ISONIC Workstation

from Sonotron NDT

A Number of Smart Inspection Systems
In One Portable Unit

Operating Manual

Revision 8.11

The definitive best-selling presentation of ISONIC by the creator of the system

Sonotron NDT
4, Pekeris str., Rabin Science Park, Rehovot, 76702, Israel
Phone:++972-(0)8-9311000 Fax:++972-(0)8-9477712

Sonotron NDT
4, Pekeris str., Rabin Science Park, Rehovot, 76702, Israel
Phone:++972-(0)8-9477701 Fax:++972-(0)8-9477712
http://www.sonotronndt.com

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 / ISONIC 2001

Ultrasonic Testing and Defect Recording Workstation and Accessories

The products identified above comply with the requirements of the 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

Accredited by the RvA
ISO-9001 REGISTERED FIRM
DNV Certification B.V., THE NETHERLANDS

Sonotron NDT

4, Pekeris str., Rabin Science Park, Rehovot, 76702, Israel
Phone:++972-(0)8-9477701 Fax:++972-(0)8-9477712
http://www.sonotronndt.com

Declaration of Compliance

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

ISONIC / ISONIC 2001

Ultrasonic Testing and Defect Recording Workstation and Inspection and True To Location Defects Imaging Software Packages

The products identified above comply with the requirements of the following rules:

- ASME Section I – Rules for Construction of Power Boilers
- ASME Section VIII, Division 1 – Rules for Construction of Pressure Vessels
- ASME Section VIII, Division 2 – Rules for Construction of Pressure Vessels. Alternative Rules
- ASME Section VIII Article KE-3 – Examination of Welds and Acceptance Criteria
- ASME Code Case 2235 Rev 6 – Use of Ultrasonic Examination in Lieu of Radiography

DNV

Accredited by the RvA

ISO-9001 REGISTERED FIRM

DNV Certification B.V., THE NETHERLANDS

UKAS 001

FCC Rules

This **ISONIC / ISONIC 2001** workstation (hereinafter called **ISONIC / ISONIC 2001**) 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 / ISONIC 2001** 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 system, the user must make sure to comply with any hints and warnings included in this manual

Depending on the power supply you ordered the **ISONIC / ISONIC 2001** 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 / ISONIC 2001** 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 system is to be set up must be in accordance with IEC requirements
- The system must be operated in accordance with the instructions
- Any expansions to the system must comply with the legal requirements, as well as with the specifications for the unit concerned
- Confirm the rated voltage of your **ISONIC / ISONIC 2001** 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 / ISONIC 2001** and a properly grounded outlet /only protection class I/
- Do not connect the **ISONIC / ISONIC 2001** 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 system 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 system 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 / ISONIC 2001**
- Do not put the **ISONIC / ISONIC 2001** in direct sunlight, near a heater, or near water. Leave space around the **ISONIC / ISONIC 2001**
- Disconnect the power cord whenever a thunderstorm is nearby. Leaving the power cord connected may damage the **ISONIC / ISONIC 2001** or your property

- When positioning the system unit, monitor, and keyboard, 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 monitor screen as glare, and that the 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 12 V is not allowed for the **ISONIC 2001** unit
- The voltage of the External DC Power Supply above 24 V is not allowed for the **ISONIC 2001** unit
- If the voltage supplied by the external DC Power supply is between 12 V and 19 V then the use of the internal battery inside the **ISONIC 2001** unit is not allowed. Oppositely it may damage the circuits controlled the internal battery charge / discharge and temperature monitoring, causing further internal battery overheating and destroying
- Charge of the internal battery either inside the **ISONIC 2001** unit or outside is allowed only with use of the AC/DC converters / chargers supplied along with the unit or authorized by Sonotron NDT
- Charge of the internal battery inside the **ISONIC 2001** unit is not allowed if the unit is suited with the soft carrying case

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 / ISONIC 2001 is a software controlled inspection device. Based on present state of the art, software can never be completely free of faults. **ISONIC / ISONIC 2001** 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 / ISONIC 2001**, please contact your local Sonotron NDT representative

1. Introduction

ISONIC is the computerized workstation for ultrasonic non-destructive testing and defects recording. The main features of the **ISONIC** are:

Fully objective acquisition, storing and representing of the ultrasonic inspection data observed through

- Mechanics-free monitoring and imaging of the location and orientation of the probe manually manipulated over the object under test (X,Y,Z coordinates and swiveling angle)
- Monitoring and imaging of the coupling degree for the probe manually manipulated over the object under test
- Creating of the background image of the scanning plan in accordance with the dimensions of object under test and necessary coverage
- Creating the background image of the inspected volume (projection views or 3D)
- Imaging of the actual scanning performance and testing integrity
- Receiving, recording and real time processing of the signals
- Real time imaging of the defects either projection views or 3D
- Observing the unique Defects Outlining Technology (DOT) while scanning manually
- On the spot creating and storing of the fully objective inspection data files
- Measuring and sizing defects

Intelligent postprocessing of the stored inspection data provided by

- Generating of the fully objective Inspection Report
- Interactive off-line evaluation of the stored defects at the different sensitivity thresholds
- Filtering and zooming of the stored images

ISONIC meets the requirements of ASME Code Case 2235 Rev 6 “Use of Ultrasonic Inspection in Lieu of Radiography”

<u>**ISONIC** Implementation</u>:

- ♦ PC based (**ISONIC**) – the workstation on board of the industrial host computer either Lap Top or Desk Top

- ♦ Portable (**ISONIC 2001**) – the workstation styled as portable flaw detector with the original all purpose extra miniature PC on board

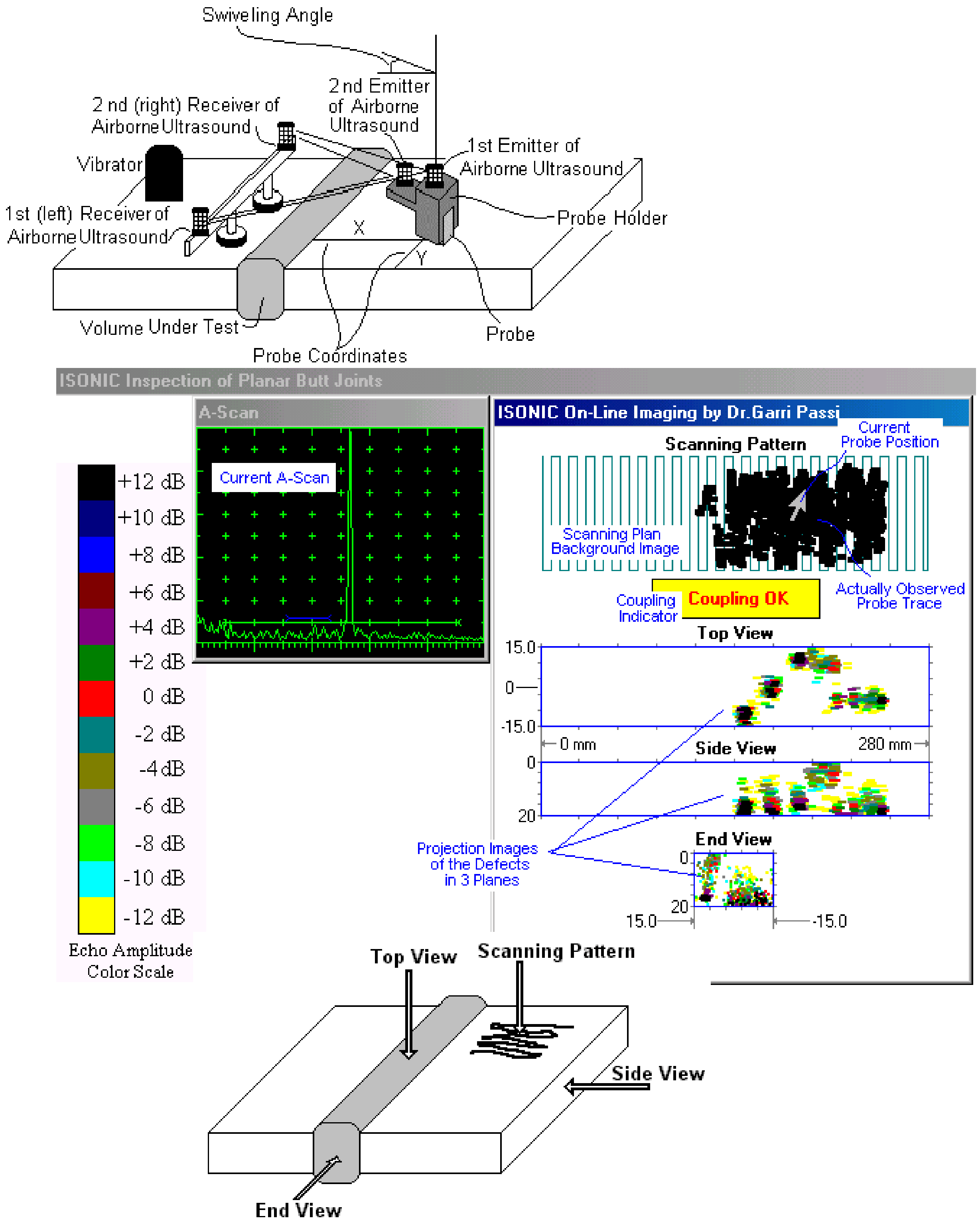
Note: the Laptop based units are still in the field but not in production since 2002. The Desktop based units are manufactured as per special orders

2. Principles of Operation and Technical Data Sheet

2.1. Principles of Operation

The principles of the **ISONIC** operation are explained with reference to the below picture illustrating:

- a planar butt weld
- the typical setup to perform the angle beam pulse echo inspection of this weld through the scanning above the adjacent material from one side
- the corresponding **ISONIC instrument** screenshot taken during the entire scanning



- **ISONIC instrument** generates the *background images* of the
    - Scanning Plan
    - Top View
    - Side View
    - End View

  related to the inspected volume - the images are stipulated by the dimensions of the said volume and by the number of the suitable parameters such as *Scan Index*, *Skip Distance*, *Probe Angle*, etc.

- The typical angle beam probe (search unit) is clamped into the probe holder, which is a *hand held implement* for manipulation by an operator

- The operator grips probe holder and applies probe to the object under test then manipulates it over the scanning area

- **ISONIC instrument** transmits the ultrasonic pulses toward the volume under test, detects signals reflected there from via the probe, and measures the received signals

- There are two emitters of airborne ultrasound equipping the probe holder. There are two receivers of airborne ultrasound placed on the object under test; said receivers detect the emitters' pulses. **ISONIC instrument** determines the probe coordinates and swiveling angle through the detected travel time of airborne ultrasound

- Vibrator emits the low frequency noise into the object under test. The low frequency noise saturating the volume of the object under test is available for pick up by the probe at any point of the scanning area. **ISONIC instrument** determines the coupling degree through the measuring level of the received low frequency noise

- **ISONIC instrument** images the actually observed probe trace through the on-line correlating between the current coupling degree and the probe coordinates and swiveling angle. The image of the actually observed probe trace represents the *testing integrity*

- On the said *testing integrity image* **ISONIC instrument** continuously generates the perceptible marks corresponding to the current coupling degree and the probe location and swiveling angle

- **ISONIC instrument** generates and records the projection images of the defects in 3 planes through the on-line correlating between the signals received by the probe from the volume under test, the probe coordinates and swiveling angle, and the coupling degree

- **ISONIC instrument** provides the recording, storing and off-line representing, postprocessing and documentation for all above data

2.2. Technical Data Sheet

2.2.1. Special Data

Mechanics Free Airborne Ultrasound Monitoring of the Probe Position and Swiveling Angle:

Area of probe manipulation:	**≤2000×3000 mm** **≤80×120 in**	**≤500×500 mm** **≤20×20 in**	**≤200×200 mm** **≤8×8 in**
Curvature radius of the scanning surface:	**≥2000 mm** **≥40 in**	**≥200 mm** **≥8 in**	**≥37 mm** **≥1.5 in**
Scanning Speed:	**≤150 mm/s** **≤6 in/s**	**≤150 mm/s** **≤6 in/s**	**≤150 mm/s** **≤6 in/s**
Scan Index:	**1 to 20 mm** controllable in **1 mm** step	**1 to 20 mm** controllable in **1 mm** step	**0.25 mm; 0.5 mm** or **1 to 20 mm** controllable in **1 mm** step
Resolution for the determining of probe coordinates:	**≥1 mm** **≥0.04 in**	**≥1 mm** **≥0.04 in**	**≥0.25 mm** **≥0.01 in**
Resolution for the determining of probe swiveling angle:	**-**	**1°**	**0.5°**
Range of the probe swiveling:	**-**	**±90°**	**±90°**
Immunity to the ambient noise:	**≤60 dB**	**≤60 dB**	**≤60 dB**
Skip Distance Range – angle beam weld inspection applications:	**0.5 to 2 skips** controllable in **0.5 skip** step	**0.5 to 2 skips** controllable in **0.5 skip** step	**0.5 to 2 skips** controllable in **0.5 skip** step

Coupling Monitor for Any Kind of Ultrasonic Probe:

Resolution **≥0.5 dB**

Scanning Speed **≤150 mm/s // ≤6 in/s**

Monitoring of the Testing Integrity:

Background imaging of the scanning plan

Recording and imaging of the actual probe trace (testing integrity)

Generating perceptible marks corresponding to the current coupling degree, probe position and swiveling angle whilst scanning

Interrupting the recording and imaging of the actual probe trace on missing coupling and/or probe position and swiveling angle

Defects Imaging

Inspection:	Angle Beam	Straight Beam
Image Type (depending on Application):	• **B-Scan** • **C-Scan** • **D-Scan** • **P-Scan** • **TOFD**	• **B-Scan** • **D-Scan** • **C-Scan** • **P-Scan**
Width of the Volume under test:	**5 to 300 mm** controllable in **1 mm** resolution – expandable /// **0.2 to 12 in** controllable in **0.01 in** resolution - expandable	**50 to 2000 mm** controllable in **1 mm** resolution – expandable /// **0.2 to 80 in** controllable in **0.01 in** resolution – expandable
Thickness of the Volume under test:	**5 to 300 mm** controllable in **1 mm** resolution – expandable /// **0.2 to 12 in** controllable in **0.01 in** resolution - expandable	**0.5 to 300 mm** controllable in **0.1 mm** resolution – expandable /// **0.02 to 12 in** controllable in **0.01 in** resolution - expandable
Image Resolution:	**0.5 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB** /// **0.02 in × 0.02 in × 0.5 • Scan Index × ≤2dB**	**0.2 mm × 0.5 mm × 0.5 • Scan Index × ≤2dB** /// **0.01 in × 0.02 in × 0.5 • Scan Index × ≤2dB**
Resolution for the Dynamic Tuning of the Gate Delay / Width:	**0.01 µs** over whole volume	not necessary
Imaging Protocol:	• **Raw data** • **SAFT** • **TOFD** • **Custom**	• **Raw data** • **SAFT** • **Custom**
Standard Color Scale (Palette):	• **Pseudo Color** • **Gray** • **Thermal**	• **Pseudo Color** • **Gray** • **Thermal**
User Defined Color Scales:	**≤2^{32} colors**	**≤2^{32} colors**
Coloring Protocol:	• **Linear** • **TCG Normalizing** • **DAC Normalizing** • **DGS Normalizing** • **Custom**	• **Linear** • **TCG Normalizing** • **DAC Normalizing** • **Custom**

Inspection Report File / Printout:

Pre Inspection Data – **description of the object under test, scope of the test, calibration dumps, etc.**

Main Inspection Data – **testing integrity evidence (Scanning Pattern), the defects images and the parameters of the inspection procedure**

Communicating to the Central Office PC:

Internet / Ethernet communicating to the Office PC:
- **Off-Line**
- **Real Time transaction of the Defects, Testing Integrity Images and Signals (while scanning) accompanied with the calibration dump – IP Protocol (option)**

Postprocessing:

3D - defects measuring and sizing

Comprehensive Kit of the Image Processing Features

2.2.2. General Data

Ultrasound Velocity:	**300 to 20000 m/s** controllable in **1 m/s** resolution - expandable **11.81 to 787.4 in/ms** controllable in **0.1 in/ms** resolution – expandable
Probe Angle:	**0…90°** controllable in **1°** resolution
Probe Delay:	**0 to 70 µs** controllable in **0.01µs** resolution - expandable
Angle Probe X-value:	**0 to 50 mm** controllable in **1 mm** resolution – expandable **0 to 2 in** controllable in **0.01 in** resolution – expandable
On-Board Computer for ISONIC 2001 at least:	**Pentium – 300MHz, 128M RAM, 10G HDD**
Host Computer for the industrial Desk Top implementation at least:	**Pentium III – 500 MHz, 128M RAM, 30G HDD**
Operating System:	**Windows™-98 SE or higher**
Interfaces:	**LAN (Ethernet), COM, LPT**
Screen:	**super VGA, 640X480, High Color Resolution (32 bit), Sun-readable**
Controls:	**All Functional Sealed PC Keyboard, Mouse Pointer, Touch Screen**
Powering:	**100 – 240 VAC, 40 – 70 Hz, auto-switch; 12 – 24 VDC; Internal Battery**
Dimensions:	**265X157X300 mm /// 320X190X300 mm with the handle**
Weight:	≤ **6.5 kg with the battery**

2.2.3. UDS3-3 – ISONIC Pulser Receiver (Internal Flaw Detector Card) – Technical Data Sheet (obsolete since Sep 1, 2004)

Pulser

Pulse Type:	**Negative Spike Pulse**
Initial Transition:	**≤5 ns** (**10-90%**)
Pulse Amplitude:	**– 140 to – 210 V into 50 Ω** **– 170 to – 310 V into 250 Ω**
Pulse Duration:	**10 to 70 ns** for **50 Ω** load depending on **Energy** and **Damping**
Energy:	**4 discrete energy values** / **12 μJ** (min) to **120 μJ** (max)
Modes:	**Single / Dual**
Damping:	**16 discrete resistances values / 24.7 Ω** min to **333 Ω** max
PRF:	**0 ... 5000 Hz** controllable in **1 Hz** step
Sync Output / Input:	Max **+5V**, **τ ≤ 5 ns, t ≥100 ns, Load Impedance ≥ 50 Ω** **Software Controlled Sync Feature**

Receiver

Gain:	**0...110 dB** controllable in **0.5 dB** or coarser steps
Advanced Low Noise Design:	**93 μV** peak to peak input referred **80 dB** gain / **35 MHz** bandwidth
Frequency Band:	**0.001 … 35 MHz** Wide Band / 15 Sub Bands:

0.001 – 35 MHz	**0.001 – 25 MHz**	**0.001 – 15 MHz**	**0.001 – 10 MHz**
0.3 – 35 MHz	**0.3 – 25 MHz**	**0.3 – 15 MHz**	**0.3 – 10 MHz**
1 – 35 MHz	**1 – 25 MHz**	**1 – 15 MHz**	**1 – 10 MHz**
5 – 35 MHz	**5 – 25 MHz**	**5 – 15 MHz**	**5 – 10 MHz**

Display:	**RF** **Rectified: Full Wave / Negative or Positive Half Wave** **Signal's Spectrum (FFT)**
Reject:	**0 ... 99 %** of screen height controllable in **1%** resolution
Absolute Sensitivity:	**120 dB**
DAC / TCG:	**Available for both Rectified and RF Display**
DAC / TCG Dynamic Range:	**40 dB**
DAC / TCG Slew Rate:	**160 dB/μs**
Range:	**0.5 ... 3000 μs -** controllable in **0.01 μs** resolution
Delay:	**0 ... 3200 μs -** controllable in **0.01 μs** resolution

Other Features:

DAC Capacity:	≤ **40 points**
DGS Support:	**Standard Library for 18 probes** / unlimitedly expandable
Gates:	**2 Independent Gates** / unlimitedly expandable
Gate Start and Gate Width:	**Controllable over whole Delay / Range Variety** in **0.1 mm** /// **0.001 in** resolution Drag and Drop setup supported
Gate Threshold:	**5** to **95 %** of the A-Scan height controllable in **1 %** resolution Drag and Drop setup supported
Measure Functions – Digital Display readout:	**27 automatic functions** / expandable
Freezing and Zooming:	**A-Scans** **Spectrum Graphs**
Storing Capacity:	**Practically Unlimited (at least 1,000,000 sets)** including the ❑ **Calibrations** ❑ **A-Scans** ❑ **Spectrum Graphs**
Data Reporting:	**Printing Out (hard copy):** ❑ **Calibrations** ❑ **A-Scans** ❑ **Spectrum Graphs** **Internet / Ethernet communicating to the Office PC:** **Real Time transaction of the current A-Scan or Spectrum Graph** **Along with the calibration dump (option)**

2.2.4. UDS3-4 – ISONIC Pulser Receiver (Internal Flaw Detector Card) – Technical Data Sheet

Pulser

Pulse Type:	**Positive Spike Pulse / Positive Square Pulse**	
Initial Transition:	**≤5 ns (10-90%)**	
Pulse Amplitude:	**Spike Pulse**	**Square Pulse**
	200 to 500 V into 1000 Ω **200 to 500 V into 500 Ω** **200 to 500 V into 250 Ω** **180 to 400 V into 75 Ω** **150 to 320 V into 50 Ω**	**400 V into 1000 Ω** **400 V into 500 Ω** **400 V into 250 Ω** **400 V into 75 Ω** **400 V into 50 Ω**
Pulse Duration:	**10 to 70 ns** for **50 Ω** load depending on **Energy** and **Damping**	**65 to 600 ns** controllable in **5ns** step
Energy:	**4 discrete energy values** / **40 μJ** (min) to **250 μJ** (max)	
Modes:	**Single / Dual**	
Damping:	**21 discrete resistances values / 13 Ω** min to **1000 Ω** max	
Internal Matching Coil – Probe Impedance Matching:	**16 discrete inductivity values / 2 μH** min to **78 μH** max	
PRF:	**0 ... 5000 Hz** controllable in **1 Hz** resolution	
Sync Output / Input:	Max **+5V**, **τ ≤ 5 ns, t ≥100 ns, Load Impedance ≥ 50 Ω** **Software Controlled Sync Feature**	

Receiver

Gain: **0...120 dB** controllable in **0.5 dB** or coarser steps

Advanced Low Noise Design: **93 μV** peak to peak input referred **80 dB** gain / **35 MHz** bandwidth

Frequency Band: **0.35 … 35 MHz** Wide Band / 34 Sub Bands:

Bandpass

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

Resonant

0.5 ± 0.15 MHz
1 ± 0.3 MHz
2 ± 0.6 MHz
4 ± 1.2 MHz
10 ± 3 MHz
15 ± 4.5 MHz

Display:	**RF** **Rectified: Full Wave / Negative or Positive Half Wave** **Signal's Spectrum (FFT)**
Reject:	**0 ... 99 %** of screen height controllable in **1%** step
Absolute Sensitivity:	**140 dB**
DAC / TCG:	**Available for both Rectified and RF Display**
DAC / TCG Dynamic Range:	**40 dB**
DAC / TCG Slew Rate:	**160 dB/μs**
Range:	**0.5 ... 3000 μs -** controllable in **0.01 μs** resolution
Delay:	**0 ... 3200 μs -** controllable in **0.01 μs** resolution

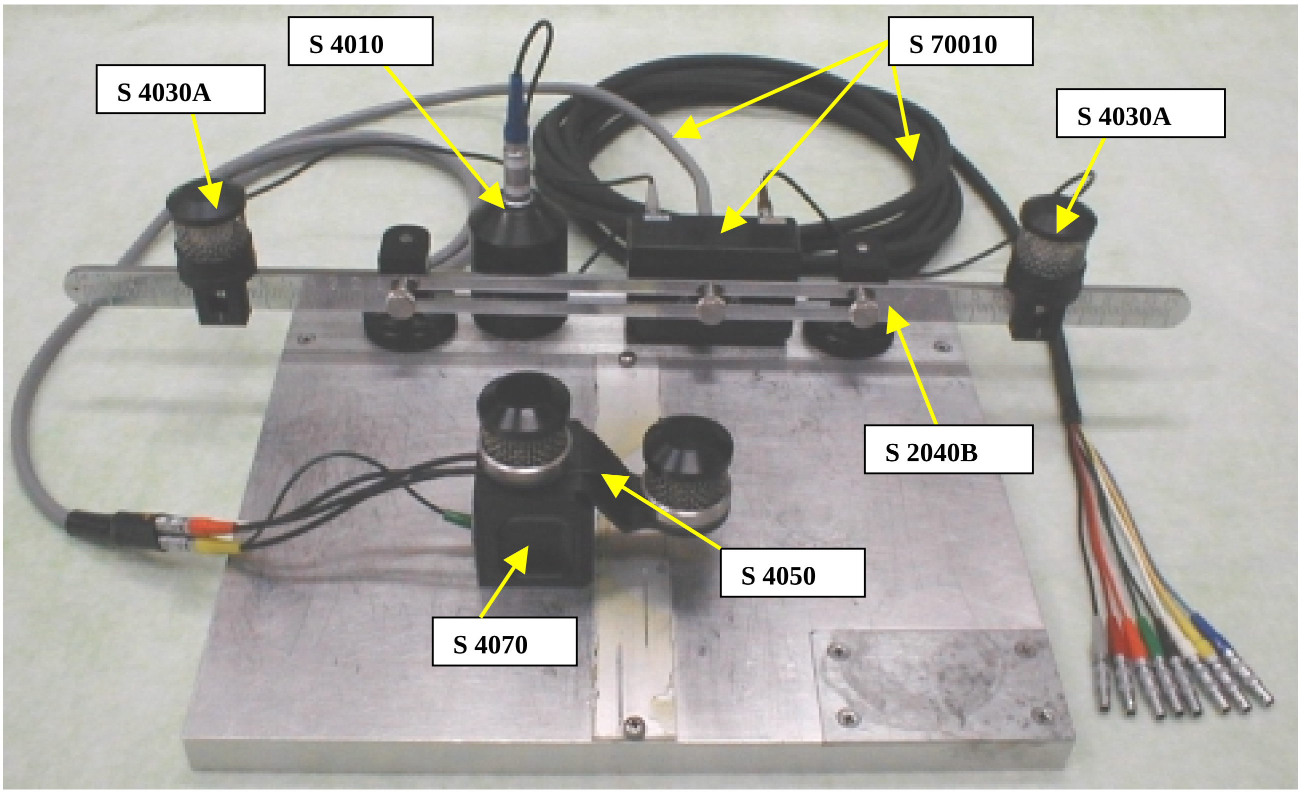
Other Features:

DAC Capacity:	≤ **40 points**
DGS Support:	**Standard Library for 18 probes** / unlimitedly expandable
Gates:	**2 Independent Gates** / unlimitedly expandable
Gate Start and Gate Width:	**Controllable over whole Delay / Range Variety** in **0.1 mm** /// **0.001 in** resolution Drag and Drop setup supported
Gate Threshold:	**5** to **95 %** of the A-Scan height controllable in **1 %** resolution Drag and Drop setup supported
Measure Functions – Digital Display readout:	**27 automatic functions** / expandable
Freezing and Zooming:	**A-Scans** **Spectrum Graphs**
Storing Capacity:	**Practically Unlimited (at least 1,000,000 sets)** including the ❑ **Calibrations** ❑ **A-Scans** ❑ **Spectrum Graphs**
Data Reporting:	**Printing Out (hard copy):** ❑ **Calibrations** ❑ **A-Scans** ❑ **Spectrum Graphs** **Internet / Ethernet communicating to the Office PC:** **Real Time transaction of the current A-Scan or Spectrum Graph** **Along with the calibration dump (option)**
Encoder Interface:	**Built In interface for the incremental one-axis mechanical encoder**

3. ISONIC Components

The example of the typical accessories accompanying the electronic unit of the **ISONIC** (**ISONIC 2001**) includes:

- Set of Acoustic Sensors for Mechanics Free Monitoring Location (X,Y,Z), Swiveling Angle and Acoustic Coupling of Manually Manipulated Ultrasonic Probe:
    - ❑ Double Emitter of Airborne Ultrasound - 1 piece (**S 4050**)
    - ❑ Single Emitter of Airborne Ultrasound - 1 piece (**S 4060**)
    - ❑ Airborne Ultrasound Receiver - 2 pieces (**S 4030A**)
    - ❑ Emitter of Acoustic Coupling Monitor Signal With Magnetic Attachment - 1 piece (**S 4010**)
    - ❑ Holder for Airborne Ultrasound Receivers with Magnetic Attachments to the Object Under Test - 1 set (**S 2040 B**)
- Holders for Standard Ultrasonic Probes with Receiver of Acoustic Coupling Monitor Signal inside:
    - ❑ Probe Holder for MWB type Ultrasonic Probes with Rear Connector - 1 piece (**S 4070**) or probe holder for any other type of ultrasonic probe
    - ❑ Probe Holder for SWB type Ultrasonic Probes with Rear Connector - 1 piece (**S 4080**) or probe holder for any other type of ultrasonic probe
- Long Single Cable System (6m) - 1 (**S 70010**)
- Carrying Case for Sensors and Accessories - 1 piece (**S 20001**)



Refer also to the *Packing List* coming with your unit

4. Operating the ISONIC

Please read the following information before you use the **ISONIC Instrument**. 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 the inspection results

4.1. Preconditions for ultrasonic testing with ISONIC

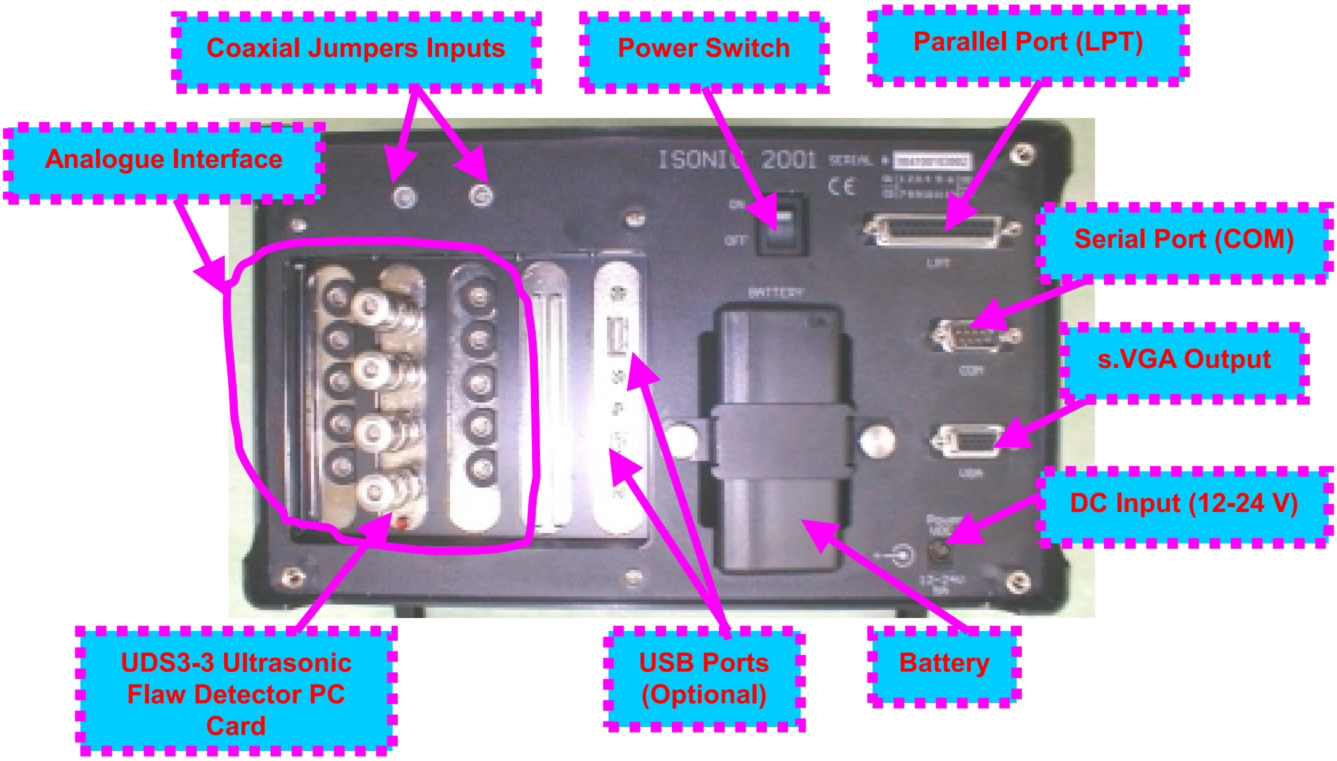
The operator of **ISONIC** must be certified as at least *Level 2 Ultrasonic Examiner* additionally having the adequate knowledge of

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

4.2. ISONIC Controls

4.2.1. ISONIC 2001

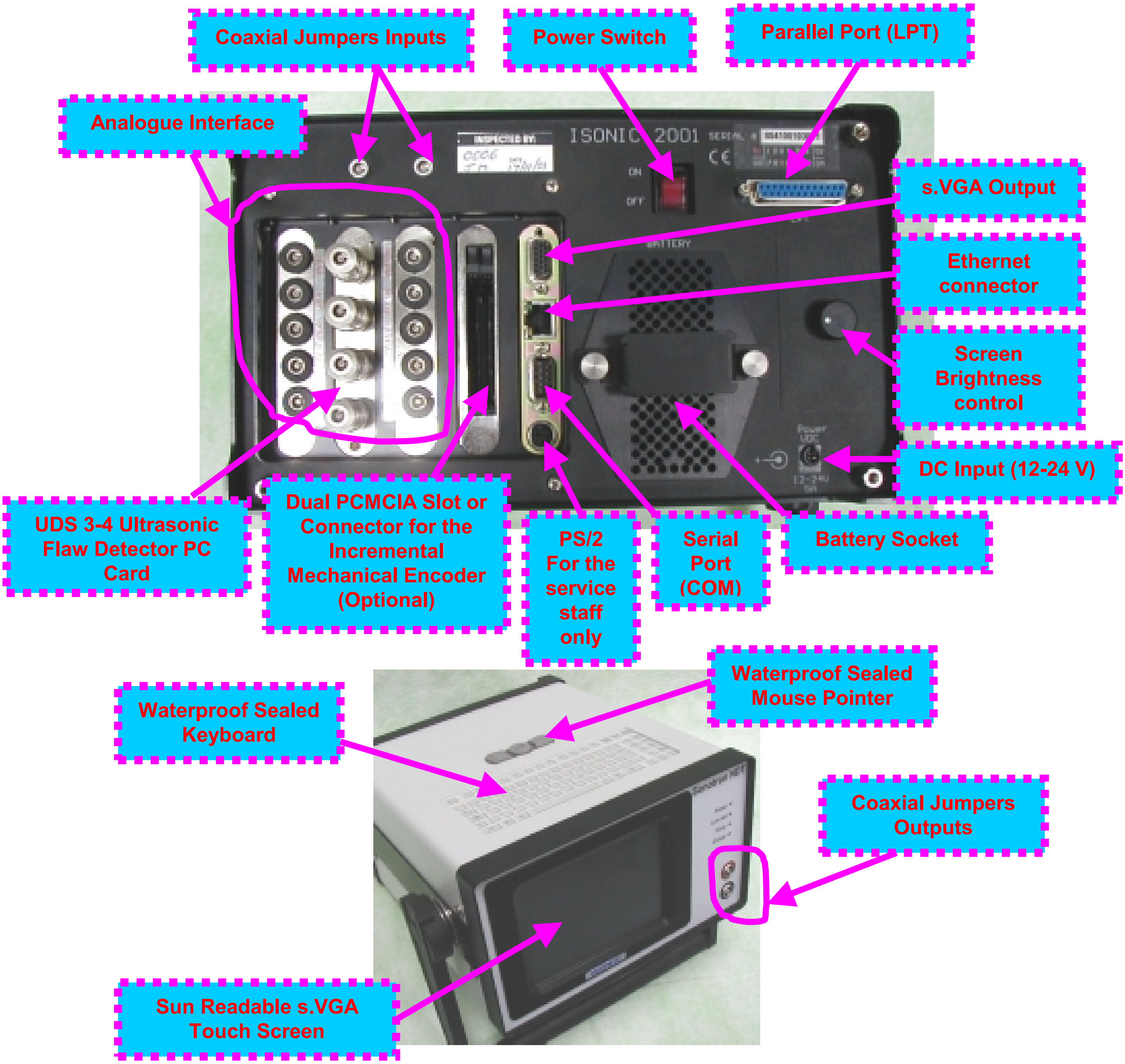
Units manufactured before May 31, 2001



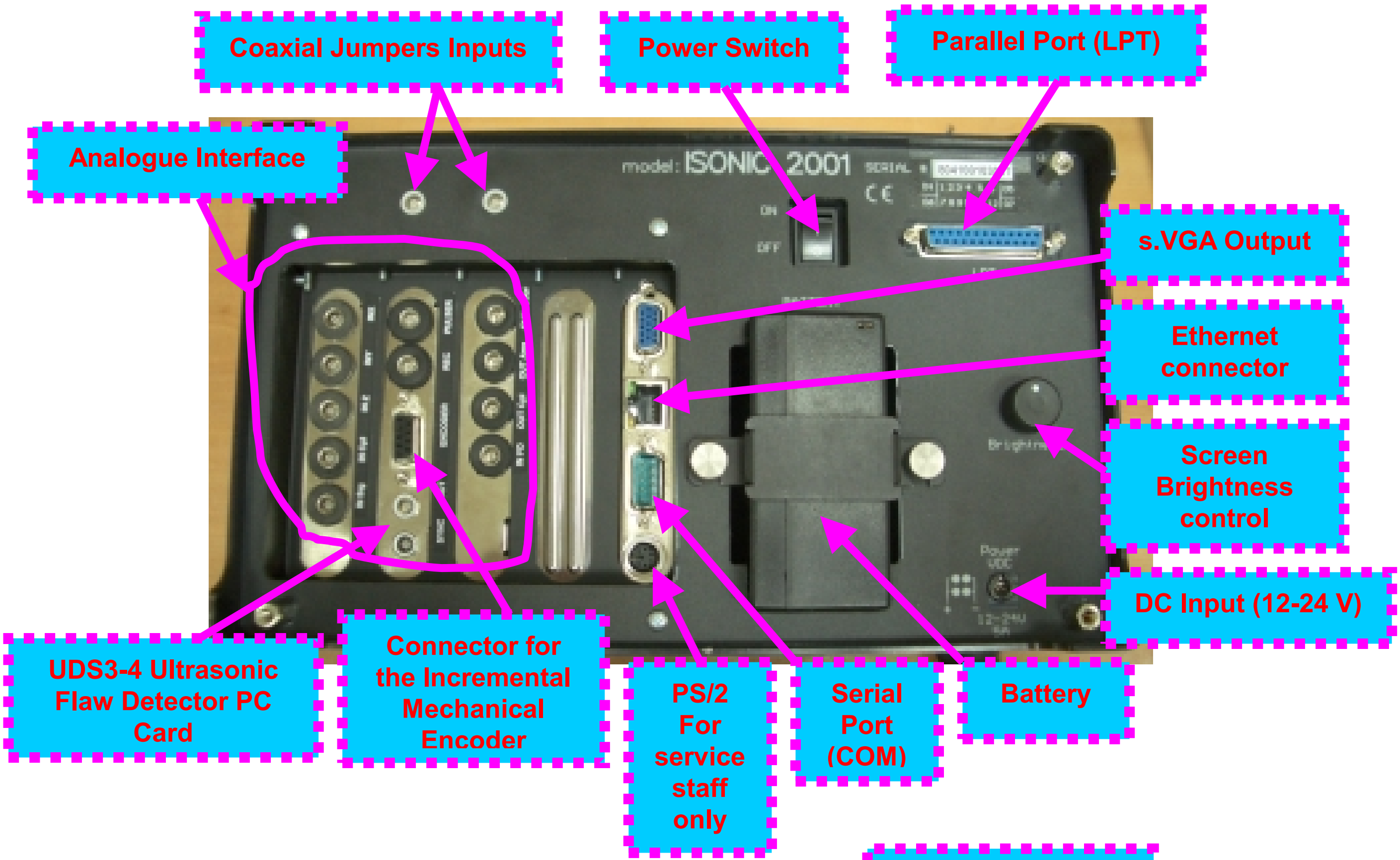
ⓘ

(a) The PCMCIA Socket replaces the UDS3-3 Card in the ISONIC 2001 (Configuration SA 80410) with USLT 2000 Ultrasonic Flaw Detector PC Card (Configuration SA 80420)
(b) Refer to the paragraphs 4.2.4 – 4.2.6 for the analogue interface cabling guide and tips

<u>Units manufactured after May 31, 2001 – UDS 3-3 Pulser Reciver Card</u>



Units manufactured after May 31, 2001 – UDS 3-4 Pulser Reciver Card



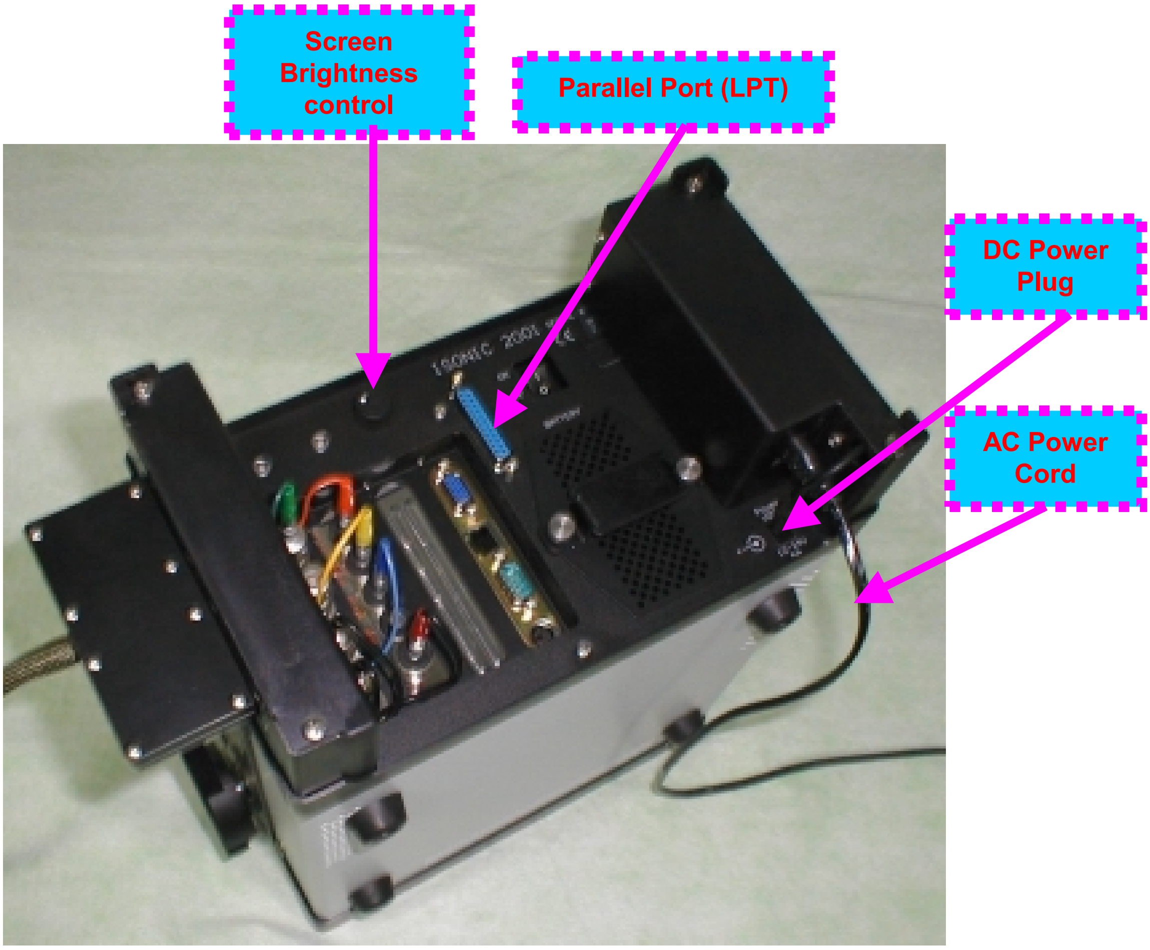
ⓘ

(a) The PCMCIA Socket replaces the UDS 3-3 or UDS3-4 Card in the ISONIC 2001 (configurations SA 80410 or SA 80430) with USLT 2000 Ultrasonic Flaw Detector PC Card (Configuration SA 80420)

(b) Refer to the paragraphs 4.2.4 – 4.2.6 for the analogue interface cabling guide and tips

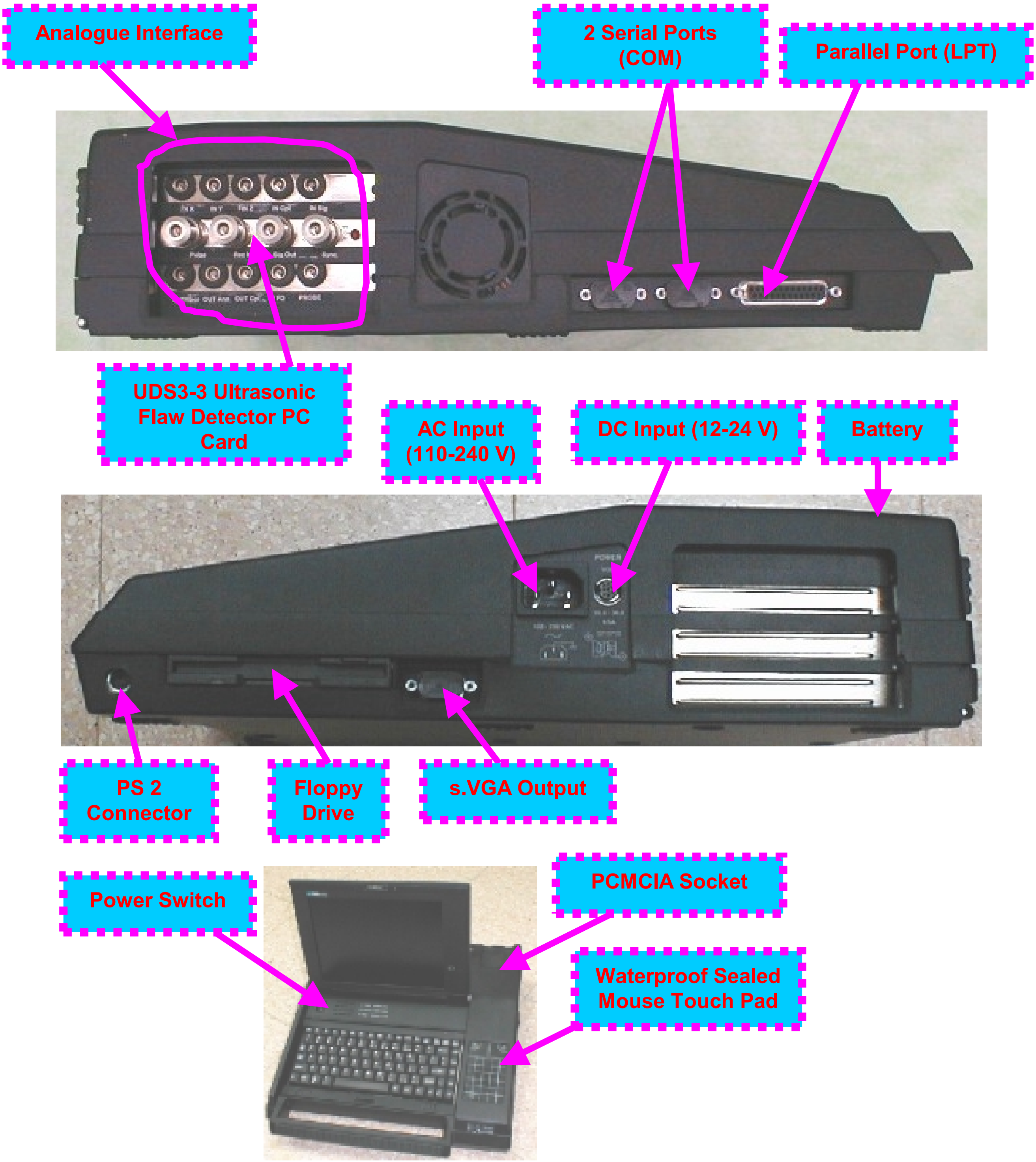
The Optional Rear Panel Commutation Box

In order to ease the rear panel commutation required for the true-to-location imaging setup variations the Rear Panel Commutation Box is available as an option (Order Code SH 98C0202 M). For the units equipped with the Rear Panel Commutation Box the positions of the Parallel Port (LPT) and Screen Brightness Control on the are different comparing to the units, which are not equipped with that box



The AC/DC converter is located inside the Rear Panel Commutation Box, which is equipped with the necessary AC power cord input. The DC Power Plug outgoing from the Rear Panel Commutation Box is connected to the DC Input as usual

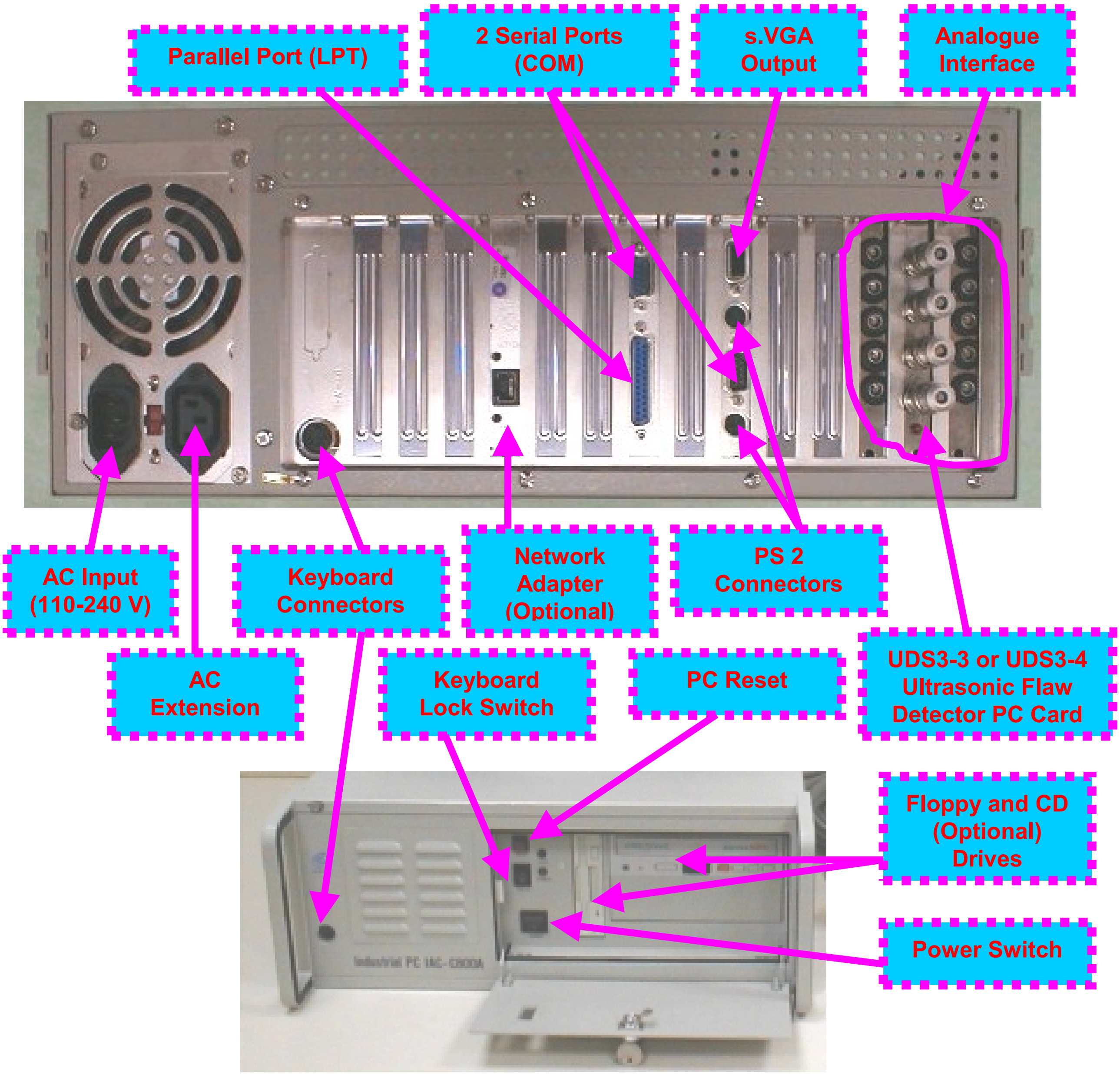
4.2.2. ISONIC Lap Top (obsolete since Dec 2001)



ⓘ

(a) The empty bracket replaces the UDS3-3 card in the ISONIC Lap Top (Configuration SA 80310) with USLT 2000 Ultrasonic Flaw Detector PC Card (Configuration SA 80320)
(b) Refer to the paragraphs 4.2.4 – 4.2.6 for the analogue interface cabling guide and hints

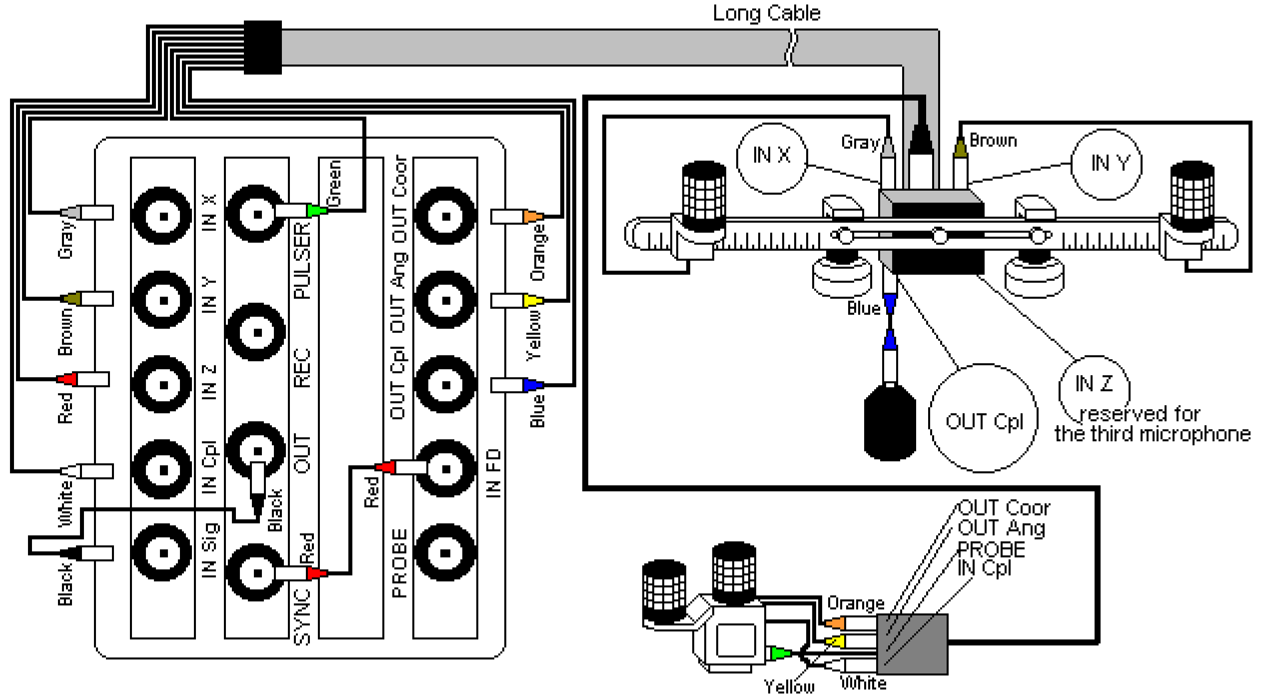
4.2.3. ISONIC Desk Top



ⓘ

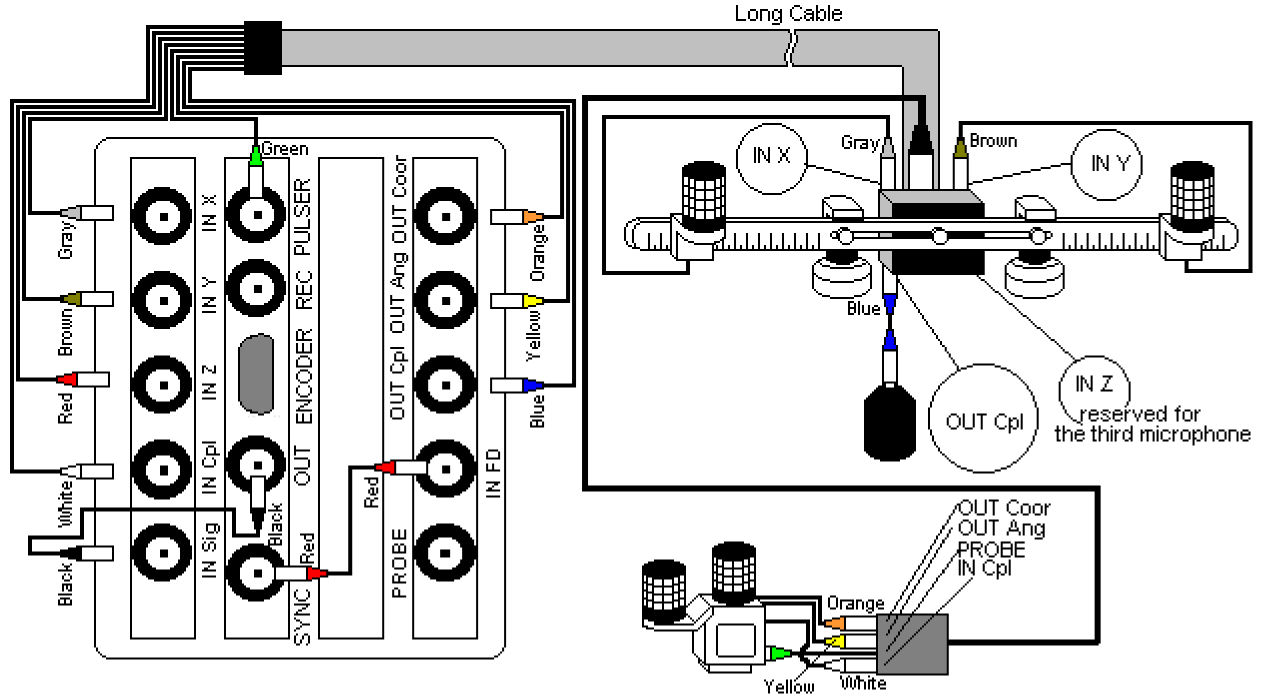
(a) The PCMCIA Socket replaces the UDS 3-3 or UDS3-4 Card in the ISONIC 2001 (configurations SA 80210 or SA 80230) with USLT 2000 Ultrasonic Flaw Detector PC Card (Configuration SA 80220)
(b) Refer to the paragraphs 4.2.4 – 4.2.6 for the analogue interface cabling guide and hints

4.2.4. Analogue Interface – Cabling Guide for the True-to-Scale Imaging with Use of the Airborne Ultrasound Probe Location



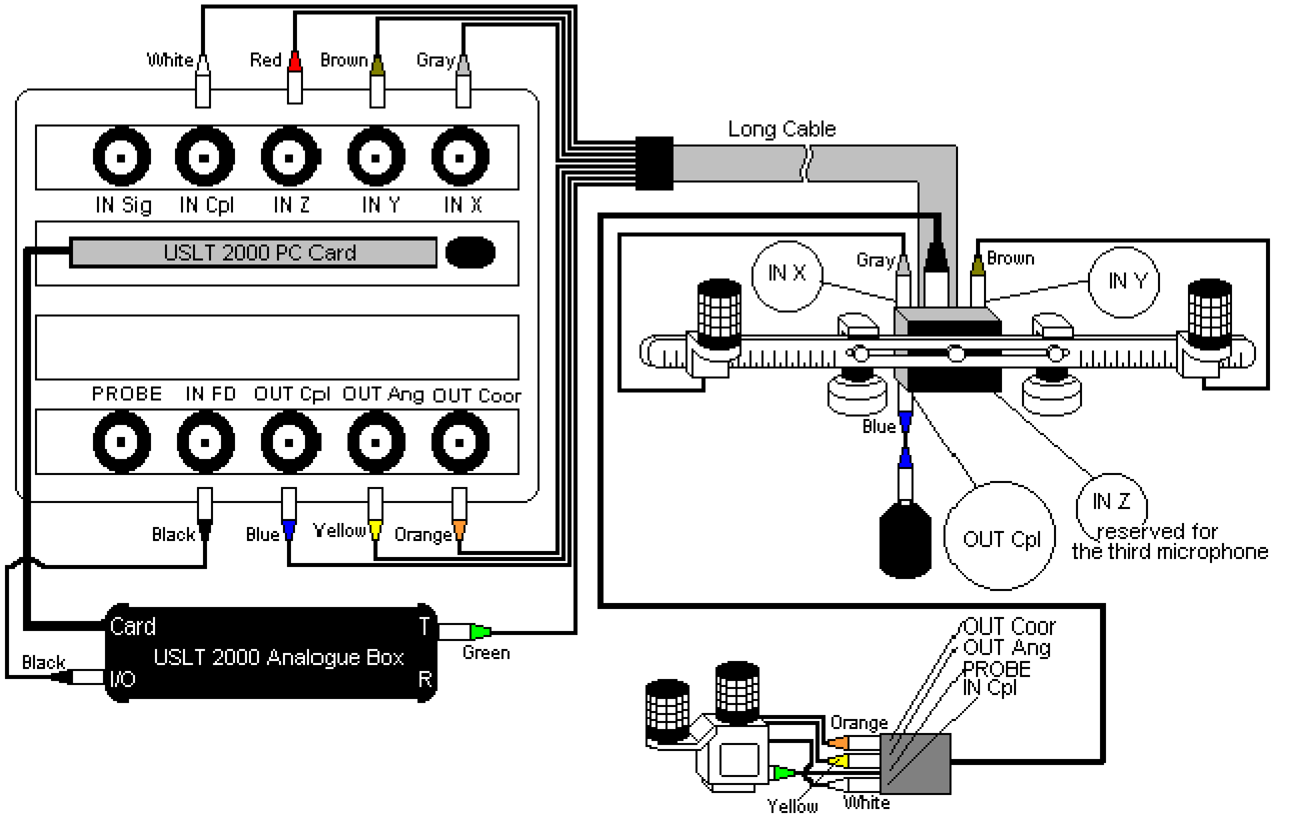
Scheme A.1: **UDS3-3** based models:

- Probe Swiveling Monitoring is active
- Use of the Single Element Probe



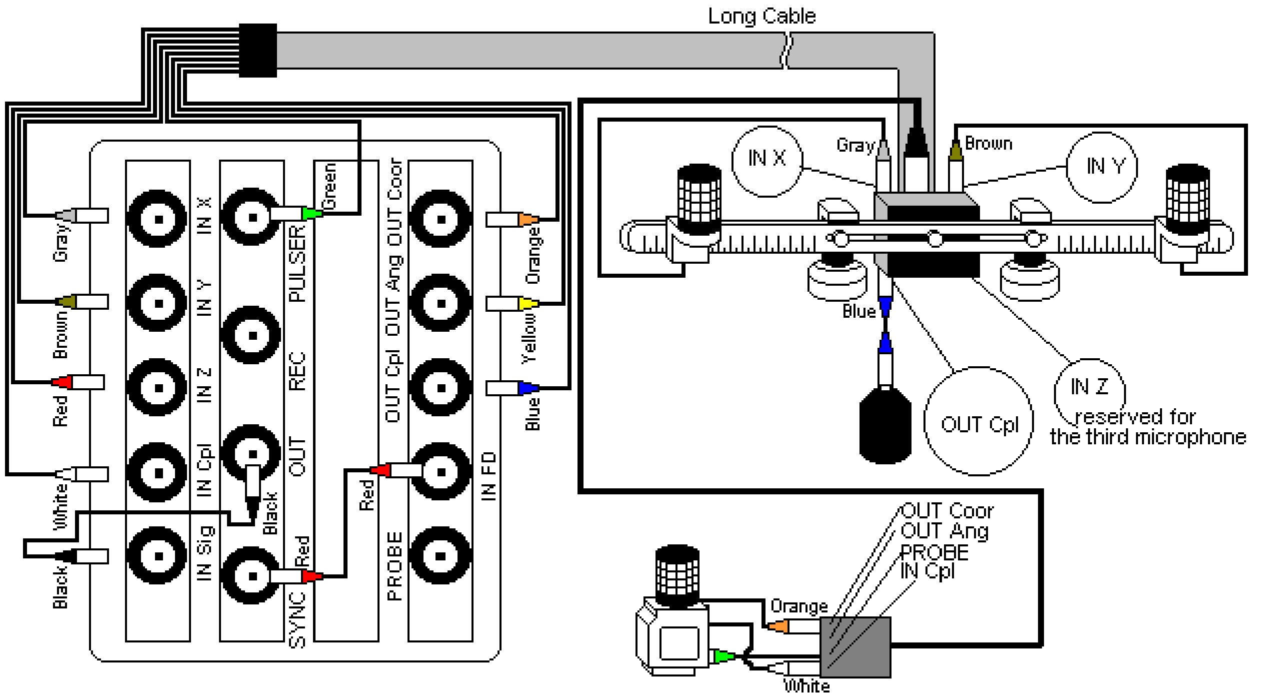
Scheme A.2: **UDS3-4** based models:

- Probe Swiveling Monitoring is active
- Use of the Single Element Probe



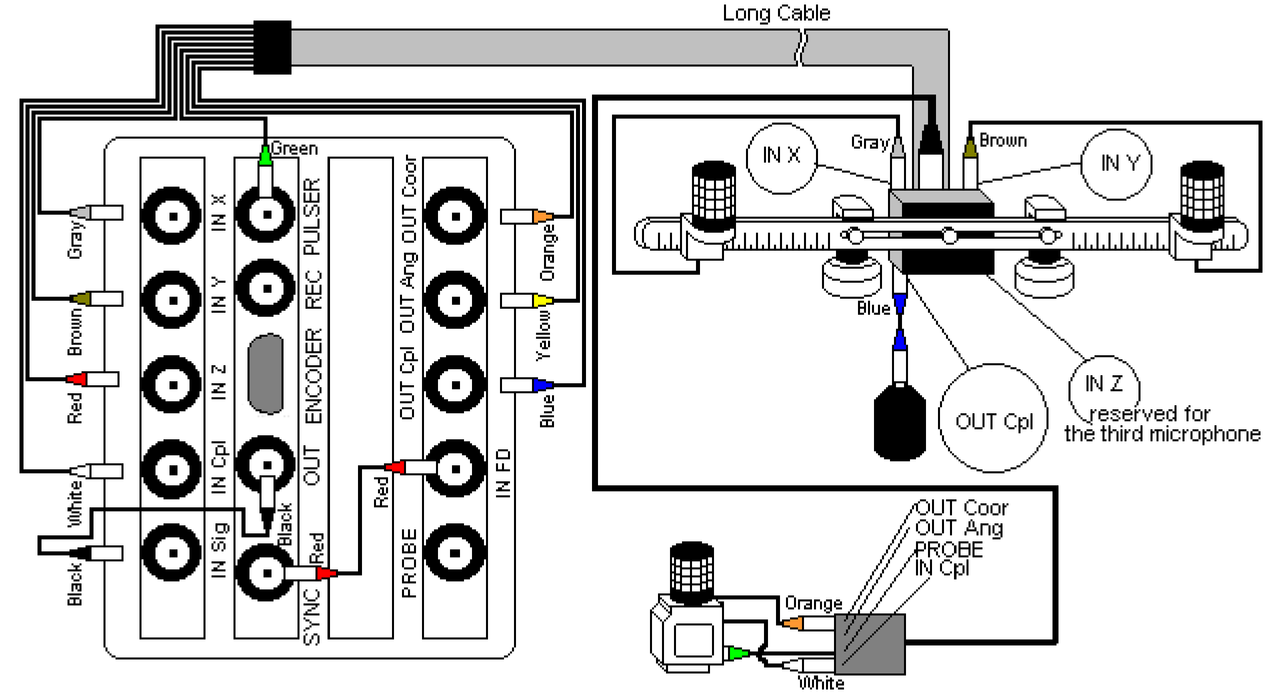
Scheme A.3: **USLT 2000** based models:

- Probe Swiveling Monitoring is active
- Use of the Single Element Probe



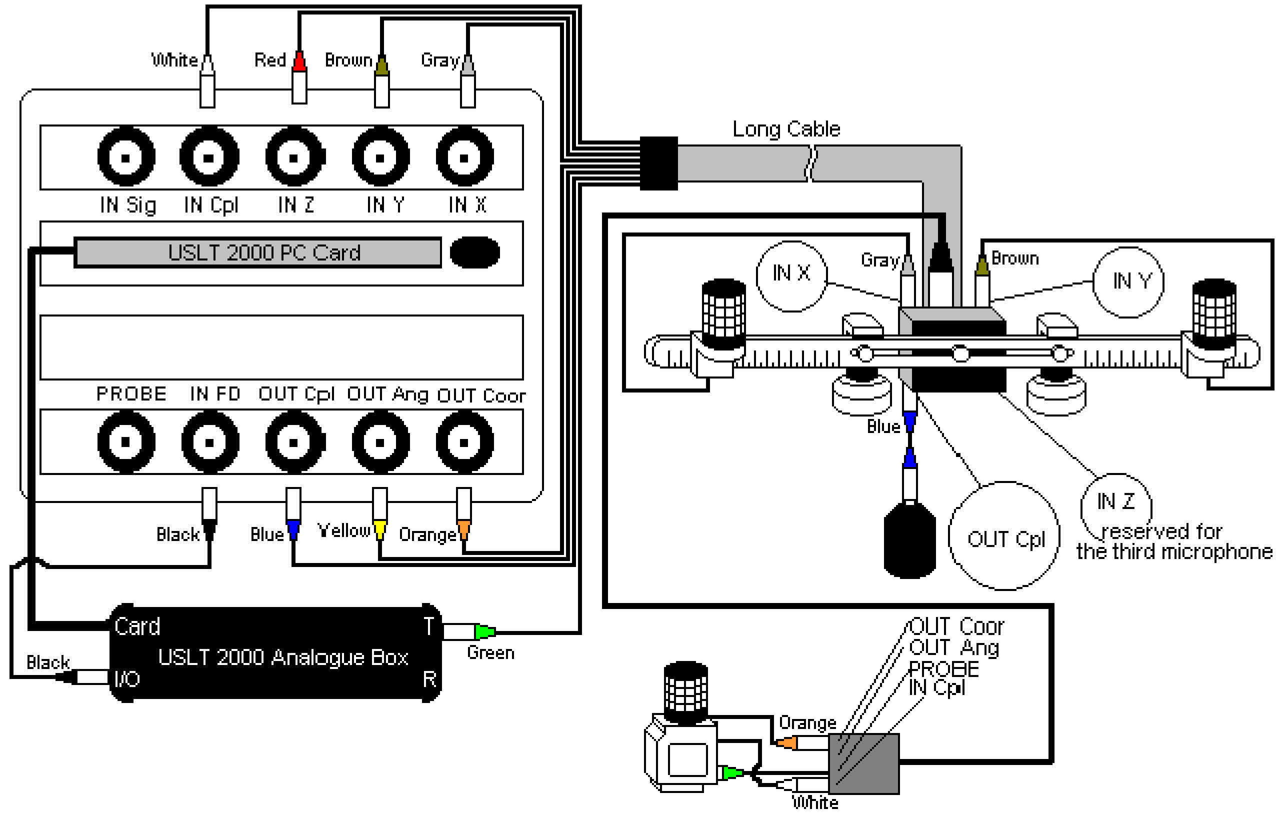
Scheme A.4: **UDS3-3** based models:

- Probe Swiveling Monitoring is not active
- Use of the Single Element Probe



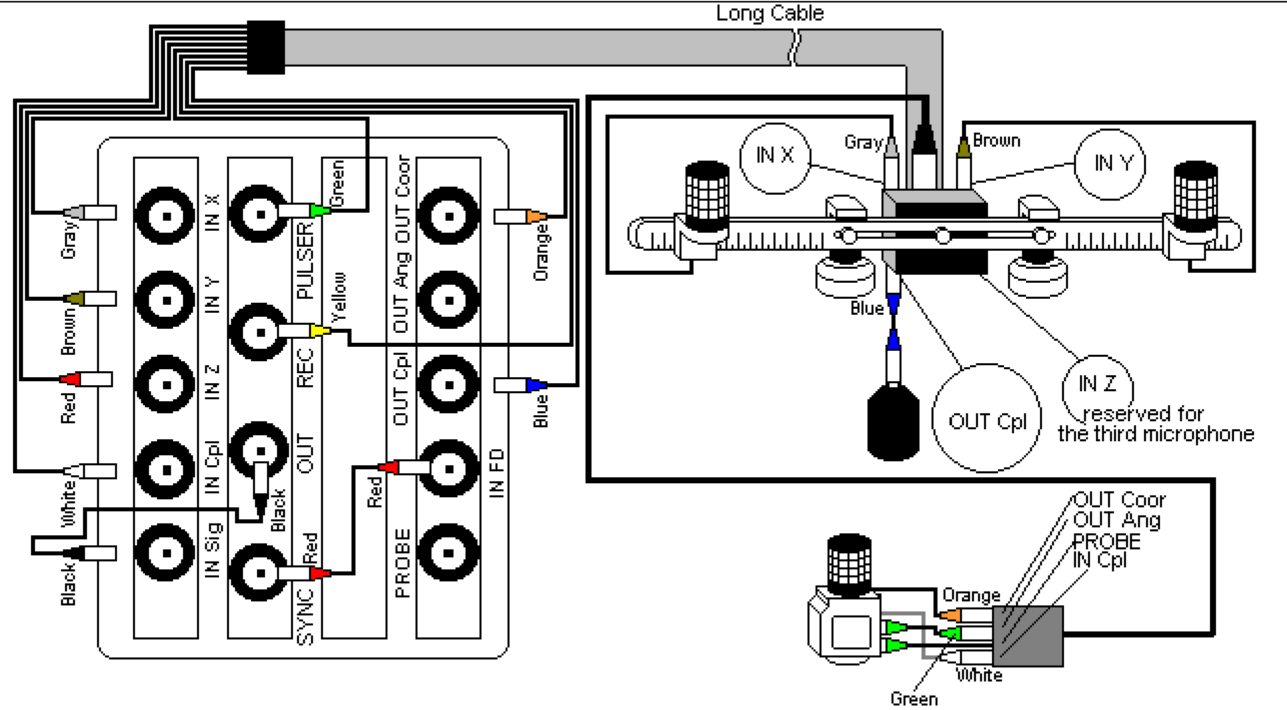
Scheme A.5: **UDS3-4** based models:

- Probe Swiveling Monitoring is not active
- Use of the Single Element Probe



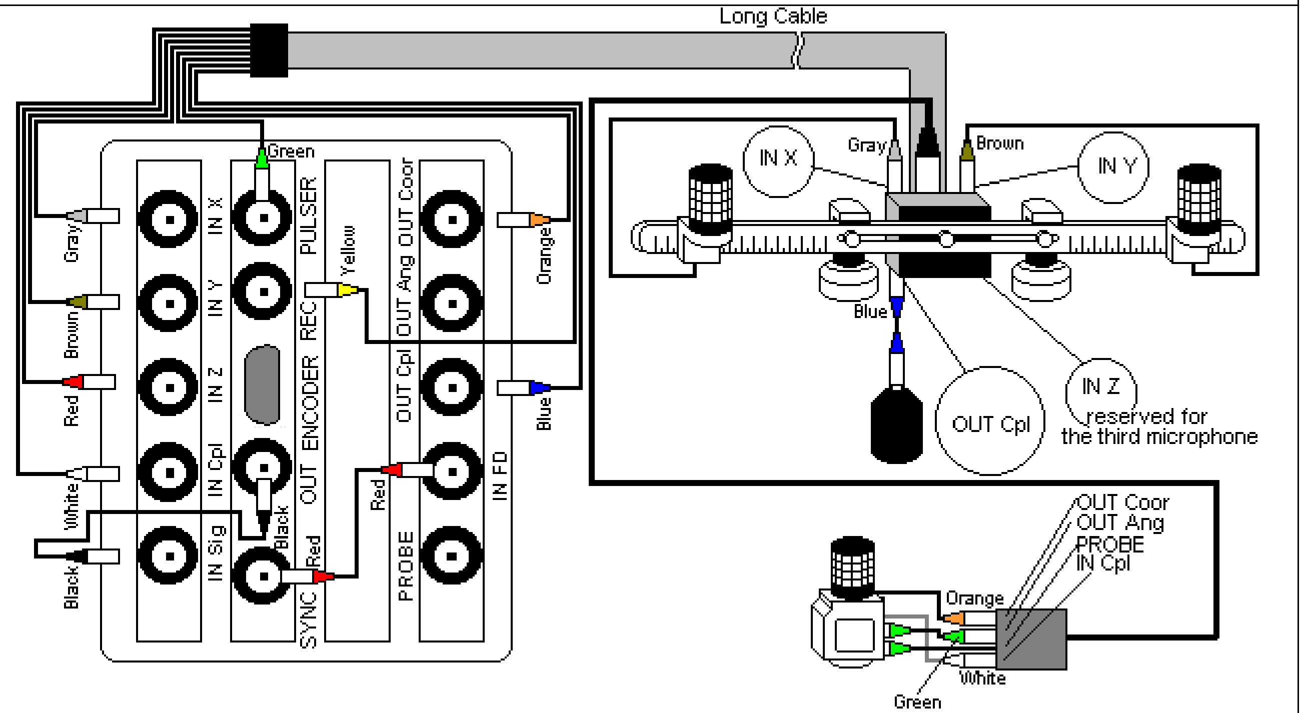
Scheme A.6: **USLT 2000** based models:

- Probe Swiveling Monitoring is not active
- Use of the Single Element Probe



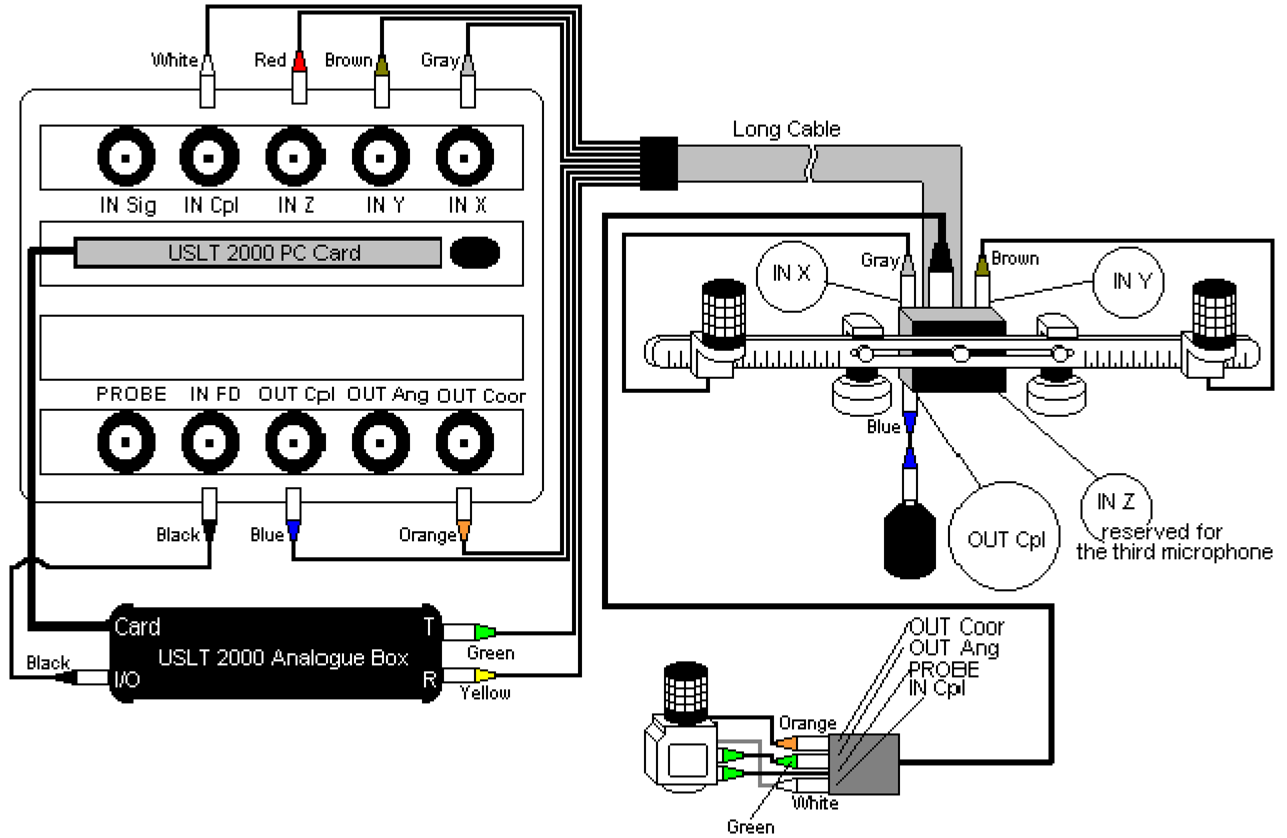
Scheme A.7: **UDS 3-3** based models:

- Probe Swiveling Monitoring is not active
- Use of the Dual Probe



Scheme A.8: **UDS 3-4** based models:

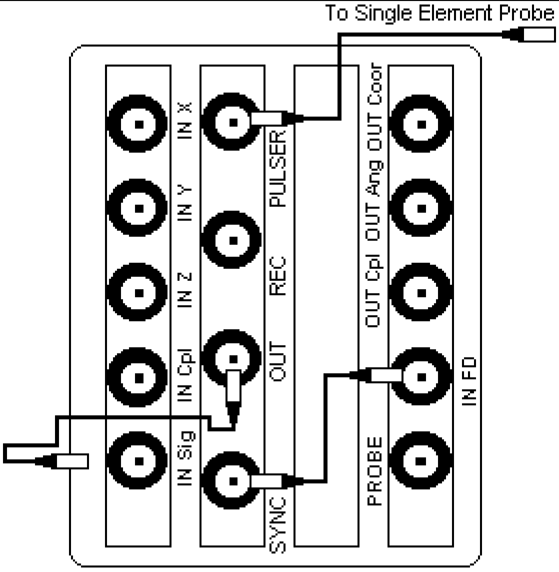
- Probe Swiveling Monitoring is not active
- Use of the Dual Probe



<u>Scheme A.9:</u> USLT 2000 based models:

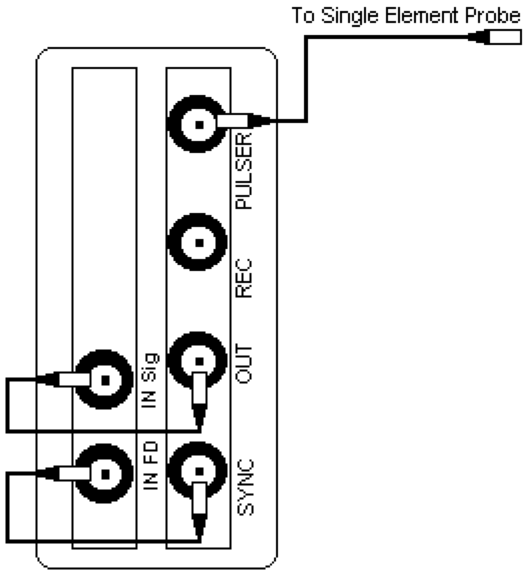
- Probe Swiveling Monitoring is not active
- Use of the Dual Probe

4.2.5. Analogue Interface – Cabling Guide for the A-Scan / t-B-Scan / t-TOFD / t-FLOORMAP_L / Encoded B-Scan / Encoded TOFD / Encoded FLOORMAP_L / Creeping Wave Inspection, Recording, and Imaging



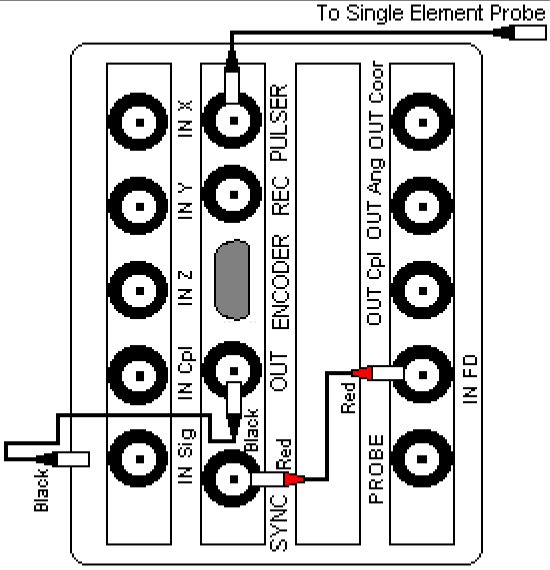
Scheme B.1: UDS3-3 based models

- ISONIC 2001
- Use of the Single Element Probe



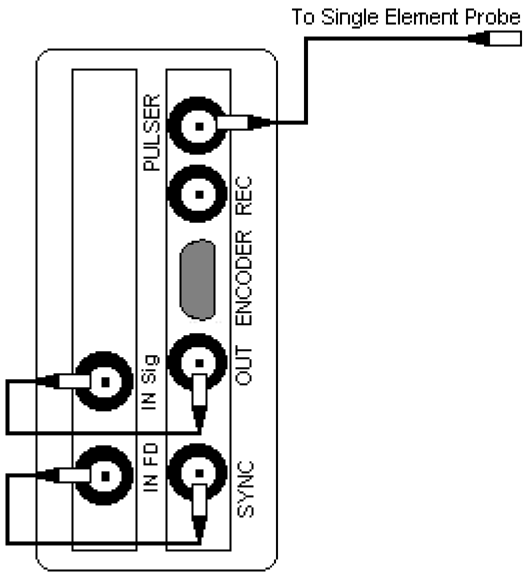
Scheme B.2: UDS3-3 based models

- ISONIC 2001R
- Use of the Single Element Probe



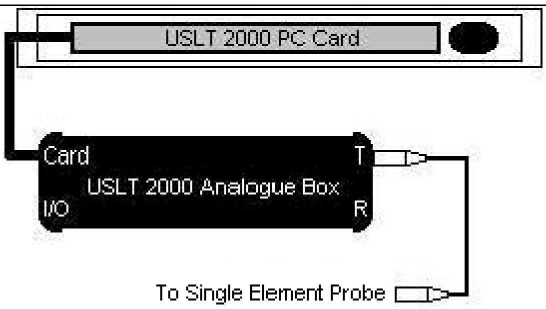
<u>Scheme B.3:</u> UDS3-4 based models

- ISONIC 2001M
- Use of the Single Element Probe



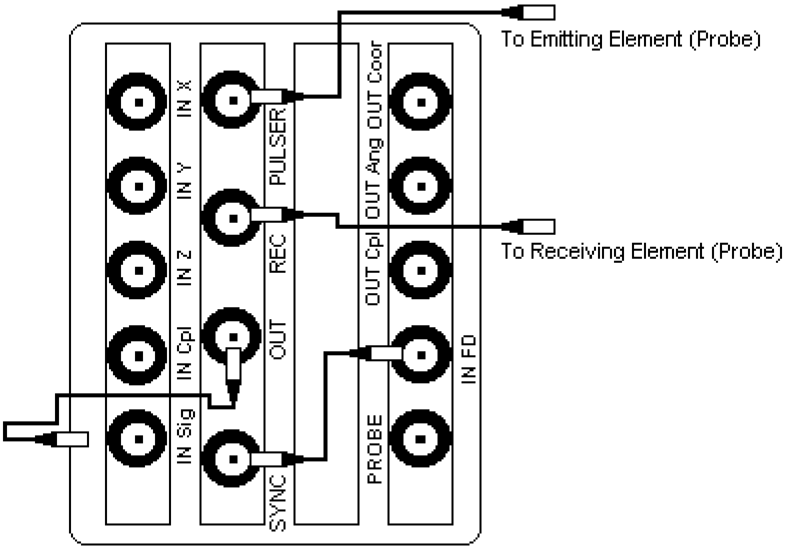
<u>Scheme B.4:</u> UDS3-4 based models

- ISONIC 2001RM
- Use of the Single Element Probe



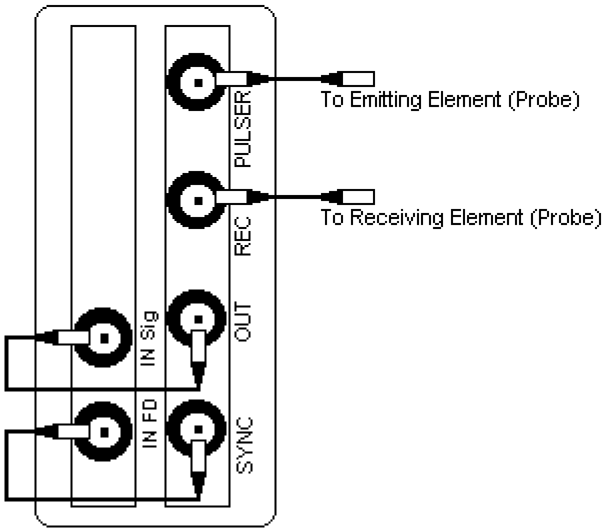
<u>Scheme B.5:</u> USLT 2000 based models

- ISONIC 2001U, ISONIC 2001 RU
- Use of the Single Element Probe



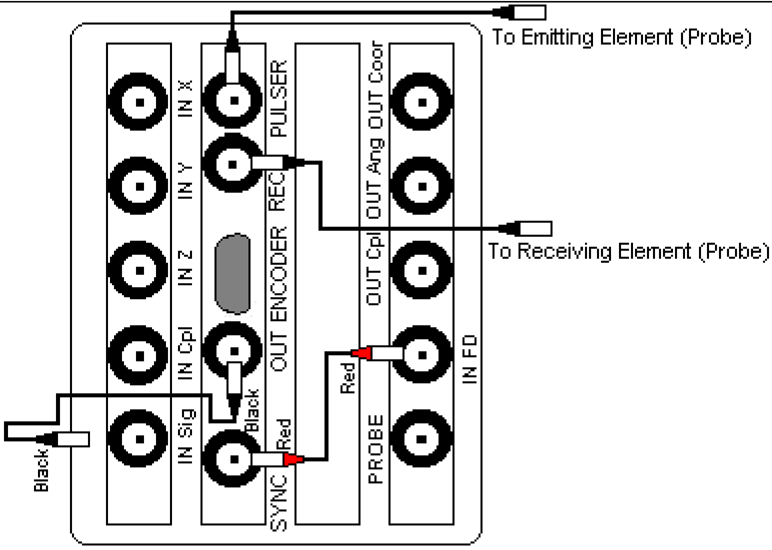
<u>Scheme B.6:</u> UDS3-3 based models

- ISONIC 2001
- Use of the Dual Probe
- Use of 2 Probes (Emitting and Receiving)



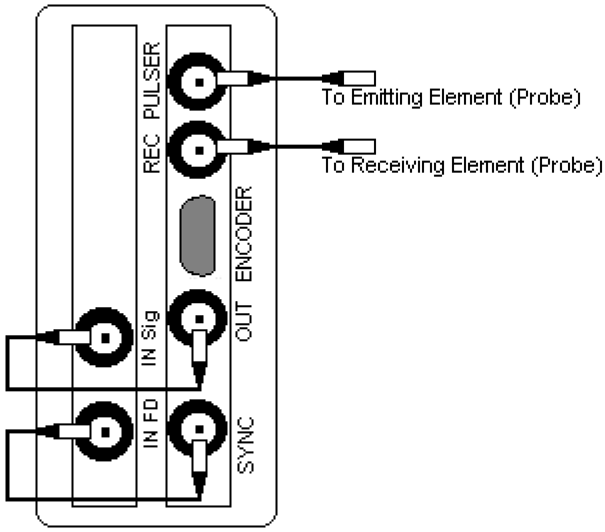
<u>Scheme B.7:</u> UDS3-3 based models

- ISONIC 2001R
- Use of the Dual Probe
- Use of 2 Probes (Emitting and Receiving)



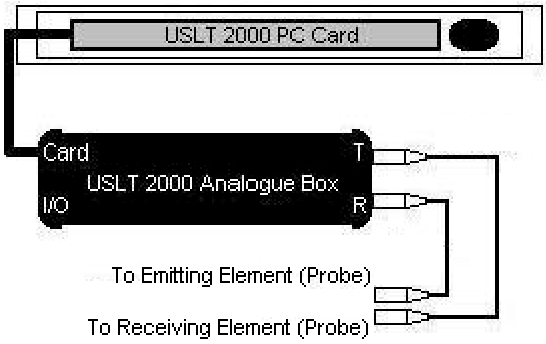
Scheme B.8: UDS3-4 based models

- ISONIC 2001M
- Use of the Dual Probe
- Use of 2 Probes (Emitting and Receiving)



Scheme B.9: UDS3-4 based models

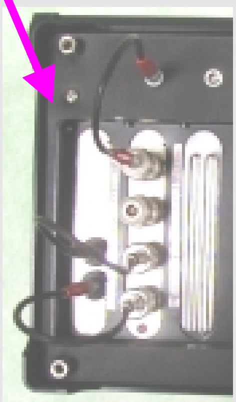
- ISONIC 2001RM
- Use of the Dual Probe
- Use of 2 Probes (Emitting and Receiving)



<u>Scheme B.10:</u> USLT 2000 based models

- ISONIC 2001U, ISONIC 2001 RU
- Use of the Dual Probe
- Use of 2 Probes (Emitting and Receiving)

4.2.6. Analogue Interface – Jumpering Pulser Receiver Sockets to the Front Panel in the UDS 3-3 / UDS 3-4 Based Models

Photo	Note
 + 	UDS3-3 / UDS3-4 based **ISONIC 2001** (SA 80410 / SA 80430) – Use of Single Element Probe, Inspection and Measurements without the 3D Imaging (Variant 2) UDS3-3 / UDS3-4 based **ISONIC 2001R** (SA 80411 / SA 80431) – Use of Single Element Probe, Inspection and Measurements without the Imaging (Variant 2) 
 + 	UDS3-3 / UDS3-4 based **ISONIC 2001** (SA 80410 / SA 80430) – Use of the Dual Probe, Inspection and Measurements without the 3D Imaging (Variant 2) UDS3-3 / UDS3-4 based **ISONIC 2001R** (SA 80411 / SA 80431) – Use of Dual Probe, Inspection and Measurements without the 3D Imaging (Variant 2) 

4.2.7. Analogue Interface – Rear Panel Commutation Box

In order to ease the rear panel commutation required for the true-to-location imaging setup variations the Rear Panel Commutation Box is available as an option (Order Code SH 98C0202 M)

The single plug-in / plug-out connector is located at the instrument end of the long cable for the units equipped with the Rear Panel Commutation Box

All necessary commutations related to the **IN X**, **IN Y**, **IN Z**, **IN Cpl** and **IN Sig** sockets as per above Fig.4.1a – c through Fig. 4.3 a – c are made inside the Rear Panel Commutation Box. Other commutations are pre-made through the jumpers outgoing from the commutation box, just the yellow-jacketed jumper has to be

swapped between **Out Ang** and **REC** sockets manually depending on the scanning mode selected according to the above Fig.4.1a – c through Fig. 4.3 a – c

4.3. Turning On

4.3.1. Power Supplies of ISONIC 2001

ISONIC 2001 is equipped with both AC/DC power supplies and with the rechargeable battery (optionally). The AC Power Supply/Charger is implemented as an external unit having AC input and DC output.

<u>AC Power Supply</u>

- Ensure the power switch is in the **OFF** position before connecting the power cords
- Connect one end of the AC power cord to the power socket of the AC Power Supply/Charger and the other end to the mains socket
- Connect the DC power cord with the suppression filter outgoing from the AC Power Supply/Charger to the DC Input of **ISONIC 2001**
- The AC Power Supply/Charger recognizes the supply voltage 100V/250V. There is no need to manually switch from 250V to 100V
- A voltage outside the range of 90V to 138V AC or 180V to 264V AC respectively is **not permissible**
- After turning the **ISONIC 2001 OFF**, please wait about at least 10 seconds before switching it **ON** again

<u>External DC Power Supply</u>

- Ensure that the power switch is in the **OFF** position
- Connect one end of the DC power cord with the suppression filter to the DC Input of **ISONIC 2001** and the other to the voltage supply
- The external DC power supply for the operating the unit must supply the voltage between 12 V and 24 V. However if the voltage supplied by the external DC Power supply is between 12 V and 19 V then the use of the internal battery inside the unit is not allowed! Oppositely it may damage the circuits controlling the internal battery charge / discharge and temperature monitoring, causing further internal battery overheating and destroying. The voltages below 12 V and above 24 V are not allowed
- After turning the **ISONIC 2001 OFF**, please wait about at least 10 seconds before switching it **ON** again

<u>Battery</u>

- Ensure that the power switch is in the **OFF** position
- Insert the battery
- After turning the **ISONIC 2001 OFF**, please wait about at least 10 seconds before switching it **ON** again

<u>Power-Up</u>

To Power-Up the **ISONIC 2001** set power switch into the **"ON"** position. An automatic system test program will then be executed; during this test, various texts and information appear on the screen. At the end of the test, the message ***ISONIC is Starting Up*** will be reported

4.3.2. Power Supplies of the ISONIC Lap Top

ISONIC Lap Top is equipped with both AC/DC power supplies and with rechargeable battery (optionally).

<u>AC Power Supply</u>

- Ensure the power switch is in the **OFF** position before connecting the power cord
- Connect one end of the AC power cord to the DC Input of **ISONIC Lap Top** and the other end to the mains socket
- The **ISONIC Lap Top** auto switch power supply unit recognizes the supply voltage 100V/250V. There is no need to manually switch from 250V to 100V
- A voltage outside the range of 90V to 138V AC or 180V to 264V AC respectively is **not permissible**
- After turning the **ISONIC Lap Top OFF**, please wait about at least 10 seconds before switching it **ON** again

<u>DC Power Supply</u>

- Ensure that the power switch is in the **OFF** position
- Connect one end of the DC power cord with the suppression filter to the DC Input of **ISONIC Lap Top** and the other to the voltage supply
- The DC power supply unit requires a voltage between 10.5V and 30V
- After turning the **ISONIC Lap Top OFF**, please wait about at least 10 seconds before switching it **ON** again

<u>Battery</u>

- Ensure that the power switch is in the **OFF** position
- Insert the battery
- After turning the **ISONIC Lap Top OFF**, please wait about at least 10 seconds before switching it **ON** again

<u>Power-Up</u>

To Power-Up the **ISONIC Lap Top** set power switch into the **"ON"** position. An automatic system test program will then be executed; during this test, various texts and information appear on the screen. At the end of the test, the message ***ISONIC is Starting Up*** will be reported

4.3.3. Power Supply of the ISONIC Desk Top

ISONIC Desk Top is equipped with the AC power supply

- Ensure the power switch is in the **OFF** position before connecting the power cord
- Connect one end of the AC power cord to the AC Input of **ISONIC Desk Top** and the other end to the mains socket
- The **ISONIC Desk Top** auto switch power supply unit recognizes the supply voltage 100V/250V. There is no need to manually switch from 250V to 100V
- A voltage outside the range of 90V to 138V AC or 180V to 264V AC respectively is **not permissible**
- After turning the **ISONIC Desk Top OFF**, please wait about at least 10 seconds before switching it **ON** again

Power-Up

To Power-Up **ISONIC Desk Top** set power switch into the **"ON"** position. An automatic system test program will then be executed; during this test, various texts and information appear on the screen. At the end of the test, the message ***ISONIC is Starting Up*** will be reported

4.4. Turning OFF

To turn the **ISONIC** Off:

- Close all working software

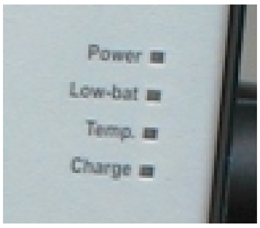
- Press **Alt+F4**, or click on **Shut Down…** from the **Start** menu

- In the **Shut Down Windows** dialog box, select **Shut down**, then press **Enter** key, or click on **Yes** or press **Y**

Wait until the message ***It's now safe to turn off the ISONIC*** appears, then put power switch into the **"OFF"** position

4.5. Mains and Internal Battery Powering of the ISONIC 2001 unit

ISONIC 2001 may be powered by the mains either AC or DC or by the internal battery. Battery will be recharge while inside the unit connected to mains. The unit may be either switched on or off entire the battery recharge. There are few LEDs on the front panel of the ISONIC 2001 unit:



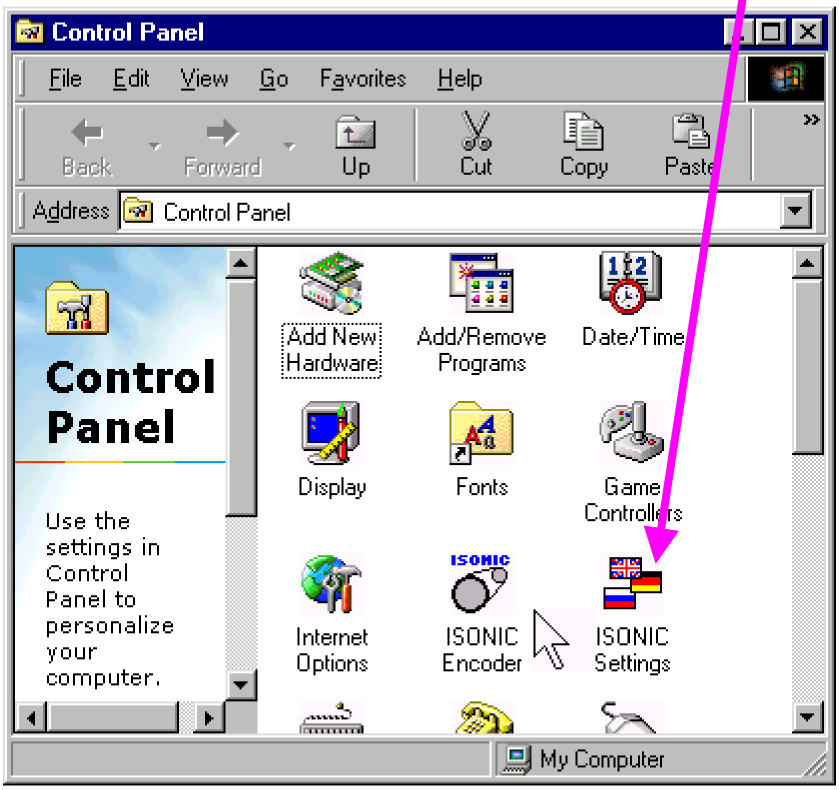
Power	This LED is continuously lighting while the ISONIC 2001 unit powered either by the internal battery or mains is switched on
Low-bat	This LED is not lighting if mains power the ISONIC 2001 unit. If the internal battery powers the ISONIC unit then the **Low-bat** LED will start flashing if the remaining battery resource is down to 10-20 min. If the remaining battery resource is down to 2-3 min then the perceptible sound alarm will accompany the **Low-bat** LED flashing. It's required to complete the current session to save all open jobs if necessary and switch the ISONIC 2001 unit off as per above Chapter 4.4
Temp.	This LED is normally not lighting. If the temperature of the battery entire the recharge or powering unit is up to 60^{o}C then the **Temp.** LED starts lighting continuously. Simultaneously the ISONIC 2001 unit automatically discontinues the battery recharge. It's recommended to pull battery out of the unit in order to get it to the normal temperature faster
Charge	This LED is not lighting if the battery is not inside the unit. The **Charge** LED ins continuously lighting entire the battery recharge. Upon getting the battery fully charged the **Charge** LED starts flashing. Simultaneously the ISONIC 2001 unit automatically discontinues the battery charge
Temp. **Charge**	These LEDs may be simultaneously lighting if the external DC source powering the ISONIC 2001 unit produces the voltage below 20VDC while the internal battery is not inside the unit. In that case the **Temp.** LED is lighting continuously and the **Charge** LED is slowly flashing

Precautions:

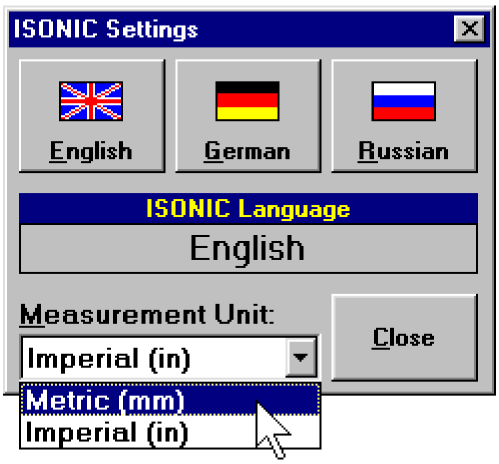
- **If the voltage supplied by the external DC Power supply is between 12 V and 19 V then the use of the internal battery inside the unit is not allowed! Oppositely it may damage the circuits controlling the internal battery charge / discharge and temperature monitoring, causing further internal battery overheating and destroying**
- **Charge of the of the of the internal battery either inside the unit or outside is allowed only with use of the AC/DC converters / chargers supplied along with the unit or authorized by Sonotron NDT**
- **Charge of the internal battery inside the unit is not allowed if the unit is suited with the soft carrying case**

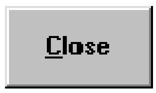
4.6. ISONIC Settings

Click on **Start**, select **Settings** then **Control Panel** and double click on the corresponding icon located in the Control Panel window



The window allowing setup of the user interface/help language and measurement units appears:

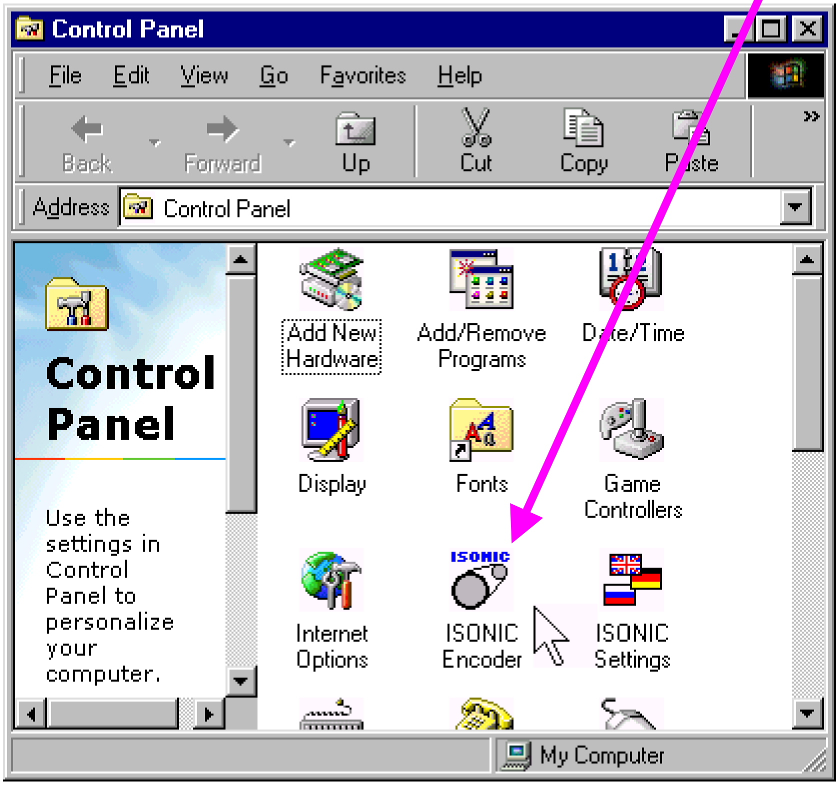


To close **ISONIC Settings** window press **Esc** or **<Alt> + <C>** on the keyboard or click on 

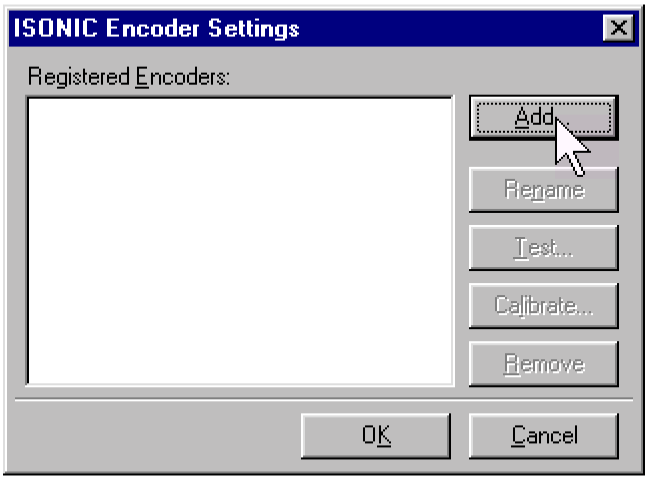
4.7. ISONIC Encoder Calibration Utility

This utility allows calibrating of the user's incremental one axis encoder to be used with the ISONIC ABIScan and/or FLOORMAP_L Inspection SW Packages. **The user's encoder must be connected to the appropriate connector according to the circuit diagram approved by Sonotron NDT!!!**

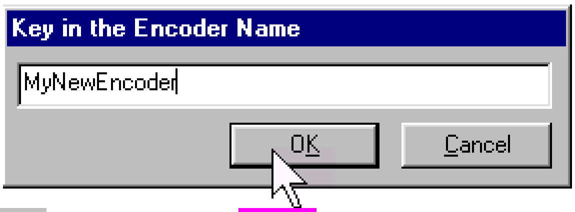
Click on **Start**, select **Settings** then **Control Panel** and double click on the corresponding icon located in the **Control Panel** window



The **ISONIC Encoder Settings** window allowing to key in the name for the new encoder name and to calibrate it appears:

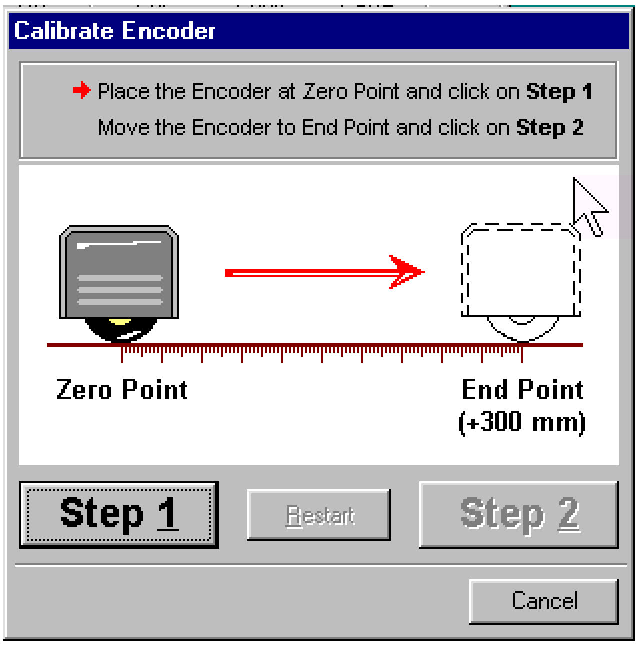


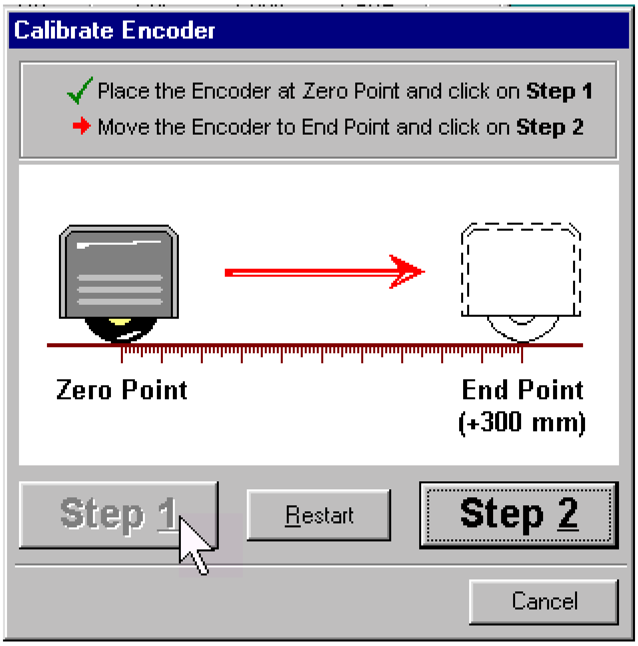
To proceed click on the **Add...** button or press **<Alt> + <A>** on the keyboard then type the name of the new encoder in the appearing window then click on the **OK** button or press **Enter** or **<Alt> + <K>** on the keyboard



To negate just click on the **Cancel** button or press **Esc** or **<Alt> + <C>** on the keyboard

The **Calibrate Encoder** window appears upon typing the new encoder name, said window contains the simple instructions to follow:



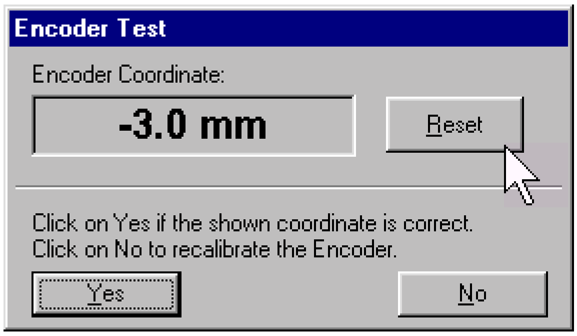


The encoder's wheel while calibrating must pass linearly the distance of 300 mm (12 in) between the *Start Point* designated through the clicking on the **Step 1** button or pressing **<Alt> + <1>** on the keyboard and *End Point* along the scale bar placed on the flat surface

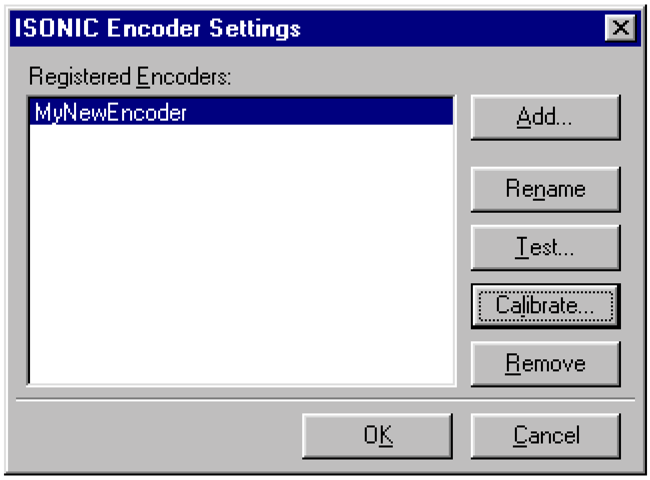
Upon reaching the *End Point* and clicking on the **Step 2** button or pressing **<Alt> + <2>** on the keyboard the new **Encoder Test** window appears allowing to check the accuracy of the new encoder calibration while manipulating it along the scale bar.

