



HANDHELD TESTERS FOR SUPERIOR FLAW DETECTION AND FASTER AIRCRAFT INSPECTIONS



Match three models and two test technologies to your inspection needs.

Perform a wide variety of tests – on aircraft structures, engine components, and wheels – with Zetec's family of handheld instruments. Choose a dedicated eddy current tester, a powerful bond tester, or for the first time, a handheld eddy current and bond tester in one.

MIZ®-21SR: the first multimode eddy current and bond tester in one.

Now you can carry one handheld instrument and access multiple test methods. Eddy current, two types of bond testing, plus conductivity and coating thickness measurement are all combined in one compact handheld tester. Enhanced technology provides superior flaw detection.

This handheld tester is packaged in a tough, cast aluminum case for superior durability. For fast learning and ease of use, the user interface features are common for both eddy current and bond testing. The sharp, high-contrast display offers excellent resolution and readability in all lighting conditions.

MIZ®-21B: the most advanced eddy current tester with dual frequency capabilities.

Take advantage of the latest eddy current technology in a convenient handheld package. Test for cracks, corrosion, heat damage, and more. Dual frequency capability and digital conductivity testing are included in the MIZ-21B.

S-21R: the power of a benchtop bond tester in a handheld package.

Here's the smallest, lightest, most convenient way to perform bond testing. The S-21R can do everything a benchtop tester can do, yet it costs less and is much easier to use. Detect impact damage, disbonds, delaminations, and other anomalies in honeycomb and composite materials. Improved sensitivity to flaws makes testing more accurate. Zetec's display technology offers excellent contrast and resolution.

ADVANCED EDDY CURRENT AND BOND TESTING TECHNOLOGY IN ONE SMART MULTIMODE INSTRUMENT

MIZ-21SR

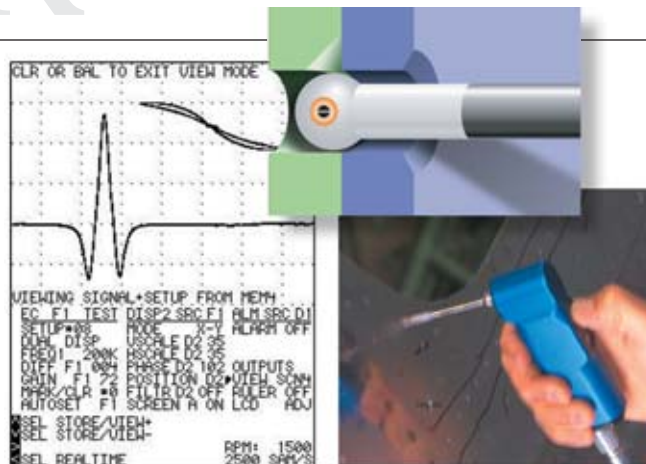
Multiple techniques, one tester.

One compact, handheld tester now combines more of the technologies you need to test aircraft. The MIZ-21SR combines eddy current with two types of bond testing methods – resonance and sondicator. It also includes a built-in mode to measure conductivity and coating thickness across a broad frequency range – from 60 kHz up to 480 kHz.

Enhanced technology for better flaw detection and faster inspections.

The MIZ-21SR employs the latest technology for superior flaw detection. High-gain input stages combined with noise-suppressing synchronous demodulation circuitry results in the best signal-to-noise ratio in the industry. The combination of a 16-bit A/D converter with high-gain analog circuitry maximizes sensitivity and signal resolution.

For the fastest inspections of boltholes with the best signal-to-noise ratio, team up the MIZ-21SR high-speed, high-resolution electronics with Zetec's latest high-speed scanner. This small, lightweight scanner is comfortable to hold while offering high probe rotation speed and torque.



The MIZ-21SR's wide frequency range (50 Hz to 8 MHz) supports a wide variety of inspection applications. Programmable analog drive and gain stages are adjustable to accommodate all probe configurations and test conditions. Three filter types (high-pass, low-pass, and band-pass) use industry-standard conventions for suppressing unwanted signals such as lift-off or motion.

