



ISONIC 2006

Portable Digital Ultrasonic Flaw Detector and Recorder with
B-Scan, C-Scan, D-Scan, P-Scan, and TOFD Inspection and Imaging Capabilities

Operating Manual

Revision 1.21



Sonotron NDT

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Sonotron NDT, 4, Pekeris st., Rabin Science Park, Rehovot, Israel, 76702

Covered by the United States patents **5524627**, **5952577**, **6545681**; other US & foreign patents pending



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EC Declaration of Conformity

Council Directive 89/336/EEC on Electromagnetic Compatibility, as amended by Council Directive 92/31/EEC & Council Directive 93/68/EEC Council Directive 73/23/EEC (Low Voltage Directive), as amended by Council Directive 93/68/EEC

We, **Sonotron NDT Ltd.**, 4 Pekeris Street, Rehovot, 76702 Israel, certify that the product described is in conformity with the Directives 73/23/EEC and 89/336/EEC as amended

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Portable Digital Ultrasonic Flaw Detector and Recorder with B-Scan, C-Scan, D-Scan, P-Scan, and TOFD Inspection and Imaging Capabilities

The product identified above complies with the requirements of above EU directives by meeting the following standards:

Safety

EN 61010-1:1993

EMC

EN 61326:1997

EN 61000-3-2:1995 /A1:1998 /A2:1998 /A14:2000

EN 61000-3-3:1995





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Declaration of Compliance

We, **Sonotron NDT Ltd.**, 4 Pekeris Street, Rehovot, 76702 Israel certify that the product described is in conformity with National and International Codes as amended

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The product identified above complies with the requirements of following 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



FCC Rules

This **ISONIC 2006** ultrasonic flaw detector and data recorder (hereinafter called **ISONIC 2006**) has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Safety Regulations



Please read this section carefully and observe the regulations in order to ensure your safety and operate the system as intended

Please observe the warnings and notes printed in this manual and on the unit

The **ISONIC 2006** has been built and tested according to the regulations specified in EN60950/VDE0805. It was in perfect working condition on leaving the manufacturer's premises

In order to retain this standard and to avoid any risk in operating the equipment, the user must make sure to comply with any hints and warnings included in this manual

Depending on the power supply the **ISONIC 2006** complies with protection class I /protective grounding/, protection class II, or protection class III

Exemption from statutory liability for accidents

The manufacturer shall be exempt from statutory liability for accidents in the case of non-observance of the safety regulations by any operating person

Limitation of Liability

The manufacturer shall assume no warranty during the warranty period if the equipment is operated without observing the safety regulations. In any such case, manufacturer shall be exempt from statutory liability for accidents resulting from any operation

Exemption from warranty

The manufacturer shall be exempt from any warranty obligations in case of the non-observance of the safety regulations
The manufacturer will only warrant safety, reliability, and performance of the **ISONIC 2006** if the following safety regulations are closely observed:

- Setting up, expansions, re-adjustments, alterations, and repairs must only be carried out by persons who have been authorized by manufacturer
- The electric installations of the room where the equipment is to be set up must be in accordance with IEC requirements
- The equipment must be operated in accordance with the instructions
- Any expansions to the equipment must comply with the legal requirements, as well as with the specifications for the unit concerned
- Confirm the rated voltage of your **ISONIC 2006** matches the voltage of your power outlet
- The mains socket must be located close to the system and must be easily accessible
- Use only the power cord furnished with your **ISONIC 2006** and a properly grounded outlet /only protection class I/
- Do not connect the **ISONIC 2006** to power bar supplying already other devices. Do not use an extension power cord
- Any interruption to the PE conductor, either internally or externally, or removing the earthed conductor will make the system unsafe to use /only protection class I/
- Any required cable connectors must be screwed to or hooked into the casing
- The equipment must be disconnected from mains before opening
- To interrupt power supply, simply disconnect from the mains
- Any balancing, maintenance, or repair may only be carried out by manufacturer authorized specialists who are familiar with the inherent dangers
- Both the version and the rated current of any replacement fuse must comply with specifications laid down
- Using any repaired fuses, or short-circuiting the safety holder is illegal
- If the equipment has suffered visible damage or if it has stopped working, it must be assumed that it can no longer be operated without any danger. In these cases, the system must be switched off and be safeguarded against accidental use
- Only use the cables supplied by manufacturer or shielded data cable with shielded connectors at either end
- Do not drop small objects, such as paper clips, into the **ISONIC 2006**
- Do not put the **ISONIC 2006** in direct sunlight, near a heater, or near water. Leave space around the **ISONIC 2006**
- Disconnect the power cord whenever a thunderstorm is nearby. Leaving the power cord connected may damage the **ISONIC 2006** or your property
- When positioning the equipment, external monitor, external keyboard, and external mouse take into account any local or national regulations relating to ergonomic requirements. For example, you should ensure that little or no ambient light is reflected off the external monitor screen as glare, and that the external keyboard is placed in a comfortable position for typing

- Do not allow any cables, particularly power cords, to trail across the floor, where they can be snagged by people walking past
- The voltage of the External DC Power Supply below 11 V is not allowed for the **ISONIC 2006** unit
- The voltage of the External DC Power Supply above 16 V is not allowed for the **ISONIC 2006** unit
- Charge of the battery for the **ISONIC 2006** unit is allowed only with use of the AC/DC converters / chargers supplied along with it or authorized by Sonotron NDT

Remember this before:

- balancing
- carrying out maintenance work
- repairing
- exchanging any parts

Please make sure batteries, rechargeable batteries, or a power supply with SELV output supplies power

Software

ISONIC 2006 is a software controlled inspection device. Based on present state of the art, software can never be completely free of faults. **ISONIC 2006** should therefore be checked before and after use in order to ensure that the necessary functions operate perfectly in the envisaged combination. If you have any questions about solving problems related to use the **ISONIC 2006**, please contact your local Sonotron NDT representative

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1. Introduction

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

ISONIC 2006 resolves a *variability of ultrasonic inspection tasks*:

- **A-Scan-based inspection** using conventional pulse echo, back echo attenuation, and through transmission techniques
- **Straight Line Scanning Record - based inspection:**
 - **Thickness Profile B-Scan** imaging and recording, which is performed through continuous measuring of thickness value along straight line type probe trace
 - **B-Scan** cross-sectional imaging and recording of defects for longitudinal and shear wave inspection, which is performed through continuous measuring of echo amplitudes and reflectors coordinates along straight line type probe trace
 - **CB-Scan** horizontal plane-view imaging and recording of defects for shear, surface, and guided wave inspection, which is performed through continuous measuring of echo amplitudes and reflectors coordinates along straight line type probe trace
 - **TOFD Inspection – RF B-Scan and D-Scan** Imaging along straight line type probe trace

For *Straight Line Scanning* records it may be used:

- *Time-based* mode – **ISONIC 2006** is equipped with built-in real time clock
- *True-to-location* mode – **ISONIC 2006** is equipped with built-in incremental encoder interface

- **XY-Scanning Record - based inspection:**
 - **Thickness Map** imaging and recording, which is performed through continuous measuring of thickness value along probe trace
 - **Flaw Detection – Pulse Echo** 3D imaging (C-Scan, B-Scan, D-Scan, P-Scan) and recording of defects for longitudinal and shear wave inspection, which is performed through continuous measuring of echo amplitudes and reflectors coordinates along probe trace with probe swiveling angle dependency where applicable
 - **Flaw Detection – Through Transmission / Back Echo Attenuation** 2D imaging and recording (C-Scan) which is performed through continuous measuring of signal amplitudes along probe trace
 - **CB-Scan** horizontal plane-view imaging and recording of defects for shear, surface, and guided wave inspection, which is performed through continuous measuring of echo amplitudes and reflectors coordinates along probe trace with probe swiveling angle dependency where applicable
 - **TOFD Inspection – RF B-Scan and D-Scan** Imaging along probe trace

For *XY-Scanning* records **ISONIC 2006** is equipped with built-in airborne ultrasound encoder controller and appropriate interface

For all types of *Straight Line Scanning* and *XY-Scanning* records A-Scans are captured for each probe position along probe trace and may be played back and evaluated off-line at postprocessing stage. This unique feature makes it possible **off-line defect characterization through echo-dynamic pattern analysis**

Thickness Profile B-Scan Data recorded during *Straight Line Scanning* and **Thickness Map** data recorded during *XY-Scanning* is presented in the format compatible with various *Risk Based Inspection and Maintenance* procedures. Off-line measurements and statistical analysis functions also meet the requirements of said procedures

ISONIC 2006 is a new generation successor of very well known **ISONIC 2001** model, which became a leader in competition between multitask portable ultrasonic testing and imaging devices during recent years (2000 through 2006) and received Frost & Sullivan Award for Product Differentiation Innovation in 2004. Comparing to its predecessor **ISONIC 2006** has *significantly improved portability and weight, battery life, ultrasonic performance, data processing speed, and human interface*

ISONIC 2006 has practically unlimited capacity for storing of

- Single **A-Scans** accompanied with corresponding instrument settings
- Ultrasonic signal **spectrum graphs (FFT)** accompanied with corresponding **RF A-Scans** and instrument settings
- Various **A-Scans** sequence records along with corresponding **Thickness Profiles, B-Scans, CB-Scans, C-Scans, D-Scans, P-Scans, or TOFD Maps** depending on mode of operation selected; each record is accompanied with corresponding instrument settings

ISONIC 2006 complies with the 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 6 – 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

2. Technical Data

2.1. Instruments manufactured on or before Dec 1, 2007

Pulse Type:	Positive Spike Pulse / Positive Square Wave Pulse																																		
Initial Transition:	≤5 ns (10-90%)																																		
Pulse Amplitude:	Spike pulse - smoothly tunable (18 levels) 50 V ... 400 V into 50 Ω at 4 levels of excitation Energy Square wave pulse - smoothly tunable (18 levels) 50V ... 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 independently controllable in 5 ns step 4 discrete energy values / 40 μJ (min) to 250 μJ (max) – at 400V amplitude Single / Dual																																		
Energy (Spike Pulse):	17 discrete resistances values / 25 Ω min to 1000 Ω max																																		
Modes:	16 discrete inductivity values / 2 μH min to 78 μH max																																		
Damping:	0 – optionally; 15...5000 Hz controllable in 1 Hz resolution																																		
Internal Matching Coil – Probe Impedance Matching:	Max +5V, τ ≤ 5 ns, t ≥ 100 ns, Load Impedance ≥ 50 Ω																																		
PRF:	0...120 dB controllable in 0.5 dB resolution																																		
Optional Sync Output / Input:	93 μV peak to peak input referred to 80 dB gain / 35 MHz bandwidth																																		
Gain:	0.35 ... 35 MHz Wide Band / 34 Sub Bands																																		
Advanced Low Noise Design:	300...20000 m/s (11.81...787.4 "/ms) controllable in 1 m/s (0.1 "/ms) resolution																																		
Frequency Band:	0.5...7000 μs controllable in 0.01 μs resolution																																		
Ultrasound Velocity:	0...3200 μs controllable in 0.01 μs resolution																																		
Range:	0...90° controllable in 1° resolution																																		
Display Delay:	0 to 70 μs controllable in 0.01 μs resolution - expandable																																		
Probe Angle:	RF, Rectified (Full Wave / Negative or Positive Half Wave), Signal's Spectrum (FFT Graph)																																		
Probe Delay:	0...99 % of screen height controllable in 1% resolution																																		
Display Modes:	Theoretical – through keying in dB/mm (dB/") factor																																		
Reject:	Experimental – through sequential recording echo amplitudes from variously distanced equal reflectors																																		
DAC / TCG:	46 dB Dynamic Range, Slope ≤ 20 dB/μs, Capacity ≤ 40 points Available for Rectified and RF Display Standard Library for 18 probes / unlimitedly expandable																																		
DGS:	2 Independent Gates / unlimitedly expandable																																		
Gates:	Controllable over whole variety of A-Scan Display Delay and A-Scan Range in 0.1 mm /// 0.001" resolution																																		
Gate Start and Width:	5...95 % of A-Scan height controllable in 1 % resolution																																		
Gate Threshold:	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																																		
Measuring Functions – Digital Display Readout:	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																																		
Freeze (A-Scans and Spectrum Graphs)	<ul style="list-style-type: none"> • Built-in controller and interface for incremental mechanical encoder • Built-in controller and interface for non-mechanical airborne ultrasound-based encoder 																																		
Encoder Interface:	Straight Line Scanning: <ul style="list-style-type: none"> ○ Time-based (built-in real time clock – 0.02 sec resolution) ○ True-to-location (incremental encoder – 0.5 mm resolution) XY Scanning: <ul style="list-style-type: none"> ○ Airborne Ultrasound (see below) 																																		
Encoding:																																			
Airborne Ultrasound Based Encoding Characteristics:	<table border="1"> <thead> <tr> <th>Area of probe manipulation:</th> <th>≤2000×3000 mm / ≤80×120 in</th> <th>≤500×500 mm / ≤20×20 in</th> <th>≤200×200 mm / ≤8×8 in</th> </tr> </thead> <tbody> <tr> <td>Curvature radius of scanning surface:</td> <td>≥2000 mm / ≥40 in</td> <td>≥200 mm / ≥8 in</td> <td>≥37 mm / ≥1.5 in</td> </tr> <tr> <td>Scanning Speed:</td> <td>≤150 mm/s / ≤6 in/s</td> <td>≤150 mm/s / ≤6 in/s</td> <td>≤150 mm/s / ≤6 in/s</td> </tr> <tr> <td>Scan Index:</td> <td>1 to 20 mm controllable in 1 mm step</td> <td>1 to 20 mm controllable in 1 mm step</td> <td>0.25 mm; 0.5 mm or 1 to 20 mm controllable in 1 mm step</td> </tr> <tr> <td>Resolution for determining of probe coordinates:</td> <td>≥1 mm / ≥0.04 in</td> <td>≥1 mm / ≥0.04 in</td> <td>≥0.25 mm / ≥0.01 in</td> </tr> <tr> <td>Resolution for determining of probe swiveling angle:</td> <td>-</td> <td>1°</td> <td>0.5°</td> </tr> <tr> <td>Range of probe swiveling:</td> <td>-</td> <td>±90°</td> <td>±90°</td> </tr> <tr> <td>Immunity to ambient noise:</td> <td>≤60 dB</td> <td>≤60 dB</td> <td>≤60 dB</td> </tr> </tbody> </table>	Area of probe manipulation:	≤2000×3000 mm / ≤80×120 in	≤500×500 mm / ≤20×20 in	≤200×200 mm / ≤8×8 in	Curvature radius of scanning surface:	≥2000 mm / ≥40 in	≥200 mm / ≥8 in	≥37 mm / ≥1.5 in	Scanning Speed:	≤150 mm/s / ≤6 in/s	≤150 mm/s / ≤6 in/s	≤150 mm/s / ≤6 in/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 in	≥1 mm / ≥0.04 in	≥0.25 mm / ≥0.01 in	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		
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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:	<ul style="list-style-type: none"> • Background imaging of Scanning Plan • Recording and imaging of Actual Probe Trace • Generating perceptible marks corresponding to current coupling degree, probe position, and swiveling angle whilst scanning • Interrupting recording and imaging of actual probe trace if 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:	<table border="1"> <thead> <tr> <th>Inspection:</th> <th>Angle Beam</th> <th>Straight Beam</th> </tr> </thead> <tbody> <tr> <td>Width of Volume under test:</td> <td>5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 in controllable in 0.01 in resolution - expandable</td> <td>50 to 2000 mm controllable in 1 mm resolution – expandable /// 0.2 to 80 in controllable in 0.01 in resolution – expandable</td> </tr> <tr> <td>Thickness of Volume under test:</td> <td>5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 in controllable in 0.01 in resolution - expandable</td> <td>0.5 to 300 mm controllable in 0.1 mm resolution – expandable /// 0.02 to 12 in controllable in 0.01 in resolution - expandable</td> </tr> <tr> <td>Image Resolution:</td> <td>0.5 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB /// 0.02 in × 0.02 in × 0.5 • Scan Index × ≤2dB</td> <td>0.2 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB /// 0.01 in × 0.02 in × 0.5 • Scan Index × ≤2dB</td> </tr> <tr> <td>Standard Color Scale (Palette):</td> <td> <ul style="list-style-type: none"> • Pseudo Color • Gray • Thermal </td> <td> <ul style="list-style-type: none"> • Pseudo Color • Gray • Thermal </td> </tr> <tr> <td>User Defined Color Scales (Palettes):</td> <td>≤2³² colors</td> <td>≤2³² colors</td> </tr> <tr> <td>Signal Amplitude Coloring Protocol:</td> <td> <ul style="list-style-type: none"> • Linear • TCG Normalizing • DAC Normalizing • DGS Normalizing • Customized </td> <td> <ul style="list-style-type: none"> • Linear • TCG Normalizing • DAC Normalizing • Customized </td> </tr> </tbody> </table>	Inspection:	Angle Beam	Straight Beam	Width of Volume under test:	5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 in controllable in 0.01 in resolution - expandable	50 to 2000 mm controllable in 1 mm resolution – expandable /// 0.2 to 80 in controllable in 0.01 in resolution – expandable	Thickness of Volume under test:	5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 in controllable in 0.01 in resolution - expandable	0.5 to 300 mm controllable in 0.1 mm resolution – expandable /// 0.02 to 12 in controllable in 0.01 in resolution - expandable	Image Resolution:	0.5 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB /// 0.02 in × 0.02 in × 0.5 • Scan Index × ≤2dB	0.2 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB /// 0.01 in × 0.02 in × 0.5 • Scan Index × ≤2dB	Standard Color Scale (Palette):	<ul style="list-style-type: none"> • Pseudo Color • Gray • Thermal 	<ul style="list-style-type: none"> • Pseudo Color • Gray • Thermal 	User Defined Color Scales (Palettes):	≤2 ³² colors	≤2 ³² colors	Signal Amplitude Coloring Protocol:	<ul style="list-style-type: none"> • Linear • TCG Normalizing • DAC Normalizing • DGS Normalizing • Customized 	<ul style="list-style-type: none"> • Linear • TCG Normalizing • DAC Normalizing • Customized
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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 instrument settings																					
Off-Line Image Analysis:	<ul style="list-style-type: none"> • Recovery and play back of A-Scan sequence at various gain levels • Echo-dynamic pattern analysis • Defects sizing, outlining, pattern recognition • Statistical analysis of Thickness / Amplitude Map data • 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, CB-Scans, C-Scans, D-Scans, P-Scans, or TOFD Maps																					
Data Storage Capacity:	<ul style="list-style-type: none"> • 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, CB-Scans, C-Scans, D-Scans, P-Scans, or TOFD Maps and complete sequence of A-Scans captured during scanning 																					
On-Board Computer:	Pentium M 300MHz																					
RAM:	128 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™98SE – instrument operation Fully compatible for networking and / or USB connection and off-line data analysis and reporting in external PC running under Windows™98SE, Windows™2000, Windows™XP																					
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 (5.83 lbs) - without battery 4.280 kg (7.88 lbs) - with battery																					

2.2. Instruments manufactured after Dec 1, 2007

Pulse Type:	Positive Spike Pulse / Positive Square Wave Pulse																																		
Initial Transition:	≤5 ns (10-90%)																																		
Pulse Amplitude:	Spike pulse - smoothly tunable (18 levels) 50 V ... 400 V into 50 Ω at 4 levels of excitation Energy Square wave pulse - smoothly tunable (18 levels) 50V ... 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 independently controllable in 5 ns step 4 discrete energy values / 40 μJ (min) to 250 μJ (max) – at 400V amplitude Single / Dual																																		
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Damping:	0 – optionally; 15...5000 Hz controllable in 1 Hz resolution																																		
Internal Matching Coil – Probe Impedance Matching:	Max +5V, τ ≤ 5 ns, t ≥ 100 ns, Load Impedance ≥ 50 Ω																																		
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Reject:	Experimental – through sequential recording echo amplitudes from variously distanced equal reflectors																																		
DAC / TCG:	46 dB Dynamic Range, Slope ≤ 20 dB/μs, Capacity ≤ 40 points Available for Rectified and RF Display Standard Library for 18 probes / unlimitedly expandable																																		
DGS:	2 Independent Gates / unlimitedly expandable																																		
Gates:	Controllable over whole variety of A-Scan Display Delay and A-Scan Range in 0.1 mm /// 0.001" resolution																																		
Gate Start and Width:	5...95 % of A-Scan height controllable in 1 % resolution																																		
Gate Threshold:	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																																		
Measuring Functions – Digital Display Readout:	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																																		
Freeze (A-Scans and Spectrum Graphs)	<ul style="list-style-type: none"> • Built-in controller and interface for incremental mechanical encoder • Built-in controller and interface for non-mechanical airborne ultrasound-based encoder 																																		
Encoder Interface:	Straight Line Scanning: <ul style="list-style-type: none"> ○ Time-based (built-in real time clock – 0.02 sec resolution) ○ True-to-location (incremental encoder – 0.5 mm resolution) XY Scanning: <ul style="list-style-type: none"> ○ Airborne Ultrasound (see below) 																																		
Encoding:																																			
Airborne Ultrasound Based Encoding Characteristics:	<table border="1"> <thead> <tr> <th>Area of probe manipulation:</th> <th>≤2000x3000 mm / ≤80x120 in</th> <th>≤500x500 mm / ≤20x20 in</th> <th>≤200x200 mm / ≤8x8 in</th> </tr> </thead> <tbody> <tr> <td>Curvature radius of scanning surface:</td> <td>≥2000 mm / ≥40 in</td> <td>≥200 mm / ≥8 in</td> <td>≥37 mm / ≥1.5 in</td> </tr> <tr> <td>Scanning Speed:</td> <td>≤150 mm/s / ≤6 in/s</td> <td>≤150 mm/s / ≤6 in/s</td> <td>≤150 mm/s / ≤6 in/s</td> </tr> <tr> <td>Scan Index:</td> <td>1 to 20 mm controllable in 1 mm step</td> <td>1 to 20 mm controllable in 1 mm step</td> <td>0.25 mm; 0.5 mm or 1 to 20 mm controllable in 1 mm step</td> </tr> <tr> <td>Resolution for determining of probe coordinates:</td> <td>≥1 mm / ≥0.04 in</td> <td>≥1 mm / ≥0.04 in</td> <td>≥0.25 mm / ≥0.01 in</td> </tr> <tr> <td>Resolution for determining of probe swiveling angle:</td> <td>-</td> <td>1°</td> <td>0.5°</td> </tr> <tr> <td>Range of probe swiveling:</td> <td>-</td> <td>±90°</td> <td>±90°</td> </tr> <tr> <td>Immunity to ambient noise:</td> <td>≤60 dB</td> <td>≤60 dB</td> <td>≤60 dB</td> </tr> </tbody> </table>	Area of probe manipulation:	≤2000x3000 mm / ≤80x120 in	≤500x500 mm / ≤20x20 in	≤200x200 mm / ≤8x8 in	Curvature radius of scanning surface:	≥2000 mm / ≥40 in	≥200 mm / ≥8 in	≥37 mm / ≥1.5 in	Scanning Speed:	≤150 mm/s / ≤6 in/s	≤150 mm/s / ≤6 in/s	≤150 mm/s / ≤6 in/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 in	≥1 mm / ≥0.04 in	≥0.25 mm / ≥0.01 in	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		
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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:	<ul style="list-style-type: none"> • Background imaging of Scanning Plan • Recording and imaging of Actual Probe Trace • Generating perceptible marks corresponding to current coupling degree, probe position, and swiveling angle whilst scanning • Interrupting recording and imaging of actual probe trace if 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:	<table border="1"> <thead> <tr> <th>Inspection:</th> <th>Angle Beam</th> <th>Straight Beam</th> </tr> </thead> <tbody> <tr> <td>Width of Volume under test:</td> <td>5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 in controllable in 0.01 in resolution - expandable</td> <td>50 to 2000 mm controllable in 1 mm resolution – expandable /// 0.2 to 80 in controllable in 0.01 in resolution – expandable</td> </tr> <tr> <td>Thickness of Volume under test:</td> <td>5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 in controllable in 0.01 in resolution - expandable</td> <td>0.5 to 300 mm controllable in 0.1 mm resolution – expandable /// 0.02 to 12 in controllable in 0.01 in resolution - expandable</td> </tr> <tr> <td>Image Resolution:</td> <td>0.5 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB /// 0.02 in × 0.02 in × 0.5 • Scan Index × ≤2dB</td> <td>0.2 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB /// 0.01 in × 0.02 in × 0.5 • Scan Index × ≤2dB</td> </tr> <tr> <td>Standard Color Scale (Palette):</td> <td> <ul style="list-style-type: none"> • Pseudo Color • Gray • Thermal </td> <td> <ul style="list-style-type: none"> • Pseudo Color • Gray • Thermal </td> </tr> <tr> <td>User Defined Color Scales (Palettes):</td> <td>≤2³² colors</td> <td>≤2³² colors</td> </tr> <tr> <td>Signal Amplitude Coloring Protocol:</td> <td> <ul style="list-style-type: none"> • Linear • TCG Normalizing • DAC Normalizing • DGS Normalizing • Customized </td> <td> <ul style="list-style-type: none"> • Linear • TCG Normalizing • DAC Normalizing • Customized </td> </tr> </tbody> </table>	Inspection:	Angle Beam	Straight Beam	Width of Volume under test:	5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 in controllable in 0.01 in resolution - expandable	50 to 2000 mm controllable in 1 mm resolution – expandable /// 0.2 to 80 in controllable in 0.01 in resolution – expandable	Thickness of Volume under test:	5 to 300 mm controllable in 1 mm resolution – expandable /// 0.2 to 12 in controllable in 0.01 in resolution - expandable	0.5 to 300 mm controllable in 0.1 mm resolution – expandable /// 0.02 to 12 in controllable in 0.01 in resolution - expandable	Image Resolution:	0.5 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB /// 0.02 in × 0.02 in × 0.5 • Scan Index × ≤2dB	0.2 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB /// 0.01 in × 0.02 in × 0.5 • Scan Index × ≤2dB	Standard Color Scale (Palette):	<ul style="list-style-type: none"> • Pseudo Color • Gray • Thermal 	<ul style="list-style-type: none"> • Pseudo Color • Gray • Thermal 	User Defined Color Scales (Palettes):	≤2 ³² colors	≤2 ³² colors	Signal Amplitude Coloring Protocol:	<ul style="list-style-type: none"> • Linear • TCG Normalizing • DAC Normalizing • DGS Normalizing • Customized 	<ul style="list-style-type: none"> • Linear • TCG Normalizing • DAC Normalizing • Customized
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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 instrument settings																					
Off-Line Image Analysis:	<ul style="list-style-type: none"> • Recovery and play back of A-Scan sequence at various gain levels • Echo-dynamic pattern analysis • Defects sizing, outlining, pattern recognition • Statistical analysis of Thickness / Amplitude Map data • 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, CB-Scans, C-Scans, D-Scans, P-Scans, or TOFD Maps																					
Data Storage Capacity:	<ul style="list-style-type: none"> • 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, CB-Scans, C-Scans, D-Scans, P-Scans, or TOFD Maps 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:	265×156×121 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 (5.83 lbs) - without battery 4.280 kg (7.88 lbs) - with battery																					

3. ISONIC 2006 – Scope of Supply

3.1. Instrument and basic accessories

#	Item	Order Code (Part #)	Note
1	<p>ISONIC 2006 – Portable Digital Ultrasonic Flaw Detector and Recorder with B-Scan, C-Scan, D-Scan, P-Scan, and TOFD Inspection and Imaging Capabilities</p> <ul style="list-style-type: none"> • ISONIC 2006 Electronic unit – including: <ul style="list-style-type: none"> > Internal PC (P-MMX-S - 300 MHz, RAM-128M, Quazi-HDD Flash Memory Card 2G, active TFT sVGA LCD High Color Sun-Readable Touch Screen, Built-In Interfaces: 2XUSB; Ethernet; PS/2; Front Panel Sealed Keyboard and Mouse; sVGA output) > 100 ... 250 VAC AC/DC converter > SE 256000 - Controller for Non-Mechanical Airborne Ultrasound Based Monitoring of Probe Coordinates (X,Y,Z) and Orientation (Swiveling Angle) on an Object Under Test While Scanning and for Coupling Monitoring Between Probe and Object Under Test While Scanning > SE 248000 - UDS 3-5 Pulsar Receiver Card: <ul style="list-style-type: none"> ☐ Combined “Spike wave – Selectable Energy” / “Square Wave – Tunable Width” Tunable Firing Level Pulsar; Single / Dual Modes of Operation; Damping: 17 discrete resistances values / 25Ω min to 1000Ω max; Internal Matching Coil – Probe Impedance Matching: 16 discrete inductivity values / 2 μH min to 78 μH max; Special Probe Protection Circuit to Prevent Probe Damage for Not Properly Adjusted Pulse Width ☐ Gain: 0...120 dB controllable in 0.5 dB resolution; Advanced Low Noise Design: 93μV peak to peak input referred to 80 dB gain / 35 MHz bandwidth; Ffrequency Band: 0.35 ... 35 MHz Wide Band / 34 Sub Bands ☐ Built-In Incremental Encoder Interface • Software <ul style="list-style-type: none"> ☐ ISONIC 2006 Multi-Functional Package (SWA 99C06200) <ul style="list-style-type: none"> • A-Scan Inspection and Straight Line Scanning Inspection and recording (Full ISONIC 2005 Functionality) <ul style="list-style-type: none"> ◆ A-Scan <ul style="list-style-type: none"> ⇒ A-Scan (Full Wave / Neg Wave / Pos Wave rectification; RF) ⇒ Selectable A-Scan color scheme ⇒ DAC, DGS, TCG ⇒ Auto Calibration for Straight Beam and Angle Beam Probes ⇒ Curved Surface / Wall Thickness / Skip - Correction for Angle Beam Inspection ⇒ Smart Automatic Measurements of Gated Signals - Flank / Flank First / Top / Top First; Auto-Marking Measuring Points on A-Scan ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition / probes characterization ⇒ Enhanced Signal Evaluation for Live and Frozen A-Scans including Gain Adjustments whilst in Freeze Mode ⇒ Dual Ultrasound Velocity Multiecho Measurements Mode ⇒ Comprehensive Setup and A-Scan / FFT graph report, Direct Connection To any Type of USB or LAN Windows Printer ◆ Thickness Profile Imaging and Recording (Typical Application: Corrosion characterization) <ul style="list-style-type: none"> ⇒ Continuous measuring of thickness value along probe trace ⇒ Time-based (real time clock) and true-to-location (built-in incremental encoder interface) modes of data recording ⇒ Recording of complete sequence of A-Scans along with thickness profile ⇒ Off-line evaluation of thickness profile images featured with: <ul style="list-style-type: none"> ▶ 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 thickness profile recording ▶ Echodynamic pattern analysis ▶ Off-line reconstruction of thickness profile image for various Gain / Gate setup ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer ◆ B-Scan cross-sectional imaging and recording of defects for longitudinal and shear wave inspection (Typical Application: Pulse echo inspection of welds, composites, metals, plastics, and the like) 	SA 80460	Standard Configuration

#	Item	Order Code (Part #)	Note
	<p>⇒ Continuous measuring of echo amplitudes and reflectors coordinates along probe trace</p> <p>⇒ Time-based (real time clock) and true-to-location (built-in incremental encoder interface) modes of data recording</p> <p>⇒ Recording of complete sequence of A-Scans along with B-Scan defects images</p> <p>⇒ Off-line evaluation of B-Scan record images featured with:</p> <ul style="list-style-type: none"> ▶ Sizing of defects at any location along stored image – coordinates and projection size ▶ Play-back and evaluation of A-Scans obtained during B-Scan imaging and recording ▶ Echodynamic pattern analysis ▶ Defects outlining and pattern recognition based on A-Scan sequence analysis ▶ Off-line reconstruction of B-Scan defects images for various Gain / Rejection level setup ▶ DAC / DGS B-Scan normalization <p>⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer</p> <p>◆ CB-Scan horizontal plane-view imaging and recording of defects for shear, surface, and guided wave inspection (Typical Application: Long range pulse echo and CHIME inspection of annular plates and piping, stress corrosion, etc; weld inspection, surface wave inspection)</p> <p>⇒ Continuous measuring of echo amplitudes and reflectors coordinates along probe trace</p> <p>⇒ Time-based (real time clock) and true-to-location (built-in incremental encoder interface) modes of data recording</p> <p>⇒ Recording of complete sequence of A-Scans along with CB-Scan defects images</p> <p>⇒ Off-line evaluation of CB-Scan record images featured with:</p> <ul style="list-style-type: none"> ▶ Sizing of defects at any location along stored image – coordinates and projection size ▶ Play-back and evaluation of A-Scans obtained during CB-Scan imaging and recording ▶ Echodynamic pattern analysis ▶ Defects outlining and pattern recognition based on A-Scan sequence analysis ▶ Off-line reconstruction of CB-Scan defects images for various Gain / Rejection level setup ▶ DAC / DGS CB-Scan normalization <p>⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer</p> <p>◆ TOFD Inspection – RF B-Scan and D-Scan Imaging (Typical Application: weld inspection; CHIME inspection)</p> <p>⇒ Time-based (real time clock) and true-to-location (built-in incremental encoder interface) modes of data recording</p> <p>⇒ Averaging A-Scans whilst recording as per operator's selection</p> <p>⇒ Recording of complete sequence of A-Scans along with TOFD map</p> <p>⇒ Off-line evaluation of TOFD Map featured with:</p> <ul style="list-style-type: none"> ▶ Improvement of near to surface resolution through removal of lateral wave and back echo records from TOFD Map ▶ Linearization and straightening of TOFD Map ▶ Increasing contrast of TOFD images through varying Gain and rectification ▶ A-Scan sequence analysis ▶ Defects pattern recognition and sizing <p>⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer</p> <ul style="list-style-type: none"> ● Activation Panel for Optional C-Scan and Other Modes of Operation (Corrosion Mapping, Pulse Echo Straight Beam Inspection and Mapping of Internal Defects, Through Transmission Inspection and Mapping, Pulse Echo Angle Beam Weld Inspection and Imaging, Long Range Inspection and Imaging; Non Mechanically Encoded True to Location TOFD, etc - refer to Optional SW Licenses for ISONIC 2006 Instrument <ul style="list-style-type: none"> ● <u>USB Flash Drive for External Data Storage</u> ● <u>24 months warranty</u> ● <u>Lifetime free software update</u> 		

#	Item	Order Code (Part #)	Note
2	Backup CD-ROM	SCD 2006098	Operating Manual on the Backup CD-ROM
3	Soft carrying bag with neck strap	SK 2006101	Optional item
4	Rechargeable Battery Ni MH 9 AH / 12V	SK 2005102	Optional item
5	Battery Charger	SK 2005103	Optional item Required for battery charge
6	Travel Hard Case	SK 2006104	Optional item Allows safe cargo transportation
7	External USB Keyboard	SK 2005105	Optional Item Extremely Useful at Postprocessing Stage
8	External USB Optical Mouse	SK 2005106	Optional Item Extremely Useful at Postprocessing Stage
9	Dual Channel TOFD preamplifier package including: ⇒ Dual Channel TOFD preamplifier ⇒ Set of 2 low noise coaxial cables (10 meters length each) for connection to the signal input of ISONIC instrument	SA 80442	Optional Item Improves long cable connection to ultrasonic probes. Typical applications are TOFD, Corrosion Detection, etc performed with probes fitted into scanner / crawler frame – refer to chapter 10 of this Operating Manual
10	ISONIC Alarmer - standard firmware configuration and hardware platform including: ⇒ Internal Speaker functioning according to alarm logic settings of UDS 3-5 Pulser Receiver in the ISONIC 2005, 2006, 2007 instruments / UDS 3-6 Pulser Receiver of ISONIC 2008 Instrument ⇒ Speaker Volume Control Wheel ⇒ Headphone Connector ⇒ 25-pin programmable Input / Output interface (blank) ⇒ USB port and cable for connecting to ISONIC 2005, 2006, 2007, 2008 instrument	SE 554780987	Optional Item Refer to paragraph 8.8.5 of this Operating Manual
11	Ultrasonic probes, fixtures, scanners, cables and other accessories depending on the inspection tasks to be resolved		Optional Items Ultrasonic probes, fixtures, scanners, cables and other accessories from any manufacturer may be used

3.2. Components of Optional Non-Mechanical Airborne Ultrasound Encoder for Monitoring Position and Orientation (Swiveling Angle) of Manually Manipulated Probe

Complete list representing all components of optional non-mechanical airborne ultrasound encoder for monitoring position and orientation (swiveling angle) of manually manipulated probe during XY scanning is presented below. Some components may have two different implementations depending on temperature of object under test – normal temperature implementation is suitable for inspection of objects, which's temperature doesn't exceed 60°C; high temperature implementation is suitable for inspection of objects, which's temperature doesn't exceed 300°C. With reference to catalog of optional inspection SW licensees for ISONIC 2006 as per paragraph 3.4 of this Operating Manual it is easy to define list of components are required for XY scanning and recording using

#	Item	Order Code (Part #)	Note
1	Umbilical Cable for Connecting Airborne Ultrasound Stuff, Coupling Monitor Stuff, and Probes to ISONIC 2006 while implementing Optional C-Scan and Other Modes of Operation	S 70200	
2	Umbilical High Temperature Protection Jacketed Cable for Connecting Airborne Ultrasound Stuff, Coupling Monitor Stuff, and Probes to ISONIC 2006 while implementing Optional C-Scan and Other Modes of Operation	S 70200 HT	↯ Inspection of Hot Objects (60C and higher)
3	Set of 2 (two) receivers of Airborne Ultrasound	S 4030A	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording
4	Set of 2 (two) receivers of Airborne Ultrasound - High Temperature Implementation	S 4030 A HT	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording ↯ Inspection of Hot Objects (60C and higher)
3	Holder for Airborne Ultrasound Receivers with Magnetic Attachments to Object Under Test	S 2040 B	
4	Double Emitter of Airborne Ultrasound	S 4050	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording
5	Double Emitter of Airborne Ultrasound - High Temperature Implementation	S 4050 HT	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording ↯ Inspection of Hot Objects (60C and higher)
6	Single Emitter of Airborne Ultrasound	S 4060	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording
7	Single Emitter of Airborne Ultrasound - High Temperature Implementation	S 4060 HT	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording ↯ Inspection of Hot Objects (60C and higher)
8	Double Emitter of Airborne Ultrasound for scanning whilst receivers of airborne ultrasound are placed in front of scanning area, for example, on a tank shell	S 4055	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording

#	Item	Order Code (Part #)	Note
9	Double Emitter of Airborne Ultrasound for scanning whilst receivers of airborne ultrasound are placed in front of scanning area, for example, on a tank shell - High Temperature Implementation	S 4055 HT	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording ⚡ Inspection of Hot Objects (60C and higher)
10	Fixture for placement of airborne ultrasound receivers on tank shell	S 2045B	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording
11	Vacuum attachment system for placement ISONIC 2006 / ISONIC 201 accessories on objects made of non magnetic materials	S 1200A	
12	Fixture for placing airborne ultrasound receivers on small diameters pipes and other tubular objects	S 89000	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording
13	Fixture for airborne ultrasound receivers for scanning with high frontal resolution	S 86000	Refer to Optional Inspection SW Licensees for ISONIC 2006 related to XY Scanning and recording
14	Twister - Rotary Adapter	S 904050	This item may be necessary for numerous applications - refer to Notes for Inspection Software Packages and Accessories
15	Carrying Case for Airborne Ultrasound and Coupling Monitor Sensors and Accessories	S 20001	
16	Probe holders with clamping unit for fitting airborne ultrasound emitters - depending on probes used for XY scanning		

3.3. Optional Stuff for Coupling Monitoring

#	Item	Order Code (Part #)	Note
1	Emitter of Acoustic Coupling Monitor Signal - Additional Emitters are Recommended for heavy thickness objects	S 4010	
2	Cable for coupling monitor emitter LEMO 01 male – LEMO 00 male	S 799028	
3	Cable for coupling monitor emitter LEMO 01 male – LEMO 00 male - High Temperature Jacketed	S 799028 HT	⚡ Inspection of Hot Objects (60C and higher)
4	Splitter for parallel connection of up to 3 Emitters of Acoustic Coupling Monitor Signal - Additional Emitters are Recommended for heavy thickness objects	SE 20220	
5	Splitter for parallel connection of up to 3 Emitters of Acoustic Coupling Monitor Signal - Additional Emitters are Recommended for heavy thickness objects - High Temperature Jacketed	SE 20220 HT	⚡ Inspection of Hot Objects (60C and higher)
6	Probe holders equipped with Receiving Crystal for Acoustic Coupling Monitor Signal - depending on probes used for XY scanning		

3.4. Optional XY Scanning Software Licensees

#	Item	Order Code (Part #)	Note
1	<p>Inspection SW Package for ISONIC 2006: I2-SONIC - Inspection of Planar Butt Joints, Scanning from One Side, Complete Raw Data Capturing</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Area) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Top View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ B-Scan (Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ D-Scan (End View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996600	<p><u>Required Accessories:</u> > S 4030A or S 4030A HT > S 2040 B > S 4050 or S 4050 HT AND/OR S 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Angle Beam Probes to Be Used for Weld Inspection</p> <p><u>Optional Accessories:</u> > S 4010 > S 799028 or S 799028 HT > SWA 996014</p>
2	<p>Inspection SW Package for ISONIC 2006: PLCROSS - Inspection of Planar Butt Joints, Scanning from Both Sides, Complete Raw Data Capturing</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Areas) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Top View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ B-Scan (Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ D-Scan (End View of the Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996603	<p><u>Required Accessories:</u> > S 4030A or S 4030A HT > S 2040 B > S 4050 or S 4050 HT AND/OR S 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Angle Beam Probes to Be Used for Weld Inspection</p> <p><u>Optional Accessories:</u> > S 904050 > S 4010 > S 799028 or S 799028 HT > SWA 996014</p>

#	Item	Order Code (Part #)	Note
3	<p>Inspection SW Package for ISONIC 2006: CIRCROSS - Inspection of Circumferential or Spiral Butt Joints, Scanning from Both Sides, Complete Raw Data Capturing, weld diameters 400 mm and above</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Areas) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Unfolded Top View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ B-Scan (Unfolded Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ B-Scan (Real Shape Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ D-Scan (End View of the Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996604	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > S 4050 or S 4050 HT AND/OR S 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Angle Beam Probes to Be Used for Weld Inspection > S 904050 <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > SWA 996014
4	<p>Inspection SW Package for ISONIC 2006: SM_PIPE - Inspection of Butt Welds between Small Diameter Pipes (80 to 800 mm), Scanning from One Side, Complete Raw Data Capturing</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Areas) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Unfolded Top View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ B-Scan (Unfolded Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ B-Scan (Real Shape Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ D-Scan (End View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996605	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > S 4050 or S 4050 HT AND/OR S 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Angle Beam Probes to Be Used for Weld Inspection > S 89000 <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > S 86000 > SWA 996014

#	Item	Order Code (Part #)	Note
5	<p>Inspection SW Package for ISONIC 2006: LONGWELD - Inspection of Longitudinal Welds In Pipes, diameter 300 mm - 4000 mm, Scanning from Both Sides, Complete Raw Data Capturing</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Areas) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Top View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ B-Scan (Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ D-Scan (End View of the Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996652	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > S 4050 or S 4050 HT AND/OR S 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Angle Beam Probes to Be Used for Weld Inspection > S 904050 <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > SWA 996014
6	<p>Inspection SW Package for ISONIC 2006: TRANSCAN - Inspection of Butt Joints for Defects Transversal to Weld Scanning from Both Sides and/or Above Machined Weld Enforcement (Standard HP 5/3)</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Areas) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Top View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ B-Scan (Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ D-Scan (End View of the Weld and Heat Affected Zone either Global or Sliced - switch able) / superimposing images obtained whilst scanning from different sides ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Sizing of defects; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996606	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > S 4050 or S 4050 HT > S 70200 or S 70200 HT > Probe Holders for Angle Beam Probes to Be Used for Weld Inspection > S 904050 <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > SWA 996014

#	Item	Order Code (Part #)	Note
7	<p>Inspection SW Package for ISONIC 2006: <u>EXPERT – High Resolution Scanning of Welds (Frontal Resolution - 0.25 mm / 0.01")</u>, Scanning from One Side, Complete Raw Data Capturing</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Area) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Top View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ B-Scan (Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ D-Scan (End View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ Defect Outlining Technology (DOT) - Extra-Capturing of A-Scan Sequences for Weld Cross Sections selected by Operator Whilst Scanning ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996609	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > S 4050 or S 4050 HT AND/OR S 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Angle Beam Probes to Be Used for Weld Inspection > S 86000 <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > SWA 996014
8	<p>Inspection SW Package for ISONIC 2006: <u>NOZZLE – Inspection of Nozzle Welds, Scanning from One Side, Complete Raw Data Capturing</u></p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Area) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Top View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ B-Scan (Side View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ D-Scan (End View of Weld and Heat Affected Zone either Global or Sliced - switch able) ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996611	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > S 4050 or S 4050 HT AND/OR S 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Angle Beam Probes to Be Used for Weld Inspection > S 904050 <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > SWA 996014 > S 86000

#	Item	Order Code (Part #)	Note
9	<p>Inspection SW Package for ISONIC 2006: TOFD – TOFD Inspection, Complete Raw Data Capturing</p> <ul style="list-style-type: none"> ⇒ Averaging A-Scans whilst recording as per operator's selection ⇒ Recording of complete sequence of A-Scans along with TOFD map ⇒ Off-line evaluation of TOFD Map featured with: <ul style="list-style-type: none"> ▶ Improvement of near to surface resolution through removal of lateral wave and back echo records from TOFD Map ▶ Linearization and straightening of TOFD Map ▶ Increasing contrast of TOFD images through varying Gain and rectification ▶ A-Scan sequence analysis ▶ Defects pattern recognition and sizing ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996610	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > 4060 or S 4060 HT > S 70200 or S 70200 HT > S 450000 > S 799017
10	<p>Inspection SW Package for ISONIC 2006: CORROMAP – Inspection with Straight Beam Ultrasonic Probes for Corrosion Mapping, Complete Raw Data Capturing</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging the Thickness / Corrosion Map ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging of Thickness / Corrosion Map ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Area) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Top View - Thickness / Corrosion Map either Global or Sliced - switch able) ⇒ B-Scan (Side View - Thickness / Corrosion Profile either Global or Sliced - switch able) ⇒ D-Scan (End View - Thickness / Corrosion Profile either Global or Sliced - switch able) ⇒ Versatile Color Palette for Thickness / Corrosion Mapping ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Gate Manipulation - Rebuild C-, B-, and D-Scan views for various Gate Settings; Statistical Analysis; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996608	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Straight Beam Probes to Be Used for Inspection <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > SWA 996014

#	Item	Order Code (Part #)	Note
11	<p><u>Inspection SW Package for ISONIC 2006: CORROMAP CU – Inspection with Sraight Beam Ultrasonic Probes for Corrosion Mapping - Scanning above Tubular or Quasi-Tubular Surface (Curvature Radius 40 - 400 mm), Complete Raw Data Capturing</u></p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging Thickness / Corrosion Map ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging of Thickness / Corrosion Map ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Area) Showing of Actually Implemented Probe Trace ⇒ C-Scan (Unfolded Top View - Thickness / Corrosion Map either Global or Sliced - switch able) ⇒ B-Scan (Unfolded Side View - Thickness / Corrosion Profile either Global or Sliced - switch able) ⇒ B-Scan (Real Shape Side View - Thickness / Corrosion Profile either Global or Sliced - switch able) ⇒ D-Scan (End View - Thickness / Corrosion Profile either Global or Sliced - switch able) ⇒ Versatile Color Palette for Thickness / Corrosion Mapping ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Gate Manipulation - Rebuild C-, B-, and D-Scan views for various Gate Settings; Statistical Analysis; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996608 CU	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Straight Beam Probes to Be Used for Inspection > S 89000 <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > SWA 996014 > S86000
12	<p><u>Inspection SW Package for ISONIC 2006: MULTISCAN-COMBO - S Inspection with Straight Beam Single Element or Dual Ultrasonic Probes for Internal Defects with Tomographical and 3D Data Presentation and User Defined Mapping Scheme, Complete Raw Data Capturing</u></p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Area) Showing of Actually Implemented Probe Trace ⇒ Pulse Echo Amplitude / Distance C-Scan (Top View of Scanning Area either Global or Sliced - switch able) ⇒ Pulse Echo B-Scan (Side View of the Scanning Area either Global or Sliced - switch able) ⇒ Pulse Echo D-Scan (End View of the Scanning Area either Global or Sliced - switch able) ⇒ Through Transmission / Back Echo Attenuation Amplitude C-Scan (Top View of Scanning Area) ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Gate Manipulation - Rebuild C-, B-, and D-Scan views for various Gate Settings; Statistical Analysis; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996613	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Straight Beam Probes to Be Used for Inspection <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > S86000 > S 554230 AND/OR S 554231 AND/OR S 554232 AND/OR S 554233

#	Item	Order Code (Part #)	Note
13	<p>Inspection SW Package for ISONIC 2006: MULTISCAN-COMBOS-CU - Inspection with Straight Beam Single Element or Dual Ultrasonic Probes for Internal Defects with Tomographical and 3D Data Presentation and User Defined Mapping Scheme - Scanning above Tubular or Quasi-Tubular Surface (Curvature Radius 40 - 400 mm), Complete Raw Data Capturing</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , DGS- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Testing Integrity / Coverage Imaging (Top View of Probe Manipulation Area) Showing of Actually Implemented Probe Trace ⇒ Pulse Echo Amplitude / Distance C-Scan (Top View of Scanning Area either Global or Sliced - switch able) ⇒ Pulse Echo B-Scan (Unfolded Side View of the Scanning Area either Global or Sliced - switch able) ⇒ Pulse Echo B-Scan (Real Shape Side View of the Scanning Area either Global or Sliced - switch able) ⇒ Pulse Echo D-Scan (End View of the Scanning Area either Global or Sliced - switch able) ⇒ Through Transmission / Back Echo Attenuation Amplitude C-Scan (Top View of Scanning Area) ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Gate Manipulation - Rebuild C-, B-, and D-Scan views for various Gate Settings; Statistical Analysis; Slicing and Filtering Images ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996613 CU	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040 B > 4060 or S 4060 HT > S 70200 or S 70200 HT > Probe Holders for Straight Beam Probes to Be Used for Inspection > S 89000 <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 4010 > S 799028 or S 799028 HT > S86000 > S 554230 AND/OR S 554231 AND/OR S 554232 AND/OR S 554233
14	<p>Inspection SW Package for ISONIC 2006: FLOORMAP - Fast Tank Floor / Shell Inspection for Pitting and Deep Corrosion Damages - Linear and/or Beam Swiveling Scanning with On-Line Image Reconstruction</p> <ul style="list-style-type: none"> ⇒ Support of all A-Scan types (Full Wave / Neg Wave / Pos Wave rectification; RF) while scanning, recording and imaging defects ⇒ Support of Linear or DAC- , TCG- normalized recording and imaging defects ⇒ FFT (Frequency Domain Signal Presentation) - additional feature for defects evaluation and / or pattern recognition ⇒ Complete Coverage of Whole Region Of Ineterst through Non Mechanically Encoded Linear and/or Beam Swiveling Scanning ⇒ CB-Scan (Top View - of Area of Interest) ⇒ Versatile Color Palette for Defects Imaging ⇒ Postprocessing: Off-line Recovery and Play-Back of A-Scans; Echo Dynamic Pattern Recognition; Sizing of defects; Filtering and Normalization of CB-Scan Image ⇒ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer 	SWA 996634	<p><u>Required Accessories:</u></p> <ul style="list-style-type: none"> > S 4030A or S 4030A HT > S 2040B AND/OR S 2045B > S 4050 or S 4050 HT AND/OR S 4060 or S 4060 HT AND/OR S 4055 or S 4055 HT > S 70200 or S 70200 HT > S 544000 or S 544000 HT <p><u>Optional Accessories:</u></p> <ul style="list-style-type: none"> > S 904050

3.5. Recommended Optional Postprocessing Software Packages and Software Utilities

#	Item	Order Code (Part #)	Note
1	<p>Postprocessing SW Package for Office PC: IOFFICE - ISONIC Office</p> <ul style="list-style-type: none"> ⇒ comprehensive postprocessing of inspection results files captured by ISONIC 2001, ISONIC 2005, ISONIC 2006, ISONIC 2007, ISONIC 2008 ⇒ automatic creating of ISONIC 2001, ISONIC 2005, ISONIC 2006, ISONIC 2007, ISONIC 2008 inspection reports in MS Word® format 	SWA99C0203	
2	<p>Postprocessing SW Package for Office PC: DSHEET - ISONIC D-Spreadsheet Creator</p> <ul style="list-style-type: none"> ⇒ automatic MS Excel® thickness spreadsheet creating through conversion of C-Scan inspection results files captured By ISONIC 2001 and ISONIC 2006 using CORROMAP, CORROMAP CU, MULTISCAN COMBO S, MULTISCAN COMBO S CU inspection SW packages and thickness B-Scan files captured by ISONIC 2005 and ISONIC 2006 using line scanning mode ⇒ compliant with various Risk Based Inspection and Maintenance procedures 	SWA99C0201	
3	<p>SW Utility for ISONIC 2001 and ISONIC 2006 Units: CSMAN – ISONIC Color Scale Manager</p> <p>Management of Color Scales (palettes) of Inspection SW Packages</p>	SWA 996014	
4	<p>SW Utility: ISONIC Par2Txt</p> <p>Converting A-Scan time domain and frequency domain files created by ISONIC 2001, ISONIC 2005, ISONIC 2006 into pure ASCII file for further analysis using Labview®, Matlab®, etc</p>	SWA99C0205	

4. Operating ISONIC 2006

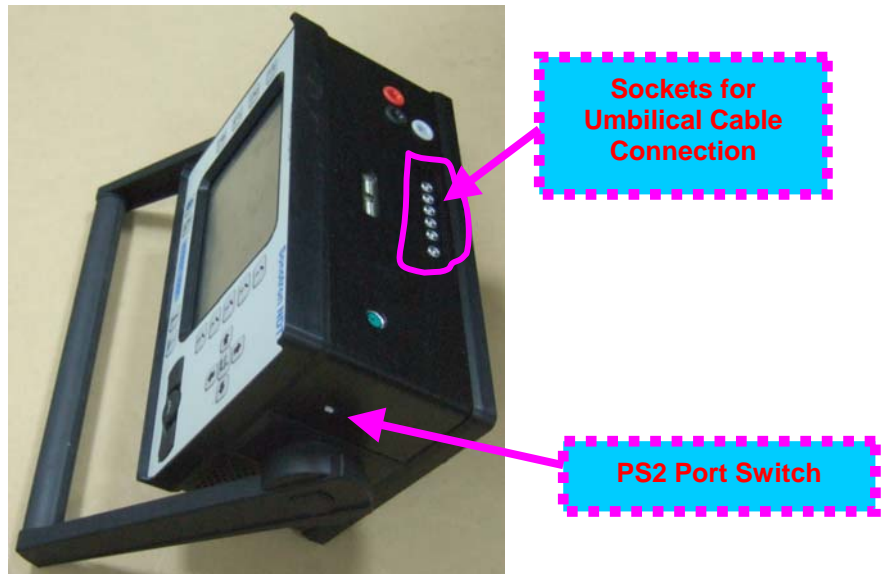
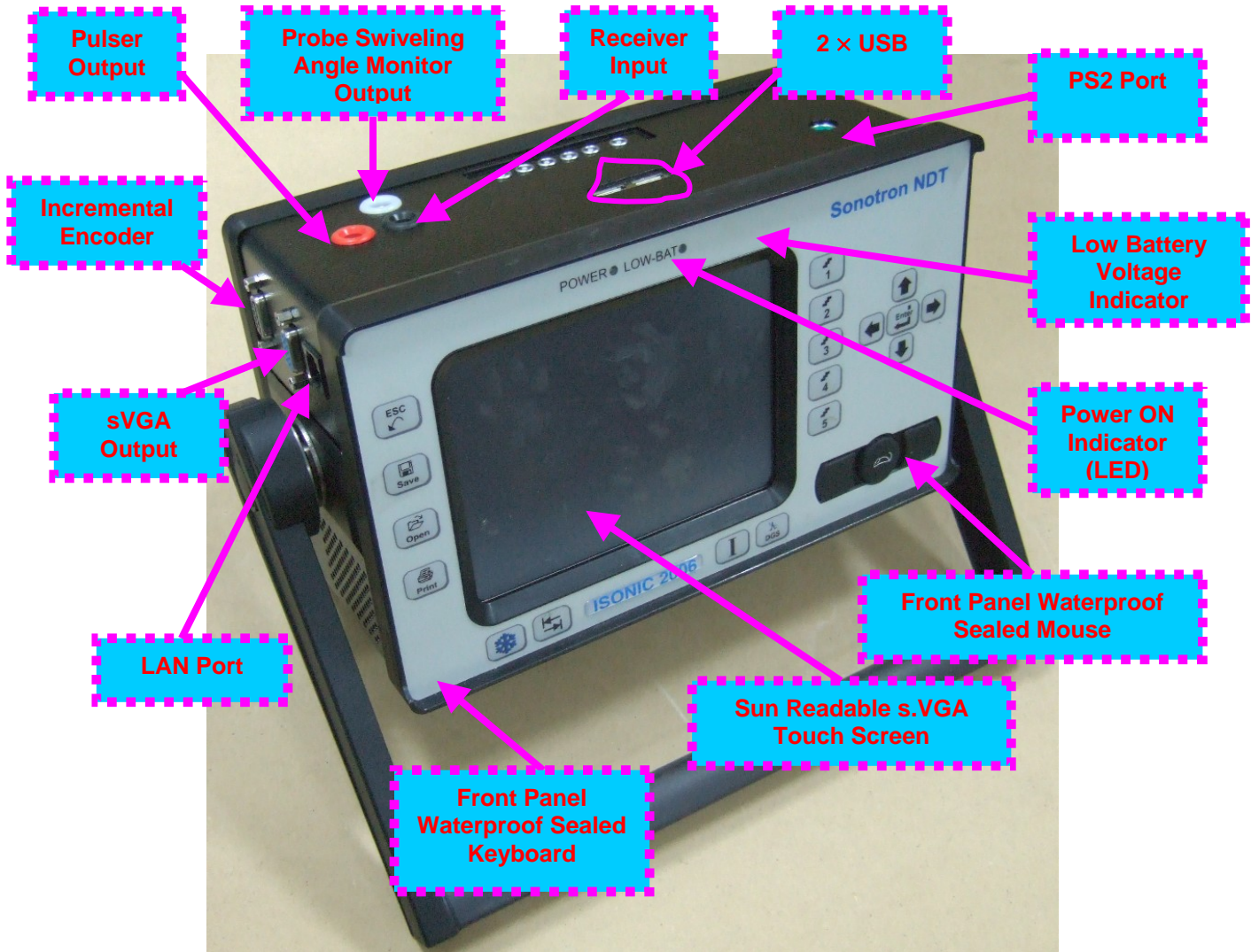
Please read the following information before you use **ISONIC 2006**. It is essential to read and understand the following information so that no errors occur during operation, which could lead damaging of the unit or misinterpretation of inspection results

4.1. Preconditions for ultrasonic testing with ISONIC 2006

Operator of **ISONIC 2006** must be certified as at least *Level 2 Ultrasonic Examiner* additionally having the adequate knowledge of

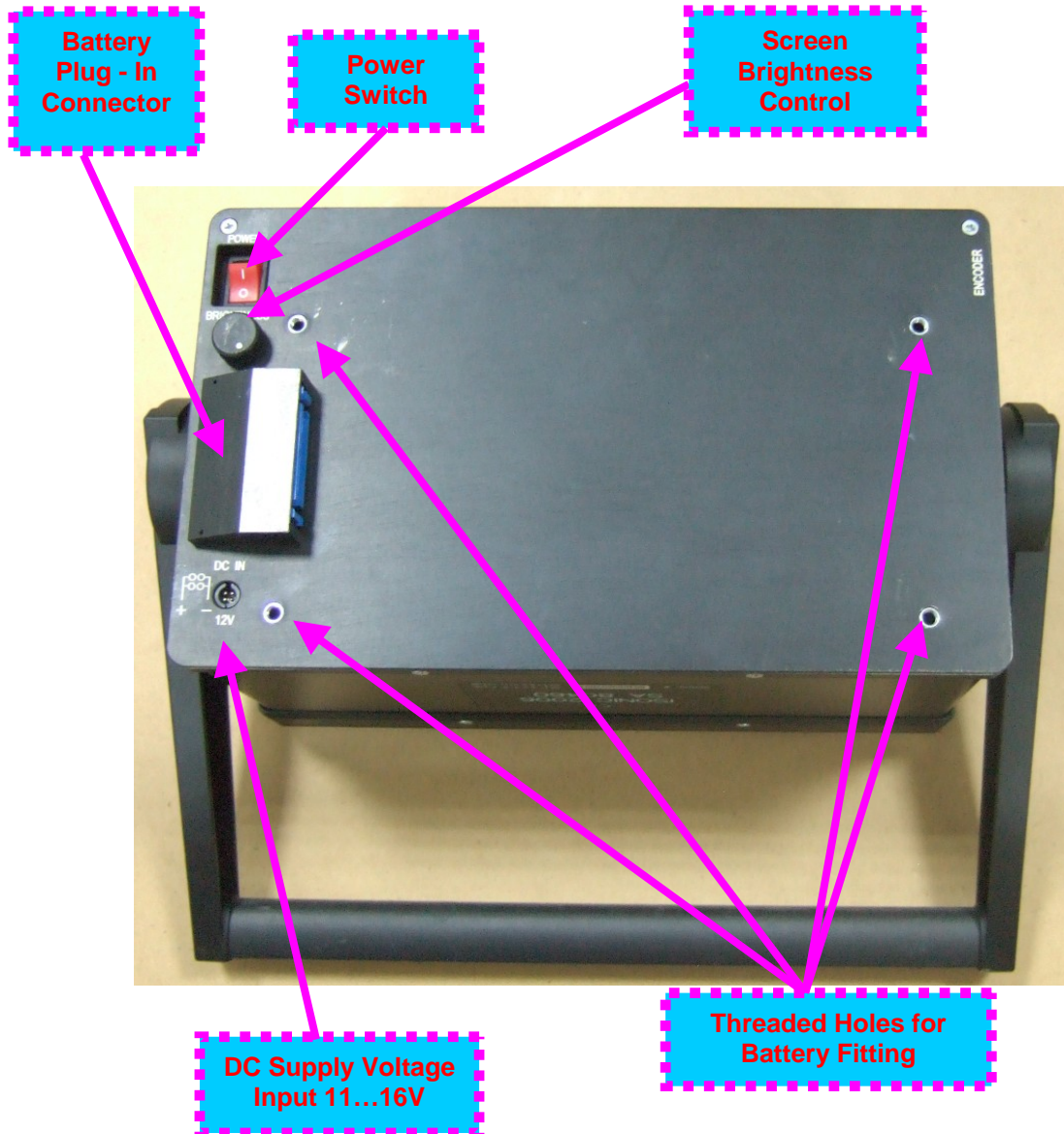
- operating digital ultrasonic flaw detector
- basics of computer operating in the **Windows™** environment including turning computer on/off, keyboard, touch screen and mouse, starting programs, saving and opening files

4.2. ISONIC 2006 Controls



PS 2 Port Switch has 2 positions:

Front – Front Panel Keyboard and Mouse active; PS2 Port inactive
 Rear – Front Panel Keyboard and Mouse inactive; PS2 Port active



4.3. Turning On / Off

ISONIC 2006 may be powered from:

- 100...250 VAC through external AC/DC converter
- External 11...16V DC source (12V – typical)
- Rechargeable battery (optionally)

AC Power Supply

- Ensure that power switch is in **O** position before connecting power cords
- Connect one end of AC power cord to AC/DC converter and plug another end into AC mains
- Connect DC power cord with suppression filter outgoing from AC/DC converter to DC Supply Voltage Input of **ISONIC 2006**

External DC Power Supply


- Ensure DC mains do supply voltage between 11 V and 16 V
- Ensure that power switch is in **O** position before connecting power cord
- Connect one end of DC power cord with suppression filter to DC Supply Voltage Input of **ISONIC 2006** and plug another end into DC mains

Battery

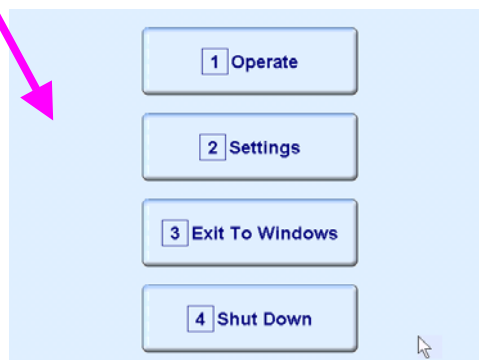
- Ensure that power switch is in **O** position
- Plug in battery and fix it using 4 screws



Power-Up and Turn Off



To Power-Up **ISONIC 2006** set power switch into **I** position. An automatic system test program will then be executed; during this test various texts and information appear followed by the screen as below while booting up



Instruments manufactured on or before Dec 1, 2007	Instruments manufactured after Dec 1, 2007
	



Wait until **ISONIC 2006 start screen** becomes active automatically upon boot up is completed





Click on  or press  on front panel keyboard or press **F1** on external keyboard to operate **ISONIC 2006** – refer to Chapters 5 through 12 of this Operating Manual

Click on  or press  on front panel keyboard or press **F2** on external keyboard to proceed with general settings of **ISONIC 2006** – refer to Chapters 13 through 15 of this Operating Manual

Click on  or press  on front panel keyboard or press **F3** on external keyboard if it is necessary to fulfill some general purpose Windows procedures such as setting up drivers for external devices (printers, USB memory card, and the like), connecting to LAN, quasi-disk management, etc – refer to Chapter 15 of this Operating Manual

To turn **ISONIC 2006** off click on  or press  on front panel keyboard or press **F4** on external keyboard then wait until the screen as below appears:

Instruments manufactured on or before Dec 1, 2007	Instruments manufactured after Dec 1, 2007
	

Set power switch into **O** position upon

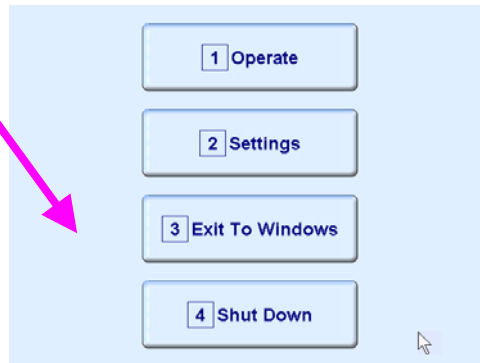


After turning **ISONIC 2006 OFF** wait at least 10...30 seconds before switching it **ON** again

5. UDS 3-5 Pulsar Receiver

5.1. Start Up UDS 3-5 Pulsar Receiver

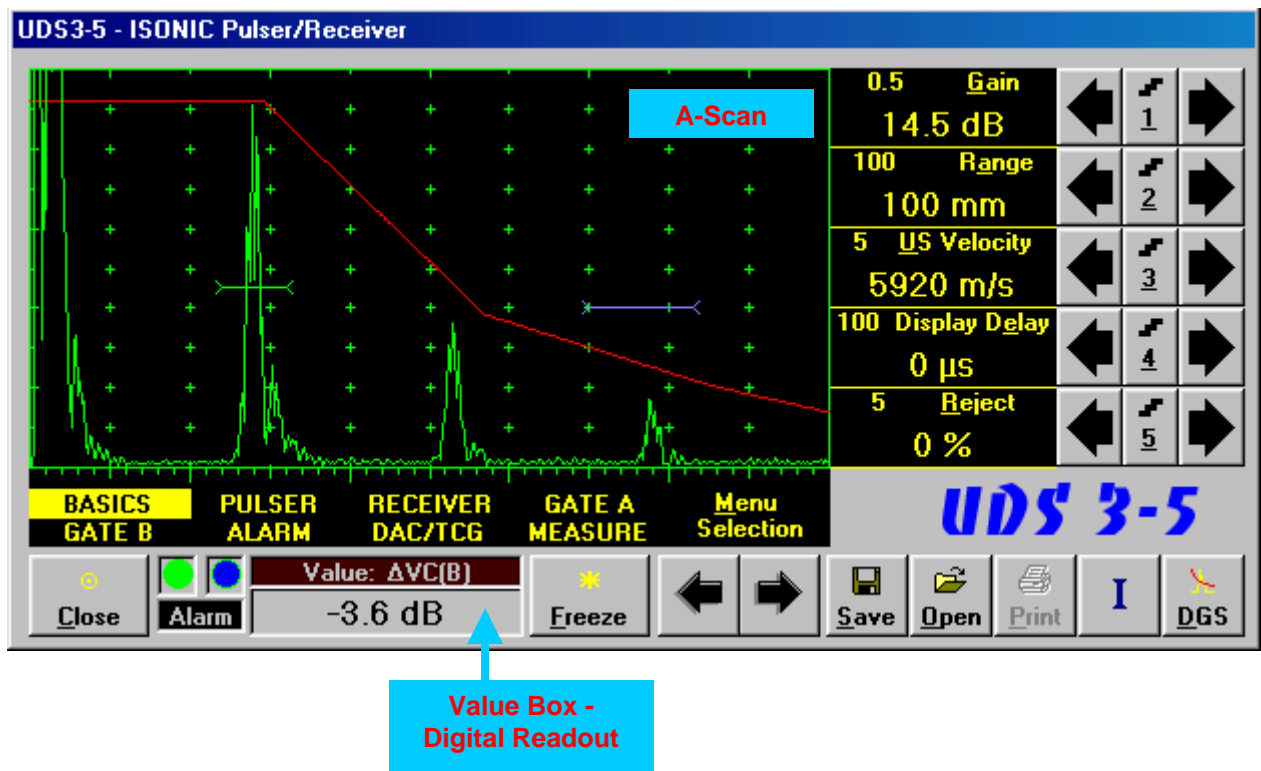
While **ISONIC 2006 start screen** is active click on  or press  on the front panel



keyboard or press **F1** on external keyboard

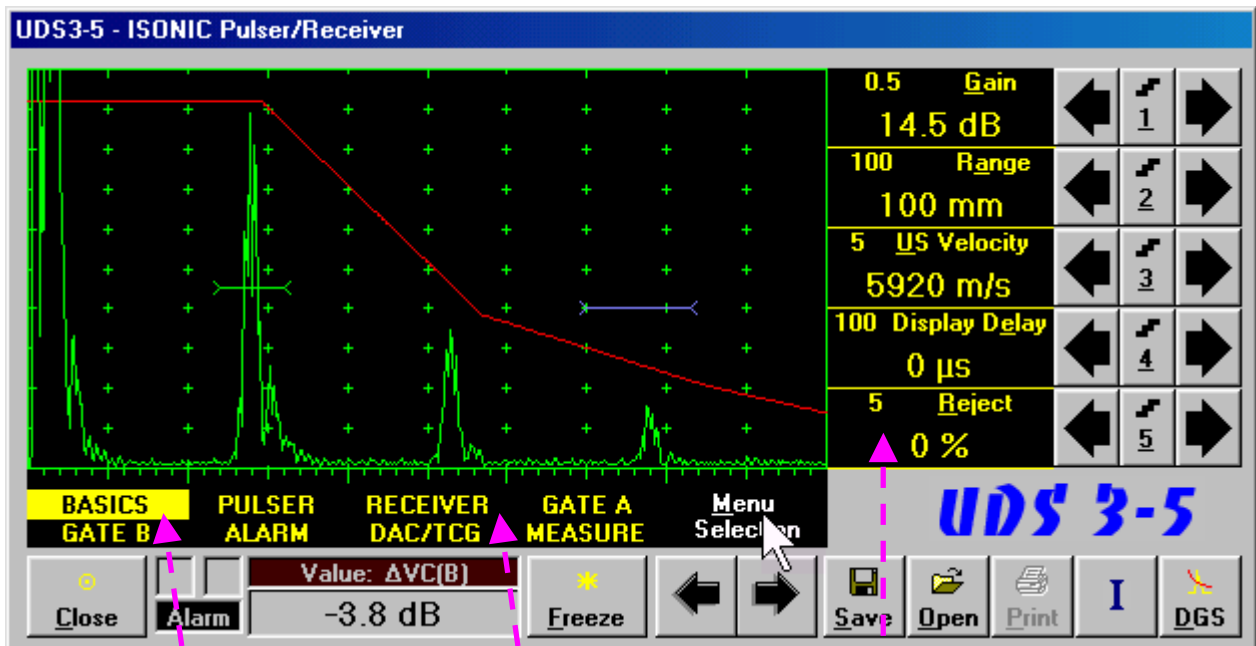
5.2. Main Operating Surface

UDS 3-5 is fully controllable through the main operating surface:



5.2.1. Main Menu

Main Menu consists of eight topics; each topic is associated with corresponding **submenu** appearing as vertical bar showing names for five parameters or modes of operation, their current settings and current value of increment/decrement for a parameter. The active topic is highlighted








Active Topic

Main Menu

Vertical bar – Submenu corresponding to highlighted active topic

To activate a topic the following manipulations are applicable:

- **Keyboard**









- Press  on front panel keyboard or **F7** on external keyboard until highlighting required topic
OR
- Press **<Alt>+<M>** on external keyboard ⇒ **Menu Selection** fore color changes to white - then use , , , 

- **Mouse / Touch Screen**

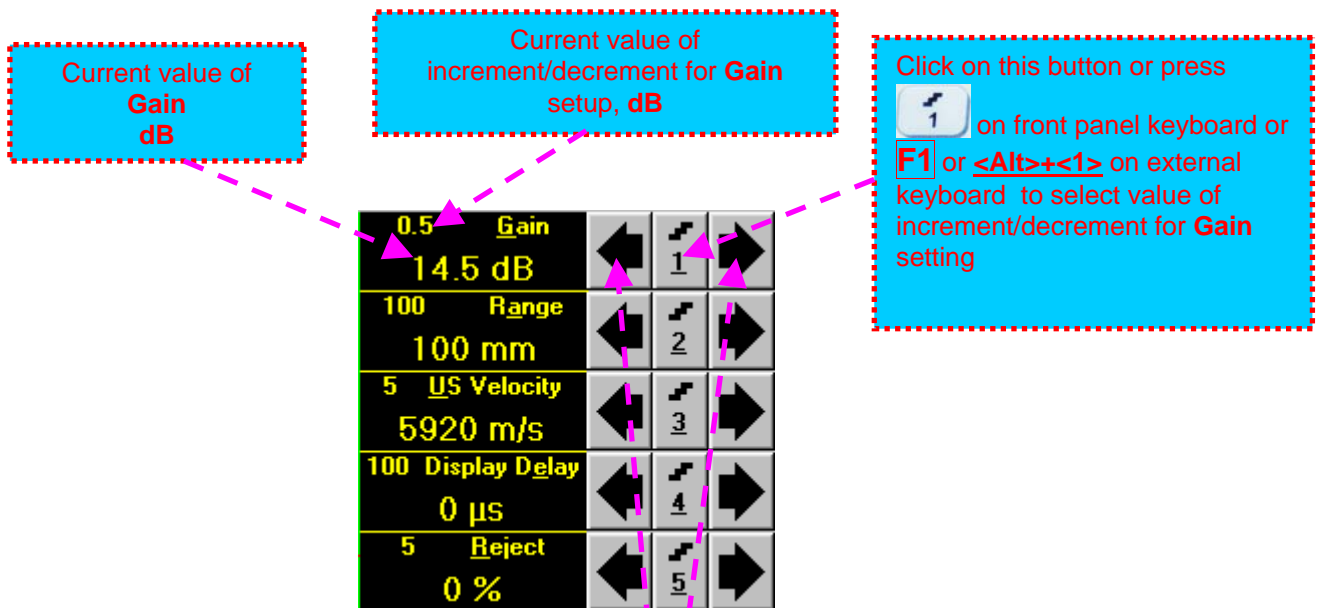
- Click on topic's name
OR

- Click on 

- **Combined**

- Click on **Menu Selection** ⇒ **Menu Selection** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

5.2.2. Sub Menu BASICS












To control **Gain** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

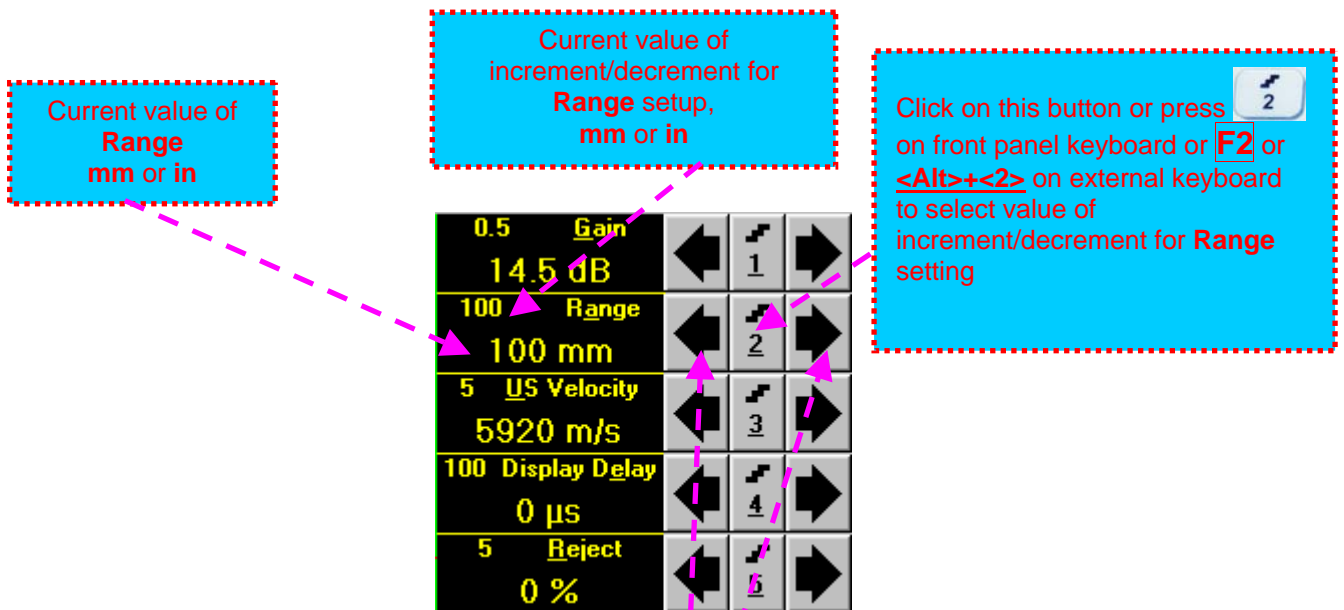
- Press  on front panel keyboard or **F1** or **<Alt>+<G>** on external keyboard ⇒ **Gain** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Gain** ⇒ **Gain** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



Gain setup is also possible through a number of other submenus following the same rules as above












To control **Range** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

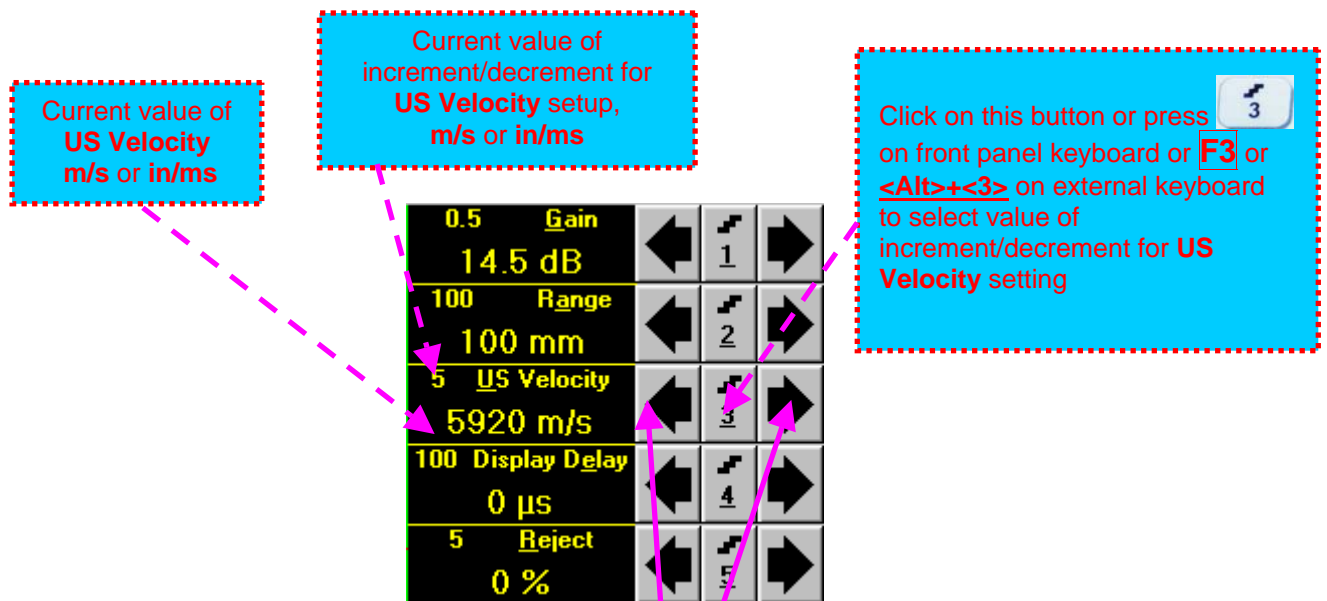
- Press  on front panel keyboard or **F2** or **<Alt>+<A>** on external keyboard ⇒ **Range** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Range** ⇒ **Range** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



Range setup is also possible through a number of other submenus following the same rules as above



To control **US Velocity** the following manipulations are applicable:

- **Mouse / Touch Screen**

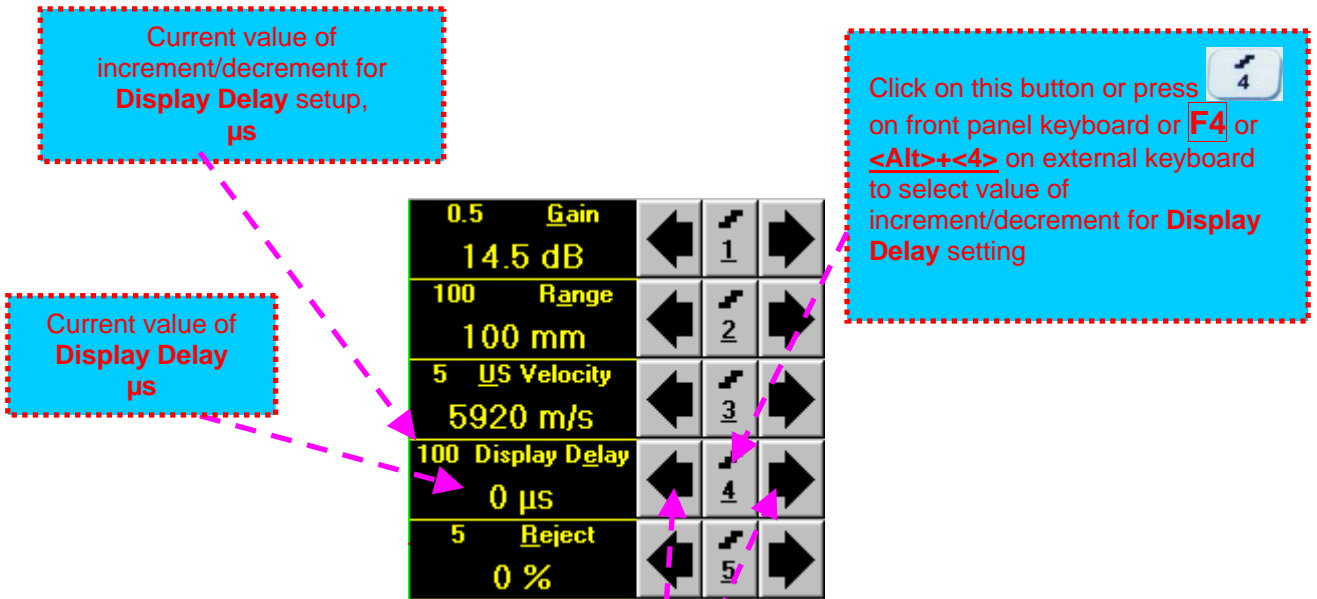
- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press on front panel keyboard or **F3** or **<Alt>+<U>** on external keyboard ⇒ **US Velocity** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **US Velocity** ⇒ **US Velocity** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard












To control **Display Delay** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

- Press  on front panel keyboard or **F4** or **<Alt>+<E>** on external keyboard ⇒ **Display Delay** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard


- **Combined**

- Click on **Display Delay** ⇒ **Display Delay** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard


















Current value of increment/decrement for **Reject** setup, %

Current value of **Reject** %

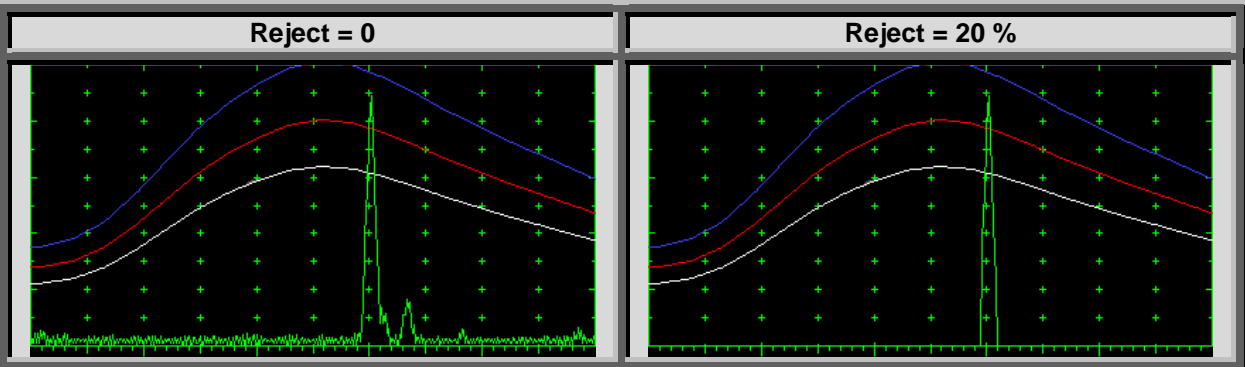
0.5	Gain	←	1	→
14.5	dB	←	2	→
100	Range	←	3	→
100	mm	←	4	→
5	US Velocity	←	5	→
5920	m/s	←		→
100	Display Delay	←		→
0	μs	←		→
5	Reject	←		→
0	%	←		→

Click on this button or press  on front panel keyboard or **F5** or **<Alt>+<5>** on external keyboard to select value of increment/decrement for **Reject** setting

To control **Reject** the following manipulations are applicable:


- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate **button**
- **Keyboard**
 - Press  on front panel keyboard or **F5** or **<Alt>+<E>** on external keyboard ⇒ **Reject** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard
- **Combined**
 - Click on **Reject** ⇒ **Reject** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- ◆ Signals below **Reject** level (small signals) are suppressed
- ◆ Signals exceeding **Reject** level (large signals) are presented on the A-Scan without affecting their original height
- ◆ Part of large signal wave form below **Reject** level is suppressed

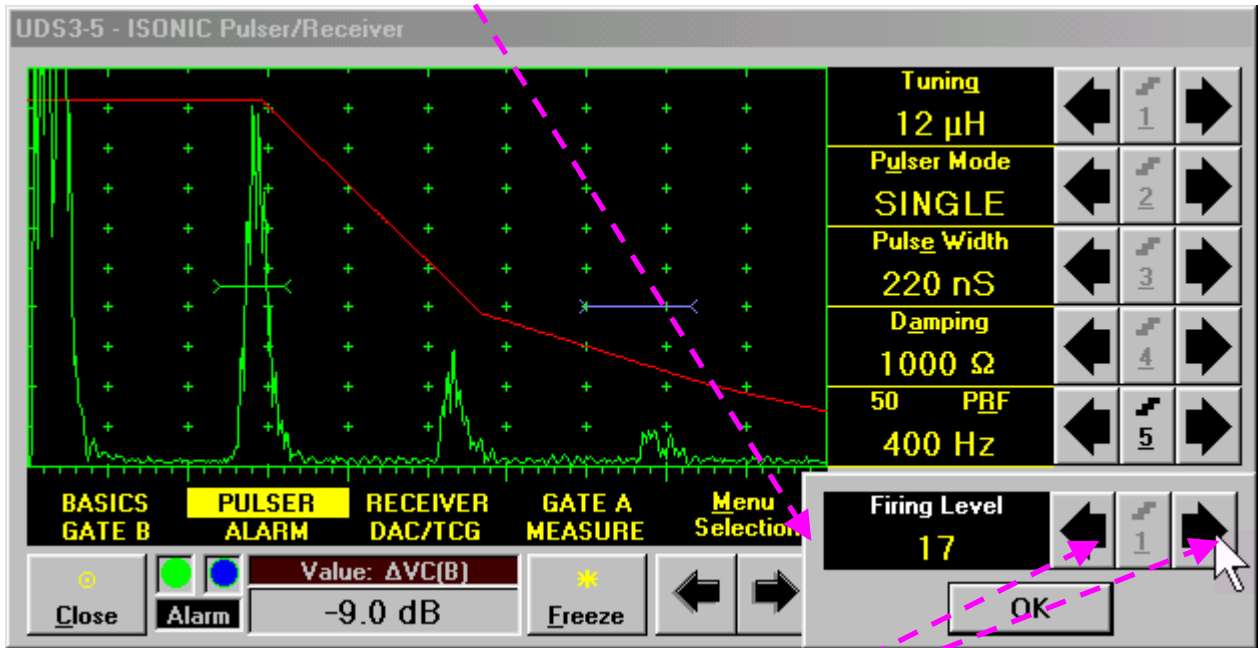


- ◆ **Reject** level may be applied to rectified signals only (Display Modes **Full**, **NegHalf** and **PosHalf** - refer to paragraph 5.2.4 of this Operating Manual)
- ◆ **Reject** setup is also possible through a number of other submenus following the same rules as above

5.2.3. Sub Menu PULSER


Amplitude of initial pulse (Firing Level) is controllable through button  appearing on the main operating surface upon activating submenu **PULSER**

To activate **Firing Level Control** subwindow click on 













To control **Firing Level** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button** Click on  or on any control outside **Firing Level Control** popup window upon completing

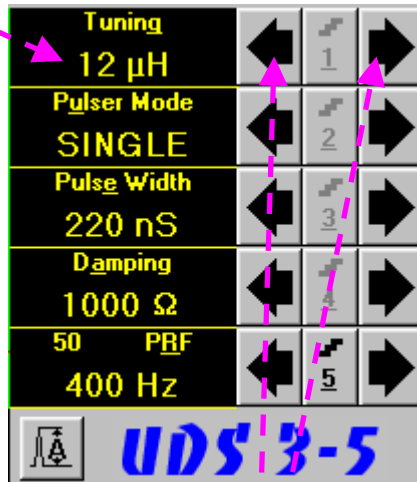
- **Combined**

Click on **Firing Level** ⇒ **Firing Level** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard. Press  or  on front panel keyboard or **Esc** or **Enter** on an external keyboard upon completing



There are 18 grades (1 through 18) for setting **Firing Level** – amplitude of initial pulse is controlled from 50 V (**Firing Level** = 1) to 400 V (**Firing Level** = 18)

Current value of
Tuning
 μH



To control **Tuning** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

- Press 1 on front panel keyboard or **F1** or **<Alt>+<G>** on external keyboard \Rightarrow **Tuning** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

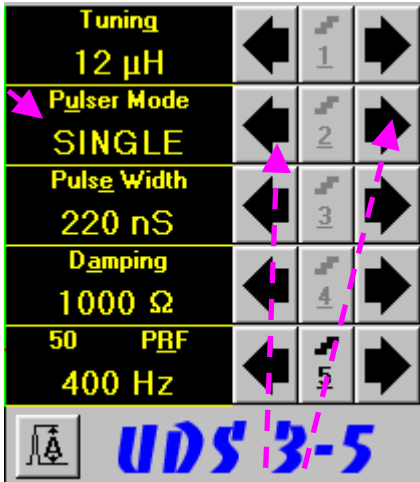
- **Combined**

- Click on **Tuning** \Rightarrow **Tuning** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard




















- ◆ There are 16 (sixteen) matching coils, which may be connected at parallel to ultrasonic probe in order to obtain best available probe impedance matching / signal to noise ratio. Possible values for the matching coil inductance are: 2 μH , 7 μH , 12 μH , 17 μH , 24 μH , 29 μH , 34 μH , 39 μH , 41 μH , 46 μH , 51 μH , 56 μH , 63 μH , 68 μH , 73 μH , and 78 μH
- ◆ Setting the **Tuning** to "NO" disconnects matching coil

Current **Pulser Mode**



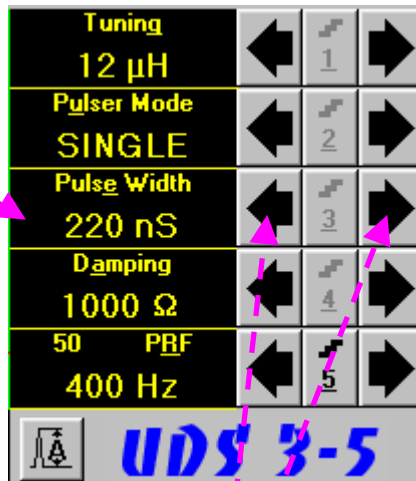
To control **Pulser Mode** the following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate **button**
- **Keyboard**
 - Press  on front panel keyboard or **F2** or **<Alt>+<U>** on external keyboard ⇒ **Pulser Mode** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard
- **Combined**
 - Click on **Pulser Mode** ⇒ **Pulser Mode** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



There are two Pulser Modes available: **Single** and **Dual**

Current value of **Pulse Width**
(Duration of Square Wave
Initial Pulse)
ns












To control **Pulse Width** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

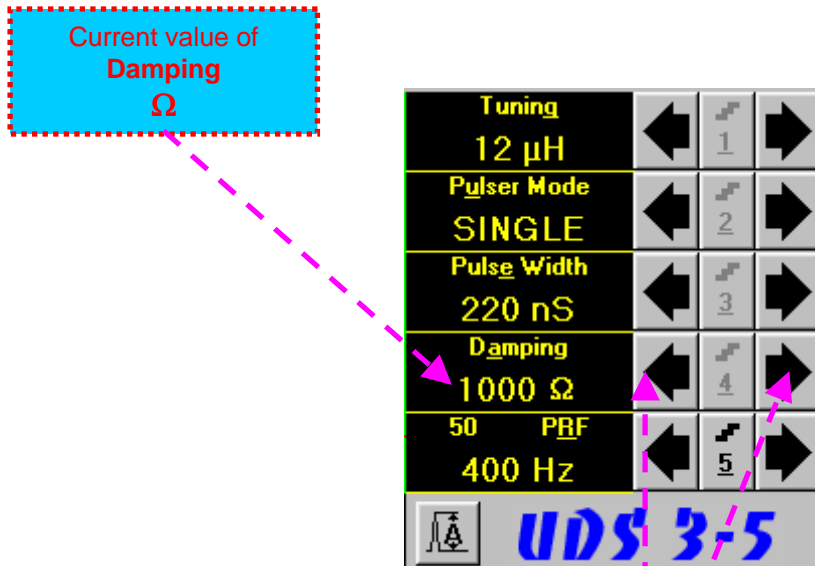
- Press  on front panel keyboard or **F3** or **<Alt>+<E>** on external keyboard ⇒ **Pulse Width** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Pulse Width** ⇒ **Pulse Width** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



- ◆ **Pulse Width** (Duration of Square Wave Initial Pulse) is tunable between 65 ns to 600 ns in 5 ns steps
- ◆ Attempt to decrease **Pulse Width** below 65 ns switches to *excitation of Spike Pulse instead of Square Wave Pulse*. There are 4 (four) energy levels available for the **Spike Pulse** excitation; said levels are indicated in the **Pulse Width** field:
 - **Spike (250μJ)** – spike pulse with the 250 μJ energy of excitation
 - **Spike (160μJ)** – spike pulse with the 160 μJ energy of excitation
 - **Spike (90μJ)** – spike pulse with the 90 μJ energy of excitation
 - **Spike (40μJ)** – spike pulse with the 40 μJ energy of excitation
- ◆ The energy of **Spike Pulse** excitation is controllable through the same controls as **Pulse Width**
- ◆ Attempt to increase energy of **Spike Pulse** excitation above 250 μJ switches to *excitation of Square Wave Pulse instead of Spike Pulse*
- ◆ Energy levels of **Spike Pulse** excitation are calibrated at **Firing Level = 18**












To control **Damping** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

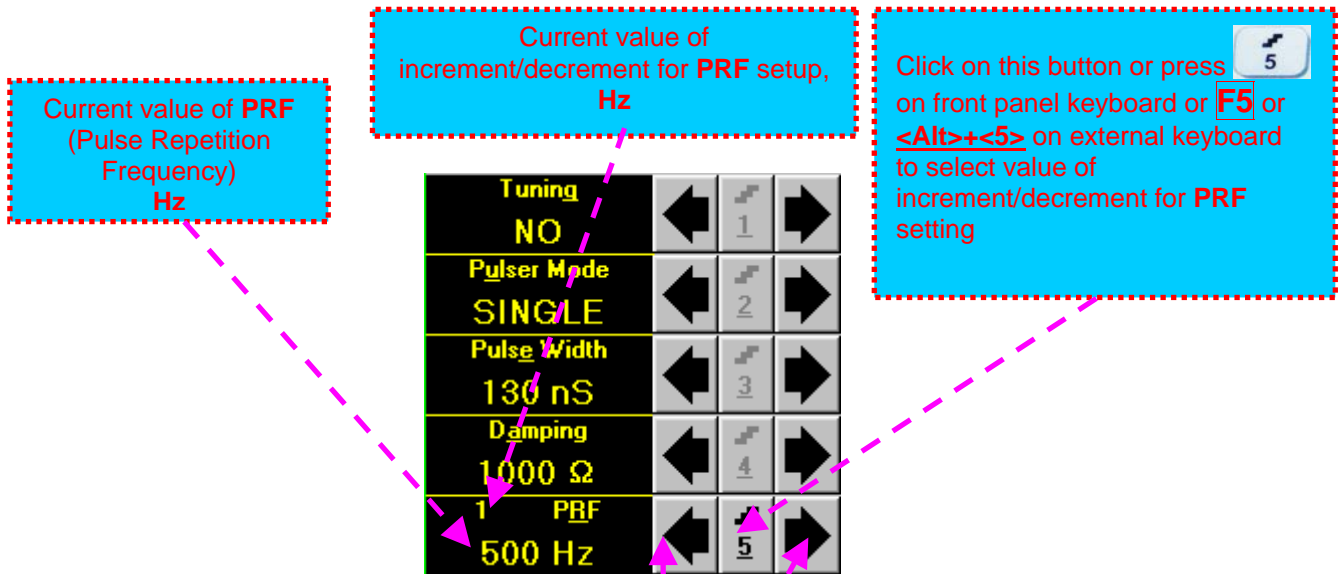
- Press  on front panel keyboard or **F4** or **<Alt>+<A>** on external keyboard ⇒ **Damping** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Damping** ⇒ **Damping** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



There are 17 (seventeen) discrete damping resistors, which may be connected at parallel to ultrasonic probe, their resistance values are 25 Ω , 30 Ω , 35 Ω , 40 Ω , 45 Ω , 56 Ω , 65 Ω , 76 Ω , 90 Ω , 115 Ω , 130 Ω , 150 Ω , 180 Ω , 240 Ω , 320 Ω , 500 Ω , and 1000 Ω












To control **PRF** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press  on front panel keyboard or **F5** or **<Alt>+<R>** on external keyboard ⇒ **PRF** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **PRF** ⇒ **PRF** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



UDS 3-5 is equipped with a protection circuit preventing probe damage, which may be caused by not proper setting of **Tuning**, or **Damping**, or **Pulse Width**, or **Firing Level**, or combination of them. Protection circuit limits total energy delivered to firing output through *automatic reducing of PRF until reaching safe mode of operation*

5.2.4. Sub Menu RECEIVER

Current setting of **Filter** representing central frequency of the narrow band (resonant) Filter
MHz










0.5 <u>G</u> ain	←	↕	→
11 dB	←	1	→
<u>F</u> ilter	←	↕	→
BB	←	2	→
<u>F</u> requency	←	↕	→
0.35-35 MHz	←	3	→
<u>D</u> isplay	←	↕	→
Full	←	4	→
5 <u>R</u> eject	←	↕	→
0 %	←	5	→

To control **Filter** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press  on front panel keyboard or **F2** or **<Alt>+<L>** on external keyboard ⇒ **Filter** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

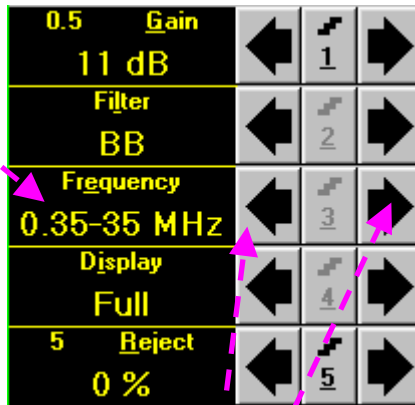
- **Combined**

- Click on **Filter** ⇒ **Filter** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



- ◆ The are 6 (six) narrow bands (resonant) filters with central frequencies as below:
 - **0.5 ± 0.15 MHz** – recommended for 0.3 ... 0.8 MHz probes
 - **1 ± 0.3 MHz** – recommended for 0.8 ... 1.5 MHz probes
 - **2 ± 0.6 MHz** – recommended for 1.5 ... 3.2 MHz probes
 - **4 ± 1.2 MHz** – recommended for 3.2 ... 7.5 MHz probes
 - **10 ± 3 MHz** – recommended for 7.5 ... 12.4 MHz probes
 - **15 ± 4.5 MHz** – recommended for 12.4 ... 17 MHz probes
- ◆ The narrow band (resonant) filtering is negated upon setting **Filter** to **BB** (Broad Band)

Current **Frequency** band of the receiver
MHz
From – To












To control receiver's **Frequency** band the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press  on front panel keyboard or **F3** or **<Alt>+<E>** on external keyboard ⇒ **Frequency** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Frequency** ⇒ **Frequency** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



There are 28 (twenty eight) receiver's **Frequency** bands:

0.35 – 35 MHz	0.35 – 19.5 MHz	0.35 – 13 MHz	0.35 – 5.2 MHz	0.35 – 2.6 MHz	0.35 – 1.3 MHz	0.35 – 0.65 MHz
0.7 – 35 MHz	0.7 – 19.5 MHz	0.7 – 13 MHz	0.7 – 5.2 MHz	0.7 – 2.6 MHz	0.7 – 1.3 MHz	
1.4 – 35 MHz	1.4 – 19.5 MHz	1.4 – 13 MHz	1.4 – 5.2 MHz	1.4 – 2.6 MHz		
2.8 – 35 MHz	2.8 – 19.5 MHz	2.8 – 13 MHz	2.8 – 5.2 MHz			
7 – 35 MHz	7 – 19.5 MHz	7 – 13 MHz				
10.5 – 35 MHz	10.5 – 19.5 MHz	10.5 – 13 MHz				

Current mode of signal presentation (**Display**)










0.5 Gain 11 dB	←	1	→
Filter BB	←	2	→
Frequency 0.35-35 MHz	←	3	→
Display Full	←	4	→
5 Reject 0 %	←	5	→

To select mode of signal presentation (**Display**) the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

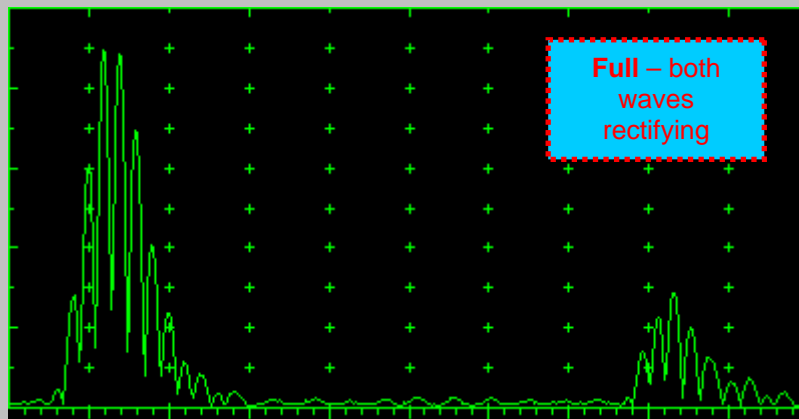
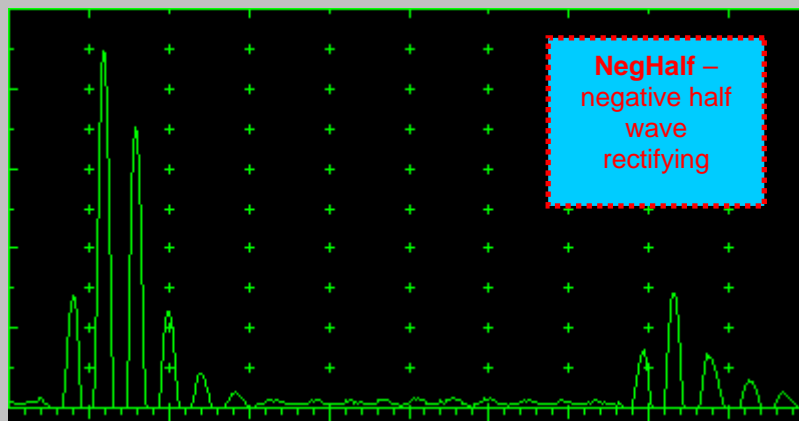
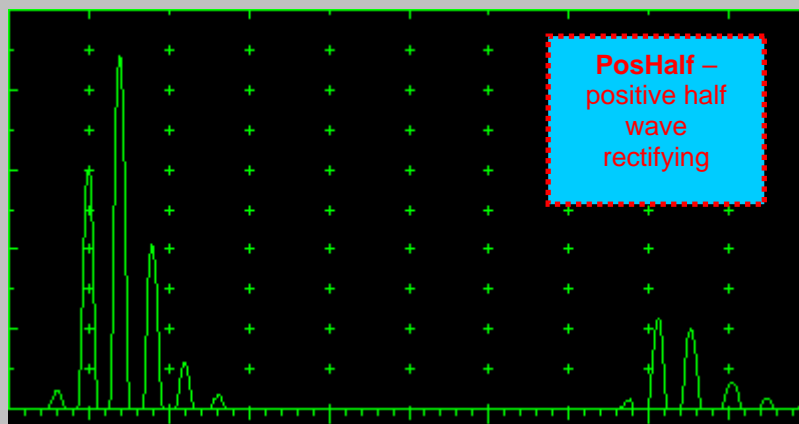
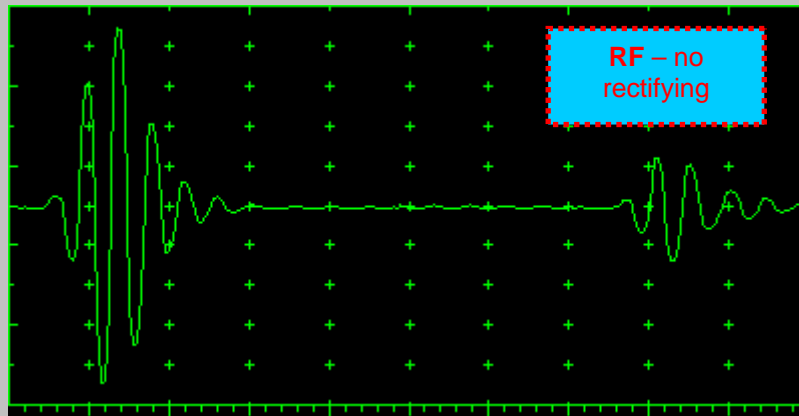
- Press  on front panel keyboard or **F4** or **<Alt>+<I>** on external keyboard ⇒ **Display** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

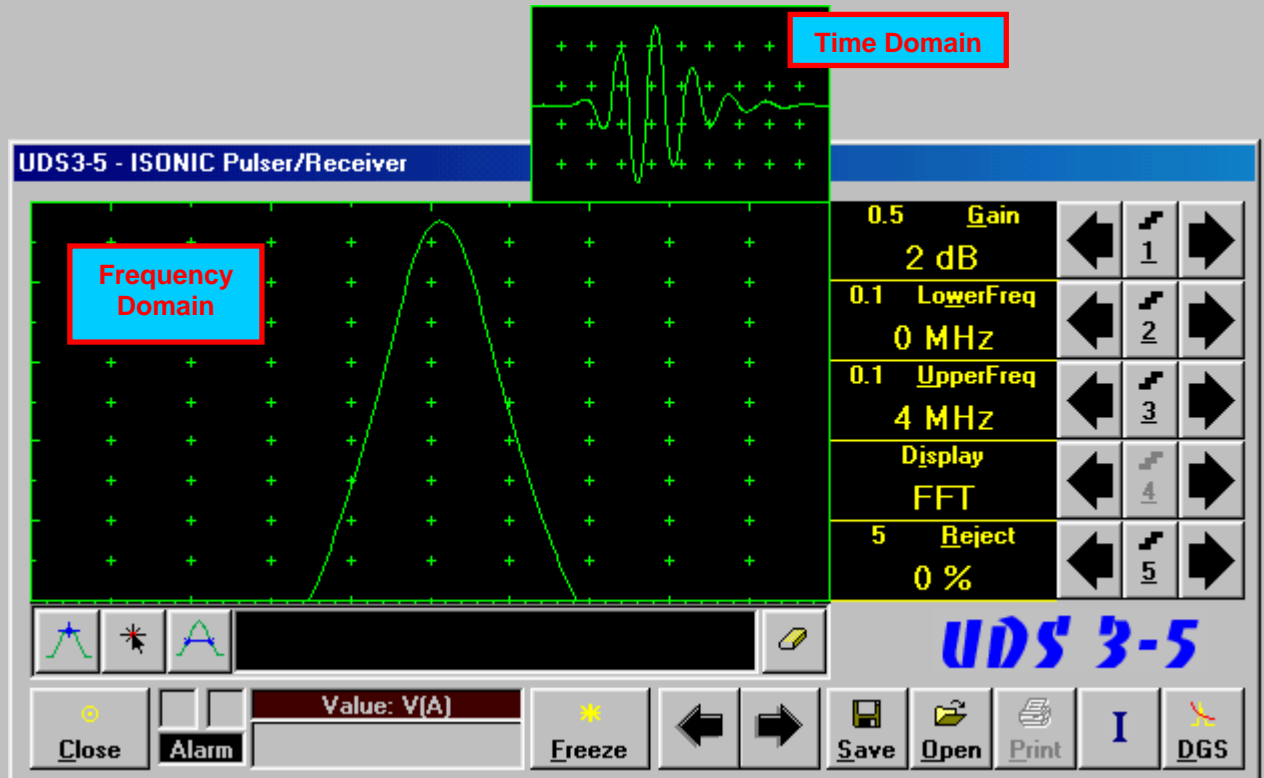
- Click on **Display** ⇒ **Display** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



- ◆ There are four **Display modes** for *time domain signal presentation*:



- ◆ Frequency domain signal presentation is available through **FFT Display mode**. Refer to paragraph 5.2.14 of this Operating Manual for instructions related to frequency domain signal presentation



Frequency Domain Signal presentation is not possible if:

- DAC is active (refer to paragraph 5.2.9 of this Operating Manual)
- TCG is active (refer to paragraph 5.2.9 of this Operating Manual)

5.2.5. Sub Menu GATE A

Current status of Gate A

0.5	Gain	←	1	→
3	dB	←	2	→
aSwitch	ON	←	3	→
2	aStart	←	4	→
26	mm	←	5	→
2	aWidth	←		→
8	mm	←		→
10	aThreshold	←		→
45	%	←		→

To switch **Gate A ON / OFF** the following manipulations are applicable:

- **Mouse / Touch Screen**

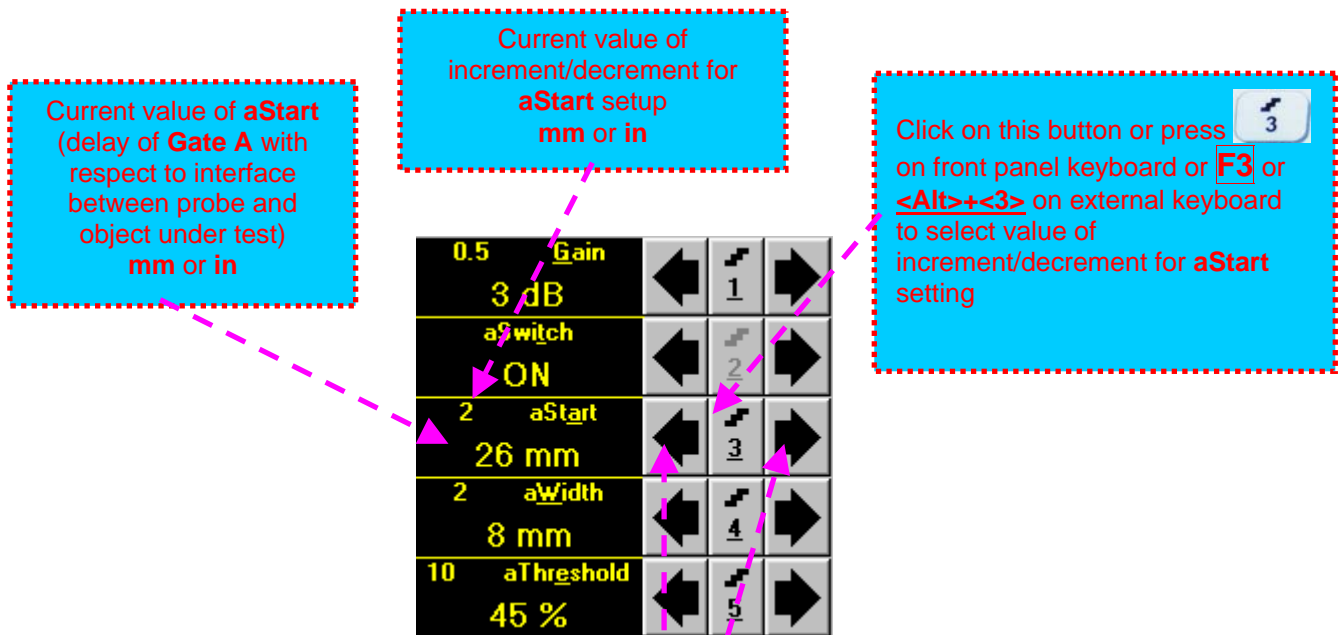
- Click or press and hold on the appropriate button

- **Keyboard**


















- Press 2 on front panel keyboard or **F2** or **<Alt>+<T>** on external keyboard ⇒ **aSwitch** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

- **Combined**

- Click on **aSwitch** ⇒ **aSwitch** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

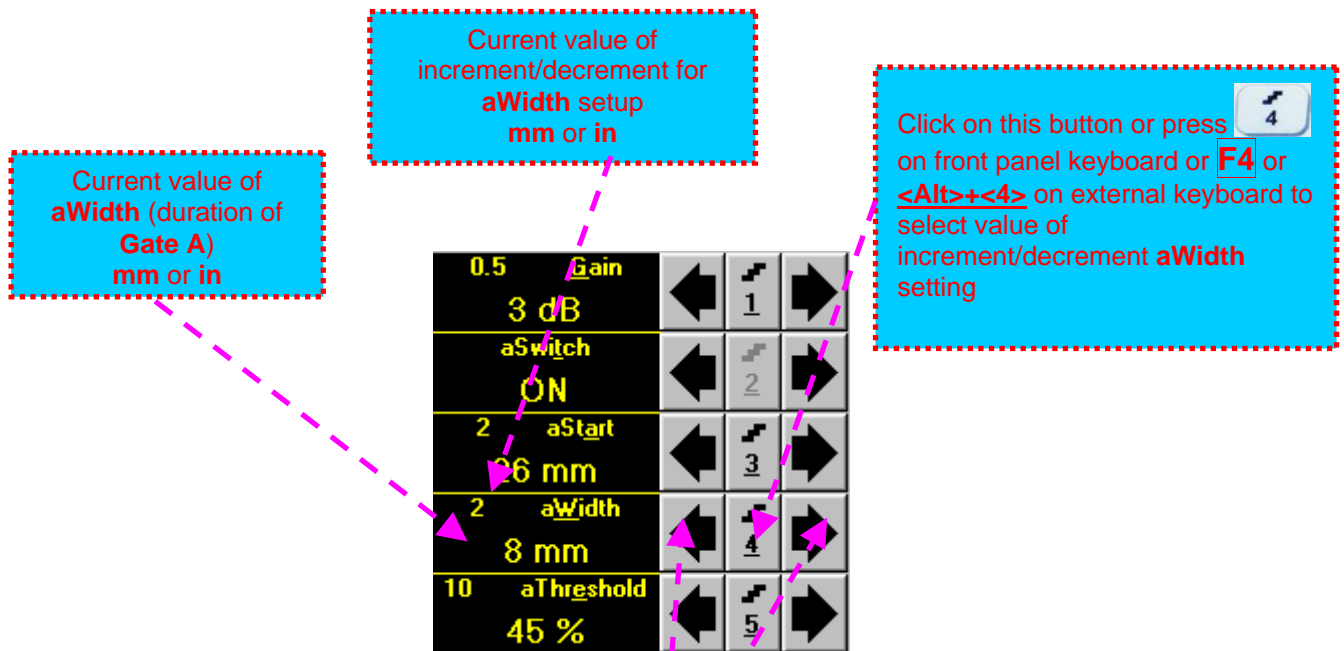


To control delay of **Gate A (aStart)** the following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate button
- **Keyboard**
 - Press  on front panel keyboard or **F3** or **<Alt>+<A>** on external keyboard ⇒ **aStart** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard
- **Combined**
 - Click on **aStart** ⇒ **aStart** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard
- **Drag and Drop (refer to paragraph 5.2.7 of this Operating Manual)**



- ◆ **aStart** setup is also possible through a number of other submenus following the same rules as above
- ◆ Counting of **aStart** value starts after finishing of **Probe Delay** count (refer to paragraphs 5.2.12 and 5.2.13 of this Operating Manual)












To control duration of **Gate A (aWidth)** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

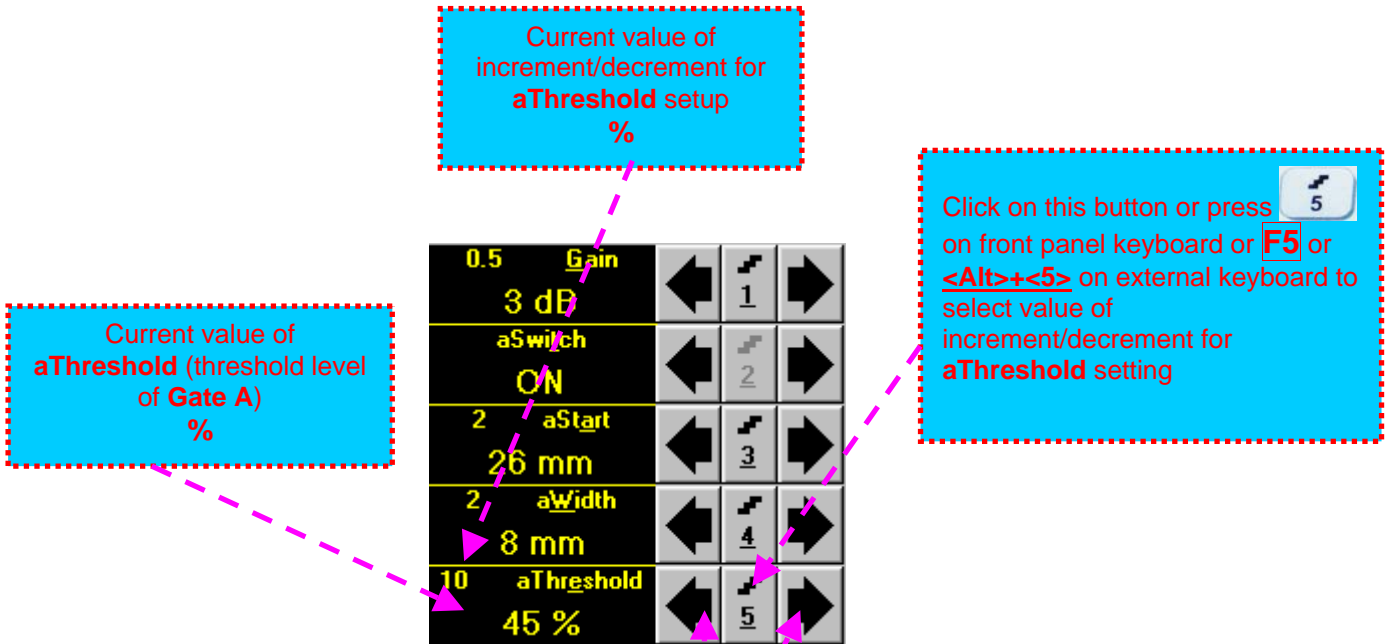
- **Keyboard**

- Press  on front panel keyboard or **F4** or **<Alt>+<W>** on external keyboard ⇒ **aWidth** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **aWidth** ⇒ **aWidth** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Drag and Drop (refer to paragraph 5.2.7 of this Operating Manual)**



To control threshold level of **Gate A** (**aThreshold**) the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press 5 on front panel keyboard or **F5** or **<Alt>+<E>** on external keyboard ⇒ **aThreshold** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **aThreshold** ⇒ **aThreshold** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Drag and Drop (refer to paragraph 5.2.7 of this Operating Manual)**

5.2.6. Sub Menu GATE B

Current status of Gate B

0.5	Gain	←	1	→
3	dB	←	2	→
bSwitch	ON	←	3	→
2	bStart	←	4	→
47.9	mm	←	5	→
2	bWidth	←		→
13.2	mm	←		→
10	bThreshold	←		→
40	%	←		→

To switch **Gate B ON / OFF** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

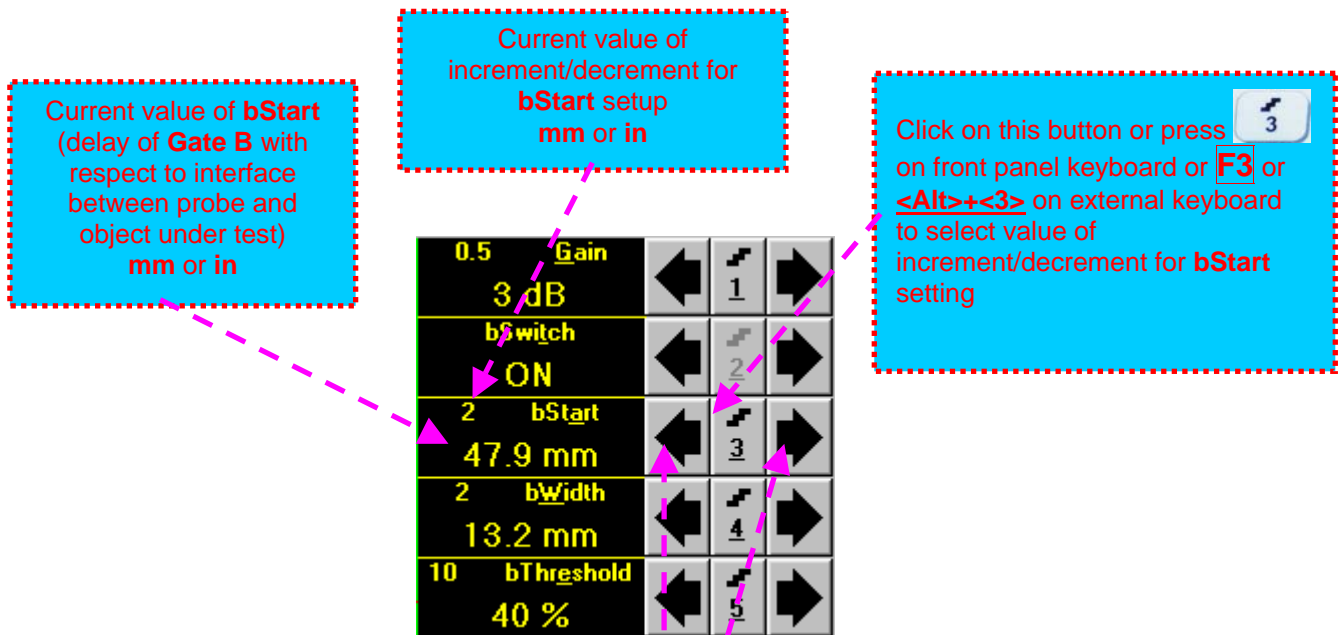
- Press 2 on front panel keyboard or **F2** or **<Alt>+<T>** on external keyboard ⇒ **bSwitch** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

- **Combined**

- Click on **bSwitch** ⇒ **bSwitch** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard



Counting of **bStart** value starts after finishing of **Probe Delay** count (refer to paragraph 5.2.12 and 5.2.13 of this Operating Manual)












To control delay of **Gate B (bStart)** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

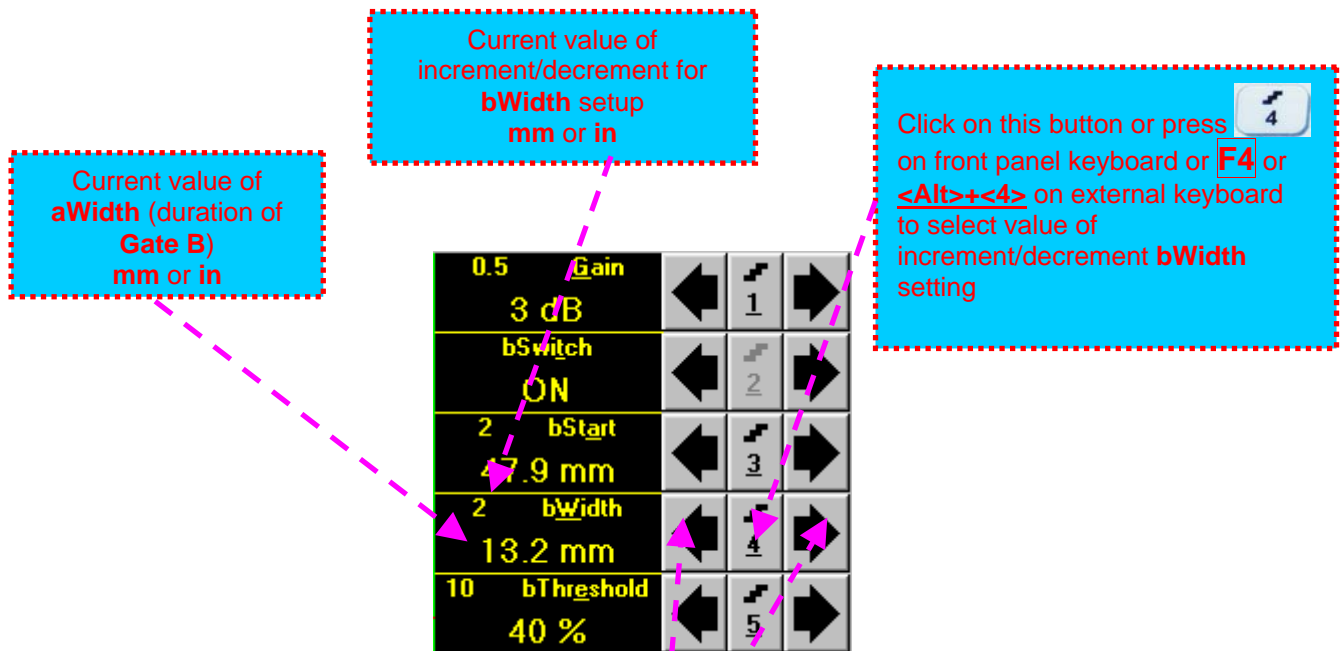
- **Keyboard**

- Press  on front panel keyboard or **F3** or **<Alt>+<A>** on external keyboard ⇒ **bStart** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **bStart** ⇒ **bStart** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Drag and Drop (refer to paragraph 5.2.7 of this Operating Manual)**



To control duration of **Gate B (bWidth)** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

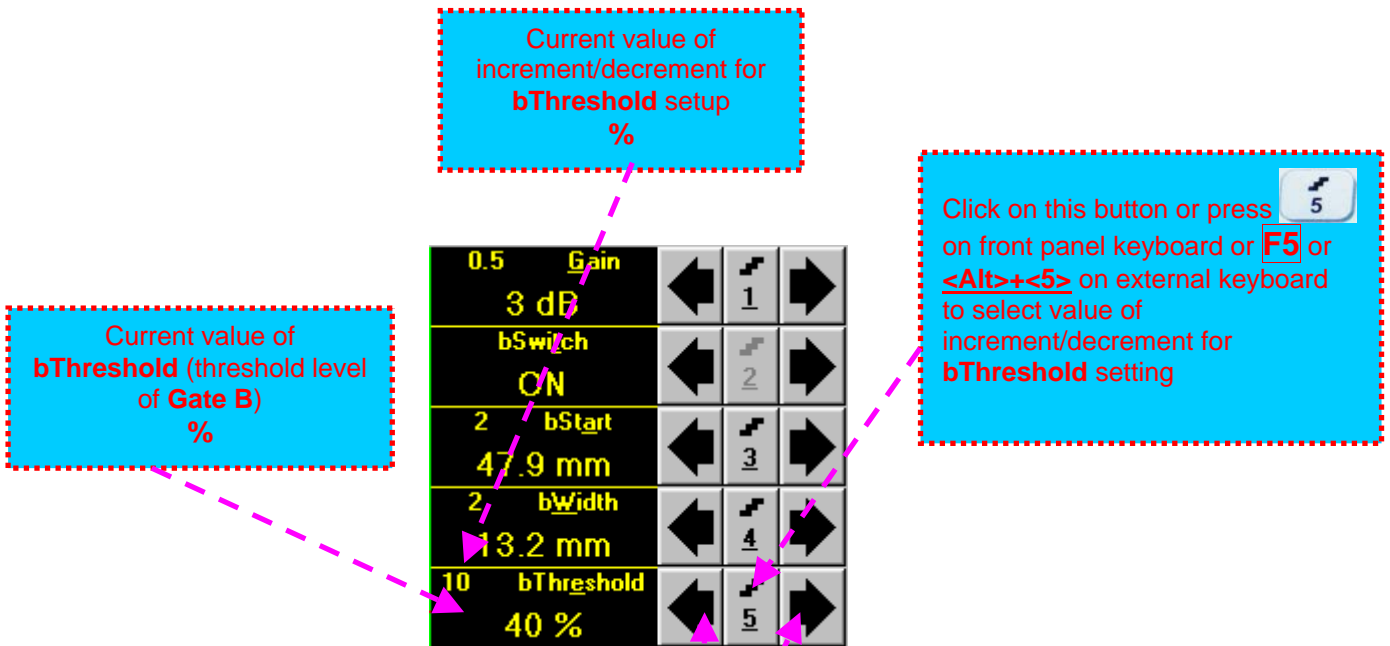
- **Keyboard**

- Press on front panel keyboard or **F4** or **<Alt>+<W>** on external keyboard ⇒ **bWidth** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **bWidth** ⇒ **bWidth** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Drag and Drop (refer to paragraph 5.2.7 of this Operating Manual)**



To control threshold level of **Gate B** (**bThreshold**) the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

- Press on front panel keyboard or **F5** or **<Alt>+<E>** on external keyboard ⇒ **bThreshold** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

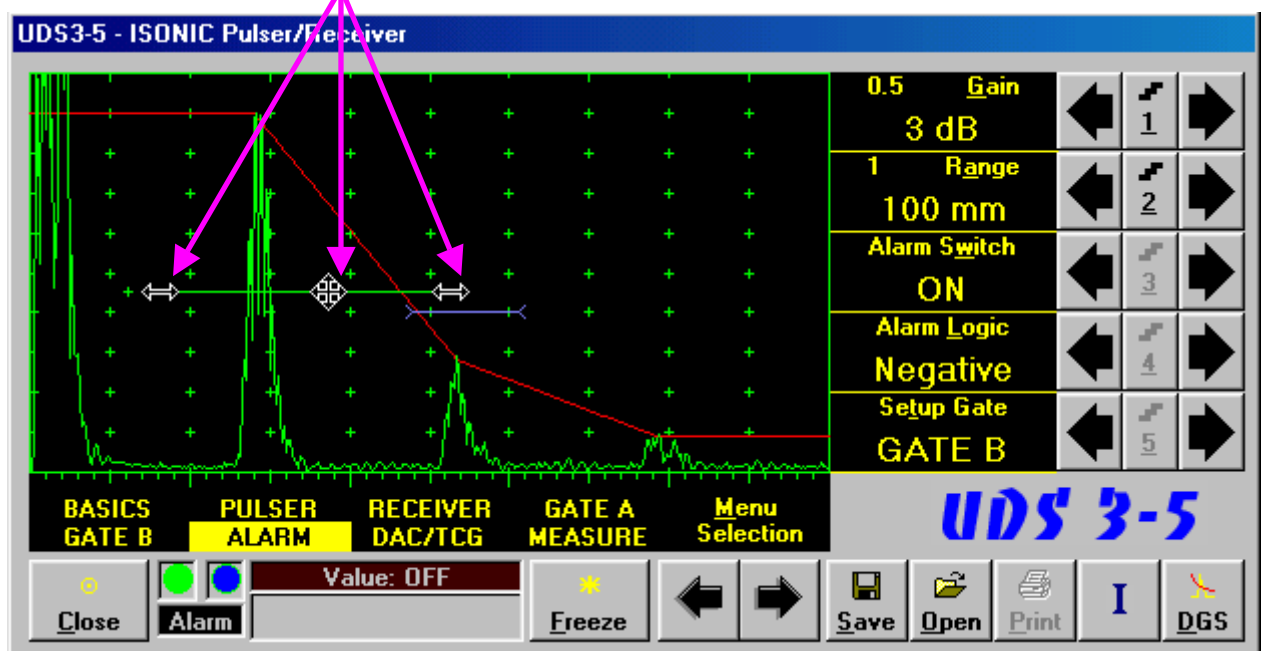
- **Combined**

- Click on **bThreshold** ⇒ **bThreshold** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Drag and Drop (refer to paragraph 5.2.7 of this Operating Manual)**

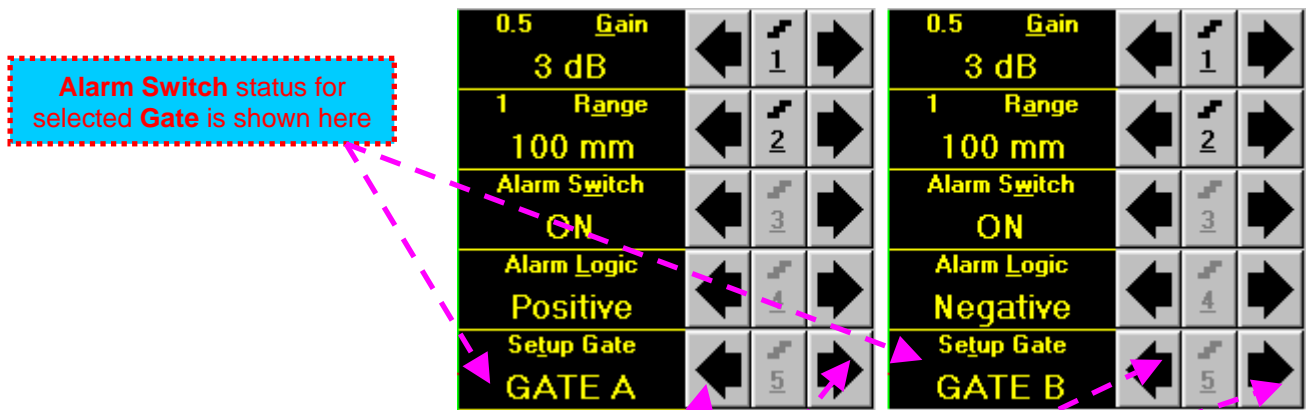
5.2.7. Drag and Drop: Gate A and Gate B

Gate A and Gate B may be manipulated through Drag and Drop provided that they are visible in the A-Scan area. Mouse pointer changes shape while placing it above appropriate section of a gate



To manage a gate just press and hold left mouse button or touch screen stylus and drag, then drop through releasing of left mouse button or touch screen stylus

5.2.8. Sub Menu ALARM












To select a **Gate** for **Alarm Setup** the following manipulations are applicable:









- **Mouse / Touch Screen**

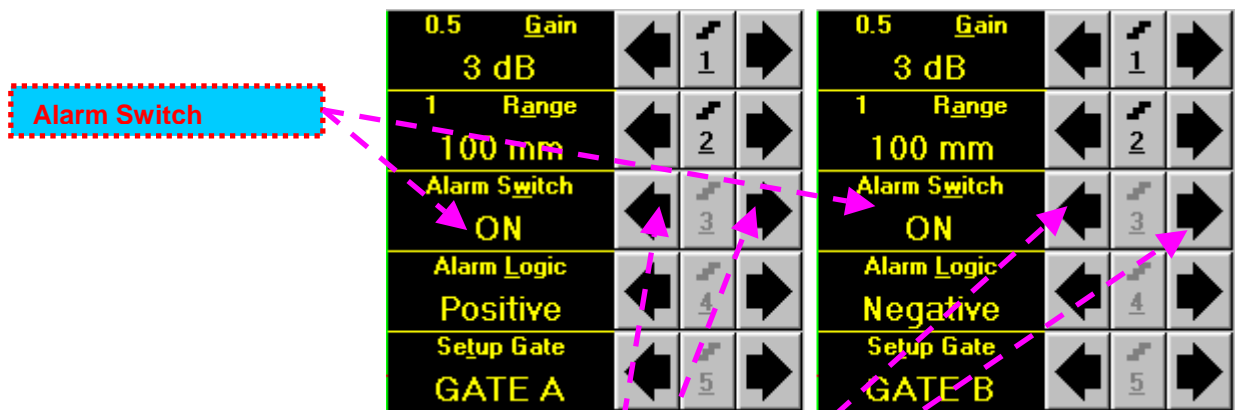
- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press  on front panel keyboard or **F5** or **<Alt>+<T>** on external keyboard ⇒ **Setup Gate** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Setup Gate** ⇒ **Setup Gate** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



To control **Alarm Switch** the following manipulations are applicable:

- **Mouse / Touch Screen**

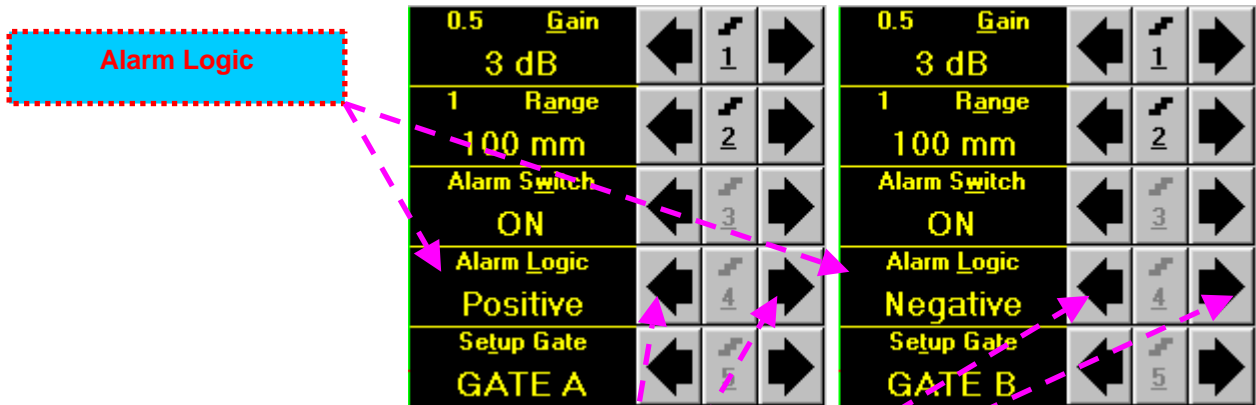
- Click or press and hold on the appropriate button

- **Keyboard**

- Press 3 on front panel keyboard or **F3** or **<Alt>+<W>** on external keyboard ⇒ **Alarm Switch** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

- **Combined**

- Click on **Alarm Switch** ⇒ **Alarm Switch** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard












To select **Alarm Logic** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

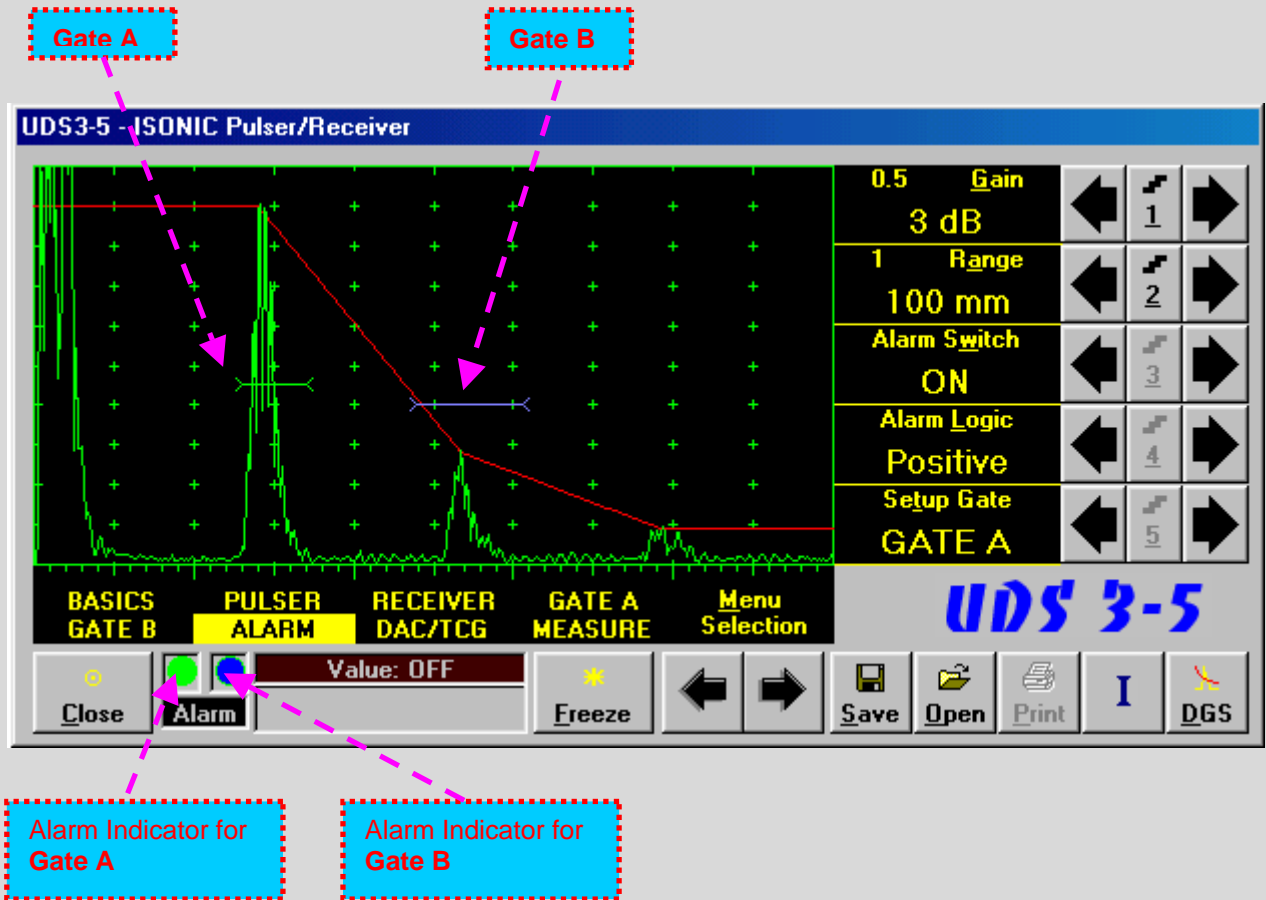
- Press  on front panel keyboard or **F4** or **<Alt>+<L>** on external keyboard ⇒ **Alarm Logic** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Alarm Logic** ⇒ **Alarm Logic** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

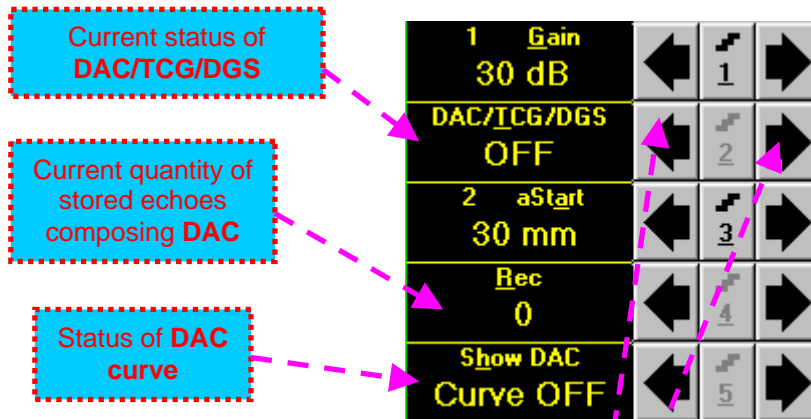


Alarm Example



- ◆ There is a pulse matching with **Gate A** and exceeding its threshold; the **Alarm Logic** setting for **Gate A** is **Positive** ⇒ **Alarm Indicator** for **Gate A** is active
- ◆ There is a pulse matching with **Gate B** and not exceeding its threshold; the **Alarm Logic** setting for **Gate B** is **Negative** ⇒ **Alarm Indicator** for the **Gate B** is active

5.2.9. Sub Menu DAC/TCG



To select required mode for **DAC/TCG/DGS** the following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate button
- **Keyboard**
 - Press on front panel keyboard or **F2** or **<Alt>+<T>** on external keyboard ⇒ **DAC/TCG/DGS** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard
- **Combined**
 - Click on **DAC/TCG/DGS** ⇒ **DAC/TCG/DGS** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



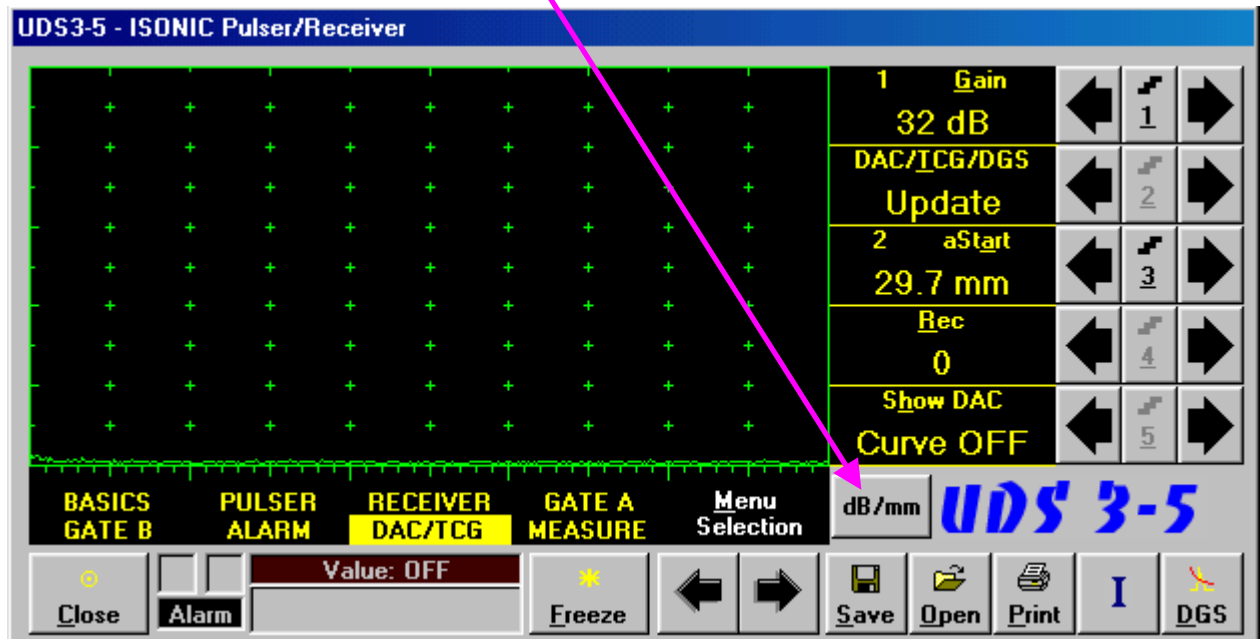
- ◆ There are four possible modes for **DAC/TCG**:
 - There are four possible modes for **DAC/TCG**:
 - **OFF** - **DAC Curve** switches automatically to **OFF** while in **OFF**
 - **DAC** - available if quantity of stored echoes is 2 (two) or more. **DAC Curve** switches automatically to **ON** while in **DAC** mode. Both experimental and theoretical methods for creating **DAC** are available
 - **TCG** - available if quantity of stored echoes is 2 (two) or more. **DAC Curve** switches automatically to **OFF** while in **TCG** mode
 - **Update** - allows to create/update new/existing **DAC**. **Update** of existing **DAC** performed through erasing of a number of sequentially recorded echoes, starting from the latest one, and/or recording of new echoes. The maximal number of echoes recorded into the one **DAC** is 40 (forty). **DAC Curve** switches automatically to **ON** if the number of recorded echoes is 2 (two) or more and switches automatically to **OFF** if number of recorded echoes is less than 2 (two) while in **Update** mode
- ◆ It is possible to Create / Modify / Activate **DAC** and **TCG** for all **Display** modes (**RF**, **Full**, **Negative**, and **Positive**)
- ◆ To create / modify **DAC/TCG** or **DGS** refer to paragraphs 5.2.10, 5.2.11 of this Operating Manual

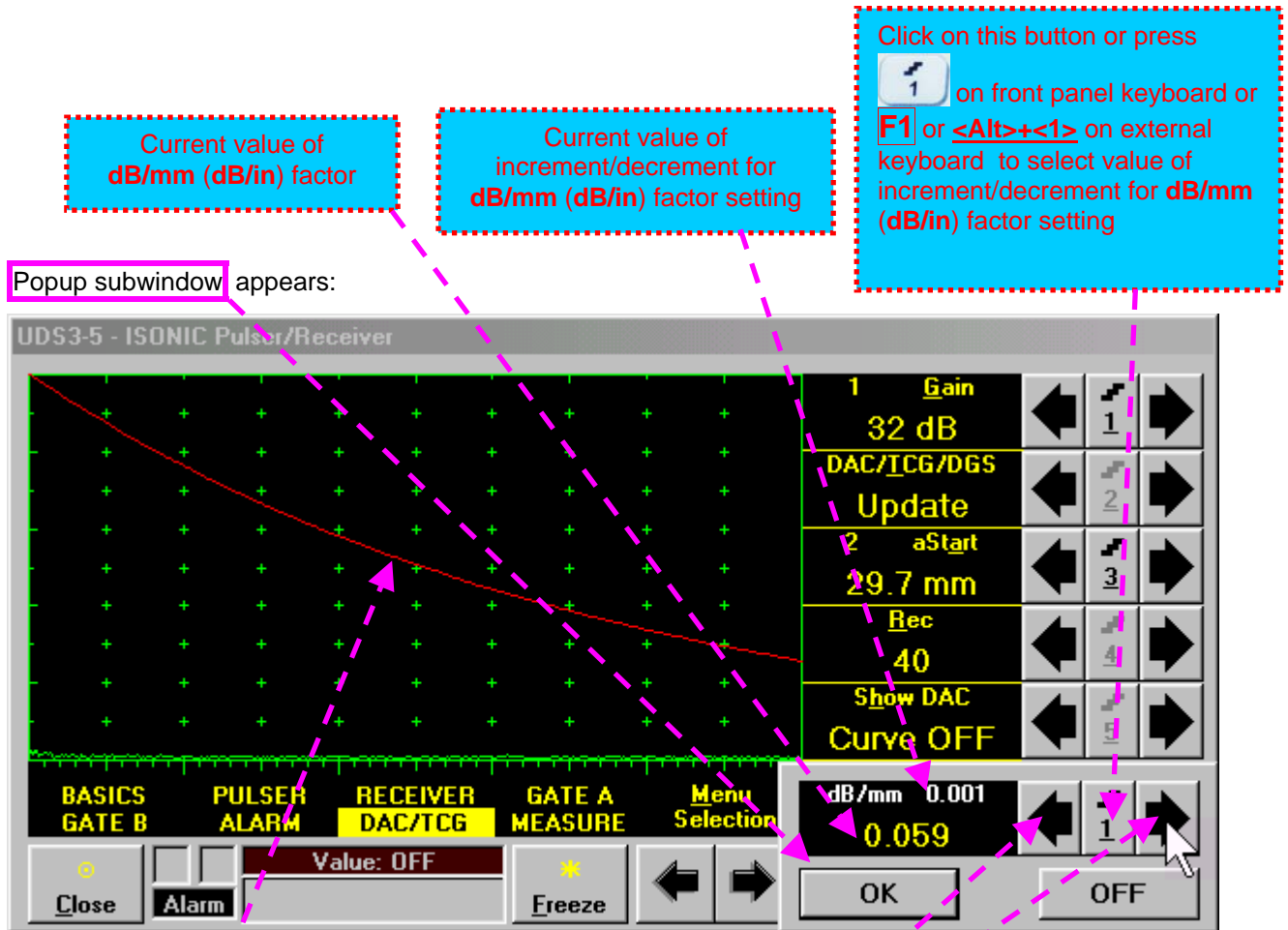
5.2.10. Create / Modify DAC

5.2.10.1 Theoretical DAC: dB/mm (dB/in)

Theoretical **DAC** represents pure exponential law for distance amplitude curve; said law is determined by **dB/mm (dB/in)** factor and value of **Probe Delay** - refer to paragraphs 5.2.12, 5.2.13 of this Operating Manual: at zero material travel distance theoretical **DAC** has start point at 100% of A-Scan height

Set **DAC/TCG/DGS** to **Update** then click **on**





Theoretical DAC according to entered **dB/mm (dB/in)** factor

To control **dB/mm (dB/in)** factor the following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate **button**
- **Keyboard**
 - Press , , , on front panel keyboard or , , , on external keyboard

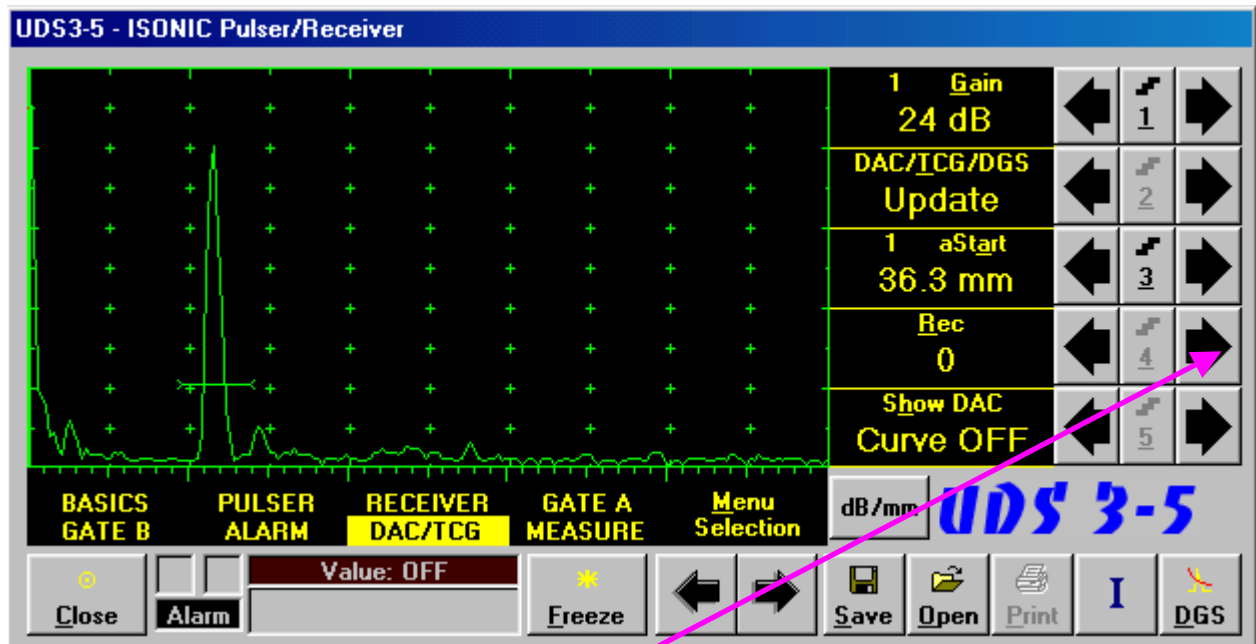
On completing **dB/mm (dB/in)** factor setting click on **OK** or press on front panel keyboard **Enter** on external keyboard. This will return to main operating surface of UDS 3-5 Pulsar Receiver and

activate theoretical **DAC**. Button **dB/mm** becomes green while theoretical **DAC** is setup; set **DAC/TCG/DGS** to **DAC** to activate theoretical **DAC** or to **TCG** if it is necessary to perform time correction of gain in accordance with theoretical **DAC** law.

