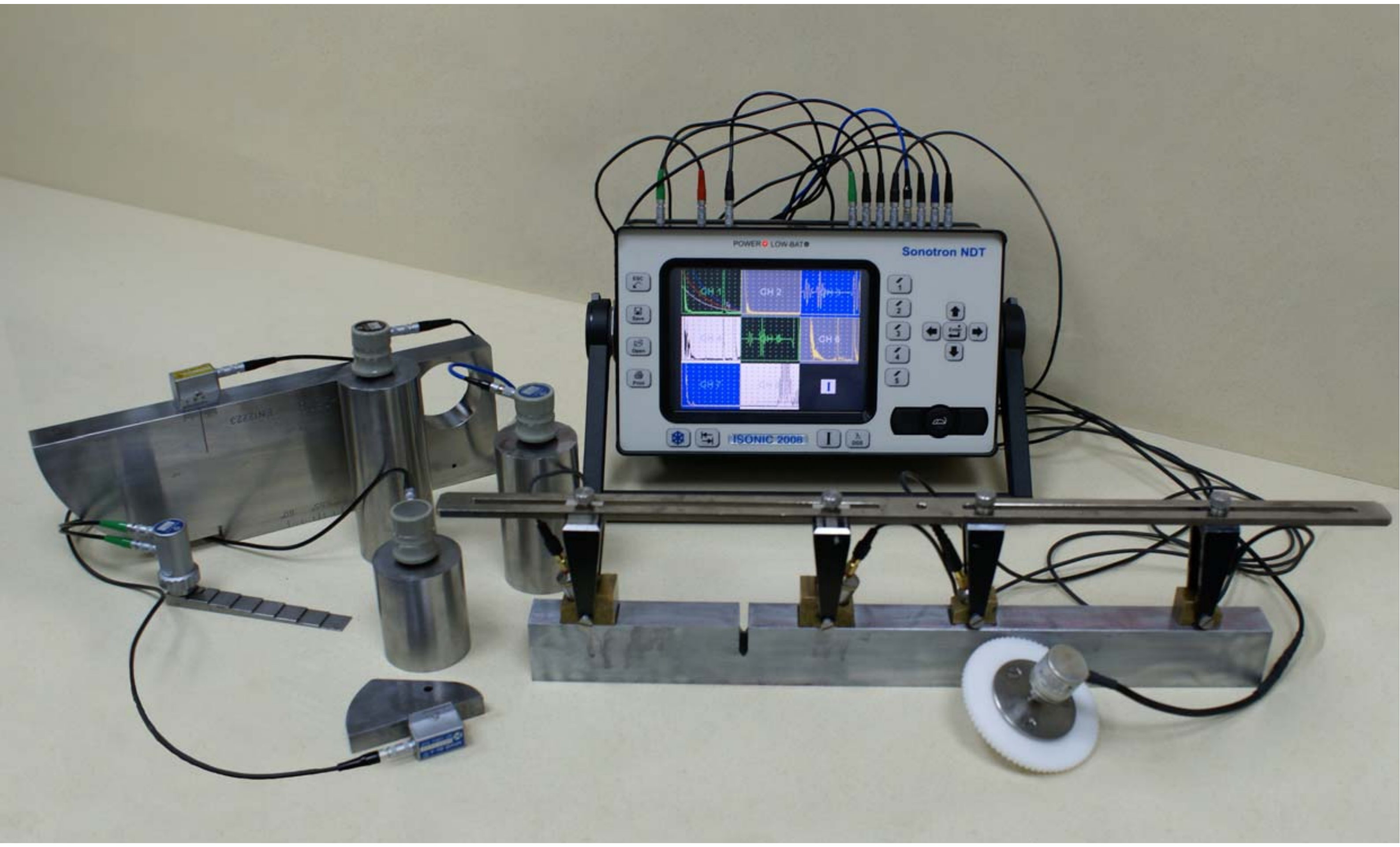
ISONIC 2008

Portable Digital 8-Channel Ultrasonic Flaw Detector Recorder



Operating Manual

Revision 1.06

Sonotron NDT

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

ISONIC 2008

Portable Digital 8-Channel Ultrasonic Flaw Detector and Recorder

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

ISO 9001 REGISTERED
DNV Certification B.V., The Netherlands

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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

ISONIC 2008

Portable Digital 8-Channel Ultrasonic Flaw Detector and Recorder

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
- ASTM E 2373 – 04 – Standard Practice for Use of the Ultrasonic Time of Flight iffraction (TOFD) Technique
- 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 2008** ultrasonic flaw detector and data recorder (hereinafter called **ISONIC 2008**) 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 2008** 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 2008** 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 2008** 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 2008** 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 2008** and a properly grounded outlet /only protection class I/
- Do not connect the **ISONIC 2008** 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 2008**
- Do not put the **ISONIC 2008** in direct sunlight, near a heater, or near water. Leave space around the **ISONIC 2008**
- Disconnect the power cord whenever a thunderstorm is nearby. Leaving the power cord connected may damage the **ISONIC 2008** 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 2008** unit
- The voltage of the External DC Power Supply above 16 V is not allowed for the **ISONIC 2008** unit
- Charge of the battery for the **ISONIC 2008** 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 2008 is a software controlled inspection device. Based on present state of the art, software can never be completely free of faults. **ISONIC 2008** 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 2008**, please contact your local Sonotron NDT representative

1. Introduction

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

ISONIC 2008 resolves a *variety of ultrasonic inspection tasks*:

- ***A-Scan-based inspection*** using conventional pulse echo, back echo attenuation, and through transmission techniques

- ***Single Channel Straight Line Scanning and Recording***:

  - ***Thickness Profile B-Scan imaging and recording*** is performed through continuous capturing of wall thickness readings along probe trace

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

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

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

- ***Multi-Channel Straight Line Scanning and Strip Chart Recording***:

  - ***Multi-Channel Thickness Profile B-Scan imaging and recording*** is performed through continuous capturing of wall thickness readings along probes trace

  - ***Multi-Channel Combined TOFD and Pulse Echo Weld Inspection and Recording*** is performed through continuous capturing of TOFD RF A-Scans and pulse echo channels amplitudes and reflectors coordinates along probes trace parallel to the weld

  - ***Multi-Channel Pulse Echo Flaw Detection*** for shear, surface, and guided wave inspection is performed through continuous measuring of echo amplitudes and reflectors coordinates along probes trace

  - ***etc***

  For ***Single and Multi-Channel Straight Line Scanning and Recording*** it may be used:

  - *Time-based* mode (built-in real time clock)

  - *True-to-location* mode (built-in incremental encoder interface)

- ***XY-Scanning and Recording*** with ***C-Scan*** and ***B-Scan*** imaging is also possible if using ***optional USB interface to multi-axis mechanical encoder*** and appropriate software package

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*** is presented in the format compatible with various *Risk Based Inspection and Maintenance procedures*

ISONIC 2008 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, TOFD Maps, strip charts depending on mode of operation selected; each record is accompanied with corresponding instrument settings

ISONIC 2008 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 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
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- WI 00121377, Welding – Use Of Time-Of-Flight Diffraction Technique (TOFD) For Testing Of Welds. – European Committee for Standardization – Document # CEN/TC 121/SC 5/WG 2 N 146, issued Feb, 12, 2003
- ASTM E 2373 – 04 – Standard Practice for Use of the Ultrasonic Time of Flight Diffraction (TOFD) Technique
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- Non-Destructive Testing – Ultrasonic Examination – Part 2: Sensitivity and Range Setting. – British and European Standard BS EN 583-2:2001
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2. Technical Data

Number of Channels:	**8**
Pulsing/Receiving Methods:	**Parallel - all channels do fire, receive, digitize, and record signals simultaneously** **Sequential – cycles of firing, receiving, digitizing, and recording signals by each channel are separated in time in a sequence loop**
Pulse Type**:	**Bipolar Square Wave Pulse**
Initial Transition**:	**≤5 ns (10-90%)**
Pulse Amplitude**:	**Smoothly tunable (12 levels) 75 V … 400 V peak to peak into 50 Ω - global parameter for all 8 channels**
Pulse Duration*:	**50…600 ns for each half wave synchronously controllable in 10 ns step**
Modes*:	**Single / Dual**
PRF**:	**0 – optionally; 15...5000 Hz controllable in 1 Hz resolution**
Optional Sync Output / Input**:	**Max +5V, τ ≤ 5 ns, t ≥100 ns, Load Impedance ≥ 50 Ω**
Gain*:	**0...100 dB controllable in 0.5 dB resolution**
Advanced Low Noise Design**:	**81 μV peak to peak input referred to 80 dB gain / 25 MHz bandwidth**
Frequency Band**:	**0.2 … 25 MHz Wide Band**
Digital Filter*:	**32-Taps FIR band pass with controllable lower and upper frequency limits**
Ultrasound Velocity*:	**300…20000 m/s (11.81…787.4 "/ms) controllable in 1 m/s (0.1 "/ms) resolution**
Range*:	**0.5...7000 μs controllable in 0.01 μs resolution**
Display Delay*:	**0...3200 μs controllable in 0.01 μs resolution**
Probe Angle*:	**0…90° controllable in 1° resolution**
Probe Delay*:	**0 to 70 μs controllable in 0.01 μs resolution - expandable**
Display Modes*:	**RF, Rectified (Full Wave / Negative or Positive Half Wave), Signal's Spectrum (FFT Graph)**
Reject*:	**0...99 % of screen height controllable in 1% resolution**
DAC / TCG*:	**Theoretical – through keying in dB/mm (dB/") factor** **Experimental – through sequential recording echo amplitudes from variously distanced equal reflectors** **46 dB Dynamic Range, Slope ≤ 20 dB/μs, Capacity ≤ 40 points** **Available for Rectified and RF Display**
DGS*:	**Standard Library for 18 probes / unlimitedly expandable**
Multiple DAC/DGS Curves*:	**Main DAC/DGS Curve plus up to 3 (three) curves with individually controllable levels in ±14 dB range**
Gates*:	**2 Independent Gates / unlimitedly expandable**
Gate Start and Width*:	**Controllable over whole variety of A-Scan Display Delay and A-Scan Range in 0.1 mm /// 0.001" resolution**
Gate Threshold*:	**5…95 % of A-Scan height controllable in 1 % resolution**
Measuring Functions – Digital Display Readout*:	**27 automatic functions / expandable; Dual Ultrasound Velocity Measurement Mode for Multi-Layer Structures; Curved Surface / Thickness / Skip correction for angle beam probes; Ultrasound velocity and Probe Delay Auto-Calibration for all types of probes**
Freeze (A-Scans and Spectrum Graphs)*:	**Freeze All – A-Scans and Spectrum Graphs / Freeze Peak – A-Scans / All measurements functions, manipulating Gates, and ±6dB Gain varying are available for frozen signals**
Encoder Interface:	**Built-in controller and interface for incremental mechanical encoder**
Encoding:	**Time-based (built-in real time clock – 0.02 sec resolution) – for single channel operation only** **True-to-location (incremental encoder – 0.5 mm resolution) – for single and multi-channel operation**
Imaging Modes:	**Single Channel: Thickness Profile B-Scan, Cross-sectional B-Scan, Plane View CB-Scan, TOFD** **Multi-Channel: Strip Charts of 4 types (Amplitude/TOF P/E; Map; TOFD; Coupling)**
Standard Length of one Straight Line Scanning record:	**50…20000 mm (2"…800"), automatic scrolling**

Method of Record:	**Complete raw data recording**
Region of Interest*:	**Controllable over entire Display Delay, Probe Delay, Range, Ultrasound Velocity and other appropriate channel settings**
Off-Line Image Analysis*:	**Recovery and play back of A-Scan sequence at various gain levels** **Echo-dynamic pattern analysis** **Defects sizing, outlining, pattern recognition** **Converting strip types** **Converting Record into ASCII Format / MS Excel format / MS Word Format**
Data Reporting**:	**Direct printout of Calibration Dumps, A-Scans, Spectrum Graphs, Thickness Profile B-Scans, cross-sectional B-Scans, plane view CB-Scans, TOFD maps, strip charts**
Data Storage Capacity:	**At least 100000 sets including calibration dumps accompanied with A-Scans and/or Spectrum Graphs** **At least 10000 sets including calibration dumps accompanied with Thickness Profile B-Scans, cross-sectional B-Scans, plane view CB-Scans, TOFD maps, strip charts, and complete sequence of A-Scans captured during scanning**
On-Board Computer:	**AMD LX 800 - 500MHz**
RAM:	**1 Gigabyte**
Internal Flash Memory - Quasi HDD:	**4 Gigabytes**
Outputs:	**LAN, USB X 2, PS 2, SVGA**
Screen:	**6.5" High Color Resolution (32 bit) SVGA 640×480 pixels 133×98 mm (5.24" × 3.86") Sun-readable LCD; Maximal A-Scan Size (working area) – 130×92 mm (5.12" × 3.62")**
Controls:	**Front Panel Sealed Keyboard, Front Panel Sealed Mouse, Touch Screen**
Compatibility with the external devices:	**PS 2 Keyboard and Mouse, USB Keyboard and Mouse, USB Flash Memory card, Printer through USB or LAN, PC through USB or LAN, SVGA External Monitor**
Operating System:	**Windows™ XP embedded**
Power:	**Mains - 100…240 VAC, 40…70 Hz, auto-switch; Battery 12V 8AH up to 6 hours continuous operation**
Housing:	**IP 53 rugged aluminum case with carrying handle**
Dimensions:	**265×156×101 mm (10.43"×6.14"×3.98") - without battery** **265×156×139 mm (10.43"×6.14"×5.47") - with battery**
Weight:	**2.500 kg (5.50 lbs) - without battery** **3.430 kg (7.55 lbs) - with battery**

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

3. ISONIC 2008 – Scope of Supply

#	Item	Order Code (Part #)	Note
1	**ISONIC 2008 – Portable Digital 8-Channel Ultrasonic Flaw Detector and Recorder** • **<u>ISONIC 2008 Electronic unit</u>** – including: > Internal PC (AMD LX 800 500 MHz, RAM 1G, Quazi-HDD Flash Memory Card 4G, Windows XP Embedded, 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 254000 – 8 channel UDS 3-6 Pulser Reciver Card: ❑ Bipolar Square Wave – Tunable Width / Tunable Firing Level Pulser; Single / Dual Modes of Operation; Special Probe Protection Circuit to Prevent Probe Damage for Not Properly Adjusted Pulse Width ❑ Gain: 0...100 dB controllable in 0.5 dB resolution; Advanced Low Noise Design: 81μV peak to peak input referred to 80 dB gain / 25 MHz bandwidth; frequency Band: 0.2 … 25 MHz Wide Band / 32-Taps FIR bandpass digital filter with controllable lower and upper frequency limits ❑ Built-In Incremental Encoder Interface • **<u>Software</u>** ❑ ISONIC 2008 Multi-Functional Package (SWA 99C08200) ● **Single Channel** Operation ◆ A-Scan ➪ A-Scan (Full Wave / Negative Half Wave / Positive Half 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 ➪ 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) ➪ 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: ▶ 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) ➪ Continuous measuring of echo amplitudes and reflectors coordinates along probe trace	SA 80480	

#	Item	Order Code (Part #)	Note
	⇨ 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 B-Scan defects images ⇨ Off-line evaluation of B-Scan record images featured with: ▶ 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 ⇨ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer ◆ 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) ⇨ Continuous measuring of echo amplitudes and reflectors coordinates 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 CB-Scan defects images ⇨ Off-line evaluation of CB-Scan record images featured with: ▶ 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 ⇨ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer ◆ TOFD Inspection – RF B-Scan and D-Scan Imaging (Typical Application: weld inspection; CHIME inspection) ⇨ Time-based (real time clock) and true-to-location (built-in incremental encoder interface) modes of data recording ⇨ 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: ▶ 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 ● **Multi-Channel** Operation ⇨ Continuous capturing and recording of up to 8 channel complete sequence of A-Scans along probe trace and real time creating of up to 8 channel strip chart		

#	Item	Order Code (Part #)	Note
	⇨ Time-based (real time clock) and true-to-location (built-in incremental encoder interface) modes of data recording ⇨ 4 types of strip chart selectable by operator: ▽ TOFD ▽ Map ▽ PE Amplitude / TOF ▽ Coupling ⇨ Comprehensive Off-line evaluation of recorded strip chart: ▶ Play-back and evaluation of A-Scans ▶ Marking Defects and Creating Defect List ▶ Varying layout of strip chart ▶ Conversion of Map Strips into PE Amplitude TOF strips and reverse conversion of PE Amplitude TOF strips into Map Strips ▶ Varying ROI and rebuild of PE Amplitude/TOF Strips ▶ Stripped C-Scan Creating ▶ Echodynamic pattern analysis ▶ Individual Postprocessing of Each strip based on strip type: ▽ TOFD ▽ Map ▽ PE Amplitude / TOF ⇨ Comprehensive Setup and Scanning Reporting, Direct Connection To any Type of USB or LAN Windows Printer • **USB Flash Drive for External Data Storage** • **12 months warranty** • **Lifetime free software update**		
2	Backup Pen-Drive	SFD 2008098	Operating Manual on the Backup Pen-Drive
3	Soft carrying bag with neck strap	SK 2005101	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 2005104	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	Postprocessing SW Package for Office PC: **IOFFICE - ISONIC Office** ⇨ comprehensive postprocessing of inspection results files captured by ISONIC 2001, ISONIC 2005, ISONIC 2006, ISONIC 2007, ISONIC 2008 instruments using Inspection SW Packages of any type ⇨ automatic creating of ISONIC 2001, ISONIC 2005, ISONIC 2006, ISONIC 2007, ISONIC 2008 inspection reports in MS Word® format	SWA99C0203	Optional item
10	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

#	Item	Order Code (Part #)	Note
11	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 9.6.5 of this Operating Manual
12	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

4. Operating ISONIC 2008

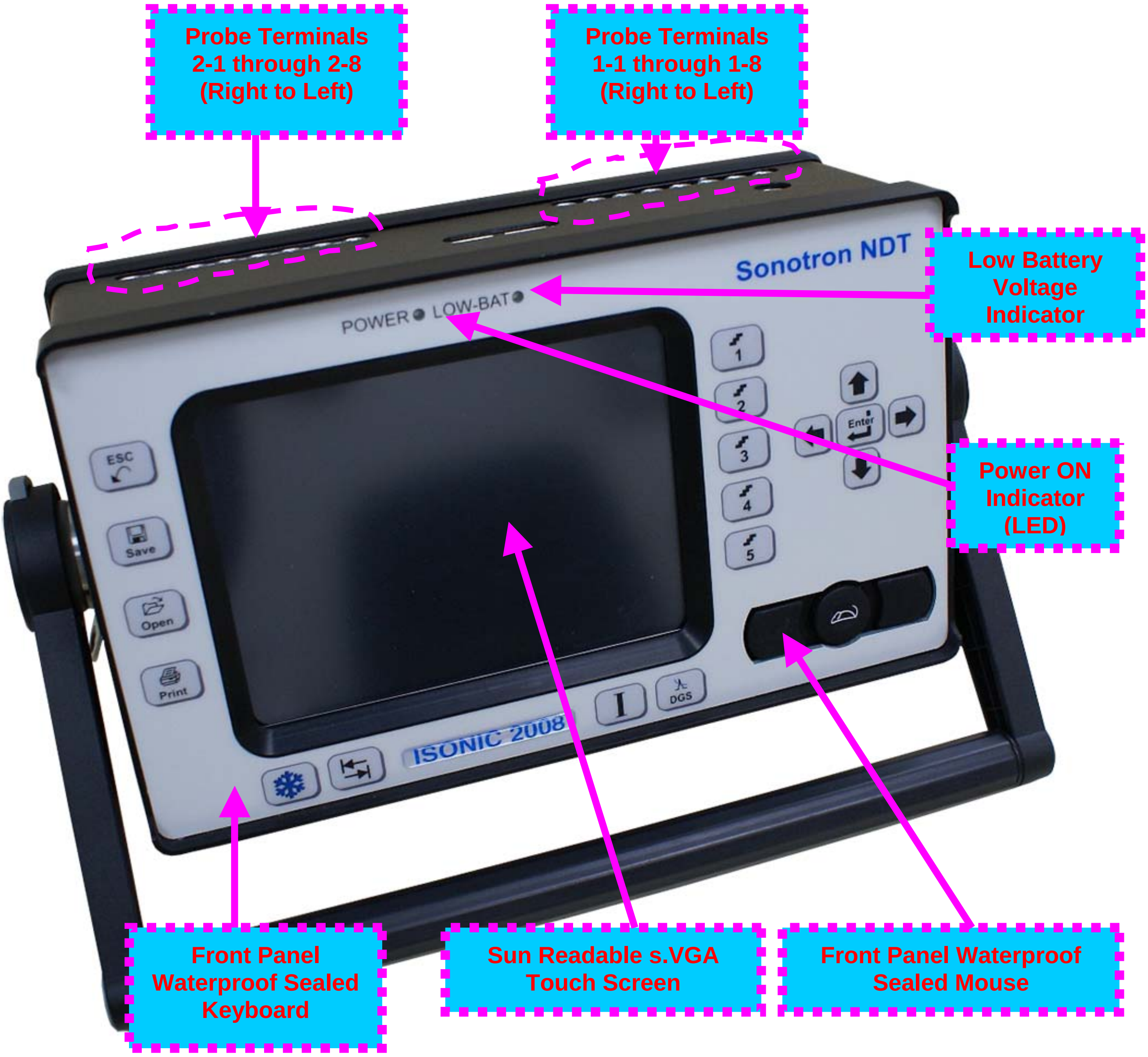
Please read the following information before you use **ISONIC 2008**. It is essential to read and understand the following information so that no errors occur during operation, which could lead damaging of the unit or misinterpretation of inspection results

4.1. Preconditions for ultrasonic testing with ISONIC 2008

Operator of **ISONIC 2008** must be certified as at least *Level 2 Ultrasonic Examiner* additionally having the adequate knowledge of

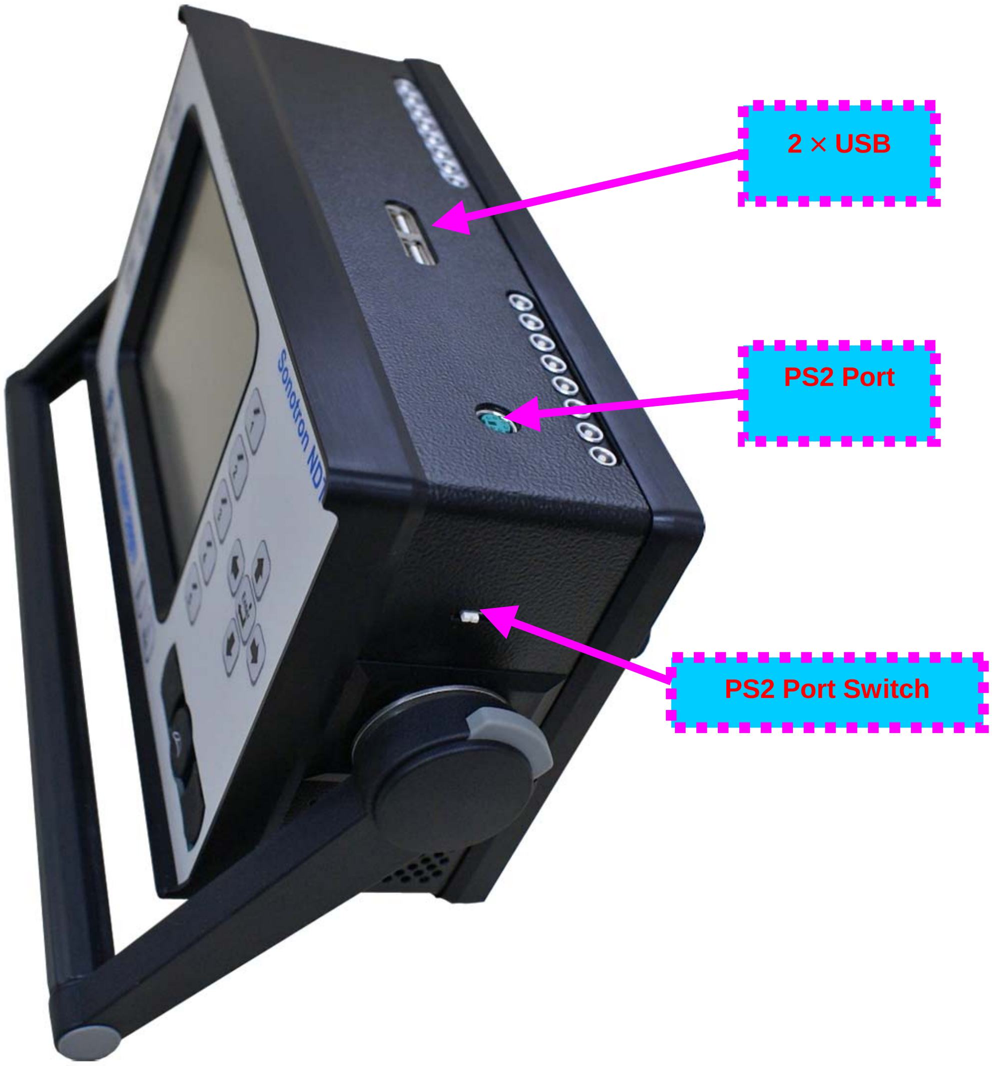
- operating digital ultrasonic flaw detector
- basics of computer operating in the **Windows™** environment including turning computer on/off, keyboard, touch screen and mouse, starting programs, saving and opening files

4.2. ISONIC 2008 Controls and Terminals



Probe Terminal	UDS 3-6 Channel #	Pulser Mode: Dual	Pulser Mode: Single
1-1	1	Receiver Input	Firing Output / Receiver Input
2-1	1	Firing Output	Not Used
1-2	2	Receiver Input	Firing Output / Receiver Input
2-2	2	Firing Output	Not Used
1-3	3	Receiver Input	Firing Output / Receiver Input
2-3	3	Firing Output	Not Used
1-4	4	Receiver Input	Firing Output / Receiver Input
2-4	4	Firing Output	Not Used
1-5	5	Receiver Input	Firing Output / Receiver Input
2-5	5	Firing Output	Not Used
1-6	6	Receiver Input	Firing Output / Receiver Input
2-6	6	Firing Output	Not Used
1-7	7	Receiver Input	Firing Output / Receiver Input
2-7	7	Firing Output	Not Used
1-8	8	Receiver Input	Firing Output / Receiver Input
2-8	8	Firing Output	Not Used


sVGA
Output
LAN Port

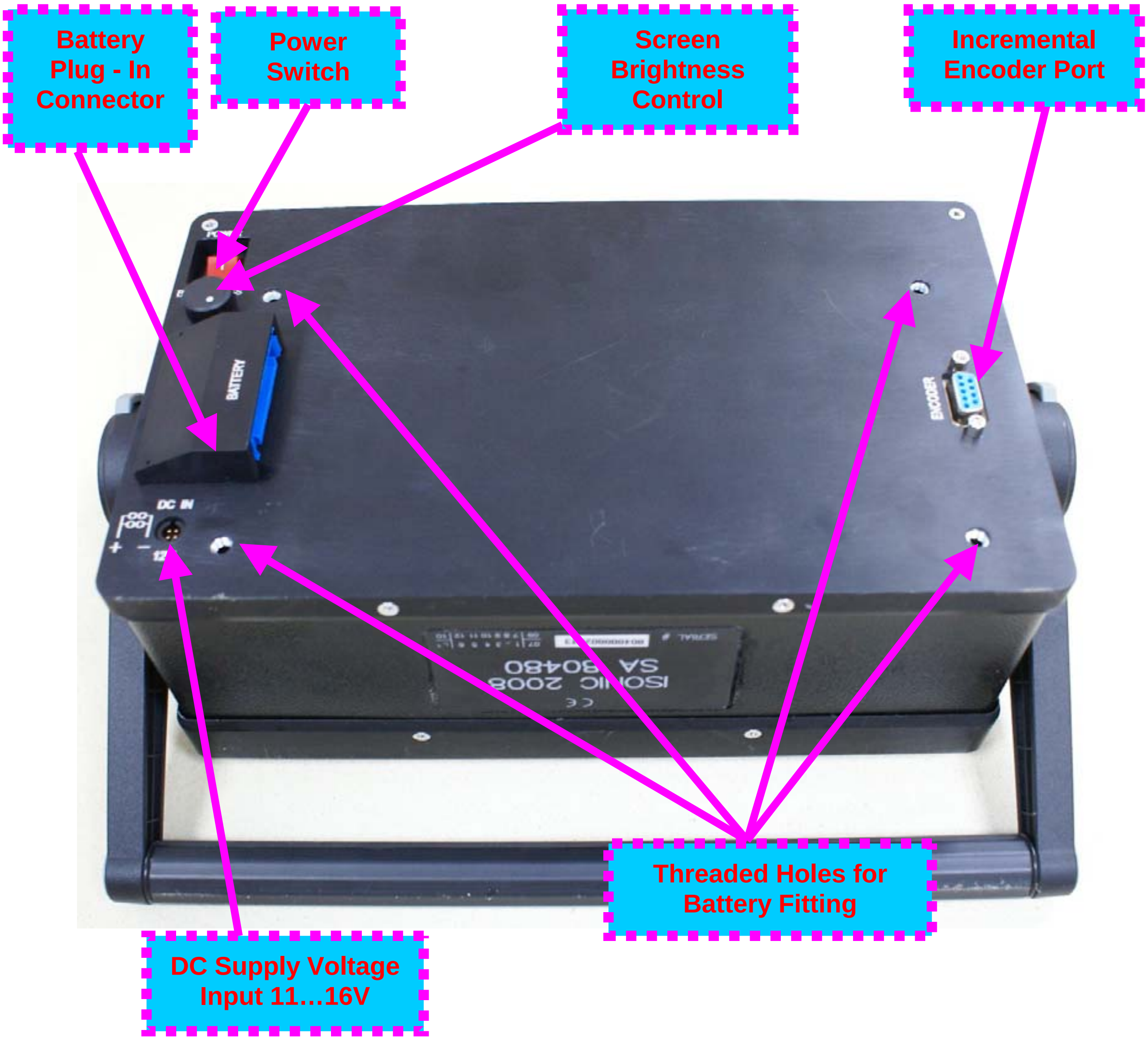


ⓘ

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


Battery Plug - In Connector
Power Switch
Screen Brightness Control
Incremental Encoder Port
BATTERY
ENCODER
DC IN
Threaded Holes for Battery Fitting
DC Supply Voltage Input 11…16V

4.3. Turning On / Off

ISONIC 2008 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 2008**

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 2008** and plug another end into DC mains

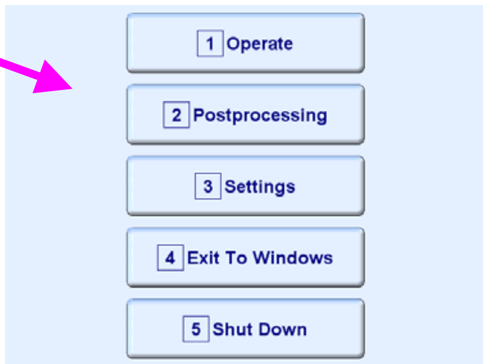
Battery

- 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 2008** 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

Wait until **ISONIC 2008 Start Screen** becomes active automatically upon boot up is completed



Click on 1 Operate or press 1 on front panel keyboard or **F1** on external keyboard to operate **ISONIC 2008** – refer to Chapters 5 through 7 of this Operating Manual

Click on 2 Postprocessing or press 2 on front panel keyboard or **F2** on external keyboard to start postprocessing of multi-channel inspection files captured by **ISONIC 2008** – refer to paragraph 7.4 of this Operating Manual

Click on 3 Settings or press 3 on front panel keyboard or **F3** on external keyboard to proceed with general settings of **ISONIC 2008** – refer to Chapters 8 and 9 of this Operating Manual

Click on 4 Exit To Windows or press 4 on front panel keyboard or **F4** 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 9 of this Operating Manual

To turn **ISONIC 2008** off click on 4 Shut Down or press on 5 on front panel keyboard or **F5** on external keyboard then wait until the screen as below appears:

Set power switch into **O** position upon

ⓘ

After turning **ISONIC 2008 OFF** wait at least 10…30 seconds before switching it **ON** again

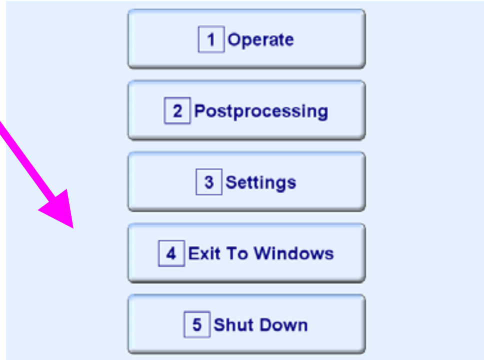
5. UDS 3-6 Pulser Receiver Channels

5.1. Start Up UDS 3-6 Pulser Receiver

While **ISONIC 2008 Start Screen** is active click on 

or press 

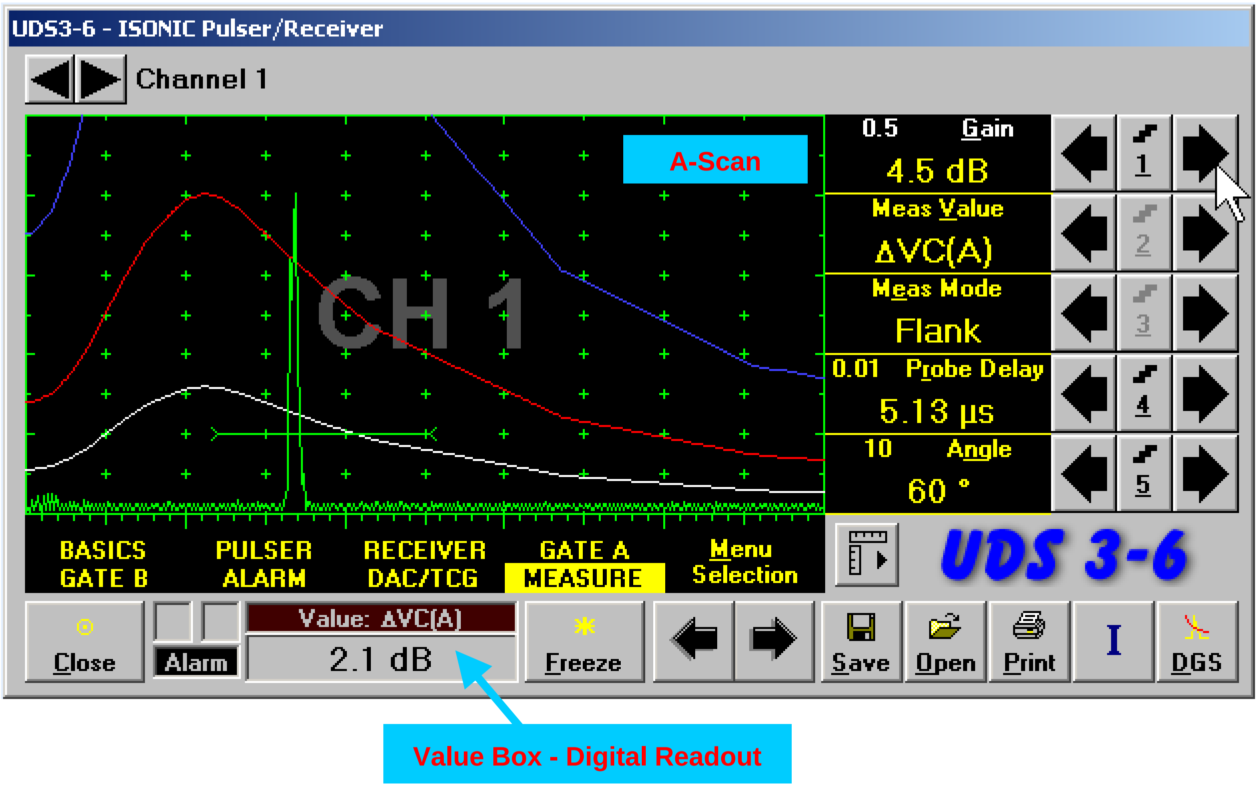
on the front panel



keyboard or press **F1** on external keyboard

5.2. UDS 3-6 Main Operating Surface

ISONIC 2008 instrument comprises eight identical **UDS 3-6** pulser receiver channels; each of them is controllable through **UDS 3-6 Main Operating Surface**. Half tone background indication of channel number is provided at the **A-Scan** background

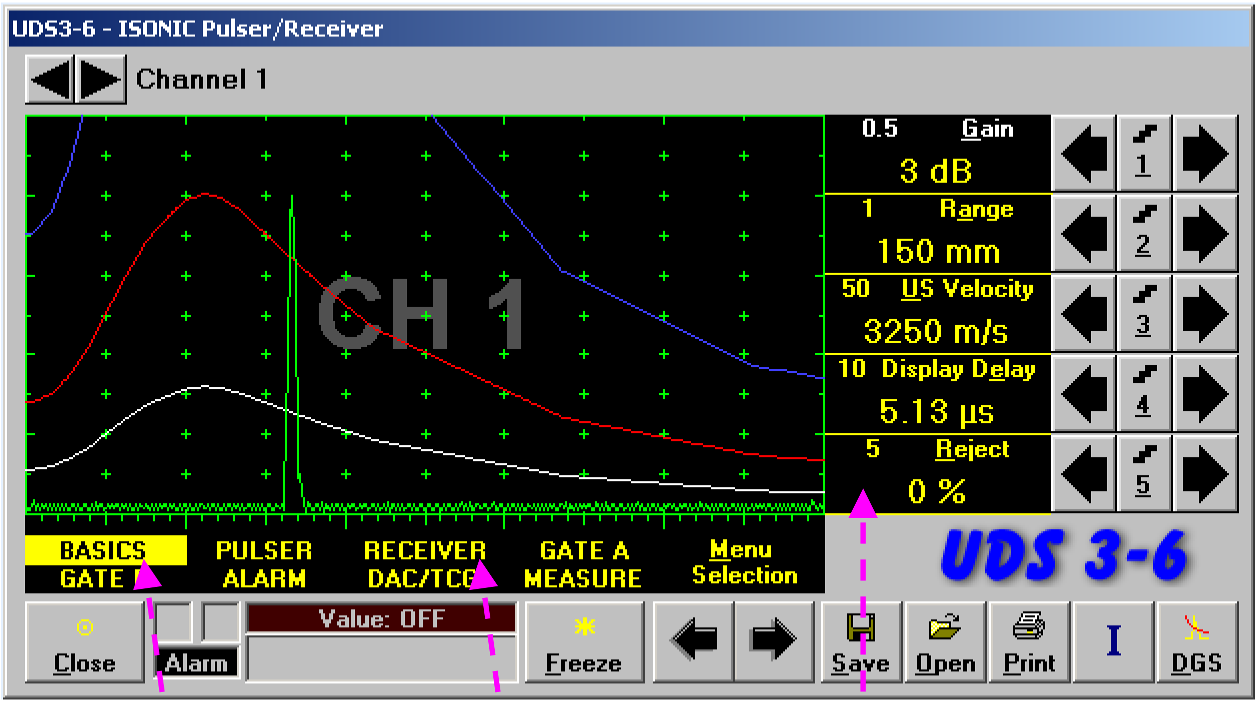


To select channel for calibration / A-Scan inspection click on

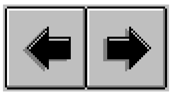
Each of **UDS 3-6** channels may be calibrated independently on others except few parameters, which are indicated as global in the present Operating Manual

5.2.1. Channel's Main Menu

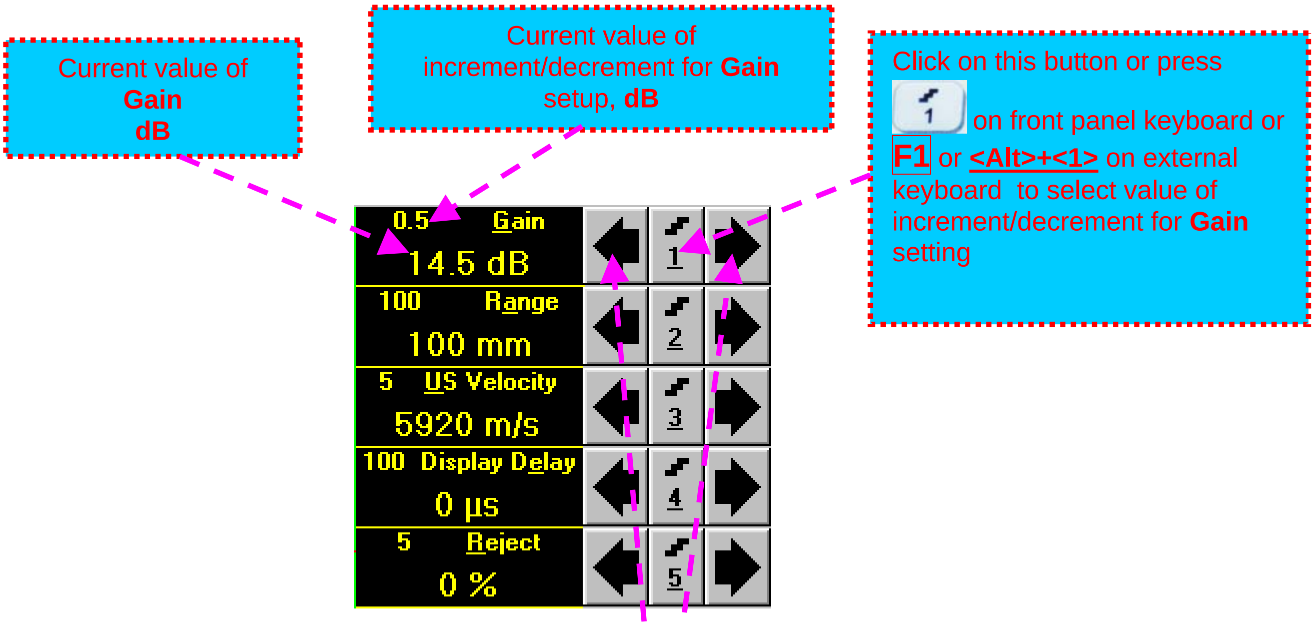
Channel's **Main Menu** consists of eight topics; each topic is associated with corresponding **submenu** appearing as vertical bar showing names for five parameters or modes of operation, their current settings and current value of increment/decrement for a parameter. The active topic is highlighted



To activate a topic the following manipulations are applicable:

- **Keyboard**
  - Press [key] 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

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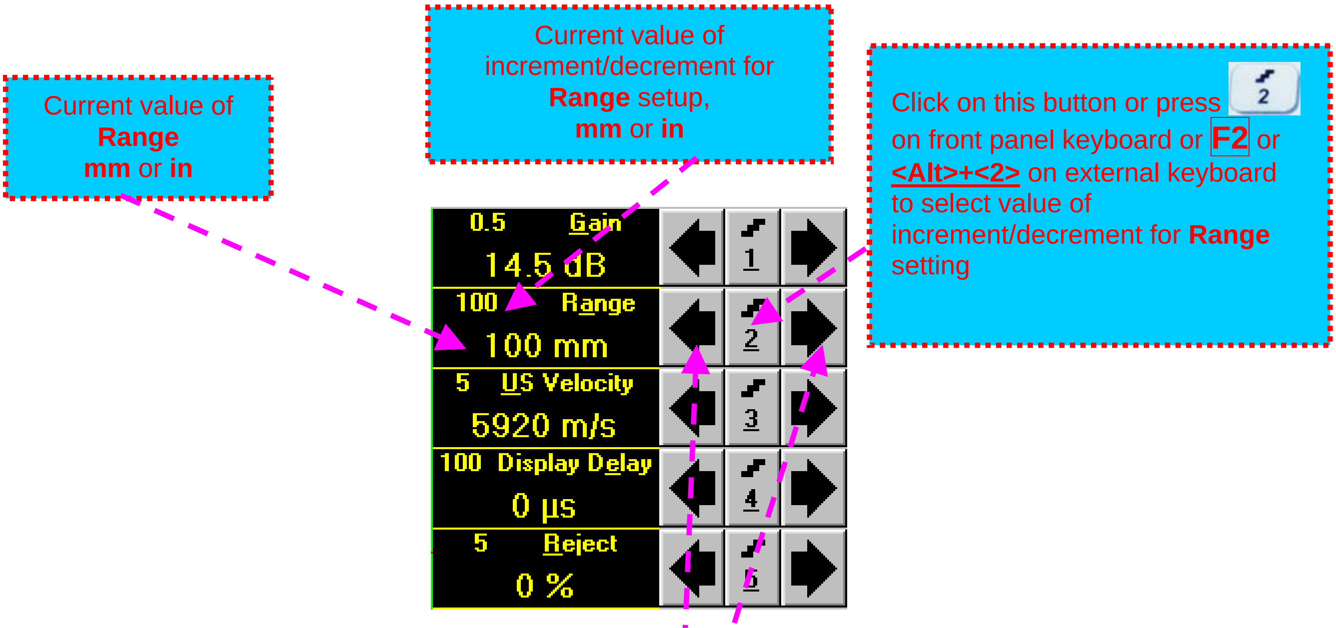
Gain setup is also possible through a number of other submenus following the same rules as above



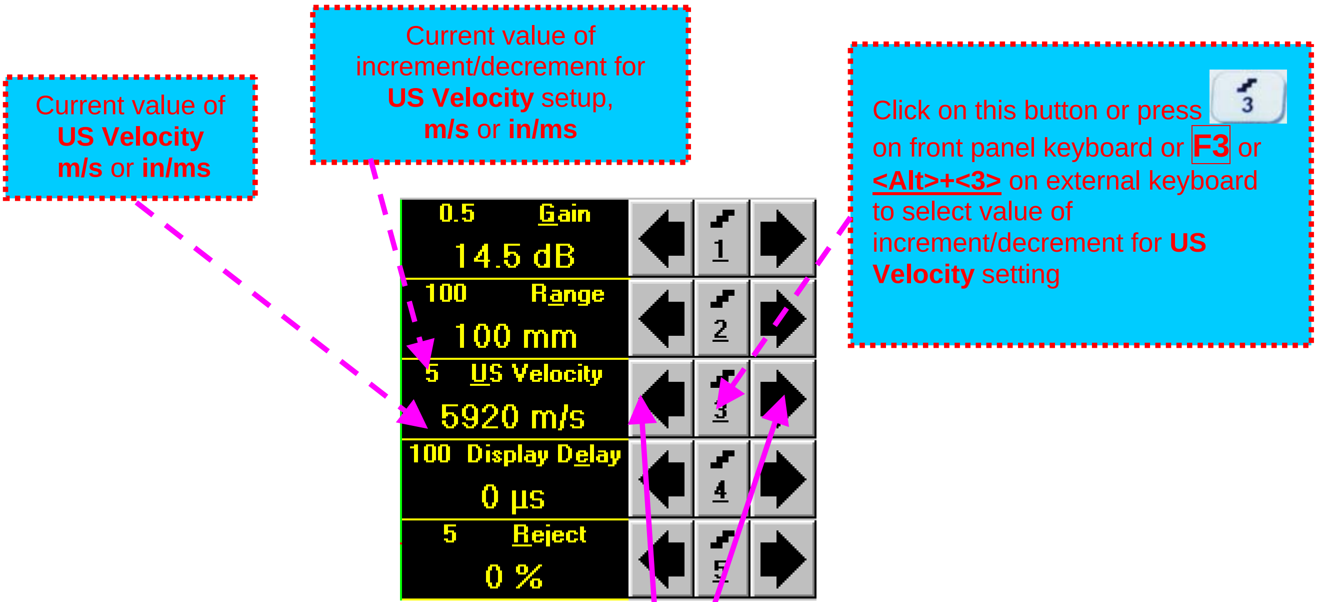
To control **Range** the following manipulations are applicable:

- **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

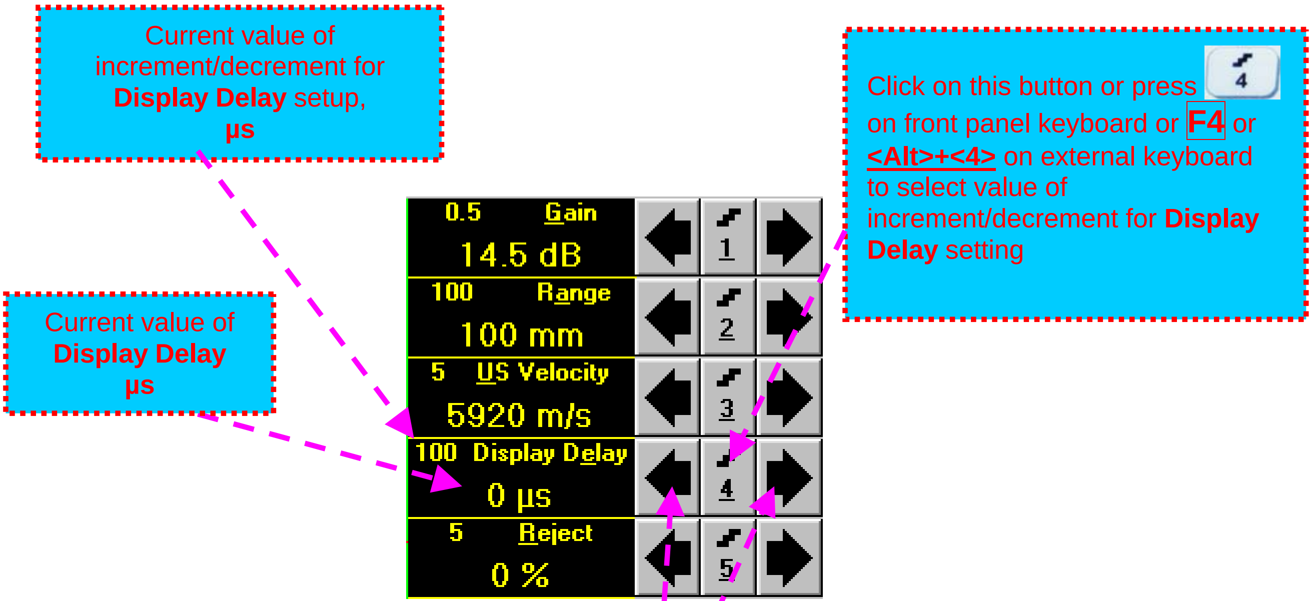
- **Combined**
  - Click on **Range** ⇒ **Range** fore color changes to white - then use , , , on front panel keyboard or ⇑, ⇒, ⇐, ⇓ on external keyboard

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



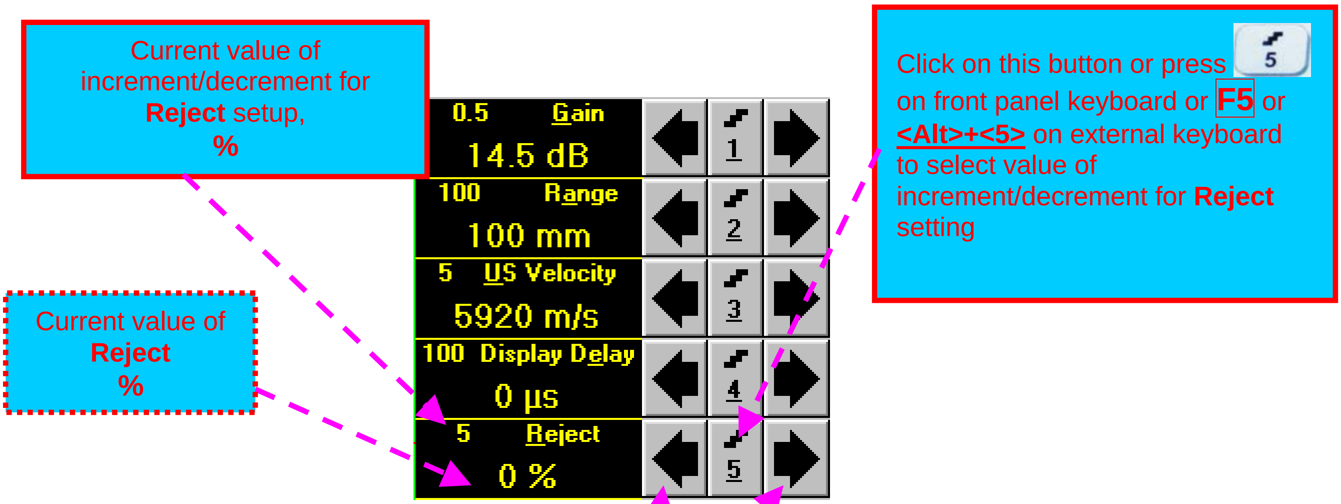
To control **US Velocity** the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press [3] 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



To control **Reject** 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 ⇒ **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

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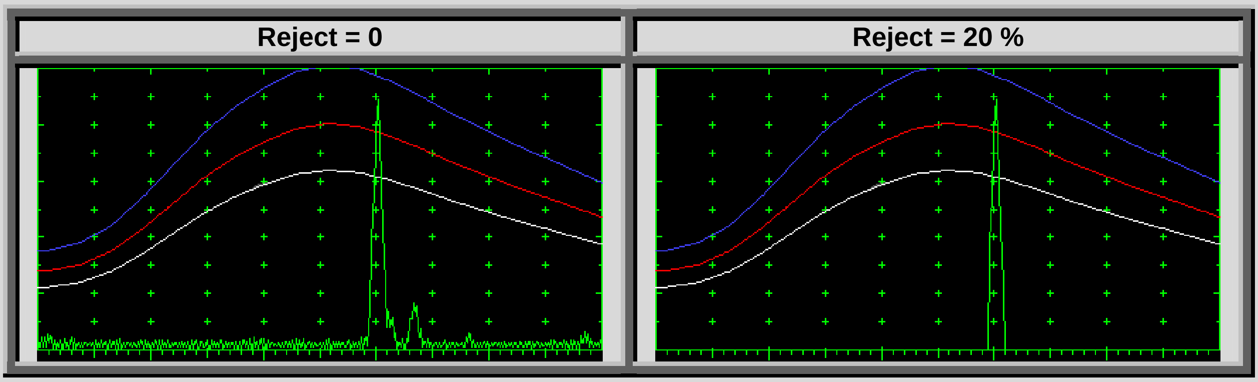
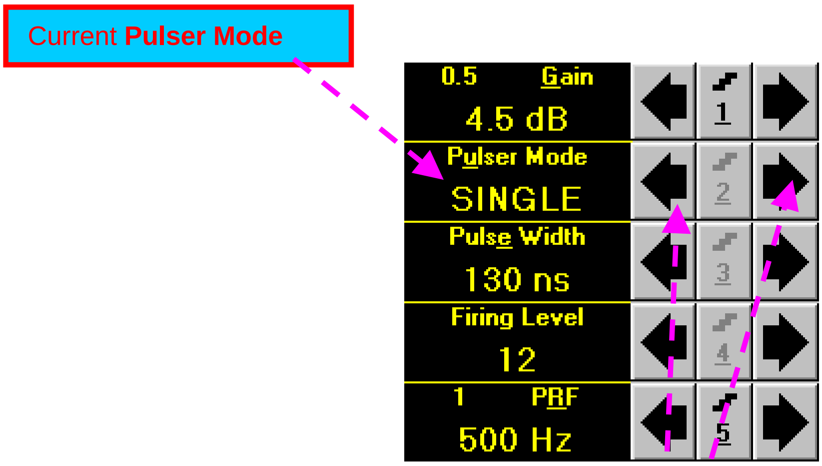
- Signals below **Reject** level (small signals) are suppressed
- Signals exceeding **Reject** level (large signals) are presented on the A-Scan without affecting their original height
- Part of large signal wave form below **Reject** level is suppressed



- **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

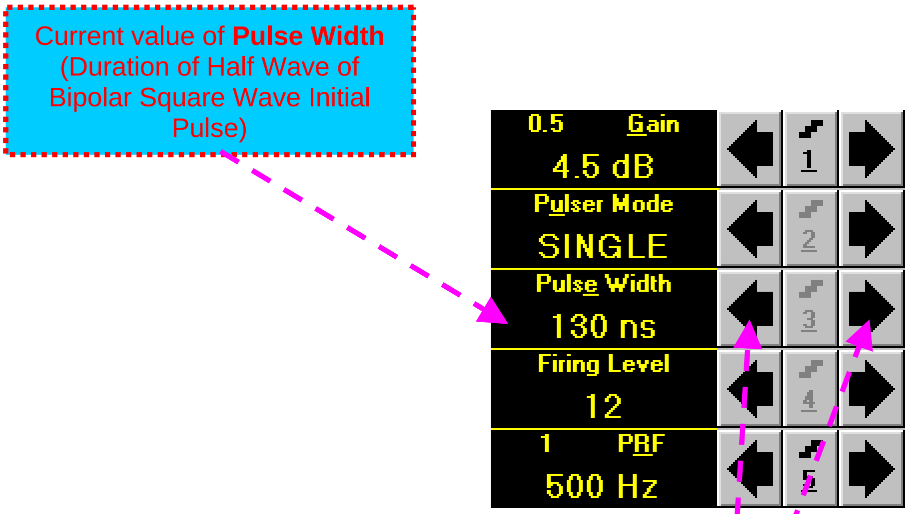
5.2.3. Sub Menu PULSER



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**



To control **Pulse Width** (Duration of Half Wave of Bipolar Square Wave Initial Pulse) 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

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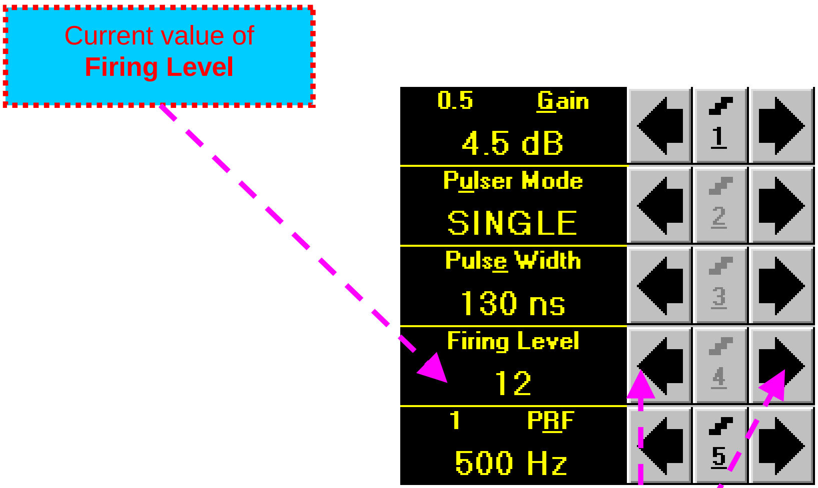
- ♦ **Pulse Width** (Duration of Half Wave of Bipolar Square Wave Initial Pulse) is tunable between 50 ns to 600 ns in 5 ns steps
- ♦ Durations of positive and negative half wave of the initial pulse are varying synchronously
- ♦ Attempt to decrease **Pulse Width** below 50 ns switches initial pulse OFF and channel may be used then as receiver only



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

- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press 4 on front panel keyboard or F4 or **<Alt>+<L>** on external keyboard ⇒ **Firing Level** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **Firing Level** ⇒ **Firing Level** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard

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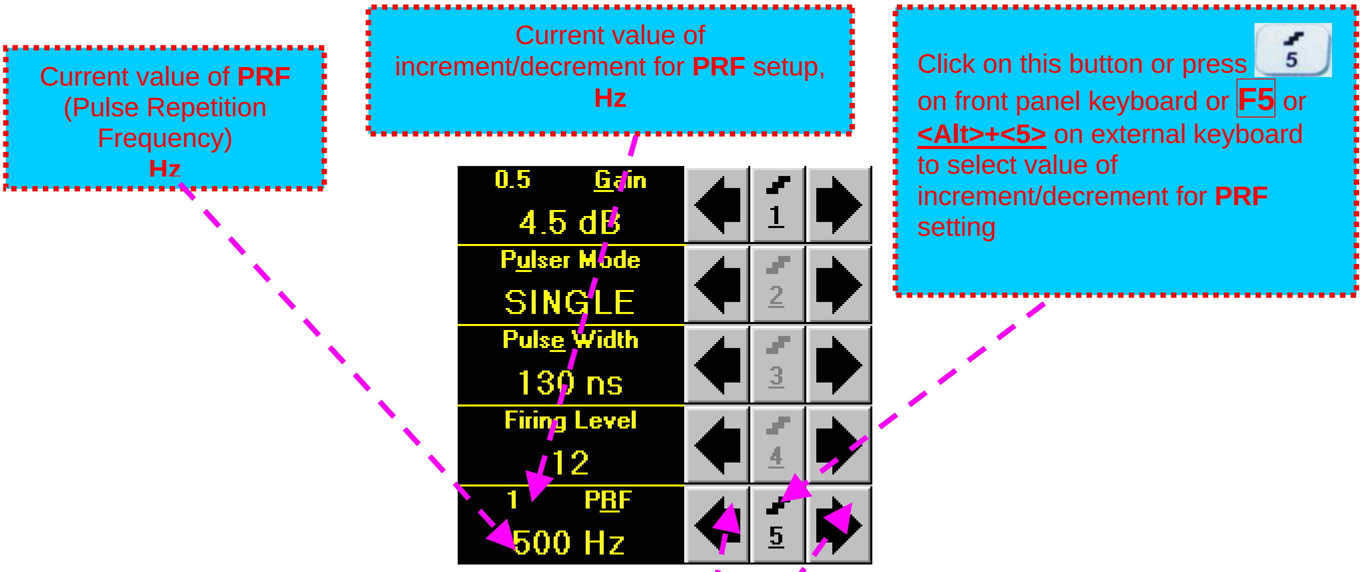
- There are 12 grades (1 through 12) for setting **Firing Level –** amplitude of initial pulse is controlled from 140 V peak to peak (**Firing Level = 1**) to 400 V peak to peak (**Firing Level = 12**)
- **Firing Level** is a global parameter, which is common for all 8 **UDS 3-6** channels of **ISONIC 2008** instrument



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

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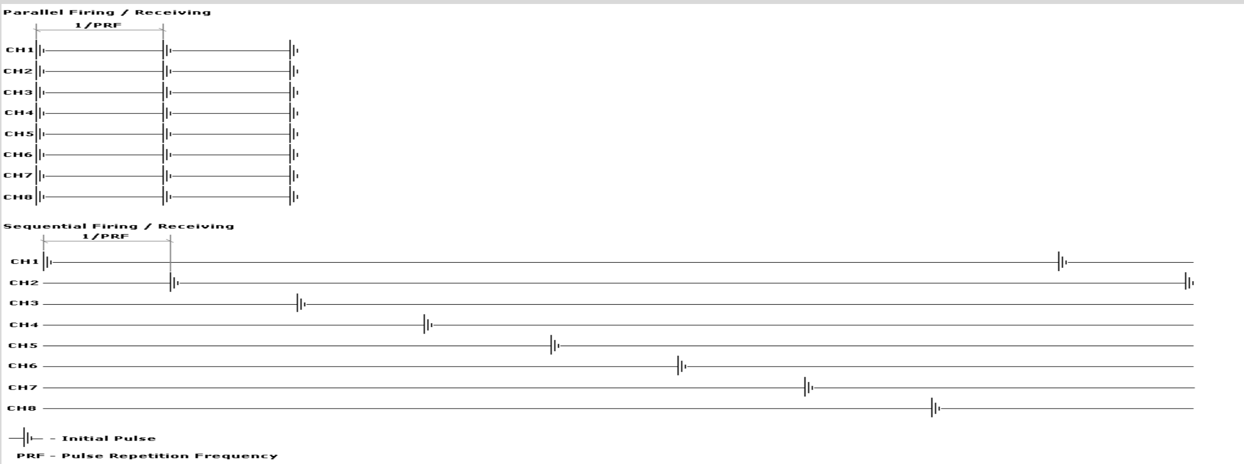
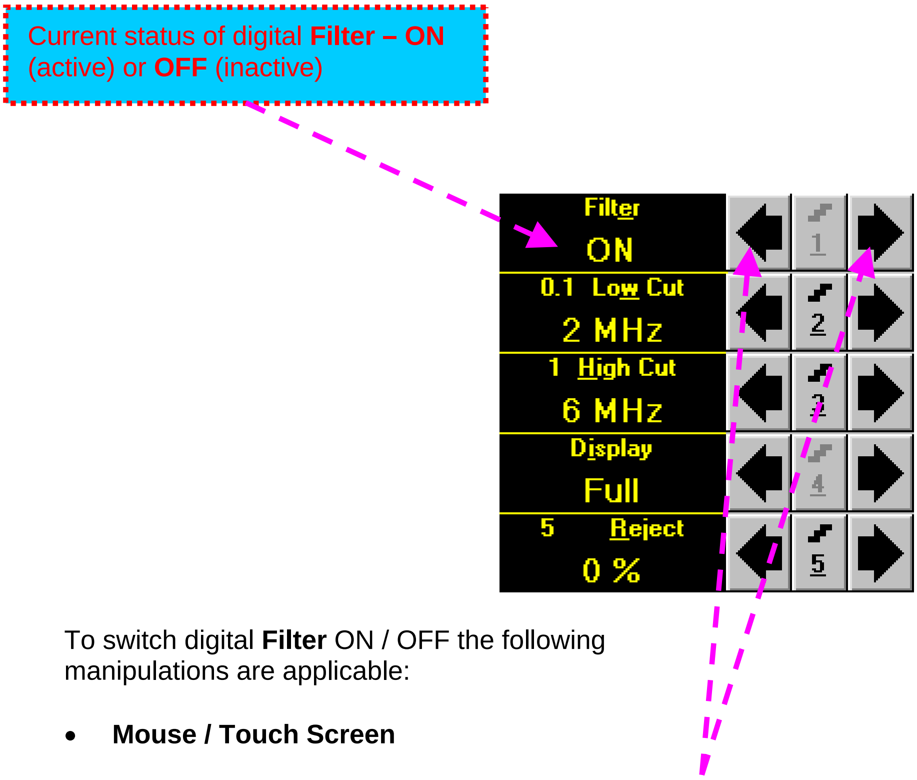
- ♦ **PRF** is global parameter, which is common for all 8 **UDS 3-6** channels of **ISONIC 2008** instrument
- ♦ There are 2 modes of pulsing in the **ISONIC 2008** (refer also to paragraph 9.2 of this Operating Manual)
- ♦ **Parallel** - all channels do fire, receive, digitize, and record signals simultaneously. For parallel firing **PRF** is global parameter for all 8 channels
- ♦ **Sequential** – cycles of firing, receiving, digitizing, and recording signals by each channel are separated in time in a sequence loop. For sequential firing **PRF** per channel is defined as **PRF/8**



5.2.4. Sub Menu RECEIVER

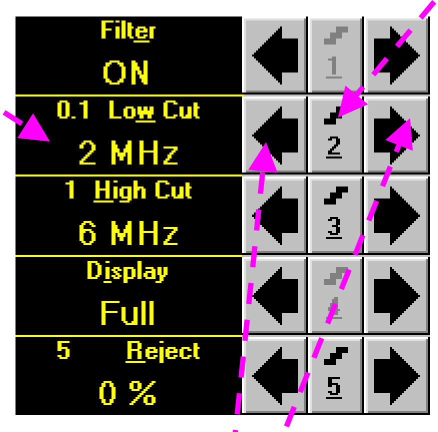


To switch digital **Filter** ON / OFF the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press on front panel keyboard or **F1** or **<Alt>+<E>** 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

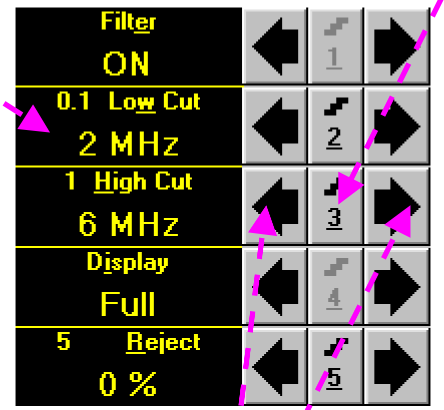
Current **Low Cut** frequency value of digital filter, **MHz**

Click on this button or press on front panel keyboard or **F2** or **<Alt>+<2>** on external keyboard to select value of increment/decrement for **Low Cut** setting



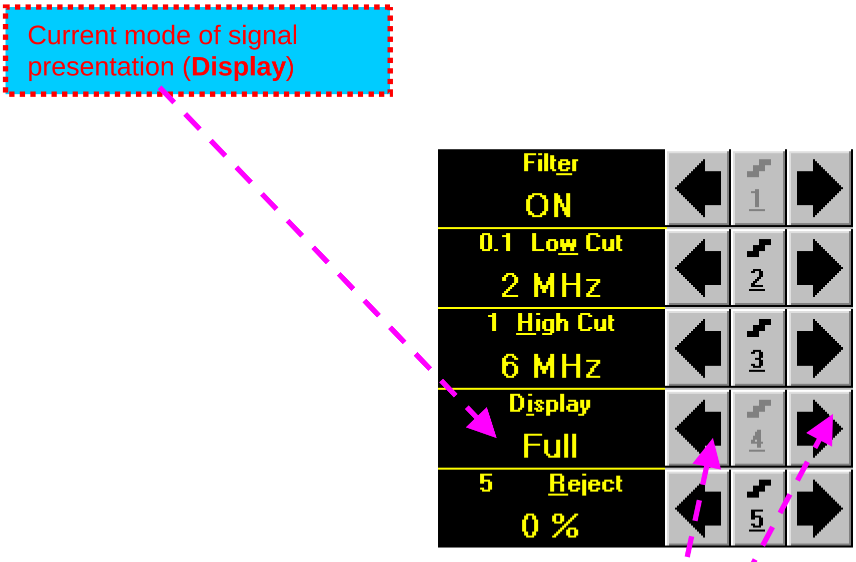
To control **Low Cut** frequency value of digital filter the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press on front panel keyboard or **F2** or **<Alt>+<W>** on external keyboard ⇒ **Low Cut** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **Low Cut** ⇒ **Low Cut** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard



To control **High Cut** frequency value of digital 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 **F3** or **<Alt>+<H>** on external keyboard ⇒ **High Cut** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **High Cut** ⇒ **High Cut** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard



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 4 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

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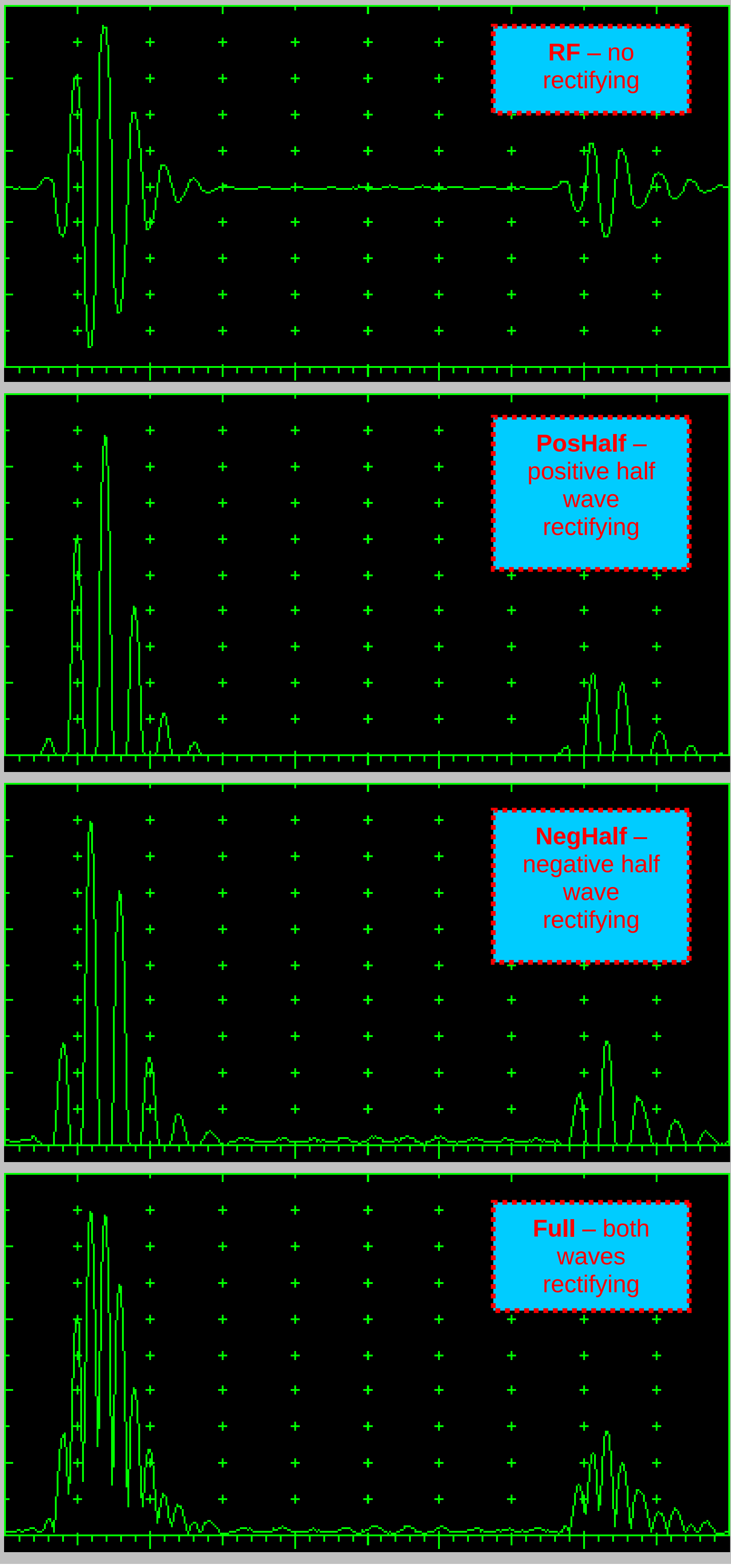
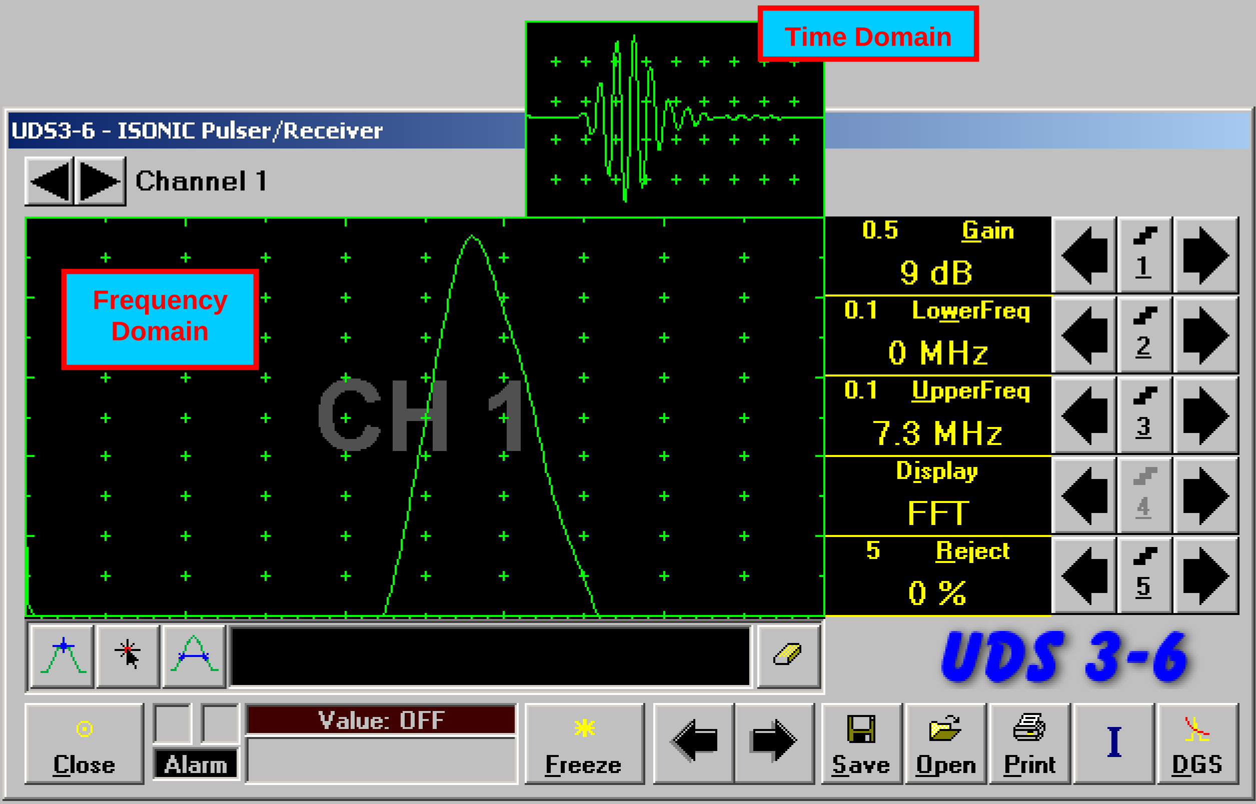
- There are four **Display modes** for *time domain signal presentation*:



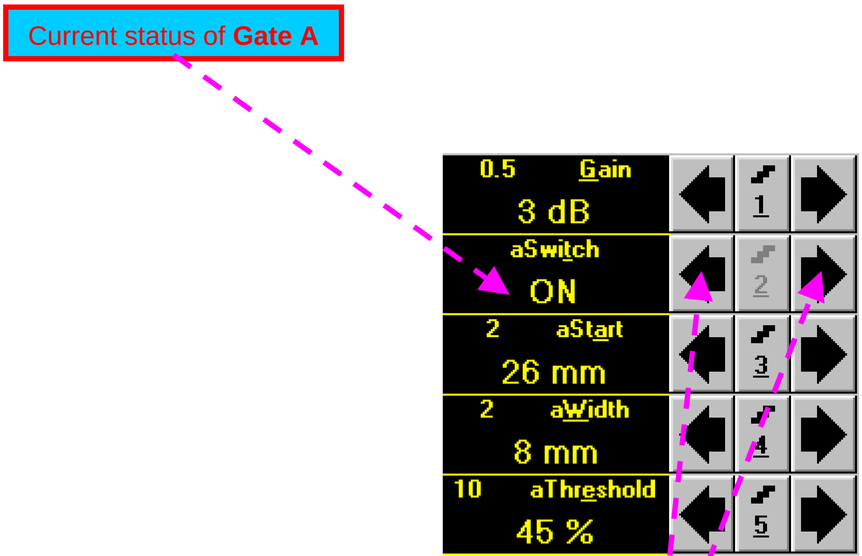
♦ *Frequency domain signal presentation* is available through **FFT Display mode.** Refer to paragraph 5.2.14 of this Operating Manual for instructions related to frequency domain signal presentation



Frequency Domain Signal presentation is not possible if:

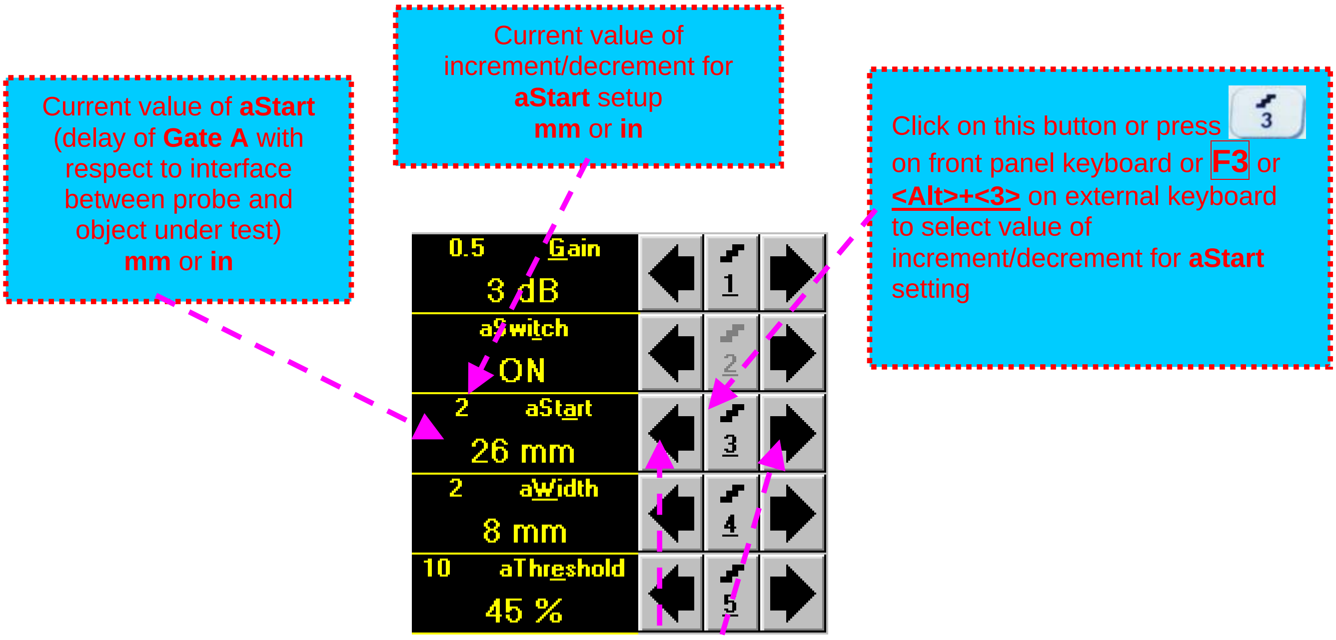
- o DAC is active (refer to paragraph 5.2.9 of this Operating Manual)
- o TCG is active (refer to paragraph 5.2.9 of this Operating Manual)
- o Digital Filter is active

5.2.5. Sub Menu GATE A



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)**

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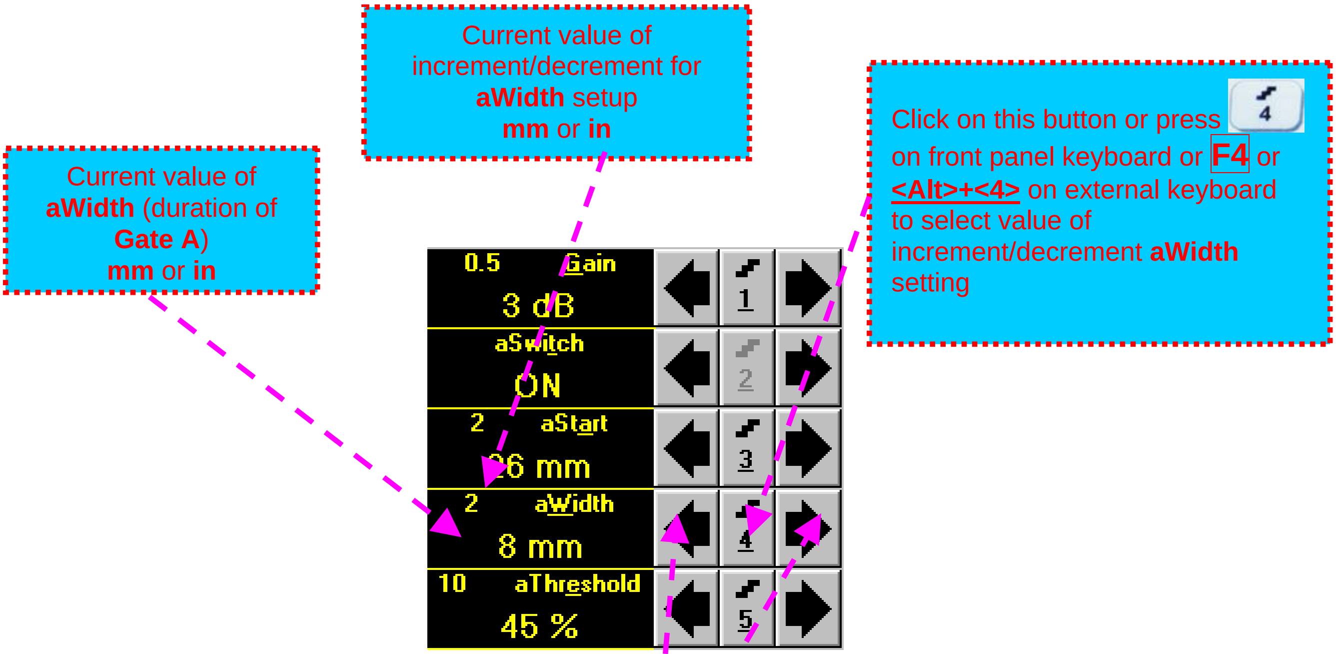
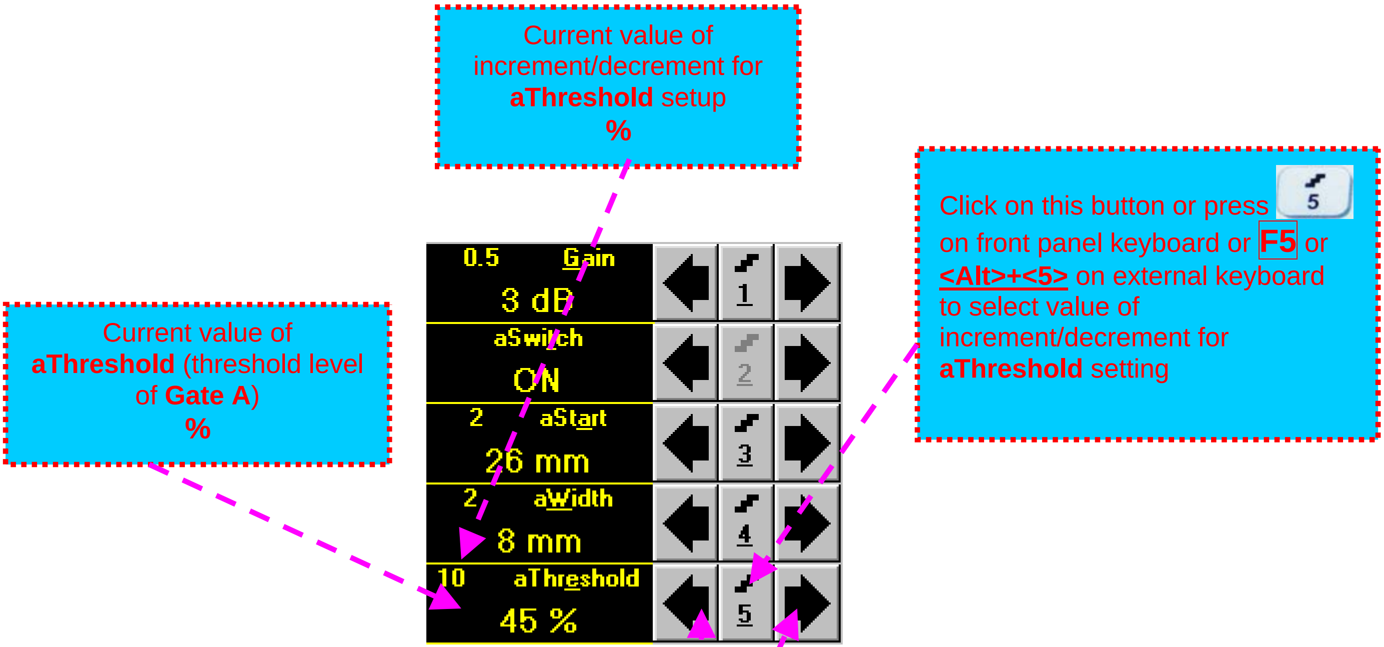
- ♦ **aStart** setup is also possible through a number of other submenus following the same rules as above
- ♦ Counting of **aStart** value starts after finishing of **Probe Delay** count (refer to paragraphs 5.2.12 and 5.2.13 of this Operating Manual)



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

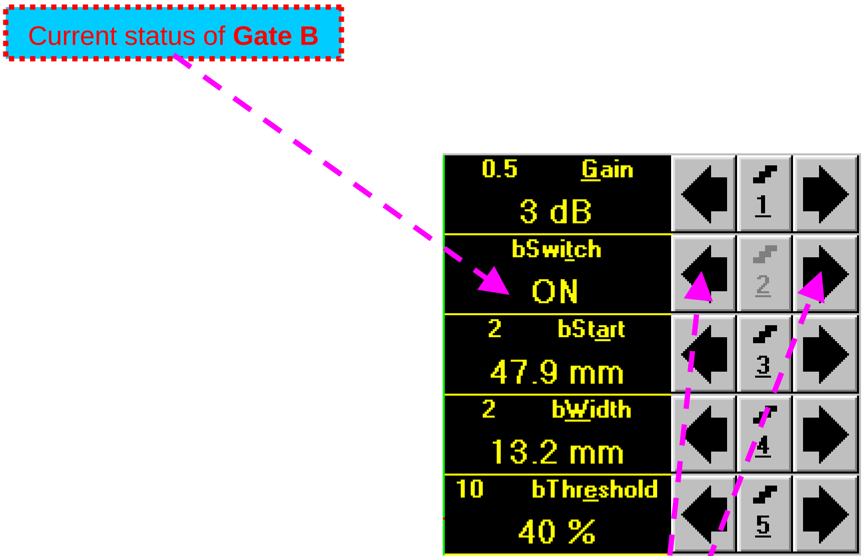
- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press on front panel keyboard or **F4** or **<Alt>+<W>** on external keyboard ⇒ **aWidth** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - 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:

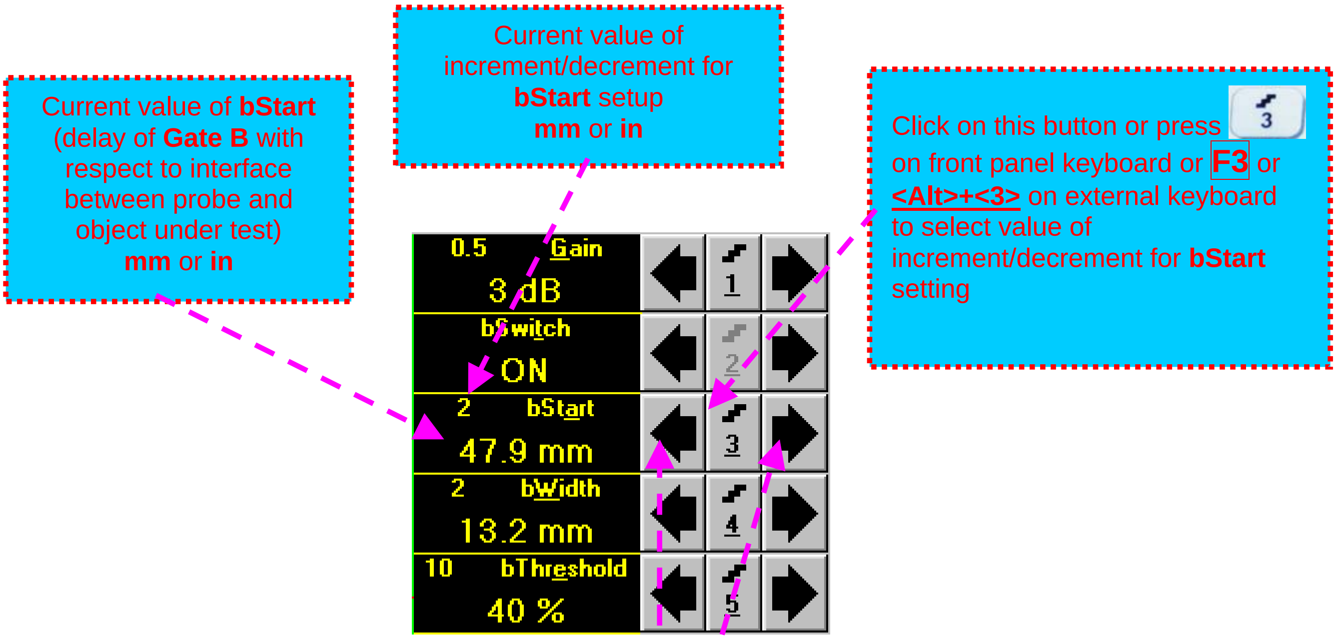
- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press on front panel keyboard or **F5** or **<Alt>+<E>** on external keyboard ⇒ **aThreshold** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
-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



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

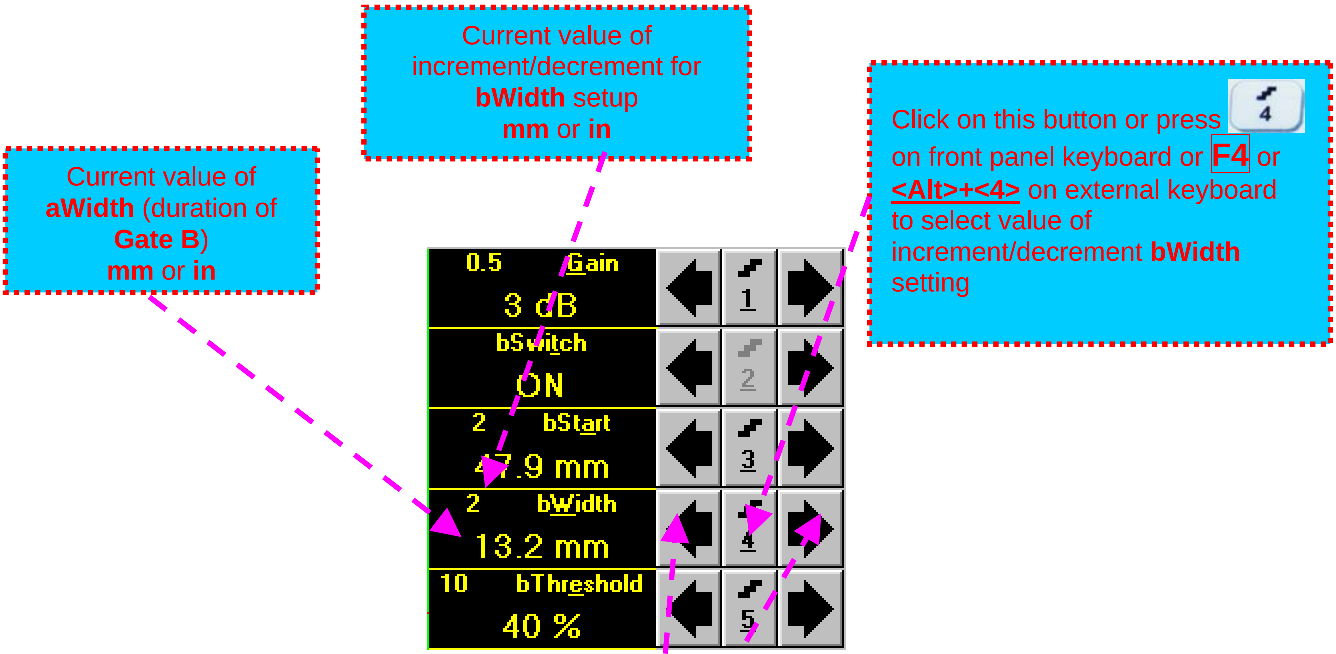
- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press on front panel keyboard or **F2** or **<Alt>+<T>** on external keyboard ⇒ **bSwitch** fore color changes to white - then use , , , on front panel keyboard or ⇑, ⇒, ⇐, ⇓ on external keyboard
- **Combined**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



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

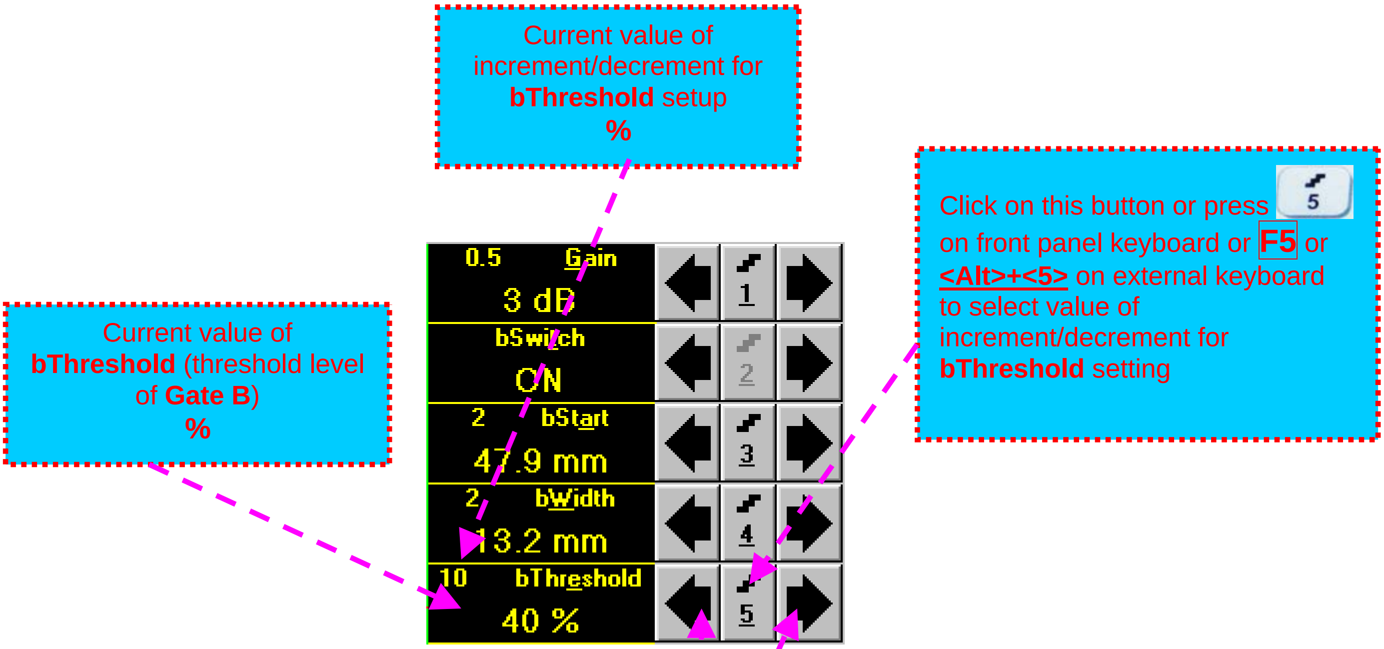
- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press on front panel keyboard or **F3** or **<Alt>+<A>** on external keyboard ⇒ **bStart** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - 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)**

ⓘ
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 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)**

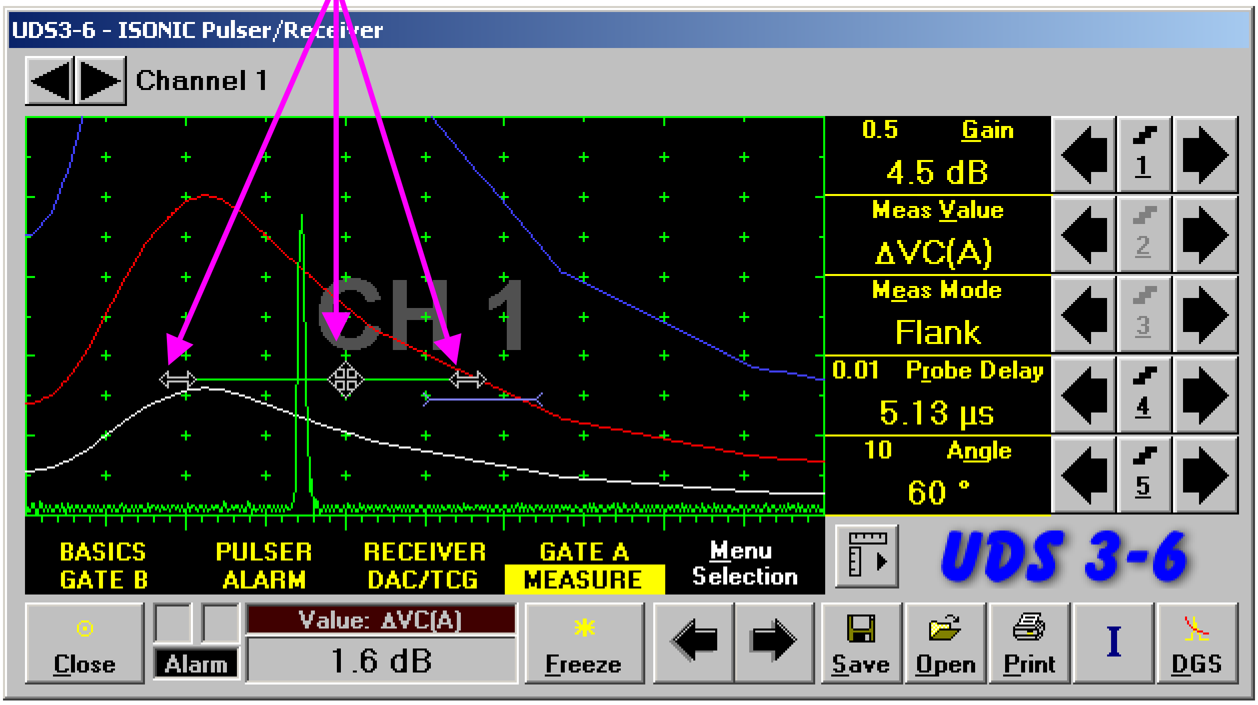


To control threshold level of **Gate B** (**bThreshold**) the following manipulations are applicable:

- **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)**

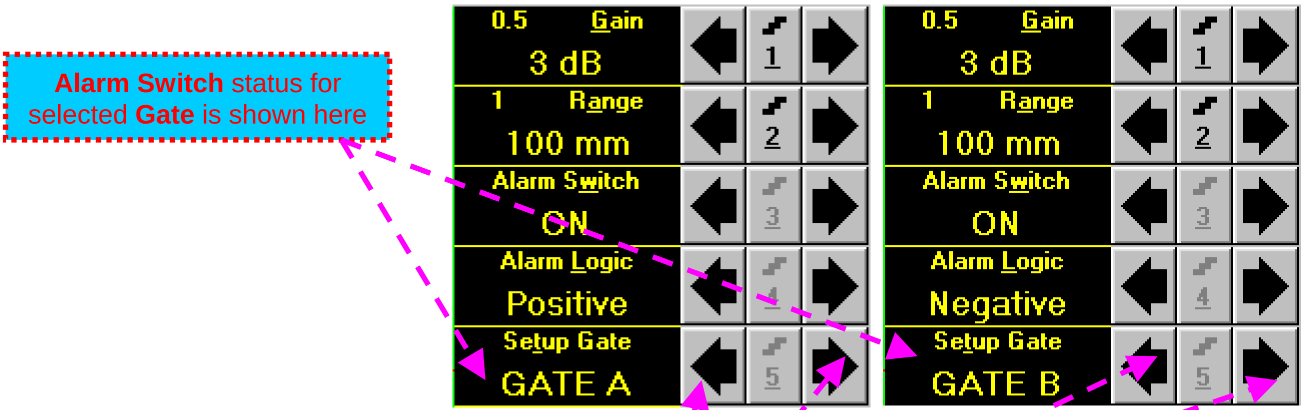
5.2.7. Drag and Drop: Gate A and Gate B

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



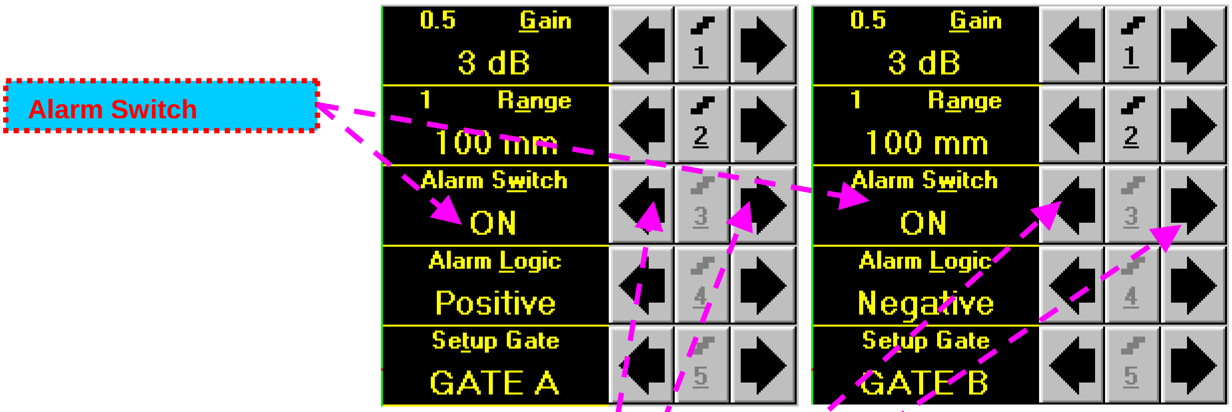
To manage a gate just press and hold left mouse button or touch screen stylus and drag, then drop through releasing of left mouse button or touch screen stylus

5.2.8. Sub Menu ALARM



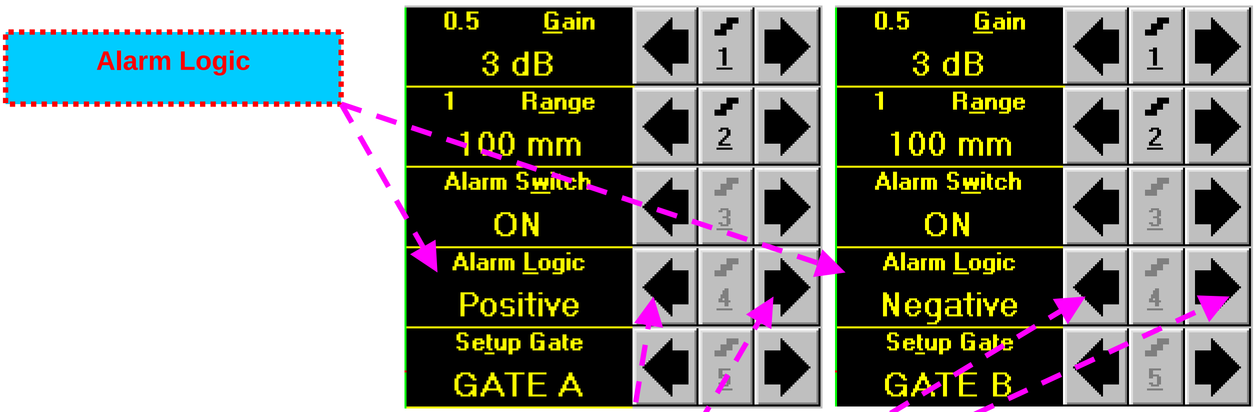
To select a **Gate** for **Alarm Setup** the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press 5 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

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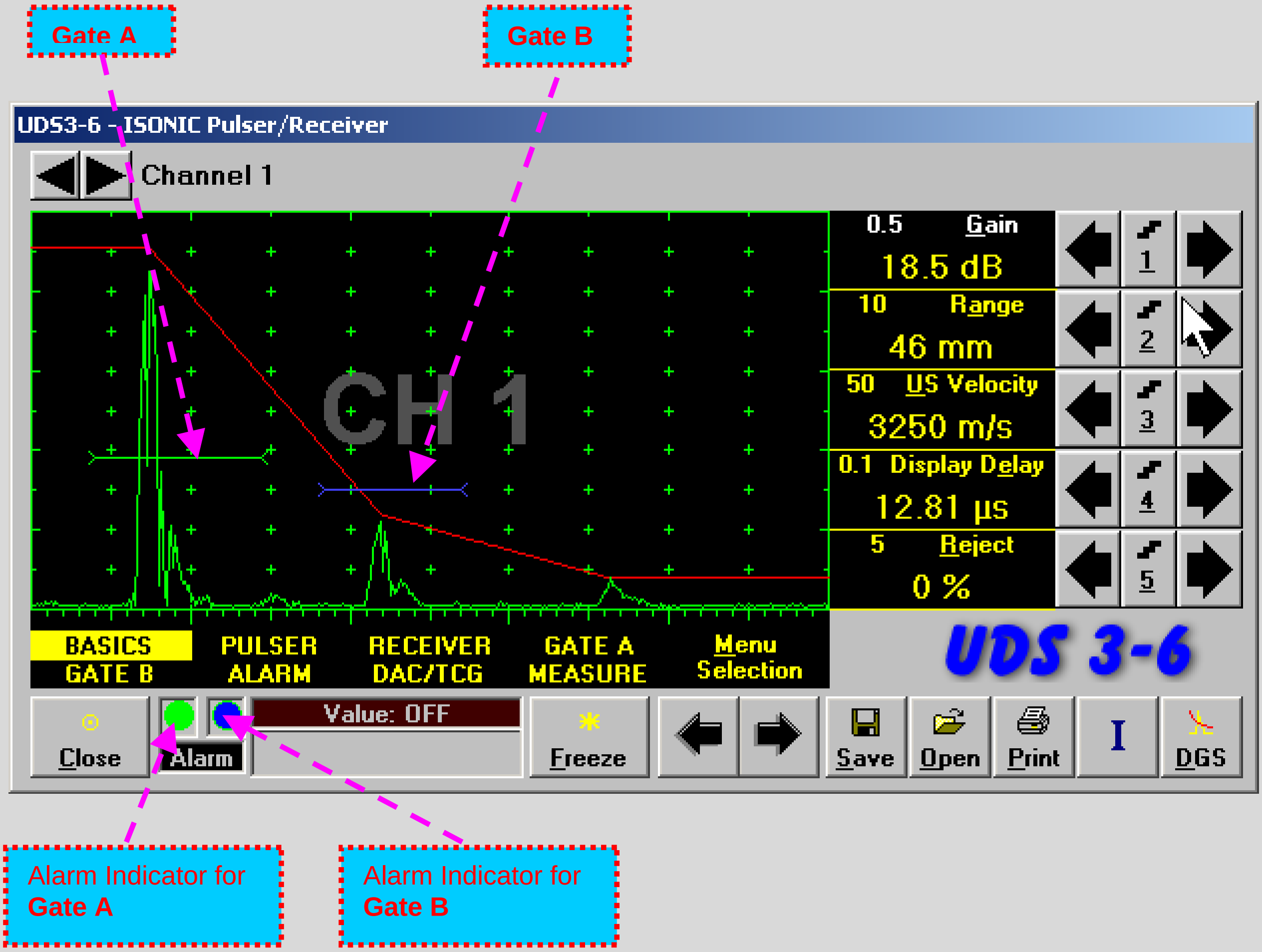
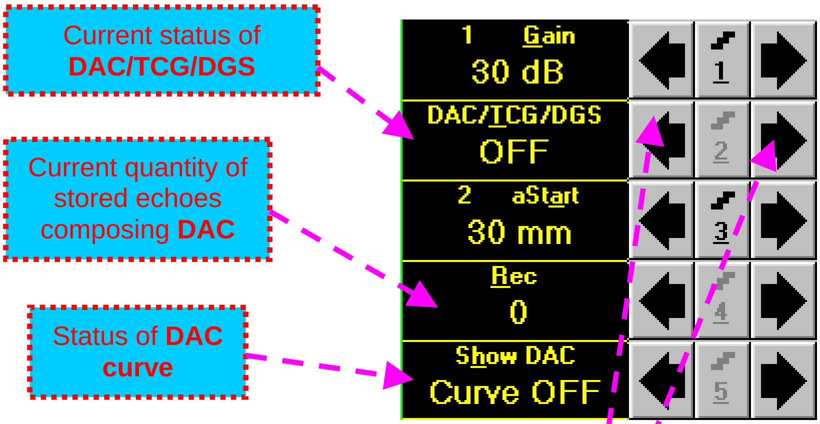
Alarm Example



- 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

5.2.9.1 ISONIC 2008 with Software Release Dated July, 2010 or Earlier



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

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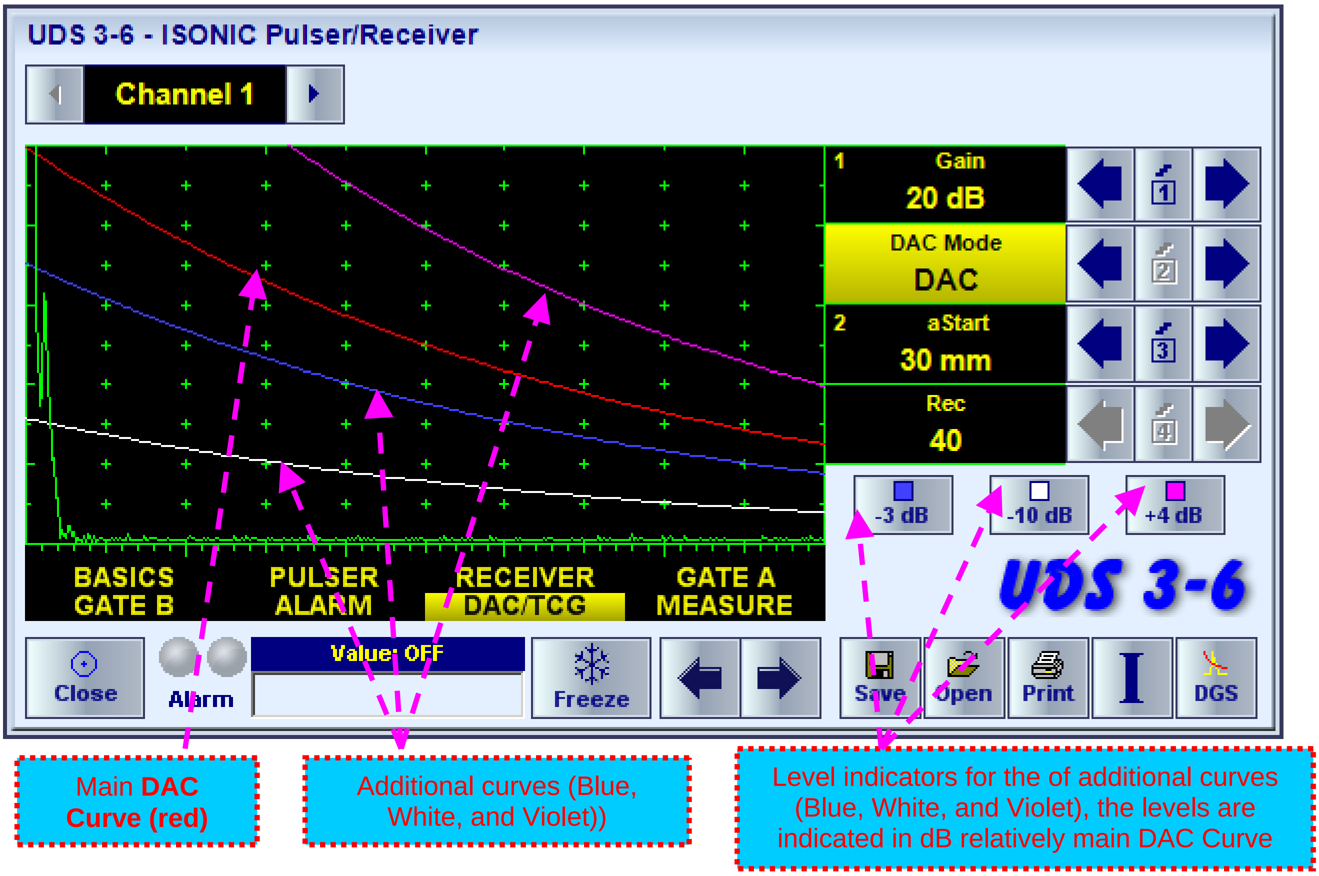
- There are four possible modes for **DAC/TCG**:
  - There are four possible modes for **DAC/TCG**:
    - **OFF** - **DAC Curve** switches automatically to **OFF** while in **OFF**
    - **DAC** - available if quantity of stored echoes is 2 (two) or more. **DAC Curve** switches automatically to **ON** 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

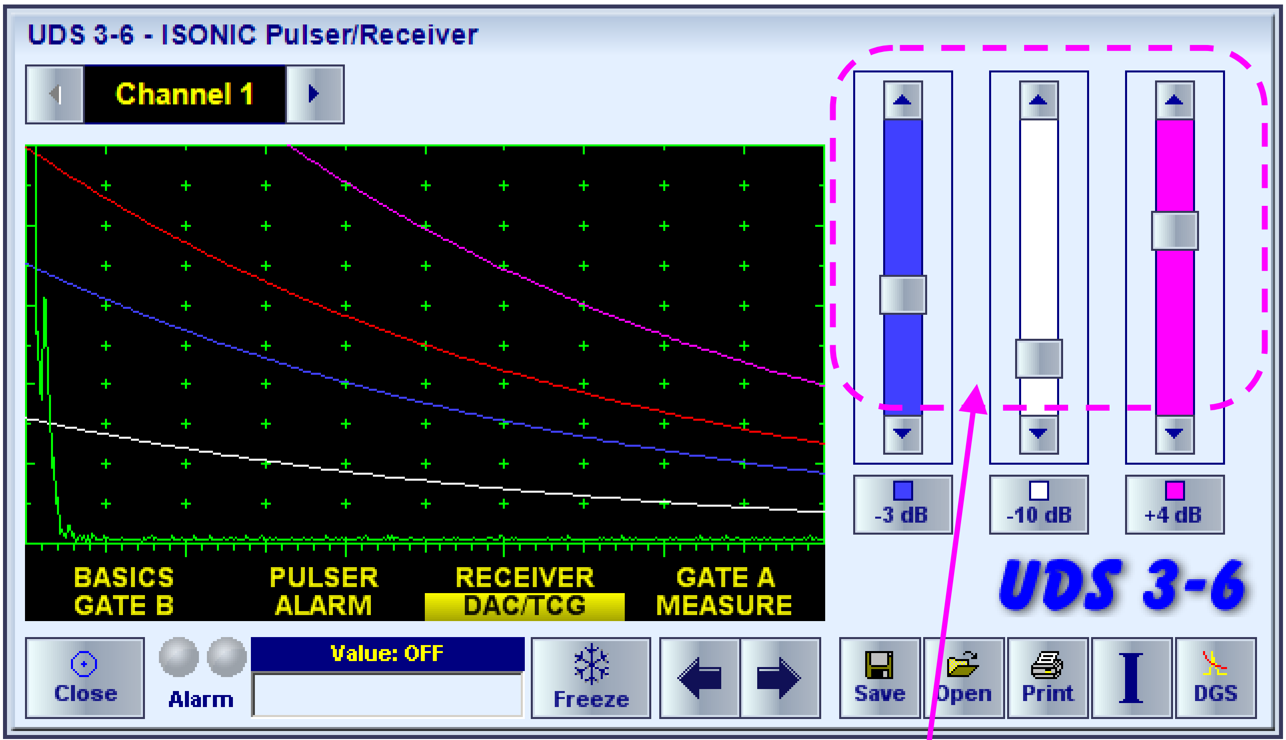
5.2.9.2 ISONIC 2008 with Software Release Dated August, 2010 or Later

Control of **ISONIC 2008** instruments with software release dated Aug, 2010 or later for DAC / TCG / DGS functions is identical to earlier SW releases except the new ability of managing up to 3 independently controllable DAC curves in addition to the main one:



To control levels of the additional DAC curves click on one of three indicators as above, for example on 

. The following screen appears:



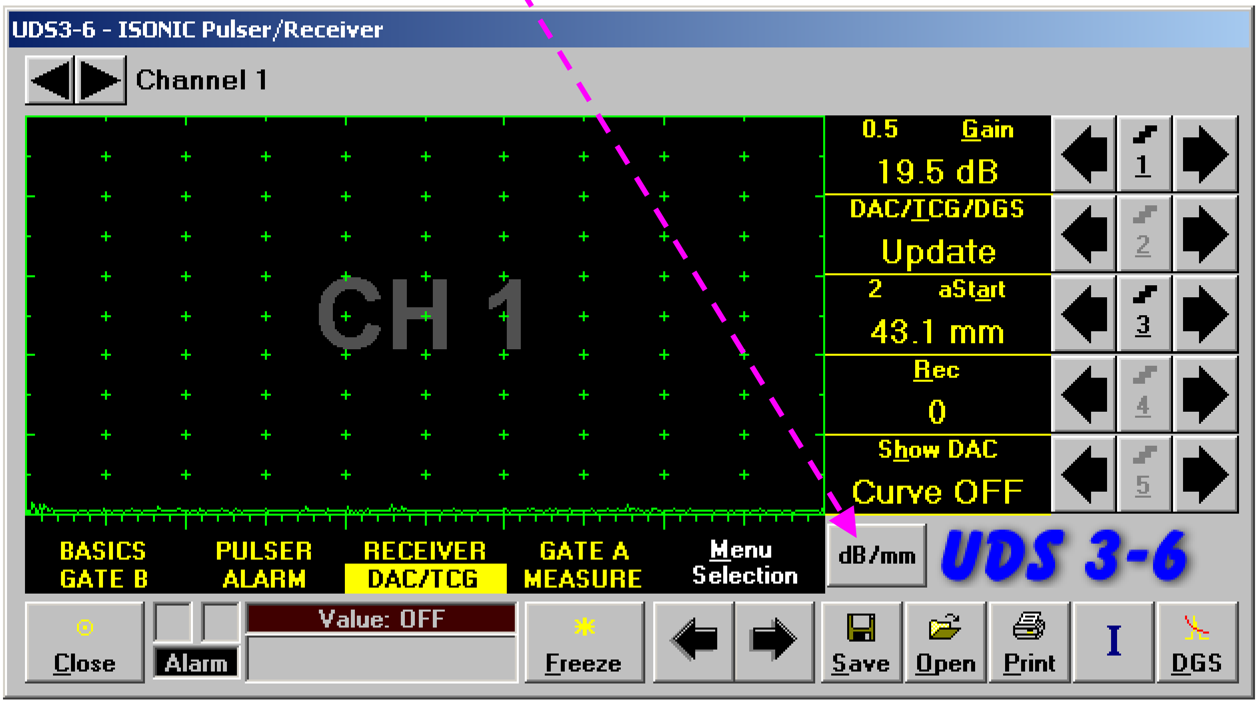
The level of each additional DAC curve is controlled through clicking on arrow buttons in the corresponding sliding bar. On completion click on a level indicator

5.2.10. Create / Modify DAC

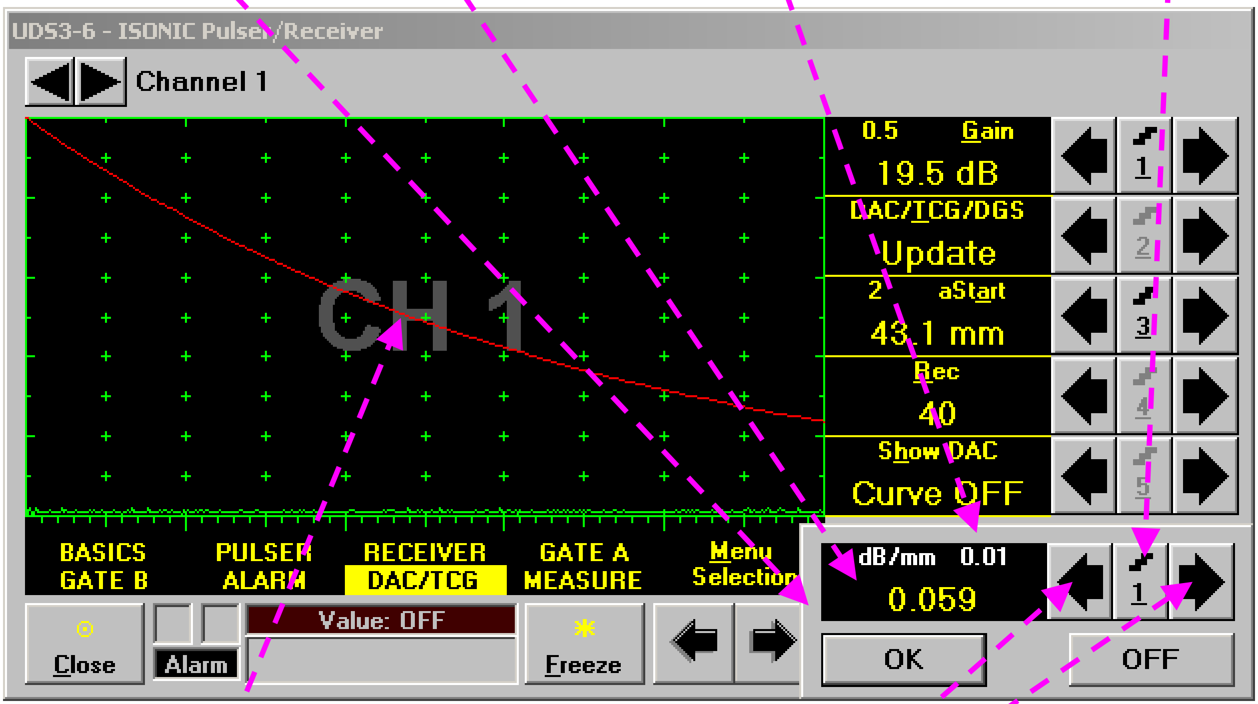
5.2.10.1 Theoretical DAC: dB/mm (dB/in)

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



Popup subwindow appears:



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

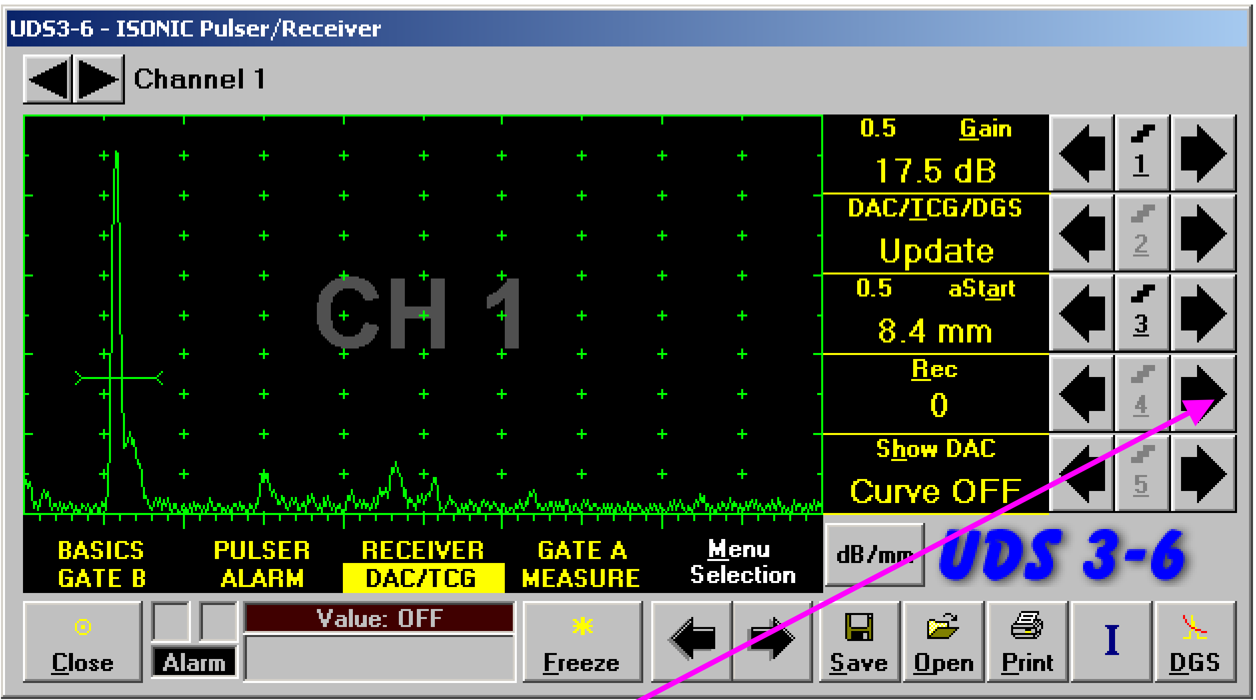
- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard

On completing **dB/mm** (**dB/in**) factor setting click on OK or press Enter on front panel keyboard **Enter** on external keyboard. This will return to main operating surface of **UDS 3-6** Pulser 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

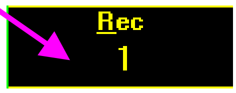
If theoretical **DAC** is active then it must be switched off according to paragraph 5.2.10.1 of this Operating Manual prior to building of experimental **DAC**. Switch on **Gate A** then set **DAC/TCG/DGS** to **Update**. Place probe onto **DAC** calibration block and maximize echo from the reflector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



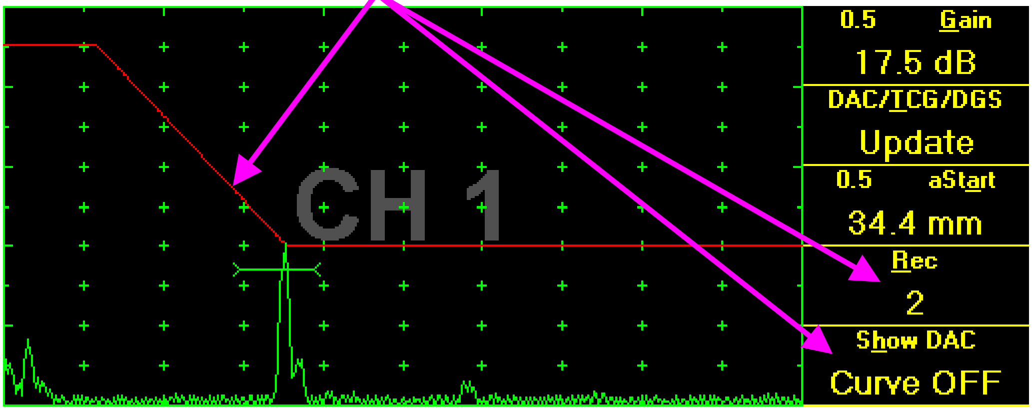
To capture *DAC echo* the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click on
- **Keyboard**
  - Press 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



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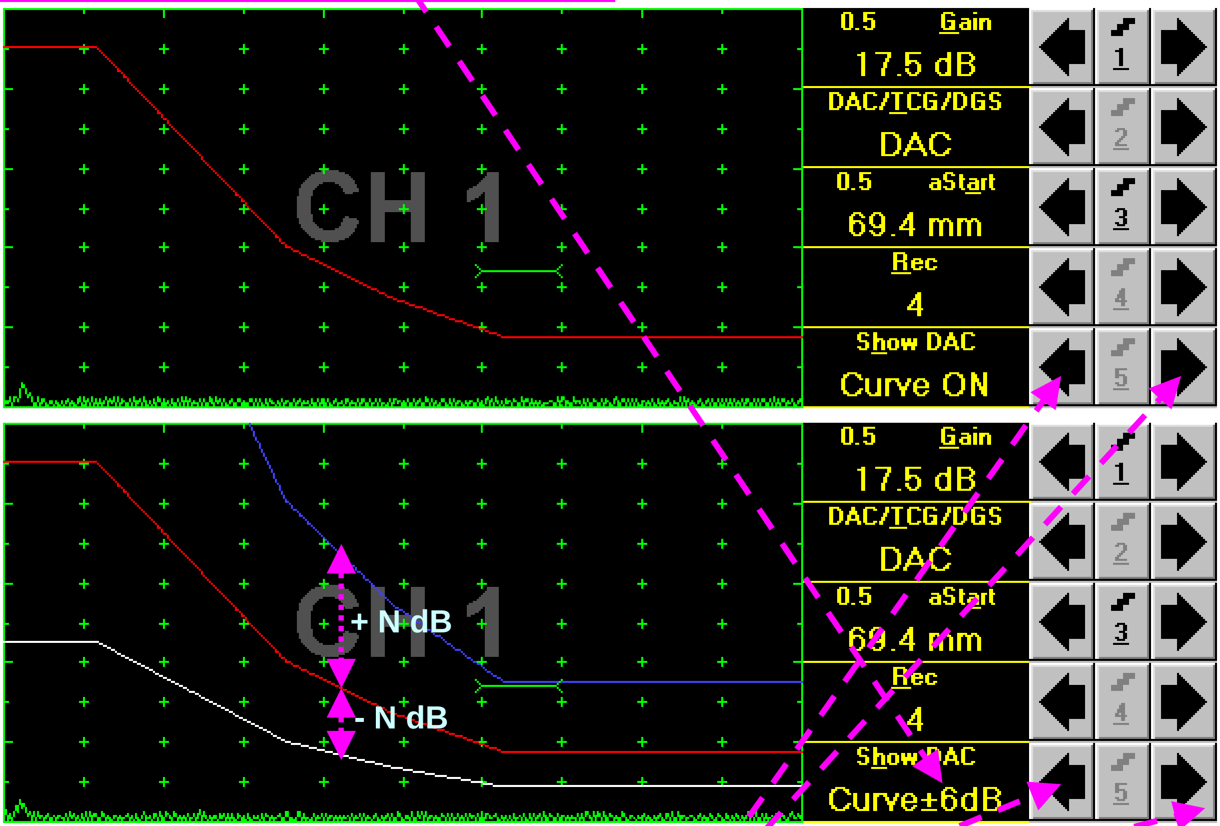
- The highest echo in the **Gate A** will be stored said echo may either exceed **Gate A** threshold level or not
- Stored echo must be below 100% of **A-Scan** height
- A total number of 40 echoes may be stored one by one by the same way as described above

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 ± N dB**, where **N may be setup either as 2, 4, 6, 8, 10, 12, or 14 dB**. To proceed follow the rules below:

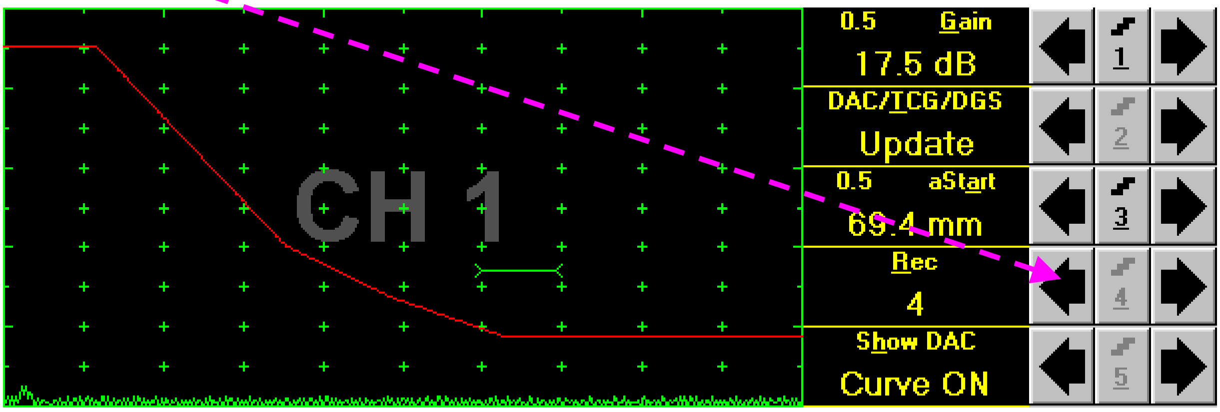


- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press on front panel keyboard or **F5** or **<Alt>+<H>** on external keyboard ⇒ **Show DAC** fore color changes to white - then use , , , on front panel keyboard or ⇑, →, ←, ⇓ on external keyboard
- **Combined**
  - Click on **Show DAC** ⇒ **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**:

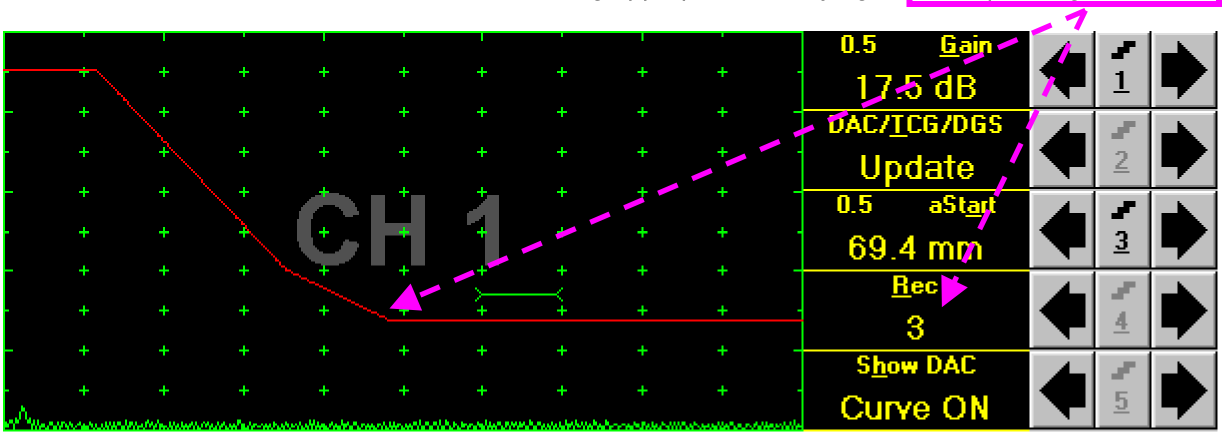
To erase the last stored echo from the **DAC** the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click on



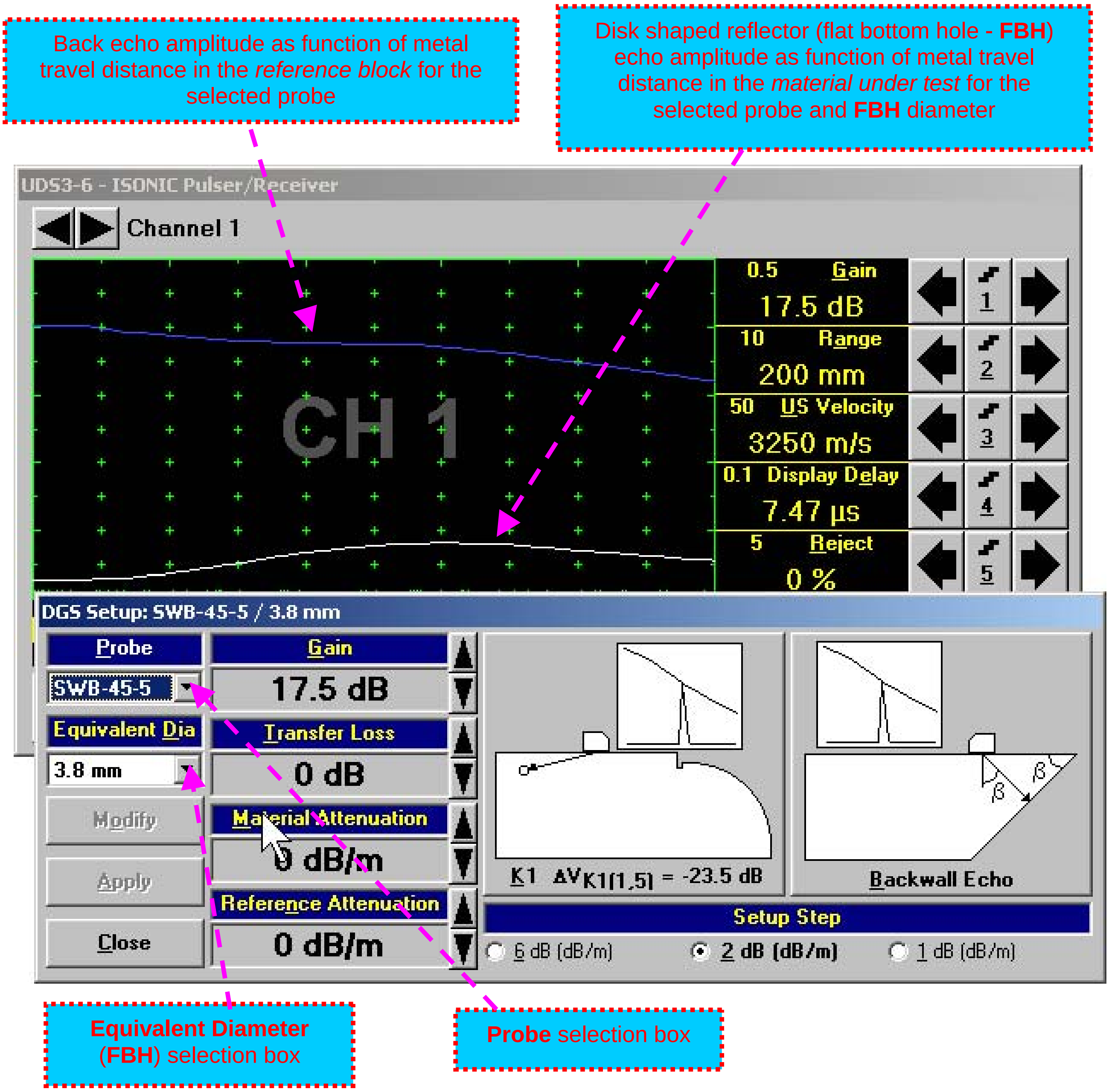
- **Keyboard**
  - Press [4] on front panel keyboard or F4 or <Alt>+<R> on external keyboard ⇒ **Rec** fore color changes to white - then use [←], [↓] on front panel keyboard or ←, ⇓ on external keyboard
- **Combined**
  - Click on **Rec** ⇒ **Rec** fore color changes to white - then use [←], [↓] on 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 DGS or press DGS on front panel keyboard or **F9** or **<Alt>+<D>** on external keyboard. The following screen appears:

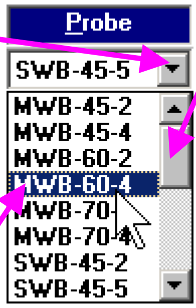


To activate **DGS** follow the steps below:

<u>Step 1: Probe Selection</u>

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

- **Mouse / Touch Screen**
  - Click on
  - Scroll probes list to see the selected one



  - Click on selected probe

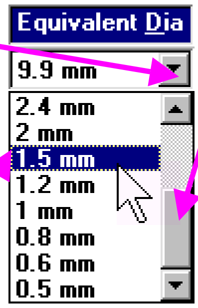
- **Keyboard**
  - Press **<Alt>+<P>** on external keyboard ⇒ **<u>P</u>robe** fore color changes to white – then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard

- **Combined**
  - Click on **<u>P</u>robe** ⇒ **<u>P</u>robe** 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
  - Scroll diameters list to see the selected one



  - Click on selected equivalent diameter

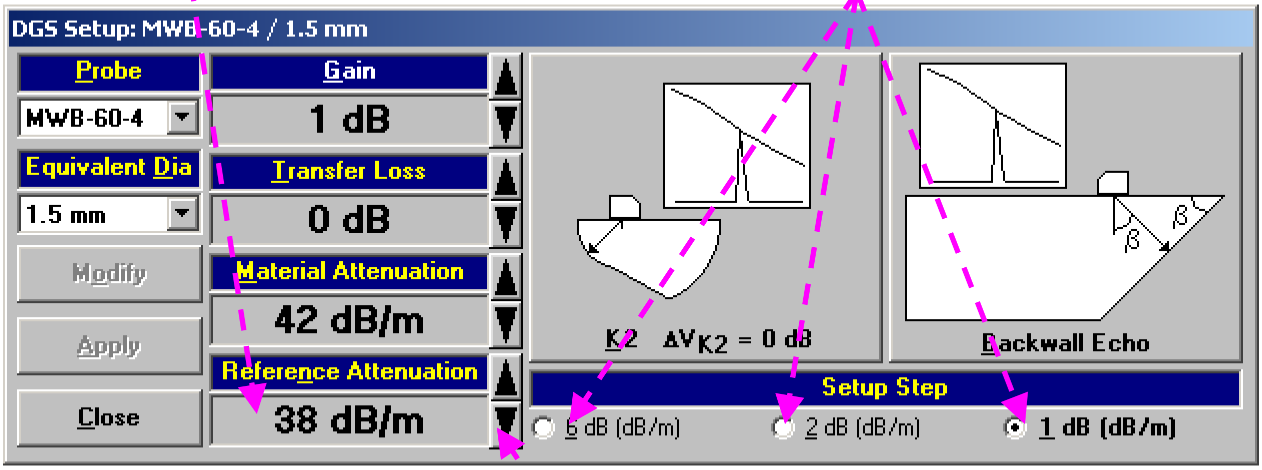
- **Keyboard**
  - Press **<Alt>+<D>** on external keyboard ⇒ **Equivalent Dia** fore color changes to white – then use , , ,  on front panel keyboard or ↑, →, ←, ↓ on external keyboard

- **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: ⦿



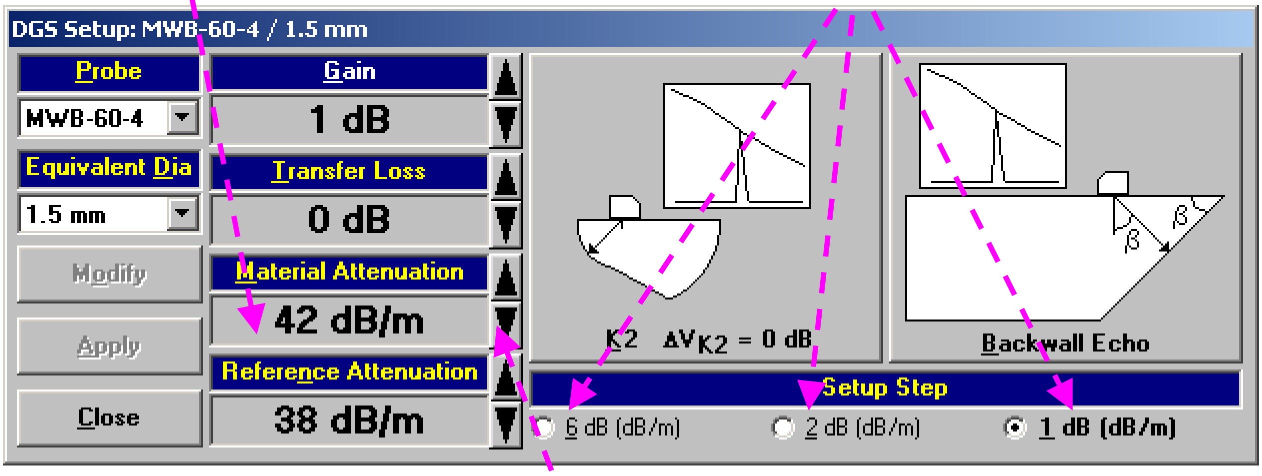
The following manipulations are applicable:

- **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

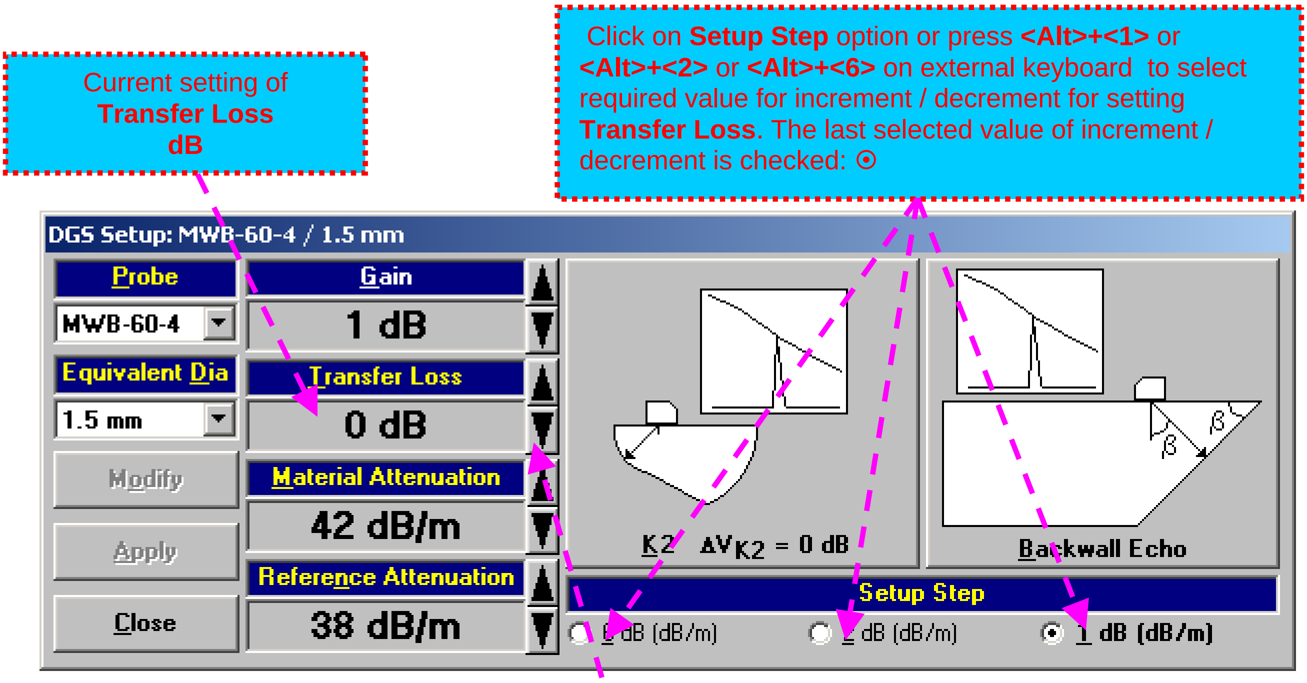
Click on **Setup Step** option or press **<Alt>+<1>** or **<Alt>+<2>** or **<Alt>+<6>** on external keyboard to select required value for increment / decrement for setting **Material Attenuation**. The last selected value of increment / decrement is checked: ⦿



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



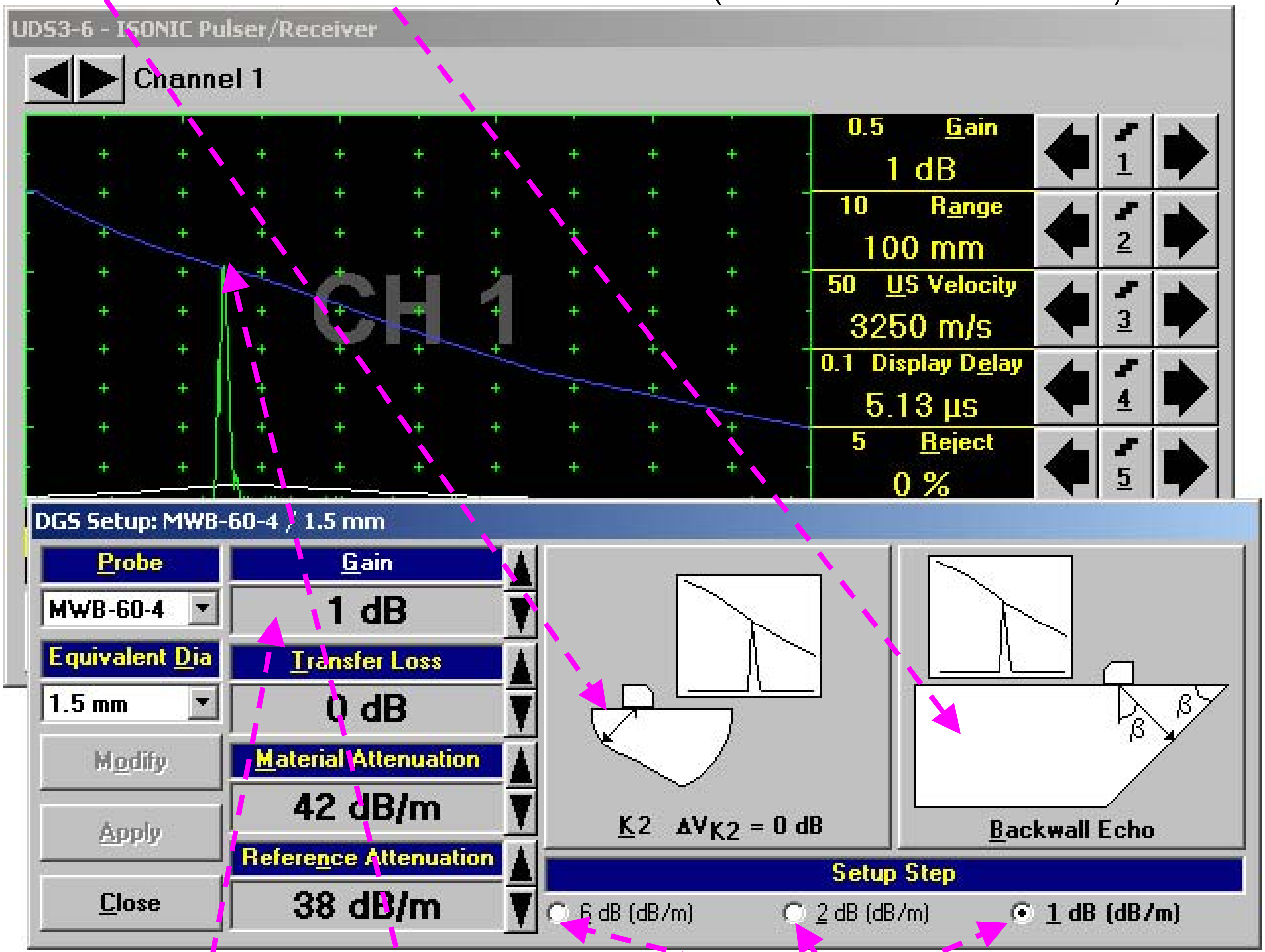
The following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press **<Alt>+<T>** on external keyboard ⇒ **Transfer Loss** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **Transfer Loss** ⇒ **Transfer 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:

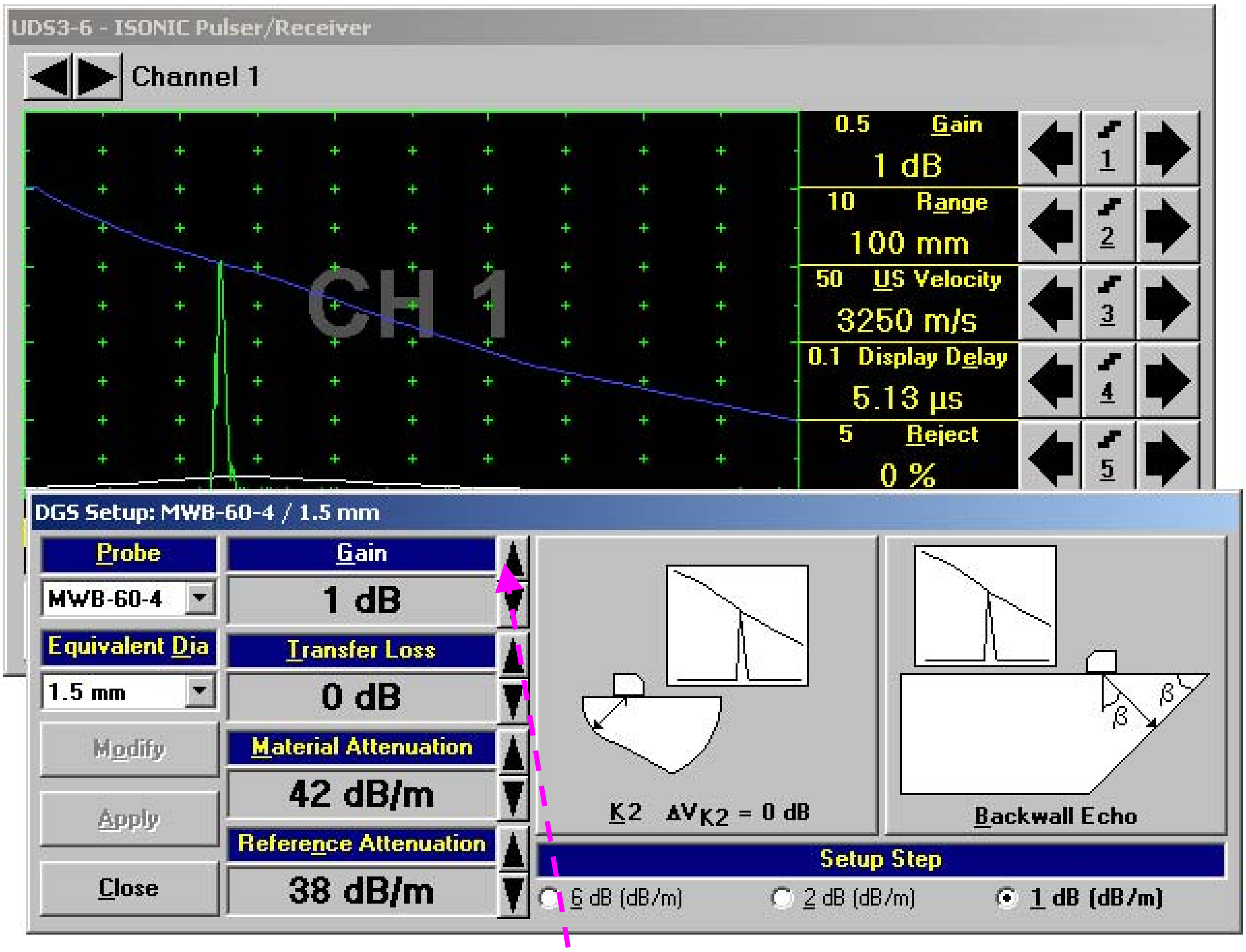
- K1 or K2 reference block (reference block and reflector are defined in the probe data sheet and reproduced automatically from the **DGS** data base upon probe selection)
- Inclined reference block (reference reflector – back surface)



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:

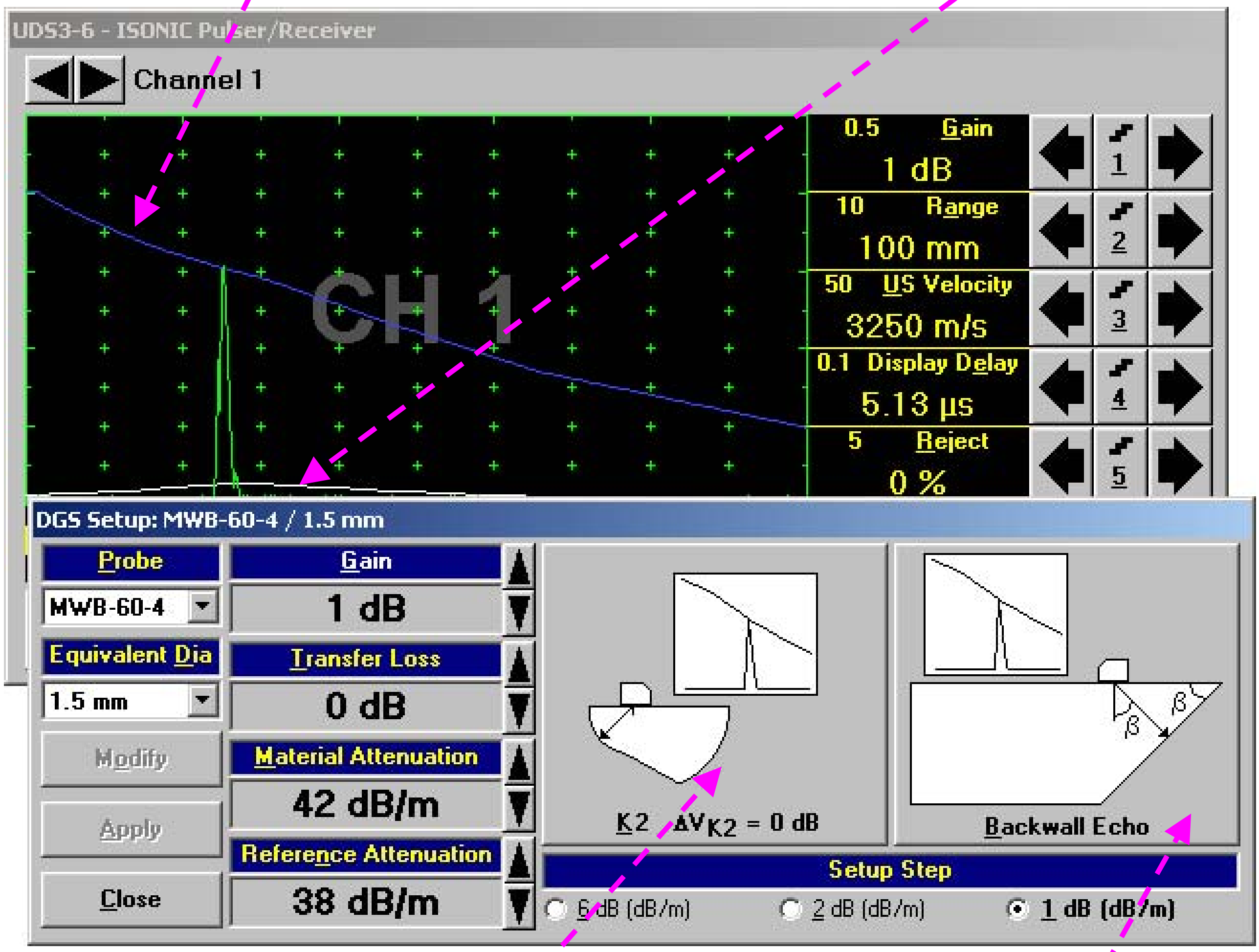
- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press **<Alt>+<G>** on external keyboard ⇒ **Gain** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **Gain** ⇒ **Gain** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard

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:

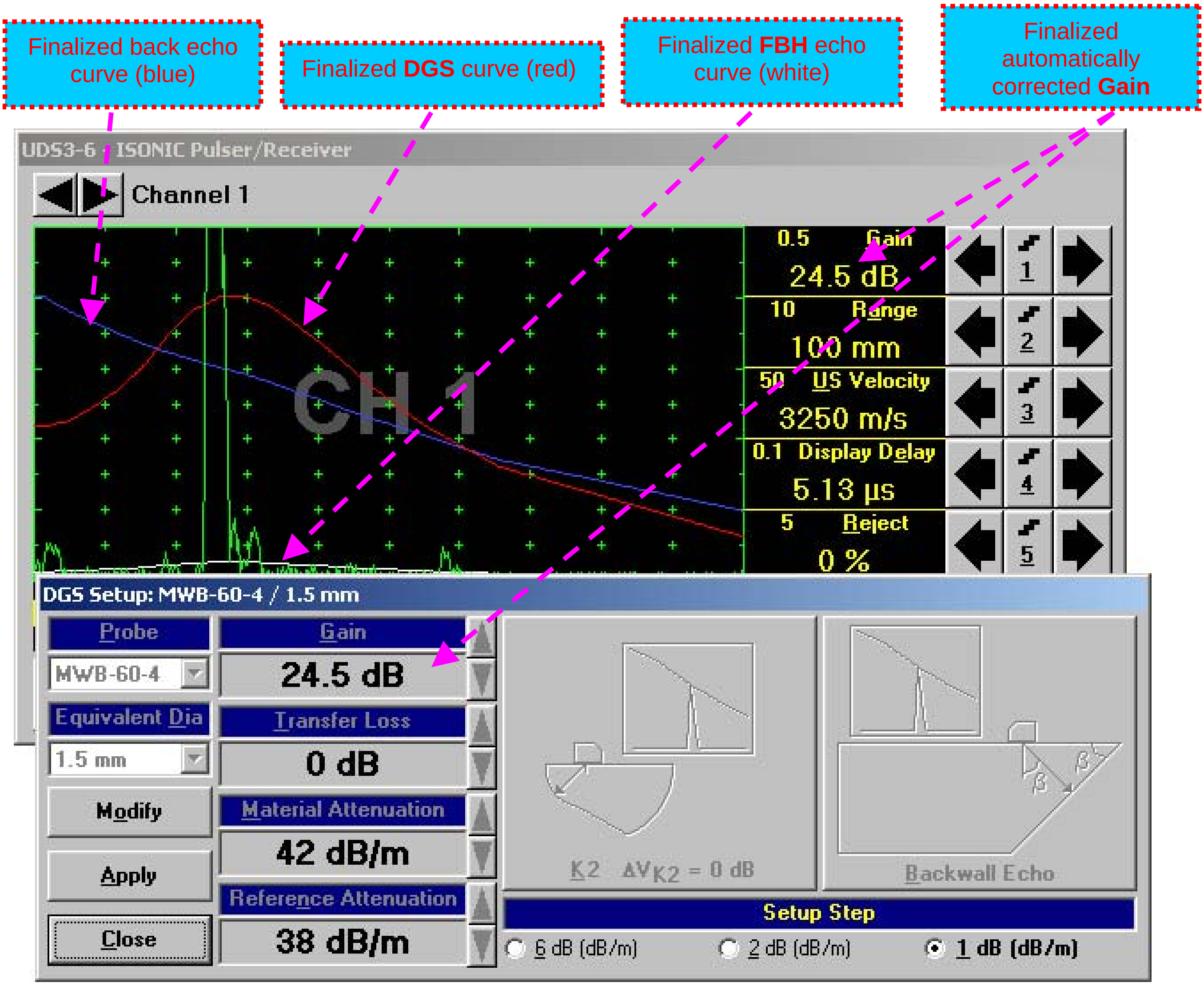
Case 1 (K1 or K2 reference block)

- **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>+<B>** on external keyboard

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



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

- **Mouse / Touch Screen**
  - Click on **Apply**

  then
  - Click on **Close**

- **Keyboard**
  - Press **<Alt>+<A>** on external keyboard, then **Esc** or **<Alt>+<C>** or ESC 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 **Modify**

  then

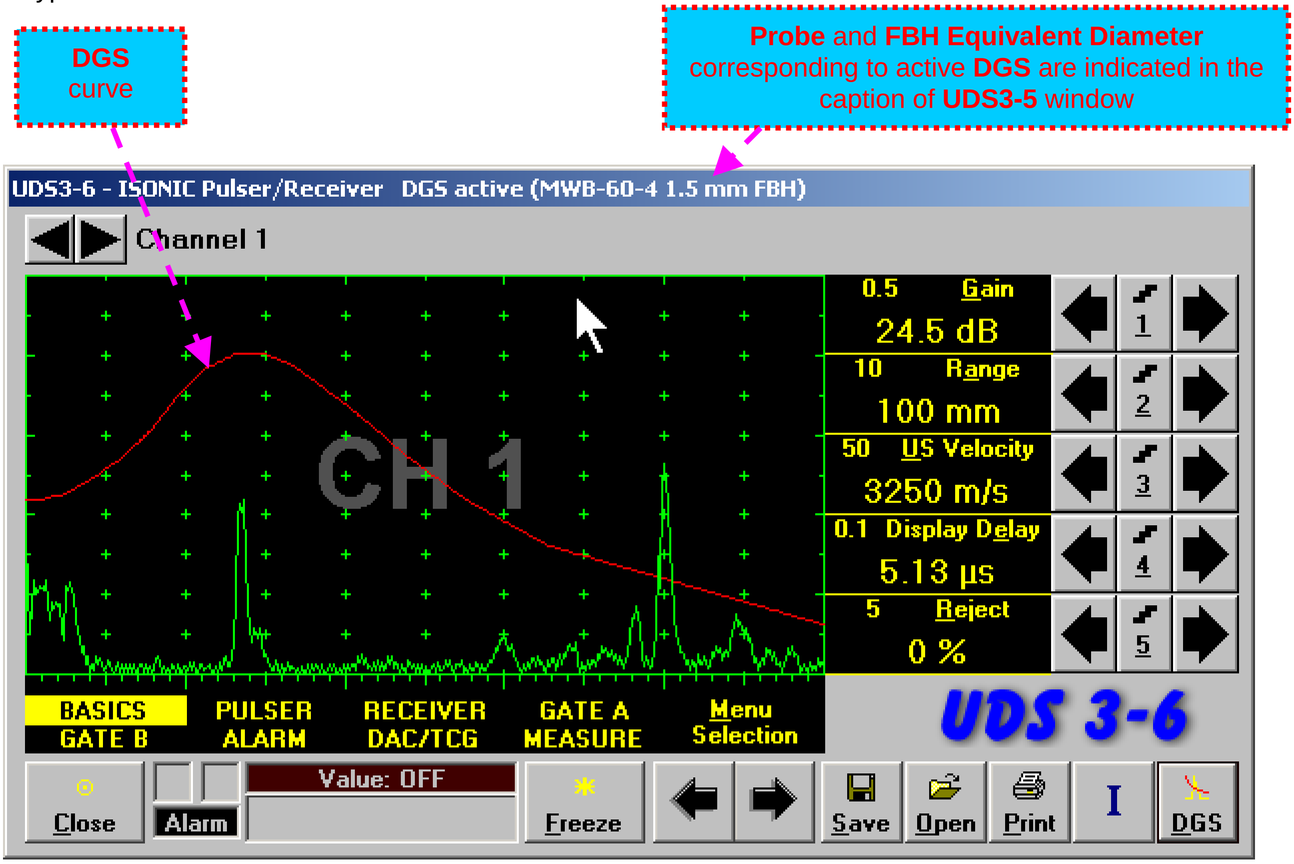
  - ■ Click on **Close**
- **Keyboard**
  - ■ Press **<Alt>+<O>**on external keyboard, then **Esc** or **<Alt>+<C>** or  on front panel keyboard

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

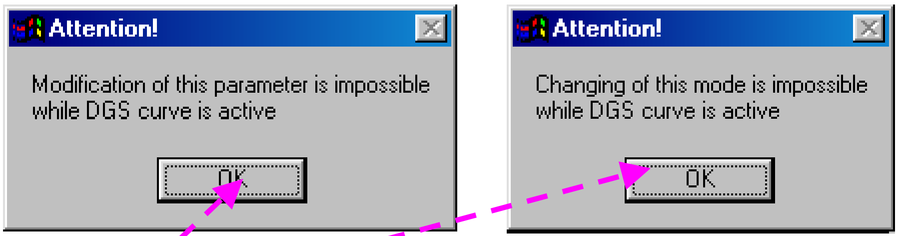
- **Mouse / Touch Screen**
  - ■ Click on **Modify**
- **Keyboard**
  - ■ Press **<Alt>+<O>** on external keyboard

Step 8: Work whilst DGS is active

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



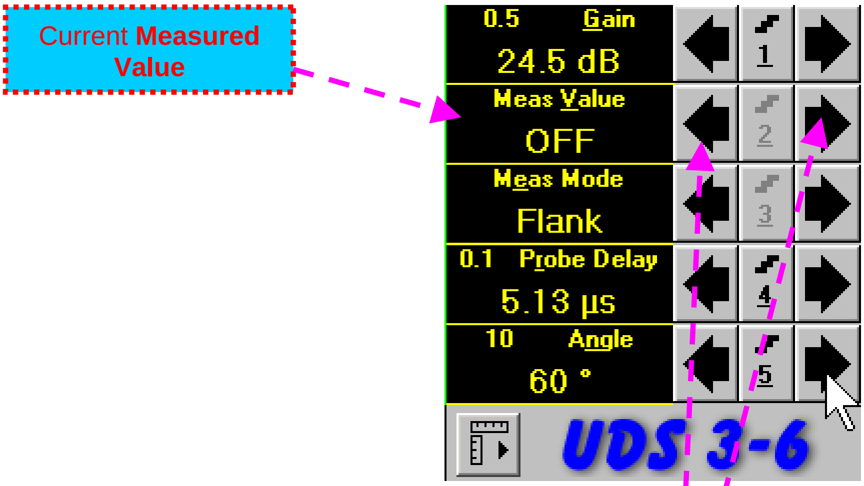
Some parameters and modes may not be modified whilst **DGS** is active - corresponding messages appear if attempting to modify:



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

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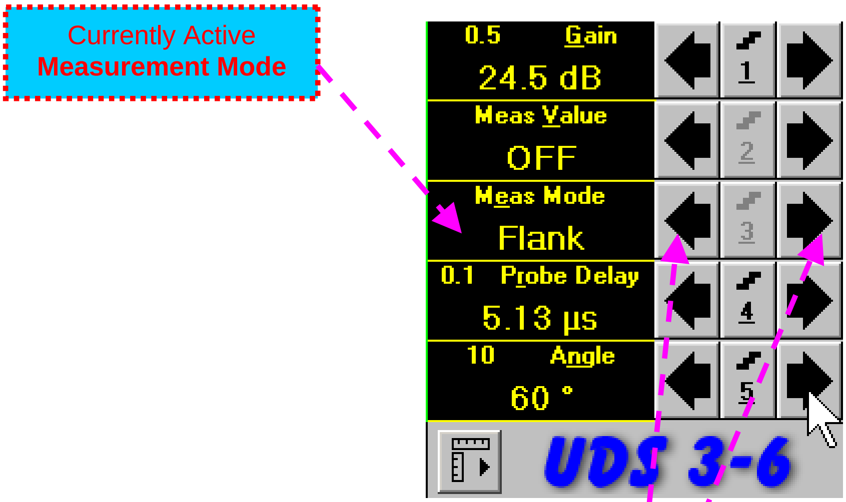
Refer to paragraph 5.2.13 of this Operating Manual for information about values available for automatic measurement and indication in the **Value Box (Digital Readout)**



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

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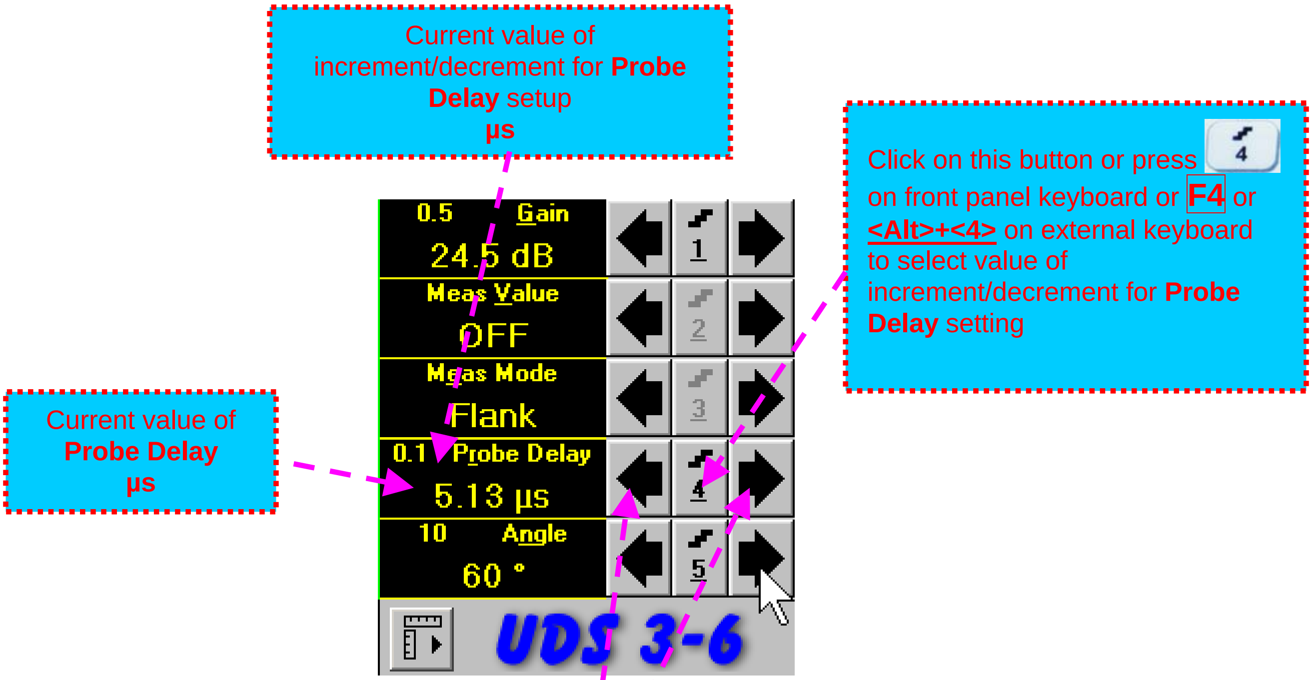
There are four Measurement Modes possible:

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

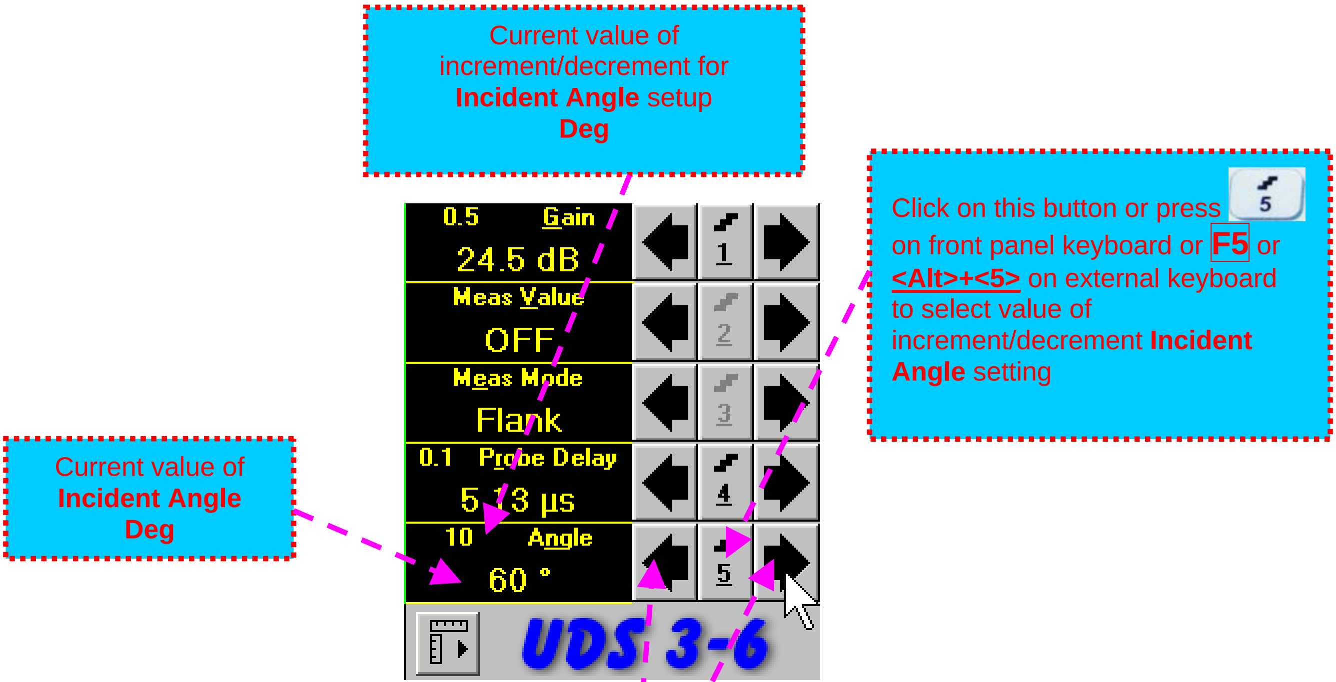
Refer to paragraph 5.2.13 of this Operating Manual for further information



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 ⇒ **Probe Delay** fore color changes to white - then use , , , on front panel keyboard or ⇑, ⇒, ⇐, ⇓ on external keyboard
- **Combined**
  - Click on **Probe Delay** ⇒ **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

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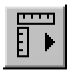
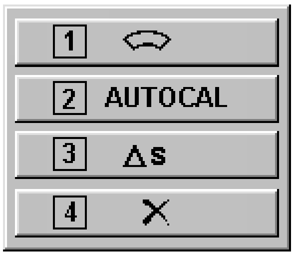
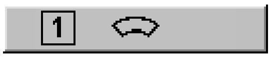
Refer to paragraph 5.2.13 of this Operating Manual for some hints on determining and / or checking **Probe Angle**

Advanced Measurements Settings Menu

Advanced measurement settings are available through button  appearing on the **UDS 3-6** 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

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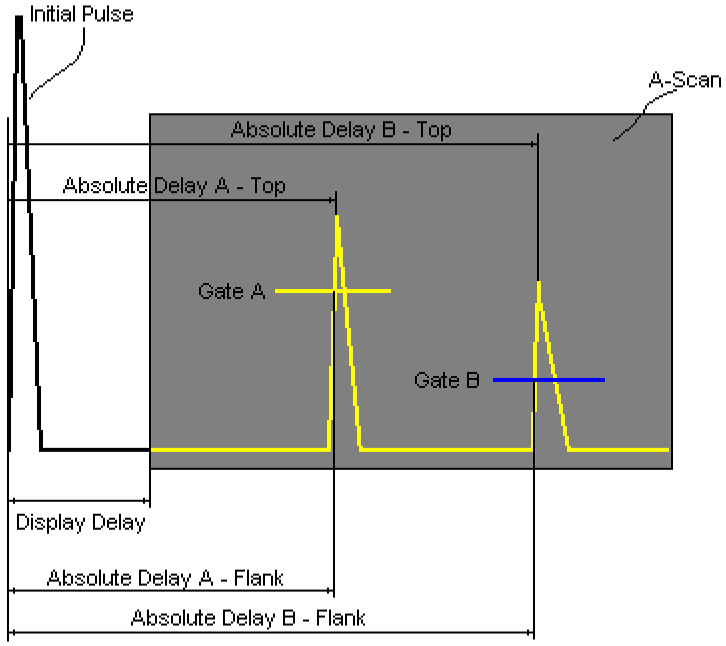
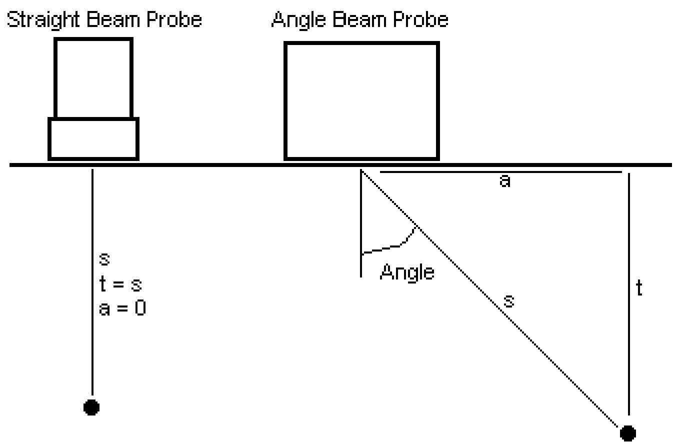
Refer to paragraph 5.2.13.3 of this Operating Manual to get instructed on:

- **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) = Absolute Delay A - 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) = Absolute Delay B - Probe Delay

Value 3: s(A)
Material Travel Distance - **mm** or **in** of an echo matching with **Gate A**:

s(A) = ½ · T(A) · US Velocity

Value 4: s(B)
Material Travel Distance - **mm** or **in** of an echo matching with **Gate B**:

s(B) = ½ · T(B) · 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) · sin (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) · sin (Angle)

Value 7: t(A)
Depth - **mm** or **in** of reflector returning an echo matching with **Gate A**:

t(A) = s(A) · cos (Angle)

Value 8: t(B)
Depth - **mm** or **in** of reflector returning an echo matching with **Gate B**:

t(B) = s(B) · cos (Angle)

Value 9: ΔT - μs:

ΔT = T(B) – T(A)

Value 10: Δs - mm or **in**:

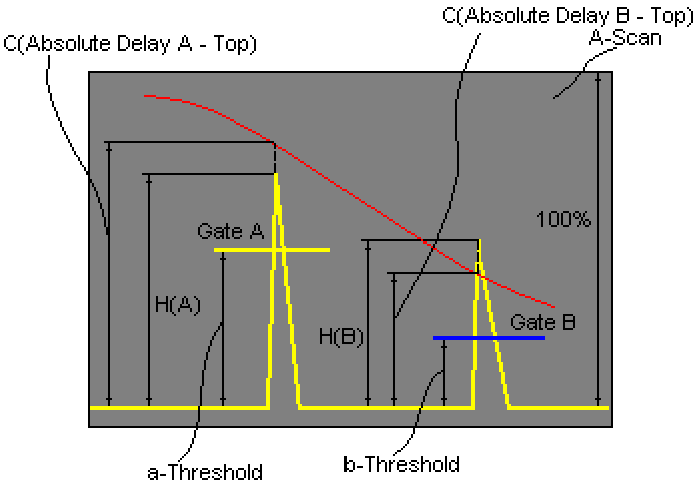
Δs = s(B) – s(A)

Value 11: Δa - mm or **in**:

Δa = a(B) – a(A)

Value 12: Δt - mm or **in**:

Δt = 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: ΔVC(A) (**dB to DAC**) – **dB**:

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

Value 19: ΔVC(B) (**dB to DAC**) – **dB**:

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

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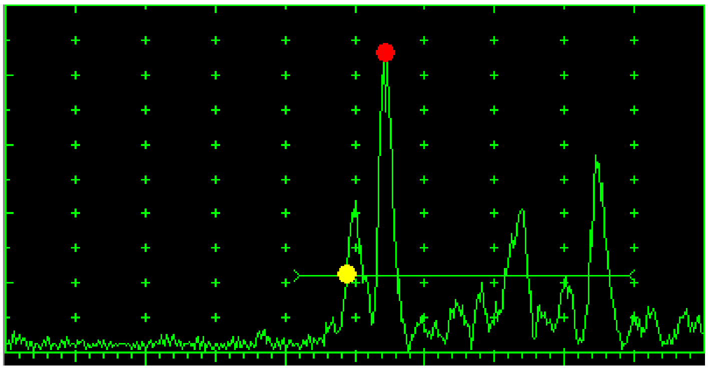
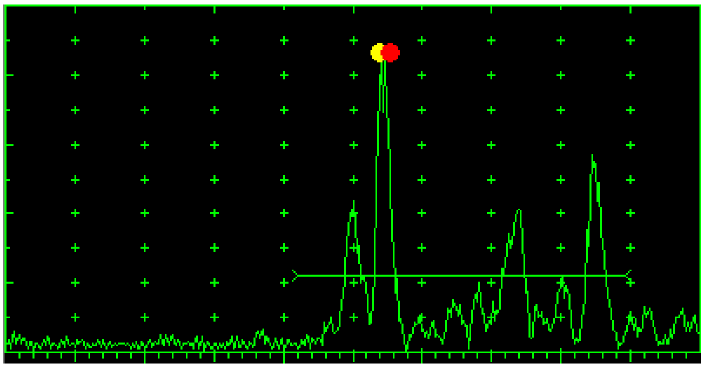
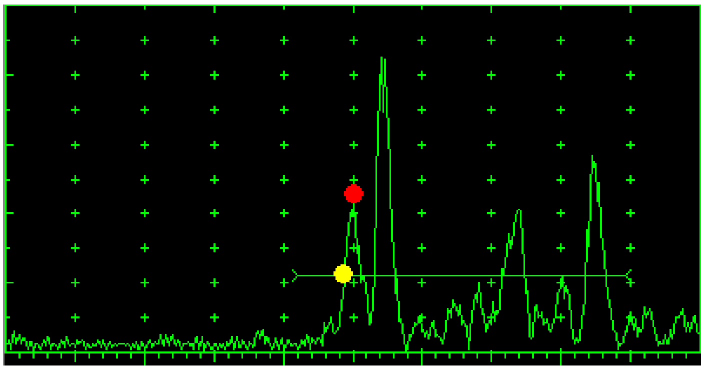
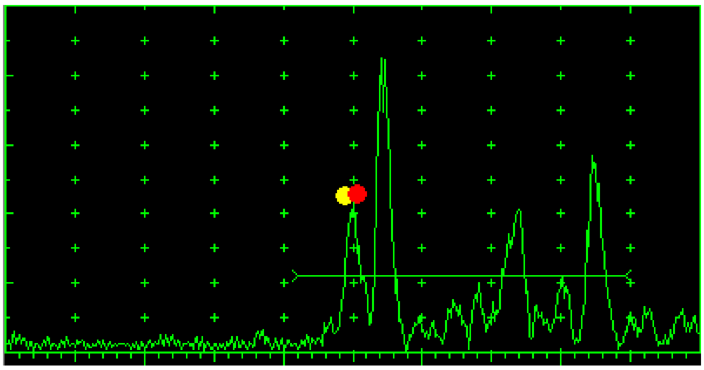
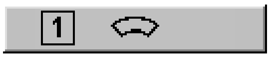
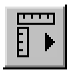
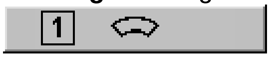
- To proceed corresponding **Gate** or both **Gates** to be active
- **ΔVC(A)** (**dB to DAC**) measurements require active **DAC/DGS**
- Amplitude measurements of echoes may be performed provided their heights don't exceed 200% of **A-Scan** height
- For 2 and more echoes matching with a **Gate** - 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**
 **● - 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)**	
 **● - 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)**	
 **● - 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)**	
 **● - 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)**	

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^{o} 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

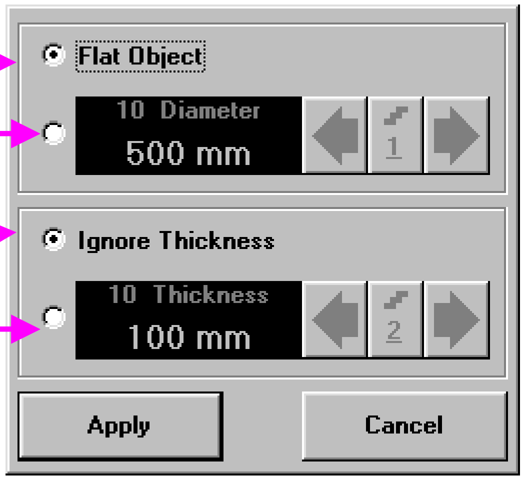
- **Flat** – click here

  Or
- **Curved** – click here

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

- **Ignored** – click here

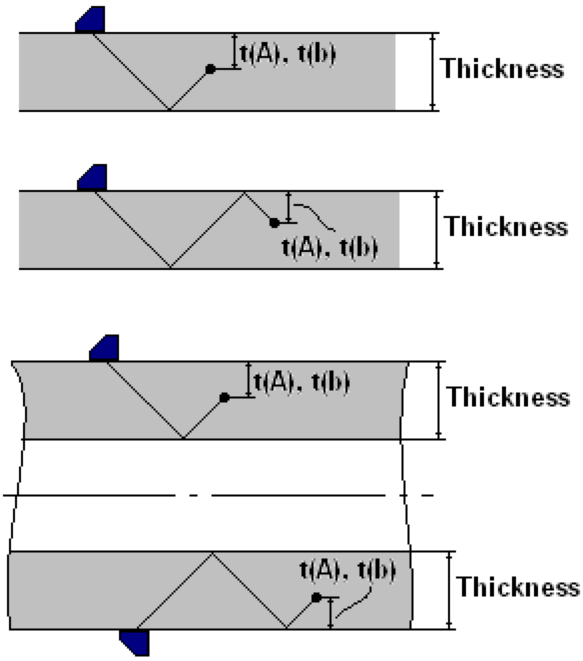
  Or
- **Entered** – click here

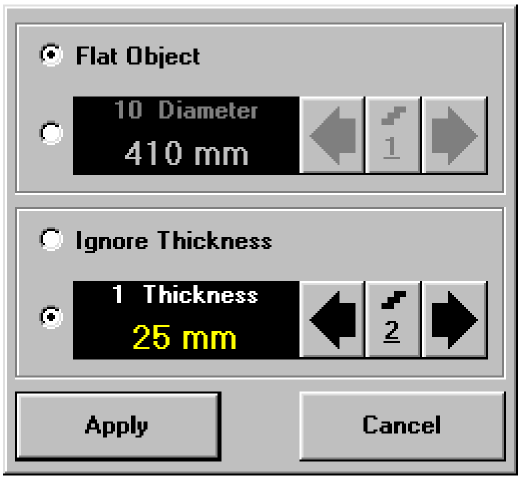


Case 1

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

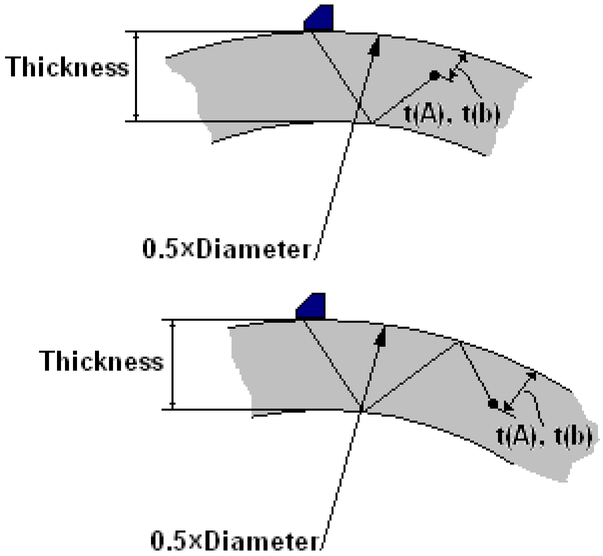
Case 2 represents scanning above plate, or scanning above tubular object longitudinally. Reflectors depth for half skip, full skip, and multi skip insonification will be determined with respect to actual **Thickness** value – **t(A)**, **t(B)** readings will be in accordance with sketches below:

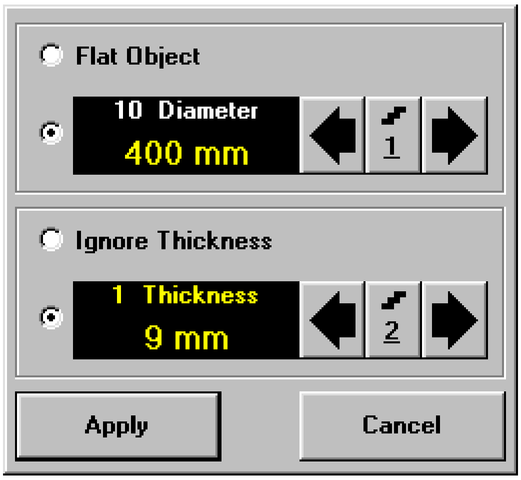




Case 2

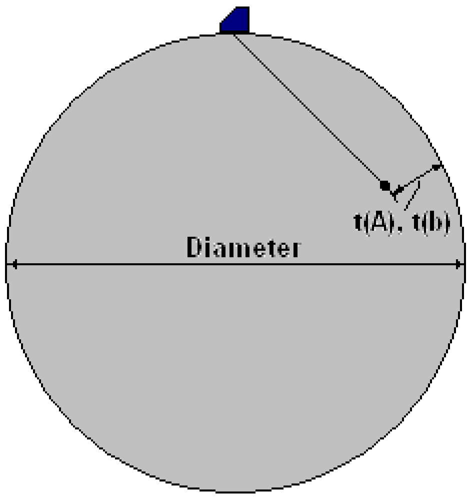
Case 3 represents scanning above curved wall surface circumferentially. Reflectors depth for half skip, full skip, and multi skip insonification will be determined with respect to actual **Thickness** and **Diameter** values – **t(A)**, **t(B)** readings will be in accordance with sketch below:

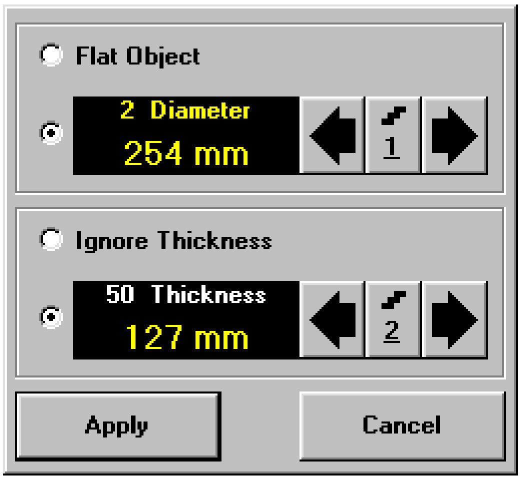




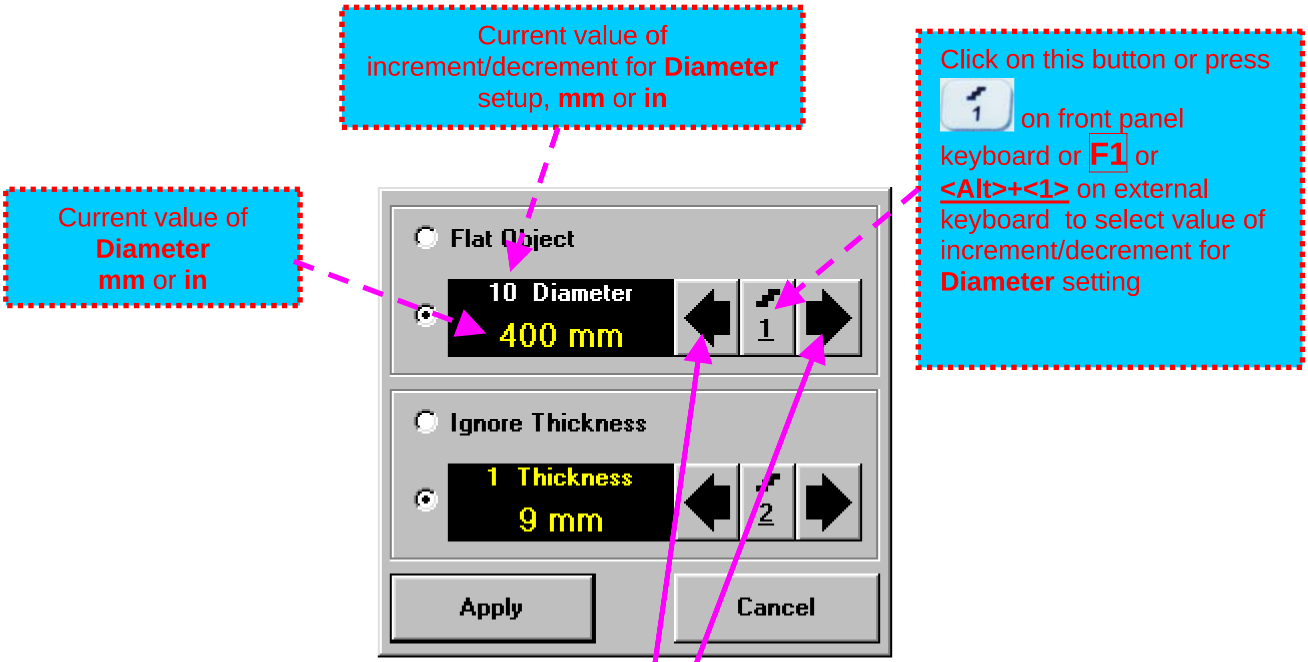
Case 3

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





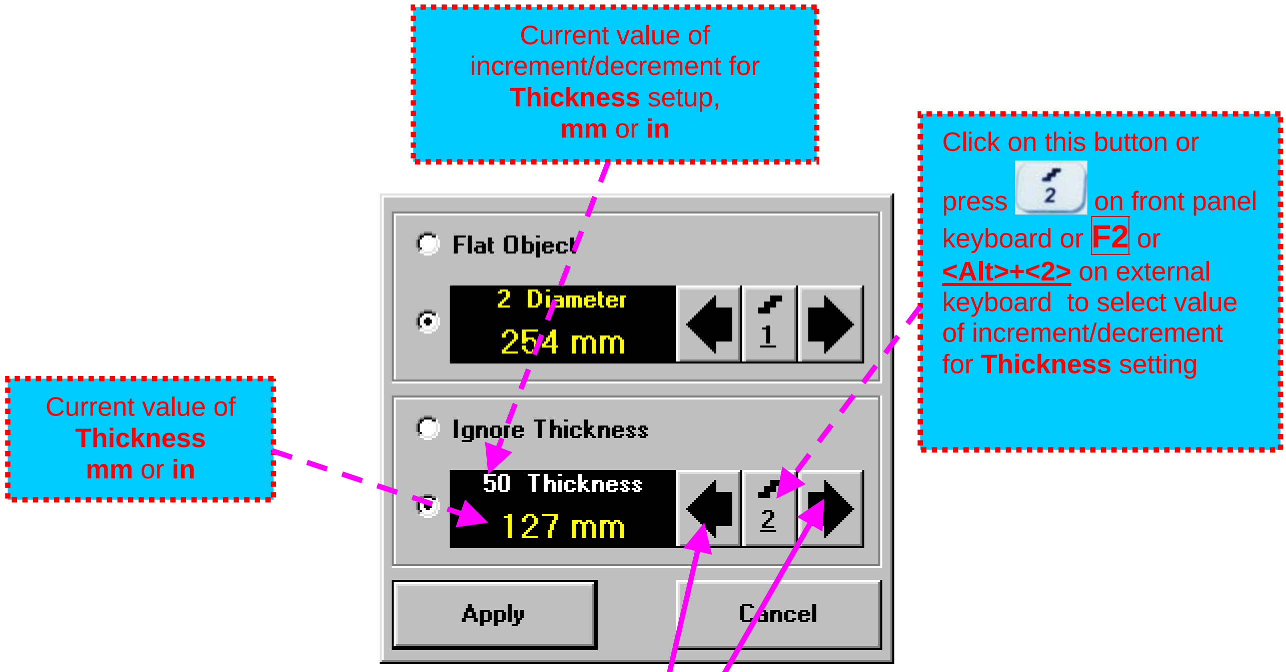
Case 4



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

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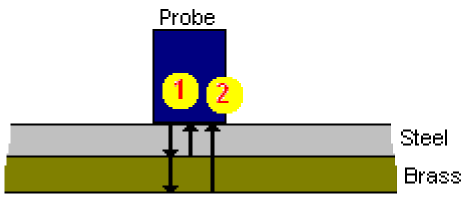
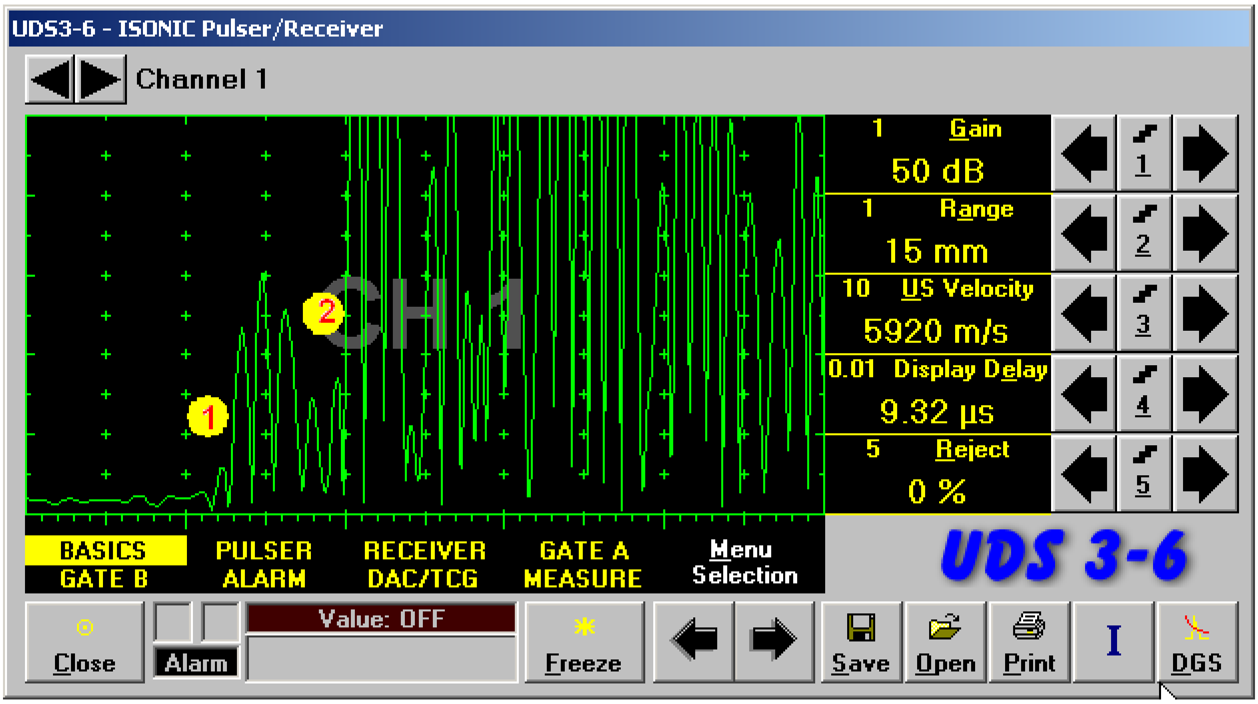
- Click on **Apply** or press on front panel keyboard or **Enter** on external keyboard to activate new settings
- Click on **Cancel** or press on front panel keyboard or **Esc** on external keyboard to negate new settings

