Inspect and Backup

ISONIC 2006

Portable Digital Ultrasonic Flaw Detector and Recorder

- Large Bright High Resolution Color Touch Screen
- Built-In Probe Position Encoding Means
- USB, LAN, VGA outputs
- Huge Data Storage Capability
- Longitudinal, Shear, Guided, and Surface Waves
- A-, B-, CB-, C-, D-, P-Scan, and TOFD
- Corrosion Profiling and Flaw Imaging
- Up To 20m Length of One Line Scanning Record
- Playback A-Scans for recorded Images
- Enhanced Signal Evaluation - Live and Frozen A-Scans
- Defect Sizing and Pattern Analysis
- Compliance with ASME and RBIM Procedures

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ISONIC 2006 complies with requirements of National and International Codes:

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 Rev 9 – Use of Ultrasonic Examination in Lieu of Radiography

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

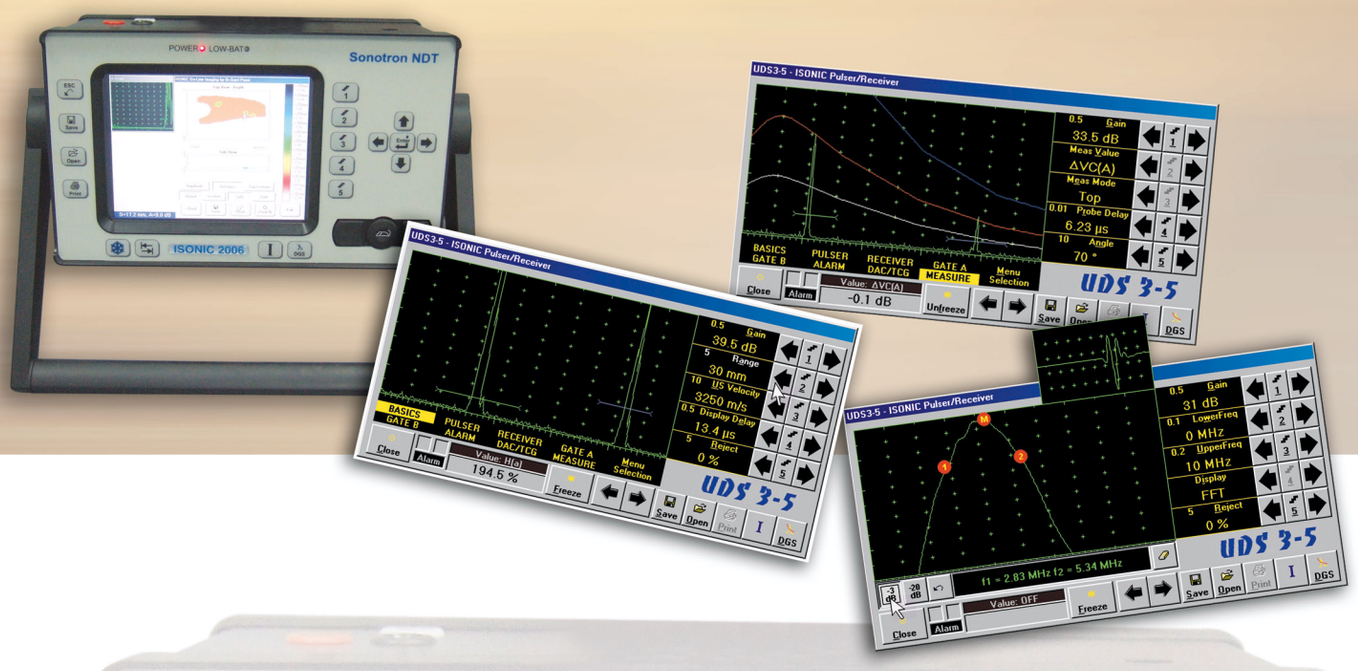
Calibration and Setting-Up of the Ultrasonic Time of Flight Diffraction (TOFD) Technique for the Detection, Location and Sizing of Flaws. – British Standard BS 7706:1993

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

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

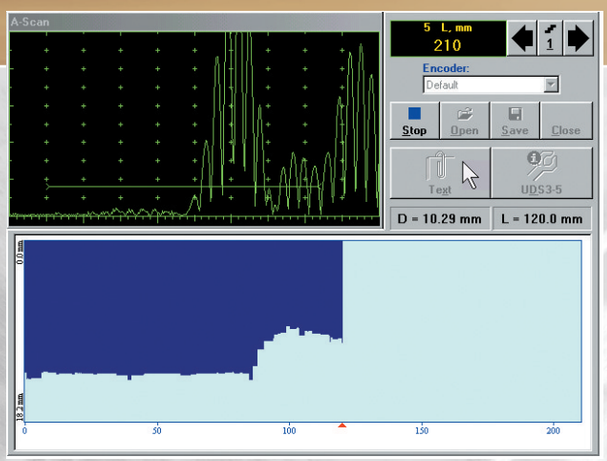
Manufacture and Testing of Pressure Vessels. Non-Destructive Testing of Welded Joints. Minimum Requirement for Non-Destructive Testing Methods – Appendix 1 to AD-Merkblatt HP5/3 (Germany).– Edition July 1989



ISONIC 2006 uniquely combines functionality and mobility of high performance portable digital ultrasonic flaw detector with recording, imaging, and data processing capabilities of smart computerized inspection system

