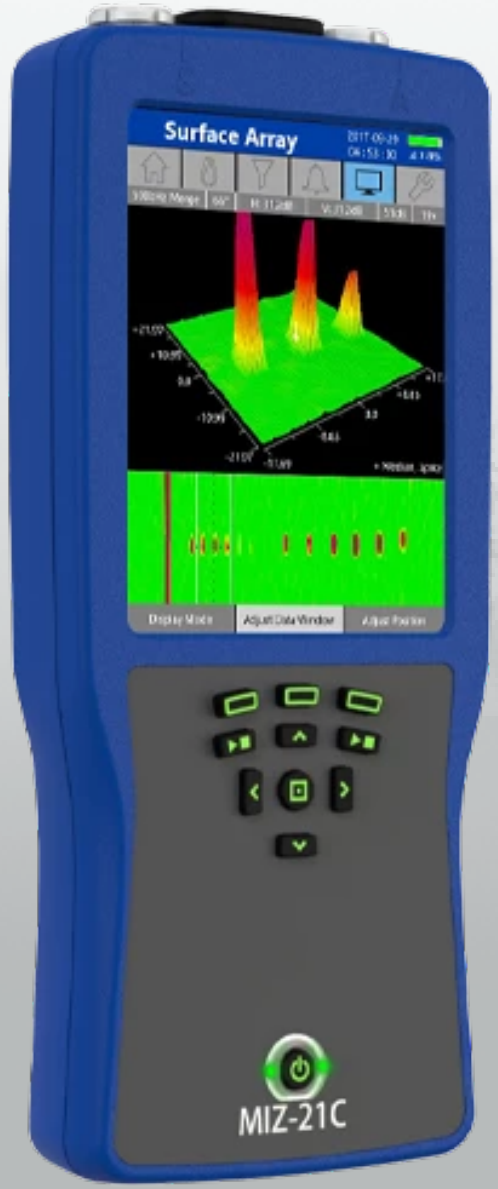
Eddyfi Technologies
Beyond current

Getting Started with

MIZ-21C



The information in this document is accurate as of its publication. Actual products may differ from those presented herein.

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Safety Precautions, Symbols, and Compliance

This section contains the most important safety precautions to follow. It identifies and explains the various symbols found on the instrument. Before turning on the instrument, make sure that these safety precautions are taken, as described below.

Safety Indications

The purpose of the various safety indications is to ensure operator safety and instrument integrity.

Warning! 	The Warning sign denotes a hazard. It calls attention to a procedure or practice which if not correctly performed or adhered to, could result in ***severe personal injury or death*.** Do not proceed beyond a Warning sign until the indicated conditions are fully understood and met.
Caution! 	The Caution sign denotes a hazard. It calls attention to a procedure or practice which if not correctly performed or adhered to, could result ***in material damage or loss of data***. Do not proceed beyond a Caution sign until the indicated conditions are fully understood and met.
Direct Current 	The Direct Current symbol is used to indicate that the equipment is suitable for direct current only and to identify relevant terminals.

Intended Use

The MIZ-21C is designed to perform non-destructive inspections on industrial and commercial materials. Indoor or outdoor use when battery powered (protected at all times from liquids, dust, direct sunlight, precipitation, and wind). When using the MIZ-21C in a handheld operation, do not remove the protective cover.

Caution!  Do not use the MIZ-21C or ZM-5 rotating scanner for any other purpose than the intended use.

Use of Equipment and Accessories

Eddyfi Technologies provides a series of eddy current probes and accessories that allow the MIZ 21C to perform a wide range of eddy current inspections. Contact Eddyfi Technologies with questions on compatibility of third-party products to ensure safe operation of the MIZ-21C or ZM-5 rotating scanner.

Warning!

Always use equipment and accessories that meet Eddyfi Technologies' specifications. Using incompatible equipment could cause malfunction and/or equipment damage, or injury.

Repair and Modification

The MIZ-21C and the ZM-5 rotating scanner do not contain user-serviceable parts. Opening the instrument or scanner will void the warranty. Contact Eddyfi Technologies to arrange for service should your MIZ-21C or ZM-5 scanner need maintenance or repair.

Caution!

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

Safe Workplace Operation

The MIZ-21C instrument is a handheld instrument that requires user interaction for operation. Before performing an inspection with the MIZ-21C, secure the workplace and ensure proper personal protective equipment appropriate for the work activity is in place.

Warning!

Use of the MIZ-21C requires user attention and interaction. Always use the proper safety precautions and personal protective equipment appropriate for the jobsite to avoid personal injury or death while operating the equipment.

Warning!

Do not use MIZ-21C AC power adapter in wet areas to avoid electrical shock. In these conditions it is recommended to operate your instruments on battery power.

Lithium Batteries Replacement and Operating Temperature Range

Never use Lithium batteries that are not from and approved by Eddyfi Technologies. Always respect the Operating Temperature Range while using the MIZ-21C. The Marking on the Batteries is LIION Wholesale Part#lgmj1pcb. When close to the maximum operating temperature, the MIZ-21C may turn off if using a very demanding setup like running rotating scanners. If that happens, then return the MIZ-21C to room temperature for an hour and the thermal protection will reset which will make the MIZ-21C functional again.

General Precautions

- Before turning on the instrument, carefully read the instructions in this user manual.
- *Never* touch connector pins, whether the instrument is turned on or not, as a shock potential may be present.
- Be familiar with this user manual and keep it available for future reference.
- Follow operation procedures carefully.
- Heed the safety warnings found on the instrument and in this manual.
- The MIZ-21C has been designed for non-destructive inspections of industrial and commercial materials. Do not use the MIZ-21C for any other purpose than the stated intended use.
- Only use cables and accessories approved by Eddyfi Technologies for this instrument and the ZM-5 scanner.
- MIZ-21C shall only be connected to the supplied power adapter and cables for charging and/or operating from mains power. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact and of the type indicated on the rating plate of the supplied power adapter.
- If the equipment is used in a manner not specified by Eddyfi Technologies, Inc., the protection provided on the equipment may be impaired.
- Do not install substitute parts or perform unauthorized modifications to the instrument.
- The MIZ-21C instrument and ZM-5 scanner must be serviced by the manufacturer only. For any problem or question regarding this instrument, contact Eddyfi Technologies, Inc., or an authorized Eddyfi Technologies, Inc. representative.

General Information

The “Info” symbol is for advice, explanation, help, hints, information, and tips.

Environmental Information

The “RoHS compliant” symbol signifies that this product is compliant, to the best of our knowledge, with RoHS 3 directive 2015/863, amending Annex II of the RoHS 2 Directive 2011/65/EU, ROHS-Recast, Article 4(1). This directive prohibits the use of lead, mercury, cadmium, hexavalent chrome, poly-bromated biphenyl (PBB), poly-bromated diphenylether (PBDE), Bis (2-Ethylhexyl) phthalate (DEHP), Benzyl butyl phthalate (BBP), Dibutyl phthalate (DBP), or Diisobutyl phthalate (DIBP) in certain classes of electrical or electronic units as of 22 July 2019.

The “Crossed-Out Wheeled Bin” symbol is a reminder to dispose of this product in accordance with local Waste Electrical and Electronic Equipment (commonly known as WEEE) regulations. This electronic instrument was manufactured according to high quality standards to ensure safe and reliable operation when used as stated in this manual. Due to its nature, this instrument may contain small quantities of substances known to be hazardous to the environment. For this reason, MIZ-21C and ZM-5 equipment should never be disposed of in the public waste stream.

Declaration of Conformity (CE)

The CE mark denotes conformity with all applicable directives and standards of the European community. The Declaration of Conformity to CE Mark Directives is document number PTP047-10. Contact Eddyfi Technologies for a copy.

EMC Directive Compliance

This instrument may generate radio frequency energy causing interference if not installed and used in strict accordance with Eddyfi Technologies instructions. The MIZ-21C has been tested and found to comply with the limits for an industrial device in accordance with the specifications of EMC standard EN 61326-1 (2012).

It is required to mention that emissions more than the levels of this standard may be generated by the instrument and/or the cabling if it is connected to test probes that are not properly manufactured or not properly connected to the instrument’s connectors.

Security Standards

The MIZ-21C is a Class 1 instrument of installation category II. It complies with standard EN-61010-1 (2010).

MIZ-21C Warranty

Any warranty covering this device is limited, conditional, and to the original buyer, only, strictly in accordance with the terms and conditions set forth in Eddyfi Technologies's quotation.
Eddyfi Technologies DOES NOT WARRANT THIS DEVICE AGAINST DEFECTS CAUSED BY MISUSE, ABNORMAL OPERATING CONDITIONS, ALTERATIONS, OR DAMAGE CAUSED BY EVENTS BEYOND THE CONTROL OF Eddyfi Technologies. Eddyfi Technologies DOES NOT WARRANT THAT THE DEVICE WILL WORK PROPERLY IN ALL ENVIRONMENTS AND APPLICATIONS, AND MAKES NO WARRANTY AND REPRESENTATION, EITHER IMPLIED OR EXPRESSED, WITH RESPECT TO QUALITY, PERFORMANCE, NON- INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.

This device includes Windows 10 IoT Core software licensed from Microsoft Corporation. By using the device, you accept the Windows 10 IoT Core license terms provided with the device. THE SOFTWARE ON YOUR DEVICE (INCLUDING THE APPS) IS LICENSED "AS IS". NEITHER THE DEVICE MANUFACTURER NOR MICROSOFT GIVES ANY EXPRESS WARRANTIES, GUARANTEES, OR CONDITIONS FOR THE SOFTWARE. TO THE EXTENT PERMITTED UNDER YOUR LOCAL LAWS, THE MANUFACTURER AND MICROSOFT EXCLUDE ALL IMPLIED WARRANTIES AND CONDITIONS, INCLUDING THOSE OF MERCHANTABILITY, QUALITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT.

Table of Contents

1. Overview of the Equipment

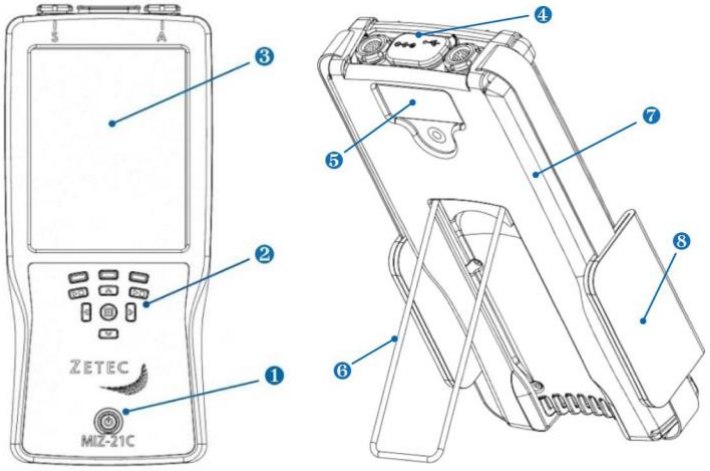
MIZ-21C Models

The MIZ-21C is available in six models with varying features suited for multiple applications. Throughout this manual, references may be provided on features not included in your specific model. Compare the model information tag on the back of your MIZ-21C with the following table to understand your exact features.

Contact Eddyfi Technologies with any questions you may have about models and features.

Feature	MIZ-21C-SF	MIZ-21C-DF	MIZ-21C-ARRAY	MIZ-21C-SF Wireless Locked	MIZ-21C-DF Wireless Locked	MIZ-21C-ARRAY Wireless Locked
Wireless Locked				✔	✔	✔
Conductivity	✔	✔	✔	✔	✔	✔
Single Frequency	✔	✔	✔	✔	✔	✔
Dual Frequency		✔	✔		✔	✔
Rotating Scanner		✔	✔		✔	✔
Eddy Current Array			✔			✔

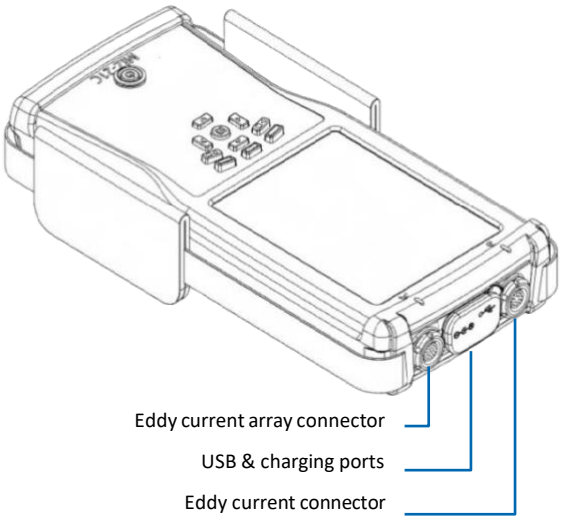
Features and Layout



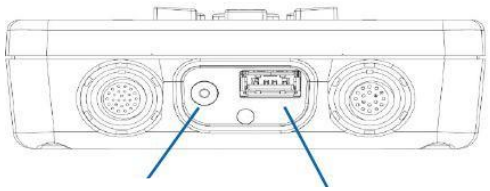
1	Power Button	5	Product Info, S/N, and 1/4-20 Mount
2	Control Buttons	6	Instrument Stand
3	System Display	7	Protective Cover
4	Connector Panel	8	Hand Strap

Figure 1-1 Features and layout

Connector Panel



The charging port is used to attach the power adapter supplied with the MIZ-21C, and to recharge the internal batteries.



Charging Port USB 2.0

The connectors accept many different probes supplied by Eddyfi Technologies. They are designed for easy connection and retention of the probe connector during operation. Attach the connector by gently inserting the probe connector into the MIZ-21C. Align the red dots and insert the connector until seated. Remove the connector by grasping the probe connector housing by the no-slip surface and gently pulling to release the latch, allowing the connector to be removed.

The USB port can be used to attach peripherals such as mouse, keyboard, headphones, or storage device. The USB port also supports the connection of a USB hub so several peripherals can be connected at once.

Direct Current

⎓

Charging Port

The MIZ-21C shall only be connected to the supplied power adapter and cables for charging and/or operating. Use of an improper power adapter may result in loss of data or damage to the instrument. Charging the instrument while operating it in high ambient temperatures may reduce charging efficiency.

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2. Preparing the MIZ-21C

Positioning the MIZ-21C

The MIZ-21C is a portable, handheld instrument with a touch display. It can be held with either hand. All buttons can be accessed using the thumb. It can also be positioned on a table or cart, or the floor. There are two stable positions to operate your MIZ-21C: 0° (no stand required), 60° (using the kick stand). These positions will ensure that your unit is secured in place.

For the angled position to be stable, the associated stand must be fully opened to ensure mechanical stability required by the electrical security for the test and measurement equipment. There is a standard 1/4-20 threaded hole in the back of the MIZ-21C for additional positioning options through mounting accessories.

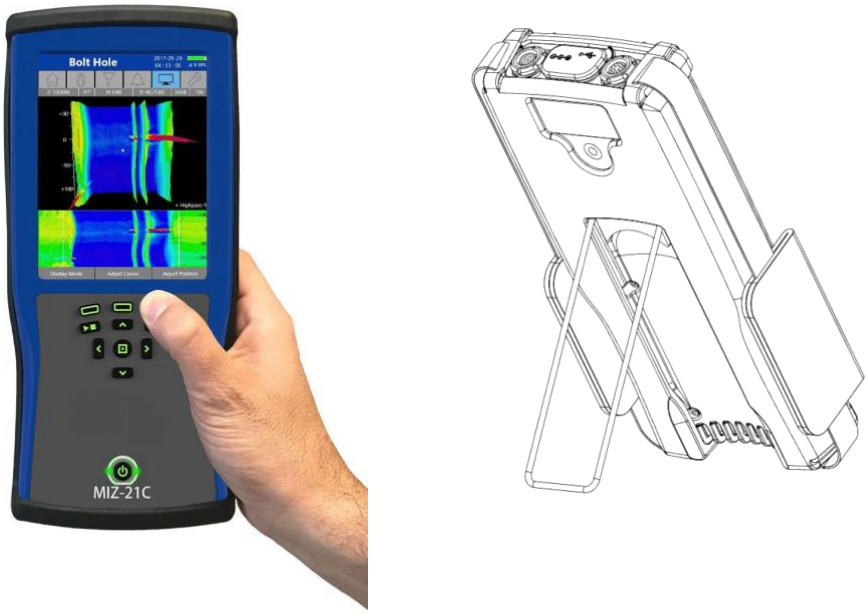


Figure 2-1 Positioning the MIZ-21C

Connecting Probes

The eddy current connector can accept standard eddy current handheld probes, +Point probes, conductivity probes, and rotating scanners. The eddy current array connector accepts multiple coil eddy current array probes. The Wireless Locked models follow the same table of connecting probes for the SF, DF, and ARRAY versions.

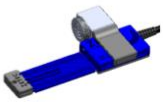
Instrument model	Pencil Probes	+Point Weld Scan	Conductivity Probes	Rotating Scanner	Surface Array
MIZ-21C-SF	✓	✓	✓		
MIZ-21C-DF	✓	✓	✓	✓	
MIZ-21C-ARRAY	✓	✓	✓	✓	✓
					

Figure 2-2 – MIZ-21C models and connecting probes

The following shows the variety of probes that can connect to the MIZ-21C. You can refer to the probe catalog for more details and for part numbers: www.eddyfi.com/en/product/miz-21c

Figure 2-3 Compatible probes

Setting up Scanners and Encoders

The MIZ-21C is compatible with a wide range of rotating scanners. Start by using the correct adapter to connect the rotating scanner. In the Bolt Hole technique, select the scanner that is connected to properly drive the scanner.

The MIZ-21C currently accepts the Surf-X Encoder. It will automatically set up the encoder when enabled in the Surface Array technique.

MIZ-21C Battery Replacement

For the best performance and safe operation, use only MIZ-21C replacement batteries sold by Eddyfi Technologies. All batteries must be charged to equal levels for maximum power capacity. Always respect the operating and storage temperature range when using the MIZ-21C.

When manipulating the batteries, use the following precautions:

- Never charge the li-ion batteries to 4.3V or above
- Do not store the batteries fully charged for an extended period of time (weeks or more)
- If the batteries must be stored, then only store in a case or individual box in a cool and dry place at approximately 3.6-3.7V
- Use only high quality battery chargers
- Do not expose to heat, direct sunlight, and high humidity
- Do not connect the positive contact to the negative contact without an appropriate load
- Never exceed the battery's specifications
- Never try to charge or discharge li-ion batteries with battery chargers that are not made for li-ion batteries
- Do not use any rechargeable battery or charger if any visible damage is present, or if known mishandling, accidental or otherwise, has occurred
- Always store and transport rechargeable cells in a safe, non-conductive container (never keep a spare battery loose in a pocket, purse, etc. and always use protective cases)
- Properly dispose of all battery cells and chargers in accordance with local laws and mandates (if you're unsure, contact your local municipality)
- If a rechargeable battery overheats, hisses, or bulges, immediately quarantine the battery from any combustible materials - ideally, take the battery outside
- If a rechargeable battery catches fire, the FAA recommends pouring water or soda on the battery and surrounding areas - ideally, use a foam extinguisher to quell the fire
- Keep batteries out of reach of small children, should a child swallow a battery, consult a physician immediately
- Do not disassemble, deform, puncture, or throw into a fire.

Replace the batteries by removing the battery cover. Release the retention lever and lift the cover as shown to expose the batteries. Ensure that the batteries are installed with the correct polarity direction as shown in the illustration.
The MIZ-21C has polarity direction icons in the battery cavity as an indicator of the correct polarity direction for installed batteries.

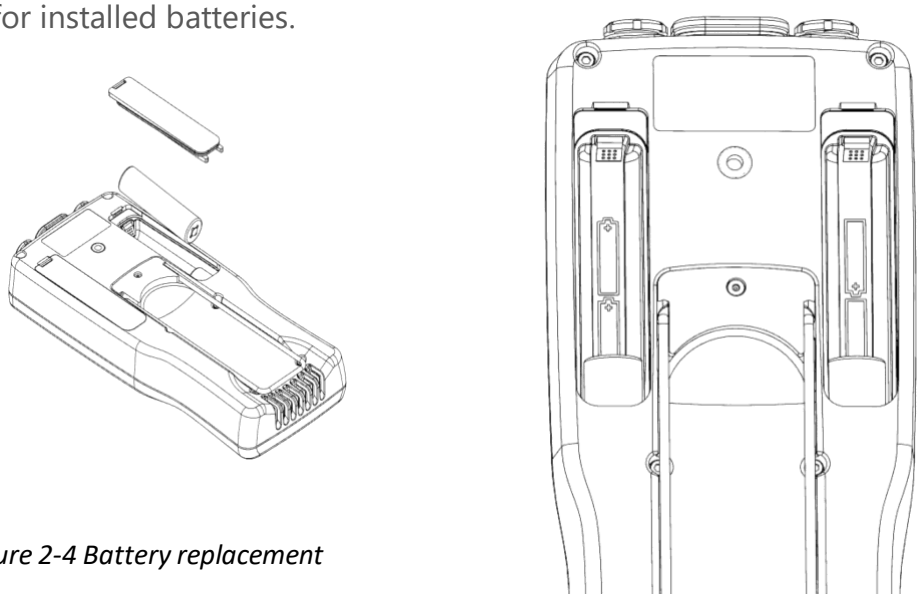


Figure 2-4 Battery replacement

Caution!

The MIZ-21C uses lithium rechargeable batteries. Each cell contains built-in protection for over-charge, over-discharge, over-current, over-temperature, and short-circuit protection. Non-protected, non-rechargeable cells are not permitted to be used in MIZ-21C. Use only batteries designed for the MIZ-21C and supplied by Eddyfi Technologies. Use of any other batteries may result in damage to the MIZ-21C or personal injury.

Battery Charging

The MIZ-21C provides a fast-charging circuit to recharge batteries efficiently. Generally, a full charge on the batteries should last for up to 10 hours of operation during typical use. Use of the MIZ-21C while charging batteries is permissible; however, simultaneous charging and operation of the MIZ-21C may cause the batteries to elevate beyond efficient charging levels depending on the test configuration being used and the environmental conditions. It is recommended to turn off the MIZ-21C to be sure the batteries fully recharge.

The MIZ-21C will alert the user should the battery temperature elevate above efficient charging levels and the charging will stop to protect the health of the batteries.

Charging of the batteries can continue once the battery temperature has dropped to normal levels.

ZM-5 Rotating Scanner Kit

Eddyfi Technologies' ZM-5 High-Speed Scanner is a convenient handheld tool designed for rapid and thorough inspection of small diameter holes, such as bolt hole and fastener holes.

With an ergonomic design, the ZM-5 enables inspection of hard-to-reach areas. A rotating transformer couples the eddy current signals for an improved operating life over conventional slip rings. The ZM-5 uses a quick-disconnect cable design for easy replacement.

The MIZ-21C can also adapt to other manufacturer's rotating scanners using adapters.

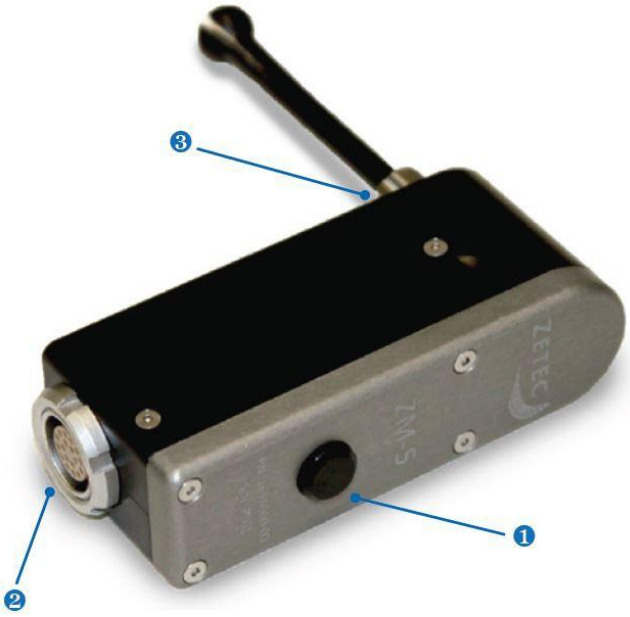
Figure 2-5 MIZ-21C and the ZM-5 High-Speed Scanner

Kit includes:

- High-speed ZM-5 rotating scanner
- Transportation case
- 1.8-m (6-ft) cable adapter for the MIZ-21C
- User manual

Note: Probes not included

Features



1 Rotation On/Off Button
2 18-pin Cable Connector
3 Probe Connector Socket

Figure 2-6 ZM-5 High-Speed Scanner

ZM-5 High Speed Scanner Specifications

Kit Part Number	169A901-00
Rotational Speed	600 to 3000 rpm
Probe Connector	4-pin Fischer
Frequency Range	50 kHz to 6 MHz
Signal Coupling	Rotary transformer
Weight	145 g (5.1 oz)
Size (L x W x H)	81 x 23 x 36 mm (3.2 x 0.9 x 1.4 in)

Supported Instruments and Probes

- Eddyfi Technologies MIZ-21C eddy current instrument using the 6-ft ZM-5 High Speed Rotating Scanner Control Cable
- Rotating scanner probes with 4-pin Fischer connector from Eddyfi Technologies or other manufacturers

The following information provides general steps to quickly start operating the ZM-5 rotating scanner.

- Connect the ZM-5 scanner and cable to the MIZ-21C 18 pin eddy current connector.
- Align the red markers on the scanner and probe, then fully insert the rotary probe into the scanner probe connector. Do not force a misaligned probe into the connector hole.
- Power up the MIZ-21C.
- On the MIZ-21C screen, select the Bolt Holes application.
- Select the Default Eddyfi Technologies technique.
- Copy the technique and edit the name of the copy.
- If necessary, edit the frequency, rpm, gain, or other settings.
- Save the changes.
- Place the probe coils inside a calibration block hole containing a longitudinal reference notch.
- Press the MIZ-21C Start/Stop button to rotate the probe and acquire data.
- With the probe coils away from the hole edges, press the MIZ-21C Instrument Null button. The probe will stop rotating during the null process. It will begin rotating again after nulling.
- Select the desired display mode using the Left/Right arrow buttons.
- Using the touch screen, adjust the data location as desired.
- Acquire calibration data. Use the ZM-5 On/Off button to stop and start rotation of the scanner. Use the MIZ-21C Start/Stop button to stop acquiring data.
- Adjust the data rotation and scale as necessary.

Tips:

- If the notch signal is not smooth, the sample rate is probably too low for the rotation speed. Lower the rotation speed or increase the sample rate.
- If high frequency noise is seen, the sample rate might be too high. Lower the sample rate.
- If the probe O-ring insertion force is excessive, apply a very light coating of silicone dielectric grease to the O-ring only.
- Remove probes from scanner after use. Probes may become difficult to remove if left inserted for long periods of time.

Navigation and Controls

Touch Control

The MIZ-21C display includes a touch user interface (TUI) that allows you to interact with the software application in a variety of ways. Throughout the software applications, various gestures of TUI are enabled depending on the current screen and action. Below are the gestures used with the MIZ-21C:

Single Tap on most screens allows you to select a menu item or move features on the data screen.

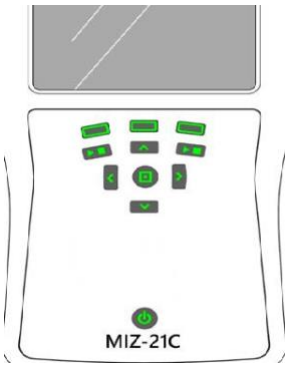
Double Tap is used on select screens to provide deeper functionality. For example, double tapping on the C-Scan display from an array technique will launch a menu with display options for the C-Scan.

Pinch and Zoom provides additional features for interacting directly with the screen image. For example, pinch and zoom on the 2D calibration Impedance/ Lissajous screen can be used to adjust the display scale.

Touch control can be disabled by selecting the Tools menu and navigating to the Touch Screen preference menu.

Control Buttons

Several user-control buttons which provide an alternative to on-screen software buttons for many functions are incorporated into the front panel of the MIZ-21C. This is useful when the job requires the use of gloves that may not be compatible with using the touch enabled display screen. The table below provides information on the use of the Control Buttons.



	Navigation Buttons provide up, down, left, right movement of the active screen item along with select button in center.
	Function Buttons correspond to the three software buttons on the lower extent of the screen. Either the touch screen or function button can be selected with the same effect. The functions vary based on the current screen.
	Start/Stop Acquire is associated with record and stop while acquiring data. The two Start/Stop buttons do the same thing. They are positioned for ease of use by lefthanded or righthanded operators. The secondary functions are next and previous when reviewing recorded data. Holding the Start/Stop button down is used to capture a screenshot.

Figure 2-7 Control buttons

Display Navigation

To navigate the software, touch the appropriate item on the screen or use the appropriate control keys. The initial screen presents the application options for the MIZ-21C. The right arrow screen symbol indicates there is further navigation from this menu choice. Selecting a menu choice can be performed by the touch screen method or through the control buttons.

Touch Screen	Control Button
Select the menu item on the screen.	Move the highlight up or down by using the Up/Down arrow buttons. Choose the menu item by either the select or right arrow button.

Figure 2-8 Navigation screen

Control Hints

The MIZ-21C is designed to be intuitive and simple to operate. Throughout the application, Control Hints on the status bar show you how to use the current feature.

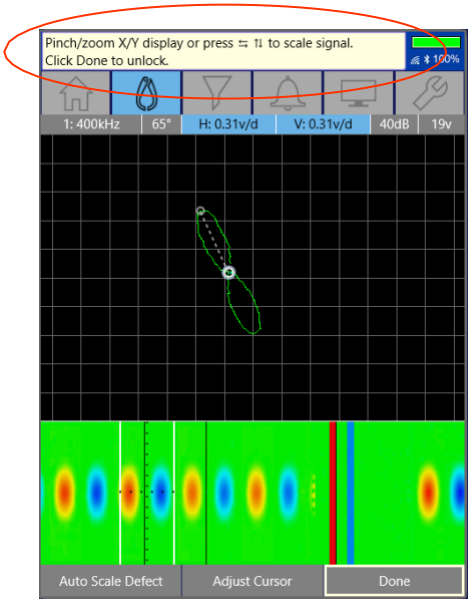


Figure 2-9 Control hints

3. MIZ-21C General Data Display Layouts

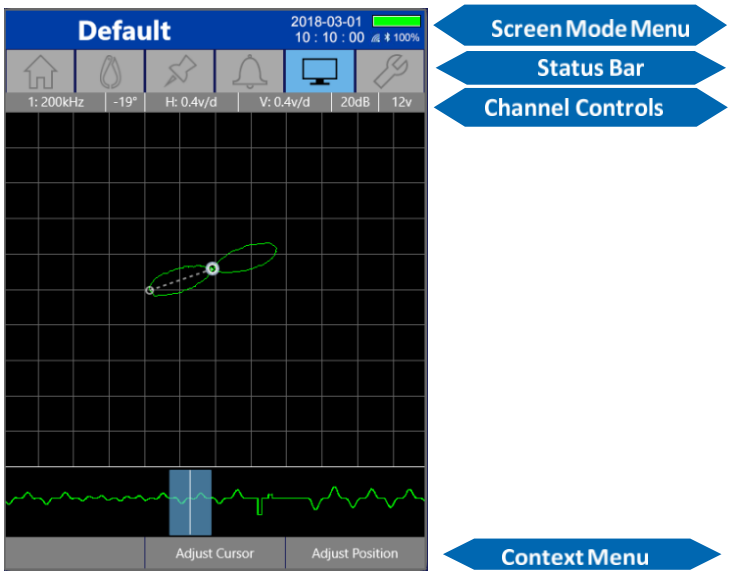
Display modes are set according to the Application Type in use. The MIZ-21C produces both Impedance and C-scan data screens. The content of the screen is automatically adjusted depending on the current mode to provide you with the most relevant controls for operation.
During acquisition, some menu items are automatically hidden to maximize the area available for live data. Once data acquisition has halted, menus and components reappear to assist you in the review of data.

Depending on the application type in use, the MIZ-21C will either display the Impedance or C-scan type of screen.

Application Type	Impedance	C-scan
Bolt Holes	✓	✓
Conductivity and Coating Thickness	✓	
Sub-Surface	✓	
Surface Array	✓	✓
Surface Cracks	✓	

During acquisition, the display may be changed using the 'left' or 'right' arrow buttons.

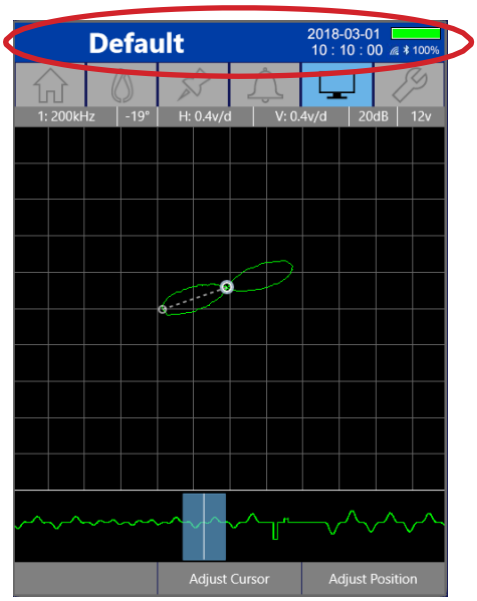
Common Data Display



Across the different data display types, the MIZ-21C presents some common interface components. The interface components noted to the left are visible in Impedance and C-scan data screens when not actively acquiring data. When acquiring data, the interface components are hidden to maximize the visibility of the data display area.

The sections below will provide general information on these common interface components.

Status Bar

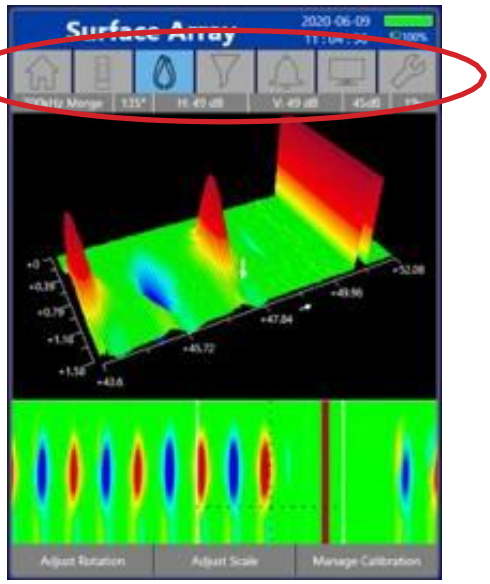


The Status Bar displays general system status including date, time, and battery power. Wi-Fi and Bluetooth status are also present for units where this feature is available.

The main title area displays the current technique name in use. When edits have been applied to the saved technique, an asterisk appears next to the name to indicate it has been modified.

This area is also used to show operational hints, when available.

Screen ModeMenu



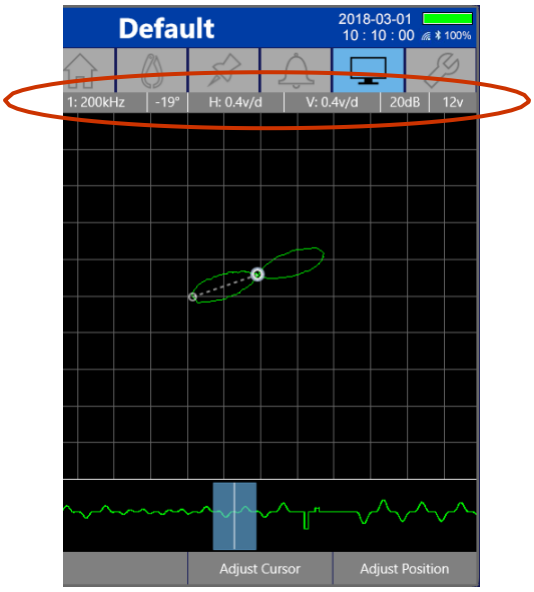
This feature is a menu across the top of many screens for quick access to the various screen modes. The active screen mode will be highlighted to indicate the current screen mode.

Main Menu Navigation

Touch Screen	Control Button
Directly select the menu item on the screen.	Navigate by using the left or right arrow button.

	**Home** recalls the current technique page.
	**Probe Information** displays the parameters for the currently connected Surf-X probe, as well as the context menu to adjust these parameters. Available for Surface Array Applications only.
	**Calibrate** displays the calibration context menu.
	**Underlay Tool** provides the ability to capture and display a reference Lissajous signal under the active data for Surface and Sub-Surface Applications.
	**Filter** displays the context menu to adjust mixes, cursor position, and filters. Not available for Conductivity and Coating Thickness Applications.
	**Alarm** displays a context menu and screen options to define an alarm box or sector based on signal response.
	**Display** shows the context menu to adjust modes of display, cursor position, and position of displayed data onscreen.
	**Tools** displays context menus to save the data file, make measurements of signals, and access the tools menu.

