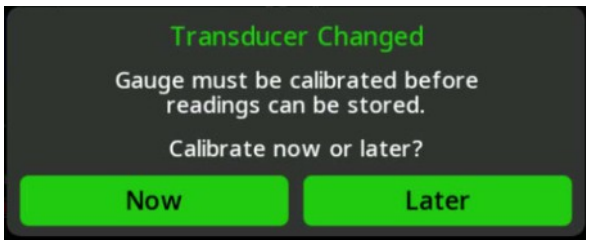


- If not using a delay line with a single element transducer, a select 'Contact'.

3 Select the manufacturer; DakotaNDT or OEM, select the frequency, diameter and type from the drop down lists followed by '✓' to confirm.

- 'Type' applies to dual element transducer only and refers to the transducer's damping and wearface; Standard (STD), Highly Damped (HD) or Coating (CT). IF the speciifcc type is unknown, select Standard (STD).
- If DakotaNDT is selected as the manufacturer and the transducer frequency, diameter and type do not match those of a DakotaNDT transducer, a message will be displayed advising that no matching transducer could be found and prompt the user to verify and correct the transducer details.

After all transducer details have been entered correctly, the gauge will switch to the new transducer and prompt the user to calibrate it. Select 'Now' to open the calibration wizard, or 'Later' to defer calibration.



Note: A calibration must be completed before a data log can be created using this transducer.

Selecting the […] icon for any stored transducer displays the transducer information summary containing all details entered during transducer setup.

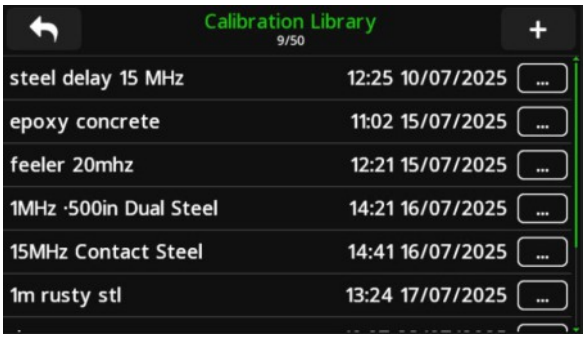


The toolbar icons (from left to right) allow the user to rename, delete or select a previously saved transducer.

[c] To cancel and exit, press '×' at any point during the process. Press '⇦' to go back to the previous step.

5 NAVIGATING THE GAUGE (continued)

5.4 MENU/CALIBRATION LIBRARY



The Calibration Library allows calibrations performed on the gauge to be stored, recalled and reviewed, providing a complete record of the procedures used to prepare the gauge for accurate measurement.

Up to 50 calibrations can be stored and made available for selection when creating a new data log file.

5.4.1 Creating a New Calibration[c]

1 Press Menu/Calibration Library followed by '+' to open the calibration setup wizard.

2 Use the keyboard to enter the following details. When complete, press '⇨' to confirm and proceed to the next step, 'Free Air'.

a) name the calibration, press '✓' to confirm.
This is a compulsory field.

b) add notes to be stored with the calibration, press '✓' to confirm.
This is an optional field.

- The details of the currently selected transducer are displayed on screen. If the transducer is incorrect, press 'X', followed by the 'Back' icon to exit the calibration wizard and return to the main menu. From the Transducer Library, select the required transducer and repeat steps 1 and 2.

3 Select the required calibration type; 'One Point', 'Two Point' or 'Known Velocity'. When 'One Point' or 'Two Point' is selected, the user is also required to select the measurement mode; PE, EE or EEV.

One Point: the simplest and most commonly used calibration method. After setting the zero point, a reading is taken and adjusted on an uncoated sample piece of test material of a known thickness to determine the sound velocity.

Two Point: more accurate than one point calibration, after setting the zero point, a reading is taken and adjusted on two uncoated sample pieces of test material of two different and known thicknesses to determine the sound velocity.

Known Velocity: calibration using the known sound velocity of the material under test. Select a preset material from the list or select 'Custom' to enter a known material sound velocity manually.

[c] To cancel and exit, press '✕' at any point during the process. Press '⇦' to go back to the previous step.

5 NAVIGATING THE GAUGE (continued)

4 Ensure the transducer face is clean of couplant and then hold it in free air making sure not to couple it to any objects. Press the measure icon '⬇' or button to set the initial gate positions based on the transducer's baseline waveform. If using 'One Point' or 'Known Velocity' calibration proceed to steps 5 and 6a. If using 'Two Point' calibration, proceed to steps 6b and 6c (step 5 is not required)

5 Apply a couplant to the transducer and couple it firmly to the gauge's integrated zero disc on the back cover. When the signal is stable, tap the measure icon '⬇' or button and the gauge will calculate the transducer's zero offset. Press '⇨' to confirm and proceed to the next step or press restart '↻' to take another reading.