To modify or switch theoretical **DAC** off set **DAC/TCG/DGS** to **Update** then click on **dB/mm**. In the appeared popup subwindow modify value **dB/mm (dB/in)** factor as it is described above or click on **OFF** then on **OK**

5.2.10.2 Experimental DAC: recording signals from variously located reflectors

If theoretical **DAC** is active then it must be switched off according to paragraph 5.2.10.1 of this Operating Manual prior to building of experimental **DAC**. Switch on **Gate A** then set **DAC/TCG/DGS** to **Update**. Place probe onto **DAC** calibration block and maximize echo from the reflector closest to the probe (first echo) then place **Gate A** over received signal and capture first *DAC echo*



To capture *DAC echo* the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click **on**

- **Keyboard**

- Press **4** on front panel keyboard or **F4** or **<Alt>+<R>** on external keyboard ⇒ **Rec** fore color changes to white - then use **↑**, **→**, **←**, **↓** on front panel keyboard or **↑**, **→**, **←**, **↓** on external keyboard

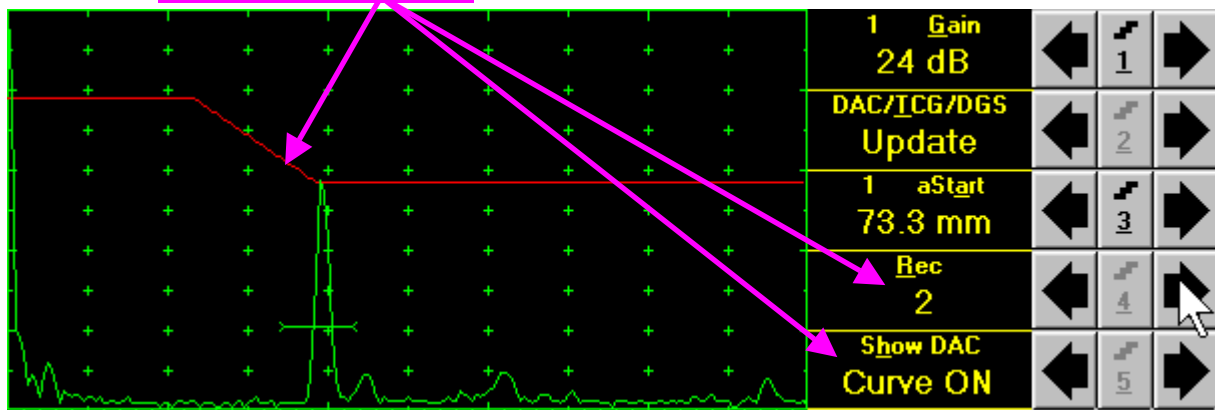
- **Combined**

- Click on **Rec** ⇒ **Rec** fore color changes to white - then use **↑**, **→** on front panel keyboard or **↑**, **→** on external keyboard

As a result the *first DAC echo* will be stored and corresponding **indication** will appear

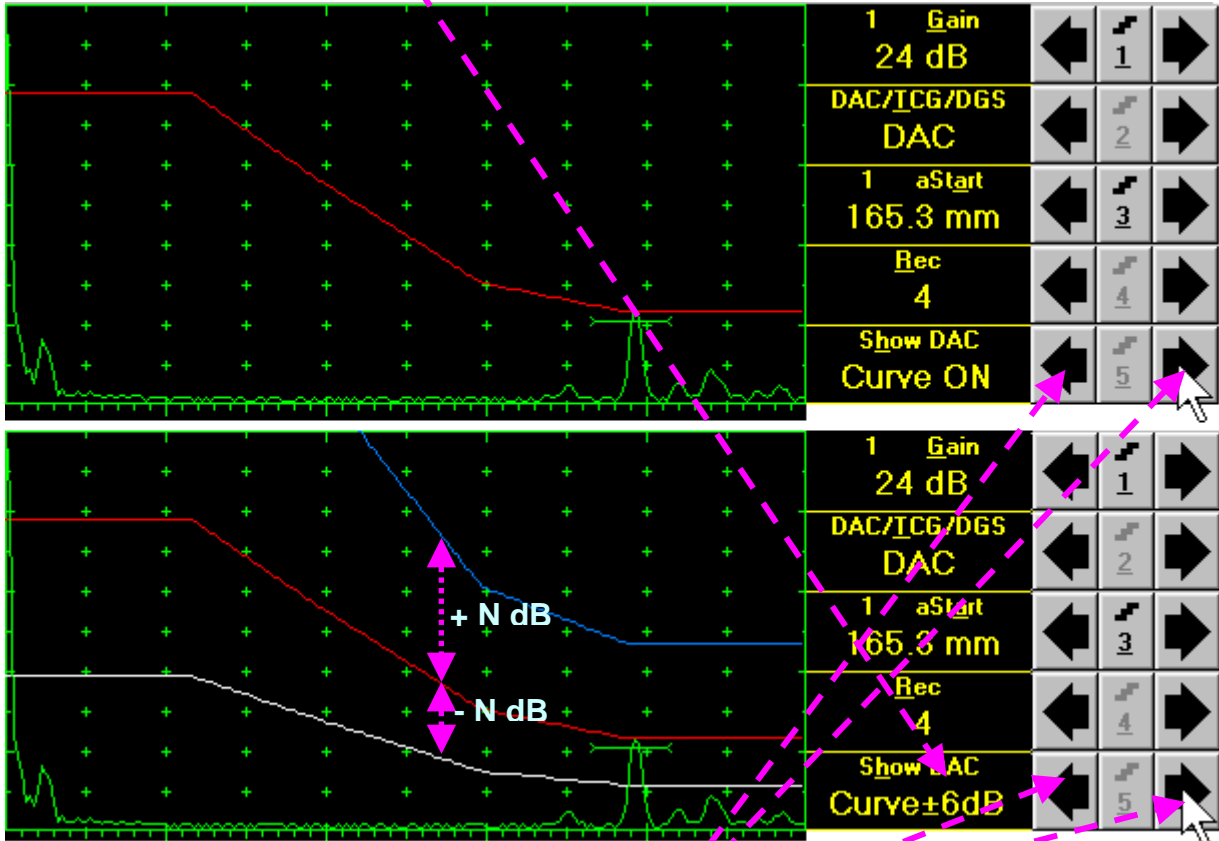


Place probe onto DAC calibration block and maximize echo from next reflector then place **Gate A** over received signal and capture *next DAC echo*. As result next *DAC echo* will be stored causing appropriate modifying of corresponding indications



- ◆ The highest echo in the **Gate A** will be stored said echo may either exceed **Gate A** threshold level or not
- ◆ Stored echo must be below 100% of **A-Scan** height
- ◆ A total number of 40 echoes may be stored one by one by the same way as described above

After creating a DAC (2 or more echoes stored) the DAC and / or TCG may be activated. There are two styles of DAC indication in the DAC mode: **Main Curve Only** and **Main Curve \pm N dB**, where **N may be setup either as 2, 4, 6, 8, 10, 12, or 14 dB**. To proceed follow the rules below:



- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

- Press 5 on front panel keyboard or **F5** or **<Alt>+<H>** on external keyboard \Rightarrow **Show DAC** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

- **Combined**

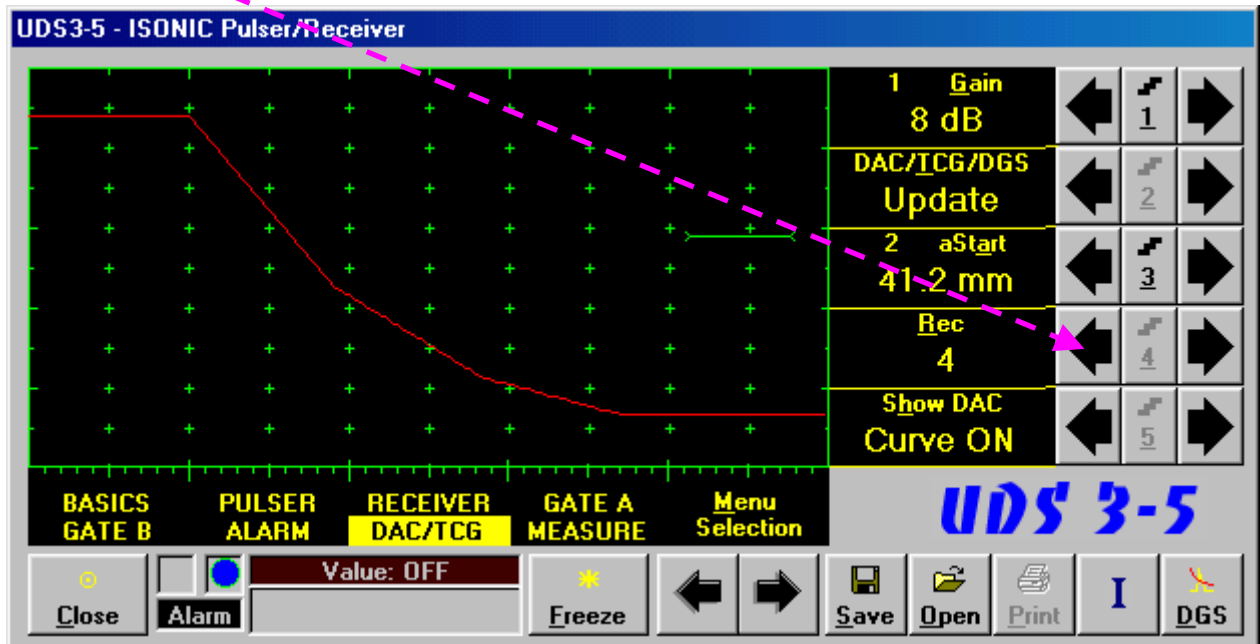
- Click on **Show DAC** \Rightarrow **Show DAC** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

It's possible to erase the last stored echo from the **DAC**. To proceed set the **DAC/TCG/DGS** to **Update**:

To erase the last stored echo from the **DAC** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on on



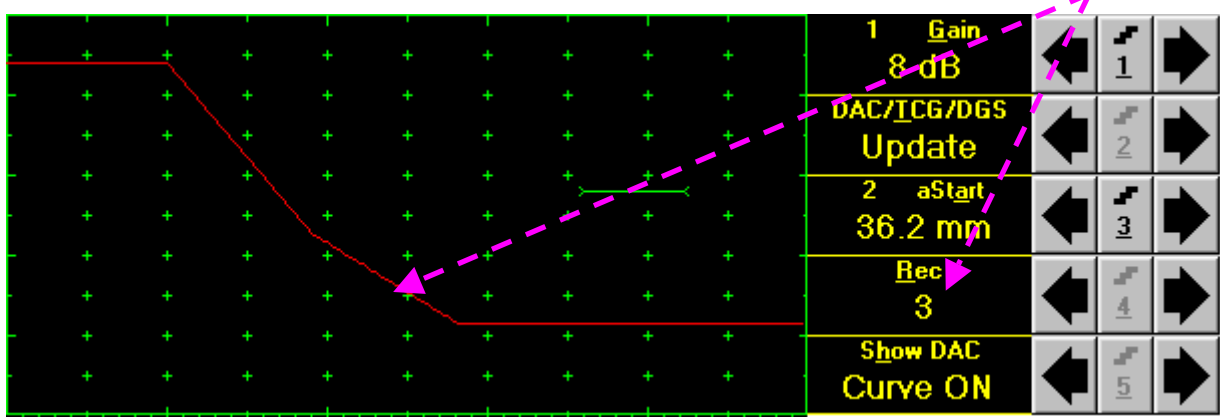
- **Keyboard**

- Press 4 on front panel keyboard or **F4** or **<Alt>+<R>** on external keyboard ⇒ **Rec** fore color changes to white - then use ←, ↓ on front panel keyboard or ←, ↓ on external keyboard



- **Combined**

- Click on **Rec** ⇒ **Rec** fore color changes to white - then use ←, ↓ on front panel keyboard or ←, ↓ on external keyboard

As a result the last stored echo will be erased causing appropriate modifying of corresponding indications

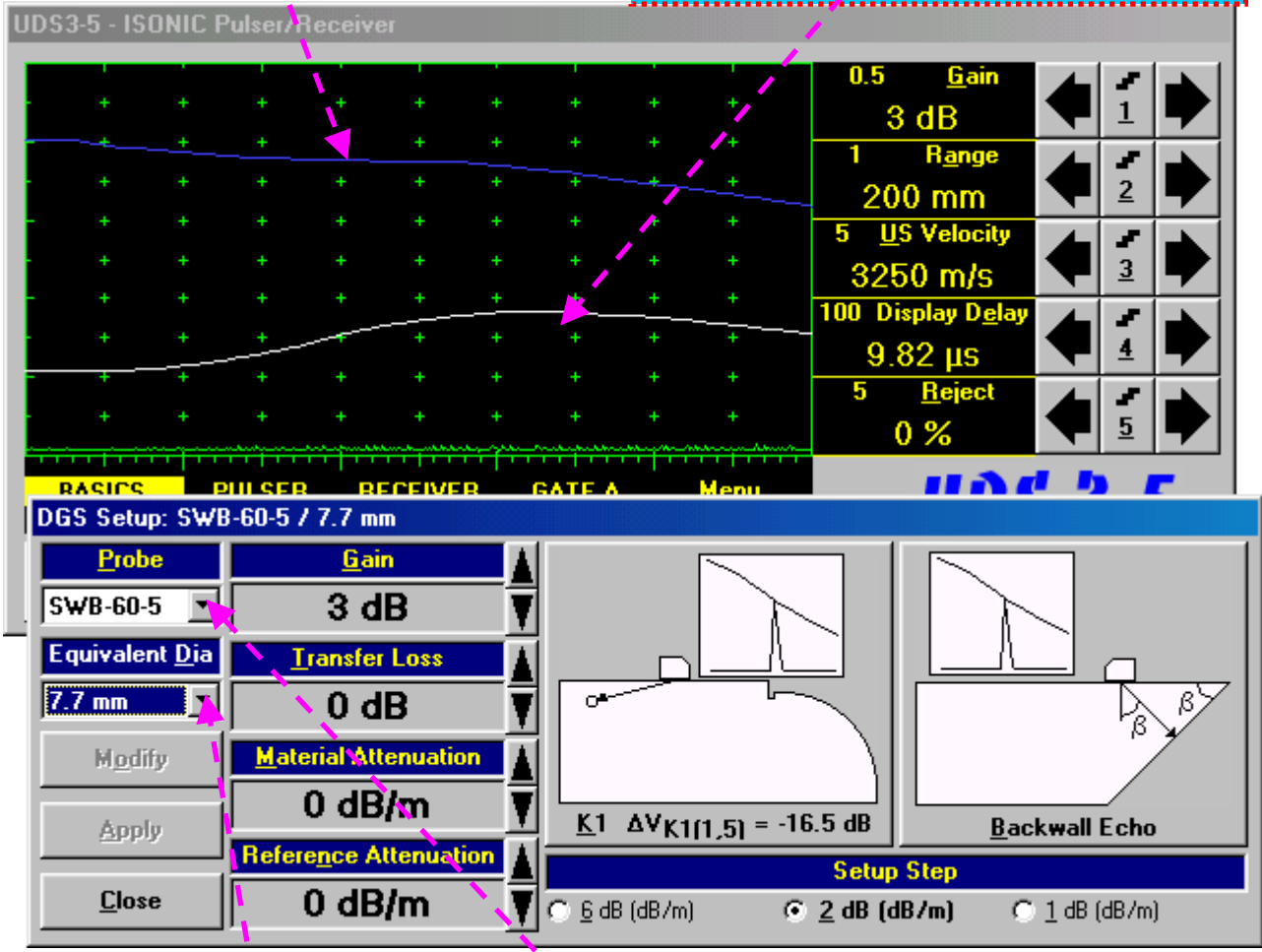


5.2.11. DGS

To setup **DGS** set **Display** to **Full** then click on  or press  on front panel keyboard or **F9** or **<Alt>+<D>** on external keyboard. The following screen appears:

Back echo amplitude as function of metal travel distance in the *reference block* for the selected probe

Disk shaped reflector (flat bottom hole - **FBH**) echo amplitude as function of metal travel distance in the *material under test* for the selected probe and **FBH** diameter



Equivalent Diameter (FBH) selection box

Probe selection box

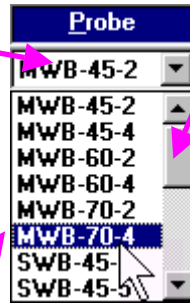
To activate **DGS** follow the steps below:

Step 1: Probe Selection

The following manipulations are applicable for the **Probe** selection:









- **Mouse / Touch Screen**

- Click on **on**
- Scroll probes list to see the selected one











- Click on **selected probe**

- **Keyboard**

- Press **<Alt>+<P>** on external keyboard ⇒ **Probe** fore color changes to white – then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

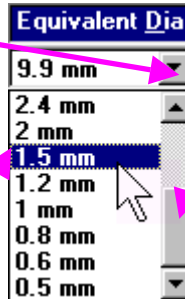
- Click on **Probe** ⇒ **Probe** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

Step 2: Equivalent Diameter of disk shaped reflector (flat bottom hole – FBH)

The following manipulations are applicable for the selection of the **Equivalent Diameter** of disk shaped reflector:

- **Mouse / Touch Screen**

- Click on **on**
- Scroll diameters list to see the selected one




- Click on **selected equivalent diameter**









- **Keyboard**

- Press **<Alt>+<D>** on external keyboard ⇒ **Equivalent Dia** fore color changes to white – then use




on front panel keyboard or , , ,  on external keyboard

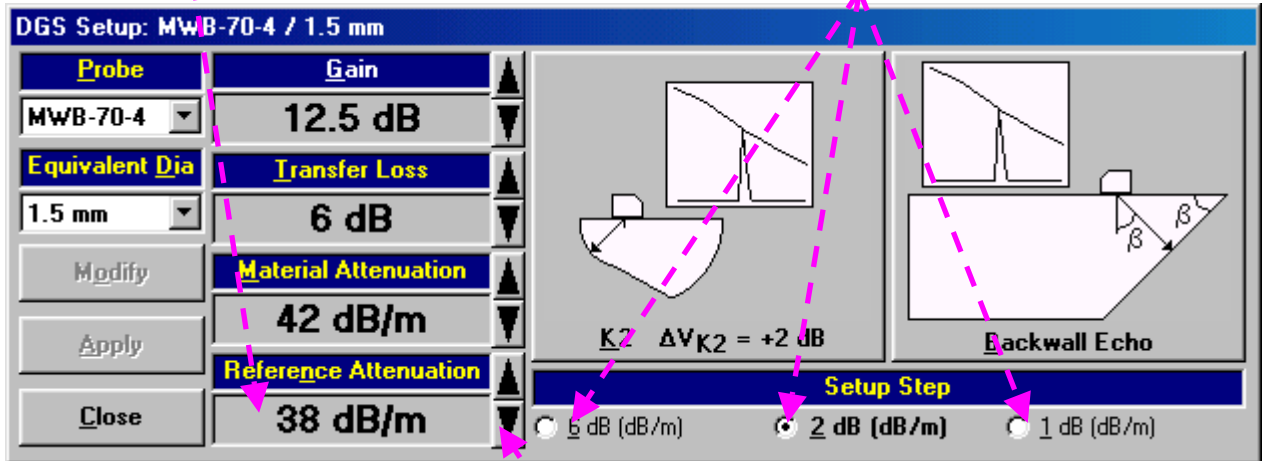
- **Combined**

- Click on **Equivalent Dia** ⇒ **Equivalent Dia** fore color changes to white – then use , , ,  on front panel keyboard or , , ,  on external keyboard

















Step 3: Attenuation in the reference block

Current setting of **Reference Attenuation** (attenuation in the reference block) **dB/m**

Click on **Setup Step** option or press **<Alt>+<1>** or **<Alt>+<2>** or **<Alt>+<6>** on external keyboard to select required value for increment / decrement for setting **Reference Attenuation**. The last selected value of increment / decrement is checked: 



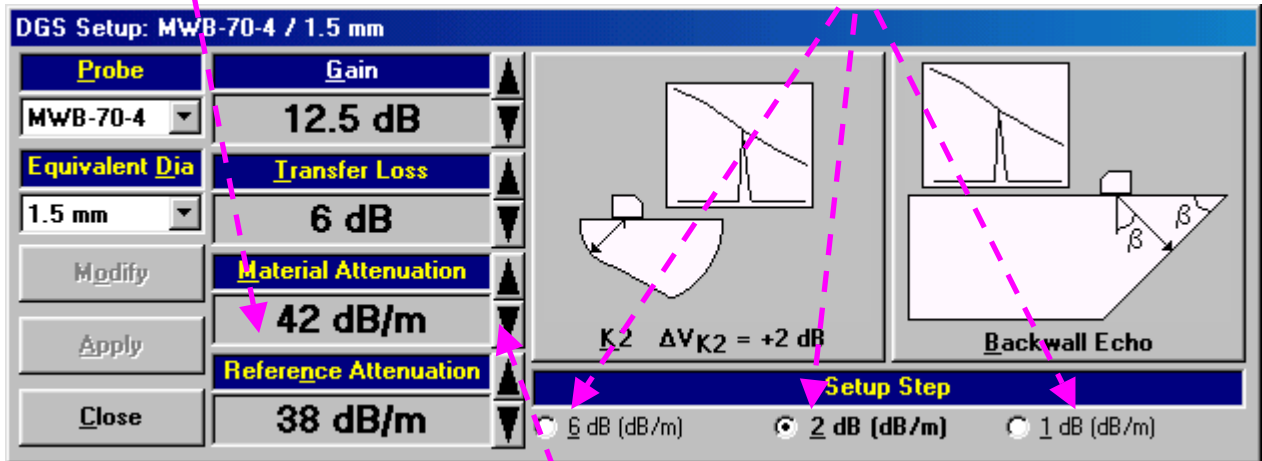
The following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate button
- **Keyboard**
 - Press **<Alt>+<N>** on external keyboard ⇒ **Reference Attenuation** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard
- **Combined**
 - Click on **Reference Attenuation** ⇒ **Reference Attenuation** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

















Step 4: Attenuation in the object under test

Current setting of **Material Attenuation** (attenuation in the object under test) **dB/m**

Click on **Setup Step** option or press **<Alt>+<1>** or **<Alt>+<2>** or **<Alt>+<6>** on external keyboard to select required value for increment / decrement for setting **Material Attenuation**. The last selected value of increment / decrement is checked:



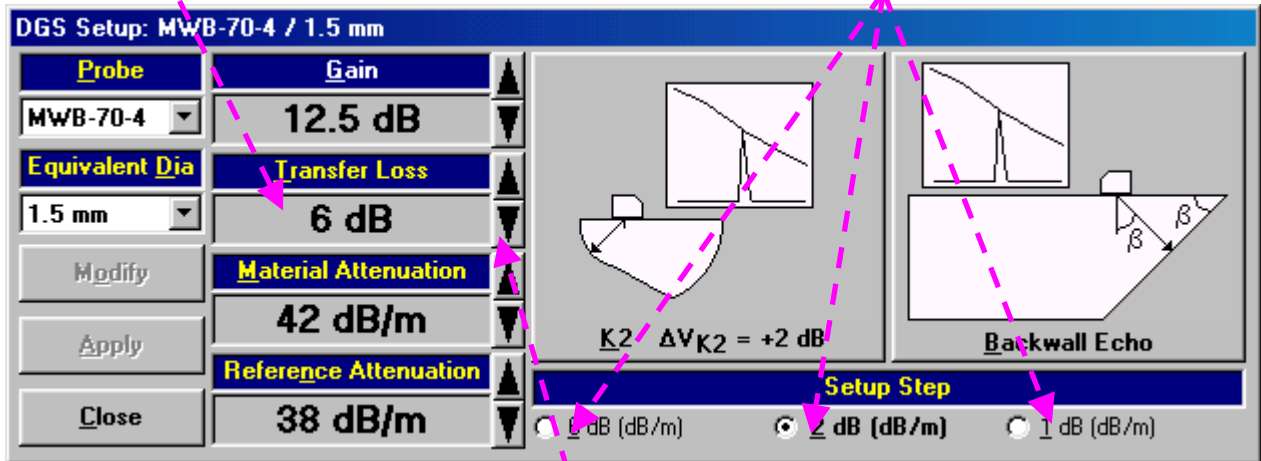
The following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate button
- **Keyboard**
 - Press **<Alt>+<M>** on external keyboard ⇒ **Material Attenuation** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard
- **Combined**
 - Click on **Material Attenuation** ⇒ **Material Attenuation** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

Step 5: Transfer loss

Current setting of
Transfer Loss
dB

Click on **Setup Step** option or press **<Alt>+<1>** or **<Alt>+<2>** or **<Alt>+<6>** on external keyboard to select required value for increment / decrement for setting **Transfer Loss**. The last selected value of increment / decrement is checked:











The following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press **<Alt>+<T>** on external keyboard ⇒ **T**ransfer Loss fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **T**ransfer Loss ⇒ **T**ransfer Loss fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

Step 6: Gain

Apply probe to the reference block to get the appropriate echo. There are two methods available:

- K1 or K2 reference block (reference block and reflector are defined in the probe data sheet and reproduced automatically from the **DGS** data base upon probe selection)
- Inclined reference block (reference reflector – back surface)

The screenshot shows the UDS3-5 ISONIC Pulsar/Receiver interface. At the top, a control panel displays various settings: Gain (0.5, 12.5 dB), Range (1, 100 mm), US Velocity (5, 3250 m/s), Display Delay (100, 6.23 μs), and Reject (5, 0%). Below this is a menu bar with options: BASICS, PULSER, RECEIVER, GATE A, and Menu. The main display area shows a DGS Setup window for probe MWB-70-4 / 1.5 mm. This window includes a table of parameters:

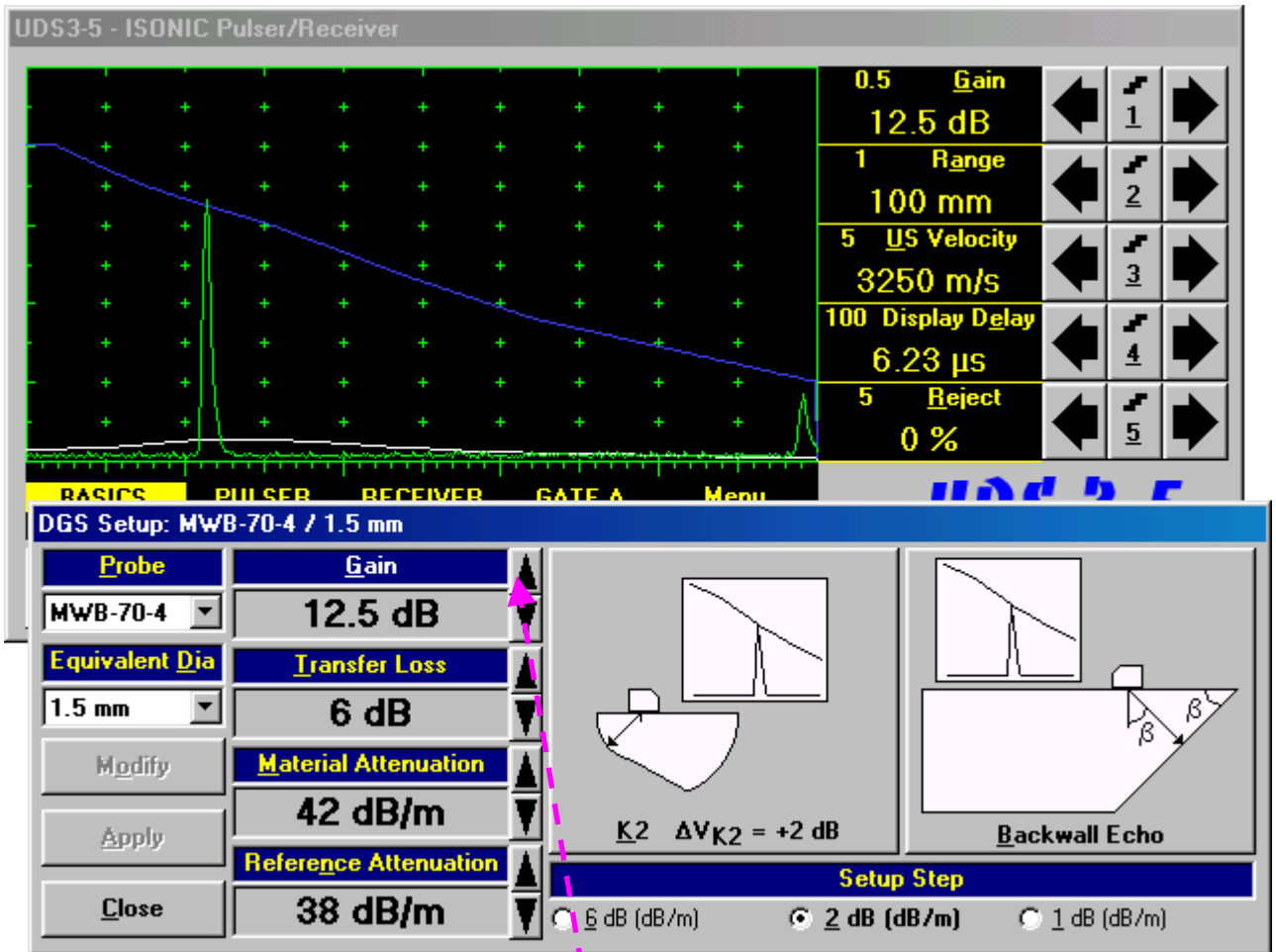
Probe	Gain
MWB-70-4	12.5 dB
Equivalent Dia	Transfer Loss
1.5 mm	6 dB
Modify	Material Attenuation
Apply	42 dB/m
Close	Reference Attenuation
	38 dB/m

To the right of the table are two diagrams: 'K2' showing a flat reflector with $\Delta V_{K2} = +2 \text{ dB}$, and 'Backwall Echo' showing an inclined reflector with angle β . Below these diagrams is a 'Setup Step' section with three radio button options: 6 dB (dB/m), 2 dB (dB/m) (which is selected), and 1 dB (dB/m). A dashed pink line connects the 'Current Gain dB' callout to the '12.5 dB' value in the Gain field.

Current Gain
dB

Click on **Setup Step** option or press **<Alt>+<1>** or **<Alt>+<2>** or **<Alt>+<6>** on external keyboard to select required value for increment / decrement for increment / decrement for setting **Gain**. The last selected value of increment / decrement is checked:

The goal of Gain setup is obtaining tip of maximized reference echo reaching back echo level (blue curve)











The following manipulations are applicable for **Gain** setup:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

- Press **<Alt>+<G>** on external keyboard ⇒ **G**ain fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

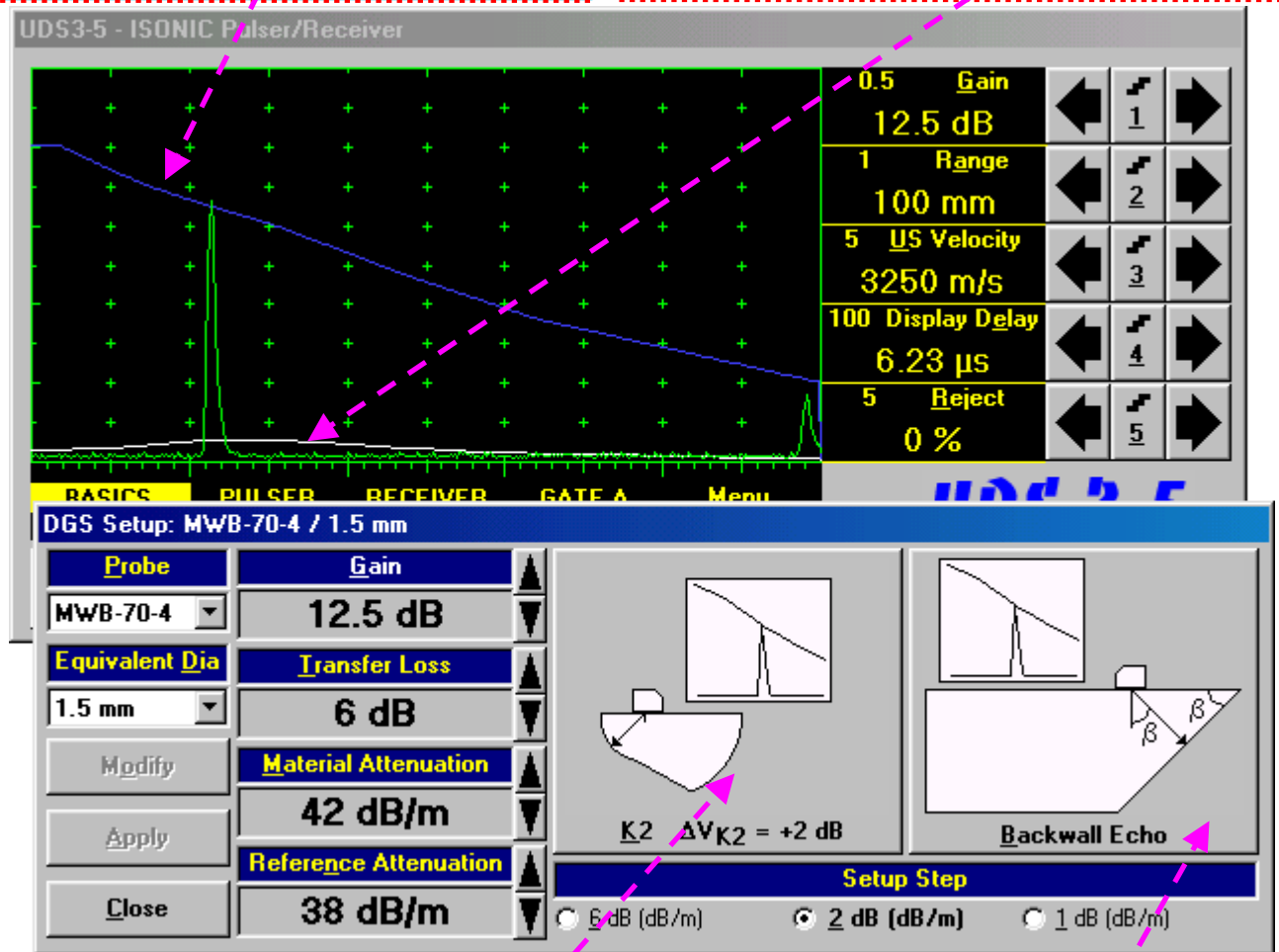
- Click on **G**ain ⇒ **G**ain fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

Step 7: Finalizing DGS curve and return to the main UDS 3-3 / UDS 3-4 window

Before finalizing the **DGS** curve:

Finalized back echo curve (blue) – depends on **Probe** and **Reference Attenuation**

Finalized FBH echo curve (white) – depends on **Probe, Equivalent Dia, and Material Attenuation**



To finalize the **DGS** curve the following manipulations are applicable:

Case 1 (K1 or K2 reference block)

- **Mouse / Touch Screen**
 - Click **on**
- **Keyboard**
 - Pressing **<Alt>+<K>** on external keyboard

Case 2 (Inclined reference block)

- **Mouse / Touch Screen**
 - Click **on**
- **Keyboard**
 - Pressing **<Alt>+** on external keyboard

The finalized **DGS** curve appears upon accompanied with *Automatic Gain Correction*:

The screenshot displays the UDS3-5 ISONIC Pulsar/Receiver interface. At the top, four callout boxes identify key features: 'Finalized back echo curve (blue)', 'Finalized DGS curve (red)', 'Finalized FBH echo curve (white)', and 'Finalized automatically corrected Gain'. The main display area shows a graph with these curves overlaid on a grid. To the right of the graph is a control panel with the following settings:

0.5	Gain	43.5 dB	←	1	→
1	Range	100 mm	←	2	→
5	US Velocity	3250 m/s	←	3	→
100	Display Delay	6.23 μs	←	4	→
5	Reject	0 %	←	5	→

Below the graph is a 'DGS Setup: MWB-70-4 / 1.5 mm' panel with the following parameters:

Probe	MWB-70-4	Gain	43.5 dB
Equivalent Dia	1.5 mm	Transfer Loss	6 dB
Modify		Material Attenuation	42 dB/m
Apply		Reference Attenuation	38 dB/m
Close			

To the right of the DGS Setup panel are two diagrams: 'K2 ΔVK2 = +2 dB' and 'Backwall Echo'. At the bottom of the DGS Setup panel is a 'Setup Step' section with three radio buttons: 6 dB (dB/m), 2 dB (dB/m) (selected), and 1 dB (dB/m).

To accept finalized **DGS** curve and return to the main operating surface the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on 

then

- Click on 

- **Keyboard**

- Press <Alt>+<A> on external keyboard, then  or <Alt>+<C> or  on front panel keyboard

To negate the finalized **DGS** curve and return to main **UDS3-5** window the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on 

then

- Click on 

- **Keyboard**

- Press **<Alt>+<O>** on external keyboard, then  or **<Alt>+<C>** or  on front panel keyboard

To create new **DGS** curve the following manipulations are applicable:

- **Mouse / Touch Screen**

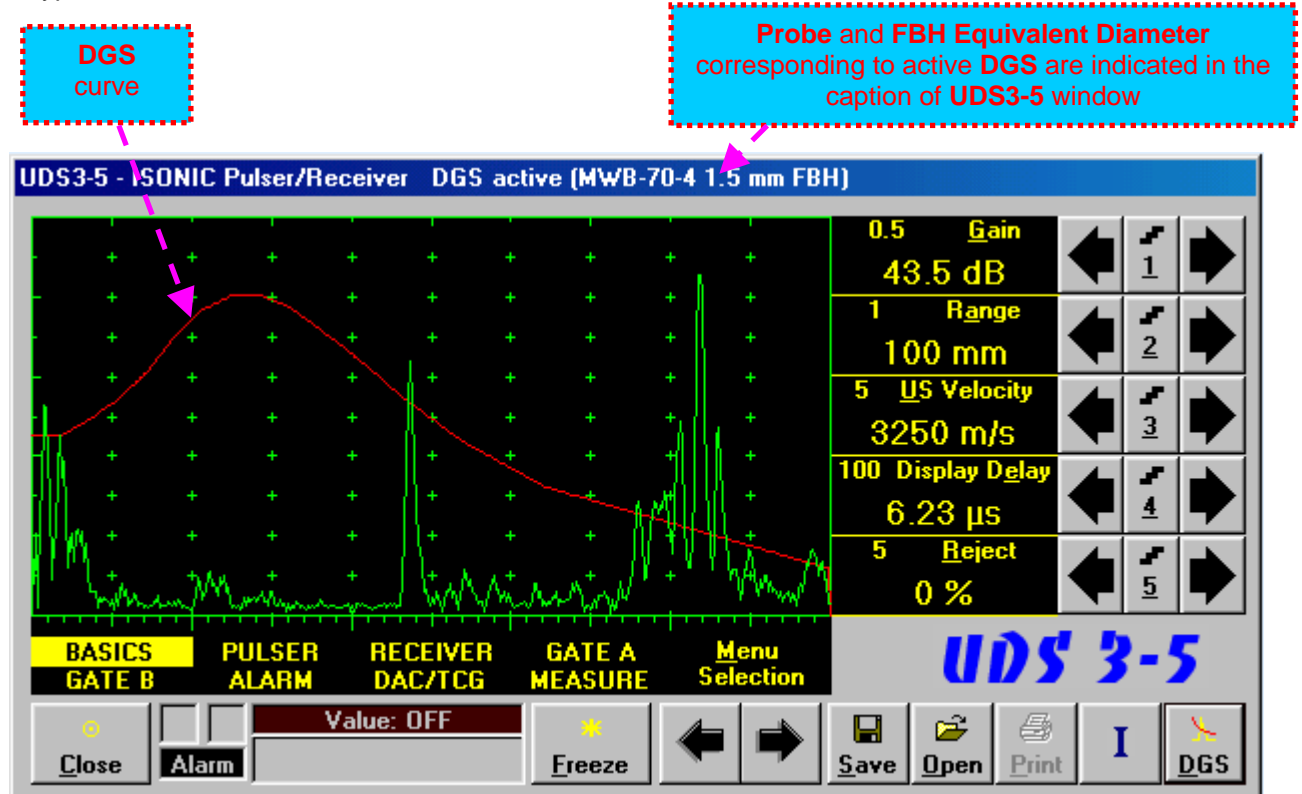
- Click on 

- **Keyboard**

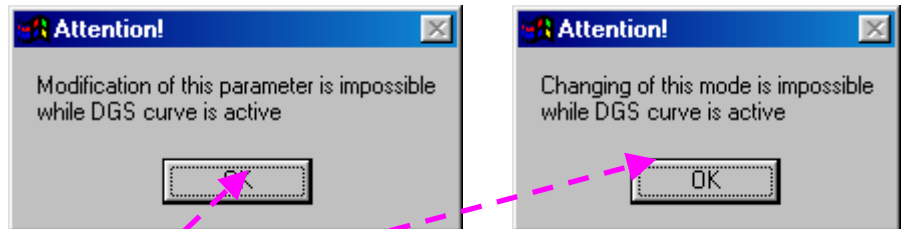
- Press **<Alt>+<O>** on external keyboard



Step 8: Work whilst DGS is active

A typical screenshot with active **DGS** is shown below



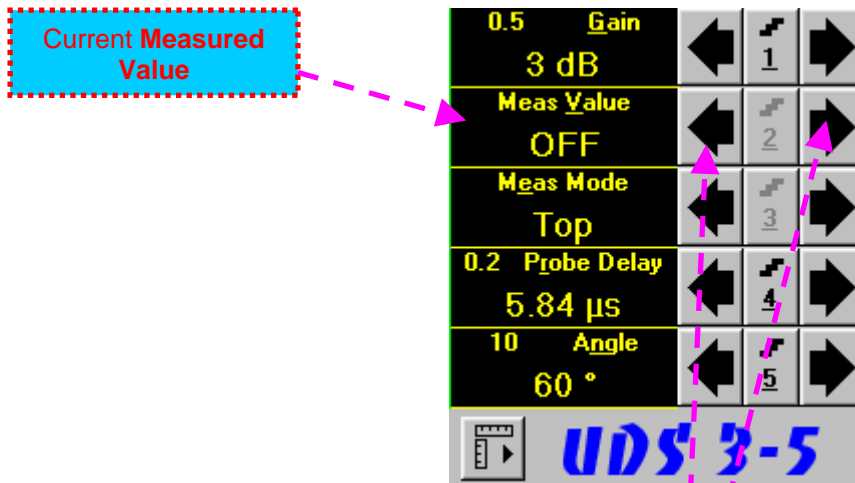
Some parameters and modes may not be modified whilst **DGS** is active - corresponding messages appear if attempting to modify:



To continue operation click on the **button** after message appears or press  or  on front panel keyboard or **Esc** or **Enter** on external keyboard

To negate the active **DGS** or create a new one click on  or press  on front panel keyboard or **F9** or **<Alt>+<D>** on external keyboard

5.2.12. Sub Menu MEASURE












To select **Measured Value** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press  on front panel keyboard or **F2** or **<Alt>+<V>** on external keyboard ⇒ **Meas Value** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

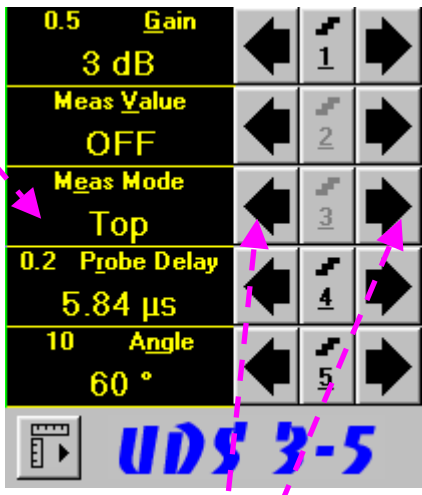
- **Combined**

- Click on **Meas Value** ⇒ **Meas Value** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



Refer to paragraph 5.2.13 of this Operating Manual for information about values available for automatic measurement and indication in the **Value Box (Digital Readout)**

Currently Active Measurement Mode



To select **Measurement Mode** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button

- **Keyboard**

- Press 3 on front panel keyboard or **F3** or **<Alt>+<E>** on external keyboard ⇒ **Meas Mode** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

- **Combined**

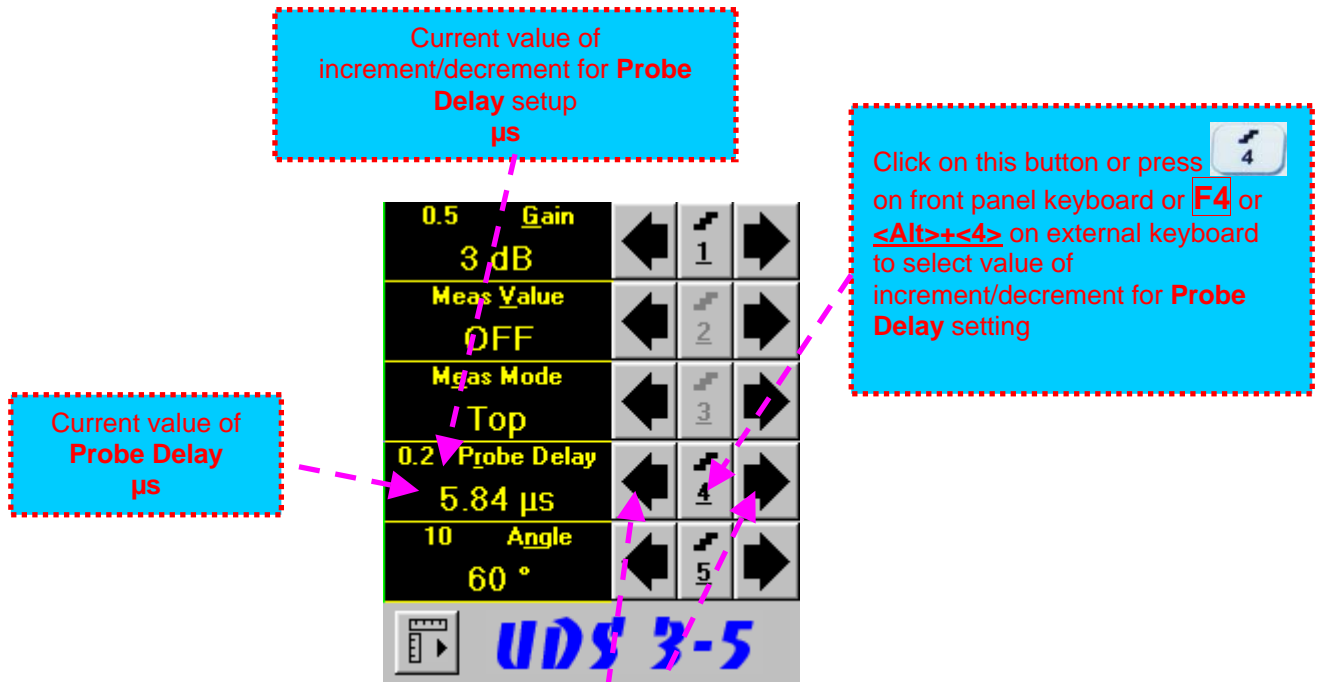
- Click on **Meas Mode** ⇒ **Meas Mode** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

i

There are four Measurement Modes possible:

- ◆ Flank
- ◆ Top
- ◆ Flank-First
- ◆ Top-First

Refer to paragraph 5.2.13 of this Operating Manual for further information












To control **Probe Delay** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

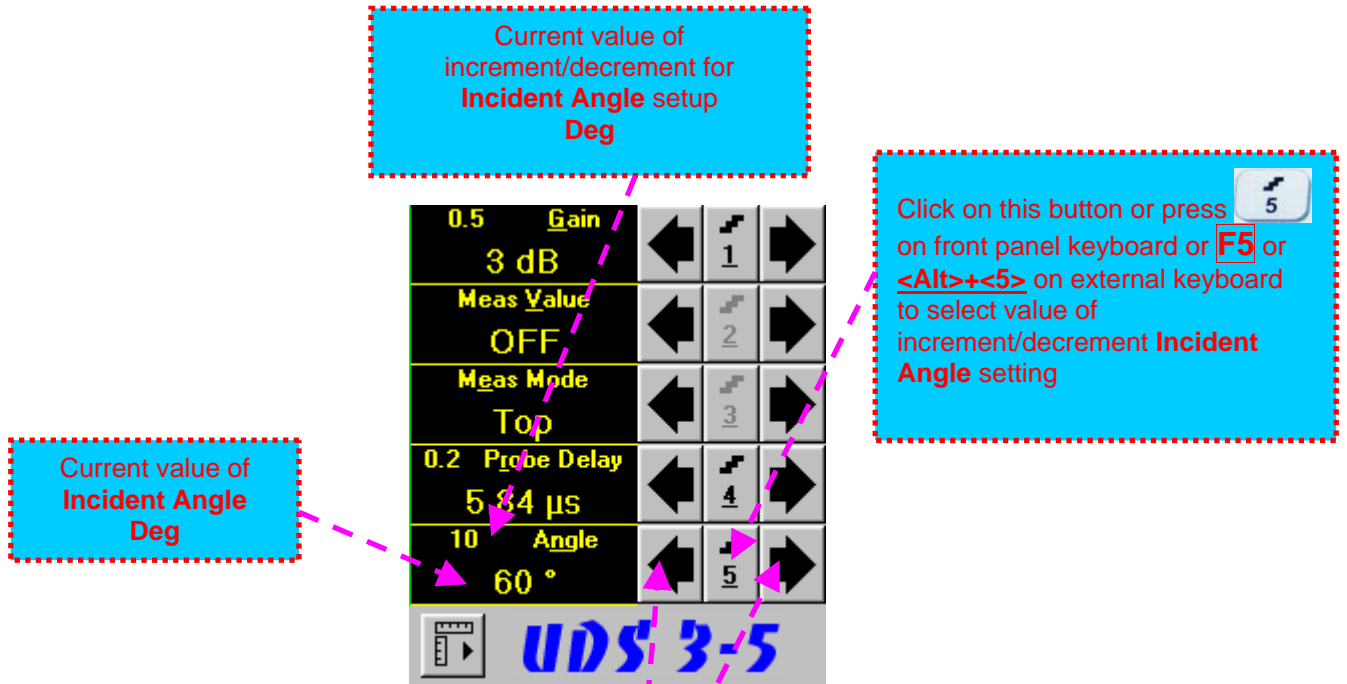
- **Keyboard**

- Press  on front panel keyboard or **F4** or **<Alt>+<R>** on external keyboard \Rightarrow **Probe Delay** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**


- Click on **Probe Delay** \Rightarrow **Probe Delay** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

 Refer to paragraph 5.2.13 of this Operating Manual for some hints on determining **Probe Delay**












To control **Incident Angle** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on the appropriate  button

- **Keyboard**

- Press  on front panel keyboard or **F5** or **<Alt>+<N>** on external keyboard ⇒ **Angle** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard


- **Combined**

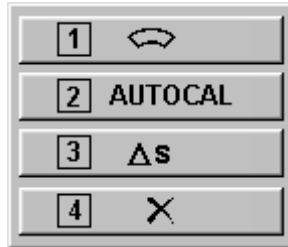
- Click on **Angle** ⇒ **Angle** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard







Refer to paragraph 5.2.13 of this Operating Manual for some hints on determining and / or checking **Probe Angle**



Advanced Measurements Settings Menu




Advanced measurement settings are available through button  appearing on the **UDS 3-5** main operating surface upon activating submenu **MEASURE**. Clicking on that button activates Advanced Measurements Settings Menu:



Press  on front panel keyboard or **F1** on external keyboard or click on  to activate **Advanced Scheme for Reflectors Depth Measurement Whilst Using Angle Beam Probe – Thickness / Skip / Curved Scanning Surface Correction**

Press  on front panel keyboard or **F2** on external keyboard or click on  to activate **Automatic Calibration Procedure**

Press  on front panel keyboard or **F3** on external keyboard or click on  to activate **Dual Ultrasound Velocity Measurement Mode**

Press  or  on front panel keyboard or **F3** on external keyboard or click on  to return to main operating surface

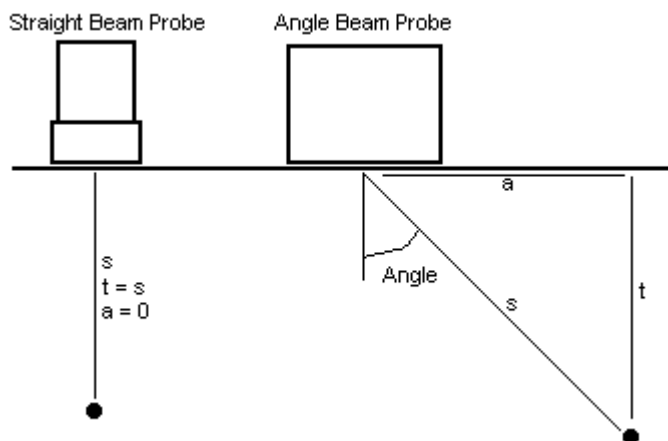
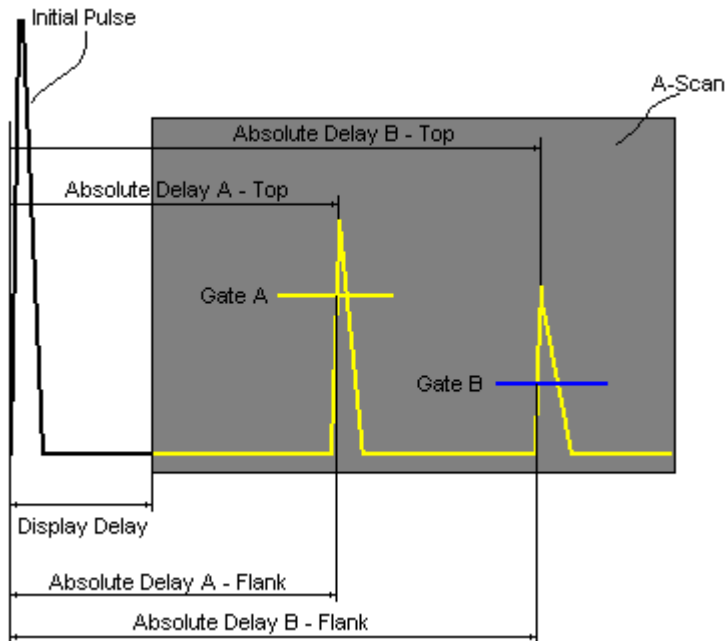


Refer to paragraph 5.2.13.3 of this Operating Manual to get instructed on:

- ◆ **Advanced Scheme for Reflectors Depth Measurement Whilst Using Angle Beam Probe – Thickness / Skip / Curved Scanning Surface Correction**
- ◆ **Automatic Calibration Procedure**
- ◆ **Dual Ultrasound Velocity Measurement Mode**

5.2.13. Time Domain Signal Evaluation - Measurements Guide

5.2.13.1. Values available for Automatic Measurements and Digital Readout



Value 1: T(A)

Time of Flight - μs of an echo matching with **Gate A** measured with respect to **Probe Delay**:

$$T(A) = \text{Absolute Delay A} - \text{Probe Delay}$$

Value 2: T(B)

Time of Flight - μs of an echo matching with **Gate B** measured with respect to **Probe Delay**:

$$T(B) = \text{Absolute Delay B} - \text{Probe Delay}$$

Value 3: s(A)

Material Travel Distance - mm or in of an echo matching with **Gate A**:

$$s(A) = \frac{1}{2} \cdot T(A) \cdot \text{US Velocity}$$

Value 4: s(B)

Material Travel Distance - mm or in of an echo matching with **Gate B**:

$$s(B) = \frac{1}{2} \cdot T(B) \cdot \text{US Velocity}$$

Value 5: a(A)

Projection Distance - mm or in of reflector returning an echo matching with **Gate A**, measured with respect to *Beam Incident Point*:

$$a(A) = s(A) \cdot \sin(\text{Angle})$$

Value 6: a(B)

Projection Distance - mm or in of reflector returning an echo matching with **Gate B**, measured with respect to *Beam Incident Point*:

$$a(B) = s(B) \cdot \sin(\text{Angle})$$

Value 7: t(A)

Depth - mm or in of reflector returning an echo matching with **Gate A**:

$$t(A) = s(A) \cdot \cos(\text{Angle})$$

Value 8: t(B)

Depth - mm or in of reflector returning an echo matching with **Gate B**:

$$t(B) = s(B) \cdot \cos(\text{Angle})$$

Value 9: ΔT - μs :

$$\Delta T = T(B) - T(A)$$

Value 10: Δs - mm or in:

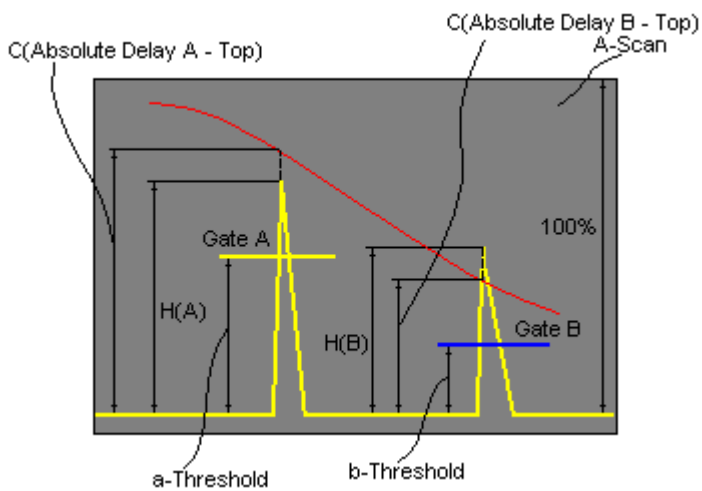
$$\Delta s = s(B) - s(A)$$

Value 11: Δa - mm or in:

$$\Delta a = a(B) - a(A)$$

Value 12: Δt - mm or in:

$$\Delta t = t(B) - t(A)$$



Value 13: H(A)

Amplitude - % of A-Scan height of an echo matching with **Gate A**

Value 14: H(B)

Amplitude - % of A-Scan height of an echo matching with **Gate B**

Value 15: V(A)

Amplitude - dB of an echo matching with **Gate A** with respect to **aThreshold**:

$$V(A) = 20 \cdot \log_{10} (H(A) / aThreshold)$$

Value 16: V(B)

Amplitude - dB of an echo matching with **Gate B** with respect to **bThreshold**:

$$V(B) = 20 \cdot \log_{10} (H(B) / bThreshold)$$

Value 17: ΔV - dB:

$$\Delta V = V(B) - V(A)$$

Value 18: $\Delta VC(A)$ (dB to DAC) - dB:

$$\Delta VC(A) = 20 \cdot \log_{10} (H(A) / C (Absolute Delay A_Top))$$

Value 19: $\Delta VC(B)$ (dB to DAC) - dB:

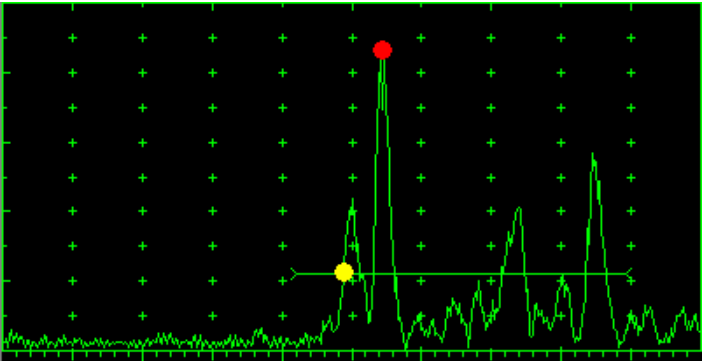
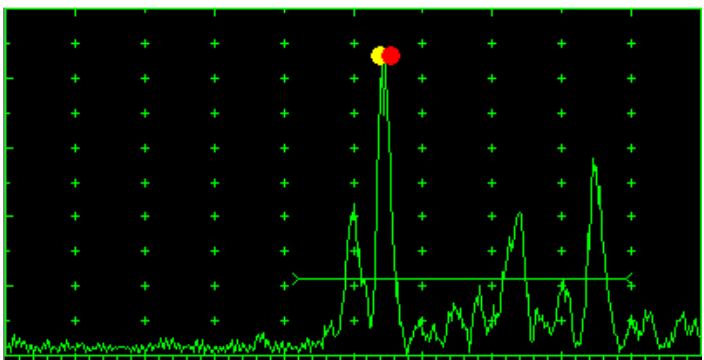
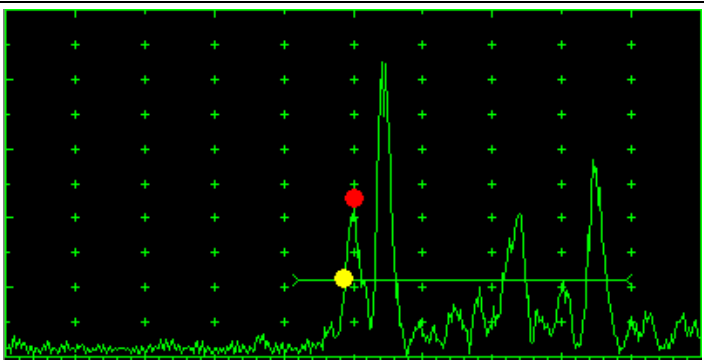
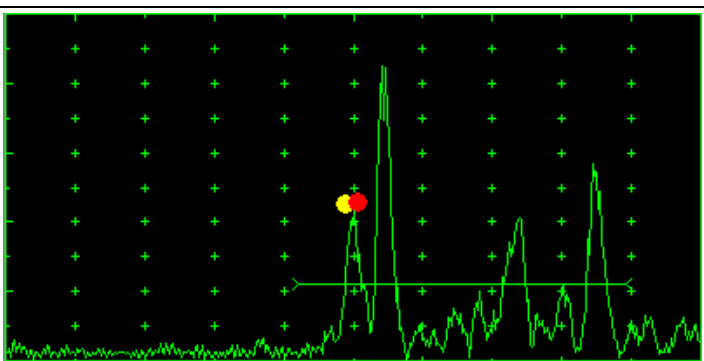
$$\Delta VC(B) = 20 \cdot \log_{10} (H(B) / C (Absolute Delay B_Top))$$



- ◆ To proceed corresponding **Gate** or both **Gates** to be active
- ◆ $\Delta VC(A)$ (dB to DAC) measurements require active **DAC/DGS**
- ◆ Amplitude measurements of echoes may be performed provided their heights don't exceed 200% of **A-Scan** height
- ◆ For 2 and more echoes matching with a **Gate** - refer to paragraph 5.2.13.2 of this Operating Manual

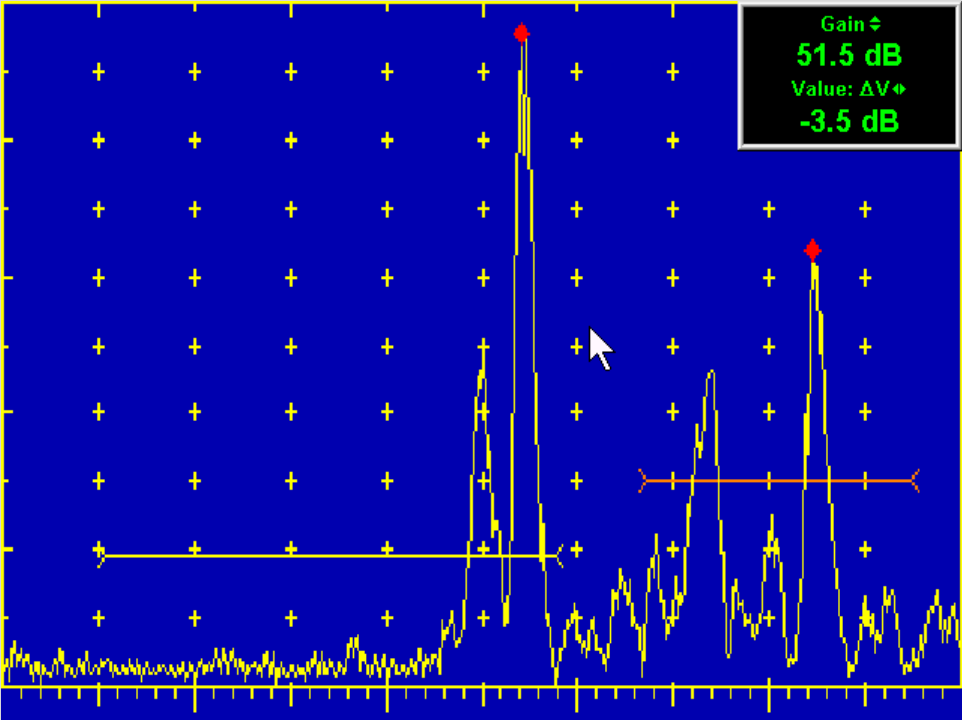
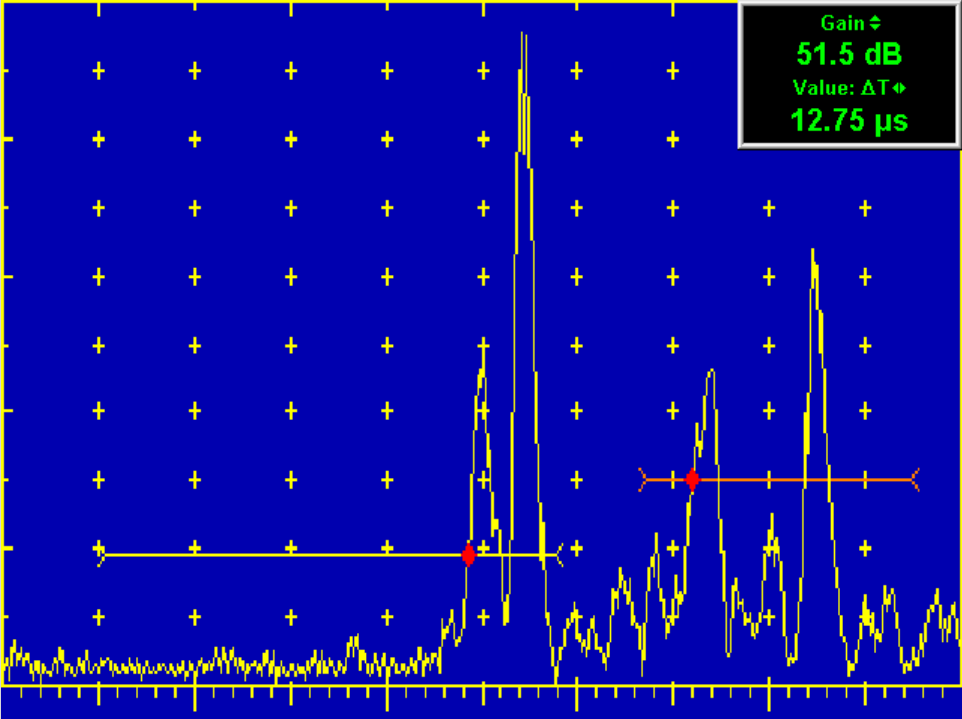
5.2.13.2. Flank, Top, Flank-First, and Top-First Modes of Measurement

The table below represents distinguishing points on an **A-Scan**, which will be taken for automatic measurements depending on **Meas Mode** setting





Meas Mode setting	A-Scan
<p style="text-align: center;">Meas Mode Flank</p> <p>● - T(A), T(B), s(A), s(B), t(A), t(B), a(A), a(B), ΔT, Δs, Δt, Δa ● - V(A), V(B), H(A), H(B), ΔV, ΔVC(A), ΔVC(B)</p>	
<p style="text-align: center;">Meas Mode Top</p> <p>● - T(A), T(B), s(A), s(B), t(A), t(B), a(A), a(B), ΔT, Δs, Δt, Δa ● - V(A), V(B), H(A), H(B), ΔV, ΔVC(A), ΔVC(B)</p>	
<p style="text-align: center;">Meas Mode Flank-First</p> <p>● - T(A), T(B), s(A), s(B), t(A), t(B), a(A), a(B), ΔT, Δs, Δt, Δa ● - V(A), V(B), H(A), H(B), ΔV, ΔVC(A), ΔVC(B)</p>	
<p style="text-align: center;">Meas Mode Top-First</p> <p>● - T(A), T(B), s(A), s(B), t(A), t(B), a(A), a(B), ΔT, Δs, Δt, Δa ● - V(A), V(B), H(A), H(B), ΔV, ΔVC(A), ΔVC(B)</p>	



Distinguishing points of signals are automatically marked on A-Scan whilst measuring:



5.2.13.3. Advanced Scheme for Reflectors Depth Measurement Whilst Using Angle Beam Probe – Thickness / Skip / Curved Scanning Surface Correction

Button  becomes available upon clicking on  if **Angle** setting differs from 0° in submenu **MEASURE**. The window as below appears after clicking on  or pressing  on front panel keyboard or **F1** on external keyboard

Object under test may be designated as either

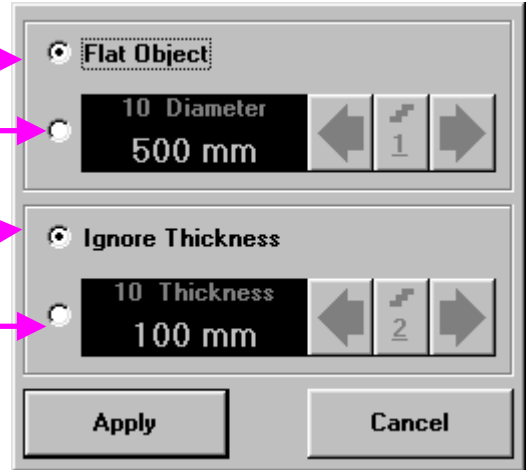
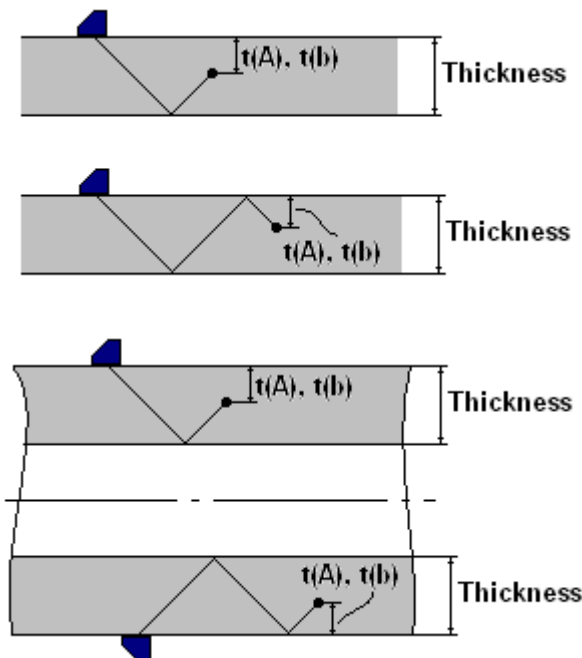
- **Flat** –  
- Or
- **Curved** –  

While scanning above plates, tube wall, and the like the finite thickness of object under test may be either

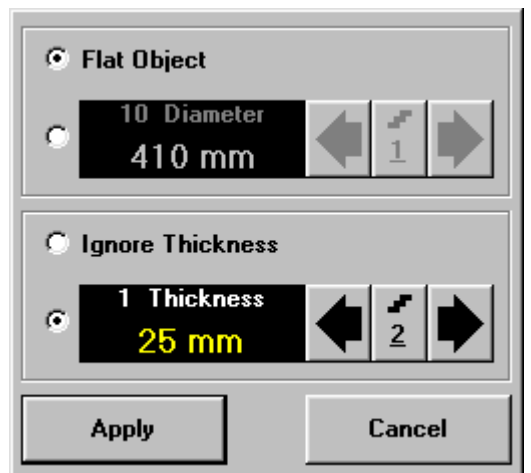
- **Ignored** –  
- Or
- **Entered** –  

Case 1 represents simplest scheme supposing that scanning is performed above hemi-space whereas coordinates **t(A)**, **t(B)** are determined in accordance with appropriate sketches, equations, and **A-Scans** shown in paragraphs 5.2.13.1 and 5.2.13.2 of this Operating Manual

Case 2 represents scanning above plate, or scanning above tubular object longitudinally. Reflectors depth for half skip, full skip, and multi skip insonification will be determined with respect to actual **Thickness** value – **t(A)**, **t(B)** readings will be in accordance with sketches below:

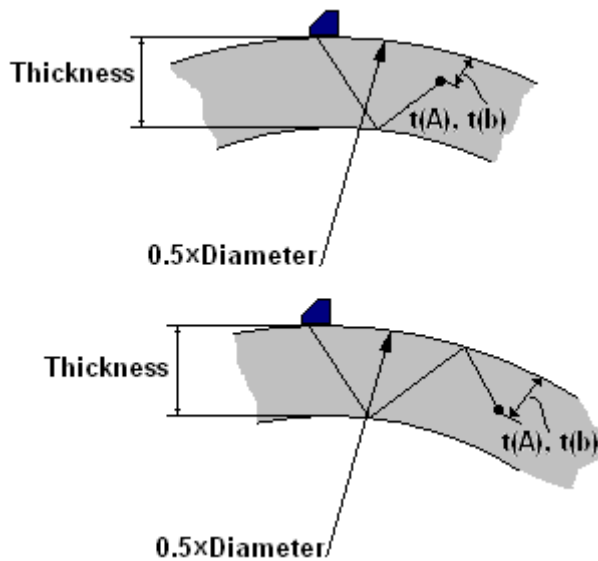


Case 1



Case 2

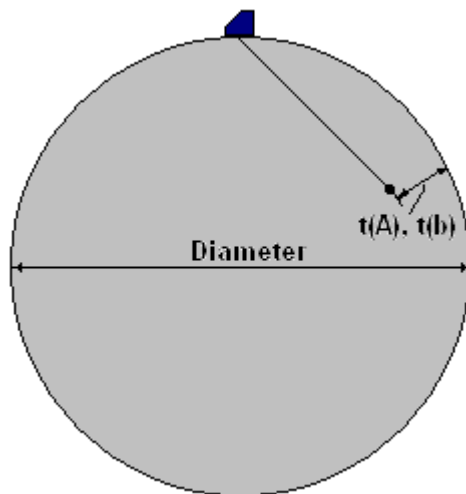
Case 3 represents scanning above curved wall surface circumferentially. Reflectors depth for half skip, full skip, and multi skip insonification will be determined with respect to actual **Thickness** and **Diameter** values – **t(A)**, **t(B)** readings will be in accordance with sketch below:



<input type="radio"/> Flat Object	10 Diameter	←	↗	→
<input checked="" type="radio"/> 10 Diameter	400 mm	←	1	→
<input type="radio"/> Ignore Thickness	1 Thickness	←	↗	→
<input checked="" type="radio"/> 1 Thickness	9 mm	←	2	→
Apply		Cancel		

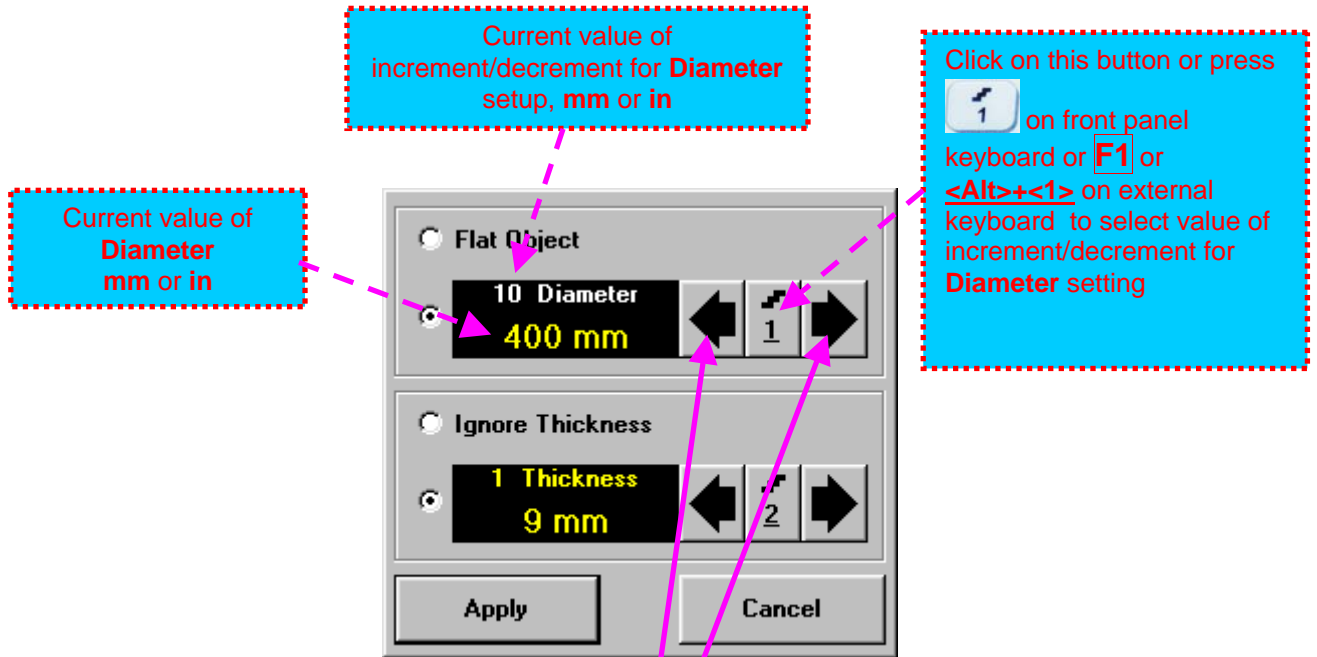
Case 3

Case 4 represents scanning above solid cylindrical object circumferentially or above spherical object. If this is a case **Thickness** setting to be: **Thickness = 0.5 x Diameter** and reflectors depth will be determined with respect to actual **Diameter** value – **t(A)**, **t(B)** readings will be in accordance with sketch below:



<input type="radio"/> Flat Object	2 Diameter	←	↗	→
<input checked="" type="radio"/> 2 Diameter	254 mm	←	1	→
<input type="radio"/> Ignore Thickness	50 Thickness	←	↗	→
<input checked="" type="radio"/> 50 Thickness	127 mm	←	2	→
Apply		Cancel		

Case 4












To control **Diameter** the following manipulations are applicable:









- **Mouse / Touch Screen**

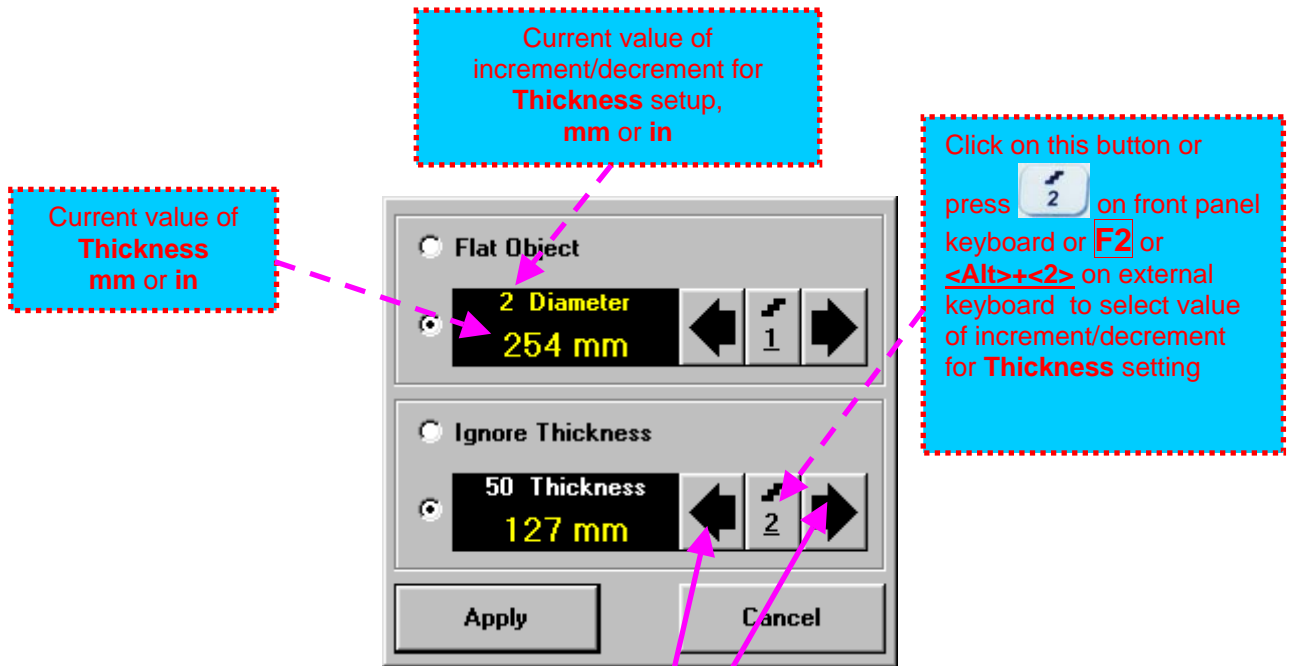
- Click or press and hold on the appropriate button

- **Keyboard**

- Press  on front panel keyboard or **F1** on external keyboard ⇒ **Diameter** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

Click on **Diameter** ⇒ **Diameter** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard












To control **Thickness** the following manipulations are applicable:








- **Mouse / Touch Screen**

- Click or press and hold on the appropriate **button**

- **Keyboard**

- Press  on front panel keyboard or **F2** on external keyboard ⇒ **Thickness** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use , , ,  on front panel keyboard or , , , on external keyboard

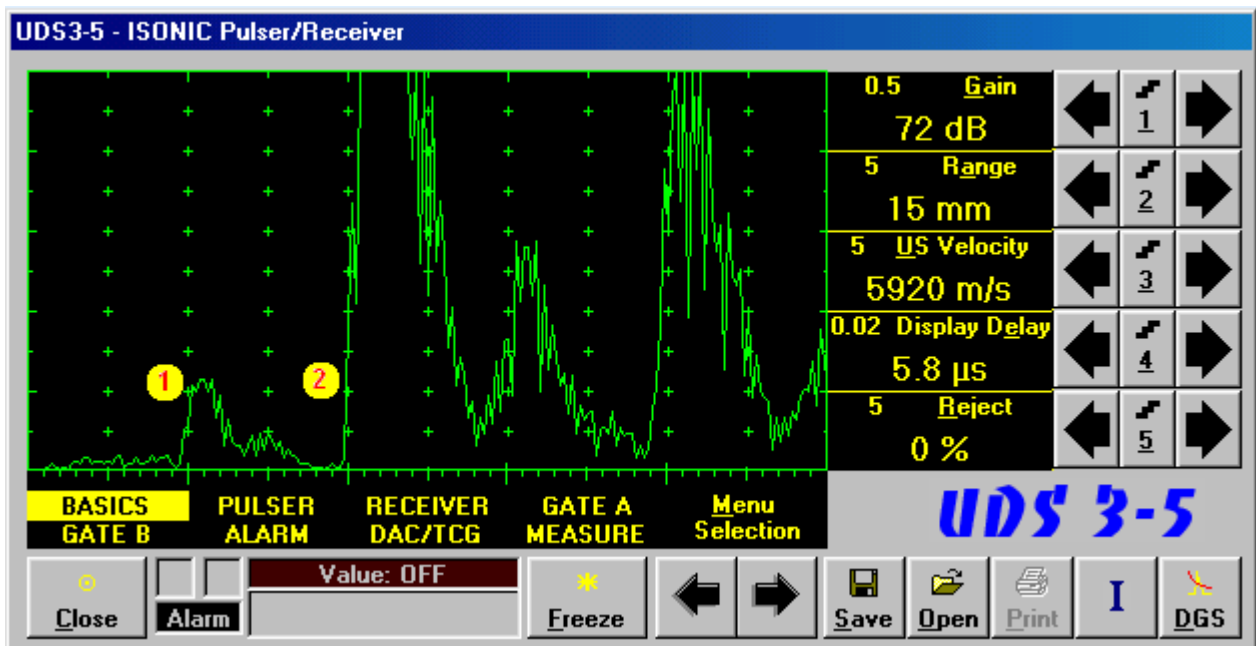
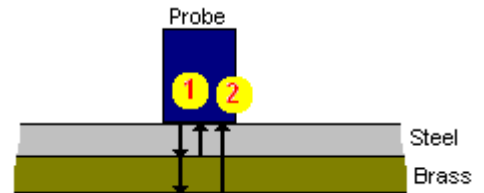


- ◆ Click on **Apply** or press  on front panel keyboard or **Enter** on external keyboard to activate new settings
- ◆ Click on **Cancel** or press  on front panel keyboard or **Esc** on external keyboard to negate new settings

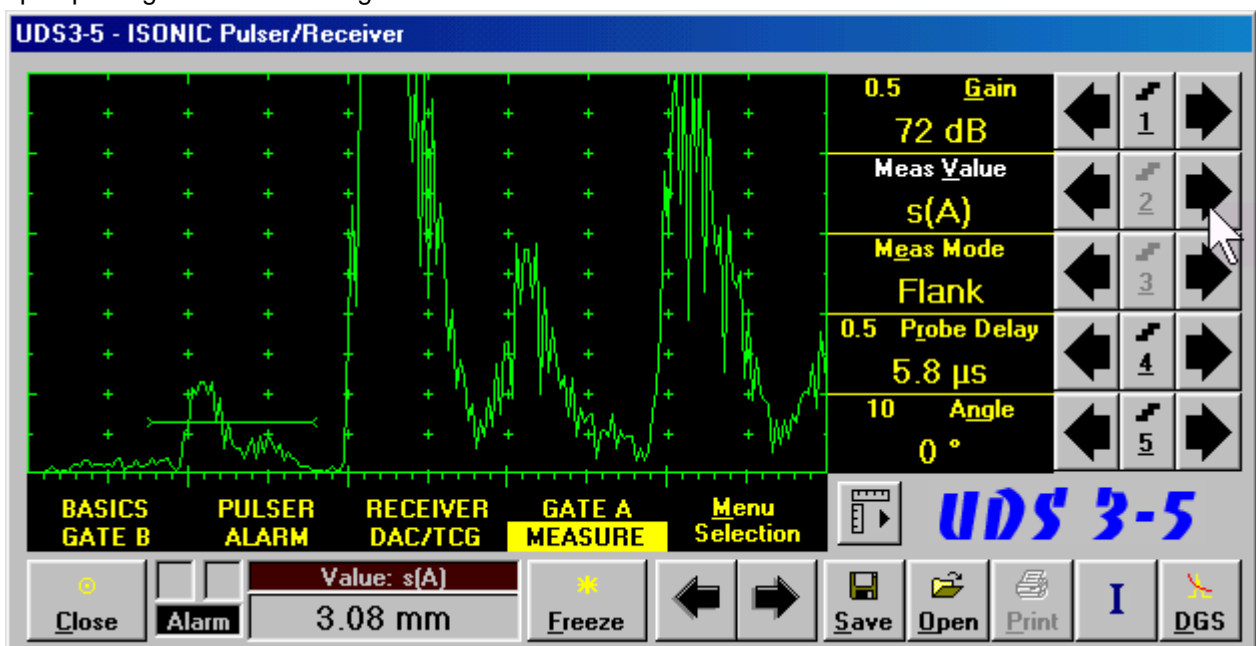
5.2.13.4. Dual Ultrasound Velocity Measurement Mode – Typical Example

For some practical applications it is necessary to measure sound path distances in dissimilar materials, multi-layer structures, and the like. Also it may occur a need in measuring sound path distances for signals representing various kinds of ultrasonic waves in the same object. Such cases are characterized by variety of **US Velocity** values to be used while measuring intervals between signals on the same **A-Scan**. To simplify measurement procedure and avoid operator's computations it may be activated **Dual Ultrasound Velocity Measurements Mode**, which's use is illustrated by the example below

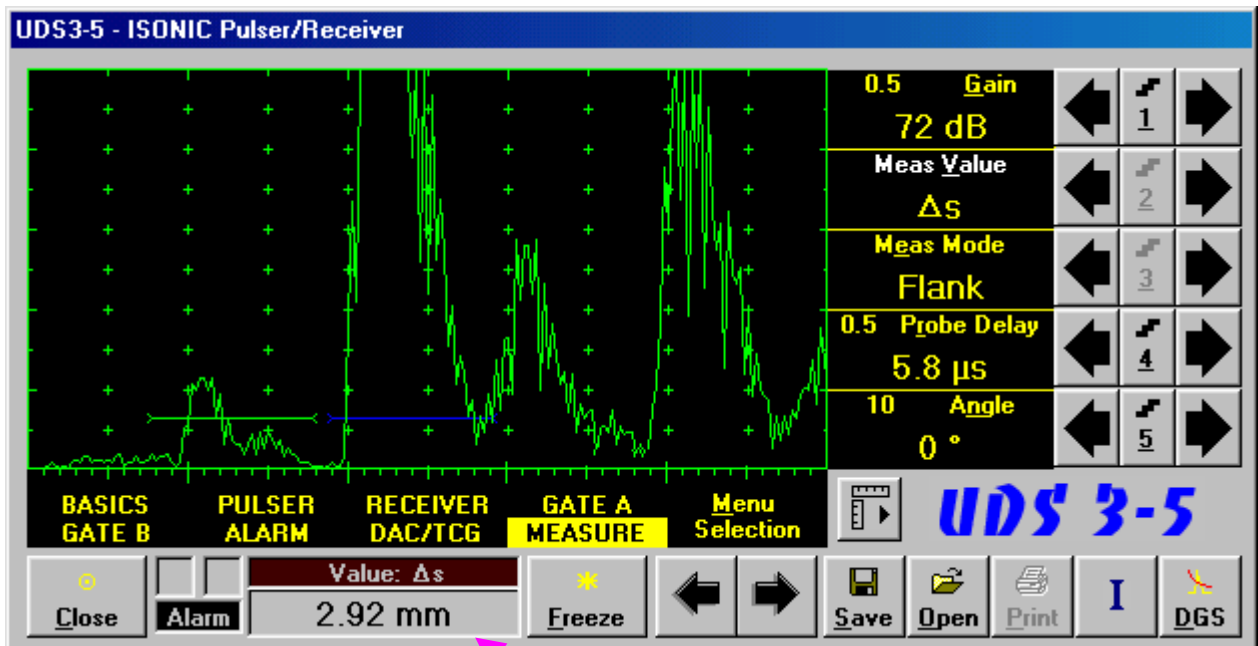
Supposing it's necessary to measure thickness of each layer of bi-metallic part made through by means of explosion welding between regular carbon steel (**US Velocity = 5920 m/s**) and brass alloy (**US Velocity = 4720 m/s**) plates while probe to be placed on low carbon steel plate. While placed on the steel side 10 MHz dual element probe with **Probe Delay = 5.8 μs** receives two clear echoes **1** and **2** from the *steel-to-brass boundary* and from the *back surface of the brass layer* correspondingly:



US Velocity setting is suitable for steel and thickness of steel layer may be found through direct reading upon placing **Gate A** above signal 1:



If placing now **Gate B** above signal **2** and selecting Δs as **Meas Value** then interval between signals **1** and **2** will be measured. To obtain proper Δs readout value of **US Velocity** valid for brass alloy layer (second material) must be keyed in

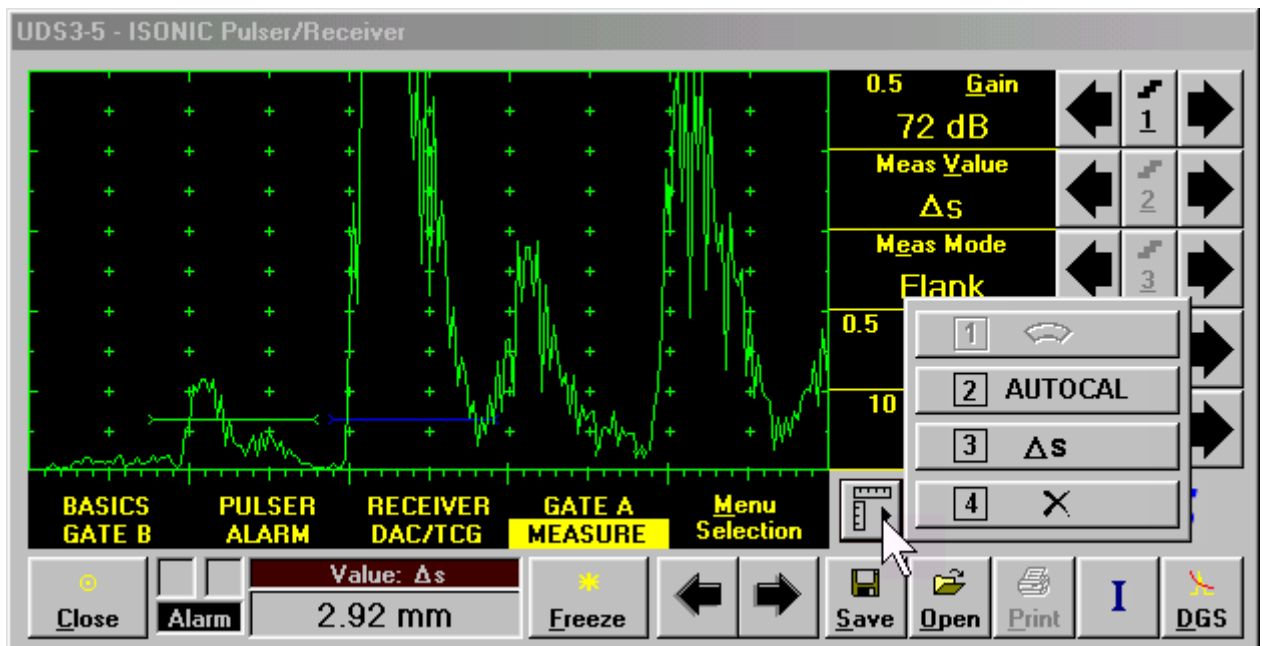




This digital readout was obtained through use of steel **US Velocity** setting (first material) and may not be recognized as a thickness of brass alloy layer (second material)

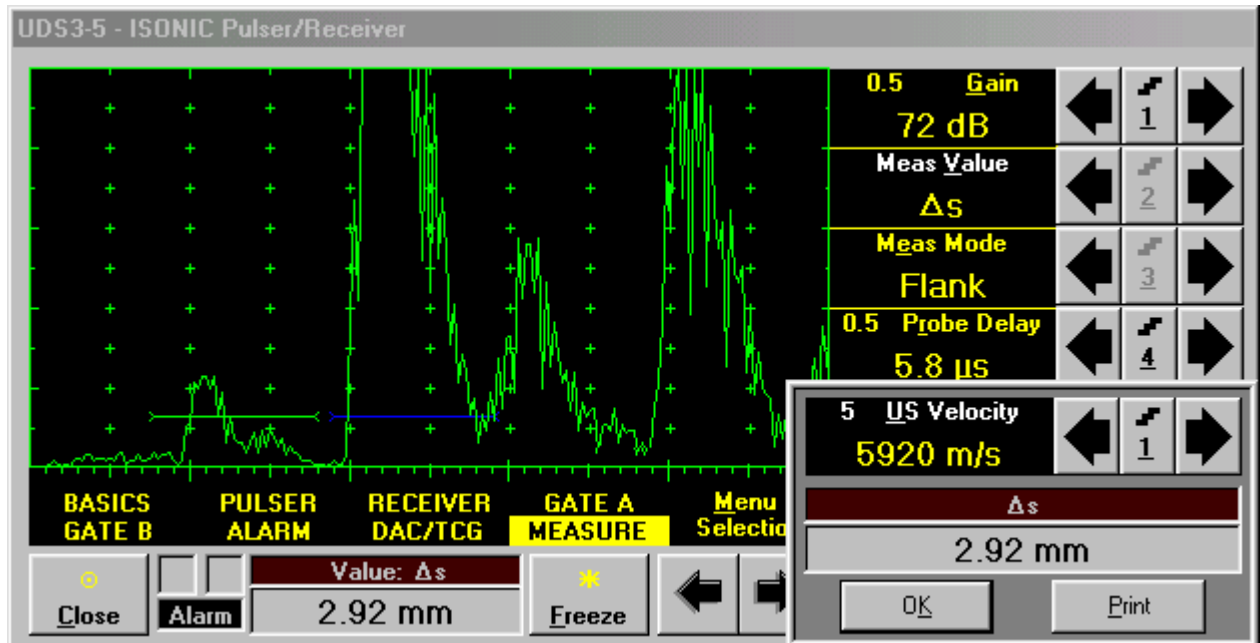
To obtain proper reading for the thickness of brass layer activate **Dual Ultrasound Velocity Measurements**

Mode - Button **3** Δs becomes available upon clicking on  if:

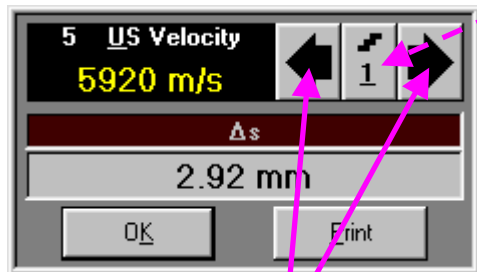
- ◆ Both **Gate A** and **Gate B** are active (refer to paragraphs 5.2.5 and 5.2.6 of this Operating Manual)
- ◆ **Meas Value** setting is Δs (refer to paragraph 5.2.12 of this Operating Manual)



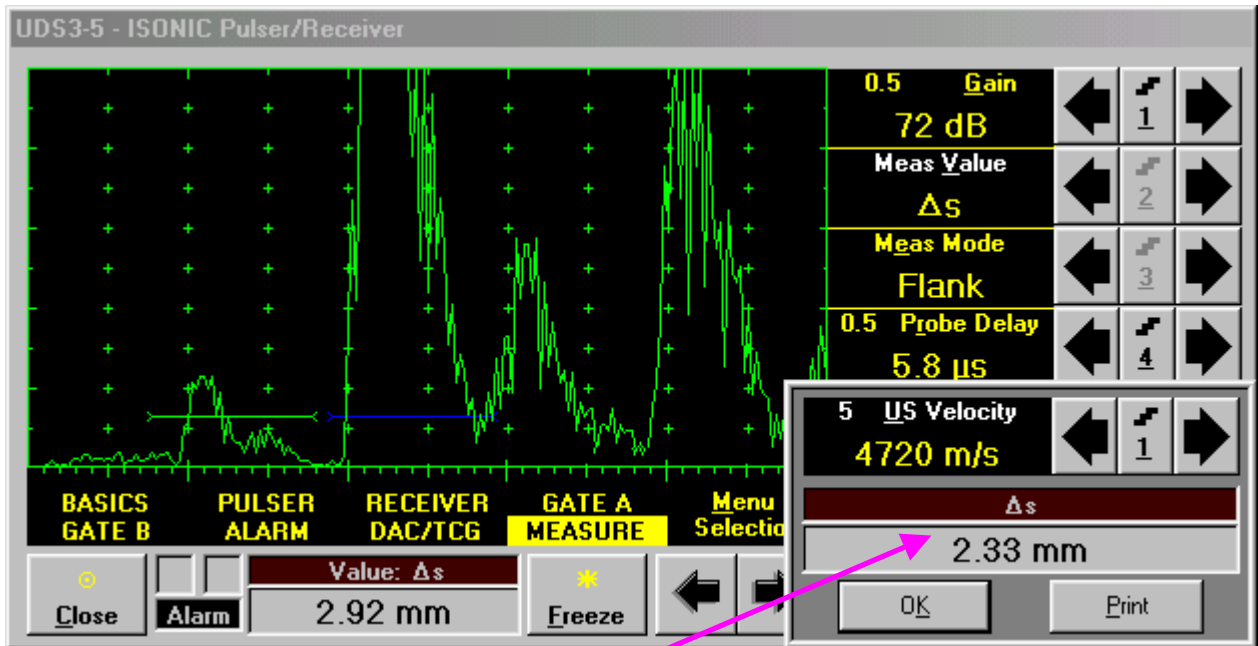
The screen as below appears after clicking on  or pressing  on front panel keyboard or **F3** on external keyboard:



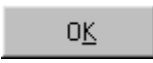


Click on this button or press  on front panel keyboard or **F1** or **<Alt>+<1>** on external keyboard to select value of increment/decrement for second **US Velocity** setting




Click on appropriate  button or press , , ,  on front panel keyboard or , , ,  on external keyboard to setup value of second **US Velocity** valid for brass alloy layer (second material)

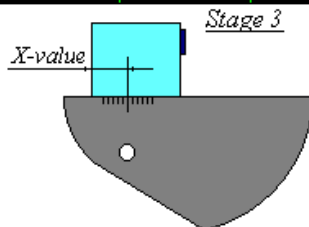
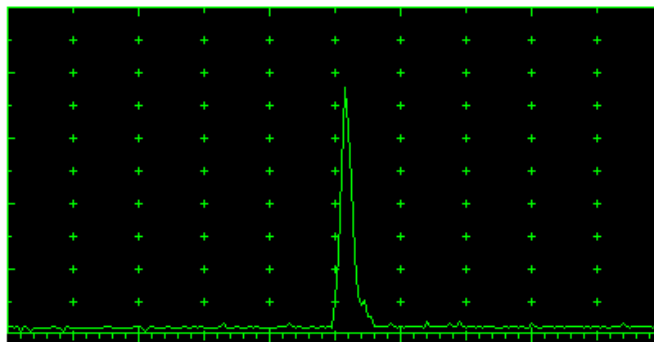
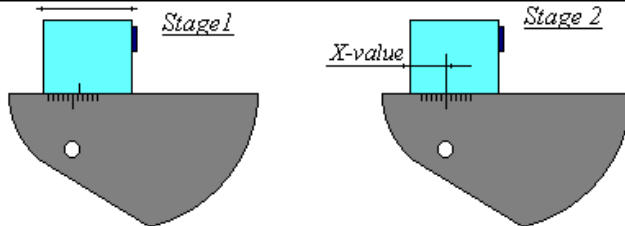
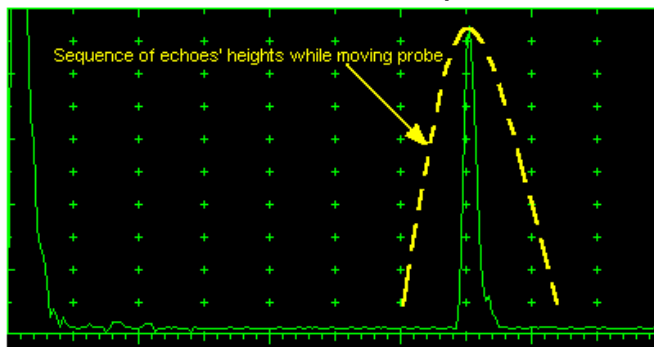


Digital readout for actual thickness of the brass alloy layer (second material) is obtained upon completing setting for second **US Velocity**

To return to the main **ISONIC Pulser Receiver** window click on  or press  or  on front panel keyboard or **<Alt>+<K>** or **Enter** or **Esc** on external keyboard

To printout **A-Scan** accompanied with setup list, measured value of Δs , and second **US Velocity** value click on  or press **<Alt>+<P>** on external keyboard (printer to be accessible through either USB or LAN port and defined as default in the **ISONIC 2006**)

5.2.13.5. Determining Probe Delay - Miniature Angle Beam Probes (contact face width 12.5 mm / 0.5 in or less) - Shear or Longitudinal Waves – Typical Example



Activate submenu **PULSER** then set:

- Pulser Mode** to **Single** or **Dual** depending on probe
- Pulse Width** to **Spike (240 μJ)** for probe having resonant frequency of 8 MHz and higher or to **PW ns**, were $PW = 0.5 / F$ (F is the probe resonant frequency) for probes having resonant frequency below 8 MHz
- Firing Level** to **18**
- Damping** to **1000 Ω**
- Tuning** to **NO**

Activate submenu **RECEIVER** then set:

- Display** to **Full** or **RF**
- Filter** to **BB**
- Frequency** to completely cover probe's effective bandwidth

Activate submenu **BASICS** topic then set:

- US Velocity** to **5920 m/s (233.1 in/ms)** for longitudinal wave probes or **3255 m/s (128.1 in/ms)** for shear wave probes
- Range** to **50.0 mm (2 in)**
- Display Delay** to **0 μs**
- Reject** to **0%**

Stage 1: Manipulate probe over main working surface of V-2 reference standard and maximize echo from 25 mm (1 in) radius concave reflector

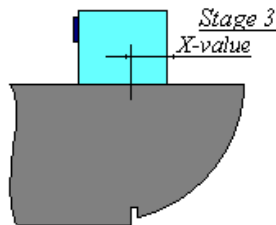
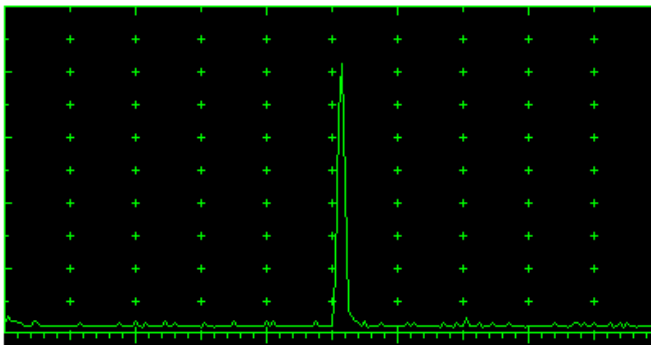
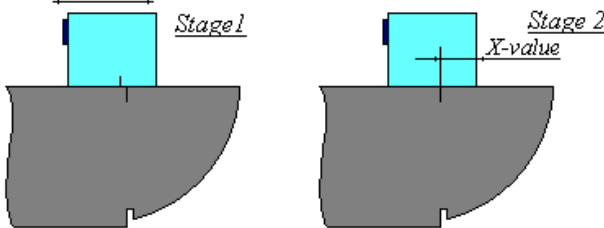
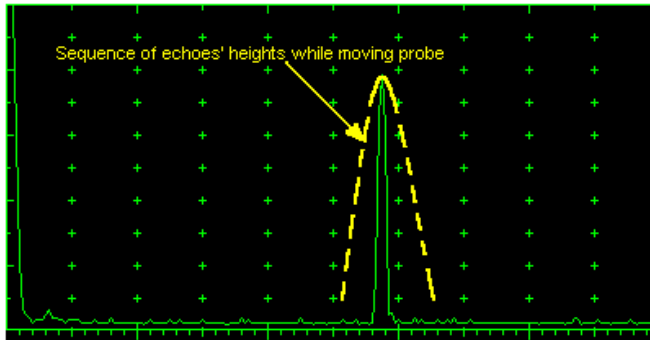
Stage 2: Fix probe in found position - the center of 25 mm (1 in) radius concave reflector will indicate **incident point** while the distance between probe's frontal edge and **incident point** is equal to **X-Value**

Stage 3: Tune **Display Delay** while probe is still fixed in found position until rising edge of maximized echo will match with 50%-grid of the **A-Scan** width. Upon completing the *obtained value of Display Delay* will be equal to *actual Probe Delay*



- ◆ It's necessary to setup **Gain** bringing height of maximized echo to **75-80%** of **A-Scan** height
- ◆ It is recommended to optimize **Tuning** in **PULSER** submenu upon obtaining maximized echo. The goal of such optimization is increasing of ultrasonic excitation energy through better matching between firing output and probe. Level of ultrasonic excitation energy is clearly represented by echo amplitude. Upon completing **Tuning** optimization **Gain** to be adjusted to bring echo to **75-80%** of **A-Scan** height

5.2.13.6. Determining Probe Delay - Large and Medium Size Angle Beam Probes (contact face width more than 12.5 mm / 0.5 in) - Shear or Longitudinal Waves – Typical Example



Activate submenu **PULSER** then set:

- Pulser Mode** to **Single** or **Dual** depending on probe
- Pulse Width** to **Spike (240 μJ)** for probe having resonant frequency of 8 MHz and higher or to **PW ns**, where $PW = 0.5 / F$ (F is the probe resonant frequency below 8 MHz)
- Firing Level** to **18**
- Damping** to **1000 Ω**
- Tuning** to **NO**

Activate submenu **RECEIVER** then set:

- Display** to **Full** or **RF**
- Filter** to **BB**
- Frequency** to completely cover probe's effective bandwidth

Activate submenu **BASICS** topic then set:

- US Velocity** to **5920 m/s (233.1 in/ms)** for longitudinal wave probes or **3255 m/s (128.1 in/ms)** for shear wave probes
- Range** to **200.0 mm (8 in)**
- Display Delay** to **0 μs**
- Reject** to **0%**

Stage 1: Manipulate probe over main working surface of V-1 reference standard and maximize echo from 100 mm (4 in) radius concave reflector

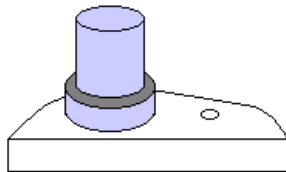
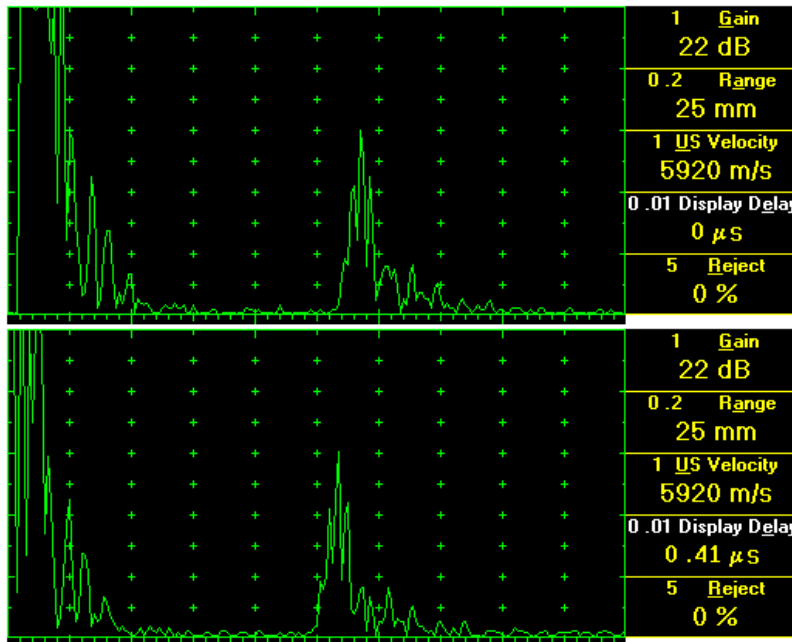
Stage 2: Fix probe in found position - the center of 100 mm (4 in) radius concave reflector will indicate **incident point** while the distance between probe's frontal edge and **incident point** is equal to **X-Value**

Stage 3: Tune **Display Delay** while probe is still fixed in found position until rising edge of maximized echo will match with 50%-grid of the **A-Scan** width. Upon completing the *obtained value of Display Delay* will be equal to actual **Probe Delay**



- ◆ It's necessary to setup **Gain** bringing height of maximized echo to **75-80%** of **A-Scan** height
- ◆ It is recommended to optimize **Tuning** in **PULSER** submenu upon obtaining maximized echo. The goal of such optimization is increasing of ultrasonic excitation energy through better matching between firing output and probe. Level of ultrasonic excitation energy is clearly represented by echo amplitude. Upon completing **Tuning** optimization **Gain** to be adjusted to bring echo to **75-80%** of **A-Scan** height

5.2.13.7. Determining Probe Delay - Straight Beam (Normal) Single Element and Dual (TR) Probes – Typical Example



Activate submenu **PULSER** then set:

- Pulser Mode** to **Single** or **Dual** depending on probe
- Pulse Width** to **Spike (240 μJ)** for probe having resonant frequency of 8 MHz and higher or to **PW ns**, where **PW = 0.5 / F** (F is the probe resonant frequency) for probes having resonant frequency below 8 MHz
- Firing Level** to **18**
- Damping** to **1000 Ω**
- Tuning** to **NO**

Activate submenu **RECEIVER** then set:

- Display** to **Full** or **RF**
- Filter** to **BB**
- Frequency** to completely cover probe's effective bandwidth

Activate submenu **BASICS** topic then set:

- US Velocity** to **5920 m/s (233.1 in/ms)** for longitudinal wave probes or **3255 m/s (128.1 in/ms)** for shear wave probes
- Range** to **25.0 mm (1 in)**
- Display Delay** to **0 μs**
- Reject** to **0%**

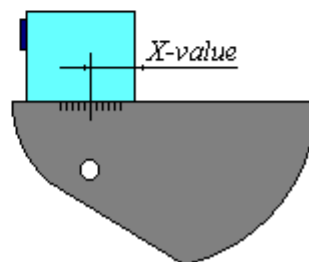
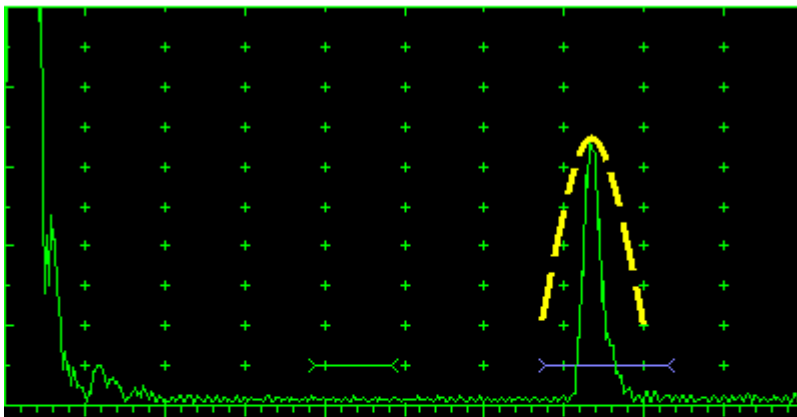
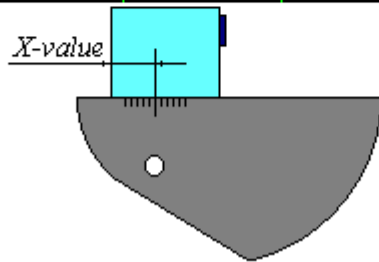
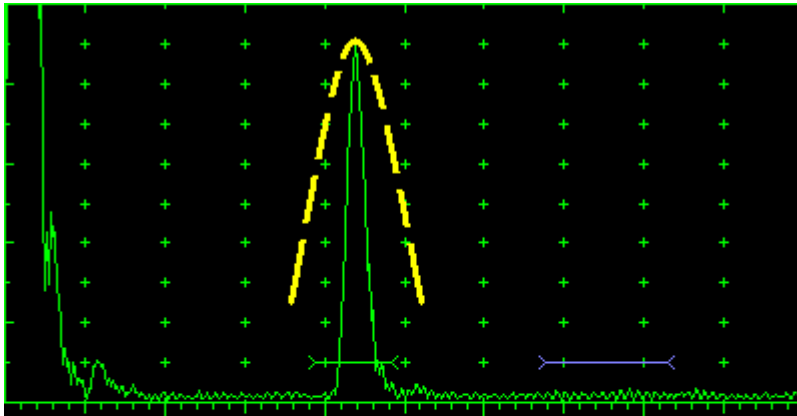
Stage 1: Apply probe to a side surface of V-2 reference standard to receive back echo

Stage 2: Tune **Display Delay** until rising edge of the *back echo* will match with the 50%-grid of the **A-Scan** width: in such case the obtained value of the **Display Delay** is equal to the actual **Probe Delay**



- ◆ It's necessary to setup **Gain** bringing height of back echo to **75-80%** of **A-Scan** height
- ◆ It is recommended to optimize **Tuning** in **PULSER** submenu upon obtaining back echo. The goal of such optimization is increasing of ultrasonic excitation energy through better matching between firing output and probe. Level of ultrasonic excitation energy is clearly represented by back echo amplitude. Upon completing **Tuning** optimization **Gain** to be adjusted to bring echo to **75-80%** of **A-Scan** height


5.2.13.8. Automatic Calibration (AUTOCAL) of Probe Delay and US Velocity - Angle Beam Probes - Shear or Longitudinal Waves – Typical Example

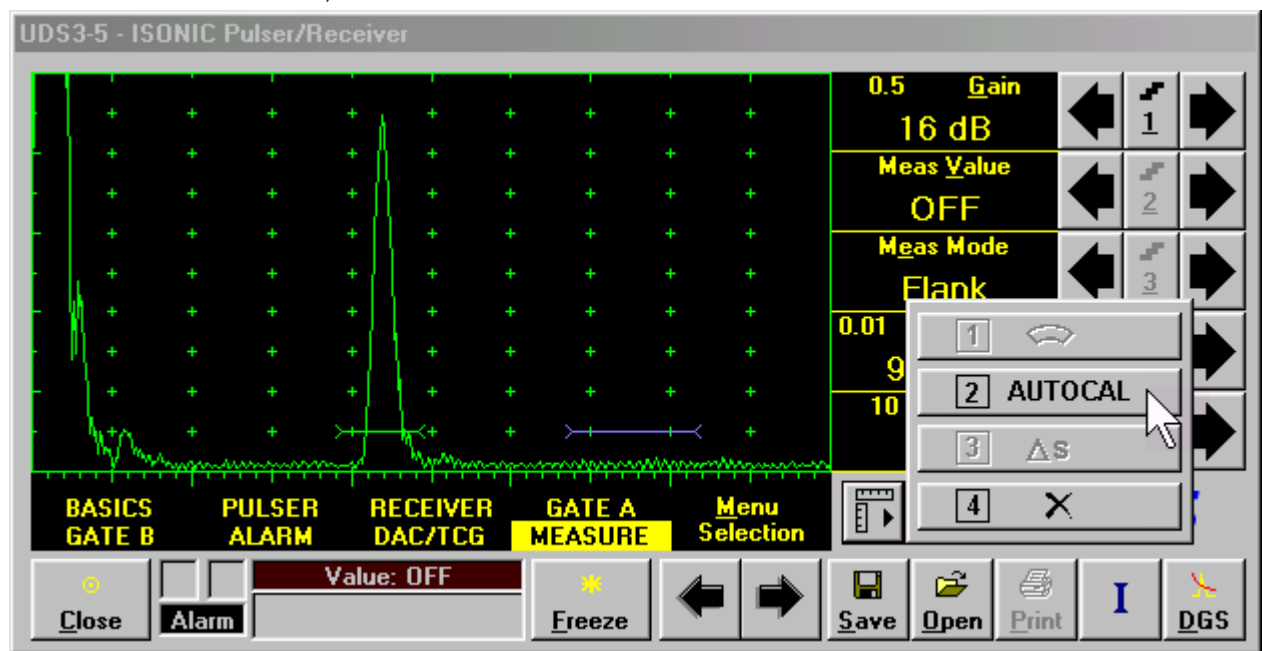



There are 2 maximized reference echoes from 2 concave reflectors with different radius 25 mm (1 in) and 50 mm (2 in) in use for performing automatic calibration of **Probe Delay** and **US Velocity**. **A-Scan** settings (**Range**, **Display Delay**, **US Velocity** – refer to paragraph 5.2.2 of this Operating Manual) must allow observing of both signals. **Gate A** to match with first reference echo received from concave reflector with smaller radius (shorter material travel distance) – refer to paragraph 5.2.5 of this Operating Manual. **Gate B** to match with second reference echo received from concave reflector with larger radius (longer material travel distance) – refer to paragraph 5.2.6 of this Operating Manual

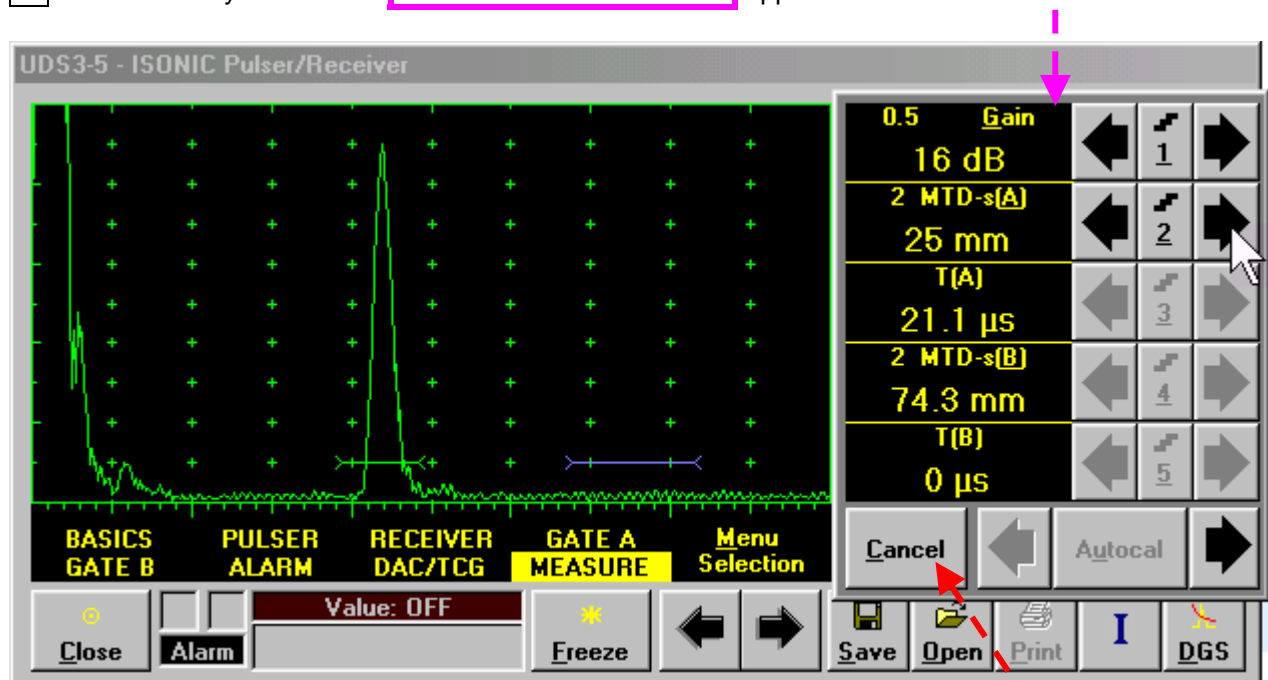



- ◆ It's necessary to setup **Gain** bringing height of back echo to **75-80%** of **A-Scan** height
- ◆ It is recommended to optimize **Tuning** in **PULSER** submenu upon obtaining back echo. The goal of such optimization is increasing of ultrasonic excitation energy through better matching between firing output and probe. Level of ultrasonic excitation energy is clearly represented by back echo amplitude. Upon completing **Tuning** optimization **Gain** to be adjusted to bring echo to **75-80%** of **A-Scan** height

Obtain first reference echo, activate submenu MEASURE then click on 

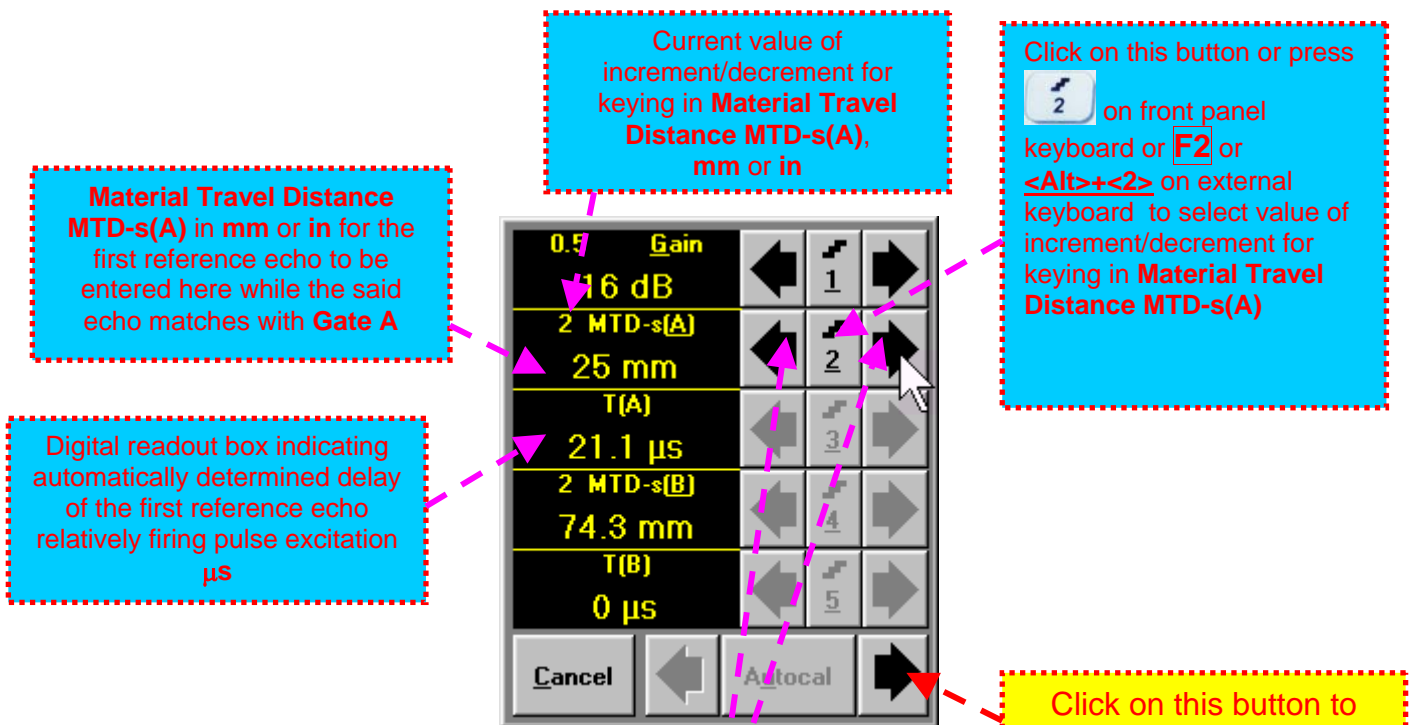


To activate AUTOCAL procedure click on **2 AUTOCAL** or press  on front panel keyboard or **F2** on external keyboard – the **AUTOCAL Control Surface** appears



Click on this button or press  on front panel keyboard or **Esc** or **<Alt>+<C>** on external keyboard to interrupt **AUTOCAL** Procedure and return to main UDS 3-5 control surface

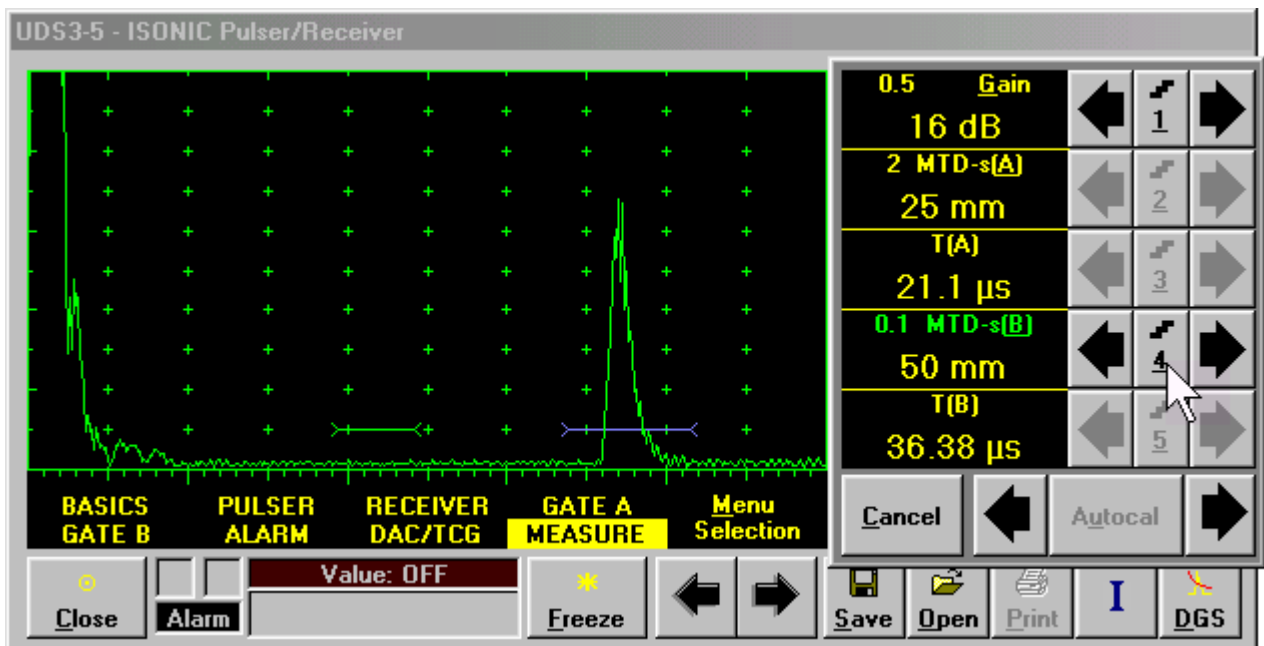
If necessary **Gain** may be re-adjusted in the **AUTOCAL Control Surface** by the same way as it is explained in paragraph 5.2.2 of this Operating Manual



To key in **Material Travel Distance MTD-s(A)** the following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate button
- **Keyboard**
 - Press on front panel keyboard or **F2** or **<Alt>+<A>** on external keyboard \Rightarrow **MTD-s(A)** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard
- **Combined**
 - Click on **MTD-s(A)** \Rightarrow **MTD-s(A)** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

Upon confirming keying in **Material Travel Distance MTD-s(A)** obtain second reference echo

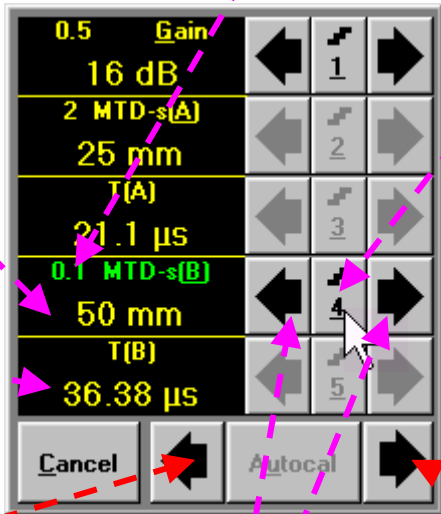


Material Travel Distance MTD-s(B) in mm or in for the second reference echo to be entered here while the said echo matches with Gate B

Current value of increment/decrement for keying in Material Travel Distance MTD-s(B), mm or in

Click on this button or press  on front panel keyboard or **F4** or **<Alt>+<4>** on external keyboard to select value of increment/decrement for keying in Material Travel Distance MTD-s(B)










Digital readout box indicating automatically determined delay of the second reference echo relatively firing pulse excitation μs



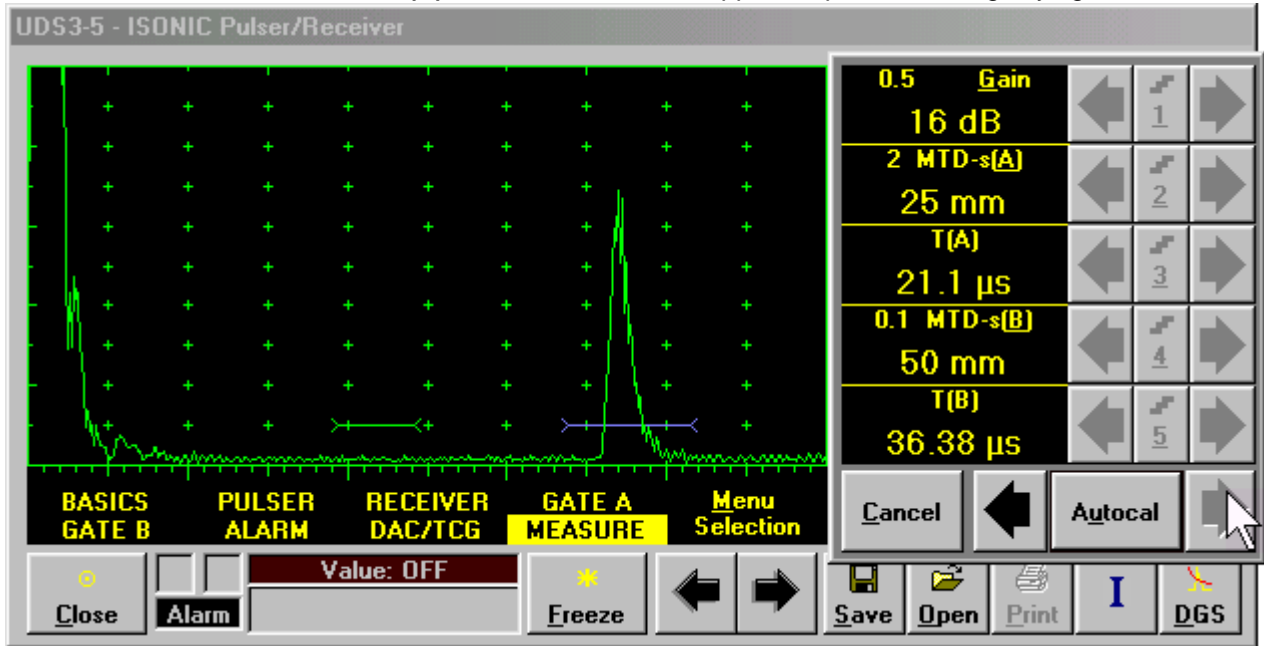
Click on this button if it is necessary to return back to keying in Material Travel Distance MTD-s(A)




Click on this button to confirm entered Material Travel Distance MTD-s(B)

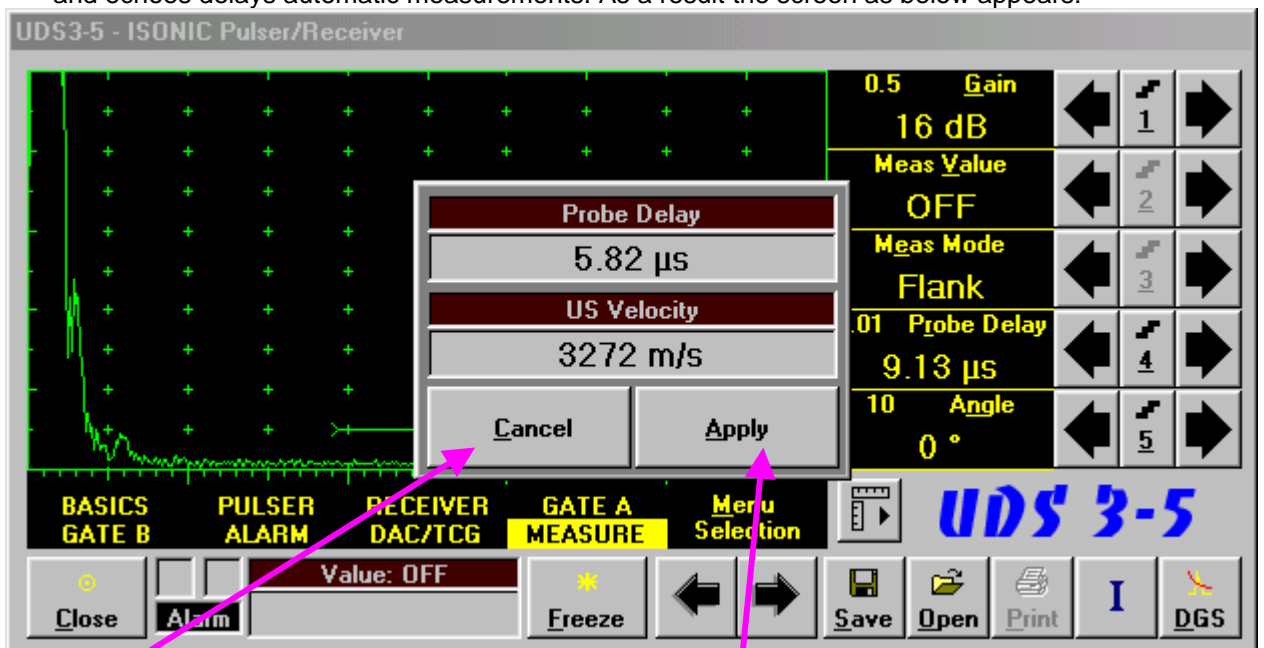
To key in Material Travel Distance MTD-s(B) the following manipulations are applicable:


- **Mouse / Touch Screen**
 - Click or press and hold on the appropriate button
- **Keyboard**
 - Press  on front panel keyboard or **F4** or **<Alt>+** on external keyboard \Rightarrow **MTD-s(B)** fore color changes to white - then use , , ,  on front panel keyboard or \uparrow , \rightarrow , \leftarrow , \downarrow on external keyboard
- **Combined**
 - Click on **MTD-s(B)** \Rightarrow **MTD-s(B)** fore color changes to white - then use , , ,  on front panel keyboard or \uparrow , \rightarrow , \leftarrow , \downarrow on external keyboard


Material Travel Distance MTD-s(B) The screen as below appears upon confirming keying in



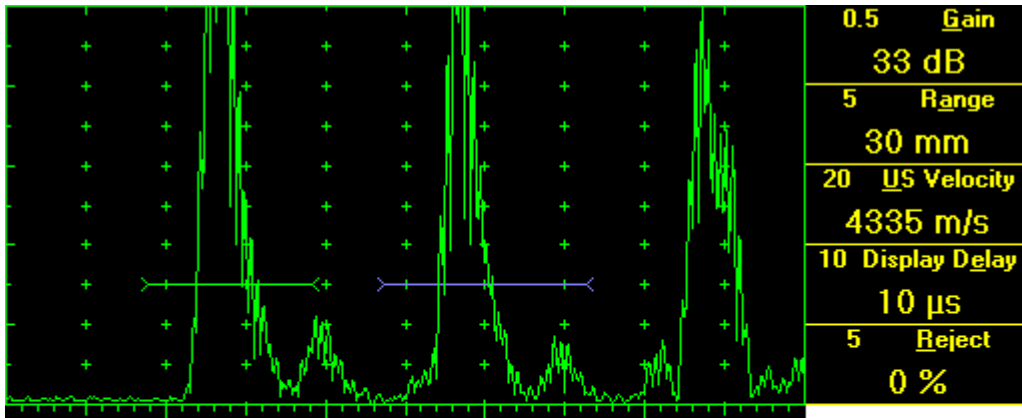
- ◆ Click on  if it is necessary to return back to keying in **Material Travel Distance MTD-s(A)**
- ◆ Click on  or press  on front panel keyboard or Enter or <Alt>+<U> on external keyboard to initialize automatic determining of **US Velocity** and **Probe Delay** based on above described keying and echoes delays automatic measurements. As a result the screen as below appears:



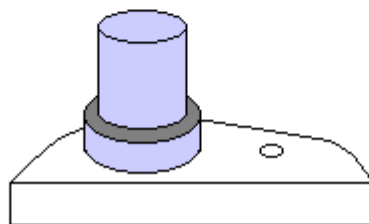
Click on  or press **Esc** or <Alt>+<C> on external keyboard to negate **AUTOCAL** results and return to main operating surface without modifying **Probe Delay** and **US Velocity** settings

Click on  or press **Enter** or <Alt>+<A> on external keyboard to accept **AUTOCAL** results and return to main operating surface with appropriate modifying **Probe Delay** and **US Velocity** settings

5.2.13.9. Automatic Calibration of Probe Delay and US Velocity - Straight Beam (Normal) Single Element and Dual (TR) Probes – Typical Example



There are 2 sequentially received back echoes required for performing automatic calibration of **Probe Delay** and **US Velocity**. **A-Scan** settings (**Range**, **Display Delay**, **US Velocity** – refer to paragraph 5.2.2 of this Operating Manual) must allow observing of both signals.