Channel Controls Menu



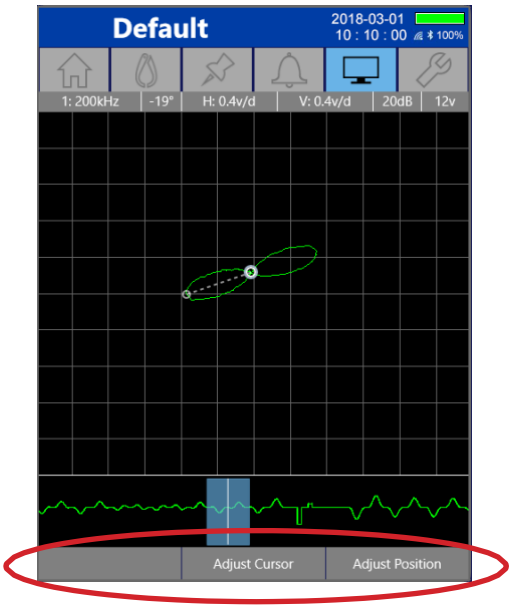
From the acquisition screen – when acquisition is not active – the Channel Controls Menu is active to allow for direct adjustment of signals. Moving from left to right, the control options are Channel, Phase, Scale, Gain, and Drive. How adjustments are made varies depending on the selection. The table below explains how to adjust the signal for the various modes.

Phase and Data Scale settings are a function of the calibration to display the data appropriately for the inspection.

Gain and Drive are a function of the technique. Changing these values will modify the current technique. To keep Gain and Drive changes, the technique must also be saved.

Control	Adjustment
Channel	Select the on-screen menu to toggle through channels or use the Up/Down arrow buttons.
Phase	Select the on-screen menu to enable Phase adjustment mode. Adjustment of the Phase angle is through direct rotation of the signal on the screen with your finger or using the buttons for coarse adjustment or buttons for fine adjustment. The context menu at the bottom of the screen will be active during Phase adjustment. Click the Done button to save changes. Phase is a function of the calibration. By default, the phase is adjusted in whole degree increments. This can be changed to 0.1-degree increments by selecting one of the "Fine" angle selections under The Angle Mode setting in the Tools menu.
Data Scale	Select the on-screen menu to enable Scale adjustment mode. The Scale of a signal can be adjusted directly on the screen through a Pinch and Zoom gesture or using the or buttons. The context menu at the bottom of the screen will be active during Scale adjustments. Click the Done button to save changes. In addition to using the manual Scale features, Auto Scale Defect will automatically set the defect within the parameters of the technique. Data Scale is a function of the calibration.
Gain	Select the on-screen menu to enable the settings menu for the eddy current drive Gain. Changes to the Gain value will be applied the next time the acquisition is started with the Start/Stop Acquire button. Gain is a function of the technique.
Drive	Select the on-screen menu to enable the settings menu for the eddy current Drive voltage. Changes to the Drive voltage value will be applied the next time the acquisition is started with the Start/Stop Acquire button. Drive is a function of the technique.

Context Menu



This feature is a three-option menu across the bottom of many screens that changes based on the current screen mode. The context menu is a screen soft key that correlates to the three keypad buttons directly below the screen.

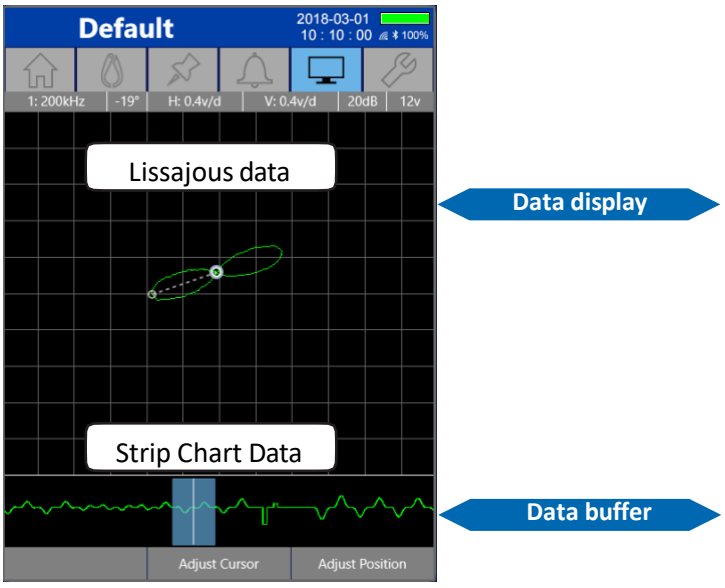
Navigate between the different screen modes by either the touch screen or control buttons.

Context Menu Navigation

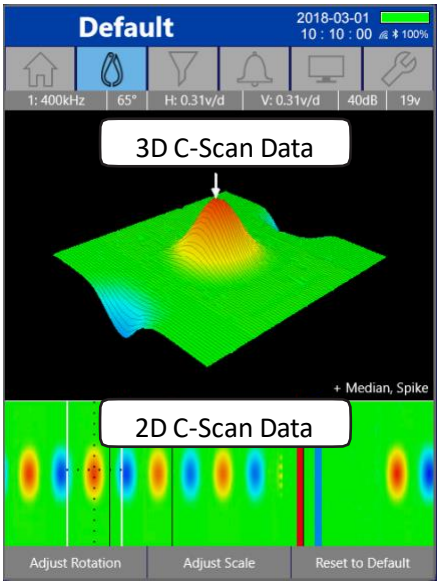
Touch Screen	Control Button
Directly select the menu item on the screen.	Select by function button directly below the screen option.

Data Display Area

Impedance Display



C-Scan Data



The data is displayed differently for the Impedance and C-scan data-type; however, the layout is similar. The Data Display areas represent the portion of the data that is within the Data Window, while the Data Buffer area represents the data that is saved in the instrument's RAM.

The type of data in the Data Display is referred to as the Lissajous data in the Impedance Display and 3D C-scan data in the C-scan Display. The type of data in the Data Buffer is referred to as the Strip Chart data in the Impedance Display and 2D C-scan data in the C-scan Display.

The Data Window is represented by the blue shaded area of the Impedance strip chart data or the white vertical boundary lines of the 2D C-scan data. The cursor is represented by the larger white circle in the Impedance Display, which corresponds with the vertical line in the data window.

In the C-scan Display, the cursor is represented by the arrow in the 3D data, which corresponds with the intersection of the dotted lines in the Data Window of the 2D data.

Getting Started

Read the safety precautions before your first use to ensure safe operation.

The following information provides steps for quick start operation of the MIZ-21C.

Powering Up the Instrument

With batteries at full charge, press the power button on the front panel to power up the MIZ-21C.

It will take several seconds to boot as the system starts.

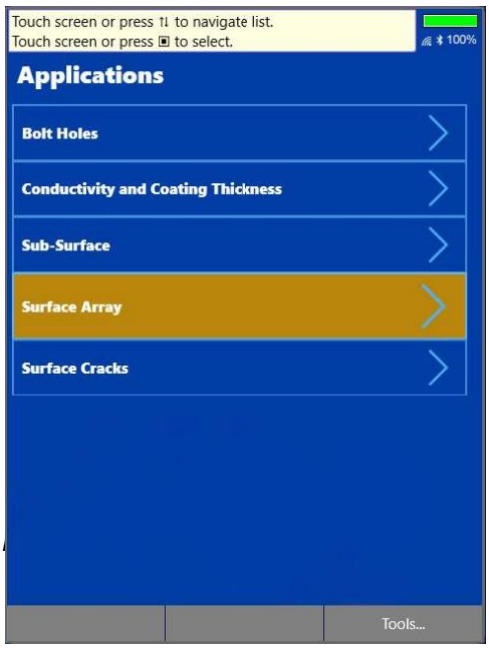
Figure 3-1 MIZ-21C power button

Powering Down the Instrument

Press and hold the power button for 1 second to power down the MIZ-21C.

A message will appear saying the instrument is shutting down.

Selecting an Application



Once the MIZ-21C is at full power, the initial display will show the various application types it supports. The MIZ-21C organizes techniques under application categories so you can quickly identify the best technique for inspection requirements. Select the category to view the available techniques.

Touch Screen	Control Button
Directly select the menu item on the screen.	Move the highlight up or down by using the Up/Down arrow buttons. Choose the menu item by either the select or right arrow button.

Selecting a Technique

The Technique screen will display a list of techniques currently available on the MIZ-21C. When the Technique is highlighted and the Technique parameters are set correctly for the application, start acquisition using the Start/Stop Acquire button.

View and edit the technique by selecting the technique on the screen or by using the right arrow on the keypad.

Template techniques are locked; however, a copy can be made from any technique and modified for use. The Copy button in the Context Menu allows for copying and naming a new technique based on the current selection.

Select Application in the Context Menu to return to the Application Screen.

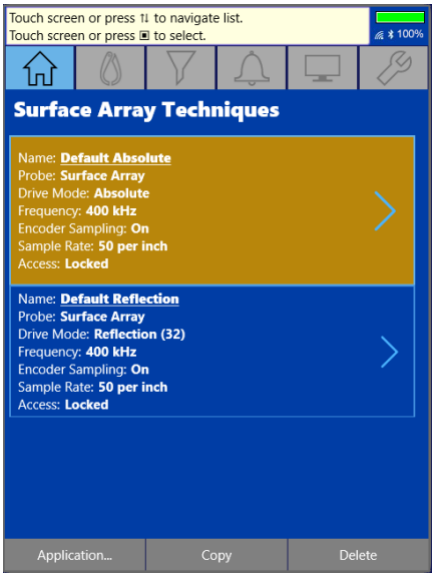


Figure 3-3 Selecting a technique

Viewing a Technique

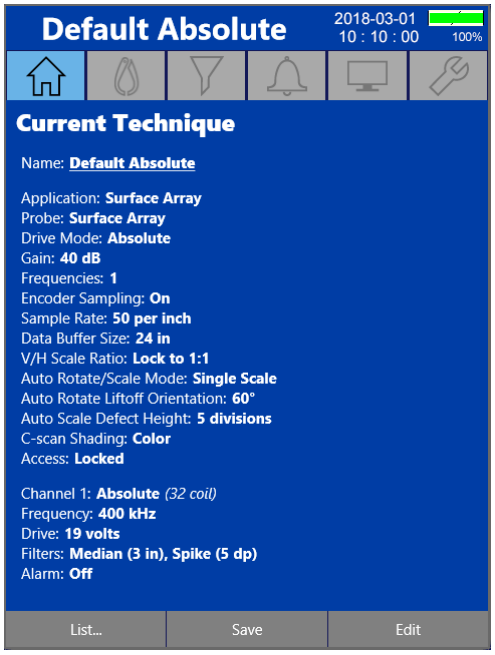


Figure 3-4 Viewing a technique

When viewing a Technique, scroll up or down on the screen or use the Up/Down arrow buttons to view the current settings.

Select List from the Context Menu to return to the list of techniques.

Select Edit from the Context Menu to modify a technique.

Editing a Technique

The Technique Editing Screen presents the user configurable features in a menu-driven list. Select any feature to enter changes to values.

Modified techniques can be run in Acquisition Mode without saving by pressing the Start/Stop Acquire button. Edited techniques that have not been saved will have an asterisk next to the technique name at the top of the screen to note the technique is not saved.

A modified technique can be saved at any time by selecting Save from the Context Menu in the editing screen. If the technique is currently locked, a prompt will display a choice to save a copy of the technique or cancel. Locked techniques cannot be changed.

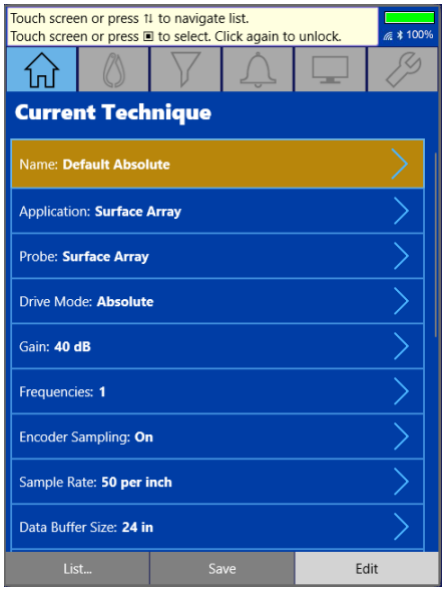


Figure 3-5 Editing a technique

Acquiring Data

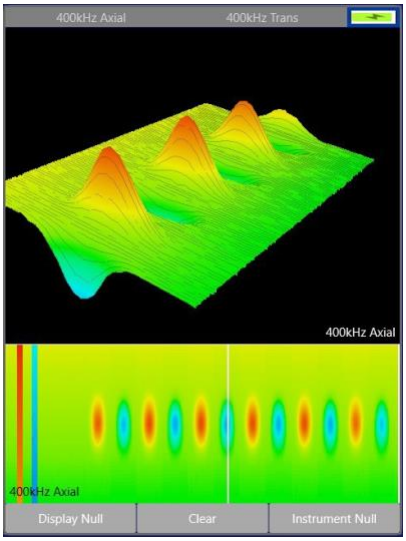


Figure 3-6 Acquiring data

With an active technique selected and an appropriate probe attached, press the Start/Stop Acquire to initiate acquisition and start scanning the specimen.

While acquiring, use the Context Menu button to perform Display Null, Instrument Null, and Clear the data buffer.

The buttons have the following functions when acquiring data:

Control Button	Function
Up/Down buttons	Change channel
Left/Right buttons	Change display
Select button (1 sec hold)	Switch to live calibration mode
Start/Stop Acquire button (1 sec hold)	Take screenshot

Changing the Display

The MIZ-21C offers a variety of display options that can be viewed during acquisition. You can cycle through these display options using the Left/Right control buttons while in acquire mode.

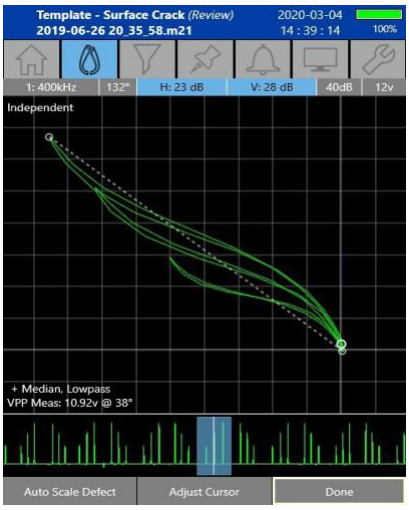
When in Review mode, go to the Display tab and press Display mode repeatedly to cycle through the displays. There are different displays for each application and different displays depending if one or two channels are configured.

Displays can be enabled and disabled from the technique.

Adjusting the Signal

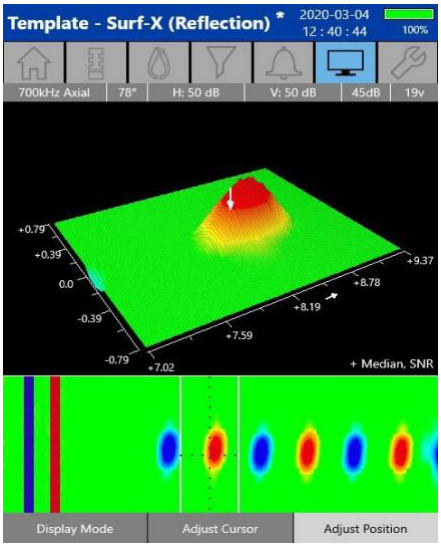
There are several controls for adjusting the signal when reviewing the data. The same controls can have different effects depending on the type of data and display. The following are descriptions of these controls for the various displays.

General Controls:



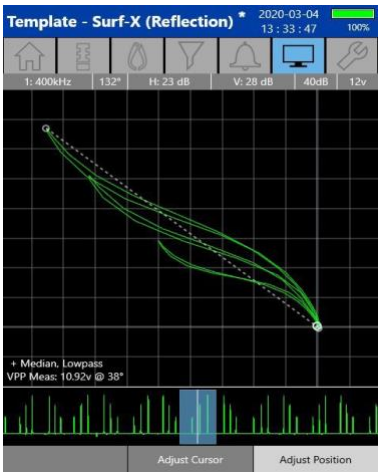
Desired Action	Touch Screen	Control Button
Data Phase Rotation	Select Adjust Rotation on the Calibration screen or select the channel rotation from the Channel Controls Menu. Two-finger tap and drag on the Data Display	Select Adjust Rotation on the Calibration Screen. Use the Up/Down buttons for fine adjustments and Left/Right buttons for coarse adjustments.
Data Scale Adjust	Select Adjust Scale on the Calibration Screen or select the H/V scales from the Channel Controls Menu. Pinch and Zoom on the Data Display	Select Adjust Scale on the Calibration Screen. Use the Up/Down or Left/ Right buttons to increase/decrease the scale in Uniform mode. Or use the Up/Down buttons to adjust the vertical scale, and the Left/Right buttons to adjust the horizontal scale in Independent mode. Holding down the center Select button will toggle between Independent and Uniform scale modes.
Data Window Zoom	Double tap on the Data Buffer	Click on the center control button

C-scan Display:



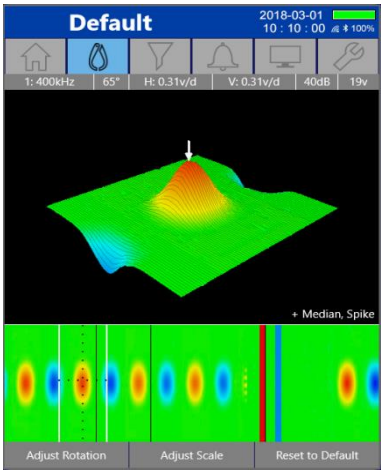
Desired Action	Touch Screen	Control Button
3D C-Scan Graphics Rotation	Single tap and drag on the 3D display	In the Display Screen mode, select Adjust Position twice to advance to Adjust Orientation. Use the directional buttons to rotate the image.
3D C-Scan Graphics Position	Two-finger tap and drag on the 3D display	In the Display Screen mode, select Adjust Position so that it is highlighted. Use the directional buttons to adjust the position.
Data Window Position	Single tap and drag on the 2D display	In any Screen mode that has Adjust Cursor available, select Adjust Cursor, then use the Left/Right directional buttons to adjust position.
Data Window Size **Click Adjust Cursor twice to Adjust Data Window** **Adjust Cursor** → **Adjust Data Window**	Pinch and Zoom on the 2D display	In any Screen mode that has Adjust Cursor available, select Adjust Cursor twice to advance to Adjust Data Window. Then use the Up/ Down or Left/Right directional buttons to adjust the Data Window size
Adjust Data Cursor	Single tap and drag on the 2D display	In any Screen mode that has Adjust Cursor available, select Adjust Cursor, then use the directional buttons to adjust position.

Impedance Display:



Desired Action	Touch Screen	Control Button
Data Position on Display Screen	Single tap and drag on the Data Display	In the Display Screen mode, select Adjust Position. Use the directional buttons to adjust accordingly.
Data Window/ Cursor Position	Single tap and drag on the strip chart display	In any Screen mode that has Adjust Cursor available, select Adjust Cursor, then use the Left/Right directional buttons to adjust position.
Data Window Size	Pinch and Zoom on the strip chart display	In any Screen mode that has Adjust Cursor available, select Adjust Cursor. Then use the Up/Down directional buttons to adjust the Data Window size.
Center on the cursor position	Double tap on the Data Display	N/A

Calibrating Data



After scanning the calibration block or plate, press the Start/Stop Acquire button to halt acquisition. Acquisition will stop and the data will be displayed in review mode. Go to the calibration screen by selecting the calibration icon or by selecting the Screen Controls for Rotation or Scale.

The Calibration screen provides tools to adjust settings such as scale and rotation. Locate the signal of interest within the Data Window and use the Context Menu buttons to calibrate the data.

See the Calibration Tutorial in the Working Examples section for more information on performing data calibration.

Note: The MIZ-21C allows data to be calibrated offline in Review mode. Flaws used for calibration can be scanned once, and then the data can be calibrated in Review mode. There is no need to calibrate the data while repeatedly scanning over a flaw.

Offline calibration has many benefits over the traditional method of calibrating while actively acquiring data:

- More precise calibration is attained because the best signal of interest can be identified for calibration
- It is easier to locate the proper calibration signal when you are not repeatedly scanning over the flaw. This is especially useful for bolt hole exams.
- The creation of the size and position of alarms can be precise
- There is less probe wear since you are only required to scan the flaw once, not repeatedly
- Precise filter settings can be set by observing how the filter affects the signal offline
- To reliably perform even a basic data analysis (such as evaluating the signal phase), data must be analyzed offline. The operator can easily review different channels of data, make phase and amplitude measurements, and adjust other parameters to better characterize signals of interest.

4. Software User Interface

Technique Parameters

Each Technique has a list of parameters that you can edit to meet your specific test requirements. Some parameters only apply to specific Applications and will be available only for those Applications. When there are changes to a technique, an asterisk is displayed next to the technique name indicating the technique has been modified from what was previously saved.

Asterisk indicating the technique has changed:

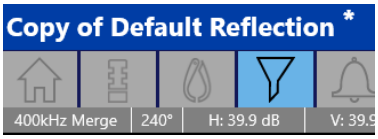


Figure 4-1 Indication asterisk

Techniques are useful as they contain the acquisition parameters for a test. For example, you can have a technique for a quarter inch bolt hole exam with one set of parameters and another technique for a half inch bolt hole exam with different parameters. These techniques can be exported and loaded onto other instruments.
Below is a description of each parameter and the options for them.

Name:
Each technique is identified with a name. Copies of the technique can be created by editing the name.

Application:
The type of application will define the specific parameters and displays to be used.

Probe:
The type of probe selected determines the specific operating parameters for the technique. The user must ensure that the correct probe type is selected for the technique. Each application has different selections for the probe type:

- Bolt Holes – The only selection available is Rotating Scanner. This is for informational purposes only.
- Conductivity and Coating Thickness has two selections:
    - Eddyfi Technologies Conductivity Probe – Use this only if a Eddyfi Technologies Conductivity probe is being used. The MIZ-21C has been specifically calibrated with Eddyfi Technologies conductivity probes to ensure accurate measurements.
    - Other – Select this if using anything except a Eddyfi Technologies

Conductivity probe. These probes may yield less accurate results and additional calibration points will have to be performed.

- Sub-Surface – This application does not have a selection for Probe type
- Surface Array – The supported Eddyfi Technologies surface array probes are listed here. Select the surface array probe which will be used for the technique.

NOTE: A surface array probe identifies itself to the instrument when connected. This information is displayed in the Probe Information Screen. If the part number of the probe does not match the probe type selection in the technique, then the following warning message will appear when you start acquire.

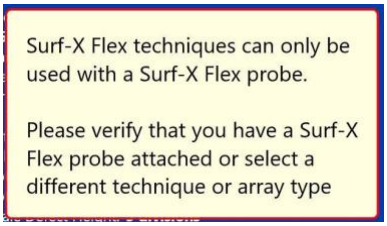


Figure 4-2 Warning message

When this warning message is displayed, either change the Probe type in the technique to match the connected probe or change the probe to match the probe type selected in the technique.

Drive Mode:

The type of Drive mode used is dependent on the probe's coil configuration. The available Drive modes are listed below. Only the applicable Drive modes will be available depending on the Application selected.

- Absolute – Single coil. Also referred to as Absolute Bridge. The MIZ-21C's virtual reference completes the bridge circuit.
- Differential – Two coils in a differential bridge configuration.
- Reflection – Transmitter coil(s) and single ended (absolute) receiver coil(s). Some probes have two receiver coils wired in a series but going to only one pin on the instrument. This is still considered single ended reflection by the instrument.
- Differential Reflection – Transmitter coil(s) and receiver coils in a differential bridge configuration.

Rotating scanners can operate in different modes. Please refer to manufacturer's rotating scanner documentation for more information.

Conductivity Coupons (Conductivity and Coating Thickness Only):

This option is used to enter the conductivity values of the calibration coupons that will be used.

Coating Thickness References (Conductivity and Coating Thickness Only):
This option is used to enter the thickness values of the calibration shims that will be used.

Motor (Bolt Hole Only):
This is used to select the type of scanner being used.

Motor Speed (Bolt Hole Only):
This is used to set the scanner's rotational speed.

Gain:
Sets the receiver gain and is adjustable from 10dB to 53dB. This gain should be set to the minimum required for flaw detection. Higher settings may increase noise levels. Once this gain is set, the digital horizontal and vertical gains in the Channel Controls should be used to adjust the signal.

Frequencies:
Sets the number of frequencies that will be used.

Mix Active (2 Frequency Techniques Only):
When using 2 frequencies, a mix channel can be activated. This channel can be used to mix out unwanted signals.

Axial/Transverse Merge (Surface Array Reflection Mode Only and with Encoder Sampling Turned On):
When using Surface Array probes in the Reflection Drive mode and Encoder Sampling, a Merge channel consisting of the axial and transverse data in one display is created.
When data is manipulated on the merge channel, its changes are also reflected on the axial and transverse channels. For example, if the vertical and horizontal gains are increased by 2dB on the merge channel, then the gains on the axial and transverse channels also increase by 2dB This is useful when calibrating as you only need to calibrate on the merge channel since the axial and transverse channels will change accordingly.

Encoder Sampling (Surface Array Only):
Surface Array probes can be used with or without an encoder. When used with an encoder, the sample density can be controlled by the encoder to provide a constant data density regardless of the scan speed.

Sample Rate:
This sets the data density (samples/unit of length) or data rate (samples/second) depending on the encoder setting.

If encoder sampling is turned ON, the desired data density is set in terms of samples/unit of

length. Changes in speed will not affect the data density since the encoder will regulate this. The instrument will display the maximum scanning speed based upon the selected data density. If this speed limit is exceeded while scanning, the speed readout in the upper left-hand corner of the acquisition display will turn red.

If encoder sampling is turned OFF, the desired data rate is set in terms of samples/second. Since this rate is constant, speed changes will affect the data density. The formula to calculate the data density is:

$$Data\ Density = \frac{Sample\ Rate}{Scanning\ Speed}$$

The maximum sample rate is a function of the test frequency. For test frequencies below 100 kHz, the maximum possible sample rate may be automatically limited. If this is the case, a message will be displayed saying the sample rate changed.

Data Buffer Size:

The data buffer is a temporary storage for the acquired data. If using an encoder, the buffer size is measured in distance, otherwise it is measured in time. The size of this buffer can be adjusted from 10 cm to 1000 cm or 5 seconds to 60 seconds. The data stored in this buffer is displayed in the bottom portion of the Display screen.

V/H Scale Ratio:

The vertical and horizontal gain (scale) can be fixed to a 1:1 ratio or be independently adjusted. If set to independent, then the center control button is used to toggle between independent or uniform adjustment.

Auto Rotate/Scale Mode (Surface Array Only):

There are several options for automatically rotating and scaling array data. The following are descriptions of each option.

- Independent Per Coil – Each channel is calibrated independently for both phase and scale. The signal to be used to set the phase and rotation must be seen by all coils. An example of this method is using a long transverse groove which is seen by all coils. This groove signal will be used to set both the phase and scale of all channels. This will provide the most accurate calibration since each channel is calibrated using independent signals.
- Single Scale – Each channel is calibrated independently for phase, but only the displayed channel is calibrated to the desired scale value. The rest of the channels are set to the relative scale value of the display channel. The signal to set phase needs to be seen by all coils (same as independent per coil), but the signal used to set scale needs only to be seen by the channel being used for calibration. An example of this method is using the liftoff signal, which is seen by all coils to set phase, and then using

an EDM notch seen by one coil to set the scale. The other channels not being displayed will set their scale relative to the channel being displayed. This is the most likely setting as it is common to set phase (such as liftoff or a groove), but a small flaw is used to set the scale.

- Single Rotation and Scale – Only the displayed channel is calibrated to the desired phase and scale value. The rest of the channels are set to the same rotation and relative scale value as the calibrated channel. An example of this method is using an EDM notch seen by one coil. That channel will have its phase and scale calibrated to the EDM notch. The other channels will have the same channel rotation value as the display channel. Their scale will be set relative to the display channel.
- (**Note**: Phase and rotation values are not the same thing. Phase refers to the angle of the signal and is displayed at the bottom of the impedance display. Rotation value refers to the instrument's rotation and is displayed next to the channel number at the top of the impedance display.)

Auto Rotate Orientation:

The desired phase value of the calibrated signal. This is usually set to zero degrees on the liftoff signal, but it could just as well be set to 60 degrees on the groove signal.

Auto Scale Defect Height:

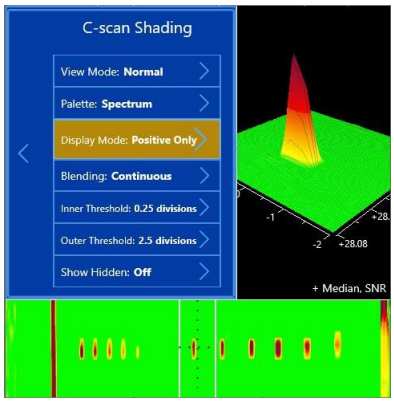
The desired vertical height, in divisions, of the calibrated signal.

Notes:

- Since this is vertical height, it is important that the phase has already been calibrated.
- Do not use auto scale on a signal which is nearly horizontal as it will expand the signal vertically.

Auto Scale Defect Width (Independent Scale Mode Only):
The desired horizontal length of the calibrated signal. When the V/H Scale Ratio is locked to a 1:1 ratio, this option is not available since it will be determined by the vertical height calibration.

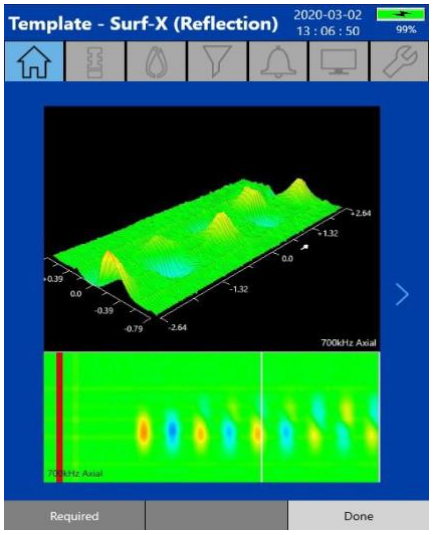
C-scan Shading (Surface Array and Bolt Hole Only):
Shading options for the C-scan display. This menu option can also be accessed by double-clicking on the 3D C-scan display. (See Working Examples ->C-scan shading for more information.)

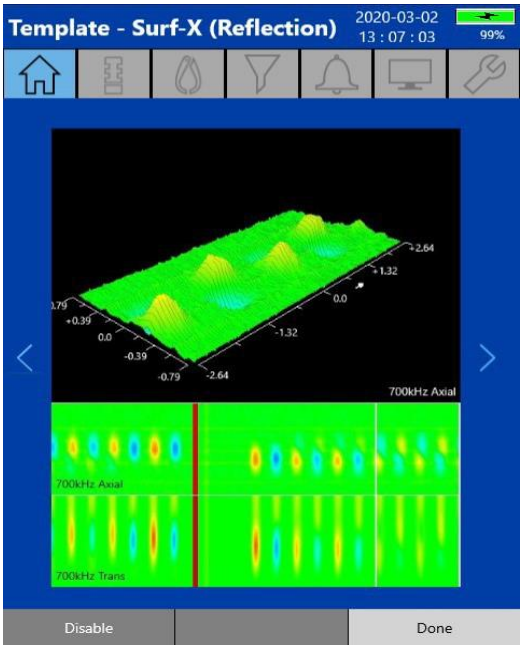


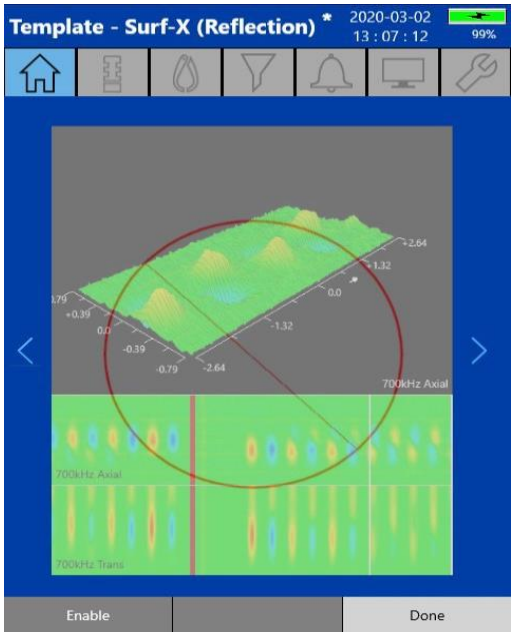
Double tap on the 3D C-scan brings up the C-scan shading menu

Acquisition Displays:
The MIZ-21C provides many display options while acquiring data. There are different display options for different applications. These displays can be enabled or disabled for the current technique.

Some displays are required and cannot be disabled. This is indicated in the lower left context menu button.







The optional displays can be enabled and disabled by the lower left context menu button.

Access:

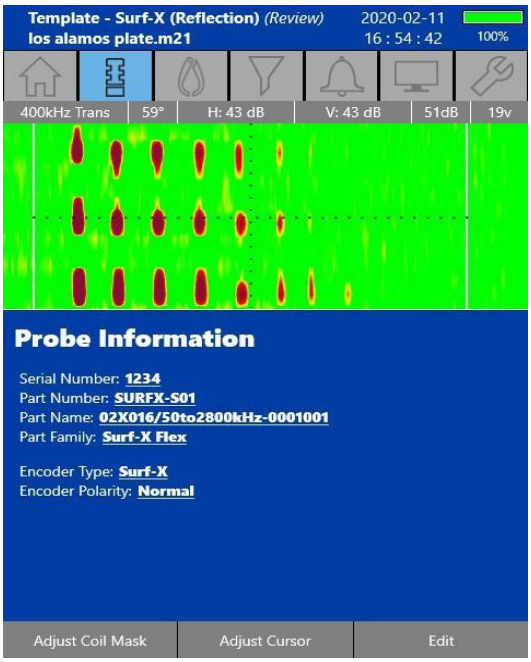
All techniques can be locked to prevent inadvertent changes from being saved. All technique templates are locked and cannot be unlocked.

Ch. (Channel Number and Frequency):

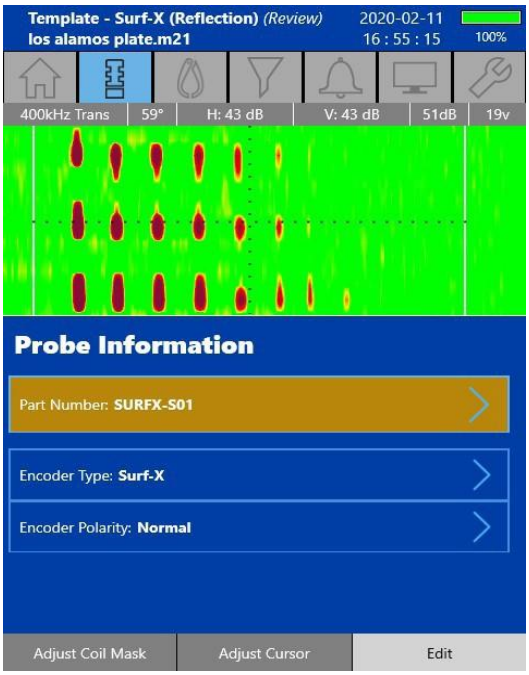
The number of channels depends on the type of application and the number of frequencies selected in the technique. The following parameters are set for each channel:

- Frequency - The selected frequency for this channel. Selectable from 5 Hz to 10 MHz. A frequency less than 100 kHz may be too low for the desired sample rate set above. If this happens, then the sample rate will change to the new maximum allowed and a message will appear saying the sample rate has changed.
- Drive – The selected drive voltage (volts peak to peak) for this channel. Select from 0 to 12 volts for most probes, and up to 19 volts for array probes.
- Filters – The applied filters for this channel. (See Software User Interface -> Filters for more information on the types of filters available.)
- Alarm – The alarm type that is applied to this channel. (See Software User Interface -> Alarms for a more information on the types of alarms available.)

Probe Information



Surface Array Applications have an additional screen mode called Probe Information. This screen displays critical information about the probe as well as the encoder settings. This information is automatically populated from the connected probe's ID chip. However, if this chip gets damaged or a different setting is desired, some of this information can be manually edited by selecting the Edit context menu.