Multiple display modes make for easy signal analysis. Select XY Impedance Plane, Bar Graph, C-scan, or three types of Sweep display – whichever is most meaningful for your test.

Flexible probe support.

The MIZ-21SR supports a wide variety of probes for eddy current testing, bond testing (resonance or sondicator) and conductivity testing. One instrument offers the flexibility to test with low-cost, single-coil probes or highly specialized, multicoil probes.

Lightweight, rugged package.

The MIZ-21SR is designed for both outdoor and indoor use. Its durable aluminum case, with additional EMI shielding, is sealed to protect the instrument from dust and moisture. The drip-proof enclosure with sealed front panel keeps out the weather.

The MIZ-21SR's compact, ergonomic package is easy to hold and operate with either hand. It also weighs less than four pounds (< 2 kg) to reduce fatigue.

The long-life NiMH batteries power the MIZ-21SR over 12 hours (without

accessories) or more than nine hours with backlight on. That's twice the energy performance of NiCDs without the drawbacks. The batteries will quick charge in less than two hours. You can recharge over and over – even partially – without memory loss.

The highest quality display in handhelds.

The 240x320 pixel LCD offers the best visibility in all environments. The wide viewing angle (60 degrees) makes the display easy to read in confined or awkward spaces.

Operate the instrument in total darkness or the brightest sunlight. The backlight offers excellent visibility with full contrast no matter how bright or dim the lighting. With its extended operating temperature range, the display remains clearly visible at temperatures below freezing.

The right- and left-handed user interface.

For comfortable, one-handed operation the sealed membrane keypad features symmetrical, dual controls with tactile feedback. This gives you the freedom to scan with a probe or operate the instrument with either hand depending on conditions. The simple menu is laid out in a single layer keeping all functions and test parameters easily accessible.

PC interface expands tester capabilities.

Store or recall test configurations and send screen captures to a PC using the MIZ-21 serial interface cable and software. It's easy to update instrument software, too.



MIZ-21B

When you need a dedicated eddy current tester, this advanced handheld instrument offers excellent value.

S-21R

An easy-to-use handheld instrument with more power than most benchtop bond testers.

Probe connector with auto-switching for all standard probe configurations

Battery connector for battery charging and external power

Remote connector supports auxiliary features and computer interface



Certified for safety, quality, and environmental protection.

The MIZ-21SR, MIZ-21B, and S-21R all carry a number of important certifications that attest to their high quality and safety. The MIL-STD-810 rating ensures that you can safely test in explosive environments, such as fuel tanks. Its CE Mark, the official mark required by the European Community for all electric and electronic equipment, is proof that this product fulfills all essential safety and environmental requirements defined by the European Directives.

The testers are also covered by ISO 9001. Zetec's quality program has been registered to ISO 9001 since 1994. This registration includes the "design, manufacture, calibration, and repair of electronic and mechanical NDT equipment including computer software" as well as "eddy current field inspection and support services."

Eight-second data buffer with adjustable cursor window

High-resolution, high-contrast, backlit display

Easy selection for alpha-numeric names

Uncomplicated, single-layer menu is easy to use

Major control buttons can be operated with right or left hand

Ergonomically designed handles

Molded rubber bumpers provide shock absorption and keep the case from slipping or marring work surfaces

Built-in tilt bail offers desktop operation and securely locks into place for vertical viewing

Optional printer for screen captures and reporting test results



With the technology built into the MIZ-21SR and MIZ-21B, you'll be prepared to take on a wide range of inspection jobs. Use eddy current testing technology to detect cracks and corrosion. Use digital conductivity testing to assess heat damage caused by fire or lightning strikes.