If it's necessary to re-designate the *Start Point* click on the **Restart** button or press **<Alt> + <R>** on the keyboard

- Click on the **Reset** button or press **<Alt> + <R>** on the keyboard to designate the local zero point
- Click on the **Yes** button or press **Enter** or **<Alt> + <Y>** on the keyboard to rename the selected encoder
- Click on the **No** button or press **Esc** or **<Alt> + <N>** on the keyboard to recalibrate the encoder



The **ISONIC Encoder** Settings window returns to the screen upon completing entering and calibrating of the new encoder. To update the registry click on the **OK** button or press **Enter** or **<Alt> + <K>** on the keyboard – this will automatically terminate the running of the Encoder Calibration utility



If running the utility next time:

- Click on the **Add...** button or press **<Alt> + <A>** on the keyboard to proceed with the next new encoder as described above
- Click on the **Rename** button or press **<Alt> + <N>** on the keyboard to rename the selected encoder
- Click on the **Test** button or press **<Alt> + <T>** on the keyboard to check the accuracy of the selected encoder calibration
- Click on the **Calibrate** button or press **<Alt> + <L>** on the keyboard to recalibrate the selected encoder
- Click on the **Remove** button or press **<Alt> + <R>** on the keyboard to remove the selected encoder from the registry
- Click on the **Cancel** button or press **Esc** or **<Alt> + <C>** on the keyboard to negate all changes and terminate the running of the ***Encoder Calibration*** utility
- Click on the **OK** button or press **Enter** or **<Alt> + <K>** on the keyboard to update the registry and terminate the running of the ***Encoder Calibration*** utility

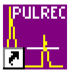
5. Operating ISONIC Pulser Receiver (Internal Ultrasonic Flaw Detector PC Card) Through "PULREC" or "USLTPR" Software Package

The contents of this chapter is valid for the PULREC SW Package version 6.1.0.6 or higher

5.1. Cabling

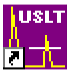
Ultrasonic Flaw Detector PC Card	Applicable Cabling Scheme	Paragraph
UDS 3-3	B.1; B.2; B.6; B.7	4.2.5
UDS 3-4	B.3; B.4; B.8; B.9	4.2.5
USLT 2000	B.5; B.10	4.2.5

5.2. Start Up PULREC Software Package (ISONIC Pulser Receiver)

Double click on the icon 

located on the **ISONIC** desktop

5.3. Start Up USLTPR Software Package (USLT 2000 Pulser Receiver)

Double click on the icon 

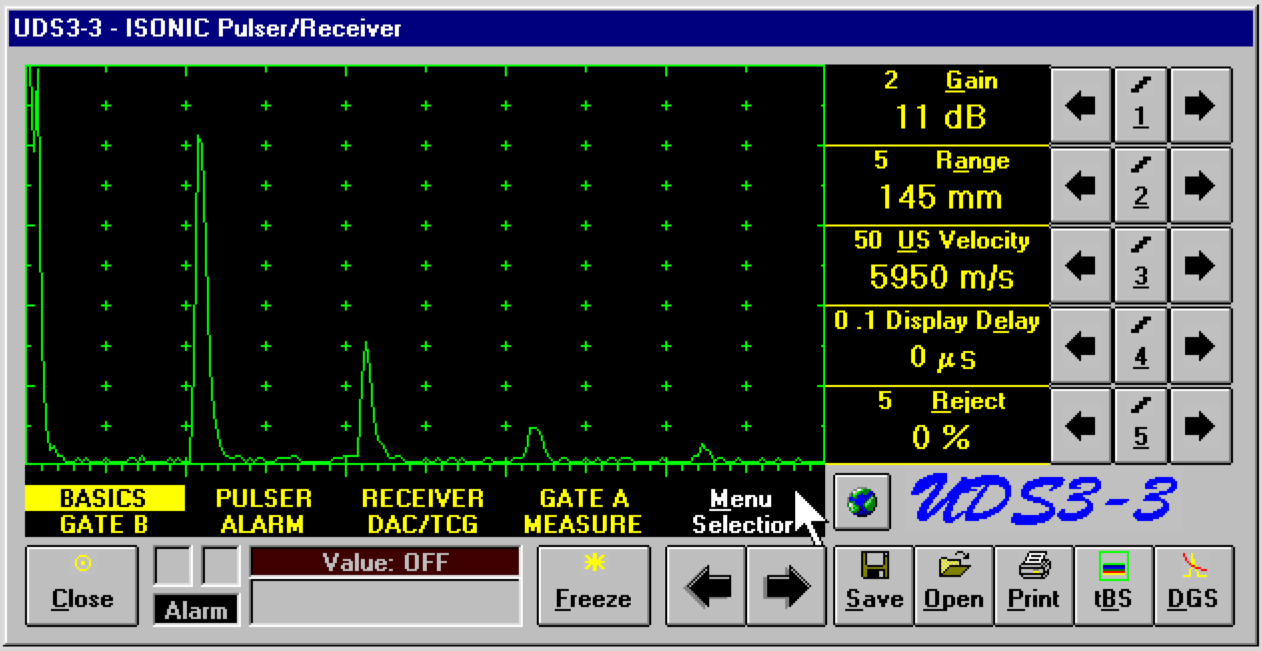
located on the **ISONIC** desktop

5.4. Operating PULREC and USLTPR Software Packages

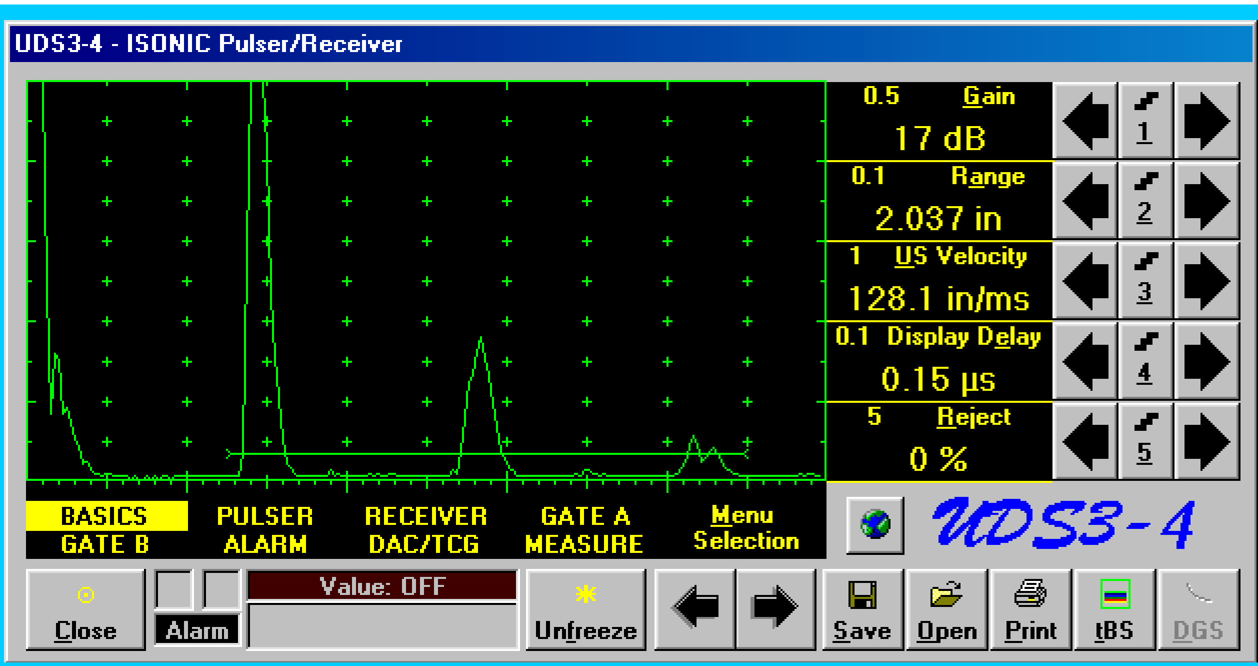
PULREC software package operates the **UDS 3-3** and **UDS 3-4** internal ultrasonic flaw detector card. The card existing in the **ISONIC** is recognized automatically

USLTPR software package operates the **USLT 2000** internal ultrasonic flaw detector card

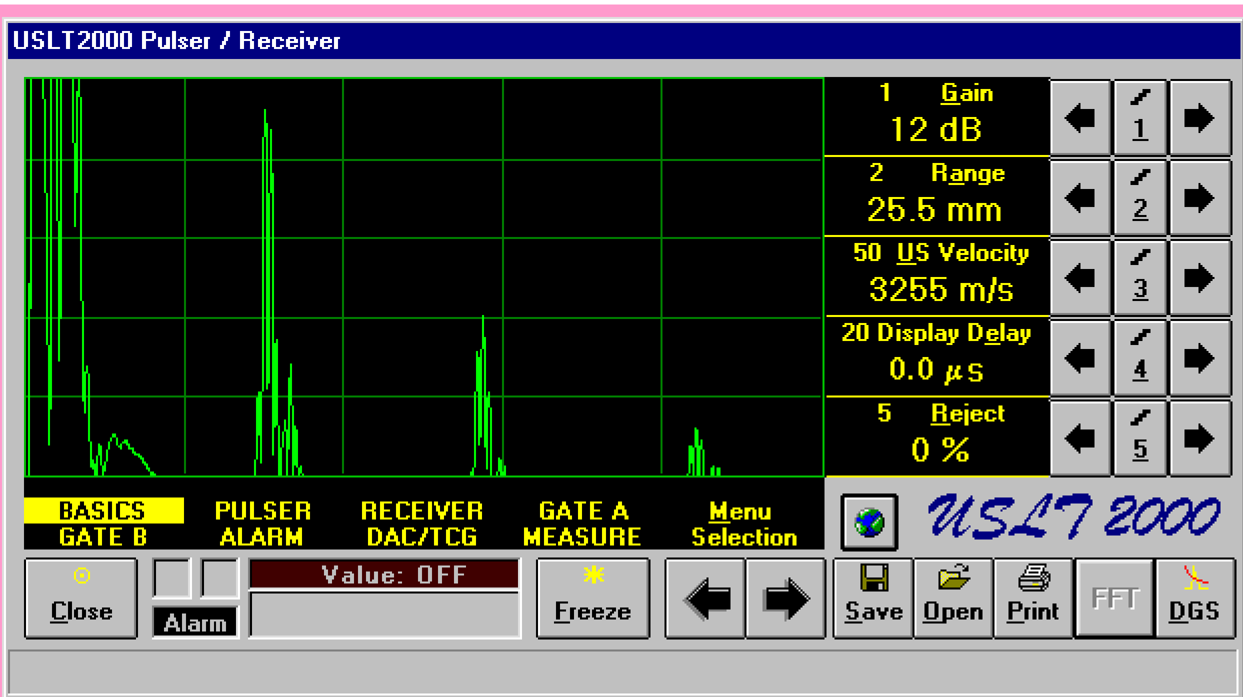
PULREC and **USLTPR** software packages have almost identical user interface. All modes of operation are realized through the main screen including the **A-Scan** and all controls. All further explanations relate to both software packages excluding the specially noted cases



UDS 3-3: Operating Surface



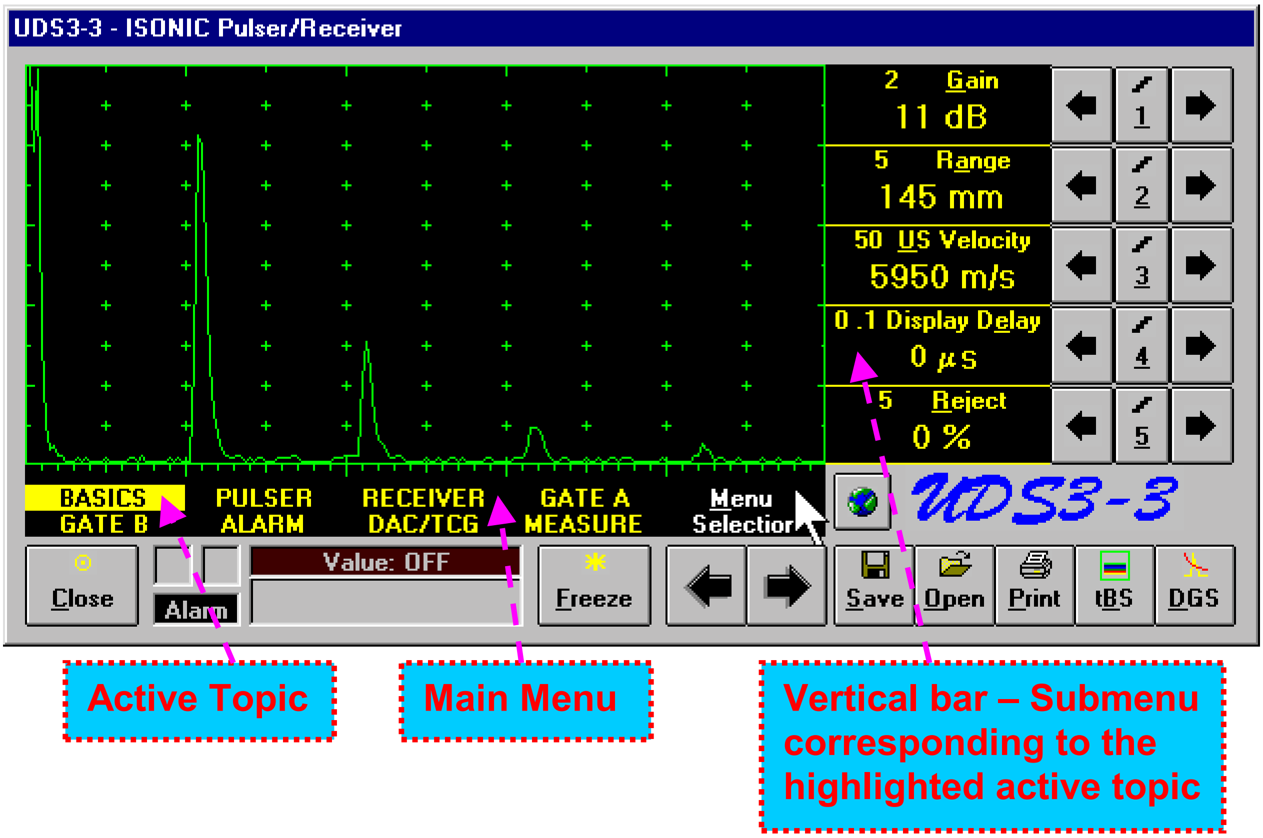
UDS 3-4: Operating Surface



USLT 2000: Operating Surface

5.4.1. Main Menu

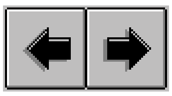
The **Main Menu** consists of eight **topics** one of then is active. The active topic is highlighted



To select a topic the following manipulations are applicable:

- **Mouse**
  - Click on the topic's name

    OR

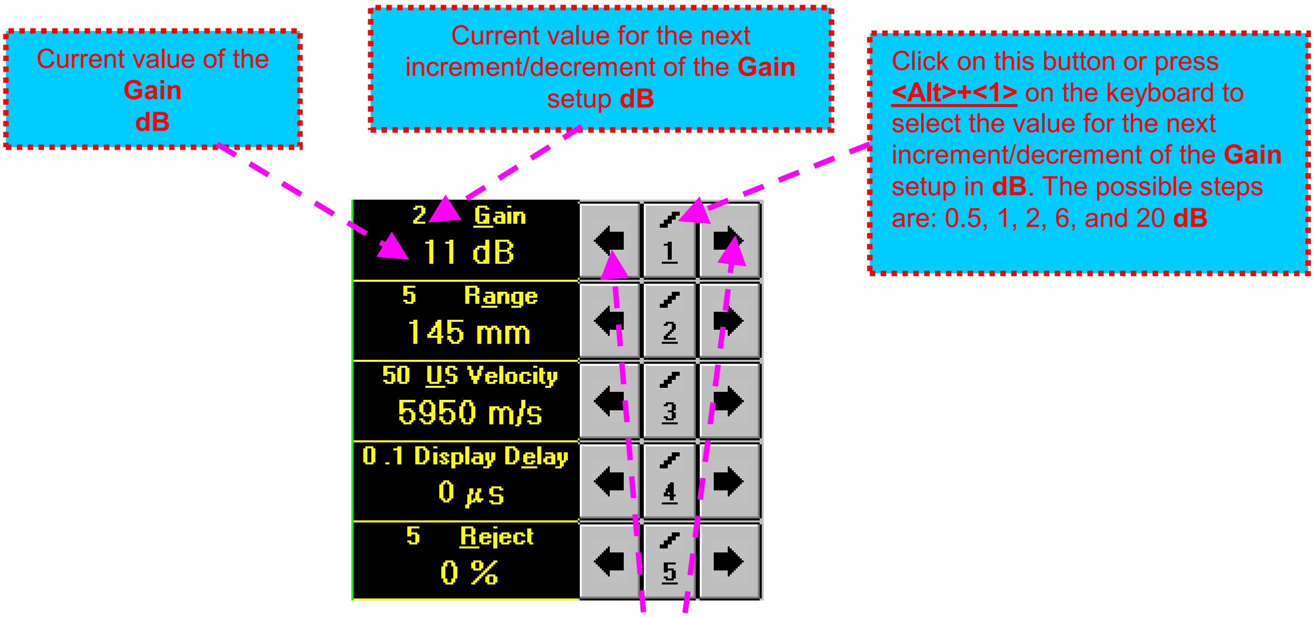
  - Click on the buttons 

- **Keyboard**
  - Pressing **<Alt>+<M>** ⇒ **Menu Selection** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Menu Selection** the letter **M** is underlined)

- **Combined**
  - Click on **Menu Selection** ⇒ **Menu Selection** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Each topic is associated with the corresponding **submenu**, which appears as the vertical bar showing the names for five parameters or modes of operation, their current setup and, if applicable, the current value for the next increment / decrement of the parameter

5.4.2. Sub Menu BASICS



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

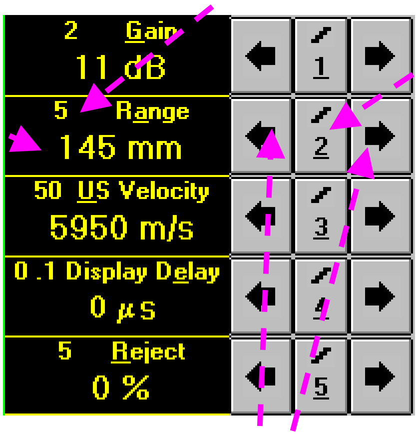
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<G>** ⇒ **Gain** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Gain** the letter **G** is underlined)
- **Combined**
  - Click on **Gain** ⇒ **Gain** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ
Gain setup is also possible through the most of other submenus following the same rules as above

Current value of the **Range** **mm** or **in**

Current value for the next increment/decrement of the **Range** setup **mm** or **in**

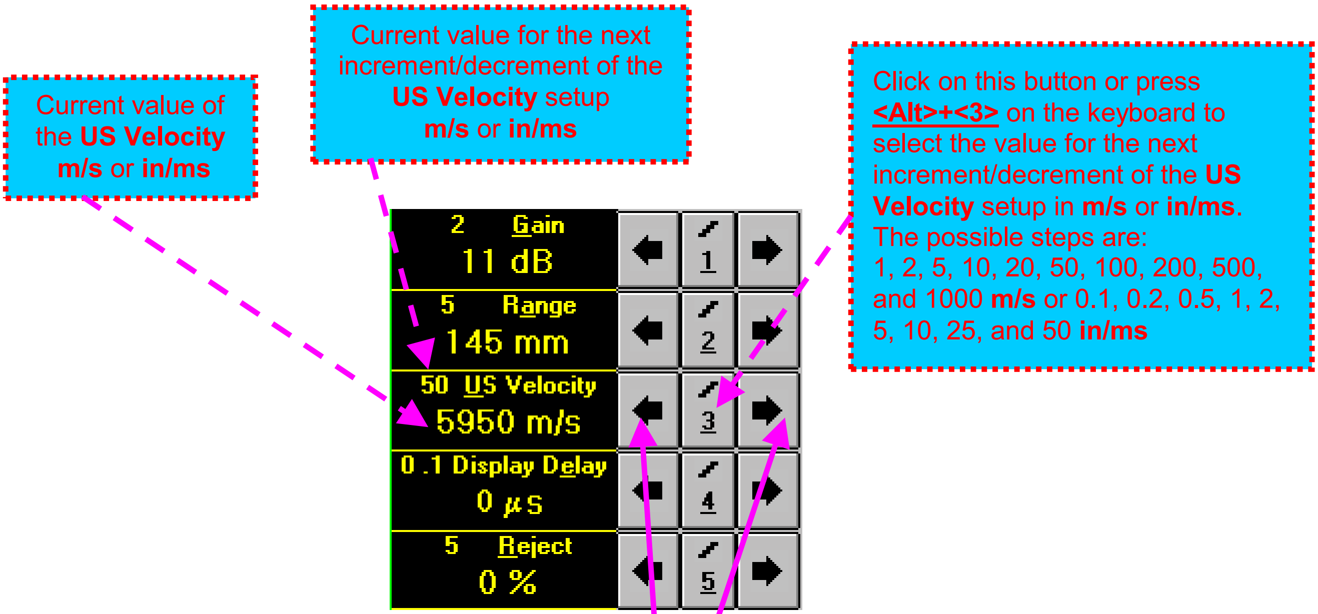
Click on this button or press **<Alt>+<2>** on the keyboard to select the value for the next increment/decrement of the **Range** setup in **mm** or **in**. The possible steps are: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 **mm** or 0.001, 0.002, 0.005, 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, and 5 **in**
Note: the steps of 0.1, 0.2, and 0.5 **mm** are possible for the **Range** not exceeding **100 mm**; the steps of 0.001, 0.002, and 0.005 **in** are possible for the **Range** not exceeding **4 in**



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

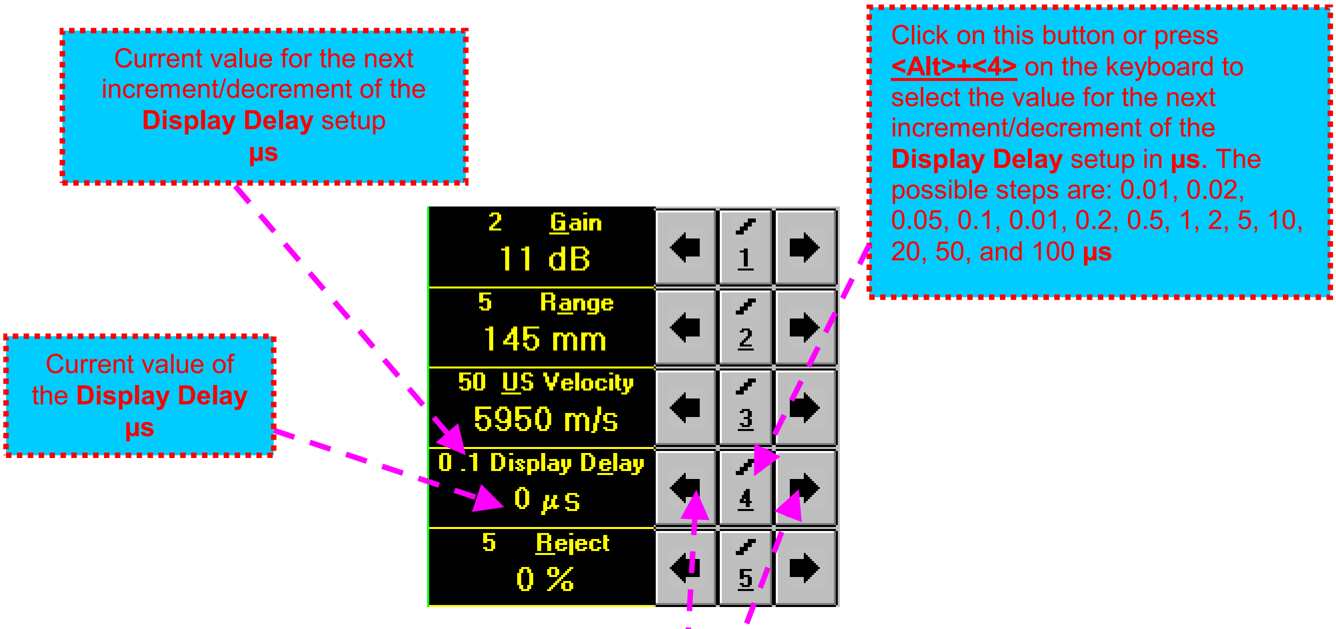
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<A>** ⇒ **Range** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Range** the letter **a** is underlined)
- **Combined**
  - Click on **Range** ⇒ **Range** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ
Range setup is also possible through some other submenus following the same rules as above



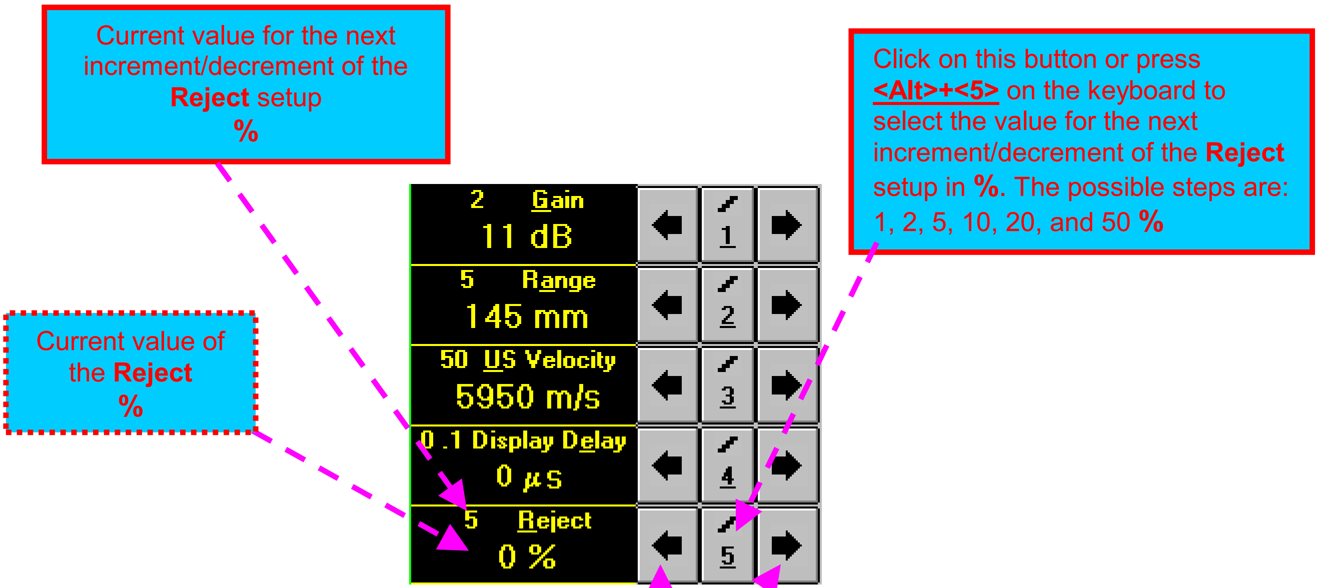
To setup **US Velocity** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<U>** ⇒ **US Velocity** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **US Velocity** the letter **U** is underlined)
- **Combined**
  - Click on **US Velocity** ⇒ **US Velocity** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard



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

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<E>** ⇒ **Display Delay** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Display Delay** the letter **e** is underlined)
- **Combined**
  - Click on **Display Delay** ⇒ **Display Delay** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

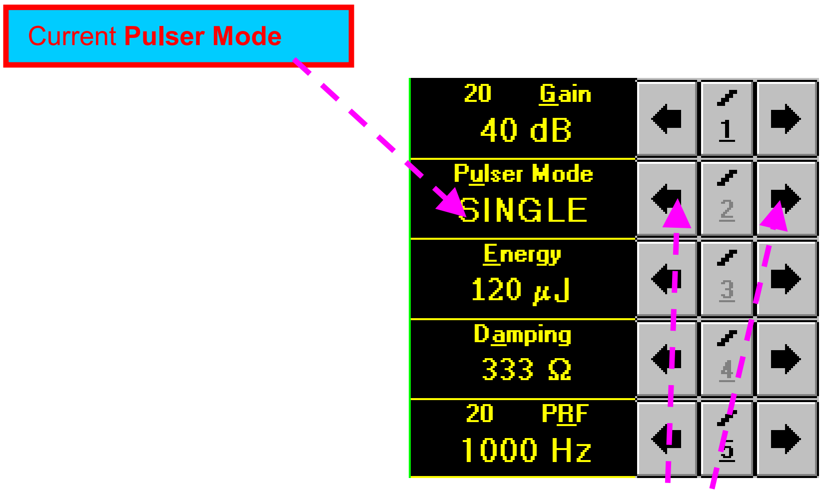


To setup **Reject** the following manipulations are applicable:

- **Mouse**
  - ■ Click or press and hold on the appropriate button
- **Keyboard**
  - ■ Pressing **<Alt>+<E>** ⇒ **<u>R</u>eject** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **<u>R</u>eject** the letter **<u>R</u>** is underlined)
- **Combined**
  - ■ Click on **<u>R</u>eject** ⇒ **<u>R</u>eject** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ
Reject setup is also possible through some other submenus following the same rules as above

5.4.3. Sub Menu PULSER (UDS 3-3 and USLT 2000)

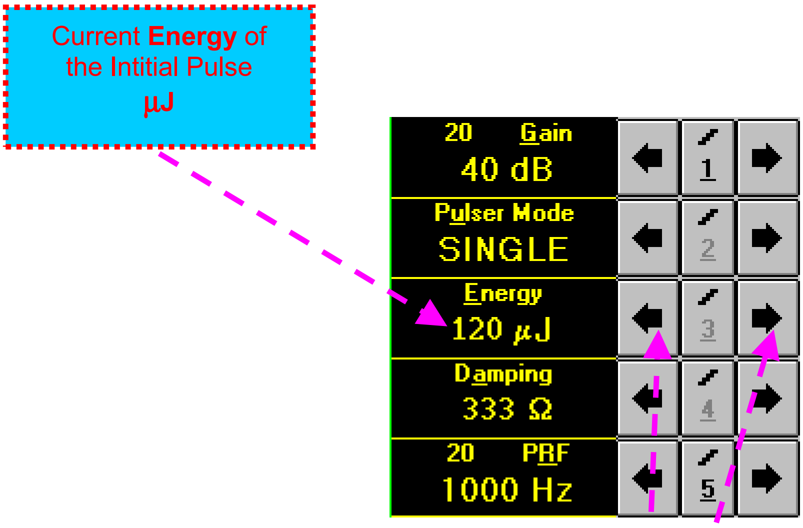


To setup **Pulser Mode** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<U>** ⇒ **Pulser Mode** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Pulser Mode** the letter **u** is underlined)
- **Combined**
  - Click on **Pulser Mode** ⇒ **Pulser Mode** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

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

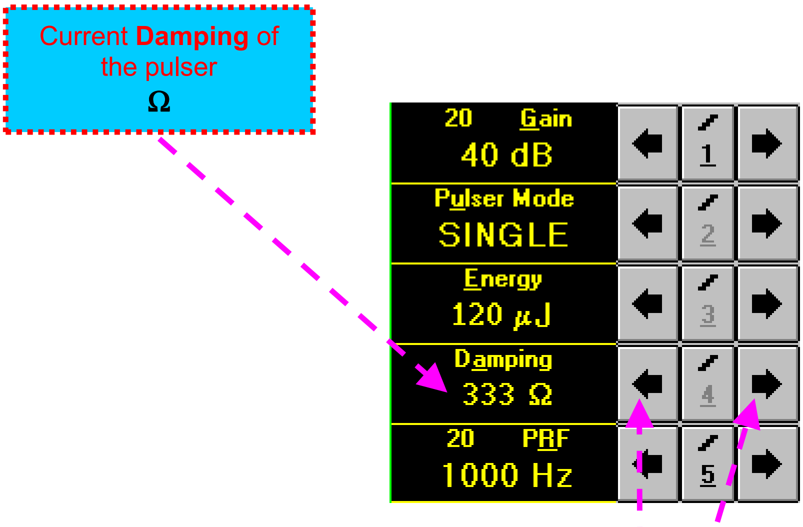


To setup **Energy** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<E>** ⇒ **Energy** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **E**nergy the letter **E** is underlined)
- **Combined**
  - Click on **Energy** ⇒ **Energy** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

- The are four levels of excitation energy are available for the **UDS 3-3**: 120 µJ, 64 µJ; 24µJ; and 12 µJ
- There are two levels of excitation energy available for the **USLT 2000**, shown as the value of the capacitor discharging onto the ultrasonic probe: 1000 pF and 220 pF. The higher excitation energy corresponds to the higher capacity

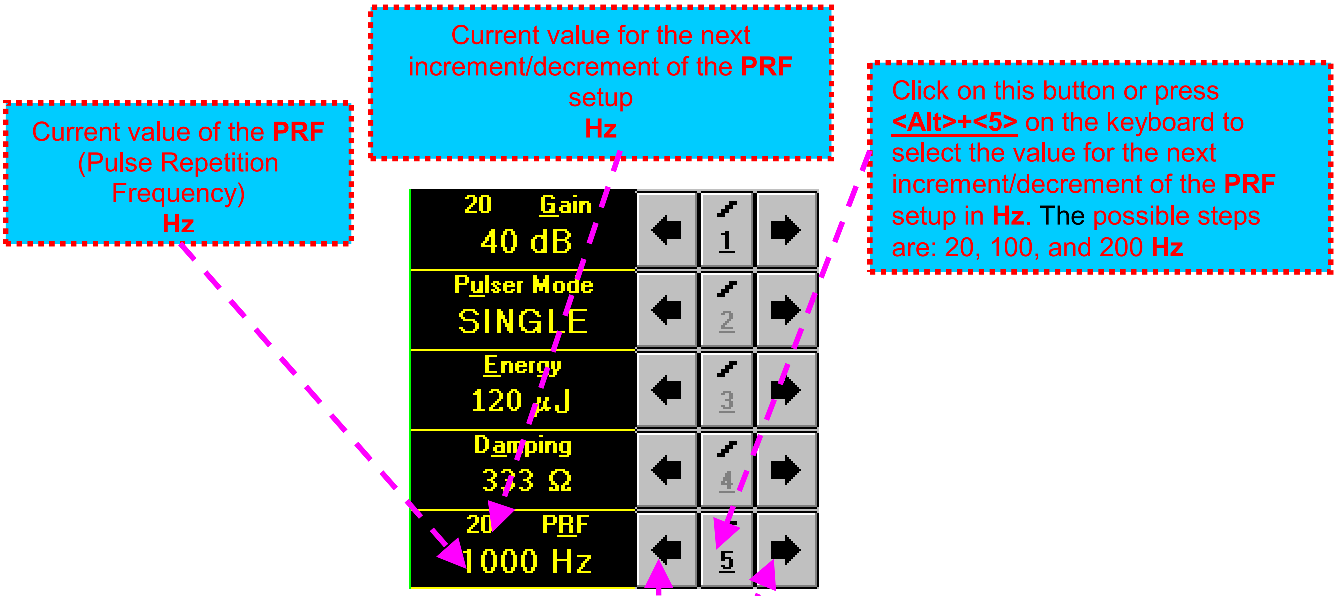


To setup **Damping** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<A>** ⇒ **Damping** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Damping** the letter **a** is underlined)
- **Combined**
  - Click on **Damping** ⇒ **Damping** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

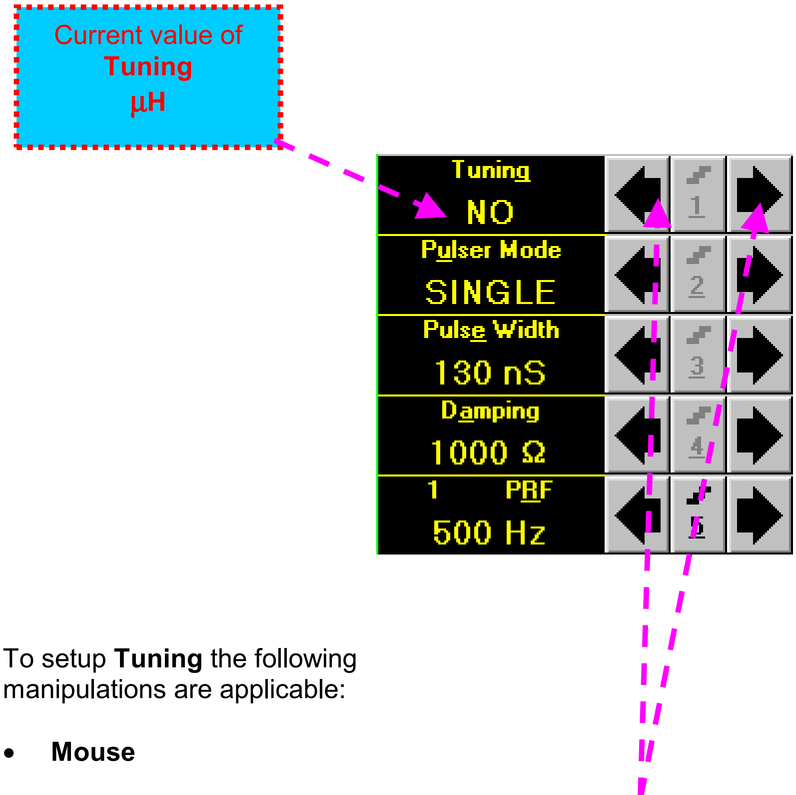
- There are 16 (sixteen) discrete values of damping available for the **UDS 3-3**: 24.7Ω, 26.3Ω, 28.1Ω, 30.3Ω, 32.8Ω, 35.7Ω, 39.2Ω, 43.4Ω, 48.8Ω, 55.6Ω, 64.6Ω, 76.9Ω, 95.4Ω, 125Ω, 182Ω, and 333 Ω
- There are 2 (two) discrete values of damping available for the **USLT 2000**: 50Ω, and 500 Ω



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

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<R>** ⇒ **PRF** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **PRF** the letter **R** is underlined)
- **Combined**
  - Click on **PRF** ⇒ **PRF** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

5.4.4. Sub Menu PULSER (UDS 3-4)

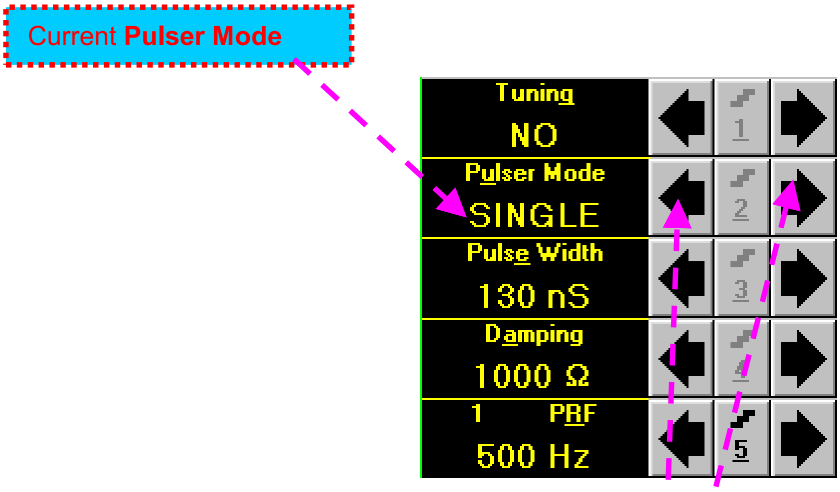


To setup **Tuning** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<G>** ⇒ **Tuning** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Tuning** the letter **g** is underlined)
- **Combined**
  - Click on **Tuning** ⇒ **Tuning** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

- **UDS 3-4** has 16 (sixteen) matching coils on-board that may be connected to the ultrasonic probe in order to get the best probe impedance matching / signal to noise ratio for the signals received from the object under test. The values of these matching coil inductances are: 2µH, 7µH, 12µH, 17µH, 24µH, 29µH, 34µH, 39µH, 41µH, 46µH, 51µH, 56µH, 63µH, 68µH, 73µH, and 78 µH
- Setting the **Tuning** to **"NO"** disconnects the matching coil

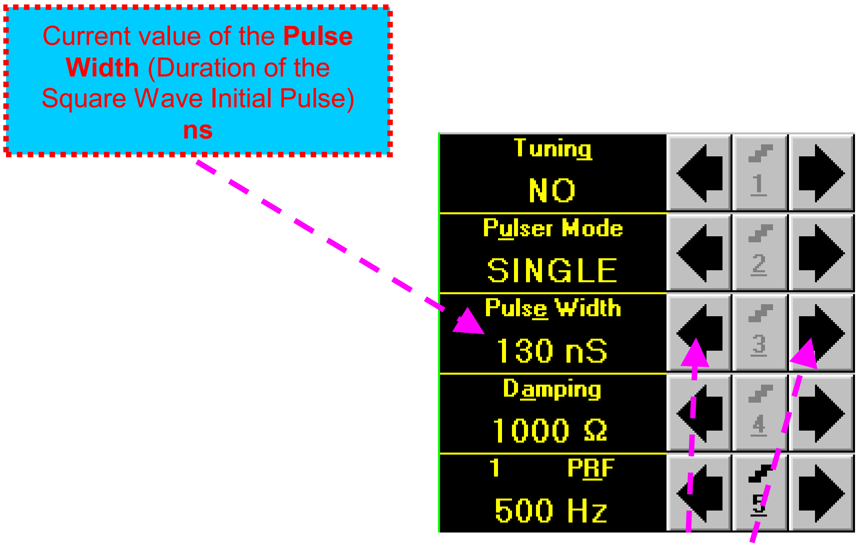


To setup **Pulser Mode** the following manipulations are applicable:

- **Mouse**
    - ■ Click or press and hold on the appropriate button
- **Keyboard**
    - ■ Pressing **<Alt>+<U>** ⇒ **Pulser Mode** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Pulser Mode** the letter **u** is underlined)
- **Combined**
    - ■ Click on **Pulser Mode** ⇒ **Pulser Mode** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

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

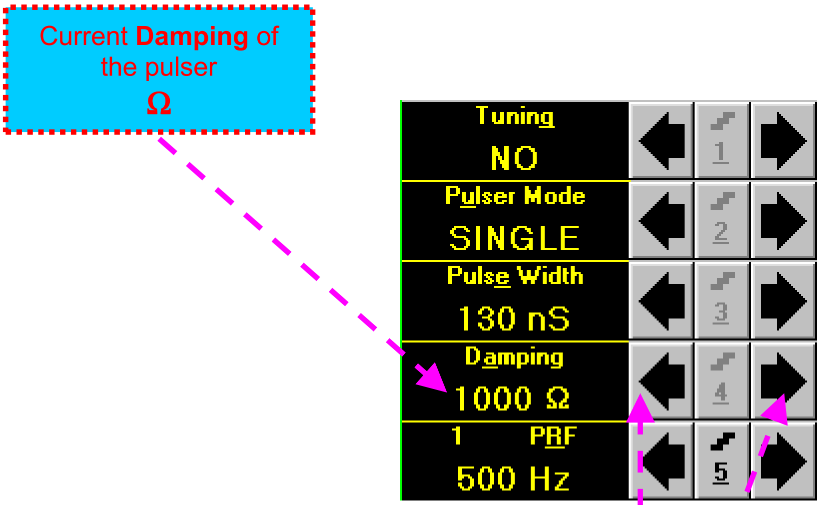


To setup **Pulse Width** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<E>** ⇒ **Pulse Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Pulse Width** the letter **E** is underlined)
- **Combined**
  - Click on **Pulse Width** ⇒ **Pulse Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

- The **Pulse Width** (Duration of the Square Wave Initial Pulse) may be tuned from 65 ns to 600 ns in 5 ns steps
- Attempt to further decrease the **Pulse Width** after setting to the minimal value of 65 ns leads to the *generation of the **Spike Pulse** instead of the **Square Wave Pulse***. There are 4 (four) energy levels available for the spike pulse excitation; said levels are indicated in the **Pulse Width** field:
  - o Spike (250µJ) – spike pulse with the 250 µJ energy of excitation
  - o Spike (160µJ – spike pulse with the 160 µJ energy of excitation
  - o Spike (90µJ) – spike pulse with the 90 µJ energy of excitation
  - o Spike (40µJ) – spike pulse with the 40 µJ energy of excitation
- The energy of the **Spike Pulse** excitation is controllable through the same controls as **Pulse Width**
- Attempt to further increase the energy of the **Spike Pulse** excitation after setting to the maximal level of 250 µJ value leads to the *generation of the **Square Wave Pulse** instead of the **Spike Pulse***

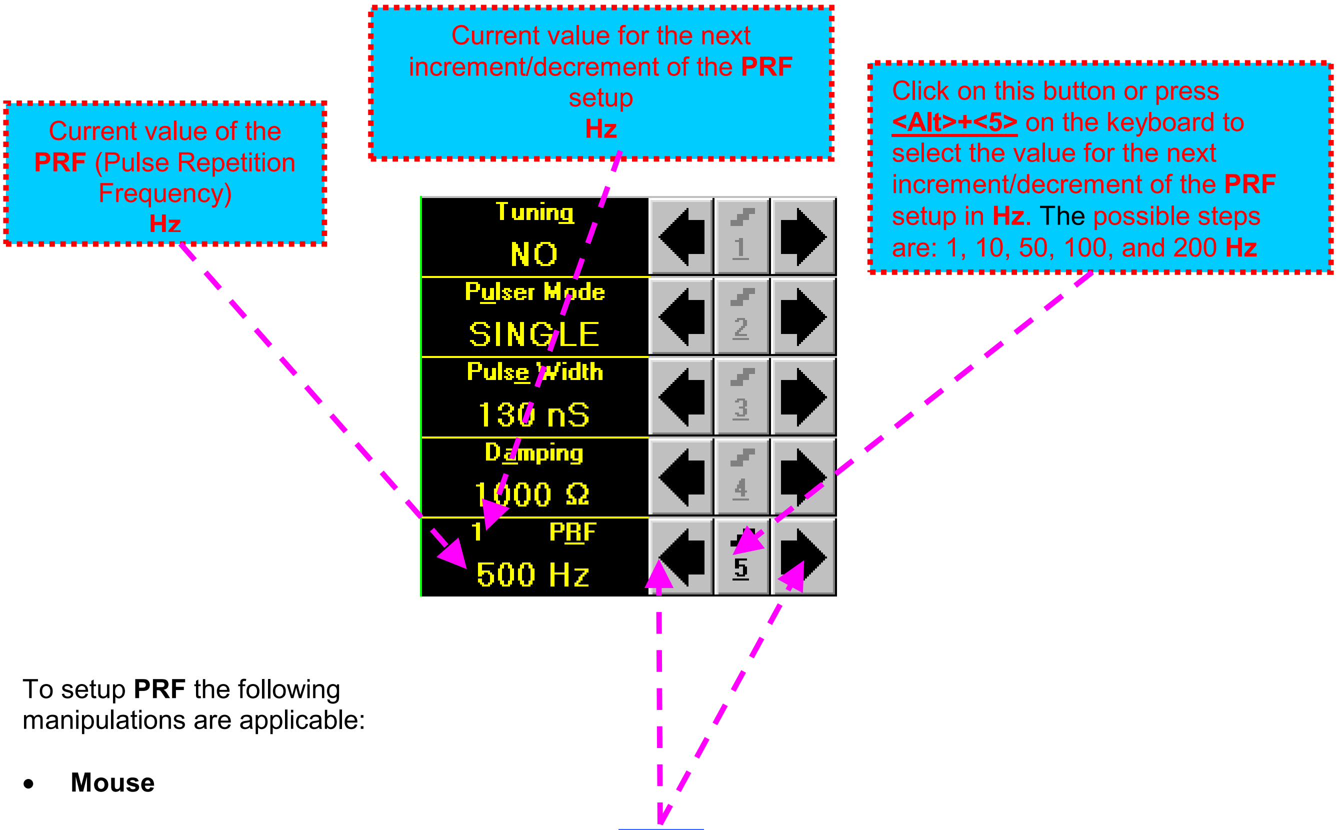


To setup **Damping** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<A>** ⇒ **Damping** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Damping** the letter **a** is underlined)
- **Combined**
  - Click on **Damping** ⇒ **Damping** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

There are 21 (twenty one) discrete values of damping available for the UDS 3-4: 13Ω, 15Ω, 17Ω, 20Ω, 25Ω, 30Ω, 35Ω, 40Ω, 45Ω, 56Ω, 65Ω, 76Ω, 90Ω, 115Ω, 130Ω, 150Ω, 180Ω, 240Ω, 320Ω, 500Ω, and 1000 Ω



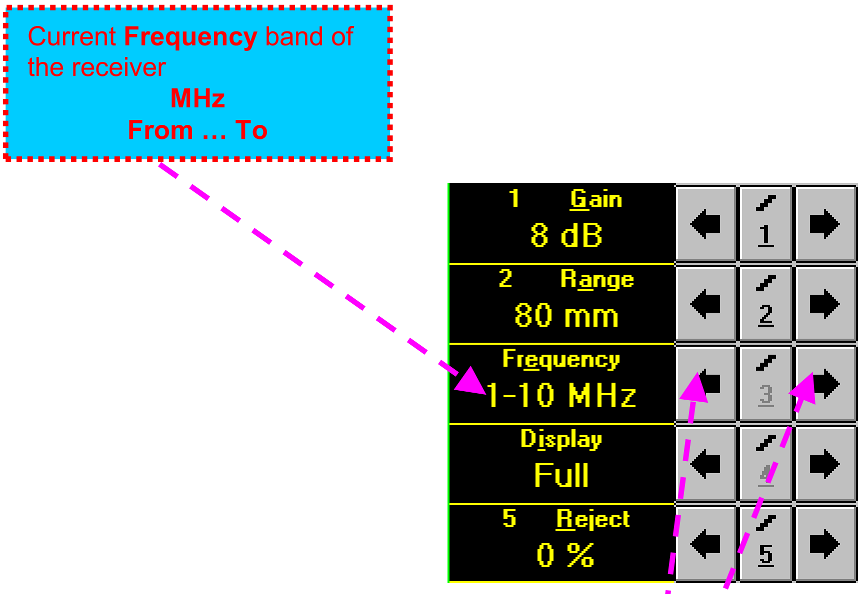
To setup **PRF** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<R>** ⇒ **PRF** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **PRF** the letter **R** is underlined)
- **Combined**
  - Click on **PRF** ⇒ **PRF** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

UDS 3-4 is equipped with the special protection circuit preventing the damage of the probe or firing driver, which may be caused by the not suitable settings of **Tuning**, or **Damping**, or **Pulse Width**, or their combination. The protection circuit limits the total energy delivered to the firing output through the *automatic reducing of the **PRF** to the safe value*

5.4.5. Sub Menu RECEIVER (UDS 3-3 and USLT 2000)



To setup **Frequency** band of the receiver the following manipulations are applicable:

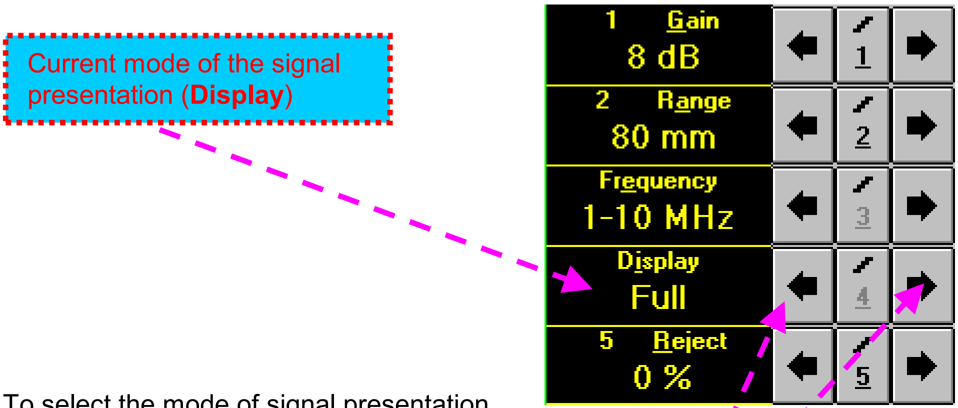
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<E>** ⇒ **Frequency** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Frequency** the letter **e** is underlined)
- **Combined**
  - Click on **Frequency** ⇒ **Frequency** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

- There are 16 (sixteen) frequency bands of the receiver available for the UDS 3-3:

0.001 – 35 MHz	0.001 – 25 MHz	0.001 – 15 MHz	0.001 – 10 MHz
0.3 – 35 MHz	0.3 – 25 MHz	0.3 – 15 MHz	0.3 – 10 MHz
1 – 35 MHz	1 – 25 MHz	1 – 15 MHz	1 – 10 MHz
5 – 35 MHz	5 – 25 MHz	5 – 15 MHz	5 – 10 MHz

- There are 4 (four) frequency bands of the receiver available for the USLT 2000:
  0.5 – 3MHz 7 – 20 MHz 2 – 7 MHz 3 – 20 MHz

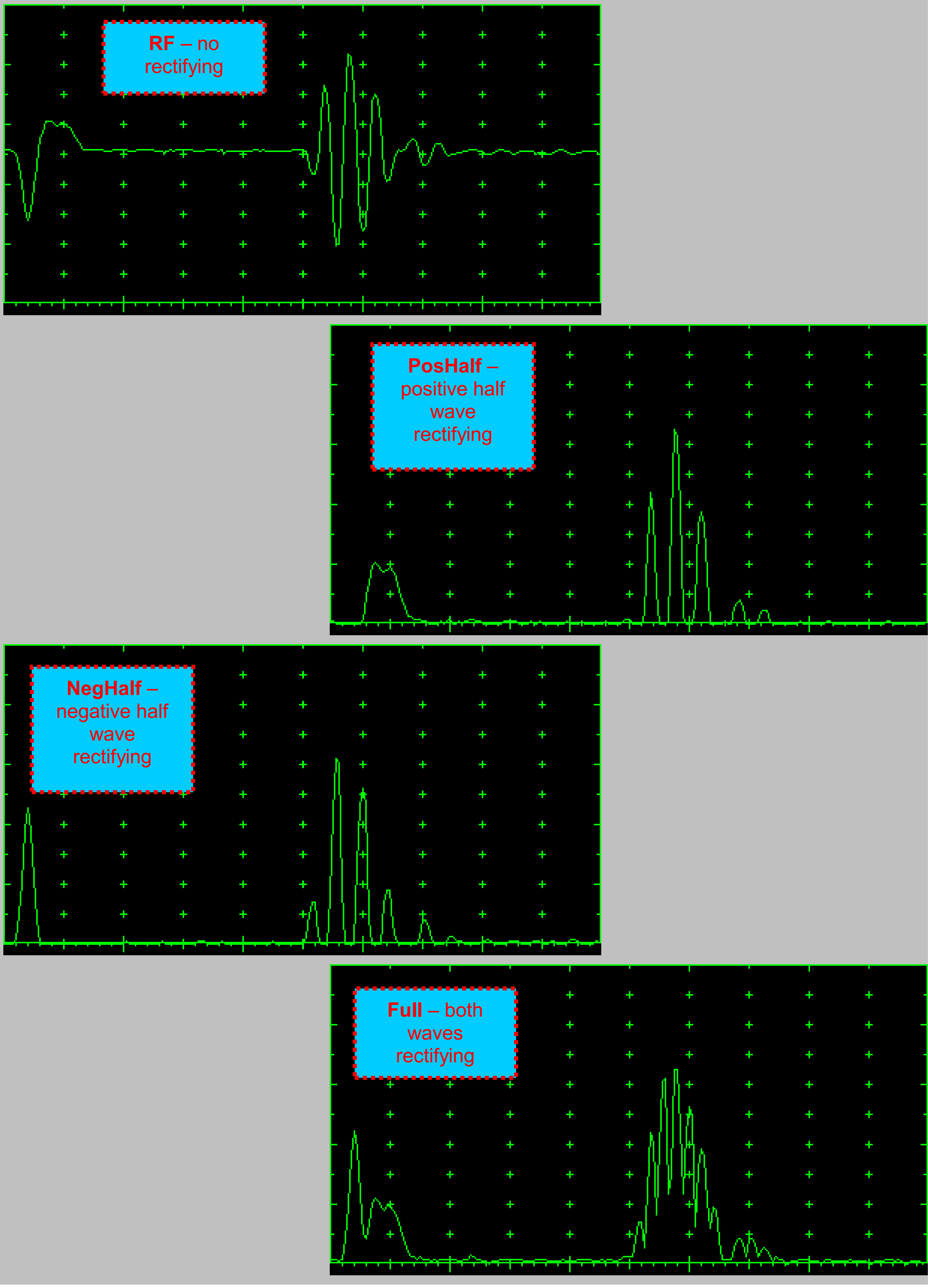


To select the mode of signal presentation (**Display**) the following manipulations are applicable:

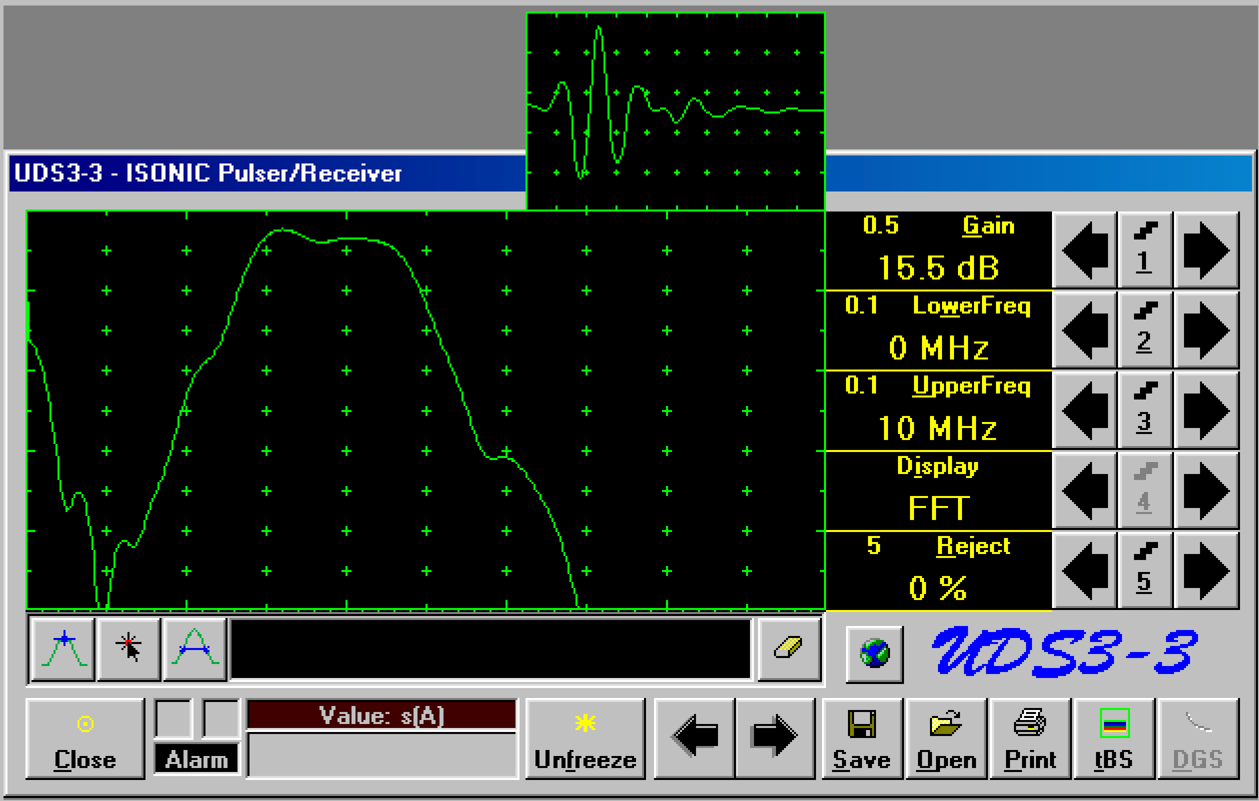
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<I>** ⇒ **Display** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Display** the letter **i** is underlined)
- **Combined**
  - Click on **Display** ⇒ **Display** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

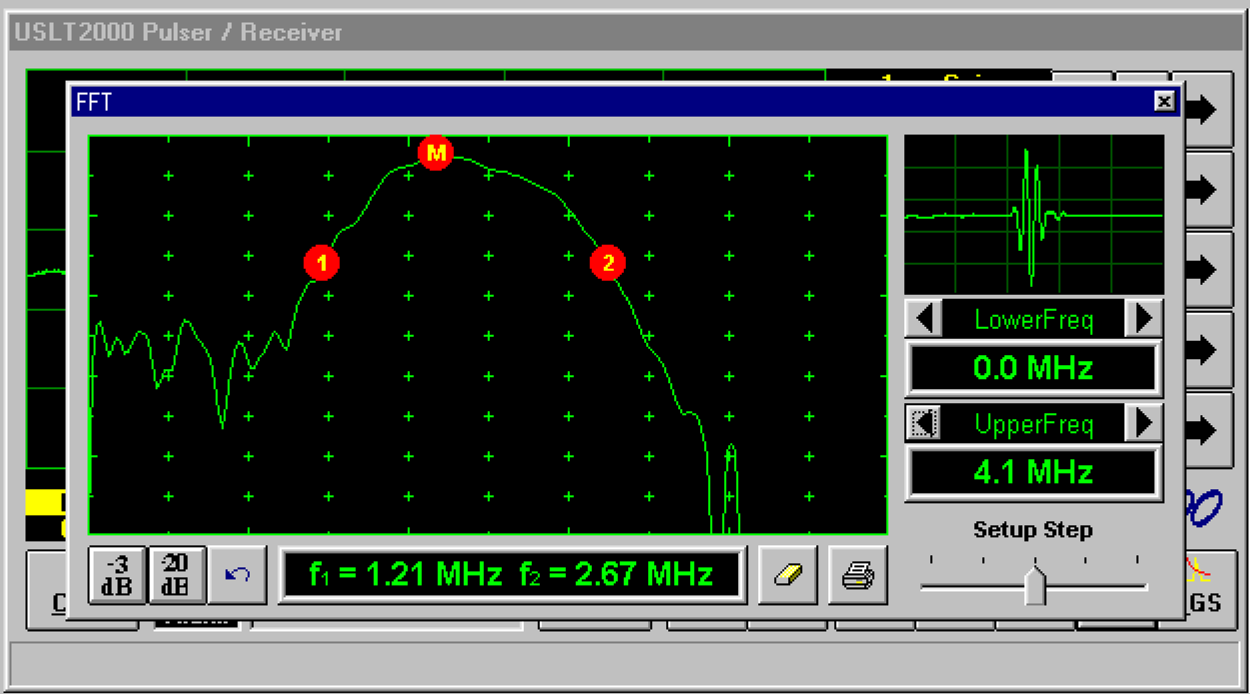
ⓘ

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

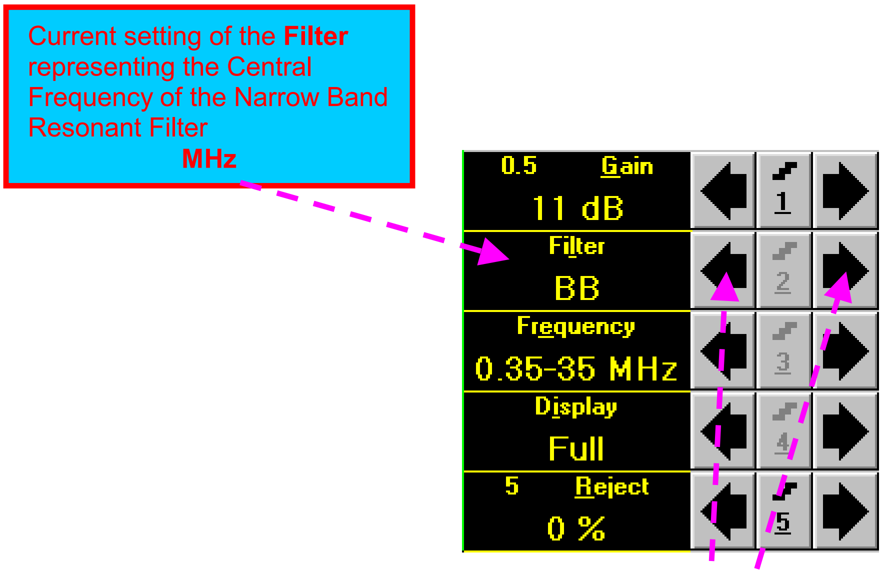


♦ The *frequency domain signal presentation* is available through the FFT **Display** mode. Refer to the paragraph 5.4.17 of this Operating Manual for the frequency domain signal presentation and measurements tips





5.4.6. Sub Menu RECEIVER (UDS 3-4)



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

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **Filter** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Filter** the letter **l** is underlined)
- **Combined**
  - Click on **Filter** ⇒ **Filter** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

- The are 6 (six) narrow bands resonant filters in the **UDS 3-4** having the central frequencies of
  0.5 ± 0.15 MHz
  1 ± 0.3 MHz
  2 ± 0.6 MHz
  4 ± 1.2 MHz
  10 ± 3 MHz
  15 ± 4.5 MHz
- The narrow band resonant filtering is negated upon setting up **Filter** to **BB** (Broad Band)

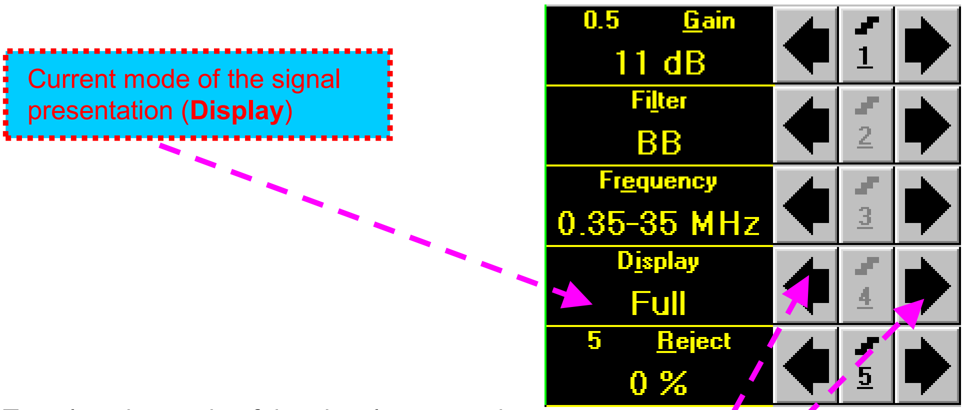
Current **Frequency** band of the receiver
MHz
From … To

To setup the **Frequency** band of the receiver the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<E>** ⇒ **Frequency** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Frequency** the letter **e** is underlined)
- **Combined**
  - Click on **Frequency** ⇒ **Frequency** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ
There are 28 (twenty eight) **Frequency** bands of the receiver available:

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

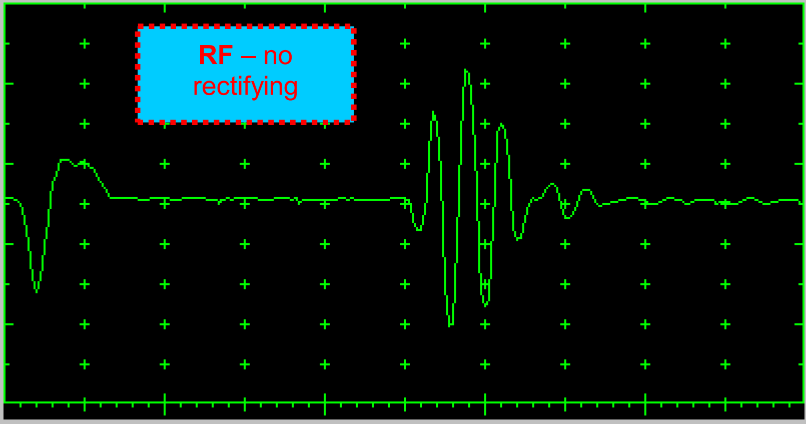


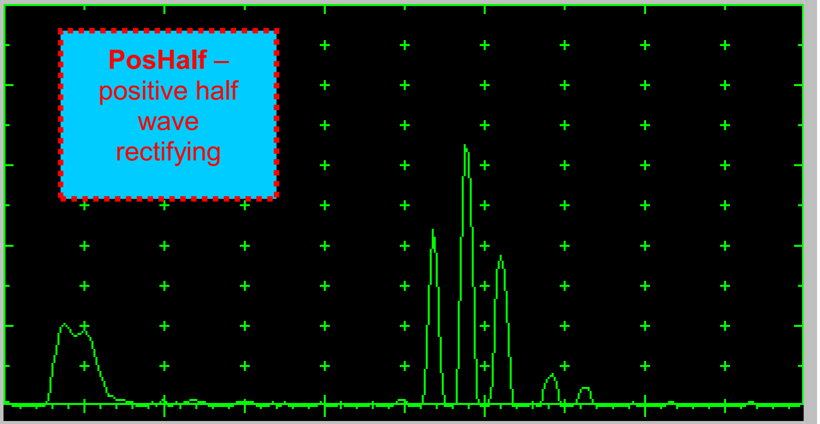
To select the mode of the signal presentation (**Display**) the following manipulations are applicable:

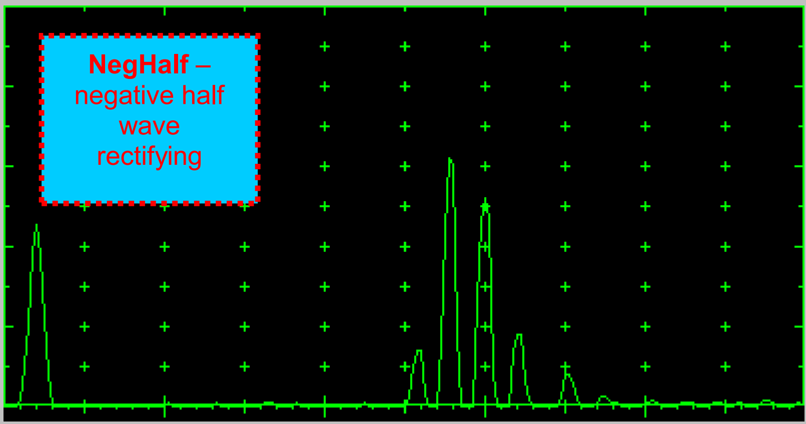
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<I>** ⇒ **Display** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Display** the letter **i** is underlined)
- **Combined**
  - Click on **Display** ⇒ **Display** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

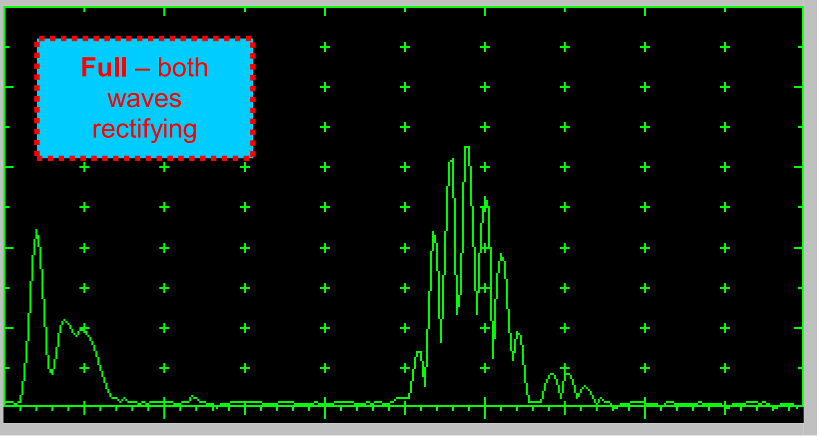
ⓘ

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

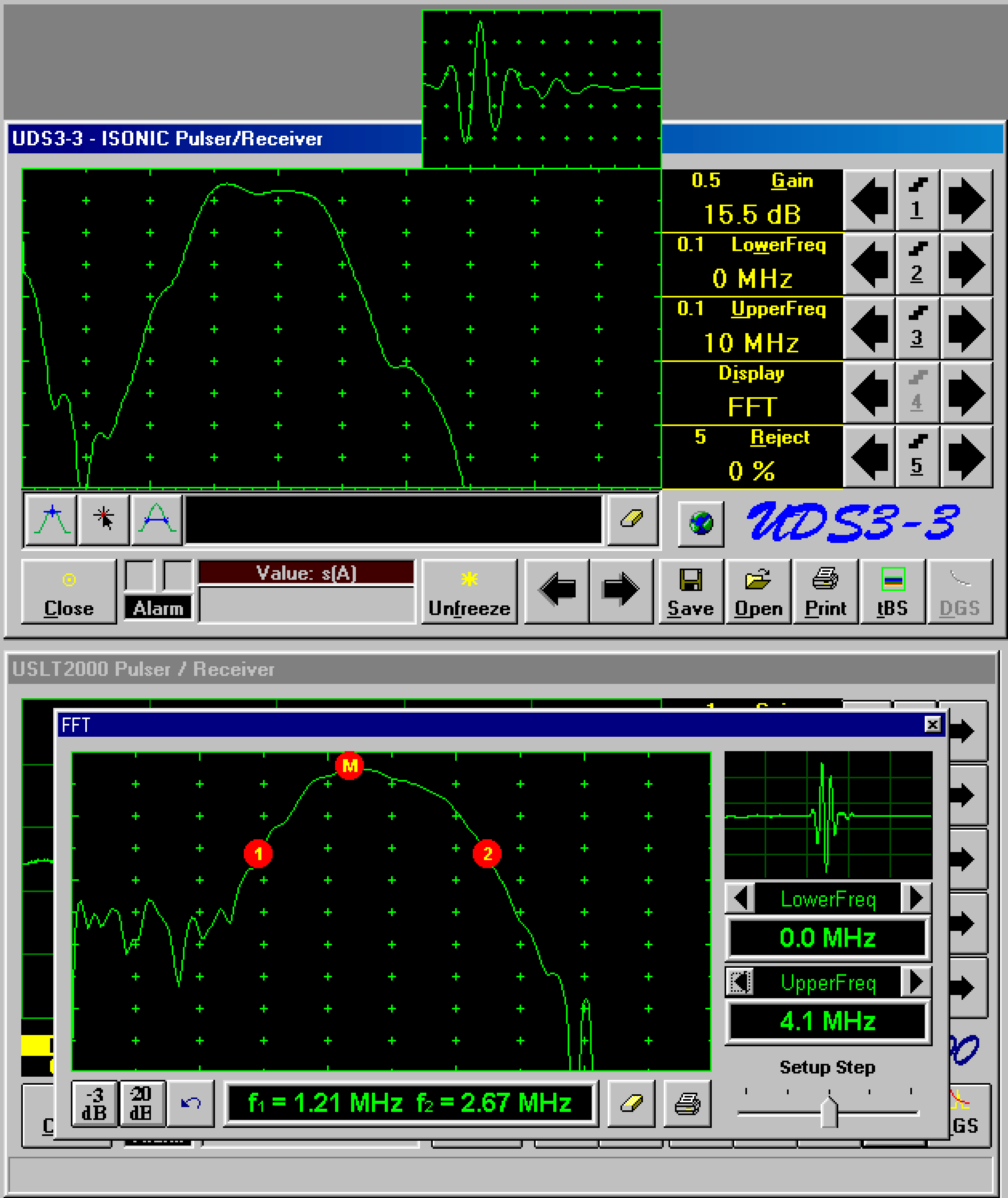




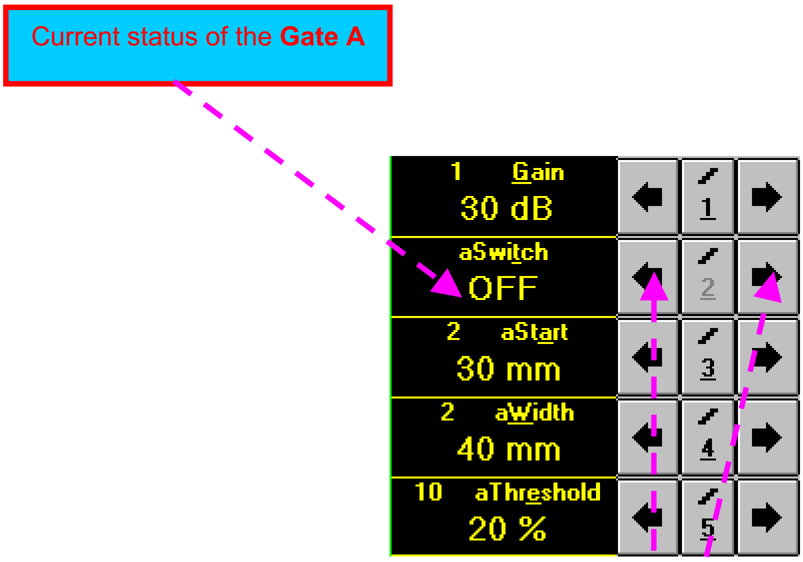




♦ The *frequency domain signal presentation* is available through the FFT **Display** mode. Refer to the paragraph 5.4.17 of this Operating Manual for the frequency domain signal presentation and measurements tips

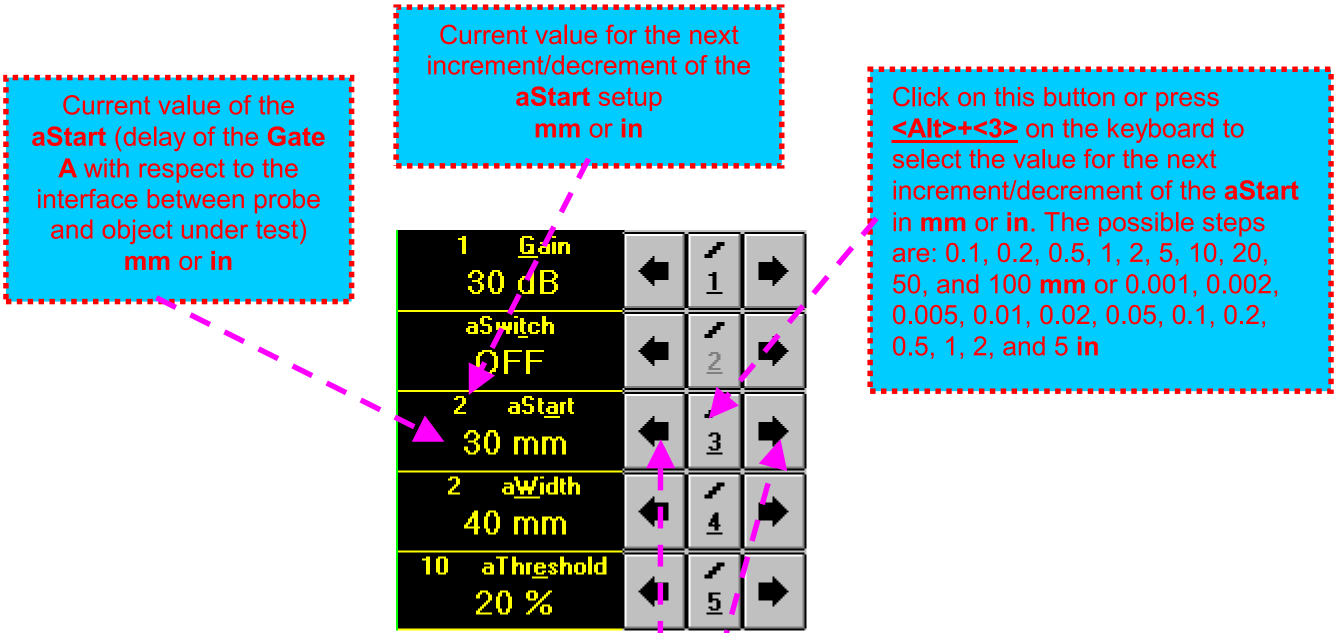


5.4.7. Sub Menu GATE A



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

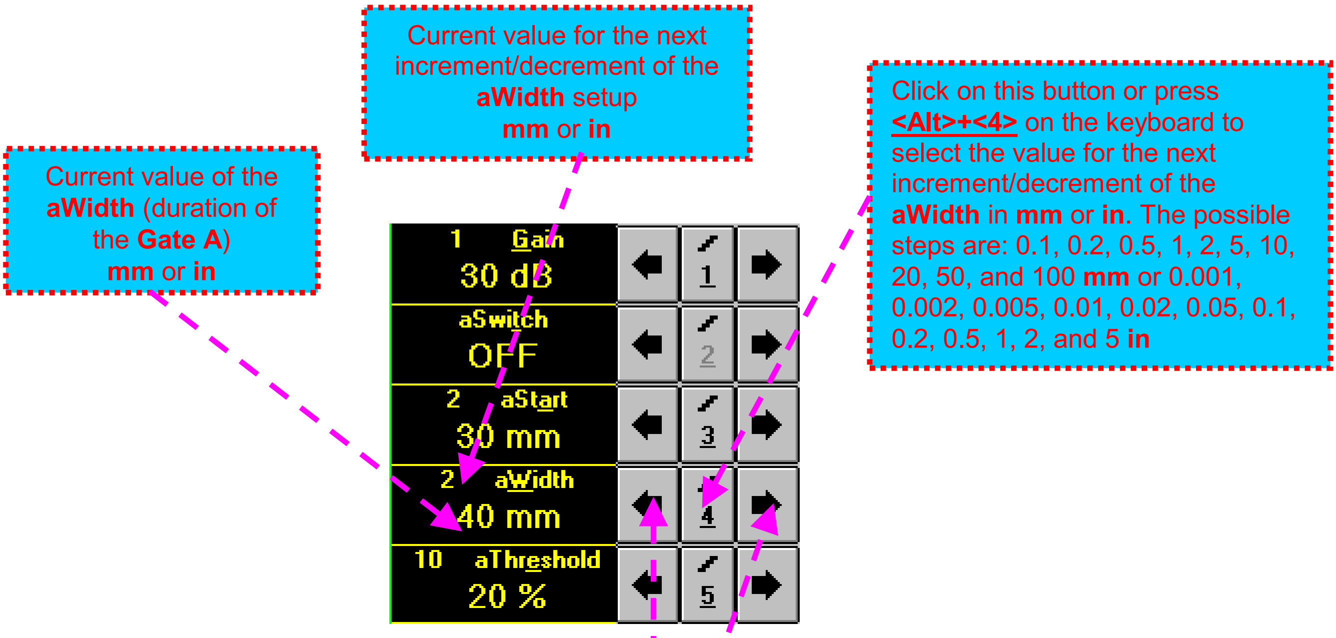
- **Mouse**
  - ■ Click or press and hold on the appropriate button
- **Keyboard**
  - ■ Pressing **<Alt>+<T>** ⇒ **aSwitch** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **aSwitch** the letter **t** is underlined)
- **Combined**
  - ■ Click on **aSwitch** ⇒ **aSwitch** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard



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

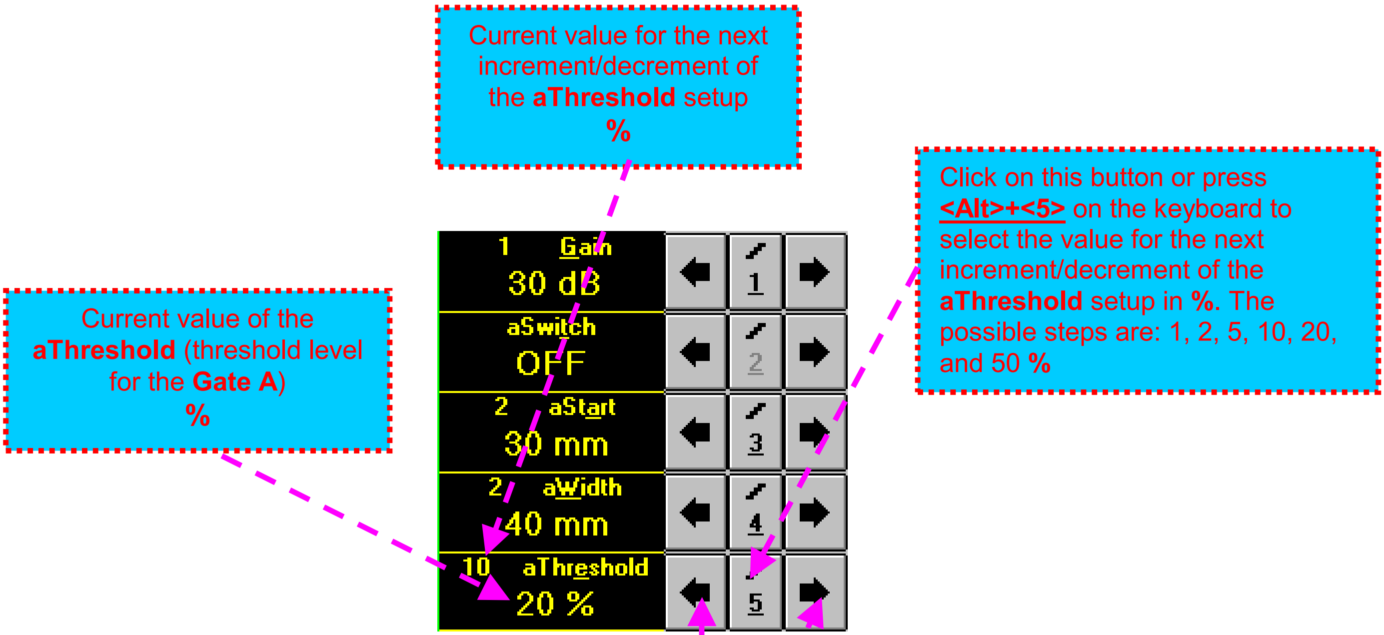
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<A>** ⇒ **aStart** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **aStart** the letter **a** is underlined)
- **Combined**
  - Click on **aStart** ⇒ **aStart** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard
- **Drag / Drop technology (refer to the paragraph 5.4.9 of this Operating Manual)**

ⓘ
aStart setup is also possible though some other submenus following the same rules as above



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

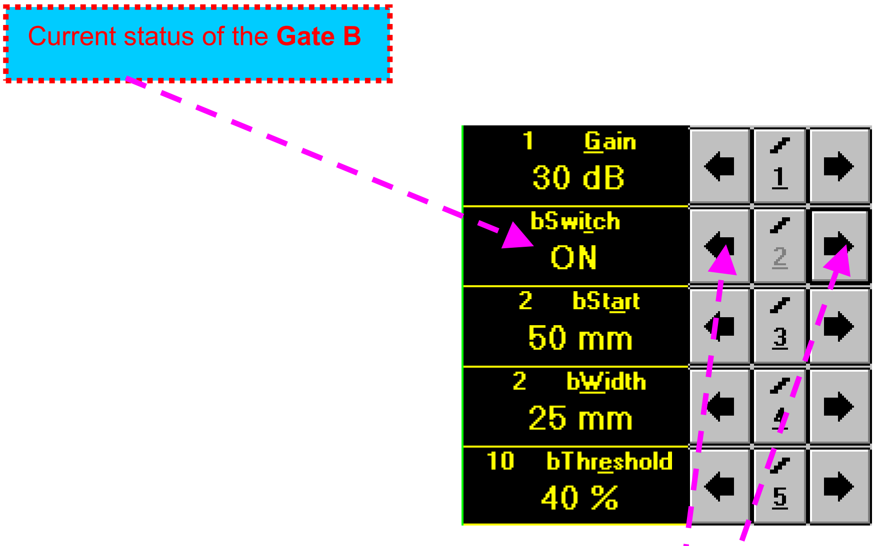
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<W>** ⇒ **aWidth** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **aWidth** the letter **W** is underlined)
- **Combined**
  - Click on **aWidth** ⇒ **aWidth** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard
- **Drag / Drop technology (refer to paragraph 5.4.9 of this Operating Manual)**



To setup the threshold level for the **Gate A** (**aThreshold**) the following manipulations are applicable:

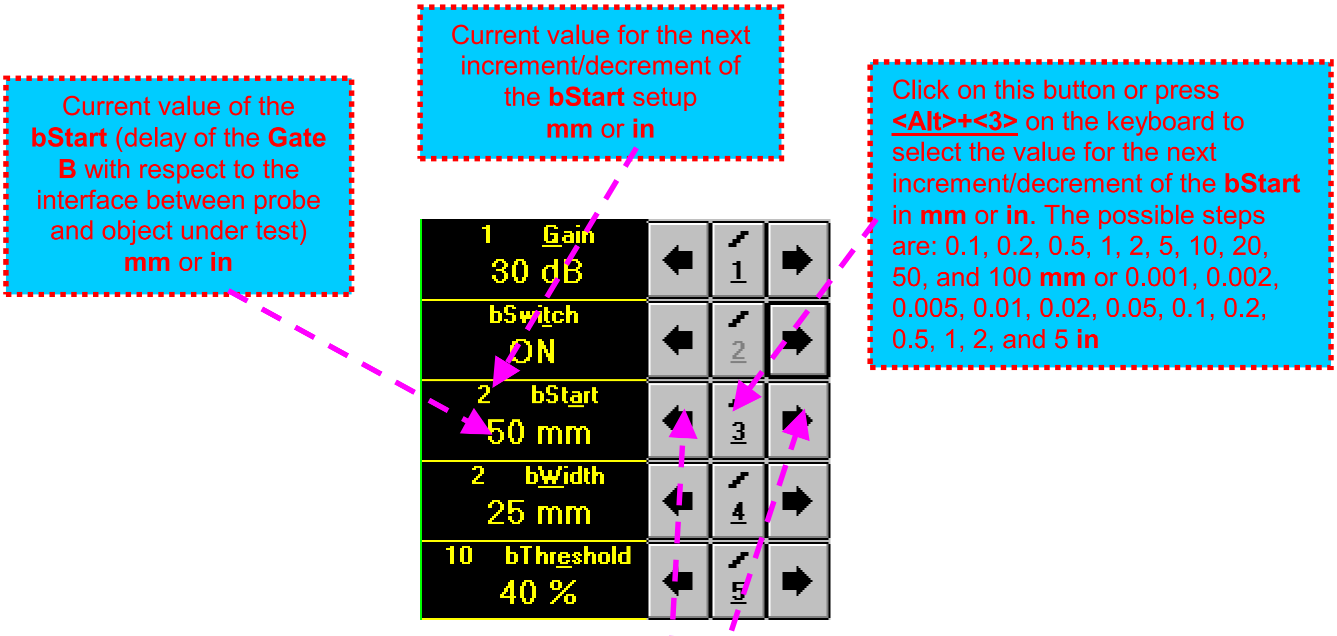
- **Mouse**
  - ■ Click or press and hold on the appropriate button
- **Keyboard**
  - ■ Pressing **<Alt>+<E>** ⇒ **aThreshold** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **aThreshold** the letter **e** is underlined)
- **Combined**
  - ■ Click on **aThreshold** ⇒ **aThreshold** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard
- **Drag / Drop technology (refer to paragraph 5.4.9 of this Operating Manual)**

5.4.8. Sub Menu GATE B



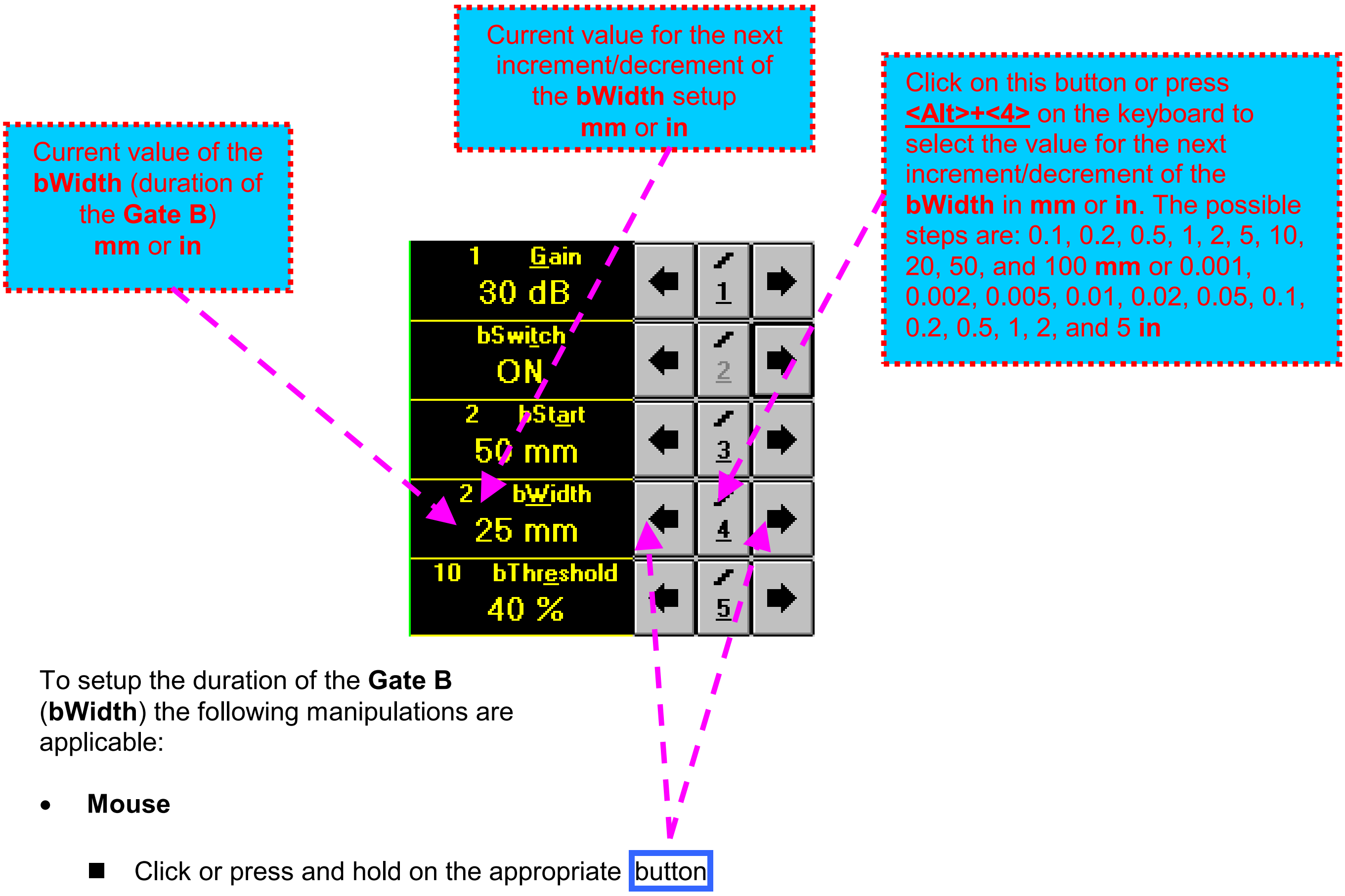
To switch **Gate B ON / OFF** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **bSwitch** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **bSwitch** the letter **t** is underlined)
- **Combined**
  - Click on **bSwitch** ⇒ **bSwitch** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard



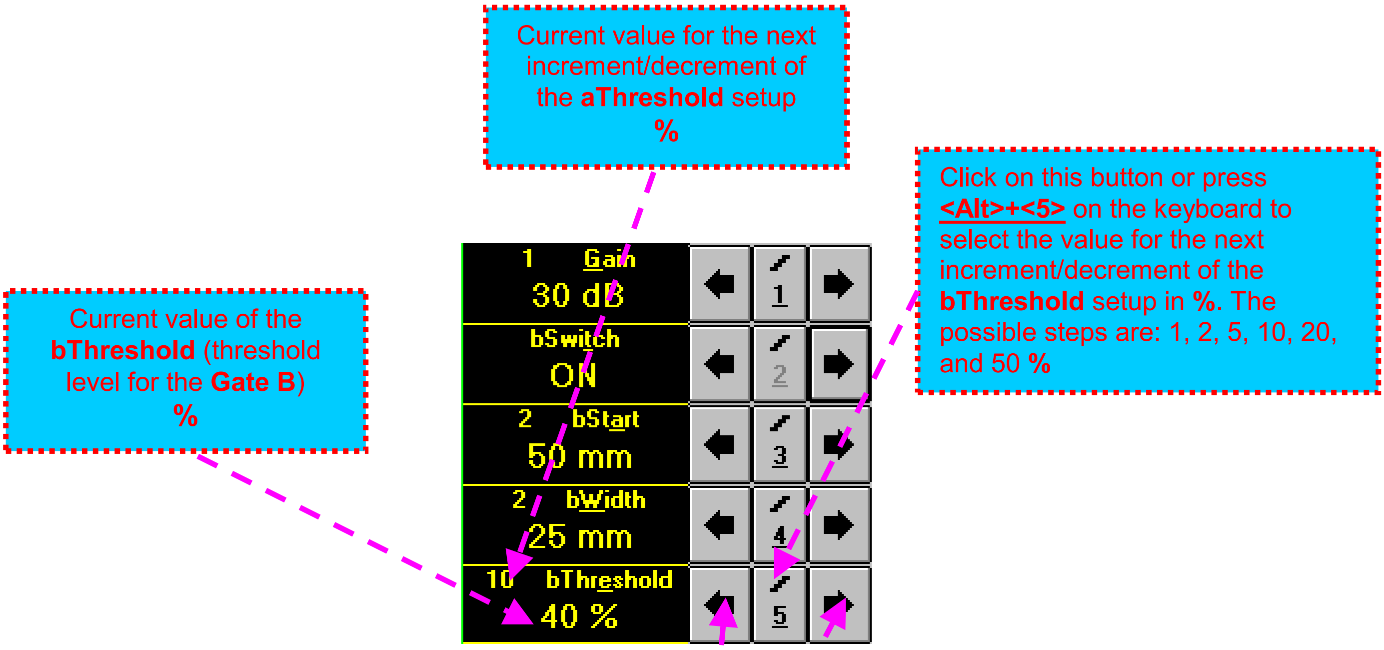
To setup the delay of the **Gate B** (**bStart**) the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<A>** ⇒ **bStart** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **bStart** the letter a is underlined)
- **Combined**
  - Click on **bStart** ⇒ **bStart** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard
- **Drag / Drop technology (refer to paragraph 5.4.9 of this Operating Manual)**



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

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<W>** ⇒ **bWidth** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **bWidth** the letter **W** is underlined)
- **Combined**
  - Click on **bWidth** ⇒ **bWidth** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard
- **Drag / Drop technology (refer to paragraph 5.4.9 of this Operating Manual)**

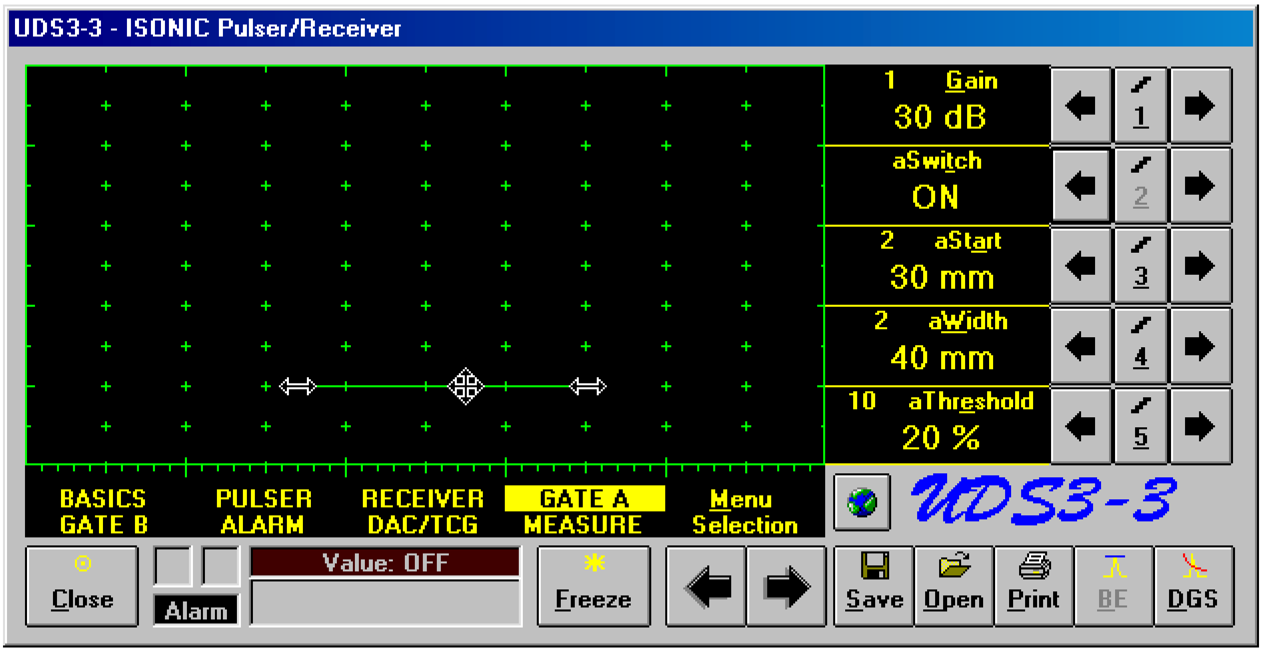


To setup the threshold level for the **Gate B** (**bThreshold**) the following manipulations are applicable:

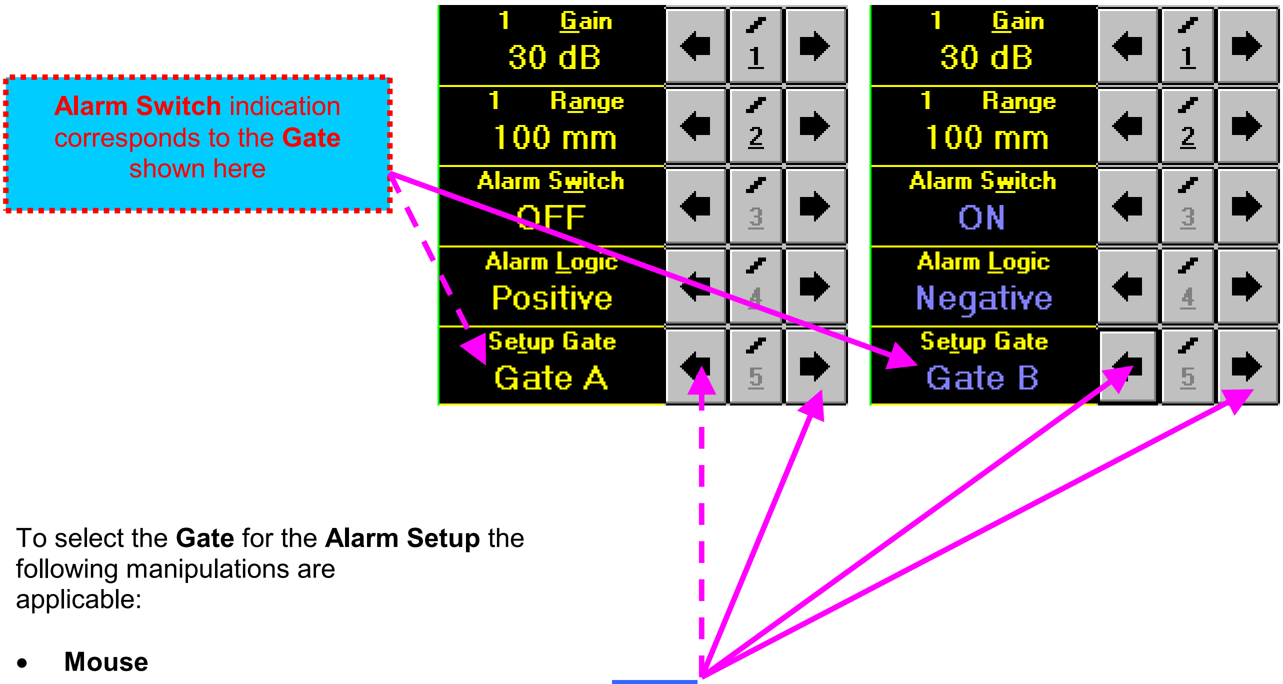
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<E>** ⇒ **bThr<u>e</u>shold** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **bThr<u>e</u>shold** the letter **<u>e</u>** is underlined)
- **Combined**
  - Click on **bThr<u>e</u>shold** ⇒ **bThr<u>e</u>shold** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard
- **Drag / Drop technology (refer to paragraph 5.4.9 of this Operating Manual)**

5.4.9. Drag and Drop technology: setup of the Gate A and Gate B

The **Drag and Drop** technology is applicable for the setup of both gates (**Gate A** and **Gate B**) provided that they are visible: if placing the mouse pointer above the appropriate section of the gate then it changes the shape correspondingly. To setup the gate just press and hold left mouse button or touch screen stylus and drag, then drop through the releasing of the left mouse button or touch screen stylus

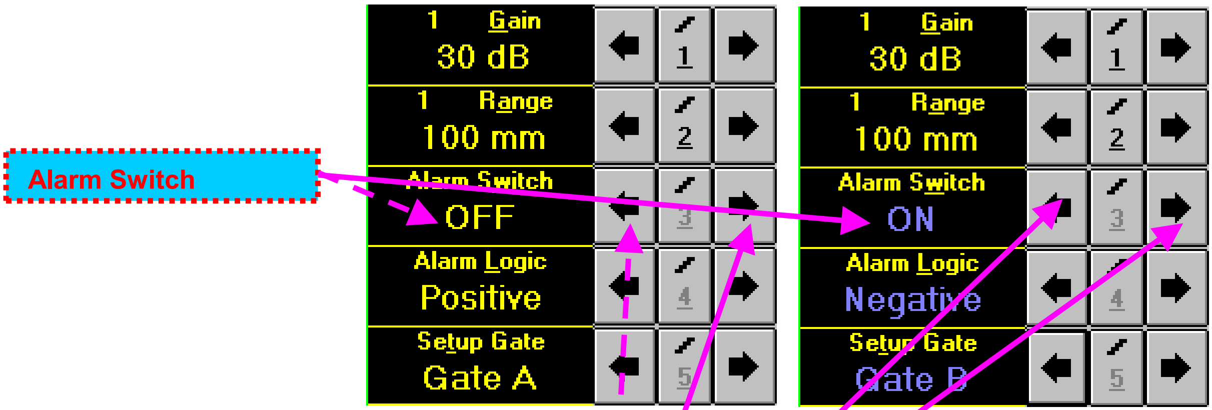


5.4.10. Sub Menu ALARM



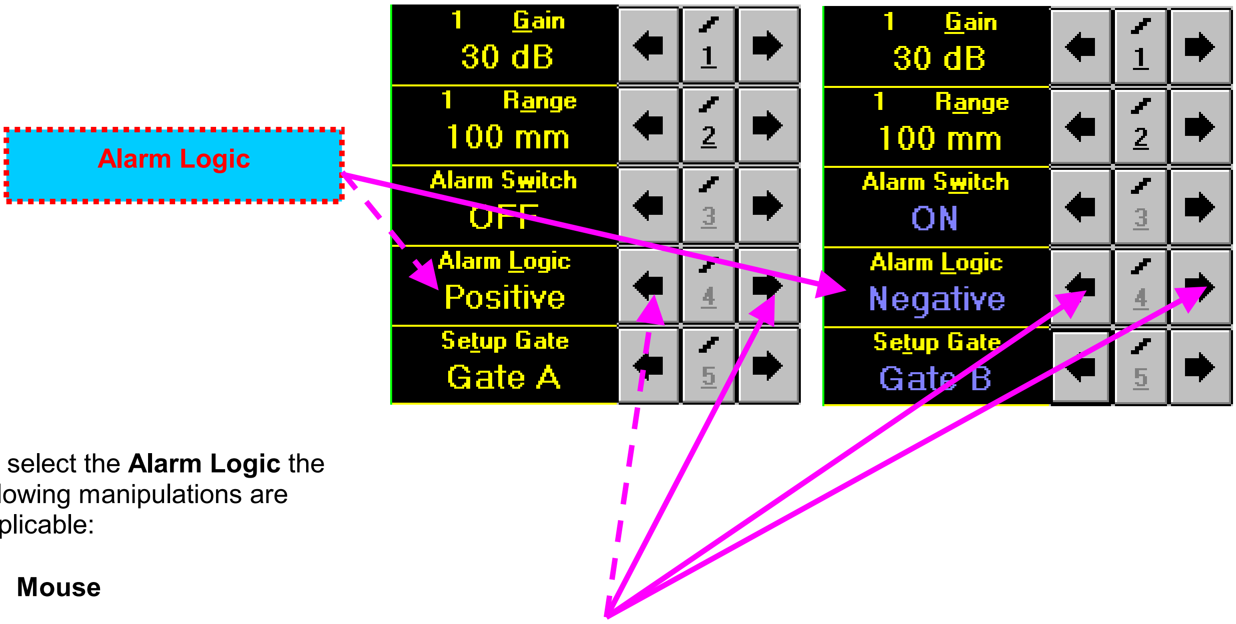
To select the **Gate** for the **Alarm Setup** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **Setup Gate** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Setup Gate** the letter **t** is underlined)
- **Combined**
  - Click on **Setup Gate** ⇒ **Setup Gate** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard



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

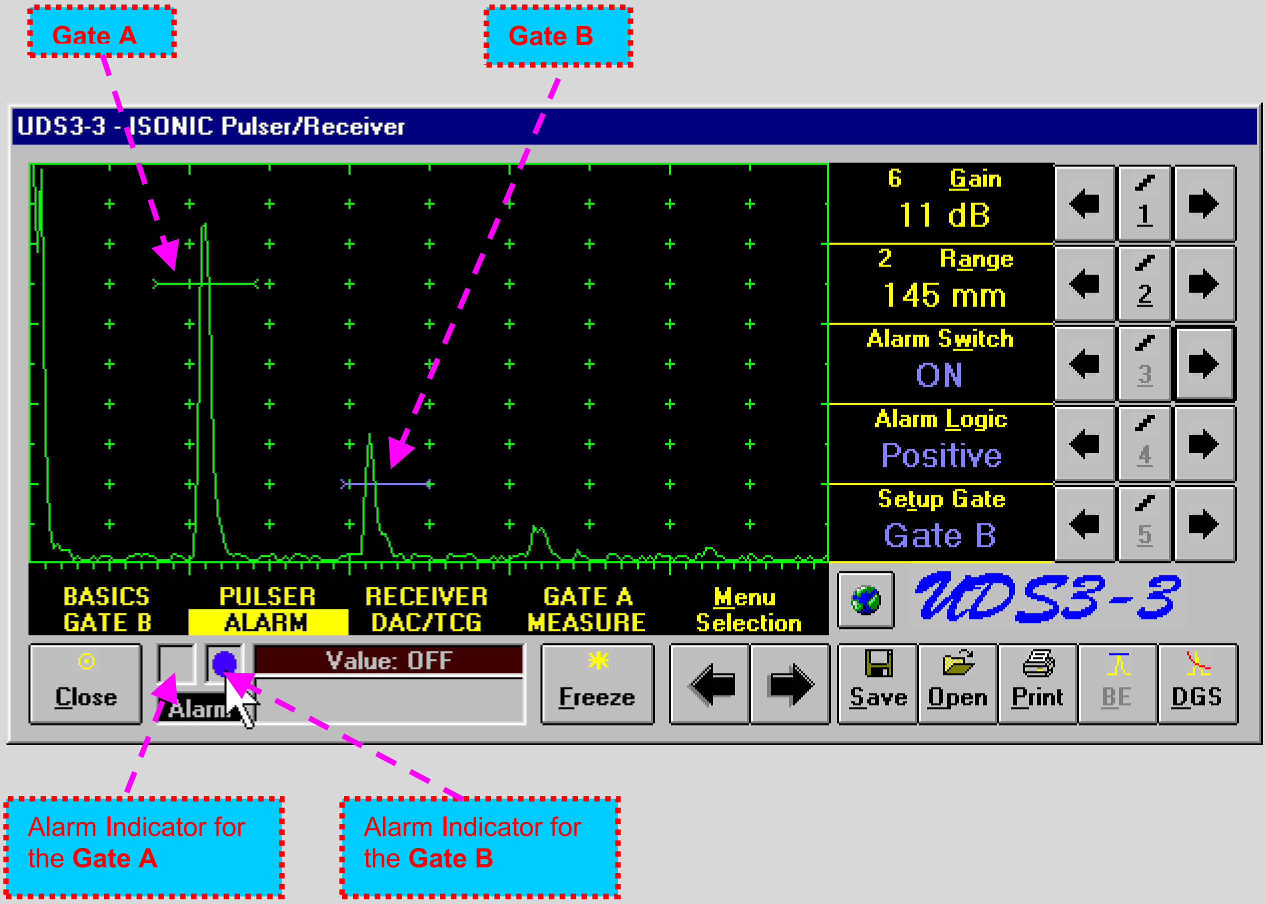
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<W>** ⇒ **Alarm Switch** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Alarm Switch** the letter **w** is underlined)
- **Combined**
  - Click on **Alarm Switch** ⇒ **Alarm Switch** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard



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

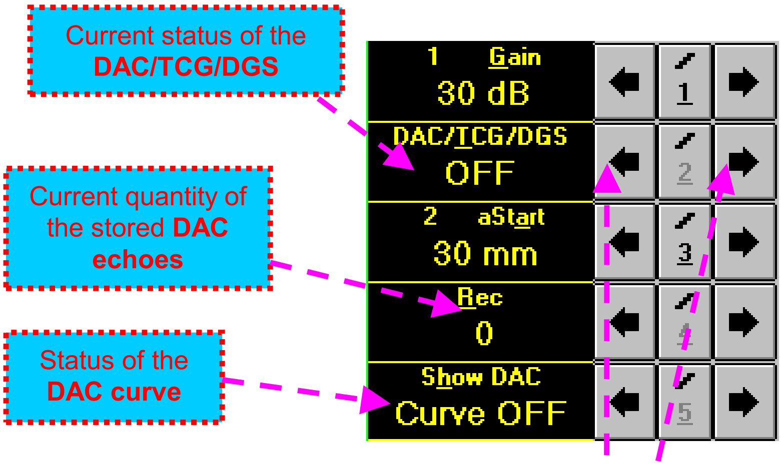
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **Alarm Logic** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Alarm Logic** the letter **L** is underlined)
- **Combined**
  - Click on **Alarm Logic** ⇒ **Alarm Logic** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ
Alarm Examples



- There is a pulse matching with the **Gate A** and exceeding its threshold; the logic of the **Gate A** is setup to **Negative**. As a result, the **Alarm Indicator** for the **Gate A** is not active
- There is a pulse matching with the **Gate B** exceeding its threshold; the logic of the **Gate B** is setup to **Positive**. As a result, the **Alarm Indicator** for the **Gate B** is active

5.4.11. Sub Menu DAC/TCG



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

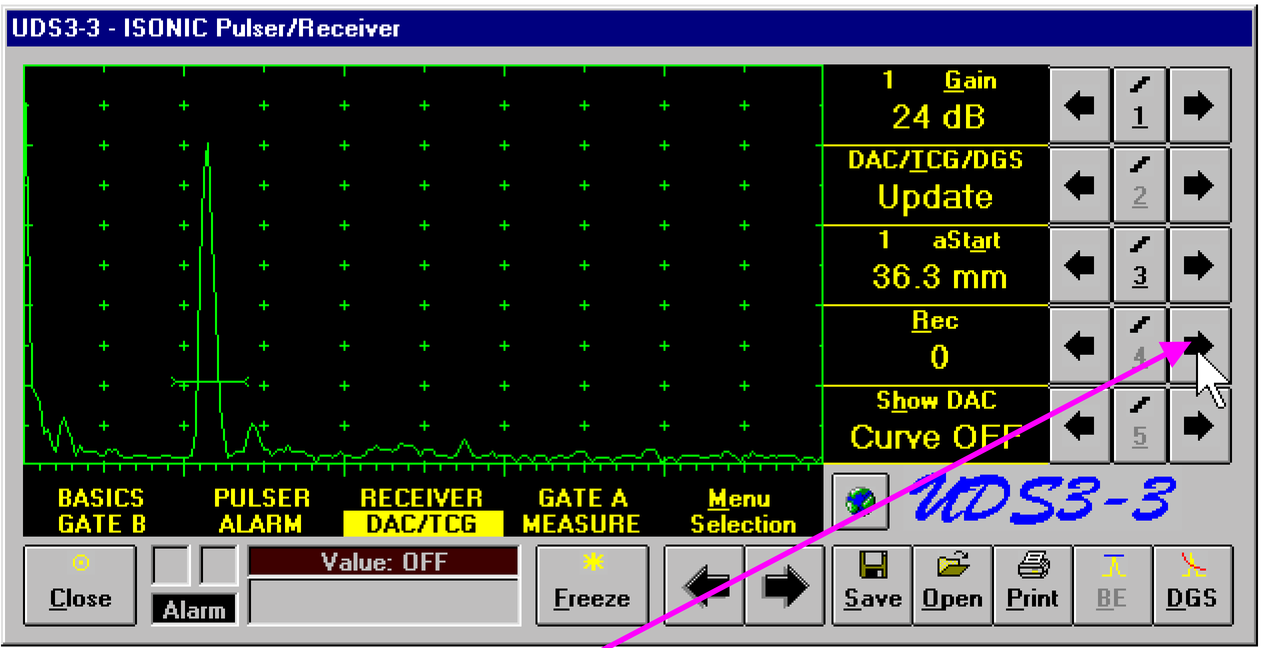
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **DAC/TCG/DGS** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **DAC/TCG/DGS** the letter **T** is underlined)
- **Combined**
  - Click on **DAC/TCG/DGS** ⇒ **DAC/TCG/DGS** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

- There are four modes available for the **DAC/TCG**:
  - **OFF** - **DAC Curve** switches automatically to **OFF** if setting mode to **OFF**
  - **DAC** - available if the quantity of stored echoes is 2 (two) or more. **DAC Curve** switches automatically to **ON** in the **DAC** mode
  - **TCG** - available if the quantity of stored echoes is 2 (two) or more. **DAC Curve** switches automatically to **OFF** in the **TCG** mode
  - **Update** - allows to creating a new or to update the existing **DAC**. Update of the existing **DAC** allows to erase a number of the sequentially recorded echoes, starting from the latest one, and/or to record new echoes. The maximal number of echoes recorded into the one **DAC** is 40 (forty) for **UDS 3-3** and **UDS 3-4** or 25 (Twenty Five) for **USLT 2000**. The **DAC Curve** switches automatically to **ON** if the number of recorded echoes is 2 (two) or more switches automatically to **OFF** if the number of recorded echoes is less than 2 (two) in the **Update** mode
- It is possible to Create / Modify / Activate **DAC** and **TCG** for all **Display** modes (**RF**, **Full**, **Negative**, and **Positive**) if using **UDS 3-3** or **UDS 3-4** Card
- It is not possible to Create / Modify / Activate **DAC** and **TCG** for the **RF Display** mode if using **USLT 2000** card
- To create / modify **DAC/TCG** or **DGS** refer to the paragraphs 5.4.12, 5.4.13, 5.4.14 of this Operating Manual
- For **USLT 2000 DAC/TCG/Update** modes are not available if the **RF** setup of the **Display**

