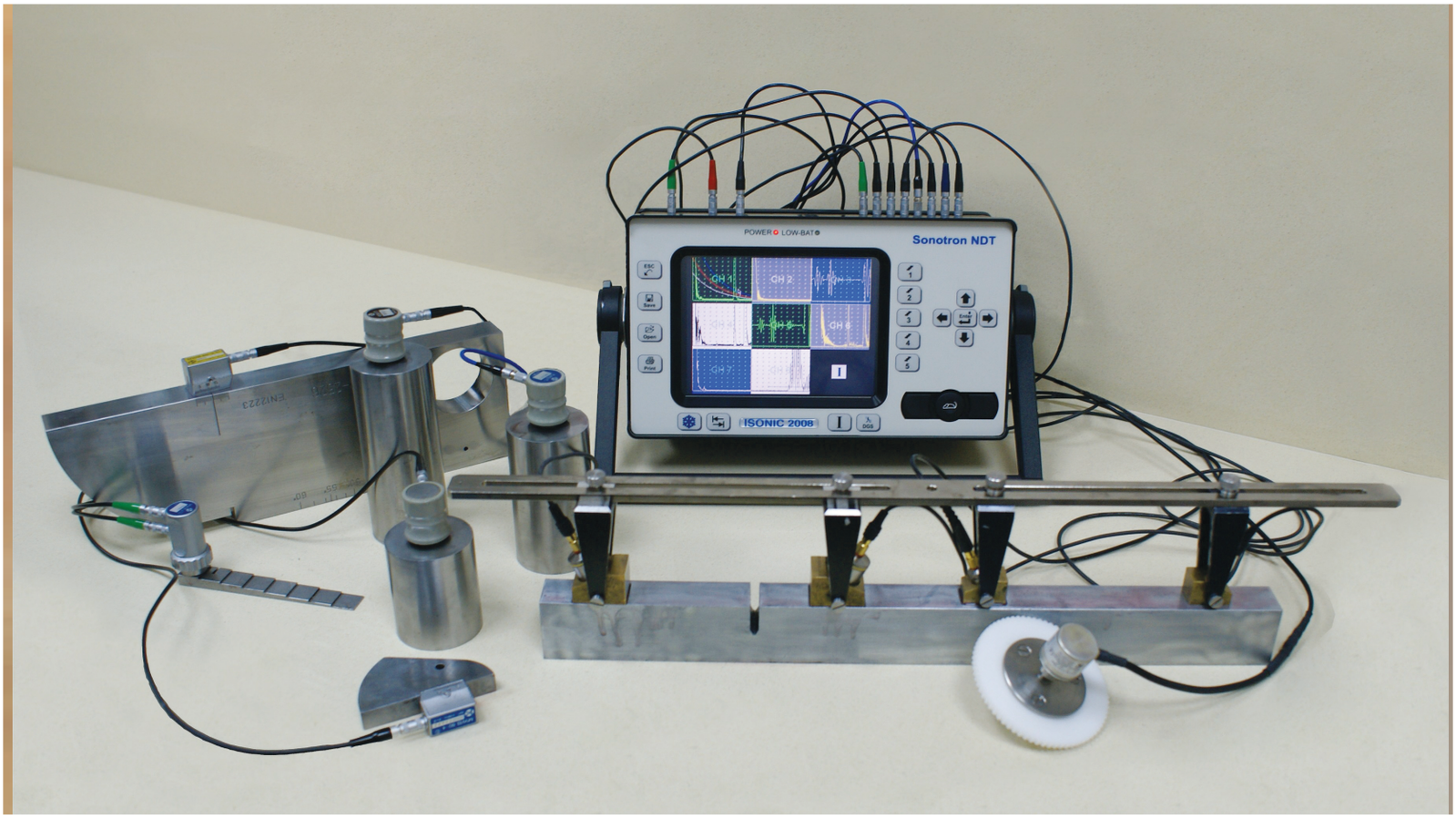
Inspect and Backup

ISONIC 2008

Portable Digital 8-Channel Ultrasonic Flaw Detector Recorder



Simply connect all necessary probes and position encoder and fit all stuff into a scanner

- Affordable Portable AUT Solution
- Single Channel and Multi-Channel Inspection
- Manual, Semiautomatic, and Automatic Scanning
- Built-In Encoder Port
- 2 Probe Terminals per Channel
- Parallel / Sequential Pulsing Receiving and Recording
- A-, B-, CB-Scan, Amplitude / TOF and Coupling Strip, TOFD
- 100% Raw Data Recording
- Built-In Remote Control Feature
- Enhanced Signal Evaluation for Live and Frozen A-Scans
- Corrosion Profiling and Flaw Detection and Imaging
- Up To 20m Length of One Standard Single or Multi-Channel Line Scanning Record
- Playback A-Scans for All Recorded Data
- Defect Sizing and Pattern Analysis
- Compliance with ASME and RBIM Procedures
- Huge Data Storage Capability
- Large Bright High Resolution Color Touch Screen
- Built-In VGA Output, USB and LAN Interface

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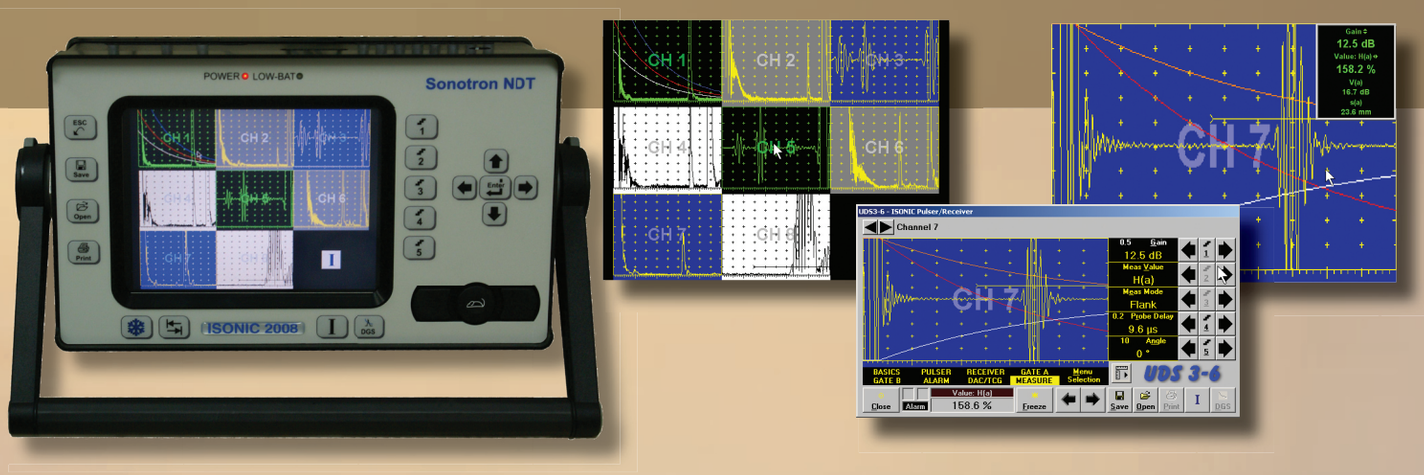
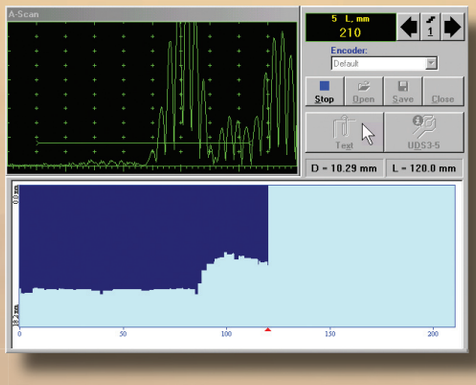


