ISONIC 3510T / ISONIC 3510

Smart Phased Array Ultrasonic Flaw Detector and Recorder with 2 Additional Channels for Conventional UT / TOFD

Designed and built under the drive for improved detection, productivity, and reducing of inspection cost **ISONIC 3510T** as well as its famous 8-years-elder brother **ISONIC 3510** resolves the well-known nowadays challenges faced by NDT and QA management such as increasing of nomenclature and complexity of inspections combined with more demanding codes, standards, and norms along with significant loss of domain expertise. **ISONIC 3510T** is a turbo-charged-performance version of **ISONIC 3510** providing significantly higher speed of scanning, data recording and processing and opening new opportunities for the improvement of inspection reliability. Full cross-compatibility of the calibration and inspection results files created by both instruments and their standard and customized optional inspection software packages and accessories provides seamless integration of **ISONIC 3510T** into all established procedures created during almost decade for the **ISONIC 3510** dramatically increasing the speed of scanning and inspection productivity

ISONIC 3510T / **ISONIC 3510** instruments carry the application based smart platforms for the regular and advanced ultrasonic testing delivering

- 5 inspection modalities – PA, TOFD, CHIME, SRUT GW, conventional UT and a combination of them
- built-in image guided scan plan creator (ray tracer) for the numerous types of simple and complex geometry welds, shafts, bolts, spindles, composite profiles, and the like
- outstanding ultrasonic performance and probability of detection
- simplicity and intuitiveness of operation and data interpretation
- rapidness in the creation of the new inspection solutions and procedures
- easily expandable on-board solutions base
- reduced training time and cost
- comprehensiveness of automatically created inspection reports

The optimal suitability of **ISONIC 3510T** / **ISONIC 3510** for resolving of the huge variety of inspection tasks for all industries and processes involving ultrasonic NDT are strongly backed by the above listed features and technical particulars and specs below

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ISONIC 3510T / ISONIC 3510

- Flaw Detection and Thickness / Corrosion Mapping
- True-To-Geometry Volume Overlay and 3D Coverage and Imaging for:
  - Butt Welds (Planar and Circumferential) with
    - Symmetrical or Asymmetrical Bevel or Unbeveled
    - Equivalent or Different Thickness of Jointed Parts
  - Longitudinal Welds
  - Fillet, Tee-, and TKY- Welds - Flat and Curved Parts
  - Corner and Nozzle Welds
  - Open Corner and Edge Welds
  - Lap Joints
  - Elbow and Transit Welds
  - Simple and Complex Geometry Solid and Hollow Shafts and Axles
  - Drill Rods, Bridge Hanger Pins, Bolts
  - Turbine Blades
  - Flat and Curved Carbon Fiber, Glass Fiber, Honeycombs Parts Including Corners and Radius Areas
  - etc
- TOFD
- CHIME (Creeping & Head Wave Inspection Technique)
- SRUT GW (Short Range Guided Wave)
- Operating 1 or 2 PA Probes Simultaneously: No External Splitter Required
- Versatile Fully Parallel PA Functionality Out of the Same Unit:
  - 1 X 16:16
  - 2 X 16:16
  - 1 X 32:32
  - 2 X 32:32
  - 1 X 64:64
  - 2 X 64:64
  - 1 X 128:128
- Freely Adjustable Emitting and Receiving Aperture
- Testing Integrity :
  - 100% Raw Data Capturing
  - EquPAS – Equalized (Homogenized) Phased Array Ultrasonic Testing Sensitivity Over Entire Scan Plan
  - Scanning Performance Monitoring, On-Line Displaying, and Recording
  - Quantitative Scanning Integrity Report
- Live FMC/TFM
- FD B-Scan (Frequency Domain B-Scan) Ultrasonic Spectroscopy
- VAUT - Video Aided UT
- Augmented Reality PAUT (AR PAUT) – live ultrasonic images embedded into video stream data in real time
- GPS and RFID data embedding
- Intuitive User Interface
- Automatic Finding, Sizing, Alarming, and Reporting of the Defects
- UT over IP: Remote Control, Observation of the Indications, Data Acquisition through LAN, Internet, Intranet, 3,4,5G
- and much more...

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Phased Array (PA) Modality:

- Fully parallel 32:32 PA electronics expandable to 128:128
- 2 PA probe terminals - *there is no external splitter required for operating 2 PA probes simultaneously*
- Ability of work with PA probes carrying up to 128 elements
- Built-In PA Probe / Wedge / Delay Line Editor
- Semiautomatic Routine for Quick Verification of Geometry (Dimensions and Angle), Velocity and Array Placement for wedges with flat and contoured contact face
- Independently adjustable emitting and receiving aperture with parallel firing, A/D conversion, and on-the-fly real time digital phasing
- Phased array pulser receiver with image guided ray tracing / scan plan designer for the numerous types of simple and complex geometry welds, shafts, bolts, spindles, composite profiles, and the like
- 8192 independently adjustable focal laws
- On-the-fly focal law editing ability
- Bi-polar square wave initial pulse: up to 300 Vpp / 100 dB analogue gain / 0.2...25 MHz bandpass / 16 bit 100 MHz ADC / 32 taps smoothly tunable digital filter
- Regular and volume overlay true-to-geometry (true-to-shape) B-Scan / Sector Scan (S-Scan) / Horizontal Plane S-Scan (CB-Scan) coverage accompanied with all-codes-compliant A-Scan based evaluation
- Multigroup coverage composed of several cross-sectional B- and S-Scans (scan plans) out of the same probe simultaneously
- Interface Echo start
- Strip Chart
- Single group and multigroup Top (C-Scan), Side, End View imaging formed through encoded / time-based line scanning, 3D-Viewer
- Single side / both sides weld coverage with use of one PA probe / pair of PA probes
- TOFD Map out of a pair of PA probes
- Top (C-Scan), Side, End View imaging formed through encoded XY- scanning, 3D-Viewer
- Scanning performance monitoring and recording along with inspection data: scanning speed combined with coupling monitor lamination checker under the wedged probe
- Equalized (homogenized) cross sectional coverage sensitivity: *TCG-independent* gain per focal law adjustment providing pure angle gain compensation (AGC) for S-Scan, etc
- DAC, TCG applied to defects imaging and evaluation in real time or at the postprocessing stage (DAC / TCG image normalization)
- Dynamic Focusing
- FMC, TFM, Back Diffraction Technique with / without and Mode Conversion
- Distinguishing and evaluation of diffracted and mode converted signals for defects sizing and pattern recognition
- Operating Linear Array (LA), Ring Array (RA), Daisy Array (DA), Matrix Array (MA), Dual Matrix Array (DMA), Dual Linear Array (DLA), and other PA probes
- FFT signal analysis - Ultrasonic Spectroscopy – for defect pattern analysis and materials structure characterization
- FD B-Scan (Frequency Domain B-Scan) for rapid material structure screening, other special tasks
- 100% raw data capturing
- Automatic finding and alarming defects / generating of editable defects list immediately upon scanning completed or at the postprocessing stage
- Advanced defects sizing and pattern analysis utilities

Conventional UT and TOFD:

- 2 channels
- Single / dual modes of pulsing/receiving for every channel
- Bi-polar square wave initial pulse: up to 300 Vpp / 100 dB analogue gain / 0.2...25 MHz bandpass / 16 bit 100 MHz ADC / 32 taps smoothly tunable digital filter
- Regular A-Scan
- Thickness B-Scan
- True-to-Geometry flaw detection B-Scan – straight / angle beam probes
- CB-Scan
- TOFD
- Strip Chart and Stripped C-Scan
- Parallel or sequential pulsing/receiving and A/D conversion
- DAC, DGS, TCG
- FFT signal analysis - Ultrasonic Spectroscopy
- 100% raw data capturing

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General:

- *Quad Core Intel Atom N4200 CPU 1.1 GHz / 2.5 GHz clock 4 GB RAM 128 GB SSD W'10.IOT.Ent on-board computer (ISONIC 3510T)*
- *Dual Core 1.6 GHz clock 2 GB RAM 128 GB SSD W'7PROEmb on-board control computer (ISONIC 3510)*
- *Intuitive User Interface*
- *Single and multi-axis encoder connection*
- *Multi-axis / multi-plane / multi-frame video stream augmented reality encoder*
- *Comprehensive postprocessing and data reporting toolkit*
- *Remote control and data capturing with use of a regular PC with no need in special software*
- *No intake air / no cooling IP 65 light rugged case*
- *Sealed all-functional keyboard and mouse*
- *8.5" ultra-high / high (ISONIC 3510T / ISONIC 3510) brightness touch screen*
- *Ethernet, USB, HDMI / sVGA (ISONIC 3510T / ISONIC 3510) terminals*

ISONIC 3510T / **ISONIC 3510** uniquely combine PA, single- and multi-channel conventional UT, and TOFD modalities providing 100% raw data recording and imaging. Along with the intuitive user interface, portability, lightweight, and battery operation this makes it suitable for all kinds of every-day ultrasonic inspections

PA modality is carried by the **fully parallel non-multiplexed 32:32 electronics** with independently adjustable emitting and receiving aperture, each may consist of 1...32 elements when operating one PA probe or 1...16 elements per probe in case of operating two PA probes simultaneously. 2 PA probes terminals allow operating of a pair of PA probes simultaneously with *no need in an external splitter*. 64- and 128-elements PA probes may be used with **ISONIC 3510T** / **ISONIC 3510** when connected to instrument's terminals through miniature active extenders, which expand the functionality to *fully parallel 1 X 64:64, 2 X 32:32, 1 X 128:128, and 2 X 64:64 (no multiplexing involved)*. The groups of PA probe elements forming emitting / receiving aperture may be fully or partially matching or totally separated allowing maximal flexibility whilst managing the incidence angles, focal distances, types of radiated and received waves including directly reflected and diffracted signals either mode converted or not

Each channel is equipped with own pulser-receiver and A/D converter. Parallel firing, A/D conversion, and "on-the-fly" digital phasing are performed for every possible composition and size of the emitting and receiving aperture so the implementing of each focal law is completed within a single pulsing/receiving cycle providing the **maximal possible speed of material coverage**

ISONIC 3510T / **ISONIC 3510** allow using of various types PA probes: linear, rings, and daisy arrays (LA, RA, and DA), dual linear arrays (LA), matrix arrays (MA), dual matrix arrays (DMA), etc

In addition to PA electronics **ISONIC 3510T** / **ISONIC 3510** carry 2 independent conventional channels for regular UT, TOFD, SRUT GW and other types of advanced inspection, imaging, and recording; each channel is capable for both single and dual modes of use

The **top level ultrasonic performance** is achieved through firing PA, TOFD, and conventional probes with bipolar square wave initial pulse with wide-range-tunable duration and amplitude (up to 300 Vpp). The high stability of the initial pulse amplitude within entire duration of the positive and negative half-waves, the extremely short boosted rising and falling edges and the automatic adaptive damping improve the signal to noise ratio and resolution allowing controlling of the analogue gain over the 0…100 dB range for each modality

ISONIC 3510T / **ISONIC 3510** provide a very powerful platform for huge number of the practical PA UT software applications available for the activation at any moment. Thanks to unique ***True-To-Geometry Volume Overlap Coverage and Real Time Imaging*** **ISONIC 3510T** / **ISONIC 3510** are suitable for high performance inspection of simple and complex geometry welds (butt, longitudinal, fillet, lap, corner, elbow, etc) with scanning from one or both sides simultaneously (when applicable), bolts, bridge hanger pins, wind turbine and other shafts, annular rings, flanges, rails and railway axles and wheels, CRFP and GRFP composite panels and profiled stuff, and the like. Precise and easy reproducible automatic ***Equalizing (Homogenizing) of the Sensitivity within Entire Cross-Section / Volume of the Material*** is provided thanks to the unique TCG-independent angle gain / gain per focal law compensation solution combined with DAC / TCG image normalization. Along with 100% raw data capturing and scanning performance monitoring, on-line displaying, and recording this provides the ***Highest Degree of Testing Integrity***

Thanks to ***True-To-Geometry Volume Overlap Coverage and Imaging*** and ***Equalizing (Homogenizing) of the Sensitivity within Entire Cross-Section / Volume of the Material*** the inspection results produced by **ISONIC 3510T** / **ISONIC 3510** are ***quickly and easy interpretable and acceptable by the UT Pros and non-Pros as well***

ISONIC 3510T / **ISONIC 3510** are packed into the IP 65 reinforced plastic case with no intake air or any other cooling means. The large 800X600 8.5" high brightness (**ISONIC 3510**) / ultra-high brightness (**ISONIC 3510T**) screen provides fine resolution and visibility for all types of inspection data presentation at strong ambient light / direct sunlight along with the optimized power consumption rate for the outdoor operation

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ISONIC 3510T / **ISONIC 3510** are fully compliant with the following codes

- *ASME Code Case 2541 – Use of Manual Phased Array Ultrasonic Examination Section V*
- *ASME Code Case 2557 – Use of Manual Phased Array S-Scan Ultrasonic Examination Section V per Article 4 Section V*
- *ASME Code Case 2558 – Use of Manual Phased Array E-Scan Ultrasonic Examination Section V per Article 4 Section V*
- *ASTM 1961– 06 – Standard Practice for Mechanized Ultrasonic Testing of Girth Welds Using Zonal Discrimination with Focused Search Units*
- *ASME Section I – Rules for Construction of Power Boilers*
- *ASME Section VIII, Division 1 – Rules for Construction of Pressure Vessels*
- *ASME Section VIII, Division 2 – Rules for Construction of Pressure Vessels. Alternative Rules*
- *ASME Section VIII Article KE-3 – Examination of Welds and Acceptance Criteria*
- *ASME Code Case 2235 – Use of Ultrasonic Examination in Lieu of Radiography*
- *Non-destructive testing of welds – Ultrasonic testing – Use of automated phased array technology. - International Standard EN ISO 13588:2019*
- *Non-destructive testing of welds — Ultrasonic testing — Use of automated phased array technology for thin-walled steel components. - International Standard EN ISO 20601:2018*
- *Non-Destructive Examination of Welded Joints – Ultrasonic Examination of Welded Joints. – British and European Standard BS EN 1714:1998*
- *Non-Destructive Examination of Welds – Ultrasonic Examination – Characterization of Indications in Welds. – British and European Standard BS EN 1713:1998*
- *Non-destructive Testing — Ultrasonic Testing — Examination for Discontinuities Perpendicular to the Surface. – International Standard ISO 16826:2012*
- *Calibration and Setting-Up of the Ultrasonic Time of Flight Diffraction (TOFD) Technique for the Detection, Location and Sizing of Flaws. – British Standard BS 7706:1993*
- *WI 00121377, Welding – Use Of Time-Of-Flight Diffraction Technique (TOFD) For Testing Of Welds. – European Committee for Standardization – Document # CEN/TC 121/SC 5/WG 2 N 146, issued Feb, 12, 2003*
- *ASTM E 2373 – 04 – Standard Practice for Use of the Ultrasonic Time of Flight Diffraction (TOFD) Technique*
- *Non-destructive testing of welds - Ultrasonic testing - Use of time-of-flight diffraction technique (TOFD). - International Standard EN ISO 10863:2011*
- *Non-Destructive Testing – Ultrasonic Examination – Part 5: Characterization and Sizing of Discontinuities. – British and European Standard BS EN 583-5:2001*
- *Non-Destructive Testing – Ultrasonic Examination – Part 2: Sensitivity and Range Setting. – British and European Standard BS EN 583-2:2001*
- *AD 2000-Merkblatt HP 5/3 Anlage 1:2015-04: Zerstörungsfreie Prüfung der Schweißverbindungen - Verfahrenstechnische Mindestanforderungen für die zerstörungsfreien Prüfverfahren - Non-destructive testing of welded joints – Minimum technical procedure requirements for non-destructive testing methods (Germany)*
- *ASME PCC-1 – 2019 - Pressure Boundary Bolted Flange Joint Assembly – Appendix D*