5.4.12. Create / Modify DAC

Switch on the **Gate A** then switch **DAC/TCG/DGS** to **Update**; place probe into the position of receiving the maximized echo from the nearest reflector (first echo), then provide the coincidence between the echo and **Gate A** and store the *first DAC echo*



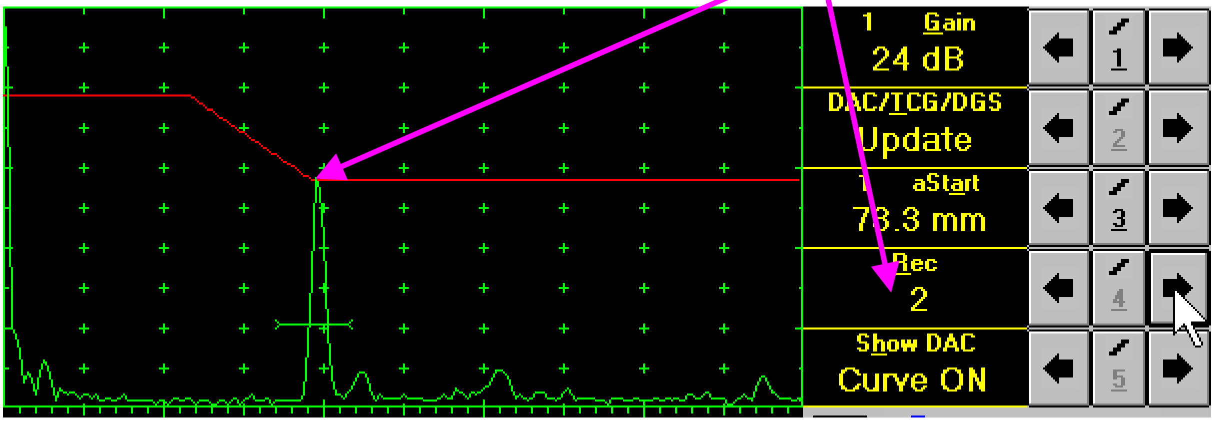
To store the DAC echo the following manipulations are applicable:

- **Mouse**
  - Click on
- **Keyboard**
  - Pressing **<Alt>+<R>** ⇒ **Rec** fore color changes to white - then press ↑ or → button on the keyboard (In the **Rec** the letter **R** is underlined)
- **Combined**
  - Click on **Rec** ⇒ **Rec** fore color changes to white - then press ↑ or → button on the keyboard

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

Place probe into the position ensuring the receiving of the maximized echo from the second reflector then provide the coincidence between the echo and **Gate A** and store the *next DAC echo*

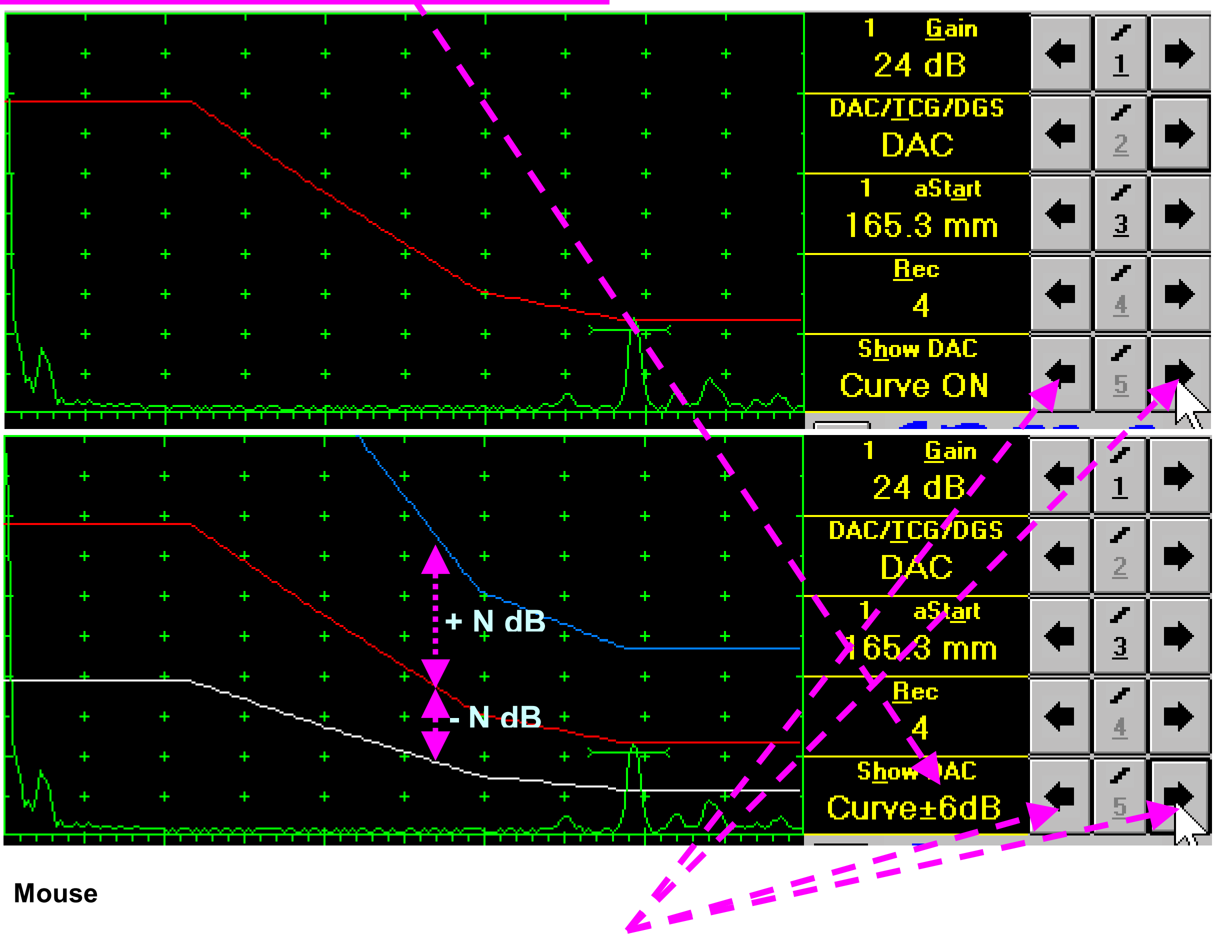
As result the *second DAC echo* will be stored and the incremented indication appears:



ⓘ

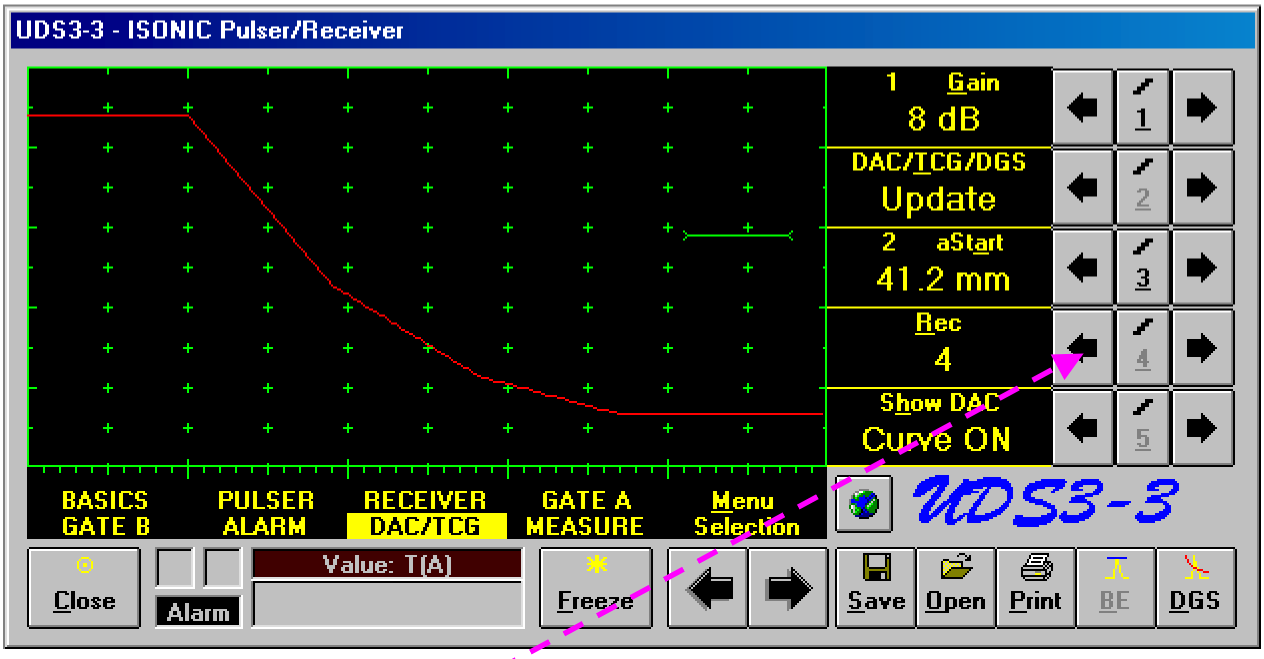
- A total number of 40 echoes may be stored one by one by the same way as described above if using the **UDS 3-3** or **UDS 3-4**
- A total number of 25 echoes may be stored if using the **USLT 2000**

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**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<H>** ⇒ **Show DAC** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Show DAC** the letter **h** is underlined)
- **Combined**
  - Click on **Show DAC** ⇒ **Show DAC** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

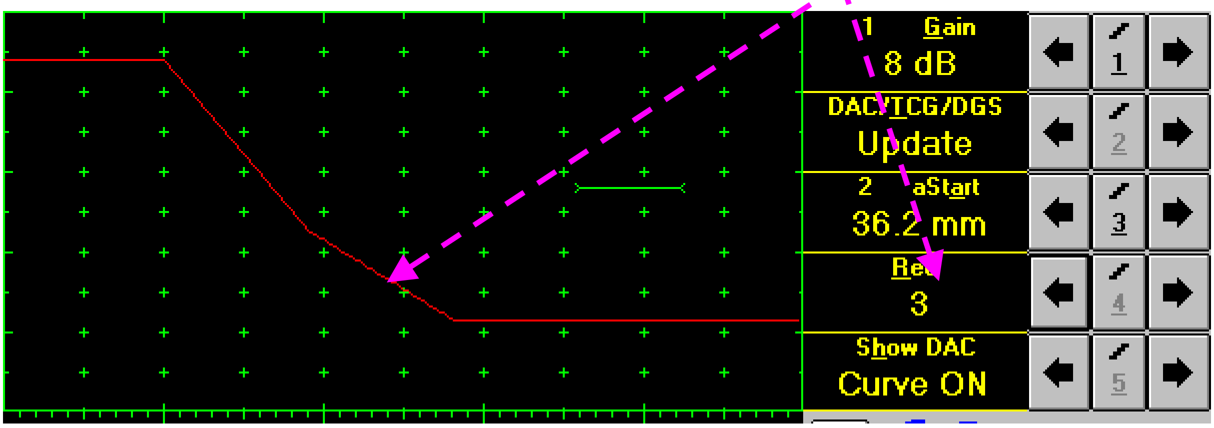
It's possible to erase the last stored echo from the **DAC**. To proceed set the **DAC/TCG/DGS** to **Update**:



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

- **Mouse**
  - Click on
- **Keyboard**
  - Pressing **<Alt>+<R>** ⇒ **Rec** fore color changes to white - then press ← or ↓ button on the keyboard (In the **Rec** the letter **R** is underlined)
- **Combined**
  - Click on **Rec** ⇒ **Rec** fore color changes to white - then press ← or ↓ button on the keyboard

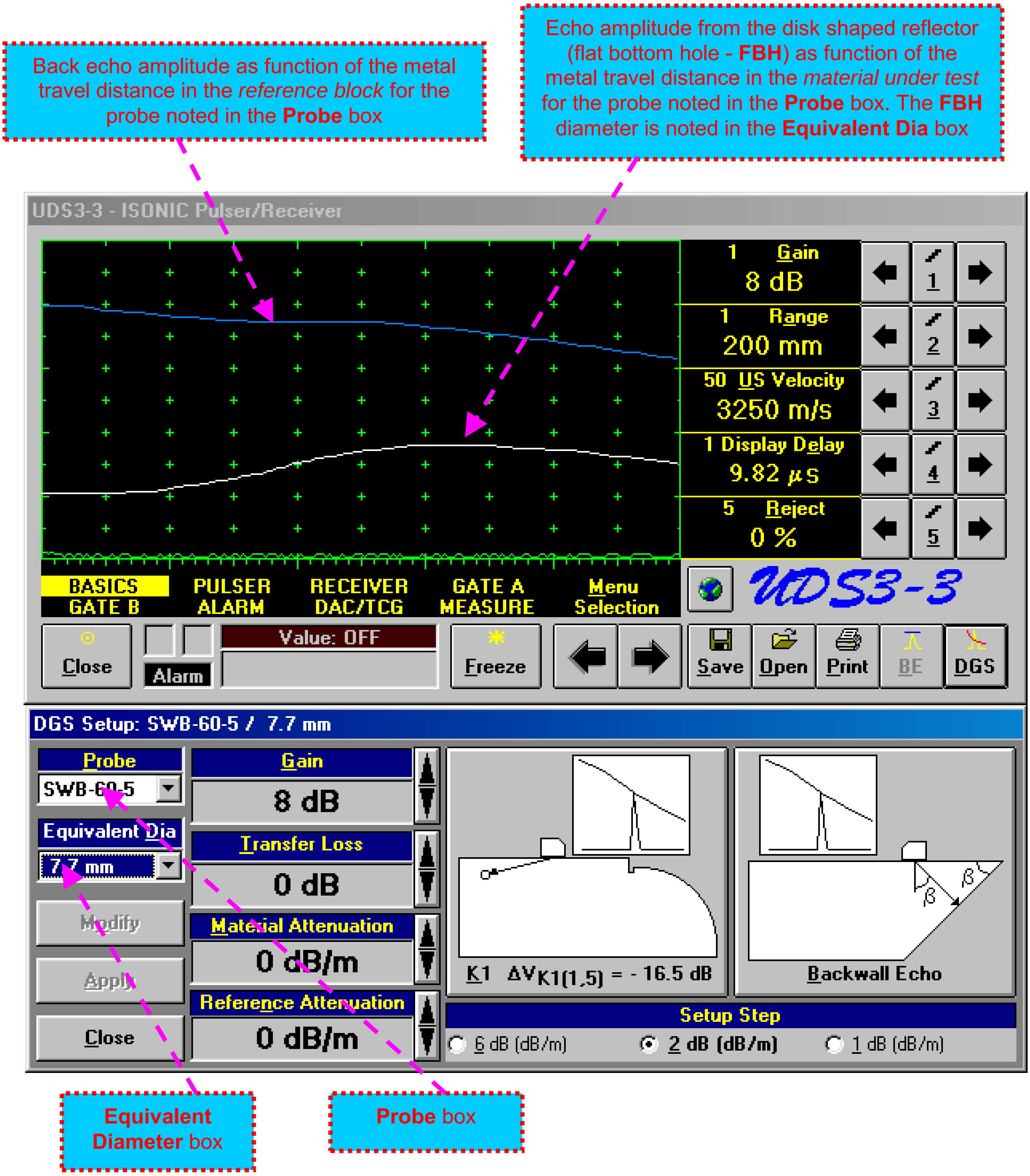
As a result the last stored echo will be erased and the decremented indication will appear:



5.4.13. DGS (UDS3-3 and UDS 3-4)

To setup **DGS** set **Display** to **Full** then click on 

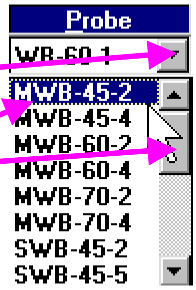
or press **<Alt>+<D>** on the keyboard. The following screen appears:



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

Step 1: Probe

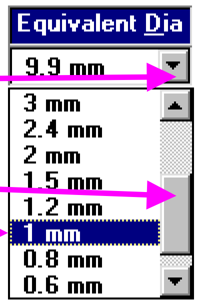
The following manipulations are applicable for the **Probe** selection:



- **Mouse**
  - ■ Click on
  - ■ Drag / drop scrolling button to select the probe
  - ■ Click on the selected probe
- **Keyboard**
  - ■ Pressing **<Alt>+<P>** ⇒ **Probe** fore color changes to white (In the **Probe** area letter **P** is underlined) then use ↑ , → , ← , ↓ buttons on the keyboard to select the probe
- **Combined**
  - ■ Click on **Probe** ⇒ **Probe** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard to select the probe

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:

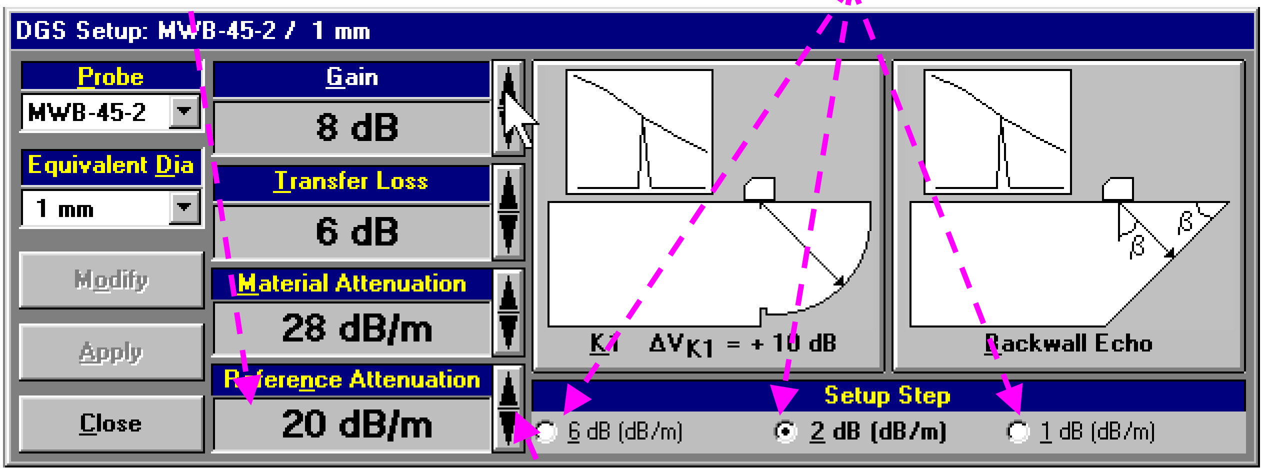


- **Mouse**
  - ■ Click on
  - ■ Drag / drop scrolling button to select the equivalent diameter
  - ■ Click on the selected equivalent diameter
- **Keyboard**
  - ■ Pressing **<Alt>+<D>** ⇒ **Equivalent Dia** fore color changes to white (In the **Equivalent Dia** area letter **D** is underlined) then use ↑ , → , ← , ↓ buttons on the keyboard to select the equivalent diameter
- **Combined**
  - ■ Click on **Equivalent Dia** ⇒ **Equivalent Dia** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard to select the equivalent diameter

Step 3: Attenuation in the reference block

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

Click on the **Setup Step** option or press **<Alt> + <1>** or **<Alt> + <2>** or **<Alt> + <3>** to select the required value for increment / decrement of the **Reference Attenuation** either 1 dB/m or 2 dB/m or 6 dB/m correspondingly. The last selected step is checked: ⦿



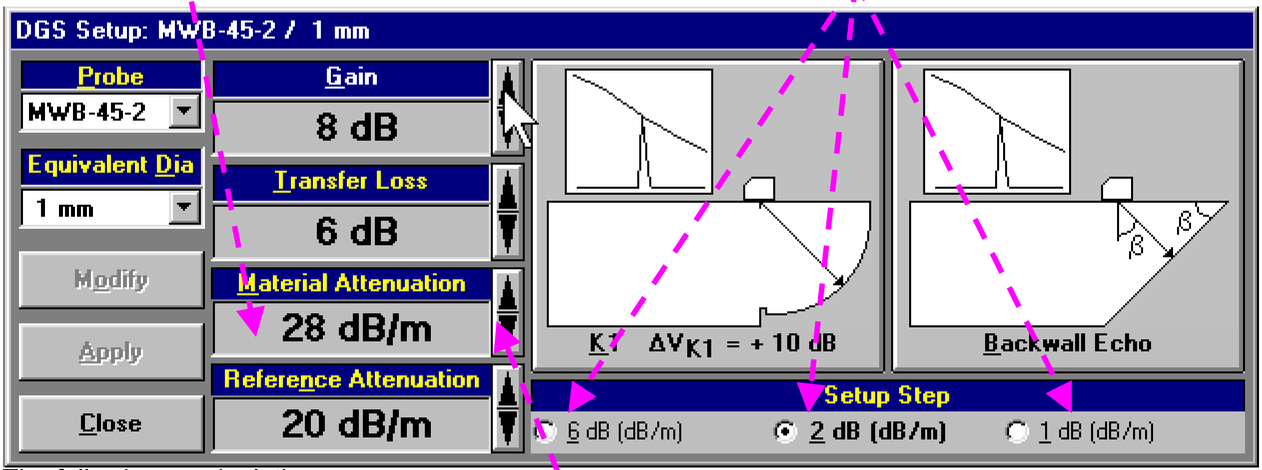
The following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<N>** ⇒ **Reference Attenuation** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Reference Attenuation** area letter **n** is underlined)
- **Combined**
  - Click on **Reference Attenuation** ⇒ **Reference Attenuation** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Step 4: Attenuation in the object under test

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

Click on the **Setup Step** option or press **<Alt> + <1>** or **<Alt> + <2>** or **<Alt> + <3>** to select the required value for increment / decrement of the **Material Attenuation** either 1 dB/m or 2 dB/m or 6 dB/m correspondingly. The last selected step is checked: ⦿



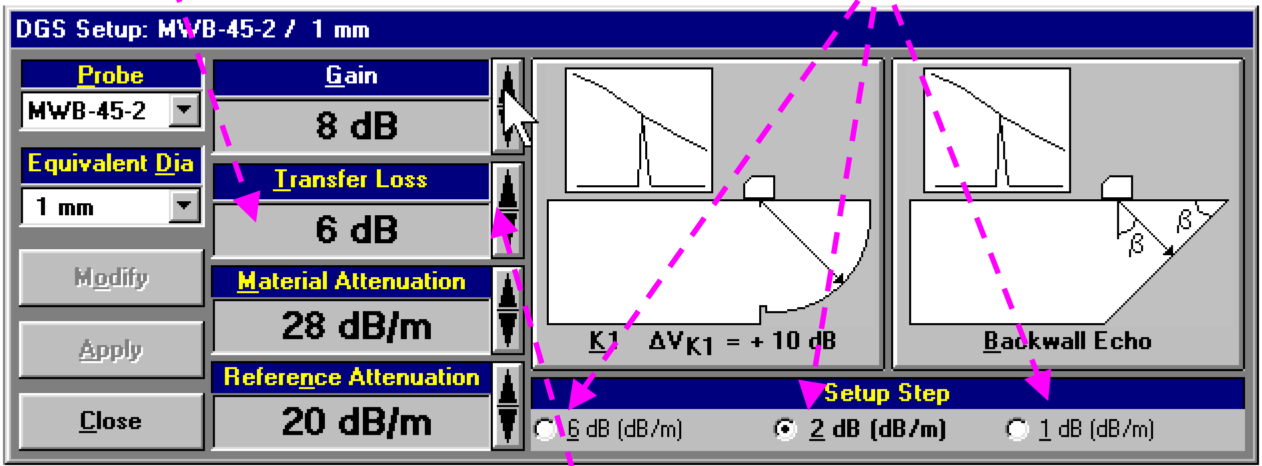
The following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<M>** ⇒ **Material Attenuation** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Material Attenuation** area letter **M** is underlined)
- **Combined**
  - Click on **Material Attenuation** ⇒ **Material Attenuation** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Step 5: Transfer loss

Current setup of the **Transfer Loss** **dB**

Click on the **Setup Step** option or press **<Alt> + <1>** or **<Alt> + <2>** or **<Alt> + <3>** to select the required value for increment / decrement of the Transfer **Loss** either 1 dB or 2 dB or 6 dB correspondingly. The last selected step is checked: ⊙



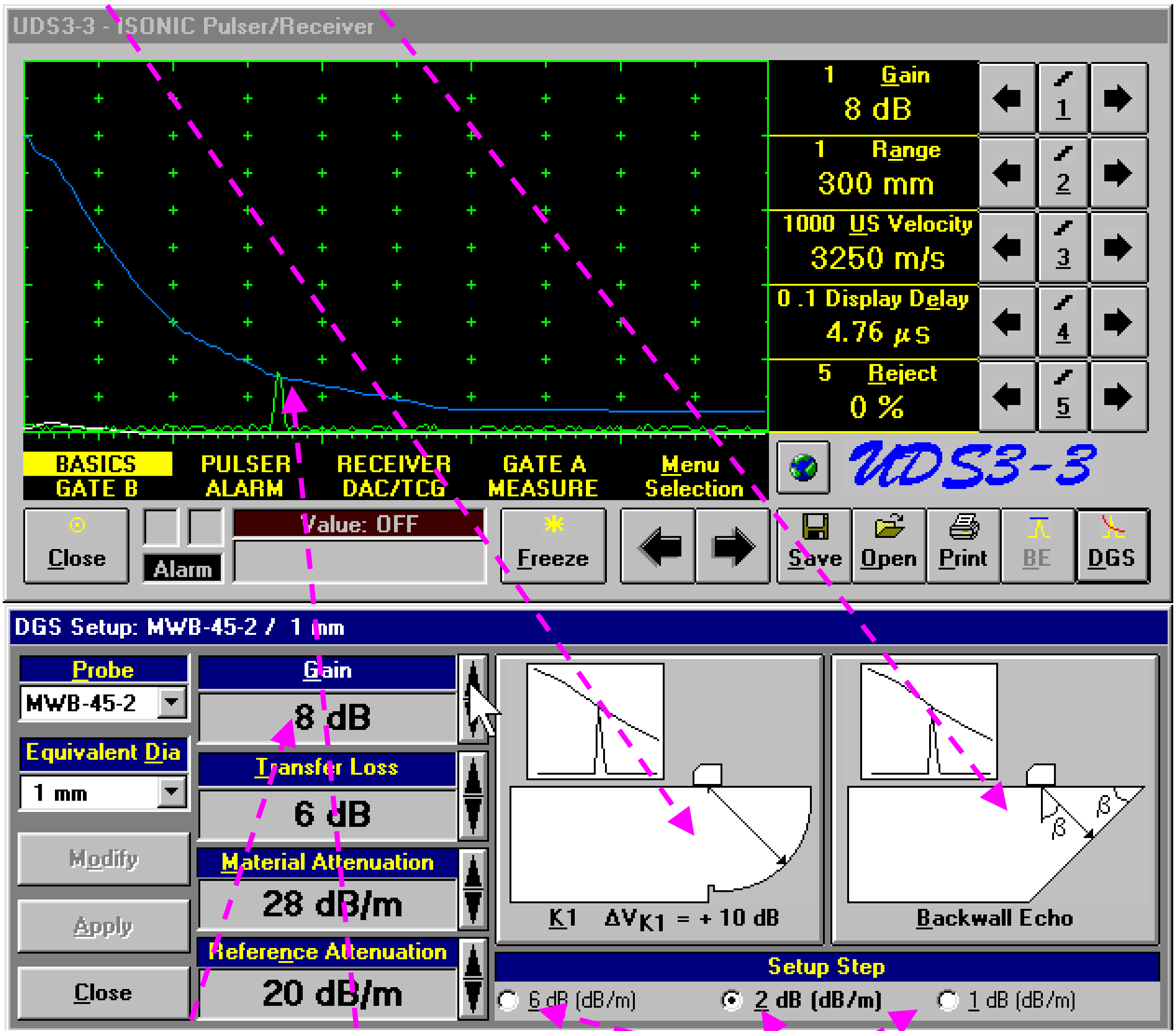
The following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **Transfer Loss** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Transfer Loss** area letter **T** is underlined)
- **Combined**
  - Click on **Transfer Loss** ⇒ **Transfer Loss** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Step 6: Gain

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

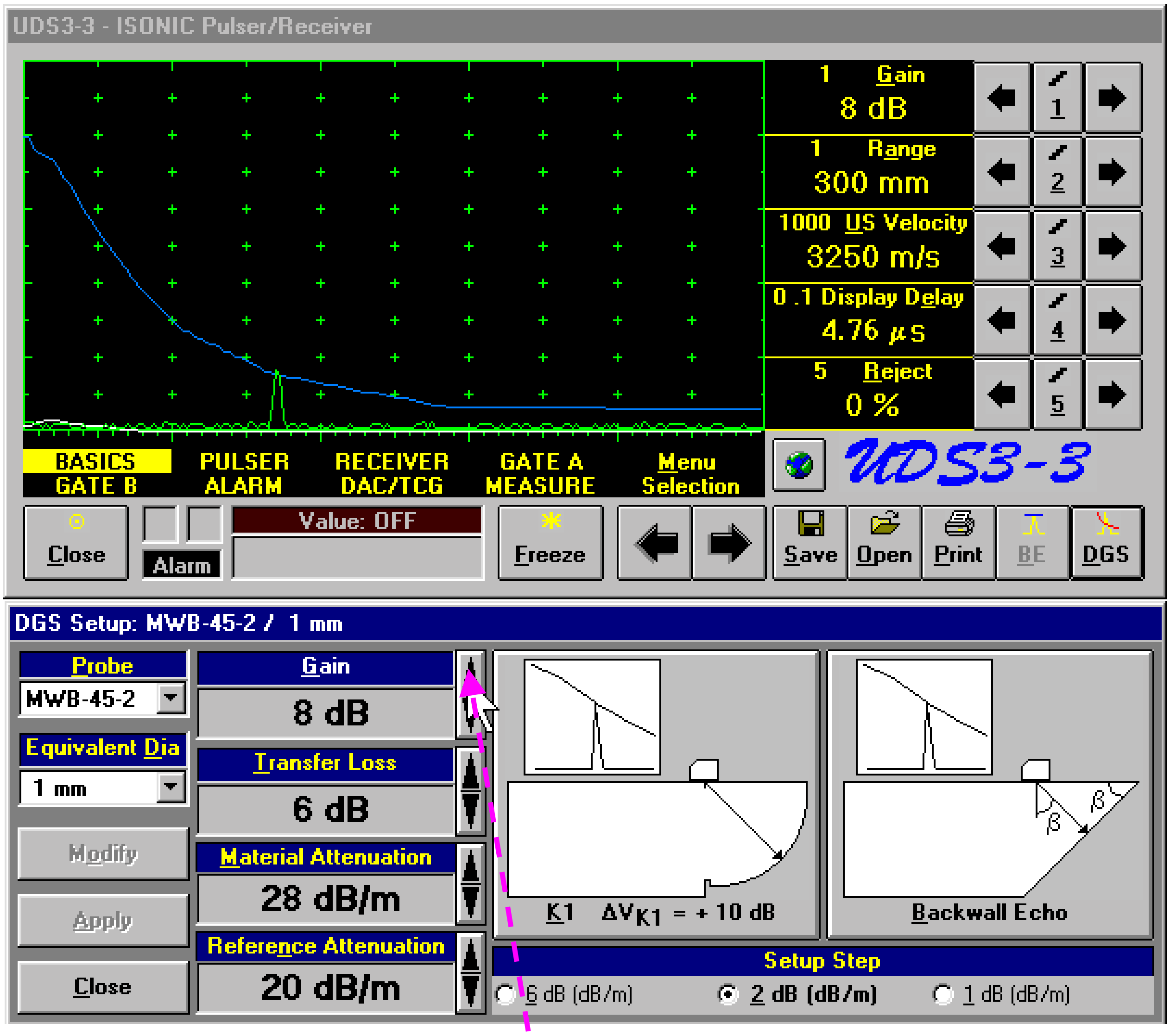
- K1 or K2 reference block (reference block and reflector are defined in the probe data sheet and reproduced automatically from the **DGS** data base upon probe selection)
- Inclined reference block (reference reflector – back surface)



Current **Gain** dB

Click on the **Setup Step** option or press **<Alt> + <1>** or **<Alt> + <2>** or **<Alt> + <3>** to select the required value for increment / decrement of the **Gain** either 1 dB or 2 dB or 6 dB correspondingly. The last selected step is checked: ⊙

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



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

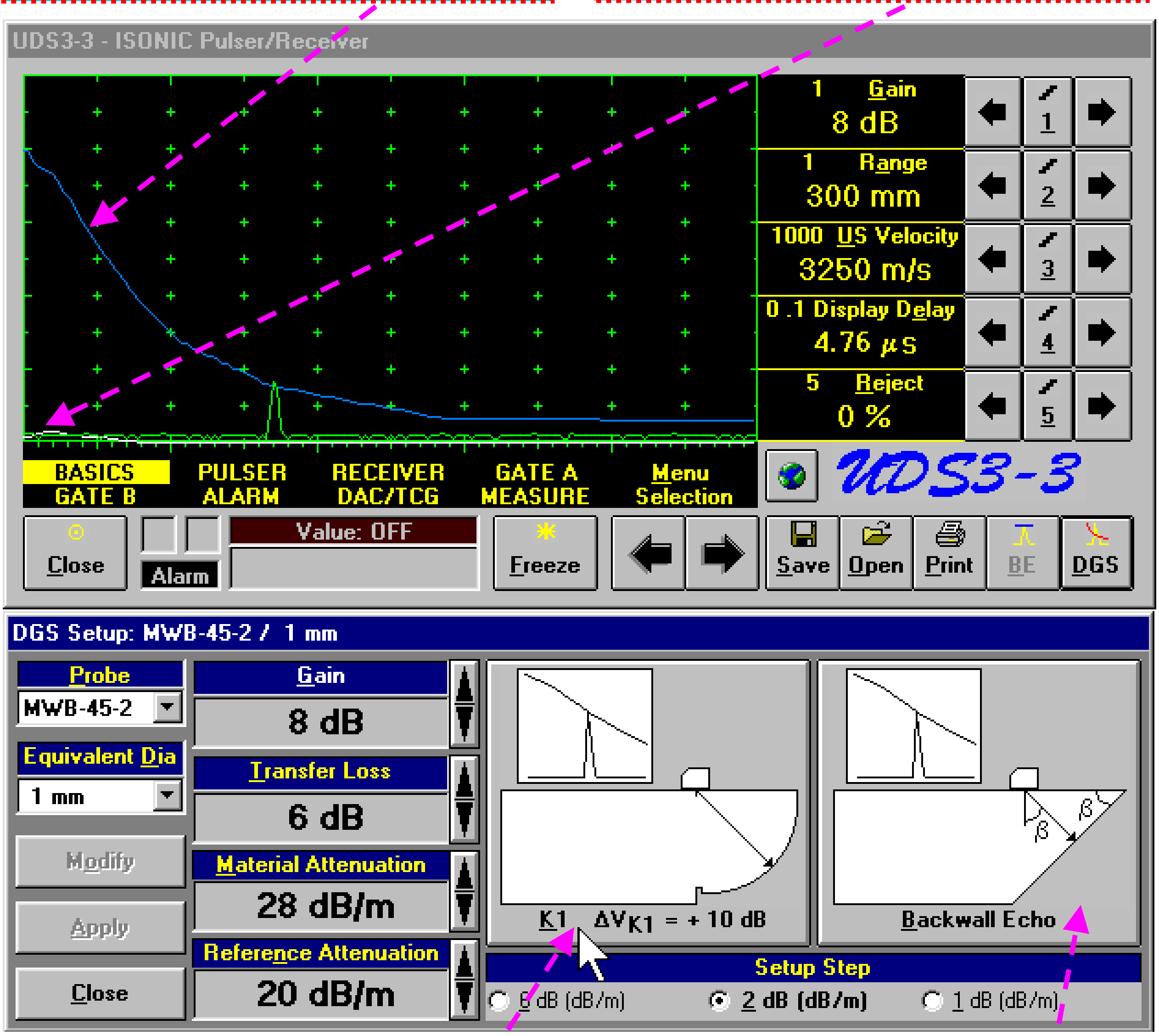
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<G>** ⇒ **Gain** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Gain** area letter **T** is underlined)
- **Combined**
  - Click on **Gain** ⇒ **Gain** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the 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 and Equivalent Dia** and **Material Attenuation**



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

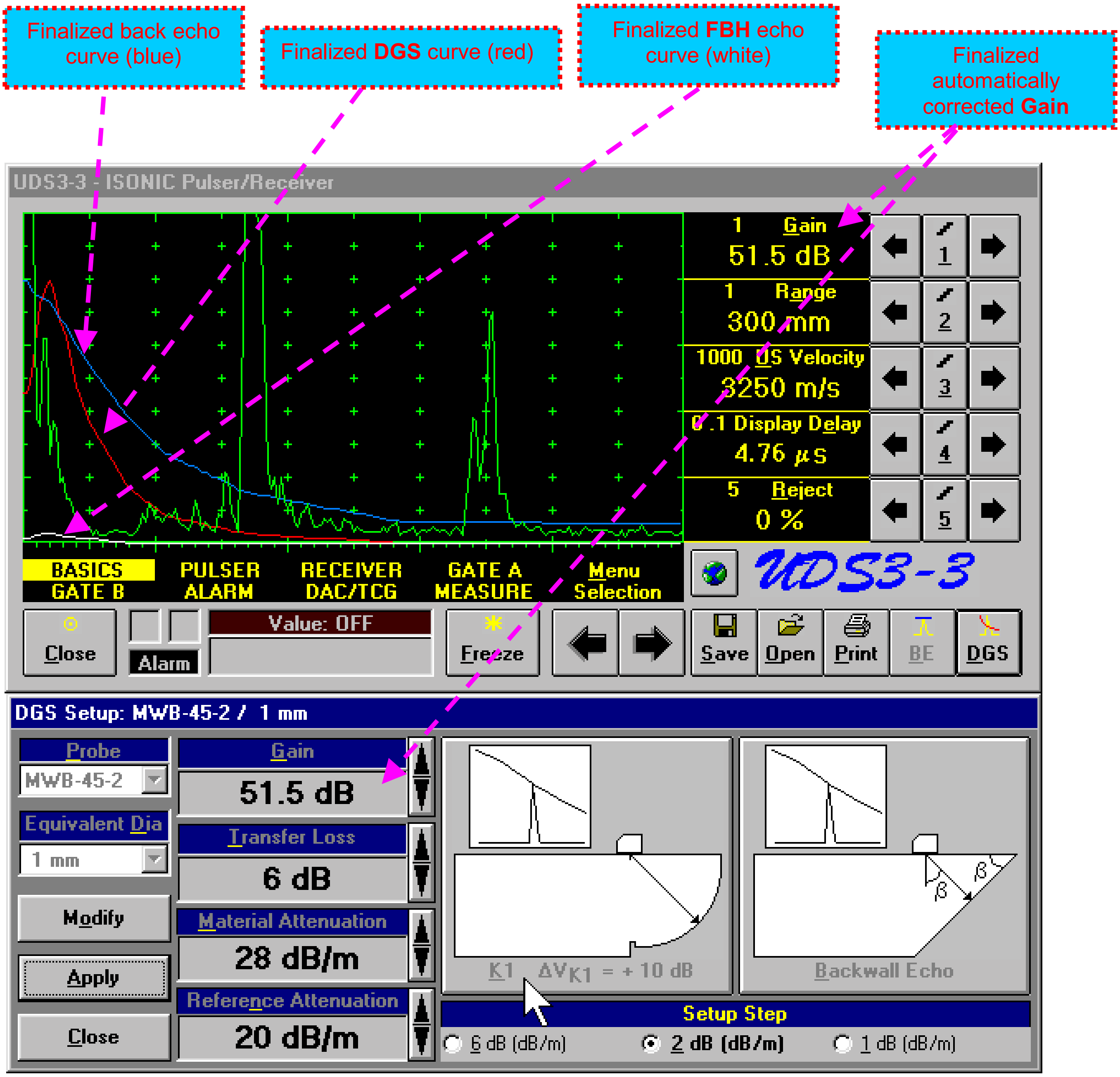
Case 1 (K1 or K2 reference block)

- **Mouse**
  - Click on
- **Keyboard**
  - Pressing **<Alt>+<K>**

Case 2 (Inclined reference block)

- **Mouse**
  - Click on
- **Keyboard**
  - Pressing **<Alt>+<B>**

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



To accept the finalized **DGS** curve and return to the main **UDS 3-3** / **UDS 3-4** window the following manipulations are applicable:

- **Mouse**
  - Click on **Apply**

  then
  - Click on **Close**

- **Keyboard**
  - Pressing **<Alt>+<A>**, then **Esc** or **<Alt>+<C>**

To negate the finalized **DGS** curve and return to the main **UDS3-3** / **UDS 3-4** window the following manipulations are applicable:

- **Mouse**
  - Click on Modify

  then
  - Click on Close
- **Keyboard**
  - Pressing **<Alt>+<O>**, then **Esc** or **<Alt>+<C>**

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

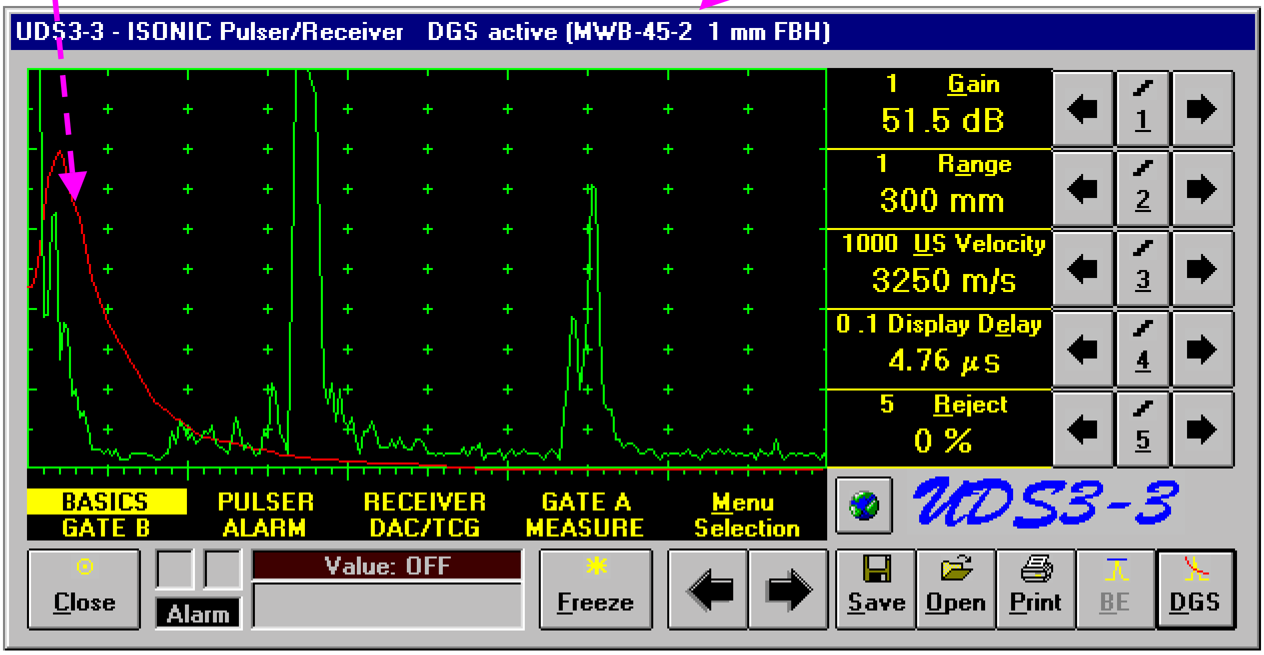
- **Mouse**
  - Click on Modify
- **Keyboard**
  - Press **<Alt>+<O>**

Step 8: Work whilst the DGS is active

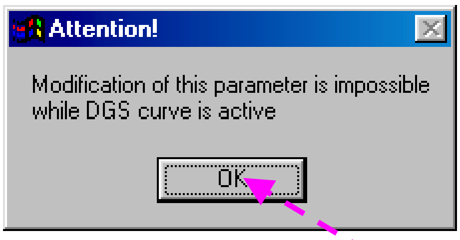
The typical screenshot with active **DGS** is shown below

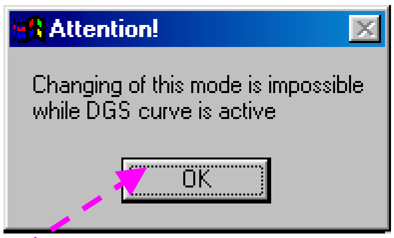
DGS curve

Probe and **Equivalent Diameter** of the **FBH** corresponding to the active **DGS** are indicated in the caption of the **UDS3-3 / UDS 3-4** window



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





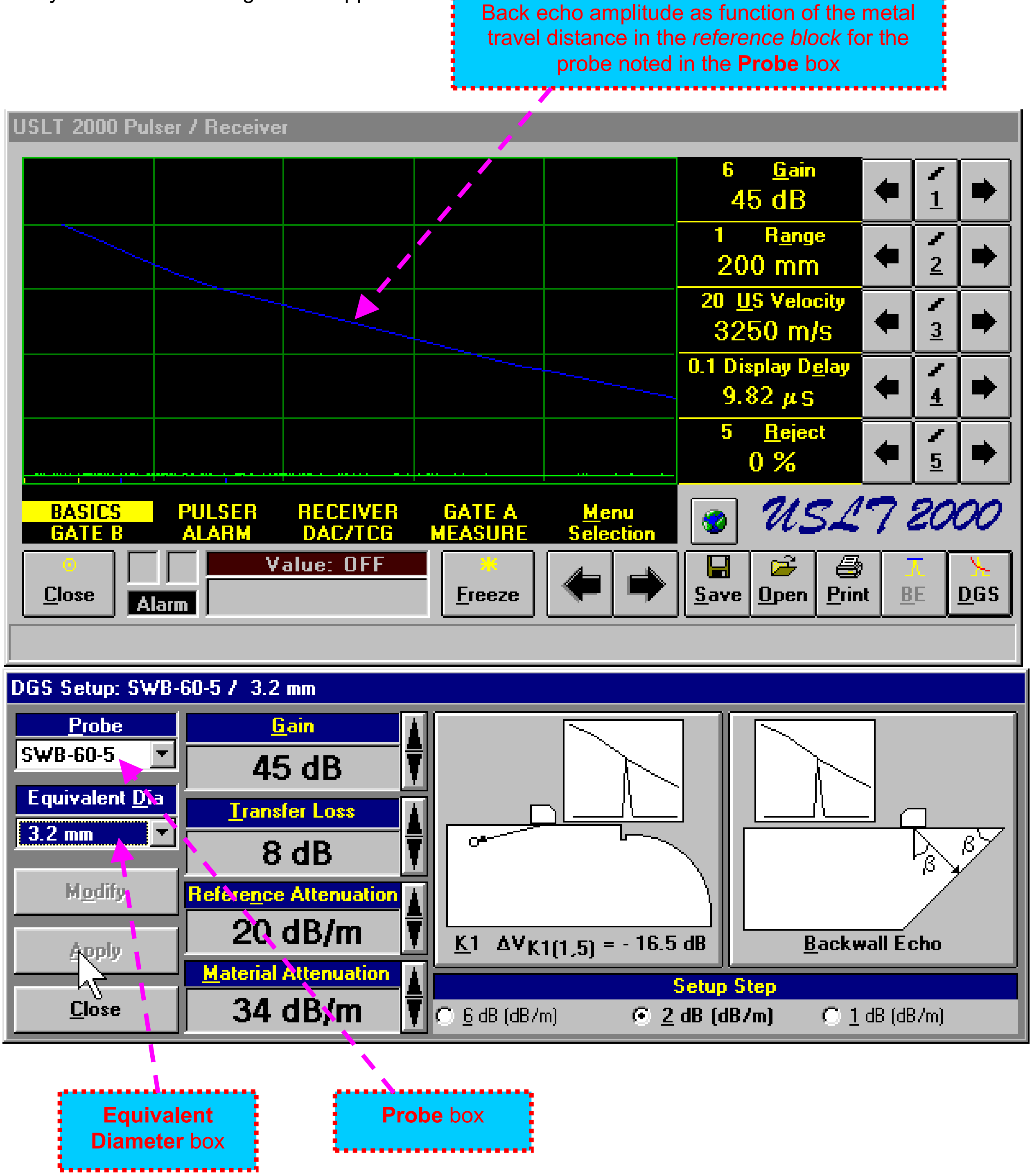
To continue operations press **Enter** or **Esc** or click on the button after the message appears

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

5.4.14. DGS (USLT 2000)

To use **DGS** set **Display** to **Full** (refer to the paragraph 5.4.5) then click on 

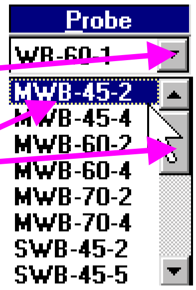
or press **<Alt>+<D>** on the keyboard. The following screen appears:



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

Step 1: Probe

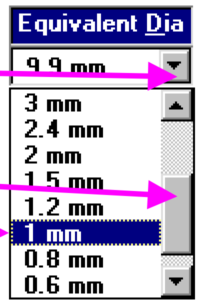
The following manipulations are applicable for the **Probe** selection:



- **Mouse**
  - Click on
  - Drag / drop scrolling button to select the probe
  - Click on the selected probe
- **Keyboard**
  - Pressing **<Alt>+<P>** ⇒ **Probe** fore color changes to white (In the **Probe** area letter **P** is underlined) then use ↑ , → , ← , ↓ buttons on the keyboard to select the probe
- **Combined**
  - Click on **Probe** ⇒ **Probe** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard to select the probe

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

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

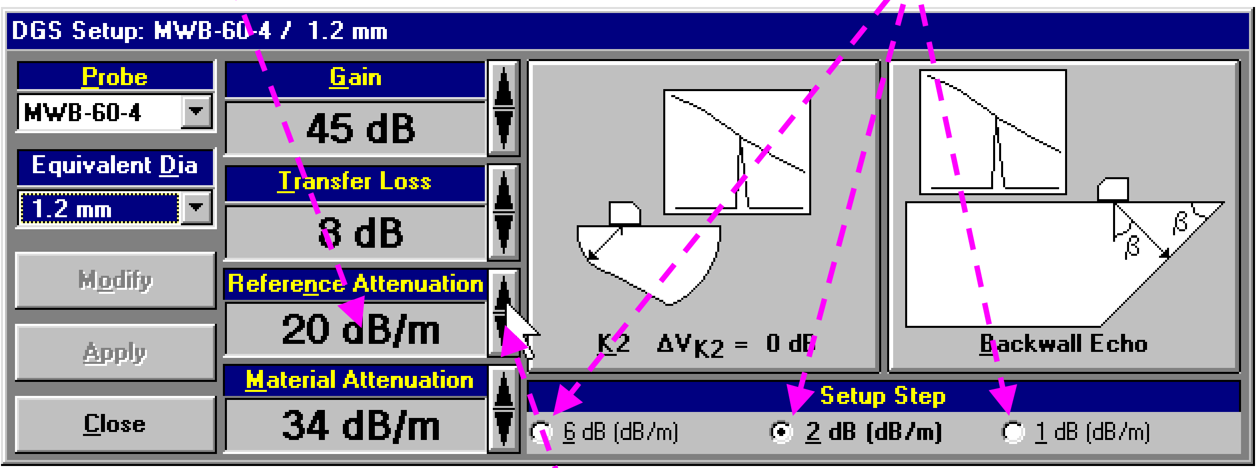


- **Mouse**
  - Click on
  - Drag / drop scrolling button to select the equivalent diameter
  - Click on the selected equivalent diameter
- **Keyboard**
  - Pressing **<Alt>+<D>** ⇒ **Equivalent Dia** fore color changes to white (In the **Equivalent Dia** area letter **D** is underlined) then use ↑ , → , ← , ↓ buttons on the keyboard to select the equivalent diameter
- **Combined**
  - Click on **Equivalent Dia** ⇒ **Equivalent Dia** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard to select the equivalent diameter

Step 3: Attenuation in the reference block

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

Click on the **Setup Step** option or press **<Alt> + <1>** or **<Alt> + <2>** or **<Alt> + <3>** to select the required value for increment / decrement of the **Reference Attenuation** either 1 dB/m or 2 dB/m or 6 dB/m correspondingly. The last selected step is checked: ⦿



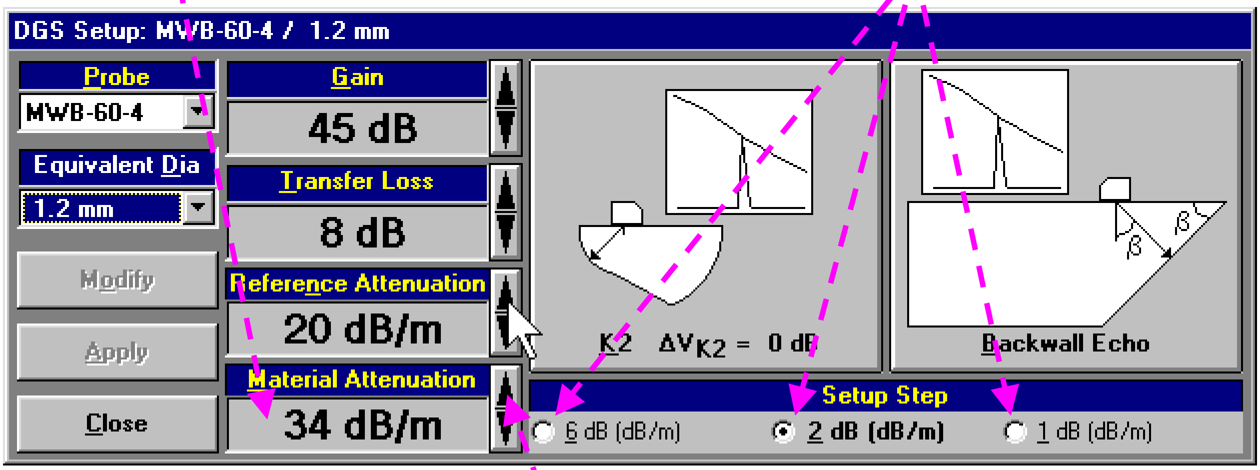
The following manipulations are applicable:

- **Mouse**
  - ■ Click or press and hold on the appropriate button
- **Keyboard**
  - ■ Pressing **<Alt>+<N>** ⇒ **Reference Attenuation** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Reference Attenuation** area letter **n** is underlined)
- **Combined**
  - ■ Click on **Reference Attenuation** ⇒ **Reference Attenuation** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Step 4: Attenuation in the object under test

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

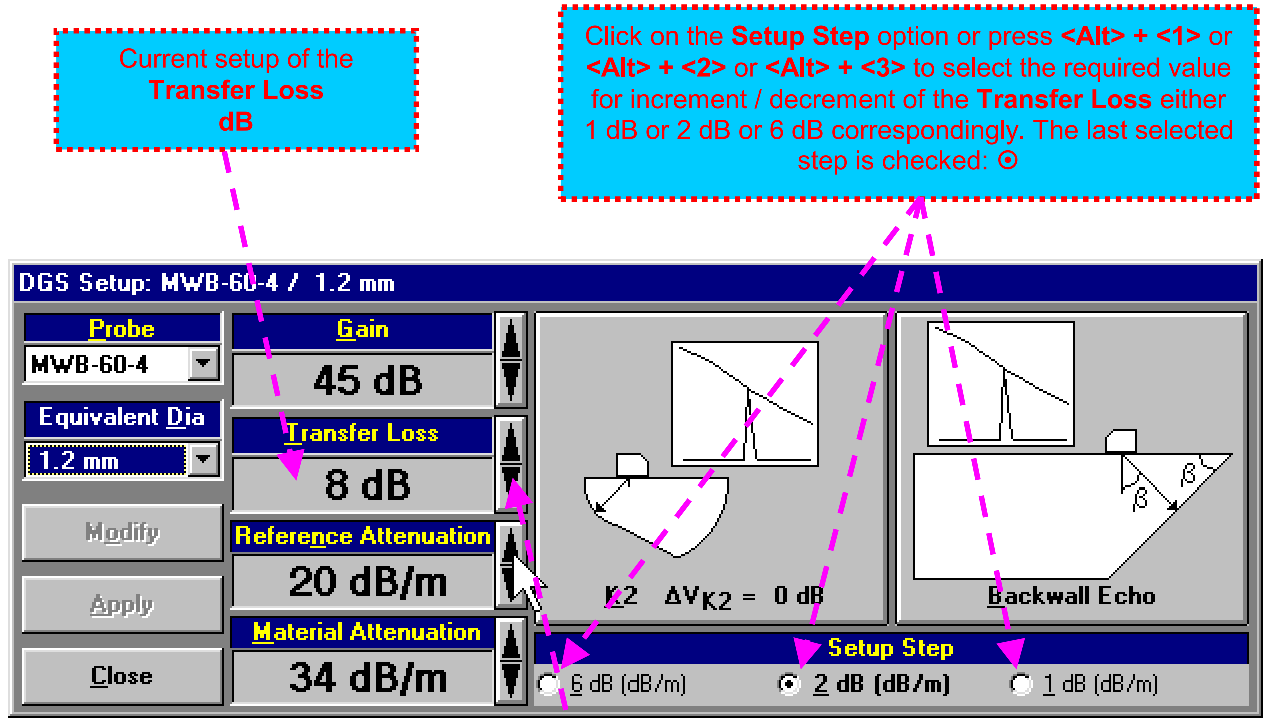
Click on the **Setup Step** option or press **<Alt> + <1>** or **<Alt> + <2>** or **<Alt> + <3>** to select the required value for increment / decrement of the **Material Attenuation** either 1 dB/m or 2 dB/m or 6 dB/m correspondingly. The last selected step is checked: ⦿



The following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<M>** ⇒ **Material Attenuation** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Material Attenuation** area letter **M** is underlined)
- **Combined**
  - Click on **Material Attenuation** ⇒ **Material Attenuation** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Step 5: Transfer loss



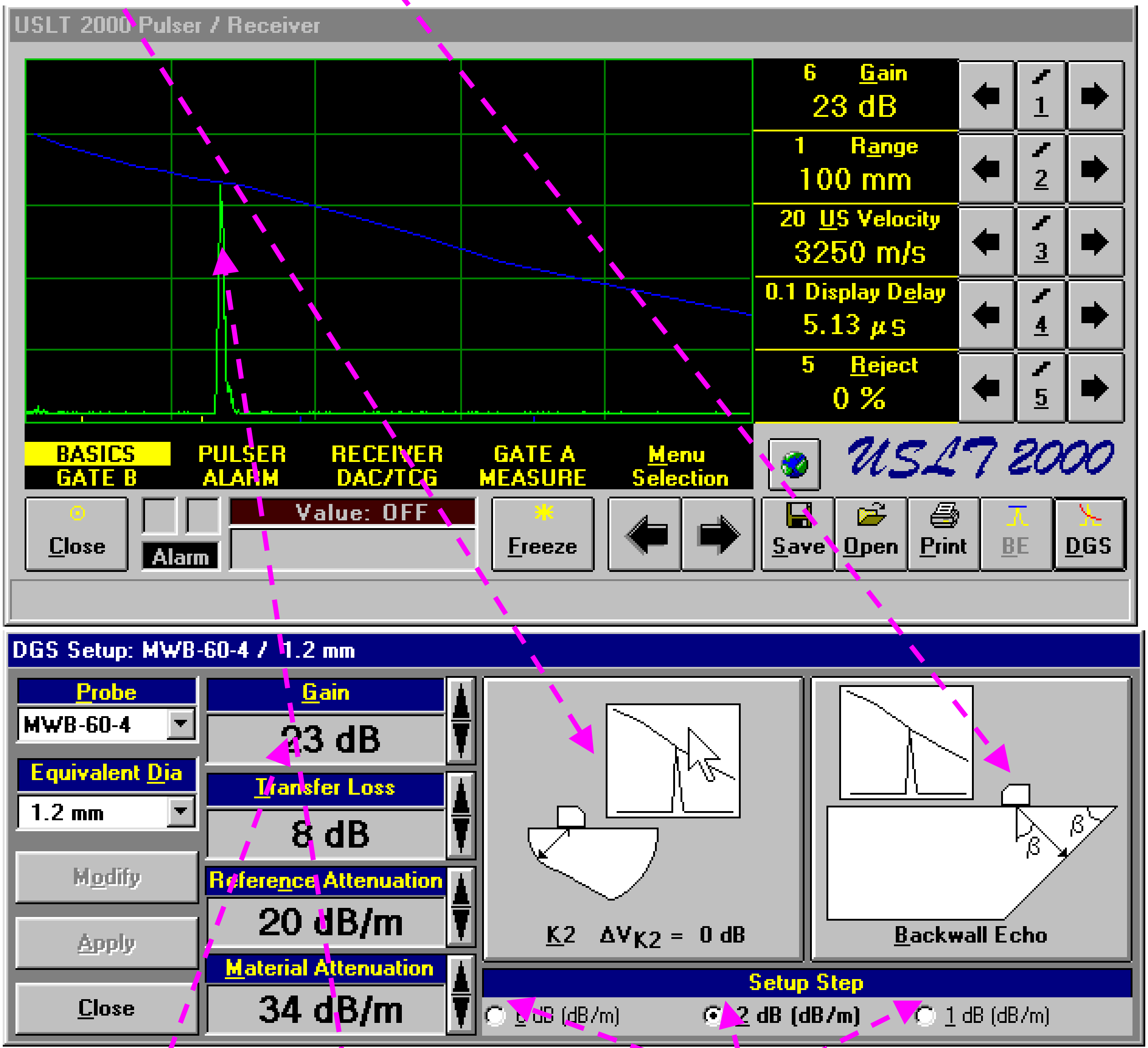
The following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **Transfer Loss** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Transfer Loss** area letter **T** is underlined)
- **Combined**
  - Click on **Transfer Loss** ⇒ **Transfer Loss** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Step 6: Gain

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

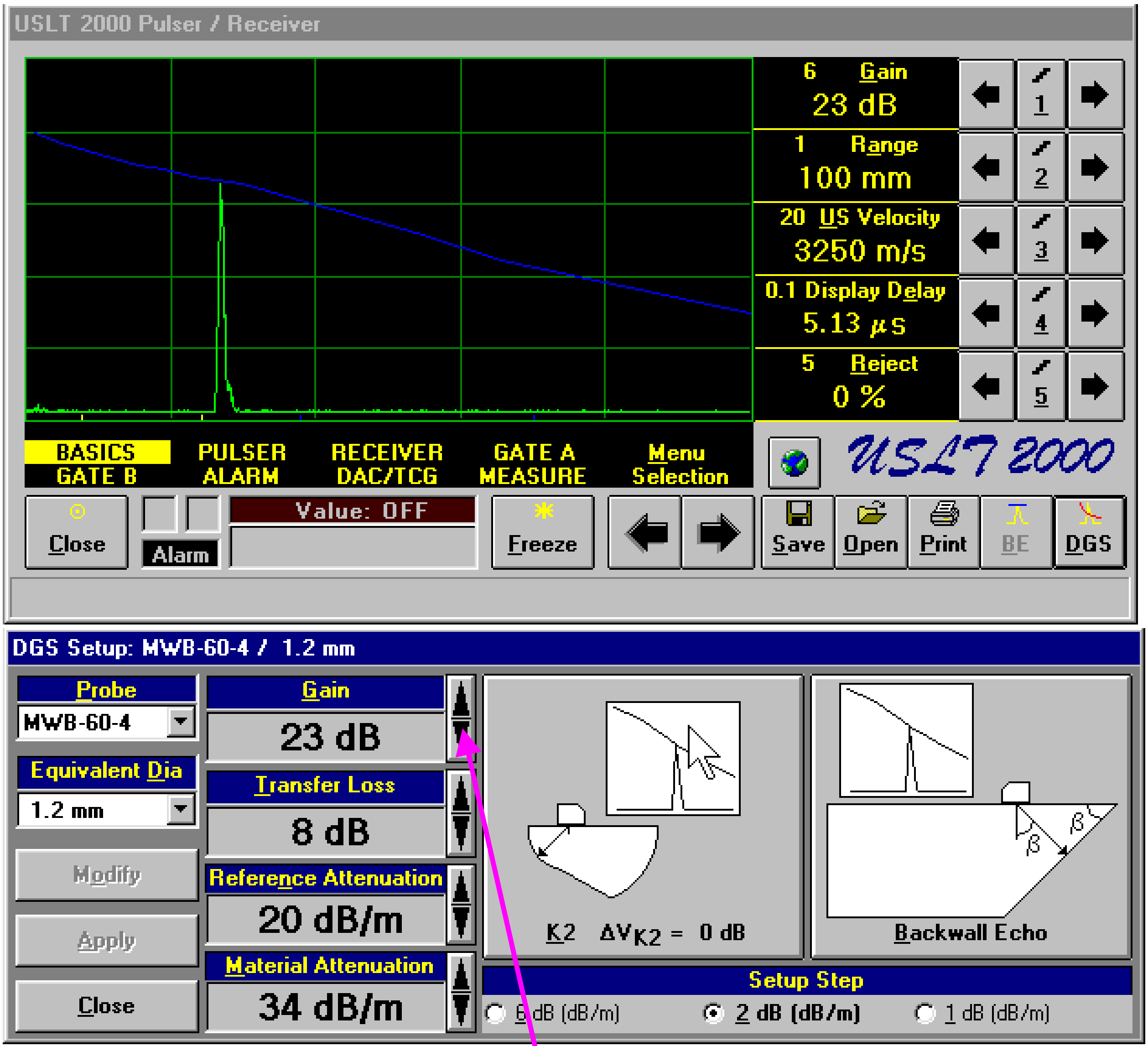
- K1 or K2 reference block (reference block and reflector are defined in the probe data sheet and reproduced automatically from the **DGS** data base upon probe selection)
- Inclined reference block (reference reflector – back surface)



Current **Gain** dB

Click on the **Setup Step** option or press **<Alt> + <1>** or **<Alt> + <2>** or **<Alt> + <3>** to select the required value for increment / decrement of the **Gain** either 1 dB or 2 dB or 6 dB correspondingly. The last selected step is checked: ⦿

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



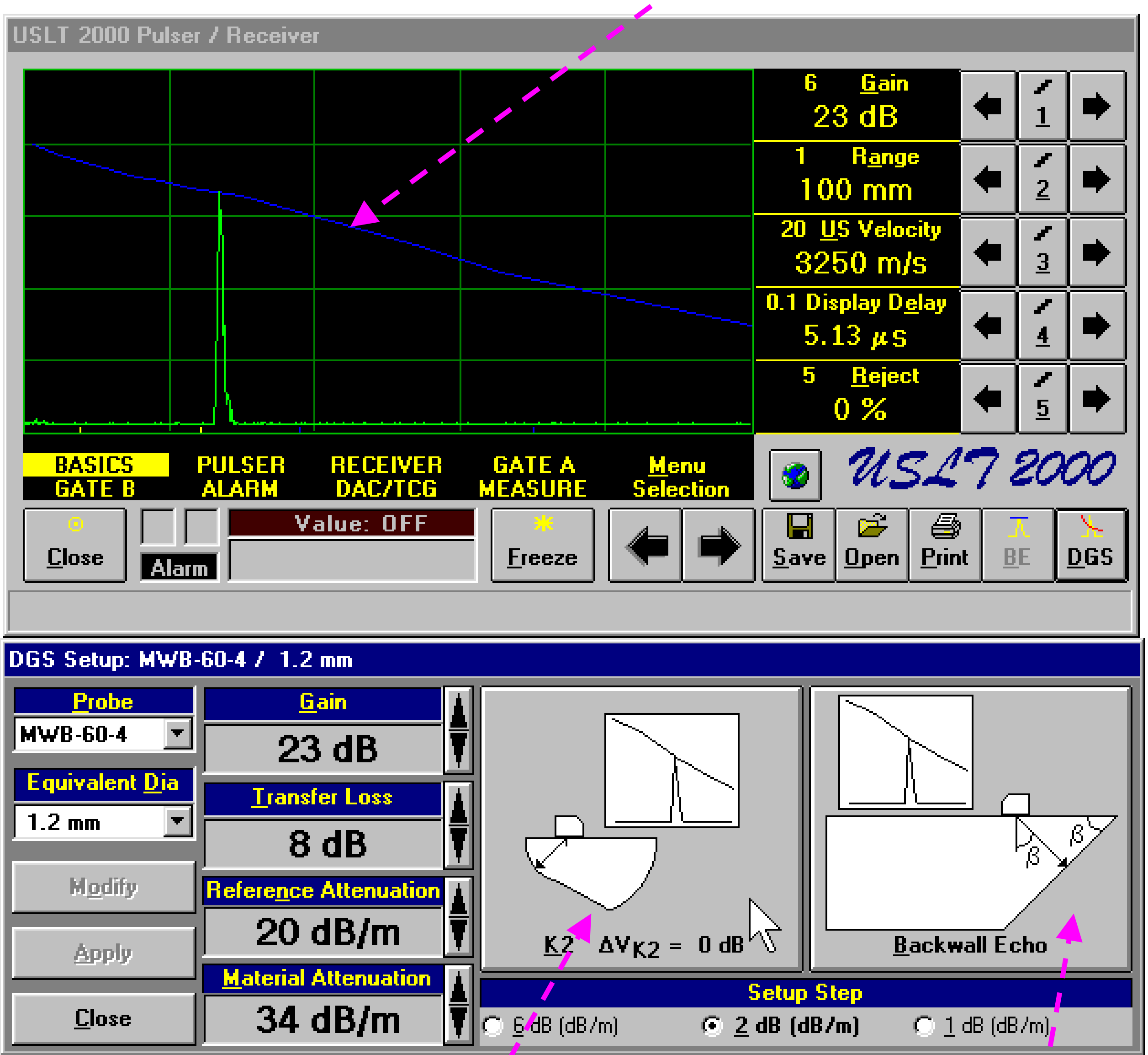
The following manipulations are applicable for the **Gain** setup:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<G>** ⇒ **Gain** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Gain** area letter **T** is underlined)
- **Combined**
  - Click on **Gain** ⇒ **Gain** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Step 7: Finalizing DGS curve and return to the main USLT 2000 window

Before finalizing the **DGS** curve:

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



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

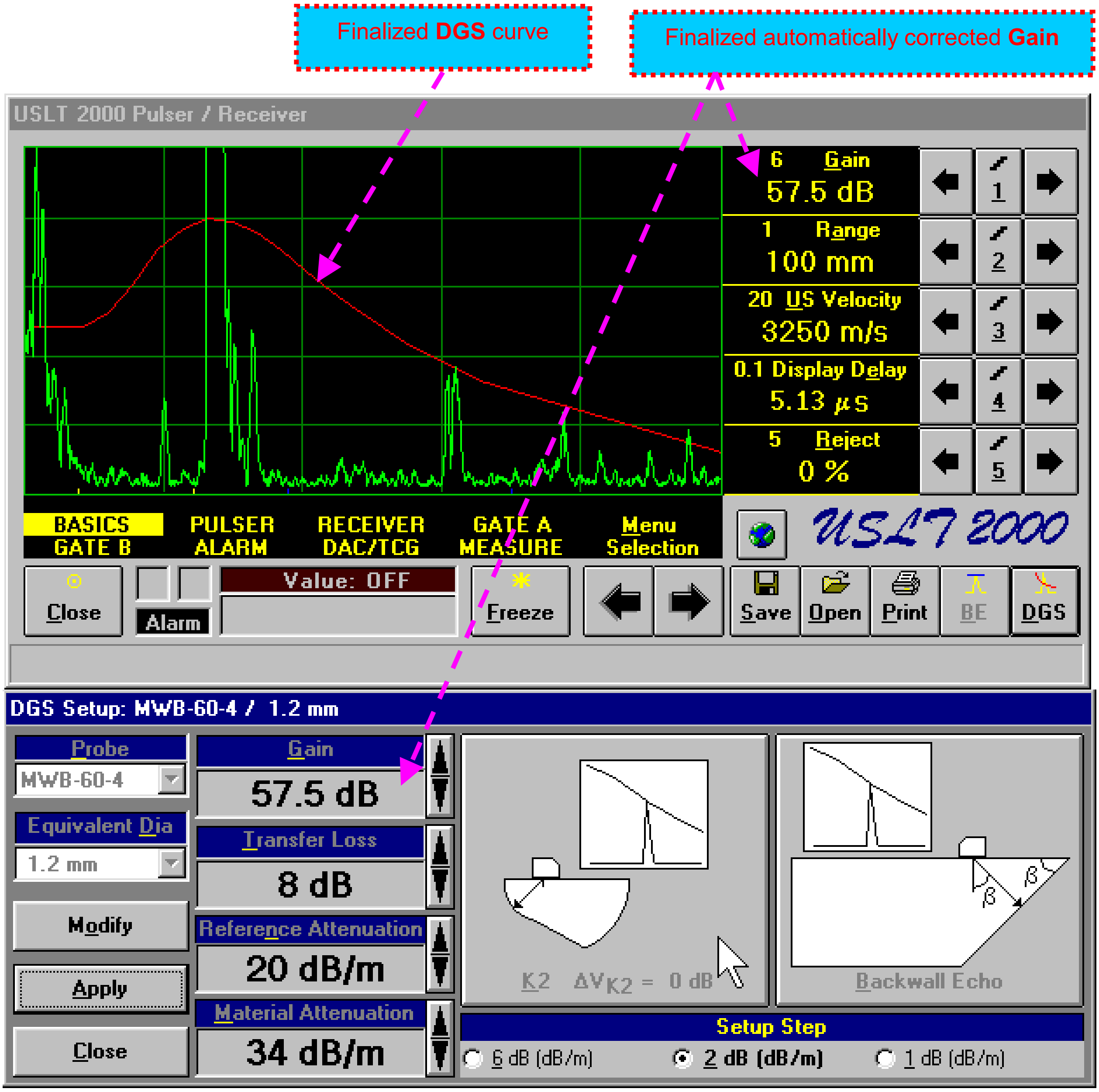
Case 1 (K1 or K2 reference block)

- **Mouse**
  - Click on
- **Keyboard**
  - Pressing **<Alt>+<K>**

Case 2 (Inclined reference block)

- **Mouse**
  - Click on
- **Keyboard**
  - Pressing **<Alt>+<B>**

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



To accept the finalized **DGS** curve and return to the main **USLT 2000** window the following manipulations are applicable:

- **Mouse**
  - Click on **Apply**

  then
  - Click on **Close**
- **Keyboard**
  - Pressing **<Alt>+<A>**, then **Esc** or **<Alt>+<C>**

To negate the finalized **DGS** curve and return to the main **USLT 2000** window the following manipulations are applicable:

- **Mouse**
  - Click on **Modify**

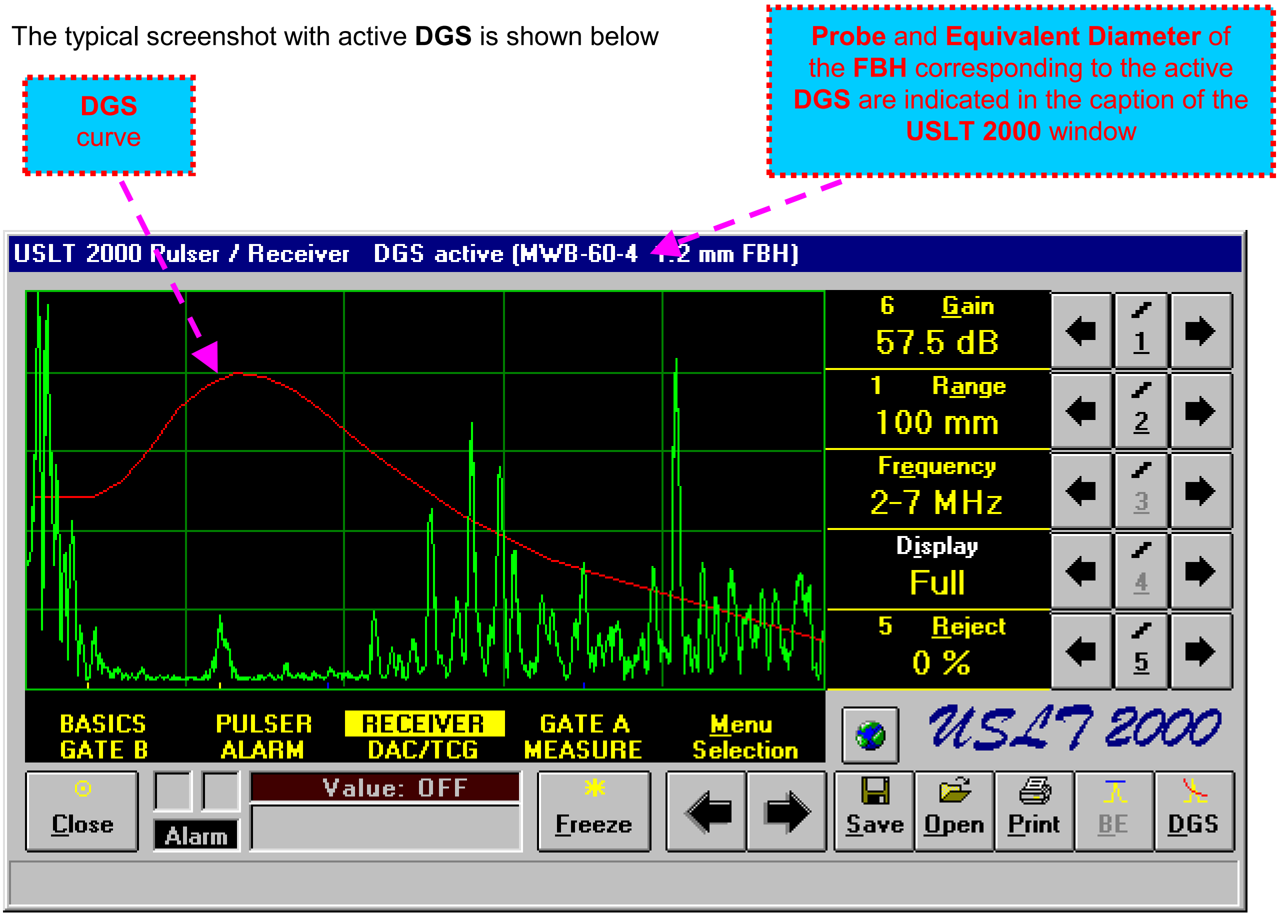
  then
  - Click on **Close**
- **Keyboard**
  - Pressing **<Alt>+<O>**, then **Esc** or **<Alt>+<C>**

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

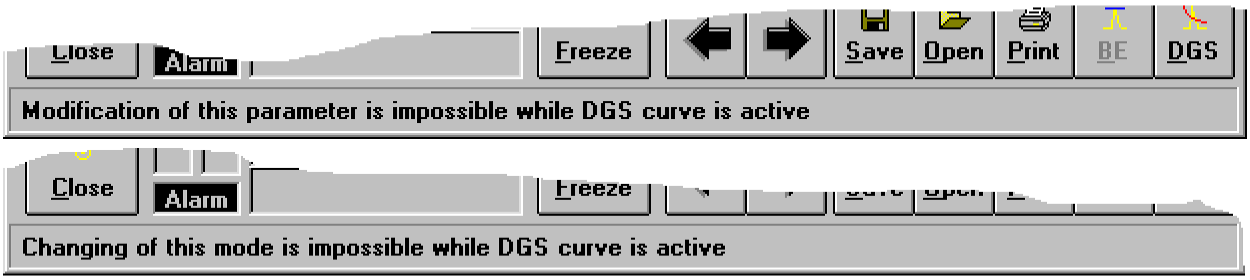
- **Mouse**
  - Click on **Modify**
- **Keyboard**
  - Press **<Alt>+<O>**

Step 8: Work whilst the DGS is active

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



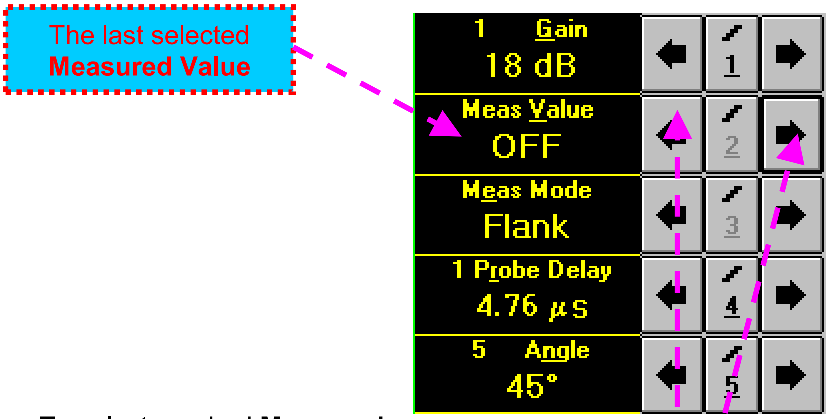
Some parameters and modes cannot be modified while DGS is active - the corresponding messages appear if attempting to modify:



To continue the operation wait until the message disappears

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

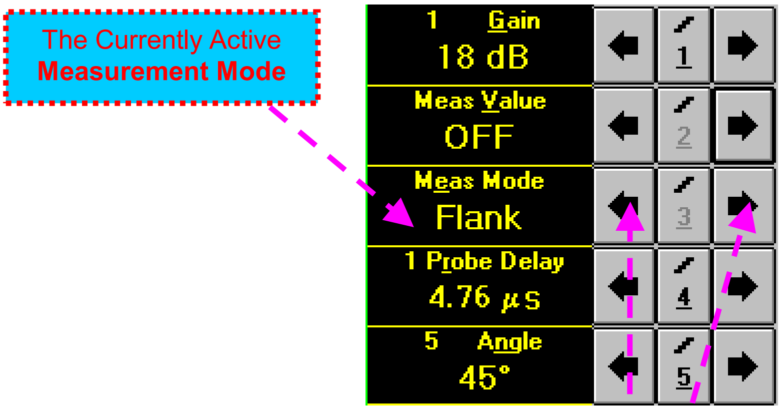
5.4.15. Sub Menu MEASURE



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

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<V>** ⇒ **Meas Value** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Meas Value** area letter **V** is underlined)
- **Combined**
  - Click on **Meas Value** ⇒ **Meas Value** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

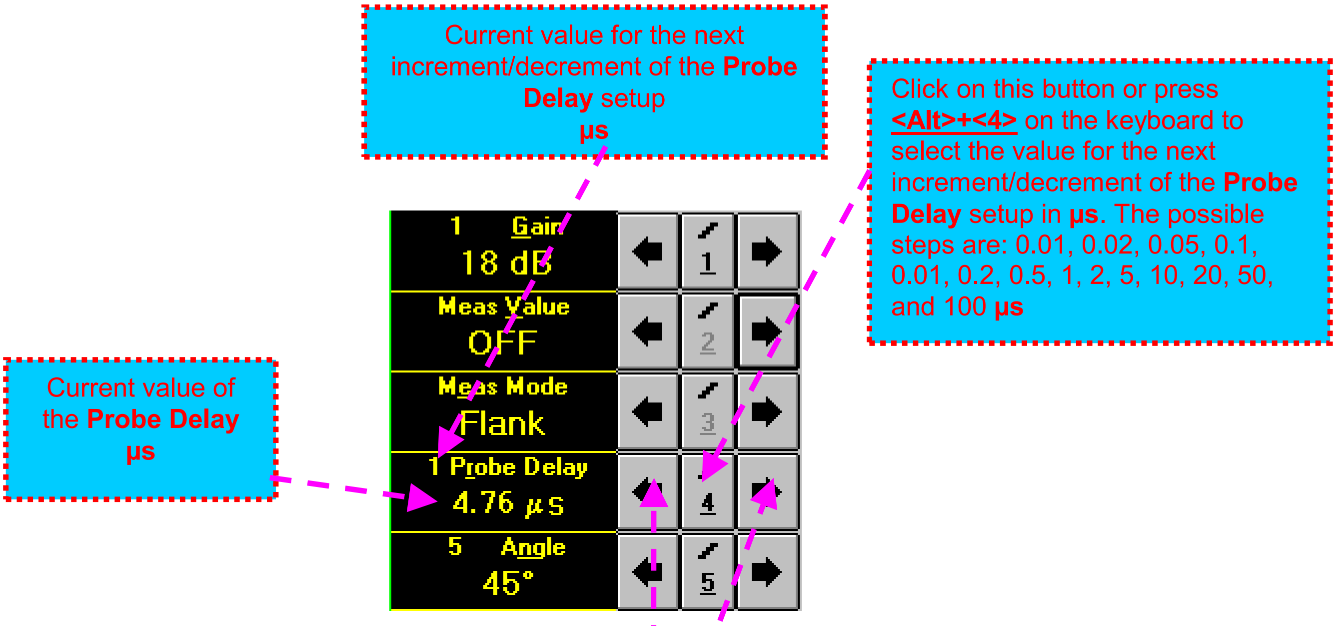
ⓘ
Refer to the paragraph 5.4.16 to get the complete list of values available for automatic measurement and indication in the **Value Box (Digital Readout)**



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

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<E>** ⇒ **Meas Mode** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Meas Mode** area letter **e** is underlined)
- **Combined**
  - Click on **Meas Mode** ⇒ **Meas Mode** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

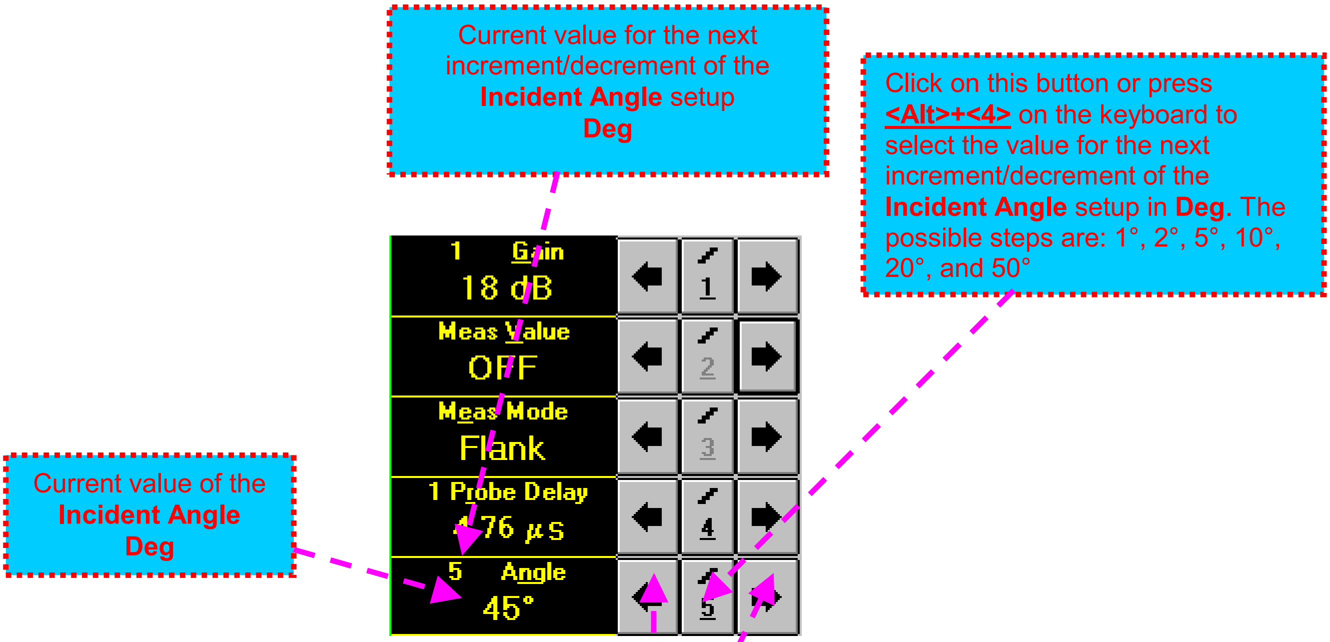
ⓘ
Refer to the paragraph 5.4.16 for the **Top** and **Flank** tips



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

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<R>** ⇒ **Probe Delay** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Probe Delay** area letter **r** is underlined)
- **Combined**
  - Click on **Probe Delay** ⇒ **Probe Delay** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ Refer to the paragraph 5.4.16 for the determining of the **Probe Delay**



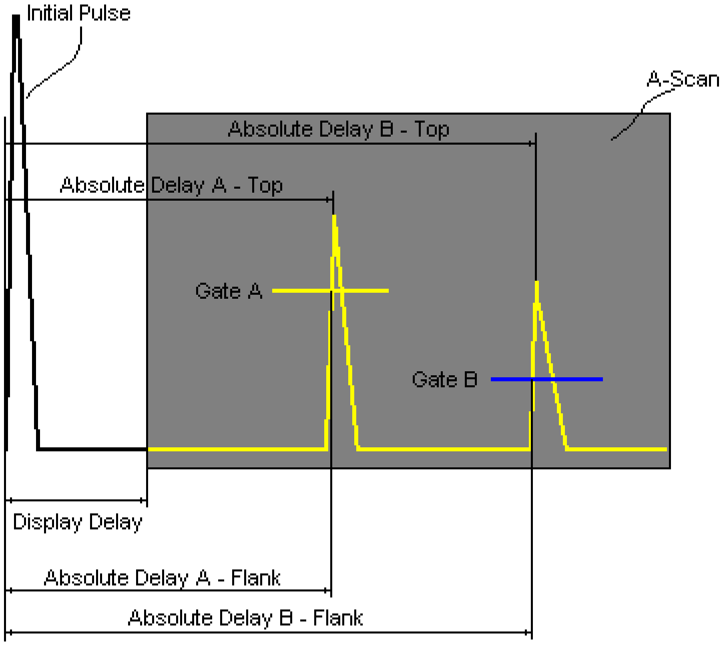
To setup **Incident Angle** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<N>** ⇒ **Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Angle** area letter **n** is underlined)
- **Combined**
  - Click on **Angle** ⇒ **Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ
Refer to the paragraph 5.4.16 for the **Probe Angle** measuring techniques

5.4.16. Time Domain Signal Evaluation - Measurements Guide

List of the Values available for the Automatic Measurements and Digital Readout



Value 1: T(A)
The **Time of Flight** - **µs** for the echo matching with the **Gate A** with respect to the **Probe Delay**:

T(A) = Absolute Delay A - Probe Delay

Value 2: T(B)
The **Time of Flight** - **µs** for the echo matching with the **Gate B** with respect to the **Probe Delay**:

T(B) = Absolute Delay B - Probe Delay

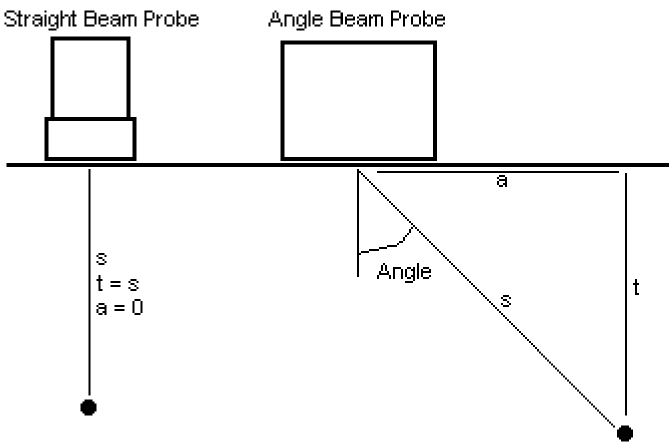
Value 3: s(A)
The **Material Travel Distance** - **mm** or **in** for the echo matching with the **Gate A**:

s(A) = ½ · T(A) · US Velocity

Value 4: s(B)
The **Material Travel Distance** - **mm** or **in** for the echo matching with the **Gate B**:

s(B) = ½ · T(B) · US Velocity

Value 5: a(A)
The **Projection Distance** - **mm** or **in** for reflector returning the echo matching with the **Gate A**, the distance measured with respect to the *Beam Incident Point*:



a(A) = s(A) · sin (Angle)

Value 6: a(B)
The **Projection Distance** - **mm** or **in** for reflector returning the echo matching with the **Gate B**, the distance measured with respect to the *Beam Incident Point*:

a(B) = s(B) · sin (Angle)

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

t(A) = s(A) · cos (Angle)

Value 8: t(B)
The **Depth** - **mm** or **in** of the reflector returning the 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**:

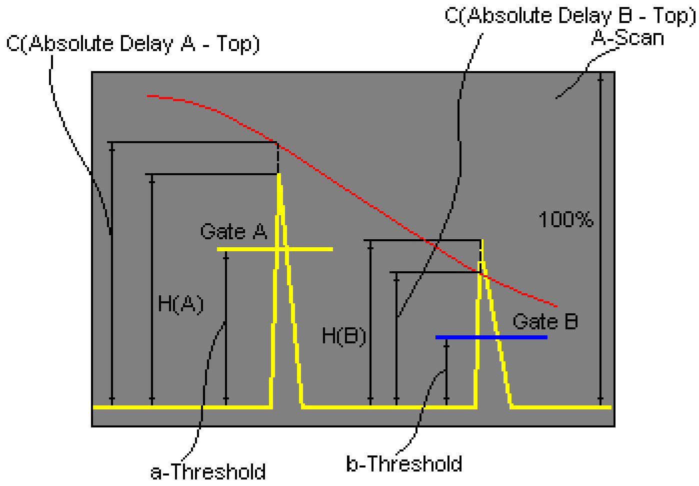
Δs = s(B) – s(A)

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)
The **Amplitude** - **% of A-Scan height** of the highest echo matching with the **Gate A**

Value 14: H(B)
The **Amplitude** - **% of A-Scan height** of the highest echo matching with the **Gate B**

Value 15: V(A)
The **Amplitude** - **dB** of the highest echo matching with the **Gate A** with respect to the **aThreshold**:

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

Value 16: V(B)
The **Amplitude** - **dB** of the highest echo matching with the **Gate B** with respect to the **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 (so called **dB to DAC**):

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

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

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

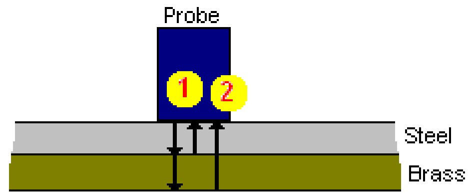
ⓘ

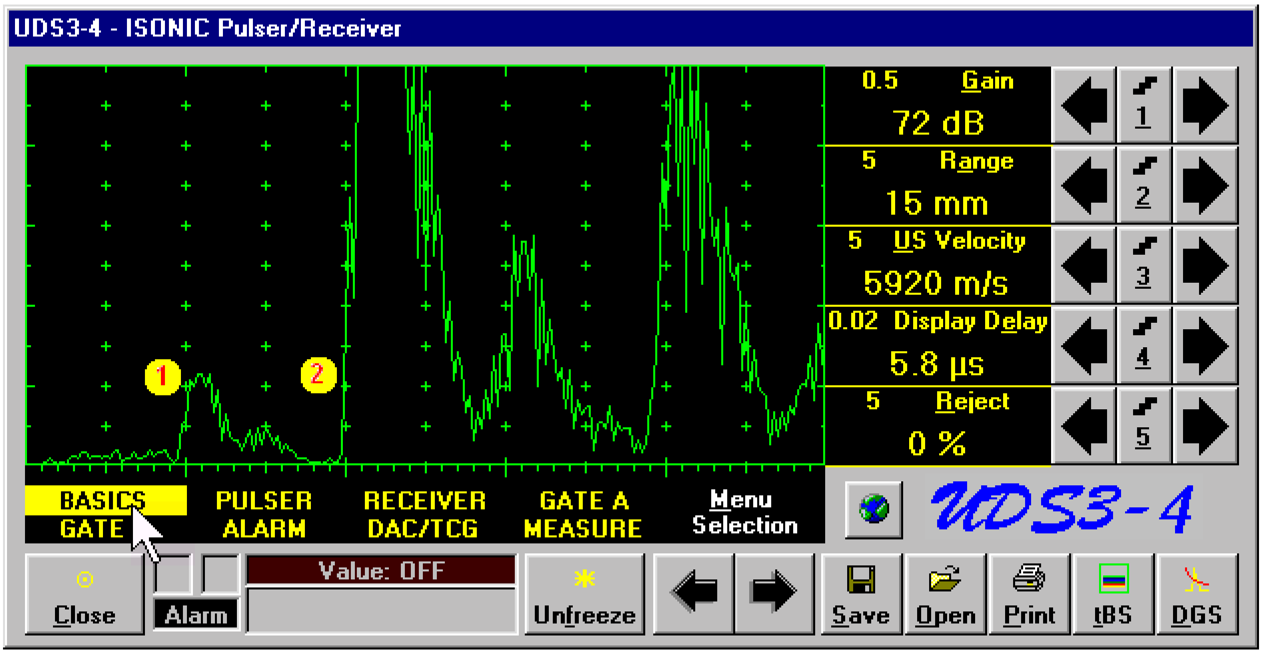
- To proceed with the measurements the corresponding **Gate** or and/or both **Gates** and/or **DAC/DGS** must be active
- The height of echo (~es) may not exceed 100% of the **A-Scan** height for all amplitude measurements
- If there are few pulses in the gate (more than 1) then the amplitude of the highest echo will be measured
- The height of measured echo (echoes) must exceed the corresponding **Gate Threshold** only if measuring the sound path / reflector's coordinates / time of flight while the **Meas Mode** is set to **Flank**

Δs - Dual Ultrasound Velocity Measurement Mode

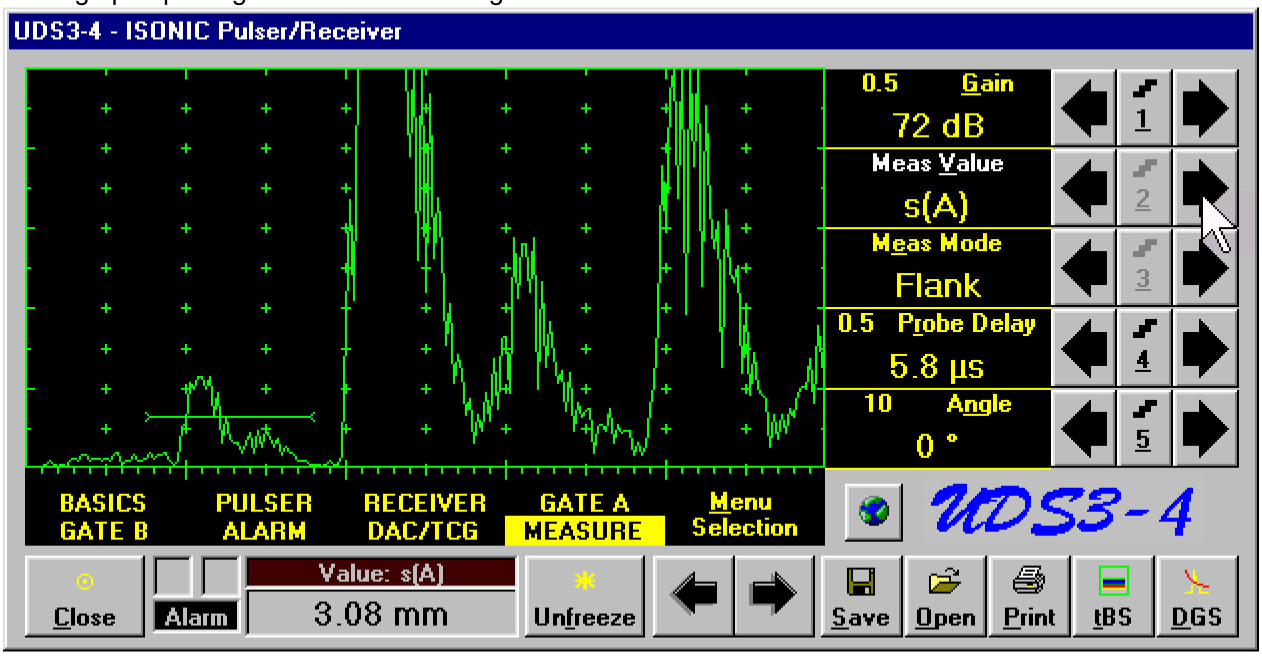
For some practical applications it may be necessary to measure the sound path distances in the different materials or in the same materials for the signals representing the different kind of waves. Such cases are characterized by different values of the **USVelocity** (ultrasound velocity) to be applied to different signals. In order to optimize the measurement procedure the *Dual Ultrasound Velocity Measurements Mode* is available and illustrated by the typical example sketch and short guidance below

There is a need to measure the thickness of each layer of the bi-metallic part made through the explosion welding between regular carbon steel (**USVelocity = 5920 m/s**) and brass alloy (**USVelocity = 4720 m/s**). The probe must be placed at the low carbon steel while measuring. The dual 10 MHz probe with the (**Probe Delay = 5.8 µs**) while placed on the steel side provides the receiving of two clear signals **1** and **2** form the *steel-brass boundary* and from the *back surface of the brass layer* correspondingly:

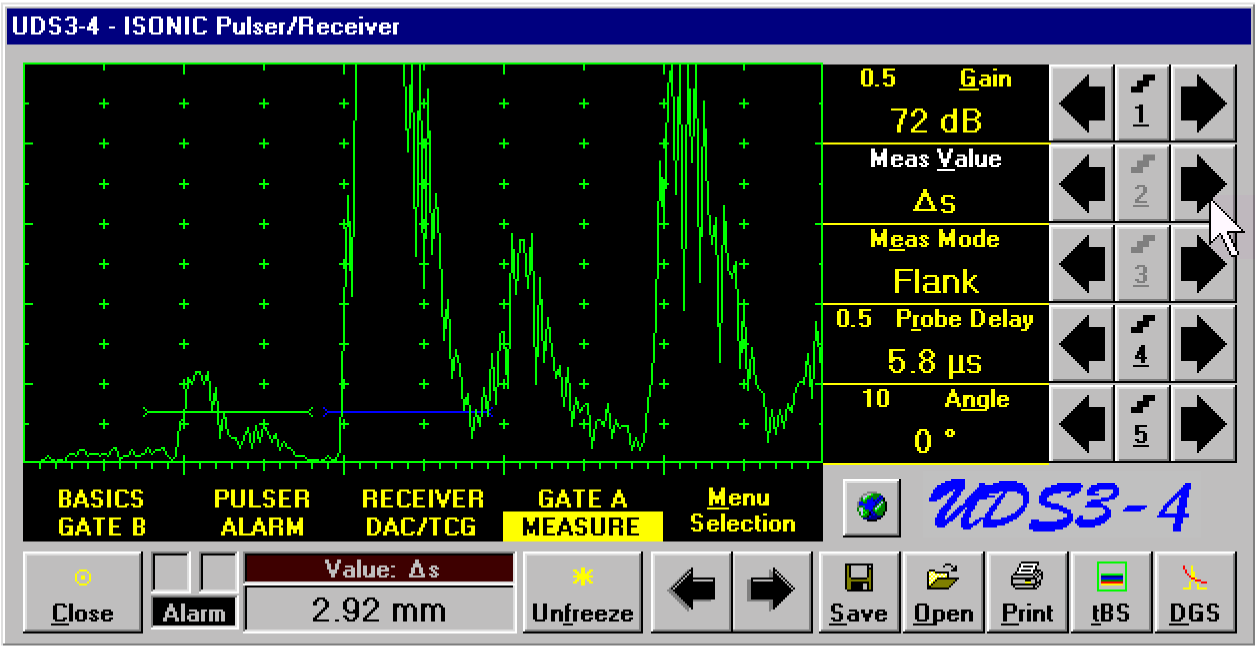




The **USVelocity** setup is suitable for the steel so the thickness of the steel layer is available for the direct reading upon placing **Gate A** above the signal **1**:

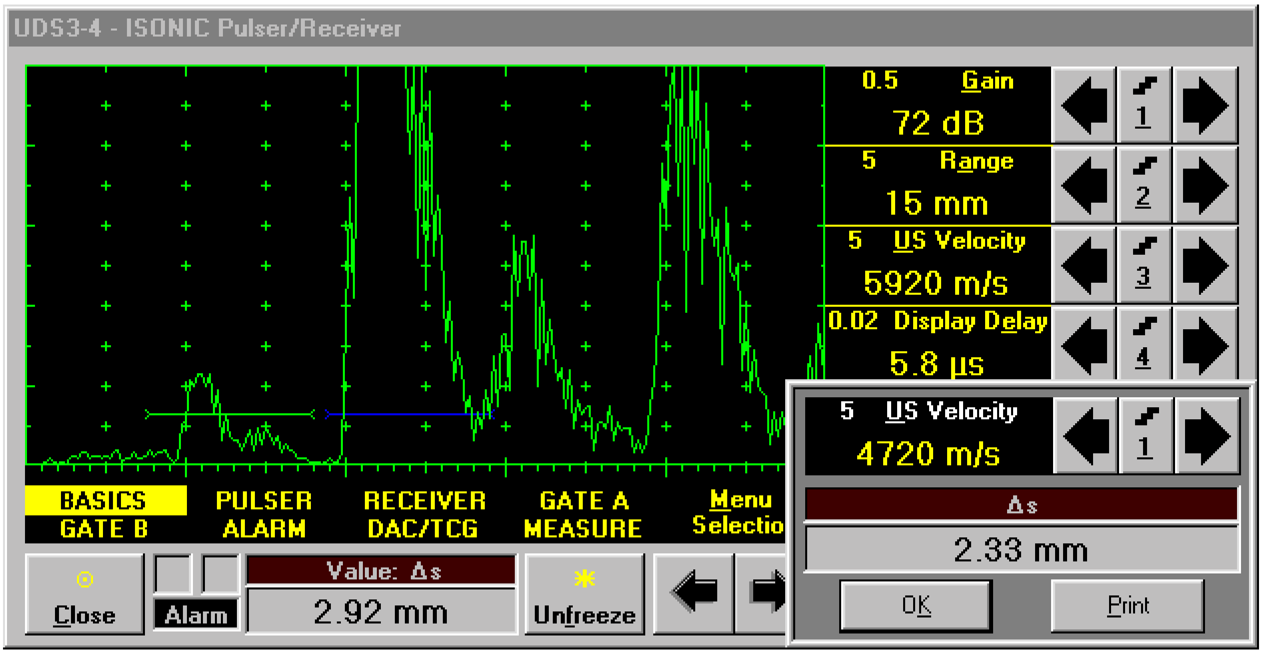


If placing now **Gate B** above the signal **2** and selecting the **Δs** value to be measured then the difference between the ultrasonic path distances covered by the signals **1** and **2** will be displayed however such distance is still calculated using the value of **USVelocity** suitable for steel:



To obtain the *proper reading* of the brass layer thickness:

- press **<Shift> + <V>** on the keyboard

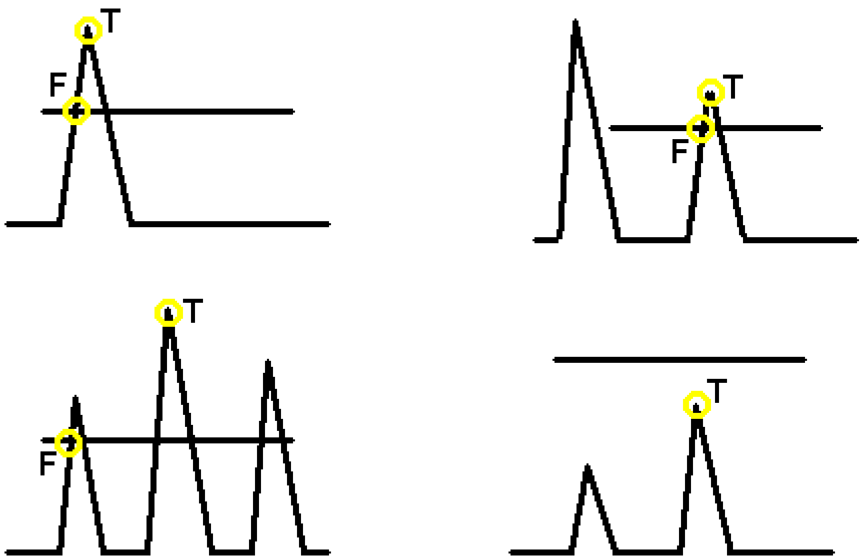


- in the appeared **Second USVelocity** subwindow set the proper value (in this specific example – the value suitable for the brass alloy) and get the proper reading immediately in the said subwindow

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

To printout the **A-Scan** accompanied with the setup list and with the measured value of **Δs** and the **Second USVelocity** click on the Print or press **<Alt>+<P>** on the keyboard

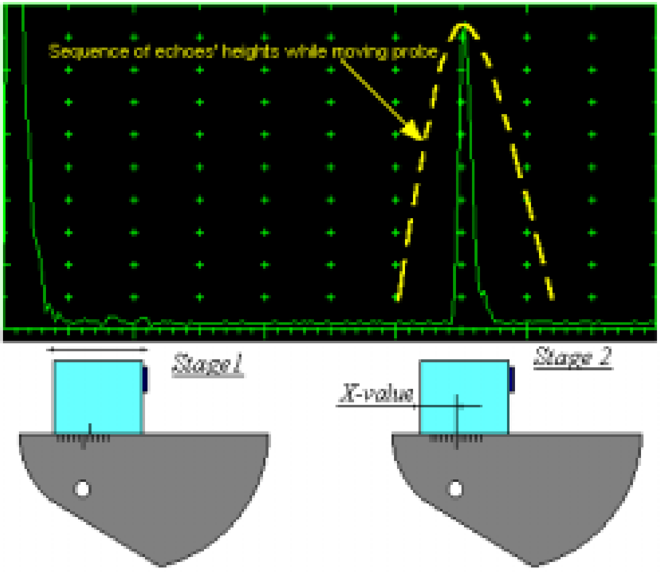
Top and Flank

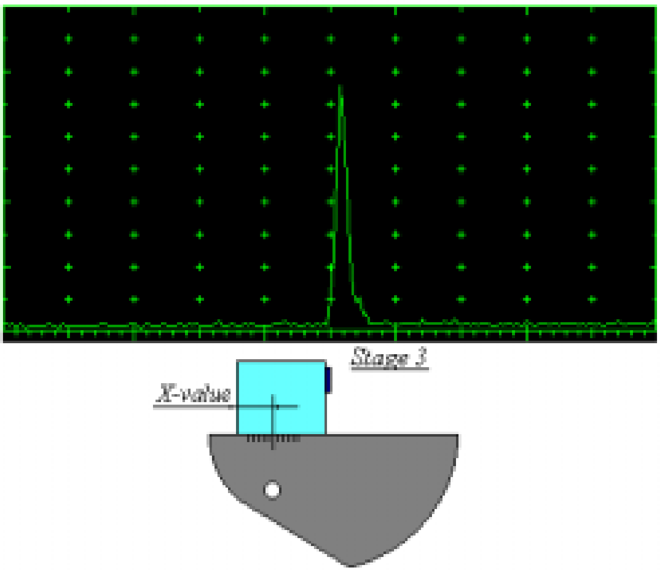


- **Top** and **Flank** relate to the measuring of the time of flight and coordinates
- First gate-cross point (**F**) is used for the **Flank** related measurements
- The tip of highest echo in the gate (**T**) used for the **Top** related measurements
- Signals out of the gate are not be measured
- If there are no signals exceeding the gate threshold than the **Top** related measurement only are possible

Probe Delay:

(a) Miniature Angle Beam Probes (contact face width 12.5 mm / 0.5 in or less) – Shear or Longitudinal Waves





Activate the **PULSER** topic then set:

- **Pulser Mode** to **Single** or **Dual** depending on the probe
- **Energy** to **120 µJ** ▸ **UDS 3-3**
- **Energy** to **High** ▸ **USLT 2000**
- **Pulse Width** to **Spike (240 µJ)** for the probe having resonant frequency of 8 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for the probes having resonant frequency below 8 MHz ▸ **UDS 3-4**
- **Damping** to **333 Ω** ▸ **UDS 3-3**
- **Damping** to **500 Ω** ▸ **USLT 2000**
- **Damping** to **1000 Ω** ▸ **UDS 3-4**
- **Tuning** to **NO** ▸ **UDS 3-4**

Activate the **RECEIVER** topic then set:

- **Display** to **Full** or **RF**
- **Filter** to **BB** ▸ **UDS 3-4**
- **Frequency** to completely cover the probe's effective bandwidth

Activate the **BASICS** topic then set:

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

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

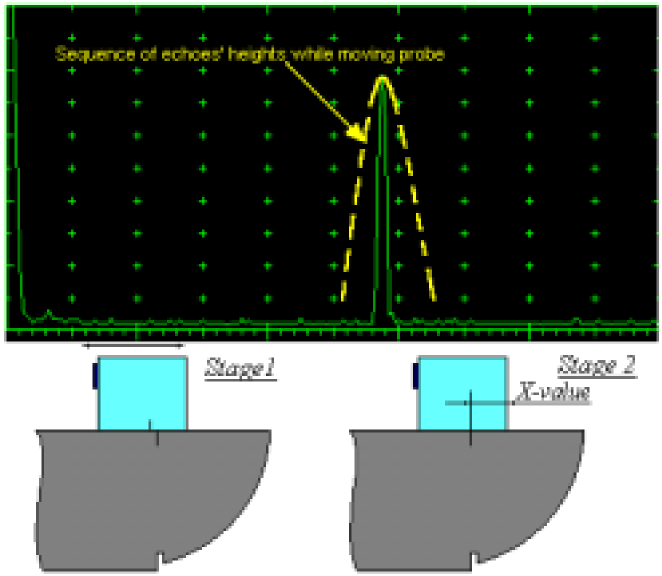
Stage 2: Fix the probe in the found position - the center of 25 mm (1 in) radius concave reflector will indicate the **incident point** while the distance between the frontal probe edge and the **incident point** is equal to **X-Value**

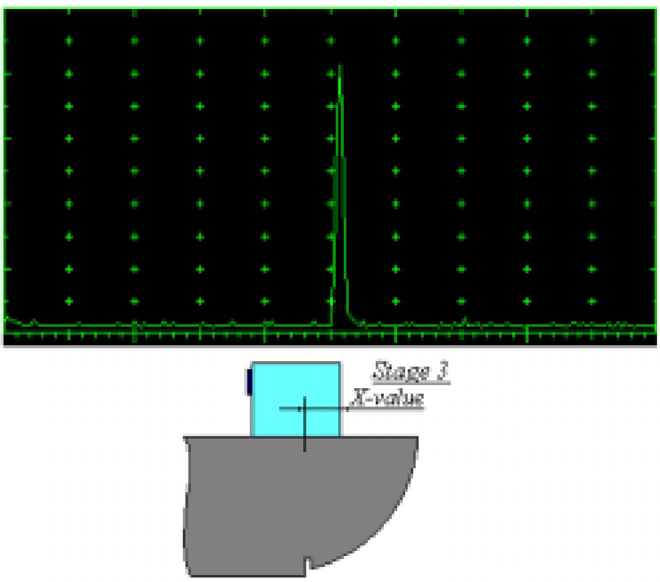
Stage 3: Tune the **Display Delay** while the probe is still fixed in the found position until rising edge of the maximized echo will match with 50%-grid of the A-Scan width: in such case the obtained value of **Display Delay** is equal to the actual **Probe Delay**

ⓘ

- It's necessary to setup **Gain** bringing the height of the maximized echo to the level of **75-80%** of the **A-Scan** height
- For the units equipped with **UDS 3-4** Pulser Receiver Card it is recommended to optimize **Tuning** in the **PULSER** submenu upon obtaining the maximized echo. The goal of the optimization is increasing of the energy of ultrasonic excitation though the better matching between firing output and probe. Level of the energy of ultrasonic excitation is clearly represented by the echo amplitude. Upon completing optimization of the **Tuning** the **Gain** to be adjusted to bring the height of the maximized echo to the vertical level of **75-80%** of the **A-Scan** height

(b) *Large and Medium Size Angle Beam Probes (contact face width more than 12.5 mm / 0.5 in) – Shear or Longitudinal Waves*





Activate the **PULSER** topic then set:

- **Pulser Mode** to **Single** or **Dual** depending on the probe
- **Energy** to **120 µJ ▸ UDS 3-3**
- **Energy** to **High ▸ USLT 2000**
- **Pulse Width** to **Spike (240 µJ)** for the probe having resonant frequency of 8 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for the probes having resonant frequency below 8 MHz **▸ UDS 3-4**
- **Damping** to **333 Ω ▸ UDS 3-3**
- **Damping** to **500 Ω ▸ USLT 2000**
- **Damping** to **1000 Ω ▸ UDS 3-4**
- **Tuning** to **NO ▸ UDS 3-4**

Activate the **RECEIVER** topic then set:

- **Display** to **Full** or **RF**
- **Filter** to **BB ▸ UDS 3-4**
- **Frequency** to completely cover the probe's effective bandwidth

Activate the **BASICS** topic then set:

- **US Velocity** to **5920 m/s** (**233.1 in/ms**) for the longitudinal wave probes or **3255 m/s** (**128.1 in/ms**) for the shear wave probes
- **Range** to **200.0 mm** (**4 in**)
- **Display Delay** to **0 µs**
- **Reject** to **0%**