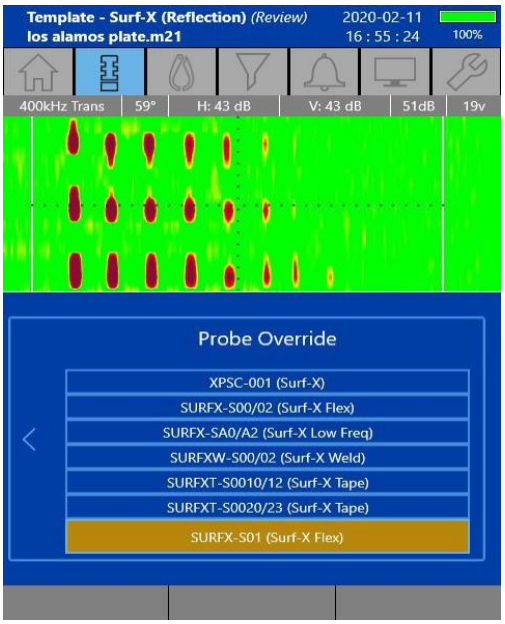


To edit the coil parameters, select the Edit context menu button. The parameters that can be edited will be displayed. Select from the available options.

Part Number – Defines the type of probe being used.

Encoder Type – Defines the type of encoder being used.

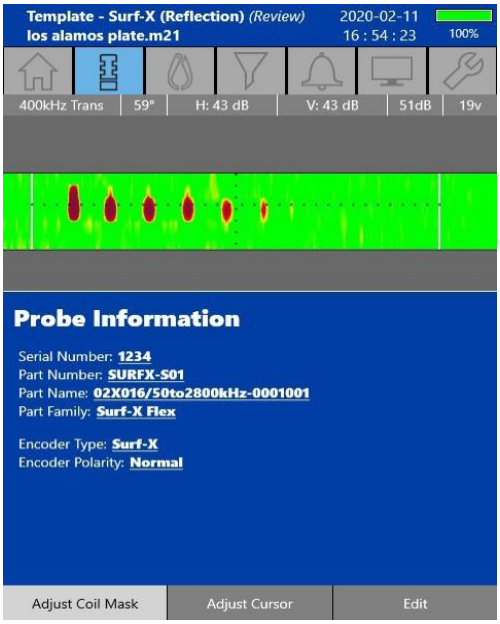
Encoder Polarity – Defines the orientation of the encoder.



The probe part number defines the type of probe being used. This will determine how the data is being displayed on the screen. In most circumstances, there is no need to change the setting, however, there are times when changing the settings is necessary. For example, if you are using a Surf-X Weld probe, but the +Point coils will not be needed, the Surf-X Flex setting can be selected so that the +Point channels will not be displayed.

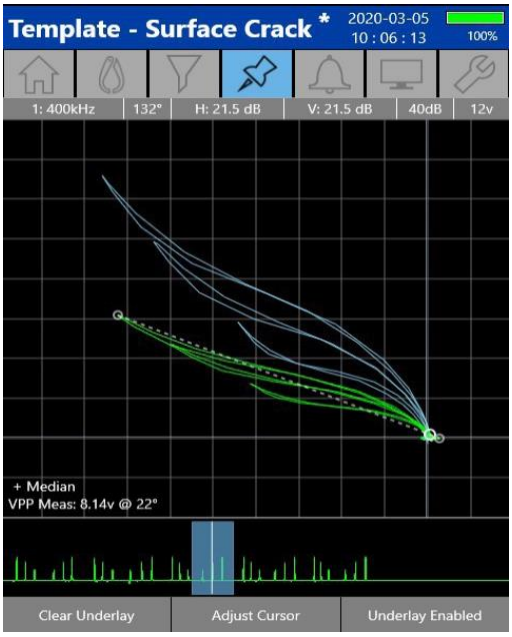
Note: The probe part number must match what is selected in the Probe field in the technique parameters. If not, then a probe mismatch message will appear once Start/Stop Acquire is pressed.

The Encoder Polarity is defined by the orientation of the encoder. If the encoder's USB connector is on the same side as the USB connector of the Electronics Module, the polarity is normal. If it is on the opposite side, the polarity is reversed.



Coil Mask: This option is used when data from only a portion of the array coils is required. Examples include scanning over a surface where some of the coils are off an edge or when it is only required to inspect a smaller portion than what the entire probe covers.
When Adjust Coil Mask is pressed, the top and/or bottom edges of the C-scan display can be dragged to hide the unwanted coils from the display.

Underlay

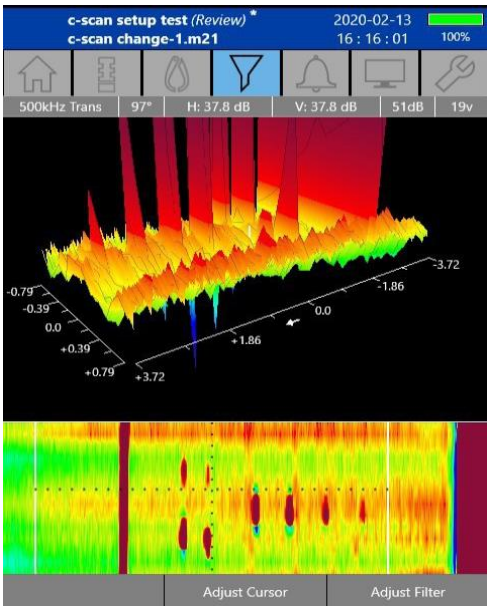


Underlay is a reference signal that can be captured and displayed under the active data for comparison purposes.
To use this tool, verify that it is enabled by selecting the corresponding context menu. Then start to acquire and scan the reference piece to capture the underlay signal.

Once the desired signal is captured, stop acquire and select Save Underlay. The underlay signal will be displayed in blue. When acquire is started again, the underlay signal will be displayed under the active data.

To delete the underlay signal, select Clear Underlay. To remove it from the display, toggle the Underlay Enabled button to disable it. The underlay signal can be re-enabled at any time, but once it is cleared, it must be recaptured.

Filters



The MIZ-21C comes with a variety of software filters that can be applied to improve the display and resolution of the data. These filters can be turned off at any time to display the data in its raw form.

To activate filters, go to the Filter Screen and select the Adjust Filter Context menu button.

Figure 4-3

The following are brief descriptions of the various filters that are available on the MIZ-21C.

Median Filter:

The median filter removes background drift from the eddy current signal. Here are some examples of how the median filter can be useful:

- Array probes: Evening out liftoff signals when inspecting complex surfaces.
- Pencil probes: Maintaining a stable operating point.
- Bolt holes: Removing horizontal noise due to out-of-round holes.

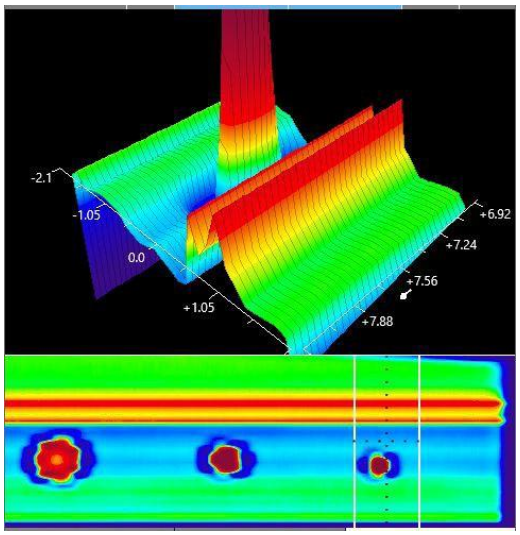
User Parameters:

- Median Filter Length: The window size the filter uses to normalize the data. The units are a distance value if using an encoder or Hz if not using an encoder.

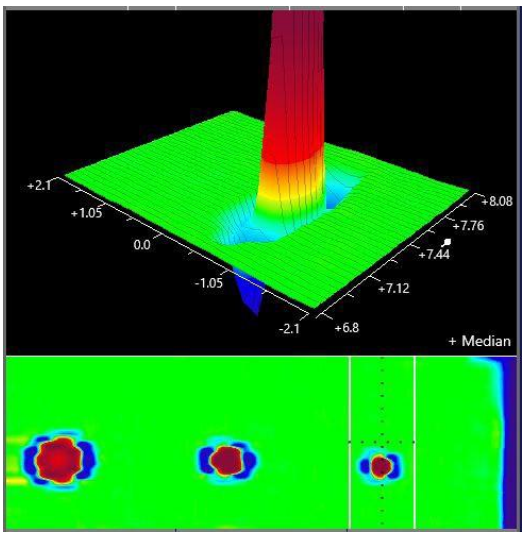
Notes:

- The filter length needs to be at least two times the length of the expected flaw length. If not, the flaw signal will become attenuated. If you are not encoder sampling, then the probe speed must be fast enough that a flaw signal does not approach the filter length (in Hz).

- On the initial start of a scan, there will be a delay equal to the filter length of when you will see data on the display. For example, if the filter length is set to 5 inches, you will not see data in most of the displays until 5 inches of data has been collected.



No median filter



Median filter applied

Highpass-1 Filter:

Highpass-1 filter cuts off the low frequency signals, allowing the higher frequency signals to pass through. This allows for filtering out low frequency noise from sources such as probe wobble, geometry changes, etc.

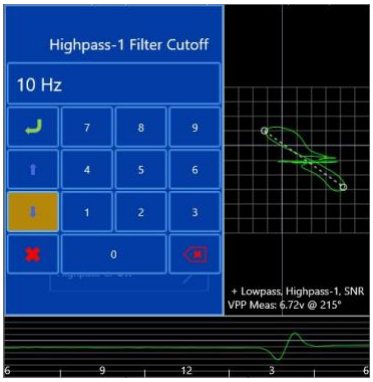
User Parameters:

- Filter Cutoff: The cutoff frequency (in Hz). All signals below this frequency will be reduced. The range is from 1 Hz to half the current sample rate.

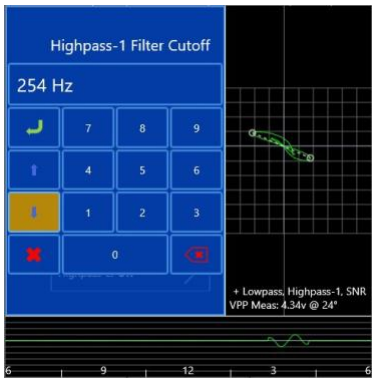
Notes:

- Hand scanning is typically done at a slower speed. Therefore, the cutoff value should be very low so the signal does not appear as a slow-moving signal which could be reduced by the Highpass-1 filter. In general, the median filter is a better filter to use than the Highpass-1 when hand scanning.
- Typically, the absolute maximum cutoff value is established by increasing the cutoff value to a point where the reduction of the signal of interest begins.

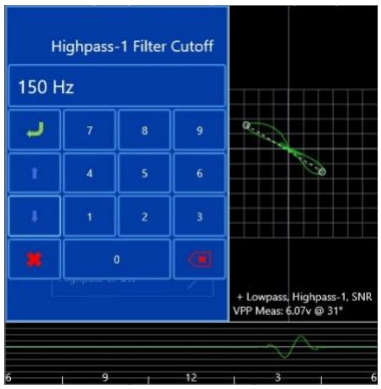
The following are graphics of the Highpass-1 Filter being set too low, too high, and optimally:



HP1 setting too low – Excessive noise



HP1 setting too high – Significant flaw signal reduction



Optimal HP1 setting – minimal noise without flaw signal reduction

Lowpass Filter:

A Lowpass Filter cuts off the higher frequency signals, allowing the lower frequency signals to pass. This allows for the filtering out high frequency signals such as electrical noise.

User Parameters:

- Filter Cutoff: The cutoff frequency (in Hz). All signals above this frequency will be reduced.
- The range is 1 Hz to half the current sample rate.

Notes:

- If a flaw is passed by very quickly, it will appear as a high frequency signal and it may be reduced by the lowpass filter. There is always a compromise when determining acceptable noise levels and being able to display flaw signals at higher scan speed.
- Typically, the absolute minimum cutoff value is established by reducing the cutoff value to a point where the reduction of the signal of interest begins.

Bandpass Filter:

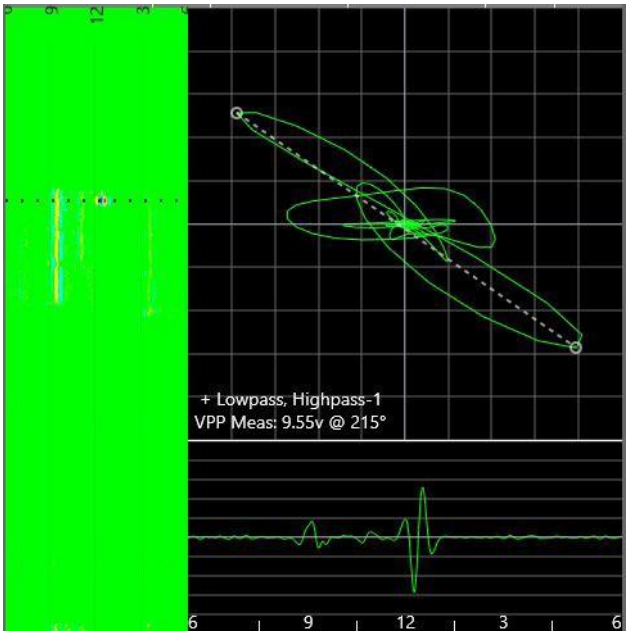
Alternative to setting both the Lowpass and Highpass Filters, a Bandpass Filter can be used. A Bandpass filter is a combination of a low and high frequency filter. The cutoff points for the low end and the high end can be set to define a frequency band that can pass through.

User Parameters:

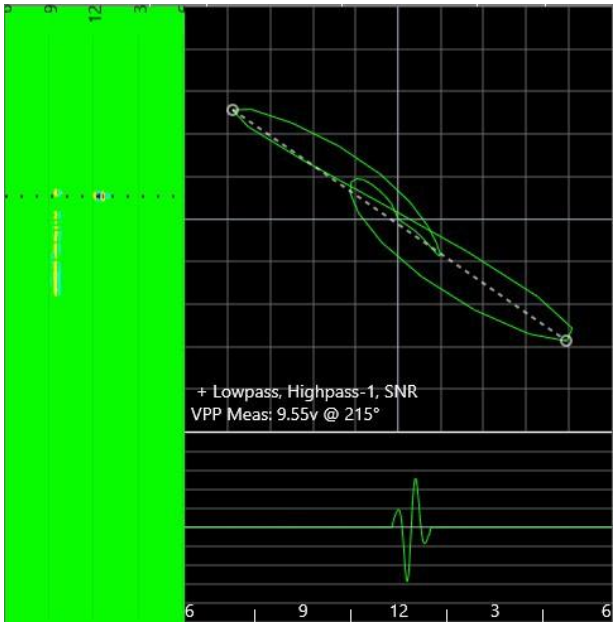
- Low Cutoff: Signals below this frequency will be reduced. This is like the Highpass-1 filter cutoff.
- High Cutoff: Signals Above this frequency will be reduced. This is like the Lowpass filter cutoff.

SNR Filter:

The SNR Filter is designed to remove low level noise below a signal to noise threshold while keeping the original signal of interest. An example of this is setting the limit to 1 division. This will remove all signals below 1 division, while keeping complete signals above 1 division. For signals above 1 division, the filter attempts to identify and keep the beginning and ending parts of the signal, even if they are below 1 division. In this way the complete signal is retained.



No SNR applied.



With SNR applied with a threshold of 1 division

Figure 4-4 The amplitude of the signal of interest remains (9.55 volts) the same but the low-level noise has been removed.

User Parameters:

- Filter Length: Sets the amount of data being evaluated for the filter. A higher setting results in more aggressive filtering of baseline signals. This is in units of data points (DP).
- SNR Limit: The vertical (Vert Max from Null) threshold of what signals to keep. The unit depends on the *Measurement Mode* setting in the Tool menu:
    - If the mode is set to Raw Voltage, the units are Divisions
    - If the mode is set to Scaled Voltage, the units are Volts (Vert Max from Null). In Scaled Voltage, 1 volt = 1 division.

Notes:

- Since the threshold is the vertical limit, any change to the channel's rotation or gain will affect which signals get filtered, therefore, the SNR filter should only be applied after signal calibration.

- If the limit is set to No Limit, the filter behavior changes to a typical spike filter. The filter attempts to remove short period, spike-like signals from the data.
- The SNR filter should be turned off when troubleshooting so all data can be displayed.
- Ensure there is enough headroom between signals to be kept and noise to be removed. If the signal to noise ratio of the data is low, it is recommended that this filter not be used as there will be a minimal difference between noise and signals of interest.

Highpass-2 Filter:

This filter is designed to enhance signals of interest while minimizing slower moving or lower frequency signals. The user sets the approximate peak to peak length for the filter to enhance. For a differential type signal, the output signal of this filter will appear as a reverse figure 6 with a higher amplitude.

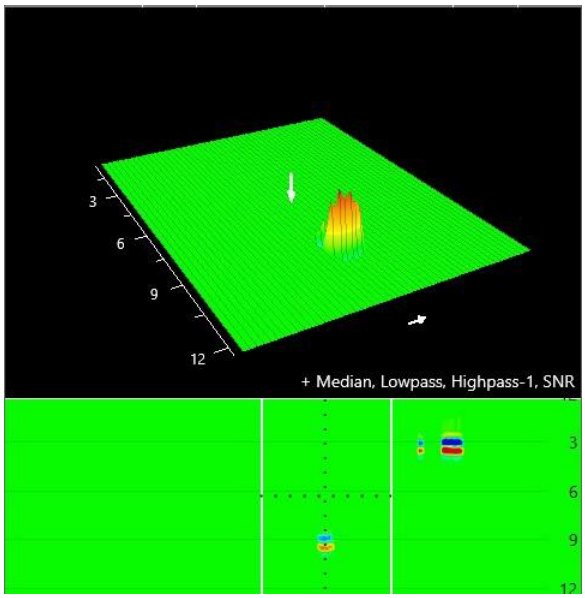


Figure 4-5 Bolt hole data without HP2 applied

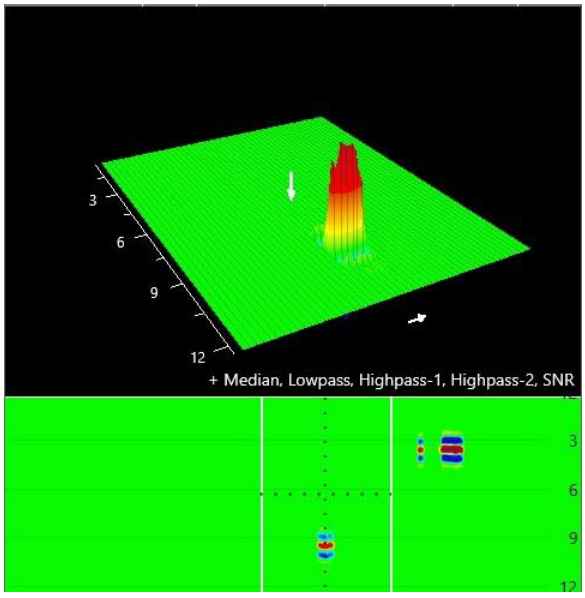


Figure 4-6 Bolt hole data with HP2applied

User Parameters:

Filter length: The length, in data points (DP), of the peak-to-peak signal of interest.

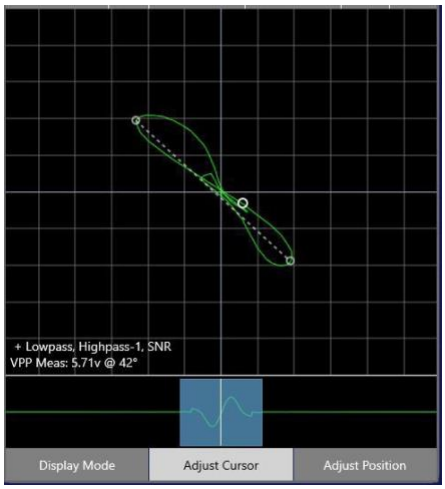


Figure 4-7 Length data points

The Adjust Cursor button can be used to count how many data points there are between peaks. In the above graphic, there are approximately 18 data points between peaks, therefore a setting of around 18 DP will yield the best results. When choosing the appropriate setting, it is not necessary to count the data points. It is recommended to start with a data point value of 1 and then increase it until the signal reaches maximum amplitude.

Please refer to the example graphics below.

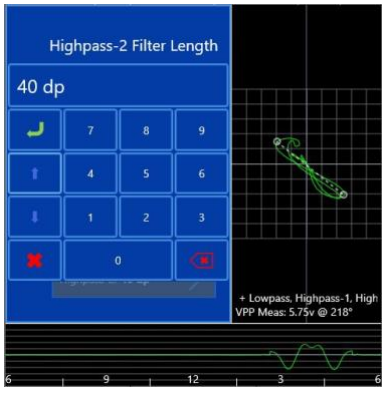


Figure 4-8 HP2 set too low – Significant signal attenuation

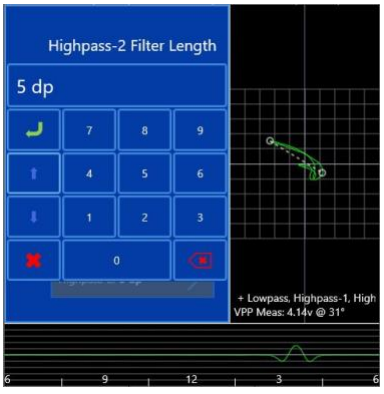


Figure 4-9 HP2 set too high – Signal artifacts being generated

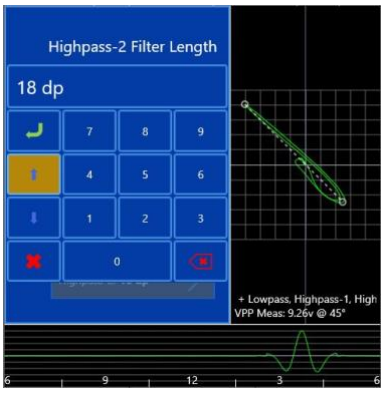


Figure 4-10 Optimal HP2 setting – Maximum amplitude and straight signal applied

Notes:

- The figure 6 signal has a well-defined end. This type of signal allows for a more accurate phase measurement.
- If the value of the filter length is significantly less than the peak to peak of the signal of interest, the signal may be reduced.

Alarms:

Alarms can be enabled and disabled from the Alarm tab. Choose between three different types: Rectangular, Vertical Only, and Polar. Also, the alarm can be activated when the data is either inside or outside the alarm area.

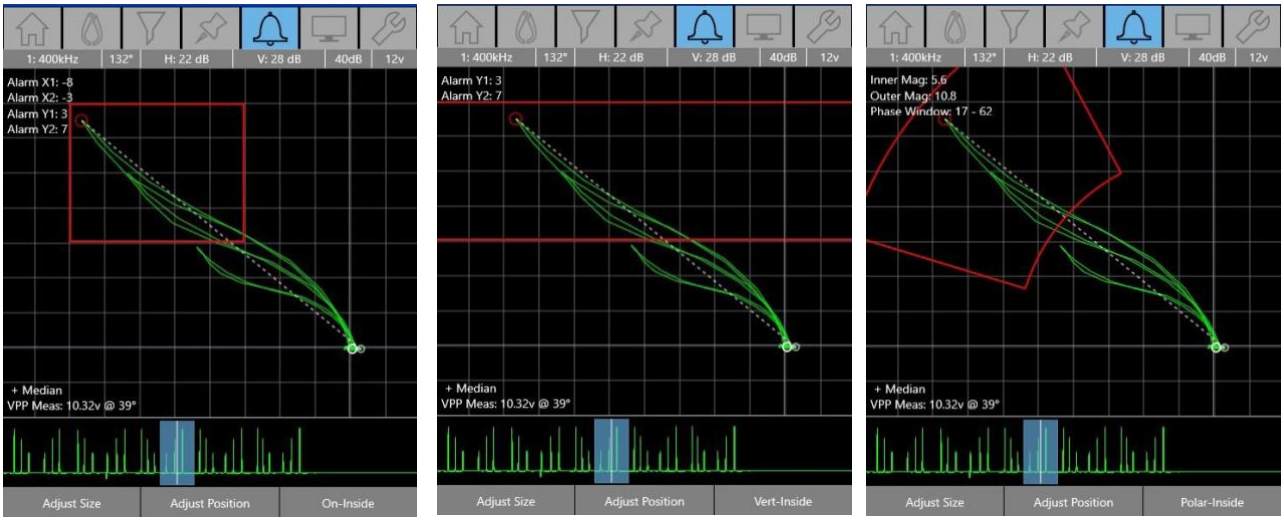


Figure 4-11 Three different types of alarms

If a circular alarm area is needed, this can be done by modifying the Polar alarm. Extend the sides all the way around and reduce the Inner Mag to Zero. This type of alarm is useful when working with eddy current signals that have both a positive and a negative component allowing for the alarm to trigger on either side of the signal.

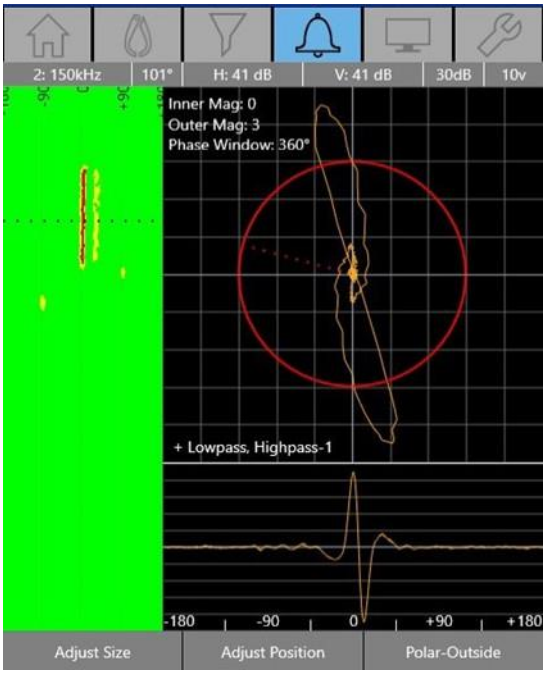


Figure 4-12 Circular alarm

When the alarm is triggered, there is an audible sound that can be heard through a small speaker on the instrument. A Bluetooth headset or speaker can be connected to the instrument to improve the audio. This option is available in the Tools menu.

There is also a visual cue when the alarm is triggered. The channel that is alarming will be highlighted in red and a red boundary will appear in the display.

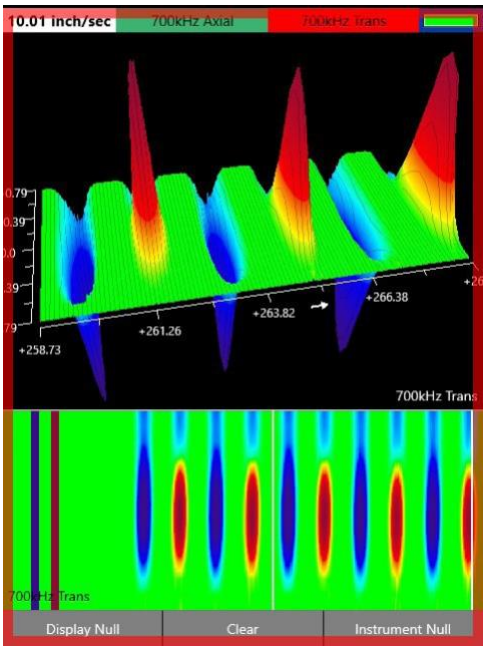


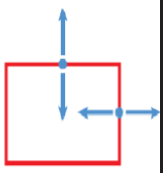
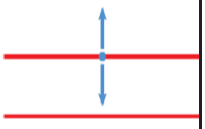
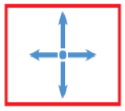
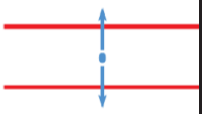
Figure 4-13 Visual alarm cue

Alarm controls:

Action	Button
Change alarm type (Vertical only, Rectangular, Polar)	Center Select button (an alarm must be already turned on)
Change if alarm triggers when signal is inside or outside the alarm area	Right context button
Turn alarm on	Right context button

These controls can also be set in the technique for each channel.

Alarm Area Adjustments:

Desired Action	Alarm Type	Touch Screen	Control Button	Picture
Adjust Size	Rectangle	Single tap and drag the edge of the alarm area.	Select the Adjust Size context menu button. Use the Up/Down control buttons to adjust the vertical size of the alarm area. Use the Right/Left control buttons to adjust the horizontal size of the alarm area.	
	Vertical Only	Single tap and drag the edge of the alarm area.	Select the Adjust Size context menu button. Use the Up/Down control buttons to adjust the vertical size of the alarm area.	
	Polar	Single tap and drag the edge of the alarm area.	Select the Adjust Size context menu button. Use the Up/Down control buttons to adjust the Outer Magnitude. Use the Right/ Left control buttons to adjust the spread of the phase window.	
Adjust Position	Rectangle	Single tap and drag from inside the alarm area.	Select the Adjust Position context menu button. Use the Up/Down control buttons to adjust the vertical position. Use the Right/ Left control buttons to adjust the horizontal position.	
	Vertical Only	Single tap and drag from inside the alarm area.	Select the Adjust Position context menu button. Use the Up/Down control buttons to adjust the vertical position.	
	Polar	Single tap and drag from inside the alarm area.	Select the Adjust Position context menu button. Use the Up/Down control buttons to adjust the radial position. Use the Right/ Left control buttons to rotate the phase window.	

Conductivity and Thickness Alarms:

The alarms for the Conductivity and Thickness application are different from the normal alarm feature since it only requires an upper and a lower limit. Therefore, there is no alarm box to configure, just values for the upper and lower limits. To configure the alarms for Conductivity and Thickness measurements, turn the alarms on from the Alarms tab, and set the upper and lower limits for each alarm.

Figure 4-14 Conductivity and thickness alarm

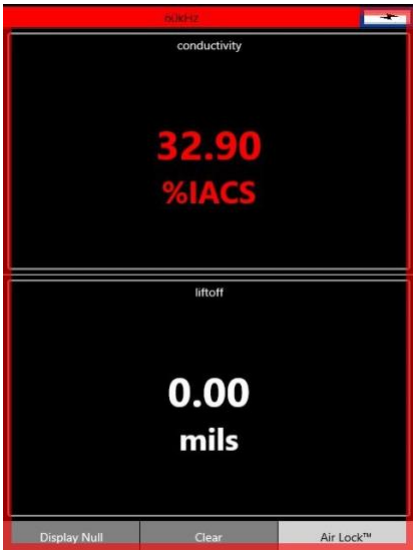
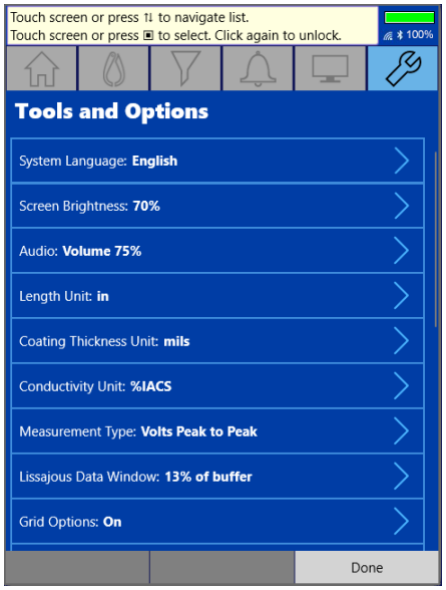


Figure 4-15 Visual cues

When the alarm is triggered, there is an audible sound that can be heard through a small speaker on the instrument. A Bluetooth headset or speaker can be connected to the instrument to improve the audio. This option is available in the **Tools** menu.

There is also a visual cue when the alarm is triggered. The channel that is alarming will be highlighted in red and a red boundary will appear in the display.

MIZ-21C Tools Menu



The Tools Menu provides a collection of tools and options to operate the MIZ-21C. Some options are specific to application types. Below is a brief description of the Tools Menu features.

System Language

The MIZ-21C offers several user language choices and can be set under this menu item.

Screen Brightness

Controls the backlight screen brightness. The MIZ-21C system will also auto dim the screen to different levels based on inactivity.

Audio

Sets the volume for alarms and prompts when used.

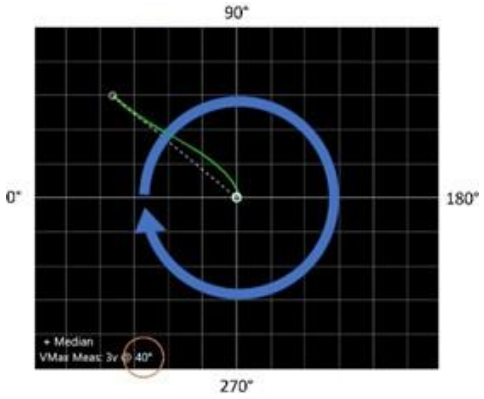
Length Unit
Sets the unit of measure for linear references.

Coating Thickness Unit
Sets the unit of measurement for conductivity shim thickness settings displayed values for coating thickness.

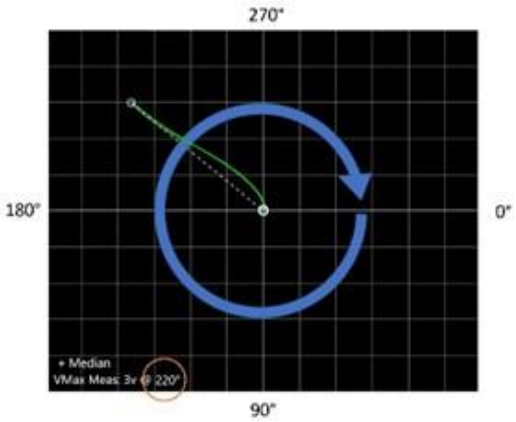
Conductivity Unit
Sets the scale standard in %IACS or MS/m (MegaSiemens per meter) for conductivity values.

Display Scale Unit
Sets the units of measure for the digital display scale in dB or mV/div (millivolts per division).

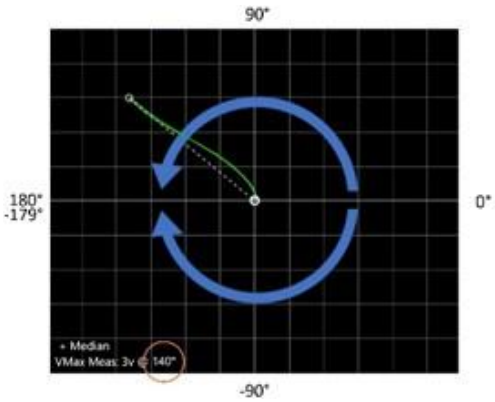
Angle Mode
Sets the zero-degree position on the impedance plane and if angle measurements are on a 0-to-360-degree scale or 0 - ±180 degrees scale. The default is the ASME method. The following pictures illustrate the different modes. Note the measured angle measurement in the orange circle in each picture.



ASME



ASME Inverted



EDF

Each of the modes have a Fine selection. When a Fine selection is selected the phase measurements and adjustments are in 0.1-degree increments.

Measurement Type

Select the type of measurement method from the following list:

- **Vert Max** – measures the voltage of the maximum vertical component of the signal in the data window.
- **Volts Peak to Peak** – measures the voltage at the two peak points of the signal in the data window.
- **Vert Max from Null** – measures the voltage of the largest maximum vertical component of the signal from the null point.
- **Volts Peak from Null** – measures the voltage of the largest peak of the signal from the null point.
- **Cursor Info** – measures the voltage and phase of the cursor position from the null point.

Measurement Mode

Sets the measurement mode between a scaled voltage mode (1 volt/division) or the eddy current signal's raw voltage at the connector pin, +/- 10 volts.

Display Measurement

Choose when to display the measurement information from three options:

- **Always –** displays the measurement information.
- **Measurement Mode Only –** displays the measurement information only when in Measurement screen.
- **Measurement Mode or Calibrating –** displays the measurement information when in the Measurement screen or in the Calibration tab.

Data Persistence (For Applications Not Using a C-scan)

Sets the time duration of the Data Window or the amount of data that will be displayed in the Data Display screen. Setting this to Manual Clear will effectively turn the Persistence off.