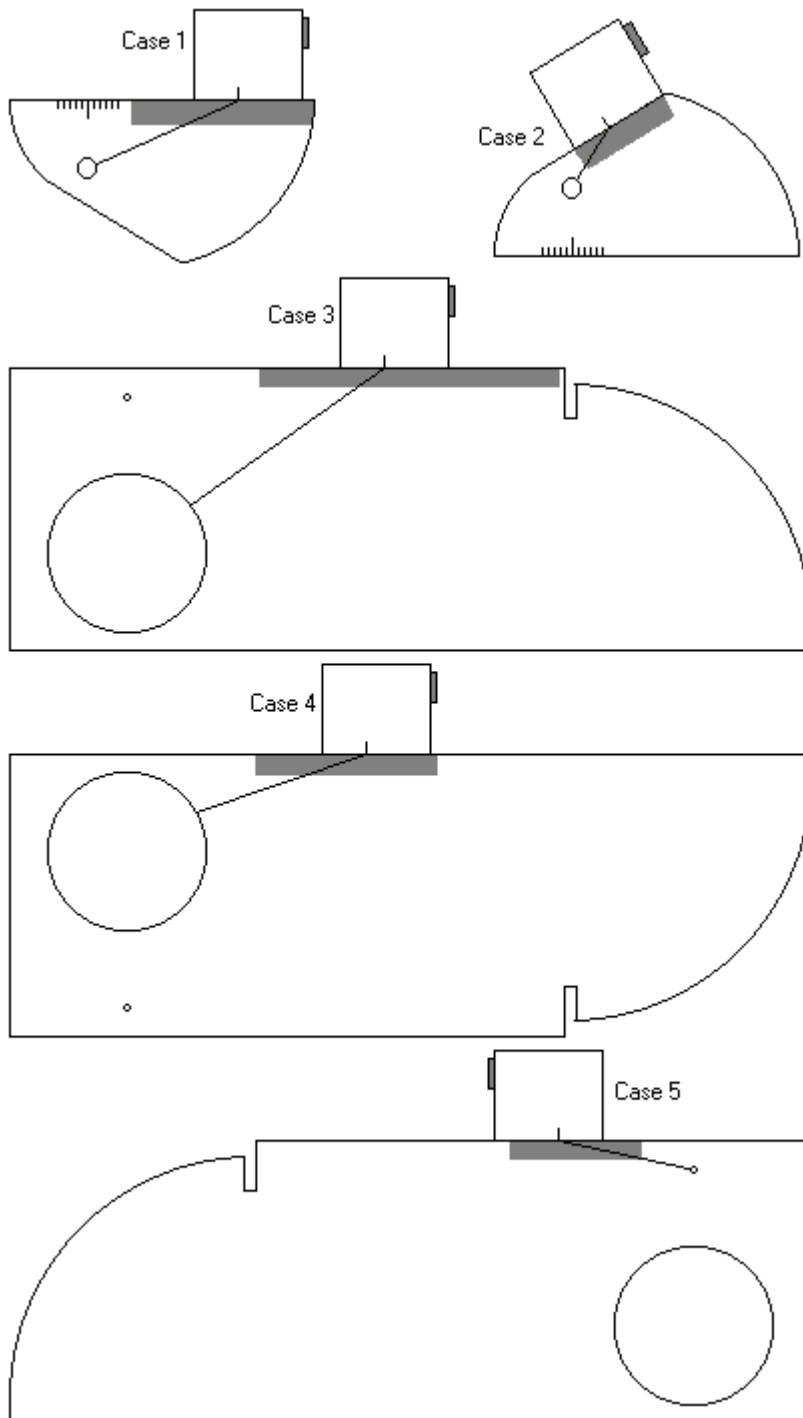
Gate A to match with first back echo (shorter material travel distance) – refer to paragraph 5.2.5 of this Operating Manual. **Gate B** to match with second back echo (longer material travel distance) – refer to paragraph 5.2.6 of this Operating Manual



- ◆ It's necessary to setup **Gain** bringing height of back echo to **75-80%** of **A-Scan** height
- ◆ It is recommended to optimize **Tuning** in **PULSER** submenu upon obtaining back echo. The goal of such optimization is increasing of ultrasonic excitation energy through better matching between firing output and probe. Level of ultrasonic excitation energy is clearly represented by back echo amplitude. Upon completing **Tuning** optimization **Gain** to be adjusted to bring echo to **75-80%** of **A-Scan** height

All further operations to be performed identically to described in paragraph 5.2.13.8 of this Operating Manual

5.2.13.10. Determining Incidence Angle (Probe Angle)



Determining of incidence angle is based on maximizing echo from side-drilled hole in reference block and reading the value of angle from corresponding scale. Depending on probe dimensions and angles there are various reference blocks and scales applicable:

Case 1: Miniature angle beam probe, incidence angle 35° to 65° , V-2 reference block

Case 2: Miniature angle beam probe, incidence angle 65° to 75° , V-2 reference block

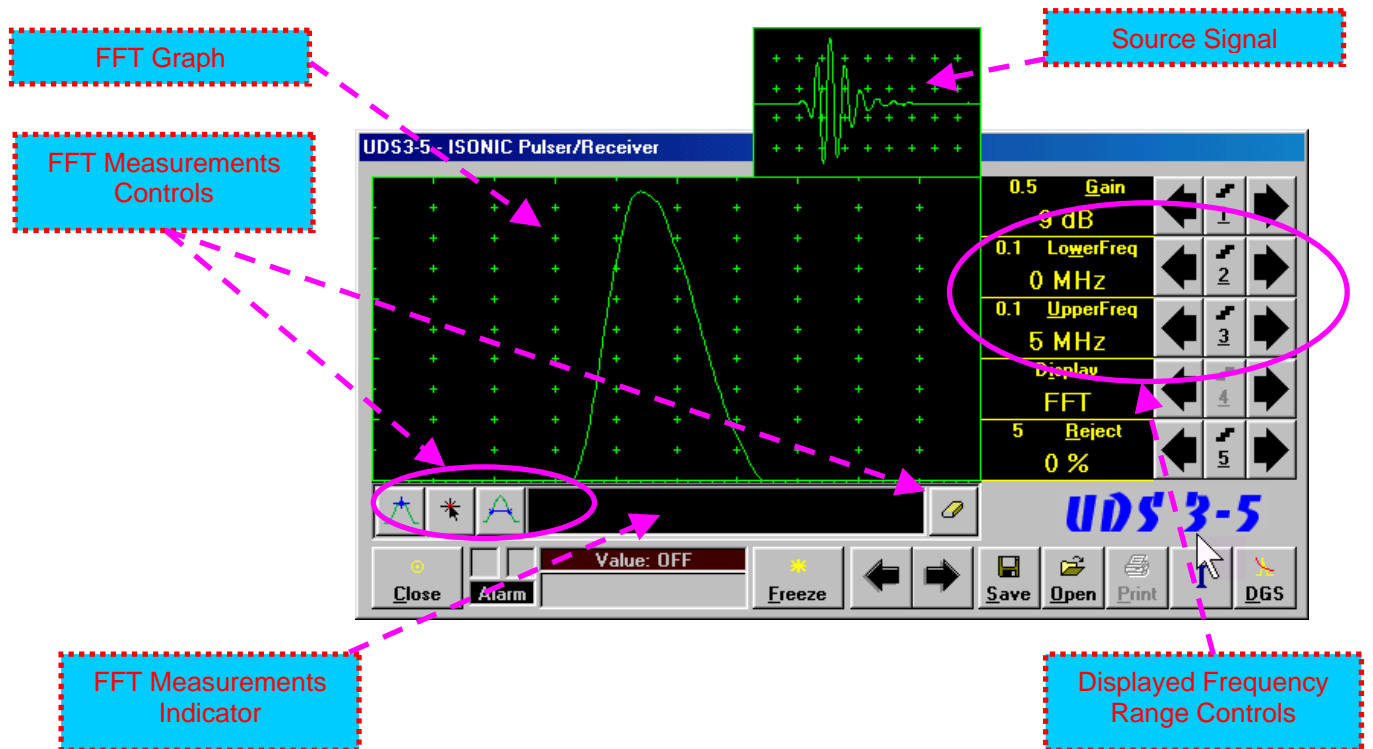
Case 3: Medium or large size angle beam probe, incidence angle 40° to 66° , V-1 reference block

Case 4: Medium or large size angle beam probe, incidence angle 60° to 76° , V-1 reference block

Case 5: Medium or large size angle beam probe, incidence angle 74° to 80° , V-1 reference block

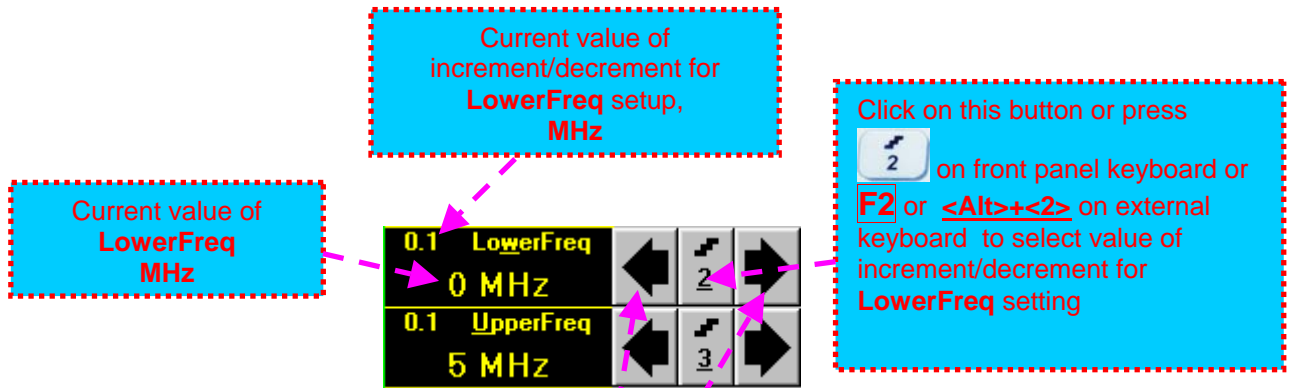
5.2.14. Frequency Domain Signal Presentation and Evaluation

Using **Range** and **Delay** parameters select a portion of **A-Scan** for frequency domain (FFT) presentation then do activate submenu **RECEIVER** and switch **Display** to **FFT** (refer to paragraph 5.2.4 of this Operating Manual). The screen as below appears:



i Display may not be switched into the FFT if the **Range** value is too long or **DAC/TCG/DGS** is active

Lower frequency bound (LowerFreq)












To control **LowerFreq** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click or press and hold on appropriate button

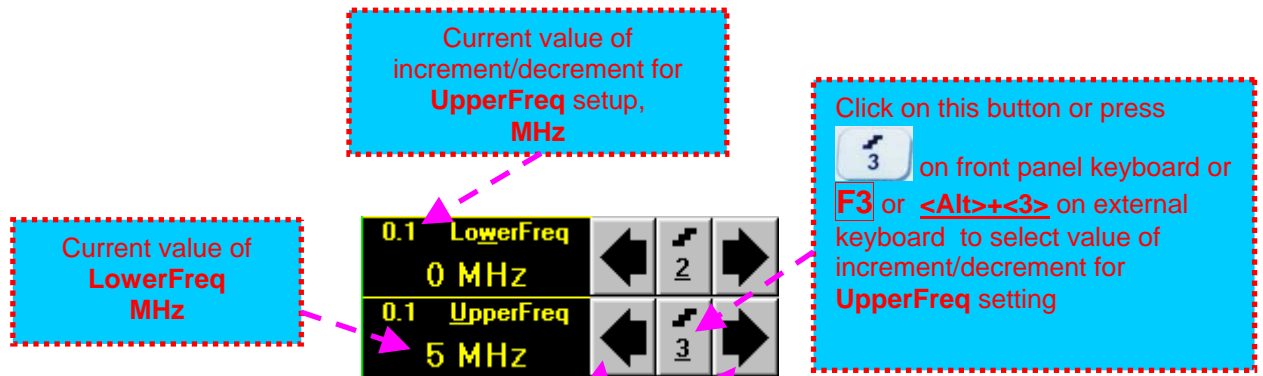
- **Keyboard**

- Press  on front panel keyboard or **F2** or **<Alt>+<W>** on external keyboard ⇒ **LowerFreq** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **LowerFreq** ⇒ **LowerFreq** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

Upper frequency bound (UpperFreq)



To control **UpperFreq** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click or press and hold on the appropriate button



- **Keyboard**

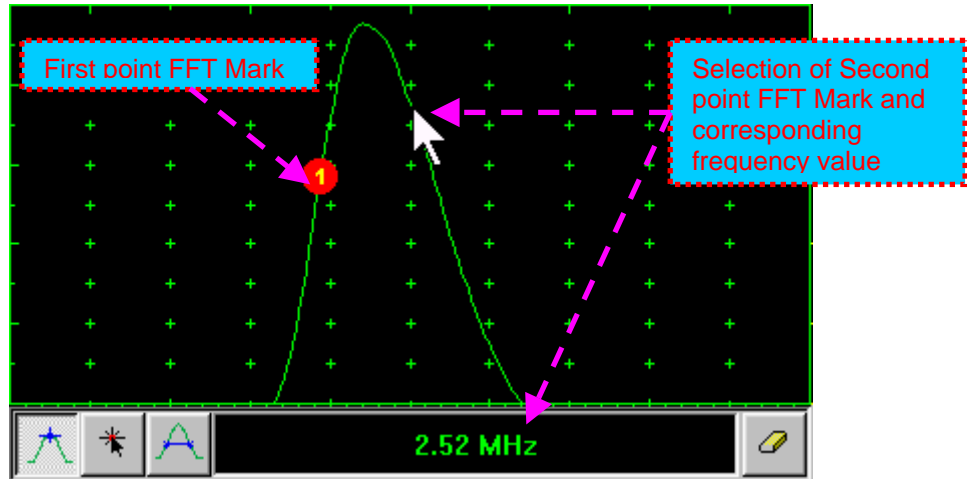
- Press 3 on front panel keyboard or **F3** or **<Alt>+<U>** on external keyboard ⇒ **UpperFreq** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard


- **Combined**

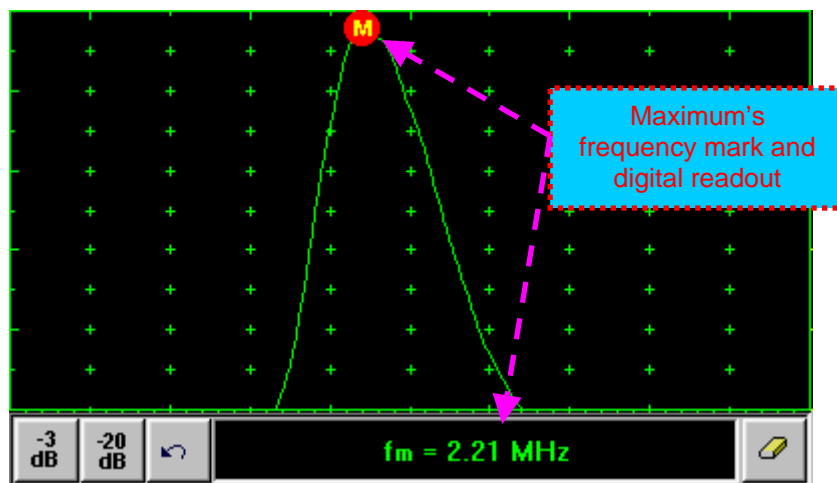
- Click on **UpperFreq** ⇒ **UpperFreq** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

Find maximum



Click on  – mouse pointer may be guided then just over FFT graph. **FFT Readout Box** displays frequency corresponding to pointer position whilst guiding the cursor. Select first point of interest by mouse click or through release of touch screen stylus. The appropriate mark  appears. Select the second point of interest by the same way

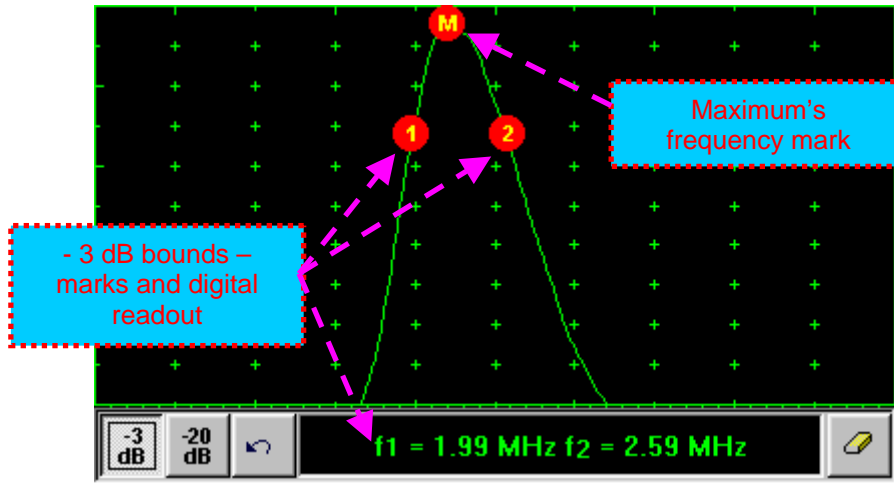


Maximum's frequency mark  appears and **FFT Readout Box** displays the found value automatically upon mouse click or releasing of touch screen stylus:



Find the -3db / -20db level bounds:


Upon finding the maximum's frequency click on  or . Two points found corresponding to selected level appear on the FFT graph and **FFT Readout Box** shows their corresponding frequency values:

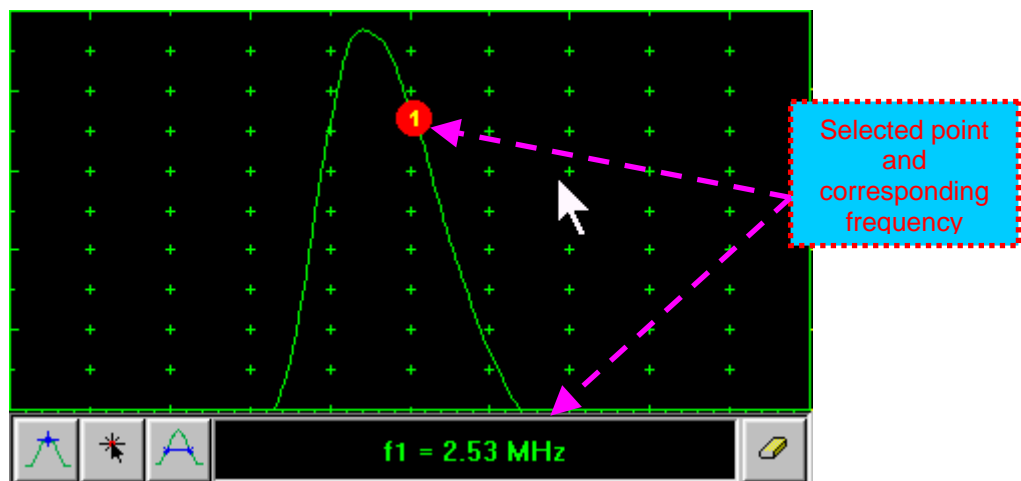


Return to FFT Measurements toolbar:


Click on 

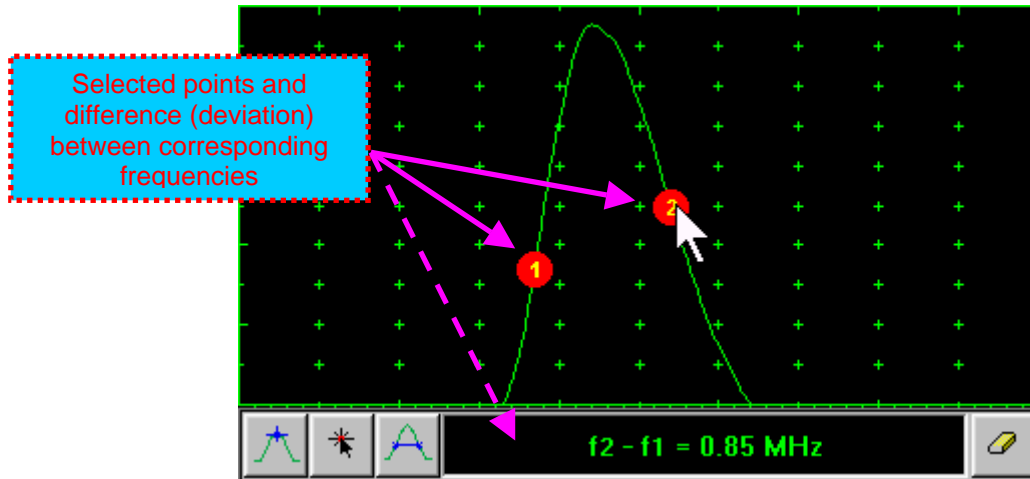
Find frequency corresponding to selected single point on FFT graph:

Click on  – mouse pointer may be guided then just over FFT graph. **FFT Readout Box** displays frequency corresponding to pointer position whilst guiding the cursor. Select first point of interest by mouse click or through release of touch screen stylus. The appropriate mark **1** appears and **FFT Readout Box** displays corresponding frequency:



Frequency difference (deviation) between two points:

Click on  – mouse pointer may be guided then just over FFT graph. **FFT Readout Box** displays frequency corresponding to pointer position whilst guiding the cursor. Select first point of interest by mouse click or through release of touch screen stylus. The appropriate mark **1** appears. Select second point of interest by the same way - the appropriate mark **2** appears and the **FFT Readout Box** displays difference (deviation) between corresponding frequencies:



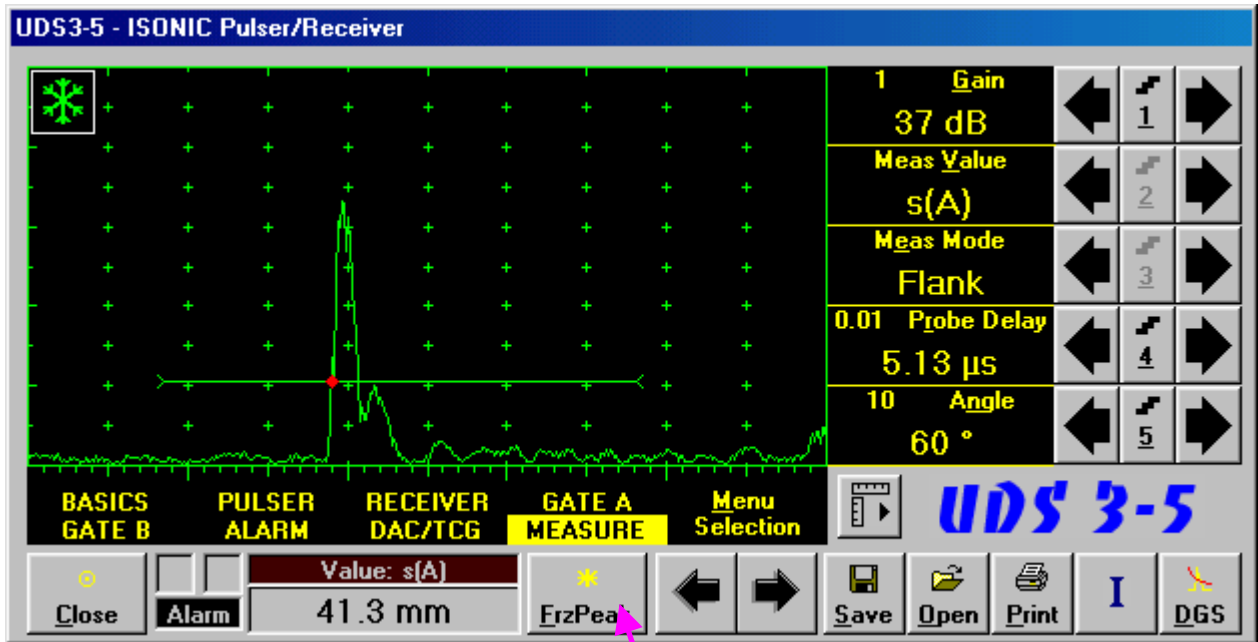
Clear FFT Marks:



Click on 

Exit FFT Mode:

Change **Display** mode

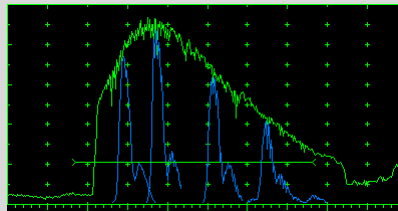
5.2.15. Freeze A-Scan / FFT Graph





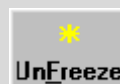
To freeze / freeze peak / unfreeze the **A-Scan** click  or press  on front panel keyboard or **F6** or **<Alt>+<F>** on external keyboard



- ◆ **Freeze Peak** mode allows representing of Hilbert envelop for sequence of echoes obtained while manipulating probe over some reflector. This function may be useful for localization of echo maximum when working in A-Scan mode:







- ◆ **Freeze Peak** mode may not be activated for RF and FFT signal presentation
- ◆ Appearing of  at the upper left corner of **A-Scan** indicates that it is frozen (**Freeze**)
- ◆ Appearing of  at the upper left corner of **A-Scan** indicates that **Freeze Peak** mode is active
- ◆ The following operations are available when time domain **A-Scan** is frozen:
 - ± 6 dB **Gain** varying according to paragraph 5.2.2 of this Operating Manual
 - Manipulating **Gates A** and **B** according to paragraphs 5.2.5, 5.2.6, 5.2.7 of this Operating Manual
 - Varying **Alarm** mode according to paragraph 5.2.8 of this Operating Manual
 - Selecting parameter (**Meas Value**) for automatic measurements and varying settings **Probe Delay** and **Angle** as per paragraph 5.2.12 of this Operating Manual and obtaining corresponding measurements results in the digital readout box (**Value**)
- ◆ The following operations are available while frequency domain **FFT Graph** is frozen:
 - ± 6 dB **Gain** varying according to paragraph 5.2.2 of this Operating Manual
 - All **FFT evaluation / measurements** as per paragraph 5.2.14 of this Operating Manual
- ◆ Caption of appropriate button changes in the **UDS 3-5 Pulser/Receiver** window when freeze / freeze peak / unfreeze **A-Scan / FFT Graph**



5.2.16. Zoom A-Scan / FFT Graph

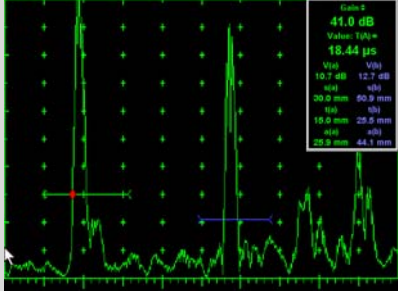
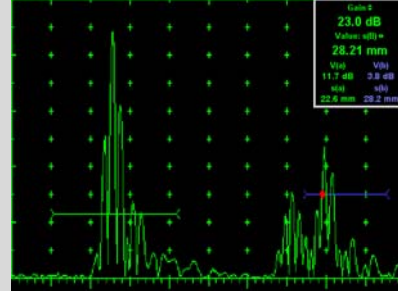
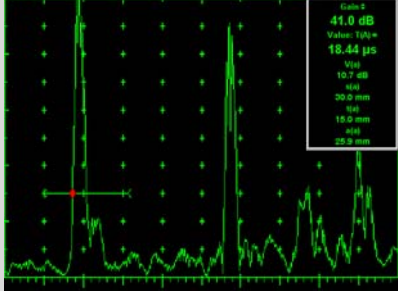
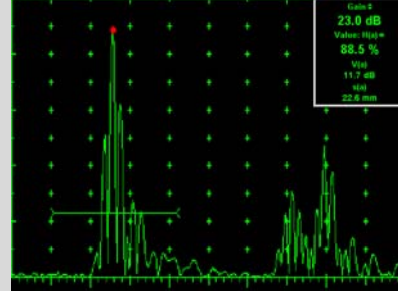
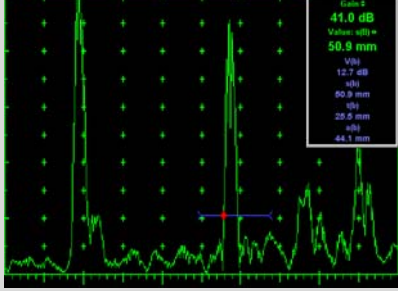
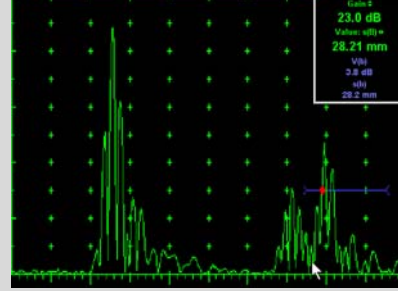
Double click on **A-Scan / FFT Graph** to get it enlarged. Enlarged **A-Scan / FFT Graph** occupies screen completely





In upright corner of **A-Scan** there is a digital readout box indicating current **Gain** value and digital readout of automatic measurements provided that corresponding **Gate** is active

To control **Gain** while **A-Scan** is enlarged use  and  on front panel keyboard or ,  on external keyboard



To freeze / freeze peak / unfreeze enlarged **A-Scan** press  on front panel keyboard or **F6** on external keyboard

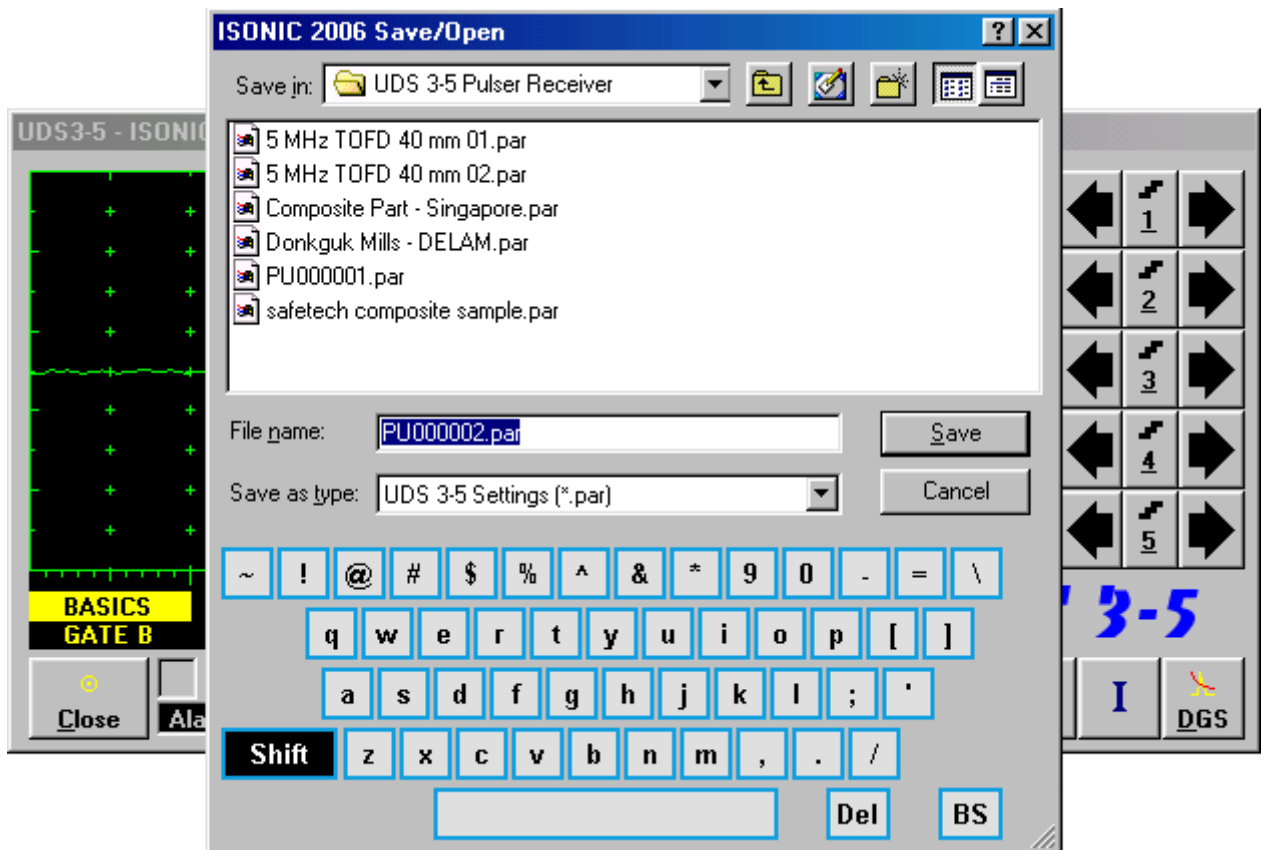
If **Gate A** and / or **Gate B** is active then:

Active Gate	Angle Beam Probe Angle > 0° in the submenu MEASURE	Straight Beam Probe Angle = 0° in the submenu MEASURE
A and B	 <p>Parameters V(A), s(A), t(A), a(A), V(B), s(B), t(B), and a(B) are measured and indicated automatically – refer to paragraph 5.2.13.1 of this Operating Manual</p>	 <p>Parameters V(A), s(A), V(B), and s(B) are measured and indicated automatically – refer to paragraph 5.2.13.1 of this Operating Manual</p>
A	 <p>Parameters V(A), s(A), t(A), and a(A) are measured and indicated automatically – refer to paragraph 5.2.13.1 of this Operating Manual</p>	 <p>Parameters V(A), and s(A) are measured and indicated automatically – refer to paragraph 5.2.13.1 of this Operating Manual</p>
B	 <p>Parameters V(B), s(B), t(B), and a(B) are measured and indicated automatically – refer to paragraph 5.2.13.1 of this Operating Manual</p>	 <p>Parameters V(B), and s(B) are measured and indicated automatically – refer to paragraph 5.2.13.1 of this Operating Manual</p>

To select an additional parameter for automatic measurement and large character indication while **A-Scan** is enlarged (**Meas Value** - refer to paragraphs 5.2.12 and 5.2.13 of this Operating Manual) use  and  on front panel keyboard or ,  on external keyboard. **Gate A** and **Gate B** if active may be drag and drop manipulated on enlarged **A-Scan** according to paragraph 5.2.7 of this Operating Manual. To return to main operating surface window double click on enlarged **A-Scan / FFT Graph**

5.2.17. Save an A-Scan and its Calibration Dump into a file

To save the **A-Scan / FFT Graph** and **Calibration Dump** into a file click on  or press  on front panel keyboard or **F12** or **<Alt>+<S>** on external keyboard – **ISONIC 2006 Save/Open** window becomes active providing automatically created name for a new file in **File name:** box:



To save a file:




- select disk drive and directory for placing a file using mouse or touch screen
- approve automatically created new file name

OR



mark a file to be replaced from the list appearing in the destination directory

OR

type a new file name using either virtual keyboard generated in **ISONIC 2006 Save/Open** window or external keyboard – standard Windows rules for file naming are applicable, long names (up to 64 characters) are supported

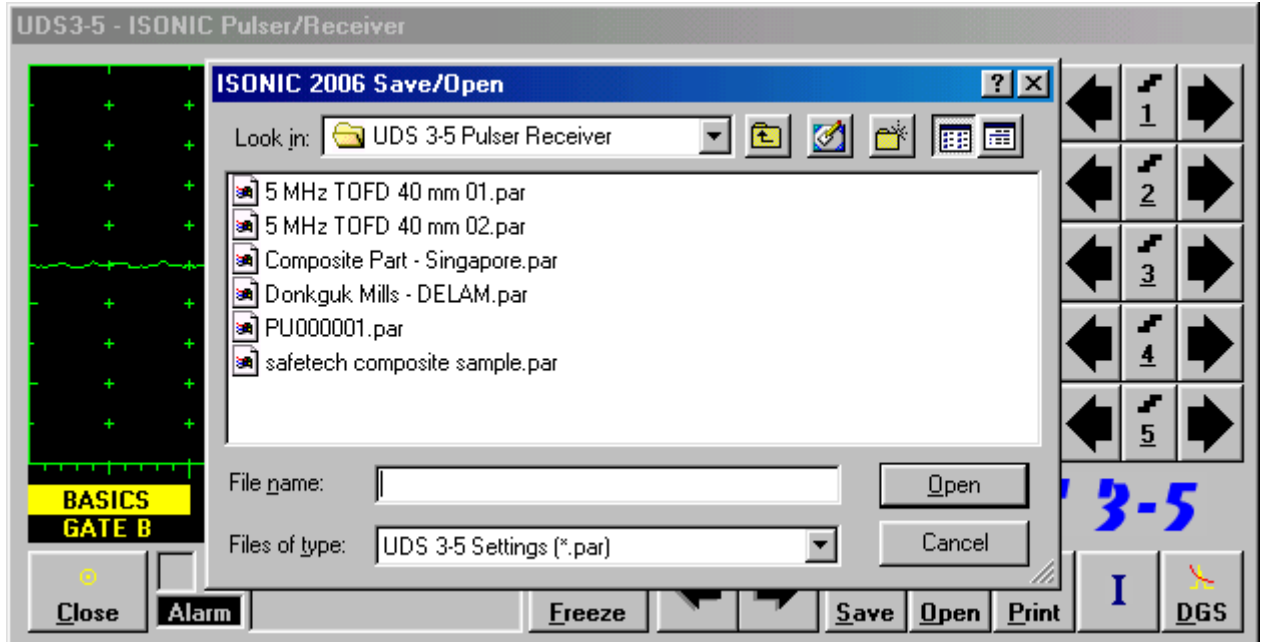
- double click on file to be replaced or click on  or press  or  on front panel keyboard or press **F12** or **Enter** or **<Alt>+<S>** on external keyboard

ISONIC 2006 Save/Open window disappears automatically upon completing saving a file




To exit from **ISONIC 2006 Save/Open** window without saving a file click on  or press  on front panel keyboard or **Esc** on external keyboard

5.2.18. Load an A-Scan and its Calibration Dump from a file

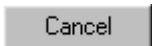

To load **A-Scan/FFT Graph** and **Calibration Dump** from a file click on  or press  on front panel keyboard or **F11** or **<Alt>+<O>** on external keyboard – **<Alt>+<O>** on the keyboard – **ISONIC 2006 Save/Open** window becomes active



To open a file:



- select disk drive and directory containing a file required
- select then file then double click on its name or click on  or press  or  on front panel keyboard or **F11** or **Enter** or **<Alt>+<O>** on external keyboard

ISONIC 2006 Save/Open window disappears automatically upon completing loading a file



To exit from **ISONIC Save/Open** window without opening a file click on  or press  on front panel keyboard or **Esc** on external keyboard

5.2.19. Print A-Scan/FFT Graph and Settings List

Ensure the printer connection is in order (printer to be accessible through either USB or LAN port and

defined as default in the **ISONIC 2006**) then click on  or press  on front panel keyboard or **F10** or **<Alt>+<P>** on external keyboard

5.2.20. Activate Main Recording and Imaging Menu

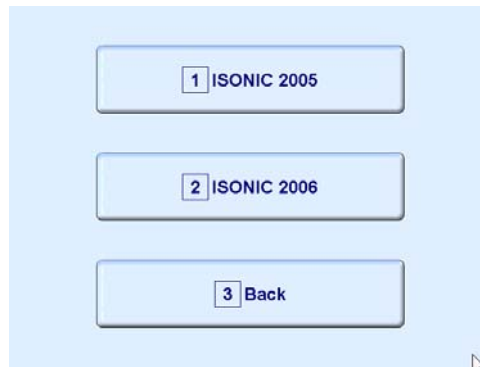
Click on  or press  on front panel keyboard or **F8** on external keyboard. Refer to Chapter 6 of this Operating Manual for further instructions

5.2.21. Switch OFF UDS 3-5

To switch OFF UDS 3-5 click on  or press  on front panel keyboard or **ESC** or **<Alt>+<C>** on external keyboard

6. Main Recording and Imaging Menu

Main Recording and Imaging Menu is shown below:





There are two recording and imaging modes possible in **ISONIC 2006** instrument:

- ◆ **Straight Line Scanning Recording and Imaging** is a standard feature allowing:
 - ❑ **Thickness Profile B-Scan imaging and recording**, which is performed through continuous measuring of thickness value along straight line type probe trace
 - ❑ **B-Scan cross-sectional imaging and recording of defects** for longitudinal and shear wave inspection, which is performed through continuous measuring of echo amplitudes and reflectors coordinates along straight line type probe trace
 - ❑ **CB-Scan horizontal plane-view imaging and recording of defects** for shear, surface, and guided wave inspection, which is performed through continuous measuring of echo amplitudes and reflectors coordinates along straight line type probe trace
 - ❑ **TOFD Inspection – RF B-Scan and D-Scan Imaging** along straight line type probe trace

For *Straight Line Scanning* records it may be used:



- *Time-based* mode – **ISONIC 2006** is equipped with built-in real time clock
- *True-to-location* mode – **ISONIC 2006** is equipped with built-in incremental encoder interface modes

In **ISONIC 2006** instrument **Straight Line Scanning Recording and Imaging** is implemented

identically to **ISONIC 2005**; to enter this mode click on  or press  on front panel keyboard or **F1** on external keyboard

- ◆ **XY Scanning Recording and Imaging** is optional feature, which may be implemented through various license protected inspection software modes. Depending of license installed in the **ISONIC 2006** instrument there is a number of inspection applications listed below possible:
 - ❑ **Thickness Map imaging and recording**, which is performed through continuous measuring of thickness value along probe trace
 - ❑ **Flaw Detection – Pulse Echo 3D imaging (C-Scan, B-Scan, D-Scan, P-Scan) and recording of defects** for longitudinal and shear wave inspection, which is performed through continuous measuring of echo amplitudes and reflectors coordinates along probe trace with probe swiveling angle dependency where applicable
 - ❑ **Flaw Detection – Through Transmission / Back Echo Attenuation 2D imaging and recording (C-Scan)** which is performed through continuous measuring of signal amplitudes along probe trace
 - ❑ **CB-Scan horizontal plane-view imaging and recording of defects** for shear, surface, and guided wave inspection, which is performed through continuous measuring of echo amplitudes and reflectors coordinates along probe trace with probe swiveling angle dependency where applicable
 - ❑ **TOFD Inspection – RF B-Scan and D-Scan Imaging** along probe trace

For *XY-Scanning* records **ISONIC 2006** is equipped with built-in airborne ultrasound encoder controller and appropriate interface

To enter **XY Scanning Recording and Imaging** mode click on  or press  on front panel keyboard or **F2** on external keyboard

To return to main operating surface click on  or press  or  on front panel keyboard or **Esc** or **F3** on external keyboard

7. Straight Line Scanning Recording and Imaging

7.1. Straight Line Scanning Recording and Imaging Menu

Straight Line Scanning Recording and Imaging Menu is shown below:








There are two straight line scanning recording and imaging submenus available:

- ◆ **Time Based Recording** submenu relates to line scanning procedures where probe is manipulated over object under test with constant speed and defects images are formed from sequence of **A-Scans** captured at equal time intervals (real time clock). To open **Time Based**

Recording submenu click on  or press  on front panel keyboard or **F1** on external keyboard

- ◆ **True to Location Recording** submenu relates to line scanning procedures where coordinate of probe manipulated over object under test is transferred to **ISONIC 2006 instrument** by means of position encoder while defects images are formed from sequence of **A-Scans** captured at equal distance intervals. To open **True to Location Recording** submenu click on













 or press  on front panel keyboard or **F2** on external keyboard




To return to **Main Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **Esc** or **F3** on external keyboard

7.2. Time Based and True to Location Recording Submenus

Both **Time Based Recording** and **True to Location Recording** submenus allow activating 4 protocols of data recording:





- ◆ **Thickness Profile imaging and recording – t-BScan(Th) or BScan(Th)** – click on  or  or press  on front panel keyboard or **F1** on external keyboard – illustrative video is available at <http://www.sonotronndt.com/video.asp?VideoID=1>
- ◆ **B-Scan cross-sectional imaging and recording of defects for longitudinal and shear wave inspection – t-ABIScan or ABIScan** – click on  or  or press  on front panel keyboard or **F2** on external keyboard – illustrative video is available at <http://www.sonotronndt.com/video.asp?VideoID=2>
- ◆ **TOFD Inspection – RF B-Scan and D-Scan Imaging – t-TOFD or TOFD** – click on  or  or press  on front panel keyboard or **F3** on external keyboard – illustrative video is available at <http://www.sonotronndt.com/video.asp?VideoID=4>
- ◆ **CB-Scan horizontal plane-view imaging and recording of defects for shear, surface, and guided wave inspection – t-FLOORMAP L or FLOORMAP L** click on  or  press  on front panel keyboard or **F4** on external keyboard – illustrative video is available at <http://www.sonotronndt.com/video.asp?VideoID=3>

To return to **Straight Line Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **Esc** or **F5** on external keyboard

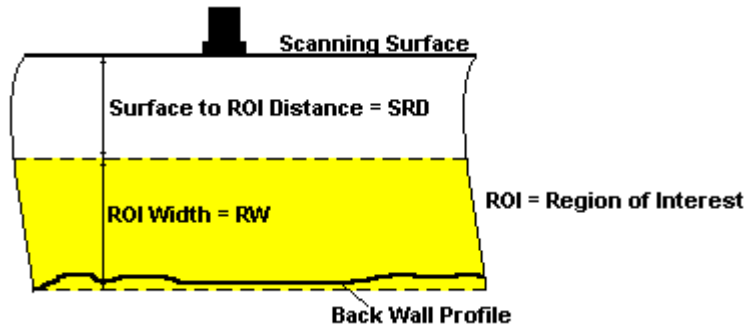
7.3. Thickness Profile Imaging and Recording – t-BScan(Th) and BScan(Th)

7.3.1. Setup Pulser Receiver for Thickness Profile Imaging and Recording

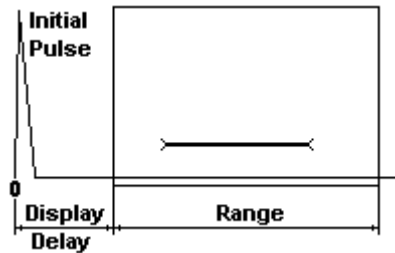
UDS 3-5 Pulser Receiver window – main operating surface – appears on ISONIC 2006 screen upon clicking on  or . The following settings to be provided:

#	Parameter or Mode	Submenu	Required Settings	Note
1	aSwitch	GATE A	ON	
2	Gain aThreshold	BASICS GATE A	Gain and aThreshold settings to provide receiving an echo from the minimal area of thickness degradation to be detected; height of the said echo to exceed aThreshold; signals from other reflectors less then defined one not to exceed aThreshold	
3	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of the Inspection Procedure	
4	Pulser Mode	PULSER	Dual for dual element probes Single for single element probes	
5	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain and aThreshold setting procedure
6	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain and aThreshold setting procedure
7	Display	RECEIVER	Display mode may be either Full, RF, PosHalf, or NegHalf	The same Display mode to be used for both Probe Delay determining and Thickness Profile Imaging
8	USVelocity	BASIC	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	
9	Probe Delay	MEASURE	Probe Delay setting to be equal to actual probe delay	Probe delay may be determined according to paragraph 5.2.13.7 or 5.2.13.9 of this Operating Manual or similarly
10	Angle	MEASURE	Angle = 0°	
11	Meas Mode	MEASURE	Flank	
12	Range, Display Delay, AStart, aWidth	BASIC GATE A	Range, Display Delay, AStart, and aWidth settings to be performed with reference to the Region of Interest for t-BScan(Th) and BScan(Th) table below	
13	Settings for other parameters and modes have no significance			

Upon completing click on  or press  on front panel keyboard or  on external keyboard



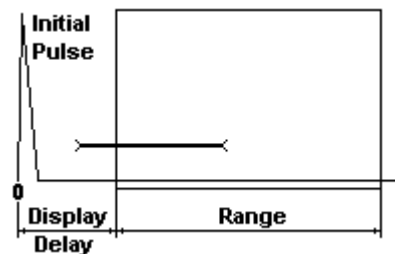
Case 1



$$SRD = aStart$$

$$RW = aWidth$$

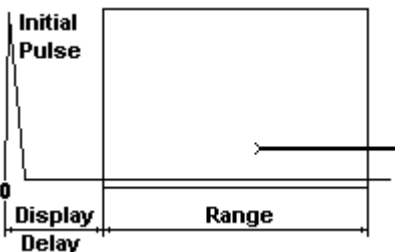
Case 2



$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

$$RW = aStart + aWidth - SRD$$

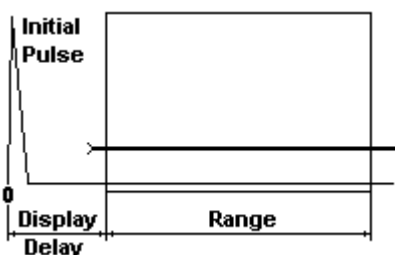
Case 3



$$SRD = aStart$$

$$RW = \frac{DisplayDelay}{2} \times USVelocity + Range - aStart$$

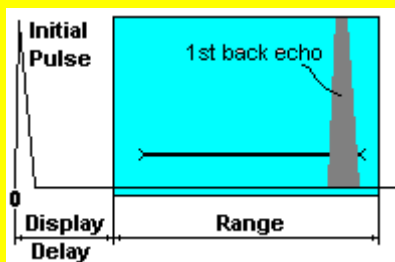
Case 4



$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

$$RW = Range$$

Preferred embodiment

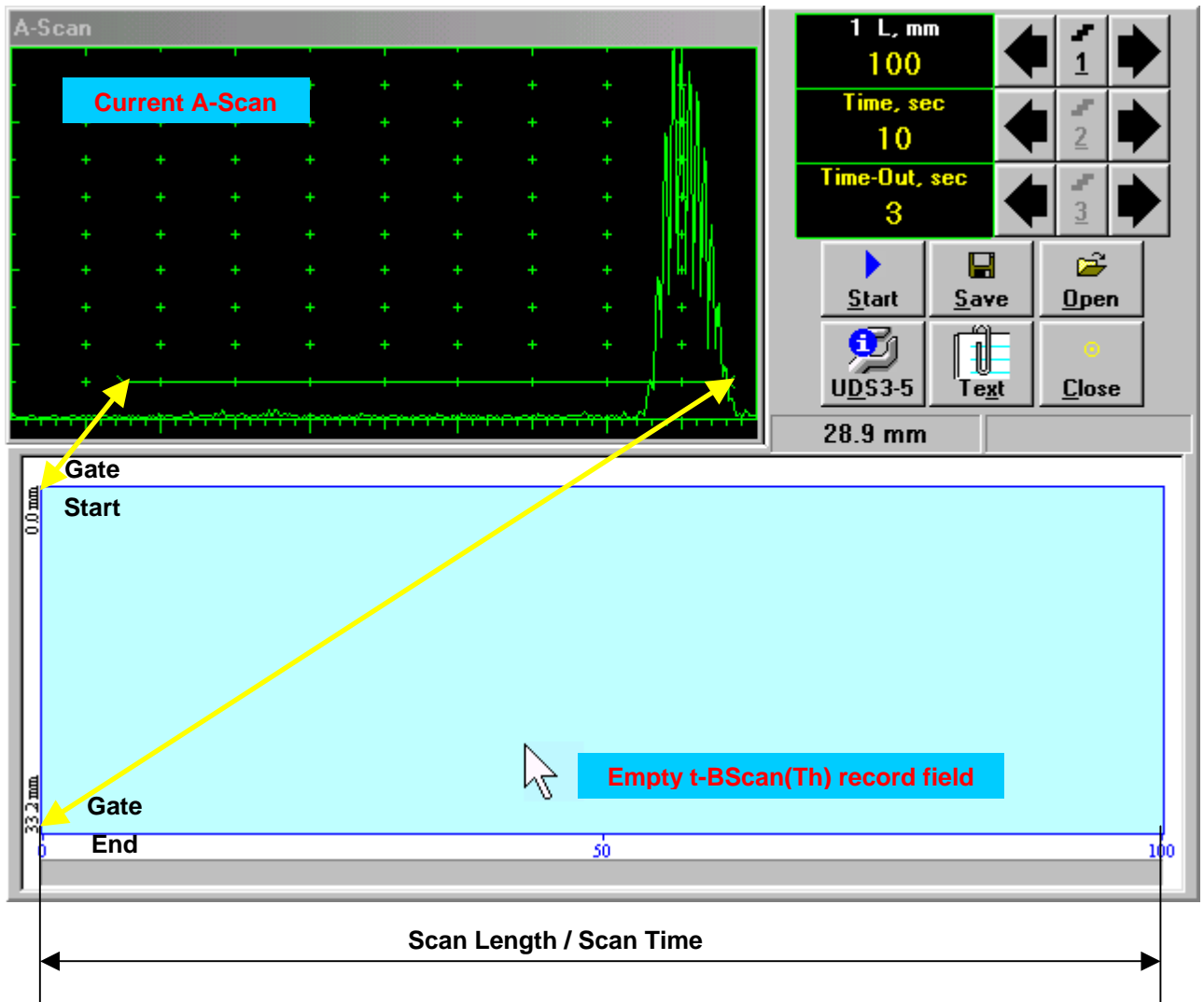


- ◆ **aStart** and **aWidth** setting to provide appearance of whole **Gate A** on the **A-Scan**
- ◆ **aWidth = (0.75...0.95) × Range**
- ◆ **First Back Echo** at the thickest area of object under test to be fully matching with Gate A
- ◆ **First Back Echo** at the thickest area of object under test to "occupy" 5-10% of the Gate A width on the **A-Scan**

7.3.2. Thickness Profile Imaging – Implementation

7.3.2.1. t-BScan(Th) – Prior to Scanning

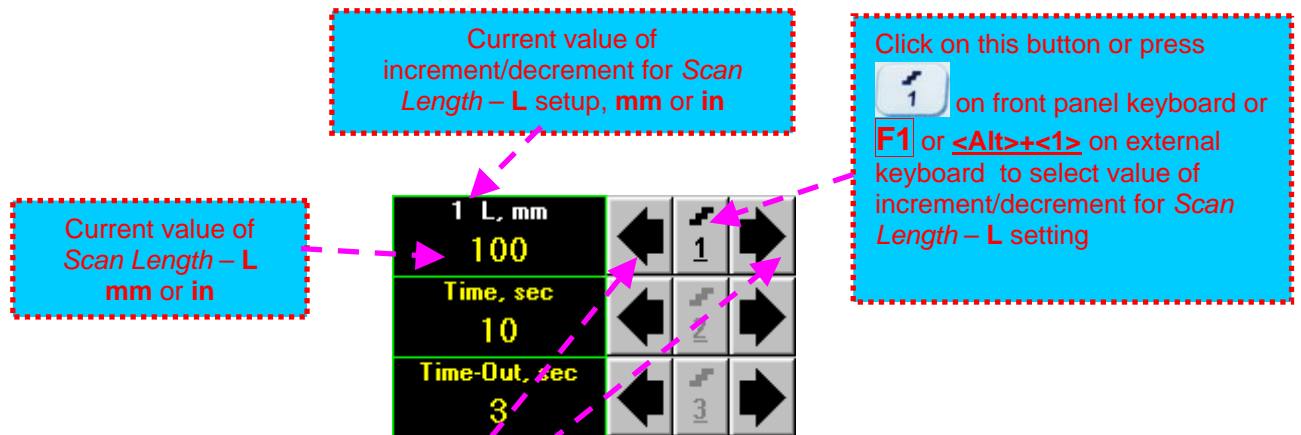
t-BScan(Th) control panel is shown below



Display Delay and **Range** settings for current **A-Scan** to be used for the recording are equivalent to the same setting of **UDS 3-5 Pulser Receiver** precessing entering into **t-BScan(Th)** mode

Scan Length and Scan Time

Scan Length – **L** represents length of section of test object to be displayed, over which probe will be scanning during recording period. **Time** (Scan Time) is the duration of recording period



To control *Scan Length* – **L** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding button

- **Keyboard**

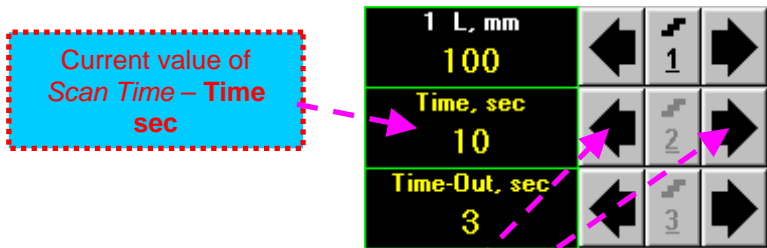
- Press on front panel keyboard or **F1** on external keyboard ⇒ **L** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **L** ⇒ **L** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of *Scan Length* – **L** is adjustable between 50 and 1000 **mm** or 2 and 40 **in**












To control *Scan Time – Time* the following manipulations are applicable:









- **Mouse / Touch Screen**


- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F2** on external keyboard ⇒ **Time** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

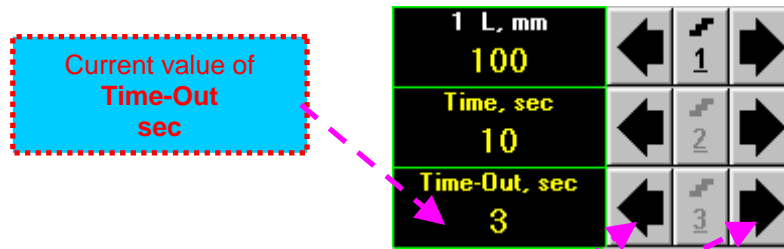
- **Combined**

- Click on **Time** ⇒ **Time** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

 The value of *Scan Time – Time* is adjustable between 5 and 60 **sec** in 1 **sec** increment/decrement

Time-out

Time-Out is waiting time for intermissions precessing **t-BScan(Th)** recording, which starts unconditionally upon **Time-Out** period is over



To control **Time-out** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F3** on external keyboard ⇒ **Time-out** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Time-Out** ⇒ **Time-Out** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

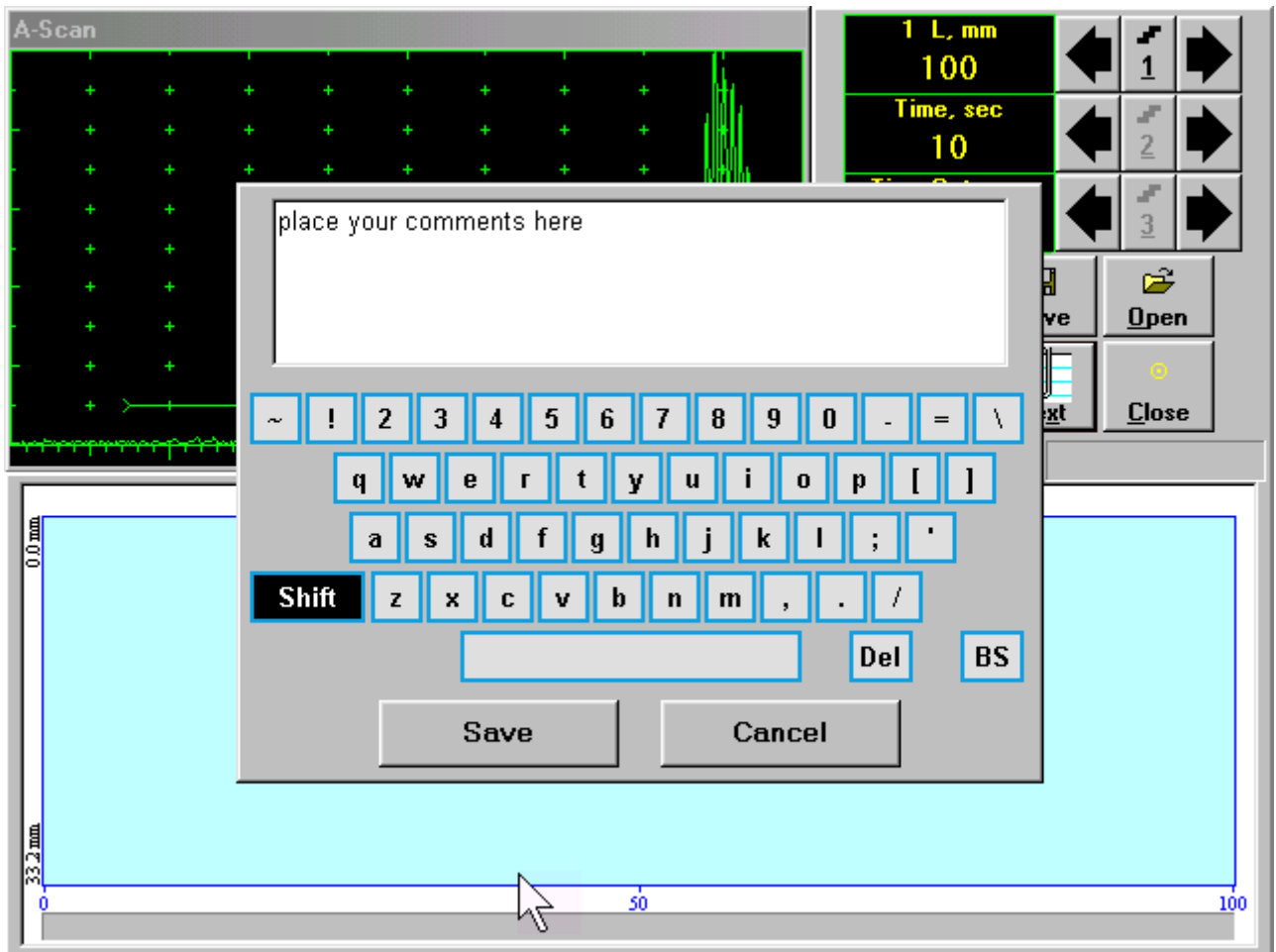


The value of **Time-Out** is adjustable between 0 and 15 **sec** in 1 **sec** increment/decrements

Insert Text Note



A text note may be entered to accompany **t-BScan(Th)** record. To proceed click on **Text** or press **<Alt>+<X>** on external keyboard



Type notes and comments to accompany scanning files: use either virtual keyboard appeared (touch screen or mouse) or external keyboard

Click on **Save** to store typed note and to return to **t-BScan(Th)** control panel

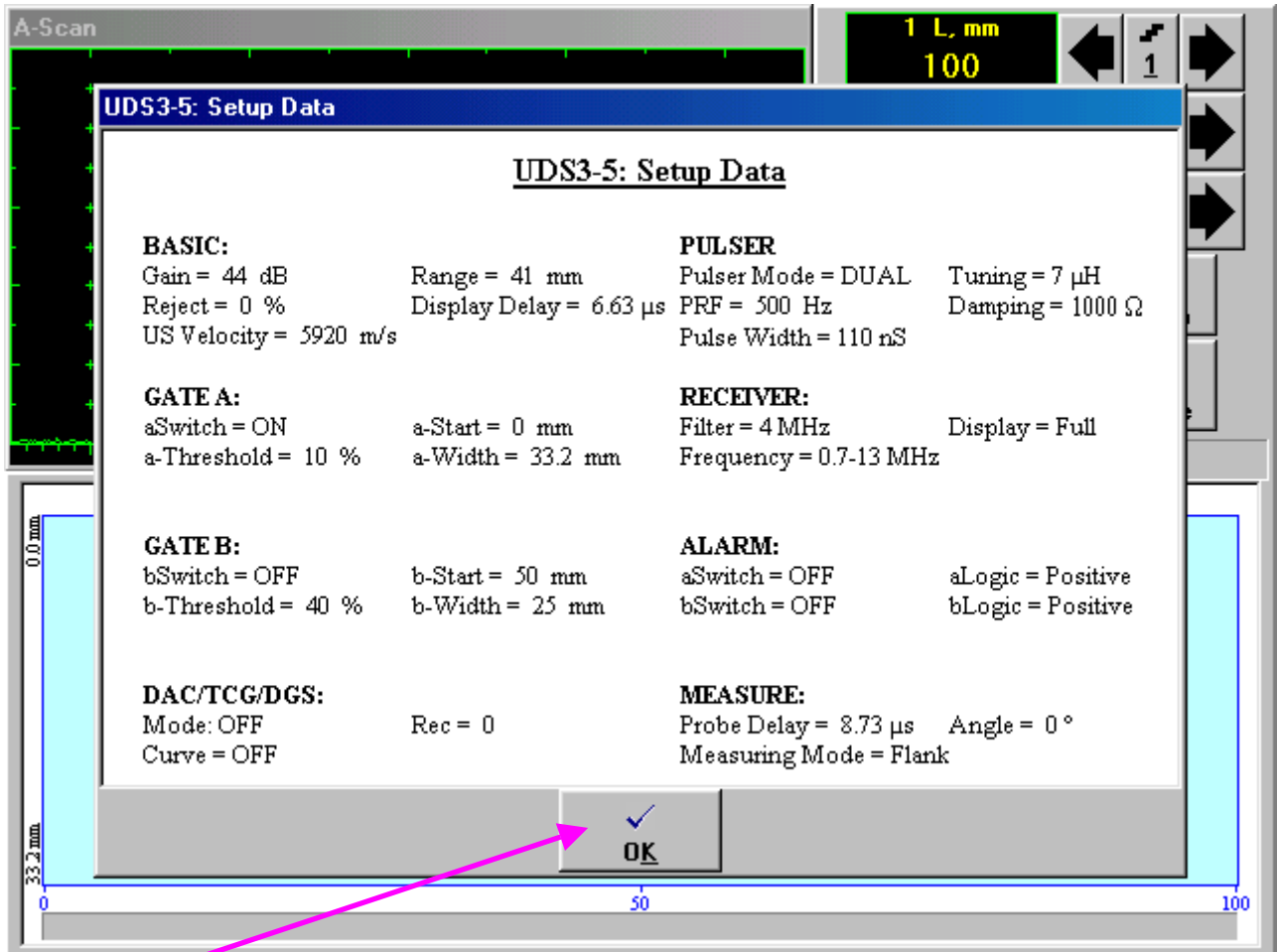
Click on **Cancel** or press **ESC** on front panel keyboard or **Esc** on external keyboard to negate typed note and to return to **t-BScan(Th)** control panel


Preview UDS 3-5 Settings

UDS 3-5 Pulser Receiver settings for the **t-BScan(Th)** record may be previewed through clicking on









or pressing **<Alt>+<D>** on external keyboard . The corresponding window appears:





Click on  or press **<Alt>+<K>** or **ESC** on external keyboard to return to return to **t-BScan(Th)** control panel



Start/Stop t-BScan(Th) recording

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **t-BScan(Th)** recording



 button becomes invisible since **t-BScan(Th)** recording starts.  button occupies its position. Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **t-BScan(Th)** recording prior to automatic completion

 button becomes invisible after completion / termination of **t-BScan(Th)** record.  button returns to its position



Save record into a file

Click on  or press  on front panel keyboard or **F12** or **<Alt>+<A>** on external keyboard to save captured **t-BScan(Th)** record accompanied with instrument calibration dump and text notes / comments into a file. Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

Open record from a file and starting postprocessing session

Click on  or press  on front panel keyboard or **F11** or **<Alt>+<O>** on external keyboard **t-B-Scan(Th)** record accompanied with instrument calibration dump and text notes / comments from a file. Refer to paragraph 5.2.18 of this Operating Manual to proceed with file opening. Refer to paragraph 7.3.2.5 of this Operating Manual to proceed with postprocessing

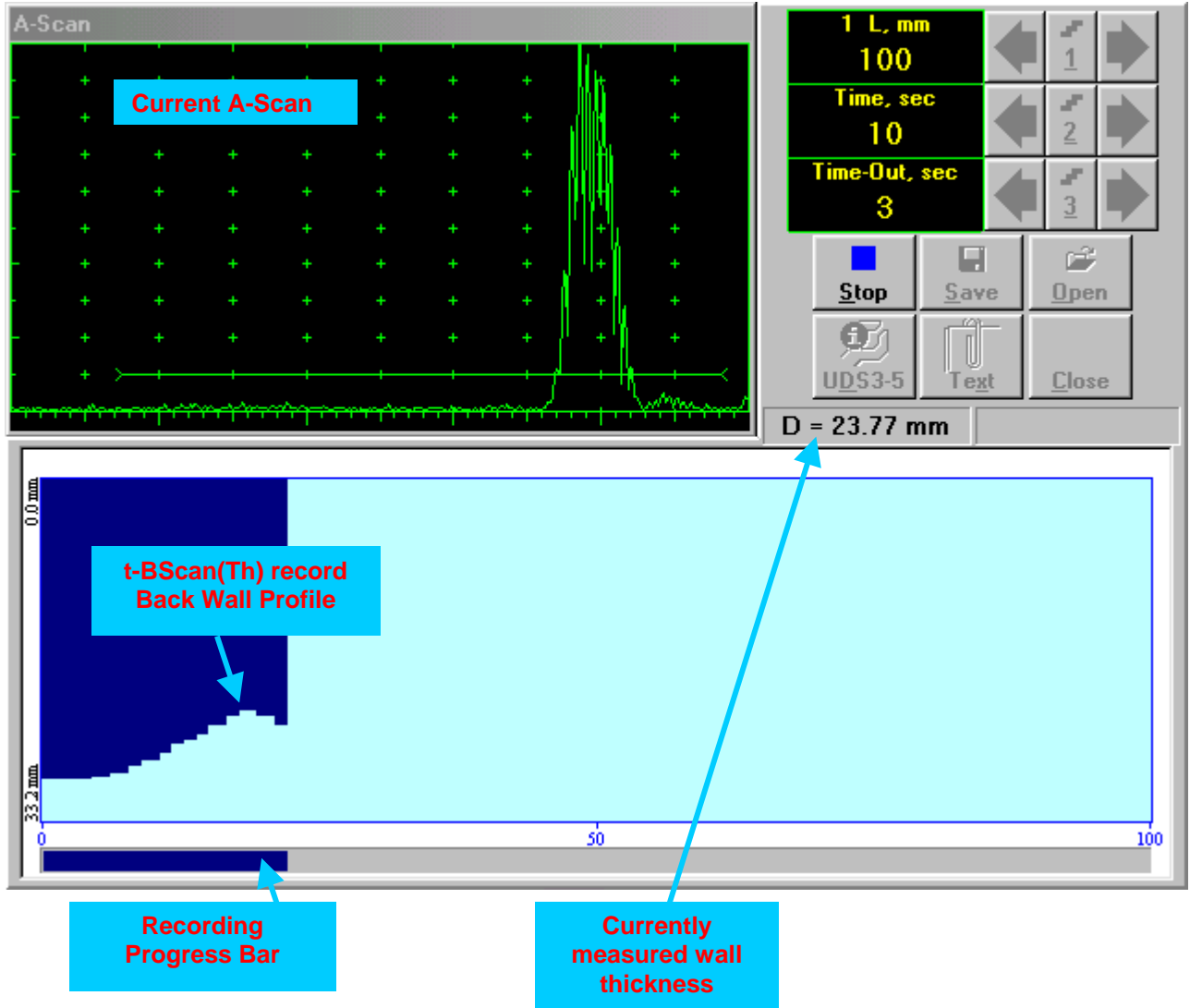
Return to UDS 3-5 main operating surface

Click on  or press  on front panel keyboard or **<Alt>+<C>** or **Esc** on external keyboard

7.3.2.2. t-BScan(Th) – Scanning

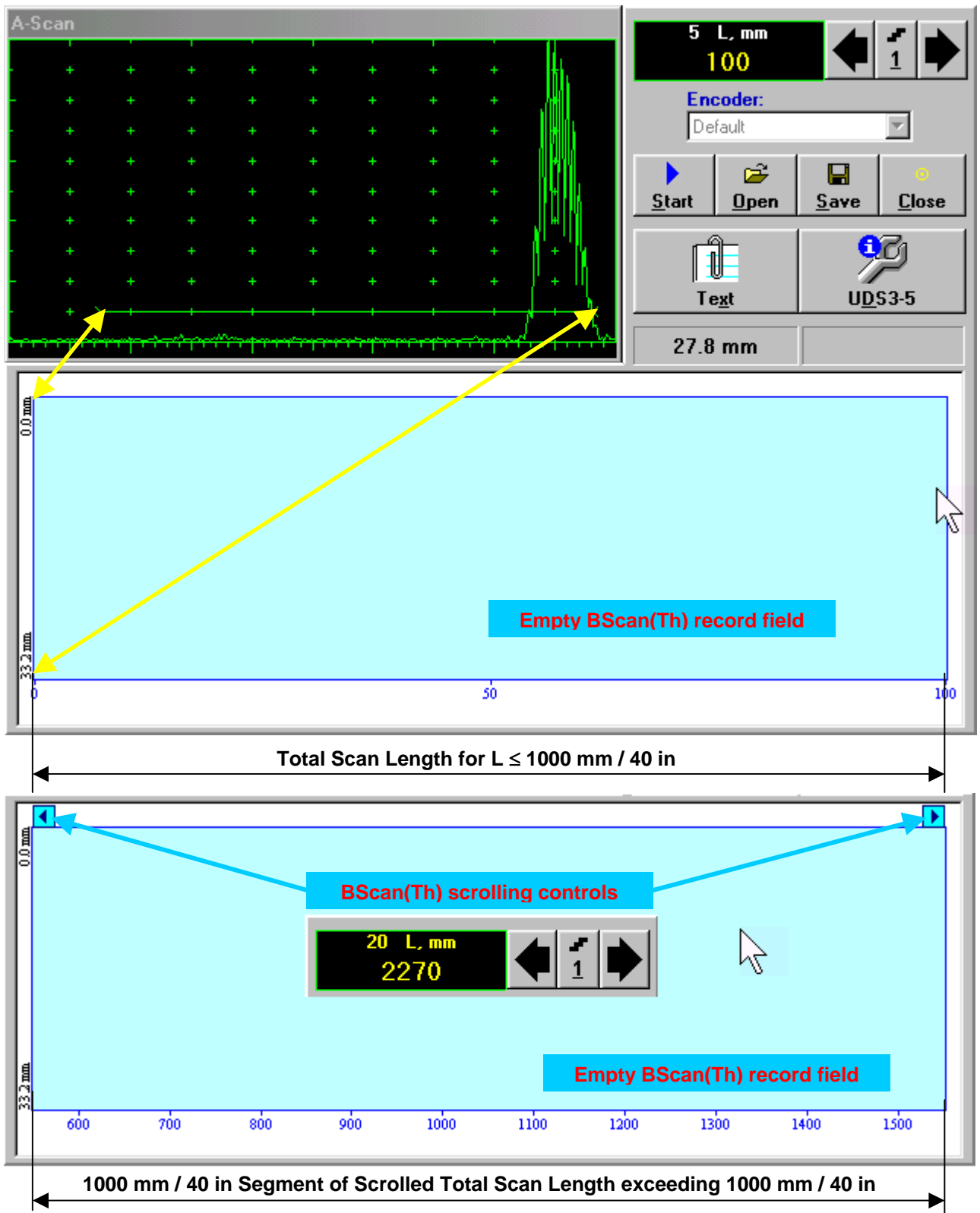
- Apply probe to test object in the start point of selected scanning line

- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line synchronously with *Recording Progress Bar* – typical scanning progress display during is shown and explained below



7.3.2.3. BScan(Th) – Prior to Scanning

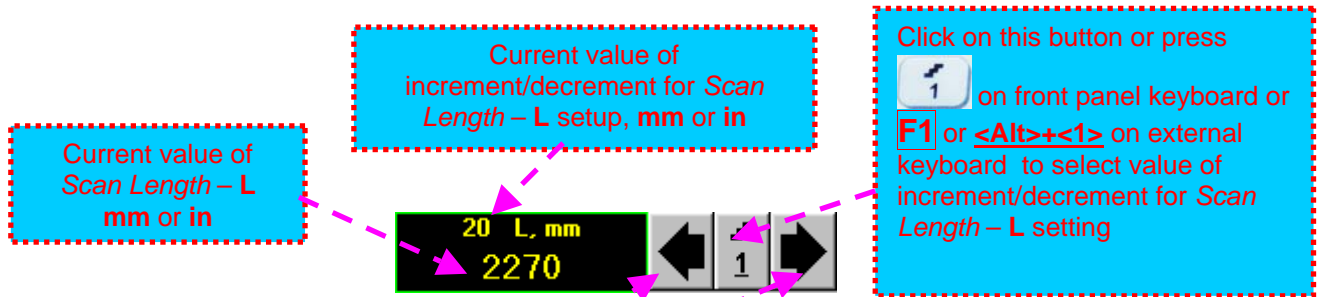
BScan(Th) control panel is shown below



Display Delay and **Range** settings for current **A-Scan** to be used for the recording are equivalent to the same setting of **UDS 3-5 Pulsar Receiver** predecesing entering into **BScan(Th)** mode

Scan Length

Scan Length – L represents length of section of test object to be displayed, over which probe will be scanning during recording period












To control *Scan Length – L* the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F1** on external keyboard ⇒ **L** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **L** ⇒ **L** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



The value of *Scan Length – L* is adjustable between 50 and 20000 **mm** or 2 and 800 **in**

Encoder

Select encoder to be used through appropriate box



Clamp probe into encoder – refer to Chapter 7 of this Operating Manual

Connect encoder to its input on the right side of **ISONIC 2006 instrument**



Insert Text Note



Refer to paragraph 7.3.2.1 of this Operating Manual



Preview UDS 3-5 Settings

Refer to paragraph 7.3.2.1 of this Operating Manual

Start/Stop BScan(Th) recording



Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **BScan(Th)** recording

 button becomes invisible since **BScan(Th)** recording starts.  button occupies its position.



Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **BScan(Th)** recording

 button becomes invisible after termination of **BScan(Th)** record.  button returns to its position



Save record into a file

Click on  or press  on front panel keyboard or **F12** or **<Alt>+<A>** on external keyboard to save captured **BScan(Th)** record accompanied with instrument calibration dump and text notes / comments into a file. Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

Open record from a file and starting postprocessing session

Click on  or press  on front panel keyboard or **F11** or **<Alt>+<O>** on external keyboard **B-Scan(Th)** record accompanied with instrument calibration dump and text notes / comments from a file. Refer to paragraph 5.2.18 of this Operating Manual to proceed with file opening. Refer to paragraph 7.3.2.5 of this Operating Manual to proceed with postprocessing

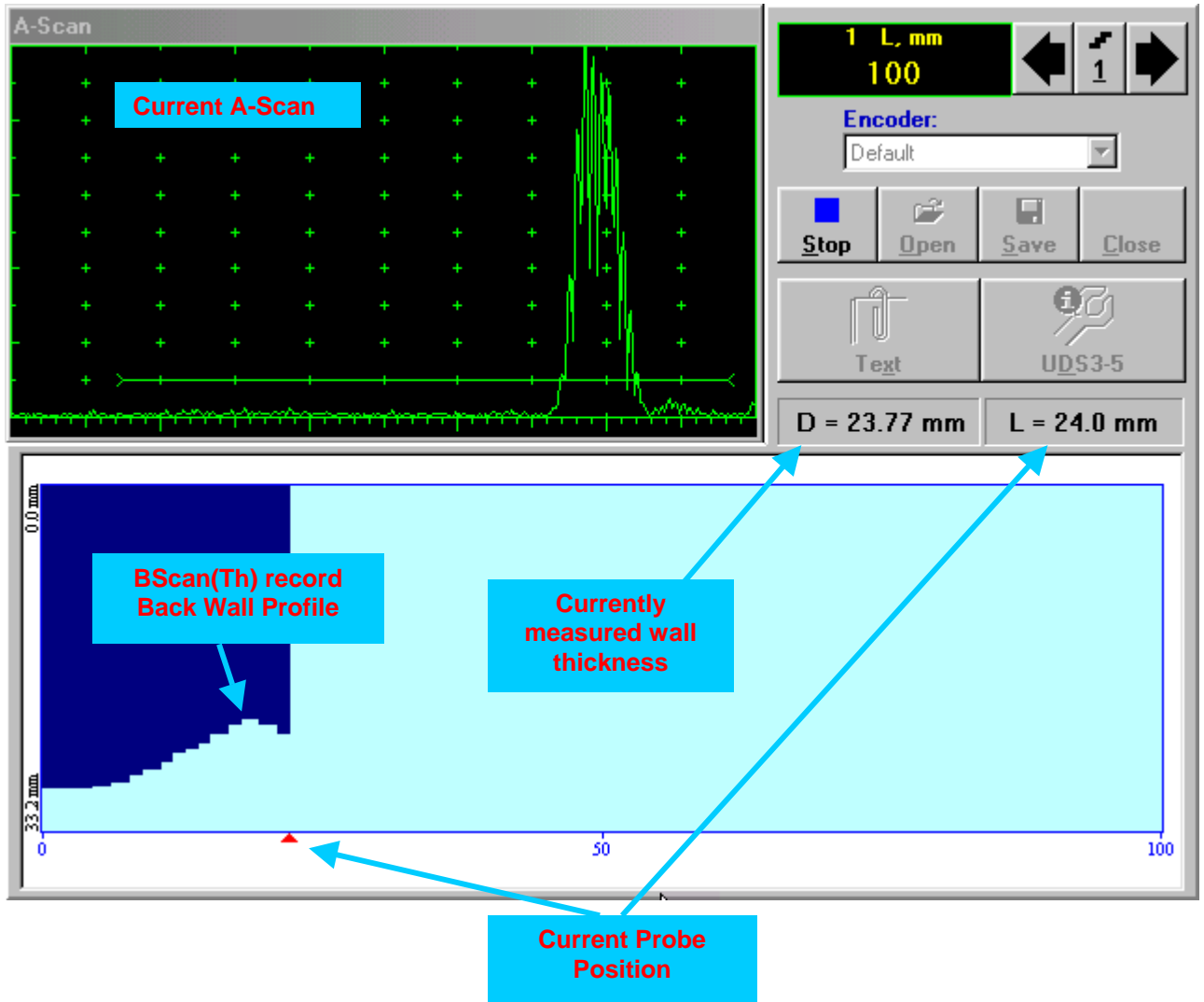
Return to UDS 3-5 main operating surface

Click on  or press  on front panel keyboard or **<Alt>+<C>** or **Esc** on external keyboard

7.3.2.4. BScan(Th) – Scanning

- Apply probe equipped with an encoder to test object in the start point of selected scanning line

- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line – typical scanning progress display is shown and explained below

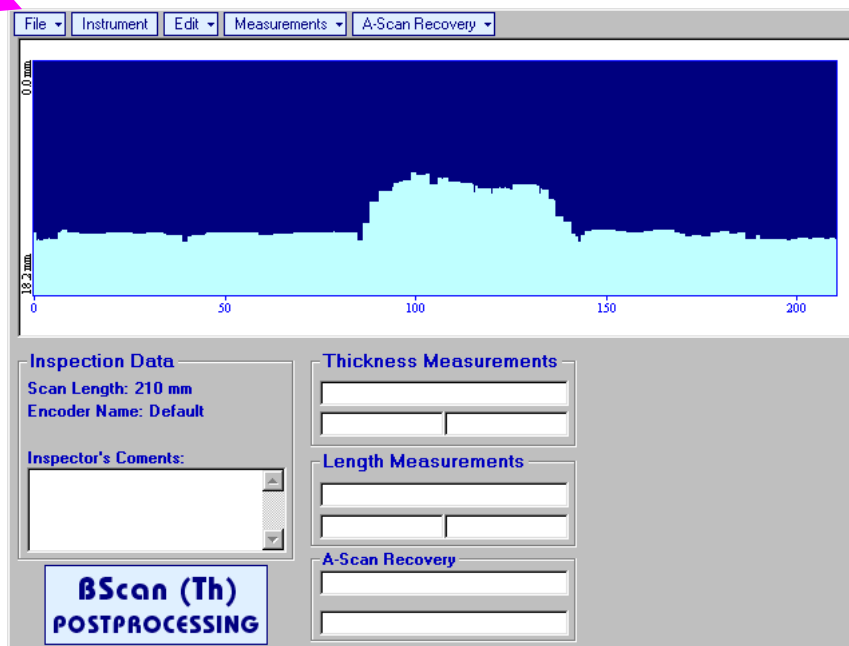


7.3.2.5. t-BScan(Th) / BScan(Th) – Postprocessing

Postprocessing of t-BScan(Th) / BScan(Th) records is featured with:





- ❑ Sizing thickness damages at any location along stored images (remaining thickness, thickness loss, and length of damage)
- ❑ Play-back and evaluation of **A-Scans** obtained and captured during thickness profile recording
- ❑ Reconstruction of thickness profile image for various **Gain** and / or **Gate A** settings

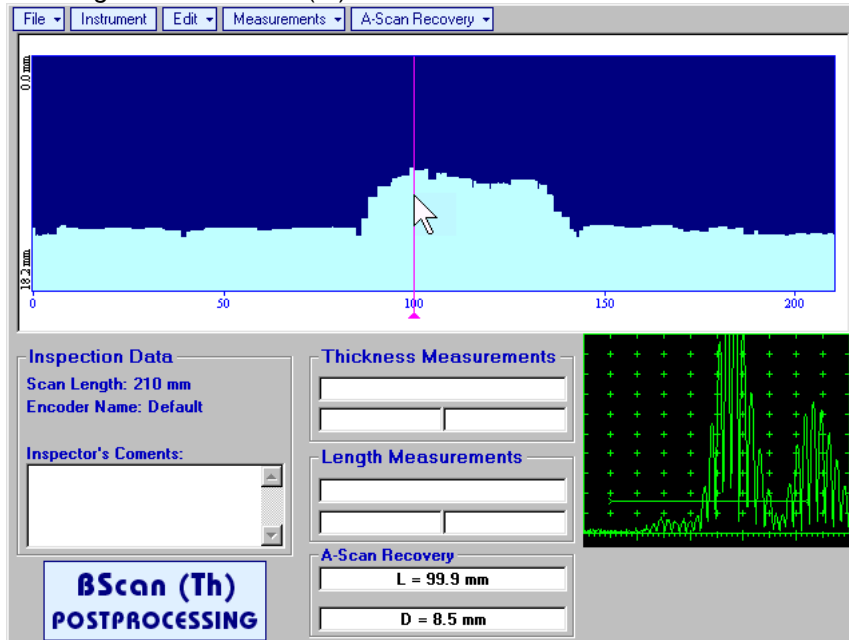
The screen as below appears upon opening file. All postprocessing procedures are performed through **menu bar** – touch screen stylus or front panel or external mouse to be used




Menu Bar Functions


- **File→Open** – opens new t-BScan(Th) / BScan(Th) file
- **File→Snapshots→Add Snapshot** – stores current postprocessing screen snapshot accompanied with appropriate settings and measurements into *postprocessing session memory stack*
- **File→Snapshots→Restore Snapshot** – recalls earlier stored postprocessing screen snapshot accompanied with appropriate settings and measurements from *postprocessing session memory stack*
- **File→Snapshots→Delete Snapshot** – deletes earlier stored postprocessing screen snapshot accompanied with appropriate settings and measurements from *postprocessing session memory stack*
- **File→Print** – prints out postprocessing screen snapshot(s) accompanied with appropriate settings and measurements
- **File→Exit** – returns to t-BScan(Th) / BScan(Th) control panel
- **Instrument** – indicates setup of UDS 3-5 Pulsar Receiver used for scanning when file was created

- A-Scan Recovery**→ON – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-BScan(Th)** / **BScan(Th)** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. In the **A-Scan Recovery** field there are indicated coordinate (**L**) of *sound path cursor* along **t-BScan(Th)** / **BScan(Th)** record and corresponding *remaining thickness* value (**D**)













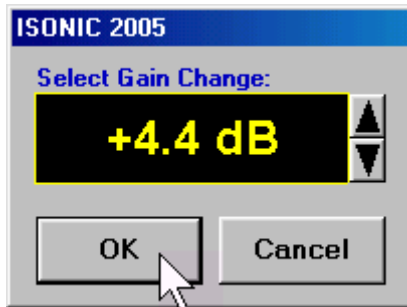
To fix position of *sound path cursor* with corresponding recovered **A-Scan** and *remaining thickness*

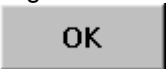

value left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard

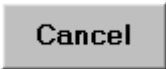

To interrupt recovery of **A-Scans** and empty **A-Scan Recovery** field right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- A-Scan Recovery**→OFF – erases *sound path cursor*, switches off recovered **A-Scan**, and empties **A-Scan Recovery** field












- Edit→Change Gain→ON** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-BScan(Th) / BScan(Th)** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to cursor position. To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates subwindow allowing off-line re-adjusting of **Gain** for all **A-Scans** captured during **t-BScan(Th) / BScan(Th)** recording in $\pm 6\text{dB}$ range with $\pm 0.1\text{ dB}$ increments through clicking or pressing and holding on  or pressing  ,  on front panel keyboard or  ,  on external keyboard

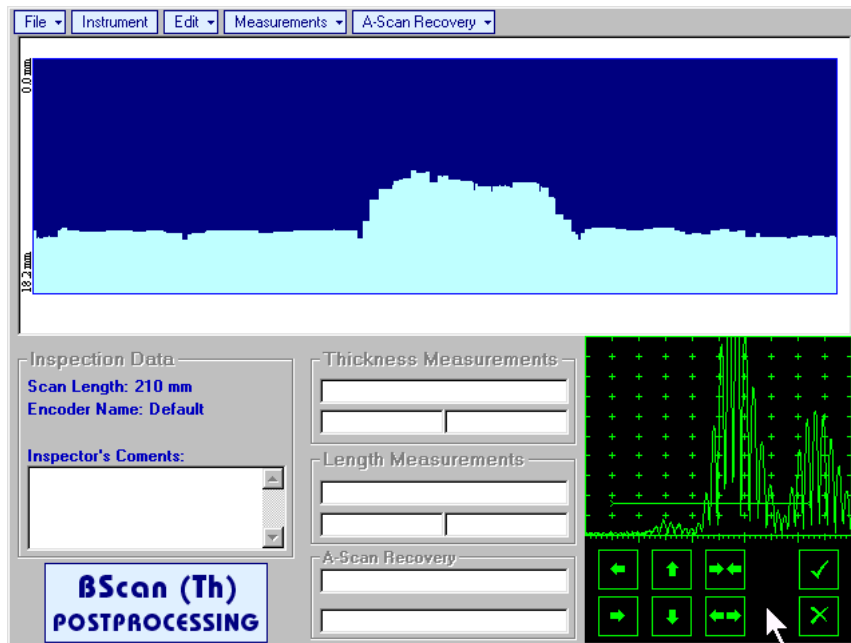


During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain** click on  or press  on front panel keyboard or **Enter** on external keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws **t-BScan(Th) / BScan(Th)** image accordingly


To interrupt re-adjusting of **Gain** click on  or press  on front panel keyboard or **Esc** on external keyboard

- Edit→Change Gain→OFF** – negates **Gain** re-adjustment and returns to originally recorded **t-BScan(Th) / BScan(Th)** image and original **Gain** setting

- Edit→ROI→ON** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-BScan(Th) / BScan(Th)** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to cursor position. To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates off-line **Gate A** controls , , , , ,  allowing to redefine **Region Of Interest** for **t-BScan(Th) / BScan(Th)** imaging



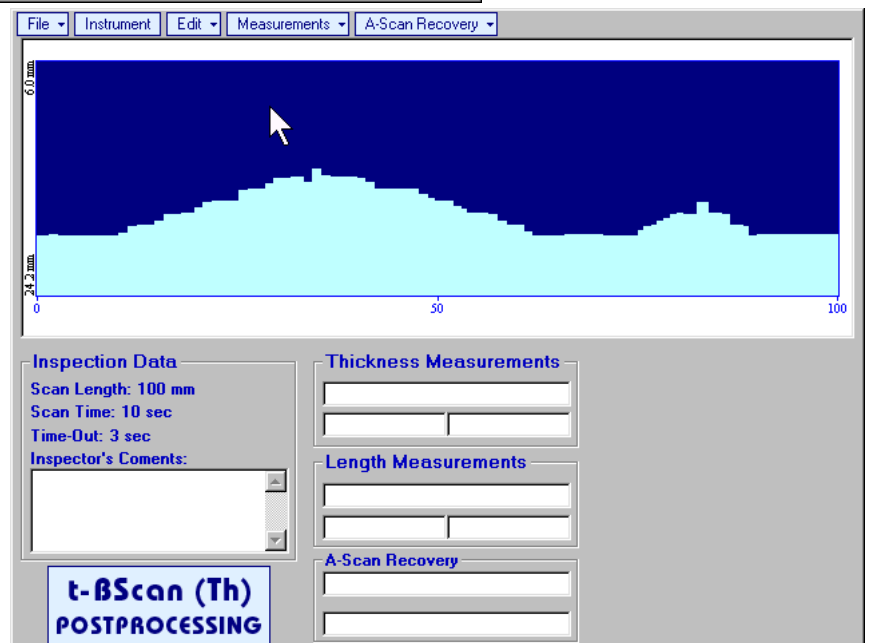
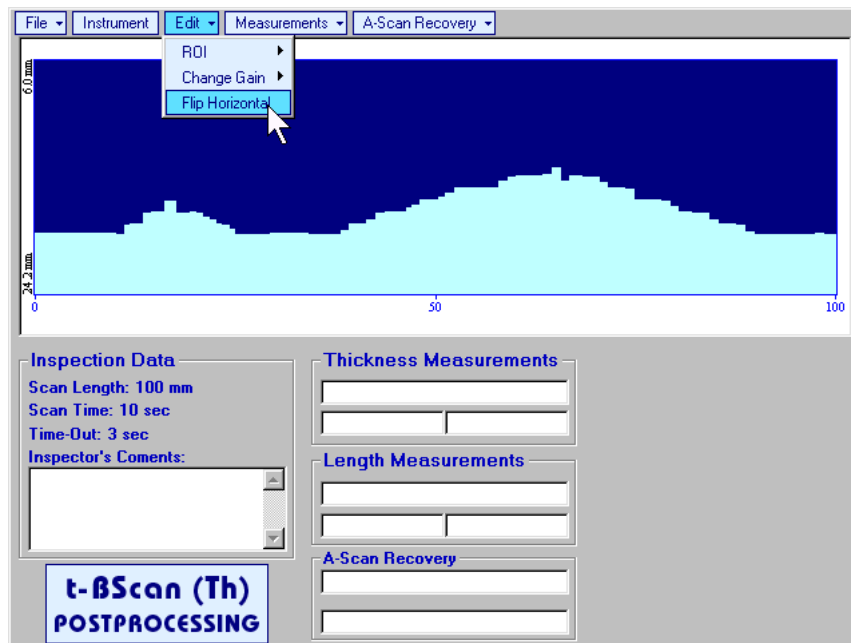
Upon completing redefining of **Region Of Interest** click on  – this applies new **Gate A** to all captured **A-Scans** and updates **t-BScan(Th) / BScan(Th)** image accordingly

To interrupt selection of reference of **A-Scan** right mouse click or press  on front panel keyboard or **Esc** on external keyboard







To interrupt re-adjustment of **Region Of Interest** after selection of reference of **A-Scan** click on 







- Edit→ROI→OFF** – negates **Gate A** re-adjustment and returns to originally recorded **t-BScan(Th) / BScan(Th)** image and original **Gate A** setting

- **Edit→Flip Horizontal** – reorders **A-Scans** captured during **t-BScan(Th)** / **BScan(Th)** recording in reverse succession and redraws **t-BScan(Th)** / **BScan(Th)** image accordingly. This service function may be useful for merging scans of neighboring sections of an object, which were scanned in opposite direction due to access conditions, etc

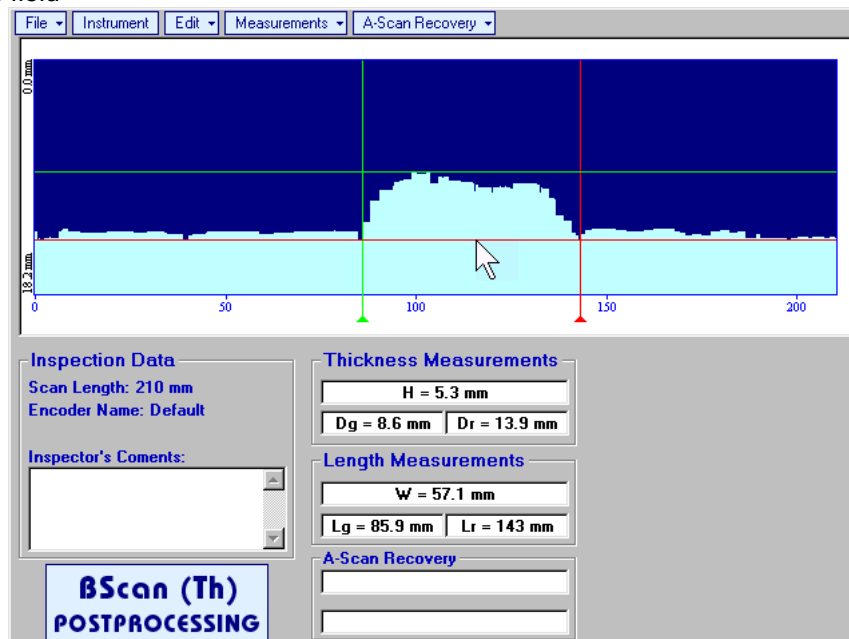


Applying of **Flip Horizontal** function empties *postprocessing session memory stack*

- Measurements→Length→ON** – generates first vertical cursor that may be guided over **t-BScan(Th)** / **BScan(Th)** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard . Coordinate of the first vertical cursor along **t-BScan(Th)** / **BScan(Th)** image (**Lg**) is indicated in the **Length Measurements** field. To fix position of the first vertical cursor left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . To interrupt vertical cursor manipulations and empty **Length Measurements** field right mouse click or press  on front panel keyboard or **Esc** on external keyboard



Second vertical cursor appears upon fixing first one, it may be manipulated by the same way. Coordinate of the second vertical cursor along **t-BScan(Th)** / **BScan(Th)** image (**Lr**) is indicated in the **Length Measurements** field along with parameter **W = Lr – Lg**. Parameter **W** represents length of defect provided that vertical cursors are placed appropriately
- Measurements→Length→OFF** – erases vertical cursors and empties **Length Measurements** field
- Measurements→Thickness→ON** – generates first horizontal cursor that may be guided over **t-BScan(Th)** / **BScan(Th)** image using either touch screen or mouse or ,  on front panel keyboard or ,  on external keyboard . Coordinate of the first horizontal cursor along **t-BScan(Th)** / **BScan(Th)** image (**Dg**) is indicated in the **Thickness Measurements** field. To fix position of the first horizontal cursor left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . To interrupt horizontal cursor manipulations and empty **Thickness Measurements** field right mouse click or press  on front panel keyboard or **Esc** on external keyboard

Second horizontal cursor appears upon fixing first one, it may be manipulated by the same way. Coordinate of the second horizontal cursor along **t-BScan(Th)** / **BScan(Th)** image (**Dr**) is indicated in the **Thickness Measurements** field along with parameter **H = Dr – Dg**. Parameter **H** represents thickness loss provided that horizontal cursors are placed appropriately
- Measurements→Thickness→OFF** – erases horizontal cursors and empties **Thickness Measurements** field




7.4. B-Scan cross-sectional imaging and recording of defects for longitudinal and shear wave inspection – t-ABIScan or ABIScan

7.4.1. Setup Pulser Receiver for t-ABIScan or ABIScan Imaging and Recording

UDS 3-5 Pulser Receiver window – main operating surface – appears on ISONIC 2006 screen upon clicking on  or . The settings as below to be provided

7.4.1.1. Straight Beam Probes

#	Parameter or Mode	Submenu	Required Settings	Note
1	Gain	BASICS	Gain setting to be performed according to inspection procedure providing required echo heights from defects to be detected	
2	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of inspection procedure	
3	Pulser Mode	PULSER	Dual for dual element probes Single for single element probes	
4	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain setting procedure
5	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain setting procedure
6	Display	RECEIVER	Display setting may be either Full, RF, PosHalf, or NegHalf	The same Display mode to be used for both Probe Delay determining and t-ABIScan / ABIScan Recording
7	USVelocity	BASIC	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	
8	Probe Delay	MEASURE	Probe Delay setting to be equal to actual probe delay	Probe delay may be determined according to paragraph 5.2.13.7 or 5.2.13.9 of this Operating Manual or similarly
9	Angle	MEASURE	Angle = 0°	
10	Settings for other parameters and modes have no significance			

Click on  or press  on front panel keyboard or **F8** on external keyboard upon completing

7.4.1.2. Angle Beam Probes

#	Parameter or Mode	Submenu	Required Settings	Note
1	Gain	BASICS	Gain setting to be performed according to inspection procedure providing required echo heights from defects to be detected	
2	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of inspection procedure	
3	Pulser Mode	PULSER	Dual for dual element probes Single for single element probes	
4	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain setting procedure
5	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain setting procedure
6	Display	RECEIVER	Display setting may be either Full, RF, PosHalf, or NegHalf	The same Display mode to be used for both Probe Delay determining and t-ABIScan / ABIScan Recording
7	USVelocity	BASIC	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	
8	Probe Delay	MEASURE	Probe Delay setting to be equal to actual probe delay	Probe delay may be determined according to paragraph 5.2.13.5 or 5.2.13.6 or 5.2.13.9 of this Operating Manual or similarly
9	Angle	MEASURE	Angle setting to be equal to actual probe angle	
10	Settings for other parameters and modes have no significance			

Click on  or press  on front panel keyboard or **F8** on external keyboard upon completing

7.4.2. B-Scan Cross Sectional Imaging – Implementation

7.4.2.1. t-ABIScan – Prior to Scanning (Straight Beam Probes)

t-ABIScan control panel for straight beam probe is shown below

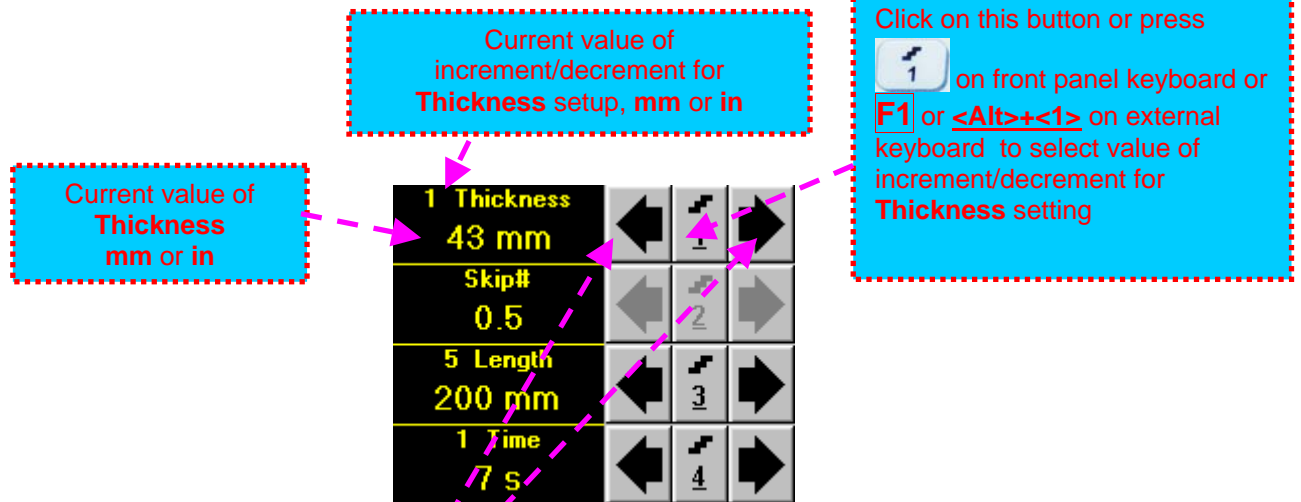
The screenshot displays the t-ABIScan control panel. On the left, an 'A-Scan' window shows a graph with a red curve and a blue curve on a grid. Below it is a 'Current A-Scan' label. The central panel contains four rows of settings: '1 Thickness 43 mm', 'Skip# 0.5', '5 Length 200 mm', and '1 Time 7 s'. Each row has left and right arrow buttons and a central button with a number (1, 2, 3, 4). To the right, a 'Coloring' section has buttons for 'Pseudo', 'Pseudo2', 'Grayscale', and 'Thermal'. Further right are buttons for 'Text', 'UDS3-5', 'Start', 'Open', 'Save', and 'Close'. The date '26-Jan-2006' is shown in the top right corner.

Below the control panel, two diagrams illustrate scanning constraints. The first diagram shows a horizontal axis from 0 to -200 with a blue box labeled 'Empty t-ABIScan record field'. A double-headed arrow below indicates 'Scan Length not exceeding 600 mm or 24 in / Scan Time'. The second diagram shows a horizontal axis from 0 to -600 with a blue box labeled 'Empty t-ABIScan record field' and another labeled 't-ABIScan scrolling controls'. A double-headed arrow below indicates 'Segment of Scrolled Total Scan Length exceeding 600 mm or 24 in / Scan Time'.

i Display Delay for current A-Scan to be used for the recording is equal to Probe Delay setting in submenu MEASURE of UDS 3-5 Pulser Receiver precessing entering into t-ABIScan mode

Thickness

Thickness setting defines the region of interest starting from the scanning surface and automatic **Range** setting for current **A-Scan** to be used for the recording: **Range = Thickness**. For objects whereas back echo is feasible it may be useful to key in **Thickness** value slightly exceeding actual thickness of the object under test – this will allow to record simultaneously defects signals and back echo itself. For the screenshot as above the actual thickness of the test piece is 40 mm while the **Thickness** setting is 43 mm thanks to such setting back echo is clearly resolved at the end of **A-Scan**



To control **Thickness** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press on front panel keyboard or **F1** on external keyboard ⇒ **Thickness** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



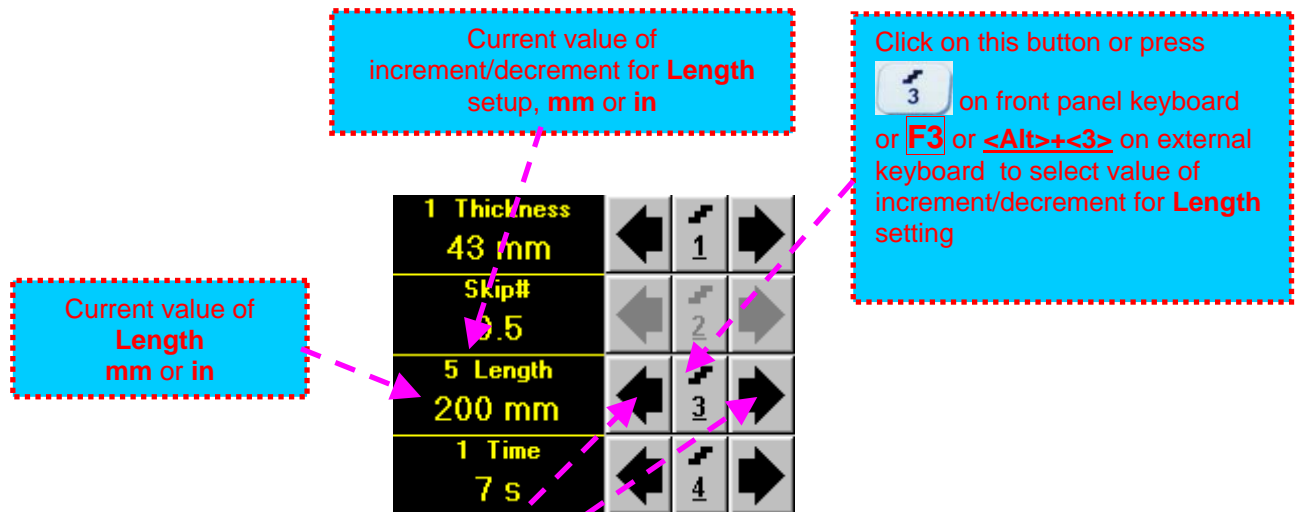
The value of **Thickness** is adjustable between 5 and 300 **mm** or 0.2 and 12 **in** (expandable on special inquire)

Skip

This setting is ignored while using straight beam probes

Scan Length and Scan Time

Length represents length of section of test object to be displayed, over which probe will be scanning during recording period. **Time** (Scan Time) is the duration of recording period

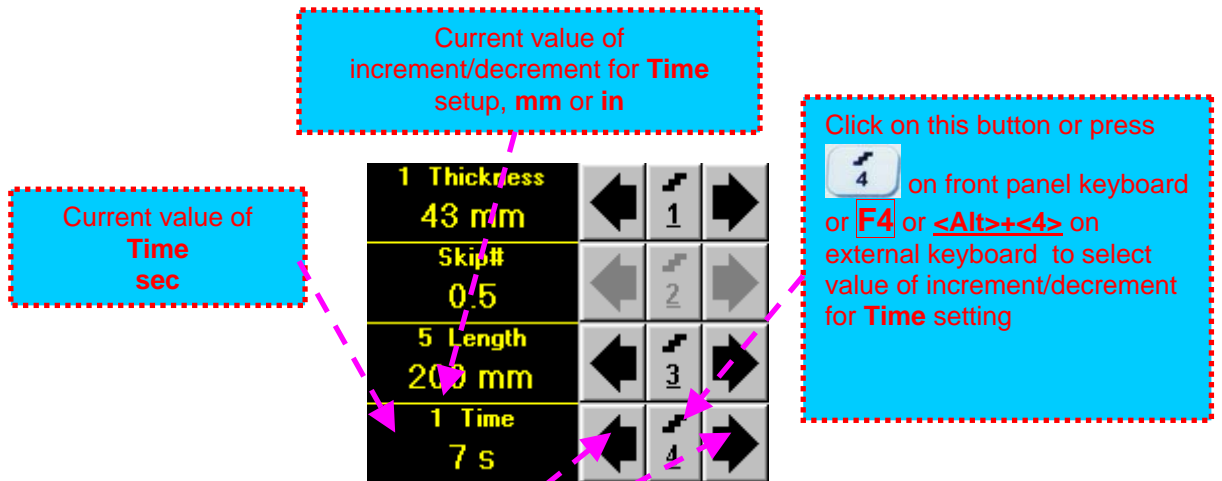


To control **Length** the following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click on corresponding **button**
- **Keyboard**
 - Press on front panel keyboard or **F3** on external keyboard ⇒ **Length** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard
- **Combined**
 - Click on **Length** ⇒ **Length** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Length** is adjustable between 50 and 1000 **mm** or 2 and 40 **in**



To control **Time** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press on front panel keyboard or **F4** on external keyboard ⇒ **Time** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **Time** ⇒ **Time** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Time** is adjustable between 5 and 60 **sec**

Time-out

Time-Out is waiting time for intermissions predcessing **ABIScan** recording, which starts unconditionally upon **Time-Out** period is over. **Time-Out** has fixed duration of 3 sec for **t-ABIScan**

Insert Text Note

Refer to paragraph 7.3.2.1 of this Operating Manual

Preview UDS 3-5 Settings



Refer to paragraph 7.3.2.1 of this Operating Manual

t-ABIScan Record Palette

There are four palettes available through click on appropriate button:





Start/Stop t-ABIScan recording


Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **t-ABIScan** recording



button becomes invisible since **t-ABIScan** recording starts.  button occupies its position.

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **t-ABIScan** recording prior to automatic completion



button becomes invisible after completion / termination of **t-ABIScan** record.  button returns to its position

Save record into a file

Refer to paragraph 7.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

Refer to paragraph 7.3.2.1 of this Operating Manual

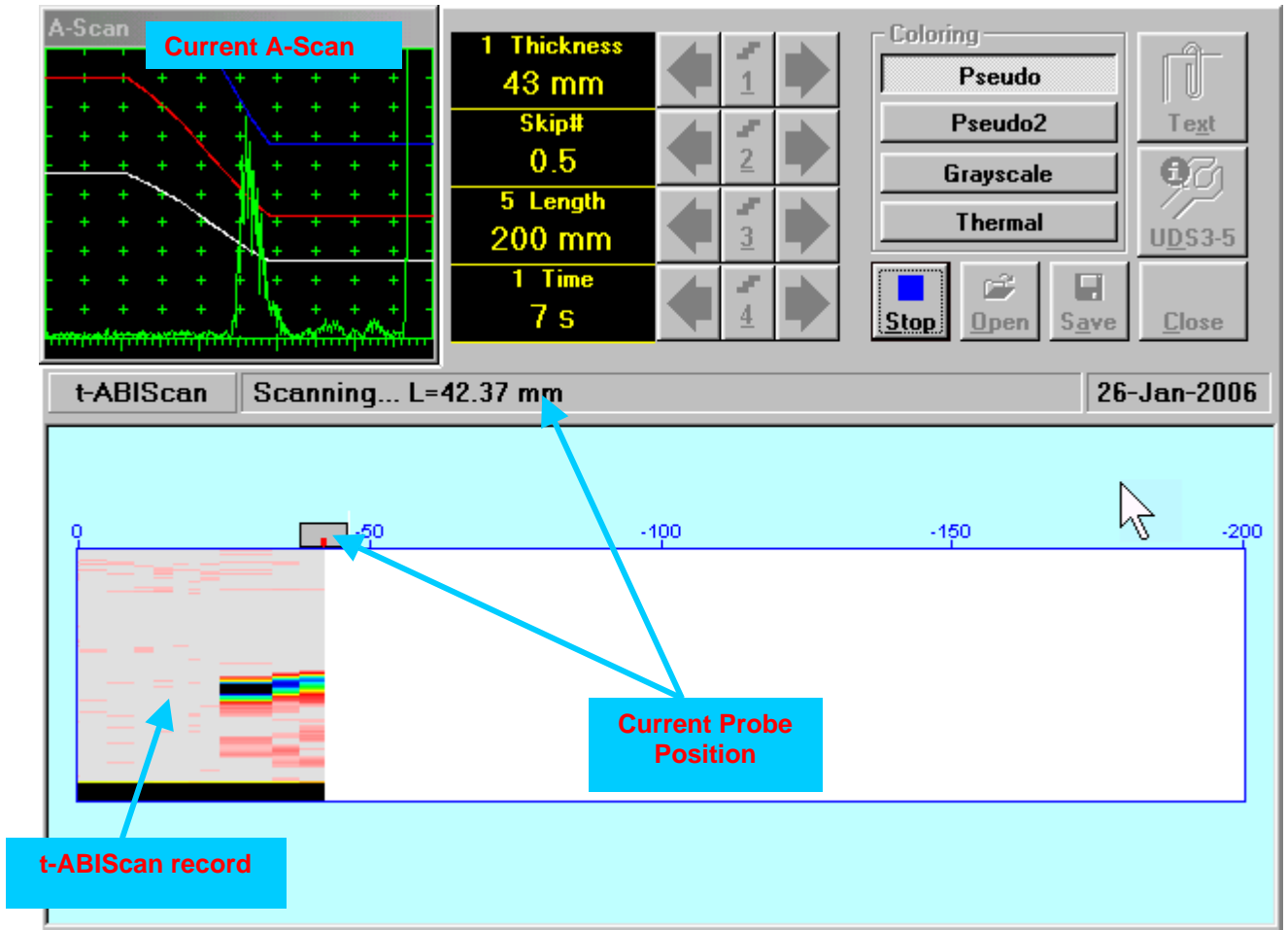
Return to UDS 3-5 main operating surface

Refer to paragraph 7.3.2.1 of this Operating Manual

7.4.2.2. t-ABIScan – Scanning (Straight Beam Probes)

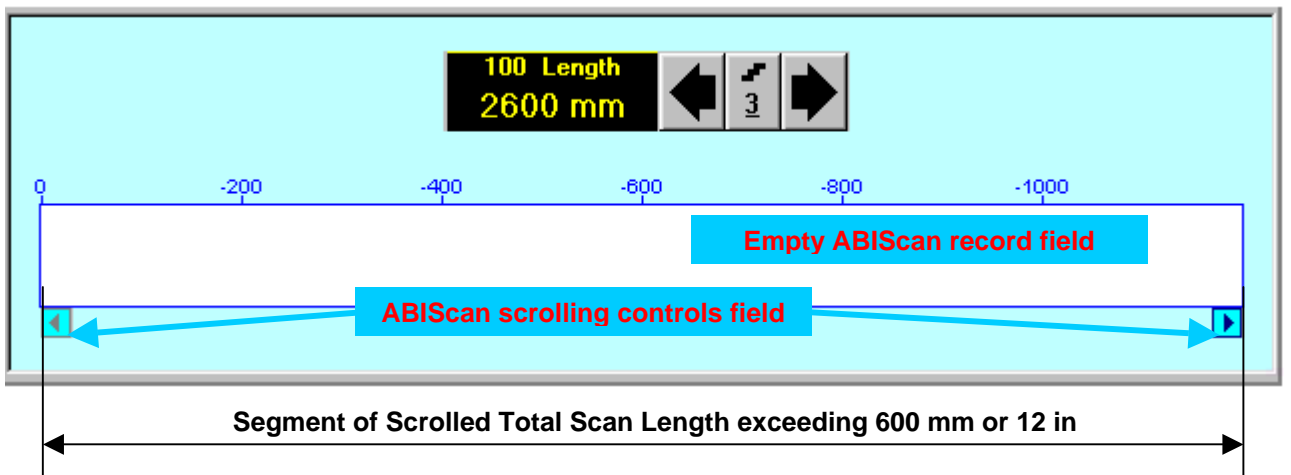
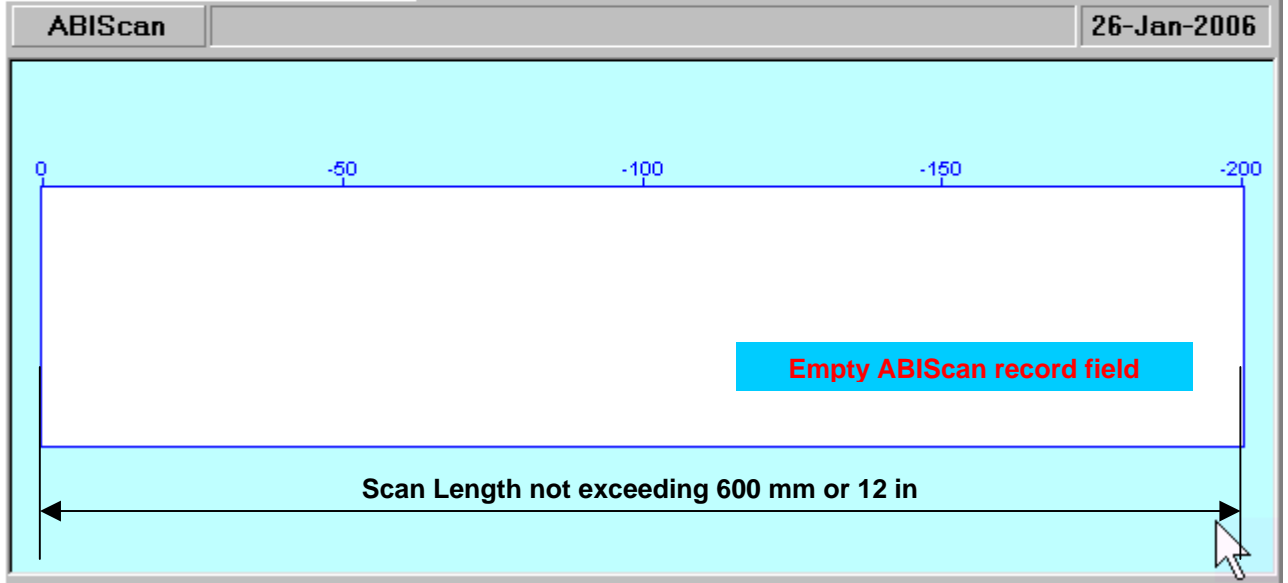
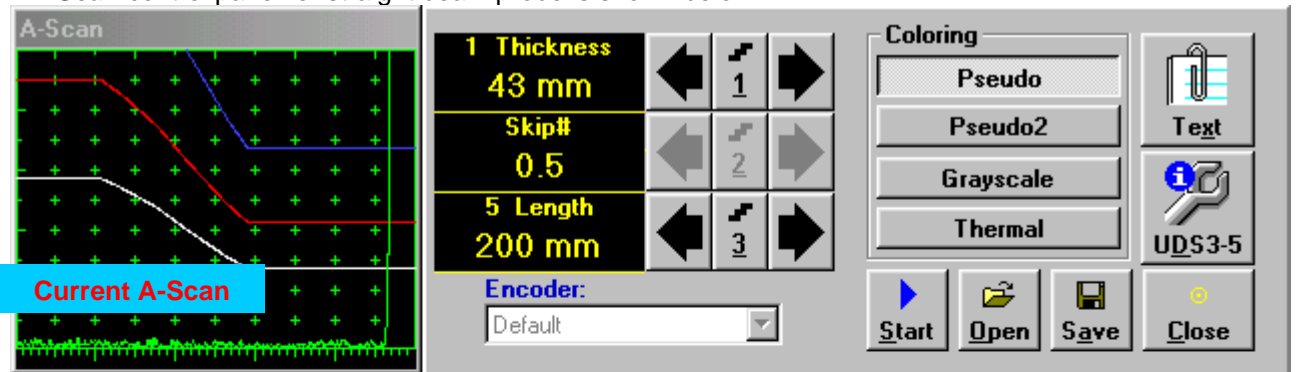
- Apply probe to test object in the start point of selected scanning line

- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line synchronously with *Probe Icon* moving with constant speed above t-ABIScan record field – typical scanning progress display during is shown and explained below



7.4.2.3. ABIScan – Prior to Scanning (Straight Beam Probes)

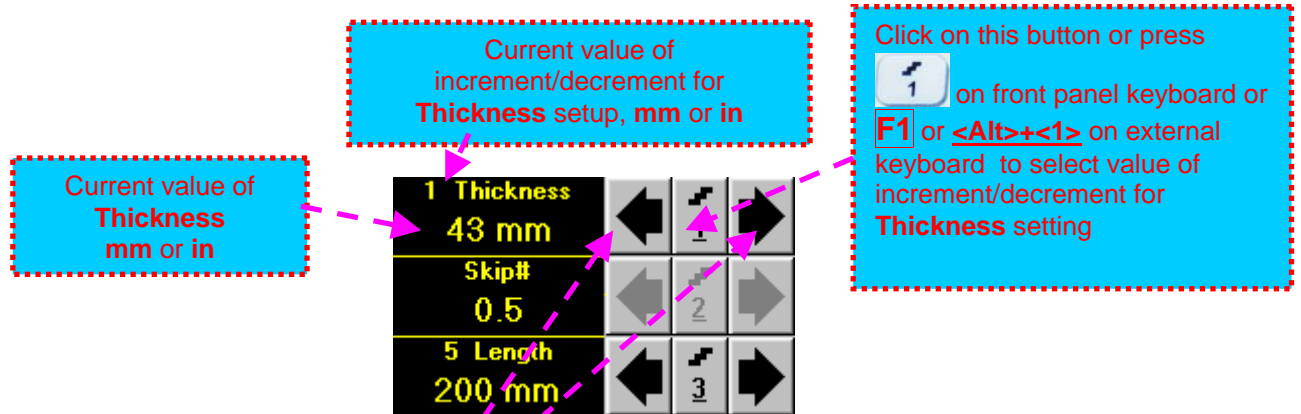
ABIScan control panel for straight beam probe is shown below



Display Delay for current A-Scan to be used for the recording is equal to **Probe Delay** setting in submenu **MEASURE** of **UDS 3-5 Pulser Receiver** precessing entering into **ABIScan** mode

Thickness

Thickness setting defines the region of interest starting from the scanning surface and automatic **Range** setting for current **A-Scan** to be used for the recording: **Range = Thickness**. For objects whereas back echo is feasible it may be useful to key in **Thickness** value slightly exceeding actual thickness of the object under test – this will allow to record simultaneously defects signals and back echo itself. For the screenshot as above the actual thickness of the test piece is 40 mm while the **Thickness** setting is 43 mm thanks to such setting back echo is clearly resolved at the end of **A-Scan**











To control **Thickness** the following manipulations are applicable:







- **Mouse / Touch Screen**

- Click on corresponding button

- **Keyboard**

- Press  on front panel keyboard or **F1** on external keyboard ⇒ **Thickness** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use , , ,  on front panel keyboard or , , , on external keyboard



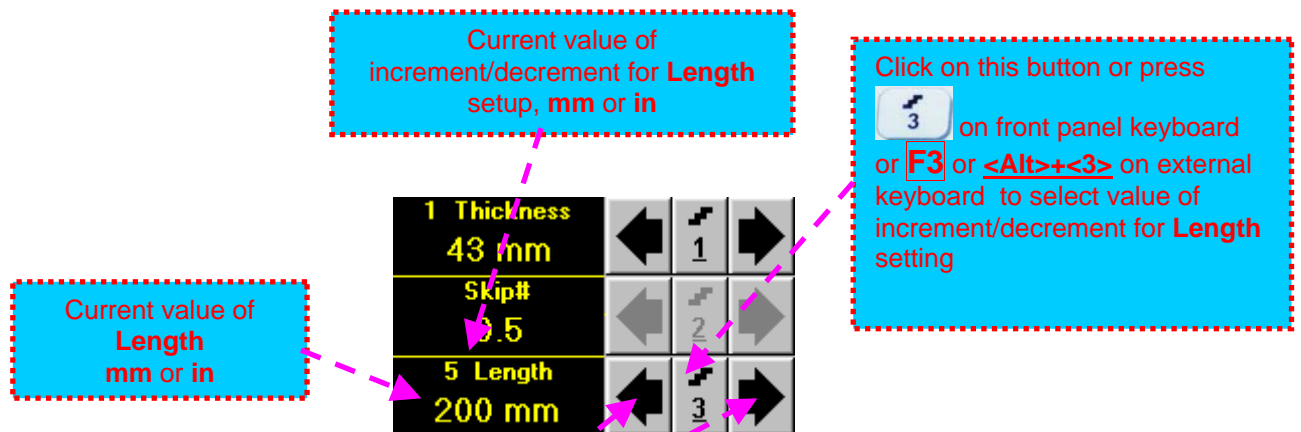
The value of **Thickness** is adjustable between 5 and 300 mm or 0.2 and 12 in (expandable on special inquire)

Skip

This setting is ignored while using straight beam probes

Scan Length

Length represents length of section of test object to be displayed, over which probe will be scanning during recording period












To control **Length** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F3** on external keyboard ⇒ **Length** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Length** ⇒ **Length** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



The value of **Length** is adjustable between 50 and 20000 mm or 2 and 800 in

Encoder

Select encoder to be used through appropriate box



Clamp probe into encoder – refer to Chapter 7 of this Operating Manual

Connect encoder to its input on the right side of **ISONIC 2006 instrument**

Insert Text Note

Refer to paragraph 7.3.2.1 of this Operating Manual

Preview UDS 3-5 Settings



Refer to paragraph 7.3.2.1 of this Operating Manual

ABIScan Record Palette


There are four palettes available through click on appropriate button:





Start/Stop ABIScan recording

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **ABIScan** recording




button becomes invisible since **ABIScan** recording starts.  button occupies its position.



Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **ABIScan** recording



button becomes invisible after termination of **ABIScan** record.  button returns to its position



Save record into a file

Refer to paragraph 7.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

Refer to paragraph 7.3.2.1 of this Operating Manual

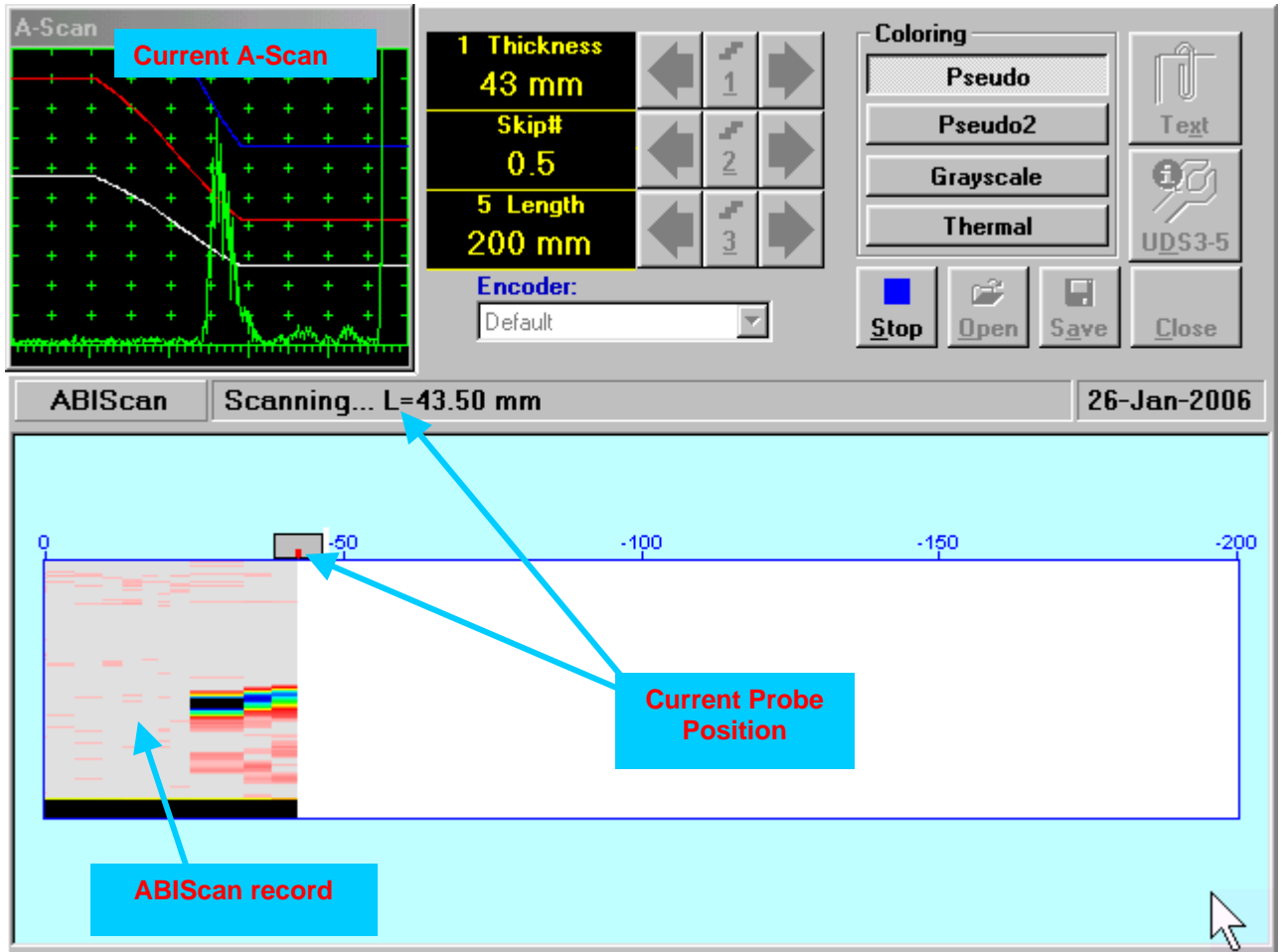
Return to UDS 3-5 main operating surface

Refer to paragraph 7.3.2.1 of this Operating Manual

7.4.2.4. ABIScan – Scanning (Straight Beam Probes)

- Apply probe equipped with an encoder to test object in the start point of selected scanning line

- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line – typical scanning progress display during is shown and explained below



7.4.2.5. t-ABIScan – Prior to Scanning (Angle Beam Probes)

t-ABIScan control panel for angle beam probe is shown below

The screenshot displays the t-ABIScan control panel interface. On the left, an 'A-Scan' plot shows a red curve on a grid with a label 'Current A-Scan'. The central control panel includes settings for '5 Thickness' (40 mm), 'Skip#' (0.5), '5 Length' (80 mm), and '1 Time' (10 s), each with left and right arrow buttons and a numeric keypad. To the right, a 'Coloring' section offers 'Pseudo', 'Pseudo2', 'Grayscale', and 'Thermal' options, along with 'Text', 'UDS3-5', 'Start', 'Open', 'Save', and 'Close' buttons. The date '26-Jan-2006' is shown in the top right.

Below the control panel, two diagrams illustrate scan length constraints. The first diagram shows a scan area with a 'Full Scan Length / Scan Time' of 100 mm (from -50 to 50) and a 'Total Length of t-ABIScan Record' of 100 mm. A label indicates this is for a record 'Not Exceeding 600 mm or 24 in'. The second diagram shows a 'Segment of Scrolled Total Scan Length / Scan Time and t-ABIScan Record' with a '5 Length' of 640 mm. It features 'ABIScan scrolling controls field' and 'Empty ABIScan record' labels, with a total length of 640 mm, also 'Not Exceeding 600 mm or 24 in'.



- **Display Delay** for current A-Scan to be used for the recording is equal to **Probe Delay** setting in submenu **MEASURE** of **UDS 3-5 Pulsar Receiver** predcessing entering into **t-ABIScan** mode
- **Total Length of t-ABIScan Record** is determined automatically according to:
 - Total Length of t-ABIScan Record = Total Scan Length + 2 * Skip # * Thickness * Tan (Angle)**
 - whereas
 - ◆ **Thickness, Skip #, and Total Scan Length = Length** are the settings of **t-ABIScan** control panel
 - ◆ **Angle** is setting in submenu **MEASURE** of **UDS 3-5 Pulsar Receiver** predcessing entering into **t-ABIScan** mode

Thickness and Skip

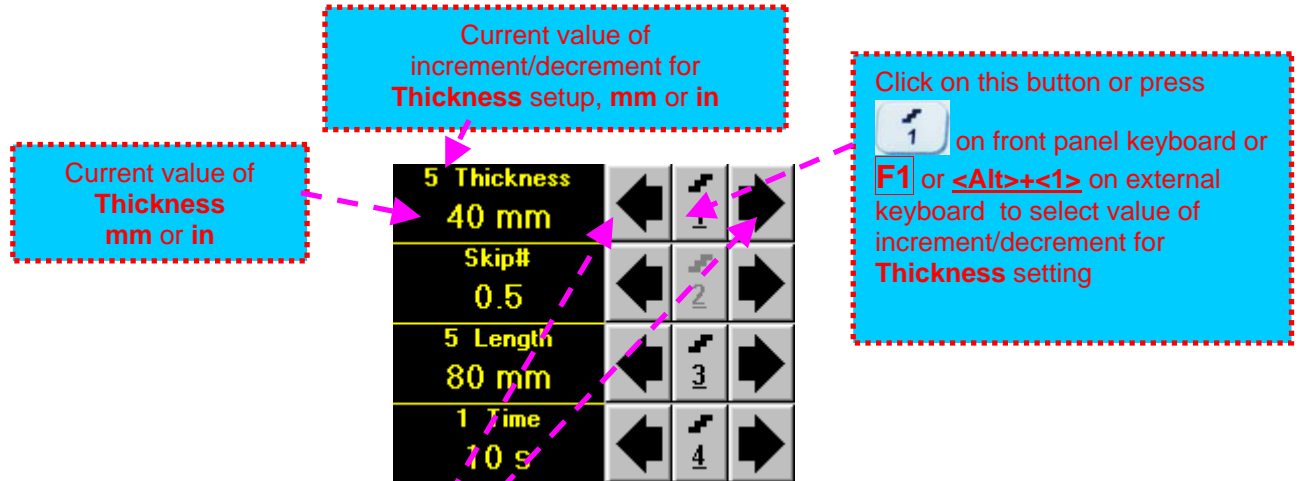
Thickness and **Skip #** settings define the region of interest starting from the scanning surface and automatic **Range** setting for current **A-Scan** to be used for the recording:

$$\text{Range} = 2 \times \text{Skip \#} \times \text{Thickness} \times \text{Cos (Angle)}$$

whereas

- ◆ **Thickness** and **Skip #** are the settings of **t-ABIScan** control panel
- ◆ **Angle** is setting in submenu **MEASURE** of **UDS 3-5 Pulsar Receiver** precessing entering into **t-ABIScan** mode

For objects with parallel surfaces the actual **Thickness** value to be entered for full skip inspection (**Skip # = 1**)



To control **Thickness** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press on front panel keyboard or **F1** on external keyboard ⇒ **Thickness** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

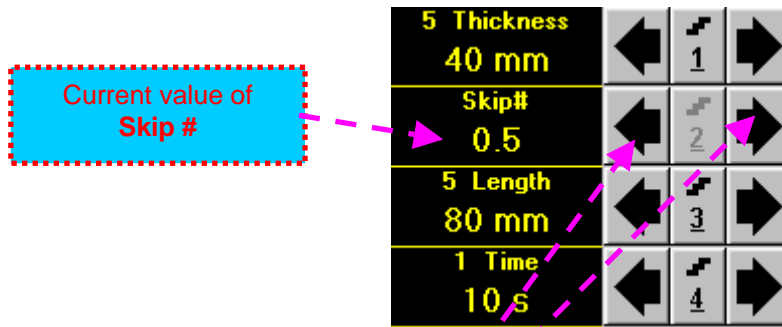
- **Combined**

- Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Thickness** is adjustable between 5 and 300 **mm** or 0.2 and 12 **in** (expandable on special inquire)

Skip












To control **Skip #** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F2** on external keyboard ⇒ **Skip #** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

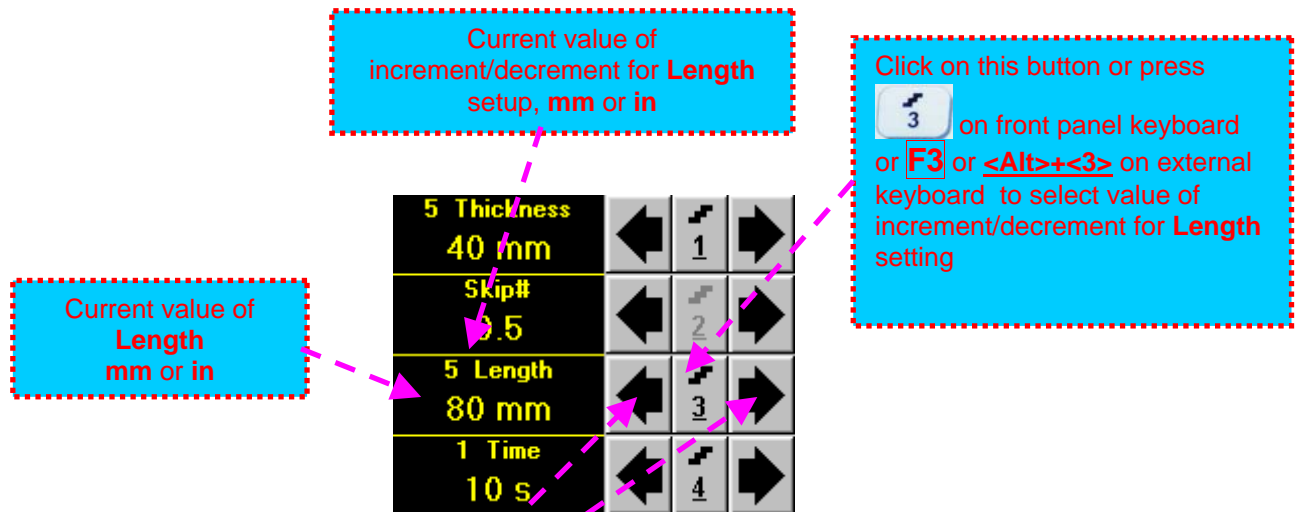
- Click on **Skip #** ⇒ **Skip #** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



















The **Skip #** setting may be **0.5** – half skip insonification or **1** – full skip insonification

Scan Length and Scan Time

Length represents length of section of test object to be displayed, over which probe will be scanning during recording period. **Time** (Scan Time) is the duration of recording period

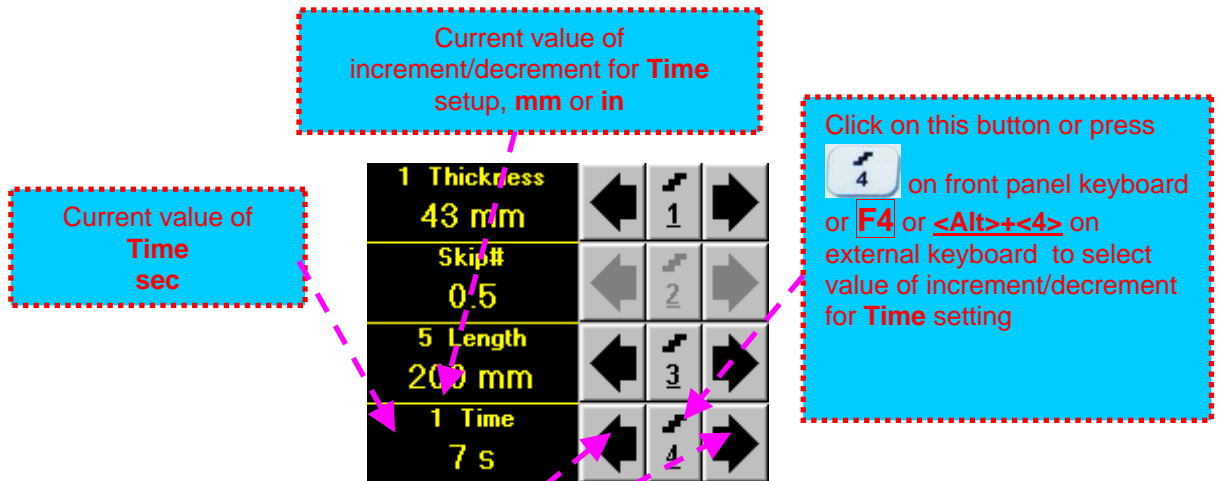


To control **Length** the following manipulations are applicable:

- **Mouse / Touch Screen**
 - Click on corresponding **button**
- **Keyboard**
 - Press  on front panel keyboard or **F3** on external keyboard ⇒ **Length** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard
- **Combined**
 - Click on **Length** ⇒ **Length** fore color changes to white - then use , , ,  on front panel keyboard or , , , on external keyboard



The value of **Length** is adjustable between 50 and 1000 **mm** or 2 and 40 **in**



To control **Time** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press on front panel keyboard or **F4** on external keyboard ⇒ **Time** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **Time** ⇒ **Time** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Time** is adjustable between 5 and 60 **sec**

Time-out

Time-Out is waiting time for intermissions predcessing **ABIScan** recording, which starts unconditionally upon **Time-Out** period is over. **Time-Out** has fixed duration of 3 sec for **t-ABIScan**

Insert Text Note

Refer to paragraph 7.3.2.1 of this Operating Manual

Preview UDS 3-5 Settings



Refer to paragraph 7.3.2.1 of this Operating Manual



t-ABIScan Record Palette



There are four palettes available through click on appropriate button:





Start/Stop t-ABIScan recording

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **t-ABIScan** recording

 button becomes invisible since **t-ABIScan** recording starts.  button occupies its position.

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **t-ABIScan** recording prior to automatic completion

 button becomes invisible after completion / termination of **t-ABIScan** record.  button returns to its position

Save record into a file

Refer to paragraph 7.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

Refer to paragraph 7.3.2.1 of this Operating Manual

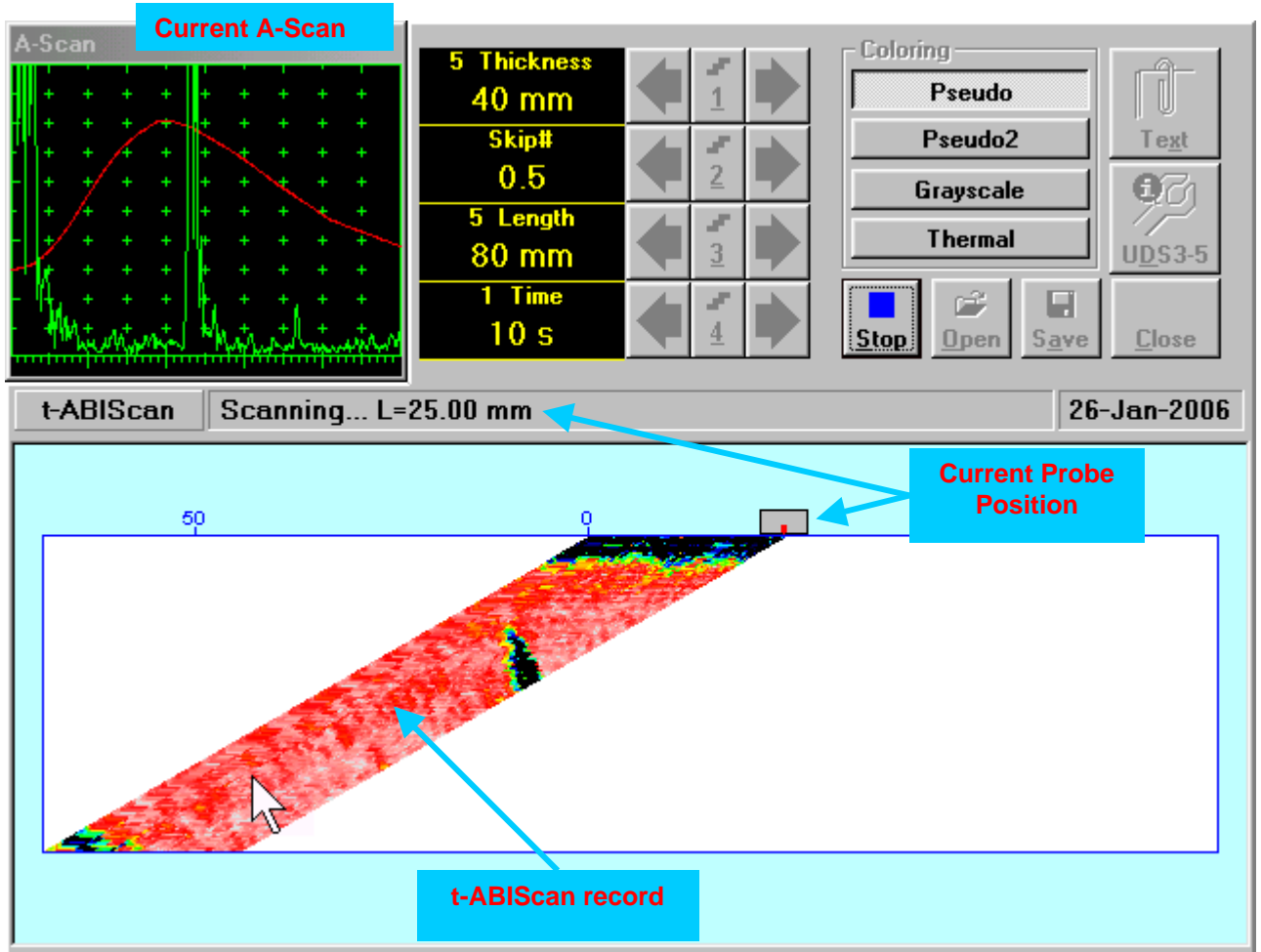
Return to UDS 3-5 main operating surface

Refer to paragraph 7.3.2.1 of this Operating Manual

7.4.2.6. t-ABIScan – Scanning (Angle Beam Probes)

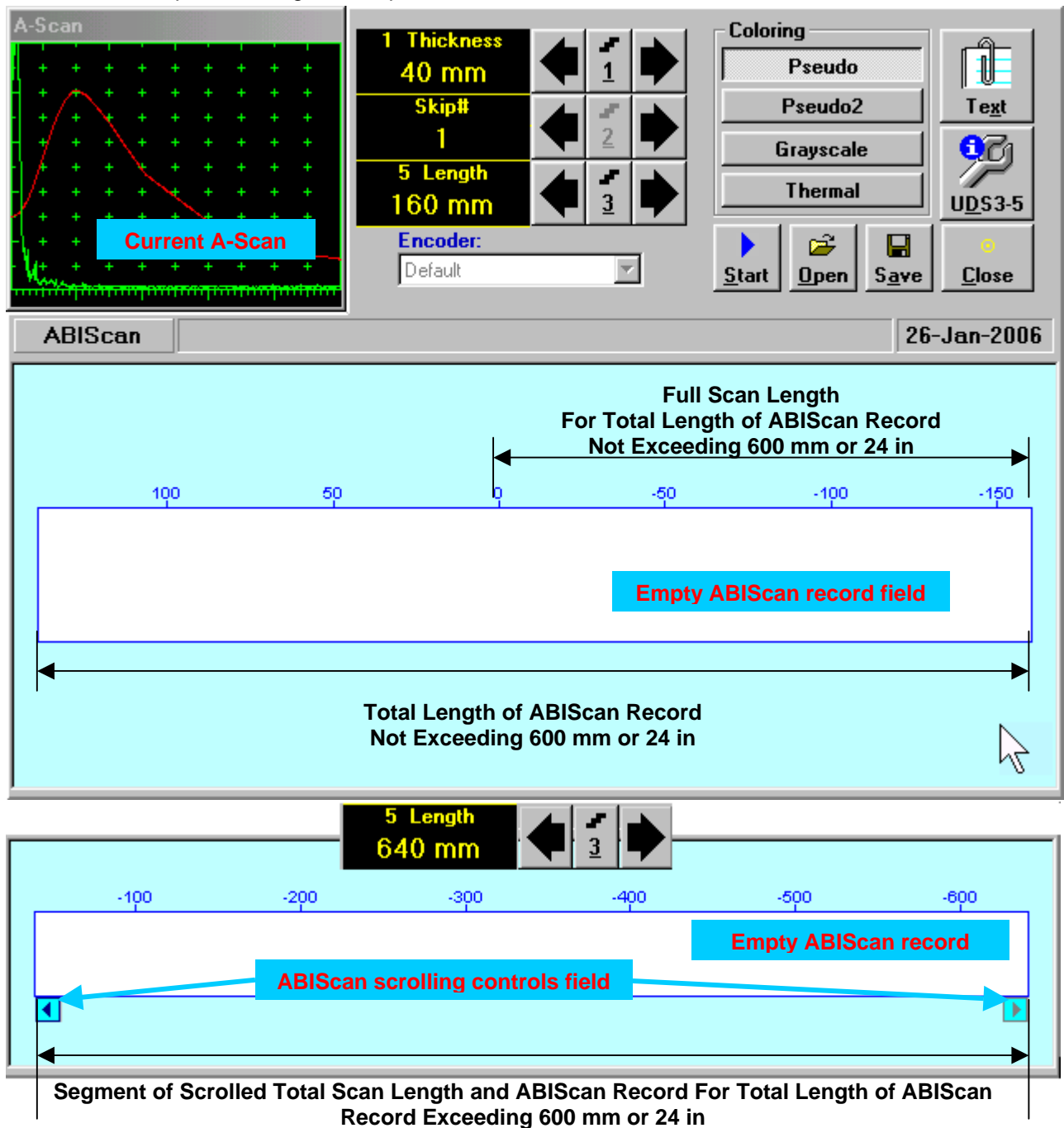
- Apply probe to test object in the start point of selected scanning line

- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line synchronously with *Probe Icon* moving with constant speed above **t-ABIScan** record field – typical scanning progress display during is shown and explained below



7.4.2.7. ABIScan – Prior to Scanning (Angle Beam Probes)

ABIScan control panel for angle beam probe is shown below



- **Display Delay** for current **A-Scan** to be used for the recording is equal to **Probe Delay** setting in submenu **MEASURE** of **UDS 3-5 Pulsar Receiver** preceeding entering into **ABIScan** mode
- **Total Length of ABIScan Record** is determined automatically according to:
 - Total Length of ABIScan Record = Total Scan Length + 2 * Skip # * Thickness * Tan (Angle)**
 - where
 - ◆ **Thickness**, **Skip #**, and **Total Scan Length = Length** are the settings of **ABIScan** control panel
 - ◆ **Angle** is setting in submenu **MEASURE** of **UDS 3-5 Pulsar Receiver** preceeding entering into **ABIScan** mode

Thickness and Skip

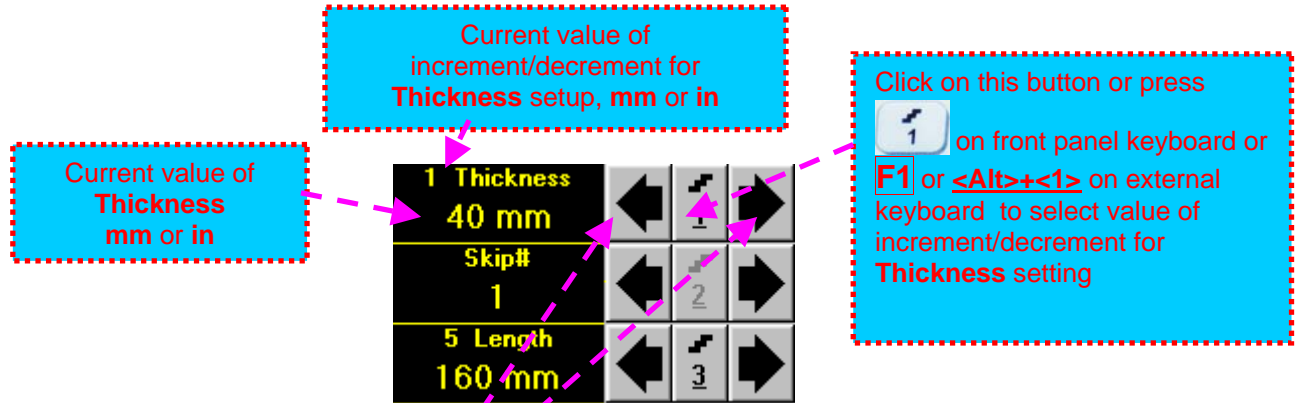
Thickness and **Skip #** settings define the region of interest starting from the scanning surface and automatic **Range** setting for current **A-Scan** to be used for the recording:

$$\text{Range} = 2 \times \text{Skip \#} \times \text{Thickness} \times \text{Cos (Angle)}$$

whereas

- ◆ **Thickness** and **Skip #** are the settings of **ABIScan** control panel
- ◆ **Angle** is setting in submenu **MEASURE** of **UDS 3-5 Pulsar Receiver** precessing entering into **ABIScan** mode

For objects with parallel surfaces the actual **Thickness** value to be entered for full skip inspection (**Skip # = 1**)











To control **Thickness** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding button

- **Keyboard**

- Press  on front panel keyboard or **F1** on external keyboard ⇒ **Thickness** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

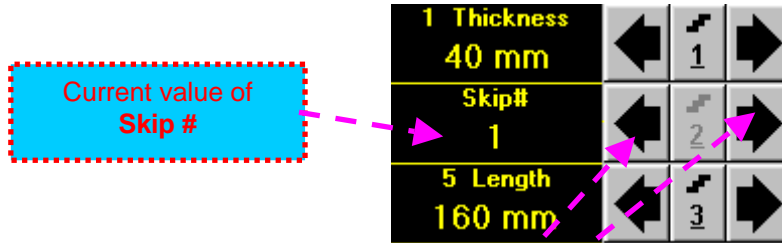
- **Combined**

- Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



The value of **Thickness** is adjustable between 5 and 300 **mm** or 0.2 and 12 **in** (expandable on special inquire)

Skip












To control **Skip #** the following manipulations are applicable:








- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F2** on external keyboard ⇒ **Skip #** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

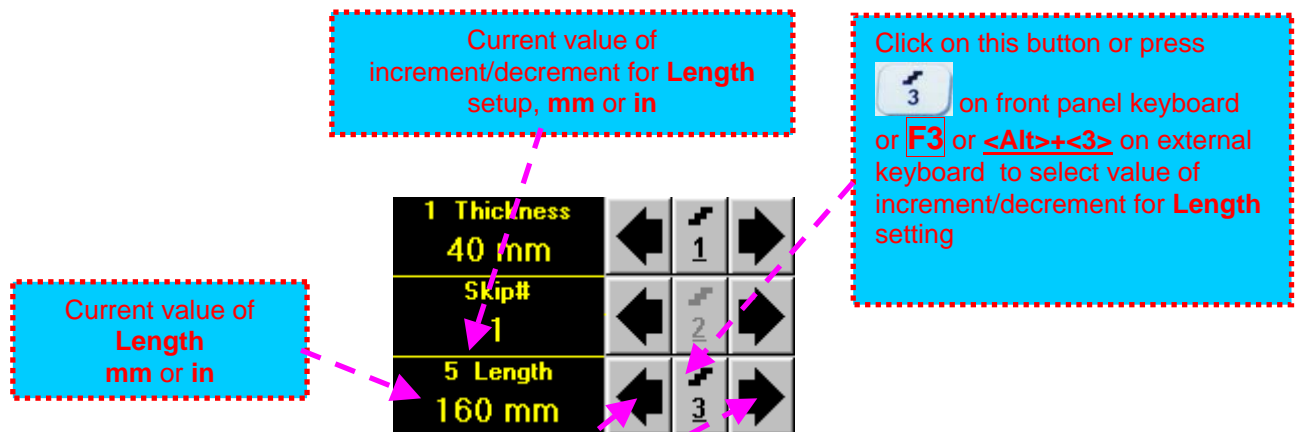
- Click on **Skip #** ⇒ **Skip #** fore color changes to white - then use , , ,  on front panel keyboard or , , , on external keyboard



The **Skip #** setting may be **0.5** – half skip insonification or **1** – full skip insonification

Scan Length

Length represents length of section of test object to be displayed, over which probe will be scanning during recording period



To control **Length** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press on front panel keyboard or **F3** on external keyboard ⇒ **Length** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **Length** ⇒ **Length** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Length** is adjustable between 50 and 1000 **mm** or 2 and 40 **in**

Encoder

Select encoder to be used through appropriate box



Clamp probe into encoder – refer to Chapter 7 of this Operating Manual

Connect encoder to its input on the right side of **ISONIC 2006 instrument**

Insert Text Note

Refer to paragraph 7.3.2.1 of this Operating Manual

Preview UDS 3-5 Settings



Refer to paragraph 7.3.2.1 of this Operating Manual

ABIScan Record Palette


There are four palettes available through click on appropriate button:





Start/Stop t-ABIScan recording

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **ABIScan** recording




button becomes invisible since **ABIScan** recording starts.  button occupies its position.



Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **ABIScan** recording prior to automatic completion



button becomes invisible after termination of **ABIScan** record.  button returns to its position



Save record into a file

Refer to paragraph 7.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session



Refer to paragraph 7.3.2.1 of this Operating Manual

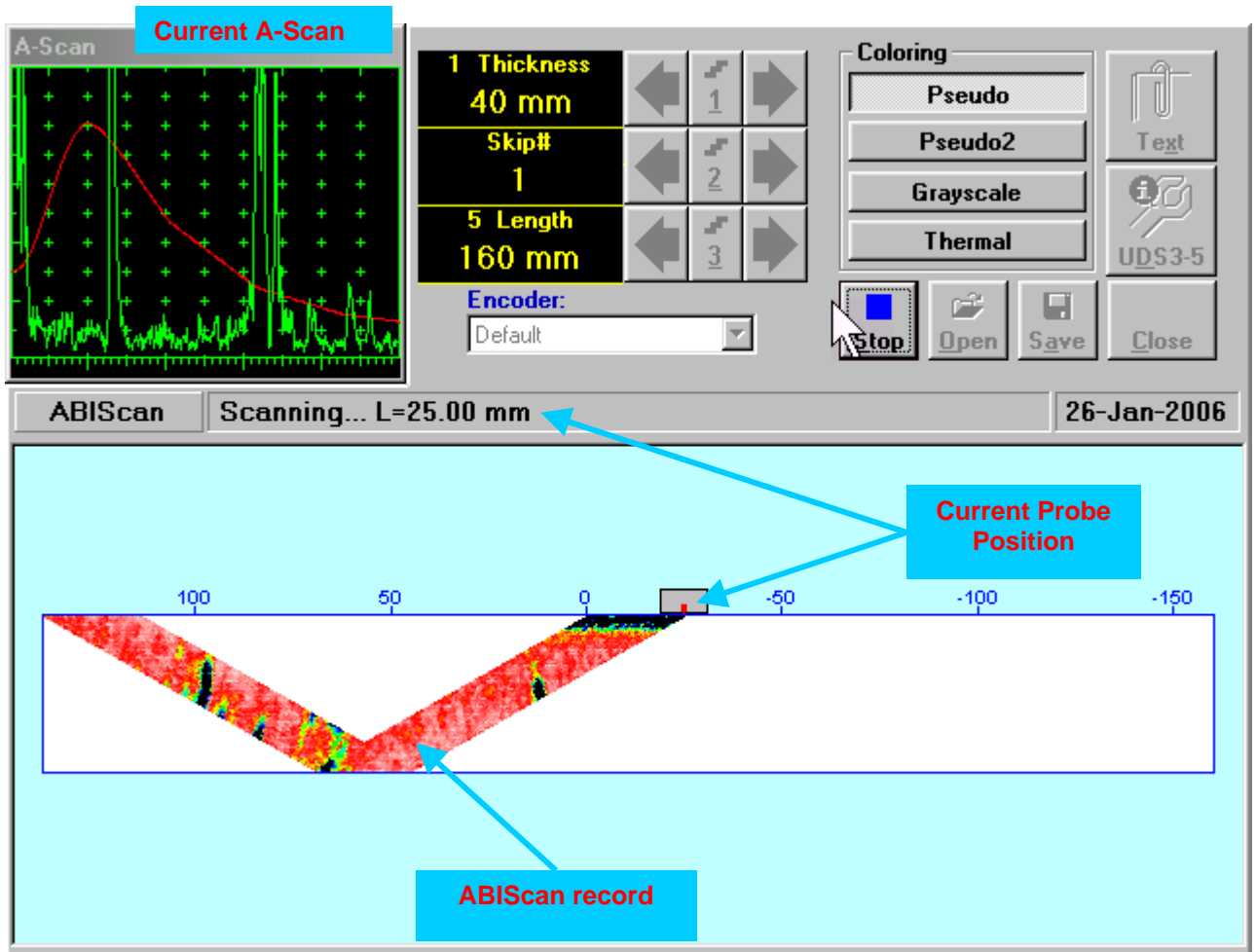
Return to UDS 3-5 main operating surface

Refer to paragraph 7.3.2.1 of this Operating Manual

7.4.2.8. ABIScan – Scanning (Angle Beam Probes)

- Apply probe equipped with an encoder to test object in the start point of selected scanning line

- Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line – typical scanning progress display during is shown and explained below



7.4.2.9. t-ABIScan / ABIScan – Postprocessing

Versatile postprocessing of **t-ABIScan / ABIScan** records is featured with:

- ❑ Sizing defects at any location along stored images (coordinates, projection size, amplitude-based evaluation)
- ❑ Play-back and evaluation of **A-Scans** obtained and captured during **t-ABIScan / ABIScan** defects imaging and recording
- ❑ Defects outlining and pattern recognition based on **A-Scan** sequence analysis – **Echo Dynamic Pattern Analysis**
- ❑ Reconstruction of **B-Scan** defects images for various **Gain, Reject, and off-line Gate** level settings
- ❑ **DAC / DGS t-ABIScan / ABIScan** normalization





The screen as below appears upon opening file. All postprocessing procedures are performed through **menu bar** – touch screen stylus or front panel or external mouse to be used

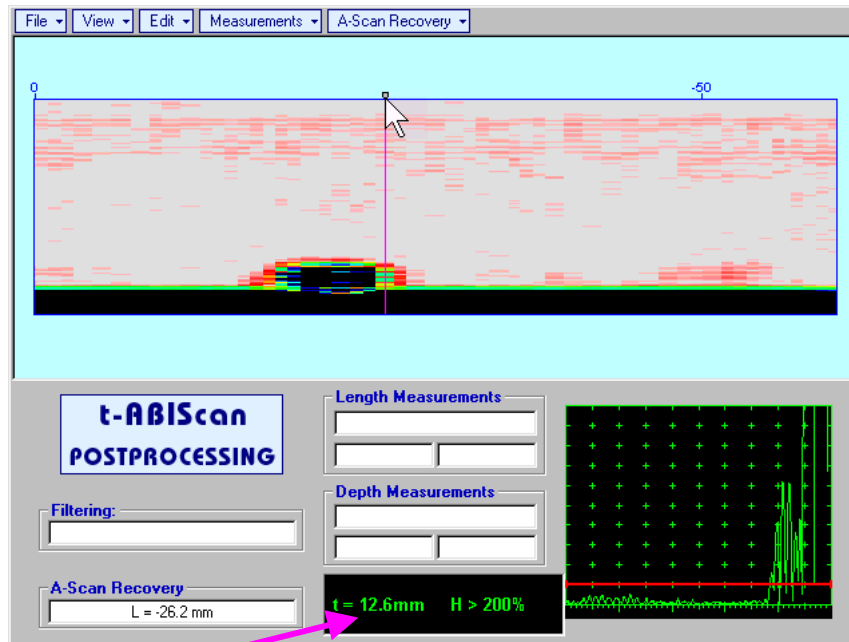


Menu Bar Functions

- **File→Open** – opens new **t-ABIScan / ABIScan** file
- **File→Snapshots→Add Snapshot** – stores current postprocessing screen snapshot accompanied with appropriate settings and measurements into *postprocessing session memory stack*
- **File→Snapshots→Restore Snapshot** – recalls earlier stored postprocessing screen snapshot accompanied with appropriate settings and measurements from *postprocessing session memory stack*
- **File→Snapshots→Delete Snapshot** – deletes earlier stored postprocessing screen snapshot accompanied with appropriate settings and measurements from *postprocessing session memory stack*
- **File→Print** – prints out postprocessing screen snapshot(s) accompanied with appropriate settings and measurements
- **File→Exit** – returns to **t-ABIScan / ABIScan** control panel
- **View→Instrument** – indicates setup of **UDS 3-5** Pulser Receiver used for scanning when file was created
- **View→Inspection Data** – indicates operator's comments entered prior to scanning
- **View→Coloring** – selects palette for **t-ABIScan / ABIScan** image

- **A-Scan Recovery →ON** (*straight beam inspection record*) – generates *cursor representing sound path* of straight beam probe's central beam in the object under test that may be guided over **t-ABIScan** /


ABIScan image using either touch screen stylus or mouse or  ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. Starting position of cursor (**L**) corresponding to probe's center is indicated in the **A-Scan Recovery** field. On the recovered **A-Scan** there is red **Off-line Gate** presented. Initially **Off-line Gate** covers whole **A-Scan** range




Automatic Measurements Display accompanies recovered **A-Scan** and indicates (refer to paragraphs 5.1.12, 5.2.13.1 and 5.2.13.2 of this Operating Manual):





- depth **t** of reflector (measurement mode - **Flank**)
- amplitude **H** of the maximal signal in the **Off-line Gate** expressed in % of full **A-Scan** height
- **ΔVC (dB to DAC)** of the maximal signal in the **Off-line Gate** provided that DAC was active whilst recording **t-ABIScan** / **ABIScan** data

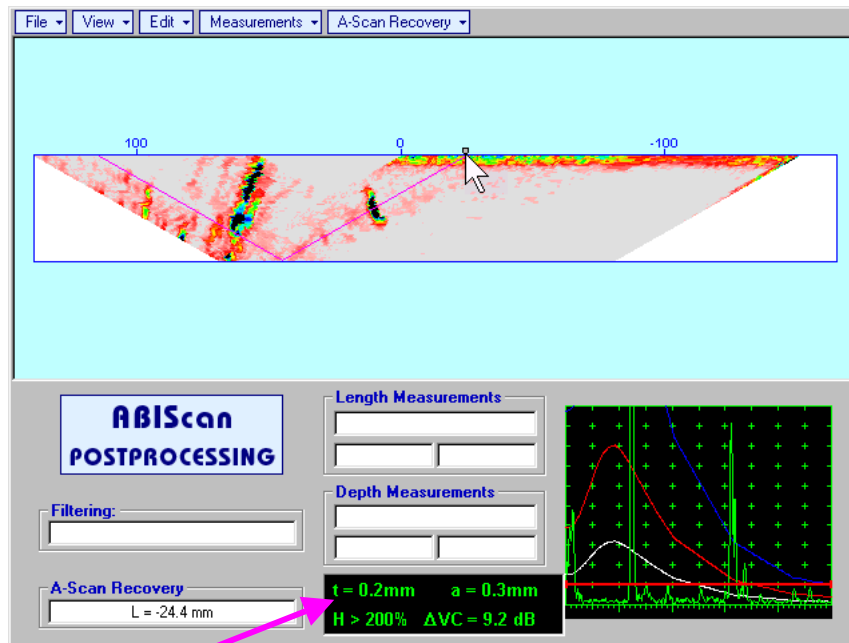
To fix position of *sound path cursor* with corresponding recovered **A-Scan** and **Automatic**

Measurements Display data left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard

To interrupt recovery of **A-Scans** and empty **A-Scan Recovery** field right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- **A-Scan Recovery →OFF** (*straight beam inspection record*) – erases *sound path cursor* with recovered **A-Scan** and **Automatic Measurements Display** and empties **A-Scan Recovery** field


- **A-Scan Recovery → ON** (*angle beam inspection record*) – generates *cursor representing sound path* of angle beam probe's central beam in the object under test that may be guided over **t-ABIScan / ABIScan** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. Starting position of cursor (**L**) corresponding to probe's incidence point is indicated in the **A-Scan Recovery** field. On the recovered **A-Scan** there is red **Off-line Gate** presented. Initially **Off-line Gate** covers whole **A-Scan** range




Automatic Measurements Display accompanies recovered **A-Scan** and indicates (refer to paragraphs 5.1.12, 5.2.13.1 and 5.2.13.2 of this Operating Manual):











- depth **t** of reflector (measurement mode - **Flank**)
- distance **a** between probe incidence point and reflector taken along scanning surface (measurement mode - **Flank**)
- amplitude **H** of the maximal signal in the **Off-line Gate** expressed in % of full **A-Scan** height
- **ΔVC (dB to DAC)** of the maximal signal in the **Off-line Gate** provided that DAC was active whilst recording **t-ABIScan / ABIScan** data

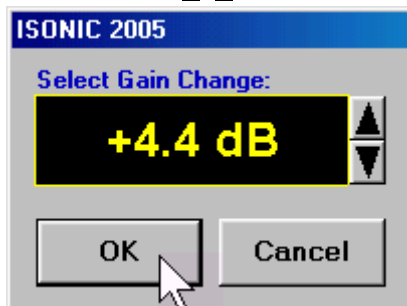
To fix position of *sound path cursor* with corresponding recovered **A-Scan** and **Automatic**

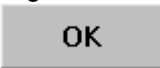

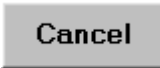

Measurements Display data left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard

To interrupt recovery of **A-Scans** and empty **A-Scan Recovery** field right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- **A-Scan Recovery → OFF** (*angle beam inspection record*) – erases *sound path cursor* with recovered **A-Scan** and **Automatic Measurements Display** and empties **A-Scan Recovery** field





- Edit→Change Gain→ON** – (*straight beam and angle beam inspection records*) generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-ABIScan** / **ABIScan** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates subwindow allowing off-line re-adjusting of **Gain** for all **A-Scans** captured during **t-ABIScan** / **ABIScan** recording in **±6dB** range with **±0.1 dB** increments through clicking or pressing and holding on  or pressing  ,  on front panel keyboard or  ,  on external keyboard










- During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain** click on  or press  on front panel keyboard or **Enter** on external keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws **t-ABIScan** / **ABIScan** image accordingly
- To interrupt re-adjusting of **Gain** click on  or press  on front panel keyboard or **Esc** on external keyboard

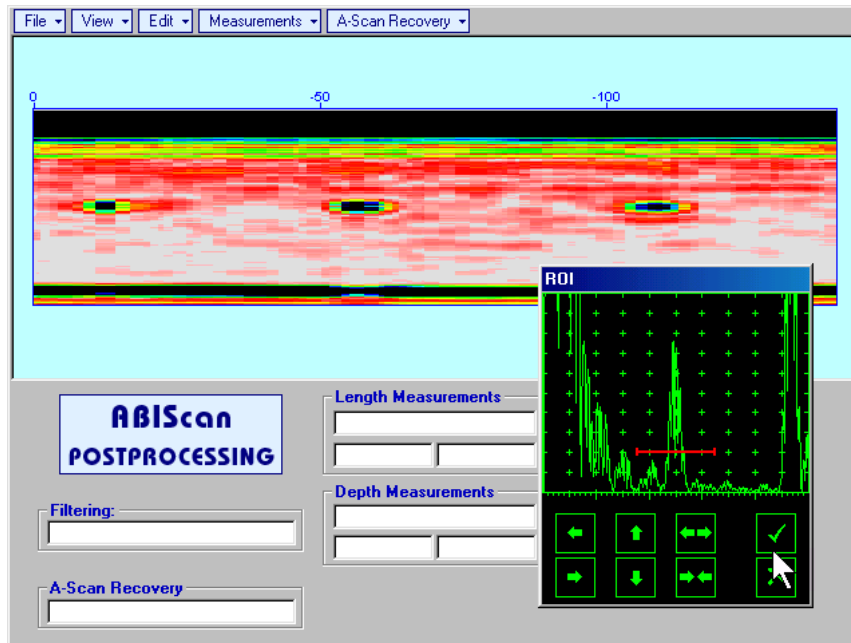
- Edit→Change Gain→OFF** – negates **Gain** re-adjustment and returns to originally recorded **t-ABIScan** / **ABIScan** image and original **Gain** setting


- **Edit→ROI→ON** (*straight beam inspection record*) – generates *cursor* representing *sound path* of straight beam probe's central beam in the object under test that may be guided over **t-ABIScan** /

ABIScan image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. To select reference **A-Scan** release touch screen stylus or left mouse click or press


 on front panel keyboard or **Enter** on external keyboard – this generates **Off-line Gate** controls

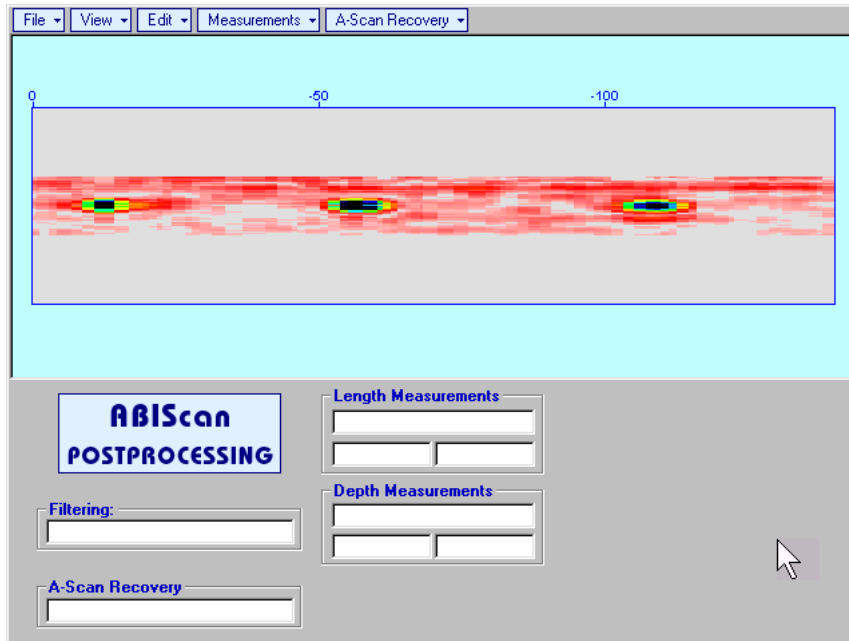
 ,  ,  ,  ,  ,  allowing to redefine **Region Of Interest** for **t-ABIScan** / **ABIScan** imaging



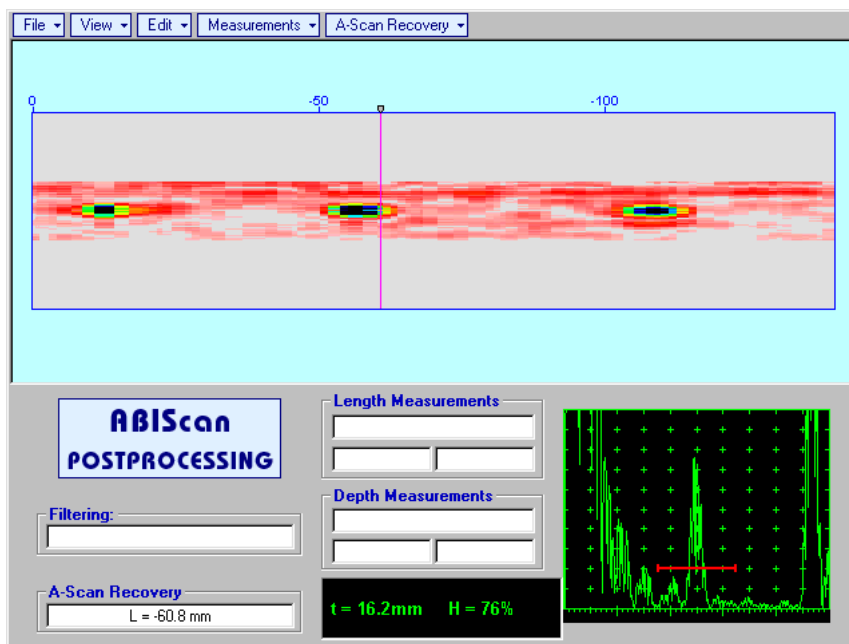
To interrupt selection of reference of **A-Scan** right mouse click or press  on front panel keyboard or **Esc** on external keyboard

To interrupt re-adjustment of **Region Of Interest** after selection of reference of **A-Scan** click on 












Upon completing redefining of **Region Of Interest** click on  – this applies new **Off-line Gate** to all captured **A-Scans** and updates **t-ABIScan / ABIScan** image accordingly – only segment of **t-ABIScan / ABIScan** image covered by newly adjusted **Off-line Gate** remains visible

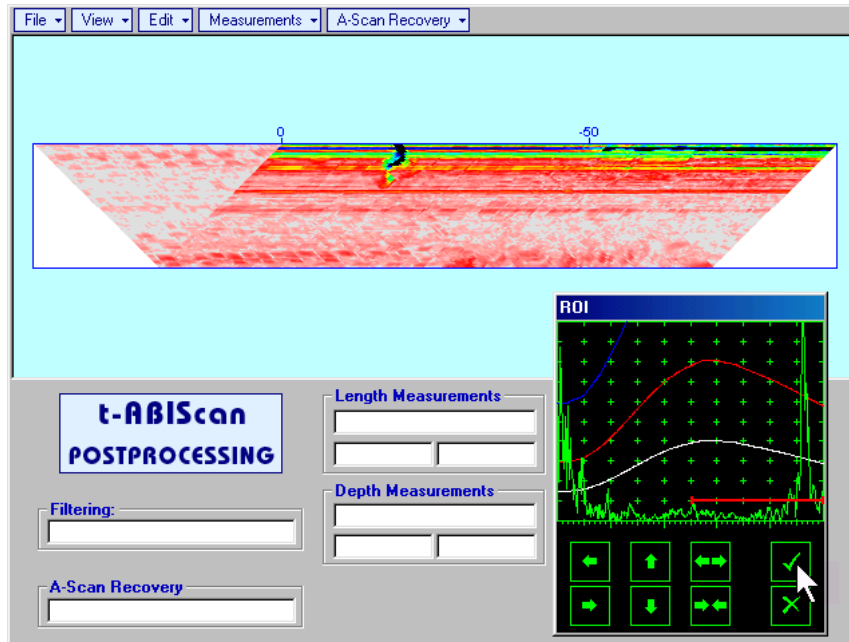



It is possible then to perform **A-Scan** signals evaluation using newly adjusted **Off-Line Gate** through **A-Scan Recovery** → **ON**





- **Edit→ROI→OFF** (*straight beam inspection record*) – negates **Off-line Gate** re-adjustment and returns to originally recorded **t-ABIScan / ABIScan** image and initial **Off-line Gate** setting

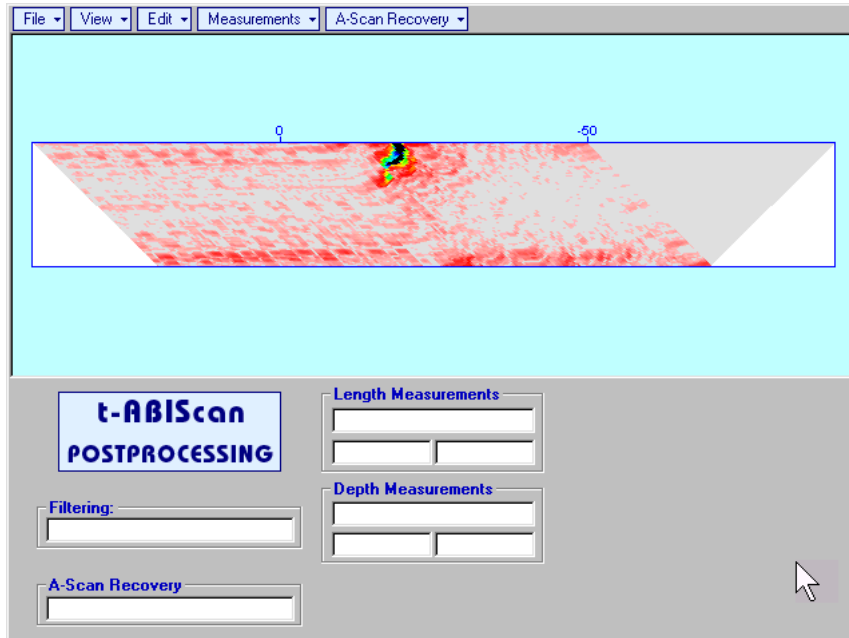
- Edit→ROI→ON** (*angle beam inspection record*) – generates *cursor representing sound path* of angle beam probe's central beam in the object under test that may be guided over **t-ABIScan / ABIScan** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates **Off-line Gate** controls , , , , ,  allowing to redefine **Region Of Interest** for **t-ABIScan / ABIScan** imaging



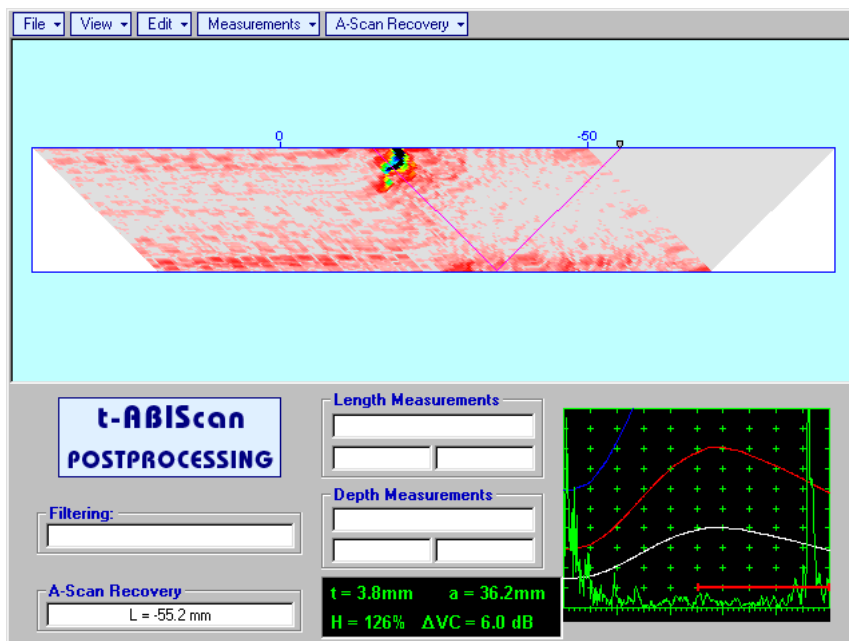
To interrupt selection of reference of **A-Scan** right mouse click or press  on front panel keyboard or **Esc** on external keyboard

To interrupt re-adjustment of **Region Of Interest** after selection of reference of **A-Scan** click on 





Upon completing redefining of **Region Of Interest** click on  – this applies new **Off-line Gate** to all **A-Scans** captured during **t-ABIScan / ABIScan** recording and updates **t-ABIScan / ABIScan** image accordingly – only segment of **t-ABIScan / ABIScan** image covered by newly adjusted **Off-line Gate** remains visible: in the present example there was under surface crack detected using full skip insonification and **Off-line Gate** was readjusted by such a way that only full skip segment of **t-ABIScan / ABIScan** image remained visible – this allowed to eliminate disturbing presence of initial pulse reverberations on the **t-ABIScan / ABIScan** image

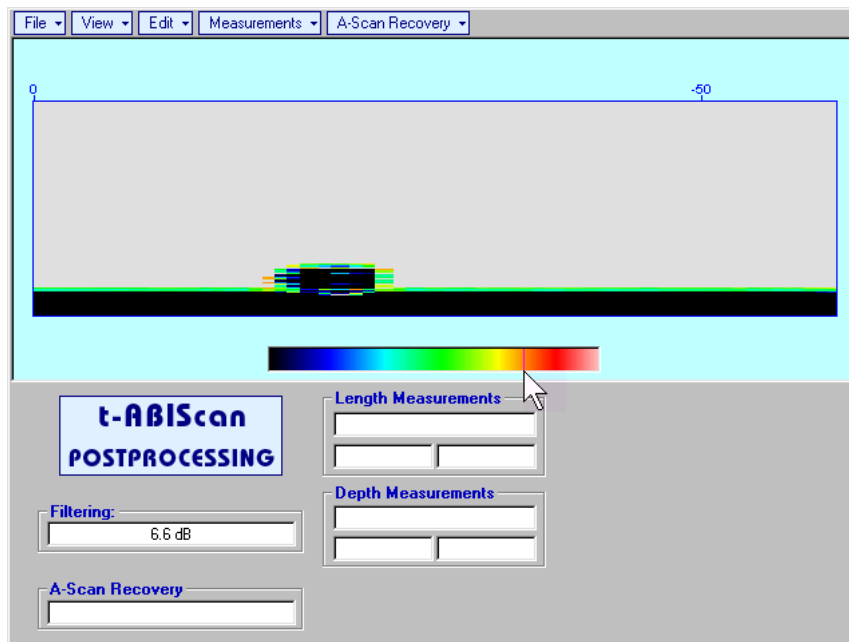


It is possible then to perform **A-Scan** signals evaluation using newly adjusted **Off-Line Gate** through **A-Scan Recovery** → **ON**



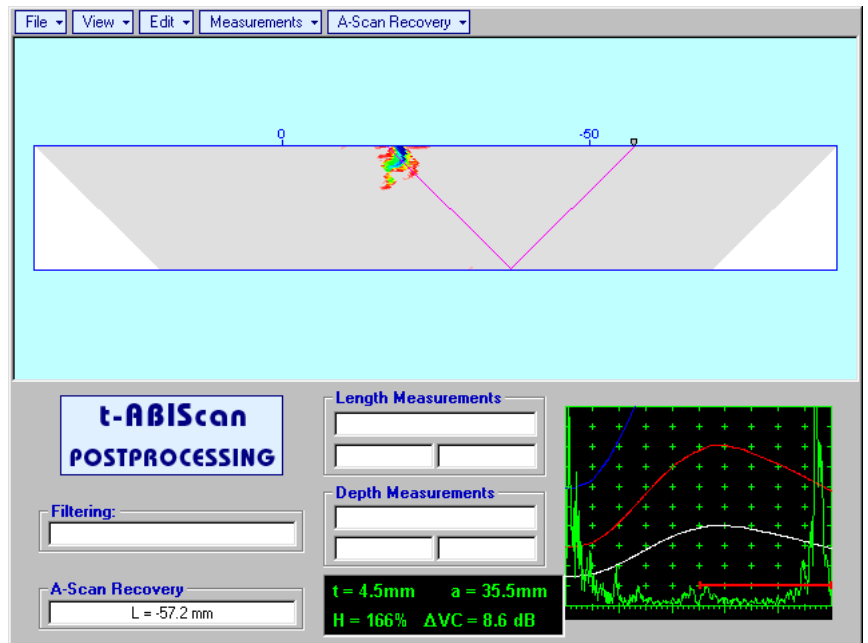
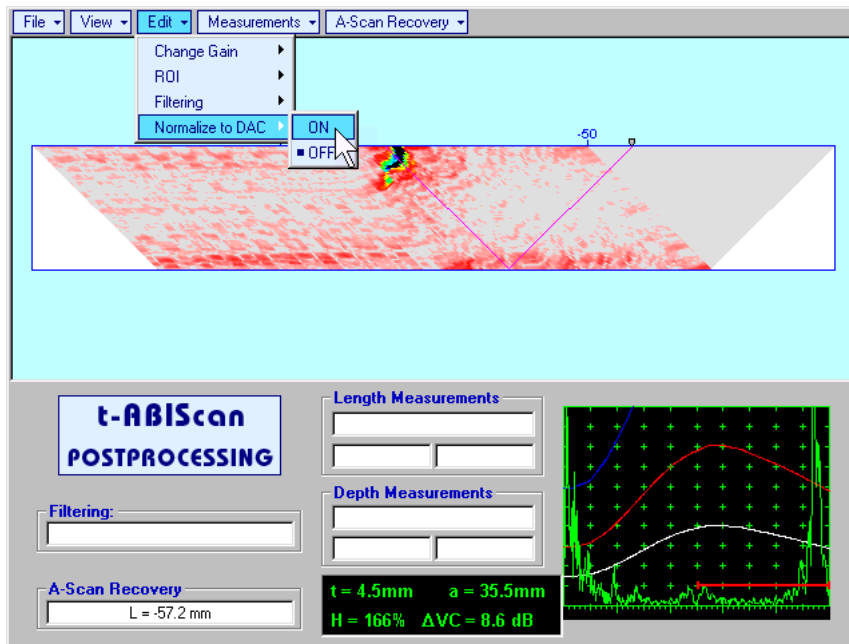
- **Edit→ROI→OFF** (*angle beam inspection record*) – negates **Off-line Gate** re-adjustment and returns to originally recorded **t-ABIScan / ABIScan** image and initial **Off-line Gate** setting

- **Edit→Filtering→ON** – (*straight beam and angle beam inspection records*) generates *amplitude palette bar* with *sliding cursor*, which may be controlled using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard . Position of the *sliding cursor* on the *amplitude palette bar* determines filtering level, which is indicated in the **Filtering** field. All elements of **t-ABIScan** / **ABIScan** image representing signal amplitude below filtering level are suppressed:



- **Edit→Filtering→OFF** (*straight beam and angle beam inspection records*) – returns to originally recorded **t-ABIScan** / **ABIScan** image and empties **Filtering** field













- **Edit→Normalize to DAC→ON** (*straight beam and angle beam inspection records*) – applies **DAC/DGS** normalized color palette to **t-ABIScan / ABIScan** image, which was recorded with active **DAC/DGS** and redraws **t-ABIScan / ABIScan** image correspondingly (**dB to DAC/DGS** normalization)

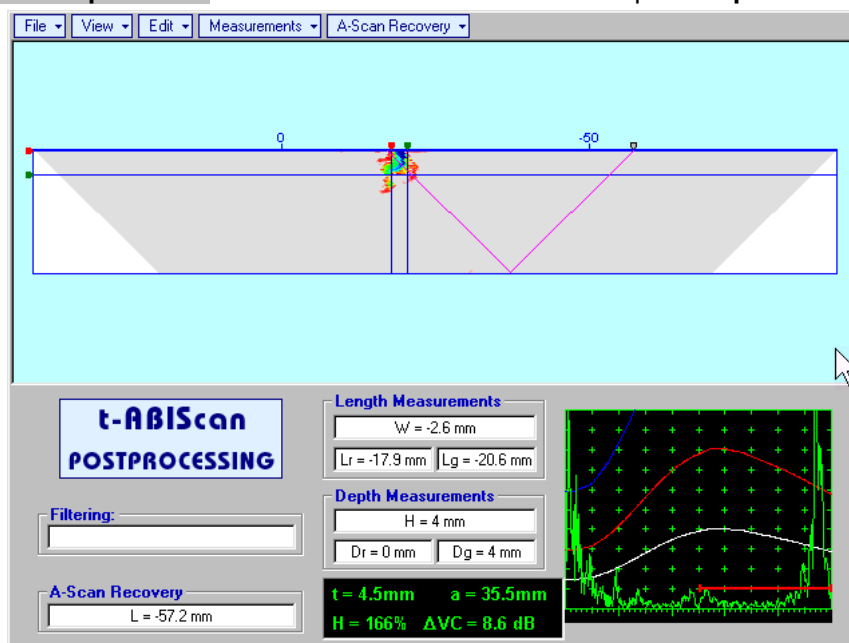


- **Edit→Normalize to DAC→OFF** (*straight beam and angle beam inspection records*) – negates **dB to DAC/DGS** normalization and returns to originally recorded **t-ABIScan / ABIScan** image





Applying of **Edit→Normalize to DAC→ON** or **Edit→Normalize to DAC→OFF** negates **Filtering** (**Edit→Filtering→OFF**)

- Measurements→Length→ON** – generates first vertical cursor that may be guided over **t-ABIScan / ABIScan** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard . Coordinate of the first vertical cursor along **t-ABIScan / ABIScan** image (**Lr**) is indicated in the **Length Measurements** field. To fix position of the first vertical cursor left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . To interrupt vertical cursor manipulations and empty **Length Measurements** field right mouse click or press  on front panel keyboard or **Esc** on external keyboard
 Second vertical cursor appears upon fixing first one, it may be manipulated by the same way. Coordinate of the second vertical cursor along **t-ABIScan / ABIScan** image (**Lg**) is indicated in the **Length Measurements** field along with parameter **W = Lg – Lr**. Parameter **W** represents projection length of defect provided that vertical cursors are placed appropriately
- Measurements→Length→OFF** – erases vertical cursors and empties **Length Measurements** field
- Measurements→Depth→ON** – generates first horizontal cursor that may be guided over **t-ABIScan / ABIScan** image using either touch screen or mouse or ,  on front panel keyboard or ,  on external keyboard . Coordinate of the first horizontal cursor along **t-ABIScan / ABIScan** image (**Dr**) is indicated in the **Depth Measurements** field. To fix position of the first horizontal cursor left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . To interrupt horizontal cursor manipulations and empty **Depth Measurements** field right mouse click or press  on front panel keyboard or **Esc** on external keyboard
 Second horizontal cursor appears upon fixing first one, it may be manipulated by the same way. Coordinate of the second horizontal cursor along **t-ABIScan / ABIScan** image (**Dg**) is indicated in the **Depth Measurements** field along with parameter **H = Dg – Dr**. Parameter **H** represents thickness loss provided that horizontal cursors are placed appropriately
- Measurements→Depth→OFF** – erases horizontal cursors and empties **Depth Measurements** field



7.5. TOFD Inspection – RF B-Scan and D-Scan Imaging and Recording – t-TOFD or TOFD

7.5.1. Setup Pulser Receiver for t-TOFD and TOFD

UDS 3-5 Pulser Receiver window – main operating surface – appears on ISONIC 2006 screen upon clicking on  or . The following settings to be provided:

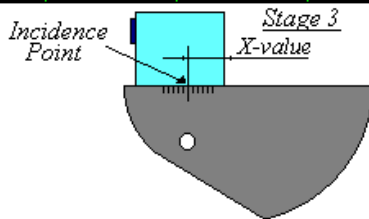
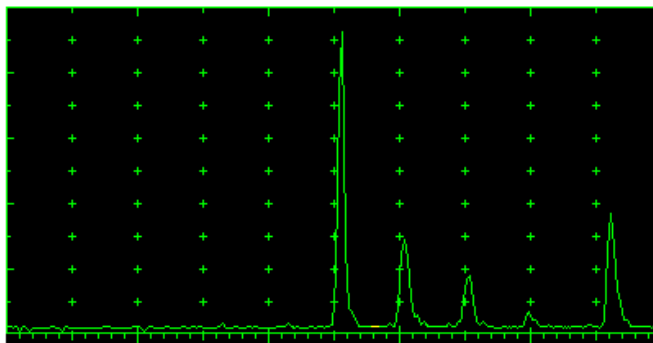
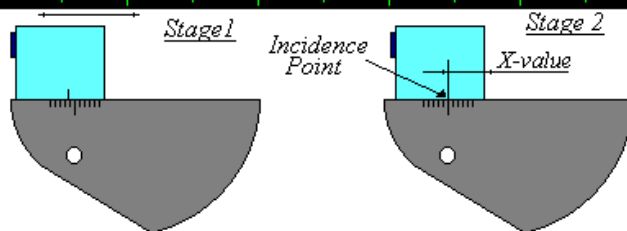
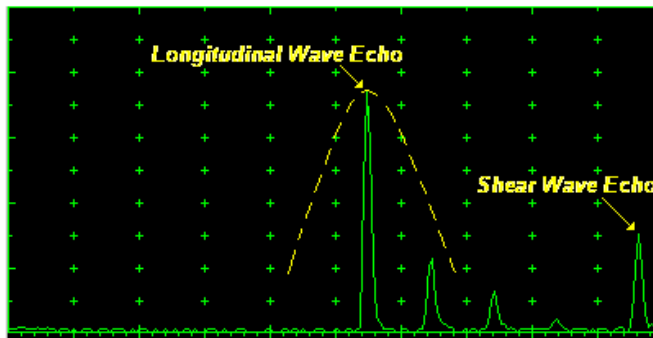
#	Parameter or Mode	Submenu	Required Settings	Note
1	Pulser Mode	PULSER	Dual	
2	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain setting procedure
3	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain setting procedure
4	Display	RECEIVER	RF	
5	USVelocity	BASIC	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	
6	Probe Delay	MEASURE	Probe Delay setting to be equal to actual Accumulated Probe Pair Delay	Accumulated Probe Pair Delay may be determined according to paragraph 7.5.1.1 of this Operating Manual
7	Display Delay Range	BASICS	Display Delay and Range to provide clear A-Scan representing: <ul style="list-style-type: none"> o Lateral Wave and Longitudinal Wave Back Echo Signals at the beginning and at the end of A-Scan correspondingly <li style="text-align: center;">OR o Lateral Wave, Longitudinal Wave Back Echo, and Mode Conversion Back Echo at the beginning, middle, and at the end of A-Scan correspondingly <li style="text-align: center;">OR o Other combination of signals required by Inspection procedure 	Display Delay and Range will be determined according to paragraph 7.5.1.2 of this Operating Manual
8	Gain	BASICS	Gain setting to be performed according to inspection procedure providing required amplitude of signals from defects to be detected	Refer to paragraph 7.5.1.3 of this Operating Manual
9	Settings for other parameters and modes have no significance			

Click on  or press  on front panel keyboard or **F8** on external keyboard upon completing

7.5.1.1. Accumulated Probe Pair Delay

Two probes to be used in order to capture the *TOFD Map*. The **Probe Delay** to be precisely measured for each of them.