Stage 1: Manipulate the probe over the main working surface of the V-2 reference standard and maximize the echo from the 100 mm (4 in) radius concave reflector

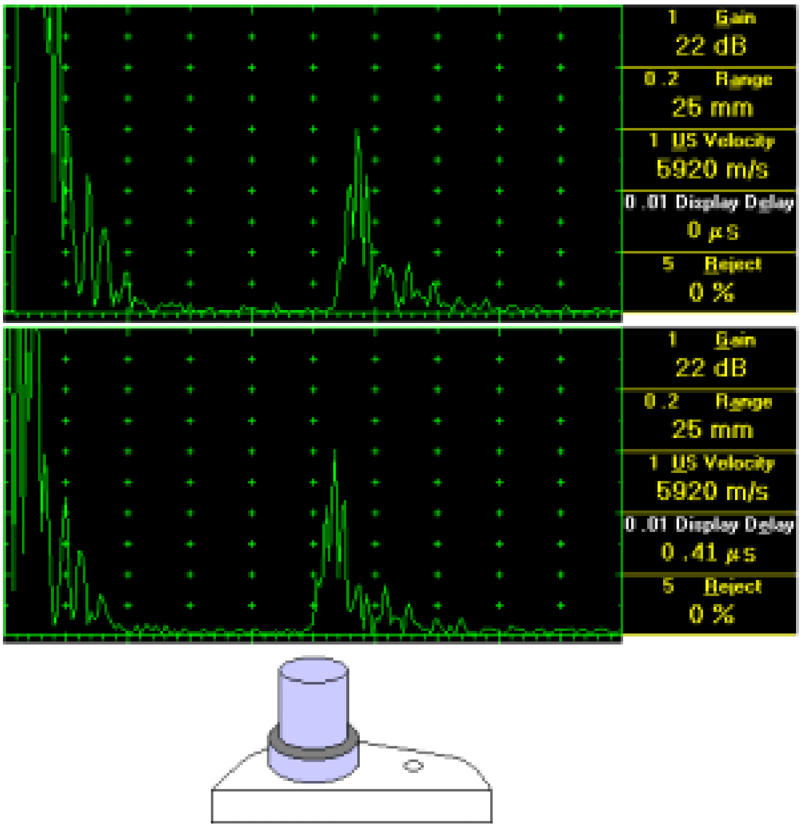
Stage 2: Fix the probe in the found position - the center of 100 mm (4 in) radius concave reflector will indicate the **incident point** while the distance between the frontal probe edge and the **incident point** is equal to **X-Value**

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

ⓘ

- It's necessary to setup **Gain** bringing the height of the maximized echo to the level of **75-80%** of the **A-Scan** height
- For the units equipped with **UDS 3-4** Pulser Receiver Card it is recommended to optimize **Tuning** in the **PULSER** submenu upon obtaining the maximized echo. The goal of the optimization is increasing of the energy of ultrasonic excitation though the better matching between firing output and probe. Level of the energy of ultrasonic excitation is clearly represented by the echo amplitude. Upon completing optimization of the **Tuning** the **Gain** to be adjusted to bring the height of the maximized echo to the vertical level of **75-80%** of the **A-Scan** height

(c) Straight Beam (Normal) Single Element and Dual (TR) Probes



Activate the **PULSER** topic then set:

- ❑ **Pulser Mode** to **Single** or **Dual** depending on the probe
- ❑ **Energy** to **120 µJ** ▸ **UDS 3-3**
- ❑ **Energy** to **High** ▸ **USLT 2000**
- ❑ **Pulse Width** to **Spike (240 µJ)** for the probe having resonant frequency of 8 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for the probes having resonant frequency below 8 MHz ▸ **UDS 3-4**
- ❑ **Damping** to **333 Ω** ▸ **UDS 3-3**
- ❑ **Damping** to **500 Ω** ▸ **USLT 2000**
- ❑ **Damping** to **1000 Ω** ▸ **UDS 3-4**
- ❑ **Tuning** to **NO** ▸ **UDS 3-4**

Activate the **RECEIVER** topic then set:

- ❑ **Display** to **Full** or **RF**
- ❑ **Filter** to **BB** ▸ **UDS 3-4**
- ❑ **Frequency** to completely cover the probe's effective bandwidth

Activate the **BASICS** topic then set:

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

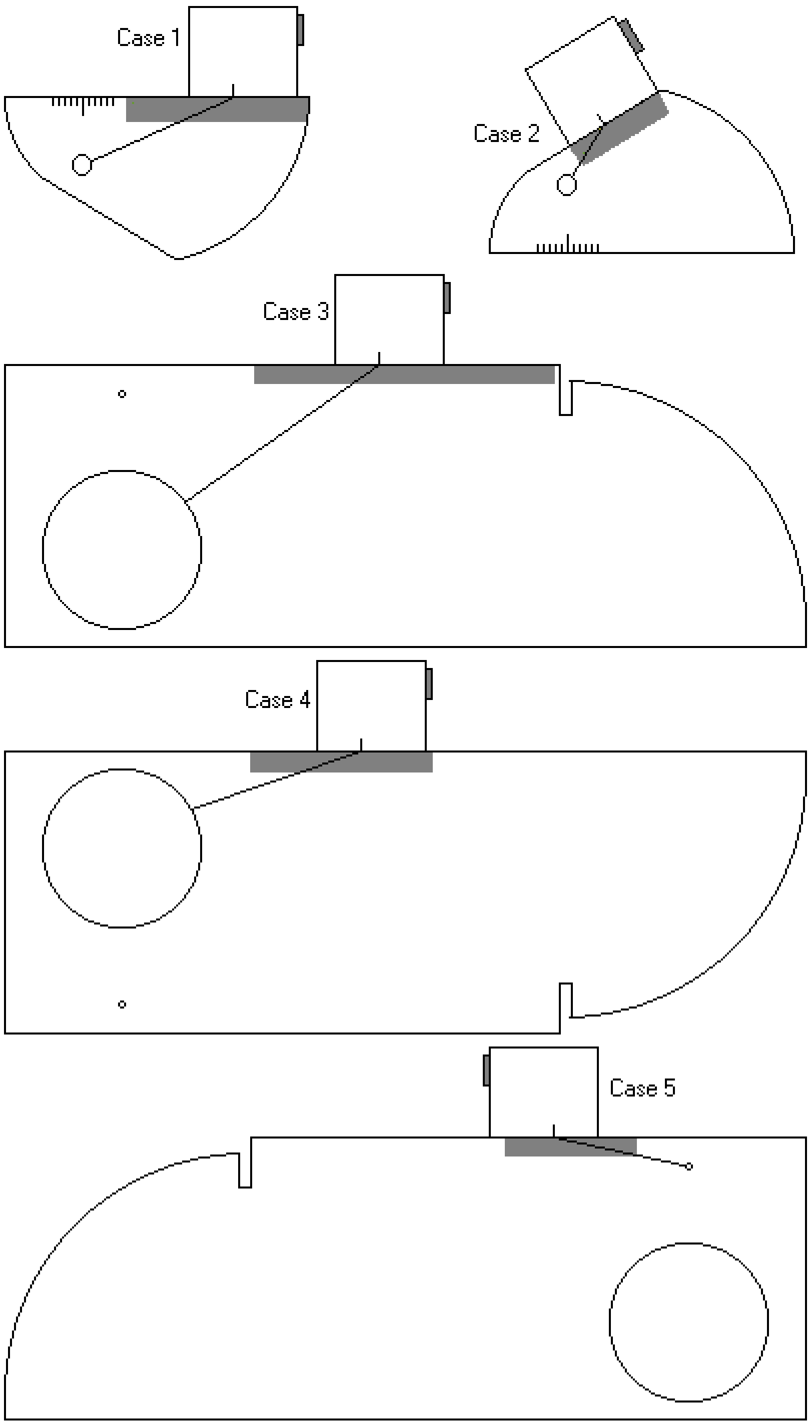
Stage 1: Apply probe to the side surface of V-2 reference standard and obtain the *back echo*

Stage 2: Tune the **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 the height of the back echo to the level of **75-80%** of the **A-Scan** height
- ♦ For the units equipped with **UDS 3-4** Pulser Receiver Card it is recommended to optimize **Tuning** in the **PULSER** submenu upon getting the back echo. The goal of the optimization is increasing of the energy of ultrasonic excitation though the better matching between firing output and probe. Level of the energy of ultrasonic excitation is clearly represented by the back echo amplitude. Upon completing optimization of the **Tuning** the **Gain** to be adjusted to bring the height of the back echo to the vertical level of **75-80%** of the **A-Scan** height

Incidence Angle (Probe Angle)



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

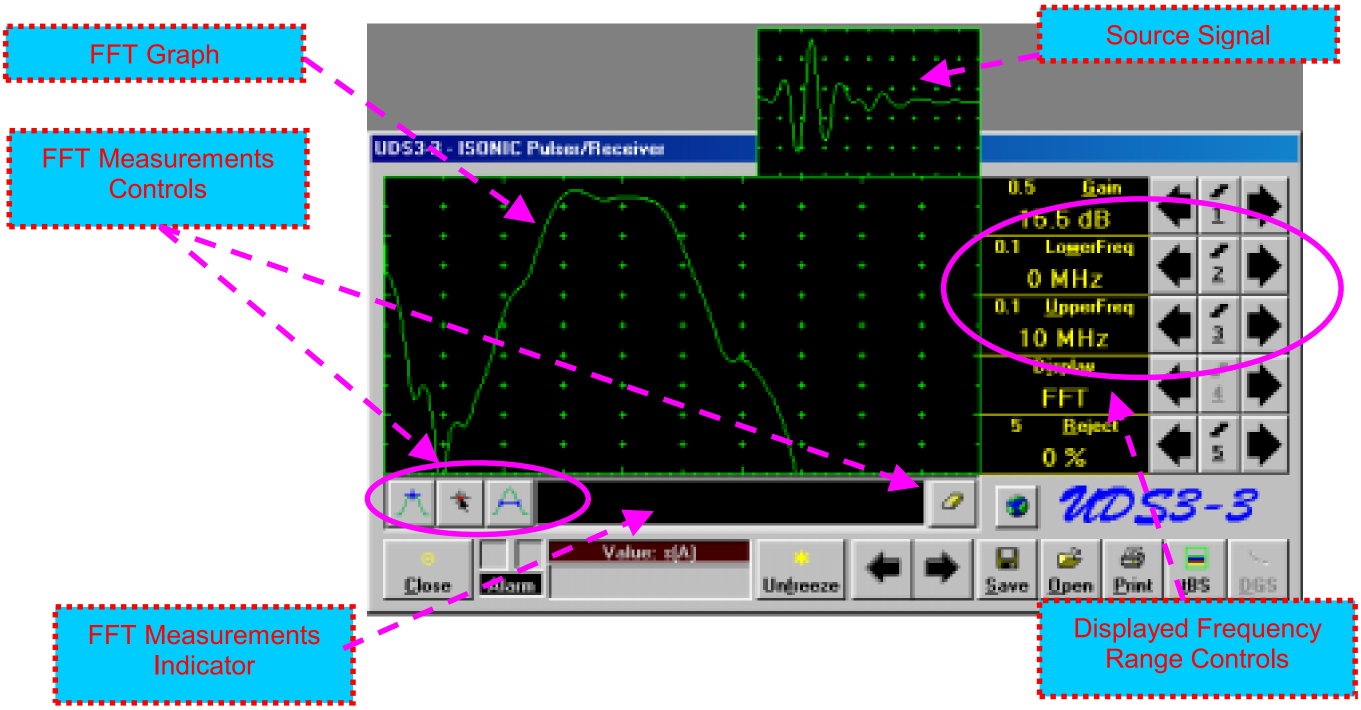
Case 5: Medium or large size angle beam probe, incidence angle 74^{o} to 80^{o}, V-1 reference block

5.4.17. Frequency Domain Signal Presentation and Evaluation

<u>**To activate FFT Mode**</u>:

Using **Range** and **Delay** parameters select the portion of signal for FFT presentation and then do as follows:

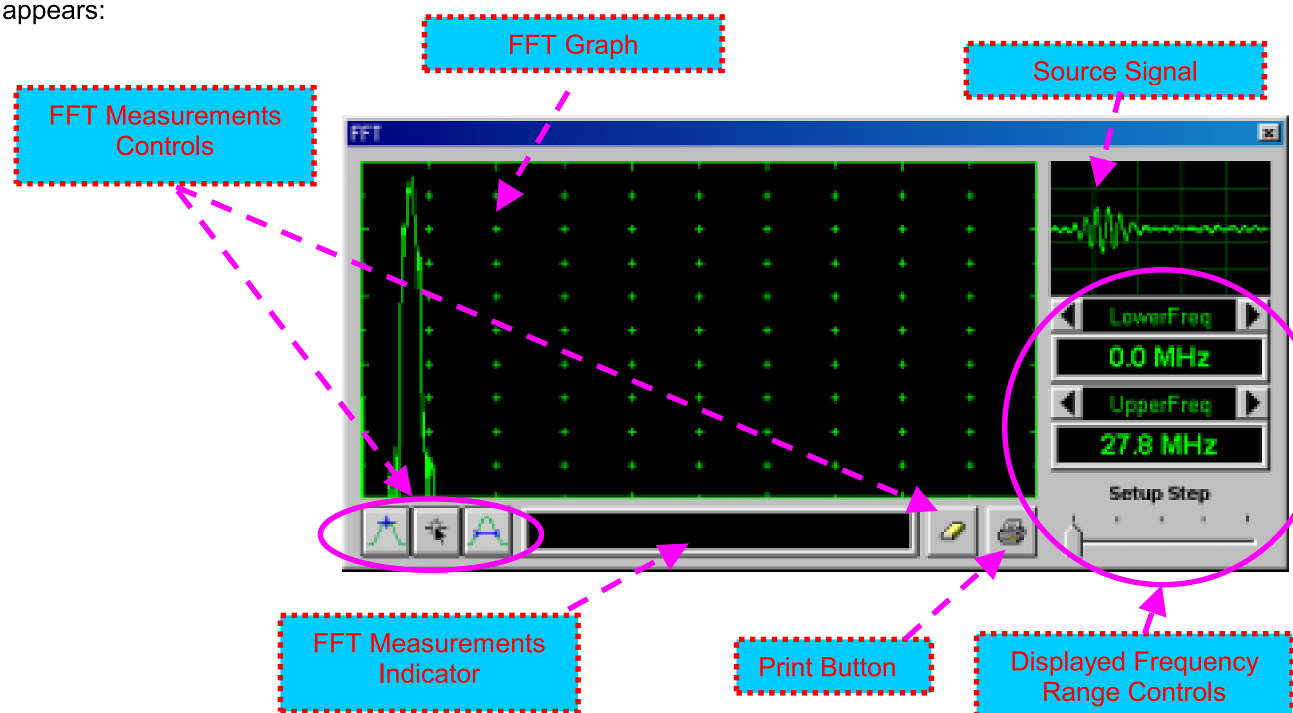
UDS 3-3 / UDS 3-4: in the **RECEIVER** submenu switch the **Display** mode to **FFT**. The window will look as below:



ⓘ

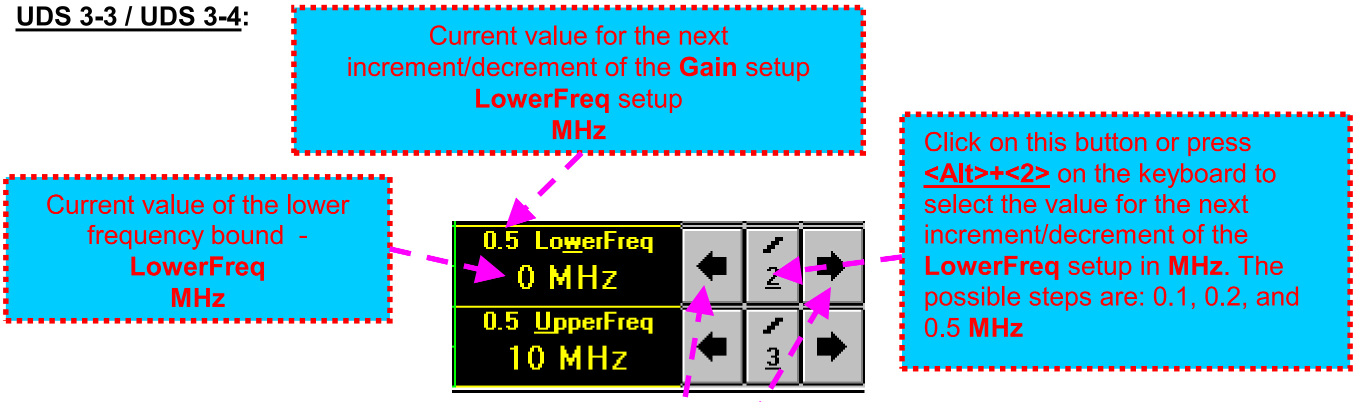
The **Display** mode may not be switched into the **FFT** if the **Range** value is too large or **DAC/TCG/DGS** is active

USLT 2000: Switch the **Display** parameter to **RF** and click on the **FFT** button upon. The **FFT** window appears:



<u>The lower frequency bound of the displayed FFT graph:</u>

<u>UDS 3-3 / UDS 3-4</u>:



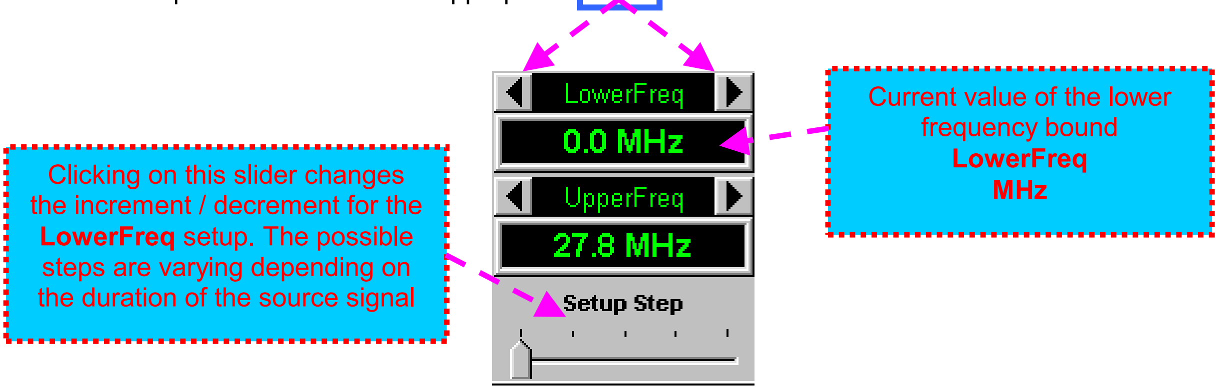
To setup **LowerFreq** the following manipulations are applicable:

- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<W>** ⇒ **Lo<u>w</u>erFreq** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Lo<u>w</u>erFreq** area letter **<u>w</u>** is underlined)
- **Combined**
  - Click on **Lo<u>w</u>erFreq** ⇒ **Lo<u>w</u>erFreq** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

<u>USLT 2000:</u>

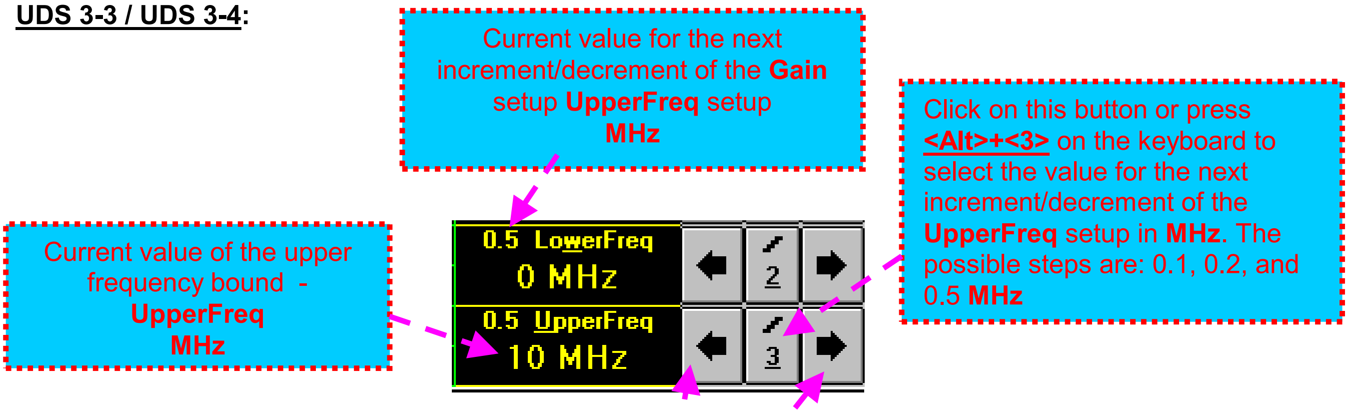
To setup **LowerFreq** the following manipulations are applicable:

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



The upper frequency bound of the displayed FFT graph:

UDS 3-3 / UDS 3-4:

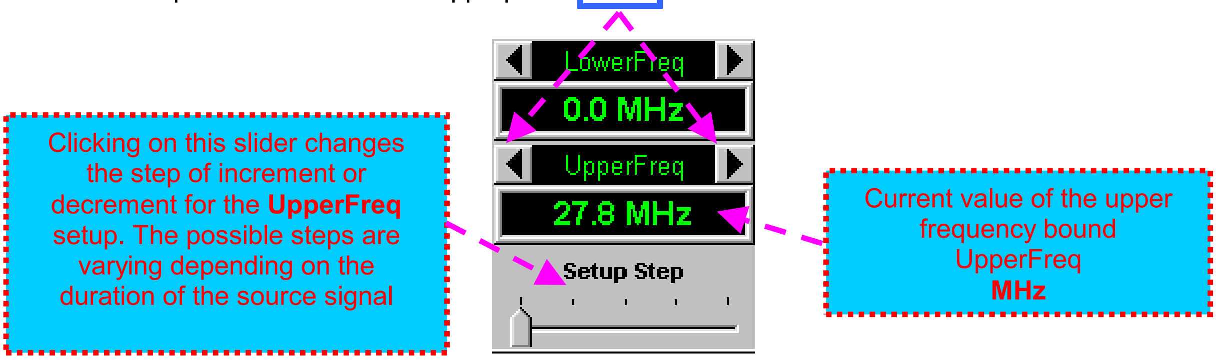


To setup **UpperFreq** the following manipulations are applicable:

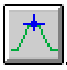
- **Mouse**
  - Click or press and hold on the appropriate button
- **Keyboard**
  - Pressing **<Alt>+<U>** ⇒ **UpperFreq** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **UpperFreq** area letter **U** is underlined)
- **Combined**
  - Click on **UpperFreq** ⇒ **UpperFreq** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

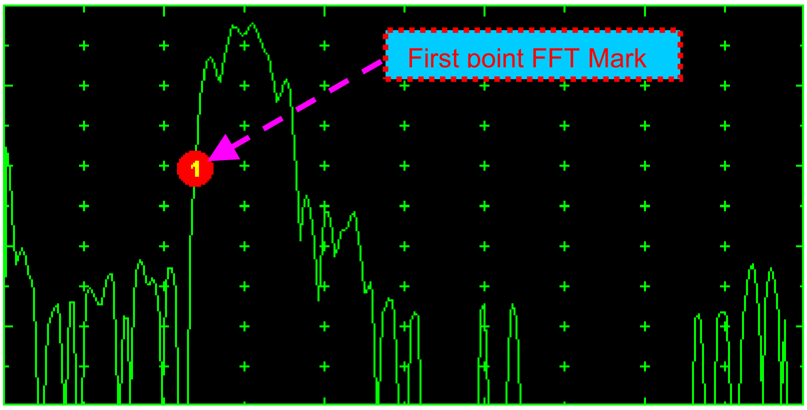
USLT 2000:
To setup **UpperFreq** the following manipulations are applicable:

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



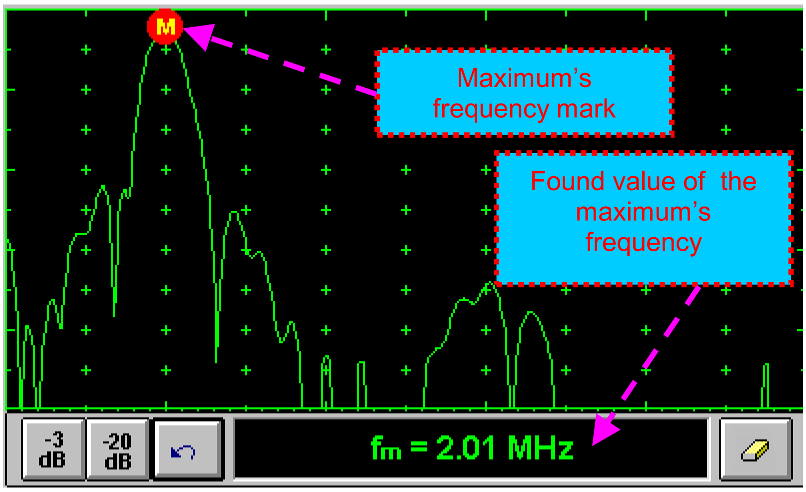
Find the maximum between two selected points on the FFT graph:

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

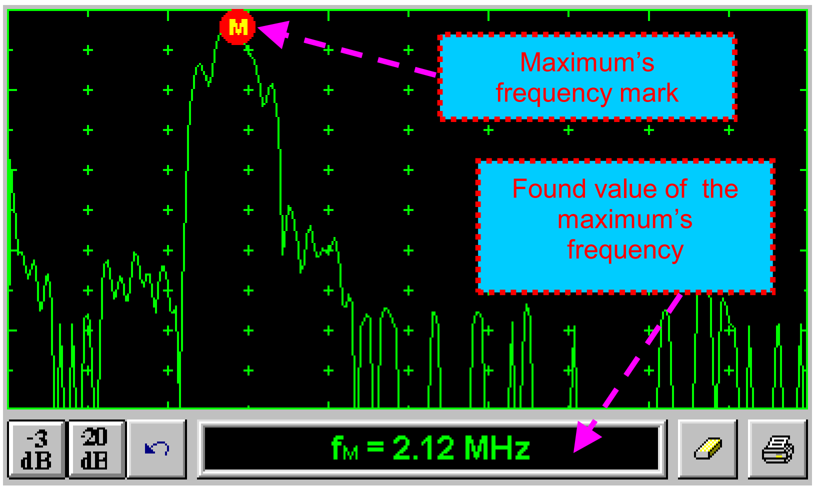


Select the second point of interest by the same way - the **maximum's frequency mark**  appears and the **FFT Measurements Indicator** displays the found value upon the mouse click or releasing of the touch screen stylus:

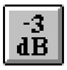
UDS 3-3 / UDS 3-4

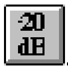


USLT 2000



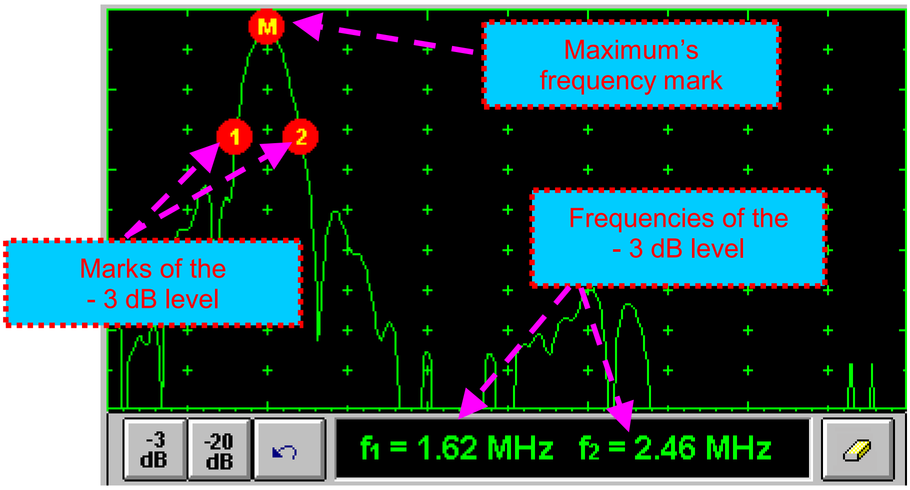
Find the –3db / –20db level bounds:

Find the maximum as described above. Click on 

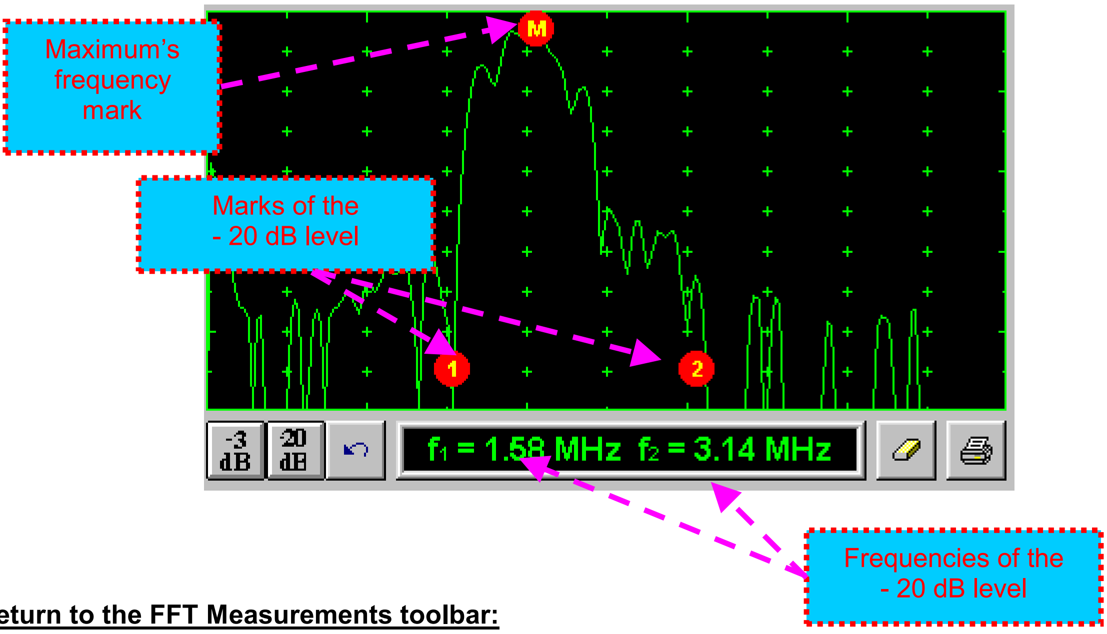
or 

. Two points found corresponding to the selected level appear on the FFT graph and the **FFT Measurements Indicator** shows their corresponding frequencies:

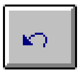
UDS 3-3 / UDS 3-4



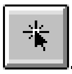
USLT 2000

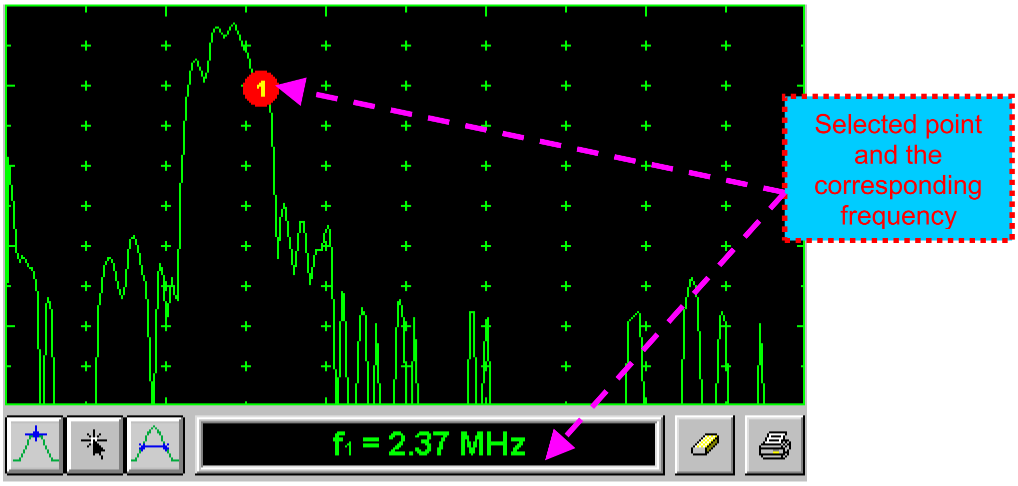


Return to the FFT Measurements toolbar:

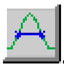
Click on 

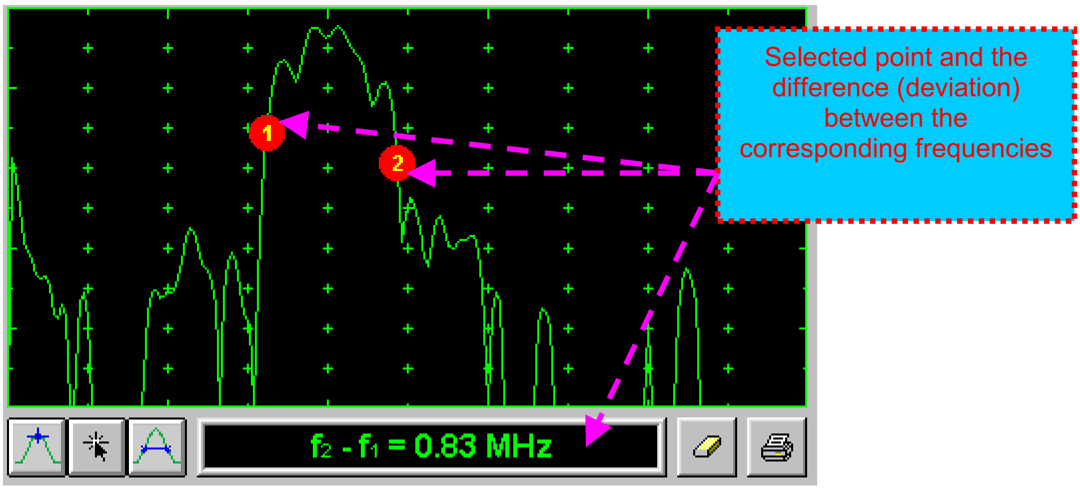
Find the frequency corresponding to the selected single point on the FFT graph:

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



Frequency difference (deviation) between two points:

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

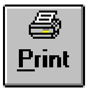


Clear the FFT Marks:

Click on 

Print the FFT graph:

UDS 3-3 / UDS 3-4:

Click on 

or press **<Alt> + <P>** on the keyboard.

USLT 2000:

Click on .

Exit FFT Mode:

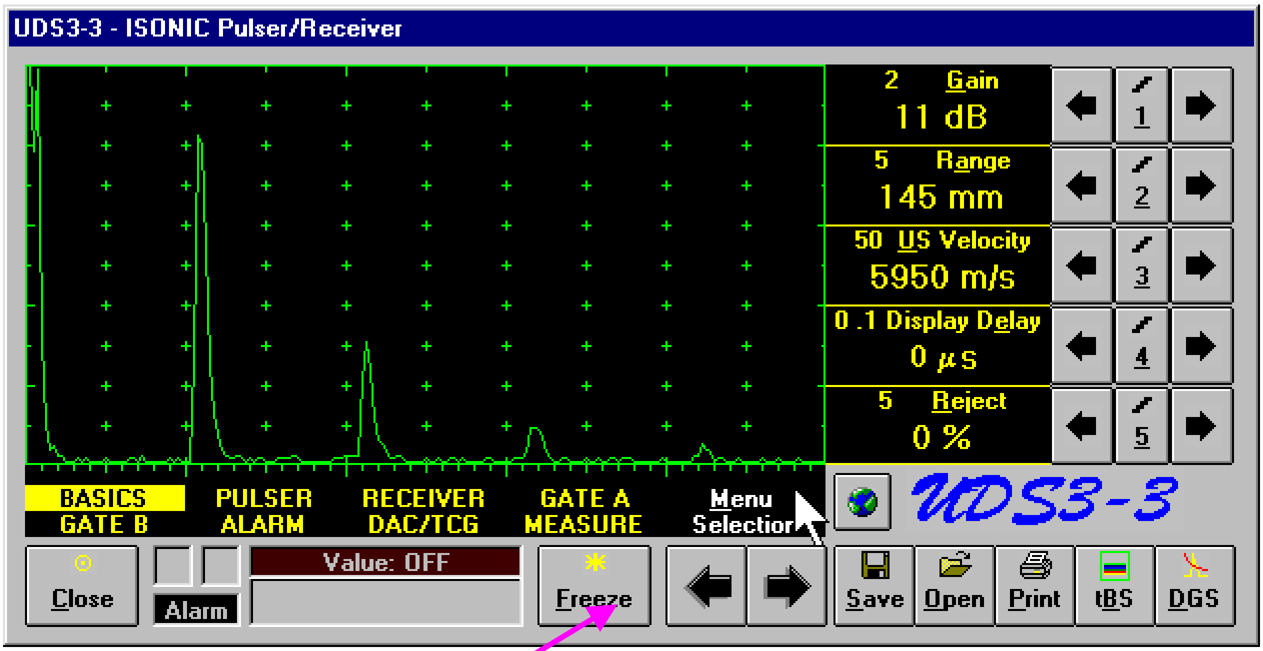
UDS 3-3 / UDS 3-4:

Change the **Display** mode.

USLT 2000:

Click on  or press **Esc**

5.4.18. Freeze the A-Scan

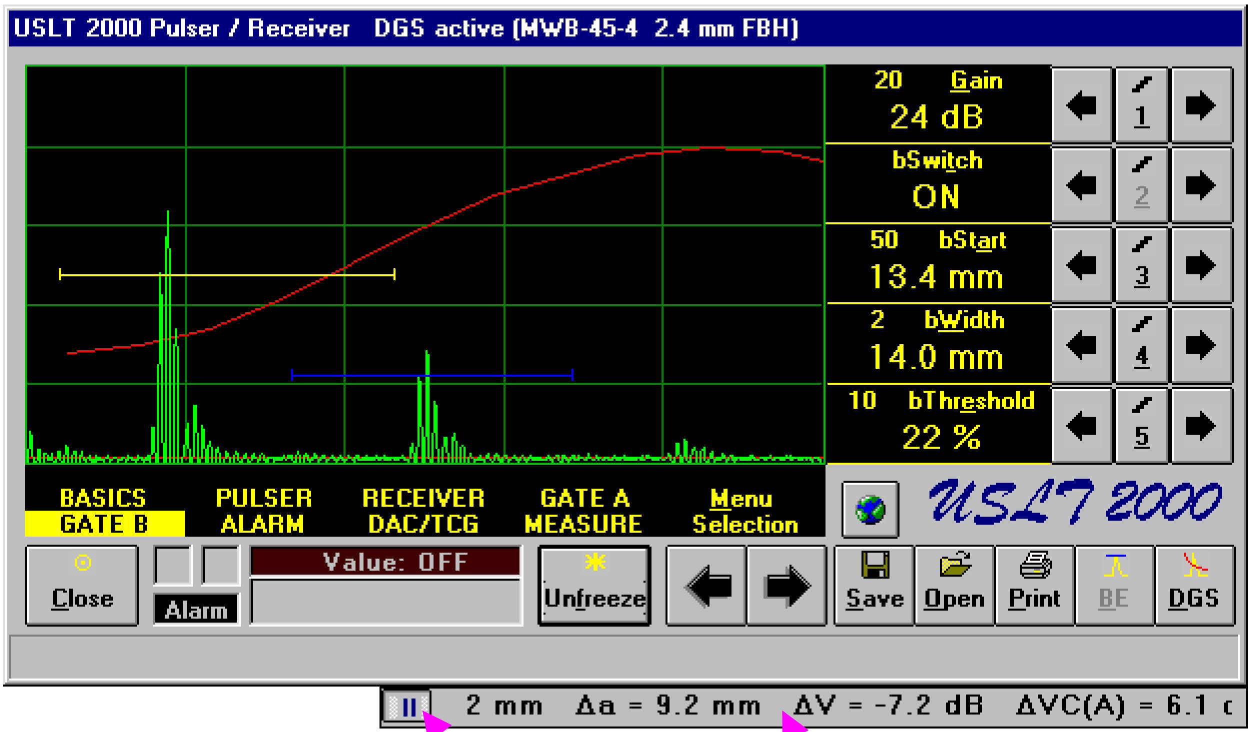


To freeze / unfreeze the **A-Scan** click on or press **<Alt>+<F>** on the keyboard

ⓘ

- The following operations are available while the time domain **A-Scan** is frozen:
  - o Manipulating **Gates A** and **B** according to the paragraphs 5.4.7 through 5.4.9 of this Operating Manual
  - o Varying **Alarm** modes according to the paragraph 5.4.10 of this Operating Manual
  - o Varying selection of the automatic measurements mode and probe parameters (**Probe Delay** and **Angle**) as per Chapter 5.4.15 of this Operating Manual and getting the corresponding measurements results in the **Value** digital readout box
- The caption of the appropriate button changes upon freeze / unfreeze the **A-Scan**

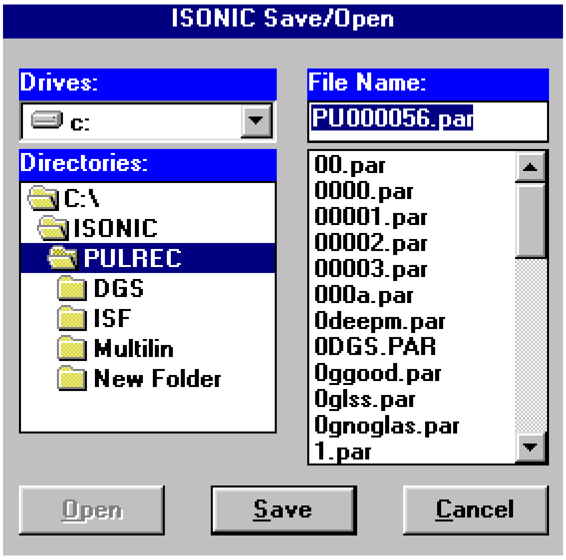
"Infinite Scrolling Tape" while freezing (USLTPR Software Package - USLT 2000 only)



Freezing **A-Scan** while some gate is active will cause appearing of the so-called "infinite scrolling tape" showing the results for all possible measurements

To pause/continue the scrolling left mouse click on.
"Infinite scrolling tape" disappears automatically upon unfreezing the **A-Scan**

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



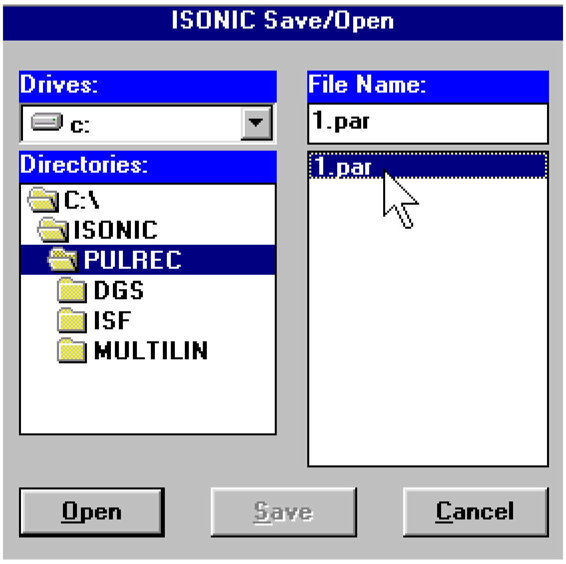
To save the **A-Scan** and **Calibration Dump** into a file click on **Save** or press **<Alt>+<S>** on the keyboard – the typical **ISONIC Save/Open** window appears. The automatically created name for a new file appears in the **File Name:** field

To save a file:

- select disk drive and directory for placing a file
- approve the automatically created or type a new file name consisting of not more of 8 symbols (letters from ***a*** to ***z*** and / or numbers from ***0*** to ***9*** only) or choose one of existing files to be replaced
- click on **Save** or double click on the name of the file to be replaced or press **Enter** or **<Alt>+<S>** on the keyboard

ISONIC Save / Open window disappears automatically upon completing saving a file. To exit from **ISONIC Save / Open** window without saving a file click on **Cancel** or press **Esc** or **<Alt>+<C>** on the keyboard

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



To load **A-Scan** and **Calibration Dump** from a file click on **Open** or press **<Alt>+<O>** on the keyboard – the typical **ISONIC Save/Open** window appears

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 **Open** or press **Enter** or **<Alt>+<O>** on the keyboard

ISONIC Save/Open window disappears automatically upon completing loading a file. To exit from **ISONIC Save/Open** window without opening a file click on **Cancel** or press **Esc** or **<Alt>+<C>** on the keyboard

5.4.21. Printing A-Scan and Calibration Dump

To print the **A-Scan and Setup list** click on **Print** or press **<Alt>+<P>** on the keyboard. The automatic measurements results if exist appear in the **A-Scan and Setup list** printout

5.4.22. Zoom Function - Enlarging the A-Scan (UDS3-3 and UDS 3-4)

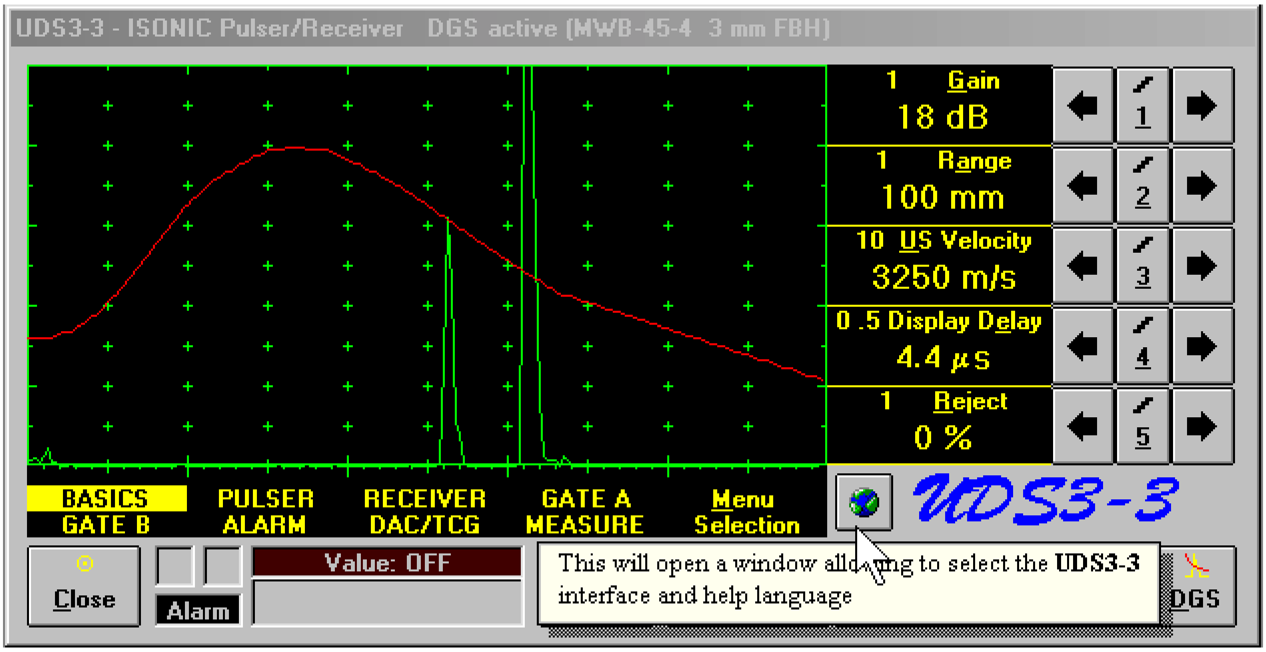
Double click on the **A-Scan** to get it enlarged. The enlarged **A-Scan** occupies the full screen width while all controls are hidden. To return back to the main **ISONIC Pulser / Receiver** window double click on the enlarged **A-Scan**

5.4.23. Set Up Language for the User Interface and On-Line Help

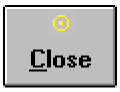
To select the user interface language and on-line help click on . Refer to the paragraph 4.6 of this Operating Manual

5.4.24. On-Line Help

To get the **On-Line Help** select an object then right mouse click on it – the help topic appears automatically. To close help topic press **Esc** or click on it. To print help topic or copy it into the Windows clipboard right mouse click on it



5.4.25. Switch OFF Pulser / Receiver

To switch OFF Pulser / Receiver click on  or press **Esc** or **<Alt>+<C>** on the keyboard

5.5. Signals' Recording and Simplest Imaging Features

The simple and fast recording and imaging of defects / thickness profile without any form of encoding device may be performed according to the following imaging schemes:

- **t-B-Scan(Th)** – timed (time-based) thickness B-Scan - graphically representing thickness profile of the object under test in the selected section allowing fast identification of the corroded, laminated or pitted areas
- **t-B-Scan(A)** – timed (time-based) amplitude multi-echo B-Scan - graphically representing in the selected section of the object under test with all amplitude defects and geometry responses
- **t-TOFD** – timed (time-based) Time of Flight Diffraction Record – the RF B-Scan

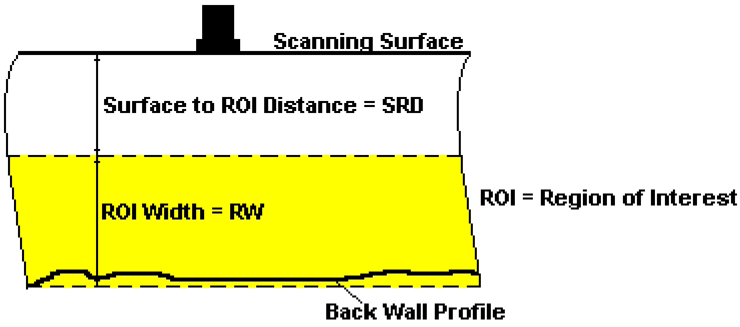
5.5.1. Timed (time-based) Thickness B-Scan: t-B-Scan(Th)

t-B-Scan(Th) mode allows to display a thickness profile of the test object in the selected section through the taking continuous thickness measurements along the scanning path over a maximum measurement period of 72 seconds. **To perform the imaging the probe must be linearly driven over the section to be displayed during the measurement period with the approximately constant speed**

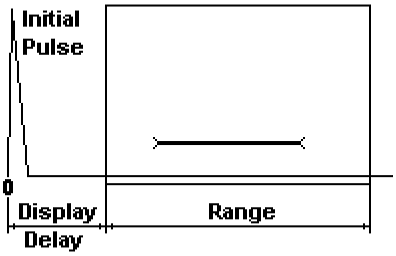
5.5.1.1. Prior to the running t-B-Scan(Th) mode

- Carry out the valid calibration for the *Probe Delay* and *US Velocity*
- Activate *Gate A*
- Referring to the table below define the *region of interest* through the setup of the *Display Delay*, *Range*, *aStart* and *aWidth*
- Select the section of the object under test to scan over and the length of the corresponding scanning line (**Scan Length**)
- Provide the appropriate calibration for *Gain* and *aThreshold*. Check the possibility of the receiving of the desired signals along the selected scanning line:
  - The *first* signal matching with the *Gate A* and exceeding its threshold will be measured during the **t-B-Scan(Th)** recording if the *Meas Mode* is setup to *Flank*
  - The *maximal* signal matching with the *Gate A* and exceeding its threshold will be measured during the **t-B-Scan(Th)** recording if the *Meas Mode* is setup to *Top*

Defining of the Region of Interest (ROI) for the **t-B-Scan(Th)** recording



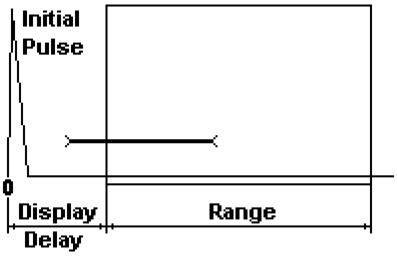
Case 1



$$SRD = aStart$$

$$RW = aWidth$$

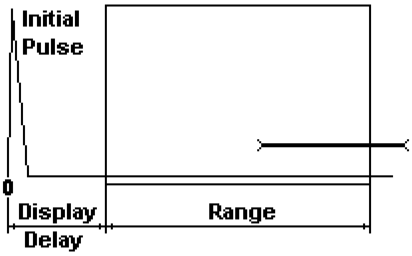
Case 2



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

$$RW = aStart + aWidth - SRD$$

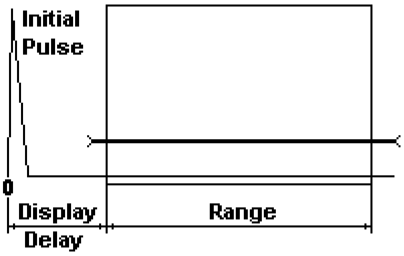
Case 3



$$SRD = aStart$$

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

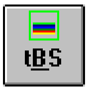
Case 4

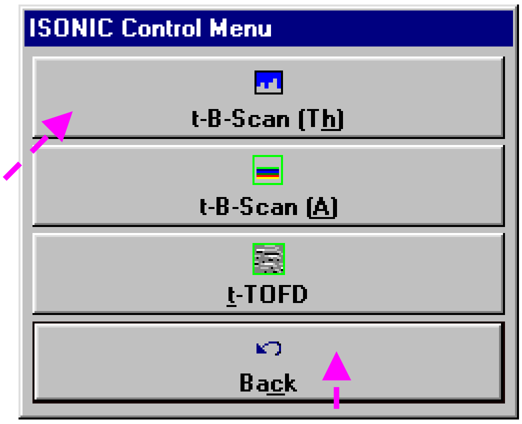


$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

$$RW = Range$$

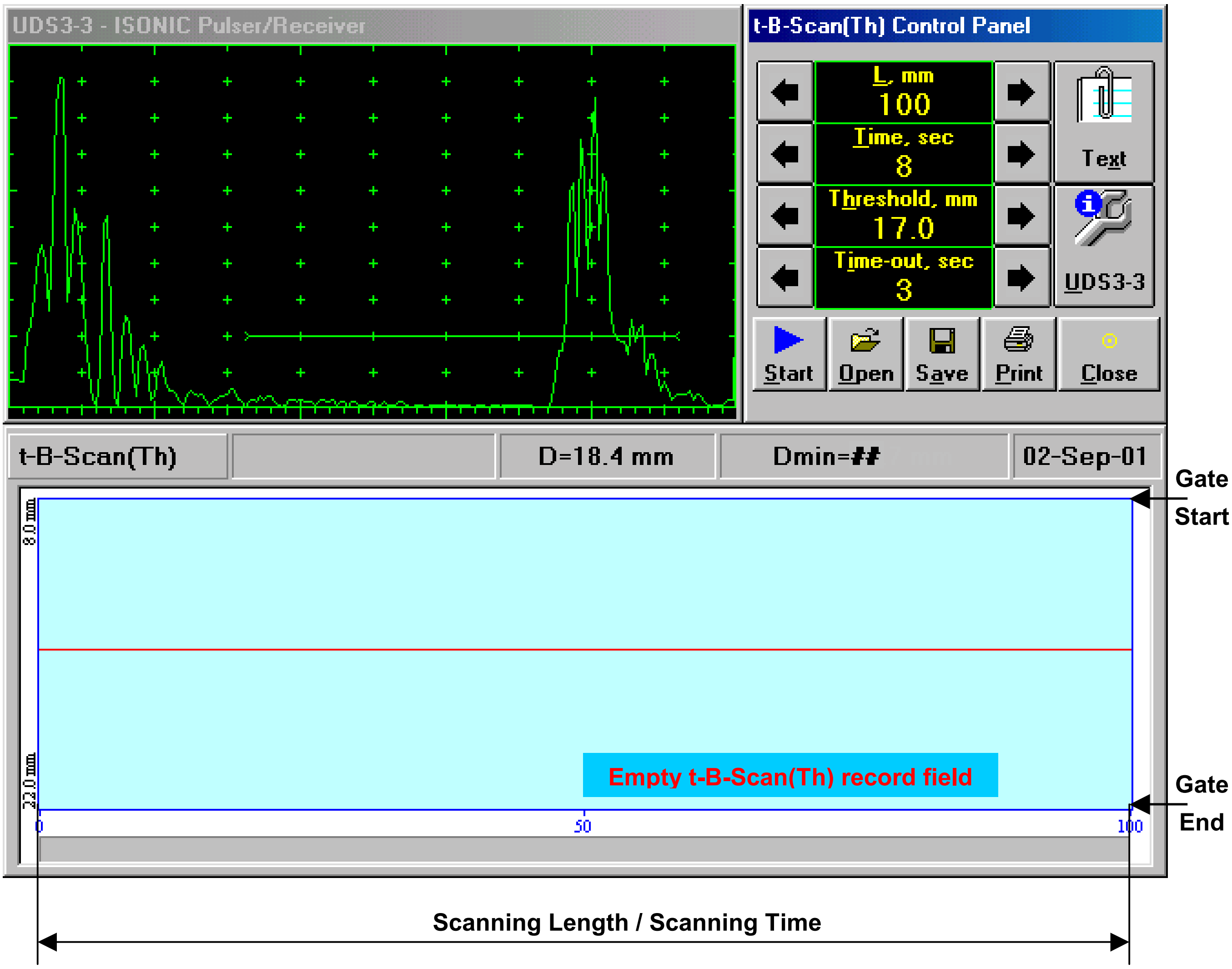
5.5.1.2. Startup the t-B-Scan(Th) mode

To run **t-B-Scan(Th)** mode click on  or press **<Alt>+<B>** on the keyboard.
The pre-recording *ISONIC Control menu* appears:



Click on or press **<Alt>+<H>** on the keyboard to run **t-B-Scan(Th)** mode. The screen as below appears upon:

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to return to the Pulser / Receiver window

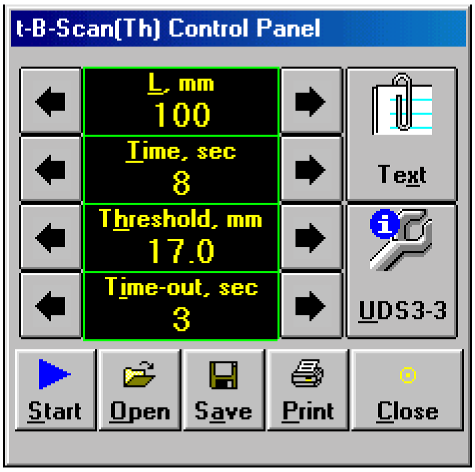


5.5.1.3. t-B-Scan(Th) Control Panel

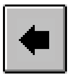
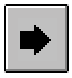
<u>**Scan Length and Scan Time**</u>

The value of **L** (Scan Length or, in other words, Scan Path) represents the length of the section of the test object to be displayed, over which the probe will be guided during the recording period. **Time** (Scan Time) is the duration of the said recording period. There are 4 (four) possible values for **L** and there are 3 (three) possible values for **Time** corresponding to the each value of **L**:

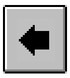
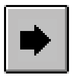
Scan Length – **L**	Possible Scan Time – **Time**
100 mm or 4 in	8, 16 and 24 sec
150 mm or 6 in	12, 24 and 36 sec
200 mm or 8 in	16, 32 and 48 sec
300 mm or 12 in	24, 48 and 72 sec



To select the required value of *Scan Length* – **L** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **<u>L</u>** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (**<u>L</u>** is underlined)
- **Combined**
  - Click on **<u>L</u>** ⇒ **<u>L</u>** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

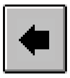
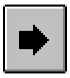
To select the required value of *Scan Time* – **Time** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **<u>T</u>ime** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **<u>T</u>ime** area letter **<u>T</u>** is underlined)
- **Combined**
  - Click on **<u>T</u>ime** ⇒ **<u>T</u>ime** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Threshold

The **Threshold** is the thickness limit, selectable by an operator. The thickness limit is permanently indicated on the cross-sectional thickness profile easing the graphic evaluation of the obtained results. The value of the **Threshold** may be setup over the whole *Region of Interest*. This provides direct reading of the object thickness at any point of interest along the **t-B-Scan(Th)** record

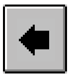
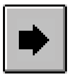
To select the required value of Thickness Limit – **Threshold** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<H>** ⇒ **Threshold** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Threshold** area the first letter **H** is underlined)
- **Combined**
  - Click on **Threshold** ⇒ **Threshold** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

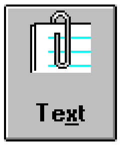
Time-out

The **Time-out** is the waiting time for intermissions. The time-out counting starts as soon as missing an echo in the gate during **t-B-Scan(Th)** recording (*Event 1*). Immediately since an echo matches with the gate again (*Event 2*) the **t-B-Scan(Th)** recording is continued if the time between *Event 1* and *Event 2* does not exceed the value of **Time-out**. Otherwise the **t-B-Scan(Th)** recording will be stopped. The value of **Time-out** in sec is adjustable in **1 sec** steps in the range **0** to **15 sec**

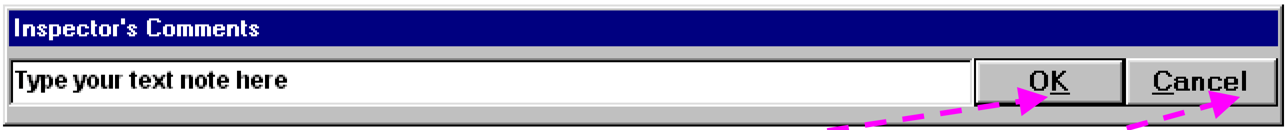
To select the required value of **Time-out** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<I>** ⇒ **Time-out** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time-out** area the first letter **i** is underlined)
- **Combined**
  - Click on **Time-out** ⇒ **Time-out** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Insert Text Note

A text note may be keyed in to accompany the **t-B-Scan(Th)** record. To proceed click on 

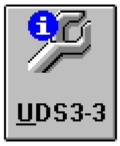
or press **<Alt>+<X>** on the keyboard



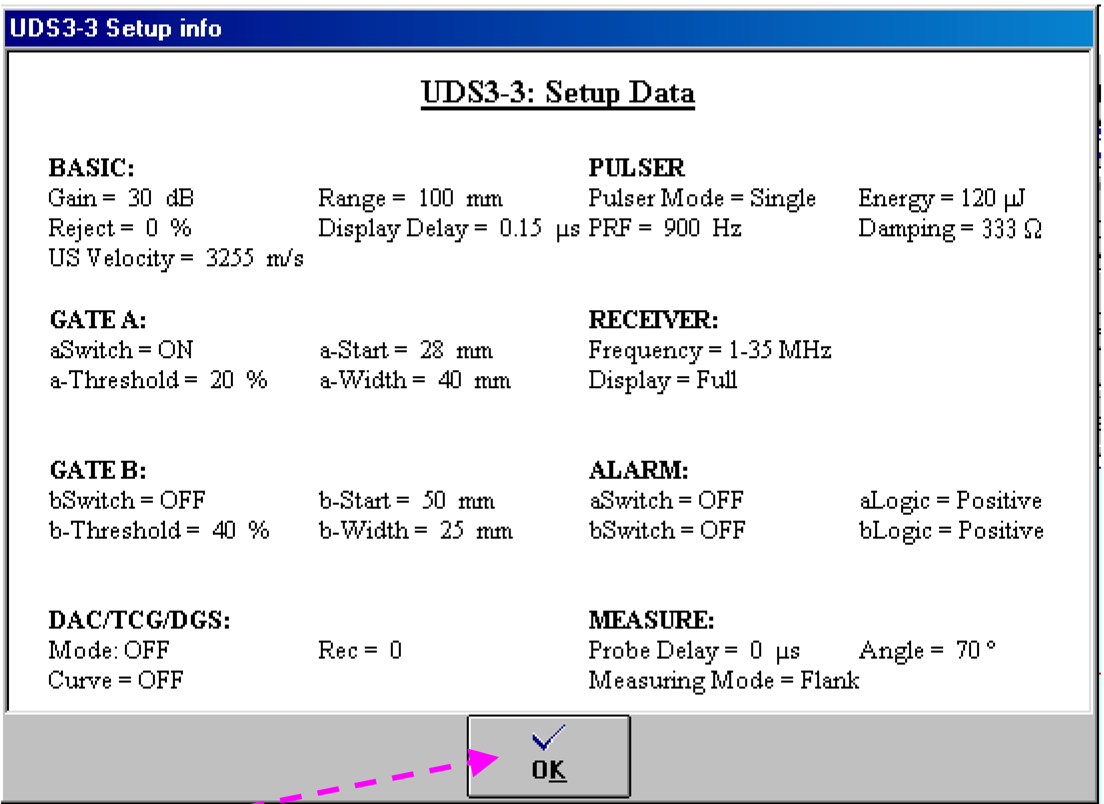
Click on or press **<Alt>+<K>** or **Enter** on the keyboard to end typing and storing of the note

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to discard the new note / comments

Preview the Instrument Settings

The instrument settings for the **t-B-Scan(Th)** record may be previewed through the clicking on 

or pressing **<Alt>+<U>** on the keyboard. The corresponding window appears:



Click on or press **<Alt>+<K>** or **Esc** on the keyboard to return to the **t-B-Scan(Th)** screen

Other Controls

Clicking on Start or pressing **<Alt>+<S>** on the keyboard starts the **t-B-Scan(Th)** recording

The Start button becomes invisible since the **t-B-Scan(Th)** recording starts. The Stop button occupies its position. Clicking on Stop or pressing **<Alt>+<S>** on the keyboard will terminate the **t-B-Scan(Th)** recording prior to the automatic completion

The Stop button becomes invisible after completion / termination of the **t-B-Scan(Th)** recording. The Start button returns to its position.

Clicking on Print or pressing **<Alt>+<P>** on the keyboard will print the **ISONIC t-B-Scan(Th) Scanning Report** comprising the **t-B-Scan(Th)** graphical record, instrument settings and accompanied text notes to the *default printer*

Clicking on Save or pressing **<Alt>+<A>** on the keyboard will save the once captured **t-B-Scan(Th)** record and accompanying instrument calibration dump and text notes / comments into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

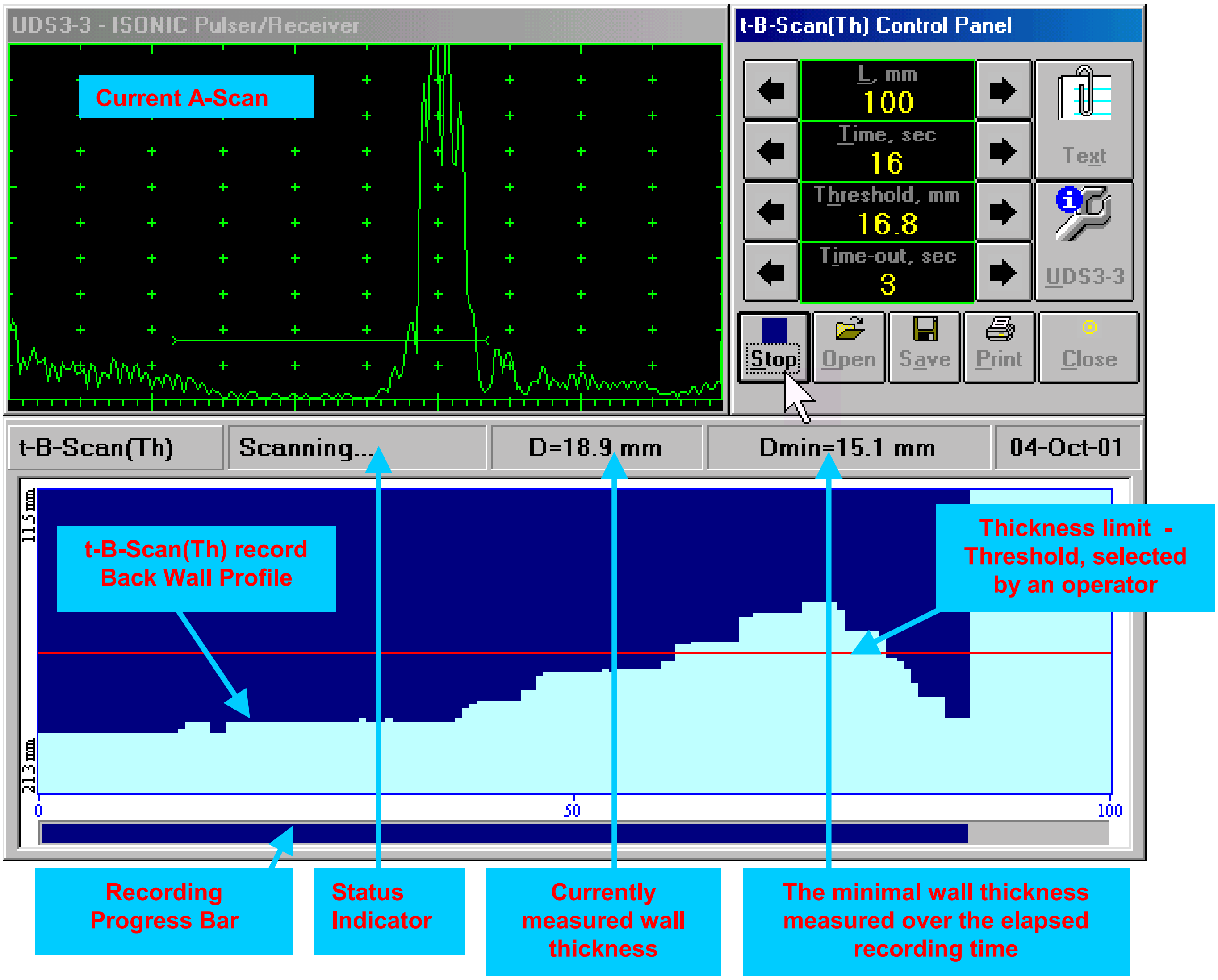
Clicking on Open or pressing **<Alt>+<O>** on the keyboard will load the once captured **t-B-Scan(Th)** record and accompanying instrument calibration dump and text notes / comments from a file. Refer to the paragraph 5.4.20 of this Operating Manual to proceed with opening a file

Clicking on Close or pressing **<Alt>+<C>** or **Esc** on the keyboard will return back to the Pulser / Receiver window

5.5.1.4. Recording t-B-Scan(Th)

To capture **t-B-Scan(Th)**:

- Apply probe to the test object in the start point of the selected scanning line
- Click on Start or press **<Alt>+<S>** on the keyboard
- Guide the probe over the scanning line – the typical display during the scanning progress is shown and explained below



<u>**Status Indicator**</u>

Status Indicator is empty prior to and after the completing/termination of the **t-B-Scan(Th)** recording

The Waiting for signal... status may appear once just if there is no any signal matching with Gate A and exceeding its threshold immediately after the start of the **t-B-Scan(Th)** recording. The first signal matching with Gate A and exceeding its threshold after the start of the **t-B-Scan(Th)** recording causes appearance of the Scanning... status. If the signal matching with Gate A and exceeding its threshold disappears then the count of the Time-Out starts: Time-Out: 2 sec. It is required to provide the sufficient signal again prior to the end of Time-Out count to continue the scanning

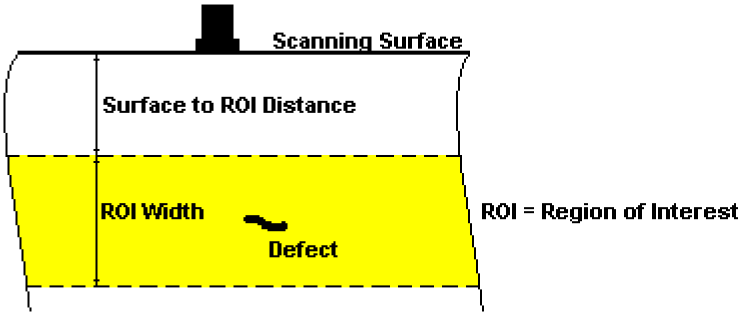
5.5.2. Timed (time-based) Amplitude B-Scan: t-B-Scan(A)

t-B-Scan(A) mode allows to display a section of the test object through the taking continuous measurements of defect responses (amplitude and coordinate) along the scanning path over a maximum measurement period of 72 seconds. **To perform the imaging the probe must be linearly driven over the section to be displayed during the measurement period with the approximately constant speed**

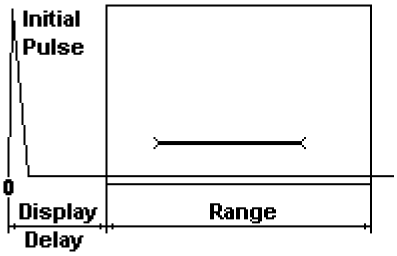
5.5.2.1. Prior to the running t-B-Scan(A) mode

- Carry out the valid calibration of the *Probe Delay* and *US Velocity*
- Activate *Gate A*
- Referring to the table below define the *region of interest* through the setup of the *Display Delay*, *Range*, *aStart* and *aWidth*
- Select the section of the object under test to scan over and the length of the corresponding scanning line (**Scan Length**)
- *All signals* matching with the *Gate A* and exceeding its threshold will be measured and recorded during the **t-B-Scan(A)** recording – provide the appropriate calibration for *Gain* and *aThreshold*. Check the possibility of receiving of the desired signals along the selected scanning line

Defining of the Region of Interest (ROI) for **t-B-Scan(A)** recording



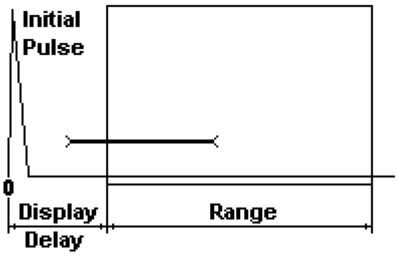
Case 1



$$SRD = aStart$$

$$RW = aWidth$$

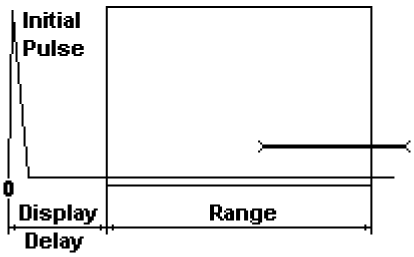
Case 2



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

$$RW = aStart + aWidth - SRD$$

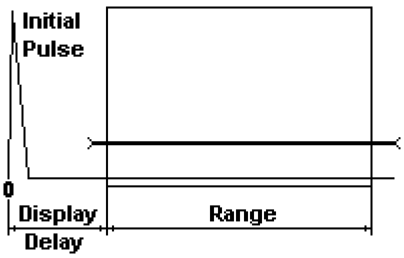
Case 3



$$SRD = aStart$$

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

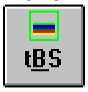
Case 4

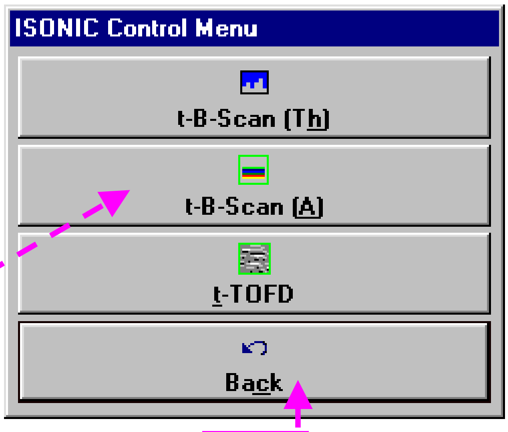


$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

$$RW = Range$$

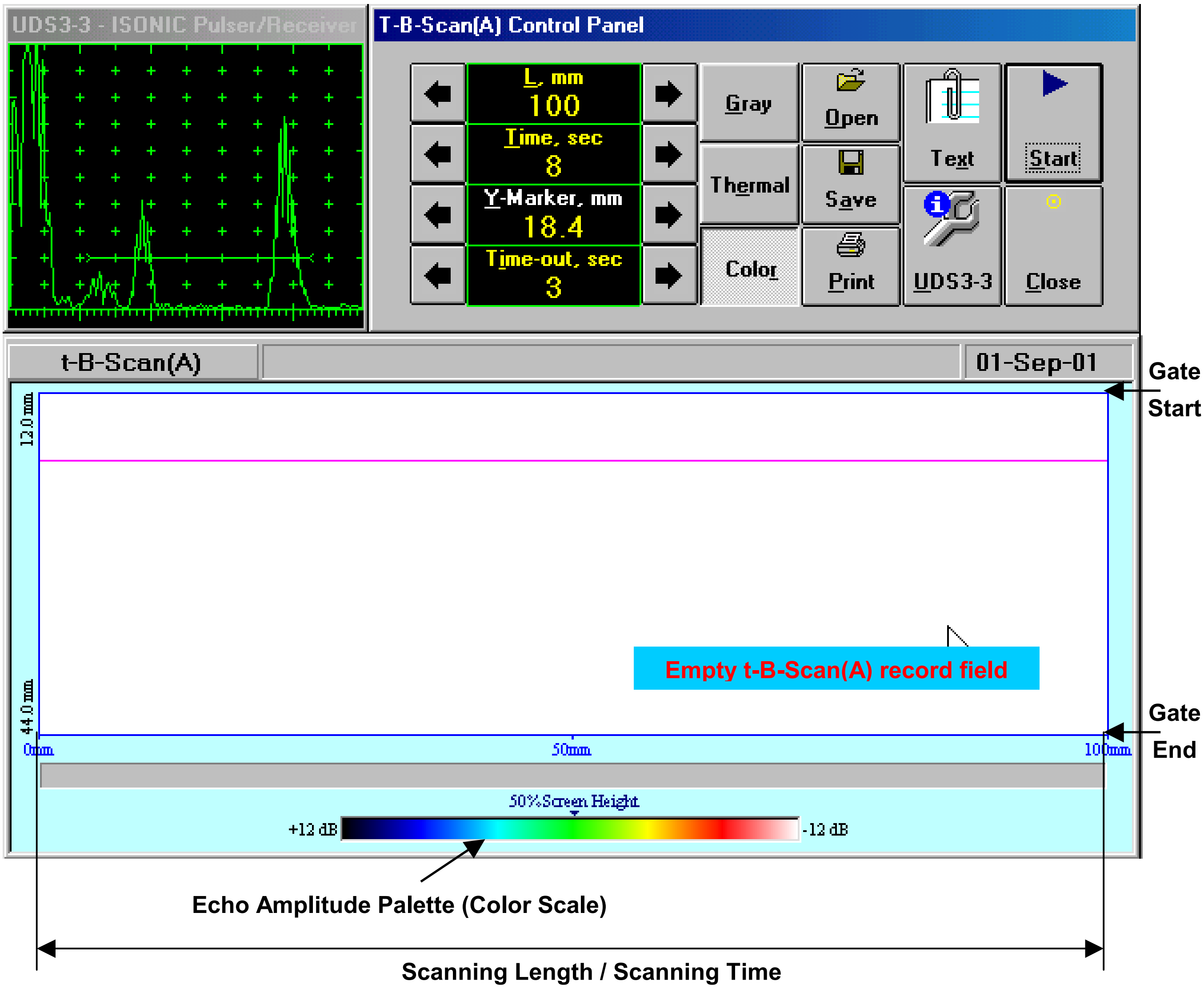
5.5.2.2. Startup the t-B-Scan(A) mode

To run **t-B-Scan(A)** mode click on  or press **<Alt>+<B>** on the keyboard.
The pre-recording ISONIC Control menu appears:

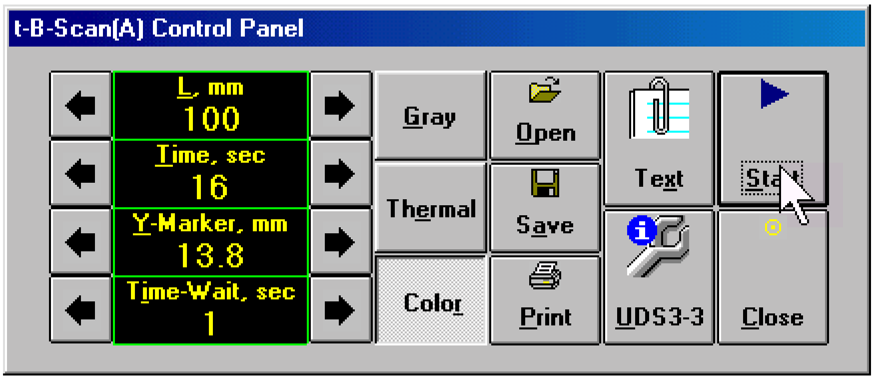


Click on or press **<Alt>+<A>** on the keyboard to run **t-B-Scan(A)** mode. The screen as below appears upon:

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to return to the Pulser / Receiver window



5.5.2.3. t-B-Scan(A) Control Panel

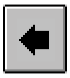
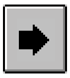


Scan Length and Scan Time

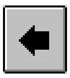
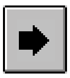
The **L** (Scan Length or, in other words, Scan Path) is the length of the section of the test object to be displayed, over which the probe will be guided during the recording period. **Time** (Scan Time) is the duration of the said recording period. There are 4 (four) possible values for **L** and there are 3 (three) possible values for **Time** corresponding to the each value of **L**:

Scan Length – **L**	Possible Scan Time – **Time**
100 mm or 4 in	8, 16 and 24 sec
150 mm or 6 in	12, 24 and 36 sec
200 mm or 8 in	16, 32 and 48 sec
300 mm or 12 in	24, 48 and 72 sec

To select the required value of Scan Length – **L** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **L** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (**L** is underlined)
- **Combined**
  - Click on **L** ⇒ **L** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

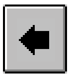
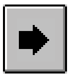
To select the required value of Scan Time – **Time** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time** area letter **T** is underlined)
- **Combined**
  - Click on **Time** ⇒ **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Y-Marker

The **Y-Marker** is permanently indicated on the cross-sectional image of the test object easing the graphic evaluation of the obtained results. **Y-Marker** may be manipulated over the whole *Region of Interest* providing the direct reading of the defect's depth

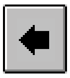
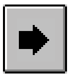
To setup the position of the **Y-Marker** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<Y>** ⇒ **Y-Marker** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Y-Marker** area the first letter **Y** is underlined)
- **Combined**
  - Click on **Y-Marker** ⇒ **Y-Marker** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Time-Wait

The **Time-Wait** is the waiting time for intermissions predcessing the **t-B-Scan(A)** recording. The **t-B-Scan(A)** recording starts unconditionally upon the **Time-Wait** period is over. The value of **Time-Wait** in sec is adjustable in **1 sec** step in the range **0** to **15 sec**

To select the required value of the **Time-Wait** the following manipulations are applicable:

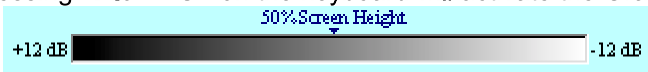
- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<I>** ⇒ **Time-Wait** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time-Wait** area the first letter **i** is underlined)
- **Combined**
  - Click on **Time-Wait** ⇒ **Time-Wait** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

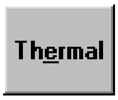
Echo Amplitude Palette (Color Scale)

The color coding of echo amplitudes is provided for the **t-B-Scan(A)** over the 24 dB range. There are 3 (three) palettes (color scales) and 2 (two) coloring protocols available

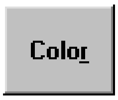
Clicking on 

or pressing **<Alt>+<G>** on the keyboard will activate the Gray-Level palette:

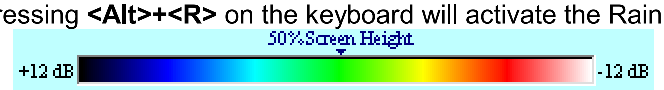


Clicking on 

or pressing **<Alt>+<E>** on the keyboard will activate the Thermo-Level palette:

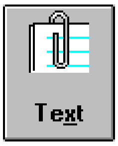
Clicking on 

or pressing **<Alt>+<R>** on the keyboard will activate the Rainbow-Level palette:

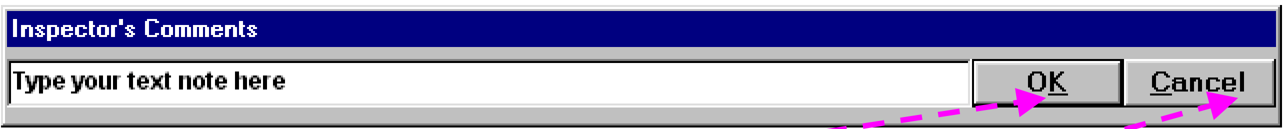


Two coloring protocols provide linear or DAC (DGS) normalizing of the recorded echoes. DAC (DGS) normalizing becomes active automatically upon setting up the DAC or DGS mode of operation

Insert Text Note

A text note may be keyed in to accompany the **t-B-Scan(Th)** record. To proceed click on 

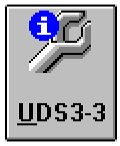
or press **<Alt>+<X>** on the keyboard



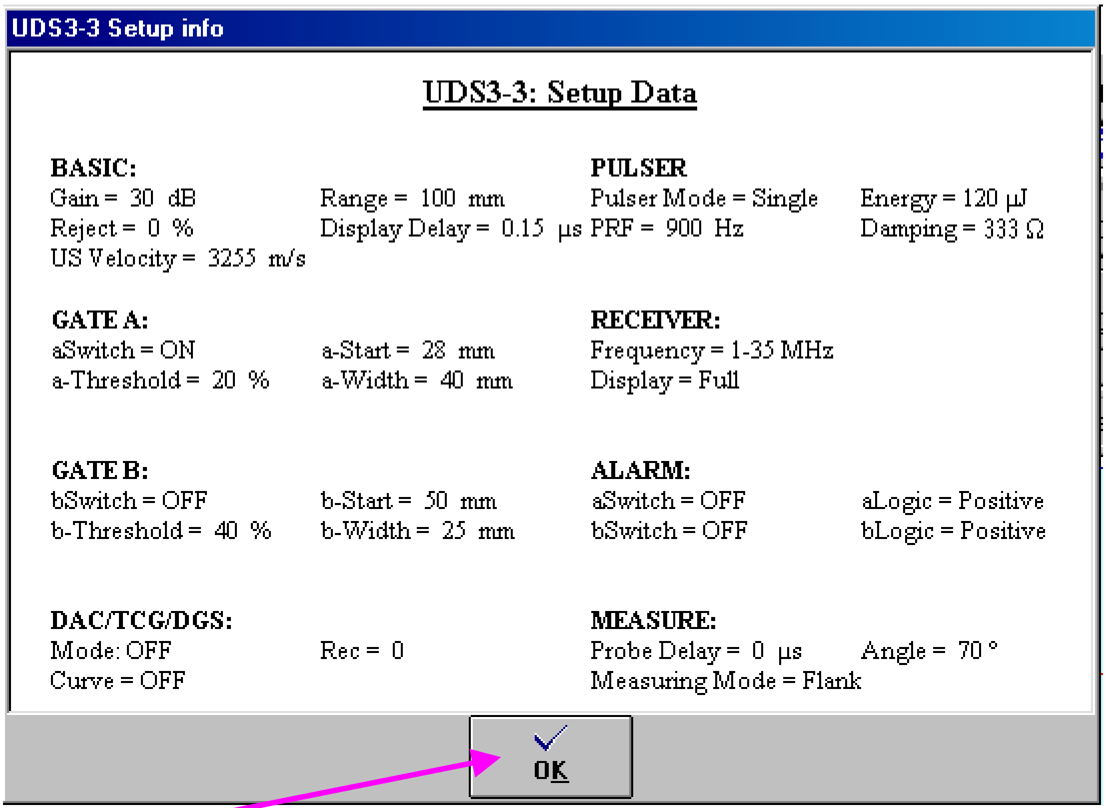
Click on or press **<Alt>+<K>** or **Enter** on the keyboard to end typing and storing of the note

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to discard the new note / comments

Preview the Instrument Settings

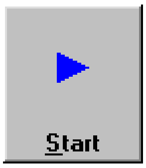
The instrument settings for the **t-B-Scan(A)** record may be previewed through the clicking on 

or pressing **<Alt>+<U>** on the keyboard. The corresponding window appears:

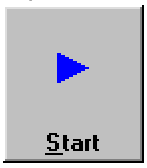


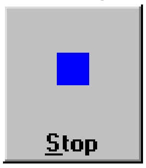
Click on or press **<Alt>+<K>** or **Esc** on the keyboard to return to the **t-B-Scan(A)** screen

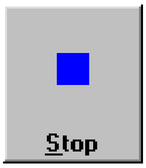
Other Controls

Clicking on 

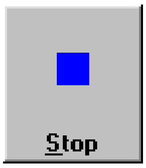
or pressing **<Alt>+<S>** on the keyboard will start the **t-B-Scan(A)** recording

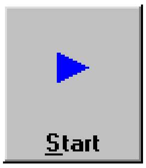
The 

button becomes invisible since the **t-B-Scan(A)** recording starts. The 

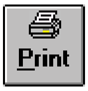
button occupies its position. Clicking on 

or pressing **<Alt>+<S>** on the keyboard will terminate the **t-B-Scan(A)** recording prior to the automatic completion

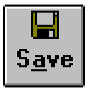
The 

button becomes invisible after completion / termination of the **t-B-Scan(A)** recording. The 

button returns to its position

Clicking on 

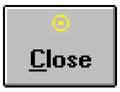
or pressing **<Alt>+<P>** on the keyboard will print the **ISONIC t-B-Scan(A) Scanning Report** comprising the **t-B-Scan(A)** graphical record, instrument settings and accompanied text notes to the *default printer*

Clicking on 

or pressing **<Alt>+<A>** on the keyboard will save the once captured **t-B-Scan(A)** record and accompanying instrument calibration dump and text notes / comments into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

Clicking on 

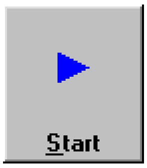
or pressing **<Alt>+<O>** on the keyboard will load the once captured **t-B-Scan(A)** record and accompanying instrument calibration dump and text notes / comments from a file. Refer to the paragraph 5.4.20 of this Operating Manual to proceed with opening a file

Clicking on 

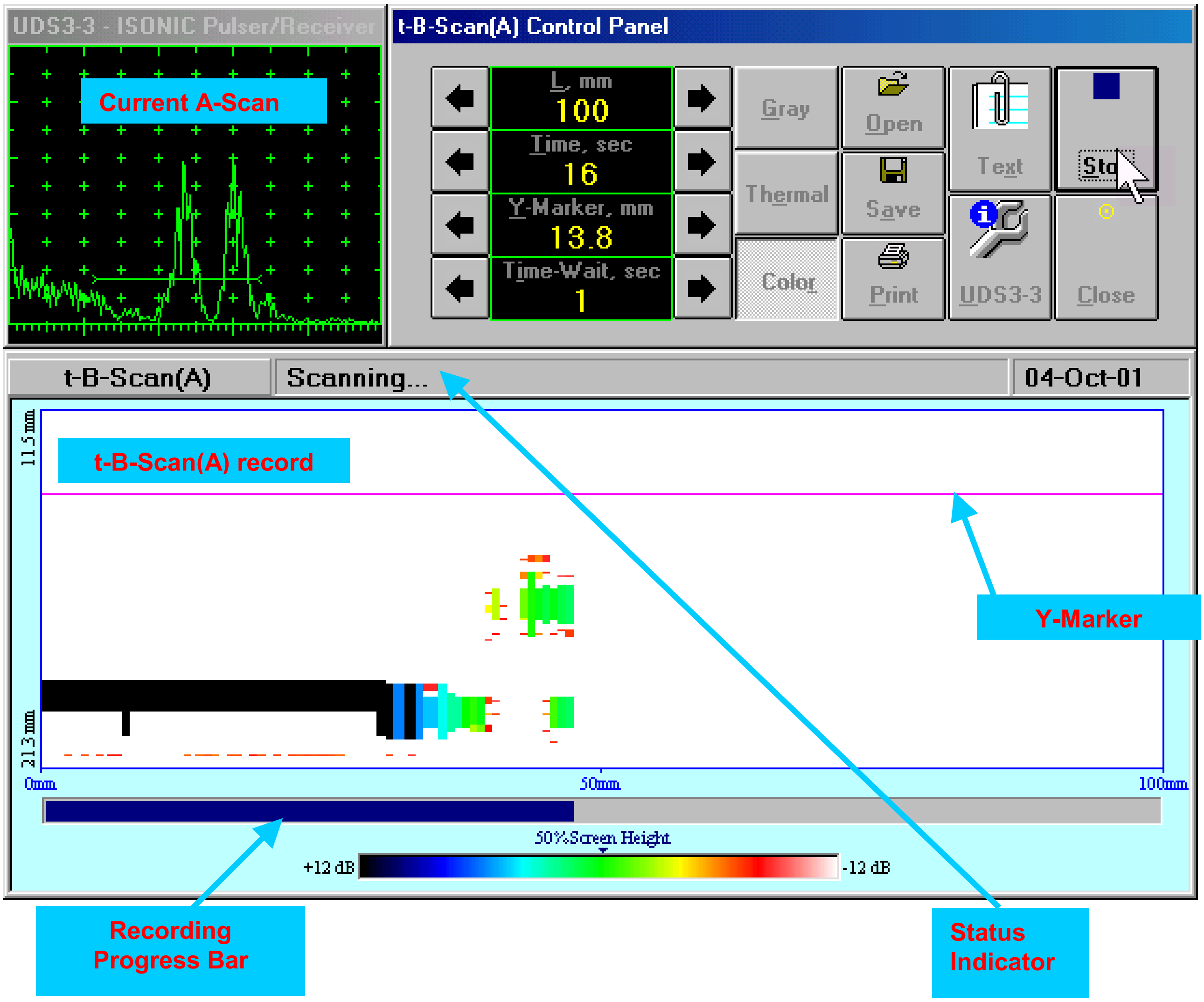
or pressing **<Alt>+<C>** or **Esc** on the keyboard will return back to the Pulser / Receiver window

5.5.2.4. Recording t-B-Scan(A)

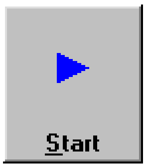
To capture **t-B-Scan(A)**:

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

or press **<Alt>+<S>** on the keyboard
- Wait for the end of Time-Wait period then guide the probe over the scanning line – the typical display during the scanning progress is shown and explained below



Status Indicator

Status Indicator is empty prior to and after the completing/termination of **t-B-Scan(A)** recording. The "Scanning will start in 1.6 sec" status appears upon clicking on 

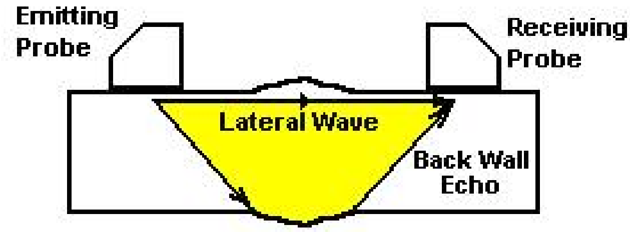
if the *non-zero* **Time-Wait** period was setup. The expiring of **Time-Wait** period causes appearance of the "Scanning..." status. Since this moment the **t-B-Scan(A)** recording is observed unconditionally

5.5.3. Timed (time – based) TOFD Record: RF t-B-Scan / t-TOFD

t-TOFD mode allows to display a section of the test object through the continuous capturing of successive RF A-Scans along the scanning path over a maximum measurement period of 48 seconds. **To perform the imaging a *probe* or *probe pair* must be linearly driven over the section to be displayed during the measurement period with the approximately constant speed**

5.5.3.1. Prior to the running t-TOFD mode

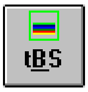
- Setup *Pulser* Mode to *Dual* and *Display* Mode to *RF Display* mode
- For **t-TOFD** mapping place two longitudinal wave angle beam probes (probe pair) from both sides of the inspected volume providing the receiving and displaying of both *Lateral Wave* and *Back Echo* - the appropriate calibration of the *Gain*, *Display Delay*, *Range* must be provided – refer to the paragraph 20.6.4 of this Operating Manual to get prepared for the TOFD Instrument settings



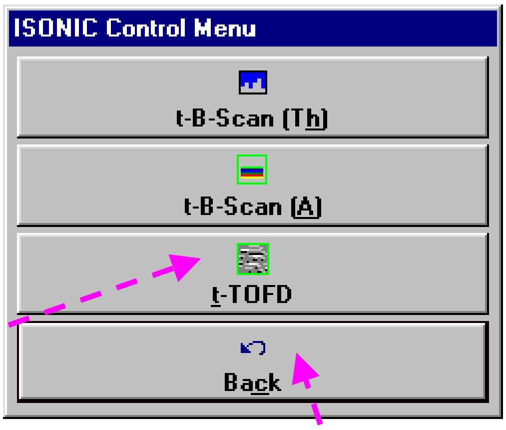
- All RF A-Scans will be measured and recorded while creating the **t-TOFD** – check the possibility of receiving of the desired signals along the selected scanning line

ⓘ
The typical placement of the TOFD probes and the original TOFD inspection scheme are shown here for the **t-TOFD** mapping. It is also possible to use other probes and inspection schemes if there is a need to capture the successive **RF A-Scans** along the selected scanning line (**RF t-B-Scan**)

5.5.3.2. Startup the t-TOFD mode

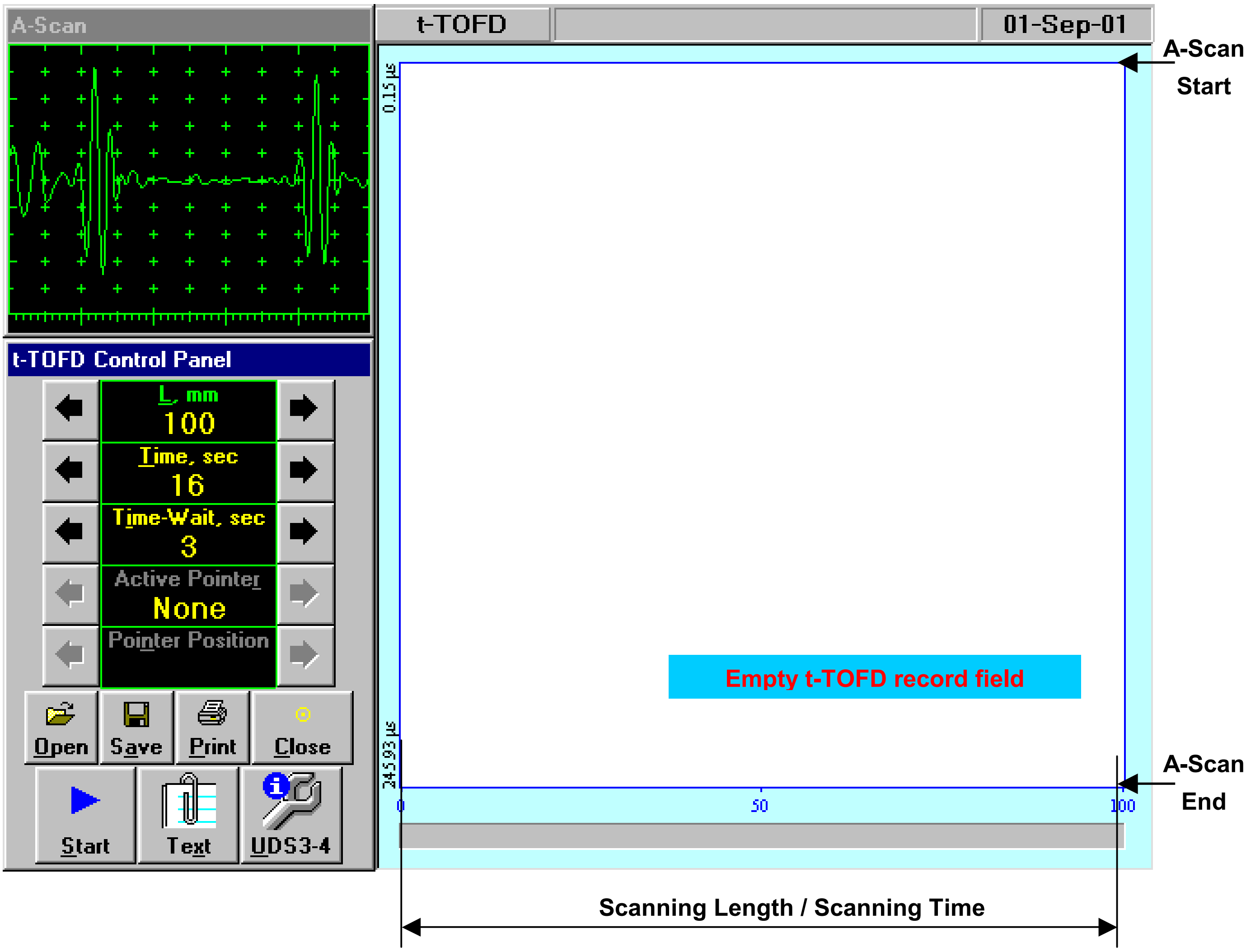
To run **t-TOFD** mode click on 

or press **<Alt>+<B>** on the keyboard. The pre-recording ISONIC Control menu appears:



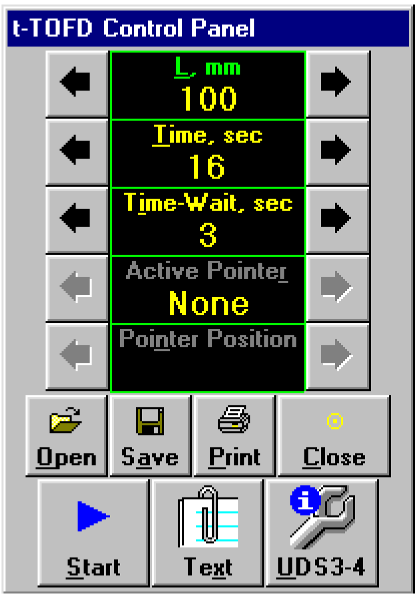
Click on or press **<Alt>+<T>** on the keyboard to run **t-TOFD** mode. The corresponding screen consisting of three fields appears:

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to return to the Pulser / Receiver window



5.5.3.3. t-TOFD Control Panel

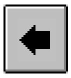
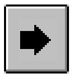
Scan Length and Scan Time



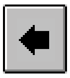
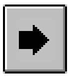
The value of **L** (Scan Length or, in other words, Scan Path) represents the length of the section of the test object to be displayed, over which the probe (probe pair) will be guided during the recording period. **Time** (Scan Time) is the duration of the said recording period. There are 3 (three) possible values for **L** and there are 3 (three) possible values for **Time** corresponding to the each value of **L**:

Scan Length – **L**	Possible Scan Time – **Time**
50 mm or 2 in	4, 8 and 12 sec
100 mm or 4 in	8, 16 and 24 sec
200 mm or 8 in	16, 32 and 48 sec

To select the required value of Scan Length – **L** the following manipulations are applicable:

- **Mouse**
  - ■ Left mouse click on the corresponding button  or 
- **Keyboard**
  - ■ Pressing **<Alt>+<L>** ⇒ **L** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (**L** is underlined)
- **Combined**
  - ■ Click on **L** ⇒ **L** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

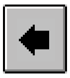
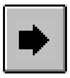
To select the required value of Scan Time – **Time** the following manipulations are applicable:

- **Mouse**
  - ■ Click on the corresponding button  or 
- **Keyboard**
  - ■ Pressing **<Alt>+<T>** ⇒ **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time** area letter **T** is underlined)
- **Combined**
  - ■ Click on **Time** ⇒ **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Time-Wait

The **Time-Wait** is the waiting time for intermissions predcessing the **t-TOFD** recording. The **t-TOFD** recording starts unconditionally upon the **Time-Wait** period is over. The value of **Time-Wait** in sec is adjustable in **1 sec** step in the range **0** to **15 sec**

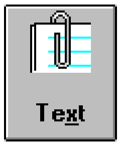
To select the required value of the **Time-Wait** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<I>** ⇒ **Time-Wait** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time-Wait** area the first letter **i** is underlined)
- **Combined**
  - Click on **Time-Wait** ⇒ **Time-Wait** fore color changes to whit - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time-Wait** area the first letter **i** is underlined)

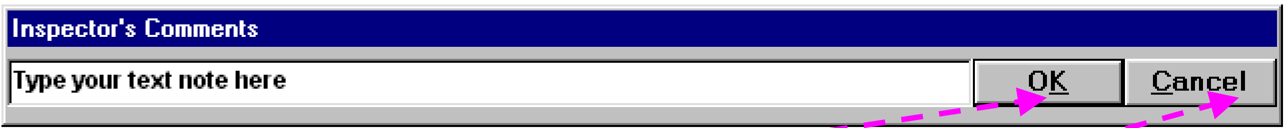
Pointers

Pointers relate to the postprocessing operations applicable to the once captured **t-TOFD** map. The meaning of each active pointer and their controls are described below in the paragraph 5.5.3.5

Insert Text Note

A text note may be keyed in to accompany the **t-TOFD** record. To proceed click on 

or press **<Alt>+<X>** on the keyboard



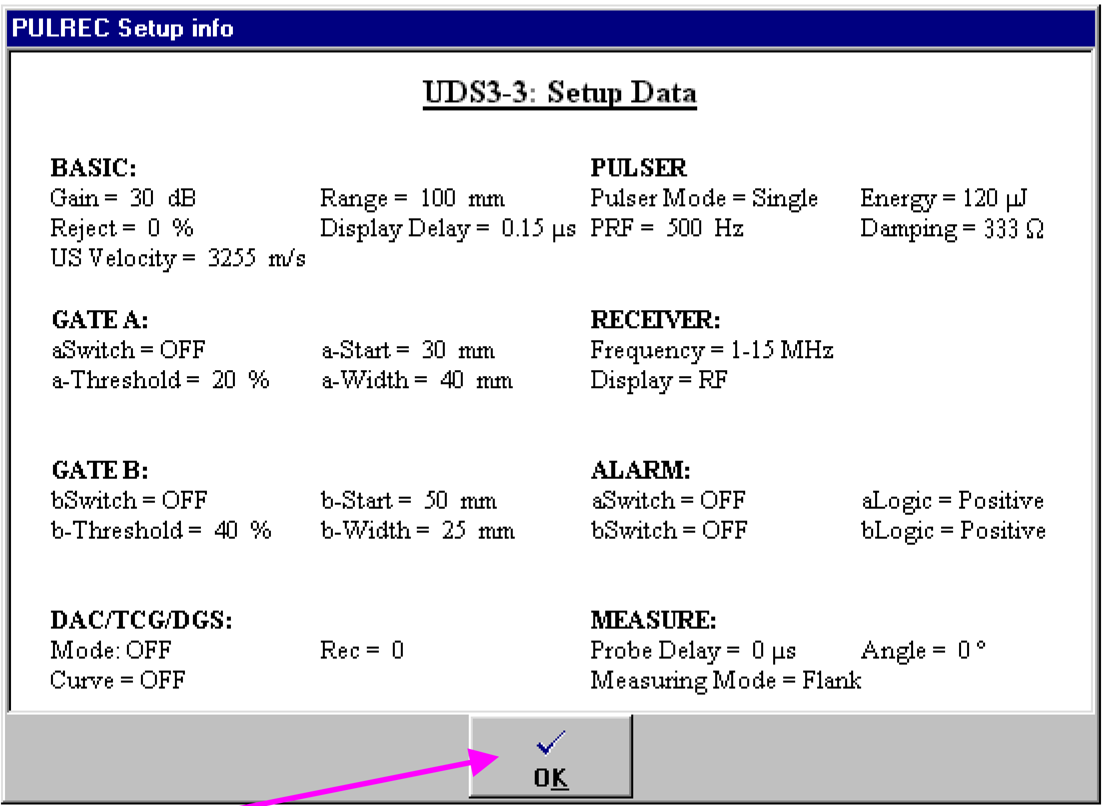
Click on or press **<Alt>+<K>** or **Enter** on the keyboard to end typing and storing of the note

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to discard the new note / comments

Preview the Instrument Settings

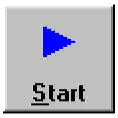
The instrument settings for the **t-TOFD** record may be previewed through the clicking on 

or pressing **<Alt>+<U>** on the keyboard. The corresponding window appears:

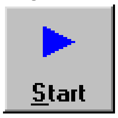


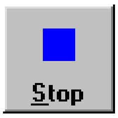
Click on or press **<Alt>+<K>** or **Esc** on the keyboard to return to the **t-TOFD** screen

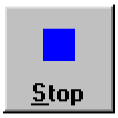
Other Controls

Clicking on 

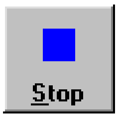
or pressing **<Alt>+<S>** on the keyboard will start the **t-TOFD** recording

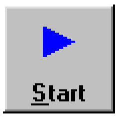
The 

button becomes invisible since the **t-TOFD** recording starts. The 

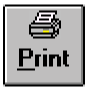
button occupies its position. Clicking on 

or pressing **<Alt>+<S>** on the keyboard will terminate the **t-TOFD** recording prior to the automatic completion

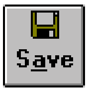
The 

button becomes invisible after completion / termination of the **t-TOFD** recording. The 

button returns to its position

Clicking on 

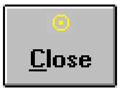
or pressing **<Alt>+<P>** on the keyboard will print the **ISONIC t-TOFD Scanning Report** comprising the **t-TOFD** graphical record, instrument settings and accompanied text notes to the *default printer*

Clicking on 

or pressing **<Alt>+<A>** on the keyboard will save the once captured **t-TOFD** record and accompanying instrument calibration dump and text notes / comments into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

Clicking on 

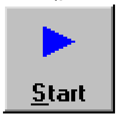
or pressing **<Alt>+<O>** on the keyboard will load the once captured **t-TOFD** record and accompanying instrument calibration dump and text notes / comments from a file. Refer to the paragraph 5.4.20 of this Operating Manual to proceed with opening a file

Clicking on 

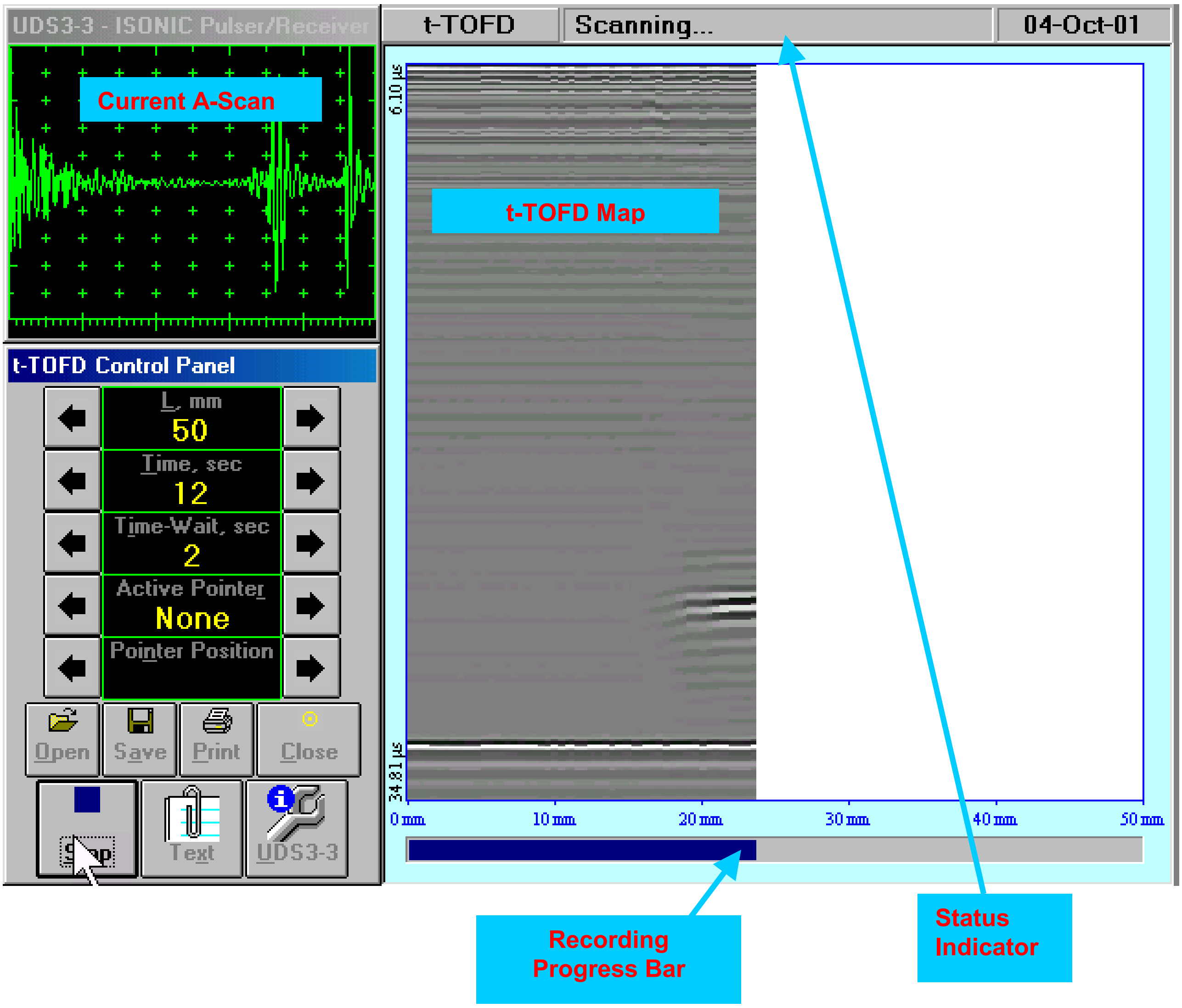
or pressing **<Alt>+<C>** or **Esc** on the keyboard will return back to the Pulser / Receiver window

5.5.3.4. Recording t-TOFD

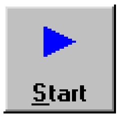
To capture **t-TOFD**:

- Apply probe (probe pair) to the test object in the start point of the selected scanning line
- Click on 

or press **<Alt>+<S>** on the keyboard
- Wait for the end of the **Time-Wait** period then guide the probe (probe pair) over the scanning line – the typical display during the scanning progress is shown and explained below



Status Indicator

Status Indicator is empty prior to and after the completing/termination of **t-TOFD** recording. The "Scanning will start in 1.6 sec" status appears upon clicking on 

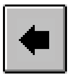
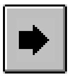
if the *non-zero* **Time-Wait** period was setup. The expiring of **Time-Wait** period causes appearance of the "Scanning..." status. Since this moment the **t-TOFD** recording is observed unconditionally

5.5.3.5. t-TOFD Postprocessing

After the **t-TOFD** recording the captured map may be evaluated off-line (postprocessing). The postprocessing allows recovering of the RF A-Scans along the scanning line and measuring the time of flight for each recovered signal. The off-line measurements are activated through the pointers.