ISONIC 2008 uniquely combines functionality and mobility of high performance portable digital ultrasonic flaw detector with recording, imaging, and data processing capabilities of smart computerized multi-channel inspection system

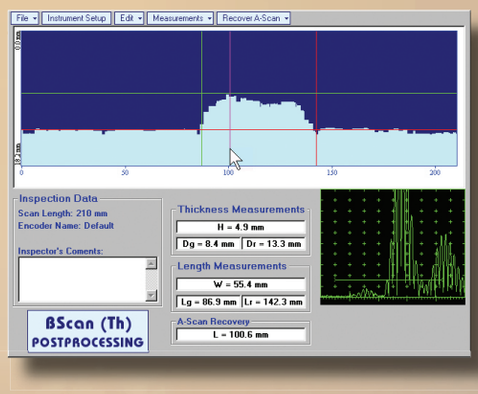
Conventional single channel pulse echo and through transmission A-Scan-based inspection

- 640X480 pixels A-Scan display with physical dimensions 130 x 90 mm (5.12" x 3.62") of working area is largest one for the plurality of portable ultrasonic flaw detectors
- Innovative bi-polar square wave pulser with tunable pulse duration and amplitude provides optimal probe driving enhancing ultrasound penetration for various materials characterized either by high or low grain, sound attenuation, and the like
- High frequency probe may not be destroyed occasionally upon connecting to instrument's firing output even if duration or amplitude of bi-polar square wave initial pulse is improper thanks to probe damage prevention circuit automatically limiting energy transmitted to the probe's crystal
- 32-Taps FIR band pass digital filter with controllable lower and upper frequency limits optimizes signal to noise ratio for various probes, materials, and inspection tasks
- 46 dB dynamic range 20 dB/μs maximum slope multiple curve DAC/TCG may be created using up to 40 data points to correct distance – amplitude variations of ultrasonic signals
- Both theoretical and experimental DAC may be activated either through keying in dB/mm (dB/") factor or through sequential recording echo amplitudes from variously located equal reflectors
- DAC/TCG may be applied to rectified A-Scans (positive, negative, and full wave) and to RF A-Scans as well
- Built-in DGS data base for standard probes is unlimitedly expandable
- Thanks to extended dynamic range signals significantly exceeding the A-Scan height (up to 199.9%) may be evaluated without dropping Gain
- Whilst A-Scan is frozen managing of Gain and Gates settings is still allowed and provides bringing signals to necessary evaluation level and performing required evaluation
- Dual Ultrasound Velocity Measurement Mode extremely simplifies resolving of sound path distances for dissimilar materials adjacent to each other whereas different values of ultrasound velocity are valid for corresponding signals appearing on the same A-Scan
- RF display mode combined with frequency domain signal analysis enhances capabilities of the instrument for materials characterization, bond inspection, testing of dissimilar materials, defect pattern analysis, and probes evaluation
- Optional data logger organizes and manages database files capable to store up to 254745 thickness readings each and organized as 2D matrix. In database every thickness reading is accompanied with corresponding raw data A-Scan and instrument setup. Automatic creating of MS Excel® thickness spreadsheet meets requirements of various Risk Based Inspection and Maintenance (RBIM) procedures
- And more… see technical data page

Single Channel Line Scanning Recording Comprises All Features of Popular ISONIC 2005 and ISONIC 2006 Instruments



On-Line



Off-Line

Thickness Profile imaging and recording is performed through continuous capturing of thickness readings along probe trace:

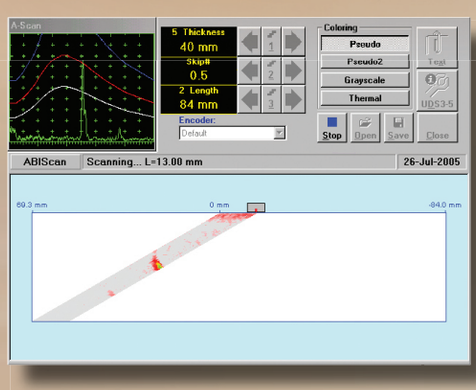
- Both time-based (real time clock) and true-to-location (built-in incremental encoder interface) mode of data recording are supported
- Complete sequence of A-Scans is recorded along with thickness profile
- Off-line evaluation of thickness profile record is featured with:
  - Sizing of thickness damages at any location along stored image: remaining thickness, thickness loss, and length of damage
  - Play-back and evaluation of A-Scans obtained during scanning
  - Off-line reconstruction of thickness profile image for various Gain and/or Gate settings
  - Automatic conversion of thickness profile B-Scan data into MS Excel® thickness spreadsheet meeting requirements of various Risk Based Inspection and Maintenance (RBIM) procedures

Typical Application: Corrosion characterization

B-Scan cross-sectional imaging and recording of defects for longitudinal and shear wave inspection is performed through continuous measuring of echo amplitudes and reflectors coordinates along probe trace:

- Both time-based (real time clock) and true-to-location (built-in incremental encoder interface) mode of data recording are supported
- Complete sequence of A-Scans is recorded along with B-Scan defects images
- Off-line evaluation of B-Scan record is featured with:
  - Sizing of defects at any location along stored image – coordinates and projection dimensions
  - Play-back and evaluation of A-Scans obtained during scanning
  - Defects outlining and echo-dynamic pattern
  - Reconstruction of B-Scan defects images for the various Gain and/or Reject settings
  - DAC / DGS B-Scan normalization

Typical Applications: Pulse echo inspection of welds, composites, metals, plastics, and the like



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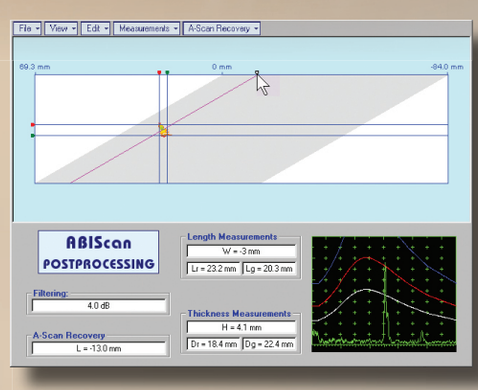