Measuring Probe Delay - Miniature Probes (contact face width 12.5 mm / 0.5 in or less) – Pulse Echo Technique



Activate submenu **PULSER** then set:

- Pulser Mode** to **Single**
- Pulse Width** to **Spike (240 μJ)** for probe having resonant frequency of 8 MHz and higher or to **PW ns**, were $PW = 0.5 / F$ (F is the probe resonant frequency) for probes having resonant frequency below 8 MHz
- Firing Level** to **18**
- Damping** to **1000 Ω**
- Tuning** to **NO**

Activate submenu **RECEIVER** then set:

- Display** to **Full** or **RF**
- Filter** to **BB**
- Frequency** to completely cover probe's effective bandwidth

Activate submenu **BASICS** topic then set:

- US Velocity** to **5920 m/s (233.1 in/ms)**
- Range** to **50.0 mm (2 in)**
- Display Delay** to **0 μs**
- Reject** to **0%**

Stage 1: Manipulate probe over main working surface of V-2 reference standard and maximize echo from 25 mm (1 in) radius concave reflector

Stage 2: Fix probe in found position - the center of 25 mm (1 in) radius concave reflector will indicate **incident point** while the distance between probe's frontal edge and **incident point** is equal to **X-Value**

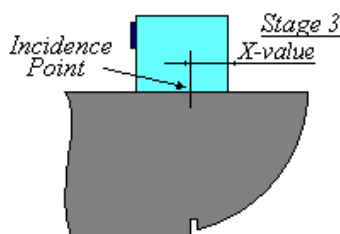
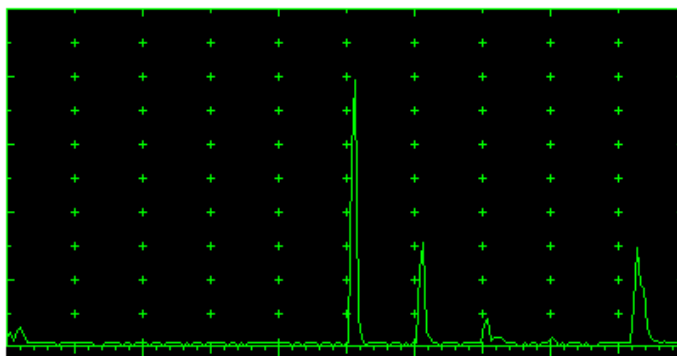
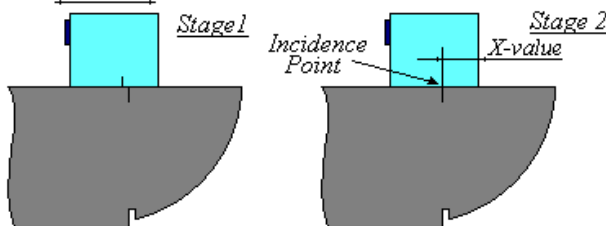
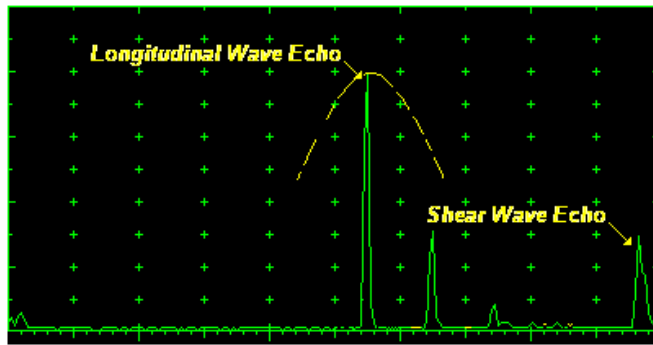
Stage 3: Tune **Display Delay** while probe is still fixed in found position until rising edge of maximized echo will match with 50%-grid of the **A-Scan** width. Upon completing the *obtained value of Display Delay* will be equal to **actual Probe Delay**



- ◆ It's necessary to setup **Gain** bringing height of maximized echo to **75-80%** of **A-Scan** height
- ◆ It is recommended to optimize **Tuning** in **PULSER** submenu upon obtaining maximized echo. The goal of such optimization is increasing of ultrasonic excitation energy through better matching between firing output and probe. Level of ultrasonic excitation energy is clearly represented by echo amplitude. Upon completing **Tuning** optimization **Gain** to be adjusted to bring echo to **75-80%** of **A-Scan** height

Supposing that **Probe Delay** values found for probes of the pair are PD_1 and PD_2
Accumulated Probe Pair Delay = $0.5 \cdot (PD_1 + PD_2)$

Measuring Probe Delay - Large and Medium Size Probes (contact face width more than 12.5 mm / 0.5 in) – Pulse Echo Technique



Activate submenu **PULSER** then set:

- Pulser Mode**
- Pulse Width** to **Spike (240 μJ)** for probe having resonant frequency of 8 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for probes having resonant frequency below 8 MHz
- Firing Level** to **18**
- Damping** to **1000 Ω**
- Tuning** to **NO**

Activate submenu **RECEIVER** then set:

- Display** to **Full** or **RF**
- Filter** to **BB**
- Frequency** to completely cover probe's effective bandwidth

Activate submenu **BASICS** topic then set:

- US Velocity** to **5920 m/s (233.1 in/ms)**
- Range** to **200.0 mm (8 in)**
- Display Delay** to **0 μs**
- Reject** to **0%**

Stage 1: Manipulate probe over main working surface of V-1 reference standard and maximize echo from 100 mm (4 in) radius concave reflector

Stage 2: Fix probe in found position - the center of 100 mm (4 in) radius concave reflector will indicate **incident point** while the distance between probe's frontal edge and **incident point** is equal to **X-Value**

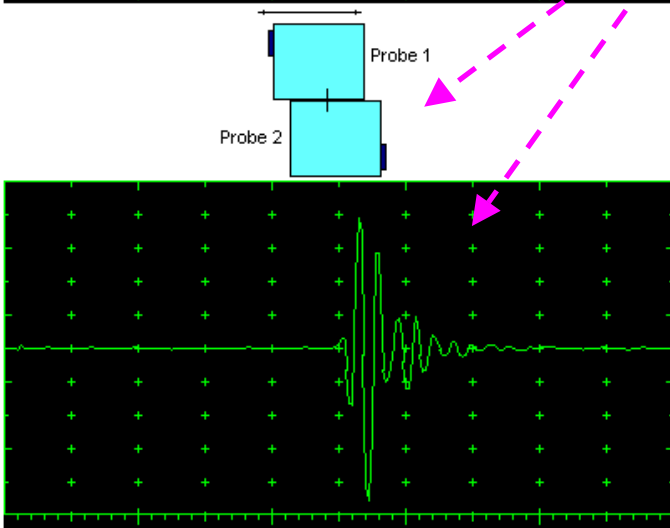
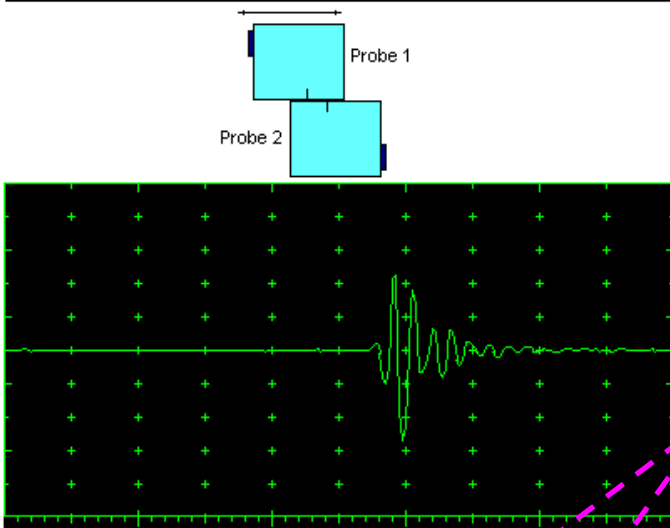
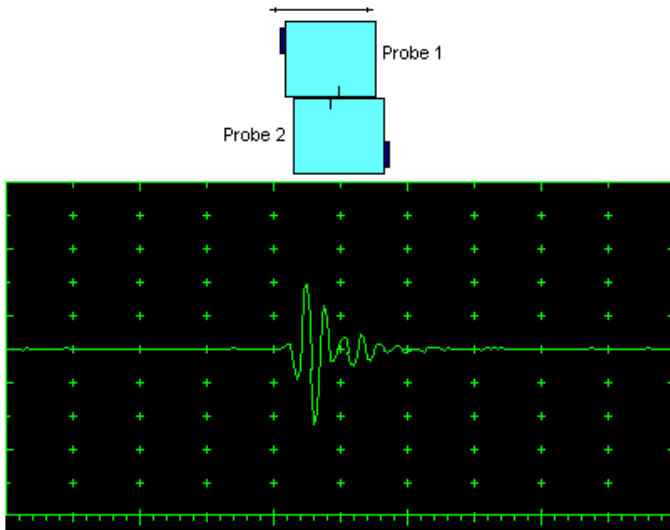
Stage 3: Tune **Display Delay** while probe is still fixed in found position until rising edge of maximized echo will match with 50%-grid of the **A-Scan** width. Upon completing the *obtained value of Display Delay will be equal to actual Probe Delay*



- ◆ It's necessary to setup **Gain** bringing height of maximized echo to **75-80%** of **A-Scan** height
- ◆ It is recommended to optimize **Tuning** in **PULSER** submenu upon obtaining maximized echo. The goal of such optimization is increasing of ultrasonic excitation energy through better matching between firing output and probe. Level of ultrasonic excitation energy is clearly represented by echo amplitude. Upon completing **Tuning** optimization **Gain** to be adjusted to bring echo to **75-80%** of **A-Scan** height

Supposing that **Probe Delay** values found for probes of the pair are **PD₁** and **PD₂**
Accumulated Probe Pair Delay = 0.5•(PD₁ + PD₂)

Direct Measurement of Accumulated Probe Pair Delay - All Sizes of Probes – Through Transmission Technique



Activate submenu **PULSER** then set:

- Pulser Mode** to **Dual**
- Pulse Width** to **Spike (240 μJ)** for probe having resonant frequency of 8 MHz and higher or to **PW ns**, were $PW = 0.5 / F$ (F is the probe resonant frequency) for probes having resonant frequency below 8 MHz
- Firing Level** to **18**
- Damping** to **1000 Ω**
- Tuning** to **NO**

Activate submenu **RECEIVER** then set:

- Display** to **RF**
- Filter** to **BB**
- Frequency** to completely cover probe's effective bandwidth

Activate submenu **BASICS** topic then set:

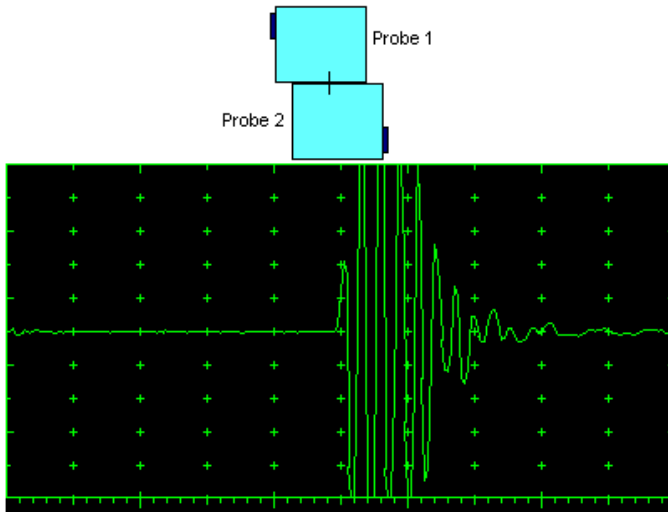
- Display Delay** to **0 μs**

Stage 1: Manipulate probes over each other and setup of **Gain**, **Range**, and **USVelocity** providing firm indication of the signal propagating in the probes wedges from emitting to receiving crystal then maximize said signal

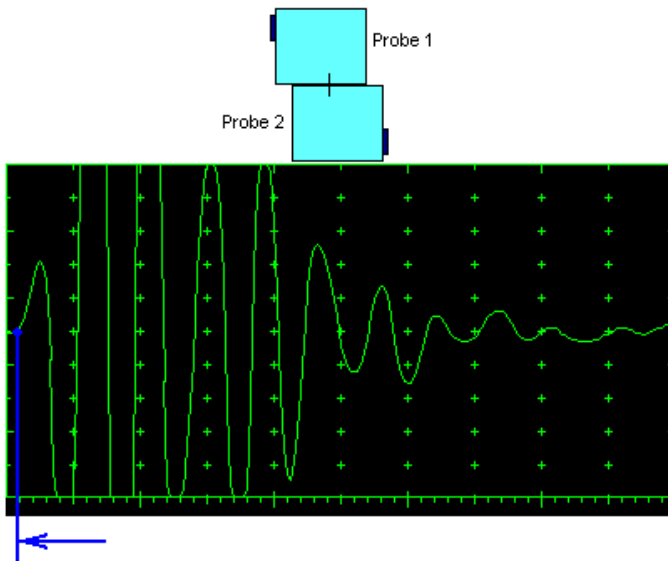
Stage 2: Fix the probe in the found position corresponding to highest signal amplitude

i

- ◆ It's necessary to setup **Gain** bringing height of maximized echo to **75-80%** of **A-Scan** height
- ◆ It is recommended to optimize **Tuning** in **PULSER** submenu upon obtaining maximized echo. The goal of such optimization is increasing of ultrasonic excitation energy through better matching between firing output and probe. Level of ultrasonic excitation energy is clearly represented by echo amplitude. Upon completing **Tuning** optimization **Gain** to be adjusted to bring echo to **75-80%** of **A-Scan** height



Stage 3: Increase Gain to provide height of first half wave of received signal reaching 20 % of total A-Scan height



Stage 4: Decrease Range to provide ~ 50% of the A-Scan width occupied by the signal

Stage 5: Start increasing of Display Delay aiming displacement of signal's start point to beginning of A-Scan horizontal base

Stage 6: Stop Display Delay manipulation upon reaching the target – at this moment value of Display Delay will represent *Accumulated Delay of the Probes Pair*

Accumulated Probe Pair Delay = Display Delay

UDS3-5 - ISONIC Pulser/Receiver

1	Gain	32 dB	←	1	→
1	Range	15.3 mm	←	2	→
100	US Velocity	5920 m/s	←	3	→
0.01	Display Delay	7.85 μs	←	4	→
5	Reject	0 %	←	5	→

BASICS PULSER RECEIVER GATE A Menu
 GATE B ALARM DAC/TCG MEASURE Selection

Close Alarm Value: OFF Freeze Save Open Print I DGS

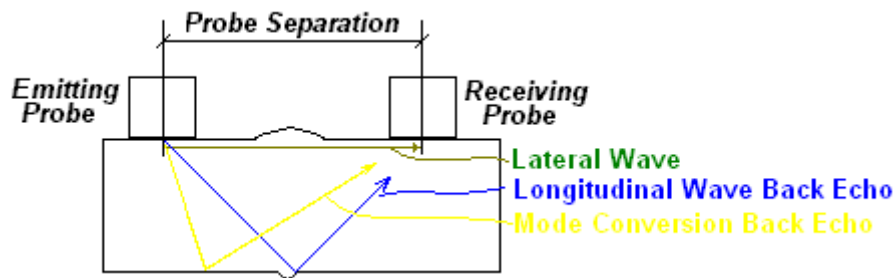
7.5.1.2. Display Delay and Range

Display Delay depends on Accumulated Probe Pair Delay, Probe Separation, and USVelocity:

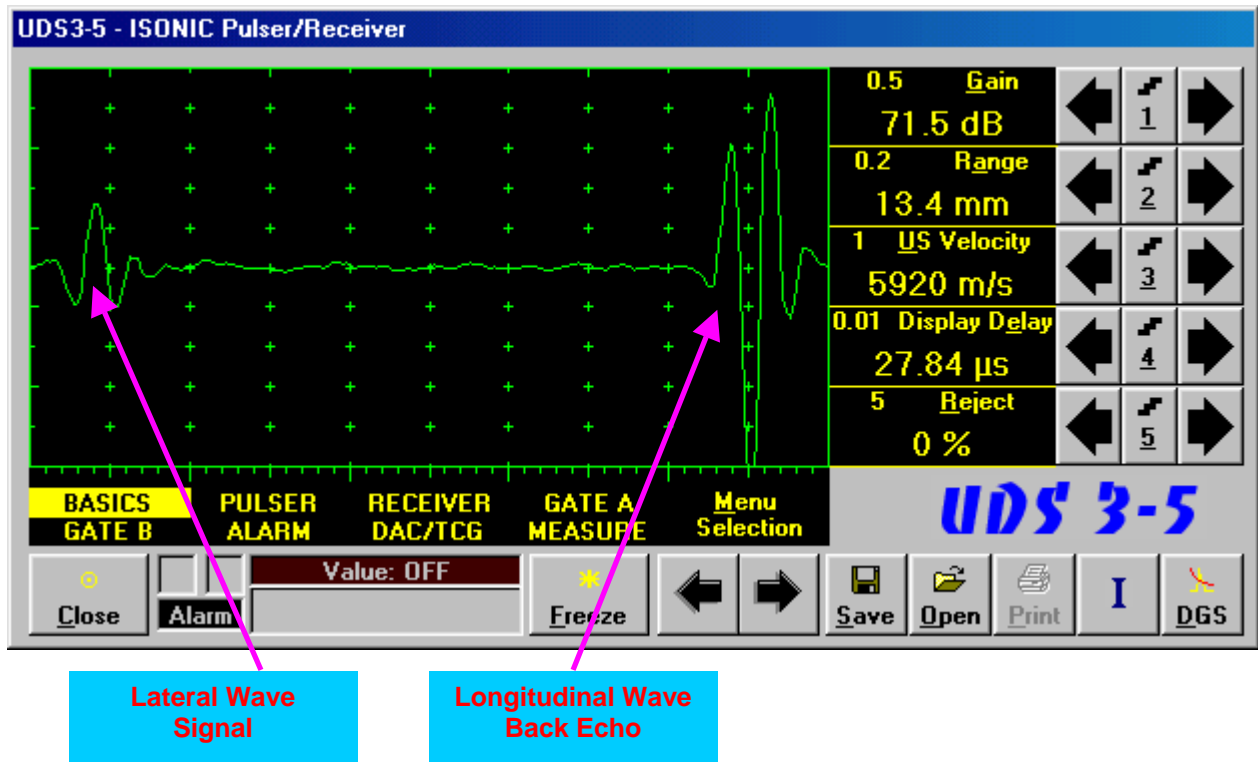
$$\text{Display Delay} = \text{Probe Delay} + \text{Probe Separation} / \text{USVelocity}$$

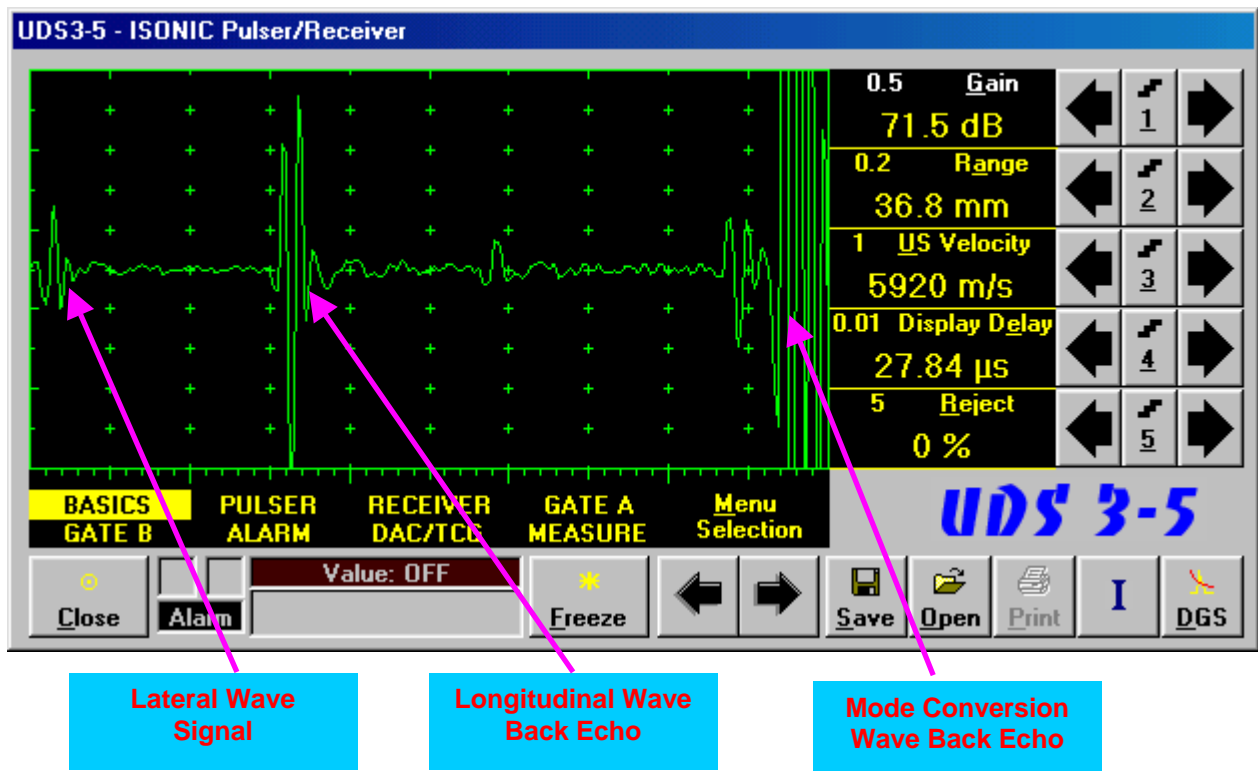
whereas:

- **USVelocity** is the *actual value of longitudinal wave velocity in the material*, of which the object under test is made
- **Probe Separation** is the distance between incidence points of the emitting and receiving TOFD probes measured along the lateral wave trace:



Probe Separation should be optimized according to Inspection procedure and probes positions in the TOFD fixture to be fixed upon. **Display Delay** and **Range** to be adjusted then to provide representing of signals according to Inspection procedure – the typical examples are given below for 40 mm thickness welded plates.





7.5.1.3. Gain

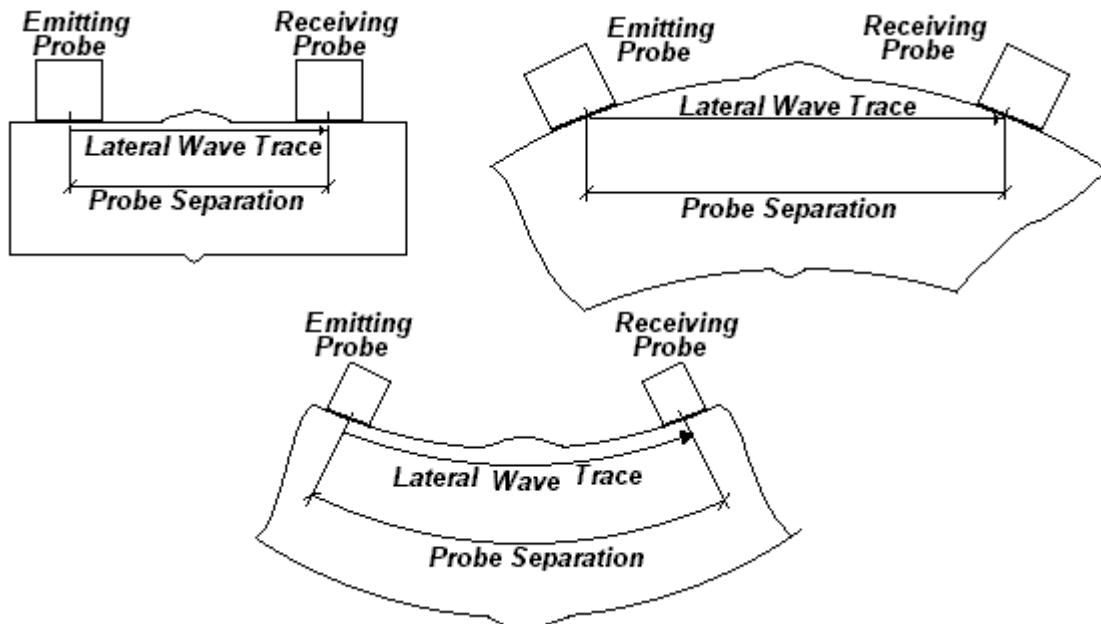
Depending on Inspection procedure (Inspection specs) **Gain** may be setup with the reference to:

- Representative flaw sample
- Artificial diffractors in the form of EDM notches or V-shaped notches
- Side drilled holes
- Grain noise
- Lateral wave signal amplitude

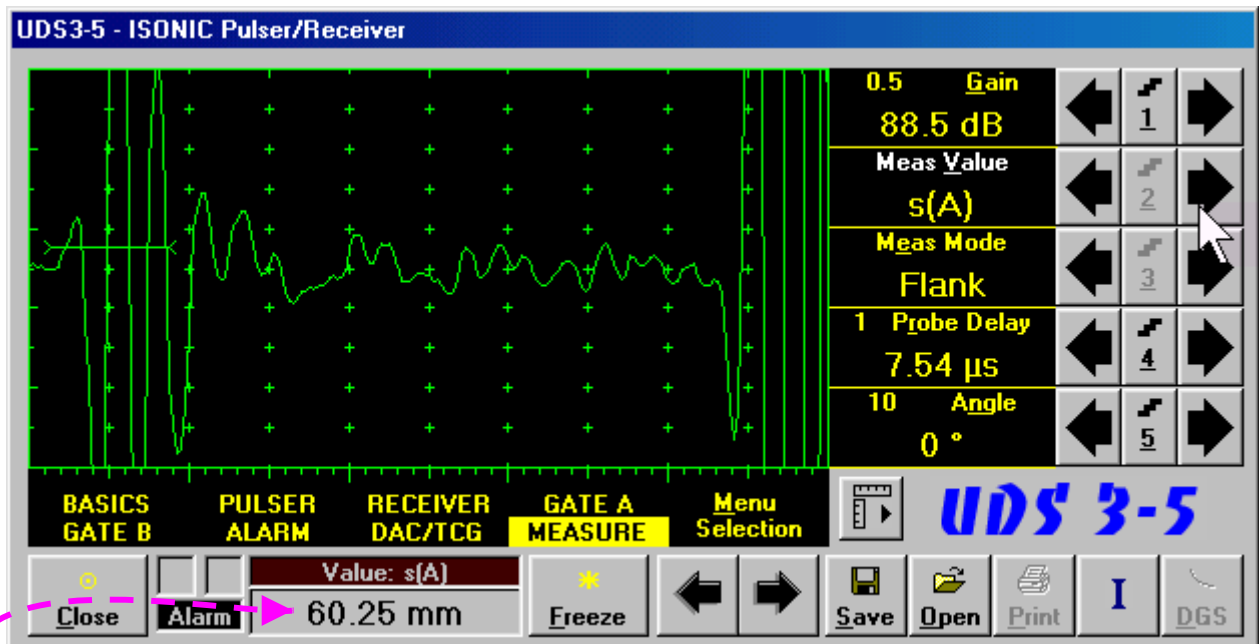
For both examples above the typical procedure of **Gain** setting was provided through bringing height of lateral wave signal to 30% of **A-Scan** height

7.5.1.4. Probe Separation

Probe Separation must be properly defined and entered to have the ability of precise defects sizing at postprocessing stage. Most widely used way of **Probe Separation** determining is mechanical measuring of distance between **TOFD** probes excitation points by using a scaled ruler. However mechanical measurements are not accurate and their implementation becomes quite complicate for objects with curved surfaces:



Probe Separation may be defined more precisely through the way as below:

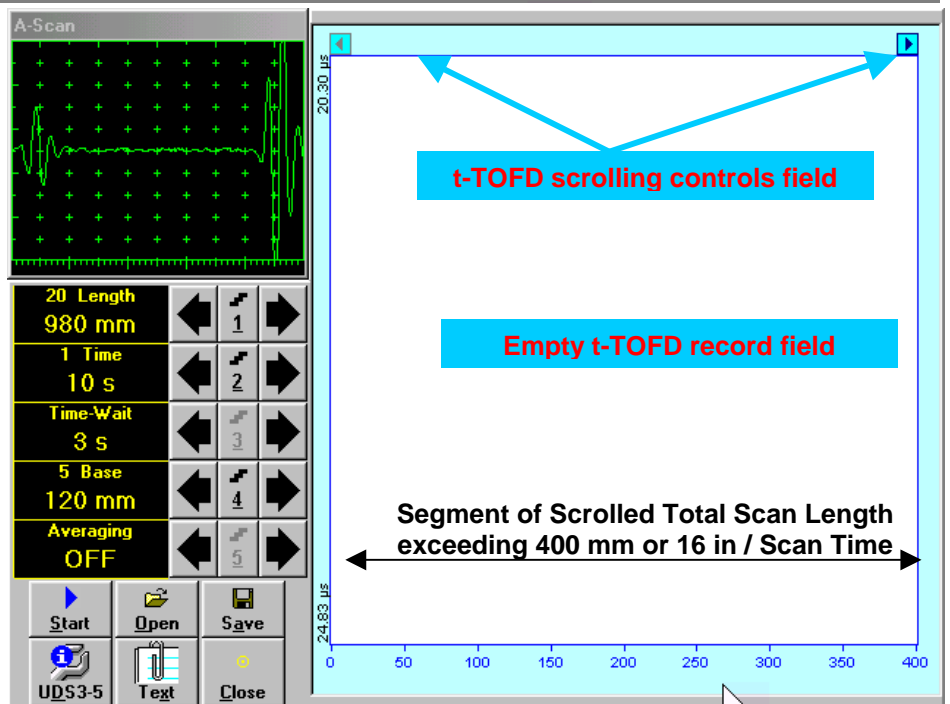
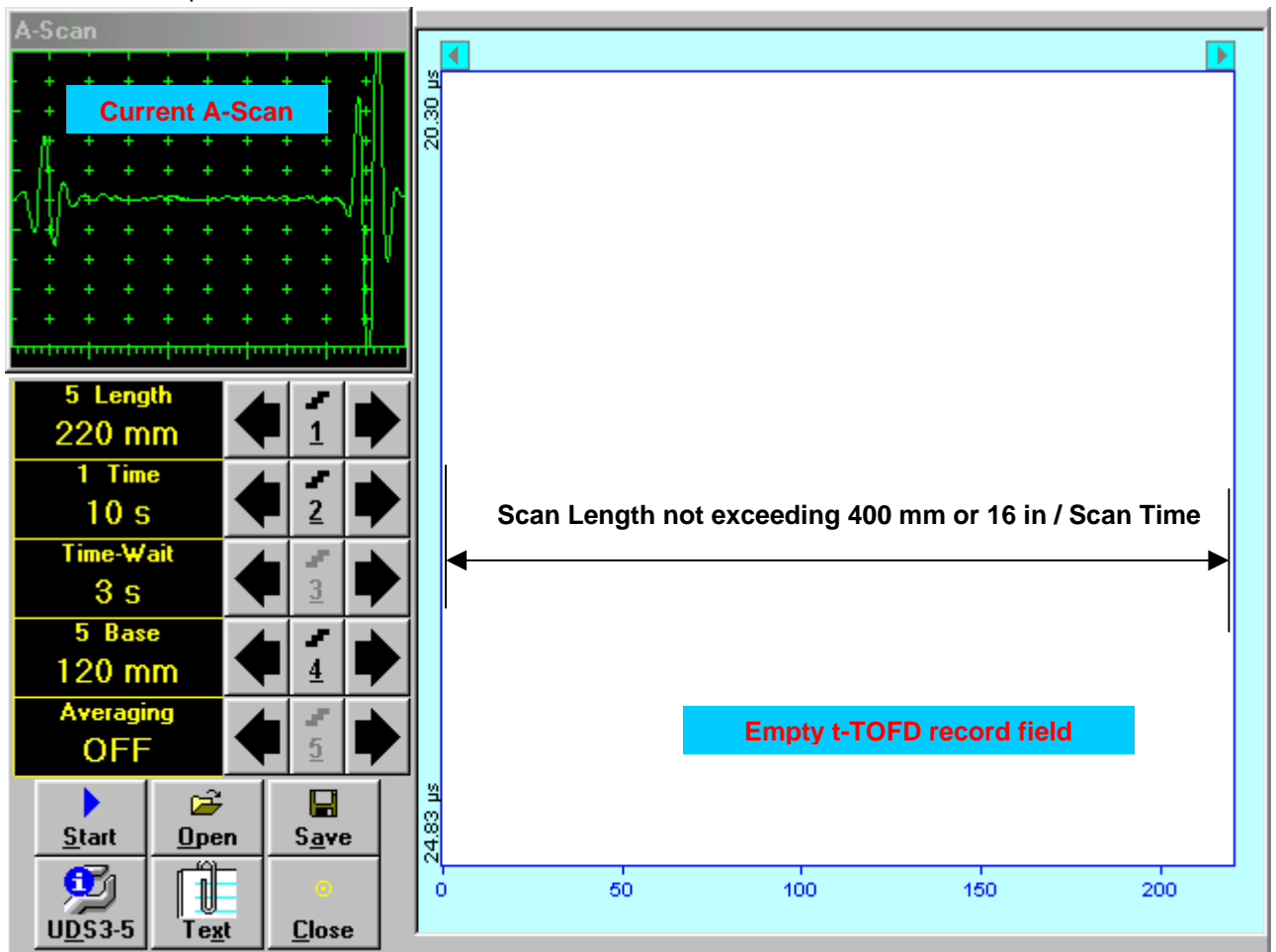


- ❑ Increase **Gain** to provide height of first half wave of lateral wave signal reaching 10-20 % of total **A-Scan** height
- ❑ Activate **Gate A**, setup **aThreshold** to 5%(submenu **GATE A**)
- ❑ Select **s(A)** as **Meas Value** and set **Meas Mode** as **Flank** (submenu **MEASURE**)
- ❑ Provide rising edge of first half wave of lateral wave will cross **Gate A**
- ❑ Define **Probe Separation** as **Probe Separation = 2 × s(A)** whereas **s(A)** is the digital readout taken from **Value** box

7.5.2. t-TOFD and TOFD – Implementation

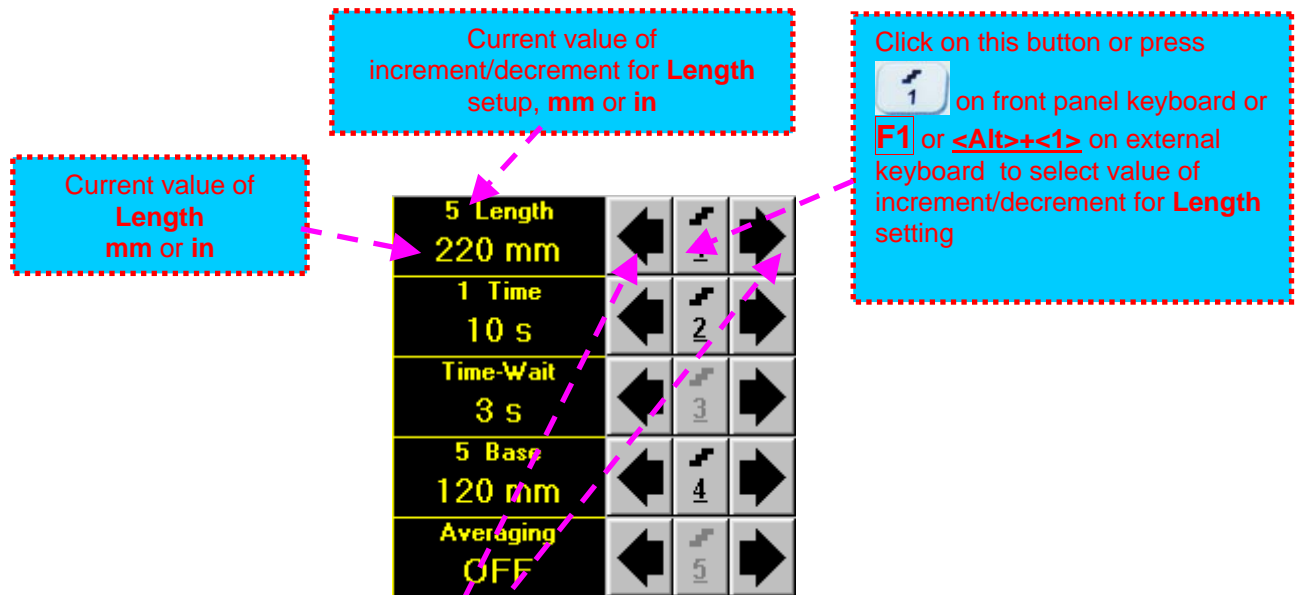
7.5.2.1. t-TOFD – Prior to Scanning

t-TOFD control panel is shown below



Scan Length and Scan Time

Length represents length of section of test object to be displayed, over which probe will be scanning during recording period. **Time** (Scan Time) is the duration of recording period



To control **Length** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

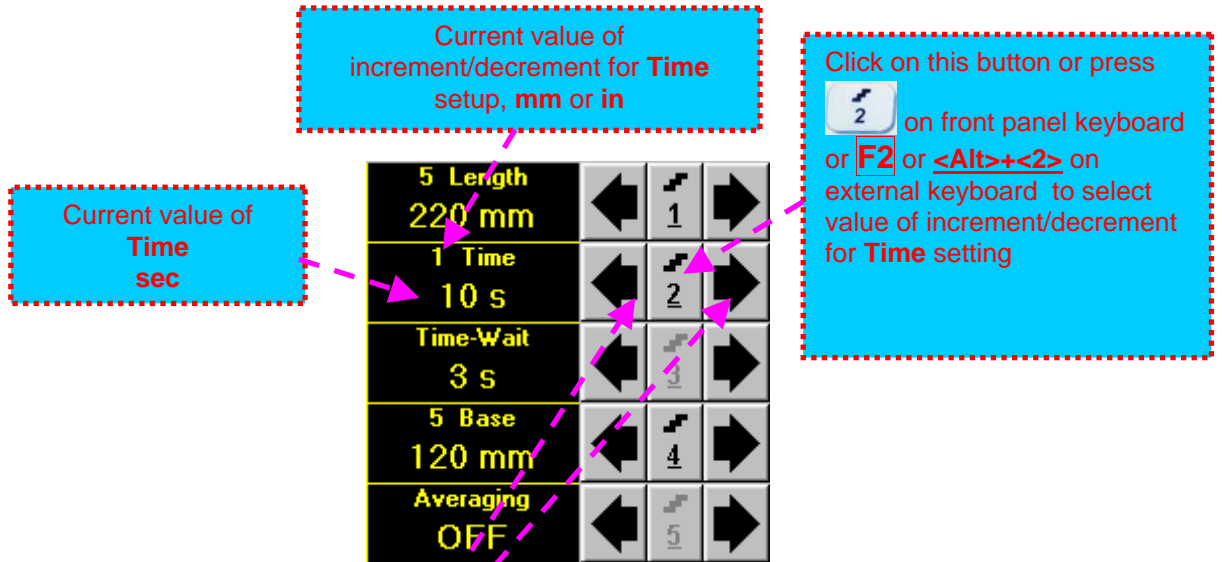
- Press on front panel keyboard or **F1** on external keyboard ⇒ **Length** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **Length** ⇒ **Length** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Length** is adjustable between 50 and 1000 **mm** or 2 and 40 **in**












To control **Time** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F2** on external keyboard ⇒ **Time** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

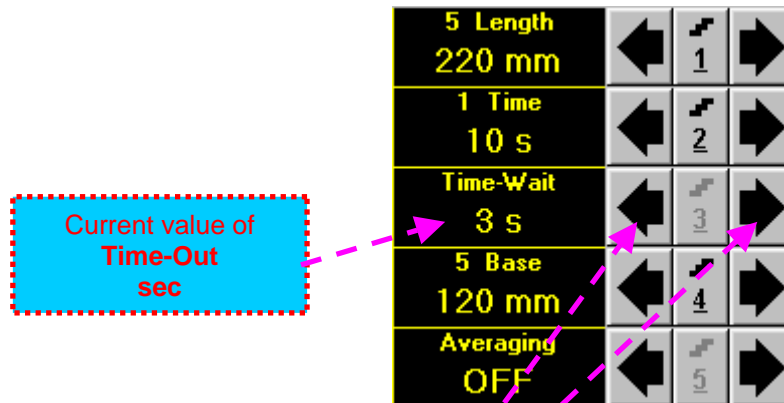
- Click on **Time** ⇒ **Time** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



The value of **Time** is adjustable between 5 and 60 **sec**

Time-Wait

Time-Wait is waiting time for intermissions preceeding **t-TOFD** recording, which starts unconditionally upon **Time-Wait** period is over











To control **Time-Wait** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding button

- **Keyboard**

- Press  on front panel keyboard or **F3** on external keyboard ⇒ **Time-Wait** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

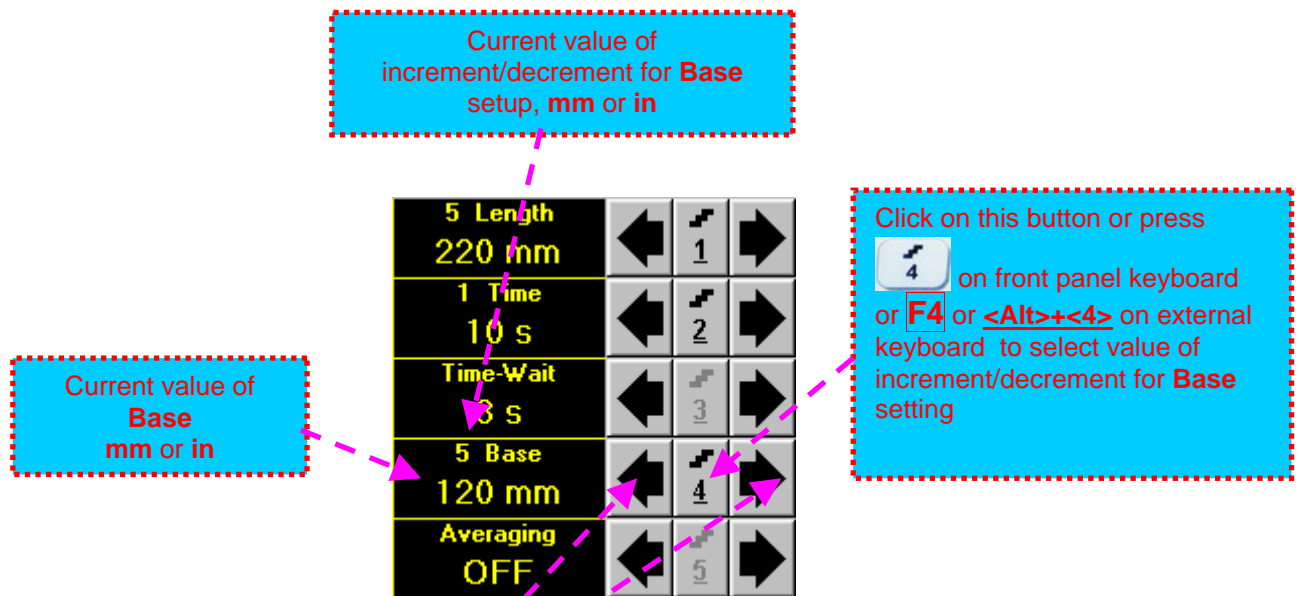
- Click on **Time-Wait** ⇒ **Time-Wait** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



The value of **Time-Wait** is adjustable between 0 and 15 **sec**

Base

Base represents **Probe Separation**



To control **Base** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding button

- **Keyboard**

- Press on front panel keyboard or **F1** on external keyboard ⇒ **Base** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

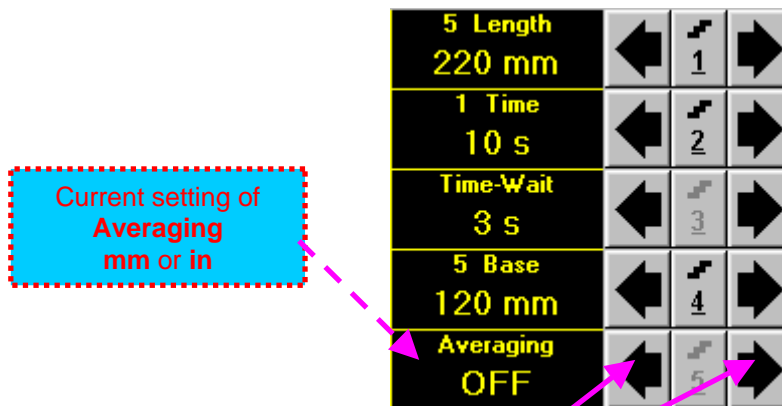
- Click on **Base** ⇒ **Base** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Base** is adjustable between 25 and 500 **mm** or 1 and 20 **in**

Averaging

Averaging of sequential **A-Scans** is required sometimes to improve signal to noise ratio of the **t-TOFD** record











To control **Averaging** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F5** on external keyboard ⇒ **Averaging** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Averaging** ⇒ **Averaging** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



Averaging may be either inactive (**OFF**) or setup for factor **2** or **4** or **8**



Insert Text Note



Refer to paragraph 7.3.2.1 of this Operating Manual



Preview UDS 3-5 Settings



Refer to paragraph 7.3.2.1 of this Operating Manual

Start/Stop t-TOFD recording

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **t-TOFD** recording

 button becomes invisible since **t-TOFD** recording starts.  button occupies its position.

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **t-TOFD** recording prior to automatic completion

 button becomes invisible after completion / termination of **t-TOFD** record.  button returns to its position

Save record into a file

Refer to paragraph 7.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

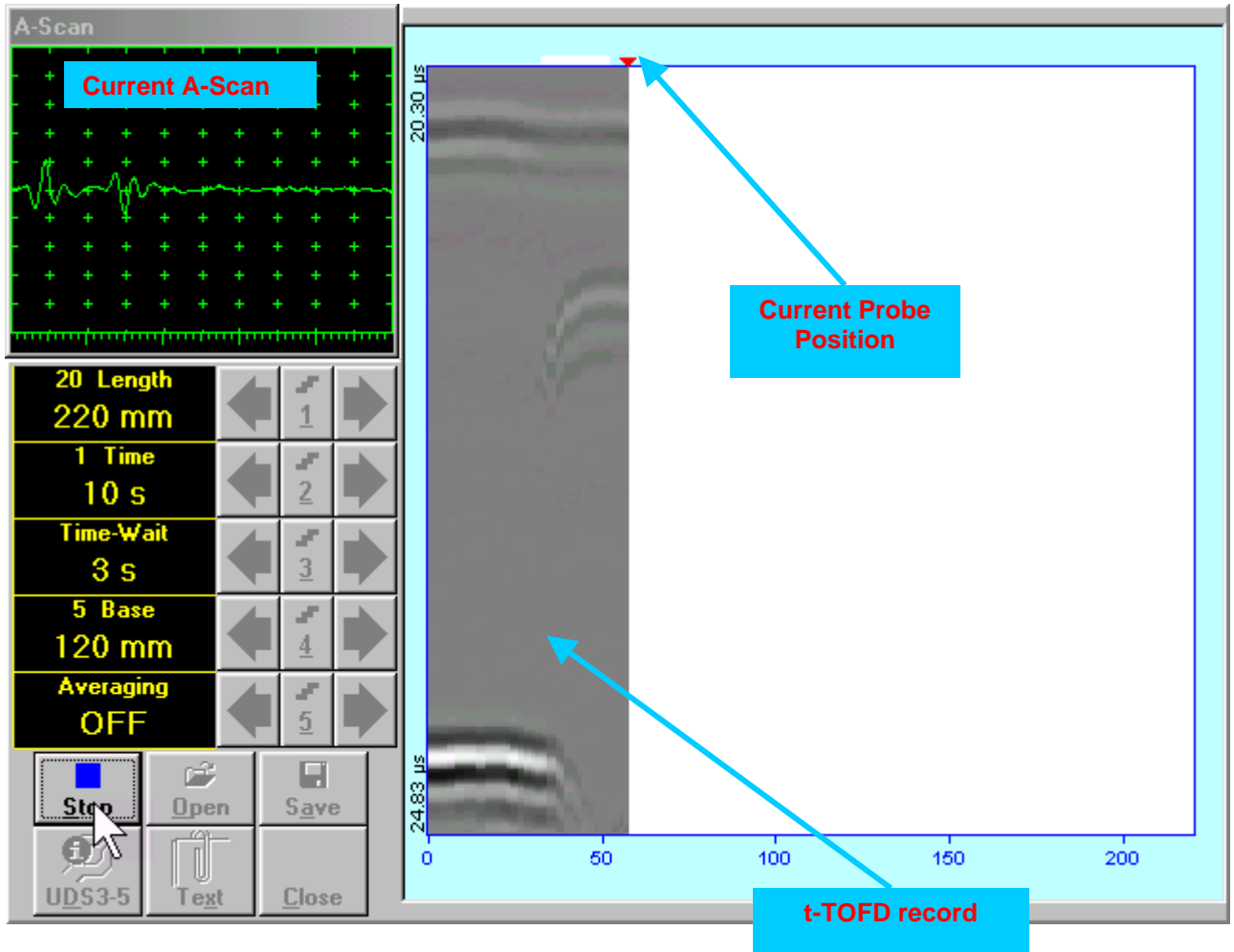
Refer to paragraph 7.3.2.1 of this Operating Manual

Return to UDS 3-5 main operating surface

Refer to paragraph 7.3.2.1 of this Operating Manual

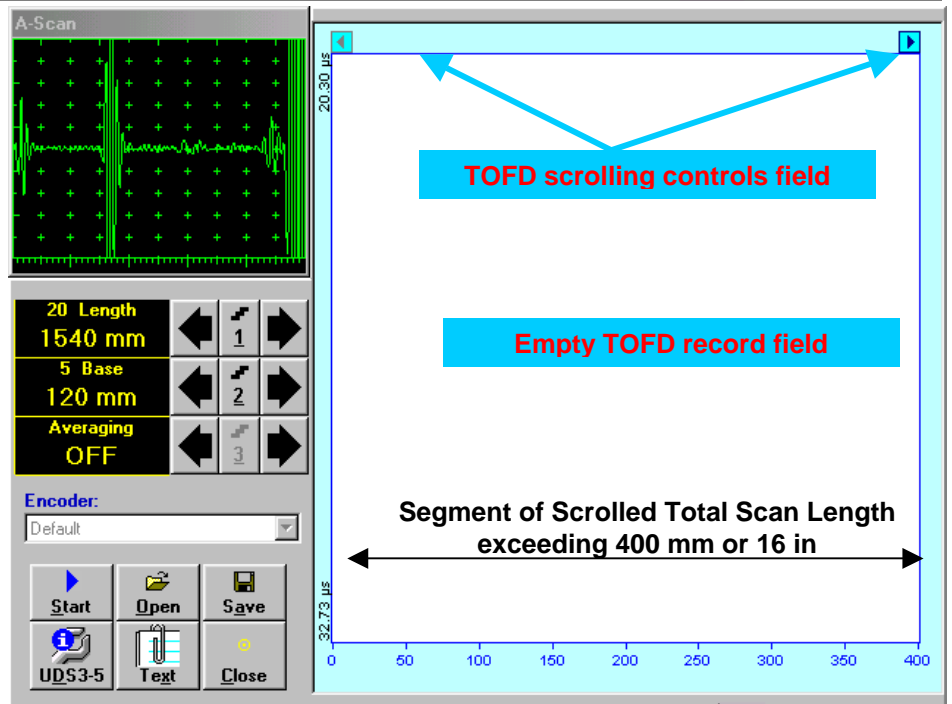
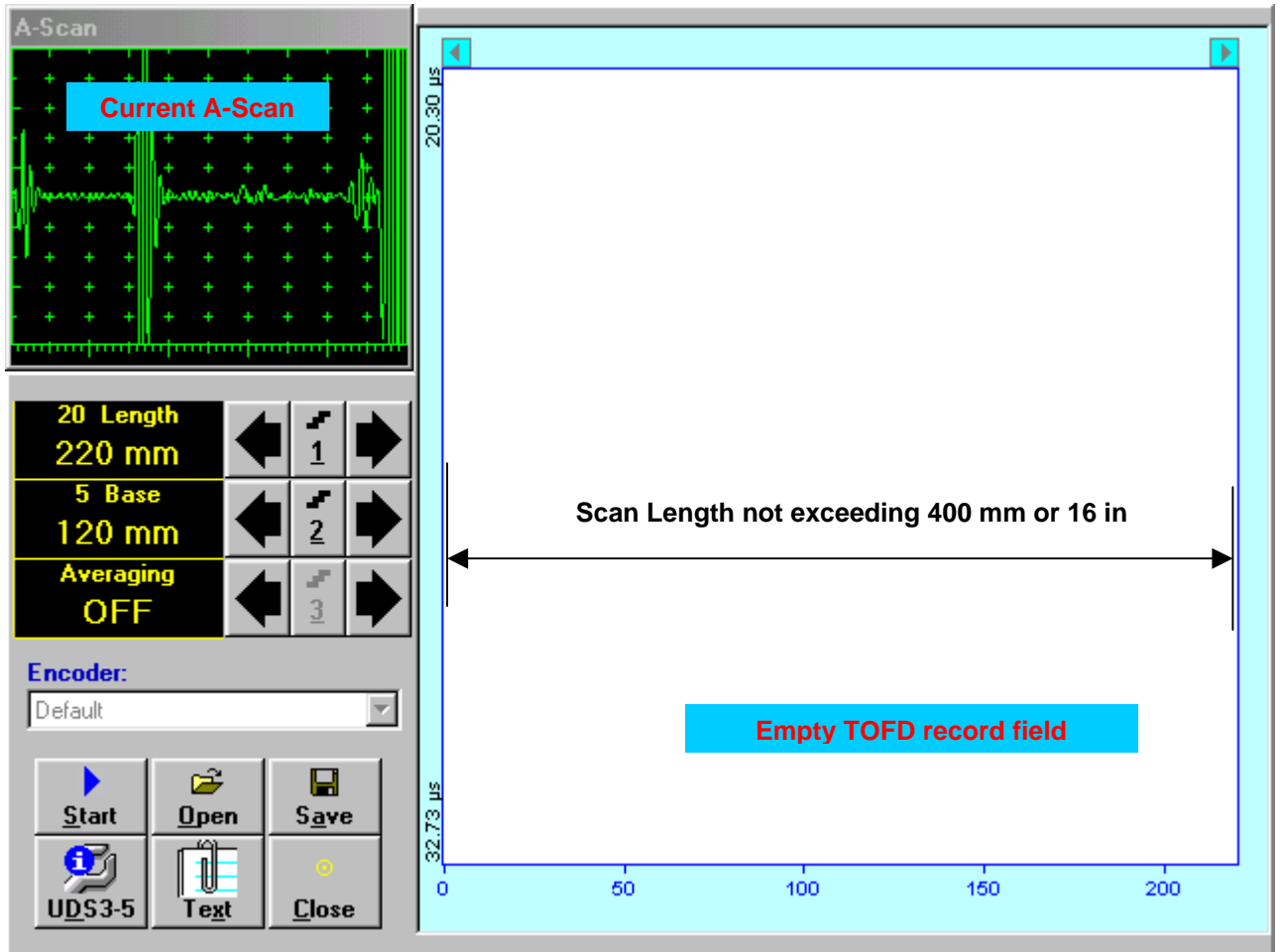
7.5.2.2. t-TOFD – Scanning

- Apply probes pair to test object in the start point of selected scanning line
- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe pair over the scanning line synchronously with *Position Icon* moving with constant speed above t-TOFD record field – typical scanning progress display during is shown and explained below



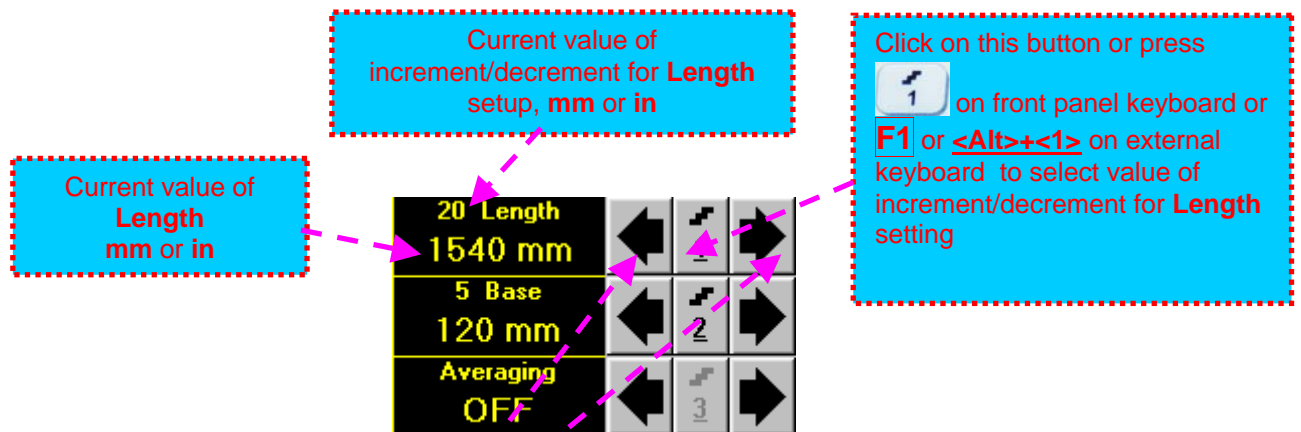
7.5.2.3. TOFD – Prior to Scanning

TOFD control panel is shown below



Scan Length

Length represents length of section of test object to be displayed, over which probe will be scanning during recording period












To control **Length** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F1** on external keyboard ⇒ **Length** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

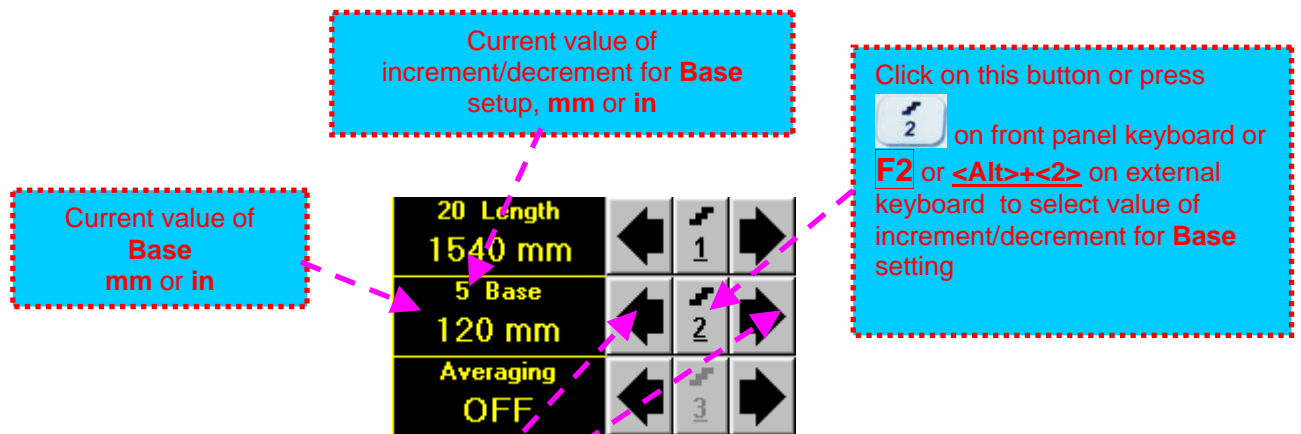
- Click on **Length** ⇒ **Length** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



The value of **Length** is adjustable between 50 and 20000 **mm** or 2 and 800 **in**

Base

Base represents **Probe Separation**



To control **Base** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F2** on external keyboard ⇒ **Base** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

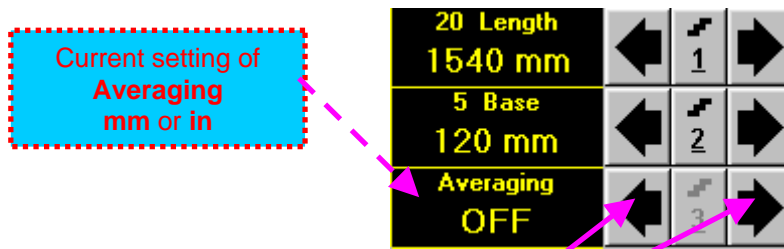
- Click on **Base** ⇒ **Base** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



The value of **Base** is adjustable between 25 and 500 **mm** or 1 and 20 **in**

Averaging

Averaging of sequential **A-Scans** is required sometimes to improve signal to noise ratio of the **TOFD** record











To control **Averaging** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F3** on external keyboard ⇒ **Averaging** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Averaging** ⇒ **Averaging** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



Averaging may be either inactive (**OFF**) or setup for factor **2** or **4** or **8**

Encoder

Select encoder to be used through appropriate box



Clamp fixture holding **TOFD** probe pair into encoder – refer to Chapter 7 of this Operating Manual
Connect encoder to its input on the right side of **ISONIC 2006 instrument**



Insert Text Note





Refer to paragraph 7.3.2.1 of this Operating Manual

Preview UDS 3-5 Settings

Refer to paragraph 7.3.2.1 of this Operating Manual

Start/Stop TOFD recording

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **TOFD** recording

 button becomes invisible since **TOFD** recording starts.  button occupies its position. Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **TOFD** recording

 button becomes invisible after termination of **TOFD** record.  button returns to its position

Save record into a file

Refer to paragraph 7.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

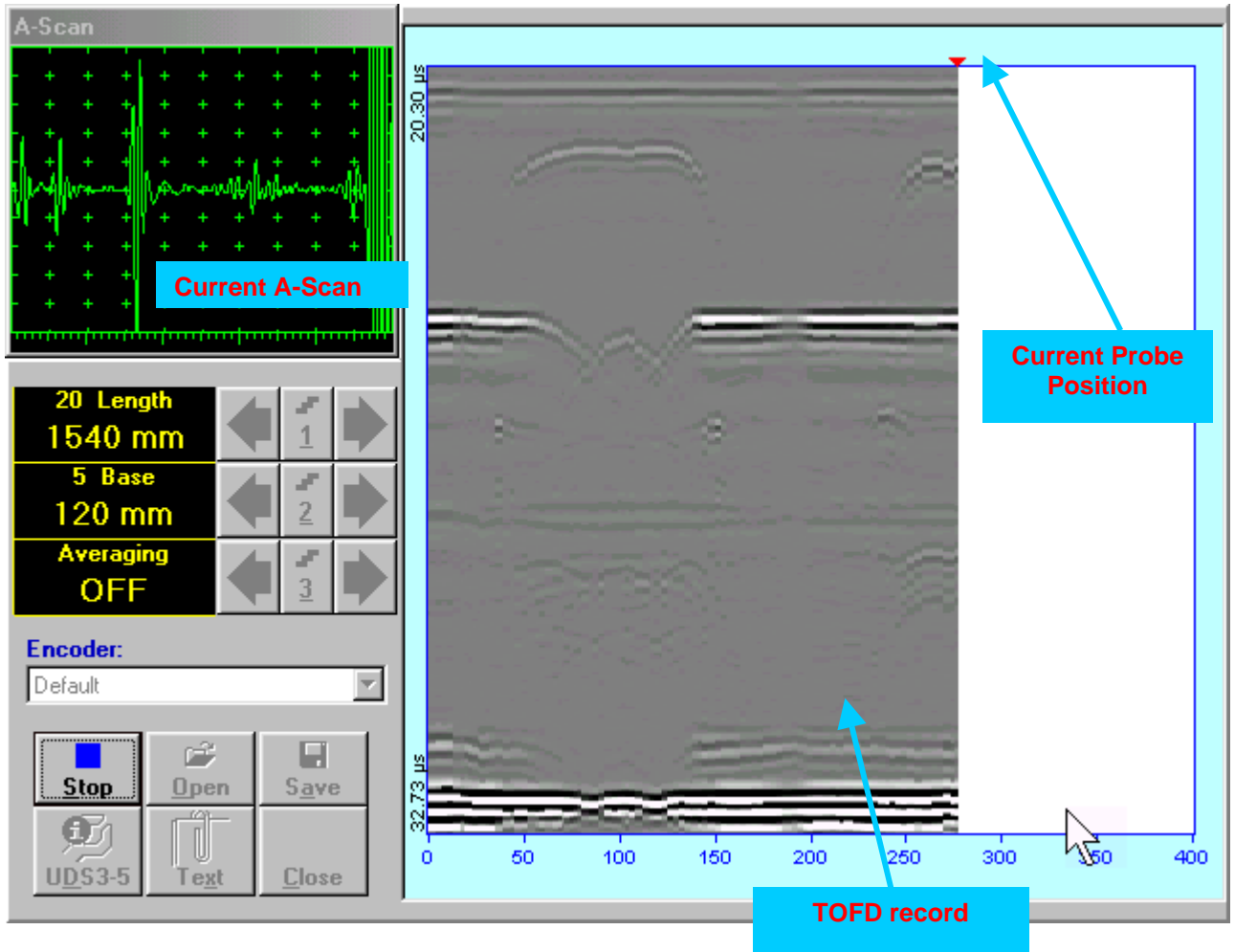
Refer to paragraph 7.3.2.1 of this Operating Manual

Return to UDS 3-5 main operating surface

Refer to paragraph 7.3.2.1 of this Operating Manual

7.5.2.4. TOFD – Scanning

- Apply probes pair to test object in the start point of selected scanning line
- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe pair over the scanning line – typical scanning progress display during is shown and explained below

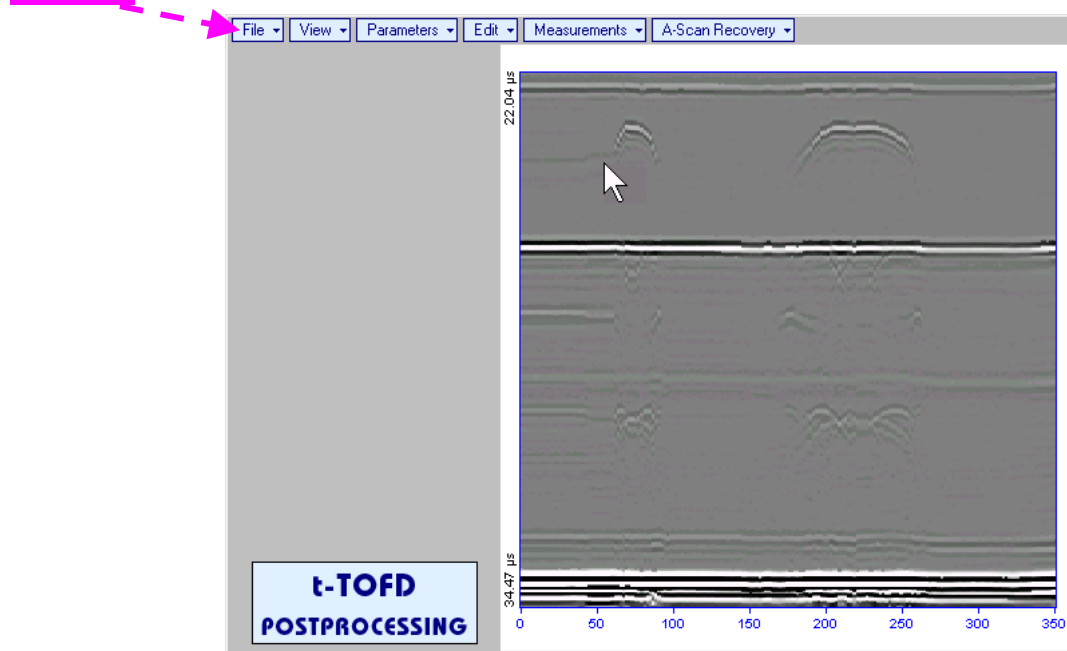


7.5.2.5. t-TOFD / TOFD – Postprocessing

Versatile postprocessing of t-TOFD / TOFD records is featured with:





- ❑ Improvement of near to surface resolution through removal of lateral wave and back echo records from t-TOFD / TOFD Map, zooming t-TOFD / TOFD Map accompanied with appropriate A-Scan expanding
- ❑ Linearization and straightening of t-TOFD / TOFD Map
- ❑ Increasing contrast of t-TOFD / TOFD images through varying Gain and rectification
- ❑ Defects pattern recognition and sizing

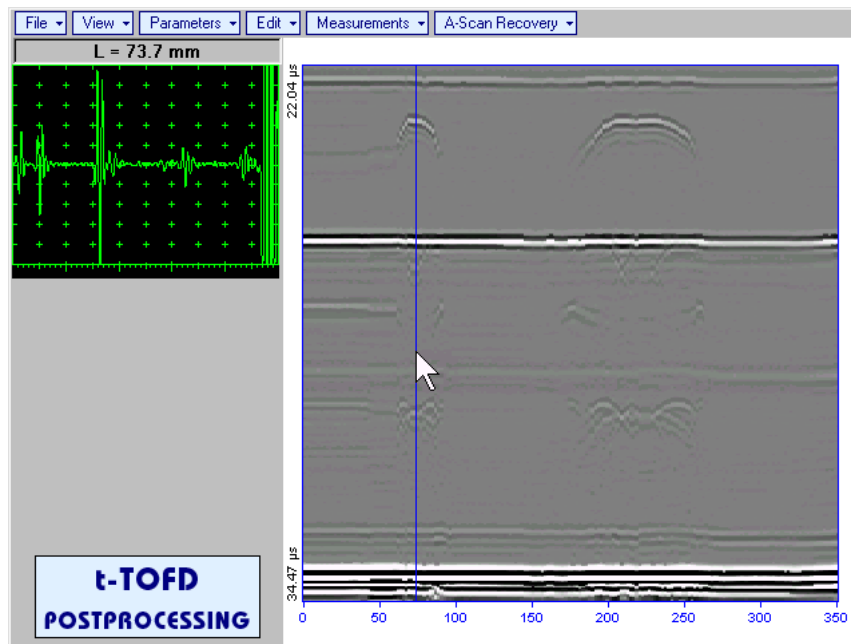
The screen as below appears upon opening file. All postprocessing procedures are performed through menu bar – touch screen stylus or front panel or external mouse to be used





Menu Bar Functions

- **File→Open** – opens new t-TOFD / TOFD file
- **File→Snapshots→Add Snapshot** – stores current postprocessing screen snapshot accompanied with appropriate settings and measurements into *postprocessing session memory stack*
- **File→Snapshots→Restore Snapshot** – recalls earlier stored postprocessing screen snapshot accompanied with appropriate settings and measurements from *postprocessing session memory stack*
- **File→Snapshots→Delete Snapshot** – deletes earlier stored postprocessing screen snapshot accompanied with appropriate settings and measurements from *postprocessing session memory stack*
- **File→Print** – prints out postprocessing screen snapshot(s) accompanied with appropriate settings and measurements
- **File→Exit** – returns to t-TOFD / TOFD control panel
- **View→Instrument** – indicates setup of UDS 3-5 Pulser Receiver used for scanning when file was created
- **View→Inspection Data** – indicates operator's comments entered prior to scanning
- **View→Coloring→Grayscale** / **View→Coloring→Thermal** – selects base color for t-TOFD / TOFD image
- **View→TOFD→Logic→Negative** / **View→TOFD→Logic→Positive** – selects black / white tones for representation of positive/negative half waves components of RF A-Scan on the TOFD Map – refer also to paragraph 15.2.2 of this Operating Manual
- **View→TOFD→Contrast→Natural** / **View→TOFD→Contrast→Soft** / **View→TOFD→Contrast→Sharp** – selects contrast of the TOFD Map – refer also to paragraph 15.2.2 of this Operating Manual

- **A-Scan Recovery→ON** – generates *cursor corresponding to A-Scan base line* that may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *A-Scan base line cursor* position. Indication of starting position of cursor (**L**) corresponding to the position of **TOFD** probes pair accompanies recovered **A-Scan**

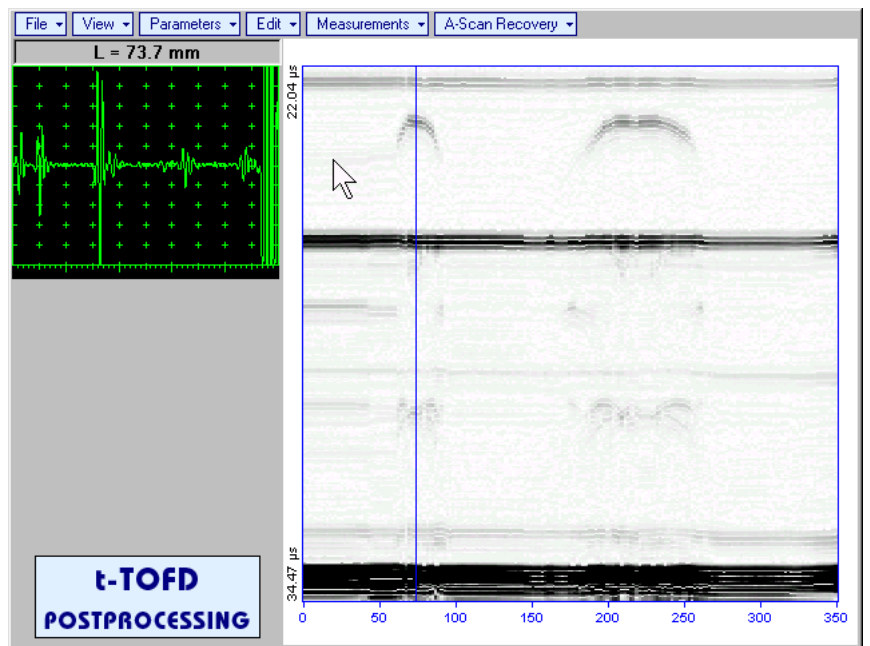
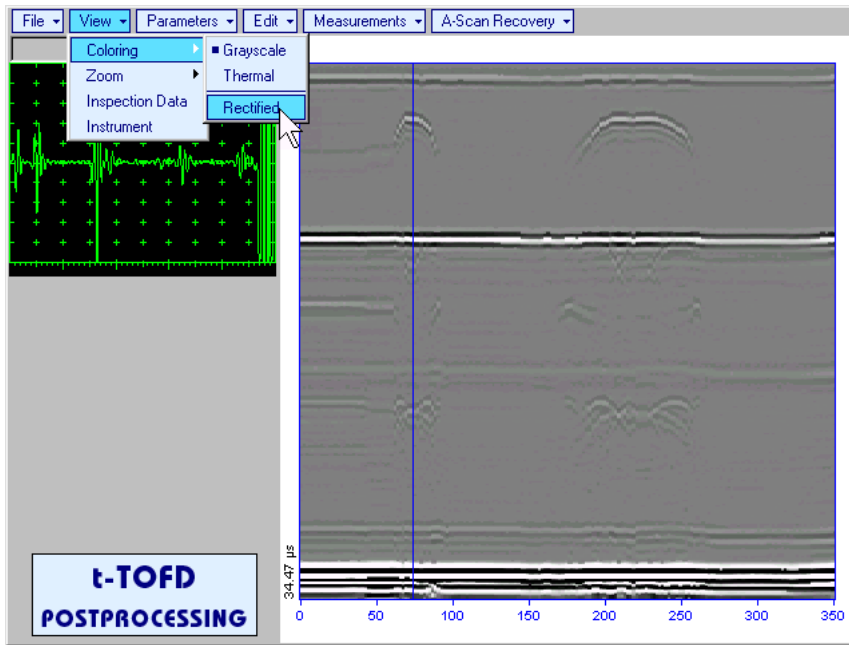


To fix position of *A-Scan base line cursor* with corresponding recovered **A-Scan** left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard

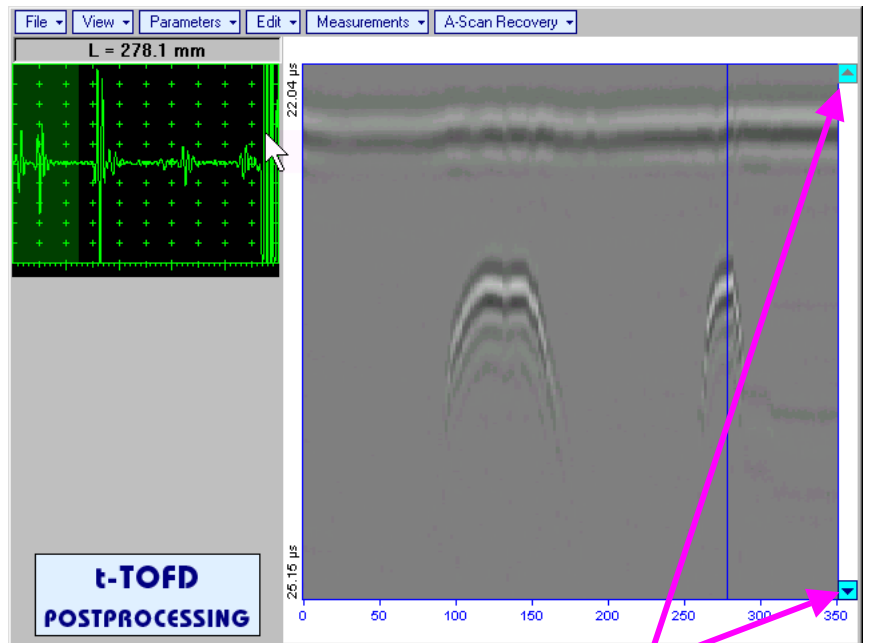
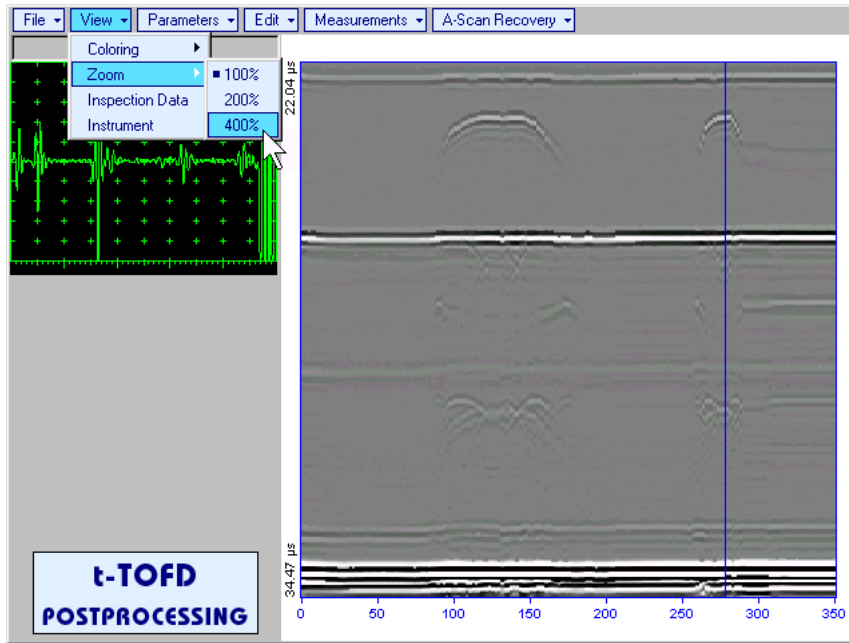
To interrupt recovery of **A-Scans** right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- **A-Scan Recovery→OFF** – erases *A-Scan base line cursor*, indicator of its position, and recovered **A-Scan**

- **View→Coloring→Rectified** – switches between rectified and RF presentation of t-TOFD / TOFD image

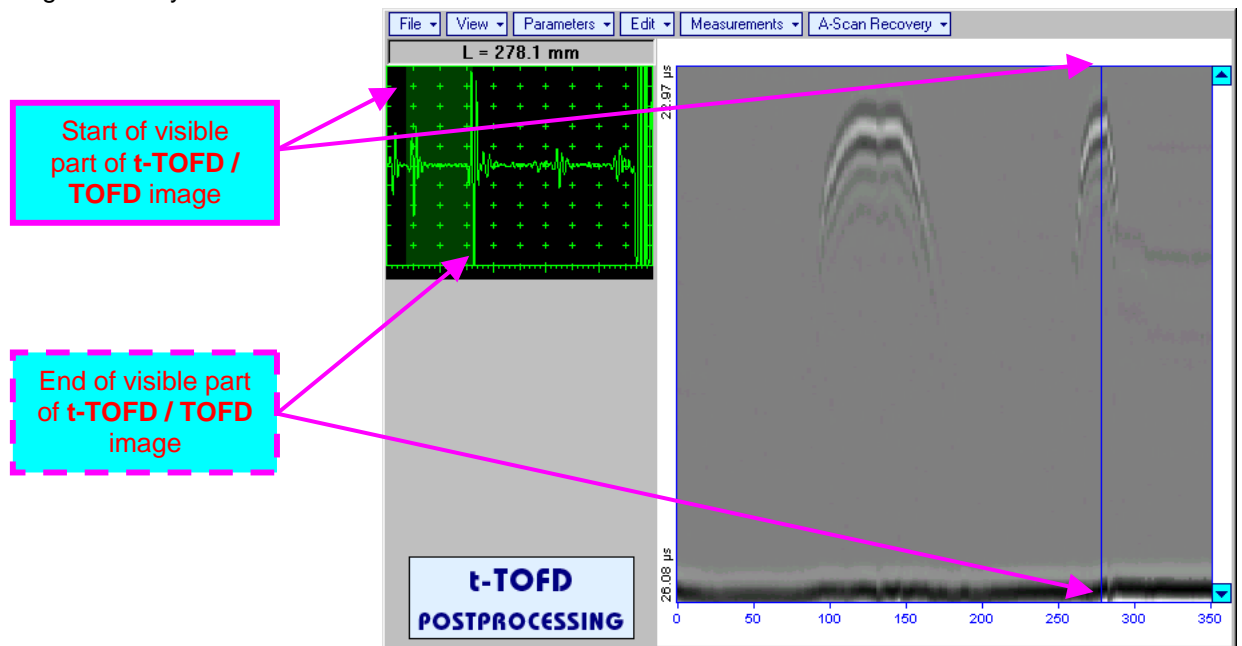


- **View→Zoom→Zoom Factor%** – expands **t-TOFD / TOFD** image along time line (vertically)

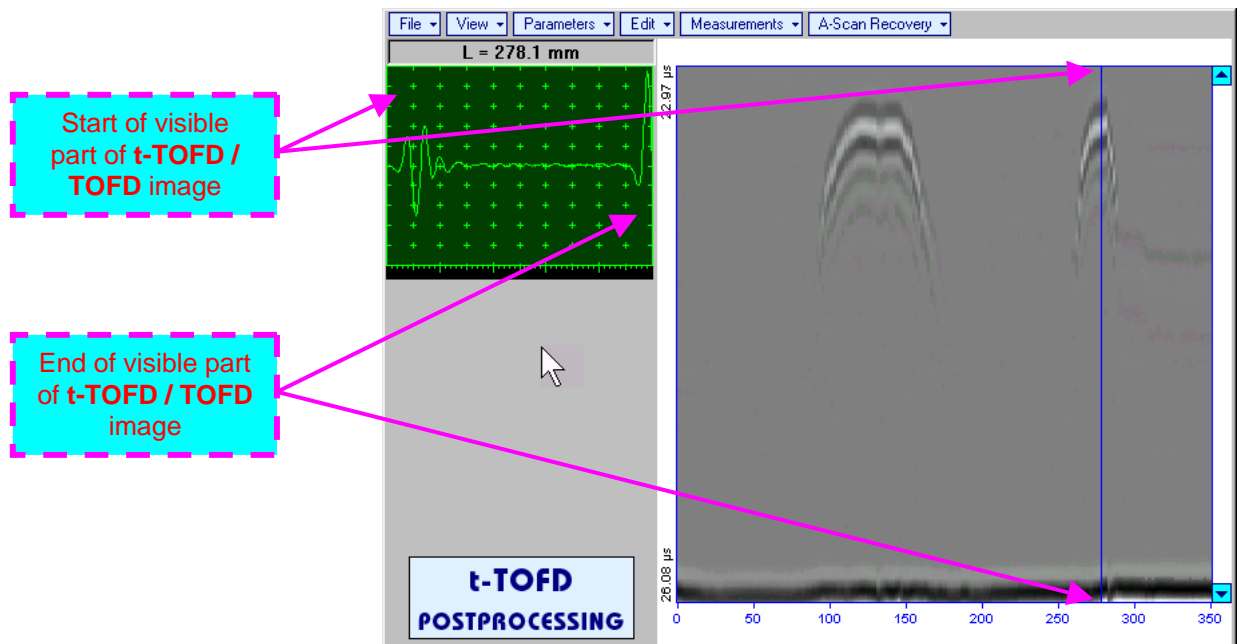


Expanded **t-TOFD / TOFD** image may be scrolled it vertically using appropriate **buttons**

Green background highlights segment of recovered **A-Scan** corresponding to visible part of **t-TOFD / TOFD** image. Said segment moves over recovered **A-Scan** background while scrolling **t-TOFD / TOFD** image vertically



Segment of recovered **A-Scan** corresponding to visible part of **t-TOFD / TOFD** image may be expanded through double click on it – whole **A-Scan** background is green for the expanded segment. Vertical scrolling of **t-TOFD / TOFD** image causes appropriate varying of **Display Delay** for recovered **A-Scan**

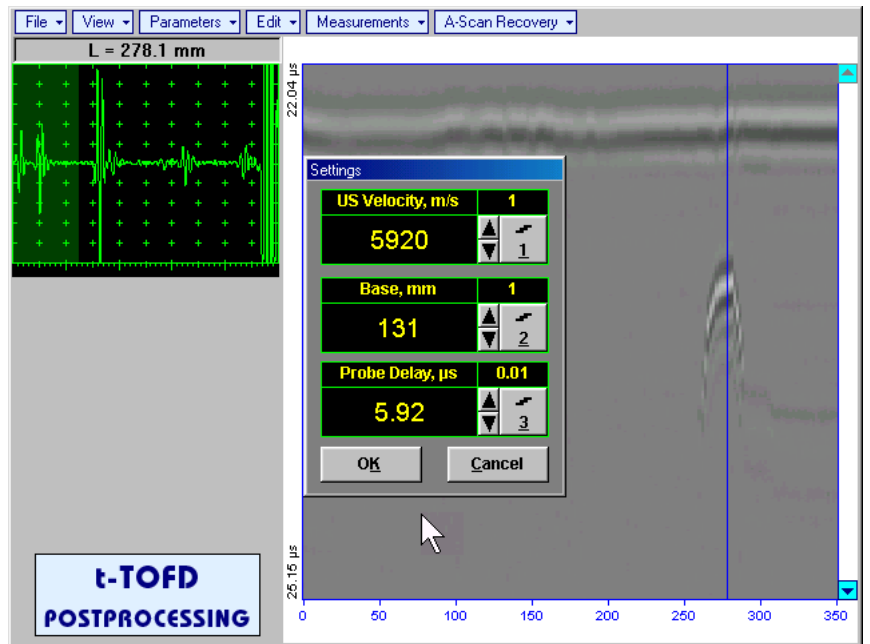
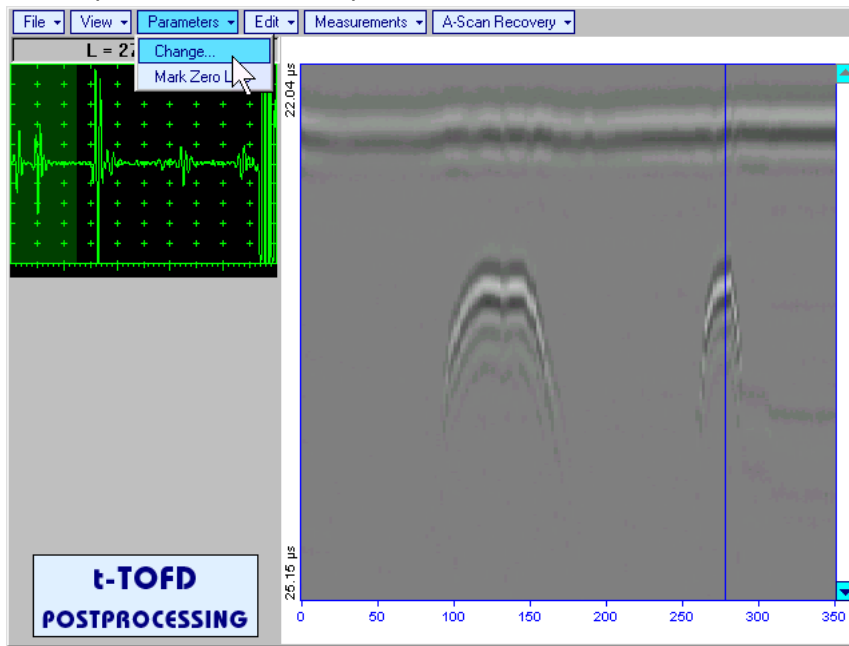


To return to complete recovered **A-Scan** visibility double click on **A-Scan** area







- ◆ Zoom function is available for t-TOFD / TOFD image composed of A-Scans longer than 5 μ s
- ◆ Possible zoom factors are defined by ISONIC 2006 software automatically
- ◆ Maximal possible Zoom factor is 400%

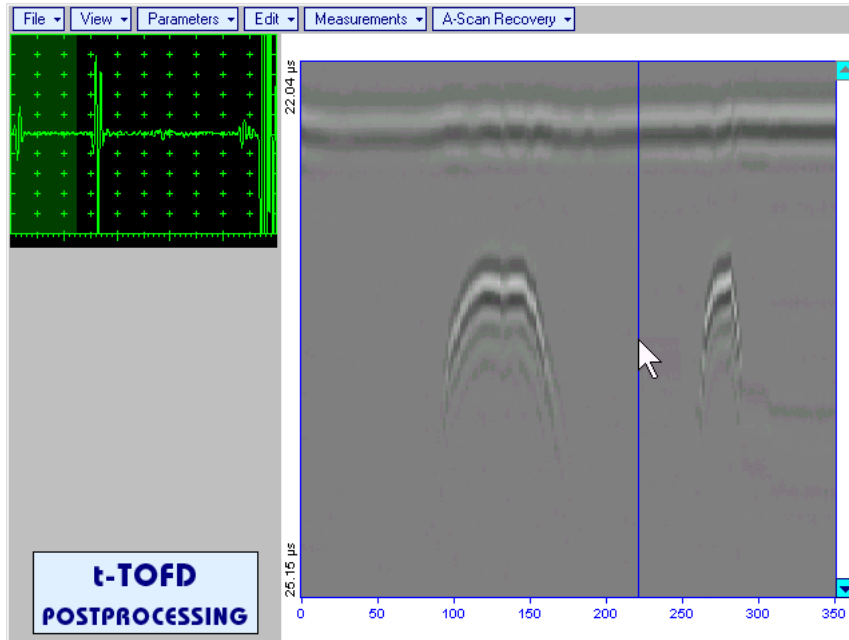
- **Parameters→Change...** – allows re-adjusting of basic parameters (**USVelocity**, **Base**, **Probe Delay**) for computation of defects depth and linearization of **t-TOFD / TOFD** image








On completing click **OK** or press **Enter** on front panel keyboard or **Enter** on external keyboard

To negate re-adjustments click on **Cancel** or press **ESC** on front panel keyboard or **Esc** on external keyboard

- Parameters → Mark Zero Line** – allows re-adjusting of **Probe Delay** for computation of defects depth and linearization of **t-TOFD / TOFD** image through mark of start point of lateral wave signal on the recorded **t-TOFD / TOFD** image with reference to recovered **A-Scan**. Initially this function generates *cursor corresponding to A-Scan base line* that may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *A-Scan base line cursor* position



Upon selecting reference **A-Scan** with clear lateral wave left mouse click or press

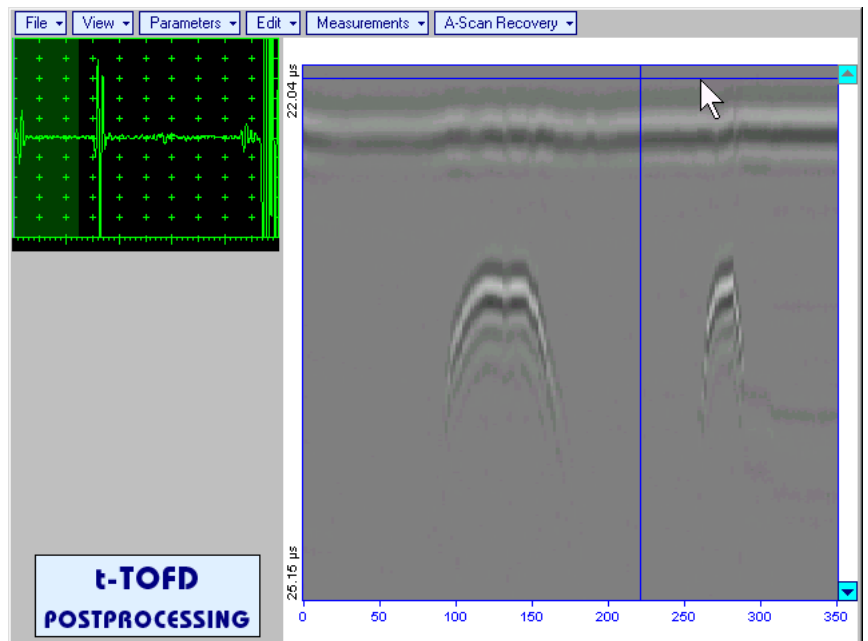
 on front panel keyboard or **Enter** on external keyboard – this generates horizontal cursor, which may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard

To mark the beginning of lateral wave signal corresponding to zero depth left mouse click or press

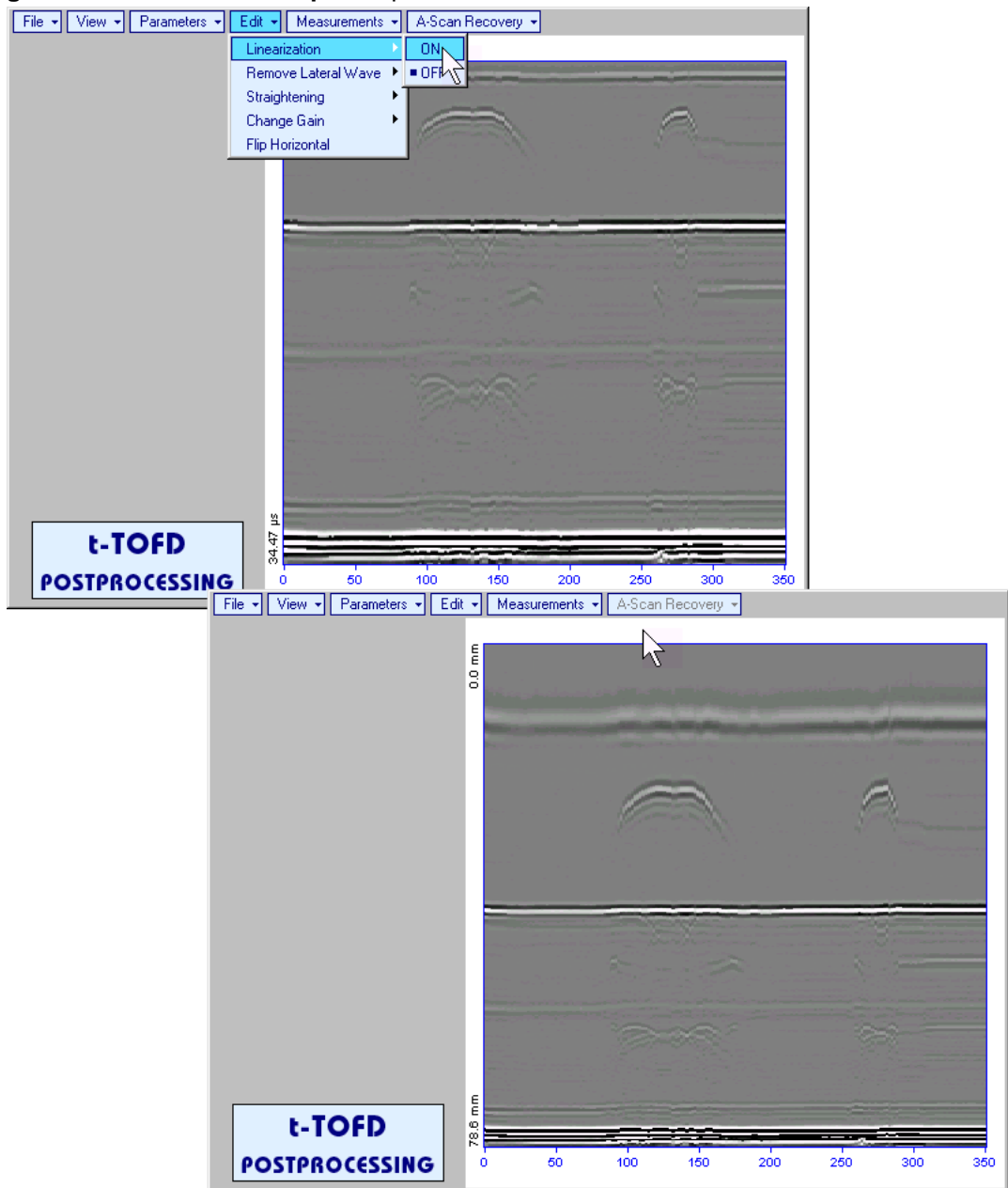
 on front panel keyboard or **Enter** on external keyboard

To interrupt function at any moment right mouse click or

press  on front panel keyboard or **Esc** on external keyboard








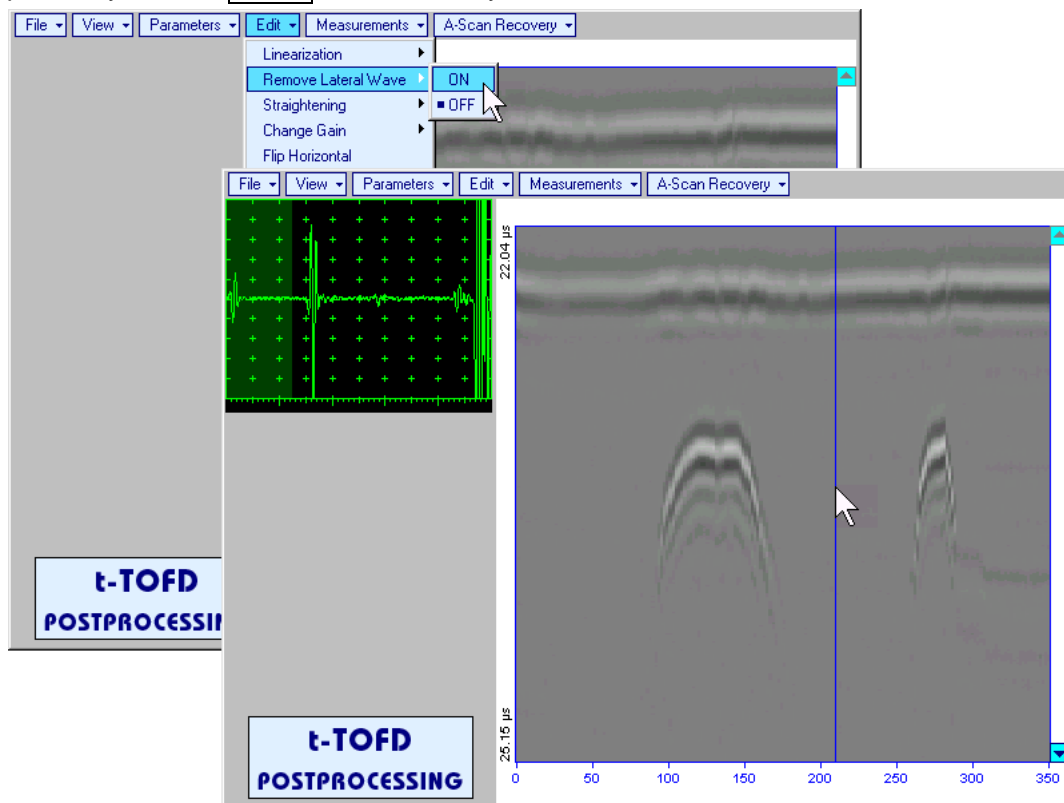
- **Edit→Linearization→ON** – recalculates depth for each point of **t-TOFD / TOFD** image and redraws it as **Longitudinal Coordinate – Depth** map








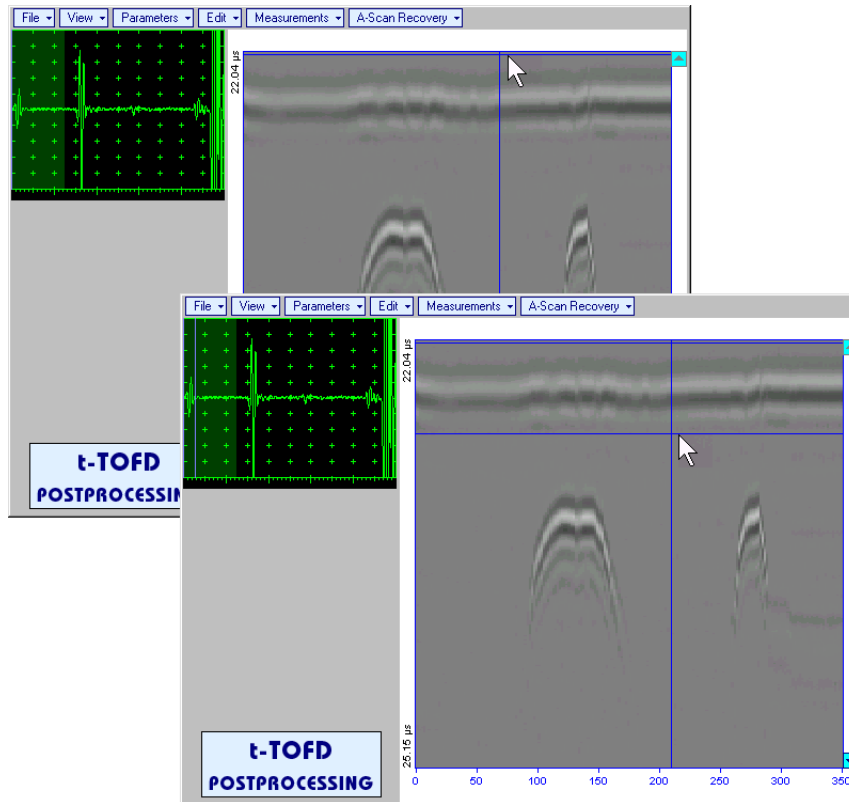
- **Edit→Linearization→OFF** – returns to original **t-TOFD / TOFD** image - **Longitudinal Coordinate – Time** map

- **Edit→Remove Lateral Wave→ON** – removes *rectangle segment* designated by an operator from **t-TOFD / TOFD** image. Most frequently this function is applied to lateral wave record, which is recorded continuously during line scanning and allows to better resolve defects located closely to scanning surface. Also this function may be applied to other signals continuously recorded during line scanning for example, backwall echo, mode conversion backwall echo, etc. - this allows to better resolve defects located closely to bottom surface. In addition to modifying of *rectangle segment* selected by an operator this function automatically straightens **t-TOFD / TOFD** image in order to compensate deviations caused by various factors during recording, for example, coupling instability, unevenness of scanning or bottom surface, etc. The described function is based on selecting *reference signal* and defining a *rectangle segment* on the **t-TOFD / TOFD** image. All signals corresponding to selected *rectangle segment* of **t-TOFD / TOFD** image are equalized by straightening function and then removed; appropriate changes do occur on **t-TOFD / TOFD** image above and under selected rectangle segment after its removal. Initially *cursor corresponding to A-Scan base line* is generated; it may be guided over **t-TOFD / TOFD** image

using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *A-Scan base line cursor* position. To select reference **A-Scan** left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard







First horizontal cursor appears on the **t-TOFD / TOFD** image upon selecting reference **A-Scan**. It may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard . To fix position of the first horizontal cursor and **designate start of reference signal** left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . Second horizontal cursor appears upon fixing first one; it may be manipulated by the same way and allows **designating end of reference signal**

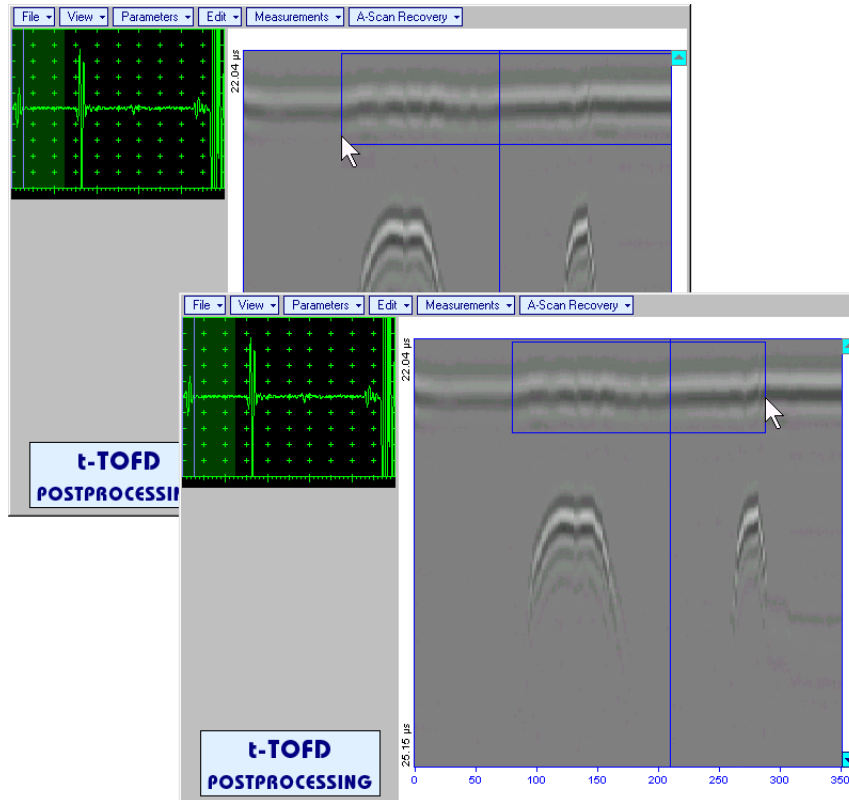


Horizontal cursors are accompanied with appropriate time cursors moving over reference A-Scan

First vertical cursor appears upon designating end of *reference signal*. Its length corresponds to duration of *reference signal* and it is located between first and second horizontal cursors. First vertical cursor may

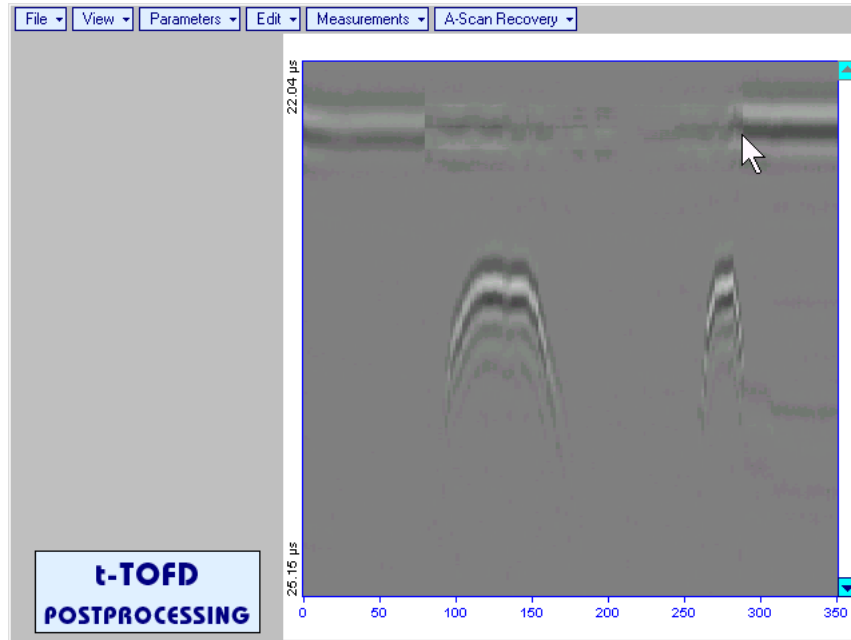
be manipulated over **t-TOFD / TOFD** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard . To **designate first border of rectangle segment**


left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . Second vertical cursor completing defining a rectangle appears upon fixing first one; it may be manipulated by the same way and allows to **designate second border of rectangle segment**








As a result:

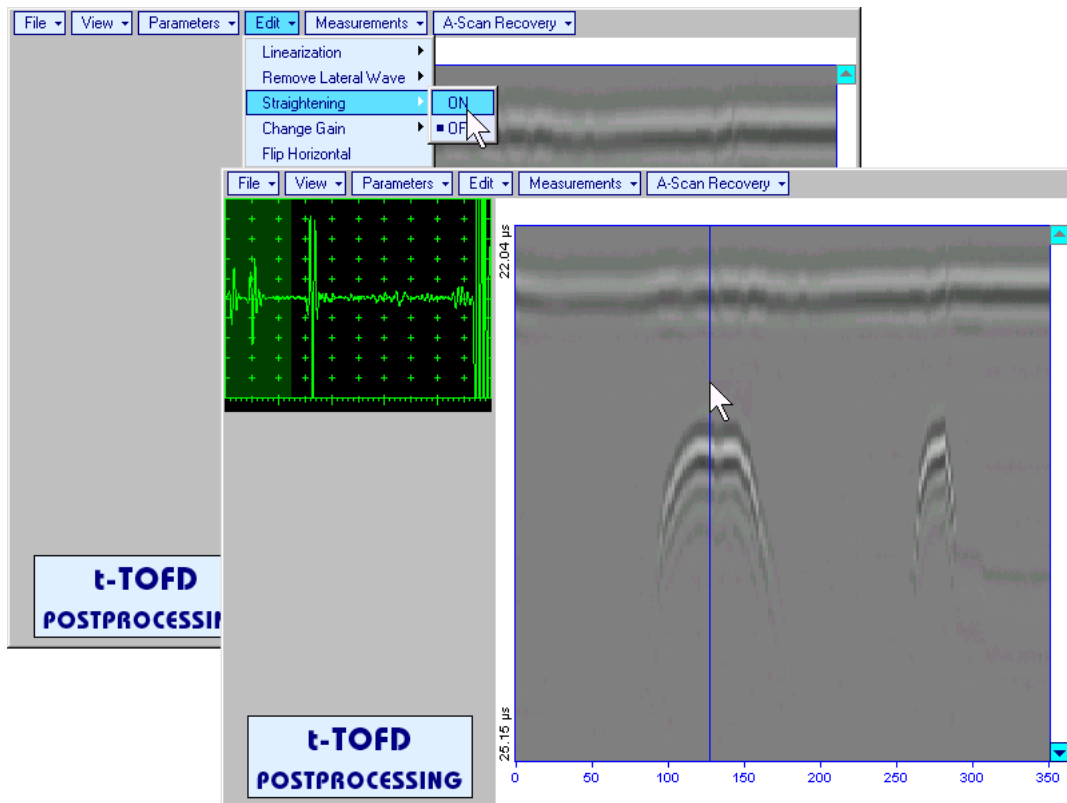
- Signs of *reference signal* and corresponding signals in the selected *rectangle segment* are removed from **t-TOFD / TOFD** image
- **t-TOFD / TOFD** image is straightened above and under selected and modified *rectangle segment* to compensate deviations caused by various factors during recording, for example, coupling instability, unevenness of scanning or bottom surfaces, etc








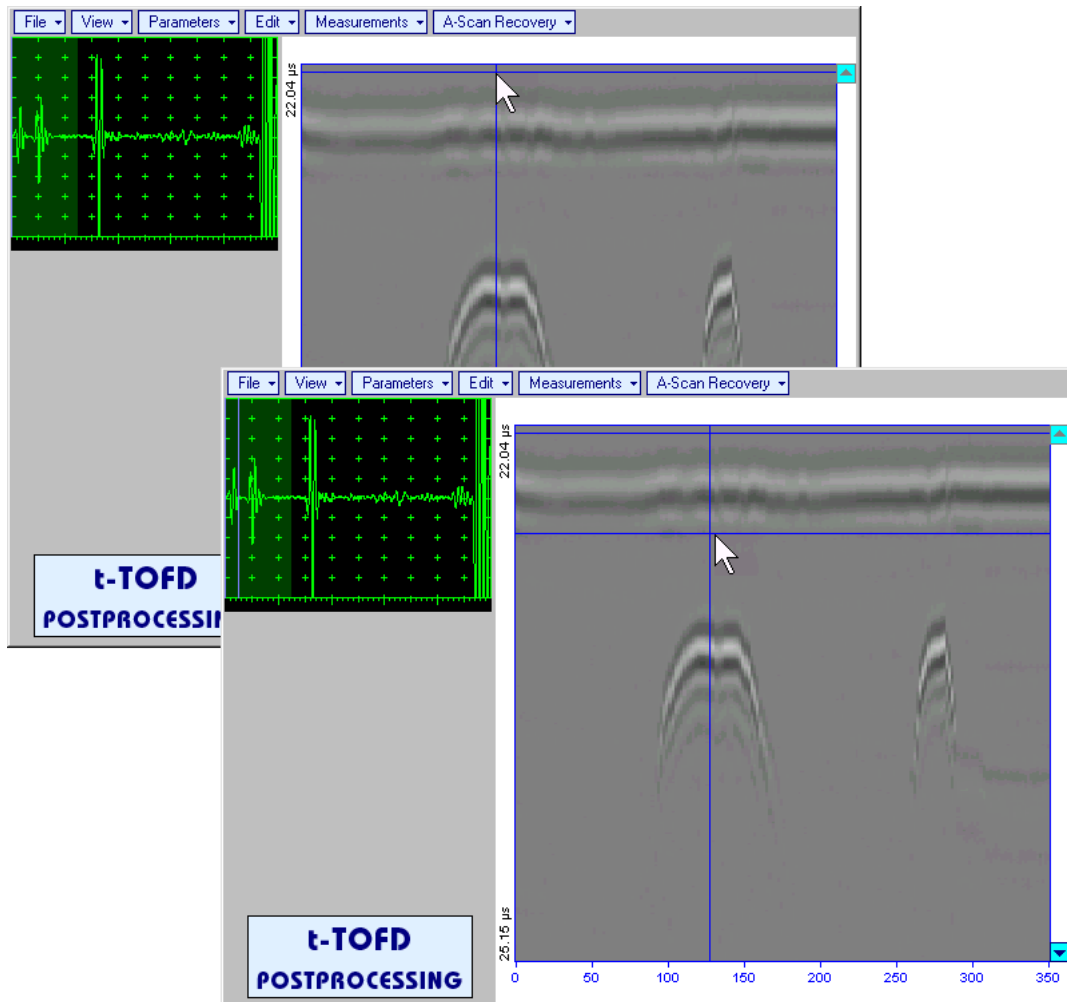
To interrupt function at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- **Edit→Remove Lateral Wave→OFF** – negates modification of selected *rectangle segment* of **t-TOFD / TOFD** image





- Edit→Straightening→ON** – straightens **t-TOFD / TOFD** image in order to compensate deviations caused by various factors during recording, for example, coupling instability, unevenness of scanning or bottom surfaces, etc. It is based on selecting *reference signal* (either lateral wave, or backwall echo, or mode conversion backwall echo, etc) and defining a *rectangle segment* on the **t-TOFD / TOFD** image. All signals corresponding to selected *rectangle segment* of **t-TOFD / TOFD** image are equalized by straightening function and appropriate changes do occur on **t-TOFD / TOFD** image above and under modified *rectangle segment*. Initially *cursor corresponding to A-Scan base line* is generated; it may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *A-Scan base line cursor* position. To select reference **A-Scan** left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard



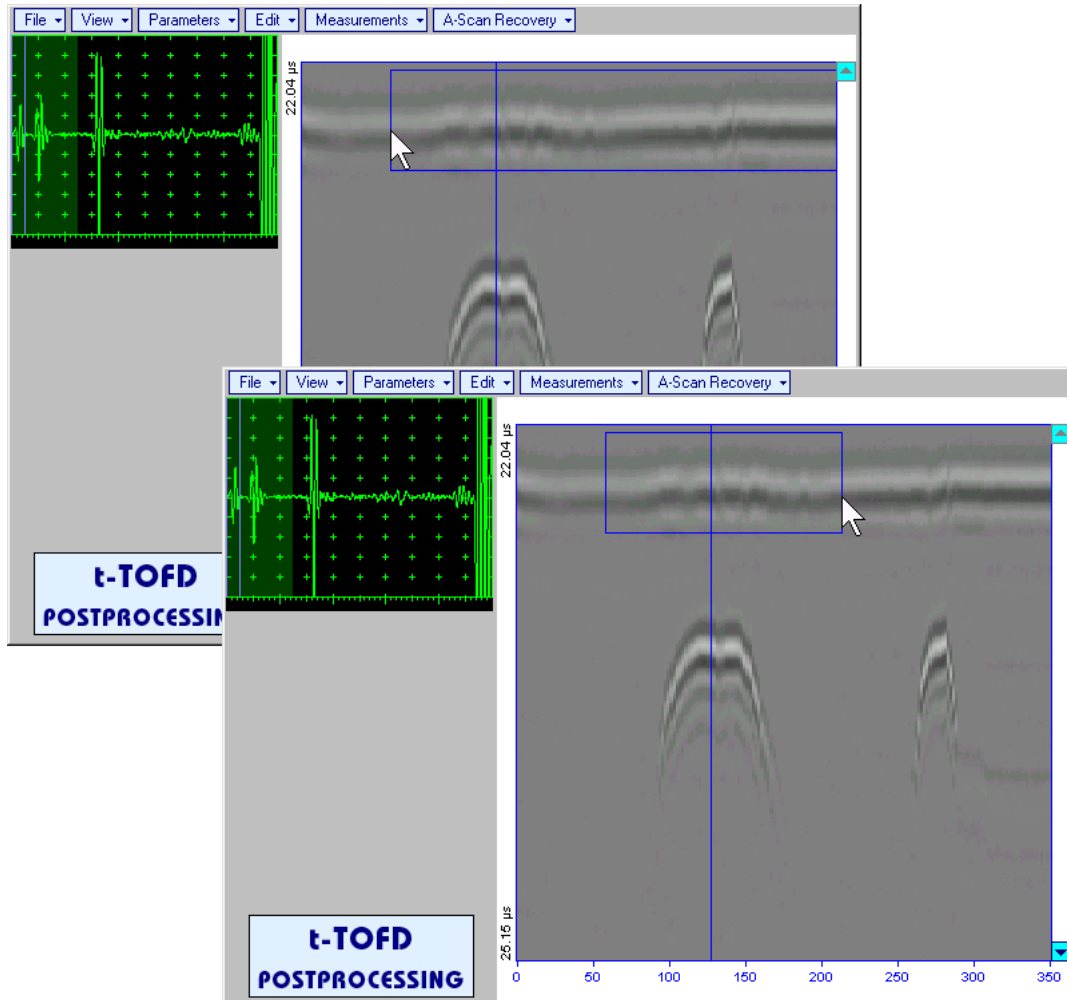
First horizontal cursor appears on the **t-TOFD / TOFD** image upon selecting reference **A-Scan**. It may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard . To fix position of the first horizontal cursor and **designate start of reference signal** left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . Second horizontal cursor appears upon fixing first one; it may be manipulated by the same way and allows to **designate end of reference signal**



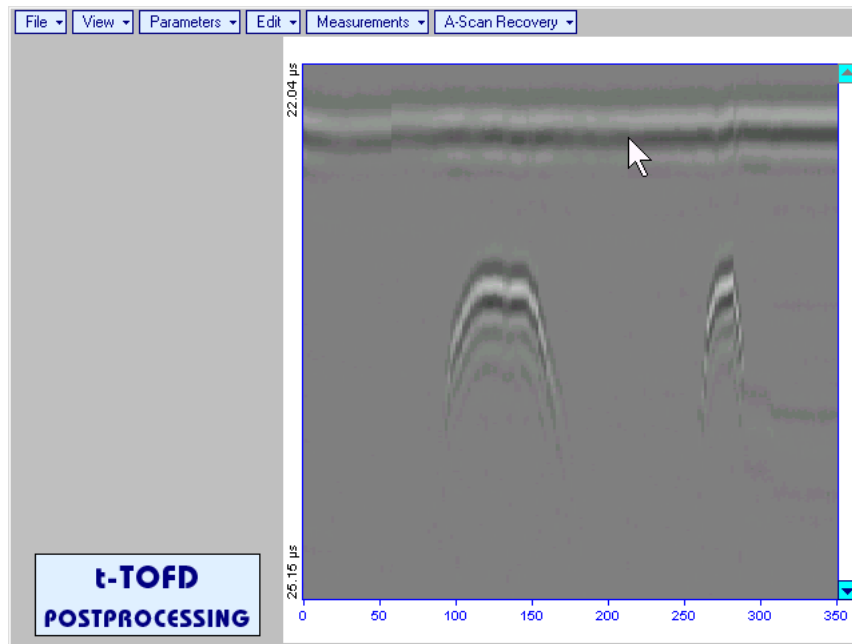
First vertical cursor appears upon designating end of *reference signal*. Its length corresponds to duration of *reference signal* and it is located between first and second horizontal cursors. First vertical cursor may


be manipulated over **t-TOFD / TOFD** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard . To **designate first border of rectangle segment**

left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . Second vertical cursor completing defining a rectangle appears upon fixing first one; it may be manipulated by the same way and allows to **designate second border of rectangle segment**













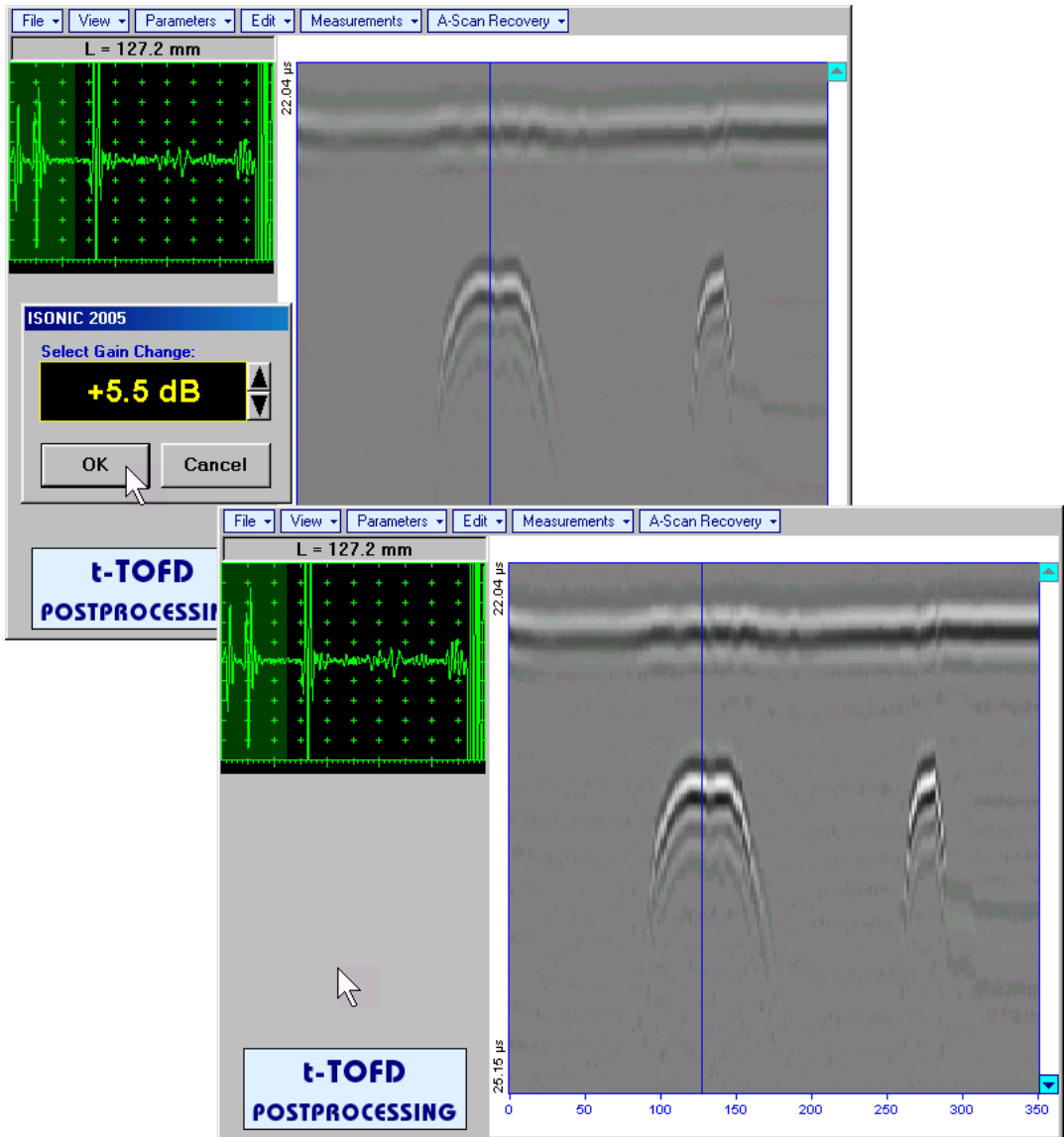
As a result **t-TOFD / TOFD** image is straightened in, above, and under selected *rectangle segment* to compensate deviations caused by various factors during recording, for example, coupling instability, unevenness of scanning or bottom surfaces, etc





To interrupt function at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- **Edit→Straightening→OFF** – negates modification of selected *rectangle segment* of **t-TOFD / TOFD** image

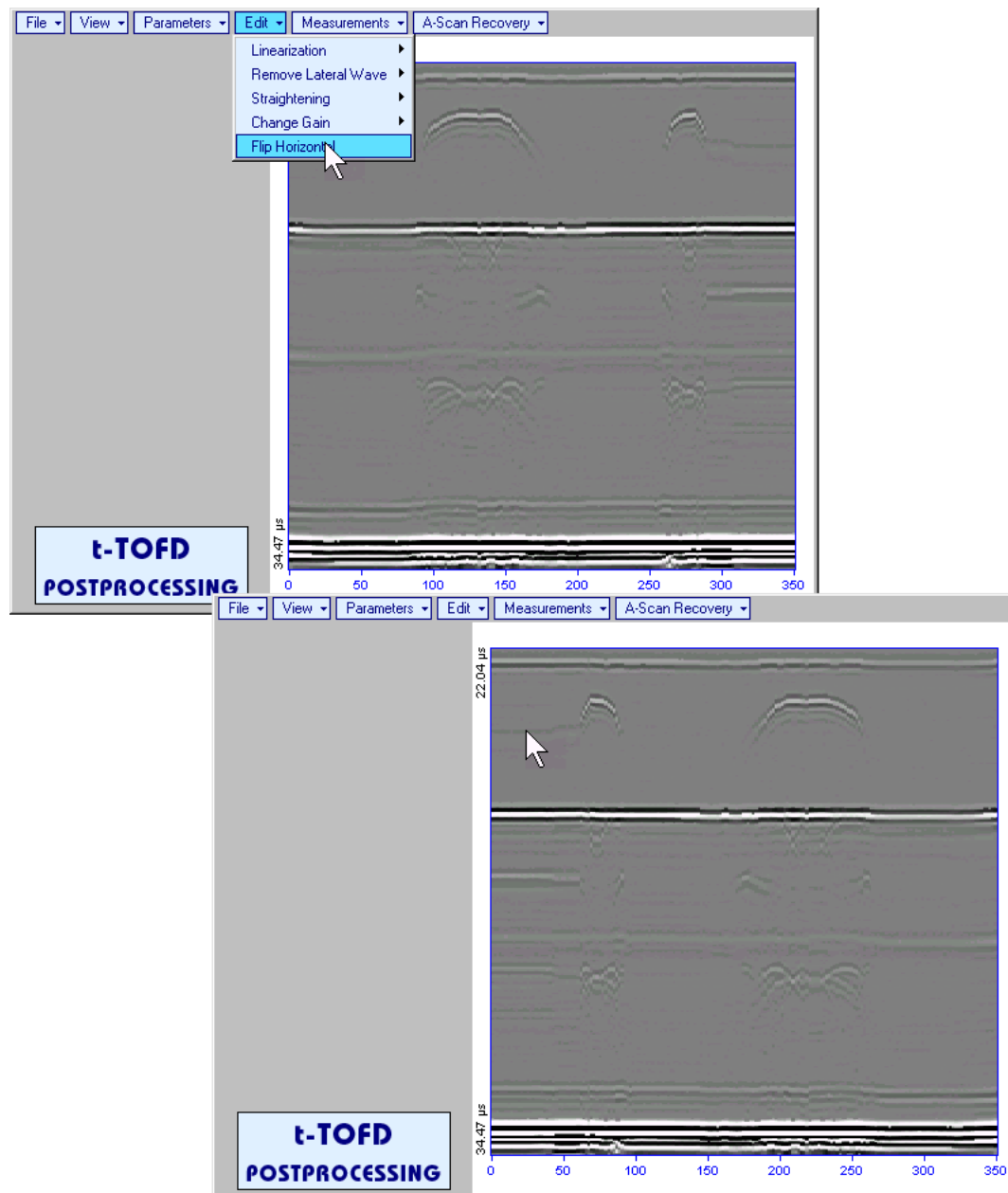
- Edit→Change Gain→ON** – generates *cursor corresponding to A-Scan base line* that may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *A-Scan base line cursor position*. To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates subwindow allowing off-line re-adjusting of **Gain** for all **A-Scans** captured during **t-TOFD / TOFD** recording in $\pm 6\text{dB}$ range with $\pm 0.1\text{ dB}$ increments through clicking or pressing and holding on  or pressing ,  on front panel keyboard or ,  on external keyboard








During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain** click on **OK** or press  on front panel keyboard or **Enter** on external keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws **t-TOFD / TOFD** image accordingly

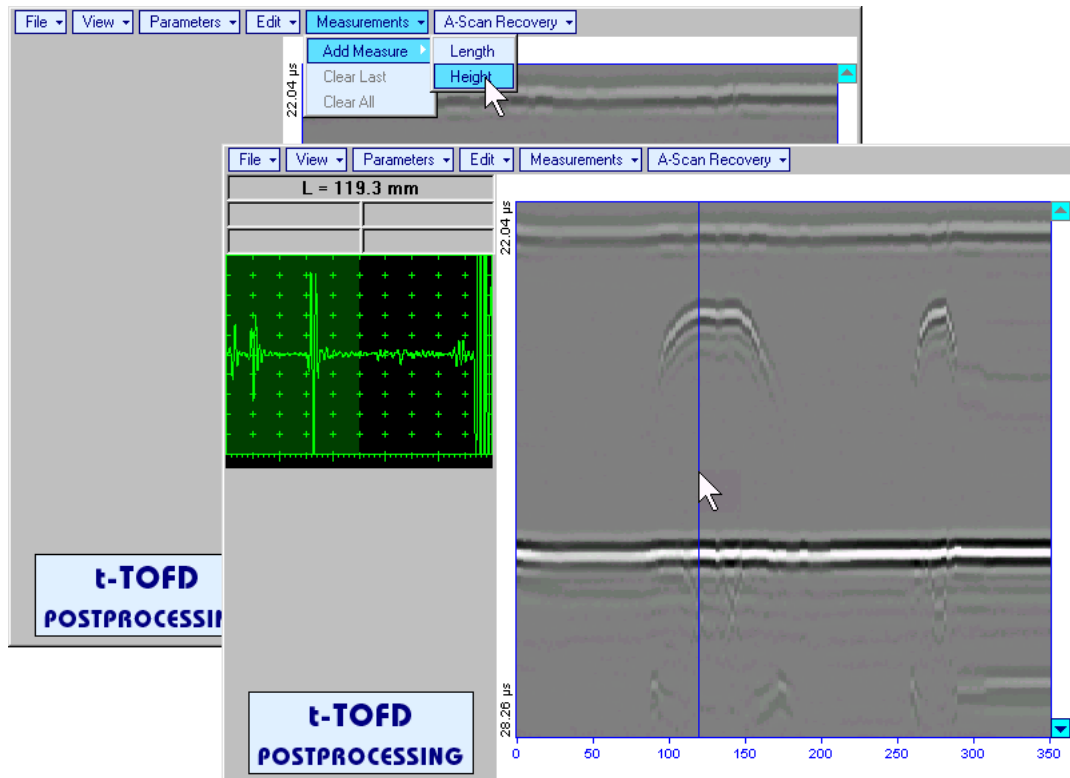
To interrupt re-adjusting of **Gain** click on **Cancel** or press  on front panel keyboard or **Esc** on external keyboard

- **Edit→Change Gain→OFF** – negates **Gain** re-adjustment and returns to originally recorded **t-TOFD / TOFD** image and original **Gain** setting
- **Edit→Flip Horizontal** – reorders **A-Scans** captured during **t-TOFD / TOFD** recording in reverse succession and redraws **t-TOFD / TOFD** image accordingly. This service function may be useful for merging scans of neighboring sections of an object, which were scanned in opposite direction due to access conditions, etc








Applying of **Flip Horizontal** function empties *postprocessing session memory stack*

- Measurements→Add Measure→Height** – generates *cursor corresponding to A-Scan base line* that may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *A-Scan base line cursor* position. Indication of starting position of cursor (**L**) corresponding to the position of **TOFD** probes pair accompanies recovered **A-Scan**. *A-Scan base line cursor* to be positioned over defect image to minimize displacement of defect's signal with regard to starting point of **A-Scan**. To fix position of *A-Scan base line cursor* release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard . Indication of starting position of cursor (**L**) corresponding to probe's center accompanies recovered **A-Scan**



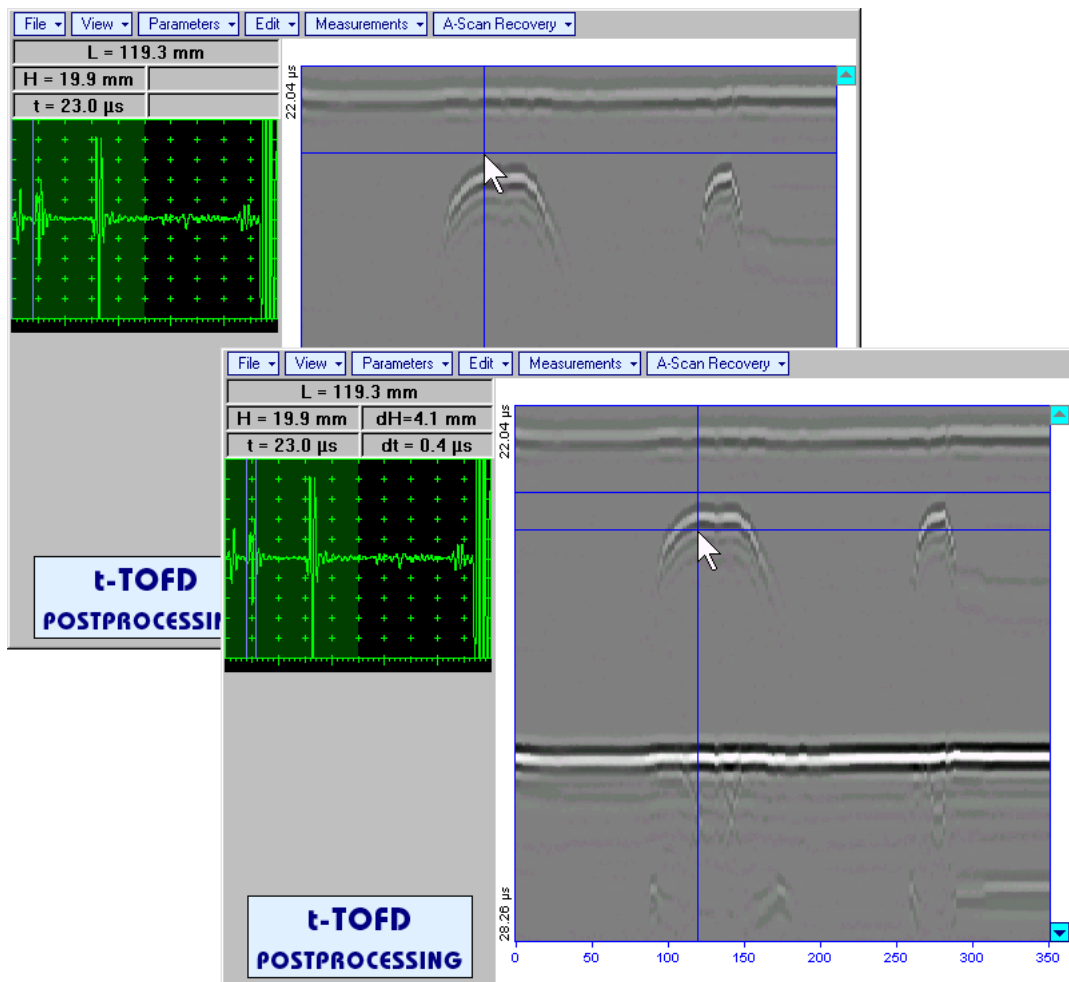
First horizontal cursor appears upon fixing *A-Scan base line cursor*, it may be guided over **t-TOFD** /


TOFD image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard . First horizontal cursor is accompanied with first *time cursor* synchronously moving over reference **A-Scan**. Coordinate of the first horizontal cursor - *depth* (**H**) and corresponding time of flight (**t**) are indicated synchronously. To fix position of the first horizontal cursor left mouse click or

release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard .

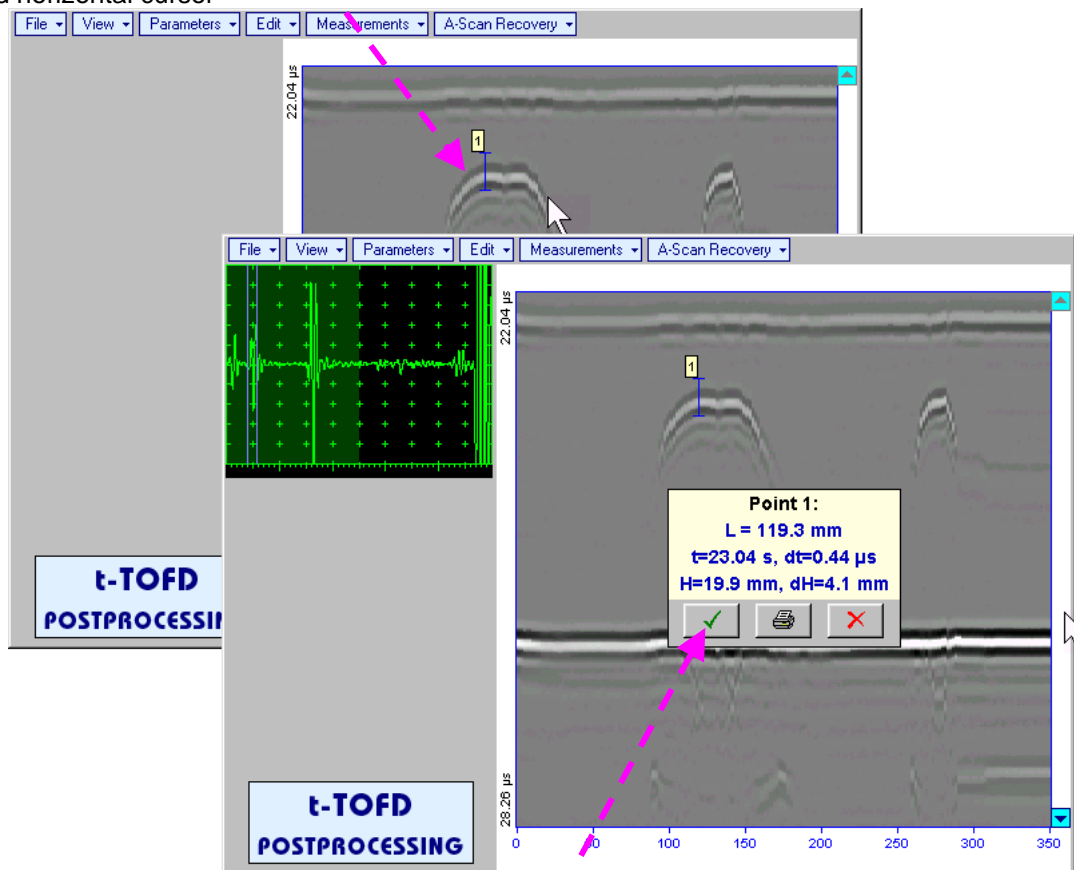
Second horizontal cursor appears upon fixing first one, it may be manipulated by the same way. Second horizontal cursor is accompanied with second *time cursor* synchronously moving over reference **A-Scan**. Coordinate of the second horizontal cursor measured relatively to position of first horizontal cursor (**dH**) and corresponding delay of second *time cursor* relatively to first *time cursor* (**dt**) are indicated synchronously. Provided the horizontal cursors are placed properly:

- **H** represents defect depth
- **t** represents time of flight for first diffracted signal
- **dH** represents defect's height
- **dt** represents delay of second diffracted signal relatively first diffracted signal



To interrupt width measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard


Vertical **depth/height measurement mark** appears on the **t-TOFD / TOFD** image upon fixing position of second horizontal cursor




Depth measurement results may be recalled into **subwindow** accompanied with corresponding **A-Scan** through double click on the *depth measurement mark*










In the subwindow appearing:

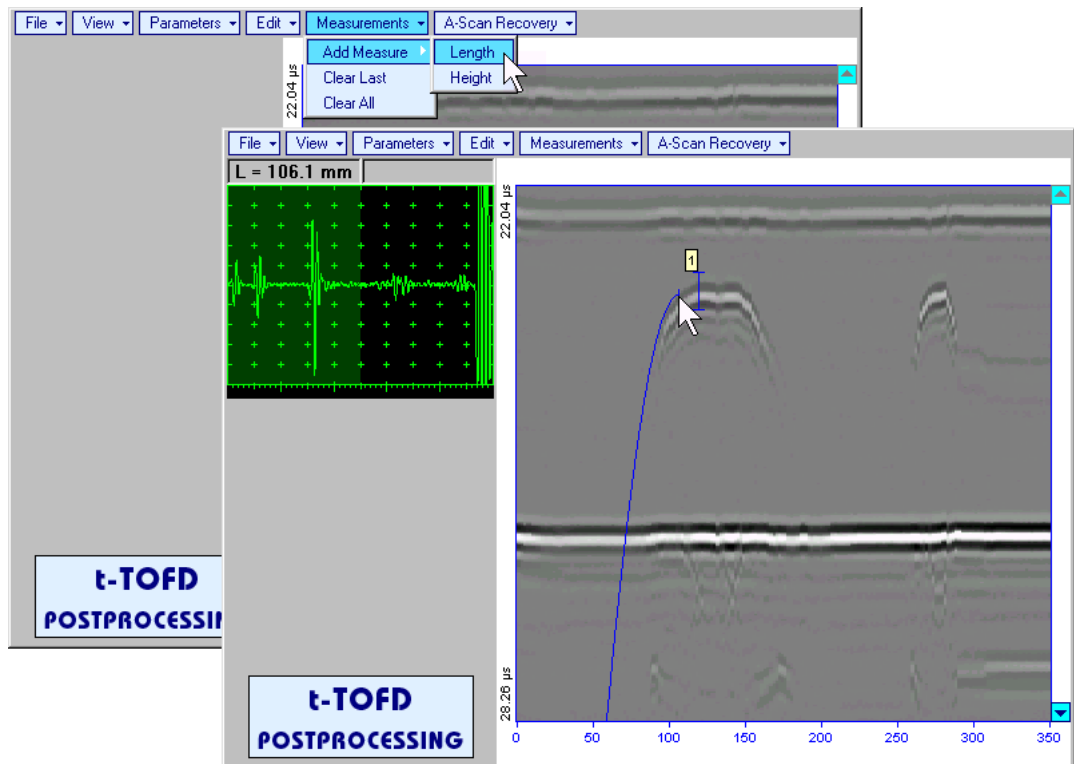
- **L** is coordinate of *depth measurement mark* along scanning line
- **H** represents defect depth
- **t** represents time of flight for first diffracted signal
- **dH** represents defect's height
- **dt** represents delay of second diffracted signal relatively first diffracted signal

Clicking on  will print current screen snapshot accompanied with *depth measurement mark* data

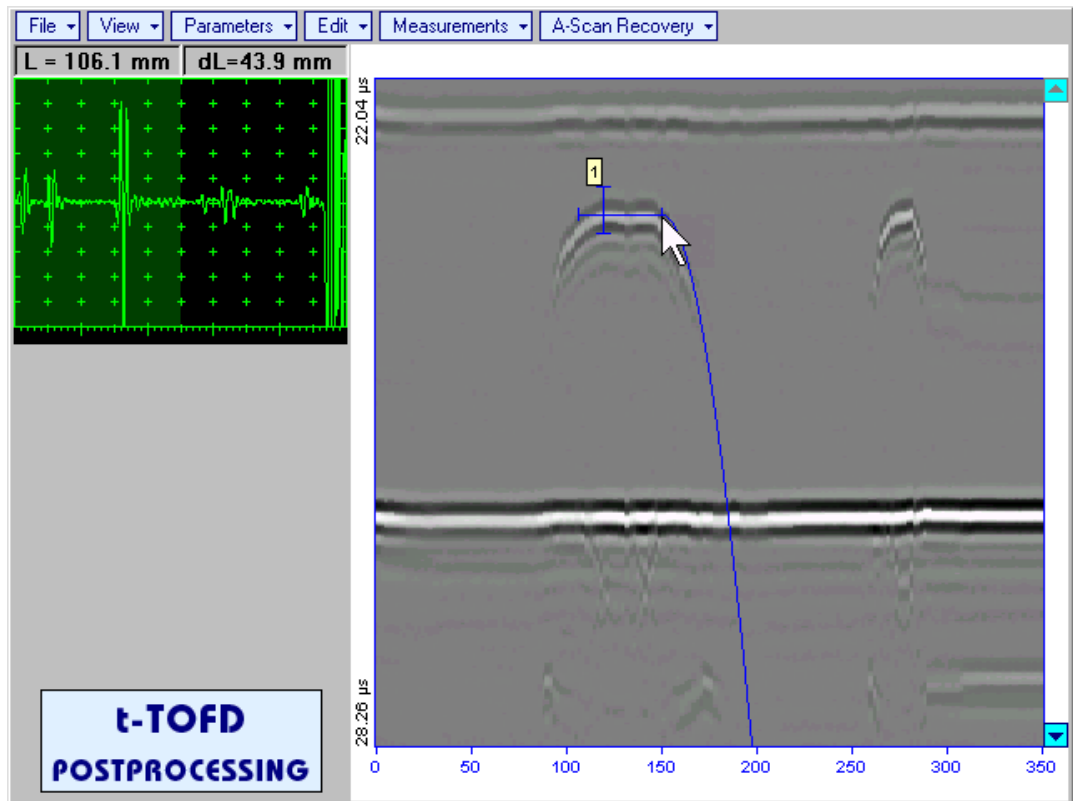
Clicking on  will hide subwindow with *depth measurement mark* data


Clicking on  will hide subwindow with *depth measurement mark* data and erase corresponding *depth measurement mark*

- Measurements→Add Measure→Length** – generates *left parabolic cursor* that may be guided over **t-TOFD / TOFD** image using either touch screen stylus or mouse or , , ,  on front panel keyboard or , , ,  on external keyboard . **A-Scan**, corresponding to coordinate (**L**) of tip of *left parabolic cursor* along scanning line is recovered synchronously. *Left parabolic cursor* to be placed over left defect's end providing shape matching. To fix position of *left parabolic cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard

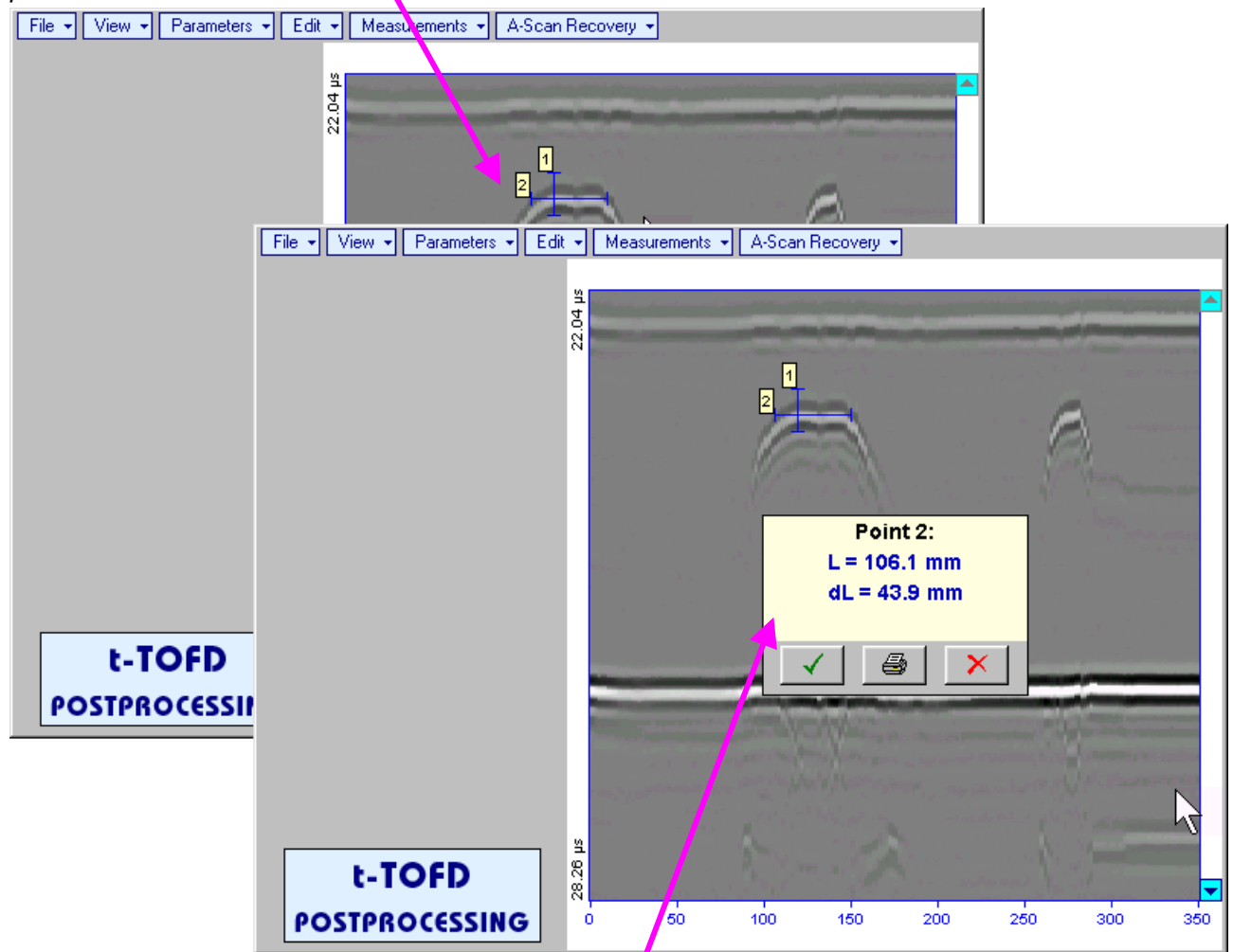


Right parabolic cursor appears upon fixing *left parabolic cursor*. It may be manipulated by the same way and must be placed over right defect's end providing shape matching. Coordinate of *right parabolic cursor* along **t-TOFD / TOFD** image measured relatively to position of *left parabolic cursor* (**dL**) is indicated synchronously, it represents length of defect area provided that both parabolic cursors are placed properly



To interrupt length measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard


Horizontal **length measurement mark** appears on **t-TOFD / TOFD** image upon fixing position of *right parabolic cursor*





Length measurement results may be recalled into **subwindow** through double click on the *length measurement mark*

In the subwindow appearing:

- **L** is coordinate of left end of the *length measurement mark*
- **dL** is length of defect area covered by *length measurement mark*
- **H** is distance between scanning line and *length measurement mark*

Clicking on  will print current screen snapshot accompanied with *length measurement mark* data



Clicking on  will hide subwindow with *length measurement mark* data

Clicking on  will hide subwindow with *length measurement mark* data and erase corresponding *length measurement mark*

- **Measurements**→**Clear Last** – erases last *length* or *depth/height measurement mark* placed on the **t-t-TOFD / TOFD** image
- **Measurements**→**Clear All** – erases all *length* and *depth/height measurement marks* placed on the **t-t-TOFD / TOFD** image


7.6. CB-Scan horizontal plane-view imaging and recording of defects for shear, surface, and guided wave inspection – t-FLOORMAP L or FLOORMAP L

7.6.1. Setup Pulser Receiver for t-FLOORMAP L and FLOORMAP L

UDS 3-5 Pulser Receiver window – main operating surface – appears on ISONIC 2006 screen upon clicking on  or . The settings as below to be provided


7.6.1.1. Angle Beam Inspection – Shear and Longitudinal Waves

#	Parameter or Mode	Submenu	Required Settings	Note
1	Gain	BASICS	Gain setting to be performed according to inspection procedure providing required echo heights from defects to be detected	
2	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of inspection procedure	
3	Pulser Mode	PULSER	Dual for dual element probes Single for single element probes	
4	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain setting procedure
5	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain setting procedure
6	Display	RECEIVER	Display setting may be either Full, RF, PosHalf, or NegHalf	The same Display mode to be used for both Probe Delay determining and t-FLOORMAP L / FLOORMAP L Recording
7	USVelocity	BASICS	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	
8	Probe Delay	MEASURE	Probe Delay setting to be equal to actual probe delay	For shear wave / longitudinal wave angle beam inspection probe delay may be determined according to paragraph 5.2.13.5, 5.2.13.6 or 5.2.13.8 of this Operating Manual or similarly
9	Display Delay	BASICS	Display Delay setting to be equal to actual probe delay	Recommend Display Delay = Probe Delay
10	Angle	MEASURE	Angle setting to be equal to actual probe angle	
11	Settings for other parameters and modes have no significance			

Click on  or press  on front panel keyboard or **F8** on external keyboard upon completing

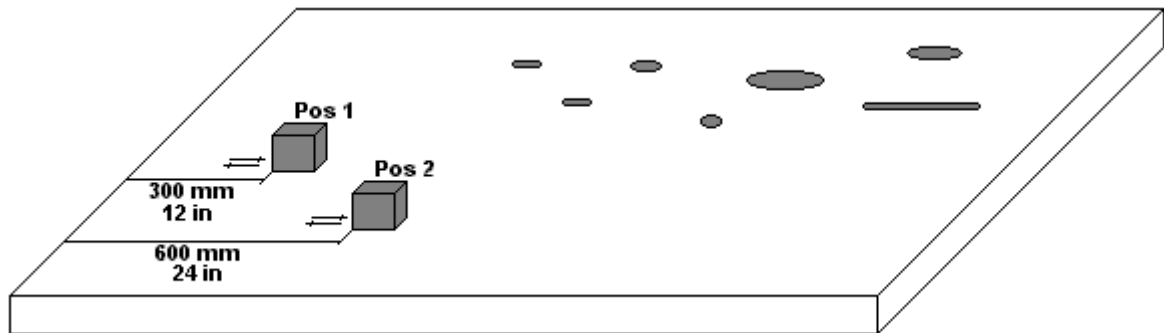
7.6.1.2. Guided, Surface, Creeping, and Head Wave Inspection

#	Parameter or Mode	Submenu	Required Settings	Note
1	Gain	BASICS	Gain setting to be performed according to inspection procedure providing required echo heights from defects to be detected	For guided / surface / creeping / head wave inspection Gain setting may be implemented according to paragraph 7.6.1.4 of this Operating Manual or similarly
2	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of inspection procedure	For guided / surface / creeping / head wave inspection DAC may be created according to paragraph 7.6.1.4 of this Operating Manual or similarly
3	Pulser Mode	PULSER	Dual for dual element probes Single for single element probes	
4	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain setting procedure
5	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain setting procedure
6	Display	RECEIVER	Display setting may be either Full, RF, PosHalf, or NegHalf	The same Display mode to be used for both Probe Delay determining and t-FLOORMAP L / FLOORMAP L Recording
7	USVelocity	BASICS	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	For guided / surface / creeping / head wave inspection ultrasound velocity may be determined according to paragraph 7.6.1.3 of this Operating Manual or similarly
8	Probe Delay	MEASURE	Probe Delay setting to be equal to actual probe delay	For guided / surface / creeping / head wave inspection probe delay may be determined according to paragraph 7.6.1.3 of this Operating Manual or similarly
9	Display Delay	BASICS	Display Delay setting to be equal to actual probe delay	Recommend Display Delay = Probe Delay
10	Angle	MEASURE	90°	
11	Settings for other parameters and modes have no significance			

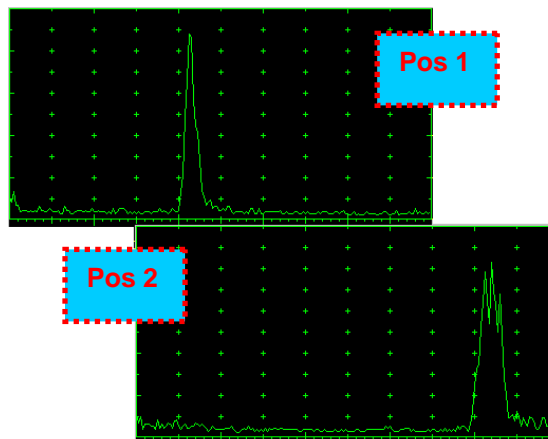
Click on  or press  on front panel keyboard or **F8** on external keyboard upon completing

7.6.1.3. Determining Probe Delay and Ultrasound Velocity for Guided / Surface / Creeping / Head Wave Inspection

The following procedure is recommended for finding **Probe Delay** and **US Velocity** settings necessary to perform guided wave inspection:



- In the **UDS 3-5 Pulser Receiver** window – submenu **BASICS** setup **Range = 750 mm** (or **30 in**)
- In the **UDS 3-5 Pulser Receiver** window – submenu **BASICS** setup **US Velocity = 3000 m/s** (or **120 in/ms**)
- Place guided wave probe into position **Pos 1** on a reference plate providing **300 mm** (or **12 in**) distance between probe's frontal surface and plate end
- Tune **Gain** to provide plate end echo reaching **80-90%** of **A-Scan** screen height
- Tune **Display Delay** (submenu **BASICS**) to provide rising edge of plate end echo matching with **40%** grid on horizontal **A-Scan** screen scale
- Place guided wave probe into position **Pos 2** on a reference plate providing **600 mm** (or **24 in**) distance between probe's frontal surface and plate end
- Tune the **US Velocity** (submenu **BASICS**) to provide rising edge of plate end echo matching with **80%** grid on horizontal **A-Scan** screen scale
- Place again guided wave probe into position **Pos 1** on a reference plate providing **300 mm** (or **12 in**) distance between probe's frontal surface and plate end
- Repeat steps (e) through (h) as above until further tuning will not be necessary, i.e. placement of guided wave probe into positions **Pos 1** and **Pos 2** causes rising edge of plate end echo appearing at **40%** and **80%** on horizontal **A-Scan** screen scale correspondingly. Since that **Display Delay** and **US Velocity** settings are proper
- In the submenu **MEASURE** provide **Probe Delay = Display Delay** whereas **Display Delay** value to be found according to above steps (a) through (i)



- Probe Delay** and **US Velocity** for surface / creeping / head wave inspection may be found similarly
- Automatic Calibration (AUTOCAL) procedure according to paragraph 5.2.13.8 of this Operating Manual is also applicable

7.6.1.4. Setting Gain and DAC for Guided / Surface / Creeping / Head Wave Inspection

For setting up **Gain** and **DAC** a reference plate containing artificial defects is required; said reference plate must have acoustical properties (longitudinal and shear wave propagation velocity, attenuation) thickness and curvature differing from the same properties of the plate to be inspected in not more than $\pm 10\%$.

Gain setting to be performed through providing sure detection of artificial defect from selected distances according to required inspection range

Optional **DAC** setting for guided wave inspection to be performed as below:

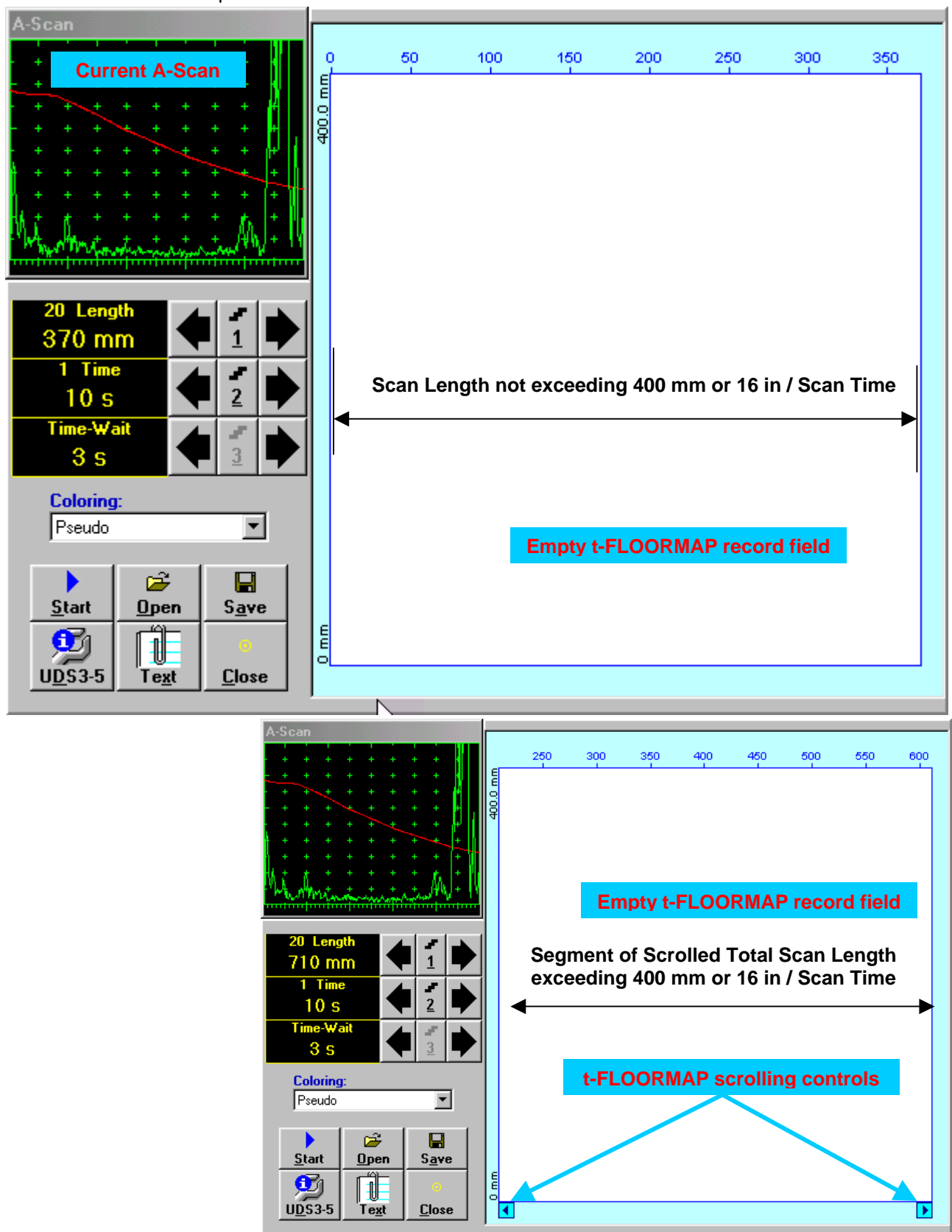
Place guided wave probe into position on reference plate providing receiving of an echo from a reflector

- (a) Place guided wave probe into position on reference plate providing receiving of an echo from a reflector passing minimal travel distance
- (b) Follow instructions of paragraph 5.2.10 of this Operating Manual to record first DAC echo
- (c) Move the probe away from the reflector keeping it's echo maximized for each new DAC echo recording paragraph 5.2.10 of this Operating Manual

7.6.2. t-FLOORMAP L and FLOORMAP L – Implementation

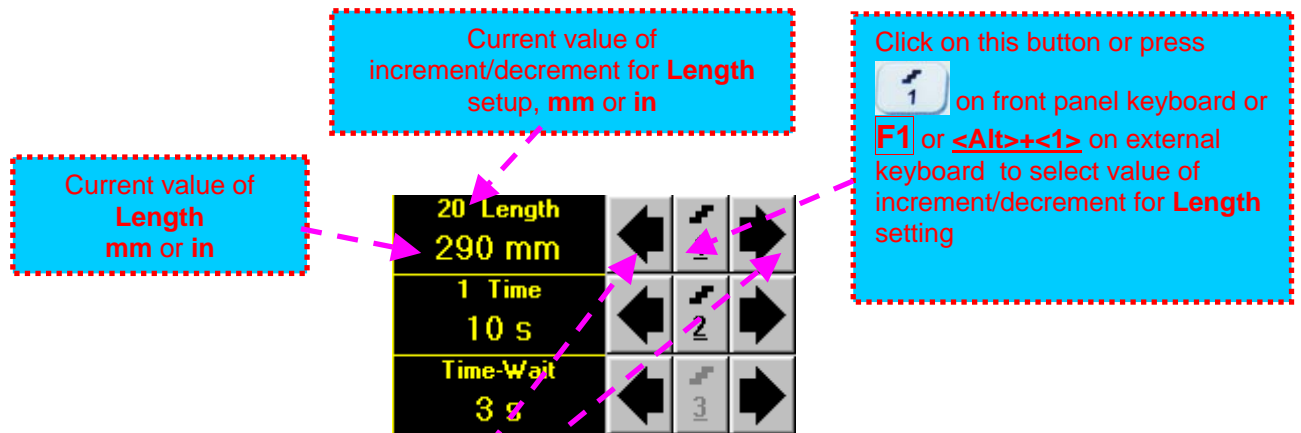
7.6.2.1. t-FLOORMAP L – Prior to Scanning

t-FLOORMAP L control panel is shown below



Scan Length and Scan Time

Length represents length of section of test object to be displayed, over which probe will be scanning during recording period. **Time** (Scan Time) is the duration of recording period



To control **Length** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

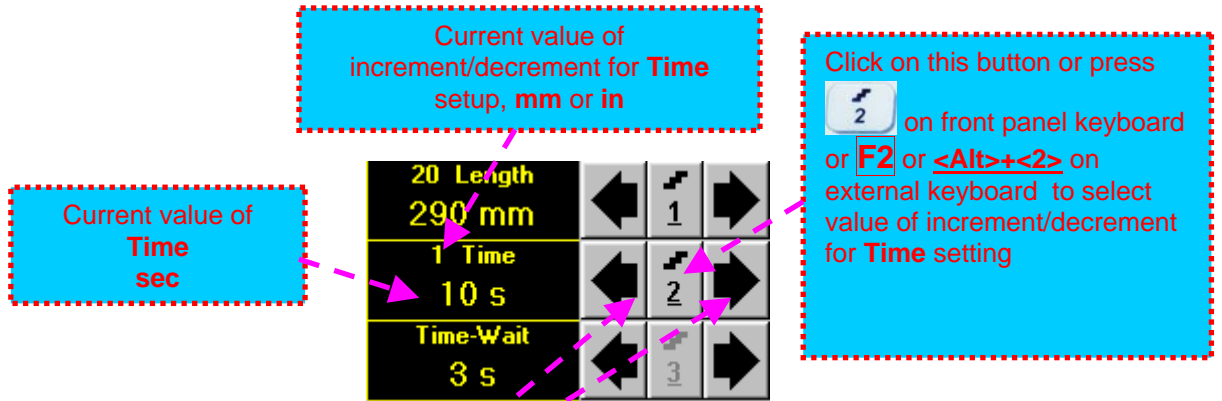
- Press on front panel keyboard or **F1** on external keyboard ⇒ **Length** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

- Click on **Length** ⇒ **Length** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Length** is adjustable between 50 and 1000 **mm** or 2 and 40 **in**



To control **Time** the following manipulations are applicable:

- **Mouse / Touch Screen**

- Click on corresponding button

- **Keyboard**

- Press on front panel keyboard or **F2** on external keyboard ⇒ **Time** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard

- **Combined**

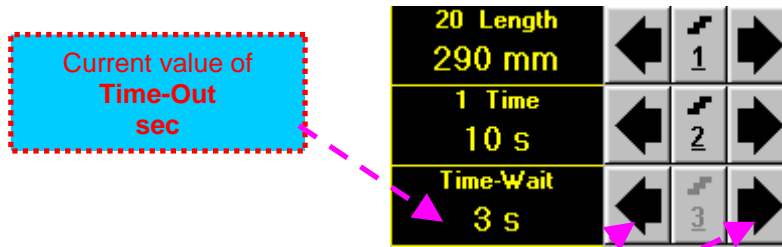
- Click on **Time** ⇒ **Time** fore color changes to white - then use , , , on front panel keyboard or , , , on external keyboard



The value of **Time** is adjustable between 5 and 60 **sec**

Time-Wait

Time-Wait is waiting time for intermissions predessing **t-TOFD** recording, which starts unconditionally upon **Time-Wait** period is over





To control **Time-Wait** the following manipulations are applicable:









- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F3** on external keyboard ⇒ **Time-Wait** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Time-Wait** ⇒ **Time-Wait** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard



The value of **Time-Wait** is adjustable between 0 and 15 sec

t-FLOORMAP L Record Palette

There are four palettes available through – select **through**





Insert Text Note





Refer to paragraph 7.3.2.1 of this Operating Manual



Preview UDS 3-5 Settings

Refer to paragraph 7.3.2.1 of this Operating Manual

Start/Stop t-FLOORMAP L recording

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **t-FLOORMAP L** recording

 button becomes invisible since **t-FLOORMAP L** recording starts.  button occupies its position. Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **t-FLOORMAP L** recording prior to automatic completion

 button becomes invisible after completion / termination of **t-FLOORMAP L** record.  button returns to its position

Save record into a file

Refer to paragraph 7.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

Refer to paragraph 7.3.2.1 of this Operating Manual

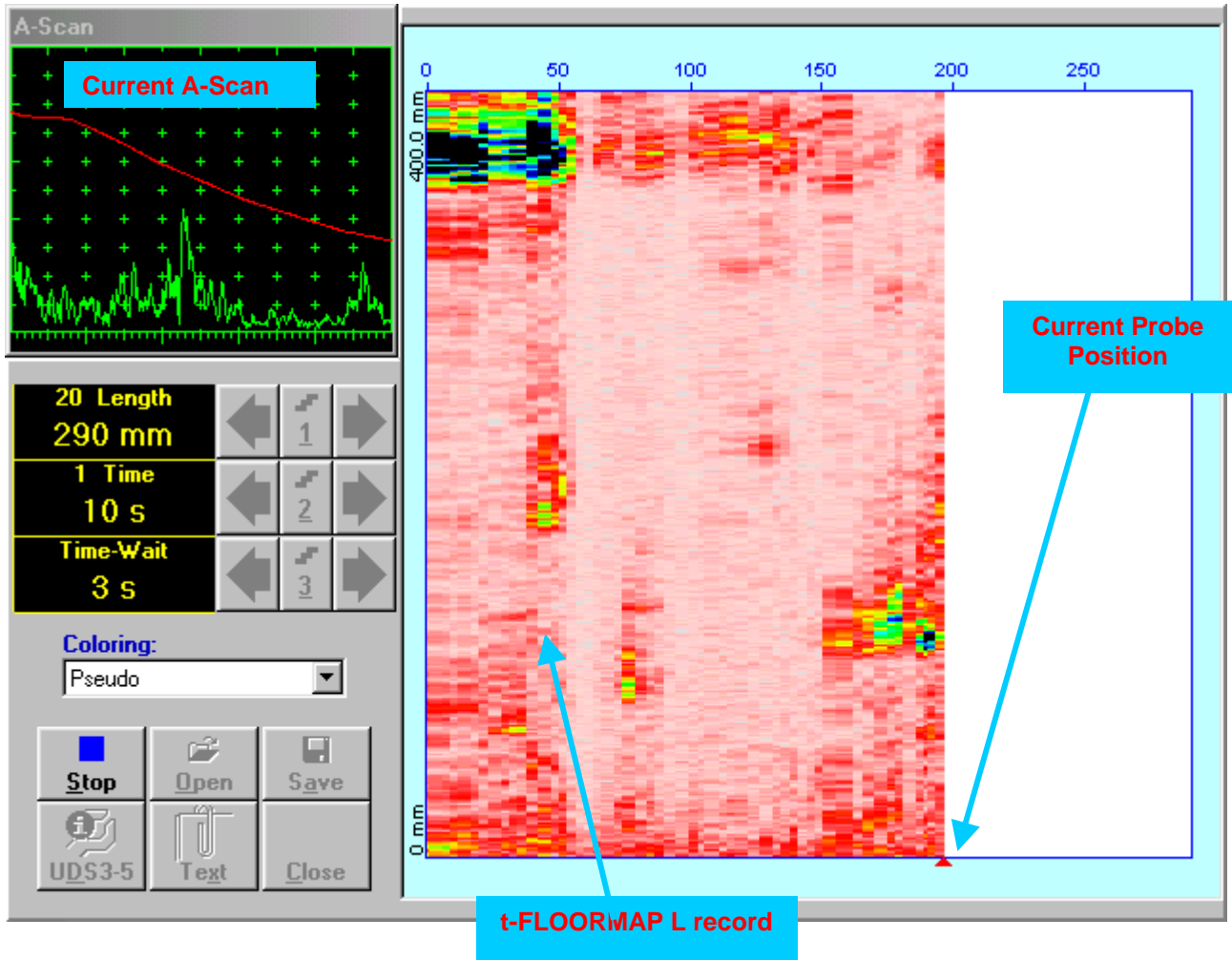
Return to UDS 3-5 main operating surface

Refer to paragraph 7.3.2.1 of this Operating Manual

7.6.2.2. t-FLOORMAP L – Scanning

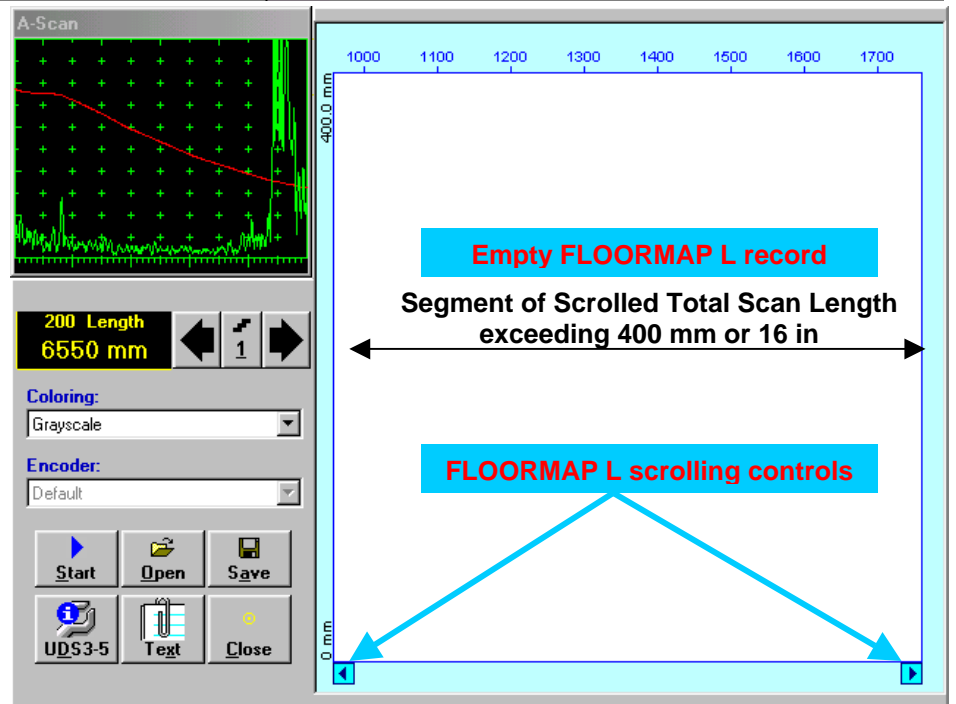
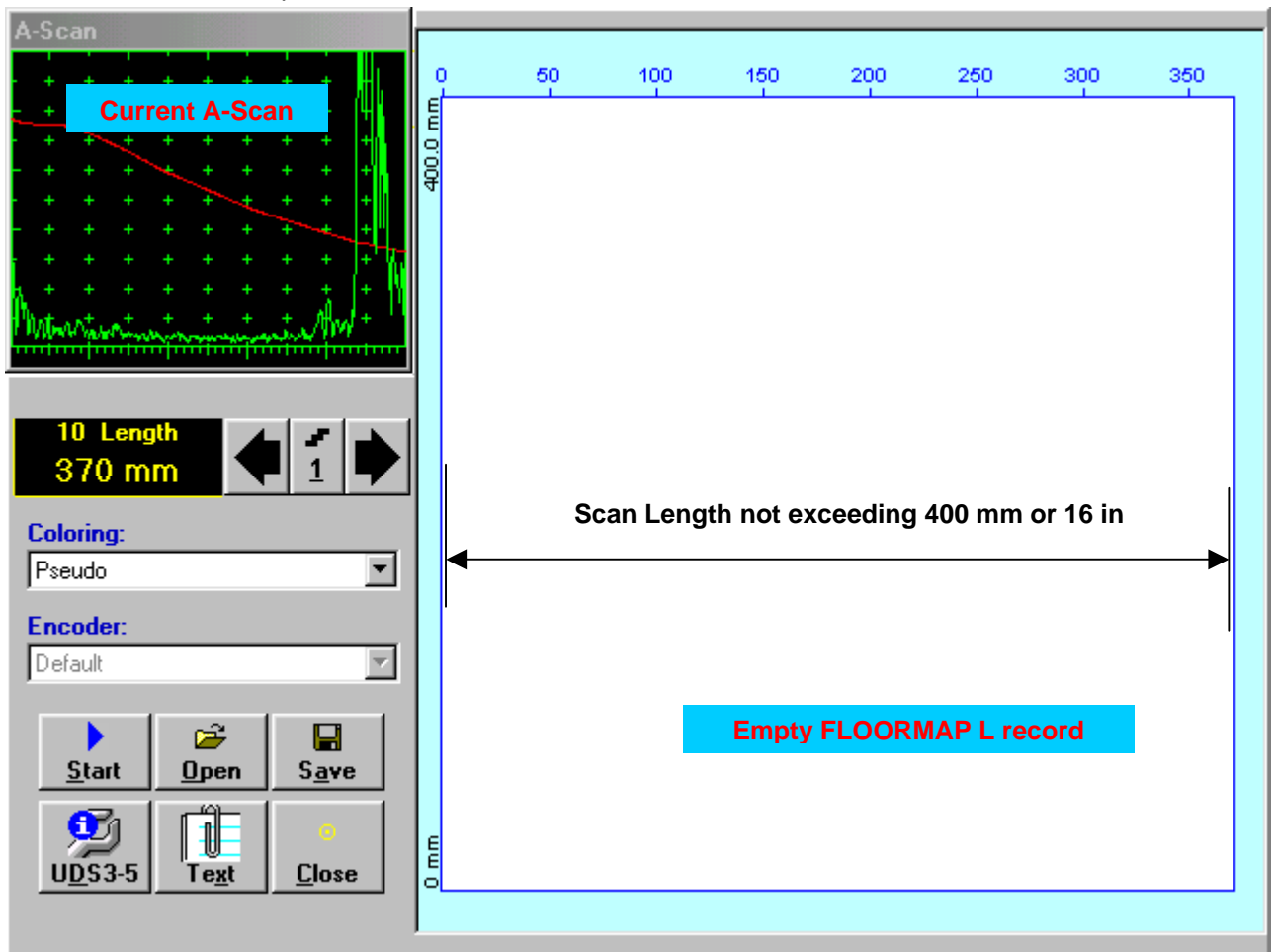
- Apply probes pair to test object in the start point of selected scanning line

- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line synchronously with *Position Icon* moving with constant speed above **t-FLOORMAP L** record field – typical scanning progress display during is shown and explained below



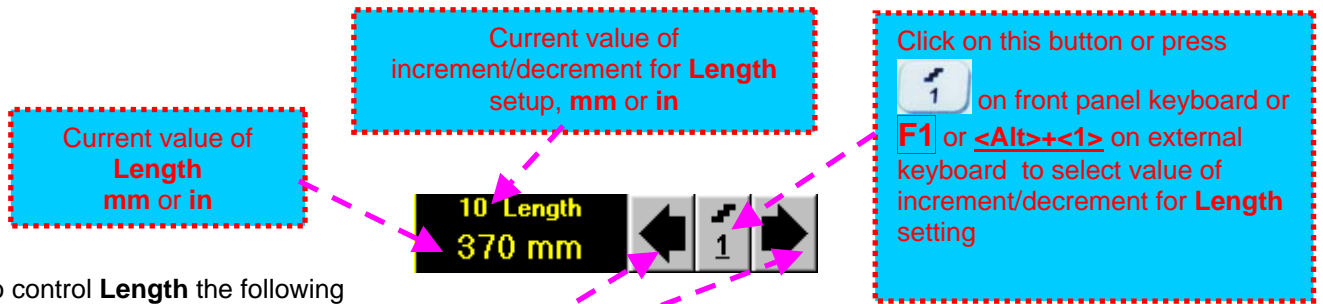
7.6.2.3. FLOORMAP L – Prior to Scanning

FLOORMAP_L control panel is shown below



Scan Length

Length represents length of section of test object to be displayed, over which probe will be scanning during recording period












To control **Length** the following manipulations are applicable:








- **Mouse / Touch Screen**

- Click on corresponding **button**

- **Keyboard**

- Press  on front panel keyboard or **F1** on external keyboard ⇒ **Length** fore color changes to white - then use , , ,  on front panel keyboard or , , ,  on external keyboard

- **Combined**

- Click on **Length** ⇒ **Length** fore color changes to white - then use , , ,  on front panel keyboard or , , , on external keyboard



The value of **Length** is adjustable between 50 and 20000 **mm** or 2 and 800 **in**

FLOORMAP L Record Palette

There are four palettes available through – select **through**



Encoder

Select encoder to be used through appropriate box



Clamp probe into encoder – refer to Chapter 7 of this Operating Manual
Connect encoder to its input on the right side of **ISONIC 2006 instrument**



Insert Text Note





Refer to paragraph 7.3.2.1 of this Operating Manual

Preview UDS 3-5 Settings

Refer to paragraph 7.3.2.1 of this Operating Manual

Start/Stop FLOORMAP L recording

Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **FLOORMAP L** recording

 button becomes invisible since **FLOORMAP L** recording starts.  button occupies its position. Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **FLOORMAP L** recording

 button becomes invisible after termination of **FLOORMAP L** record.  button returns to its position

Save record into a file

Refer to paragraph 7.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

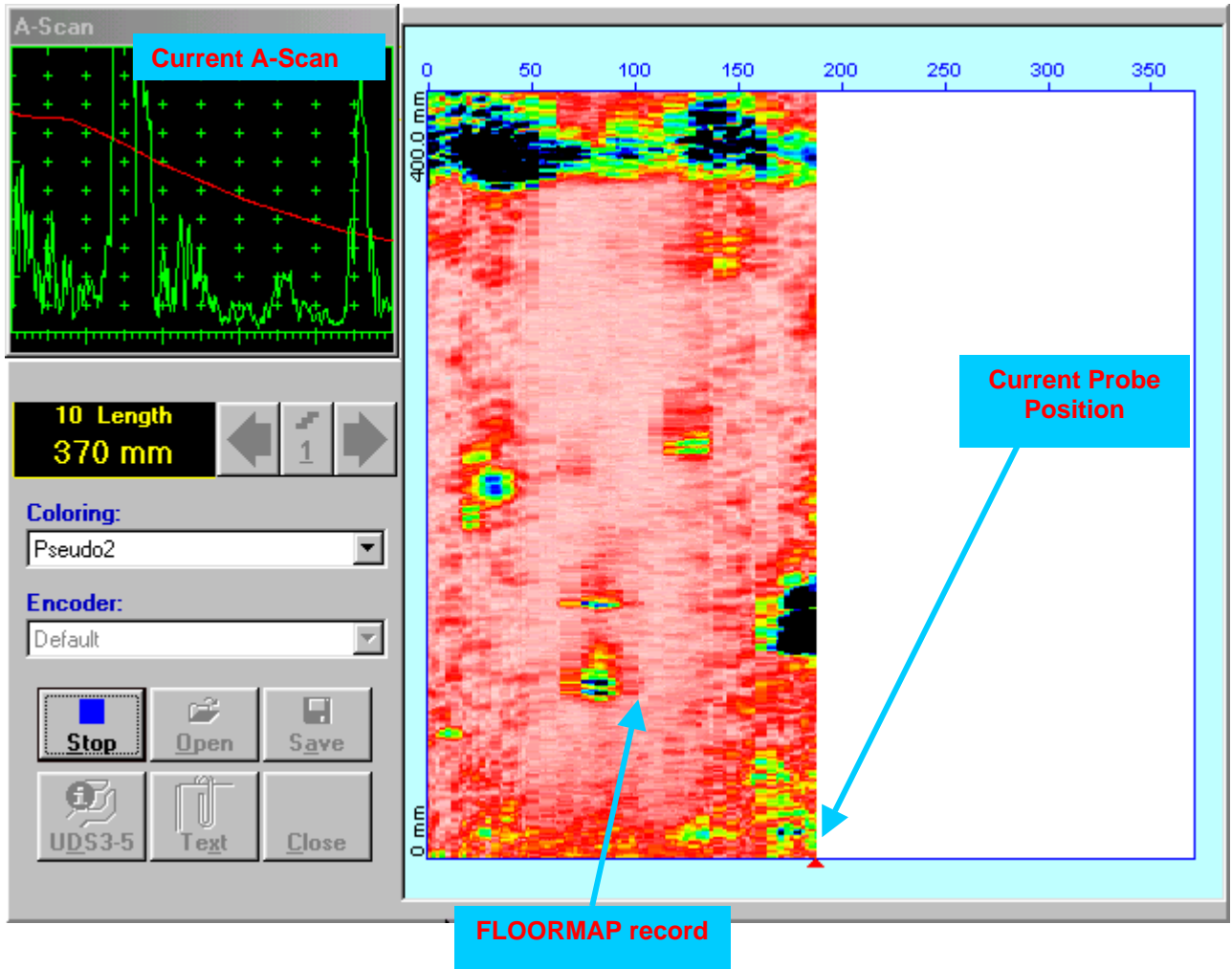
Refer to paragraph 7.3.2.1 of this Operating Manual

Return to UDS 3-5 main operating surface

Refer to paragraph 7.3.2.1 of this Operating Manual

7.6.2.4. FLOORMAP L – Scanning

- Apply probes pair to test object in the start point of selected scanning line
- Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line – typical scanning progress display during is shown and explained below

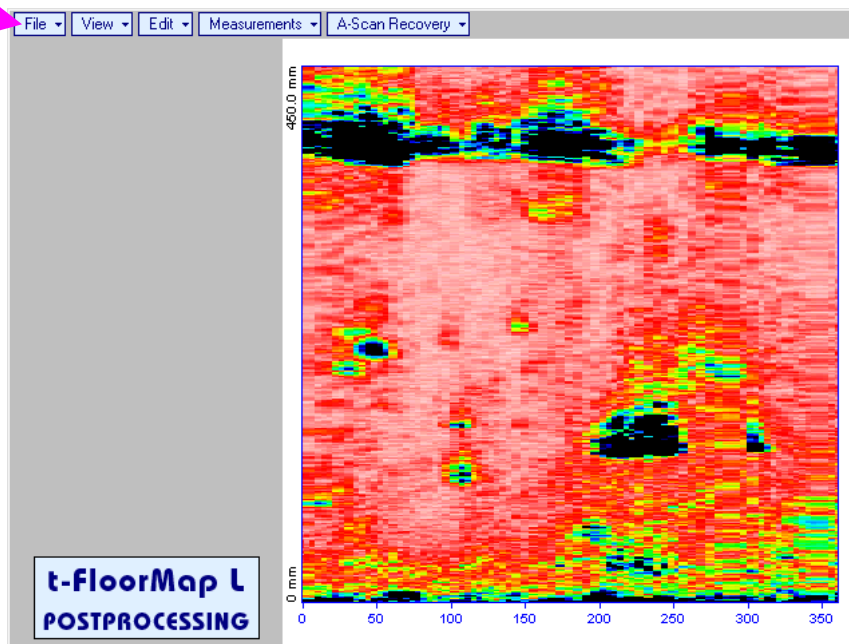


7.6.2.5. t-FLOORMAP L / FLOORMAP L – Postprocessing

Versatile postprocessing of t-FLOORMAP L/FLOORMAP L (CB-Scan) records is featured with:





- ❑ Sizing of the defects at any location along stored images (coordinates, projection size, amplitude-based evaluation)
- ❑ Play-back and evaluation of **A-Scans** obtained and captured during t-FLOORMAP L / FLOORMAP L (CB-Scan) defects imaging and recording
- ❑ Defects outlining and pattern recognition based on **A-Scan** sequence analysis – **Echo Dynamic Pattern Analysis**
- ❑ Reconstruction of t-FLOORMAP L / FLOORMAP L (CB-Scan) defects images for various **Gain, Reject, and off-line Gate** level settings
- ❑ **DAC/DGS t-FLOORMAP L / FLOORMAP L (CB-Scan)** normalization

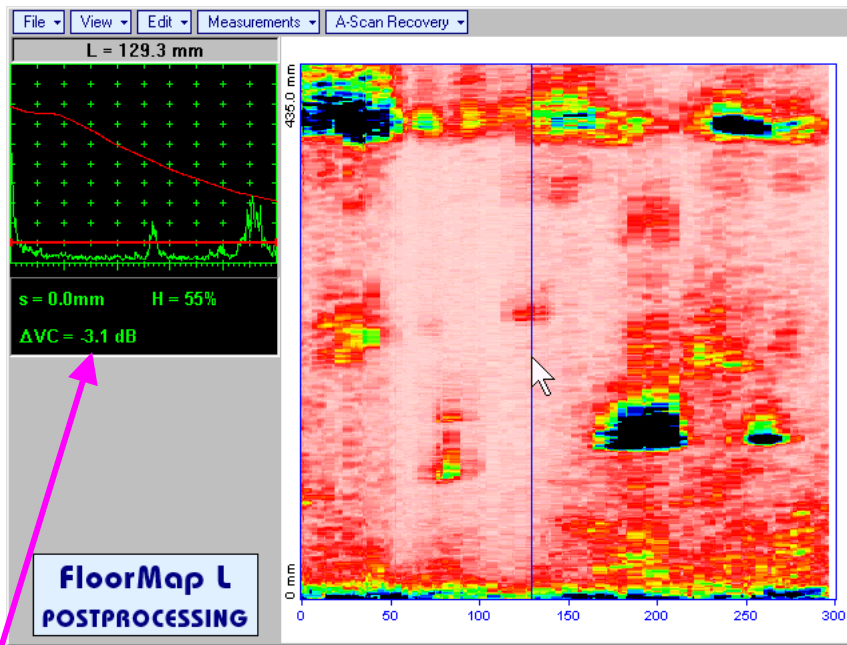
The screen as below appears upon opening file. All postprocessing procedures are performed through **menu bar** – touch screen stylus or front panel or external mouse to be used



Menu Bar Functions

- **File→Open** – opens new t-FLOORMAP L / FLOORMAP L (CB-Scan) file
- **File→Snapshots→Add Snapshot** – stores current postprocessing screen snapshot accompanied with appropriate settings and measurements into *postprocessing session memory stack*
- **File→Snapshots→Restore Snapshot** – recalls earlier stored postprocessing screen snapshot accompanied with appropriate settings and measurements from *postprocessing session memory stack*
- **File→Snapshots→Delete Snapshot** – deletes earlier stored postprocessing screen snapshot accompanied with appropriate settings and measurements from *postprocessing session memory stack*
- **File→Print** – prints out postprocessing screen snapshot(s) accompanied with appropriate settings and measurements
- **File→Exit** – returns to t-FLOORMAP L / FLOORMAP L (CB-Scan) control panel
- **View→Instrument** – indicates setup of **UDS 3-5** Pulser Receiver used for scanning when file was created
- **View→Inspection Data** – indicates operator's comments entered prior to scanning
- **View→Coloring** – selects palette for t-FLOORMAP L / FLOORMAP L (CB-Scan) image


- **A-Scan Recovery →ON** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. Indication of starting position of cursor (**L**) corresponding to probe's center accompanies recovered **A-Scan**. On the recovered **A-Scan** there is red **Off-line Gate** presented. Initially **Off-line Gate** covers whole **A-Scan** range




Automatic Measurements Display accompanies recovered **A-Scan** and indicates (refer to paragraphs 5.1.12, 5.2.13.1 and 5.2.13.2 of this Operating Manual):

- sound path **s** between reflector and probe's center (measurement mode - **Flank**)
- amplitude **H** of the maximal signal in the **Off-line Gate** expressed in % of full **A-Scan** height
- **ΔVC (dB to DAC)** of the maximal signal in the **Off-line Gate** provided that DAC was active whilst recording **t-FLOORMAP L / FLOORMAP L (CB-Scan)** data


To fix position of *sound path cursor* with corresponding recovered **A-Scan** and **Automatic**






Measurements Display data left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard

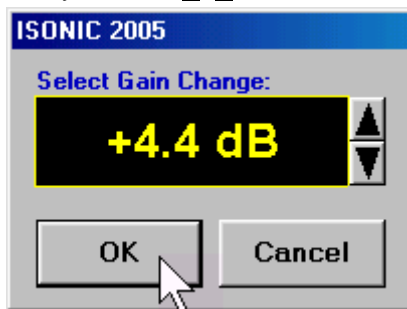
To interrupt recovery of **A-Scans** and empty **A-Scan Recovery** field right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- **A-Scan Recovery →OFF** – erases *sound path cursor* with recovered **A-Scan**, indicator of *sound path cursor* position, and **Automatic Measurements Display**



- **Edit→Change Gain→ON** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position.



To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates subwindow allowing off-line re-adjusting of **Gain** for all **A-Scans** captured during **t-FLOORMAP L / FLOORMAP L (CB-Scan)**

recording in **±6dB** range with **±0.1 dB** increments through clicking or pressing and holding on  or pressing  ,  on front panel keyboard or  ,  on external keyboard














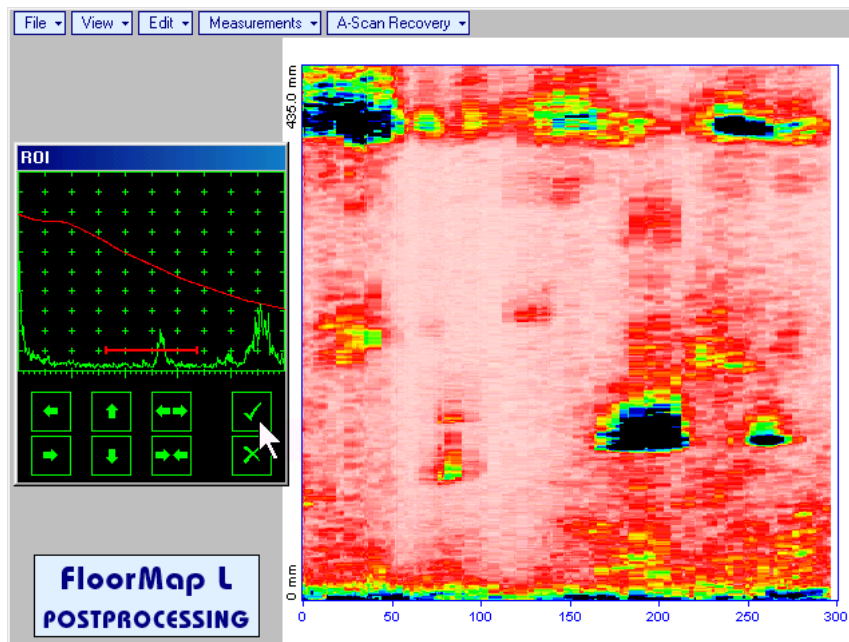
During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain**


click on  or press  on front panel keyboard or **Enter** on external keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image accordingly

To interrupt re-adjusting of **Gain** click on  or press  on front panel keyboard or **Esc** on external keyboard


- **Edit→Change Gain→OFF** – negates **Gain** re-adjustment and returns to originally recorded **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image and original **Gain** setting

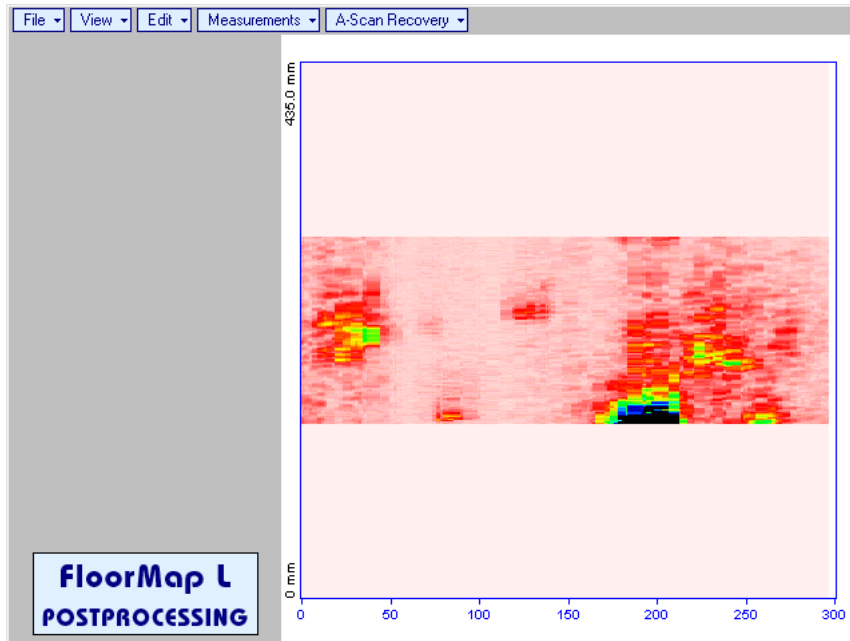
- Edit→ROI→ON** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image using either touch screen stylus or mouse or   on front panel keyboard or   on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates **Off-line Gate** controls       allowing to redefine **Region Of Interest** for **t-FLOORMAP L / FLOORMAP L (CB-Scan)** imaging



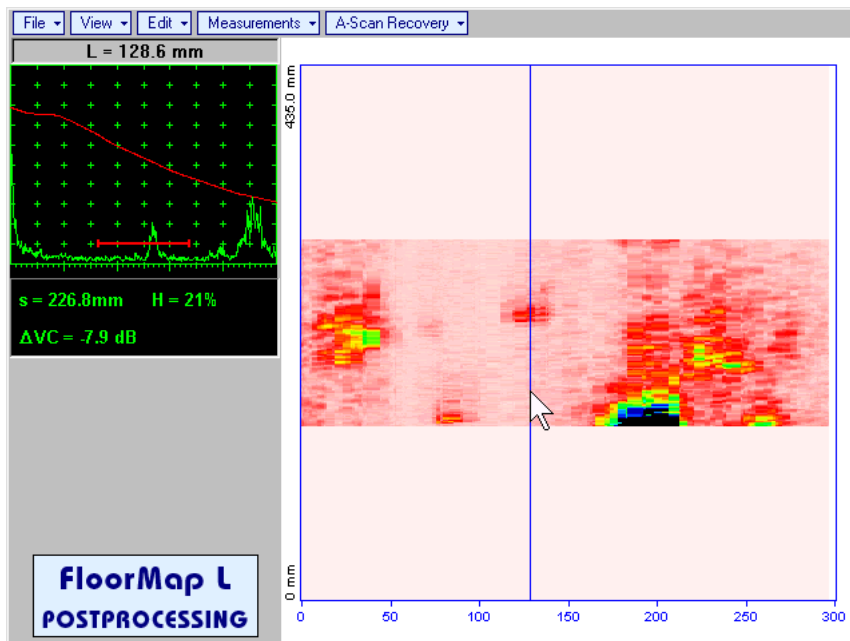
To interrupt selection of reference of **A-Scan** right mouse click or press  on front panel keyboard or **Esc** on external keyboard

To interrupt re-adjustment of **Region Of Interest** after selection of reference of **A-Scan** click on 





Upon completing redefining of **Region Of Interest** click on  – this applies new **Off-line Gate** to all captured **A-Scans** and updates **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image accordingly – only segment of **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image covered by newly adjusted **Off-line Gate** remains visible

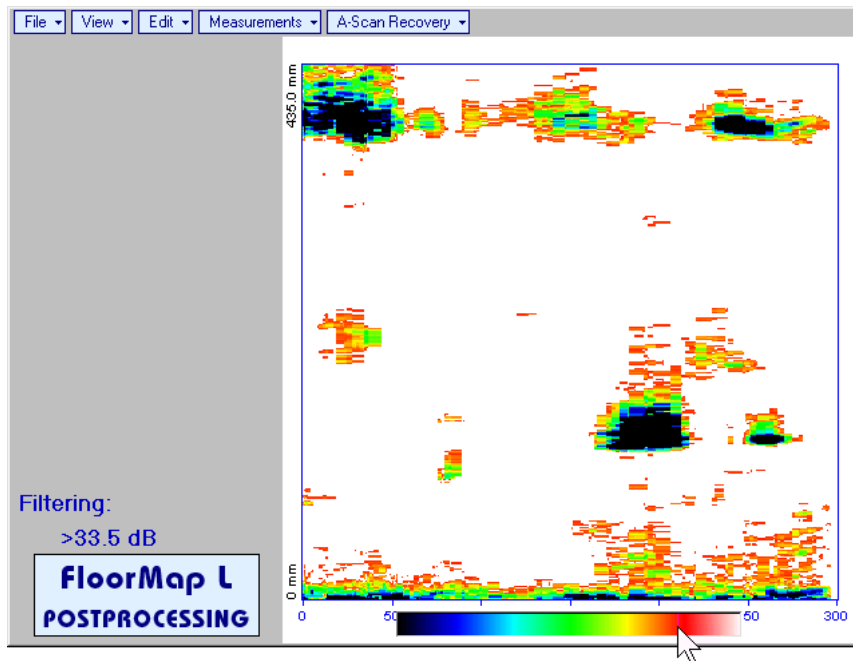


It is possible then to perform **A-Scan** signal evaluation using newly adjusted **Off-Line Gate** through **A-Scan Recovery** → **ON**



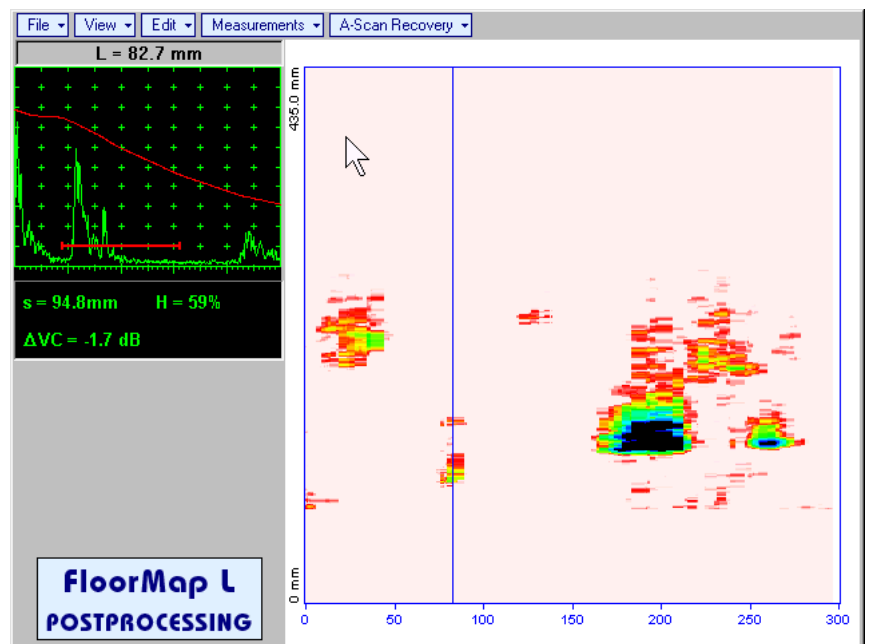
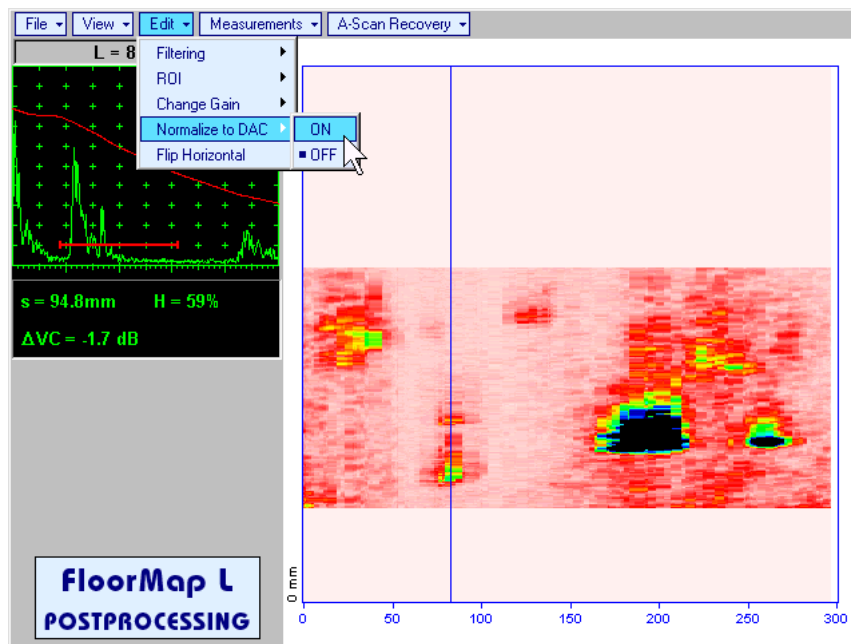
- **Edit**→**ROI**→**OFF** – negates **Off-line Gate** re-adjustment and returns to originally recorded **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image and initial **Off-line Gate** setting

- **Edit→Filtering→ON** – generates *amplitude palette bar* with *sliding cursor*, which may be controlled using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard . Position of the *sliding cursor* on the *amplitude palette bar* determines filtering level, which is indicated as **Filtering**. All elements of **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image representing signal amplitude below filtering level are suppressed:



- **Edit→Filtering→OFF** – returns to originally recorded **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image and removes **Filtering** indication

- **Edit→Normalize to DAC→ON** – applies **DAC/DGS** normalized color palette to **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image, which was recorded with active **DAC/DGS** and redraws **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image correspondingly (**dB to DAC/DGS** normalization)

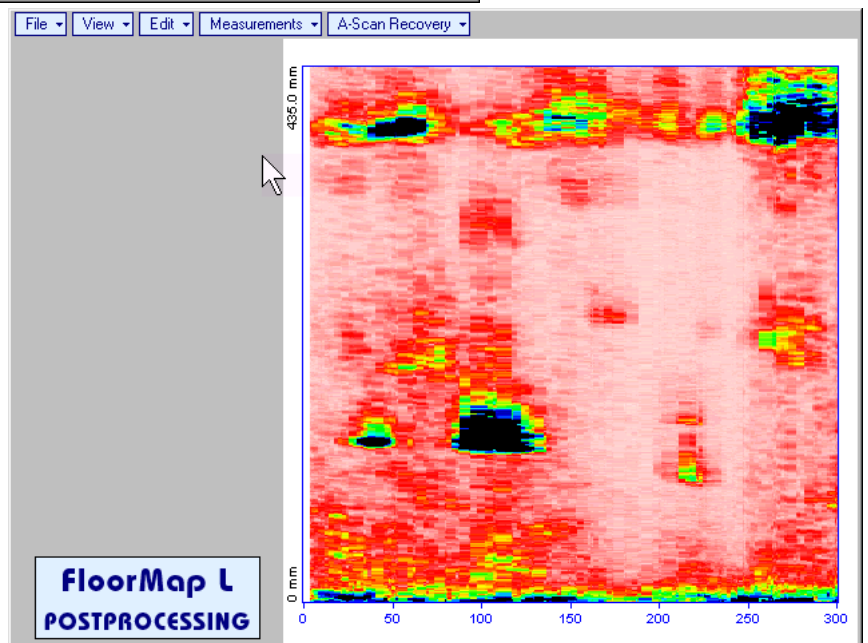
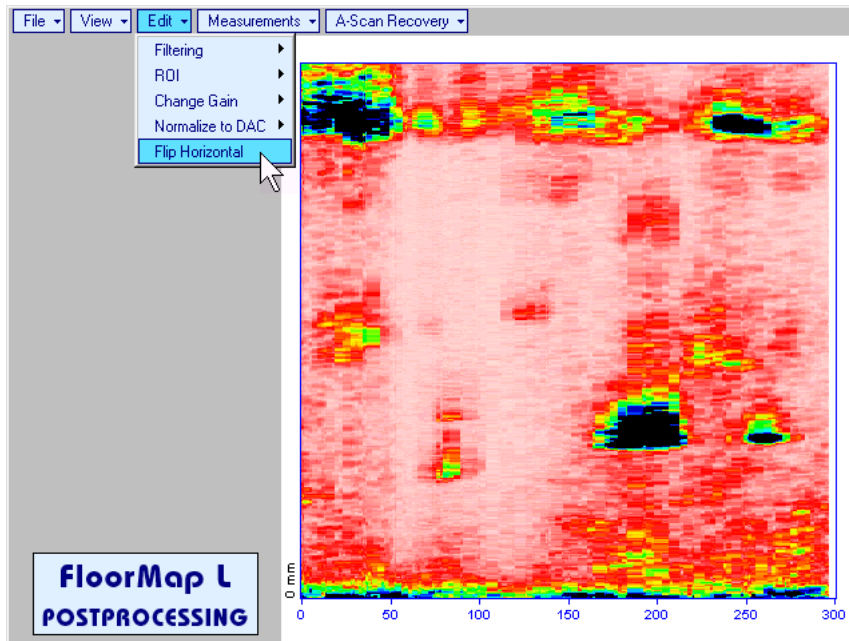


- **Edit→Normalize to DAC→OFF** – negates **dB to DAC/DGS** normalization and returns to originally recorded **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image








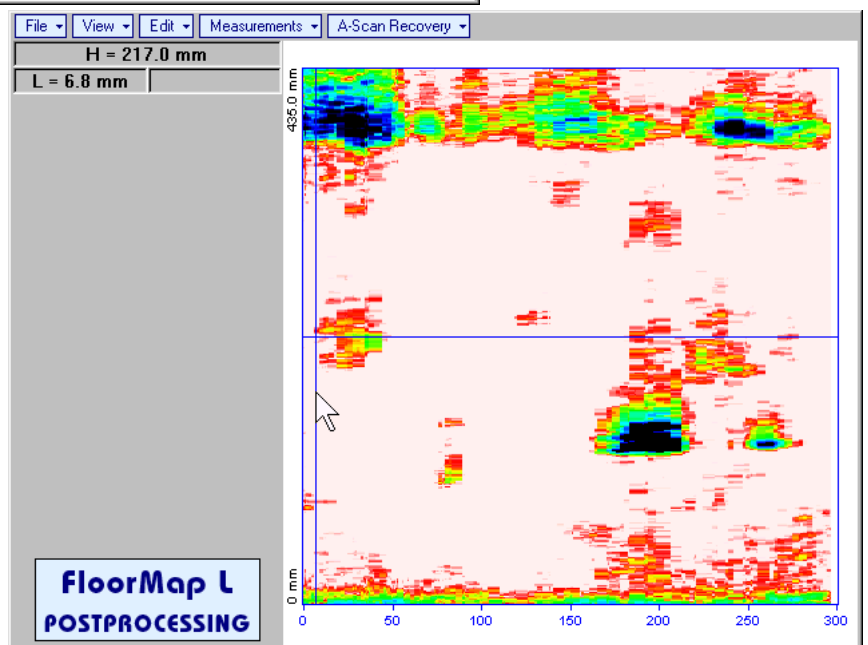
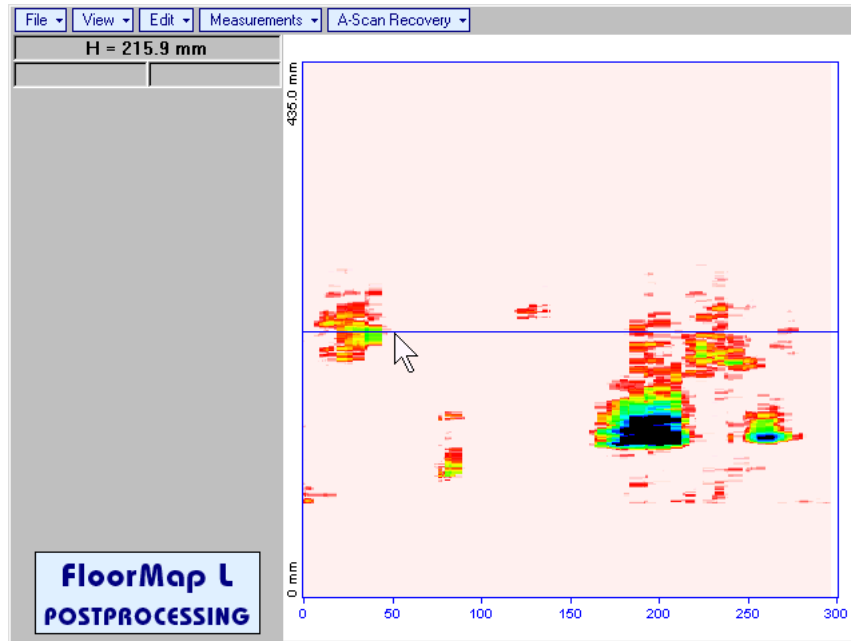
Applying of **Edit→Normalize to DAC→ON** or **Edit→Normalize to DAC→OFF** negates **Filtering (Edit→Filtering→OFF)**






- **Edit→Flip Horizontal** – reorders **A-Scans** captured during **t-FLOORMAP L / FLOORMAP L (CB-Scan)** recording in reverse succession and redraws **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image accordingly. This service function may be useful for merging scans of neighboring sections of an object, which were scanned in opposite direction due to access conditions, etc




Applying of **Flip Horizontal** function empties *postprocessing session memory stack*

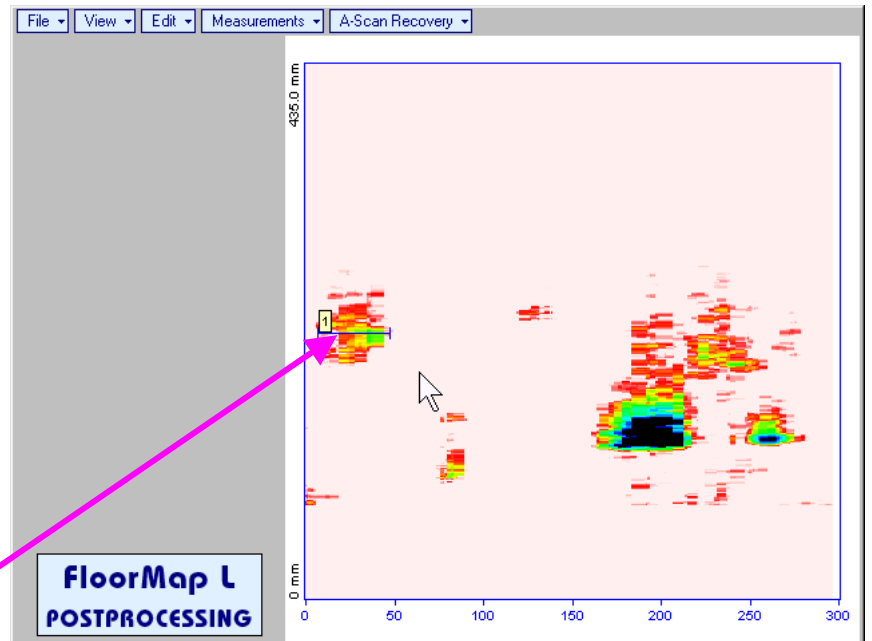
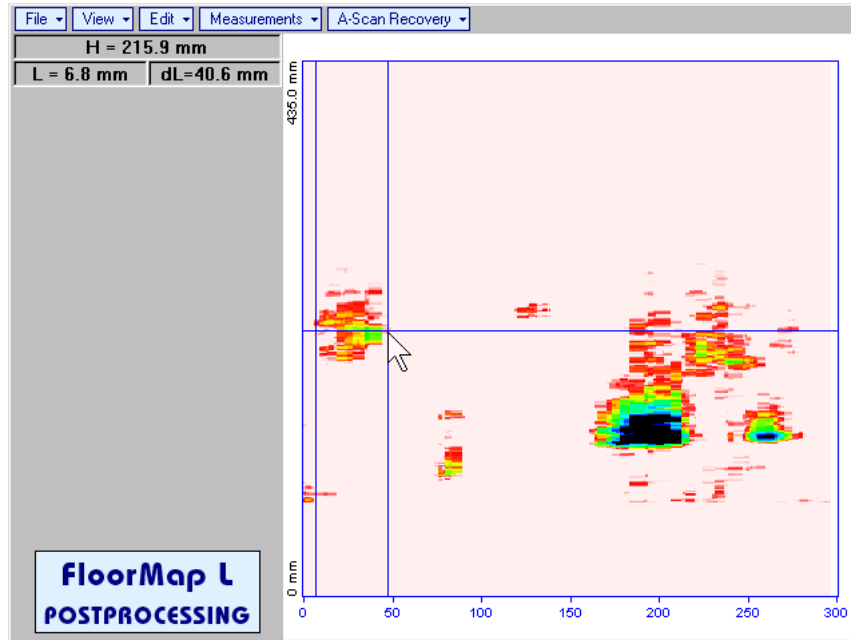
- **Measurements→Add Measure→Length** – generates horizontal cursor that may be guided over **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard . Horizontal cursor to be positioned over defect area, which's length along the scanning line to be evaluated. Position of horizontal cursor characterizes its coordinate (**H**) relatively scanning line. To fix position of horizontal cursor left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard



First vertical cursor appears upon fixing horizontal cursor, it may be guided over **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard . Coordinate of the first vertical cursor along **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image (**L**) is indicated synchronously. To fix position of the first vertical cursor left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard

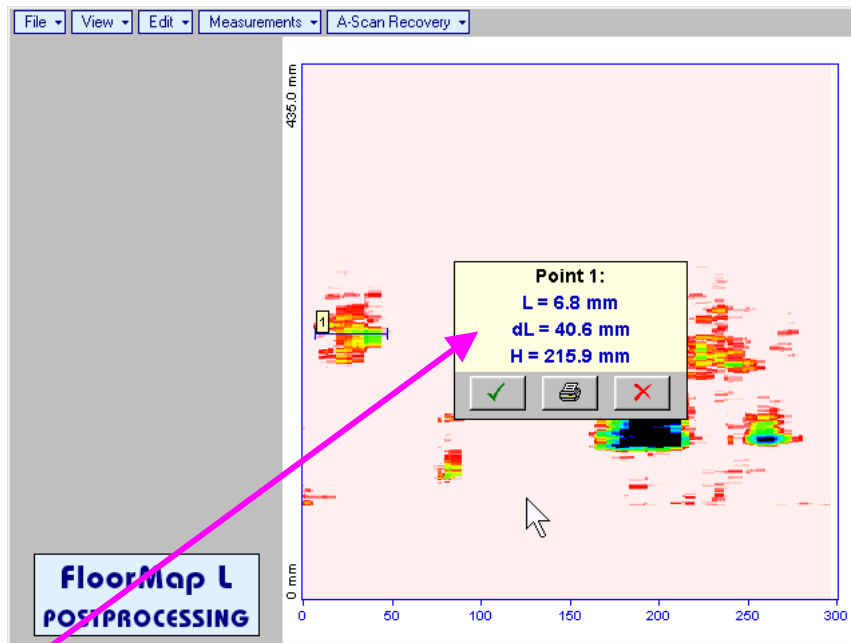
Second vertical cursor appears upon fixing first one, it may be manipulated by the same way. Coordinate of the second vertical cursor along **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image measured with relatively first vertical cursor (**dL**) is indicated synchronously, it represents projection length of defect area provided that vertical cursors are placed properly

To interrupt length measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard




Horizontal **length measurement mark** appears on the **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image upon fixing position of second vertical cursor


Length measurement results may be recalled through double click on the *length measurement mark*




In the **subwindow** appearing:





- **L** is coordinate of left end of the *length measurement mark*
- **dL** is length of defect area covered by *length measurement mark*
- **H** is distance between scanning line and *length measurement mark*

Clicking on  will print current screen snapshot accompanied with *length measurement mark* data

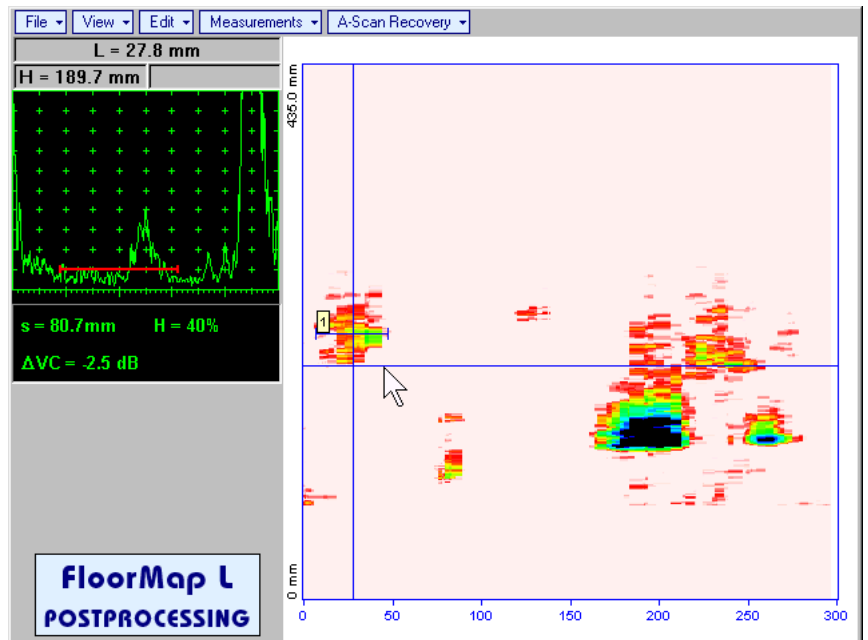
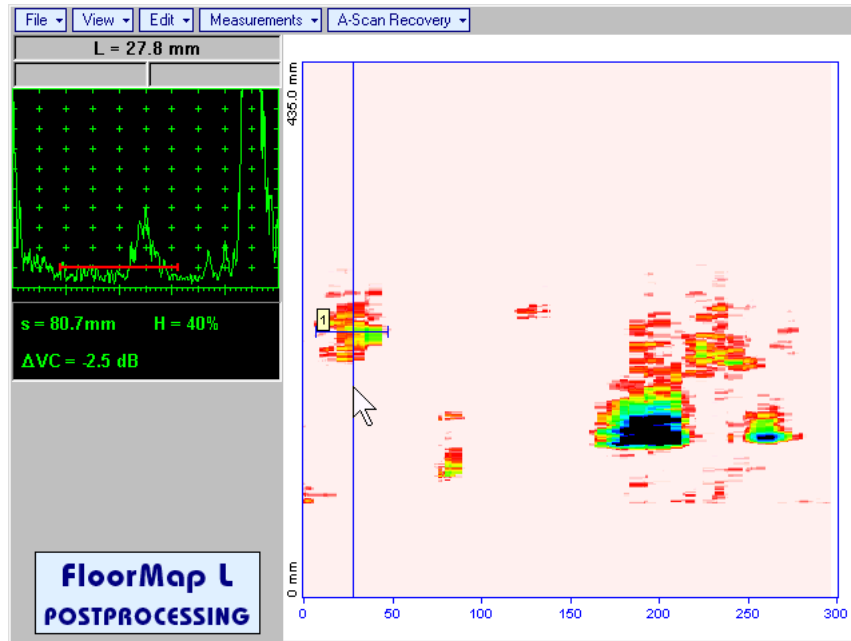
Clicking on  will hide subwindow with *length measurement mark* data

Clicking on  will hide subwindow with *length measurement mark* data and erase corresponding *length measurement mark*





- **Measurements**→**Add Measure**→**Width** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-FLOORMAP L / FLOORMAP L (CB-Scan)**


image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. Indication of starting position of cursor (**L**) corresponding to probe's center accompanies recovered **A-Scan**. *Sound path cursor* to be positioned over defect area, which's width along the sound path line to be evaluated. To fix position of *sound path cursor* left mouse click or release touch screen


stylus or press  on front panel keyboard or **Enter** on external keyboard

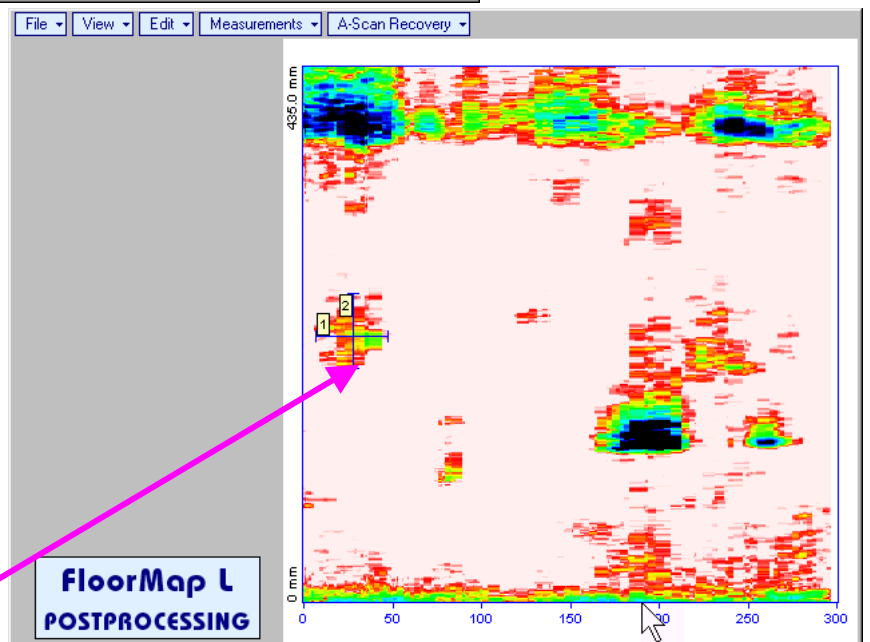
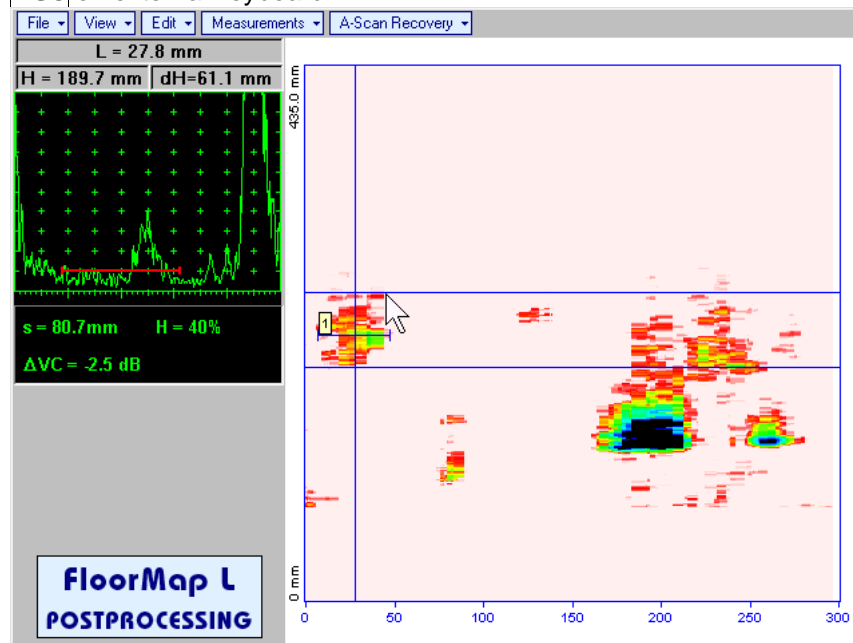


First horizontal cursor appears upon fixing *sound path cursor*, it may be guided over **t-FLOORMAP L /**

FLOORMAP L (CB-Scan) image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard . Coordinate of the first horizontal cursor along sound path (**H**) is indicated synchronously

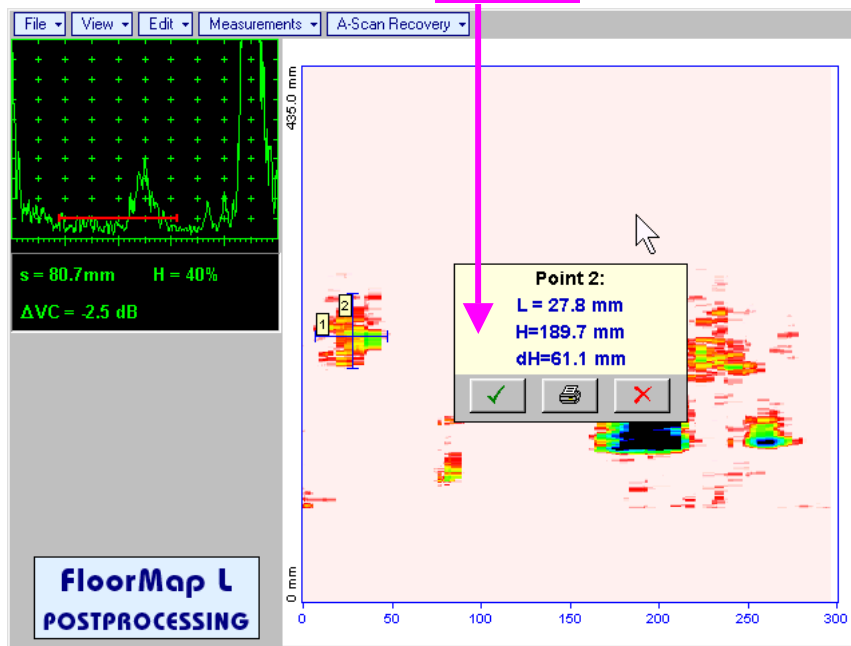
To fix position of the first horizontal cursor left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard . Second horizontal cursor appears upon fixing first one, it may be manipulated by the same way. Coordinate of the second horizontal cursor along sound path measured with relatively first horizontal cursor (**dH**) is indicated synchronously, it represents projection with of defect area provided that horizontal cursors are placed properly. To interrupt width

measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard




Vertical **width measurement mark** appears on the **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image upon fixing position of second horizontal cursor

Width measurement results may be recalled through double click on the *width measurement mark*. This causes appearance of corresponding A-Scan and **subwindow**




In the subwindow appearing:

- **L** is coordinate of the *width measurement mark* along scanning line
- **H** is distance between scanning line and *width measurement mark*
- **dH** is width of defect area covered by *width measurement mark*

Clicking on  will print current screen snapshot accompanied with *width measurement mark* data

Clicking on  will hide subwindow with *width measurement mark* data

Clicking on  will hide subwindow with *width measurement mark* data and erase corresponding *width measurement mark*

- **Measurements** → **Clear Last** – erases last *length* or *width measurement mark* placed on the **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image
- **Measurements** → **Clear All** – erases all *length* and *width measurement marks* placed on the **t-FLOORMAP L / FLOORMAP L (CB-Scan)** image

8. XY Scanning Recording and Imaging – General Notes

8.1. XY Scanning Recording and Imaging Menu

XY Scanning Recording and Imaging Menu is shown below:



ISONIC 2006 Applications field includes group of controls related to various inspections:

- **Straight beam Inspection**



Activates mode of operation covered by **MULTISCAN COMBO S** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 9.1 for operating instructions



Activates mode of operation covered by mode of operation covered by **MULTISCAN COMBO S CU** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 9.2 for operating instructions



Activates mode of operation covered by **CORROMAP** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 9.3 for operating instructions



Activates mode of operation covered by **CORROMAP CU** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 9.4 for operating instructions

- Angle beam weld inspection



Activates mode of operation covered by **I2-SONIC** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 10.1 for operating instructions



Activates mode of operation covered by **EXPERT** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 10.7 for operating instructions



Activates mode of operation covered by **SMPipe** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 10.5 for operating instructions



Activates mode of operation covered by **NOZZLE** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 10.6 for operating instructions



Activates mode of operation covered by **PLCROSS** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 10.2 for operating instructions



Activates mode of operation covered by **CIRCROSS** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 10.3 for operating instructions



Activates **CORROMAP CU** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 10.4 for operating instructions



Activates mode of operation covered by **TRANSCAN** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 10.8 for operating instructions

- Long range Inspection



Activates mode of operation covered by **FLOORMAP** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 11 for operating instructions












- TOFD Inspection



Activates mode of operation covered by **TOFD** license. Refer to paragraph 3.4 of this Operating Manual for brief characteristics and to paragraph 12 for operating instructions

In order to activate a mode of operation click on its button











OR

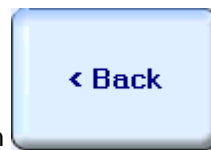
select mode using , , ,  or  on front panel keyboard or , , ,  or **F7** on external keyboard then press  or  on front panel keyboard or press **F8** or **Enter** on external keyboard – selected mode is indicated through framing of it's icon and name as it is shown below:



To enter postprocessing mode click on

OR

select this button using , , ,  on front panel keyboard or , , ,  on external keyboard then press  or  on front panel keyboard or press **F8** or **Enter** on external keyboard



To return to **Main Recording and Imaging Menu** click on

OR

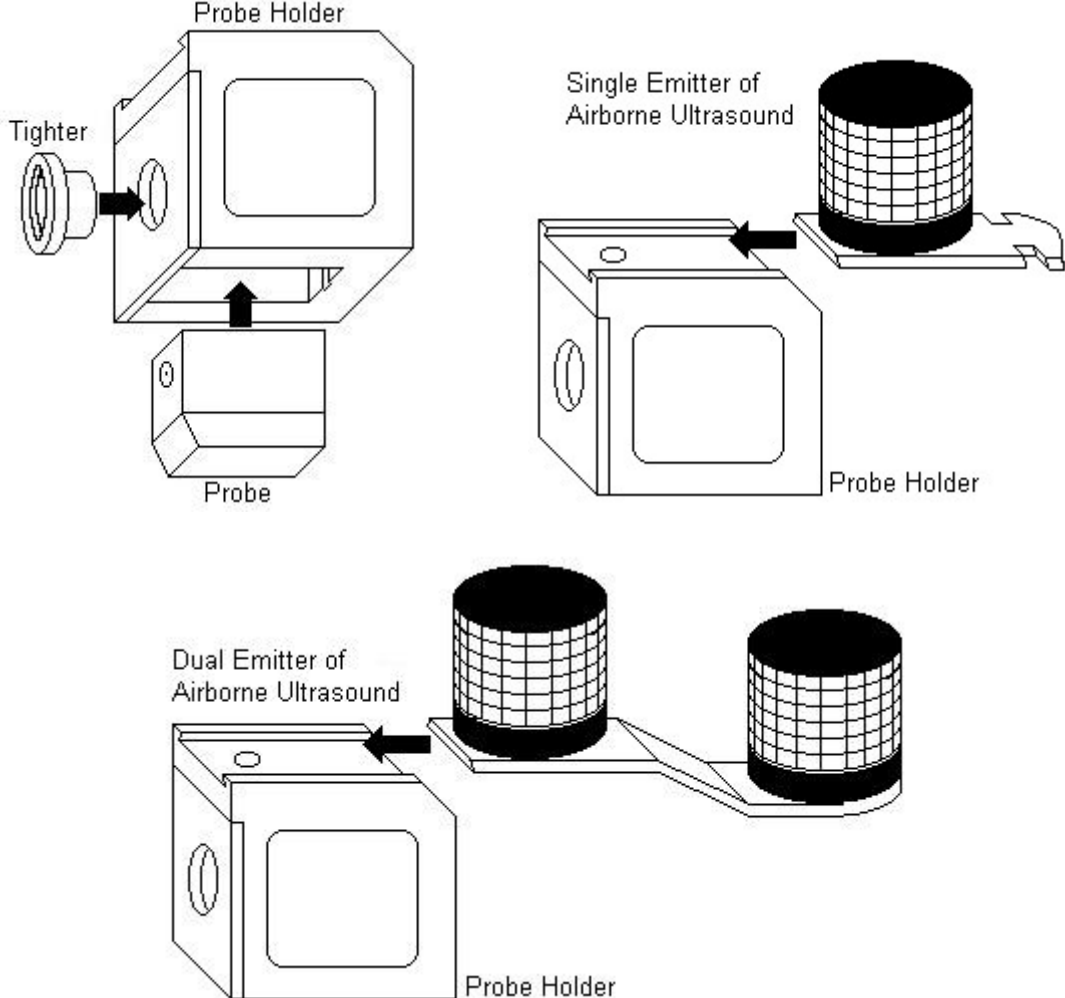
press  on front panel keyboard or **Esc** on external keyboard

OR

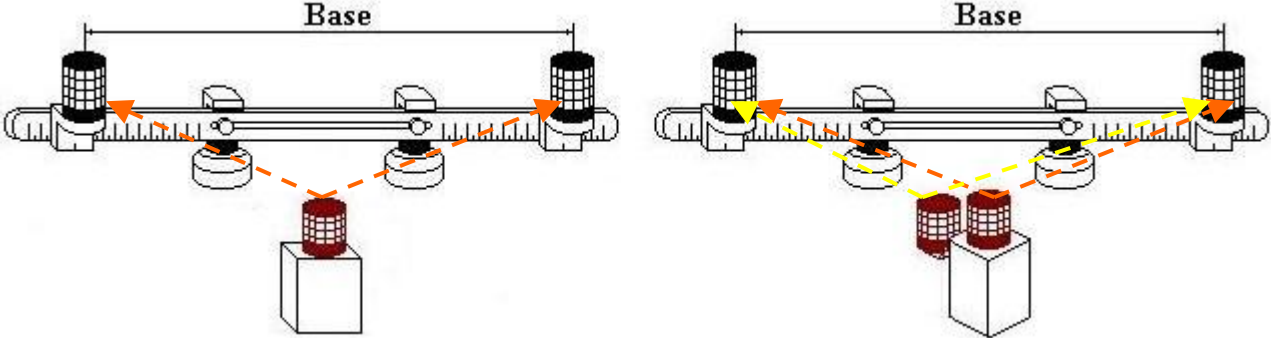
select this using , , ,  on front panel keyboard or , , ,  on external keyboard then press  or  on front panel keyboard or press **F8** or **Enter** on external keyboard

8.2. Airborne Ultrasound Encoder of Probe Position and Orientation (Swiveling Angle)

In **ISONIC 2006** instrument encoding of manually manipulated ultrasonic probe position and orientation during XY scanning is provided by means of airborne ultrasound. To perform XY scanning probe is fitted into appropriate probe holder, equipped with detachable single or dual emitter of airborne ultrasound:



Operator grips probe holder and manipulates it over scanning area whilst probe is applied to object under test. Emitter of airborne ultrasound produces pulses, which propagate around in the air. For standard XY scanning applications there are two receivers of airborne ultrasound placed near scanning area to pickup signals produced by emitter of airborne ultrasound. Distance between receivers of airborne ultrasound (**Base**) is determines width of scanning area, it must be entered into **ISONIC 2006** instrument prior to scanning. Receivers of airborne ultrasound are mounted on the graded bar with magnetic clamps or vacuum cups ensuring placement on variously oriented surfaces:



ISONIC 2006 instrument determines probe coordinates through detecting travel time for airborne ultrasound propagating between emitter and receivers followed by real time triangulation. Probe orientation (swiveling angle) may be additionally determined if using dual emitter of airborne ultrasound – for that purpose detecting travel time and triangulation are provided for both emitting elements displaced at predetermined distance from each other

Scanning of ferromagnetic materials – magnetic clamps



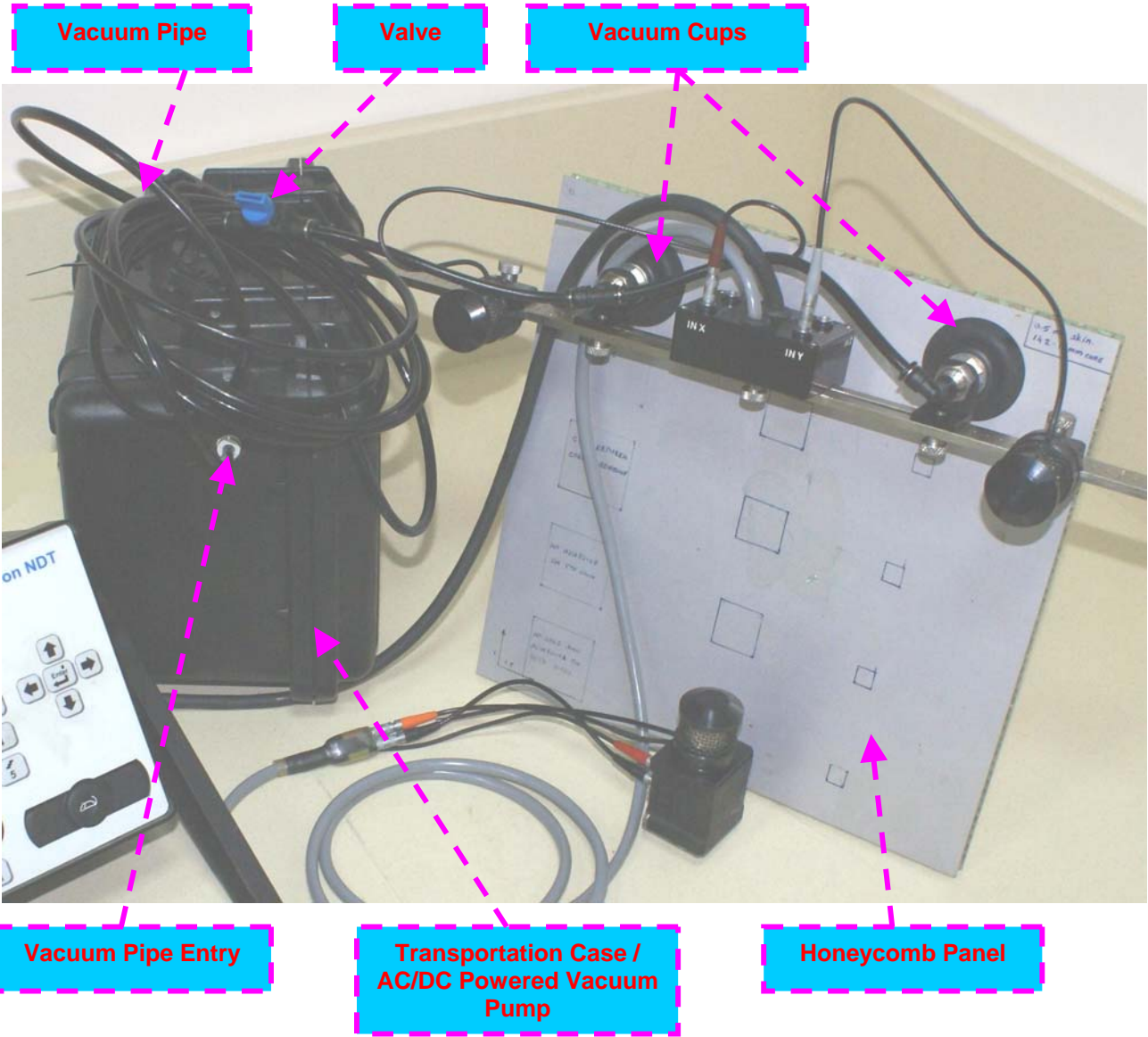
Airborne ultrasound based encoding of probe position only



Airborne ultrasound based encoding of probe position and swiveling angle

Scanning of non-magnetic materials – pumped vacuum cups

Airborne ultrasound based encoding of probe position





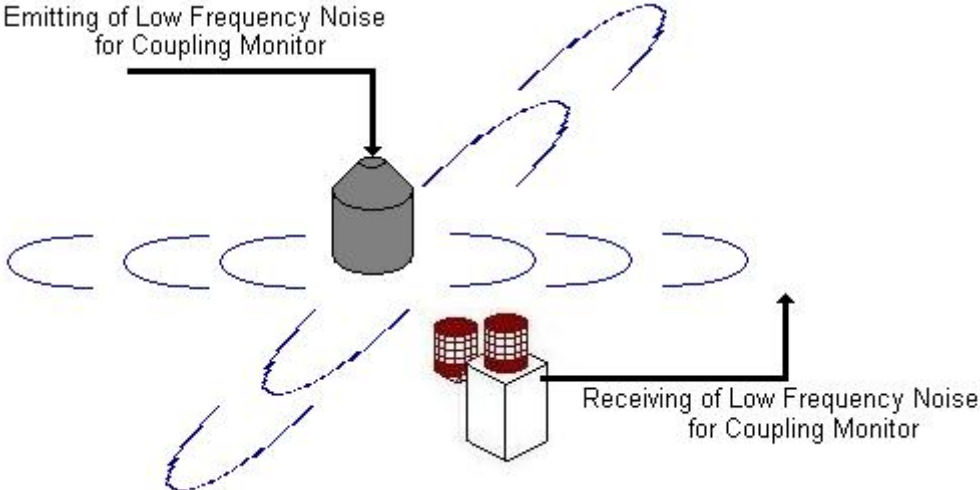
- ◆ It is necessary to grip probe holder providing open space around emitting element airborne ultrasound



- ◆ Airborne ultrasound velocity and zero offset must be properly calibrated according to Chapter 14 of this Operating Manual
- ◆ Use of two receivers of airborne ultrasound allows determining of probe position and orientation on flat, quasi-flat, tubular, and quasi-tubular, round, and quasi-round surfaces. For non flat surfaces software application requires keying-in of curvature diameter (radius) at setup time
- ◆ In **ISONIC 2006** instrument is featured with third input of airborne ultrasound for implementation of special inspection software packages related to scanning on complex geometry objects

8.3. Coupling Monitor

There is coupling monitor channel in **ISONIC 2006** instrument, which generates low frequency noise signal emitted into object under test by appropriate emitter. Low frequency noise saturating volume of object under test is available for pick up by probe at any point of scanning area. Coupling monitor signal received by probe is converted into electrical input in probe holder and delivered to dedicated input of **ISONIC 2006** instrument



ISONIC 2006 instrument analyses level of received low frequency noise and provides perceptible indication and recording during XY scanning

8.4. Cabling for XY Scanning and Recording

Umbilical cable S 70200 (or S 70200 HT) is necessary to perform XY Scanning and recording

8.4.1. Instrument

8.4.1.1. Use of Single Element Probe

- ◆ Red Plug → Red Socket
- ◆ White Plug → White Socket
- ◆ Black Socket is FREE



8.4.1.2. Use of Dual Probe or Two Single Element Probes for Through-transmission Inspection

- ◆ Red Plug → Red Socket
- ◆ White Plug → Black Socket
- ◆ White Socket is FREE



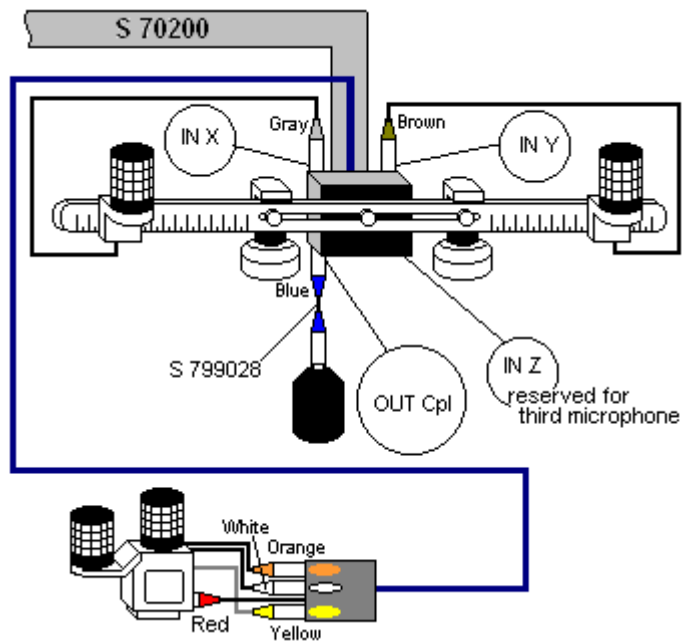
8.4.2. Airborne Ultrasound Encoder, Coupling Monitor, and Probe

8.4.2.1. Use of Single Element probe and Dual Emitter of Airborne Ultrasound

- ◆ Receivers of airborne ultrasound → sockets **IN X** and **IN Y**
- ◆ Emitter of low frequency noise → socket **Out Cpl** through **cable S 799028** with **Blue** jacketed plugs
- ◆ Socket **IN Z** is **FREE** for standard XY Scanning applications
- ◆ **Red** plug → Ultrasonic probe
- ◆ **Orange** plug → **Orange** marked socket
- ◆ **White** plug → **White** marked socket
- ◆ **Yellow** plug → **Yellow** marked socket

If probe holder is not equipped with coupling monitor receiver then:

- **Yellow** plug does not exist and **Yellow** socket is **FREE**
- Socket **Out Cpl** is **FREE**, cable **S 799028** with **Blue** jacketed plugs and emitter of low frequency noise are not in use

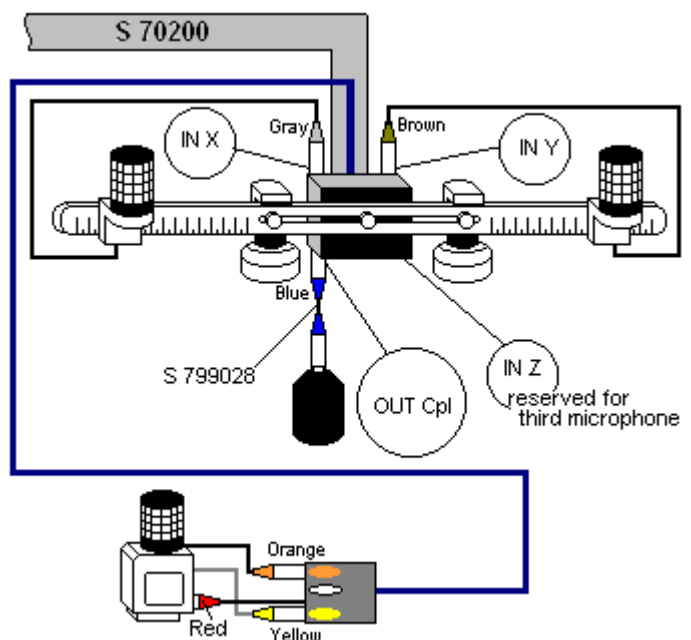


8.4.2.2. Use of Single Element Probe and Single Emitter of Airborne Ultrasound

- ◆ Receivers of airborne ultrasound → sockets **IN X** and **IN Y**
- ◆ Emitter of low frequency noise → socket **Out Cpl** through **cable S 799028** with **Blue** jacketed plugs
- ◆ Socket **IN Z** is **FREE** for standard XY Scanning applications
- ◆ **Red** plug → Ultrasonic probe
- ◆ **Orange** plug → **Orange** marked socket
- ◆ **White** marked socket is **FREE**
- ◆ **Yellow** plug → **Yellow** marked socket

If probe holder is not equipped with coupling monitor receiver then:

- **Yellow** plug does not exist and **Yellow** socket is **FREE**
- Socket **Out Cpl** is **FREE**, cable **S 799028** with **Blue** jacketed plugs and emitter of low frequency noise are not in use

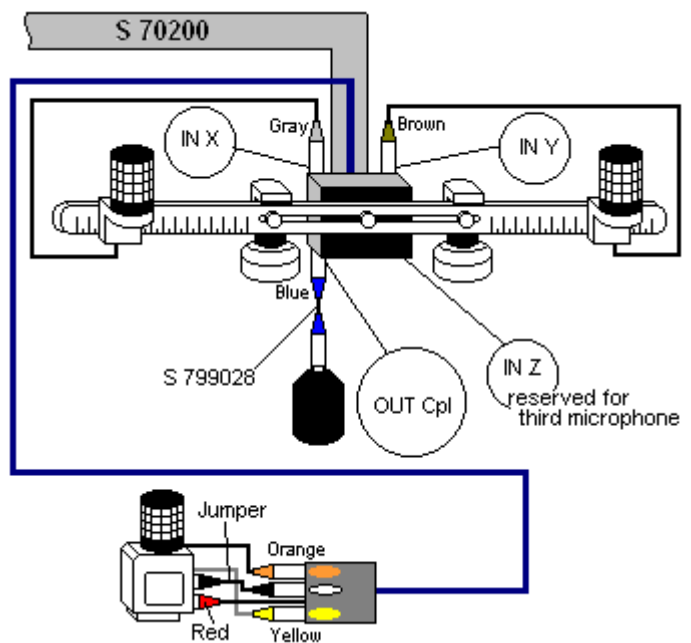


8.4.2.3. Use of Dual Element Probe and Single Emitter of Airborne Ultrasound

- ◆ Receivers of airborne ultrasound → sockets **IN X** and **IN Y**
- ◆ Emitter of low frequency noise → socket **Out Cpl** through **cable S 799028** with **Blue** jacketed plugs
- ◆ Socket **IN Z** is **FREE** for standard XY Scanning applications
- ◆ **Red** plug → **Emitting** element of ultrasonic probe
- ◆ **White** marked socket → **Receiving** element of ultrasonic probe through appropriate **Jumper**
- ◆ **Orange** plug → **Orange** marked socket
- ◆ **Yellow** plug → **Yellow** marked socket

If probe holder is not equipped with coupling monitor receiver then:

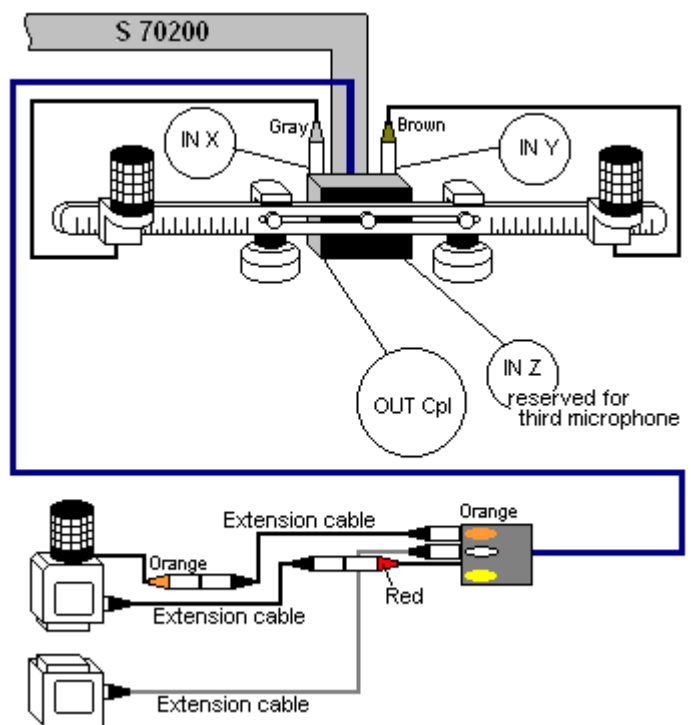
- **Yellow** plug does not exist and **Yellow** socket is **FREE**
- Socket **Out Cpl** is **FREE**, cable **S 799028** with **Blue** jacketed plugs and emitter of low frequency noise are not in use



8.4.2.4. Through-transmission Inspection – Two Single Element Probes and Single Emitter of Airborne Ultrasound

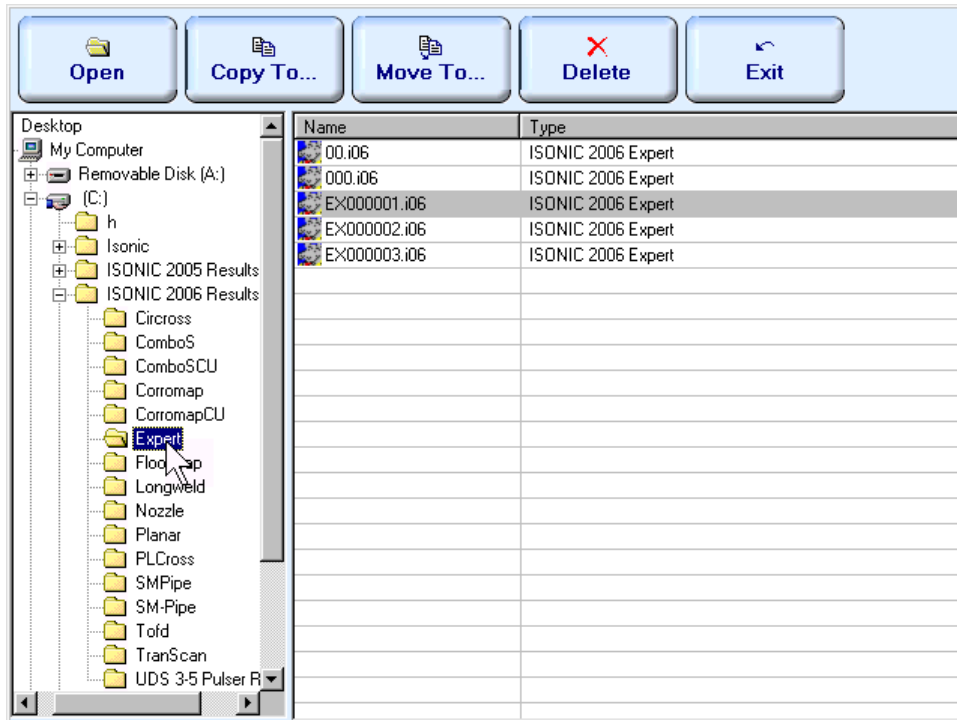
- ◆ Receivers of airborne ultrasound → sockets **IN X** and **IN Y**
- ◆ **Out Cpl** is **FREE**
- ◆ Socket **IN Z** is **FREE** for standard XY Scanning applications
- ◆ **Red** plug → **Emitting** ultrasonic probe through appropriate **Extension cable**
- ◆ **White** marked socket → **Receiving** ultrasonic probe through appropriate **Extension cable**
- ◆ **Orange** plug → **Orange** marked socket through appropriate **Extension cable**
- ◆ **Yellow** marked socket is **FREE**

Probes / probe holders to be placed into appropriate yoke to provide necessary concentricity during scanning






8.5. Off-line analysis (postprocessing) for XY Scanning records

While in postprocessing mode it is strictly recommended to use external USB mouse. **ISONIC 2006 XY Scanning Records Postprocessing** explorer window appears on entering into postprocessing mode

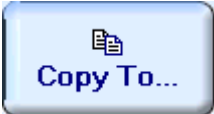




Left panel of **ISONIC 2006 XY Scanning Records Postprocessing** explorer window allows selecting of required directory (folder); right panel represents all XY scanning record files in selected folder, which are accompanied with name of mode used for inspection. To open record file for off-line analysis and reporting





double click on its name or mark file and click on  or press  or  on front panel keyboard or **F11** or **Enter** on external keyboard . Upon opening file off-line analysis (postprocessing) is possible in accordance with instructions related to corresponding XY scanning mode

Other functions

-  Copy marked file into a new location
-  Relocate marked file into a new location
-  Delete marked file (relocate into Recycle Bin)

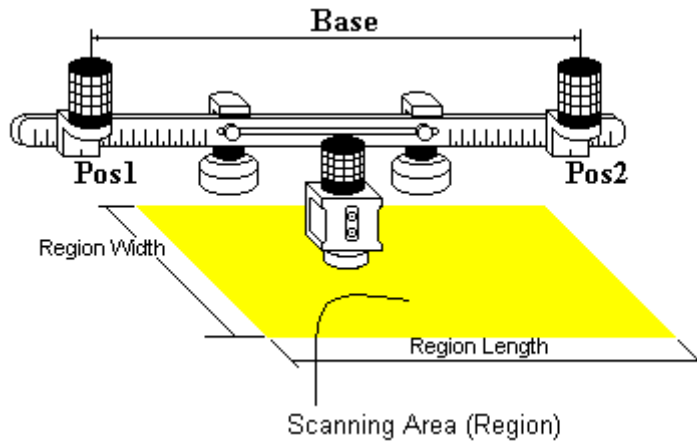


To return to **XY Scanning Recording and Imaging Menu** click on  or press  on front panel keyboard or **Esc** on external keyboard

9. XY Scanning and Recording for Straight Beam Inspection

9.1. Running MULTISCAN COMBO S Mode

9.1.1. Preparations



For *Pulse Echo* or *Back Wall Echo Attenuation* inspection insert ultrasonic probe into probe holder then fix single emitter of airborne ultrasound on the top of probe holder – refer to paragraph 8.2 of this Operating Manual

For *Through Transmission* inspection probes to be mounted into yoke – refer to paragraph 9.3 of this Operating Manual

Provide cabling according to paragraph 8.4.2 of this Operating Manual

Apply bar with receivers of airborne ultrasound at parallel to selected side of rectangle probe manipulation area. Single emitter and receivers of airborne ultrasound located on the bar to be equally distanced from scanning surface level. Distance between two receivers of airborne ultrasound (**Base**) is defined as:

$$\text{Base} = B_0 + \text{Pos1} + \text{Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly;

B₀ is parameter of the bar:

- **B₀ = 200 mm / 8 in** for long bar (order code / part # S 2040 B)
- **B₀ = 100 mm / 4 in** for short bar (order code / part # S 86000)



Region Length = Base



Enter **MULTISCAN COMBO S** mode according to paragraph 8.1 of this Operating Manual

9.1.2. Description Data

In the **Describe the Object Under Test...** screen it is possible to key in description of object under test – this may be required for inspection report – use virtual keyboard generated on the touch screen or external keyboard:

To return back to **XY Scanning Recording and Imaging Menu** click on **Exit [4]** or press **4** or **ESC** on front panel keyboard or **F4** or **Esc** on external keyboard

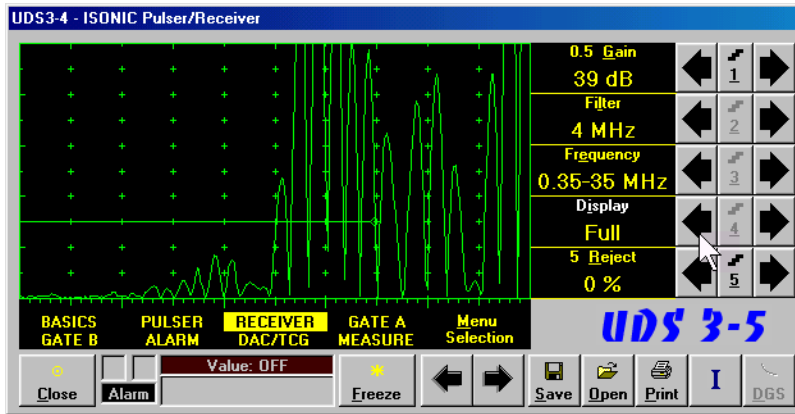
To continue click on **Next >** or press **I** on front panel keyboard or **F8** on external keyboard – **Inspection Data** screen appears allowing to key in data describing inspection process – this may be required for inspection report – use virtual keyboard generated on the touch screen or external keyboard

To return back to **XY Scanning Recording and Imaging Menu** click on **Exit [4]** or press **4** or **ESC** on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on **< Back [ESC]** or press **ESC** on front panel keyboard or **Esc** on external keyboard

To continue click on **Next >** or press **I** on front panel keyboard or **F8** on external keyboard – this will enter next stage related to calibration of **UDS 3-5** pulser receiver

9.1.3. Pulsar Receiver Settings



Calibration of **UDS 3-5 Pulsar Receiver** to be provided with reference to Chapter 5 and paragraphs 9.1.3.1 and 9.1.3.2 of this Operating Manual

To return to previous screen click on

 or press  on front panel keyboard or **Esc** or **<Alt>+<C>** on external keyboard

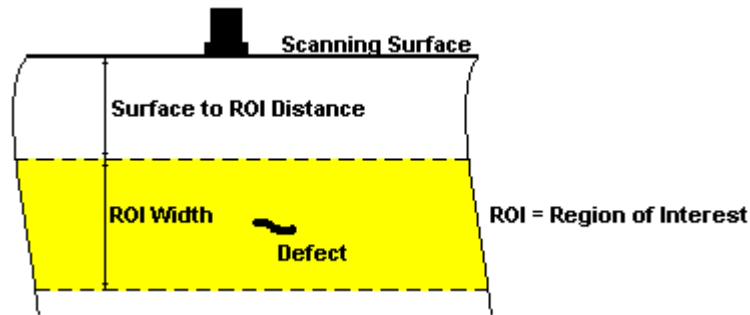
On completing calibration click on

 or press  on front panel keyboard or **F8** on external keyboard

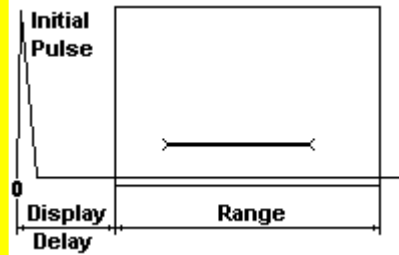
9.1.3.1. Pulse Echo

#	Parameter or Mode	Submenu	Required Settings	Note
1	aSwitch	GATE A	ON	
2	Gain	BASICS	Gain setting to be performed according to inspection procedure providing required echo heights from defects to be detected	
3	aThreshold	GATE A	aThreshold settings to provide echo heights from defects to be detected exceeding aThreshold; signals from other reflectors – not exceeding aThreshold	
4	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of inspection procedure	
5	Pulsar Mode	PULSER	Dual for dual element probes Single for single element probes	
6	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain and aThreshold setting procedures
7	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain and aThreshold setting procedures
8	Display	RECEIVER	Display setting may be either Full, RF, PosHalf, or NegHalf	The same Display mode to be used for both Probe Delay determining and MULTISCAN COMBO S Recording
9	USVelocity	BASIC	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	
10	Probe Delay	MEASURE	Probe Delay setting to be equal to actual probe delay	Probe delay may be determined according to paragraph 5.2.13.7 or 5.2.13.9 of this Operating Manual or similarly
11	Angle	MEASURE	Angle = 0°	
12	Meas Mode	MEASURE	Flank	
13	Range, Display Delay, AStart, aWidth	BASIC GATE A	Range, Display Delay, aStart, and aWidth settings to be performed with reference to below table Region of Interest for MULTISCAN COMBO S	
14	Settings for other parameters and modes have no significance			

Region of Interest for MULTISCAN COMBO S



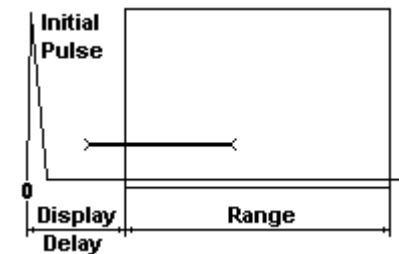
Case 1 – preferred embodiment



$$SRD = aStart$$

$$RW = aWidth$$

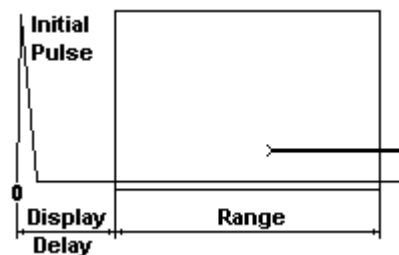
Case 2



$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

$$RW = aStart + aWidth - SRD$$

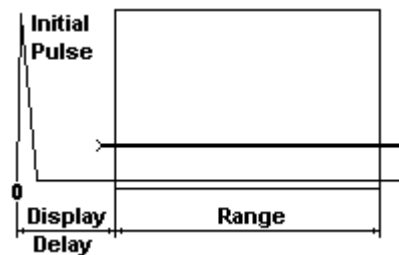
Case 3



$$SRD = aStart$$

$$RW = \frac{DisplayDelay}{2} \times USVelocity + Range - aStart$$

Case 4



$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

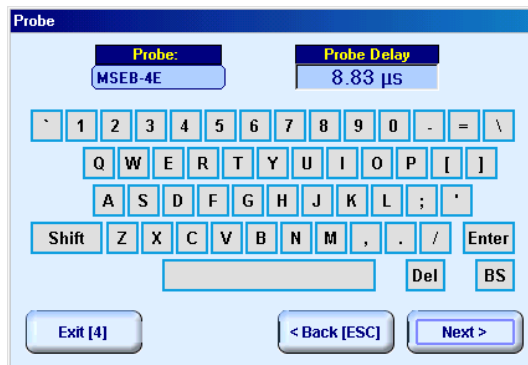
$$RW = Range$$




9.1.3.2. Back Wall Echo Attenuation and Through-Transmission



#	Parameter or Mode	Submenu	Required Settings	Note
1	Gain	BASICS	Gain setting to be performed according to inspection procedure providing required amplitude of back wall echo or through-transmitted signal	
2	aSwitch	GATE A	ON	
3	Range, Display Delay, aStart, aWidth	BASIC GATE A	Range, Display Delay, aStart, and aWidth settings to be performed to provide presence of back wall echo or through-transmitted signal on the A-Scan and time coincidence of evaluated signal with Gate A	
4	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of inspection procedure	
5	Pulser Mode	PULSER	Dual for dual element probes and for through-transmission inspection with use of two probes Single for single element probes	
6	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain setting procedures
7	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain setting procedures
8	Display	RECEIVER	Display setting may be either Full, RF, PosHalf, or NegHalf	
9	Settings for other parameters and modes have no significance			



9.1.4. Probe

Probe screen appears on completing calibration of **UDS 3-5 Pulsar Receiver**; it is necessary to key in probe name using either virtual keyboard generated on the touch screen or external keyboard. Value of **Probe Delay** is imported from settings of **UDS 3-5 Pulsar Receiver**



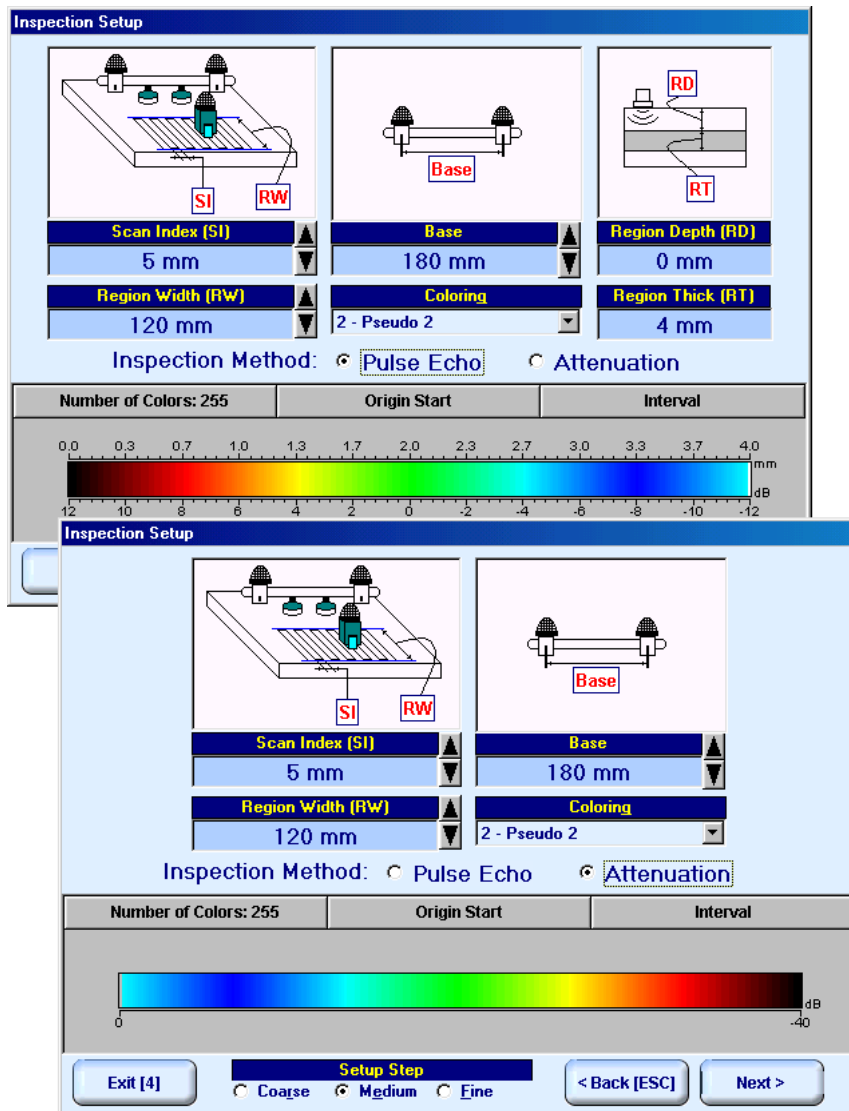
To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard – this will enter next stage related to defining inspection mode and scanning parameters


9.1.5. Inspection Modes and Scanning Parameters


Layout of **Inspection Setup** screen depends on option selected – it is necessary to check **Pulse Echo** or **Attenuation** in the **Inspection Method** field (click on). **Attenuation** mode is suitable for both back wall echo attenuation and through-transmission inspection





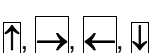


In the **Inspection Setup** screen it is necessary to key in:

- ❑ **Base** (distance between two receivers of airborne ultrasound), which defines length of rectangular scanning area – refer to paragraph 9.1.1 of this Operating Manual
- ❑ **Region Width**, which defines width of rectangular scanning area – refer to paragraph 9.1.1 of this Operating Manual
- ❑ **Scan Index** – value of **Scan Index** defining coverage of scanning area to be selected and entered according to inspection procedure

Setting of said parameters to be performed through clicking / pressing corresponding spin button  with **Fine**, **Medium**, or **Coarse** increments according to checked option (click on) in the **Setup Step** field

Alternatively parameter for setting may be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on its label. Label indicating name of selected parameter changes

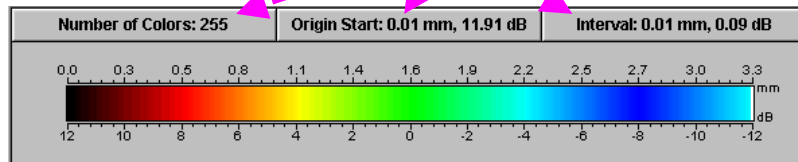
it's fore color from yellow to white – since that moment parameter may be modified using , , ,  on front panel keyboard or  on external keyboard

Values of **Region Depth (RD)** and **Region Thick (RT)** for pulse echo mode indicated in the **Inspection Setup** screen are defined by **Gate A** settings of **UDS 3-5 Pulsar Receiver**:

Region Depth (RD) = aStart

Region Thick (RT) = aWidth

Color scale (palette) representing signal amplitudes and defects coordinates may consist of up to 255 grades. Customizing is possible through corresponding **controls** (click on)



Style of palette (**Pseudo**, **Thermal**, or **Gray**) is selectable through clicking **on**:



To return back to **XY Scanning Recording and Imaging Menu** click on **Exit [4]** or press



or press

on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on **< Back [ESC]** or press



on front panel keyboard or **Esc** on external keyboard

To continue click on



or press












on front panel keyboard or **F8** on external keyboard

9.1.6. Coupling Monitor (Pulse Echo Mode Only)

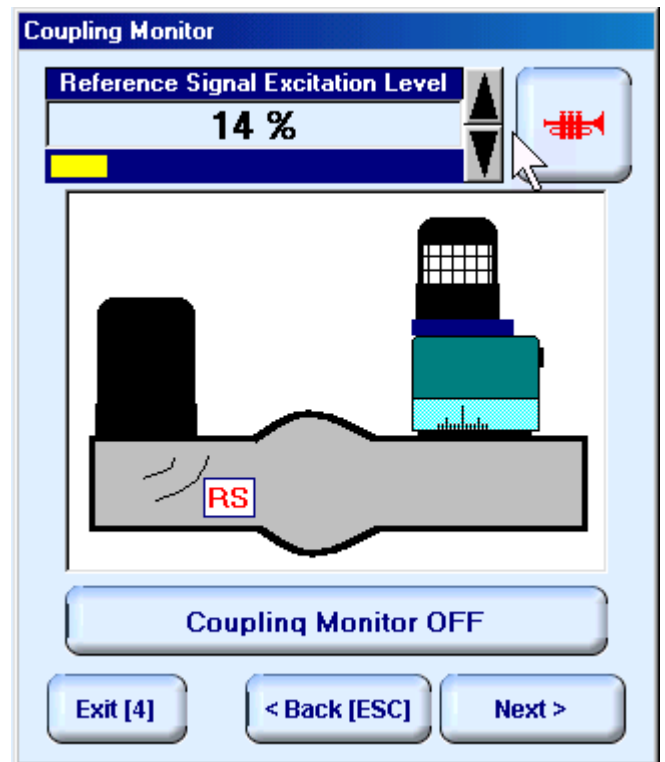
In the **Coupling Monitor** screen activation of coupling monitor to be performed through setting of **Reference Signal Excitation Level**

Setting of **Reference Signal Excitation Level** may be performed through clicking / pressing its spin


button  or through pressing , , ,  on front panel keyboard or , , ,  on external keyboard

To setup coupling monitor proceed as below:

- ❑ apply emitter of acoustic coupling monitor signal and probe with probe holder equipped with emitter of airborne ultrasound to object under test using excessive quantity of couplant
- ❑ find threshold of **Reference Signal Excitation Level**, which is perceptible trough changing color of horizontal bar indicator (red color means insufficient coupling or still low level of excitation) and audible alarm (if active)
- ❑ add 3% to 7% to found threshold value








To switch coupling monitor OFF click on  or set **0%** for **Reference Signal Excitation Level**



To switch ON / OFF audible alarm for insufficient coupling click on 



- ❑ If dimensions of object under test and / or its surface conditions don't allow reaching sufficient coupling indication even if value of **Reference Signal Excitation Level** is set to 100% then two or more emitters of acoustic coupling monitor signal must be connected to **Out Cpl** socket of **ISONIC** via appropriate splitter SE 20220
- ❑ **MULTISCAN COMBO S** supposes use of straight beam single element or dual probes. If geometry of object under test allows receiving of back wall echo then amplitude of back wall echo is automatically recognized as an additional parameter for coupling monitoring provided it is in coincidence with **Gate A**

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

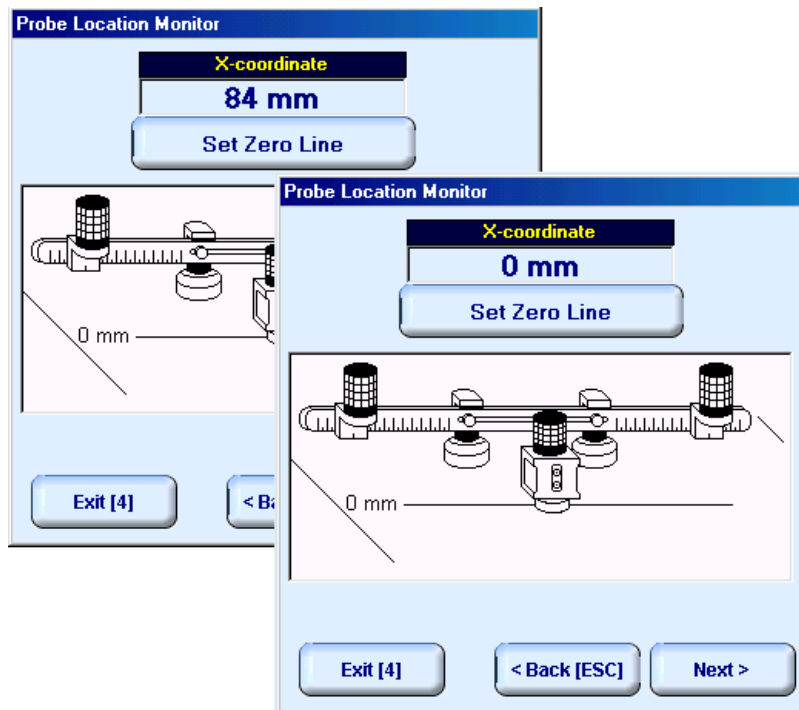
9.1.7. Referring Scanning Area (Zero Line)




Side of rectangle scanning area closest to bar with receivers of airborne ultrasound to be defined as **Zero Line** in the **Probe Location Monitor** screen: place probe equipped with emitter of airborne ultrasound above **Zero Line** – at this position absolute distance between bar and probe is indicated in **X-coordinate** box – then:



click on 



OR

select  using , , ,  or  on front panel keyboard or , , ,  or **F7** on external keyboard then press  on front panel keyboard or **Enter** on external keyboard



To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

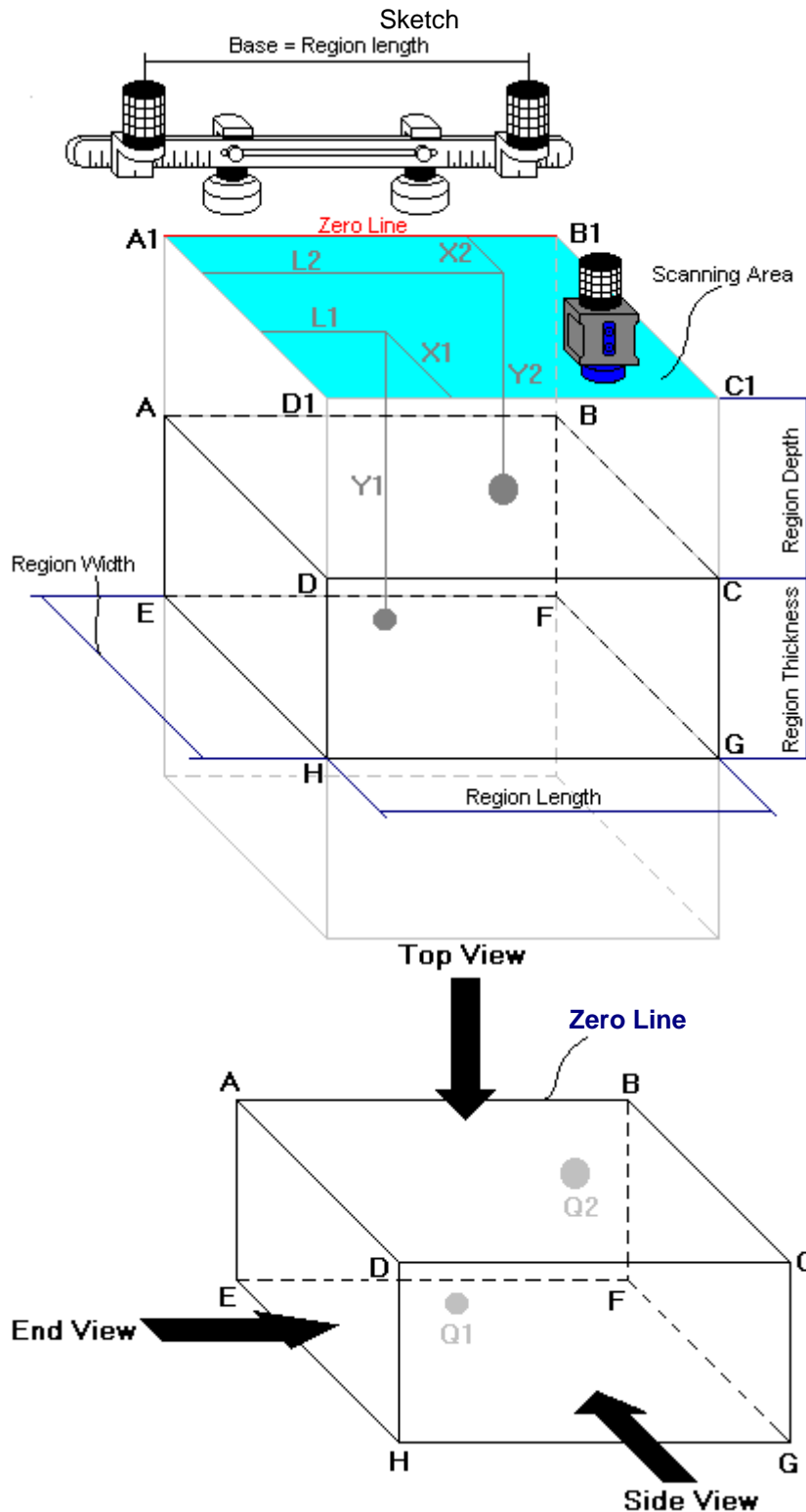
To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

9.1.8. Imaging Principles: Pulse Echo

##

1



- Q1 (L1, X1, Y1) – Internal Reflector 1
- Q2 (L2, X2, Y2) – Internal Reflector 2

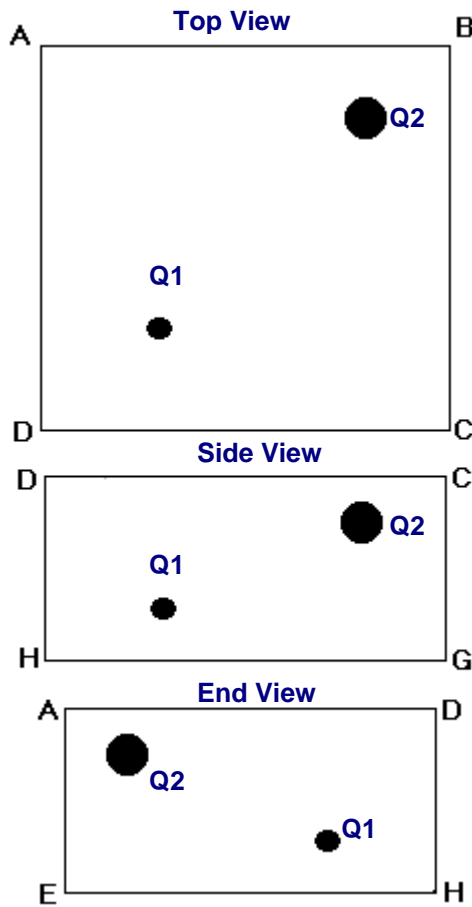
Note

General

- (a) Volume Under Test (**Region of Interest**) is located between two parallel rectangles namely ABCD and EFGH
- (b) Scanning is provided above surface of rectangle A1B1C1D1
- (c) Lines A1B1 and AB are parallel to line connecting receivers of airborne ultrasound. Position of lines A1B1 and AB with respect to said receivers is defined by setting up Zero Line as per paragraph 9.1.6 of this Operating Manual
- (d) With reference to **Inspection Setup** screen – Pulse Echo Mode (paragraph 9.1.4 of this Operating Manual):
 - A1A = Region Depth
 - AB = Region Length (Base)
 - AD = Region Width
 - DH = Region Thickness
- (e) In the present example it is supposed that there are two reflectors Q1 and Q2 in **Region of Interest**, said reflectors have different dimensions and coordinates

2

Sketch



Note

Global Top, Side, and End View

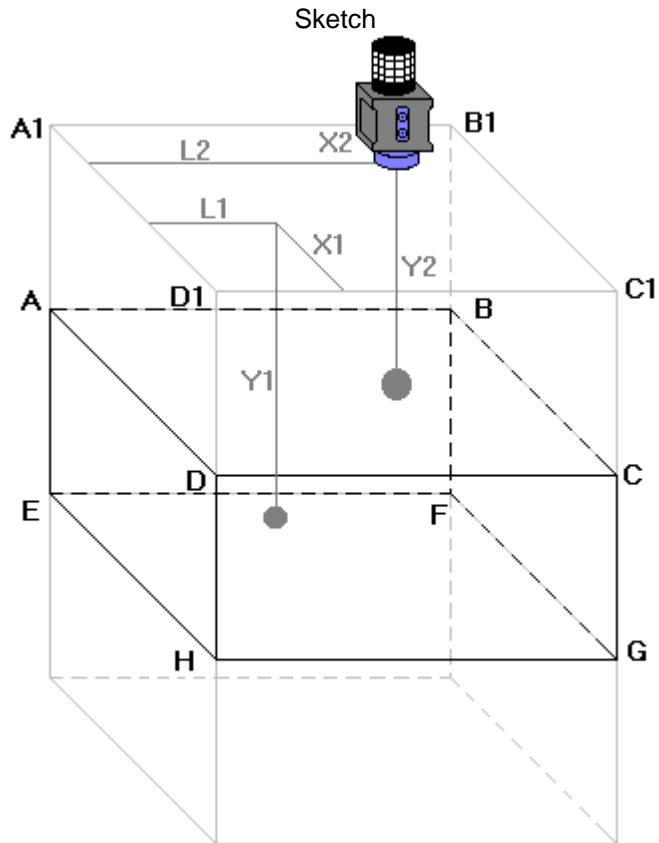
Supposing that scanning is well completed reflectors Q1 and Q2 will be detected and represented in global **Top, Side, and End View** according to sketch # 2

Global **Top View** is obtained through superimposing of parallel planes between rectangles ABCD and EFGH. Global **Top View** may be presented in two modes: *Depth Map* and *Amplitude Map*. *Amplitude Map* represents distribution of echo amplitude above scanning surface. *Depth Map* represents distribution of minimum reflector depth above scanning surface. Thanks to complete raw data storing technology implemented in **ISONIC 2006** it is possible to switch between Depth Map and Amplitude Map while scanning

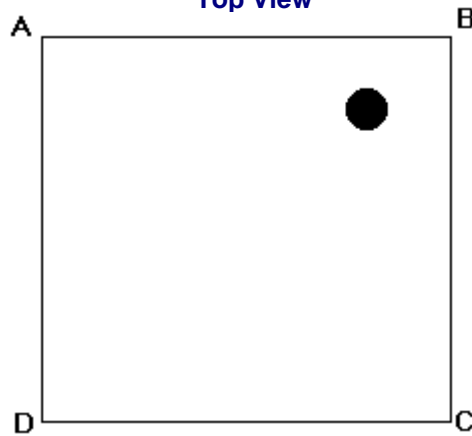
Global **Side View** and **End View** are orthogonal images composed through superimposing of corresponding cross sectional views along and across of whole **Region of Interest**. **Side View** and **End View** images represent distribution of highest echo amplitudes, depth of reflectors and their cross-sectional locations

Acquired data is converted into 3D-matrix allowing sectional presentation of **Top View, Side View** and **End View** during scanning – refer to below sketches ## 3 through 8

3



Top View



Note

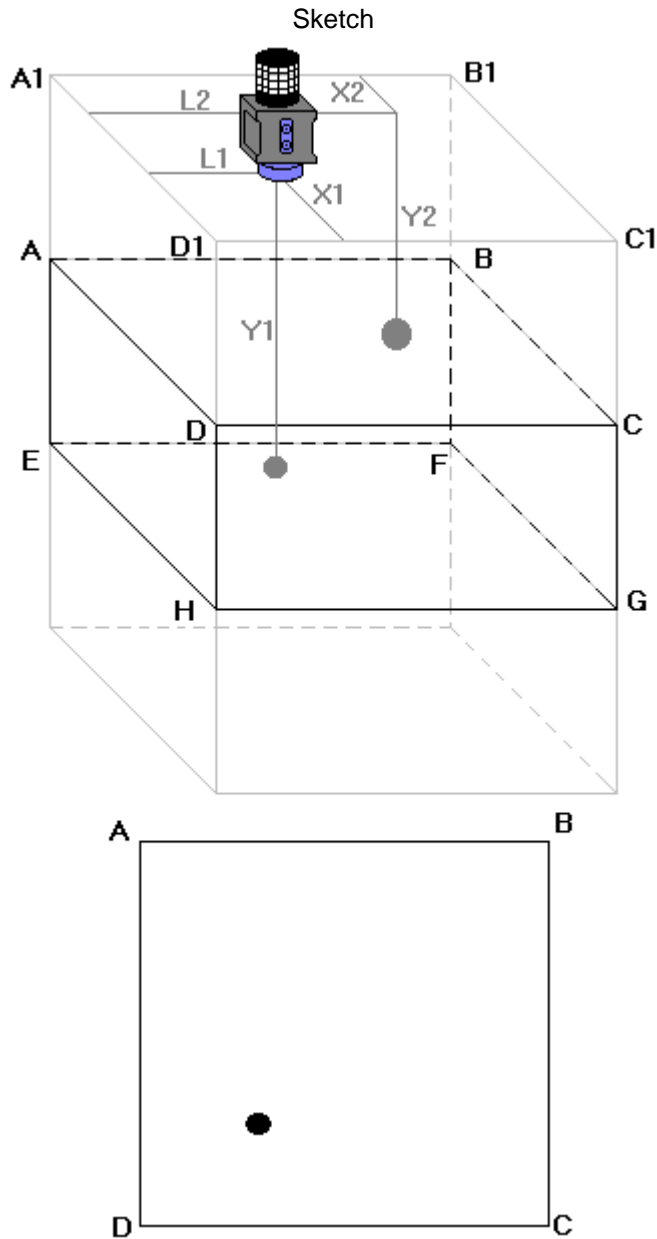
Sectional Top View
(Horizontal Slice)

Sketches ## 3 and 4 illustrate composing of sectional **Top View**

Top View section currently represented on **ISONIC 2006** screen corresponds to:

- current probe coordinates on scanning surface
- depth of reflector closest to probe on A-Scan obtained for current probe coordinates on scanning surface – **Top View** section represents horizontal slice at depth corresponding to reflector closest to probe

4



Note

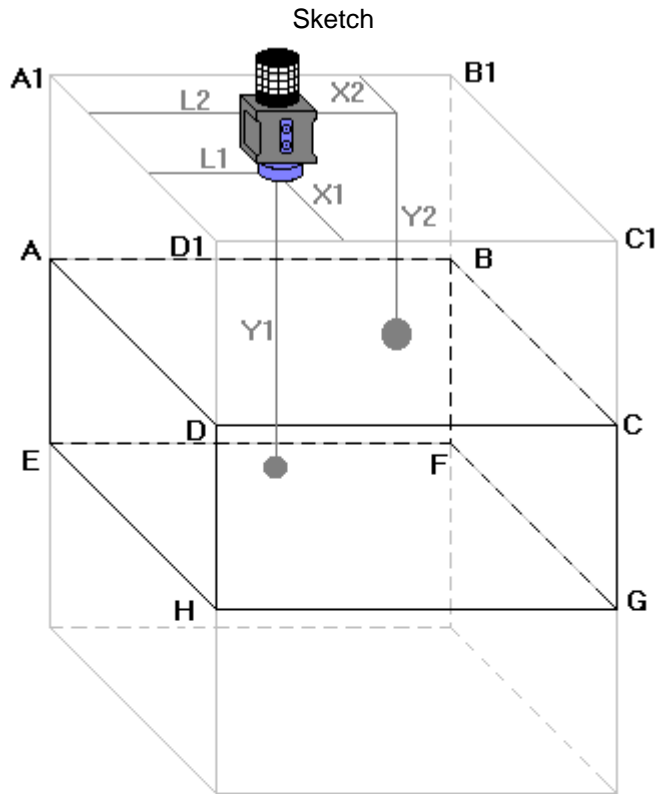
Sectional Top View
(Horizontal Slice)

Sketches ## 3 and 4 illustrate composing of sectional **Top View**

Top View section currently represented on **ISONIC 2006** screen corresponds to:

- current probe coordinates on scanning surface
- depth of reflector closest to probe on A-Scan obtained for current probe coordinates on scanning surface – **Top View** section represents horizontal slice at depth corresponding to reflector closest to probe

5



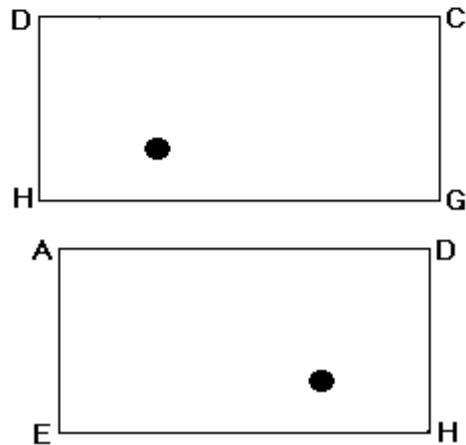
Note

Sectional Side and End View (Vertical Cut Slices)

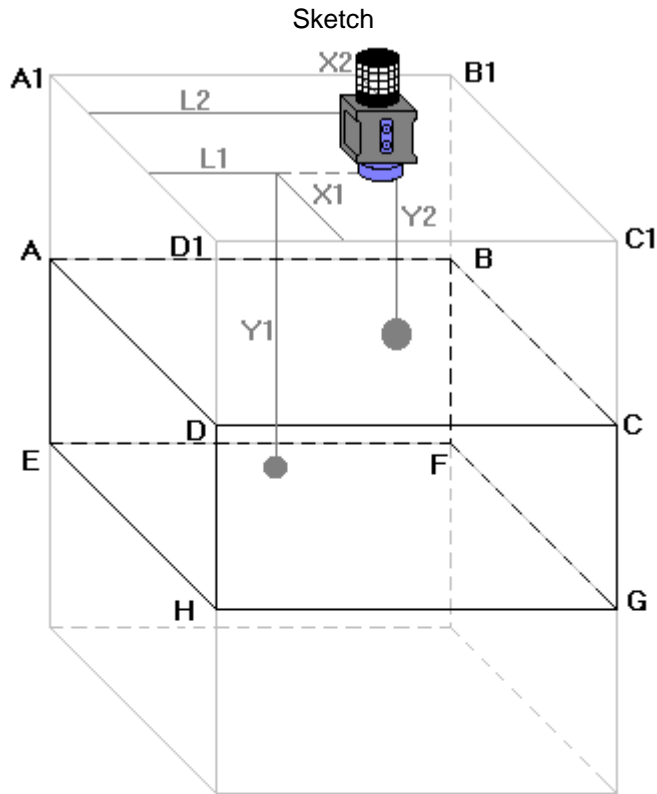
Sketches ## 5, 6, 7, and 8 illustrate composing of sectional **Side View** and **End View**

Side View section currently represented on **ISONIC 2006** screen corresponds to current **X**-coordinate of probe

End View section currently represented on **ISONIC 2006** screen corresponds to current **L**-coordinate of probe



6



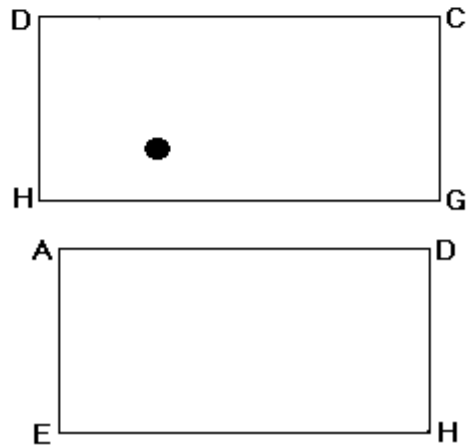
Note

Sectional Side and End View (Vertical Cut Slices)

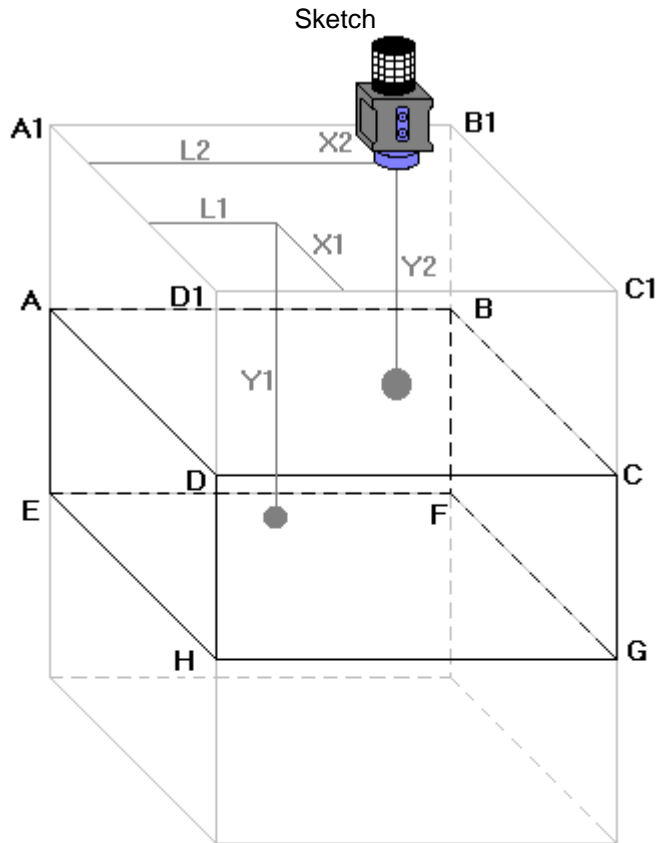
Sketches ## 5, 6, 7, and 8 illustrate composing of sectional **Side View** and **End View**

Side View section currently represented on **ISONIC 2006** screen corresponds to current **X**-coordinate of probe

End View section currently represented on **ISONIC 2006** screen corresponds to current **L**-coordinate of probe



7



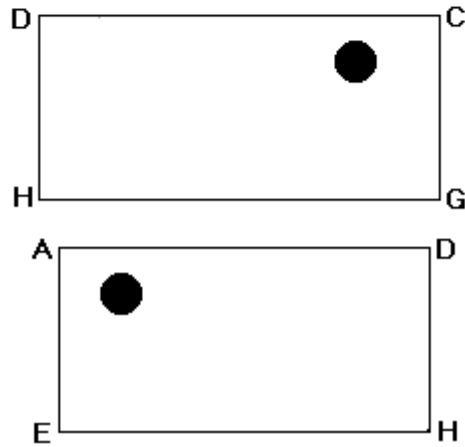
Note

Sectional Side and End View (Vertical Cut Slices)

Sketches ## 5, 6, 7, and 8 illustrate composing of sectional **Side View** and **End View**

Side View section currently represented on **ISONIC 2006** screen corresponds to current **X**-coordinate of probe

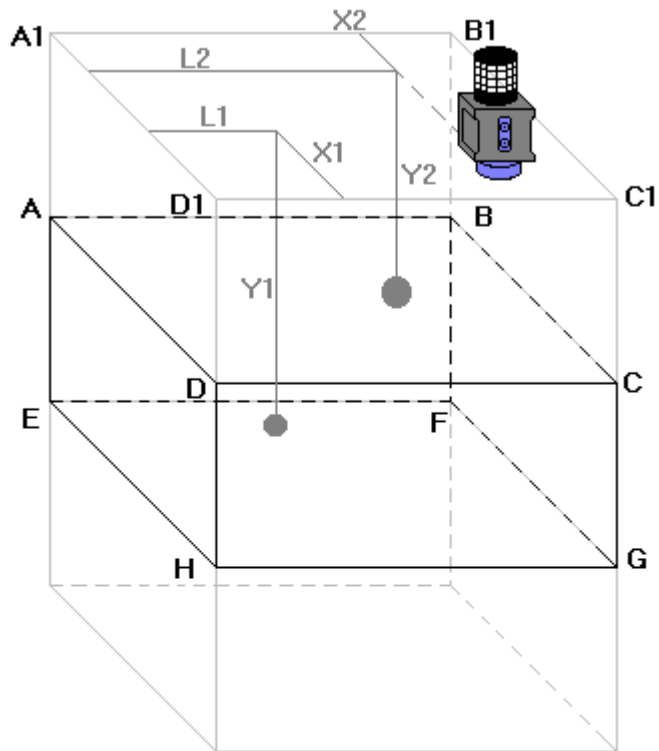
End View section currently represented on **ISONIC 2006** screen corresponds to current **L**-coordinate of probe