Detecting cracks near fastener holes

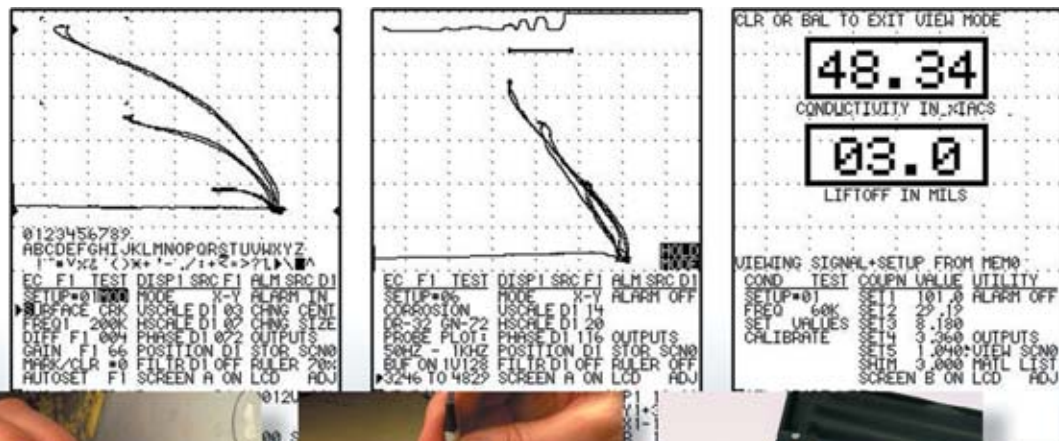
Pencil probes are ideal for detecting small cracks in close proximity to fastener holes. Use a known crack or notch standard to set up the MIZ-21B or MIZ-21SR signal display. As you scan the test piece, you can estimate the depth and length of each surface crack by comparing the phase and amplitude of the generated eddy current signal to the standard's signal.

Multi-layer Corrosion Inspection

Identifying corrosion is one of the most critical and complex aspects of airframe inspections. Changes in skin thickness as well as varying multi-layer structures usually make it difficult to recognize signals. The MIZ-21B and MIZ-21SR have the power to penetrate thick sections. Exceptional signal-to-noise ratio helps inspectors distinguish even a small loss of material. Dual-frequency with mixing nearly eliminates the unwanted signals caused by varying air gaps between layers that can "mask" the signal of interest.

Digital Conductivity and Nonconductive Coating Thickness Measurement

Use digital conductivity measurements (resistivity) to characterize material or to inspect parts damaged by fire or lightning strikes. Directly measure the conductivity of metals and alloys, such as aluminum aircraft structures, using a dedicated conductivity probe. These probes have a broad operating frequency range, 50 kHz to 500 kHz, and are available with 1/4" or 3/8" diameter coils. Or measure a nonconductive coating such as paint. The instruments offer a wide measurement range for both conductivity and thickness.