Active Pointer

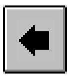
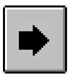
To select the active pointer the following manipulations are applicable:

- **Mouse**
  - ■ Click on the corresponding button  or 
- **Keyboard**
  - ■ Pressing **<Alt>+<R>** ⇒ **Active Pointer** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Active Pointer** area the first letter **I** is underlined)
- **Combined**
  - ■ Click on **Active Pointer** ⇒ **Active Pointer** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The following grades are possible for the **Active Pointer**:

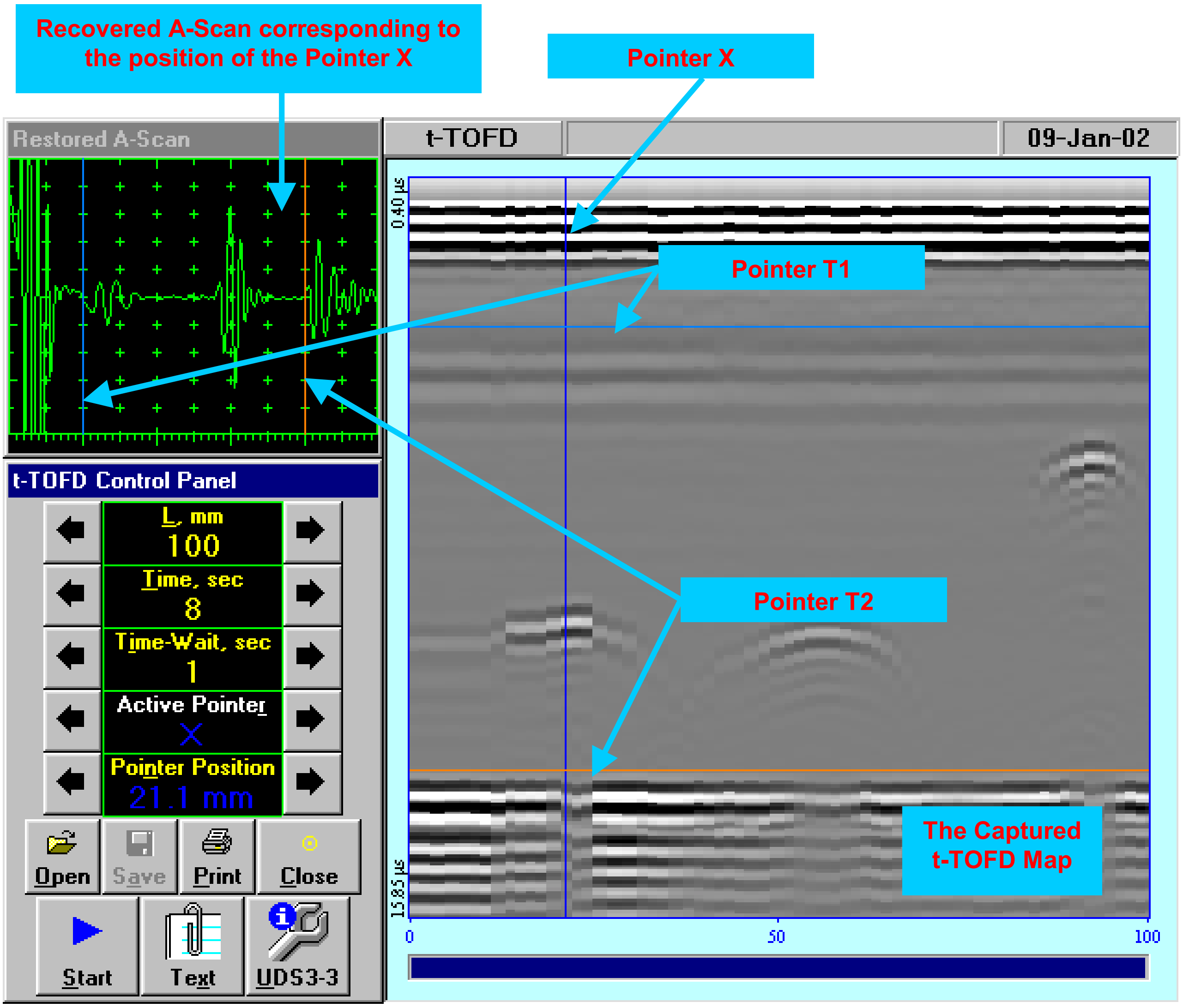
- ❑ **None** – there are no any pointer either horizontal or vertical on the captured TOFD Map: *the live RF A-Scan corresponding to the currently received signals is reproduced*
- ❑ **X** – there are 3 (three) pointers on the **t-TOFD** Map, one of them is vertical and two others are horizontal. *The recovered A-Scan corresponding to the position of vertical pointer along the scanning path is reproduced*. There are two pointers on the restored A-Scan, each one corresponds to the same color horizontal pointer on the **t-TOFD** Map. The pointer **X** (vertical) is *guidable* entire the **t-TOFD** Map width
- ❑ **T1** – there are 3 (three) pointers on the **t-TOFD** Map, one of them is vertical and two others are horizontal. *The recovered A-Scan corresponding to the position of vertical pointer along the scanning path is reproduced*. There are two pointers on the recovered A-Scan, each one corresponds to the same color horizontal pointer on the **t-TOFD** Map. The pointer **T1** (horizontal blue) is *guidable* entire the **t-TOFD** Map height and simultaneously entire the A-Scan width
- ❑ **T2** – there are 3 (three) pointers on the **t-TOFD** Map, one of them is vertical and two others are horizontal. *The recovered A-Scan corresponding to the position of vertical pointer along the scanning path is reproduced*. There are two pointers on the recovered A-Scan, each one corresponds to the same color horizontal pointer on the **t-TOFD** Map. The pointer **T2** (horizontal red) is *guidable* entire the **t-TOFD** Map height and simultaneously entire the A-Scan width

To guide the active pointer the following manipulations are applicable:

- **Mouse**
  - ■ Click on the corresponding button  or 
- **Keyboard**
  - ■ Pressing **<Alt>+<N>** ⇒ **Pointer Position** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Pointer Position** area the first letter **N** is underlined)
- **Combined**
  - ■ Click on **Pointer Position** ⇒ **Pointer Position** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

Pointer position is indicated in corresponding units allowing to read-out the off-line measurements results.

The below screenshot illustrates the t-TOFD posprocessing



For the off-line **t-TOFD** image processing and defects sizing refer to the Chapter 22 of this Operating Manual

6. Enhanced B-Scan Recording and Imaging - Operating 'ABIScan' Software Package - ISONIC ABIScan

The contents of this chapter is valid for the ABIScan SW Package version 1.2.0.8 or higher

6.1. General

ISONIC ABIScan inspection software package (inspection application) for the **ISONIC / ISONIC 2001** workstation provides the *enhanced B-Scan recording and imaging*

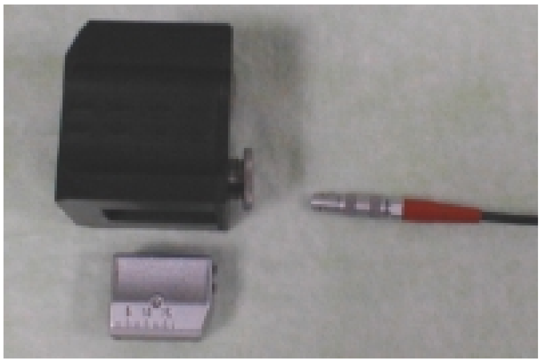
6.2. Cabling and Fixture

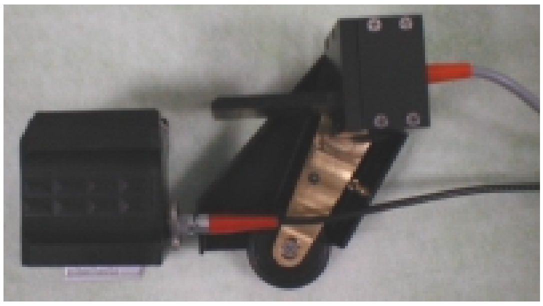
Ultrasonic Flaw Detector PC Card	Applicable Cabling Scheme	Paragraph
UDS 3-3	B.1; B.2; B.6; B.7	4.2.5
UDS 3-4	B.3; B.4; B.8; B.9	4.2.5
USLT 2000	B.5; B.10	4.2.5

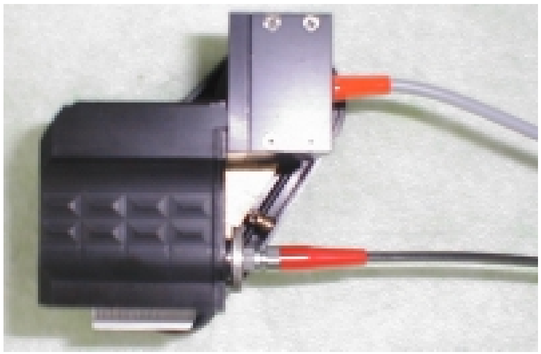
For the encoded (true-to-scale) imaging

- clamp the probe into the probe holder then into encoder

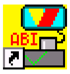
- connect the encoder's cable to its input on the rear panel of the **ISONIC**





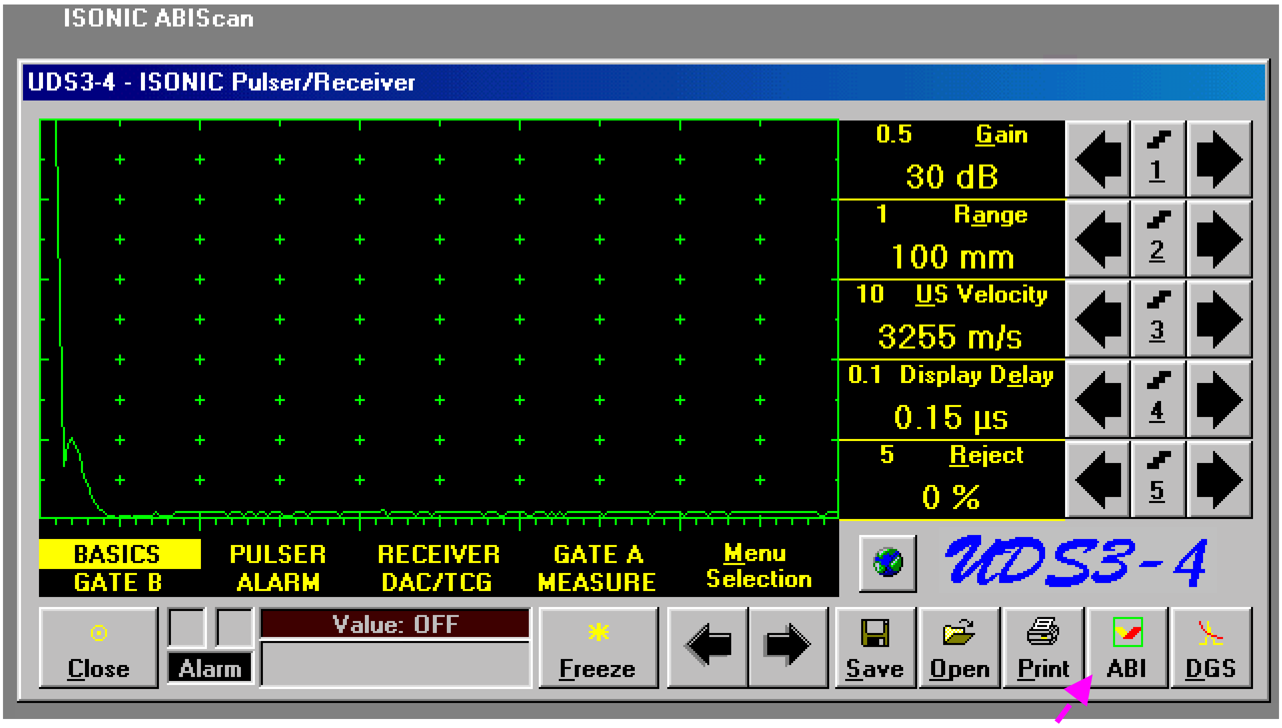


6.3. Start Up

Double click on the icon  located on the **ISONIC** desktop

6.4. Operating ABIScan Software Package

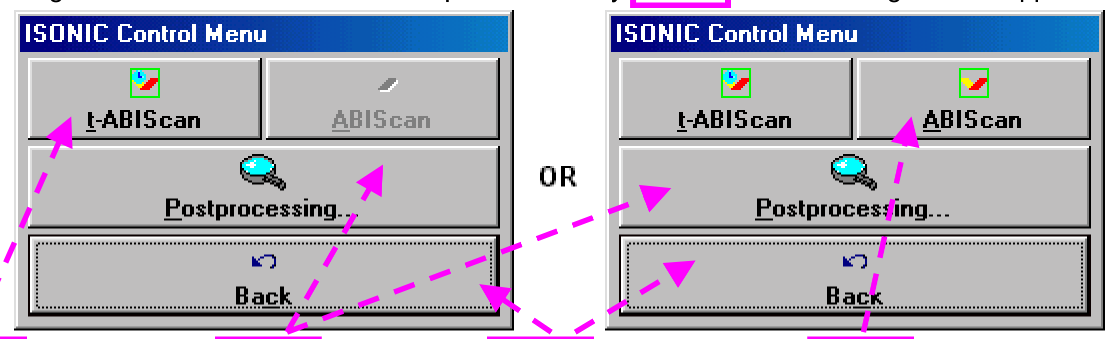
ABIScan software package operates the **UDS 3-3**, **UDS 3-4** and **USLT 2000** internal ultrasonic flaw detector card. The card existing in the **ISONIC** unit is recognized automatically. The ultrasonic flaw detector panel appears upon starting up. *Operating of the flaw detector is exactly the same as for PULREC and USLTPR software packages* described and explained in details in the Chapter 5 of this Operating Manual.



Prior to proceeding with the **ABIScan** recording provide the proper setup for:

- **Gain**
- **USVelocity**
- **Reject (optional)**
- **Pulser – mode, energy, damping, etc**
- **Receiver – filtering**
- **Display (either RF, Full, Neg or Pos)**
- **DAC/DGS/TCG (optional)**
- **Probe Delay**
- **Angle**

After getting the ultrasonic flaw detector setup as necessary click on. The following window appears upon:



Click on or press **<Alt>+<T>** on the keyboard to start timed (time-based) enhanced B-Scan recording and imaging

Click on or press **<Alt>+<P>** on the keyboard to load the captured record for the off-line analysis (postprocessing)

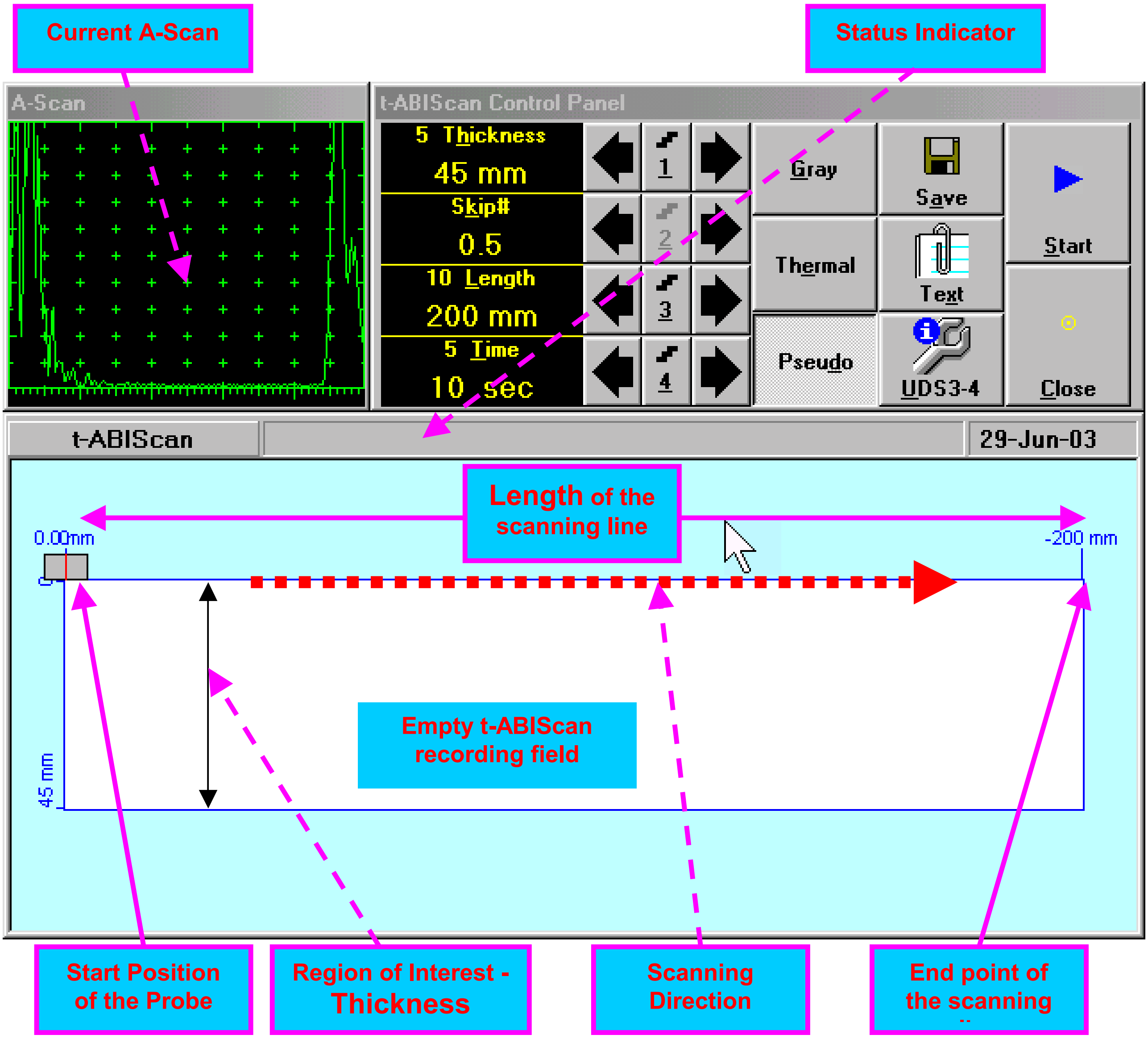
Click on or or press **<Alt>+<C>** on the keyboard or Esc on the keyboard to return back to the ultrasonic flaw detector panel

Click on or press **<Alt>+<A>** on the keyboard to start encoded (true-to-scale) enhanced B-Scan recording and imaging – *the button is enabled if the encoder is connected to the* **ISONIC**

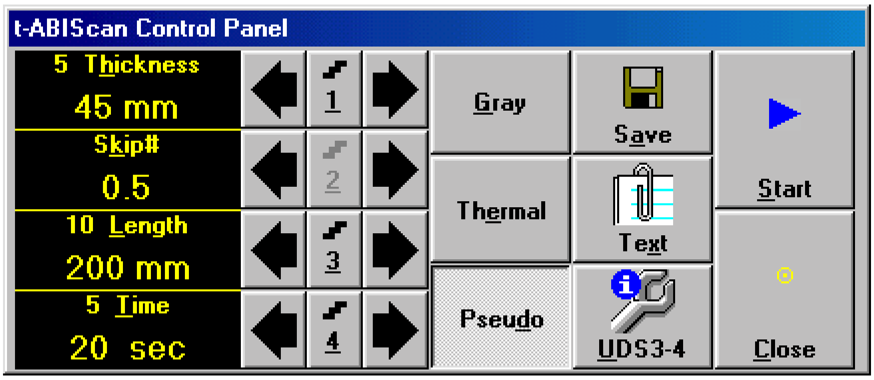
6.4.1. Time (time-based) Imaging – t-ABIScan – Normal Probe

The screen as below appears upon clicking on 

or pressing **<Alt>+<T>** on the keyboard if the **Angle** was setup to $\mathbf{0^o}$ (Normal Probe) in the submenu **MEASURE**



6.4.1.1. t-ABIScan Control Panel – Normal Probe



Thickness and Skip#

The value of **Thickness** defines the *Region of Interest* (**ROI**) starting from the *scanning surface*. **t-ABIScan** imaging is provided *without using a gate* – the ***whole visible A-Scan area is recorded***. The *A-Scan Range* used for the **t-ABIScan** imaging – normal probe is defined as:

$$\mathbf{Range_{t\text{-}ABIScan} = Thickness}$$

The *A-Scan Display Delay* used for the **t-ABIScan** imaging is defined as:

$$\mathbf{Display\ Delay_{t\text{-}ABIScan} = Probe\ Delay}$$

ⓘ

- The value of **Thickness** is controllable through the **t-ABIScan Control Panel**,
- The value of **Probe Delay** is taken from the ultrasonic flaw detector setup (submenu **MEASURE**)
- The value of **Skip#** is automatically ***ignored*** and may not be changed if the **Angle** was setup to **0°** (Normal Probe) in the submenu **MEASURE**

To setup the required value of **Thickness** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button ◀ or ▶
- **Keyboard**
  - Pressing **<Alt>+<H>** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Thickness** area the letter **h** is underlined)
- **Combined**
  - Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Thickness** is over the **5 … 300 mm** (or **0.2 … 12 in**) range with **1 mm** (or **0.05 in**) resolution.

The resolution is selectable through clicking on [1] or pressing **<Alt>+<1>** on the keyboard

Scan Length and Scan Time

The value of **Length** (*Scan Length* or, in other words, *Scan Path*) represents the length of the section of the test object to be displayed, over which the probe will be guided during the recording period. **Time** (*Scan Time*) is the duration of the said recording period

To setup the required value of **Length** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button or
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Length** area the letter **L** is underlined)
- **Combined**
  - Click on **Length** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Length** is controllable over the **50…300 mm** range (or **2…12 in**) with **1 mm** (or **0.05 in**) resolution. The resolution is selectable through clicking on or pressing **<Alt>+<3>** on the keyboard

To setup the required value of **Time** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button or
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time** area letter **T** is underlined)
- **Combined**
  - Click on **Time** ⇒ **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Time** is controllable over the **5…60 sec** range with **1 sec** resolution. The resolution is selectable through clicking on or pressing **<Alt>+<4>** on the keyboard

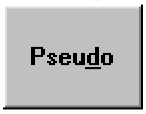
Echo Amplitude Palette (Color Scale)

The color coding of echo amplitudes is provided during the **t-ABIScan** recording over the **28 dB** range (**- 14 dB** through **+ 14 dB**; **0 dB** level corresponds to the **50% A-Scan Height**)

There are three palettes available:

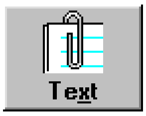
- Clicking on 

 or pressing **<Alt>+<G>** on the keyboard will activate the Gray-Level coloring of echo amplitudes
- Clicking on 

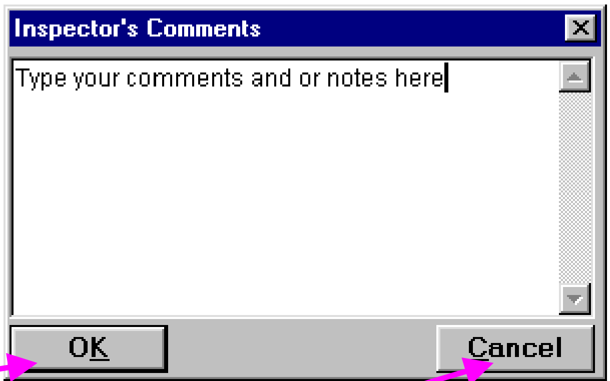
 or pressing **<Alt>+<E>** on the keyboard will activate the Thermo-Level coloring of echo amplitudes
- Clicking on 

 or pressing **<Alt>+<D>** on the keyboard will activate the Pseudocolor-Level coding of echo amplitudes

Insert Text Note

A text note/comments may be typed to accompany the **t-ABIScan** record after clicking on 

 or pressing **<Alt>+<X>** on the keyboard:



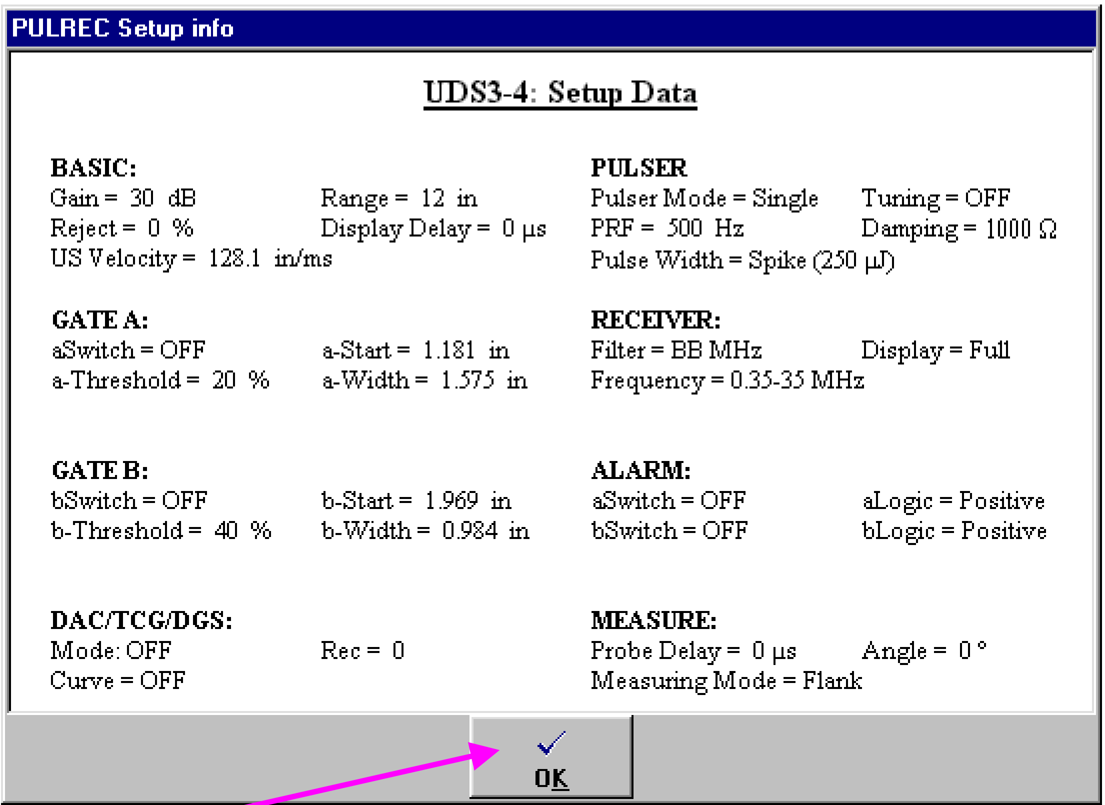
Click on or press **<Alt>+<K>** or **Enter** on the keyboard to end typing and storing of the note/comments

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to discard the new note/comments

Preview the Instrument Settings

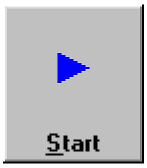
The instrument settings for the **t-ABIScan** record may be previewed through the clicking on 

or pressing **<Alt>+<U>** on the keyboard:

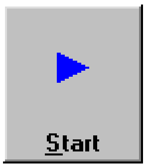


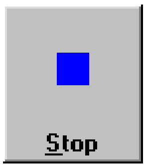
Click on or press **<Alt>+<K>** or **Esc** on the keyboard to exit this preview window

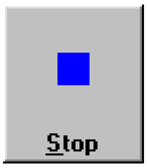
Start/Stop t-ABIScan recording

Clicking on 

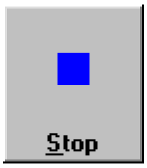
or pressing **<Alt>+<S>** on the keyboard will start the **t-ABIScan** recording, which will be either completed automatically or terminated by an operator

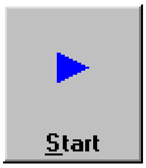
The 

button becomes invisible upon the **t-ABIScan** recording starts. The 

button occupies its position. Clicking on 

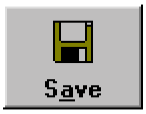
or pressing **<Alt>+<S>** on the keyboard will terminate the **t-ABIScan** recording prior to the automatic completion

The 

button becomes invisible after the completion / termination of the **t-ABIScan** recording – the 

button returns to its position

Save the captured t-ABIScan record

Clicking on 

or pressing **<Alt>+<A>** on the keyboard will save the **t-ABIScan** record and accompanying instrument calibration dump and text notes / comments into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

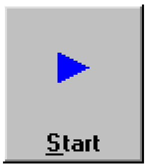
Return to the Pulser Receiver window

Clicking on 

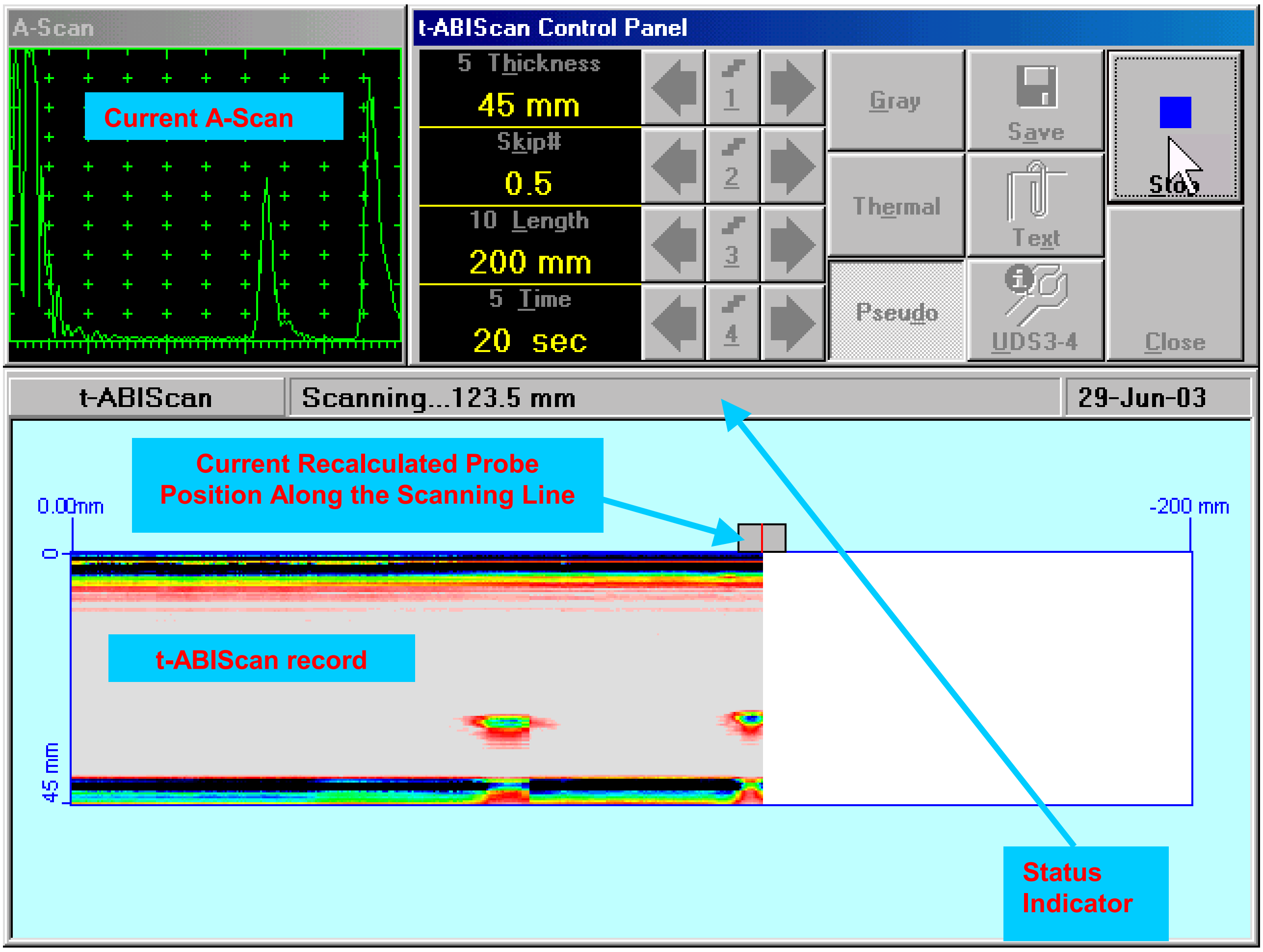
or pressing **<Alt>+<C>** or **Esc** on the keyboard will return to the Pulser / Receiver window

6.4.1.2. t-ABIScan Recording – Normal Probe

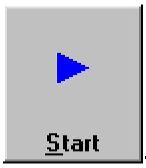
To capture **t-ABIScan**:

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

 or press **<Alt>+<S>** on the keyboard – the counting of the **3 sec** interval reserved for the intermissions starts
- Wait for the end of the intermissions interval then guide the probe over the scanning line with the approximately constant speed – the typical display during the scanning progress is shown and explained below

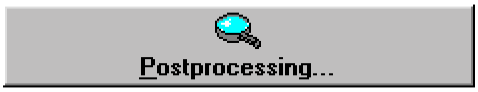


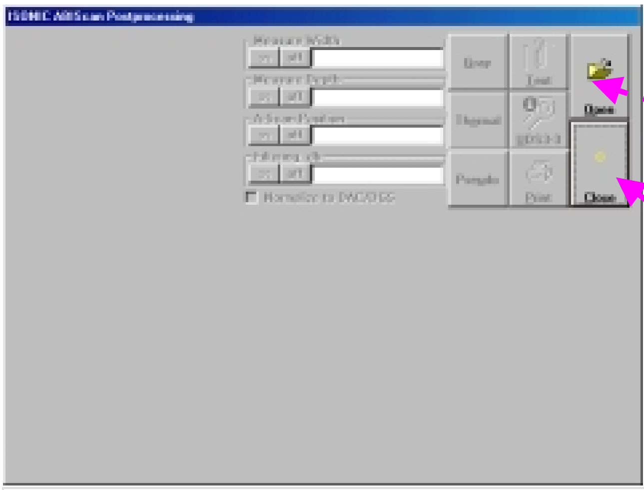
Status Indicator

Status Indicator is empty prior to and after the completing/termination of **t-ABIScan** recording. The Scanning will start in 1.6 sec status appears upon clicking on 

. The expiring of the intermissions period causes appearance of the Scanning...123.5 mm status. Since this moment the **t-ABIScan** recording is observed unconditionally. The current recalculated probe coordinate along the scanning path is permanently updated after the **Scanning…** in the Status Indicator whilst **t-ABIScan** recording is in progress

6.4.1.3. t-ABIScan Postprocessing – Normal Probe

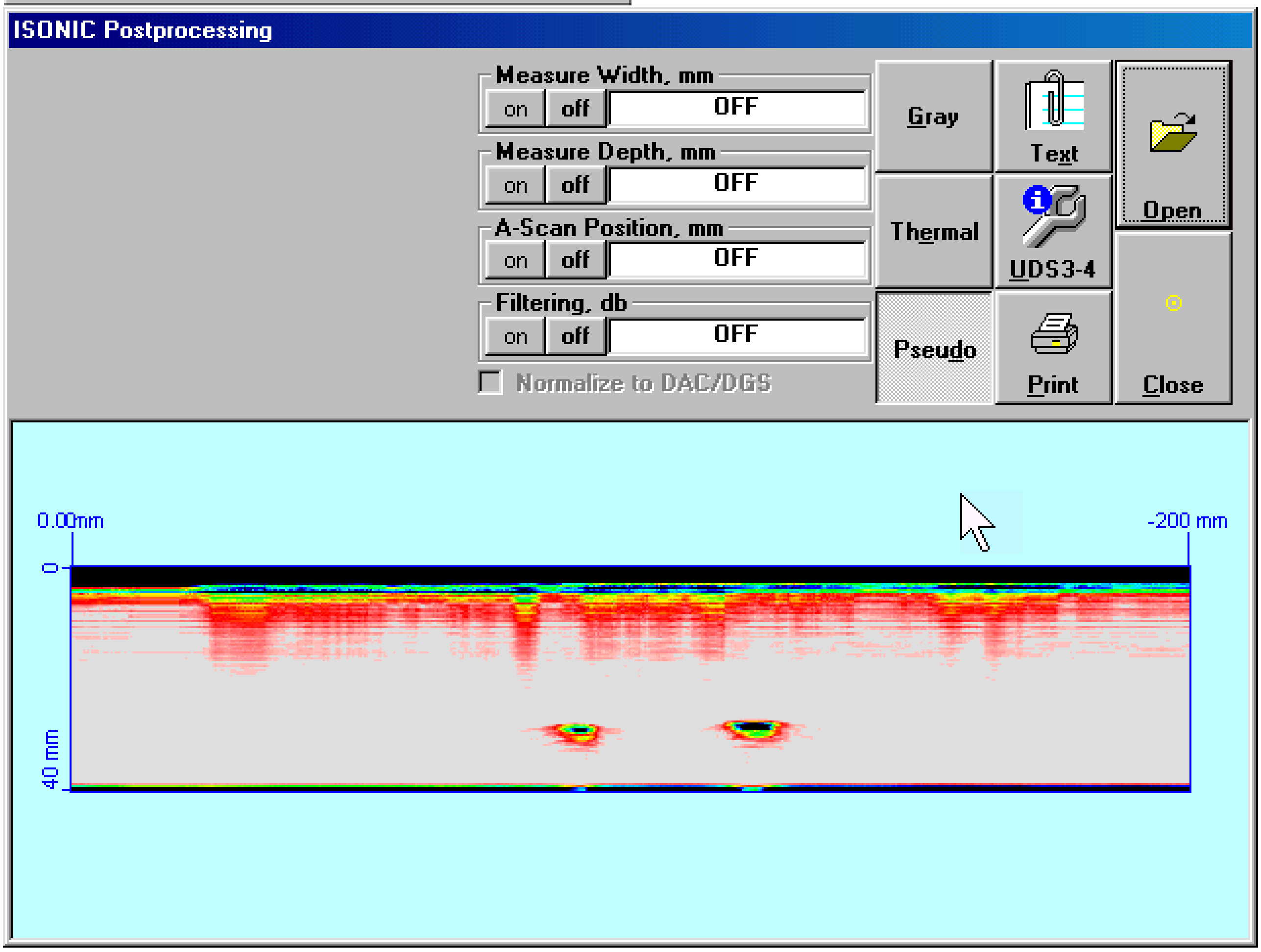
The window as below appears upon clicking on 



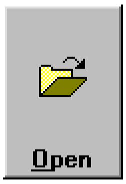
Click on or press **<Alt>+<O>** on the keyboard to open a file for the postrpocessing. Refer to the paragraph 5.4.20 of this Operating Manual to proceed with opening a file

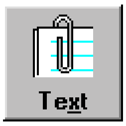
Click on or press **<Alt>+<C>** or **Esc** on the keyboard to return to the Pulser Receiver window

The captured **t-ABIScan** (**ABIScan**) record appears in the window upon opening a file

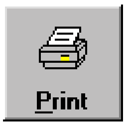


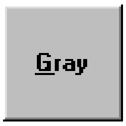
The following controls allow managing of the postrocessing procedures:

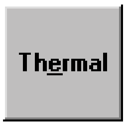
- 

 - opening the next **t-ABIScan** (**ABIScan**) record accompanied with the instrument calibration dump from a file. Refer to the paragraph 5.4.20 of this Operating Manual to proceed with opening a file
- 

 - previewing the comments made prior to the **t-ABIScan** (**ABIScan**) recording
- 

 - previewing the instrument calibration dump actual while capturing the **t-ABIScan** (**ABIScan**) record
- 

 - print the **t-ABIScan** (**ABIScan**) record to the default printer
- 

 - redrawing the map using the Gray palette
- 

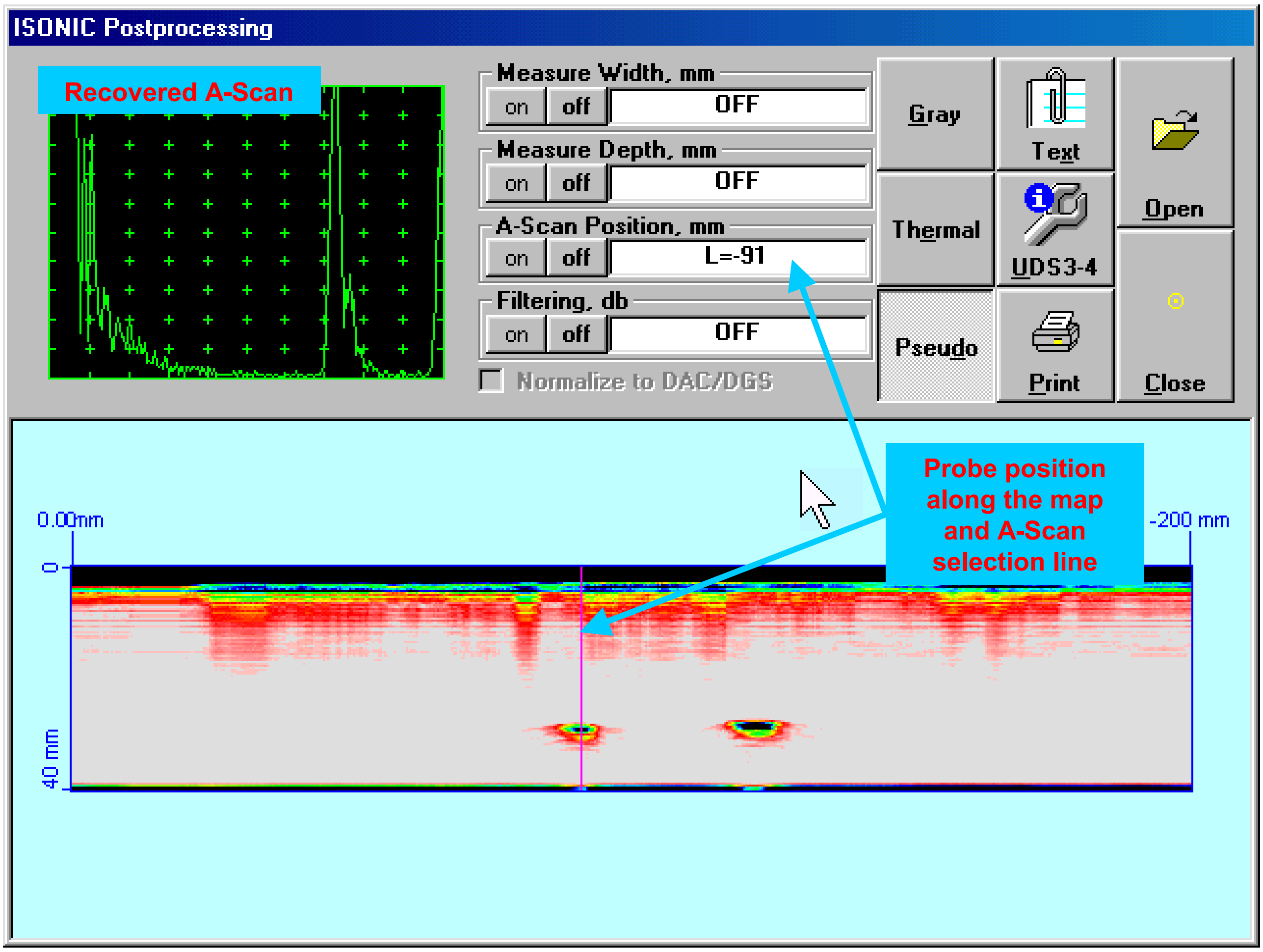
 - redrawing the map using the Thermo palette
- 

 - redrawing the map using the Pseudocolor palette
- 

 - checkbox. If the map was captured whilst DAC/DGS active then at the postprocessing stage it may be represented using the palette related to the signal amplitude either linearly (box is not checked) or with respect to the DAC/DGS (checked). The checkbox is disabled for the map captured whilst DAC/DGS inactive (refer to the paragraph 6.4.5 of this Operating Manual) o 

- Off-line virtual scanning with A-Scan recovery

Clicking on on will place the cursor above the "contact surface" line allowing the *off-line virtual scanning*. The cursor position matching with the probe's incidence point is accompanied with its central beam trace and indicated as **A-Scan Position, mm**



The virtual scanning may be controlled by the touch screen stylus or mouse or ← and → buttons on the keyboard. *The A-Scans are recovered and represented dynamically for each cursor position allowing the defect's characterization according to **BS EN 583-5***

Upon completing the virtual scanning and selection of the necessary A-Scan (for example – representing the maximal echo) release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard – this will free the cursor for further procedures

To switch off the restored A-Scan click on off o 

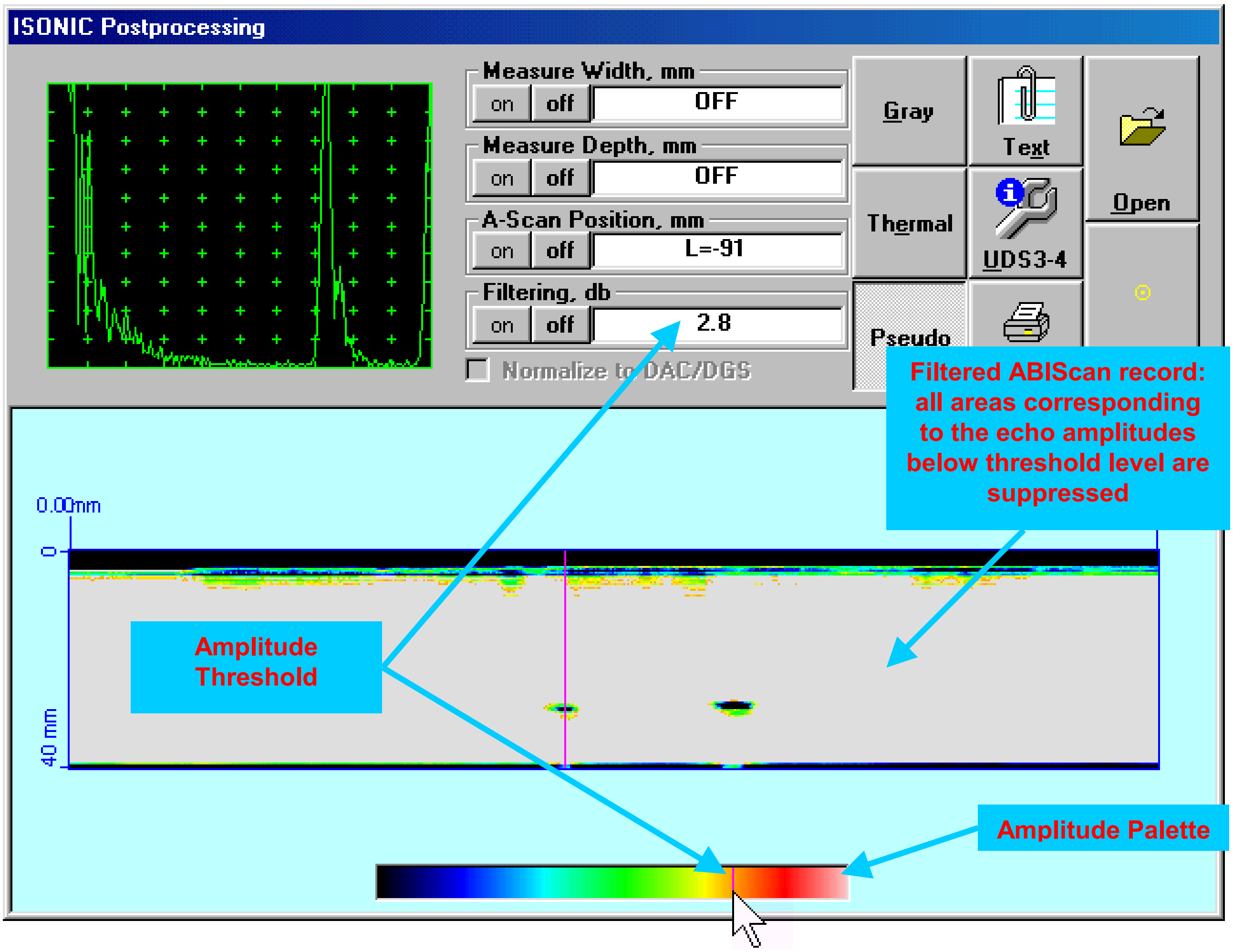
- Filtering the **t-ABIScan** (**ABIScan**) record through the suppressing of the echo amplitudes below the selected **threshold level**

To proceed click on on. As a result:

- The **amplitude threshold line** representing the **threshold level** appears above the palette; the cursor is "sticked" to the **amplitude threshold line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ←, → buttons on the keyboard
- The value of the **amplitude threshold** is displayed as **Filtering, dB**
- Images of the reflectors returning the echo amplitudes below the **amplitude threshold** are erased from the **t-ABIScan** (**ABIScan**) record i.e. rejected

To fix the **threshold level** left mouse click or release the stylus from the touch screen.

To switch back to the unfiltered **t-ABIScan** (**ABIScan**) record representation click on off

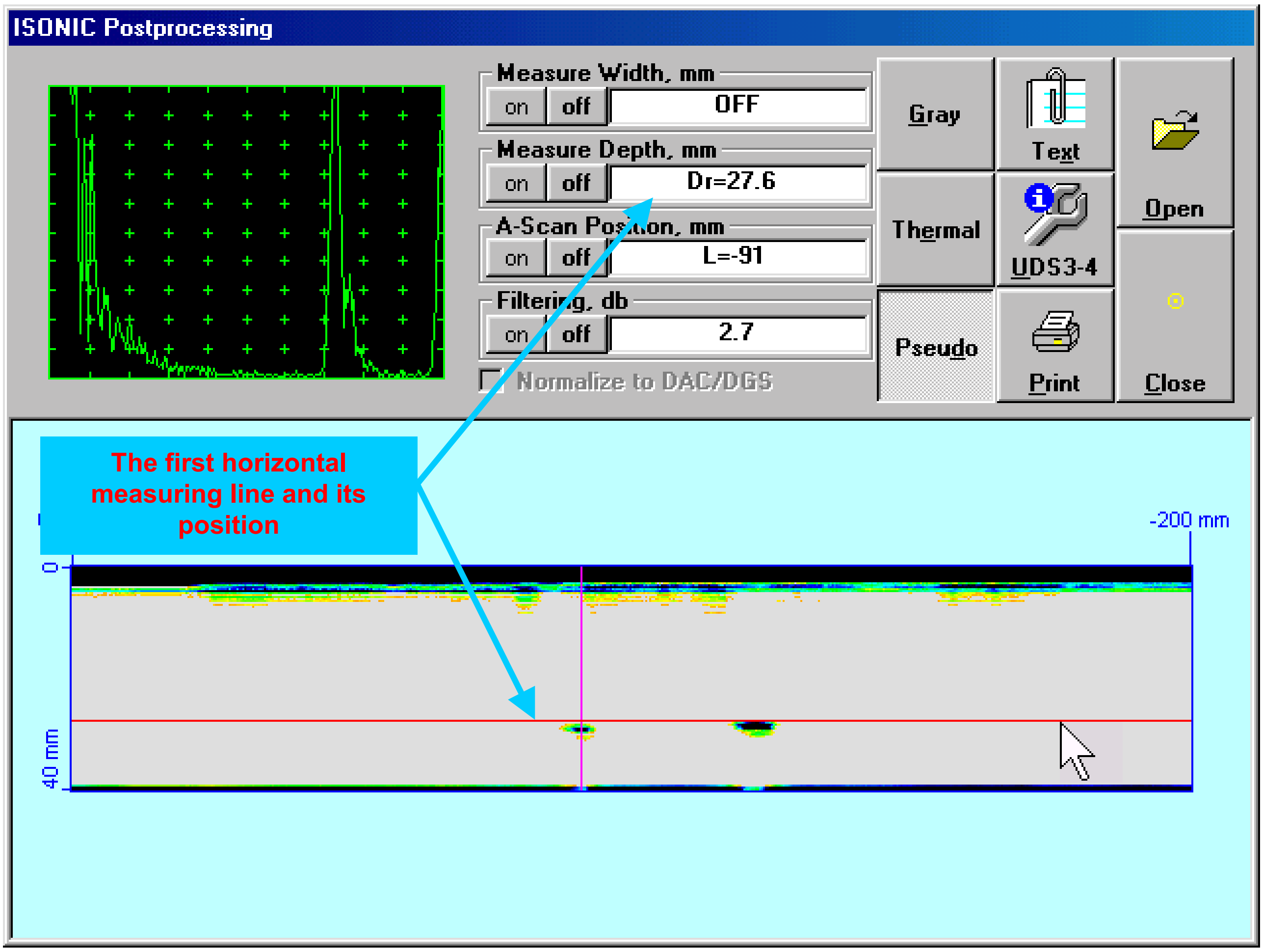


o 

- measuring defect's depth and projection height. To proceed click on on. As a result:

- ➢ The **first horizontal measuring line** appears on the (**ABIScan**) record; the mouse pointer is "sticked" to the **first horizontal measuring line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard
- ➢ The position of the **first horizontal measuring line** is indicated as **D_r**

To fix the position of the **first horizontal measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard

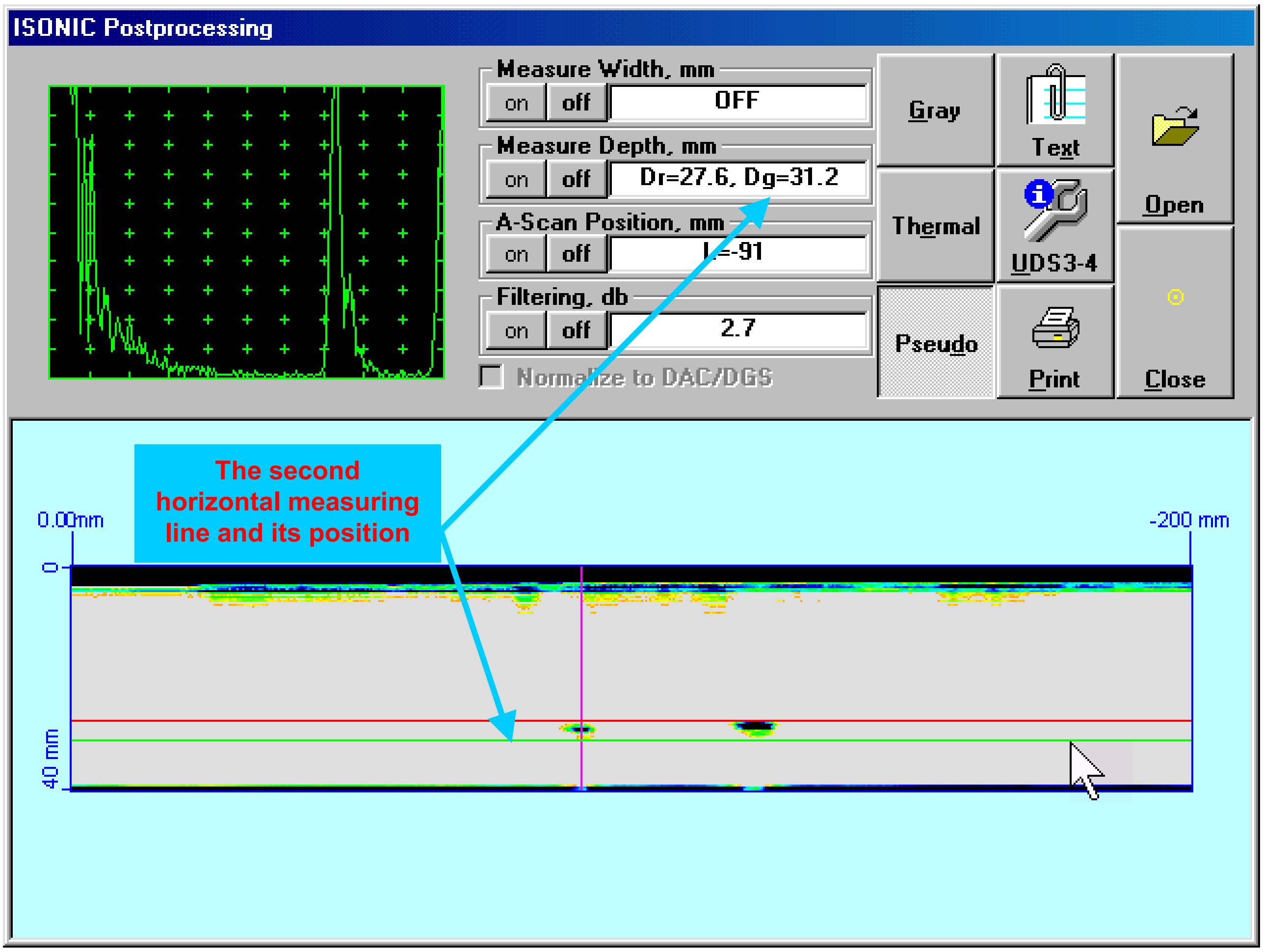


As a result:

- The **second horizontal measuring line** appears on the **t-ABIScan** (**ABIScan**) record; the mouse pointer is "sticked" to the **second horizontal measuring line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard
- The position of the **second horizontal measuring line** with respect to the **first horizontal measuring line** is indicated as $\mathbf{D_g}$

To fix the position of the **second horizontal measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard

To negate the horizontal measuring lines click on off

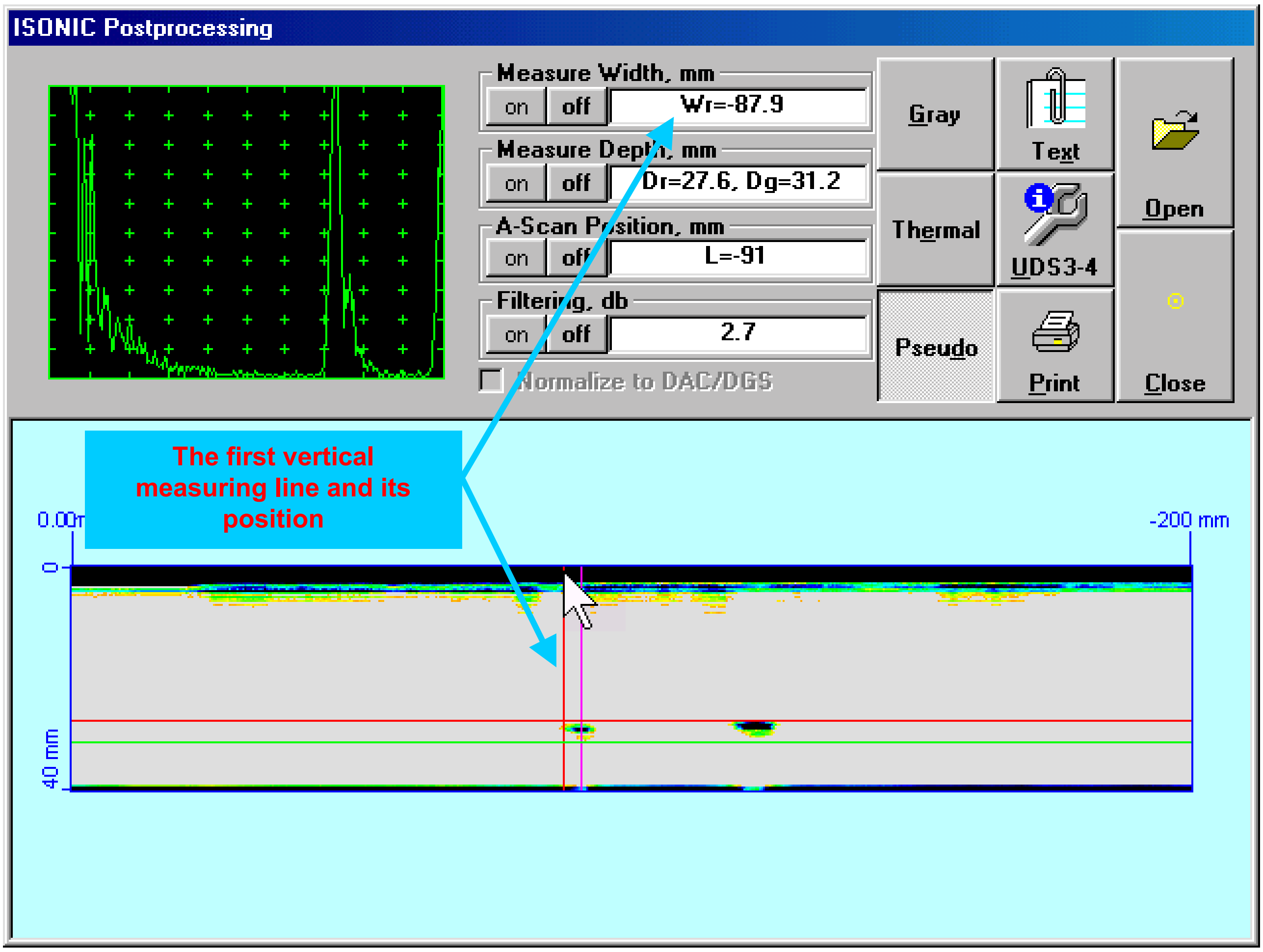


o 

- measuring defect's coordinate and width along the **t-ABIScan** (**ABIScan**) record. To proceed click on on. As a result:

- ➢ The **first vertical measuring line** appears on the **t-ABIScan** (**ABIScan**) record; the cursor is "sticked" to the **first vertical measuring line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ← , → buttons on the keyboard
- ➢ The position of the **first vertical measuring line** is indicated as **W_r**

To fix the position of the **first vertical measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard

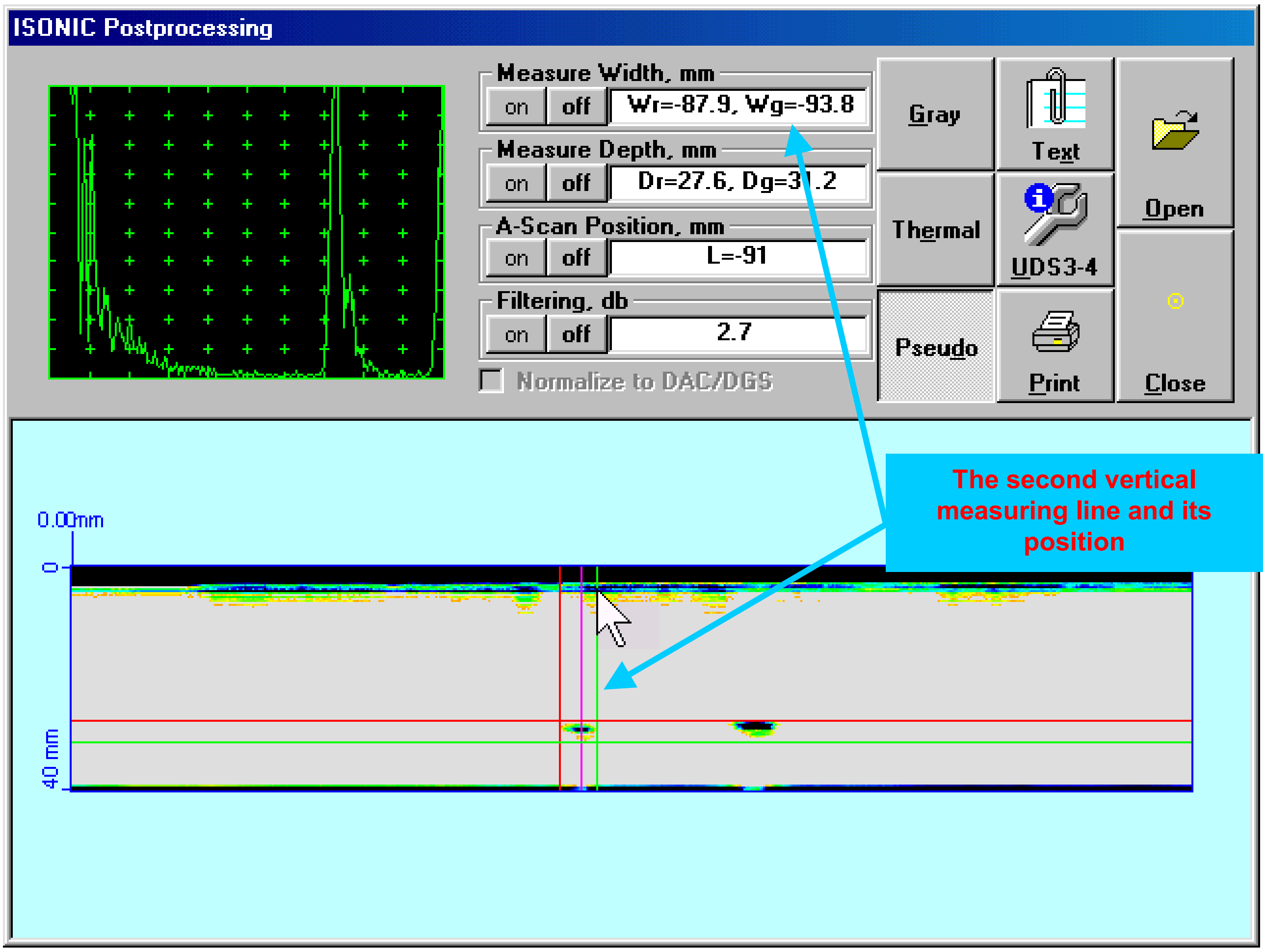


As a result:

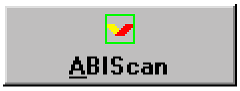
- The **second vertical measuring line** appears on the **t-ABIScan** (**ABIScan**) record; the mouse pointer is "sticked" to the **second vertical measuring line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ← , → buttons on the keyboard
- The position of the **second vertical measuring line** with respect to the **first vertical measuring line** is indicated as $\mathbf{W_g}$

To fix the position of the **second vertical measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard

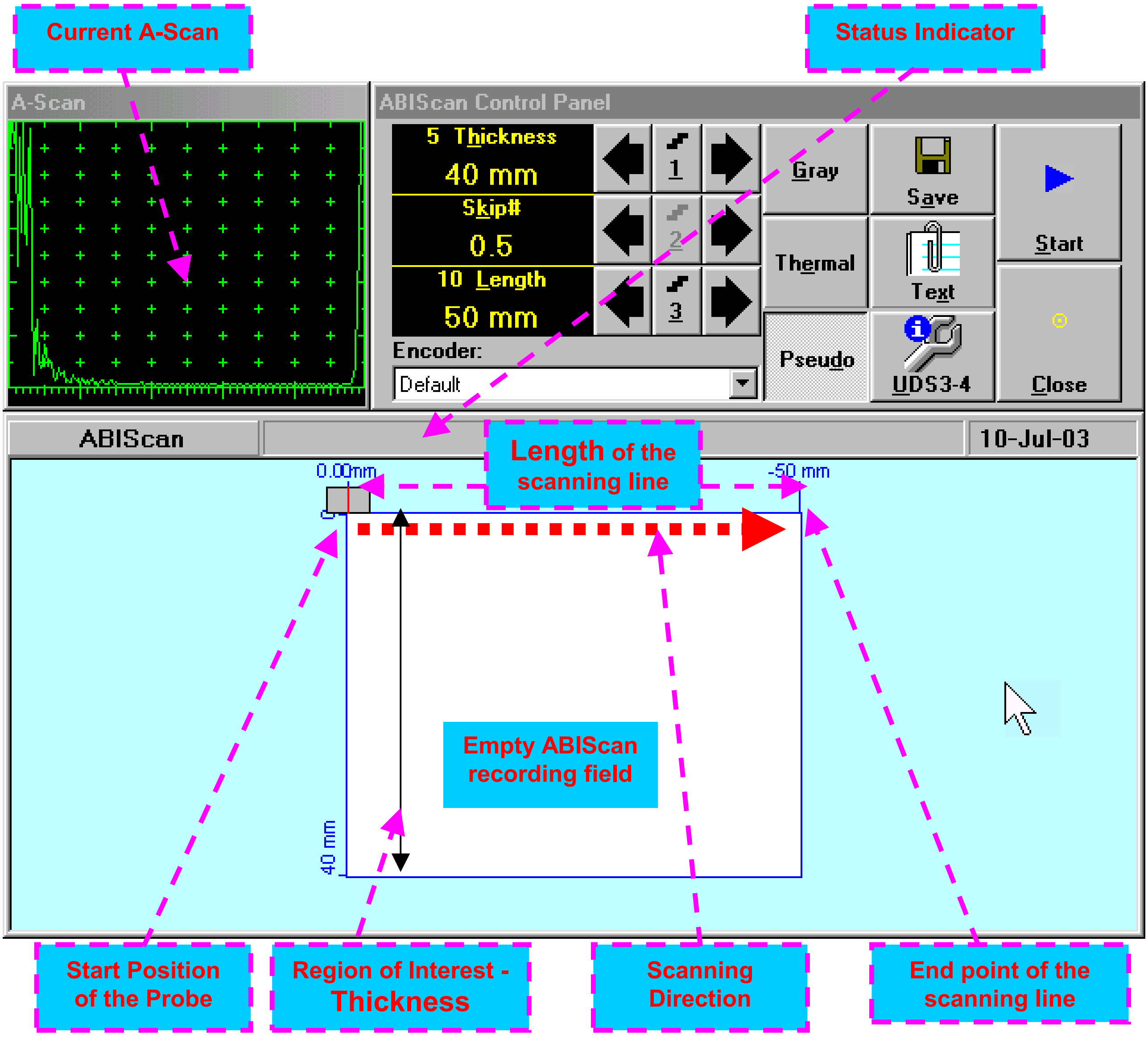
To negate the vertical measuring lines click on off



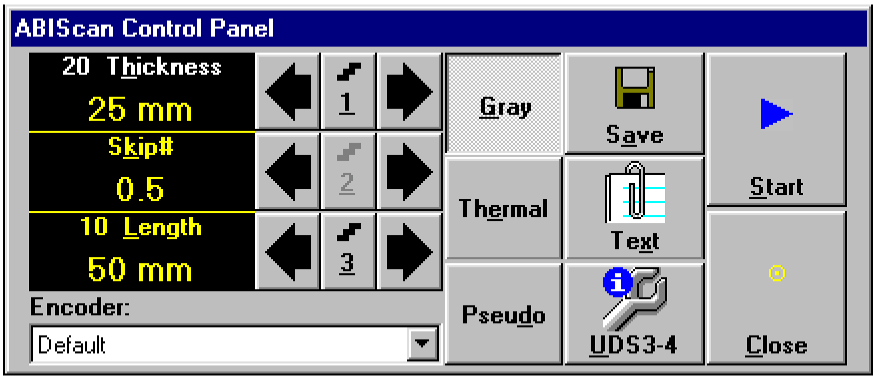
6.4.2. Encoded (true-to-scale) Imaging – ABIScan – Normal Probe

The screen as below appears upon clicking on 

or pressing **<Alt>+<A>** on the keyboard if the **Angle** was setup to **0**^{o} (Normal Probe) in the submenu **MEASURE**



6.4.2.1. ABIScan Control Panel – Normal Probe



Thickness and Skip#

The value of **Thickness** defines the *Region of Interest* (**ROI**) starting from the *scanning surface*. **ABIScan** imaging is provided *without using a gate* – the ***whole visible A-Scan area is recorded***. The *A-Scan Range* used for the **ABIScan** imaging – normal probe is defined as:

$$\mathbf{Range_{ABIScan} = Thickness}$$

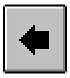
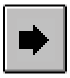
The *A-Scan Display Delay* used for the **ABIScan** imaging is defined as:

$$\mathbf{Display\ Delay_{ABIScan} = Probe\ Delay}$$

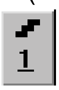
ⓘ

- The value of **Thickness** is controllable through the **ABIScan Control Panel**,
- The value of **Probe Delay** is taken from the ultrasonic flaw detector setup (submenu **MEASURE**)
- The value of **Skip#** is automatically ***ignored*** and may not be changed if the **Angle** was setup to **0°** (Normal Probe) in the submenu **MEASURE**

To setup the required value of **Thickness** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<H>** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Thickness** area the letter **h** is underlined)
- **Combined**
  - Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

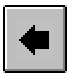
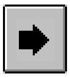
The value of **Thickness** is over the **5 … 300 mm** (or **0.2 … 12 in**) range with **1 mm** (or **0.05 in**) resolution.

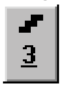
The resolution is selectable through clicking on  or pressing **<Alt>+<1>** on the keyboard

Scan Length

The value of **Length** (*Scan Length* or, in other words, *Scan Path*) represents the length of the section of the test object to be displayed, over which the probe will be guided

To setup the required value of **Length** the following manipulations are applicable:

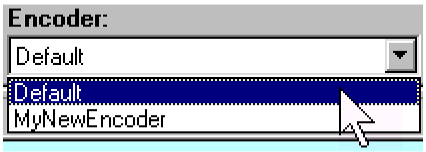
- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Length** area the letter **L** is underlined)
- **Combined**
  - Click on **Length** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Length** is controllable over the **50…300 mm** range (or **2…12 in**) with **1 mm** (or **0.05 in**) resolution. The resolution is selectable through clicking on 

or pressing **<Alt>+<3>** on the keyboard

Encoder Selection

Select the encoder to be used and click on its name:



Echo Amplitude Palette (Color Scale)

The color coding of echo amplitudes is provided during the **ABIScan** recording over the **28 dB** range (**- 14 dB** through **+ 14 dB**; **0 dB** level corresponds to the **50% A-Scan Height**)

There are three palettes available:

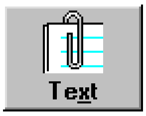
- Clicking on 

or pressing **<Alt>+<G>** on the keyboard will activate the Gray-Level coloring of echo amplitudes
- Clicking on 

or pressing **<Alt>+<E>** on the keyboard will activate the Thermo-Level coloring of echo amplitudes
- Clicking on 

or pressing **<Alt>+<D>** on the keyboard will activate the Pseudocolor-Level coding of echo amplitudes

Insert Text Note

A text note/comments may be typed to accompany the **ABIScan** record after clicking on 

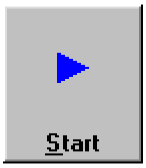
or pressing **<Alt>+<X>** on the keyboard

Preview the Instrument Settings

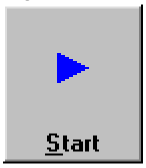
The instrument settings for the **ABIScan** record may be previewed through the clicking on 

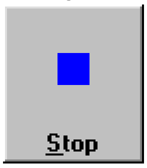
or pressing **<Alt>+<U>** on the keyboard

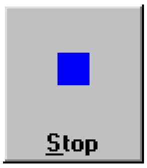
Start/Stop ABIScan recording

Clicking on 

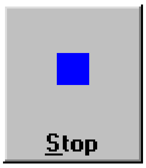
or pressing **<Alt>+<S>** on the keyboard will start the **ABIScan** recording

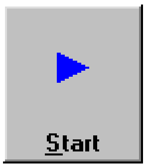
The 

button becomes invisible upon the **ABIScan** recording starts. The 

button occupies its position. Clicking on 

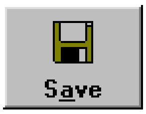
or pressing **<Alt>+<S>** on the keyboard will terminate the **ABIScan** recording prior to the completion

The 

button becomes invisible after the completion / termination of the **ABIScan** recording – the 

button returns to its position

Save the captured ABIScan record

Clicking on 

or pressing **<Alt>+<A>** on the keyboard will save the once captured **ABIScan** record and accompanying instrument calibration dump and text notes / comments into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

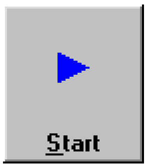
Return to the Pulser Receiver window

Clicking on 

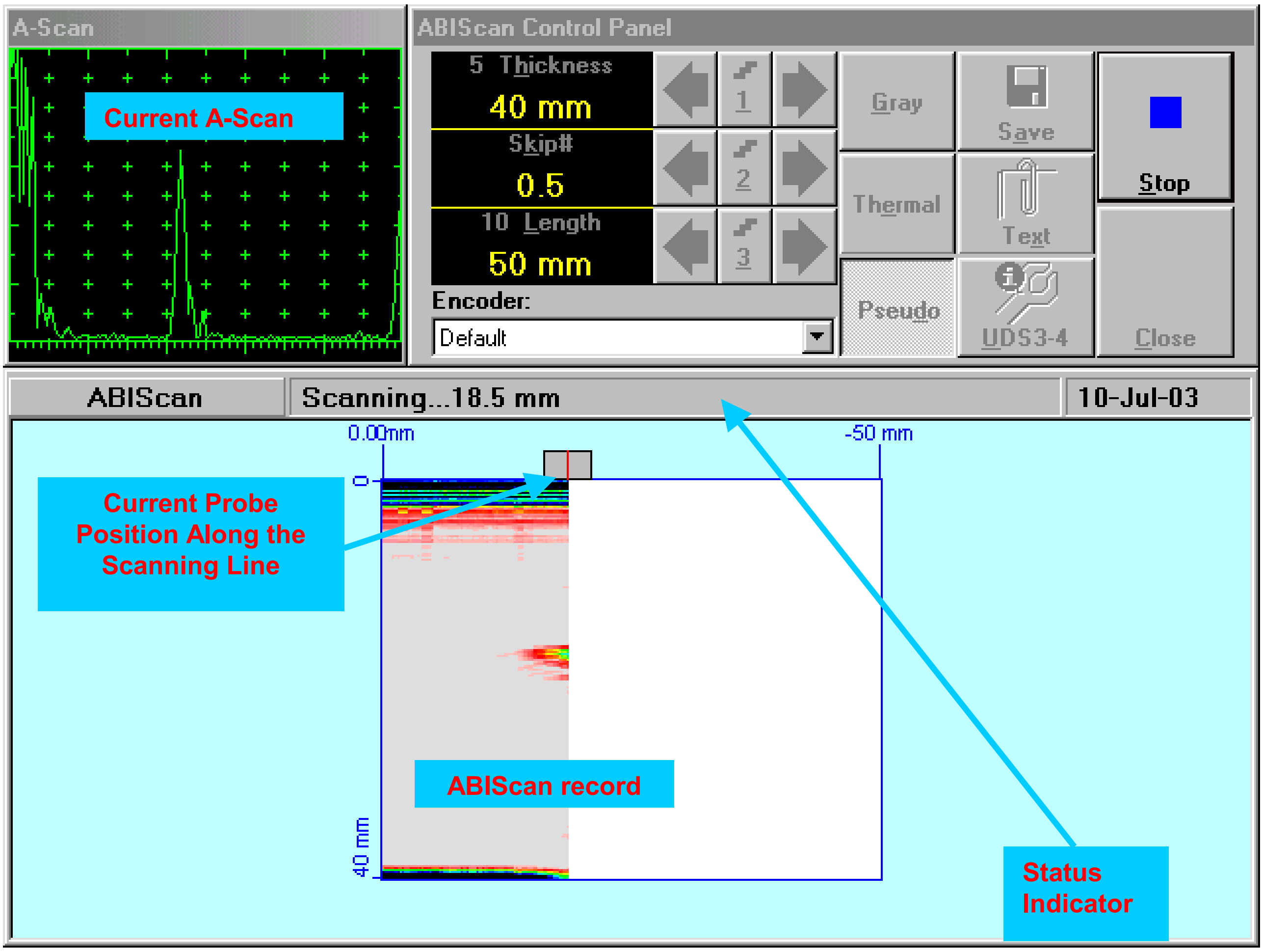
or pressing **<Alt>+<C>** or **Esc** on the keyboard will return to the Pulser / Receiver window

6.4.2.2. ABIScan Recording – Normal Probe

To capture **ABIScan**:

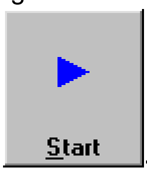
- Apply probe to the test object in the start point of the selected scanning line
- Click on 

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



Status Indicator

Status Indicator is empty prior to and after the completing/termination of **ABIScan** recording. The 

status appears upon clicking on 

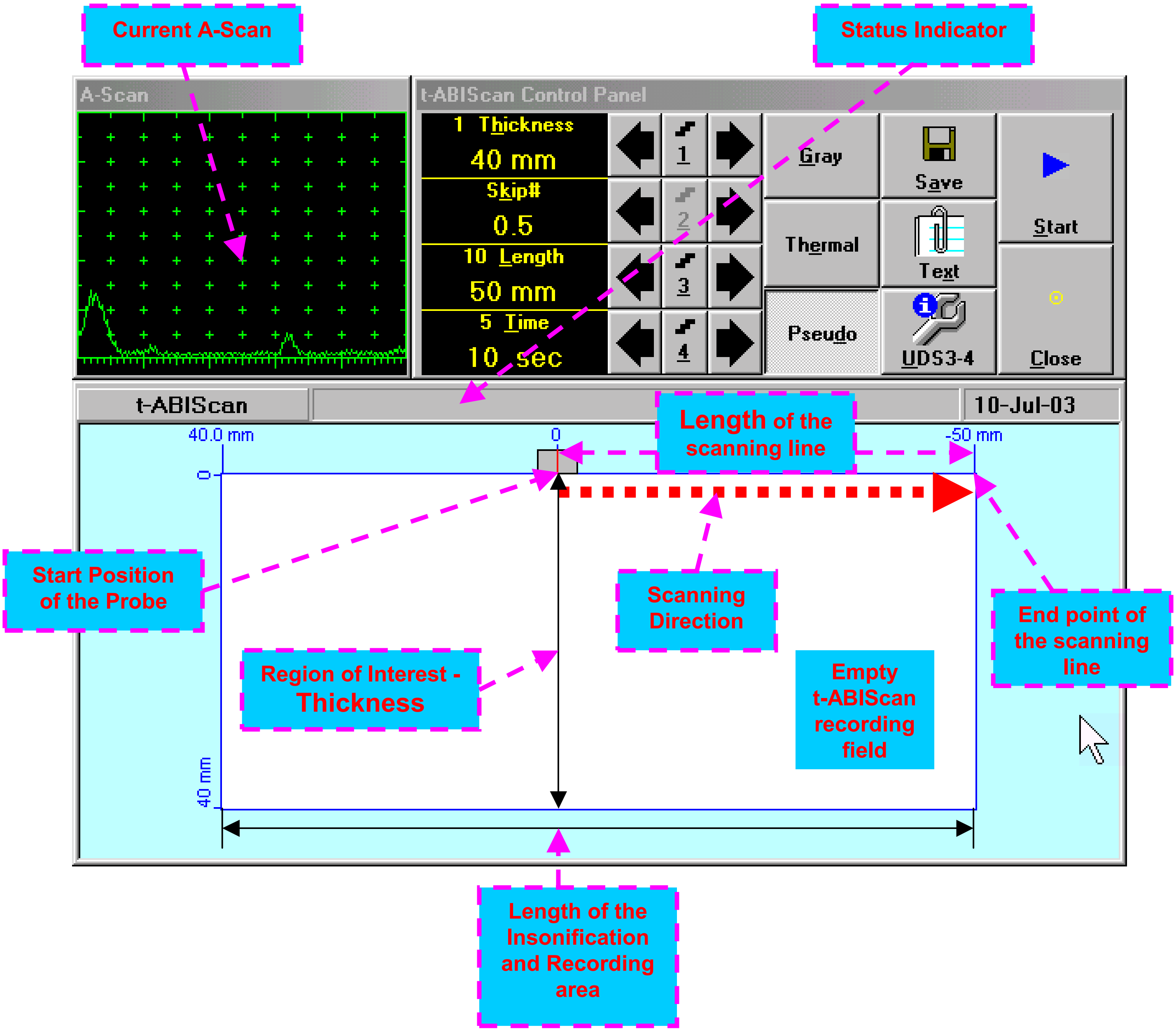
. The current probe coordinate along the scanning path is permanently updated after the **Scanning…** in the Status Indicator whilst **ABIScan** recording is in progress

6.4.2.3. ABIScan Postprocessing – Normal Probe

Refer to the paragraph 6.4.1.3 of this Operating Manual

6.4.3. Time (time-based) Imaging – t-ABIScan – Angle Beam Probe

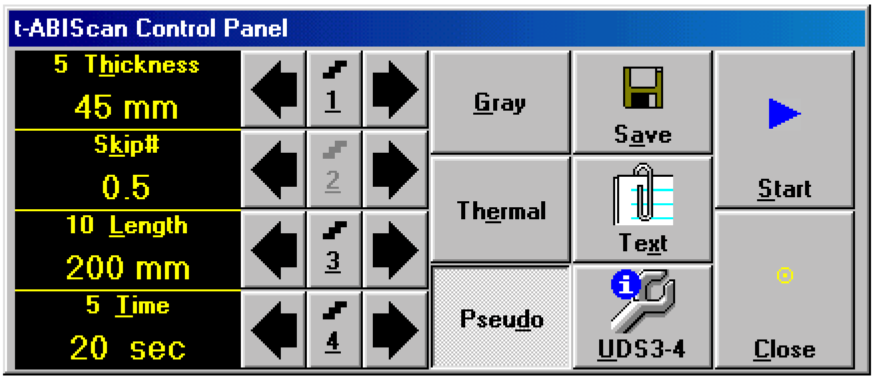
The screen as below appears upon clicking on [t-ABIScan] or pressing **<Alt>+<T>** on the keyboard if the **Angle** setup was **>0° value** (Angle Beam Probe) in the submenu **MEASURE**



6.4.3.1. t-ABIScan Control Panel – Angle Beam Probe

Thickness and Skip#

The values of **Thickness** and **Skip#** define the *Region of Interest* (**ROI**) starting from the *scanning surface*. **t-ABIScan** imaging is provided *without using a gate* – the ***whole visible A-Scan area is recorded***. The *A-Scan Range* used for the **t-ABIScan** imaging – angle beam probe is defined as:



$$\mathbf{Range_{t\text{-}ABIScan} = 2 \bullet Skip\# \bullet Thickness / Cos(Angle)}$$

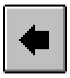
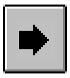
The *A-Scan Display Delay* used for the **t-ABIScan** imaging is defined as:

$$\mathbf{Display\ Delay_{t\text{-}ABIScan} = Probe\ Delay}$$

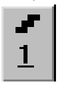
ⓘ

- ♦ The value of **Thickness** is controllable through the **t-ABIScan Control Panel**,
- ♦ The value of **Probe Delay** is taken from the ultrasonic flaw detector setup (submenu **MEASURE**)

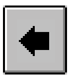
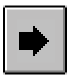
To setup the required value of **Thickness** the following manipulations are applicable:

- **Mouse**
  - ■ Click on the corresponding button  or 
- **Keyboard**
  - ■ Pressing **<Alt>+<H>** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Thickness** area the letter **h** is underlined)
- **Combined**
  - ■ Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Thickness** is over the **5 … 300 mm** (or **0.2 … 12 in**) range with **1 mm** (or **0.05 in**) resolution.

The resolution is selectable through clicking on  or pressing **<Alt>+<1>** on the keyboard

To select the required value of **Skip#** the following manipulations are applicable:

- **Mouse**
  - ■ Click on the corresponding button  or 
- **Keyboard**
  - ■ Pressing **<Alt>+<K>** ⇒ **Skip#** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Skip#** area the letter **k** is underlined)
- **Combined**
  - ■ Click on **Skip#** ⇒ **Skip#** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Skip#** may be either **0.5** or **1**

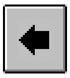
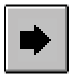
Scan Length and Scan Time

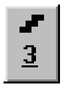
The value of **Length** (*Scan Length* or, in other words, *Scan Path*) represents the length of scanning line, over which the probe will be guided during the recording period. **Time** (*Scan Time*) is the duration of the said recording period. The value of **Length** along with **Skip#** represents the length of the section of the test object to be displayed (**Length of the Insonification and Recording area**).

Length of the Insonification and Recording area	**= Length + 2 • Skip# • Thickness / Tan(Angle)**

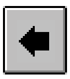
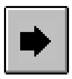
Simultaneously the value of **Length**

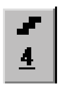
To setup the required value of **Length** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Length** area the letter **L** is underlined)
- **Combined**
  - Click on **Length** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Length** is controllable over the **50…300 mm** range (or **2…12 in**) with **1 mm** (or **0.05 in**) resolution. The resolution is selectable through clicking on  or pressing **<Alt>+<3>** on the keyboard

To setup the required value of **Time** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time** area letter **T** is underlined)
- **Combined**
  - Click on **Time** ⇒ **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Time** is controllable over the **5…60 sec** range with **1 sec** resolution. The resolution is selectable through clicking on  or pressing **<Alt>+<4>** on the keyboard

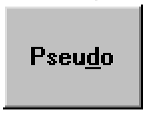
Echo Amplitude Palette (Color Scale)

The color coding of echo amplitudes is provided during the **t-ABIScan** recording over the **28 dB** range (**- 14 dB** through **+ 14 dB**; **0 dB** level corresponds to the **50% A-Scan Height**)

There are three palettes available:

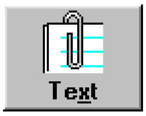
- Clicking on 

 or pressing **<Alt>+<G>** on the keyboard will activate the Gray-Level coloring of echo amplitudes
- Clicking on 

 or pressing **<Alt>+<E>** on the keyboard will activate the Thermo-Level coloring of echo amplitudes
- Clicking on 

 or pressing **<Alt>+<D>** on the keyboard will activate the Pseudocolor-Level coding of echo amplitudes

Insert Text Note

A text note/comments may be typed to accompany the **ABIScan** record after clicking on 

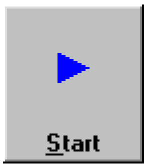
 or pressing **<Alt>+<X>** on the keyboard

Preview the Instrument Settings

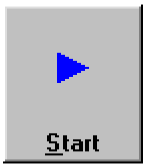
The instrument settings for the **ABIScan** record may be previewed through the clicking on 

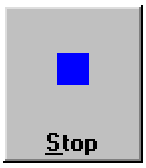
 or pressing **<Alt>+<U>** on the keyboard

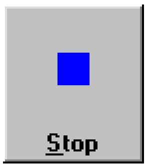
Start/Stop t-ABIScan recording

Clicking on 

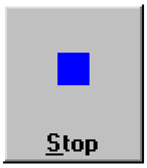
or pressing **<Alt>+<S>** on the keyboard will start the **t-ABIScan** recording, which will be either completed automatically or terminated by an operator

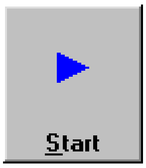
The 

button becomes invisible upon the **t-ABIScan** recording starts. The 

button occupies its position. Clicking on 

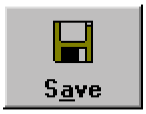
or pressing **<Alt>+<S>** on the keyboard will terminate the **t-ABIScan** recording prior to the automatic completion

The 

button becomes invisible after the completion / termination of the **t-ABIScan** recording – the 

button returns to its position

Save the captured t-ABIScan record

Clicking on 

or pressing **<Alt>+<A>** on the keyboard will save the **t-ABIScan** record and accompanying instrument calibration dump and text notes / comments into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

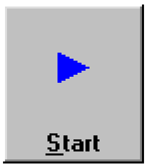
Return to the Pulser Receiver window

Clicking on 

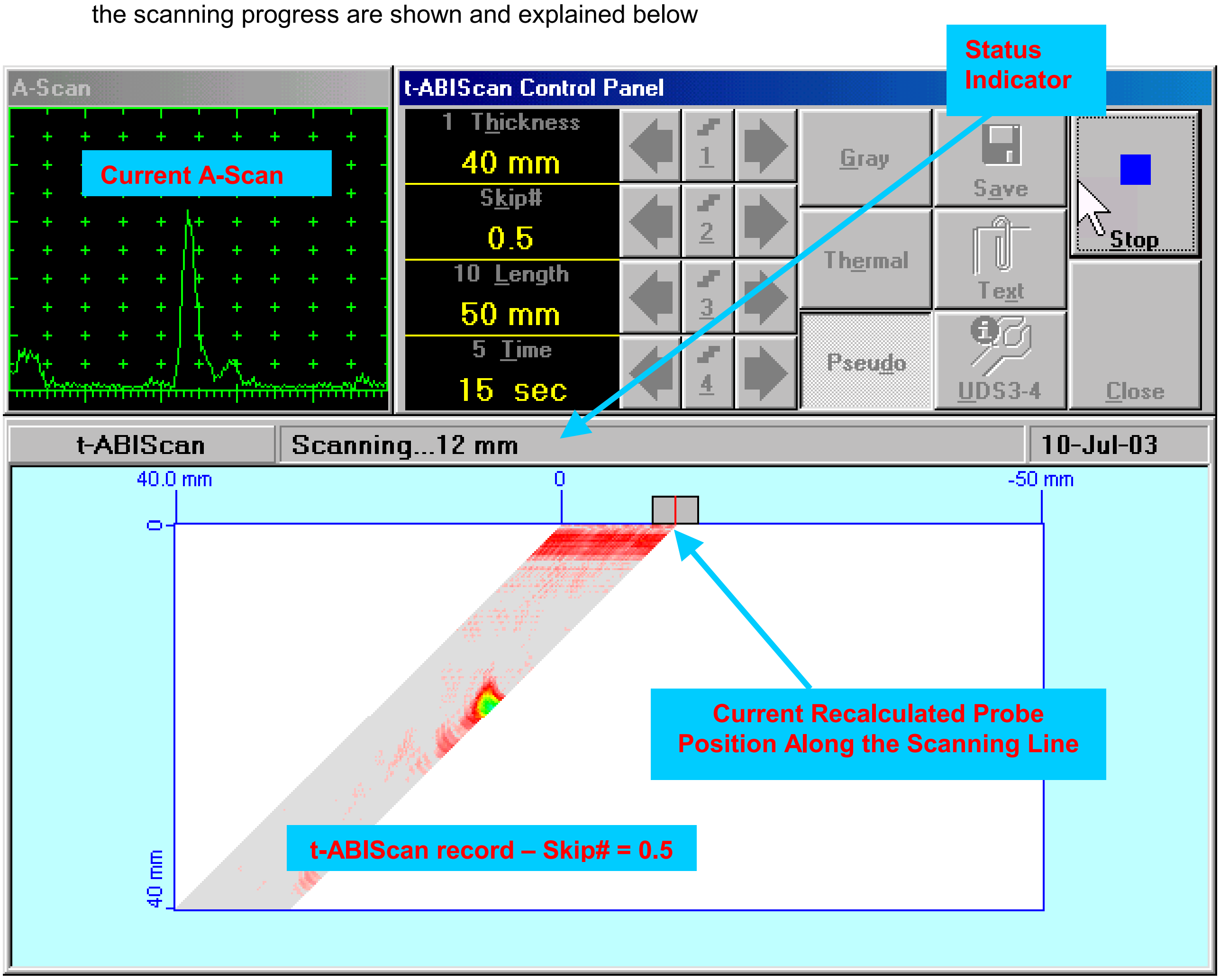
or pressing **<Alt>+<C>** or **Esc** on the keyboard will return to the Pulser / Receiver window

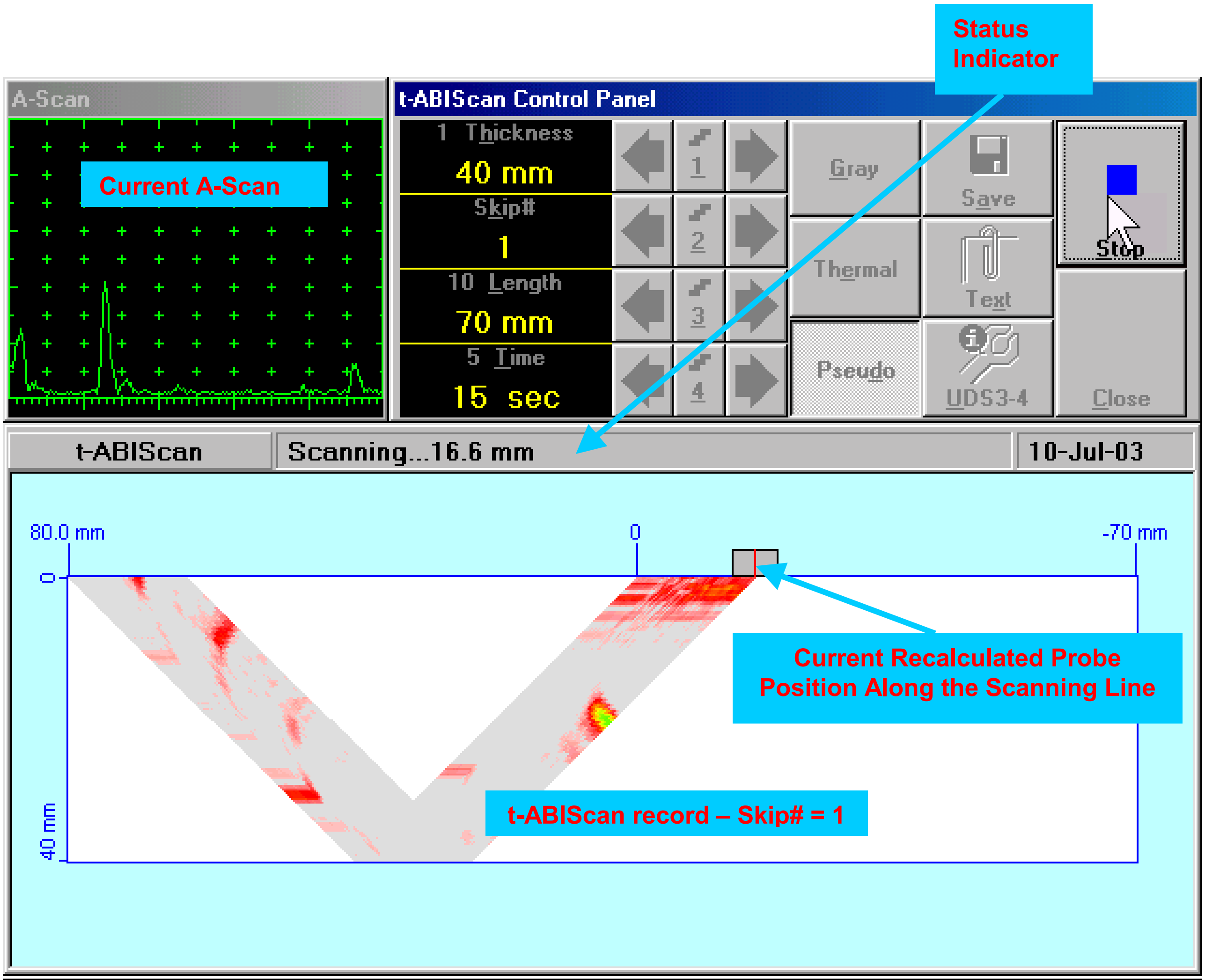
6.4.3.2. t-ABIScan Recording – Angle Beam Probe

To capture **t-ABIScan**:

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

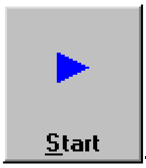
 or press **<Alt>+<S>** on the keyboard – the counting of the **3 sec** interval reserved for the intermissions starts
- Wait for the end of the intermissions interval then guide the probe over the scanning line with the approximately constant speed – the typical displays for the **Skip# = 0.5** and **Skip# = 1** cases during the scanning progress are shown and explained below





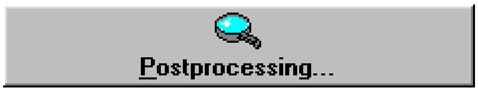
In order to ease the understanding both screenshots are taken for the scanning of the same 40 mm thick test sample with the same 45^{0} probe, said screenshots are valid for the detection of the same reflector located at 20 mm depth in the test sample

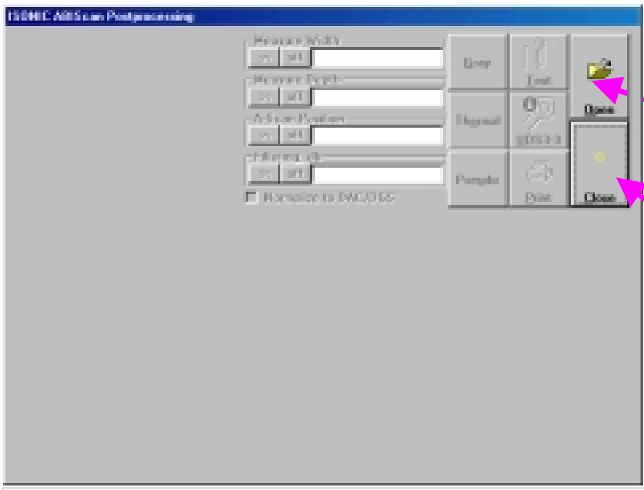
Status Indicator

Status Indicator is empty prior to and after the completing/termination of **t-ABIScan** recording. The Scanning will start in 1.6 sec status appears upon clicking on 

. The expiring of the intermissions period causes appearance of the Scanning...123.5 mm status. Since this moment the **t-ABIScan** recording is observed unconditionally. The current recalculated probe coordinate along the scanning path is permanently updated after the **Scanning…** in the Status Indicator whilst **t-ABIScan** recording is in progress

6.4.3.3. t-ABIScan Postprocessing – Angle Beam Probe

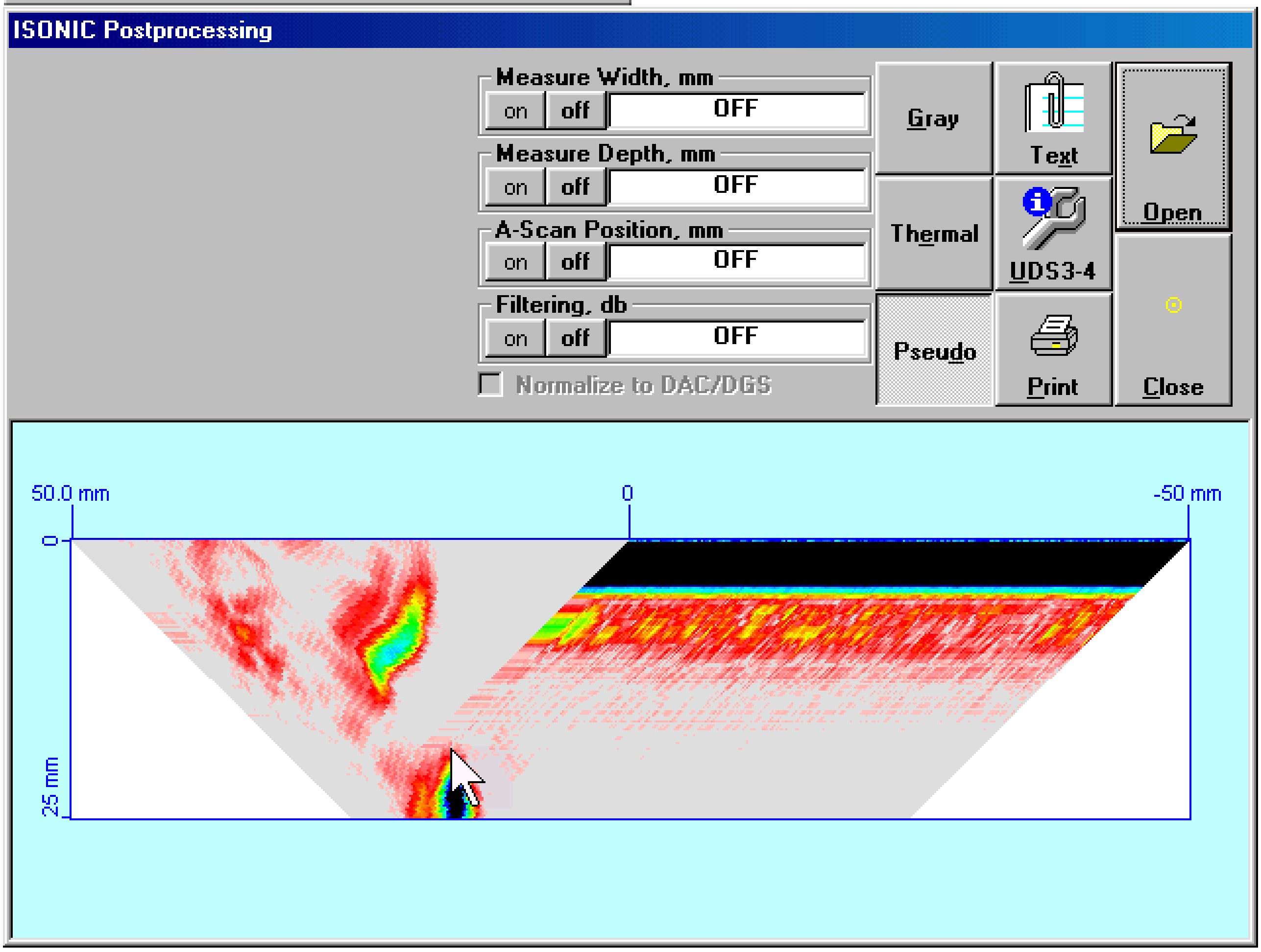
The window as below appears upon clicking on 



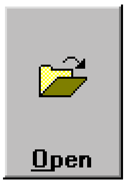
Click on or press **<Alt>+<O>** on the keyboard to open a file for the postrpocessing. Refer to the paragraph 5.4.20 of this Operating Manual to proceed with opening a file

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to return to the Pulser Receiver window

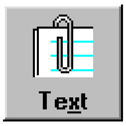
The captured **t-ABIScan** (**ABIScan**) record appears in the window upon opening a file



The following controls allow managing of the postrocessing procedures:

- o 

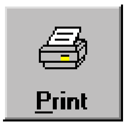
- opening the next **t-ABIScan** (**ABIScan**) record accompanied with the instrument calibration dump from a file. Refer to the paragraph 5.4.20 of this Operating Manual to proceed with opening a file

- o 

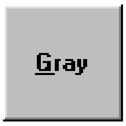
- previewing the comments made prior to the **t-ABIScan** (**ABIScan**) recording

- o 

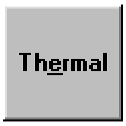
- previewing the instrument calibration dump actual while capturing the **t-ABIScan** (**ABIScan**) record

- o 

- print the **t-ABIScan** (**ABIScan**) record to the default printer

- o 

- redrawing the map using the Gray palette

- o 

- redrawing the map using the Thermo palette

- o 

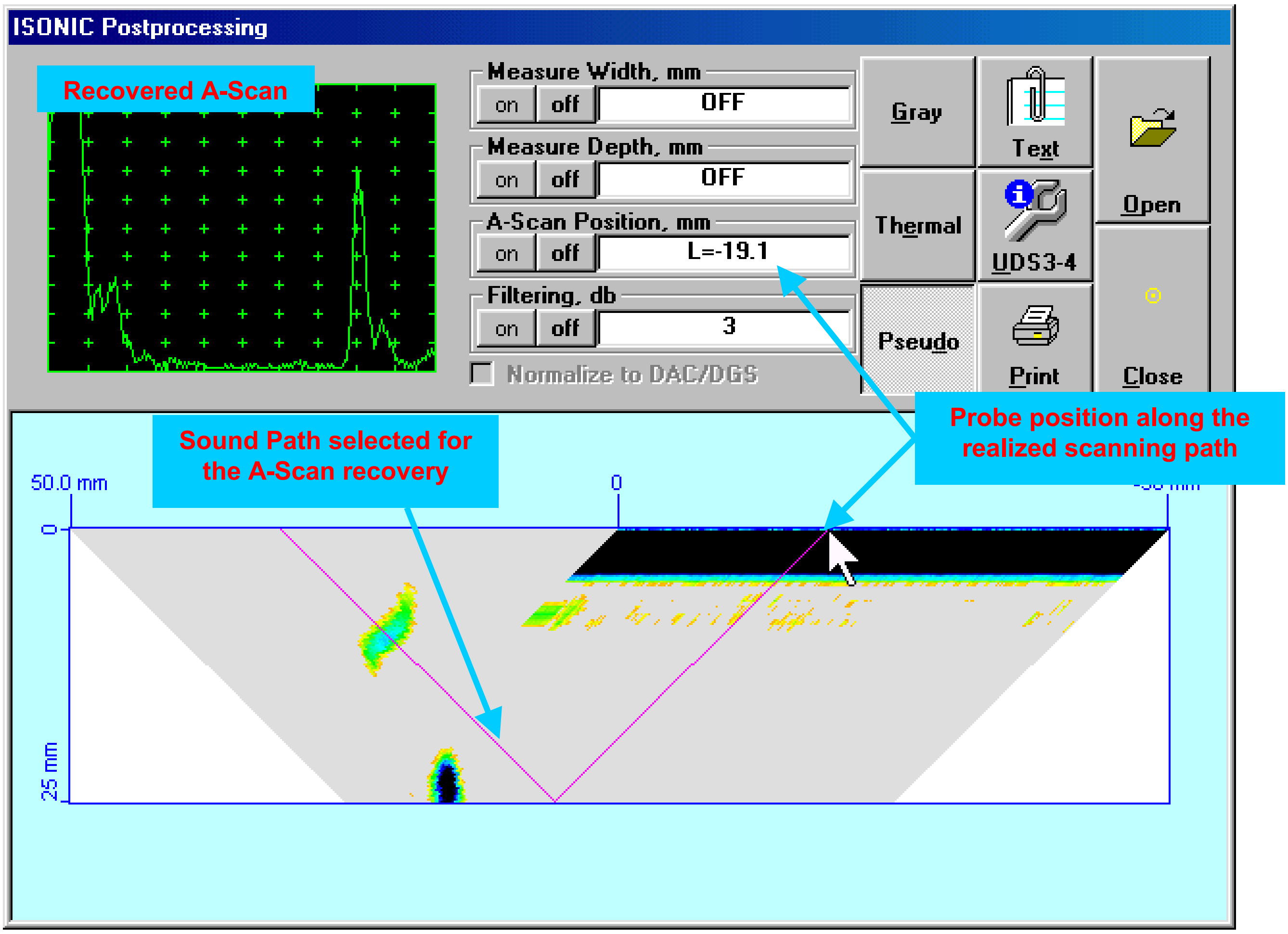
- redrawing the map using the Pseudocolor palette

- o 

- checkbox. If the map was captured whilst DAC/DGS active then at the postprocessing stage it may be represented using the palette related to the signal amplitude either linearly (box is not checked) or with respect to the DAC/DGS (checked). The checkbox is disabled for the map captured whilst DAC/DGS inactive (refer to the below Chapter 6.4.5) o 

- Off-line virtual scanning with A-Scan recovery

Clicking on on will place the cursor above the "contact surface" line allowing the *off-line virtual scanning*. The cursor position matching with the probe's incidence point is accompanied with its central beam trace and indicated as **A-Scan Position, mm**



The virtual scanning may be controlled by the touch screen stylus or mouse or ← and → buttons on the keyboard. *The A-Scans are recovered and represented dynamically for each cursor position allowing the defect's characterization according to **BS EN 583-5***

Upon completing the virtual scanning and selection of the necessary A-Scan (for example – representing the maximal echo) release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard – this will free the cursor for further procedures

To switch off the restored A-Scan click on off o 

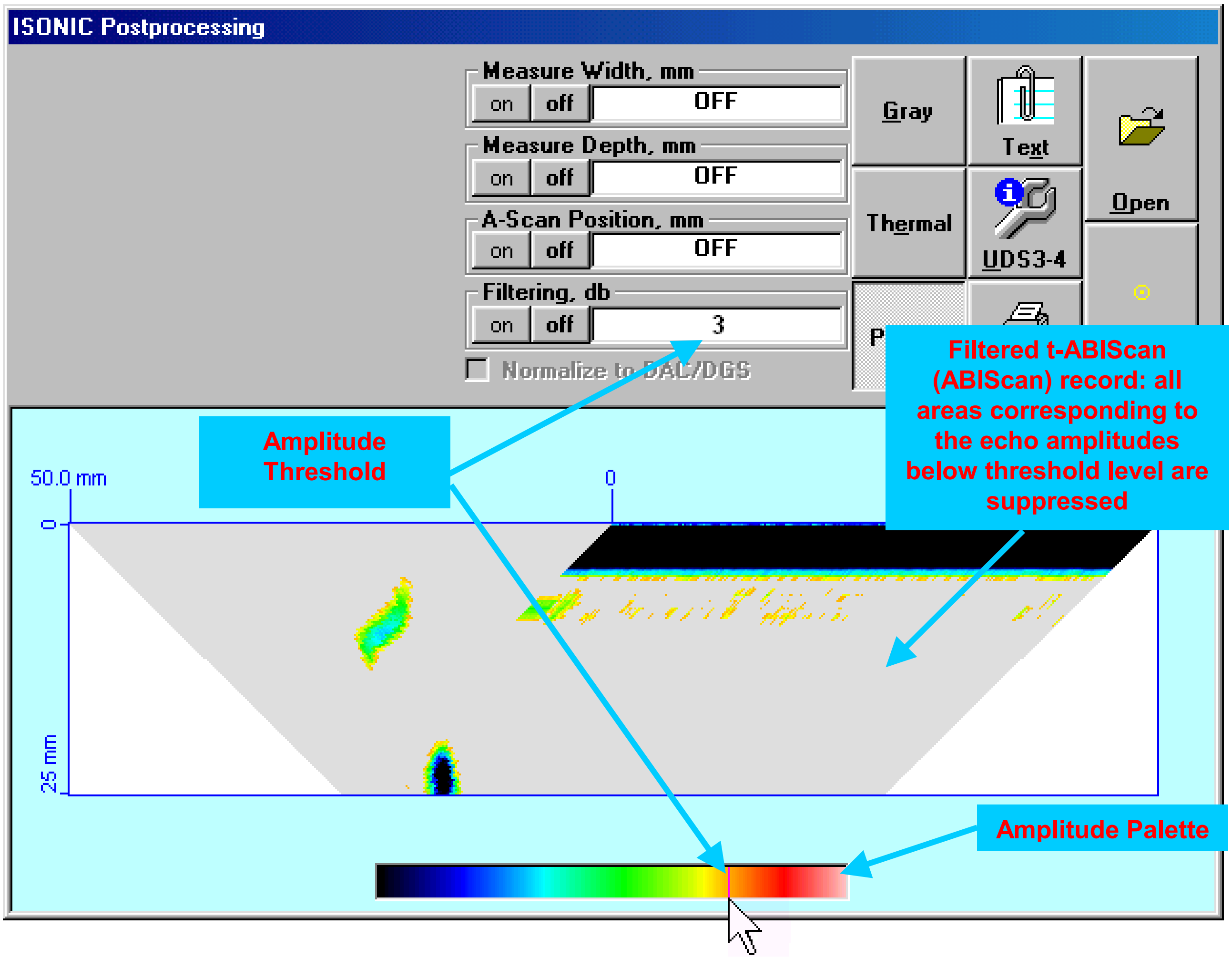
- Filtering the **t-ABIScan** (**ABIScan**) record through the suppressing of the echo amplitudes below the selected **threshold level**

To proceed click on on. As a result:

- The **amplitude threshold line** representing the **threshold level** appears above the palette; the cursor is "sticked" to the **amplitude threshold line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ⟵ , ⟶ buttons on the keyboard
- The value of the **amplitude threshold** is displayed as **Filtering, dB**
- Images of the reflectors returning the echo amplitudes below the **amplitude threshold** are erased from the **t-ABIScan** (**ABIScan**) record i.e. rejected

To fix the **threshold level** left mouse click or release the stylus from the touch screen.