8

Sketch

Note

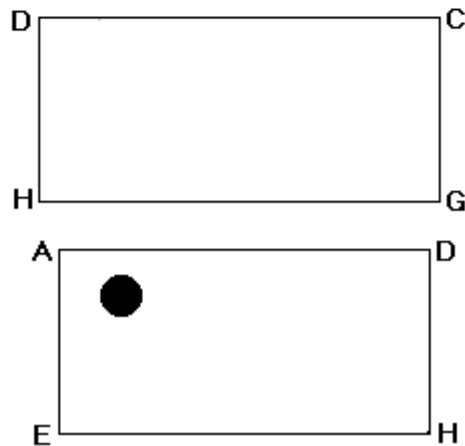


Sectional Side and End View (Vertical Cut Slices)

Sketches ## 5, 6, 7, and 8 illustrate composing of sectional **Side View** and **End View**

Side View section currently represented on **ISONIC 2006** screen corresponds to current **X**-coordinate of probe

End View section currently represented on **ISONIC 2006** screen corresponds to current **L**-coordinate of probe

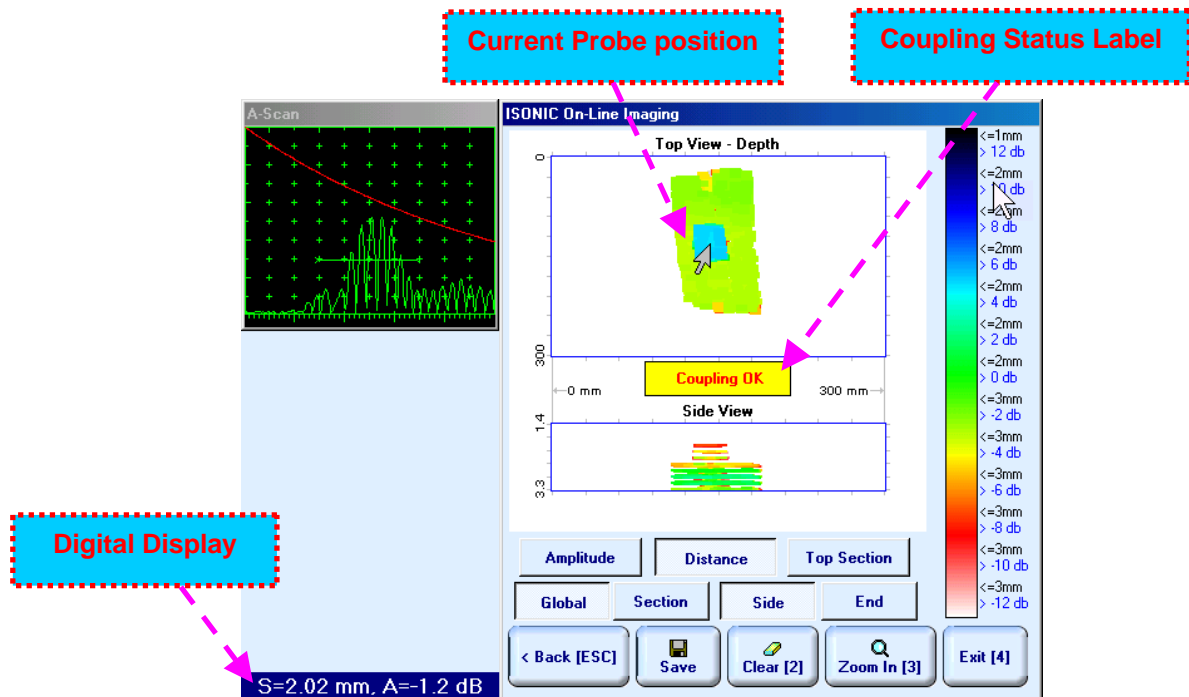


9.1.9. Imaging Principles: Attenuation


In attenuation mode it is generated *Amplitude Map* representing distribution of back wall echo amplitude or through transmission signal amplitude above scanning surface

9.1.10. Scanning: Pulse Echo

During scanning **ISONIC On-Line Imaging** screen is accompanied with **A-Scan** and **Digital Display** box




ISONIC On-Line Imaging screen represents:

- ❑ Current Probe Position
- ❑ Current Coupling Status (optionally, provided that coupling monitor is active – refer to paragraph 9.1.6 of this Operating Manual)
- ❑ **Top View:**
 - for **Amplitude** pressed down – *Global Amplitude Map*
 - for **Distance** pressed down – *Global Depth Map*
 - for **Top Section** pressed down – *Horizontally Sliced Amplitude Map* according to sketches ## 3 and 4 – paragraph 9.1.8 of this Operating Manual
- ❑ **Side View** for **Side** pressed down or **End View** for **End** pressed down or press  on front panel keyboard or **F7** on external keyboard to switch between **Side** and **End View**





Depending on which button is pressed – **Global** or **Section** – **Side View** and **End View** are presented either in global mode according to sketch # 2 – paragraph 9.1.8 of this Operating Manual or in sectional mode according to sketches ## 5, 6, and 7 – paragraph 9.1.8 of this Operating Manual







- ❑ All **A-Scans** are captured during scanning unconditionally however projection images **Top View**, **Side View**, and **End View** are updated only with signals exceeding threshold of **Gate A** presented on **A-Scan** however
- ❑ Highest amplitude and minimal sound path are dominant while recording data into **Top View – Amplitude** and **Top View – Distance** correspondingly
- ❑ **Map Repair Function** is active while keeping pressed  on front panel keyboard or **F8** on external keyboard – new readings will overwrite already recorded data unconditionally; this allows record correction after finding some non-relevant data recorded with dominance

Digital Display represents:

- ❑ coordinate (sound path **S**) of reflector generating first signal in the **Gate A** (measurement mode – **Flank**)
- ❑ amplitude **A** of maximal signal exceeding threshold of **Gate A**, which is expressed in **dB** referred either to **DAC** (if active) or to **50% of A-Scan height** level

To Zoom In **ISONIC On-Line Imaging** screen click on  or press  on front panel keyboard or **F3** on external keyboard. To Zoom Out click on  or press  on front panel keyboard or **Esc** on external keyboard

To cleanup **Top View**, **Side View**, and **End View** fields in **ISONIC On-Line Imaging** screen click on  or press  on front panel keyboard or **F2** on external keyboard

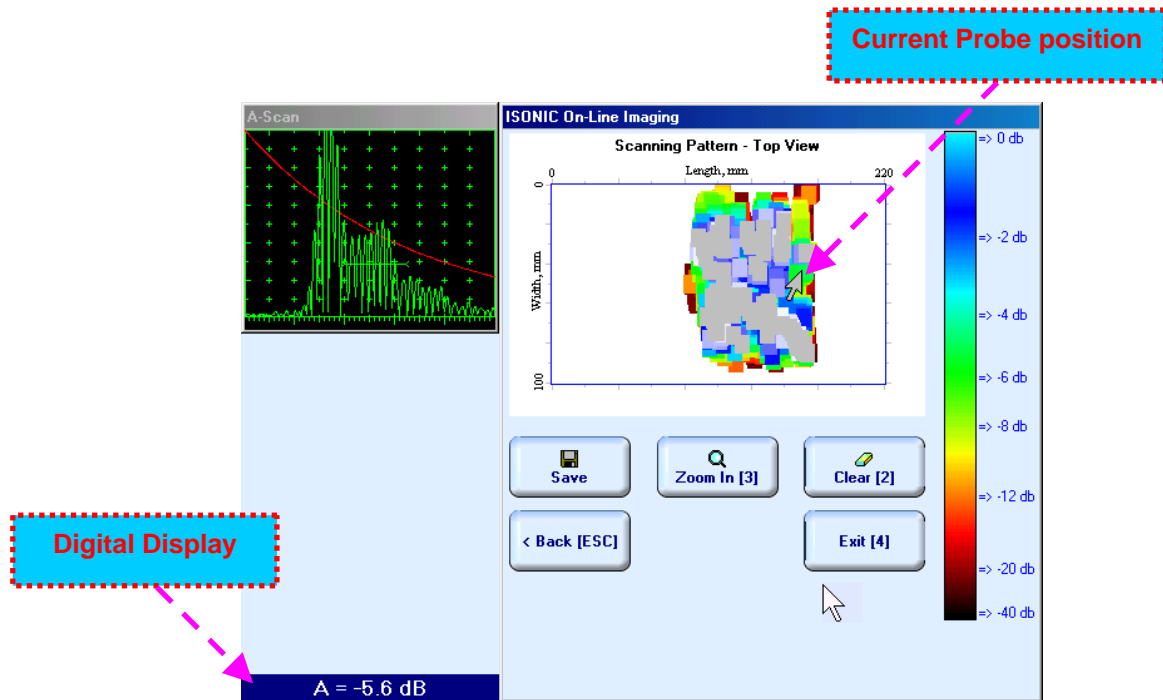
To save **MULTISCAN COMBO S** record into a file click on  or press  on front panel keyboard or **F12** on external keyboard. Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

9.1.11. Scanning: Attenuation

During scanning **ISONIC On-Line Imaging** screen is accompanied with **A-Scan** and **Digital Display** box





ISONIC On-Line Imaging screen represents:



- ❑ Current Probe Position
- ❑ **Top View** as *Amplitude Map* representing distribution of back wall echo amplitude or through transmission signal amplitude above scanning surface



Digital Display with reference to **A-Scan** represents amplitude **A** of maximal among all signals being in coincidence with **Gate A**. Amplitude **A** is expressed in dB with reference to 100% of **A-Scan** height level

To Zoom In **ISONIC On-Line Imaging** screen click on  or press  on front panel keyboard or

F3 on external keyboard. To Zoom Out click on  or press  on front panel keyboard or **Esc** on external keyboard

To cleanup **Top View** field in **ISONIC On-Line Imaging** screen click on  or press  on front panel keyboard or **F2** on external keyboard

To save **MULTISCAN COMBO S** record into a file click on  or press  on front panel keyboard or **F12** on external keyboard. Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

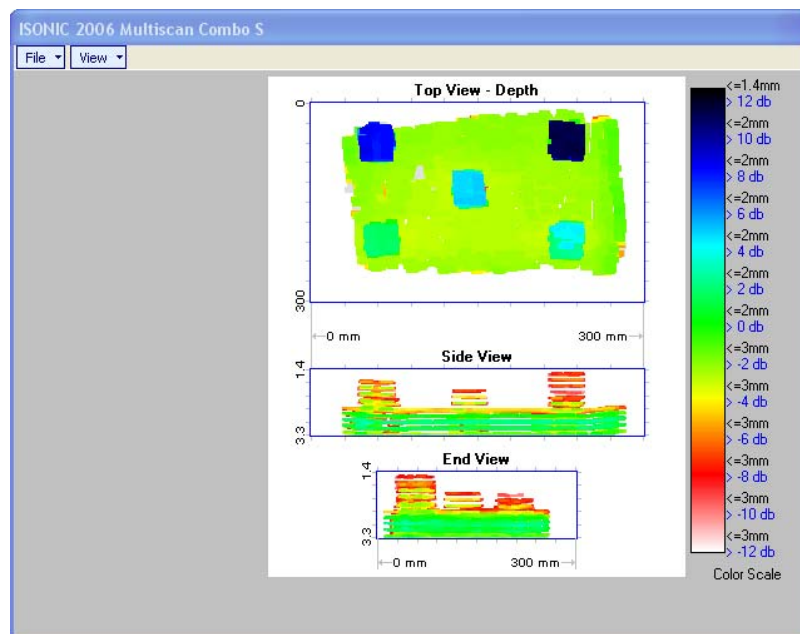
To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

9.1.12. Postprocessing

Postprocessing of **MULTISCAN COMBO S** records may be performed directly in the instrument or in external computer using **IOFFICE** or **MULTIPP** SW package. User interface and operations are practically identical except two features listed below:

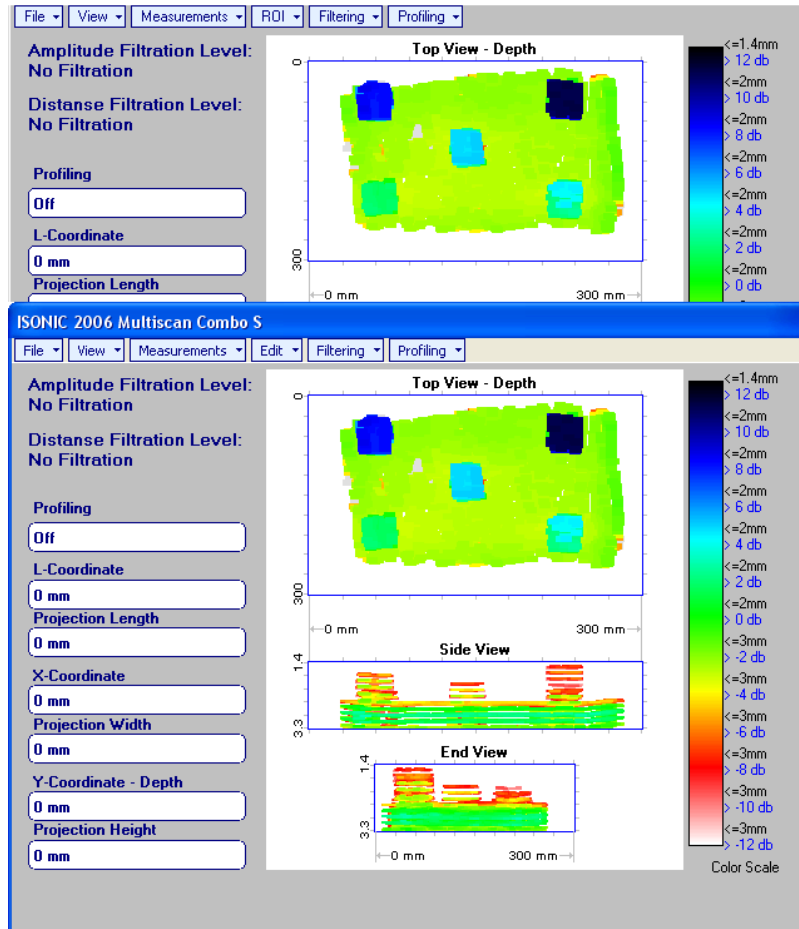
	Off-line analysis directly in ISONIC 2006 instrument	Off-line analysis in external computer using MULTIPP SW Package	Off-line analysis in external computer using IOFFICE SW Package
Off-line re-adjustment of Gain for MULTISCAN COMBO S record	NO	YES	YES
Automatic creation of Inspection report in MS Word® format	NO	YES	YES

Menu Bar Functions on Opening File









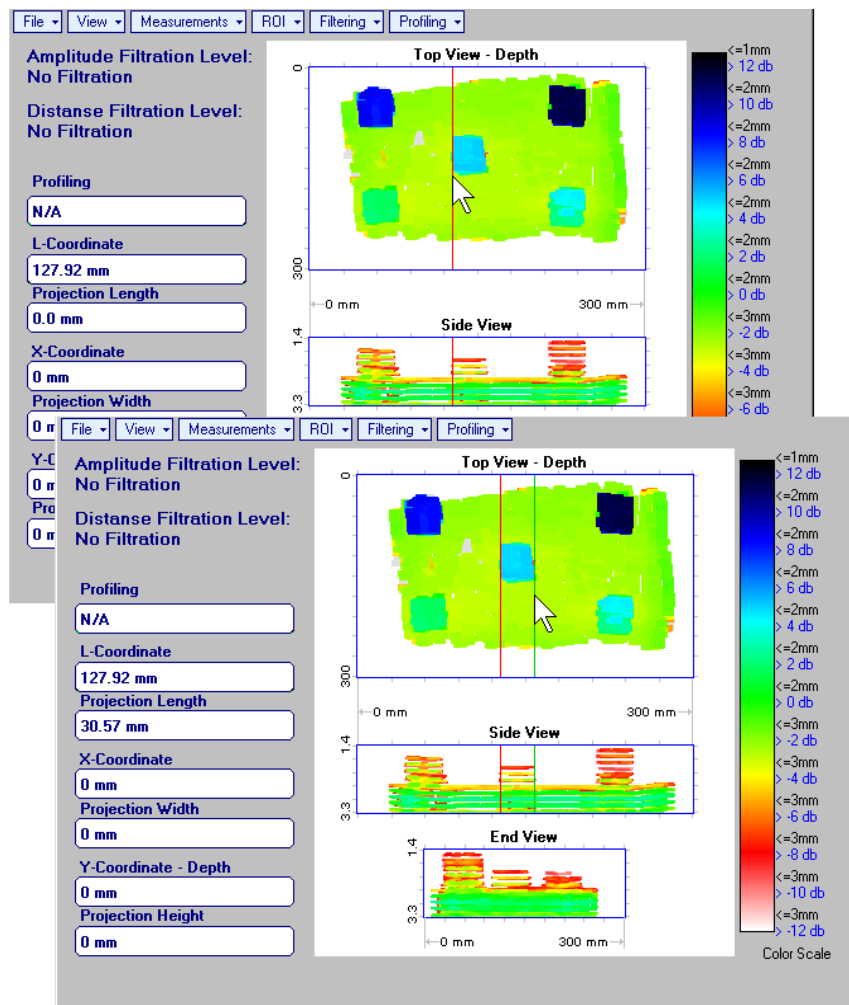
- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word®** as printer to create inspection report as doc file (**IOFFICE** SW Package only)
 - selection of paper sheet size either A4 or Letter
- **File → Print → Whole Report** – prints out complete inspection report including **UDS 3-5 Pulser Receiver** settings, inspection setup and scanning parameters, recorded maps, and additional data entered at the appropriate pre-inspection stages as it is described in paragraphs 9.1.2 and 10.1.3 of this Operating Manual
- **File → Print → Graphics Only** – prints out scanning recorded maps
- **File → Exit** – ends postprocessing session
- **View → Primary Information** – previews **UDS 3-5 Pulser Receiver** settings, inspection setup and scanning parameters, and additional data entered at the appropriate pre-inspection stages as it is described in paragraphs 9.1.2 and 9.1.3 of this Operating Manual
- **View → ISONIC Image Processing** – activates menu for detailed off-line analysis of the record







ISONIC Image Processing Menu Bar Functions

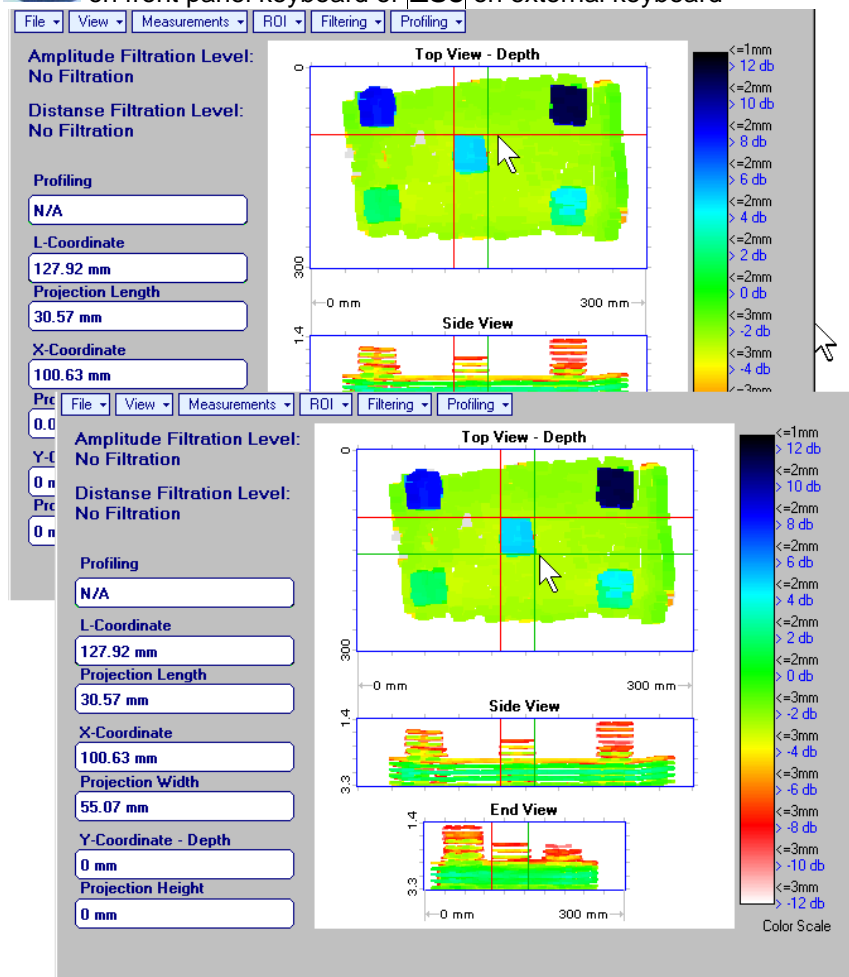








- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word®** as printer to create inspection report as doc file (**IOFFICE SW Package** only)
 - selection of paper sheet size either A4 or Letter
- **File → Print** – prints current postprocessing page
- **File → Exit** – ends postprocessing session
- **View → ISONIC Image Processing** – returns to initial postprocessing screen appearing on opening file
- **View → Top View Mode** – represents **Top View C-Scan** image as either **Amplitude** or **Distance Map**
- **View → Zoom** – zooms either **Top**, or **Side**, or **End View** image as per operator's selection
- **View → Coloring** – allows to **edit color scale (palette)** applied to **Top**, **Side**, and **End View** images

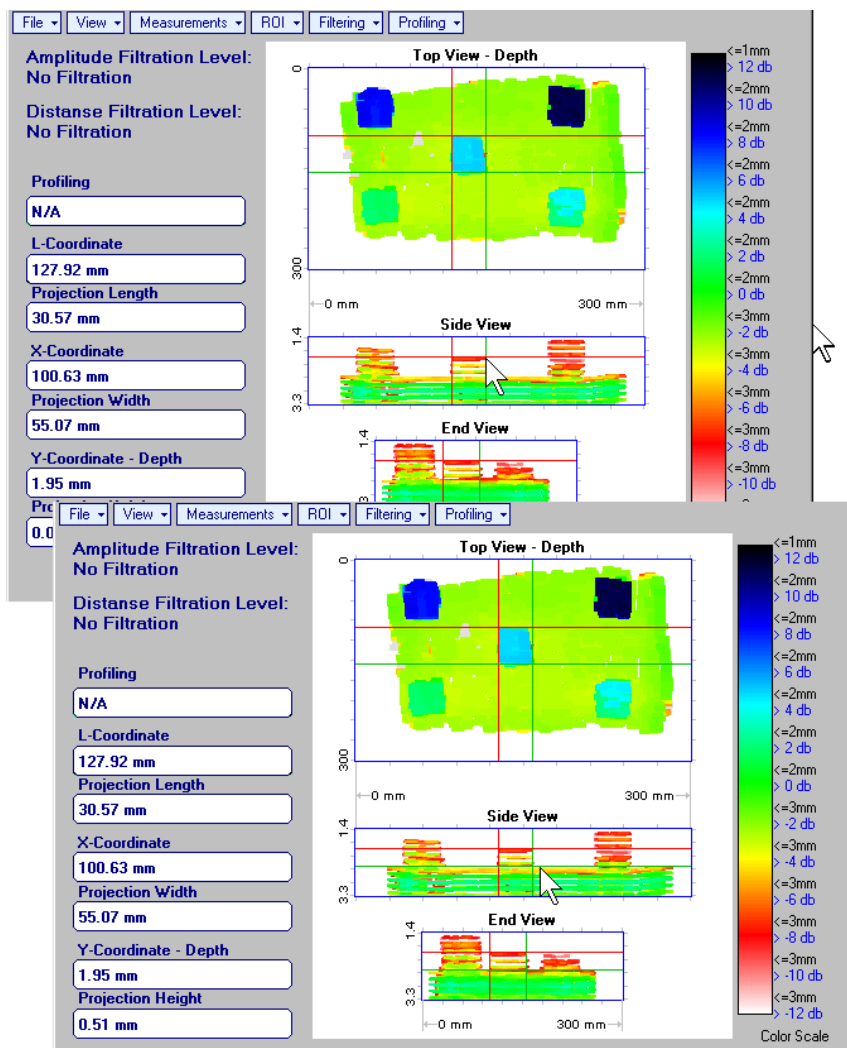
- Measurements → L-Coordinate, Projection Length** – generates *first vertical cursor* that may be guided over **Top** and **Side View** images using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first vertical cursor* along **Top** and **Side View** images is indicated in the **L-Coordinate** field. To fix position of the *first vertical cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second vertical cursor* appears upon fixing the first one; it may be manipulated by the same way. Coordinate of the *second vertical cursor* along **Top** and **Side View** images measured relatively first vertical cursor is indicated in the **Projection Length** field. Provided that *vertical cursors* are placed properly:
 - **L-Coordinate** represents distance between left border of scanning area and left defect's end
 - **Projection Length** represents appropriate size of defect
 To interrupt **L-Coordinate** and **Projection Length** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard













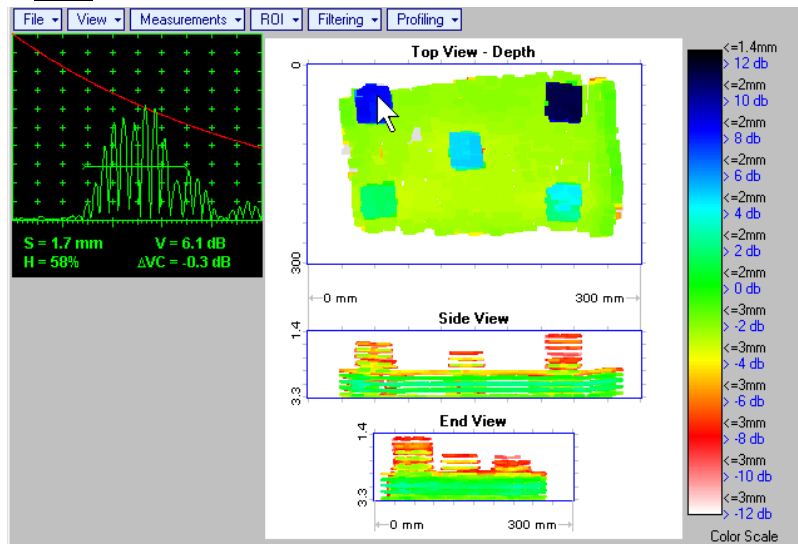
- Measurements → X-Coordinate, Projection Width** – generates *first horizontal cursor* that may be guided over **Top View** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first horizontal cursor* along **Top View** image is indicated in the **X-Coordinate** field. To fix position of the *first horizontal cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second horizontal cursor* appears upon fixing first one; it may be manipulated by the same way. Coordinate of the *second horizontal cursor* along **Top View** image measured relatively *first horizontal cursor* is indicated in the **Projection Width** field. Provided that *horizontal cursors* are placed properly:
 - **X-Coordinate** represents distance between zero line of scanning area and closest defect end
 - **Projection Width** represents appropriate size of defect
 Horizontal cursors generated and manipulated over **Top View** image are accompanied with synchronous vertical cursors over **End View** image
 To interrupt **X-Coordinate** and **Projection Width** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard






- Measurements → Y-Coordinate - Depth, Projection Height** – generates *first horizontal cursor* that may be guided over **Side** and **End View** images using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first horizontal cursor* along **Side** and **End View** images is indicated in the **Y-Coordinate-Depth** field. To fix position of the first *horizontal cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second horizontal cursor* appears upon fixing first one, it may be manipulated by the same way. Coordinate of the *second horizontal cursor* along **Side** and **End View** images measured relatively *first horizontal cursor* is indicated in the **Projection Height** field. Provided that *horizontal cursors* are placed properly:
 - **Y-Coordinate - Depth** represents depth of defect
 - **Projection Height** represents appropriate size of defect
 To interrupt **Y-Coordinate - Depth** and **Projection Height** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard

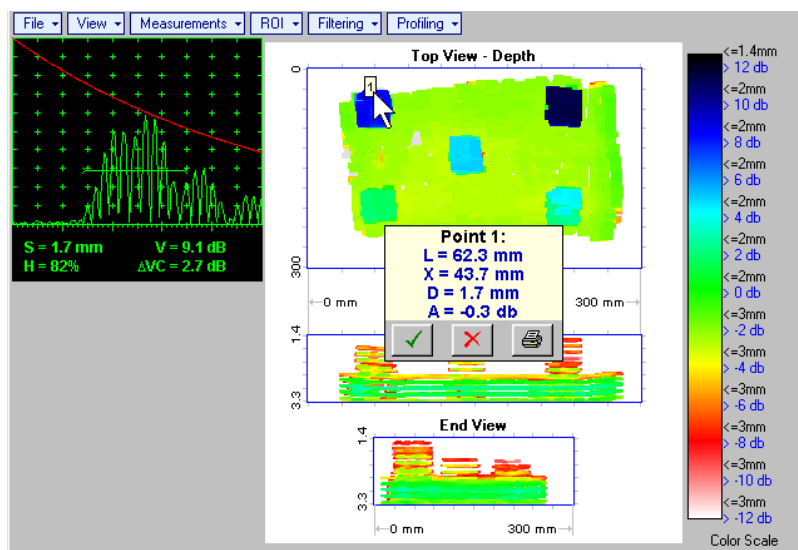


- Measurements → Point TOF & Echo Amplitude → Set Points** – generates *pointing cursor* that may be guided over **Top View** image using either touch screen stylus or mouse or , , ,  on front panel keyboard or , , ,  on external keyboard; by means of said *pointing cursor* representing probe's central point virtual off-line scanning is performed with recovering of recorded **A-Scans**, which are accompanied with appropriate **Gate A** measurements – refer to paragraph 5.2.13 of this Operating Manual for measurements legend. To memorize **A-Scan** related to current cursor *pointing cursor* for further printing out release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard. To interrupt virtual off-line scanning press  on front panel keyboard or **Esc** on external keyboard





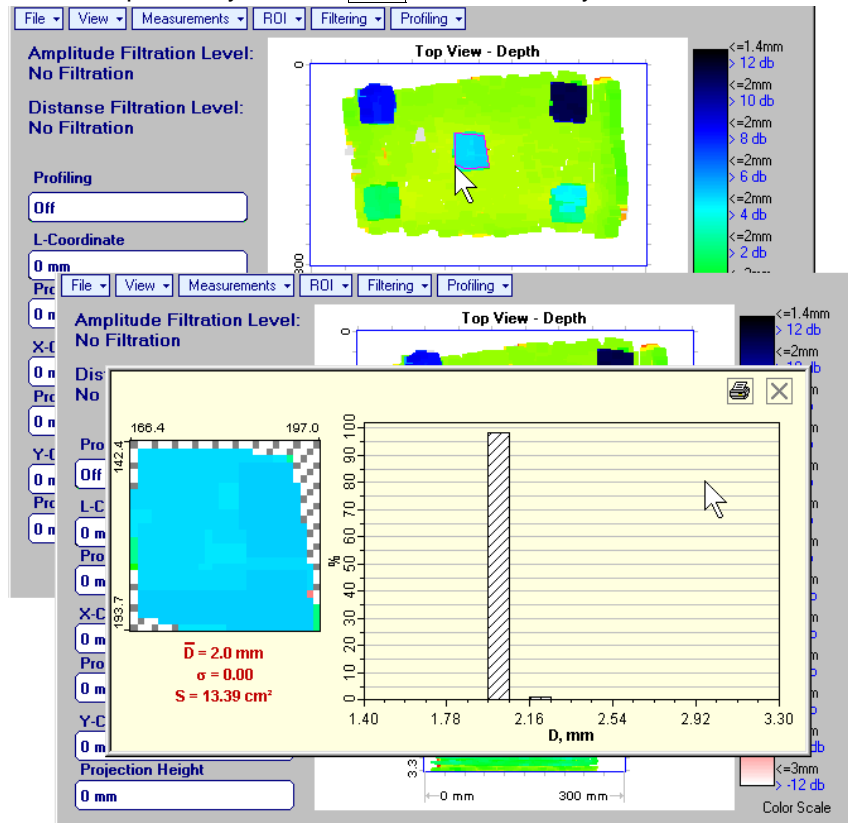
Points with memorized **A-Scans** and measuring results are highlighted by appropriate numbered marks on **Top View** image; to preview a point double click on it – this will generate popup box as below:

- To erase highlighted mark click on 
- To print out individual point report click on 
- To return to main menu operation click on 





- Measurements → Point TOF & Echo Amplitude → Remove Last Point** – erases last pointed mark from **Top View** image
- Measurements → Point TOF & Echo Amplitude → Remove All Points** – erases all marks from **Top View** image

- **Measurements → Polygon** – activates procedure of enveloping of area of interest on **Top View** image by polygon, each apex of polygon is appointed through touch screen stylus or left mouse click; last apex of polygon is appointed through double touch screen stylus or left mouse click or pressing  on front panel keyboard or **Enter** on external keyboard. To interrupt creating of polygon right mouse click or press  on front panel keyboard or **Esc** on external keyboard







Provided that polygon is placed properly:


- \bar{D} represents the average value of informative parameter (amplitude or distance) represented by colors in the area of polygon
- σ represents dispersion of informative parameter (amplitude or distance) represented by colors in the area of polygon; statistical distribution is presented by appropriate graph
- **S** represents area occupied by defect

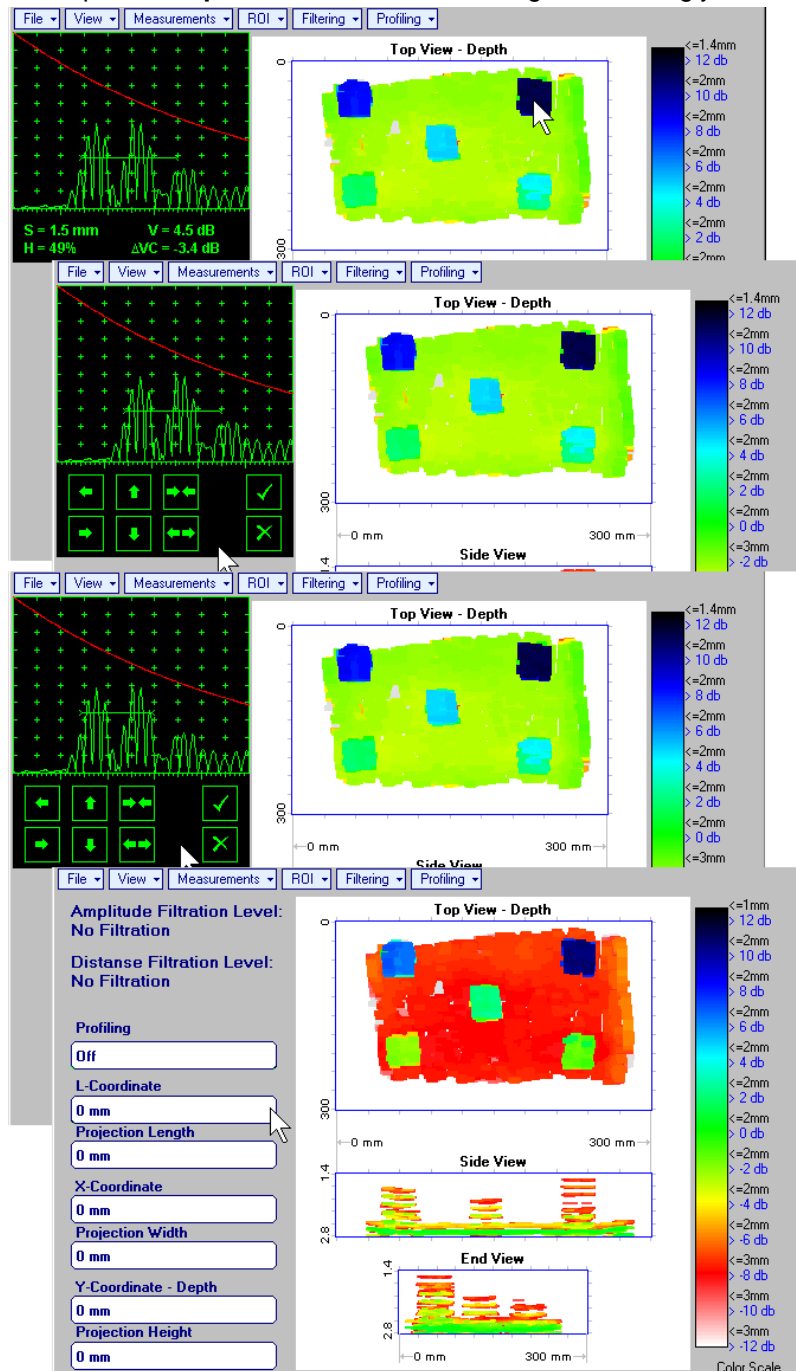
To printout polygon analysis click on ; to close polygon analysis window click on 


- **ROI → ON (ISONIC 2006 instrument)** or **EDIT → ROI → ON (IOFFICE and MULTIPP SW Packages for external computer)** – generates *pointing cursor* that may be guided over **Top View** image using either

touch screen stylus or mouse or  on front panel keyboard or  on external keyboard; by means said *pointing cursor* representing probe's central point virtual off-line scanning is performed with recovering of recorded **A-Scans**, which are accompanied with appropriate **Gate A** measurements – refer to paragraph 5.2.13 of this Operating Manual for measurements legend.





To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates off-line **Gate A** controls  allowing to redefine **Region Of Interest** for **MULTISCAN COMBO S** imaging.




Upon completing redefining of **Region Of Interest** click on  – this applies new **Gate A** to all captured **A-Scans** and updates **Top**, **Side**, and **End View** images accordingly

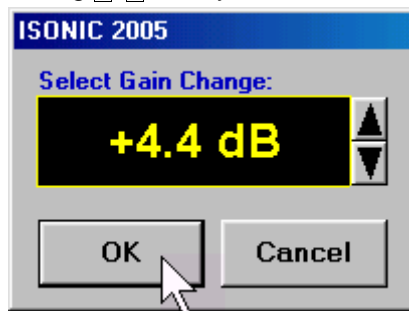


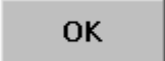
To interrupt selection of reference of **A-Scan** right mouse click or press  on front panel keyboard or **Esc** on external keyboard

To interrupt re-adjustment of **Region Of Interest** after selection of reference of **A-Scan** click on 

- **ROI → OFF** (ISONIC 2006 instrument) or **EDIT → ROI → OFF** (IOFFICE and MULTIPP SW Packages for external computer) – negates **Gate A** re-adjustment and returns to originally recorded **Top, Side, and End View** images and original **Gate A** setting
- **Edit→Change Gain→ON** – (IOFFICE and MULTIPP SW Packages for external computer) – generates *pointing cursor* that may be guided over **Top View** image either mouse or , , ,  on external keyboard; by means said *pointing cursor* representing probe's central point virtual off-line scanning is performed with recovering of recorded **A-Scans**. To select reference **A-Scan** left mouse click or press **Enter** – this generates popup window allowing off-line re-adjusting of **Gain** for all **A-Scans** captured during **MULTISCAN COMBO S** Scanning in $\pm 6\text{dB}$ range with $\pm 0.1\text{ dB}$ increments through clicking or

pressing and holding on  or pressing ,  on keyboard








During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain** click on  or press **Enter** on keyboard – this applies new **Gain** value to all captured **A-Scans** and updates **Top, Side, and End View** images accordingly

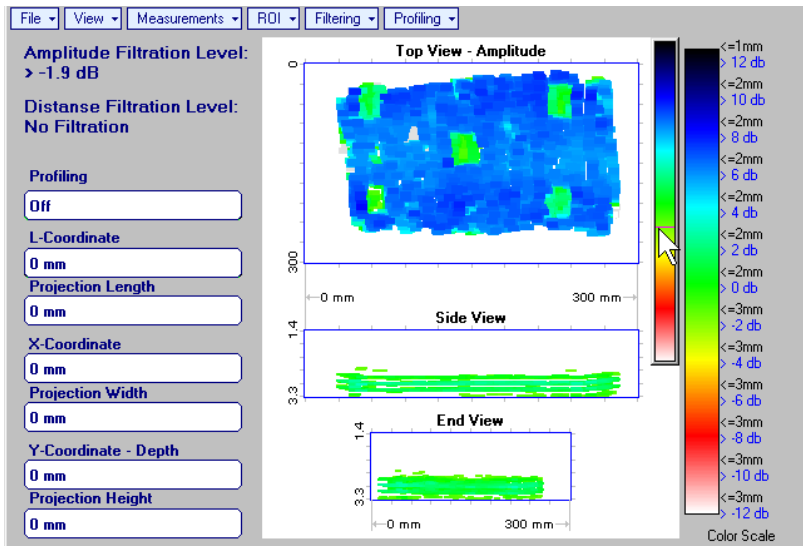
To interrupt selection of reference of **A-Scan** right mouse click or press **Esc** on keyboard





To interrupt re-adjusting of **Gain** click on  or press **Esc** on keyboard


- **Edit→Change Gain→OFF** (IOFFICE and MULTIPP SW Packages for external computer)– negates **Gain** re-adjustment and returns to originally recorded **Top, Side, and End View** images and original **Gain** setting

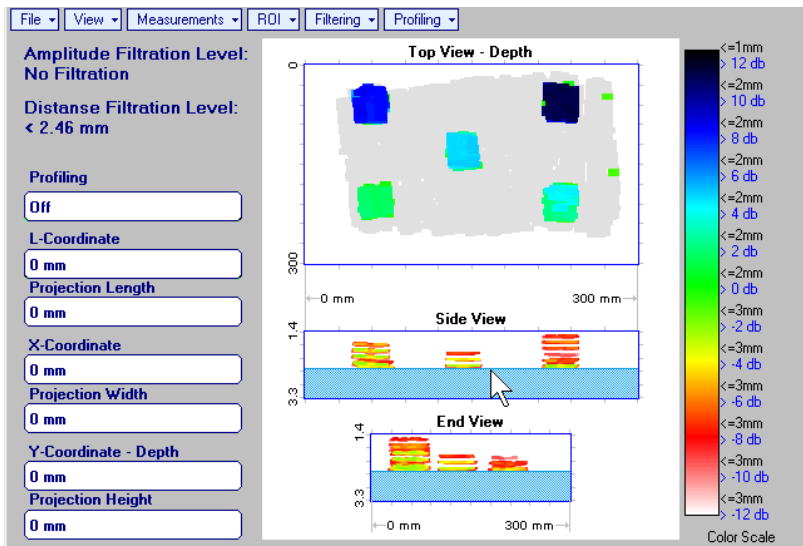
- **Filtering → Amplitude → Filtering ON** – generates *amplitude palette bar* with *sliding cursor*, which may be controlled using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard. Position of *sliding cursor* on the *amplitude palette bar* determines **Amplitude Filtration Level**, which is appropriately indicated. All elements of **Top**, **Side**, and **End View** images representing signal amplitude below filtering level are suppressed

To interrupt filtering procedure right mouse click or press  on front panel keyboard or **Esc** on external keyboard












- **Filtering → Amplitude → Filtering OFF** – returns to originally recorded **Top**, **Side**, and **End View** images
- **Filtering → Distance → Filtering ON** – generates *sliding horizontal cursor* above **Side** and **End View** images, which may be controlled using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard. Position of the *sliding horizontal cursor* determines **Distance Filtration Level**, which is appropriately indicated. All elements of **Top**, **Side**, and **End View** images related to distances exceeding **Distance Filtration Level** are suppressed

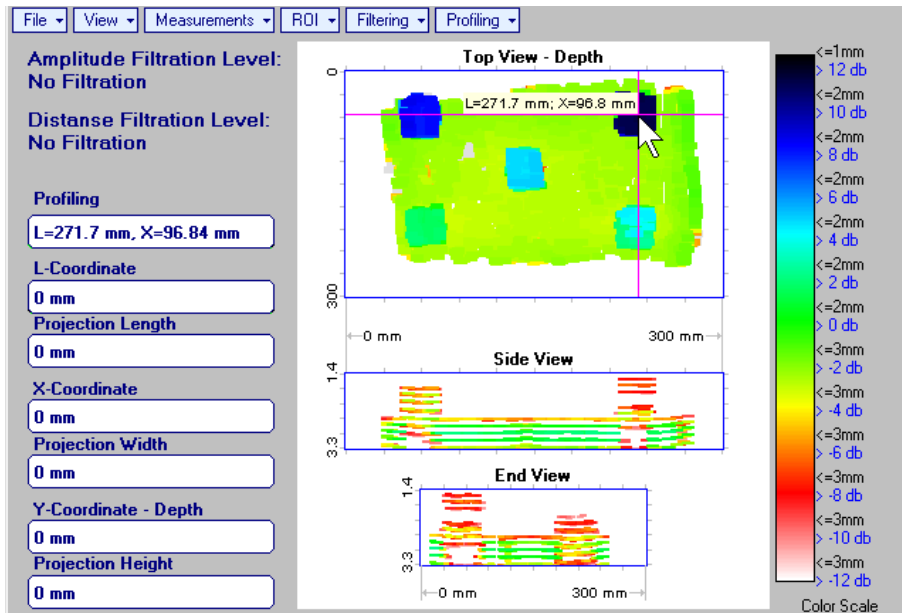
To interrupt filtering procedure right mouse click or press  on front panel keyboard or **Esc** on external keyboard








- **Filtering → Distance → Filtering OFF** – returns to originally recorded **Top**, **Side**, and **End View** images

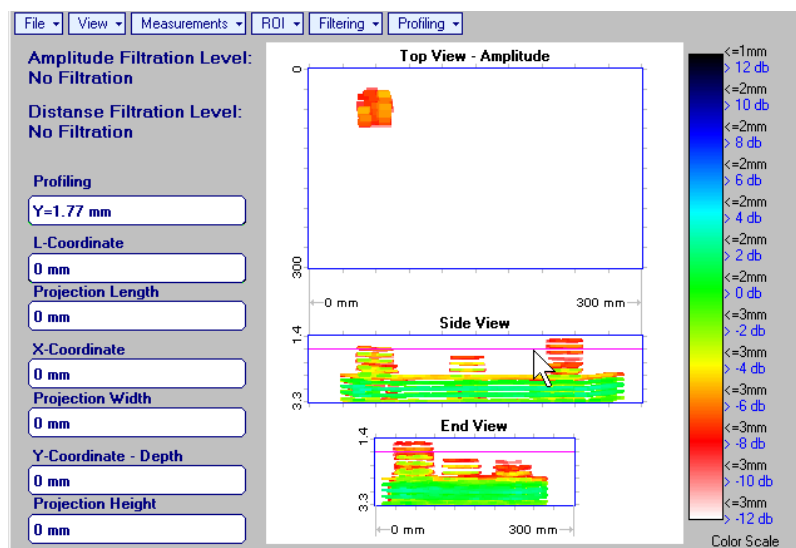
- Profiling → L,X Profiling** – generates *sliding horizontal and vertical cursors* above **Top View**, which may be controlled using either touch screen stylus or mouse or  ,  ,  ,  on front panel keyboard or  ,  ,  ,  on external keyboard . Positions of both *sliding cursors* are appropriately indicated in the **Profiling** box. Horizontal cursor determines sectional cut (vertical slice) represented as **Side View** image; vertical cursor determines sectional cut (vertical slice) represented as **End View** image

To interrupt profiling procedure right mouse click or press  on front panel keyboard or **Esc** on external keyboard



- Profiling → Y Profiling** – generates *sliding horizontal cursor* above **Side** and **End View** images, which may be controlled using either touch screen stylus or mouse or  ,  on front panel keyboard or  ,  on external keyboard. Position of *sliding horizontal cursor* is appropriately indicated in the **Profiling** box. Horizontal cursor determines sectional cut (horizontal slice) represented as **Top View** image

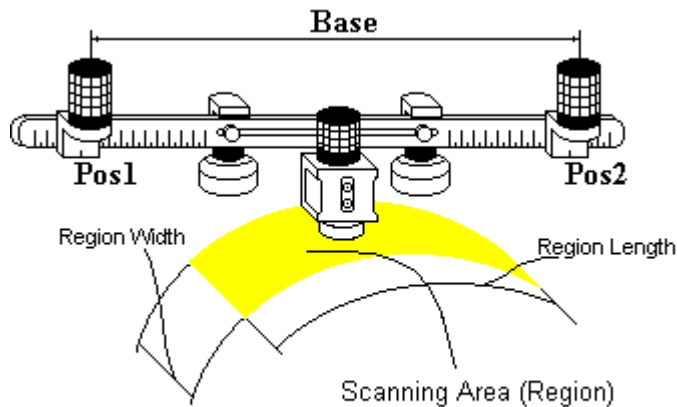
To interrupt profiling procedure right mouse click or press  on front panel keyboard or **Esc** on external keyboard



- Profiling → Profiling Off** – returns to global **Top**, **Side**, and **End View** images

9.2. Running MULTISCAN COMBO S CU Mode

9.2.1. Preparations



Enter **MULTISCAN COMBO S CU** mode according to paragraph 8.1 of this Operating Manual

9.2.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

9.2.3. Pulsar Receiver Settings

Refer to paragraph 9.1.3 of this Operating Manual

For *Pulse Echo* or *Back Wall Echo Attenuation* inspection insert ultrasonic probe into probe holder then fix single emitter of airborne ultrasound on the top of probe holder – refer to paragraph 8.2 of this Operating Manual

For *Through Transmission* inspection probes to be mounted into yoke – refer to paragraph 9.3 of this Operating Manual

Provide cabling according to paragraph 8.4.2 of this Operating Manual

Apply bar with receivers of airborne ultrasound at parallel to curved side of rectangle probe manipulation area. Single emitter and receivers of airborne ultrasound located on the bar to be equally distanced from scanning surface level. Distance between two receivers of airborne ultrasound (**Base**) is defined as:

$$\mathbf{Base = B_0 + Pos1 + Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly; **B₀** is parameter of the bar:

- **B₀ = 200 mm / 8 in** for long bar (order code / part # S 2040 B)
- **B₀ = 100 mm / 4 in** for short bar (order code / part # S 86000)



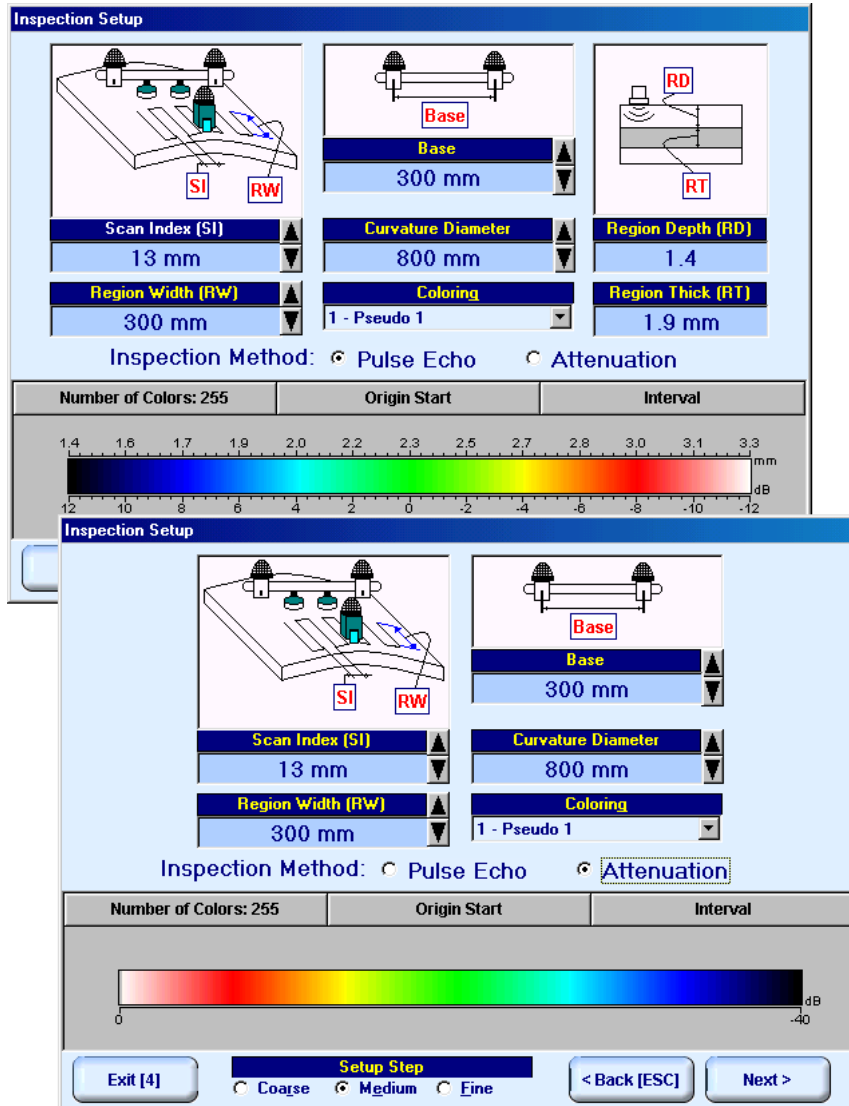
- Exact length of *Scanning area (Region Length)* depends on **Base** and **Curvature Diameter** and calculated automatically
- It may occur that modifying of preliminary entered value of **Base** will be required – appropriate correction will be performed by **ISONIC 2006** automatically

9.2.4. Probe

Refer to paragraph 9.1.4 of this Operating Manual

9.2.5. Inspection Modes and Scanning Parameters


Layout of **Inspection Setup** screen depends on option selected – it is necessary to check **Pulse Echo** or **Attenuation** in the **Inspection Method** field (click on). **Attenuation** mode is suitable for both back wall echo attenuation and through-transmission inspection












In the **Inspection Setup** screen it is necessary to key in:

- Curvature Diameter**, which must reflect *outside* diameter of object under test
- Base** (distance between two receivers of airborne ultrasound)
- Region Width**, which defines width of rectangular scanning area – refer to paragraph 9.2.1 of this Operating Manual
- Scan Index** – value of **Scan Index** defining coverage of scanning area to be selected and entered according to inspection procedure

Length of curved side of scanning area is defined by 2 parameters - **Curvature Diameter** and **Base**

Setting of said parameters to be performed through clicking / pressing corresponding spin button  with **Fine**, **Medium**, or **Coarse** increments according to checked option (click on) in the **Setup Step** field

It may occur that reducing of preliminary entered value of **Base** will be required – the appropriate correction is performed by **ISONIC 2006** instrument automatically – hence it is necessary to monitor value of **Base** whilst keying in **Curvature Diameter** and readjust airborne ultrasound receivers on the bar if necessary

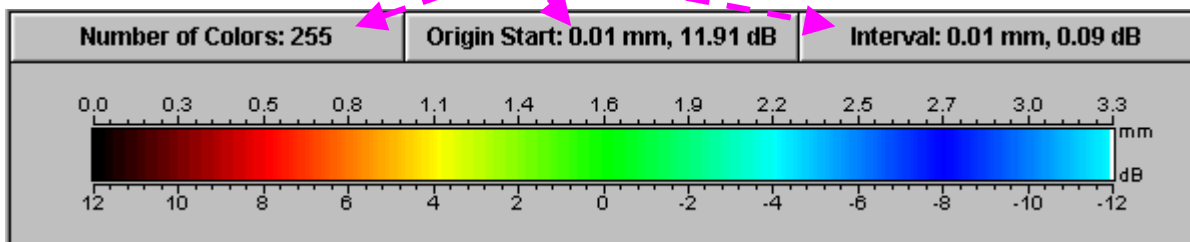
Alternatively parameter for setting may be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on it's label. Label indicating name of selected parameter changes it's fore color from yellow to white – since that moment parameter may be modified using , , ,  on front panel keyboard or , , ,  on external keyboard

Values of **Region Depth (RT)** and **Region Thick (RT)** reflected on the **Inspection Setup** screen for pulse echo mode are defined by **Gate A** settings of **UDS 3-5 Pulsar Receiver**:

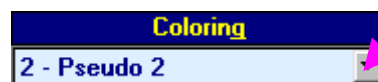
Region Depth (RD) = aStart

Region Thick (RT) = aWidth



Color scale (palette) representing signal amplitudes and defects coordinates may have up to 255 grades. It may be customized using corresponding **controls** (click on)





Style of palette (**Pseudo**, **Thermal**, or **Gray**) is selectable through clicking **on**:



To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **ESC** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **ESC** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

9.2.6. Coupling Monitor (Pulse Echo Mode Only)

Refer to paragraph 9.1.6 of this Operating Manual

9.2.7. Referring Scanning Area (Zero Line)

Curved side of scanning area closest to bar supporting receiver of airborne ultrasound must be defined as **Zero Line** in the **Probe Location Monitor** screen – proceed according to paragraph 9.1.7 of this Operating Manual

9.2.8. Imaging Principles: Pulse Echo

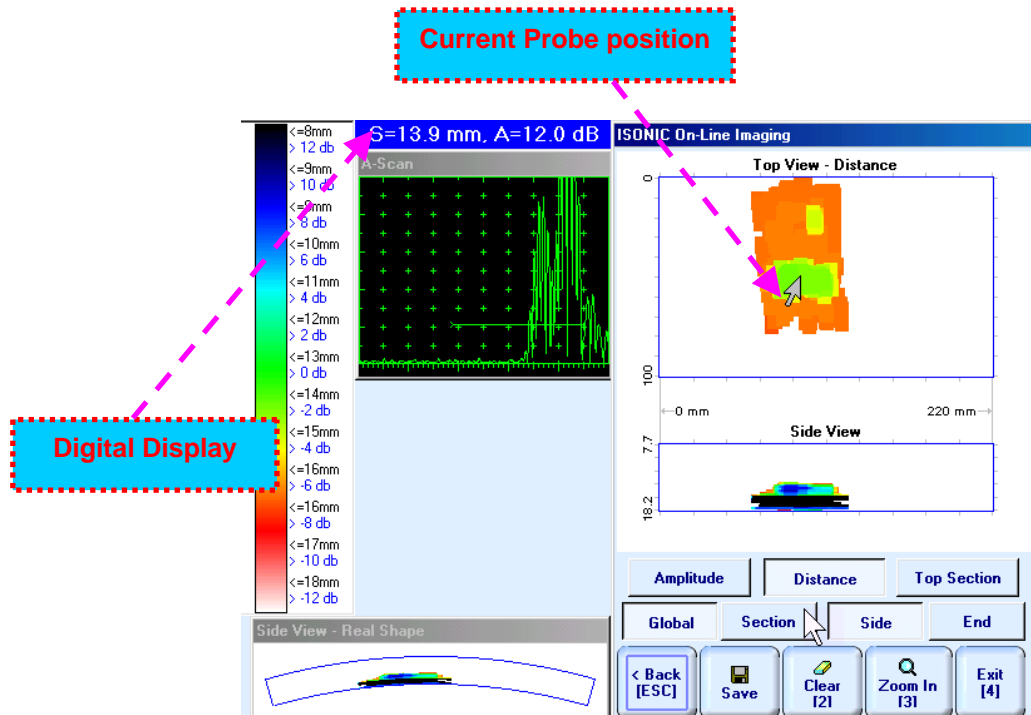
Refer to paragraph 9.1.8 of this Operating Manual

9.2.9. Imaging Principles: Attenuation

Refer to paragraph 9.1.9 of this Operating Manual

9.2.10. Scanning: Pulse Echo

Side View - Real Shape image is provided in addition to unfolded **Top**, **Side**, and **End View** images. For other notes and instructions refer to paragraph 9.1.10 of this Operating Manual

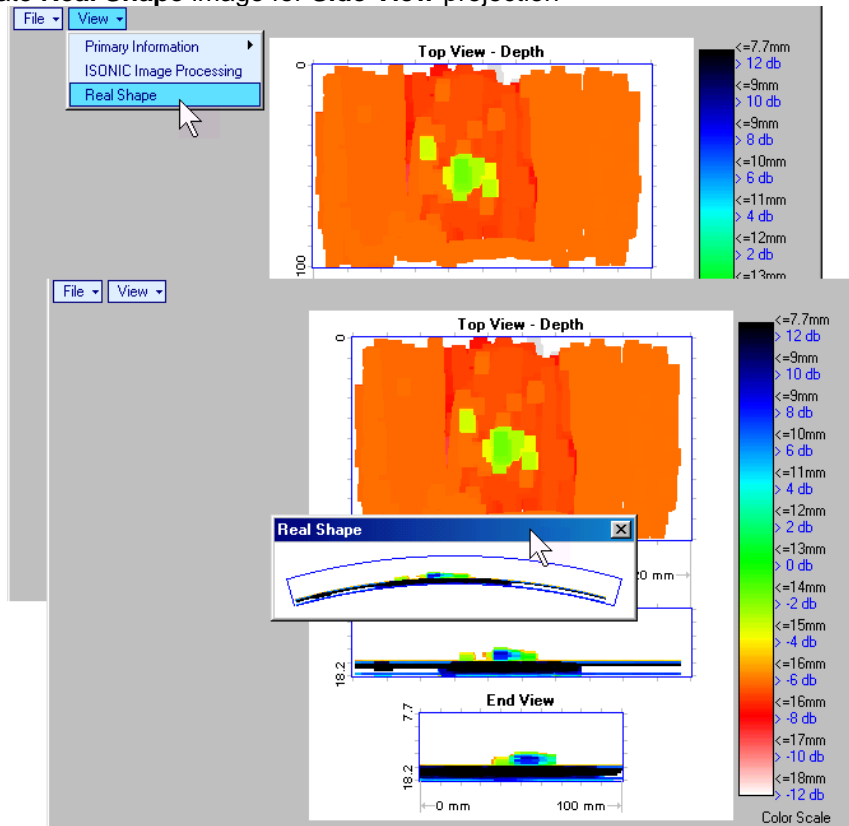


9.2.11. Scanning: Attenuation

Refer to paragraph 9.1.11 of this Operating Manual

9.2.12. Postprocessing

Postprocessing menus for **MULTISCAN COMBO S CU** records are practically identical to the same related to **MULTISCAN COMBO S** records – refer to paragraph 9.1.11 of this Operating Manual. In addition it is possible to generate **Real Shape** image for **Side View** projection



9.3. Yokes for Through Transmission Inspection

9.3.1. Short Yoke (0.5 m)



Assembling - Step 1

Assembling - Step 2



Assembling - Step 3

Assembling - Step 4



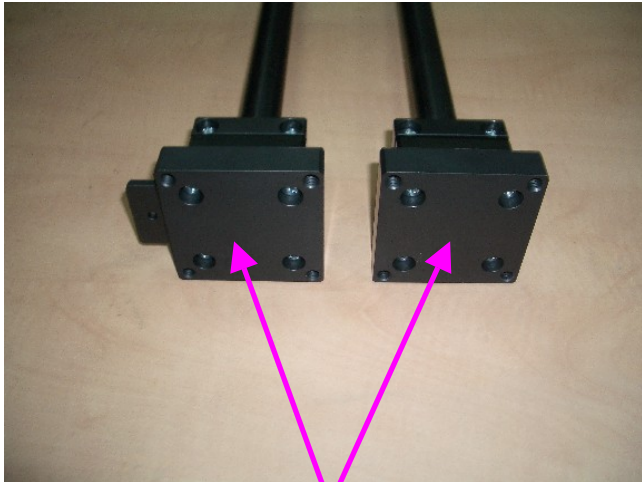
Assembling - Step 5



Assembling - Step 6



Assembling - Step 7



Probe Fitting Preparation – 4 X M6

Assembling - Step 8

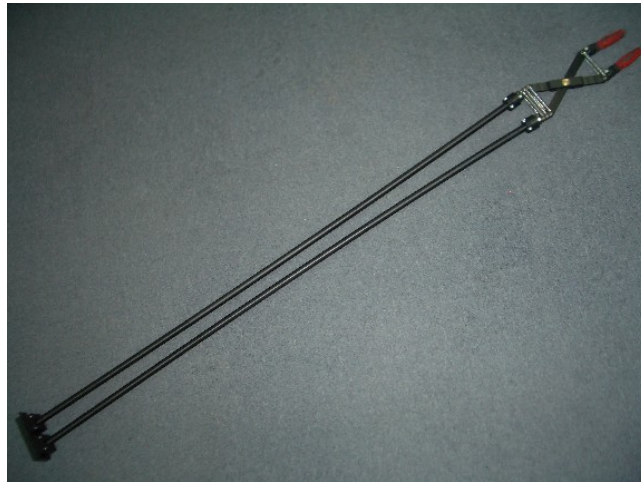


The emitter of airborne ultrasound to be placed above the center of the emitting or receiving probes, said probes to be oriented coincidentally

Handling yoke while scanning



9.3.2. Long Yokes (>0.5 m)



Assembling - Step 1

Assembling - Step 2



Assembling - Step 3

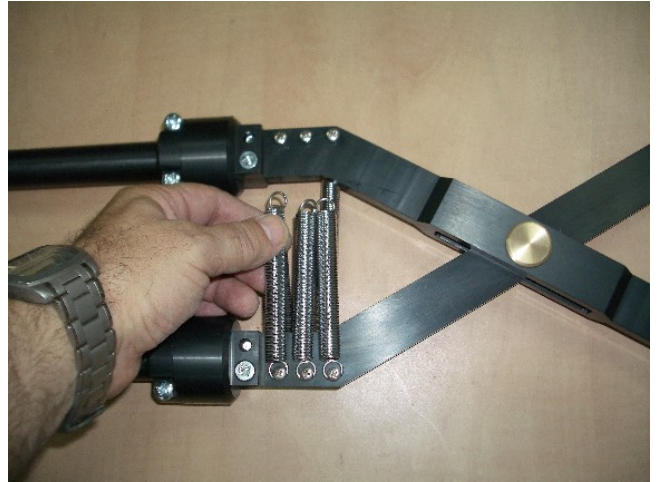
Assembling - Step 4



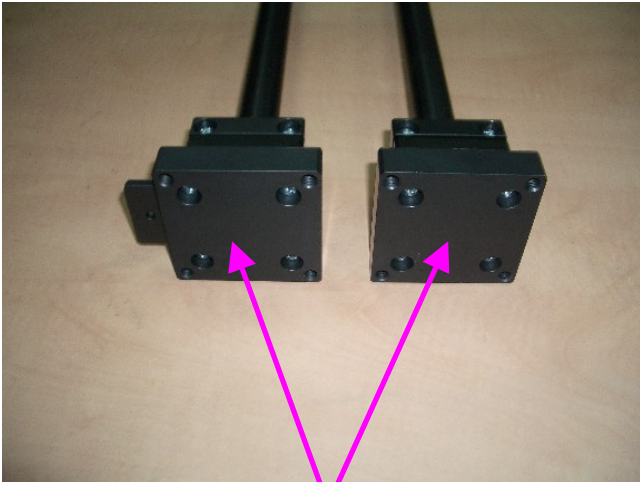
Assembling - Step 5



Assembling - Step 6

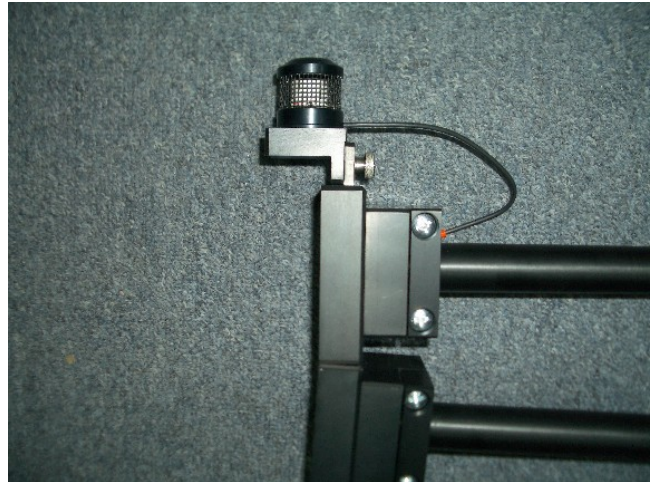


Assembling - Step 7



Probe Fitting Preparation – 4 X M6

Assembling - Step 8



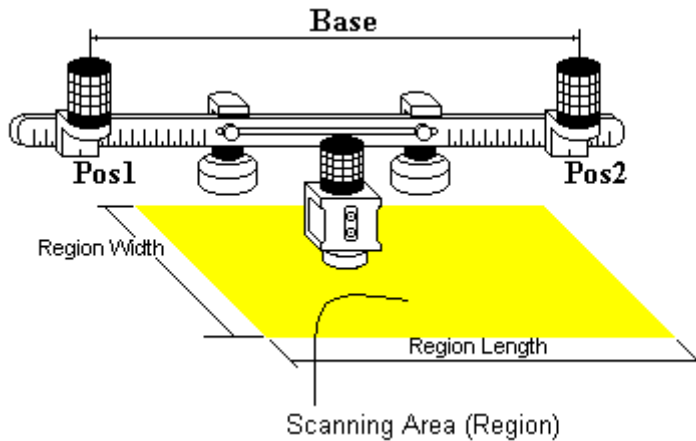
The emitter of airborne ultrasound to be placed above the center of the emitting or receiving probes, said probes to be oriented coincidentally

Handling yoke while scanning



9.4. Running CORROMAP Mode

9.4.1. Preparations



Insert ultrasonic probe into probe holder then fix single emitter of airborne ultrasound on the top of probe holder – refer to paragraph 8.2 of this Operating Manual. Provide cabling according to paragraph 8.4.2 of this Operating Manual

Apply bar with receivers of airborne ultrasound at parallel to a side of rectangle probe manipulation area. Single emitter and receivers of airborne ultrasound located on the bar to be equally distanced from scanning surface level. Distance between two receivers of airborne ultrasound (**Base**) is defined as:

$$\text{Base} = B_0 + \text{Pos1} + \text{Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly;

B₀ is parameter of the bar:

- **B₀ = 200 mm / 8 in** for long bar (order code / part # S 2040 B)
- **B₀ = 100 mm / 4 in** for short bar (order code / part # S 86000)



Region Length = Base

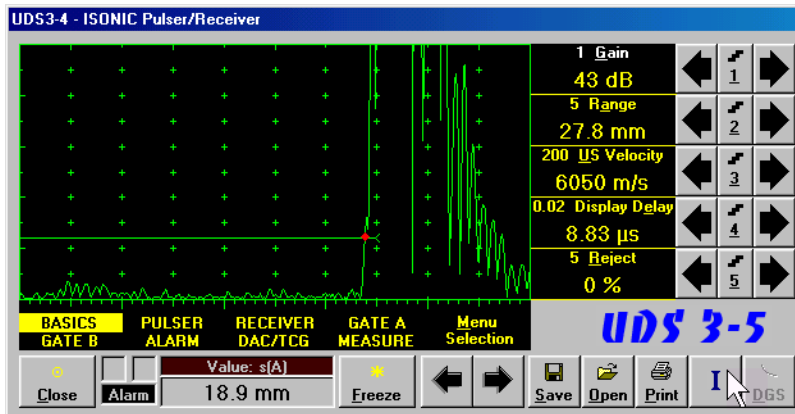


Enter **CORROMAP** mode according to paragraph 8.1 of this Operating Manual



9.4.2. Description Data



Refer to paragraph 9.1.2 of this Operating Manual

9.4.3. Pulsar Receiver Settings

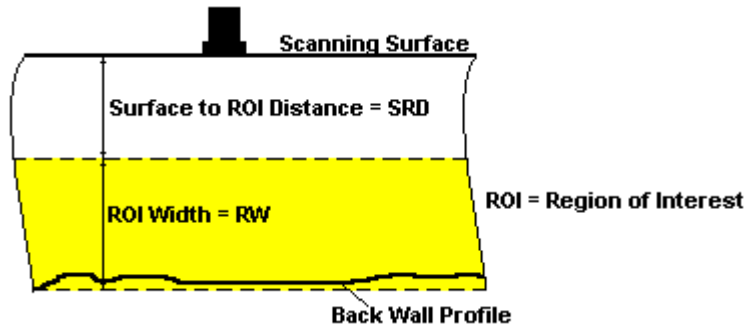


Calibration of **UDS 3-5 Pulsar Receiver** to be provided with reference to Chapter 5 of this Operating Manual and tables below
To return to previous screen click on

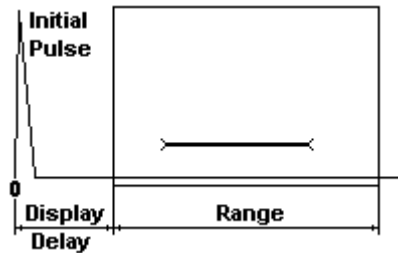
 or press  on front panel keyboard or **ESC** or **<Alt>+<C>** on external keyboard

On completing calibration click on  or press  on front panel keyboard or **F8** on external keyboard

#	Parameter or Mode	Submenu	Required Settings	Note
1	aSwitch	GATE A	ON	
2	Gain aThreshold	BASICS GATE A	Gain and aThreshold settings to provide receiving an echo from the minimal area of thickness degradation to be detected; height of the said echo to exceed aThreshold; signals from other reflectors less then defined one not to exceed aThreshold	
3	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of the Inspection Procedure	
4	Pulsar Mode	PULSER	Dual for dual element probes Single for single element probes	
5	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain and aThreshold setting procedure
6	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain and aThreshold setting procedure
7	Display	RECEIVER	Display mode may be either Full, RF, PosHalf, or NegHalf	The same Display mode to be used for both Probe Delay determining and Thickness Profile Imaging
8	USVelocity	BASIC	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	
9	Probe Delay	MEASURE	Probe Delay setting to be equal to actual probe delay	Probe delay may be determined according to paragraph 5.2.13.7 or 5.2.13.9 of this Operating Manual or similarly
10	Angle	MEASURE	Angle = 0°	
11	Meas Mode	MEASURE	Flank	
12	Range, Display Delay, AStart, aWidth	BASIC GATE A	Range, Display Delay, AStart, and aWidth settings to be performed with reference to the Region of Interest for CORROMAP table below	
13	Settings for other parameters and modes have no significance			



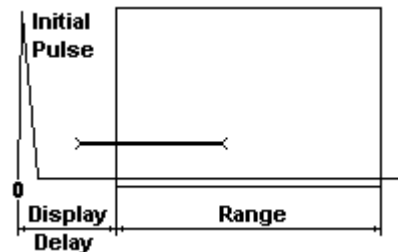
Case 1



$$SRD = aStart$$

$$RW = aWidth$$

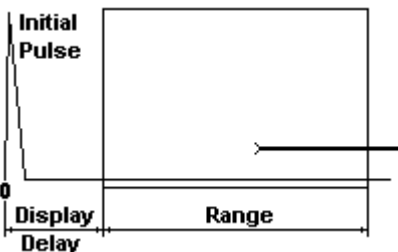
Case 2



$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

$$RW = aStart + aWidth - SRD$$

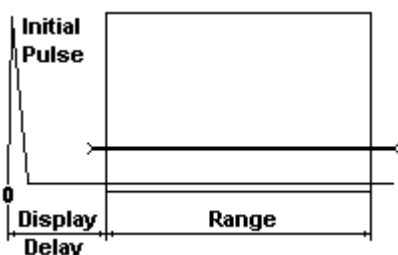
Case 3



$$SRD = aStart$$

$$RW = \frac{DisplayDelay}{2} \times USVelocity + Range - aStart$$

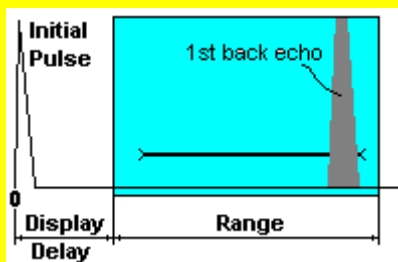
Case 4



$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

$$RW = Range$$

Preferred embodiment

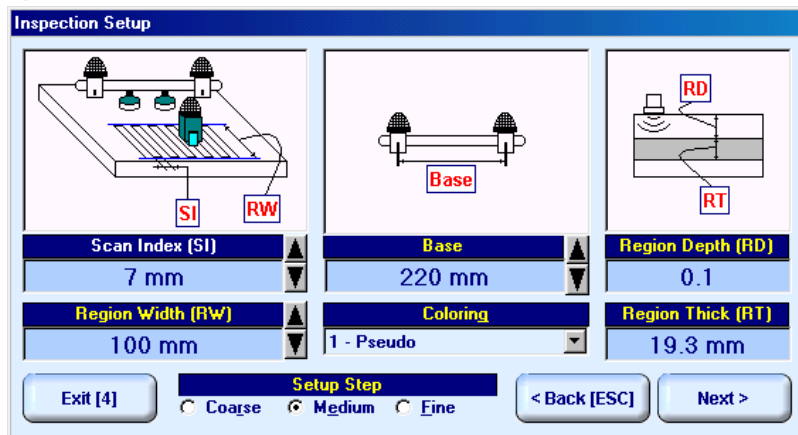


- ◆ **aStart** and **aWidth** setting to provide appearance of whole **Gate A** on the **A-Scan**
- ◆ **aWidth = (0.75...0.95) × Range**
- ◆ **First Back Echo** at the thickest area of object under test to be fully matching with Gate A
- ◆ **First Back Echo** at the thickest area of object under test to "occupy" 5-10% of the Gate A width on the **A-Scan**

9.4.4. Probe


Refer to paragraph 9.1.4 of this Operating Manual





9.4.5. Scanning Parameters



In the **Inspection Setup** screen it is necessary to key in:

- ❑ **Base** (distance between two receivers of airborne ultrasound), which defines length of rectangular scanning area – refer to paragraph 9.4.1 of this Operating Manual
- ❑ **Region Width**, which defines width of rectangular scanning area – refer to paragraph 9.4.1 of this Operating Manual
- ❑ **Scan Index** – value of **Scan Index** defining coverage of scanning area to be selected and entered according to inspection procedure

Setting of said parameters to be performed through clicking / pressing corresponding spin button  with **Fine**, **Medium**, or **Coarse** increments according to checked option (click on) in the **Setup Step** field

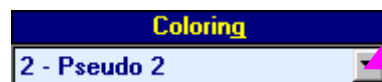
Alternatively parameter for setting may be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on its label. Label indicating name of selected parameter changes its fore color from yellow to white – since that moment parameter may be modified using ,  on front panel keyboard or  on external keyboard




Values of **Region Depth (RD)** and **Region Thick (RT)** for pulse echo mode indicated in the **Inspection Setup** screen are defined by **Gate A** settings of UDS 3-5 Pulsar Receiver:



$$\text{Region Depth (RD)} = a\text{Start}$$



$$\text{Region Thick (RT)} = a\text{Width}$$

Style of palette (**Pseudo**, **Thermal**, **Gray**, or **Custom**) is selectable through clicking on:



To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

9.4.6. Coupling Monitor

Refer to paragraph 9.1.6 of this Operating Manual

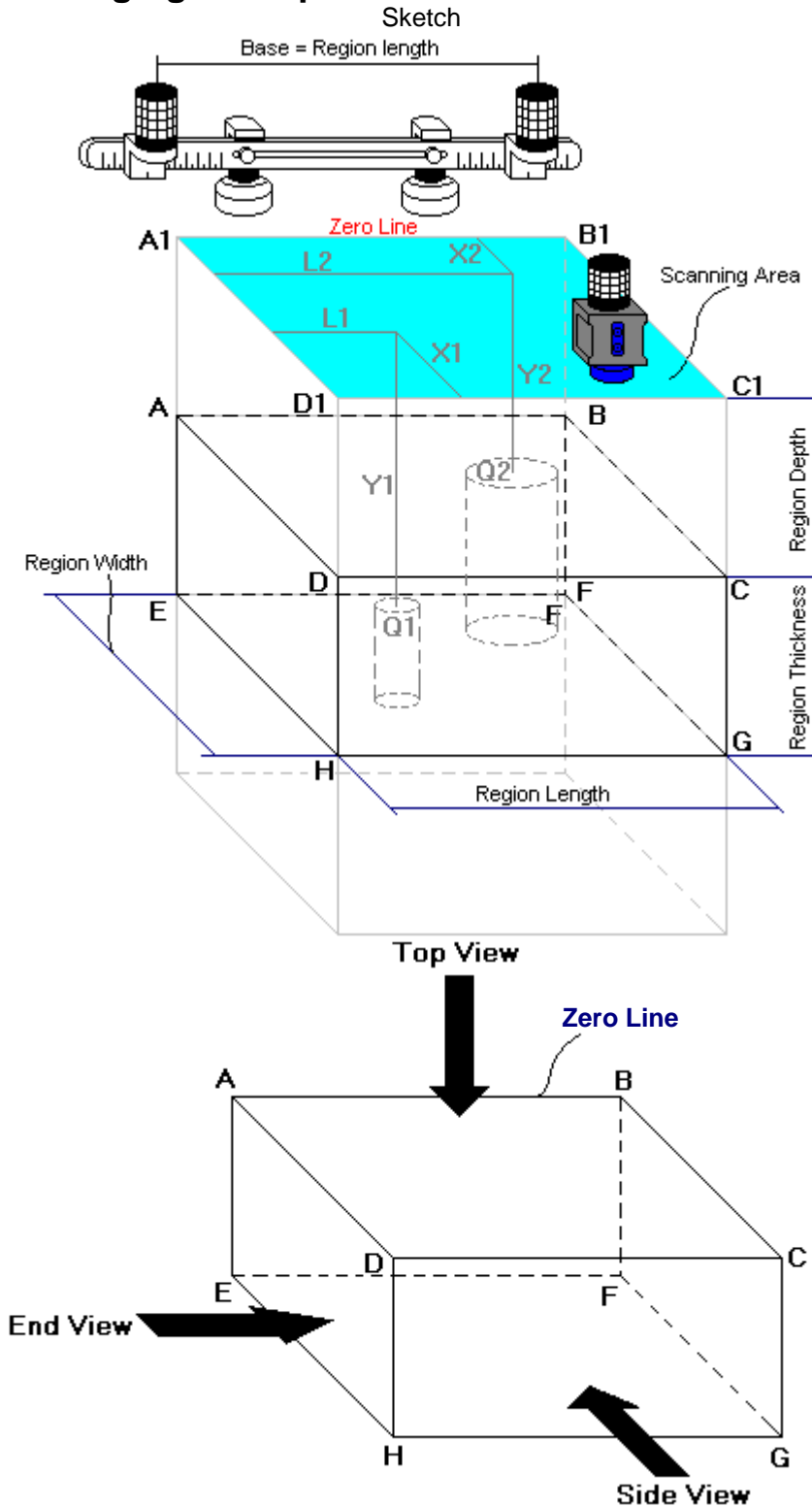
9.4.7. Referring Scanning Area (Zero Line)

Refer to paragraph 9.1.7 of this Operating Manual

9.4.8. Imaging Principles

##

1



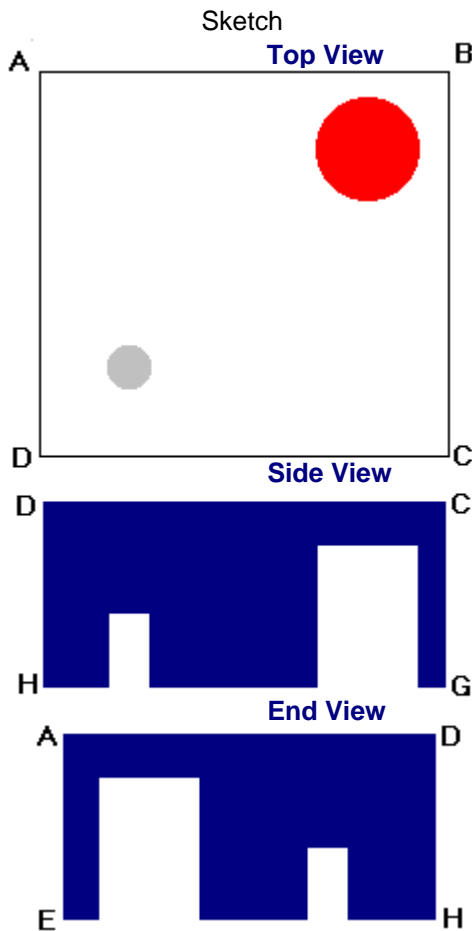
Note

General

- (a) Volume Under Test (**Region of Interest**) is located between the two parallel rectangles namely ABCD and EFGH
- (b) Scanning is provided above surface of rectangle A1B1C1D1
- (c) Lines A1B1 and AB are parallel to line connecting receivers of airborne ultrasound. Position of lines A1B1 and AB with respect to said receivers is defined by setting up the Zero Line as per paragraph 9.1.6 of this Operating Manual
- (d) With reference to **Inspection Setup** screen – paragraph 9.4.4 of this Operating Manual:
 - **A1A = Region Depth**
 - **AB = Region Length**
 - **AD = Region Width**
 - **DH = Region Thickness**
 - **A1E = Normal Material Thickness**
- (e) In the example it is supposed that there are two flat bottom drills in the object under test, said drills have different diameters, coordinates and depths of penetration into **Region of Interest**

- **Q1 (L1, X1, Y1) – Center of the Drill # 1's Bottom Surface**
- **Q2 (L2, X2, Y2) – Center of the Drill # 2's Bottom Surface**

2



Note

Top View, Global Side and End View

Supposing that scanning is well completed drills bottoms Q1 and Q2 will be detected and represented in **Top View**, and global **Side View** and **End View**

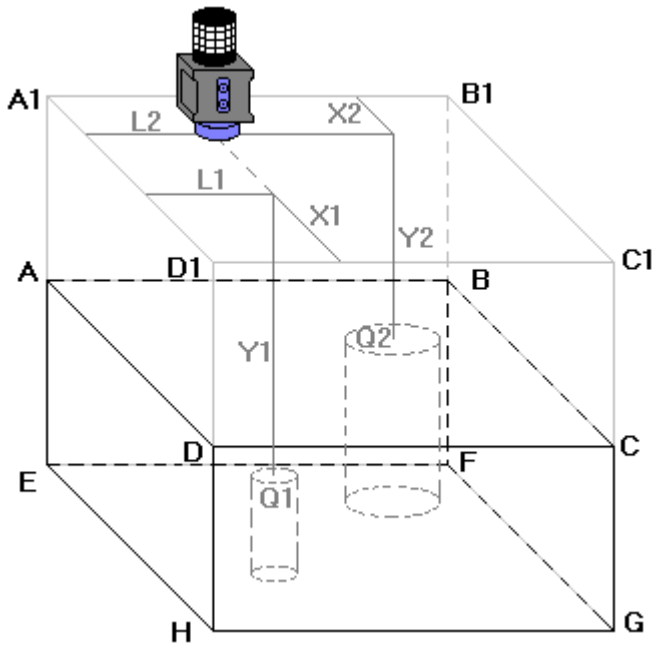
Top View is obtained through superimposing of parallel planes between rectangles ABCD and EFGH and represents distribution of minimum thickness above scanning surface

Global **Side View** and **End View** are orthogonal images composed through superimposing of the corresponding cross sectional profiles along and across the whole **Region of Interest**, said superimposing is performed by overwriting of high value of remaining material thickness with lower value and provides representation of least remaining thickness values

Acquired data is converted into 3D-matrix allowing sectional presentation of **Side** and **End View** during scanning – refer to below sketches ## 3, 4, and 5

3

Sketch



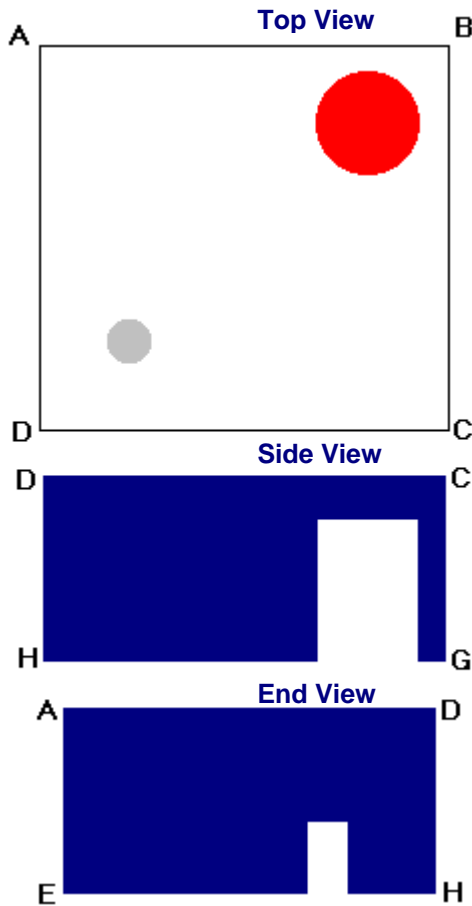
Note

Sectional Side and End View (Vertical Cut Slice)

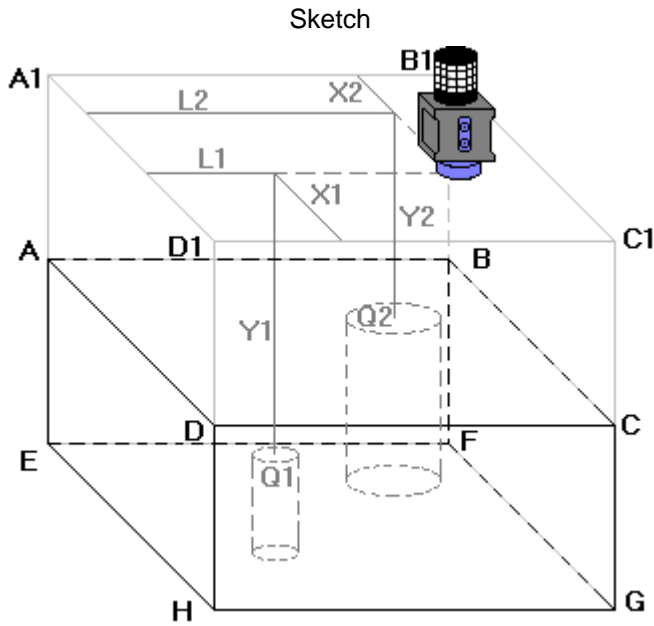
Sketches ## 3, 4, and 5 illustrate composing of sectional **Side View** and **End View**

Side View section currently represented on **ISONIC 2006** screen corresponds to current **X**-coordinate of probe

End View section currently represented on **ISONIC 2006** screen corresponds to current **L**-coordinate of probe



4



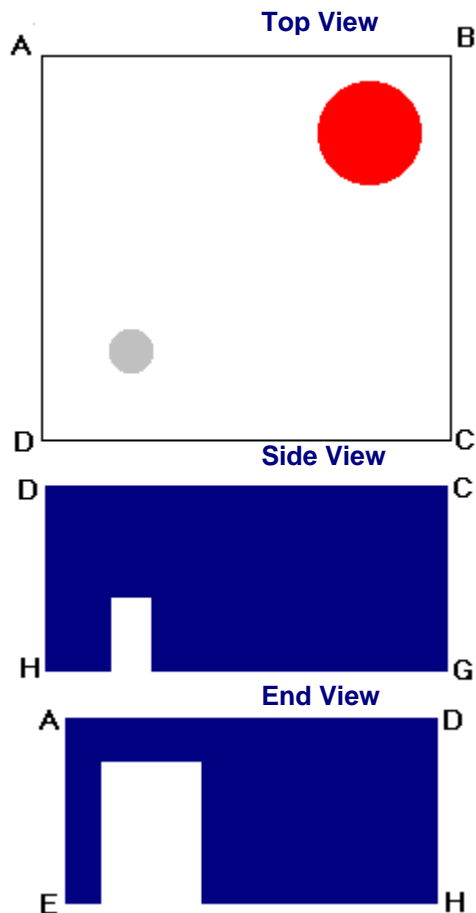
Note

Sectional Side and End View (Vertical Cut Slice)

Sketches ## 3, 4, and 5 illustrate composing of sectional **Side View** and **End View**

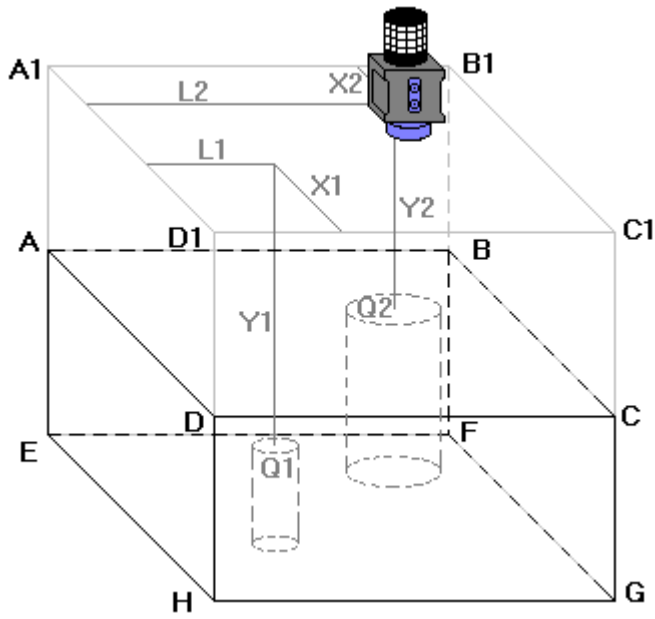
Side View section currently represented on **ISONIC 2006** screen corresponds to current **X**-coordinate of probe

End View section currently represented on **ISONIC 2006** screen corresponds to current **L**-coordinate of probe



5

Sketch



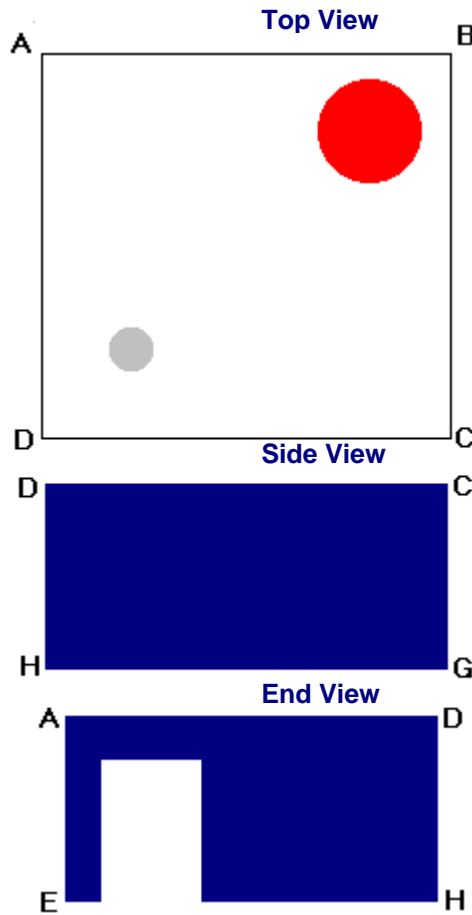
Note

Sectional Side and End View (Vertical Cut Slice)

Sketches ## 3, 4, and 5 illustrate composing of sectional **Side View** and **End View**

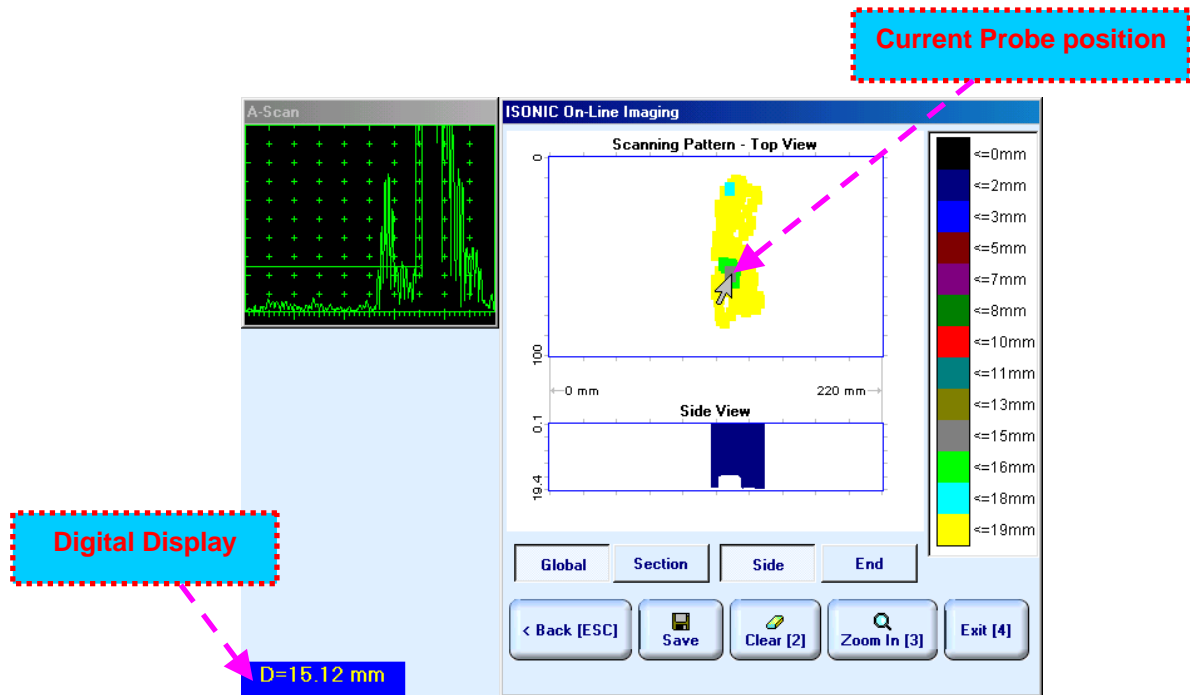
Side View section currently represented on **ISONIC 2006** screen corresponds to current **X**-coordinate of probe

End View section currently represented on **ISONIC 2006** screen corresponds to current **L**-coordinate of probe




9.4.9. Scanning

During scanning **ISONIC On-Line Imaging** screen is accompanied with **A-Scan** and **Digital Display** box



ISONIC On-Line Imaging screen represents:





- Current Probe Position
- Current Coupling Status (optionally, provided that coupling monitor is active – refer to paragraph 9.1.7 of this Operating Manual)
- Top View**
- Side View** for **Side** pressed down or **End View** for **End** pressed down or press  on front panel keyboard or **F7** on external keyboard to switch between **Side** and **End View**



Depending on which button is pressed – **Global** or **Section** – **Side View** and **End View** are presented either in global mode according to sketch # 2 – paragraph 9.4.8 of this Operating Manual or in sectional mode according to sketches ## 3, 4, and 5 – paragraph 9.4.8 of this Operating Manual







- All **A-Scans** are captured during scanning unconditionally however projection images **Top View**, **Side View**, and **End View** are updated only with signals exceeding threshold of **Gate A** presented on **A-Scan** however
- Minimal thickness is dominant while recording data into **Top View**
- Map Repair Function** is active while keeping pressed **I** on front panel keyboard or **F8** on external keyboard – new readings will overwrite already recorded data unconditionally; this allows record correction after finding some non-relevant data recorded with dominance




Digital Display represents thickness **D** for first signal in the **Gate A** (measurement mode – **Flank**)

To Zoom In **ISONIC On-Line Imaging** screen click on  or press  on front panel keyboard or **F3** on external keyboard. To Zoom Out click on  or press  on front panel keyboard or **Esc** on external keyboard

To cleanup **Top View**, **Side View**, and **End View** fields in **ISONIC On-Line Imaging** screen click on  or press  on front panel keyboard or **F2** on external keyboard

To save **CORROMAP** record into a file click on  or press  on front panel keyboard or **F12** on external keyboard . Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

To save **CORROMAP** record into a file click on  or press  on front panel keyboard or **F12** on external keyboard . Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

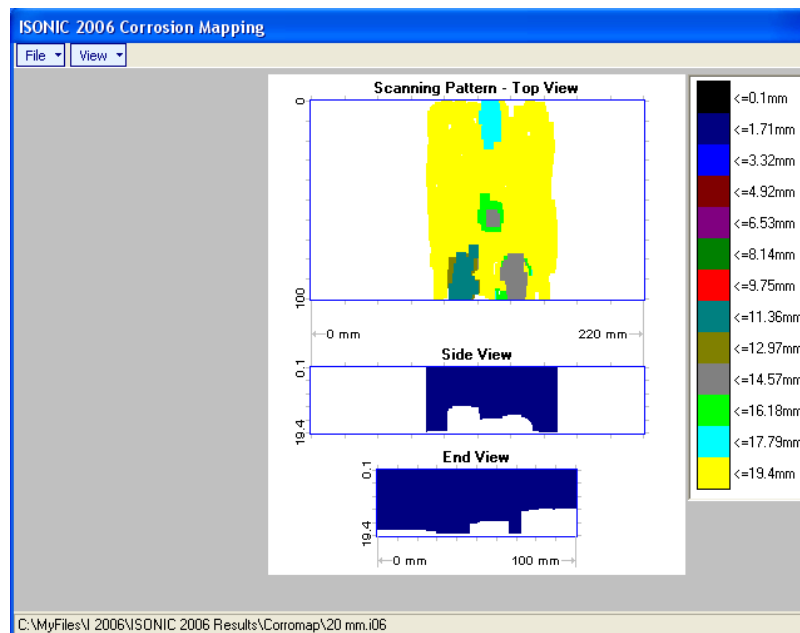
To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

9.4.10. Postprocessing

Postprocessing of **CORROMAP** records may be performed directly in the instrument or in external computer using **IOFFICE** or **MULTIPP** SW package. User interface and operations are practically identical except two features listed below:

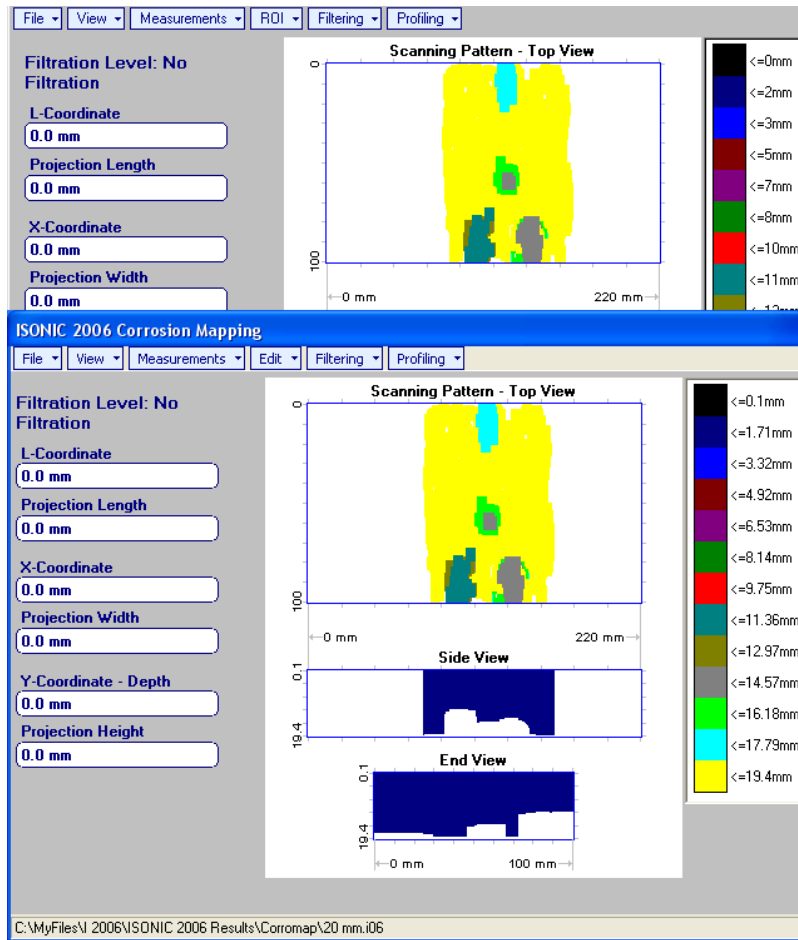
	Off-line analysis directly in ISONIC 2006 instrument	Off-line analysis in external computer using MULTIPP SW Package	Off-line analysis in external computer using IOFFICE SW Package
Off-line re-adjustment of Gain for CORROMAP record	NO	YES	YES
Automatic creation of Inspection report in MS Word® format	NO	YES	YES

Menu Bar Functions on Opening File









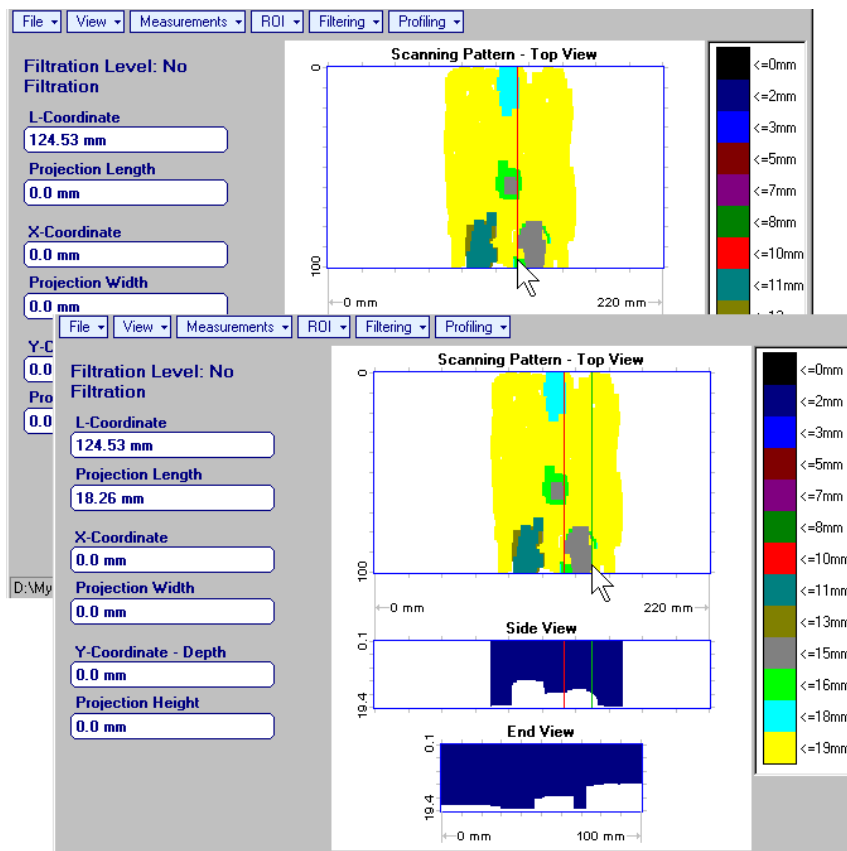
- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word®** as printer to create inspection report as doc file (**IOFFICE** SW Package only)
 - selection of paper sheet size either A4 or Letter
- **File → Print → Whole Report** – prints out complete inspection report including **UDS 3-5 Pulser Receiver** settings, inspection setup and scanning parameters, recorded maps, and additional data entered at the appropriate pre-inspection stages as it is described in paragraphs 9.1.2 and 10.1.3 of this Operating Manual
- **File → Print → Graphics Only** – prints out scanning recorded maps
- **File → Exit** – ends postprocessing session
- **View → Primary Information** – previews **UDS 3-5 Pulser Receiver** settings, inspection setup and scanning parameters, and additional data entered at the appropriate pre-inspection stages as it is described in paragraphs 9.1.2 and 9.1.3 of this Operating Manual
- **View → ISONIC Image Processing** – activates menu for detailed off-line analysis of the record







ISONIC Image Processing Menu Bar Functions

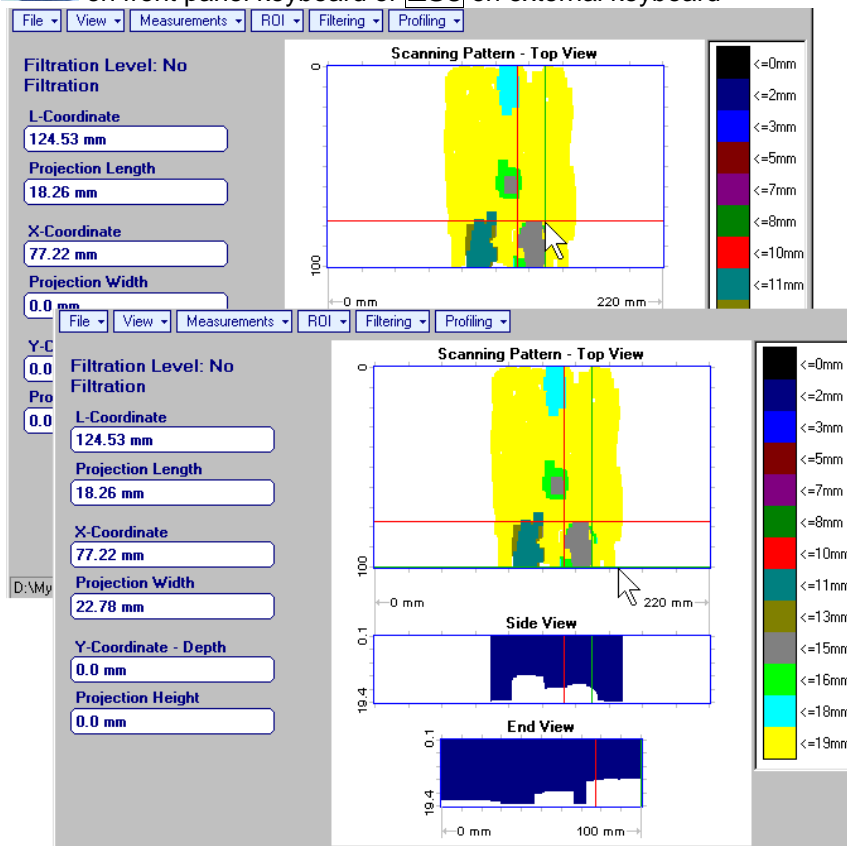








- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word®** as printer to create inspection report as doc file (**IOFFICE SW Package** only)
 - selection of paper sheet size either A4 or Letter
- **File → Print** – prints current postprocessing page
- **File → Exit** – ends postprocessing session
- **View → ISONIC Image Processing** – returns to initial postprocessing screen appearing on opening file
- **View → Zoom Top View** – zoom **Top View** image
- **View → Coloring** – selection of **color scale (palette)** style for **Top View** image

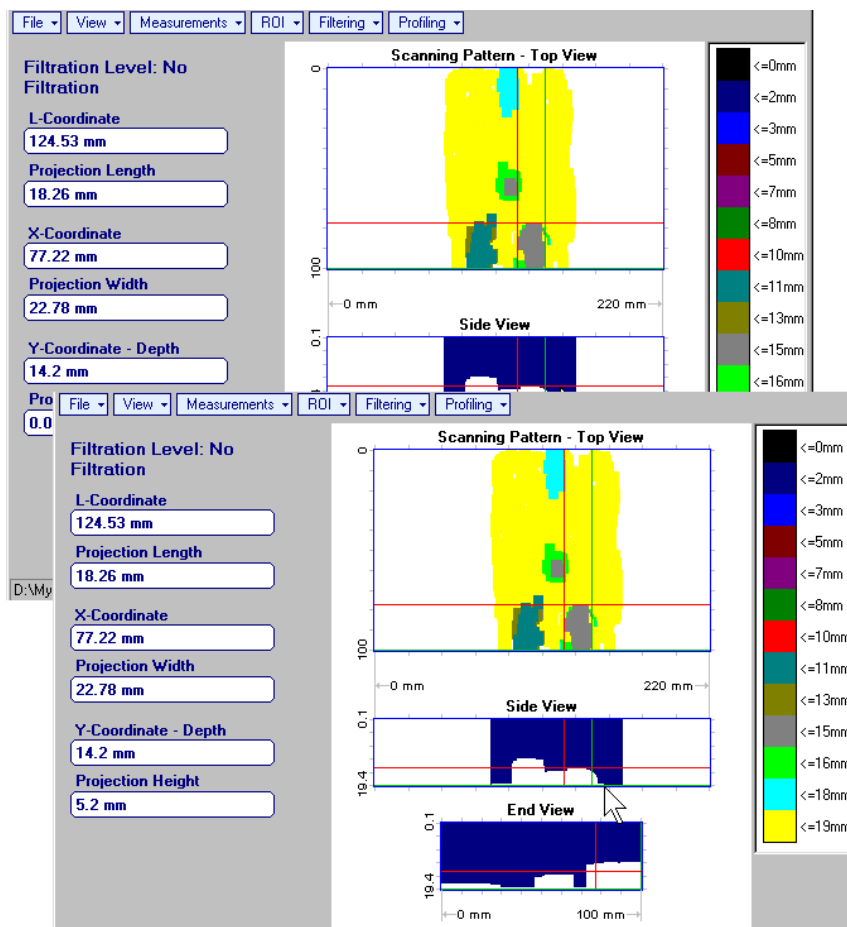
- Measurements → L-Coordinate, Projection Length** – generates *first vertical cursor* that may be guided over **Top** and **Side View** images using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first vertical cursor* along **Top** and **Side View** images is indicated in the **L-Coordinate** field. To fix position of the *first vertical cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second vertical cursor* appears upon fixing the first one; it may be manipulated by the same way. Coordinate of the *second vertical cursor* along **Top** and **Side View** images measured relatively first vertical cursor is indicated in the **Projection Length** field. Provided that *vertical cursors* are placed properly:
 - L-Coordinate** represents distance between left border of scanning area and left end of corrosion damage
 - Projection Length** represents appropriate size of corrosion damage
 To interrupt **L-Coordinate** and **Projection Length** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard













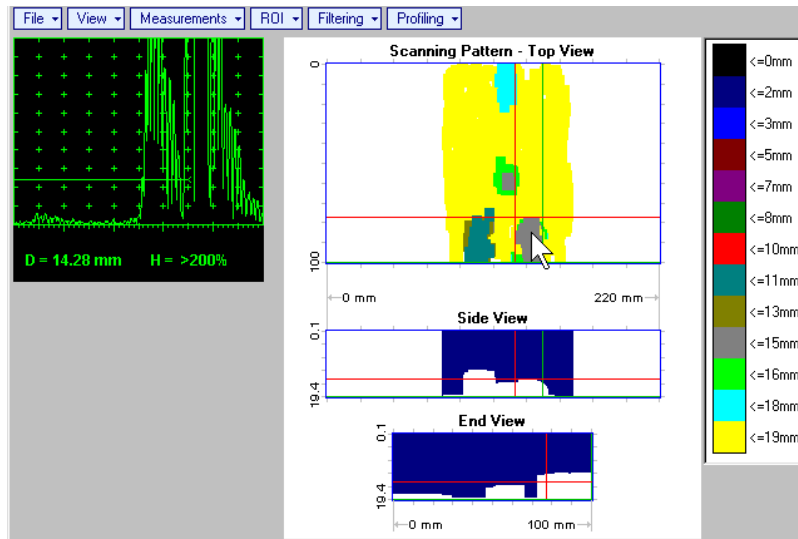
- Measurements → X-Coordinate, Projection Width** – generates *first horizontal cursor* that may be guided over **Top View** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first horizontal cursor* along **Top View** image is indicated in the **X-Coordinate** field. To fix position of the *first horizontal cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second horizontal cursor* appears upon fixing first one; it may be manipulated by the same way. Coordinate of the *second horizontal cursor* along **Top View** image measured relatively *first horizontal cursor* is indicated in the **Projection Width** field. Provided that *horizontal cursors* are placed properly:
 - **X-Coordinate** represents distance between zero line of scanning area and closest end of corrosion damage
 - **Projection Width** represents appropriate size of corrosion damage
 Horizontal cursors generated and manipulated over **Top View** image are accompanied with synchronous vertical cursors over **End View** image
 To interrupt **X-Coordinate** and **Projection Width** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard






- Measurements → Y-Coordinate - Depth, Projection Height** – generates *first horizontal cursor* that may be guided over **Side** and **End View** images using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first horizontal cursor* along **Side** and **End View** images is indicated in the **Y-Coordinate-Depth** field. To fix position of the first *horizontal cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second horizontal cursor* appears upon fixing first one, it may be manipulated by the same way. Coordinate of the *second horizontal cursor* along **Side** and **End View** images measured relatively *first horizontal cursor* is indicated in the **Projection Height** field. Provided that *horizontal cursors* are placed properly:
 - **Y-Coordinate - Depth** represents remaining thickness
 - **Projection Height** represents appropriate depth of corrosion damage
 To interrupt **Y-Coordinate - Depth** and **Projection Height** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard

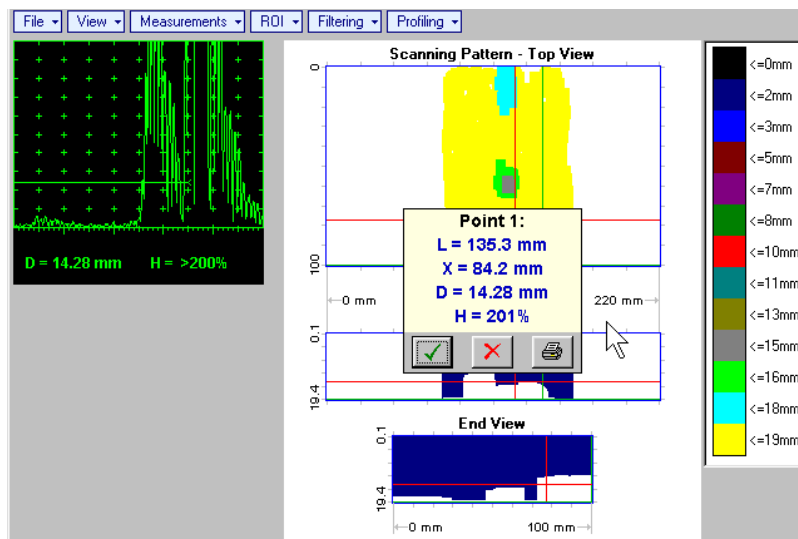


- Measurements → Point** – generates *pointing cursor* that may be guided over **Top View** image using either touch screen stylus or mouse or , , ,  on front panel keyboard or , , ,  on external keyboard; by means of said *pointing cursor* representing probe's central point virtual off-line scanning is performed with recovering of recorded **A-Scans**, which are accompanied with appropriate **Gate A** measurements – refer to paragraph 5.2.13 of this Operating Manual for measurements legend. To memorize **A-Scan** related to current cursor *pointing cursor* for further printing out release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard. To interrupt virtual off-line scanning press  on front panel keyboard or **Esc** on external keyboard.





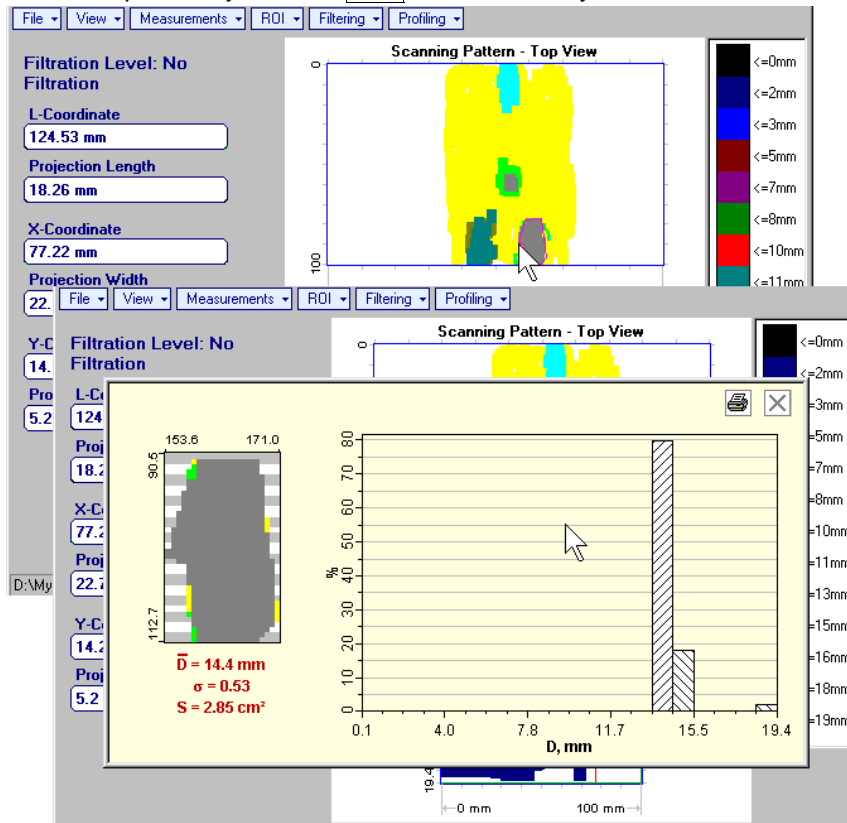
Points with memorized **A-Scans** and measuring results are highlighted by appropriate numbered marks on **Top View** image; to preview a point double click on it – this will generate popup box as below:

- To erase highlighted mark click on 
- To print out individual point report click on 
- To return to main menu operation click on 





- Measurements → Point → Clear Last** – erases last pointed mark from **Top View** image
- Measurements → Point → Clear All** – erases all marks from **Top View** image

- **Measurements → Polygon** – activates procedure of enveloping of area of interest on **Top View** image by polygon, each apex of polygon is appointed through touch screen stylus or left mouse click; last apex of polygon is appointed through double touch screen stylus or left mouse click or pressing  on front panel keyboard or **Enter** on external keyboard. To interrupt creating of polygon right mouse click or press  on front panel keyboard or **Esc** on external keyboard


















Provided that polygon is placed properly:


- \bar{D} represents average remaining thickness represented by colors in the area of polygon
- σ represents dispersion of remaining thickness represented by colors in the area of polygon; statistical distribution is presented by appropriate graph
- S represents area occupied by corrosion damage

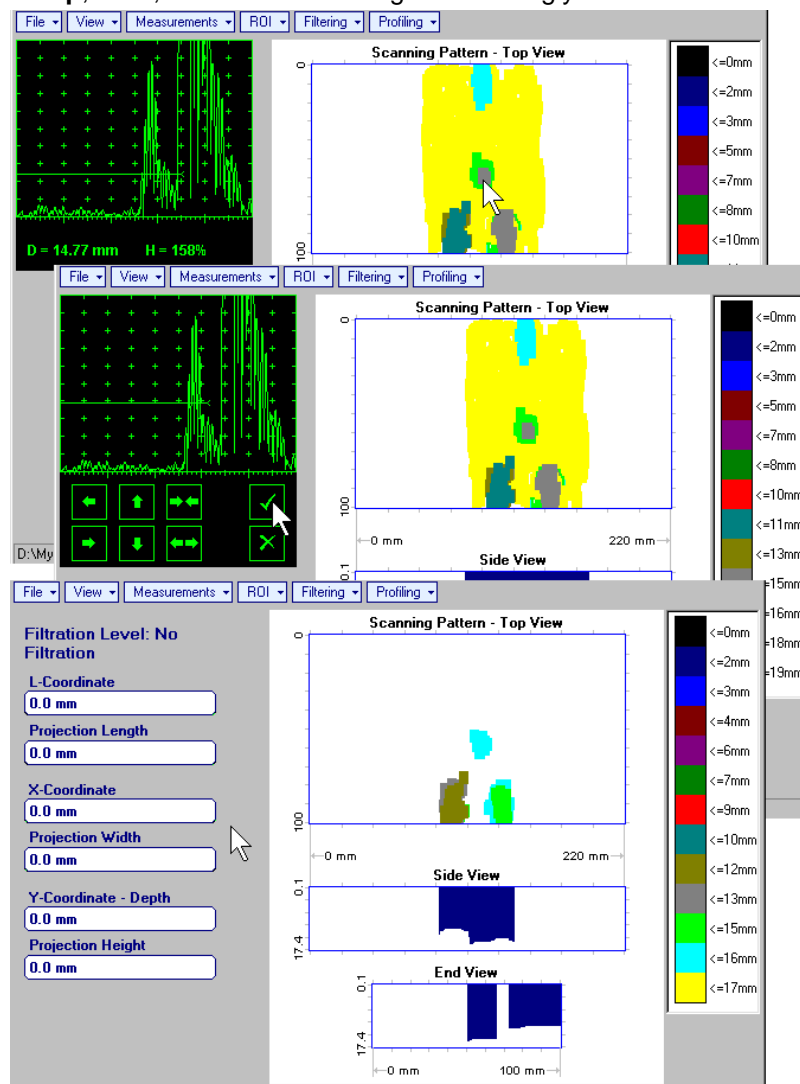
To printout polygon analysis click on ; to close polygon analysis window click on 


- **ROI → ON** (ISONIC 2006 instrument) or **EDIT → ROI → ON** (IOFFICE and MULTIPP SW Packages for external computer) – generates *pointing cursor* that may be guided over **Top View** image using either

touch screen stylus or mouse or , , ,  on front panel keyboard or , , ,  on external keyboard; by means said *pointing cursor* representing probe's central point virtual off-line scanning is performed with recovering of recorded **A-Scans**, which are accompanied with appropriate **Gate A** measurements – refer to paragraph 5.2.13 of this Operating Manual for measurements legend.

To select reference **A-Scan** release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard – this generates off-line **Gate A** controls , , , , ,  allowing to redefine **Region Of Interest** for **CORROMAP** imaging. Upon





completing redefining of **Region Of Interest** click on  – this applies new **Gate A** to all captured **A-Scans** and updates **Top**, **Side**, and **End View** images accordingly



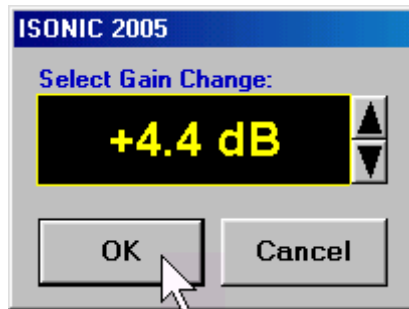
To interrupt selection of reference of **A-Scan** right mouse click or press  on front panel keyboard or **Esc** on external keyboard

To interrupt re-adjustment of **Region Of Interest** after selection of reference of **A-Scan** click on 


- **ROI → OFF** (ISONIC 2006 instrument) or **EDIT → ROI → OFF** (IOFFICE and MULTIPP SW Packages for external computer) – negates **Gate A** re-adjustment and returns to originally recorded **Top**, **Side**, and **End View** images and original **Gate A** setting

- **Edit→Change Gain→ON** – (IOFFICE and MULTIPP SW Packages for external computer) – generates *pointing cursor* that may be guided over **Top View** image either mouse or , , ,  on external keyboard; by means said *pointing cursor* representing probe's central point virtual off-line scanning is performed with recovering of recorded **A-Scans**. To select reference **A-Scan** left mouse click or press **Enter** – this generates popup window allowing off-line re-adjusting of **Gain** for all **A-Scans** captured during **CORROMAP** Scanning in $\pm 6\text{dB}$ range with $\pm 0.1\text{ dB}$ increments through clicking or pressing and

holding on  or pressing ,  on keyboard







During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain**


click on  or press **Enter** on keyboard – this applies new **Gain** value to all captured **A-Scans** and updates **Top**, **Side**, and **End View** images accordingly

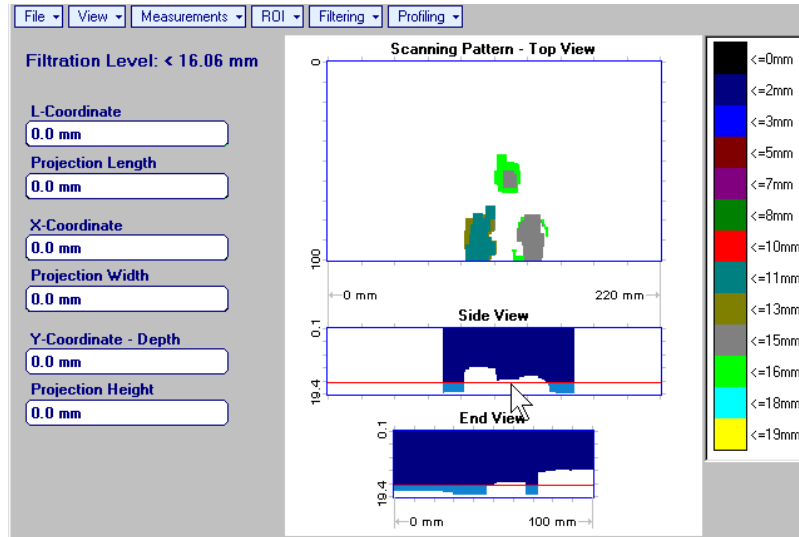
To interrupt selection of reference of **A-Scan** right mouse click or press **Esc** on keyboard









To interrupt re-adjusting of **Gain** click on  or press **Esc** on keyboard


- **Edit→Change Gain→OFF** (IOFFICE and MULTIPP SW Packages for external computer)– negates **Gain** re-adjustment and returns to originally recorded **Top**, **Side**, and **End View** images and original **Gain** setting

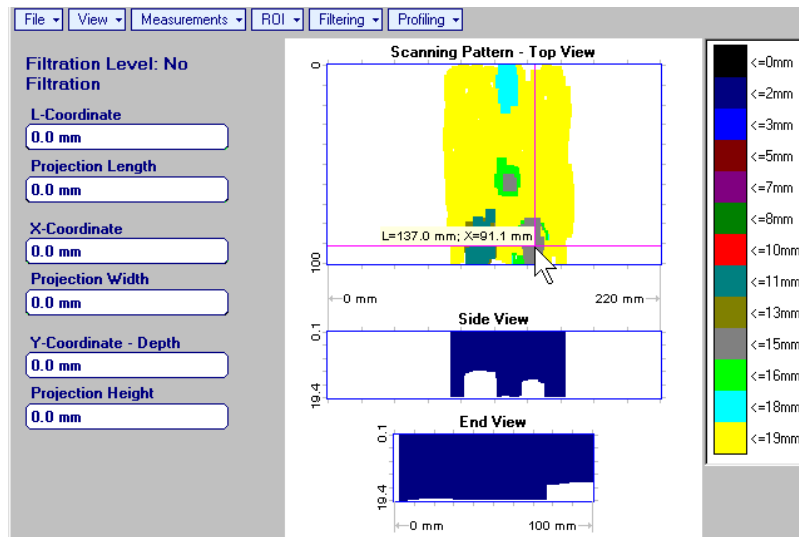
- Filtering → ON** – generates *sliding horizontal cursor* above **Side** and **End View** images, which may be controlled using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard. Position of the *sliding horizontal cursor* determines **Distance Filtration Level**, which is appropriately indicated. All elements of **Top**, **Side**, and **End View** images related to distances exceeding **Distance Filtration Level** are suppressed

To interrupt filtering procedure right mouse click or press  on front panel keyboard or **Esc** on external keyboard



- Filtering → OFF** – returns to originally recorded **Top**, **Side**, and **End View** images
- Profiling → ON** – generates *sliding horizontal and vertical cursors* above **Top View**, which may be controlled using either touch screen stylus or mouse or , , ,  on front panel keyboard or , , ,  on external keyboard. Positions of both *sliding cursors* are appropriately indicated in the **Profiling** box. Horizontal cursor determines sectional cut (vertical slice) represented as **Side View** image; vertical cursor determines sectional cut (vertical slice) represented as **End View** image

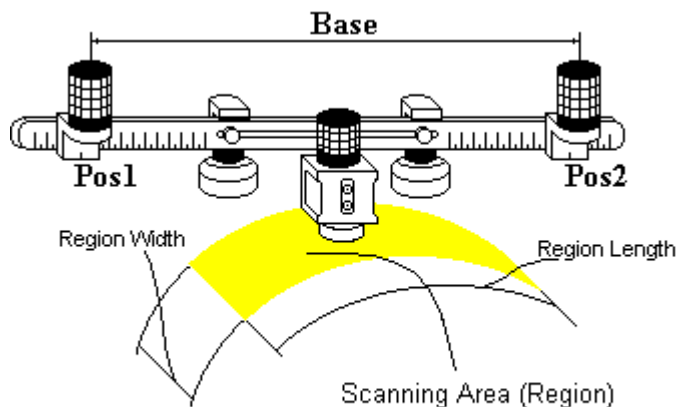
To interrupt profiling procedure right mouse click or press  on front panel keyboard or **Esc** on external keyboard



- Profiling → OFF** – returns to global **Top**, **Side**, and **End View** images

9.5. Running CORROMAP CU Mode

9.5.1. Preparations



Insert ultrasonic probe into probe holder then fix single emitter of airborne ultrasound on the top of probe holder – refer to paragraph 8.2 of this Operating Manual. Provide cabling according to paragraph 8.4.2 of this Operating Manual

Apply bar with receivers of airborne ultrasound at parallel to curved side of rectangle probe manipulation area. Single emitter and receivers of airborne ultrasound located on the bar to be equally distanced from scanning surface level. Distance between two receivers of airborne ultrasound (**Base**) is defined as:

$$\text{Base} = B_0 + \text{Pos1} + \text{Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly; **B₀** is parameter of the bar:

- **B₀** = 200 mm / 8 in for long bar (order code / part # S 2040 B)
- **B₀** = 100 mm / 4 in for short bar (order code / part # S 86000)



- Exact length of *Scanning area (Region Length)* is defined on **Base** and **Curvature Diameter** and calculated automatically
- It may occur that reducing of preliminary entered value of **Base** will be required – the appropriate indication will be generated by ISONIC 2006 – refer to paragraph 9.2.5 below



Enter **CORROMAP CU** mode according to paragraph 8.1 of this Operating Manual

9.5.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

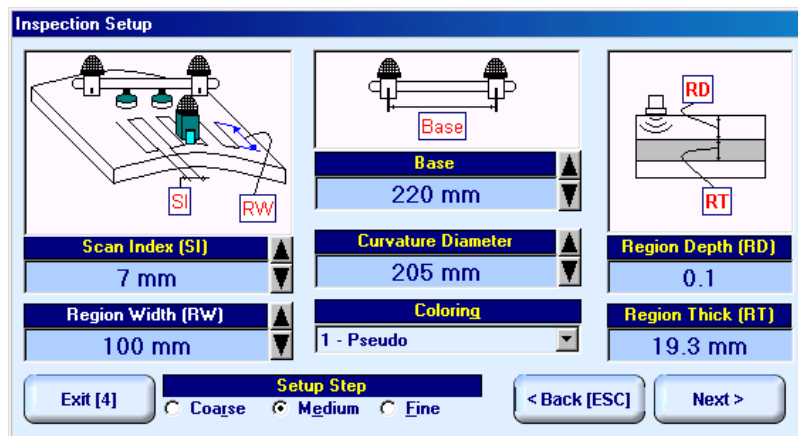
9.5.3. Pulser Receiver Settings

Refer to paragraph 9.1.3 of this Operating Manual

9.5.4. Probe

Refer to paragraph 9.1.4 of this Operating Manual


9.5.5. Scanning Parameters












In the **Inspection Setup** screen it is necessary to key in:

- ❑ **Curvature Diameter**, which must reflect *outside* diameter of object under test
- ❑ **Base** (distance between two receivers of airborne ultrasound)
- ❑ **Region Width**, which defines width of rectangular scanning area – refer to paragraph 9.5.1 of this Operating Manual
- ❑ **Scan Index** – value of **Scan Index** defining coverage of scanning area to be selected and entered according to inspection procedure

Unfolded length of curved side of scanning area is defined by 2 parameters - **Curvature Diameter** and **Base**

Setting of said parameters to be performed through clicking / pressing corresponding spin button  with **Fine**, **Medium**, or **Coarse** increments according to checked option (click on) in the **Setup Step** field

Alternatively parameter for setting may be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on its label. Label indicating name of selected parameter changes

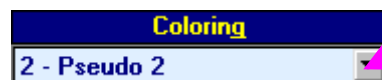
its fore color from yellow to white – since that moment parameter may be modified using , , ,  on front panel keyboard or , , ,  on external keyboard




Values of **Region Depth (RT)** and **Region Thick (RT)** for pulse echo mode indicated in the **Inspection Setup** screen are defined by **Gate A** settings of **UDS 3-5 Pulser Receiver**:



Region Depth (RD) = aStart

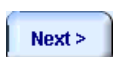

Region Thick (RT) = aWidth

Style of palette (**Pseudo**, **Thermal**, **Gray**, or **Custom**) is selectable through clicking on:



To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

9.5.6. Coupling Monitor

Refer to paragraph 9.1.6 of this Operating Manual

9.5.7. Referring Scanning Area (Zero Line)

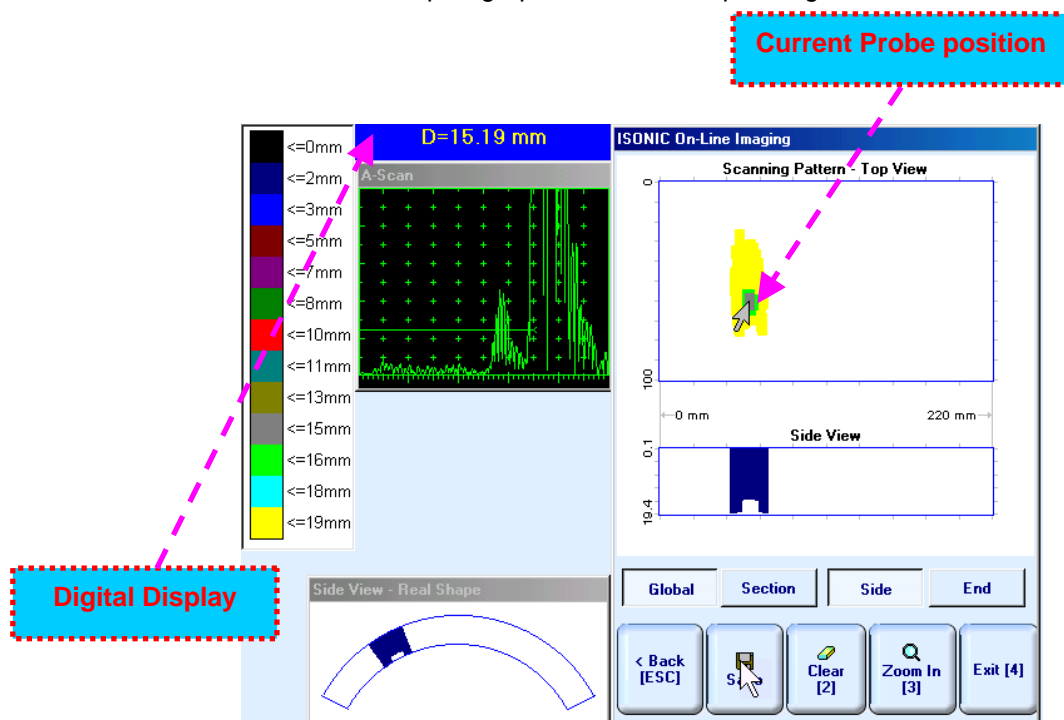
Refer to paragraph 9.1.7 of this Operating Manual

9.5.8. Imaging Principles

Refer to paragraph 9.4.8 of this Operating Manual

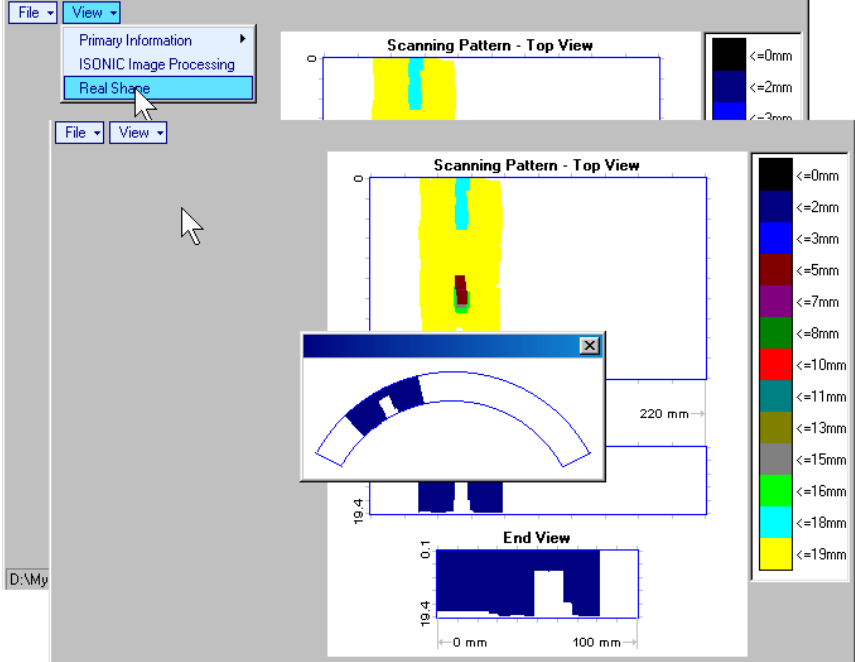
9.5.9. Scanning

Side View - Real Shape image is provided in addition to unfolded **Top**, **Side**, and **End View** images. For other notes and instructions refer to paragraph 9.5.9 of this Operating Manual



9.5.10. Postprocessing

Postprocessing menus for **CORROMAP CU** records are practically identical to the same related to **CORROMAP** records – refer to paragraph 9.4.10 of this Operating Manual. In addition it is possible to generate **Real Shape** image for **Side View** projection

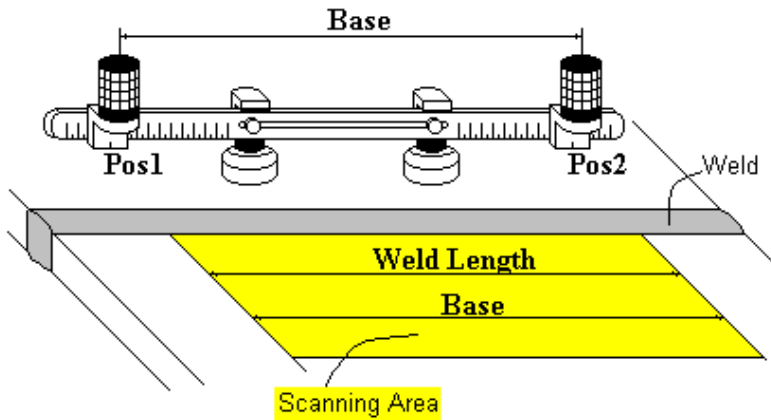


10. XY Scanning and Recording for Angle Beam Weld Inspection

10.1. Running I2-SONIC Mode – Inspection of Planar Butt Welds – Scanning from One Side

10.1.1. Preparations

Insert ultrasonic probe into probe holder and fix single or double emitter of airborne ultrasound on the top of probe holder – refer to paragraph 8.2 of this Operating Manual. Provide cabling according to paragraph 8.4.2 of this Operating Manual



Apply bar with receivers of airborne ultrasound at parallel to the weld: scanning area and bar to be situated at opposite sides of the weld. Single emitter or top element of double emitter and receivers of airborne ultrasound located on the bar to be equally distanced from scanning surface level. Distance between two receivers of airborne ultrasound (**Base**) is defined as:

$$\text{Base} = B_0 + \text{Pos1} + \text{Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly;

B₀ is parameter of the bar. Long bar (order code / part # S 2040 B) to be used for **I2-SONIC** mode: **B₀ = 200 mm / 8 in**



Base defines length of weld section, for which scanning and recording will be performed

$$\text{Weld Length} = \text{Base}$$



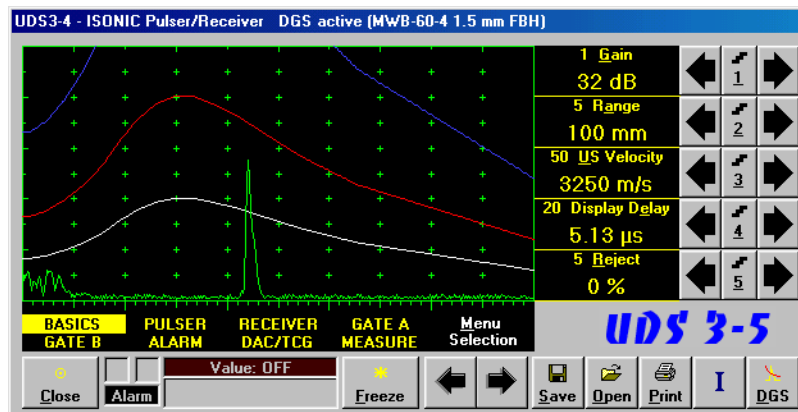
Enter **I2-SONIC** mode according to paragraph 8.1 of this Operating Manual

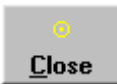

10.1.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

10.1.3. Pulsar Receiver Settings

Calibration of **UDS 3-5 Pulsar Receiver** to be provided with reference to Chapter 5 of this Operating Manual and table below



To return to previous screen click on  or press  on front panel keyboard or **Esc** or **<Alt>+<C>** on external keyboard

On completing calibration click on  or press  on front panel keyboard or **F8** on external keyboard

#	Parameter or Mode	Submenu	Required Settings	Note
1	Gain	BASICS	Gain setting to be performed according to inspection procedure providing required echo heights from defects to be detected	
2	DAC/TCG	DAC/TCG	DAC/TCG settings to meet requirements of inspection procedure	
3	Pulsar Mode	PULSER	Dual for dual element probes Single for single element probes	
4	Tuning, Pulse Width, Firing Level, Damping	PULSER	Tuning, Pulse Width, Firing Level, and Damping settings to provide optimal signal to noise ratio	To synchronize with Gain setting procedure
5	Filter, Frequency	RECEIVER	Filter and Frequency settings to match with probe's frequency	To synchronize with Gain setting procedure
6	Display	RECEIVER	Display setting may be either Full, RF, PosHalf, or NegHalf	The same Display mode to be used for both Probe Delay determining and t-ABIScan / ABIScan Recording
7	USVelocity	BASIC	USVelocity setting to be equal to actual value of ultrasound velocity in the object under test	
8	Probe Delay	MEASURE	Probe Delay setting to be equal to actual probe delay	Probe delay may be determined according to paragraph 5.2.13.5 or 5.2.13.6 or 5.2.13.9 of this Operating Manual or similarly
9	Angle	MEASURE	Angle setting to be equal to actual probe angle	
10	Settings for other parameters and modes have no significance			

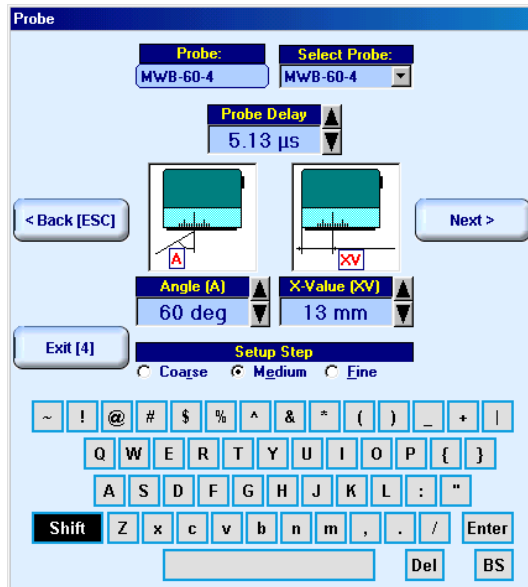
10.1.4. Probe

In the **Probe** screen it is necessary to select probe from database through click **on**




OR


to key in name of new probe to be used














It is necessary to key in or confirm:



- ❑ **Probe Delay** - value of **Probe Delay** is imported from settings of **UDS 3-5 Pulsar Receiver** or from probes database, it may be corrected if necessary. Value of probe delay confirmed in the **Probe** screen is dominant and will be used for automatic measurements and imaging whilst scanning
- ❑ **Angle** – incidence angle to be entered or imported from probes data base or from settings of **UDS 3-5 Pulsar Receiver**
- ❑ **X-value** – to be entered or imported from probes data base



Setting of said parameters to be performed through clicking / pressing corresponding spin button  with **Fine, Medium, or Coarse** increments according to checked option (click on) in the **Setup Step** field

Alternatively parameter for setting may be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on its label. Label indicating name of selected parameter changes

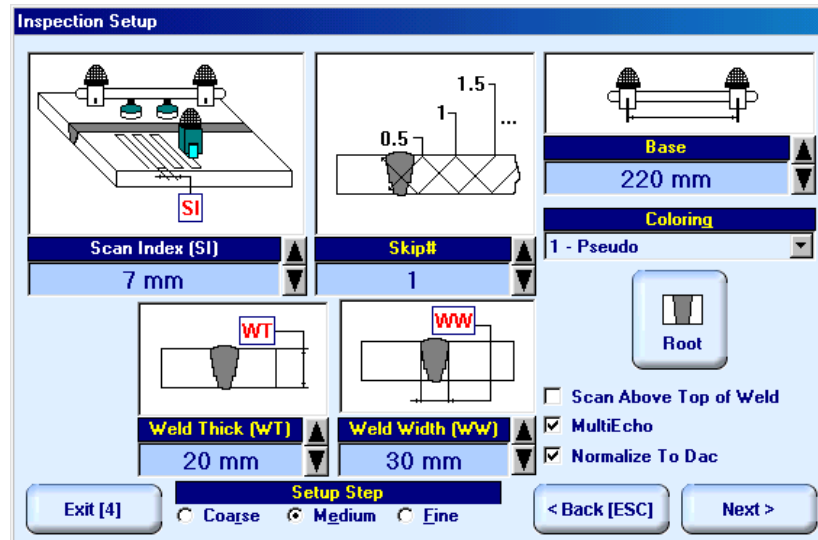
it's fore color from yellow to white – since that moment parameter may be modified using , , ,  on front panel keyboard or , , ,  on external keyboard

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard


To continue click on  or press  on front panel keyboard or **F8** on external keyboard – this will enter next stage related to defining inspection mode and scanning parameters


10.1.5. Scanning Parameters










In the **Inspection Setup** screen it is necessary to key in:

- ❑ **Base** – distance between two receivers of airborne ultrasound, which defines length of weld section, for which scanning and recording will be performed
- ❑ **Skip #** – defines cross-sectional insonification scheme; **Skip #** setting to be according to inspection procedure
- ❑ **Scan Index** – defines coverage of scanning area – to be selected and entered according to inspection procedure
- ❑ **Weld Thick** – thickness of parent material
- ❑ **Weld Width** – depending on inspection procedure value of **Weld Width** must cover weld metal width either with or without heat affected zone

Setting of said parameters to be performed through clicking / pressing corresponding spin button  with **Fine, Medium, or Coarse** increments according to checked option (click on) in the **Setup Step** field


Alternatively parameter for setting may be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on its label. Label indicating name of selected parameter changes

it's fore color from yellow to white – since that moment parameter may be modified using , , ,

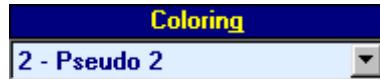
 on front panel keyboard or , , ,  on external keyboard




If scanning above machined weld cap is required – check **Scan Above Top of Weld** – refer also to paragraph 10.1.9.3 of this Operating Manual



Imaging options:



- ❑ **Root signals imaging** to be activated/negated through click on 
- ❑ **Multiecho** or **SAFT** imaging protocol to be activated/negated through check/don't check **Multiecho** option
- ❑ **Normalize to DAC** – echo amplitude color palette may be normalized either to **DAC/DGS** (check option) or to **50% of A-Scan** height level (don't check option) – refer also to paragraph 10.1.9.2 of this Operating Manual

Style of palette (**Pseudo, Thermal, Gray, or Custom**) is selectable through clicking on:



To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard










To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

10.1.6. Coupling Monitor

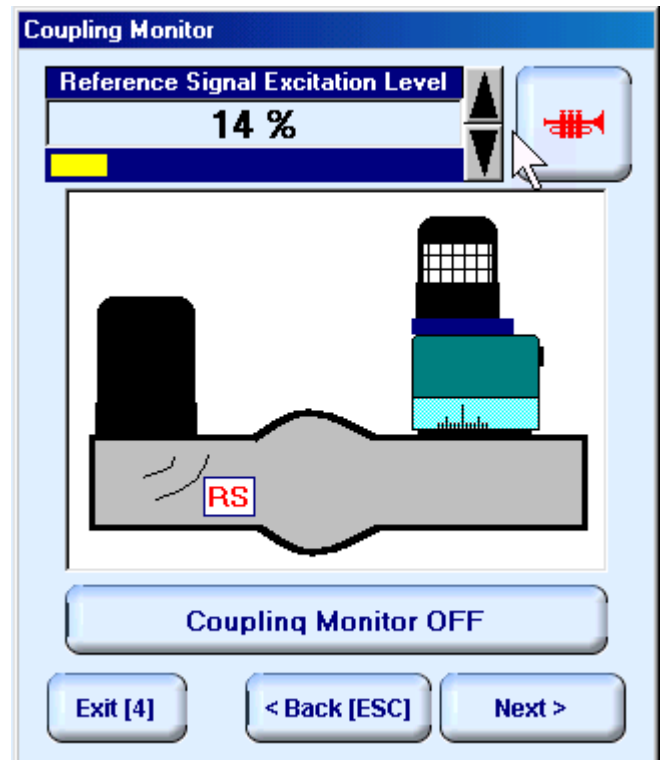
In the **Coupling Monitor** screen activation of coupling monitor to be performed through setting of **Reference Signal Excitation Level**

Setting of **Reference Signal Excitation Level** may be performed through clicking / pressing its spin


button  or through pressing , , ,  on front panel keyboard or , , ,  on external keyboard

To setup coupling monitor proceed as below:

- ❑ apply emitter of acoustic coupling monitor signal and probe with probe holder equipped with emitter of airborne ultrasound to object under test using excessive quantity of couplant
- ❑ find threshold of **Reference Signal Excitation Level**, which is perceptible trough changing color of horizontal bar indicator (red color means insufficient coupling or still low level of excitation) and audible alarm (if active)
- ❑ add 3% to 7% to found threshold value








To switch coupling monitor OFF click on  or set **0%** for **Reference Signal Excitation Level**



To switch ON / OFF audible alarm for insufficient coupling click on 



If dimensions of object under test and / or its surface conditions don't allow reaching sufficient coupling indication even if value of **Reference Signal Excitation Level** is set to 100% then two or more emitters of acoustic coupling monitor signal must be connected to **Out Cpl** socket of **ISONIC** via appropriate splitter SE 20220

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

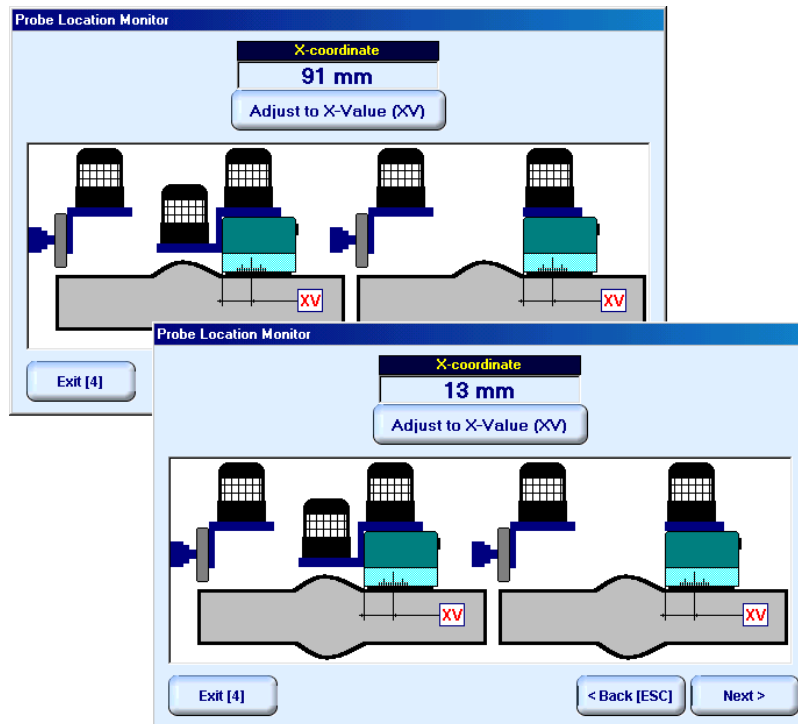
10.1.7. Referring Scanning Area



Place probe equipped with emitter of airborne ultrasound into scanning area according to sketch generated in the **Probe Location Monitor** screen then:


click on **Adjust to X-Value (XV)**


OR

select **Adjust to X-Value (XV)** using , , ,  or  on front panel keyboard or , , ,  or **F7** on external keyboard then press  on front panel keyboard or **Enter** on external keyboard



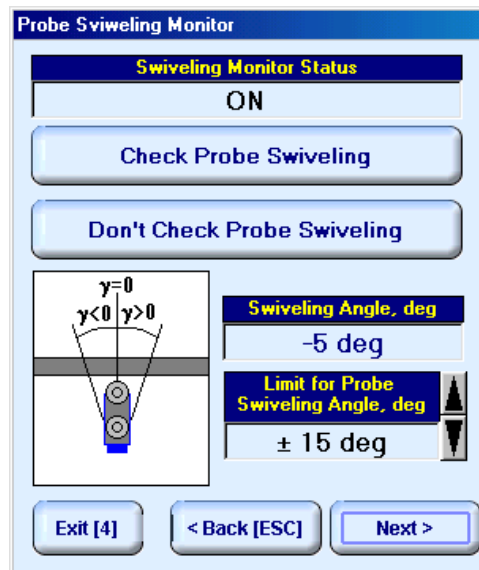
To return back to **XY Scanning Recording and Imaging Menu** click on **Exit [4]** or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on **< Back [ESC]** or press  on front panel keyboard or **Esc** on external keyboard










To continue click on **Next >** or press  on front panel keyboard or **F8** on external keyboard




10.1.8. Probe Swiveling Monitor



In **Probe Swiveling Monitor** screen it is necessary to activate/negate probe swiveling monitor through click on appropriate button. Double emitter of airborne ultrasound S 4050 is necessary to monitor probe swiveling angle





If **Probe Swiveling Monitor** is active then it is necessary to set **Limit for Probe Swiveling Angle** in

accordance with inspection procedure through clicking / pressing its spin button  or through pressing , , ,  on front panel keyboard or , , ,  on external keyboard

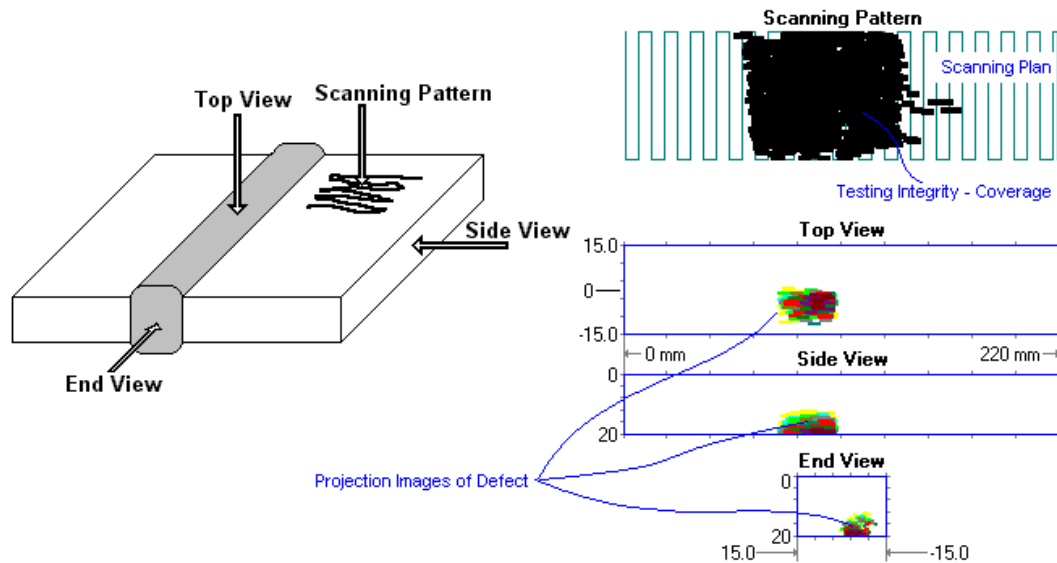
To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