5.2.13.4. Dual Ultrasound Velocity Measurement Mode – Typical Example

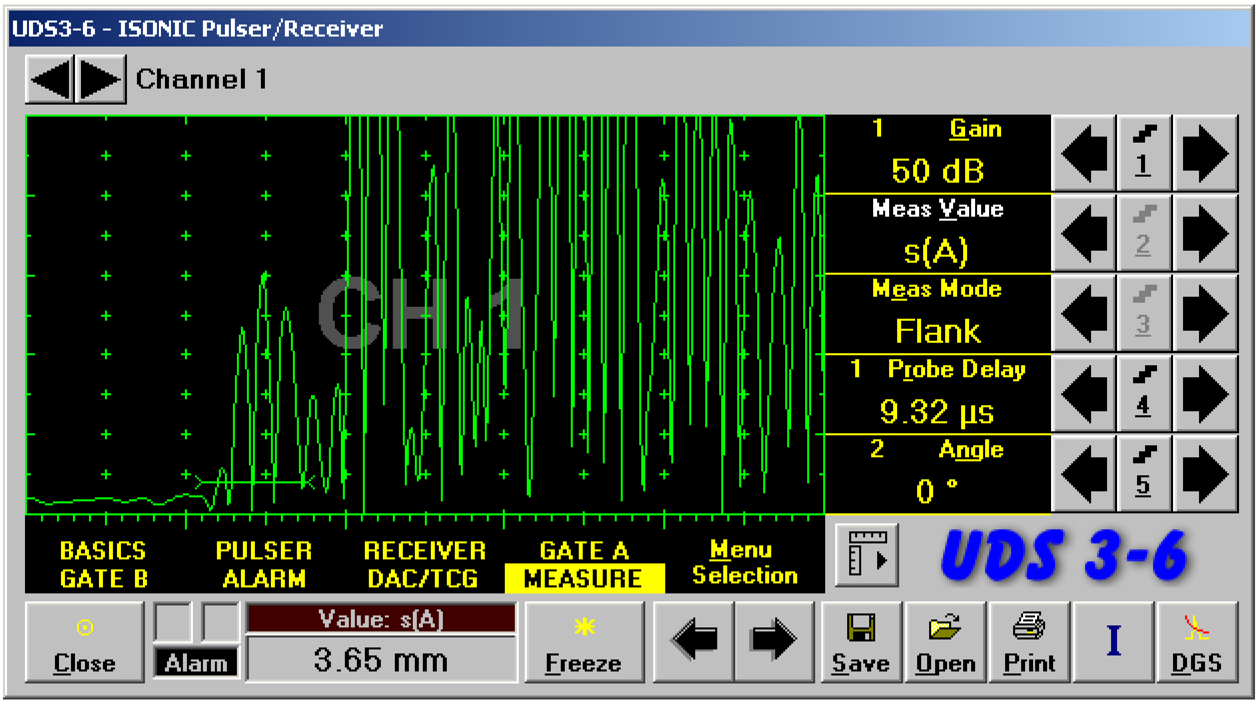
For some practical applications it is necessary to measure sound path distances in dissimilar materials, multi-layer structures, and the like. Also it may occur a need in measuring sound path distances for signals representing various kinds of ultrasonic waves in the same object. Such cases are characterized 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 5 MHz dual element probe with **Probe Delay = 9.32 μs** provides receiving of two clear echoes **1** and **2** form the *steel-to-brass boundary* and from the *back surface of the brass layer* correspondingly:

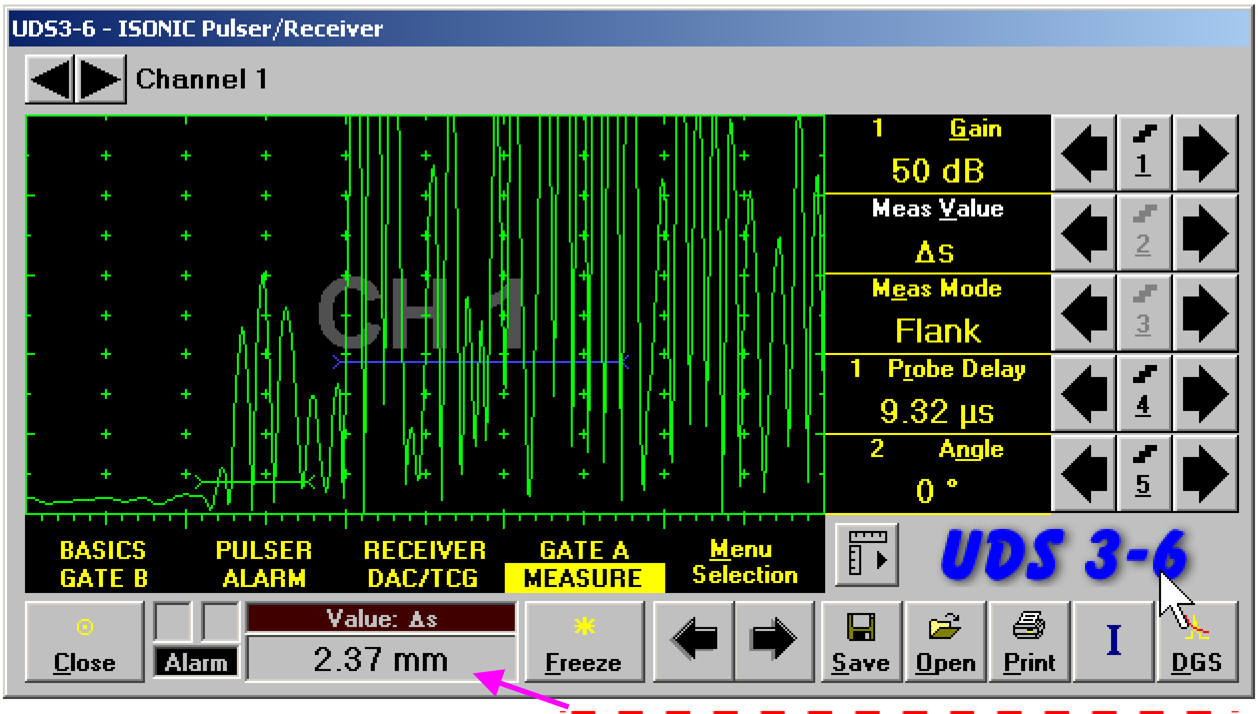




US Velocity setting is suitable for steel and thickness of steel layer may be found through direct reading upon placing **Gate A** above signal **1**:

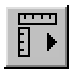


If placing now **Gate B** above signal **2** and selecting **Δs** as **Meas Value** then interval between signals **1** and **2** will be measured. To obtain proper **Δs** readout value of **US Velocity** valid for brass alloy layer (second material) must be keyed in

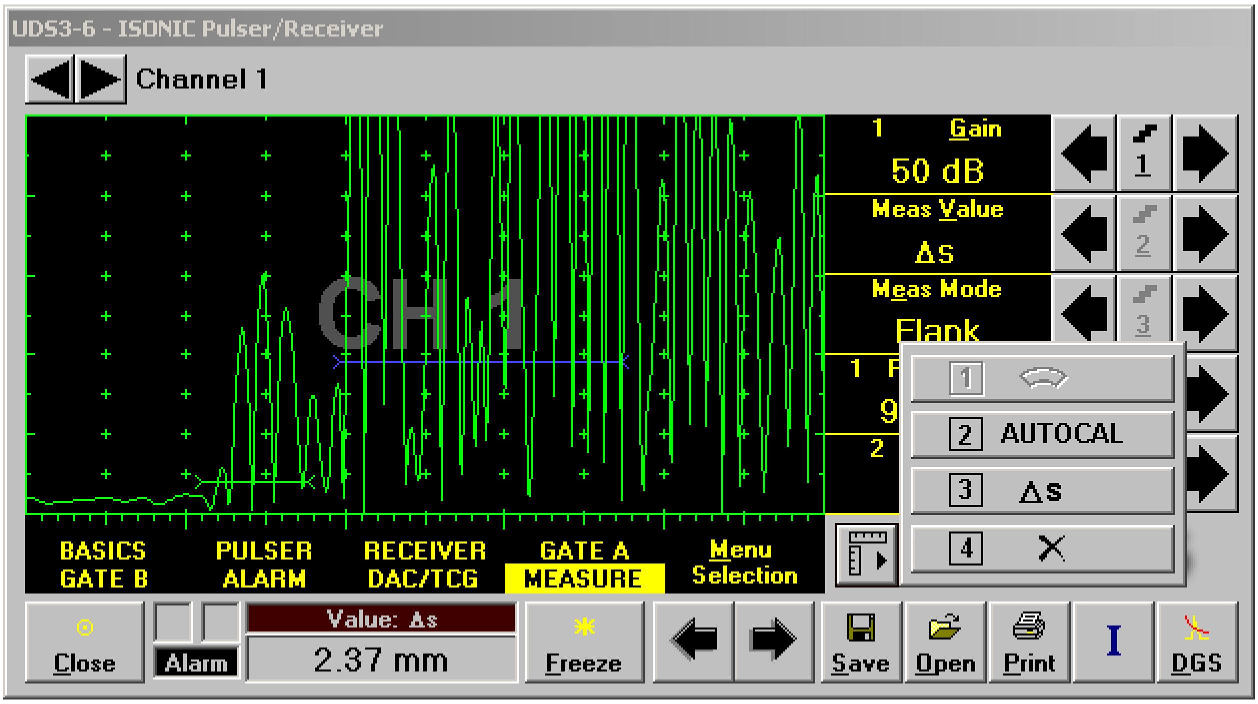


This digital readout was obtained through use of steel **US Velocity** setting (first material) and may not be recognized as a thickness of brass alloy layer (second material)

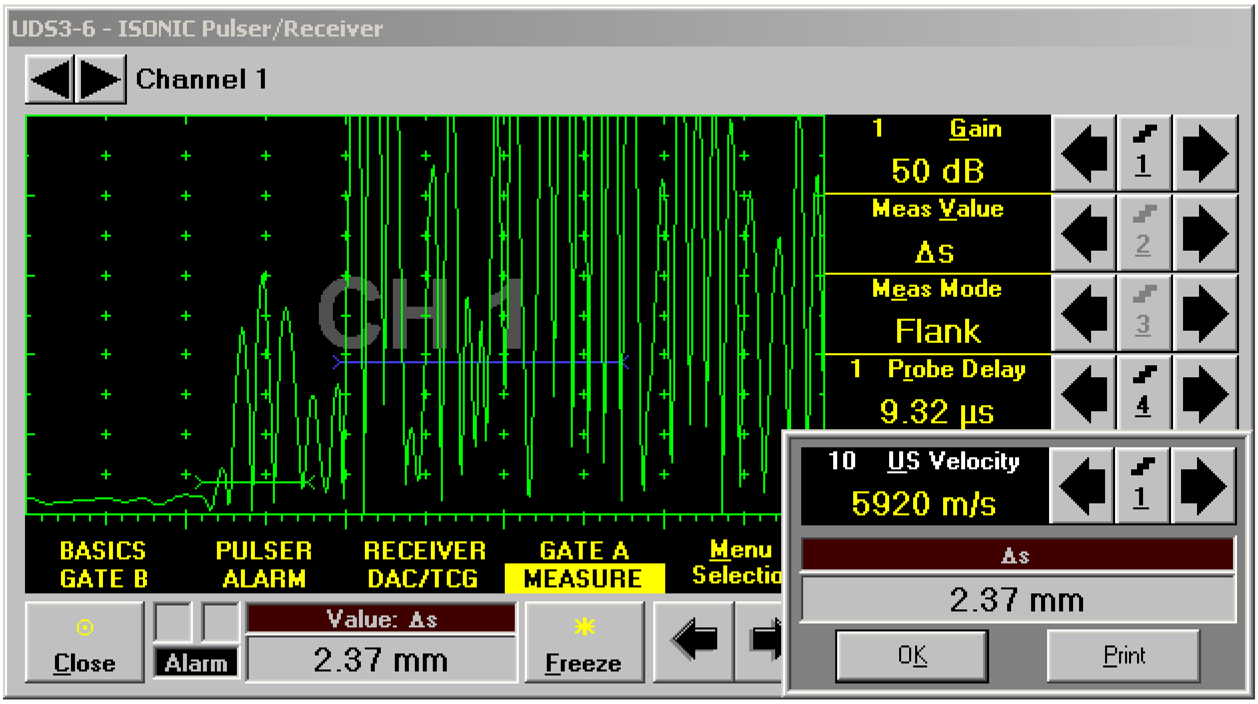
To obtain proper reading for the thickness of brass layer activate **Dual Ultrasound Velocity Measurements Mode -** Button 

becomes available upon clicking on  if:

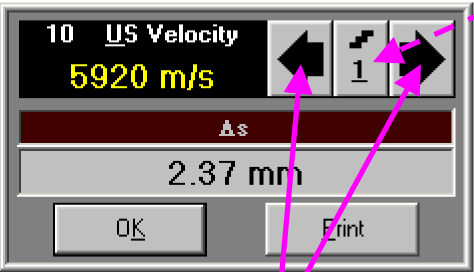
- Both **Gate A** and **Gate B** are active (refer to paragraphs 5.2.5 and 5.2.6 of this Operating Manual)
- **Meas Value** setting is **Δs** (refer to paragraph 5.2.12 of this Operating Manual)



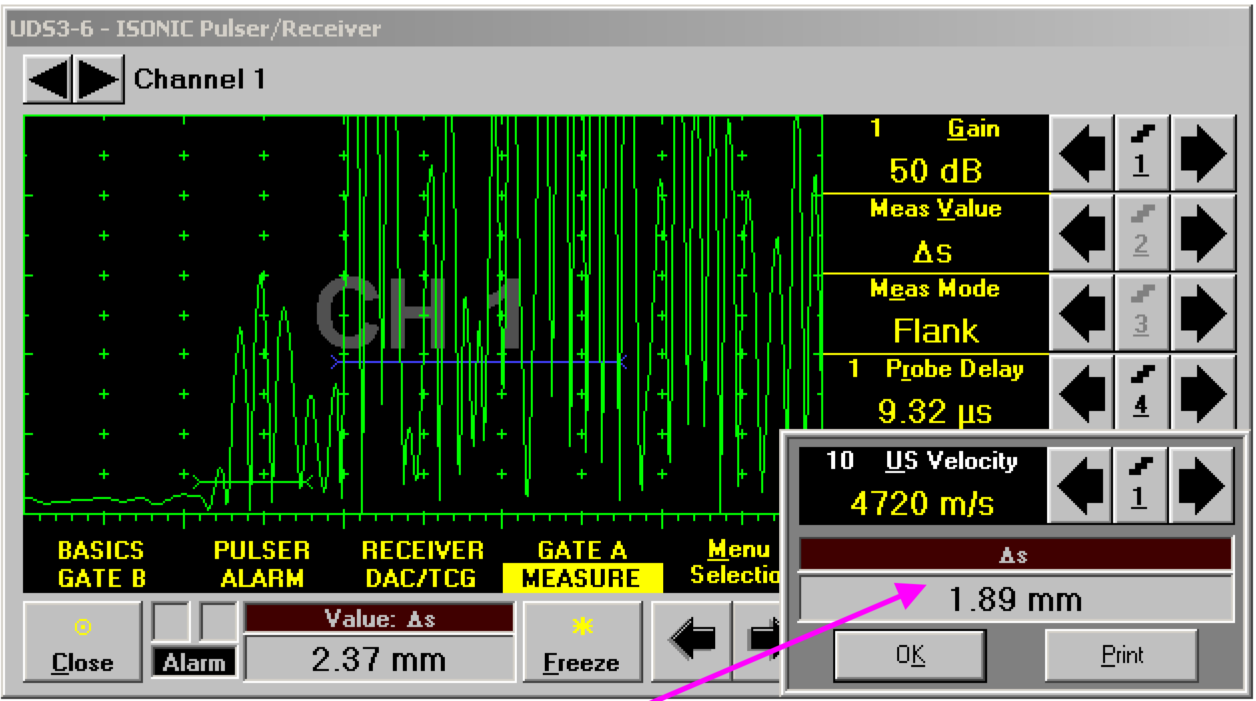
The screen as below appears after clicking on 3 As or pressing 3 on front panel keyboard or **F3** on external keyboard:



Click on this button or press 1 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)

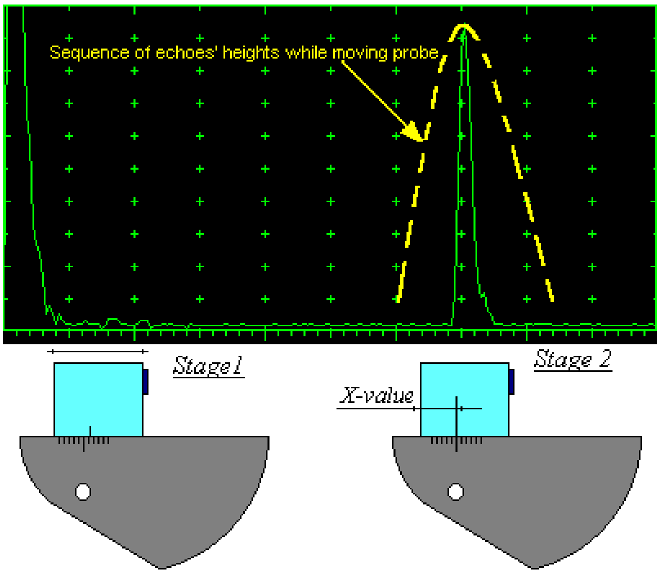


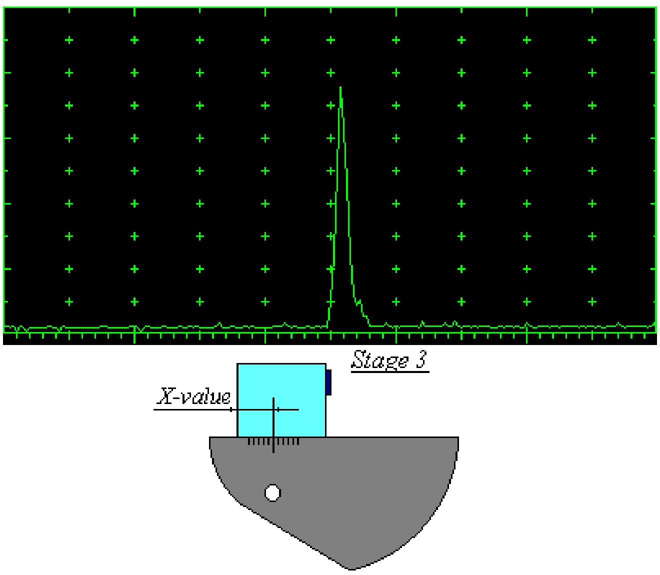
Digital readout for actual thickness of the brass alloy layer (second material) is obtained upon completing setting for second **US Velocity**

To return to the main **ISONIC Pulser Receiver** window click on OK or press Enter or ESC 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 Print or press **<Alt>+<P>** on external keyboard (printer to be accessible through either USB or LAN port and defined as default in the **ISONIC 2008**)

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 **50 ns** for probe having resonant frequency of 10 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for probes having resonant frequency below 10 MHz
- **Firing Level** to **12**

Activate submenu **RECEIVER** then set:

- **Display** to **Full** or **RF**
- **Filter** to **OFF** or **ON**
- **Low Cut** and **High Cut** to completely cover probe's effective bandwidth on case if **Filter** setting is **ON**

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%**

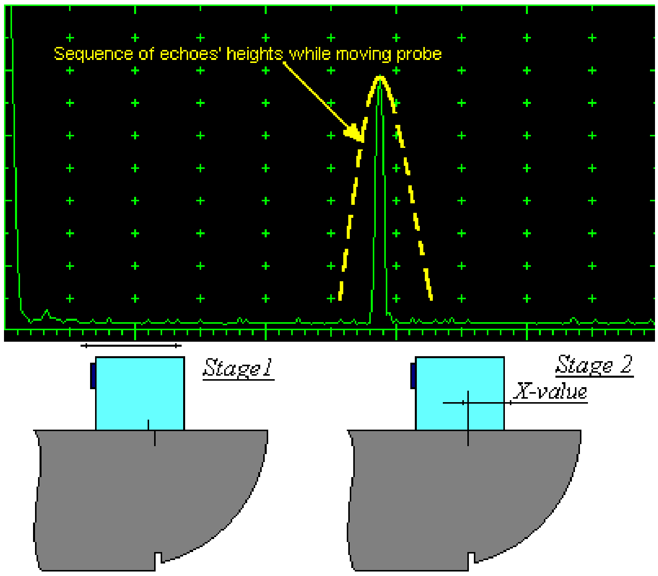
Stage 1: Manipulate probe over main working surface of V-2 reference standard and maximize echo from 25 mm (1 in) radius concave reflector

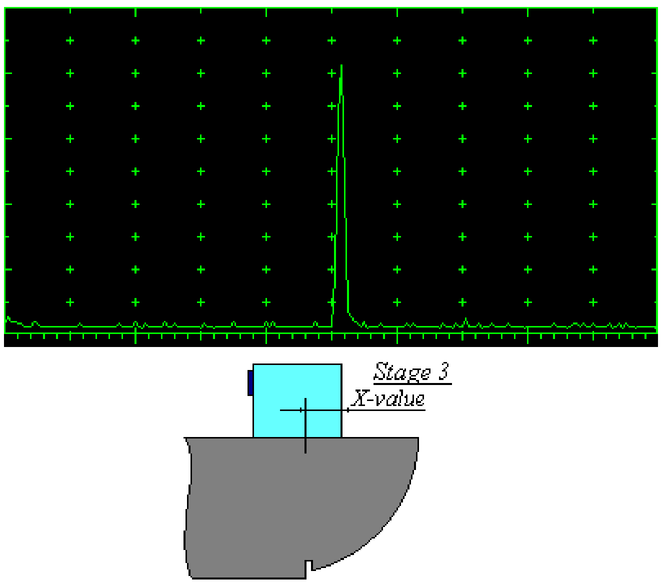
Stage 2: Fix probe in found position - the center of 25 mm (1 in) radius concave reflector will indicate **incident point** while the distance between probe's frontal edge and **incident point** is equal to **X-Value**

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

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 **50 ns** for probe having resonant frequency of 10 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for probes having resonant frequency below 10 MHz
- **Firing Level** to **12**

Activate submenu **RECEIVER** then set:

- **Display** to **Full** or **RF**
- **Filter** to **OFF** or **ON**
- **Low Cut** and **High Cut** to completely cover probe's effective bandwidth on case if **Filter** setting is **ON**

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%**

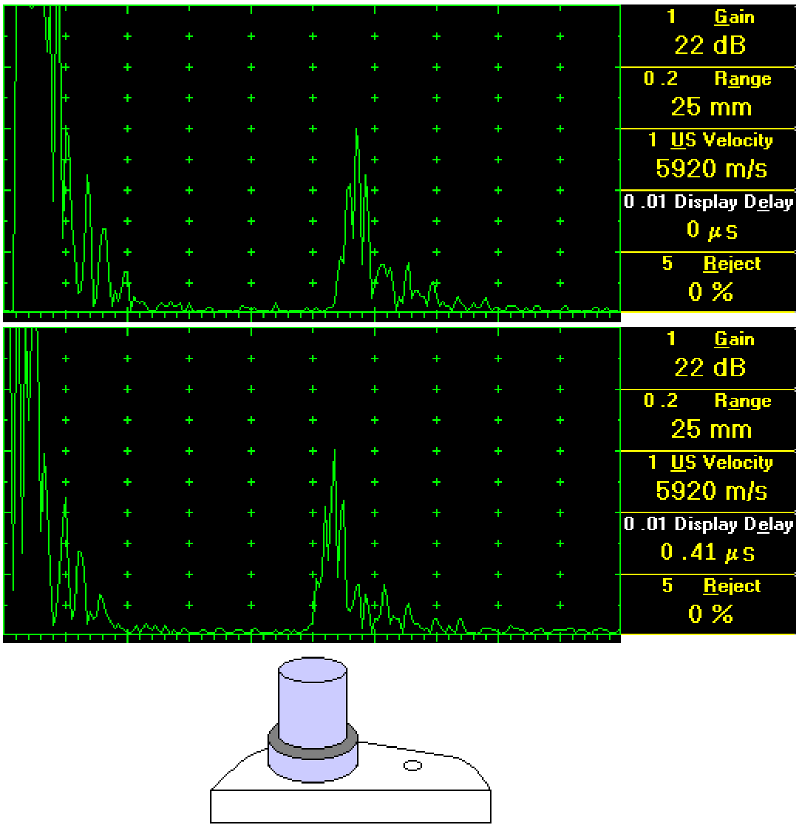
Stage 1: Manipulate probe over main working surface of V-1 reference standard and maximize echo from 100 mm (4 in) radius concave reflector

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

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 **50 ns** for probe having resonant frequency of 10 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for probes having resonant frequency below 10 MHz
- **Firing Level** to **12**

Activate submenu **RECEIVER** then set:

- **Display** to **Full** or **RF**
- **Filter** to **OFF** or **ON**
- **Low Cut** and **High Cut** to completely cover probe's effective bandwidth on case if **Filter** setting is **ON**

Activate submenu **BASICS** topic then set:

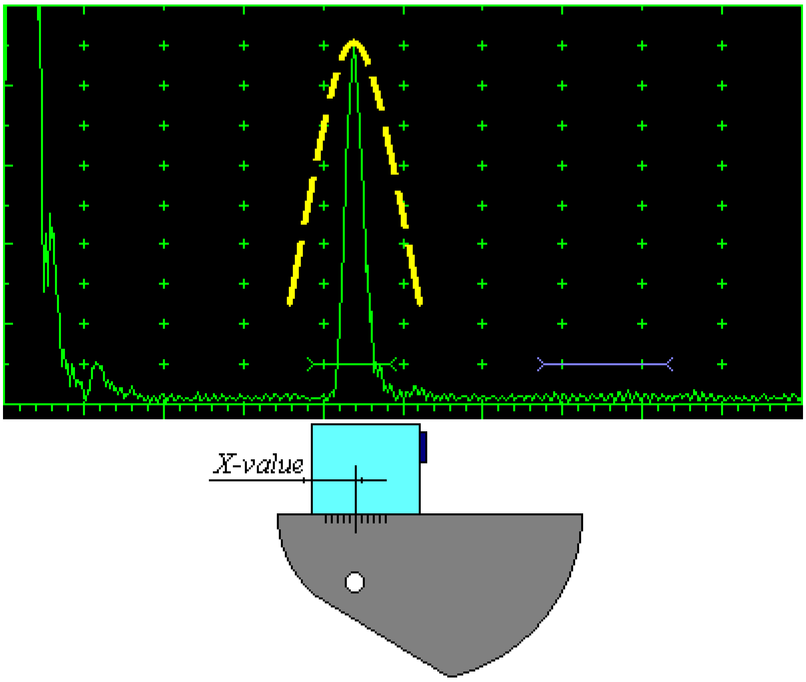
- **US Velocity** to **5920 m/s** (**233.1 in/ms**) for longitudinal wave probes or **3255 m/s** (**128.1 in/ms**) for shear wave probes
- **Range** to **25.0 mm** (**1 in**)
- **Display Delay** to **0 µs**
- **Reject** to **0%**

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**

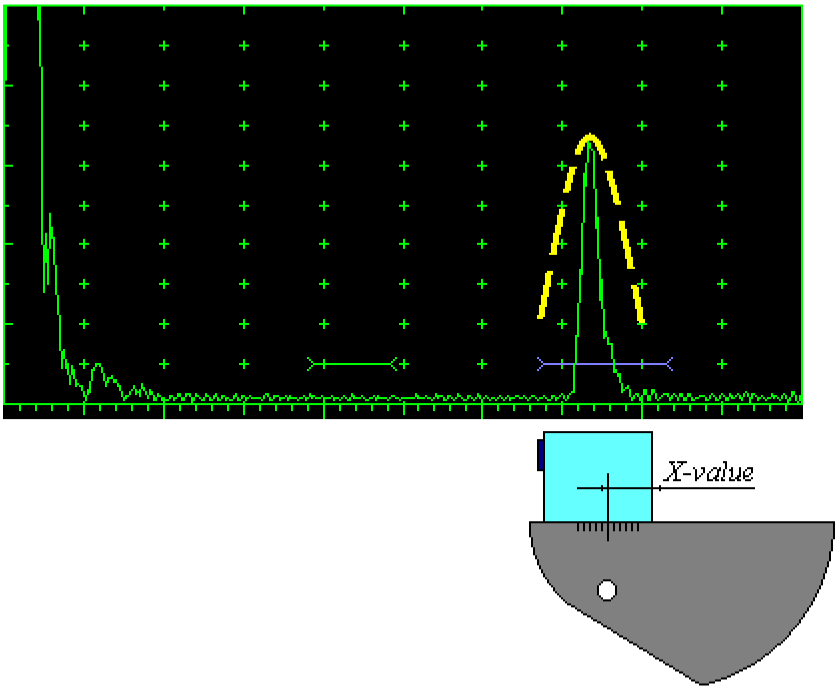
ⓘ It's necessary to setup **Gain** bringing height of maximized echo to **75-80%** of **A-Scan** height

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

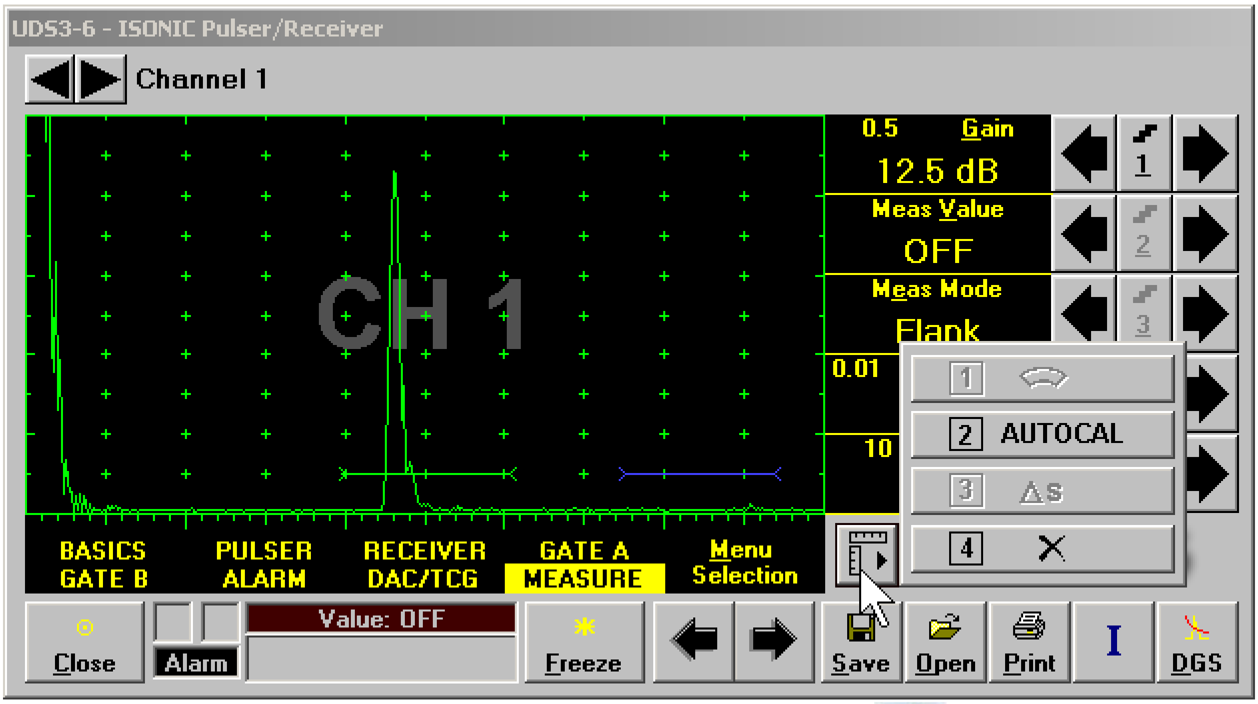


There are 2 maximized reference echoes from 2 concave reflectors with different radius 25 mm (1 in) and 50 mm (2 in) in use for performing automatic calibration of **Probe Delay** and **US Velocity**. **A-Scan** settings (**Range**, **Display Delay**, **US Velocity** – refer to paragraph 5.2.2 of this 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

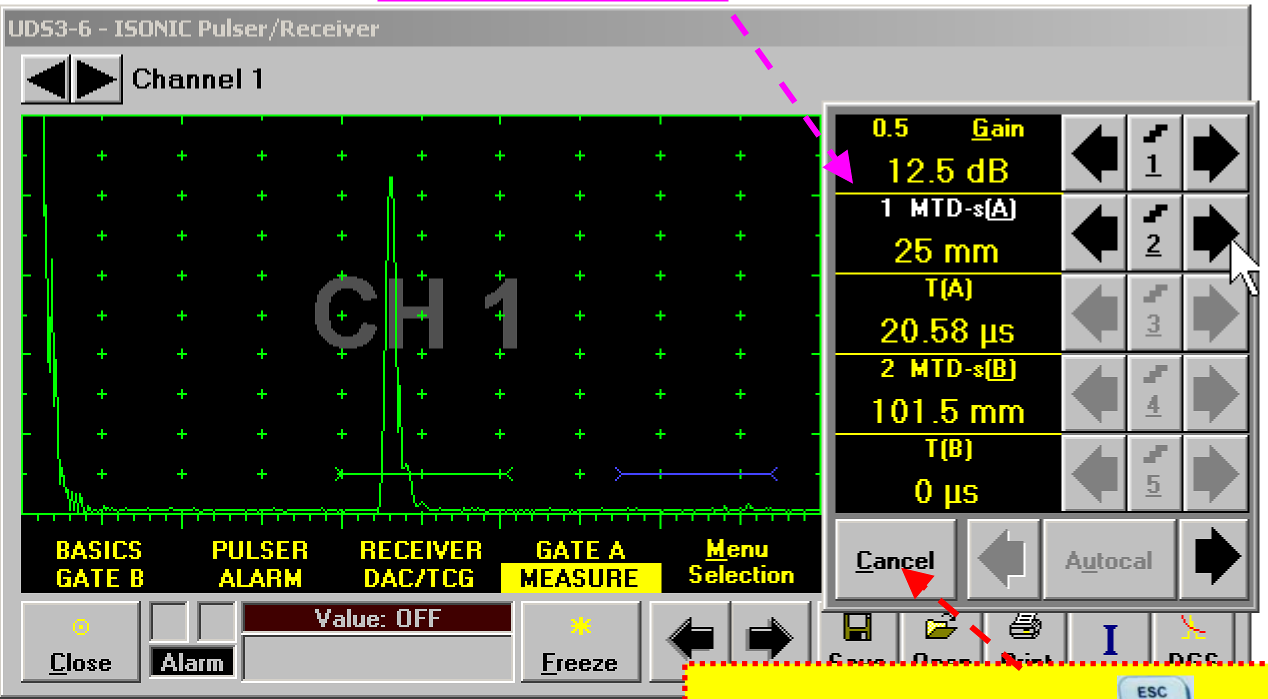
ⓘ It's necessary to setup **Gain** bringing height of far reflector echo to **75-95%** of **A-Scan** height



Obtain first reference echo, activate submenu MEASURE then click on

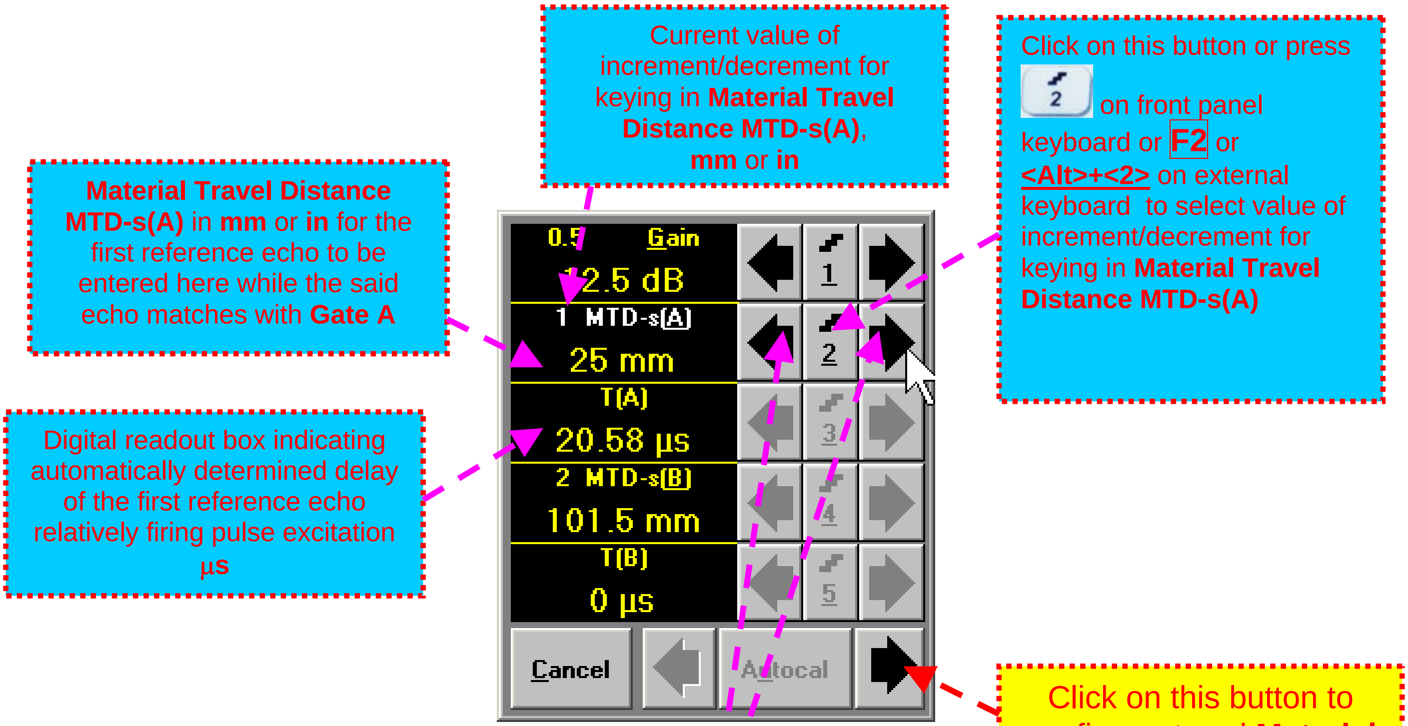


To activate AUTOCAL procedure click on 2 AUTOCAL or press 2 on front panel keyboard or **F2** on external keyboard – the **AUTOCAL Control Surface** appears



Click on this button or press press ESC on front panel keyboard or **Esc** or **<Alt>+<C>** on external keyboard to interrupt **AUTOCAL** Procedure and return to main UDS 3-6 control surface

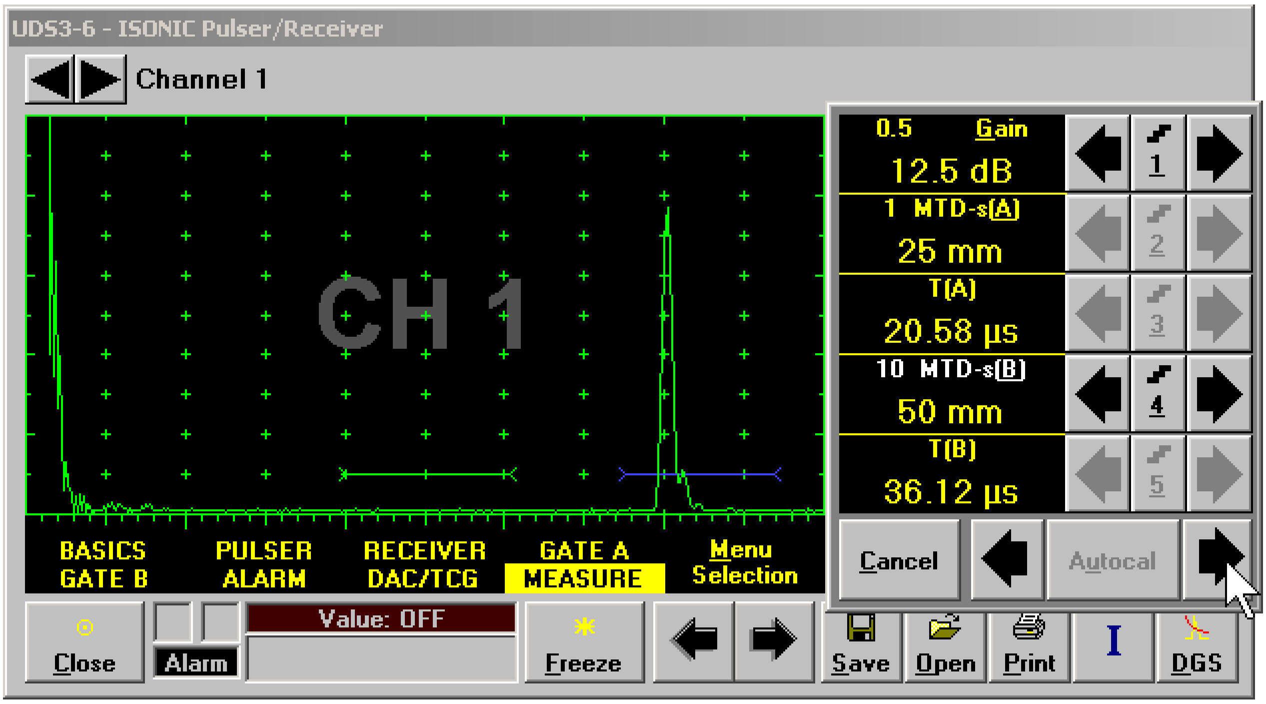
If necessary **Gain** may be re-adjusted in the **AUTOCAL Control Surface** by the same way as it is explained in paragraph 5.2.2 of this Operating Manual

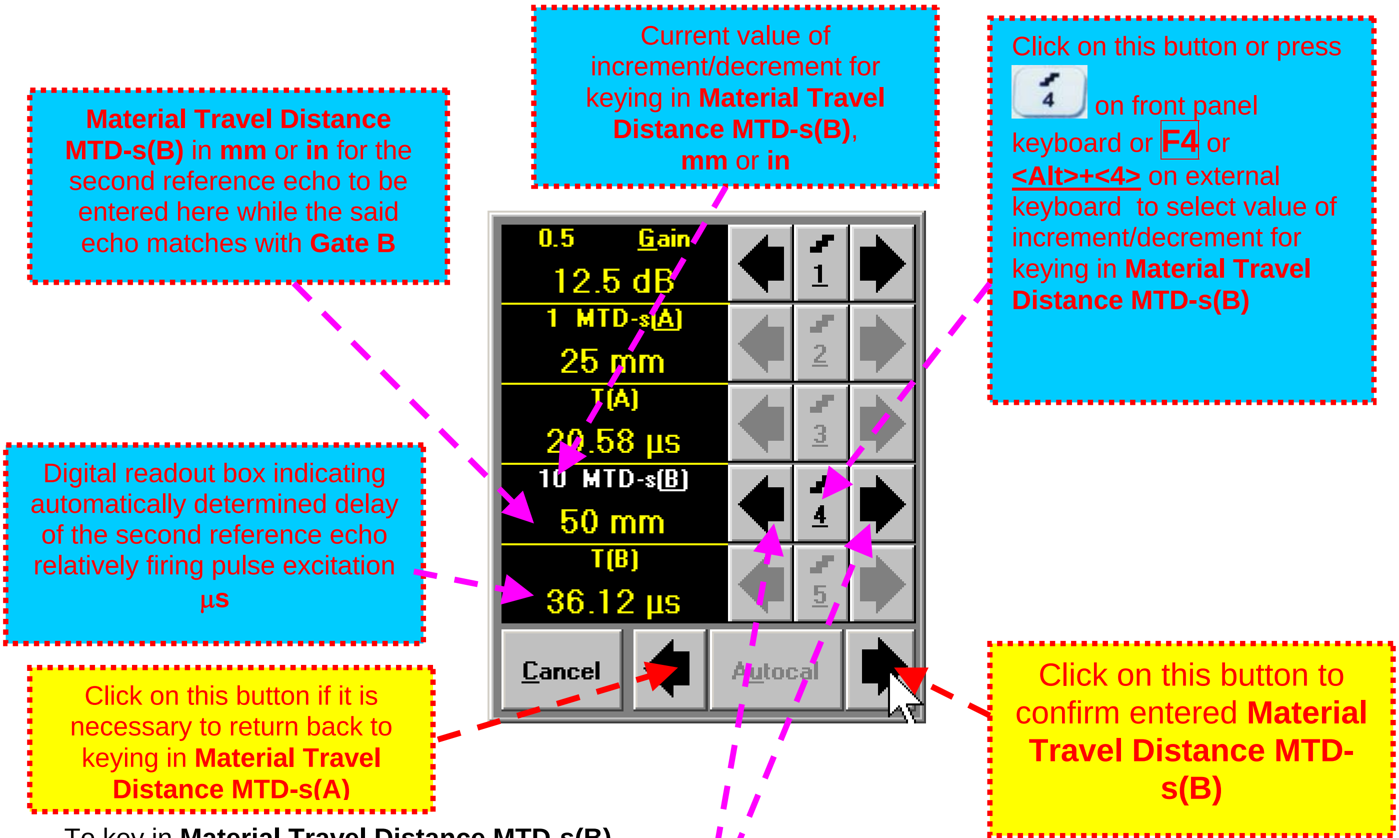


To key in **Material Travel Distance MTD-s(A)** the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press [2] on front panel keyboard or **F2** or **<Alt>+<A>** on external keyboard ⇒ **MTD-s(A)** fore color changes to white - then use [↑], [→], [←], [↓] on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **MTD-s(A)** ⇒ **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

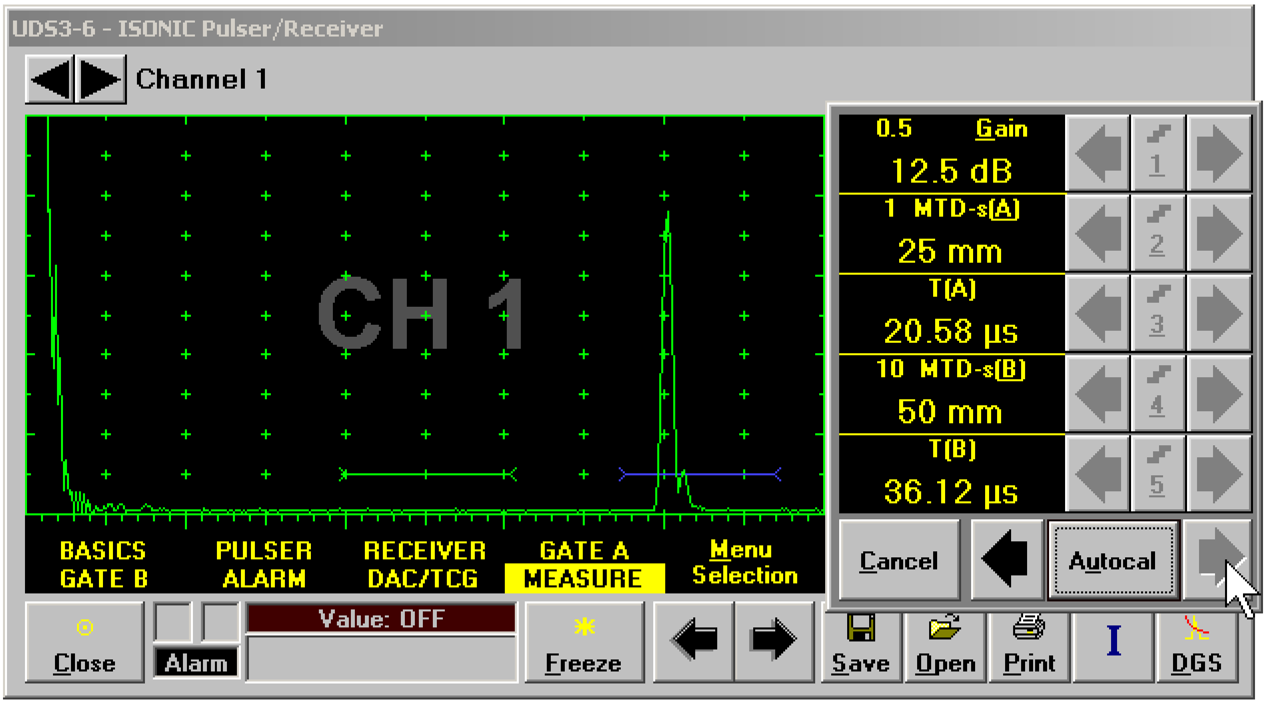


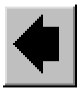
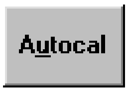


To key in **Material Travel Distance MTD-s(B)** the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press 4 on front panel keyboard or F4 or **<Alt>+<B>** on external keyboard ⇒ **MTD-s(B)** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **MTD-s(B)** ⇒ **MTD-s(B)** fore color changes to white - then use ↑, →, ←, ↓ on front panel keyboard or ↑, →, ←, ↓ on external keyboard

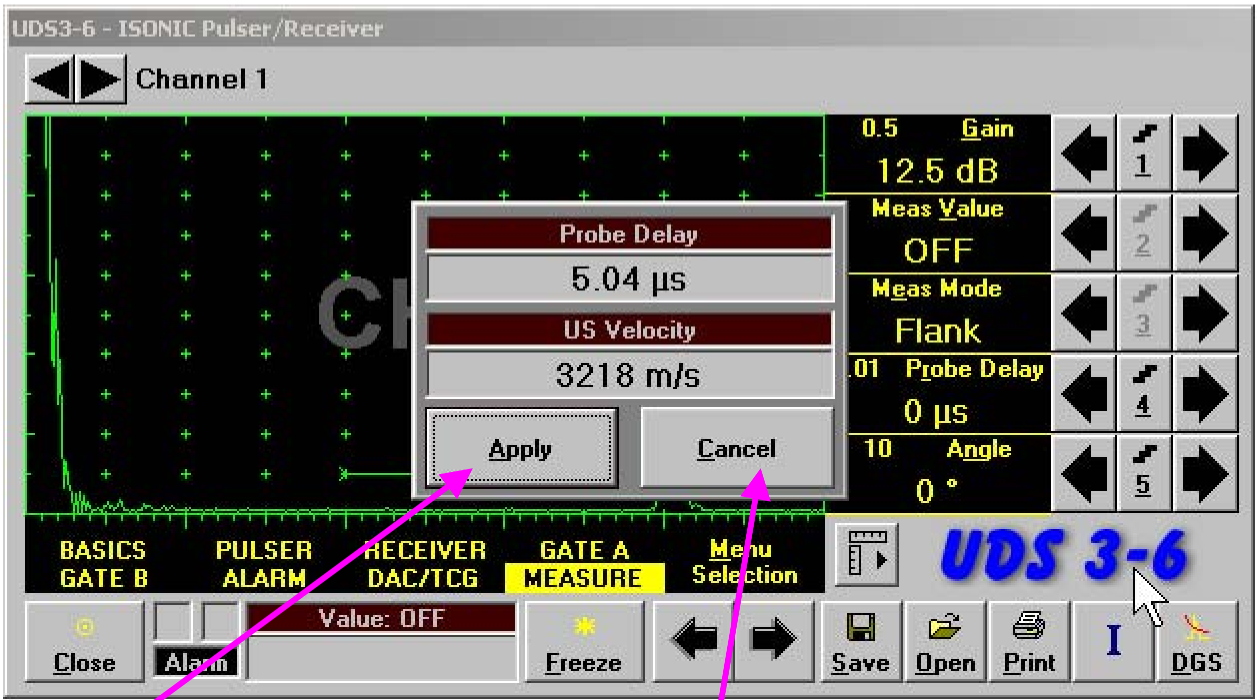
Material Travel Distance MTD-s(B) The screen as below appears upon confirming keying in



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

or press 

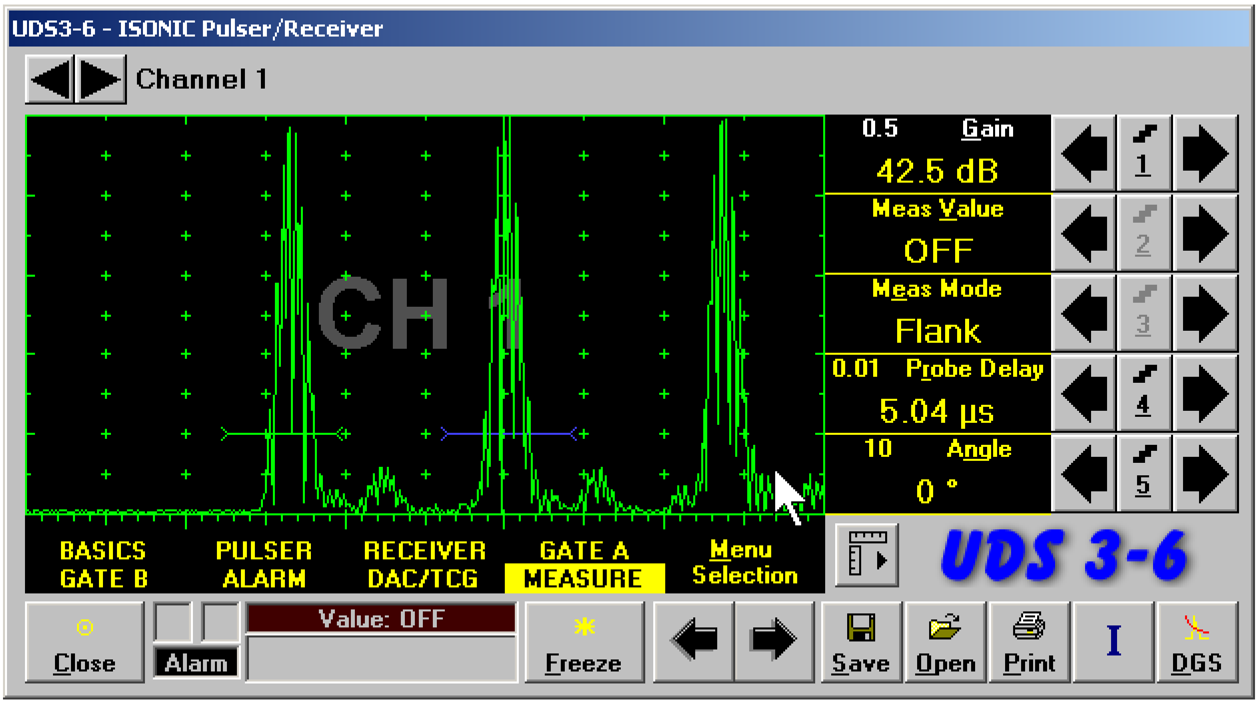
on front panel keyboard or Enter or **<Alt>+<U>** on external keyboard to initialize automatic determining of **US Velocity** and **Probe Delay** based on above described keying and echoes delays automatic measurements. As a result the screen as below appears:

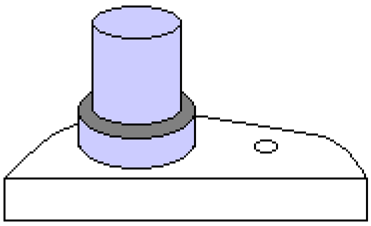


Click on or press  on front panel keyboard or **Esc** or **<Alt>+<C>** on external keyboard to negate **AUTOCAL** results and return to main operating surface without modifying **Probe Delay** and **US Velocity** settings

Click on or press  on front panel keyboard or **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



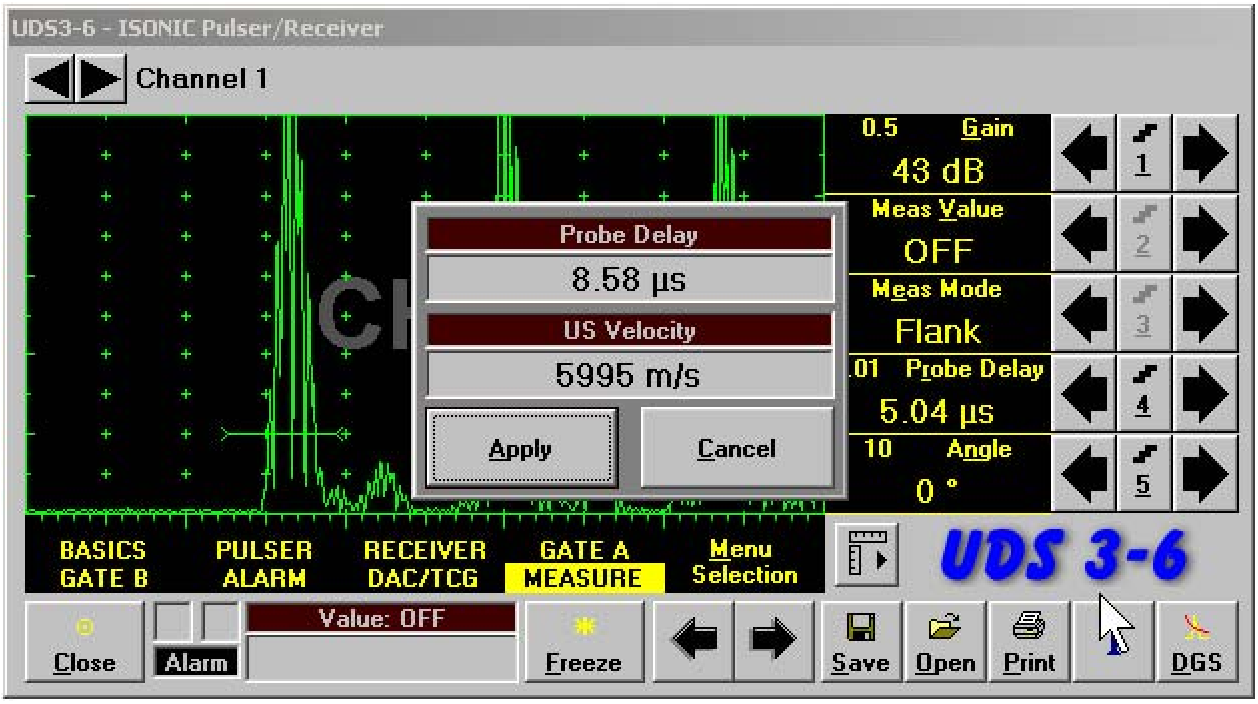


There are two received back echoes following each other (normally – first and second) required for performing automatic calibration of **Probe Delay** and **US Velocity**. **A-Scan** settings (**Range**, **Display Delay**, **US Velocity** – refer to paragraph 5.2.2 of this Operating Manual) must allow 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

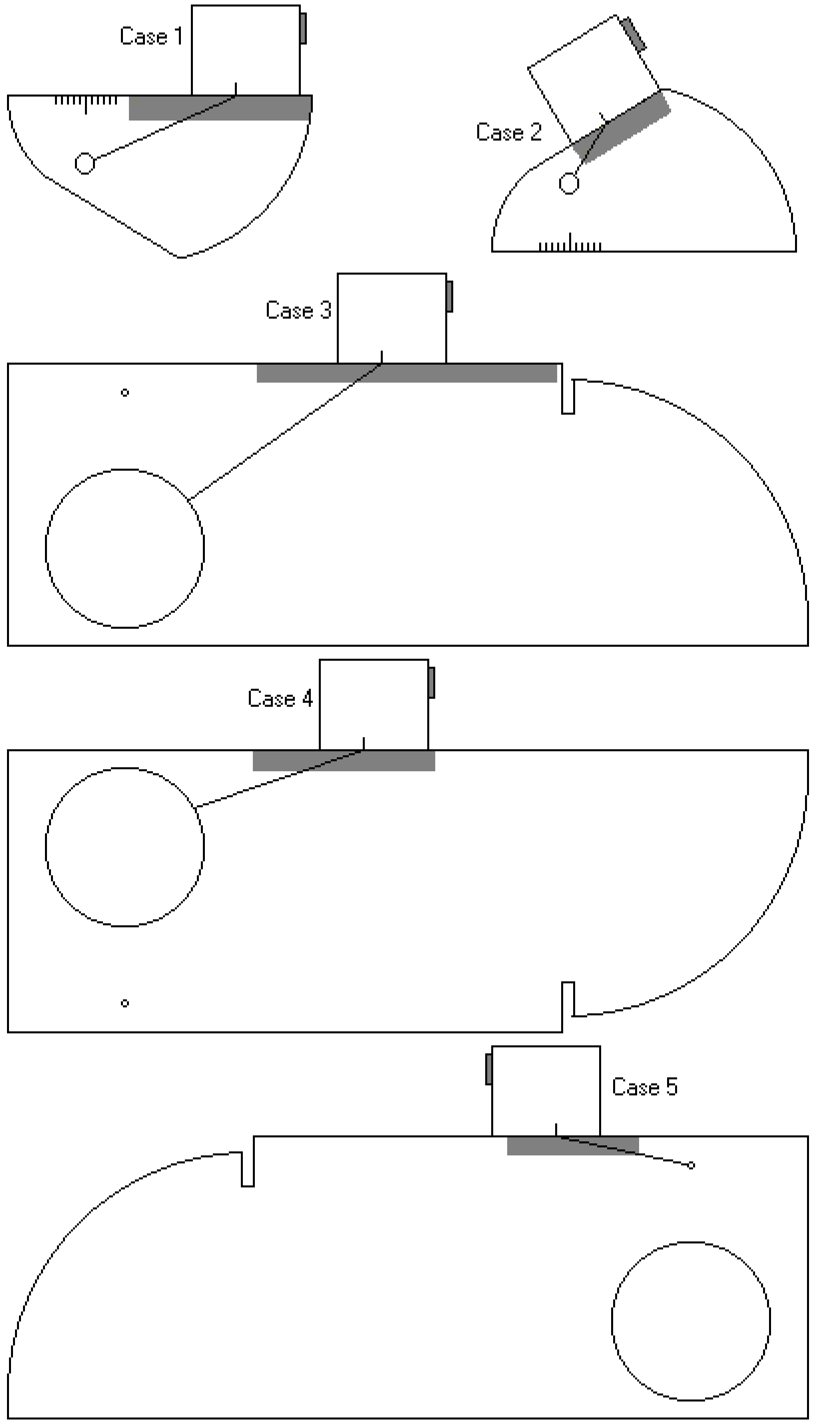
ⓘ

It's necessary to setup **Gain** bringing height of third back echo to **75-100%** 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^{o} to 65^{o}, V-2 reference block

Case 2: Miniature angle beam probe, incidence angle 65^{o} to 75^{o}, V-2 reference block

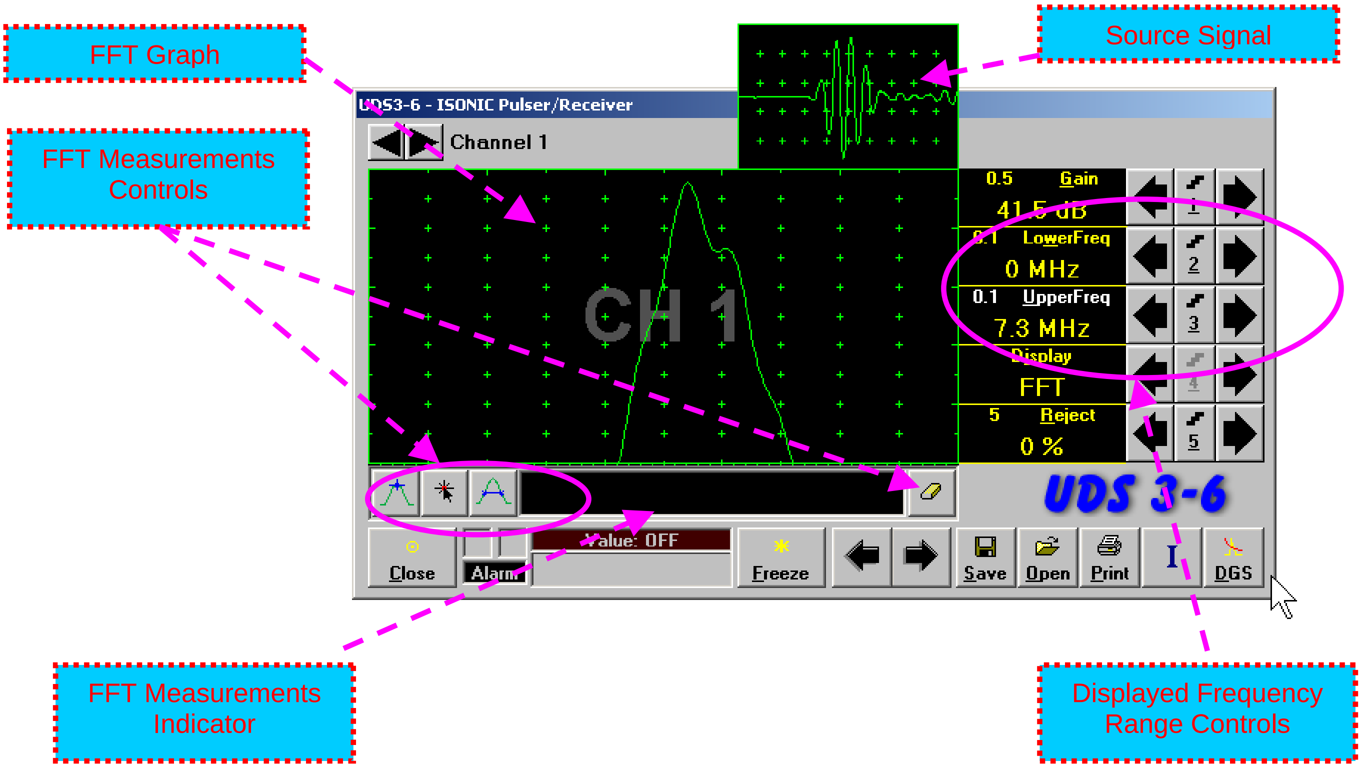
Case 3: Medium or large size angle beam probe, incidence angle 40^{o} to 66^{o}, V-1 reference block

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

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

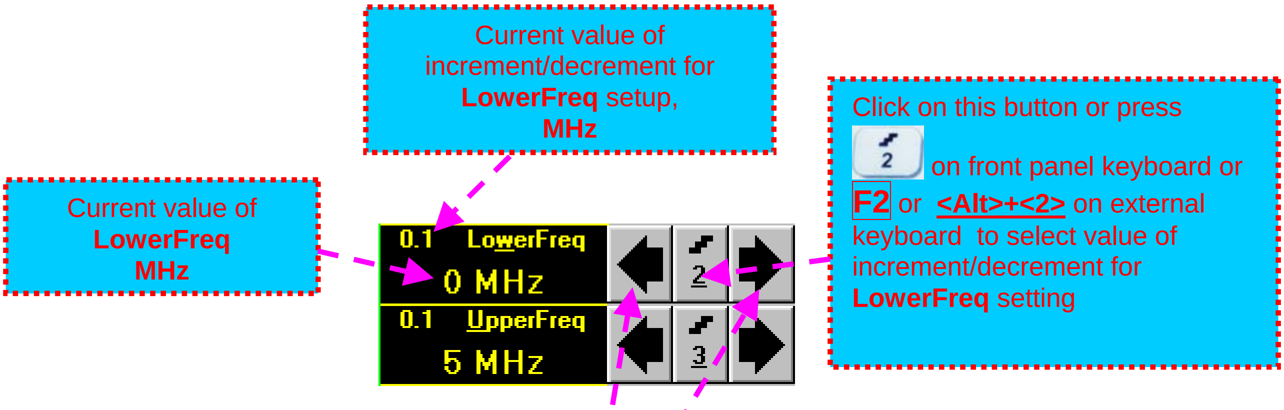
5.2.14. Frequency Domain Signal Presentation and Evaluation

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:



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

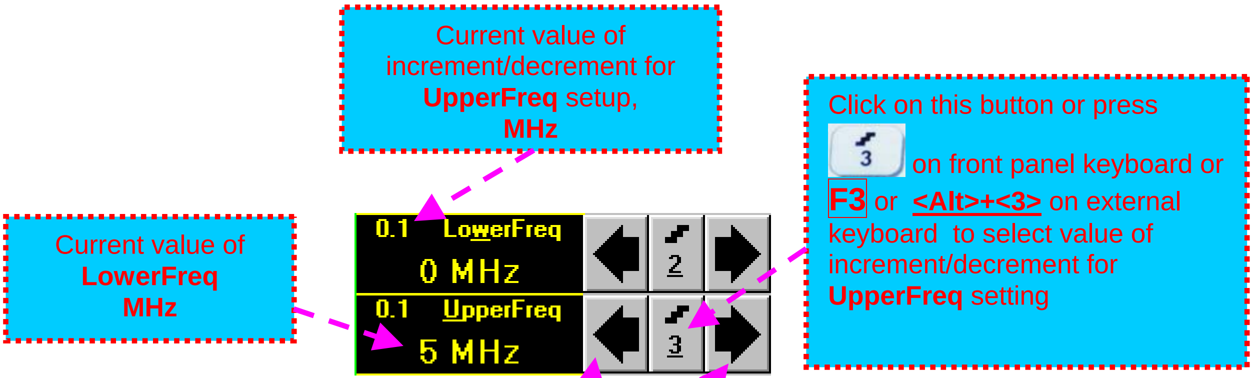
Lower frequency bound (LowerFreq)



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

- **Mouse / Touch Screen**
  - Click or press and hold on appropriate button
- **Keyboard**
  - Press [2] 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

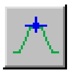
Upper frequency bound (UpperFreq)

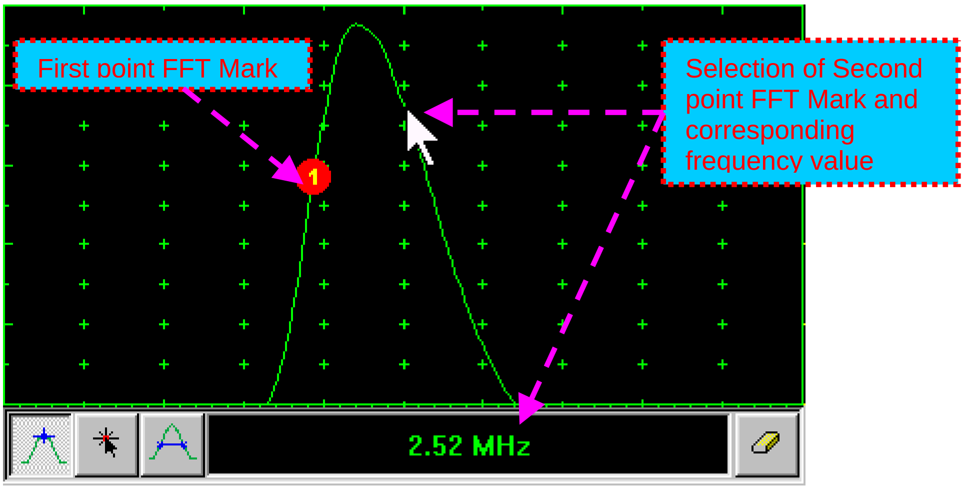


To control **UpperFreq** the following manipulations are applicable:

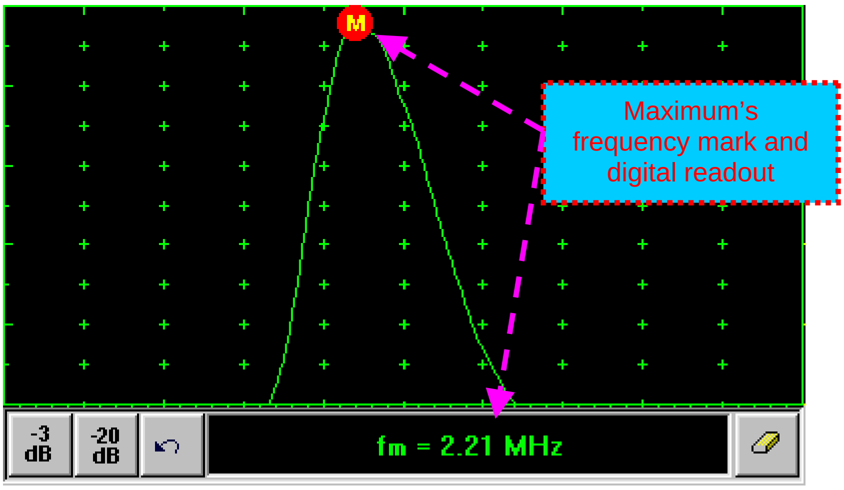
- **Mouse / Touch Screen**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Press on front panel keyboard or **F3** or **<Alt>+<U>** on external keyboard ⇒ **UpperFreq** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **UpperFreq** ⇒ **UpperFreq** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard

Find maximum

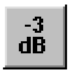
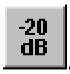
Click on  – mouse pointer may be guided then just over FFT graph. **FFT Readout Box** displays frequency corresponding to pointer position whilst guiding the cursor. Select first point of interest by mouse click or through release of touch screen stylus. The appropriate mark  appears. Select the second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

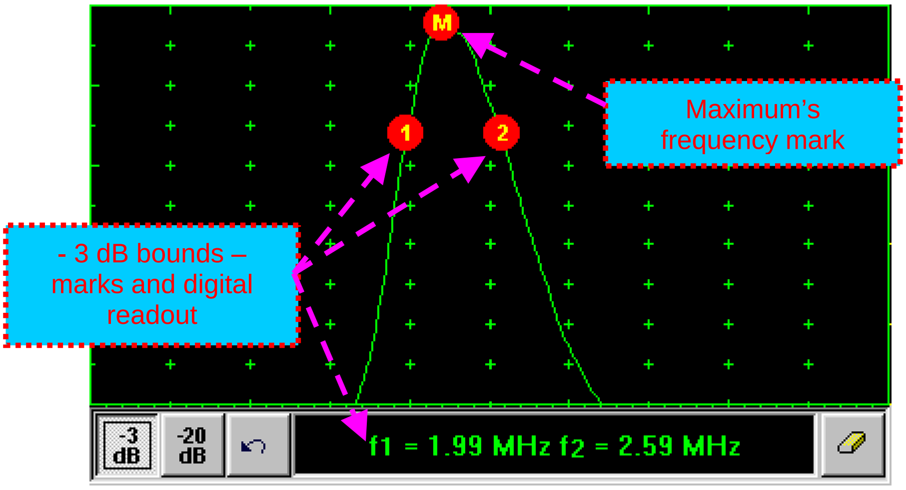


Maximum's frequency mark  appears and **FFT Readout Box** displays the found value automatically upon mouse click or releasing of touch screen stylus:

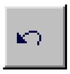


Find the –3db / –20db level bounds:

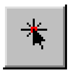
Upon finding the maximum's frequency click on  or . Two points found corresponding to selected level appear on the FFT graph and **FFT Readout Box** shows their corresponding frequency values:

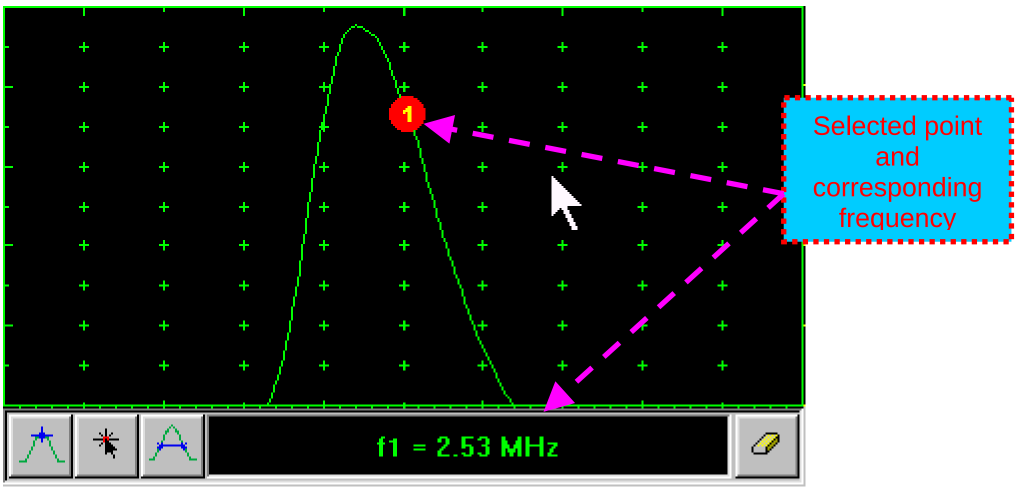


Return to FFT Measurements toolbar:

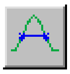
Click on 

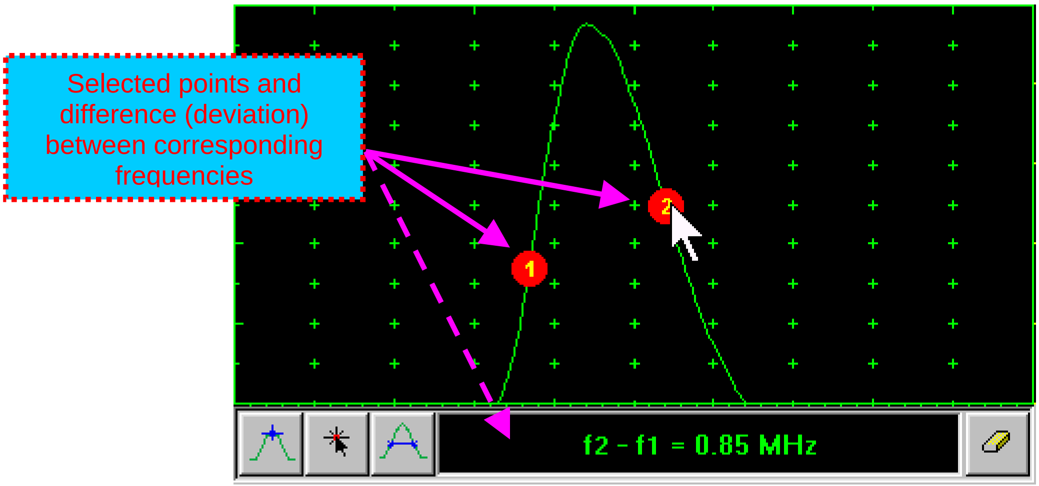
Find frequency corresponding to selected single point on FFT graph:

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  appears and **FFT Readout Box** displays corresponding frequency:

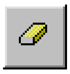


Frequency difference (deviation) between two points:

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  appears. Select second point of interest by the same way - the appropriate mark  appears and the **FFT Readout Box** displays difference (deviation) between corresponding frequencies:



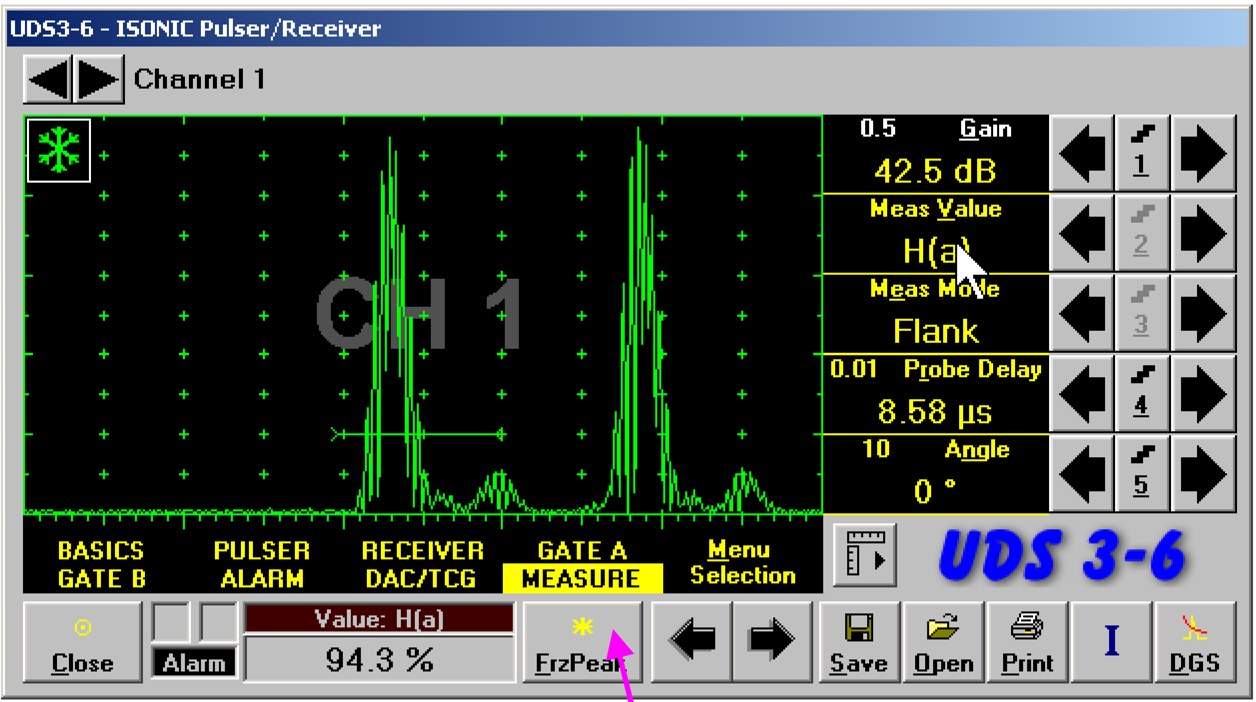
Clear FFT Marks:

Click on 

Exit FFT Mode:

Change **Display** mode

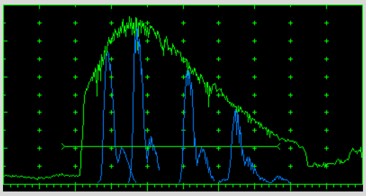
5.2.15. Freeze A-Scan / FFT Graph

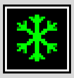
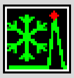


To freeze / freeze peak / unfreeze the **A-Scan** click on or press  on front panel keyboard or **F6** or **<Alt>+<F>** on external keyboard

ⓘ

- **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:
  - o ± **6 dB Gain** varying according to paragraph 5.2.2 of this Operating Manual
  - o Manipulating **Gates A** and **B** according to paragraphs 5.2.5, 5.2.6, 5.2.7 of this Operating Manual
  - o Varying **Alarm** mode according to paragraph 5.2.8 of this Operating Manual
  - o 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:
  - o ± **6 dB Gain** varying according to paragraph 5.2.2 of this Operating Manual
  - o All **FFT evaluation / measurements** as per paragraph 5.2.14 of this Operating Manual
- Caption of appropriate button changes in the **UDS 3-6 Pulser/Receiver** window when freeze / freeze peak / unfreeze **A-Scan / FFT Graph**

5.2.16. Zoom A-Scan / FFT Graph

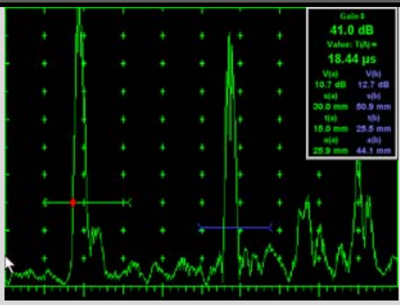
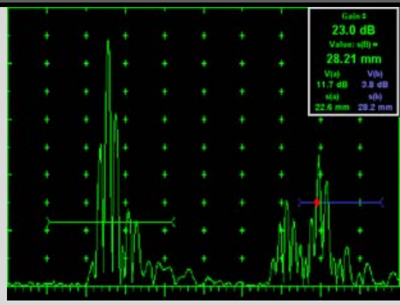
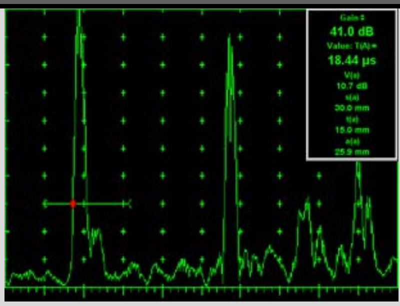
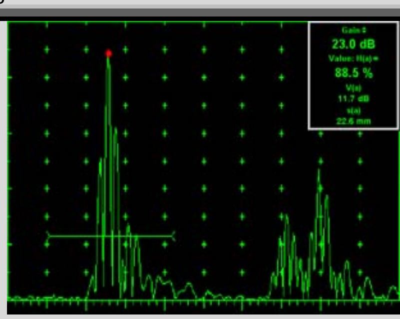
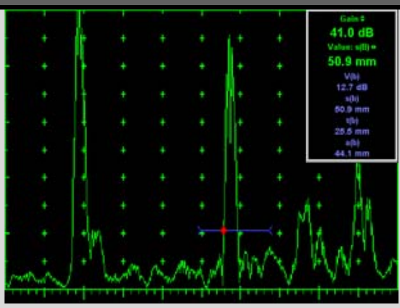
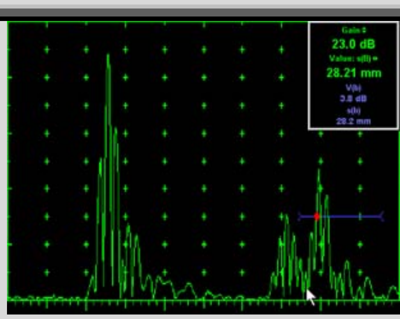
Double click on **A-Scan / FFT Graph** to get it enlarged. Enlarged **A-Scan / FFT Graph** occupies screen completely

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

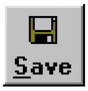
To freeze / freeze peak / unfreeze enlarged **A-Scan** press on front panel keyboard or **F6** on external keyboard

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**	 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	 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
A	 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	 Parameters **V(A),** and **s(A)** are measured and indicated automatically – refer to paragraph 5.2.13.1 of this Operating Manual
B	 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	 Parameters **V(B),** and **s(B)** are measured and indicated automatically – refer to paragraph 5.2.13.1 of this Operating Manual

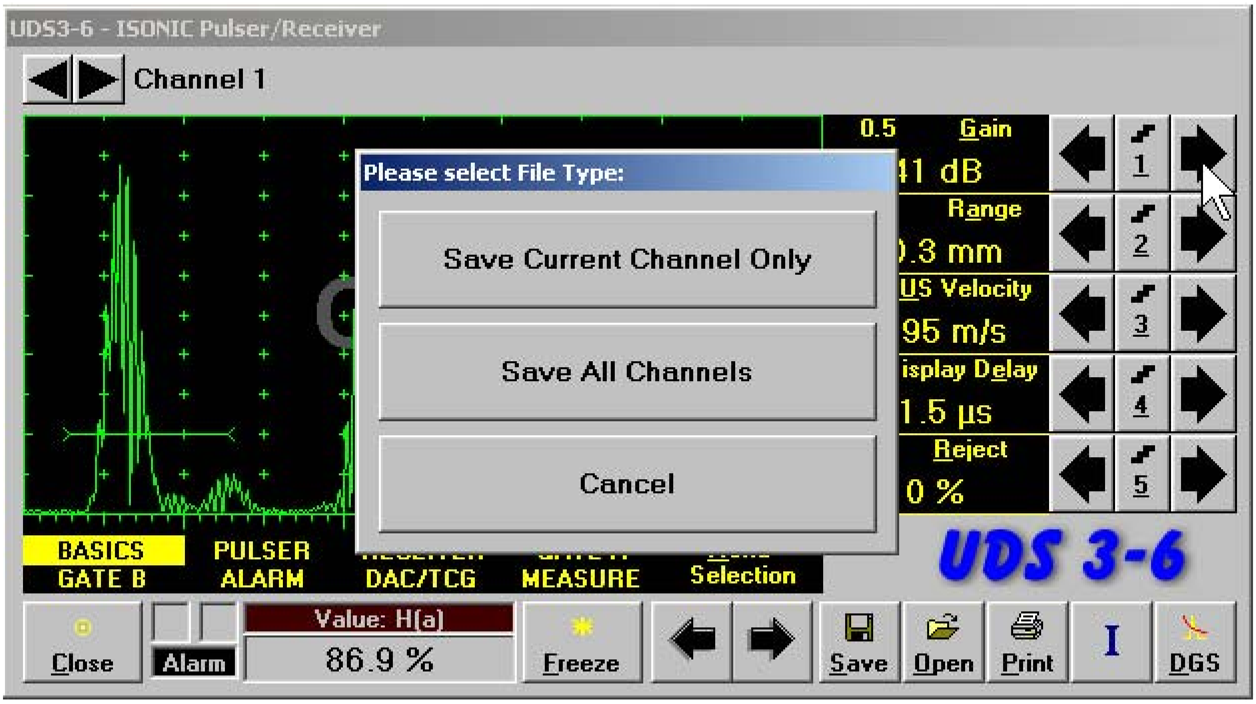
To select an additional parameter for automatic measurement and large character indication while **A-Scan** is enlarged (**Meas Value** - refer to paragraphs 5.2.12 and 5.2.13 of this Operating Manual) use and on front panel keyboard or →, ← on external keyboard. **Gate A** and **Gate B** if active may be drag and drop manipulated on the 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 current channel **A-Scan / FFT Graph** and **Calibration Dump** or file including **Calibration Dumps for 8 channels** into a file click on 

or press 

on front panel keyboard or **F12** or **<Alt>+<S>** on external keyboard – the dialogue prompting to select type of file appears:



To store the current channel **A-Scan / FFT Graph** and **Calibration Dump** click on

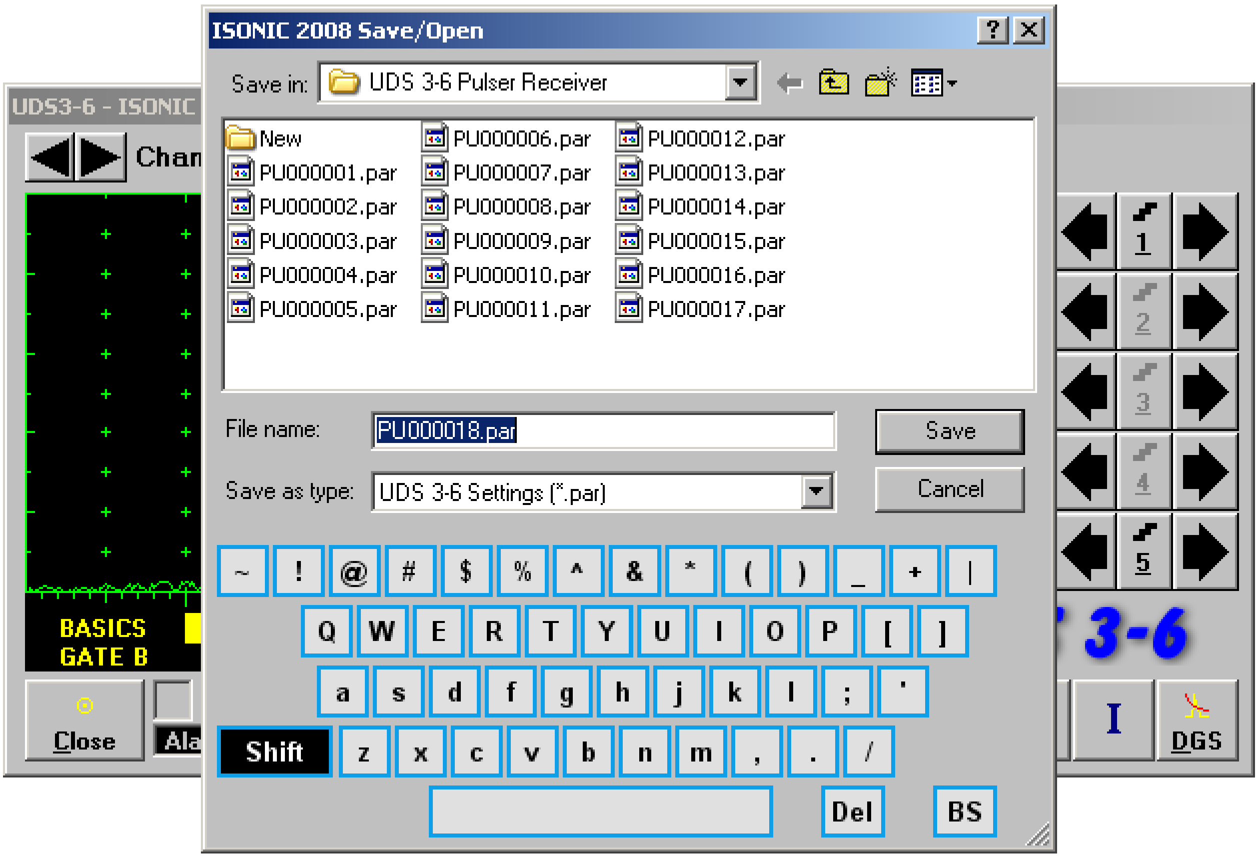
To store **Calibration Dumps for 8 channels** click on

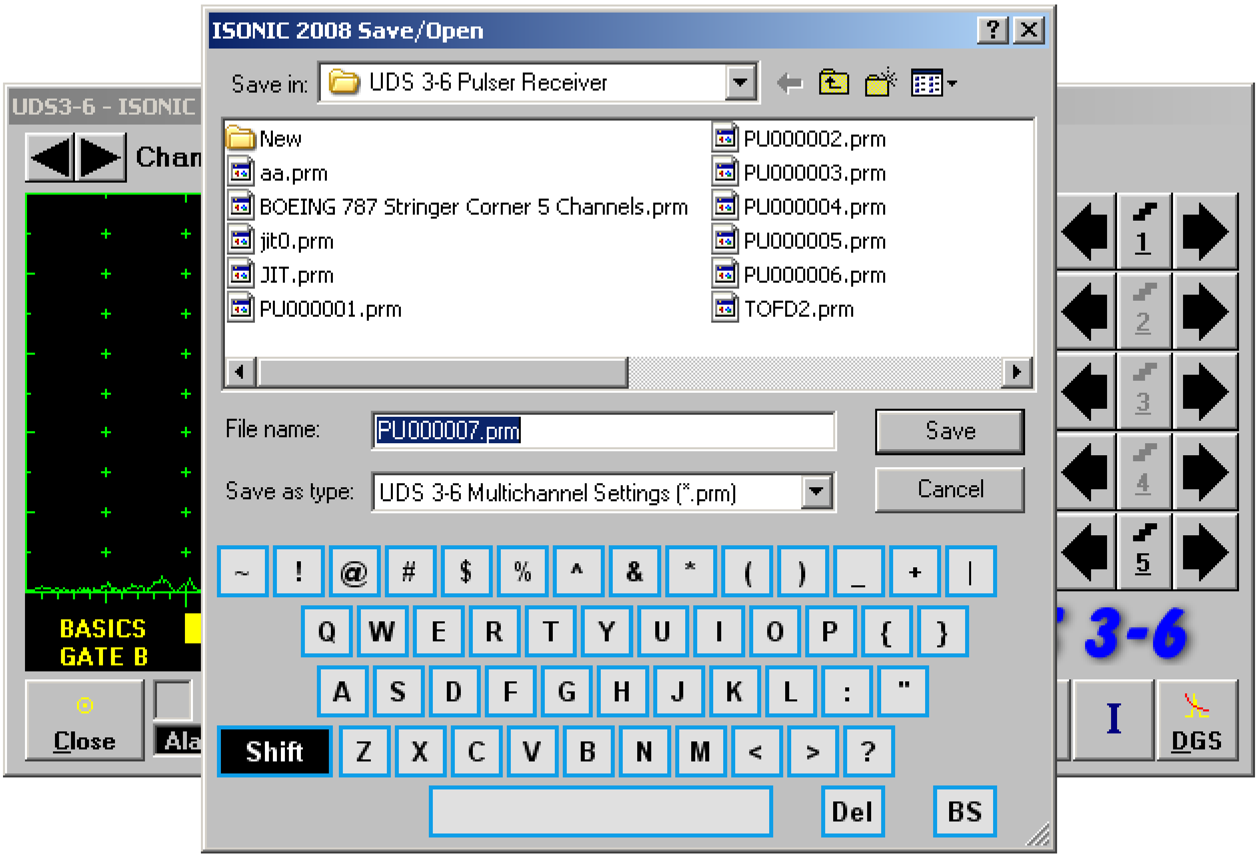
To return to **UDS 3-6 Pulse Receiver** screen click on 

or press 

on front panel keyboard or **Esc** on external keyboard

Depending on selection made **ISONIC 2008 Save/Open** window becomes active providing automatically created name for a new file in the 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