Holding down the Clear button while acquiring data will also bring up this persistence screen:

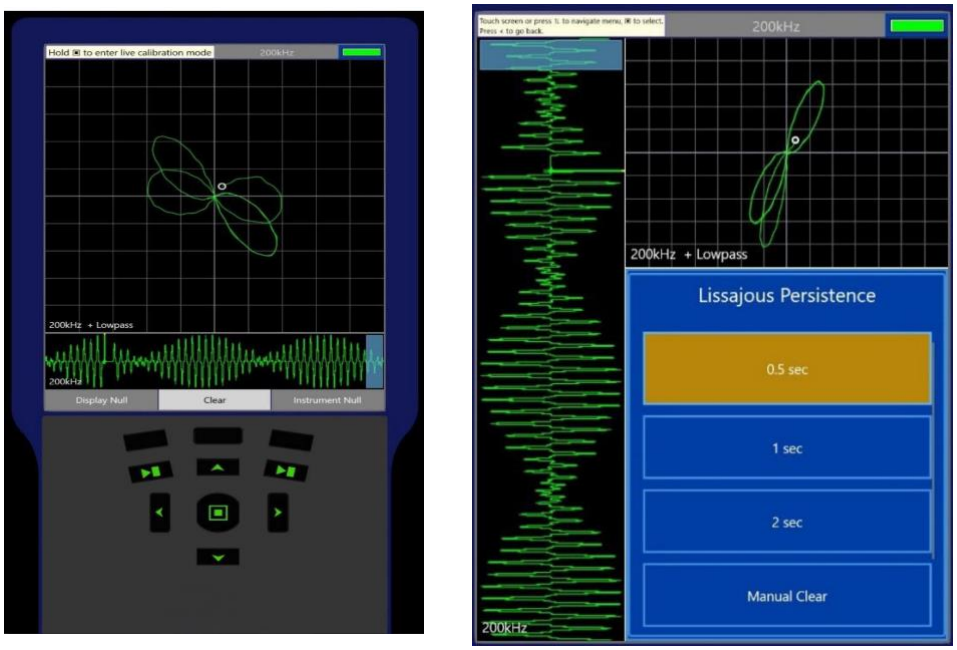


Figure 4-16 Lissajous persistence

C-scan Persistence (For C-scan Applications)

Sets the amount of data in the 3D C-scan. Also known as Data Persistence. This is in units of distance if using an encoder or units of seconds if not using an encoder. Adjusting the white goal post lines in the 2D C-scan also adjusts this value.
Holding down the Clear button while acquiring data will also bring up this persistence screen.

Grid Options

Options for how the gridlines are displayed:

- Off
- 10 x 10 – Fixed 10 grid divisions horizontally and vertically. There will be unused space on the sides of the screen for some displays.
- Fine – Fixed 10 grid divisions vertically. The number of horizontal grid divisions will vary so that the whole screen is used, regardless of what display is being shown.
- Coarse –This has half the number of divisions than Fine.

Note: When divisions are used as a unit of measure (such as the SNR filter and C-scan Shading Thresholds), the measurement is still based upon the Fine grid. For example, if the C-scan Shading Outer Threshold is set to 1 division, this is shown as 0.5 divisions when in Coarse mode.

Acquisition Direction

Flips the direction of how C-Scan and data buffer windows scroll data onto the screen depending on operator preference.

Array Coil Orientation (For Surface Array Applications)

Sets the direction of travel for a surface array probe when encoder sampling is turned on in the technique.

C-scan Tick Display (For Bolt Hole Applications)

Sets the circumferential units of measure for a rotating scan. The options are Degrees or Clock.

Write To

Sets the location where the data will be saved, either to the internal drive storage or to an externally attached USB drive.

Touch Screen
The touch user interface mode of the display can be enabled or disabled.

Connectivity
Options to configure Network, Bluetooth, and Remote Displays.

Hardware Diagnostics
The MIZ-21C has built-in hardware diagnostics to test system performance. Diagnostics performs checks of many features without the need for external equipment. The Diagnostics (18 & 26-Pin) and Surface Array (Probe) diagnostics require the addition of a hardware load plug or a surface array probe, which places an impedance load on the system to test a greater portion of the system. Any of the diagnostic tests will provide visual feedback during execution and a viewable report when complete.

File Management
Screenshots and data files from the internal storage can be recalled or deleted. When a USB device is connected, the following additional options are available:

- Internal screenshots and data files can be copied to the USB device. Screenshots and data files stored on the USB device cannot be copied to the internal storage.
- Screenshots and data files on the USB device can be recalled.
- Techniques can be exported and imported. A master technique can be created on one instrument and then it can be copied to other instruments.
- Diagnostic logs can be copied to the USB device.

Material List
Provides a list of common materials and their conductivity values.

System Updates

System Updates provides several functions:

1. Adjusts the data and time settings of the operating system.
2. Updates Software and Firmware using updates provided by Eddyfi Technologies on a USB drive.
3. Use Factory Reset with caution.

Caution!

If you engage Factory Reset, all user applied changes to the system settings will be reset. All your data files, screenshots, and customized techniques will be deleted.

Status and Information

This option provides a report of current version numbers of the operating system, software, firmware, and FPGA program for the MIZ-21C. The current runtime of the system and temperatures of critical components are also displayed.

Display Dimming Timeout

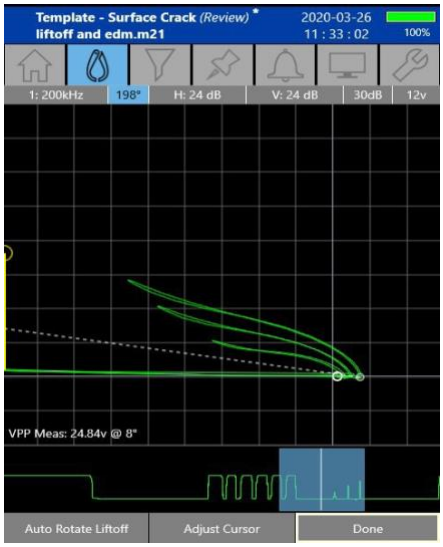
Sets the time duration the display is required to be idle before it goes to sleep. Default value is 5 minutes.

5. Working Examples

Calibration Tutorial

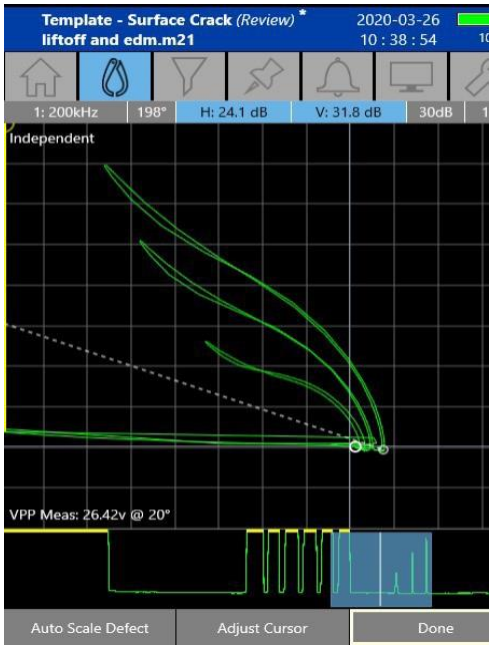
Calibrations can be performed in live acquisition mode or in the data review mode. Calibrations performed in Data Review mode are done on the actual raw data. Therefore, the changes will be accurately reflected during acquisition.

Calibrating Non-Array data (Review Mode):



Acquire the calibration signal, then press the Start/ Stop button to review the data. Locate the signal of interest within the Data Window.

On the calibration screen, select the Adjust Rotation context menu. The context menu options will change, and the H and V scale displays will be highlighted as shown in the example on the left. Use the Up/Down (fine) and Left/Right (coarse) control buttons to adjust the rotation of the signal. Alternately, use the Auto Rotate Liftoff button to rotate the signal to the value set in the Technique options. Normally, this would be set to Horizontal, and the liftoff signal would be used to set the rotation.



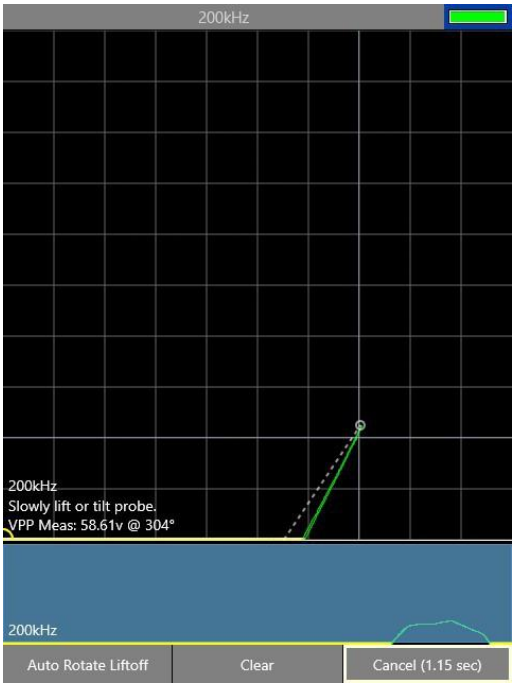
Next, adjust scale by selecting the Adjust Scale context menu. The context menu options will change, and the H and V scale displays will be highlighted as shown in the example on the left. Use the Up/Down and Left/Right control buttons to adjust the scale of the signal.

The scale can be adjusted uniformly (adjusting the horizontal and vertical scale simultaneously) or independently. The adjustment mode is displayed in the upper left corner of the Impedance display. You can toggle between the two modes by pressing the center Select button.

The scale can also be locked to a 1:1 ratio by selecting this in Technique options.

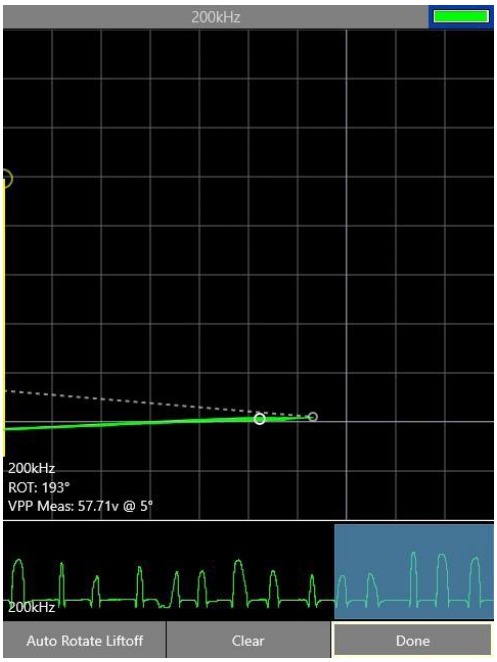
Alternately, use the Auto Scale Defect button to automatically adjust the scale to the value set in the Technique options. Place the signal to be scaled inside the data window and select the Auto Scale Defect context menu button.

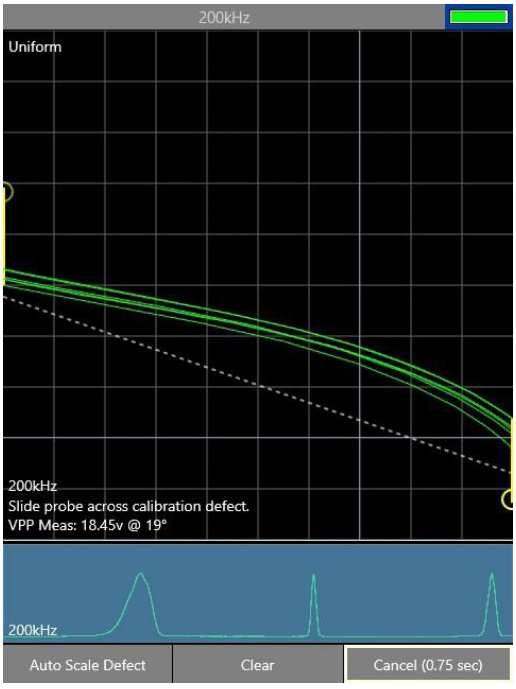
Calibrating Non-Array Data (Live Mode):

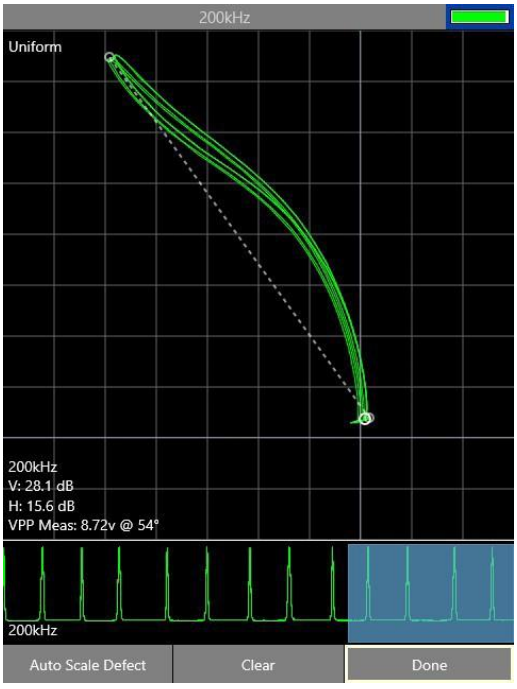


During acquisition, enter into and out of live calibration mode by holding down the center Select button. The context menu buttons will change to calibration mode. Select Adjust Rotation and use the up/down (fine) and Left/Right (coarse) control buttons to adjust the rotation.

Alternately, use the Auto Rotate button to automatically rotate the signal to the value set in the technique options. Normally, this would be set to Horizontal and the liftoff signal would be used to set the rotation. In live mode, the desired signal must be captured within 3 seconds to use for rotation. The operation can be cancelled within 3 seconds.







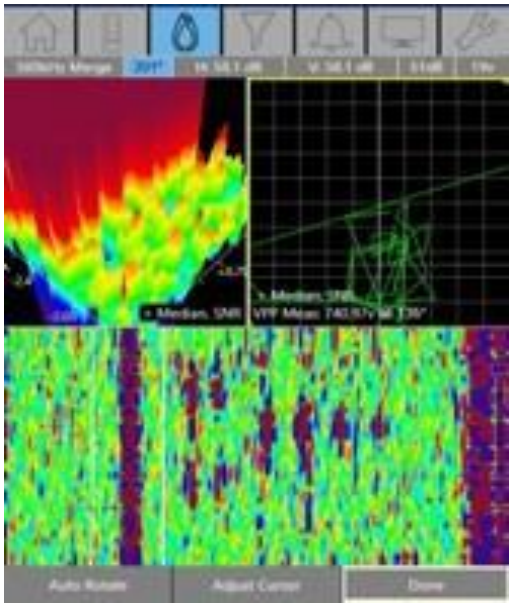
Next, adjust scale by selecting the Adjust Scale context menu button. Use the Up/Down and Left/ Right control buttons to adjust the scale of the signal.

The scale can be adjusted uniformly (adjusting the horizontal and vertical scale simultaneously) or independently. The adjustment mode is displayed in the upper left corner of the Impedance display. You can toggle between the two modes by pressing the center Select button.

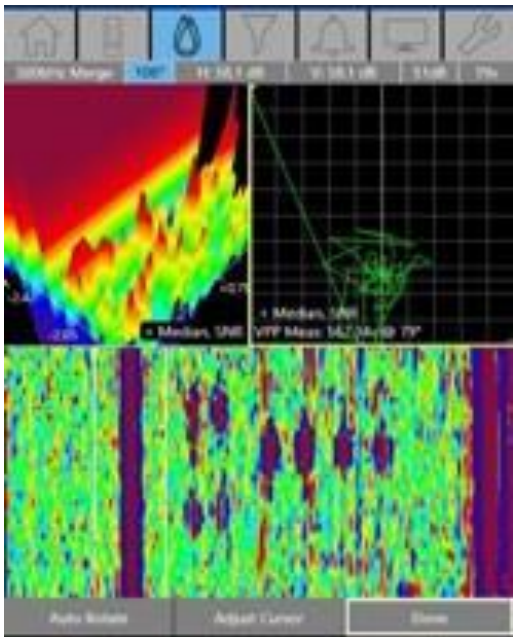
The scale can also be locked to a 1:1 ratio by selecting this in Technique options.

Alternately, use the Auto Scale Defect button to automatically adjust the scale to the value set in the Technique options. In live mode, the desired signal must be captured within 3 seconds to use for rotation. The operation can be cancelled within 3 seconds.

Calibrating Array Data (Review Mode):



Before Rotation



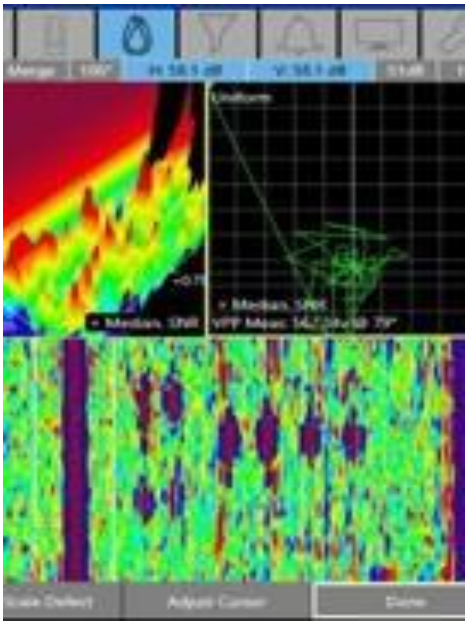
After Rotation

Figure 5-1 Before and after rotation

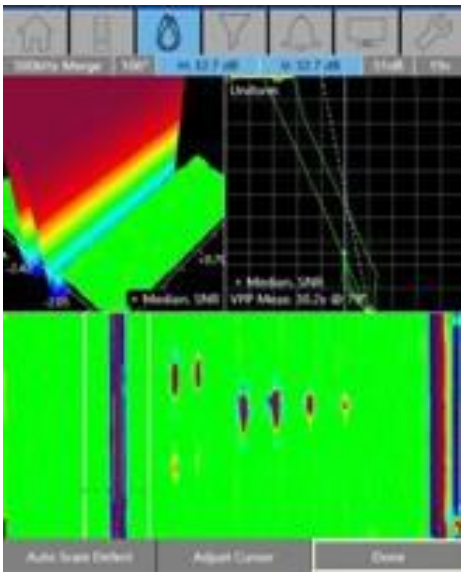
Acquire the calibration signal, then press the Start/ Stop button to review the data. Locate the signal of interest within the Data Window.
(**Note**: Ensure that only the calibration signal is inside this window. Other signals inside this window may interfere with the calibration.)

On the calibration screen, select the Adjust Rotation context menu. The context menu options will change, and the rotation display will be highlighted as shown in the example on the left. Use the Auto Rotate Liftoff button to rotate the signal to the value set in the Technique options. Then use the Up/Down (fine) and Left/Right (coarse) control buttons to make additional adjustments.

(**Note**: Manual adjustments will apply to all the channels at the same time. Therefore, Auto Rotate should be used initially to set the rotation of all channels to the same value.)



Before Scale



After Scale

Figure 5-2 Before and after scale

Next, adjust scale by selecting the Adjust Scale context menu. The context menu options will change, and the H and V scale displays will be highlighted as shown in the example on the left.

Use the Auto Scale Defect button to automatically adjust the scale to the value set in the Technique options. Then use the Up/Down and Left/Right control buttons to adjust the scale of the signal.
(**Note**: Manual adjustments will apply to all the channels at the same time. Therefore, Auto Rotate should be used initially to set the scale of all channels to the same value.)

Adjust the scale uniformly, either by adjusting the horizontal and vertical scale simultaneously or independently. The adjustment mode is displayed in the upper left corner of the Impedance display. You can toggle between the two modes by pressing the Select button.

The scale can also be locked to a 1:1 ratio by selecting this in technique options.

Calibrating Array Data (Live Mode):

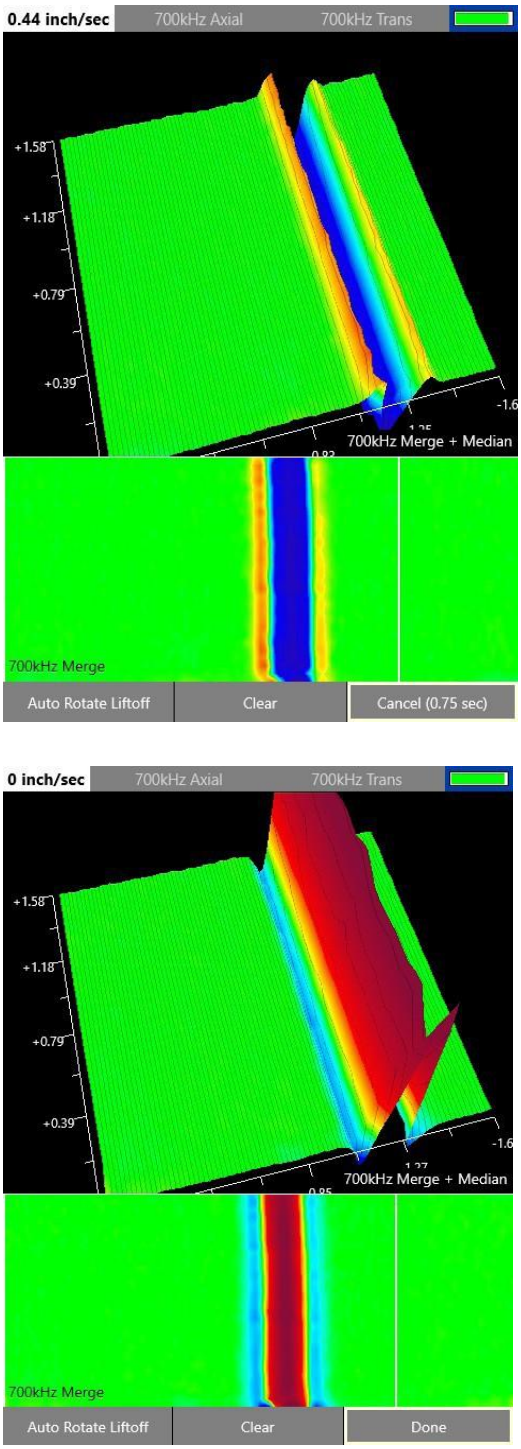


Figure 5-3 Live mode – data array

During acquisition, enter into and out of live calibration mode by holding down the Select button. The context menu buttons will change to calibration mode. Select Adjust Rotation and use the up/down (fine) and Left/Right (coarse) control buttons to adjust the rotation.

Alternately, use the Auto Rotate button to automatically rotate the signal to the value set in the technique options. For this example, the rotation setting was set to 60 degrees for the groove signal on the calibration plate. In live mode, the desired signal must be captured within 3 seconds to use for rotation. The operation can be cancelled within 3 seconds.

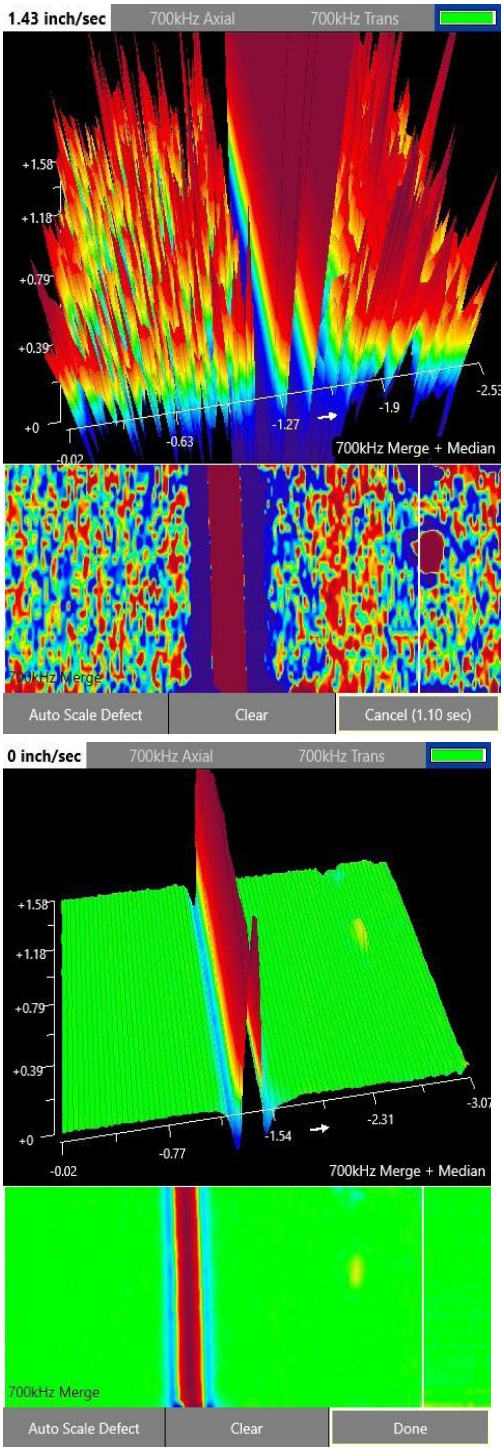


Figure 5-4 Auto scale defect

Next, adjust scale by selecting the Adjust Scale context menu button. Use the Up/Down and Left/ Right control buttons to adjust the scale of the signal.

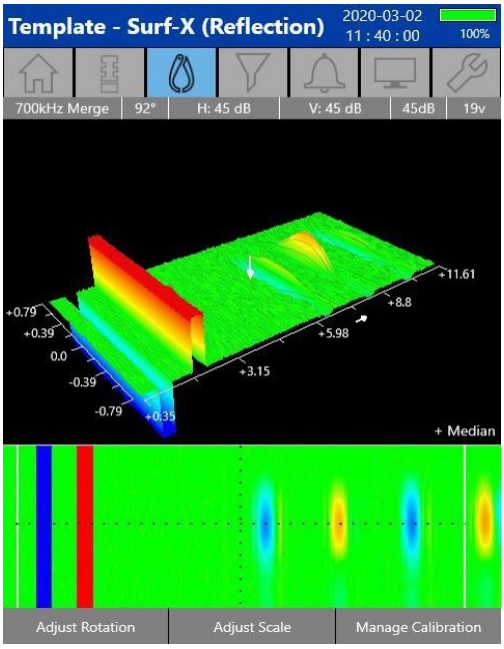
Alternately, use the Auto Scale Defect button to automatically adjust the scale to the value set in the Technique options (in this example, the scale height was set to 5 divisions for the groove signal on the calibration plate).

In live mode, the desired signal must be captured within 3 seconds to use for rotation. The operation can be cancelled within 3 seconds.

Note: If there are multiple channels, the calibration must be performed on each channel.

Note: Whenever calibration is performed, the rotation should always be adjusted before adjusting scale.

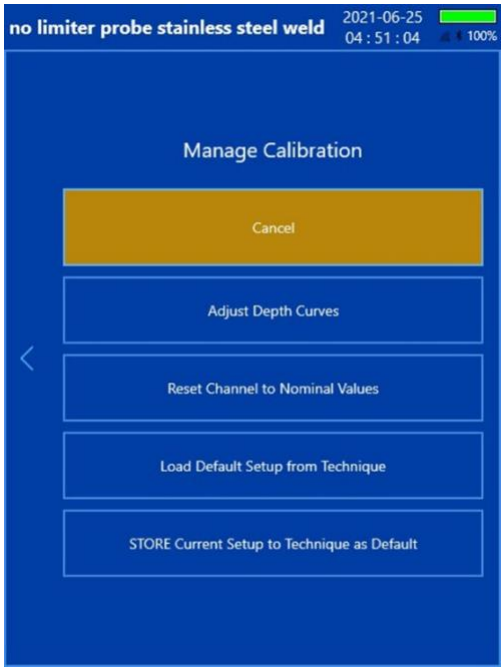
Manage Calibration



Manage Calibration provides several options for the calibration settings. Calibration settings as well as other non-technique parameters are part of the Setup. A Setup can be saved to a Technique, loaded from a Technique, or just reside in current memory.

A Setup consists of the following parameters:

- Channel rotation
- Horizontal/Vertical gains or scales
- Operating point
- Alarm box size
- Alarm box position
- Zoom amount (review only)
- Conductivity calibration points
- Bolt hole clocking position
- Whether the underlay is enabled or not
- Array C-scan blinders



Adjust Depth Curves – This option is for configuring a depth curve which can be more than one channel.

Reset Channel to Nominal Values – This option applies a factory calibration setting to all channels. This can be useful for removing any unwanted calibration settings.

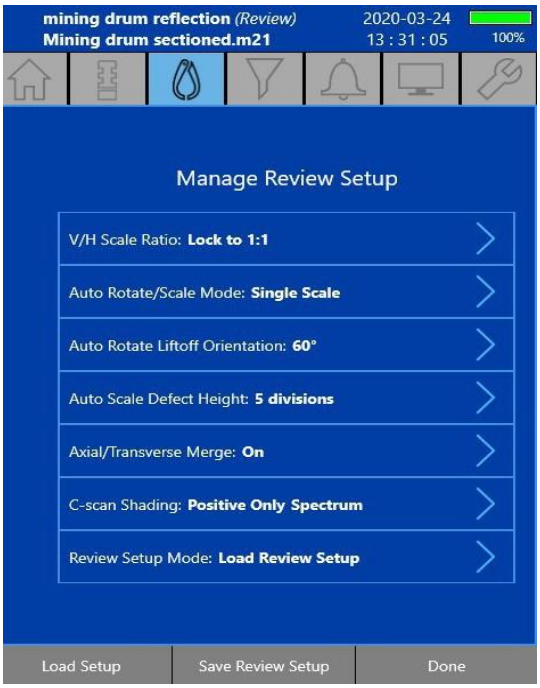
Load Default Setup from Technique – Every technique has a default setup stored with it. This option loads the default setup.

Store Current Setup to Technique as Default – This option saves the current Setup to the Technique as the Default Setup. This will overwrite the existing Default Setup.

When a new Setup is saved to the Technique, it will get an asterisk identifying that it has been modified. Then save the current Technique or rename it to something different.

Notes:

- If Reset Channel to Nominal Values is pressed by mistake, the load setup function will load the stored setup again.
- After you save a setup and you want it to be final, the Technique must also be saved. (In other words, save the technique after the setup has been saved. Verify no asterisk next to the technique name.)



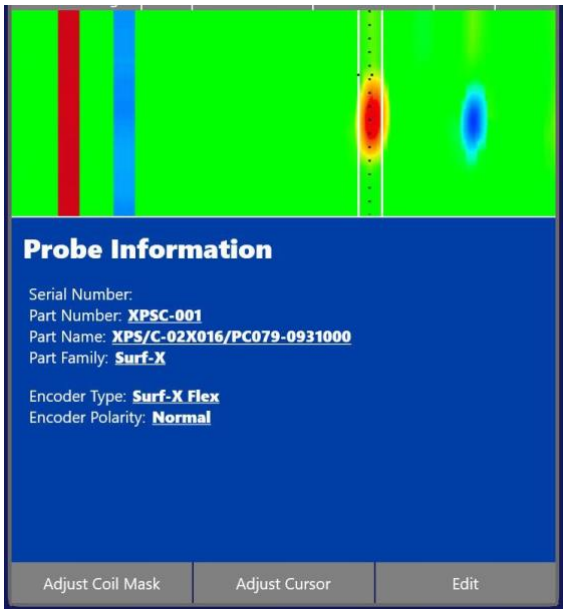
When reviewing saved data files, the Manage Calibration feature has different menu options. This is because some features are only adjustable in the technique and when reviewing data files, the
associated technique may not be available. This way, a new setup can be saved for saved data files if the original setup that came with the data file is not desirable.
The features available in the Manage Review Setup are:

- V/H Scale Ratio
- Auto Rotate/Scale Mode
- Auto Rotate Liftoff Orientation
- Auto Scale Defect Height
- Axial/Transverse Merge
- C-scan Shading
- Review Setup Mode – allows for choosing between loading the setup from the saved Review Setup or the original setup from the data file.

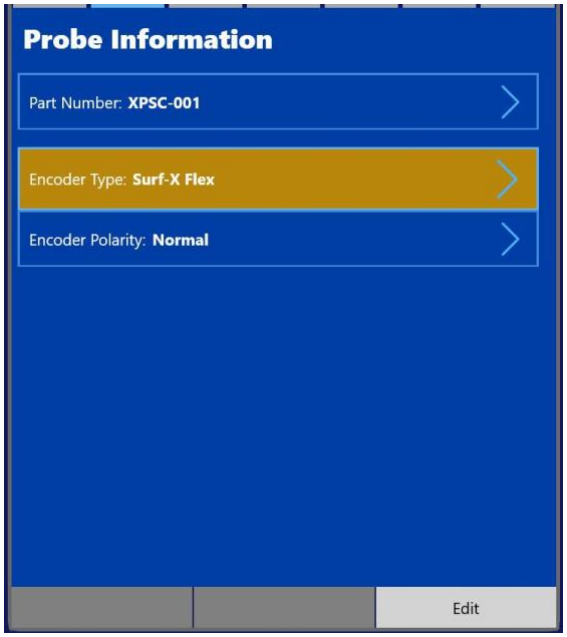
Note: Only one Review Setup can be saved per technique. Therefore, if there are several data files from the same technique, there will be only one Review Setup for all those data files.

Encoder Configuration

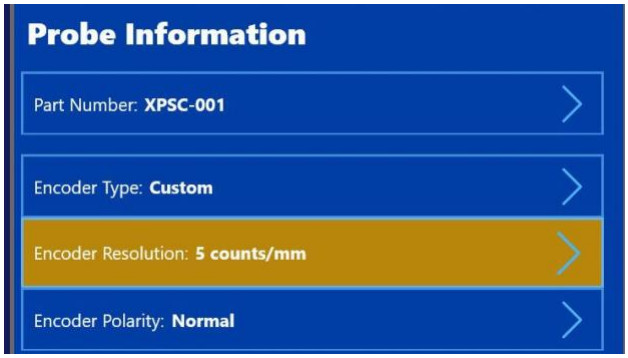
The Surf-X Flex encoder does not need to be configured. However, other types of encoders can be connected to the instrument. The instrument needs to know the encoder resolution (i.e., counts/inch or counts/mm). This can be directly entered, or this can be calculated using a known distance to calibrate the encoder.



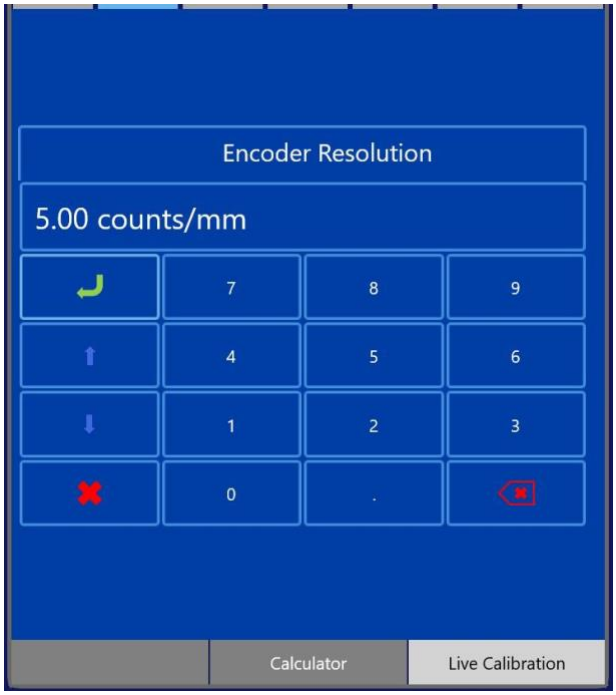
In this picture, the Encoder Type is set to Surf-X Flex. Press the Edit button to change the information in the Probe Information tab.



Select the Encoder Type to change the encoder being used. Then select Custom on the following screen.



When a custom encoder is selected, the Encoder Resolution can be configured. When selected, the encoder resolution can be entered in three ways as shown below.



Directly enter the encoder resolution in counts per unit traveled.

When Calculator is selected, the wheel diameter and the encoder Counts Per Revolution can be entered. The encoder counts per revolution often is found on the encoder datasheet.

From this information, the instrument will calculate the encoder resolution.

When Live Calibration is selected, the encoder resolution is calculated by move the encoder over a known distance.

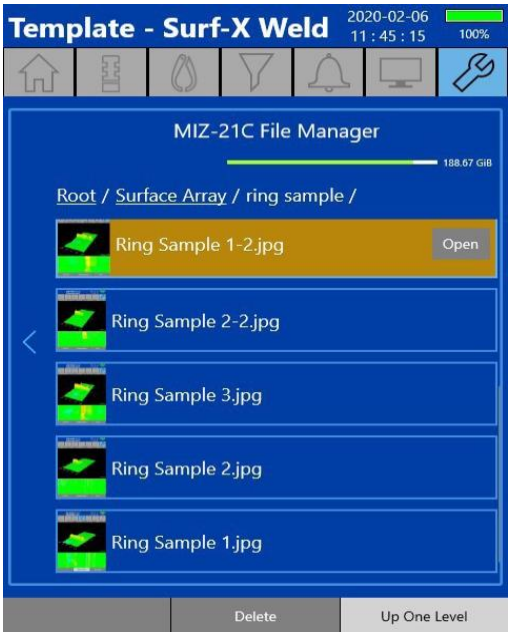
Place the encoder at a start position and press Select Start

Move the encoder over a known distance and press Select End.