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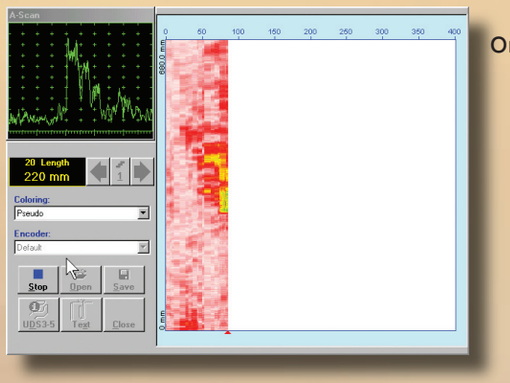
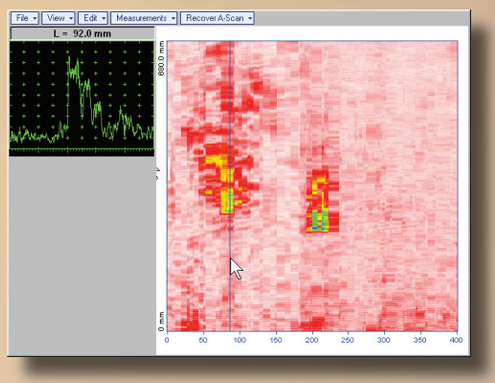


On-Line



Off-Line

CB-Scan horizontal plane-view imaging and recording of defects for shear, surface, and guided wave inspection performed through continuous measuring of echo amplitudes and reflectors coordinates along probe trace:

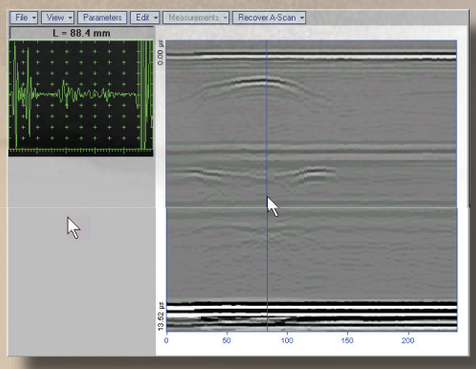
- Both time-based (real time clock) and true-to-location (built-in incremental encoder interface) mode of data recording are supported
- Complete sequence of A-Scans is recorded along with CB-Scan defects images
- Off-line evaluation of CB-Scan record is featured with:
  - Sizing of defects at any location along stored image – coordinates and projection dimensions
  - Play-back and evaluation of A-Scans obtained during scanning
  - Defects outlining and echo-dynamic pattern analysis
  - Reconstruction of CB-Scan defects images for various Gain and/or Reject settings
  - DAC/DGS CB-Scan normalization

Typical Applications: Long range pulse echo and CHIME inspection of annular plates and pipes, for pitting, stress corrosion, etc; weld inspection, surface wave inspection

TOFD Inspection – RF B-Scan and D-Scan Imaging

- Both time-based (real time clock) and true-to-location (built-in incremental encoder interface) mode of data recording are supported
- Averaging A-Scans whilst recording as per operator's selection
- Complete sequence of RF A-Scans is recorded along with TOFD map
- Off-line evaluation of TOFD Map is featured with:
  - Improvement of near to surface resolution through removal of lateral wave and/or back echo record
  - Linearization and straightening
  - Play-back and evaluation of A-Scans obtained during scanning
  - Increasing contrast of TOFD images through varying Gain setting and/or rectification
  - Defects pattern analysis and sizing
  - Zoom of TOFD Map and A-Scans

Typical Applications: weld inspection; CHIME inspection



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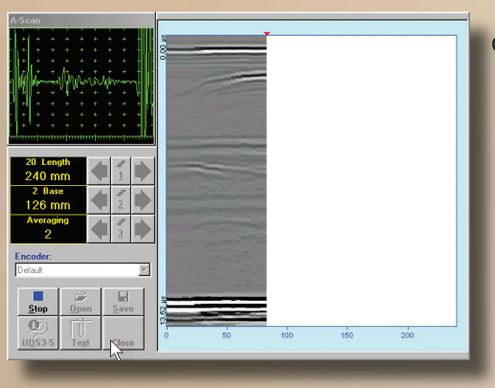

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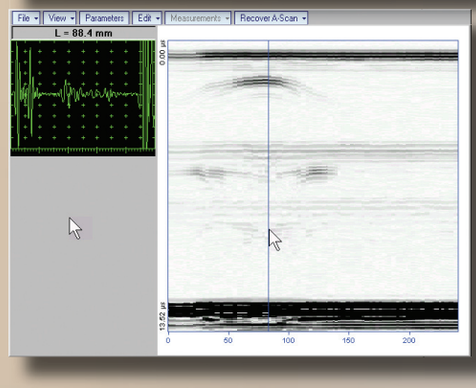
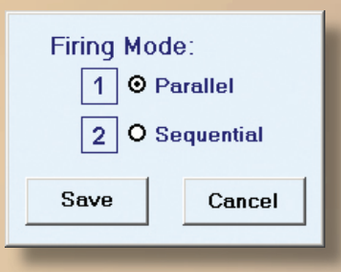


Multi-Channel Pulsing Receiving



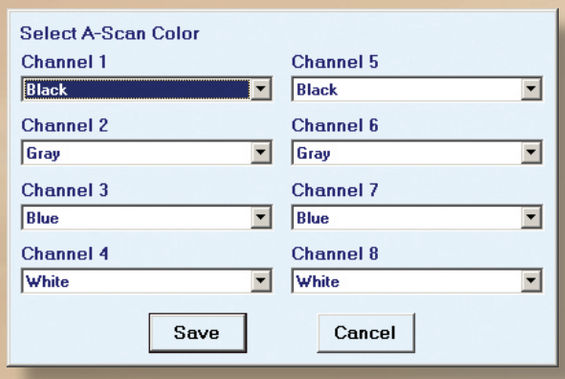
ISONIC 2008 comprises 8 identical UDS 3-6 pulsing-receiving channels. Most of parameters such as gain, filter settings, pulse duration, display mode, delay, range, ultrasound velocity, etc are individually calibrated per channel. Just firing level (the amplitude of initial pulse) and PRF (pulse repletion frequency) are common for all channels. Every channel may drive either single or dual element probe or probe pair through 2 probe terminals

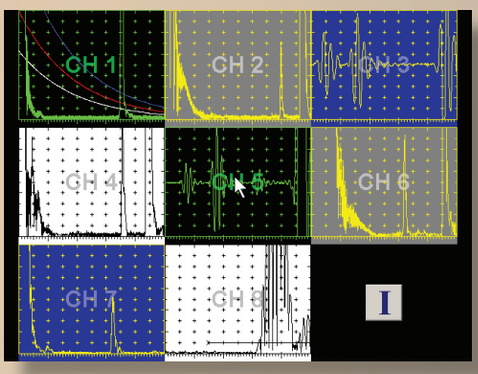
Every channel has its own signal digitizer (A/D Converter)