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

- 640X480 pixels A-Scan display with physical dimensions 130 x 92 mm (5.12” x 3.62”) of working area is largest one for the plurality of portable ultrasonic flaw detectors
- Combined adjustable spike wave / square wave pulser equipped with variety of probe impedance matching coils provides optimal 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 of square wave initial pulse is improperly long thanks to probe damage prevention circuit automatically limiting energy transmitted to probe's crystal
- 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 keing 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 library for standard probes is unlimitedly expandable
- Thanks to extended dynamic range signals significantly exceeding A-Scan height (up to 199.9%) may be evaluated without drop of instrument 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 the technical data page



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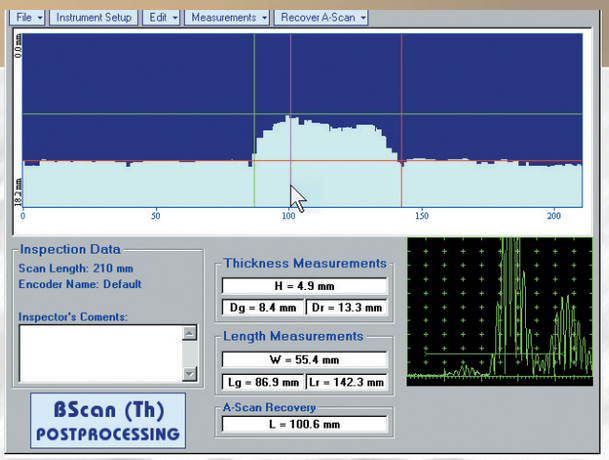


Off-Line

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) modes 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
  - Reconstruction of thickness profile image for various Gain and/or Gate setings
  - Automatic conversion of thickness profile B-Scan data into MS Excel® thickness spreadsheet meeting requirements of various *Risk Based Inspection and Maintenance* (RBIM) procedures

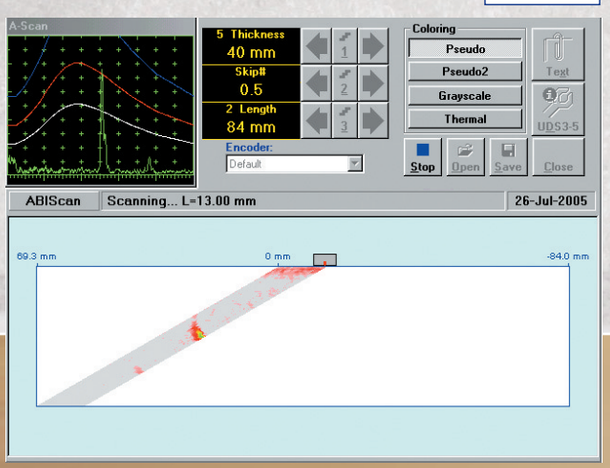
Typical Application: Corrosion detection and characterization

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) modes 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 analysis
  - Reconstruction of B-Scan defects images for various Gain and/or Reject settings
  - DAC / DGS B-Scan normalization

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

On-Line



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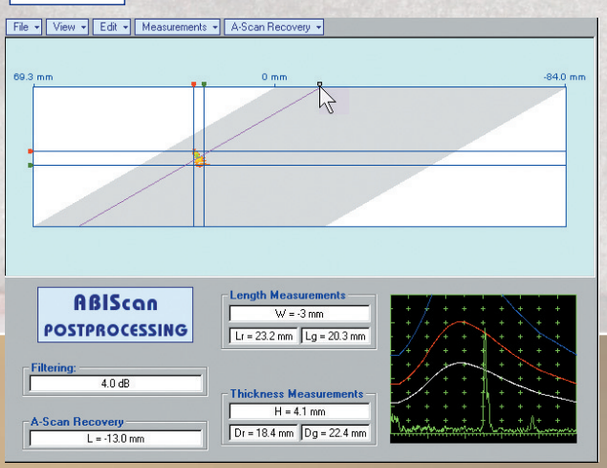

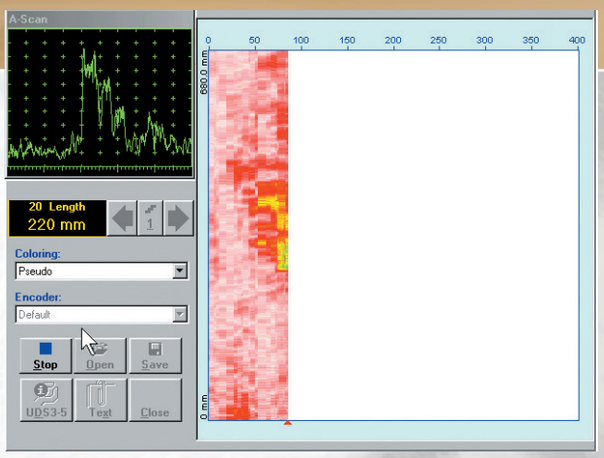

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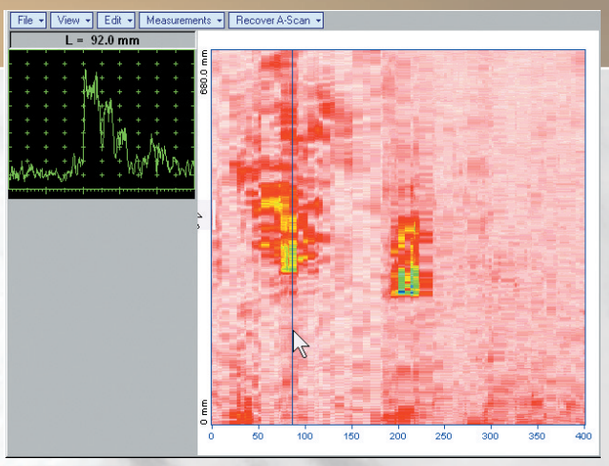