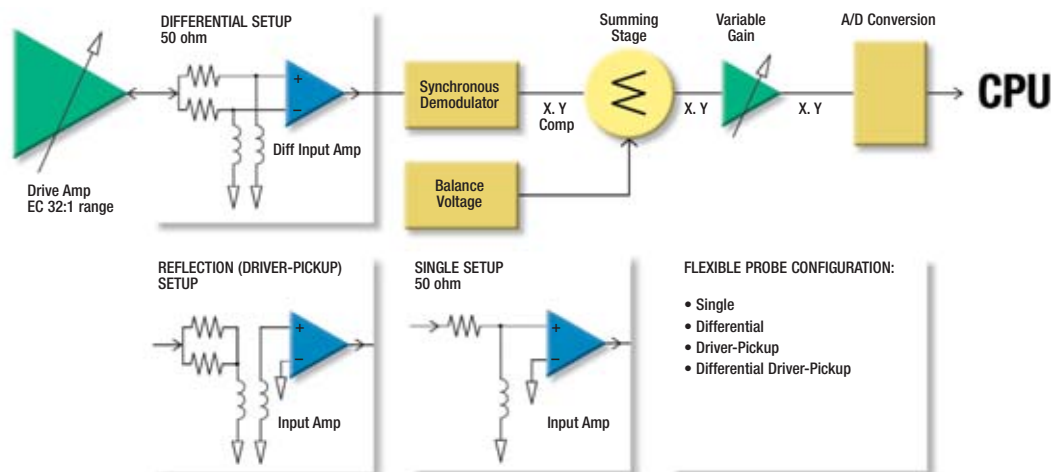
EDDY CURRENT



The MIZ-21B offers all of the technology, packaging, and user interface enhancements of the MIZ-21SR. It incorporates the power of dual-frequency testing, digital conductivity testing, and nonconductive coating thickness measurement. Its industry standard 50-ohm probe drive provides the optimum balance between probe input and instrument output. Yet it's priced to provide excellent value when you need a dedicated eddy current instrument.

The MIZ-21B has *seven* different eddy current data display modes. Choose XY Impedance Plane, Bar Graph, Triggered Sweep, Auto Sweep (slow or fast), C-scan,

The eddy current method is based on inducing electrical current (eddy currents) in electrically conductive material. Any change in the material (such as cracking, corrosion, pitting, thinning, or other discontinuities) disrupts the flow of the eddy currents. The highly sensitive MIZ-21B reliably detects these disruptions and displays the resulting signal. Higher frequencies (up to 8MHz) are used to detect surface flaws. Lower frequencies (down to 50Hz) are used when deeper, subsurface penetration is required.



ONE HANDHELD EDDY CURRENT TESTER GIVES YOU MORE WAYS TO FIND MORE DEFECTS IN LESS TIME

MIZ-21B

and digital conductivity. For rapid analysis, the dual display feature can present signals side-by-side in sweep and XY modes. Or, you can view a reference signal and a live test signal simultaneously.

The MIZ-21B's *dual-frequency mixing* capability suppresses undesirable variables to let you more easily identify and size flaws. Digitally mark up to 10 display points on the screen. Signal size is identified as a percent of screen height using the ruler on the electronic graticule.

The 8-second buffer offers other analysis enhancements. Display the buffer as a strip chart, then scroll through the data to select areas of interest for more in-depth review. Using a rotating scanner, you can display buffered data as a C-scan display.

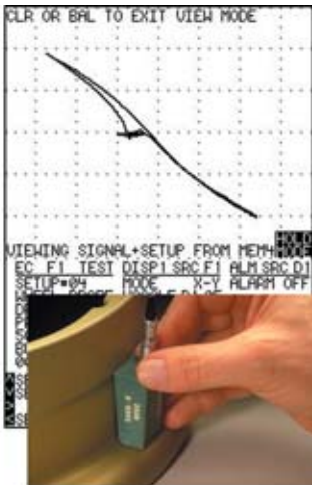
Automatic features save you time.

Use the simple menus to quickly and automatically set values for probe drive, gain, scale, and rotation. Autoset Phase sets the rotation so that the lift-off signal deflects horizontally to the left from the reference signal.

To save set-up time, the MIZ-21B can store and recall up to 50 test configurations. The set-up information is displayed with the test data so you can verify parameters at a glance. The on-screen Help menu provides a quick reference for parameter control. A message area alerts you to low battery or digital overload (analog-to-digital saturation).



Zetec handheld instruments support hundreds of Zetec eddy current, resonance, and sonicator probes. With selectable internal or external balance load for single-coil operation, the testers are also compatible with other manufacturers' single-coil probes and scanners that you may already own.



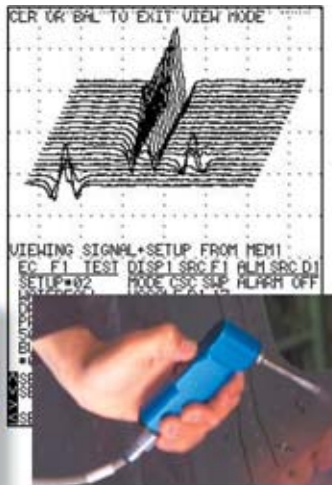
Wheel Bead Seat Inspection

Early crack detection allows you to repair or replace damaged wheels before bigger problems develop. With Zetec's Bead Seat Probes, you can inspect this region with only one pass around the wheel, greatly increasing throughput. Each probe is molded to exactly fit a specific wheel, reducing the probe motion normally associated with free-hand pencil probe inspection. This stability results in better signal recognition and test consistency.



