ISONIC AUT 16/32

Multi Channel Flaw Detector for Automatic Ultrasonic Testing

Core component for automatic ultrasonic inspection systems

ISONIC AUT 16/32 portable instruments are built to serve as core components of in-line production and in-service automatic ultrasonic inspection systems

ISONIC AUT 16 comprises 16 and **ISONIC AUT 32** comprises 32 identical independent **UDS 3-6** channels, each equipped with own pulser, receiver, and 100 MHz sampling rate signal digitizer (A/D Converter). Every channel may drive either single or dual element probe or probe pair through 2 probe terminals. Highest scanning speed is achieved through simultaneous (parallel) pulsing, receiving, digitizing, and recording of signals by up to 16 / 32 channels. On case of ultrasonic cross-talking **UDS 3-6** channels may be toggled to work sequentially

Significant improvement of signal to noise ratio and dynamic range is achieved through firing probes with unique bi-polar square wave initial pulse reaching up to 400 Volt peak-to-peak amplitude. Duration and amplitude for both positive and negative half-waves of the initial pulse may be tuned in wide range. Further it is provided high stability of firing amplitude selected by an operator while leading and falling edges of bi-polar initial pulse are electronically boosted

Every channel is featured with 3 independent gates providing unique ability of Gain per Gate Adjustment (GGA) – this allows implementing of back echo attenuation, interface gate synchronizing, suppression of large geometry echoes, and other functions typical for automatic ultrasonic inspection

ISONIC AUT 16/32 electronics is featured with:

- multi-axis encoder interface
- scanner motor control and powering interface
- pedal and/or button "start/stop inspection" inputs
- programmable outputs for driving paint guns, audible alarm sirens, GO/NO-GO parts sorters
- signal TOF / amplitude proportional analogue outputs

The appropriate terminals may be arranged for all above external devices or any combination of them according to scope of inspection requirements

ISONIC AUT 16/32 instruments are packed into rugged portable and light IP 67 sealed cases, which may be either fitted onto the scanner's chassis or mounted into a cabinet at the stationary inspection deck or just dropped onto a ground while performing inspection at the filed site. Regular remote laptop or desktop PC equipped with inspection software package provides full control of the instrument and real time data acquisition through Ethernet. Ultrasonic signals are sampled on-board then digitised raw inspection data is transferred to remote PC for further processing, storage, and imaging. Fully digital through-Ethernet control and data transfer provide practically unlimited length of distance to remote PC enabling flexibility of creating control rooms or multiple monitor stations throughout the factory / hangar / weld station, etc

Scope of ultrasonic inspection techniques implemented by **ISONIC AUT 16/32** instruments includes thickness gauging, pulse echo, pitch-catch, and through-transmission flaw detection, TOFD, and the like. Multi-channel scanning strategy and data presentation are implemented under control and processing of inspection software package running in the remote PC

For line scanning applications inspection data is presented in a form of strip chart. The following types of strips may be formed:

PE
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 within 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
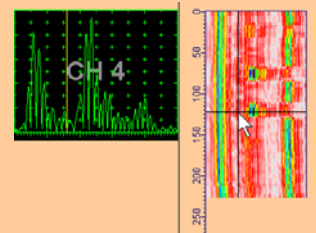
For geometry echoes matching within specially designated Gate Tail the *Amplitude Line* is not produced, just *TOF Rectangle*
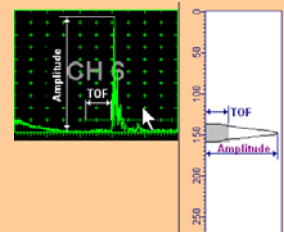
**Map**
Up to 256 Colors Palette **Map Strip** represents sequence of A-Scans whereas color of points for each horizontal line is coded according to corresponding signal level and default palette

TOFD
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
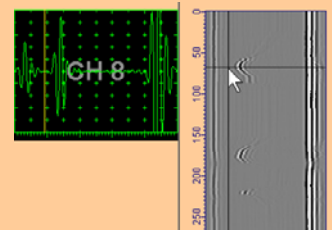

Coupling
Coupling Strip is formed through comparing amplitude of reference signal with the gate threshold. Green *Sufficient Coupling* record is provided for signals exceeding gate threshold; red *Insufficient Coupling* record is provided in opposite case