Enter the known distance on the next screen.

From this information, the instrument will calculate the encoder resolution.

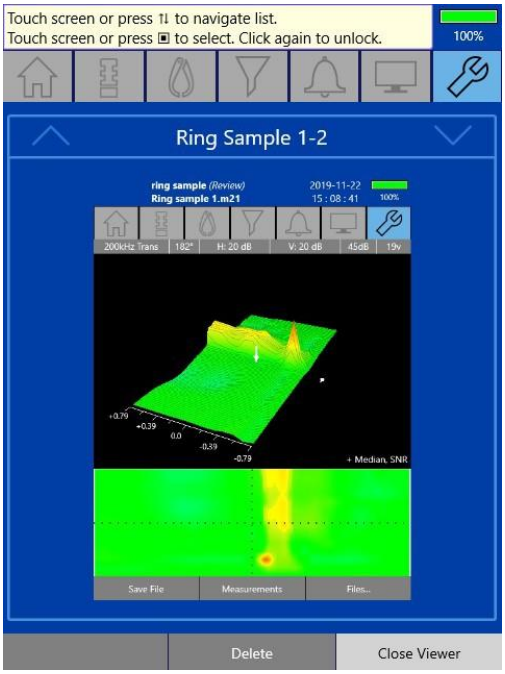
Screenshots



Take screenshots by pressing the Start/Stop button on the control button panel for two seconds. A window will open in which the file can be named. Press Enter to save the file.

View captured screens by recalling the file through the File Management option in the Tools menu. Screenshots are saved under the associated technique name.

In this image, screenshots saved with the "ring sample" technique are displayed. Select the Up One Level button to navigate to the Surface Array directory where a list of techniques in the application will be displayed. Selecting the left arrow will display the File Management menu.

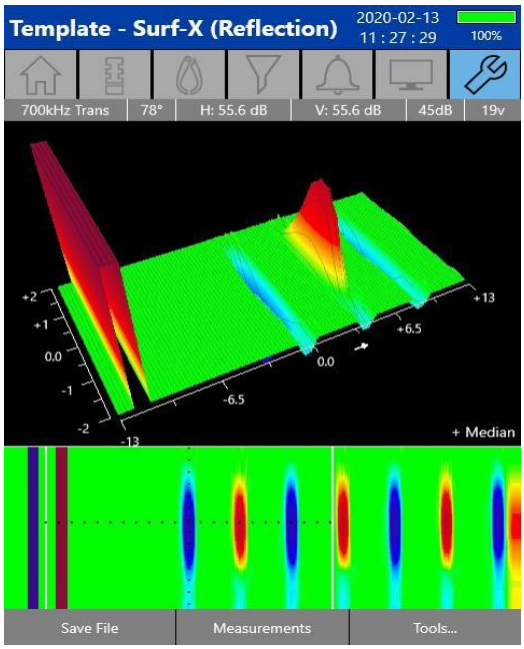


Use the Up/Down control buttons or the Up/Down arrows on the screen to flip through each screenshot.

Select the Close Viewer button to go back to the list of screenshots in the file manager.

Use standard finger gestures to zoom and move the screenshot.

Saving Data Files



Data files that have been acquired are initially saved in the data buffer. Every time acquisition starts, the data in the data buffer is overwritten. To keep the acquired data, save the data file.

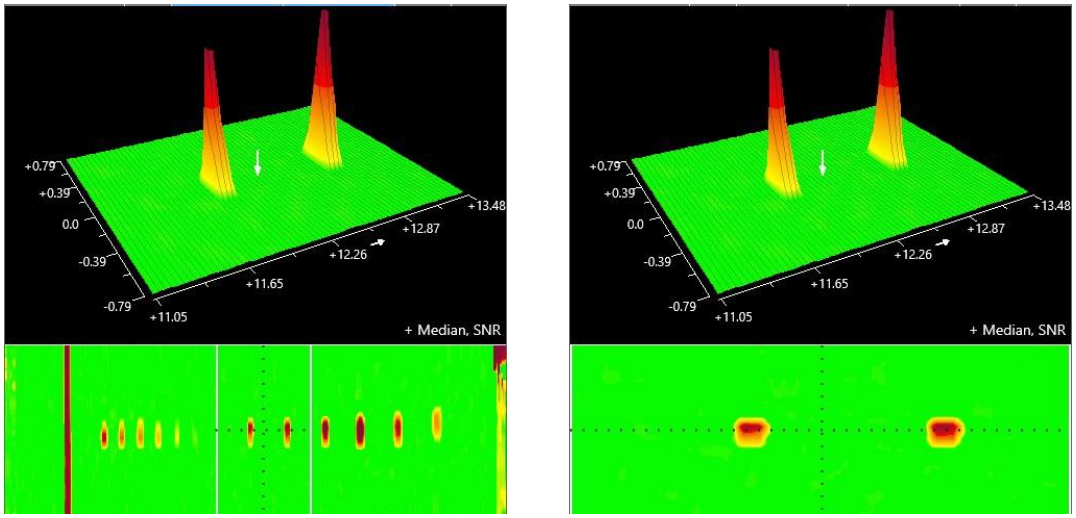
To save data files, go to the Tools screen and select the Save File context menu button.

All data files will initially be named according to the date and time; however, you have the option to rename the data file before saving.

Use the keypad to rename the file and select the Enter button to save.

Selecting the X button will cancel this action.

It may be necessary to save just a portion of the data. When the strip chart or 2D C-Scan data is zoomed, only that portion of the data is saved. The data inside the Data Window can be zoomed by pressing the center select button.



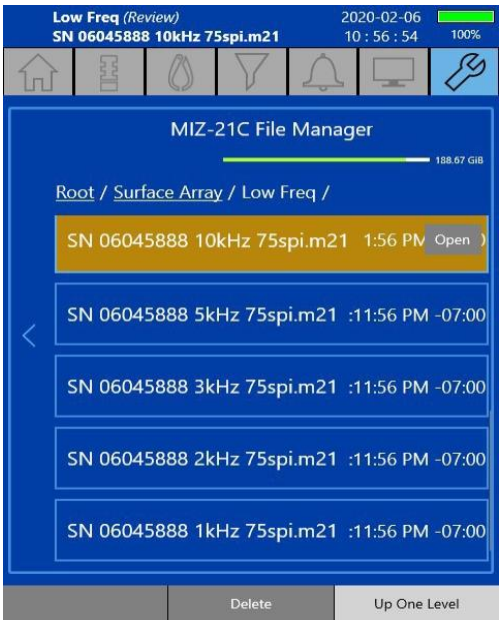
Standard view of data (all data in the buffer is saved)

Zoomed view of data (only this data is saved)

Figure 5-5 Data files

Note: The function to save a portion of the data exists with data in the buffer (not yet recorded) and data that is already saved. For example, a data file can be recalled and then a portion of that data file can be zoomed in and saved as a new data file.

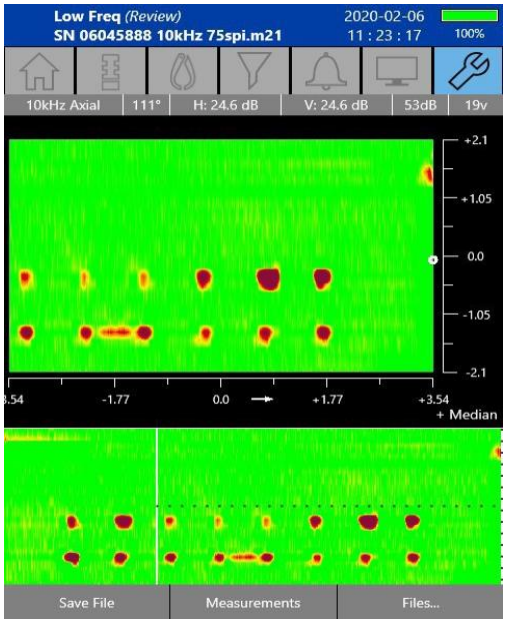
Reviewing Saved Data Files



Review saved data files by recalling the data through the File Management option in the Tools menu. The data files are saved under its associated technique name.

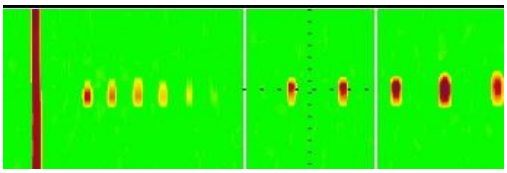
In this image, data files recorded with the Low Freq technique are displayed. Select the Up One Level button to navigate to the Surface Array directory where a list of techniques in the application will be displayed.

Select the left arrow to go back to the File Management menu.



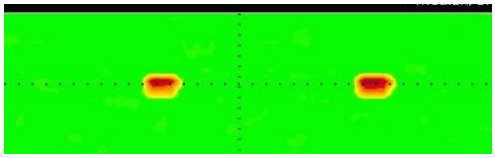
When reviewing saved data files, the instrument goes into a review mode. All the buttons function as they normally would except for the Start/Stop buttons. These buttons are used to load the next (right Start/Stop) or the previous (left Start/Stop) data files in the current folder.

Selecting the Files... context menu will return you to the list of data files.



Save a segment of a data file by saving the zoomed portion

To save portions of a data file, zoom in on a particular area and use the Save File function.
A new data file with only the zoomed in portion of the data will be created.



Select the Home Screen to exit the data review mode.

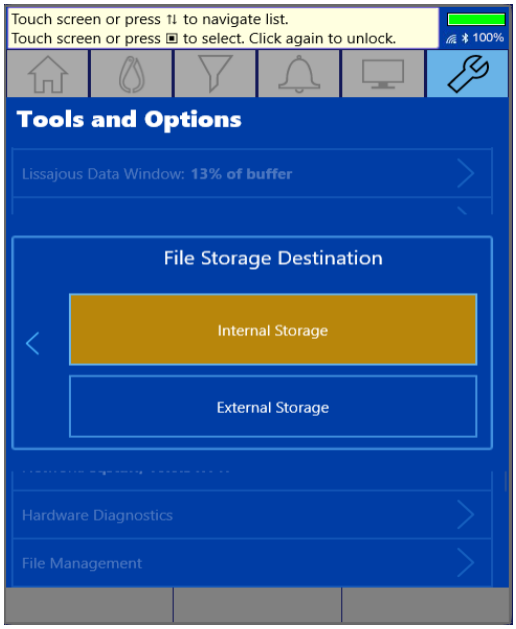
There will be two options to choose from via the context menu buttons.

Exit Review will bring you back to the acquisition mode with the original technique that was loaded prior to reviewing saved data files.

Make Live will return to the acquisition mode using the technique which the recalled data file was acquired with.

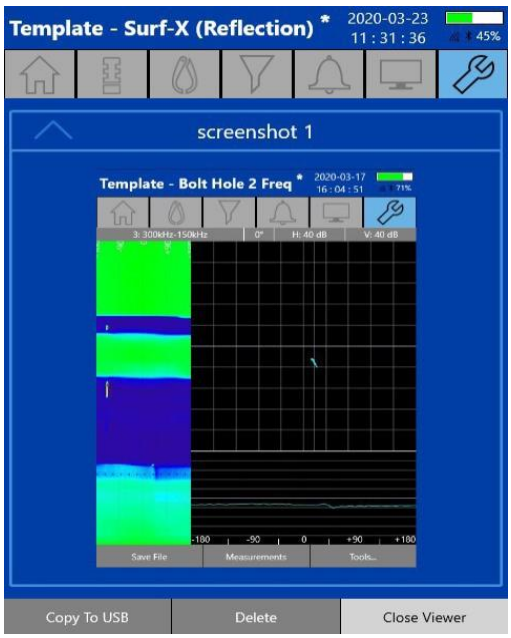
For example, if a recalled data file was acquired with a technique called “200 kHz Pencil Probe”, Make Live will extract this technique from the data file and will display this in the technique directory. This is useful if acquiring data using the exact same settings of how the data file was originally recorded.

Saving Files to USB



The destination for data files and screenshots can be configured using the Write To option in the Tools menu. Selecting this option allows for choosing where to save files: to the internal or external (USB) storage.

The External Storage option is available when a USB device is attached to the USB port on the connector panel. This setting can be changed at any time to direct the location to store files.



Files that are saved in the internal storage can be copied to a USB device through the File Management option in the Tools menu.

When a file is loaded or selected in the instrument and a USB device is connected, the Copy to USB context menu button will be available in the lower left corner of the screen.

In this way, individual files or whole folders can be saved to the USB device.

To copy all the data files under a technique or application, navigate up to the desired level and select the folder to be copied. In this example, all data files for the Bolt Hole application can be copied to the USB.

Making Measurements

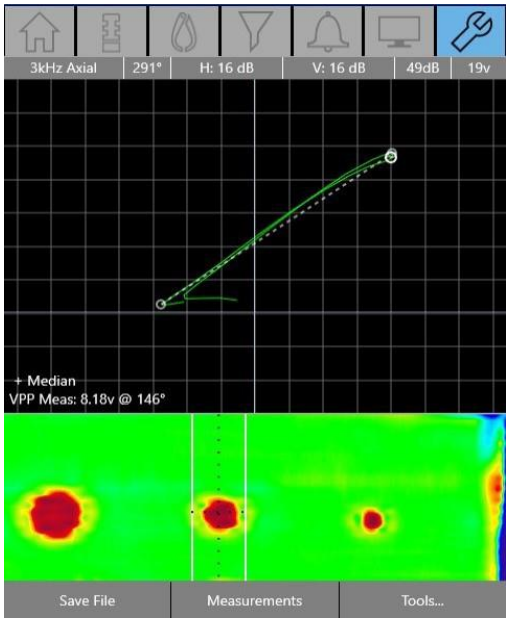
Various types of measurements can be made on any part of the acquired signal. The types of measurements that can be made are Amplitude, Phase, and Length.
Amplitude measurements are displayed in volts, and the measurement type can be selected in the Tools menu. There are several different measurement types to choose from. They are:

- Vert Max – the vertical value between the maximum peak points.
- Volts Peak to Peak – the absolute value between the maximum peak points.
- Vert Max from Null – the vertical value between null and the peak point.
- Volts Peak from Null – the absolute value between null and the peak point.
- Cursor info – the absolute value between null and the cursor position.

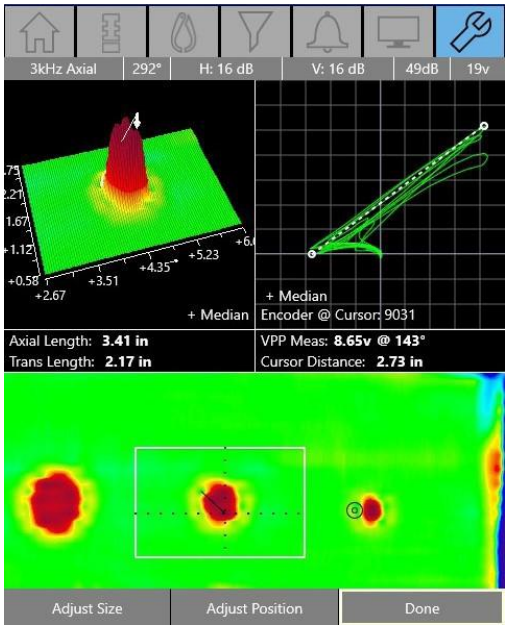
Phase measurements are displayed from 0 to 360 degrees with 0 degrees being the left X axis or 9 o'clock position.

Length measurements are displayed in either inches, centimeters, or millimeters. This can be selected in the Tools menu.

There is an option that defines when to display measurements. Measurements can always be displayed, or only when making measurements. This option can be found in the Tools menu.



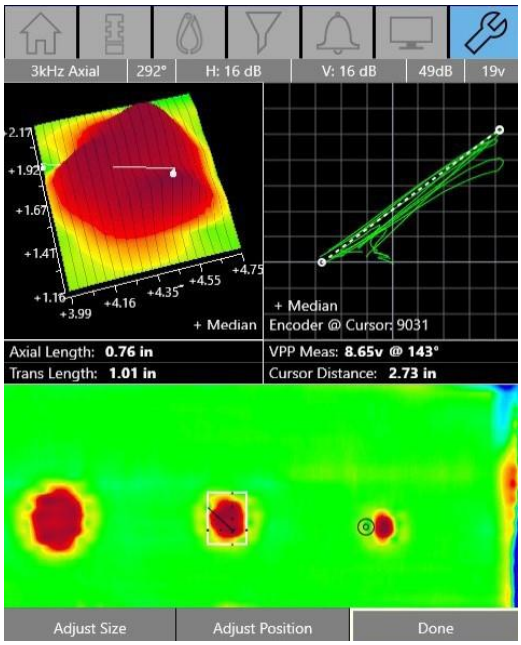
For array data, basic measurements can be made in the normal Impedance display. Additional measurements can be made in the Measurements tool. To use the Measurements tool, select the Measurements context menu button in the Tools screen.



The measurement window for Array data is split into three sections: The Impedance Plane, 3D C-scan, and 2D C-scan. The 2D C-scan section has a white box with a dotted cross hatch. This is the Measurement Box. The data inside this box is displayed in the 3D C-scan and the Impedance display. The data inside this box is what is being measured. The intersection of the dotted lines is the data cursor, which corresponds with the white arrow in the 3D C-scan display. The black solid line in the measurement box signifies the measurement line, which corresponds with the white solid line in the 3D C-scan display and the white dotted line in the impedance display.

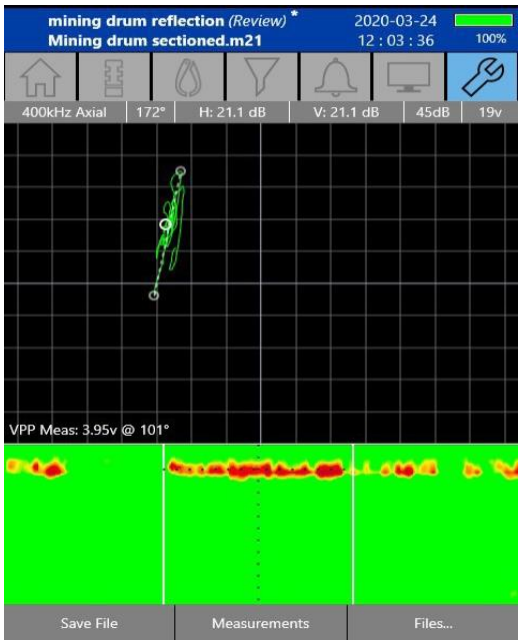
The 2D C-scan section also has a black circle ◎. This is a cursor which is used to measure the distance from the cursor to the center of the measurement box. The cursor can be moved to any place on the 2D C-scan display for a distance measurement. Touch and drag anywhere on the 2D C-scan display to move the cursor. Alternatively, with no context buttons selected, the cursor can be moved with the arrow buttons.

The amplitude and phase measurements, as well as the cursor distance, are displayed under the impedance display.

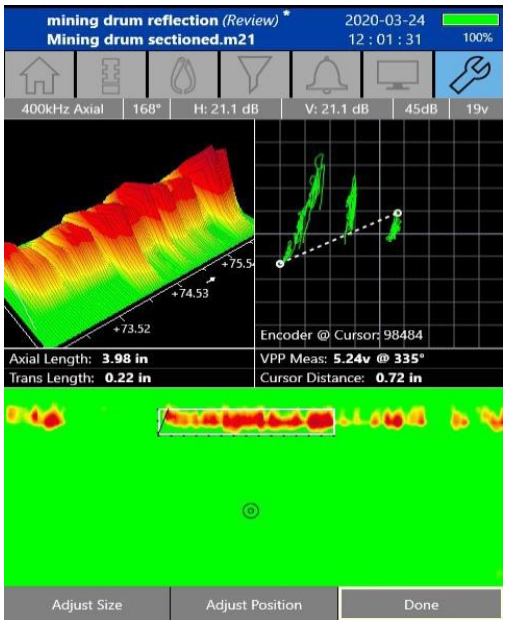


The measurement box is used to measure the length of the signal. Resize the box around the signal of interest to get the length measurements. The axial and transverse length values of the measurement box are displayed under the 3D C-scan.

The measurement points are chosen automatically by the software. The software will select the peak points of the signal in the data window and use these points to make the measurements.



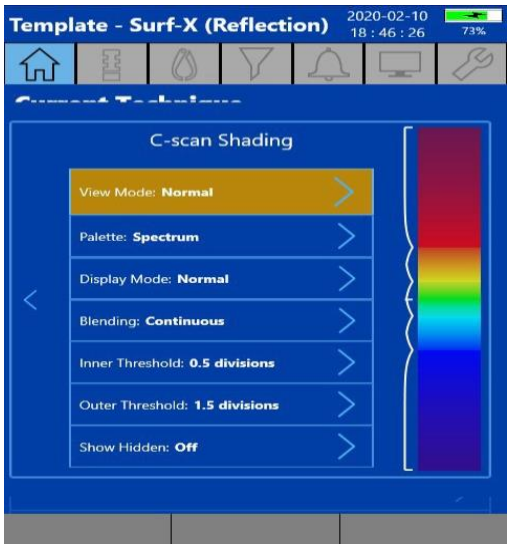
The normal impedance display only shows the data from one channel (or coil) that the cursor is on, and the measurement is taken on this signal.



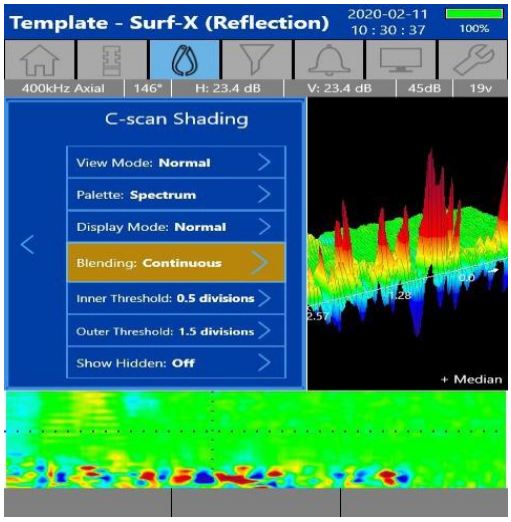
In the Measurements tool, all channels inside the measurement box is shown in the impedance display, and the measurement is taken on the combined data. Therefore, the measurement values between these two methods may not be the same.

C-scan Shading:

The C-scan Shading menu provides many options for displaying the C-scan data. This menu can be accessed in the technique options or by double-tapping on the 3D C-scan display.



This is the C-scan Shading menu interface when accessed through the technique options. Changes to the settings will be displayed on the color palette on the right side of the display.



This is the C-scan Shading menu interface when accessed by double tapping the 3D C-scan Display. Changes to the settings will be displayed on the C-scan data.

The following is a description of all the C-scan Shading options.

View Mode:

Normal – A 3D view of the data that can be oriented in any direction.

Top-Down Mode – A top-down view of the 3D display with no parallax.

Hide Scan Lines – A 3D view of the data with the scan lines removed.

Palette:

Spectrum – The default color palette with red at the positive end, blue at the negative end, and green at neutral.

Grey Scale – A black and white palette with white at the positive end, black at the negative end, and grey at neutral.

Inverse Grey Scale – A black and white palette with black at the positive end, white at the negative end, and grey at neutral.

Custom – A highly customizable color palette for each section of the spectrum (the custom palette is adjustable in the technique options menu).

Display Mode:

Normal – Displays the data with positive amplitudes above the neutral plane and negative amplitudes below the neutral plane.

Absolute – Applies the positive end color palette to both the positive and negative amplitude data.

Positive Only – Removes all the negative amplitude data from the display.

Blending:

Continuous – Provides a continuous transition of the color palette within each section.

Graduated – Provides a more segmented transition of the color palette within each section.

Minimal – Provides a single color for each section. No color transition within each section.

Inner Threshold:

The point at which the color palette transitions from neutral to the next section in both positive and negative directions. Defined by number of divisions.

Outer Threshold:

The point at which the color palette transitions from the mid-section to the end section of the spectrum in both positive and negative directions. Defined by number of divisions.

Show Hidden:

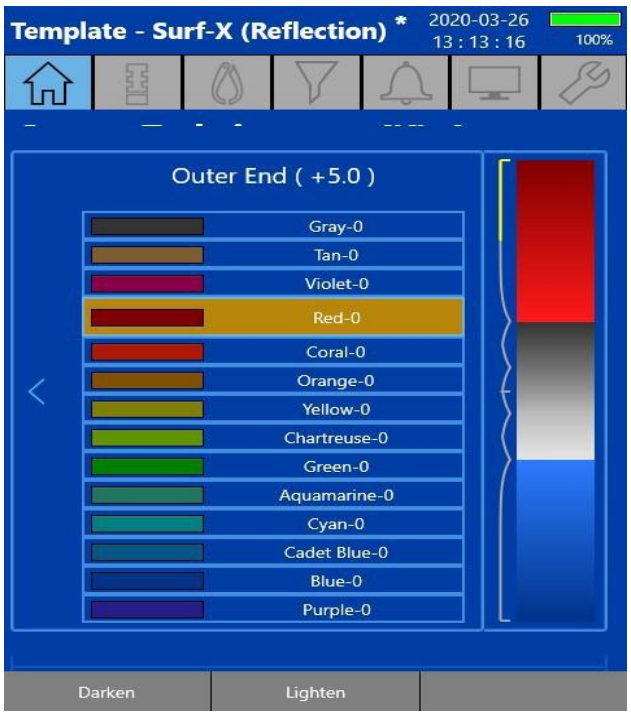
The option to display the part of the 3D data that is hidden behind a large signal.

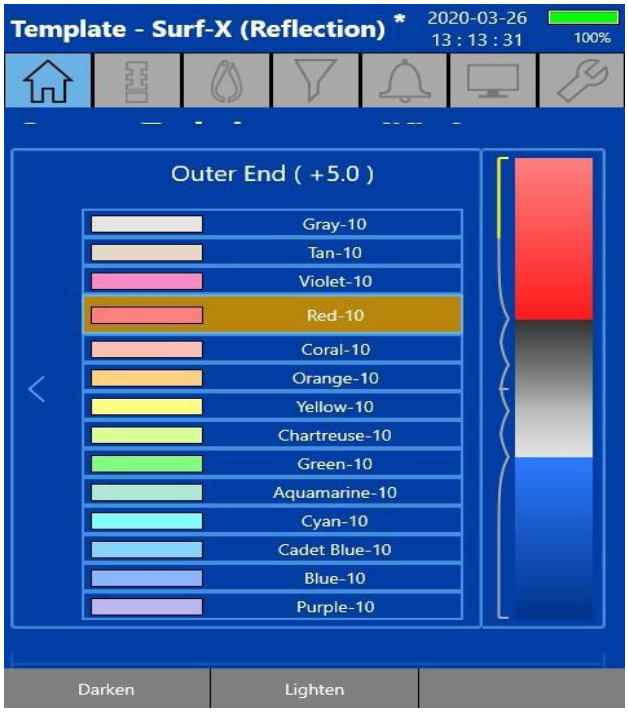
Custom Palette

The custom color palette allows for the selection of a specific color for each vertical region of the C-scan data. The palette is divided into 5 positive and 5 negative sections corresponding to the Inner and Outer Threshold values. There is one center section corresponding to the null position. The active section is highlighted in yellow.

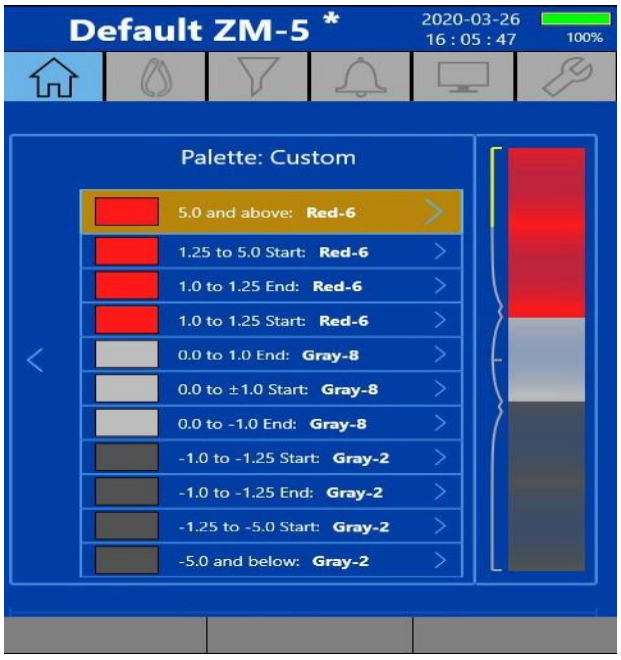
Each section corresponds to the start or end of the color transition and these transition points are denoted by the Threshold value. In this example, the Inner Threshold value is 1 division, and the Outer Threshold value is 2.0 divisions above null.

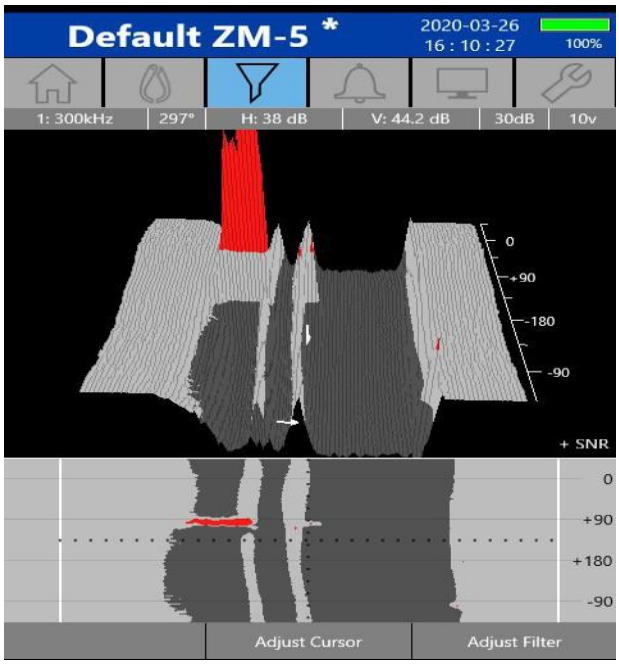
To change the color, select the section to be modified, then select the color to use. The shades of the color can be adjusted using the two context menu buttons labeled Darken and Lighten. The range goes from 0 (darkest) to 10 (lightest).

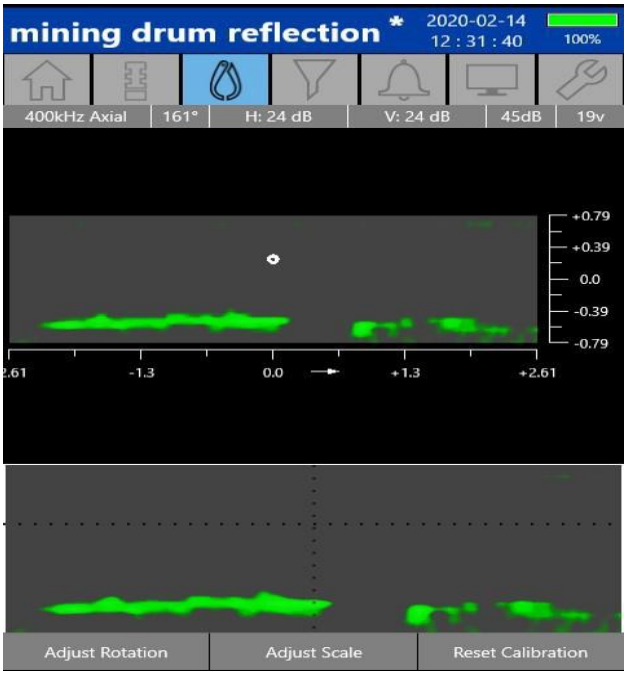




Here are some examples of custom color palettes:







Note: The negative sections of the palette will be n/a if the Display Mode is set to Absolute or Positive Only.

Mix Channels

When working with two frequency techniques, a mix channel can be created and used to suppress unwanted signals or signals of no interest, such as support structures in tubing or rivets in airplane skins.

To create a mix channel, turn on the Mix Active option in a two-frequency technique. This will create a third channel for the mix. Make sure the primary inspection frequency is on Ch 1 and the suppression channel is on Ch 2.

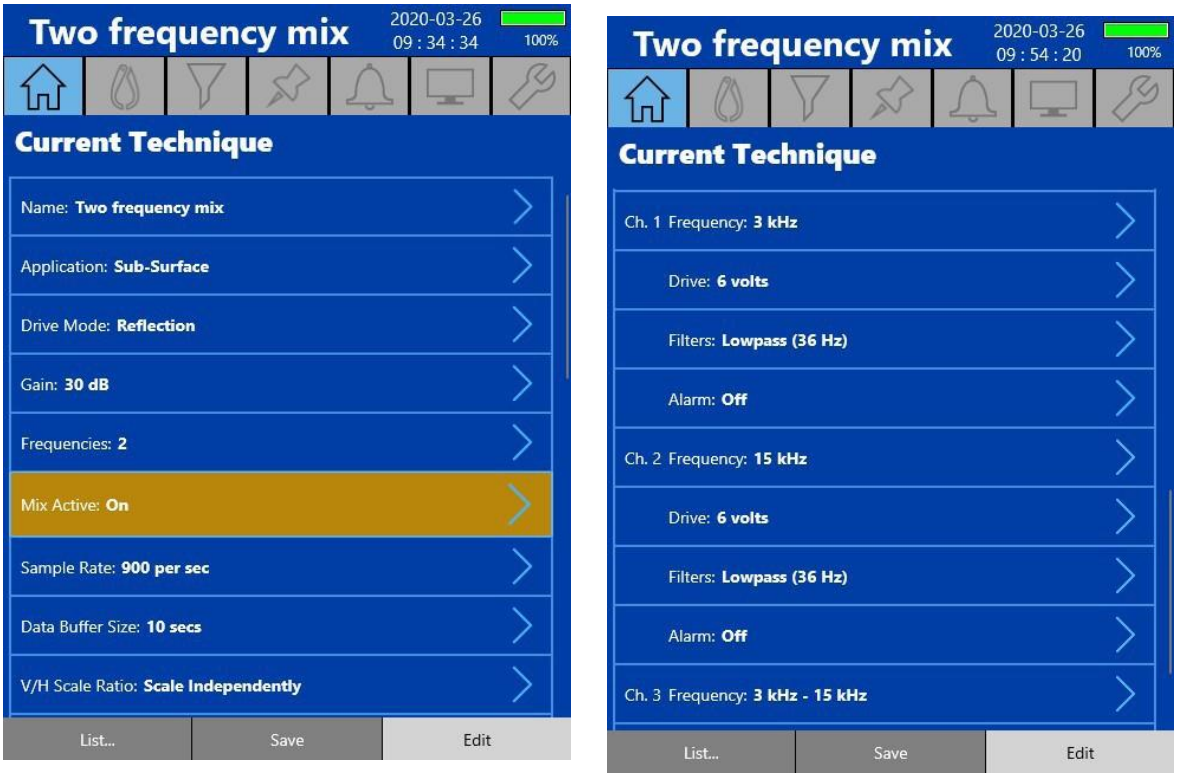
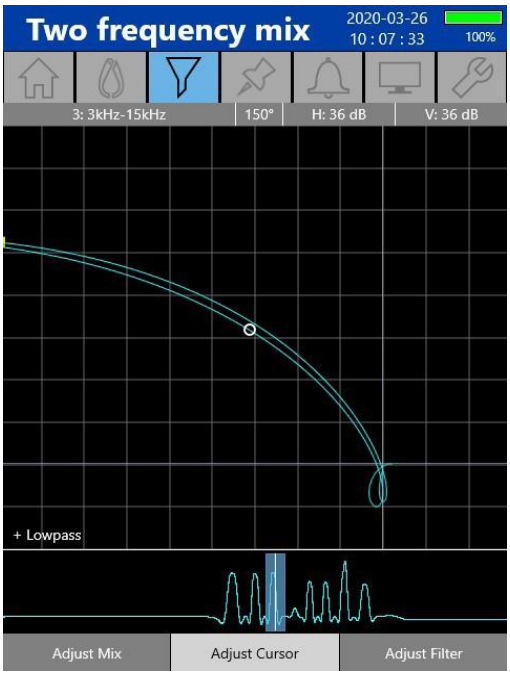
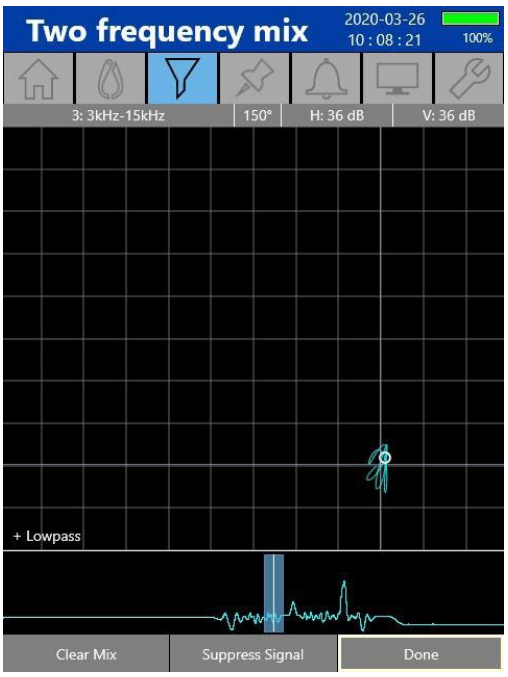


Figure 5-6 Mix channels

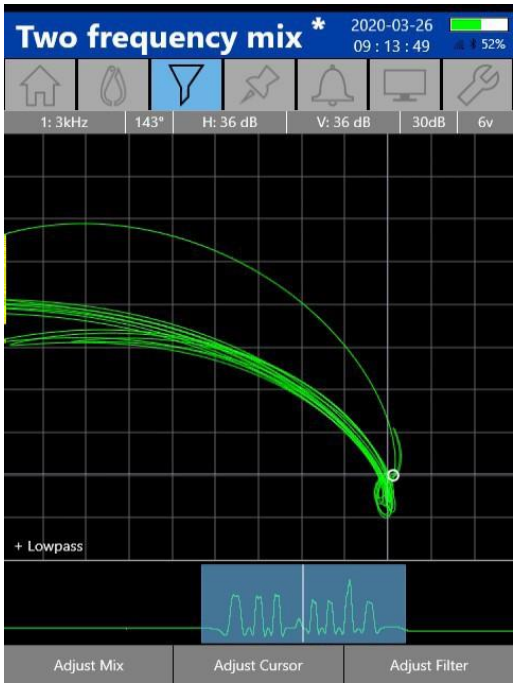
Turning on the mix activates a third channel used for the mix



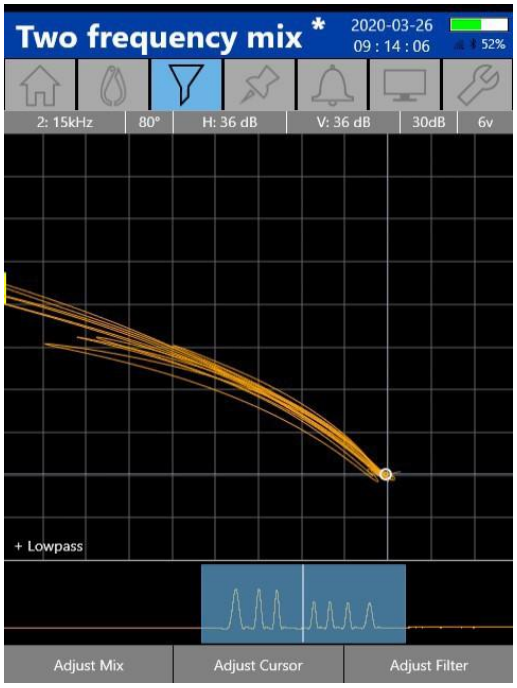
To perform the mix, scan the calibration sample. From Ch 3, locate the signal to be suppressed inside the data window. Select the Adjust Mix context menu button.