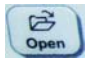
  type a new file name using either virtual keyboard generated in **ISONIC 2008 Save/Open** window or external keyboard – standard Windows rules for file naming are applicable, long names (up to 64 characters) are supported

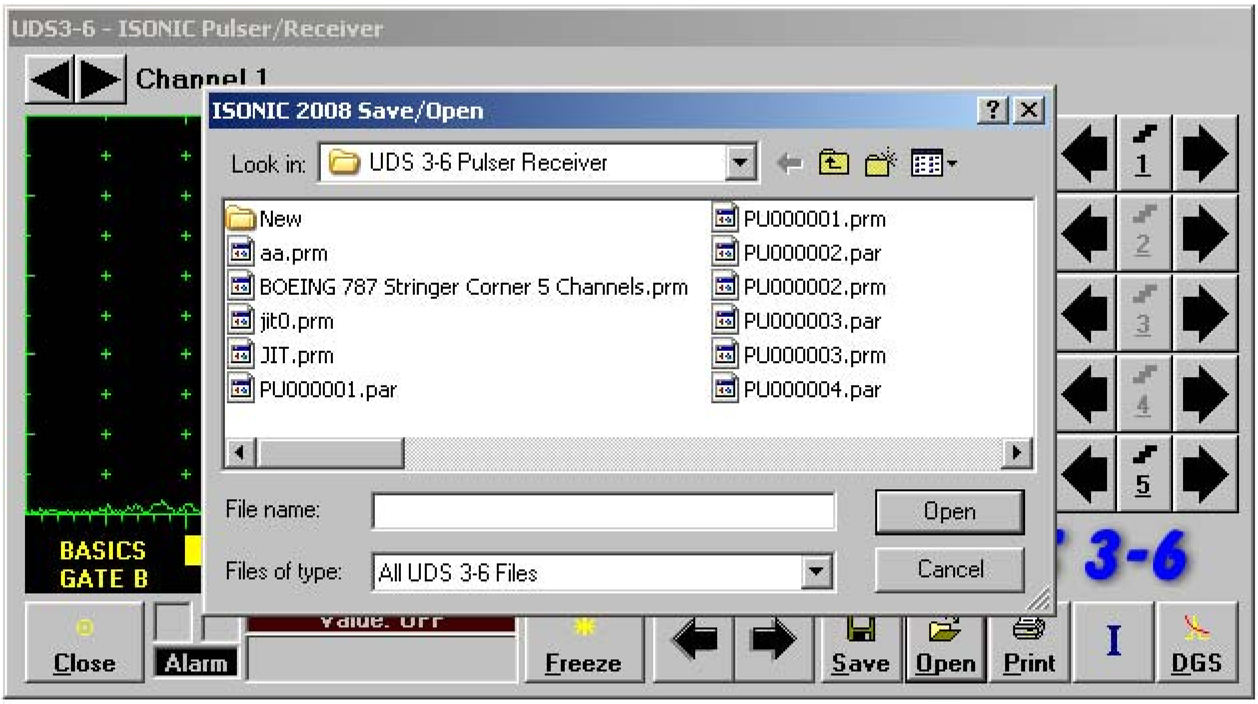
- double click on file to be replaced or click on Save or press  or  on front panel keyboard or press **F12** or **Enter** or **<Alt>+<S>** on external keyboard

ISONIC 2008 Save/Open window disappears automatically upon completing saving a file

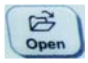
To quit **ISONIC 2008 Save/Open** window without saving a file click on Cancel or press  on front panel keyboard or **Esc** on external keyboard

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 2008 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 2008 Save/Open window disappears automatically upon completing loading a file

To quit **ISONIC 2008 Save/Open** window without opening a file click on  or press  on front panel keyboard or **Esc** on external keyboard

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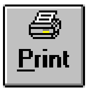
- ♦ **PAR** file uploads calibration dump and freeze A-Scan onto currently active channel
- ♦ **PRM** file uploads 8 calibration dumps into all **UDS 3-6** channels of **ISONIC 2008** instrument

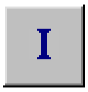
5.2.19. Print A-Scan/FFT Graph and Settings List

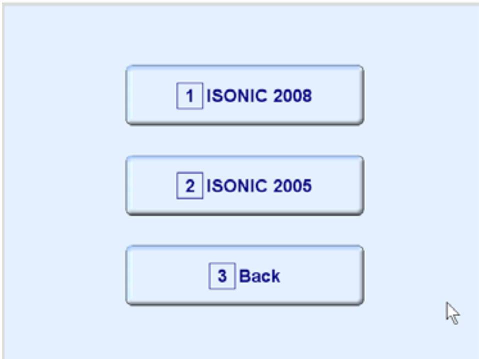
Ensure the printer connection is in order (printer to be accessible through either USB or LAN port and defined as default in the **ISONIC 2008**) then click on 

or press 

on front panel keyboard or **F10** or **<Alt>+<P>** on external keyboard

5.2.20. Activate Main Recording Menu

Click on  or press  on front panel keyboard or **F8** on external keyboard. The **Main Recording Menu** appears



To go ahead with multi-channel scanning and recording click on 

or press  on front panel keyboard or **F1** on external keyboard, the follow instructions of Chapter 7 of this Operating Manual for further instructions

To go ahead with multi-channel scanning and recording (**ISONIC 2005** modes of imaging and recording) click on 

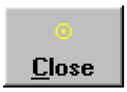
or press  on front panel keyboard or **F2** on external keyboard, the follow instructions of Chapter 6 of this Operating Manual for further instructions

To return to **UDS 3-6 Pulse Receiver** screen click on 

or press 

or  on front panel keyboard or **Esc** or **F3** on external keyboard

5.2.21. Switch OFF UDS 3-6

To switch OFF **UDS 3-6** and to return to **ISONIC 2008 Start Screen** click on 

or press 

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

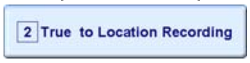
6. Recording and Imaging – Single Channel (CH 1)

6.1. Main Recording Menu – Single Channel (CH 1)

Main Recording Menu – Single Channel (CH 1) is shown below:

There are 2 recording 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 2008** 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 **UDS 3-6 Pulse Receiver** screen click on  or press  or  on front panel keyboard or **Esc** or **F3** on external keyboard

6.2. 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 1 t-BScan (Th) or 1 BScan (Th) or press 1 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 2 t-ABIScan or 2 ABIScan or press 2 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 3 t-TOFD or 3 TOFD or press 3 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 4 t-Floormap L or 4 Floormap L press 4 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 **Main Recording Menu – Single Channel (CH 1)** screen click on 5 Back or press ESC or 5 on front panel keyboard or **Esc** or **F5** on external keyboard

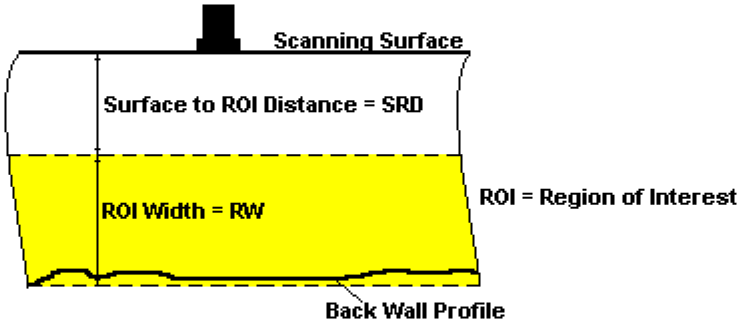
6.3. Thickness Profile Imaging and Recording – t-BScan(Th) and BScan(Th)

6.3.1. Setup Pulser Receiver for Thickness Profile Imaging and Recording

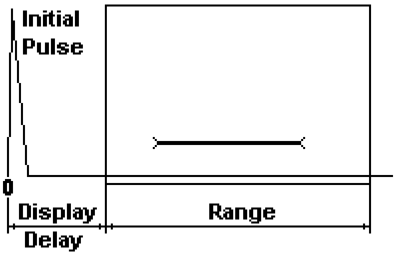
UDS 3-6 Pulser Receiver screen appears upon clicking on 1 t-BScan (Th) or 1 BScan (Th). The following settings to be provided:

#	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	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain and aThreshold setting procedure**
6	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**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^o**	
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 I or press I on front panel keyboard or F8 on external keyboard



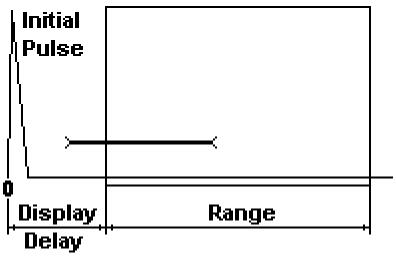
Case 1



$$SRD = aStart$$

$$RW = aWidth$$

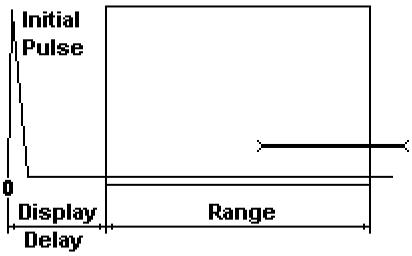
Case 2



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

$$RW = aStart + aWidth - SRD$$

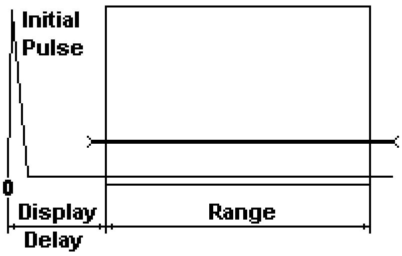
Case 3



$$SRD = aStart$$

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

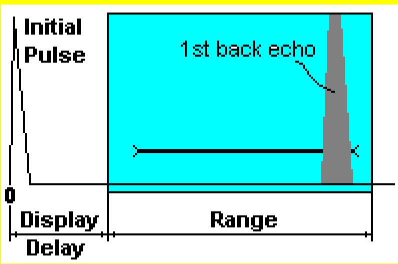
Case 4



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

$$RW = Range$$

Preferred embodiment

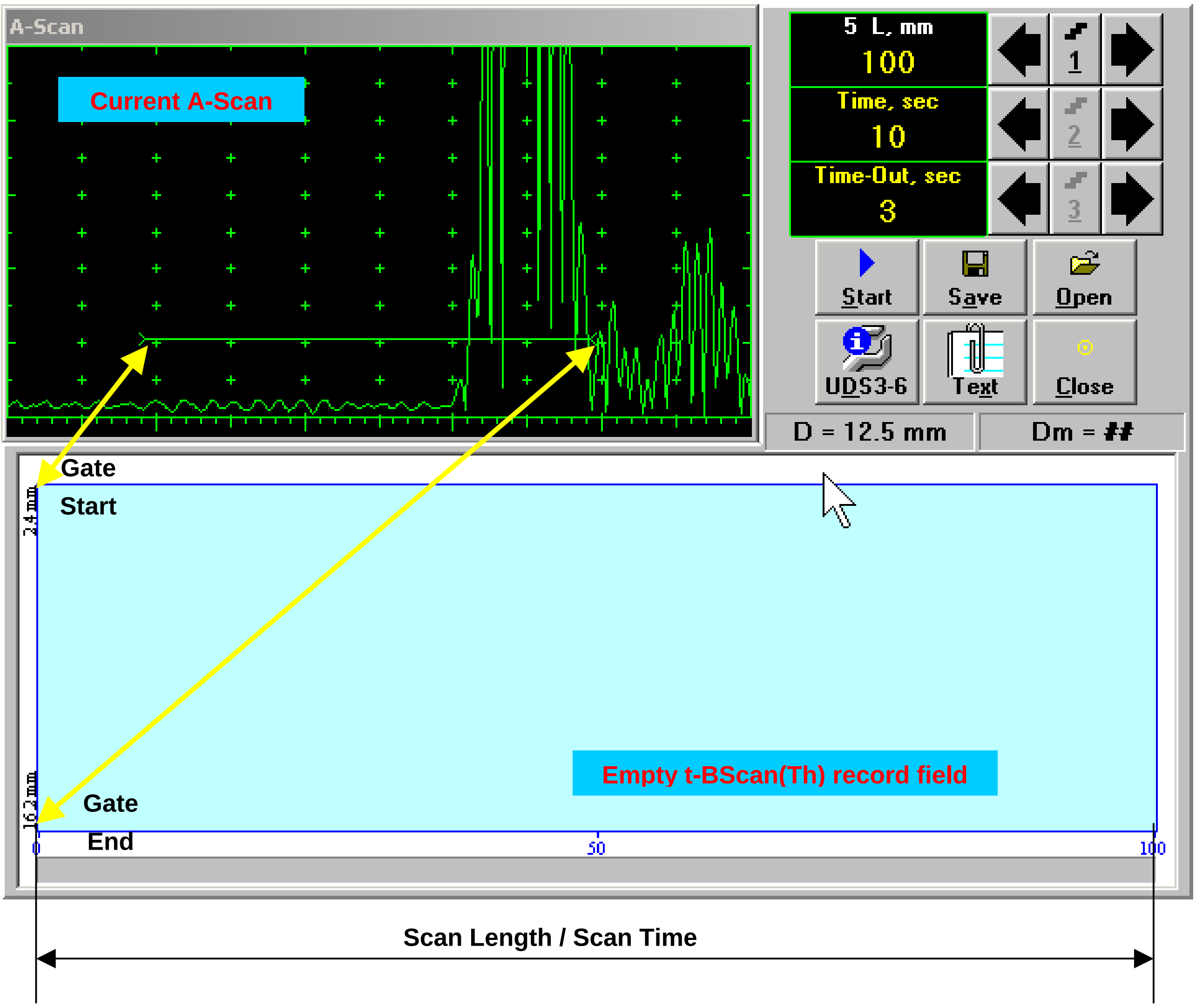


- **aStart** and **aWidth** setting to provide appearance of whole **Gate A** on the **A-Scan**
- **aWidth = (0.75…0.95)** × **Range**
- **First Back Echo** at the thickest area of object under test to be fully matching with Gate A
- **First Back Echo** at the thickest area of object under test to "occupy"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

6.3.2. Thickness Profile Imaging – Implementation

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

t-BScan(Th) control panel is shown below



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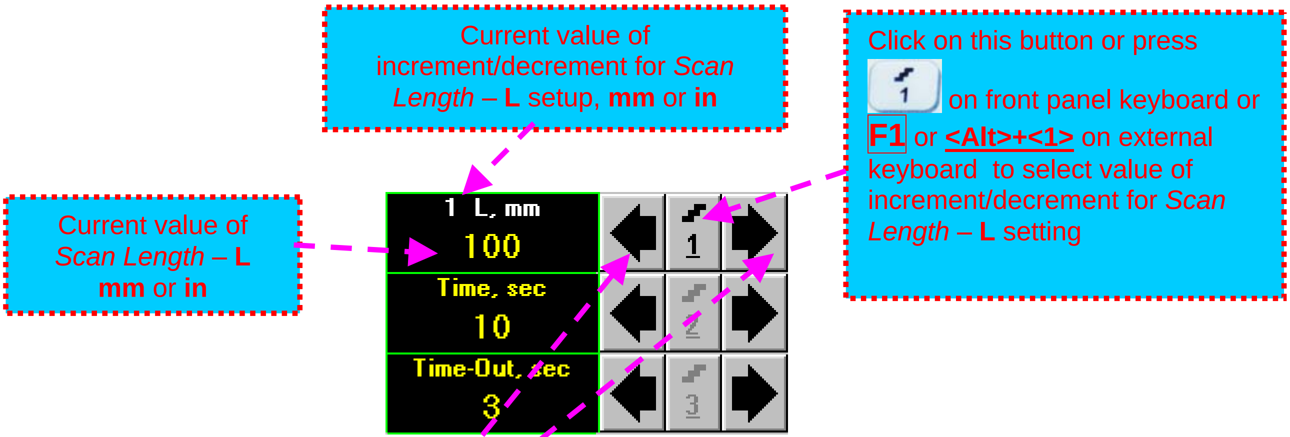
Display Delay and **Range** settings for current **A-Scan** to be used for the recording are equivalent to the same setting of **UDS 3-6 Pulser Receiver** predcessing entering into **t-BScan(Th)** mode

Scan Length and Scan Time

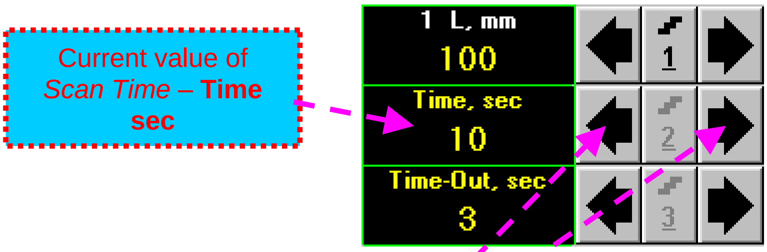
Scan Length – **L** represents length of section of test object to be displayed, over which probe will be scanning during recording period. **Time** (Scan Time) is the duration of recording period



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

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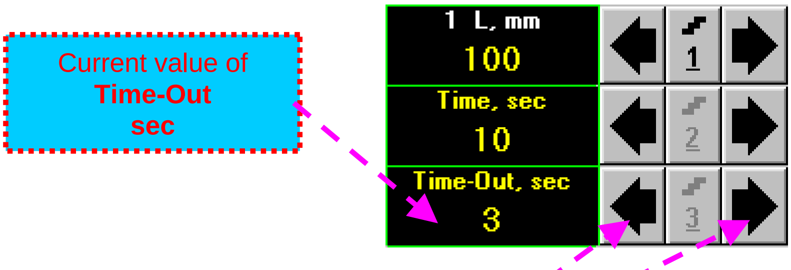
The value of *Scan Time* – **Time** is adjustable between 5 and 60 **sec** in 1 **sec** increment/decrement

Time-out

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

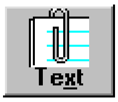


To control **Time-out**
the following manipulations are applicable:

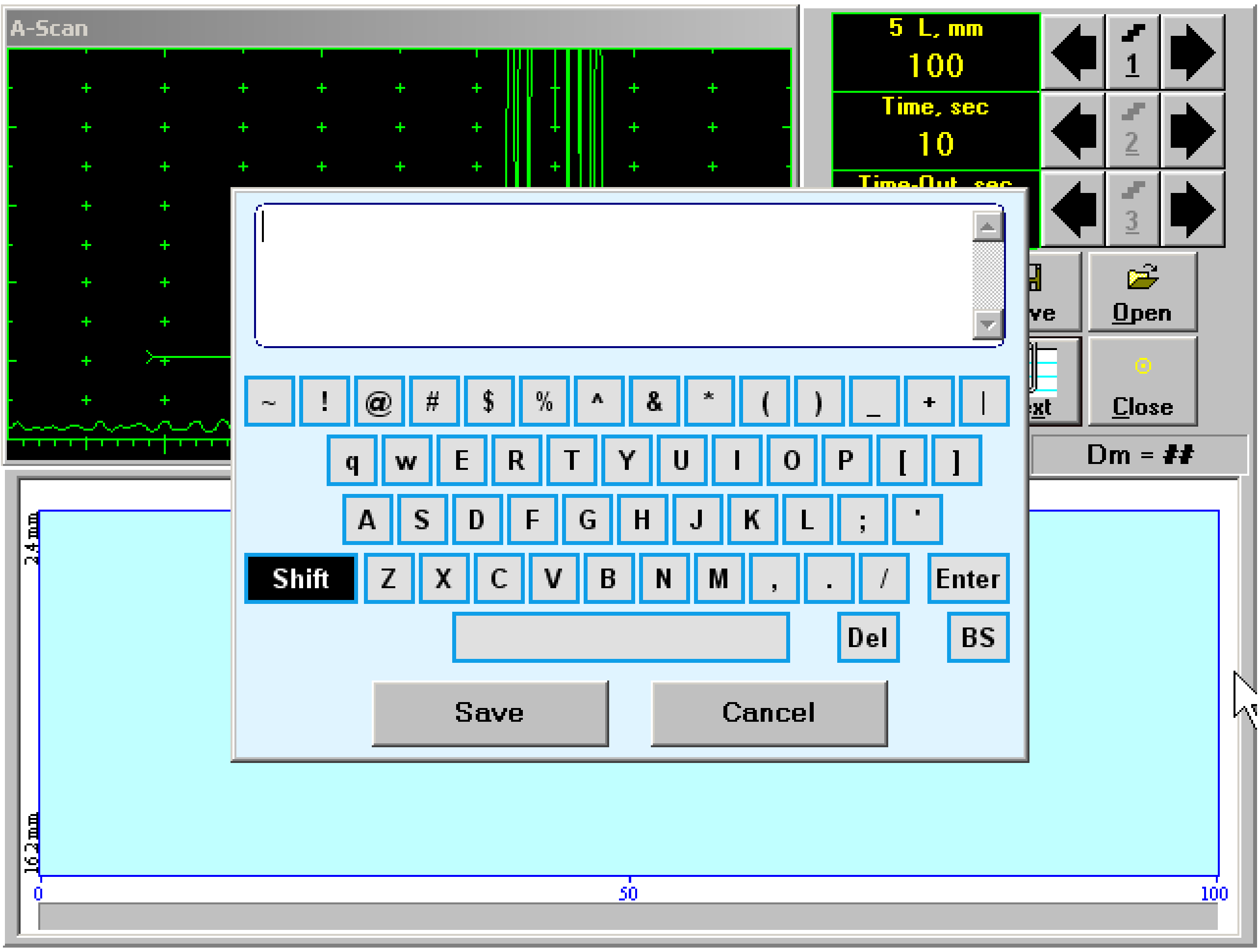
- **Mouse / Touch Screen**
  - Click on corresponding button
- **Keyboard**
  - Press on front panel keyboard or **F3** on external keyboard ⇒ **Time-out** fore color changes to white - then use , , , on front panel keyboard or ⇑, →, ←, ⇓ on external keyboard
- **Combined**
  - Click on **Time-Out** ⇒ **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 

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

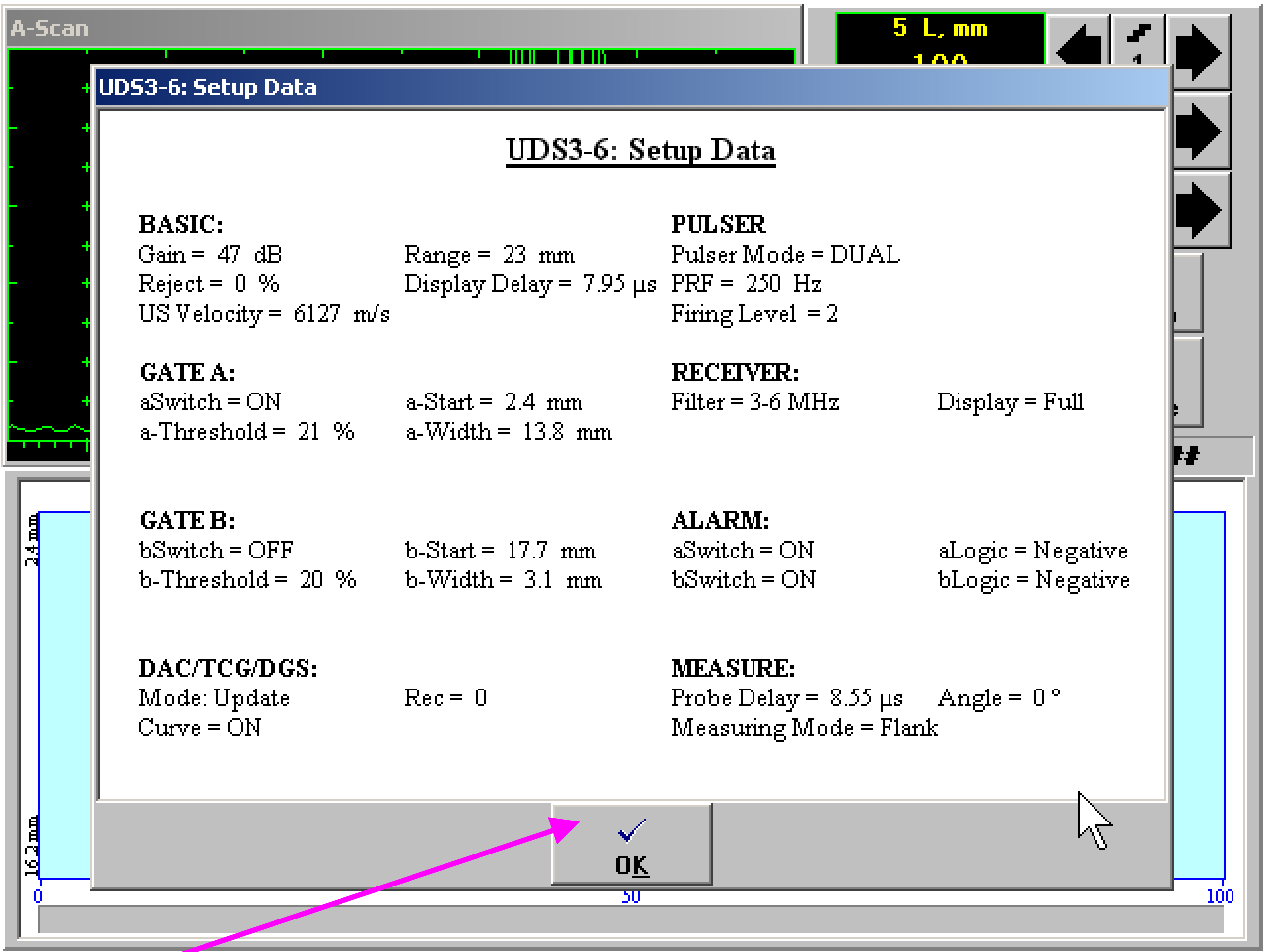
Click on **Cancel** or press 

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

Preview UDS 3-6 Settings

UDS 3-6 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

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

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

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

Save record into a file

Click on Save or press Save 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

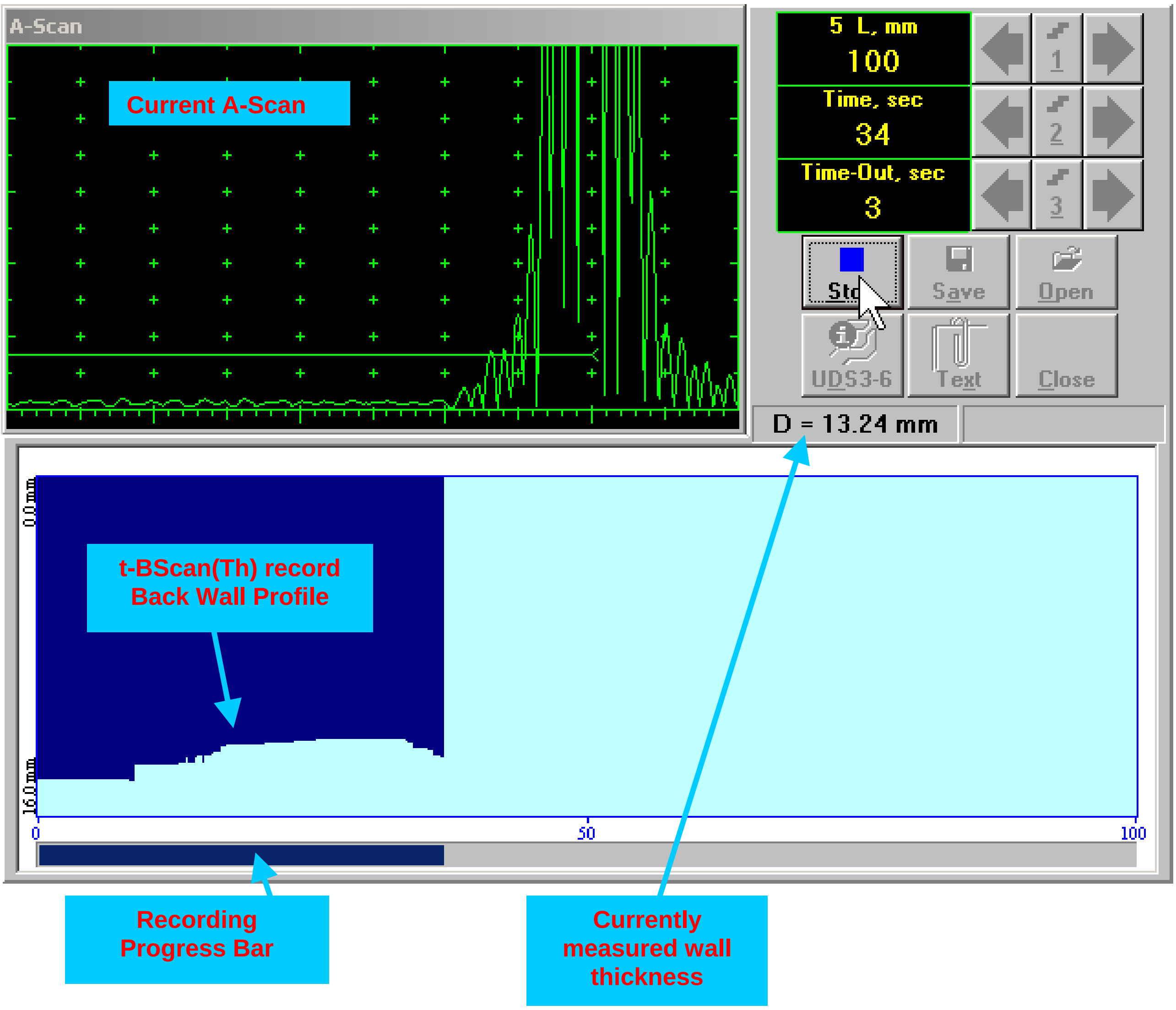
Click on Open or press Open on front panel keyboard or F11 or **<Alt>+<O>** on external keyboard **t-B-Scan(Th)** record accompanied with instrument calibration dump and text notes / comments from a file. Refer to paragraph 5.2.18 of this Operating Manual to proceed with file opening. Refer to paragraph 6.3.2.5 of this Operating Manual to proceed with postprocessing

Return to UDS 3-6 main operating surface

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

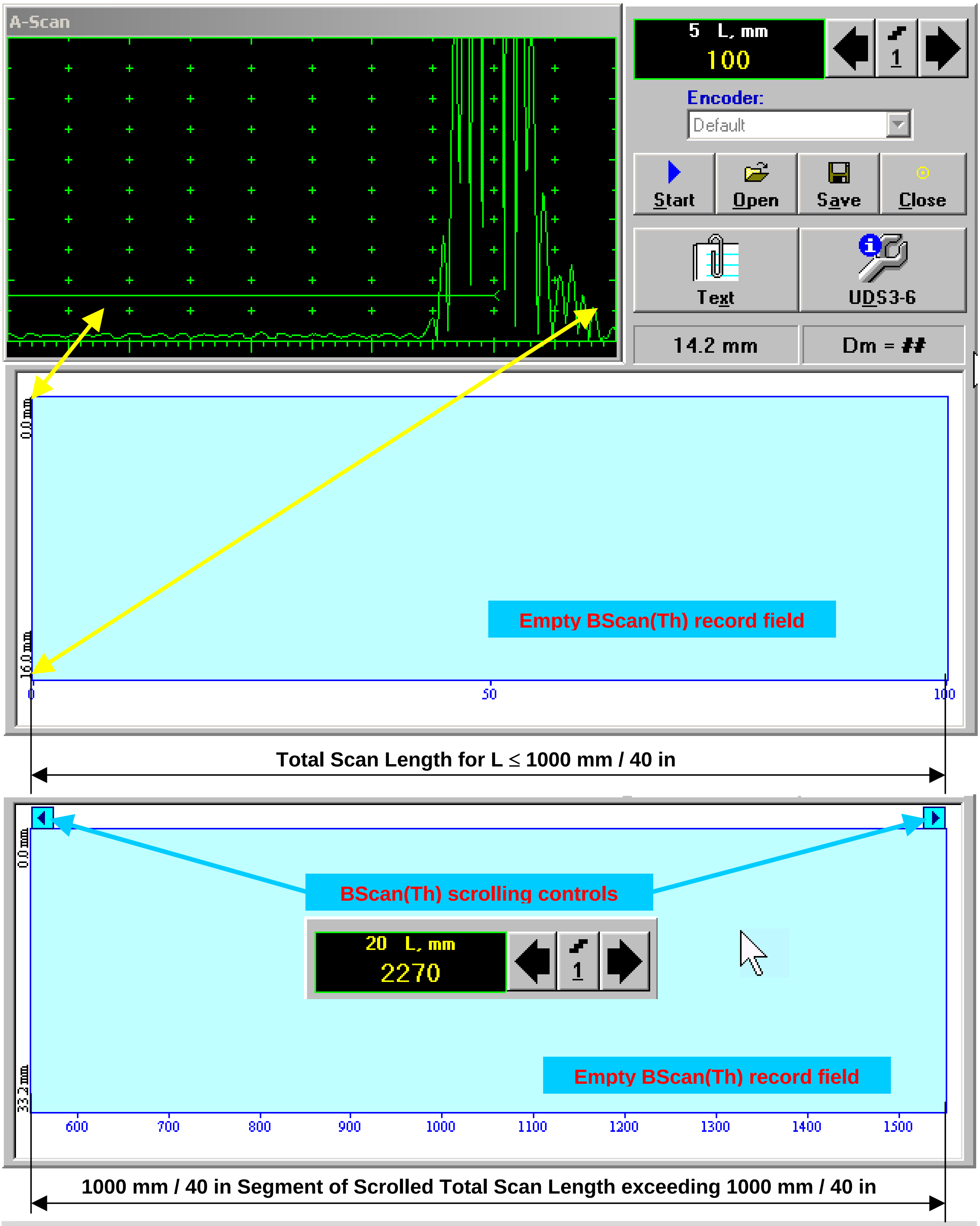
6.3.2.2. t-BScan(Th) – Scanning

- 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



6.3.2.3. BScan(Th) – Prior to Scanning

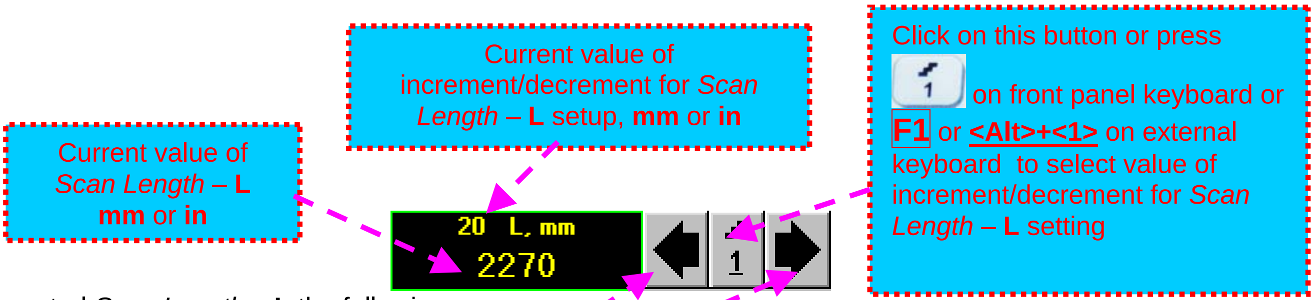
BScan(Th) control panel is shown below



ⓘ
Display Delay and **Range** settings for current **A-Scan** to be used for the recording are equivalent to the same setting of **UDS 3-6 Pulser Receiver** predcessing 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



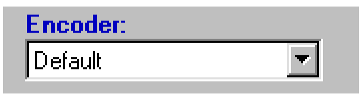
To control *Scan Length* – **L** the following manipulations are applicable:

- **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 rear panel of **ISONIC 2008** instrument

Insert Text Note

Refer to paragraph 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

Refer to paragraph 6.3.2.1 of this Operating Manual

Start/Stop BScan(Th) recording

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

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

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

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

Save record into a file

Click on Save or press Save 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

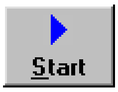
Open record from a file and starting postprocessing session

Click on Open or press Open 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 6.3.2.5 of this Operating Manual to proceed with postprocessing

Return to UDS 3-6 main operating surface

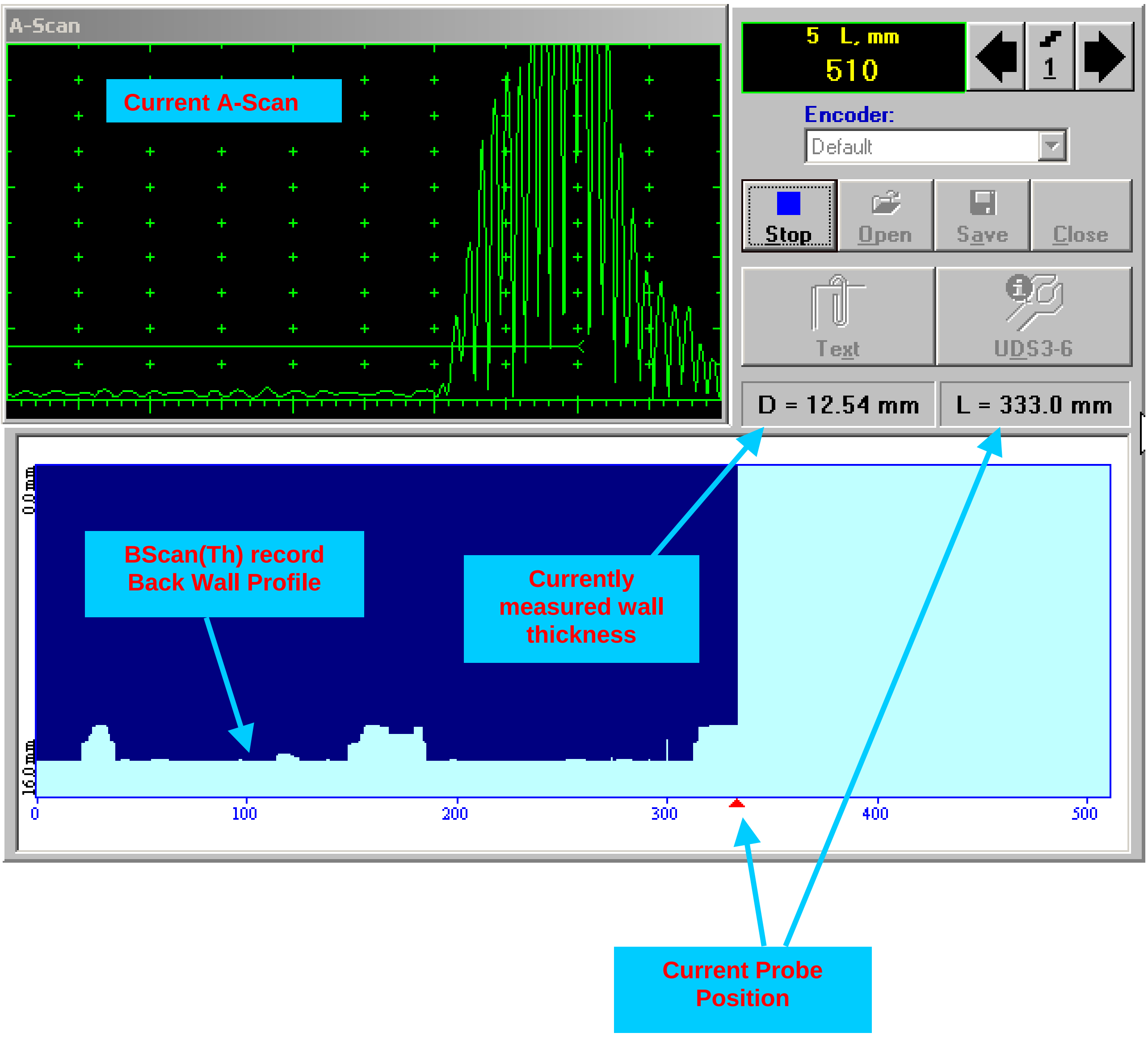
Click on Close or press ESC on front panel keyboard or **<Alt>+<C>** or Esc on external keyboard

6.3.2.4. BScan(Th) – Scanning

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

or press 

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

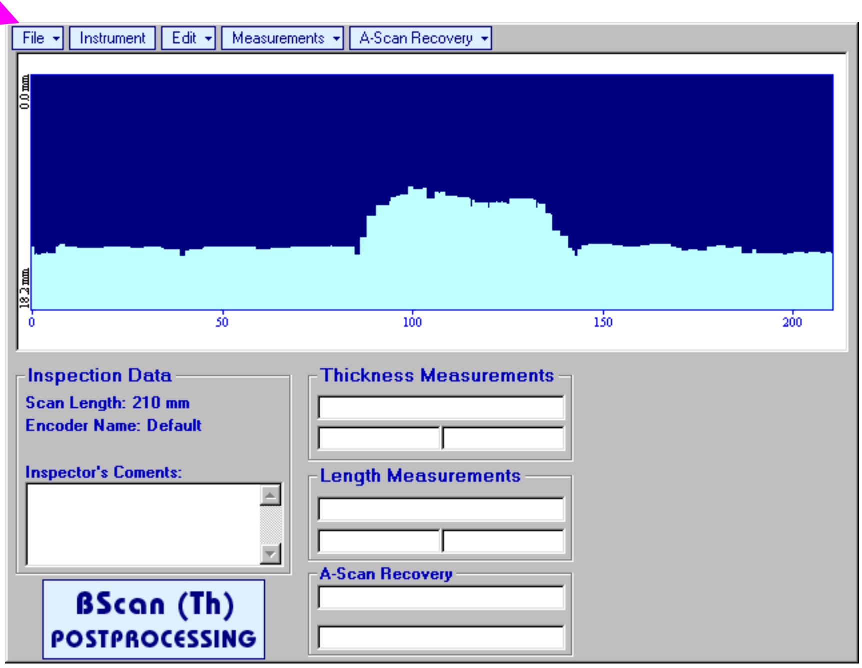


6.3.2.5. t-BScan(Th) / BScan(Th) – Postprocessing

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

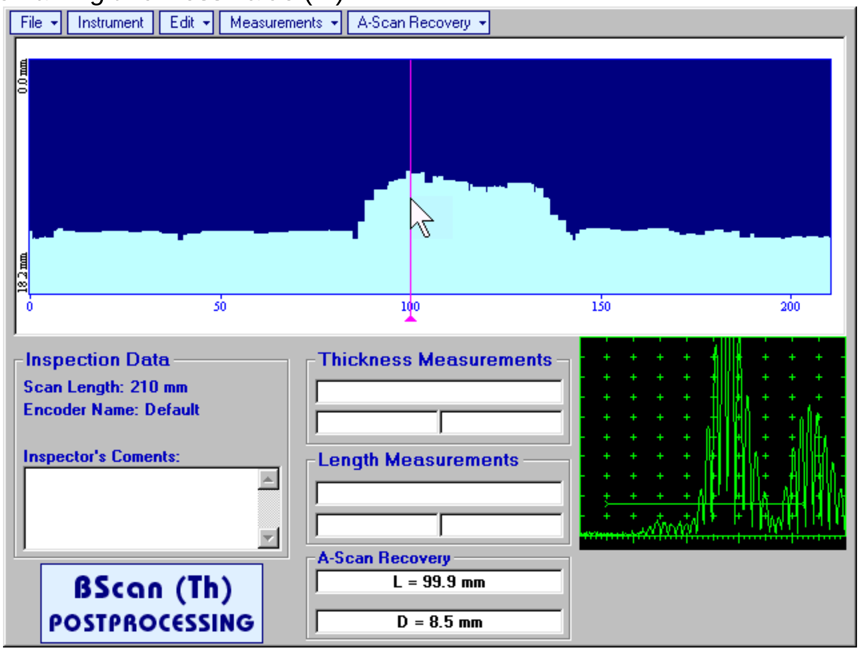
The screen as below appears upon opening file. All postprocessing procedures are performed through menu bar – touch screen stylus or front panel or external mouse to be used



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 3-6** Pulser 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**)

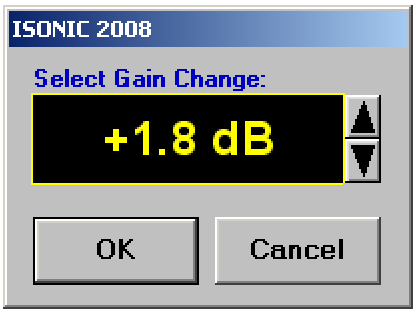


To fix position of *sound path cursor* with corresponding recovered **A-Scan** and *remaining thickness* value left mouse click or release touch screen stylus or press on front panel keyboard or **Enter** on external keyboard

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 ±**6dB** range with ±**0.1 dB** increments through clicking or pressing and holding on or pressing , on front panel keyboard or ↑, ↓ on external keyboard

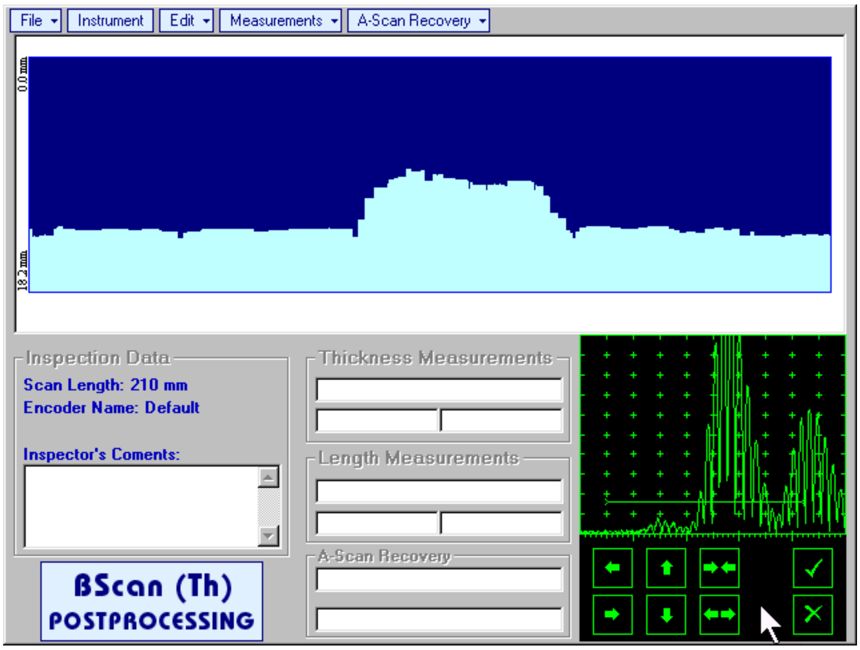


During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain** click on OK or press on front panel keyboard or **Enter** on external keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws **t-BScan(Th)** / **BScan(Th)** image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



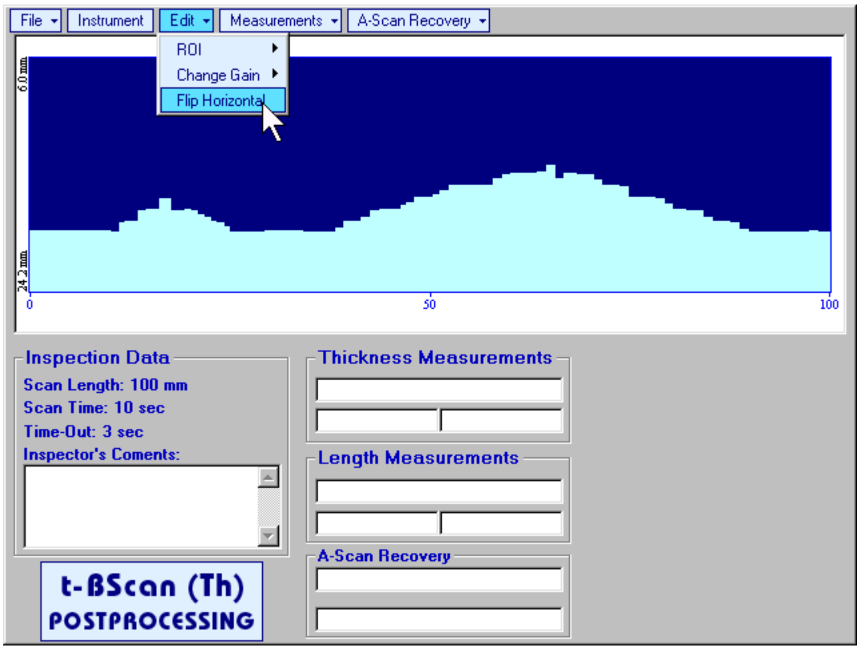
Upon completing redefining of **Region Of Interest** click on – this applies new **Gate A** to all captured **A-Scans** and updates **t-BScan(Th)** / **BScan(Th)** image accordingly

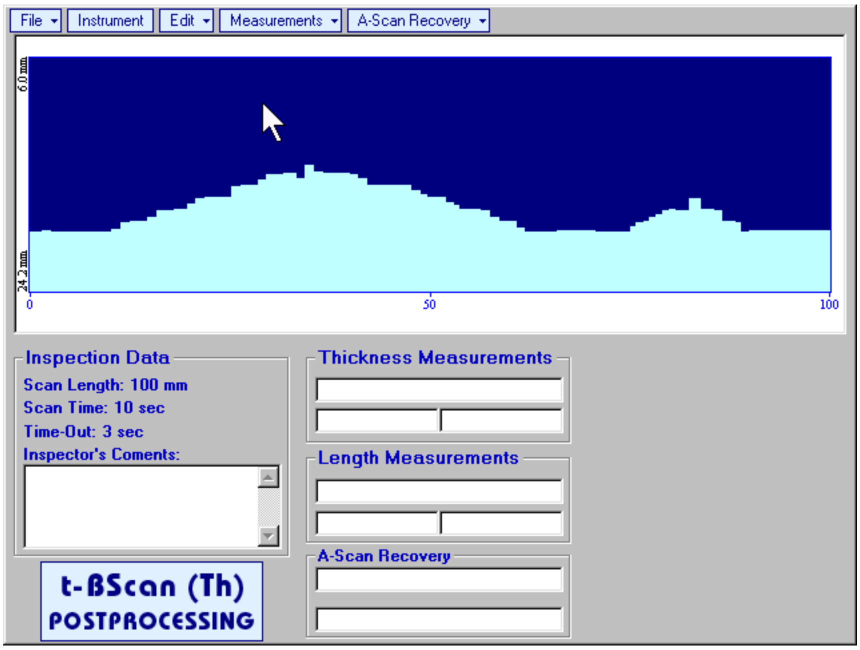
To interrupt selection of reference of **A-Scan** right mouse click or press on front panel keyboard or **Esc** on external keyboard

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

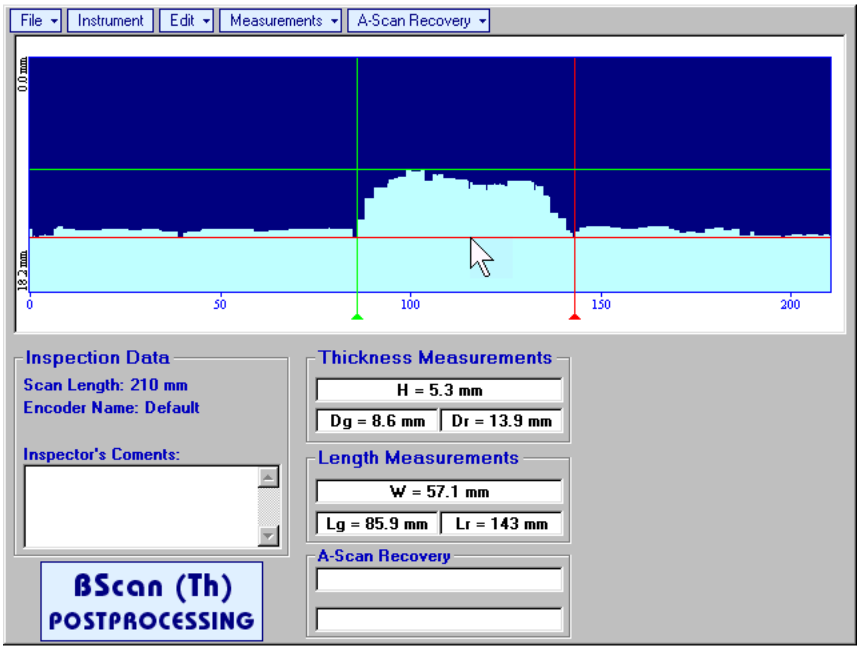




ⓘ

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



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

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

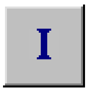
UDS 3-6 Pulser Receiver screen appears upon clicking on 

or 

. The following settings to be provided:

6.4.1.1. 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	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain setting procedure**
5	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**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**			

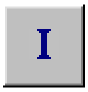
Click on 

or press 

on front panel keyboard or $\boxed{\textbf{F8}}$ on external keyboard upon completing

6.4.1.2. Angle Beam Probes

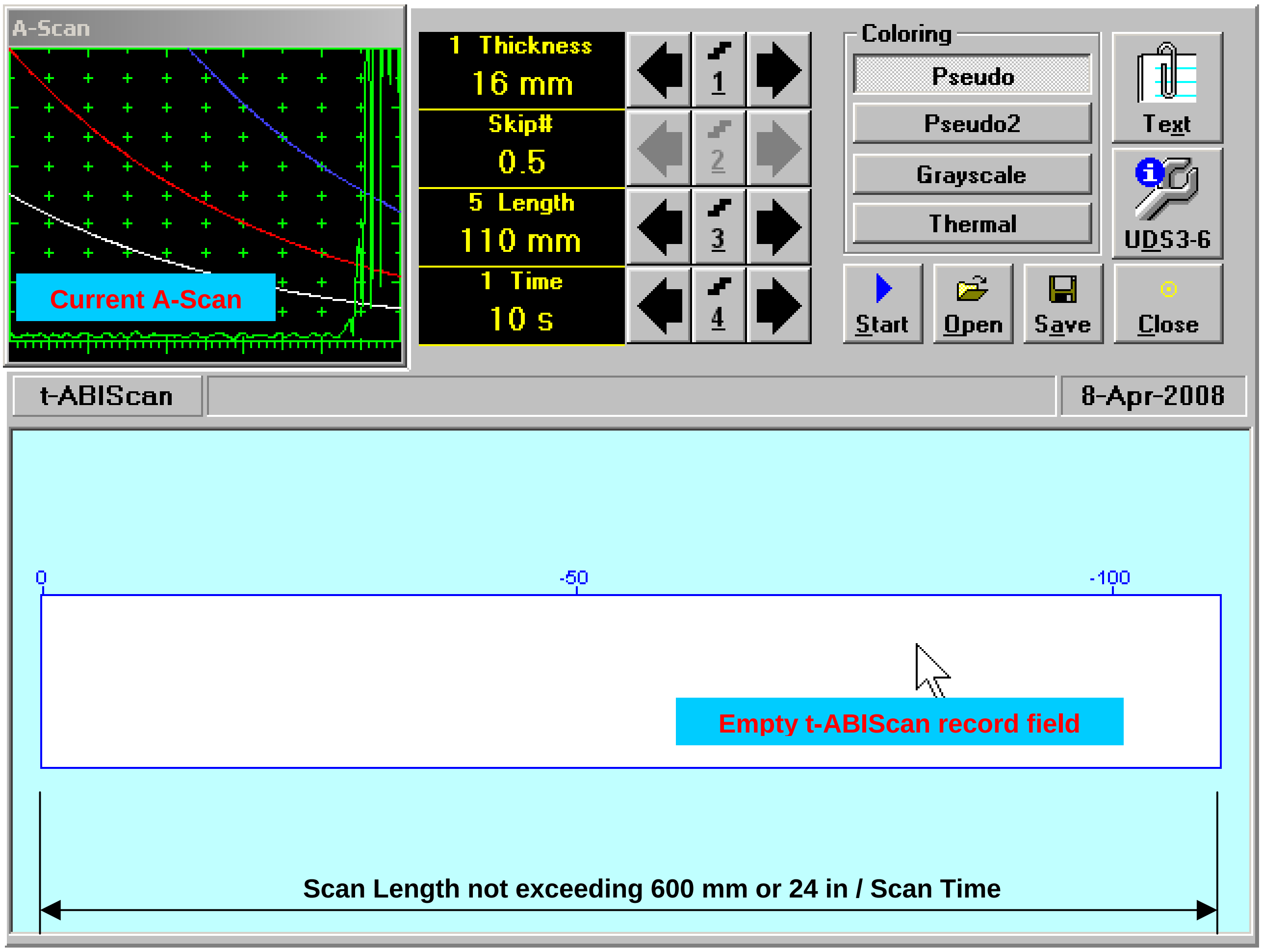
#	Parameter or Mode	Submenu	Required Settings	Note
1	**Gain**	**BASICS**	**Gain** setting to be performed according to inspection procedure providing required echo heights from defects to be detected	
2	**DAC/TCG**	**DAC/TCG**	**DAC/TCG** settings to meet requirements of inspection procedure	
3	**Pulser Mode**	**PULSER**	**Dual** for dual element probes **Single** for single element probes	
4	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain setting procedure**
5	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**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**			

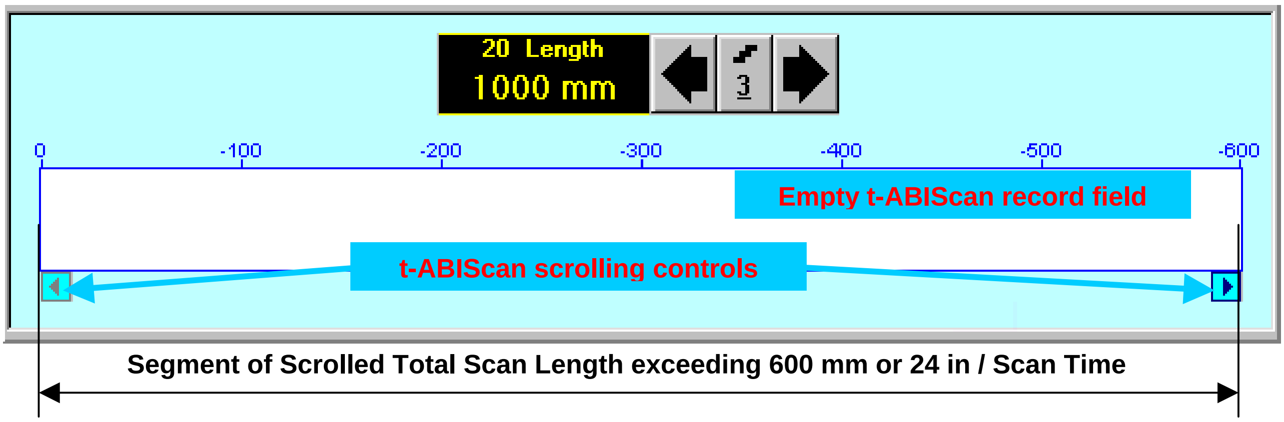
Click on  or press  on front panel keyboard or **F8** on external keyboard upon completing

6.4.2. B-Scan Cross Sectional Imaging – Implementation

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

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



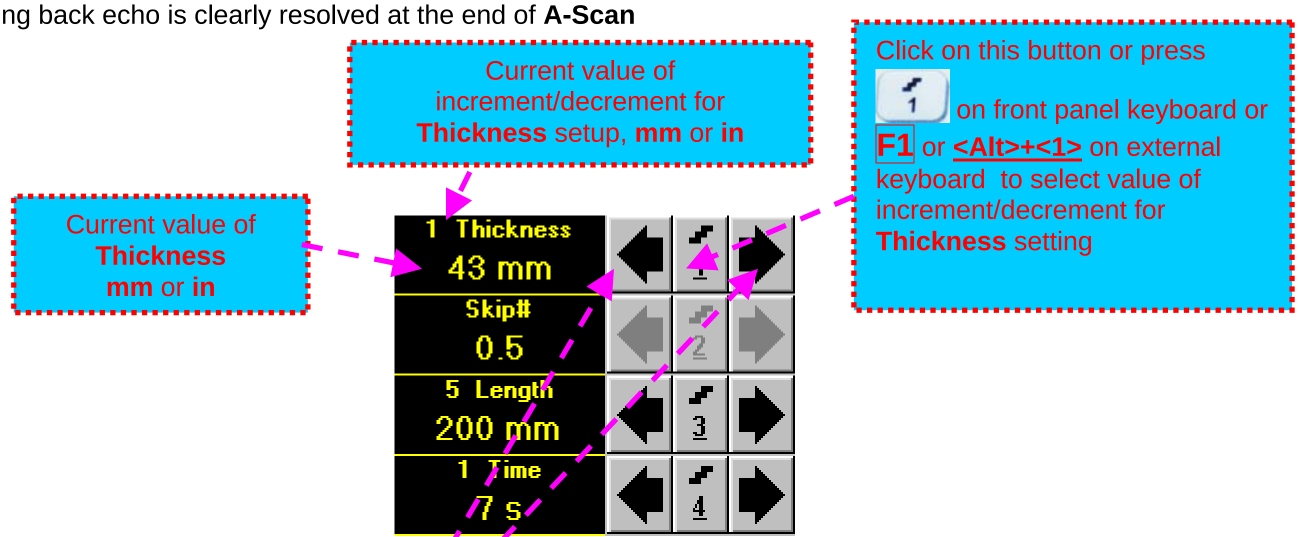


ⓘ

Display Delay for current **A-Scan** to be used for the recording is equal to **Probe Delay** setting in submenu **MEASURE** of **UDS 3-6 Pulser Receiver** predcessing 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

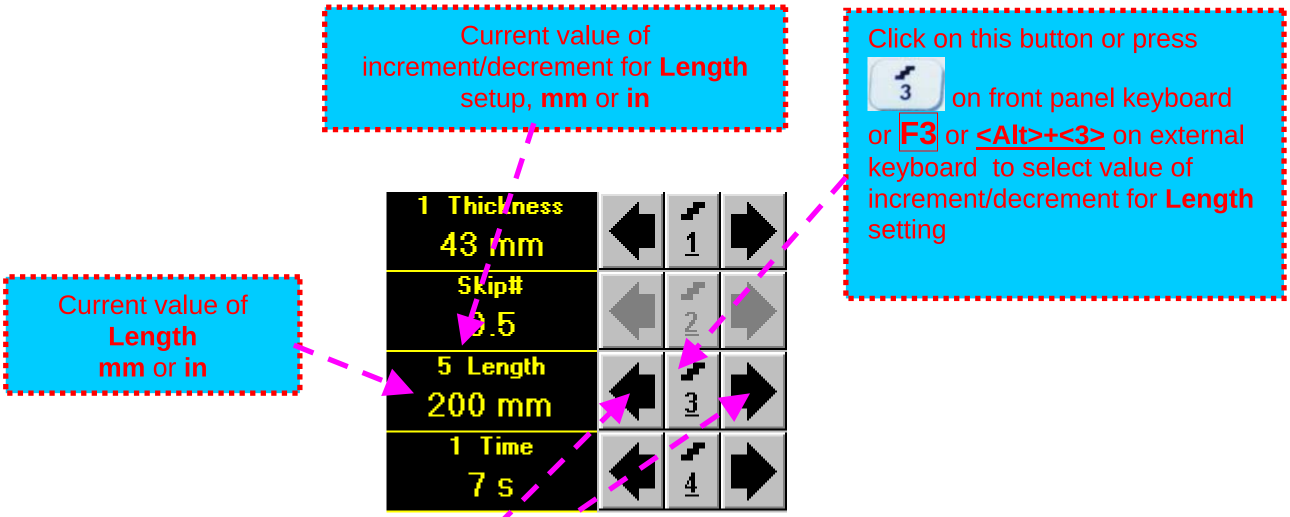
ⓘ
The value of **Thickness** is adjustable between 5 and 300 **mm** or 0.2 and 12 **in** (expandable on special inquire)

Skip

This setting is ignored while using straight beam probes

Scan Length and Scan Time

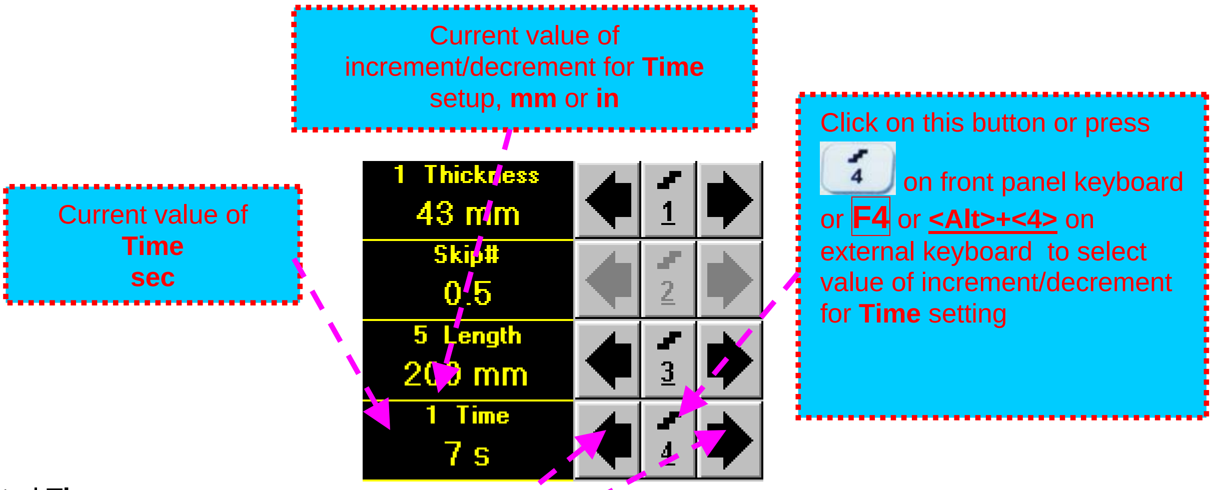
Length represents length of section of test object to be displayed, over which probe will be scanning during recording period. **Time** (Scan Time) is the duration of recording period



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

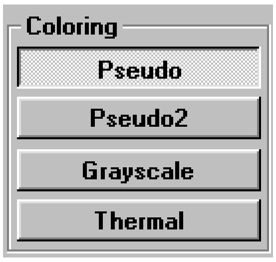
Refer to paragraph 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

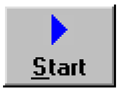
Refer to paragraph 6.3.2.1 of this Operating Manual

t-ABIScan Record Palette

There are four palettes available through click on appropriate button:

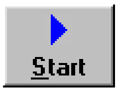


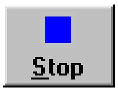
Start/Stop t-ABIScan recording

Click on 

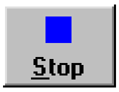
 or press 

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



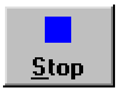
 button becomes invisible since **t-ABIScan** recording starts. 

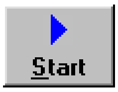
 button occupies its position.

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 6.3.2.1 of this Operating Manual

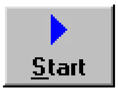
Open record from a file and starting postprocessing session

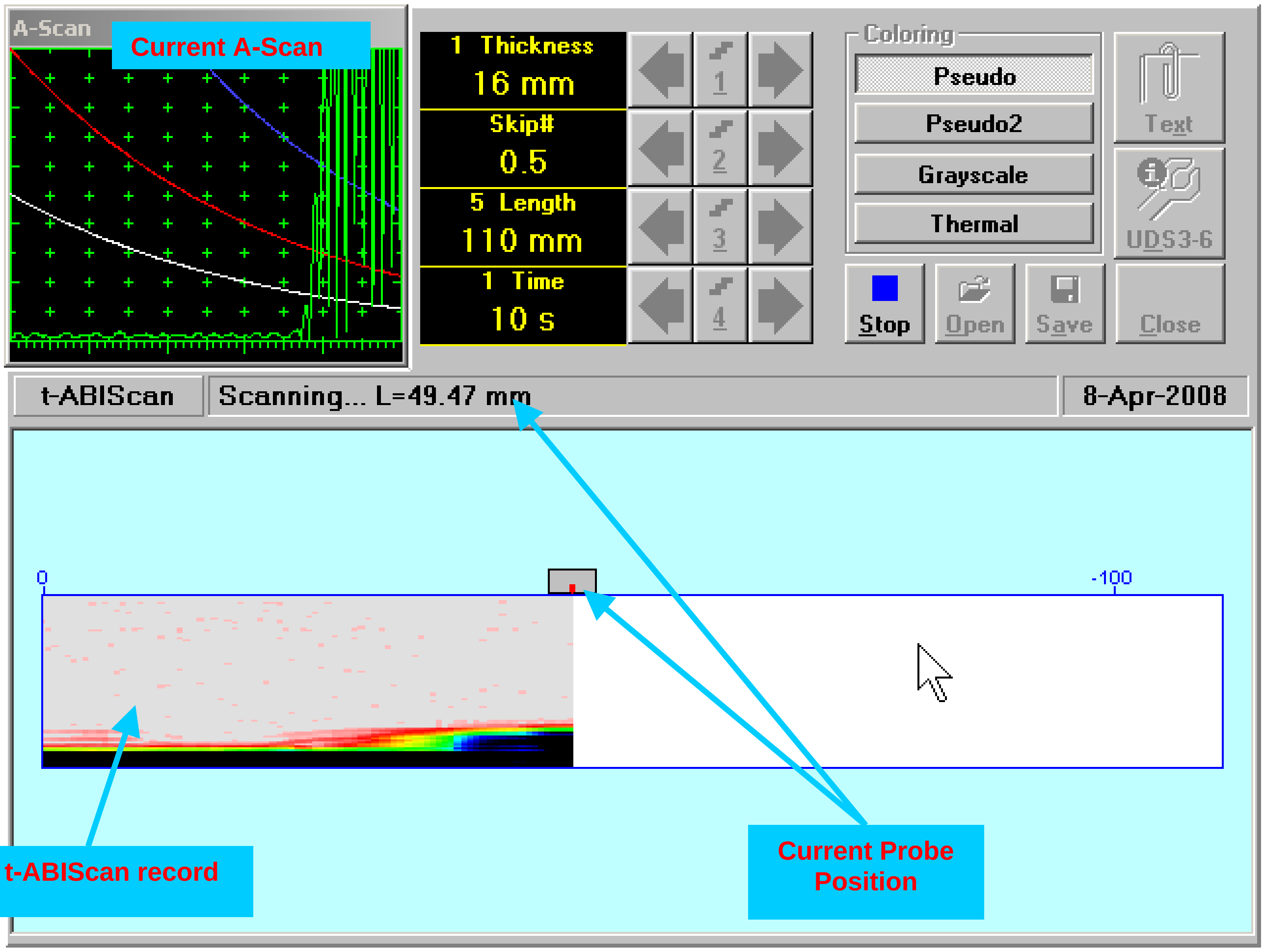
Refer to paragraph 6.3.2.1 of this Operating Manual

Return to UDS 3-6 main operating surface

Refer to paragraph 6.3.2.1 of this Operating Manual

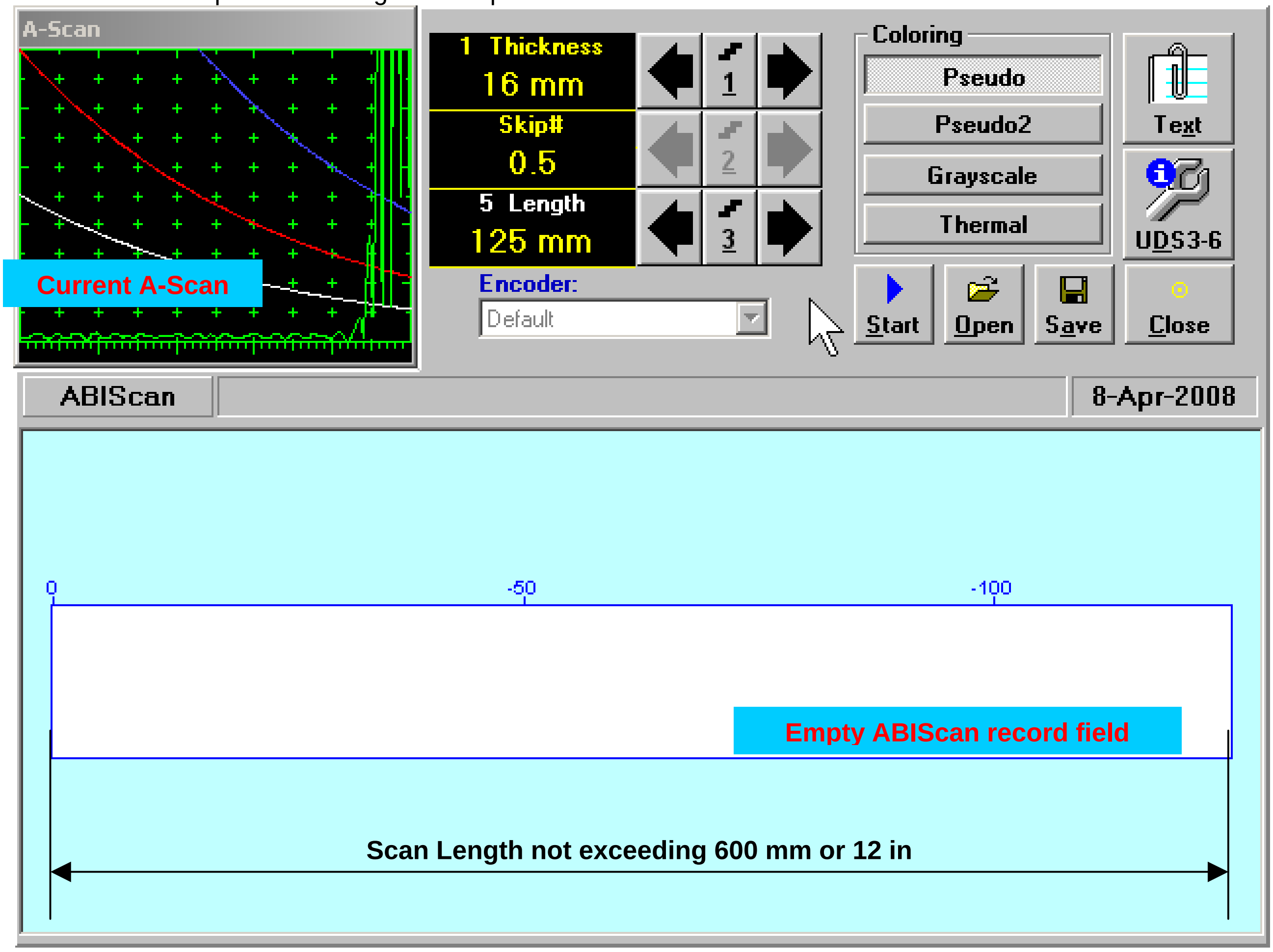
6.4.2.2. t-ABIScan – Scanning (Straight Beam Probes)

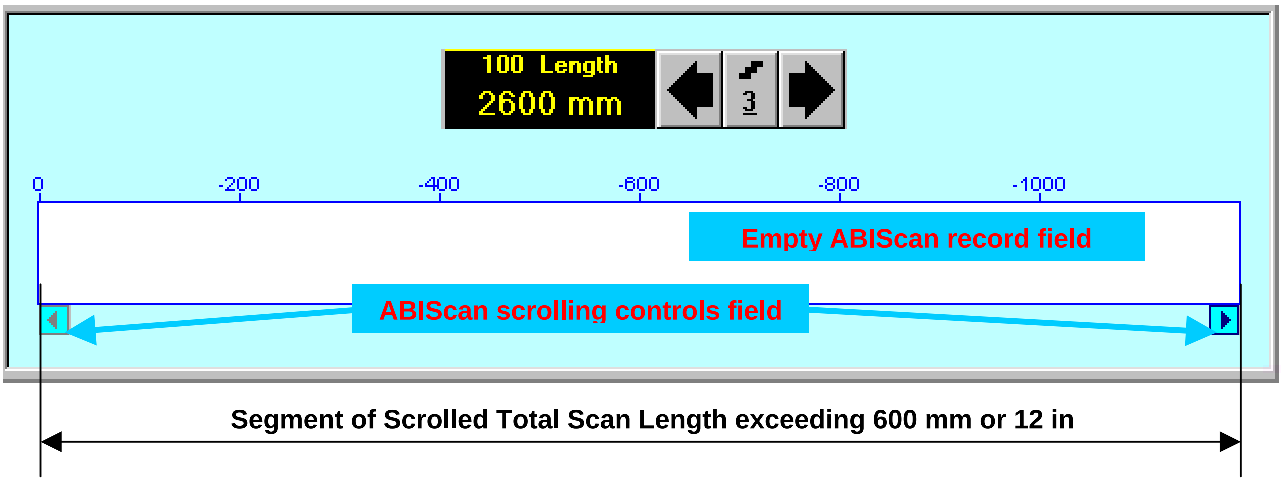
- ❑ Apply probe to test object in the start point of selected scanning line
- ❑ Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- ❑ Guide probe over the scanning line synchronously with *Probe Icon* moving with constant speed above **t-ABIScan** record field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



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

ABIScan control panel for straight beam probe is shown below



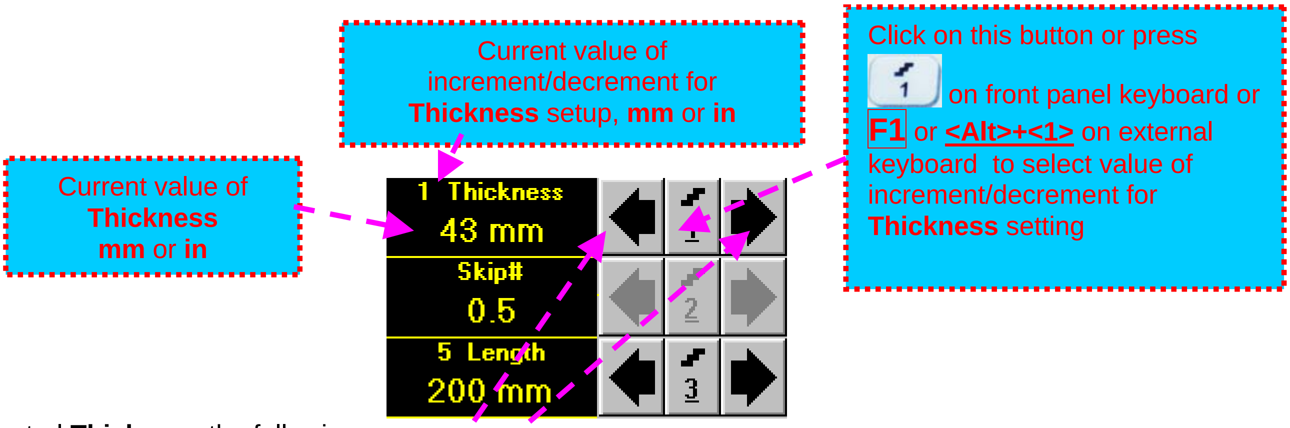


ⓘ

Display Delay for current **A-Scan** to be used for the recording is equal to **Probe Delay** setting in submenu **MEASURE** of **UDS 3-6 Pulser Receiver** predcessing 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

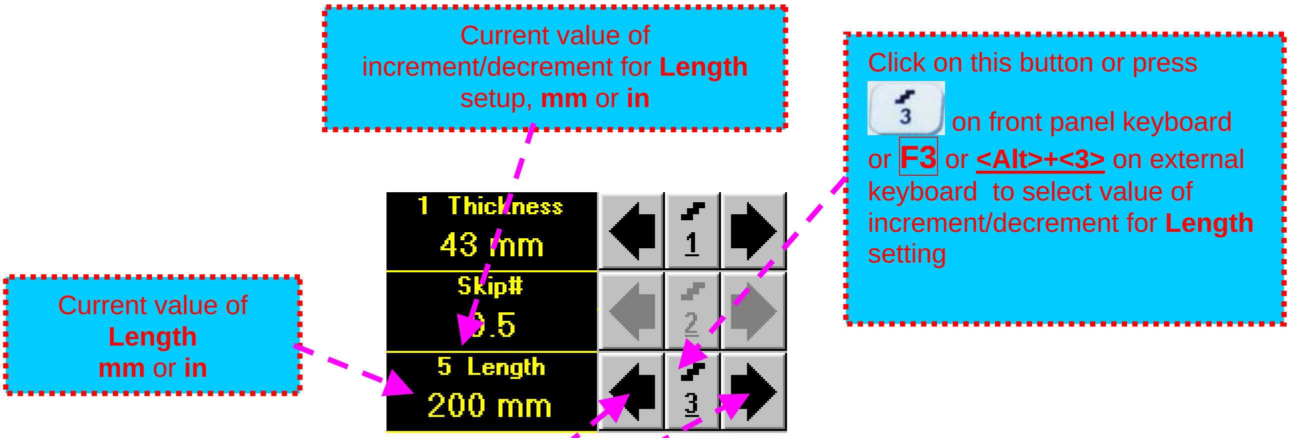
ⓘ
The value of **Thickness** is adjustable between 5 and 300 **mm** or 0.2 and 12 **in** (expandable on special inquire)

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



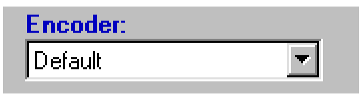
To control **Length** the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click on corresponding button
- **Keyboard**
  - Press [3] 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 rear panel of **ISONIC 2008** instrument

Insert Text Note

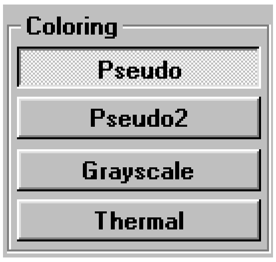
Refer to paragraph 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

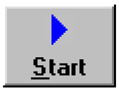
Refer to paragraph 6.3.2.1 of this Operating Manual

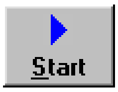
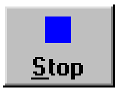
ABIScan Record Palette

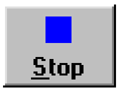
There are four palettes available through click on appropriate button:

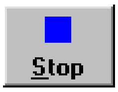
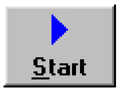


Start/Stop ABIScan recording

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 6.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

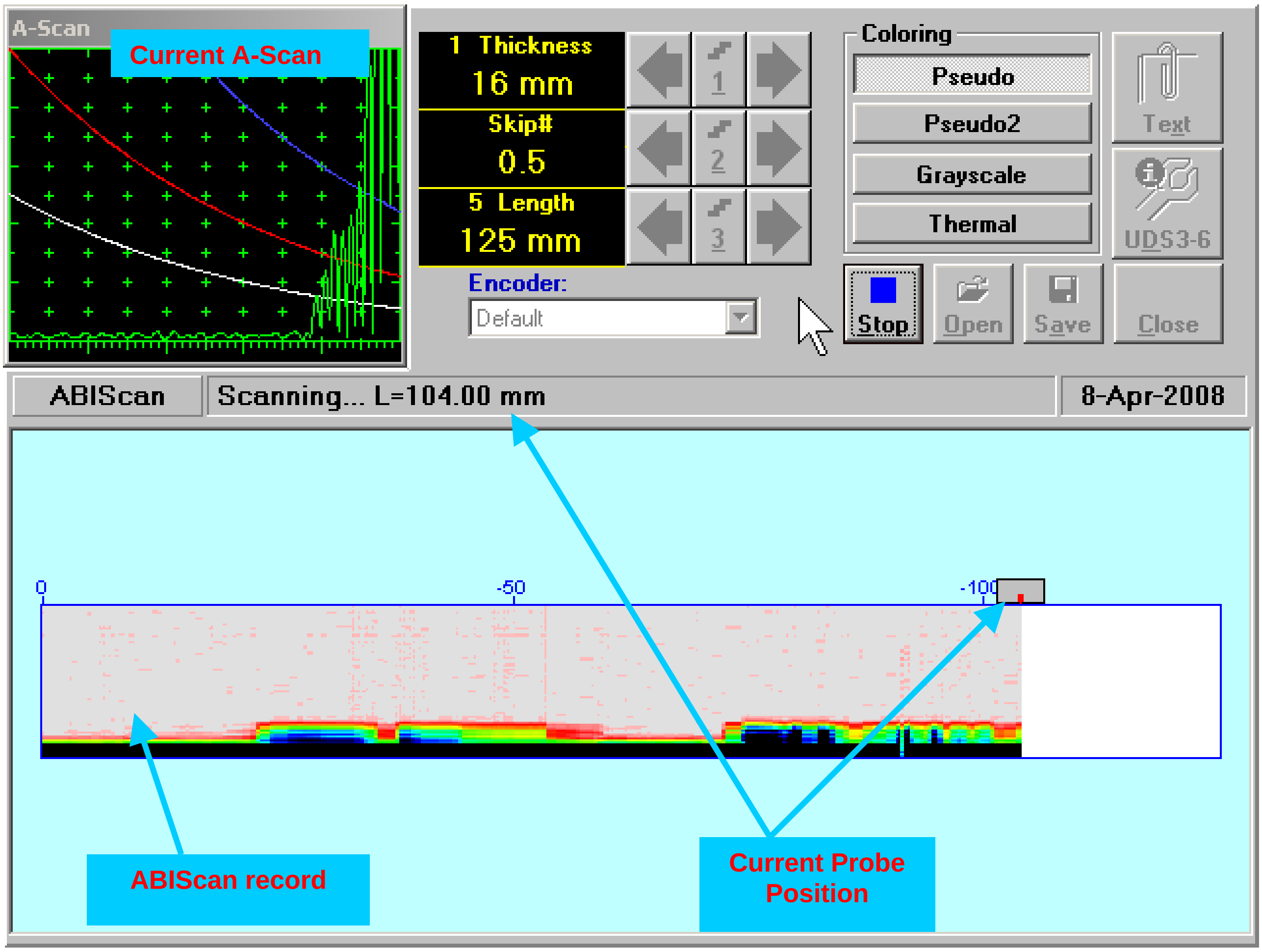
Refer to paragraph 6.3.2.1 of this Operating Manual

Return to UDS 3-6 main operating surface

Refer to paragraph 6.3.2.1 of this Operating Manual

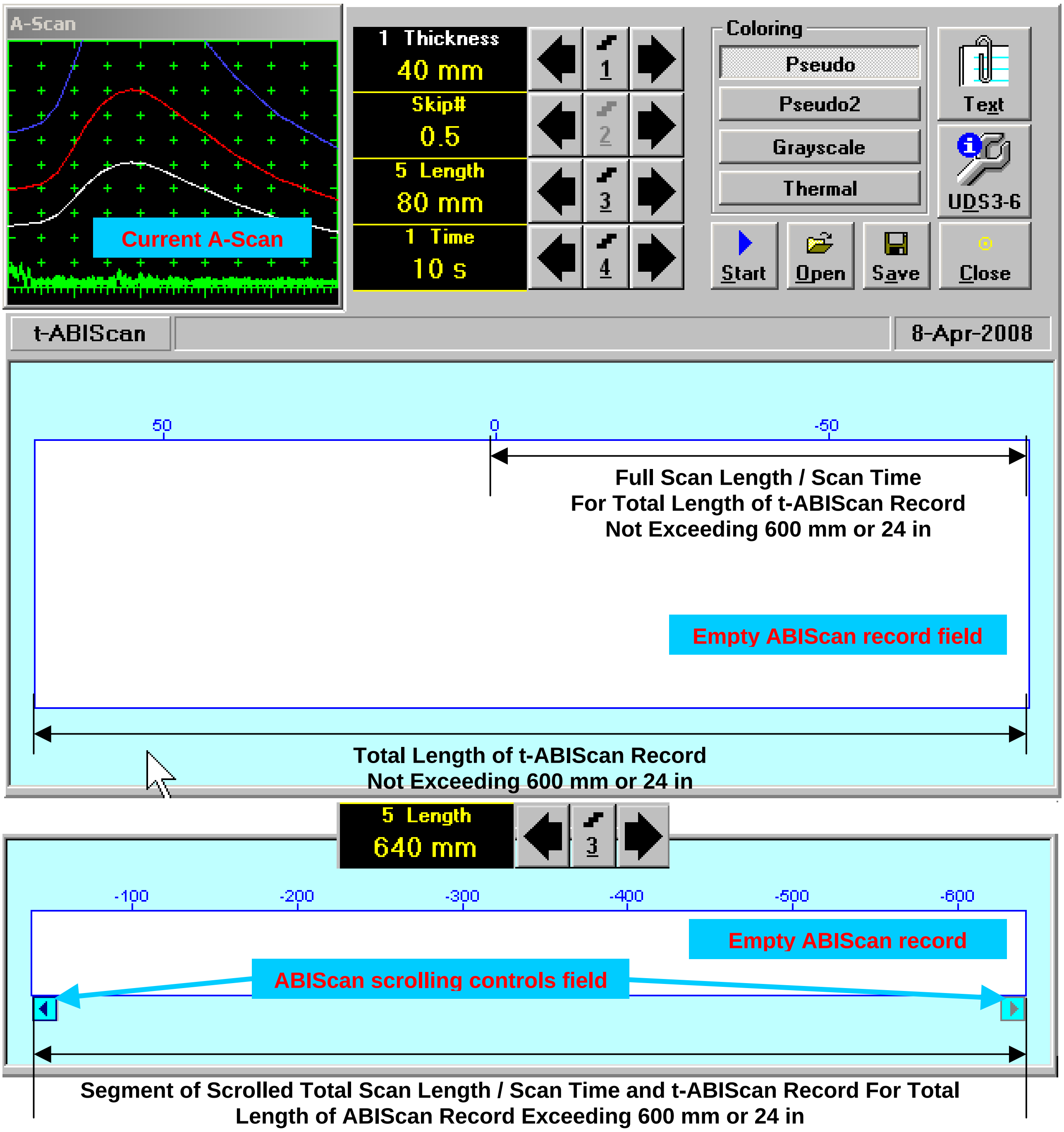
6.4.2.4. ABIScan – Scanning (Straight Beam Probes)

- 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



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

t-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 3-6 Pulser 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 3-6 Pulser Receiver** predcessing entering into **t-ABIScan** mode

Thickness and Skip #

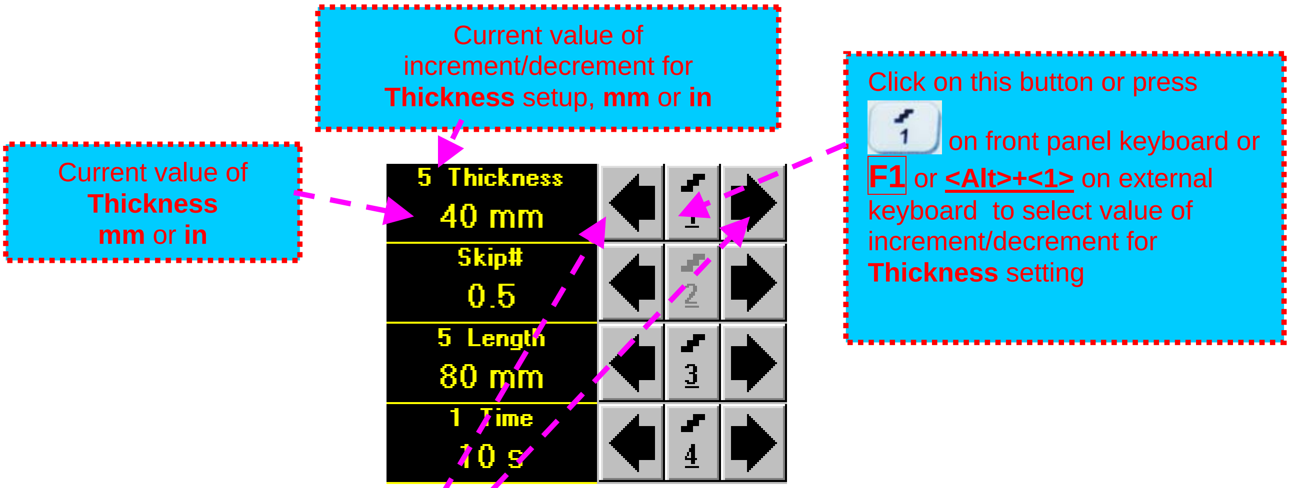
Thickness and **Skip #** settings define the region of interest starting from the scanning surface and automatic **Range** setting for current **A-Scan** to be used for the recording:

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

whereas

- **Thickness** and **Skip #** are the settings of **t-ABIScan** control panel
- **Angle** is setting in submenu **MEASURE** of **UDS 3-6 Pulser Receiver** predcessing entering into **t-ABIScan** mode

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



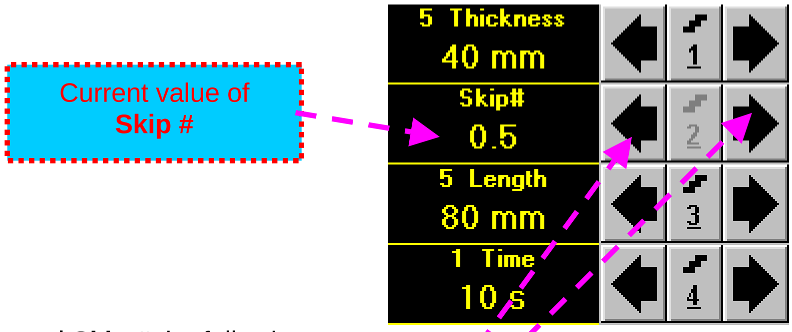
To control **Thickness** the following manipulations are applicable:

- **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 #



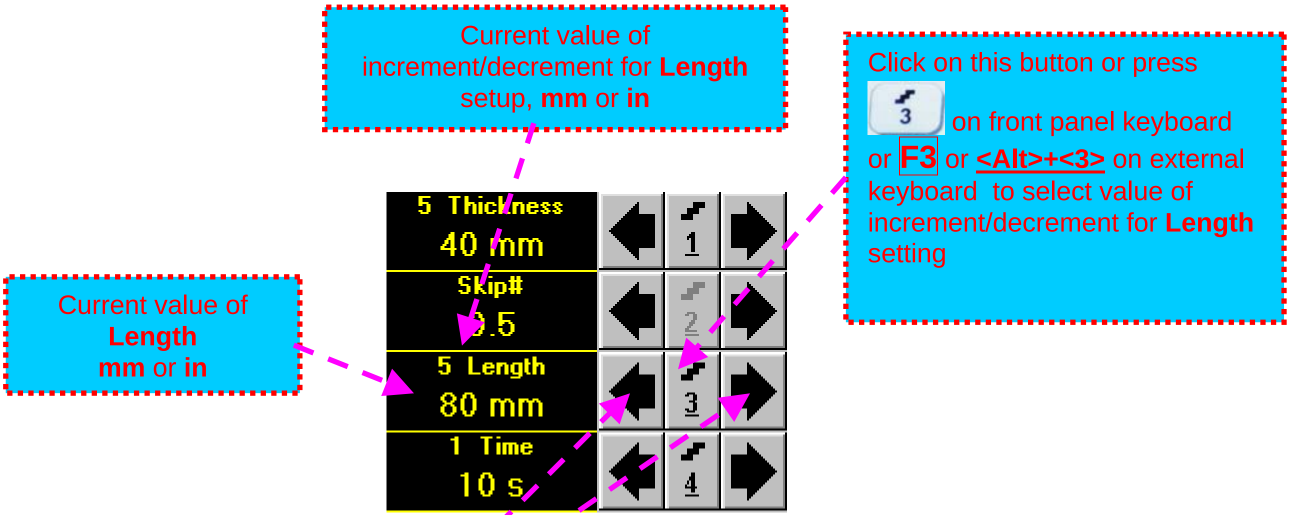
To control **Skip #** the following manipulations are applicable:

- **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

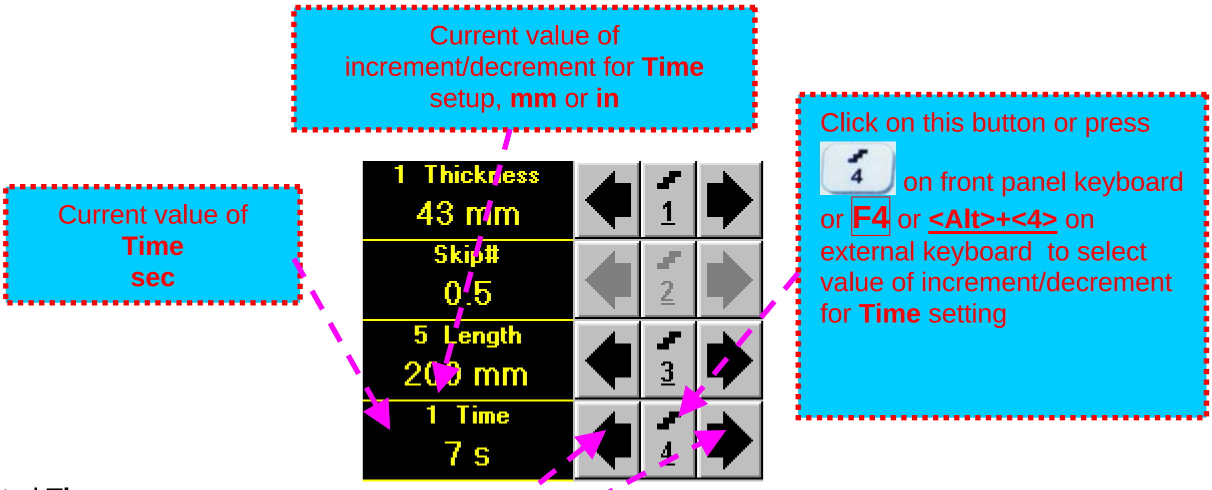
Length represents length of section of test object to be displayed, over which probe will be scanning during recording period. **Time** (Scan Time) is the duration of recording period



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

- **Mouse / Touch Screen**
  - Click on corresponding button
- **Keyboard**
  - Press 3 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

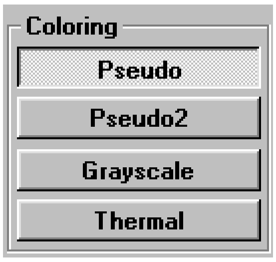
Refer to paragraph 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

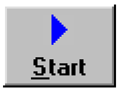
Refer to paragraph 6.3.2.1 of this Operating Manual

t-ABIScan Record Palette

There are four palettes available through click on appropriate button:

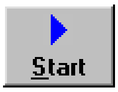


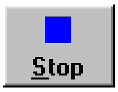
Start/Stop t-ABIScan recording

Click on 

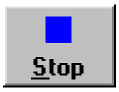
or press 

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



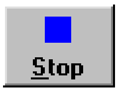
button becomes invisible since **t-ABIScan** recording starts. 

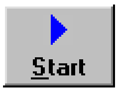
button occupies its position.