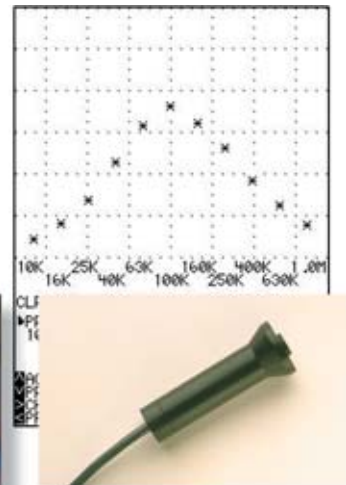
Airframe Fastener Row Inspection

Rapidly detect longitudinal fatigue cracks between fastener holes, such as at lap splices, with the MIZ-21B and the Reflection (Driver-Pickup) Sliding Probe. The inspection is performed with fasteners in place. The wide frequency range, 1-100 kHz, allows you to select low frequency for the multi-layer inspection, then switch to a higher frequency for top-layer crack detection. The shape and direction of the signal movement determines the location and approximate length of the flaw.



C-scan Display for Fastener Holes

The C-scan display is a unique way to present the "big picture" in fastener hole inspection. This method works exceptionally well with an indexing rotating scanner when fasteners are removed. As the scanner rotates, successive sweep lines, 0-360 degrees, are drawn on the screen creating a pseudo 3D representation of flaws in the hole. Use the position of the flaw on the sweep line to plot its radial position. Each sweep line represents a known distance, so you can measure the location of the defect.



Probe Optimization

The MIZ-21B and MIZ-21SR also include a Probe Plot feature that plots probe response to both the test and reference specimens over a range of frequencies. This feature helps you choose the probe's optimum operating frequency for each application.

TWO BOND TESTING TECHNIQUES DOUBLE YOUR POWER TO DETECT DISBONDS AND DELAMINATIONS BETWEEN LAYERS

Modern aircraft make extensive use of composite materials – from structural panels and control surfaces to helicopter rotor blades and propellers. Delaminations within these materials jeopardize their structural integrity.

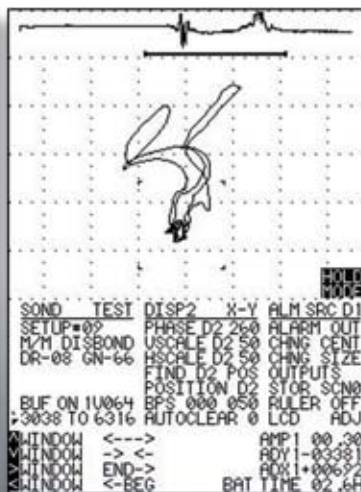
The MIZ-21SR Multimode Tester and S-21R Bond Tester offer two important Non-Destructive Inspection (NDI) techniques for detecting disbonds and delaminations in multilayered composite structures. Both have origins in the ultrasonic testing (UT) discipline. While most UT is done in the megahertz frequency range, Zetec's sondicator and resonance techniques perform examinations in the lower kilohertz range, 0.5 to 500 kHz. Sondicator technology is a "dry" method: No couplants are

required, reducing clean up. (Resonance testing does require a liquid couplant to transmit energy between the transducer and the test material.)

Together, these two techniques double your bond testing capabilities. Use the pitch-catch (sondicator) technique to ensure quality of bonded repairs and evaluate impact or structural damage. Reliably detect disbonds in honeycomb structures, face-sheet disbonding, and delamination from the honeycomb structure. Switch to the resonance mode to pinpoint which plies are unbonded in multilayer laminate structures. Depending on the application, either technique can be used to inspect metal-to-metal bonded structures.