Highest scanning speed may be achieved through simultaneous (parallel) pulsing, receiving, signal digitizing, and recording by up to 8 channels. Measures avoiding cross talking to be taken while placing simultaneously fired probes on the object under test – the probes must be well separated

Most compact probes placement on the object under test with complete avoiding of cross talking is provided through pulsing, receiving, signal digitizing, and recording channels separately in time in a sequence loop (sequentially). Sequential pulsing-receiving also saves battery life

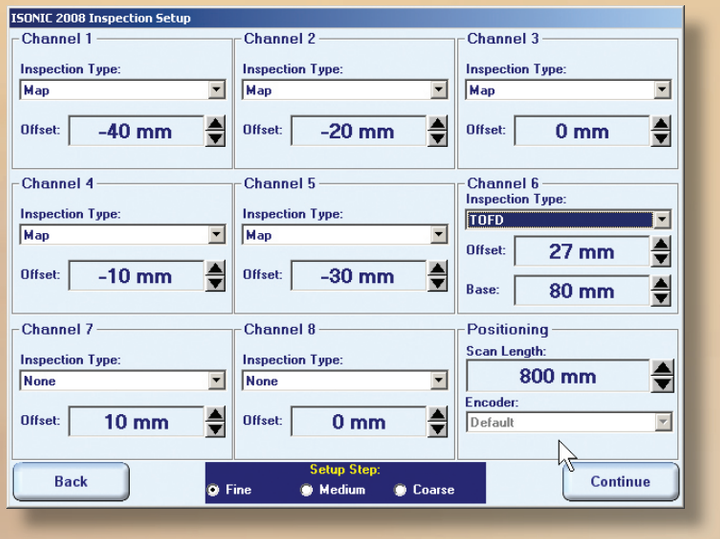
Various color combinations may be used for each channel A-Scan. This provides easy distinguishing between channels for multiple A-Scan observations





Two types of calibration files created by ISONIC 2008 may contain settings either for single channel or for all 8 channels simultaneously

Multi-Channel Recording

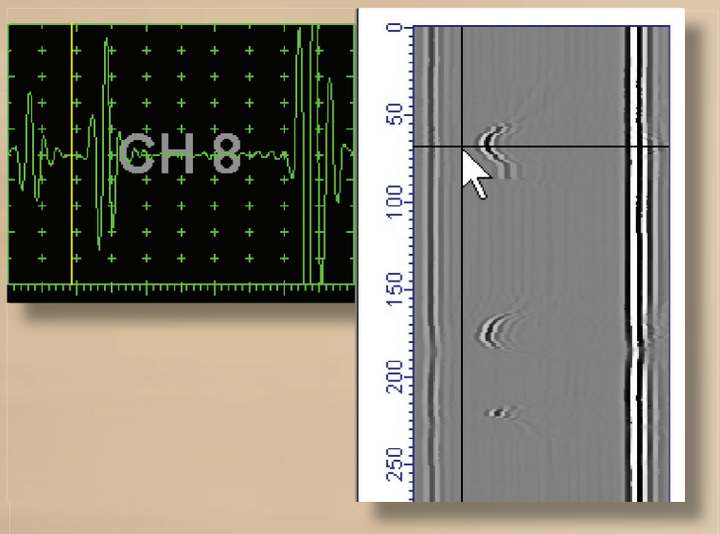


Multi-channel record includes few strips of the following types:

- TOFD
- Map
- Amplitude / TOF Pulse Echo
- Coupling

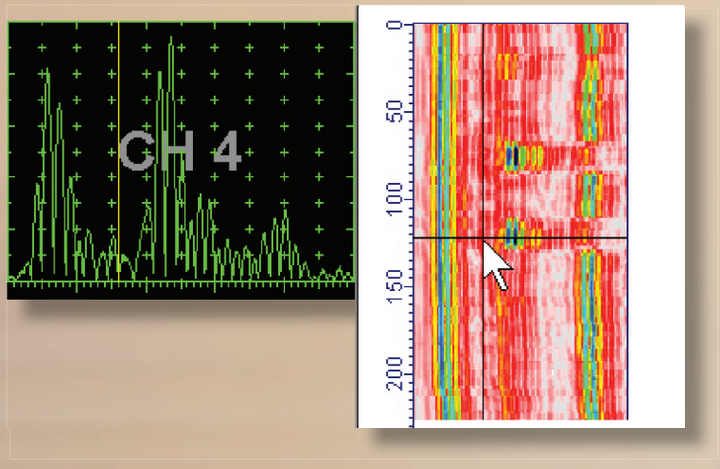
Strips may appear in any combination created by an operator according to inspection procedure.

Positioning of the probes in the scanner relatively to each other (the offset) to be keyed in at pre-scanning stage to align the strips



256 gray levels TOFD strip represents sequence of RF A-Scans whereas brightness of points for each horizontal line is modulated according to corresponding signal level.

Main use TOFD strip is recording of TOFD channels data for weld inspection. TOFD strip is also useful for recording CHIME inspection and for some applications where obtaining of RF B-Scan is necessary



256 Colors Palette Map Strip represents sequence of A-Scans whereas color of points for each horizontal line is coded according to corresponding signal level.

Main use Map Strip is recording of pulse echo inspections using either longitudinal, shear, surface, or guided waves

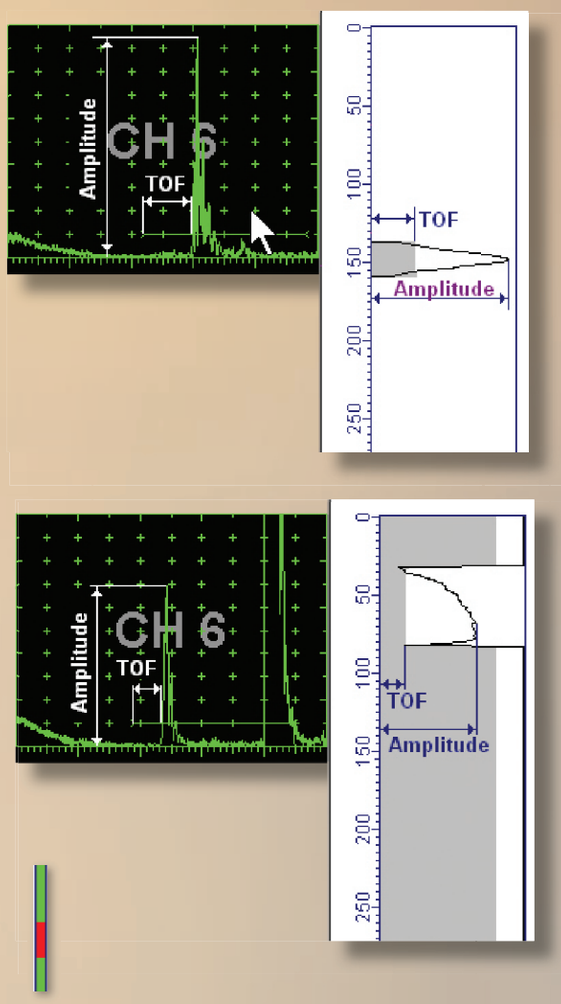
Amplitude / TOF Pulse Echo Strip represents peak amplitude and time of flight for signals matching with Gate and exceeding it's threshold level