10.1.9. Imaging Principles

10.1.9.1. Scanning Plan and Projection Images of Weld Volume



- **Background Images** are generated for:

- **Scanning Plan**
- **Top View**
- **Side View**
- **End View**

said images are stipulated by **Weld Thickness, Weld Width, Scan Index, Skip#, and Probe Angle**

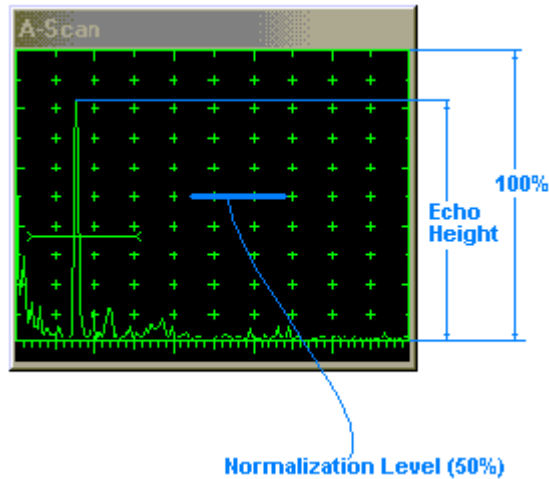
- **Actually Performed Probe Trace** is imaged in real time above **Scanning Plan** in the **Scanning Pattern** area. If **Coupling Monitor** and/or **Probe Swiveling Monitor** are/is active then image of **Actually Performed Probe Trace** is updated by condition of sufficient coupling and/or swiveling angle; said image represents **Testing Integrity**
- **Defects Projection Images** are generated in 3 planes – **Top, Side, and End View** – through on-line correlating between received echoes, probe coordinates, swiveling angle (optionally), and coupling degree (optionally)

10.1.9.2. Echo Amplitude Palette

Echo amplitude is represented by color of corresponding segment of defect image in **Top, Side, End View**; there are 13 color grades covering 24 dB range with 2 dB increment according to protocol selected by operator. There are 3 protocols available:

- **Standard Level Normalizing** (in the **Inspection Setup** screen uncheck **Normalize to DAC** option) – dB rate of echo height is determined through relation to 50% A-Scan Height level:

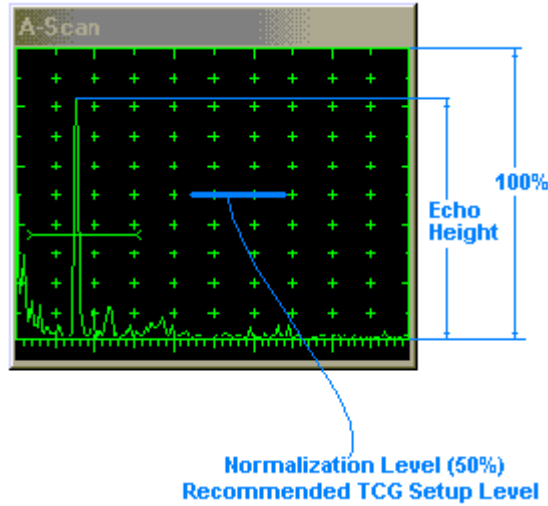
$$Color_Grade = 6 + Int \left[\frac{1}{2} \times \left(20 \times Log_{10} \frac{Echo_Height, \%}{50\%} \right) \right]$$



Color Grade	Echo Height (EH) in % of the A-Scan Screen Height	Color / dB
0	EH ≤ 12.5 %	- 12
1	12.5 % < EH ≤ 15.8 %	- 10
2	15.8 % < EH ≤ 19.9 %	- 8
3	19.9 % < EH ≤ 25.0 %	- 6
4	25.0 % < EH ≤ 31.5 %	- 4
5	31.5 % < EH ≤ 39.7 %	- 2
6	39.7 % < EH ≤ 50.0 %	0
7	50.0 % < EH ≤ 62.9 %	2
8	62.9 % < EH ≤ 79.2 %	4
9	79.2 % < EH ≤ 100.0 %	6
10	100.0 % < EH ≤ 125.6 %	8
11	125.6 % < EH ≤ 158.1 %	10
12	158.1 % < EH	12

- Standard Level TCG Normalizing** (in the **Inspection Setup** screen uncheck **Normalize to DAC** option) – dB rate of TCG-normalized echo height is determined through relation to 50% A-Scan Height level:

$$Color_Grade = 6 + Int \left[\frac{1}{2} \times \left(20 \times \log_{10} \frac{Echo_Height, \%}{50\%} \right) \right]$$



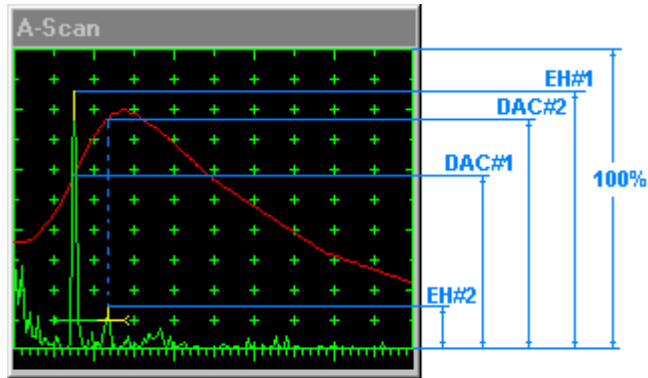
Color Index	Echo Height (EH) in % of the A-Scan Screen Height	Color / dB
0	EH ≤ 12.5 %	- 12
1	12.5 % < EH ≤ 15.8 %	- 10
2	15.8 % < EH ≤ 19.9 %	- 8
3	19.9 % < EH ≤ 25.0 %	- 6
4	25.0 % < EH ≤ 31.5 %	- 4
5	31.5 % < EH ≤ 39.7 %	- 2
6	39.7 % < EH ≤ 50.0 %	0
7	50.0 % < EH ≤ 62.9 %	2
8	62.9 % < EH ≤ 79.2 %	4
9	79.2 % < EH ≤ 100.0 %	6
10	100.0 % < EH ≤ 125.6 %	8
11	125.6 % < EH ≤ 158.1 %	10
12	158.1 % < EH	12



TCG to be active – refer to paragraph 10.1.3 of this Operating Manual

- **DAC/DGS Normalizing** (in the **Inspection Setup** screen check **Normalize to DAC** option) – dB rate of echo height is determined through relation to corresponding DAC/DGS level

$$Color_Grade = 6 + Int \left[\frac{1}{2} \times \left(20 \times \log_{10} \frac{Echo_Height, \%}{DAC / DGS_Level, \%} \right) \right]$$



EH#1 - Echo Height # 1
 DAC#1 - DAC Level Corresponding to the Echo # 1
 EH#2 - Echo Height # 2
 DAC#2 - DAC Level Corresponding to the Echo # 2

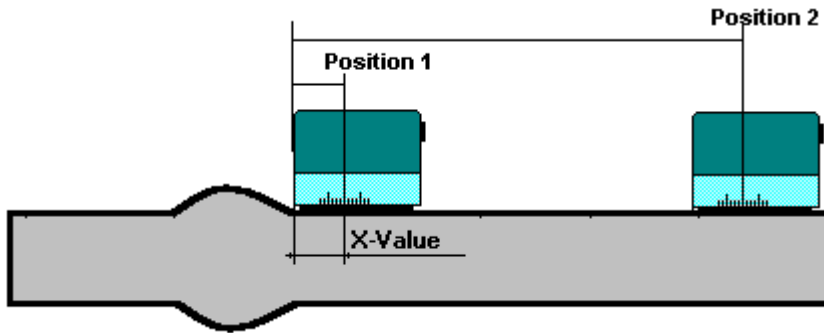
Color Index	Echo Height (EH) with respect to the Corresponding DAC Level	Color / dB
0	$EH/DAC \leq 0.250$	- 12
1	$0.250 < EH/DAC \leq 0.316$	- 10
2	$0.316 < EH/DAC \leq 0.398$	- 8
3	$0.398 < EH/DAC \leq 0.500$	- 6
4	$0.500 < EH/DAC \leq 0.630$	- 4
5	$0.630 < EH/DAC \leq 0.794$	- 2
6	$0.794 < EH/DAC \leq 1.000$	0
7	$1.000 < EH/DAC \leq 1.258$	2
8	$1.258 < EH/DAC \leq 1.584$	4
9	$1.584 < EH/DAC \leq 2.000$	6
10	$2.000 < EH/DAC \leq 2.512$	8
11	$2.512 < EH/DAC \leq 3.162$	10
12	$3.162 < EH/DAC$	12



DAC/DGS to be active – refer to paragraph 10.1.3 of this Operating Manual

10.1.9.3. Scanning Area

Scanning Scheme # 1:

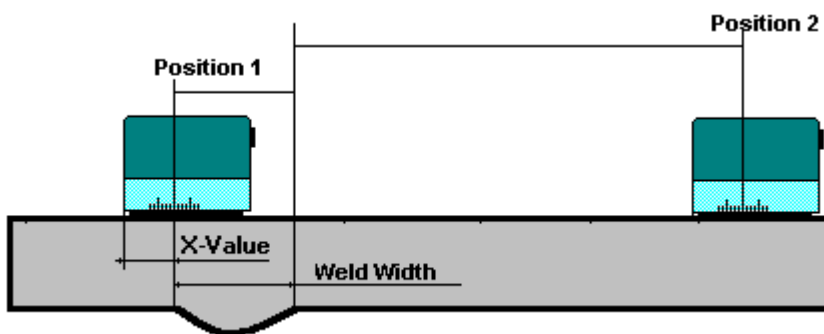


To perform scanning *above the parent material only* uncheck **Scan Above Top of Weld** option in the **Inspection Setup** screen; the limits for the transversal probe manipulation will be defined then automatically as:

Position 1 = X-Value

Position 2 = 2 * Skip# * Material Thickness * Tan (ProbeAngle)

Scanning Scheme # 2:

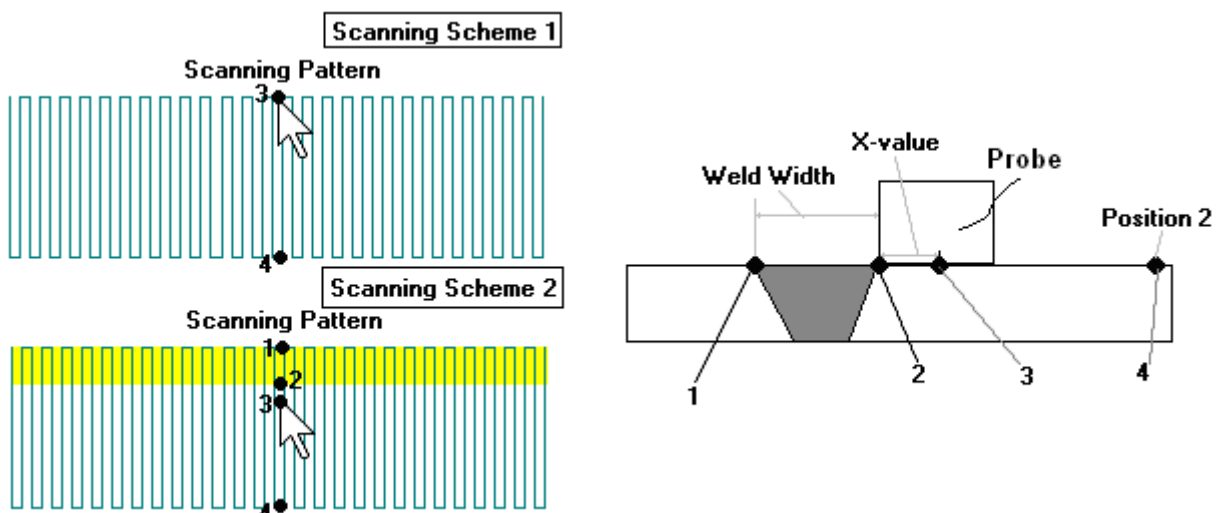


To perform scanning *above the parent material and machined weld cap* check **Scan Above Top of Weld** option in the **Inspection Setup** screen; the limits for the transversal probe manipulation will be defined then automatically as:

Position 1 = - Weld Width

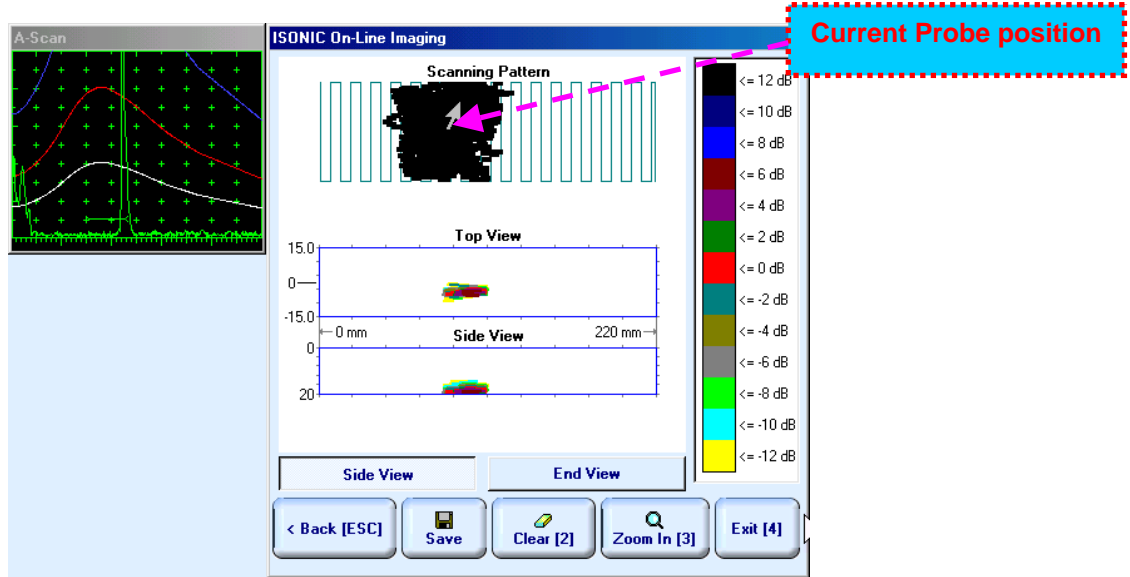
Position 2 = 2 * Skip# * Material Thickness * Tan (ProbeAngle)

Background image of scanning plan depends on the **Scanning Scheme** selected:






10.1.10. Scanning

During scanning **ISONIC On-Line Imaging** screen is accompanied with **A-Scan**







ISONIC On-Line Imaging screen represents:



- Current Probe Position
- Current Coupling Status (optionally, provided that coupling monitor is active – refer to paragraph 10.1.6 of this Operating Manual)
- Current Probe Swiveling Status (optionally, provided that probe swiveling monitor is active – refer to paragraph 10.1.8 of this Operating Manual)
- Top View**



- Side View** for  pressed down or **End View** for  pressed down or press  on front panel keyboard or **F7** on external keyboard to switch between **Side** and **End View**








While scanning delay and width of the **Gate A** are changed dynamically depending on the probe position; this represents corresponding part of weld volume, which is currently insonified. All **A-Scans** are captured unconditionally however projection images **Top View**, **Side View**, and **End View** are updated only with signals exceeding threshold of **Gate A** presented on the **A-Scan**

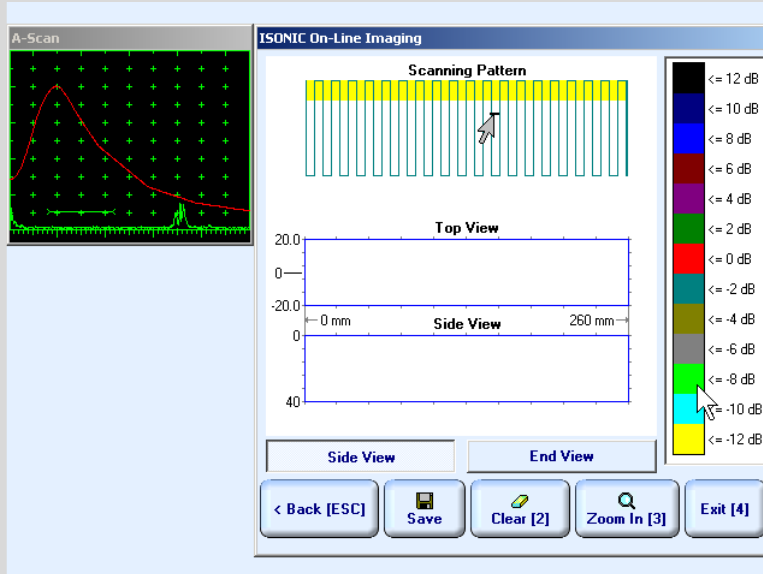
To **Zoom In** **ISONIC On-Line Imaging** screen click on  or press  on front panel keyboard or **F3** on external keyboard. To **Zoom Out** click on  or press  on front panel keyboard or **Esc** on external keyboard

To cleanup **Top View**, **Side View**, and **End View** fields in **ISONIC On-Line Imaging** screen click on  or press  on front panel keyboard or **F2** on external keyboard

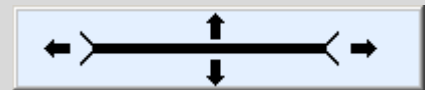
To save **I2-SONIC** record into a file click on  or press  on front panel keyboard or press **F12** on external keyboard. Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard









To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

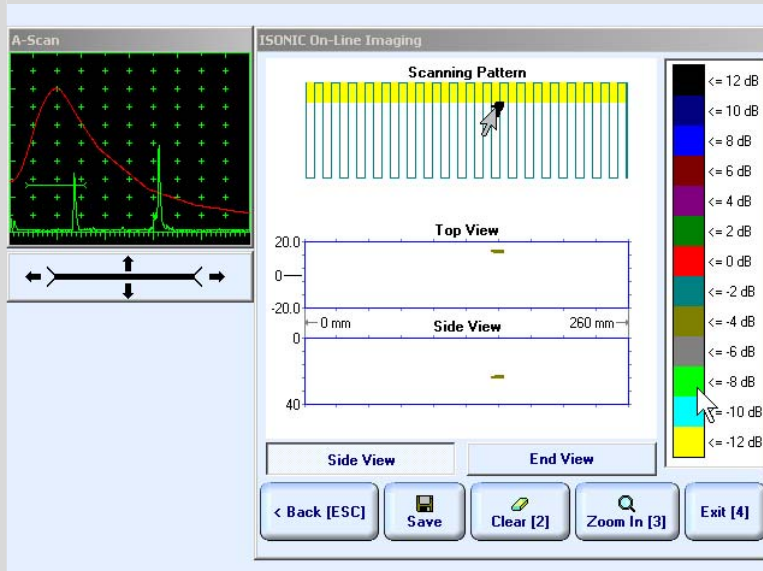


On case of scanning above parent material is combined with scanning above the machined weld cap the scanning screen depends on current probe position: on case of probe is placed above the machined weld cap there is additional control indicated under the A-Scan field:



Use of this control is possible through

pressing , , ,  on front panel keyboard or , , ,  on external keyboard – this allows to adjust threshold and minimal limit for the delay of **Gate A** to avoid imaging of reverberations in the probe wedge while probe is placed above top of the weld

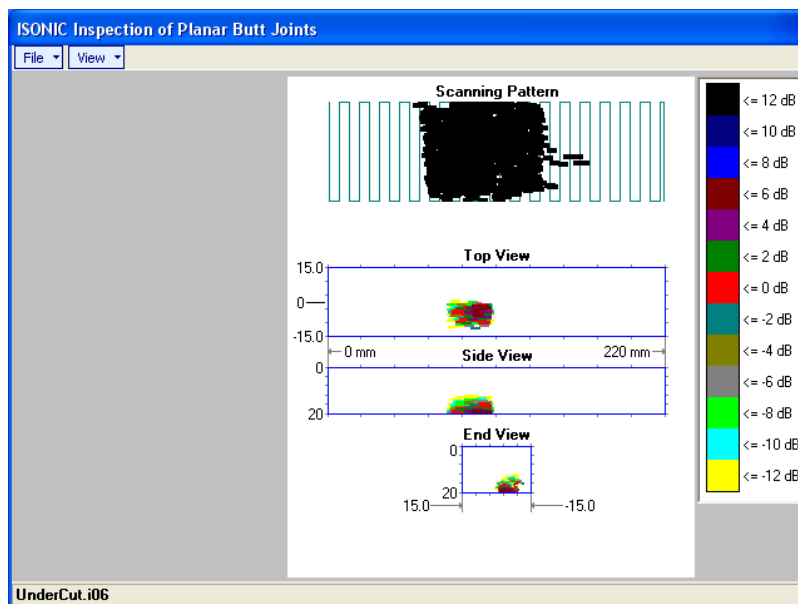


10.1.11. Postprocessing

Postprocessing may be performed in the instrument or in external computer using **IOFFICE** SW package. User interface and operations are practically identical except two features listed below:

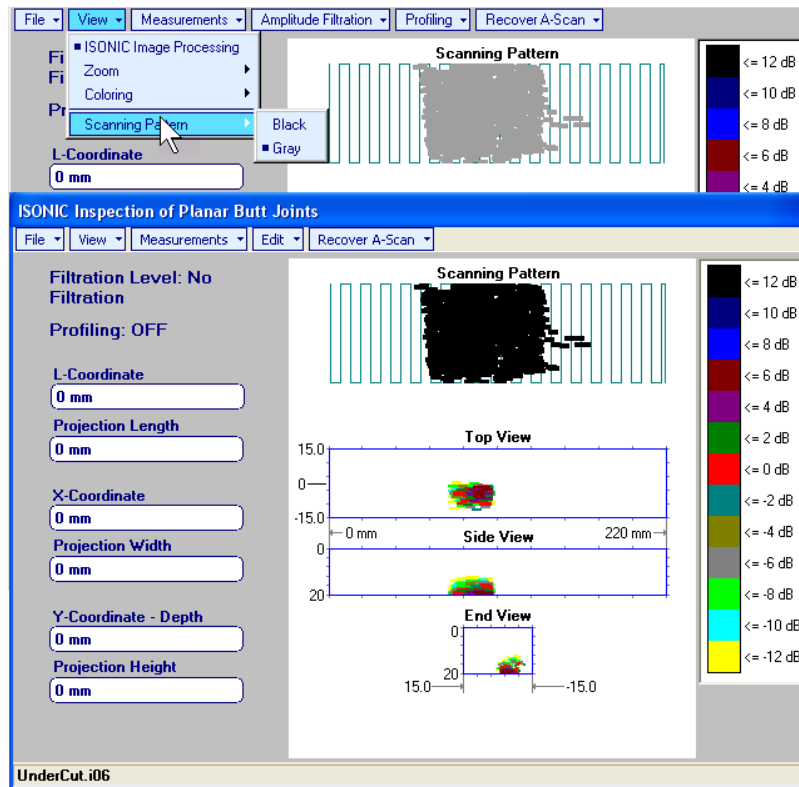
	Off-line analysis in the instrument	Off-line analysis in external computer using IOFFICE SW Package
Off-line re-adjustment of Gain	NO	YES
Automatic creation of Inspection report in MS Word® format	NO	YES

Menu Bar Functions on Opening File









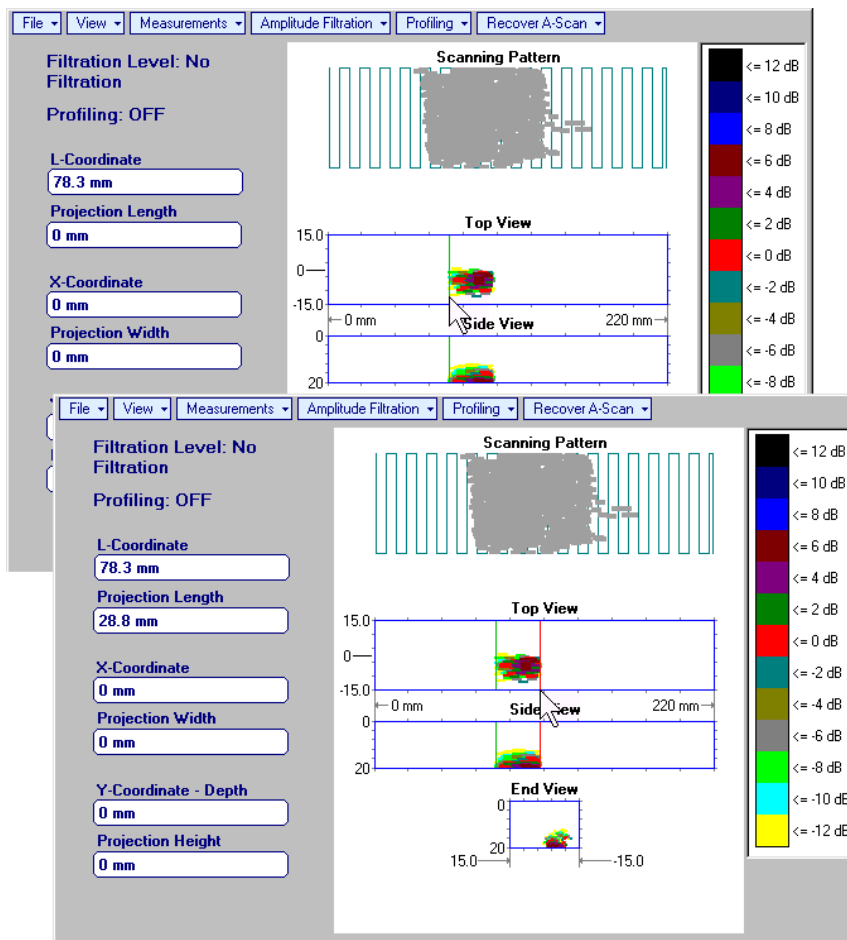
- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word®** as printer to create inspection report as doc file (**IOFFICE** SW Package only)
 - selection of paper sheet size either A4 or Letter
- **File → Print → Whole Report** – prints out complete inspection report including **UDS 3-5 Pulsar Receiver** settings, inspection setup and scanning parameters, recorded maps, and additional data entered at the appropriate pre-inspection stages as it is described in paragraphs 9.1.2 and 10.1.3 of this Operating Manual
- **File → Print → Graphics Only** – prints out scanning recorded maps
- **File → Exit** – ends postprocessing session
- **View → Primary Information** – previews **UDS 3-5 Pulsar Receiver** settings, inspection setup and scanning parameters, and additional data entered at the appropriate pre-inspection stages as it is described in paragraphs 9.1.2 and 10.1.3 of this Operating Manual
- **View → Scanning Pattern** – allows to select between black and gray colors for image of actually performed probe trace
- **View → ISONIC Image Processing** – activates menu for detailed off-line analysis of the record







ISONIC Image Processing Menu Bar Functions

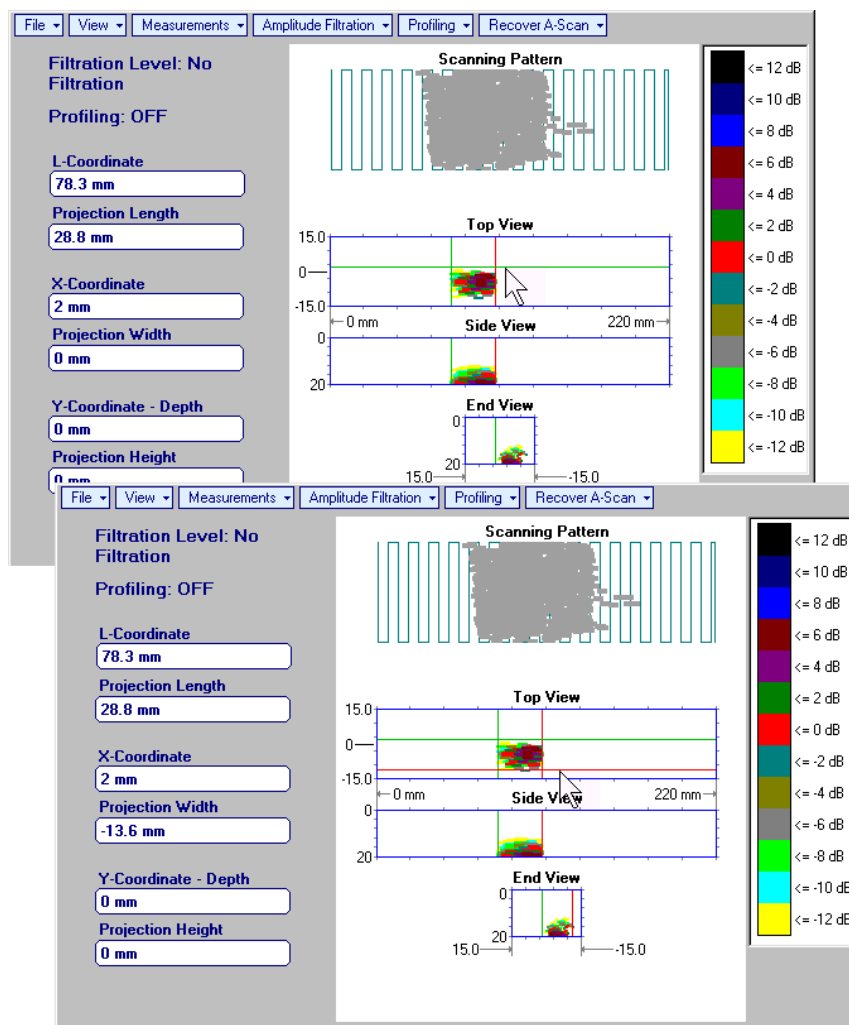








- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word**® as printer to create inspection report as doc file (**IOFFICE SW Package** only)
 - selection of paper sheet size either A4 or Letter
- **File → Print** – prints current postprocessing page
- **File → Exit** – ends postprocessing session
- **View → ISONIC Image Processing** – returns to initial postprocessing screen appearing on opening file
- **View → Zoom** – zooms maps as per operator's selection
- **View → Coloring** – selection of **color scale (palette)** style applied to maps
- **View → Scanning Pattern** – selection of black or gray color for representation of actually performed probe trace

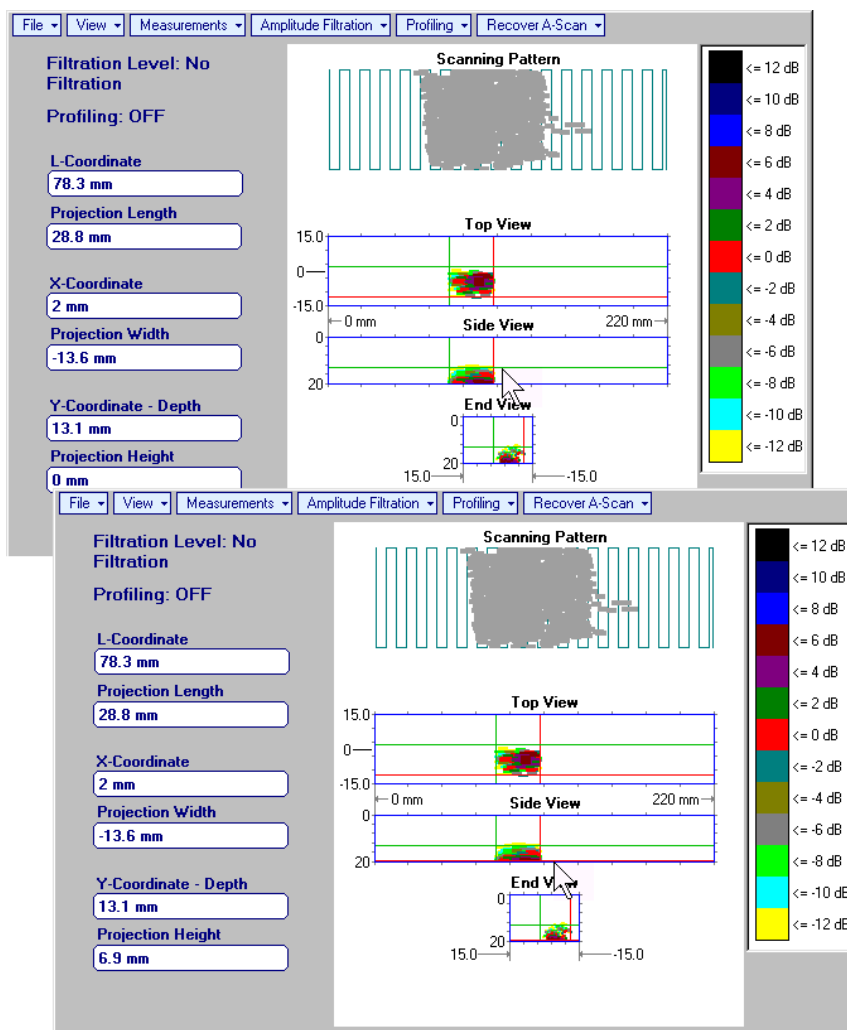
- Measurements → L-Coordinate, Projection Length** – generates *first vertical cursor* that may be guided over **Top** and **Side View** images using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first vertical cursor* along **Top** and **Side View** images is indicated in the **L-Coordinate** field. To fix position of the *first vertical cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second vertical cursor* appears upon fixing the first one; it may be manipulated by the same way. Coordinate of the *second vertical cursor* along **Top** and **Side View** images measured relatively first vertical cursor is indicated in the **Projection Length** field. Provided that *vertical cursors* are placed properly:
 - L-Coordinate** represents distance between left border of scanning area and selected defect's end
 - Projection Length** represents appropriate size of defect
 To interrupt **L-Coordinate** and **Projection Length** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard













- Measurements → X-Coordinate, Projection Width** – generates *first horizontal cursor* that may be guided over **Top View** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first horizontal cursor* along **Top View** image is indicated in the **X-Coordinate** field. To fix position of the *first horizontal cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second horizontal cursor* appears upon fixing first one; it may be manipulated by the same way. Coordinate of the *second horizontal cursor* along **Top View** image measured relatively *first horizontal cursor* is indicated in the **Projection Width** field. Provided that *horizontal cursors* are placed properly:
 - **X-Coordinate** represents distance between weld centerline and selected defect's end
 - **Projection Width** represents appropriate size of defect
 Horizontal cursors generated and manipulated over **Top View** image are accompanied with synchronous vertical cursors over **End View** image
 To interrupt **X-Coordinate** and **Projection Width** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard

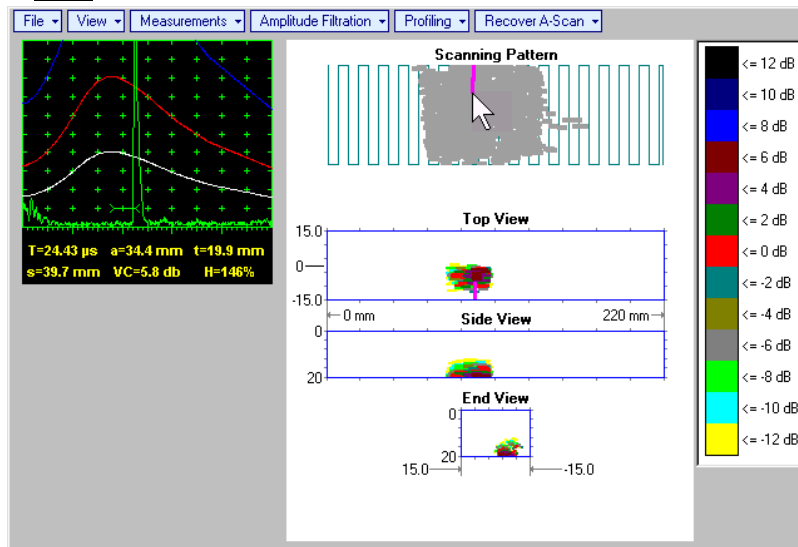


- Measurements → Y-Coordinate - Depth, Projection Height** – generates *first horizontal cursor* that may be guided over **Side** and **End View** images using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first horizontal cursor* along **Side** and **End View** images is indicated in the **Y-Coordinate-Depth** field. To fix position of the first *horizontal cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second horizontal cursor* appears upon fixing first one, it may be manipulated by the same way. Coordinate of the *second horizontal cursor* along **Side** and **End View** images measured relatively *first horizontal cursor* is indicated in the **Projection Height** field. Provided that *horizontal cursors* are placed properly:
 - **Y-Coordinate - Depth** represents depth of defect
 - **Projection Height** represents appropriate size of defect
 To interrupt **Y-Coordinate - Depth** and **Projection Height** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard






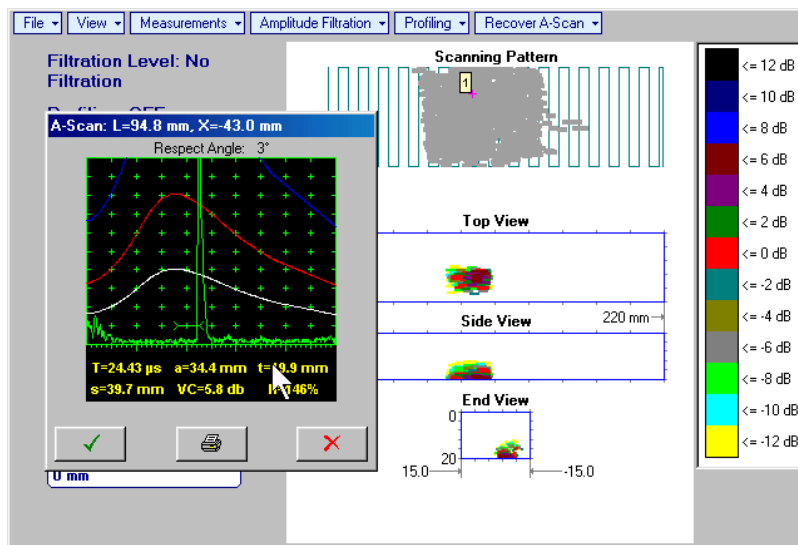
- **Recover A-Scan → Add Point** – generates *pointing cursor* that may be guided over **Scanning Pattern**

image using either touch screen stylus or mouse or , , ,  on front panel keyboard or , , ,  on external keyboard; by means of said *pointing cursor* representing probe's incidence point virtual off-line scanning is performed with recovering of recorded **A-Scans**, which are accompanied with appropriate **Gate A** measurements – refer to paragraph 5.2.13 of this Operating Manual for measurements legend. Pointing cursor is accompanied with blue beam indicator above **Scanning Pattern** and **Top View** images, said beam indicator represents probe swiveling angle and weld volume crossing for recovered **A-Scan**. To memorize **A-Scan** related to current *pointing cursor* position for further printing out release touch screen stylus or left mouse click or press  on front panel keyboard or **Enter** on external keyboard. To interrupt virtual off-line scanning press  on front panel keyboard or **Esc** on external keyboard



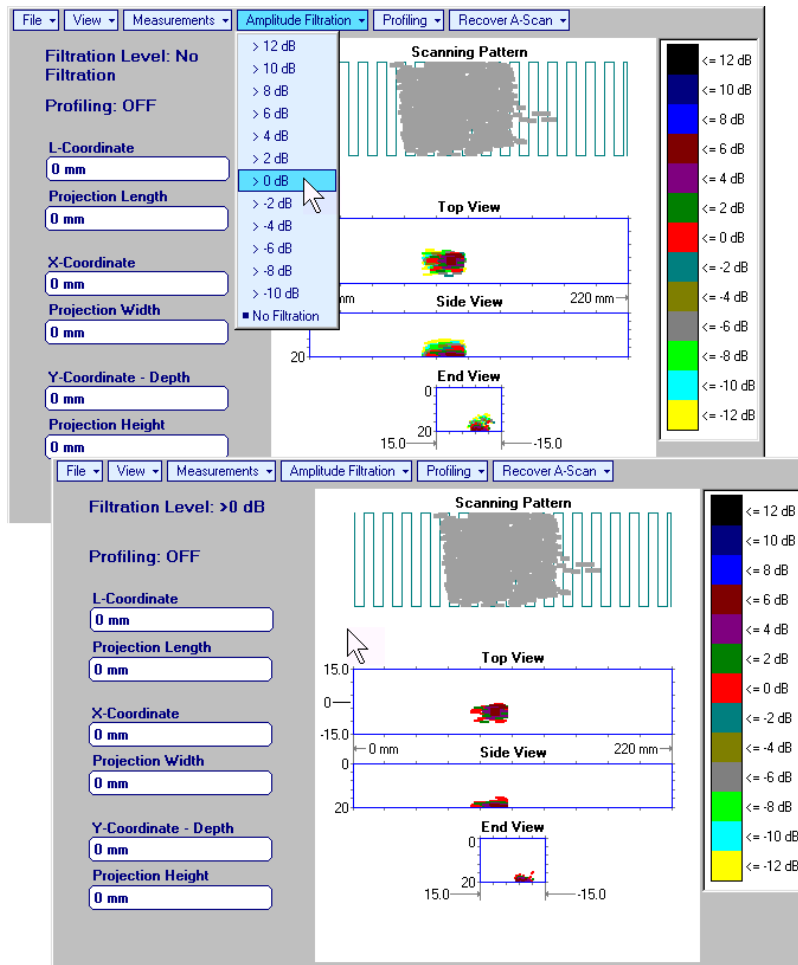
Points with memorized **A-Scans** and measuring results are highlighted by appropriate numbered marks on **Top View** image; to preview a point double click on it – this will generate popup box as below:

- To erase highlighted mark click on 
- To print out individual point report click on 
- To return to main menu operation click on 





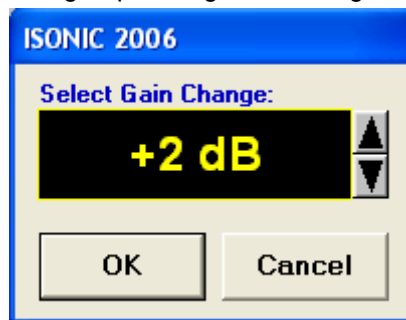
- **Recover A-Scan → Clear Last** – erases last pointed mark from **Scanning Pattern** image
- **Recover A-Scan → Clear All** – erases all marks from **Scanning Pattern** image

- **Amplitude Filtration** (instrument) or **Edit → Amplitude Filtration** (IOFFICE SW Package for external computer) – applies reject level to **Top**, **Side**, and **End View** maps – segments of these images corresponding to echo amplitudes below selected level will be suppressed



- **Edit→Change Gain→ON** – (IOFFICE SW Package for external computer) – generates popup window allowing off-line re-adjusting of **Gain** for all **A-Scans** captured during **I2-SONIC** Scanning in **±6dB** range

with **±2 dB** increments through clicking or pressing and holding on  or pressing  on keyboard












Upon completing re-adjusting **Gain** click on  or press **Enter** on keyboard – this applies new **Gain** value to all captured **A-Scans** and updates **Top**, **Side**, and **End View** images accordingly

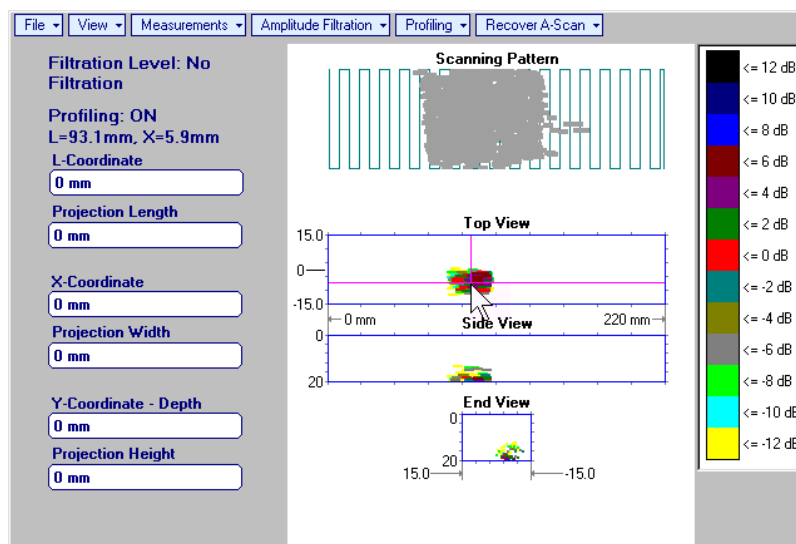
To interrupt re-adjusting of **Gain** click on  or press **Esc** on keyboard

- **Edit→Change Gain→OFF** (IOFFICE SW Package for external computer)– negates **Gain** re-adjustment and returns to originally recorded **Top**, **Side**, and **End View** images and original **Gain** setting





- **Profiling → L,X Profiling** (instrument) or **Edit → Profiling → L,X Profiling** (IOFFICE SW Package for external computer) – generates *sliding horizontal and vertical cursors* above **Top View**, which may be


controlled using either touch screen stylus or mouse or , , ,  on front panel keyboard or , , ,  on external keyboard. Positions of both *sliding cursors* are appropriately indicated. Horizontal cursor determines vertical slice represented as **Side View** image; vertical cursor determines vertical slice represented as **End View** image

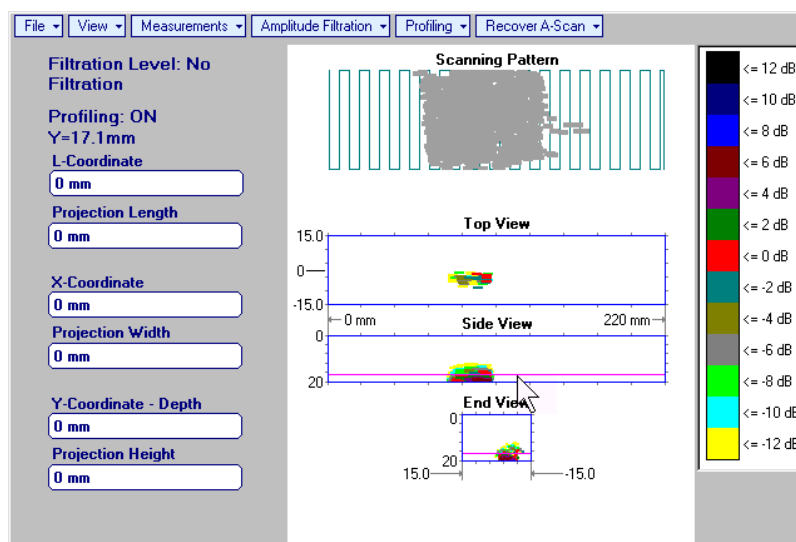
To interrupt profiling procedure right mouse click or press  on front panel keyboard or **Esc** on external keyboard



- **Profiling → Y Profiling** (instrument) or **Edit → Profiling → Y Profiling** (IOFFICE SW Package for external computer) – generates *sliding horizontal cursor* above **Side** and **End View** images, which may

be controlled using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard. Position of *sliding horizontal cursor* is appropriately indicated. Horizontal cursor determines horizontal slice represented as **Top View** image

To interrupt profiling procedure right mouse click or press  on front panel keyboard or **Esc** on external keyboard

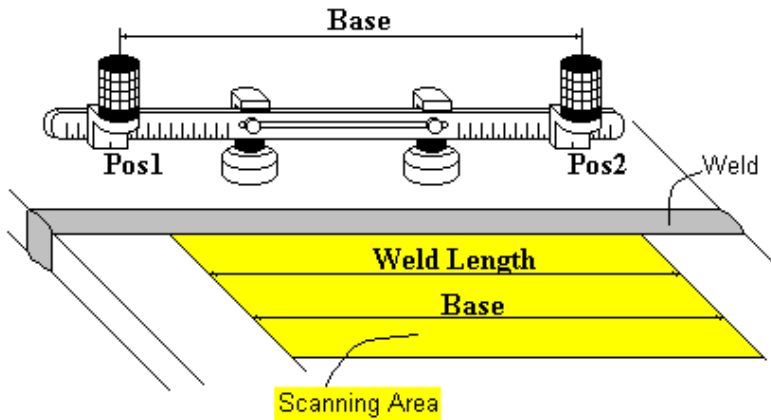


- **Profiling → Profiling Off** (instrument) or **Edit → Profiling → Profiling Off** (IOFFICE SW Package for external computer) – returns to global **Top**, **Side**, and **End View** images

10.2. Running EXPERT Mode – Expert Evaluation of Short Welded Sections

10.2.1. Preparations

Insert ultrasonic probe into probe holder and fix single or double emitter of airborne ultrasound on the top of probe holder – refer to paragraph 8.2 of this Operating Manual. Provide cabling according to paragraph 8.4.2 of this Operating Manual



Apply bar with receivers of airborne ultrasound at parallel to the weld: scanning area and bar to be situated at opposite sides of the weld. Single emitter or top element of double emitter and receivers of airborne ultrasound located on the bar to be equally distanced from scanning surface level. Distance between two receivers of airborne ultrasound (**Base**) is defined as:

$$\text{Base} = B_0 + \text{Pos1} + \text{Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly;

B₀ is parameter of the bar:

- **B₀ = 200 mm / 8 in** for long bar (order code / part # S 2040 B)
- **B₀ = 100 mm / 4 in** for short bar (order code / part # S 86000)



Base defines length of weld section, for which scanning and recording will be performed

$$\text{Weld Length} = \text{Base}$$



Enter **EXPERT** mode according to paragraph 8.1 of this Operating Manual

10.2.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

10.2.3. Pulser Receiver Settings

Refer to paragraph 10.1.3 of this Operating Manual

10.2.4. Probe

Refer to paragraph 10.1.4 of this Operating Manual

10.2.5. Scanning Parameters

To provide highest frontal resolution the value of **Scan Index** may be setup to **0.25** or **0.5 mm / 0.01** or **0.02 in.** For other instructions and notes refer to paragraph 10.1.4 of this Operating Manual

10.2.6. Coupling Monitor

Refer to paragraph 10.1.6 of this Operating Manual

10.2.7. Referring Scanning Area

Refer to paragraph 10.1.7 of this Operating Manual

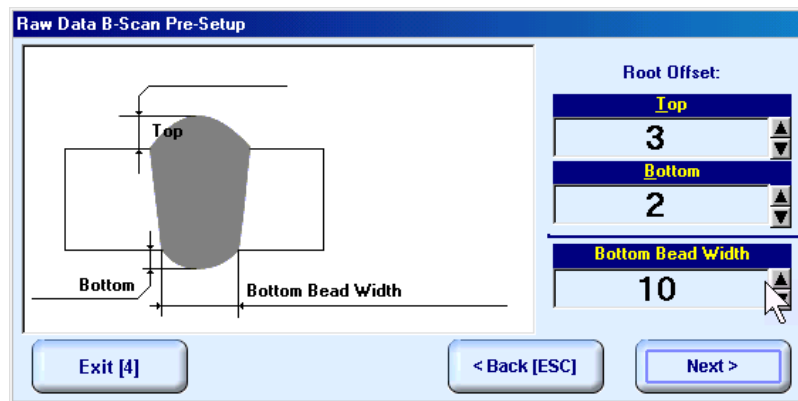
10.2.8. Probe Swiveling Monitor

Refer to paragraph 10.1.8 of this Operating Manual

10.2.9. Imaging Principles


Top, Side, and End View of weld with projection images of defects are formed as it is explained in paragraph 10.1.9 of this Operating Manual. It is also possible to provide raw data **B-Scan** cross sectional imaging at any location along weld and to compress all raw data cross-sectional **B-Scans** and **Scanning Pattern, Top, Side, and End View** data into a sole inspection file. **B-Scan** cross sectional imaging is provided as true-to-location **ABIScan** according to paragraphs 7.4.2.7 and 7.4.2.8 of this Operating Manual


10.2.10. Cross Sectional Weld Profile




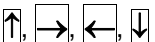
In **Raw Data B-Scan Pre-Setup** screen it is necessary to key in:




- ❑ **Top** – level of excessive weld metal above scanning side of parent material – for the standard EXPERT configuration **Top** value may vary in the range **0...30% of Weld Thickness**
- ❑ **Bottom** – level of excessive weld metal below bottom side of the weld – for the standard EXPERT configuration **Bottom** value may vary in the range **0...30% of Weld Thickness**
- ❑ **Bottom Bead Width** – width of the weld at bottom side



Setting of said parameters to be performed through clicking / pressing corresponding spin button 



Alternatively parameter for setting may be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on its label. Label indicating name of selected parameter changes

it's fore color from yellow to white – since that moment parameter may be modified using ,

 on front panel keyboard or  on external keyboard

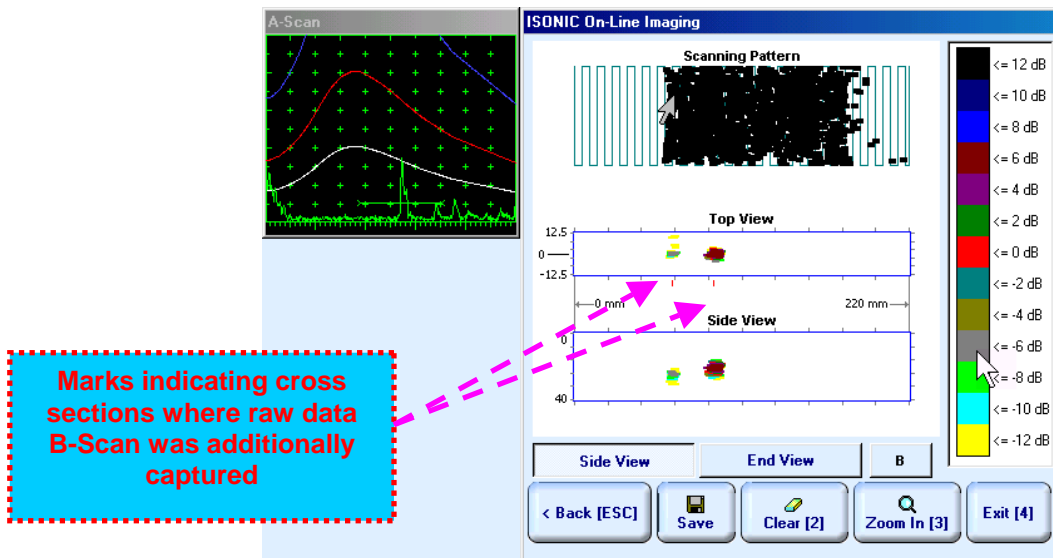
To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard


To continue click on  or press  on front panel keyboard or **F8** on external keyboard

10.2.11. Scanning

During scanning **ISONIC On-Line Imaging** screen is accompanied with **A-Scan**

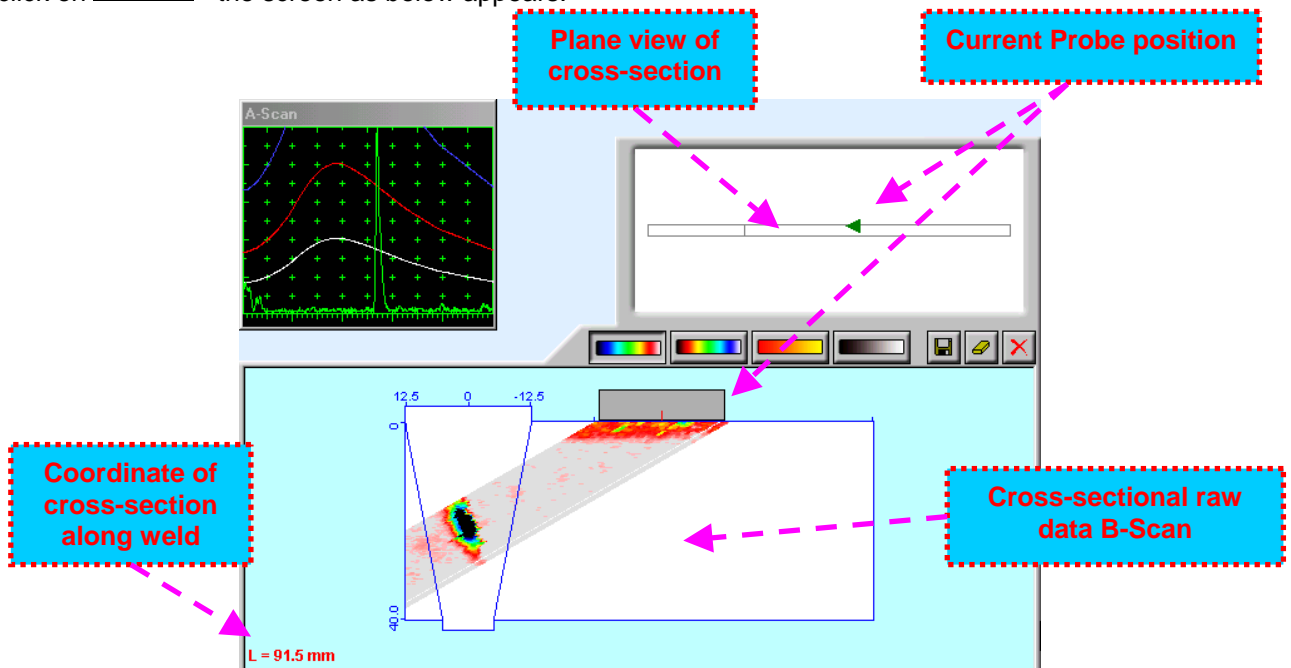


ISONIC On-Line Imaging screen represents:

- ❑ Current Probe Position
- ❑ Current Coupling Status (optionally, provided that coupling monitor is active – refer to paragraph 10.1.6 of this Operating Manual)
- ❑ Current Probe Swiveling Status (optionally, provided that probe swiveling monitor is active – refer to paragraph 10.1.8 of this Operating Manual)
- ❑ **Top View:**
- ❑ **Side View** for **Side View** pressed down or **End View** for **End View** pressed down or press  on front panel keyboard or **F7** on external keyboard to switch between **Side** and **End View**)
- ❑ Marks indicating cross sections where raw data **B-Scan** was additionally captured

To capture additional raw data **B-Scan** for selected cross section of the weld place probe appropriately then

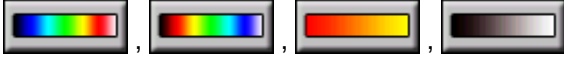



click on **B** - the screen as below appears:



Raw data **B-Scan** capturing screen represents:

- ❑ Current Probe Position
- ❑ Current Coupling Status (optionally, provided that coupling monitor is active – refer to paragraph 10.1.6 of this Operating Manual)
- ❑ Current Probe Swiveling Status (optionally, provided that probe swiveling monitor is active – refer to paragraph 10.1.8 of this Operating Manual)
- ❑ Coordinate of cross-section along weld
- ❑ Plane view of cross-section, which's width is determined by **Scan Index**
- ❑ Raw data **B-Scan** above cross sectional image of the weld

The following controls are available in the raw data **B-Scan** capturing screen:

- ❑  - defining signal amplitude representation palette
- ❑  - erasing raw data **B-Scan** data for rescanning selected cross-section
- ❑  - erasing raw data **B-Scan** data and returning to **ISONIC On-Line Imaging** screen
- ❑  - storing of raw data **B-Scan** with embedding into **Scanning Pattern, Top View, Side View, and End View** data batch

For other instructions and notes refer to paragraph 10.1.9 of this Operating Manual

10.2.12. Postprocessing

Postprocessing of **EXPERT** records may be performed in the instrument or in external computer using **IOFFICE** SW package. User interface and operations are practically identical except two features listed below:

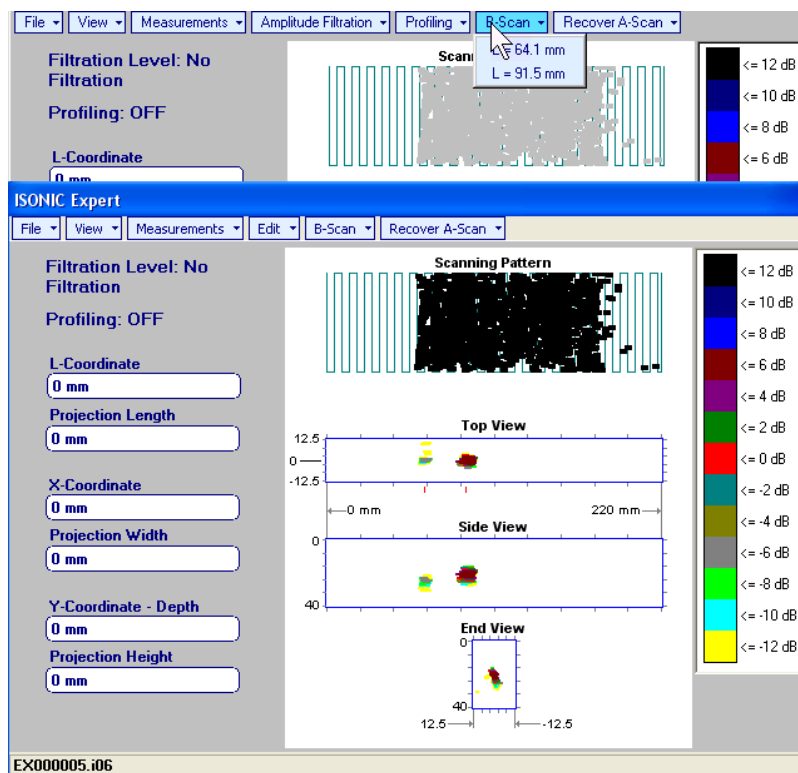
	Off-line analysis directly in ISONIC 2006 instrument	Off-line analysis in external computer using IOFFICE SW Package
Off-line re-adjustment of Gain for EXPERT record	NO	YES
Automatic creation of Inspection report in MS Word® format	NO	YES

Menu Bar Functions on Opening File

Refer to paragraph 10.1.11 of this Operating Manual

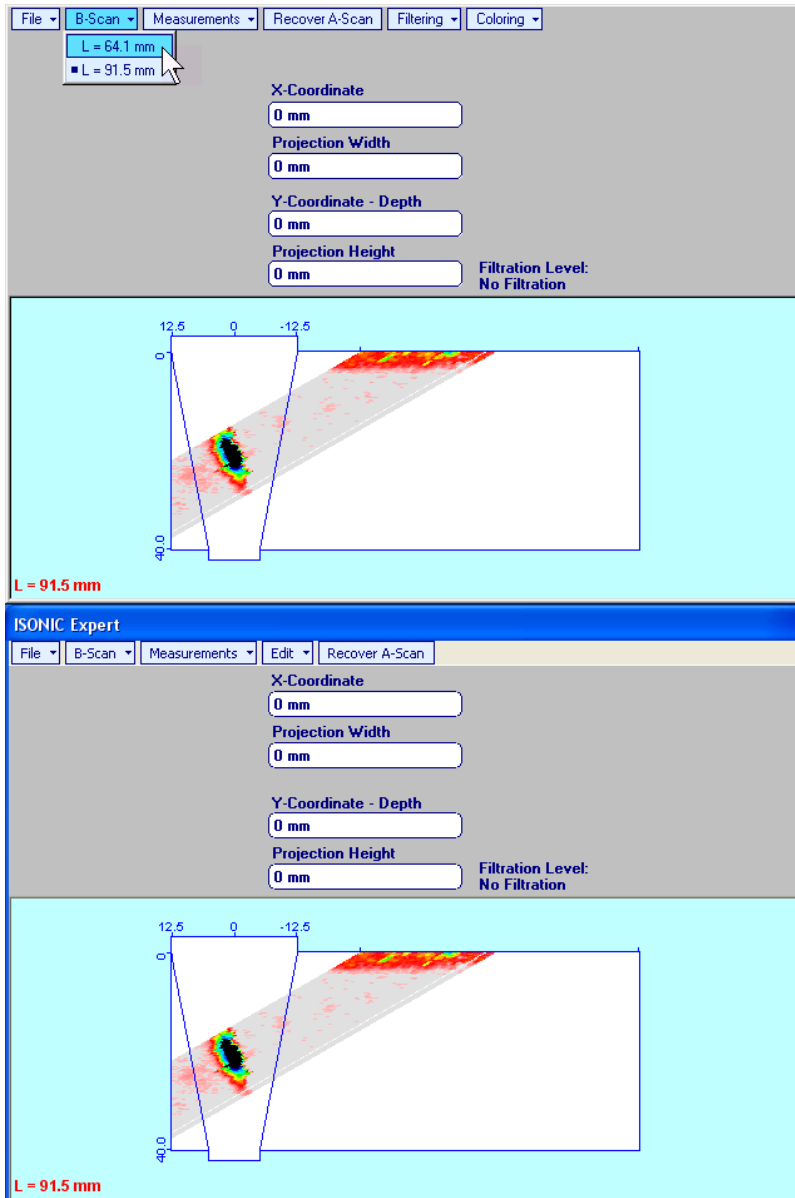
ISONIC Image Processing Menu Bar Functions

ISONIC Image Processing menu and operations for **EXPERT** records are identical to the same menu related to **I2-SONIC** records – refer to paragraph 10.1.11 of this Operating Manual. The only addition is **B-Scan** topic, which opens list of coordinates of cross sections, for which raw data **B-Scan** imaging was performed:















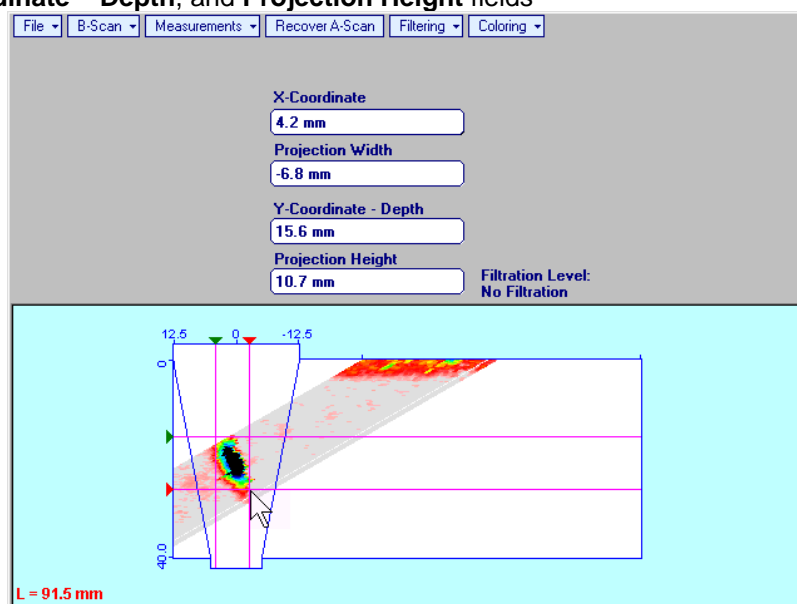
Clicking on one of selected coordinates enters into **Raw Data B-Scan Postprocessing Menu**





Raw Data B-Scan Postprocessing Menu

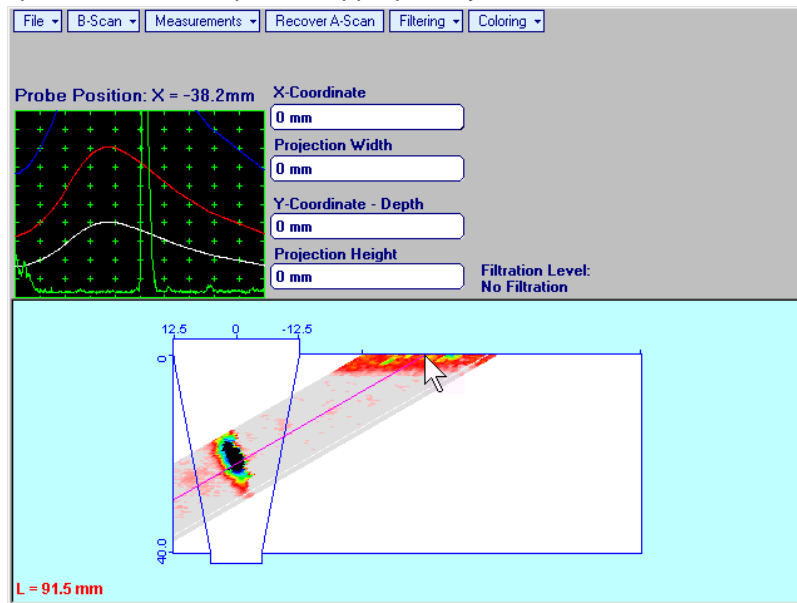



- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word**® as printer to create inspection report as doc file (**IOFFICE SW Package** only)
 - selection of paper sheet size either A4 or Letter
- **File → Print** – prints current postprocessing page
- **File → Exit** – ends postprocessing session for raw data **B-Scan**
- **B-Scan** – returns to initial postprocessing screen appearing on opening file





- Measurements → X-Coordinate, Projection Width** – generates *first vertical cursor* that may be guided over raw data **B-Scan** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard. Coordinate of the *first vertical cursor* along raw data **B-Scan** image is indicated in the **X-Coordinate** field. To fix position of the *first vertical cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second vertical cursor* appears upon fixing first one, it may be manipulated by the same way. Coordinate of the *second vertical cursor* along raw data **B-Scan** image respectively *first vertical cursor* is indicated in the **Projection Width** field. Provided that *vertical cursors* are placed appropriately – displacement of defect from weld centerline and it's **Projection Width** will be measured. To interrupt *vertical cursor* manipulations and empty **X-Coordinate** and **Projection Width** fields right mouse click or press  on front panel keyboard or **Esc** on external keyboard
- Measurements → Y-Coordinate - Depth, Projection Height** – generates *first horizontal cursor* that may be guided over raw data **B-Scan** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard. Coordinate of the *first horizontal cursor* along raw data **B-Scan** image is indicated in the **Y-Coordinate - Depth** field. To fix position of the *first horizontal cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second horizontal cursor* appears upon fixing first one, it may be manipulated by the same way. Coordinate of the *second horizontal cursor* along raw data **B-Scan** image respectively *first horizontal cursor* is indicated in the **Projection Height** field. Provided that *horizontal cursors* are placed appropriately – depth of defect and it's **Projection Height** will be measured. To interrupt *horizontal cursor* manipulations and empty **Y-Coordinate - Depth** and **Projection Height** fields right mouse click or press  on front panel keyboard or **Esc** on external keyboard
- Measurements → OFF** – erases horizontal and vertical cursors and empties **X-Coordinate, Projection Width, Y-Coordinate - Depth, and Projection Height** fields

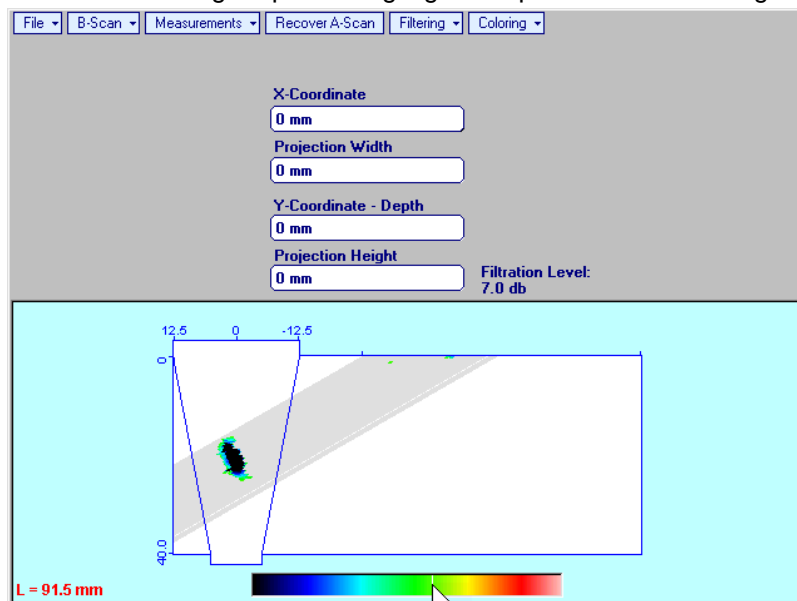


- **Recover A-Scan** – generates *cursor representing sound path* of angle beam probe's central beam in the object under test that may be guided over raw data **B-Scan** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. Starting position of cursor (**X**) corresponding to probe's incidence point is appropriately indicated



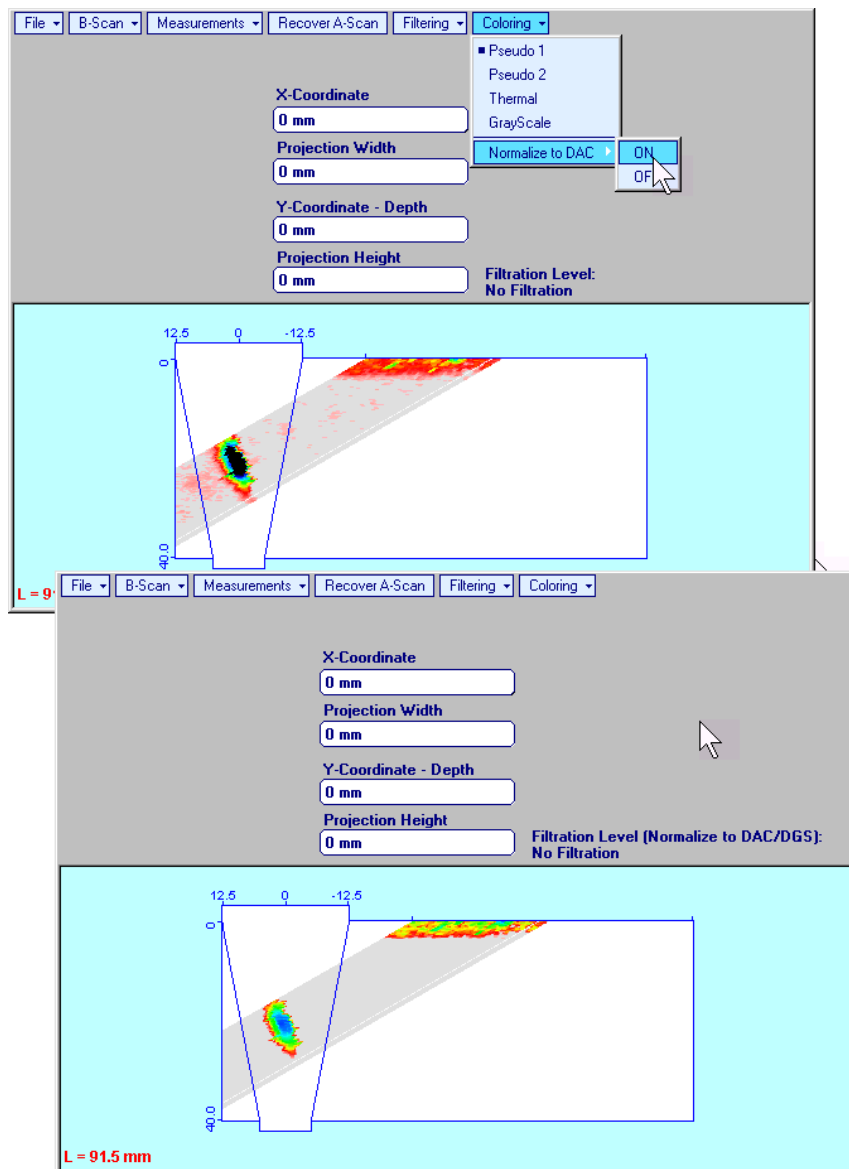
To interrupt recovery of **A-Scans** right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- **Filtering → ON** – (instrument) or **Edit → Filtering → ON** (IOFFICE SW Package for external computer) – generates *amplitude palette bar with sliding cursor*, which may be controlled using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard. Position of the *sliding cursor* on the *amplitude palette bar* determines filtering level, which is appropriately indicated. All elements of raw data **B-Scan** image representing signal amplitude below filtering level are suppressed:




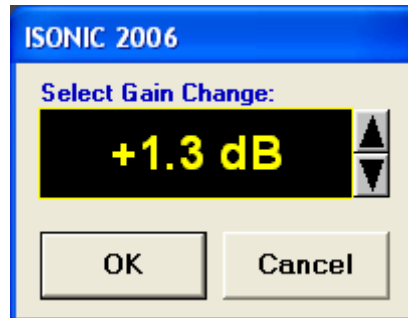
- **Filtering → ON** – (instrument) or **Edit → Filtering → ON** (IOFFICE SW Package for external computer) – returns to originally recorded raw data **B-Scan** image

- **Coloring** – (instrument) or **Edit → Coloring** (IOFFICE SW Package for external computer) – selecting of palette style and **DAC Normalized** or **Linear** color coding applied to raw data **B-Scan** image:




- **Edit → Change Gain** (IOFFICE SW Package for external computer) – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over raw data **B-Scan** image using mouse or \rightarrow , \leftarrow on keyboard – corresponding **A-Scan** is recovered synchronously according to *sound path cursor* position. To select reference **A-Scan** left mouse click or press **Enter** on keyboard – this generates popup window allowing off-line re-adjusting of **Gain** for all **A-Scans** composing raw data **B-Scan** record in $\pm 6\text{dB}$ range with $\pm 0.1\text{ dB}$ increments through clicking or pressing

and holding on  or pressing \uparrow , \downarrow on keyboard



During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain**

click on  or press **Enter** on keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws raw data **B-Scan** image accordingly

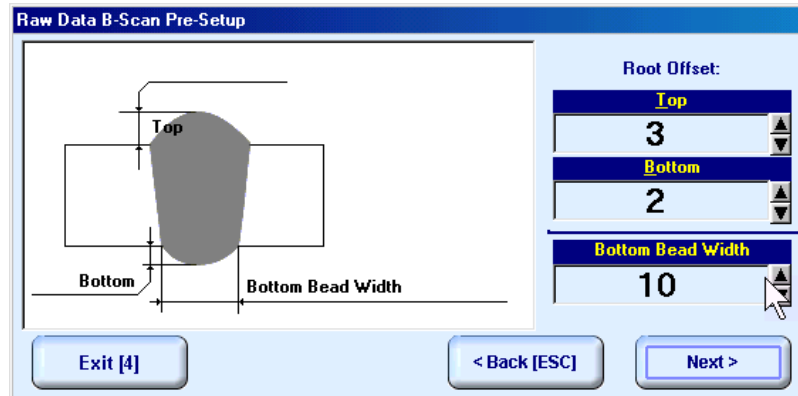
To interrupt re-adjusting of **Gain** click on  or press **Esc** on keyboard

- **Edit→Change Gain→OFF** – negates **Gain** re-adjustment and returns to originally recorded raw data **B-Scan** image and original **Gain** setting

10.2.13 Optional Extended EXPERT SW Configuration

10.2.13.1. Top and Bottom Settings for Using Optional Extended EXPERT SW Configuration

Optional extended EXPERT SW configuration allows cross sectional defect outlining for butt welds and for corner, edge, fillet and other types of welds as well

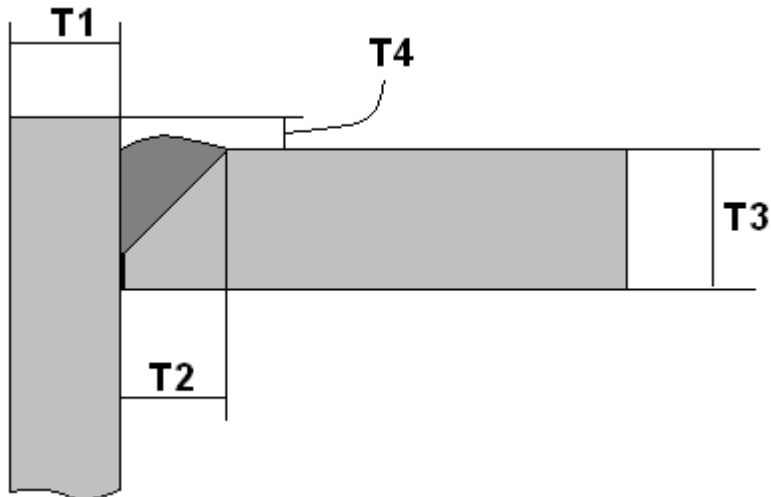


In **Raw Data B-Scan Pre-Setup** screen it is necessary to key in:

- ❑ **Top** – level of excessive weld metal above scanning side of parent material – for the standard EXPERT configuration **Top** value **may vary in the range 0...95% of Weld Thickness**
- ❑ **Bottom** – level of excessive weld metal below bottom side of the weld – for the standard EXPERT configuration **Bottom** value **may vary in the range 0...95% of Weld Thickness**
- ❑ **Bottom Bead Width** – width of the weld at bottom side

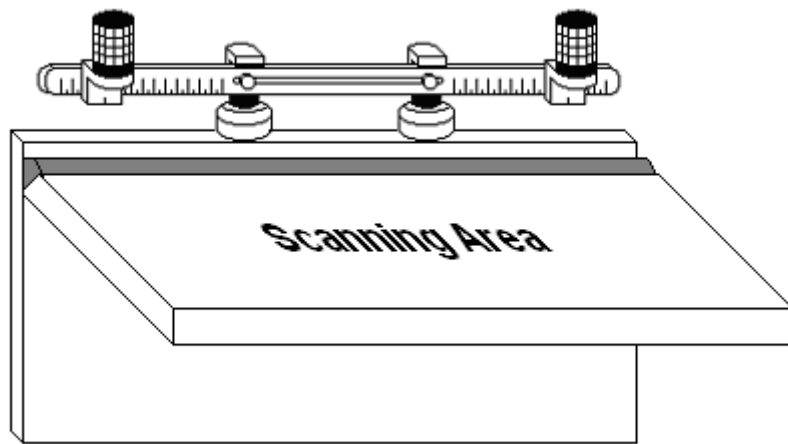
10.2.13.2. Example - Using Optional Extended EXPERT SW For Corner Welds

Fillet weld geometry:



Goal of the inspection – detection and outlining lack of penetration at the flange side

Scanning Area and Placement of airborne ultrasound receivers:



Settings required:

Inspection Setup

Scan Index (SI): 7 mm

Skip#: 1

Base: 220 mm

Coloring: 1 - Pseudo

Root

Weld Thick (WT): 20 mm

Weld Width (WW): 30 mm

Setup Step: Coarse Medium Fine

Scan Above Top of Weld:

MultiEcho:

Normalize To Dac:

Raw Data B-Scan Pre-Setup

Root Offset: Top 3, Bottom 2

Bottom Bead Width: 10

WeldThick = T3

WeldWidth = T1 + T2

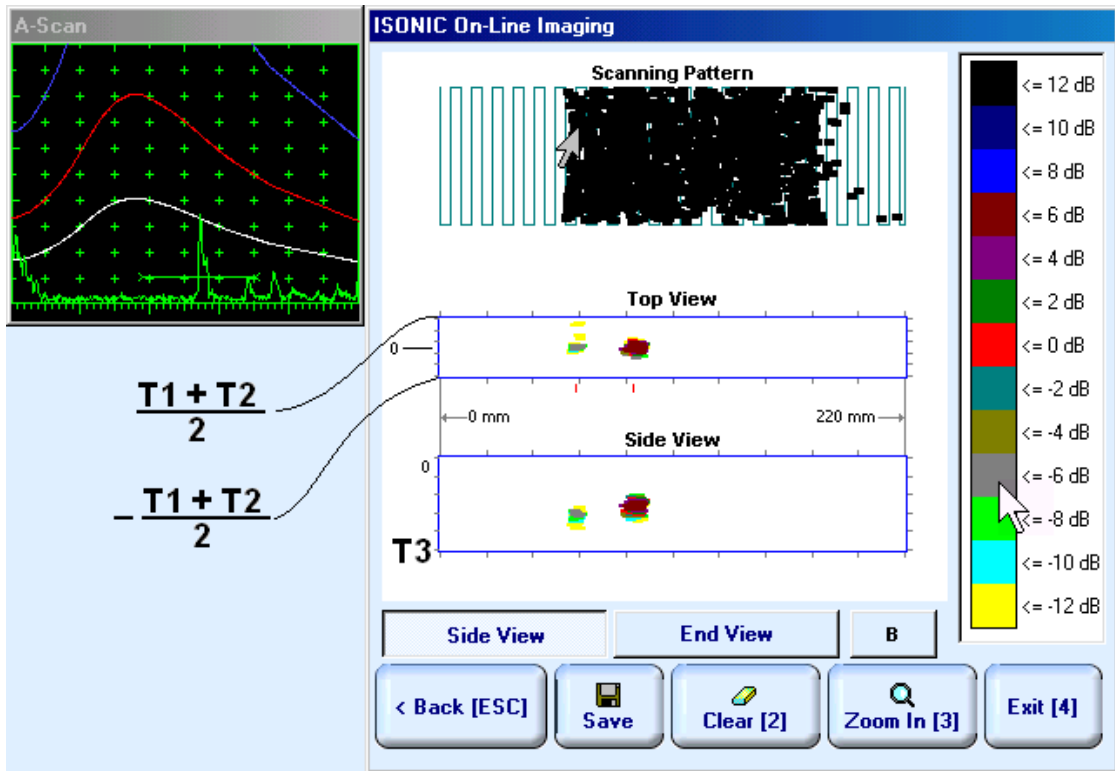
Skip # = 1 or 1.5

Top = T4

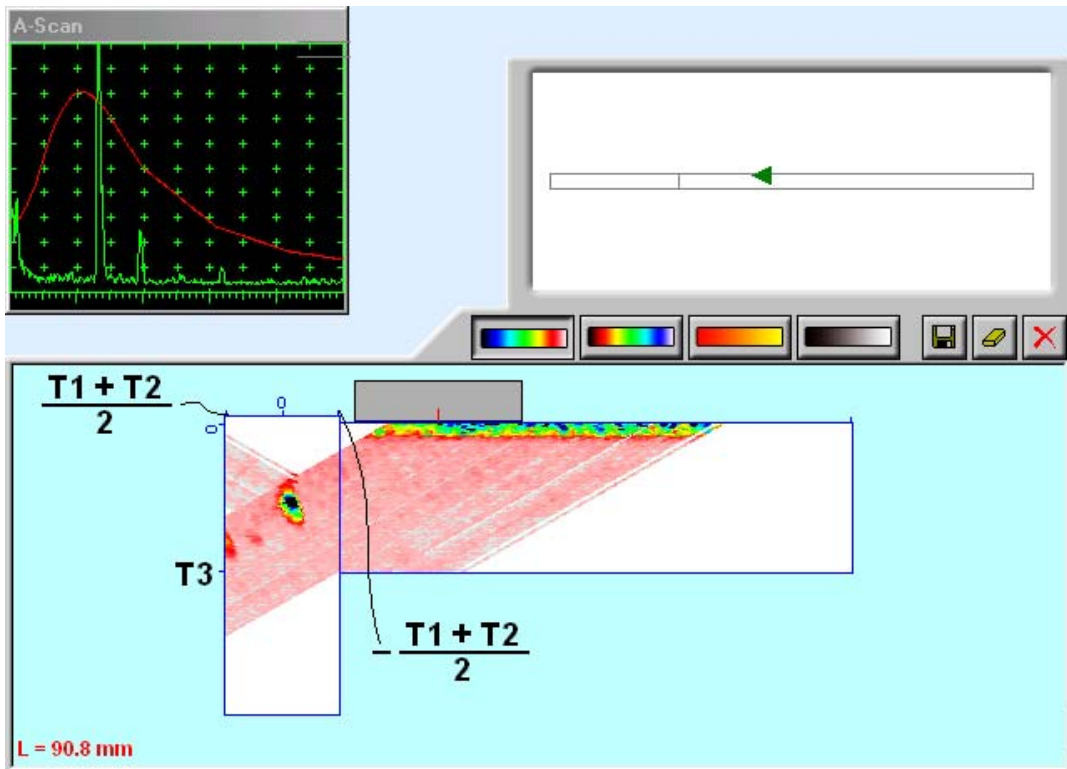
Bottom = Maximal Possible

Scanning and Postprocessing:

The routine scanning screen is lined out as for the standard EXPERT SW configuration



Background of B-Scan capturing screen represents actual geometry of the seam under inspection



10.2.13.3. Implementation for Other Geometry Welds

Scanning Area and Placement of airborne ultrasound receivers:

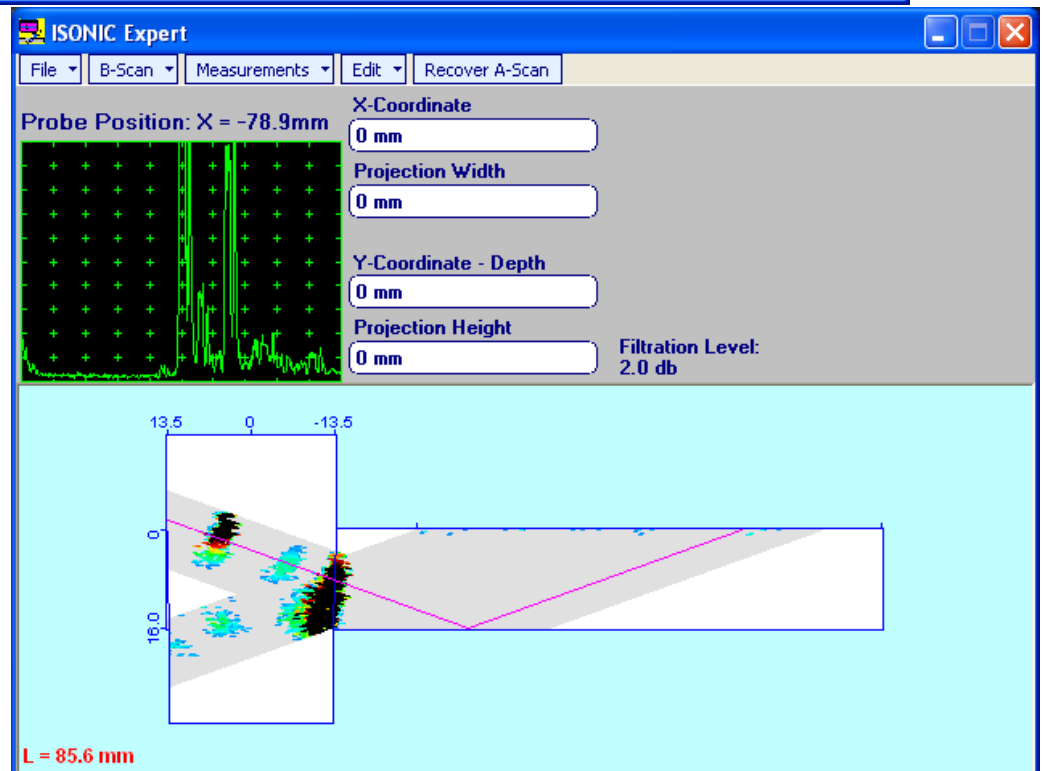
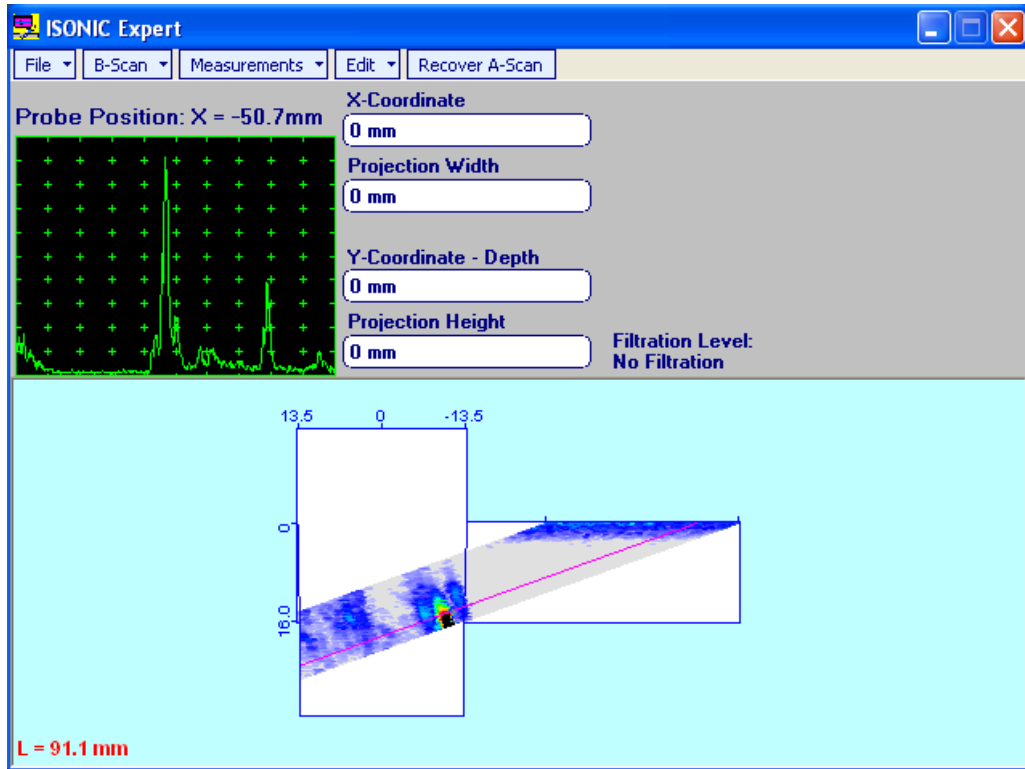
Flanges:



Nozzles:



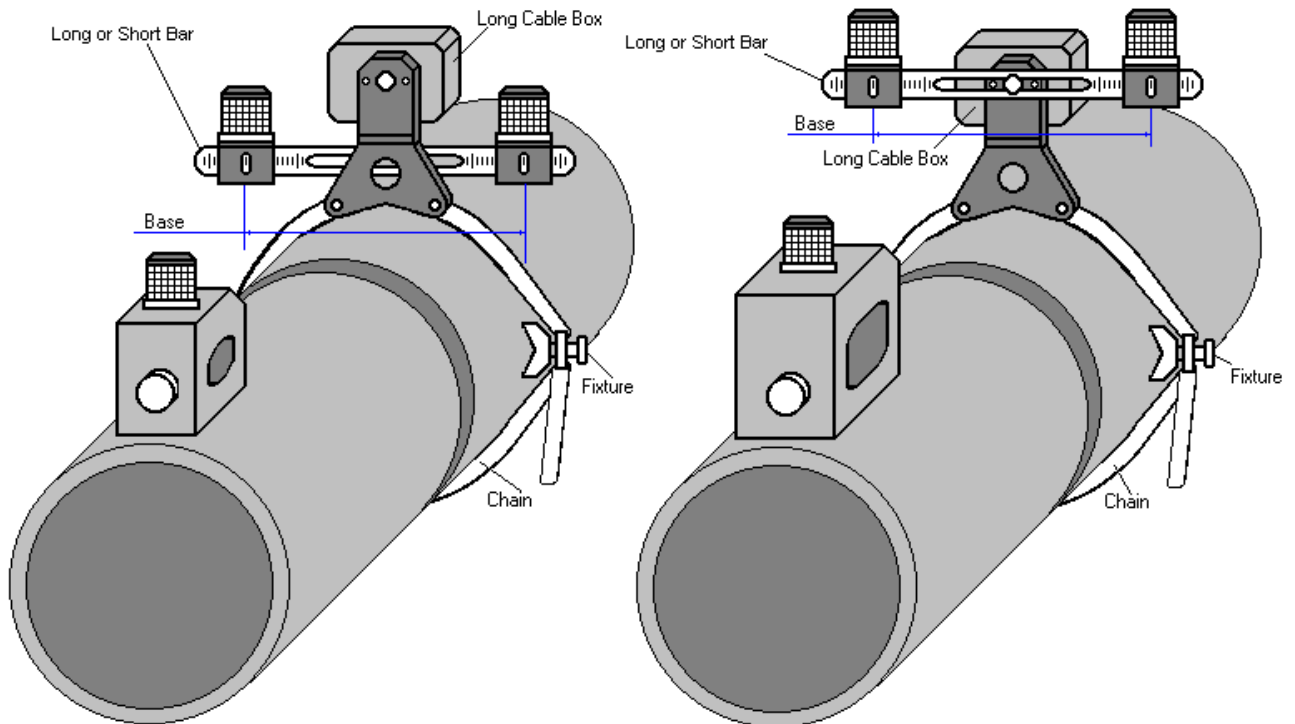
Typical cross sectional images:



10.3. Running SMPIPE Mode – Inspection of Butt Welds between Small Diameter Pipes (80 to 800 mm) – Scanning from One Side

10.3.1. Preparations

Insert ultrasonic probe into probe holder and fix single or double emitter of airborne ultrasound on the top of probe holder – refer to paragraph 8.2 of this Operating Manual. Provide cabling according to paragraph 8.4.2 of this Operating Manual



Apply bar with receivers of airborne ultrasound at parallel to be inspected using either magnetic legs, or vacuum cups, or fixture S 89000 may be used – scanning area and bar to be situated at opposite sides of the weld. Single emitter or top element of double emitter and receivers of airborne ultrasound located on the bar to be equally distanced from scanning surface level while probe is located in front of the bar center. Distance between two receivers (**Base**) is defined as:

$$\text{Base} = B_0 + \text{Pos1} + \text{Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly;

B₀ is parameter of the bar:

- **B₀** = **200 mm / 8 in** for long bar (order code / part # S 2040 B)
- **B₀** = **100 mm / 4 in** for short bar (order code / part # S 86000)



- Length of weld section to be scanned (**Weld Length**) depends on **Base** and **Curvature Diameter** and calculated automatically
- It may occur that modifying of preliminary entered value of **Base** will be required – appropriate calculation will be performed by instrument automatically and indicated in the **Inspection Setup** screen



Enter **SMPipe** mode according to paragraph 8.1 of this Operating Manual

10.3.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

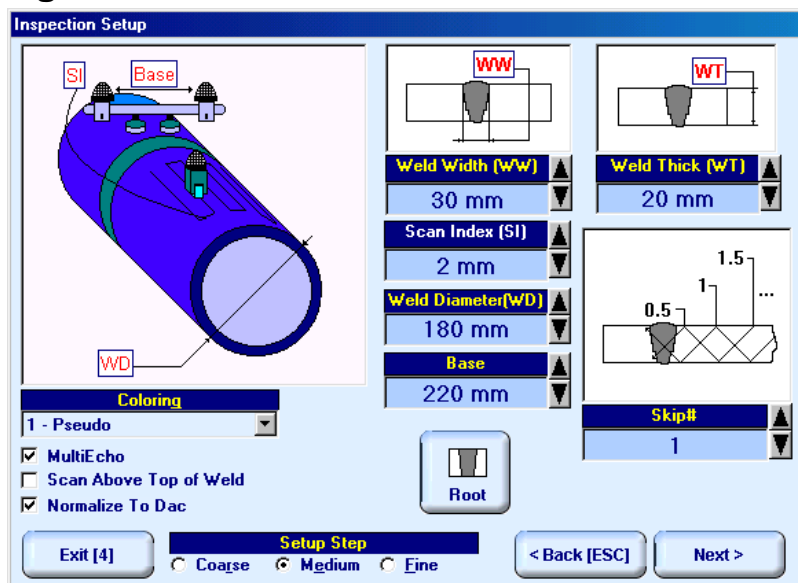
10.3.3. Pulsar Receiver Settings

Refer to paragraph 10.1.3 of this Operating Manual

10.3.4. Probe

Refer to paragraph 10.1.4 of this Operating Manual

10.3.5. Scanning Parameters



In the **Inspection Setup** screen it is necessary to key in:

- Base** – distance between two receivers of airborne ultrasound
- Weld Diameter** – outside diameter of pipe at side, above which scanning will be performed
- Skip #** – defines cross-sectional insonification scheme; **Skip #** setting to be according to inspection procedure
- Scan Index** – defines coverage of scanning area – to be selected and entered according to inspection procedure
- Weld Thick** – thickness of parent material
- Weld Width** – depending on inspection procedure value of **Weld Width** must cover weld metal width either with or without heat affected zone

Length of curved weld section to be inspected and recorded is defined by 2 parameters - **Weld Diameter** and **Base** and calculated by instrument automatically

For other notes and instructions refer to paragraph 10.1.5 of this Operating Manual

10.3.6. Coupling Monitor

Refer to paragraph 10.1.6 of this Operating Manual

10.3.7. Referring Scanning Area

Refer to paragraph 10.1.7 of this Operating Manual

10.3.8. Probe Swiveling Monitor

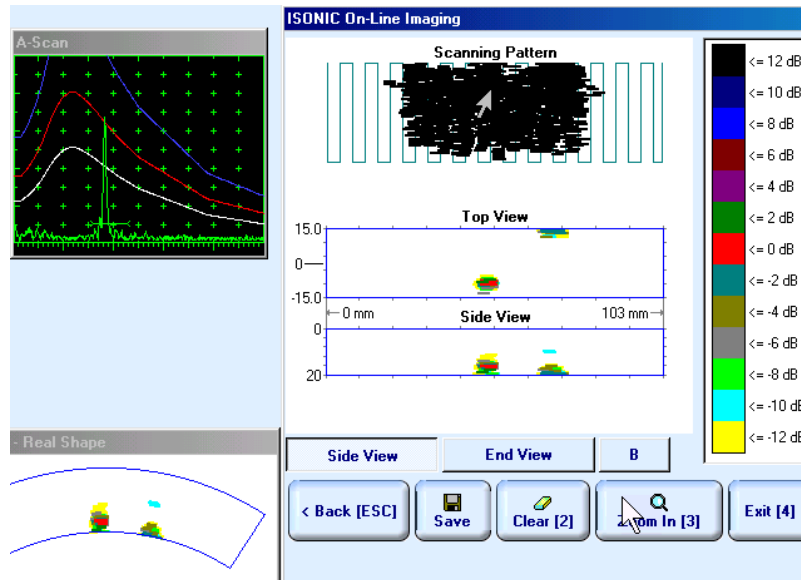
Refer to paragraph 10.1.8 of this Operating Manual

10.3.9. Imaging Principles

Refer to paragraph 10.1.9 of this Operating Manual

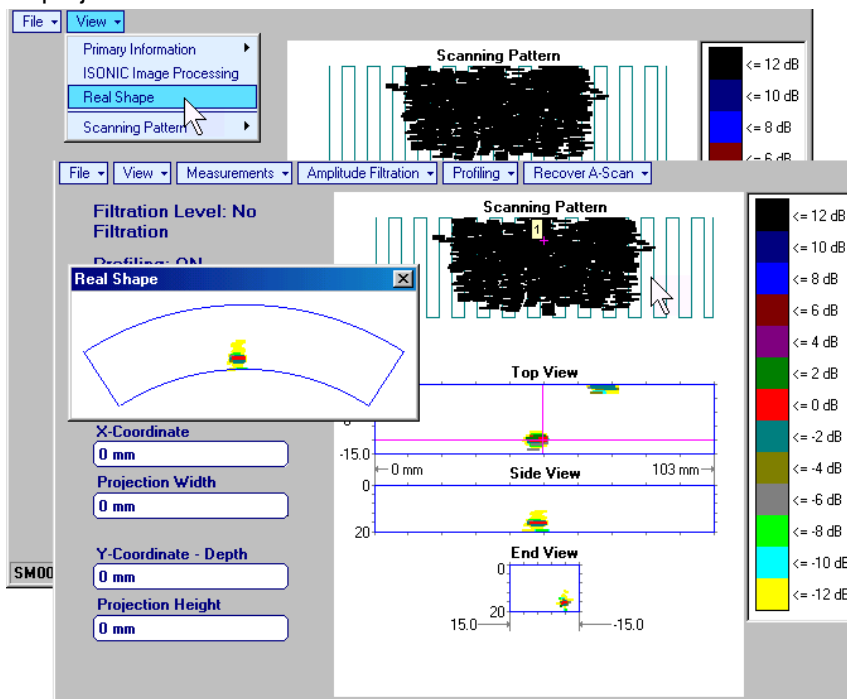
10.3.10. Scanning

Side View - Real Shape image is provided in addition to unfolded **Scanning Pattern**, **Top**, **Side**, and **End View** images. Clicking on **B** allows reproducing of enlarged cross sectional B-Scan for interesting cases while scanning. For other notes and instructions refer to paragraph 10.1.10 of this Operating Manual



10.3.11. Postprocessing

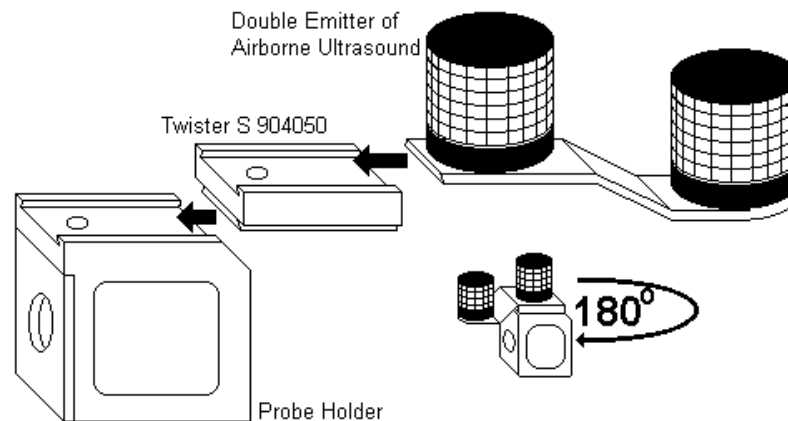
Postprocessing menus for **SMPIPE** records are practically identical to the same related to **I2-SONIC** records – refer to paragraph 10.1.11 of this Operating Manual. In addition it is possible to generate **Real Shape** image for **Side View** projection



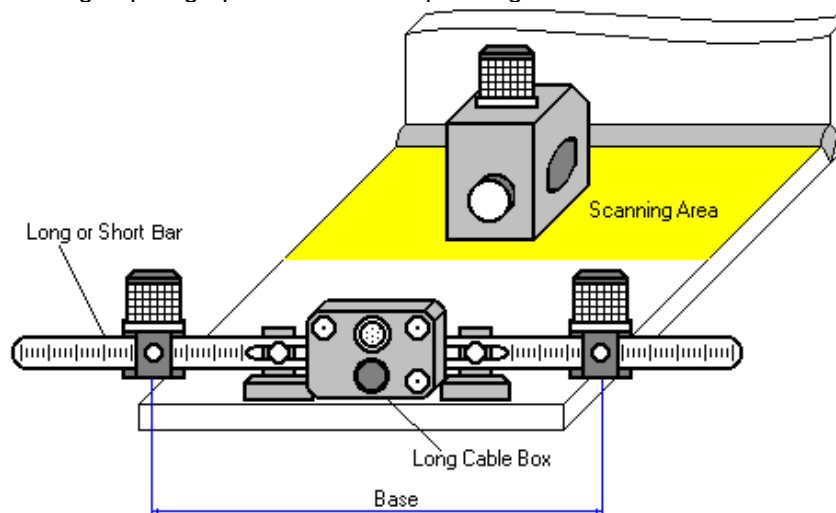
10.4. Running NOZZLE Mode – Inspection of Nozzle and Corner Welds

10.4.1. Preparations

Insert ultrasonic probe into probe holder and fix single or double emitter of airborne ultrasound on the top of probe holder. For single emitter of airborne ultrasound refer to paragraph 8.2 of this Operating Manual. Double emitter of airborne ultrasound to be fitted into probe holder using twister S 904050:



Provide cabling according to paragraph 8.4.2 of this Operating Manual



Apply bar with receivers of airborne ultrasound at parallel to weld to be inspected behind scanning area. Single emitter or top element of double emitter and receivers of airborne ultrasound located on the bar to be equally distanced from scanning surface level. Distance between two receivers (**Base**) is defined as:

$$\text{Base} = B_0 + \text{Pos1} + \text{Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly;

B₀ is parameter of the bar:

- **B₀** = 200 mm / 8 in for long bar (order code / part # S 2040 B)
- **B₀** = 100 mm / 4 in for short bar (order code / part # S 86000)



Base defines length of weld section, for which scanning and recording will be performed

$$\text{Weld Length} = \text{Base}$$



Enter **NOZZLE** mode according to paragraph 8.1 of this Operating Manual

10.4.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

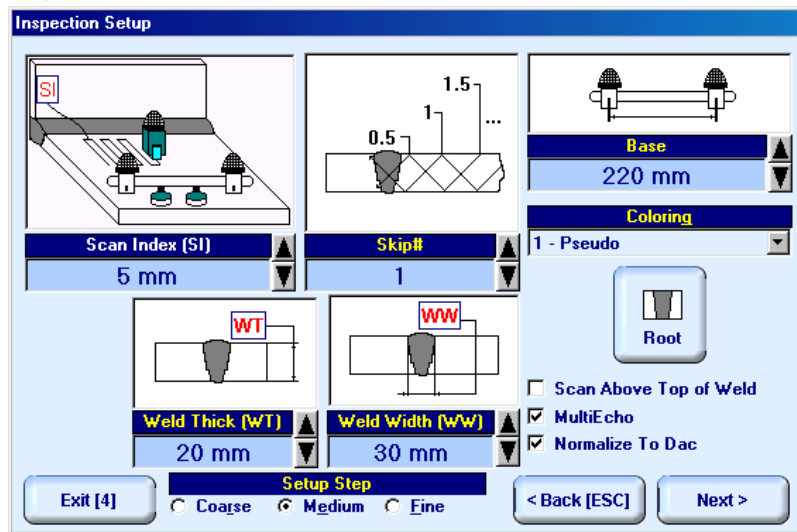
10.4.3. Pulsar Receiver Settings

Refer to paragraph 10.1.3 of this Operating Manual

10.4.4. Probe

Refer to paragraph 10.1.4 of this Operating Manual

10.4.5. Scanning Parameters



In the **Inspection Setup** screen it is necessary to key in:

- ❑ **Base** – distance between two receivers of airborne ultrasound, which defines length of weld section, for which scanning and recording will be performed
- ❑ **Skip #** – defines cross-sectional insonification scheme; **Skip #** setting to be according to inspection procedure
- ❑ **Scan Index** – defines coverage of scanning area – to be selected and entered according to inspection procedure
- ❑ **Weld Thick** – thickness of parent material
- ❑ **Weld Width** – depending on inspection procedure value of **Weld Width** must cover weld metal width either with or without heat affected zone

For other notes and instructions refer to paragraph 10.1.5 of this Operating Manual

10.4.6. Coupling Monitor

Refer to paragraph 10.1.6 of this Operating Manual

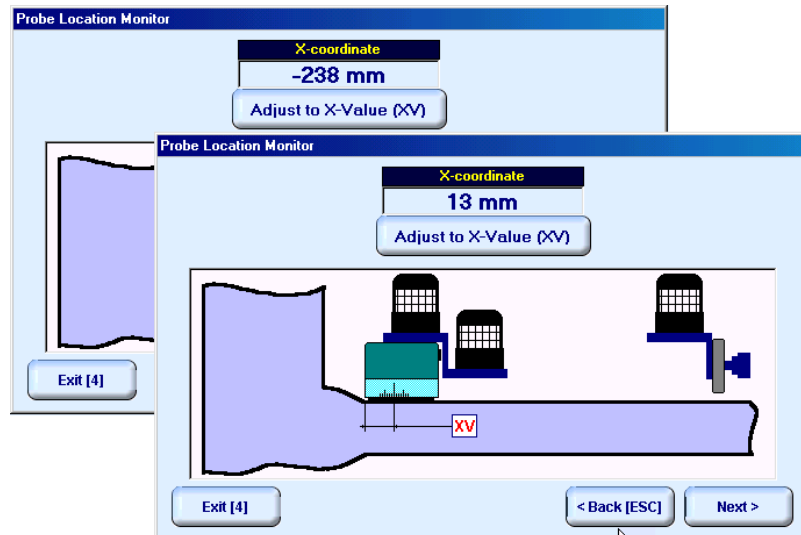
10.4.7. Referring Scanning Area



Place probe equipped with emitter of airborne ultrasound into scanning area as it is shown in the **Probe Location Monitor** screen – at this position absolute distance between bar and probe is indicated in **X-coordinate** box – then:


click on **Adjust to X-Value (XV)**


OR

select **Adjust to X-Value (XV)** using , , ,  or  on front panel keyboard or , , ,  or **F7** on external keyboard then press  on front panel keyboard or **Enter** on external keyboard



To return back to **XY Scanning Recording and Imaging Menu** click on **Exit [4]** or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on **< Back [ESC]** or press  on front panel keyboard or **Esc** on external keyboard

To continue click on **Next >** or press  on front panel keyboard or **F8** on external keyboard

10.4.8. Probe Swiveling Monitor

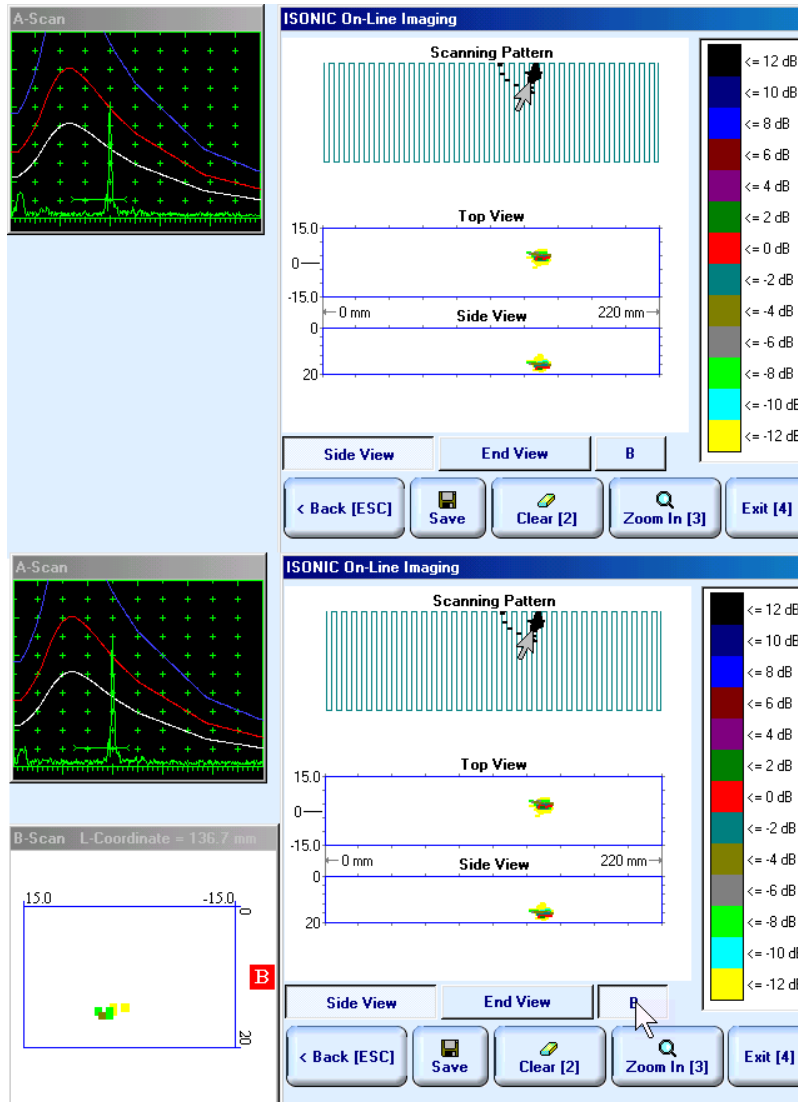
Refer to paragraph 10.1.8 of this Operating Manual

10.4.9. Imaging Principles

Refer to paragraph 10.1.9 of this Operating Manual

10.4.10. Scanning

Clicking on **B** allows reproducing of enlarged cross sectional B-Scan for interesting cases while scanning. For other notes and instructions refer to paragraph 10.1.10 of this Operating Manual



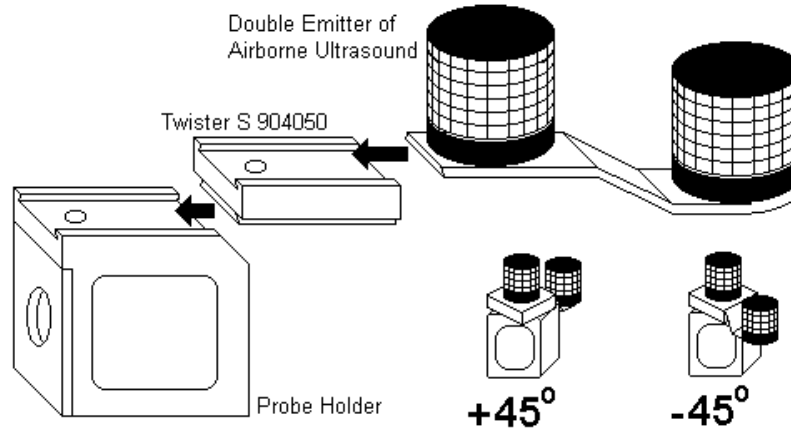
10.4.11. Postprocessing

Refer to paragraph 10.1.11 of this Operating Manual

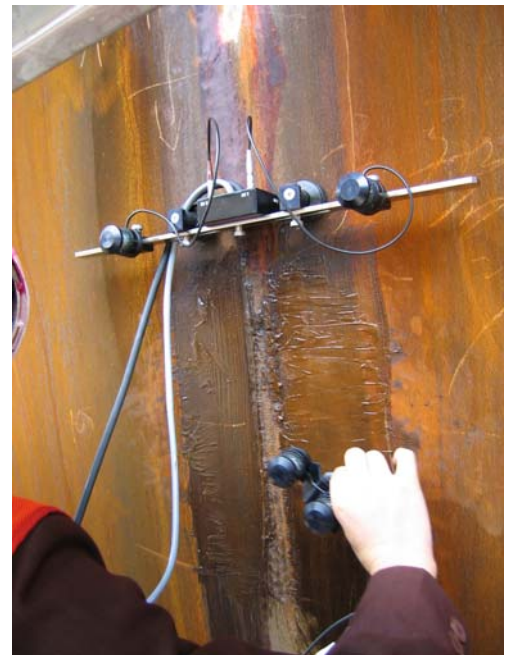
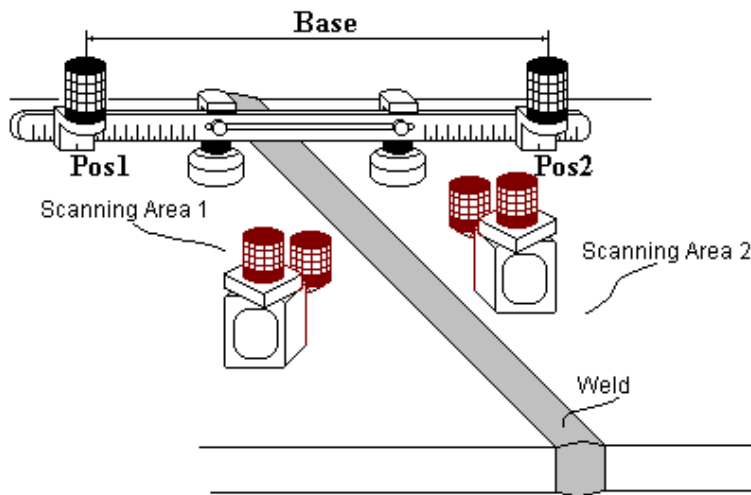
10.5. Running PLCROSS Mode – Inspection of Planar Butt Welds – Scanning from Both Sides

10.5.1. Preparations

Insert ultrasonic probe into probe holder and fix single or double emitter of airborne ultrasound on the top of probe holder. For single emitter of airborne ultrasound refer to paragraph 8.2 of this Operating Manual. Double emitter of airborne ultrasound to be fitted into probe holder using twister S 904050:



Provide cabling according to paragraph 8.4.2 of this Operating Manual



There are two scanning areas at opposite sides of the weld. Standard long bar (order code / part # S 2040 B) or custom made bar may be used while working in **PLCROSS** mode

Apply bar with receivers of airborne ultrasound to object under test at rectangle to the weld. Center of the bar must be located above weld centerline. Depending on probe to be used and scanning scheme selected positions **Pos1** and **Pos2** of receivers at left and right side of the bar correspondingly will be calculated by instrument automatically and indicated for providing – refer to paragraph 10.5.7 of this Operating Manual



Enter **PLCROSS** mode according to paragraph 8.1 of this Operating Manual

10.5.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

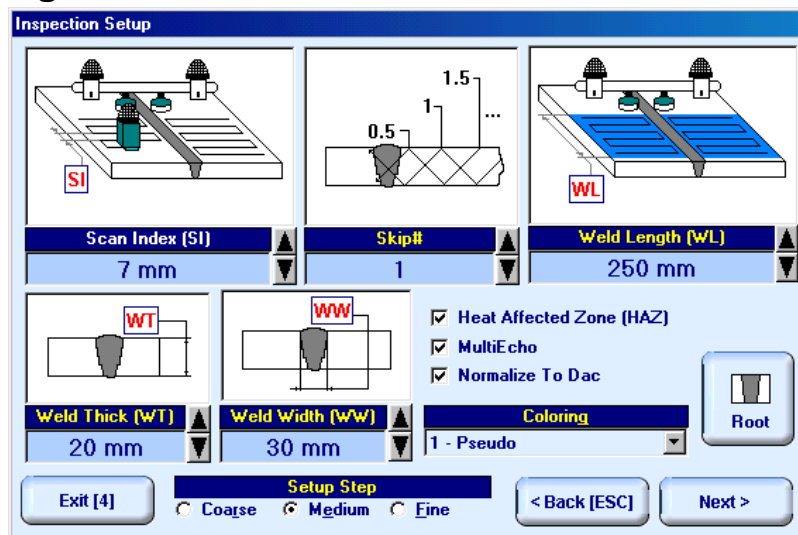
10.5.3. Pulsar Receiver Settings

Refer to paragraph 10.1.3 of this Operating Manual

10.5.4. Probe

Refer to paragraph 10.1.4 of this Operating Manual

10.5.5. Scanning Parameters



In the **Inspection Setup** screen it is necessary to key in:

- Weld Length** – length of weld section, for which scanning and recording will be performed
- Skip #** – defines cross-sectional insonification scheme; **Skip #** setting to be according to inspection procedure
- Scan Index** – defines coverage of scanning area – to be selected and entered according to inspection procedure
- Weld Thick** – thickness of parent material
- Weld Width** – depending on inspection procedure value of **Weld Width** must cover weld metal width either with or without heat affected zone

If it is necessary to inspect weld metal and heat-affected zone then option **Heat Affected Zone (HAZ)** must be checked

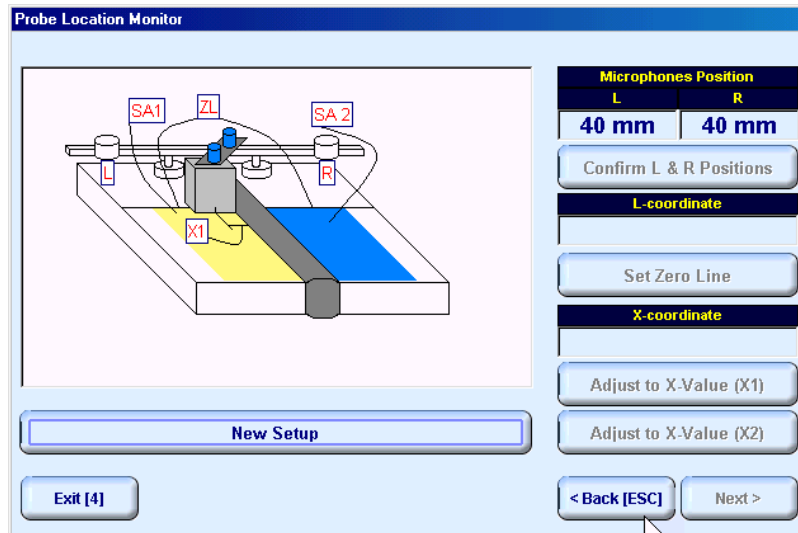
For other notes and instructions refer to paragraph 10.1.5 of this Operating Manual

10.5.6. Coupling Monitor

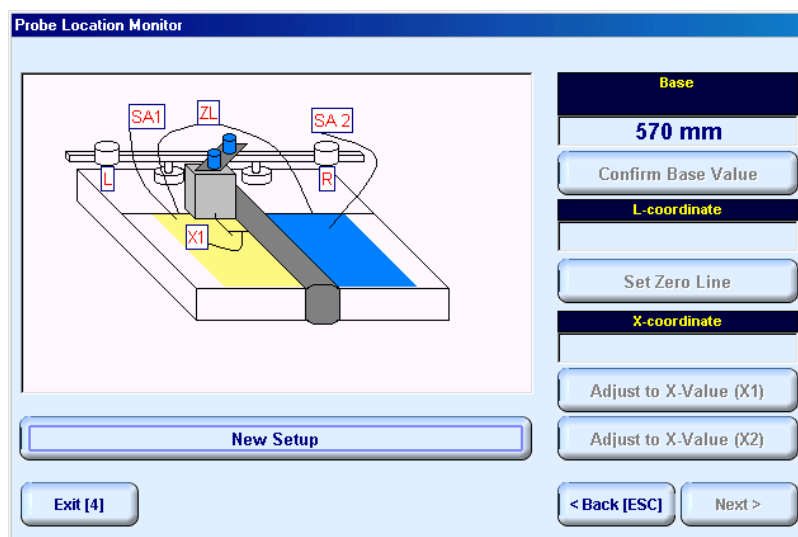
Refer to paragraph 10.1.6 of this Operating Manual

10.5.7. Referring Scanning Area

On opening **Probe Location Monitor** screen positions of airborne ultrasound receivers (**Pos 1** and **Pos 2**) and distance between (**Base**) them on the bar are calculated automatically to cover scanning areas at both sides of the welds completely – refer to paragraph 10.5.1 of this Operating Manual. If calculated value of **Base** does not exceed **480 mm / 19 in** then standard long bar (part # S 2040 B) to be used and corresponding positions are indicated on opening **Probe Location Monitor** screen (**Pos 1 = L ; Pos 2 = R**):





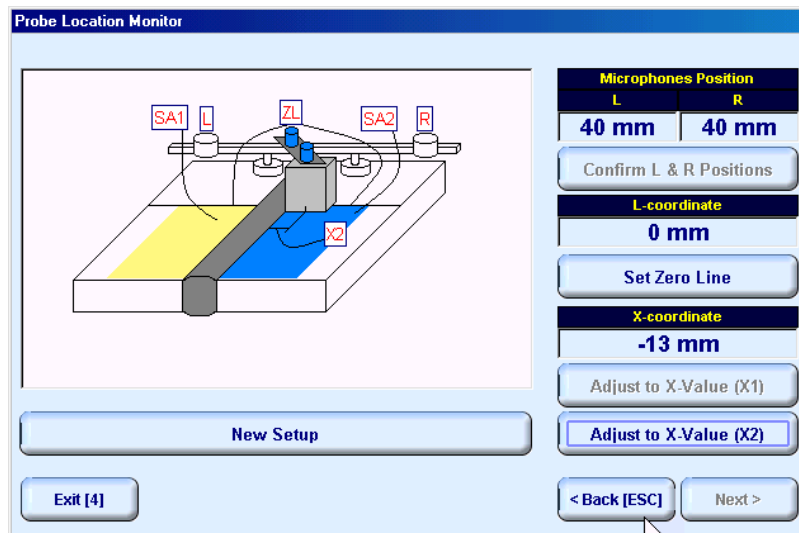
If calculated value of **Base** exceeds **480 mm / 19 in** then customized long bar to be used and value of **Base** to be provided is indicated on opening **Probe Location Monitor** screen:






Top refer probe location monitor:


- click on **New Setup** or press  on front panel keyboard **Enter** on external keyboard
- fix receivers of airborne ultrasound in appropriate positions on the bar then click on either **Confirm L & R Positions** or **Confirm Base Value** or press  on front panel keyboard **Enter** on external keyboard


- place probe at position closest to the bar as it is shown in the **Probe Location Monitor** screen then click on **Set Zero Line** or press  on front panel keyboard **Enter** on external keyboard
- keeping probe in the previous position click on **Adjust to X-Value (X1)** or press  on front panel keyboard **Enter** on external keyboard – this will define Scanning Area 1 and change sketch in the **Probe Location Monitor** screen:



- place probe at new position as it is shown in the **Probe Location Monitor** screen then click on **Adjust to X-Value (X2)** or press  on front panel keyboard **Enter** on external keyboard

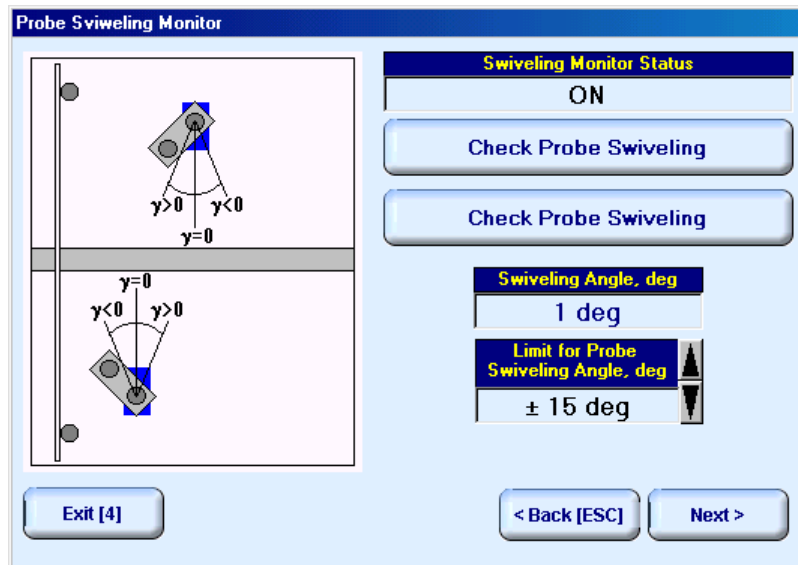
To return back to **XY Scanning Recording and Imaging Menu** click on **Exit [4]** or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on **< Back [ESC]** or press  on front panel keyboard or **Esc** on external keyboard










To continue click on **Next >** or press  on front panel keyboard or **F8** on external keyboard




10.5.8. Probe Swiveling Monitor



Double emitter of airborne ultrasound S 4050 and twister S 904050 are necessary to monitor probe swiveling angle. Depending on scanning side – 45° or $+45^\circ$ to be provided as it is shown in above paragraph 10.5.1 of this Operating Manual and in **Probe Swiveling Monitor** screen. In the **Probe Swiveling Monitor** screen it is necessary to activate/negate probe swiveling monitor through click on appropriate button





If **Probe Swiveling Monitor** is active then it is necessary to set appropriate **Limit for Probe Swiveling**

Angle through clicking / pressing its spin button  or through pressing , , ,  on front panel keyboard or , , ,  on external keyboard

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

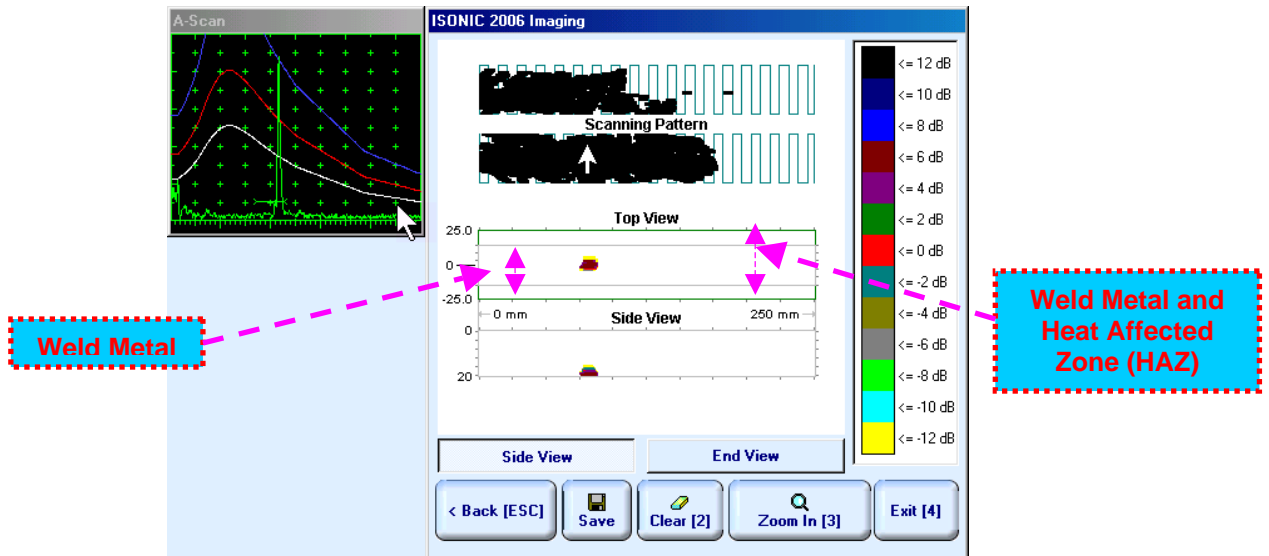
To continue click on  or press  on front panel keyboard or **F8** on external keyboard

10.5.9. Imaging Principles

Refer to paragraph 10.1.9 of this Operating Manual

10.5.10. Scanning

Two scanning areas are represented in the **Scanning Pattern** field in **ISONIC On-Line Imaging** screen **Top View** field proportionally represents weld metal and heat affected zone area provided that corresponding option was checked as it is noted in paragraph 10.5.5 of this Operating Manual. For other notes and instructions refer to paragraph 10.1.10 of this Operating Manual



10.5.11. Postprocessing

Refer to paragraph 10.1.11 of this Operating Manual

10.6. Running CIRCROSS Mode – Inspection of Circumferential Butt Welds – Scanning from Both Sides

10.6.1. Preparations

Refer to paragraph 10.5.1 of this Operating Manual for airborne ultrasound stuff, probe holder, and cabling



Enter **CIRCROSS** mode according to paragraph 8.1 of this Operating Manual

10.6.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

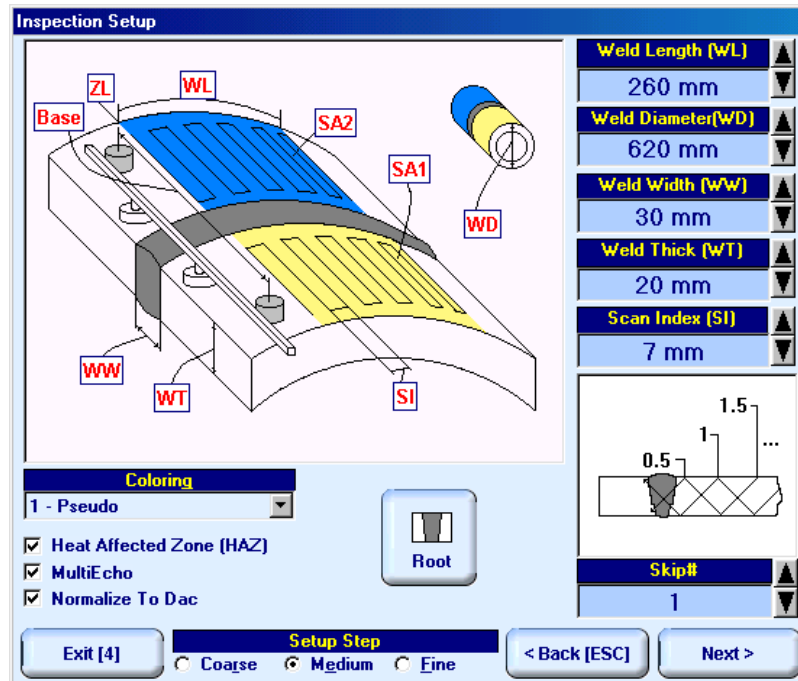
10.6.3. Pulsar Receiver Settings

Refer to paragraph 10.1.3 of this Operating Manual

10.6.4. Probe

Refer to paragraph 10.1.4 of this Operating Manual

10.6.5. Scanning Parameters



In the **Inspection Setup** screen it is necessary to key in:

- Weld Length** – unfolded length of weld section, for which scanning and recording will be performed
- Skip #** – defines cross-sectional insonification scheme; **Skip #** setting to be according to inspection procedure
- Scan Index** – defines coverage of scanning area – to be selected and entered according to inspection procedure
- Weld Thick** – thickness of parent material
- Weld Width** – depending on inspection procedure value of **Weld Width** must cover weld metal width either with or without heat affected zone

If it is necessary to inspect weld metal and heat-affected zone then option **Heat Affected Zone (HAZ)** must be checked

For other notes and instructions refer to paragraph 10.1.5 of this Operating Manual

10.6.6. Coupling Monitor

Refer to paragraph 10.1.6 of this Operating Manual

10.6.7. Referring Scanning Area

Refer to paragraph 10.5.7 of this Operating Manual

10.6.8. Probe Swiveling Monitor

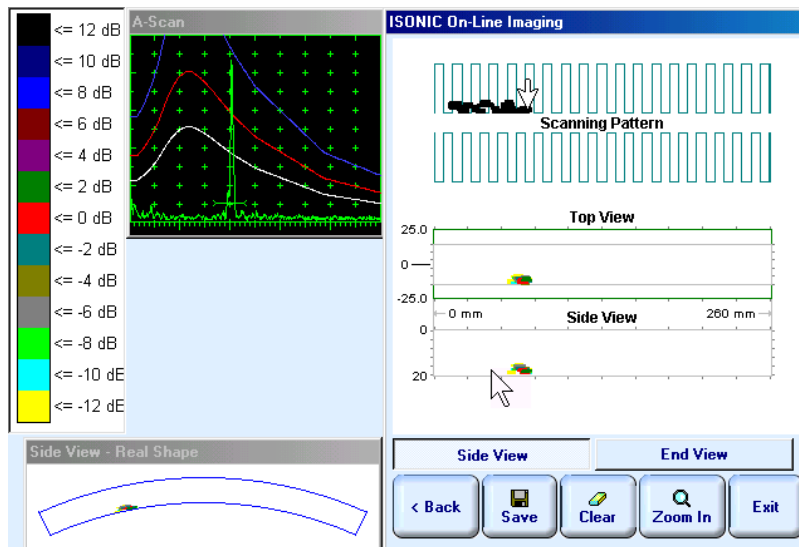
Refer to paragraph 10.5.8 of this Operating Manual

10.6.9. Imaging Principles

Refer to paragraph 10.1.9 of this Operating Manual

10.6.10. Scanning

Side View - Real Shape image is provided in addition to unfolded **Scanning Pattern**, **Top**, **Side**, and **End View** images. For other notes and instructions refer to paragraphs 10.1.10 and 10.5.10 of this Operating Manual



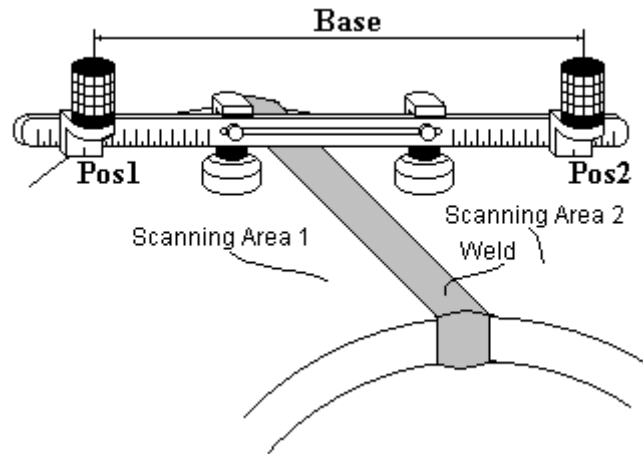
10.6.11. Postprocessing

Refer to paragraph 10.1.11 of this Operating Manual

10.7. Running LONGWELD Mode – Inspection of Longitudinal Butt Welds in Tubular Objects – Scanning from Both Sides

10.7.1. Preparations

Refer to paragraph 10.5.1 of this Operating Manual for airborne ultrasound stuff, probe holder, and cabling



Enter **LONGWELD** mode according to paragraph 8.1 of this Operating Manual

10.7.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

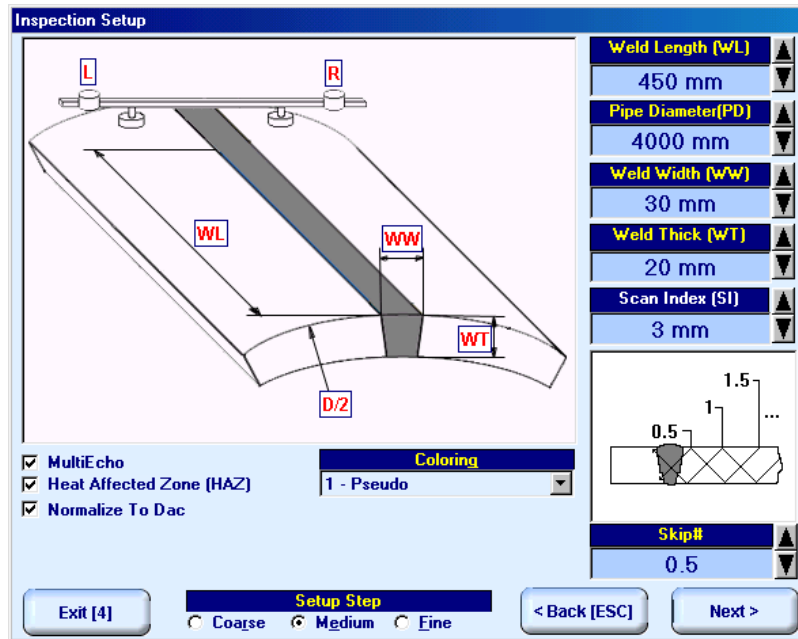
10.7.3. Pulsar Receiver Settings

Refer to paragraph 10.1.3 of this Operating Manual

10.7.4. Probe

Refer to paragraph 10.1.4 of this Operating Manual

10.7.5. Scanning Parameters



In the **Inspection Setup** screen it is necessary to key in:

- Weld Length** – length of weld section, for which scanning and recording will be performed
- Pipe Diameter** – outside diameter to be entered
- Skip #** – defines cross-sectional insonification scheme; **Skip #** setting to be according to inspection procedure
- Scan Index** – defines coverage of scanning area – to be selected and entered according to inspection procedure
- Weld Thick** – thickness of parent material
- Weld Width** – depending on inspection procedure value of **Weld Width** must cover weld metal width either with or without heat affected zone

If it is necessary to inspect weld metal and heat-affected zone then option **Heat Affected Zone (HAZ)** must be checked

For other notes and instructions refer to paragraph 10.1.5 of this Operating Manual

10.7.6. Coupling Monitor

Refer to paragraph 10.1.6 of this Operating Manual

10.7.7. Referring Scanning Area

Refer to paragraph 10.5.7 of this Operating Manual

10.7.8. Probe Swiveling Monitor

Refer to paragraph 10.5.8 of this Operating Manual

10.7.9. Imaging Principles

Refer to paragraph 10.1.9 of this Operating Manual

10.7.10. Scanning

Refer to paragraph 10.5.10 of this Operating Manual

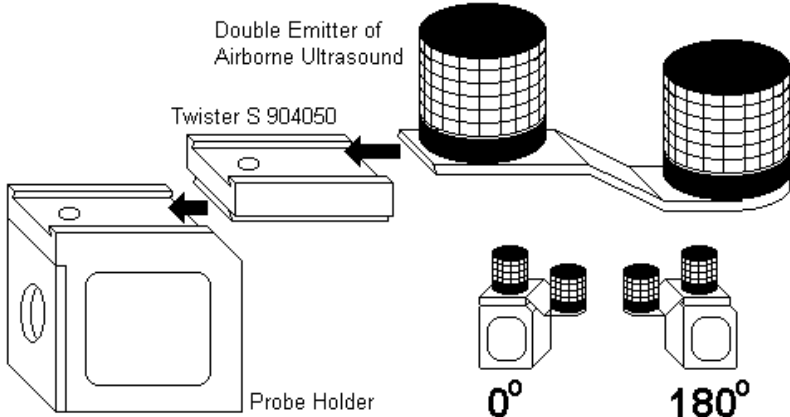
10.7.11. Postprocessing

Refer to paragraph 10.1.11 of this Operating Manual

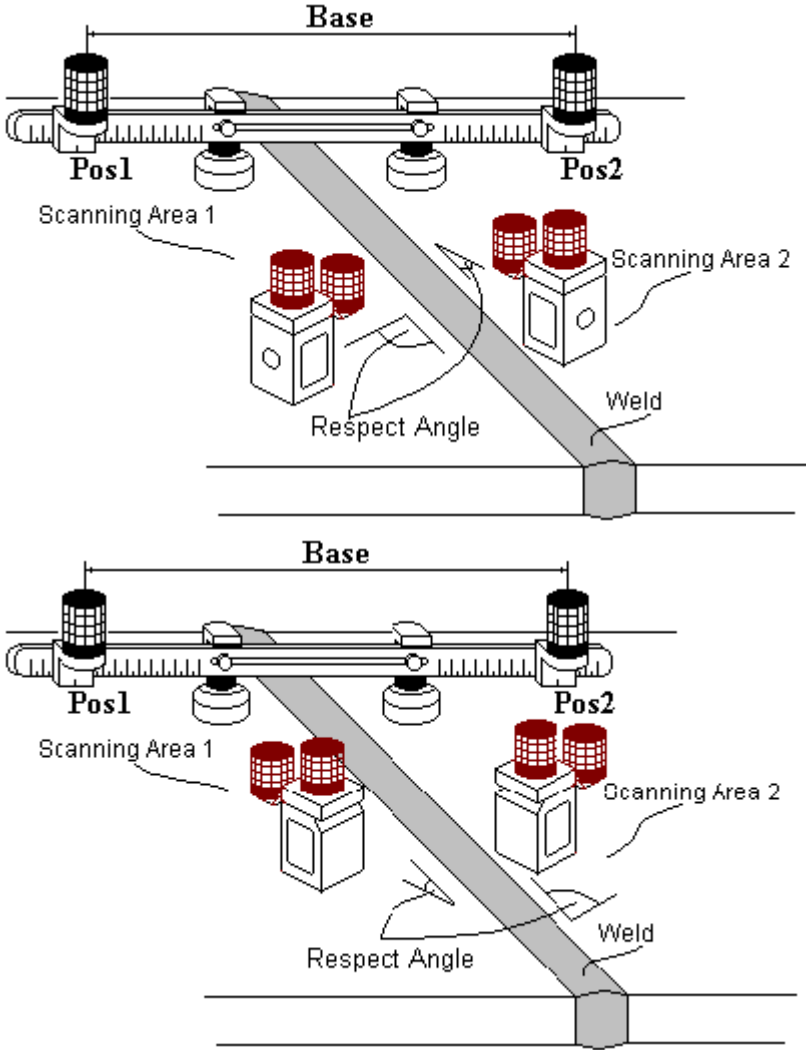
10.8. Running TRANSCAN Mode – Inspection of Butt Joints – for Defects Transversal to Weld Scanning from Both Sides and/or Above Machined Weld Cap (Standard HP 5/3)

10.8.1. Preparations

Insert ultrasonic probe into probe holder and fix single or double emitter of airborne ultrasound on the top of probe holder. For single emitter of airborne ultrasound refer to paragraph 8.2 of this Operating Manual. Double emitter of airborne ultrasound to be fitted into probe holder using twister S 904050:



Provide cabling according to paragraph 8.4.2 of this Operating Manual



There are two scanning areas at opposite sides of the weld. Standard long bar (order code / part # S 2040 B) or custom made bar may be used while working in **TRANSCAN** mode. Apply bar with receivers of airborne ultrasound to object under test at rectangle to the weld. Center of the bar to be located above weld centerline. Depending on probe to be used and scanning scheme selected positions **Pos1** and **Pos2** of receivers at left and right side of the bar correspondingly will be calculated by instrument automatically and indicated for providing – refer to paragraph 10.8.7 of this Operating Manual.