- The display will show a thickness value which is constantly updating. The stability of the reading is indicated on the stability bar to the right of the display. A valid reading has a stability of 5 or more.

6a When prompted, apply couplant to the uncoated sample or calibration standard. Press the transducer on to the uncoated sample or calibration standard. When the signal is stable, tap the measure icon '⬇' or button then enter the known thickness of the sample. Press '⇨' to confirm and proceed to the next step or press restart '↻' to take another reading. Proceed to step 7.

- The display will show a thickness value which is constantly updating. The stability of the reading is indicated on the stability bar to the right of the display. A valid reading has a stability of 5 or more.

6b When prompted, apply couplant to the ***thinner*** uncoated sample or calibration standard. Press the transducer on to the uncoated sample or calibration standard. When the signal is stable, tap the measure icon '⬇' or button then enter the known thickness of the sample. Press '⇨' to confirm and proceed to the next step or press restart '↻' to take another reading. Proceed to step 6b.

- The display will show a thickness value which is constantly updating. The stability of the reading is indicated on the stability bar to the right of the display. A valid reading has a stability of 5 or more.

6c When prompted, apply couplant to the ***thicker*** uncoated sample or calibration standard. Press the transducer on to the uncoated sample or calibration standard. When the signal is stable, tap the measure icon '⬇' or button then enter the known thickness of the sample. Press '⇨' to confirm and proceed to the next step or press restart '↻' to take another reading. Proceed to step 7.

- The display will show a thickness value which is constantly updating. The stability of the reading is indicated on the stability bar to the right of the display. A valid reading has a stability of 5 or more.

5 NAVIGATING THE GAUGE (continued)

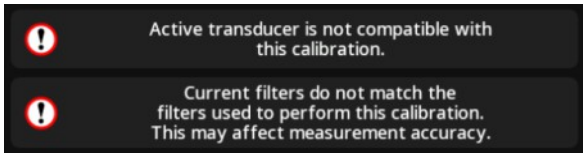
7 The calibration summary screen is displayed. Review the information and if correct, press '✓' to save and apply the calibration. If any information needs to be changed, press '⇦' to return to the previous steps and make the necessary adjustments.



Selecting the […] icon for any stored calibration displays the calibration information summary containing all details entered during setup.

The toolbar icons (from left to right) allow the user to rename, delete or select a previously saved calibration.

If the selected calibration is not valid for the transducer connected, the '✓' icon will be greyed out to prevent selection and warning messages are displayed to explain the cause.

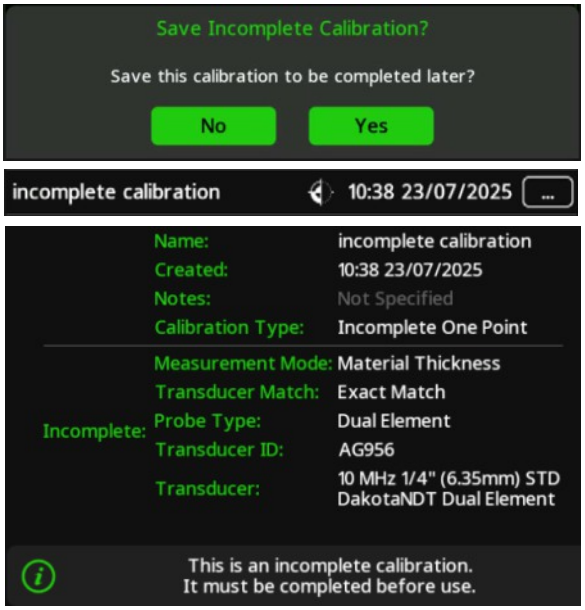


5.4.2 Saving Incomplete Calibrations

If the calibration routine is exited before completion, the gauge will prompt the user to save the unfinished calibration so it can be resumed at a later time.

In the Calibration Library, incomplete calibrations are identified by an icon next to the calibration name, indicating that the process has not yet been completed.

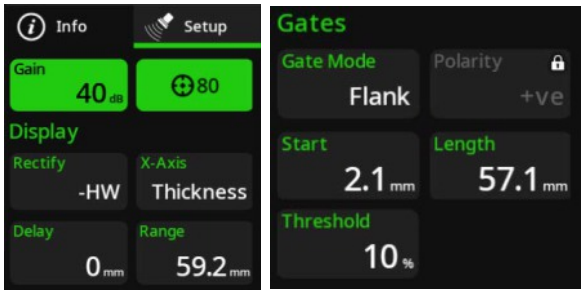
Viewing the calibration details will display a message advising that the calibration is incomplete and must be finalised before it can be selected for use in a data log.