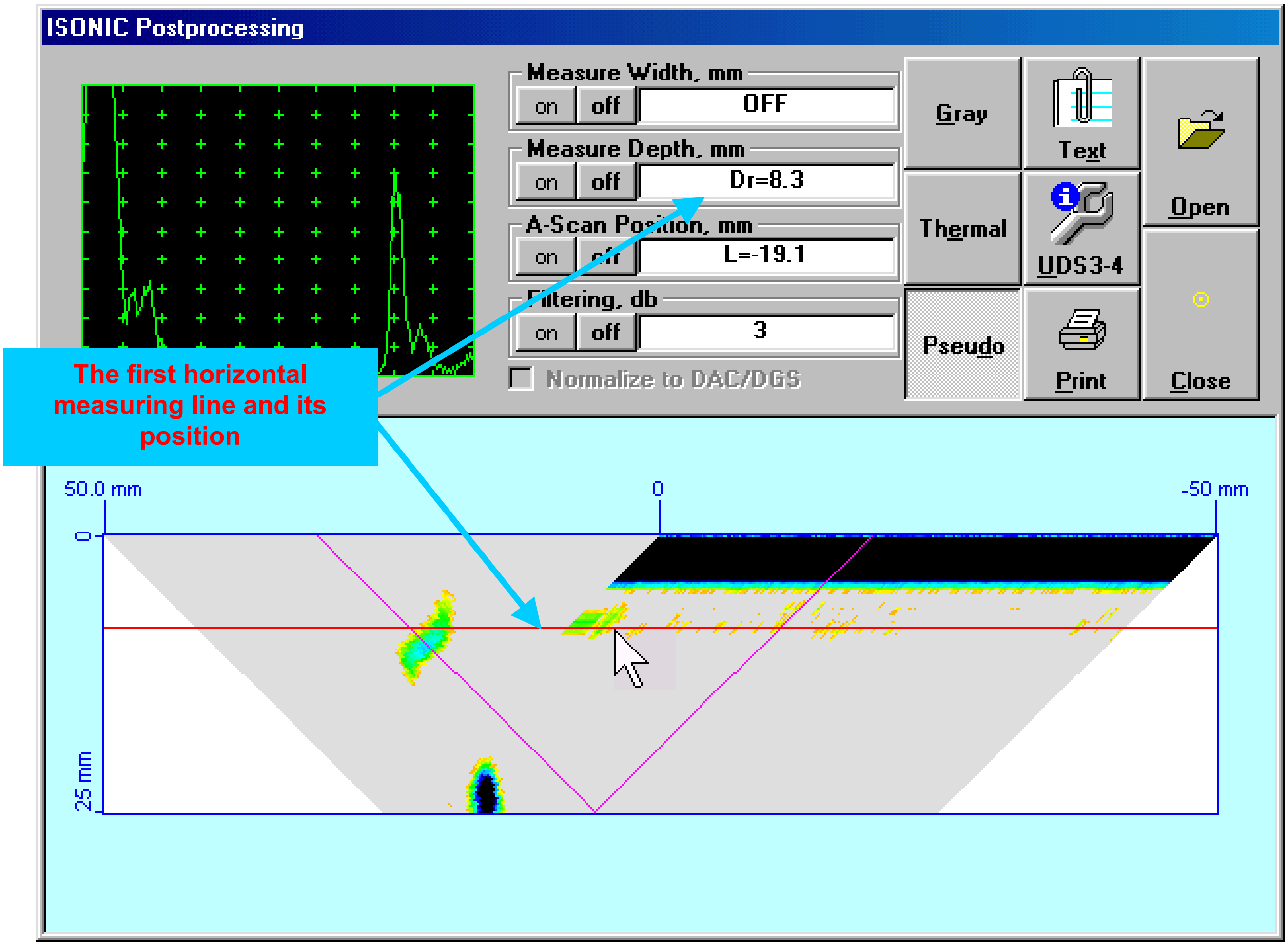
To switch back to the unfiltered **t-ABIScan** (**ABIScan**) record representation click on off



o  - measuring defect's depth and projection height. To proceed click on . As a result:

- The **first horizontal measuring line** appears on the (**ABIScan**) record; the mouse pointer is "sticked" to the **first horizontal measuring line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard
- The position of the **first horizontal measuring line** is indicated as **D_r**

To fix the position of the **first horizontal measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard

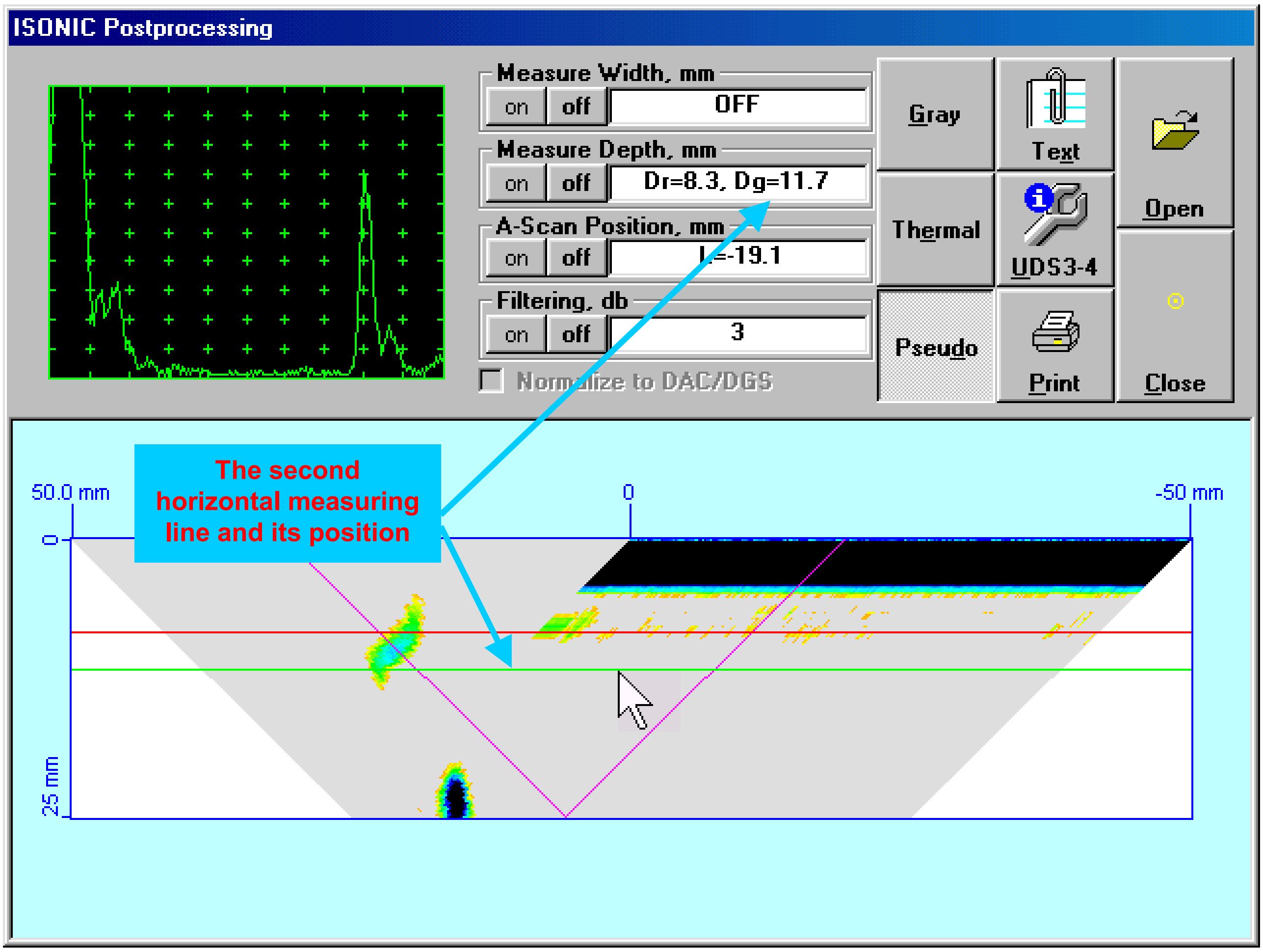


As a result:

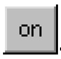
- The **second horizontal measuring line** appears on the **t-ABIScan** (**ABIScan**) record; the mouse pointer is "sticked" to the **second horizontal measuring line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard
- The position of the **second horizontal measuring line** with respect to the **first horizontal measuring line** is indicated as $\mathbf{D_g}$

To fix the position of the **second horizontal measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard

To negate the horizontal measuring lines click on off



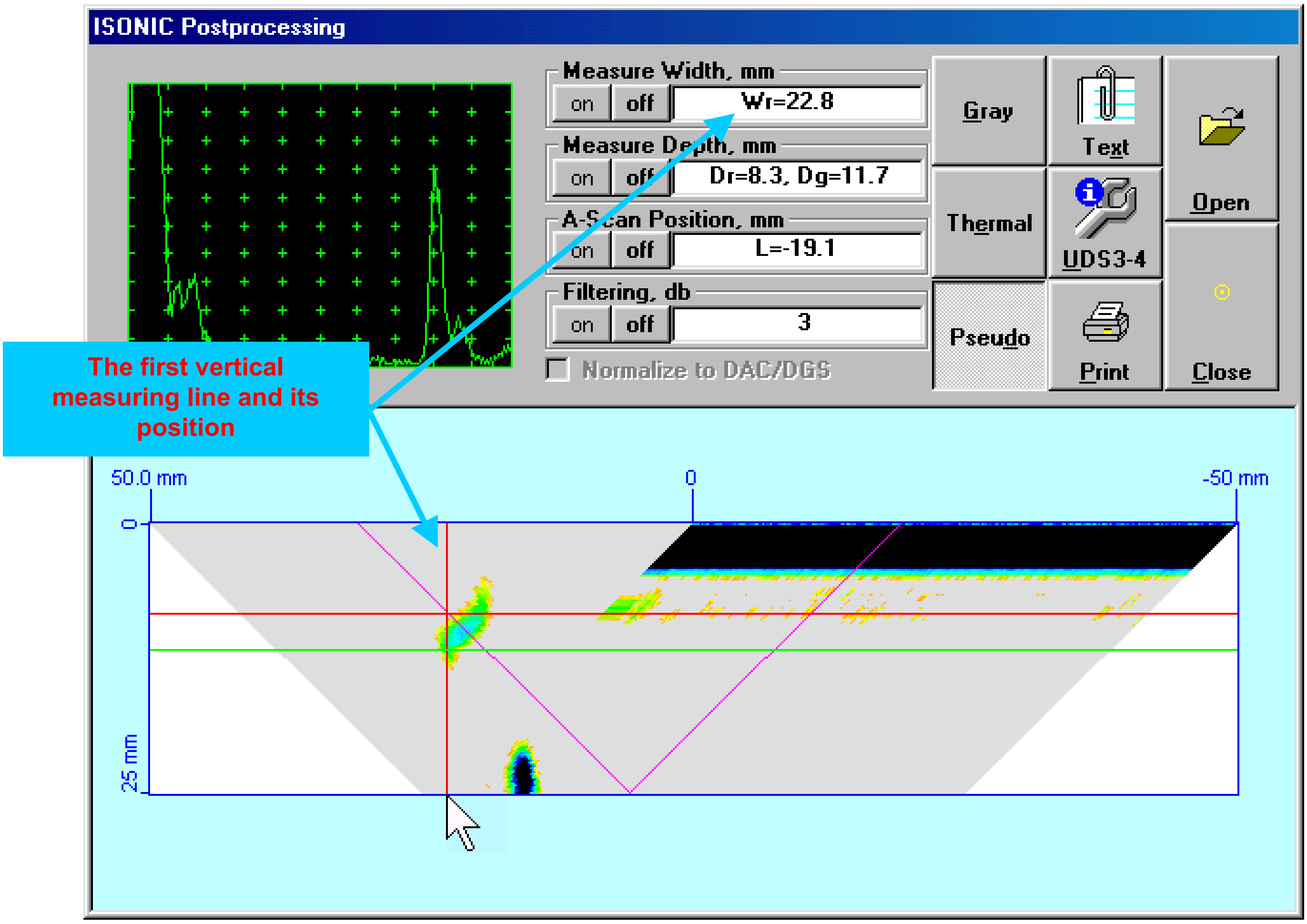
o 

- measuring defect's coordinate and width along the **t-ABIScan** (**ABIScan**) record. To proceed click on 

. As a result:

- ➢ The **first vertical measuring line** appears on the **t-ABIScan** (**ABIScan**) record; the cursor is "sticked" to the **first vertical measuring line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ←, → buttons on the keyboard
- ➢ The position of the **first vertical measuring line** is indicated as $\mathbf{W_r}$

To fix the position of the **first vertical measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard

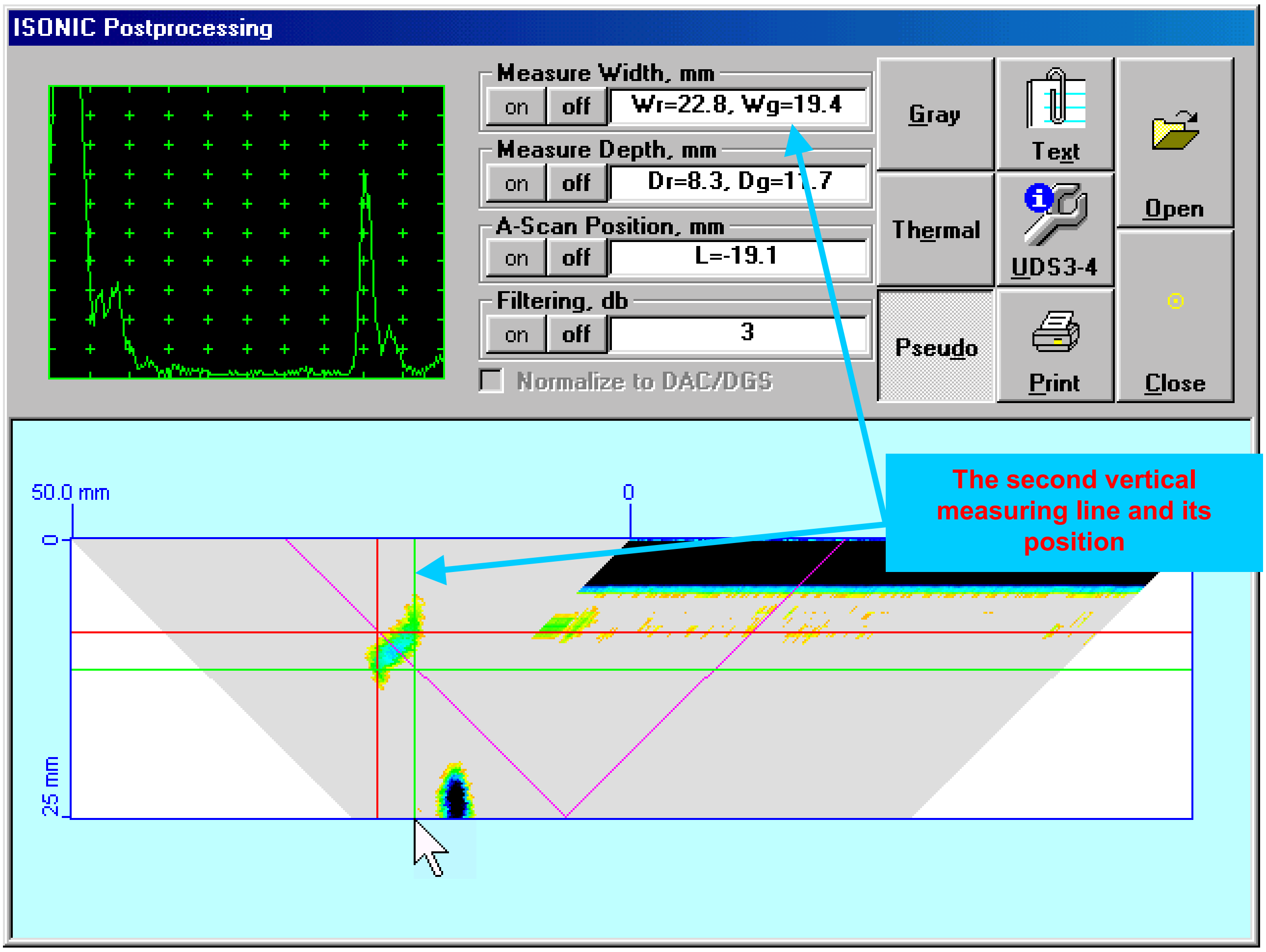


As a result:

- The **second vertical measuring line** appears on the **t-ABIScan** (**ABIScan**) record; the mouse pointer is "sticked" to the **second vertical measuring line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ←, → buttons on the keyboard
- The position of the **second vertical measuring line** with respect to the **first vertical measuring line** is indicated as $\mathbf{W_g}$

To fix the position of the **second vertical measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard

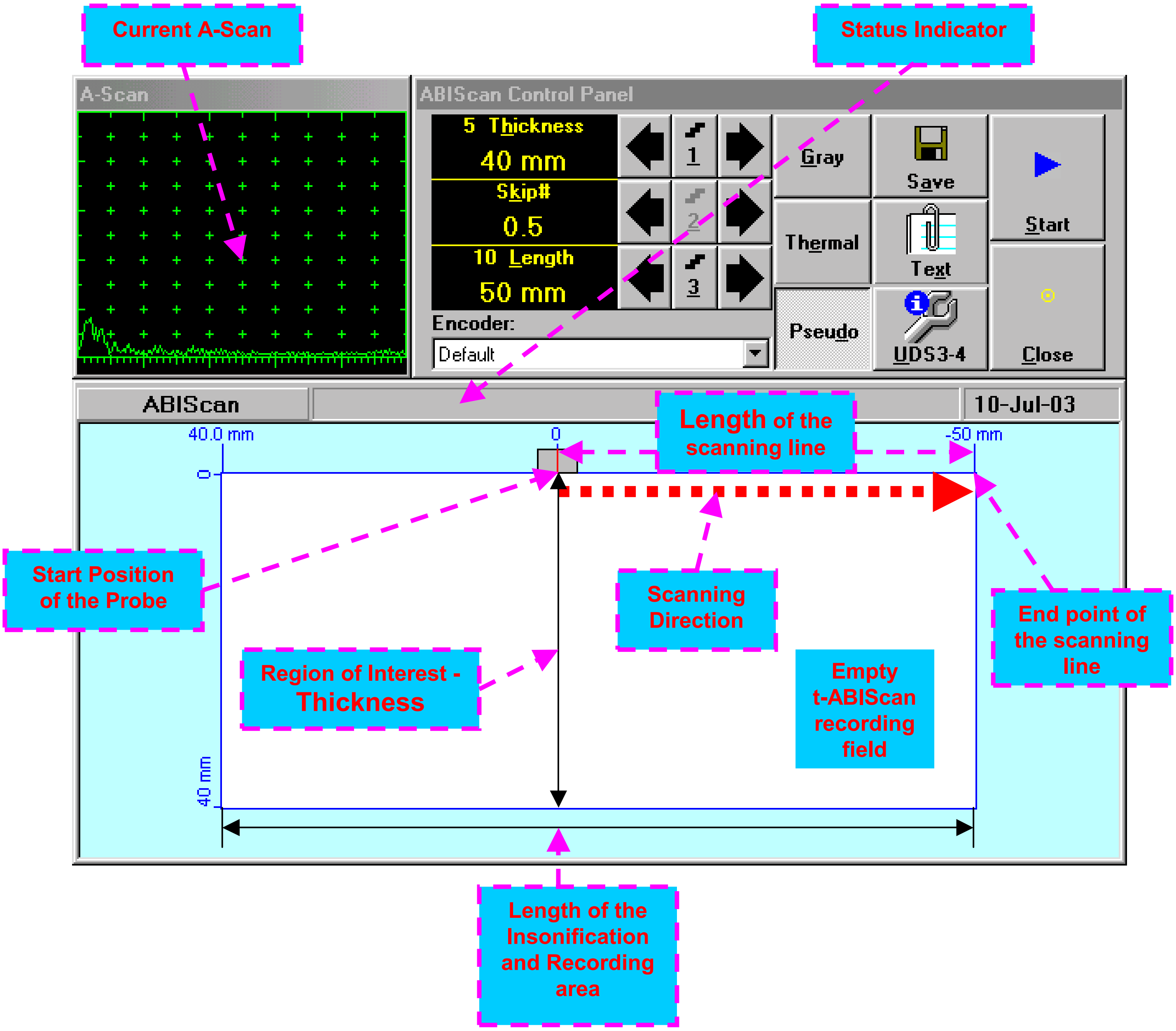
To negate the vertical measuring lines click on off



6.4.4. Encoded (true-to-scale) Imaging – ABIScan - Angle Beam Probe

The screen as below appears upon clicking on 

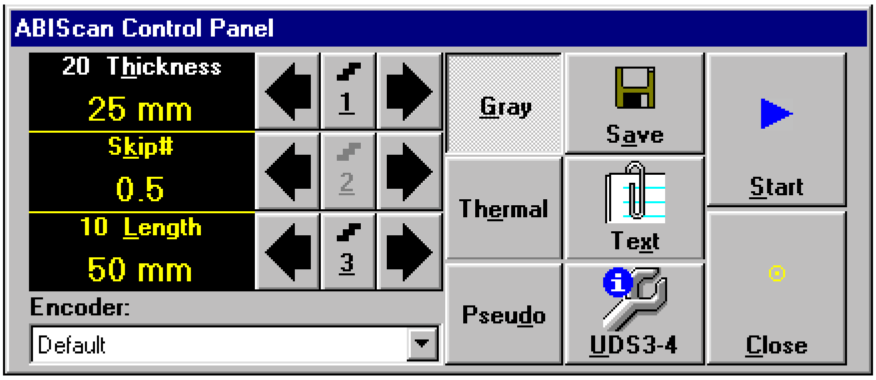
or pressing **<Alt>+<A>** on the keyboard if the **Angle** setup was **>0^{o} value** (Angle Beam Probe) in the submenu **MEASURE**



6.4.4.1. ABIScan Control Panel – Angle Beam Probe

Thickness and Skip#

The values of **Thickness** and **Skip#** define the *Region of Interest* (**ROI**) starting from the *scanning surface*. **ABIScan** imaging is provided *without using a gate* – the ***whole visible A-Scan area is recorded***. The *A-Scan Range* used for the **ABIScan** imaging – angle beam probe is defined as:



$$\textbf{Range}_{\textbf{t-ABIScan}} = \textbf{2} \bullet \textbf{Skip\#} \bullet \textbf{Thickness / Cos(Angle)}$$

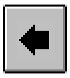
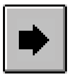
The *A-Scan Display Delay* used for the **ABIScan** imaging is defined as:

$$\textbf{Display Delay}_{\textbf{t-ABIScan}} = \textbf{Probe Delay}$$

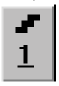
ⓘ

- The value of **Thickness** is controllable through the **ABIScan Control Panel**,
- The value of **Probe Delay** is taken from the ultrasonic flaw detector setup (submenu **MEASURE**)

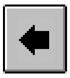
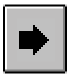
To setup the required value of **Thickness** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<H>** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Thickness** area the letter **h** is underlined)
- **Combined**
  - Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Thickness** is over the **5 … 300 mm** (or **0.2 … 12 in**) range with **1 mm** (or **0.05 in**) resolution.

The resolution is selectable through clicking on  or pressing **<Alt>+<1>** on the keyboard

To select the required value of **Skip#** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<K>** ⇒ **Skip#** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Skip#** area the letter **k** is underlined)
- **Combined**
  - Click on **Skip#** ⇒ **Skip#** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Skip#** may be either **0.5** or **1**

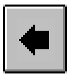
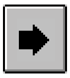
Scan Length

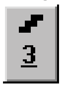
The value of **Length** (*Scan Length* or, in other words, *Scan Path*) represents the length of scanning line, over which the probe will be guided. The value of **Length** along with **Skip#** represents the length of the section of the test object to be displayed (**Length of the Insonification and Recording area**).

$$\boxed{\text{Length of the Insonification and Recording area}} = \text{Length} + 2 \bullet \text{Skip\#} \bullet \text{Thickness} / \text{Tan(Angle)}$$

Simultaneously the value of **Length**

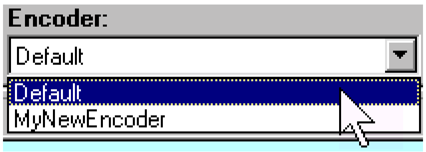
To setup the required value of **Length** the following manipulations are applicable:

- **Mouse**
  - ■ Click on the corresponding button  or 
- **Keyboard**
  - ■ Pressing **<Alt>+<L>** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (in the **Length** area the letter **L** is underlined)
- **Combined**
  - ■ Click on **Length** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of **Length** is controllable over the **50…300 mm** range (or **2…12 in**) with **1 mm** (or **0.05 in**) resolution. The resolution is selectable through clicking on  or pressing **<Alt>+<3>** on the keyboard

Encoder Selection

Select the encoder to be used and click on its name:



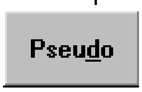
Echo Amplitude Palette (Color Scale)

The color coding of echo amplitudes is provided during the **t-ABIScan** recording over the **28 dB** range (**- 14 dB** through **+ 14 dB**; **0 dB** level corresponds to the **50% A-Scan Height**)

There are three palettes available:

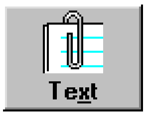
- Clicking on 

 or pressing **<Alt>+<G>** on the keyboard will activate the Gray-Level coloring of echo amplitudes
- Clicking on 

 or pressing **<Alt>+<E>** on the keyboard will activate the Thermo-Level coloring of echo amplitudes
- Clicking on 

 or pressing **<Alt>+<D>** on the keyboard will activate the Pseudocolor-Level coding of echo amplitudes

Insert Text Note

A text note/comments may be typed to accompany the **ABIScan** record after clicking on 

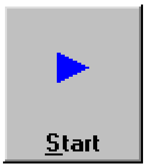
or pressing **<Alt>+<X>** on the keyboard

Preview the Instrument Settings

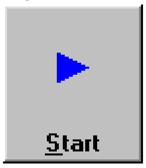
The instrument settings for the **ABIScan** record may be previewed through the clicking on 

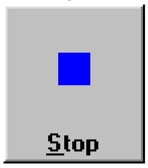
or pressing **<Alt>+<U>** on the keyboard

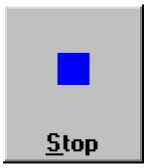
Start/Stop t-ABIScan recording

Clicking on 

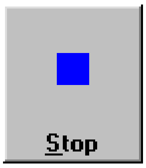
or pressing **<Alt>+<S>** on the keyboard will start the **ABIScan** recording

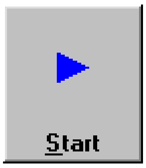
The 

button becomes invisible upon the **ABIScan** recording starts. The 

button occupies its position. Clicking on 

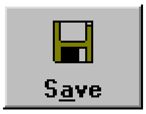
or pressing **<Alt>+<S>** on the keyboard will terminate the **ABIScan** recording prior to the completion

The 

button becomes invisible after the completion / termination of the **ABIScan** recording – the 

button returns to its position

Save the ABIScan record

Clicking on 

or pressing **<Alt>+<A>** on the keyboard will save the **ABIScan** record and accompanying instrument calibration dump and text notes / comments into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

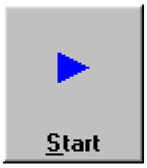
Return to the Pulser Receiver window

Clicking on 

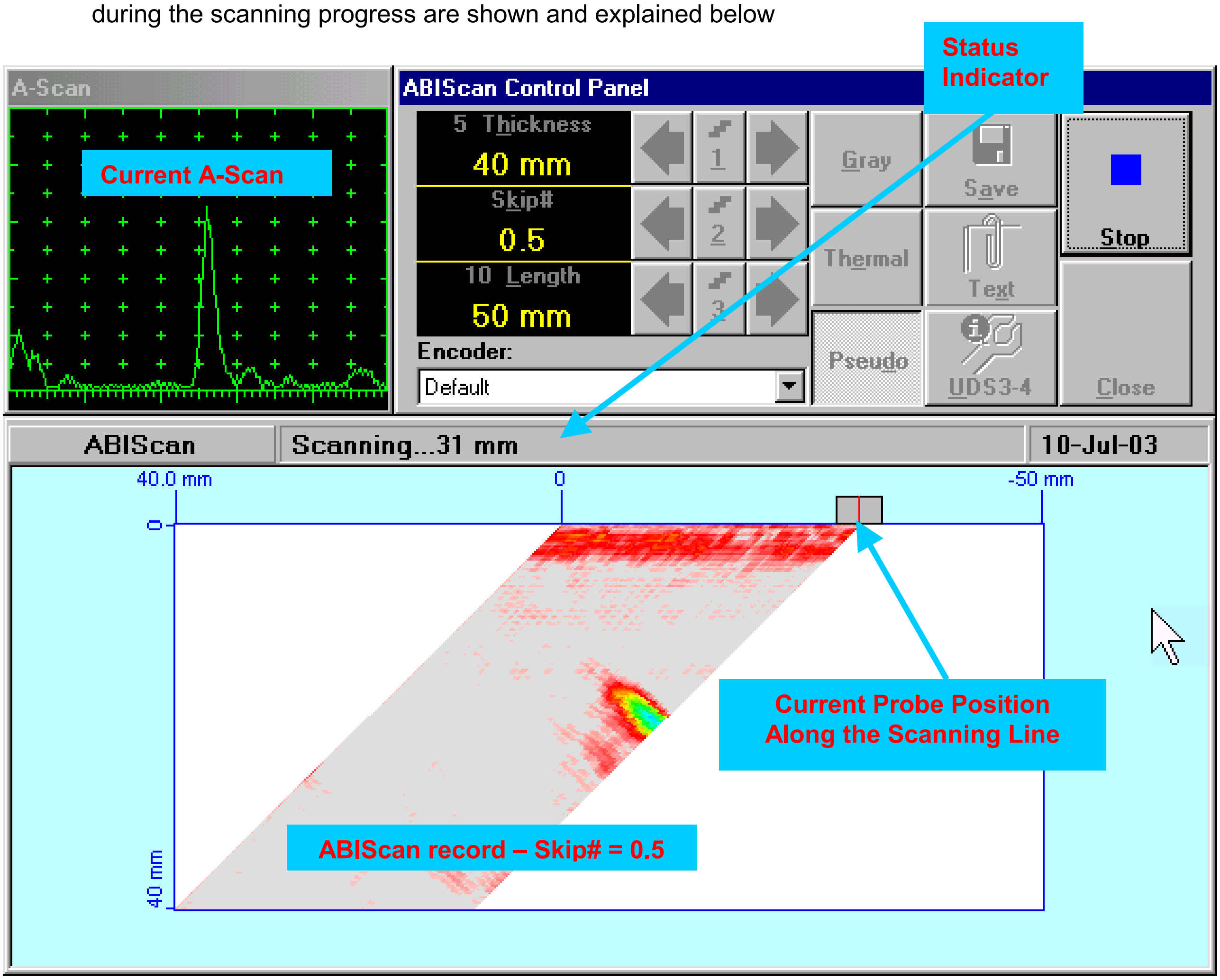
or pressing **<Alt>+<C>** or **Esc** on the keyboard will return to the Pulser / Receiver window

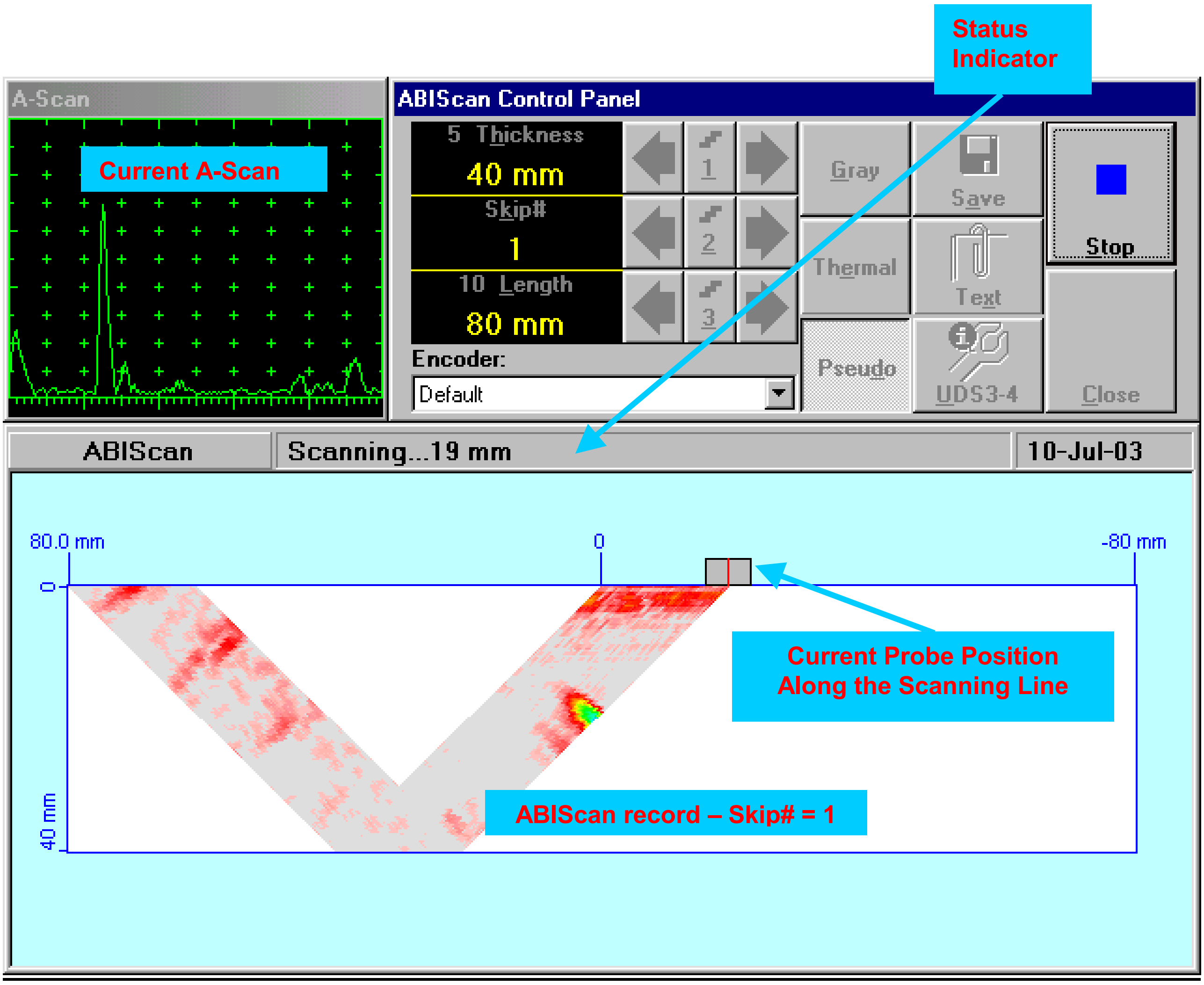
6.4.4.2. ABIScan Recording – Angle Beam Probe

To capture **ABIScan**:

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

 or press **<Alt>+<S>** on the keyboard
- Guide the probe over the scanning line – the typical displays for the **Skip# = 0.5** and **Skip# = 1** cases during the scanning progress are shown and explained below

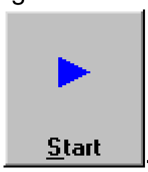




In order to ease the understanding both screenshots are taken for the scanning of the same 40 mm thick test sample with the same 45^{0} probe, said screenshots are valid for the detection of the same reflector located at 20 mm depth in the test sample

Status Indicator

Status Indicator is empty prior to and after the completing/termination of **ABIScan** recording. The 

status appears upon clicking on 

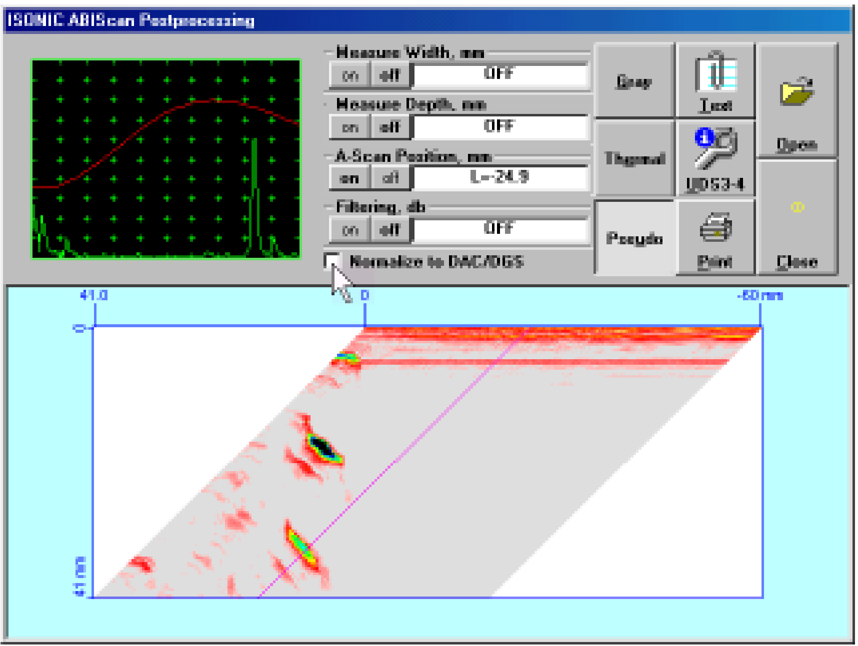
. The current probe coordinate along the scanning path is permanently updated after the **Scanning…** in the Status Indicator whilst **ABIScan** recording is in progress

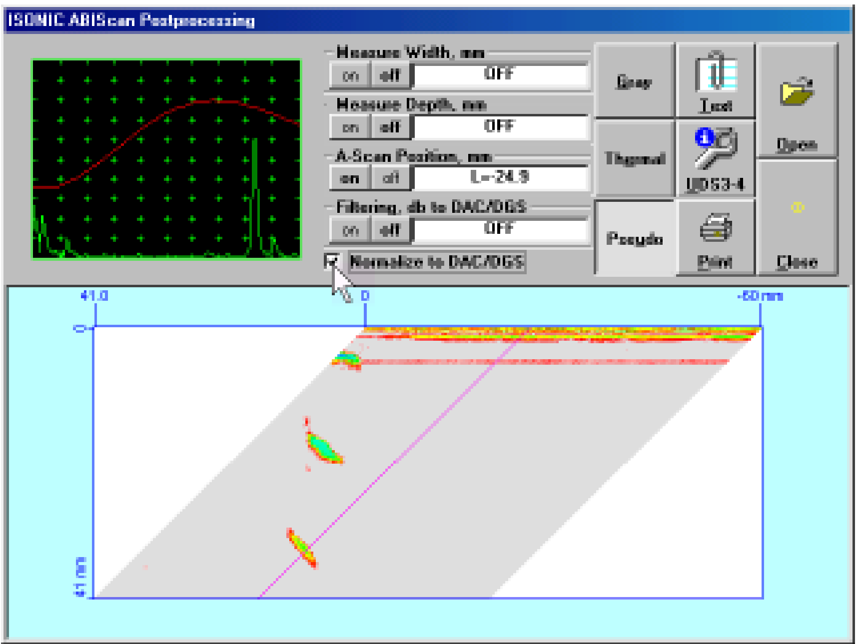
6.4.4.3. ABIScan Postprocessing – Angle Beam Probe

Refer to the paragraph 6.4.3.3 of this Operating Manual

6.4.5. DAC/DGS Normalizing of the Captured B-Scan

At the postprocessing stage the **B-Scans** captured whilst DAC/DGS active may be represented using the palette reflecting the signal amplitude either linearly (**Normalize to DAC/DGS** box is not checked) or with normalization respectively the DAC/DGS (**Normalize to DAC/DGS** box is checked). The **Normalize to DAC/DGS** checkbox is disabled for the maps captured whilst DAC/DGS inactive. The screenshots below illustrate the switching from the linear to the DAC/DGS normalized palette





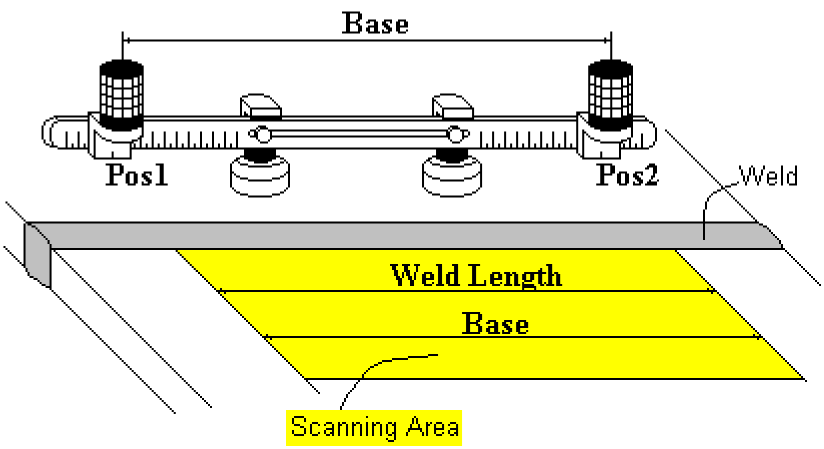
After switching to the DAC/DGS Normalized Palette the 0 dB the **Filtering** parameter is **dB to DAC**

7. Operating 'I2-ISONIC' Software Package - ISONIC Inspection of Planar Butt Joints, Scanning From One Side

The contents of this chapter is valid for the I2-SONIC SW Package version 7.1.0.5 or higher

7.1. Preparing for the Inspection

7.1.1. Fixture



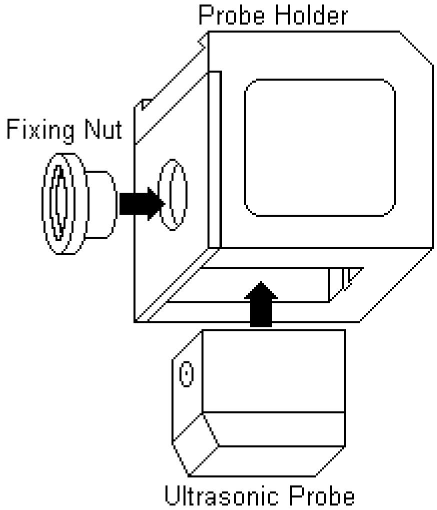
Apply the bar with the receivers of airborne ultrasound to the object under test at parallel to the weld. The distance between two receivers (**Base**) on the bar is defined as:

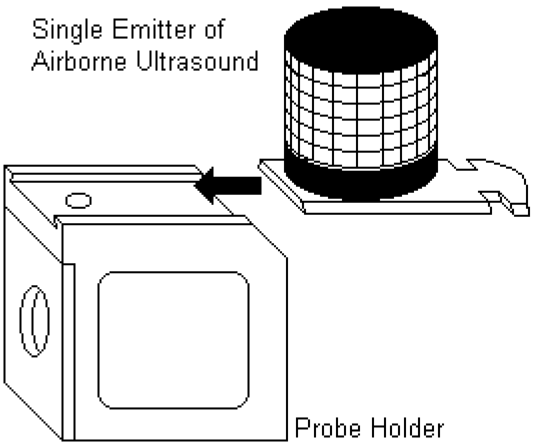
Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

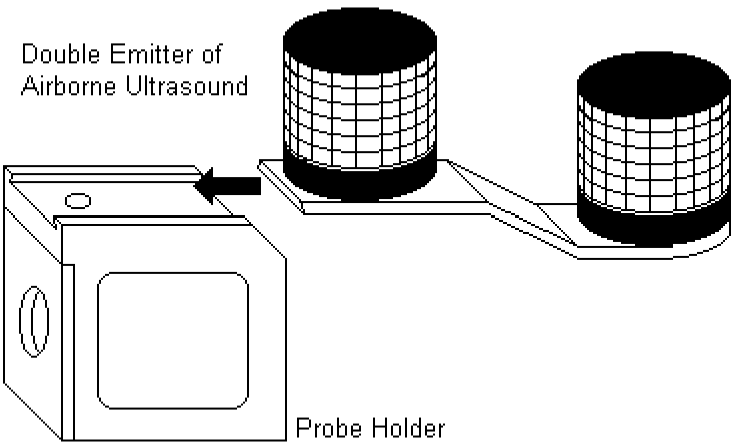
Pos1 and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly. The value of **Base** must be known prior to the scanning. Wrong determining of the **Base** causes mistakes in monitoring probe location and defects imaging

Important: The *Scanning Area* is located at the opposite side of the weld with respect to the bar position

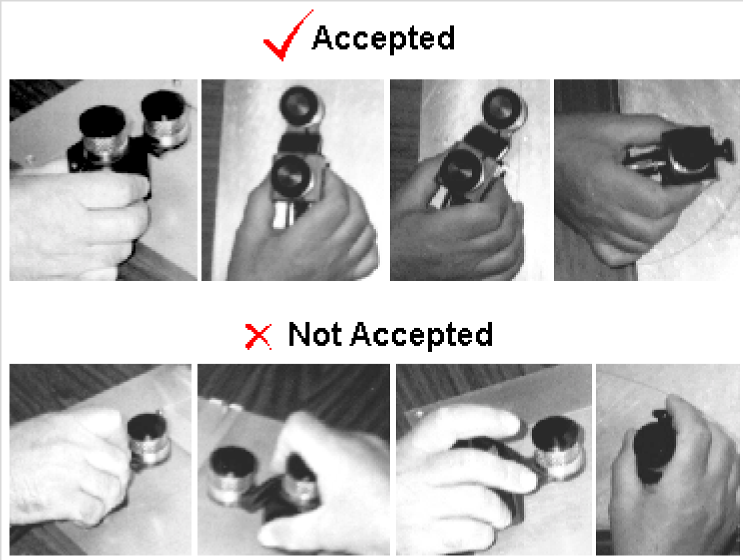
Insert ultrasonic probe into the appropriate probe holder then fix the double or single emitter of airborne ultrasound on the top of the probe holder:







Remember!

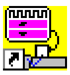


Double emitter of airborne ultrasound is required if there is a need to monitor the probe coordinates and swiveling angle simultaneously while scanning. **Single emitter** is required if there is a need to monitor the probe coordinates only

7.1.2. Cabling

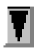
Ultrasonic Flaw Detector PC Card	Applicable Cabling Scheme	Paragraph
UDS 3-3	A.1; A.4	4.2.4
UDS 3-4	A.2; A.5	4.2.4
USLT 2000	A.3; A.6	4.2.4

7.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

7.3. Operating the software: general hints

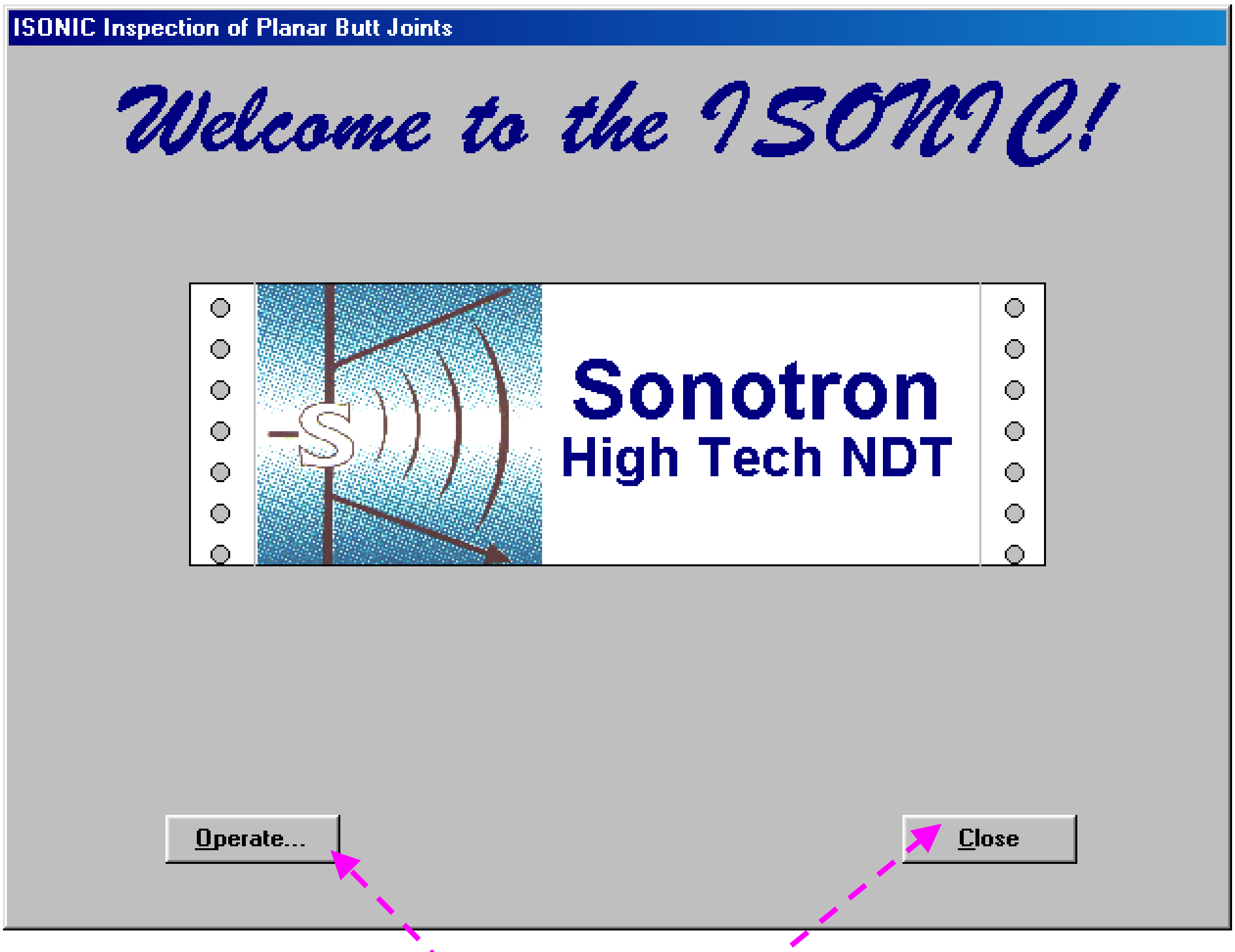
- All functions may be activated either through the mouse (trackball, touchpad, touchscreen, etc.) or keyboard manipulations or through the combining of both of them
- To activate the pseudo button click on it (left mouse button or touch screen stylus) or use the shortcut referring to the underlined letter in the button's caption by pressing **<Alt> + <underlined letter>** key on the keyboard. For example, the shortcut for Postprocessing... is **<Alt>+<P>**
- To get **On-Line Help** for some object, control, etc. right mouse click on it - the **help topic** appears
- To close the active help topic click on it or press **Esc** on the keyboard. To print help topic or copy it into the Windows clipboard right mouse click on it
- Setup for all parameters is performed through the corresponding spins . To increment the parameter's value **press and hold** left mouse button on . To decrement the parameter's value **press and hold** left mouse button on 
- Each spin  is associated with the label and display, showing the corresponding parameter's name and its value. For example the control for the **Probe Delay** looks like: 

. The parameter name **Probe Delay, µs** is normally yellow; the letter "**D**" is underlined. Pressing <**Alt>+<D**> on the keyboard or click on the **Probe Delay, µs** will change the fore color of **Probe Delay, µs** to white making it controllable through the using of the keyboard arrows:
    - pressing ↑ or → on the keyboard acts as  - button of the spin
    - pressing ← or ↓ buttons on the keyboard acts as  - button of the spin

Other tips and hints applicable for operating the software are explained additionally while describing the corresponding modes of operation

7.4. Getting started...

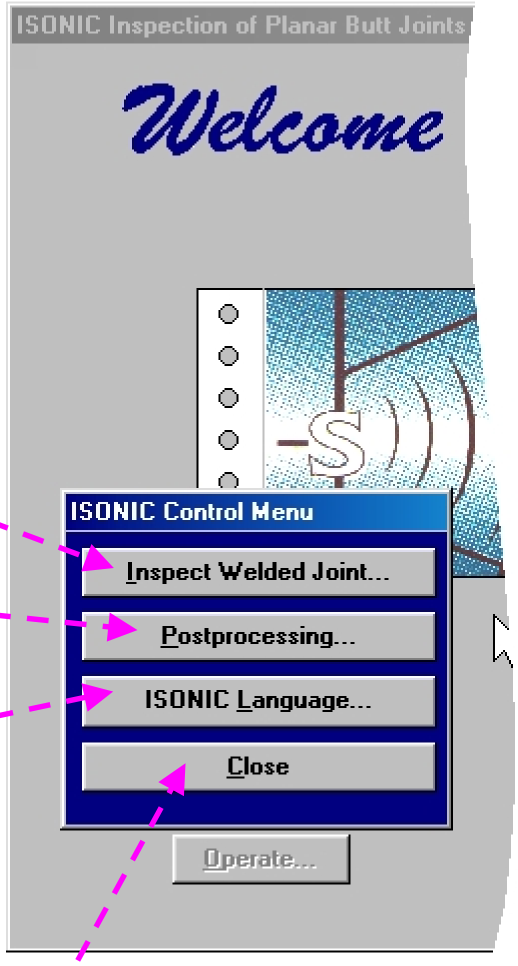
The **Welcome...** window appears after the program starts



To open **ISONIC Control Menu** click on or press
or press **<Alt>+<O>** on the keyboard

To terminate the current **ISONIC Session** click on or press **<Alt>+<C>** or **Esc** on the keyboard

7.5. ISONIC Control Menu



7.5.1. Start New Inspection Procedure

Click on or press **<Alt>+<I>** on the keyboard: - the **ISONIC Pre-Inspection Data…** window appears

7.5.2. Start Postprocessing

Click on

or press **<Alt>+<P>** on the keyboard

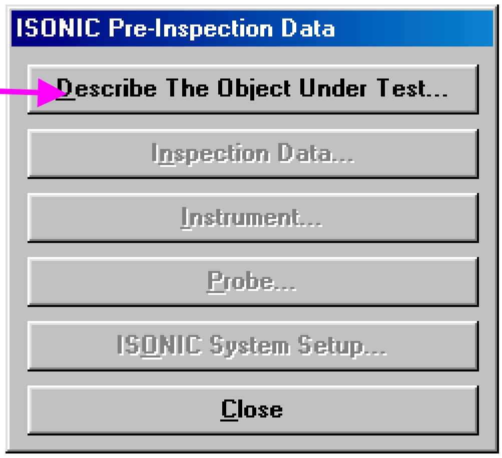
7.5.3. Set Up Language for User Interface and On-Line Help

Click on or press **<Alt>+<L>** on the keyboard

Click on this button or press **<Alt>+<C>** or **Esc** on the keyboard to close the **ISONIC Control Menu** and return to the welcome window

7.6. Pre-Inspection

7.6.1. Describe the object under test…



Left mouse click on

or press **<Alt>+<D>** on the keyboard – the **Describe the Object Under Test...** window appears: there are 12 standard items to fill, each not longer then 16 symbols. It's possible to add free-style comments to the Inspection Report, total length not more than 160 symbols. All items may be filled with some data existing from the previous session. Depending on the current need the existing data may be either applied or modified or replaced with a new data

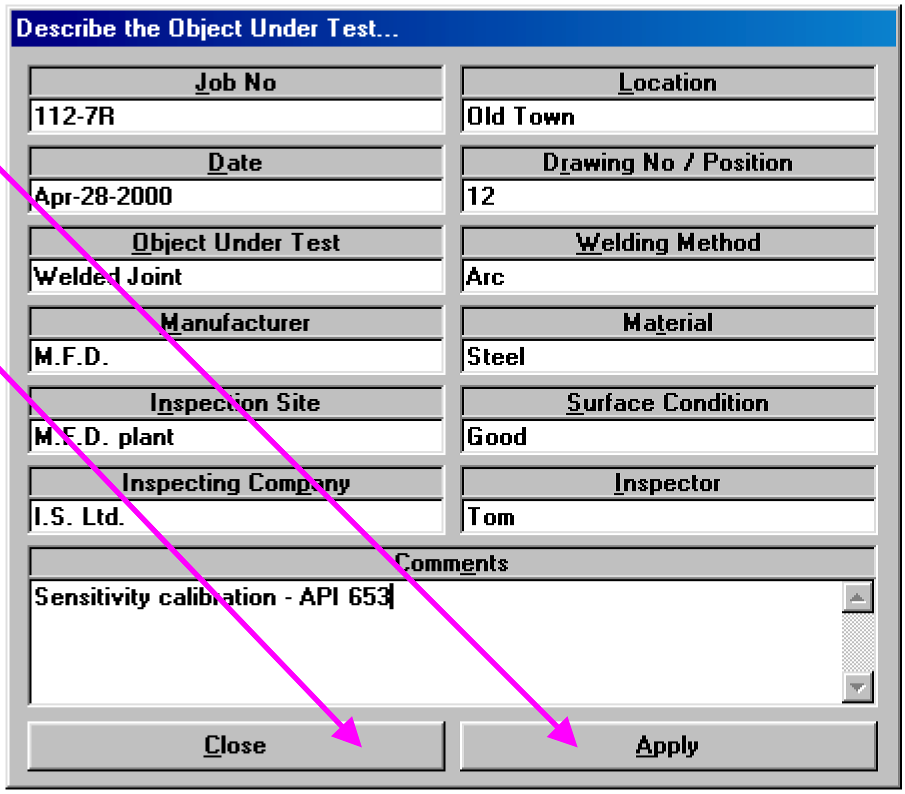
Click on

or press **<Alt>+<A>** on the keyboard upon completing

Click on

or press **<Alt>+<C>**

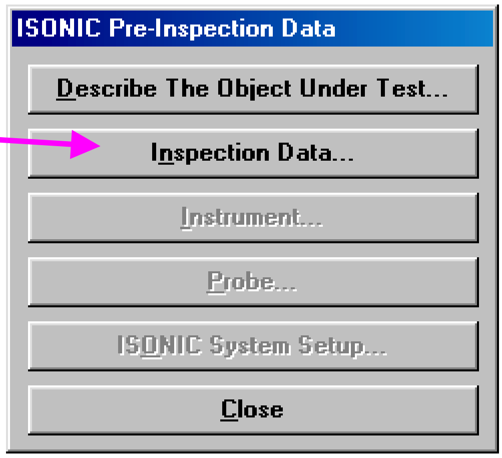
or **Esc** on the keyboard to return to the **ISONIC Pre- Inspection Data…** window



ⓘ

Return to the **ISONIC Pre-Inspection Data…** window without *applying* discards all new keying in made

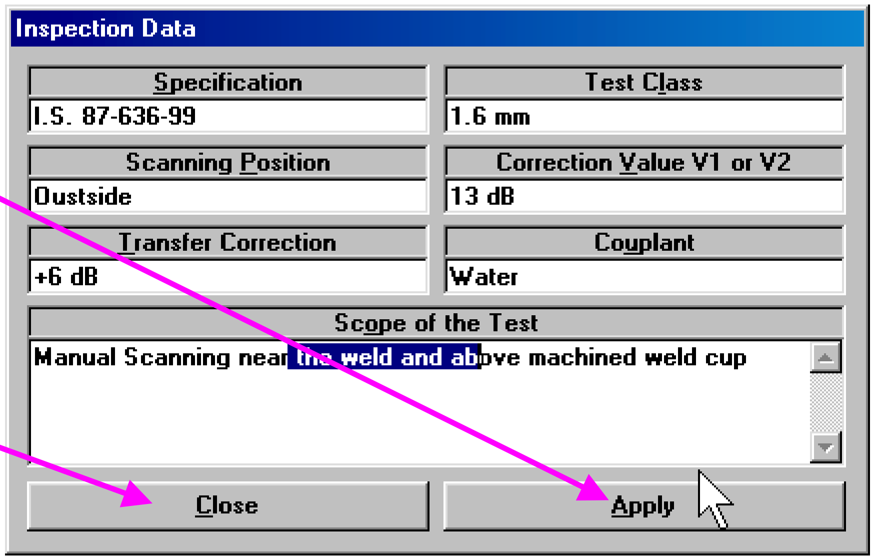
7.6.2. Inspection Data …



Click on

or press **<Alt>+<N>** on the keyboard – the corresponding window appears

There are 6 standard items to fill in the **Inspection Data**... window, each not longer then 16 symbols. It's possible to add free-style scope of the test to Inspection Report, total length not more than 160 symbols. All items may be filled with some data existing from the previous session. Depending on the current need the existing data may be either applied or modified or replaced with a new data



Click on

or press **<Alt>+<A>** on the keyboard upon completing

Click on

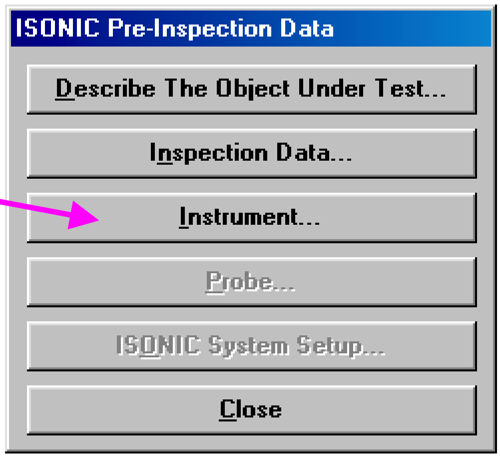
or press **<Alt>+<C>** or **Esc** on the keyboard to return to **ISONIC Pre- Inspection Data…** window

ⓘ

Return to the **ISONIC Pre-Inspection Data…** window without *applying* discards all new keying in made

7.6.3. Instrument …

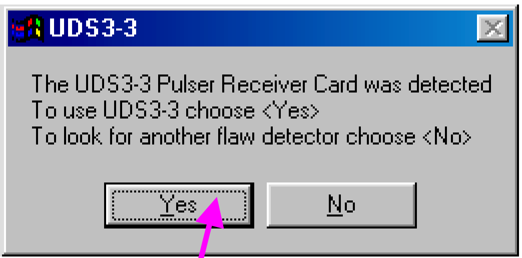
Click on



or press **<Alt>+<I>** on the keyboard

__Case 1:__ **UDS 3-3 Pulser Receiver Card – Ultrasonic Flaw Detector Inside**

ISONIC recognizes the **UDS 3-3** card automatically and the corresponding question box appears:

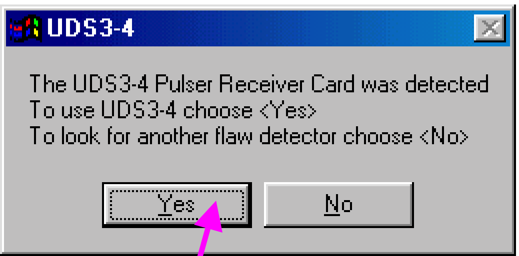


To continue click on

or press **<Alt>+<Y>** or press **Enter** on the keyboard, then the **UDS 3-3 Pulser Receiver** window appears allowing to calibrate the ultrasonic flaw detector according to the *Inspection Specs*. To proceed refer to the paragraph 5 of this Operating Manual

__Case 2:__ **UDS 3-4 Pulser Receiver Card – Ultrasonic Flaw Detector Inside**

ISONIC recognizes the **UDS 3-4** card automatically and the corresponding question box appears:

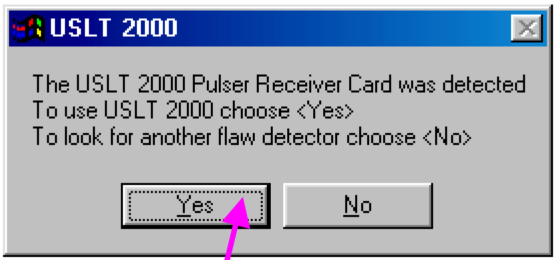


To continue click on

or press **<Alt>+<Y>** or **Enter** on the keyboard, then the **UDS 3-4 Pulser Receiver** window appears allowing to calibrate the ultrasonic flaw detector according to the *Inspection Specs*. To proceed refer to the paragraph 5 of this Operating Manual

<u>Case 3:</u> USLT 2000 Pulser Receiver Card – Ultrasonic Flaw Detector Inside

ISONIC recognizes the **USLT 2000** card automatically and the corresponding question box appears:



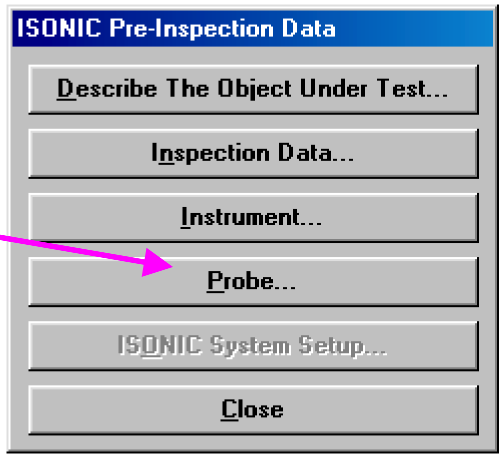
To continue click on

or press **<Alt> + <Y>** or **Enter** on the keyboard, then the **USLT 2000 Pulser Receiver** window appears allowing to calibrate ultrasonic flaw detector according to the *Inspection Specs*. To proceed refer to the paragraph 5 of this Operating Manual

7.6.4. Probe …

Click on

or press **<Alt>+<P>** on the keyboard – the corresponding window appears



- Select probe through the combo box or key in a new probe name
  - Click on

    (the list of the existing probes appears) then select probe from the list by clicking on its name: another way is to press **<Alt>+<P>** on the keyboard and then to select a probe from the list through pressing on ↑ , → , ← , ↓ buttons on the keyboard

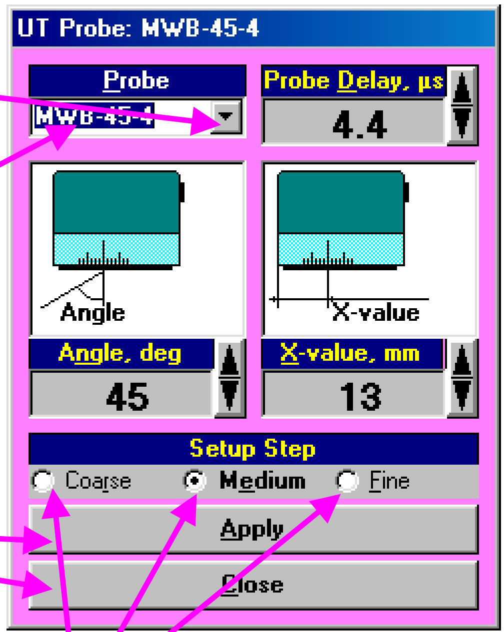
    OR

  - Key in a new probe name here (8 symbols or less)

- Ensure that values of **Probe Delay**, **Angle** and **X-Value** are relevant, otherwise provide the appropriate update then click on

  or press **<Alt>+<A>** on the keyboard then click on

  or press **Esc** or **<Alt>+<C>** on the keyboard



ⓘ

There are three degrees for **Setup Step** available for setting up the parameter's value. To select required Setup Step degree just click on it or use corresponding shortcut on the keyboard:

- o **<Alt>+<R>** for **Coarse**
- o **<Alt>+<E>** for **Medium**
- o **<Alt>+<F>** for **Fine**

Probe Delay

To setup the value of **Probe Delay** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<D>** ⇒ **Probe Delay** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Probe Delay** area letter **D** is underlined)

- **Combined**

  - Click on **Probe Delay** ⇒ **Probe Delay** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

    *The value of **Probe Delay** is set in **µs***
    *The possible values of increment / decrement for **Probe Delay** are:*
    *0.1 **µs** - Fine*
    *0.5 **µs** - Medium*
    *1.0 **µs** - Coarse*

Angle

To setup the value of **Angle** the following manipulations are applicable:

- **Mouse**

  - Click on the corresponding spin 

- **Keyboard**

  - Pressing **<Alt>+<N>** ⇒ **Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Angle** area letter **N** is underlined)

- **Combined**

  - Click on **Angle** ⇒ **Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

    *The value for the **Probe Angle** is set in **degrees***
    *The possible values of increment / decrement for **Probe Angle** are:*
    *1 **deg** - Fine*
    *5 **deg** - Medium*
    *10 **deg** - Coarse*

X-Value

To setup or update the **X-Value** the following manipulations are applicable:

- **Mouse**

  - Click on the corresponding spin 

- **Keyboard**

  - Pressing **<Alt>+<X>** ⇒ **X-Value** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **X-Value** area letter **X** is underlined)

- **Combined**

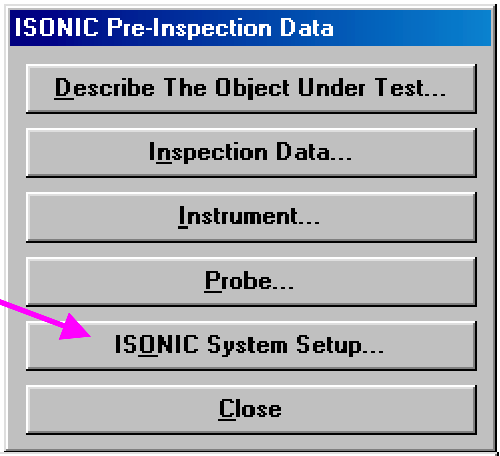
  - Click on **X-Value** ⇒ **X-Value** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

    *The **X-value** is set in **mm** or **in***
    *The possible values of increment / decrement for the **X-value** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.04 in*
Medium	*2 mm*	*0.08 in*
Coarse	*10 mm*	*0.4 in*

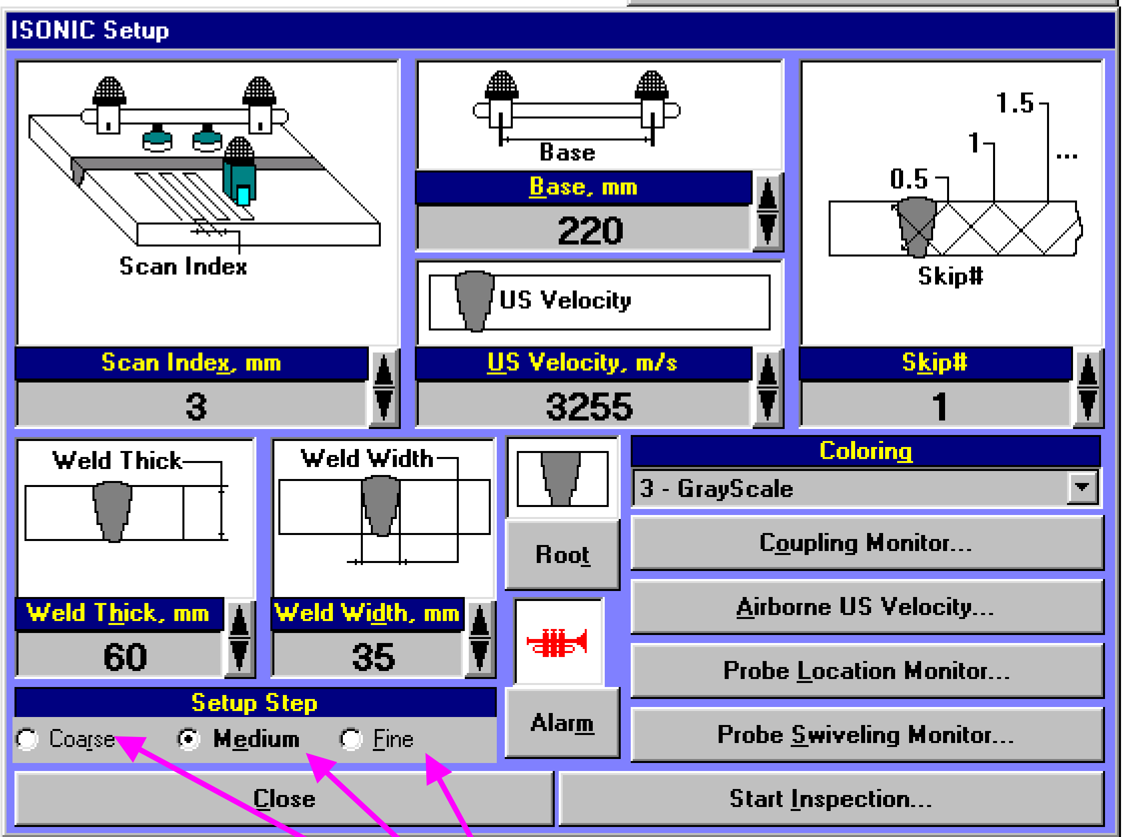
7.6.5. ISONIC System Setup …

Click on



or press **<Alt>+<O>** on the keyboard to start **ISONIC Setup** window. The following observations to be performed in / from the **ISONIC Setup** window:

- setting up *Static Parameters and Modes*
- setting up *Dynamic Parameters and Modes*
- start of the *Inspection (Scanning)*



Setup Static Parameters and Modes

There are three degrees for the **Setup Step** available for the setting up the value of each parameter. To select the required degree click on its name or use the corresponding keyboard shortcuts:

- o **<Alt>+<R>** for **Coarse**
- o **<Alt>+<E>** for **Medium**
- o **<Alt>+<F>** for **Fine**

To return back to the **ISONIC Pre-Inspection…** window click on Close or press **<Alt>+<C>** or **Esc** on the keyboard

Scan Index

To setup the value of **Scan Index** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<X>** ⇒ **Scan Index** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Scan Index** area letter **x** is underlined)
- **Combined**
  - Click on **Scan Index** ⇒ **Scan Index** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

    *The value for the **Scan Index** is set in **mm** or **in***
    *The possible values of increment / decrement for **Scan Index** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*2 mm*	*0.1 in*
Coarse	*5 mm*	*0.5 in*

Base

To setup the value of **Base** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<B>** ⇒ **Base** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Base** area letter **B** is underlined)
- **Combined**
  - Click on **Base** ⇒ **Base** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

    *The value for the **Base** is set in **mm** or **in***
    *The possible values of increment / decrement for **Base** are:*

Resolution	Metric	Imperial
Fine	*2 mm*	*0.25 in*
Medium	*10 mm*	*0.5 in*
Coarse	*100 mm*	*1 in*

US Velocity

To setup the value of **US Velocity** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin
- **Keyboard**
  - Pressing **<Alt>+<U>** ⇒ **US Velocity** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **US Velocity** area letter **U** is underlined)
- **Combined**
  - Click on **US Velocity** ⇒ **US Velocity** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

  *The value for the **US Velocity** is set in **m/s** or **in/ms***
  *The possible values of increment / decrement for **US Velocity** are:*

Resolution	Metric	Imperial
Fine	*5 m/s*	*0.1 in/ms*
Medium	*100 m/s*	*1 in/ms*
Coarse	*500 m/s*	*10 in/ms*

ⓘ

Typically the *shear wave* angle beam probes are used for the inspection of welds made of low carbon steel. For the inspection of austenitic welds the *longitudinal wave* angle beam probe are applicable. The value of **US Velocity** must be setup accordingly

Skip#

To setup the value of **Skip#** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin
- **Keyboard**
  - Pressing **<Alt>+<K>** ⇒ **Skip#** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Skip#** area letter **k** is underlined)
- **Combined**
  - Click on **Skip#** ⇒ **Skip#** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

ⓘ

For the inspection of austenitic welds the longitudinal wave angle beam probe are applicable. The value of **Skip#** for such probes must be setup to **0.5**

Weld Thick

To setup the value of **Weld Thick** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard shortcuts**
  - Pressing **<Alt>+<H>** ⇒ **Weld Thick** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Weld Thick** area letter **h** is underlined)
- **Combined**
  - Click on **Weld Thick** ⇒ **Weld Thick** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **Weld Thick** is set in **mm** or **in***
*The possible values of increment / decrement for **Weld Thick** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*2 mm*	*0.2 in*
Coarse	*5 mm*	*1 in*

ⓘ
Weld Thick setup – dependence of Nominal Material Thickness (**NMT**)

Nominal Weld Thickness **NMT**	Typical Probe Angle	Possible value of the **Skip#**	**Weld Thick** setup	Note
5 to **30 mm** **0.2** to **1.2 in**	**70°**	**0.5, 1** and more	**Weld Thick = NMT**	Insonification of the whole volume of the weld
30 to **60 mm** **1.2** to **2.4 in**	**60°**	**0.5** and **1**	**Weld Thick = NMT**	Insonification of the whole volume of the weld
≥ **60 mm** ≥ **2.4 in**	**45°**	**0.5** and **1**	**Weld Thick = NMT**	Insonification of the whole volume of the weld
≥ **60 mm** ≥ **2.4 in**	**60°**	**0.5** only	**Weld Thick = ULT**	Insonification of the **Upper Layer** (closest to the scanning surface) of the weld only. The thickness of the said layer - **ULT** is to be defined as the **Weld Thick** in order to provide the better resolution and the optimized scanning pattern
≥ **60 mm** ≥ **2.4 in**	**70°**	**0.5** only	**Weld Thick = ULT**	Insonification of the **Upper Layer** (closest to the scanning surface) of the weld only. The thickness of the said layer - **ULT** is to be defined as the **Weld Thick** in order to provide the better resolution and the optimized scanning pattern

Weld Width

To setup the value of **Weld Width** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<D>** ⇒ **Weld Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Weld Width** area letter **d** is underlined)
- **Combined**
  - Click on **Weld Width** ⇒ **Weld Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

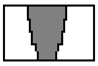
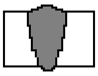
*The value for the **Weld Width** is set in **mm** or **in***
*The possible values of increment / decrement for **Weld Width** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*2 mm*	*0.2 in*
Coarse	*5 mm*	*1 in*

Suppression of the Echoes Caused by Weld Geometry

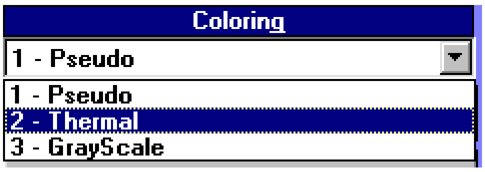
Click on 

or press **<Alt>+<T>** on the keyboard to enable / disable the mode of operation providing suppression of echoes caused by the weld geometry, for example, signals caused by the reflections from the weld enforcements. The corresponding indication is provided:

-  - Suppression of echoes caused by the weld geometry is ON
-  - Suppression of echoes caused by the weld geometry is OFF

Coloring (palette)

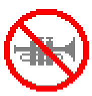
To select the color scale (palette) for flaw imaging mouse-operate the combo box under **Coloring** label or press **<Alt>+<G>** and use ↑ , ↓ keys on the keyboard:



Audible alarm of missing coupling

Click on 

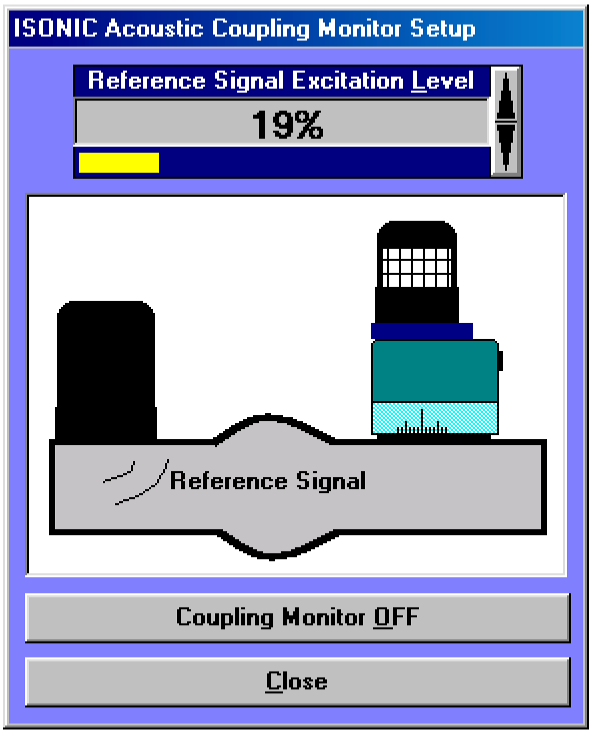
or press **<Alt>+<M>** on the keyboard to enable / disable the audible alarm when missing the coupling. The corresponding indication is provided:

-  - The audible alarm is ON
-  - The audible alarm is OFF

Setup Dynamic Parameters and Modes

Coupling Monitor

Click on **Coupling Monitor...** or press **<Alt>+<O>** on the keyboard to open the **ISONIC Acoustic Coupling Monitor Setup** window.



To setup the value of **Reference Signal Excitation Level** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **Reference Signal Excitation Level** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Reference Signal Excitation Level** area letter **L** is underlined)
- **Combined**
  - Click on **Reference Signal Excitation Level** ⇒ **Reference Signal Excitation Level** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

To setup coupling monitor proceed as below:

- apply the emitter of reference signal and the probe inside the probe holder equipped with emitter(s) of airborne ultrasound to the object under test using excessive quantity of couplant as it is shown in the window
- find the threshold of Reference Signal Excitation Level, which is indicated trough the audible alarm if active and changing color of the Reference Signal Excitation Level horizontal bar indicator (red color means not sufficient coupling or still low level of excitation)
- add 3% to 7% to the found threshold of Reference Signal Excitation Level

ⓘ

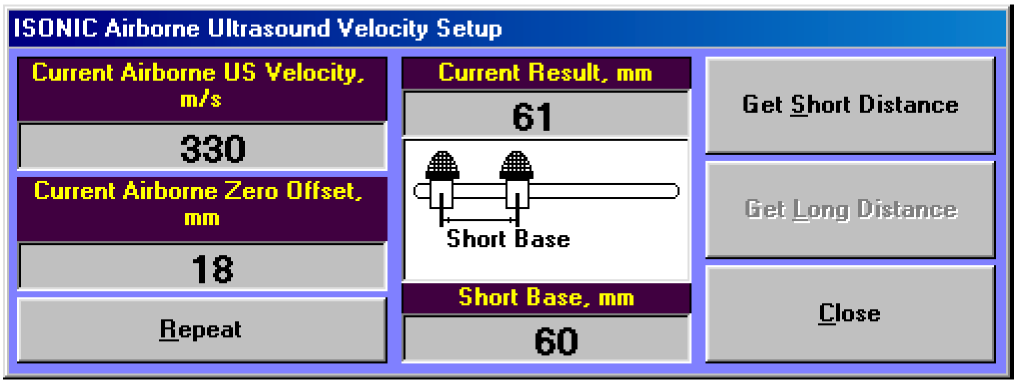
Sometime the dimensions of the object under test and its surface conditions don't allow reaching sufficient coupling indication even if the value of *Reference Signal Excitation Level* is set to 100%. If this is a case two or more emitters of reference signal must be connected to **Out Cpl** socket of **ISONIC** via special splitter (order code **SE 20220**)

To switch the coupling monitor **OFF** set the **Reference Signal Excitation Level** to 0% or click on **Coupling Monitor OFF** or press **<Alt>+<O>** on the keyboard

To return back to the **ISONIC Setup** window click on **Close** or press **<Alt>+<C>** or **Esc** on the keyboard

Airborne Ultrasound Velocity

Click on [Airborne US Velocity...] or press **<Alt>+<A>** on the keyboard to open the **ISONIC Airborne Ultrasound Velocity Setup** window



To find and setup the actual values of **Airborne US Velocity** and **Zero Offset** proceed as below:

- Connect the first receiver of airborne ultrasound to the **IN X** socket of long cable box
- Connect the second receiver of airborne ultrasound to the **OUT Coor** socket of probe cable
- Place the receivers on the left or right side of the bar at the distance of **60** *mm* or **2.5** *in* (**Short Base**)
- Click on [Get Short Distance] or press **<Alt>+<S>** on the keyboard
- Place the receivers on the left or right side of the bar at the distance of **120** *mm* or **5** *in* (**Long Base**)
- Click on [Get Long Distance] or press **<Alt>+<L>** on the keyboard – this causes the automatic recalculation indication and setup of the new values for **Airborne US Velocity** and **Zero Offset**

To restart the described procedure click on [Repeat] or press **<Alt>+<R>** on the keyboard

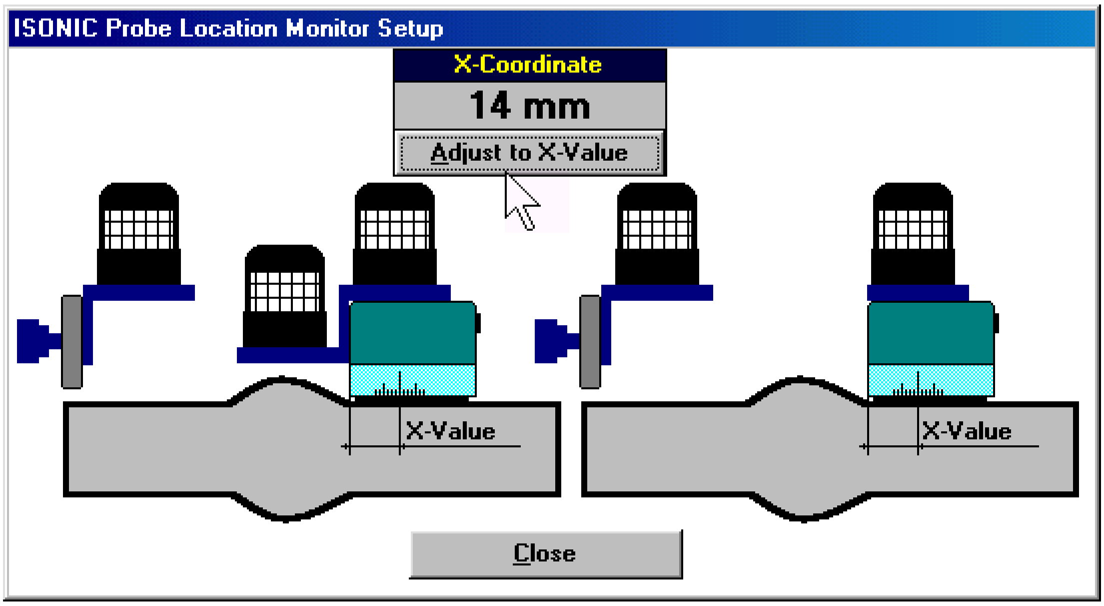
To return back to the **ISONIC Setup** window click on [Close] or press **<Alt>+<C>** or **Esc** on the keyboard

ⓘ

Perform the *Airborne US Velocity Setup* at the beginning of the working shift and repeat it only in case of 10^{o}C change of the ambient temperature entire the working shift

Referring Probe Location Monitor to the Weld Position

Click on Probe Location Monitor... or press **<Alt>+<L>** on the keyboard to open the **ISONIC Probe Location Monitor Setup** window



Apply the probe inside the probe holder equipped with emitter(s) of airborne ultrasound to the object under test as it is illustrated in the window and click on Adjust to X-Value or press **<Alt>+<A>** on the keyboard

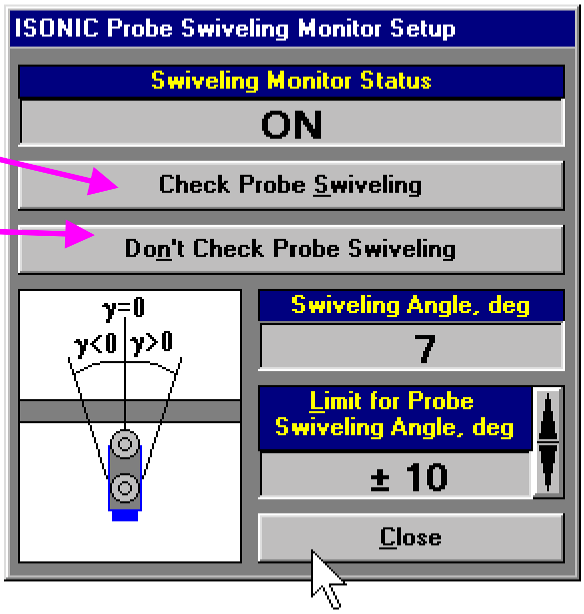
To return back to **ISONIC Setup** window click on Close or press **<Alt>+<C>** or **Esc** on the keyboard

ⓘ

The described procedure also relates to the machined welds

Probe Swiveling Monitor Setup

Click on **Probe Swiveling Monitor...** or press **<Alt>+<S>** on the keyboard to open the **ISONIC Probe Swiveling Monitor Setup** window



Click on or press **<Alt>+<S>** on the keyboard to switch *Probe Swiveling Monitor* ON

Click on or press **<Alt>+<N>** on the keyboard to switch *Probe Swiveling Monitor* OFF

To setup the value of the **Limit for Probe Swiveling Angle** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Press **<Alt>+<L>** ⇒ **Limit for Probe Swiveling Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Limit for Probe Swiveling Angle** area letter **L** is underlined)
- **Combined**
  - Click on **Limit for Probe Swiveling Angle** ⇒ **Limit for Probe Swiveling Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

To return back to the **ISONIC Setup** window click on **Close** or press **<Alt>+<C>** or **Esc** on the keyboard

ⓘ

Probe Swiveling Monitor must be switched OFF if using single emitter of airborne ultrasound

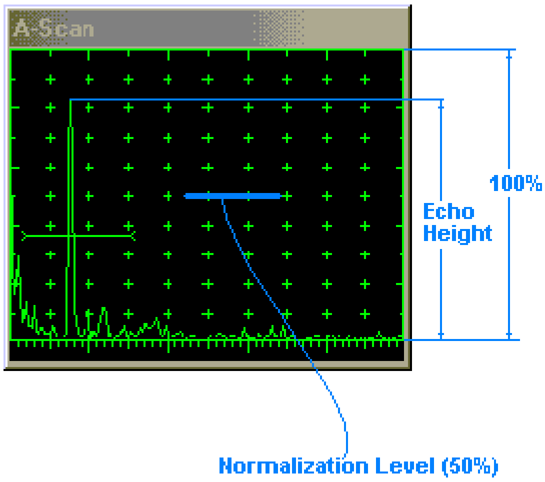
Echo Amplitude Color Coding Protocol

While scanning each echo amplitude is represented by the corresponding color of the appropriate segment of flaw image in 2 dB steps over 24 dB range

The following protocols for the color coding of echo amplitude may be used:

- ***Standard Level Linear Normalizing*** – the echo amplitude is normalized with respect to the 50% of A-Scan Height. Normalization law is:

$$Color\_Index = 6 + Int\left[\frac{1}{2}\times\left(20\times Log_{10}\frac{Echo\_Height,\%}{50\%}\right)\right]$$

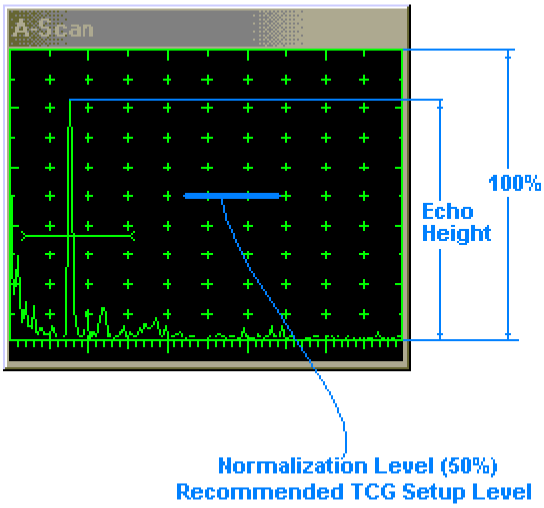


According to the above normalization law there are 13 colors having index from 0 to 12, each color covers echo variations over 2 dB sub-range:

Color Index	Echo Height (EH) in % of the A-Scan Screen Height	Color / dB
0	EH ≤ 12.5 %	- 12
1	12.5 % < EH ≤ 15.8 %	- 10
2	15.8 % < EH ≤ 19.9 %	- 8
3	19.9 % < EH ≤ 25.0 %	- 6
4	25.0 % < EH ≤ 31.5 %	- 4
5	31.5 % < EH ≤ 39.7 %	- 2
6	39.7 % < EH ≤ 50.0 %	0
7	50.0 % < EH ≤ 62.9 %	2
8	62.9 % < EH ≤ 79.2 %	4
9	79.2 % < EH ≤ 100.0 %	6
10	100.0 % < EH ≤ 125.6 %	8
11	125.6 % < EH ≤ 158.1 %	10
12	158.1 % < EH	12

- ***Standard Level TCG Normalizing*** – the echo amplitude is normalized with respect to the 50% of A-Scan Height while TCG is active. Normalization law is:

$$Color\_Index = 6 + Int\left[\frac{1}{2}\times\left(20\times Log_{10}\frac{Echo\_Height,\%}{50\%}\right)\right]$$



According to the above normalization law there are 13 colors having index from 0 to 12, each color covers echo variations over 2 dB sub-range:

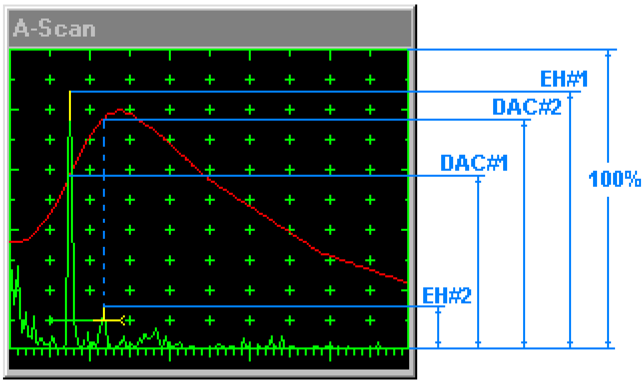
Color Index	Echo Height (EH) in % of the A-Scan Screen Height	Color / dB
0	EH ≤ 12.5 %	- 12
1	12.5 % < EH ≤ 15.8 %	- 10
2	15.8 % < EH ≤ 19.9 %	- 8
3	19.9 % < EH ≤ 25.0 %	- 6
4	25.0 % < EH ≤ 31.5 %	- 4
5	31.5 % < EH ≤ 39.7 %	- 2
6	39.7 % < EH ≤ 50.0 %	0
7	50.0 % < EH ≤ 62.9 %	2
8	62.9 % < EH ≤ 79.2 %	4
9	79.2 % < EH ≤ 100.0 %	6
10	100.0 % < EH ≤ 125.6 %	8
11	125.6 % < EH ≤ 158.1 %	10
12	158.1 % < EH	12

ⓘ

- TCG mode must be active
- It's recommended to provide TCG setup at the 50% of the A-Scan Screen Height

- ***DAC Normalizing*** – the echo amplitude is normalized with respect to the corresponding DAC level. Normalization law is:

$$Color\_Index = 6 + Int\left[\frac{1}{2} \times \left(20 \times Log_{10}\frac{Echo\_Height,\%}{DAC\_Level,\%}\right)\right]$$



EH#1 - Echo Height # 1
DAC#1 - DAC Level Corresponding to the Echo # 1
EH#2 - Echo Height # 2
DAC#2 - DAC Level Corresponding to the Echo # 2

According to the above normalization law there are 13 colors having index from 0 to 12, each color covers echo variations over 2 dB sub-range:

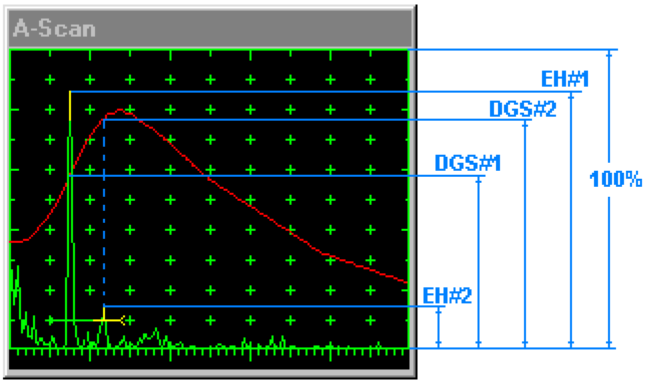
Color Index	Echo Height (EH) with respect to the Corresponding DAC Level	Color / dB
0	EH/DAC ≤ 0.250	- 12
1	0.250 < EH/DAC ≤ 0.316	- 10
2	0.316 < EH/DAC ≤ 0.398	- 8
3	0.398 < EH/DAC ≤ 0.500	- 6
4	0.500 < EH/DAC ≤ 0.630	- 4
5	0.630 < EH/DAC ≤ 0.794	- 2
6	0.794 < EH/DAC ≤ 1.000	0
7	1.000 < EH/DAC ≤ 1.258	2
8	1.258 < EH/DAC ≤ 1.584	4
9	1.584 < EH/DAC ≤ 2.000	6
10	2.000 < EH/DAC ≤ 2.512	8
11	2.512 < EH/DAC ≤ 3.162	10
12	3.162 < EH/DAC	12

ⓘ

The DAC normalizing is supported by hardware configurations based on the internal flaw detector PC card either UDS 3-3 or UDS 3-4 or USLT 2000. It may not be implemented if using the external ultrasonic flaw detector

- ***DGS Normalizing*** – the echo amplitude is normalized with respect to the corresponding DGS level. Normalization law is:

$$Color\_Index = 6 + Int\left[\frac{1}{2} \times \left(20 \times Log_{10}\frac{Echo\_Height,\%}{DGS\_Level,\%}\right)\right]$$



EH#1 - Echo Height # 1
DGS#1 - DGS Level Corresponding to the Echo # 1
EH#2 - Echo Height # 2
DGS#2 - DGS Level Corresponding to the Echo # 2

According to the above normalization law there are 13 colors having index from 0 to 12, each color covers echo variations over 2 dB sub-range:

Color Index	Echo Height (EH) with respect to the Corresponding DGS Level	Color / dB
0	EH/DGS ≤ 0.250	- 12
1	0.250 < EH/DGS ≤ 0.316	- 10
2	0.316 < EH/DGS ≤ 0.398	- 8
3	0.398 < EH/DGS ≤ 0.500	- 6
4	0.500 < EH/DGS ≤ 0.630	- 4
5	0.630 < EH/DGS ≤ 0.794	- 2
6	0.794 < EH/DGS ≤ 1.000	0
7	1.000 < EH/DGS ≤ 1.258	2
8	1.258 < EH/DGS ≤ 1.584	4
9	1.584 < EH/DGS ≤ 2.000	6
10	2.000 < EH/DGS ≤ 2.512	8
11	2.512 < EH/DGS ≤ 3.162	10
12	3.162 < EH/DGS	12

ⓘ

The DGS normalizing is supported by hardware configurations based on the internal flaw detector PC card either UDS 3-3 or UDS 3-4 or USLT 2000. It may not be implemented if using the external ultrasonic flaw detector

Follow the table below to select the required *Echo Amplitude Color Coding Protocol*

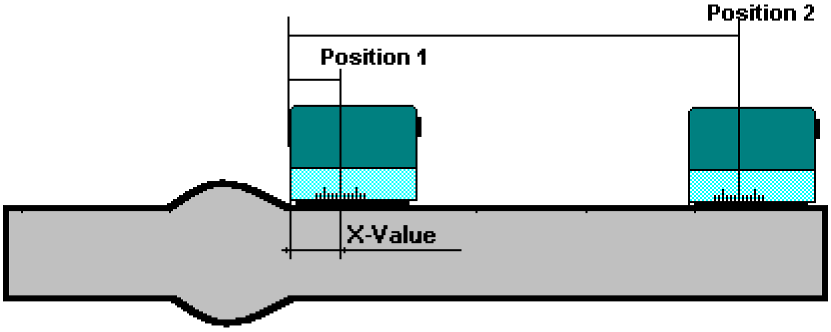
Echo Amplitude Color Coding Protocol	What is necessary
DGS Normalizing	o Internal flaw detector PC card UDS3-3 or UDS3-4 or USLT 2000 o **DAC/TCG/DGS Mode Setup: DGS** (refer to the paragraph 5.4.13 or 5.4.14) o **Meas Value Setup: ΔVC(A)** (submenu MEASURE in the Pulser Receiver window - refer to the paragraphs 5.4.15 and 5.4.16)
DAC Normalizing	o Internal flaw detector PC card UDS3-3 or UDS3-4 or USLT 2000 o **DAC/TCG/DGS Mode Setup: DAC** (refer to the paragraph 5.4.11 and 5.4.12) o **Meas Value Setup: ΔVC(A)** (submenu MEASURE in the Pulser Receiver window - refer to the paragraphs 5.4.15 and 5.4.16)
Standard Level TCG Normalizing	o All possible hardware configurations o **DAC/TCG/DGS Mode Setup: TCG** (refer to the paragraph 5.4.11 and 5.4.12 for the internal flaw detector PC card or to the corresponding chapter of the external ultrasonic flaw detector operating manual)
Standard Level Linear Normalizing	o All possible hardware configurations o **DAC/TCG/DGS Mode Setup: OFF** or **Update** (refer to the paragraph 5.4.11 and 5.4.12 for the internal flaw detector PC card or to the corresponding chapter of the external ultrasonic flaw detector operating manual)

Start Inspection Procedure (Scanning)

Scanning Schemes

I2-SONIC software package supports 2 (two) scanning schemes:

Scanning Scheme 1 – scanning above the material adjacent to the weld (suitable for all hardware configurations)



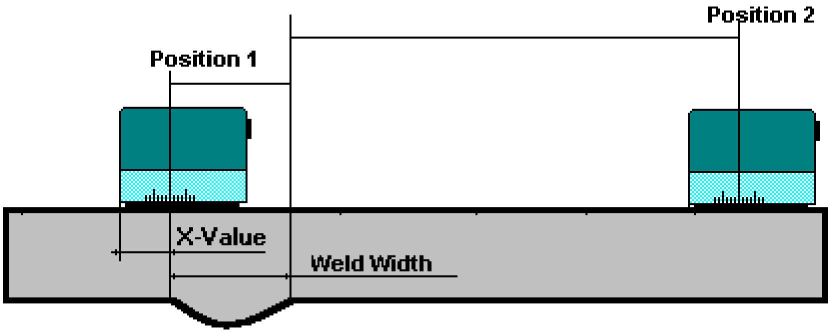
The closest location (**Position 1**) of incidence point with relate to the weld edge:

Position 1 = X-Value

The farthest location (**Position 2**):

Position 2 = 2 * Skip# * Material Thickness * Tan (Angle)

Scanning Scheme 2 – scanning above the material adjacent to the weld and above the machined weld (Internal flaw detector card either **UDS 3-3** or **UDS 3-4** or **USLT 2000** required)



The closest location (**Position 1**) of incidence point with relate to the weld edge:

Position 1 = – Weld Width

The farthest location (**Position 2**):

Position 2 = 2 * Skip# * Material Thickness * Tan (Angle)

Flaw Imaging

I2-SONIC software package supports 2 (two) techniques for the flaw imaging:

Flaw Imaging Technique 1: **SAFT** imaging based on dynamic correlation analysis between sequences of probe locations and swiveling angles and received echoes (all hardware configurations)

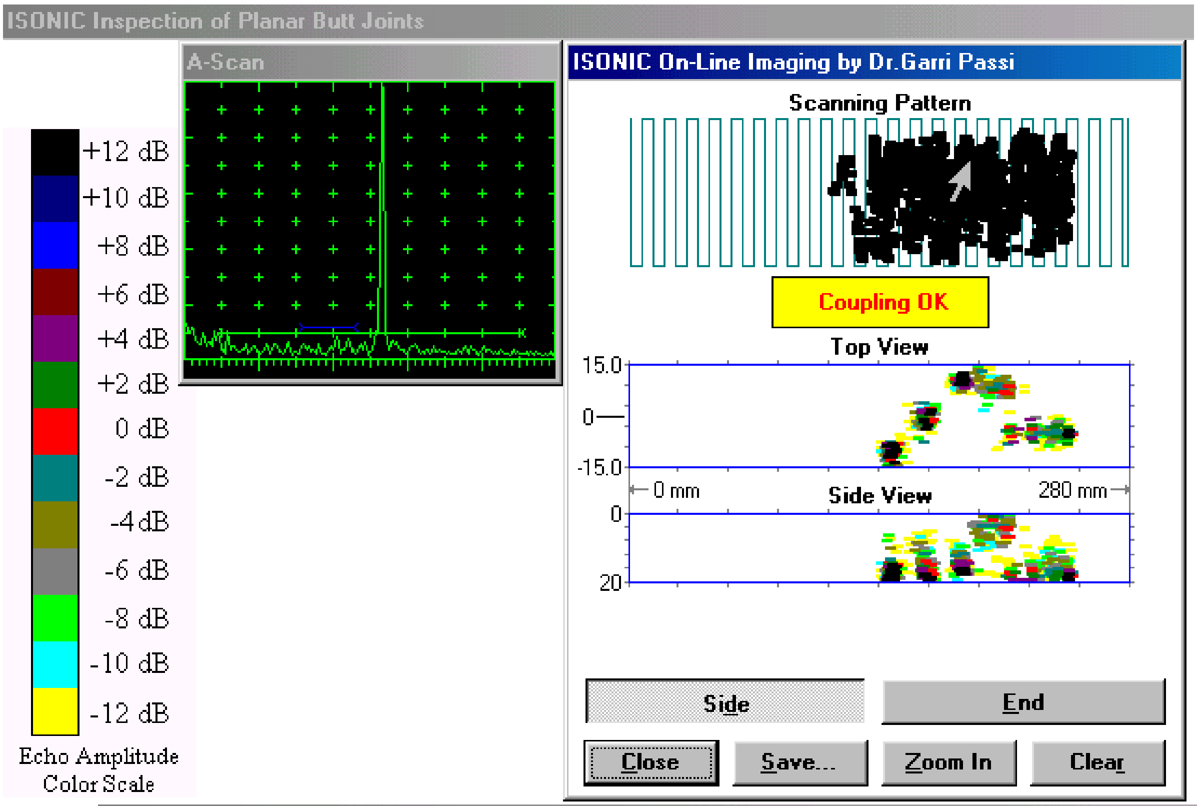
Flaw Imaging Technique 2: **Raw** imaging (Internal flaw detector card either **UDS 3-3** or **UDS 3-4** required)

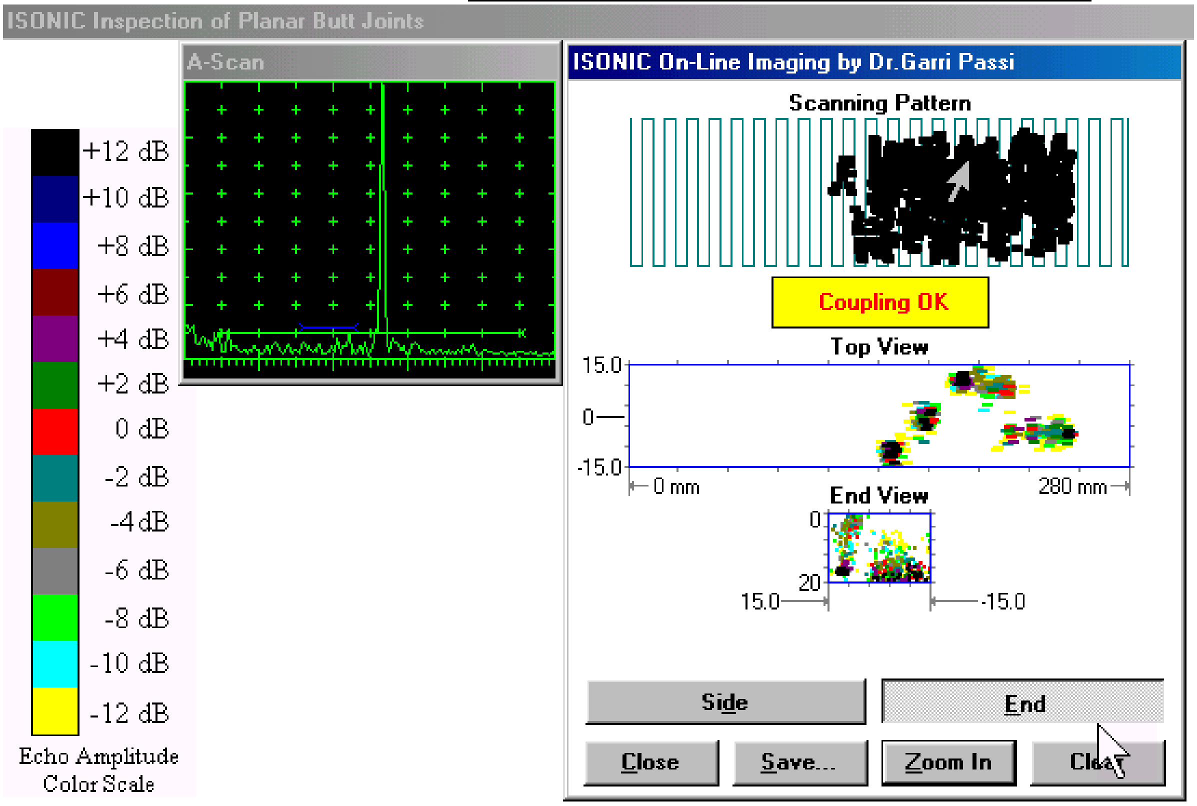
The following manipulations start the inspection procedure (scanning):

Scanning Scheme 1 **and** **Flaw Imaging Technique 1**	Click on Start Inspection... or press **<Alt>+<I>** on the keyboard
Scanning Scheme 2 **and** **Flaw Imaging Technique 1**	• Press and hold **<Shift>+<T>** on the keyboard • Click on Start Inspection... or press **<Alt>+<I>** on the keyboard • Release **<Shift>+<T>** on the keyboard
Scanning Scheme 1 **and** **Flaw Imaging Technique 2**	• Press and hold **<Shift>+<M>** on the keyboard • Click on Start Inspection... or press **<Alt>+<I>** on the keyboard • Release **<Shift>+<M>** on the keyboard
Scanning Scheme 2 **and** **Flaw Imaging Technique 2**	• Press and hold **<Shift>+<N>** on the keyboard • Click on Start Inspection... or press **<Alt>+<I>** on the keyboard • Release **<Shift>+<N>** on the keyboard

7.7. Inspection

The typical screens for the inspection of the weld using the **I2-SONIC** Inspection SW Package are shown below and comprehensively explained in the paragraph 2.1 of this Operating Manual





The target of the operator is to completely "paint" over the *Scanning Pattern* area providing the necessary testing integrity. The defects are recorded and imaged automatically upon receiving the relevant echoes

The following controls are available while scanning:

- End and Side - clicking on the appropriate button or pressing **<Alt>+<E>** or **<Alt>+<S>** on the keyboard highlights the **End View** or **Side View** along with the **Top View** and **Scanning Pattern** permanently presented in the **ISONIC On-line Imaging** window

- Save... - click on this button or press **<Alt>+<S>** on the keyboard to save a file containing inspection data. For the file placement and naming proceed according to the paragraph 5.4.19 of this Operating Manual

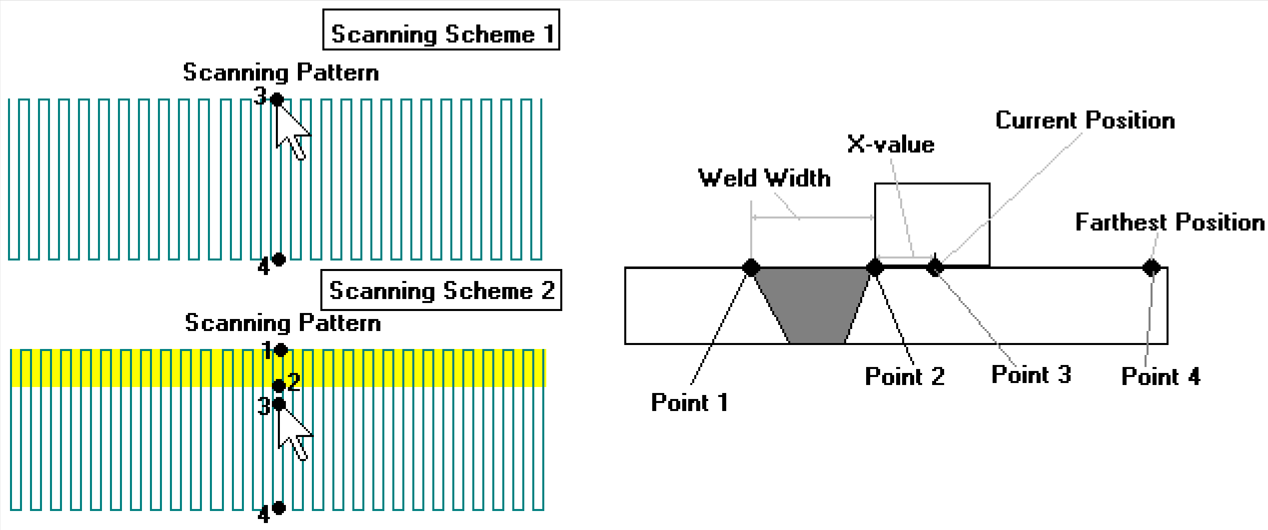
- Zoom In - click on this button or press **<Alt>+<Z>** on the keyboard to zoom the **ISONIC On-Line Imaging** window

- Clear - click on this button or press **<Alt>+<R>** on the keyboard to reset to background in the **ISONIC On-Line Imaging** window

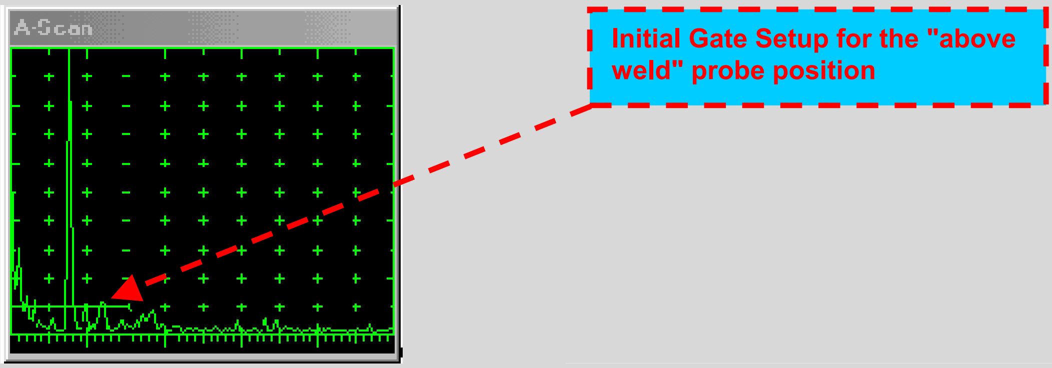
- Close - click on this button or press **<Alt>+<C>** or **Esc** on the keyboard to return back to the **ISONIC Setup** window

Inspection Note 1

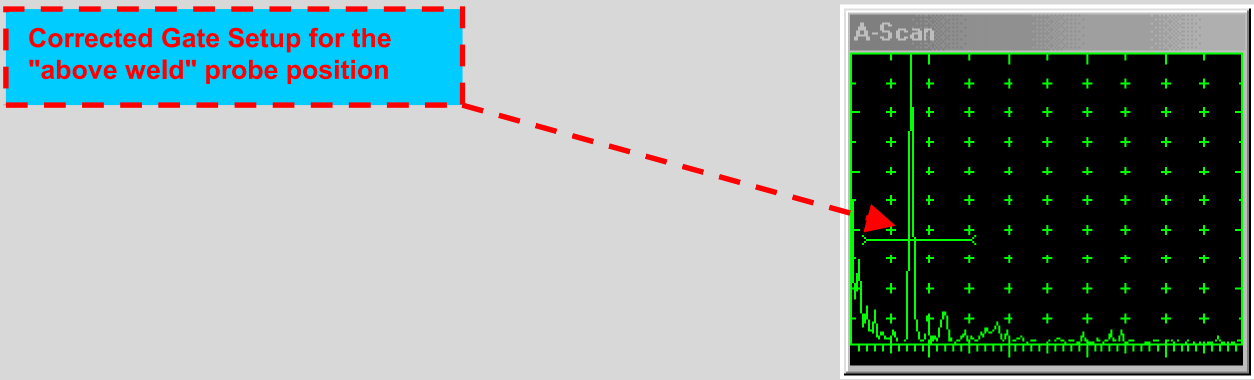
Background image of Scanning Pattern and Indication of the Current Probe Position depend on the selected scanning scheme:



Inspection Note 2

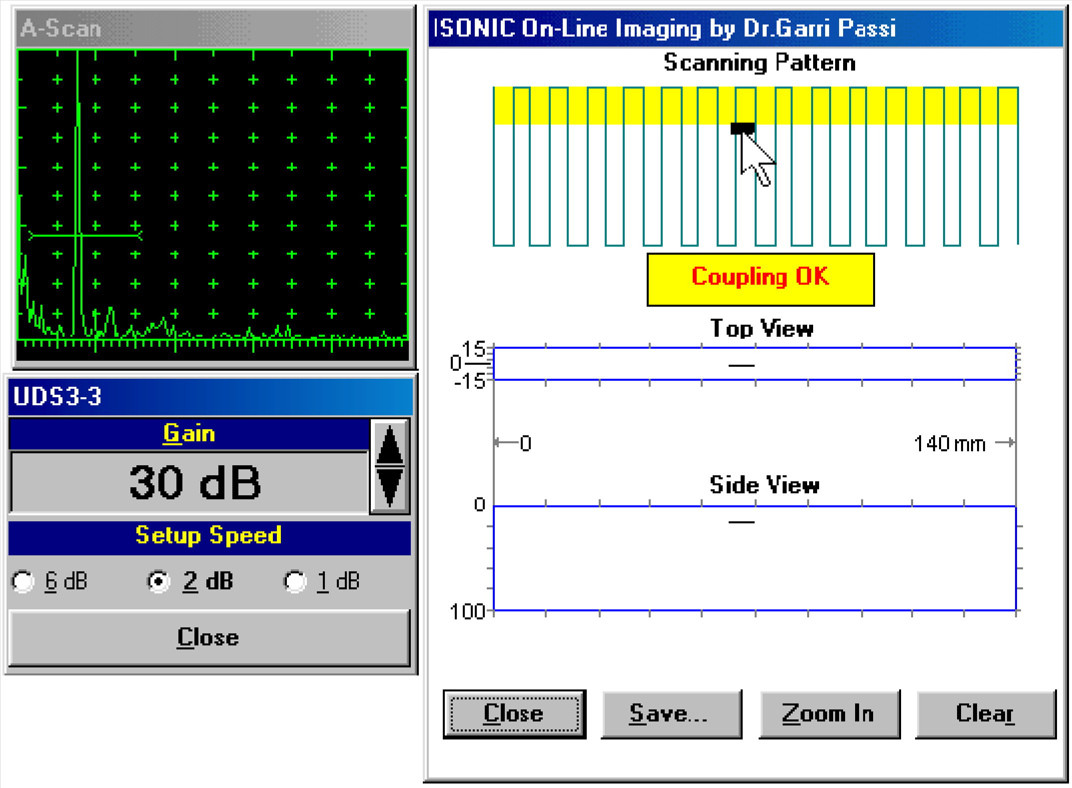


It may occur that the falling edge of initial pulse or reverberations caused by the initial pulse will not allow to process echoes while the probe is situated above the machined weld. To resolve the problem it is necessary to tune the gate threshold and delay for the "above weld" probe positioning through the pressing **<Shift>+<↑>**, **<Shift>+<→>**, **<Shift>+<←>**, **<Shift>+<↓>** on the keyboard:



Inspection Note 3

It is possible to pause scanning and recording of the inspection data and then to evaluate echoes trough the varying gain if using the internal flaw detector PC card. To proceed press **<Shift>+<Z>** on the keyboard: the additional gain-varying window appears



To vary the value of Gain the following manipulations applicable:

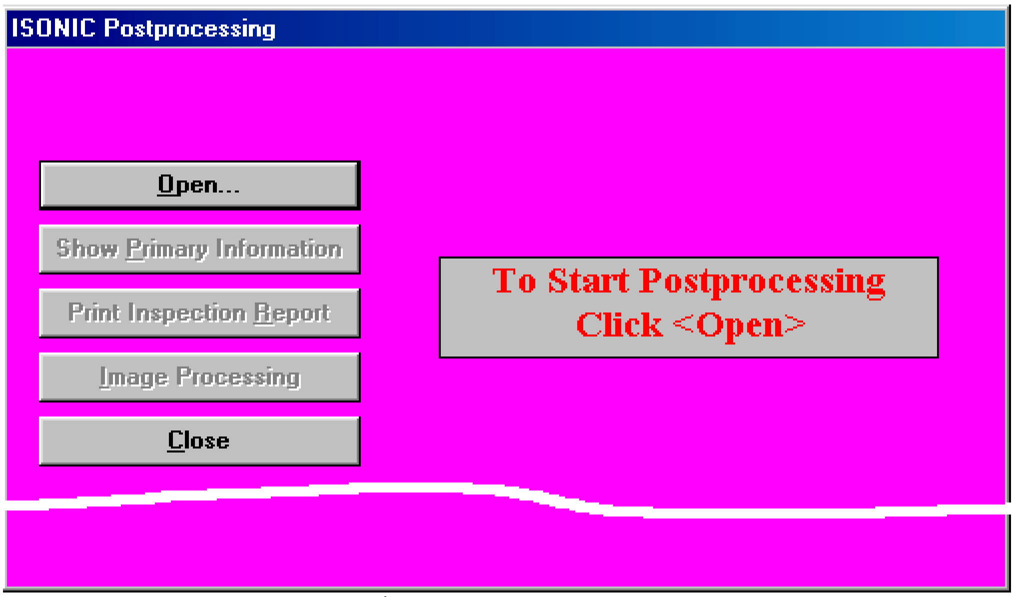
- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<G>** ⇒ **Gain** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Gain** the letter **G** is underlined)
- **Combined**
  - Click on **Gain** ⇒ **Gain** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