Enter **TRANSCAN** mode according to paragraph 8.1 of this Operating Manual

10.8.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

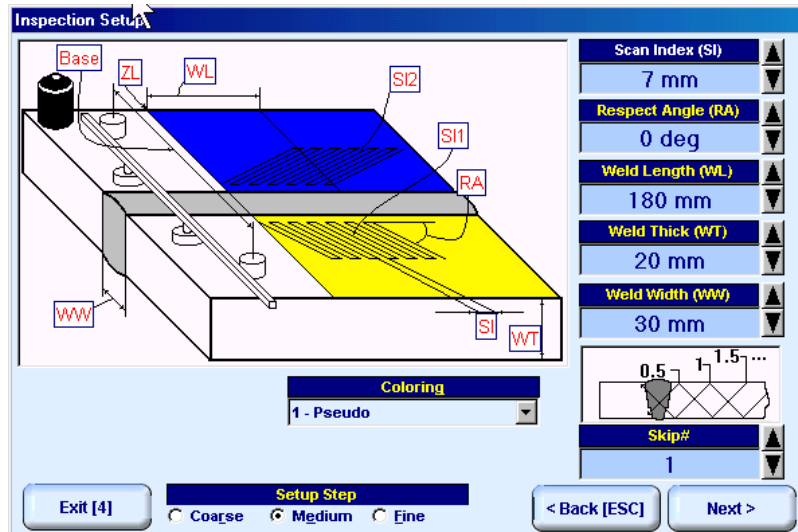
10.8.3. Pulser Receiver Settings

Refer to paragraph 10.1.3 of this Operating Manual

10.8.4. Probe

Refer to paragraph 10.1.4 of this Operating Manual

10.8.5. Scanning Parameters



In the **Inspection Setup** screen it is necessary to key in:

- Weld Length** – length of weld section, for which scanning and recording will be performed
- Skip #** – defines cross-sectional insonification scheme; **Skip #** setting to be according to inspection procedure
- Scan Index** – defines coverage of scanning area – to be selected and entered according to inspection procedure
- Weld Thick** – thickness of parent material
- Weld Width** – depending on inspection procedure value of **Weld Width** must cover weld metal width either with or without heat affected zone
- Respect Angle** – for welds with machined weld cap to be 0° ; for weld with non machined weld cap to be selected $0...10^{\circ}$ or $5...15^{\circ}$ or $10...20^{\circ}$ according to inspection procedure

For other notes and instructions refer to paragraph 10.1.5 of this Operating Manual

10.8.6. Coupling Monitor

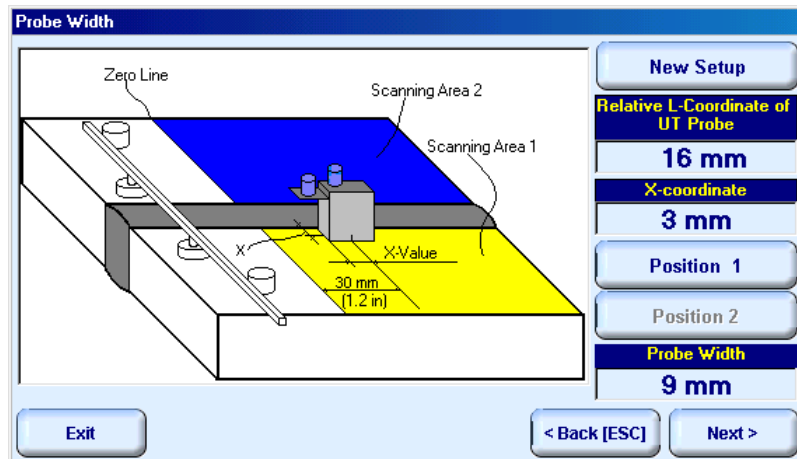
Refer to paragraph 10.1.6 of this Operating Manual

10.8.7. Referring Scanning Area

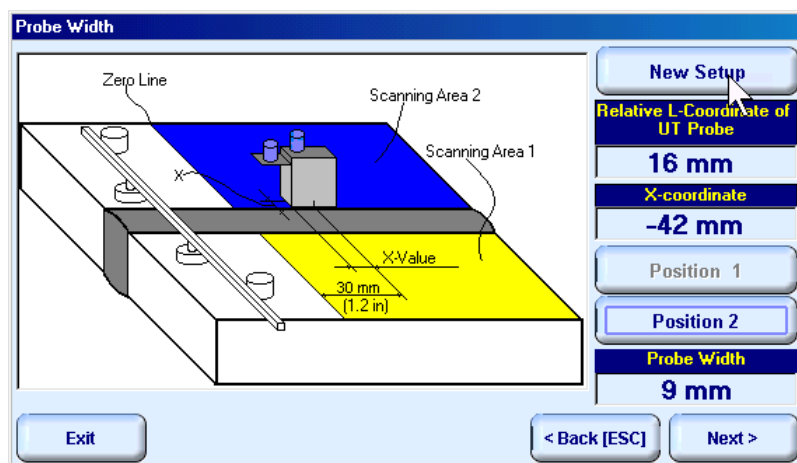
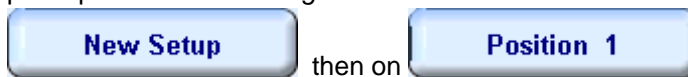
Refer to paragraph 10.5.7 of this Operating Manual

10.8.8. Probe Width

Probe Width to be measured prior to scanning while running **TRANSCAN** Mode:








- place probe into *Scanning Area 1* as it is shown on the sketch in **Probe Width** screen then click on





- place probe into *Scanning Area 2* as it is shown on the sketch in **Probe Width** screen then click on

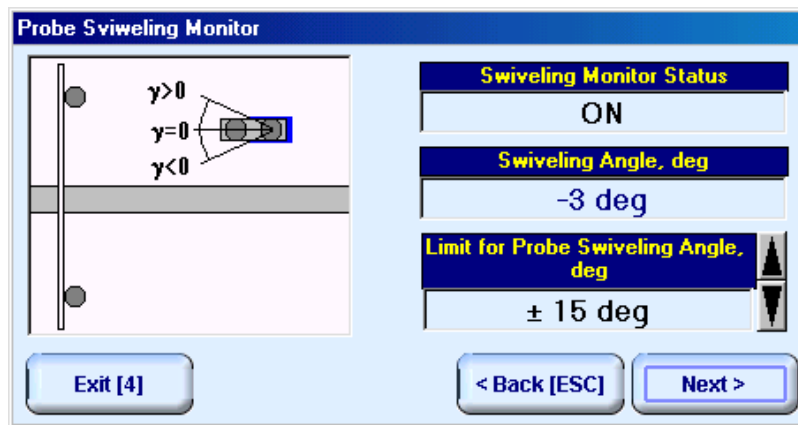


To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard


To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard




To continue click on  or press  on front panel keyboard or **F8** on external keyboard



10.8.9. Probe Swiveling Monitor





Set **Limit for Probe Swiveling Angle** in accordance with inspection procedure through clicking / pressing its

spin button  or through pressing , , ,  on front panel keyboard or , , ,  on external keyboard

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

10.8.10. Imaging Principles

Refer to paragraph 10.1.9 of this Operating Manual

10.8.11. Scanning

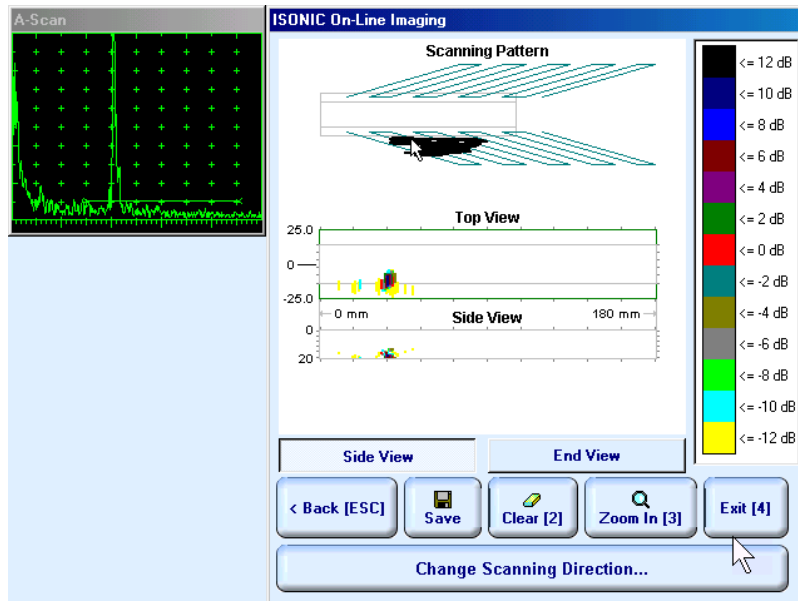
Two scanning areas are represented in the **Scanning Pattern** field in **ISONIC On-Line Imaging** screen **Top View** field proportionally represents weld metal and heat affected zone area

According to HP5/3 and ASME practice scanning for transversal cracks to be performed in 2 opposite directions with respect to weld centerline – after covering scanning plan in one direction click on

Change Scanning Direction...

then turn twister S 904050 as it is shown in paragraph 10.8.1 of this Operating Manual and continue scanning

For other notes and instructions refer to paragraph 10.1.10 of this Operating Manual



10.8.12. Postprocessing

Refer to paragraph 10.1.11 of this Operating Manual

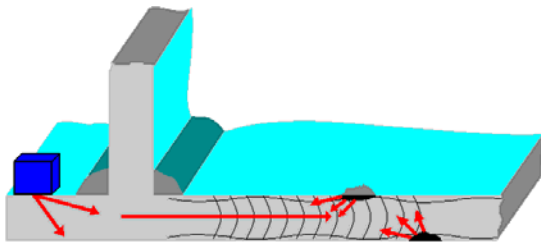
11. XY Scanning and Recording for Long Range Inspection

11.1. FLOORMAP Foreword

FLOORMAP is technology for express ultrasonic screening and mapping of pitting (corrosion) in large metallic plates either flat or curved. Complete ultrasonic coverage of plate volume is provided by use of guided waves and does not require scanning above whole surface of the plate. Typical objects under test:

- ❑ Annular plates of storage tanks - inspection from outside
- ❑ Shell and walls of storage tanks - inspection from outside
- ❑ Floor plates of storage tanks - inspection from inside
- ❑ Inaccessible pipe walls – inspection from outside (for example pipe walls above support, coated pipes, etc.)
- ❑ Walls of underground storage tanks – inspection from outside

FLOORMAP technology is also useful for encoded scanning with surface wave and angle beam probes



FLOORMAP technology package provides screening and mapping of pitting (corrosion) through:

- continuous linear or XY encoded scanning with guided wave probe at plate end
- encoded guided wave probe swiveling at plate end
- combined encoded linear-XY-swiveling scanning at plate end



High degree scattered corrosion, inter-crystal corrosion dropping elastic properties of plate material, coatings of some types may decrease inspection range

Restrictions

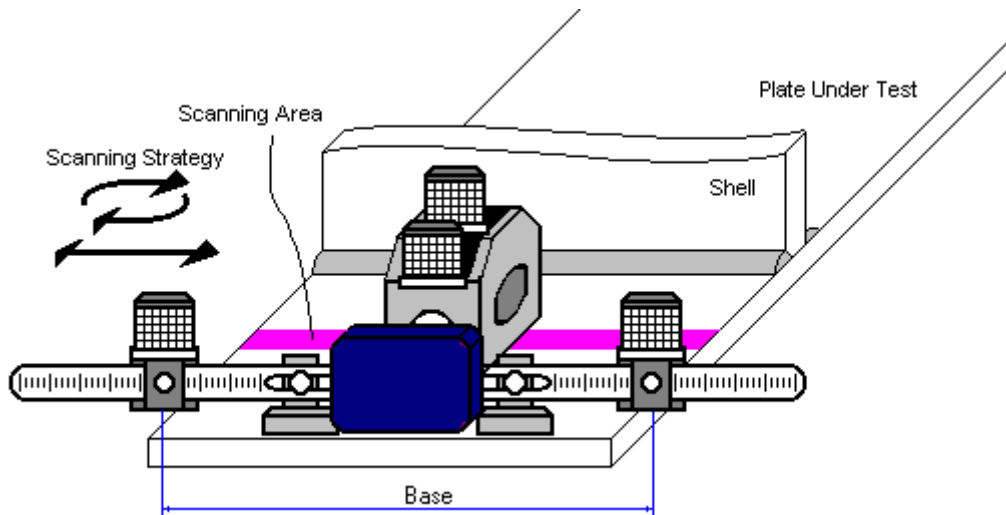
- No discrimination between top and reverse side corrosion is possible
- Scanning surface must be free of impurities, welding droplets, surface corrosion and coating (well bonded paint or coating is acceptable)
- Poor annular plate condition may decrease inspection range

11.2. Preparations

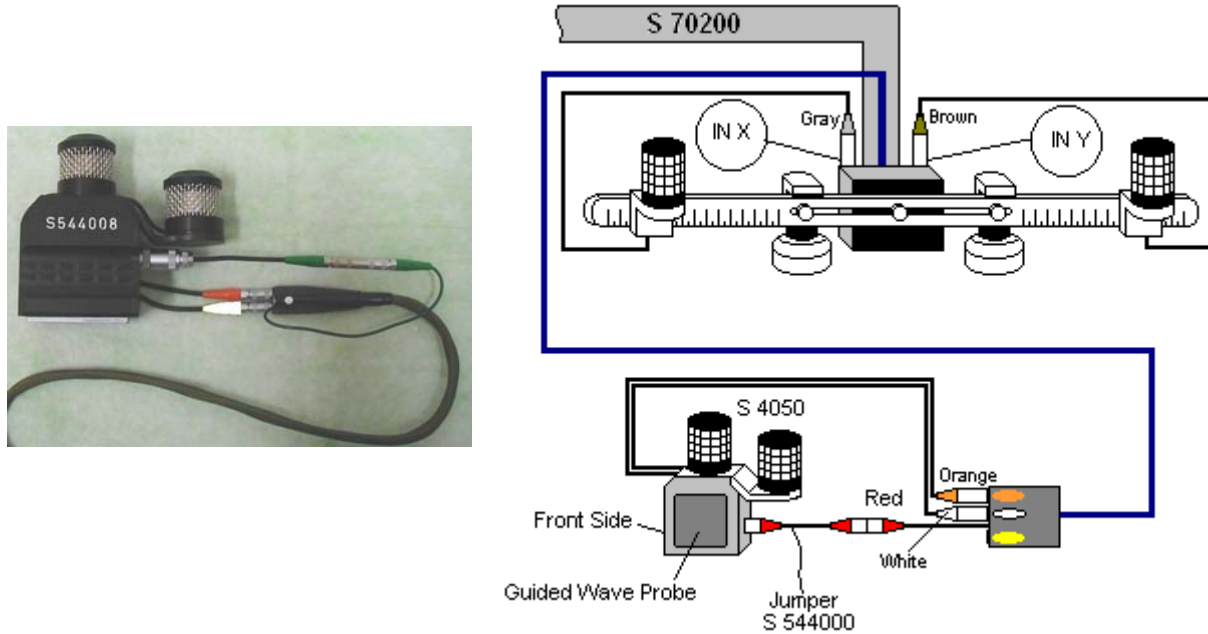
11.2.1 Placement of receivers of airborne ultrasound behind scanning area

XY Scanning with swiveling

Fit double emitter of airborne ultrasound S 4050 into clasper located on the top of guided wave probe. Bar supporting receivers of airborne ultrasound to be placed behind scanning area at parallel to tank shell



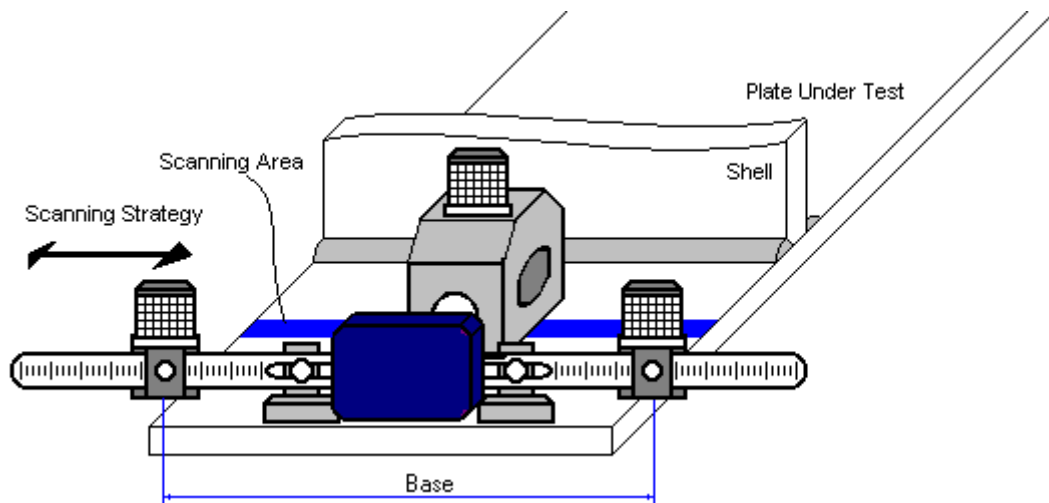
Cabling at probe side to be according to sketch and photo below, jumper S 544000 to be used:



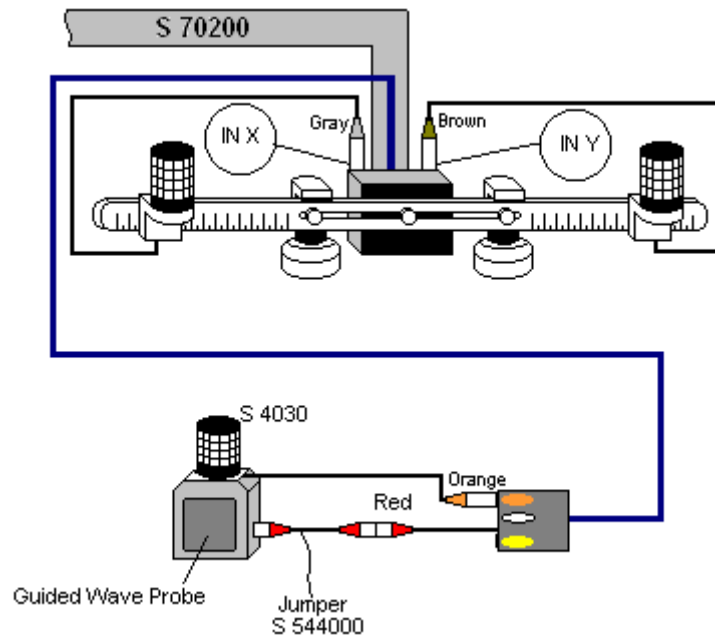
Cabling at the instrument side to be according to paragraph 8.4.1.1 of this Operating Manual

XY Scanning without swiveling

Fit single emitter of airborne ultrasound S 4060 into clamber located on the top of guided wave probe. Bar supporting receivers of airborne ultrasound to be placed behind scanning area at parallel to tank shell



Cabling at probe side to be according to sketch below, jumper S 544000 to be used:

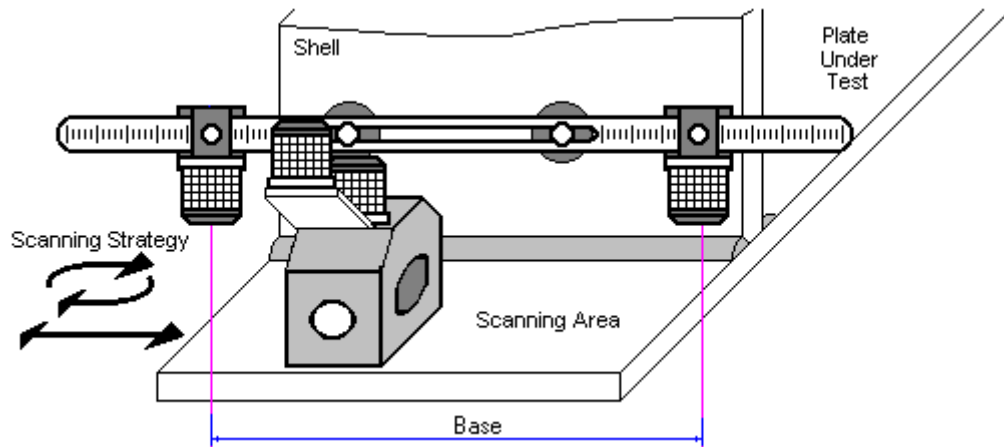


Cabling at the instrument side to be according to paragraph 8.4.1.1 of this Operating Manual

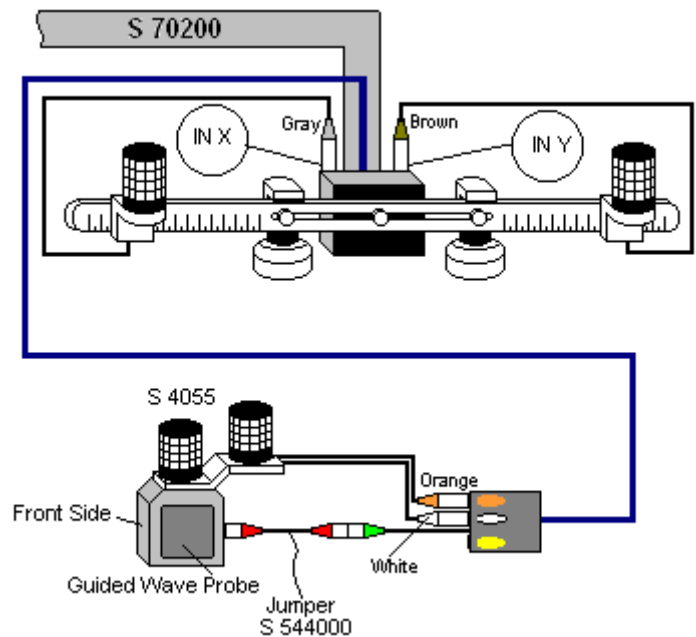
11.2.2 Placement of receivers of airborne ultrasound on tank shell

XY Scanning with swiveling

Fit double emitter of airborne ultrasound S 4055 into clasper located on the top of guided wave probe. Bar supporting receivers of airborne ultrasound to be placed on tank shell



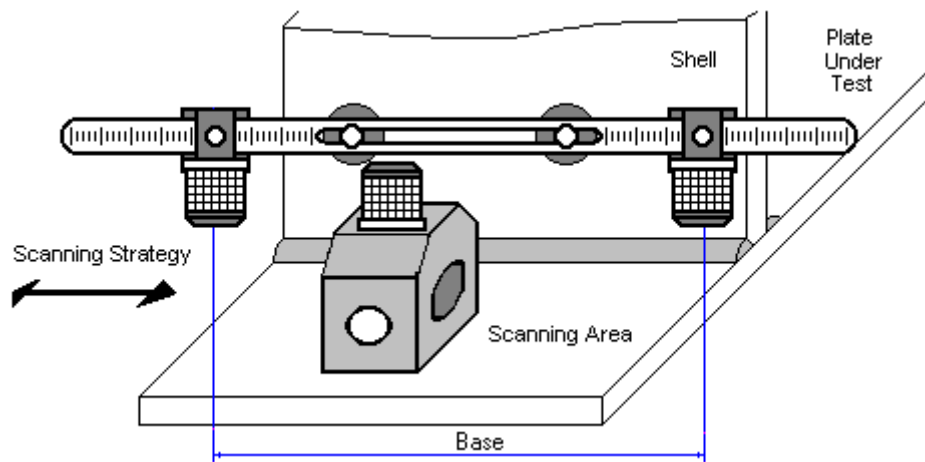
Cabling at probe side to be according to sketch and photo below, jumper S 544000 to be used:



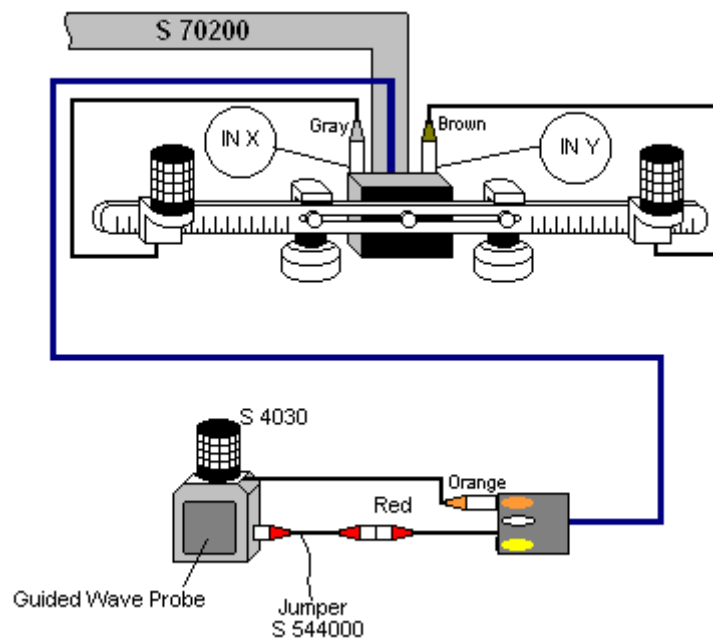
Cabling at Instrument site to be according to paragraph 8.4.1.1 of this Operating Manual

XY Scanning without swiveling

Fit single emitter of airborne ultrasound S 4060 into clammer located on the top of guided wave probe. Bar supporting receivers of airborne ultrasound to be placed on tank shell



Cabling at probe side to be according to sketch below, jumper S 544000 to be used:



Cabling at Instrument site to be according to paragraph 8.4.1.1 of this Operating Manual

Fixture S 2045B is required to place receivers of airborne ultrasound on the tank shell:

1. Equipping 2 magnetic legs with elbow



2. Fitting the legs into the receivers bar



4. Equipping cable box with separate magnetic leg



5. Applying bar with receivers or airborne ultrasound and cable box on the tank shell



Distance between two receivers of airborne ultrasound (**Base1**) is defined as:

$$\text{Base} = B_0 + \text{Pos1} + \text{Pos2}$$

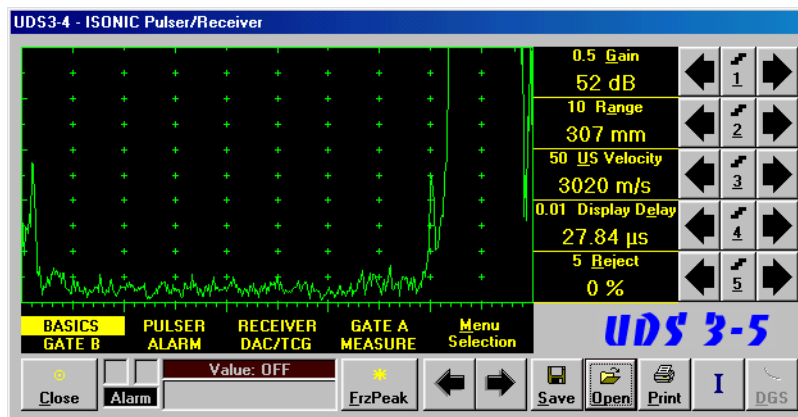
Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly;

B₀ is parameter of the bar. Long bar only (order code / part # S 2040 B) may be used while working in **TOFD** mode: **B₀** = 200 mm / 8 in





Enter **FLOORMAP** mode according to paragraph 8.1 of this Operating Manual

11.3. Pulsar Receiver Settings



Provide instrument settings according to paragraphs 7.6.1.2 through 7.6.1.4 of this Operating Manual


To return to previous screen click on  or press  on front panel keyboard or **Esc** or **<Alt>+<C>** on external keyboard


On completing calibration click on  or press  on front panel keyboard or **F8** on external keyboard




11.4. Referring Scanning Area






In the **Inspection Setup** screen it is necessary to enter value of Base – distance between receivers of airborne ultrasound on the bar, said distance defines length of scanning area. It is also possible to key in textual comments to be added to inspection report if necessary. Popup screen for that purpose will appear if




click on 



Setting of **Base** to be performed through clicking / pressing spin button  with **Fine**, **Medium**, or **Coarse** increments according to checked option (click on) in the **Setup Step** field



Alternatively **Base** for setting to be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on its label. Label indicating name of selected parameter changes it's

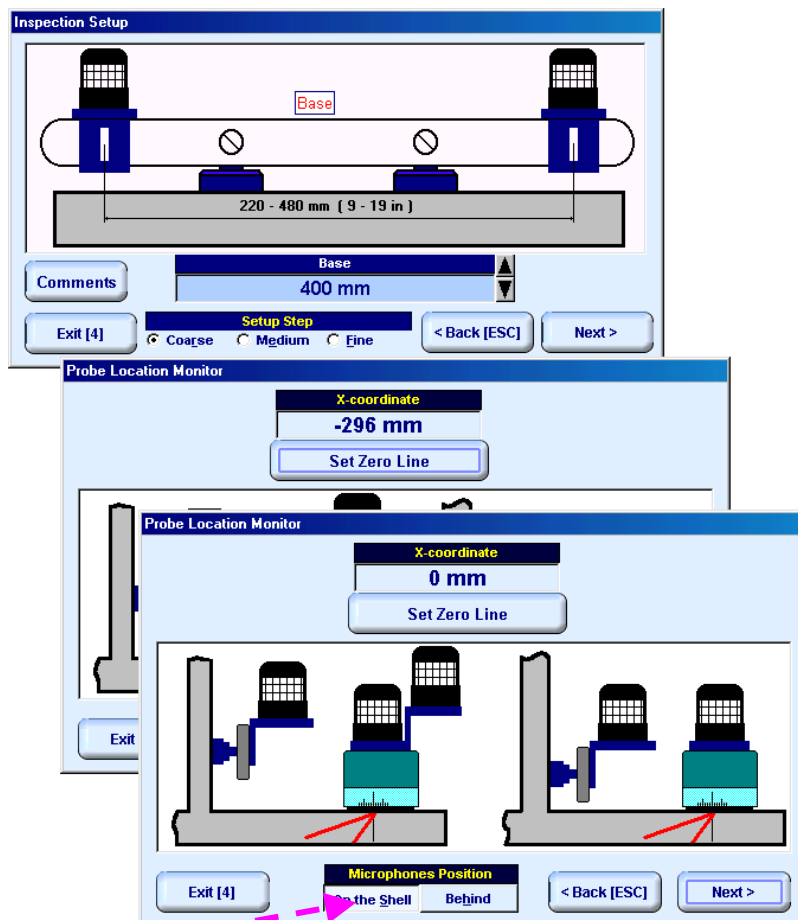
fore color from yellow to white – since that moment parameter may be modified using , , ,

 on front panel keyboard or , , ,  on external keyboard



To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard




To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard



To continue click on  or press  on front panel keyboard or **F8** on external keyboard - this will open **Probe Location Monitor** screen:





It is necessary to **designate** location of bar with receivers of airborne ultrasound – either behind scanning area or on the tank shell

On completing place guided probe onto selected *Zero Line* and click on  or press or press  on front panel keyboard **Enter** on external keyboard

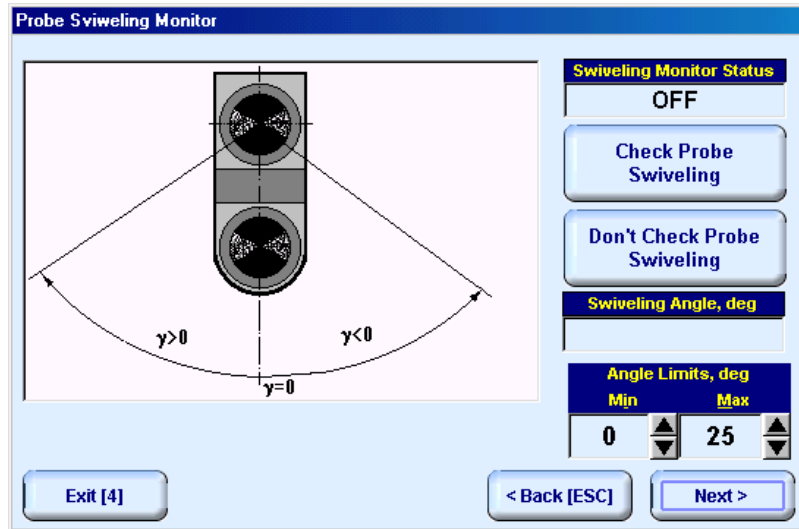
To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard

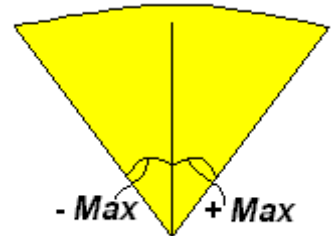
11.5. Probe Swiveling Monitor

To activate / negate Probe Swiveling Monitor click on



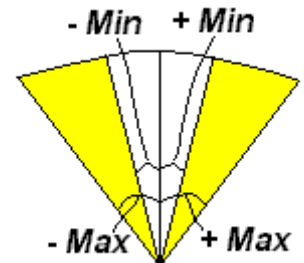
There are *two limits* for **Probe Swiveling Angle** to be entered (**Angle Limits**):

If **Min = 0 deg** then signals related to insonification of whole sector **[- Max ... + Max]** will be recorded and whole sector image will be provided



If **Min > 0 deg** then:

- Signals related to insonification of sectors **[- Max ... - Min]** and **[+ Min ... + Max]** will be recorded and imaging of these two sectors will be provided
- Signals related to insonification of sector **[- Min ... + Min]** will not be recorded – this allows to avoid recording of echoes from fillet weld between the shell and annular plate, which may mask the close to shell pitting (corrosion damage) – for such setting it is necessary to combine XY scanning and probe swiveling to provide complete volume insonification and recording

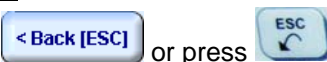


To return back to **XY Scanning Recording and Imaging Menu** click on



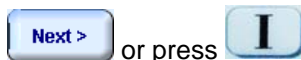
on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on



on front panel keyboard or **Esc** on external keyboard

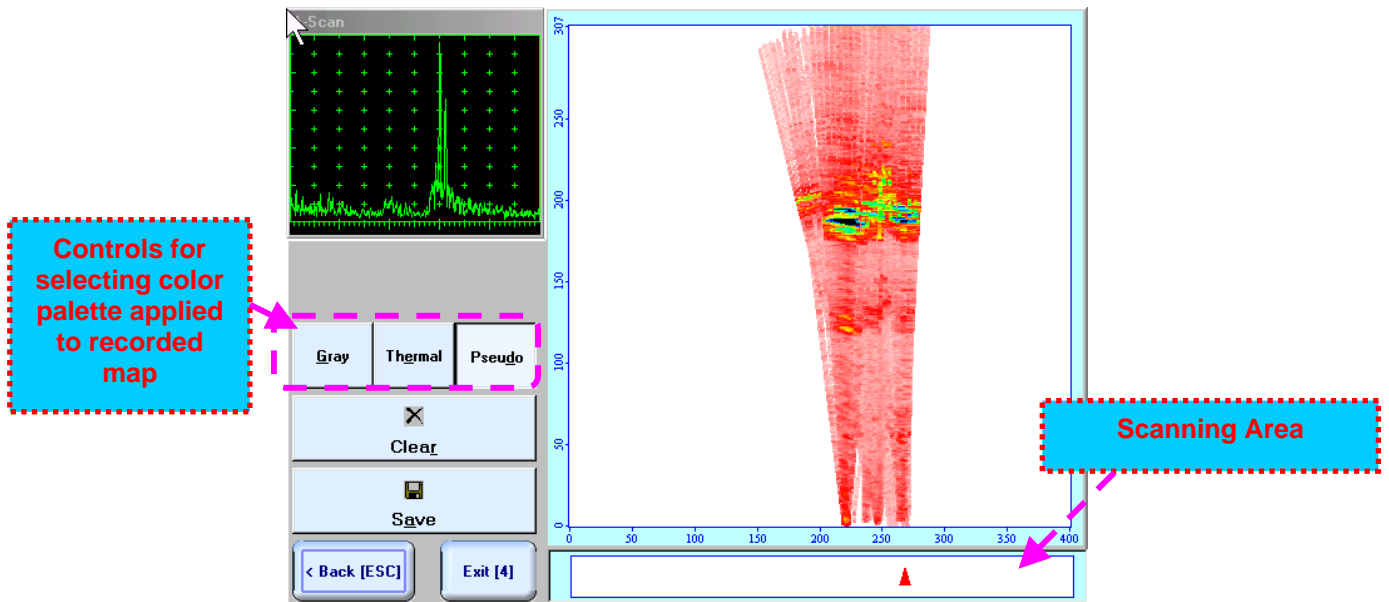
To continue click on







or press **I** on front panel keyboard or **F8** on external keyboard




11.6. Scanning



Map of inspected volume is accompanied with **A-Scan** while scanning. Current probe position and swiveling angle are represented by arrow ▲, which moves synchronously with probe in the scanning area



To cleanup recorded map click on  or press  on front panel keyboard or **F2** on external keyboard

To save **FLOORMAP** record into a file click on  or press  on front panel keyboard or **F12** on external keyboard. Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

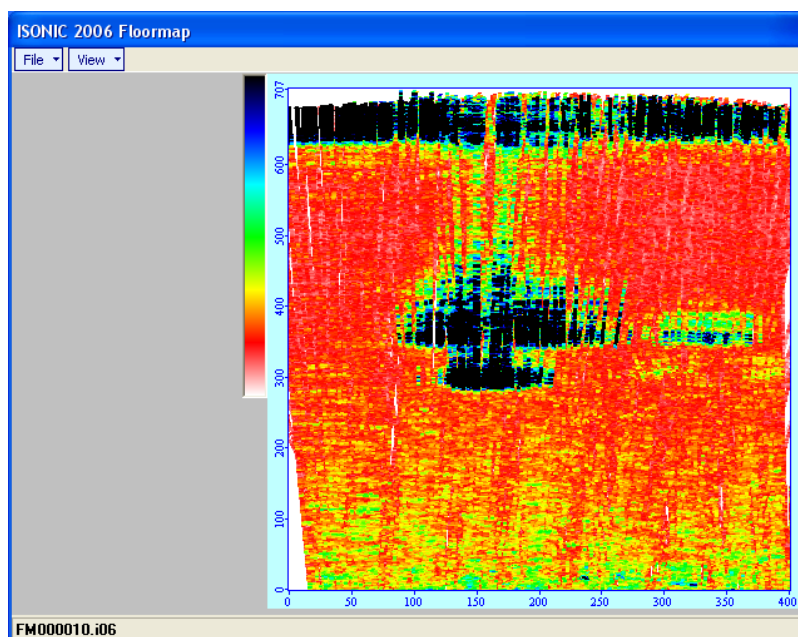
To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

11.7. Postprocessing

Postprocessing may be performed in the instrument or in external computer using **IOFFICE** SW package. User interface and operations are practically identical except two features listed below:

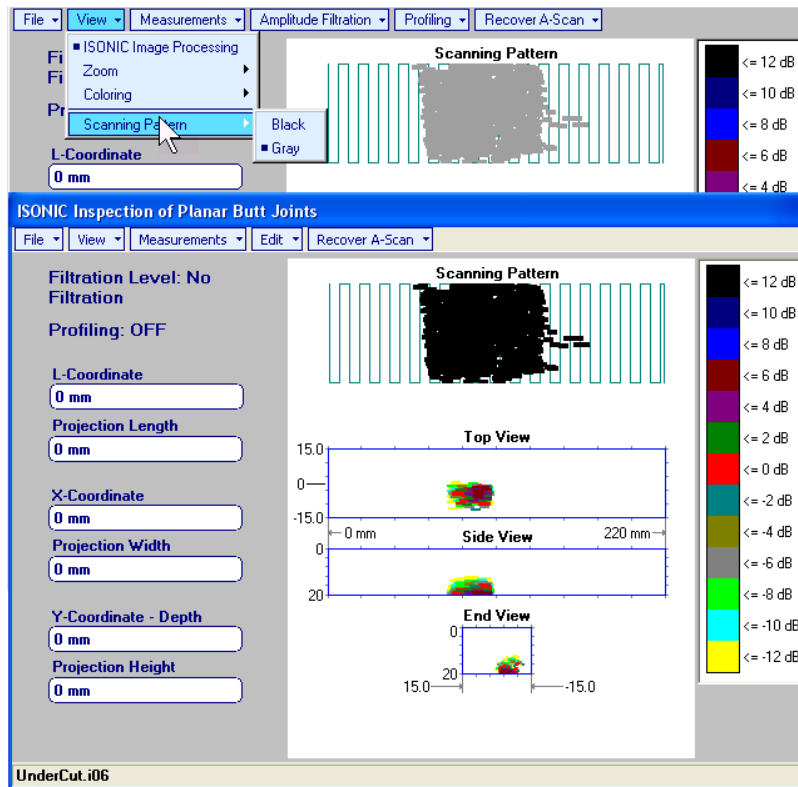
	Off-line analysis in the instrument	Off-line analysis in external computer using IOFFICE SW Package
Off-line re-adjustment of Gain	NO	YES
Automatic creation of Inspection report in MS Word® format	NO	YES

Menu Bar Functions on Opening File









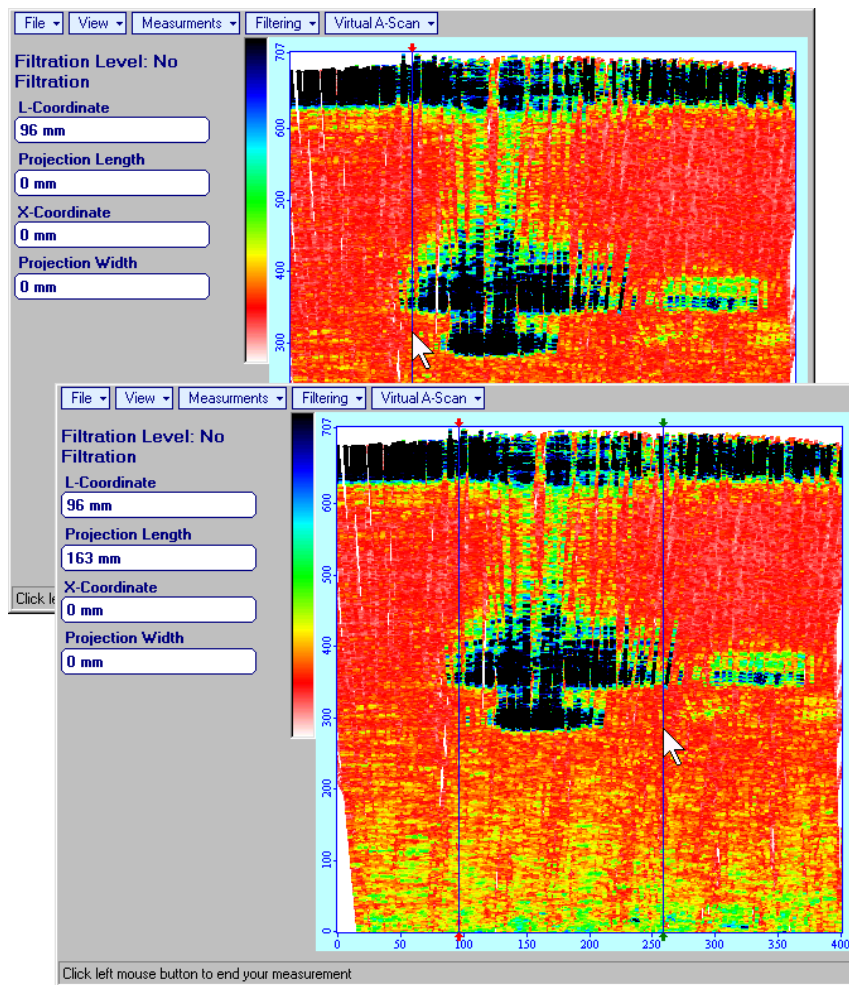
- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word®** as printer to create inspection report as doc file (**IOFFICE** SW Package only)
 - selection of paper sheet size either A4 or Letter
- **File → Print** – prints complete **FLOORMAP** inspection report
- **File → Exit** – ends postprocessing session
- **View → Primary Information** – previews **UDS 3-5 Pulsar Receiver** settings, inspection setup and operator's comments if entered at pre-scanning stage stages as it is described in paragraph 11.4 of this Operating Manual
- **View → ISONIC Image Processing** – activates menu for detailed off-line analysis of the record







ISONIC Image Processing Menu Bar Functions

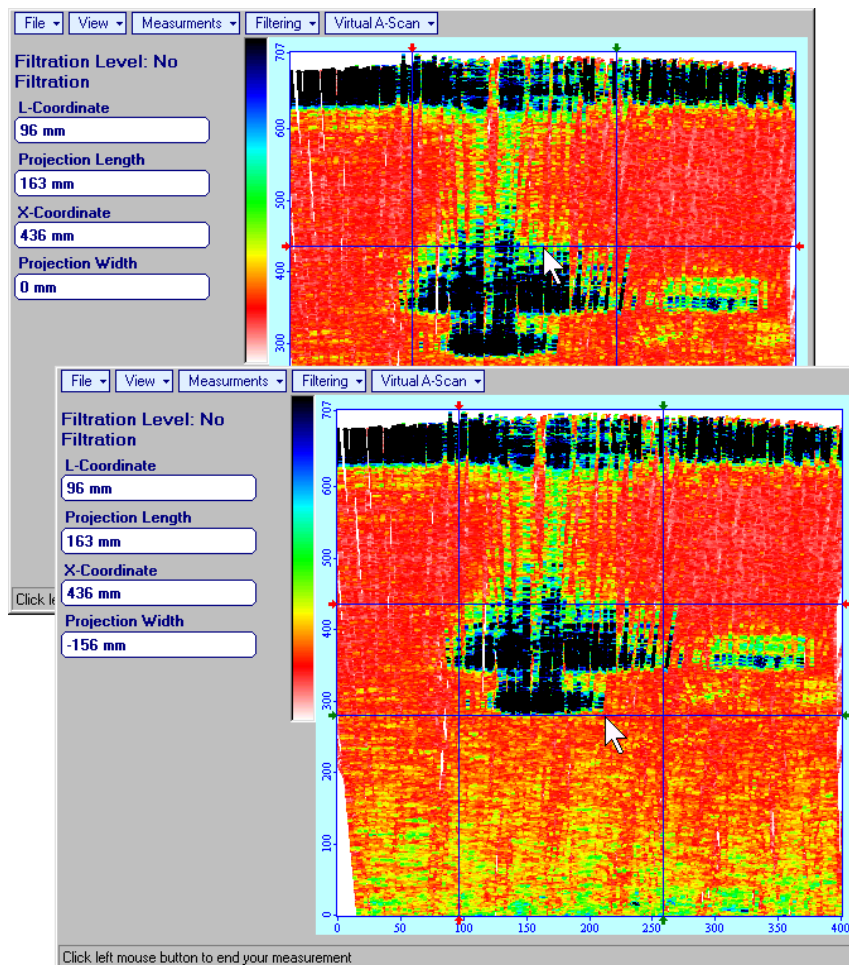


- **File → Print To**
 - selection of printer among available for printing out inspection report
 - selection of **MS Word**[®] as printer to create inspection report as doc file (**IOFFICE SW Package** only)
 - selection of paper sheet size either A4 or Letter
- **File → Print** – prints current postprocessing page
- **File → Exit** – ends postprocessing session
- **View → ISONIC Image Processing** – returns to initial postprocessing screen appearing on opening file
- **View → Coloring** – selection of **color scale (palette)** style applied to **FLOORMAP** image

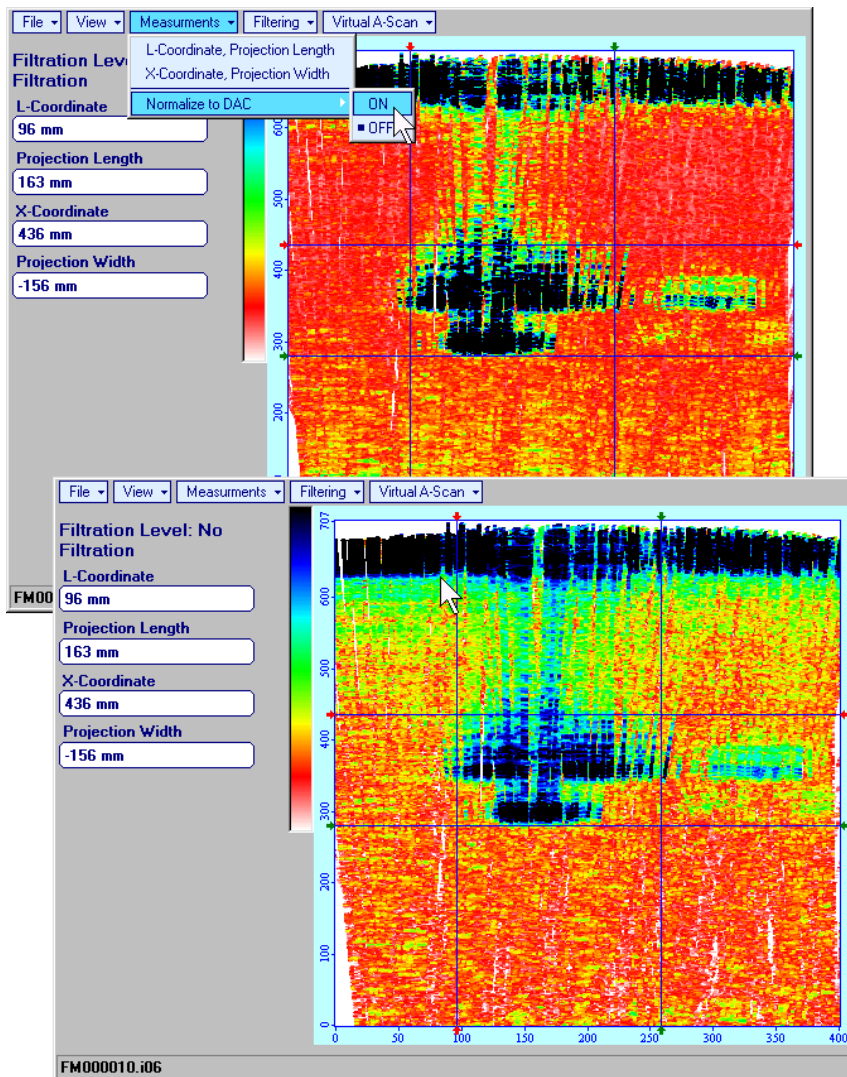
- Measurements → L-Coordinate, Projection Length** – generates *first vertical cursor* that may be guided over **FLOORMAP** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first vertical cursor* along **FLOORMAP** image is indicated in the **L-Coordinate** field. To fix position of the *first vertical cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second vertical cursor* appears upon fixing the first one; it may be manipulated by the same way. Coordinate of the *second vertical cursor* along **FLOORMAP** image measured relatively first vertical cursor is indicated in the **Projection Length** field. Provided that *vertical cursors* are placed properly:
 - **L-Coordinate** represents distance between left border of scanning area and selected defect's end
 - **Projection Length** represents appropriate size of defect
 To interrupt **L-Coordinate** and **Projection Length** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard



- Measurements → X-Coordinate, Projection Width** – generates *first horizontal cursor* that may be guided over **FLOORMAP** image using either touch screen stylus or mouse or ,  on front panel keyboard or ,  on external keyboard; coordinate of the *first horizontal cursor* along **FLOORMAP** image is indicated in the **X-Coordinate** field. To fix position of the *first horizontal cursor* left mouse click or release touch screen stylus or press  on front panel keyboard or **Enter** on external keyboard. *Second horizontal cursor* appears upon fixing first one; it may be manipulated by the same way. Coordinate of the *second horizontal cursor* along **FLOORMAP** image measured relatively *first horizontal cursor* is indicated in the **Projection Width** field. Provided that *horizontal cursors* are placed properly:
 - **X-Coordinate** represents distance between scanning zero line and selected defect's end
 - **Projection Width** represents appropriate size of defect
 To interrupt **X-Coordinate** and **Projection Width** measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard



- **Measurements → Normalize to DAC → ON** – applies **DAC** normalized color palette to **FLOORMAP** data recorded with active **DAC** and redraws **FLOORMAP** image correspondingly (**dB** to **DAC** normalization)







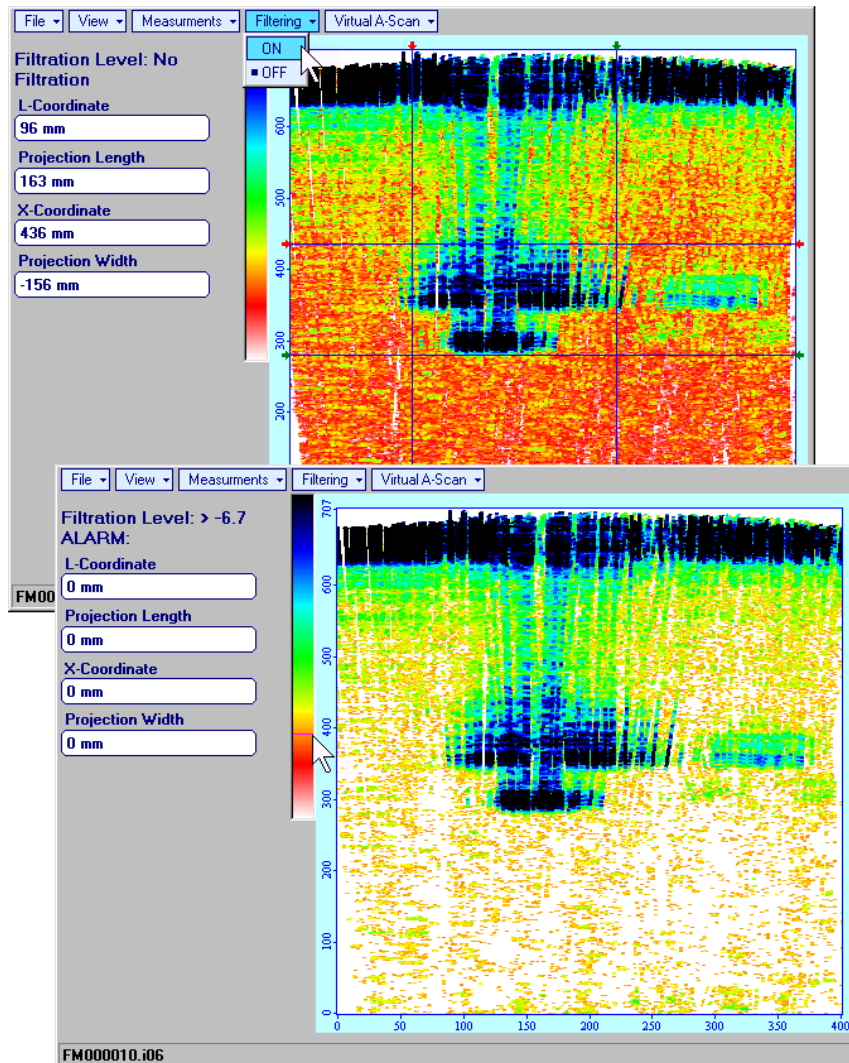
- **Measurements → Normalize to DAC → OFF** – negates **dB** to **DAC** normalization



Applying / negating of **dB** to **DAC** normalization negates **Filtering**



- **Filtering → ON** – (instrument) or **Edit → Filtering → ON** (IOFFICE SW Package for external computer) – generates *sliding cursor* above *amplitude palette bar*, which may be controlled using either touch

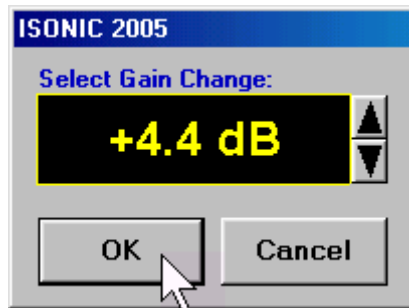
screen stylus or mouse or   on front panel keyboard or   on external keyboard. Position of the *sliding cursor* on the *amplitude palette bar* determines filtering level, which is appropriately indicated. All elements of **FLOORMAP** image representing signal amplitude below filtering level are suppressed:




- **Filtering → OFF** – (instrument) or **Edit → Filtering → OFF** (IOFFICE SW Package for external computer) – returns to originally recorded **FLOORMAP** image

- **Edit→Change Gain→ON** – (IOFFICE SW Package for external computer) – generates popup window allowing off-line re-adjusting of **Gain** for all data captured during **FLOORMAP** Scanning in $\pm 6\text{dB}$ range

with $\pm 0.1 \text{ dB}$ increments through clicking or pressing and holding on  or pressing  on keyboard

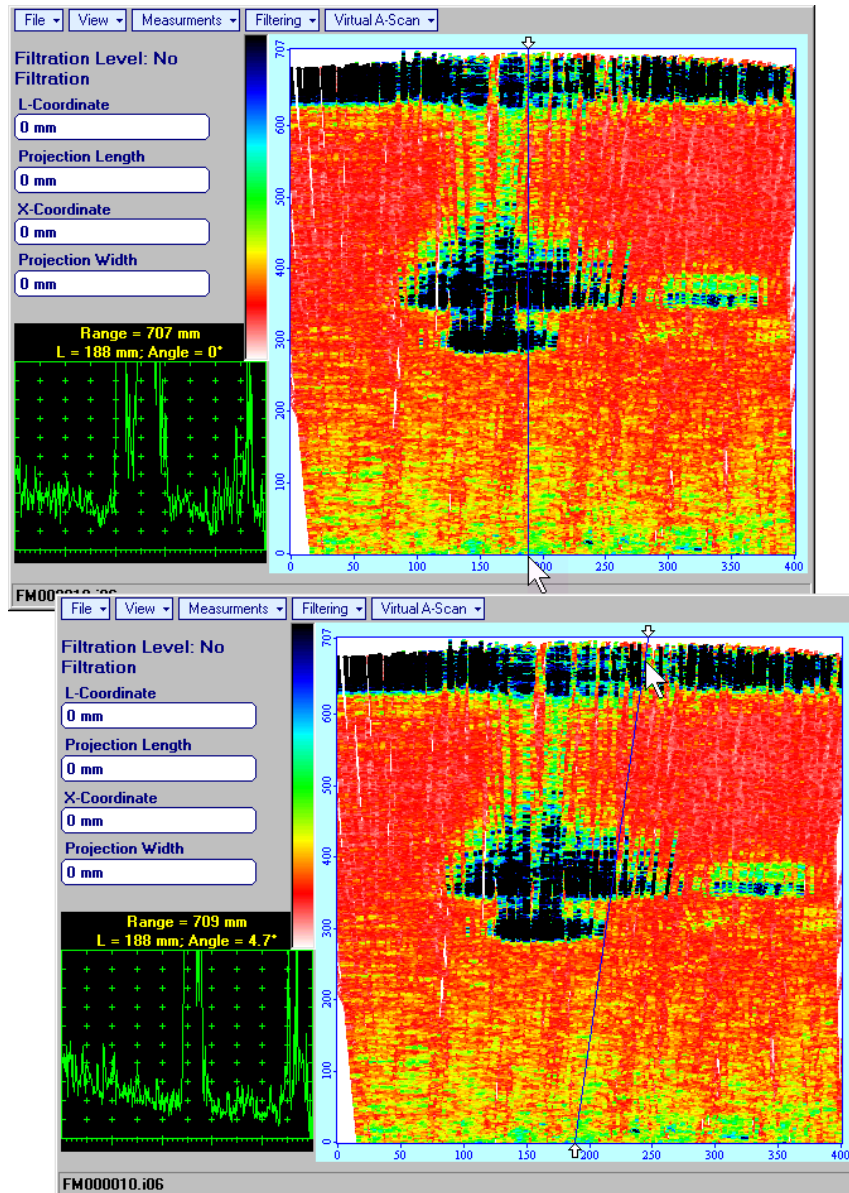


Upon completing re-adjusting **Gain** click on  or press **Enter** on keyboard – this applies new **Gain** value to all captured **A-Scans** and updates **FLOORMAP** image accordingly

To interrupt re-adjusting of **Gain** click on  or press **Esc** on keyboard

- **Edit→Change Gain→OFF** (IOFFICE SW Package for external computer)– negates **Gain** re-adjustment and returns to originally recorded **FLOORMAP** image and original **Gain** setting

- Virtual A-Scan→ON** – generates *positioning vertical cursor* that may be manipulated using either touch screen stylus or mouse simulating positioning of probe along scanning area. To fix positioning vertical cursor release touch screen stylus or left mouse click – this converts *positioning vertical cursor* into *direction cursor* and fixes mouse pointer at top end of *direction cursor*. *Direction cursor* is controllable using either touch screen stylus or mouse simulating swiveling of probe in selected position. Simulated position of probe and its swiveling angle are indicated along with recovered **A-Scan**. To fix *direction cursor* release touch screen stylus or left mouse click

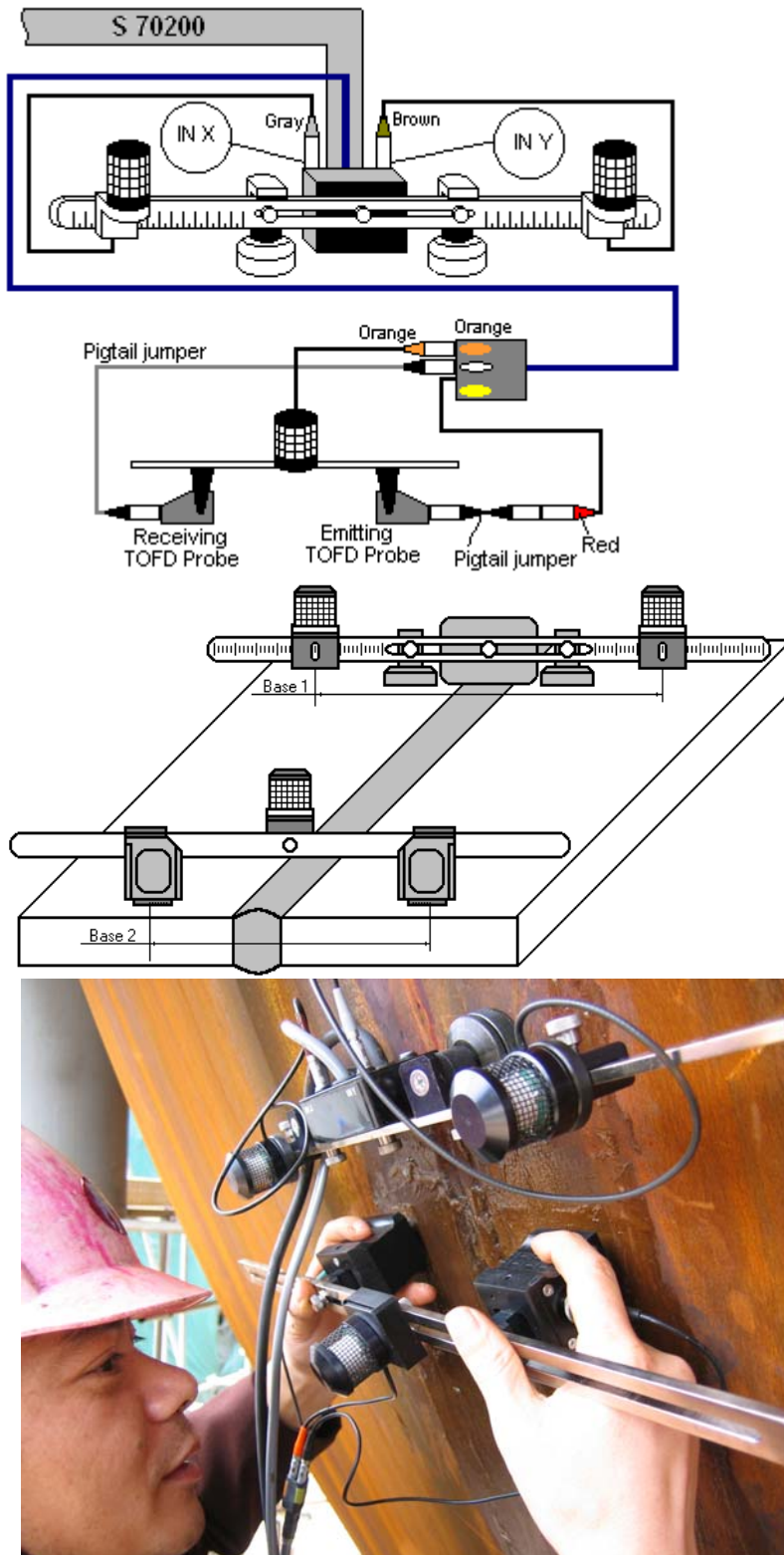


- Virtual A-Scan→OFF** – negates **A-Scan** recovery

12. XY Scanning and Recording for TOFD Inspection

12.1. Preparations

Fit emitting and receiving TOFD probes and single emitter of airborne ultrasound into TOFD fixture bar and provide cabling as below:



Cabling at the instrument side to be according to paragraph 8.4.1.2 of this Operating Manual

Apply bar with receivers of airborne ultrasound at rectangle to weld to be inspected. Distance between two receivers or airborne ultrasound (**Base1**) is defined as:

$$\mathbf{Base1} = \mathbf{B_0} + \mathbf{Pos1} + \mathbf{Pos2}$$

Pos1 and **Pos2** are positions of receivers at left and right side of the bar correspondingly;

B₀ is parameter of the bar. Long bar only (order code / part # S 2040 B) may be used while working in TOFD mode: **B₀ = 200 mm / 8 in**

Emitting and receiving probes to be located at opposite sides of the weld, probe separation **Base 2** to be defined according to paragraph 7.5.1 of this Operating Manual

Longitudinal scanning to be performed for defects finding; transversal scanning to be performed in defects section for evaluation purposes. Value of **Base 1** to be selected by such way that for both scanning directions single emitter of airborne ultrasound will be in the area limited by virtual lines outgoing from receivers of airborne ultrasound at parallel to weld centerline

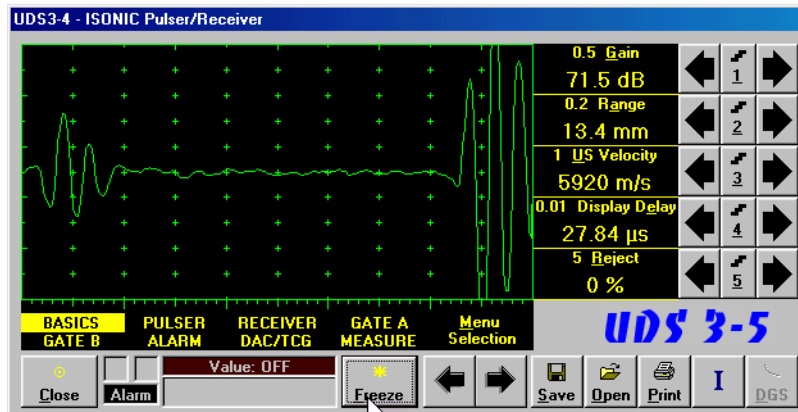


Enter TOFD mode according to paragraph 8.1 of this Operating Manual



12.2. Description Data

Refer to paragraph 9.1.2 of this Operating Manual

12.3. Pulsar Receiver Settings

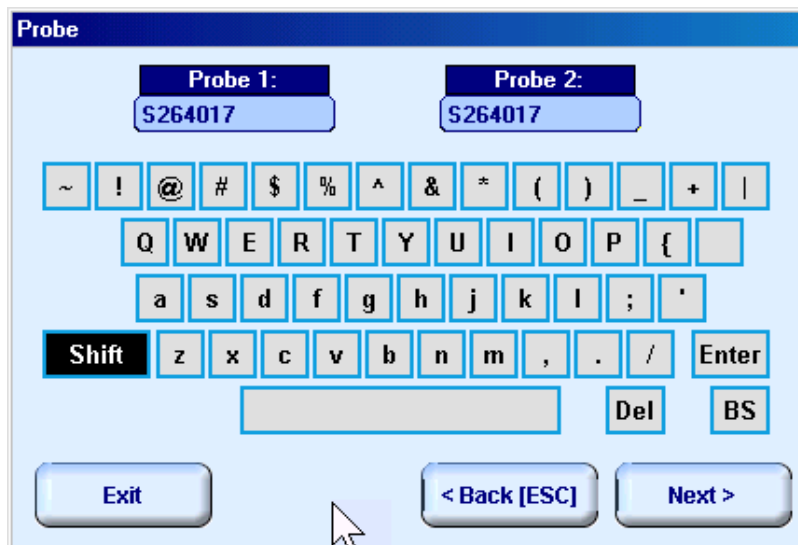


Provide instrument settings according to paragraph 7.5.1 of this Operating Manual




To return to previous screen click on  or press  on front panel keyboard or **Esc** or **<Alt>+<C>** on external keyboard



On completing calibration click on  or press  on front panel keyboard or **F8** on external keyboard



12.4. Probes



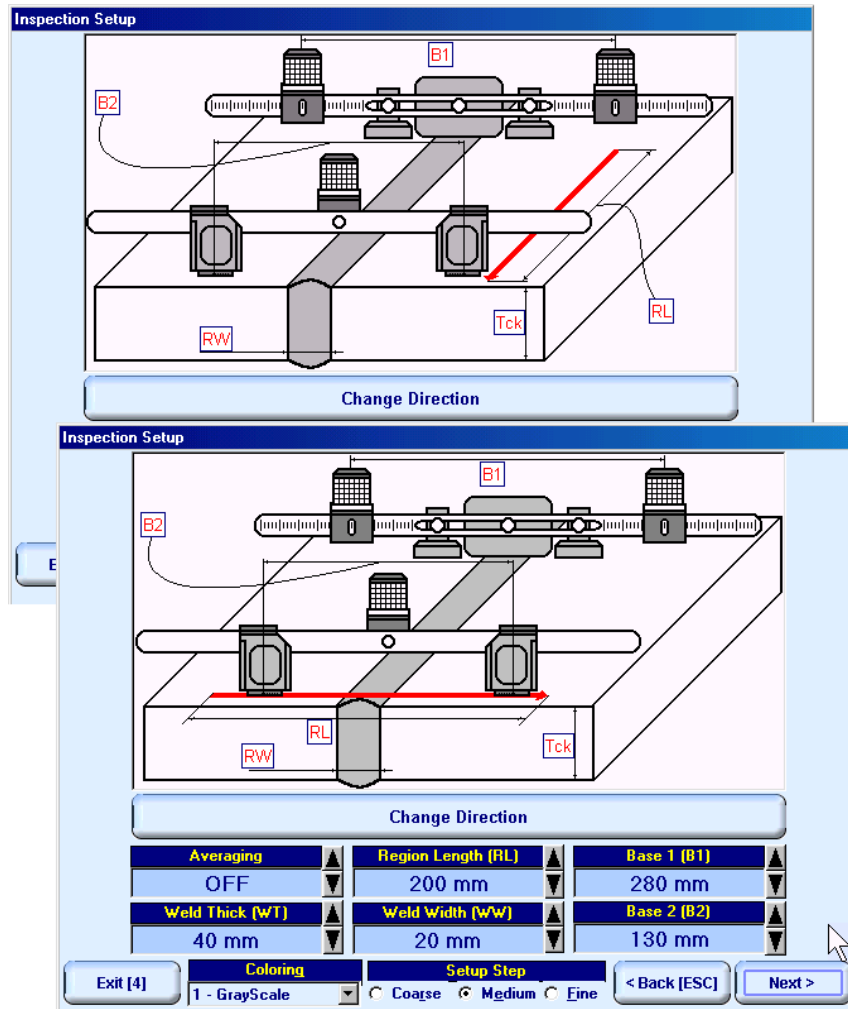
Types of emitting and receiving probes to be entered in **Probe** screen

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard


To continue click on  or press  on front panel keyboard or **F8** on external keyboard – this will enter next stage related to defining inspection mode and scanning parameters


12.5. Scanning Parameters






In the **Inspection Setup** screen it is necessary to key in:

- Base 1** – distance between two receivers of airborne ultrasound located on the bar
- Base 2** – probes separation
- Region Length** – length of scanning line
- Averaging** – **Averaging** of sequential **A-Scans** is required sometimes to improve signal to noise ratio of **TOFD** record; it may be either inactive (**OFF**) or setup for factor **2** or **4** or **8**
- Weld Thick** and **Weld Width** thickness of parent material and width of weld metal correspondingly, these parameters to be entered for documenting purposes only

Setting of said parameters to be performed through clicking / pressing corresponding spin button  with **Fine**, **Medium**, or **Coarse** increments according to checked option (click on) in the **Setup Step** field

Alternatively parameter for setting may be selected through pressing  on front panel keyboard or **F7** on external keyboard or through clicking on its label. Label indicating name of selected parameter changes

it's fore color from yellow to white – since that moment parameter may be modified using ,  on front panel keyboard or  on external keyboard




It is also necessary to select scanning direction either along or across the weld through clicking on







– the appropriate indication is provided

Style of palette applied to **TOFD Map** (Thermal or Gray) is selectable through clicking on:



To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

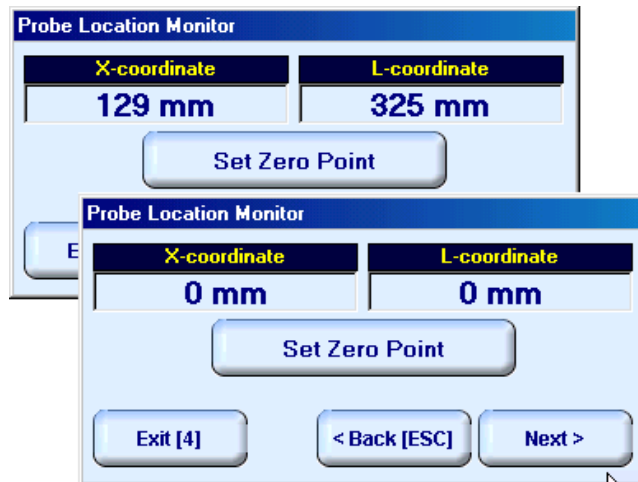
To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard




To continue click on  or press  on front panel keyboard or **F8** on external keyboard



12.6. Referring Scanning Area

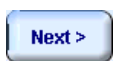

While **Probe Location Monitor** screen is active place probe pair into starting point of selected scanning line

then click on 



To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

To continue click on  or press  on front panel keyboard or **F8** on external keyboard





12.7. Imaging Principles

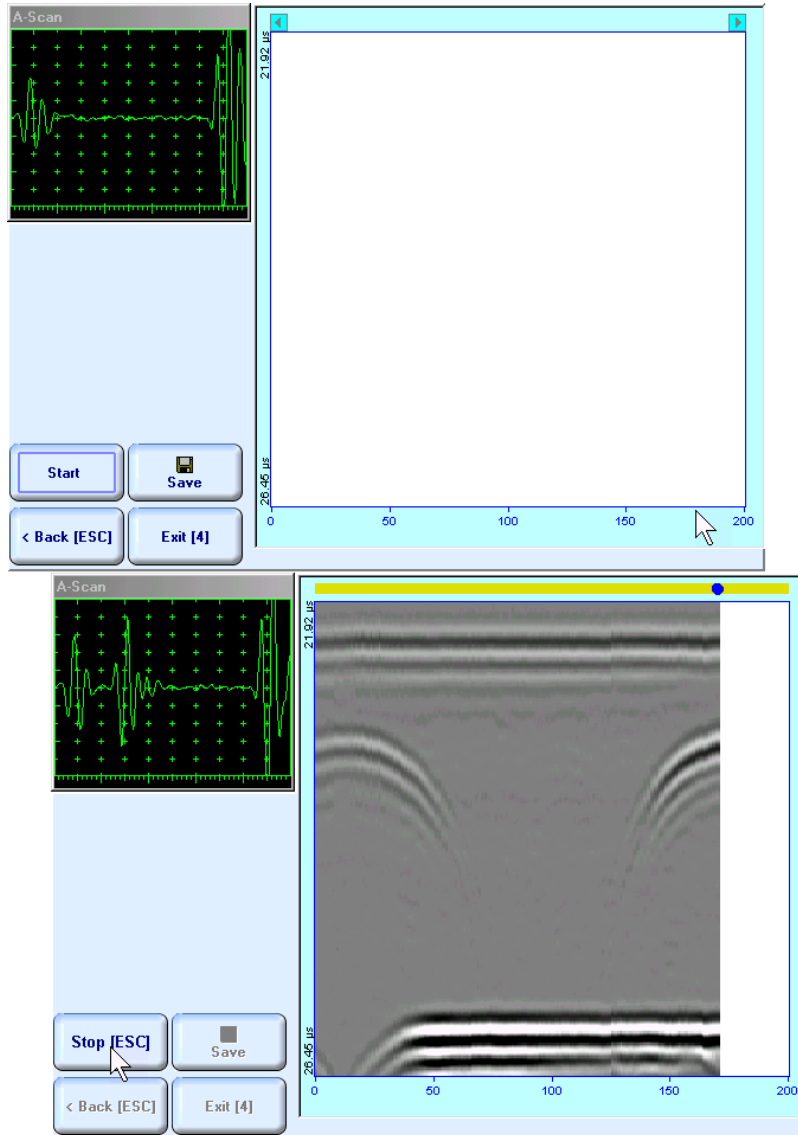
TOFD Map is recorded as **RF B-Scan** – refer to paragraph 7.5 of this Operating Manual



12.8. Scanning



To cleanup **TOFD Map** field and start scanning click on  or press  on front panel keyboard or **F8** on external keyboard

During scanning current probe position is represented by special marks:

-  – scanning is performed along current line selected
-  ,  – unacceptable transversal displacements of probe pair respectively selected scanning line, no record performing; it is necessary to return to selected scanning line
-  – unacceptable longitudinal displacement of probe pair respectively selected scanning line, no record performing; it is necessary to return to selected scanning line



To complete or interrupt scanning click on  or press  on front panel keyboard or **Esc** on external keyboard

To save **TOFD** record into a file click on  or press  on front panel keyboard or **F12** on external keyboard. Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

To return back to **XY Scanning Recording and Imaging Menu** click on  or press  or  on front panel keyboard or **F4** or **Esc** on external keyboard

To return to previous screen click on  or press  on front panel keyboard or **Esc** on external keyboard

12.9. Postprocessing

Refer to paragraph 7.5.2.5 of this Operating Manual

13. Incremental Encoders

13.1. Standard Encoder SK 2001108 ABI

Encoder **SK 2001108 ABI** is originally designed for **BScan(Th)** and **ABISCan** recording with **ISONIC 2001**, **ISONIC 2005**, and **ISONIC 2006** instruments. It does not require calibration for using with these instruments (recognized as default encoder)

To start with encoder follow simple guidance as below

Step 1

Fit probe into appropriate probe holder and connect signal cable(s) to probe



Step 2

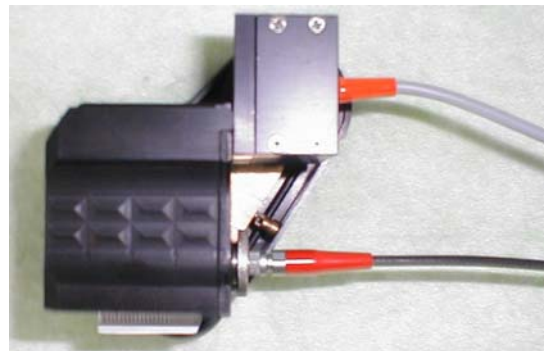
Fit probe holder with probe into encoder



Step 3

Connect probe signal cable(s) to appropriate coaxial socket on **ISONIC 2006** unit – refer to paragraph 4.2 of this Operating Manual

Connect encoder data cable to the appropriate D-Type connector on rear panel of **ISONIC 2006** unit – refer to paragraph 4.2 of this Operating Manual



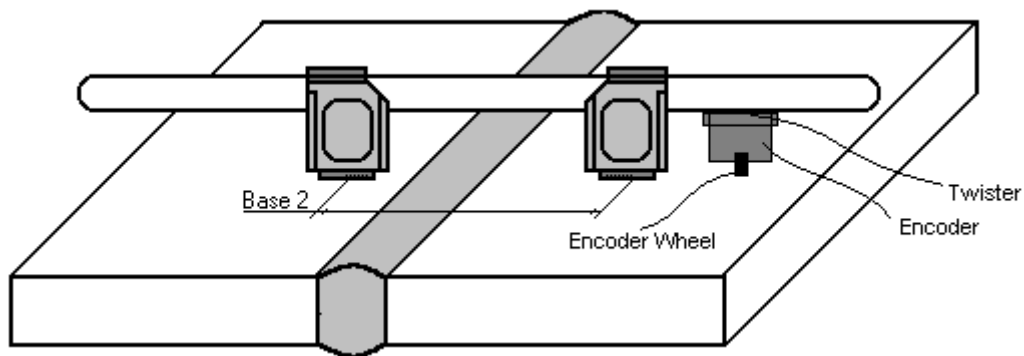
13.2. Standard Encoder SK 2001108 FM

Encoder **SK 2001108 FM** is originally designed for **TOFD** and **FLOORMAP L** recording with **ISONIC 2001**, **ISONIC 2005**, and **ISONIC 2006** instruments. It does not require calibration if using with these instruments (recognized as default encoder). To start with encoder follow simple guidance as below

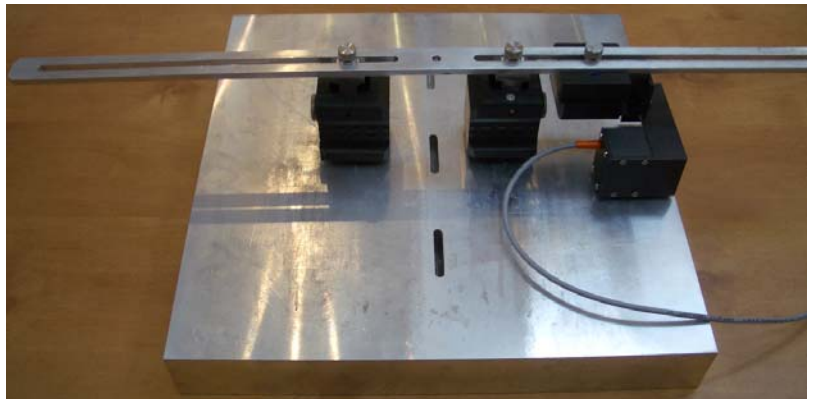
13.2.1. TOFD

Insert ultrasonic probes into their probe holders then:

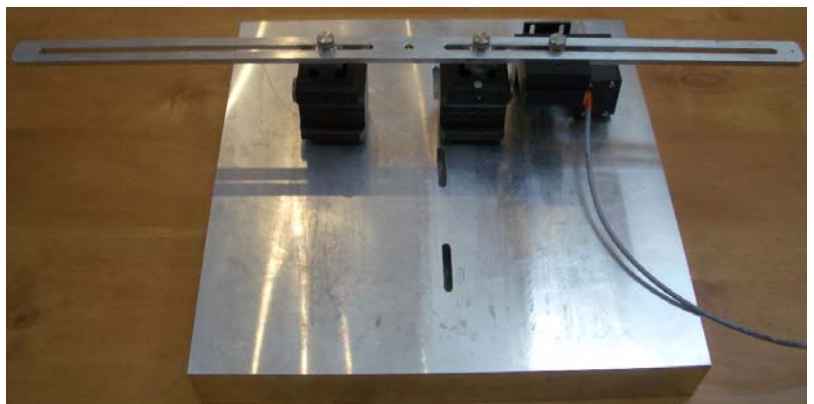
- ❑ Fit probe holders with probes on **TOFD** bar and fix them at at necessary separation distance
- ❑ Fix twister **S 904050** on the **TOFD** bar
- ❑ Fit encoder **SK 2001108 FM** into twister **S 904050** and provide necessary orientation of encoder's wheel – it must be oriented at parallel to the desired probes' trace either along or across the weld – refer to the sketch and photos below



TOFD Fixture and encoder positioning for scanning along the weld



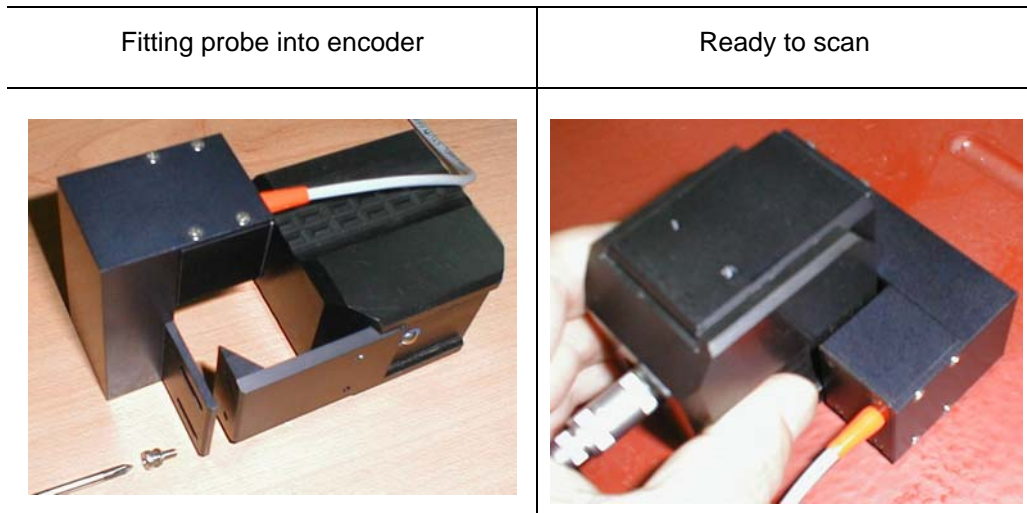
TOFD Fixture and encoder positioning for scanning across the weld



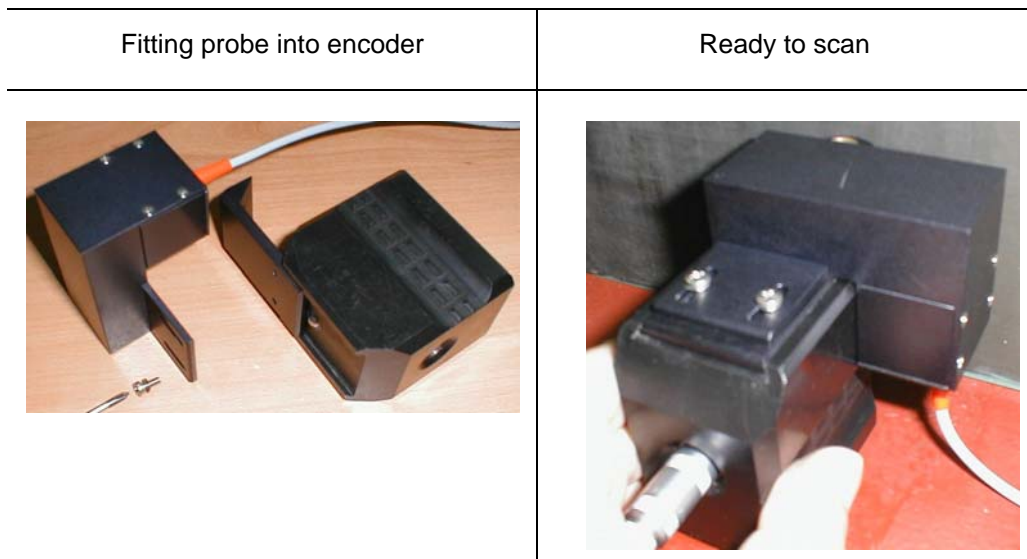
13.2.2. FLOORMAP L

Encoder **SK 2001108 FM** allows 2 ways of direct fitting of S 544 series guided wave probes or other probes fitted into appropriate probe holders:

- Both encoder's wheel and probe contact face are situated on scanning surface:



- Encoder's wheel is situated on surface, which is rectangular to scanning surface:



13.3. Customized Encoders for Proprietary Inspection Tasks

Various custom made encoders for proprietary inspection tasks may be used with **ISONIC 2006**. For appropriate encoder data cable and connector pinout contact

- ❑ Nearest Sonotron NDT representative

OR

- ❑ Directly to Sonotron NDT – mail to support@sonotronndt.com with subject **ISONIC 2006 encoder connection**



Improper cable outcoming from custom made encoder for proprietary inspection tasks may lead to warranty exempted damaging ISONIC 2006 unit


13.4. Encoder Calibration

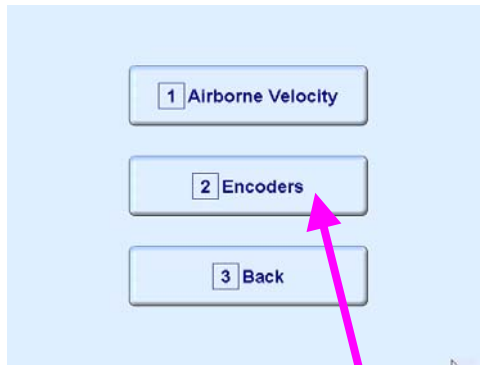
Custom made encoder must be calibrated once for further use with **ISONIC 2006**



To proceed with the calibration in the **ISONIC 2006 start screen** **click on** or press  on front panel keyboard or **F2** on external keyboard

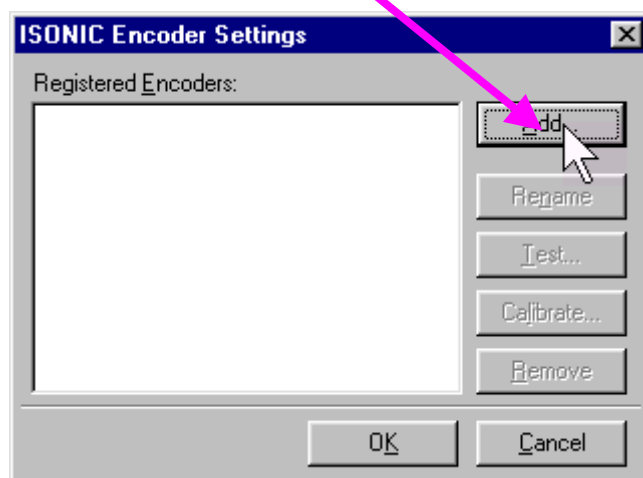


In the appeared **ISONIC 2006 Settings Menu** **click on** or press  on front panel keyboard or **F3** on external keyboard

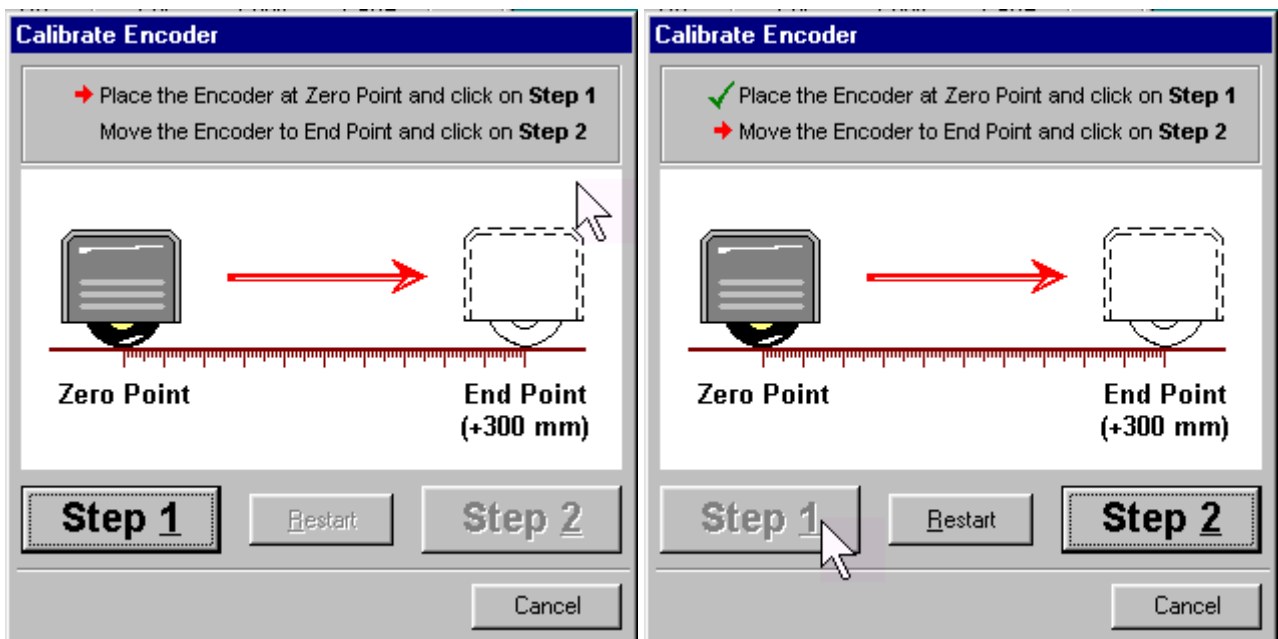


In the appeared **ISONIC 2006 Positioning Devices Menu** click on **2** or press **F2** on front panel keyboard or **F2** on external keyboard

In the appeared **ISONIC Encoder Settings** window click on **Add** or press **<Alt>+<A>** on external keyboard



The **Calibrate Encoder** window appears; it contains simple instructions to follow:





Encoder's wheel while calibrating must pass linearly the distance of **300 mm (12 in)** between **Zero Point** designated through clicking on **Step 1** or pressing **<Alt>+<1>** on external keyboard and **End Point** along scale bar attached to flat surface

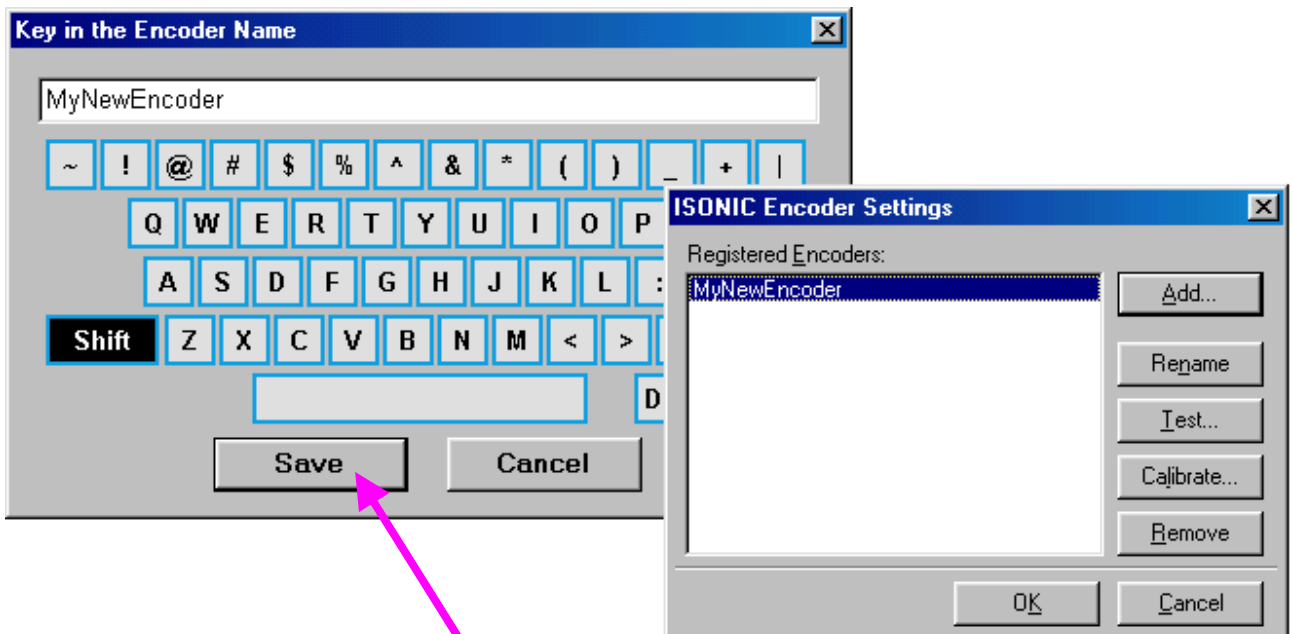
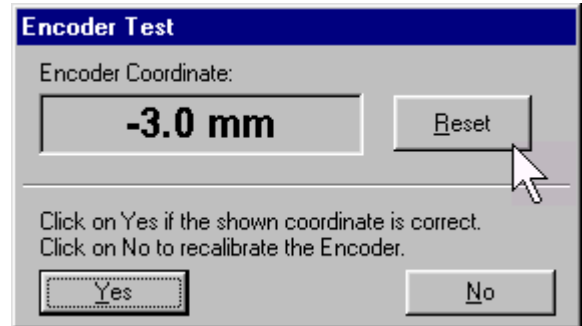
Upon reaching **End Point** and clicking on **Step 2** button or pressing **<Alt>+<2>** on external keyboard new **Encoder Test** window appears




If it's necessary to re-designate **Zero Point** click on **Restart** button or press **<Alt>+<R>** on external keyboard

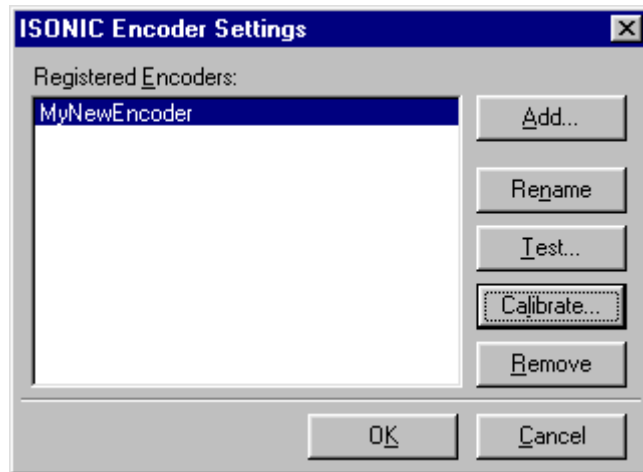
In the **Encoder Test** window:

- ❑ Click on **Reset** button or press **<Alt>+<R>** on external keyboard to designate **local zero point** for continuing test
- ❑ Click on **Yes** button or press  on front panel keyboard or **Enter** or **<Alt>+<Y>** on external keyboard to name the selected encoder – **Key in the Encoder Name window** appears
- ❑ Click on **No** button or press  on front panel keyboard or press **Esc** or **<Alt>+<N>** on external keyboard to recalibrate the encoder – return to **Calibrate Encoder** window





Upon keying in new Encoder name **click on** **ISONIC Encoder Settings** window returns upon

To update the registry of **ISONIC 2006** with new encoder data click on the **OK** button or press  on front panel keyboard or **Enter** or **<Alt>+<Y>** on external keyboard – this will automatically return to **ISONIC 2006 Settings Menu**

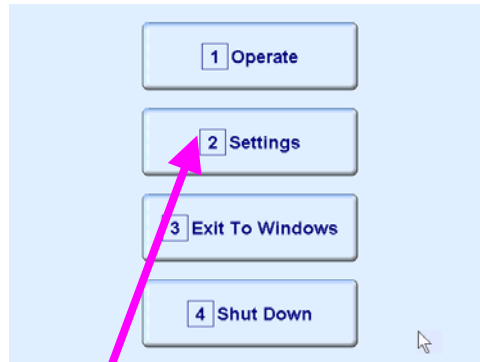


While running encoder calibration next time:

- ❑ Click on **Add...** button or press **<Alt>+<A>** on external keyboard to proceed with next new encoder by the same way as described above
- ❑ Click on **Rename** button or press **<Alt>+<N>** on external keyboard to rename the selected encoder
- ❑ Click on **Test** button or press **<Alt>+<T>** on external keyboard to check the accuracy of selected encoder calibration
- ❑ Click on **Calibrate** button or press **<Alt>+<L>** on external keyboard to recalibrate selected encoder
- ❑ Click on **Remove** button or press **<Alt>+<R>** on external keyboard to remove selected encoder from the registry of **ISONIC 2006**
- ❑ Click on the **Cancel** button or press  on front panel keyboard or press **Esc** or **<Alt>+<C>** on external keyboard to negate all changes and return to **ISONIC 2006 Settings Menu**
- ❑ Click on the **OK** button or press  on front panel keyboard or **Enter** or **<Alt>+<K>** on external keyboard to update the registry of **ISONIC 2006** and return to **ISONIC 2006 Settings Menu**


14. Calibrating Airborne Ultrasound Based Probe Location and Swiveling Monitor

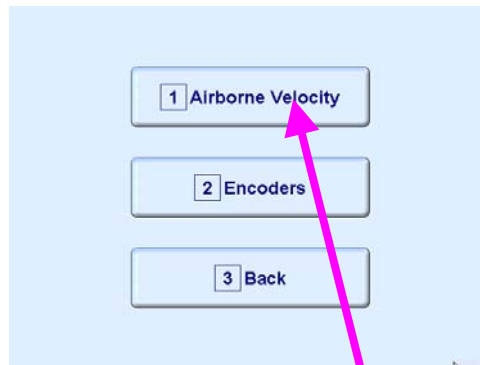
Airborne ultrasound based probe location and swiveling monitor used for XY scanning and recording in the **ISONIC 2006** to be calibrated prior to working shift. During working shift calibration to be performed repeatedly only for 10°C varying of ambient temperature; to proceed follow instructions below:




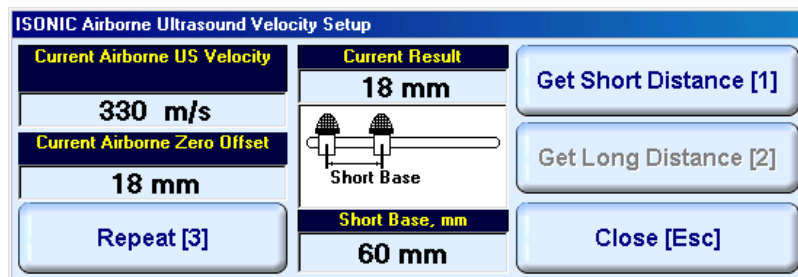
In the **ISONIC 2006 start screen** click on **2** or press  on front panel keyboard or **F2** on external keyboard



In the appeared **ISONIC 2006 Settings Menu** click on **3** or press  on front panel keyboard or **F3** on external keyboard



In the appeared **ISONIC 2006 Positioning Devices Menu** click on **1** or press  on front panel keyboard or **F1** on external keyboard – the screen as below appears

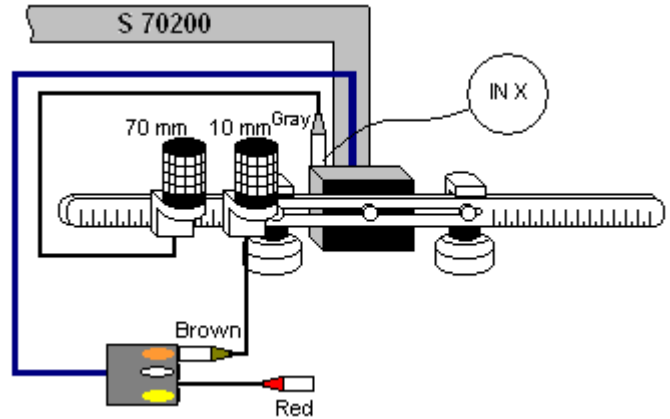


Step 1

Place airborne ultrasound receivers on the bar in positions 10 and 70 mm and provide cabling according to sketch. Cabling at instrument side to be according to paragraph 8.4.1.1 of this Operating Manual. On completing click on

Get Short Distance [1]

or press **1** on front panel keyboard or **F1** on external keyboard

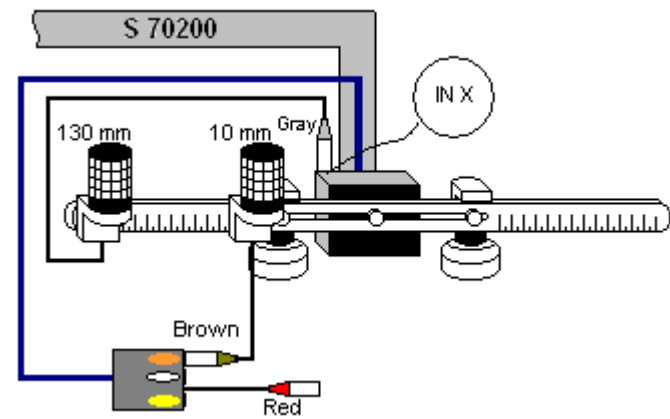


Step 2

Place airborne ultrasound receivers on the bar in positions 10 and 130 mm and provide cabling according to sketch. Cabling at instrument side to be according to paragraph 8.4.1.1 of this Operating Manual. On completing click on

Get Long Distance [2]

or press **2** on front panel keyboard or **F2** on external keyboard – this will complete calibration procedure

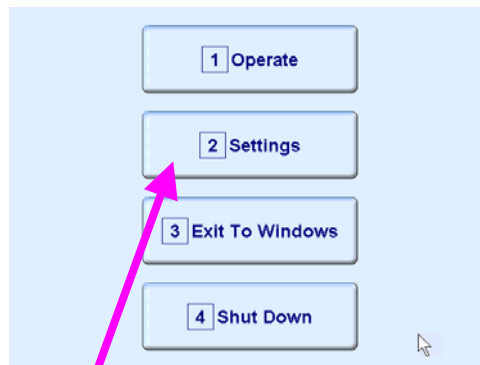


To repeat calibration click on **Repeat [3]** or press **3** on front panel keyboard or **F3** on external keyboard

On completing calibration click on **Close [Esc]** or press **ESC** on front panel keyboard or **Esc** on external keyboard


15. Miscellaneous

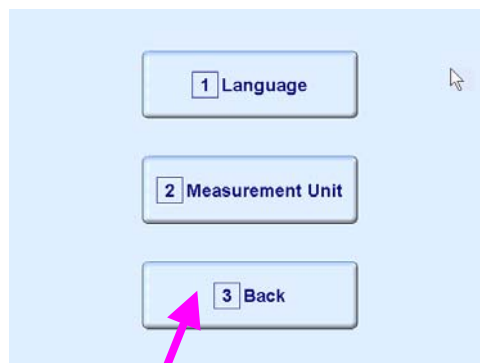
15.1. International Settings





In the **ISONIC 2006 start screen** **click on** or press  on front panel keyboard or **F2** on external keyboard

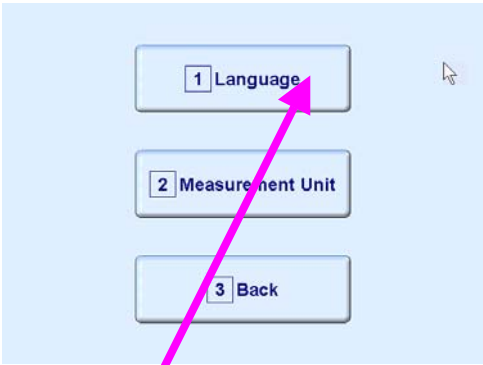



In the appeared **ISONIC 2006 Settings Menu** **click on** or press  on front panel keyboard or **F1** on external keyboard , the **International Settings** screen appears:

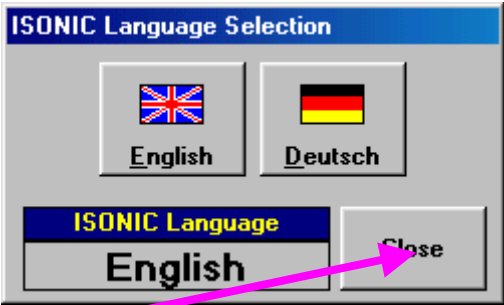


To return to **ISONIC 2006 Settings Menu** **click on** or press  or  on front panel keyboard or **F3** or **Esc** on external keyboard


15.1.1. Language



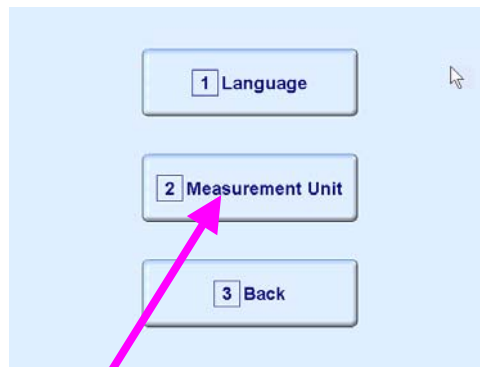
In the **International Settings** screen **clicks on** or press  on front panel keyboard or **F1** on external keyboard



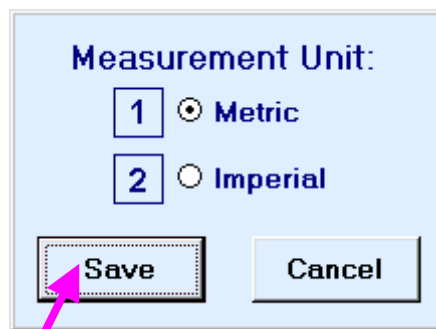
Select language then **click on**

 Standard languages of **ISONIC 2006** are English and German. Other languages are available upon request

15.1.2. Metric and Imperial Units



In the **International Settings** screen **click on** or press  on front panel keyboard or **F2** on external keyboard



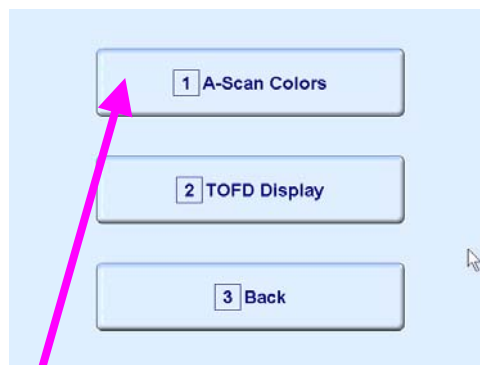
Select measurement units then **click on**

15.2. Display Settings



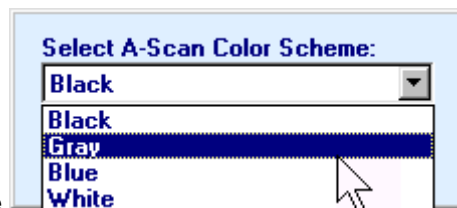
In the **ISONIC 2006 Settings Menu** **click on** or press  on front panel keyboard or **F2** on external keyboard

15.2.1. A-Scan Color Scheme

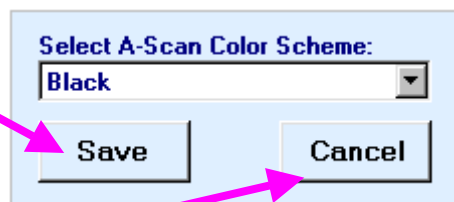


In the **Display Settings Menu** **click on** or press  on front panel keyboard or **F1** on external keyboard

then mark the selected color scheme



then **click on**



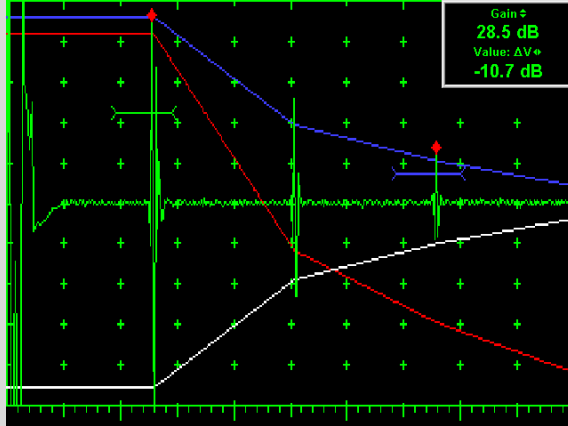
To negate new selection **click on**



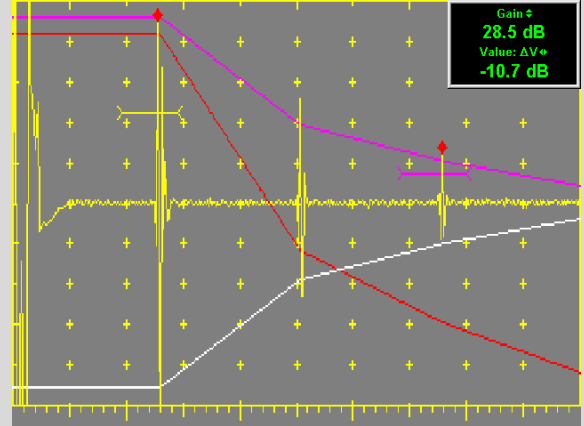


There are 4 A-Scan Color Schemes available:

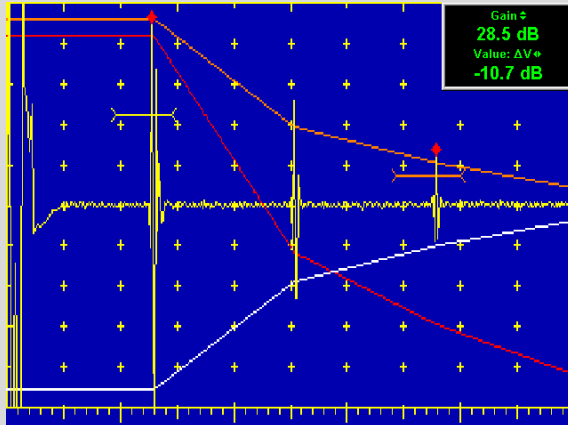
Black



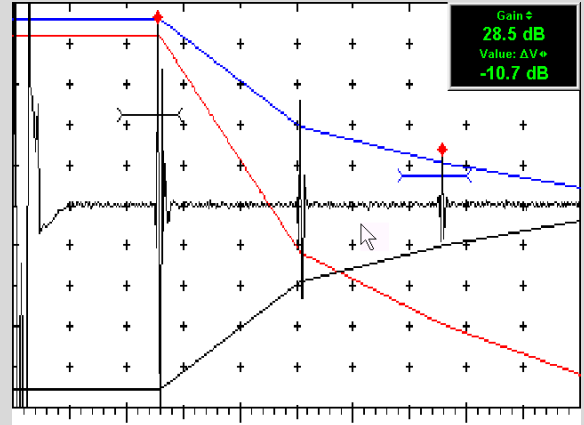
Gray



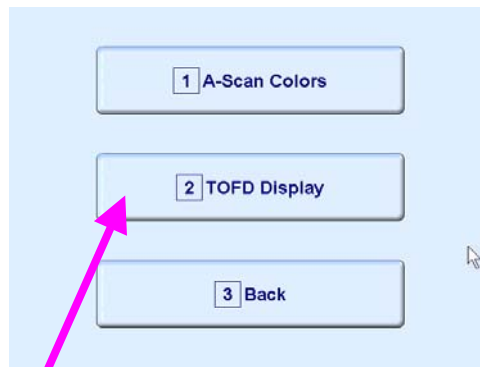
Blue




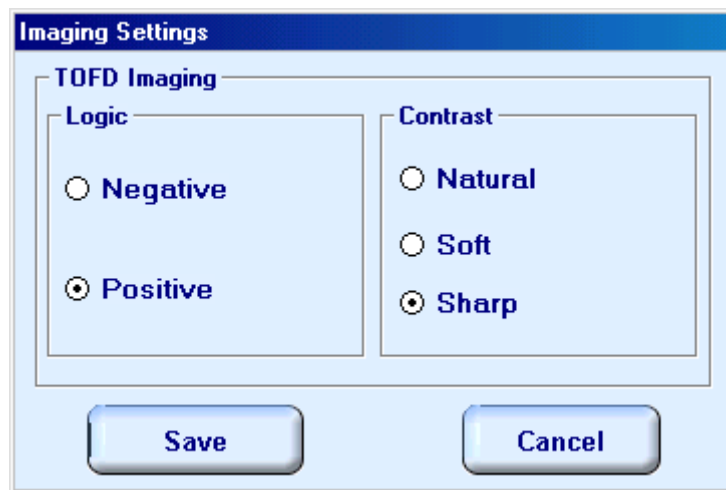
White



15.2.2. TOFD Display Settings



In the **Display Settings Menu** **click on** or press  on front panel keyboard or **F2** on external keyboard then check the selected options:





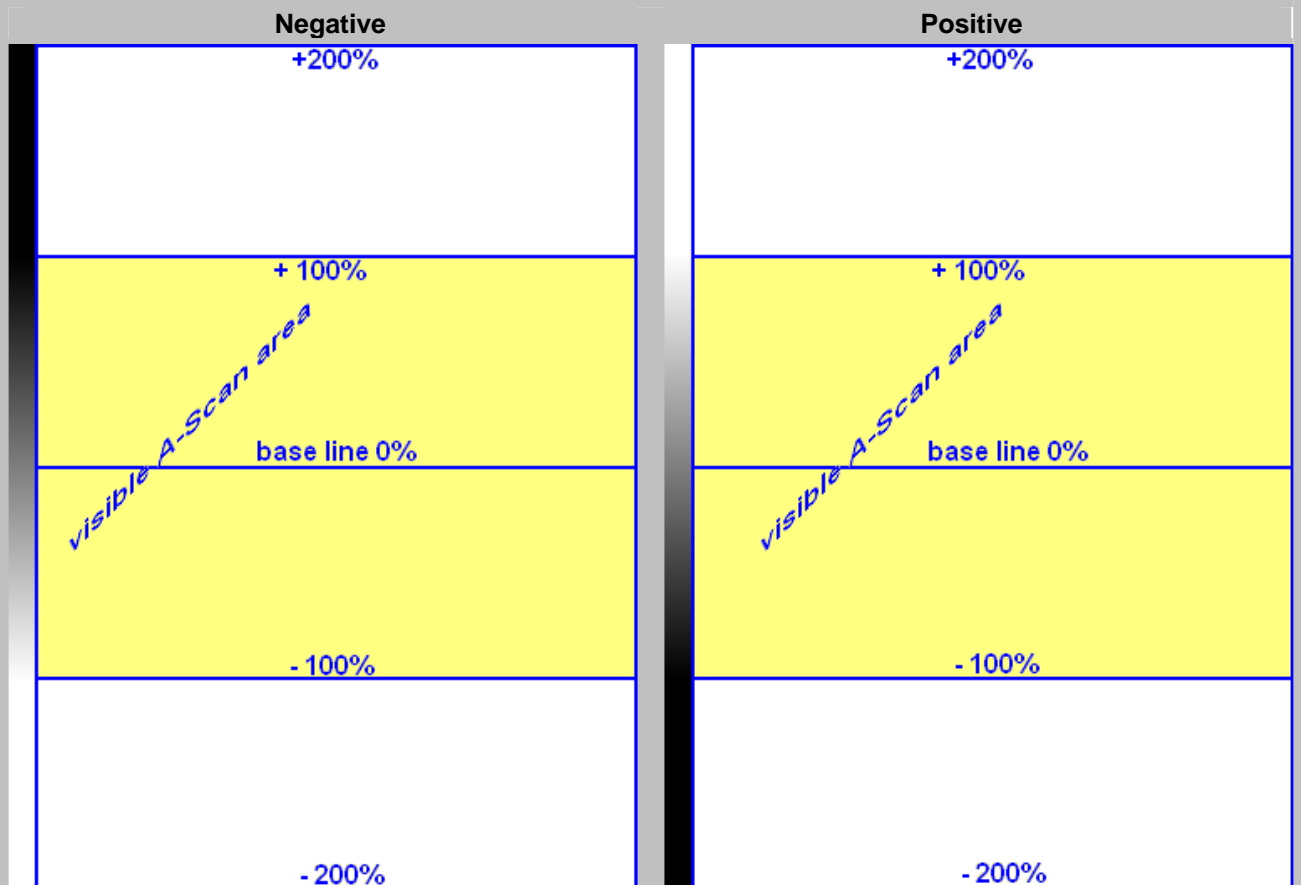
Natural Contrast TOFD Display

Negative

256 brightness levels of **TOFD Map** from absolutely white to absolutely black are distributed for RF signals, which's half waves do vary from minus 100% to plus 100% of A-Scan display height. Positive half wave signals equal or exceeding plus 100% of A-Scan display height are represented by absolutely black color. Negative half wave signals equal or exceeding minus 100% of A-Scan display height are represented by absolutely white color

Positive

256 brightness levels of **TOFD Map** from absolutely black to absolutely white are distributed for RF signals, which's half waves do vary from minus 100% to plus 100% of A-Scan display height. Positive half wave signals equal or exceeding plus 100% of A-Scan display height are represented by absolutely white color. Negative half wave signals equal or exceeding minus 100% of A-Scan display height are represented by absolutely black color





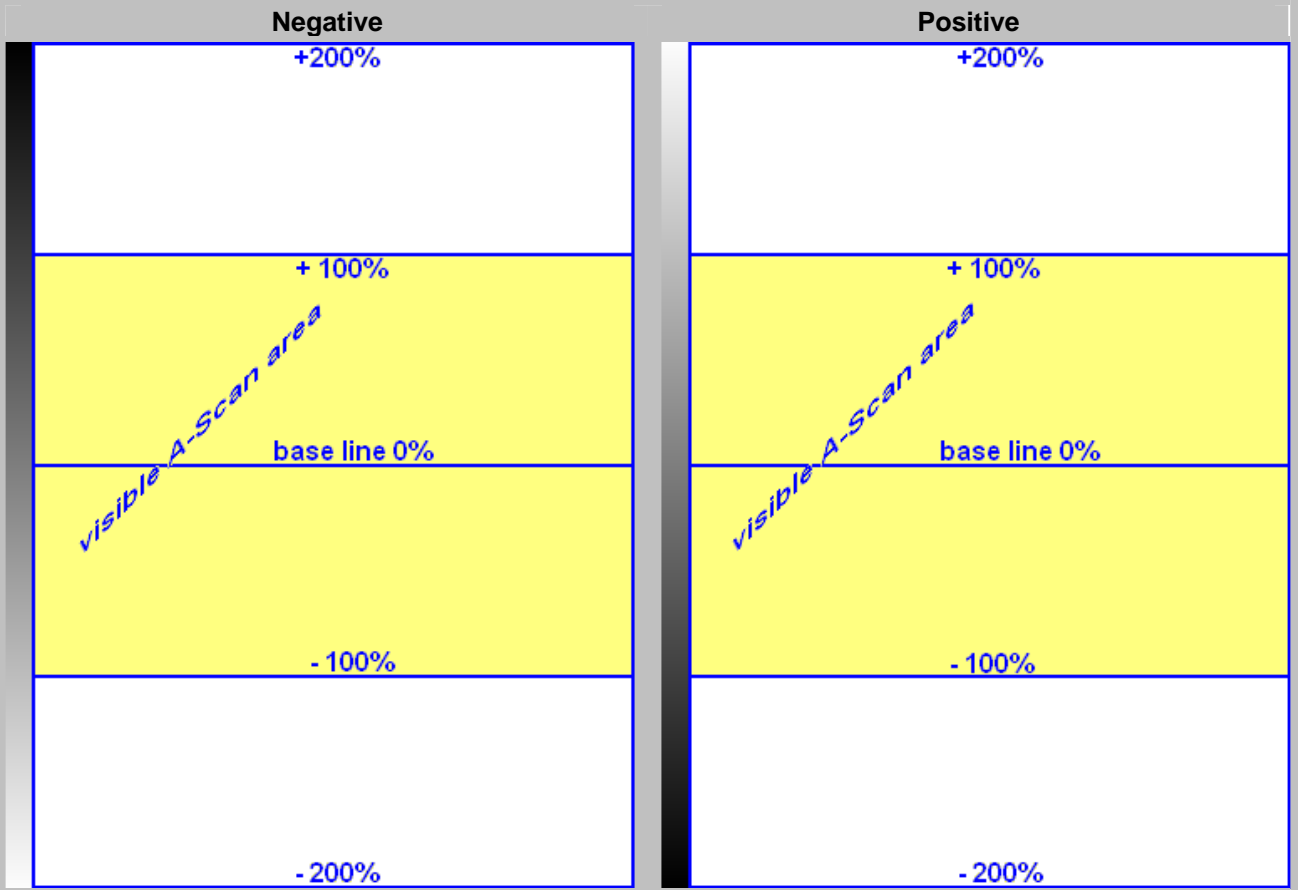
Soft Contrast TOFD Display

Negative

256 brightness levels of **TOFD Map** from absolutely white to absolutely black are distributed for RF signals, which's half waves do vary from minus 200% to plus 200% of A-Scan display height. Positive half wave signals equal or exceeding plus 200% of A-Scan display height are represented by absolutely black color. Negative half wave signals equal or exceeding minus 200% of A-Scan display height are represented by absolutely white color

Positive

256 brightness levels of **TOFD Map** from absolutely black to absolutely white are distributed for RF signals, which's half waves do vary from minus 200% to plus 200% of A-Scan display height. Positive half wave signals equal or exceeding plus 200% of A-Scan display height are represented by absolutely white color. Negative half wave signals equal or exceeding minus 200% of A-Scan display height are represented by absolutely black color





Sharp Contrast TOFD Display

Negative

256 brightness levels of **TOFD Map** from absolutely white to absolutely black are distributed for RF signals, which's half waves do vary from minus 50% to plus 50% of A-Scan display height. Positive half wave signals equal or exceeding plus 50% of A-Scan display height are represented by absolutely black color. Negative half wave signals equal or exceeding minus 50% of A-Scan display height are represented by absolutely white color

Positive

256 brightness levels of **TOFD Map** from absolutely black to absolutely white are distributed for RF signals, which's half waves do vary from minus 50% to plus 50% of A-Scan display height. Positive half wave signals equal or exceeding plus 50% of A-Scan display height are represented by absolutely white color. Negative half wave signals equal or exceeding minus 50% of A-Scan display height are represented by absolutely black color

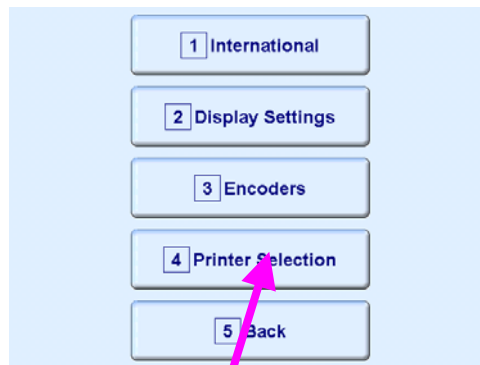



15.3. Printer Selection

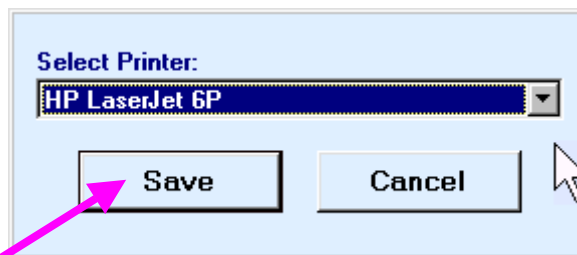
This option is available if there are more than 1 printer drivers installed in **ISONIC 2006**



In the **ISONIC 2006 start screen** click on **Settings** or press  on front panel keyboard or **F2** on external keyboard

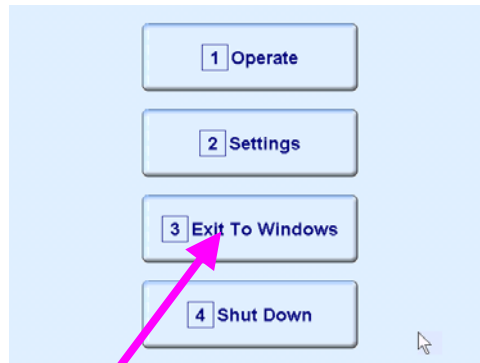


In the appeared **ISONIC 2006 Settings Menu** click on **Printer Selection** or press  on front panel keyboard or **F4** on external keyboard




Select printer then click on **Save**

15.4. Exit to Windows



In the **ISONIC 2006 start screen** click on **3** or press  on front panel keyboard or **F3** on external keyboard

To return to **ISONIC 2006** Operation double click on icon  located in the Windows Desktop



Exit to Windows is required for:

- Connection to network
 - Printing inspection results to network printer
 - Transferring data to / from remote PC
- Installing printer driver(s)
- Installing USB memory stick (disk on key) driver (for **ISONIC 2006** instruments running under Windows 98 SE Operating System)
- Quasi-disk management

In order to prevent overloading of **ISONIC 2006** quasi-disk and memory with data and non **ISONIC 2006** software that may affect instrument performance it's not allowed to install non **ISONIC 2006** software except drivers noted above. Affecting of instrument performance through installing on non **ISONIC 2006** software except drivers noted above is the warranty exemption damage

15.5. Connection to Network

To connect **ISONIC 2006** to local area network using Ethernet connector (refer to paragraph 4.2 of this Operating Manual) and standard Windows rules

15.6. External USB Devices

15.6.1. Mouse

Use one of 2 USB Connectors (refer to paragraph 4.2 of this Operating Manual). **ISONIC 2006** finds and registers external USB mouse automatically through standard Windows routine. Microsoft optical mouse is recommended

15.6.2. Keyboard

Use one of 2 USB Connectors (refer to paragraph 4.2 of this Operating Manual). **ISONIC 2006** finds and registers USB keyboard automatically through standard Windows routine. Microsoft keyboard is recommended

15.6.3. Memory Stick (Disk on Key)

Use one of 2 USB Connectors (refer to paragraph 4.2 of this Operating Manual)

ISONIC 2006 running under Windows XP Embedded finds and registers USB memory stick (disk on key) automatically through standard Windows routine.

For **ISONIC 2006** instruments running under Windows 98 SE preliminary driver setup is required. To install driver use network connection (refer to paragraph 8.5 of this Operating Manual)

15.6.4. Printer

Use one of 2 USB Connectors (refer to paragraph 4.2 of this Operating Manual). Preliminary driver setup is required. To install driver use network connection (refer to paragraph 8.5 of this Operating Manual) or USB memory stick (disk on key) if it's already registered in **ISONIC 2006**

15.6.5. ISONIC Alarmer

For a variety of manual and automatic inspection applications it may be necessary:

- generating sound alarm on defect detection
- controlling some external devices, such as sorters, multi-element go/no go display panels, etc
- starting inspection and recording process upon receiving triggering signal from an external device
- etc

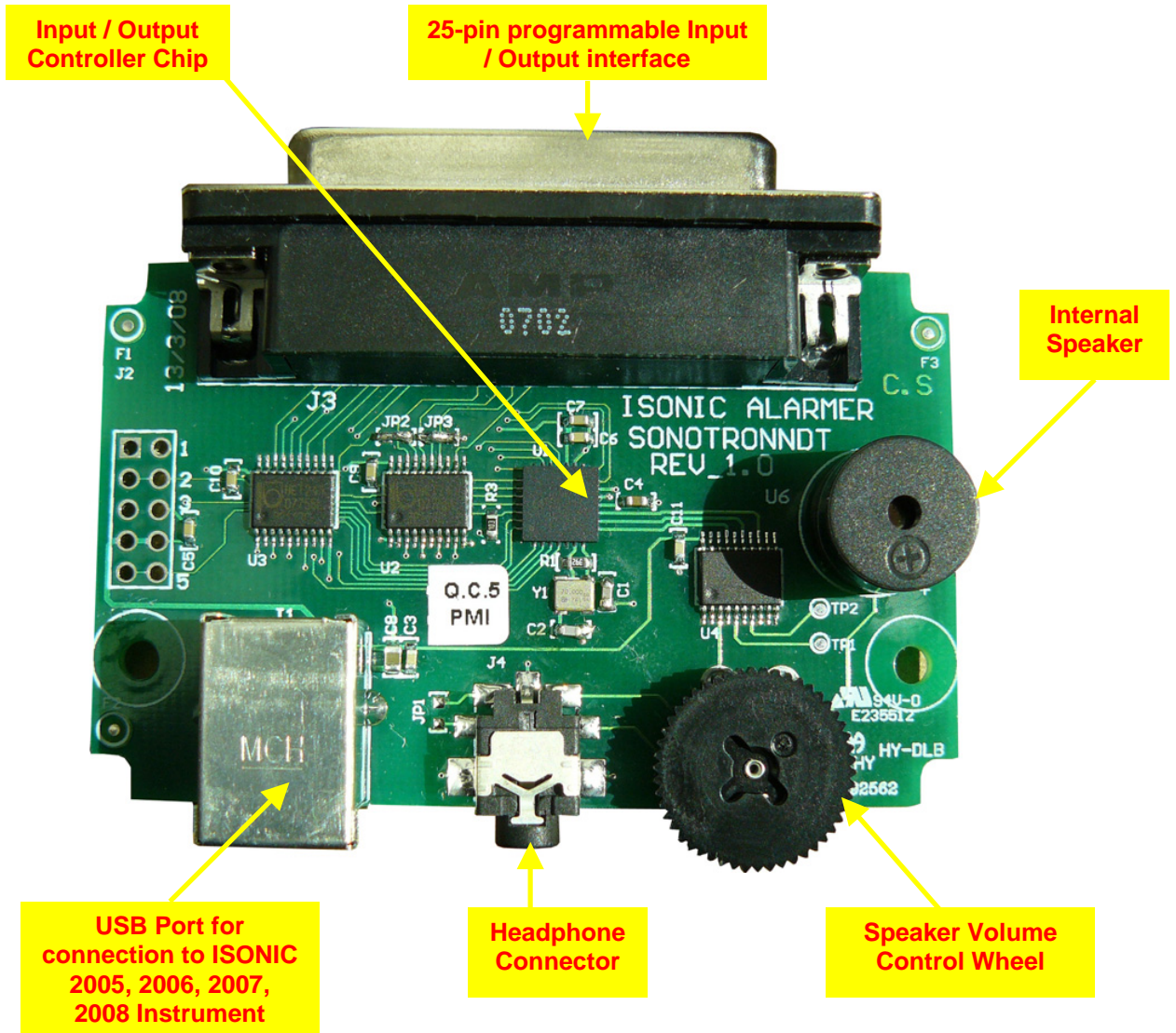
A variety of above tasks is resolved by simple **ISONIC Alarmer** (part # SE 554780987), which is interfaced to ISONIC 2005, 2006, 2007, 2008 instrument through USB port



- **ISONIC Alarmer** may be connected to the instrument at any moment since **ISONIC 2005 Start Screen** became active (refer to paragraph 4.3 of this Operating Manual)
- **ISONIC Alarmer** may be disconnected from the instrument at any moment prior to shut down (refer to paragraph 4.3 of this Operating Manual)

ISONIC Alarmer includes:

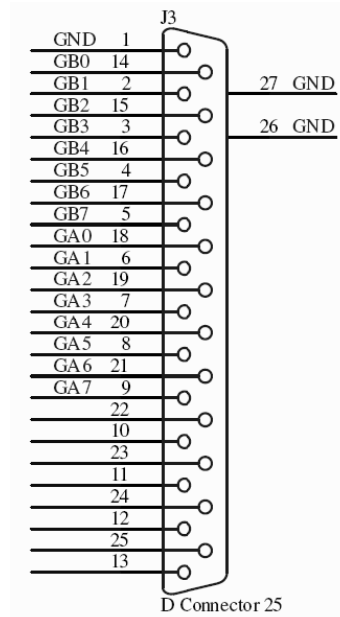
- Internal Speaker, which is switched ON / OF according to alarm logic settings of UDS 3-5 Pulser Receiver in the ISONIC 2005, 2006, 2007 instruments / UDS 3-6 Pulser Receiver of ISONIC 2008 Instrument
- Speaker Volume Control Wheel
- Headphone Connector
- Input / Output Control chip
- 25-pin programmable Input / Output interface



Initially **ISONIC Alarmer** is configured to deliver sound through speaker and headphone connector (standard configuration)

25-pin input / output interface is configured according to the duty book, which is agreed with the customer (optional configuration)

Standard configuration pin-out of 25-pin input / output interface D-Type connector is shown below:



Pin Number	Function
1	Ground
2	Alarm Gate B – Channel 1 (Only Channel for ISONIC 2005, 2006)
3	Alarm Gate B – Channel 3
4	Alarm Gate B – Channel 5
5	Alarm Gate B – Channel 7
6	Alarm Gate A – Channel 1 (Only Channel for ISONIC 2005, 2006)
7	Alarm Gate A – Channel 3
8	Alarm Gate A – Channel 5
9	Alarm Gate A – Channel 7
10	NC
11	NC
12	NC
13	NC
14	Alarm Gate B – Channel 0
15	Alarm Gate B – Channel 2
16	Alarm Gate B – Channel 4
17	Alarm Gate B – Channel 6
18	Alarm Gate A – Channel 0
19	Alarm Gate A – Channel 2
20	Alarm Gate A – Channel 4
21	Alarm Gate A – Channel 6
22	NC
23	NC
24	NC
25	NC

15.7. External VGA screen / VGA projector

Connect to appropriate connector (refer to paragraph 4.2 of this Operating Manual) while at least one of 2 devices either **ISONIC 2006** or external screen / projector is switched OFF then switch on one or both devices

15.8. Software Upgrade

Refer to <http://www.sonotronndt.com/support.htm> in the Internet

15.9. ISONIC Office Software package for office PC

ISONIC Office (IOFFICE) software package allows performing of all-function postprocessing for all types of inspection files (XY scanning, Line scanning, par files) captured using **ISONIC 2006** in an office PC. If Microsoft Word is installed in an office PC then postprocessing snapshots including all graphics and accompanying setup and / or measurement data may be converted into the Microsoft® Word (.doc) file automatically


15.10. ISONIC Par2Txt Converter Software package

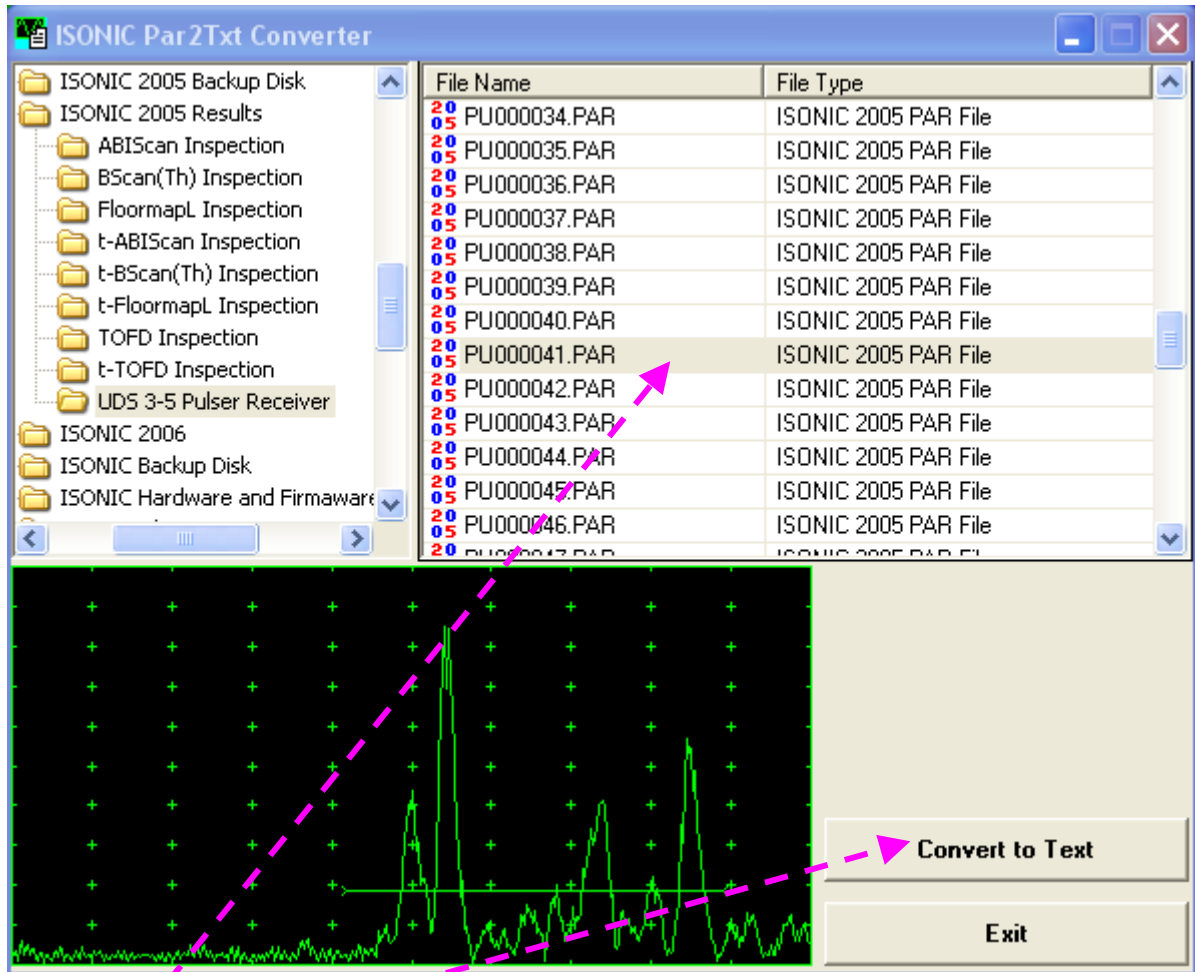


Contents of this chapter is valid for the **ISONIC Par2Txt Converter** SW Package version 2.0.0.1 or higher

ISONIC Par2Txt Converter converts variously configured *.par files created by **ISONIC 2001, ISONIC 2005, ISONIC 2006, ISONIC 2007, ISONIC 2008** instruments into *.txt files. Both pure **A-Scans** and **A-Scans** accompanied with frequency domain (FFT) graphs are presented in ASCII format in *.txt files. This allows further off-line signal analysis using popular software packages **Mathlab, Labview**, and the like

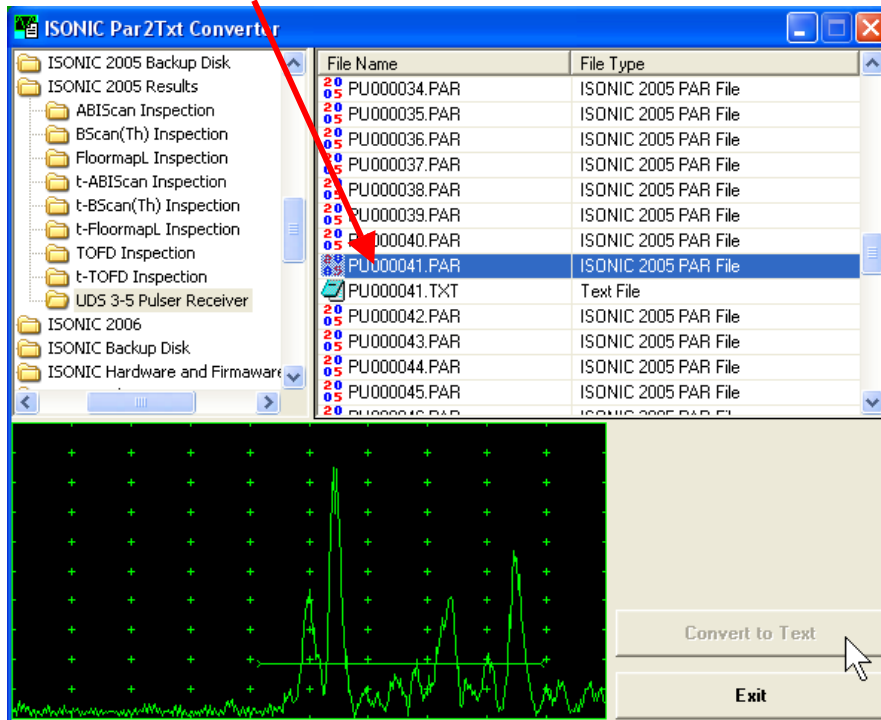


Click on *Start* then select *Programs* ⇒ *ISONIC* ⇒ *ISONIC Par2Txt Converter* or click on  icon located in the desktop to run **ISONIC Par2Txt Converter** - window as below appears:

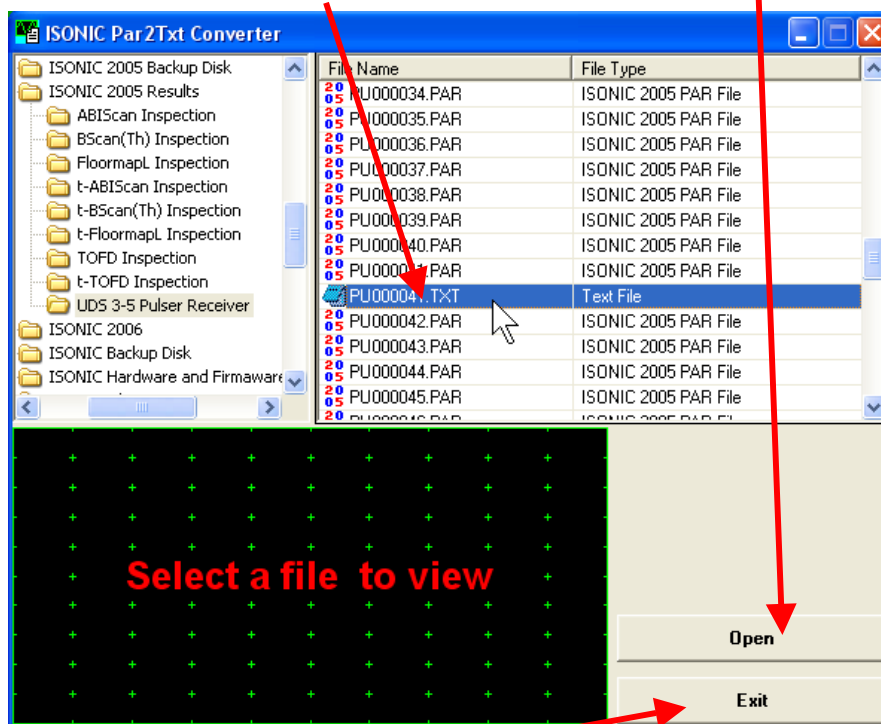


Select the **file of interest** then **click on**

As a result the corresponding ***.txt file** appears



To preview the contents of *.txt file **double click on its name** or mark it and **click on**




To end ISONIC Par2Txt Converter session **click on**

15.11. ISONIC D-Line and ISONIC D-Spreadsheet Creator Software Packages

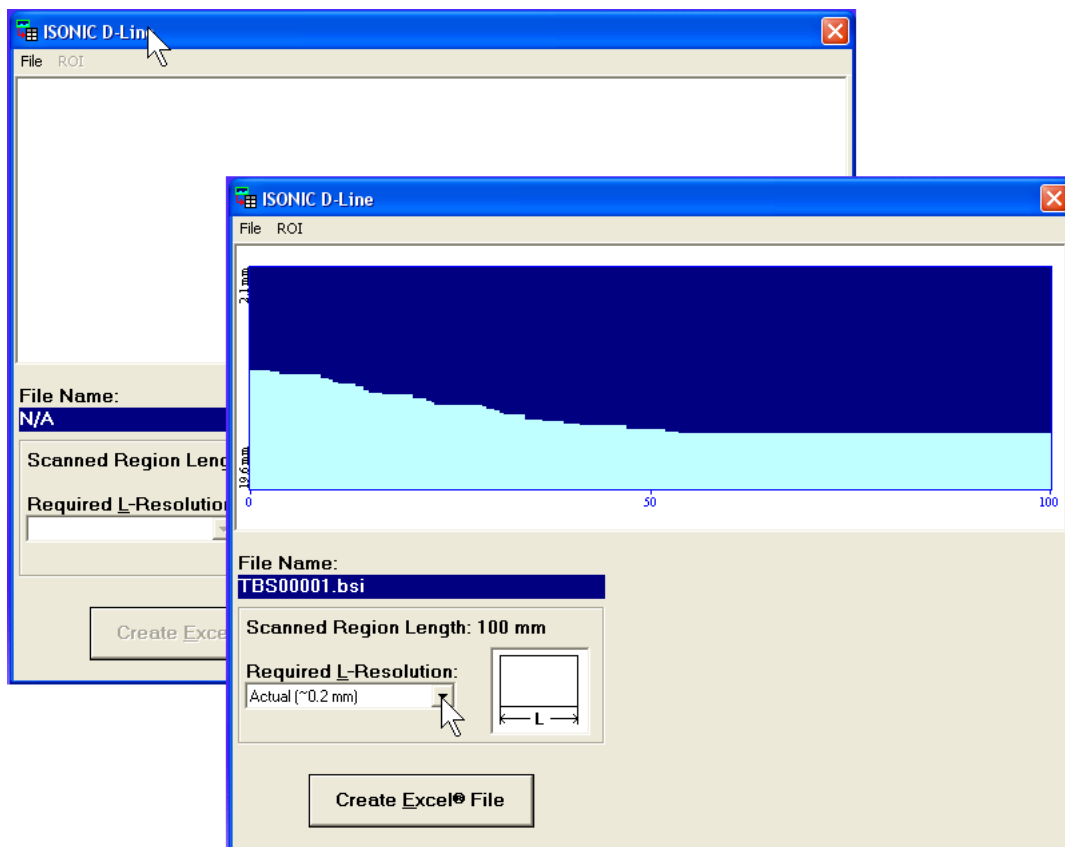
15.11.1 t-BScan(Th)/BScan(Th) files

ISONIC D-Line and ISONIC D-Spreadsheet Creator software packages for office computer equipped with Microsoft® Office allow converting of t-BScan(Th)/BScan(Th) files (special format *.bsi) into Microsoft® Excel (.xls) spreadsheet file



ISONIC D-Line







Click on *Start* then select *Programs* ⇒ *ISONIC* ⇒ *ISONIC D-Line* or click on  icon located in the desktop to run **ISONIC D-Line**

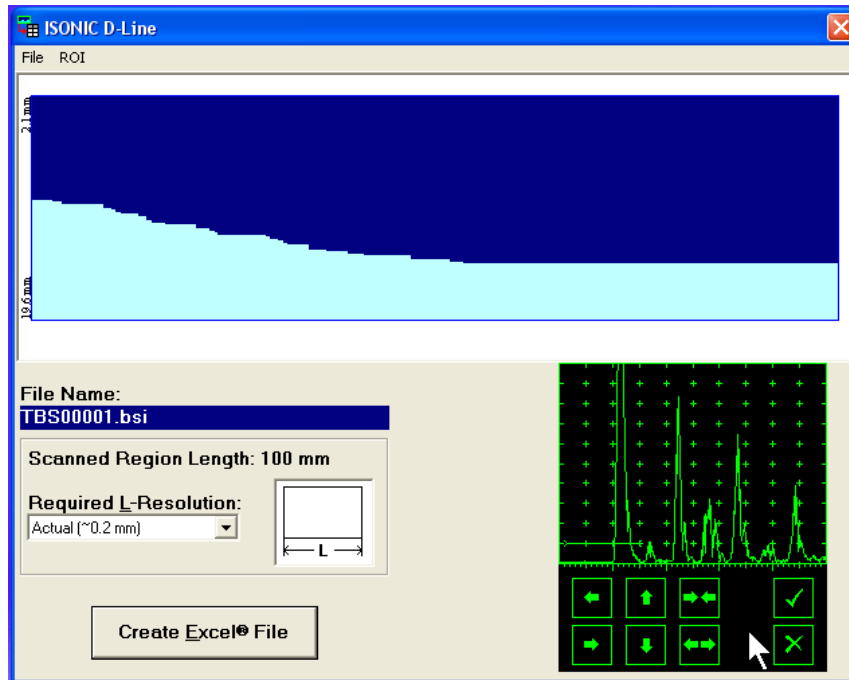
- **File → Open** allows selection and loading of *.bsi format t-BScan(Th)/BScan(Th) data file




On completing download:

- **ROI → ON** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-BScan(Th) / BScan(Th)** image using either mouse or ,  buttons on keyboard – corresponding **A-Scan** is recovered synchronously according to cursor position. To select reference **A-Scan** left mouse click or press **Enter** on external keyboard – this generates off-line **Gate**

A controls , , , , ,  allowing to redefine **Region Of Interest** for **t-BScan(Th) / BScan(Th)** imaging

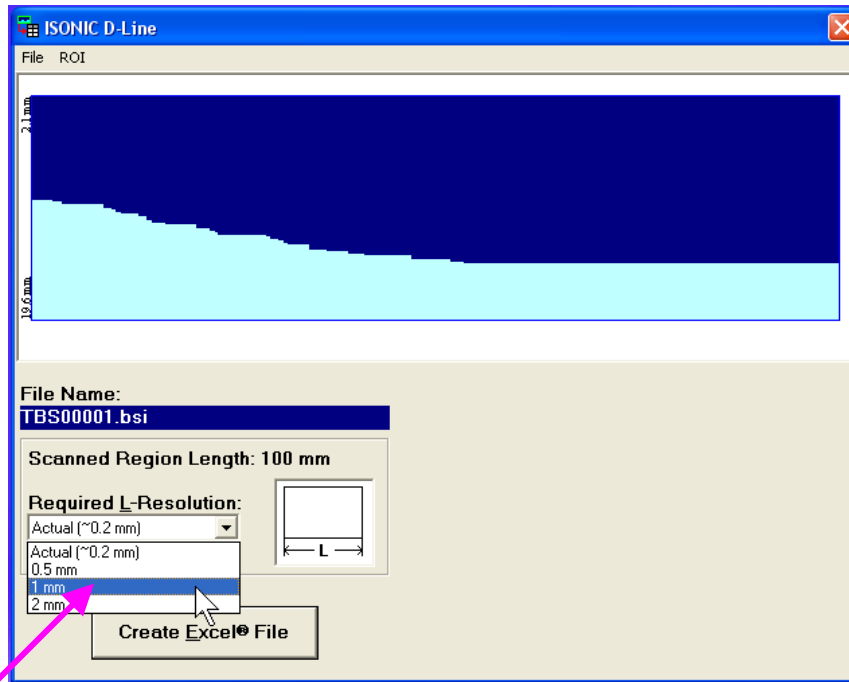


Upon completing redefining of **Region Of Interest** click on  – this applies new **Gate A** to all captured **A-Scans** and updates **t-BScan(Th) / BScan(Th)** image accordingly

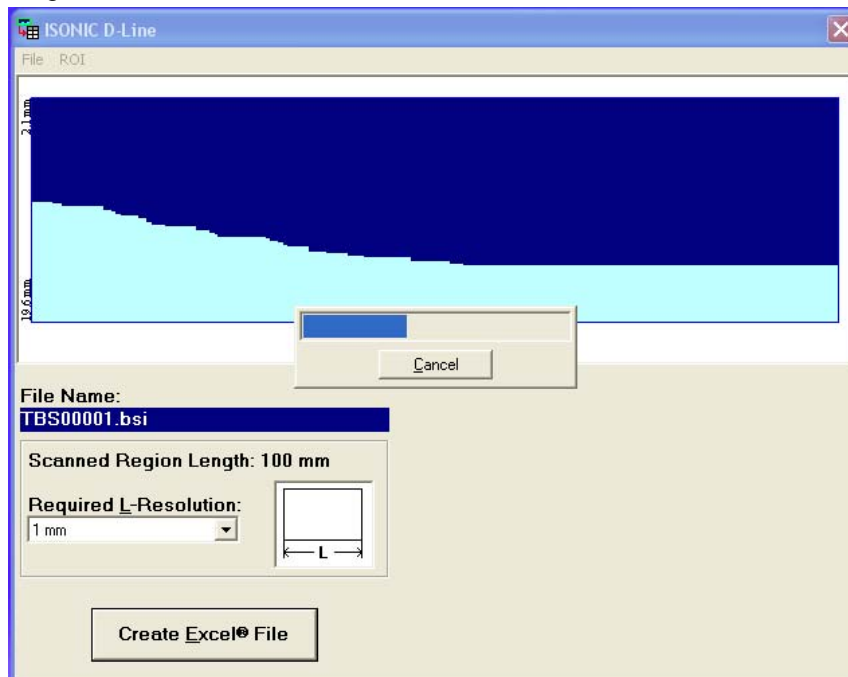
To interrupt selection of reference of **A-Scan** right mouse click or press **ESC** on keyboard

To interrupt re-adjustment of **Region Of Interest** after selection of reference of **A-Scan** click on 

- **ROI→OFF** – negates **Gate A** re-adjustment and returns to originally recorded **t-BScan(Th) / BScan(Th)** image and original **Gate A** setting



- Required L-Resolution** – this control allows selecting of necessary longitudinal scanning coordinate increments for depth spreadsheet to be created. Best possible resolution (actual) corresponding to minimal possible increment is default – it corresponds to single depth reading per each coordinate. On selecting coordinate increment larger than actual **ISONIC D-Line** software will analyze all depth readings with actual resolution for each interval covered by selected increment and place minimal values into corresponding cells

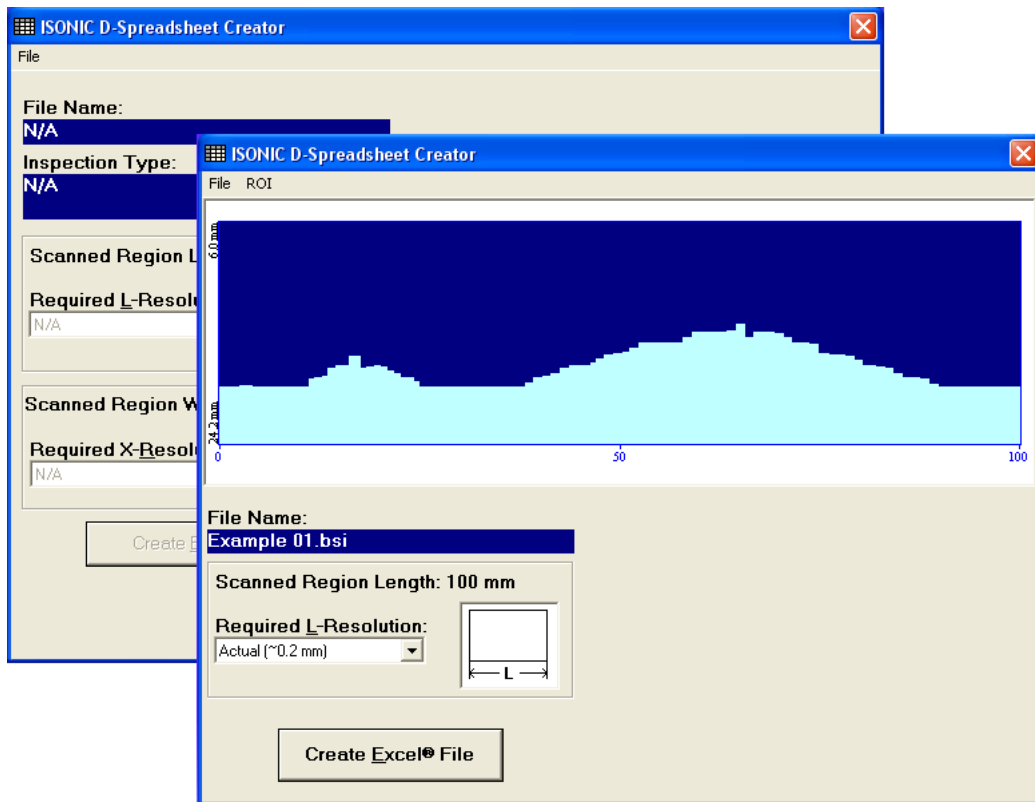


- Create Excel® File** – clicking on this button will initiate automatic creation of spreadsheet followed by starting Microsoft® Excel software
- File→Exit** – quits **ISONIC D-Line** software

ISONIC D-Spreadsheet Creator



Click on *Start* then select *Programs* ⇒ *ISONIC* ⇒ *ISONIC D-Spreadsheet Creator* or click on  icon located in the desktop to run **ISONIC D-Spreadsheet Creator**



- **File → Open** allows selection and loading of *.bsi format t-BScan(Th)/BScan(Th) data file

All further operations are identical to above described for **ISONIC D-Line**

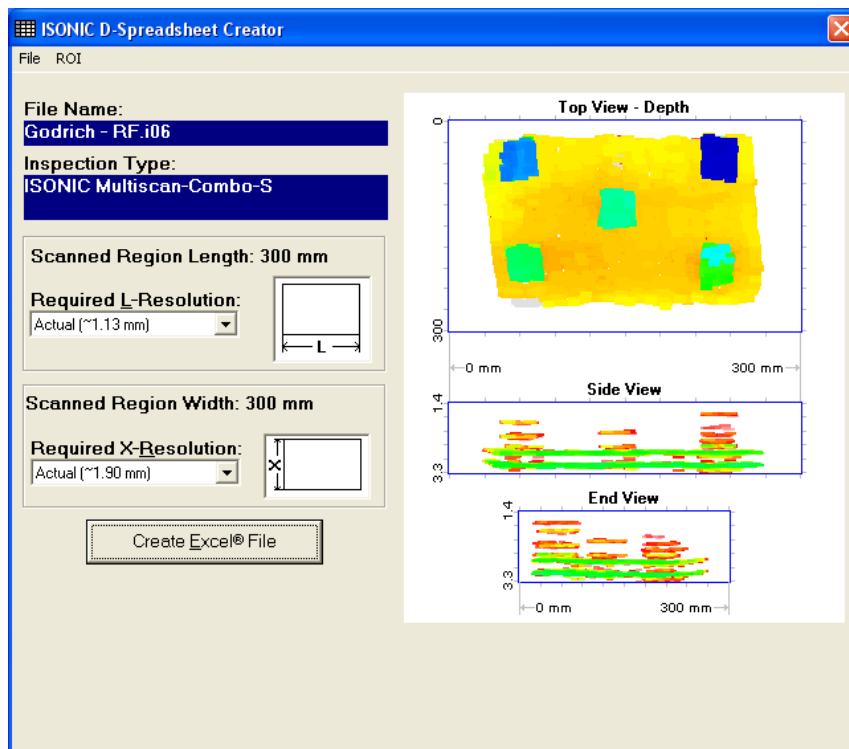
15.11.2 CORROMAP, CORROMAP CU, MULTISCAN COMBO S, and MULTISCAN COMBO S CU Files

ISONIC D-Spreadsheet Creator software packages for office computer equipped with Microsoft® Office allows converting of **CORROMAP**, **CORROMAP CU**, **MULTISCAN COMBO S**, and **MULTISCAN COMBO S CU** files (format *.rst) into Microsoft® Excel (.xls) spreadsheet file







Click on *Start* then select *Programs* ⇒ *ISONIC* ⇒ *ISONIC D-Spreadsheet Creator* or click on  icon located in the desktop to run **ISONIC D-Spreadsheet Creator**

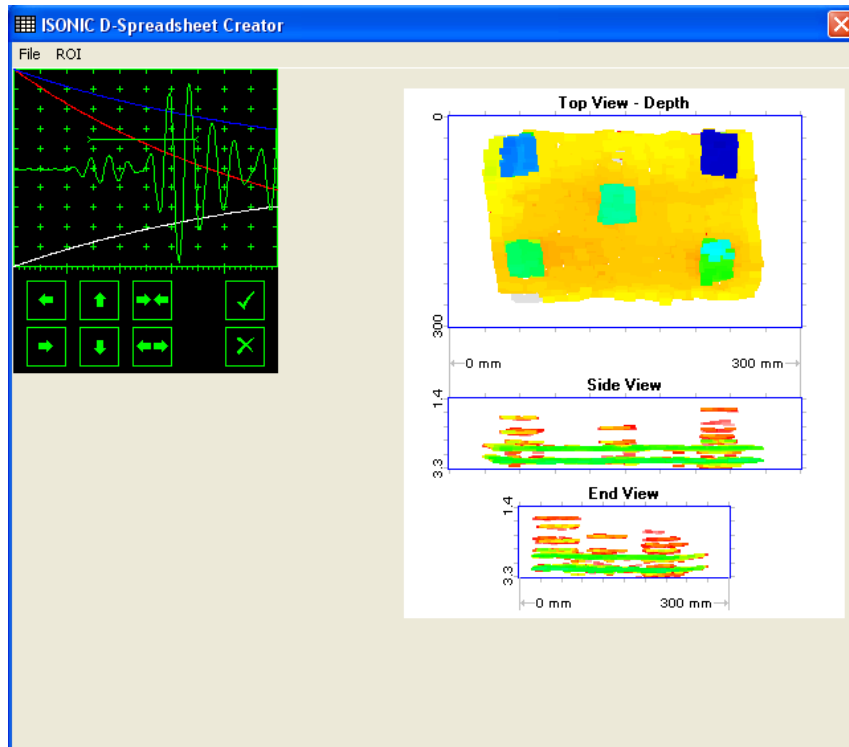
- **File → Open** allows selection and loading of *.rst format **CORROMAP**, **CORROMAP CU**, **MULTISCAN COMBO S**, and **MULTISCAN COMBO S CU** files data file:



On completing download:

- **ROI → ON** – generates *probe center cursor* that may be guided over **CORROMAP**, **CORROMAP CU**, **MULTISCAN COMBO S**, or **MULTISCAN COMBO S CU** image using either mouse or , , ,  buttons on keyboard – corresponding **A-Scan** is recovered synchronously according to cursor position. To select reference **A-Scan** left mouse click or press **Enter** on external keyboard – this generates off-

line **Gate A** controls , , , , ,  allowing to redefine **Region Of Interest** for **CORROMAP**, **CORROMAP CU**, **MULTISCAN COMBO S**, or **MULTISCAN COMBO S CU** imaging

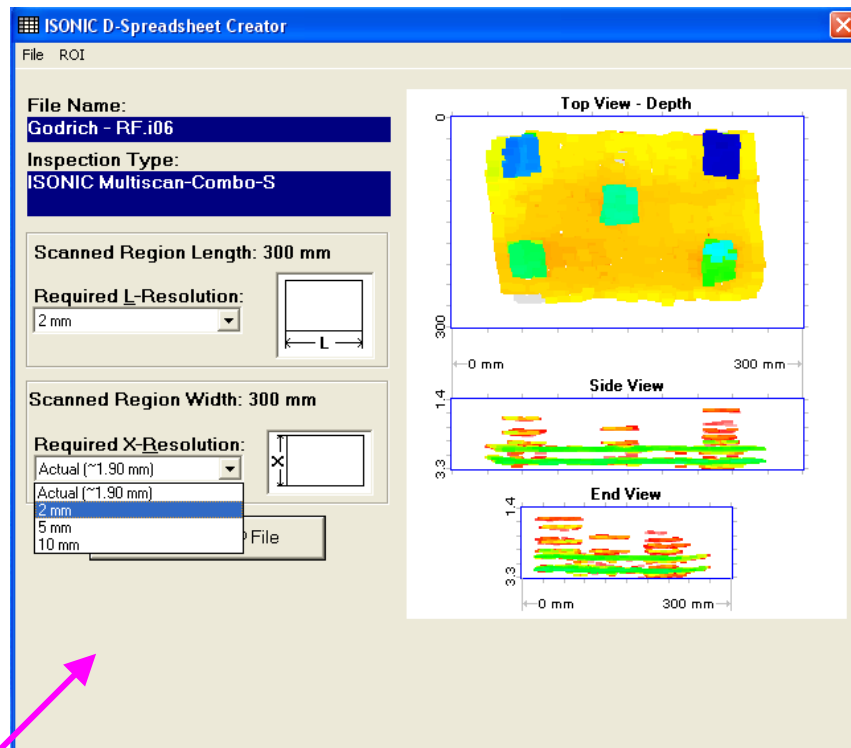


Upon completing redefining of **Region Of Interest** click on  – this applies new **Gate A** to all captured **A-Scans** and updates **CORROMAP**, **CORROMAP CU**, **MULTISCAN COMBO S**, or **MULTISCAN COMBO S CU** image accordingly

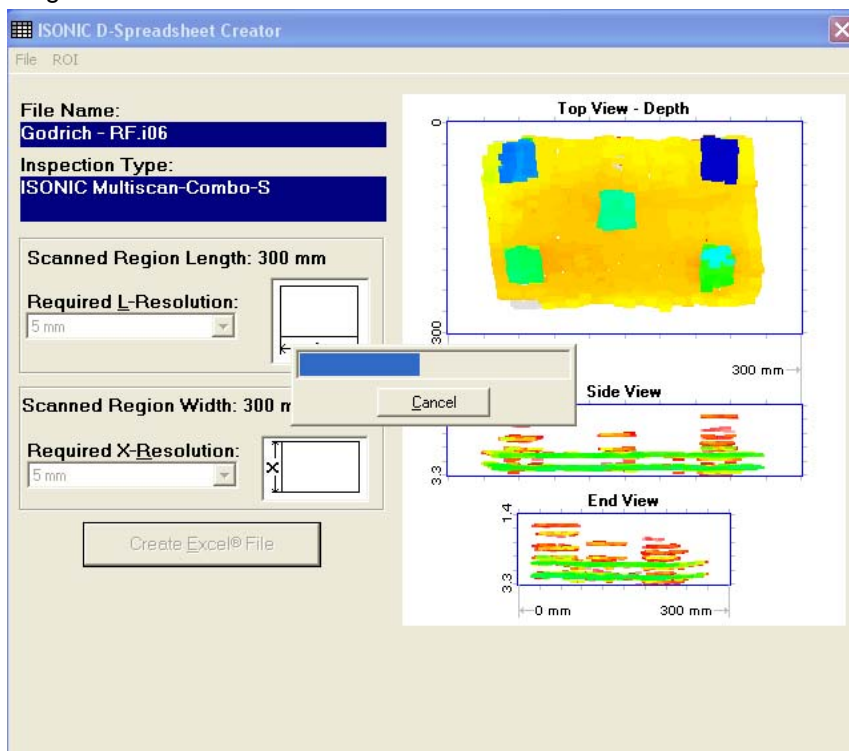
To interrupt selection of reference of **A-Scan** right mouse click or press **Esc** on keyboard

To interrupt re-adjustment of **Region Of Interest** after selection of reference of **A-Scan** click on 

- **ROI→OFF** – negates **Gate A** re-adjustment and returns to originally recorded **CORROMAP**, **CORROMAP CU**, **MULTISCAN COMBO S**, or **MULTISCAN COMBO S CU** image and original **Gate A** setting



- Required L-Resolution and X-Resolution** – these controls allow selecting of necessary coordinate increments for depth spreadsheet to be created. Best possible resolution (actual) corresponding to minimal possible increment is default – it corresponds to single depth reading per each coordinate. On selecting coordinate increment larger than actual **ISONIC D-SHEET** software will analyze all depth readings with actual resolution for each interval covered by selected increment and place minimal values into corresponding cells



- Create Excel® File** – clicking on this button will initiate automatic creation of spreadsheet followed by starting Microsoft® Excel software
- File→Exit** – quits **ISONIC D-SHEET** software

15.12. Charging Battery

Battery of **ISONIC 2006** may be charged while disconnected from the unit. The special charger is required (refer to Chapter 3 of this Operating Manual). Connect charger to the battery as it is shown below



There is **Charge** LED on the charger. While charging the battery this LED emits solid light. **Charge** LED starts flashing upon charge is completed



If a battery is new and almost completely discharged then "boiling" effect in the electrolyte may start earlier than battery is fully charged. In order to prevent battery charger stops on detecting boiling "boiling" effect:

- ❑ If temperature inside battery does not exceed 60°C deg limit then **Charge** LED starts flashing – for such case it is necessary to disconnect charger from mains for few minutes and to connect it to mains again. The normal charging will continue
- ❑ If temperature inside battery exceeds 60°C deg limit then **Temp** LED starts flashing – for such case it is necessary to disconnect charger from mains for at least 2 hours and to connect it to mains again. The normal charging will continue

After few charge / discharge cycles battery becomes "trained" and probability of "boiling" effect decreases to almost zero

16. Dual Channel TOFD preamplifier

SA 80442 Fixed Gain Dual Channel Preamplifier Package from Sonotron NDT improves long cable connection to ultrasonic probes, which may be required in NDT practice very often. Typical applications are TOFD, Corrosion Detection, and the like implemented through use of probes fitted into the scanner / crawler frame



Technical Data:

Independent Channels	2
Frequency Band	0.2...25 MHz at -3 dB
Advanced Low Noise Design	34 nV peak to peak input referred to 20 dB gain / 25 MHz bandwidth
Gain	20 dB
Output Impedance	50 Ω
Output Driving Capacity – Cable Length	≤ 30 m
Terminals	Input 2 X LEMO 00 Output 2 X LEMO 01
Power	4 X Dry Alkaline Batteries AA Size
Flashing LED Indicators	Channel 1 Switch ON Channel 2 Switch ON Low Battery
Housing	Sealed IP 67 Rugged Aluminum Case
Dimensions	62 X 30 X 112 mm (2.44 X 1.18 X 4.4 “)
Weight	320 g (0.7 lbs)