The zero point test and annual verification procedures of **ISONIC 3510T** / **ISONIC 3510** are fully compliant with the international standards below and the corresponding national norms

PA channels

- *ISO 18563-1. Non-destructive testing — Characterization and verification of ultrasonic phased array equipment. Part 1: Instruments*
- *ISO 18563-3. Non-destructive testing — Characterization and verification of ultrasonic phased array equipment. Part 3: Combined systems*

Conventional channels

- *EN 12668-1 / ISO 22232-1. Non-destructive testing – Characterization and verification of ultrasonic examination equipment. Part 1: Instruments*
- *EN 12668-3 / ISO 22232-3. Non-destructive testing – Characterization and verification of ultrasonic examination equipment. Part 3: Combined Equipment*

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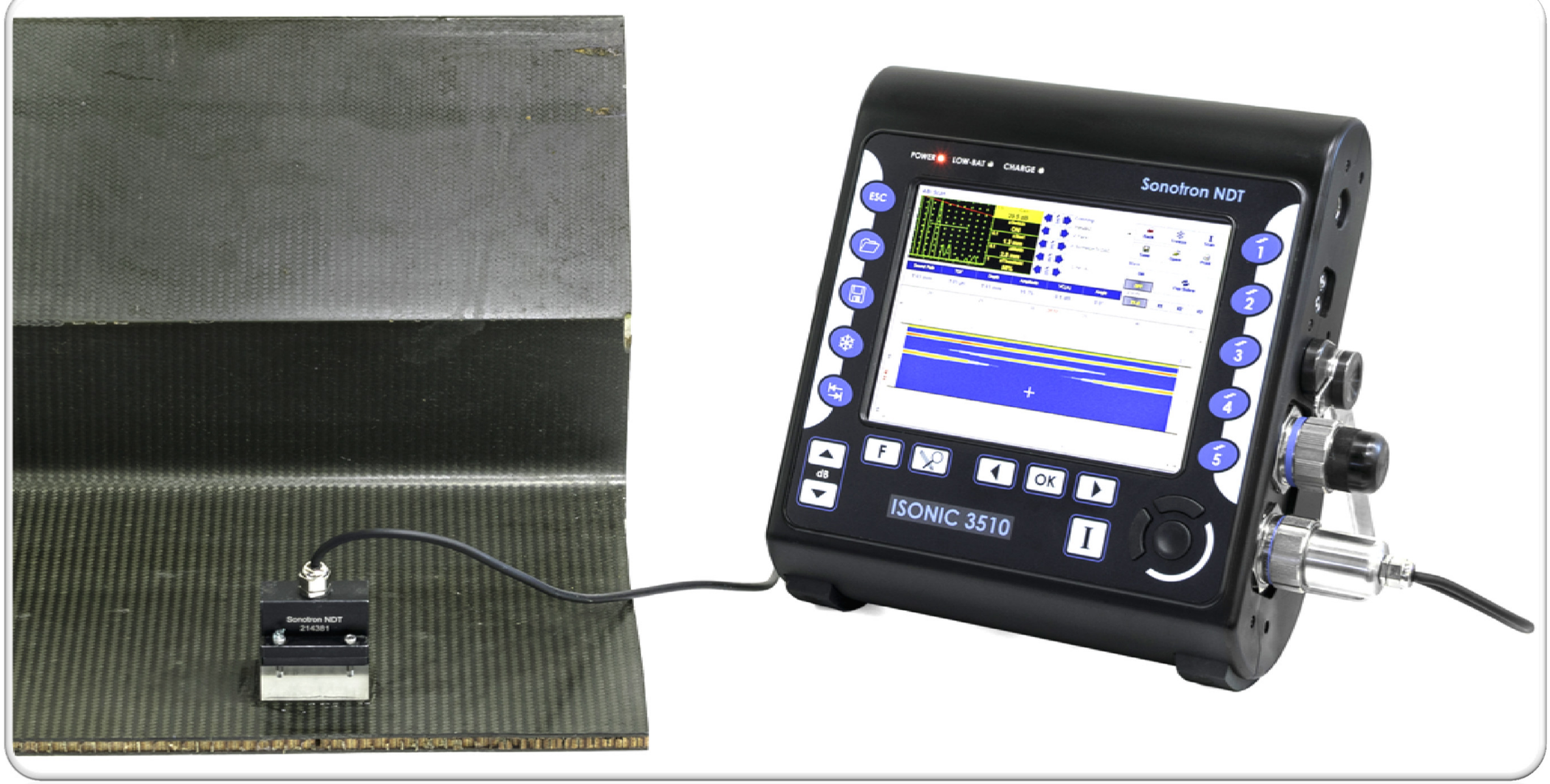

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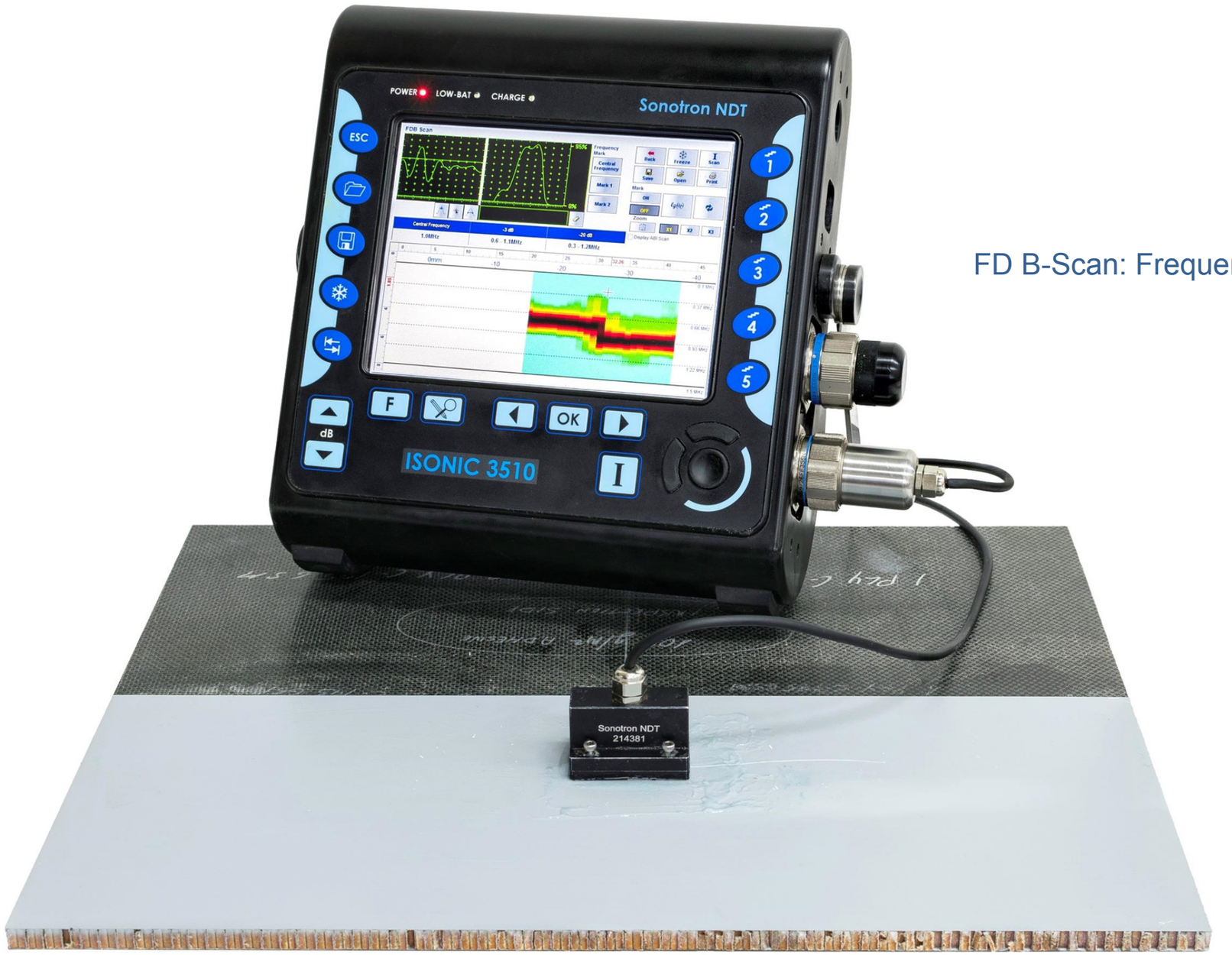

FD B-Scan: Frequency Domain B-Scan

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AGI – Power, Oil, Gas, Transportation, etc

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TTGI S-Scan

On-the-run toggling between True-to-Geometry Imaging (TTGI) S-Scan and Live FMC/TFM

Live FMC/TFM

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TTGI S-Scan

On-the-run toggling between True-to-Geometry Imaging (TTGI) S-Scan and Live FMC/TFM

Live FMC/TFM

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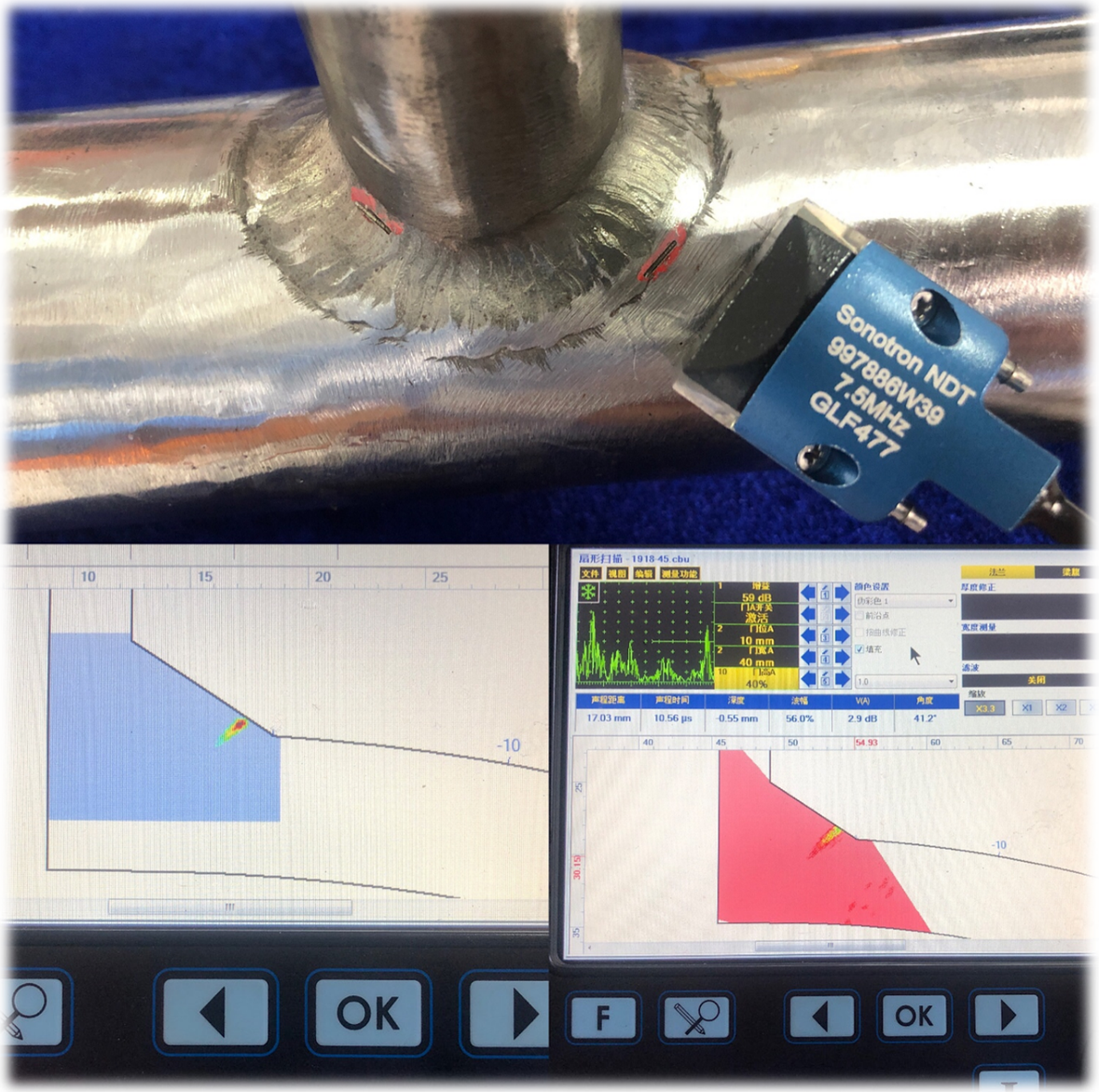