Select Suppress Signal. If the result of the mix is satisfactory, select Done. If the mix is not satisfactory, clear the mix and try again with a different part of the signal.

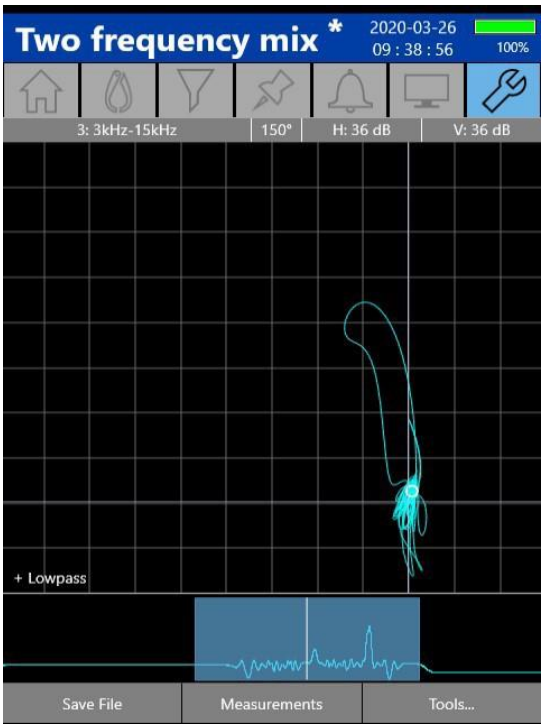


Mix channel 1



Mix channel 2

The result should be the suppression of unwanted signals with the desired flaw indications clearly visible.



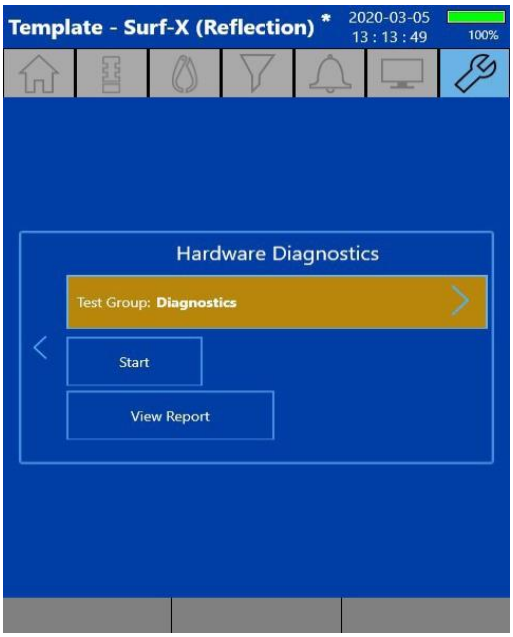
Resultant mix

Figure 5-7 Frequency mixes

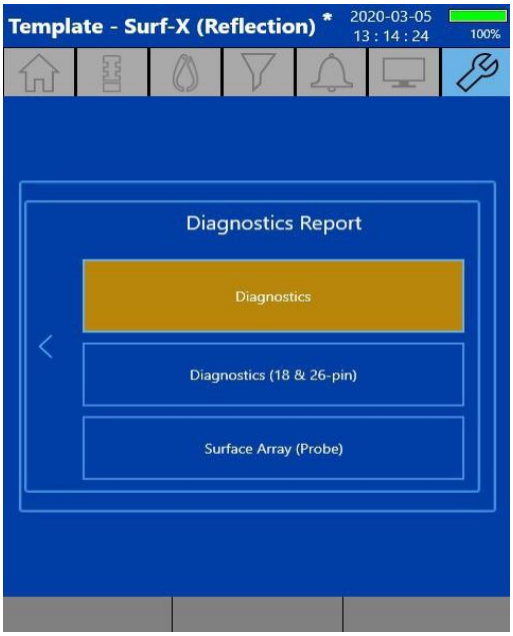
Hardware Diagnostics

The MIZ-21C has built-in hardware diagnostics to test system performance. There are three different diagnostics to choose from: Diagnostics, Diagnostics 18 & 26-pin, and Surface Array (Probe). Diagnostics is a basic check that requires no hardware to perform. Diagnostics 18 & 26-pin requires a load plug that connects to each of the probe connectors and is performed at a Eddyfi Technologies Calibration Lab. Surface Array (Probe) requires an Array Probe to be connected to the 26-pin connector and can be performed by the user. The following table lists the checks each type of diagnostics performs.

Diagnostics	Diagnostics (18 & 26-pin)	Surface Array (Probe)
Power Supply	Gain Accuracy	Amplitude check on each coil
Temperature	Drive Amplitude	
Gain Drive Amplitude Accuracy	Noise Level	
Noise Level	Digital I/O	
Hardware Null		
Demodulation		



To perform a diagnostic check, go to the Hardware Diagnostics option in the Tools menu.



Select the desired Test Group. If selecting Surface Array (Probe), make sure an array probe is connected to the instrument.

Select the Start button. The status and the results of the diagnostic tests will be displayed on the screen.

Once all tests are complete, see a detailed report by selecting the View Report button. If a USB storage device is connected, there is also an option to copy the report to the storage device.

Swept Frequency

The Swept Frequency feature provides a graph of the amplitude of the signal for a range of frequencies. This Swept Frequency plot can be used to determine the peak frequency for the probe and material being tested. This helps determine the test frequency for a material, if it is unknown.

To access the Swept Frequency feature, load a pencil probe technique, go to the Tool screen and select Tools, then select the Swept Frequency context menu button.

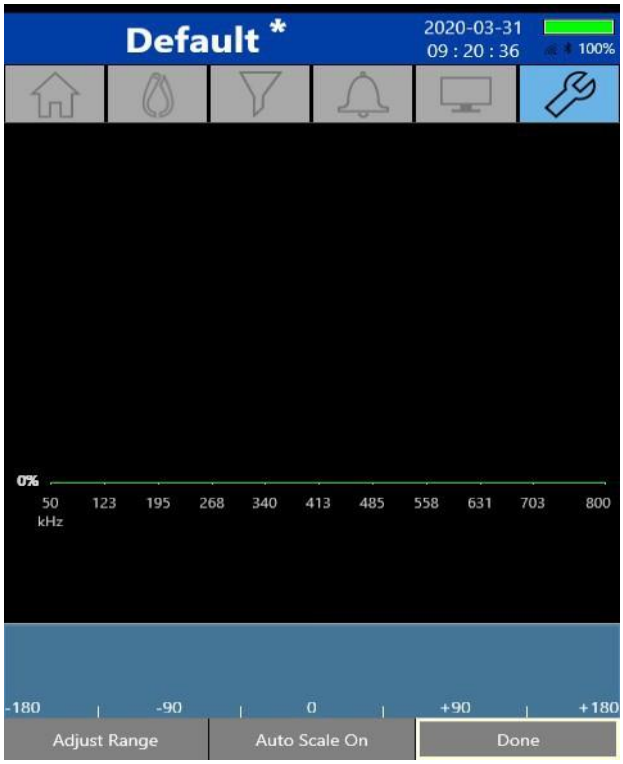


Figure 5-8 Swept frequency

The frequency range can be adjusted by selecting the Adjust Range context menu button. Choose a range that is appropriate for the probe you are using.

To create a plot, follow these steps:

1. Start acquire.
2. Balance the probe on the test material.
3. Scan a large defect.
4. Stop acquire.

The cursor can be moved to any part of the acquired signal to display the plot for that data point. Set the cursor at the peak point of the flaw signal by using the Left/Right control buttons. This will show the peak frequency.

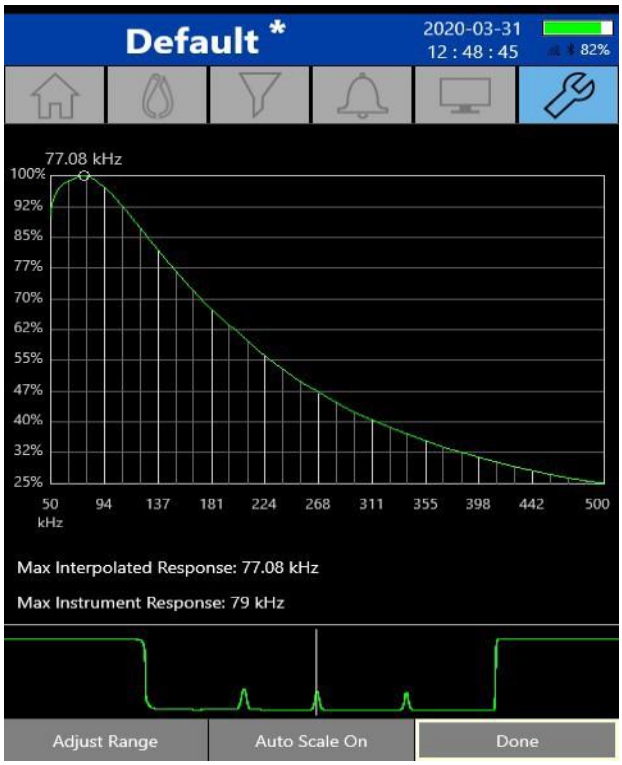


Figure 5-9 Default

The Auto Scale feature automatically scales the data so the entire signal is displayed inside the strip chart, however, if there is a large liftoff signal within the scan, the Auto Scale feature can make the signal of interest small. In this case, the Auto Scale can be turned off by selecting the Auto Scale On context menu button. The Up/Down arrows can be used to manually scale the data.

Press the center control button to zoom in on the strip chart data.

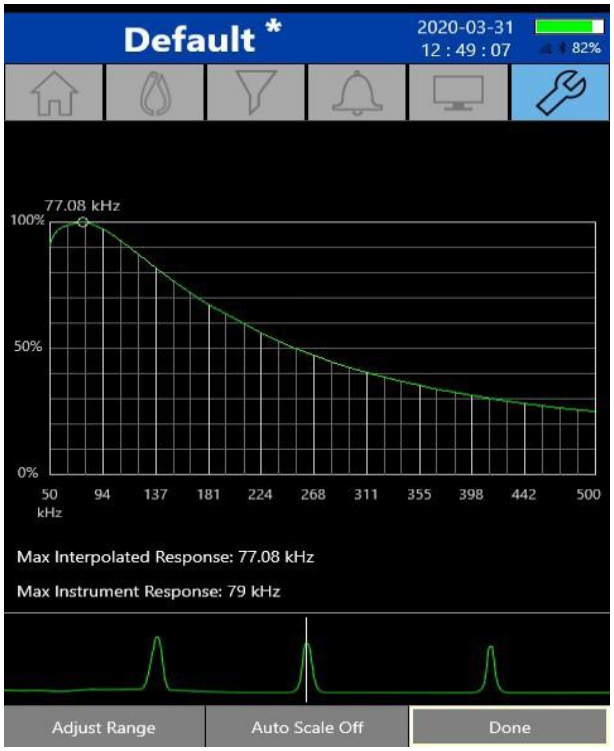


Figure 5-10

Selecting Done will exit out of the Swept Frequency feature. Once done, the data will no longer be available.

Airlock

The Conductivity and Coating Thickness application has a feature called Airlock. During operation, the instrument and environmental conditions can change which can affect the operating point, causing it to drift. This can affect measurements and cause erroneous results. Airlock detects and adjusts for this drift, so the conductivity and thickness measurements remain unaffected. This feature should always remain on; however, it can be turned off if necessary.

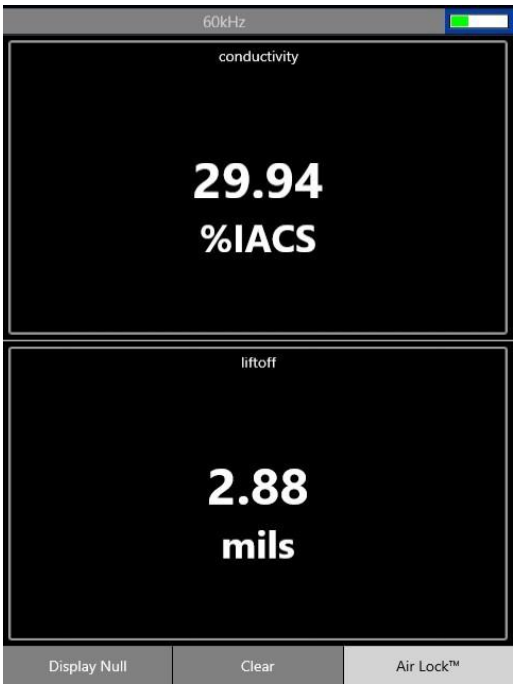


Figure 5-11 Airlock

File Management

Data files, screenshots, technique files, and logs are managed from the File Management option in the Tools menu.

Without a USB drive plugged in, screenshots and data files stored on the internal storage can either be recalled or deleted. When a USB is plugged in, there are additional options:

- USB File Manager – Screenshots and datafiles stored on the USB drive can be recalled or deleted. In addition, when navigating internal files, an option is available to copy the selected file or the entire folder to the USB drive.
    - Use the Up One Level context menu button to move up one folder. Use the right arrow or select button to open a selected folder.
    - Highlight the folder or file and select the Copy To USB context menu button to copy to the USB device.
    - Select the left arrow to return to the File Management screen.

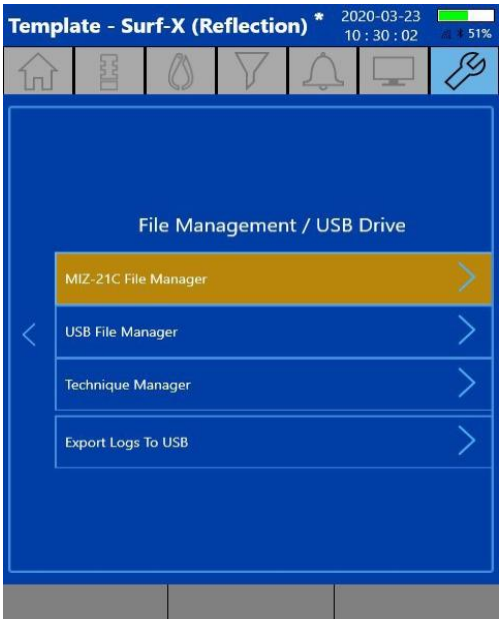


Figure 5-12 File Management Options

Figure 5-13 Individual files

Individual files can be opened or copied to USB when highlighted.

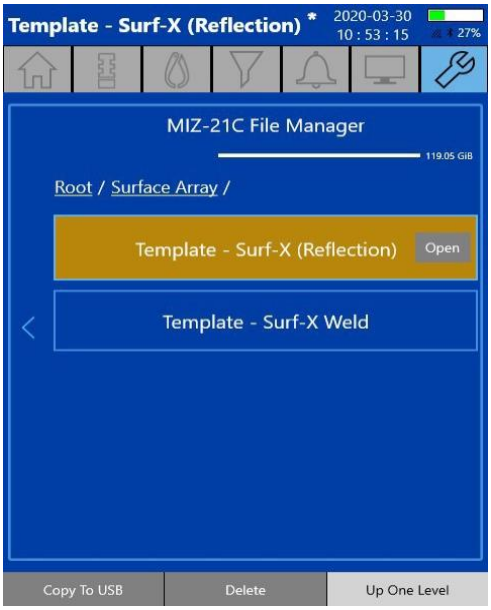


Figure 5-14 File

Entire folders can be copied to USB when highlighted.

Technique Manager – Technique files can either be backed up to, or imported from, the USB device.

Figure 5-15 Technique Manager

When techniques are backed up or imported, only new techniques or newer revisions of existing techniques will be copied. Identical techniques will be ignored.

Note: If there is a newer version of a technique, it will overwrite the older version as shown below:

Figure 5-16 Versions of techniques

- Export Logs to USB – Log files that have been created can be copied to the USB device. These logs can be sent to Eddyfi Technologies for diagnostic and troubleshooting purposes.

The files on the USB device are organized in a similar file structure as on the instrument. The root directory will have a folder labeled "MIZ-21C", which will contain a folder for Techniques and Screenshots (labeled "Pictures") as well as logs, diagnostics reports, and software updates.

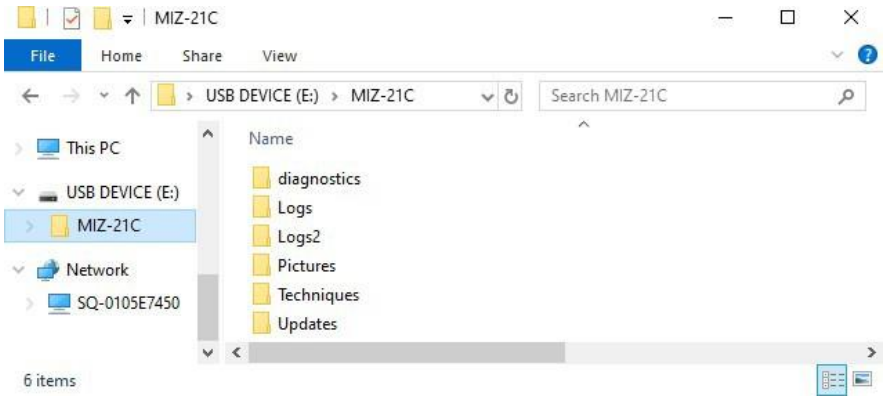


Figure 5-17 File structure

Techniques, data files, and screenshots are stored under the corresponding application and

technique name.

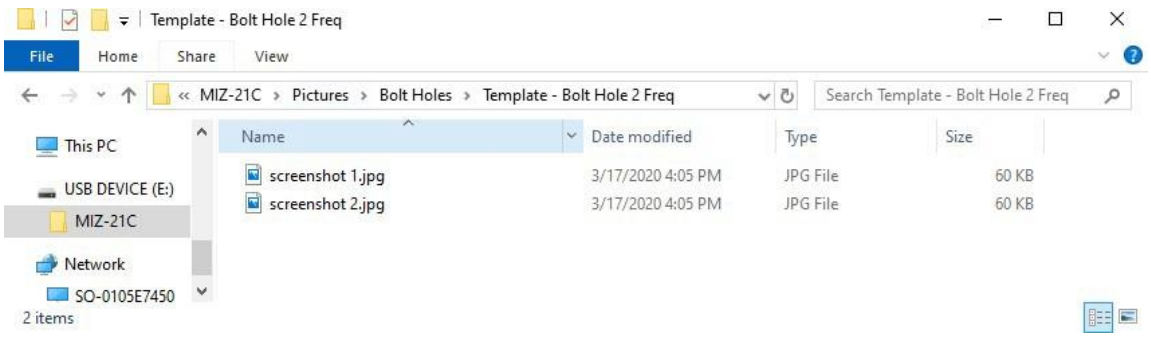


Figure 5-18 Screenshots

Depth Curves

Depth sizing is a critical need in many inspection applications to determine crack depth, the extent of corrosion penetration, or other types of flaw sizing. Depth sizing can be done with conventional probes or Surf-X Array probes. Near Surface or Far Surface (ID vs OD) both apply and have a different response. Define the curve by amplitude volts or phase angle and many types of curves are available to select from to give the best results.

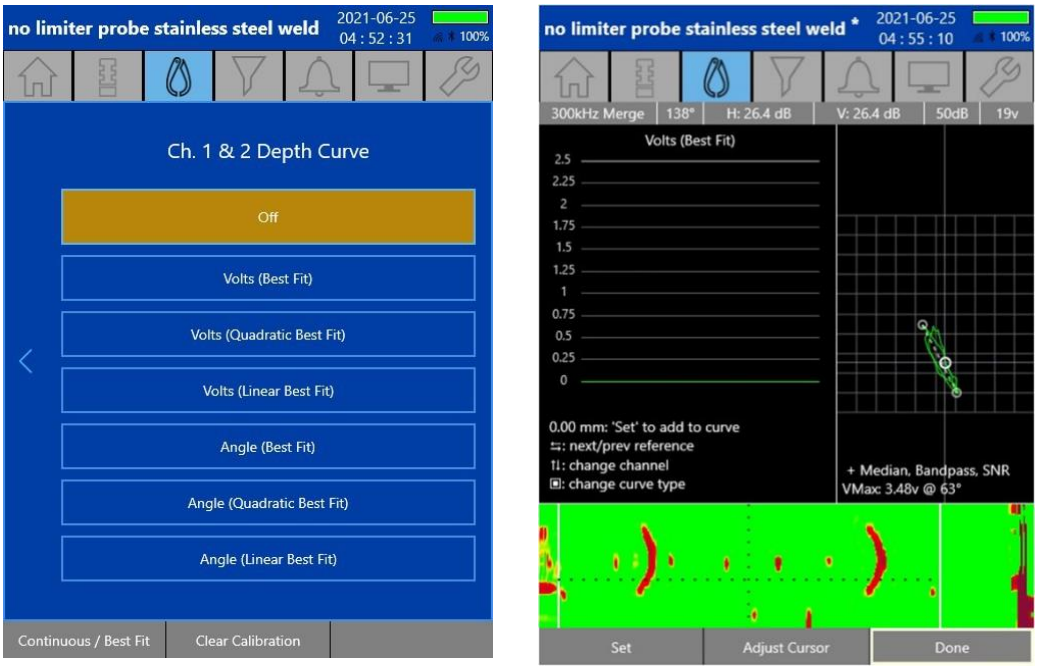


Figure 5-19 Depth Curve Options & Setup

There is an option for a 'Best Fit' of points to the curve type, as well as an option for 'Continuous', where the curve is made up of any number of curves, smoothly interpolated together between calibration points. 'Best Fit' does not have to go through the points, while

‘Continuous’ is forced to go through all defined points.

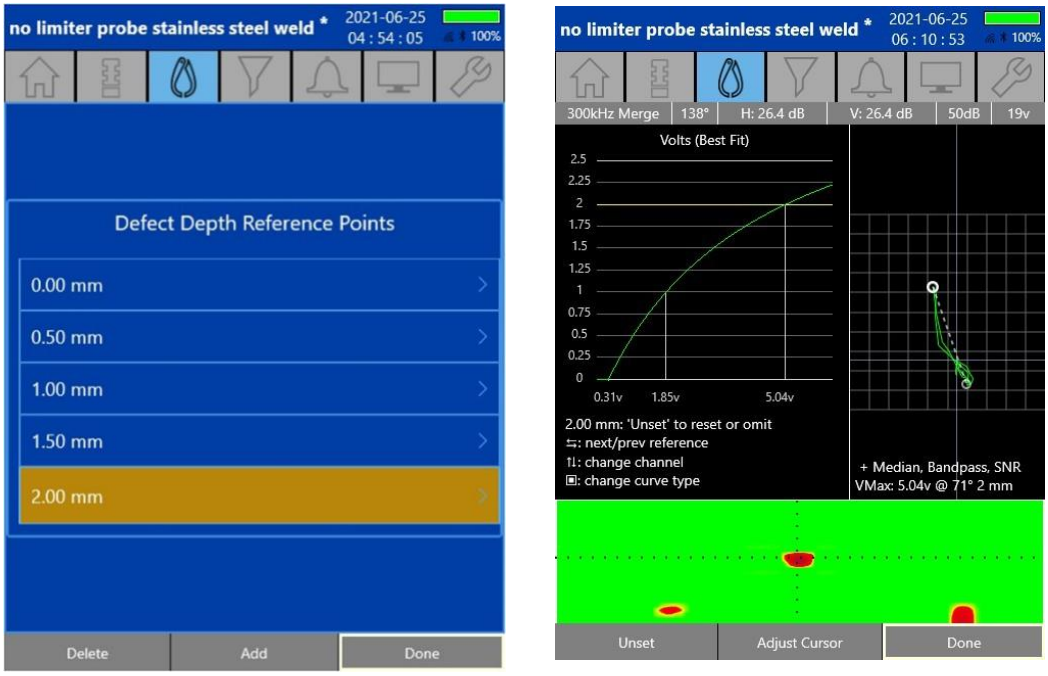


Figure 5-20 Depth Reference Points & Setup

The depth curves can be independently configurable per channel. Depth Curve type per channel will be visible at the technique level, but all depth reference calibration points as well as the actual calibration will be at the data setup level only. Adding depth references or calibrating your curve will not modify your technique (indicated by an * next to the technique name). The depth curve configuration and calibration will be storable both to the review setup and to the technique as desired.

Curve reference depths are a single set that can apply to all channels. However, each channel may use any number of these reference depths allowing for points to be ignored. Once the reference curve is defined, the depth measurement is shown for the channel it is defined on, wherever a measurement is displayed. The curve is valid to within +/- 10 degrees of the angle calibration points, and from 0.0 volts up to 25% greater than the max calibration point voltage. When your current measurement is outside these ranges then the display shows '--- mils' instead of a depth value.

Calibration values can be hand entered. When hitting 'Set' to enter the current measurement values during curve calibration, a keypad entry will pop up to allow the value to be changed as necessary. For example, the cursor may be put wherever for the 0 depth reference, hit 'Set’ and enter '0' in the keypad rather than trying to find a suitably quiet reading. Channels can be toggled during calibration, such that the cursor can be put on a desired flaw and then go

through each channel and easily set that cal point before moving on to the next flaw location.

Depth Curve Setup

Under the Tools menu, select Measurement Type which allows the user to determine the type of measurement classification used for the curve, measurements are one of two types, either amplitude or phase angle based. Touching the > to the right will open the Measurement Type screen. From this screen select the type of measurement to use. Make sure that measurement type selected to calibrate the depth curve is the same measurement type that will be used to it matches the measurement type used to make the actual measurements.

> **Note:** The measurement classification can be changed at any time. It is strongly suggested that the user Reset their calibration points if switching from amplitude to phase or vice versa.

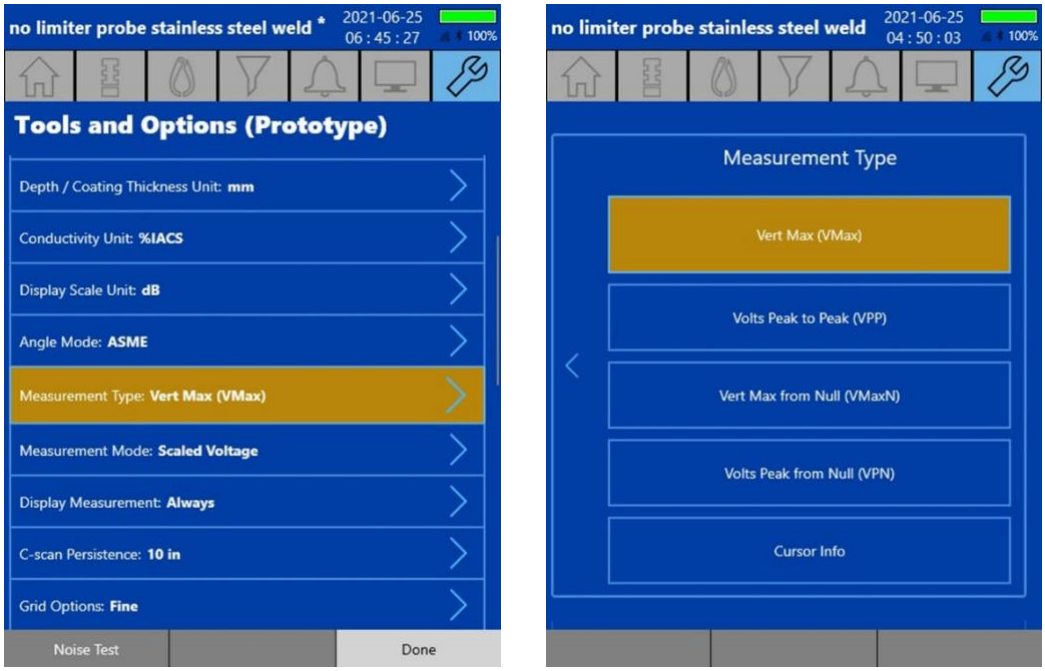


Figure 5-21 Measurement Type, Mode, Display

The Measurement Mode is recommended to be used as Raw Voltage since adjusting scale will not affect the voltage measurements. Scaled Voltage can be used but be aware that if the scale is changed the measurement will change as well.

Measurement Display should be selected to Always so that the measurement will always be displayed. If this is not selected, then it will only be displayed when making measurements.

Configure Depth Curve

Go to the Calibration tab on the menu buttons located at the top of the display and select Manage Calibration. The display below will open. Select Adjust Depth Curves. The display below will open. Notice that the center top of the display shows Off. To activate a specific type of curve, press the Center button between the direction arrows which will go to the Depth Curve main window.

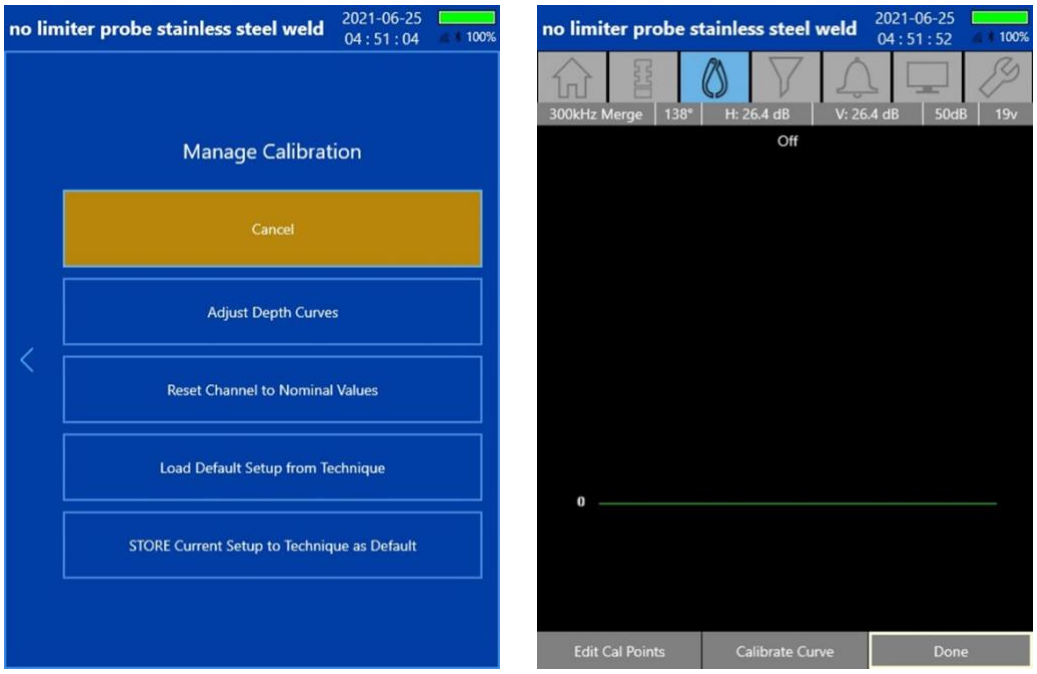


Figure 5-22 Adjust Depth Curves

The list of curves built into the software will be available shown in the Ch. Depth Curve screen. There are two sets of curves based on Volts or Angle. Each set has three options for curve types. The first is a Eddyfi Technologies proprietary depth curve algorithm, then Quadratic, and Linear. Notice that the button at the lower left of the display shows Continuous/Best Fit. This is because each curve type has two different ways to establish the curve. Continuous will draw a straight line between each calibration point used, while Best Fit selects the best slope through the points. Clear Calibration wipes out the calibration curve currently in the system while retaining all calibration points created by the user. Select the Depth Curve type for every channel that is being used for measurement.

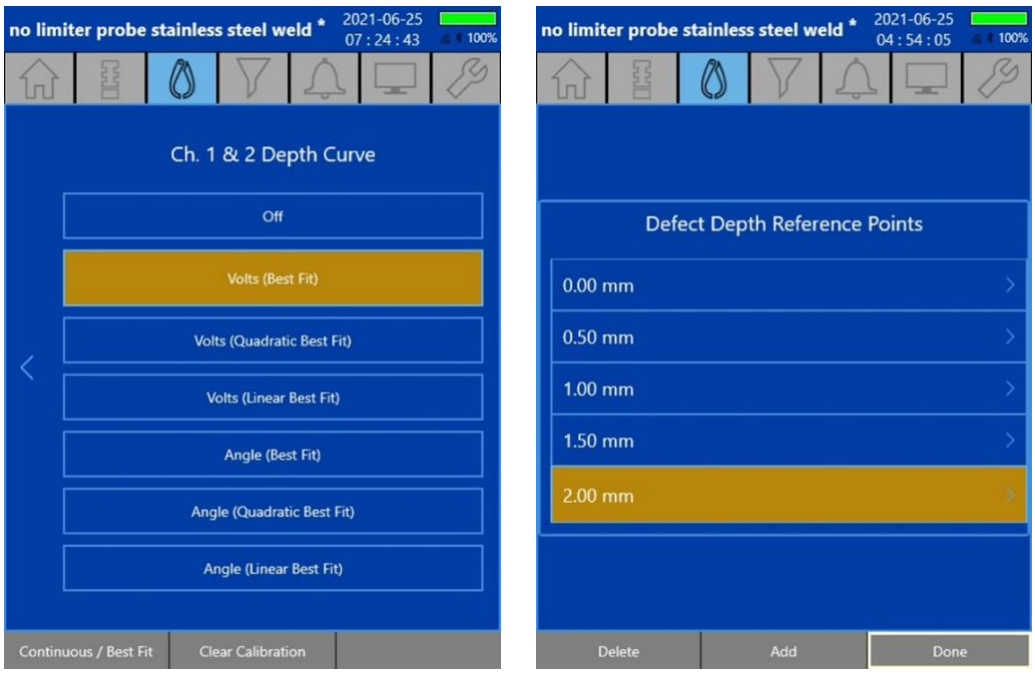


Figure 5-23 Depth Curve Type & Setting Reference Points

Acquire the data to be used to set up the Depth Curve and go through the standard calibration process. Once this is done, then in the Adjust Depth Curves Menu, the lower left button will display Edit Cal Point which is where the user enters the depths of the indications (mils or mm) to be utilized during curve creation. This is the Defect Depth Reference Points.