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 6.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

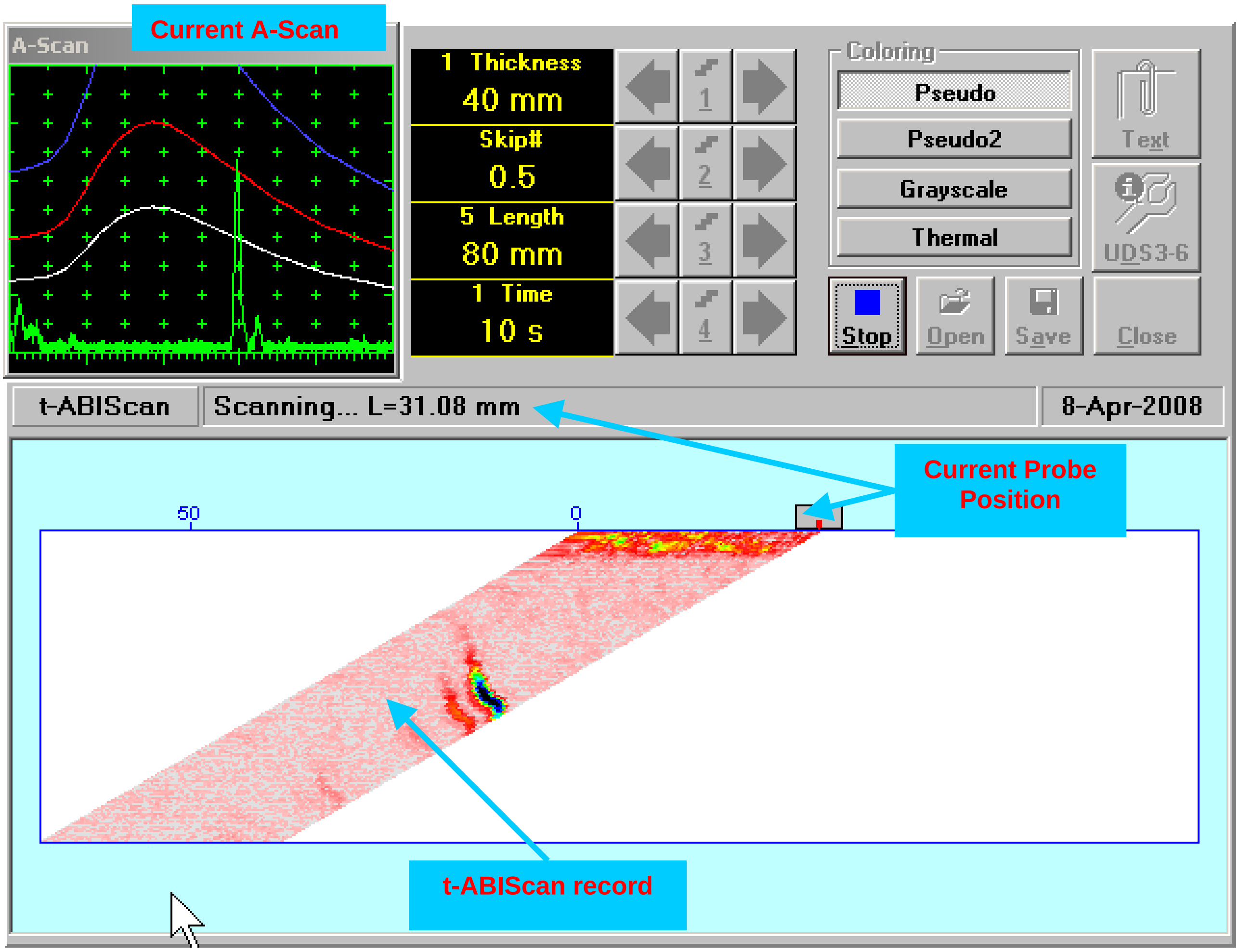
Refer to paragraph 6.3.2.1 of this Operating Manual

Return to UDS 3-6 main operating surface

Refer to paragraph 6.3.2.1 of this Operating Manual

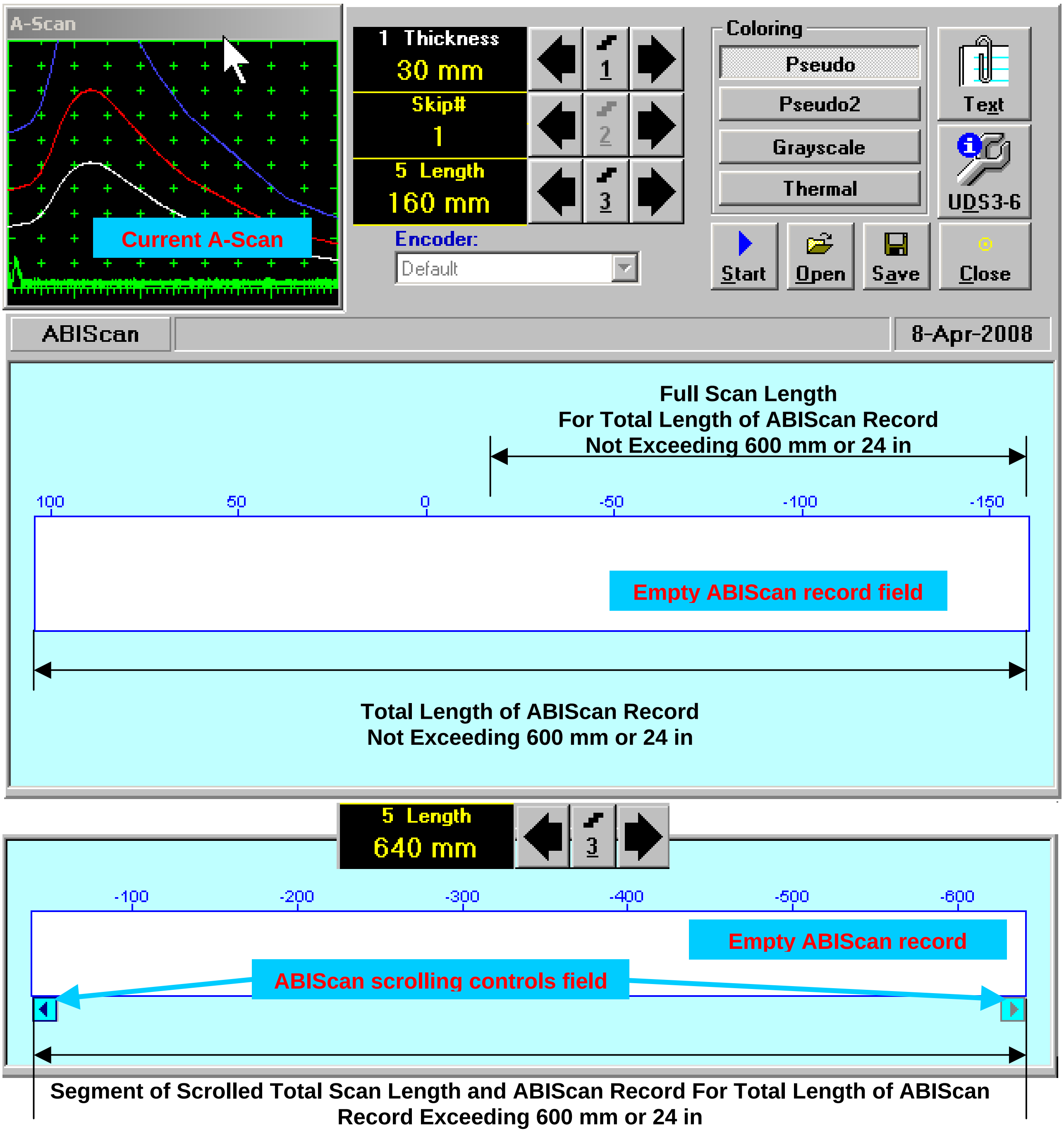
6.4.2.6. t-ABIScan – Scanning (Angle Beam Probes)

- 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



6.4.2.7. 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 3-6 Pulser Receiver** predcessing 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 3-6 Pulser Receiver** predcessing entering into **ABIScan** mode

<u>Thickness and Skip #</u>

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:

Range = 2 × Skip # × Thickness × Cos (Angle)

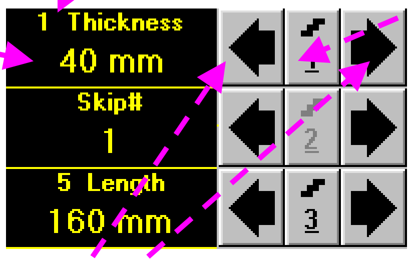
whereas

- **Thickness** and **Skip #** are the settings of **ABIScan** control panel
- **Angle** is setting in submenu **MEASURE** of **UDS 3-6 Pulser Receiver** predcessing entering into **ABIScan** mode

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

Current value of increment/decrement for **Thickness** setup, **mm** or **in**

Current value of **Thickness** **mm** or **in**



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

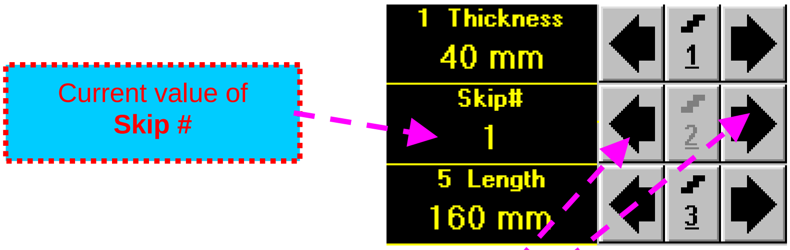
To control **Thickness** the following manipulations are applicable:

- **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



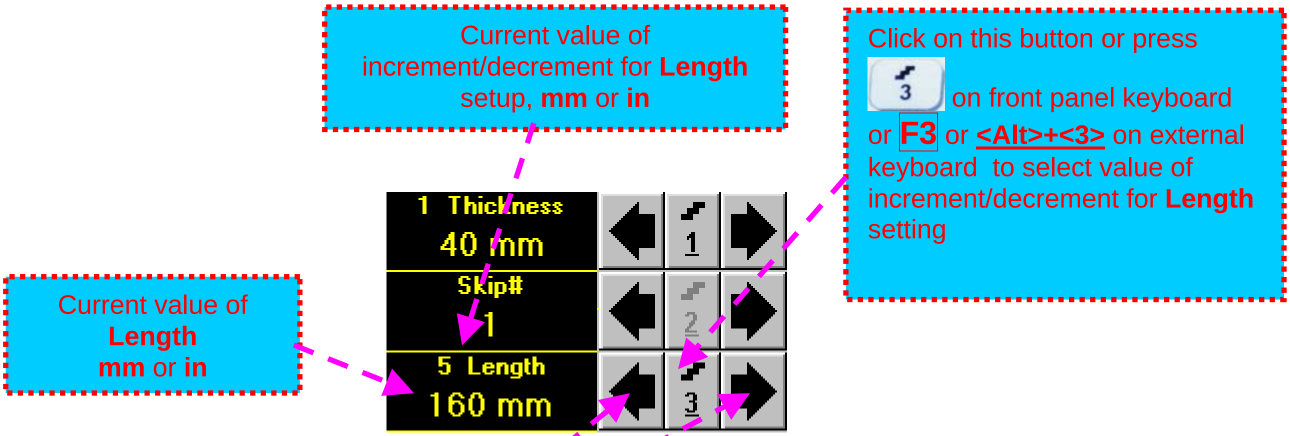
To control **Skip #** the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click on corresponding button
- **Keyboard**
  - Press [2] 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



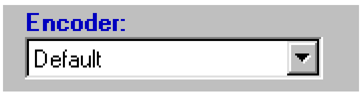
To control **Length** the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click on corresponding button
- **Keyboard**
  - Press 3 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 rear panel of **ISONIC 2008** instrument

Insert Text Note

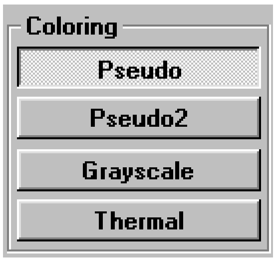
Refer to paragraph 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

Refer to paragraph 6.3.2.1 of this Operating Manual

ABIScan Record Palette

There are four palettes available through click on appropriate button:



Start/Stop t-ABIScan recording

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

[Start] button becomes invisible since **ABIScan** recording starts. [Stop] button occupies its position.

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

[Stop] button becomes invisible after termination of **ABIScan** record. [Start] button returns to its position

Save record into a file

Refer to paragraph 6.3.2.1 of this Operating Manual

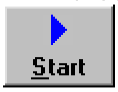
Open record from a file and starting postprocessing session

Refer to paragraph 6.3.2.1 of this Operating Manual

Return to UDS 3-6 main operating surface

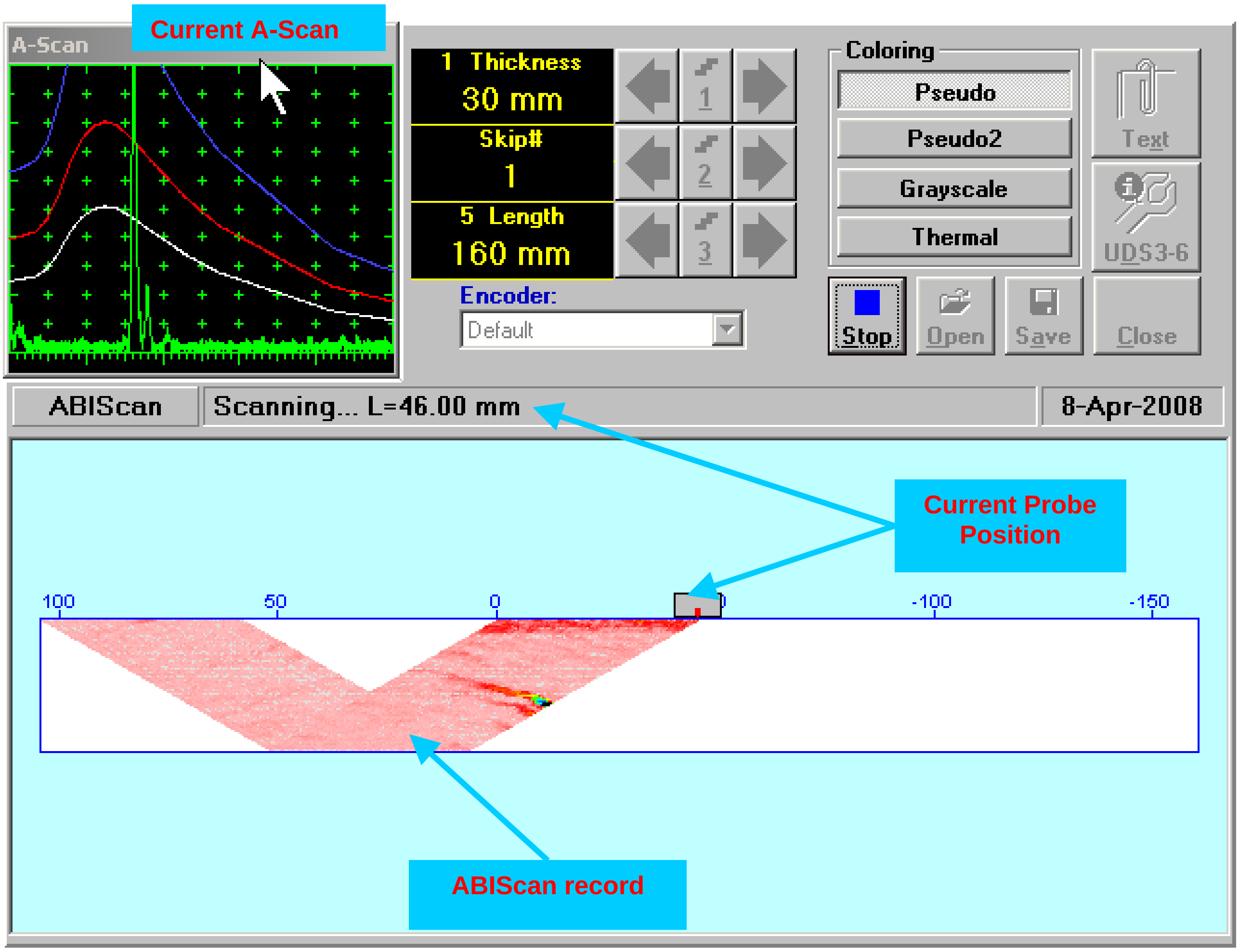
Refer to paragraph 6.3.2.1 of this Operating Manual

6.4.2.8. 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



6.4.2.9. 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 3-6** 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):

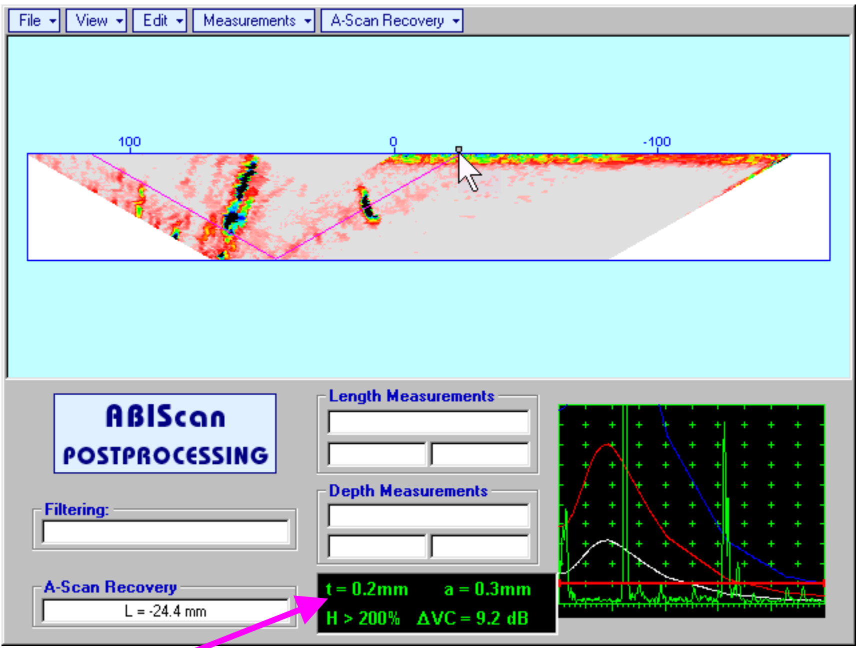
- depth **t** of reflector (measurement mode - **Flank**)
- amplitude **H** of the maximal signal in the **Off-line Gate** expressed in **%** of full **A-Scan** height
- **ΔVC (dB to DAC)** of the maximal signal in the **Off-line Gate** provided that DAC was active whilst recording **t-ABIScan** / **ABIScan**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

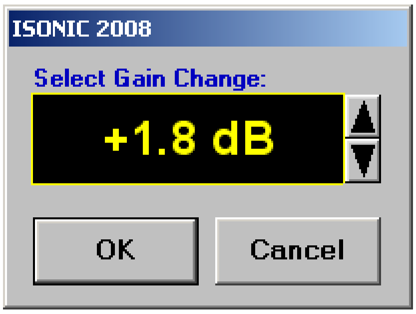
  - depth **t** of reflector (measurement mode - **Flank**)
  - distance **a** between probe incidence point and reflector taken along scanning surface (measurement mode - **Flank**)
  - amplitude **H** of the maximal signal in the **Off-line Gate** expressed in % of full **A-Scan** height
  - **ΔVC (dB 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

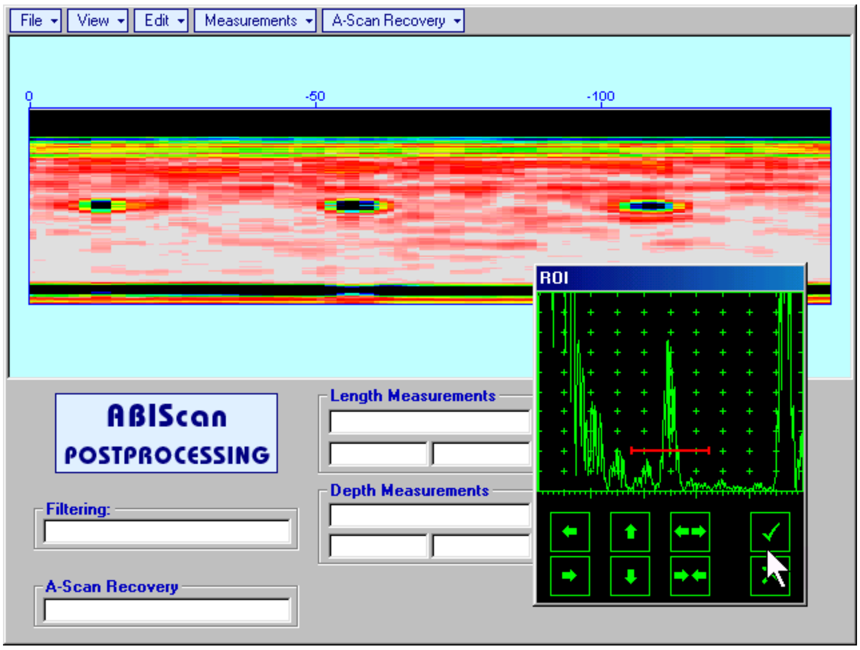


During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain** click on OK or press on front panel keyboard or **Enter** on external keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws **t-ABIScan** / **ABIScan** image accordingly

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

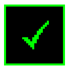
- **Edit→Change Gain→OFF** – negates **Gain** re-adjustment and returns to originally recorded **t-ABIScan** / **ABIScan** image and original **Gain** setting

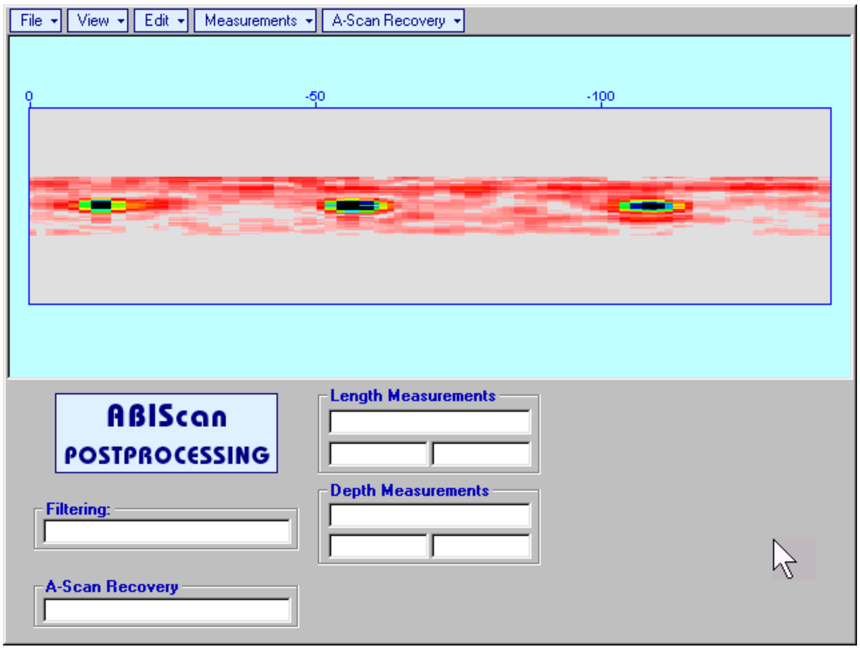
- **Edit→ROI→ON** (*straight beam inspection record*) – generates *cursor representing sound path* of straight beam probe's central beam in the object under test that may be guided over **t-ABIScan** / **ABIScan** image using either touch screen stylus or mouse or , on front panel keyboard or →, ← on 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



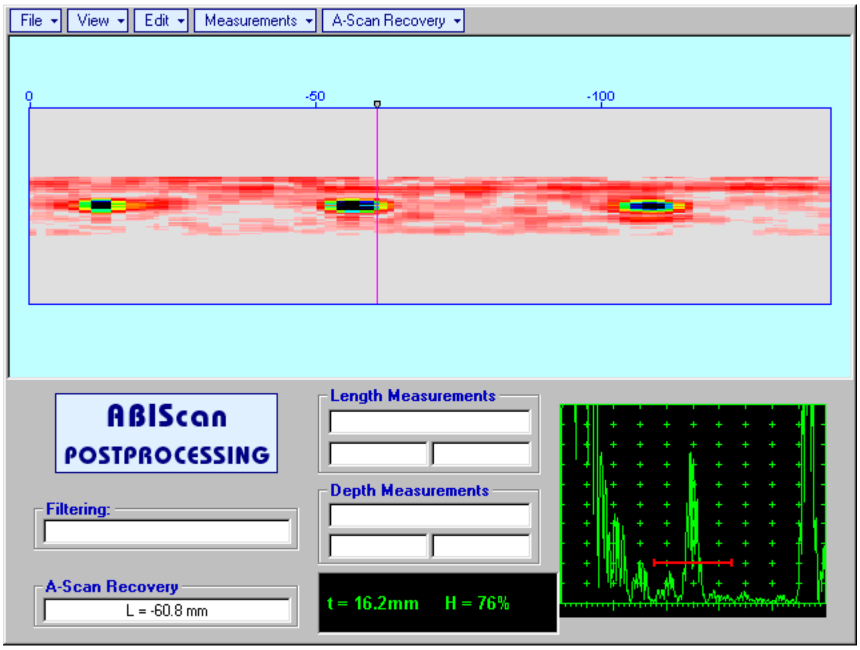
To interrupt selection of reference of **A-Scan** right mouse click or press on front panel keyboard or **Esc** on external keyboard

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

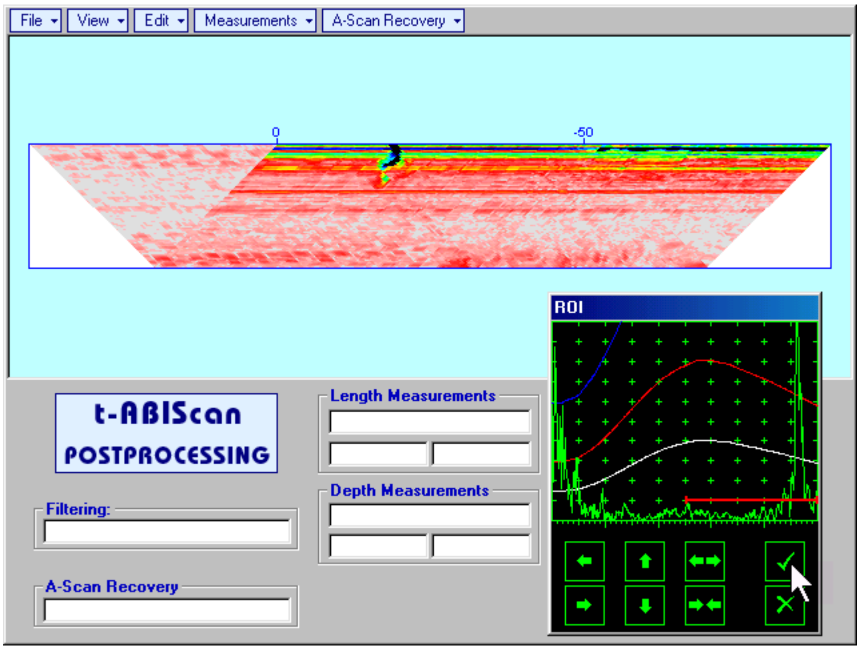


It is possible then to perform **A-Scan** signals evaluation using newly adjusted **Off-Line Gate** through **A-Scan Recovery →ON**



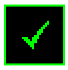
- **Edit→ROI→OFF** (*straight beam inspection record*) – negates **Off-line Gate** re-adjustment and returns to originally recorded **t-ABIScan** / **ABIScan** image and initial **Off-line Gate** setting

- **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

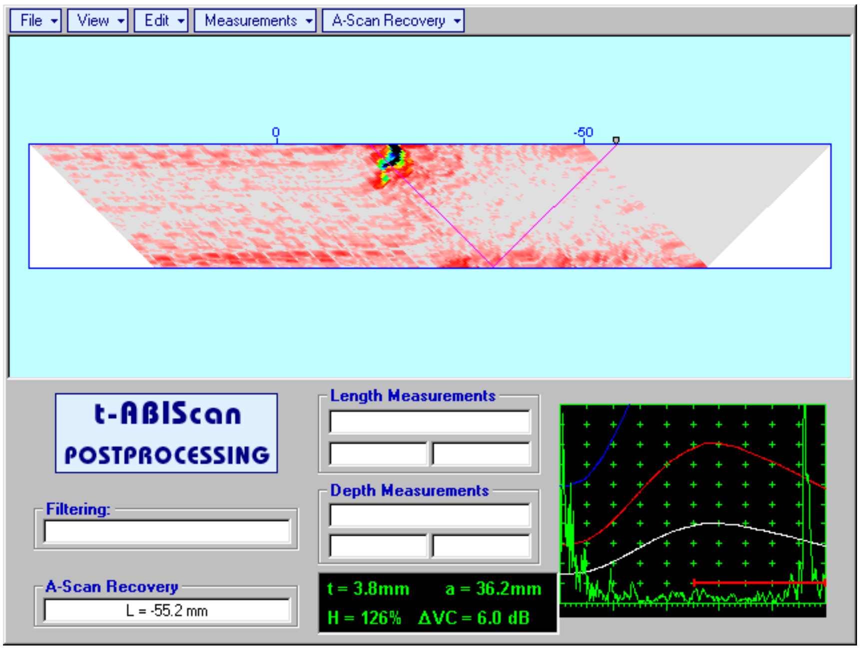


To interrupt selection of reference of **A-Scan** right mouse click or press on front panel keyboard or **Esc** on external keyboard

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

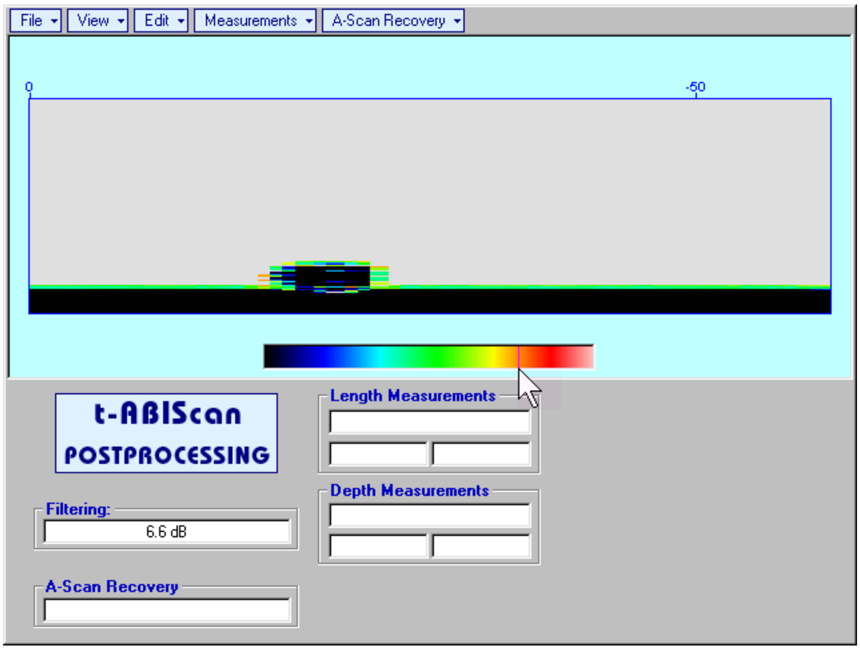
Upon completing redefining of **Region Of Interest** click on  – this applies new **Off-line Gate** to all **A-Scans** captured during **t-ABIScan** / **ABIScan** recording and updates **t-ABIScan** / **ABIScan** image accordingly – only segment of **t-ABIScan** / **ABIScan** image covered by newly adjusted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



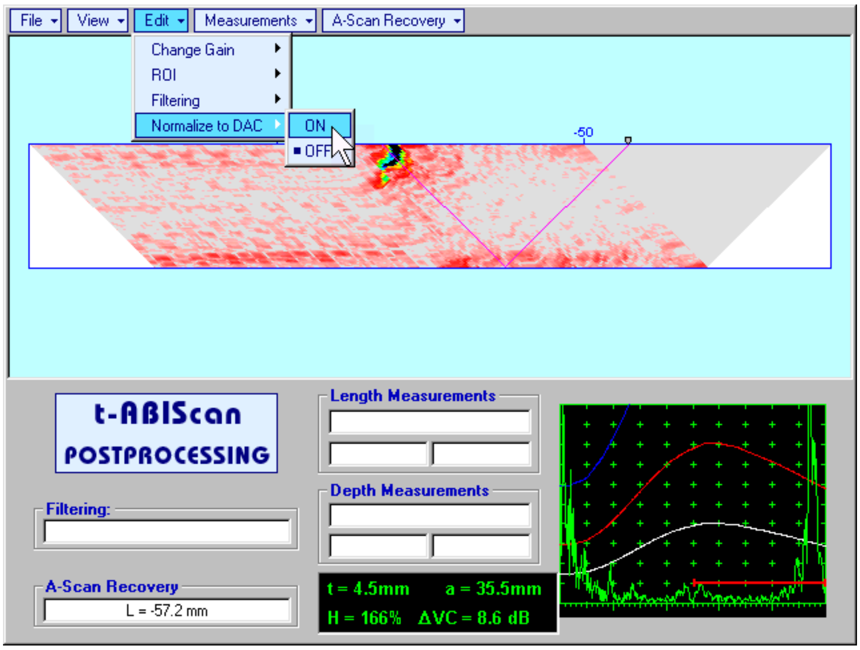
- **Edit→ROI→OFF** (*angle beam inspection record*) – negates **Off-line Gate** re-adjustment and returns to originally recorded **t-ABIScan** / **ABIScan** image and initial **Off-line Gate** setting

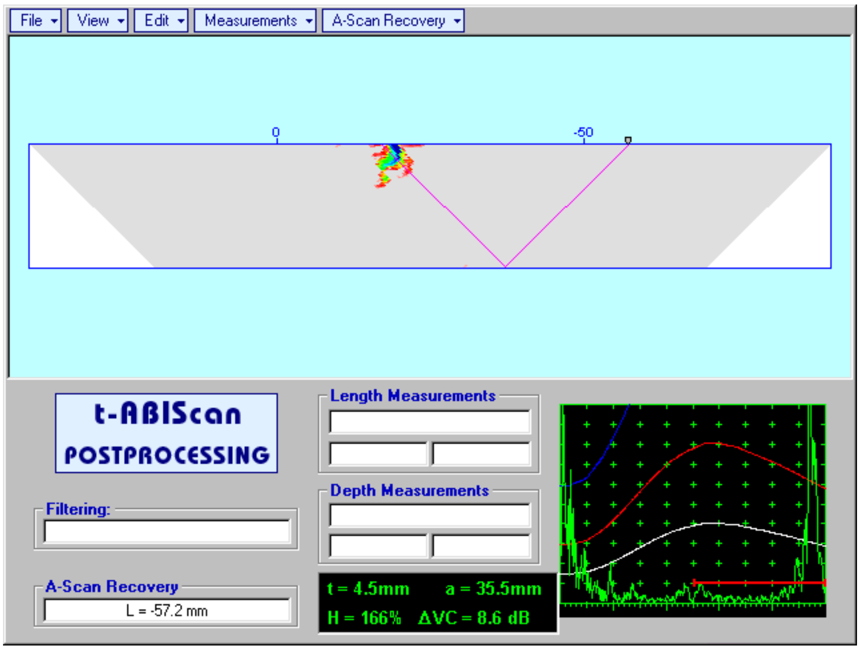
- **Edit→Filtering→ON** – (*straight beam and angle beam inspection records*) generates *amplitude palette bar* with *sliding cursor*, which may be controlled using either touch screen stylus or mouse or ➡, ⬅ on front panel keyboard or →, ← on external keyboard . Position of the *sliding cursor* on the *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)



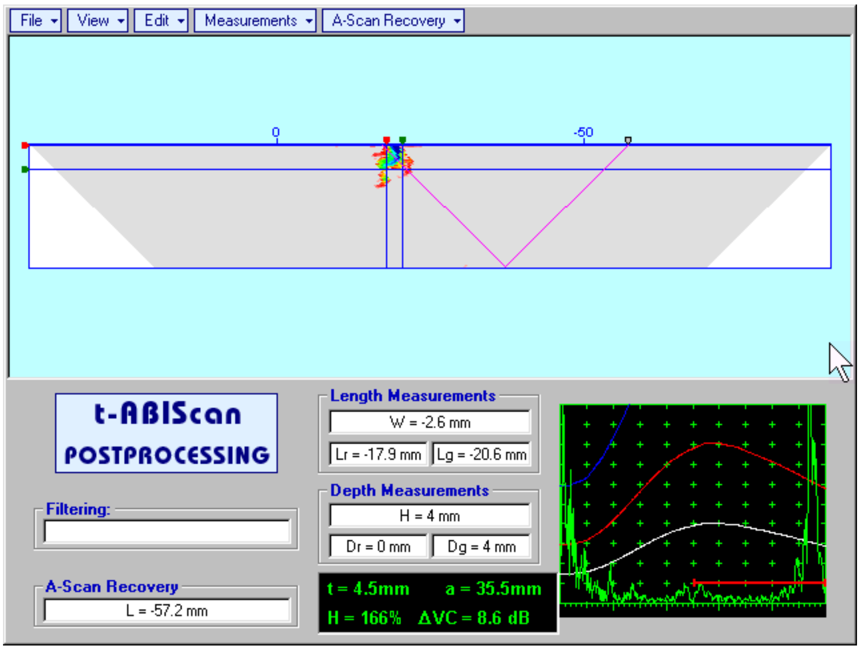


- **Edit→Normalize to DAC→OFF** (*straight beam and angle beam inspection records*) – negates **dB to DAC/DGS** normalization and returns to originally recorded **t-ABIScan** / **ABIScan** image

ⓘ

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



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

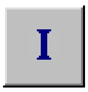
6.5.1. Setup Pulser Receiver for t-TOFD and TOFD

UDS 3-6 Pulser Receiver screen appears upon clicking on 

or 

. The following settings to be provided:

#	Parameter or Mode	Submenu	Required Settings	Note
1	**Pulser Mode**	**PULSER**	**Dual**	
2	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain setting procedure**
3	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**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 6.5.1.1 of this Operating Manual**
7	**Display Delay Range**	**BASICS**	**Display Delay** and **Range** to provide clear **A-Scan** representing: o Lateral Wave and Longitudinal Wave Back Echo Signals at the beginning and at the and of **A-Scan** correspondingly 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 OR o Other combination of signals required by Inspection procedure	**Display Delay and Range will be determined according to paragraph 6.5.1.2 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 6.5.1.3 of this Operating Manual**
9	**Settings for other parameters and modes have no significance**			

Click on 

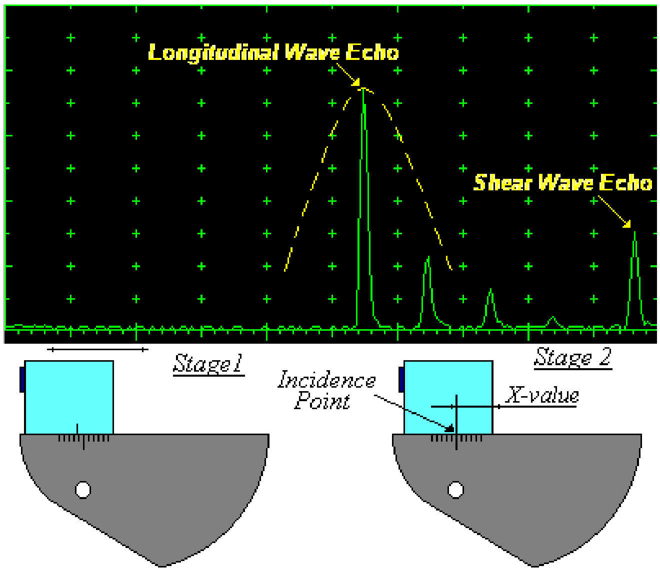
or press 

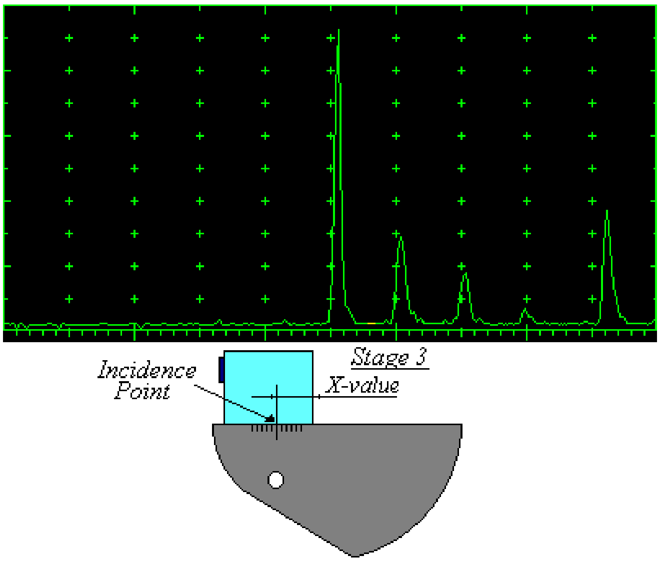
on front panel keyboard or **F8** on external keyboard upon completing

6.5.1.1. 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 **50 ns** for probe having resonant frequency of 10 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for probes having resonant frequency below 10 MHz
- **Firing Level** to **12**

Activate submenu **RECEIVER** then set:

- **Display** to **Full** or **RF**
- **Filter** to **OFF** or **ON**
- **Low Cut** and **High Cut** to completely cover probe's effective bandwidth on case if **Filter** setting is **ON**

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**

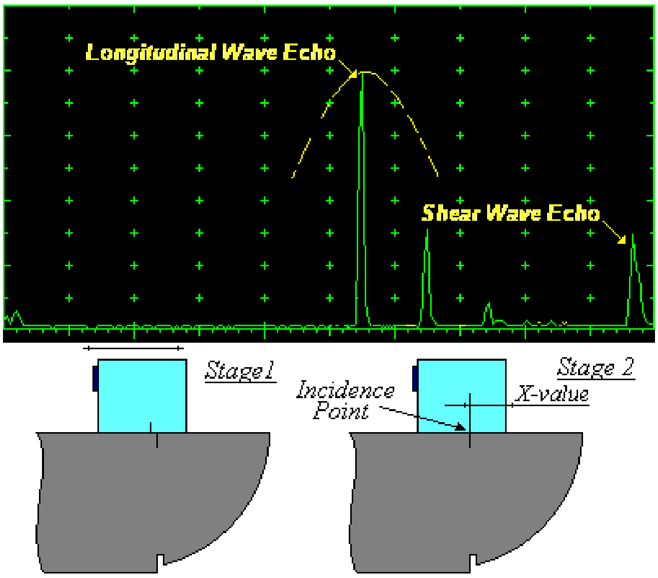
Stage 3: Tune **Display Delay** while probe is still fixed in found position until rising edge of maximized echo will match with 50%-grid of the **A-Scan** width. Upon completing the *obtained value of **Display Delay** will be equal to actual **Probe Delay***

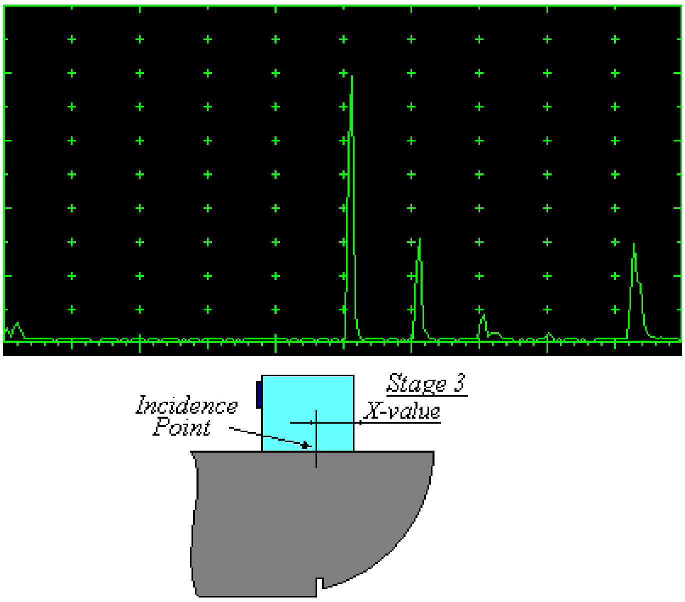
ⓘ It's necessary to setup **Gain** bringing height of maximized echo to **75-80%** of **A-Scan** height

Supposing that **Probe Delay** values found for probes of the pair are **PD$_1$** and **PD$_2$**

Accumulated Probe Pair Delay = 0.5•(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 **50 ns** for probe having resonant frequency of 10 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for probes having resonant frequency below 10 MHz
- **Firing Level** to **12**

Activate submenu **RECEIVER** then set:

- **Display** to **Full** or **RF**
- **Filter** to **OFF** or **ON**
- **Low Cut** and **High Cut** to completely cover probe's effective bandwidth on case if **Filter** setting is **ON**

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**

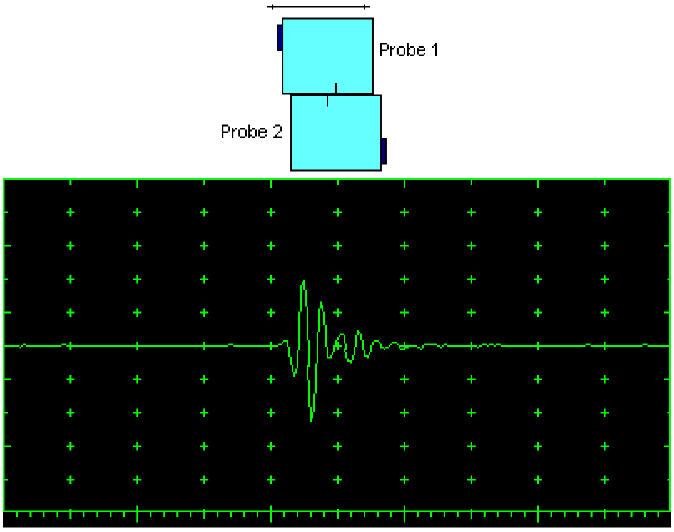
Stage 3: Tune **Display Delay** while probe is still fixed in found position until rising edge of maximized echo will match with 50%-grid of the **A-Scan** width. Upon completing the *obtained value of **Display Delay** will be equal to actual **Probe Delay***

ⓘ It's necessary to setup **Gain** bringing height of maximized echo to **75-80%** of **A-Scan** height

Supposing that **Probe Delay** values found for probes of the pair are **PD_1** and **PD_2**

Accumulated Probe Pair Delay = $0.5\bullet(PD_1 + PD_2)$

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



Activate submenu **PULSER** then set:

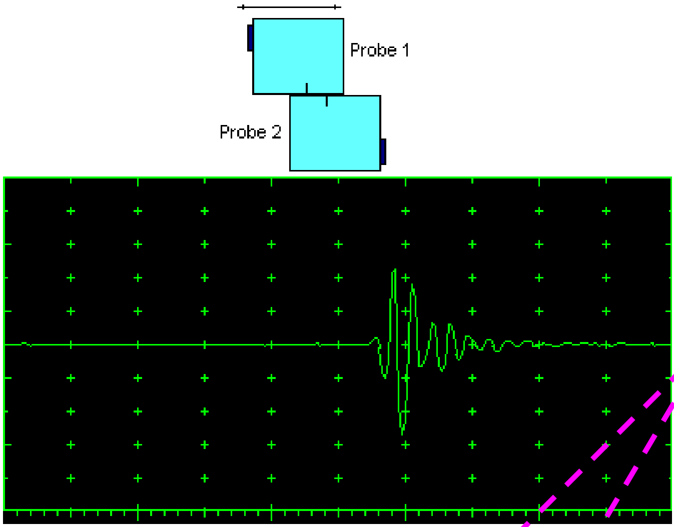
- **Pulser Mode**
- **Pulse Width** to **50 ns** for probe having resonant frequency of 10 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for probes having resonant frequency below 10 MHz
- **Firing Level** to **12**

Activate submenu **RECEIVER** then set:

- **Display** to **Full** or **RF**
- **Filter** to **OFF** or **ON**
- **Low Cut** and **High Cut** to completely cover probe's effective bandwidth on case if **Filter** setting is **ON**

Activate submenu **BASICS** topic then set:

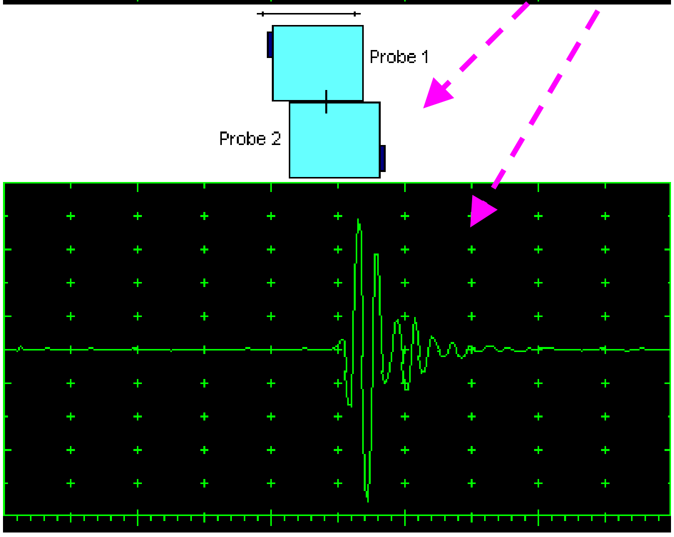
- **Display Delay** to **0 µs**

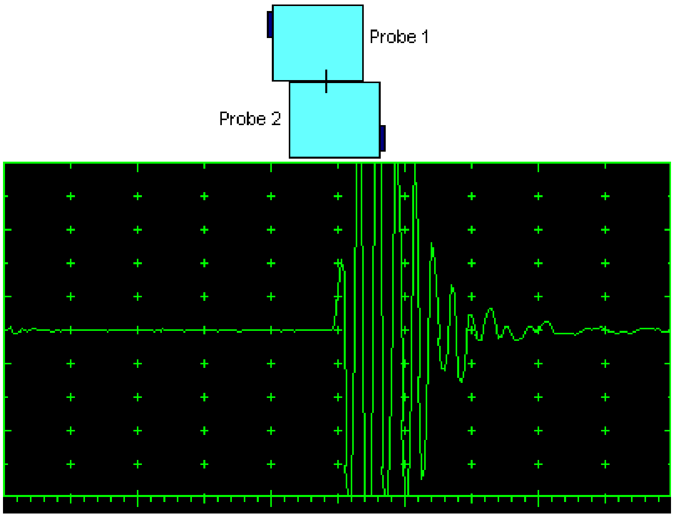


Stage 1: Manipulate probes over each other and setup of **Gain**, **Range**, and **USVelocity** providing firm indication of the signal propagating in the probes wedges from emitting to receiving crystal then maximize said signal

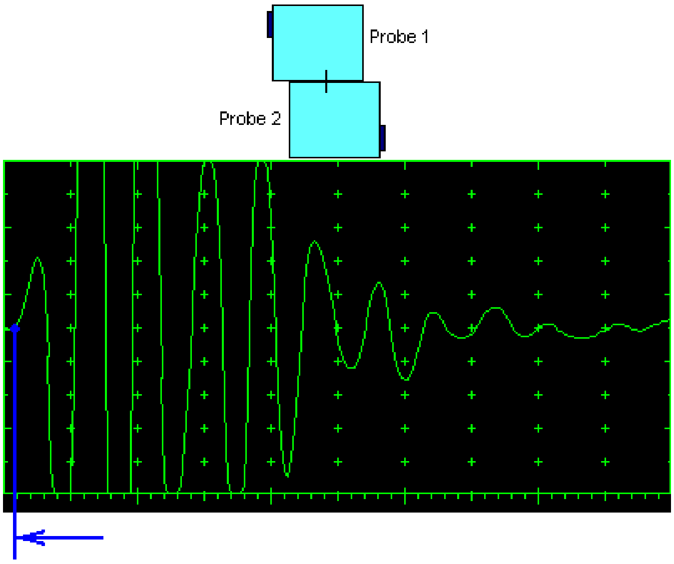
Stage 2: Fix the probe in the found position corresponding to highest signal amplitude

ⓘ It's necessary to setup **Gain** bringing height of maximized 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

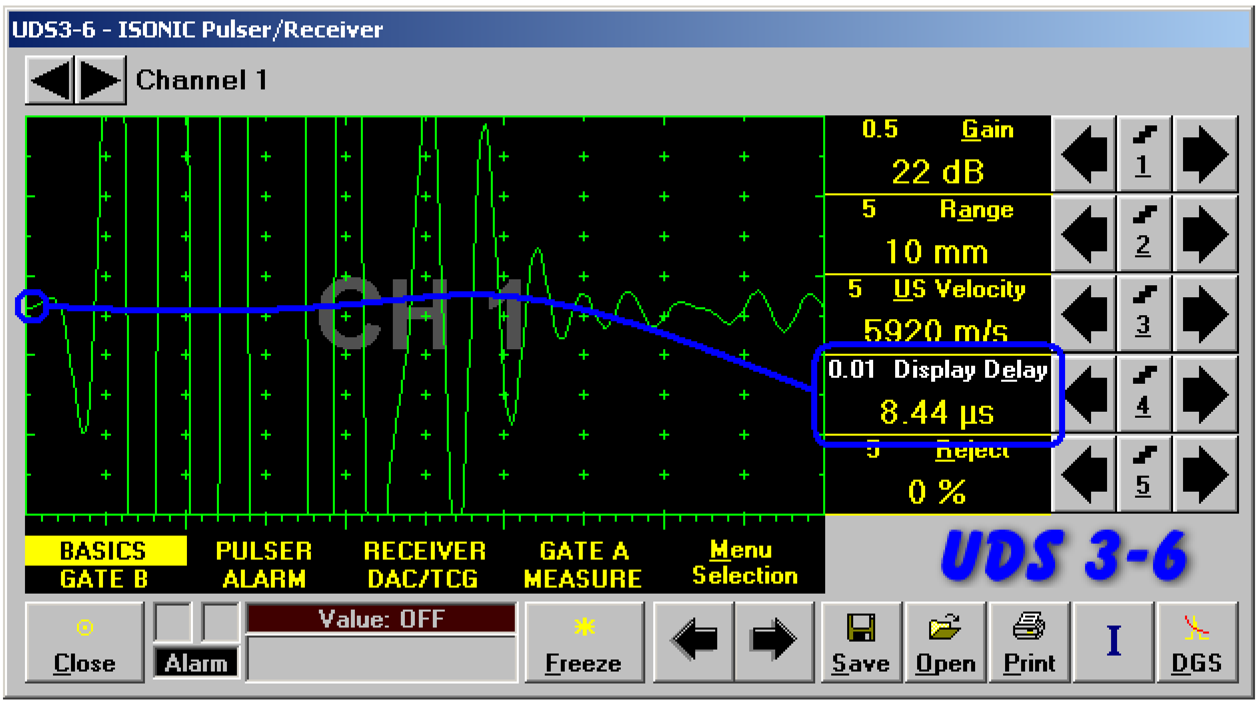


Stage 4: Decrease **Range** to provide ~ 50% of the **A-Scan** width occupied by the signal

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



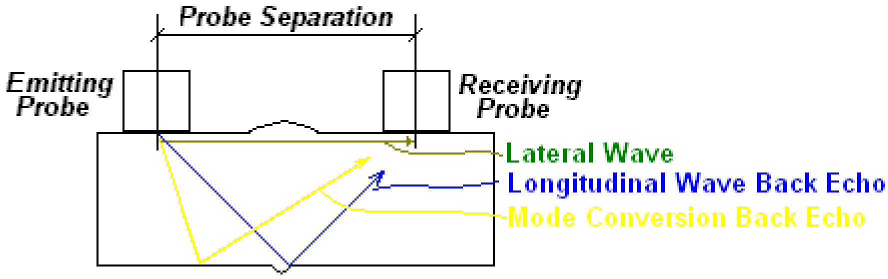
6.5.1.2. Display Delay and Range

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

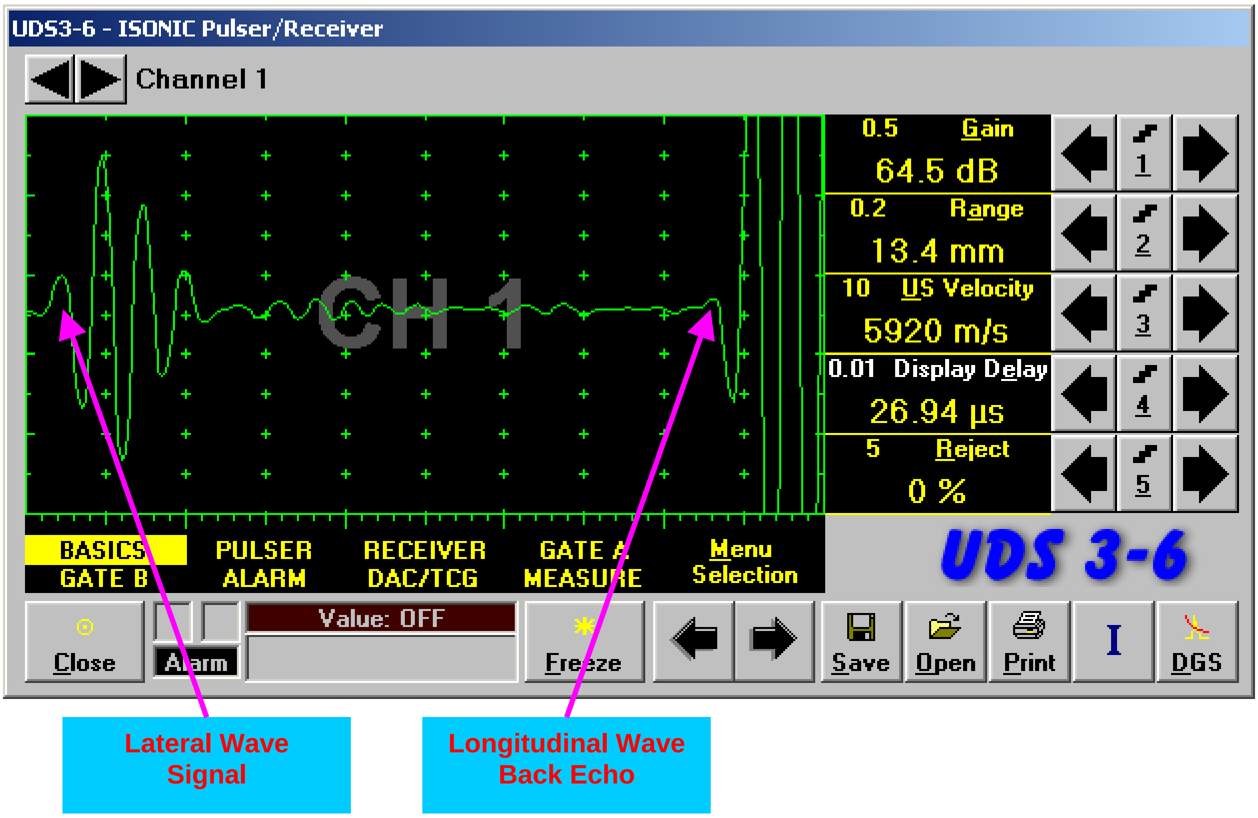
Display Delay = Probe Delay + Probe Separation / USVelocity

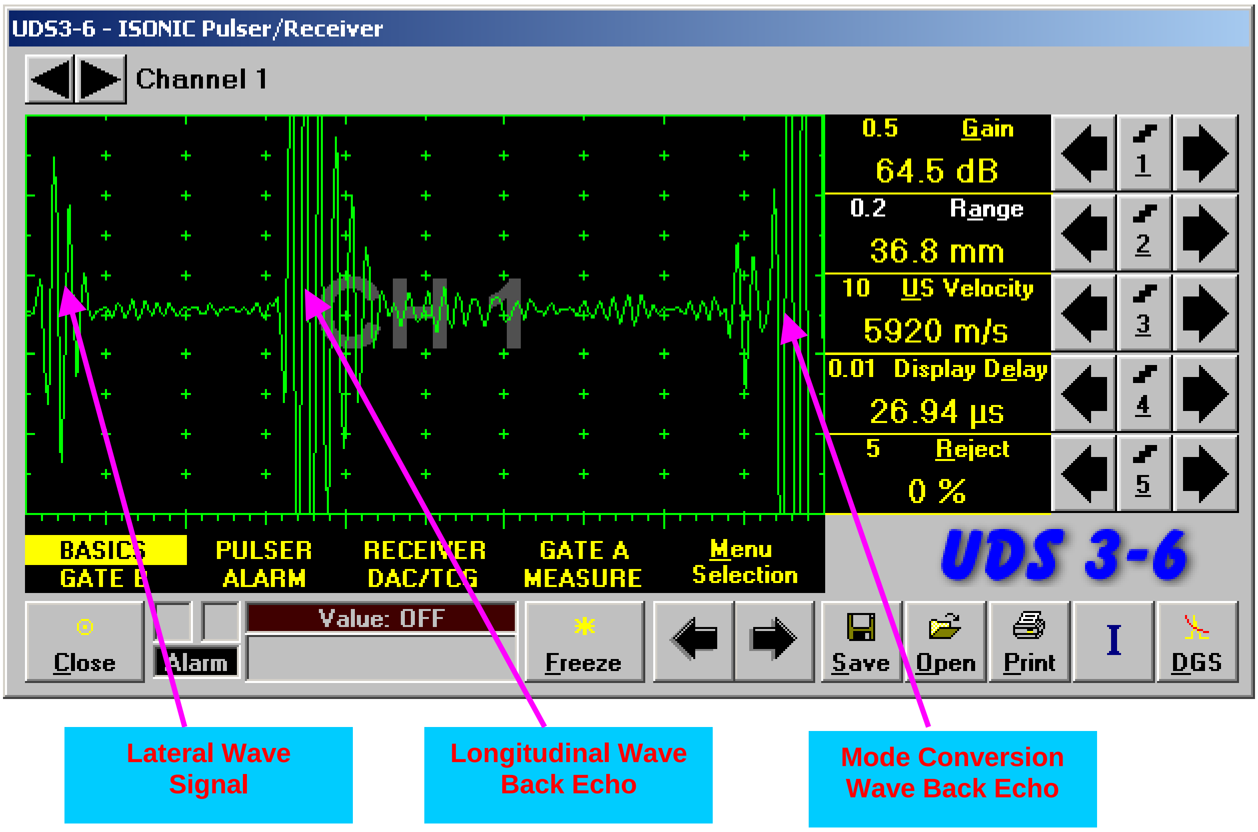
whereas:

- **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.





6.5.1.3. Gain

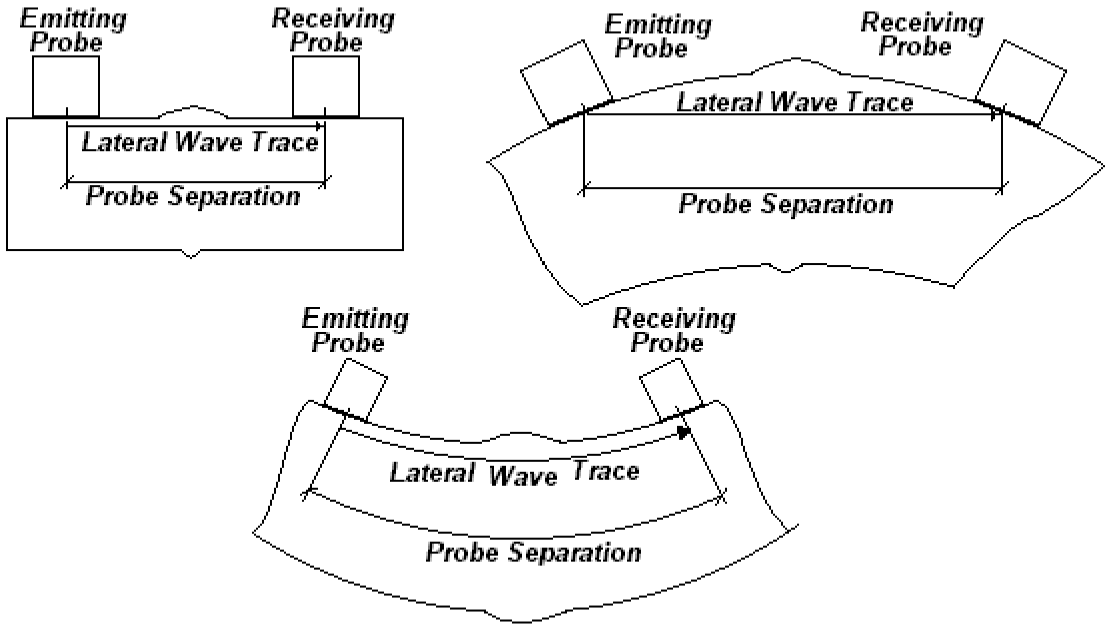
Depending on Inspection procedure (Inspection specs) **Gain** may be setup with the reference to:

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

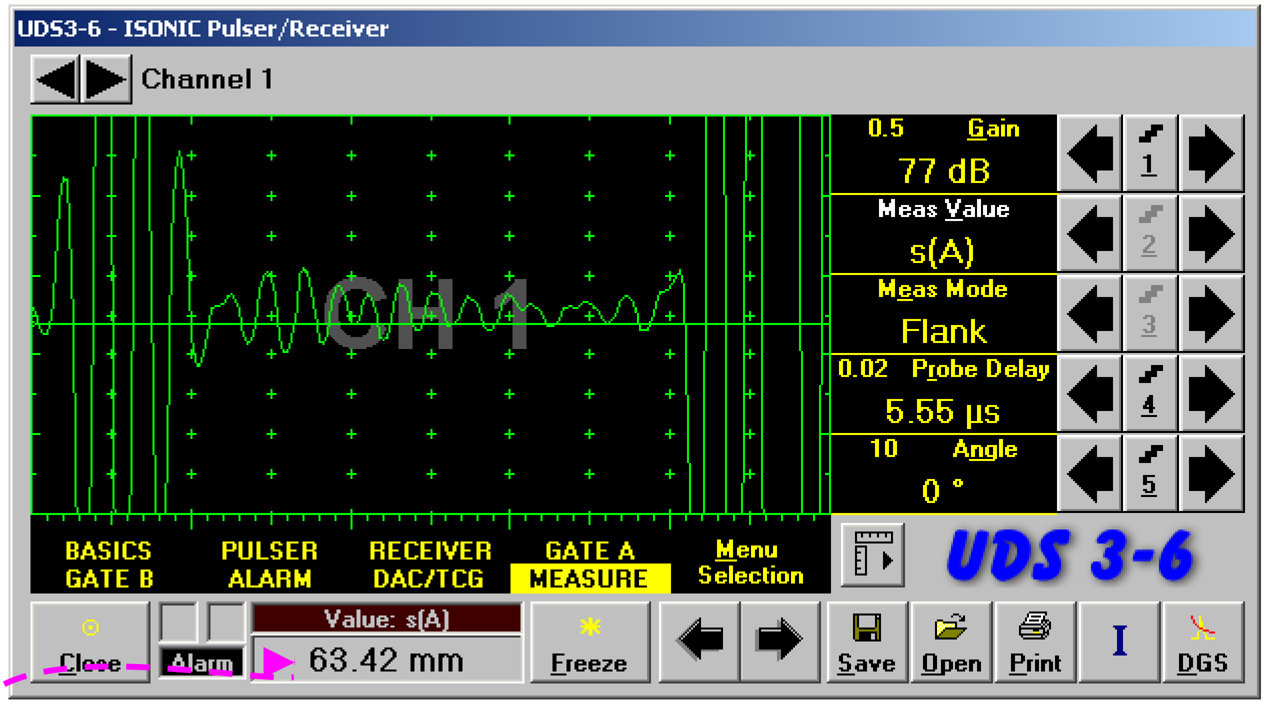
For both examples above the typical procedure of **Gain** setting was provided through bringing height of lateral wave signal to 30% of **A-Scan** height

6.5.1.4. Probe Separation

Probe Separation must be properly defined and entered to have the ability of precise defects sizing at posprocessing 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:

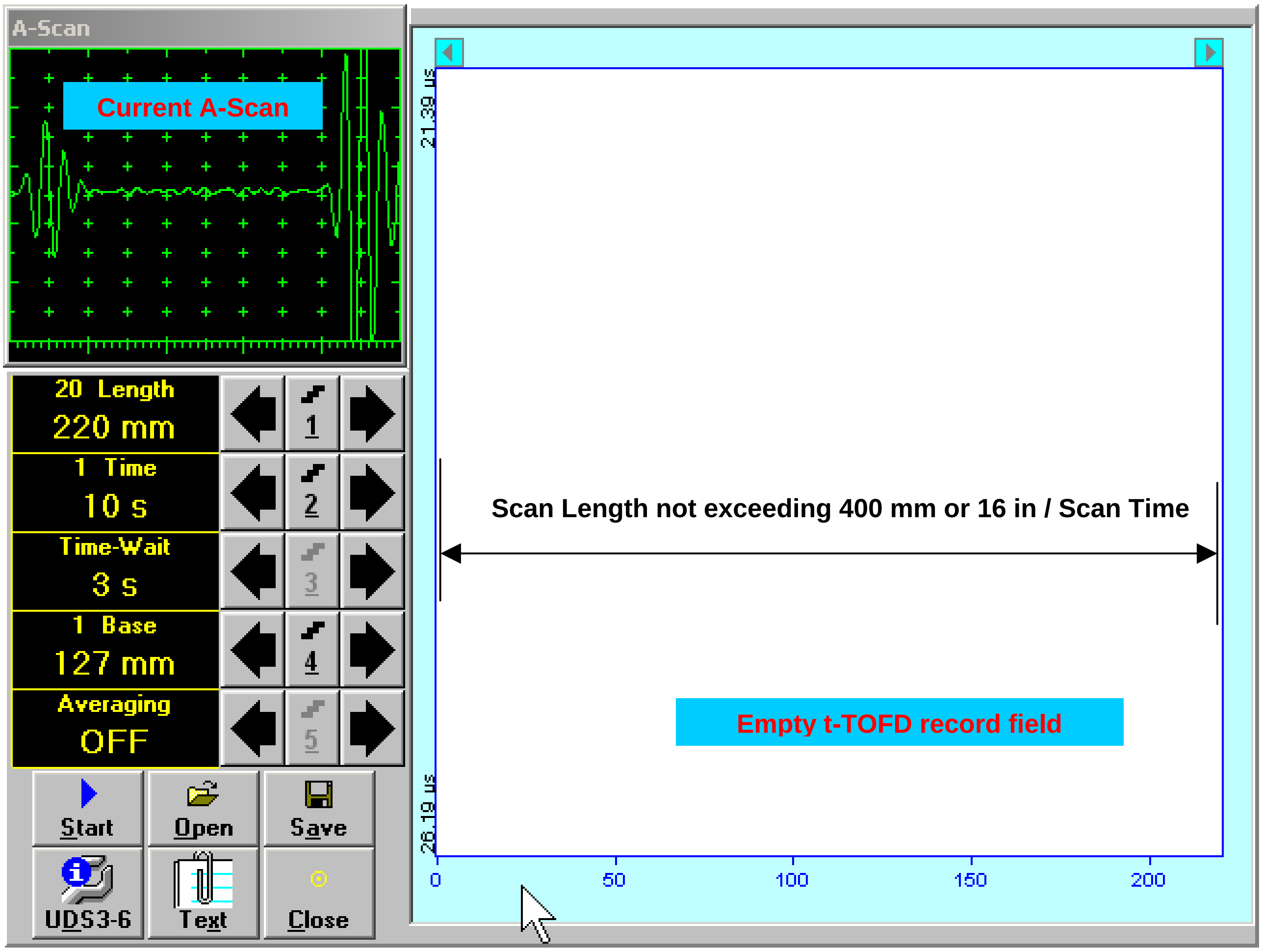


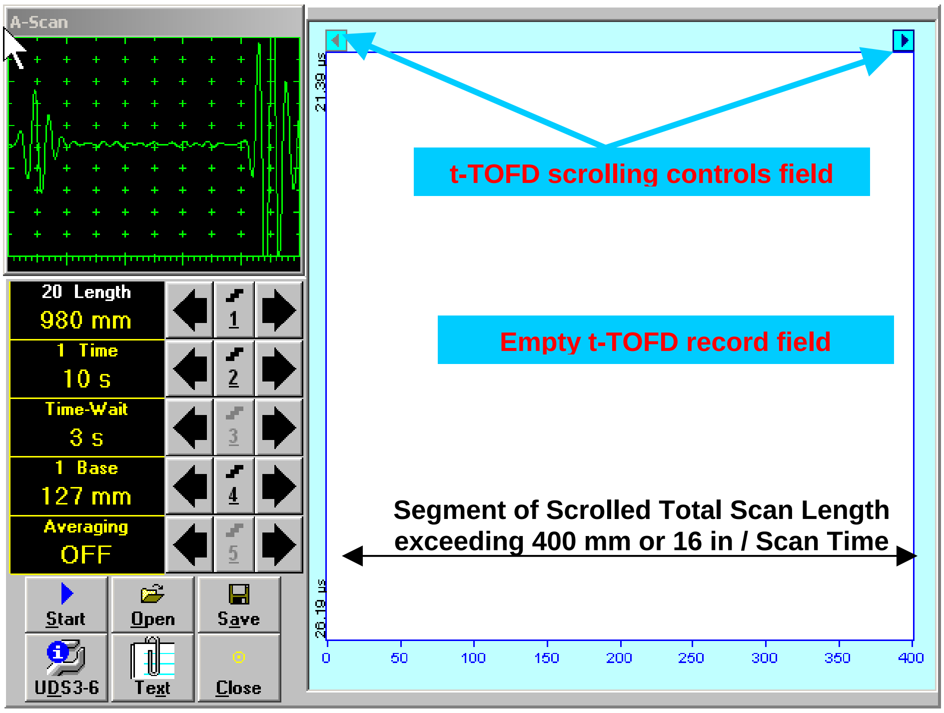
- Increase **Gain** to provide height of first half wave of lateral wave signal reaching 10-20 % of total **A-Scan** height
- Activate **Gate A**, setup **aThreshold** to **5%**(submenu **GATE A**)
- Select **s(A)** as **Meas Value** and set **Meas Mode** as **Flank** (submenu **MEASURE**)
- Provide 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

6.5.2. t-TOFD and TOFD – Implementation

6.5.2.1. t-TOFD – Prior to Scanning

t-TOFD control panel is shown below





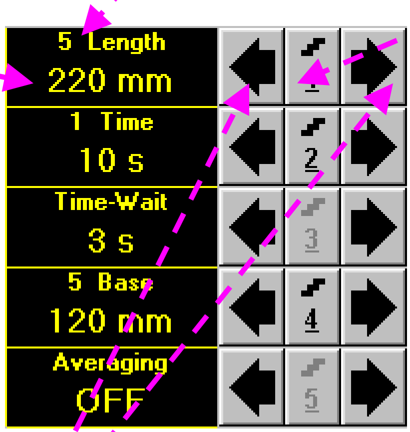
Scan Length and Scan Time

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

Current value of increment/decrement for **Length** setup, **mm** or **in**

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 **Length** setting

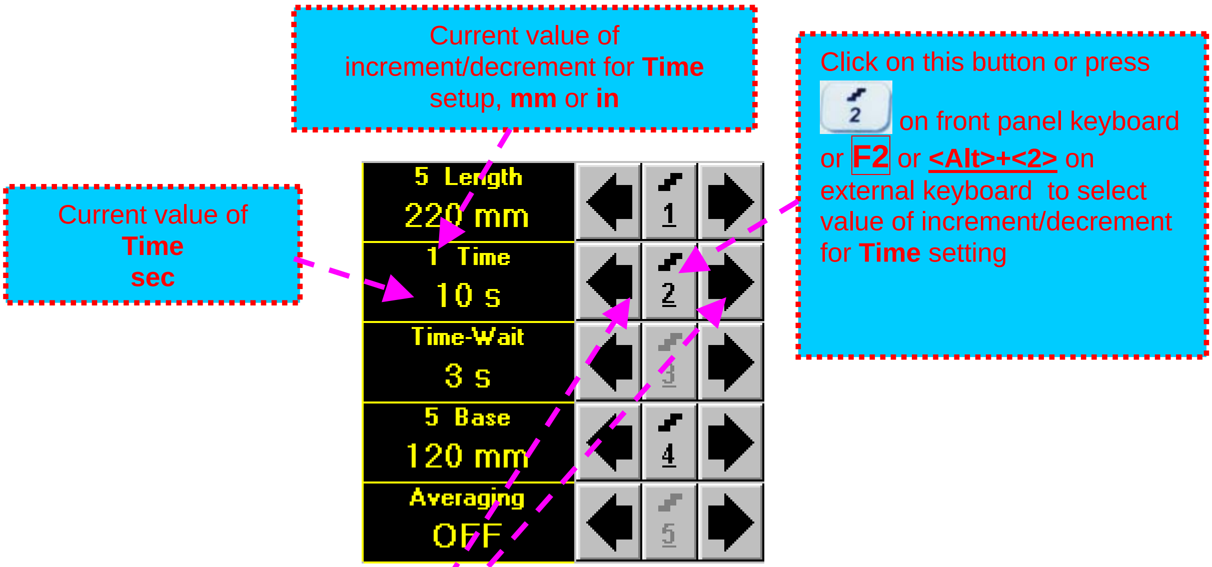
Current value of **Length** **mm** or **in**



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**



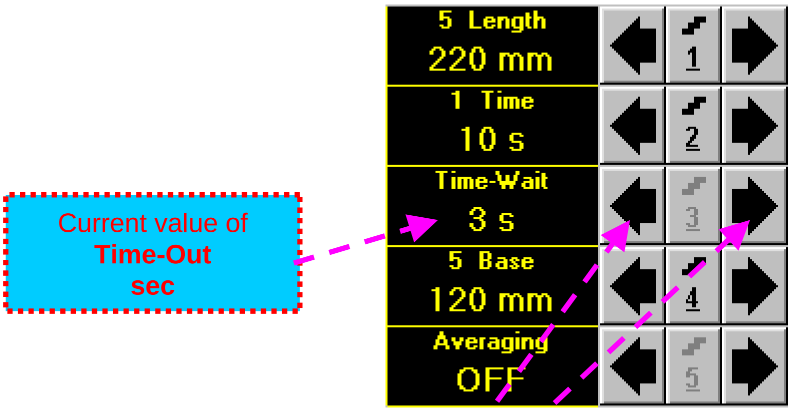
To control **Time**
the following manipulations are applicable:

- **Mouse / Touch Screen**
  - Click on corresponding button
- **Keyboard**
  - Press 2 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 predcessing **t-TOFD** recording, which starts unconditionally upon **Time-Wait** period is over



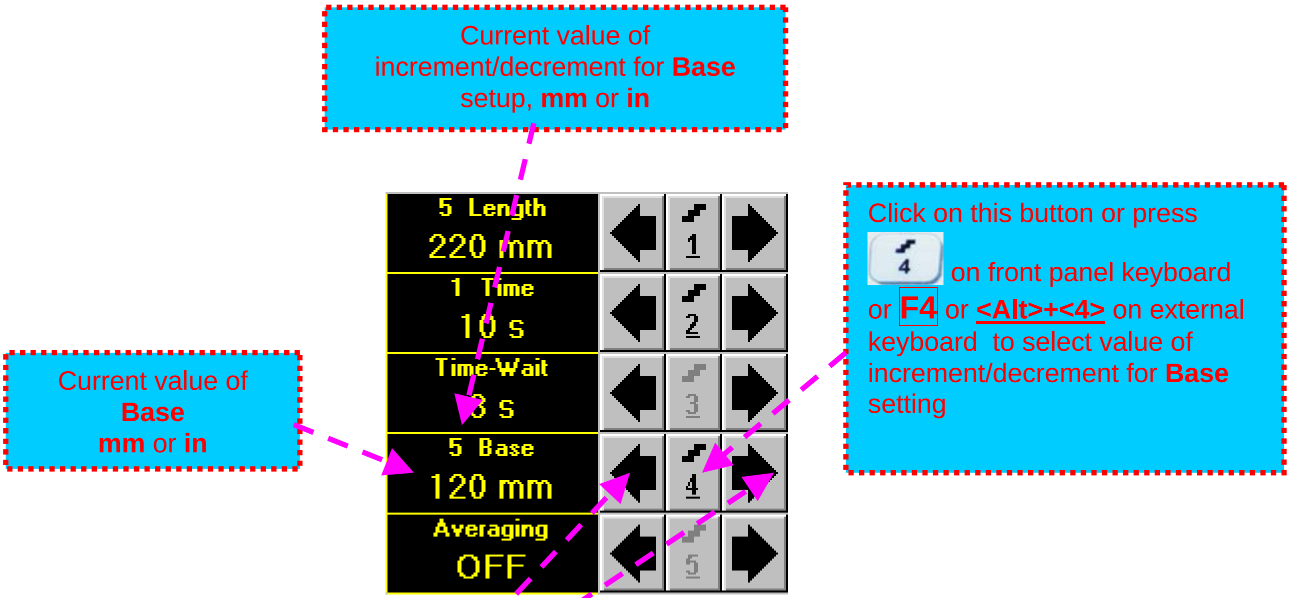
To control **Time-Wait** the following manipulations are applicable:

- **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**



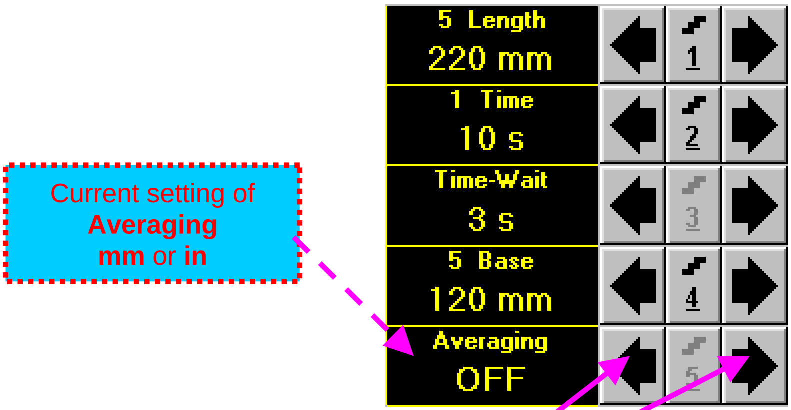
To control **Base** the following manipulations are applicable:

- **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 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

Refer to paragraph 6.3.2.1 of this Operating Manual

Start/Stop t-TOFD recording

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

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

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

Save record into a file

Refer to paragraph 6.3.2.1 of this Operating Manual

Open record from a file and starting postprocessing session

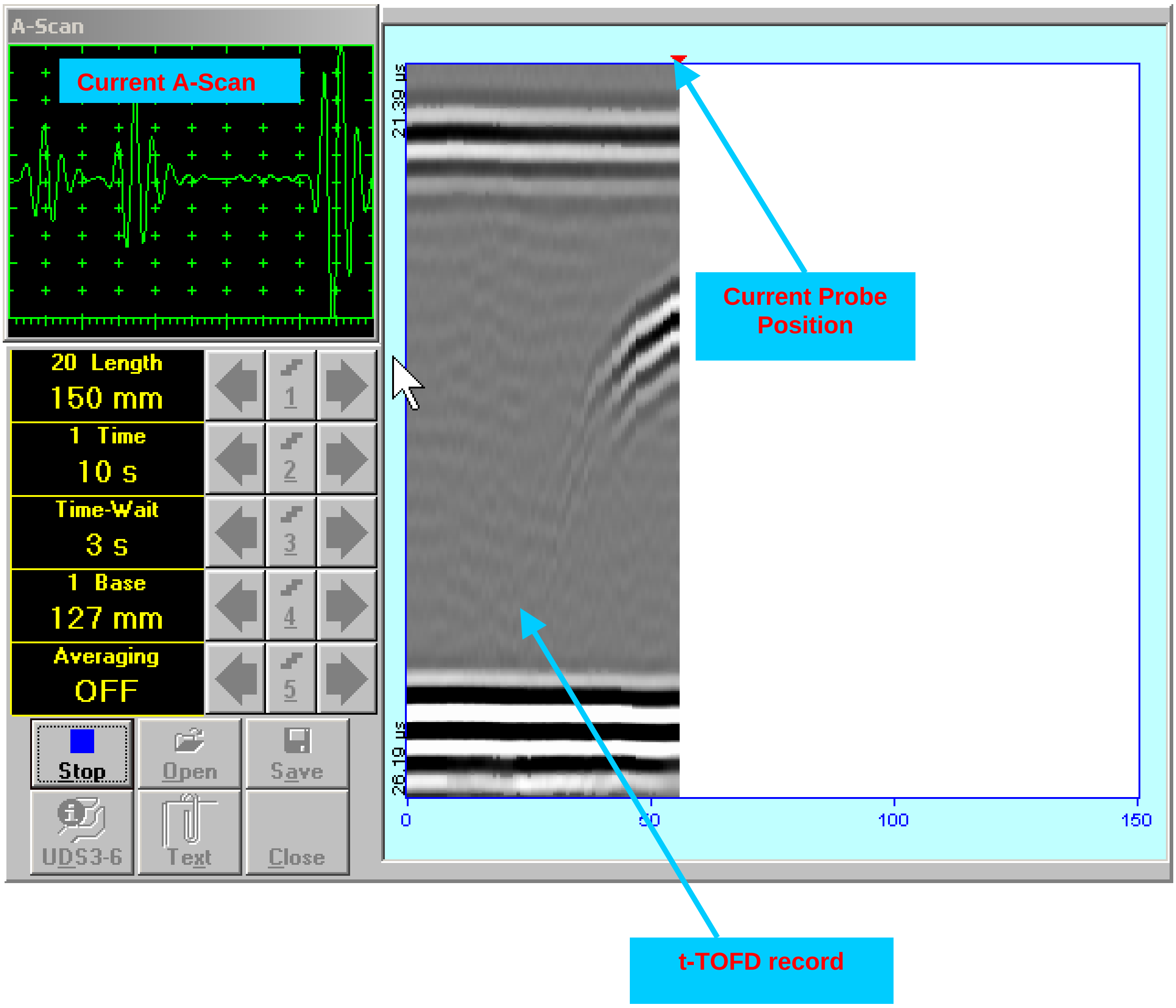
Refer to paragraph 6.3.2.1 of this Operating Manual

Return to UDS 3-6 main operating surface

Refer to paragraph 6.3.2.1 of this Operating Manual

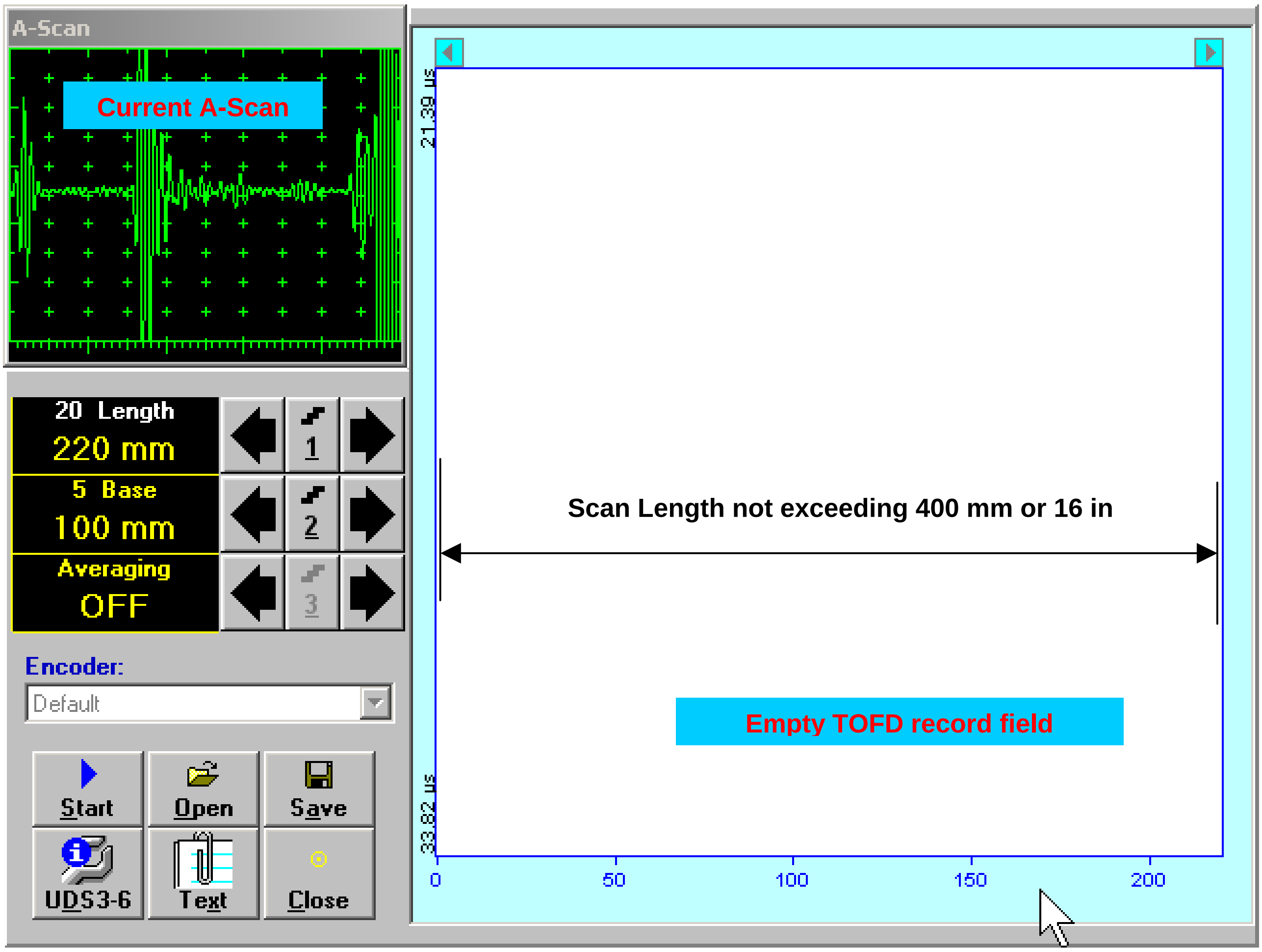
6.5.2.2. t-TOFD – Scanning

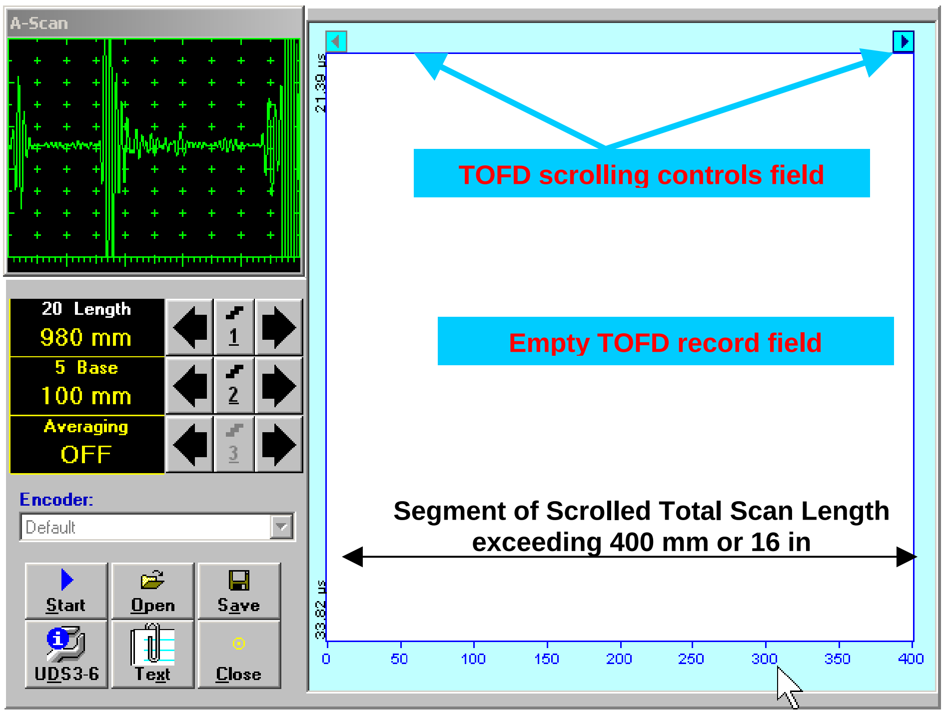
- Apply probes pair to test object in the start point of selected scanning line
- Click on or press on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe pair over the scanning line synchronously with *Position Icon* moving with constant speed above **t-TOFD** record field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



6.5.2.3. TOFD – Prior to Scanning

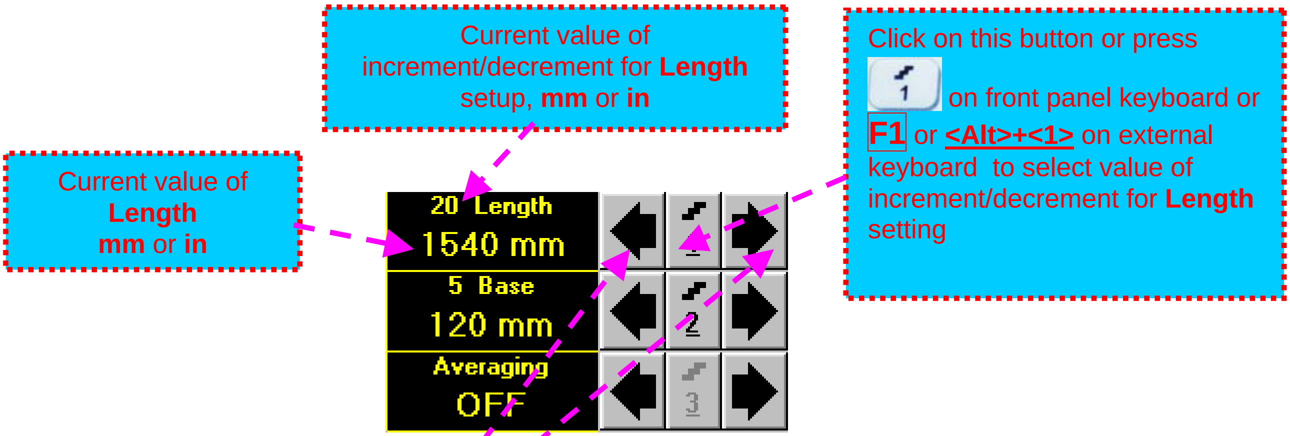
TOFD control panel is shown below





Scan Length

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



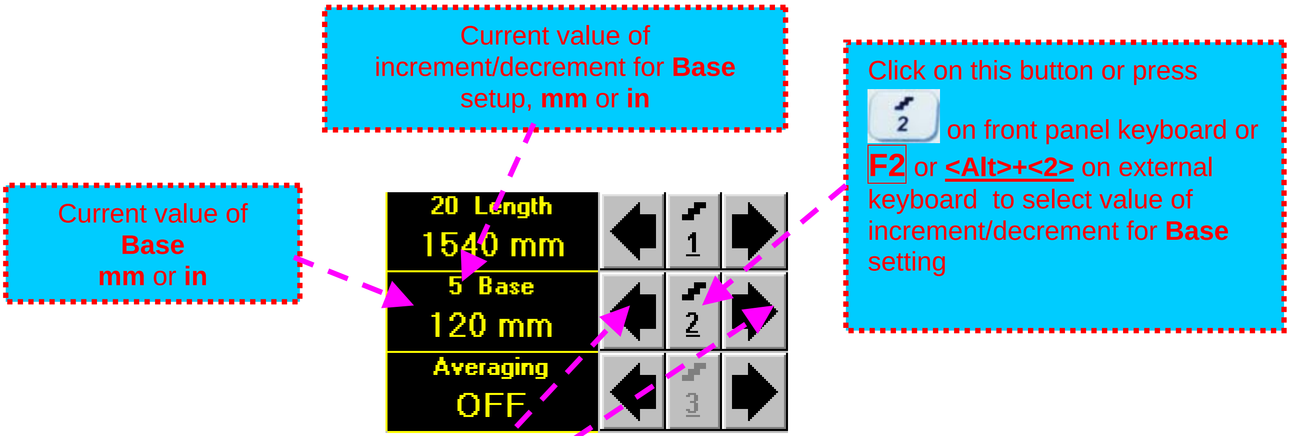
To control **Length** the following manipulations are applicable:

- **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**



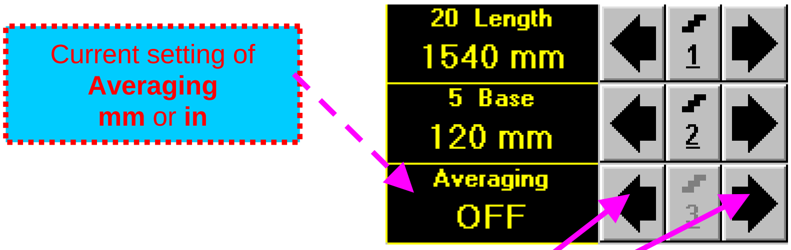
To control **Base** the following manipulations are applicable:

- **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:

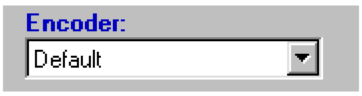
- **Mouse / Touch Screen**
  - Click on corresponding button
- **Keyboard**
  - Press on front panel keyboard or **F3** on external keyboard ⇒ **Averaging** fore color changes to white - then use , , , on front panel keyboard or ↑, →, ←, ↓ on external keyboard
- **Combined**
  - Click on **Averaging** ⇒ **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 rear panel of **ISONIC 2008** instrument

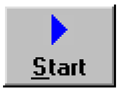
Insert Text Note

Refer to paragraph 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

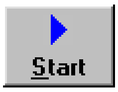
Refer to paragraph 6.3.2.1 of this Operating Manual

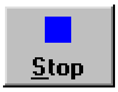
Start/Stop TOFD recording

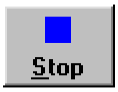
Click on 

or press 

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

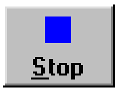


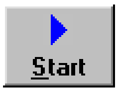
button becomes invisible since **TOFD** recording starts. 