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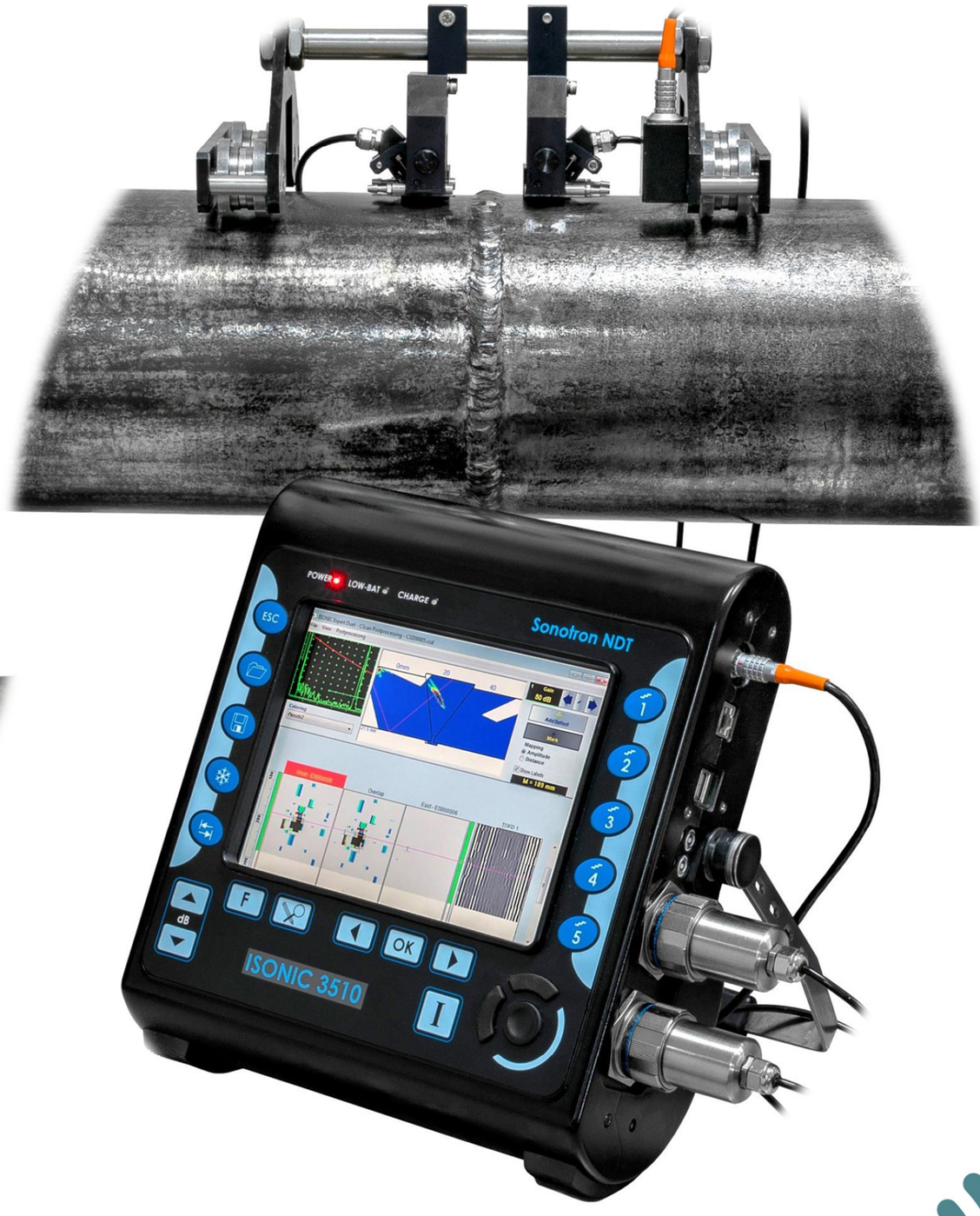

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Longitudinal Seam - ERW: TTGI S-Scan

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Spiral Weld: TTGI S-Scan

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Spiral Weld: Live FMC/TFM

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SS316 weld: TTGI C-Scan and 3D

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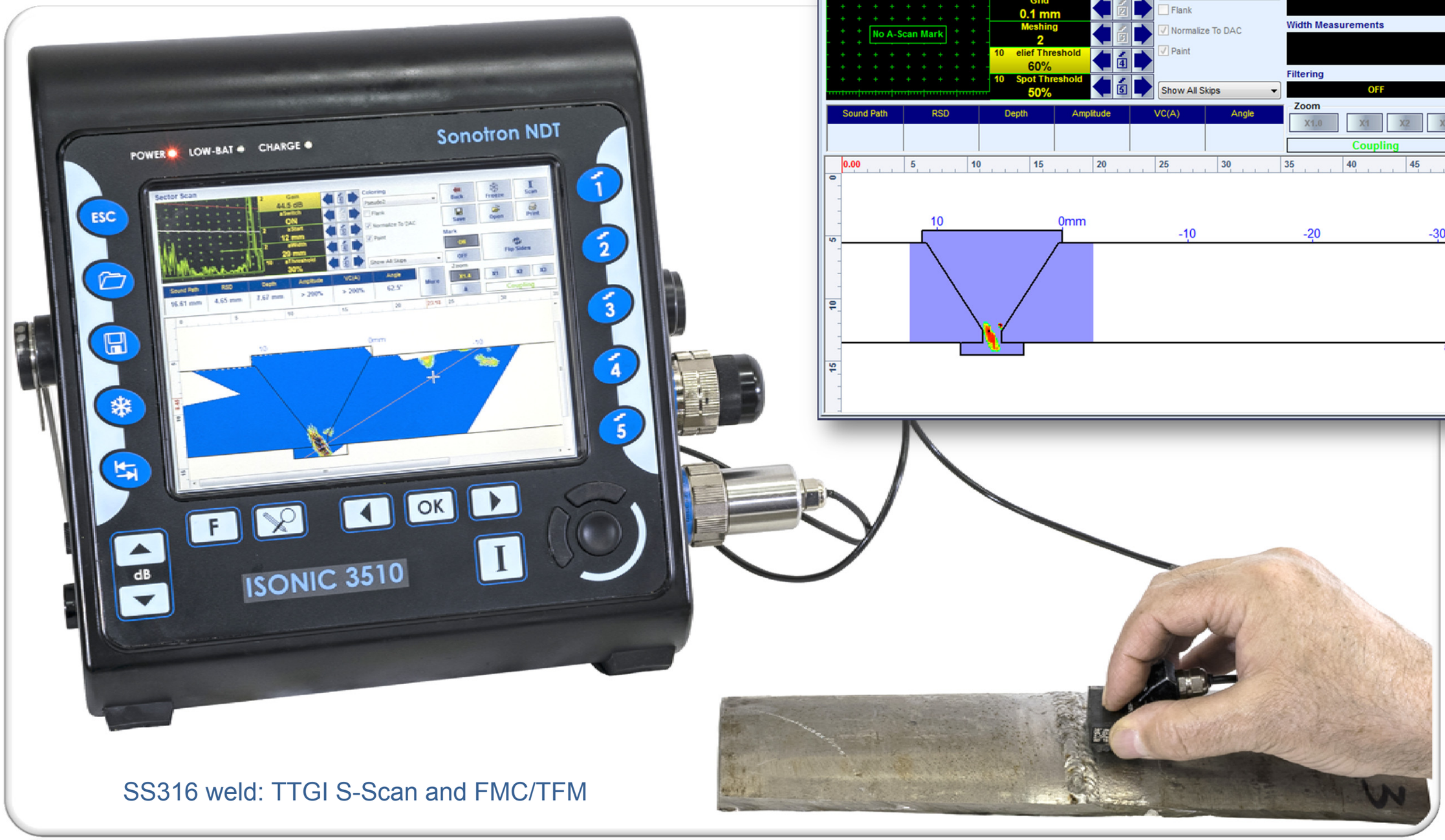

SS316 weld: TTGI S-Scan and FMC/TFM

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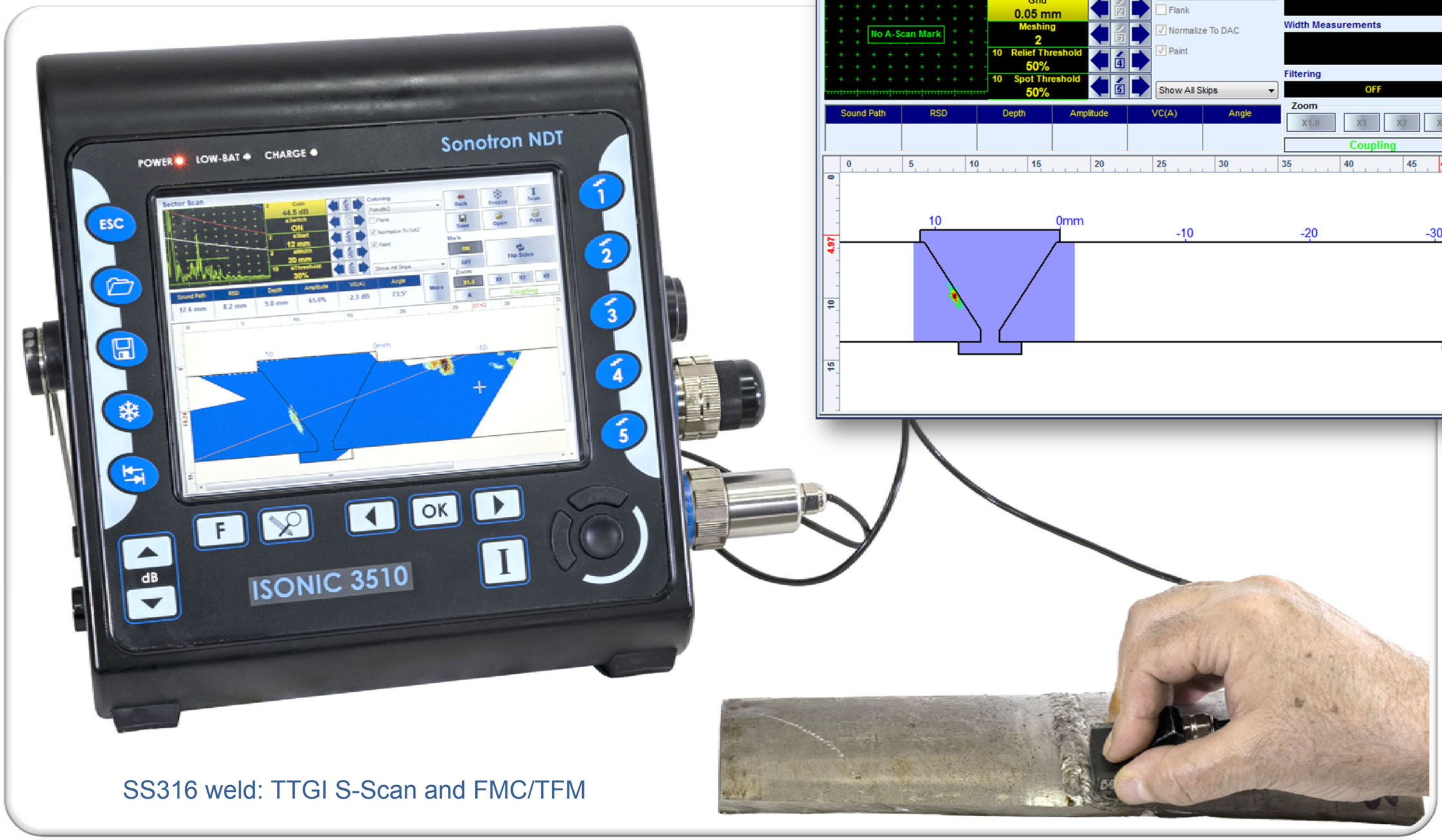

SS316 weld: TTGI S-Scan and FMC/TFM

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CRA Butt Weld (Hastelloy C-276) in the Cladded Pipe: TTGI C-Scan

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Thin Wall (2 mm) Stainless Steel Weld

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Zonal Discrimination Strip-chart out of a Sequence of Tandem and Pulse Echo Shots

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Inspection of annular rings for corrosion damages from the protrusion (outer chime)

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Checking integrity of the protrusion (outer chime)

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SRUT GW – PA Modality

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Strip-chart out of several

SRUTGW PA Modality Focal Laws

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Strip-chart out of two

SRUTGW PA Modality Focal Laws

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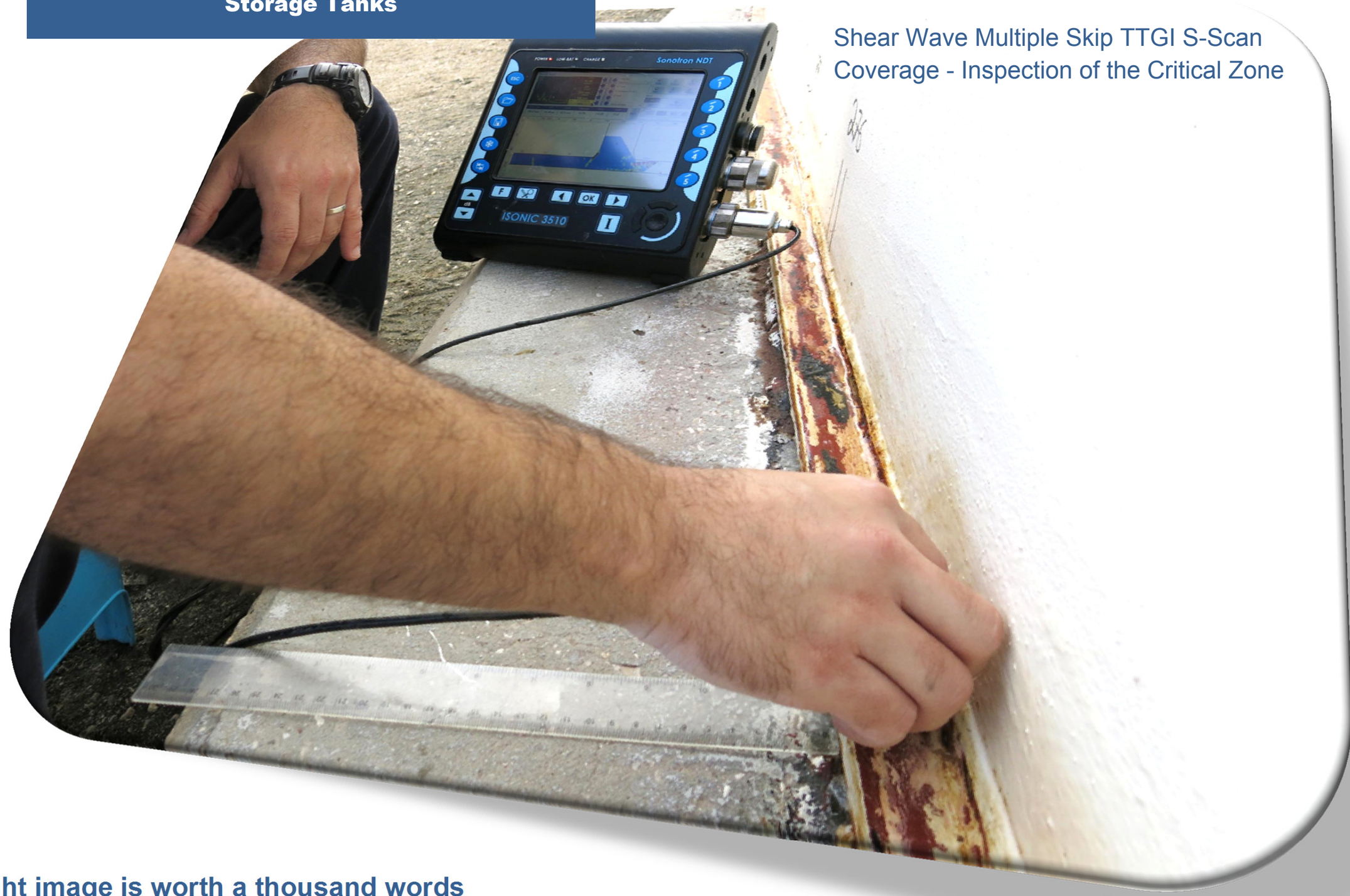