It should be noted that not all points entered are required to create a curve. For instance, in the displays below there are a total of five reference points, however only the 0 mm, 1.00 mm and 2.00 mm indications were used to create the curve. Once the calibration points have been entered press the Done button to return to the calibration screen. Select the Calibrate Curve button in the center of the lower display. This will open the window in the display below. The display provides directions for the user on how to use the Left/Right (next/prev reference) arrow, while the up/down arrow permits the user to select the channel that the curve(s) are set to. The center square button allows the user to change the curve type.

For the curve used in this document, a Volts (amplitude) Best Fit curve was selected. For the 0.00 mm set point, the cursor is placed in the section of the data consisting of no indications. Notice that the display is showing 0.00 mm Set this is based on the information entered by the user as the points to be used for calibration. Once the Set button is pressed, a secondary window will appear that permits the user to modify the voltage used. It is suggested that if using a 0 reference point, that the user enter 0.00 volts at this point. This will hard set the curve so that 0 volts equals 0 percent. Once the first point is set, pressing the Right arrow will move the cursor to the next calibration point.

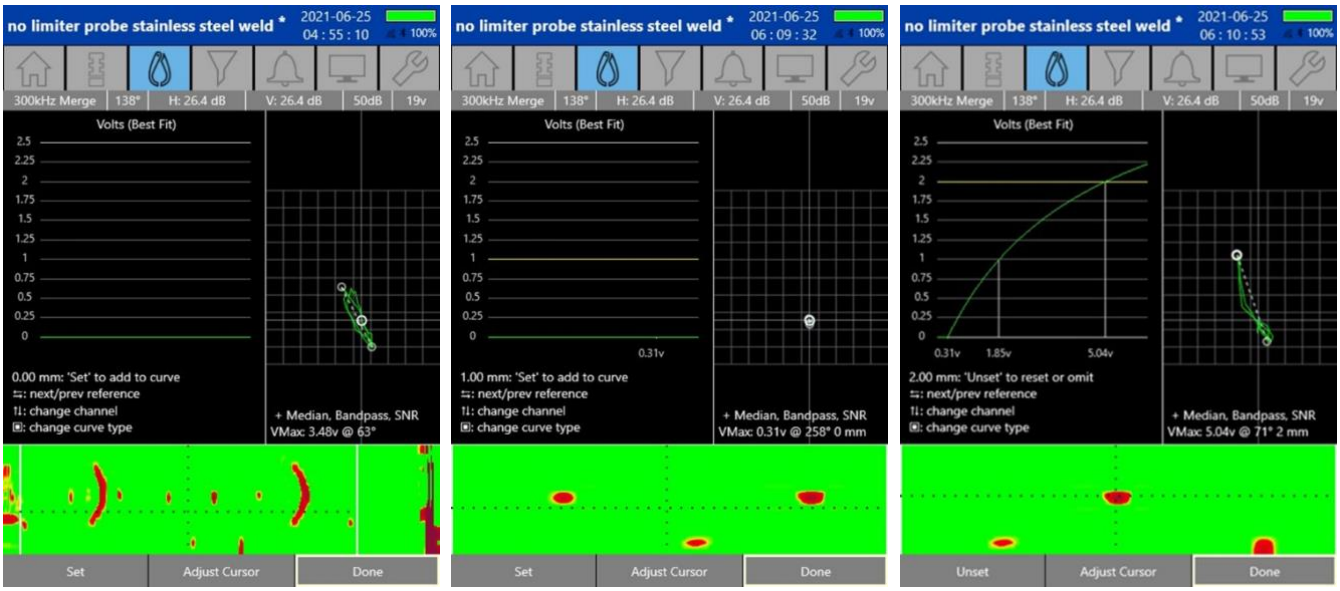


Figure 5-24 Depth Curve Calibration

Move the data cursor to the 1 mm indication, press the right arrow on the screen and the yellow cursor in the curve window will move to the next calibration point, in this case 1 mm. Again, press the Set button to fix this point/voltage in the curve.

Repeat this process above for the 2 mm indication. The resultant curve can be seen in the graphic. Measurements can be made in one of two ways; either through the Calibrate Curves screen (suggested for array data) or via the Tools, Measurement screen. However, once a depth curve has been established, depth measurements will automatically be displayed in the acquisition screen while the instrument is in Review mode.

6. Application Examples

This section gives basic procedures for each of the Applications. For more information on how to configure a particular function, refer to the applicable function in Software User Interface or Working Examples.

Bolt Hole Inspection

This procedure gives an overview of the setup and calibration of common bolt hole inspections. The following equipment is required for this procedure:

- Rotating scanner: ZM-5
- Bolt hole probe: RTP-002, 9.5-11.1 mm (0.375-0.437 in), 100-2000 kHz
- Bolt hole standard: NRK-006, 7075-T6 Aluminum, 3 layers

Technique Setup

1. From the Application page, select Bolt Holes
2. Select the Template – Bolt Hole 1 Freq technique
3. This technique uses 300 kHz for a test frequency. If a different frequency is needed, press Edit and scroll to the bottom of the technique page to change the frequency. All other settings are appropriate for this general procedure.

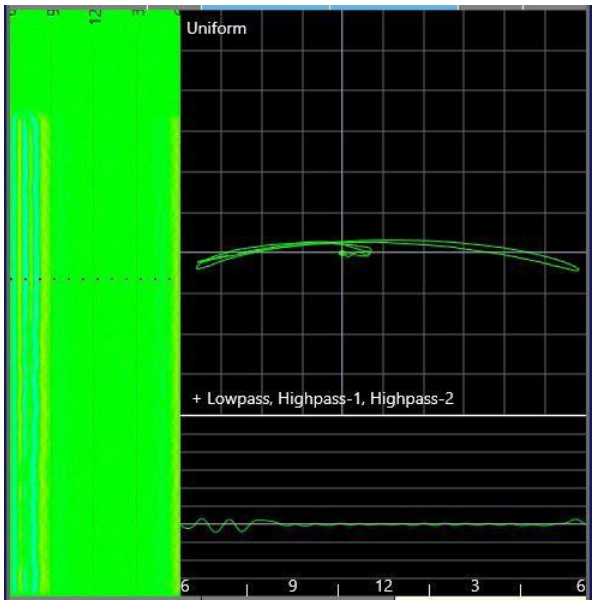
Signal Calibration (Review Mode)

Calibrate the liftoff signal

> **Note:** It may be preferable to perform the calibration of the liftoff signal without the Highpass-1 and Highpass-2 filters enabled. If so, turn off the filters by going to the Filters tab and selecting the Adjust Filters button.

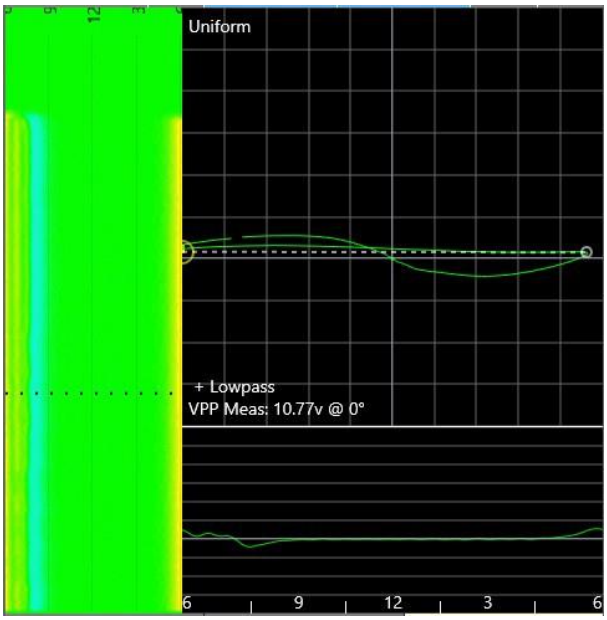
1. Press the Start/Stop Acquire button to start acquisition
2. With the probe in air, press the Instrument Null button
3. Acquire a liftoff signal. Typically, this is done by gently letting the probe coils rotate over a flat surface.
4. Press the Start/Stop Acquire button to stop acquisition
5. Go to the Calibration tab if not there already
6. Use the curser to locate the signal to calibrate on

Liftoff signal with Highpass filters enabled

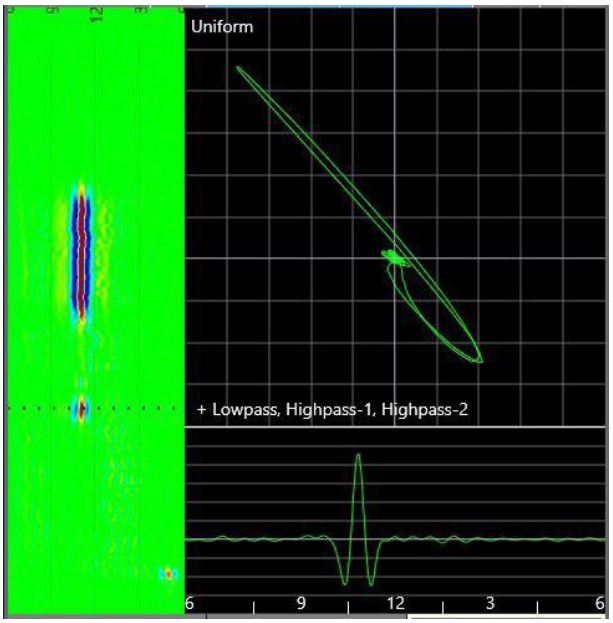


7. Press Adjust Rotation or touch the channel rotation value on the Channel Controls to enter adjust rotation mode
8. Use the arrow keys to rotate the liftoff signal horizontal
9. Press Done to exit out of Adjust Rotation mode
10. Press Adjust Scale or touch the H and V gains on the Channel Controls to enter adjust scale mode
11. Verify you are in Uniform scaling, then use the arrow keys to adjust the Gain so the liftoff signal is approximately full screen width
12. Press Done to exit adjust scale mode

Liftoff signal without Highpass filters

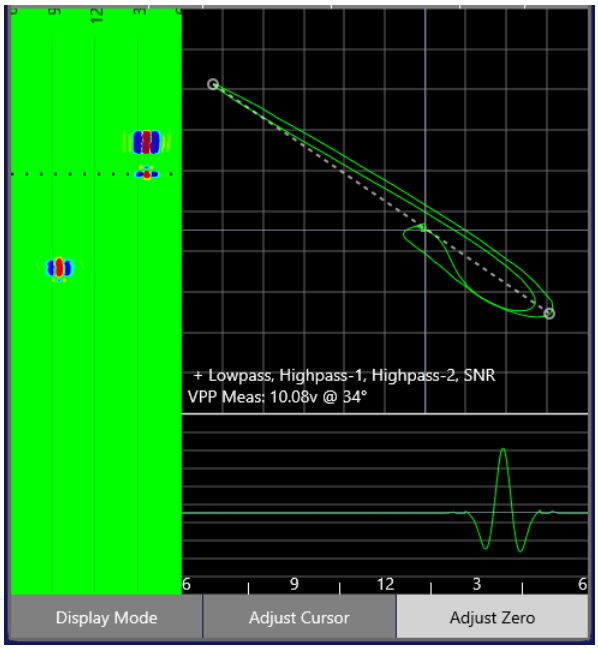


Calibrate the flaw signal

1. Press the Start/Stop Acquire button to start acquisition 2. Scan the bolt hole 3. Press the Start/Stop Acquire button to stop acquisition 4. Go to the Calibration tab if not there already 5. Use the curser to locate the signal to calibrate on 6. Press Adjust Scale or touch the H and V gains on the Channel Controls to enter adjust scale mode 7. Press the Select button to switch to Independent mode and use the left arrow key to reduce the horizontal gain until the flaw rotates to approximately 45 degrees 8. Press the Select button again to switch to Uniform mode and use the arrow keys to increase the gain uniformly so the flaw is approximately full screen height 9. Press Done to exit out of adjust scale mode.	Properly calibrated signal 

At this point, the calibration is complete. It may be necessary to fine tune other settings.

Set the clock position

1. Press Adjust Position two times. The button will change to Adjust Zero. 2. Use the arrow keys to adjust the clocking position of the flaw signal	  Click Adjust Cursor twice to Adjust Data Window

Adjust filters:

Go to the Filters tab and press Adjust Filter to modify the Lowpass, Highpass-1, Highpass2, and SNR filter settings:

- Highpass-1 and Lowpass: The cutoffs should be where noise is minimized without significant reduction of the flaw signal.
- Highpass-2: The filter length should be set to where maximum amplitude of the flaw signal is obtained, and the signal is straight.
- SNR: The vertical peak of the flaw signal should be significantly higher than the SNR limit

Saving the setup and technique:

Once the calibration is complete and all other settings are finalized, the setup can be stored, and the final technique can be saved if desired.

Note: The setup and technique do not need to be saved to continue. All settings are stored in non- volatile memory, even if the instrument is powered down. Saving the setup and technique allows the user to go back to these settings after other changes are made.

1. Go to the Calibration tab and press Manage Calibration
2. Press STORE Current Setup to Technique as Default
3. Go to the Home tab. The Template – Bolt Hole 1 Freq technique is displayed with an asterisk indicating the technique has been modified. Since this technique is a template, it cannot be modified. Therefore, the technique needs to be given a new name.
4. Press the Edit button
5. Give the technique a new name
6. Press the Save button

Adjusting the C-Scan to show layers

The C-scan display can be used to visualize flaw morphology and to distinguish different areas of interest. An example of this is exposing layer boundaries in a multi-layer stack-up to identify in which layer a flaw is located. This information can help determine if the flaw is in a critical structure where repair would be needed.

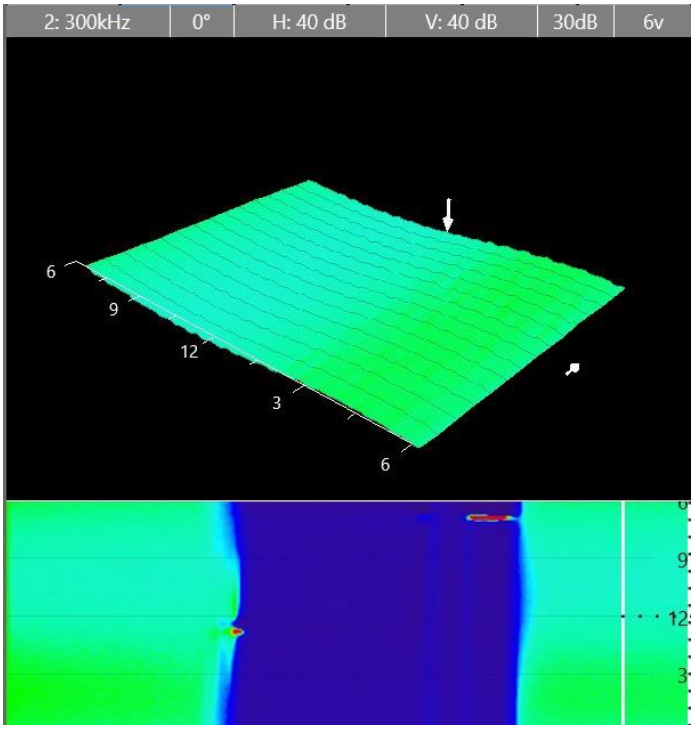
The same equipment used in the bolt hole calibration procedure is used for this example.

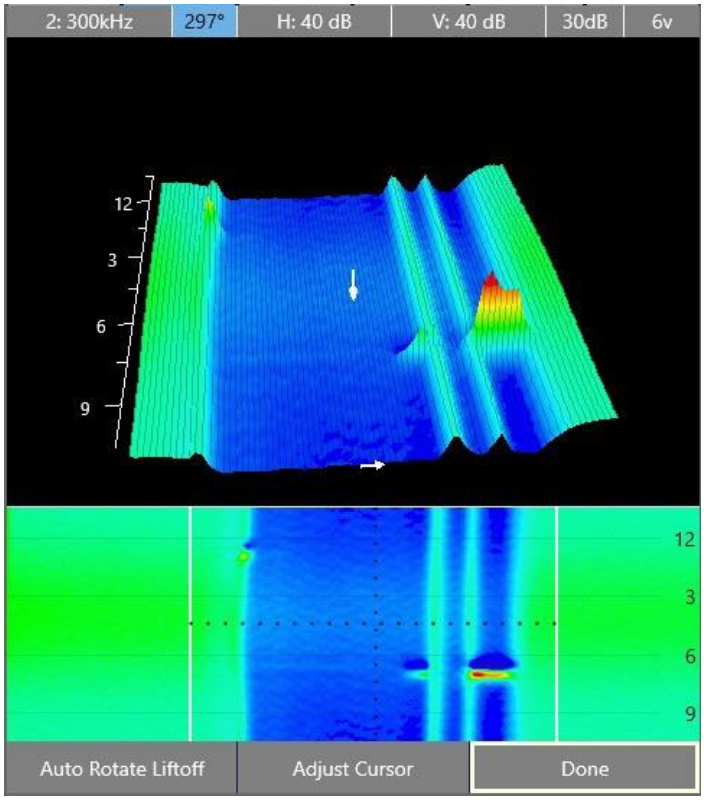
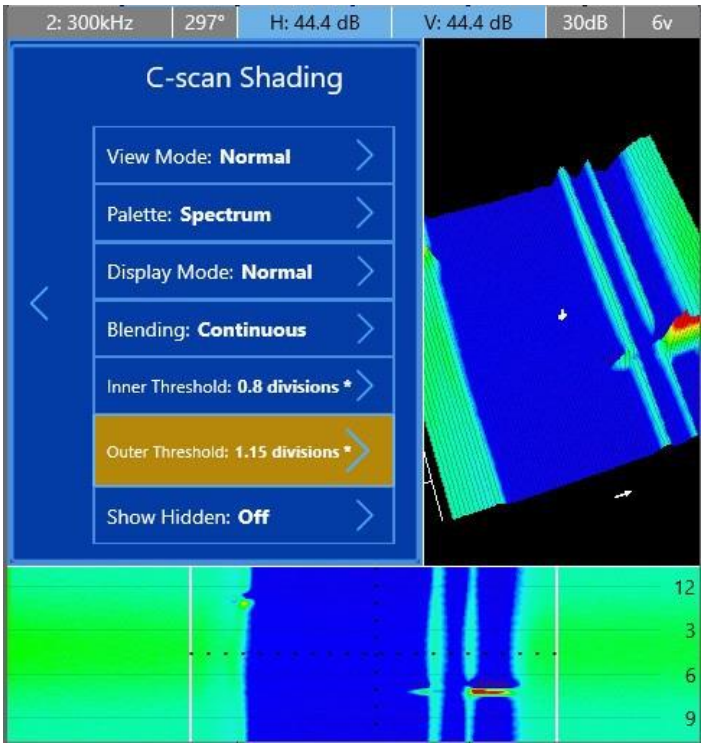
Technique Setup and Data Acquisition

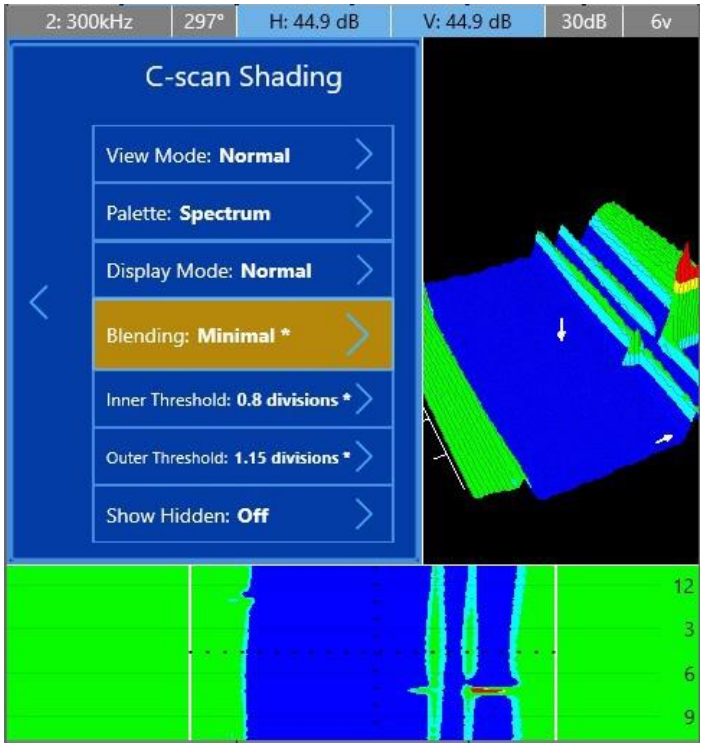
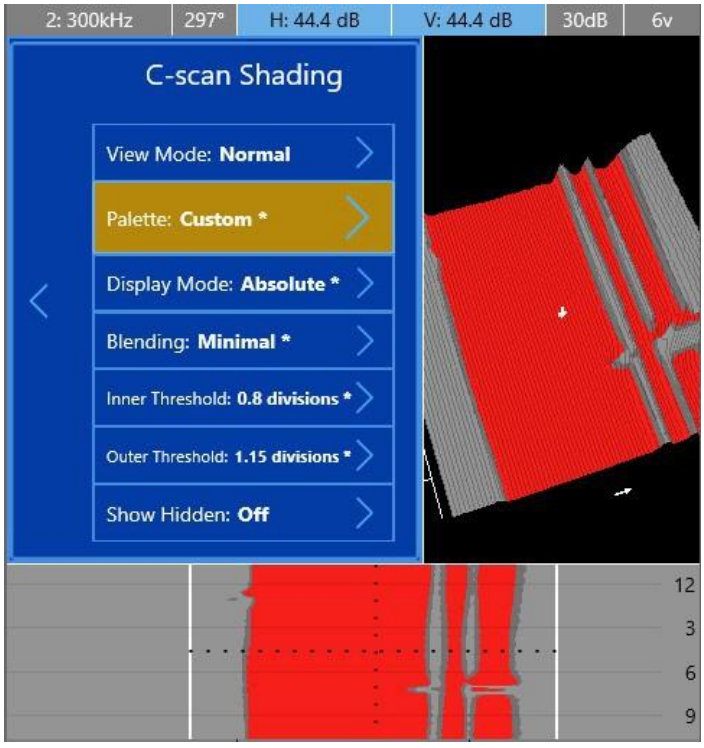
1. From the Application page, select Bolt Holes
2. Select the Template – Bolt Hole 2 Freq technique
3. The 2-frequency technique uses dual 300 kHz channels. Channel 1 (the first 300 kHz channel) is used for flaw detection and Channel 2 (the second 300 kHz channel) is used for layer detection. This procedure just focuses on Channel 2 for layer detection.
4. Press the Start/Stop Acquire button to start acquisition
5. With the probe in air, press the Instrument Null button
6. Scan the bolt hole
7. Press the Start/Stop Acquire button to stop acquisition
8. Display channel 2

C-Scan Manipulation

The graphic on the right shows what the bolt hole looks like when all settings are at factory defaults (channel rotations = 0°, H/V gains = 40 dB) and without any filters enabled.



Channel rotation is the first parameter to be adjusted. Adjust the channel rotation until structures or areas of interest become visible. The graphic on the right illustrates how the rotation was displayed to show three layers (areas in blue)	
After the layers become visible, adjust the C-Scan Shading parameters to optimize the display. The H/V gains may be adjusted as well to enhance the signals. In most cases, the Inner and Outer Thresholds are the primary adjustments followed by the other C-scan Shading options. The following graphics illustrate how changing various C-scan shading parameters affect the display:	

Adjusting blending	
Adjusting the Palette and Display Mode	

The above examples are just a few of the shading options available. Become familiar with all the options and how they affect the data to gain proficiency in optimizing the display.

Conductivity

This conductivity procedure gives an overview of the setup and calibration of Eddyfi Technologies conductivity probes using two conductivity coupons and a 6 mils shim. Additional coupons can be used to further increase the accuracy of the conductivity calibration. This procedure requires the following equipment:

- Conductivity probe: 10025171 (ZHHP-T/D-375-SP-6-4PF), 4 pin Fischer
- Probe adapter: 18-pin to 4-pin Fischer
- Two conductivity coupons: 8.31 %IACS and 101.30 %IACS
- Shim: SHIM-001, set of 13 shims of varying thicknesses

Technique Setup

Note: Conductivity readings are affected by temperature. With the probe connected to the instrument, the instrument should sit idle for at least 15 minutes for the system temperature to stabilize.

1. From the Applications page, select Conductivity and Coating Thickness
2. Select the Template – Conductivity technique
3. This technique uses the Eddyfi Technologies conductivity probe at the optimal 60 kHz for a test frequency. If a different frequency and/or probe is needed, press Edit to change the frequency and probe type. All other settings are appropriate for this general procedure.

Note: The MIZ-21C has been specially calibrated with Eddyfi Technologies conductivity probes. Other probes may be used but may yield less accurate results. Additional calibration points are recommended if using a non- Eddyfi Technologies conductivity probe.

Conductivity Calibration Wizard

1. Go to the Calibration tab and select Tap to Calibrate.
2. Press Add/Delete to go to the add/delete coupon page.
3. Press Add, then enter the conductivity value of the first coupon (8.31 %IACS in this example).
4. Press Add, then enter the conductivity value of the second coupon (101.30 %IACS in this example).
5. Press Next to go to the add/delete Coating Thickness Reference Points page.
6. Press Add, then enter the thickness of the shim (6 mils in this example).
7. Press Next. The wizard will now display the impedance plane with instructions in the bottom left corner of the screen for each subsequent step.
8. Place the probe in air and press Next. The instrument will perform a hardware null.

9. Place the probe on the 8.31 %IACS coupon and press Next.
10. Place the probe on the 101.3 %IACS coupon and press Next.
11. Place the probe on the 8.31 % IACS coupon with the 6 mils shim and press Next.
12. Place the probe on the 101.30 %IACS coupon with the 6 mils coupon and press Next.

The calibrated conductivity curves will now be displayed as an Underlay as shown here:

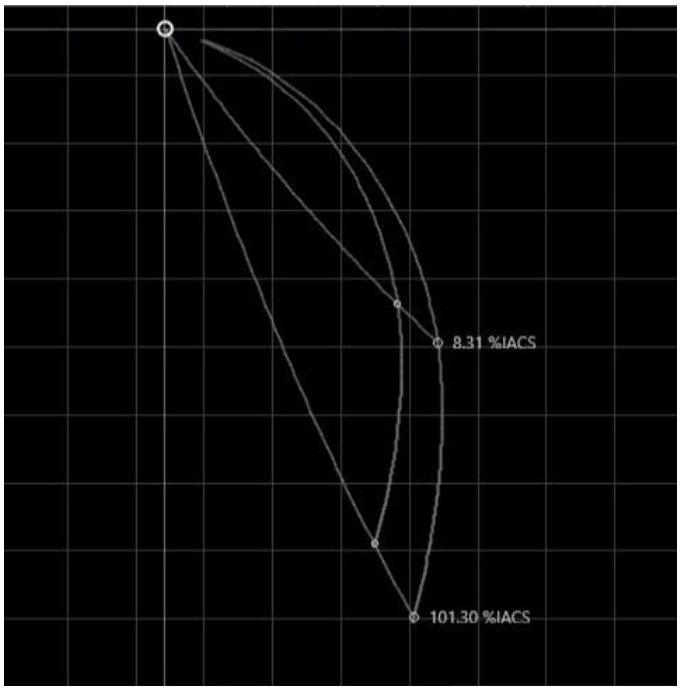


Figure 6-1

Note: While in the calibration wizard, use the left arrow key to go back to repeat a previous step.

Note: Having a smaller calibration window between calibration points will yield more accurate results. For example, a calibration window between 30.00 %IACS and 60.00 %IACS will yield more accurate results than having a window between 3.00 %IACS and 100.00 %IACS.

Note: The target conductivity and/or thickness values should be within the calibration points for best results.

Performing Conductivity and thickness measurements

1. After a successful calibration is performed, press the Start/Stop button to begin acquiring data
2. Use the left/right arrow keys to cycle through the various displays.
3. Place the probe on the test material to get the conductivity and thickness measurements.

Figure 6-2

Press the Start/Stop button at any time to review all data stored in the buffer. In review mode, a time-based strip chart is displayed to make it easy to select measurements of interest.

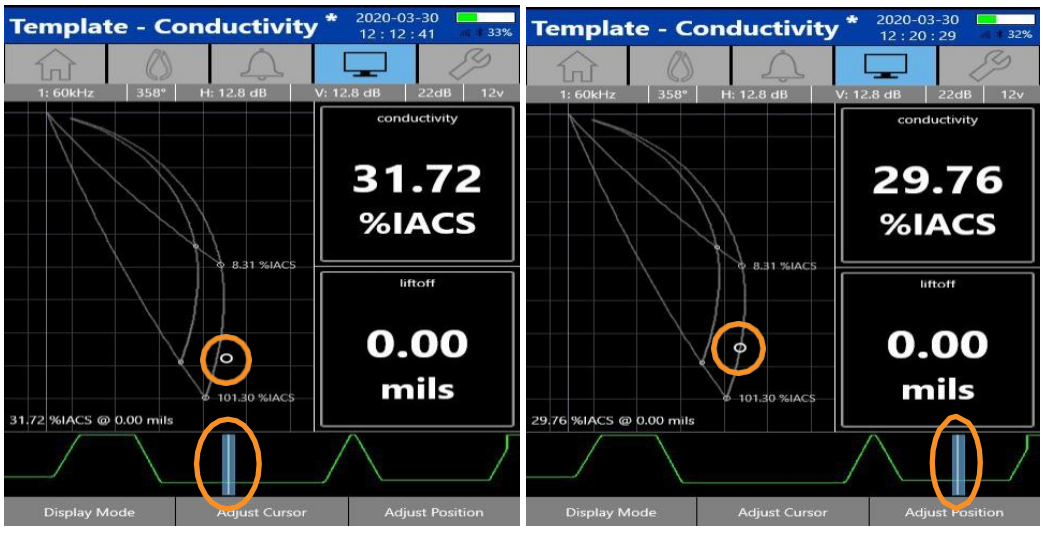


Figure 6-3 Positioning the curser at different conductivity data points

Fine tuning and other optional settings

- To show/hide the Underlay (conductivity curves): From the Tools tab, press the Underlay button to show/hide the Underlay.
- To change scale: From the Calibration tab, press the Adjust Scale button or touch the H and V gains on the Channel Controls from any tab.
- To change channel rotation: From the Calibration tab, Press Adjust Rotation or touch the channel rotation value on the Channel Controls from any tab.

Sub-Surface

This procedure gives an overview of the setup and calibration of a slide probe for the detection of subsurface flaws in aircraft lap splices. This procedure requires the following equipment:

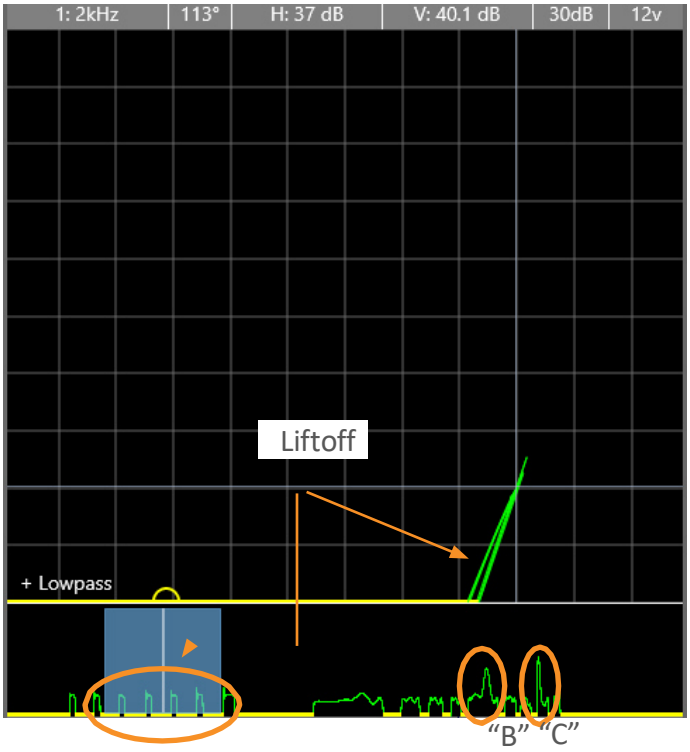
- Slide probe: SLD-001, triax connector
- Probe cable: 18 pin to triax
- Lap splice reference standard: 1087-8. Two layers fastened by rivets. Three EDM's in the second (bottom) layer marked "A", "B", "C". "A" and "C" are EDM notches emanating from rivets. "B" is a freespan EDM notch in between rivets.

Technique Setup

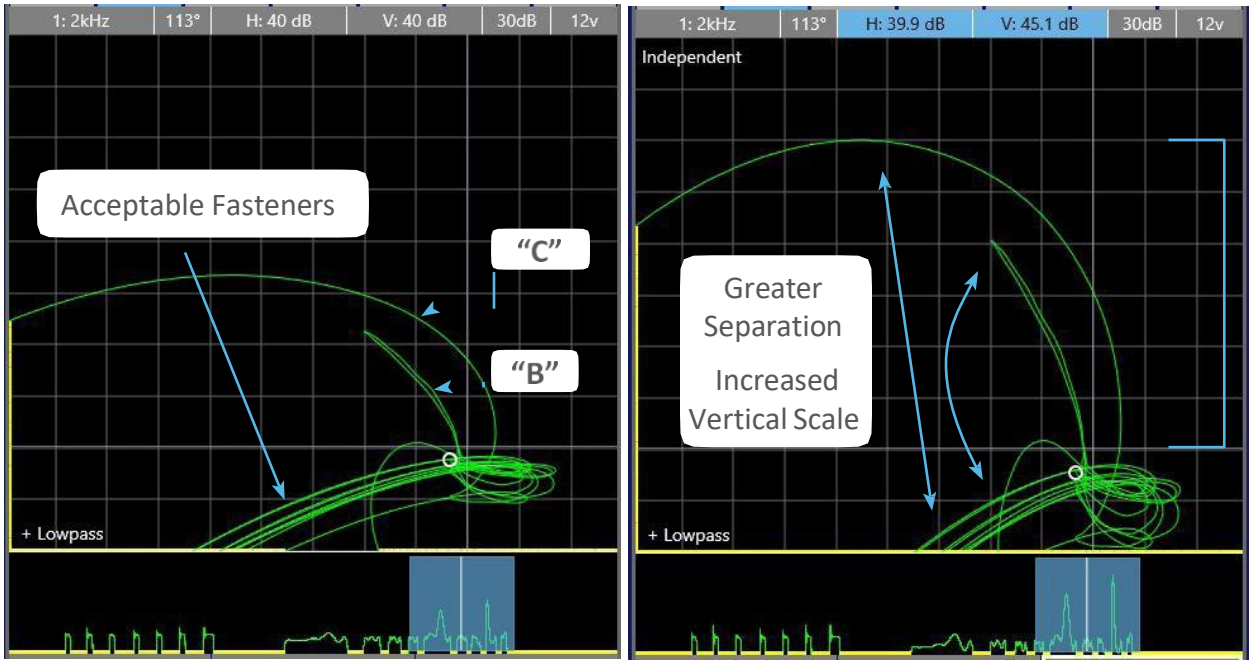
1. From the Applications page, select Sub-Surface.
2. Select the Template – Sub-Surface technique.
3. This technique uses 2 kHz for a test frequency. If a different frequency is needed, press Edit and scroll to the bottom of the technique page to change the frequency. All other settings are appropriate for this general procedure.

Review Mode Signal Calibration

1. Press the Start/Stop Acquire button to start acquisition
2. Place the probe in an area of defect free material, away from the edge. In this case, the probe is centered in between two fasteners.
3. Press the Instrument Null button
4. Tap the probe against the standard to acquire a liftoff signal
5. Run the probe across the entire rivet line which has the EDM notches "B" and "C"
6. Press the Start/Stop Acquire button to stop acquisition
7. Go to the Calibration tab if not there already
8. Position the operating point in the lower-right part of the screen. Refer to figure on the right.
9. Use the curser to locate the liftoff signal
10. Press Adjust Rotation or touch the channel rotation value to enter adjust rotation mode
11. Use the arrow keys to rotate the liftoff signal down and to the left of the operating point. Refer to figure on the right.
12. Press Done to exit out of Adjust Rotation mode
13. Press Adjust Scale or touch the H and V gains to enter adjust scale mode
14. Position the curser and adjust the Data Window so notches "B" and "C" are in the impedance display.
15. Press the Select button to switch to Independent scale mode. Use the arrows keys to separately adjust the horizontal and vertical gains such that:
    - There is adequate separation between the acceptable fasteners and notch "B"
    - The notch signals are at least three vertical divisions.
16. Press Done to exit Adjust Scale mode



Refer to the examples below:



Signals with 1:1 scaling

Signals with independent scales to achieve desired separation and scale

Figure 6-4 Signal examples

Saving the setup and technique:

Once the calibration is complete and all other settings are finalized, the setup can be stored, and the final technique can be saved if desired.