Position of Amplitude Line on the strip is proportional to the signal height. Echo amplitude equal or exceeding 100% of A-Scan height brings Amplitude Line trace to full strip width level

Width of gray Time of Flight (TOF) Rectangle is proportional to the signal position in the Gate. For signals, which's time of flight measurement point matches with the Gate end width of gray Time of Flight (TOF) Rectangle is equal to the full strip width

For defects signals followed by strong geometry echoes Amplitude Line may represent either first or maximal signal amplitude depending on operator's choice while width of gray Time of Flight (TOF) Rectangle will represent position of the first signal crossing gate level

Amplitude / TOF Pulse Echo Strip may be used for thickness/corrosion profiling and for various flaw detection tasks

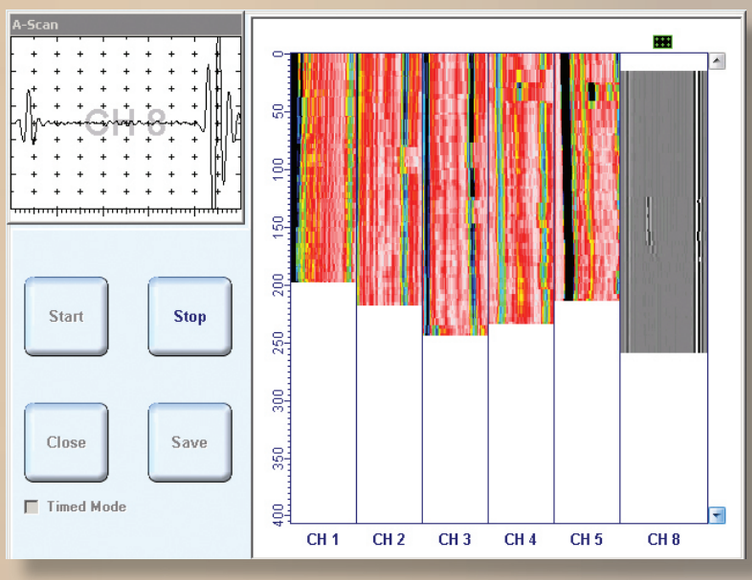


Coupling Strip is formed through comparing amplitude of reference signal with the gate threshold. Green Sufficient Coupling record is provided for signals exceeding gate threshold; red Insufficient Coupling record is provided in opposite case

Both time-based and true-to-location strip chart creating is available. For true-to-location strip chart forming it is used built-in incremental encoder interface

Observation of A-Scan is possible for every channel whilst scanning. Strip accompanied with A-Scan is marked with . To observe A-Scan related to another strip it is necessary just to click on the strip selected

Position of each probe along scanning line is taken into account while forming strip chart through use of appropriate offset values keyed in at pre-scanning stage. Thanks to such feature the same defect detected by different probes will be indicated in the same longitudinal position in each corresponding strip

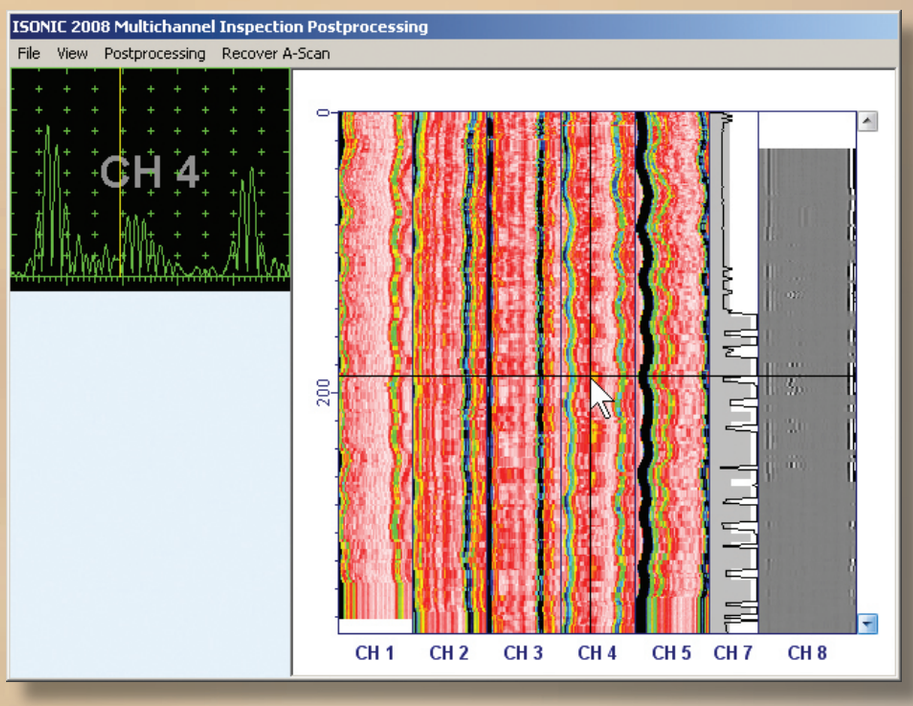


Complete sequences of A-Scans for each strip are recorded during scanning making ISONIC 2008 inspection fully compatible with ASME 2235-9 Code Case for radiography replacement and other national and international codes. Upon scanning is completed strip chart accompanied with the entire raw data and instrument settings may be stored into a file

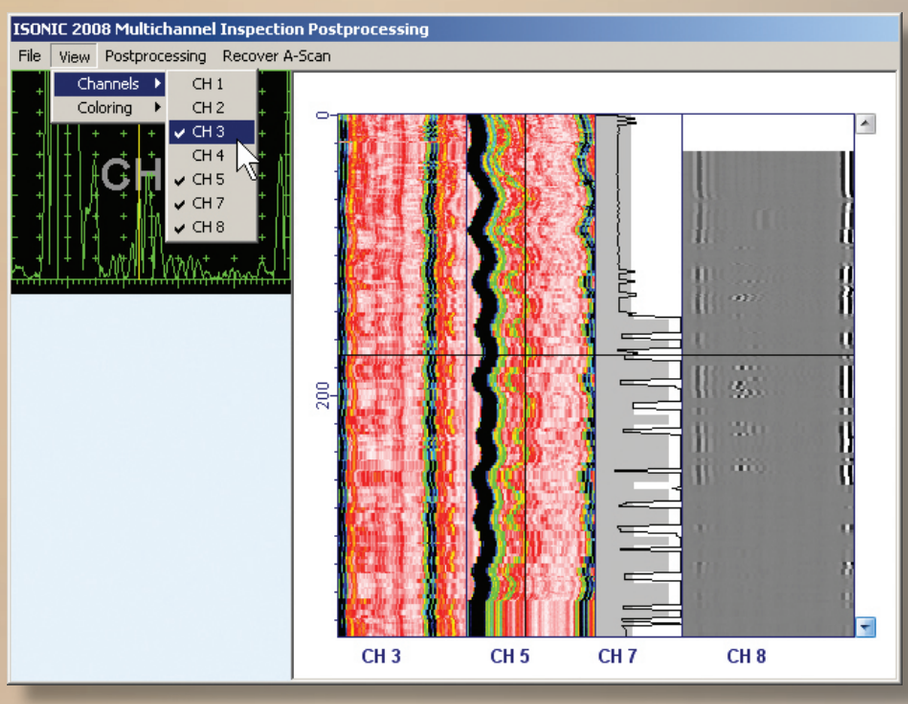
Postrocessing of Multi-Channel Scanning Data