Shear Wave Multiple Skip TTGI S-Scan
Coverage - Inspection of the Critical Zone

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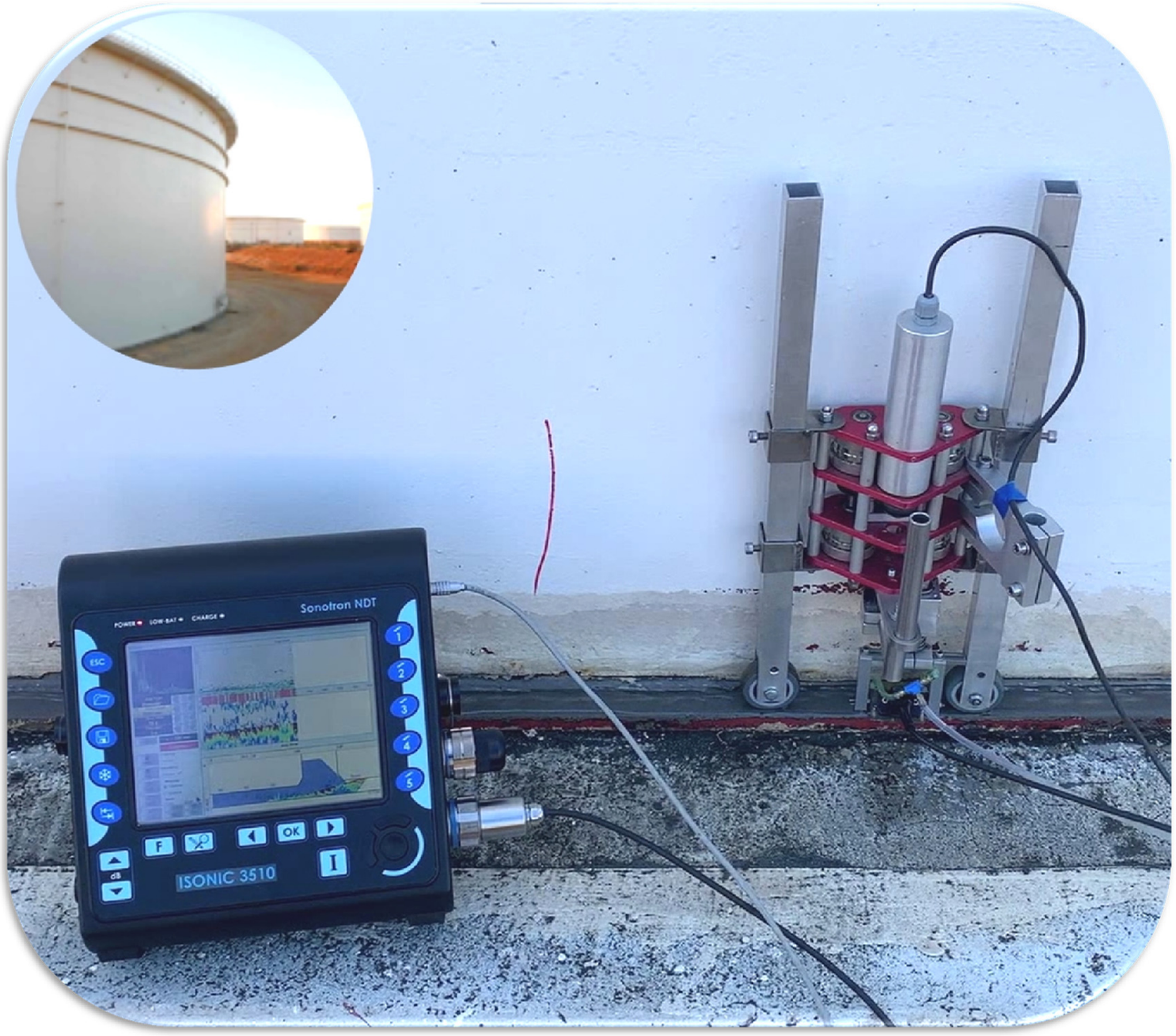

Shear Wave Multiple Skip TTGI S-Scan Coverage - Inspection of the Critical Zone – Automatic Scanning and Recording

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Shear Wave Multiple Skip TTGI S-Scan Coverage - Inspection of the Critical Zone: implementation of several scan plans simultaneously (multi-group) accelerates data interpretation simplifying the distinguishing of the indications

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Shear Wave Multiple Skip TTGI S-Scan and FMC/TFM Coverage - Through-paint quantitative evaluation of corrosion blisters, scabs, etc

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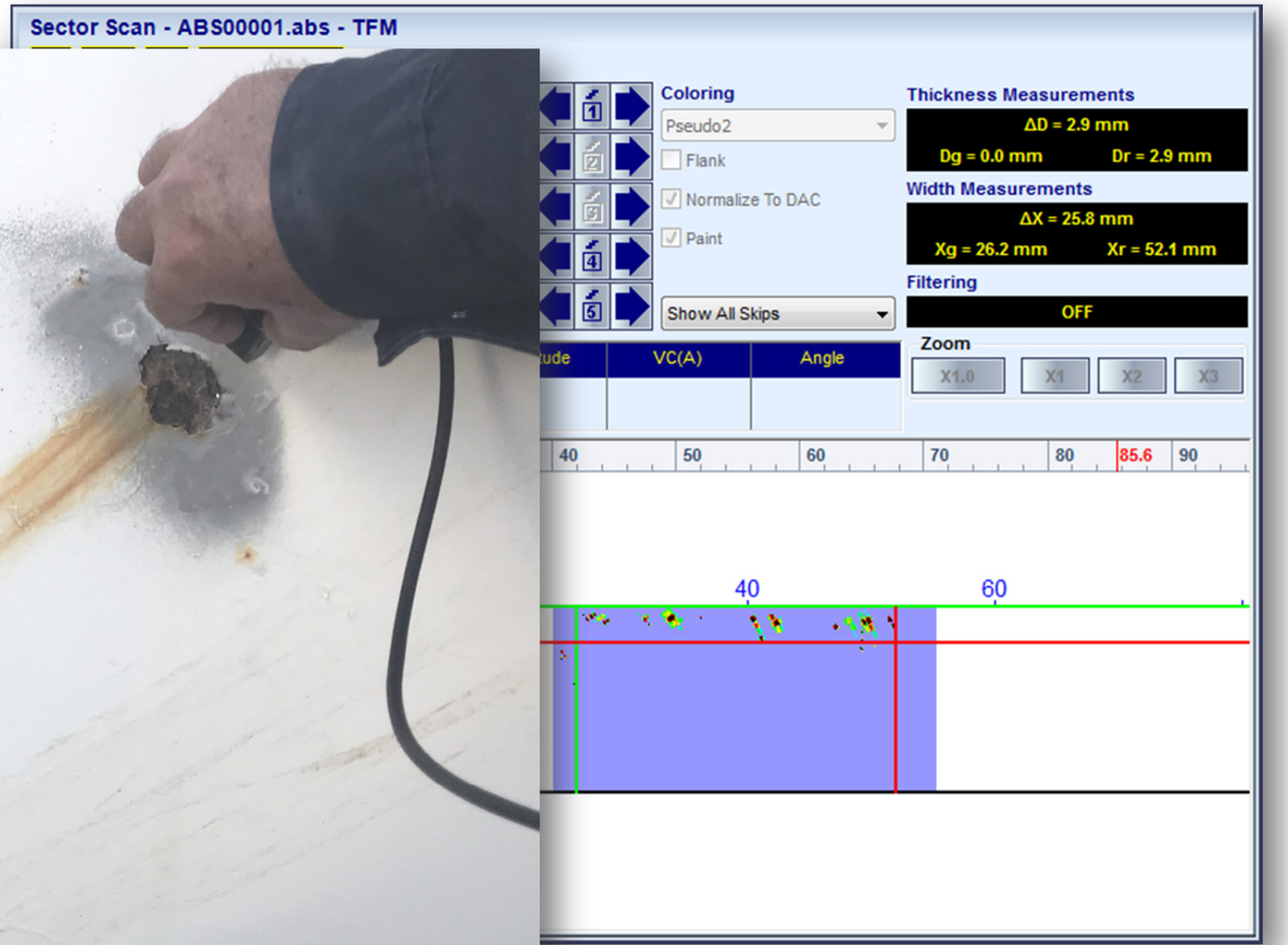
Storage Tanks



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Piping – CUPS, Touch Point Corrosion, etc

Shear Wave Multiple Skip TTGI S-Scan and FMC/TFM Coverage - Through-paint quantitative evaluation of touch-point corrosion, blisters, scabs, internal pitting, etc

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Pipes, Poles – Air-to-Soil Interface Corrosion

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Power Generation

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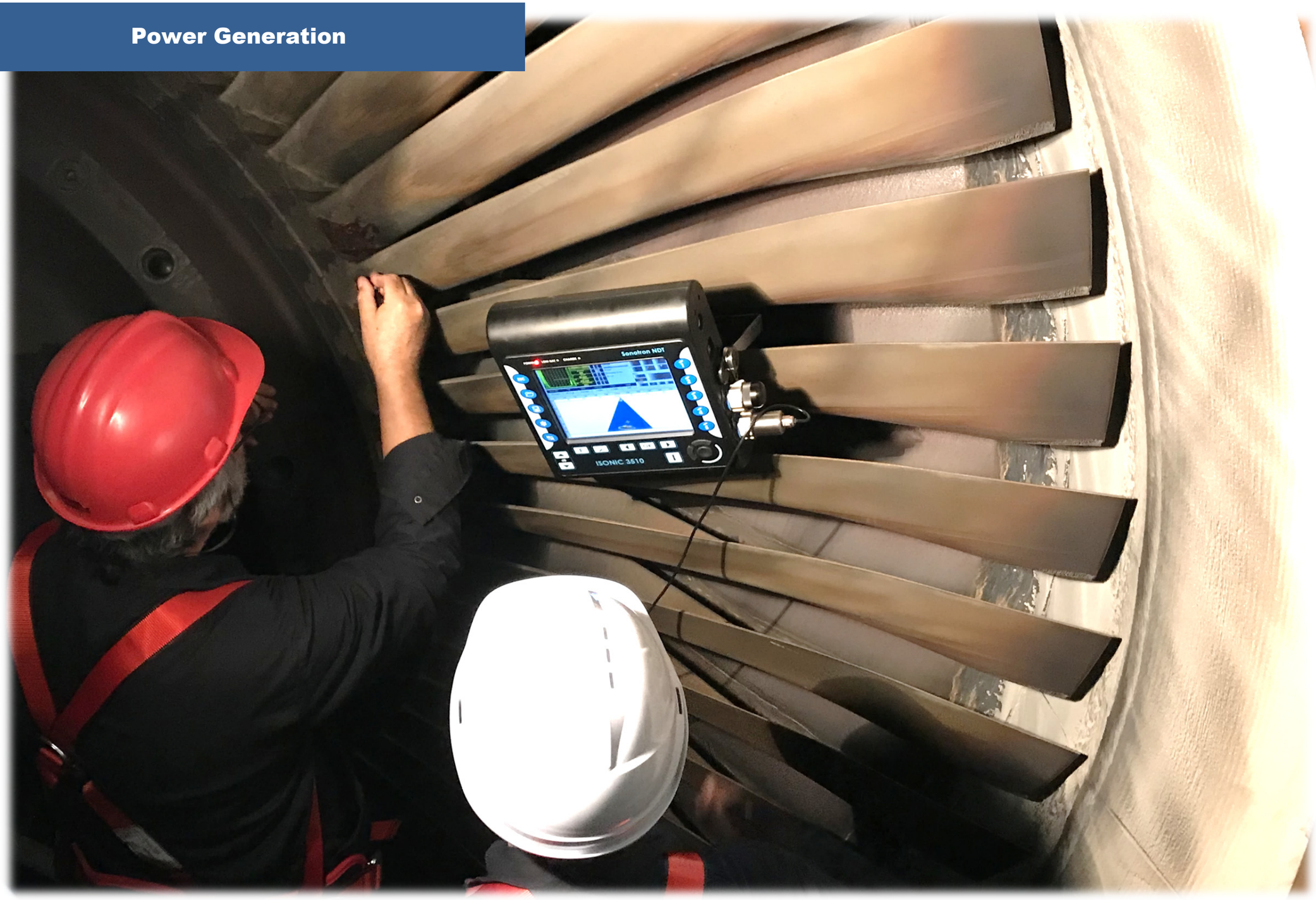
Power Generation



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Power Generation

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Power Generation

Crack on the ID Surface
of Retainer Ring

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Power Generation

Compression Wave TTGI S-Scan –
Inspection of double threaded hollow stud bolt

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Hot Heavy Stuff: Detection of HTHA Damage

Live FMC/TFM

TTGI S-Scan

On-the-run toggling between True-to-Geometry Imaging (TTGI) S-Scan and Live FMC/TFM

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Metallurgy: Screening of Metal Structure

FD B-Scan: Frequency Domain B-Scan

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CRA / Duplex / Super Duplex Welds