5.4.3 Adjusting Readings Parameters in the Calibration Wizard

On stages where a reading is required from the transducer, the 'Setup' tab can be used to adjust the A-Scan and Gate settings to enable measurement.

This may be necessary when calibrating on large, noisy or very attenuative objects.



5 NAVIGATING THE GAUGE (continued)

While in the Setup tab, the measurement gates can be moved and adjusted by dragging on the A-Scan screen.

5.5 MENU/LIMIT LIBRARY

Limits are a convenient and reusable way to explicitly outline acceptance and rejection criteria for thickness inspections by setting different limits for individual measurements within a data log file. Up to 50 preset limits can be stored in the Limit Library.

5.5.1 Adding a Limit Set to the Library[c]

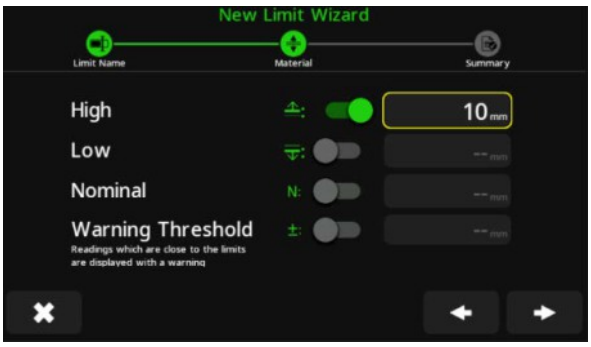
1 Press Menu/Limit Library followed by '+' to open the limit creation wizard.

2 Use the keyboard to enter the following details. When complete, press '⇨' to confirm and proceed to the next step, 'Material'.

a) name the limit set, press '✓' to confirm.
This is a compulsory field.

b) add notes to be stored with the limit set, press '✓' to confirm.
This is an optional field.

3 On the 'Material' screen, a High, Low and/or Warning Threshold can be set. Toggle on the option and enter the value followed by '✓' to confirm'. Repeat for each parameter as required and when complete, press '⇨' to confirm and proceed to the next step.



- 'Not all values need to be set to create a valid limit set but a High or Low value must be set.

High: the maximum value a measurement can be before the limit is triggered.

Low: the minimum value a measurement can be before the limit is triggered.

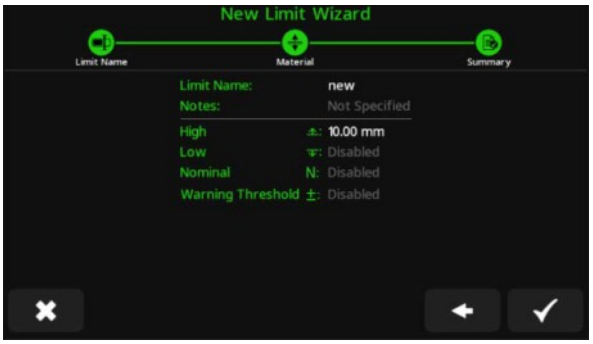
Warning Threshold: displays a warning if the value of a measurement is less than Threshold distance from the High or Low limits e.g. if the High is set to 10mm and the Threshold is set to 1mm, the gauge will display a warning on any measurements between 9mm and 10mm.

Nominal: a nominal or target value.

[c] To cancel and exit, press '✖' at any point during the process. Press '⇦' to go back to the previous step.

5 NAVIGATING THE GAUGE (continued)

4 The limit set summary screen is displayed. Review the information and if correct, press '✓' to save. If any information needs to be changed, press '⇦' to return to the previous steps and make the necessary adjustments.



Selecting the […] icon for any stored limit set displays the summary containing all details entered during setup.

The toolbar icons (from left to right) allow the user to rename, delete or select a previously saved limit set.

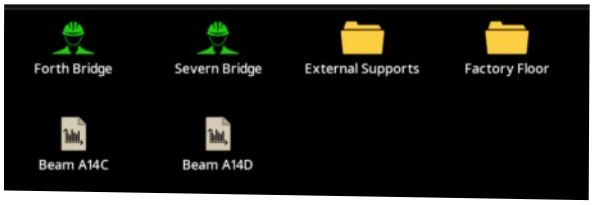
Note: Limit sets can only be enable when creating a new data log file.

5.6 MENU/DATA

The Dakota CMX10-DL has both internal storage and an external memory card slot (SD type) for archiving data.