Postprocessing is featured with:

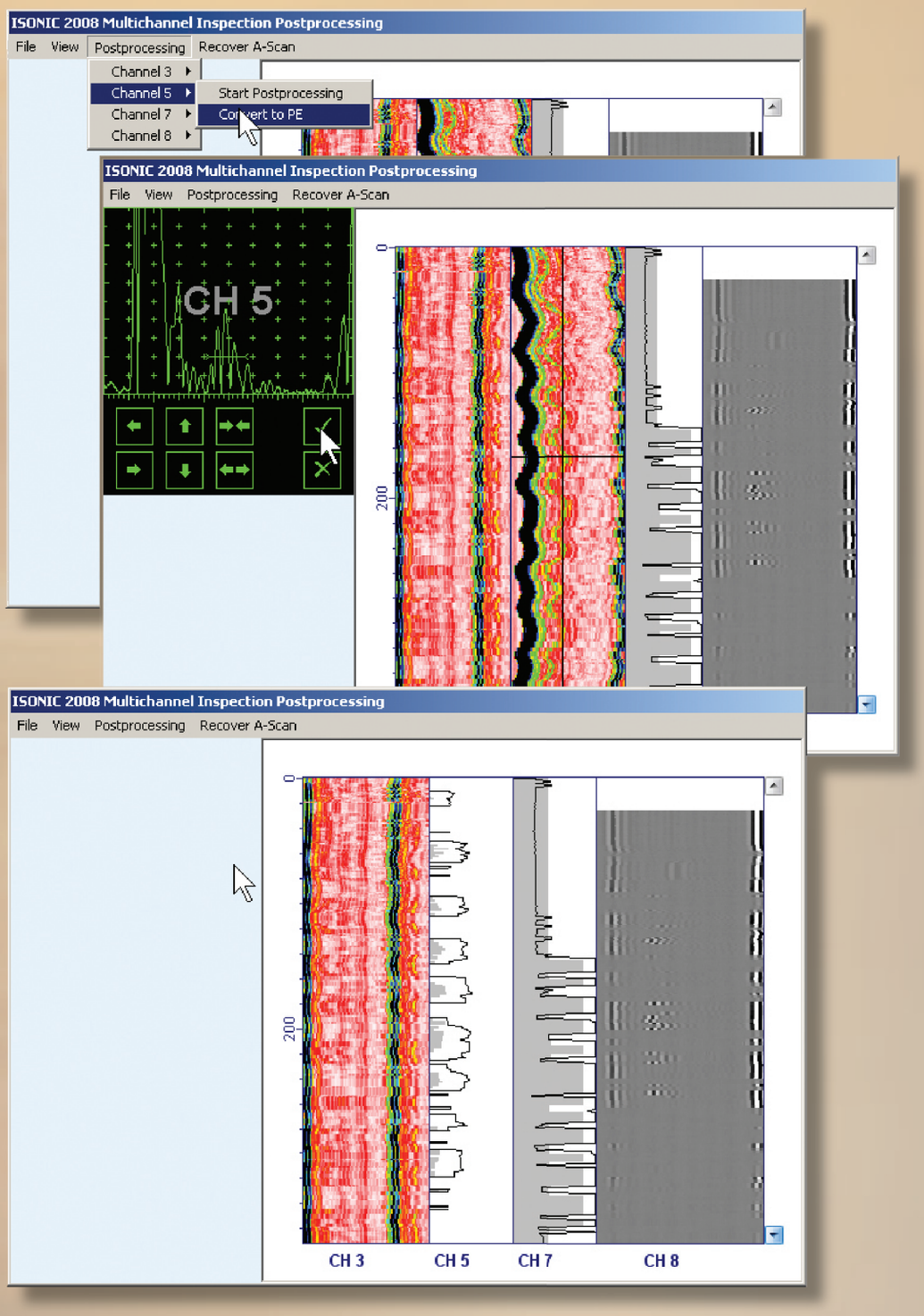
- Previewing and scrolling of whole strip chart
- Recovery of A-Scans for each channel through simple placement of cross-hair cursor above channel's strip