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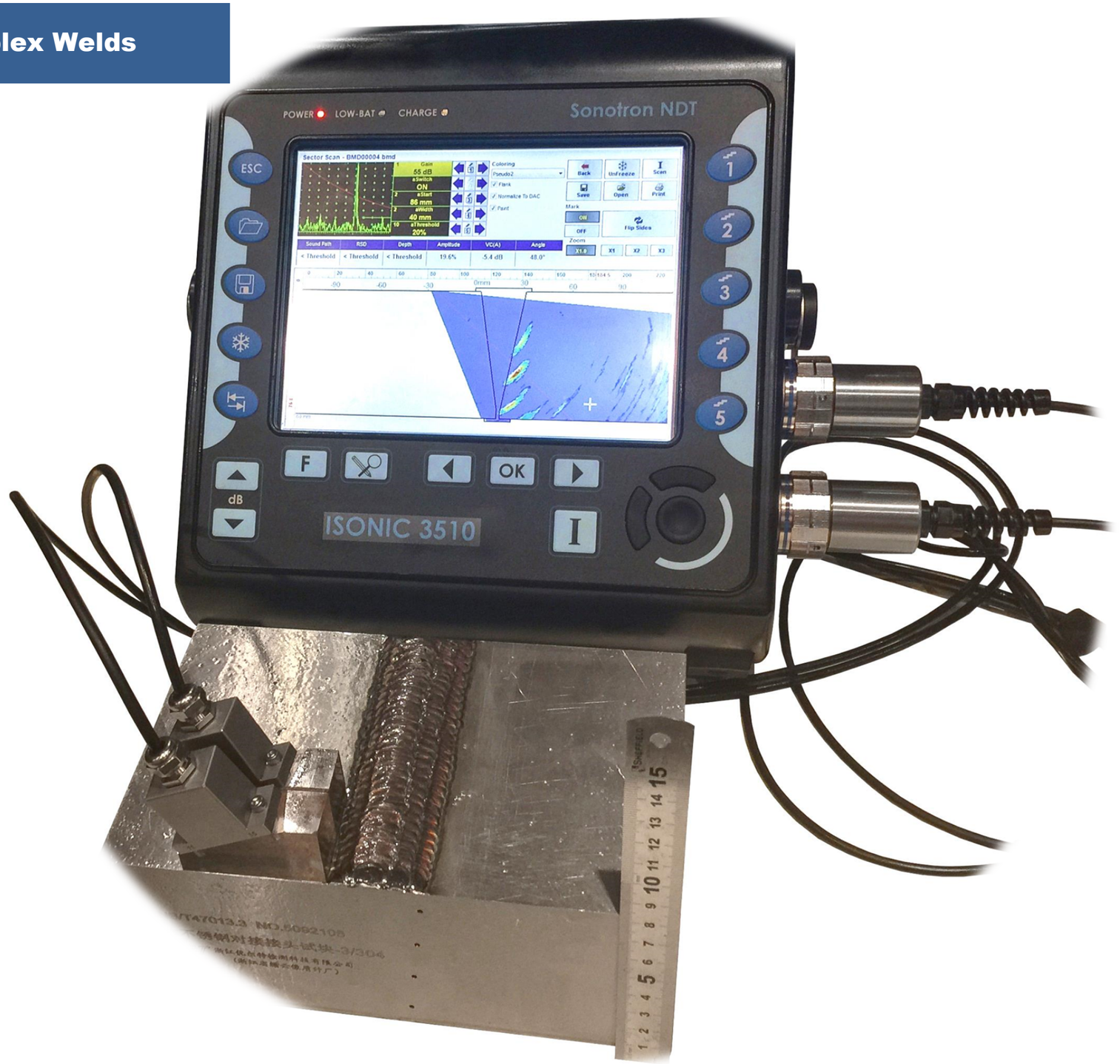
CRA / Duplex / Super Duplex Welds



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CRA / Duplex / Super Duplex Welds

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True-to-Geometry Imaging (TTGI) S-Scan

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Live FMC/TFM

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Industrial and Civil Contsruction

Structural straight corner weld between thin wall hollow rectangle profiles

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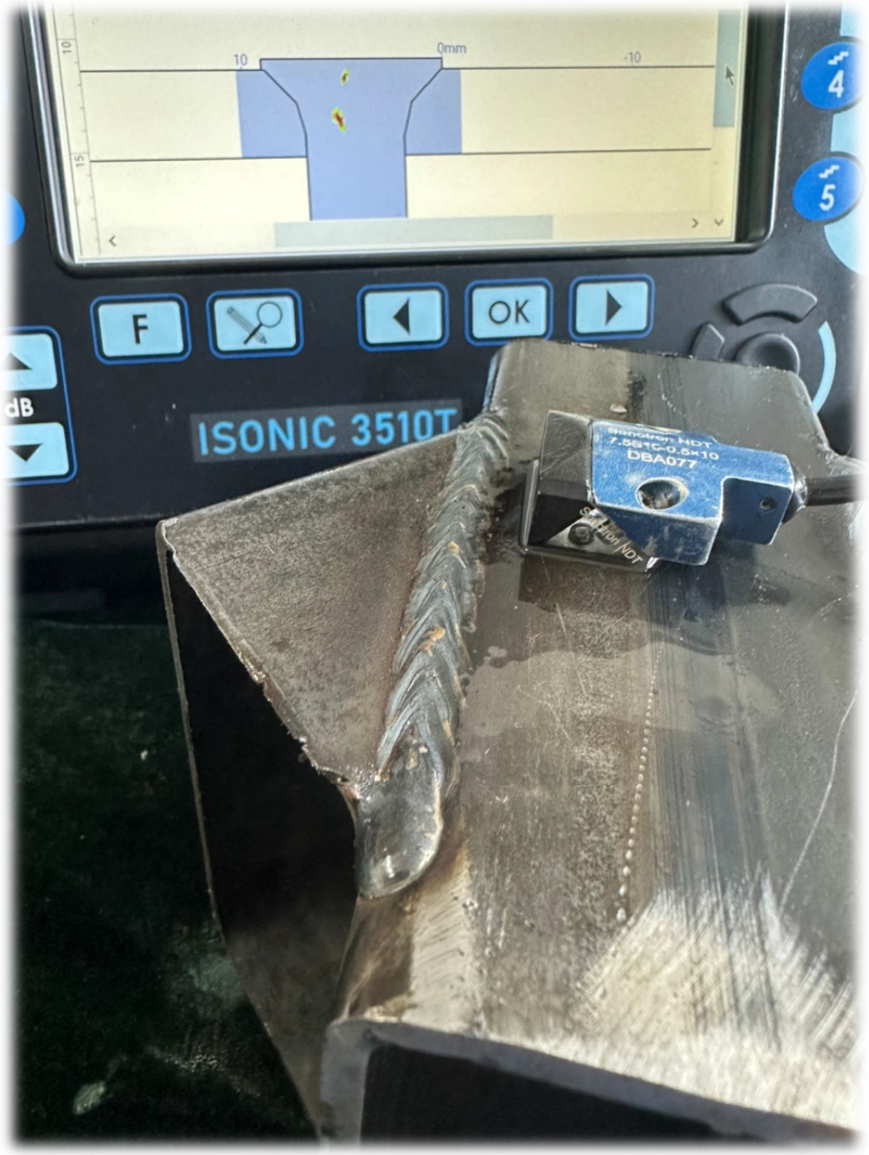
Industrial and Civil Contsruction



Structural butt weld and triple-wall butt weld between thin wall hollow rectangle profiles

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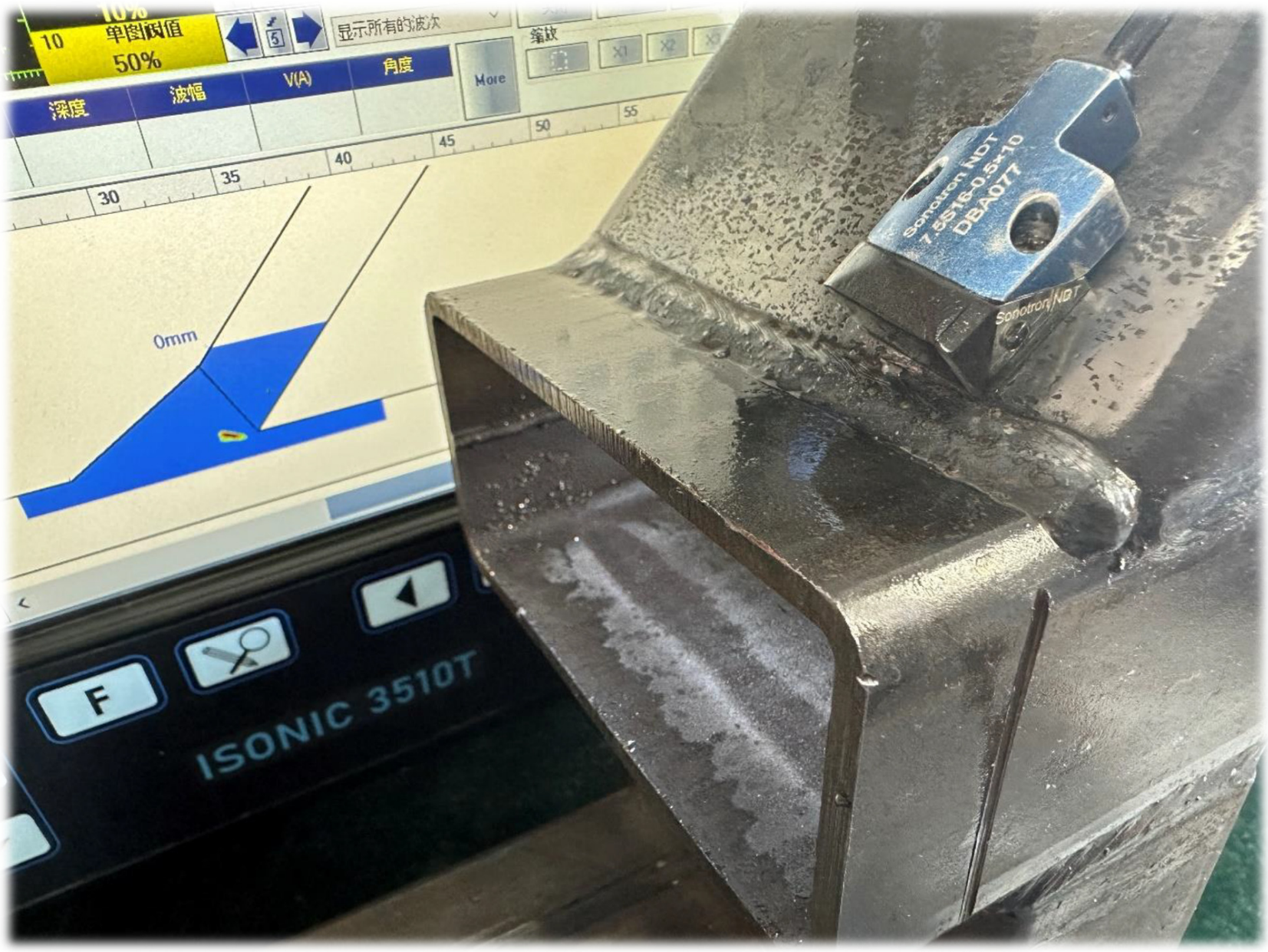
Industrial and Civil Contsruction



Structural skewed fillet weld between thin wall hollow rectangle profiles

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Defect Pattern Analysis

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Special Materials

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Special Materials

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Special Materials

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Heavy Wall Stuff: Tip Diffraction B-Scan

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Heavy Wall Stuff: Tip Diffraction B-Scan

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Energy: Tandem B-Scan

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Trucks, buggers, cranes etc

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Trucks, buggers, cranes etc

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Bridges

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Railways

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Railways

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Railways

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Preventive Maintenance: SRUT GW – CUPS

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Preventive Maintenance: FFC

Probing and Sizing of the Flange Face Corrosion (FFC)

From the flange

From the taper

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Preventive Maintenance: FFC

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Preventive Maintenance: FFC

Flange Face Corrosion Recording and Mapping from the Taper:
Unfolded and Rounded View

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Preventive Maintenance: FAC

Probing and Sizing of the
Flow Accelerated Corrosion (FAC)

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Preventive Maintenance: FAC

Probing and Sizing of the
Flow Accelerated Corrosion (FAC)

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Wind Energy: Glass Fiber

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Yachts, Boats, Other Ships: Glass Fiber

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Drilling and Exploration

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Casting, forging, other raw materials

Live FMC/TFM toggled with S-Scan coverage: high sensitivity combined with precise imaging

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Casting, forging, other raw materials

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Semiconductors Industry - Tooling

Detection of Voids above Heat Sink Plates

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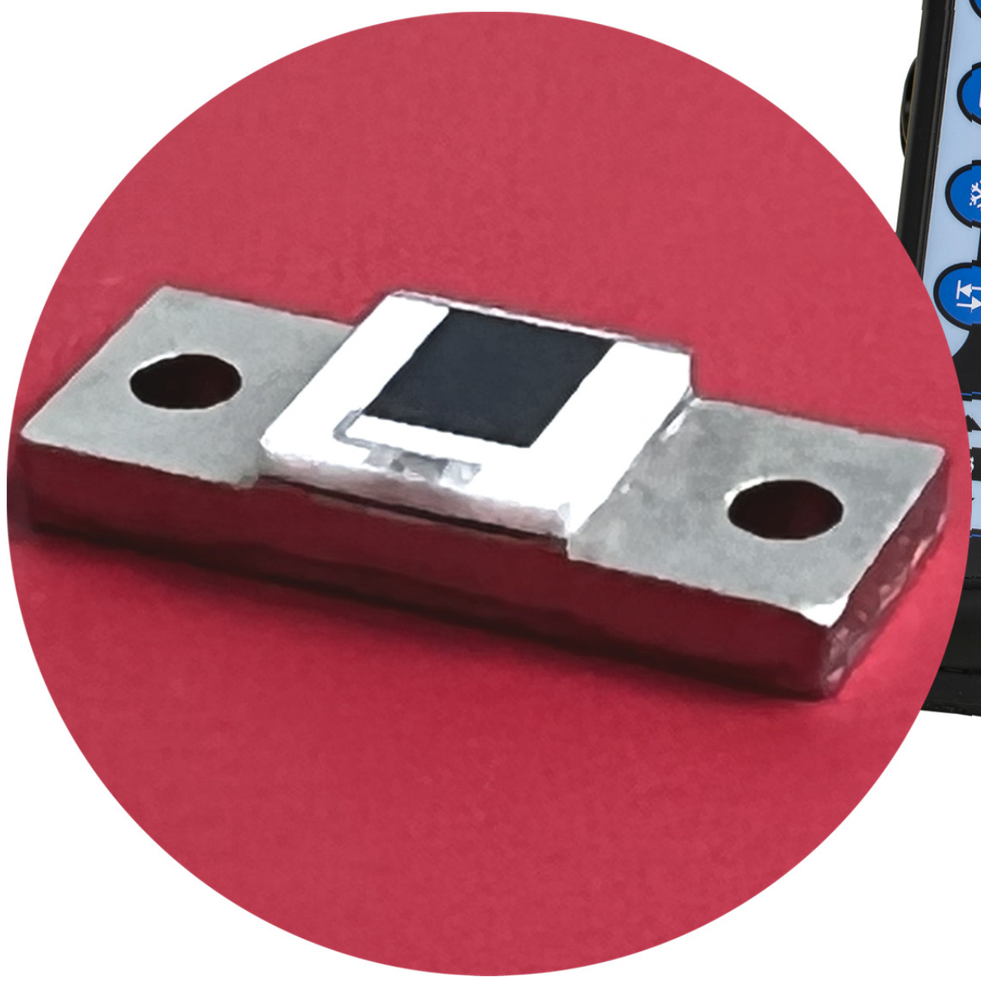
Semiconductors Industry - Products

Evaluation of the bonding between ceramic base of the chip and its heatsink plate



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Lifting Equipment

Sample of the shaft (performance demonstration block) with artificial and natural reflectors scanned from the end surface

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ISONIC 3510T / ISONIC 3510

VAUT: Video Aided UT

VAUT (**V**ideo **A**ided **UT**) technology is the standard feature of **ISONIC 3510T** / **ISONIC 3510** that provides displaying of the live image of the probe manipulated over the material and the corresponding UT data simultaneously: this concentrates most of the operator's attention on the instrument screen whilst scanning manually. Every single A-Scan or cross-sectional view such as S-Scan, etc obtained in the corresponding static probe position may be stored into a file comprising the UT data along with the embedded photo representing the test piece and the probe placement. Every record comprising a sequence of A-Scans and cross-sectional views composing the C-Scan or / and strip chart may be stored into a file comprising the UT data and video of the scanning process