Internal Storage	128MB[d]
Data Log	Sequential: up to 10,000 readings Grid: up to 100 x 100 readings
A-Scans	up to 20,000
Recordings	up to 25 minutes
External Memory (maximum supported)	32GB SD Card (can store up to 4 million A-Scans or 100 hours of recording)

The gauge's data structure has been designed for easy filing and retrieval using a simple tree-type filing structure; **Projects, Folders** and **Data Logs**.



Icon	Function
 	**Project / Folder:** these are interchangeable and can be used to help retrieve Data Log files more easily
	**Data Log:** individual readings can be stored in data log files. Data logs can be saved in Folders or Projects

5 NAVIGATING THE GAUGE (continued)

5.6.1 Creating a New Project or Folder[b]

1 Press Menu/Data/Internal Storage followed by '+'.
2 Select the 'Project' or 'Folder' icon.
3 Using the keyboard name the project or folder, press '✓' to confirm.
4 Press '✓' again to create the project or folder.

5.6.2 Creating a New Data Log File[c]

1 Press Menu/Data/Internal Storage followed by '+'.
2 Select the 'Data Log' icon to open the data log creation wizard.
3 Select the current setup or a stored setup for the new data log. Once selected, press '⇨' to confirm and proceed to the next step.
4 Using the keyboard enter the following details. When complete, press '⇨' to confirm and proceed to the next step.

   a) name the data log, press '✓' to confirm.
   This is a compulsory field.
   b) enter the data log operator's name, press '✓' to confirm.
   This is an optional field.

5 Select how the measurements are stored; as a ***Sequential***, ***Grid*** or ***Image Collect*** data log. When selected, press '⇨' to confirm and proceed to the next step.

   Sequential: stores each reading in a linear, sequential file. The user will be asked if the readings are to be stored in a ***single*** batch; continuously take readings up to maximum storage capacity or ***fixed*** batches; store readings in a linked series of sub-batches of a pre-defined size.

   Grid: stores the readings in a spreadsheet format. The user will be asked to input the number of rows and columns and also to define the collection order in which the readings will be taken.

   Image Collect: uses an image to identify the measurement points and store the measurement points.

6 Select limits, if any, to be applied to the data log measurements. When selected, press '⇨' to confirm and proceed to the next step.

   No Limits: no warning limits applied.

   Custom Limits: create a set of limit parameters to be applied. A 'High', 'Low' 'Nominal' and / or 'Warning Threshold' (limits which are close to the limits are displayed with a warning) can be set.

   Stored Limits: select from a previously defined set of limit parameters saved in the 'Limit Library'.

[c] To cancel and exit, press '×' at any point during the process. Press '⇦' to go back to the previous step.

5 NAVIGATING THE GAUGE (continued)

7 Once complete, the new data log wizard summary is displayed. Press '✓' to create the data log, '⇦' to go back and edit any of the details entered on the previous screens.

5.6.3 Renaming Projects Folders or Data Log Files[c]

1 Press Menu/Data/Internal Storage followed by edit '✎'.
2 Select the project, folder or data log to be renamed followed by 'Rename'.
3 Using the keyboard amend the project, folder or data log name, press '✓' to confirm.
4 Press '✓' again to confirm.

5.6.4 Moving Projects, Folders or Data Log Files

1 Press Menu/Data/Internal Storage followed by edit '✎'.
2 Select the project(s), folder(s) and / or data log(s) to be moved followed by 'Move'.
- Multiple projects, folders and / or data logs can be selected at once.

3 Select the new location, press '✓' to confirm.

5.6.5 Clearing a Data Log File[c]

1 Press Menu/Data/Internal Storage followed by edit '✎'.
2 Select the data log(s) to be cleared followed by 'Clear'.
- If the selected data log file is currently open, the user will be asked to close the data log to continue.

3 Press 'Yes' to confirm or 'No' to cancel and exit.

Note: Clearing a data log will delete the readings but the data log settings will be retained ready for new measurements to be saved.

5.6.6 Deleting Projects, Folders or Data Log Files

1 Press Menu/Data/Internal Storage followed by edit '✎'.
2 Select the project(s), folder(s) and / or data log(s) to be deleted followed by 'Delete'.
- If attempting to delete a data log file which is currently open, the user will be asked to close the data log to continue.

3 Press 'Yes' to confirm or 'No' to cancel and exit.

Note: When deleting a project or folder, all projects, folders and data log files stored within the project or folder will also be deleted.

5.6.7 Exporting Projects, Folders or Data Log Files

Projects, folders and data log files can be archived from the gauge's internal storage to an external SD type memory card (32GB maximum), freeing up space in the gauge memory.

[c] To cancel and exit, press '✕' at any point during the process. Press '⇦' to go back to the previous step.