The strips as described may form strip-chart in any user-defined composition comprising up 32 strips with use of **ISONIC AUT 16** and up to 64 strips with use of **ISONIC AUT 32**, all raw data A-Scans are stored upon saving strip chart into a file and may be played-back and processed off-line then
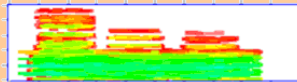
For the area scanning inspection data may be presented in a form combining amplitude / TOF / Thickness C-Scan, B- and D-Scan, 3D-View, etc. Significant increasing of scanning speed is provided through use of grape-, brush-, or other type of composition of several probes driven each by it's own channel into one inspection head
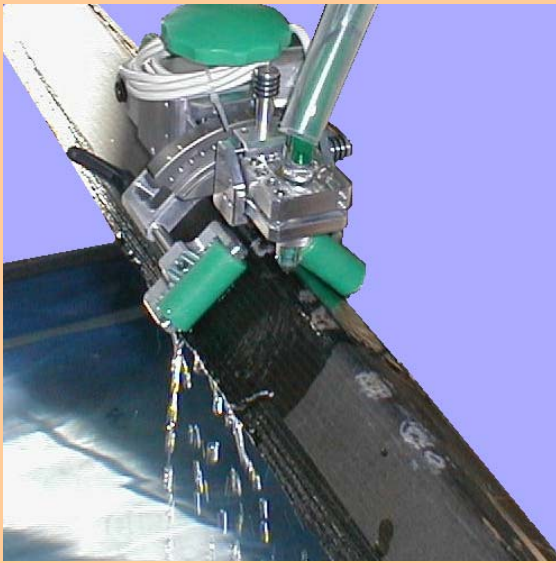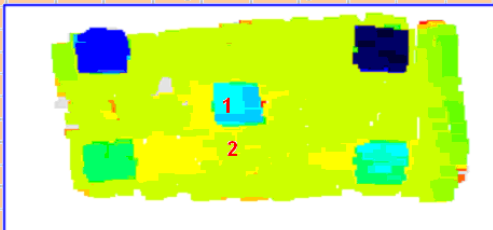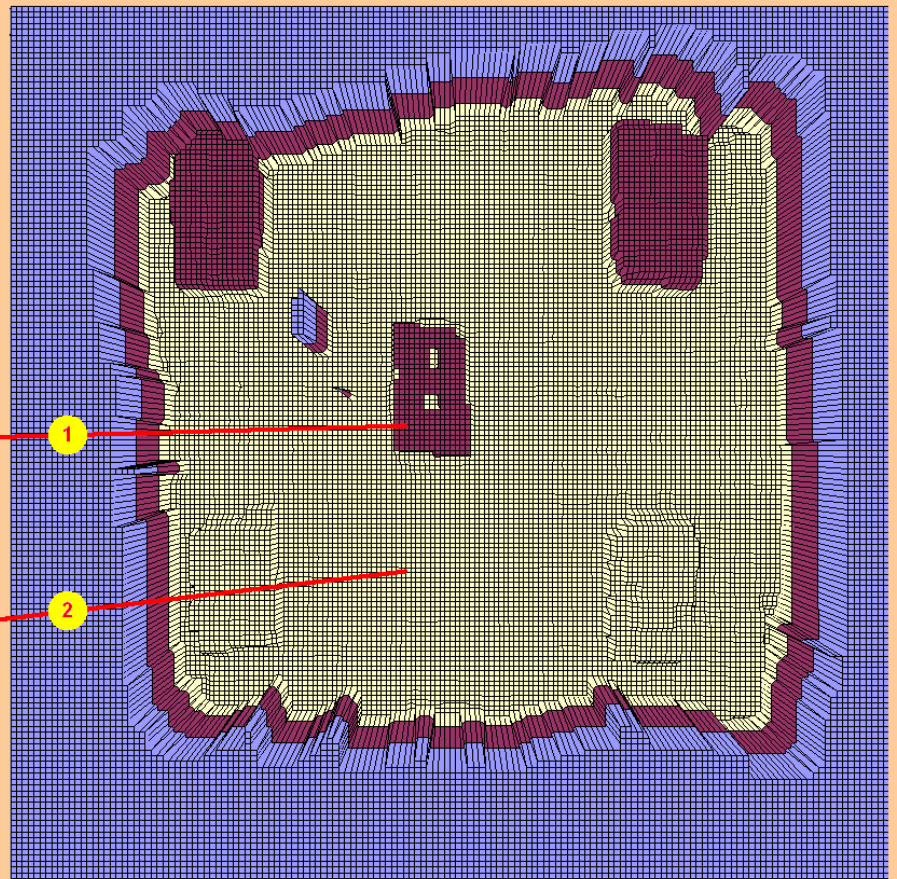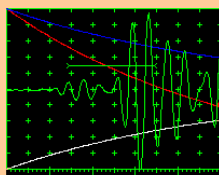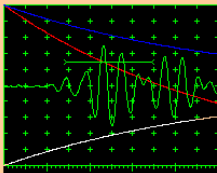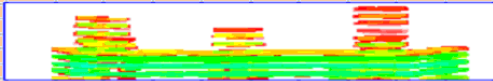