To continue scanning and recording of the inspection data click on Close or press **<Alt>+<C>** or **Esc** on the keyboard – the value of **Gain** returns to the **default** level automatically

7.8. Postprocessing

7.8.1. Start

The empty **ISONIC Postprocessing** window appears when activating it from the **ISONIC Control Menu**

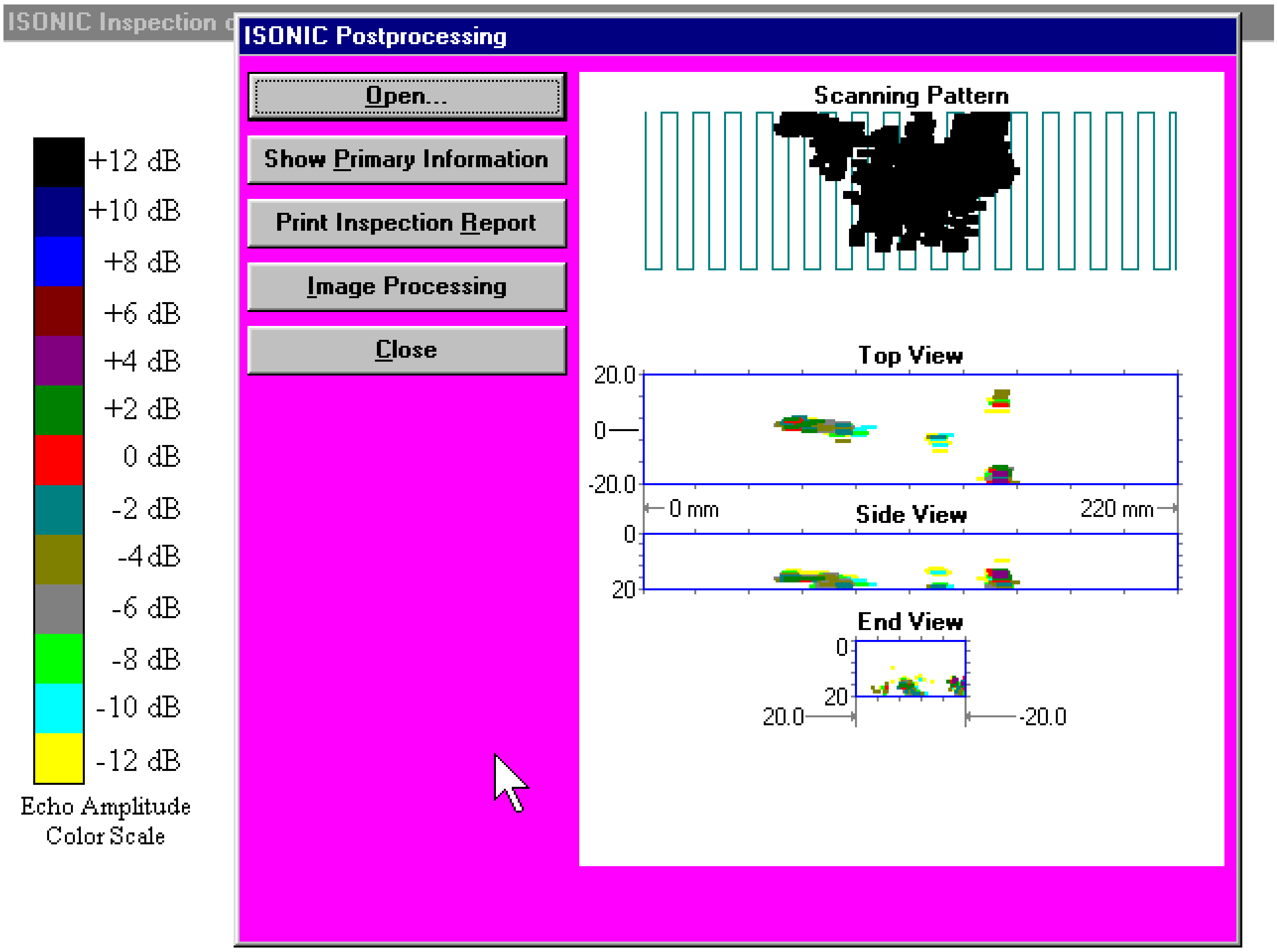


- Click on **Open...** or press **<Alt>+<O>** on the keyboard to start **Postprocessing Mode** - proceed according to the paragraph 5.4.20 of this Operating Manual for opening a file

- Click on **Close** or press **<Alt>+<C>** or press **Esc** on the keyboard to return back to **ISONIC Control Menu**

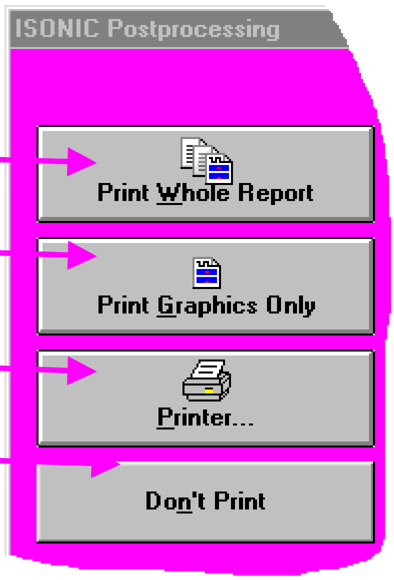
7.8.2. Postprocessing Procedures

After loading results from file the following screen appears:



- Click on **Show Primary Information** or press **<Alt>+<P>** on the keyboard to preview the pre-inspection data including description of the object under test, inspection data, operator's comments and scope of inspection, ultrasonic flaw detector setup, probe information and **ISONIC** system setup

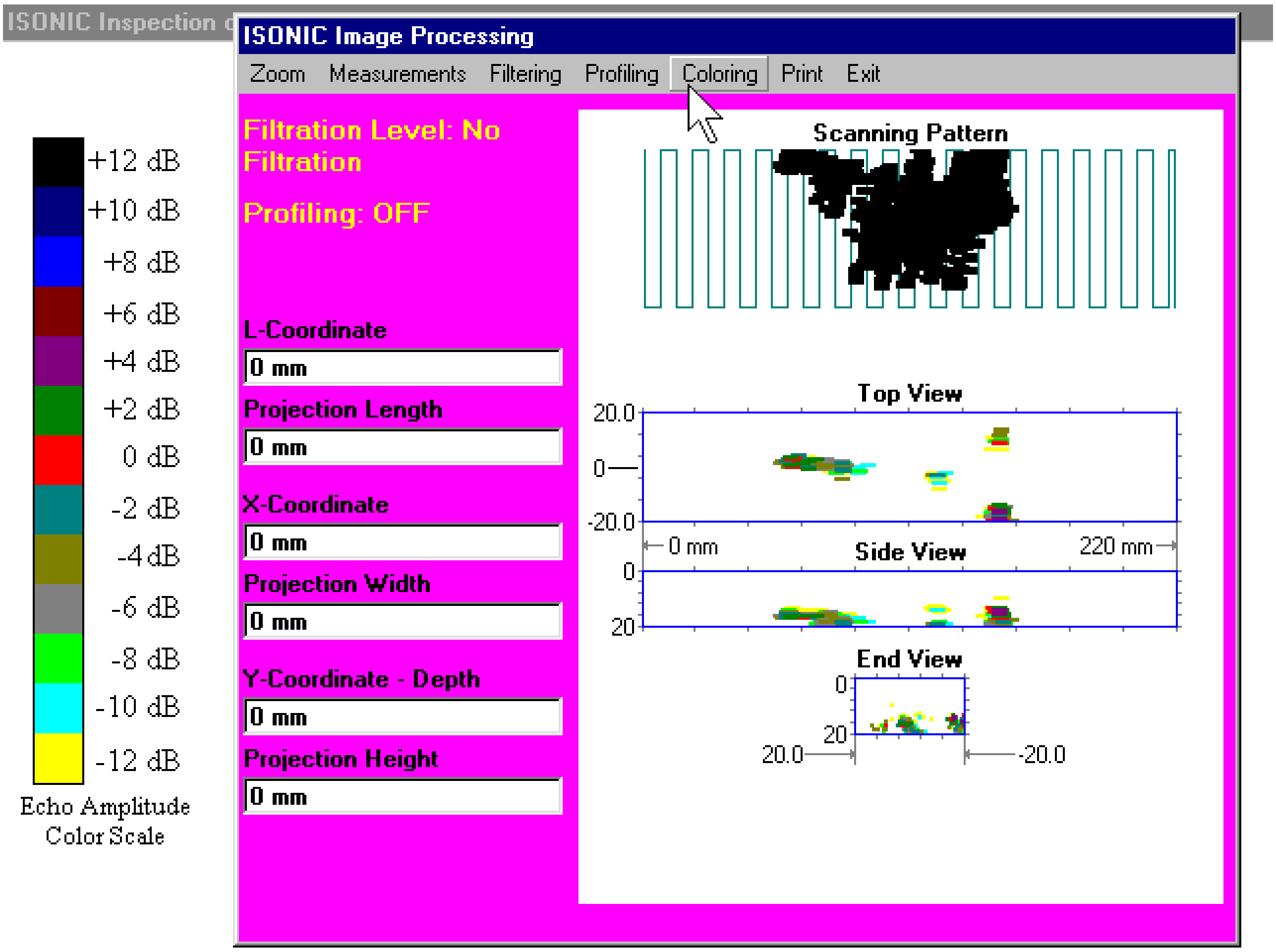
- Click on **Print Inspection Report** or press **<Alt>+<R>** on the keyboard to manage printouts – the corresponding buttons block appears:



  - Click on
    or press **<Alt>+<W>** on the keyboard to print the complete Inspection Report
  - Click on
    or press **<Alt>+<G>** on the keyboard to print the graphical part of the Inspection Report only
  - Click on
    or press **<Alt>+<P>** on the keyboard for the *Printer Setup*
  - Click on
    or press **<Alt>+<N>** or **Esc** on the keyboard to decline printing

- Click on **Image Processing** or press **<Alt>+<I>** on the keyboard to start *Image Processing*

7.8.3. Image Processing



The Image Processing Menu Bar provides 7 opportunities:

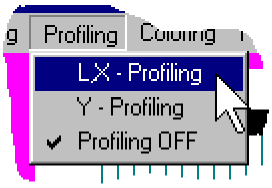
- **Profiling** – slicing the volume with the captured defects images in 3 planes
- **Filtering** – redrawing defect images with suppressing the segments corresponding to echo amplitudes below user-selected threshold level
- **Measurements** – measuring the coordinates and projection sizes for each defect and the distances between defects at any user-selected threshold
- **Zoom** – zooming, printing and filtering any region of Scanning Pattern, Top View and Side View, simultaneously or separately with automatic detection of highest echo in the user-selected region of interest
- **Coloring** – redrawing defect images referring to a newly selected color scale (palette)
- **Print** – printing processed images
- **Exit** – return back to unprocessed presentation of inspection results

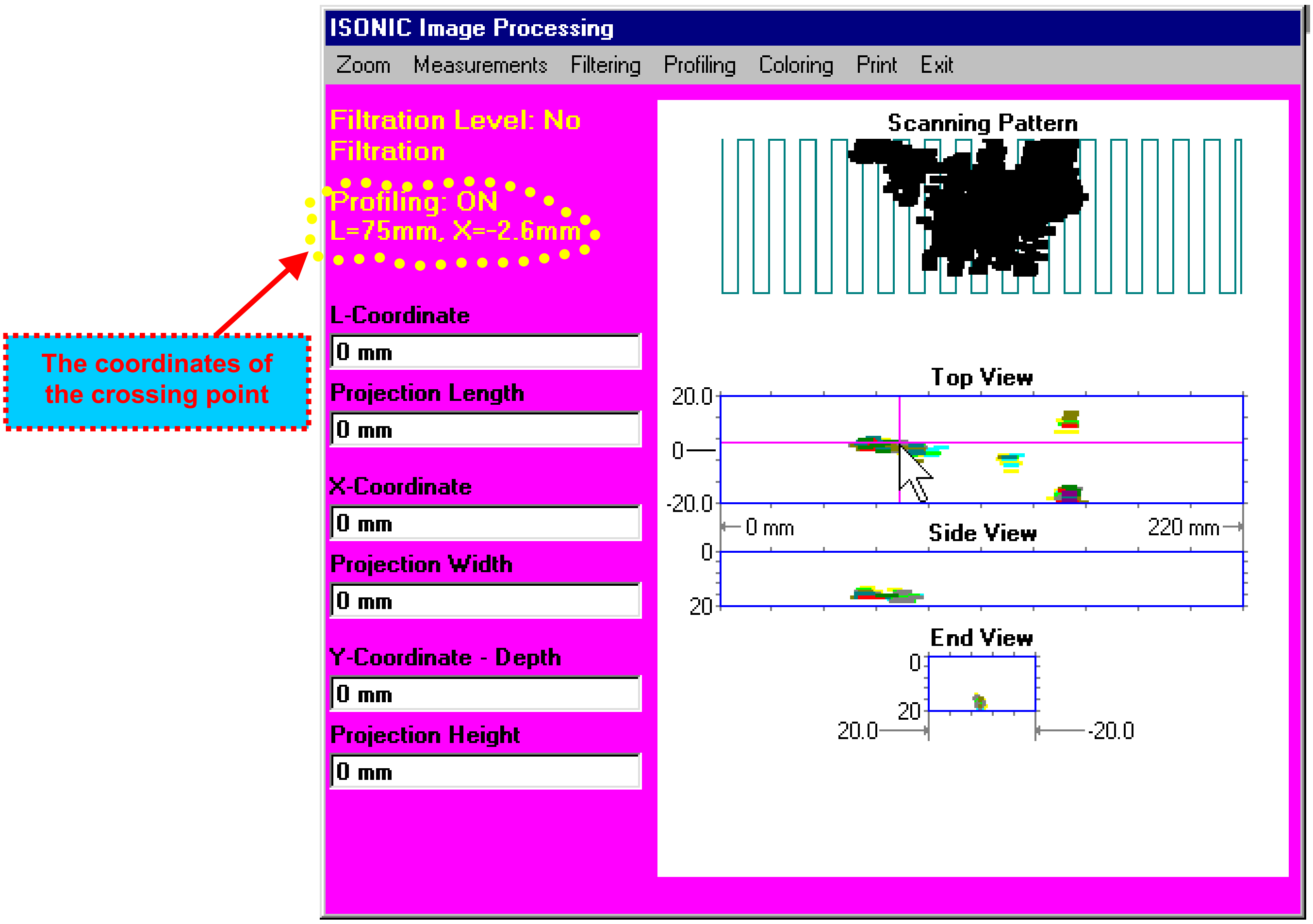
Some screenshots below illustrate Image Processing hints

Profiling

LX – Profiling

Profiling → LX-Profiling





As a result:

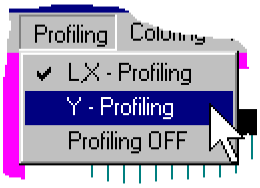
- o two orthogonal lines appear above the **Top View**
- o the mouse pointer is "sticked" to the crossing point of the said lines
- o both lines may be moved up / down and left / right correspondingly by the mouse or touch screen stylus or buttons ↑ ↓ → ← on the keyboard
- o the crossing point coordinates display appears
- o the horizontal line and its **X-coordinate** provide representing of the corresponding sectional **Side View**
- o the vertical line and its **L-coordinate** provide representing of the corresponding sectional **End View**

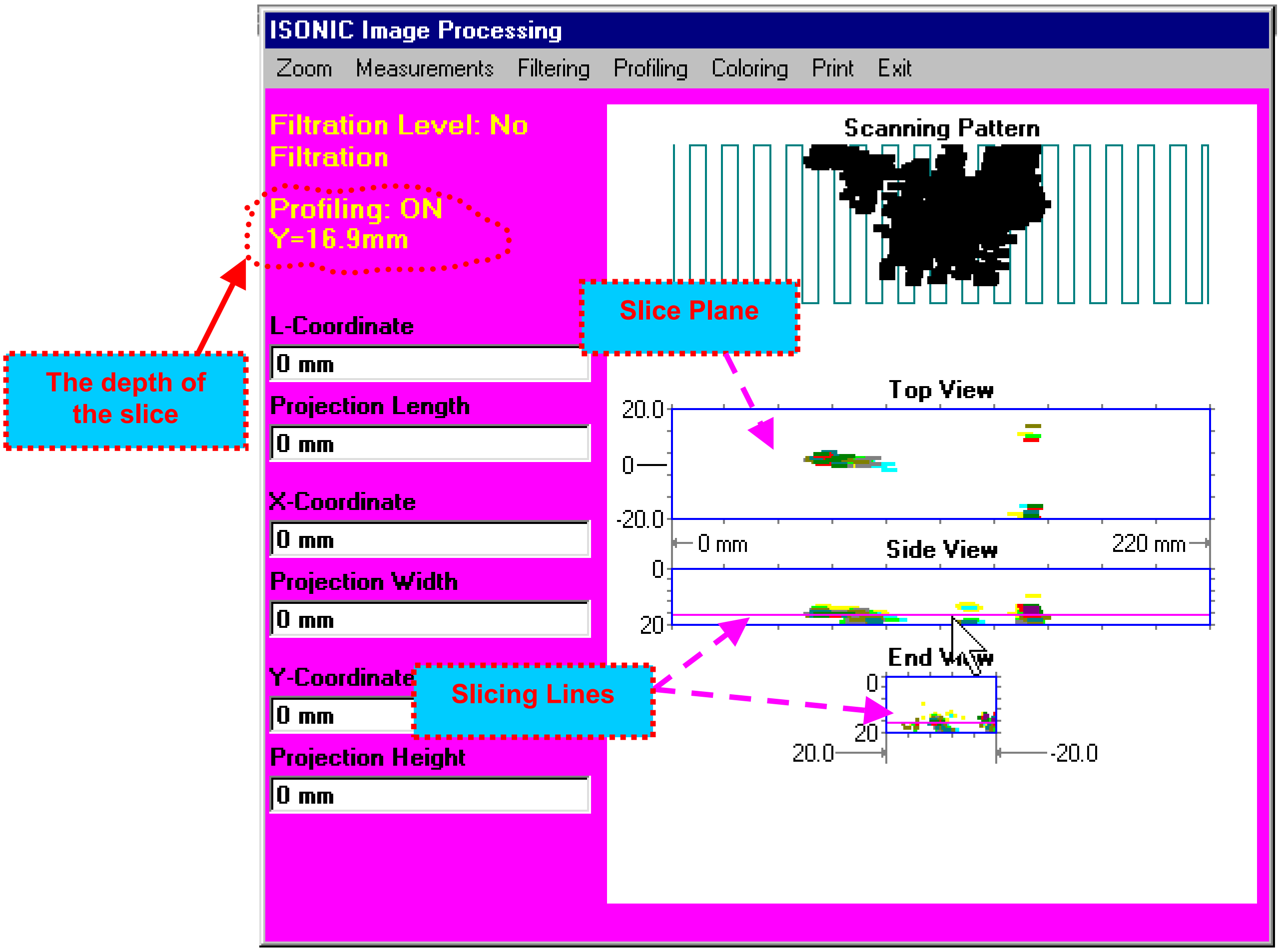
Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the obtained sectional **Side View** and **End View** and free mouse pointer for the further procedures

To interrupt the ***LX-Profiling*** procedure right mouse click or press **Esc** on the keyboard

Y- Profiling (Slicing)

Profiling → Y-Profiling





As a result:

- two horizontal slicing lines reflecting the **depth of the slice plane** appear above the **Side** and **End Views**
- the mouse pointer is "sticked" to the horizontal line above the **Side View**
- the display of the slice depth appears
- both horizontal lines may be moved up / down synchronously by the mouse or touch screen stylus or buttons ↑ ↓ on the keyboard
- the reflectors matching with the **slice plane** are only visible in the sectional **Top View**

Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the selected threshold and free the mouse pointer for the further procedures

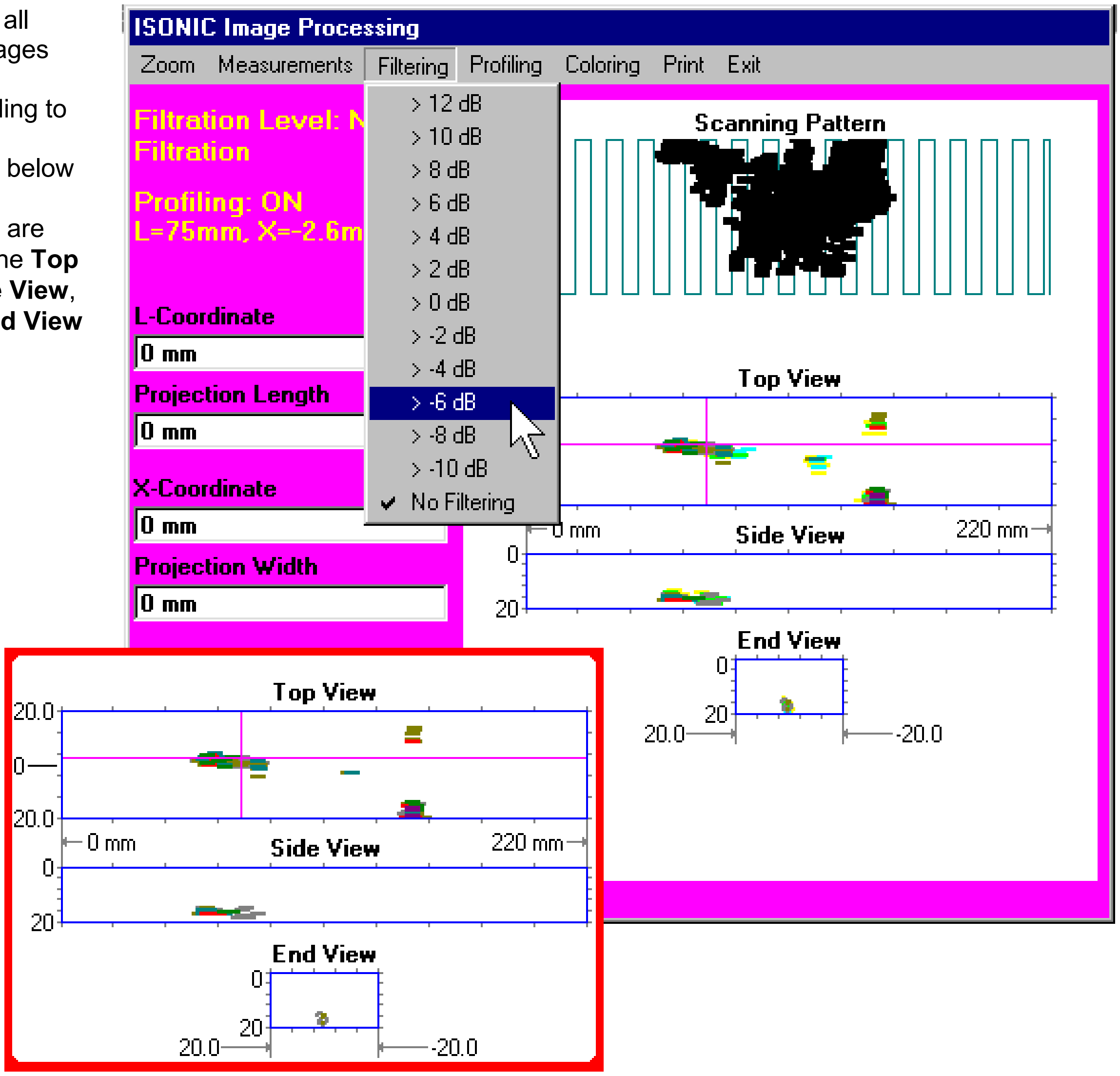
To interrupt the ***Y-Profiling (Slicing)*** procedure right mouse click or press **Esc** on the keyboard

Profiling → Profiling OFF switches the active profiling function off

Filtering

Filtering → Selected Amplitude Threshold

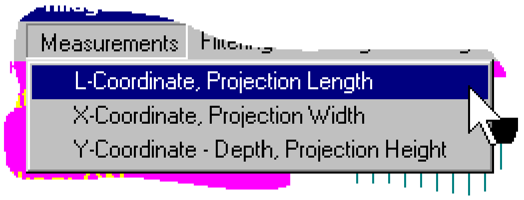
As a result all defects images segments corresponding to the echo amplitudes below selected **Threshold** are erased in the **Top View**, **Side View**, and the **End View**



Measuring defects' coordinates and projection sizes

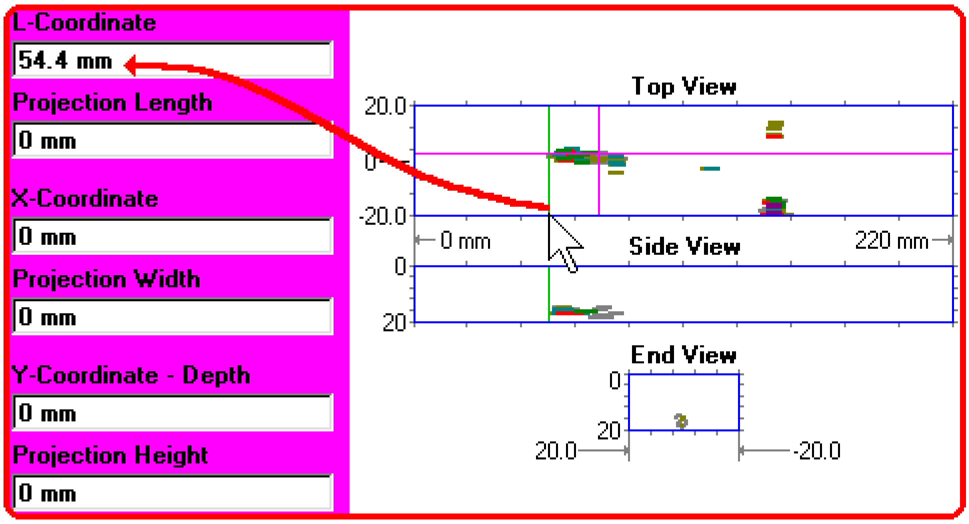
Measurements → Selected Measurements Direction

For example: **Measurements → L-Coordinate, Projection Length**



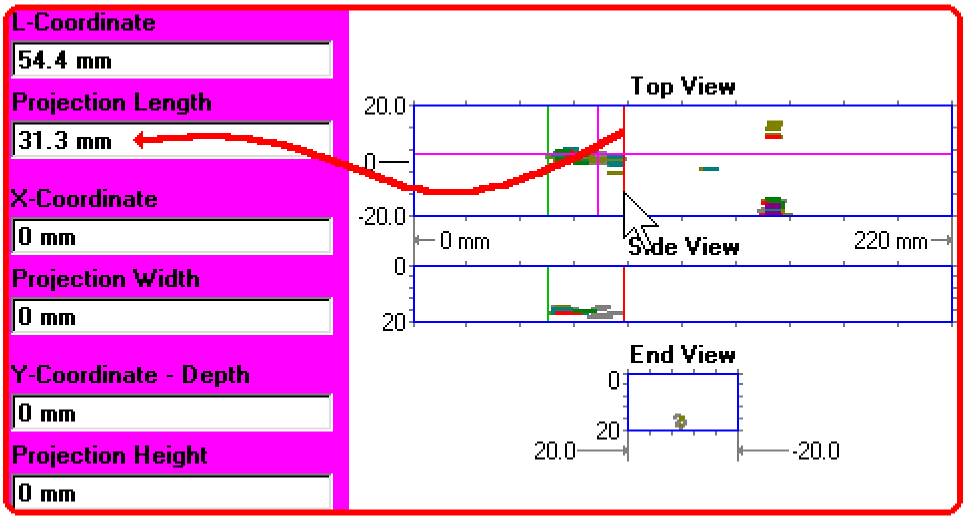
As a result:

- the **first reference line** appear with the mouse pointer "sticked" to it
- depending on the selected **Measurement Direction** the **first reference line** be moved either up / down or left / right by the mouse or touch screen stylus or buttons ↑ ↓ or → ← on the keyboard
- the coordinate of the first reference line is shown under the "**L-Coordinate**" or "**X-Coordinate**" or "**Y-Coordinate - Depth**" label while guiding along the corresponding **Measurement Direction**



Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the position of the **first reference line**

As a result



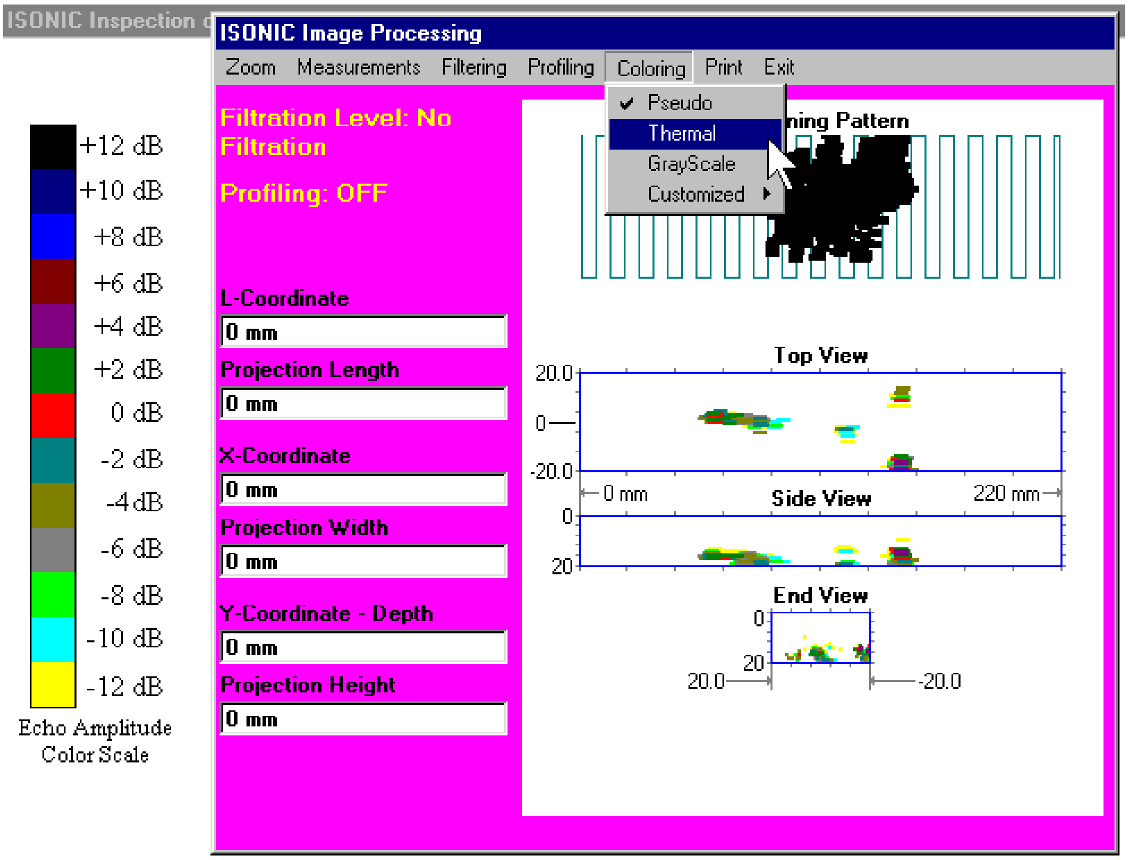
- the **second reference line** appear with the mouse pointer "sticked" to it
- depending on the selected **Measurement Direction** the **second reference line** be moved either up / down or left / right by the mouse or touch screen stylus or buttons ↑ ↓ or → ← on the keyboard
- the relative coordinate of the **second reference line** with respect to the **first reference line** is shown under the "**Projection Length**" or "**Projection Width**" or "**Projection Height**" label while guiding along the corresponding **Measurement Direction**

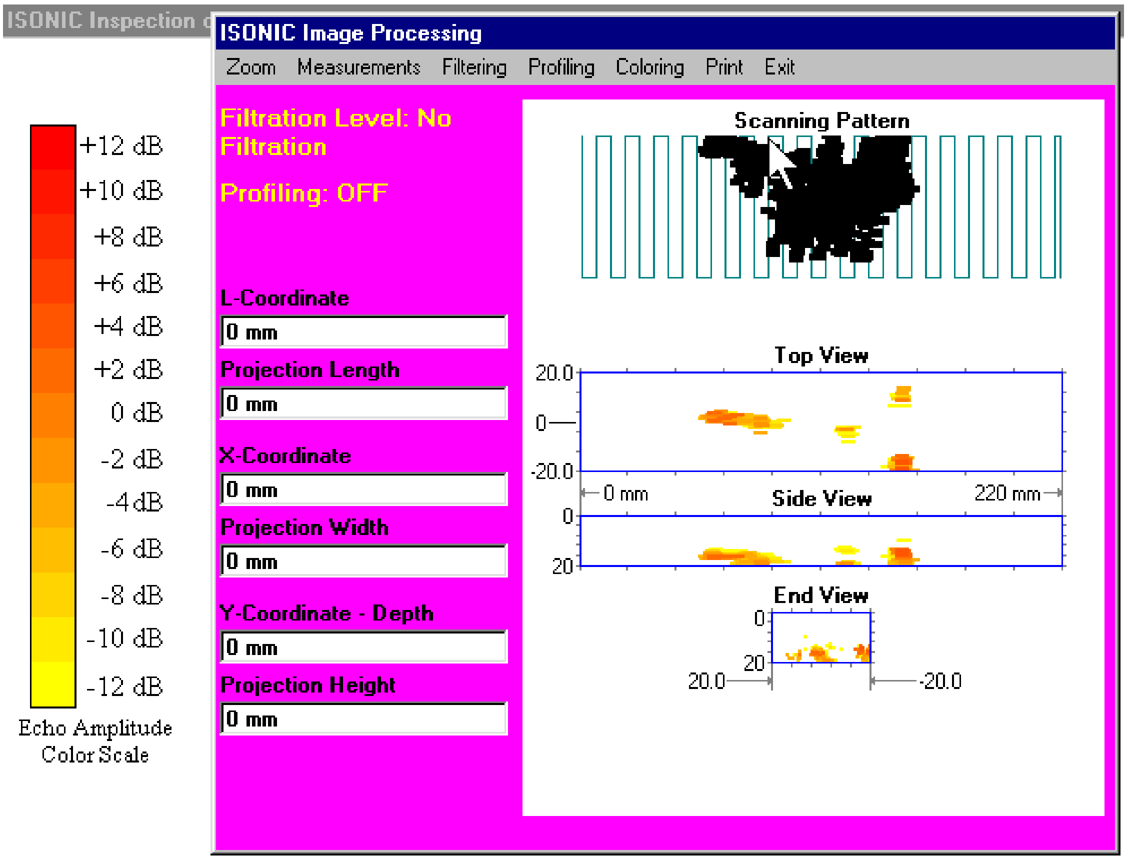
Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the position of the **first reference line**

To interrupt the **Measuring defects' coordinates and projection sizes** procedure right mouse click or press **Esc** on the keyboard

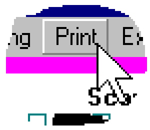
<u>Redrawing defects' images using a new color scale (palette)</u>

Coloring → Selected Palette



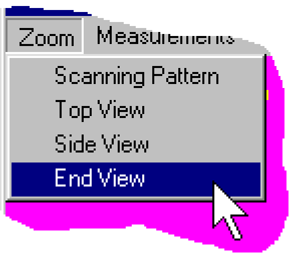


Print the postprocessing pages



The postprocessing page may be printed at any moment, for example, after the necessary slicing, filtering measuring and coloring procedures are finalized. Click on **Print** to proceed:

Zoom



Zoom → Selected Zoom Area

The selected **Zoom Area** appears in the additional window. The images from zoom windows may be filtered and printed

8. Operating 'Expert' Software Package - ISONIC Expert

The contents of this chapter is valid for the EXPERT SW Package version 5.0.0.15 or higher

8.1. Preparing for the Inspection

Follow the instructions of paragraph 7.1 of this Operating Manual and to the figures below

Short and long bar for the receivers of airborne ultrasound

It's possible to use either short or long bar for the receivers of airborne ultrasound while running the **EXPERT** Inspection SW Package. The value of **Base** (the distance between two receivers of airborne ultrasound) may be from 100 to 240 *mm* or 4 to 10 *in*. The short bar is required if the value of **Base** does not exceed 200 *mm* or 8 *in*. If this is a case then the distance between the receivers is defined as:

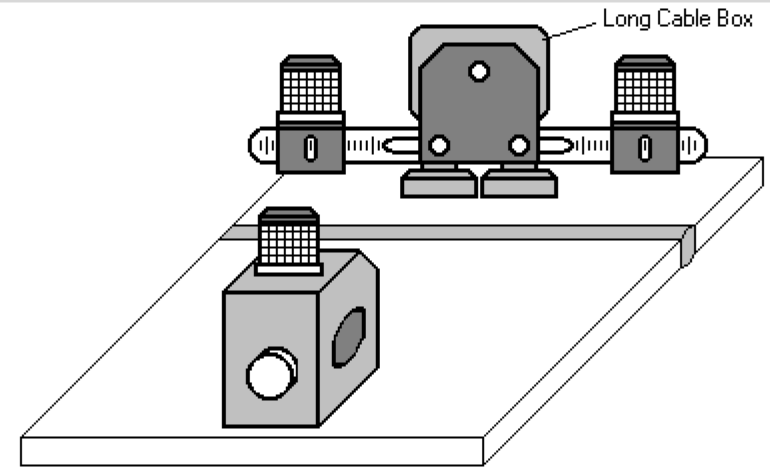
Base = **100** + **Pos1** + **Pos2**, *mm*
or
Base = **4** + **Pos1** + **Pos2**, *in*

The long bar is required if the value of **Base** is more than 200 *mm* or 8 *in*. If this is a case then the distance between the receivers is defined as:

Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

In the above formulas **Pos1** and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly

Placement of the short ruler:



8.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

8.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

8.4. Getting started...

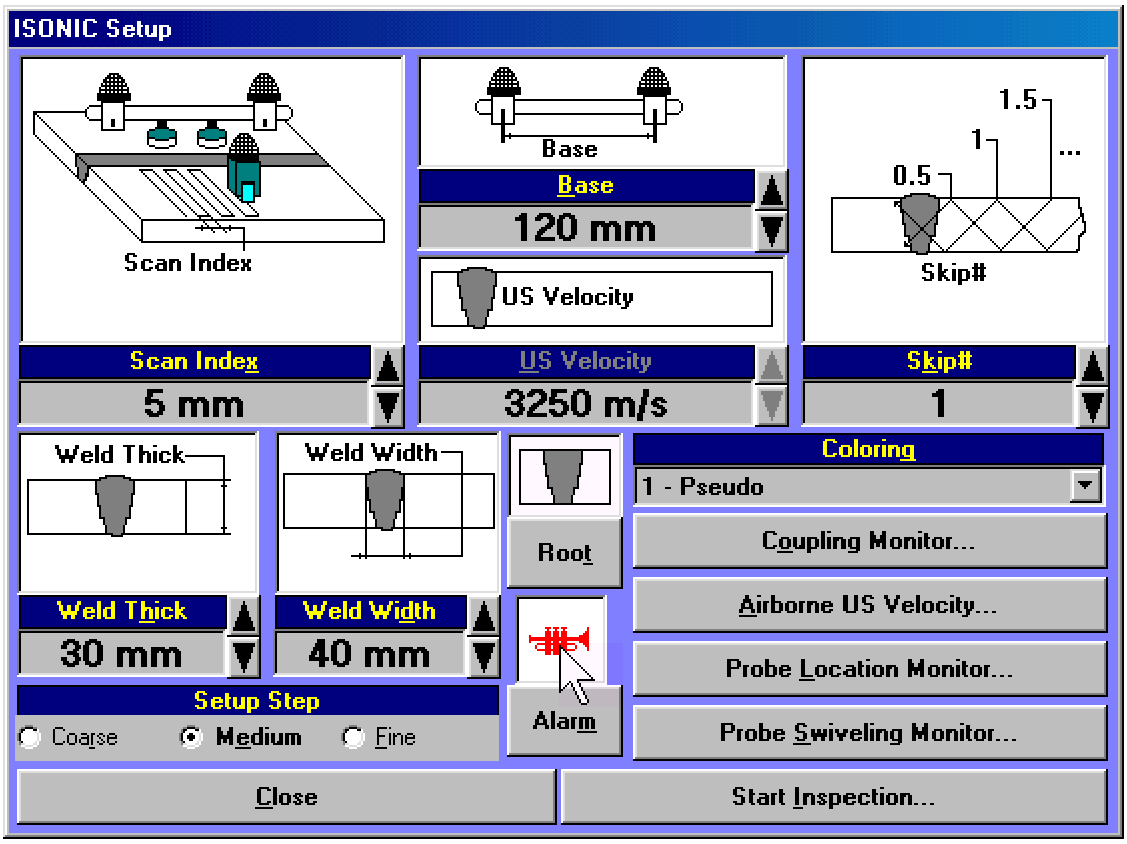
Refer to the paragraph 7.4 of this Operating Manual

8.5. ISONIC Control Menu

Refer to the paragraph 7.5 of this Operating Manual

8.6. Pre-Inspection

Refer to the paragraph 7.6 of this Operating Manual and to the figures below



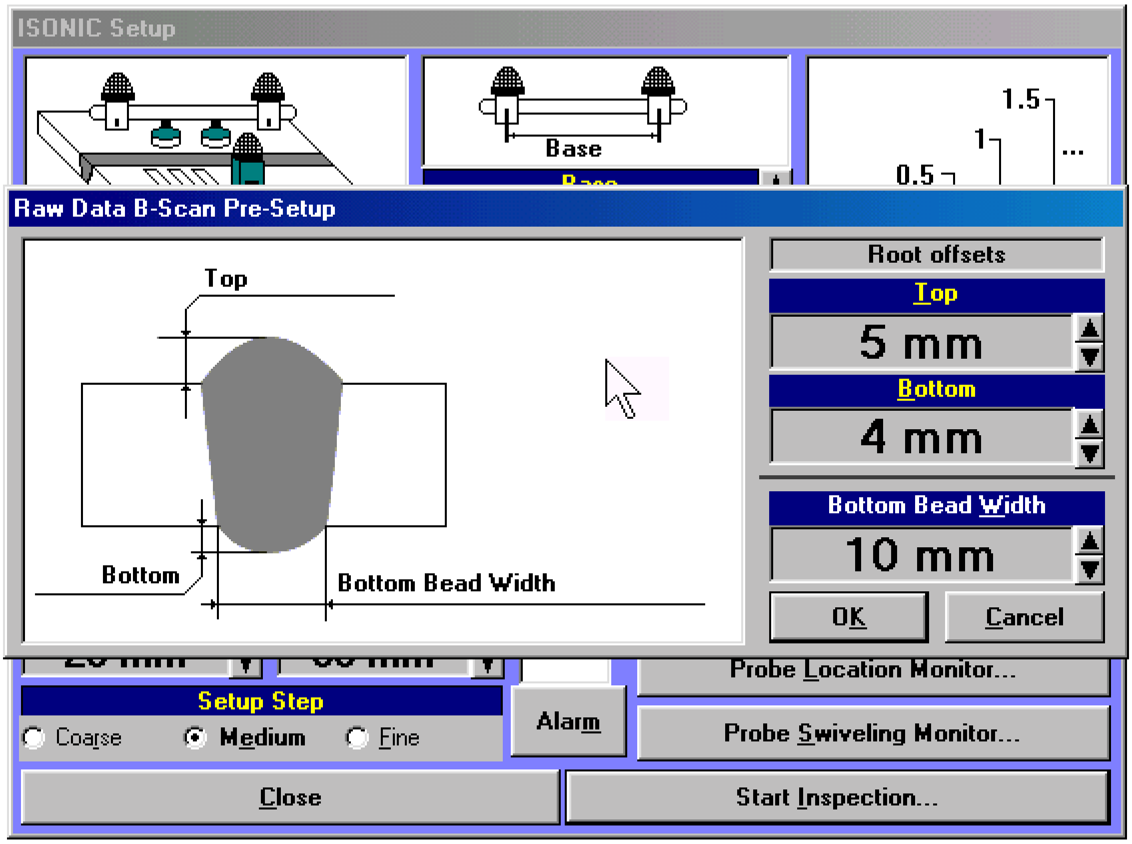
Scan Index providing high frontal resolution

To provide high frontal resolution the value of **Scan Index** may be setup to 0.25 or 0.5 mm / 0.01 or 0.02 in

The Defect Outlining Technology (DOT)

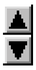
The **EXPERT** Inspection SW Package is additionally featured with the ***Defect Outlining Technology (DOT)*** mode of operation based on the capturing of the **Raw Data B-Scans** whilst scanning multiply above the numerous weld cross-sections selected by an operator. This allows acquiring maximum possible information about the indications found: all A-Scans are captured entire the ***DOT*** scanning and may be recovered then off-line and utilized for the defect outlining and pattern recognition through the *virtual rescanning*

The additional key-ins will be required upon clicking on the Start Inspection... button opening the intermediate **Raw Data B-Scan Pre-Setup** window, said key-ins are necessary for the characterization of the weld defects more precisely while utilizing ***DOT*** mode. If the ***Scanning Scheme 1*** was selected as it is described in the paragraph 7.6.5 of the present Operating Manual (scanning above the parent material adjacent to the weld) then the **Raw Data B-Scan Pre-Setup** window looks as below



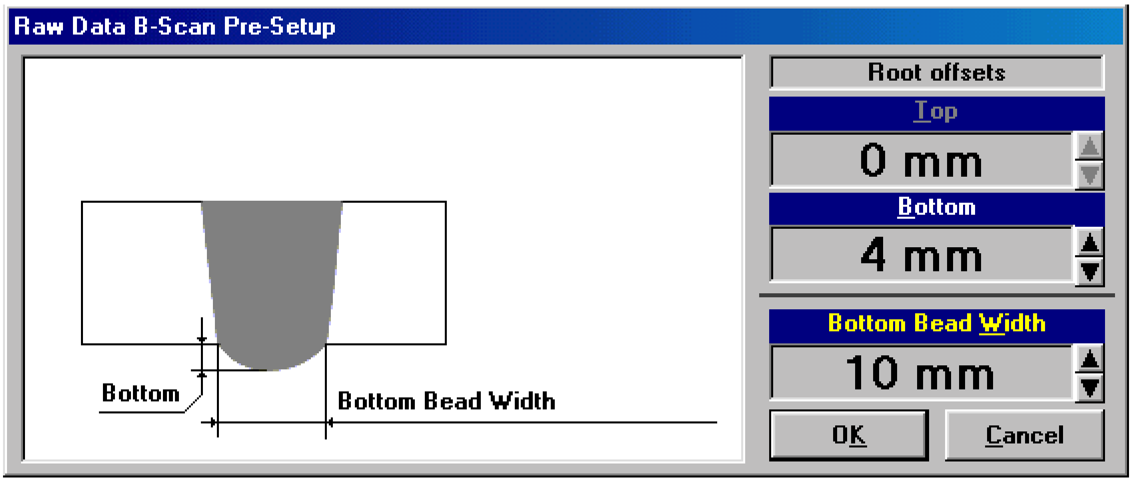
Top Root Offset

To setup the value of **Top Root Offset** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<T>** ⇒ **Top** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Top** area letter **T** is underlined)
- **Combined**
  - Click on **Top** ⇒ **Top** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

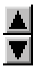
*The value of **Top Root Offset** is set in **mm** or **in** with the increment of **1 mm** or **0.05 in** correspondingly between **0** and **30%** of the **WeldThick** (refer to the paragraph 7.6.5 of this Operating Manual)*

If the ***Scanning Scheme 2*** was selected as it is described in the paragraph 7.6.5 of the present Operating Manual (scanning above both the machined weld cap and the adjacent material) then the value of **Top Root Offset** is automatically setup to **0** and may not be modified prior to the scanning



Bottom Root Offset

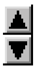
To setup the value of **Bottom Root Offset** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<B>** ⇒ **Bottom** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Bottom** area letter **B** is underlined)
- **Combined**
  - Click on **Bottom** ⇒ **Bottom** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value of **Bottom Root Offset** is set in **mm** or **in** with the increment of **1 mm** or **0.05 in** correspondingly between **0** and **30%** of the **WeldThick** (refer to the paragraph 7.6.5 of this Operating Manual)*

Bottom Bead Width

To setup the value of **Bottom Bead Width** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<W>** ⇒ **Bottom Bead Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Bottom Bead Width** area letter **W** is underlined)
- **Combined**
  - Click on **Bottom Bead Width** ⇒ **Bottom Bead Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value of **Bottom Bead Width** is set in **mm** or **in** with the increment of **1 mm** or **0.05 in** correspondingly between **0** and **100%** of the **WeldWidth** (refer to the paragraph 7.6.5 of this Operating Manual)*

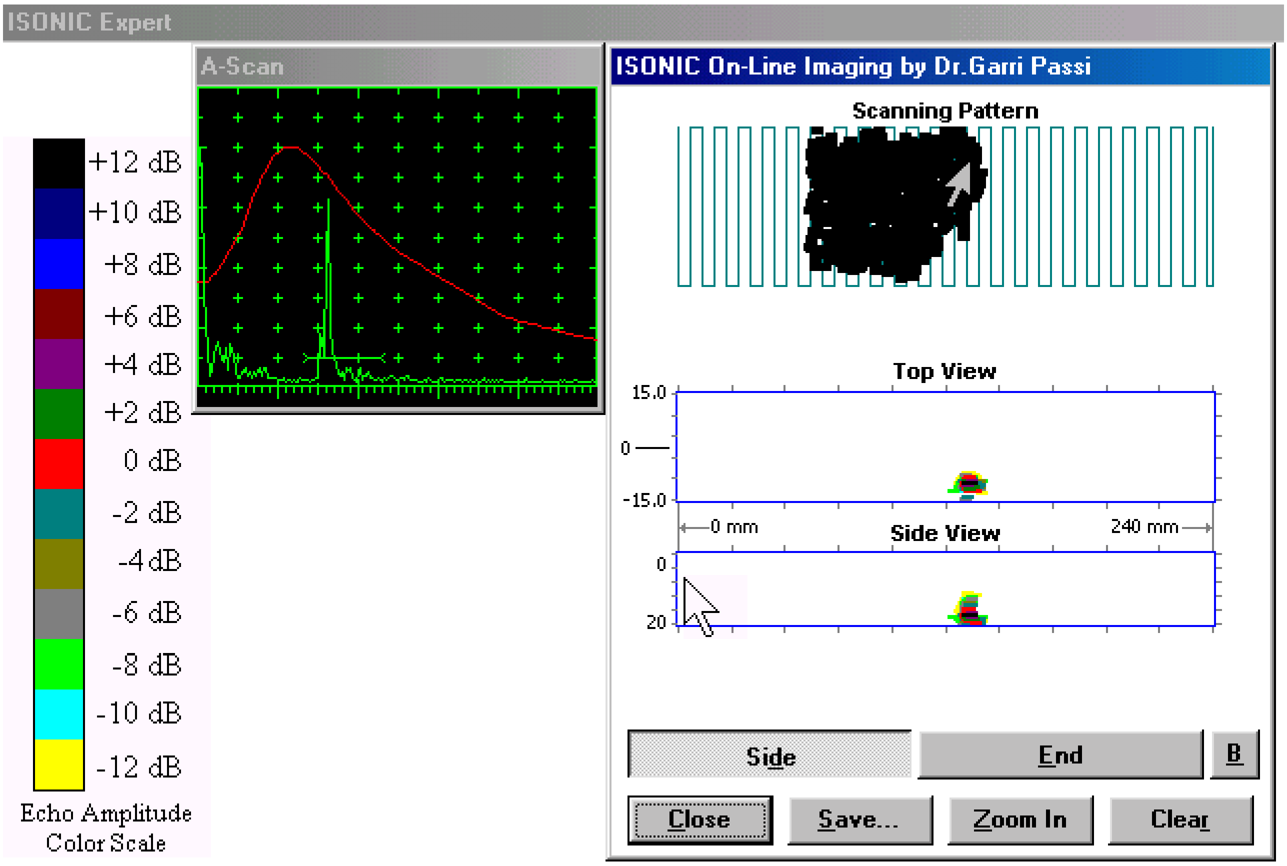
Click on OK or press **<Alt>+<K>** or **Enter** on the keyboard upon completing with the settings in the **Raw Data B-Scan Pre-Setup** window to start scanning

Click on Cancel or press **<Alt>+<C>** or **Esc** on the keyboard to return to the **ISONIC Setup** window

8.7. Inspection

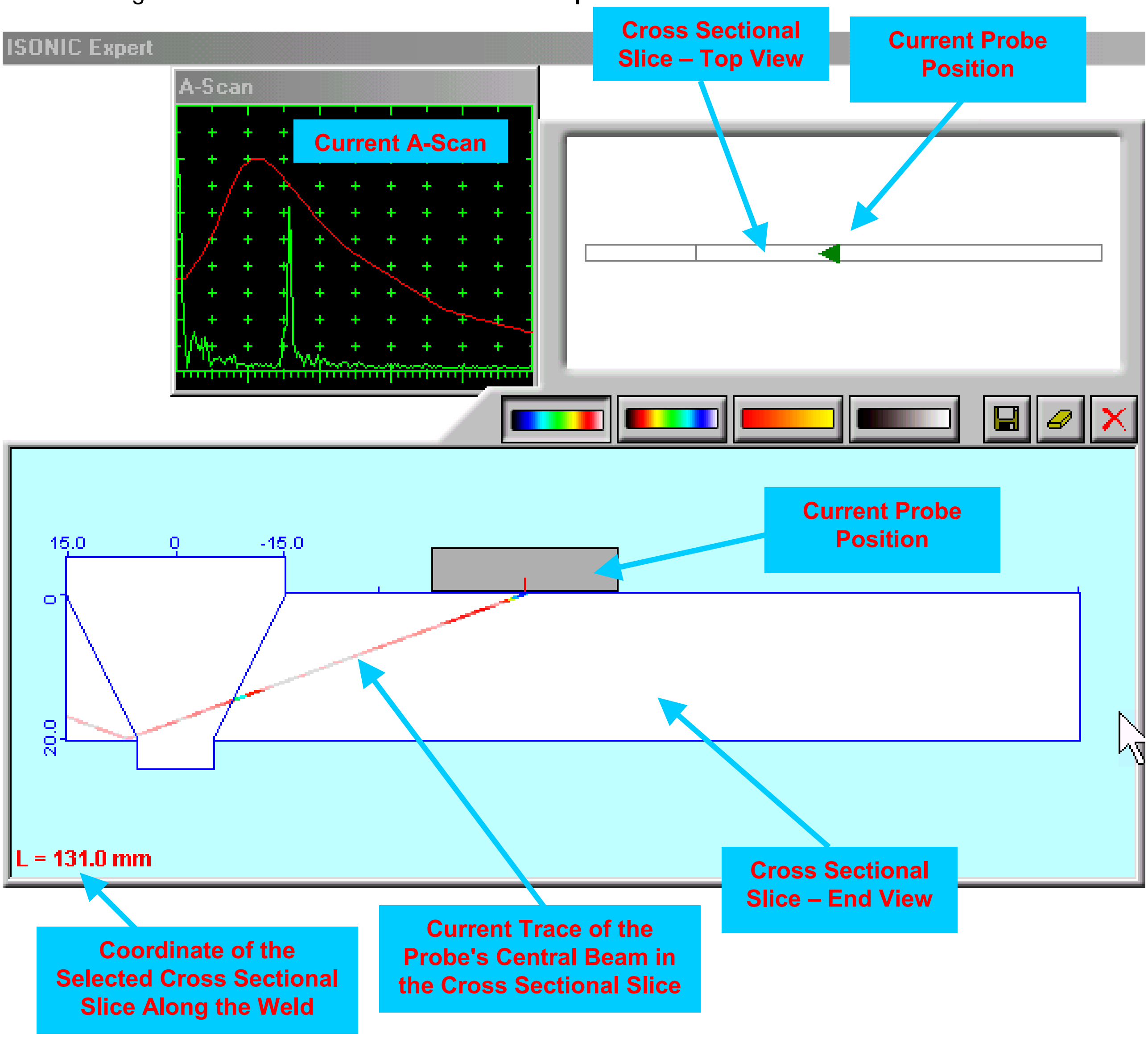
Refer to the paragraph 7.7 of this Operating Manual to scan the whole selected weld length

Upon detecting an indication the ***Defect Outlining Technology (DOT)*** may be applied through the scanning multiply above the cross-sectional slice containing the indication found and capturing of the **Raw Data B-Scan**. For that purpose place the probe above the cross section where the indication was found and click on B or press **<Alt>+<B>** on the keyboard. The proper placement of the probe may be ensured through the getting again the echo just prior to the clicking on B

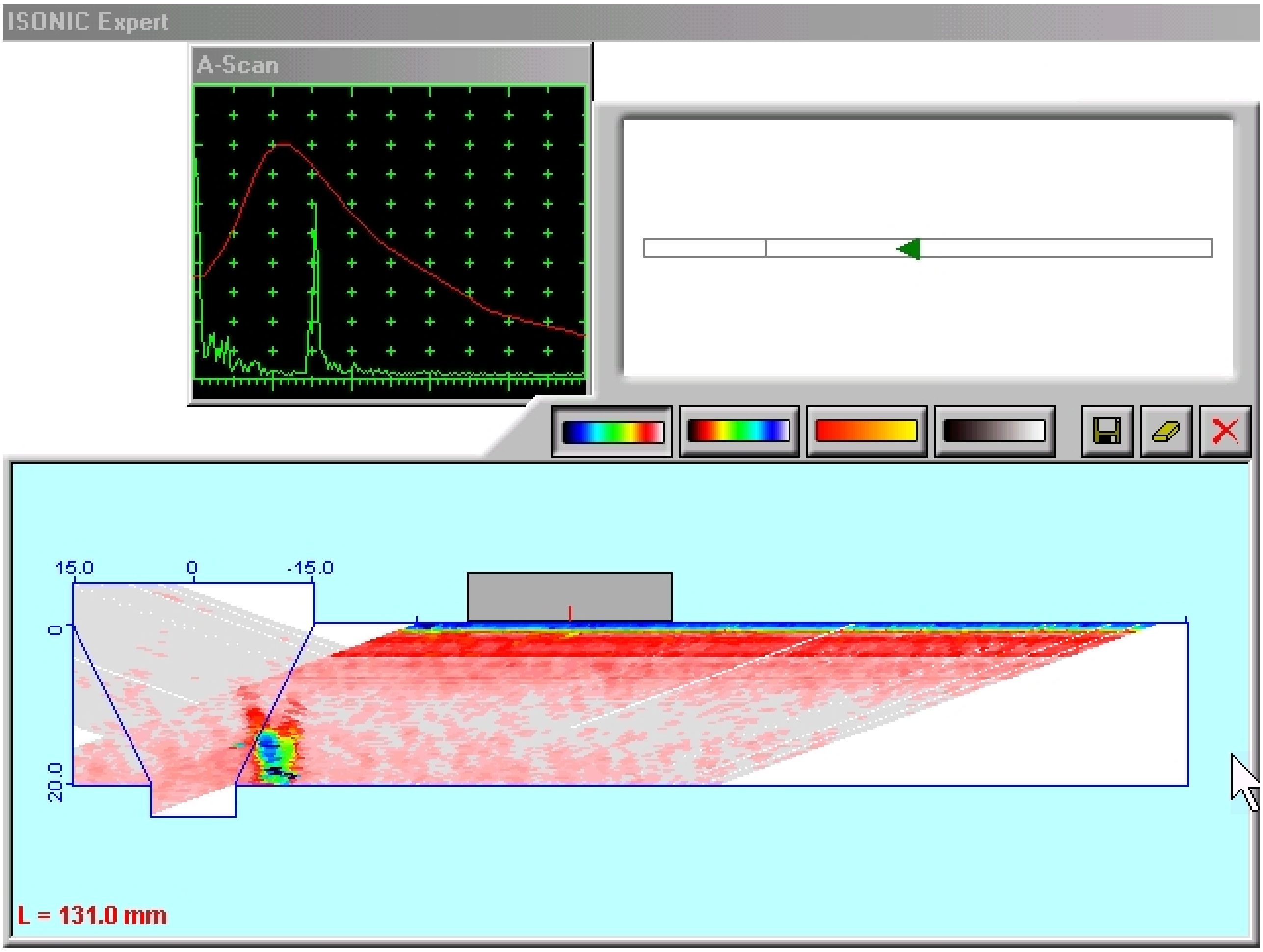


As a result the **DOT** window appears representing the cross sectional slice of the weld and adjacent material along with:

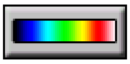
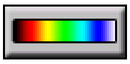
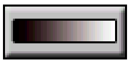
- Coordinate **L** of the selected cross sectional slice along the weld axis
- Width of the selected cross sectional slice, which is equal to the value of **Scan Index** designated in the **ISONIC Setup** window (refer to the paragraph 7.6.5 of the present Operating Manual) before the scanning
- Current probe position above the selected cross sectional slice
- Current A-Scan
- Current trace of the probe's central beam in the selected cross sectional slice, said trace is modulated point by point according to the signal's amplitude in the current A-Scan
- Weld geometry defined through the **WeldThick** and **WeldWidth** designated in the **ISONIC Setup** window and through the **Top Root Offset**, **Bottom Root Offset**, and **Bottom Bead Width** designated in the **Raw Data B-Scan Pre-Setup** window



It's necessary to scan multiply forward and back above the selected cross sectional slice to acquire the maximum of raw data A-Scans optimizing them for the better signal appearance. As a result the *raw data B-Scan with the sharply outlined defect* will fill the **End View** of the cross sectional slice:



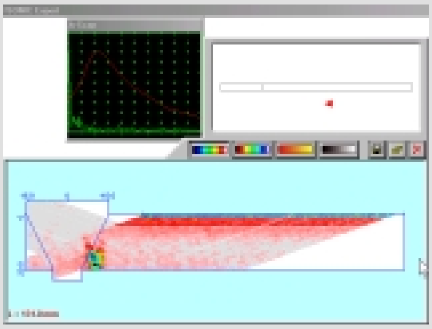
The following controls are available in the **DOT** window:

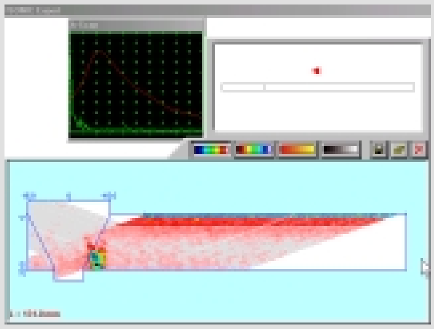
-  ,  ,  ,  - clicking on one of these buttons will designate the active palette representing the signal amplitude on the raw data B-Scan
-  - clicking on this button will erase the raw data B-Scan and clear the **DOT** window while the **DOT** mode will remain still active
-  - clicking on this button will erase the raw data B-Scan and return to the scanning mode (**ISONIC On-Line Imaging** window) without storing the **DOT** data
-  - clicking on this button will store completely the **DOT** data as a part of the whole weld inspection data including **Top**, **Side** and **End Views** and return to the scanning mode (**ISONIC On-Line Imaging** window)

ⓘ

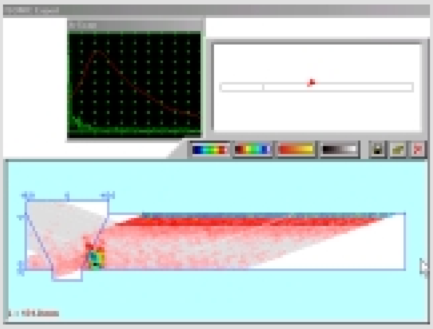
Scanning violations interrupting the data acquisition whilst in the **DOT** window:

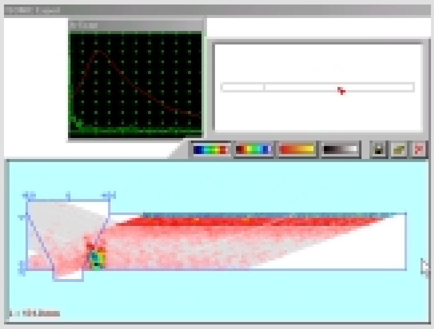
- *Placement of the probe aside of the selected cross sectional slice*. In that case the actual probe position will be still indicated in the **Top View** plane while the probe itself will not be shown in the **End View** plane:



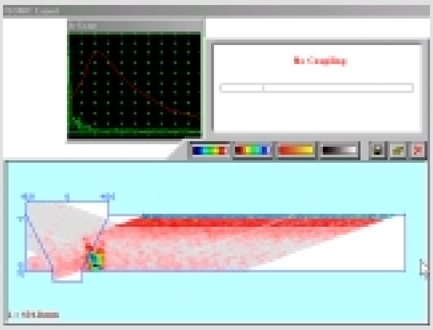


- *Improper probe orientation.* This violation will be automatically detected if the Probe Swiveling Angle Monitor was activated before start scanning (refer to the paragraph 7.6.5 of the present Operating Manual). If this is a case then the actual probe position will be still indicated in the **Top View** plane along with the improper probe orientation sign or while the probe itself will not be shown in the **End View** plane:



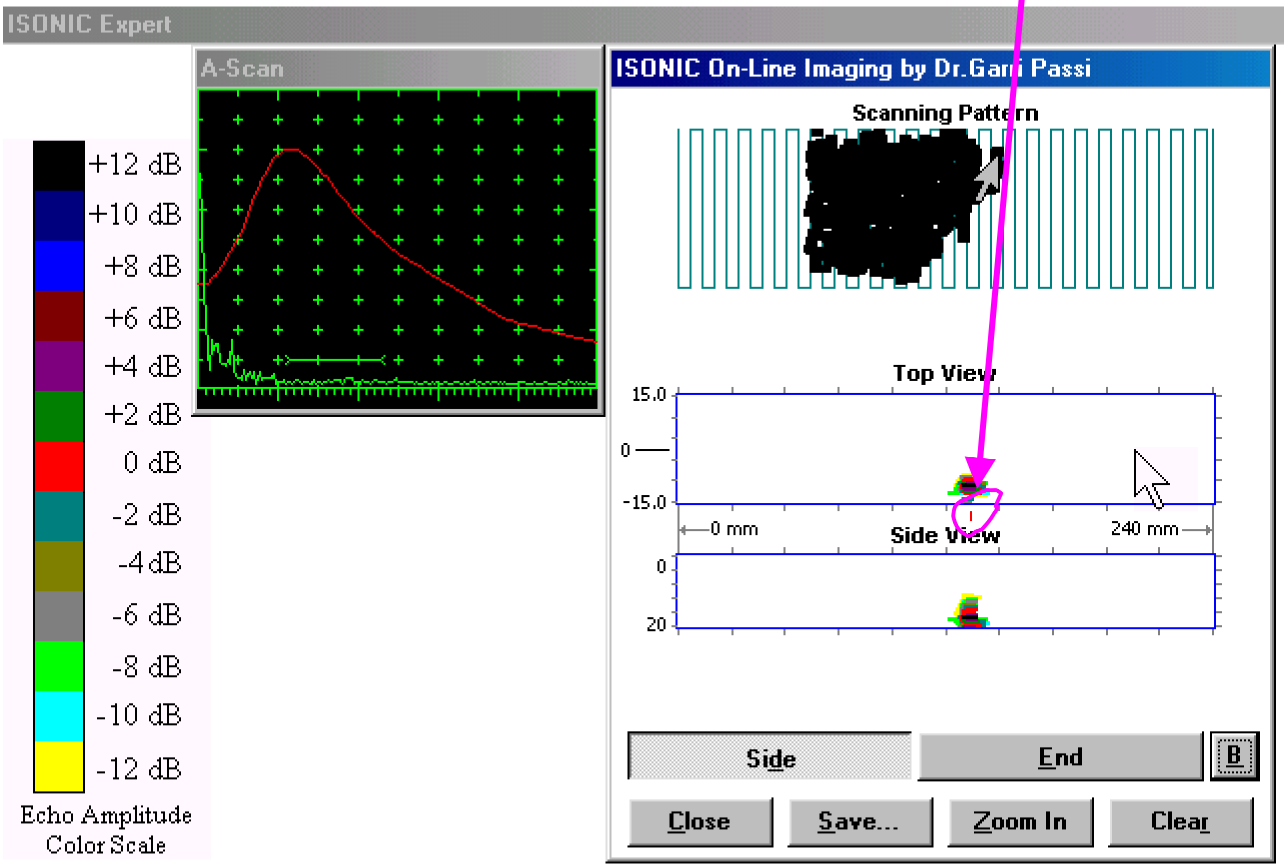


- *Coupling loss.* This violation will be automatically detected if the Acoustic Coupling Monitor was activated before start scanning (refer to the paragraph 7.6.5 of the present Operating Manual). If this is a case then the probe position will not be indicated in the **Top View** plane and the probe itself will not be shown in the **End View** plane. The **No Coupling** message will appear in the **Top View** plane image:

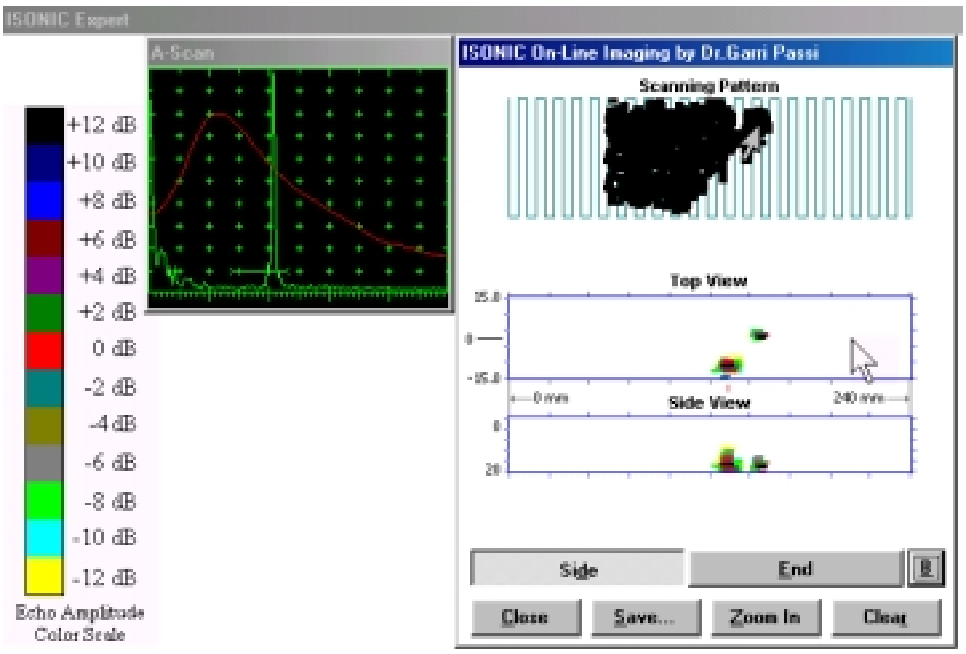


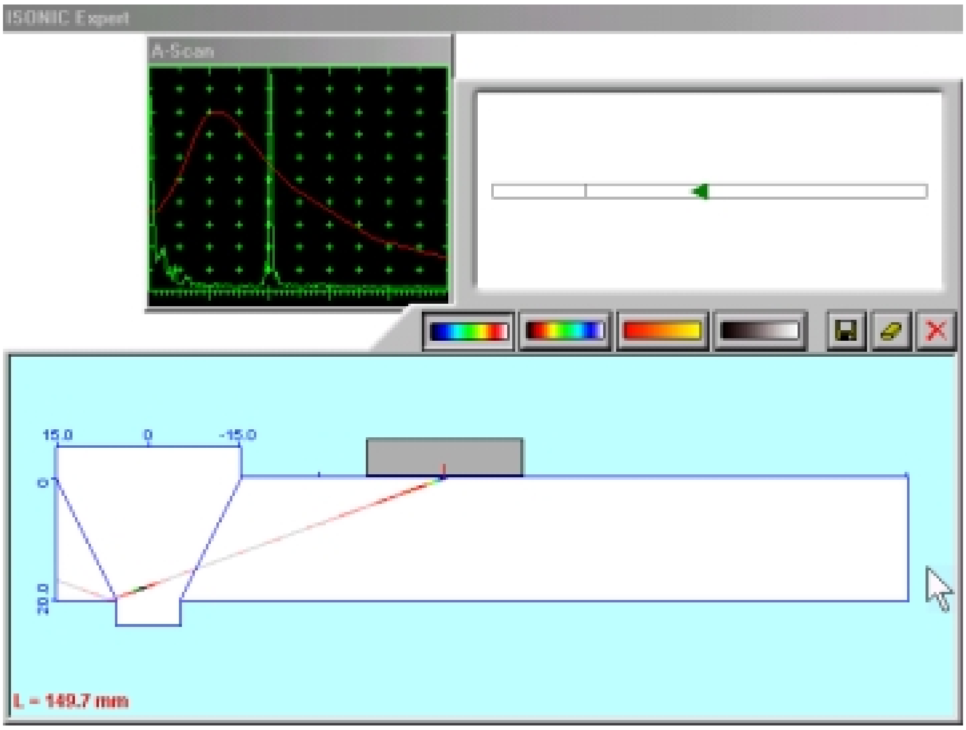
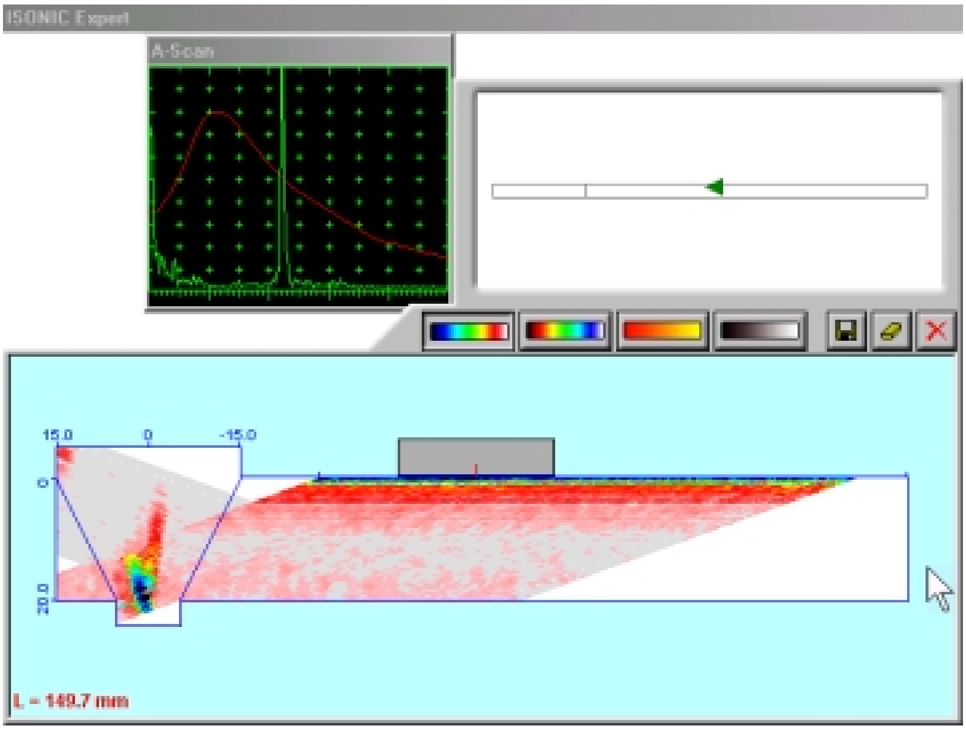
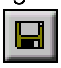
- *A combination of the above*

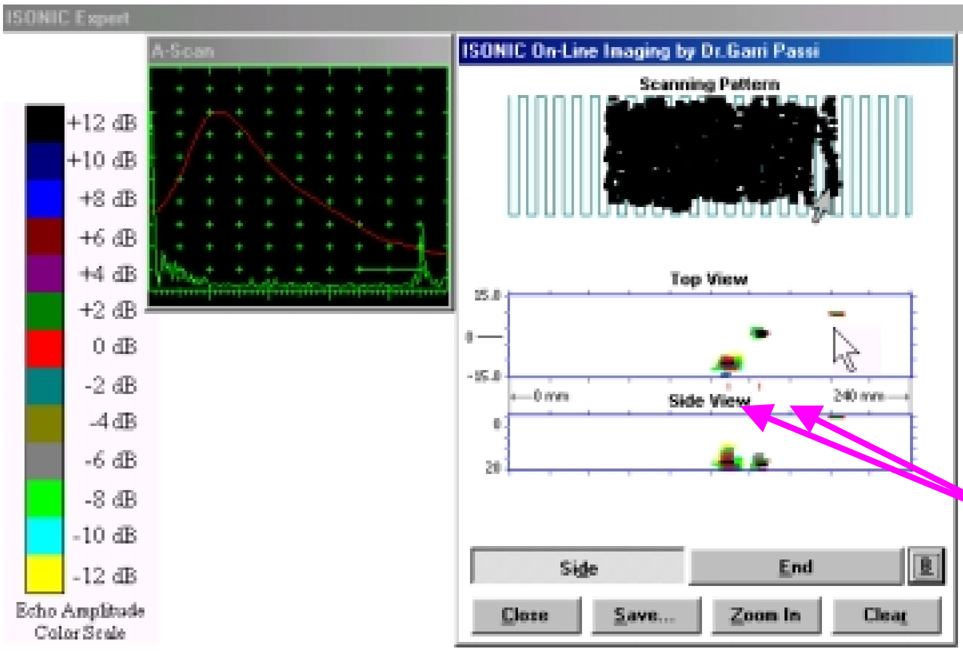
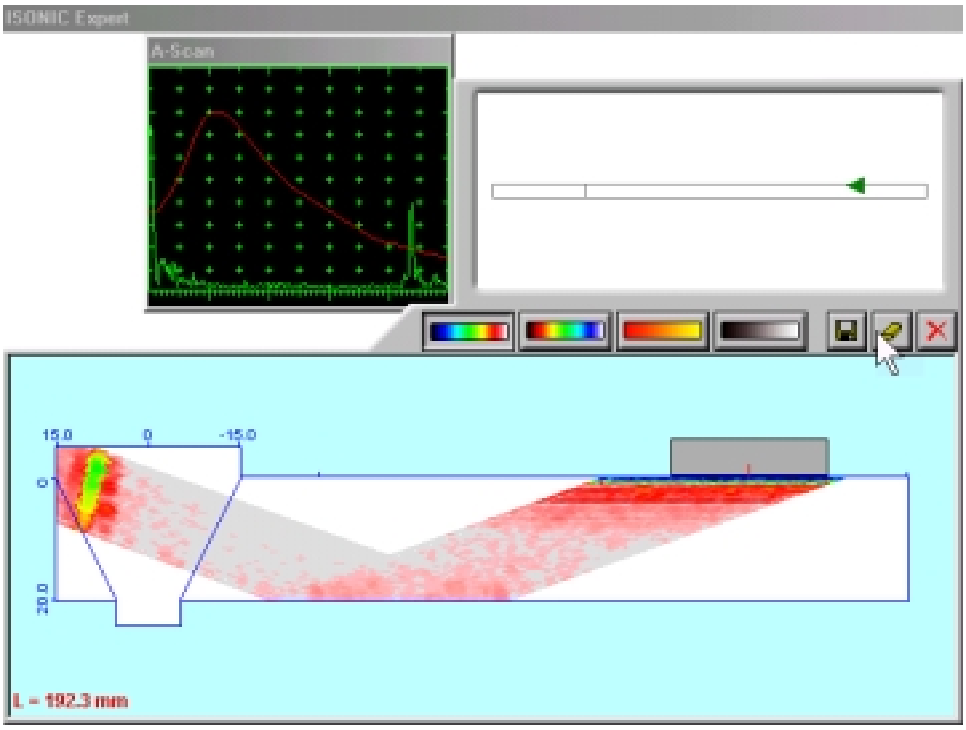
The cross section with the already stored **DOT** data will be highlighted by the **special mark** upon returning to the **ISONIC On-Line Imaging** window:

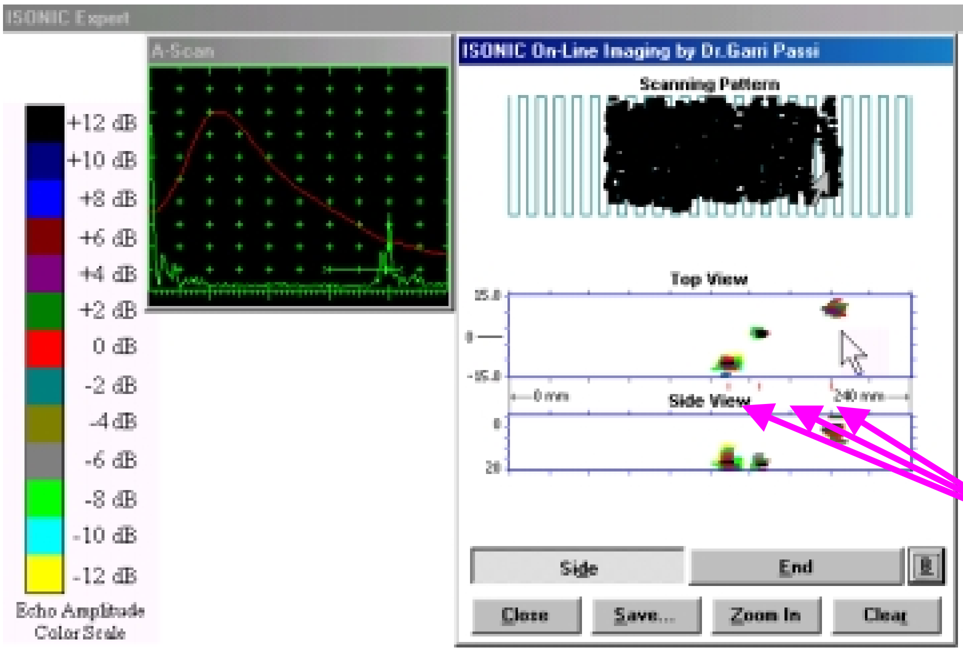


It's possible to store practically unlimited number of the raw data B-Scans entire the scanning session for each cross sectional slice one by one selected by the operator as it is illustrated by the sequence of the screenshots below

#	ISONIC Screenshot	Comments
1		Continuing scanning and detection of the next indication → click on **B**

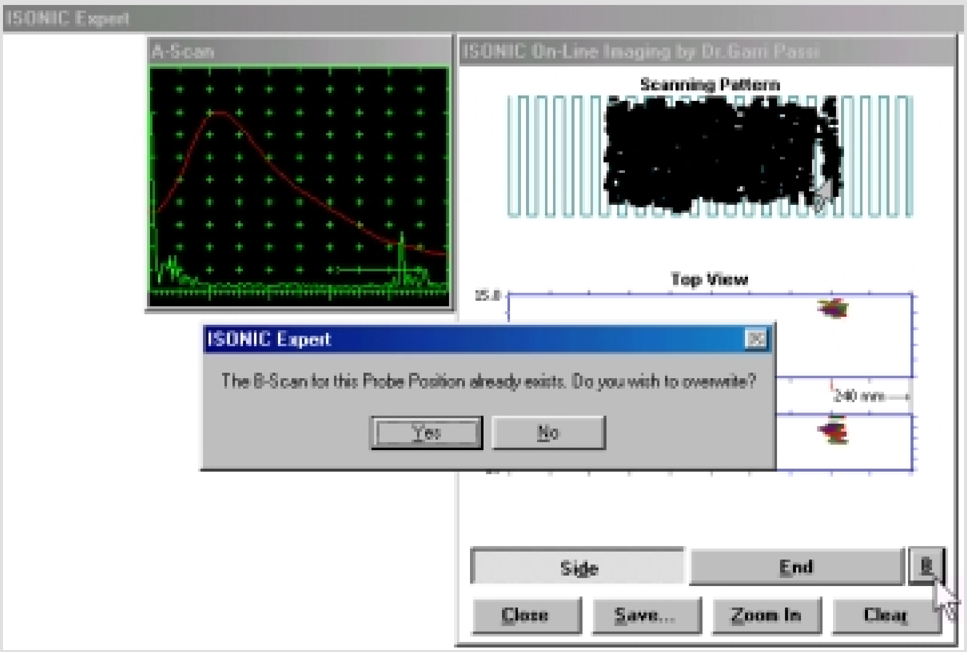
#	ISONIC Screenshot	Comments
2		Switch to the **DOT** window for the cross sectional slice containing the indication to be outlined
3		Completing outlining, storing the **DOT** data, and return to the scanning mode (**ISONIC On-Line Imaging** window) trough the clicking on 

#	ISONIC Screenshot	Comments
4		Continuing scanning and detection of the next indication → click on B Special marks indicate the presence of **two** cross sectional slices already filled with the **DOT** data
5		Completing outlining, storing the **DOT** data, and return to the scanning mode (**ISONIC On-Line Imaging** window) trough the clicking on 

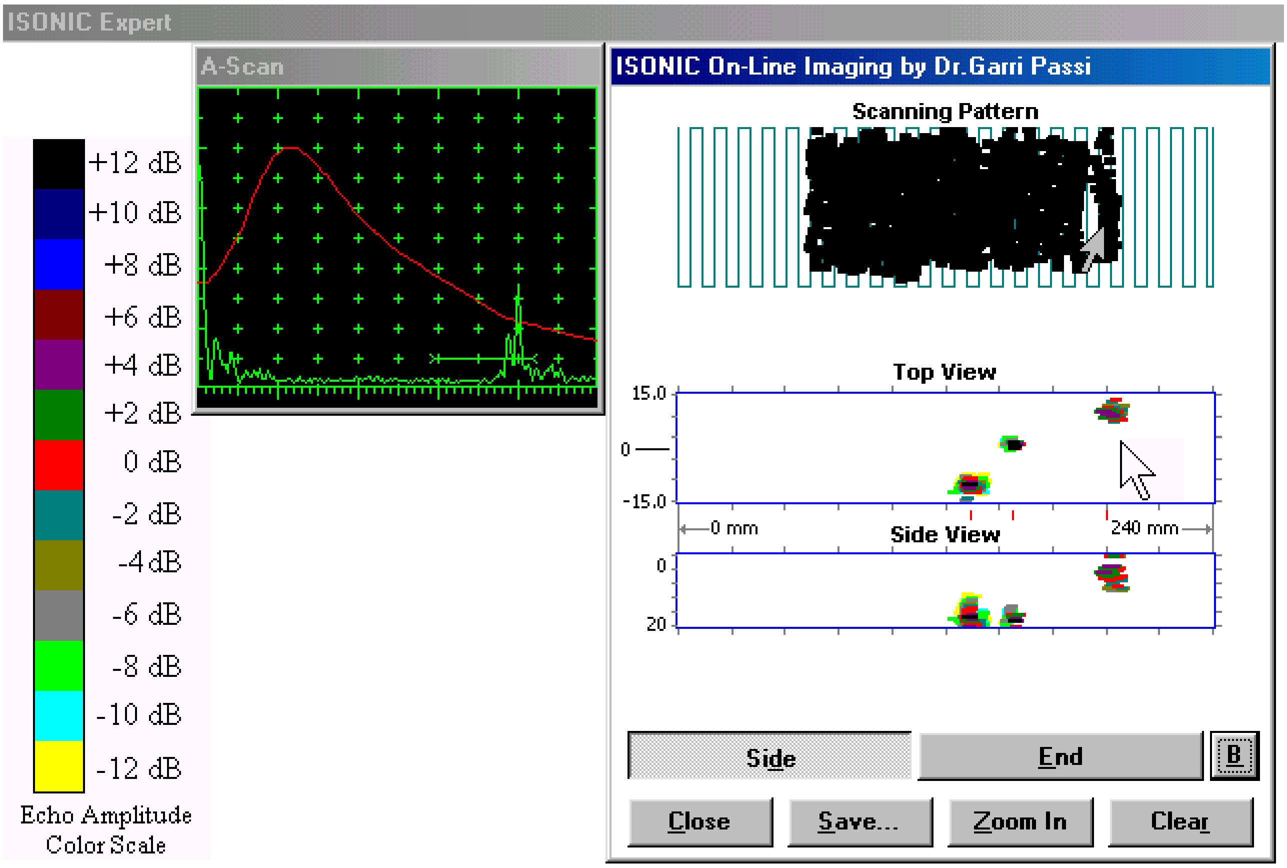
#	ISONIC Screenshot	Comments
6		Continuing scanning Special marks indicate the presence of **three** cross sectional slices already filled with the **DOT** data

ⓘ

An attempt to record the new **DOT** data for the cross sectional slice already containing such data causes the warning as below:



Clicking on Yes will erase the existing **DOT** data for the selected cross sectional slice and enter into the **DOT** window allowing capturing of the new data. Clicking on No will return to the scanning mode – **ISONIC On-Line Imaging** window



The following controls beside **B** are available while scanning:

- **End** and **Side** - clicking on the appropriate button or pressing **<Alt>+<E>** or **<Alt>+<S>** on the keyboard highlights the **End View** or **Side View** along with the **Top View** and **Scanning Pattern** permanently presented in the **ISONIC On-line Imaging** window

- **Save...** - click on this button or press **<Alt>+<S>** on the keyboard ***to save a file completely containing the scanning results along with the complete DOT data for all cross sectional slices captured by an operator***. For the file placement and naming proceed according to the paragraph 5.4.19 of this Operating Manual

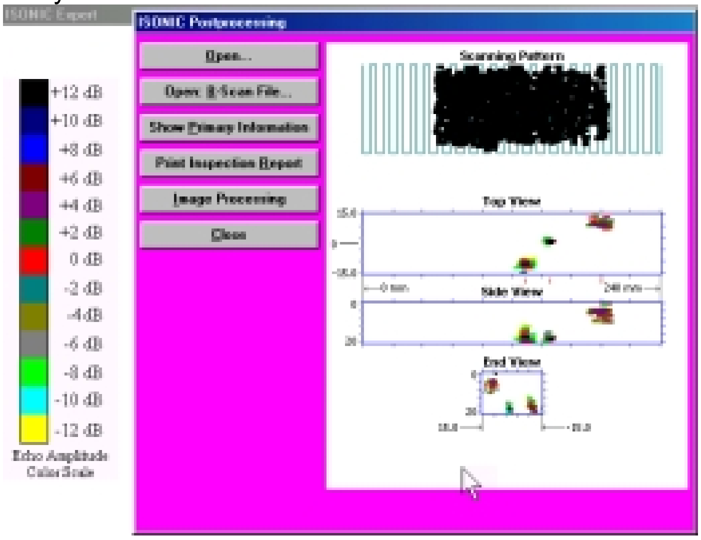
- **Zoom In** - click on this button or press **<Alt>+<Z>** on the keyboard to zoom the **ISONIC On-Line Imaging** window

- **Clear** - click on this button or press **<Alt>+<R>** on the keyboard to reset to background in the **ISONIC On-Line Imaging** window

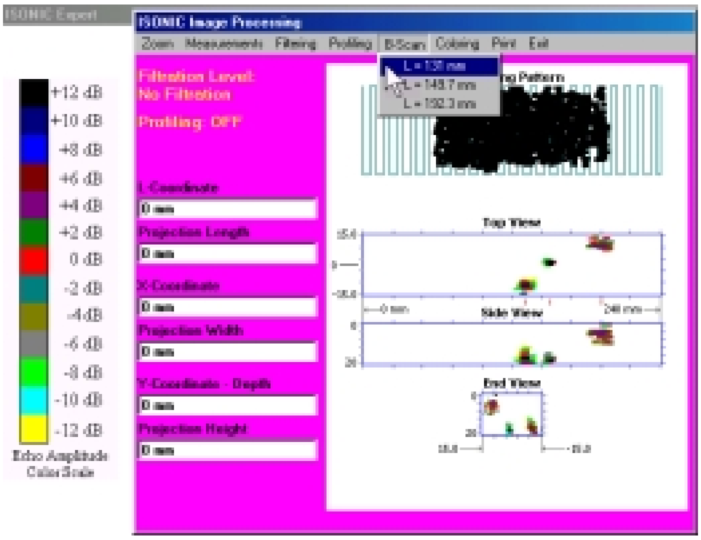
- **Close** - click on this button or press **<Alt>+<C>** or **Esc** on the keyboard to return back to the **ISONIC Setup** window

8.8. Postprocessing

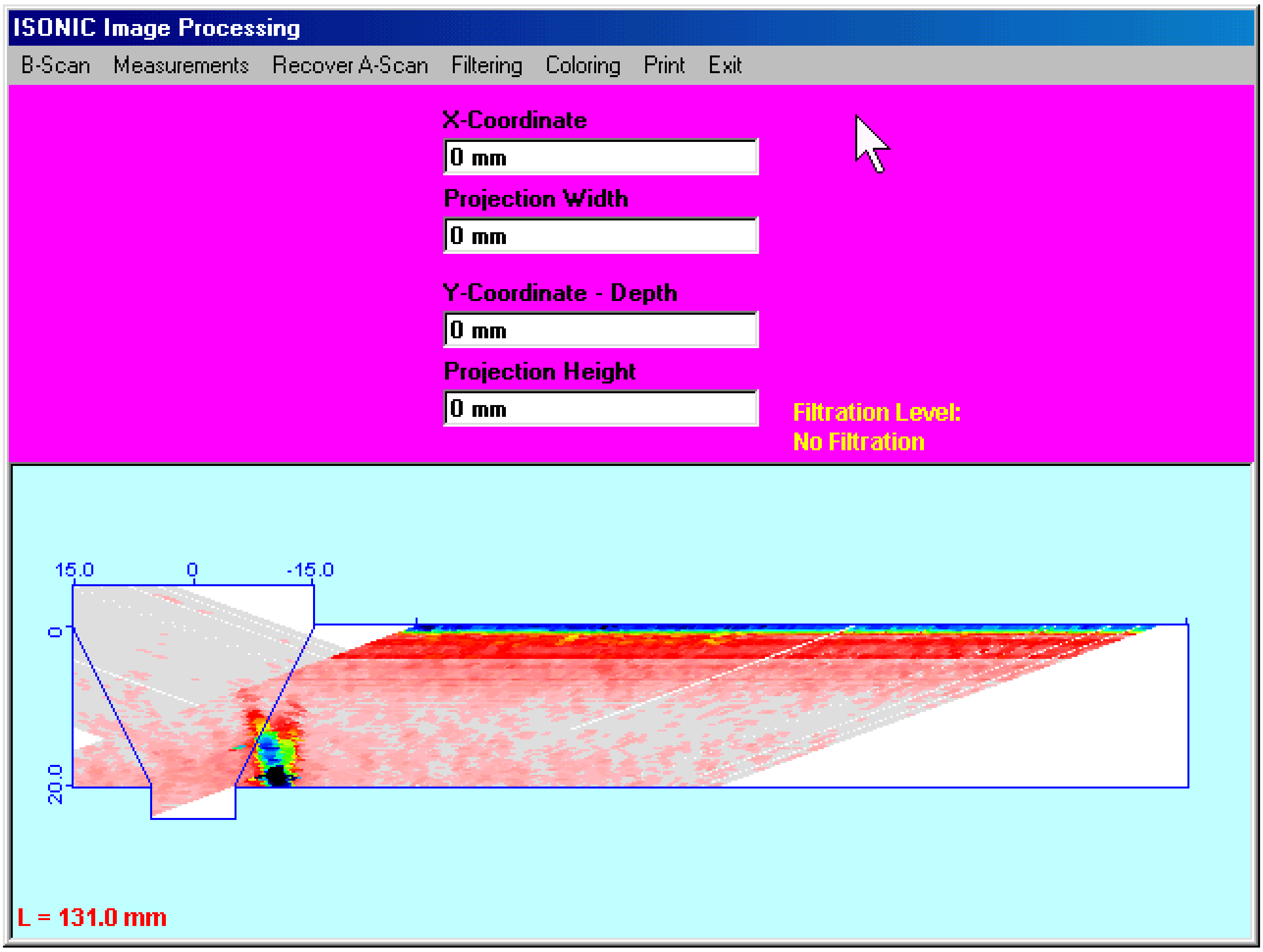
Refer to the paragraph 7.8 of this Operating Manual and to the below specific notes related to the off-line analysis of the **DOT** data



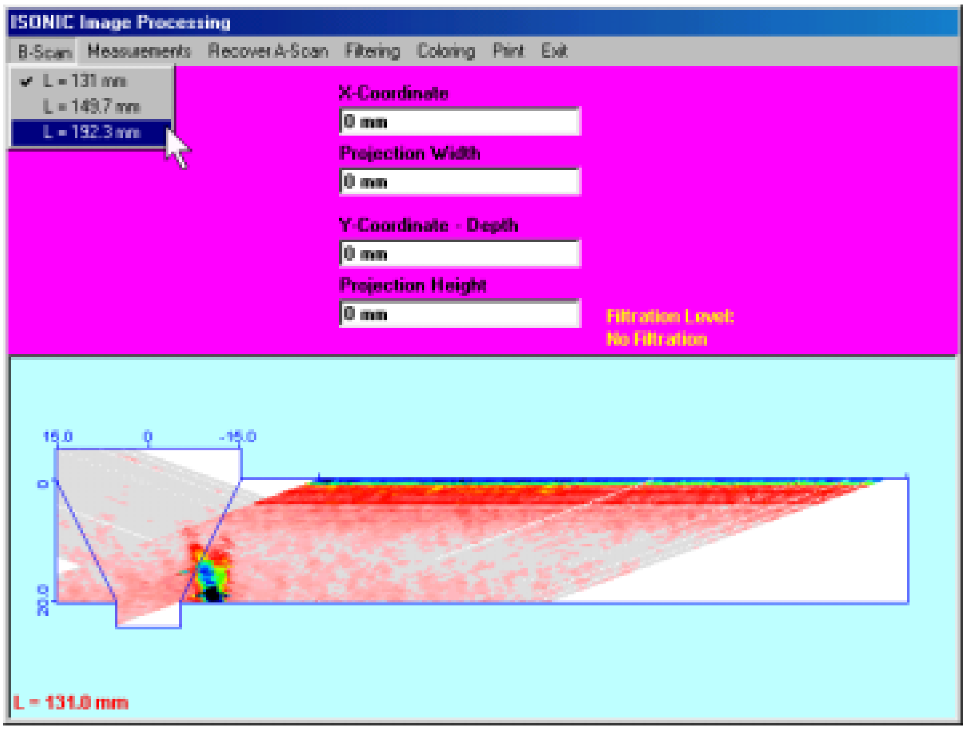
To proceed with the off-line analysis of the **DOT** data click on **Image Processing** or press **<Alt>+<I>** on the keyboard upon opening the file then click on the **B-Scan** in the horizontal menu bar and select the cross sectional slice by it's **L-coordinate** through the opened vertical menu bar

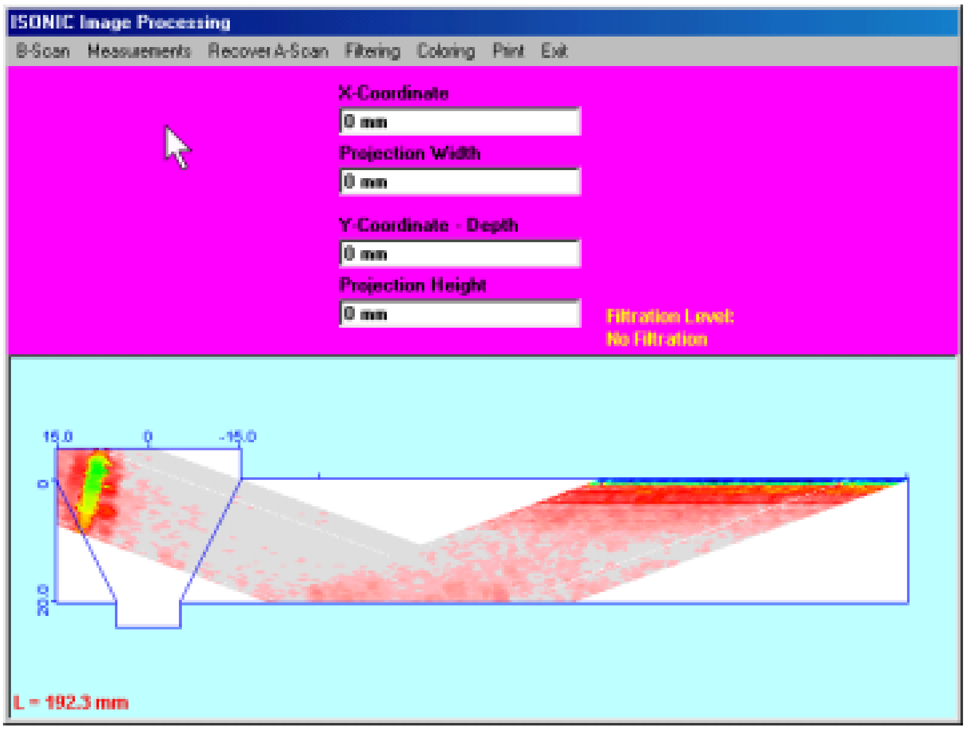


As a result the **DOT** off-line analysis window appears



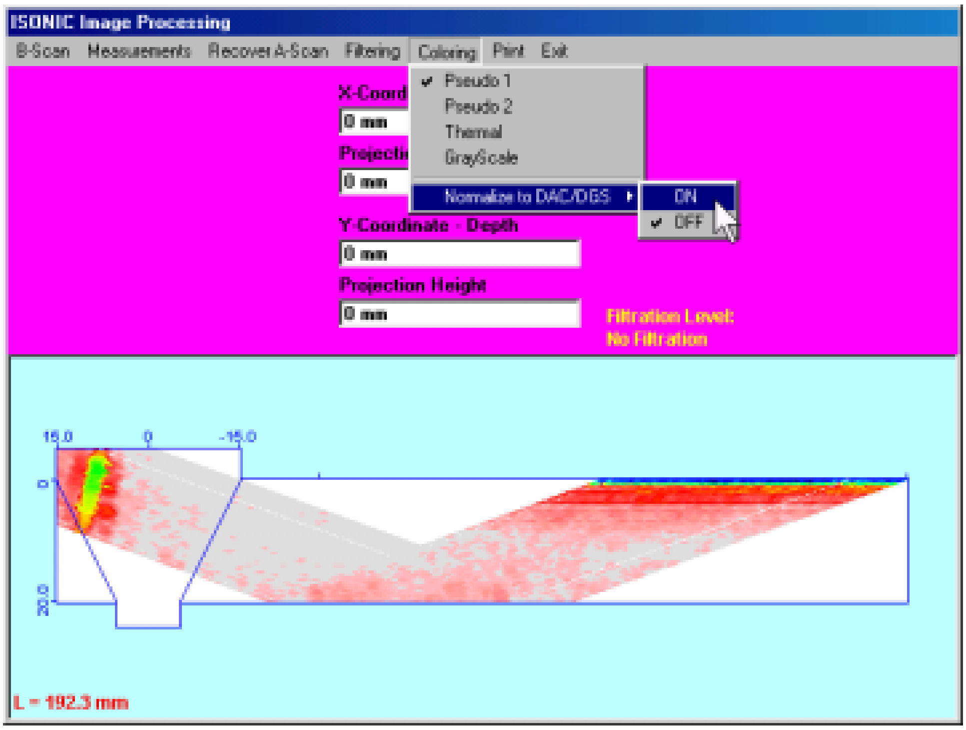
All operations in the **DOT** off-line analysis window are controlled through the horizontal menu bar as it is explained and illustrated below





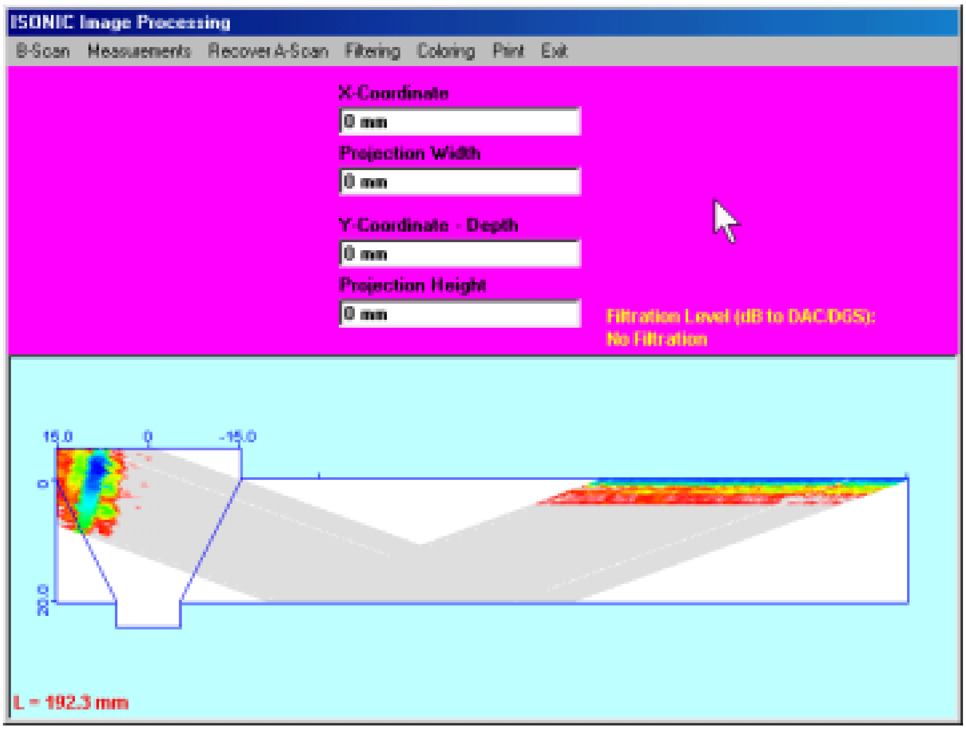
B-Scan → L-coordinate

Switch from the unfolded cross sectional slice to another one provided that there were more then one of them captured and stored along with the scanning data



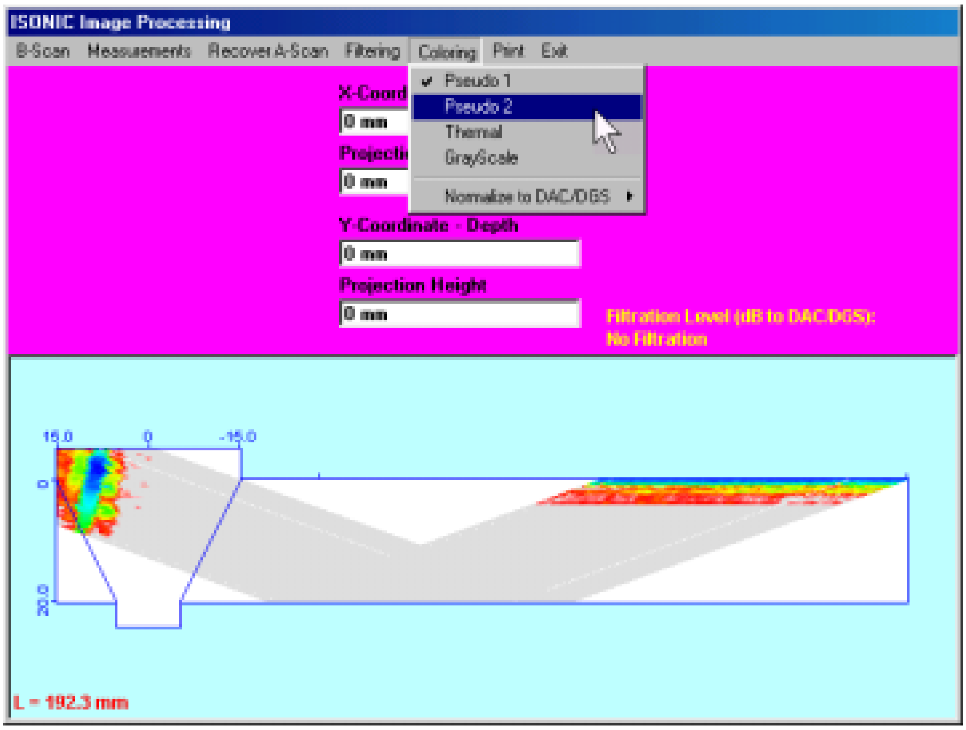
Coloring → Normalize to DAC/DGS → ON

If the **DOT** data was captured whilst DAC / DGS was active then the **Raw Data B-Scan** may be represented at **dB to DAC / DGS** rate where the palette reflects echo amplitudes *normalized to DAC / DGS*



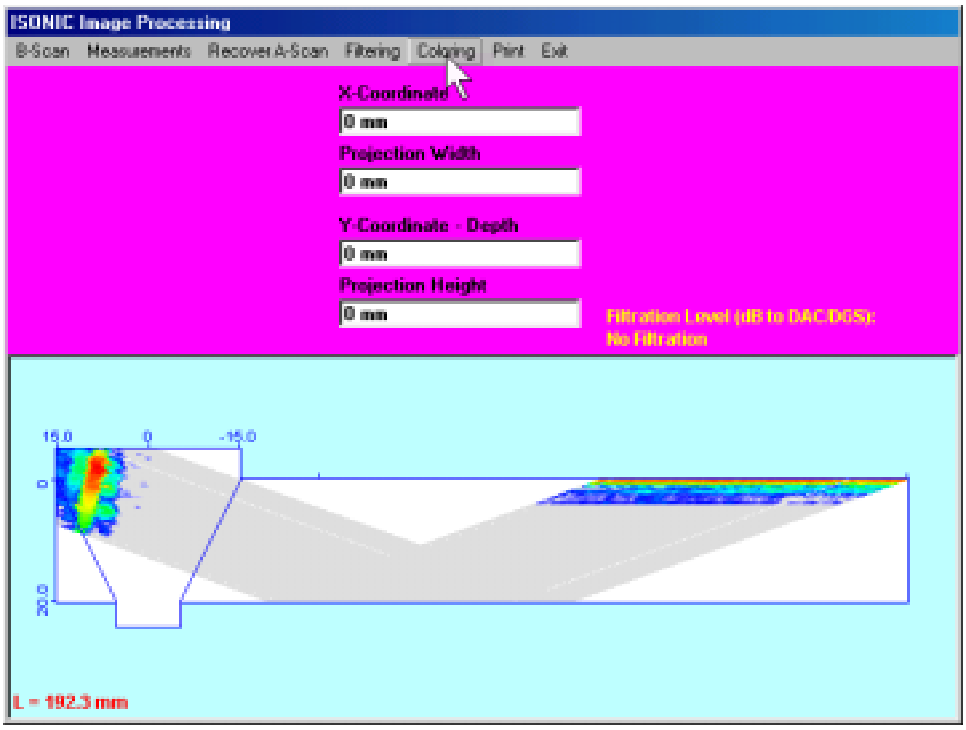
Coloring → Normalize to DAC/DGS → OFF

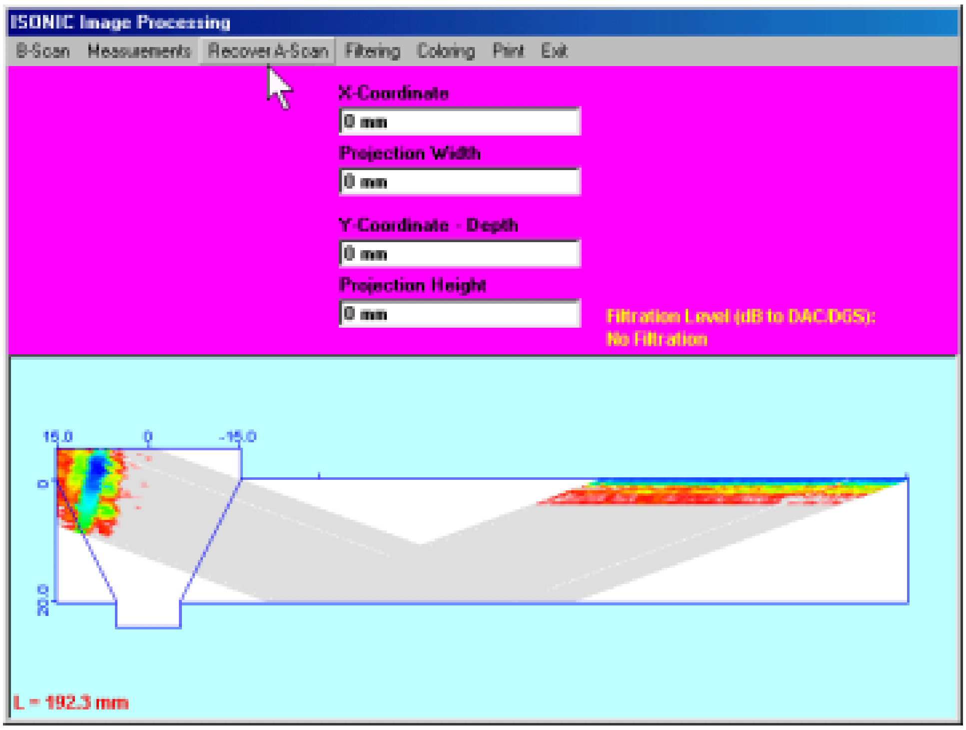
This combination will return to representation of the **Raw Data B-Scan** using the palette linearly reflecting the echo amplitudes

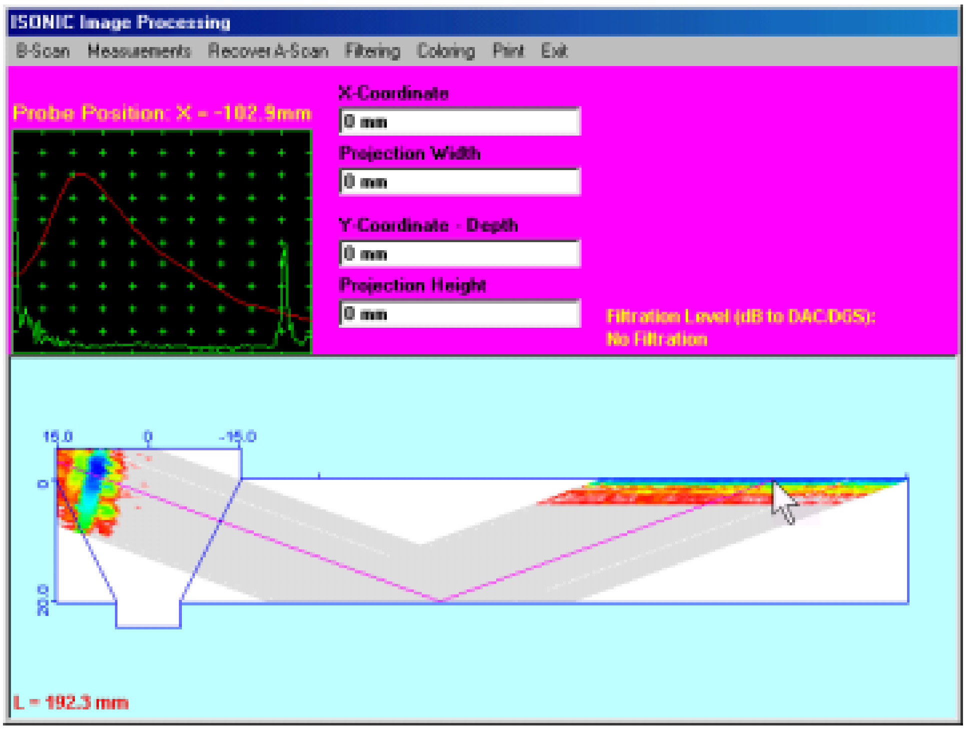


Coloring → <Palette> where the **<Palette>** may be either **Pseudo 1** or **Pseudo 2** or **Thermal** or **GrayScale**