5 NAVIGATING THE GAUGE (continued)

1 Press Menu/Data/Internal Storage followed by edit ‘ ’.

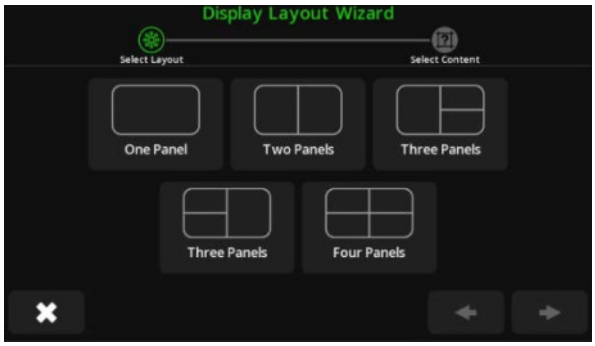
2 Select the project(s), folder(s) and / or data log(s) to be exported followed by ‘Export’.
- If attempting to export a data log file which is currently open, the user will be asked to close the data log to continue.

3 Press ‘Yes’ to confirm or ‘No’ to cancel and exit.

Note: When a data log has been exported, it is archived and becomes read-only - it cannot be re-opened via the external memory to save more readings. Data logs stored on the external memory can still be imported into DakMaster™. To transfer archived data logs into the internal storage, the data log most be opened via DakMaster™ and more readings added.

5.7 MENU/DISPLAY SETTINGS

The Display Settings menu allows the user to customise the home screen to show specific information.



There are 5 different layouts to choose from and 4 separate panels that can be selected to populate each:

Note: When setting up the display, all panels must be populated and cannot be left empty. The default setting button will autofill the panels with a standard layout.

Option	Function
A-Scan	Displays received echo signals on an amplitude/distance graph.
Statistics	When using a data log, the Statistics panel will collate statistical information about the saved readings such as mean, median and type.
Live Reading	Displays the currently measured value, along with the reading stability indicator.
Grid	When using a data log, the Grid panel will display the saved readings in an interactive manner that can be panned and zoomed.
Image Collect	Displays the image with the specified measurement points.

5 NAVIGATING THE GAUGE (continued)

Option	Function
Beam Path Correction	When using TRIG measurement mode, this provides a visualisation of the beam path within the part / component being measured. **Note:** This is a new feature available on gauges with gauge firmware version 2.0 and later. Gauges with earlier firmware versions should be updated to the latest version via DakMaster™ to benefit from this feature, see Section 7.
DAC (Distance Amplitude Correction)	Displays the following measurement values for the active DAC curve: **%FSH:** the amplitude of the signal which exceeded the curve. **%DAC:** the ratio between the signal amplitude and the curve amplitude. An echo which just touches the curve would have a value of 100%. An echo which has double the amplitude of the curve would have a value of 200%. **Note:** This is a new feature available on gauges with gauge firmware version 2.0 and later. Gauges with earlier firmware versions should be updated to the latest version via DakMaster™ to benefit from this feature, see Section 7.

5.8 MENU/GAUGE SETTINGS

Option	Function
Bluetooth	Enable and disable the Bluetooth on the gauge. Displays the Bluetooth ID; Access to a QR code link to download DakMaster™
Volume	Adjust or mute the gauge speaker's volume.
Screen	Adjust the screen brightness or enable Auto Adjust (brightness will be adjusted based on ambient levels). Adjust or disable the Auto Sleep function; shuts down the gauge after a period of inactivity. Adjust or disable the Auto DIM function; dims the screen after a period of inactivity. **Note:** Auto sleep and dim will only take effect while the gauge is in a menu, while on a reading screen the gauge will remain at full power.

5 NAVIGATING THE GAUGE (continued)

Option	Function
Regional	Set the gauge language, measurement units, style of decimal separator and keyboard layout. **Note:** Any changes to the regional settings will require a full gauge restart to take effect.
Time & Date	Set the date and time. Adjust the display format. Enable or disable the time display on the taskbar.
Input Functions	Enable utility features that can make using the gauge feel more intuitive including: ***Tap To Focus:*** changes how the user interacts with settings across the rest of the gauge. If enabled, tapping on a control will highlight it in yellow, which then allows the user to adjust the control using the gauge's arrow keys. If disabled, tapping a control widget will instead open the numerical entry panel. ***Home Screen Gain Adjustment:*** allows the user to adjust the gain on the home screen by using the up and down arrow keys. The Auto-80 routine can also be activated by pressing the right arrow. The Gain Step control determines how much the gain will increase or decrease by when modified using the arrow keys. ***Control Screen:*** enables or disables the swipe down command screen. If enabled, this menu can be displayed by swiping downwards from the top edge of the screen. The command screen allows quick adjustment of several gauge settings without having to navigate the menu.
Recording	Allows the user to change the maximum length of any A-Scan recordings and to configure a timed countdown for recordings, giving the user time to press the button and then position the transducer correctly before the recording begins.
Reset	Allows a factory reset of the gauge without deleting user data such as Transducers, Data Logs, Calibrations, Limits or Setups.