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 6.3.2.1 of this Operating Manual

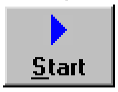
Open record from a file and starting postprocessing session

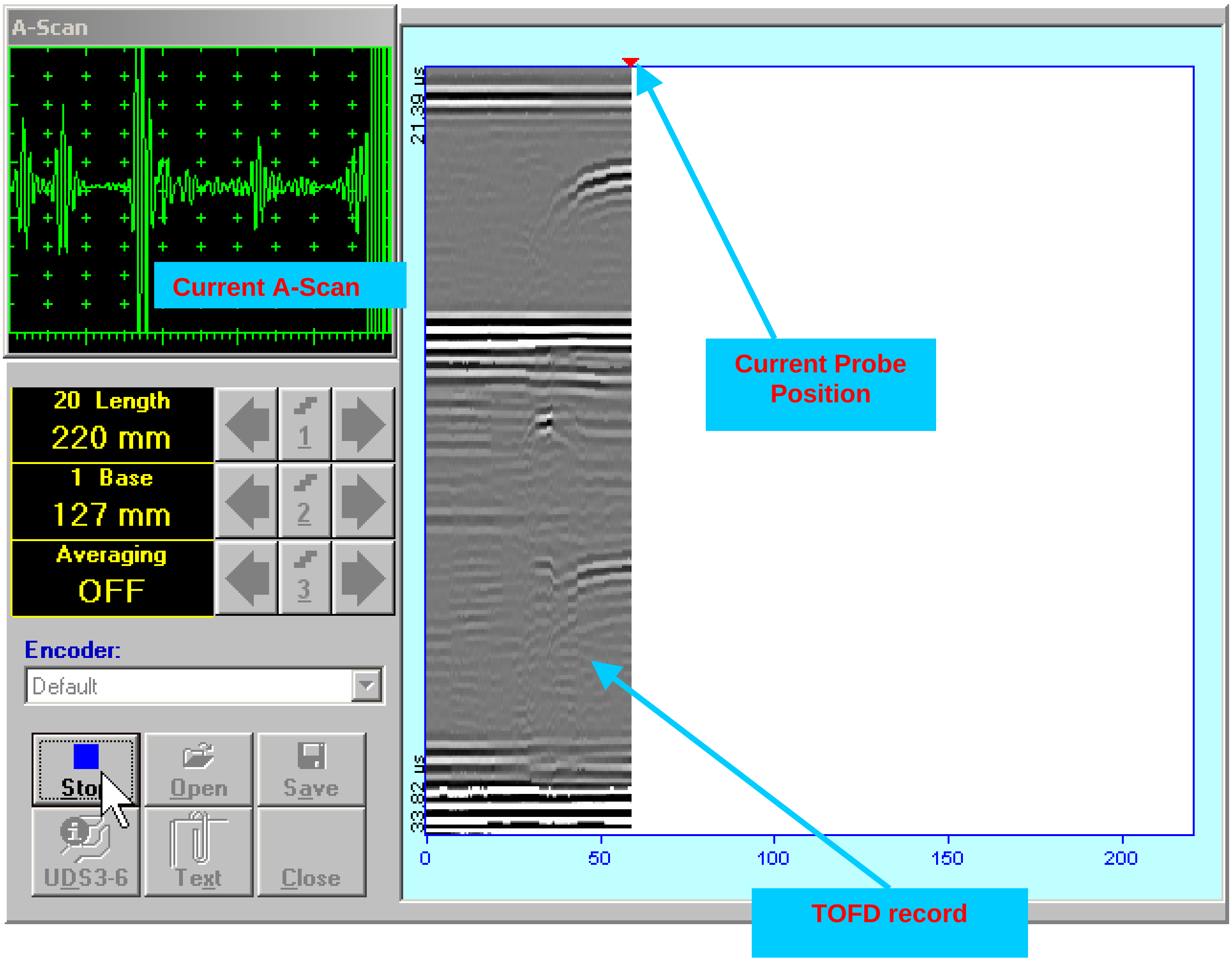
Refer to paragraph 6.3.2.1 of this Operating Manual

Return to UDS 3-6 main operating surface

Refer to paragraph 6.3.2.1 of this Operating Manual

6.5.2.4. TOFD – Scanning

- ❑ Apply probes pair 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 pair over the scanning line – typical scanning progress display during is shown and explained below

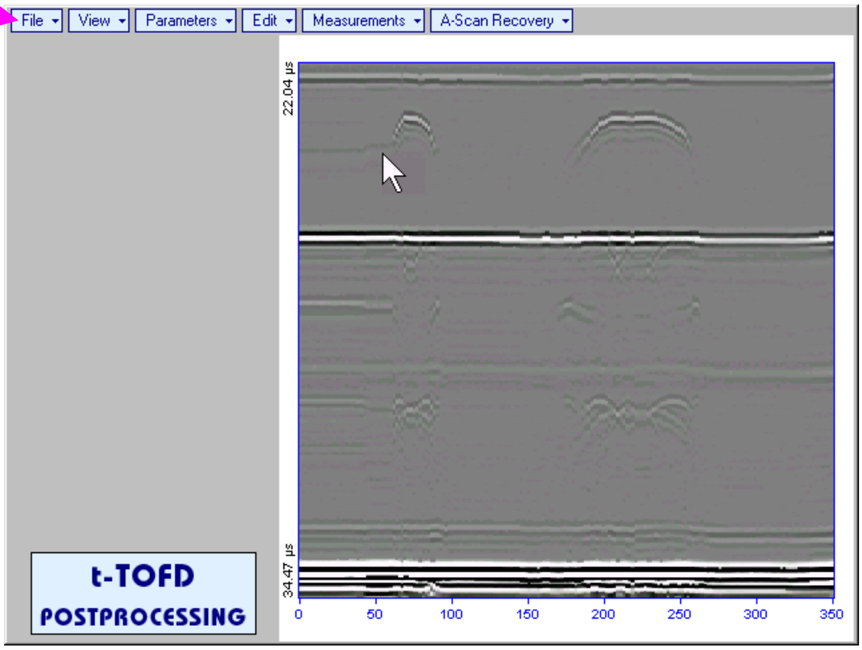


6.5.2.5. t-TOFD / TOFD – Postprocessing

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

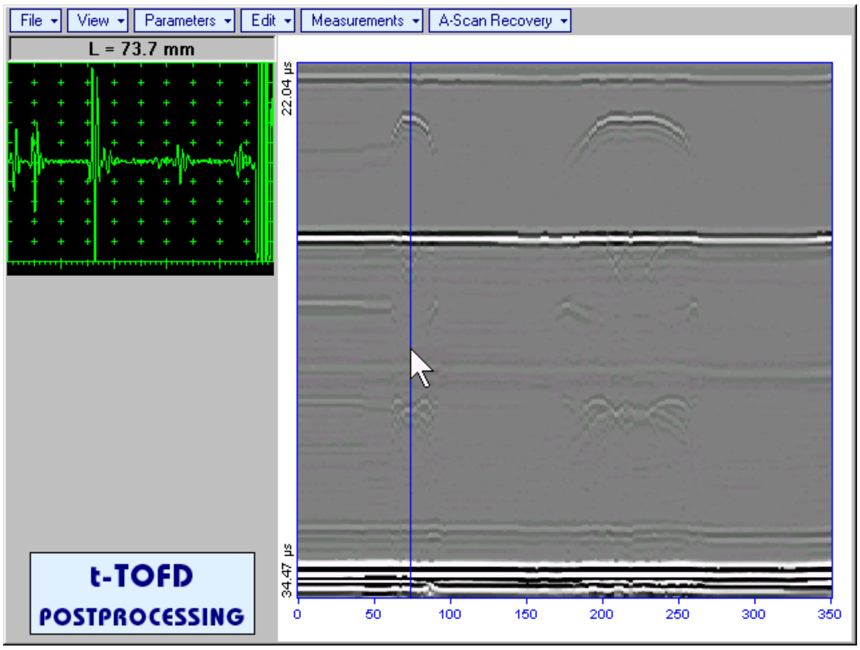
The screen as below appears upon opening file. All postprocessing procedures are performed through menu bar – touch screen stylus or front panel or external mouse to be used



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 3-6** Pulser Receiver used for scanning when file was created
- **View→Inspection Data** – indicates operator's comments entered prior to scanning
- **View→TOFD Display→Logic→Positive/View→TOFD Display→Logic→Positive** – defines which polarity half wave is represented by white / black levels on the **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 9.2.4 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 9.2.4 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**

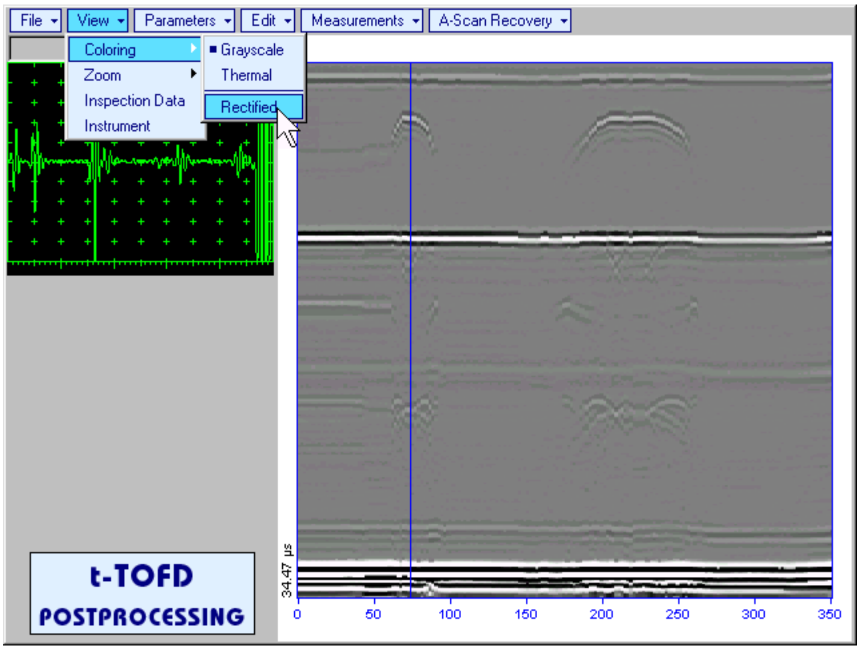


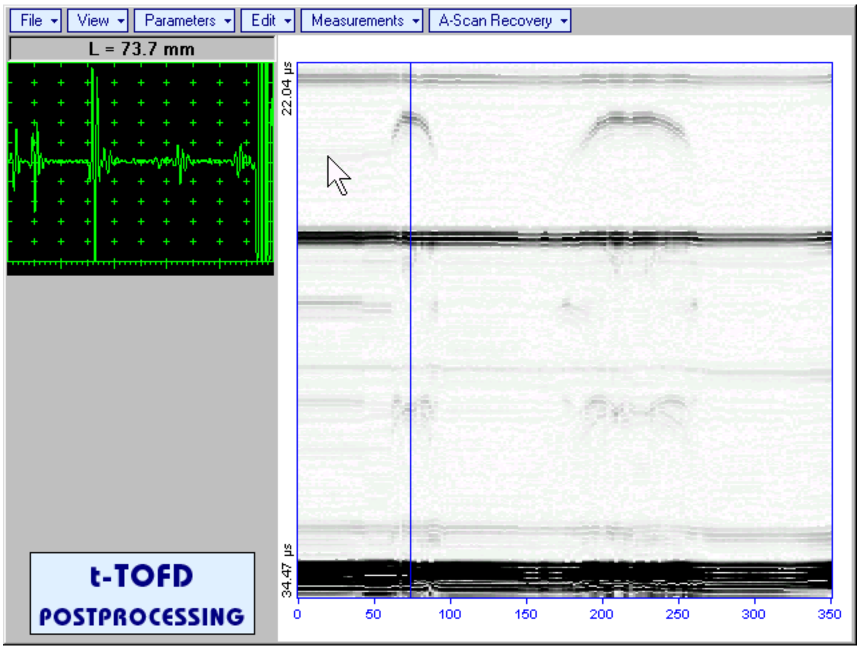
To fix position of *A-Scan base line cursor* with corresponding recovered **A-Scan** left mouse click or release touch screen stylus or press on front panel keyboard or **Enter** on external keyboard

To interrupt recovery of **A-Scans** right mouse click or press on front panel keyboard or **Esc** on external keyboard

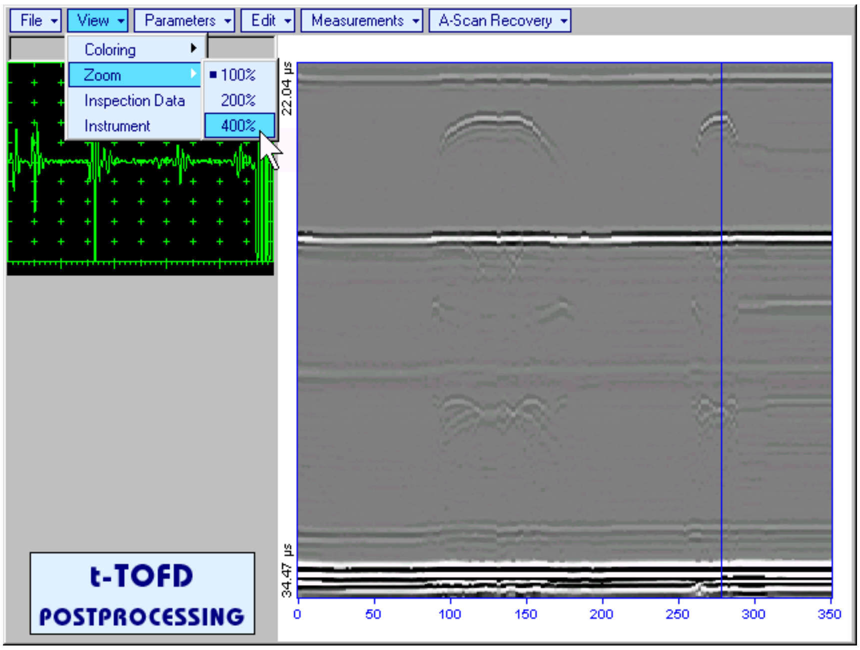
- **A-Scan Recovery→OFF** – erases *A-Scan base line cursor*, indicator of its position, and recovered **A-Scan**

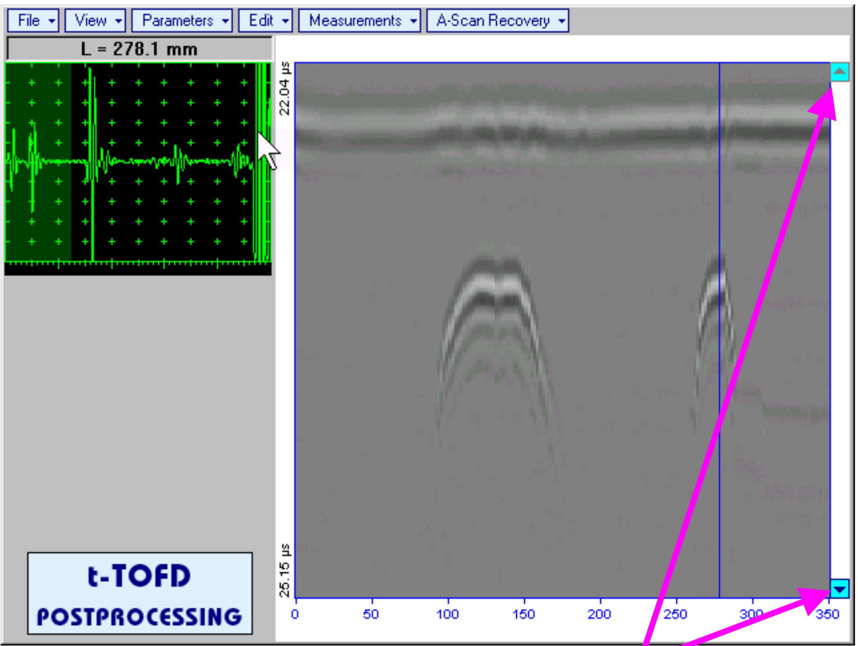
- **View→Coloring→Rectified** – switches between rectified and RF presentation of **t-TOFD** / **TOFD** image





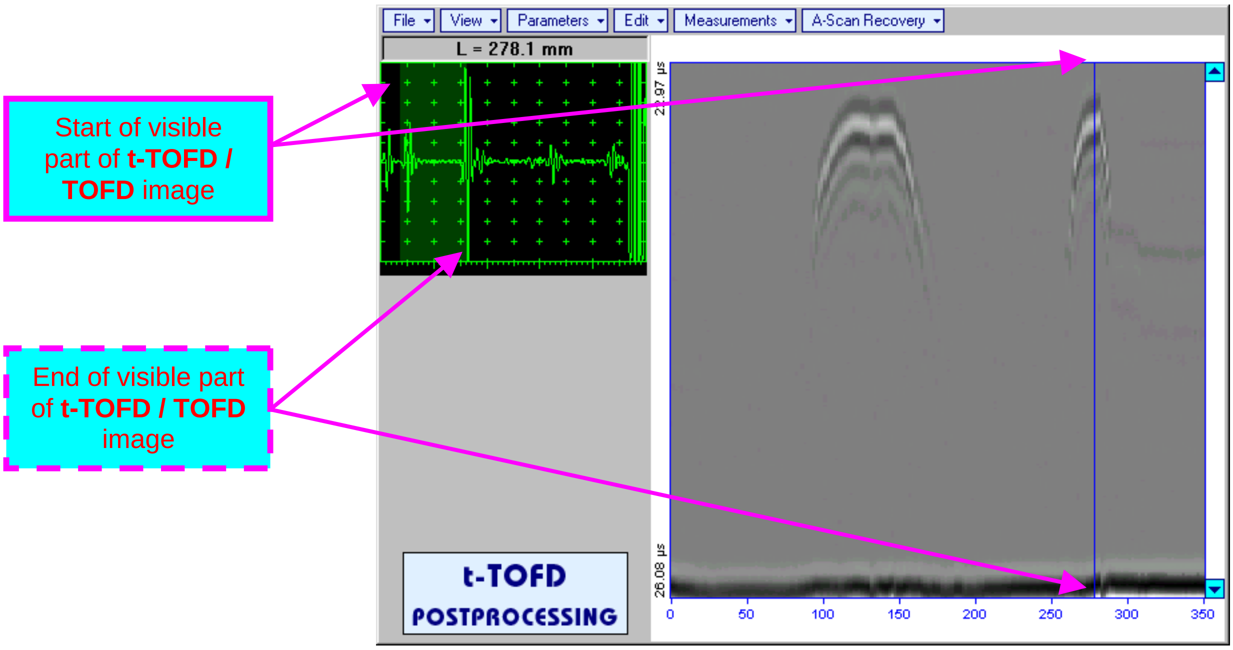
- **View→Zoom→Zoom Factor%** – expands **t-TOFD** / **TOFD** image along time line (vertically)



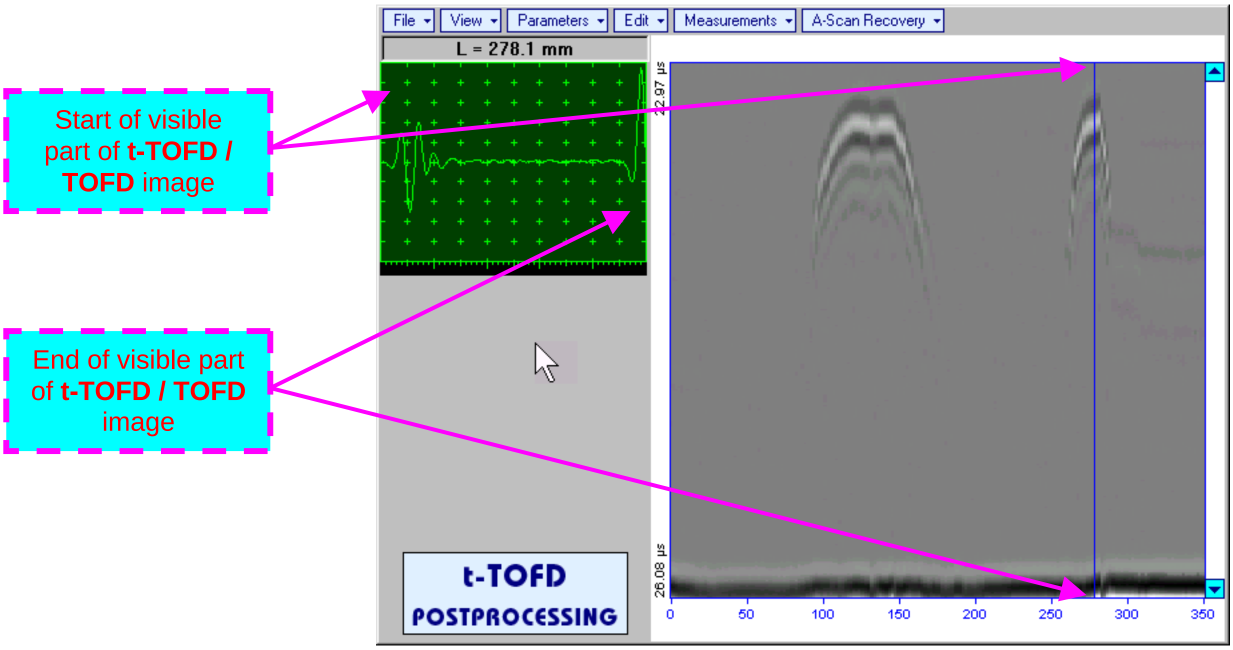


Expanded **t-TOFD** / **TOFD** image may be scrolled it vertically using appropriate buttons

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**

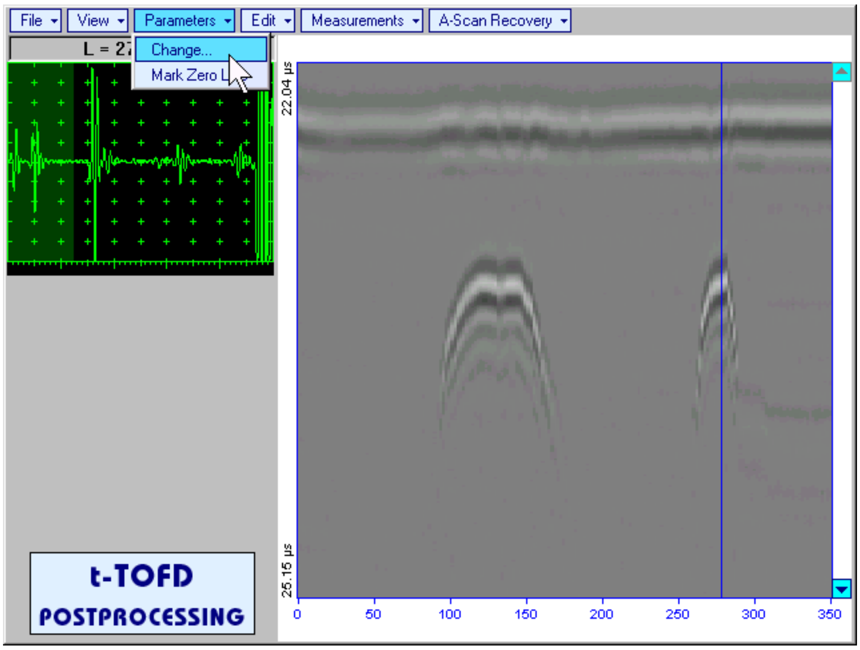


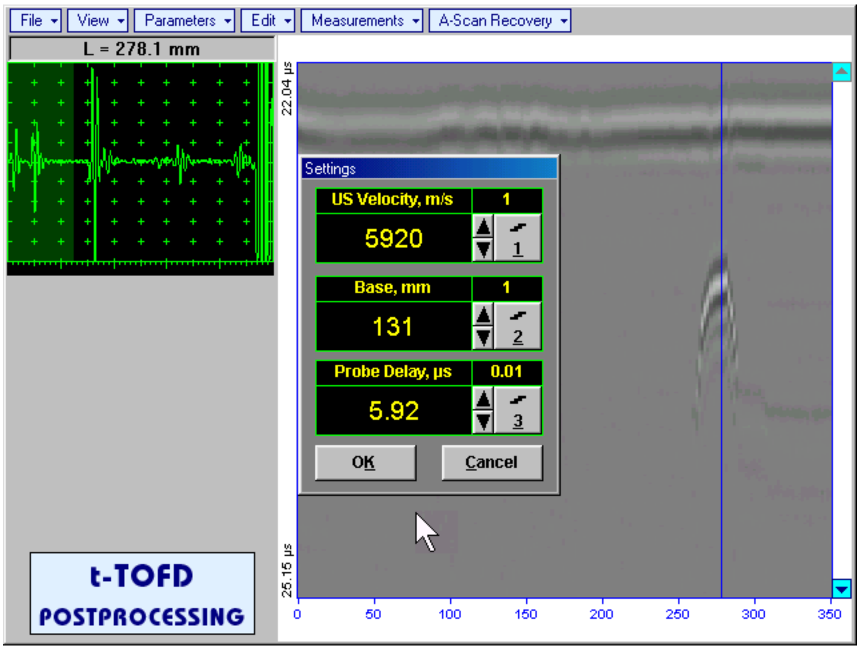
To return to complete recovered **A-Scan** visibility double click on **A-Scan** area

ⓘ

- **Zoom function is available for t-TOFD / TOFD image composed of A-Scans longer than 5 µs**
- **Possible zoom factors are defined by ISONIC 2008 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

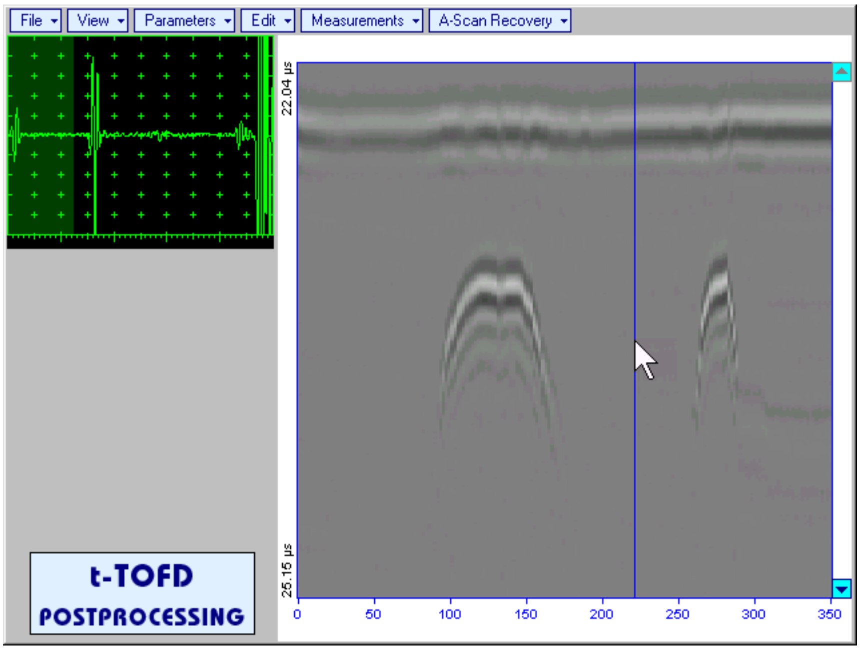




On completing click **OK** or press  on front panel keyboard or **Enter** on external keyboard

To negate re-adjustments click on **Cancel** or press  on front panel keyboard or **Esc** on external keyboard

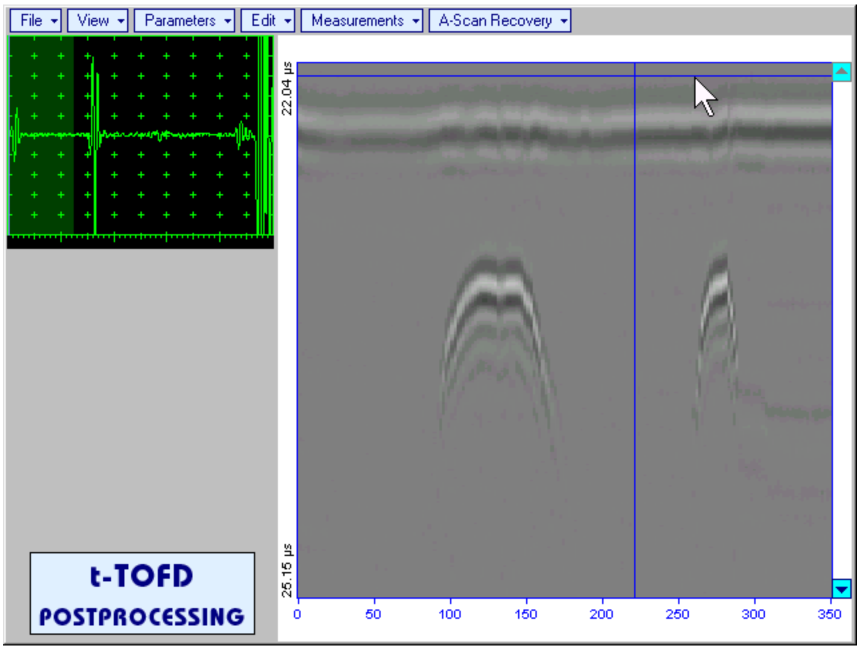
- **Parameters→Mark Zero Line** – allows re-adjusting of **Probe Delay** for computation of defects depth and linearization of **t-TOFD** / **TOFD** image through mark of start point of lateral wave signal on the recorded **t-TOFD** / **TOFD** image with reference to recovered **A-Scan**. Initially this 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



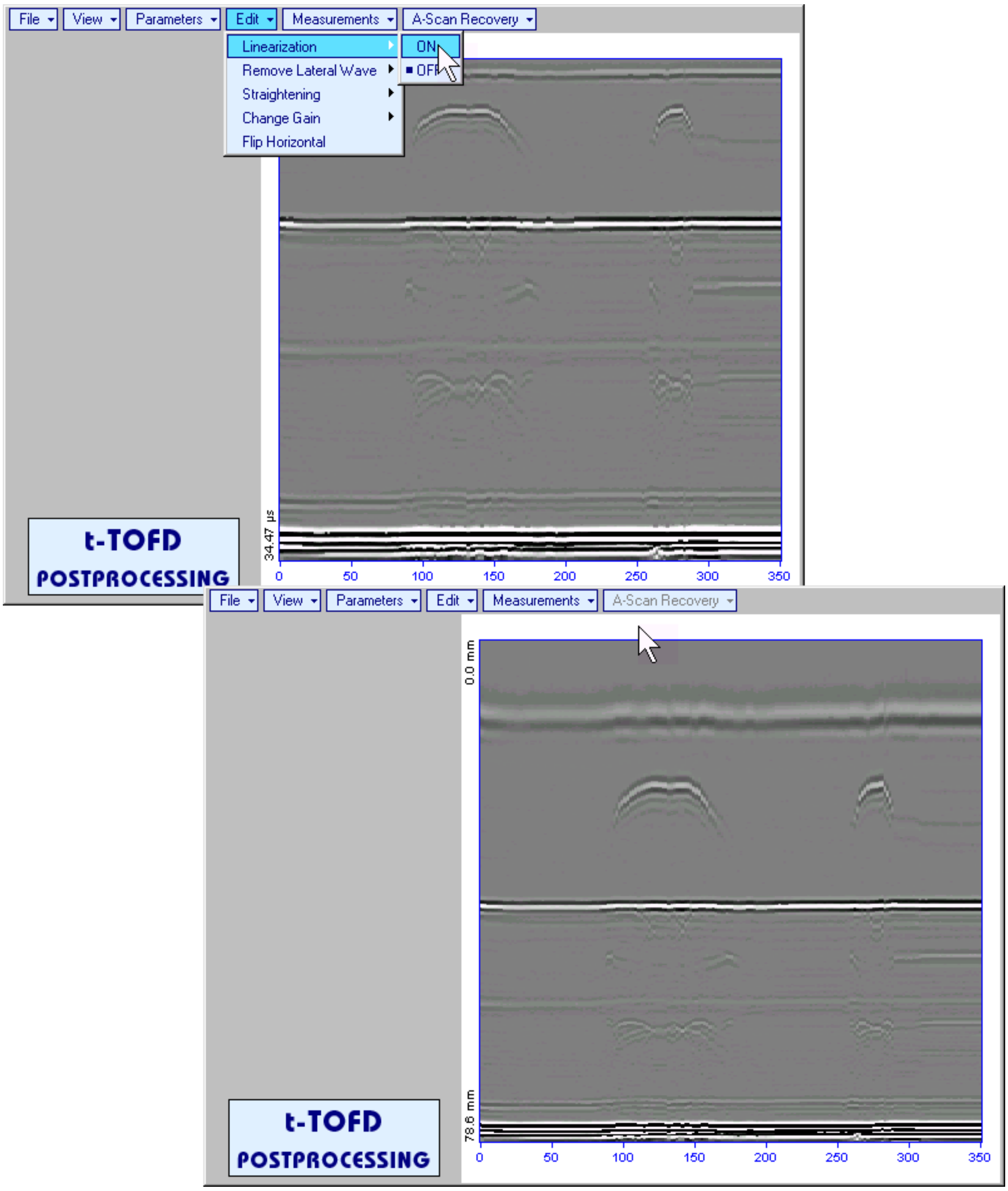
Upon selecting reference **A-Scan** with clear lateral wave left mouse click or press on front panel keyboard or **Enter** on external keyboard – this generates horizontal cursor, which may be be guided over **t-TOFD** / **TOFD** image using either touch screen stylus or mouse or , on front panel keyboard 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

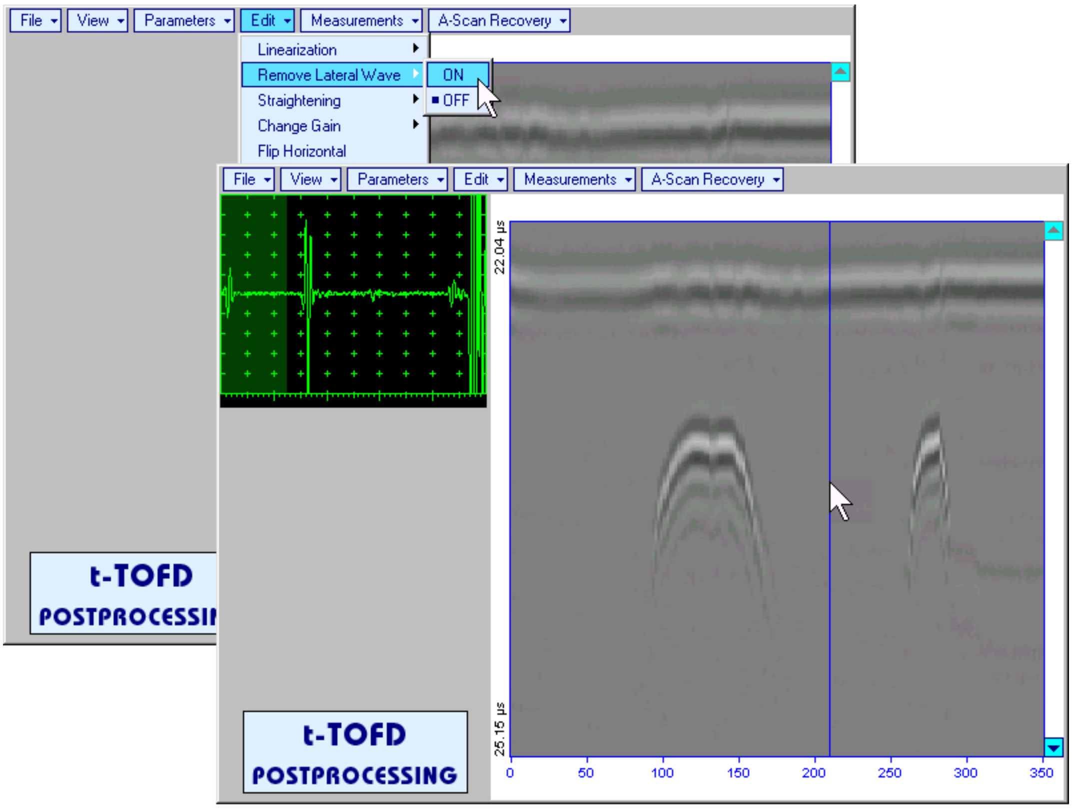


- **Edit→Linearization→ON** – recalculates depth for each point of **t-TOFD** / **TOFD** image and redraws it as **Longitudinal Coordinate – Depth** map

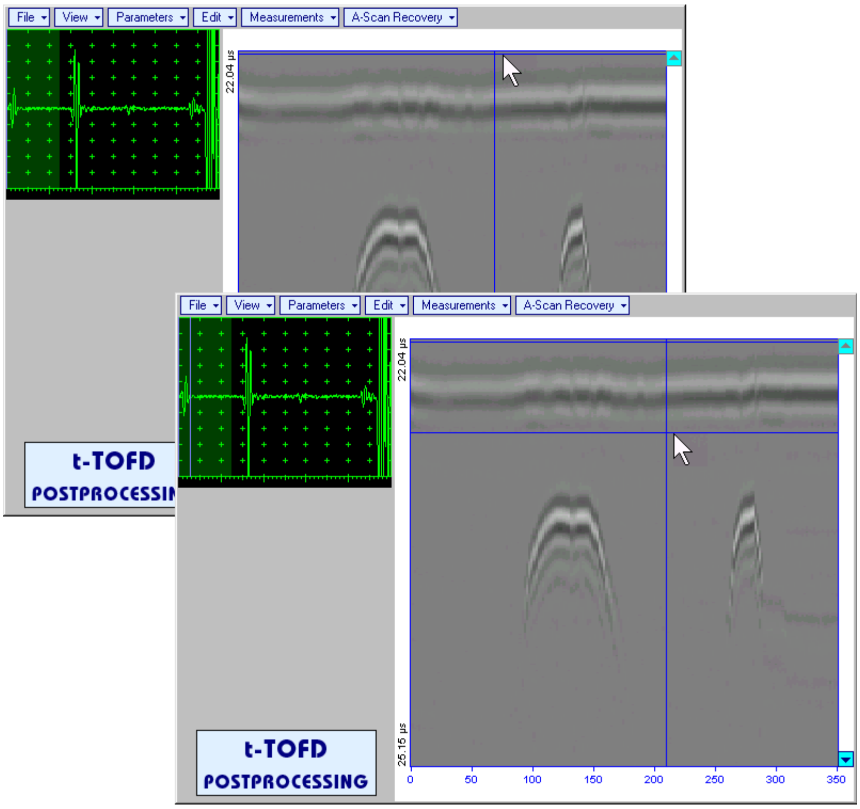


- **Edit→Linearization→OFF** – returns to original **t-TOFD** / **TOFD** image - **Longitudinal Coordinate – Time** map

- **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

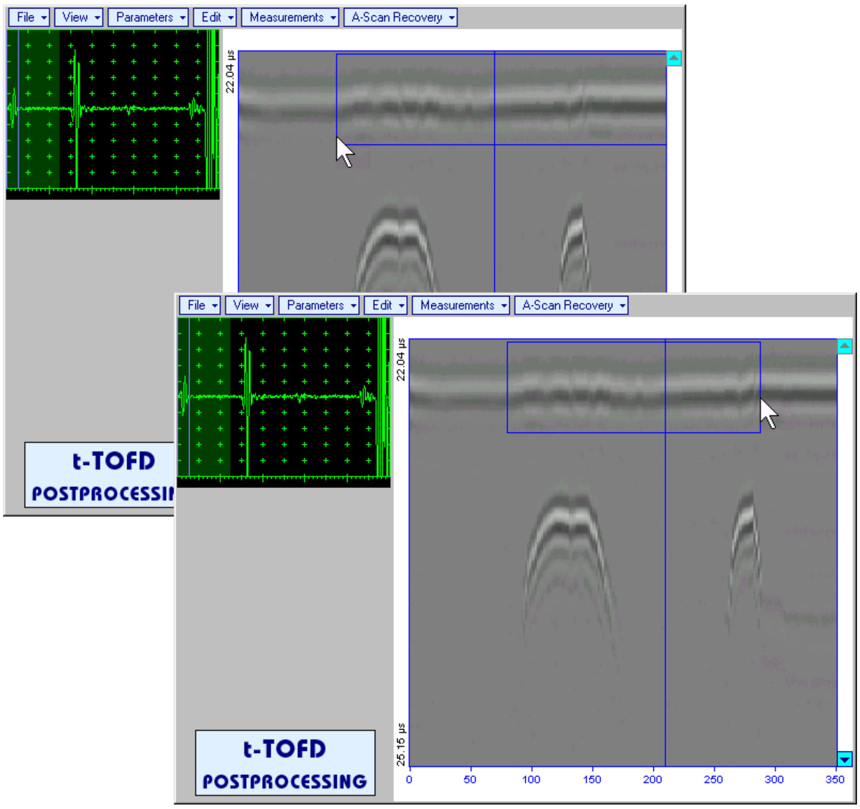


First horizontal cursor appears on the **t-TOFD** / **TOFD** image upon selecting reference **A-Scan**. It may be guided over **t-TOFD** / **TOFD** image using either touch screen stylus or mouse or ⇧, ⇩ on front panel keyboard or ⇧, ⇩ on external keyboard . To fix position of the first horizontal cursor and **designate start of *reference signal*** left mouse click or release touch screen stylus or press Enter 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***



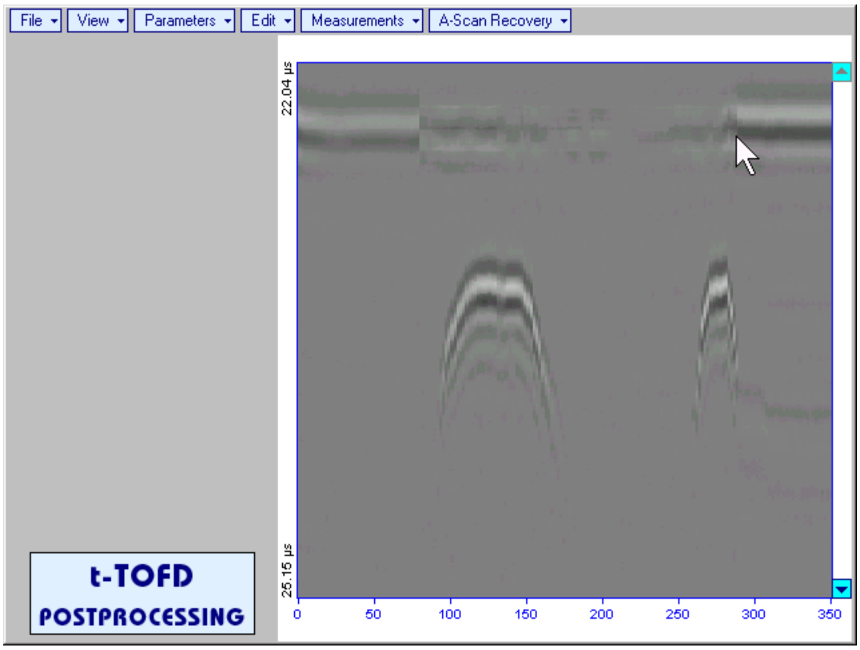
Horizontal cursors are accompanied with appropriate time cursors moving over reference A-Scan

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:

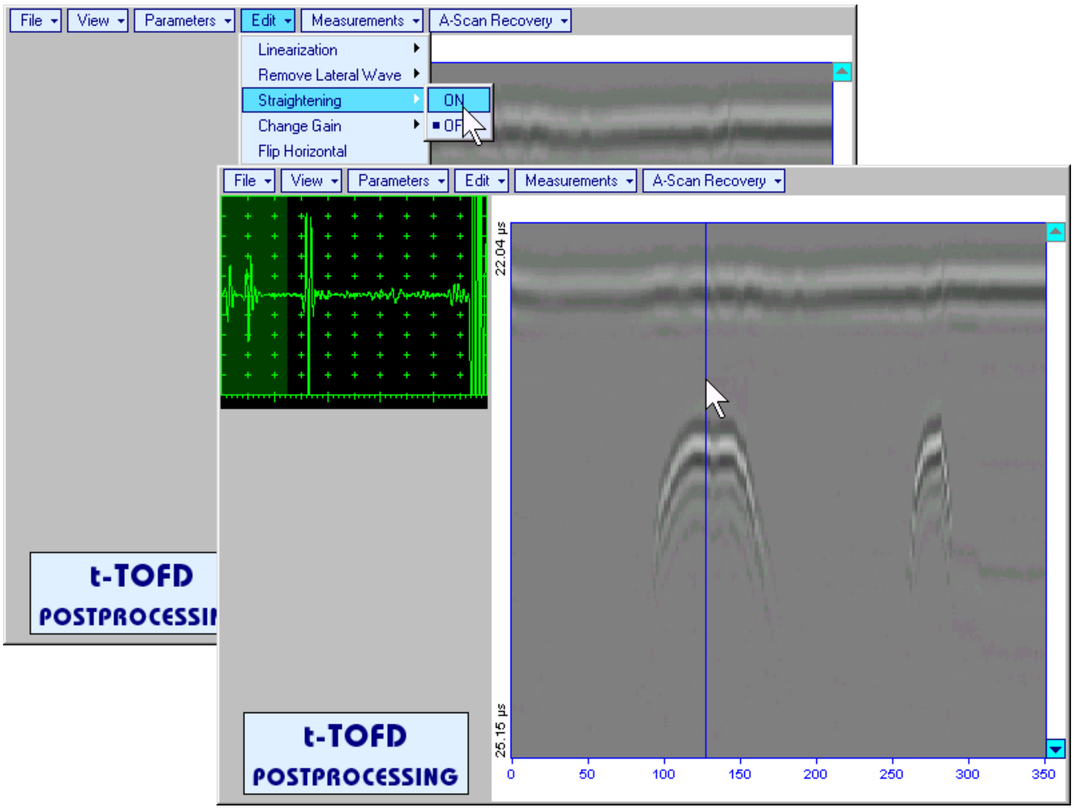
- o Signs of *reference signal* and corresponding signals in the selected *rectangle segment* are removed from **t-TOFD** / **TOFD** image
- o **t-TOFD** / **TOFD** image is straightened above and under selected and modified *rectangle segment* to compensate deviations caused by various factors during recording, for example, coupling instability, unevenness of scanning or bottom surfaces, etc



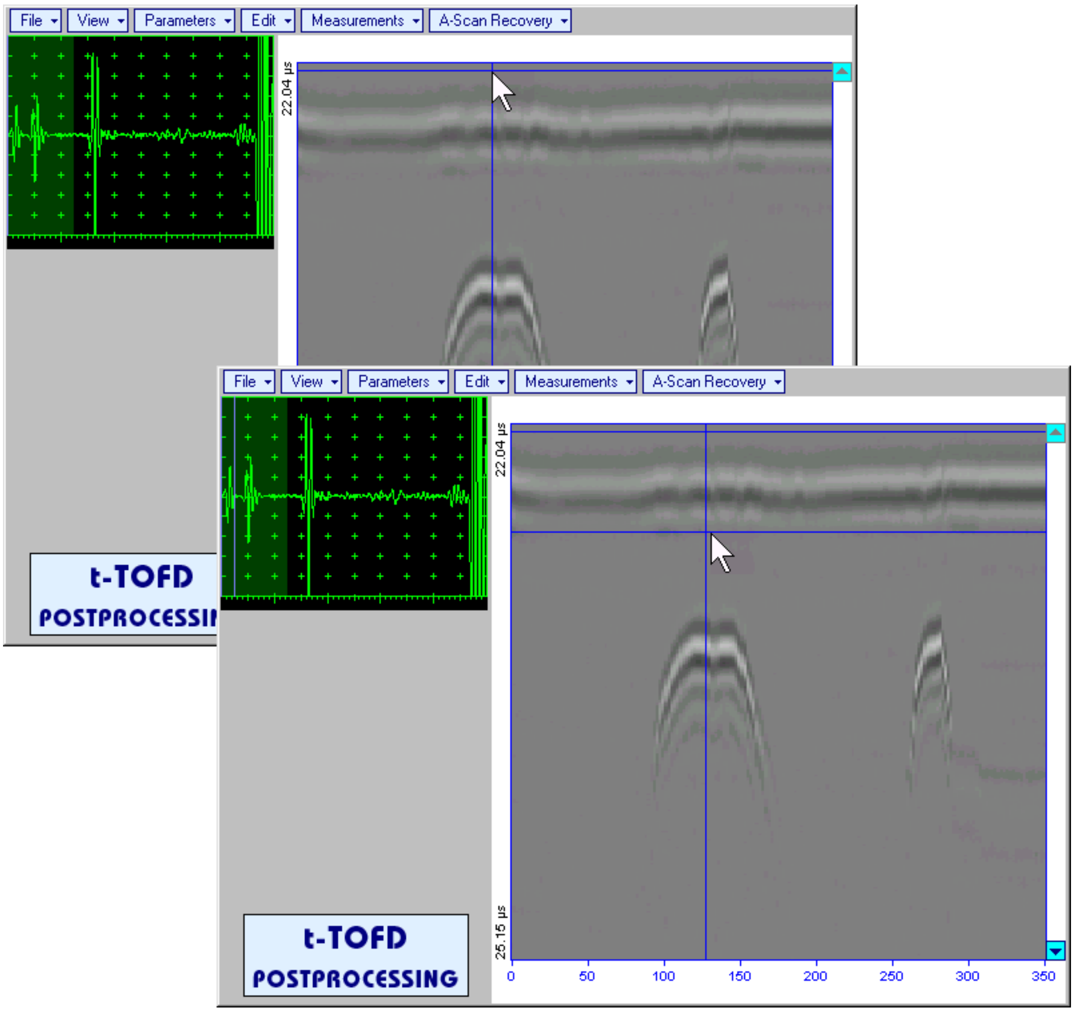
To interrupt function at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard

- **Edit→Remove Lateral Wave→OFF** – negates modification of selected *rectangle segment* of **t-TOFD** / **TOFD** image

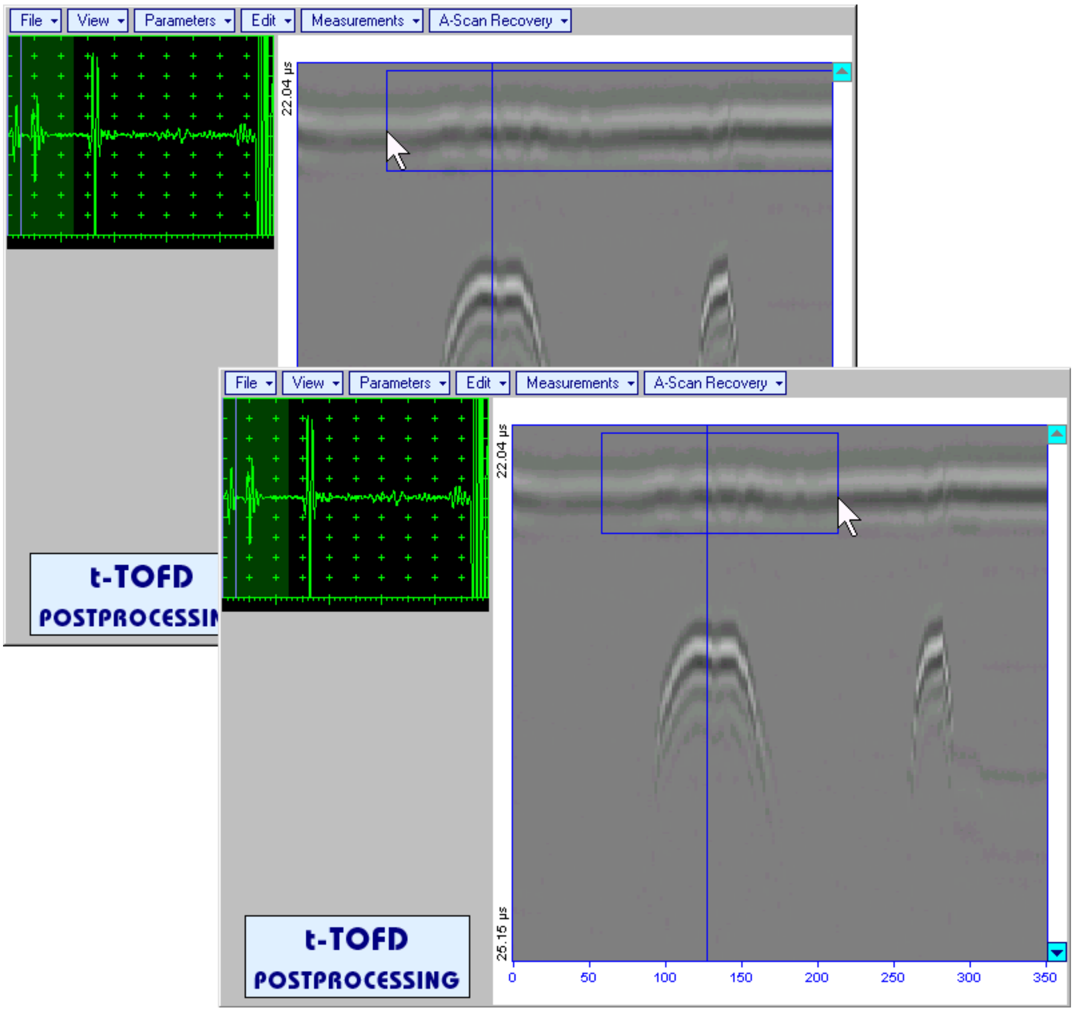
- **Edit→Straightening→ON** – straightens **t-TOFD** / **TOFD** image in order to compensate deviations caused by various factors during recording, for example, coupling instability, unevenness of scanning or bottom surfaces, etc. It is based on selecting *reference signal* (either lateral wave, or backwall 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



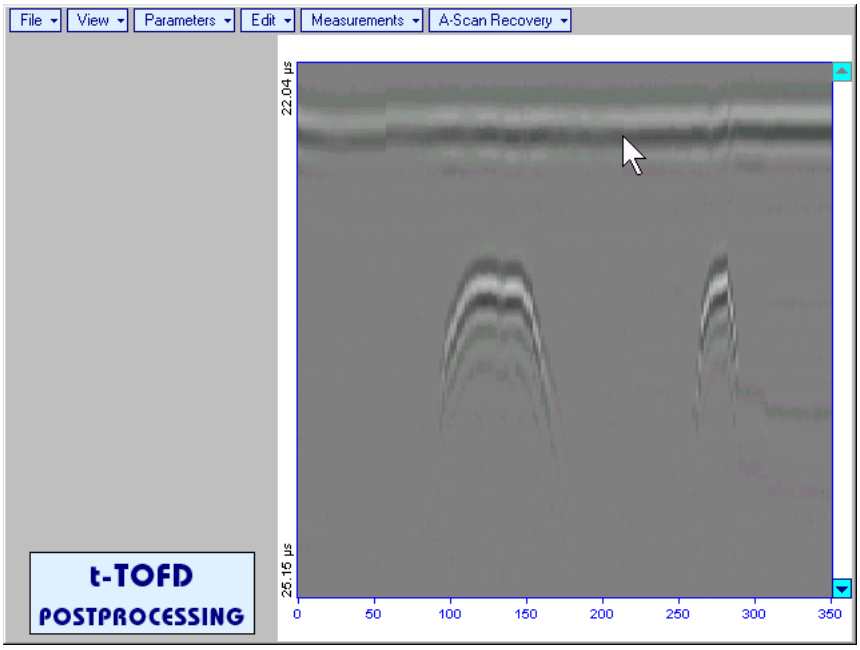
First horizontal cursor appears on the **t-TOFD** / **TOFD** image upon selecting reference **A-Scan**. It may be guided over **t-TOFD** / **TOFD** image using either touch screen stylus or mouse or ⬆, ⬇ on front panel keyboard or ↑, ↓ on external keyboard . To fix position of the first horizontal cursor and **designate start of *reference signal*** left mouse click or release touch screen stylus or press Enter 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 Enter 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

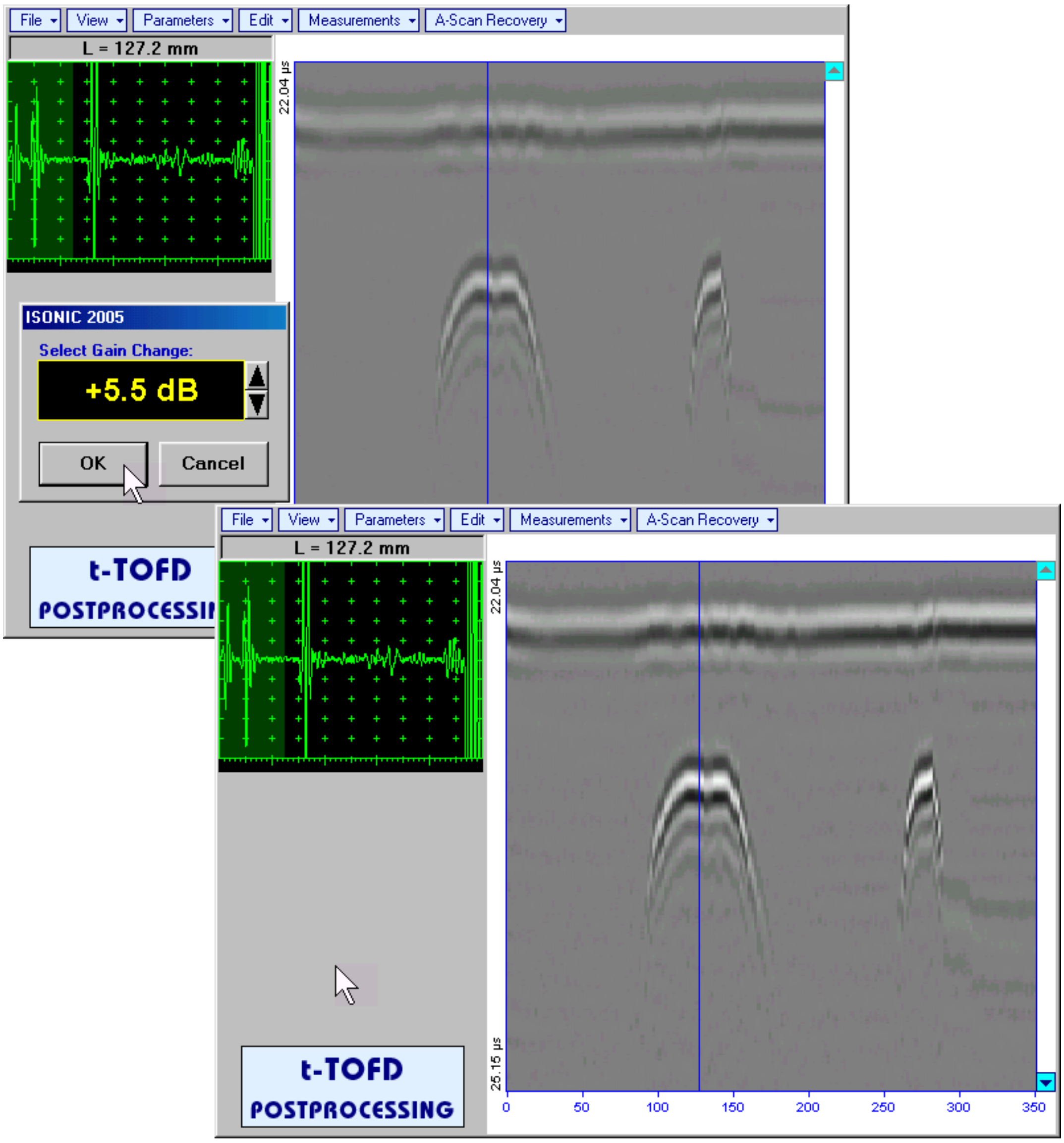


To interrupt function at any moment right mouse click or press 

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 ±**6dB** range with ±**0.1 dB** increments through clicking or pressing and holding on or pressing , on front panel keyboard or ↑, ↓ on external keyboard

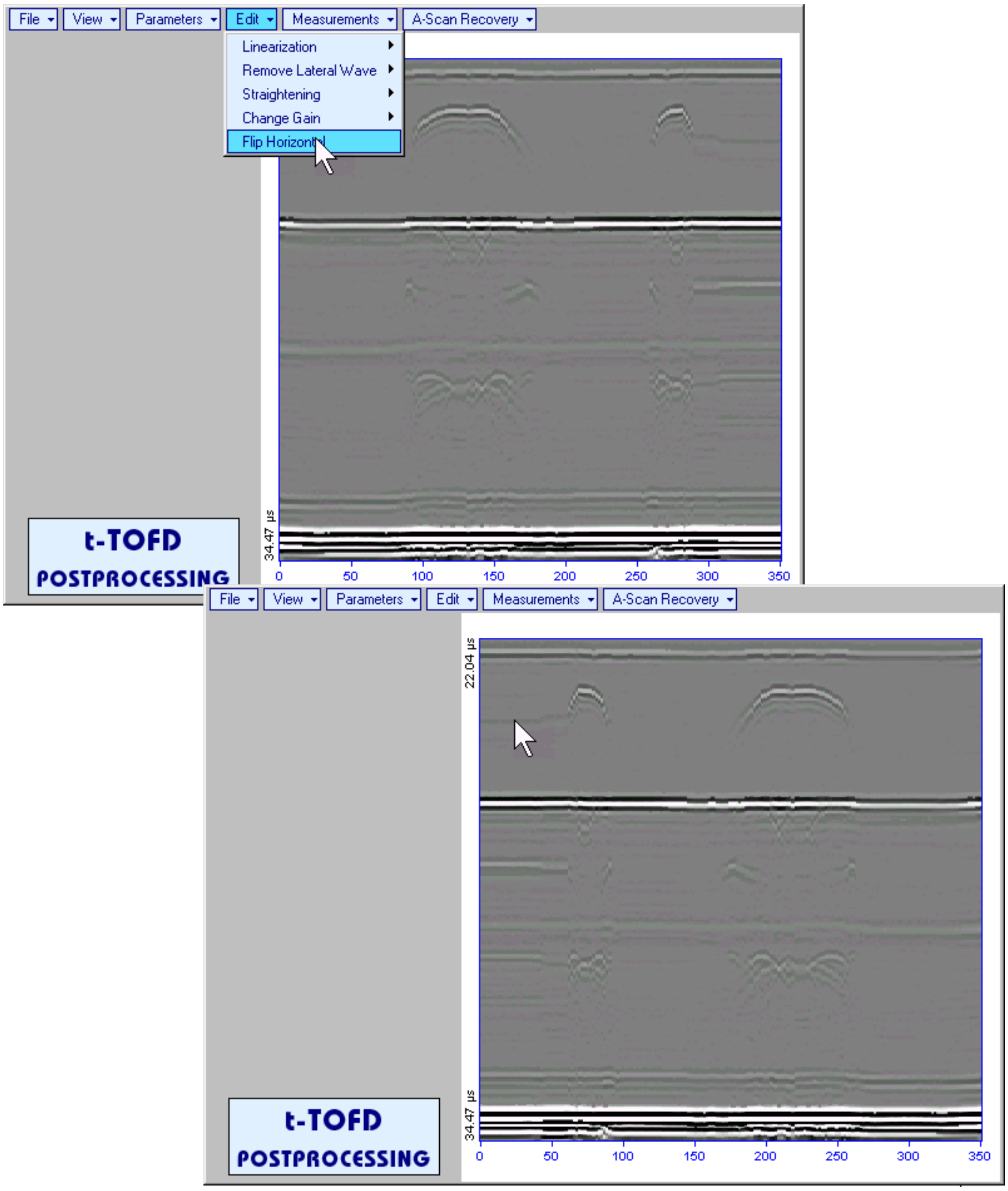


During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain** click on OK or press on front panel keyboard or **Enter** on external keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws **t-TOFD** / **TOFD** image accordingly

To interrupt re-adjusting of **Gain** click on **Cancel** or press ESC 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

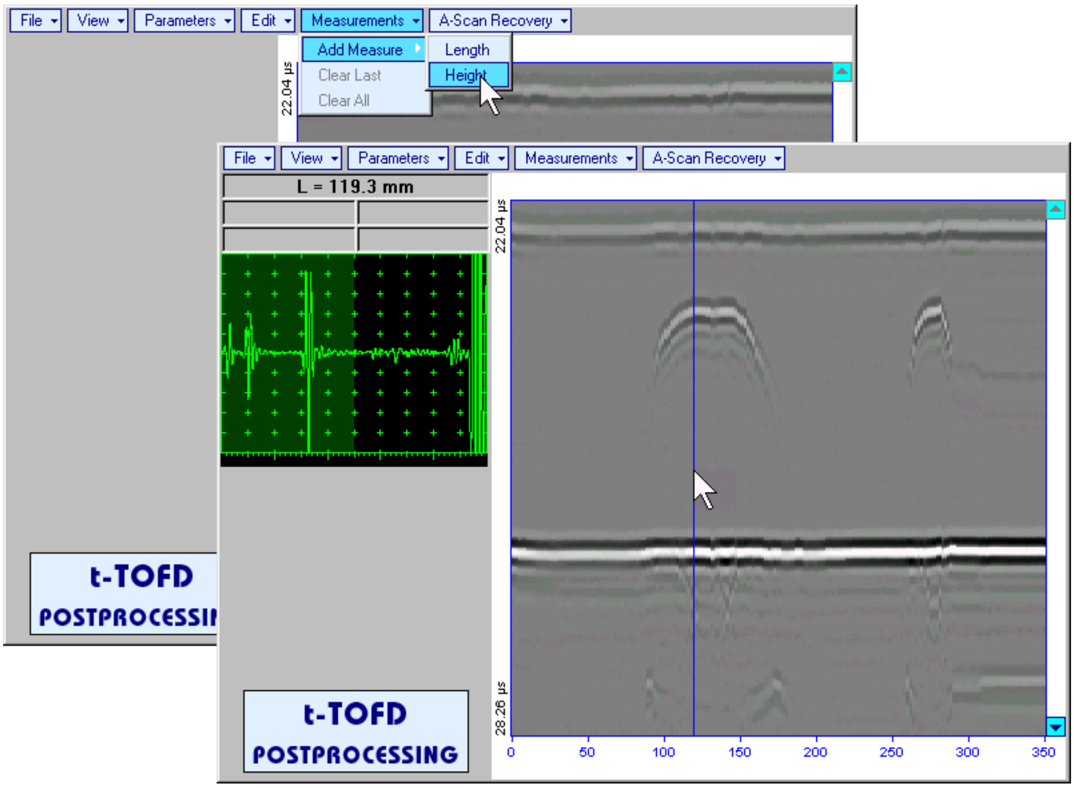
- **Edit→Flip Horizontal** – reorders **A-Scans** captured during **t-TOFD** / **TOFD** recording in reverse succession and redraws **t-TOFD** / **TOFD** image accordingly. This service function may be useful for merging scans of neighboring sections of an object, which were scanned in opposite direction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



ⓘ

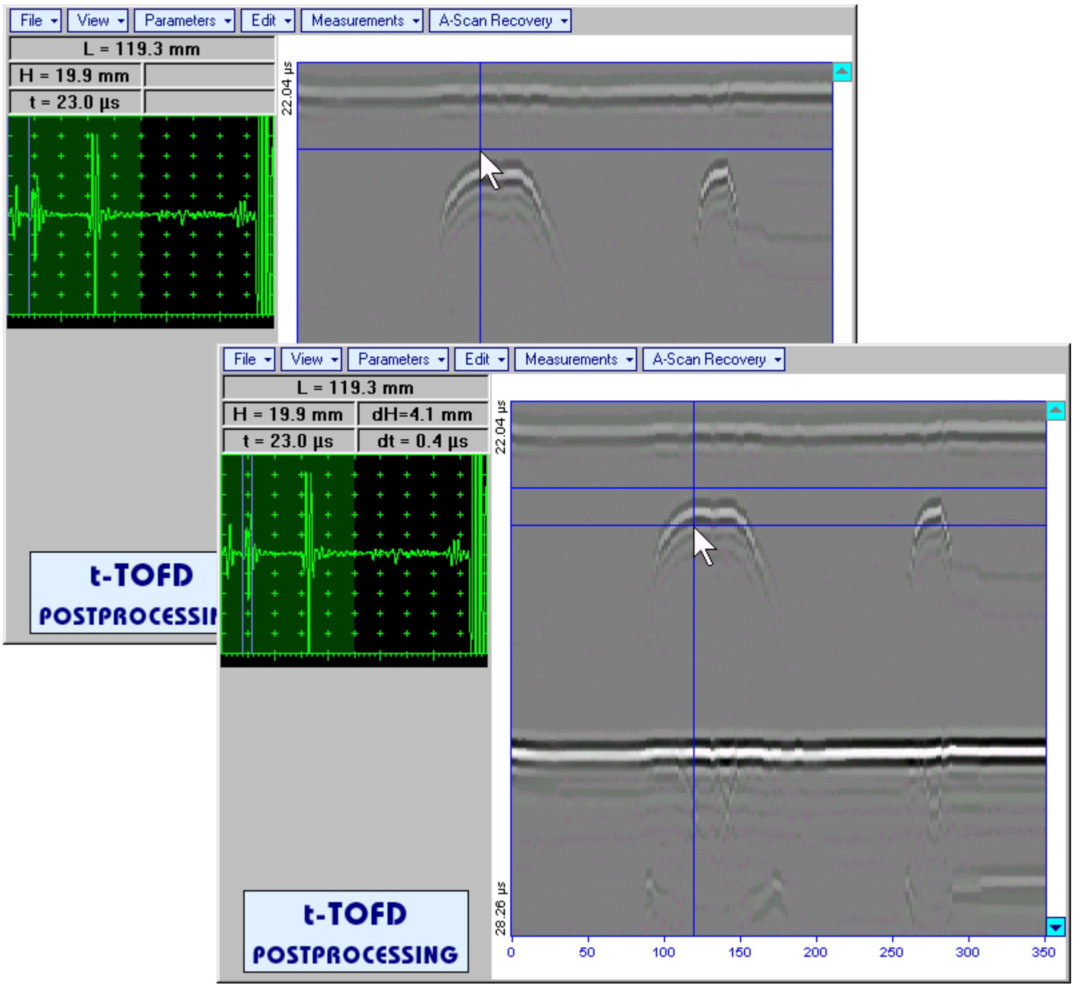
Applying of **Flip Horizontal** function empties *postprocessing session memory stack*

- **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**



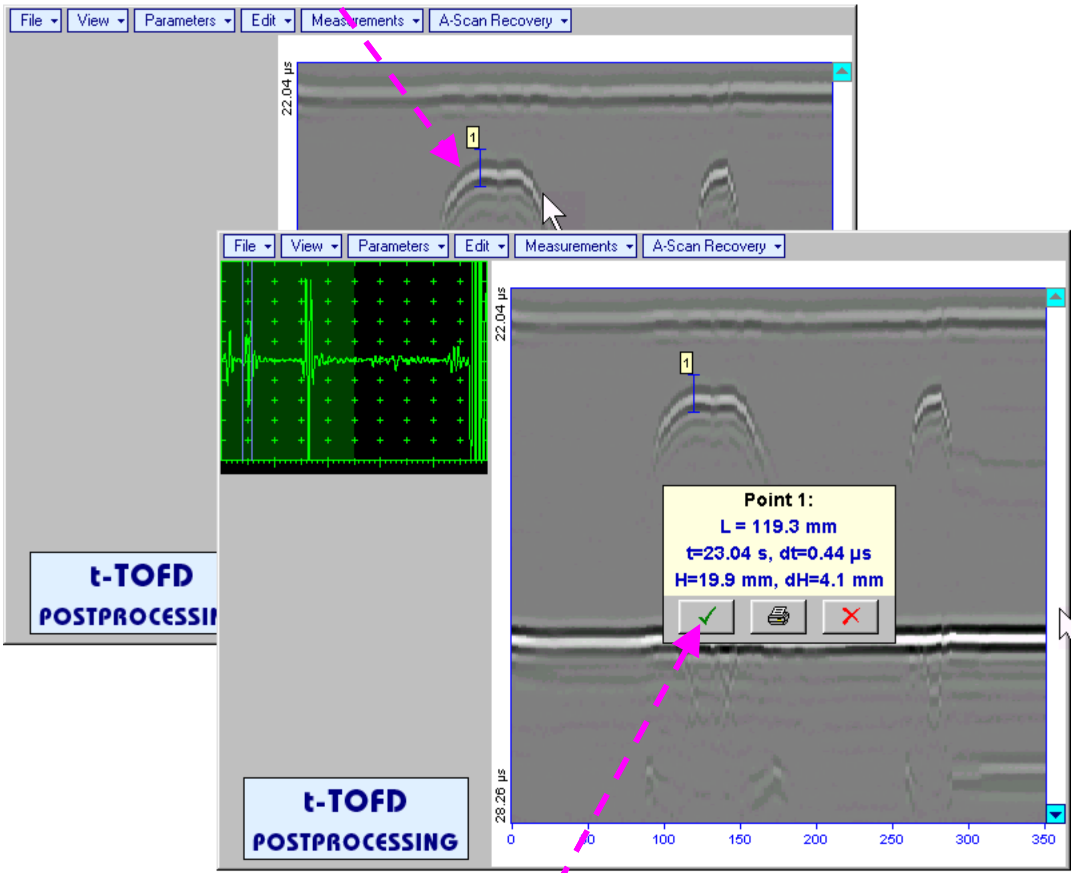
First horizontal cursor appears upon fixing *A-Scan base line cursor*, it may be guided over **t-TOFD** / **TOFD** image using either touch screen stylus or mouse or , on front panel keyboard or ⇑, ⇓ on external keyboard . First horizontal cursor is accompanied with first *time cursor* synchronously 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

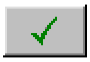


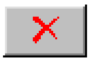
Depth measurement results may be recalled into subwindow accompanied with corresponding **A-Scan** through double click on the *depth measurement mark*

In the subwindow appearing:

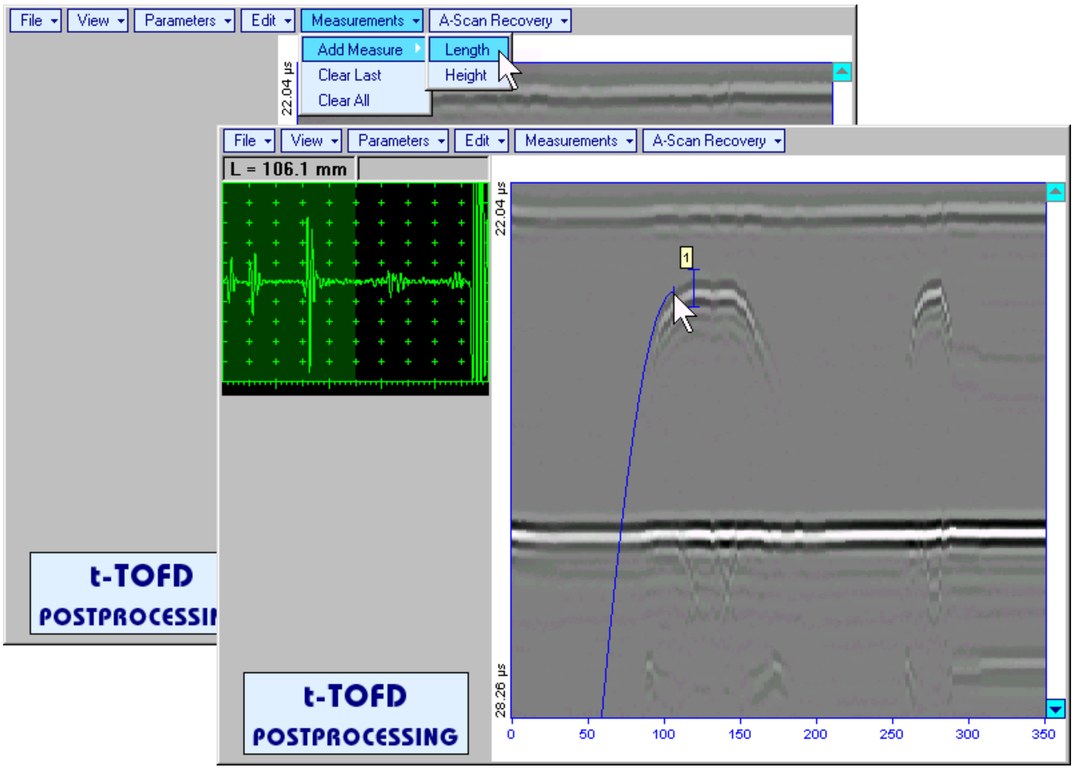
- **L** is coordinate of *depth measurement mark* along scanning line
- **H** represents defect depth
- **t** represents time of flight for first diffracted signal
- **dH** represents defect's height
- **dt** represents delay of second diffracted signal relatively first diffracted signal

Clicking on  will print current screen snapshot accompanied with *depth measurement mark* data

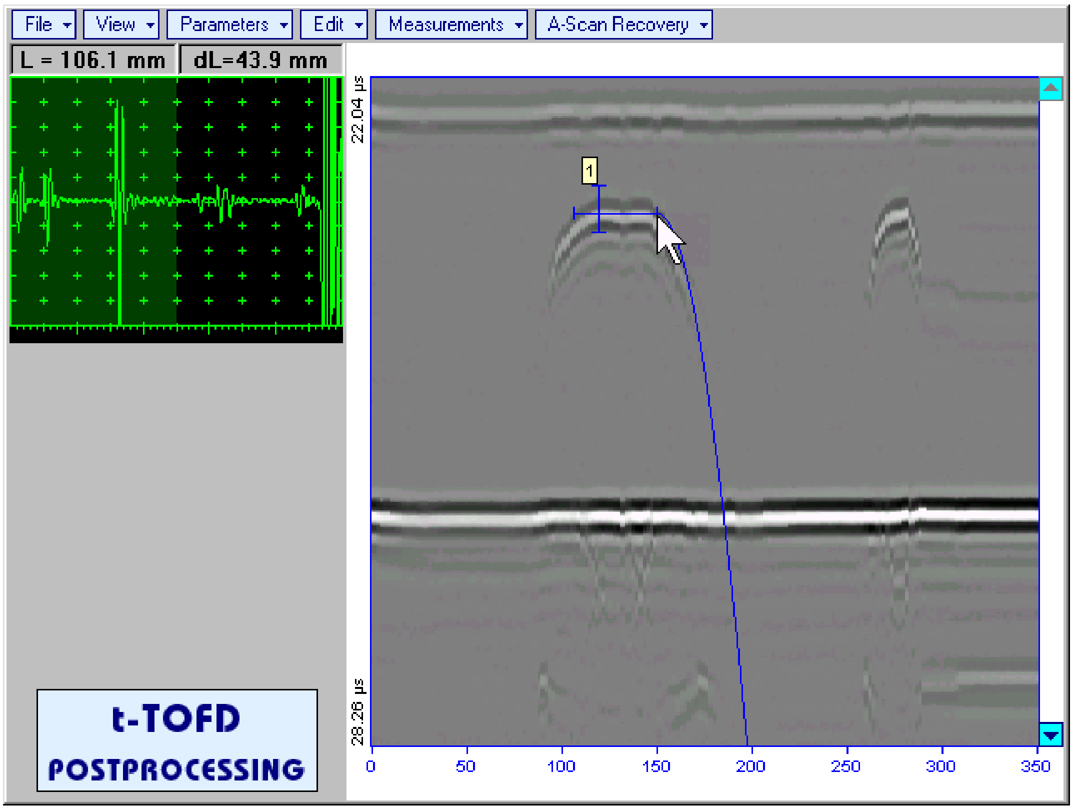
Clicking on  will hide subwindow with *depth measurement mark* data

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 Enter on front panel keyboard or **Enter** on external keyboard



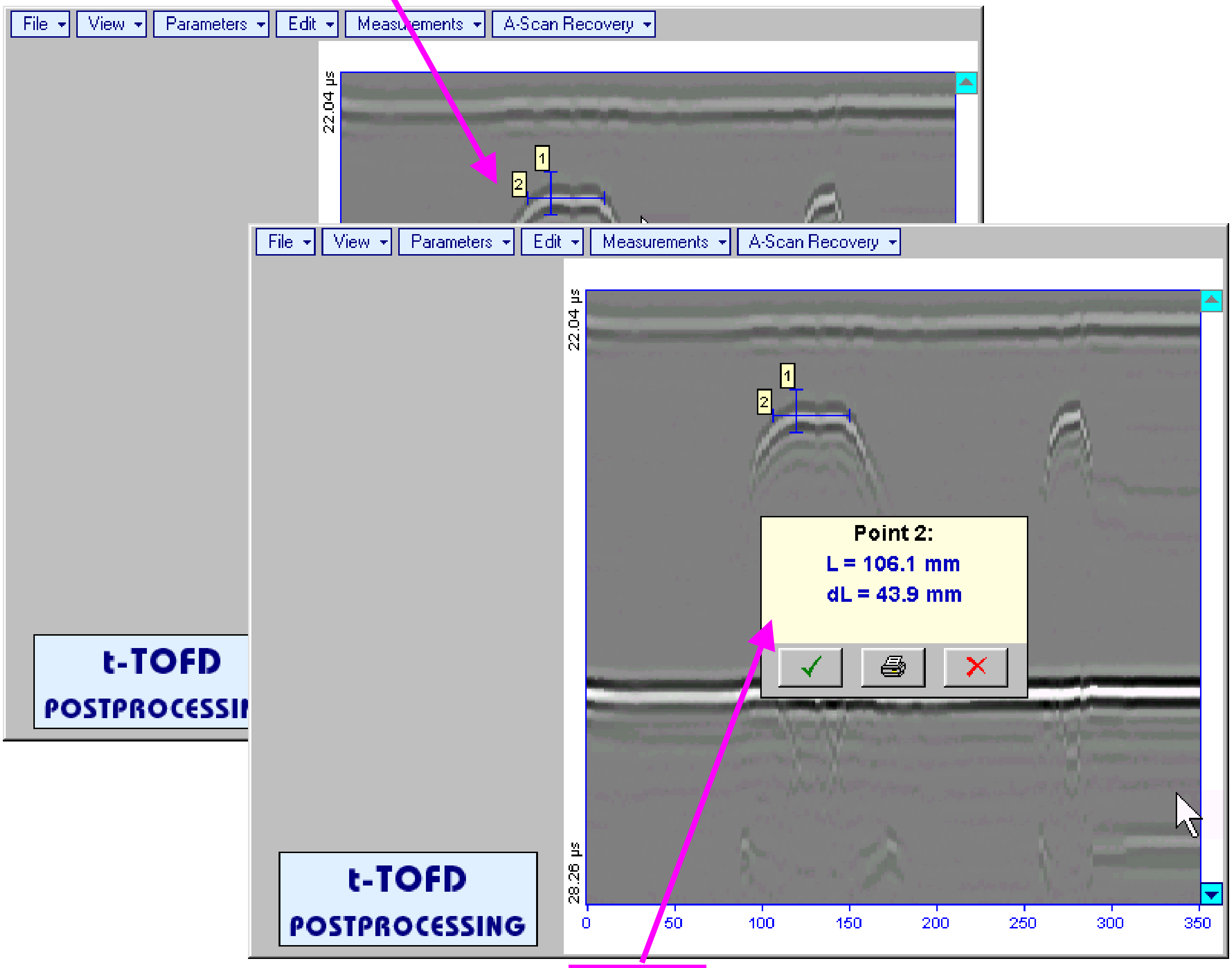
Right parabolic cursor appears upon fixing *left parabolic cursor.* It may be manipulated by the same way and must be placed over right defect's end providing shape matching. Coordinate of *right parabolic cursor* along **t-TOFD** / **TOFD** image measured relatively to position of *left parabolic cursor* (**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*

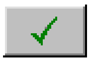


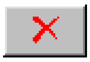
Length measurement results may be recalled into subwindow through double click on the *length measurement mark*

In the subwindow appearing:

- o **L** is coordinate of left end of the *length measurement mark*
- o **dL** is length of defect area covered by *length measurement mark*
- o **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-TOFD** / **TOFD** image

6.6. CB-Scan horizontal plane-view imaging and recording of defects for shear, surface, and guided wave inspection – t-FLOORMAP L or FLOORMAP L

6.6.1. Setup Pulser Receiver for t-FLOORMAP L and FLOORMAP L

UDS 3-6 Pulser Receiver screen appears upon clicking on 4 t-Floormap L or 4 Floormap L. The following settings to be provided:

6.6.1.1. 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	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain setting procedure**
5	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**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 I or press I on front panel keyboard or F8 on external keyboard upon completing

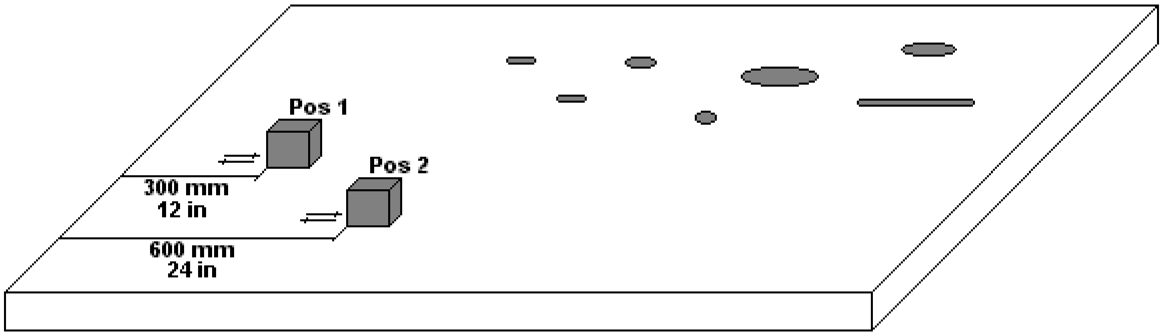
6.6.1.2. Guided, Surface, Creeping, and Head Wave Inspection

#	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 6.6.1.4 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 6.6.1.4 of this Operating Manual or similarly**
3	**Pulser Mode**	**PULSER**	**Dual** for dual element probes **Single** for single element probes	
4	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain setting procedure**
5	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**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 6.6.1.3 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 6.6.1.3 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**			

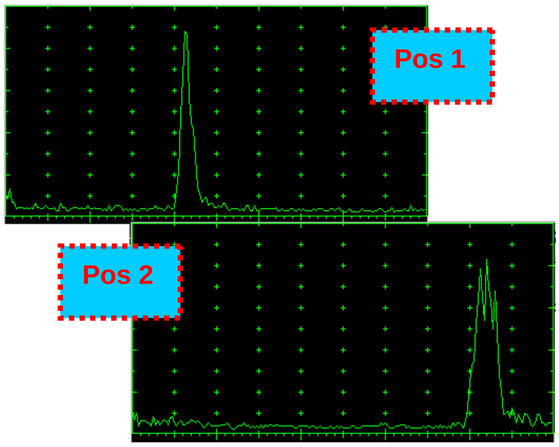
Click on **I** or press **I** on front panel keyboard or **F8** on external keyboard upon completing

6.6.1.3. 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:



(a) In the **UDS 3-6 Pulser Receiver** window – submenu **BASICS** setup **Range = 750 mm** (or **30 in**)
(b) In the **UDS 3-6 Pulser Receiver** window – submenu **BASICS** setup **US Velocity = 3000 m/s** (or **120 in/ms**)
(c) 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
(d) Tune **Gain** to provide plate end echo reaching **80-90%** of **A-Scan** screen height
(e) Tune **Display Delay** (submenu **BASICS**) to provide rising edge of plate end echo matching with **40%** grid on horizontal **A-Scan** screen scale
(f) 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
(g) Tune the **US Velocity** (submenu **BASICS**) to provide rising edge of plate end echo matching with **80%** grid on horizontal **A-Scan** screen scale
(h) 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
(i) 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
(j) 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

6.6.1.4. 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 ±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

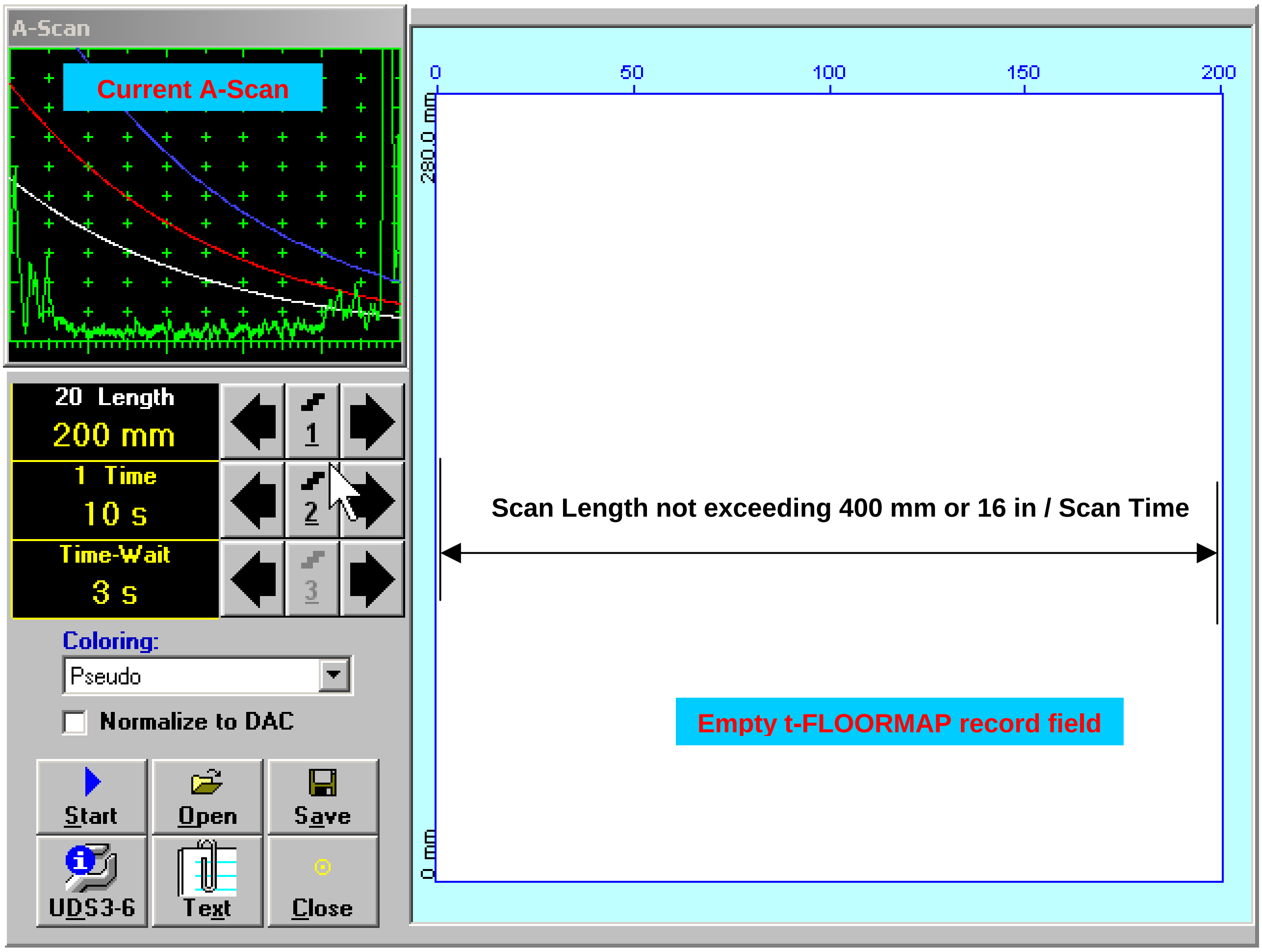
(a) Place guided wave probe into position on reference plate providing receiving of an echo from a reflector passing minimal travel distance
(b) Follow instructions of paragraph 5.2.10 of this Operating Manual to record first DAC echo
(c) Move the probe away from the reflector keeping it's echo maximized for each new DAC echo recording paragraph 5.2.10 of this Operating Manual

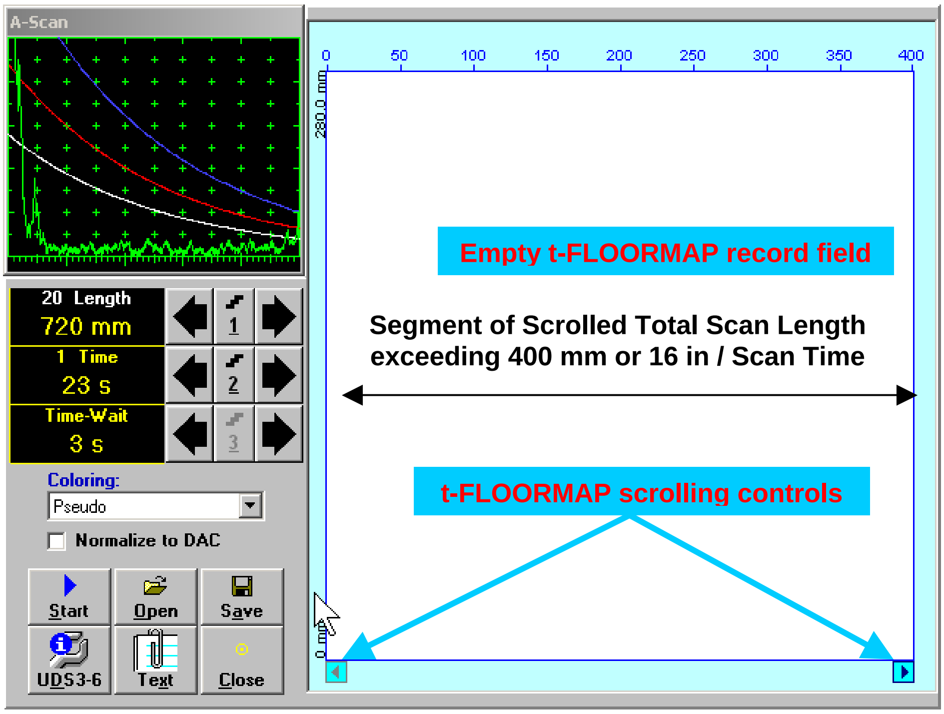
1.

6.6.2. t-FLOORMAP L and FLOORMAP L – Implementation

6.6.2.1. t-FLOORMAP L – Prior to Scanning

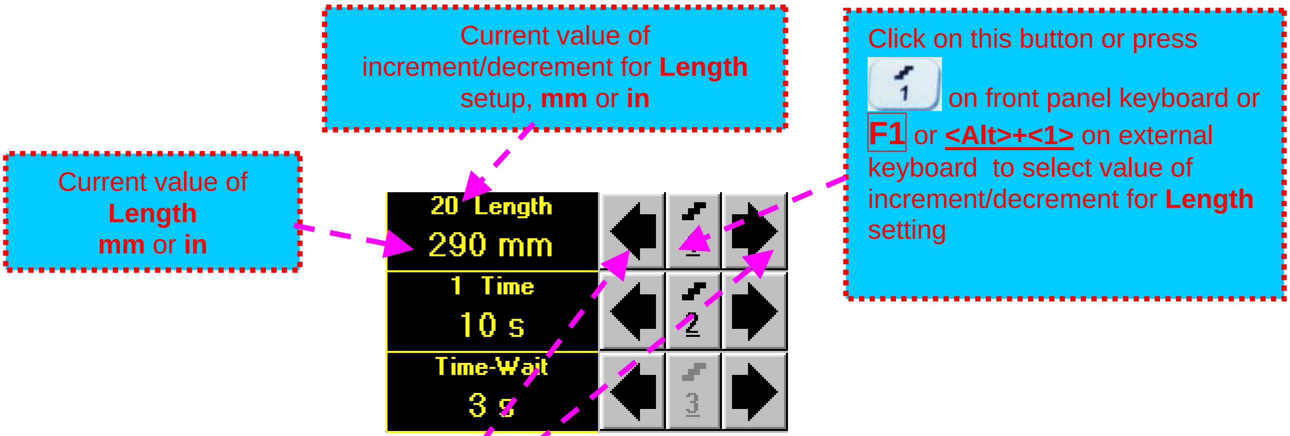
t-FLOORMAP L control panel is shown below





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

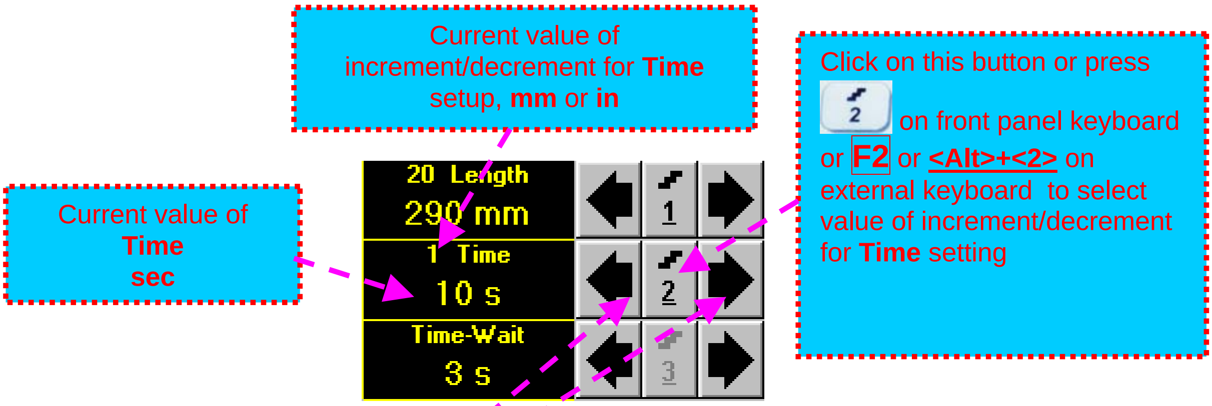


To control **Length** the following manipulations are applicable:

- **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**



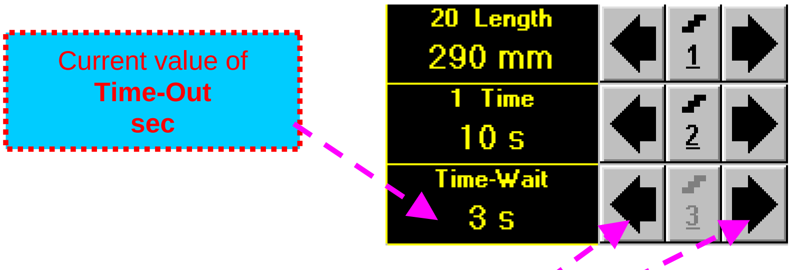
To control **Time**
the following manipulations are applicable:

- **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 predcessing **t-TOFD** recording, which starts unconditionally upon **Time-Wait** period is over



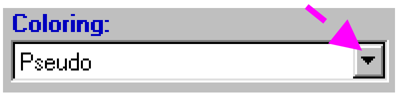
To control **Time-Wait** the following manipulations are applicable:

- **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



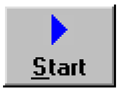
Insert Text Note

Refer to paragraph 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

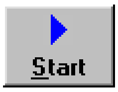
Refer to paragraph 6.3.2.1 of this Operating Manual

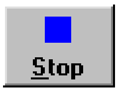
Start/Stop t-FLOORMAP L recording

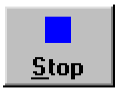
Click on 

or press 

on front panel keyboard or F8 or **<Alt>+<S>** on external keyboard to start **t-FLOORMAP L** recording

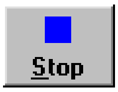


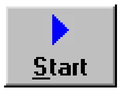
button becomes invisible since **t-FLOORMAP L** recording starts. 