Off-Line

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

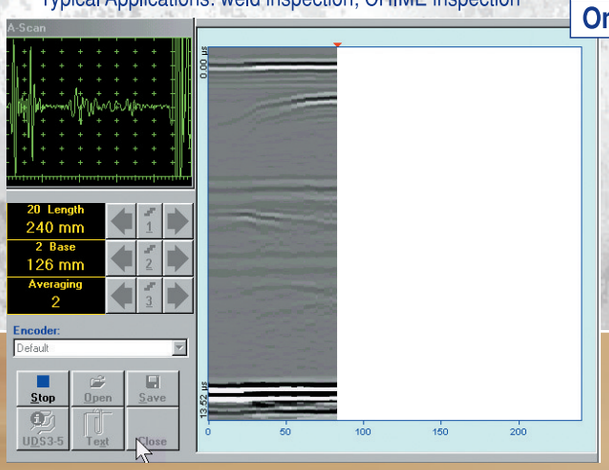
- Both time-based (real t) and true-to-location (built-in incremental encoder interface) modes of data recording are supported
- Complete sequence of A-Scans is recorded along with CB-Scan defects images
- Off-line evaluation of CB-Scan record is featured with:
  - Sizing of defects at any location along stored image – coordinates and projection dimesions
  - 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 and mechanics free airborne ultrasound encoder) modes 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 analysis 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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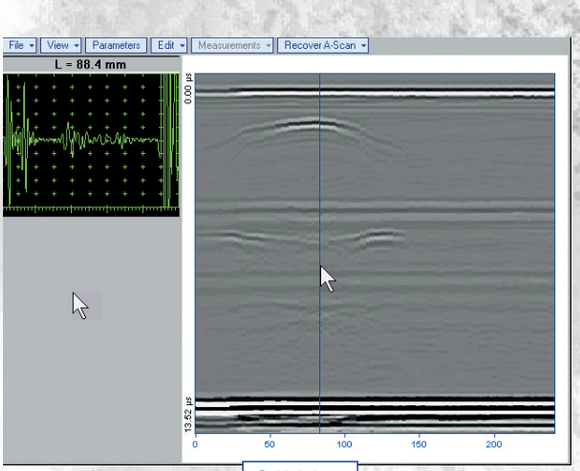

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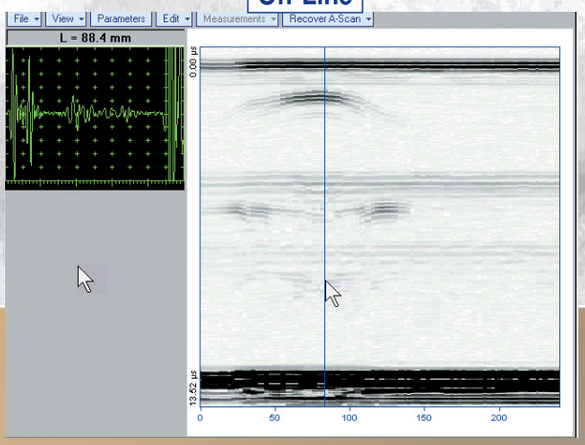
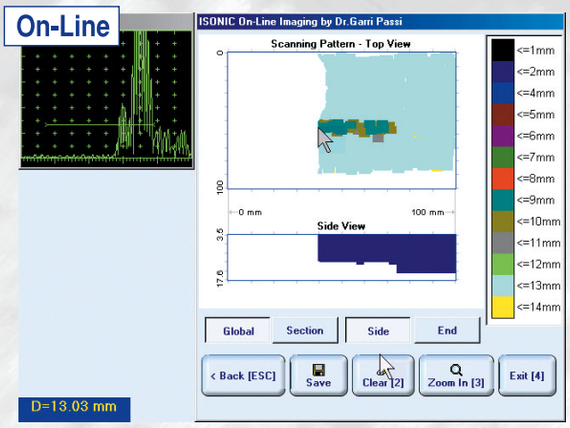


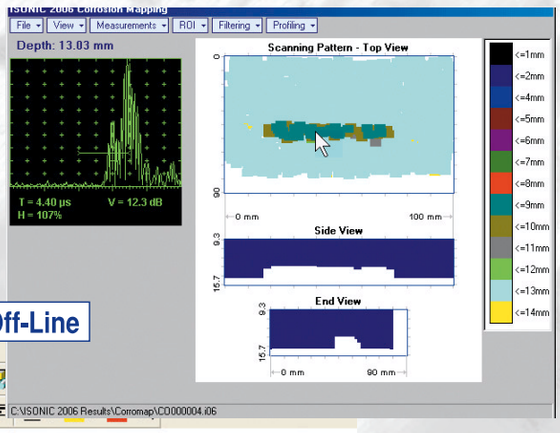
Corrosion (thickness) mapping is performed through continuous capturing of wall thickness readings during XY scanning:

- True-to-location data recording is provided through mechanics free airborne ultrasound determining of probe location on planar and curved surfaces
- Complete sequence of A-Scans is recorded along with real time back wall surface rendering
- Off-line evaluation of captured XY wall thickness and A-Scan distribution data is featured with
  - Sizing of thickness damages at any location of scanned surface: remaining thickness, thickness loss, XY dimensions, and area of damage
  - Play-back and evaluation of A-Scans obtained during scanning
  - Back wall surface profile reconstruction for various Gain and/or Gate settings
  - Statistical analysis of XY wall thickness distribution data and its automatic conversion into MS Excel" spreadsheet meeting requirements of various *Risk Based Inspection and Maintenance* (RBIM) procedures

Typical Application: Corrosion detection and characterization

On-Line





Off-Line

Microsoft Excel - Book1

File Edit View Insert Format Tools Data Window Help

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2												
3		0	2	4	6	8	10	12	14	16	18	20
4	0	##	14.8	14.8	14.8	14.8	14.8	14.8	14.91	14.91	15.14	15.14
5	2	##	14.8	14.8	14.8	14.8	14.8	14.74	14.74	14.74	14.8	14.8
6	4	##	14.8	14.8	14.8	14.8	14.8	14.74	14.74	14.74	14.74	14.74
7	6	##										74
8	8	##										74
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13	18	14.8										74
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31	54	14.74	14.74	14.74	14.74	14.69	14.69	14.69	14.69	13.31	13.31	13.31
32	56	14.74	14.74	14.74	14.74	14.74	14.74	14.74	14.74	14.74	14.74	14.74
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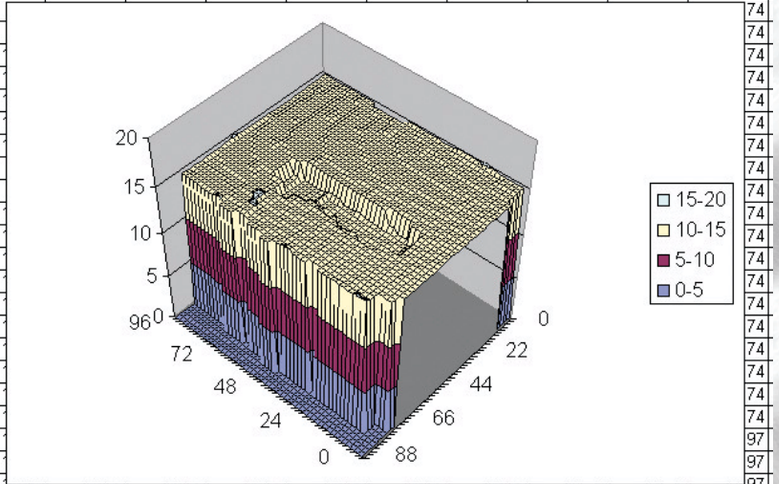
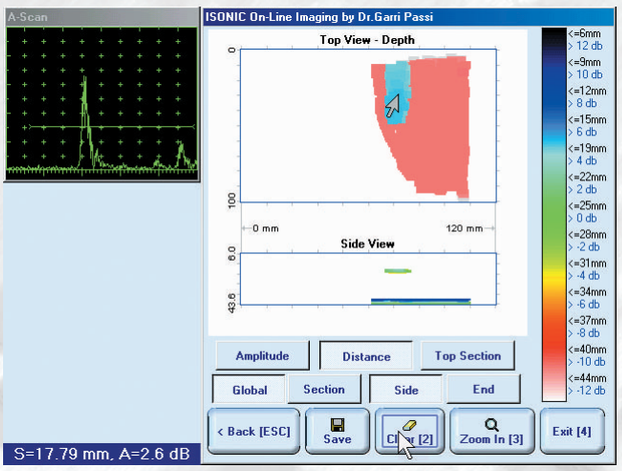


Depth Spreadsheet

Ready

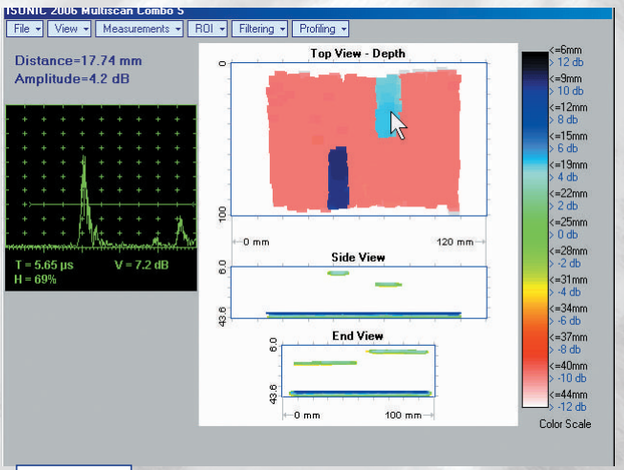
On-Line



Straight beam inspection with 3D data presentation (B-, C-, and D-Scan) is performed through continuous measuring and recording of echo amplitudes and reflectors coordinates during XY scanning:

- True-to-location data recording is provided through mechanics free airborne ultrasound determining of probe location on planar and curved surfaces
- Complete sequence of A-Scans is recorded along with real time B-, C-, and D-Scan imaging
- Off-line evaluation of captured B-, C-, and D-Scan images and A-Scan distribution data is featured with
  - Sizing of defects at any location of scanned volume: coordinates, XY projection dimensions, and area
  - Play-back and evaluation of A-Scans obtained during scanning; echo-dynamic pattern analysis
  - B-, C-, and D-Scan image reconstruction for various Gain and/or Gate and/or Reject settings
  - Slicing of C-Scan and D-Scan images
  - Statistical analysis of B-, C-, and D-Scan image and its automatic conversion into MS Excel" spreadsheet meeting requirements of various *Risk Based Inspection and Maintenance* (RBIM) procedures

Typical Applications: Flaw detection and imaging in metals, composites, plastics, and the like; corrosion detection and characterization



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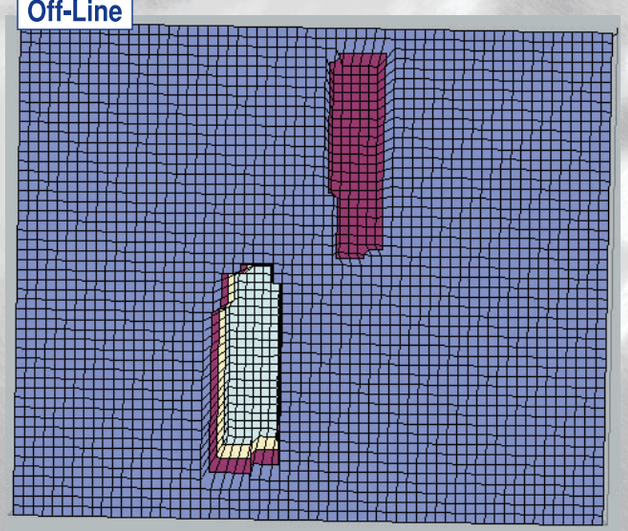
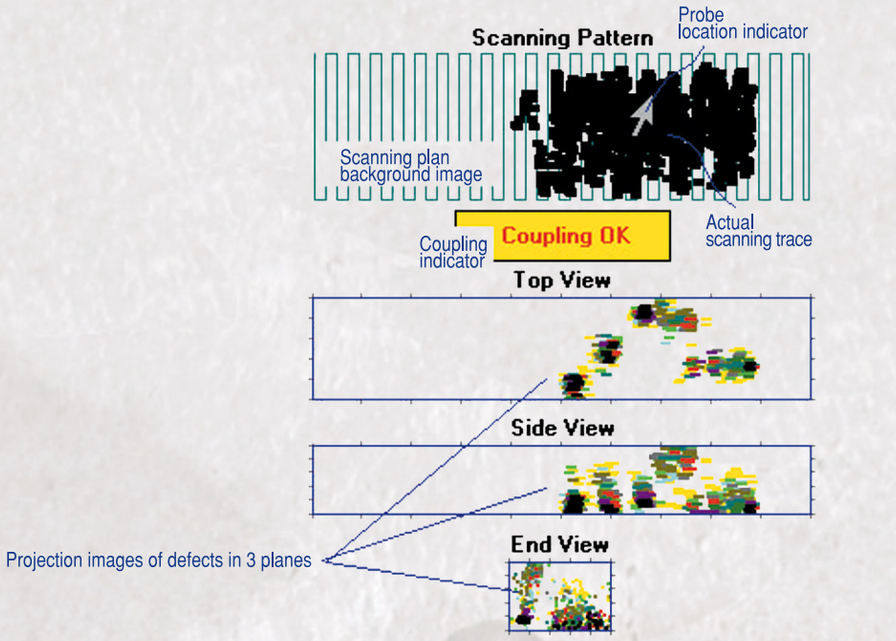
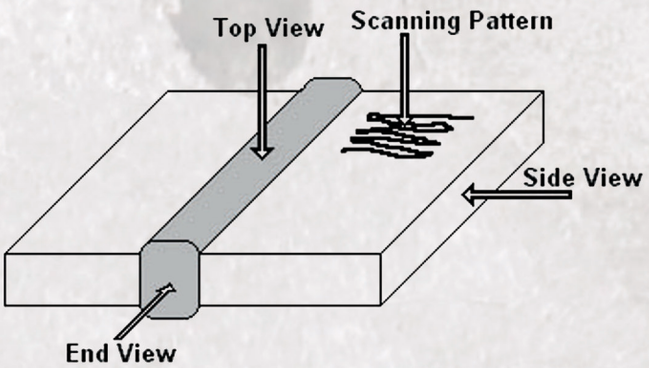