6 A-SCAN RECORINGS & B-SCANS

A 10-second recording of the A-Scan waveform alongside a measurement can be saved in any data log file. In some circumstances, it may be preferable to record the A-Scan display to highlight specific echodynamic features that may be present during an inspection.

6.1 RECORDING MODE

To create a recording, press the recording button (l) on the top toolbar on the main screen. This icon will appear next to the 'Measure' icon (k) when a data log file is open and active.

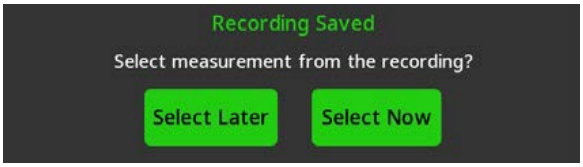


After the configured countdown delay, the recording will begin, and a timer will appear inside the record button to show how long is left before it completes.



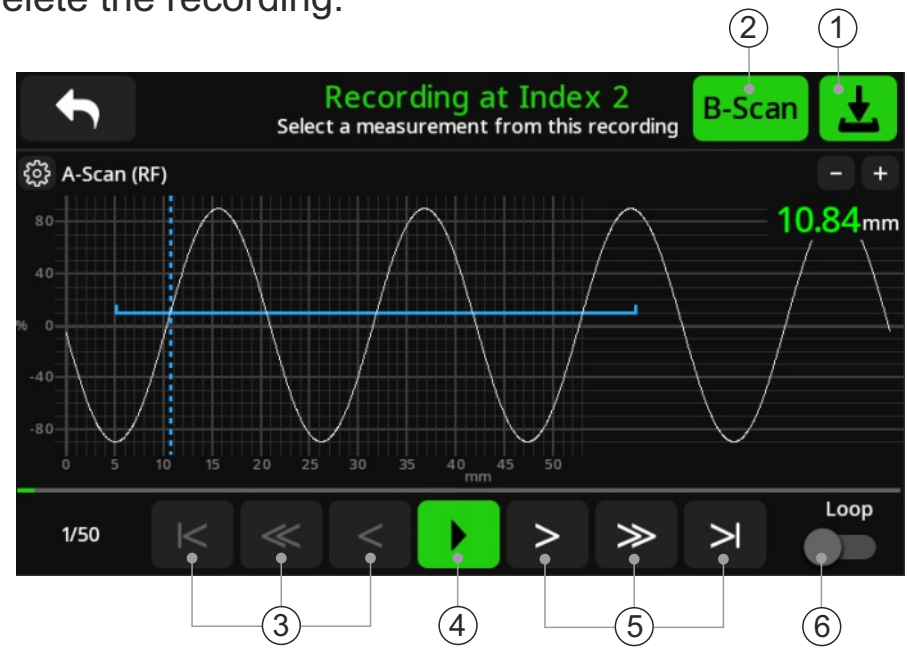
A recording can be stopped earlier by pressing the button again.

Once the recording has been stopped, the user will be asked if they wish to select an individual frame from the recording as the measurement.



The selected measurement will determine the thickness reading and A-Scan displayed in the data log for reporting purposes, while the full recording will be saved separately.

The 'Recording' screen will appear if 'Select Now' is chosen. Once satisfied with the frame selection, pressing the 'Select Frame' button will save that frame as the measurement and then prompt the user to choose if they wish to keep or delete the recording.



6 A-SCAN RECORINGS & B-SCANS (continued)

Button		Function
1	**Select Frame**	Selects the currently displayed frame as the chosen frame to display when this measurement is reviewed.
2	**Generate B-Scan**	Creates a B-Scan image from the currently displayed recording and navigates to the B-Scan inspection view.
3	**Back / Back 10 / Start**	Allows the user to move backwards through the recording by different frame amounts.
4	**Play / Pause**	Starts or stops the playback of the A-Scan recording.
5	**Skip / Skip 10 / End**	Allows the user to move forward through the recording by different frame amounts.
6	**Loop Toggle**	When enabled, playback will restart from the beginning once the end of the recording is reached.

6.2 GENERATE B-SCAN FROM RECORDING

Amplitude B-Scans can be created from saved A-Scan recordings to better examine the echodynamic profile of parts under test. While reviewing a recording, the B-Scan can be generated by pressing the ‘B-Scan’ icon.