Raw data A-Scans are stored completely upon saving inspection results into a file and may be played-back and processed off-line then enabling echo-dynamic pattern analysis, defects sizing, outlining, pattern recognition. Inspection data may be converted into widely used ASCII, MS Excel, MS Access, MS Word formats

One regular PC may control and acquire data from several **ISONIC AUT 16/32** instruments simultaneously allowing rational organization of AUT jobs on-site and minimizing manpower involved

Technical Data

Number of Channels:	**16 - ISONIC AUT 16**
	32 - ISONIC AUT 32
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, $\tau \le 5$ ns, t ≥100 ns, Load Impedance ≥ 50 Ω**
Gain*:	**0...100 dB controllable in 0.5 dB resolution**
Advanced Low Noise Design:	**81 μV peak to peak input referred to 80 dB gain / 25 MHz bandwidth**
Frequency Band**:	**0.2 … 25 MHz Wide Band**
A/D Conversion:	**Parallel 100 MHz 16 bit**
Digital Filter*:	**32-Taps FIR band pass with lower and upper frequency limits controllable with 0.1 MHz resolution**
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/μs, Capacity ≤ 40 points
	Available for Rectified and RF Display
DGS*:	**Standard Library for 18 probes / unlimitedly expandable**
Gates*:	**3 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**
Gate per Gain Correction*:	**Independently controllable for each gate in 26 dB range with 0.5 dB 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**
Scanning Speed:	**20…100 mm/sec controllable in 1 mm/sec resolution**
Encoder Interface:	**Built-in controller and interface for multi-axis incremental mechanical encoder**
Encoding:	**Time-based (built-in real time clock – 0.02 sec resolution) – for line scanning only**
	True-to-location (single-axis and multi-axis incremental mechanical encoder) – for line and area scanning
Imaging Modes:	**Strip Charts of 4 types (Amplitude/TOFD P/E, Map, TOFD, Coupling)**
	Amplitude / TOF / Thickness C-Scan, B-Scan, D-Scan, 3D-View
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 Record into ASCII / MS Excel / MS Access / MS Word formats
Real Time Hardware Outputs:	**Up to 67/134 independent user programmable digital lines (+24V or +9V logic) for controlling audible alarm sirens, paint guns, GO/NO-GO parts sorters – ISONIC AUT 16/32**
	Up to 16/32 independent user programmable TOF /Amplitude proportional analogue output lines (0…5V) – ISONIC AUT 16/32
Hardware Control Inputs:	**Up to 3 independent user programmable lines for pedal/button "Start/Stop Inspection" control**
On-Board Computer:	**AMD LX 800 - 500MHz**
Operating System:	**Windows™ XP embedded**
RAM:	**512 Megabytes**
Internal Flash Memory - Quasi HDD:	**4 Gigabytes**
Interface:	**Ethernet**
Scanner Motor Interface:	**DC powering / RS 232 control - stepped motor**
Power:	**Mains - 100…240 VAC, 40…70 Hz, auto-switch**
Housing:	**IP 67 rugged aluminum case**
Dimensions:	**295×174×346mm (11.62"×6.85"×13.62")**
Weight:	**5.910 kg (13.00 lbs)**

*   individually controllable per channel
**   common for all channels