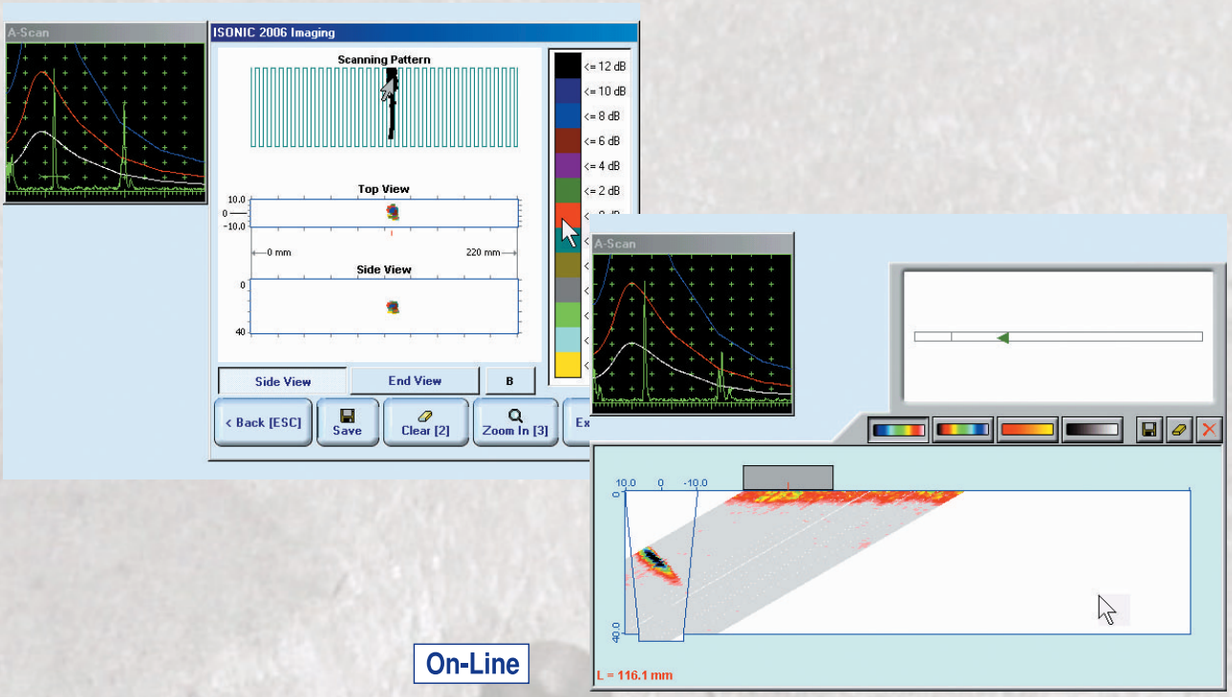




Angle beam inspection with 3D data presentation (P-, D-, and B-Scan) is performed through continuous measuring and recording of echo amplitudes, reflectors coordinates, and probe swiveling angle during XY scanning:

- True-to-location data recording is provided through mechanics free airborne ultrasound determining of probe location and swiveling angle on planar and curved surfaces
- Complete sequence of A-Scans is recorded along with real time P-, D-, and B-Scan imaging
- Off-line evaluation of captured P-, D-, and B-Scan images and A-Scan distribution data is featured with:
  - Sizing of defects at any location of scanned volume: coordinates, XY projection dimensions, and area
  - Play-back and evaluation of A-Scans obtained during scanning; echo-dynamic pattern analysis
  - P-, D-, and B-Scan image reconstruction for various Gain and/or Reject settings
  - Slicing of P-Scan and D-Scan images

Typical Application: Weld and base metal angle beam inspection



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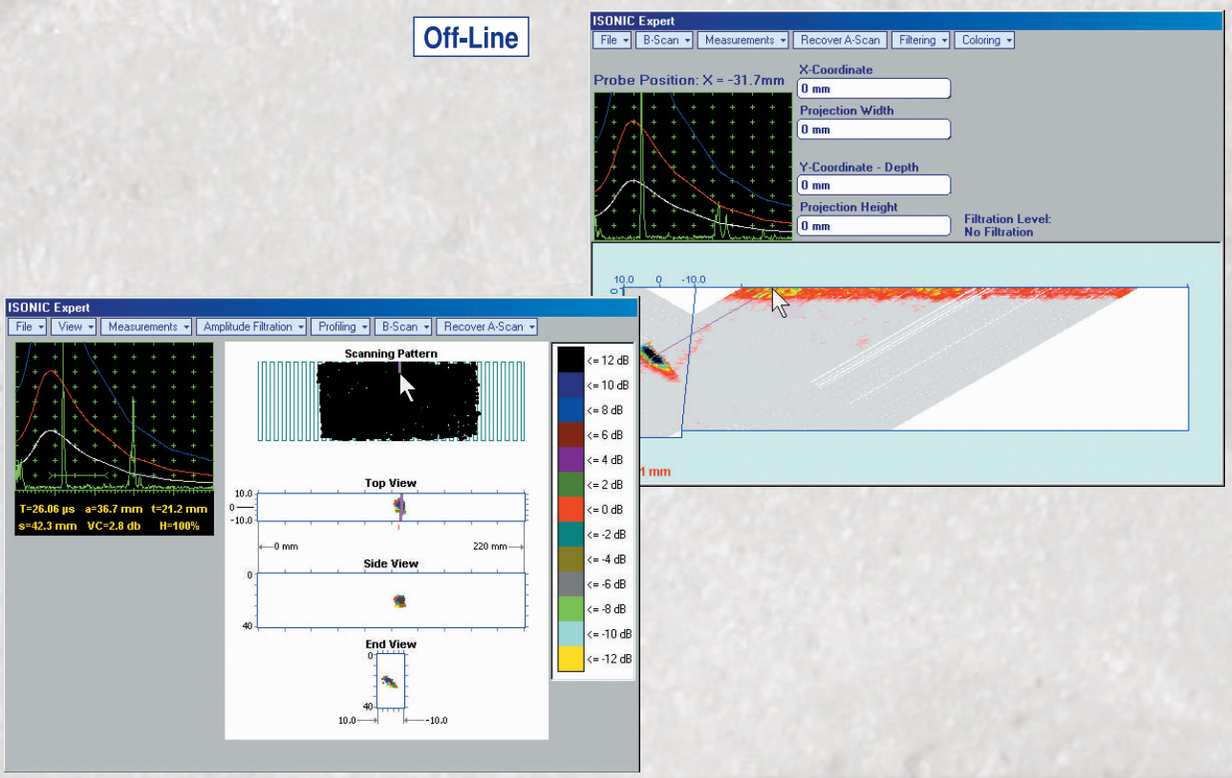
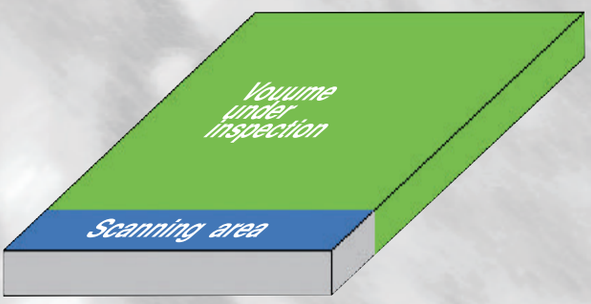