- Composing combination of simultaneously visible strips

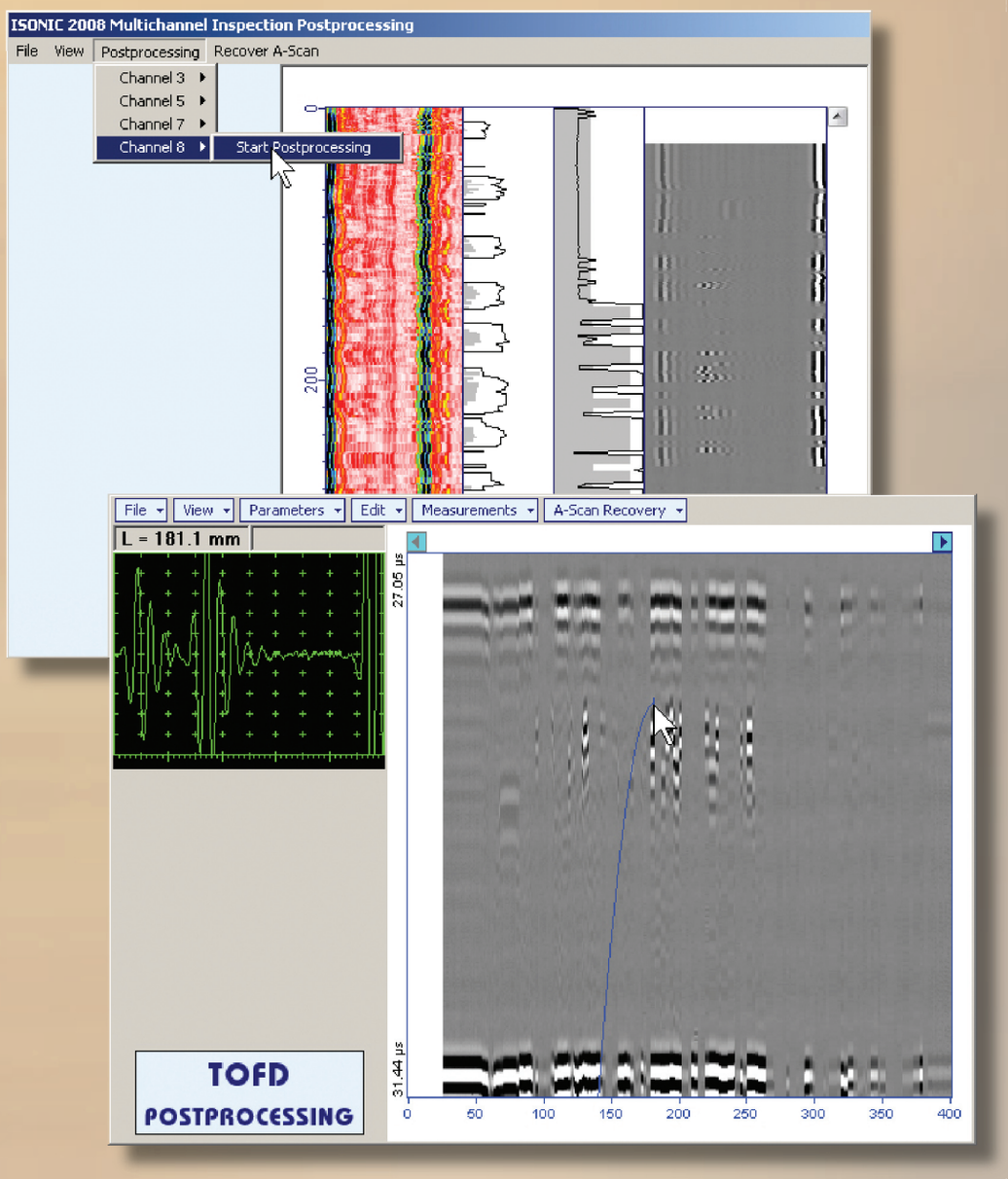


- Conversion of any Map Strip into Amplitude / TOF Pulse Echo Strip and reversal



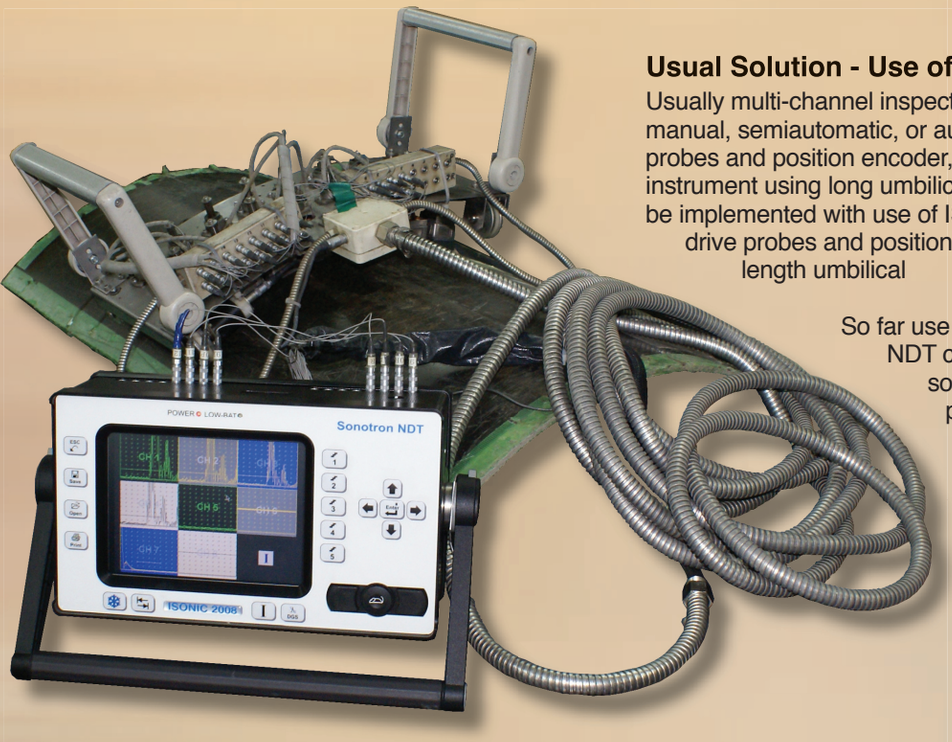
- Varying Region of Interest (Gate) settings for every **Amplitude / TOF Pulse Echo Strip**
- Marking defects and generating of Strip Chart Inspection Report

- Postprocessing each strip individually using applicable technology either TOFD, CB-Scan, or Thickness Profile including full scope of suitable procedures such as defects sizing, snap-shoots, off-line Gain correction, filtering, etc



- Converting combination of few strips into thickness, distance or amplitude C-Scan with further C-Scan analysis

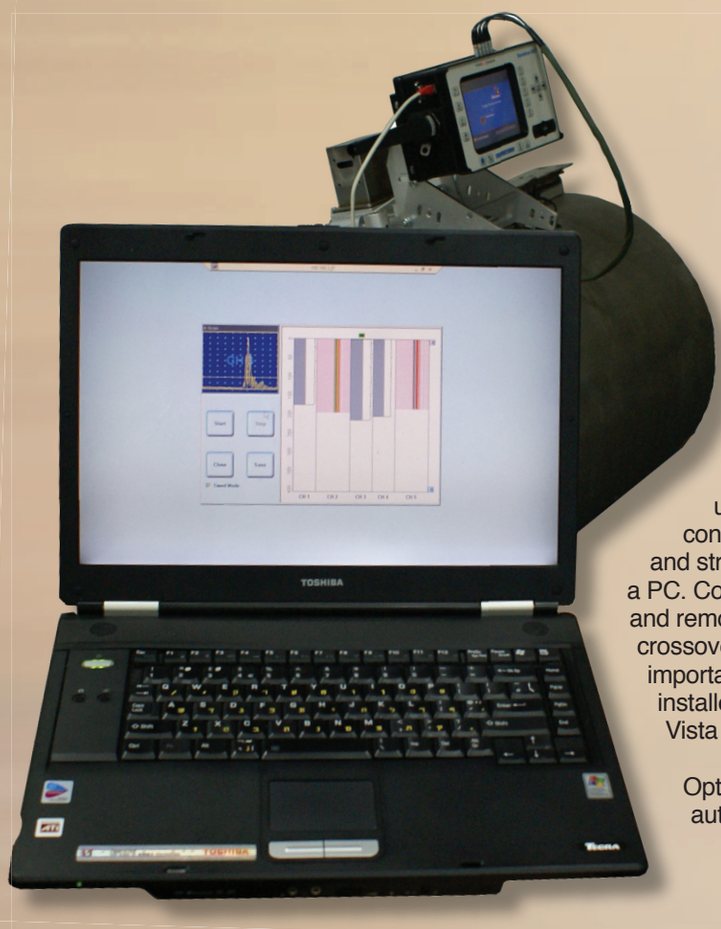
Remote Control and Data Acquisition



Usual Solution - Use of Umbilical

Usually multi-channel inspection is performed with use of manual, semiautomatic, or automatic scanner carrying all probes and position encoder, which are connected to the instrument using long umbilical. This conventional way may be implemented with use of ISONIC 2008, which is capable to drive probes and position encoder through up to 50 meters length umbilical