The Sondicator Mode: Finding a metal-to-metal disbond.

You can use the XY (Flying Dot) or YT display for sondicator testing. This example shows the XY mode. During the inspection, you can freeze the Phase/Amplitude display with the HOLD function. Use the BUFFER to review any signal obtained in the last 8 seconds. By expanding or contracting the Data Cursor window within the data buffer, you can isolate specific signals for in-depth evaluation.



The Resonance Mode: Which ply has a disbond?

Disbonds are easy to locate using the resonance test mode of the S-21R or MIZ-21SR. Start by calibrating the tester on a composite step block or standard of known thickness. Plot up to ten calibration reference points to represent various thicknesses. Adjust the display for your requirements using screen scaling V/H, rotation, and position. Then place the transducer on the test material and observe where the signal stabilizes. Correlate the test signal's position to one of the plotted points to determine thickness.



BOND TESTING

THE POWER OF A BENCHTOP BOND TESTER IN AN EASY-TO-USE HANDHELD TESTER

S-21R

The S-21R offers more power and capabilities than benchtop bond testers. It incorporates all of the bond testing technology, packaging, and user interface enhancements of the MIZ-21SR. With much greater sensitivity, it's more effective in detecting defects, yet it costs less than benchtop testers.

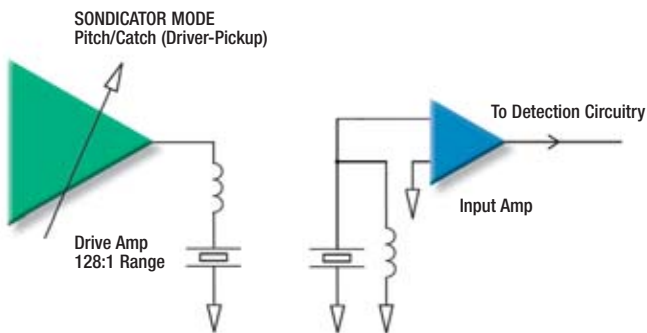
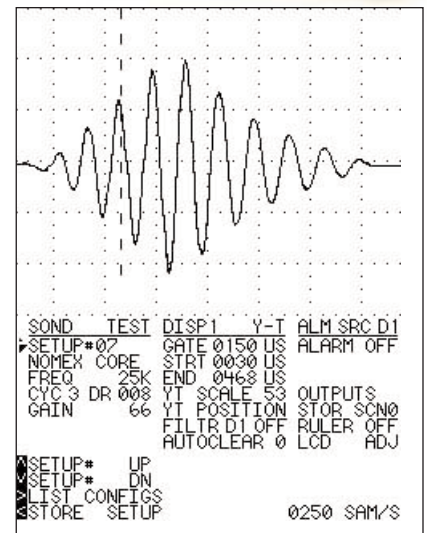
The user interface makes the S-21R much easier and faster to use than other bond testers. With the same high-contrast display as the MIZ-21B and MIZ-21SR, it provides excellent visibility. And at less than four pounds, the S-21R is much smaller than benchtop bond testers, so inspectors can easily maneuver in limited access areas. It stores up to 40 test configurations (20 Sondicator mode, 20 Resonance mode) and can operate more than 12 hours on one battery charge.

You can use the S-21R in the Sondicator mode to test for disbonds or delaminations in composite and metal-to-metal bonded materials. Or, in the Resonance mode, it can perform more specific thickness checks, confirming a good sound path through a section of composite, or identifying which layer is disbonded.

The S-21R's broad frequency range supports a wide range of applications and probes.



Use the YT display for the initial test setup in Sondicator mode. The sampling gate detects changes in phase and amplitude of the YT signal and converts this to the XY vector display.