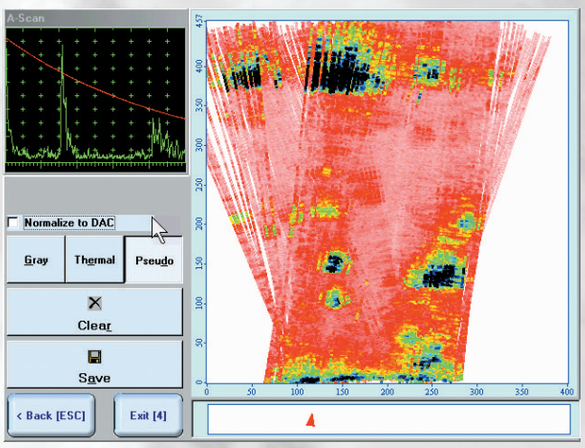


CB-Scan imaging of volume under test aside of narrow scanning area is performed through continuous measuring and recording of echo amplitudes, reflectors coordinates, and probe swiveling angle during XY probe manipulating:

- True-to-location data recording is provided through mechanics free airborne ultrasound determining of probe location and swiveling angle
- Complete sequence of A-Scans is recorded along with real time CB-Scan imaging
- Off-line evaluation of captured CB-Scan images and A-Scan distribution data is featured with
  - Sizing of defects at any location of scanned volume: coordinates, XY projection dimensions, and area
  - Play-back and evaluation of A-Scans obtained during scanning; echo-dynamic pattern analysis
  - CB-Scan image reconstruction for various Gain and /or Reject settings

Typical Application: Flaw detection and corrosion screening using guided and surface waves; defect outlining using angle beam probes

On-Line



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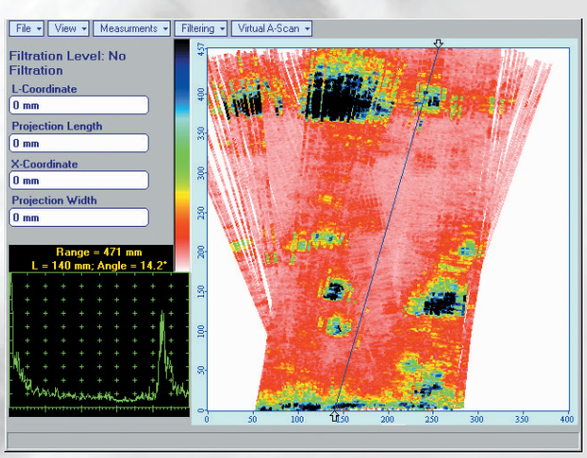

ISONIC 2006 – Technical Data

Pulse Type:	**Positive Spike Pulse / Positive Square Wave Pulse**
Initial Transition:	**≤5 ns (10-90%)**
Pulse Amplitude:	**Spike pulse - smoothly tunable (18 levels) 50…400 V into 50 Ω at 4 levels of Excitation Energy** **Square wave pulse - smoothly tunable (18 levels) 50…400 V into 50 Ω**
Pulse Duration:	**Spike pulse - 10...70 ns for 50 Ω load depending on Energy and Damping setup** **Square wave pulse - 65...600 ns controllable in 5 ns step with driving of both leading edge and trailing edge of the pulse**
Energy (Spike Pulse):	**4 discrete energy values / 40 μJ (min) to 250 μJ (max)**
Modes:	**Single / Dual**
Damping:	**17 discrete resistances values / 25 Ω min to 1000 Ω max**
Internal Matching Coil – Probe Impedance Matching:	**16 discrete inductivity values / 2 μH min to 78 μH max**
PRF:	**0 Hz - optionally; 0...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...120 dB controllable in 0.5 dB resolution**
Advanced Low Noise Design:	**93 μV peak to peak input referred to 80 dB gain / 35 MHz bandwidth**
Frequency Band:	**0.35…35 MHz Wide Band / 34 Sub Bands**
Ultrasound Velocity:	**300...20000 m/s (11.81...787.4 "/ms) controllable in 1 m/s (0.1 "/ms) resolution**
Range:	**0.5...3000 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...70 μs controllable in 0.01μs resolution - expandable**
Display Modes:	**RF, Rectified (Full Wave / Negative or Positive Half Wave), Signal's Spectrum (FFT)**
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 located 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:	**2 Independent Gates / unlimitedly expandable**
Gate Start and Width:	**Controllable over whole variety of A-Scan Display Delay and A-Scan Range settings in 0.1 mm /// 0.001" resolution**
Gate Threshold:	**5...95% of the 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 Mode (A-Scans and Spectrum Graphs):	**Freeze All** **Freeze Peak** **All signal and spectrum evaluation functions, managing Gates and Gain settings are allowed for frozen signals**
Encoding:	**Straight Line Scanning:** **Time-based (built-in real time clock – 0.02 sec resolution)** **True-to-location (incremental encoder – 0.5 mm resolution)** **XY Scanning: Airborne Ultrasound (see below)**