Note: The setup and technique do not need to be saved to continue. All settings are stored in non- volatile memory, even if the instrument is powered down. Saving the setup and technique allows the user to return to these settings after other changes are made.

1. Go to the Calibration tab and press Manage Calibration
2. Press STORE Current Setup to Technique as Default
3. Go to the Home tab. The Template – Sub-Surface technique is displayed with an asterisk indicating the technique has been modified. Since this technique is a template, it cannot be modified. Therefore, the technique needs to be given a new name.
4. Press the Edit button
5. Give the technique a new name
6. Press the Save button

Surface Array

This surface array procedure gives a general overview of the setup and calibration of surface array probes for the detection of surface breaking flaws. The concepts for probe calibration, data manipulation, and fine tuning of parameters are common to all materials and surface array probes. This procedure requires the following equipment:

- PLT-006 is used for probe calibration and flaw demonstration. The plate has a transverse groove for calibration, EDM notches of various sizes and round bottom holes of various sizes.
- Surf-X Flex Array: SURFX-S01 with detachable encoder and electronics module

Technique Setup

1. From the Application page, select Surface Array
2. Select the Template – Reflection Surface Array technique
3. This technique uses 700 kHz for a test frequency. If a different frequency is needed, press Edit and scroll to the bottom of the technique page to change the frequency.
4. This technique uses an encoder to regulate the sample density. If no encoder is being used, press Edit and turn Encoder Sampling to Off and set the Sample Rate to 200 samples/sec. At this sample rate, the scanning speed needs to be less than 4 inches/sec to achieve a sample density greater than or equal to 50 samples/inch (or 100 mm/sec to be greater than or equal to 2 samples/mm).

Calibration

Set Rotation

1. Place the probe on a section of the calibration plate that is free of defects
2. Press Start/Stop to start acquisition
3. Press Instrument Null
4. Scan the entire plate
5. Press Start/Stop to stop acquisition
6. Go to the Calibration tab if not already there
7. Press Adjust Rotation
8. Press the Up arrow or touch the Channel label to display the Merge channel.
9. Calibration will be done on the merge channel since rotation and scale changes made to the merge channel automatically get applied to the axial and transverse channels.
10. Place the data window over the entire groove
11. Touch and drag the cursor on the 2D C-scan to the groove
12. Adjust the data window so that only the groove signal is displayed:
    a. Touch: Use a pinch gesture to open or close the data window
    b. Buttons:
        i. Press Adjust Curser two times. The button label will change to Adjust Data

Window.

ii. Use the arrow keys to open or close the data window

The following graphic shows how the data window should be positioned:

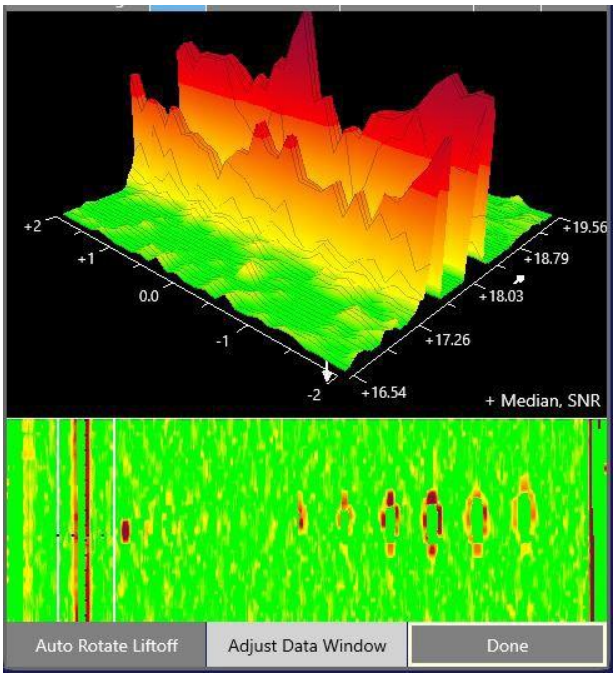


Figure 6-5

13. Press Auto Rotate Liftoff

The groove signal will be rotated to 60 degrees on all channels. By default, it is set to 60 degrees in the Auto Rotate Liftoff Orientation field.
The data should look like the following graphic:

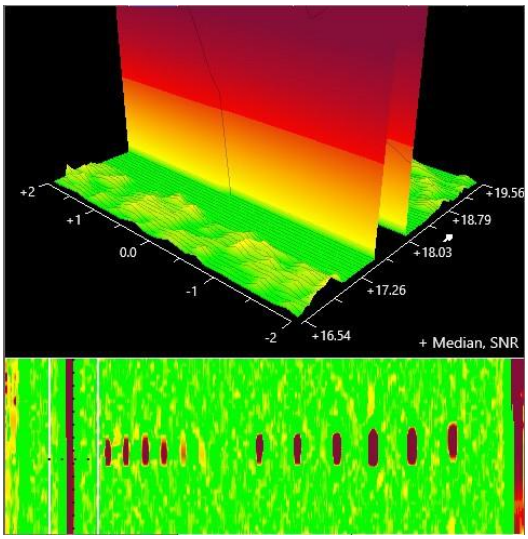


Figure 6-6

14. Press Done

Set Scale

1. From the Calibration tab, press Adjust Scale
2. Place the cursor on the signal to be used to set scale. Use the same methods described above for the groove.
3. Press Adjust Scale

The displayed signal will be scaled to 5 divisions. This is the default setting in the Auto Scale Defect Height field in the Technique settings.

All other channels will have their scale set relative to the display channel since the Auto Rotate/Scale Mode is set to Single Scale.

The data should look like the following graphic:

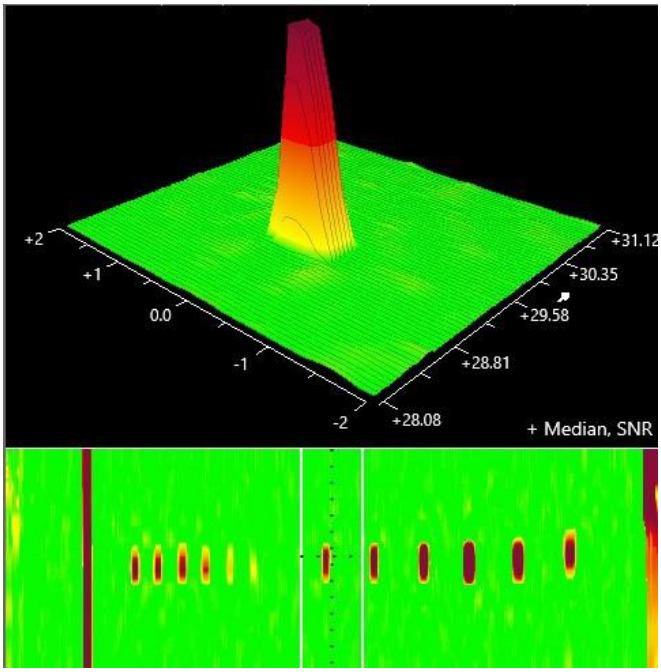


Figure 6-7

4. Press Done

The axial and transverse channels will also be calibrated because the merge channel affects all channels. These channels can be calibrated separately using the same methods.

Fine Tuning and adjusting other optional settings:

Adjusting rotations and scale

After the auto calibration is performed, it may be necessary to fine tune the rotation and scale. Any manual adjustments to rotation and scale made on the merge channel will have the same change on the axial and transverse channels.

1. Go to the merge, axial, or transverse channel needing adjustment

It may be useful to view a channel on the impedance plane when manually adjusting the rotation and scale:

2. Go to the Display tab
3. Press Display Mode until you have the tri-display of impedance, 3D and 2D C-scans as shown below:

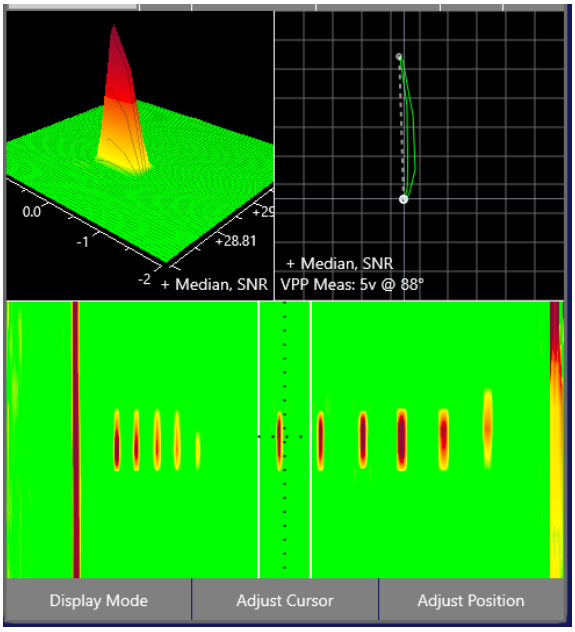


Figure 6-8

To manually adjust rotation:

1. Go to the Calibration tab and press Adjust Rotation or touch the rotation label on the Channel Controls to enter Adjust Rotation mode
2. Use the arrow keys to adjust the signa to the desired rotation

To manually adjust scale:

1. Go to the Calibration tab and press Adjust Scale or touch the H and V gains on the Channel Controls to enter Adjust Scale mode
2. Use the arrow keys to adjust the signal to the desired scale

Adjust Filters

Go to the Filters tab and press Adjust Filter to modify Median and SNR filters.

- Median Filter: The Filter Length should be set as low as possible, but at least two times the expected flaw length
- SNR Filter: The vertical peak of the flaw signal should be significantly higher than the SNR limit

Adjust C-Scan shading

There are many options available to change the look of the C-Scan. All of these are found in the C-Scan Shading menu:

1. If there is not a 3D C-Scan already displayed, go to the Display tab and cycle the Display Mode to display a 3D C-Scan.
2. Double tap the display to bring up the C-Scan shading menu

When done correctly, the C-Scan menu will now be displayed:

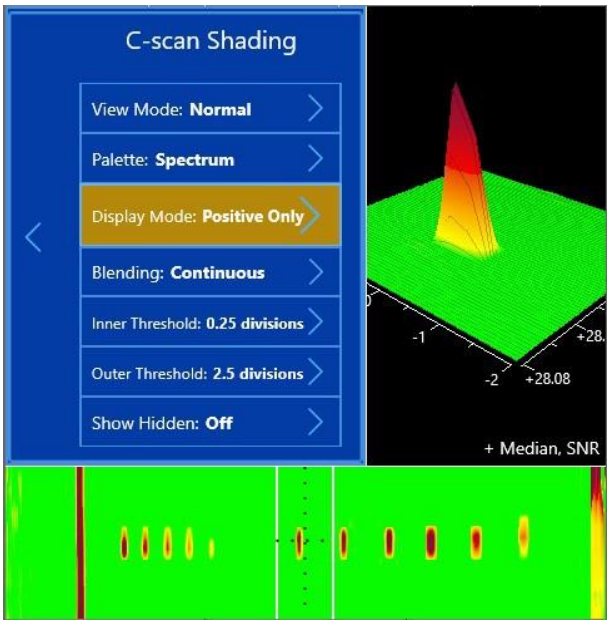


Figure 6-9

Please see Working Examples -> C-scan Shading section for details on each of the settings

Saving the Setup and Technique:

Once the calibration is complete and all other settings are finalized, the setup can be stored, and the final technique can be saved if desired.

> **Note**: The setup and technique do not need to be saved to continue. All settings are stored in non- volatile memory, even if the instrument is powered down. Saving the setup and technique allows the user to return to these settings after other changes are made.

1. Go to the Calibration tab and press Manage Calibration
2. Press Store Current Setup to Technique as Default
3. Go to the Home tab. The Template – Bolt Hole 1 Freq technique is displayed with an asterisk indicating the technique has been modified. Since this technique is a template, it cannot be modified. Therefore, the technique needs to be given a new

name.

4. Press the Edit button
5. Give the technique a new name
6. Press the Save button

Surface Crack Inspection

This procedure gives an overview of the setup and calibration of a typical pencil probe for the detection of surface breaking flaws. The concepts for probe calibration, data manipulation, and fine tuning of parameters are common to most materials and pencil probe types. This procedure requires the following equipment:

- Pencil probe: DPT45-002, 50-500 kHz, triax connector
- Probe cable: 18 pin to triax
- Crack surface standard: NDT-3025AL, 7075-T6 Aluminum

Technique Setup

1. From the Applications page, select Surface Cracks
2. Select the Template – Surface Crack technique
3. This technique uses 200 kHz for a test frequency. If a different frequency is needed, press Edit and scroll to the bottom of the technique page to change the frequency. All other settings are appropriate for this procedure.

Note: If a single absolute coil probe (i.e., any probe with a single microdot connector) is being used, then the Drive Mode in the technique needs to be changed from Differential to Absolute.

Signal Calibration (Review Mode)

1. Press the Start/Stop Acquire button to start acquisition
2. Place the probe in an area of defect free material, away from the edge
3. Press the Instrument Null button
4. Tap the probe against the standard to acquire a liftoff signal
5. Run the probe over the four notches
6. Press Start/Stop Acquire to stop acquisition
7. Go to the Calibration tab
8. Use the cursor to locate the liftoff signal
9. Press Adjust Rotation or touch the channel rotation value to enter adjust rotation mode
10. Use the arrow keys to rotate the liftoff signal horizontal

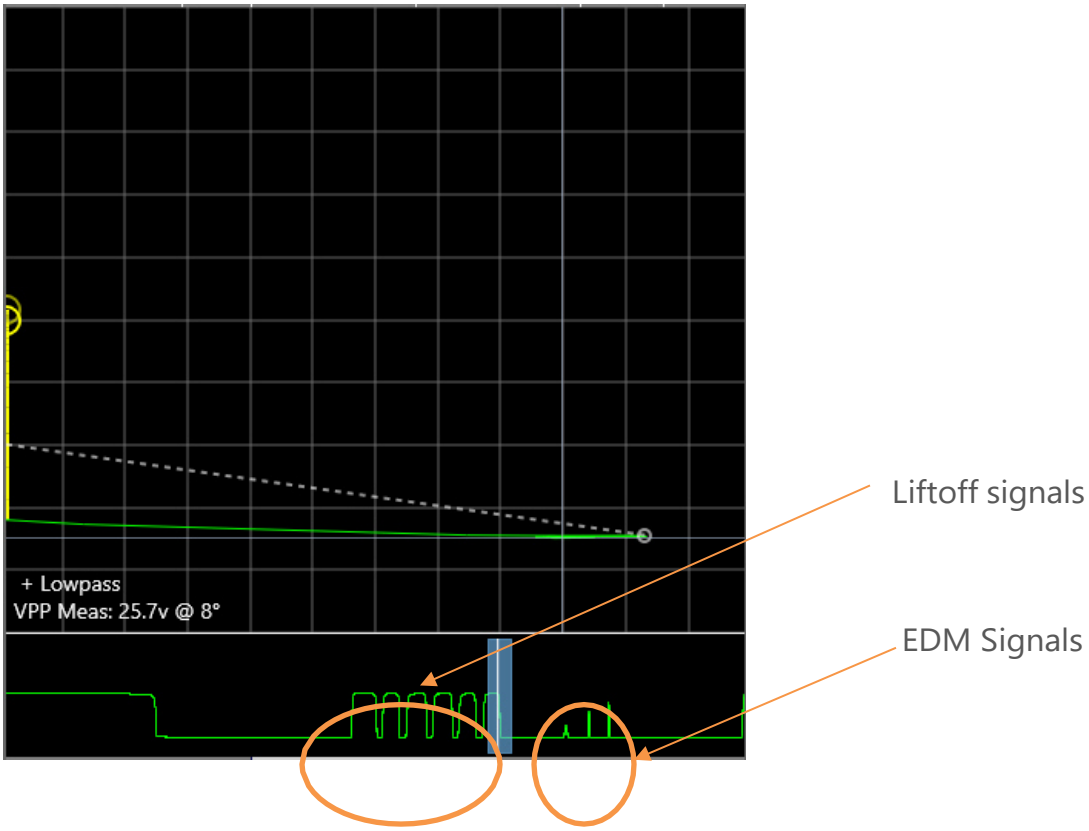


Figure 6-10 Rotating liftoff signal horizontal

11. Press Done to exit out of Adjust Rotation mode
12. Press Adjust Scale or touch the H and V gains to enter adjust scale mode
13. Use the cursor to locate the EDM signals
14. If needed, adjust the data window so all three EDM notches are in the impedance display:
    - Press Adjust Cursor and use the up/down arrows or use a pinch and zoom gesture to adjust the data window size as needed.
    - Press Adjust Cursor again to return to adjust scale mode
15. Use the arrow buttons to adjust the horizontal and vertical gain so the largest notch signal is 80% full screen height. The horizontal gain should be set so all notch signals are on the screen and there is adequate horizontal separation. The picture below is an example how the signals should look.

Note: Use the Select button as needed to switch between Uniform and Independent scale modes

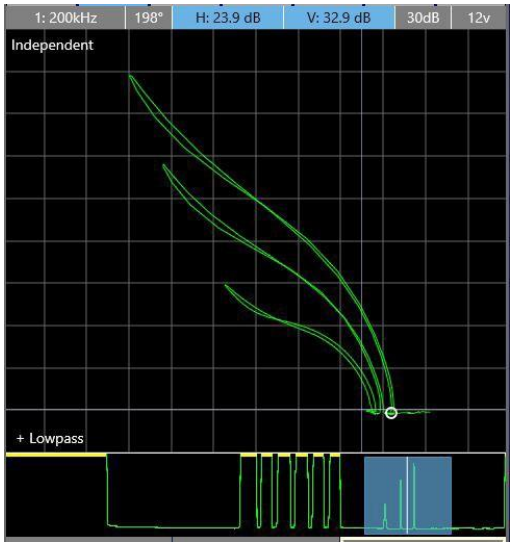


Figure 6-11 Scale modes

Median Filter Setup

The median filter is an excellent filter to maintain the stability of the operating point, even if the probe orientation to the surface is changing (rocking the probe back and forth or scanning over uneven surfaces).

1. Go to the Filter tab and press Adjust Filter
2. Select the Median Filter
3. Set the Median Filter Length to 3 Hz.

   Note: At 3 Hz, axial flaws longer than 150 data points will start having their signal amplitude reduced.

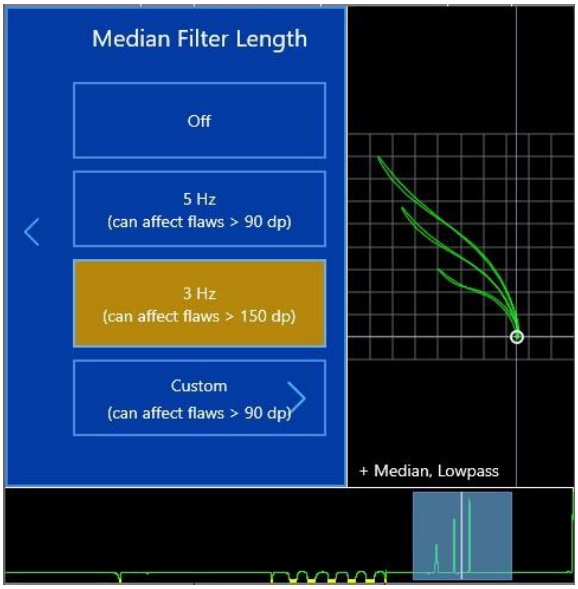


Figure 6-12 Median filter applied to minimize signal drift

Saving the setup and technique:
Once the calibration is complete and all other settings are finalized, the setup can be stored, and the final technique can be saved if desired.

> **Note:** The setup and technique do not need to be saved to continue. All settings are stored in non- volatile memory, even if the instrument is powered down. Saving the setup and technique allows the user to return to these settings after other changes are made.

Go to the Calibration tab and press Manage Calibration:

1. Press STORE Current Setup to Technique as Default
2. Go to the Home tab. The Template – Surface Crack technique is displayed with an asterisk indicating the technique has been modified. Since this technique is a template, it cannot be modified. Therefore, the technique needs to be given a new name.
3. Press the Edit button
4. Give the technique a new name
5. Press the Save button

7. Additional Learning

Eddyfi Technologies offers training videos to supplement the information in this manual to help users become proficient with the setup and use of the MIZ-21C.

Visit http://www.Eddyfi_Technologies.com/miz-21c-training/ to explore the various videos available.

Users can also go to the Eddyfi Technologies NDT YouTube Channel (https://www.youtube.com/channel/UCAjOz3- UrHq0kYUHmsVOnrw) to learn more about Eddyfi Technologies products and solutions.

8. Specifications

General

This section contains the general specifications for the MIZ-21C.

Feature	Specification
Voltage	100 to 240 VAC, Auto-Switching
Frequency	50 to 60 Hz
Output Voltage	15 VDC
Maximum Power	40 W
Operating Temperature	-10°C to 50°C (14°F to 122°F)
Storage Temperature	-20°C to 70°C (-4°F to 158°F) (w/out batteries)
Relative Humidity	95% non-condensing
IP Rating	Designed to IP-66
Altitude	Up to 1700 m
Overvoltage Category	II
Pollution Degree	PD3 on battery power, PD2 with external power supply, Indoor or outdoor use when battery powered (protected at all times from liquids, dust, direct sunlight, precipitation, and wind)
Wet Locations	On battery power only
Supply Voltage Fluctuation for AC Adapter	±10%
CE mark is an attestation of the conformity with all applicable directives and standards of the European Community. WEEE, RoHS, ISO 12718, ISO 15549, ISO 15548.	
MIZ-21C NRTL: IEC 61010-1:2010, AMD1:2016 All CENELEC members listed in EN 61010-1:2010+A1:2016. Canada National Differences according to CSA C22.2 No. 61010-1 + Amd 1. US National Differences according to UL 61010-1(3rd Ed.); Am.1 Switzerland National Differences according to SN EN 61010-1:2010 Australian National Differences according to AS 61010-1.	
Environmental Tests as per MIL-STD-810H:	
Cold Storage	502.7 procedure I
Cold Operation	502.7 procedure II
Heat Storage	501.7 procedure I
Heat Operation	501.7 procedure II
Shock	514.8 procedure I
Vibration	514.8 Annex C Table 514.8C-IX
Transit Drop	516.8 procedure IV
Drop Test	516.8 procedure IV, 1.2 m (4 ft) with cover
Explosive Atmosphere	511.7 procedure I

Operating Specifications

This section details the operating specifications of the MIZ-21C.

Feature	Specification
Size (H × W × D)	267 × 122 × 38 mm (10.5 × 4.8 × 1.5 in)
Weight	1.2 kg (2.6 lb) (including batteries and cover)
Multi-Touch Display	5.7 in (480 x 640 pixels)
Battery Life	Up to 10 hours
Eddy Current Connector	18-Pin LEMO
Eddy Current Array Connector	26-Pin LEMO
Connectivity	USB 2.0, Wi-Fi, Bluetooth
Encoders	2 axes, Quadrature, Only 1 axis is currently available for surface array applications
Probe Recognition and Setup	Automatic with Eddyfi Technologies ID Chip
Coil Inputs	MIZ-21C-SF: 1, MIZ-21C-DF: 1, MIZ-21C-ARRAY: 3
Frequencies Per Timeslot	MIZ-21C-SF: 1, MIZ-21C-DF: 2, MIZ-21C-ARRAY: 2
Data Channels	MIZ-21C-SF: 32, MIZ-21C-DF: 64, MIZ-21C-ARRAY: 192
Maximum Probe Coils	MIZ-21C-SF: 2, MIZ-21C-DF: 2, MIZ-21C-ARRAY: 32
Frequency Range	5 Hz to 10 MHz
Generator Output	Up to 12 Vpp (19 Vpp for ECA) in 0.1 Volt increments
Injection Modes	Continuous and Super-Multiplex
Receiver Gain	10 to 173 dB
Phase	0 to 359.9° down to 0.1° increments
Data Resolution	16 bits
Probe Drive	50 Ohm
Filters	Median, High Pass, Low Pass, High Pass 2 (Adjustable CC), Bandpass, Spike, SNR
Alarms	Adjustable Box, Sector, and Polar, Audio adjustable volume, Headphone support
Conductivity Frequency	60, 120, 240 and 480 kHz
Conductivity Specification	Digital readout in 0.9 to 110 %IACS (0.5 to 70 MS/m), Accuracy within ±0.5% IACS from 0.9% to 65% IACS and within ±1.0% of values over 65%
Non-Conductive Coating Thickness	Can measure non-conductive coating thickness from 0 mm to 1.000 mm. Accuracy of 0.025 mm (±0.001 in.) over a 0 mm to 0.64 mm range
Rotating Scanner	MIZ-21C-SF: No, MIZ-21C-DF: Yes, MIZ-21C-ARRAY: Yes Eddyfi Technologies Rotating Scanner, Others
Maximum Data File Size	60 seconds or 10 meters
Languages	English, Spanish, French, German, Chinese, Japanese, Portuguese, Russian
Internal Storage	128 GB
Instrument Calibration	ISO 15548-1:2013, ISO/IEC 17025:2005, Meets or exceeds manufacturer's requirements

9. Maintenance

Cleaning the Instrument

The MIZ-21C external surfaces (housing and front panel) can be cleaned when needed.

To clean the instrument:

1. Make sure the instrument is turned OFF, the power cord is disconnected, and all batteries are removed.
2. To bring the instrument back to its original finish, clean the housing and the front panel with a soft cloth.
3. To get rid of persistent stains, use a damp cloth with a soft soapy solution. Do not use abrasive products or powerful solvents that might damage the finish.
4. Wait until the instrument dries completely before placing the batteries in their compartment and/or plugging in the power cord and cables.

Caution! 	Do not clean the instrument with a water jet, spray can, or spray bottle. The connector contacts could stay wet and produce a short circuit when plugging cables.
Caution! 	The display and touch panelcan be cleaned as described above, however, the instrument must never be submerged or overly dampened (by water or cleaning products) which can cause the detachment of the touch panel.
Caution! 	Never try to clean the inside of the battery compartment with liquid. Contact Eddyfi Technologies if you have any questions.

Performing a MIZ-21C Diagnostic Test

You can generate an automatic self-diagnostic test of your MIZ-21C without any external equipment attached. This test shows an overall status of the equipment as follows:

- Channel to channel gain deviation reported
- Drive from low to high deviations reported
- Noise measured in three settings
- Hardware Null validated
- Demodulation test at four frequencies

External self-diagnostic tests can be done with Load Plugs attached. These tests show an overall status of the equipment as follows:

- Same tests as internal but run through 18-pin and 26-pin connectors
- Digital I/O tests

Factory Maintenance

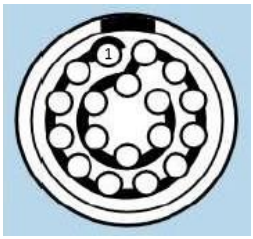
The MIZ-21C can be sent to one of Eddyfi Technologies' service centers. These sites also perform calibrations.

Licensing

Your MIZ-21C software does not require licensing. Software updates can be found on the Eddyfi Technologies website and installed through the USB port.

10. Connector References

Standard Eddy Current Connector

Standard Eddy Current Connector	"S"
Type	18-Pin LEMO
Front View (Female)	

Mating Connector	FGG.2B.318.CLAD62Z

Pin	Name	Description
1	GND	Ground, Common Return
2	ALARM1	Alarm 1, Digital Output: Sink 30 mA, Source 1 mA @ 3.5V
3	ACQ-CLK/TRIGGER*	Acquisition Clock/Trigger, Digital Input: 3.3V to 5.0V
4	ROTARY-DRIVE	Rotary Motor Drive
5	ROTARY-RETURN	Rotary Motor Return
6	GND	Ground, Common Return
7	+15V	+15 Volts @ 100 mA
8	GEN1	Generator 1, Direct Drive: 19 Vpp @ 250 mA
9	GND	Ground, Common Return
10	REF-COIL	Reference Coil
11	TEST-COIL	Test Coil
12	GND	Ground, Common Return
13	BALANCE	Balance, Digital Input: 3.3V to 5.0V
14	MIZ-ID	MIZ-iD Automatic Device Detection
15	TACH*	Tachometer
16	ON-OFF*	On/Off Momentary Switch
17	HOLD	Hold, Digital Input: 3.3V to 5.0V
18	+3.3V	+3.3 Volts @ 100 mA

*Varies by Rotating Scanner

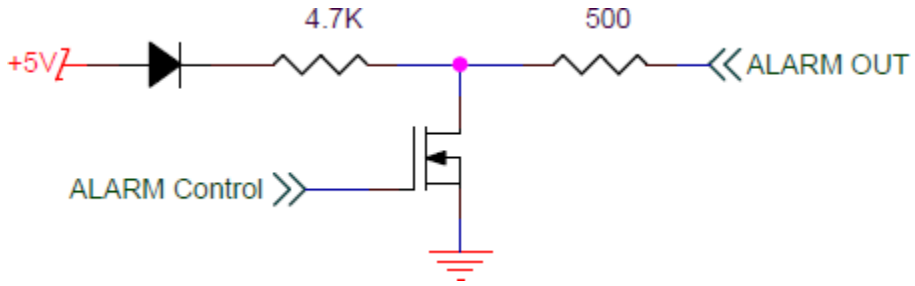
Eddy Current Array Connector

Eddy Current Array Connector	"A"
Type	26-Pin LEMO
Front View (Female)	
Mating Connector	FGG.2B.326.CLAD62Z

Pin	Name	Description
1	GND	Ground, Common Return
2	ENC1B	Encoder 1B, Digital Input: 3.3V to 5.0V
3	ENC1A	Encoder 1A, Digital Input: 3.3V to 5.0V
4	-15V	-15 Volts @ 100 mA
5	GND	Ground, Common Return
6	+15V	+15 Volts @ 100 mA
7	GND	Ground, Common Return
8	ECA	Eddy Current Array
9	GND	Ground, Common Return
10	ECA	Eddy Current Array
11	GND	Ground, Common Return
12	ECA	Eddy Current Array
13	GND	Ground, Common Return
14	GEN1	Generator 1, Direct Drive: 19 Vpp @ 250 mA
15	ECA	Eddy Current Array
16	ECA	Eddy Current Array
17	ECA	Eddy Current Array
18	ALARM2	Alarm 2, Digital Output: Sink 30 mA, Source 1 mA @ 3.5V
19	HOLD	Hold, Digital Input: 3.3V to 5.0V
20	BALANCE	Balance, Digital Input: 3.3V to 5.0V
21	ENC2B	Encoder 2B, Digital Input: 3.3V to 5.0V
22	ENC2A	Encoder 2A, Digital Input: 3.3V to 5.0V
23	+3.3V	+3.3 Volts @ 100 mA, Encoder Power
24	ECA	Eddy Current Array
25	MIZ-ID	MIZ-iD Automatic Device Detection
26	PRESET	Encoder Preset, Digital Input: 3.3V to 5.0V

Alarm Interface

Alarm Interface	
18-Pin Connector	Pin 2
26-Pin Connector	Pin 18

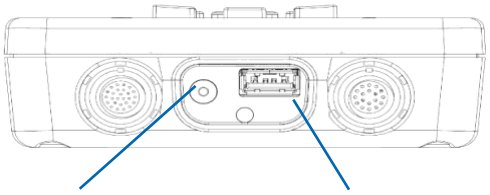


Digital Inputs

Function	Pulled up to 3.3V through a 10K resistor
18-Pin Connector	Pins 3, 13, 17
26-Pin Connector	Pins 2, 3, 19, 20, 21, 22, 26

USB Connector

The USB 2.0 port can be used to attach peripherals such a mouse, keyboard, headphones, or storage device. The USB port also supports the connection of a USB hub so several peripherals can be connected at once.



Charging Port USB 2.0

Description	USB 2.0 Port, Type A, Female Connector
Max. Cable Length	5m
Maximum Capacity Per Port	0.1 A

Power Connector

The charging port is used to attach the power adapter supplied with the MIZ-21C. The charging port is used to recharge the internal batteries.

Direct Current ⎓	**Charging Port** The MIZ-21C shall only be connected to the supplied power adapter and cables for charging and/or operating. Use of an improper power adapter may result in loss of data or damage to the instrument.

11. Problem with Your MIZ-21C Instrument

Basic Troubleshooting

The table below lists the error messages a user may encounter. For each error message, a description of the message is given, followed by troubleshooting steps. If the problem is not resolved after performing the troubleshooting steps, contact Eddyfi Technologies for support.

Error Message	Description	Action
Failed to balance	The Instrument Null failed	1. Isolate the probe and the instrument: a. Perform an Instrument Null with no probe connected. If the balance fails, then this indicates there is a problem with the instrument. Contact Eddyfi Technologies for servicing. If the instrument successfully balances, then this indicates a problem at the probe side. Proceed to step 2. 2. Reduce hardware gain. Probes in absolute mode and thin film probes require less gain than differential or reflection probes. 3. If using a surface array probe, run the Surface Array diagnostic and check for coil failures.
Buffer overflow	The data buffer is full	Reboot the instrument.
Acquisition has been halted	Data acquisition stopped due to a system event.	Do not connect/disconnect anything to the instrument while acquiring data. This includes USB devices, probes, network/ Bluetooth connections
Sorry, something went wrong. Please cycle the power button and try again	Internal communication is lost	Reboot the instrument
Gain Adjustment table not found. Please perform calibration	The instrument calibration data is not present.	An instrument calibration of the acquisition circuit is required
Instrument is out of calibration. Please contact your service provider	The instrument calibration data is not present.	An instrument calibration of the acquisition circuit is required
Unable to find/load review setup	The user selects Load Review Setup, but a Review Setup has not been saved	Ensure there is a saved Review Setup prior to attempting to load a Review Setup

Error Message	Description	Action
Unable to save review setup	There was a problem saving the setup to disk or USB	This may be an isolated error. If it persists: • Disconnect/re-connect the USB device • Try another USB device • If writing to the internal drive, then contact Eddyfi Technologies for servicing
Unexpected error encountered attempting to load data file	Data file being loaded is either not a MIZ-21C data file or it is corrupt.	Load a different data file to verify the suspect data file is corrupt.
CPU Temperature approaching shutdown MPIC Temperature approaching shutdown System Temperature approaching shutdown	The respective system temperature monitoring sensor is reporting a high temperature situation	Move the unit to a cooler environment immediately to avoid a system shutdown
Technique sample rate of (original sample rate) has been reset to instrument limit of (new sample rate)	At lower test frequencies, the maximum allowable sample rate may be limited based upon the test frequency.	Increase the test frequency to increase the maximum allowable sample rate.
Maximum scanning speed has been reset to instrument limit of (new speed)	A change in sample rate or data density caused the maximum scanning speed to change	Review the new sample rate and/or data density to understand the speed change
(ECA Probe Type) techniques can only be used with (ECA Probe Type) probe. Please verify you have a (ECA Probe Type) probe attached or select a different technique or array type	The ECA probe connected to the instrument does not match the probe selection in the technique	Change the probe to match what is selected in the probe field in the technique or change the probe field in the technique to match the connected probe
Unable to access raw data directory	Problem while saving a file to the destination folder	Check USB device for proper permissions or data corruption. Attempt to save a file from a computer to the destination folder
Too many copies of (name of filename). Please try another name	There are too many copies of the data file or screen shot with the same filename	Use a different filename or delete the other copies.

Error message	Description	Action
Unable to create data file Failed to create screenshot file	Unknown problem which prevented the file from being created	Check USB device for problems. If saving to the MIZ-21C, the contact Eddyfi Technologies if the problem persists.
No USB Device Found. Resolve the issue and try again	Occurs when the USB device is disconnected while attempting to write/read from it	Check USB device for intermittent disconnects. This could be a faulty USB connector on the MIZ-21C if this occurs with several USB devices.
Battery is critically low. The system is shutting down to prevent data loss Battery is running very low. The system will shut down unless it is plugged in to AC power very soon Battery is running low. You may continue working but will need to plug in to AC power soon	Low battery alarms at approximately battery levels: Critically low – 0% Very low – 5% Low – 10%	Change batteries or plug in AC power