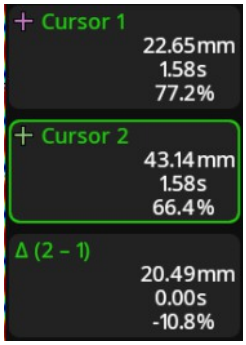
The colours are chosen based on the amplitude of the A-Scan's waveform at each position; an Amplitude B-Scan is a collection of A-Scan waveforms stacked side by side and coloured according to signal height.

Tapping the gear icon on the top left of the B-Scan enables a menu which allows the user to display the measurement cursors and adjust the display output.

6.2.1 Cursor Measurement Mode

Cursors allow the user to measure the depth and time of indications on the B-Scan by displaying these variables in a toolbar on the right-hand side of the display.

Cursor Mode	Description
Off	No cursors will be displayed.
One Cursor	A single cursor will be displayed.
Two Cursors	Two cursors will be displayed, a third information box will be displayed showing the difference between them.



The first line is the measured depth of the signal, the second line is the time that A-Scan was taken, and the third line is the measured amplitude of that signal.

6 A-SCAN RECORINGS & B-SCANS (continued)

6.2.2 Show Grid, Threshold and Amplitude Smoothing

There are three display features that allow for changes to the B-Scan output.

Show Grid: toggles the visibility of the time/distance measurement grid.

Threshold: hides all signals below a certain threshold value, ensuring that only sections of waveform above a certain height are displayed on the scan. This can be useful with very noisy materials to artificially raise the noise floor and only show indications above a certain size. For example, if Threshold is set to 10%, all indications below 10% will be reduced to 0.

Amplitude Smoothing: applies a visual smoothing effect to make the output scan look less jagged. Smoothing is applied after scan generation so it will not alter the values displayed by the cursors.

7 INTRODUCING DAKMASTER™

Ultrasonic NDT inspections require different types of data to be collected and stored for later auditing and reporting: thickness spot readings, corrosion grids, A-Scans, B-Scan and tension results. All of these need to be logged and tracked.



DakotaNDT have designed a series of data management software packages that will link directly with the data collection devices (gauges) and instantly produce professional reports, offering full traceability of the inspection proving compliance to the relevant standard being followed.

Our free software package, DakMaster™ is the most flexible data management software on the market. Designed to meet the demanding needs of the quality inspector whilst offering the ultimate flexibility for managing data into ‘projects’ for ease of use.

Available for PC and as a Mobile App for Android™ or iOS devices, using DakMaster™, the Dakota CMX10-DL can transmit readings to a PC for archiving and report generation. Data can be transferred via USB or Bluetooth®.

Gauge firmware can be upgraded to the latest version by the use DakMaster™, as it becomes available. DakMaster™ will inform the user of any updates when the gauge is connected to the PC with an internet connection.

For more information on DakMaster™, scan the QR code or visit www.dakotandt.com.

DakMaster™

8 TECHNICAL SPECIFICATION (continued)

Measurement Range (probe dependent)	PE	0.65 - 1480mm (0.026 - 58.3”)
	PE2	2nd Layer Thickness: 0.18mm - 1480mm (0.007 - 58.3”) 1st Layer Minimum: 6.35mm (0.25”)
	EE	0.18 - 592mm (0.007 - 23.3")
	EE2	2nd Layer Thickness: 0.18 - 592mm (0.00 - 23.3”) 1st Layer Minimum: 6.35mm (0.25”)
	EEV	0.18 - 296mm (0.007 - 11.7”)
Measurement Accuracy	±0.01mm (±0.001") or ±1% of the Reading (whichever is the greater) @ 5MHz 1/4” on Steel	
Measurement Resolution	±0.001mm (±0.0001”)	
Velocity Calibration Range	200 - 20000 m/sec (0.0079 - 0.7874 in/µs)	
Power Supply	Lithium Ion Battery Pack or Mains Power	
Battery Type	RC2040 Rechargeable Smart Battery Pack Li-Ion, Nominal Voltage 10.8V, 3350mAh/36.20Wh	
Battery Life	up to 15 hours (depending on usage)	
Power Consumption from Battery	4.5W	
External PSU	External PSU Input Voltage: 100-240V~/50-60Hz/600-300mA Unit Input Voltage from external PSU: 15V, 2A, 30W Power consumption from external PSU: 15V @ 1.25A (18.75W) (as this is also charging the lithium ion battery)	
USB Rating	USB C, 5V Power Rating 0.6A / 3W	
LCD Display	800 x 480 pixels, Colour, Touchscreen, Graphical, TFT Display	
Operating Temperature	-10 to 50°C (14 to 112°F)	
Relative Humidity	0 to 95%	
IP Rating (equivalent to)	IP65 (gauge only)	