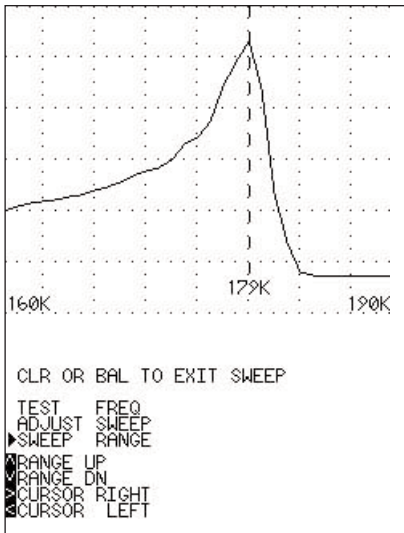
Sondicator technology:

A Sondicator probe uses a dual element piezoelectric transducer to introduce sound waves into composite materials. One of the transducer elements is a transmitter, the other a receiver. If the material being inspected is undamaged, the sound waves travel through the material in a predictable time period. Any disbonds or delaminations within the inspection zone attenuate the sound waves (and the material vibrations that they create). This decreases the energy transmitted beyond that point.

The sondicator method provides digital signatures defining normal and abnormal conditions, displayed as a classic RF waveform format or as an XY screen plot. An experienced technician can interpret these signatures and determine the location and relative size of the disbond condition.



The display provides a 60-degree viewing angle.



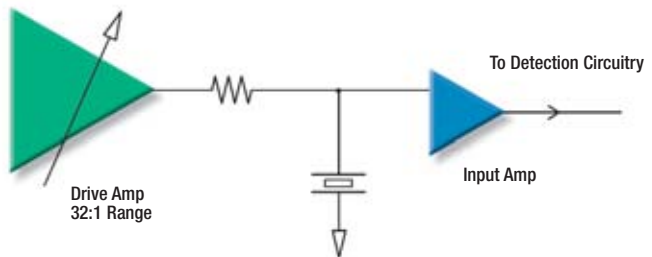
The Resonance Sweep display automatically calculates the resonant frequency of the transducer. This instrument identifies the frequency to within 1 kHz for optimum test sensitivity.

Resonance technology:

Closely related to traditional ultrasonic inspection but in a lower frequency range, this variable frequency test electronically monitors the impedance changes of the contact transducer's piezoelectric element. Small variations in the tested structure alter the mechanical loading (particle vibration) on the transducer face. This in turn affects the transducer's electrical impedance. In adhesive bonded materials, changes in the thickness (caused by disbonds) affect the phase and amplitude of the signal at the transducer's resonant frequency. In multi-layered structures, phase relates to the relative depth of the disbond.



RESONANCE MODE



MIZ-21SR Multimode Eddy Current/Bond Tester

combines all features and functions from both the MIZ-21B and S-21R into one instrument.