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 6.3.2.1 of this Operating Manual

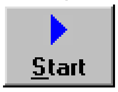
Open record from a file and starting postprocessing session

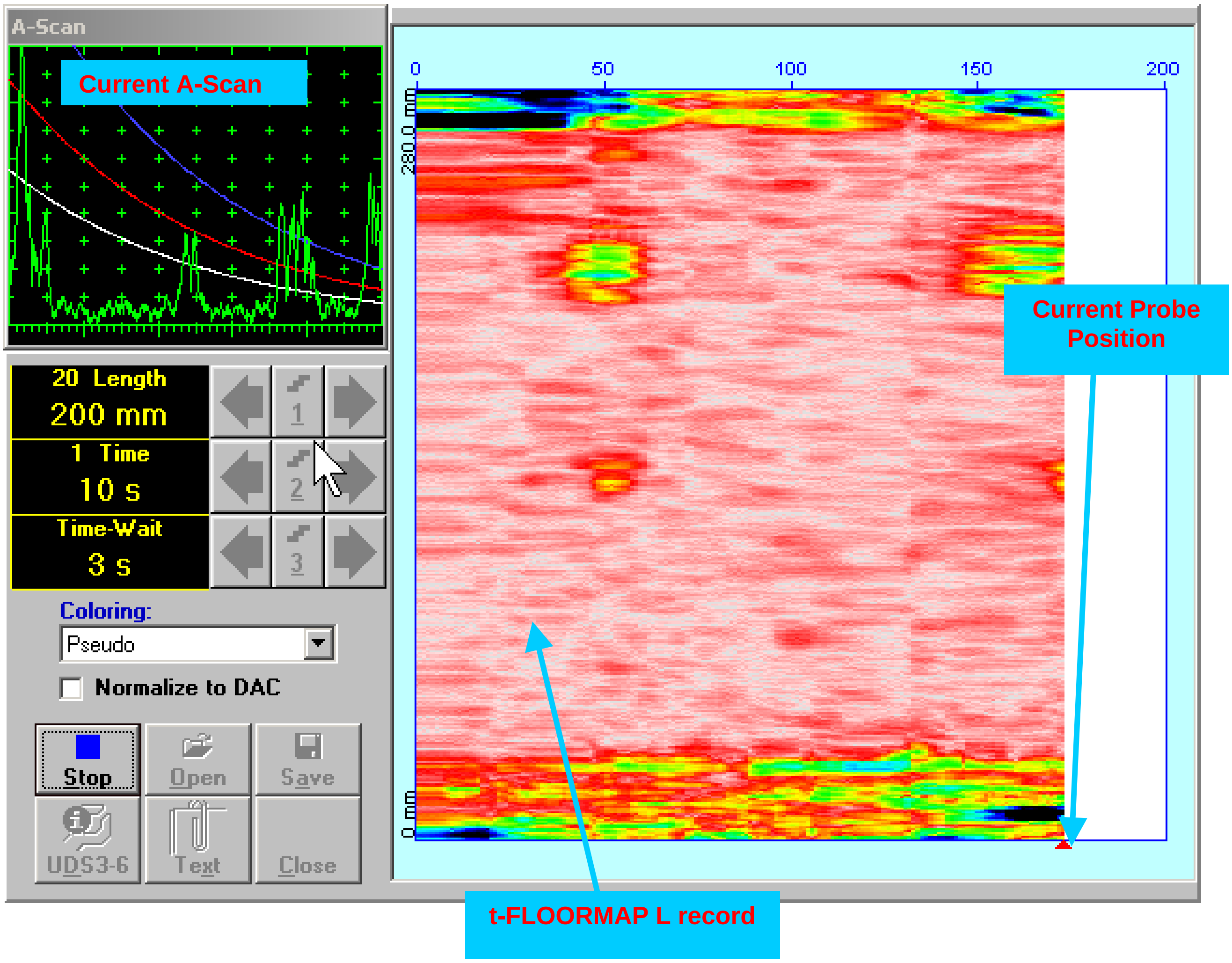
Refer to paragraph 6.3.2.1 of this Operating Manual

Return to UDS 3-6 main operating surface

Refer to paragraph 6.3.2.1 of this Operating Manual

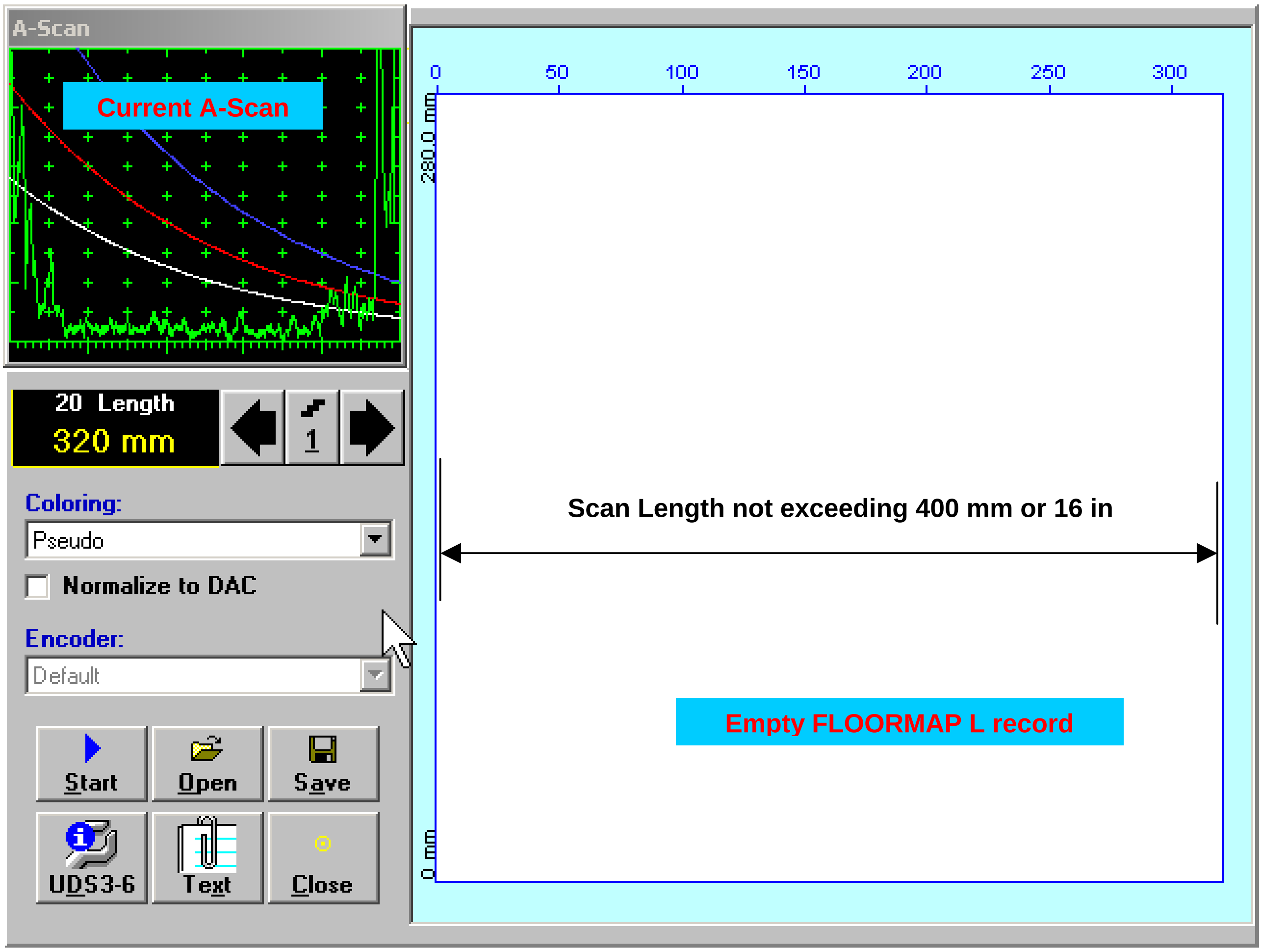
6.6.2.2. t-FLOORMAP L – Scanning

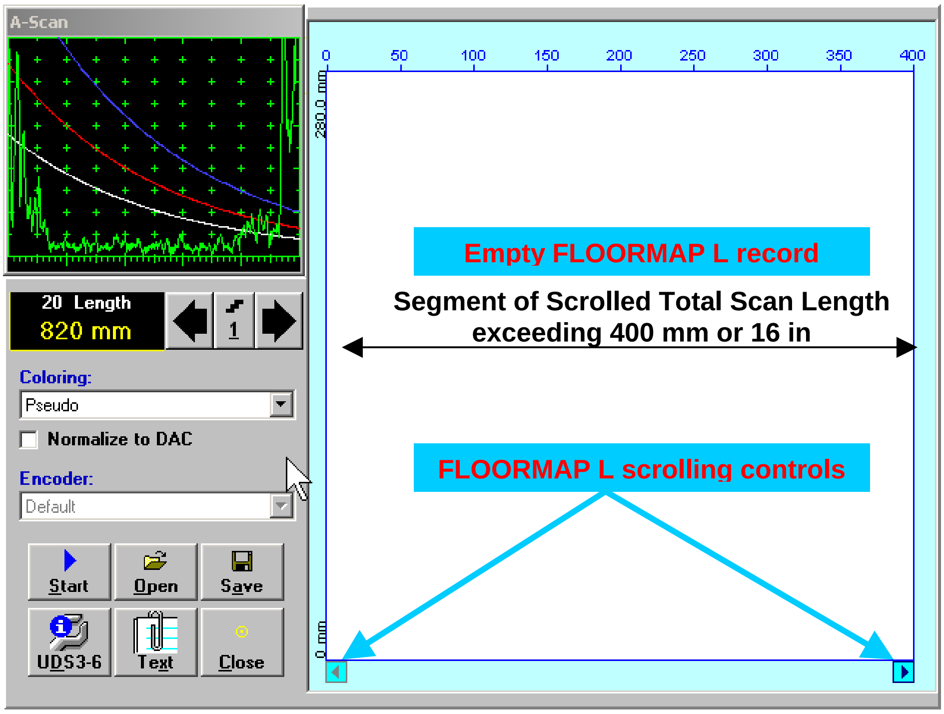
- Apply probes pair to test object in the start point of selected scanning line
- Click on  or press  on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard
- Guide probe over the scanning line synchronously with *Position Icon* moving with constant speed above **t-FLOORMAP L** record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



6.6.2.3. FLOORMAP L – Prior to Scanning

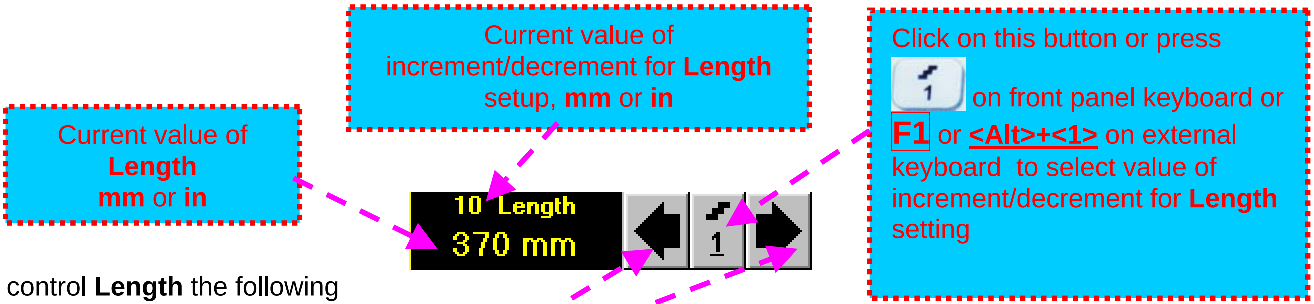
FLOORMAP L control panel is shown below





Scan Length

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



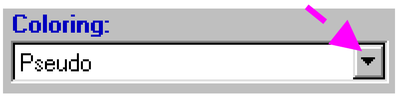
To control **Length** the following manipulations are applicable:

- **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**

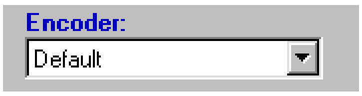
FLOORMAP L Record Palette

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 appropriate input on the rear panel of **ISONIC 2008** instrument

Insert Text Note

Refer to paragraph 6.3.2.1 of this Operating Manual

Preview UDS 3-6 Settings

Refer to paragraph 6.3.2.1 of this Operating Manual

Start/Stop FLOORMAP L recording

Click on **Start** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to start **FLOORMAP L** recording

Start button becomes invisible since **FLOORMAP L** recording starts. **Stop** button occupies its position. Click on **Stop** or press **I** on front panel keyboard or **F8** or **<Alt>+<S>** on external keyboard to terminate **FLOORMAP L** recording

Stop button becomes invisible after termination of **FLOORMAP L** record. **Start** button returns to its position

Save record into a file

Refer to paragraph 6.3.2.1 of this Operating Manual

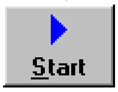
Open record from a file and starting postprocessing session

Refer to paragraph 6.3.2.1 of this Operating Manual

Return to UDS 3-6 main operating surface

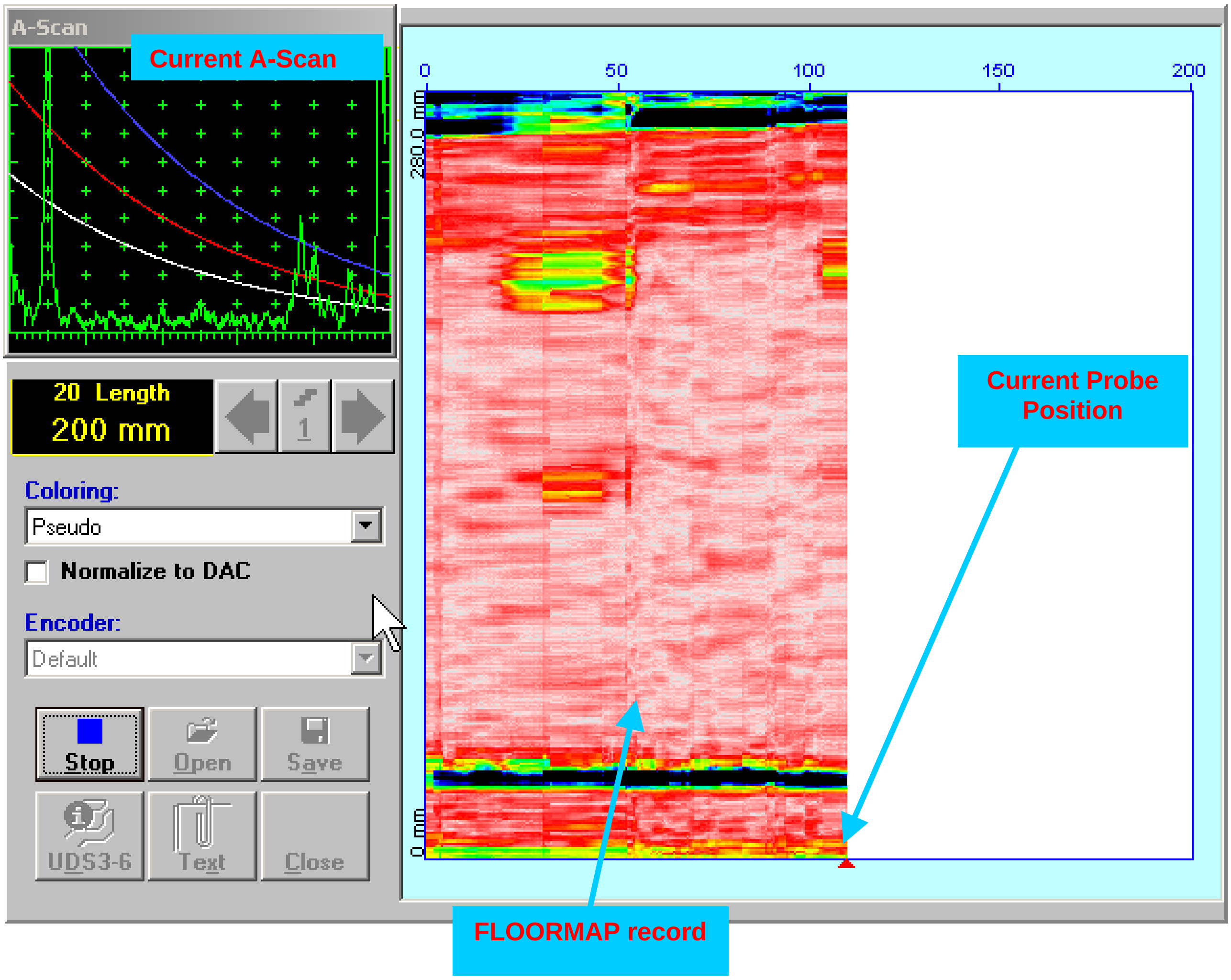
Refer to paragraph 6.3.2.1 of this Operating Manual

6.6.2.4. FLOORMAP L – Scanning

- Apply probes pair 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

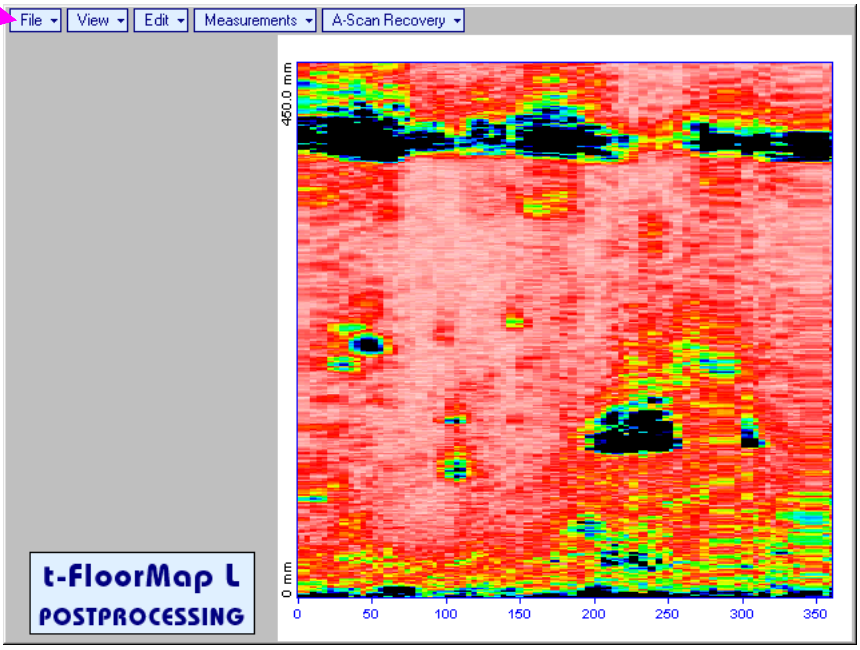


6.6.2.5. t-FLOORMAP L / FLOORMAP L – Postprocessing

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

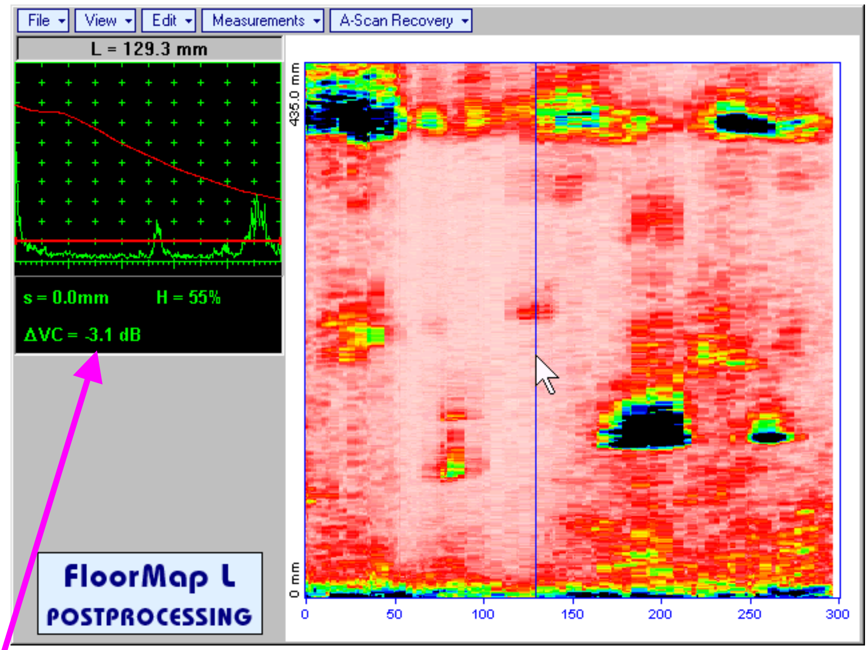
The screen as below appears upon opening file. All postprocessing procedures are performed through menu bar – touch screen stylus or front panel or external mouse to be used



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 3-6** 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

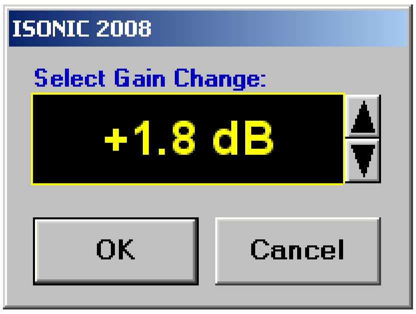
To fix position of *sound path cursor* with corresponding recovered **A-Scan** and **Automatic Measurements Display** data left mouse click or release touch screen stylus or press on front panel keyboard or **Enter** on external keyboard

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

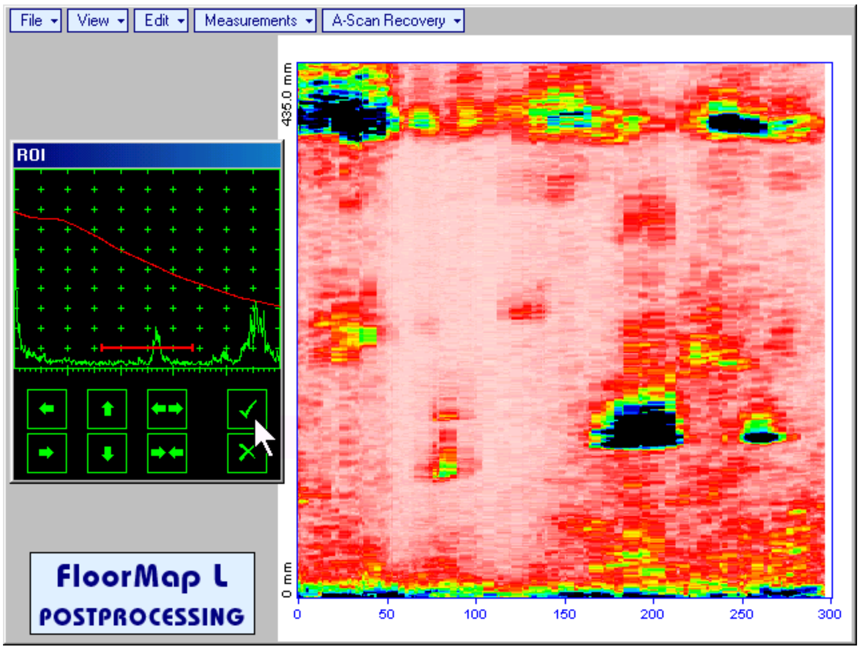


  During **Gain** re-adjusting reference **A-Scan** is modified accordingly. Upon completing re-adjusting **Gain** click on OK or press on front panel keyboard or **Enter** on external keyboard – this applies new **Gain** value to all captured **A-Scans** and redraws **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**)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

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

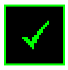
- **Edit→Change Gain→OFF** – negates **Gain** re-adjustment and returns to originally recorded **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image and original **Gain** setting

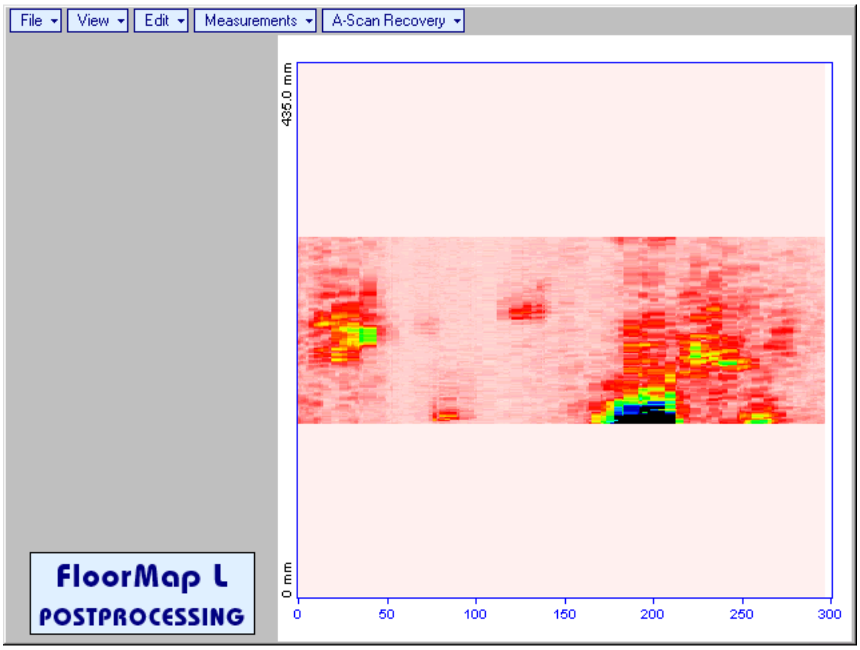
- **Edit→ROI→ON** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image using either touch screen stylus or mouse or , on front panel keyboard or →, ← on external keyboard – corresponding **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



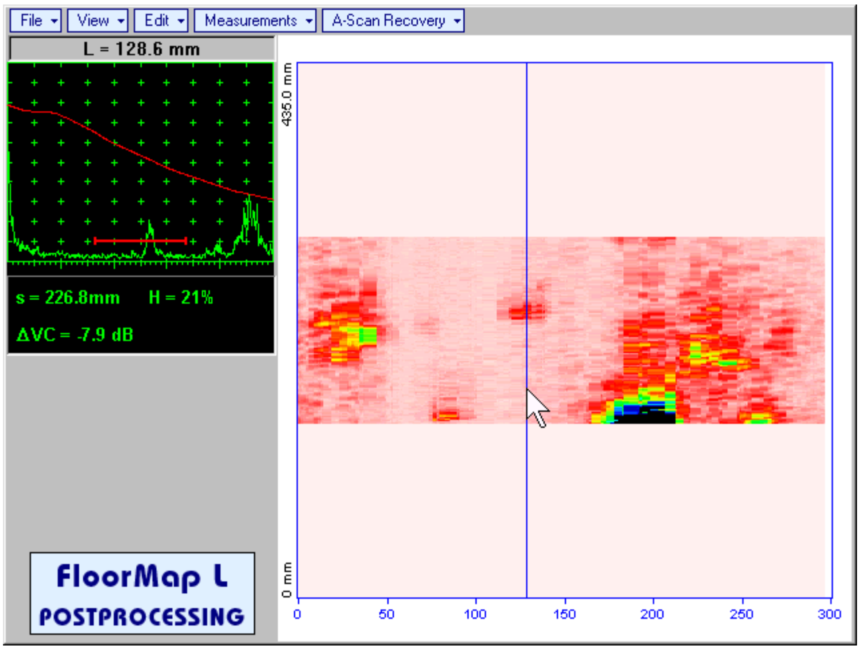
To interrupt selection of reference of **A-Scan** right mouse click or press on front panel keyboard or **Esc** on external keyboard

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

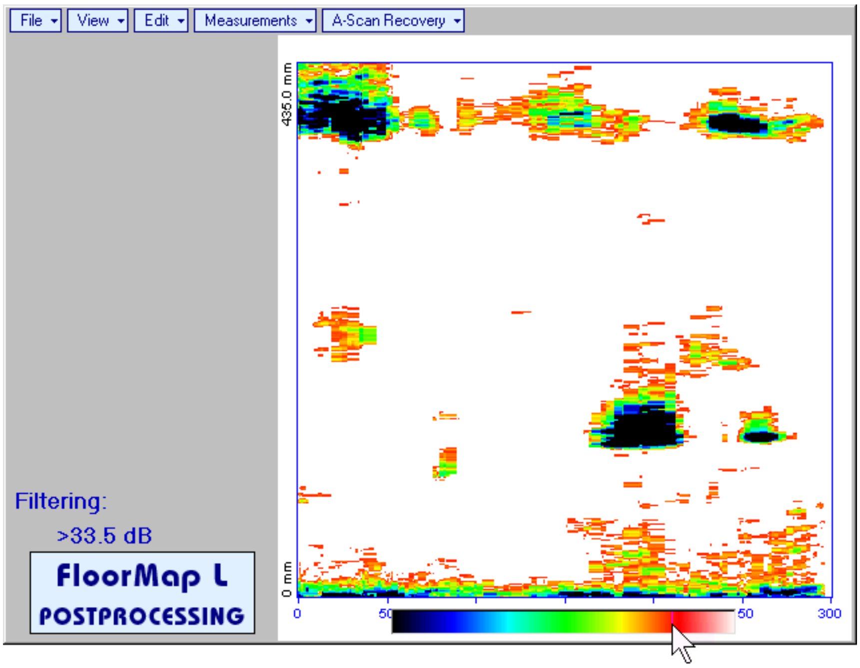


It is possible then to perform **A-Scan** signal evaluation using newly adjusted **Off-Line Gate** through **A-Scan Recovery →ON**



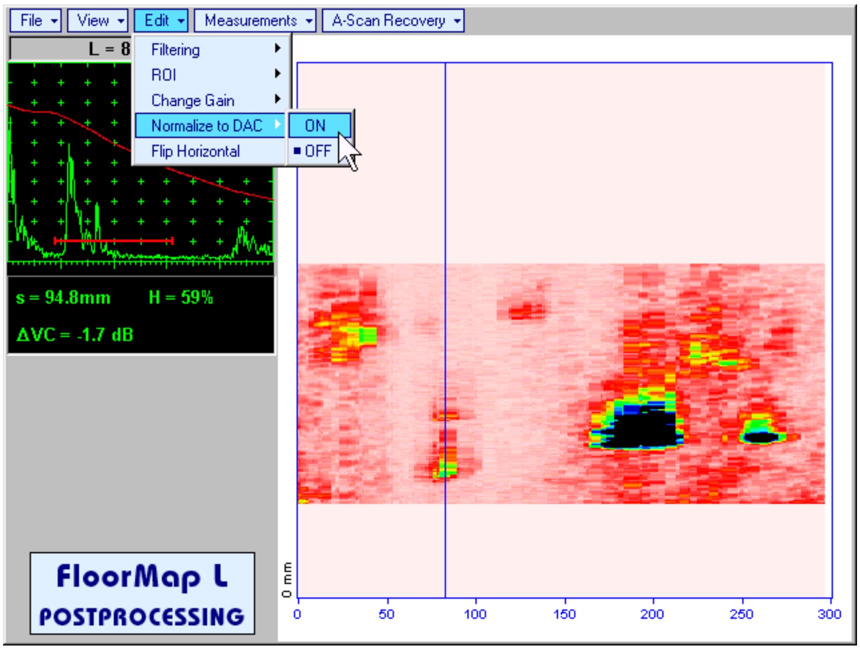
- **Edit→ROI→OFF** – negates **Off-line Gate** re-adjustment and returns to originally recorded **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image and initial **Off-line Gate** setting

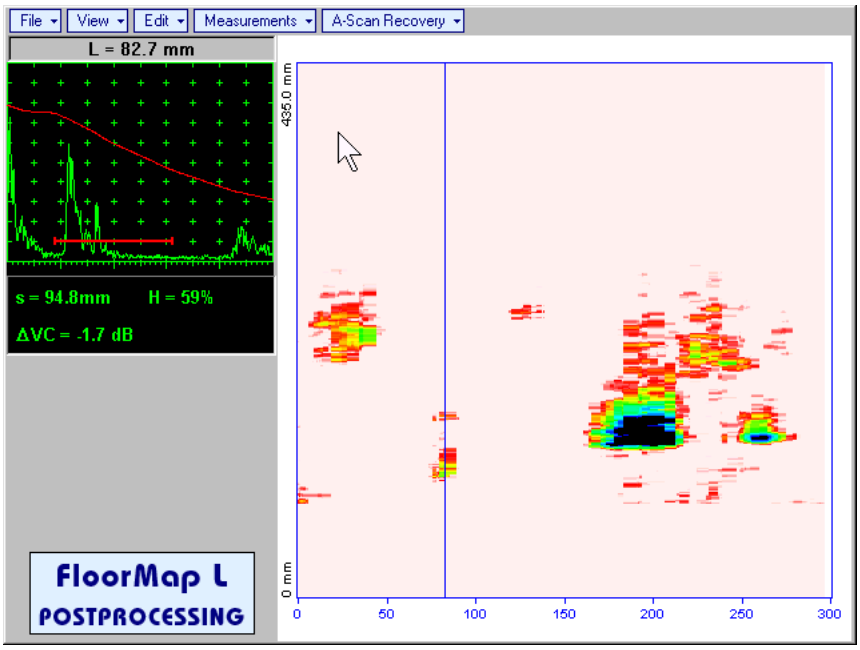
- **Edit→Filtering→ON** – generates *amplitude palette bar* with *sliding cursor*, which may be controlled using either touch screen stylus or mouse or , on front panel keyboard or →, ← on external keyboard . Position of the *sliding cursor* on the *amplitude palette bar* determines filtering level, 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)



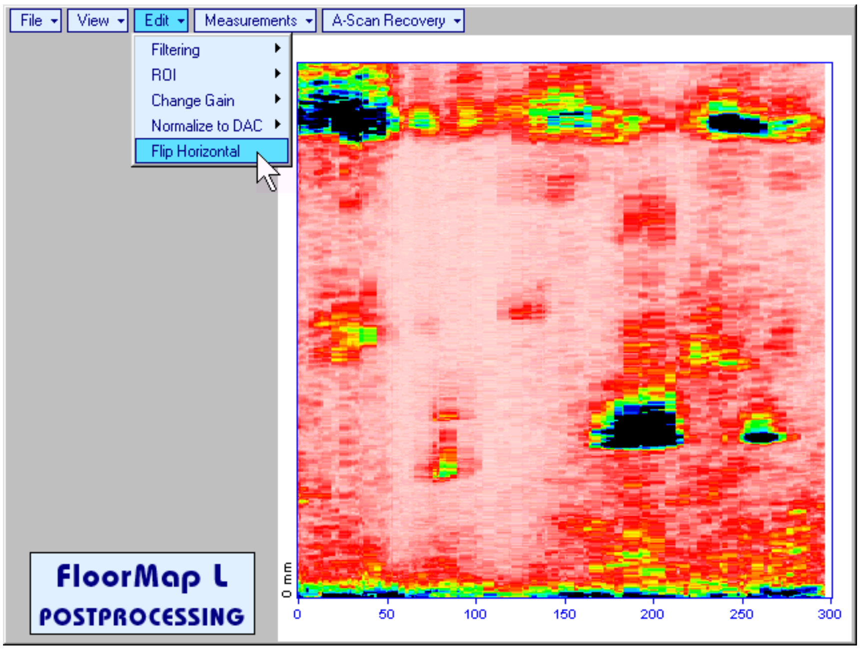


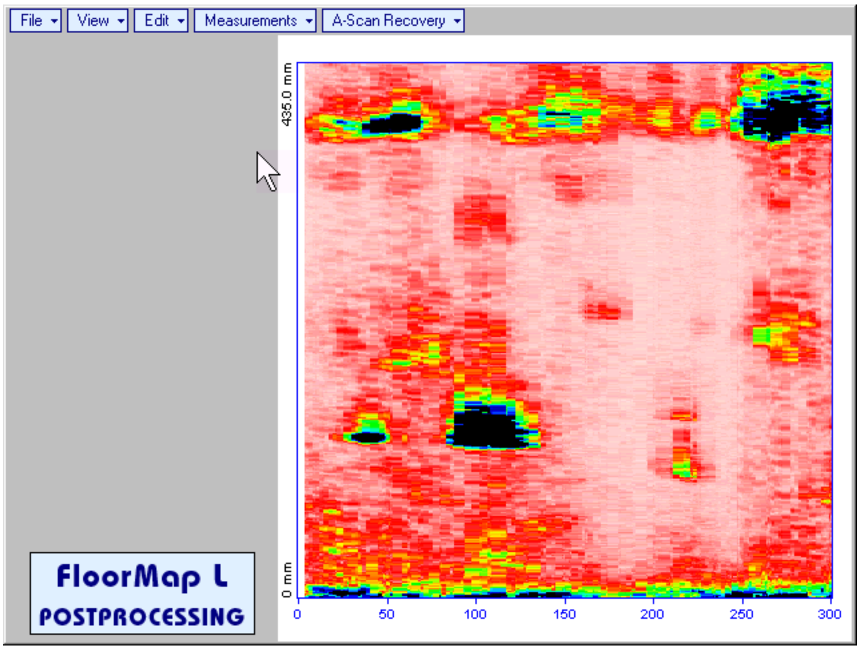
- **Edit→Normalize to DAC→OFF** – negates **dB to DAC/DGS** normalization and returns to originally recorded **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image

ⓘ

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

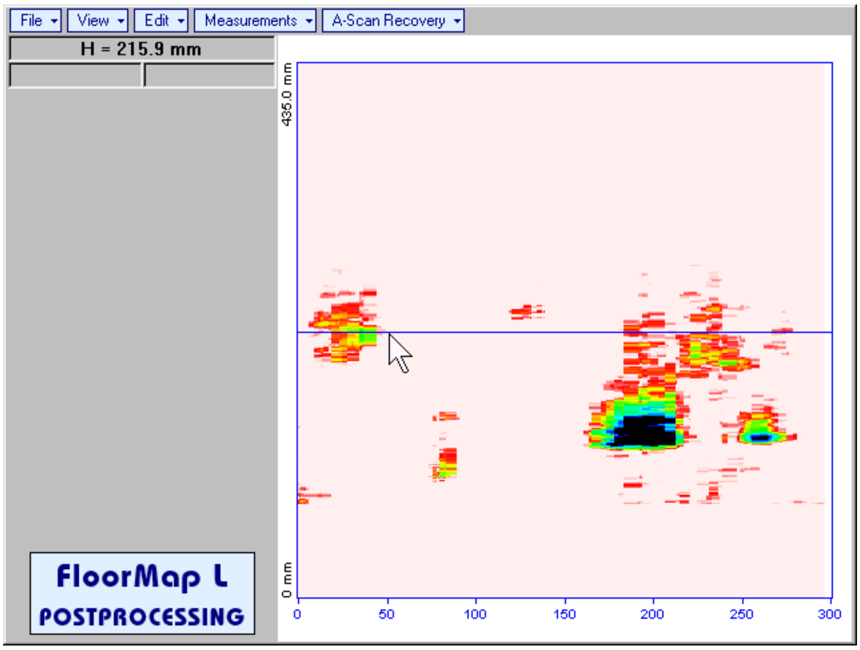


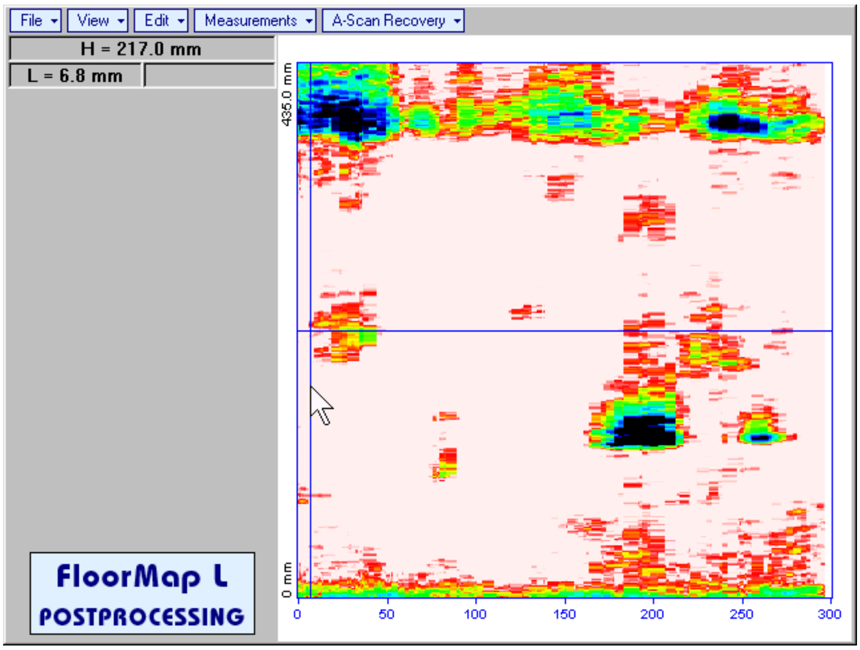


ⓘ

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

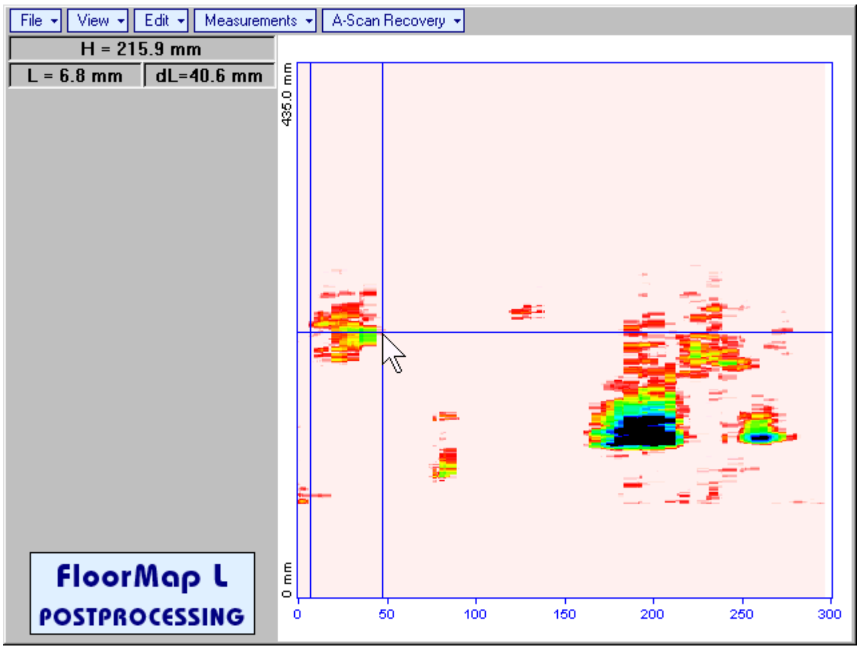


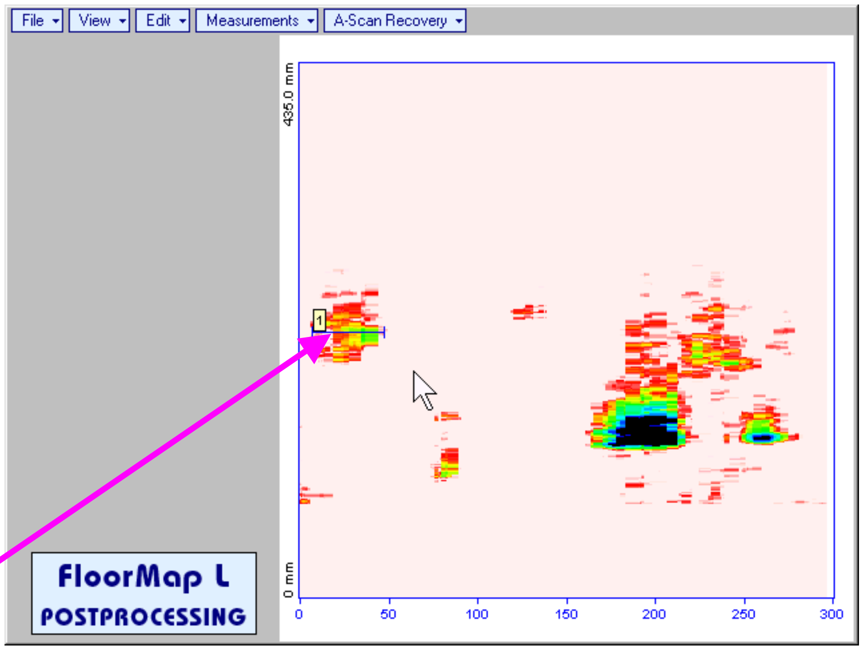


First vertical cursor appears upon fixing horizontal cursor, it may be guided over **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image using either touch screen stylus or mouse or , on front panel keyboard or →, ← on external keyboard . Coordinate of the first vertical cursor along **t-FLOORMAP L** / **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

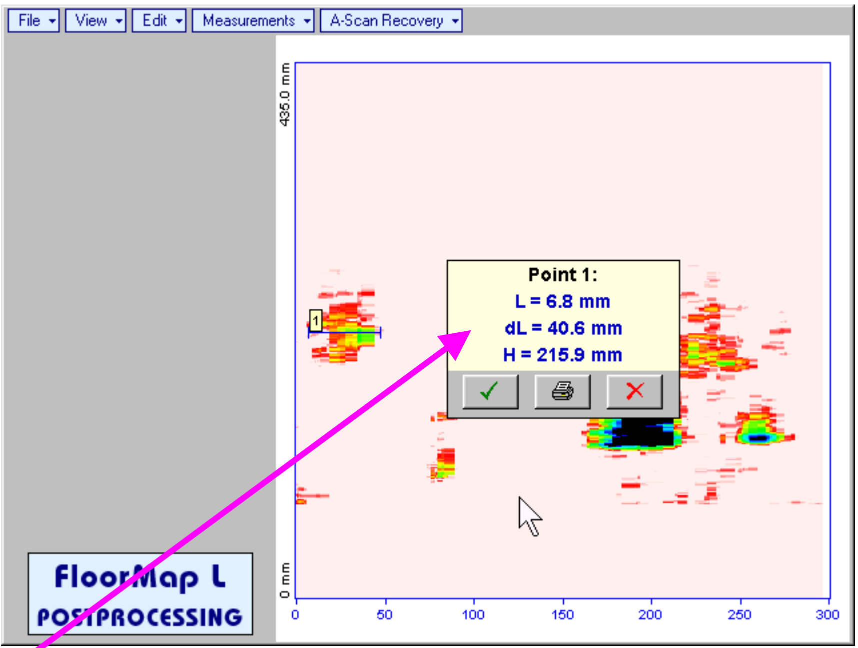
To interrupt length measurement procedure at any moment right mouse click or press  on front panel keyboard or **Esc** on external keyboard





Horizontal *length measurement mark* appears on the **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image upon fixing position of second vertical cursor

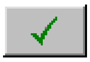
Length measurement results may be recalled through double click on the *length measurement mark*

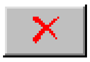


In the subwindow appearing:

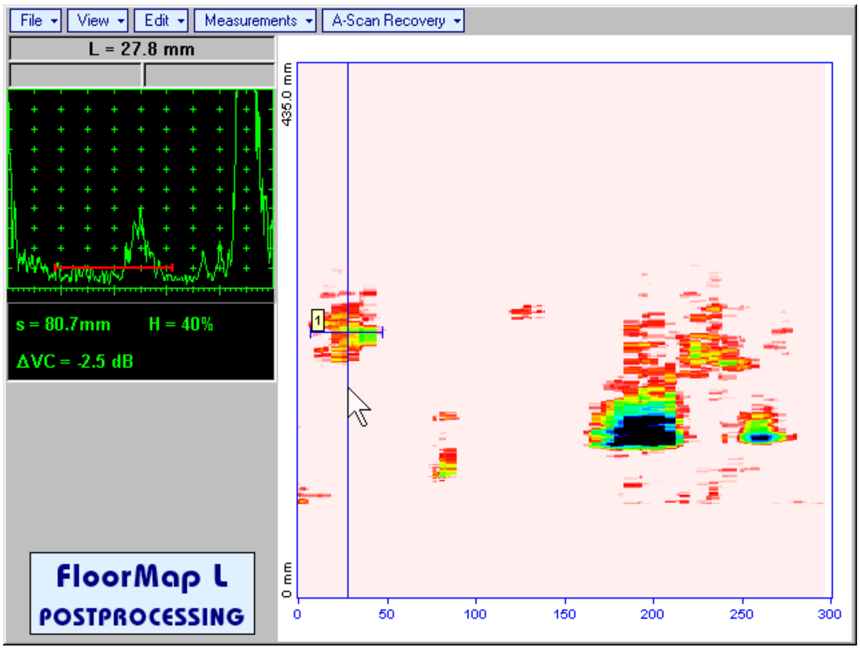
- o **L** is coordinate of left end of the *length measurement mark*
- o **dL** is length of defect area covered by *length measurement mark*
- o **H** is distance between scanning line and *length measurement mark*

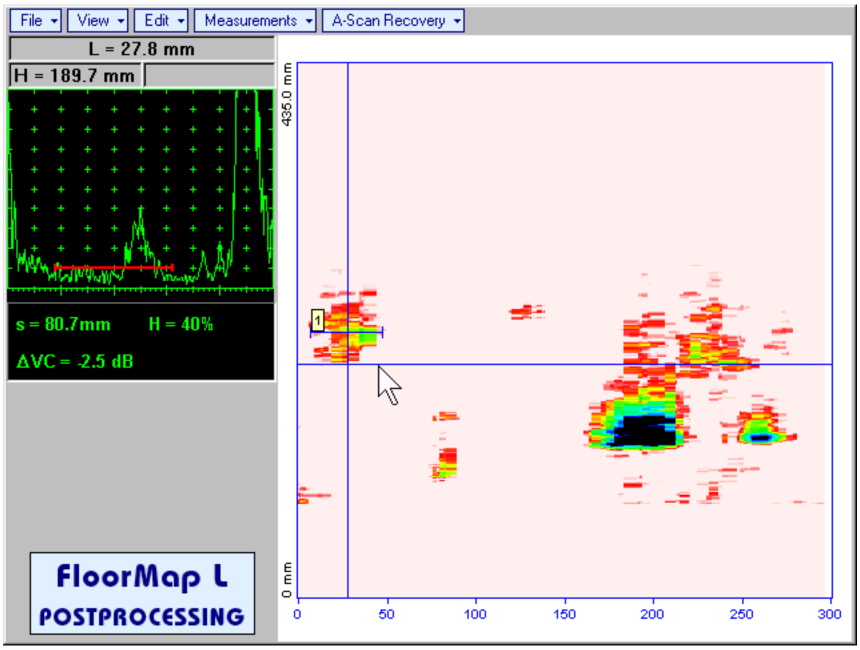
Clicking on  will print current screen snapshot accompanied with *length measurement mark* data

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*

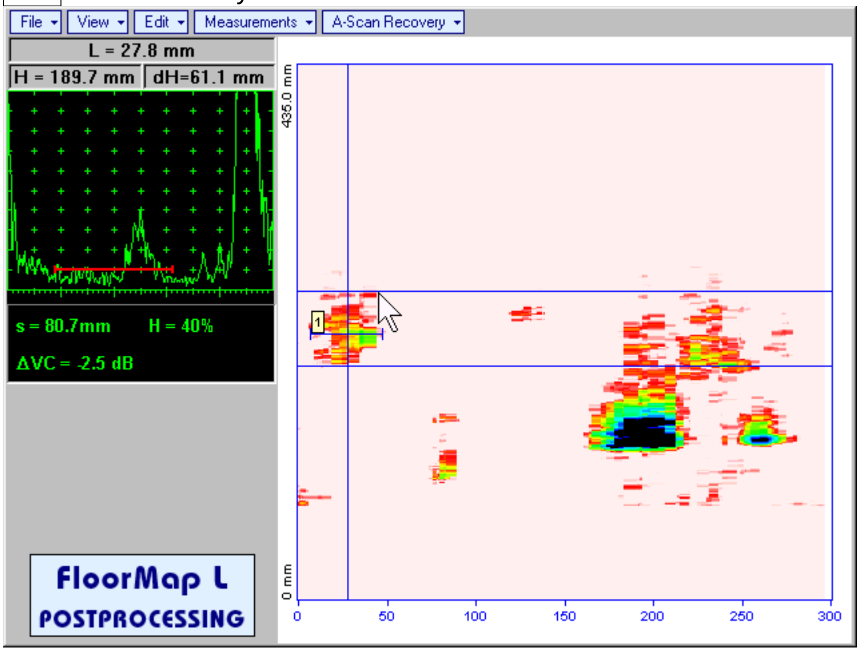
- **Measurements→Add Measure→Width** – generates *cursor representing sound path* of probe's central beam in the object under test that may be guided over **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image using either touch screen stylus or mouse or [→], [←] on front panel keyboard or →, ← on external 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 [Enter] on front panel keyboard or **Enter** on external keyboard

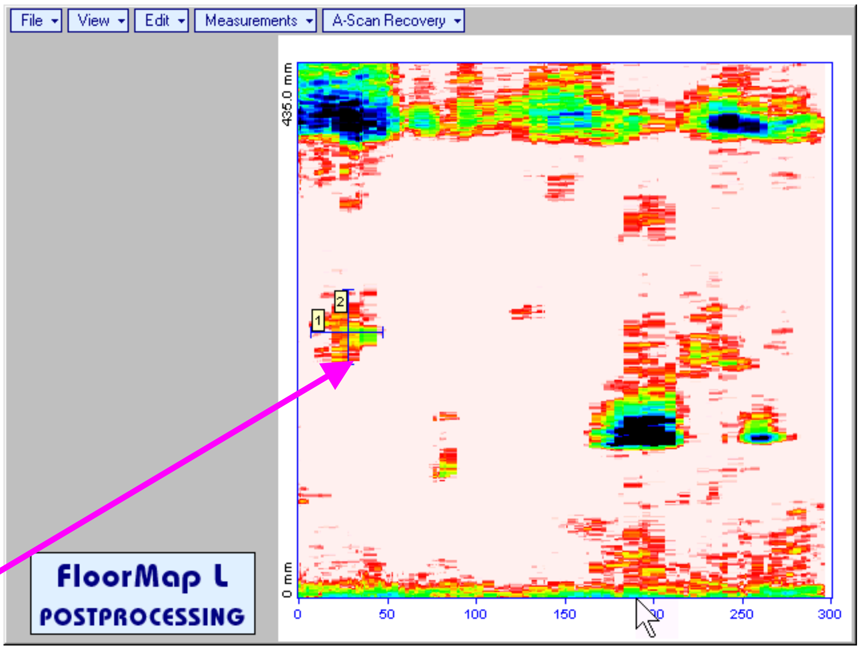




First horizontal cursor appears upon fixing *sound path cursor*, it may be guided over **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image using either touch screen stylus or mouse or [↑], [↓] on front panel keyboard or ↑, ↓ on external keyboard . Coordinate of the first horizontal cursor along sound path (**H**) is indicated synchronously

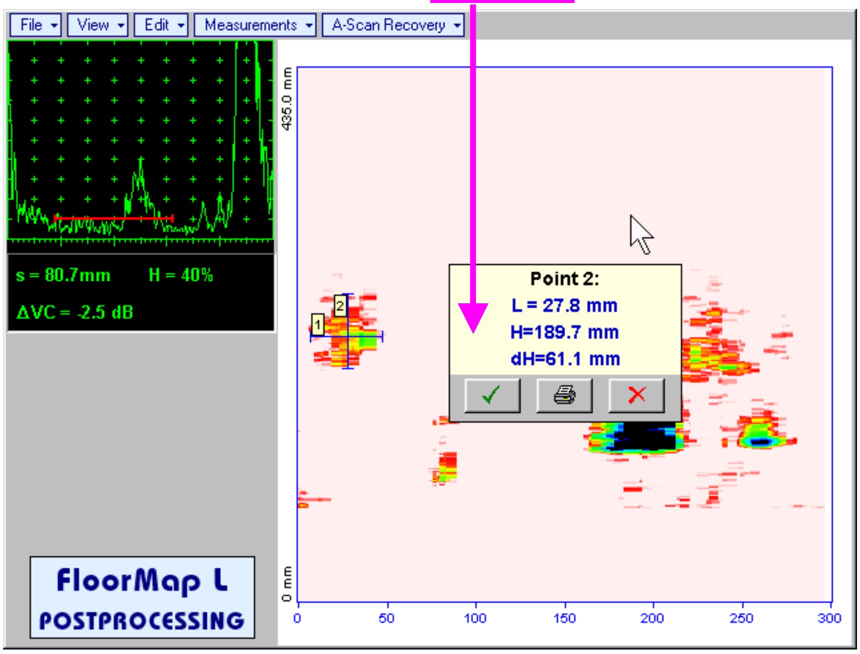
To fix position of the first horizontal cursor left mouse click or release touch screen stylus or press on front panel keyboard or **Enter** on external keyboard . Second horizontal cursor appears upon fixing first one, it may be manipulated by the same way. Coordinate of the second horizontal cursor 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:

- o **L** is coordinate of the *width measurement mark* along scanning line
- o **H** is distance between scanning line and *width measurement mark*
- o **dH** is width of defect area covered by *width measurement mark*

Clicking on [print] 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 *with measurement mark* placed on the **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image

- **Measurements→Clear All** – erases all *length* and *with measurement marks* placed on the **t-FLOORMAP L** / **FLOORMAP L** (**CB-Scan**) image

7. Recording and Imaging – Multi Channel

7.1. Multi Channel Recording – General Notes

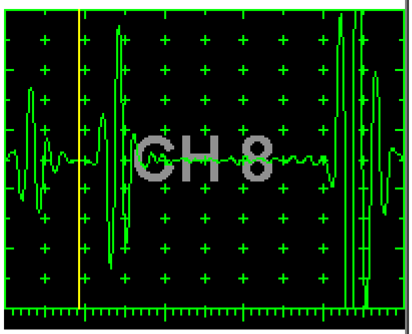
Multi channel record may include 1 through 8 strips comprising the strip chart. Every strip is formed based on sequence of A-Scans obtained by corresponding **UDS 3-6** pulsing-receiving channel

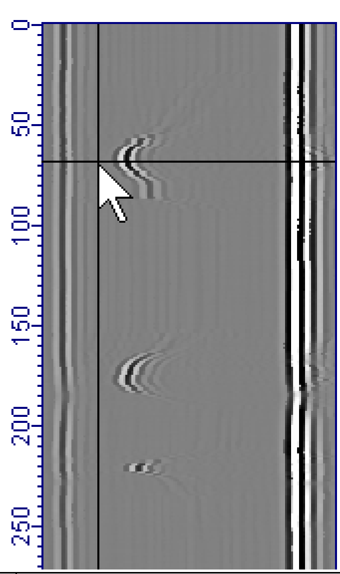
7.1.1. TOFD Strip

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

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

In order to perform typical **TOFD** inspection and recording of **TOFD strip** the following settings to be provided for corresponding **UDS 3-6** pulsing-receiving channel





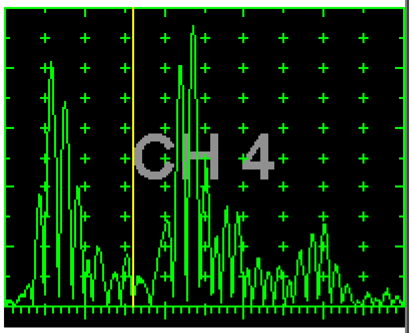
#	Parameter or Mode	Submenu	Required Settings	Note
1	**Pulser Mode**	**PULSER**	**Dual**	
2	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain setting procedure**
3	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**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 6.5.1.1 of this Operating Manual**
7	**Display Delay** **Range**	**BASICS**	**Display Delay** and **Range** to provide clear **A-Scan** representing: o Lateral Wave and Longitudinal Wave Back Echo Signals at the beginning and at the and of **A-Scan** correspondingly 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 OR o Other combination of signals required by Inspection procedure	**Display Delay and Range will be determined according to paragraph 6.5.1.2 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 6.5.1.3 of this Operating Manual**
9	**Settings for other parameters and modes have no significance**			

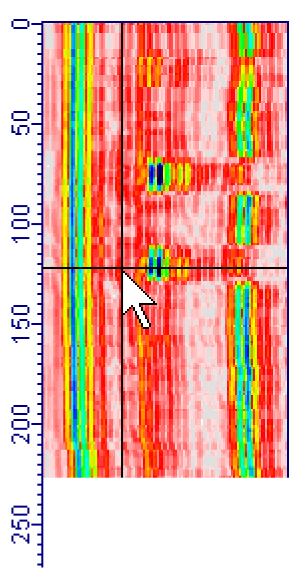
7.1.2. Map Strip

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

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

The following settings of **UDS 3-6** pulsing-receiving channel to be provided in order to provide pulse echo flaw detection and recording of the **Map Strip:**

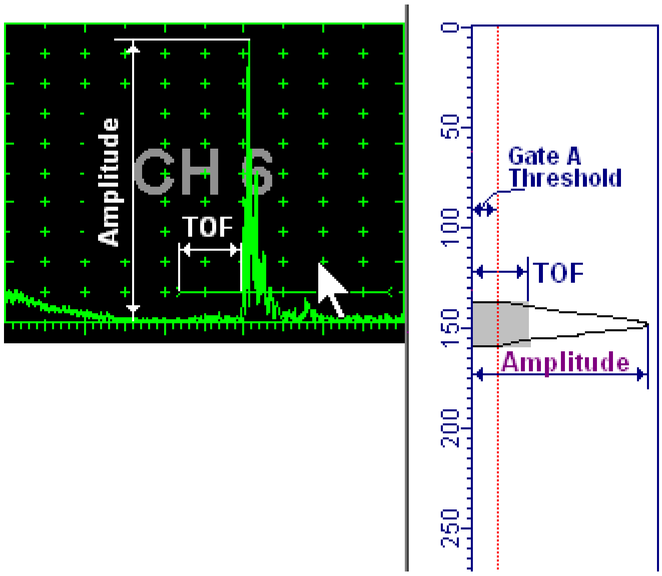




#	Parameter or Mode	Submenu	Required Settings	Note
1	**Gain**	**BASICS**	**Gain** setting to be performed according to inspection procedure providing required echo heights from defects to be detected	
2	**DAC/TCG**	**DAC/TCG**	**DAC/TCG** settings to meet requirements of inspection procedure	
3	**Pulser Mode**	**PULSER**	**Dual** for dual element probes **Single** for single element probes	
4	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain setting procedure**
5	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**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 Probe Delay determining and 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	**Settings for other parameters and modes have no significance**			

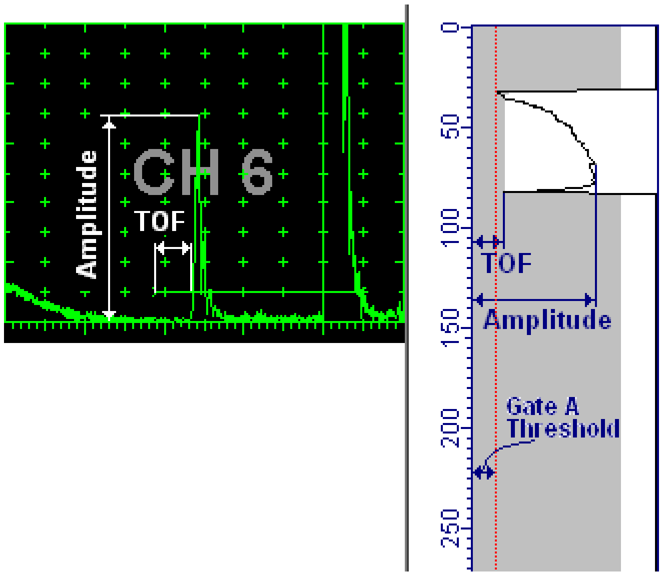
7.1.3. Amplitude / TOF Pulse Echo Strip

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



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

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



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

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

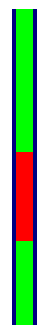
The following settings of **UDS 3-6** pulsing-receiving channel to be provided in order to provide pulse echo flaw detection and recording of the **Amplitude / TOF Pulse Echo Strip**:

#	Parameter or Mode	Submenu	Required Settings	Note
1	**aSwitch**	**GATE A**	**ON**	
2	**Gain** **aThreshold**	**BASICS** **GATE A**	**Gain** setting to be performed according to inspection procedure providing required echo heights from defects to be detected will 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	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width** and **Firing Level** settings to optimize signal to noise ratio	**To synchronize with Gain and aThreshold setting procedure**
6	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**To synchronize with Gain and aThreshold setting procedure**

#	Parameter or Mode	Submenu	Required Settings	Note
7	**Display**	**RECEIVER**	**Display** mode may be either **Full, RF, PosHalf,** or **NegHalf**	**The same Display mode to be used for Probe Delay determining and Inspection**
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	**Meas Mode**	**MEASURE**	**Flank** or **Flank First**	
11	**Range, Display Delay, aStart, aWidth**	**BASIC GATE A**	**Range, Display Delay, AStart,** and **aWidth** settings to cover the **Region of Interest** completely	
12	**Settings for other parameters and modes have no significance**			

7.1.4. Coupling Strip

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



The following settings of **UDS 3-6** pulsing-receiving channel to be provided in order to provide pulse echo flaw detection and recording of the **Coupling Strip**:

#	Parameter or Mode	Submenu	Required Settings	Note
1	**aSwitch**	**GATE A**	**ON**	
2	**Gain** **aThreshold**	**BASICS** **GATE A**	**Gain** setting to be performed providing height of coupling reference signal will exceed **aThreshold** on case of satisfactory coupling conditions; will not exceed **aThreshold** on case of non satisfactory coupling conditions	
3	**Pulser Mode**	**PULSER**	**Dual** for dual element probes and on case of coupling monitor probe receiving signals generated by inspection probes **Single** for single element probes	
4	**Pulse Width, Firing Level**	**PULSER**	**Pulse Width = OFF** for coupling monitor probe receiving signals generated by inspection probes **Pulse Width** and **Firing Level** settings to optimize signal to noise ratio on case if channel is used for active coupling check	**To synchronize with Gain and aThreshold setting procedure**
5	**Filter, Low Cut, and High Cut Frequencies**	**RECEIVER**	**Filter** and **Low Cut** and **High Cut** settings to match with probe's frequency to optimize signal to noise ratio	**To synchronize with Gain and aThreshold setting procedure**
6	**Display**	**RECEIVER**	**Display** mode may be either **Full, RF, PosHalf,** or **NegHalf**	
7	**Range, Display Delay, aStart, aWidth**	**BASIC** **GATE A**	**Range, Display Delay, aStart,** and **aWidth** settings to cover the coupling reference signal	
8	**Settings for other parameters and modes have no significance**			

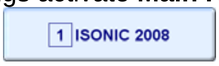
7.1.5. Entering into Multi Channel Recording Mode

With reference to paragraph 9.2 of this Operating Manual and depending on insonification scheme setup Firing Mode to either **Parallel** or **Sequential**

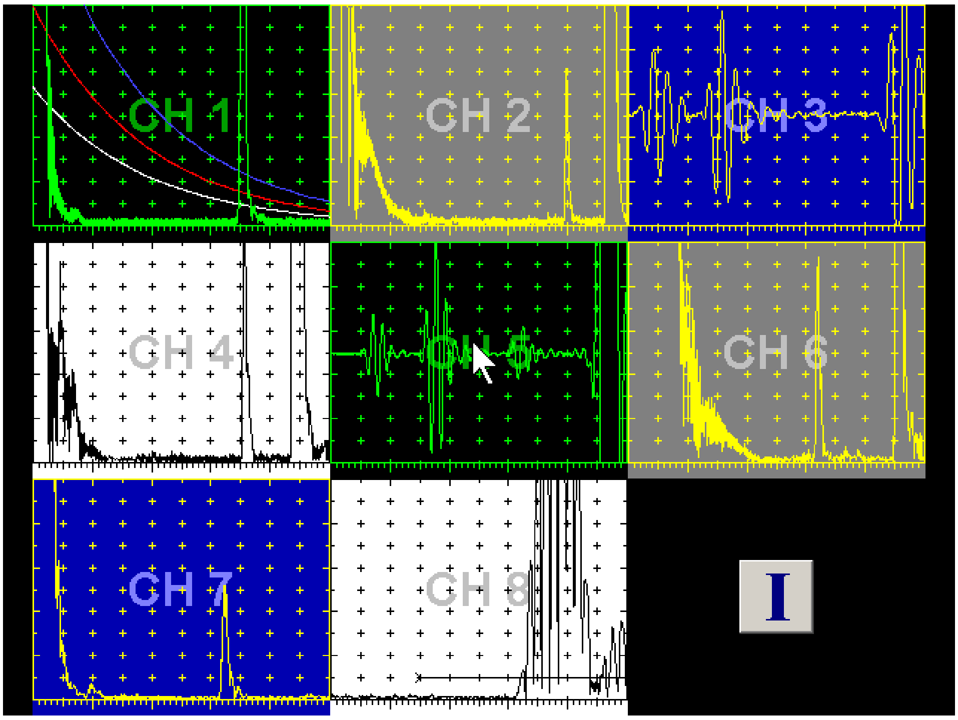
ⓘ

- Highest scanning speed may be achieved through simultaneous (parallel) pulsing, receiving, signal digitizing, and recording by up to 8 channels. Measures avoiding cross talking to be taken while placing simultaneously fired probes on the object under test – the probes must be well separated
- Most compact probes placement on the object under test with complete avoiding of cross talking is provided through pulsing, receiving, signal digitizing, and recording channels separately in time in a sequence loop (sequentially). Sequential pulsing-receiving also saves battery life

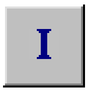
With reference to Chapter 5 of this Operating Manual calibrate all **UDS 3-6** channels, for which the recording is necessary. It is recommended that for **UDS 3-6** channels, which will not be used for the recording the following setting will be provided: **Pulse Width = OFF** (submenu **PULSER**)

Upon completion **UDS 3-6** settings activate **Main Recording Menu** (refer to paragraph 5.2.20 of this Operating Manual, then click on 

or press  on front panel keyboard or **F1** on external keyboard. The **Multi Channel A-Scan** screen appears allowing simultaneous observation of signals for all 8 **UDS 3-6** pulsing receiving channels:



To return to calibration of a certain **UDS 3-6** pulsing receiving channel double click on it's A-Scan

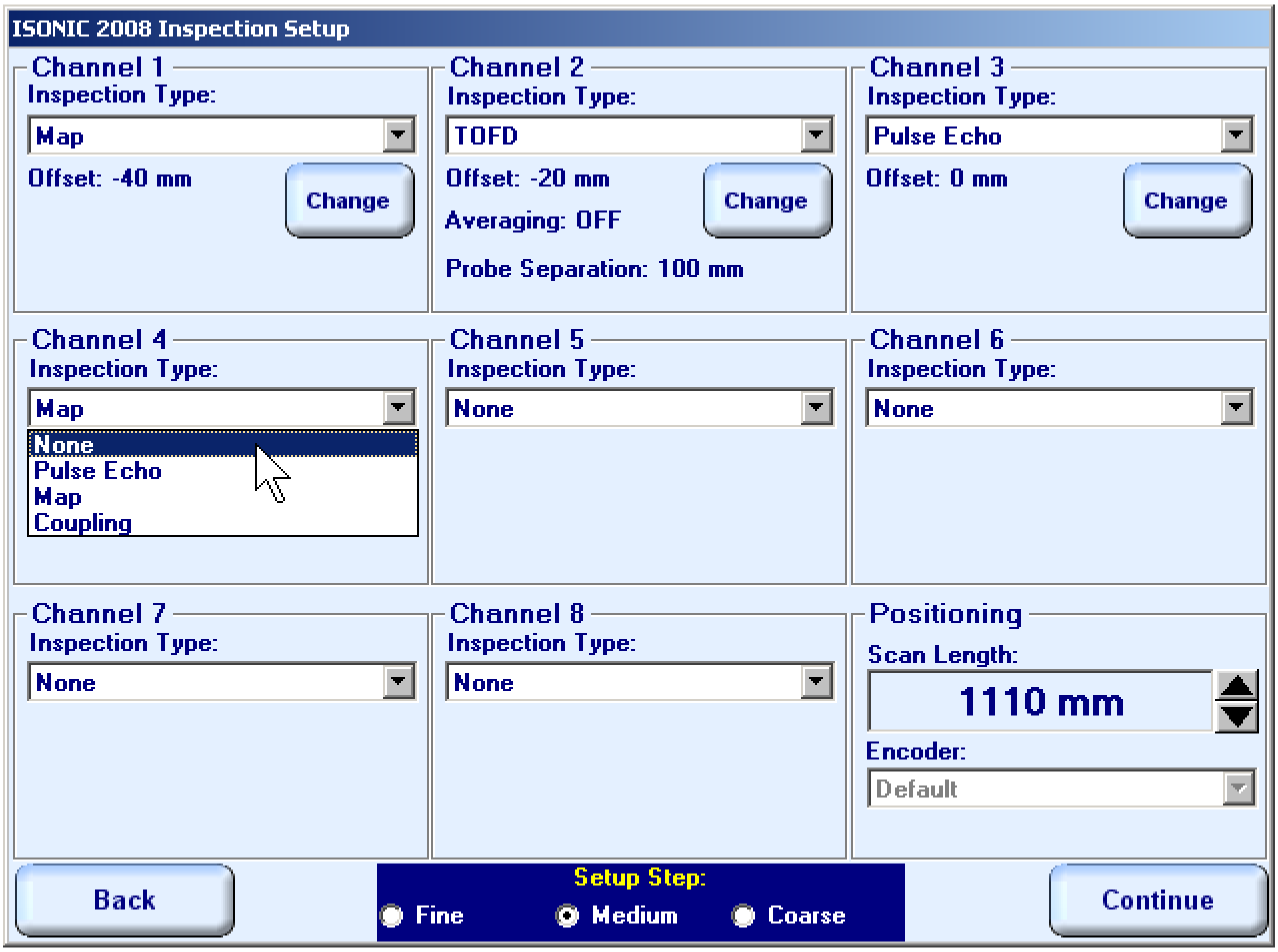
To proceed with Multi Channel inspection and recording click on 

or press 

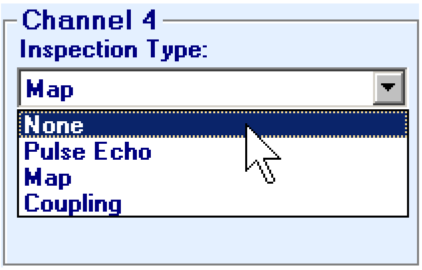
on front panel keyboard or **F8** on external keyboard

7.2. Multi Channel Recording Control Screen

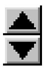
Multi-Channel Recording Control Screen is shown below:



Depending on the inspection procedure and implemented calibrations of **UDS 3-6** pulsing receiving channels it is possible to select type of strip for each channel or to switch strip generation off:

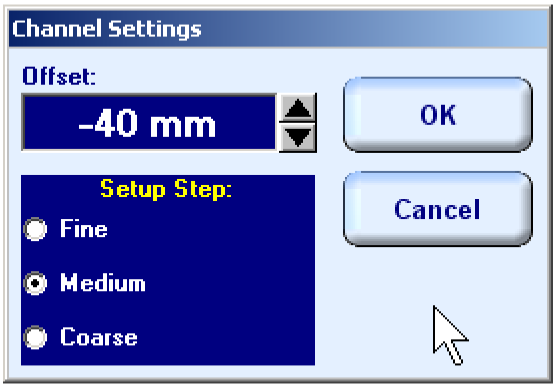


For each channel, activated for recording button  becomes visible

Scan Length to be keyed in through clicking on  while increment for setting **Scan Length** value may be selected through check of appropriate option **Fine**, **Medium**, or **Coarse**

Encoder to be selected through appropriate box

For **Map**, **Pulse Echo**, and **Coupling** strip type click on generates simple popup window for setting **Offset** value, which represents positioning of the probes in the scanner relatively to each other:



Increment for setting **Offset** value may be selected through check of appropriate option **Fine**, **Medium**, or **Coarse**. To vary **Offset** value click on or press , , , on front panel keyboard or ⇑, →, ←, ⇓ on external keyboard

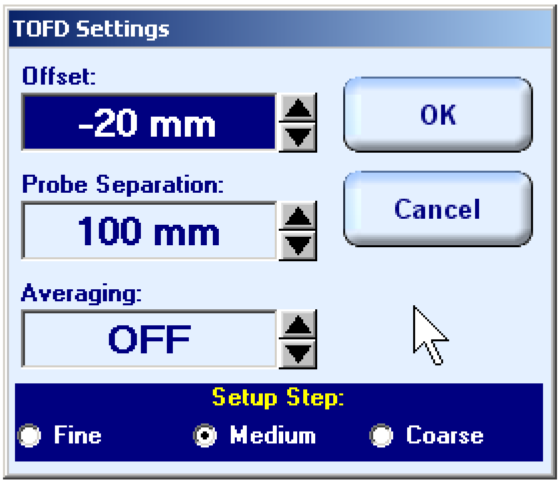
To complete and store last **Offset** value click on or press on front panel keyboard or **Enter** on external keyboard

To negate **Offset** value modification click on or press on front panel keyboard or **Esc** on external keyboard

ⓘ

Offset values to keyed in for each channel to be used by **ISONIC 2008** while forming strip chart automatically. Thanks to such feature the same defect detected by different probes will be indicated in the same longitudinal position in each corresponding strip

For **TOFD** strip type click on generates simple popup window for setting **Offset, Probe Separation**, and **Averaging** values:



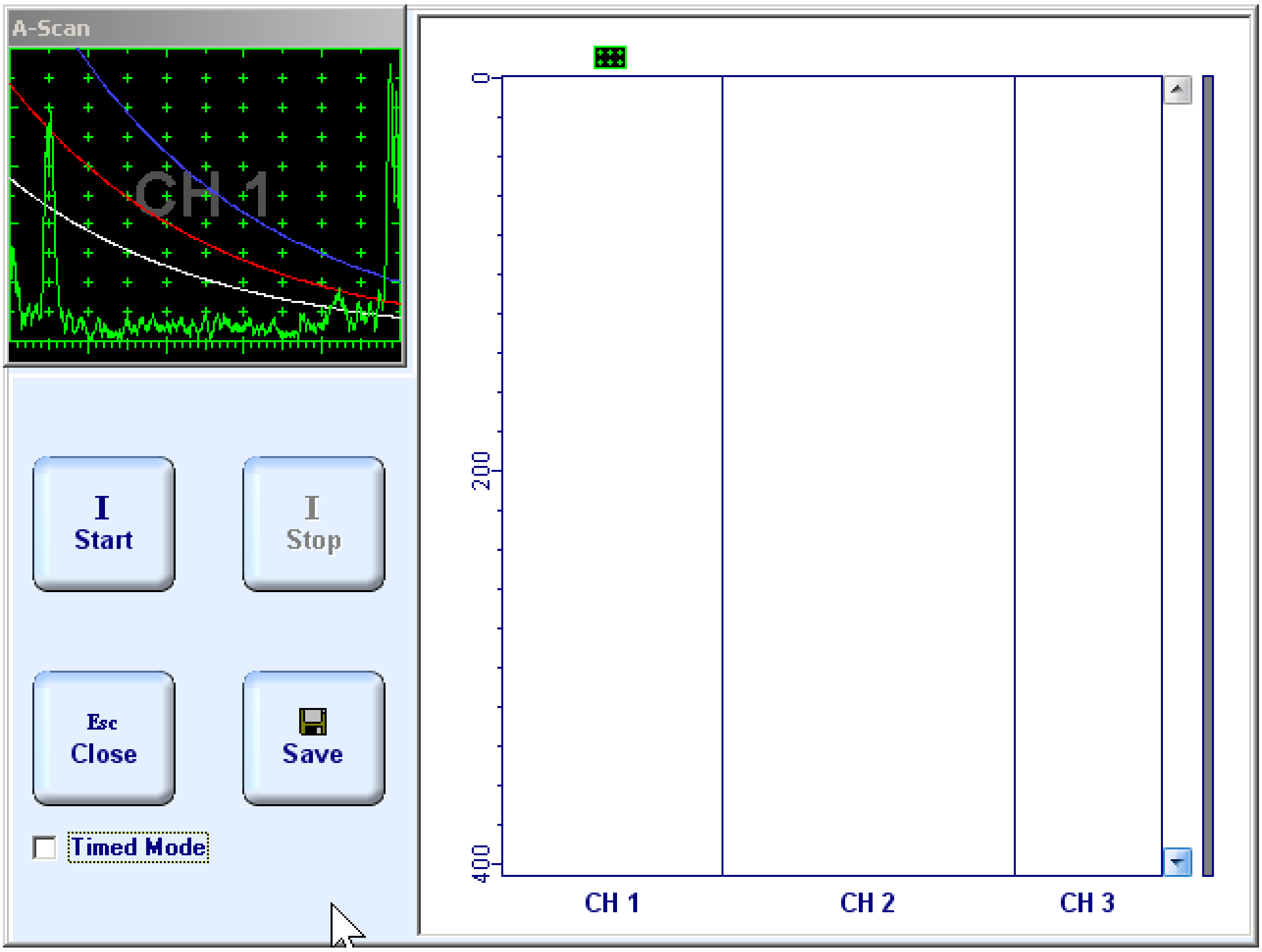
Setting of these values to be performed by the same way. For more data about **Probe Separation** refer to paragraph 6.5.1.4 of this Operating Manual; for Averaging refer to paragraph 6.5.2.1 of this Operating Manual

To return to calibration of **UDS 3-6** pulsing receiving channels click on **Back** or press **ESC** on front panel keyboard or **Esc** on external keyboard

To proceed to inspection with strip chart recording click on **Continue** or or press **I** on front panel keyboard or **F8** on external keyboard

7.3. Scanning and Strip Chart Forming

Scanning and Strip Chart forming are controlled through screen as below:



Symbol ▪ is placed above strip, for which the A-Scan is indicated. To observe A-Scan related to another select another strip click on the selected strip. This switch is possible before scanning and during scanning as well

Option ☐ Timed Mode to be checked on case if there is a need in **Time-Based Strip Chart Forming** and unchecked for **True-to-Location (Encoded) Strip Chart Forming**

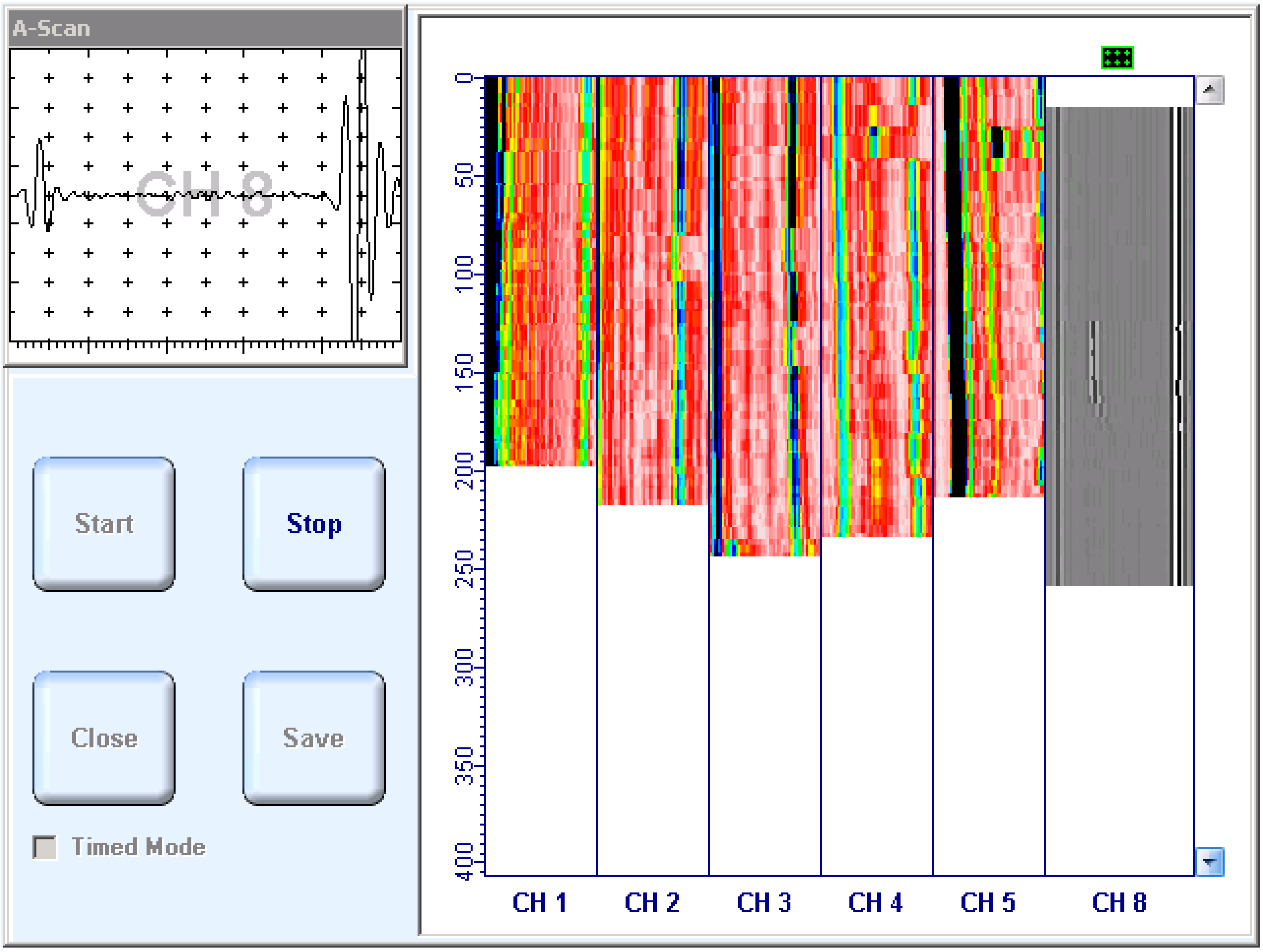
For **True-to-Location (Encoded) Strip Chart Forming** connect encoder to appropriate terminal of **ISONIC 2008** instrument

Start/Stop Strip Chart Forming

Click on or press on front panel keyboard or **F8** on external keyboard to start strip chart forming

Click on or press on front panel keyboard or **F8** on external keyboard to stop strip chart forming

Typical screen during scanning is presented below:



Save record into a file

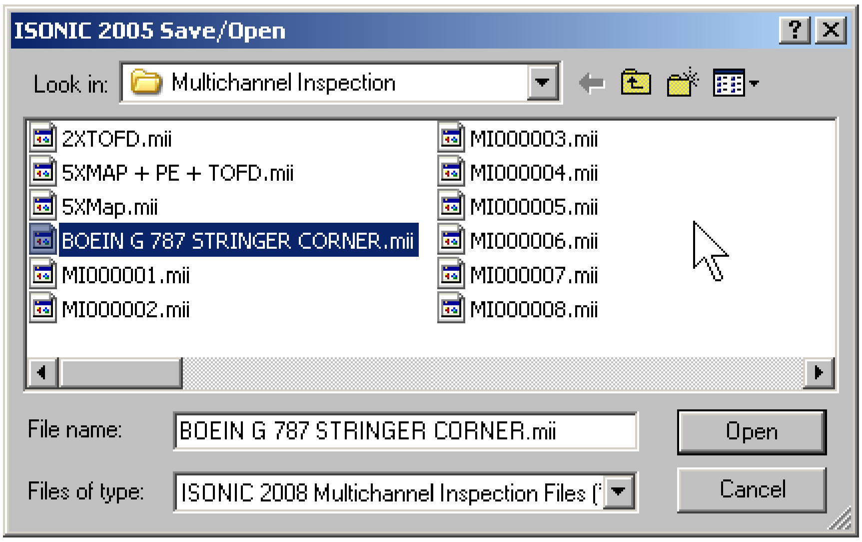
Click on or press on front panel keyboard or **F12** on external keyboard to save captured **Strip Chart** record accompanied with channels calibration dumps into a file. Refer to paragraph 5.2.17 of this Operating Manual to proceed with file saving

Return to Multi-Channel Recording Control Screen

Click on or press on front panel keyboard or **Esc** on external keyboard to return to **Multi-Channel Recording Control Screen**

7.4. Strip Chart Postprocessing

In the **ISONIC 2008 Start Screen** (refer to paragraph 4.3 of this Operating Manual) click on 2 Postprocessing or press 2 on front panel keyboard or press **F2** on external keyboard – **ISONIC 2008 Save/Open** dialogue appears:

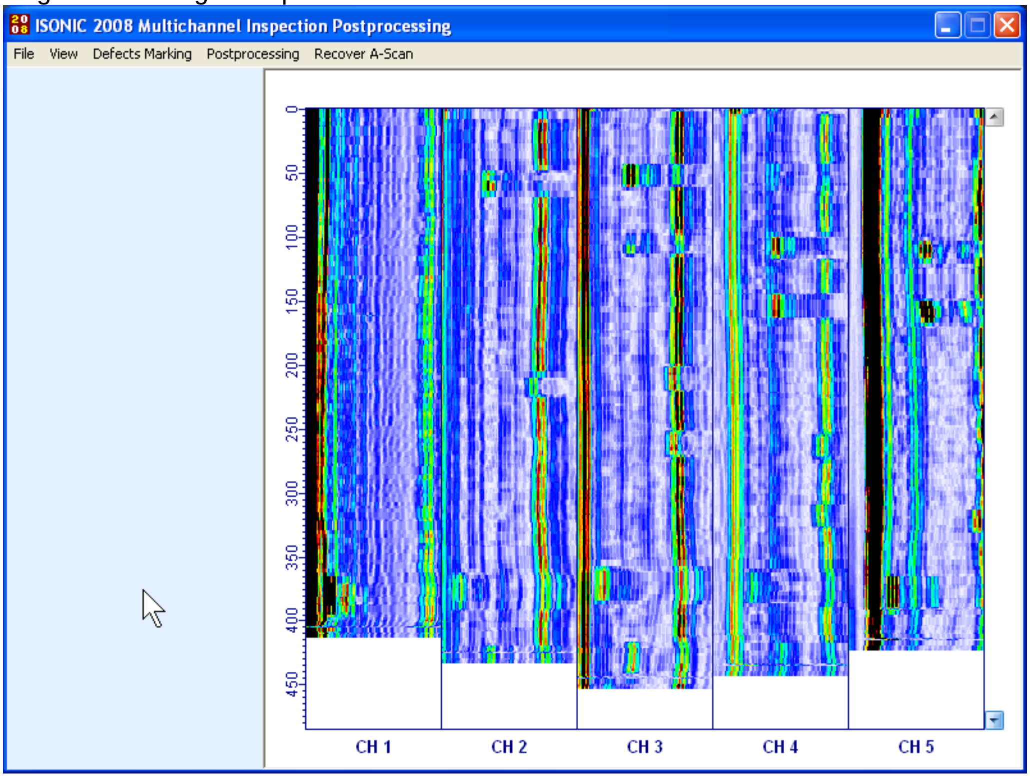


Double click on file name selected or select file then press or press Enter on front panel keyboard or **Enter** on external keyboard

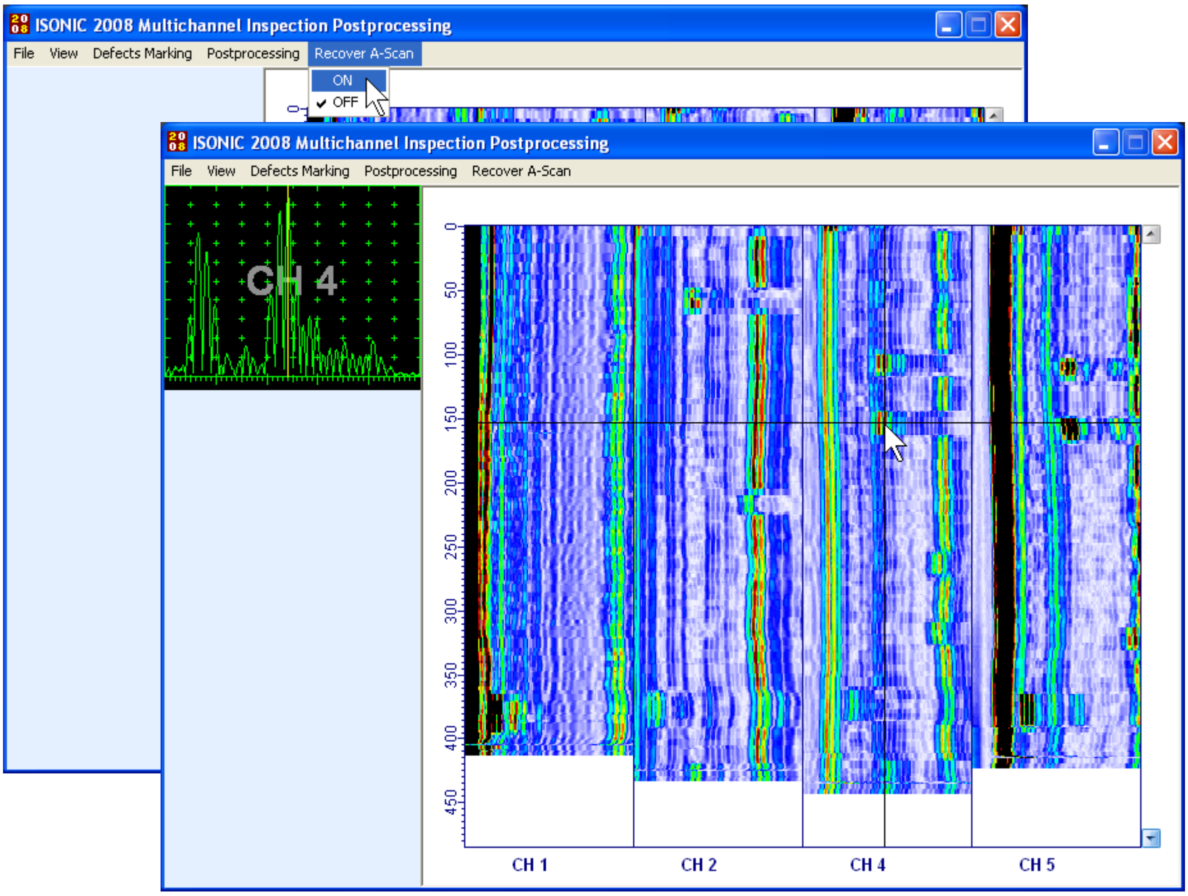
To return to **ISONIC 2008 Start Screen** click on Cancel or press ESC on front panel keyboard or **Esc** on external keyboard

Postprocessing is controlled through Menu Bar functions and featured with:

- Previewing and scrolling of strip chart

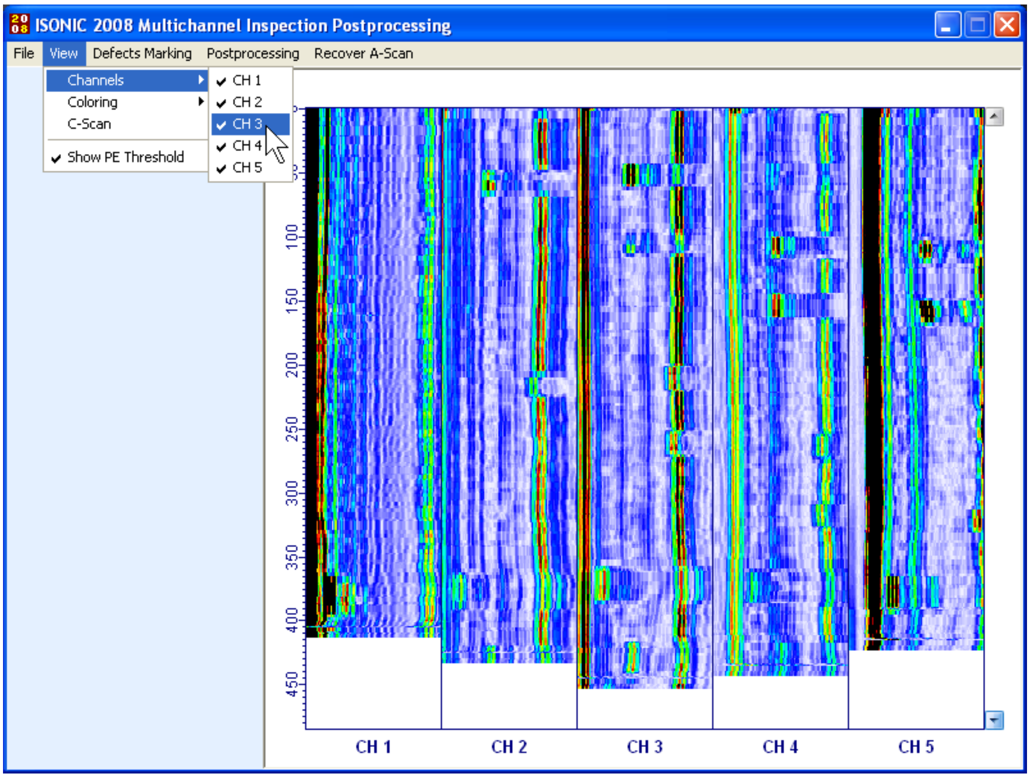


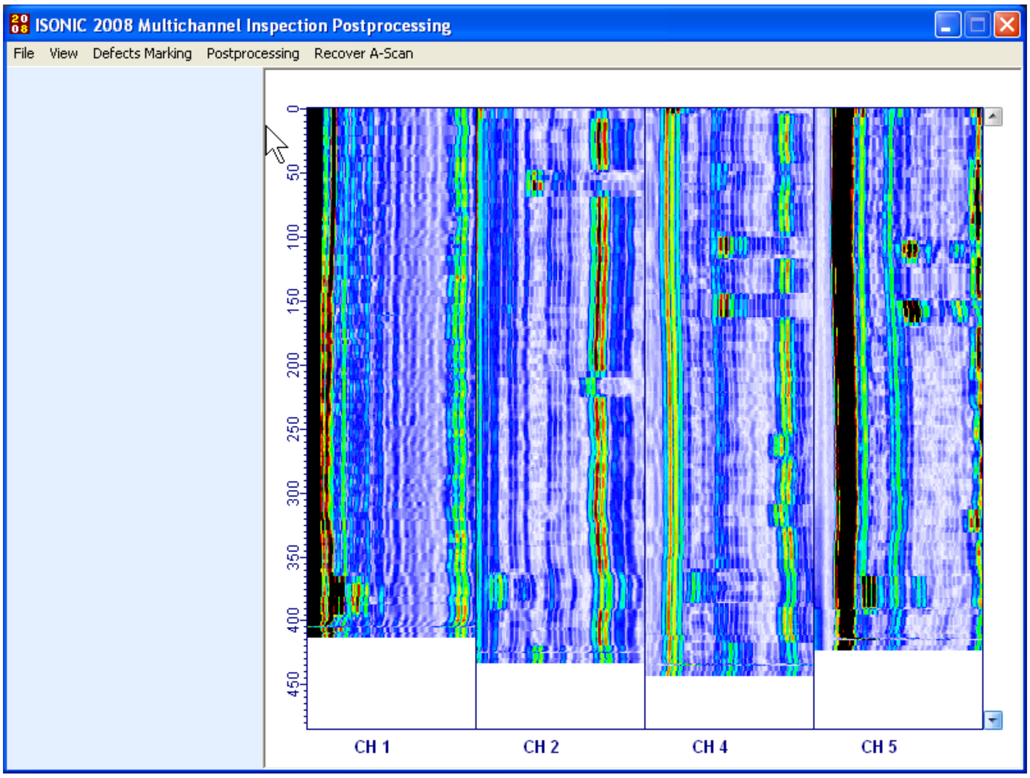
- Recovery of A-Scans for each channel through placement of cross-hair cursor above channel's strip (Menu Bar function **Recover A-Scan→ON/OFF**)



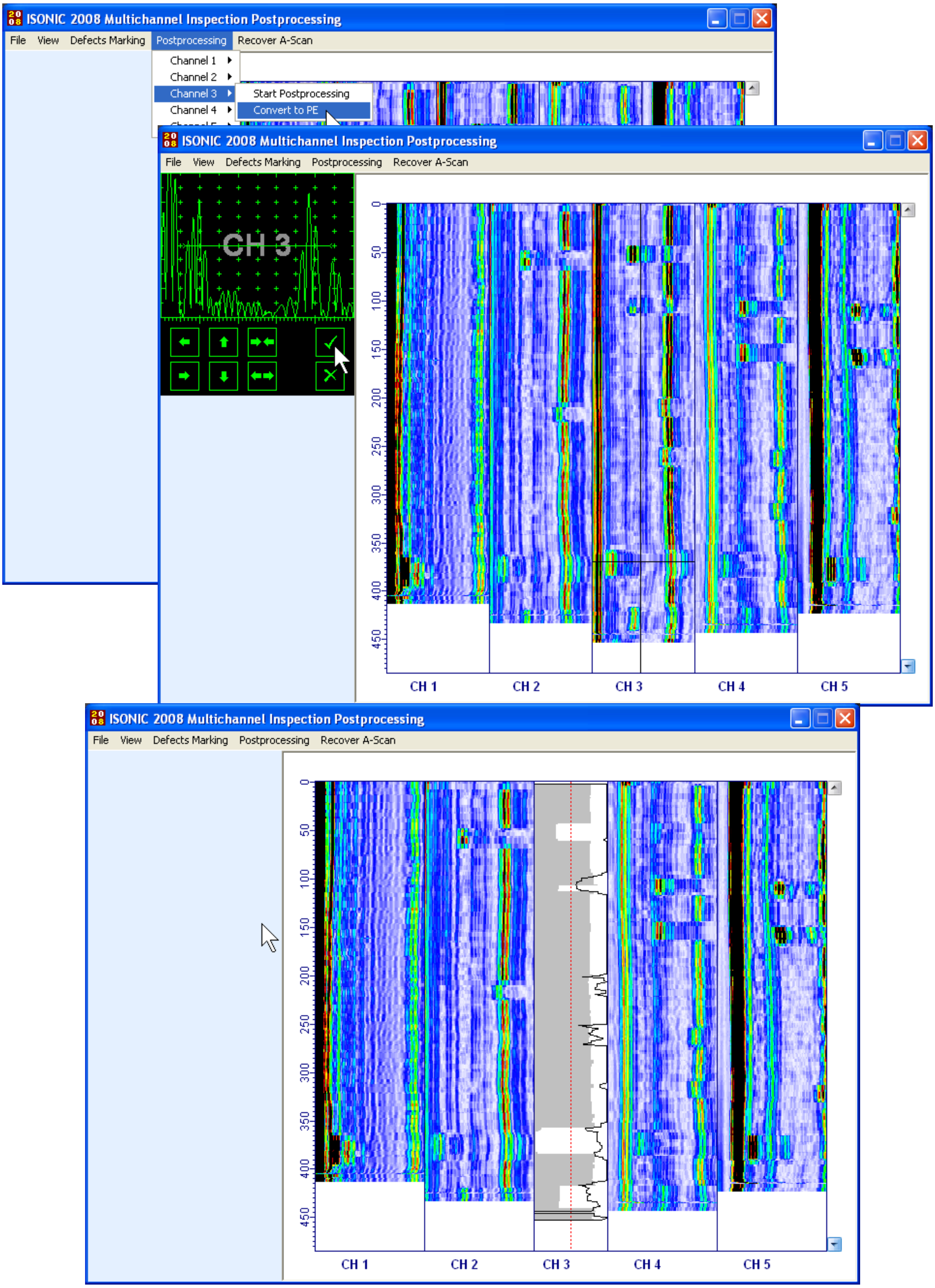
To freeze selected A-Scan and cross hair cursor left mouse click; to interrupt play back of A-Scans right mouse click