8 TECHNICAL SPECIFICATION (continued)

Dimensions	108 x 105 x 53mm (7.1 x 4.1 x 2.0") (gauge without transducer)
Weight	872g (1.92lb) (includes battery, without transducer)
Pollution Degree	Level 3
Altitude Rating	Maximum 4000m



IMPORTANT: LITHIUM ION RECHARGEABLE BATTERY PACK

- **ONLY** use battery packs recommended by DakotaNDT.
- **DO NOT** use unapproved battery packs.
- When transporting the gauge by air, check the carrier's requirements relating to the transport of products containing lithium ion batteries.
- When shipping a gauge with a battery pack, refer to the carrier's regulations relating to the carriage of lithium ion powered products and attach the appropriate UN3481 or UN3480 label to the packaging.
- When returning a gauge for service, calibration or repair, remove the battery pack and return the gauge without the battery pack.
- Never ship a battery that is damaged or suspected of being faulty.

If in doubt, contact DakotaNDT or your DakotaNDT supplier for guidance.

Note: Battery packs must be disposed of carefully to avoid environmental contamination. Please consult your local Environmental Authority for information on disposal in your region. **Do not dispose of any batteries in fire.**

Note: A Material Safety Data Sheet for the rechargeable lithium ion battery pack is available to download via our website:

https://downloads.dakotandt.com/MSDS/DakotaNDT_CMX10-DL_Rechargeable Smart Battery Pack.pdf

9 WARRANTY

The Dakota CMX10-DL is supplied with a one year warranty against manufacturing defects, excluding contamination and wear.

The Dakota CMX10-DL does not contain any other user-serviceable components. In the unlikely event of a fault, please contact DakotaNDT or your local DakotaNDT supplier.

10 LEGAL NOTICES & REGULATORY INFORMATION

Declaration of Conformity - CE:

2014/53/EU	Radio Equipment - Directive 2014/30/EU EMC - Directive
2011/65/EU	Restriction of the Use of Certain Hazardous Substances in Electrical an Electronic Equipment (RoHS) - Directive

The Declaration of Conformity (CE) is available to download via:
https://downloads.dakotandt.com/Declaration_of_Conformity/English/DoC_CMX10-DL.pdf

Declaration of Conformity - UKCA:

S.I. 2017 No. 1206	Radio Equipment Regulations 2017
S.I. 2016 No. 1091	Electromagnetic Compatibility Regulations 2016
S.I. 2012 No. 3032	Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Regulations 2012

The Declaration of Conformity((UKCA) is available to download via:
https://downloads.dakotandt.com/Declaration_of_Conformity/English/DoC_CMX10-DL_UKCA.pdf

This product is designed for indoor and outdoor use Operational Frequency Band: 2,402 - 2,480 MHz Maximum Transmitted Power: <4 dBm

This product is Class B, Group 1 ISM equipment according to CISPR 11.

Class B product: Suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Group 1 ISM product: A product in which there is intentionally generated and/or used conductively coupled radio frequency energy which is necessary for the internal functioning of the equipment itself.

USB C: 5V Power Rating 300mW. The USB is for data transfer only. It is not a charging cable and is not to be connected to the mains via a USB mains adapter.

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 ACMA compliance mark can be accessed via Menu /About/Legal Information/Regulatory

The Giteki mark, its product identification code, the FCC ID and Bluetooth SIG QDID can be accessed via Menu/About/Legal

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
-- Consult the dealer or an experienced radio/TV technician for help.

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

10 LEGAL NOTICES & REGULATORY INFORMATION (continued)

Modifications not expressly approved by Elcometer Limited could void the user's authority to operate the equipment under FCC rules.

This device complies with Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This Class B digital apparatus complies with CAN ICES-3 (B)/NMB-3(B).

is a registered trademark of Elcometer Limited, Edge Lane, Manchester, M43 6BU. United Kingdom.

Bluetooth are trademarks owned by Bluetooth SIG Inc and licensed to Elcometer Limited.

DakotaNDT is an Elcometer company.

DakotaNDT is a trademark of Elcometer Limited.

DakMaster is a trademark of Elcometer Limited.

VELCRO® is a registered trademark of Velcro IP Holdings LLC.

All other trademarks acknowledged.

The Dakota CMX10-DL is packed in a cardboard package. Please ensure that all packaging is disposed of in an environmentally sensitive manner. Consult your local Environmental Authority for further guidance.

Head-Office: Elcometer Limited, Edge Lane, Manchester, M43 6BU, United Kingdom

THIS PAGE IS INTENTIONALLY BLANK