All models	MIZ-21B Eddy Current Tester	S-21R Bond Tester
Case - Dimensions: 11 L x 5 W x 2.5 D inches (28 x 13 x 6 cm) - Weight: 3.9 lb (1.7 kg) Power - Batteries: internal, rechargeable, memory-free long-life nickel metal hydride (NiMH) 12-hr operation without additional accessories; more than 9 hours with backlight on - On-screen message area for low battery and signal saturation - Less than 2.5-hr quick charge - Universal charger power input: 85-264 VAC / 47-63 Hz - Optional external 12 VDC alkaline battery power pack LCD Display with Backlight 240 x 320 pixels 2.25 x 4.50 inches (5.7 x 11.4 cm) - Fast-responding, high-contrast - Wide viewing angle (60°) - Extended temperature range maintains clear visibility and speed at temperatures below freezing - Backlight with long-life LED - Operates in total darkness - Maintains full contrast in brightest sunlight - High-strength polycarbonate window with scratch-resistant coating Inputs/Outputs - Remote Connector (serial port) for PC interface, supports: - Printing via Hewlett-Packard, Epson emulation, or Seiko DPU-414 Type II thermal printer - Screen capture to PC - Store or recall test configurations to PC - Software revision updates - Selectable horizontal and vertical analog outputs - Probe Connector – auto-switches to interface with all standard probe configurations - Battery Connector – charging and external power Environmental - Operating temperature range: 14° to 131°F (-10° to 55°C) - Storage temperature range: 0° to 140°F (-17.7° to 60°C) - Humidity: 0 to 100% noncondensing Certification - MIL-STD-810 - CE Mark - ISO 9001	Flaw Detection - Programmable analog drive and gain stages - Noise-suppressing synchronous demodulation circuitry 16-bit A/D converter - High-gain analog circuitry Display Modes - XY Impedance Plane - Bar Graph - Triggered Sweep - Auto Sweep Slow - Auto Sweep Fast - C-scan (Plotted Waterfall) - Screen data clearing is manual (CLR button) or automatic (variable persist mode) 2-signal display can show two signals side-by-side in sweep and XY modes Scanner Support - Supports HS Scanners - Support for other manufacturers' scanners is available, consult Zetec for details Memory Non-volatile (data retained with power off): - Stores 50 test configurations - Stores 10 screen images for review or comparison 8-second buffer memory: adjustable cursor scrolls through entire data buffer to select a range of data points for more in-depth review - Stores up to 10 reference points Conductivity Testing/Metal Sorting - Conductivity and coating thickness measurement at 4 frequencies: 60, 120, 240 and 480 kHz - Digital readout in 1 to 102 %IACS (0.5 to 70 MS/m) - Meets BAC 5651 requirements Autoset Phase/Autoset Gain - Quickly and automatically set values for probe drive, gain, scale, and rotation. Autoset Phase sets the rotation so that the lift-off signal deflects horizontally to the left from the reference signal. Frequency 50 Hz to 8 MHz 2 independent frequency selections to support dual frequency testing Phase - Manually adjustable in one- and ten-degree steps from 0° to 359°	Gain Adjustment Range - Vertical and horizontal scale independently adjustable from 1 to 99 Probe Drive - Adjustable to six output drive levels 50-ohm probe drive (industry standard) provides optimum balance between probe input and instrument output Filters - Adjustable high-pass, low-pass, and bandpass filters - On-screen numeric read-out of cutoff frequency Alarms - Audio alarm with adjustable volume - Visual LED alarm - Alarm area is shown on the display; alarm box size and positioning are independently adjustable - Alarms can be set for all display modes, as well as for conductivity limits - In XY, YT, and Bar Graph display modes, alarm can trigger either inside or outside of the gated area - TTL, visual, and adjustable audio output alarms are provided - Headphone outputs Probe Configuration Internally switches to interface with all standard probe configurations - Single - Differential (selectable internal or external balance load for single-coil operation) - Reflection (Driver-Pickup) - Differential Driver-Pickup Display Modes - XY Impedance Plane - Bar Graph - YT Sweep - Combined XY/YT Sweep Memory Non-volatile (data retained with power off): - Stores 40 test setups: 20 sonicator and 20 resonance - Stores 10 screen images for review or comparison - Stores up to 10 reference points with numeric label in resonance mode Frequency Selection - Sonicator mode: 0.5 kHz to 500 kHz (external tuning) or 4 pre-selected frequencies of 7, 14, 25, and 40 kHz (internal tuning) - Resonance mode: 0.5 kHz to 500 kHz Filters - Adjustable high-pass, low-pass, and bandpass filters - On-screen numeric read-out of cutoff frequency Alarms - Audio alarm with adjustable volume - Visual LED alarm - Alarm area is shown on the display; alarm box size and positioning are independently adjustable - Alarm triggers either inside or outside of the gated area - TTL, visual, and adjustable audio output alarms are provided - Headphone outputs - Optional probe with LED alarm that lights when user-specified parameters are exceeded Probe Configuration Internally switches to interface with probe configurations - Resonance - Pitch/Catch Operating Variables - Burst length in the transmitted pulse is adjustable from 1 to 9 cycles - Combined transmit drive/preamp gain adjustable over 1 to 128 range - Analog amplifier gain adjustable over 48 dB (1 to 255 range) - Optimize the flaw response with adjustable DELAY gate for XY signal set-up