Airborne Ultrasound Encoding Characteristics:

Area of probe manipulation:	**≤2000×3000 mm / ≤80×120 "**	**≤500×500 mm / ≤20×20 "**	**≤200×200 mm / ≤8×8 "**
Curvature radius of scanning surface:	**≥2000 mm / ≥40 "**	**≥200 mm / ≥8 "**	**≥37 mm / ≥1.5 "**
Scanning Speed:	**≤150 mm/s / ≤6 "/s**	**≤150 mm/s / ≤6 "/s**	**≤150 mm/s / ≤6 "/s**
Scan Index:	**1 to 20 mm controllable in 1 mm step**	**1 to 20 mm controllable in 1 mm step**	**0.25 mm; 0.5 mm or 1 to 20 mm controllable in 1 mm step**
Resolution for determining of probe coordinates:	**≥1 mm / ≥0.04 "**	**≥1 mm / ≥0.04 "**	**≥0.25 mm / ≥0.01 "**
Resolution for determining of probe swiveling angle:	**-**	**1°**	**0.5°**
Range of probe swiveling:	**-**	**±90°**	**±90°**
Immunity to ambient noise:	**≤60 dB**	**≤60 dB**	**≤60 dB**

Coupling Monitor:	**Built-in controller and interface for Coupling Monitor suitable for any kind of ultrasonic probe at scanning speed up to 150 mm /sec (6 in /sec); resolution – 0.5 dB**

Testing Integrity Monitoring:	**Background imaging of Scanning Plan** **Recording and imaging of Actual Probe Trace** **Generating perceptible marks corresponding to coupling degree, probe position, and swiveling angle during scanning** **Interrupting of recording and imaging on missing coupling and/or probe position and/or swiveling angle**
Imaging Modes:	**Thickness Profile B-Scan, Cross-sectional B-Scan, Plane View CB-Scan, C-Scan, D-Scan, P-Scan, TOFD – depending on mode of operation selected accompanied with corresponding instrument settings**

Imaging Characteristics:

Inspection:	Angle Beam	Straight Beam
Width of Volume under test:	5 to 300 mm controllable in 1 mm resolution – expandable // 0.2 to 12 " controllable in 0.01 " resolution - expandable	50 to 2000 mm controllable in 1 mm resolution – expandable /// 0.2 to 80 " controllable in 0.01 " resolution – expandable
Thickness of Volume under test:	5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 " controllable in 0.01 " resolution - expandable	0.5 to 300 mm controllable in 0.1 mm resolution – expandable /// 0.02 to 12 " controllable in 0.01 " resolution - expandable
Image Resolution:	0.5 mm × 0.5 mm × 0.5•ScanIndex 0.02 " × 0.02 " × 0.5•ScanIndex	0.2 mm × 0.5 mm × 0.5•ScanIndex 0.01 " × 0.02 " × 0.5•ScanIndex
Standard Color Scale (Palette):	Pseudo Color Gray Thermal	Pseudo Color Gray Thermal
User Defined Color Scales (Palettes):	$\leq 2^{32}$ colors	$\leq 2^{32}$ colors
Signal Amplitude Coloring Protocol:	Linear TCG Normalizing DAC Normalizing DGS Normalizing Customized	Linear TCG Normalizing DAC Normalizing Customized

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, US Velocity and other appropriate instrument settings**
Off-Line Analysis:	**Recovery and play back of A-Scans captured during scanning** **Echo-dynamic pattern analysis** **Defects sizing and outlining** **Statistical analysis of Thickness / Amplitude data** **Converting record into ASCII / MS Excel® / 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, C-Scans, D-Scans, P-Scans, TOFD maps**
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, C-Scans, D-Scans, P-Scans, TOFD maps and complete sequence of A-Scans captured during scanning**
Data Logger:	**Optional - creates and manages data base files capable to store up to 254745 records each and organized as 2D matrix; in database every record includes thickness reading accompanied with corresponding raw data A-Scan and instrument setup**
On-Board Computer:	**AMD LX 800 - 500MHz**
RAM:	**512 Megabytes**
Flash Memory - Quasi HDD:	**4 Gigabytes**
Outputs:	**LAN, USB X 2, PS 2, SVGA**
Screen:	**6.5" High Color Resolution (32 bit) SVGA 640x480 pixels 133x98 mm (5.24" x 3.86") Sun-readable LCD; Maximal A-Scan Size (working area) - 130x92 mm (5.12" x 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 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:	**265×156×121 mm (10.43"×6.14"×4.76") - without battery** **265×156×159 mm (10.43"×6.14"×6.26") - with battery**
Weight:	**3.150 kg (6.93 lbs) - without battery** **4.280 kg (9.42 lbs) - with battery**