So far use of umbilical was accepted by NDT community an no-alternative solution despite low reliability, problems with signal to noise ratio, heavy weight and high cost



Innovative Alternative Solution Available for ISONIC 2008

An alternative to heavy, noisy, and expensive long umbilical is available at last. Thanks to low weight and compact size ISONIC 2008 may be easy fitted into a scanner and connected to probes and position encoder using short umbilical. In that case full remote control of ISONIC 2008 and observation of A-Scans and strip chart in real time may be performed through a PC. Communication between ISONIC 2008 instrument and remote PC may be provided using cheap and reliable crossover Ethernet cable of up to 200 meters length. It is important that there is no need in special software to be installed in the remote PC just standard Windows XP or Vista operating system

Optional software and hardware drivers for control of automatic scanner motor are available

ISONIC 2008 - Technical Data

Number of Channels:	**8**
Pulsing/Receiving Methods:	**Parallel - all 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**
Pulse Type**:	**Bipolar Square Wave Pulse**
Initial Transition**:	**≤5 ns (10-90%)**
Pulse Amplitude**:	**Smoothly tunable (12 levels) 75 V … 400 V peak to peak into 50 Ω**
Pulse Duration*:	**50…600 ns for each half wave synchronously controllable in 10 ns step**
Modes*:	**Single / Dual**
PRF**:	**0 – optionally; 15...5000 Hz controllable in 1 Hz resolution**
Optional Sync Output / Input**:	**Max +5V, τ ≤ 5 ns, t ≥100 ns, Load Impedance ≥ 50 Ω**
Gain*:	**0...100 dB controllable in 0.5 dB resolution**
Advanced Low Noise Design**:	**81 mV peak to peak input referred to 80 dB gain / 25 MHz bandwidth**
Frequency Band**:	**0.2 … 25 MHz Wide Band**
Digital Filter*:	**32-Taps FIR band pass with controllable lower and upper frequency limits**
Ultrasound Velocity*:	**300…20000 m/s (11.81…787.4 "/ms) controllable in 1 m/s (0.1 "/ms) resolution**
Range*:	**0.5...7000 μs controllable in 0.01 μs resolution**
Display Delay*:	**0...3200 μs controllable in 0.01 μs resolution**
Probe Angle*:	**0…90° controllable in 1° resolution**
Probe Delay*:	**0 to 70 μs controllable in 0.01 μs resolution - expandable**
Display Modes*:	**RF, Rectified (Full Wave / Negative or Positive Half Wave), Signal's Spectrum (FFT Graph)**
Reject*:	**0...99 % of screen height controllable in 1% resolution**
DAC / TCG*:	**Theoretical – through keying in dB/mm (dB/") factor** **Experimental – through sequential recording echo amplitudes from variously distanced equal reflectors** **46 dB Dynamic Range, Slope ≤ 20 dB/ms, Capacity ≤ 40 points** **Available for Rectified and RF Display**
DGS*:	**Standard Library for 18 probes / unlimitedly expandable**
Gates*:	**2 Independent Gates / unlimitedly expandable**
Gate Start and Width*:	**Controllable over whole variety of A-Scan Display Delay and A-Scan Range** **in 0.1 mm /// 0.001" resolution**
Gate Threshold*:	**5…95 % of A-Scan height controllable in 1 % resolution**
Measuring Functions – Digital Display Readout*:	**27 automatic functions / expandable; 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-Scans and Spectrum Graphs)*:	**Freeze All – A-Scans and Spectrum Graphs / Freeze Peak – A-Scans / All measurements functions, manipulating Gates, and ±6dB Gain varying are available for frozen signals**
Encoder Interface:	**Built-in controller and interface for incremental mechanical encoder**
Encoding:	**Time-based (built-in real time clock – 0.02 sec resolution) – for single channel operation only** **True-to-location (incremental encoder – 0.5 mm resolution) – for single and dual channel operation**
Imaging Modes:	**Single Channel: Thickness Profile B-Scan, Cross-sectional B-Scan, Plane View CB-Scan, TOFD** **Multi-Channel: Strip Charts of 4 types (Amplitude/TOFD P/E, Map, TOFD, Coupling)**
Standard Length of one Straight Line Scanning record:	**50…20000 mm (2"…800"), automatic scrolling**
Method of Record:	**Complete raw data recording**
Region of Interest*:	**Controllable over entire Display Delay, Probe Delay, Range, Ultrasound Velocity and other appropriate channel settings**
Off-Line Image Analysis*:	**Recovery and play back of A-Scan sequence at various gain levels** **Echo-dynamic pattern analysis** **Defects sizing, outlining, pattern recognition** **Converting strip types** **Converting Record into ASCII Format / MS Excel format / MS Word Format**
Data Reporting**:	**Direct printout of Calibration Dumps, A-Scans, Spectrum Graphs, Thickness Profile B-Scans, cross-sectional B-Scans, plane view CB-Scans, TOFD maps, strip charts**
Data Storage Capacity:	**At least 100000 sets including calibration dumps accompanied with A-Scans and/or Spectrum Graphs** **At least 10000 sets including calibration dumps accompanied with Thickness Profile B-Scans, cross-sectional B-Scans, plane view CB-Scans, TOFD maps, strip charts, and complete sequence of A-Scans captured during scanning**
On-Board Computer:	**AMD LX 800 - 500MHz**
RAM:	**512 Megabytes**
Internal Flash Memory - Quasi HDD:	**4 Gigabytes**
Outputs:	**LAN, USB X 2, PS 2, SVGA**
Screen:	**6.5" High Color Resolution (32 bit) SVGA 640´480 pixels 133´98 mm (5.24" ´ 3.86") Sun-readable LCD; Maximal A-Scan Size (working area) – 130´92 mm (5.12" ´ 3.62")**
Controls:	**Front Panel Sealed Keyboard, Front Panel Sealed Mouse, Touch Screen**
Compatibility with the external devices:	**PS 2 Keyboard and Mouse, USB Keyboard and Mouse, USB Flash Memory card, Printer through USB or LAN, PC through USB or LAN, SVGA External Monitor**
Operating System:	**Windows™ XP Embedded**
Power:	**Mains - 100…240 VAC, 40…70 Hz, auto-switch; Battery 12V 8AH up to 6 hours continuous operation**
Housing:	**IP 53 rugged aluminum case with carrying handle**
Dimensions:	**265´156´101 mm (10.43"´6.14"´3.98") - without battery 265´156´139 mm (10.43"´6.14"´5.47") - with battery**
Weight:	**2.500 kg (5.50 lbs) - without battery 3.430 kg (7.55 lbs) - with battery**

* individually controllable per channel ** common parameter / mode / feature for all channels