The embedded photo or video is assigned to the UT data in the file only and it is not openable / reproducible separately. On opening the file the recorded photo / video will be played along with ultrasonic data recoverable for each probe position

If the video camera is fitted into the scanner or encoder frame and focused onto material surface the inspection results file will carry the synchronized **UT** and **VT (Visual Testing)** data providing the **dual modality inspection results obtained in one pass** and comprised together; this increases the global productivity of NDE

VAUT technology also allows **embedding of the GPS- or GLONASS- coordinate and the RFID data of the part under test into the inspection files** provided the appropriate standard gadgets are connected to the instrument at the time of inspection. Along with the photo and / or video the global position and RFID data embedded into the same UT inspection files will improve the operation and reliability of the RBIM (Risk-Based Inspection and Maintenance) databases avoiding the mistaken assigning of the NDT results to the wrongly designated objects

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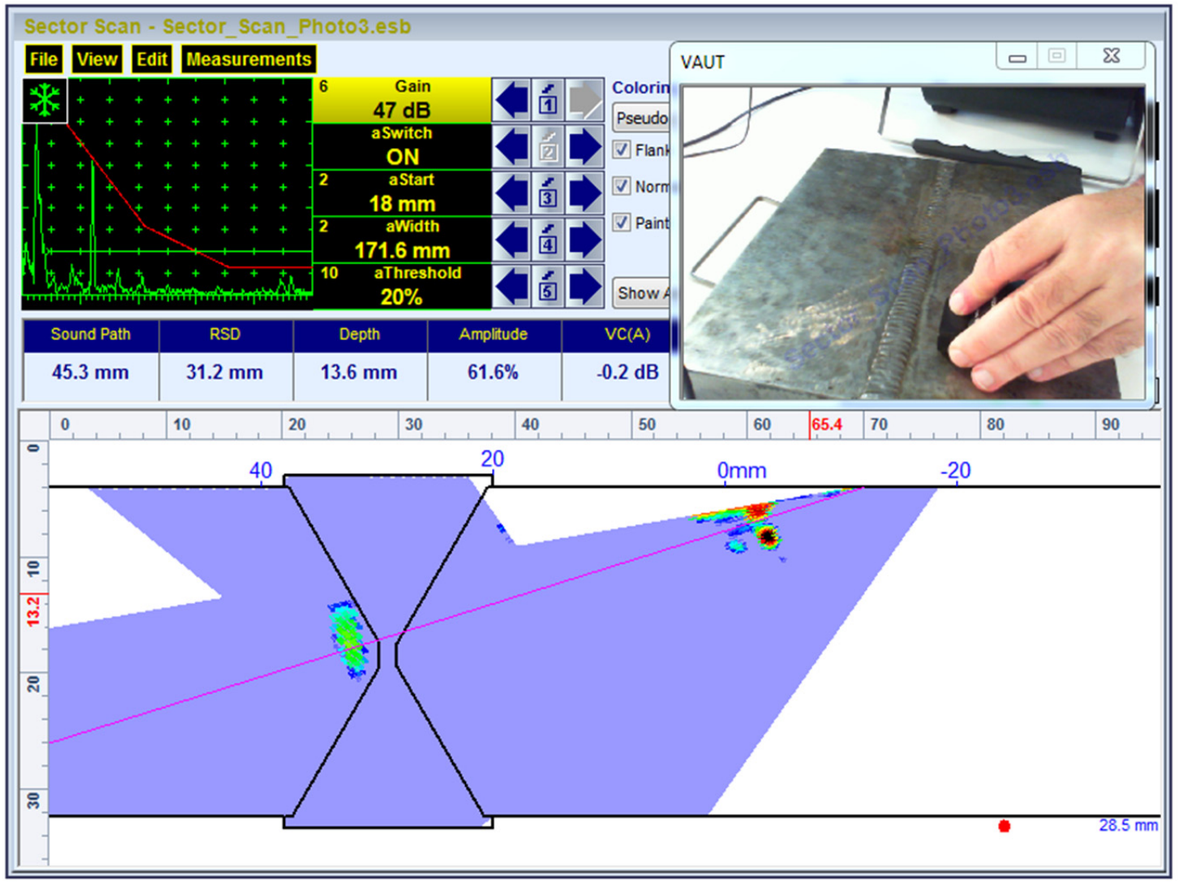
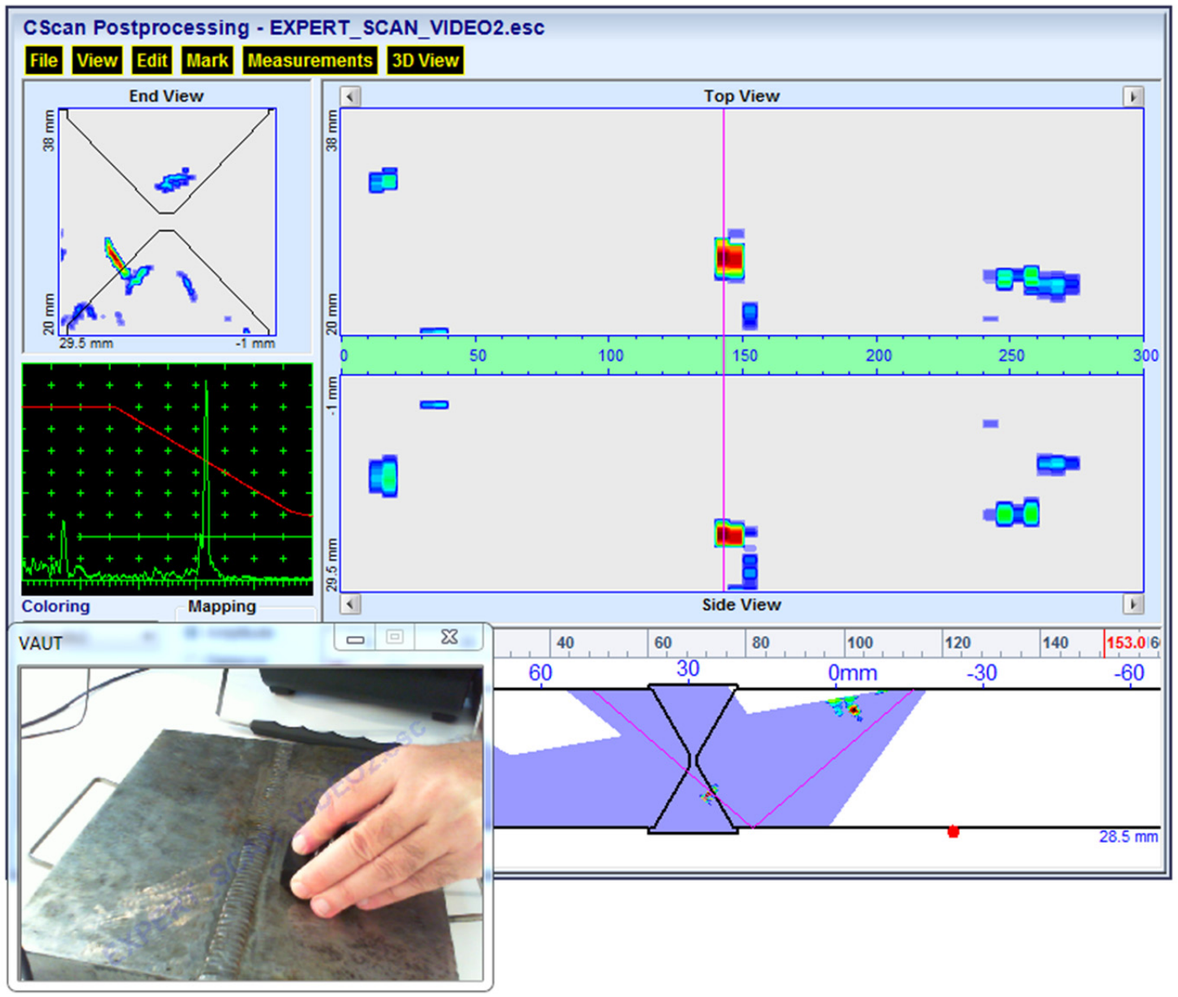
VAUT: Video Aided UT

A number of cameras may be connected to **ISONIC 3510T** / **ISONIC 3510** unit capable to process several video streams simultaneously. This opens the opportunity of the video-encoded scanning similarly to the famous Hawkeye® tennis ball tracing technology without add-on devices such as encoders, probe holders, etc





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Augmented Reality PAUT (AR PAUT)

Once HD camera settled nearby scanning area is connected to the instrument's USB port **ISONIC 3510T** / **ISONIC 3510** allows embedding of live segment of True-to-Geometry S-Scan into the reality video stream in connection to PA probe position and swiveling angle. Live cross-sectional image of the material is updated according to the stream of ultrasonic data and current probe's X,Y,Z coordinates and α, β, γ turning (swiveling) angles in 3 planes for each new position. Thanks to the real time dynamic modifying of focal laws forming the currently implemented scan plan True-to-Geometry S-Scan coverage and imaging is performed according to the current swiveling angle – this increases probability of detection and precision of defects evaluation

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Augmented Reality PAUT (AR PAUT)

Comprehensive set of parameters for the probe position and swiveling carried by video stream and processed by **ISONIC 3510T** / **ISONIC 3510** provides the opportunity of absolutely free-lance and very precise line- and XY- scanning without affecting the quality of the recorded data. Scanning process may be interrupted at any point as well as resumed at any moment and at any new probe position without some data loss and affecting the quality of the recorded and imaged map. Real time warnings generated in result of processing video stream data prevent imperfection of data recording and minimize the time consumption required for completion of the inspection

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UT over IP

ISONIC 3510T / **ISONIC 3510** may be controlled remotely from a regular computer running under Win'XP, 7, 8, 10, 11. There is no need in the special software for that purpose, just the same software that runs in the instrument. The instrument and the PC should be connected to the LAN or to the router distributing IPs automatically. Since the connection is established the instrument enters into the slave mode driving the probes and capturing the A-Scans, the hardware measurements, and the encoder data supplying them to the computer, which provides full control of the instrument along with data acquisition, processing, displaying and storage on the local drives

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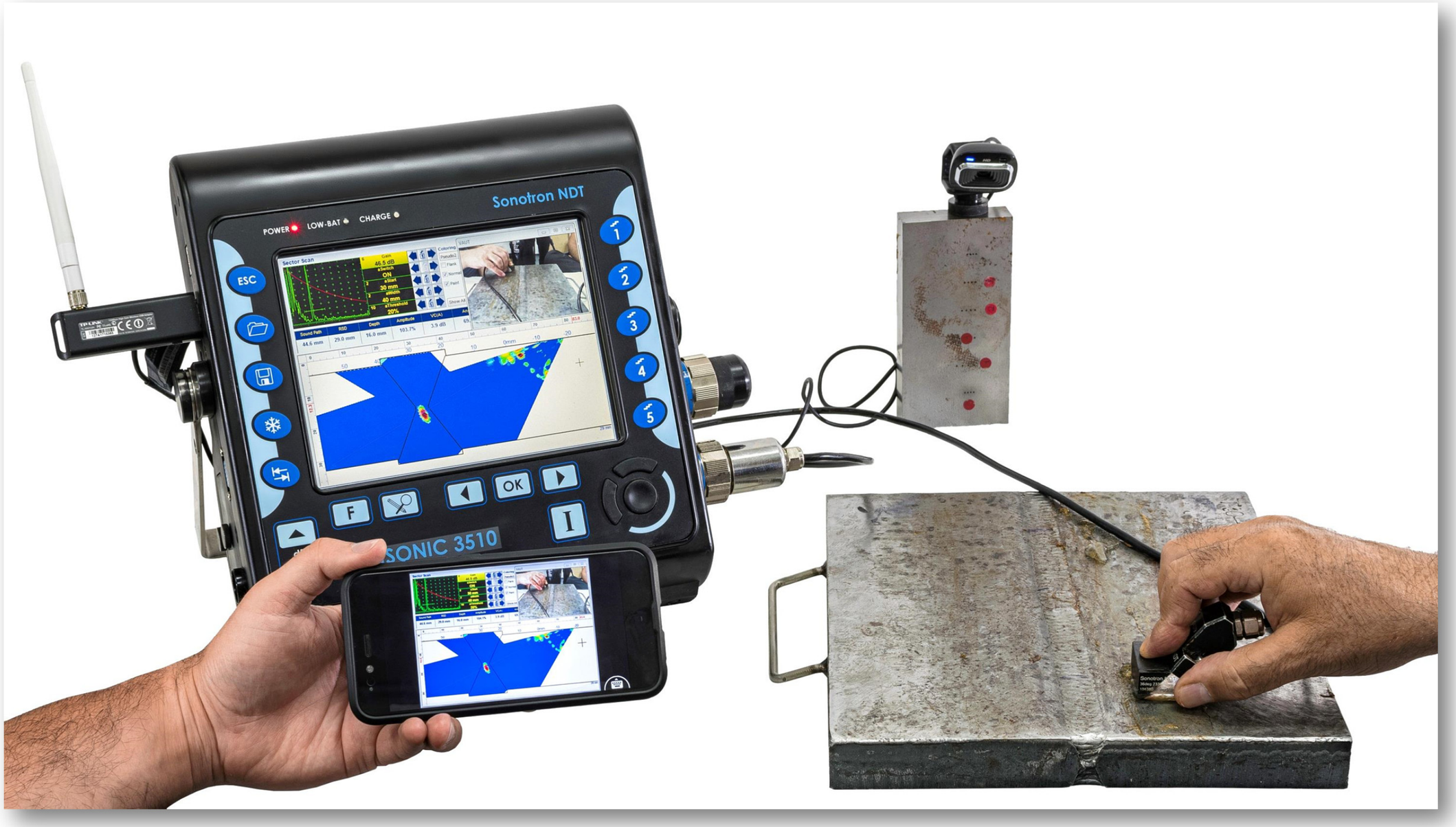
UT over IP

Supervisor or level III specialist may assist the operator in real time over the internet using the smartphone or tablet observing the live instrument screen, the probe and its position on the material and performing the instrument control at parallel with the technician in the field