♦ Composing combination of simultaneously visible strips (Menu Bar Function **View→Channels→Check/Uncheck CH#**)

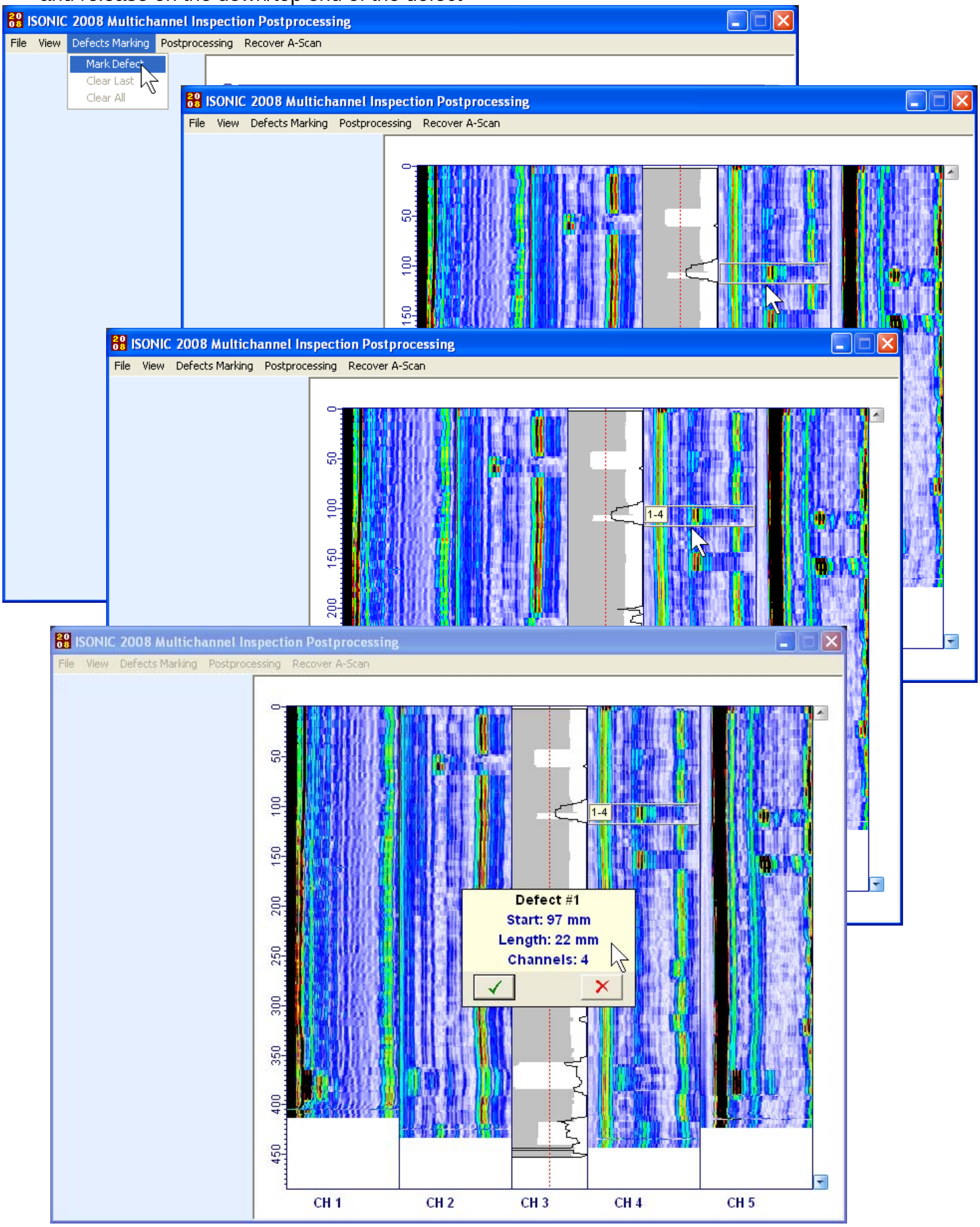




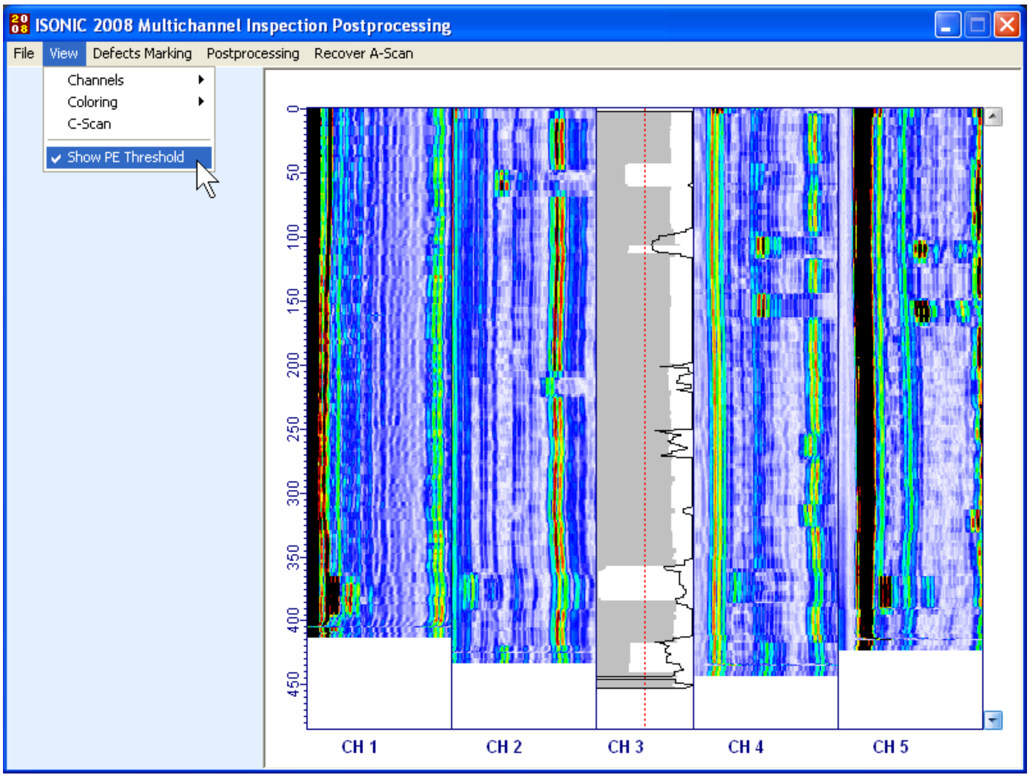
- Conversion of selected **Map Strip** into **Amplitude / TOF Pulse Echo Strip** and reversal (Menu Bar Function **Postprocessing→Channel#→Convert to PE/Convert to Map**) – refer to **Edit→ROI** function as per paragraph 6.3.2.5 of this Operating Manual to vary selected gate settings for **Amplitude / TOF Pulse Echo Strip**

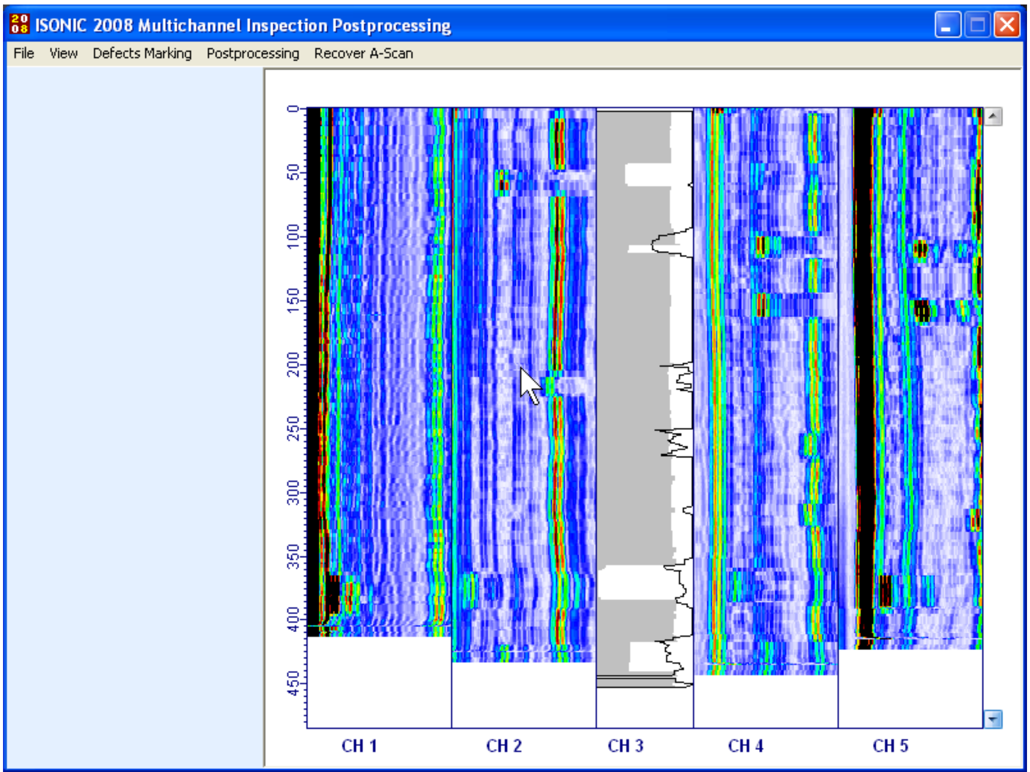


- Varying **Region of Interest (Gate)** settings for every **Amplitude / TOF Pulse Echo Strip** (Menu Bar Function **Postprocessing→Channel#→ROI→ON/OFF**) – refer to **Edit→ROI** function as per paragraph 6.3.2.5 of this Operating Manual to vary selected gate settings for **Amplitude / TOF Pulse Echo Strip**
- Marking defects and generating of *Strip Chart Inspection Report* (Menu Bar Function **Defects Marking→Mark Defect**) which is implemented through left mouse press on the top/down end of defect and release on the down/top end of the defect



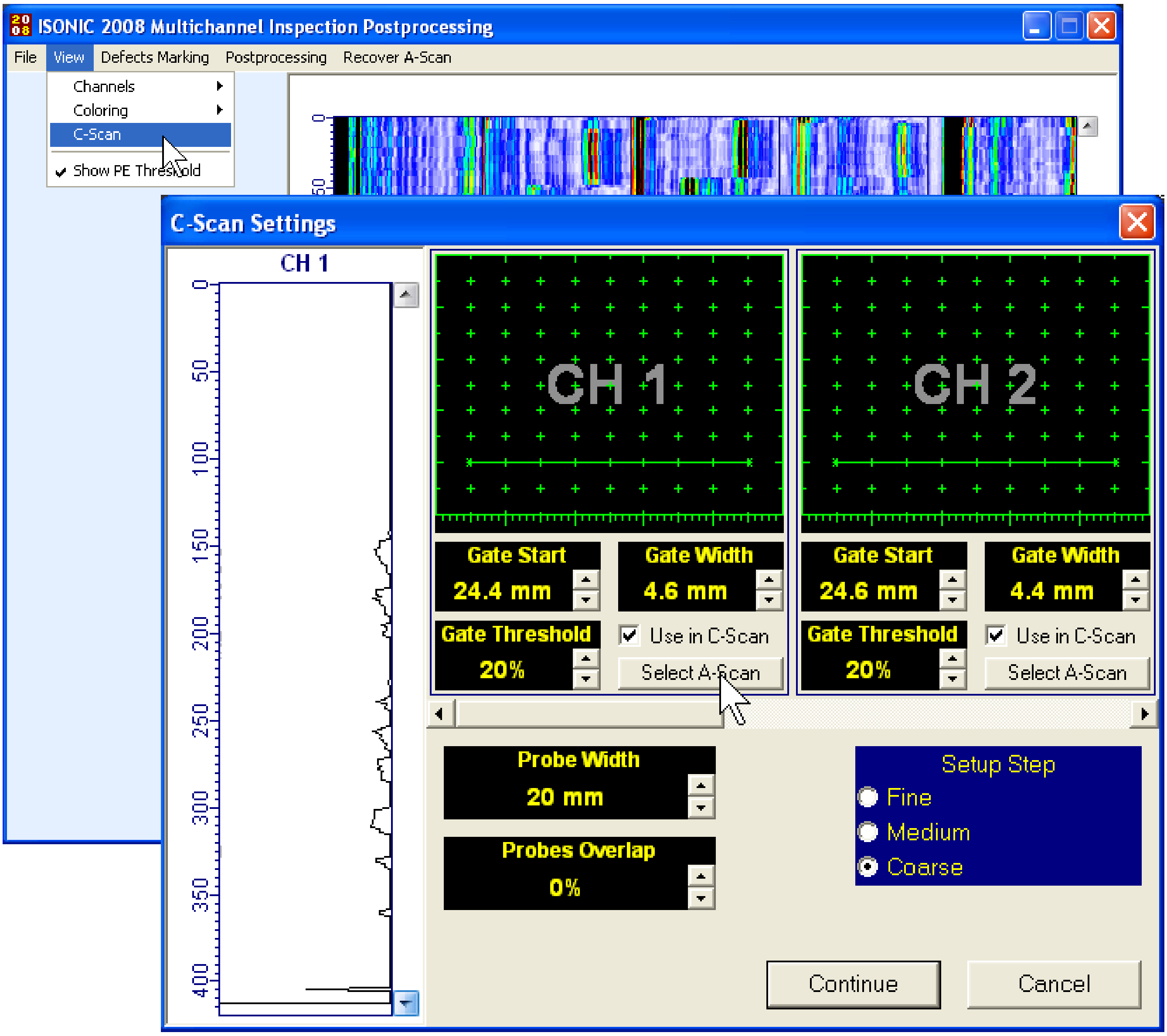
- Place/Remove dashed Gate A threshold line above PE strip (Menu Bar Function **View→Show PE Threshold**)





- Varying **Color Palette** for **Map Strips** (Menu Bar Function **View→Coloring→Map→Palette#**)
- Varying **Color Palette** for **TOFD Strips** (Menu Bar Function **View→Coloring→TOFD→Palette#**)
- Varying **Contrast** for **TOFD Strips** (Menu Bar Function **View→TOFD→Contrast→Contrast#**)
- Varying **Logic** for **TOFD Strips** (Menu Bar Function **View→TOFD→Logic→Positive/Negative**)
- Printing **Strip Chart** (Menu Bar Function **File→Print**)

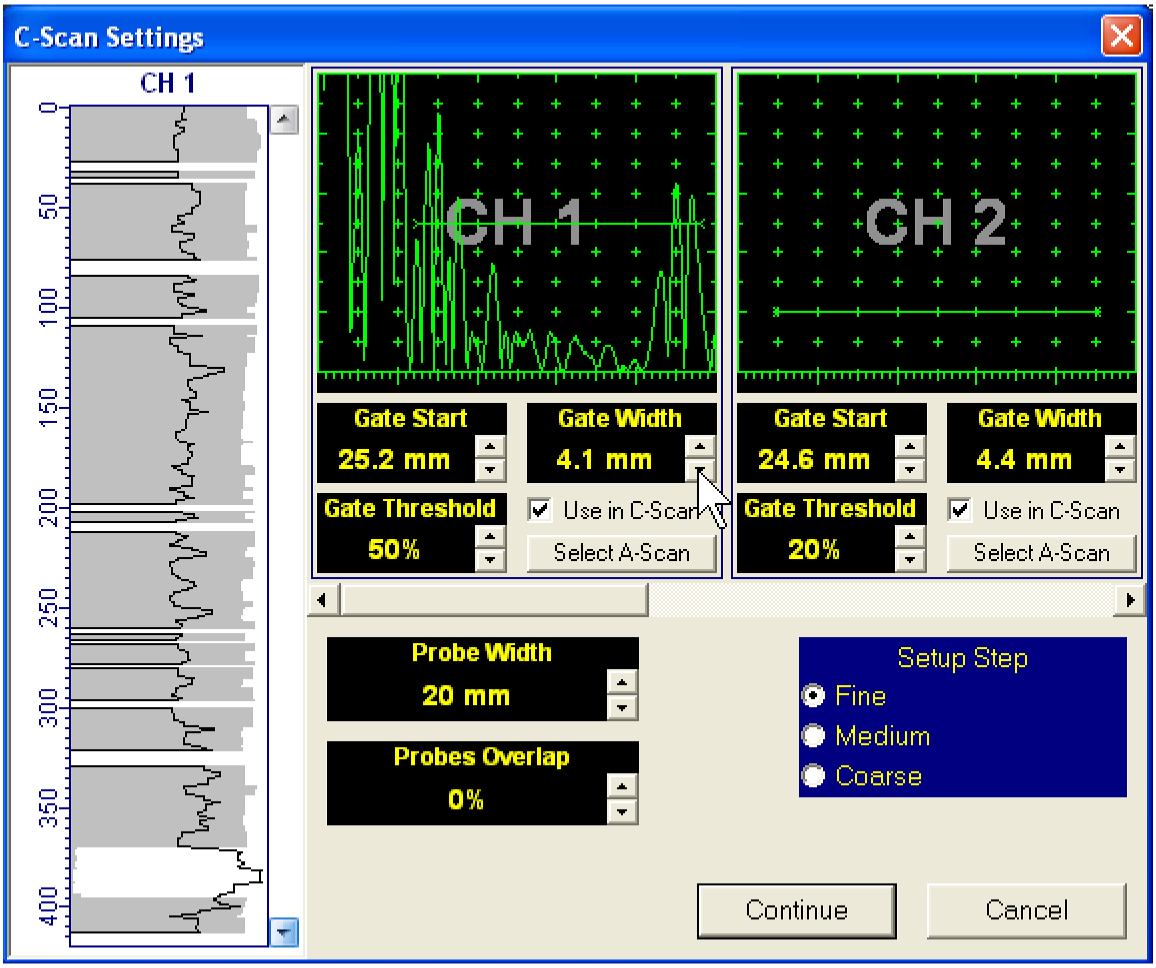
- Individual postprocessing of each strip (Menu Bar Function **Postprocessing→Scannel#→Start Postprocessing**) – **TOFD strip** individual postprocessing is according to paragraph 6.5.2.5 of this Operating Manual; **Map Strip** individual postprocessing is according to paragraph 6.6.2.5 of this Operating Manual; **Amplitude/TOF Pulse Echo Strip** individual postprocessing is according to paragraph 6.3.2.5 of this Operating Manual
- Return to **ISONIC 2008 Start Screen** (Menu Bar Function **File→Exit**)
- Conversion of few **Map** or **Amplitude/TOF Pulse Echo Strips** into **Stripped C-Scan** (Menu Bar Function **View→C-Scan**)

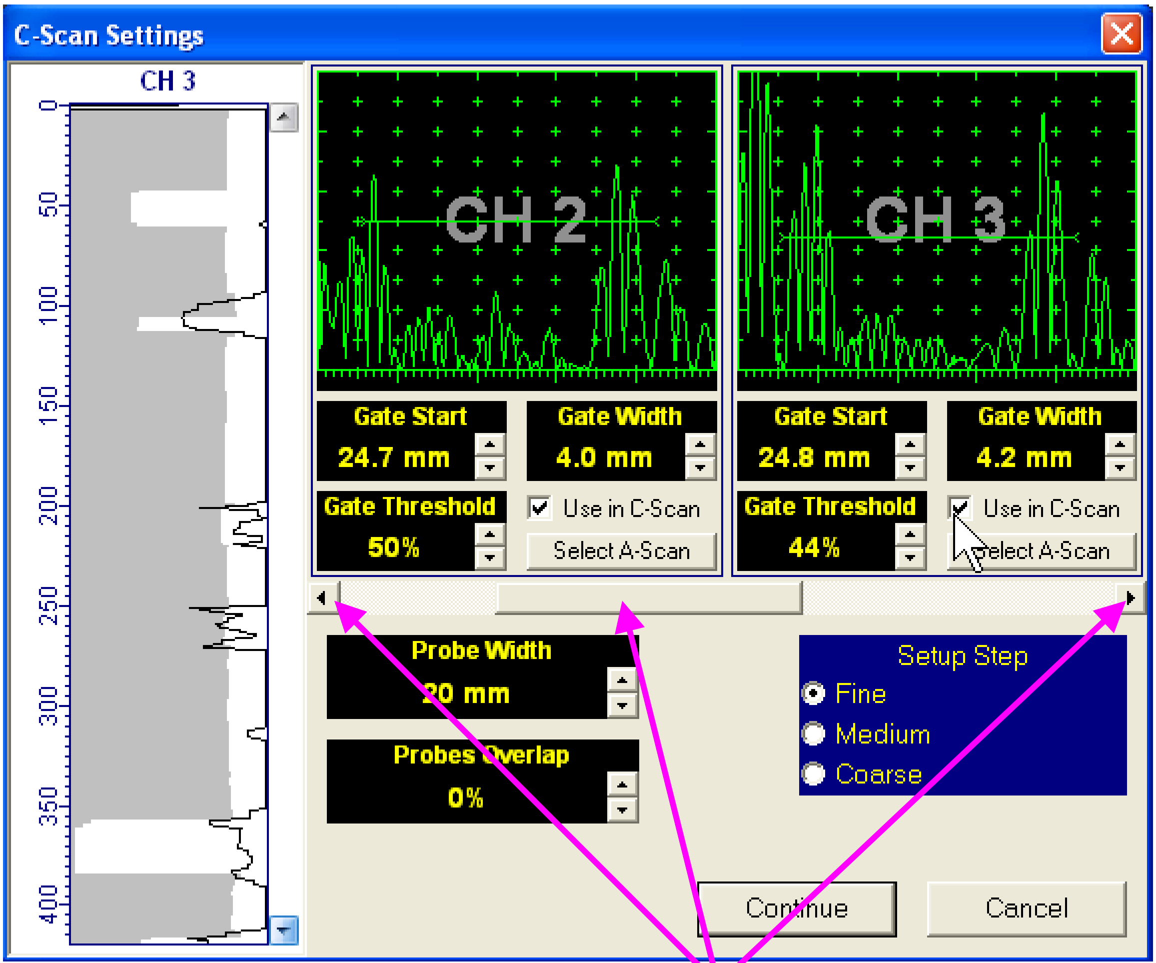


This causes appearance of **C-Scan Settings** screen requiring performing of several preparations. For each strip it is necessary:

- to include / skip it's data in the formed **Stripped C-Scan** (Check / Don't Check **Use in C-Scan** option)

- to arrange Gate settings for every strip selected to submit data into the C-Scan using **Gate Start** , **Gate Width** , and **Gate Threshold** controls; to optimize Gate settings it is recommended to play back captured A-Scan through clicking on Select A-Scan ; playing back of A-Scan is possible then through manipulating of mouse cursor above the strip; left mouse click freezes last selected A-Scan allowing to adjust Gate settings; increment / decrement for modifying of Gate settings is selectable through clicking on appropriate option in the **Setup Speed** field





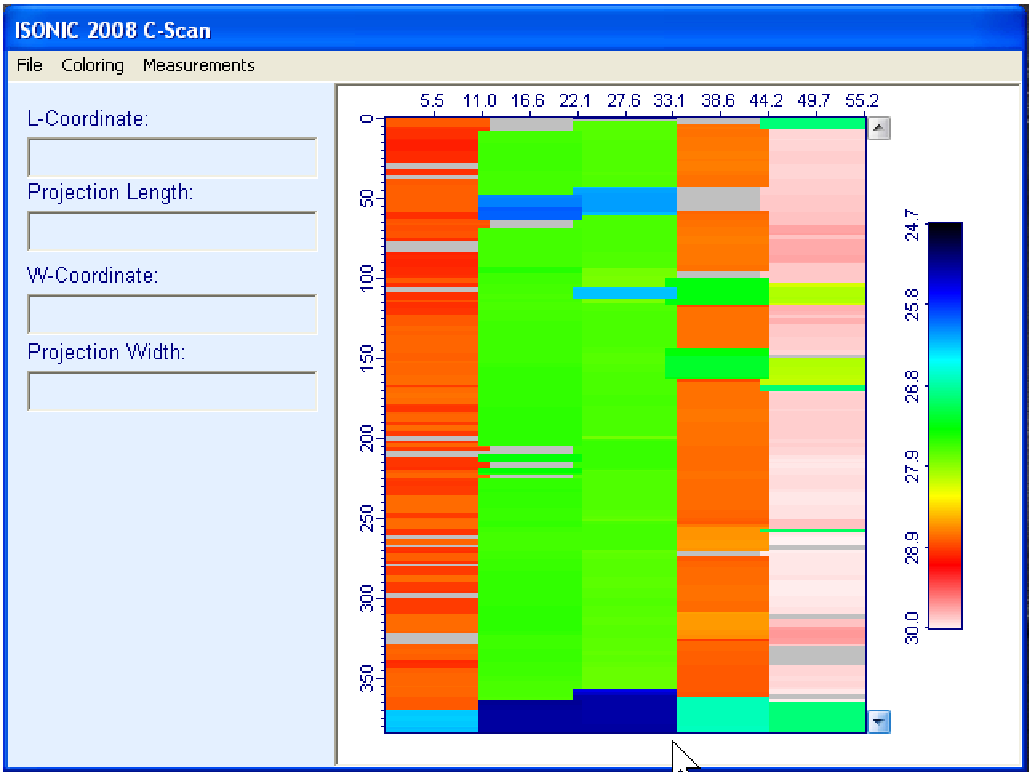
Navigation through all strips is possible through use of horizontal scrolling bar

Stripped C-Scan is generated supposing that there were brush shaped probe array used for scanning, whereas all probes of the brush have equal width. Accumulated width of the **Stripped C-Scan** is defined through keying in of **Probe Width** and **Probes Overlap** parameters

On completion C-Scan settings click on Continue - this will generate **Stripped C-Scan**

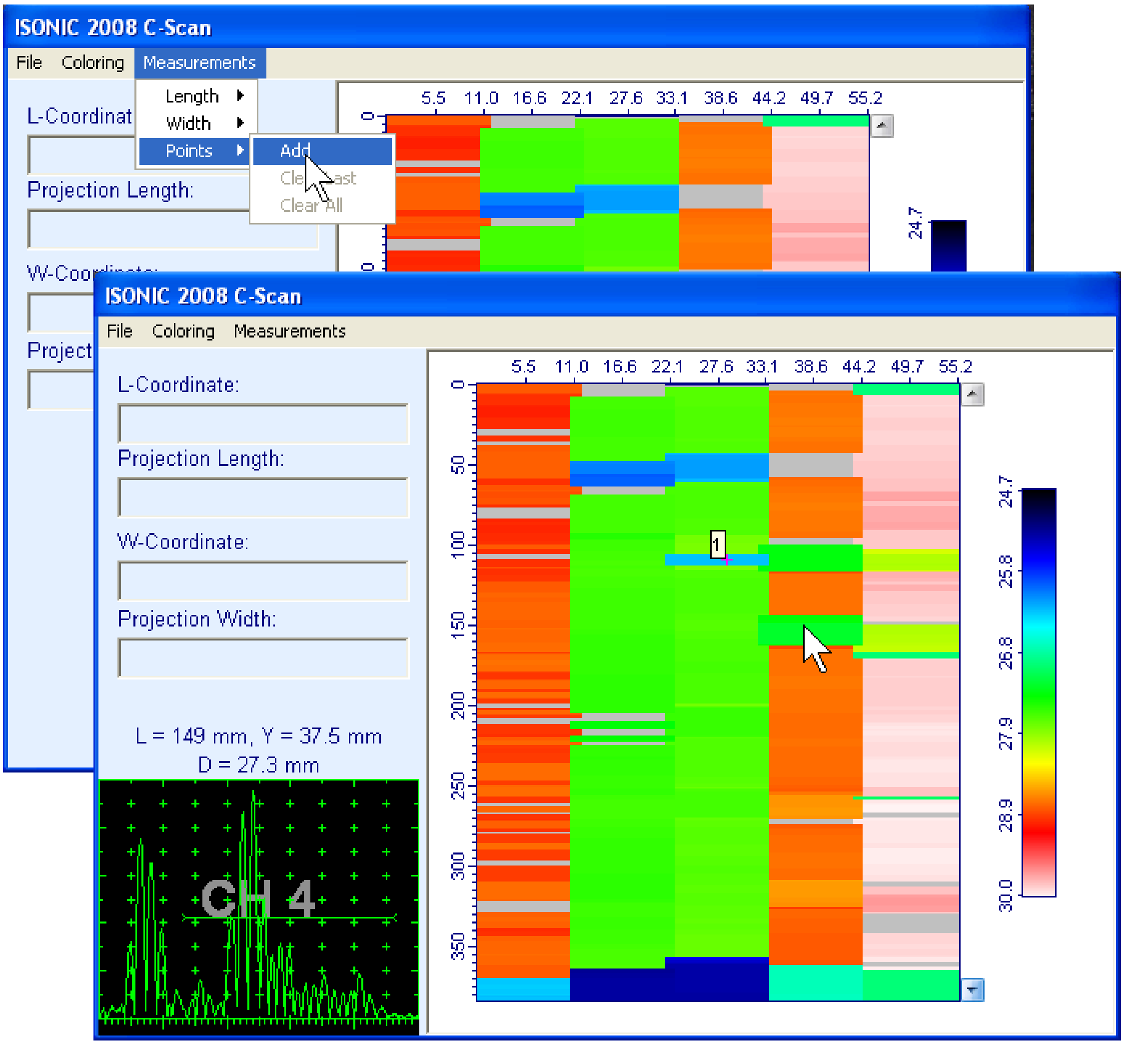
To return to complete strip chart presentation click Cancel

The following manipulations are possible for the **Stripped C-Scan** screen:

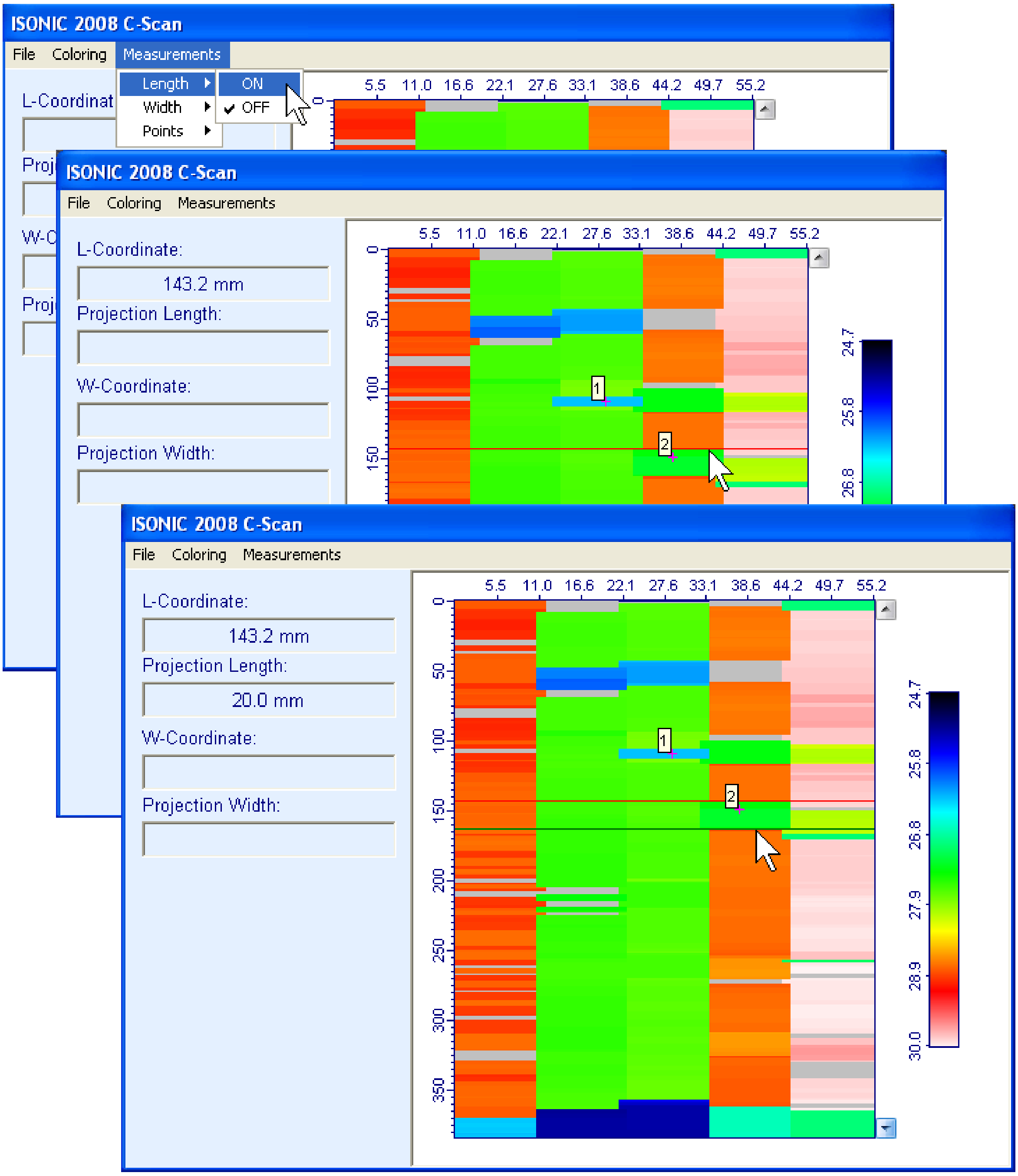


- ♦ Varying **Color Palette** (Menu Bar Function **Coloring→Palette#**)
- ♦ Return to **C-Scan Settings** screen (Menu Bar Function **File→Back**)
- ♦ Return to strip chart presentation (Menu Bar Function **File→Exit**)
- ♦ Printing out postprocessing results (Menu Bar Function **File→Print**)

- Recovery of A-Scan and marking corresponding points on the map (Menu Bar Function **Measurements→Points→Add**) – upon activating this procedure manipulating of cursor above **Stripped C-Scan** screen becomes possible – A-Scans corresponding to cursor positions are recovered; on selecting point for marking left mouse click; to interrupt the procedure without marking point right mouse click
    - to erase last marked point from **Stripped C-Scan** screen select **Measurements→Points→Clear Last**
    - to erase all marked points from **Stripped C-Scan** screen select **Measurements→Points→Clear All**
    - to preview A-Scan for the marked point in the marked point on the **Stripped C-Scan** screen double click on it's number

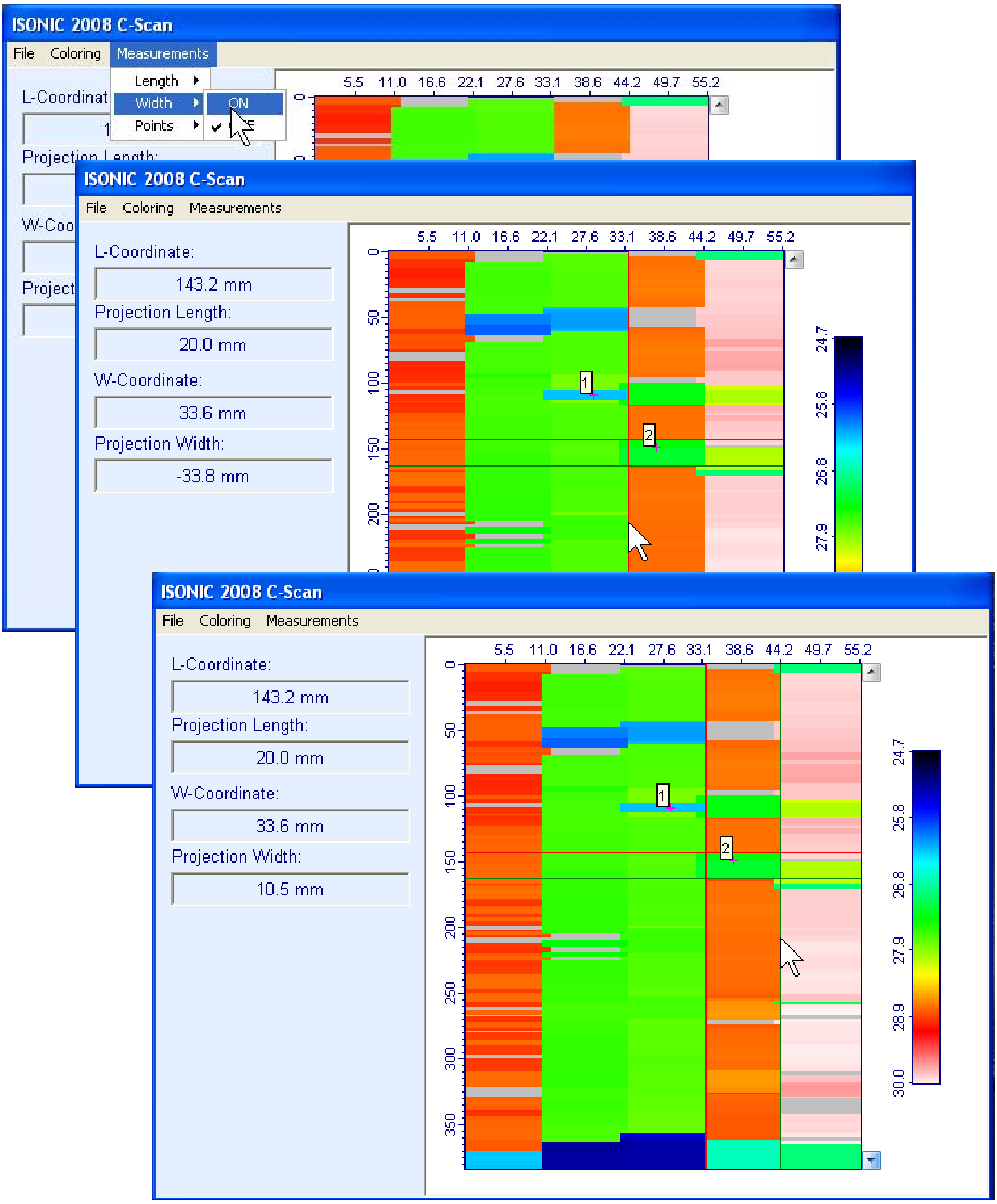


- Measuring length of the indication map (Menu Bar Function **Measurements→Length→ON**) – this generates *first horizontal cursor* that may be guided over **Stripped C-Scan** image; coordinate of the *first horizontal cursor* is indicated in the **L-Coordinate** field; to fix position of the *first horizontal cursor* left mouse click; *second horizontal cursor* appears upon fixing first one; it may be manipulated over **Stripped C-Scan** image by the same way; coordinate of the *second horizontal cursor* measured relatively *first horizontal cursor* is indicated in the **Projection Length** field



To interrupt **L-Coordinate** and **Projection Length** measurement right mouse click

- Measuring width of the indication map (Menu Bar Function **Measurements→Width→ON**) – this generates *first vertical cursor* that may be guided over **Stripped C-Scan** image; coordinate of the *first vertical cursor* is indicated in the **W-Coordinate** field; to fix position of the *first horizontal cursor* left mouse click; *second horizontal cursor* appears upon fixing first one; it may be manipulated over **Stripped C-Scan** image by the same way; coordinate of the *second horizontal cursor* measured relatively *first horizontal cursor* is indicated in the **Projection Width** field



To interrupt **W-Coordinate** and **Projection Width** measurement right mouse click

8. Incremental Encoders

8.1. Standard Encoder SK 2001108 ABI – Single Channel Operation

Encoder **SK 2001108 ABI** is originally designed for **BScan(Th)** and **ABIScan** recording with **ISONIC 2001**, **ISONIC 2005**, **ISONIC 2006**, **ISONIC 2007**, **ISONIC 2008** instruments – single channel operation

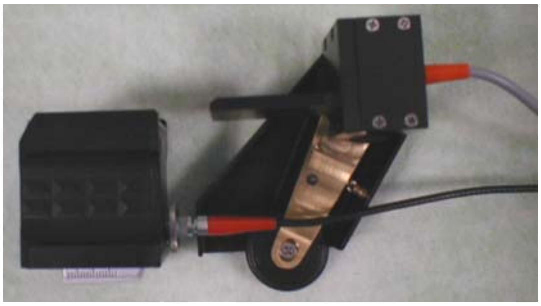
To start use of the encoder refer to simple guidance as below

Step 1

Fit probe into appropriate probe holder and connect signal cable(s) to probe

Step 2

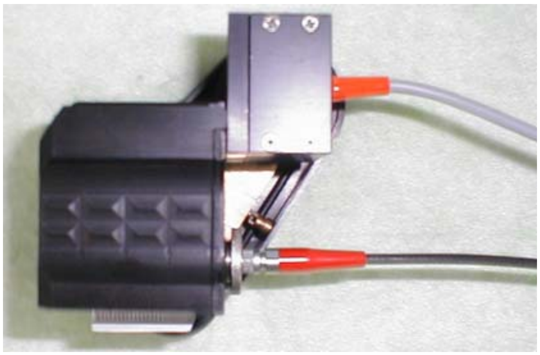
Fit probe holder with probe into encoder



Step 3

Connect probe signal cable(s) to appropriate coaxial socket on **ISONIC 2008** instrument – refer to paragraph 4.2 of this Operating Manual

Connect encoder data cable to the appropriate D-Type connector on rear panel pf **ISONIC 2008** instrument – refer to paragraph 4.2 of this Operating Manual



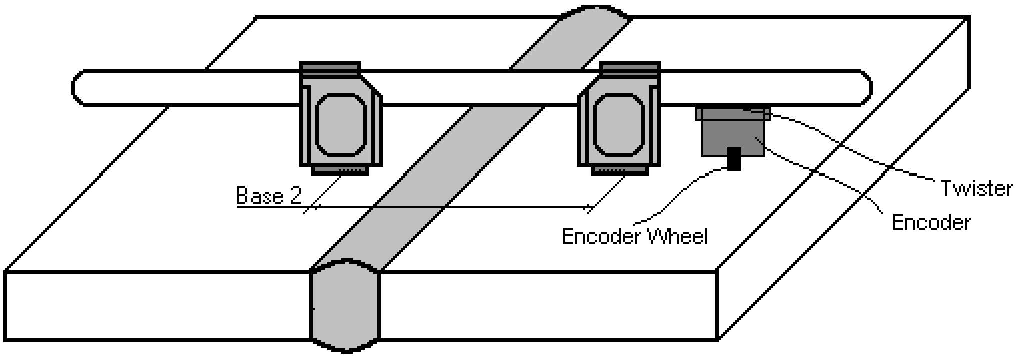
8.2. Standard Encoder SK 2001108 FM – Single Channel Operation

Encoder **SK 2001108 FM** is originally designed for **TOFD** and **FLOORMAP L** recording with **ISONIC 2001**, **ISONIC 2005**, **ISONIC 2006**, **ISONIC 2007**, **ISONIC 2008** instruments – single channel operation. To start use of the encoder refer to simple guidance as below

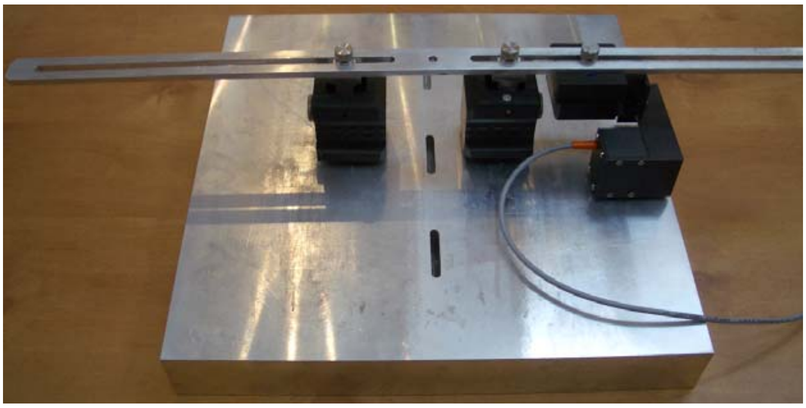
8.2.1. TOFD

Insert ultrasonic probes into their probe holders then:

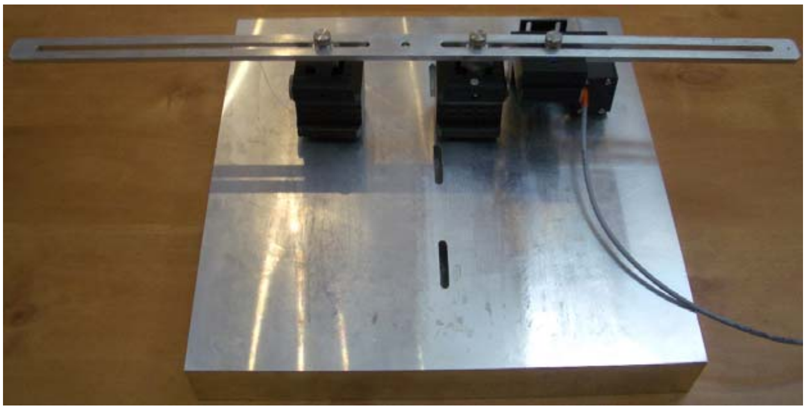
- Fit probe holders with probes on **TOFD** bar and fix them at at necessary separation distance
- Fix twister **S 904050** on the **TOFD** bar
- Fit encoder **SK 2001108 FM** into twister **S 904050** and provide necessary orientation of encoder's wheel – it must be oriented at parallel to the desired 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



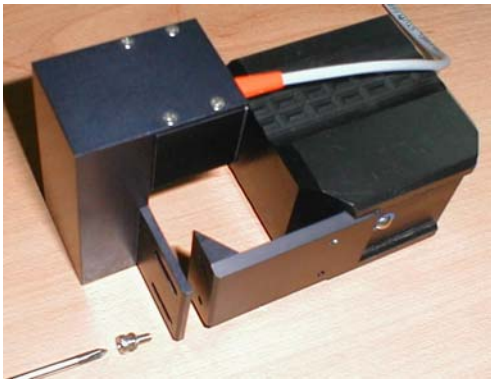
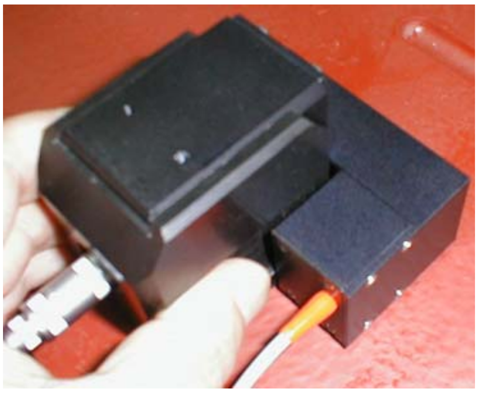
TOFD Fixture and encoder positioning for scanning across the weld



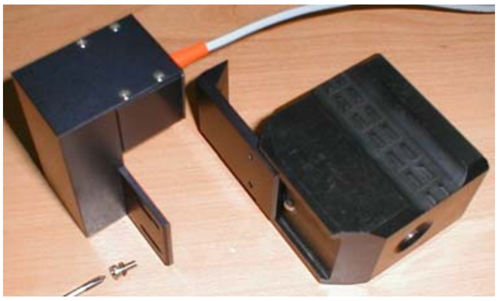
8.2.2. FLOORMAP L

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:

Fitting probe into encoder	Ready to scan
	

- Encoder's wheel is situated on surface, which is rectangular to scanning surface:

Fitting probe into encoder	Ready to scan
	

8.3. Customized Encoders for Proprietary Inspection Tasks – Single and Multi Channel Operation

Various custom made encoders for proprietary inspection tasks may be used with **ISONIC 2008**. For appropriate encoder data cable and connector pin-out contact

- Nearest Sonotron NDT representative

OR

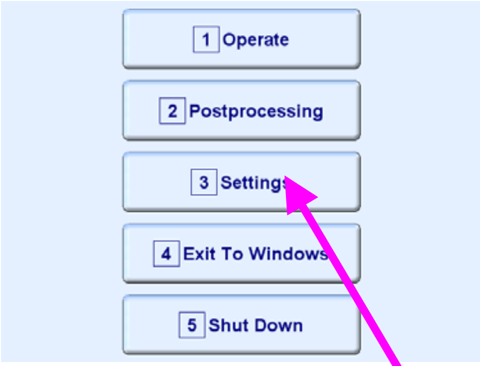
- Directly to Sonotron NDT – mail to support@sonotronndt.com with subject **ISONIC 2008 encoder connection**

ⓘ

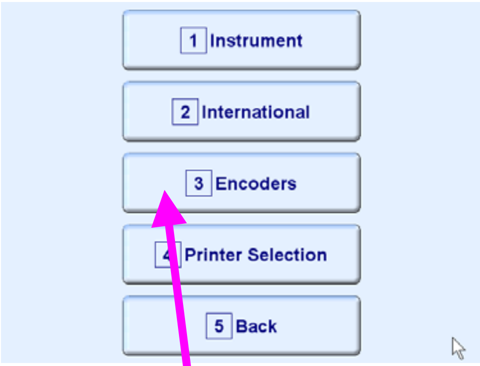
Improper cable out-coming from custom made encoder for proprietary inspection tasks may lead to warranty exempted damaging ISONIC 2008 instrument

8.4. Encoder Calibration

All encoders to be calibrated once for further use with **ISONIC 2008**.

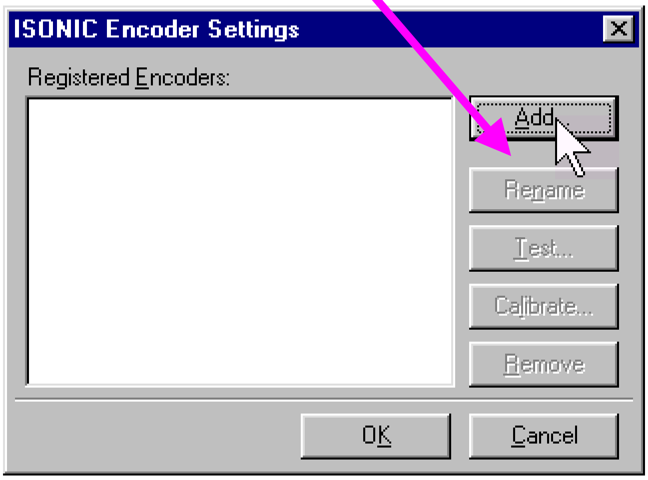


To proceed with the calibration in the **ISONIC 2008 Start Screen** click on or press  on front panel keyboard or press **F3** on external keyboard

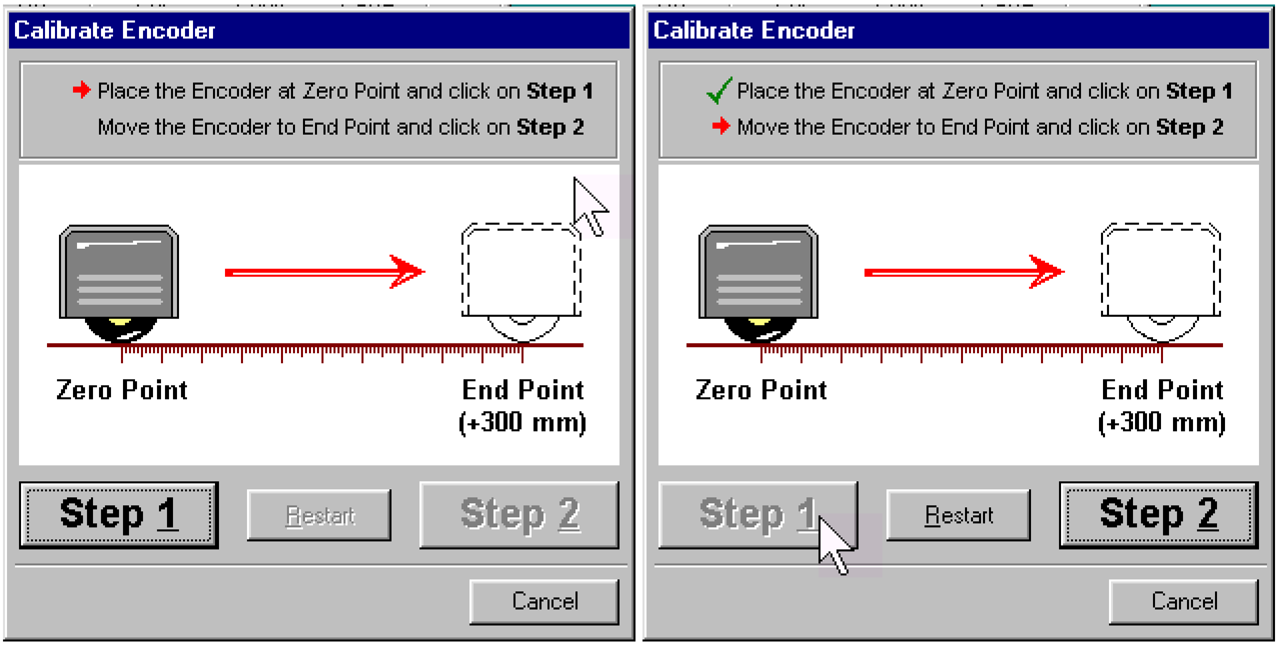


In the appeared **ISONIC 2008 Settings Menu** click on or press  on front panel keyboard or **F3** on external keyboard

In the appeared **ISONIC Encoder Settings** window click on 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** or pressing **<Alt>+<2>** on external keyboard new **Encoder Test** window appears

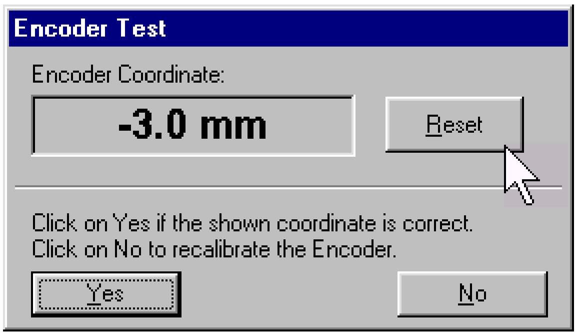
ⓘ
If it's necessary to re-designate **Zero Point** click on **Restart** or press **<Alt>+<R>** on external keyboard

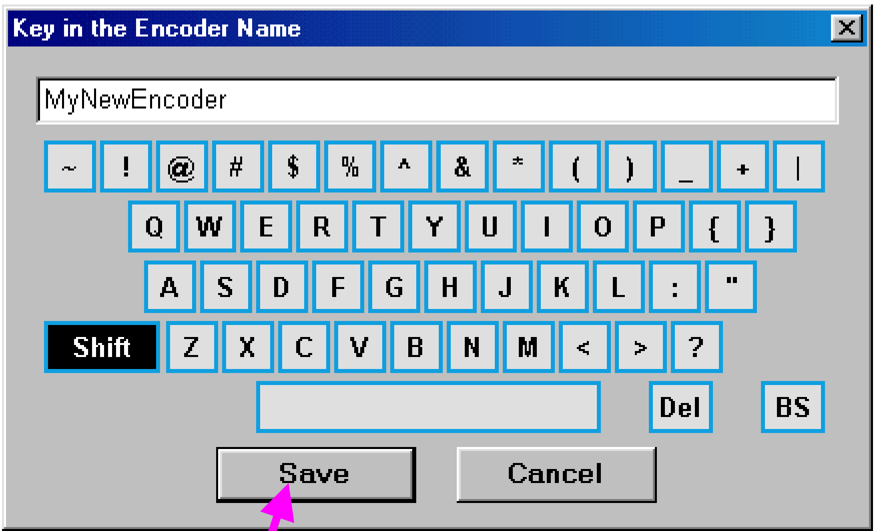
In the **Encoder Test** window:

- Click on **Reset** or press **<Alt>+<R>** on external keyboard to designate **local zero point** for continuing test
- Click on **Yes** or press 

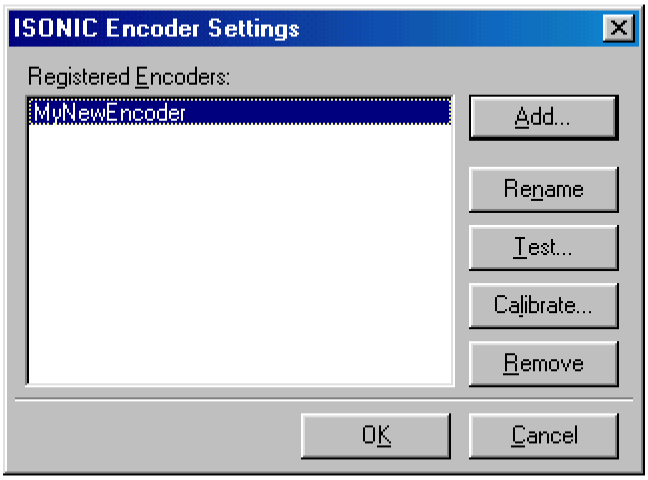
on front panel keyboard or **Enter** or **<Alt>+<Y>** on external keyboard to name the selected encoder – **Key in the Encoder Name window** appears
- Click on **No** or press 

on front panel keyboard or press **Esc** or **<Alt>+<N>** on external keyboard to recalibrate the encoder – return to **Calibrate Encoder** window

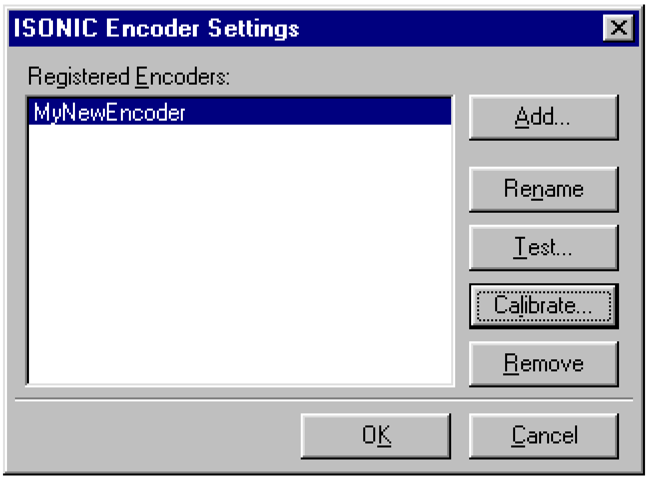




Upon keying in new Encoder name click on. **ISONIC Encoder Settings** window returns upon



To update the registry of **ISONIC 2008** with new encoder data click on the **OK** or press  on front panel keyboard or **Enter** or **<Alt>+<Y>** on external keyboard – this will automatically return to **ISONIC 2008 Settings Menu**

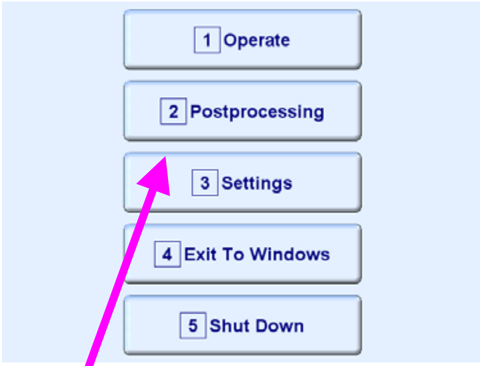


While running encoder calibration next time:

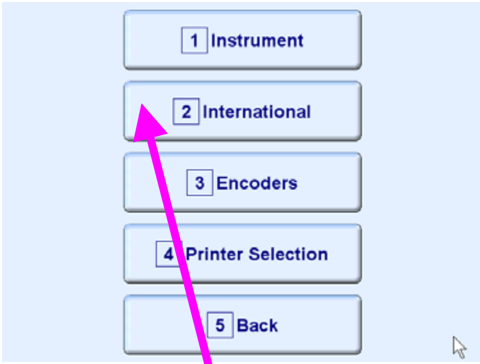
- Click on **Add...** or press **<Alt>+<A>** on external keyboard to proceed with next new encoder by the same way as described above
- Click on **Rename** or press **<Alt>+<N>** on external keyboard to rename the selected encoder
- Click on **Test** or press **<Alt>+<T>** on external keyboard to check the accuracy of selected encoder calibration
- Click on **Calibrate** or press **<Alt>+<L>** on external keyboard to recalibrate selected encoder
- Click on **Remove** or press **<Alt>+<R>** on external keyboard to remove selected encoder from the registry of **ISONIC 2008**
- Click on the **Cancel** or press  on front panel keyboard or press **Esc** or **<Alt>+<C>** on external keyboard to negate all changes and return to **ISONIC 2008 Settings Menu**
- Click on the **OK** or press  on front panel keyboard or **Enter** or **<Alt>+<K>** on external keyboard to update the registry of **ISONIC 2008** and return to **ISONIC 2008 Settings Menu**

9. Miscellaneous

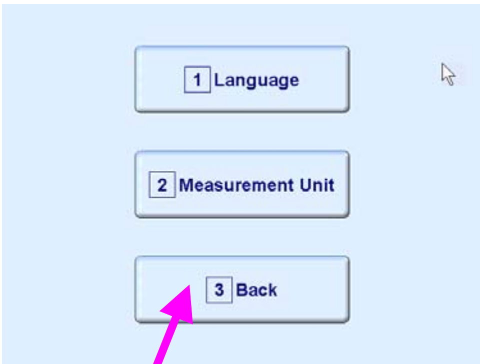
9.1. International Settings



In the **ISONIC 2008 Start Screen** click on or press  on front panel keyboard or press F3 on external keyboard

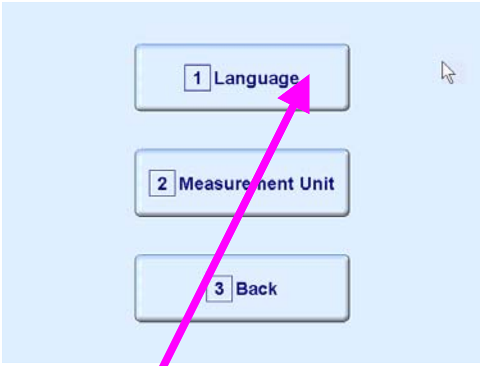


In the appeared **ISONIC 2008 Settings Menu** click on or press  on front panel keyboard or press F2 on external keyboard, the **International Settings** screen appears:

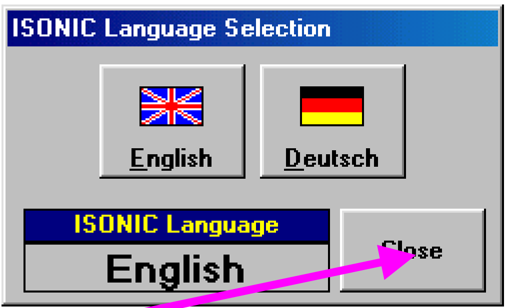


To return to **ISONIC 2008 Settings Menu** click on or press  or  on front panel keyboard or F3 or Esc on external keyboard

9.1.1. Language



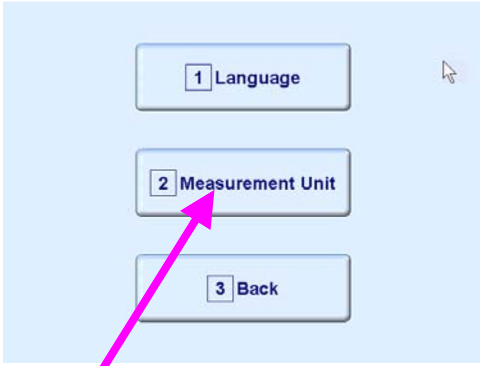
In the **International Settings** screen clicks on or press  on front panel keyboard or **F1** on external keyboard



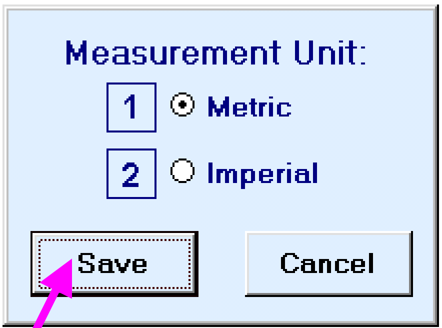
Select language then click on

ⓘ
Standard languages of **ISONIC 2008** ate English and German. Other languages are available upon request

9.1.2. Metric and Imperial Units

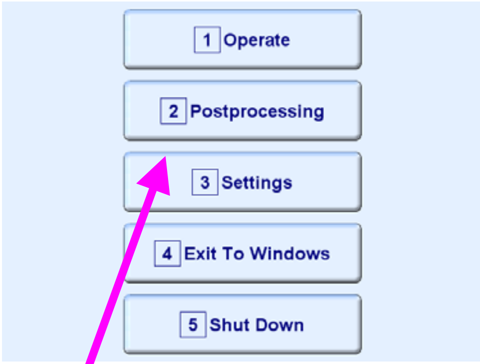


In the **International Settings** screen click on or press  on front panel keyboard or **F2** on external keyboard

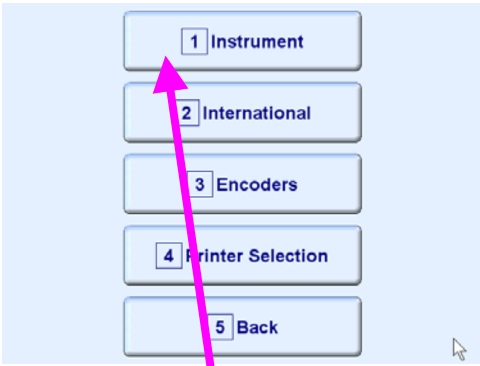


Select measurement units then click on

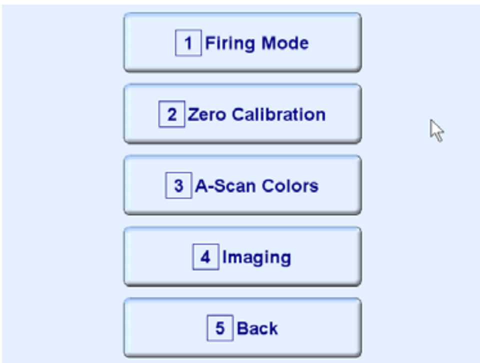
9.2. Instrument Settings



In the **ISONIC 2008 Start Screen** click on or press  on front panel keyboard or **F3** on external keyboard

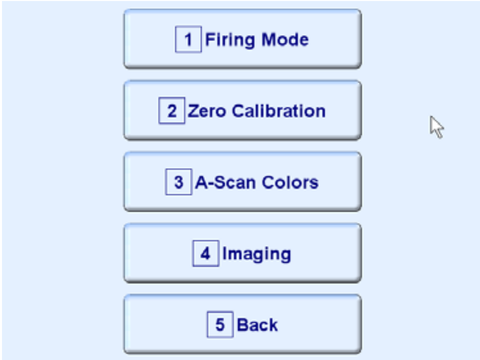


In the appeared **ISONIC 2008 Settings Menu** click on or press  on front panel keyboard or **F1** on external keyboard, the **Instrument Settings** screen appears:



Clicking on  or pressing on  on front panel keyboard or **F5** on external keyboard will return to **ISONIC 2008 Start Screen**

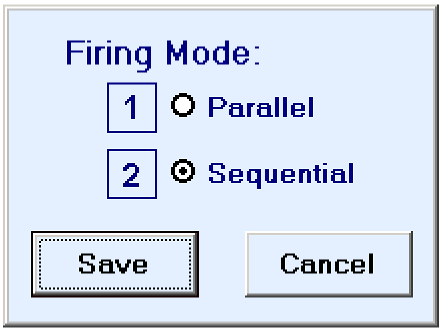
9.2.1. Firing Mode



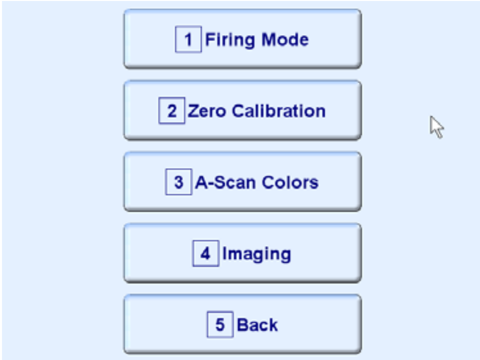
Clicking on 

or pressing 

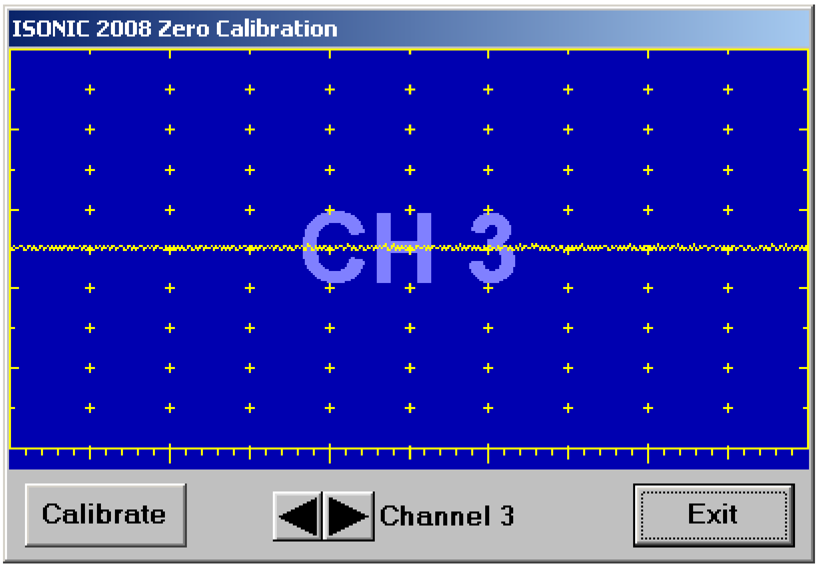
on front panel keyboard or **F1** on external keyboard will open simple dialogue for selection of **Firing Mode** for **Multi Channel** inspection:



9.2.2. Base Line Zero Calibration

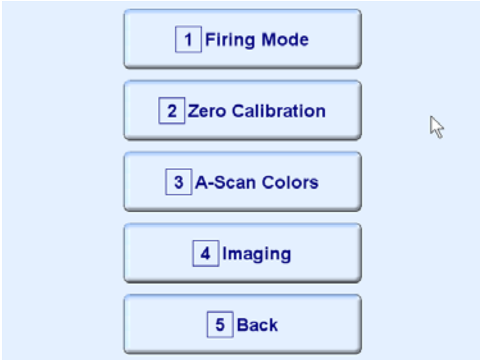


Clicking on  or pressing  on front panel keyboard or **F2** on external keyboard will open simple dialogue for *zeroing base lines* in **UDS 3-6** channels:

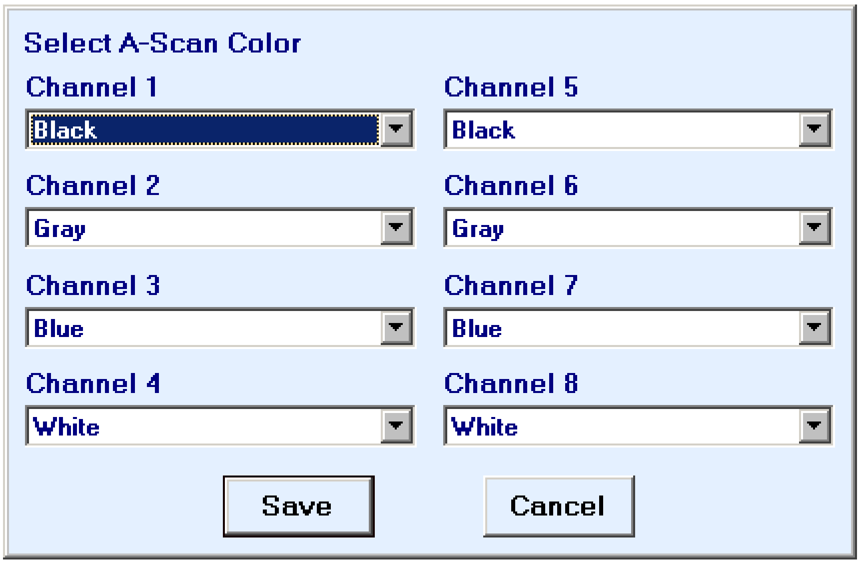


ALL PROBE TERMINALS MUST BE FREE FOR ZEROING BASE LINES

9.2.3. A-Scan Color Scheme



Clicking on  or pressing  on front panel keyboard or **F3** on external keyboard will open simple dialogue for selection of **A-Scan color scheme** for each of 8 **UDS 3-6** pulsing receiving channels:

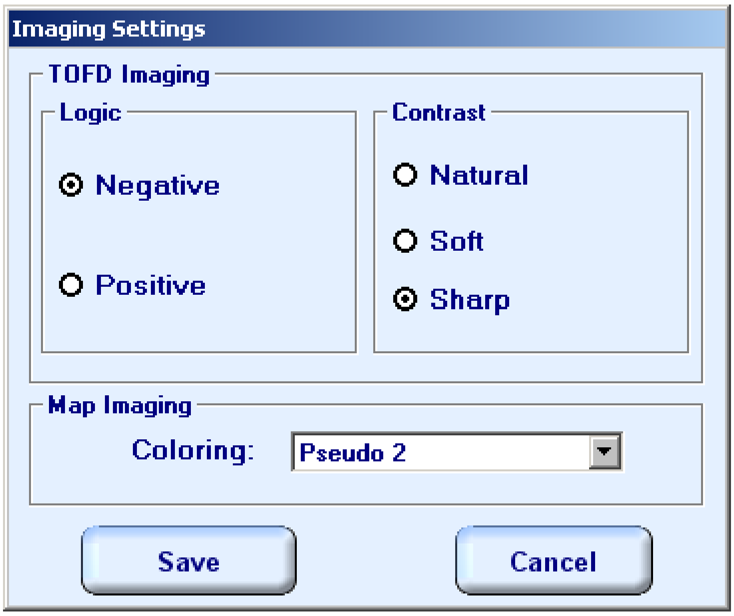


9.2.4. TOFD and Map Imaging

Clicking on 

or pressing 

on front panel keyboard or F4 on external keyboard will open simple dialogue for selection of **TOFD** image logic and contrast and palette for **Map Strip**:



On completion click on 

to activate new settings

Click on 

to negate new settings

ⓘ

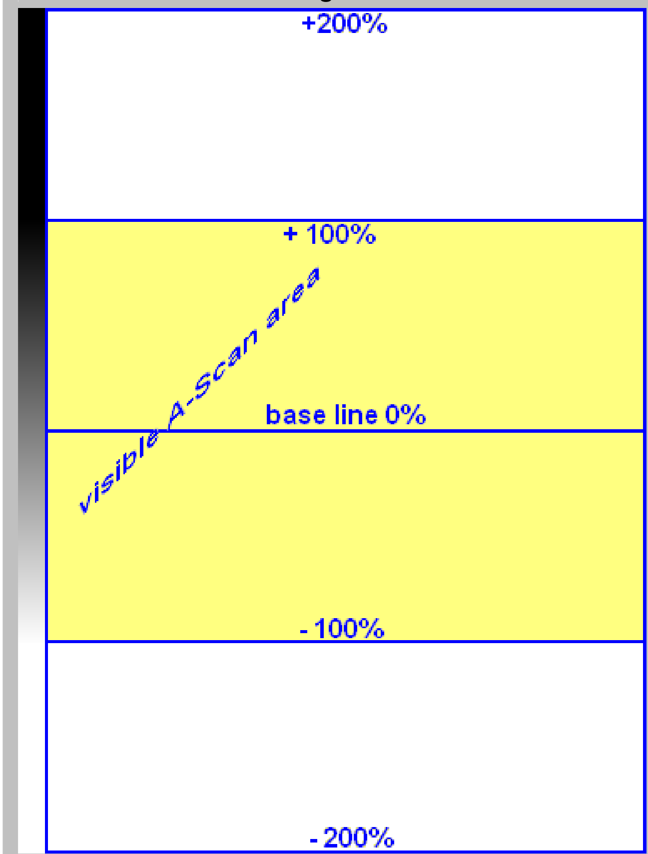
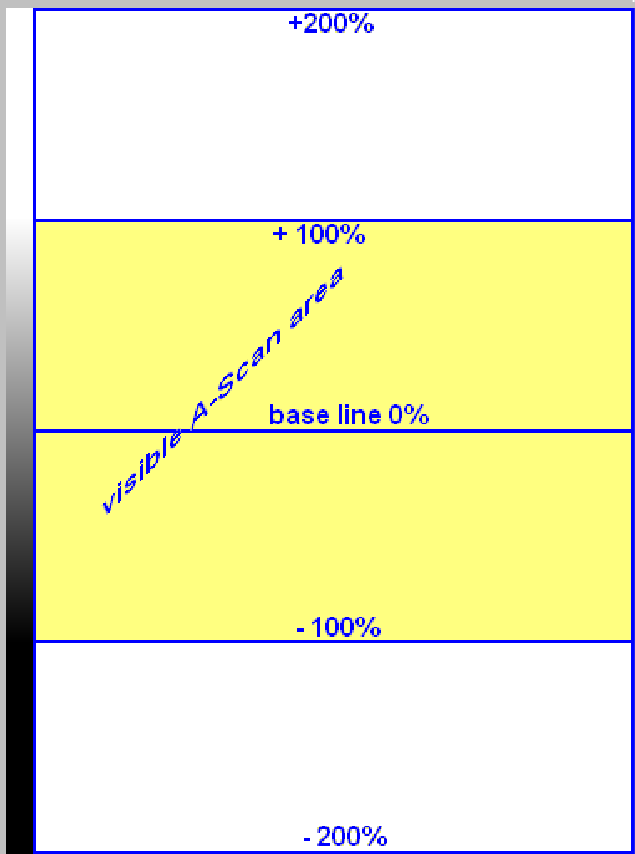
Natural Contrast TOFD Display

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

Negative	Positive
	

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ⓘ

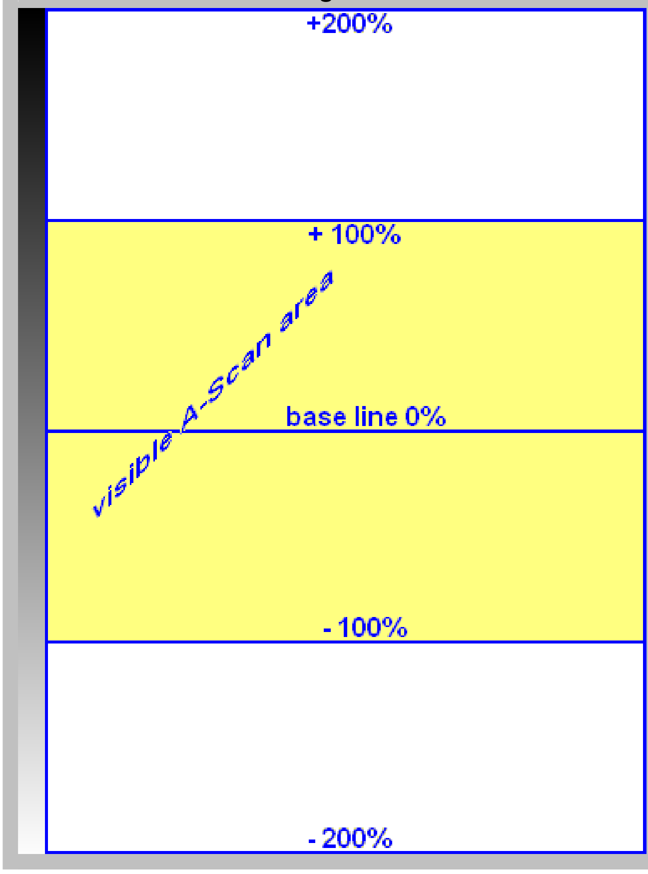
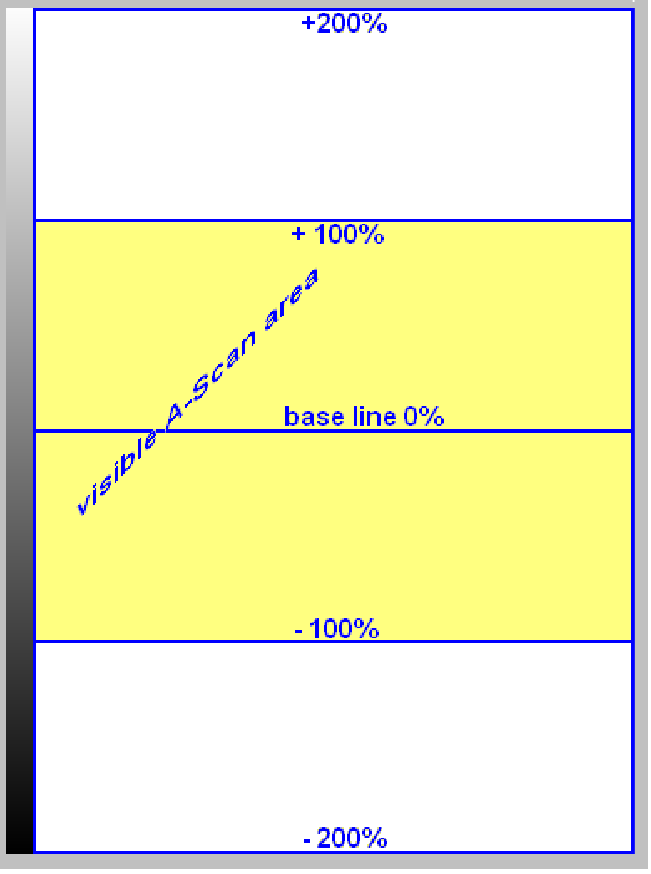
Soft Contrast TOFD Display

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

Negative	Positive
	

ⓘ

Sharp Contrast TOFD Display

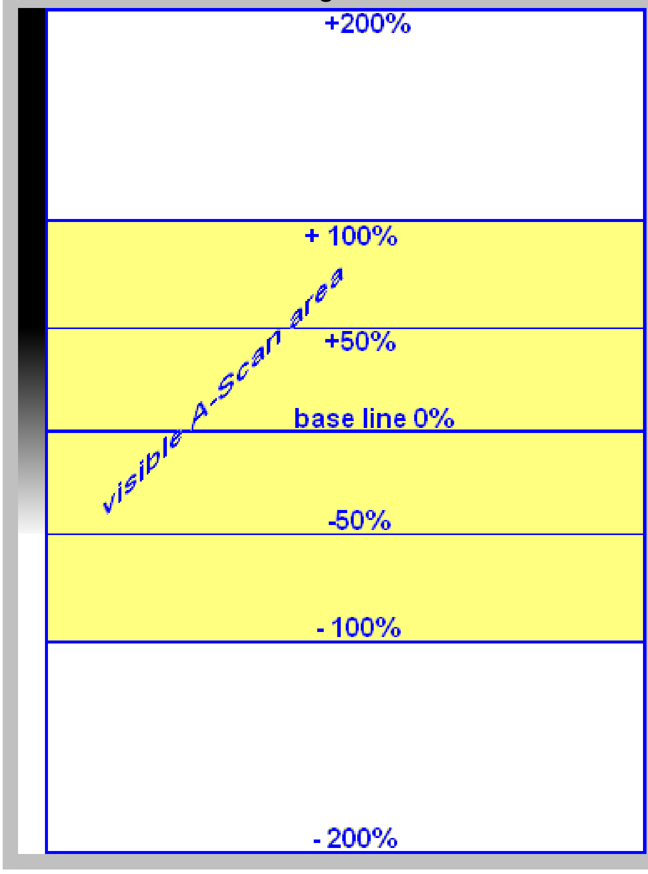
Negative

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

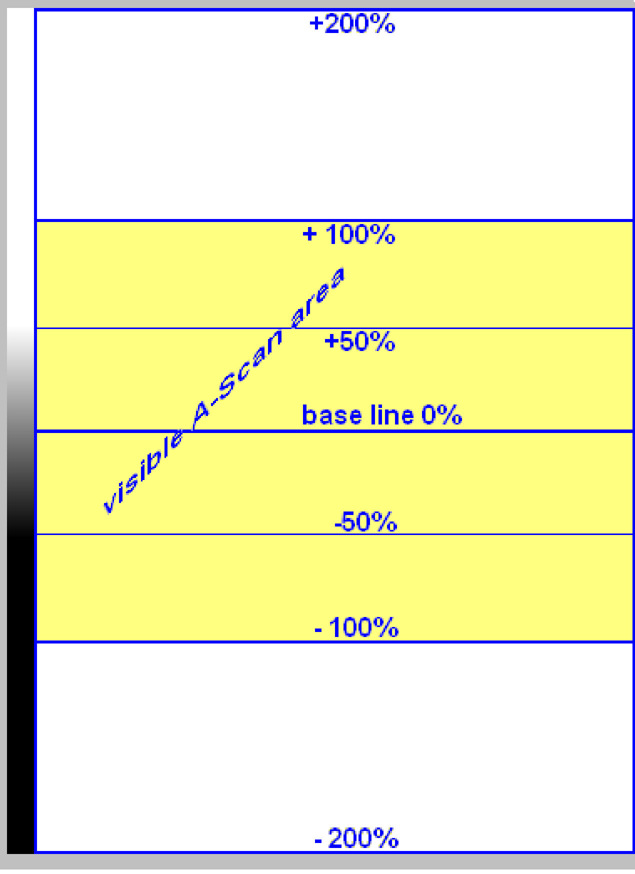
Positive

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

Negative



Positive



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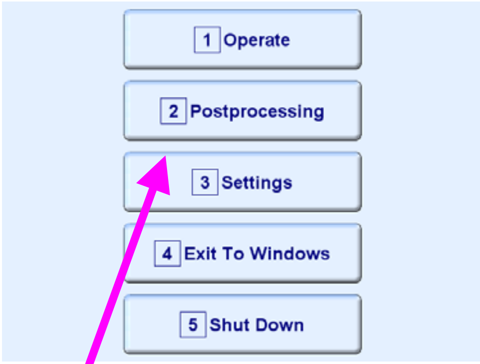
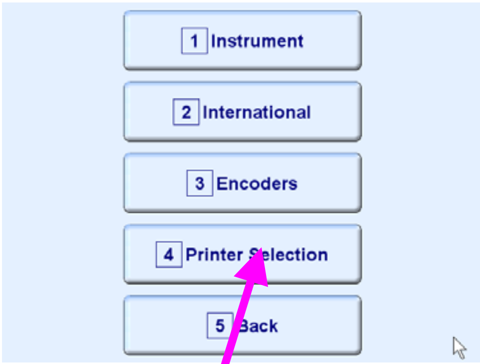
9.3. Printer Selection

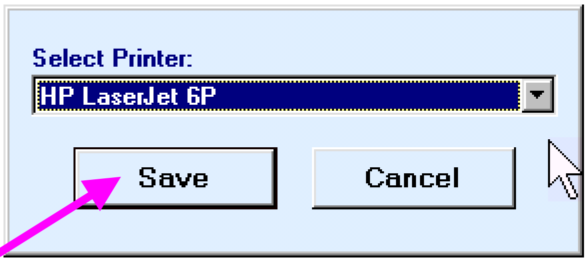
This option is available if there are more than 1 printer drivers installed in **ISONIC 2008**



In the **ISONIC 2008 Start Screen** click on or press  on front panel keyboard or F3 on external keyboard

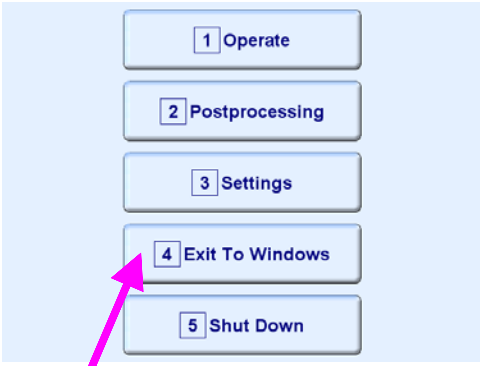


In the appeared **ISONIC 2008 Settings Menu** click on or press  on front panel keyboard or F4 on external keyboard



Select printer then click on

9.4. Exit to Windows



In the **ISONIC 2008 Start Screen** click on or press on front panel keyboard or F4 on external keyboard

To return to **ISONIC 2008** Operation double click on icon located in the Windows Desktop

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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)
- Quasi-disk management

In order to prevent overloading of **ISONIC 2008** quasi-disk and memory with data and non **ISONIC 2008** software that may affect instrument performance it's not allowed to install non **ISONIC 2008** software except drivers noted above. Affecting of instrument performance through installing on non **ISONIC 2008** software except drivers noted above is the warranty exemption damage

9.5. Connection to Network

To connect **ISONIC 2008** to local area network using Ethernet connector (refer to paragraph 4.2 of this Operating Manual) and standard Windows rules

9.6. External USB Devices

9.6.1. Mouse

Use one of 2 USB Connectors (refer to paragraph 4.2 of this Operating Manual). **ISONIC 2008** founds and registers external USB mouse automatically through standard Windows routine. Microsoft optical mouse is recommended

9.6.2. Keyboard

Use one of 2 USB Connectors (refer to paragraph 4.2 of this Operating Manual). **ISONIC 2008** founds and registers USB keyboard automatically through standard Windows routine. Microsoft keyboard is recommended

9.6.3. Memory Stick (Disk on Key)

Use one of 2 USB Connectors (refer to paragraph 4.2 of this Operating Manual)

ISONIC 2008 running under Windows XP Embedded founds and registers USB memory stick (disk on key) automatically through standard Windows routine.

9.6.4. 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 2008**

9.6.5. ISONIC Alarmer

For a variety of manual and automatic inspection applications it may be necessary:

- genrating 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

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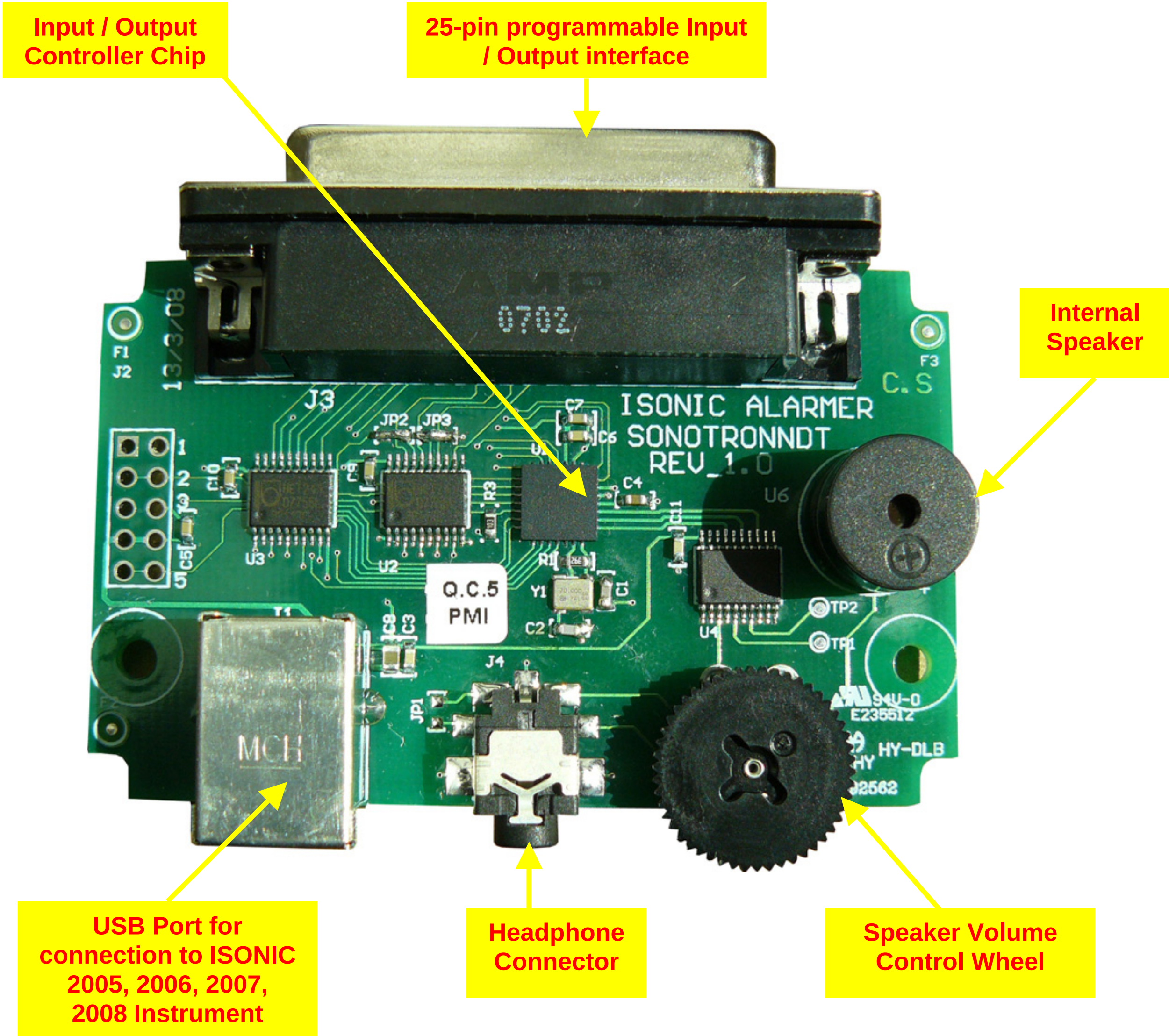
- **ISONIC Alarmer** may be connected to the instrument at any moment since **ISONIC 2008 Start Screen** became active (refer to paragraph 4.3 of this Operating Manual)
- **ISONIC Alarmer** may be disconnected from the instrument at any moment prior to shut down (refer to paragraph 4.3 of this Operating Manual)

ISONIC Alarmer includes:

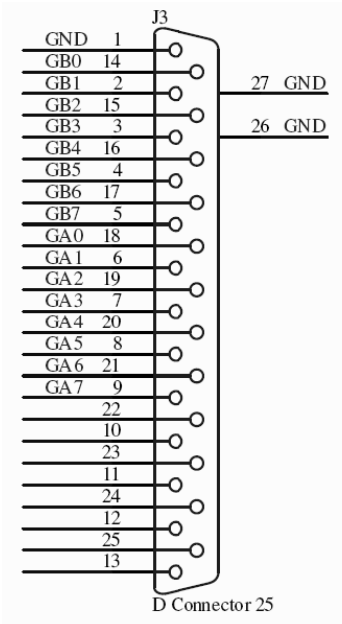
- Internal Speaker, which is switched ON / OF according to alarm logic settings of UDS 3-5 Pulser Receiver in the ISONIC 2005, 2006, 2007 instruments / UDS 3-6 Pulser Receiver of ISONIC 2008 Instrument
- Speaker Volume Control Wheel
- Headphone Connector
- Input / Output Control chip
- 25-pin programmable 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

9.7. 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 2008** or external screen / projector is switched OFF then switch on one or both devices

9.8. Software Upgrade

Refer to **http://www.sonotronndt.com/support.htm** in the Internet

9.9. Charging Battery

Battery of **ISONIC 2008** 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

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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^{o}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^{o}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

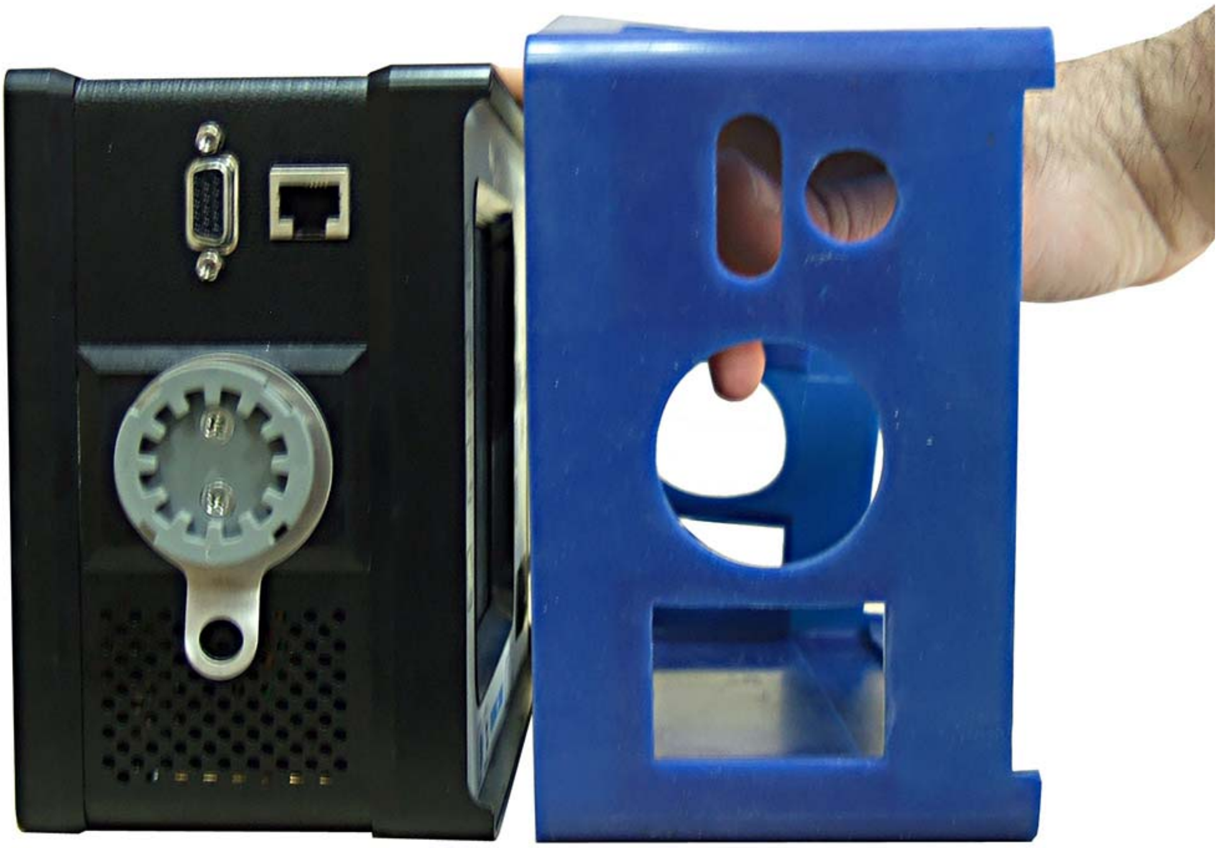
9.10. Silicon Rubber Jacket

Establishing Image:

Push the gray buttons of the handle on both sides, and rotate the handle until it is released:

Lift-up and remove the handle:

Place the Silicone Rubber Jacket so that the holes match the ports of the ISONIC machine:



Slip the Silicone Rubber Jacket around the machine until it fits properly and covers all edges:

A view from the back:

Put the handle back in position and twist it until it locks in place:

DONE!

10. 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)**