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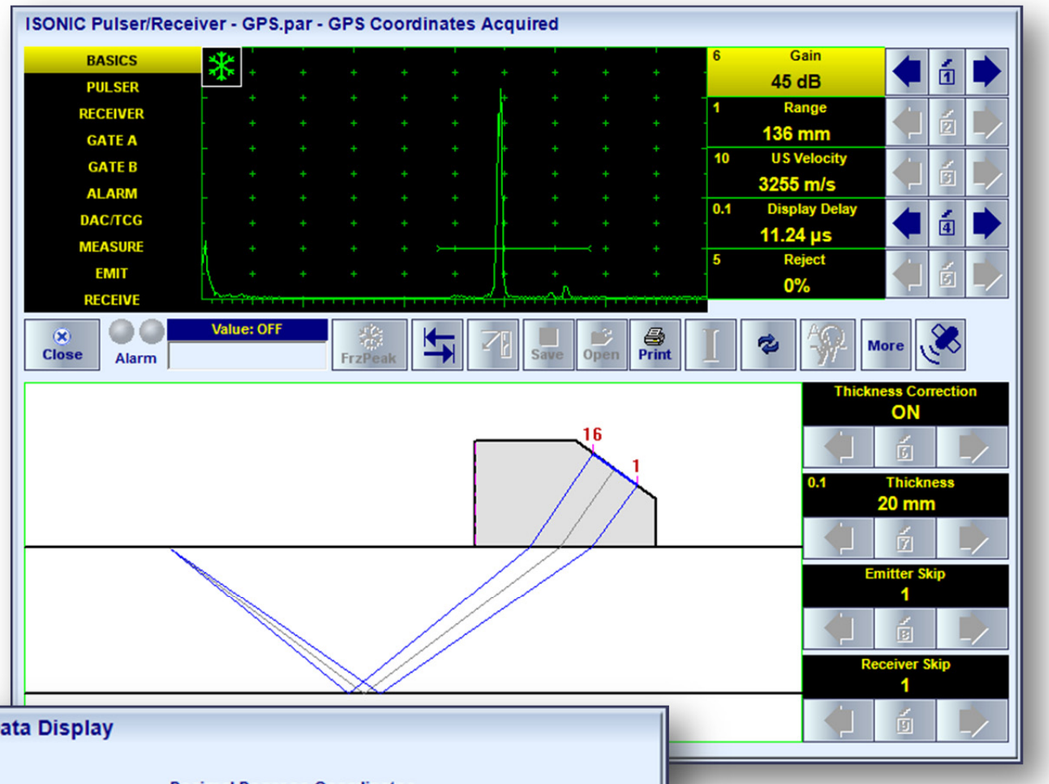
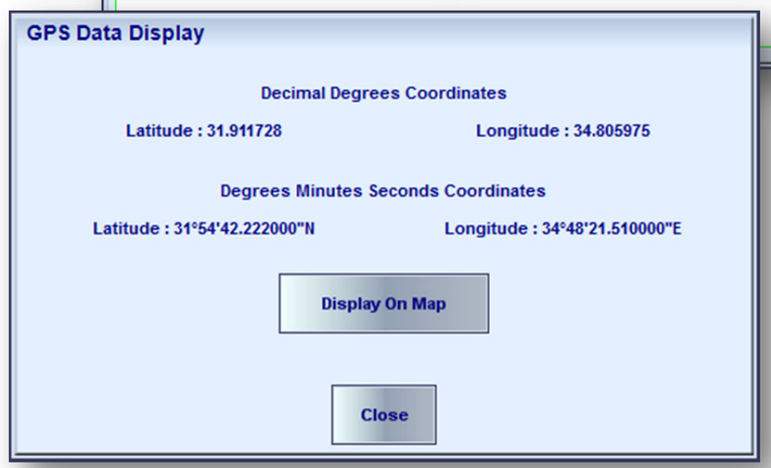
GPS Location





Whilst on the inspection side in the field the GPS coordinate may be obtained and displayed automatically along with UT data with use of an external GPS receiver connected to the instrument's USB Port and embedded into the data files for the reporting purposes

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Versatile Fully Parallel PA Functionality

Use of miniature active PA functionality extenders fitted between instrument's terminals and the instrument ends of probe cables allows quick and simple adjustment of PA architecture of the same instrument for best matching with different PA probes or pairs of probes that may be required by numerous inspection procedures

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Versatile Fully Parallel PA Functionality

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PAUT Easy Adoptable to UT Classics

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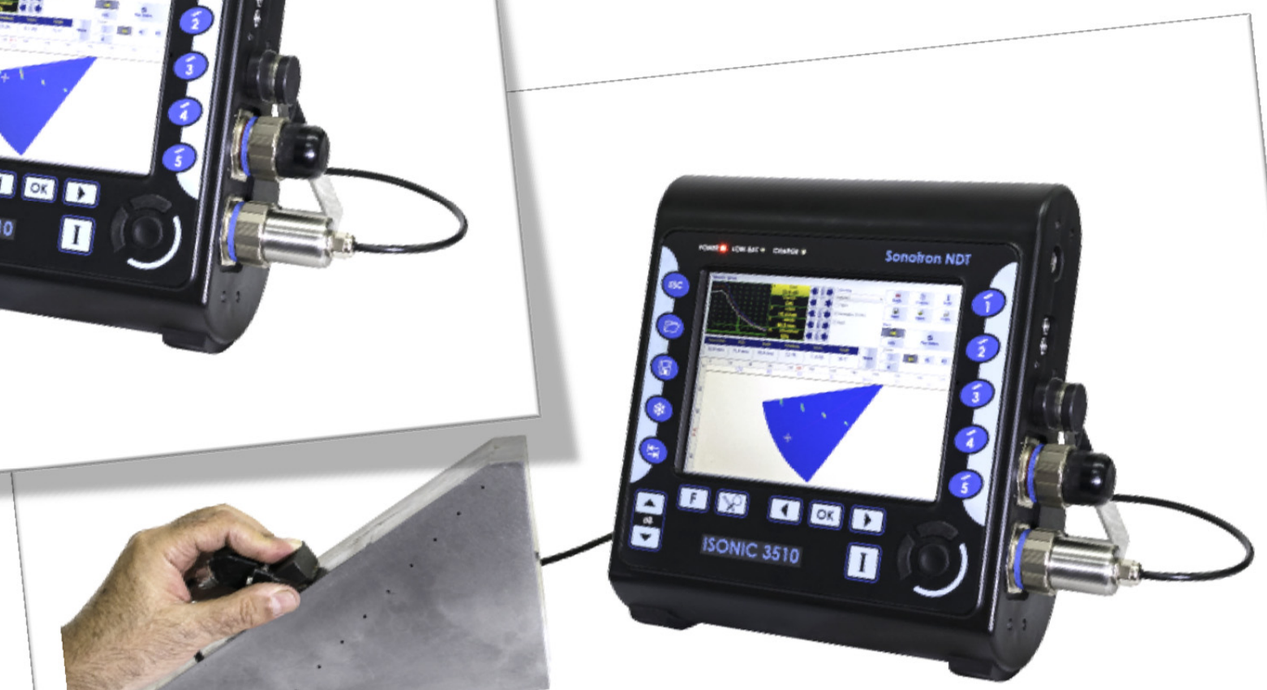
EquPAS – Homogenized Coverage Sensitivity



Homogeneous sensitivity within entire cross-section / volume of the material is provided in easy reproducible manner thanks to unique TCG-independent angle gain compensation (gain per focal law compensation) solution combined with the DAC / TCG image normalization (**EquPAS** solution)

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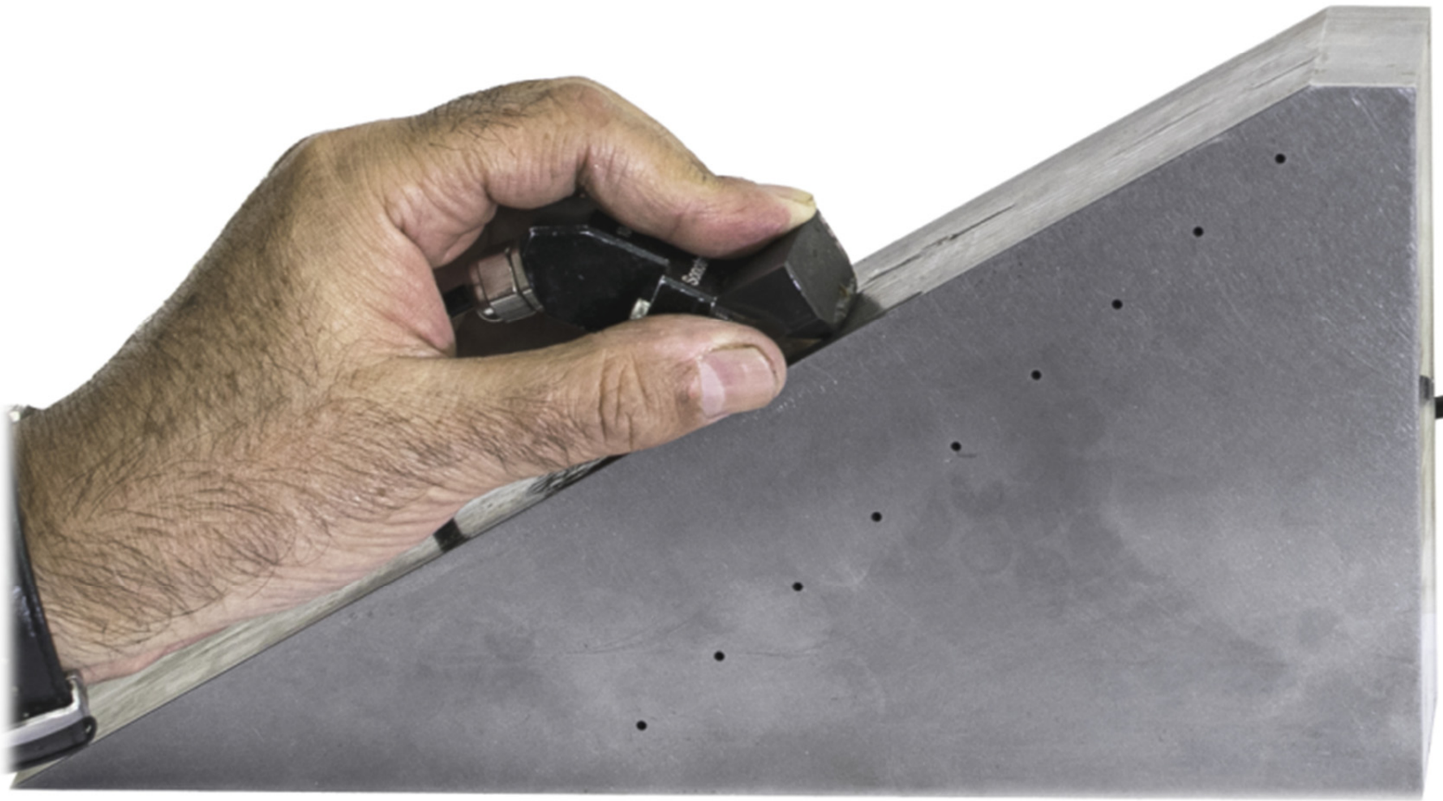
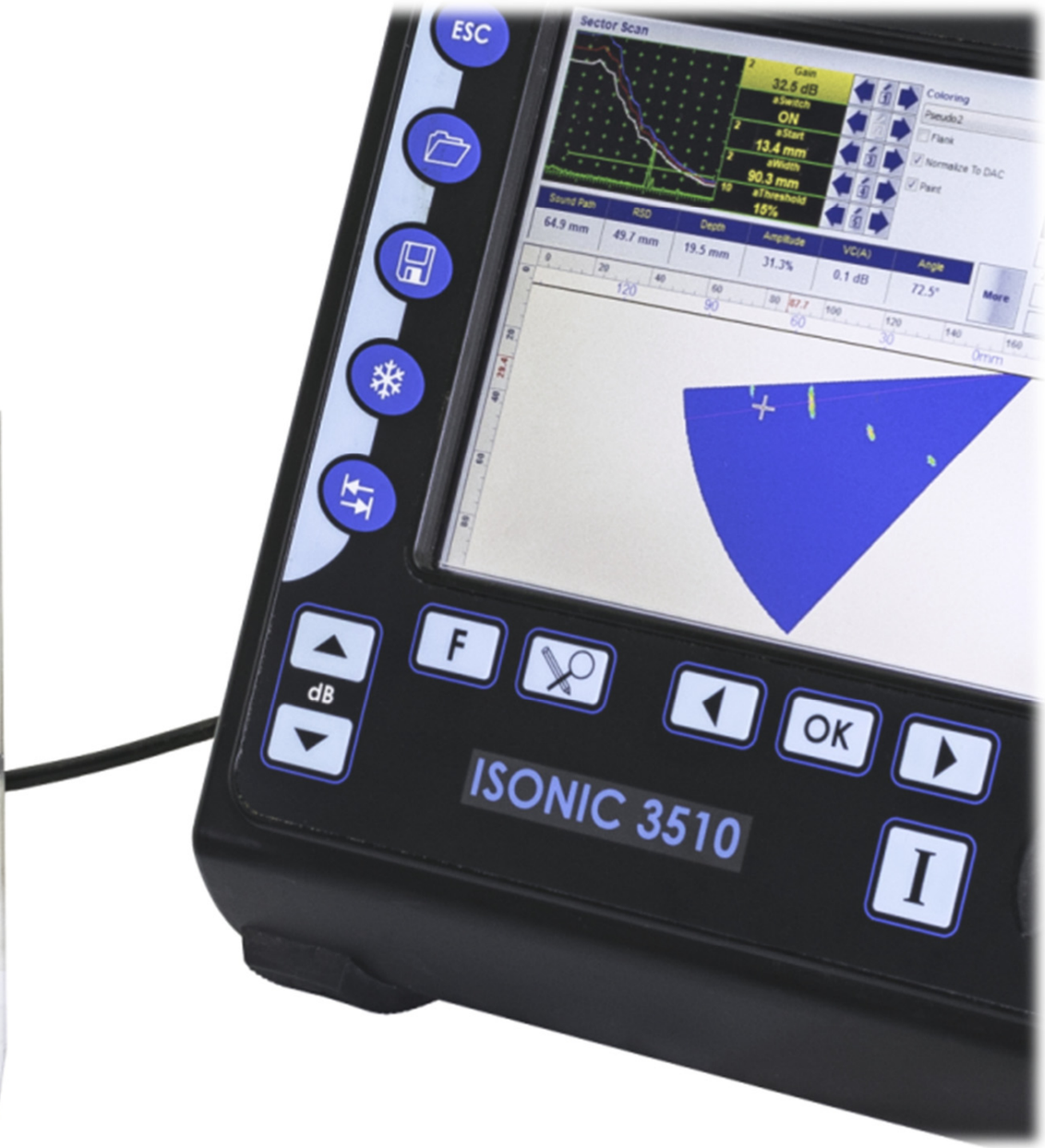
EquPAS – Homogenized Coverage Sensitivity

EquPAS solution for homogenizing sensitivity within entire covered cross-section / volume of the material is applicable for every desired type of reference reflector used in the industry such as SDH (Side Drilled Hole), FBH (Flat Bottom Hole), EDM Notch, and the like





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Multi-Group

MULTIGROUP and **MULTIGROUP T** modes of operation allow implementing of several different scan plans (up to 5) simultaneously out of the same probe increasing the probability of detection and precision of the defects evaluation

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Scanning Performance Strip

Along with recording and displaying of the inspection data characterizing the quality of the material the on-line monitoring of scanning performance is provided:

- perceptible operative indication is submitted through progressive filling of the *Scanning Performance Strip* with green (normal process), red (coupling loss – total data loss), and violet (over-speed – partial data loss) colors urging the operator to rescan the imperfectly passed segments
- scanning performance data is recorded synchronously with the inspection data and stored into the same file

100% raw data capturing and homogenized inspection sensitivity over entire cross-section (volume) of the material as determined by the scan plan and the scanning performance data monitored on-line and recorded at parallel with the inspection results bring the testing integrity to the highest level

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Scanning Integrity Report

Scanning Integrity

Total length scanned	Scanning duration	AVG speed
298 mm	37.2 s	8.02 mm/s

	Total		Maximal segment
Coupling lost	8 %	[24 mm]	24 mm
Over speed	10 %	[32 mm]	16 mm

Close

Quantitative Scanning Integrity Report may be generated automatically as soon as scanning completed. Alternatively thanks to 100% raw data capturing it may be formed out of the stored files at the postprocessing stage

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Multi-Axis Encoding

Inspection applications involving special scanners either automatic, manual or robotic are implemented through running of corresponding optional application software utilizing Multi-Axis Encoding of probe position, which is provided in the **ISONIC 3510T** / **ISONIC 3510** through use of Multi-Axis Encoder Interface Device connected directly to the standard instrument's terminal usually used with single-axis incremental encoders. Besides counting single-axis encoding ticks controller of the said terminal settled on the PAUT/UT card of the instrument also carries the ability of real time data exchange. Multi-Axis Encoder Interface Device forms and delivers probe coordinates data stream to PAUT/UT card, which processes it synchronously with ultrasonic signals in real time. In result the data stream of ultrasonic signals synchronized with probe's coordinates is carried to the instrument's on-board computer for further processing required for resolving of the inspection task

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Conventional Modality

Beside PA electronics **ISONIC 3510T** / **ISONIC 3510** carries 2 independent top performance conventional channels providing the regular A-Scan and advanced inspections such as TOFD, Short Range Guided Wave (SRUT GW), etc with 100% raw data recording each. The said inspections may be performed either independently or in synchronized combination with PA modality inspection

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Conventional Modality – Probes Arrays

For a variety of practical inspection tasks use of arrays composed out of a number of conventional probes is more efficient comparing to PA modality. For the dealing with such occasionally occurring inspection projects PA channels of **ISONIC 3510T** / **ISONIC 3510** may be utilized for the driving of arrays of conventional probes. Thanks to fully parallel architecture each PA channel of the instrument may be operated as stand-alone conventional ultrasonic flaw detector. Calibration for as many conventional probes either single- or dual element or pairs of probes (Pulser Settings, Gain, Time Base, Gates, DAC or TCG, etc) as necessary to be performed in a regular manner upon connecting them to the individually dedicated sockets. Once a group of probes is formed and calibration is completed the multiple A-Scan observation and strip chart forming with 100% raw data recording is possible

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ISONIC 3510T / ISONIC 3510 - Technical Data

PA Modality

Structure:	1 X 32:32 switchable to / from 2 X 16:16 1 X 64:64* switchable to / from 2 X 32:32* 1 X 128:128* switchable to / from 2 X 64:64* * - with use of corresponding active PA functionality extension adapters **Important:** there is no external splitter required in case of using 2 PA probes simultaneously
Initial Pulse:	Bipolar Square Wave with Boosted Rising and Falling Edges, Guaranteed Shell Stability, and Active Damping
Transition:	≤7.5 ns (10-90% for rising edges / 90-10% for falling edges)
Amplitude:	Smoothly tunable (12 levels) 50 … 300 Vpp into 50 Ω
Half Wave Duration:	50…600 ns controllable in 5 ns step
Emitting aperture:	1...32/64*/128* adjustable as fully or partially matching OR mismatching with the receiving aperture * - with use of corresponding active PA functionality extension adapters
Receiving Aperture:	1...32/64*/128* adjustable as fully or partially matching OR mismatching with the emitting aperture * - with use of corresponding active PA functionality extension adapters
Phasing - emitting and receiving:	0…100 µs with 5 ns resolution independently controllable
Analogue Gain:	0...100 dB controllable in 0.5 dB resolution
Advanced Low Noise Design:	85 µV peak to peak input referred to 80 dB gain / 25 MHz bandwidth
Frequency Band:	0.2 … 25 MHz
A/D Conversion:	100 MHz 16 bit
Digital Filter:	32-Taps FIR band pass with controllable lower and upper frequency limits; non-linear acoustics technique supported
Superimposing of receiving aperture signals:	On-the-fly, no multiplexing involved
Phasing (receiving aperture):	On-the-fly 0…100 µs with 5 ns resolution
Dynamic Focusing:	Supported
FMC, TFM, Back Diffraction Technique with / without and Mode Conversion:	Supported
A-Scan:	• RF • Rectified (Full Wave / Negative or Positive Half Wave) • Signal's Spectrum (FFT Graph)
Reject:	0...99 % of screen height controllable in 1% resolution
Material Ultrasound Velocity:	300...20000 m/s (11.81…787.4 "/ms) controllable in 1 m/s (0.1 "/ms) resolution

Time Base - Range:	0.5...7000 µs - controllable in 0.01 µs resolution
Time Base - Display Delay:	0...400 µs - controllable in 0.01 µs resolution
Probe Delay:	Automatically settled depending on the PA probe / wedge / delay line in use according to the desired: • Aperture(s) • Incidence angle • Focal point position • etc
DAC / TCG:	• One Per Focal Law • Multi-curve • Slope ≤ 46 dB/µs • Available for the rectified and RF A-Scans • Theoretical – through entering dB/mm (dB/") factor • Experimental – through recording echoes from several reflectors; capacity - up to 40 points
Automatic Gain Correction:	Complimentary Mechanism Independent on DAC / TCG: • AGC - Angle Gain Compensation for the sectorial scan coverage • GPSC - Gain Shot (Focal Law) Correction for other types of coverage
EquPAS - Equalized (Homogenized) PA Inspection Sensitivity:	Provided for every desired type of reference reflector: • SDH (Side Drilled Hole) • FBH (Flat Bottom Hole) • EDM Notch • etc
Gates:	• 2 Independent gates per focal law (**A** and **B**) with the **Start** / **Width** controllable over entire time base in 0.1 mm /// 0.001" resolution • **IE** gate per focal law for the standard *Interface Echo start* function controllable over entire time base in 0.1 mm /// 0.001" resolution
Threshold:	5…95 % of A-Scan height controllable in 1 % resolution
Phased Array Probes:	• 1D Array – linear (LA), rings (RA), daisy (DA), and the like • Dual Linear Array (DLA) • Matrix Array (MA) • Dual Matrix Array (DMA)

Focal Laws:	• 8192
	• Independently adjustable gain / time base / apertures / pulsing receiving modes / focal point positions, etc for each focal law among the plurality of implemented within a frame composing sequence
	• On-the-fly focal law editing ability
	• Dynamic focusing:
	  ○ for any set of points distributed within entire cross-section of the material covered by linear array probe / group of probes and forming either straight, curved, zigzag, or broken line
	  ○ for any set of points distributed inside 3D space within entire cube or other volumetric polygon of the material covered by matrix array probe / group of probes

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Scanning and Imaging:	• *Cross-Sectional B-Scan (E-Scan) – regular and/or Volume Overlay True-To-Geometry* • *Cross-Sectional Sector Scan (S-Scan) – regular and/or Volume Overlay and True-To-Geometry* • *Cross-Sectional Tandem B-Scan – Volume Overlay and True-To-Geometry* • *Tip Diffraction B-Scan for sizing of surface breaking cracks* • *Multi-group image composed of several cross-sectional B- and S-Scans* • *Horizontal Plane S-Scan* • *FMC/TFM synthetic aperture images* • *Back-diffraction image* • *FD B-Scan (Frequency Domain B-Scan)* • *Strip Chart* • *TOFD Map out of a pair of PA probes* • *Top (C-Scan), Side, End View imaging formed through encoded / time-based line scanning, 3D-Viewer* • *Top (C-Scan), Side, End View imaging formed through encoded XY- scanning, 3D-Viewer* • *Scanning Performance Strip representing Coupling Loss and Over-Speed events* • *Quantitative Scanning Integrity Report*
GPS Coordinate:	Obtained and Displayed Automatically Along with UT Data with Use of the External GPS Receiver Connected to Instrument's USB Port
VAUT:	Video Data from One or Two External Cameras Connected to Instrument's USB Port(s) is Displayed Automatically Along with UT Data
Data Storage:	• 100% Raw Data Capturing • GPS Coordinate Embedded Into the Data File in Case of GPS Receiver Connected • Photo Embedded Into the Single A-Scan / Cross-sectional Image Data File in Case of USB Camera Connected • Video Embedded Into the Scanning Results Data File in Case of USB Camera Connected
Postrpocessing:	• Built-in means for the comprehensive postprocessing in the instrument • ISONIC PA Office - freely distributable postprocessing package for the computer running under W'XP, W'7, W'8, W'10, W'11

Conventional UT and TOFD

Number of Channels:	2
Pulsing/Receiving (dual channel operation):	• Parallel - both channels do fire, receive, digitize, and record signals simultaneously • Sequential – cycles of firing, receiving, digitizing, and recording signals by each channel are separated in time in a sequence loop
Initial Pulse:	Bipolar Square Wave with Boosted Rising and Falling Edges, Guaranteed Shell Stability, and Active Damping
Transition:	≤7.5 ns (10-90% for rising edges / 90-10% for falling edges)
Amplitude:	Smoothly tunable (12 levels) 50 … 300 Vpp into 50 Ω
Half Wave Duration:	50…600 ns controllable in 10 ns step
Modes:	Single / Dual
Analogue Gain:	0...100 dB controllable in 0.5 dB resolution

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Advanced Low Noise Design:	85 µV peak to peak input referred to 80 dB gain / 25 MHz bandwidth
Frequency Band:	0.2 … 25 MHz Wide Band
A/D Conversion:	100 MHz 16 bit
Digital Filter:	32-Taps FIR band pass with controllable lower and upper frequency limits
A-Scan:	• RF • Rectified (Full Wave / Negative or Positive Half Wave) • Signal's Spectrum (FFT Graph)
Reject:	0...99 % of screen height controllable in 1% resolution
Material Ultrasound Velocity:	300...20000 m/s (11.81…787.4 "/ms) controllable in 1 m/s (0.1 "/ms) resolution
Time Base - Range:	0.5...7000 µs - controllable in 0.01 µs resolution
Time Base - Display Delay:	0...400 µs - controllable in 0.01 µs resolution
Probe Angle:	0…90° controllable in 1° resolution
Probe Delay:	0...70 µs controllable in 0.01µs resolution
DAC / TCG:	• Multi-curve • Slope ≤ 46 dB/µs • Available for the rectified and RF A-Scans • Theoretical – through entering dB/mm (dB/") factor • Experimental – through recording echoes from several reflectors; capacity - up to 40 points
DGS:	Standard Library for 18 probes / unlimitedly expandable
Gates:	2 Independent gates (**A** and **B**) with the **Start** / **Width** controllable over entire time base in 0.1 mm /// 0.001" resolution
Threshold:	5…95 % of A-Scan height controllable in 1 % resolution
HW Gates:	Standard Option
Interface Echo:	Standard Option
Digital Readout:	• 27 automatic functions • Dual Ultrasound Velocity Measurement Mode for Multi-Layer Structures • Curved Surface / Thickness / Skip correction for angle beam probes • Ultrasound velocity and Probe Delay Auto-Calibration for all types of probes
Freeze A-Scan:	• Freeze All • Freeze Peak Note: signal evaluation, manipulating Gates and Gain is possible for the frozen A-Scans as for live
Scanning and Imaging - Single Channel:	• Thickness Profile B-Scan • True-To-Geometry Angle / Skip Corrected Cross-sectional B-Scan • High Resolution B-Scan • Horizontal Plane View CB-Scan • TOFD

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Scanning and Imaging - Dual Channel:	• Strip Chart - strips of 4 types, namely P/E Amplitude/TOF; Map; TOFD; Coupling • Stripped C-Scan
Standard length of one line scanning record:	50…20000 mm (2"…800"), automatic scrolling
Data storage:	100% raw data capturing
Postprocessing:	• Built-in means for the comprehensive postprocessing in the instrument • ISONIC Office L - freely distributable postprocessing package for the computer running under W'XP, W'7, W'8, W'10, W'11

General

PRF:	10...5000 Hz controllable in 1 Hz resolution
On-Board Computer CPU:	• ISONIC 3510T - Quad Core Intel Atom N4200 CPU 1.1 GHz / 2.5 GHz • ISONIC 3510 - Dual Core Intel Atom N2600 CPU 1.6 GHz
RAM:	• ISONIC 3510T - 4 GB • ISONIC 3510 - 2 GB
Quasi HDD:	SSD Hard Drive 128 GB
Screen:	• ISONIC 3510T - 8.5" High Color Ultra High Brightness Direct Sun Readable 800 x 600 • ISONIC 3510 - 8.5" High Color High Brightness Sun Readable 800 x 600
Controls:	• Touch screen • Front Panel Sealed Keyboard and Mouse
Standard Ports:	• 2 x USB (optionally expandable up to 8) • Ethernet • sVGA (ISONIC 3510) • HDMI (ISONIC 3510T) • Wi Fi (optional – through optional external USB dongle) • 3,4,5G (optional – through optional external USB dongle)
Operating System:	• ISONIC 3510T - W'10.IOT.Ent • ISONIC 3510 - W'7PROEmb
Encoder Port:	• Single Axis Incremental TTL encoder – direct connection • Multi-Axis (2, 3, 4, etc) Incremental TTL Encoder – Through Miniature Scanner Mounted Optional Multi-Axis Encoder Interface Box
USB Encoder Port:	• Dual Axis Incremental TTL Encoder – Through Optional Miniature Scanner Mounted Dual Axis Encoder Interface Box • Multi-axis / multi-plane / multi-frame video stream augmented reality encoder for free-hand manual and mechanized probe manipulation with encoding of X,Y,Z probe coordinates and α,β,γ swiveling / skewing angles in 3 orthogonal planes on flat and complex surfaces

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Remote Control:	• From an external computer running under W'XP, W'7, W'8, W'10, W'11 through Ethernet or Wi Fi • From 3,4,5G Cell Phone • No special software required • All calibration and inspection data is stored in the control computer
Ambient Temperature:	• -30°C ... +60°C (operation) • -50°C ... +60°C (storage)
Housing:	• Rugged reinforced plastic case with the stainless steel carrying handle / MIL-STD-810H 516,8 applicable tests passed • IP 65 • No air intake • The cooling is not required • Available in black and red color (on demand)
Dimensions:	292x295x115 mm (11.50"x11.61"x4.53") - with / without battery inside
Weight:	4,850 kg (10.70 lbs) – with battery 4.200 kg (9.26 lbs) – without battery

the right image is worth a thousand words

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