Selection of the palette to represent the **Raw Data B-Scan**



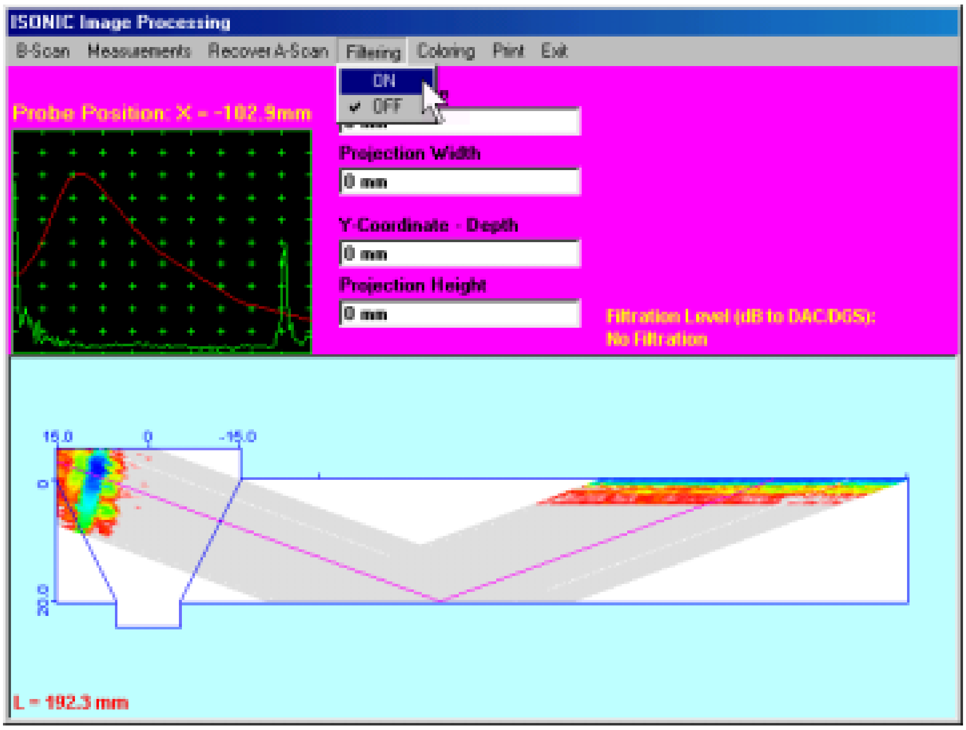


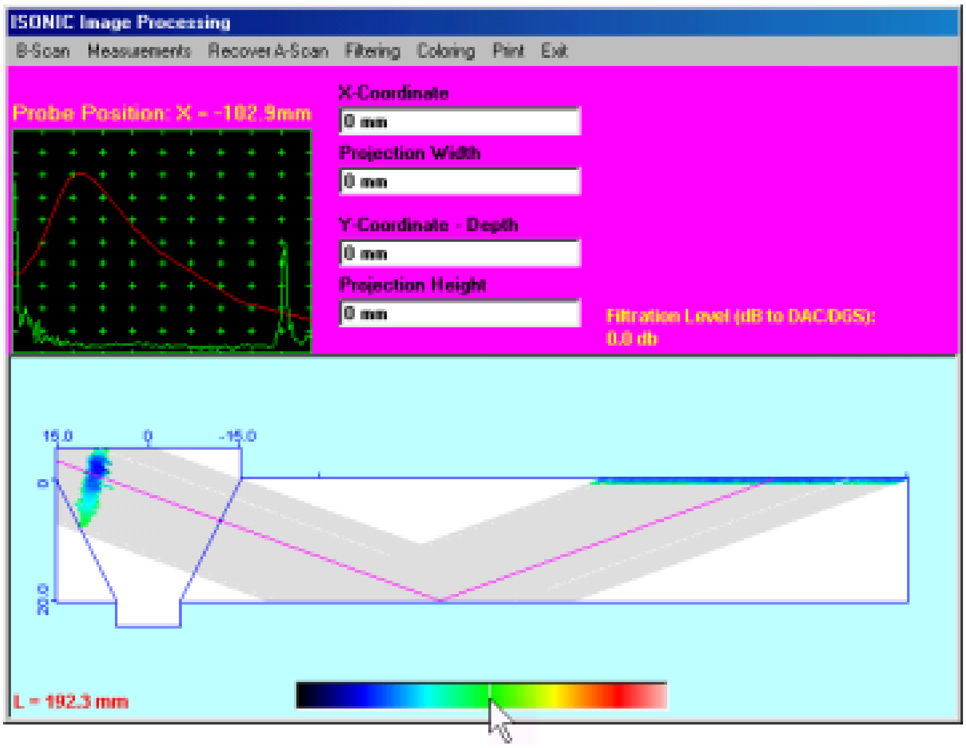


Recover A-Scan

Clicking on this topic will place the cursor above the "contact surface" line of the cross sectional slice allowing the *off-line virtual scanning across the weld*. The cursor position matching with the probe's incidence point is accompanied with its central beam trace and indicated as **Probe Position**. The virtual scanning across the weld may be controlled by the touch screen stylus or by mouse or by the ← and → buttons on the keyboard. *The A-Scans are recovered and represented dynamically for each cursor position allowing the defect's characterization according to* ***BS EN 583-5***

Upon completing the virtual scanning and selection of the necessary A-Scan (for example – representing the maximal echo) release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard – this will free the cursor for further procedures





Filtering → ON

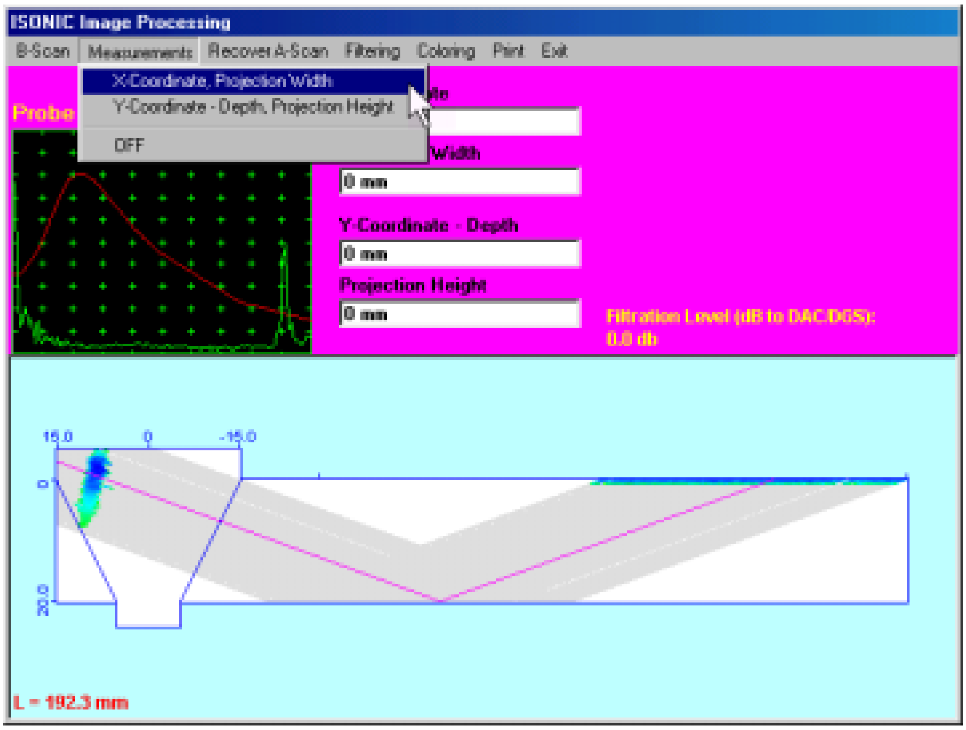
Filtering of the **Raw Data B-Scan** through the suppressing of the echo amplitudes below the selected **threshold level**:

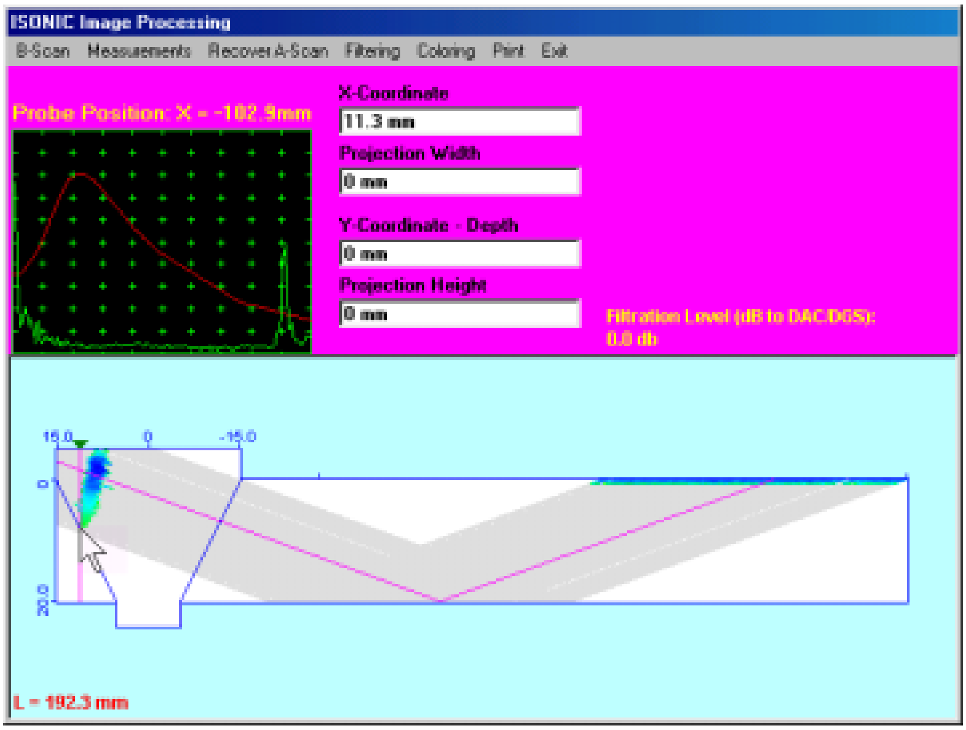
- The **amplitude threshold line** representing the **threshold level** appears above the palette; the cursor is "sticked" to the **amplitude threshold line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ← , → buttons on the keyboard
- The value of the **amplitude threshold** is displayed as **Filtration Level, dB** or **dB to DAC/DGS** depending on the **DAC/DGS normalization** is **OFF** or **ON**
- Images of the reflectors returning the echo amplitudes below the **amplitude threshold** are erased from the **Raw Data B-Scan** i.e. rejected

To fix the **threshold level** left mouse click or release the stylus from the touch screen

Filtering → OFF

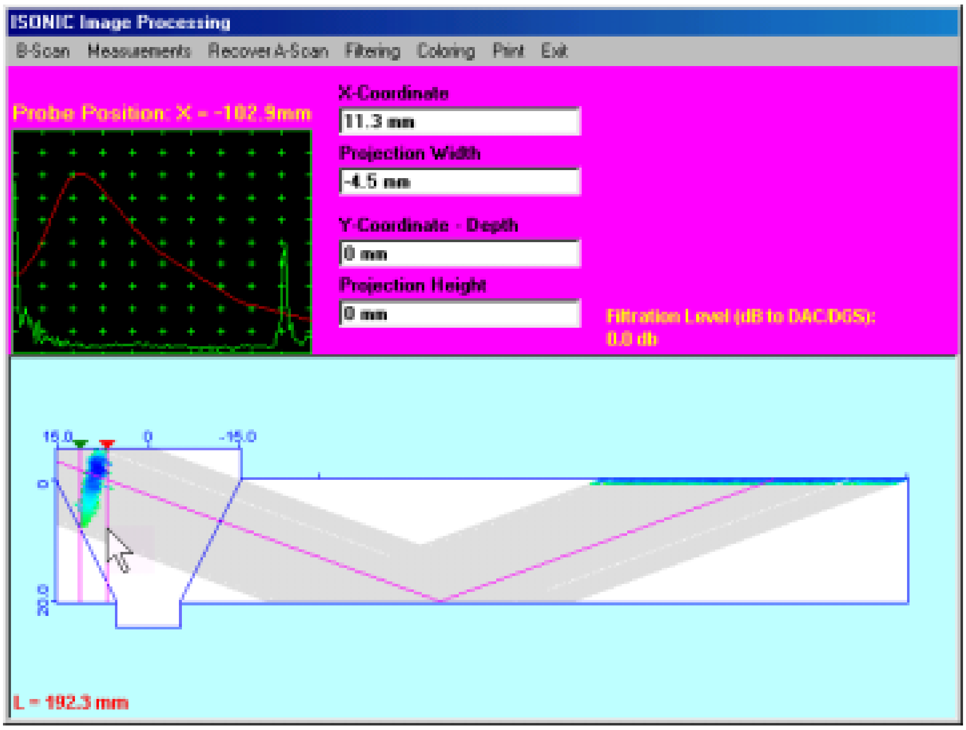
This switches back to the unfiltered **Raw Data B-Scan** representation





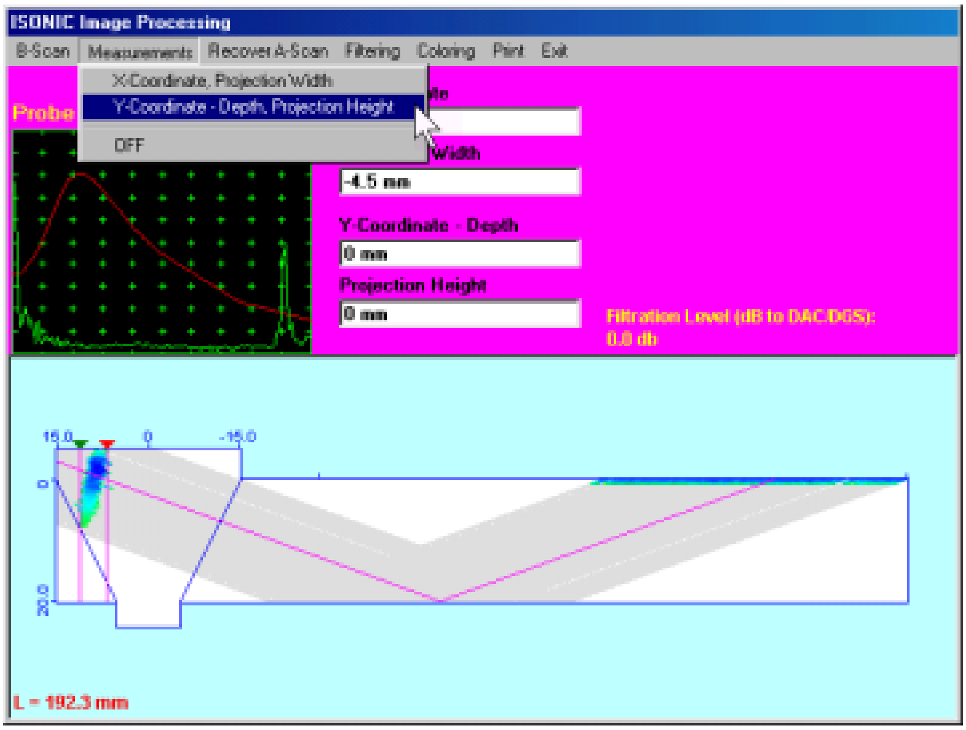
Measurements → X-Coordinate, Projection Width

- The **first vertical measuring line** appears on the **Raw Data B-Scan**; the cursor is "sticked" to the **first vertical measuring line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ← , → buttons on the keyboard
- The position of the **first vertical measuring line** is indicated as **X-Coordinate**
- To fix the position of the **first vertical measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard



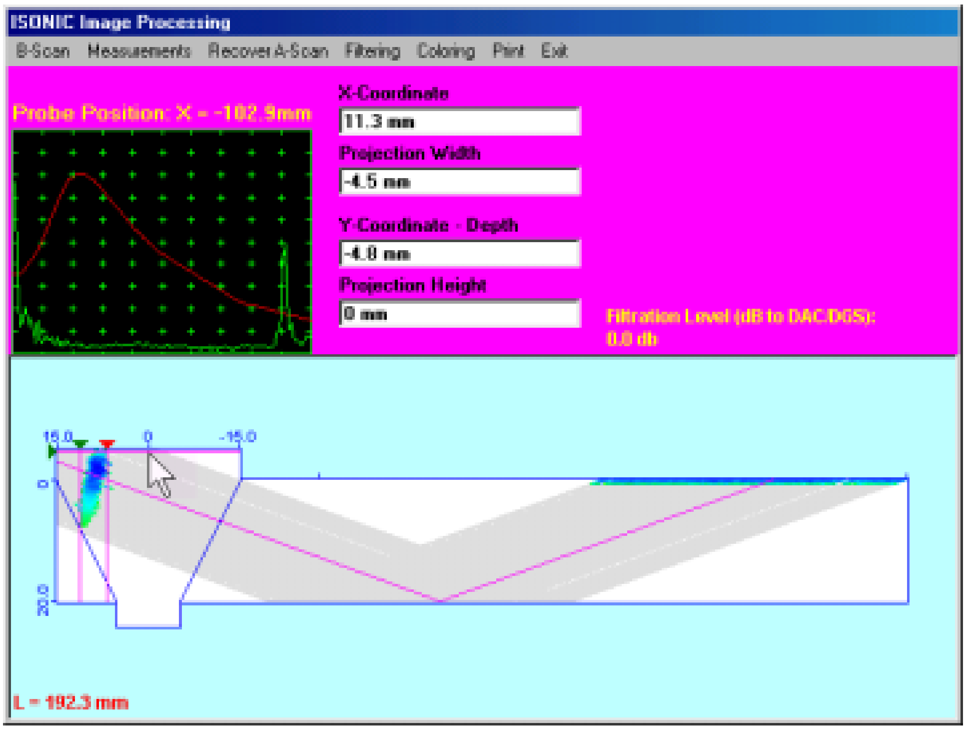
As a result:

- The **second vertical measuring line** appears on the **Raw Data B-Scan**; the mouse pointer is "sticked" to the **second vertical measuring line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ←, → buttons on the keyboard
- The position of the **second vertical measuring line** with respect to the **first vertical measuring line** is indicated as **Projection Width**
- To fix the position of the **second vertical measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard



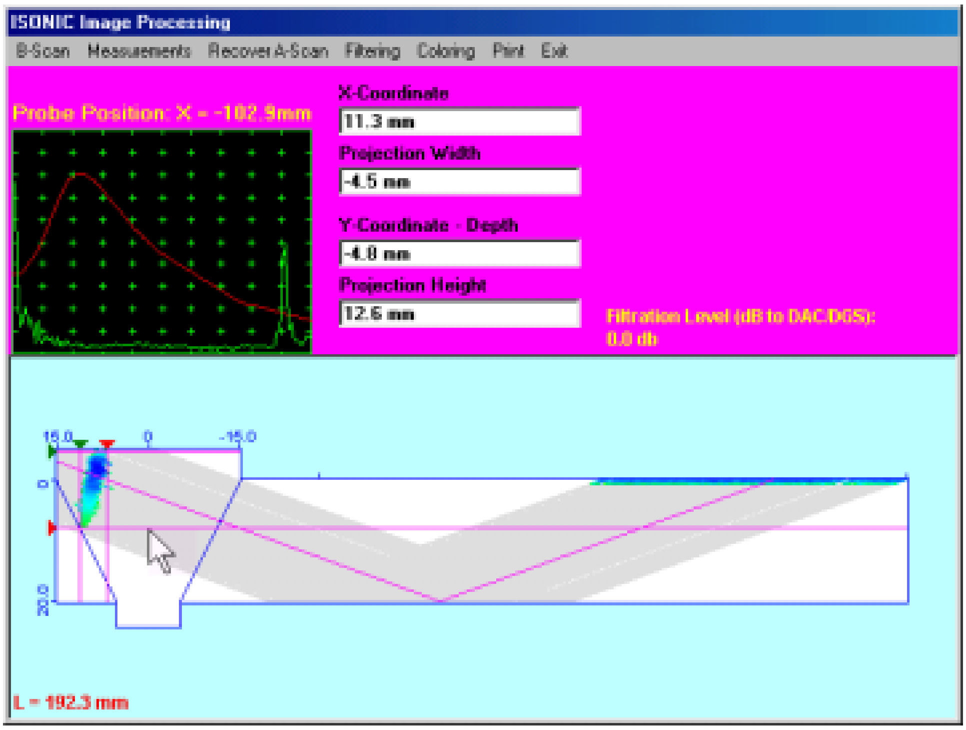
Measurements → Y-Coordinate, Projection Height

- The **first horizontal measuring line** appears on the **Raw Data B-Scan**; the mouse pointer is "sticked" to the **first horizontal measuring line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard



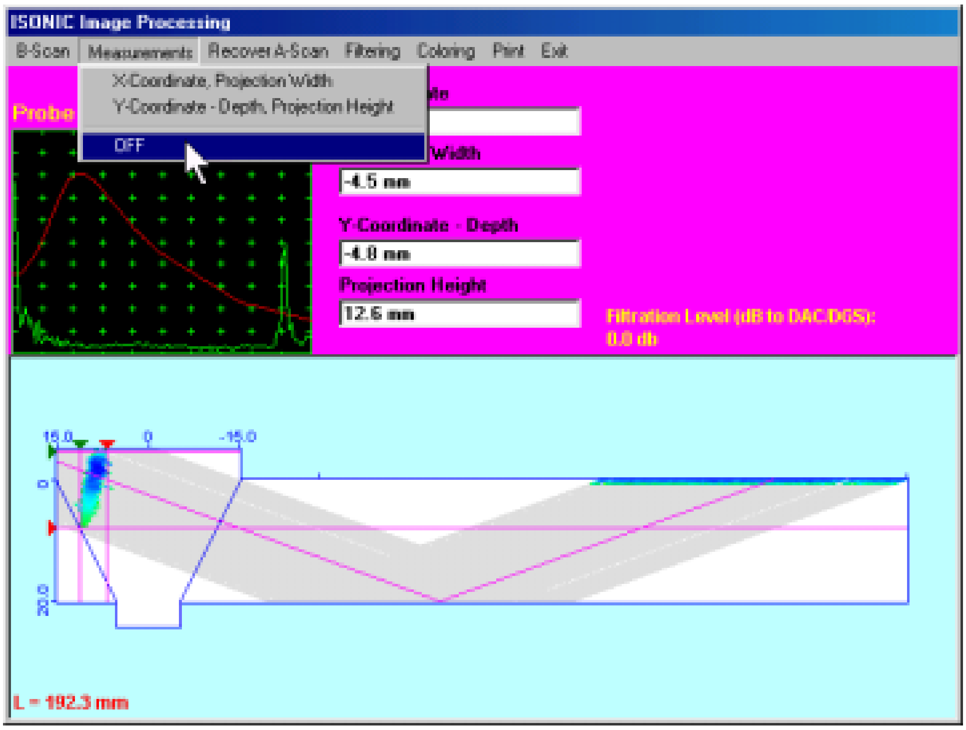
- The position of the **first horizontal measuring line** is indicated as **Y-Coordinate, Depth**

- To fix the position of the **first horizontal measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard



As a result:

- The **second horizontal measuring line** appears on the **Raw Data B-Scan**; the mouse pointer is "sticked" to the **second horizontal measuring line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard
- The position of the **second horizontal measuring line** with respect to the **first horizontal measuring line** is indicated as **Projection Height**
- To fix the position of the **second horizontal measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard



Measurements → OFF

This will negate the measurement lines on the **Raw Data B-Scan** and clear the measurement boxes

Print - clicking on this topic will print the apparent postprocessing view along with the measurements and filtering data

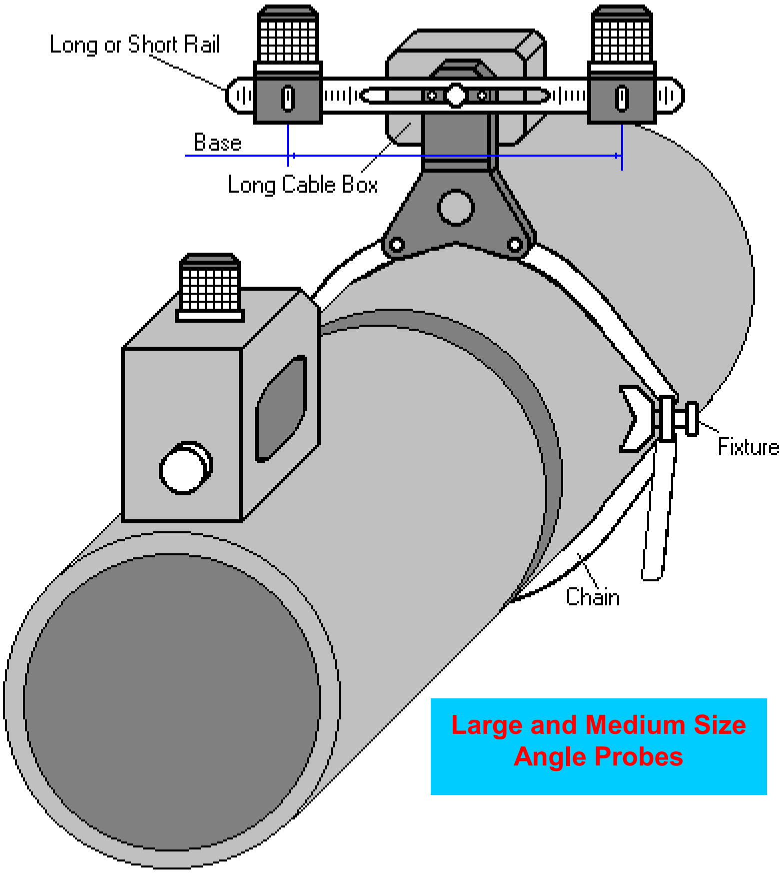
Exit – clicking on this button will return to the **ISONIC Image Processing** window containing **Top View**, **Side View**, and **End View** of the whole scanned weld

9. Operating 'SM-PIPE' Software Package - ISONIC Inspection of Small Diameter Welds

The contents of this chapter is valid for the SM-PIPE SW Package version 4.1.0.5 or higher

9.1. Preparing for the Inspection

9.1.1. Fixture



Place the fixture and the bar with the receivers of airborne ultrasound on the pipe. The bar must be oriented at parallel to weld. Depending on the probe dimensions there are two ways for fitting the bar to the fixture – refer to the corresponding pictures.

The value of **Base** (the distance between two receivers of airborne ultrasound) may be from 100 to 300 *mm* or 4 to 12 *in*. The short bar is required if the value of **Base** is not exceeding 200 *mm* or 8 *in*. If this is a case then the distance between the receivers is defined as:

Base = **100** + **Pos1** + **Pos2**, *mm*
or
Base = **4** + **Pos1** + **Pos2**, *in*

The long bar is required if the value of **Base** is more than 200 *mm* or 8 *in*. If this is a case then the distance between the receivers is defined as:

Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

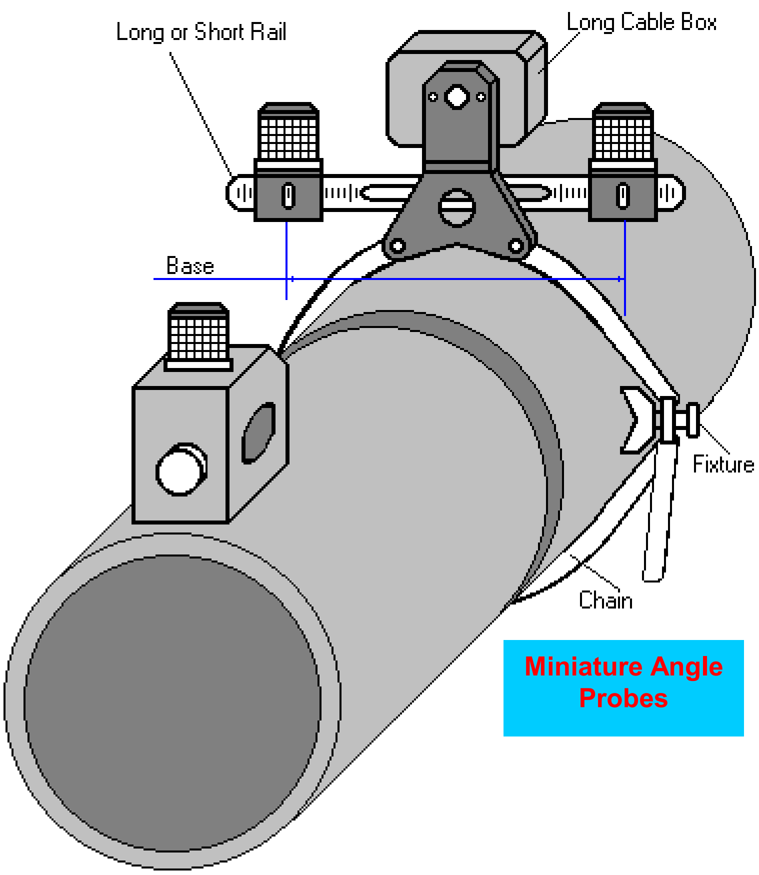
In the above formulas **Pos1** and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly

The value of **Base** must be known prior to the scanning. Wrong determining of the **Base** causes the mistakes in monitoring probe location and defects imaging

Important:

- The exact length of the inspected area (**Weld Length**) depends on **Base** and **Weld Diameter** and it is calculated automatically while running the SM-PIPE software package (refer to the below paragraphs 9.6 and 9.7 of this Operating Manual)
- It may occur that reducing of the preliminary selected **Base** value will be required by the software running (refer to the paragraph 9.6 of this Operating Manual)

Follow also the instructions of paragraph 7.1 of this Operating Manual for fitting probe into the probe holder, etc.



9.1.2. Cabling

Refer to the paragraph 7.1.2 of this Operating Manual

9.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

9.3. Operating the software: general hints

Follow the instructions of paragraph 7.3 of this Operating Manual

9.4. Getting started...

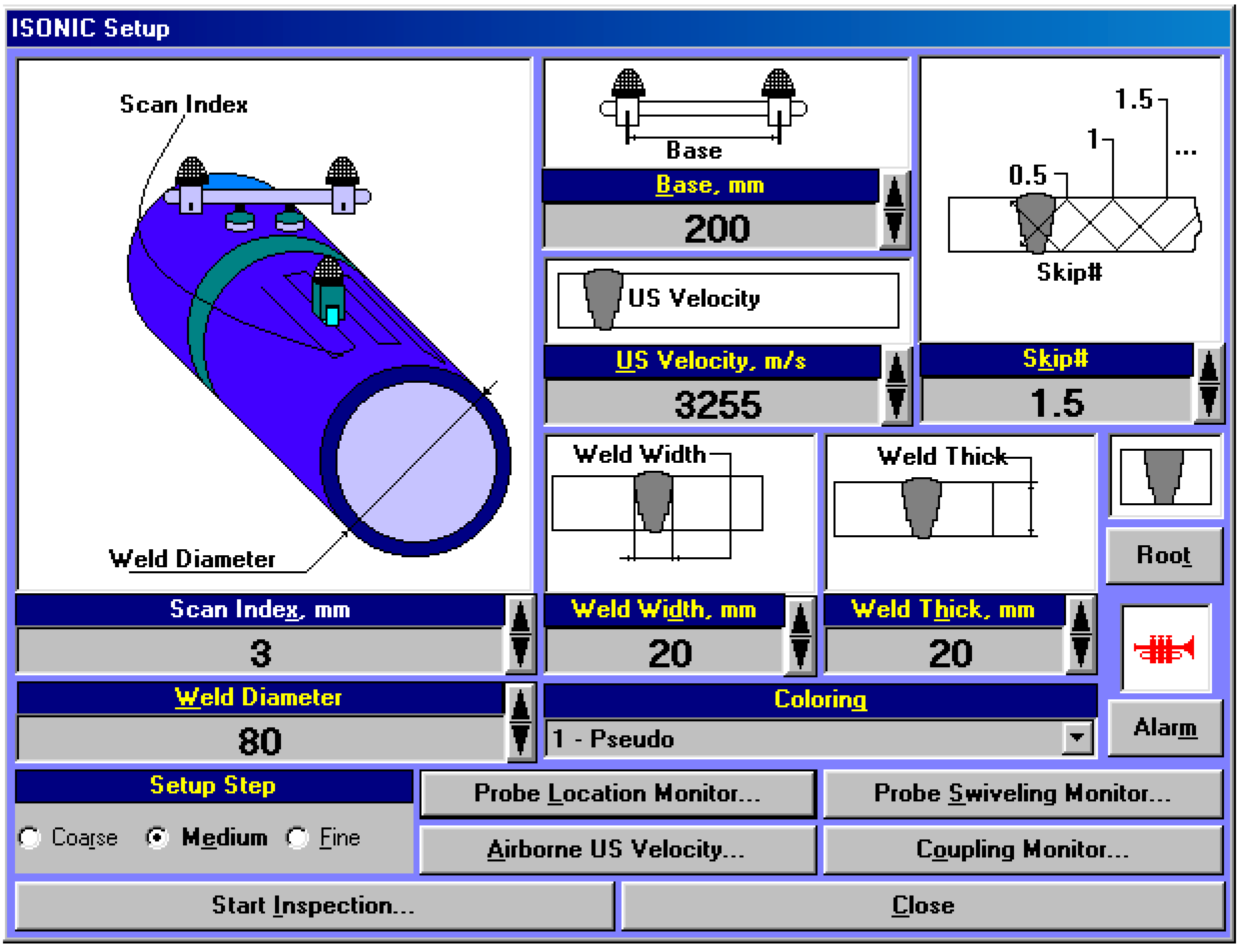
Follow the instructions of paragraph 7.4 of this Operating Manual

9.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

9.6. Pre-Inspection

Refer to the paragraph 7.6 of this Operating Manual and to the figures below



Weld Diameter

To setup the value of **Weld Diameter** the following manipulations applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard shortcuts**
  - Pressing **<Alt>+<W>** ⇒ **Weld Diameter** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Weld Diameter** area letter **W** is underlined)
- **Combined**
  - Click on **Weld Diameter** ⇒ **Weld Diameter** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

  *The value for the **Weld Diameter** is set in **mm** or **in***

  *The possible values of increment / decrement for **Weld Diameter** are:*

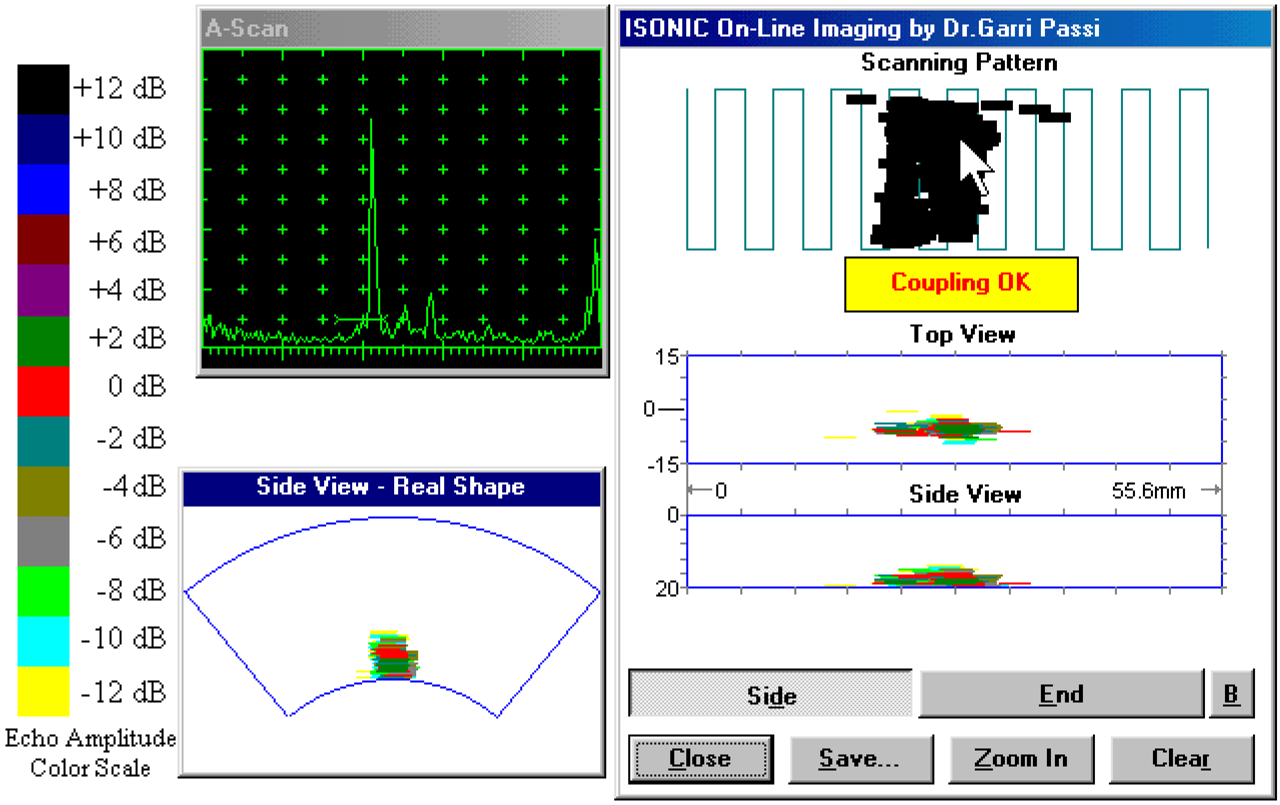
Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*5 mm*	*0.25 in*
Coarse	*10 mm*	*0.5 in*

- The length of the inspected area (**Weld Length**) is defined by the SM-PIPE software package automatically with respect to the **Base** and **Weld Diameter** values. Generally, the upper limit for **Base** is 300 *mm* (12 *in*), however it can be lower for welds having small diameters and so the value of **Base** may be reduced automatically while keying the **Weld Diameter** value. If this is a case then:
  - provide the distance between the receivers of airborne ultrasound equal to the value of **Base** recalculated and indicated by SM-PIPE software
  - re-refer probe location monitor to the weld position (as it is explained in the paragraph 7.6.5 of this Operating Manual) after each change of the distance between the receivers of airborne ultrasound (**Base**)
- The exact length of the inspected area (**Weld Length**) will be indicated in the **ISONIC On-Line Imaging** window after starting inspection. It will be also stored in each file containing the inspection results and printed in the Inspection Report

Scan Index providing high frontal resolution

To provide high frontal resolution the value of **Scan Index** may be setup to 0.25 or 0.5 mm / 0.01 or 0.02 in

9.7. Inspection



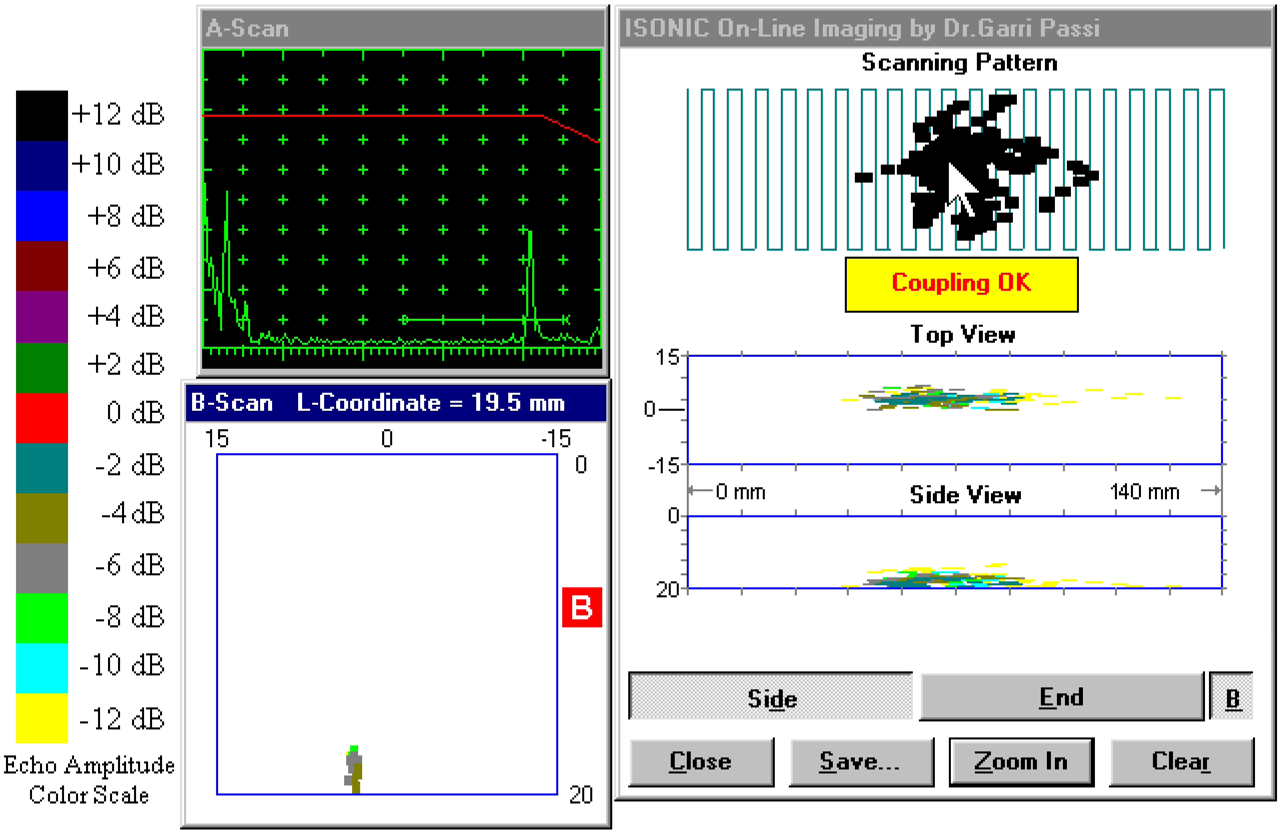
The above screenshot illustrates **ISONIC** screen while scanning using the *SM-PIPE Inspection SW Package*. The exact length of weld under inspection is shown under the **Top View** in the **ISONIC On-Line Imaging …** window. The **Scanning Pattern**, **Top View** and **Side View** images are shown unfolded and simultaneously the additional **Real Shape Side View** window is generated making it possible to evaluate the defects locations more precisely. The **End View** and **Side View** are switch-able while scanning. It is also possible to obtain the separate cross-sectional **B-Scan** images during the inspection. Refer to the paragraphs 7.7 and 8.7 of this Operating Manual – all instruction on the ISONIC operation while scanning are applicable to the *SM-PIPE Inspection SW Package*.

Additional Hint: obtaining the separate cross-sectional B-Scan image whilst scanning

To record the cross-sectional **B-Scan** image:

- place probe above the selected section
- click on B or press **<Alt>+<B>** on the keyboard

The additional **B-Scan** window appears on the **ISONIC** screen



The **B-Scan** image is created in the said additional window through the moving probe across the selected section of the weld and

$$L_{B\text{-}Scan} - \tfrac{1}{2} * \text{Scan Index} \leq L \leq L_{B\text{-}Scan} + \tfrac{1}{2} * \text{Scan Index}$$

here:

$L_{B\text{-}Scan}$ is the probe coordinate along the weld under test at the moment of activating of the additional **B-Scan** window

L is the current probe coordinate along the weld under test

B-Scan image will not be created if

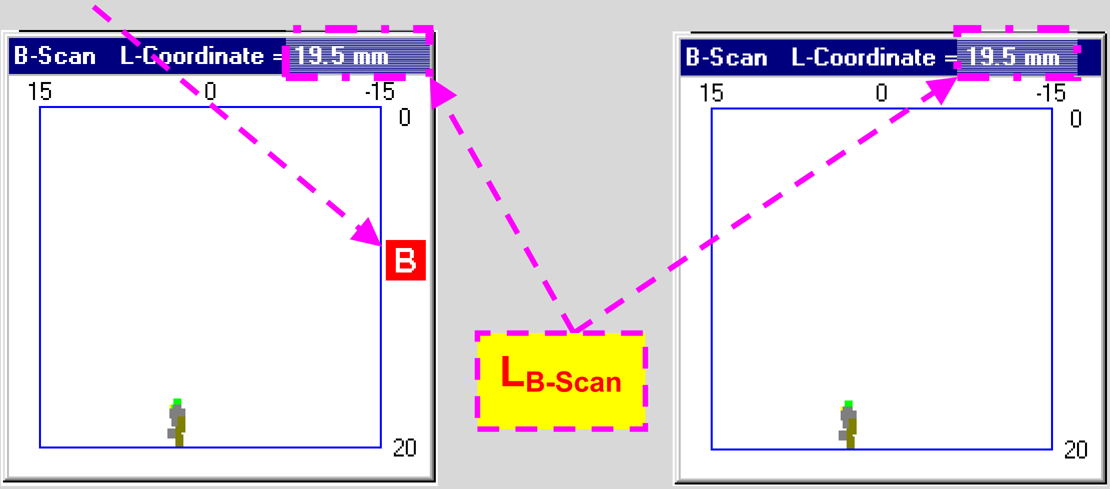
$$L \leq \; - \tfrac{1}{2} * \text{Scan Index} \text{ or } L \geq L_{B\text{-}Scan} + \tfrac{1}{2} * \text{Scan Index}$$

The **Top**, **Side** and **End View** as well as the **Scanning Pattern** are continuously and unconditionally updated without any dependence on presence or not of the **B-Scan** window on the **ISONIC** screen

Separate B-Scan Imaging Notes:

----(1)----

The special label indicates if the **B-Scan** image is under update



Update *No Update*

----(2)----

To close the additional B-Scan window click on B or press **<Alt>+<B>** on the keyboard

9.8. Postprocessing

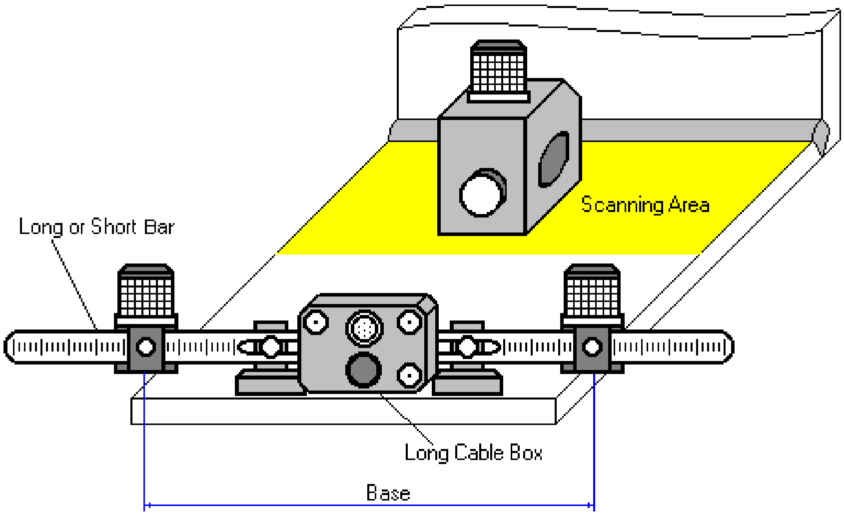
Refer to the paragraph 7.8 of this Operating Manual

10. Operating 'NOZZLE' Software Package - ISONIC Inspection of Nozzle Welds

The contents of this chapter is valid for the NOZZLE SW Package version 3.1.0.5 or higher

10.1. Preparing for the Inspection

10.1.1. Fixture



Place the bar with the receivers of airborne ultrasound behind the scanning area at parallel to the weld. The value of **Base** (the distance between two receivers of airborne ultrasound) may be from 100 to 480 *mm* or 4 to 19 *in*. The short bar is required if the value of **Base** is not exceeding 200 *mm* or 8 *in*. If this is a case then the distance between the receivers is defined as:

Base = **100** + **Pos1** + **Pos2**, *mm*
or
Base = **4** + **Pos1** + **Pos2**, *in*

The long bar is required if the value of **Base** is more than 200 *mm* or 8 *in*. If this is a case then the distance between the receivers is defined as:

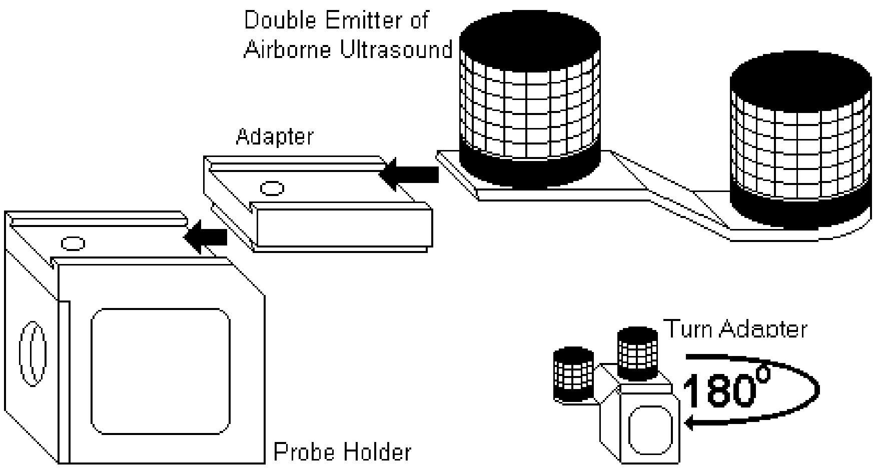
Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

In the above formulas **Pos1** and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly

The value of **Base** must be known prior to the scanning. Wrong determining of the **Base** causes the mistakes in monitoring probe location and defects imaging

Insert ultrasonic probe into appropriate probe holder as it is shown in the paragraph 7.1.1 of this Operating Manual. The **single emitter** is required if there is a need to monitor the probe coordinates only. Fix the **single emitter** of airborne ultrasound on the top of probe holder as it is shown in the paragraph 7.1.1 of this Operating Manual.

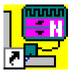
The **double emitter** of airborne ultrasound is required if there is a need to monitor the probe coordinates and swiveling angle simultaneously. The nozzle welds the **double emitter** must be fixed on the top of the probe holder together with the rotating adapter – refer to the picture below. Refer to the paragraph 6.1.1 of this Operating Manual for the reference on proper manipulation of the probe holder equipped by single or double emitter of airborne ultrasound



10.1.2. Cabling

Refer to the paragraph 7.1.2 of this Operating Manual

10.2. Start Up

Double left mouse click on the icon  located on the **ISONIC** desktop

10.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

10.4. Getting started...

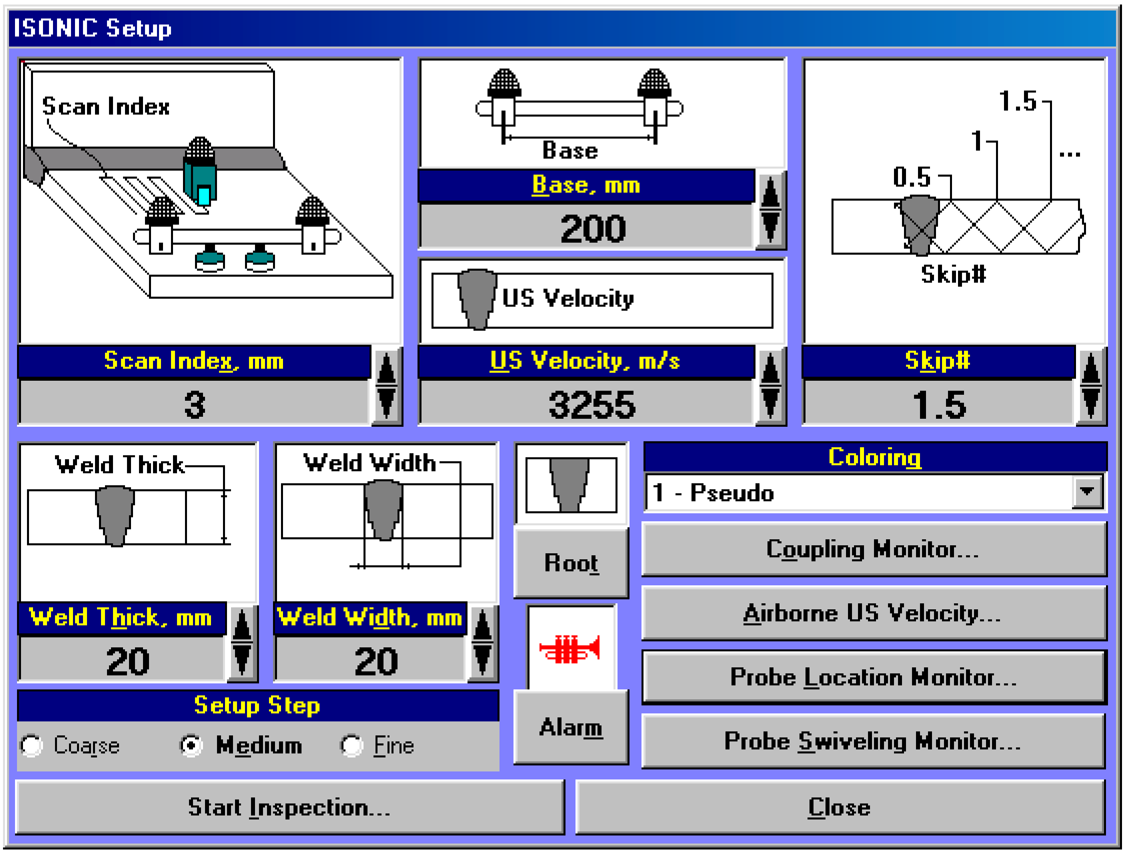
Refer to the paragraph 7.4 of this Operating Manual

10.5. ISONIC Control Menu

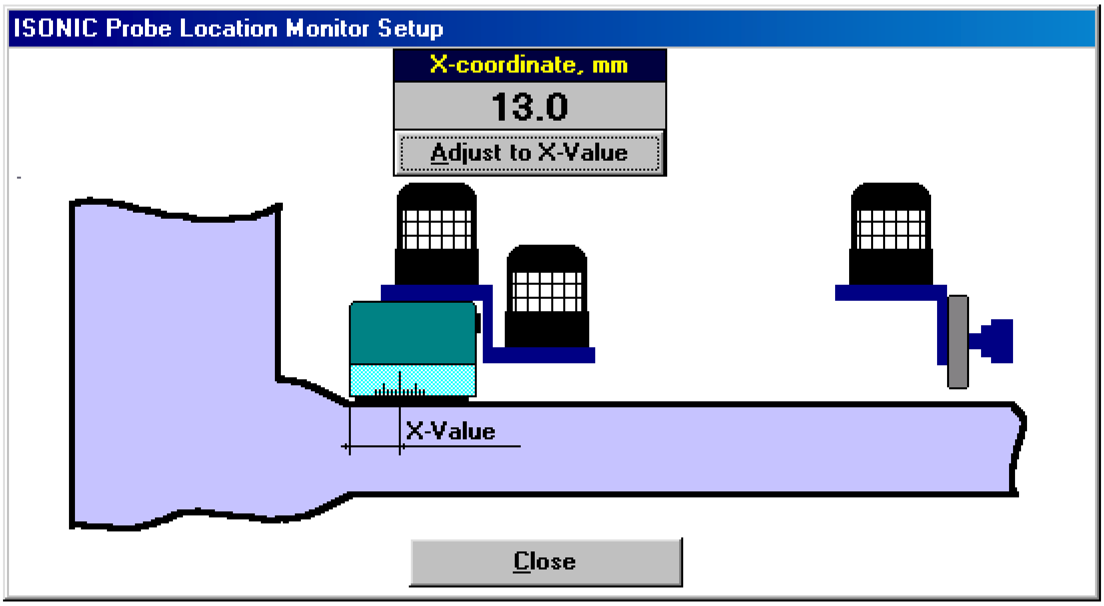
Refer to the paragraph 7.5 of this Operating Manual

10.6. Pre-Inspection

Refer to the paragraph 7.6 of this Operating Manual and to the figures below

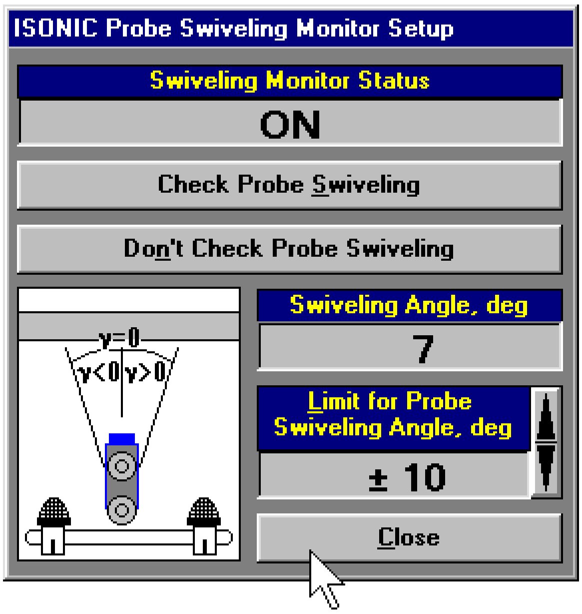


Referring Probe Location Monitor to the Nozzle Weld Position



Place probe equipped with the **single** or **double emitter** of airborne ultrasound as it is shown in the corresponding window

Probe Swiveling Monitor Setup



Place probe equipped with the **double emitter** of airborne ultrasound as it is shown in the corresponding window

Flaw Imaging

NOZZLE software package supports 2 (two) techniques for the flaw imaging:

Flaw Imaging Technique 1: **SAFT** imaging based on dynamic correlation analysis between sequences of probe locations and swiveling angles and received echoes (all hardware configurations)

Flaw Imaging Technique 2: **Raw** imaging (Internal flaw detector card either **UDS 3-3** or **UDS 3-4** required)

The following manipulations start the inspection procedure (scanning):

Flaw Imaging Technique 1	Click on Start Inspection... or press **<Alt> + <I>** on the keyboard
Flaw Imaging Technique 2	• Press and hold **<Shift> + <M>** on the keyboard • Click on Start Inspection... or press **<Alt> + <I>** on the keyboard • Release **<Shift> + <M>** on the keyboard

10.7. Inspection

Refer to the paragraphs 7.7 and 8.7 of this Operating Manual

10.8. Postprocessing

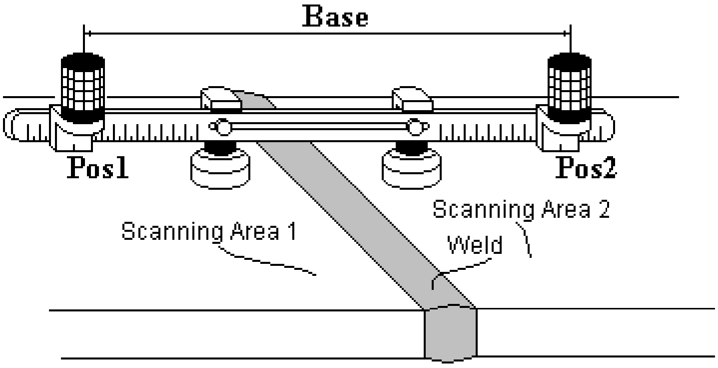
Refer to the paragraph 7.8 of this Operating Manual

11. Operating 'PLCROSS' Software Package - ISONIC Inspection of Planar Butt Joints from Both Sides

The contents of this chapter is valid for the PLCROSS SW Package version 5.1.0.6 or higher

11.1. Preparing for the Inspection

11.1.1. Fixture



Place the bar with the receivers of airborne ultrasound aside of the scanning area at rectangle to the weld. The distance between two receivers (**Base**) on the bar is defined as:

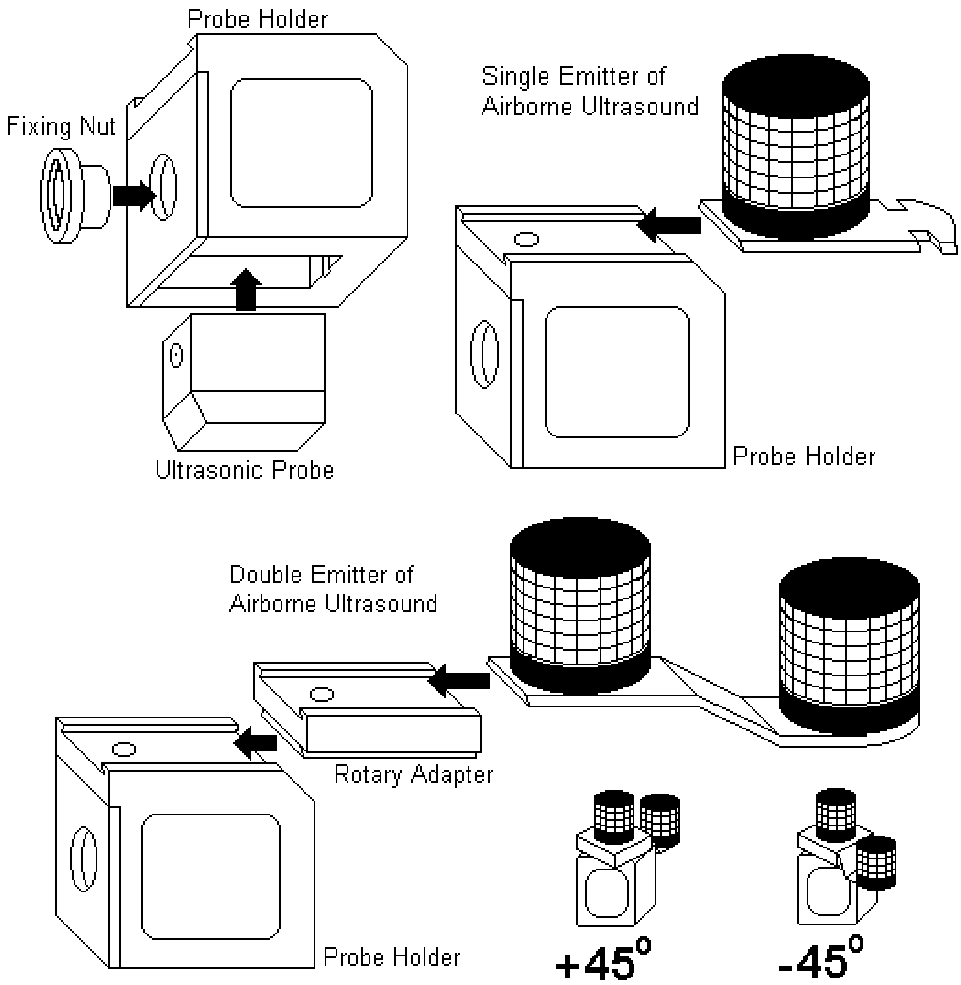
Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

Pos1 and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly. The value of **Base** must be set up according to the paragraph 11.6. Wrong determining of the **Base** causes mistakes in monitoring probe location and defects imaging.

Important:

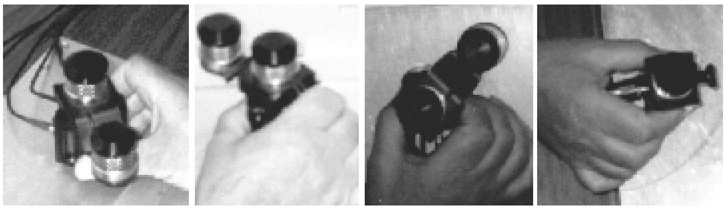
- There are two Scanning Areas located at the both sides of the weld
- The start point and length for both areas must be setup according to the paragraph 11.6

Insert ultrasonic probe into the appropriate probe holder then fix the double or single emitter of airborne ultrasound on the top of the probe holder; use the rotary adapter for the double emitter of airborne ultrasound referring on the below sketches:

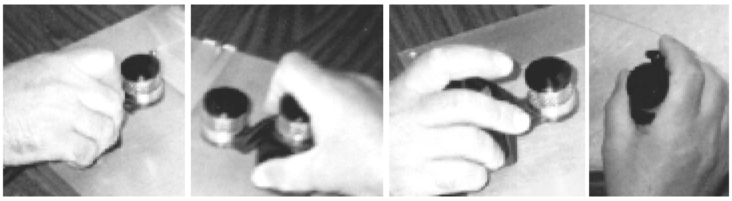


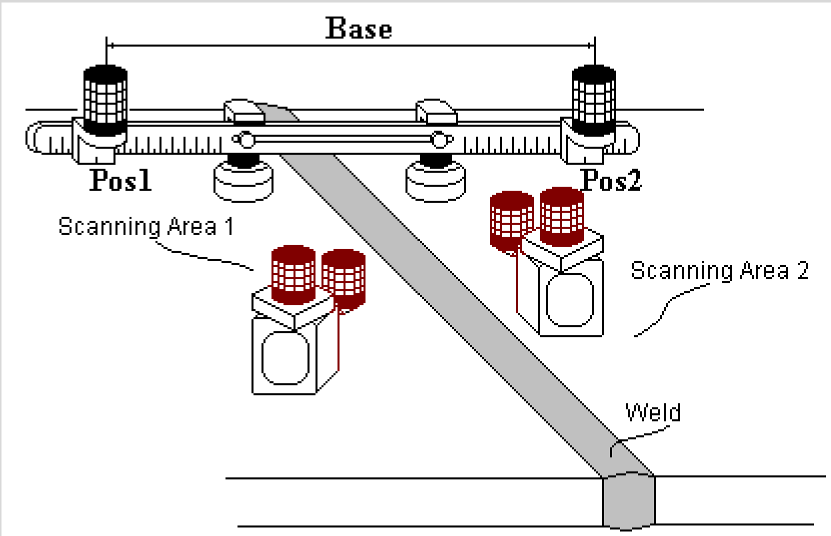
Remember!

✓ Accepted



✗ Not Accepted



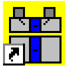


Double emitter of airborne ultrasound is required if there is a need to monitor the probe coordinates and swiveling angle simultaneously while scanning. **Single emitter** is required if there is a need to monitor the probe coordinates only

11.1.2. Cabling

Refer to the paragraph 7.1.2 of this Operating Manual

11.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

11.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

11.4. Getting started...

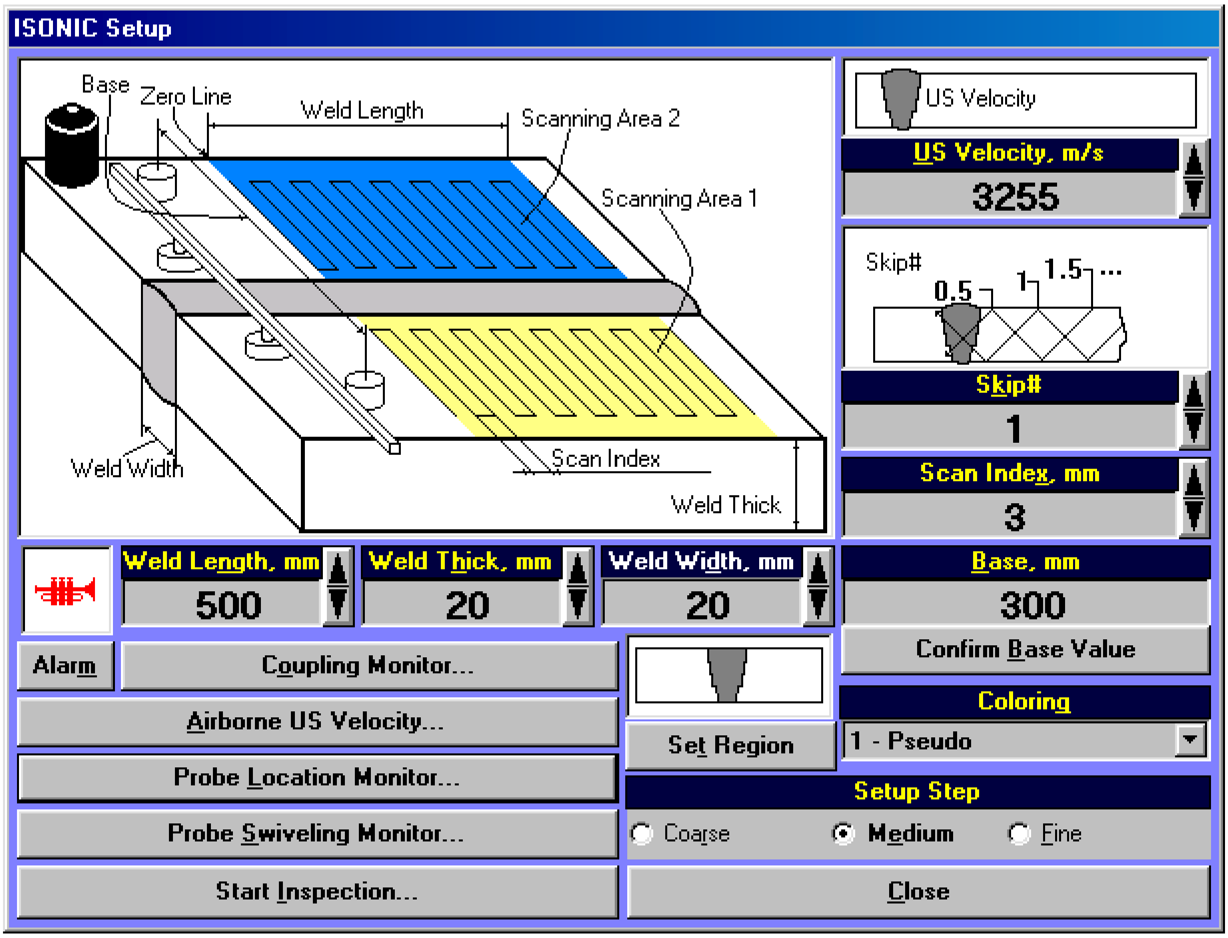
Refer to the paragraph 7.4 of this Operating Manual

11.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

11.6. Pre-Inspection

Refer to the paragraph 7.6 of this Operating Manual and to the figures below



Weld Length

Weld Length is the length of weld under test, inspection of which is to be performed and recorded in one shot. **Weld Length** is counted from the **Zero Line** selected by an operator – refer to the sketch in the ISONIC Setup window and to the below subchapter **Referring Probe Location Monitor to Weld Position**. To setup the value of **Weld Length** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<N>** ⇒ **Weld Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Weld Length** area letter **N** is underlined)
- **Combined**
  - Click on **Weld Length** ⇒ **Weld Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

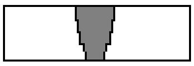
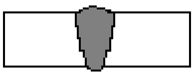
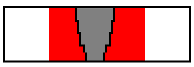
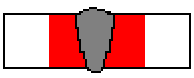
*The value for the **Weld Length** is set in **mm** or **in***
*The possible values of increment / decrement for **Weld Length** are:*

Resolution	Metric	Imperial
Fine	*10 mm*	*0.5 in*
Medium	*50 mm*	*2 in*
Coarse	*100 mm*	*4 in*

Region of Interest

Click on 

or press **<Alt>+<G>** on the keyboard to select the **Region of Interest**. The corresponding indication is provided:

-  - Inspection of weld area only / Suppression of echoes caused by the weld geometry is ON (for example, signals caused by the reflections from the weld enforcements will be suppressed)
-  - Inspection of weld area only / Suppression of echoes caused by the weld geometry is OFF
-  - Inspection of weld area and heat affected zones from both sides / Suppression of echoes caused by the weld geometry is ON (The width of heat affected zone is determined automatically as 1/3 of **Weld Thick** but not less than 10 mm (0.4 in) and not more than 20 mm (0.8 in) as per Standard HP 5/3)
-  - Inspection of weld area and heat affected zones from both sides / Suppression of echoes caused by the weld geometry is OFF

Confirm Base Value

While running the PLCROSS software package the value of **Base** is recalculated automatically depending on the following operator's inputs:

- **Skip#**
- **Weld Thick**
- **Weld Width**
- **Region of Interest**

After the completion of all inputs:

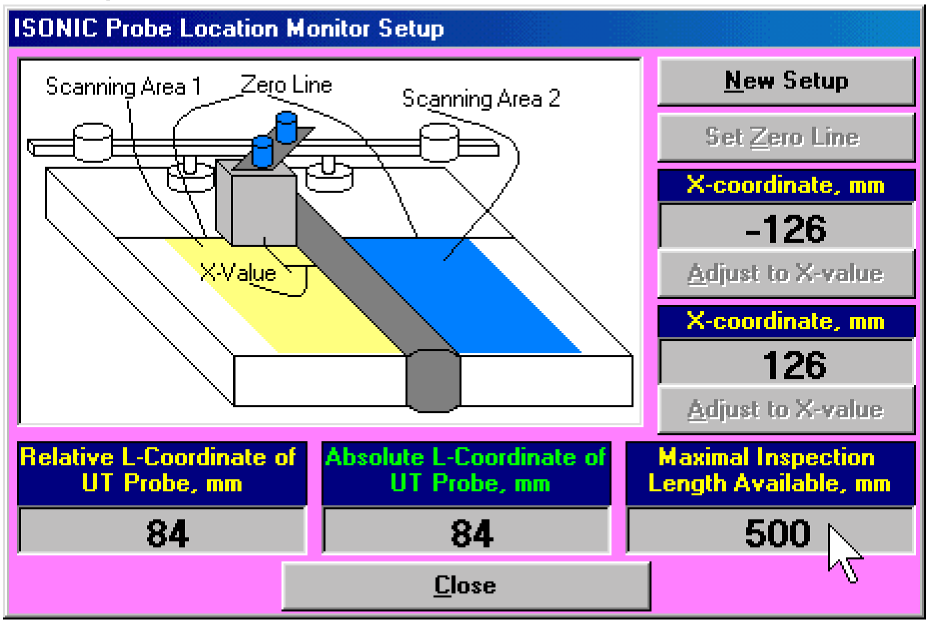
- Place the receivers of airborne ultrasound into the required positions

Base ≤ **480 mm / 19.2 in** – Use the Standard Bar	**Base** > **480 mm / 19.2 in** – Use the Special Long Bar	**Base** > **480 mm / 19.2 in** – Use the Separate Supports for each Airborne Ultrasound Receiver
The value of **Base** is determined as: **Base** = **200** + **Pos1** + **Pos2**, *mm* or **Base** = **8** + **Pos1** + **Pos2**, *in* **Pos1**, **Pos2** are the coordinates of the receivers on the left and right scales of the bar	The value of **Base** is determined as: **Base** = **200** + **Pos1** + **Pos2**, *mm* or **Base** = **8** + **Pos1** + **Pos2**, *in* **Pos1**, **Pos2** are the coordinates of the receivers on the left and right scales of the bar	Provide the required distance between the receivers using the measuring tape

- Click on **Confirm Base Value** or click **<Alt>+<B>** on the keyboard

Referring Probe Location Monitor to Weld Position

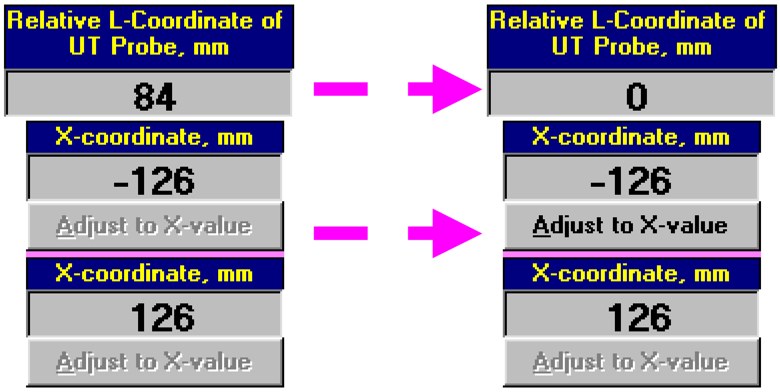
Click on **Probe Location Monitor...** or press **<Alt>+<L>** on the keyboard to open the **ISONIC Probe Location Monitor Setup** window



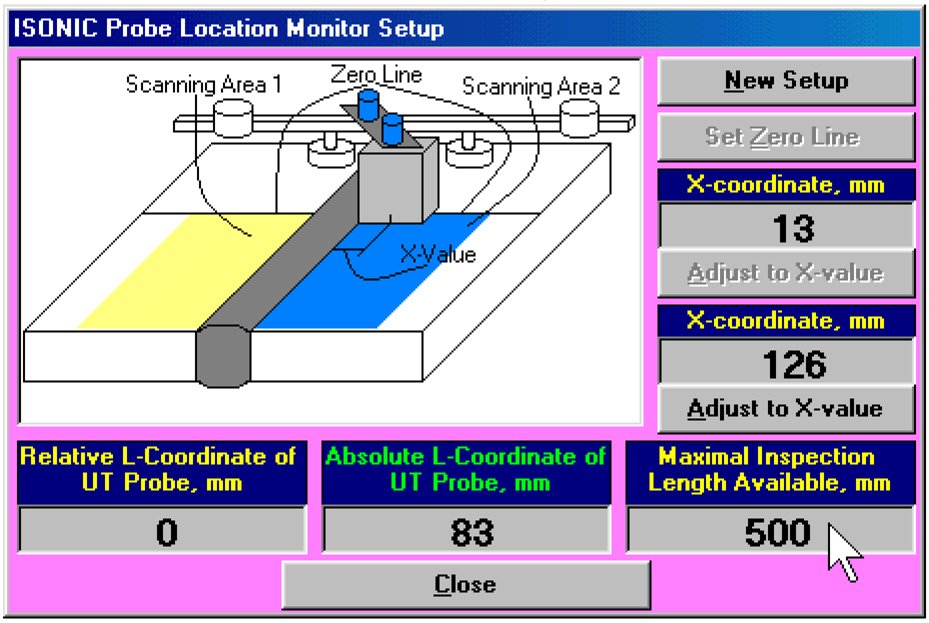
Select the line closest to the bar (**Zero Line**); apply the probe equipped with probe holder and emitter(s) of airborne ultrasound to the **Scanning Area 1** on the object under test as it is illustrated in the **ISONIC Probe Location Monitor Setup** window's sketch then:

- click on **New Setup** or press **<Alt>+<N>** on the keyboard – this will reset probe location monitor and enable **Set Zero Line** button

- click on **Set Zero Line** or press **<Alt>+<Z>** on the keyboard – this will reset **Relative L-Coordinate** to **0** defining **Zero Line** and enable the first **Adjust to X-Value** button:



- click on first **Adjust to X-Value** button or press **<Alt>+<A>** on the keyboard. This will refer the probe location monitor to the weld at the adjacent **Scanning Area 1** and also change the guiding sketch in the **ISONIC Probe Location Monitor Setup** window enabling the second **Adjust to X-Value** button



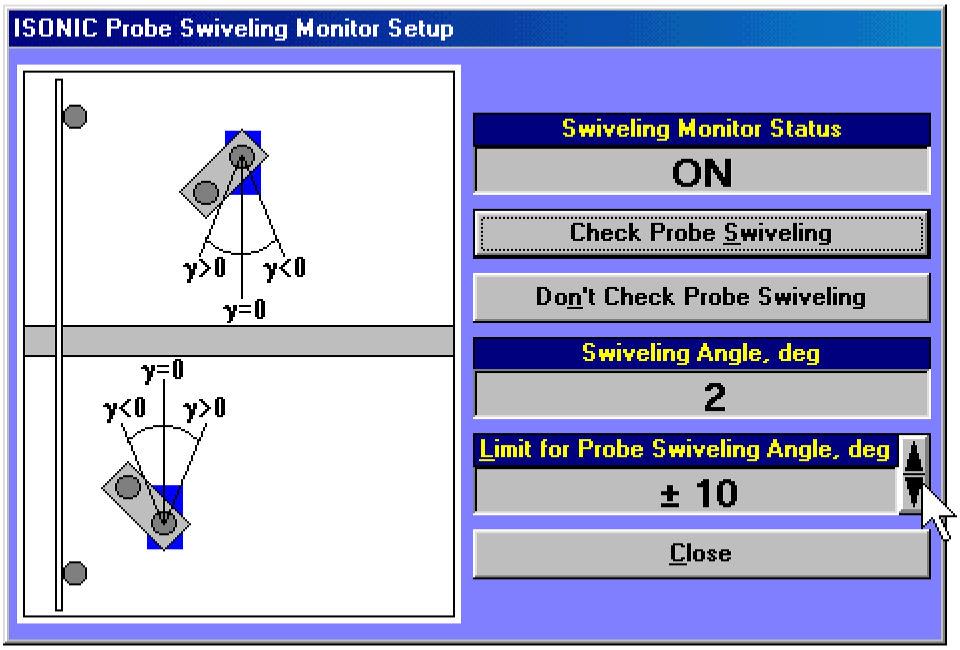
Apply the probe equipped with probe holder and emitter(s) of airborne ultrasound to the **Scanning Area 2** on the object under test as it is illustrated in the **ISONIC Probe Location Monitor Setup** window's sketch then click on the second **Adjust to X-Value** button or press **<Alt>+<A>** on the keyboard. This refers probe location monitor to the weld from **Scanning Area 2** and end probe location monitor setup

To return back to the **ISONIC Setup** window click on **Close** or press **<Alt>+<C>** or **Esc** on the keyboard

ⓘ
The described procedure also relates to the machined welds

Probe Swiveling Monitor

Place probe equipped with the **double emitter** of airborne ultrasound as it is shown in the corresponding window

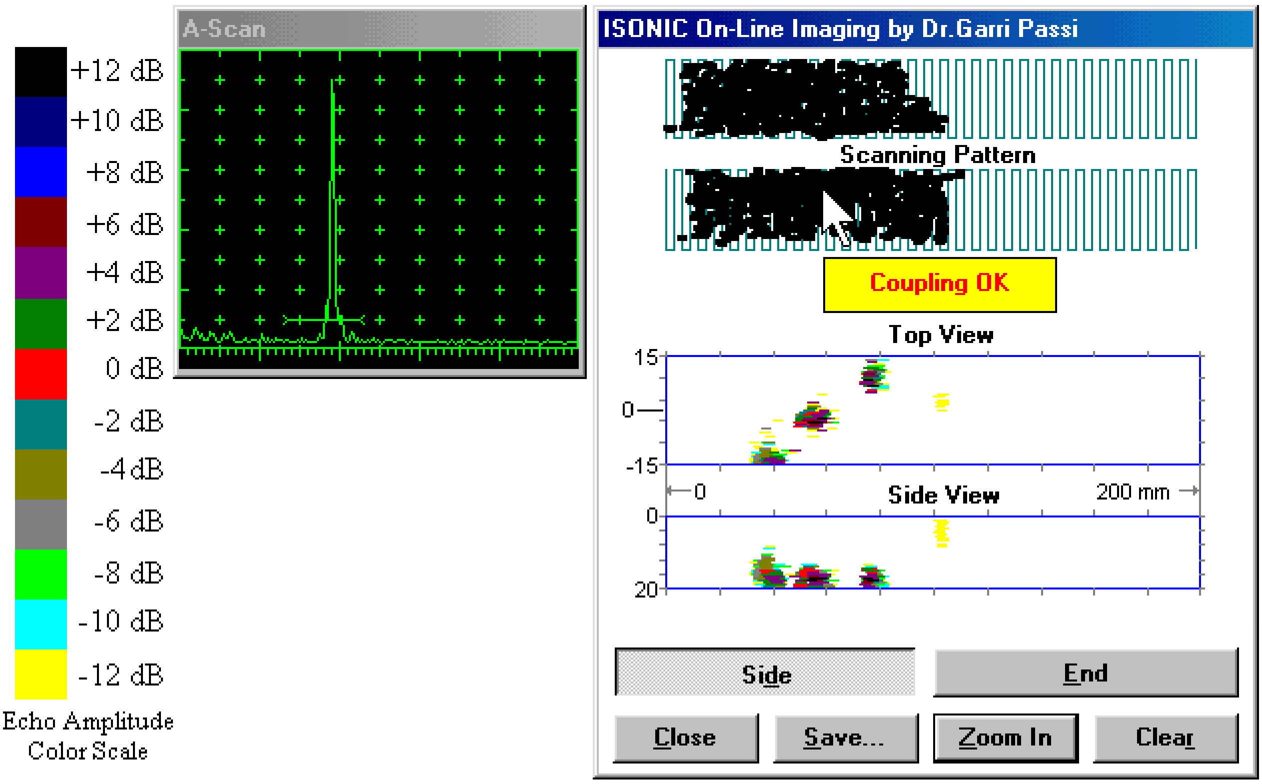


Flaw Imaging

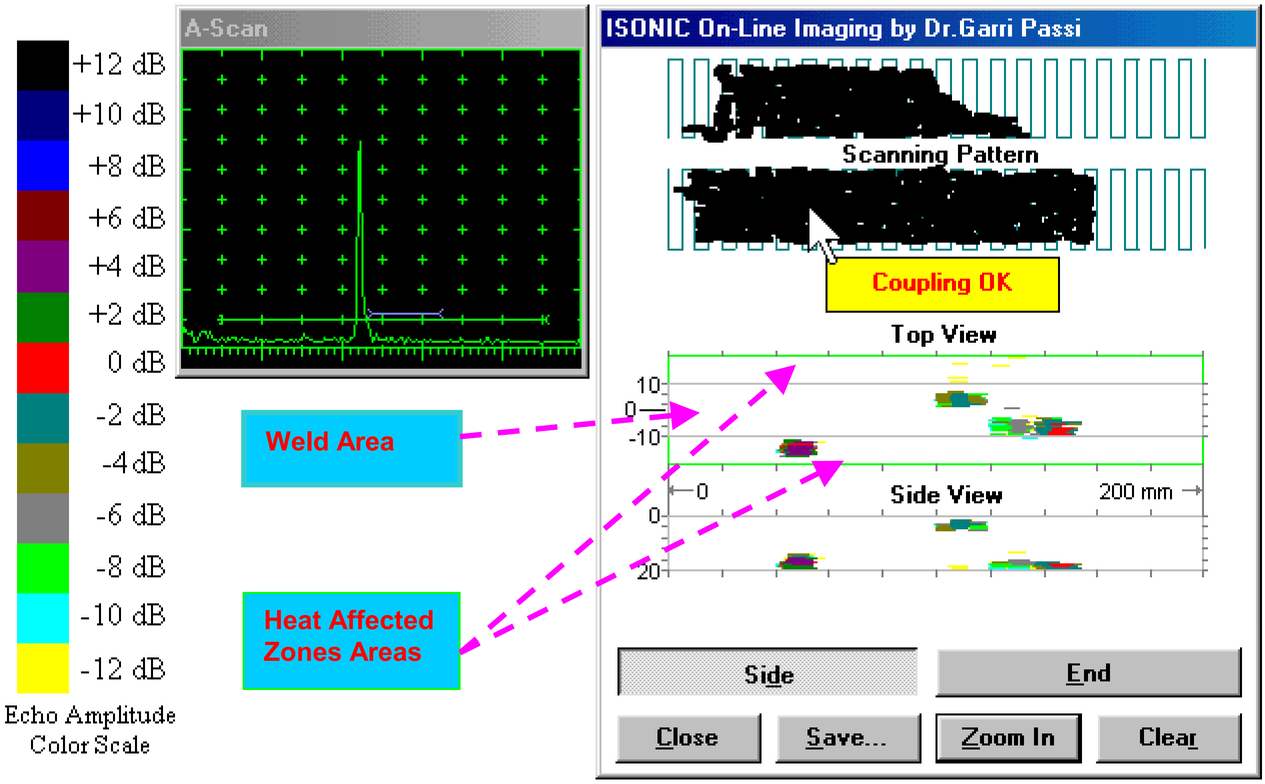
Refer to the paragraph 10.6 of this Operating Manual

11.7. Inspection

Region of Interest: Weld Only



Region of Interest: Weld and Heat Affected Zones



The above screenshots illustrate the **ISONIC** screen while scanning using PLCROSS software. Refer to the paragraphs 7.7 of this Operating Manual to get instructed on control **ISONIC** while scanning.

11.8. Postprocessing

Refer to the paragraphs 7.8 of this Operating Manual

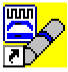
12. Operating 'CIRCROSS' Software Package - ISONIC Inspection of Circumferential Butt Joints

The contents of this chapter is valid for the
CIRCROSS SW Package version 5.1.0.5 or higher

12.1. Preparing for the Inspection

Refer to the paragraph 11.1 of this Operating Manual

12.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

12.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

12.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

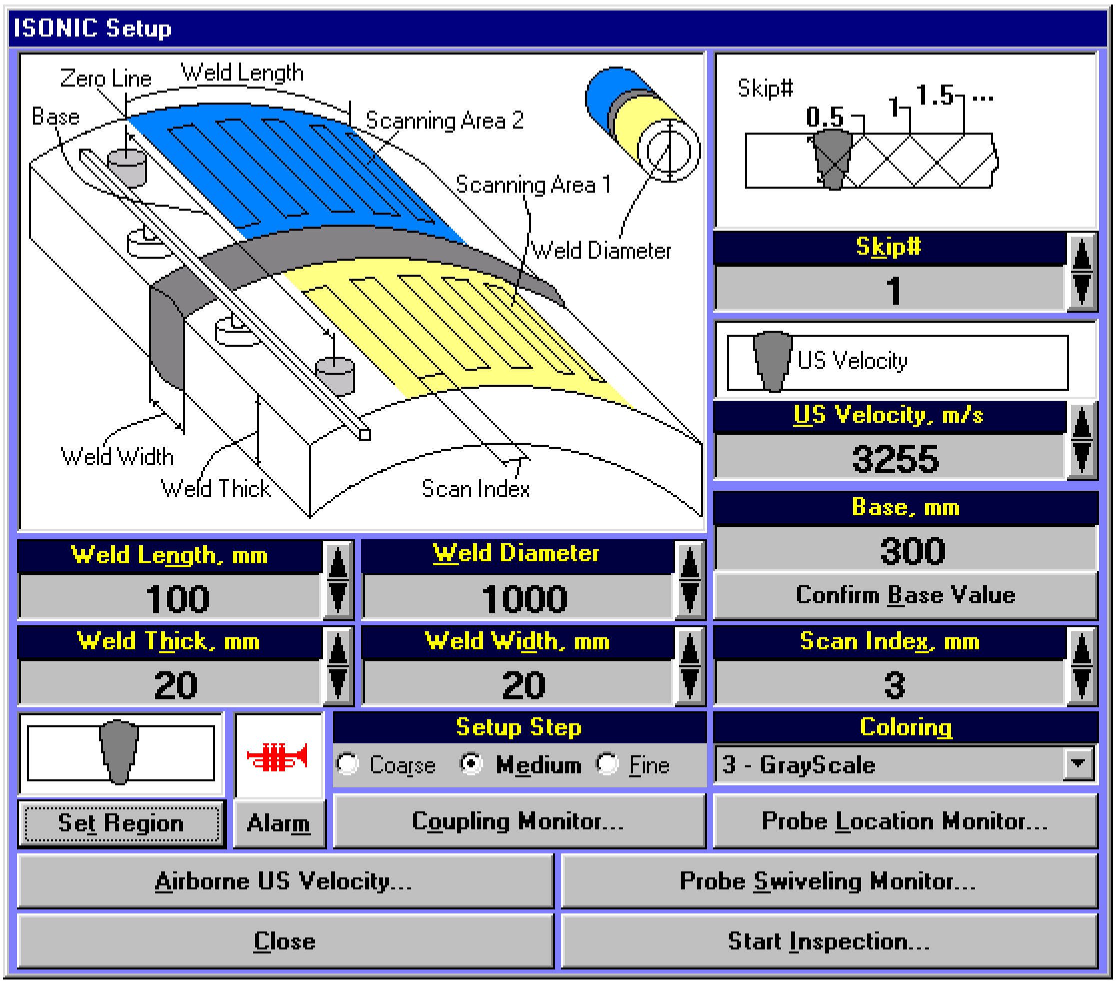
12.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

12.6. Pre-Inspection

Refer to the paragraphs 7.6 and 11.6 of this Operating Manual and to the figures below

Weld Diameter



Weld Diameter

To setup the value of **Weld Diameter** the following manipulations are applicable:

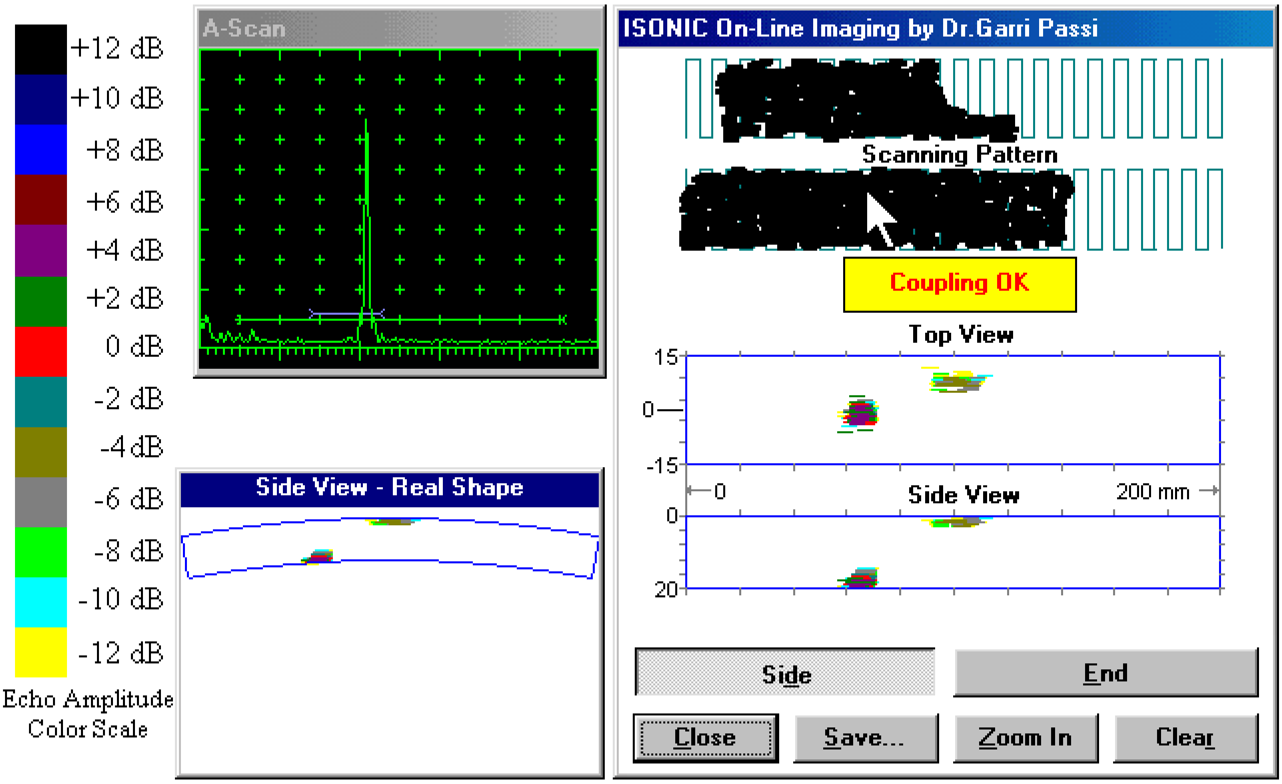
- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<W>** ⇒ **Weld Diameter** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Weld Diameter** area letter **W** is underlined)
- **Combined**
  - Click on **Weld Diameter** ⇒ **Weld Diameter** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **Weld Diameter** is set in **mm** or **in***
*The possible values of increment / decrement for **Weld Diameter** are:*

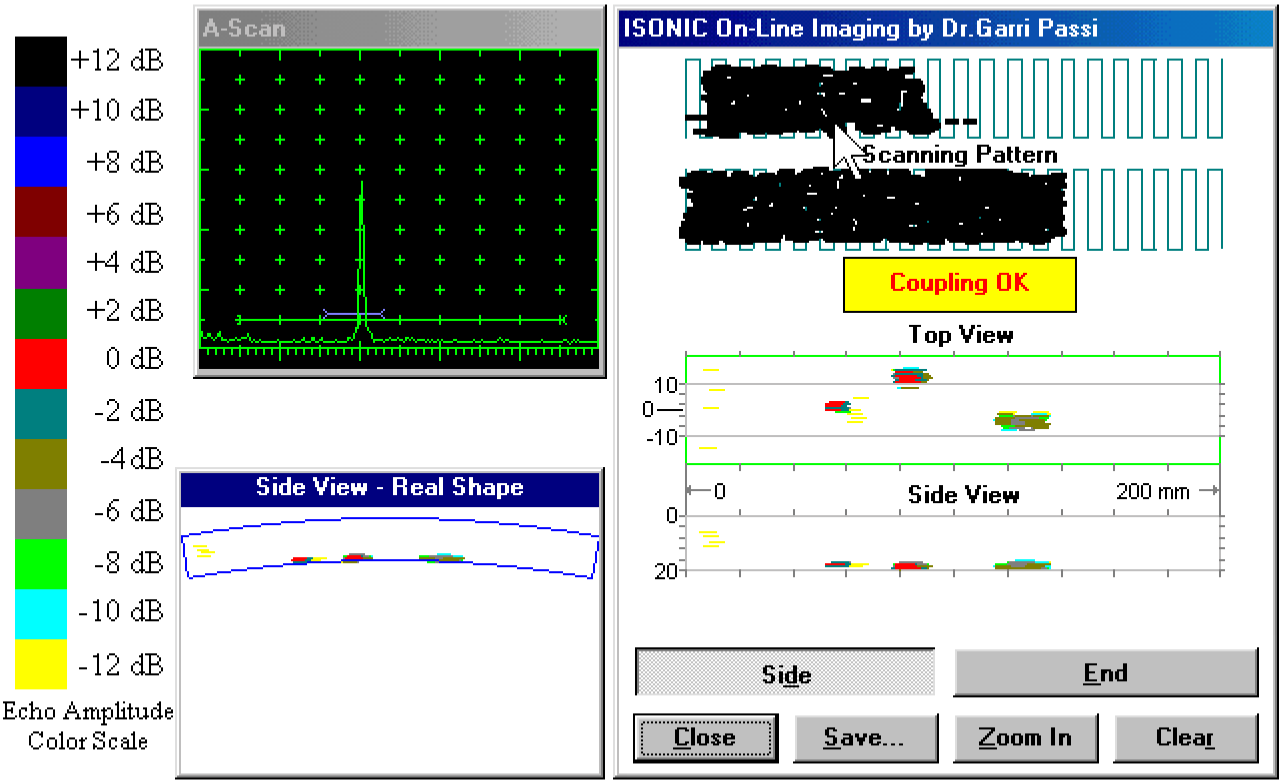
Resolution	Metric	Imperial
Fine	*2 mm*	*0.1 in*
Medium	*10 mm*	*0.4 in*
Coarse	*20 mm*	*2 in*

12.7. Inspection

Region of Interest: Weld Only



Region of Interest: Weld and Heat Affected Zones



The above screenshots illustrate the **ISONIC** screen while scanning using **CIRCROSS** software. Refer to the paragraphs 7.7 of this Operating Manual to get instructed on control **ISONIC** while scanning.

12.8. Postprocessing

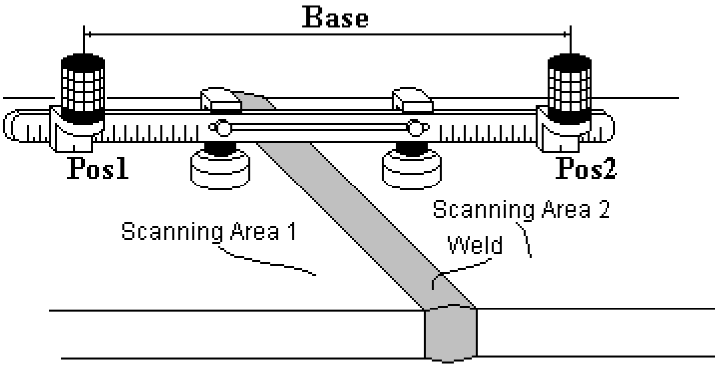
Refer to the paragraph 7.8 of this Operating Manual

13. Operating 'TRANSCAN' Software Package - ISONIC Inspection of Butt Welds for Defects Transversal to the Weld

The contents of this chapter is valid for the TRANSCAN SW Package version 5.1.0.5 or higher

13.1. Preparing for the Inspection

13.1.1. Fixture



Place the bar with the receivers of airborne ultrasound aside of the scanning area at rectangle to the weld. The distance between two receivers (**Base**) on the bar is defined as:

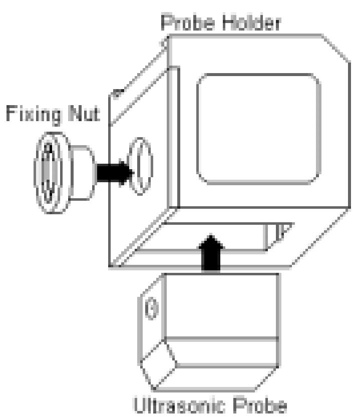
Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

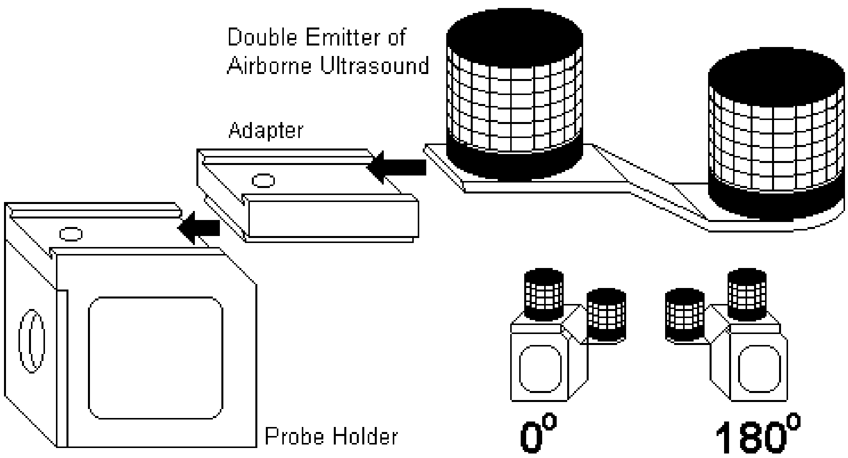
Pos1 and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly. The value of **Base** must be set up according to the paragraph 11.6. Wrong determining of the **Base** causes mistakes in monitoring probe location and defects imaging.

Important:

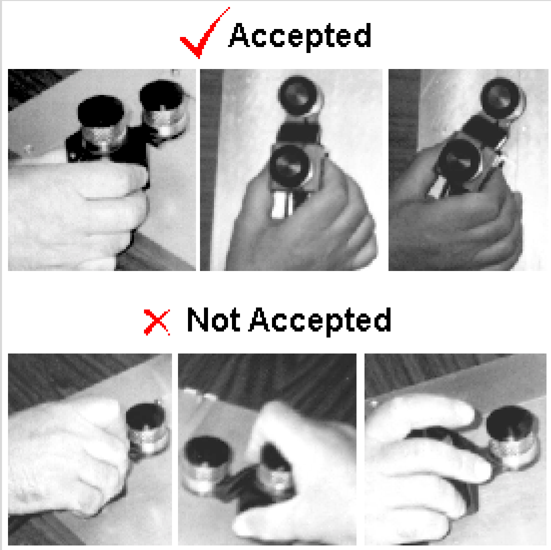
- There are two Scanning Areas located at the both sides of the weld
- The start point and length for both areas must be setup according to the paragraph 11.6

Insert ultrasonic probe into the appropriate probe holder then fix the double emitter of airborne ultrasound on the top of the probe holder; use the rotary adapter for the double emitter of airborne ultrasound referring on the below sketches:

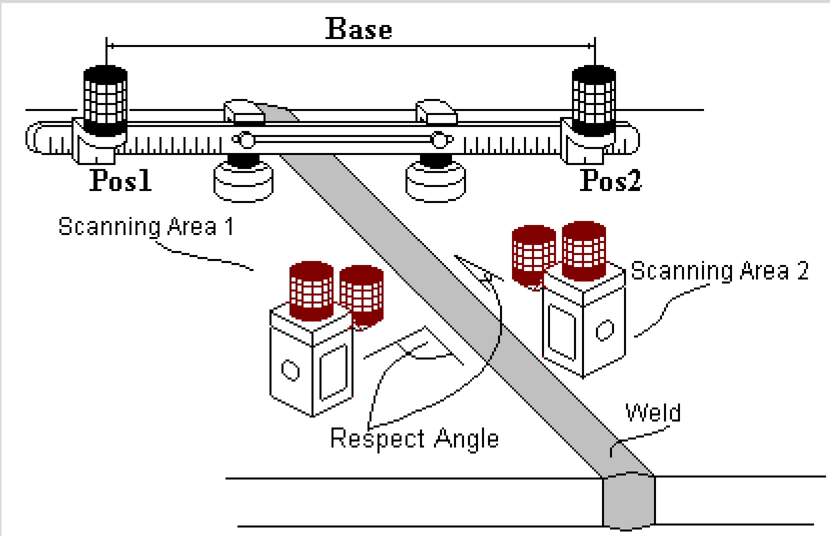


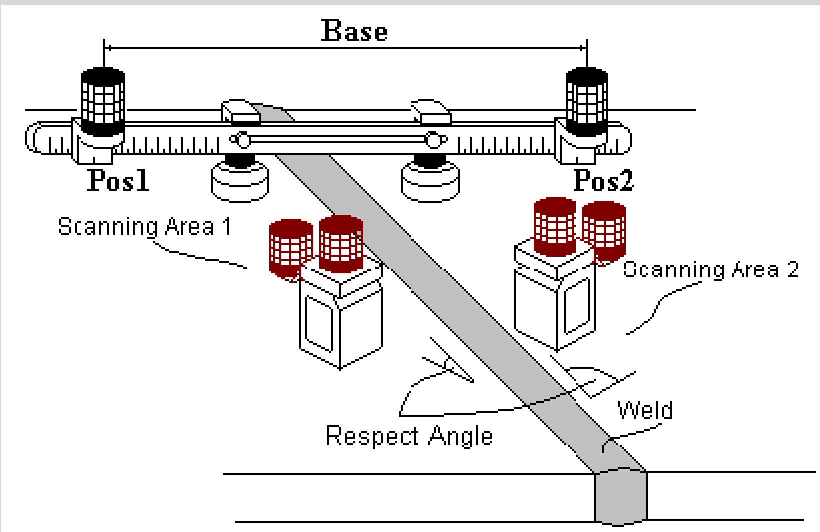


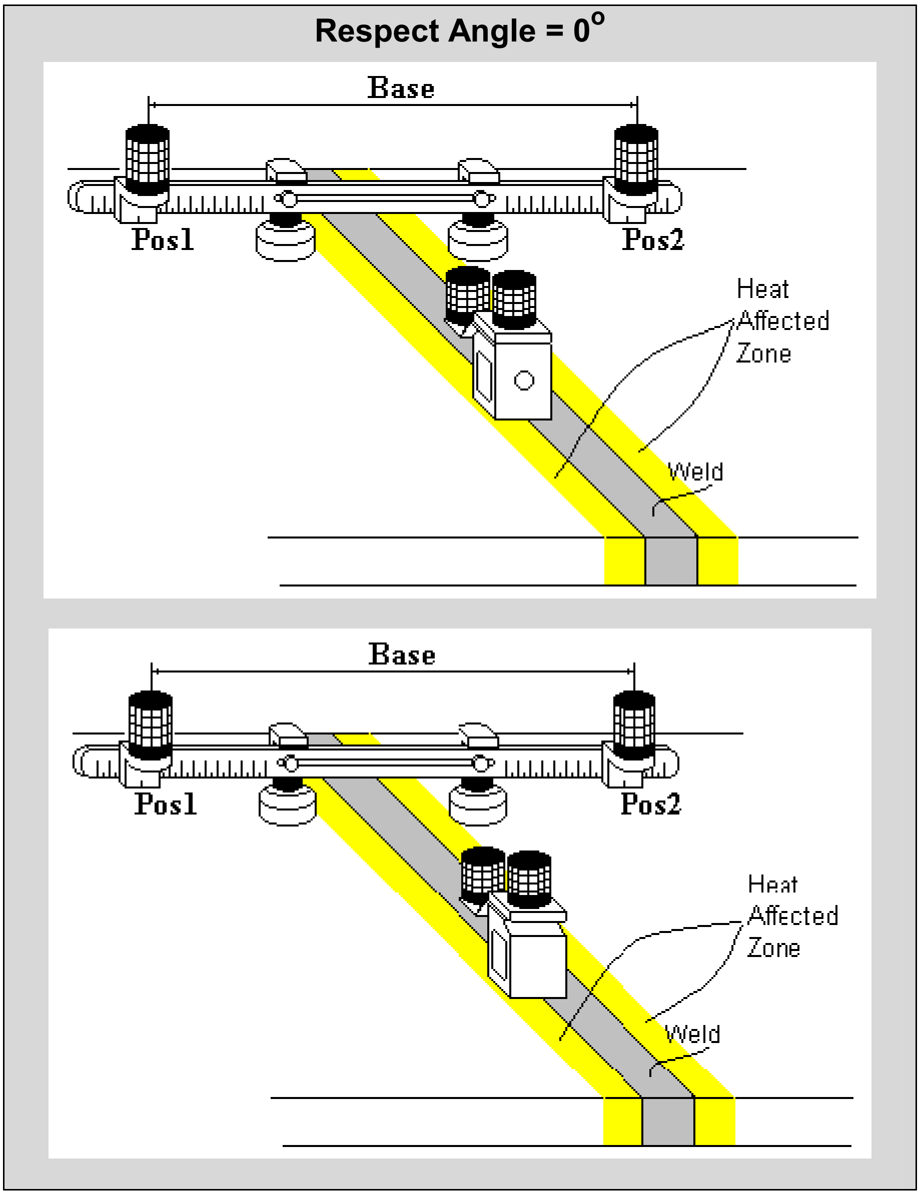
Remember!



Respect Angle ≥ 0^o



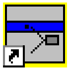




13.1.2. Cabling

Refer to the paragraph 7.1.2 of this Operating Manual

13.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

13.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

13.4. Getting started...

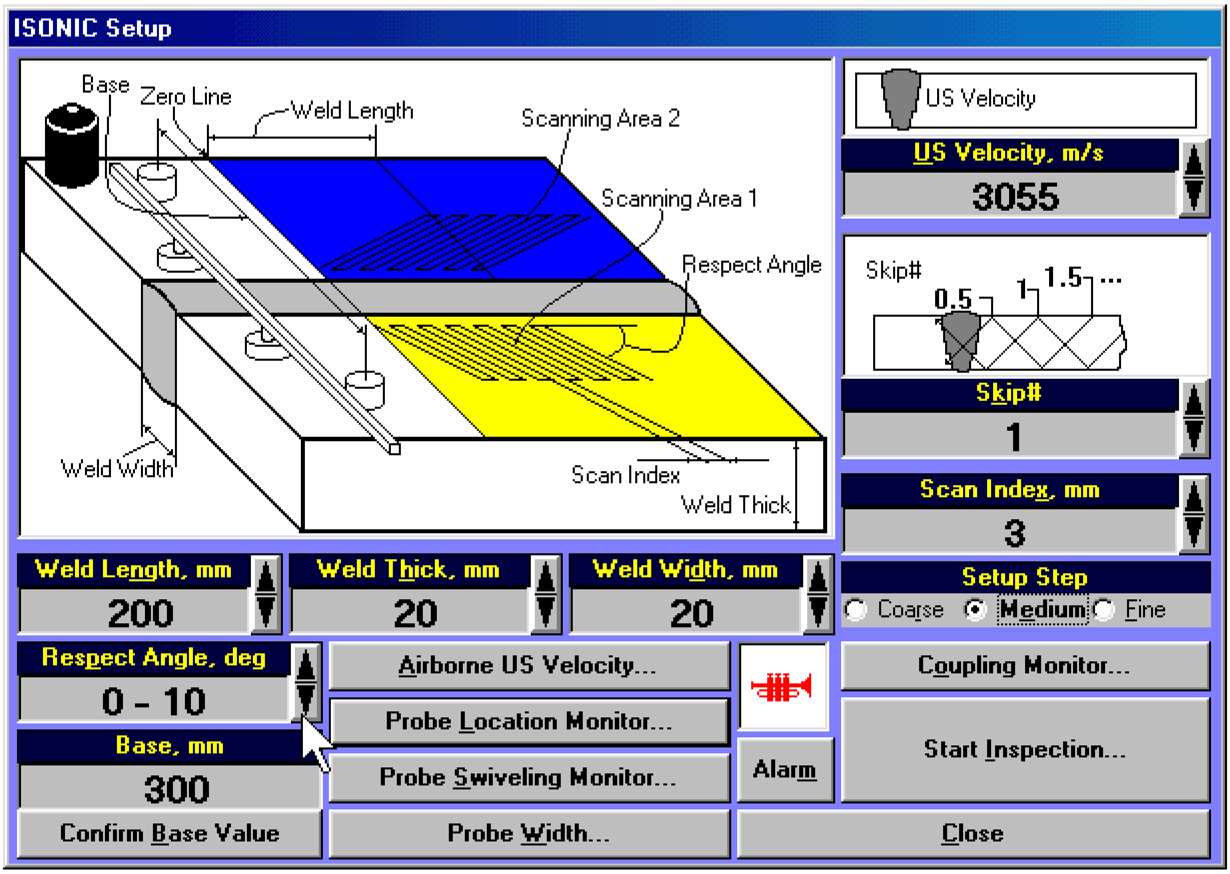
Refer to the paragraph 7.4 of this Operating Manual

13.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

13.6. Pre-Inspection

Refer to the paragraphs 7.6 and 11.6 of this Operating Manual and to the figures below



Respect Angle

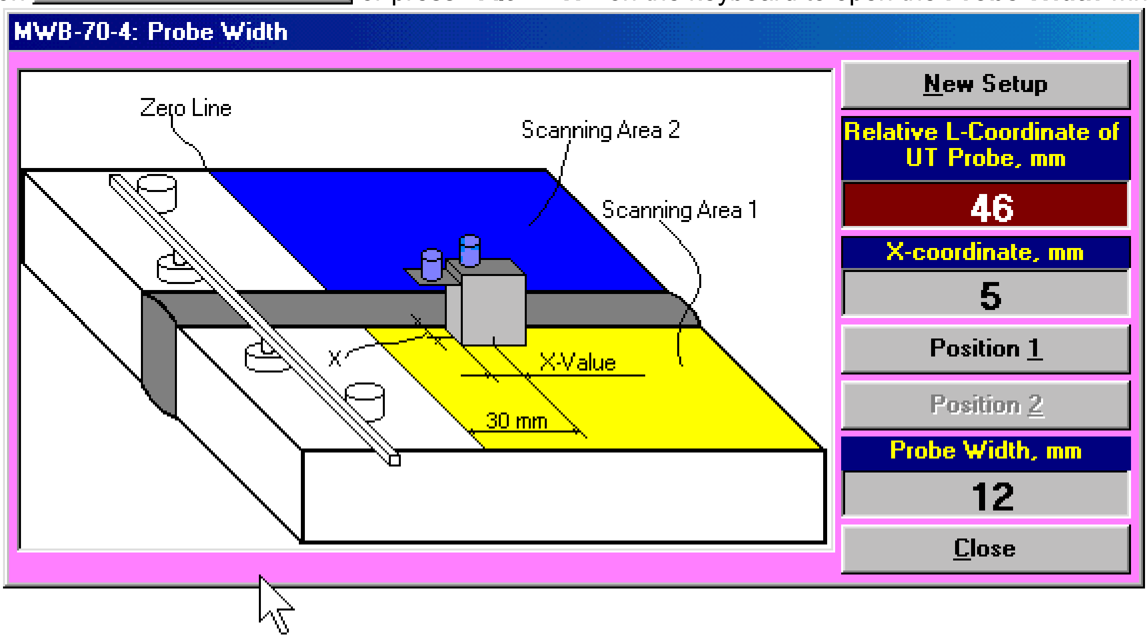
Refer to the corresponding sketches in the paragraph 13.1.1 of this Operating Manual

To select the required **Respect Angle** the following manipulations applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<P>** ⇒ **Respect Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Respect Angle** area letter **p** is underlined)
- **Combined**
  - Click on **Respect Angle** ⇒ **Respect Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

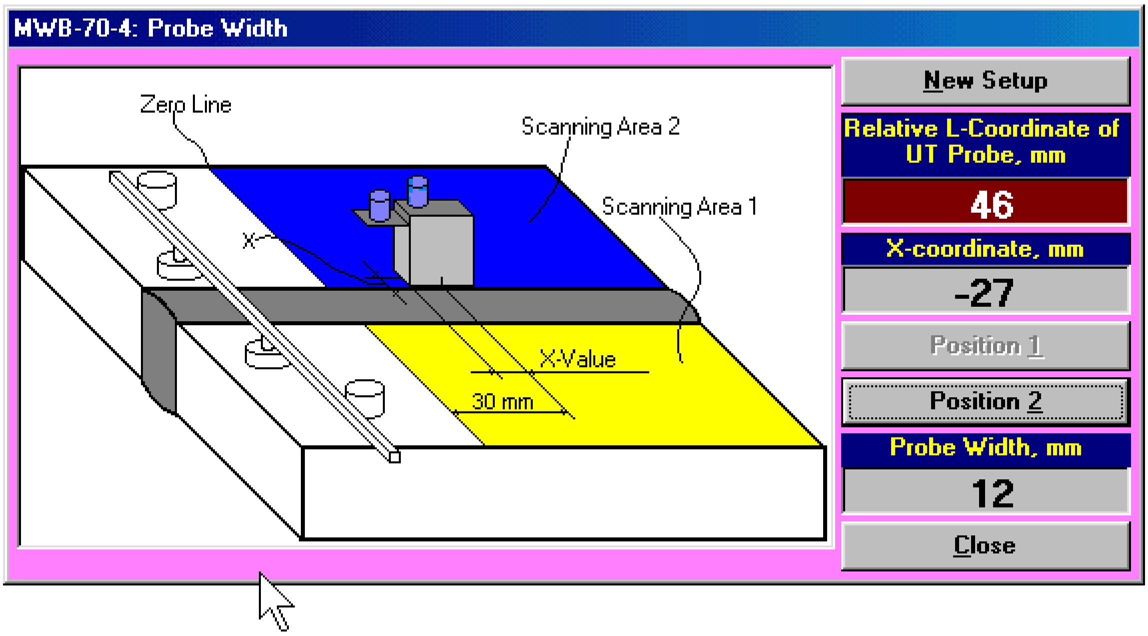
Probe Width Setup – Additional Referring of the Probe Location Monitor to the Weld Position

Click on **Probe Width...** or press **<Alt>+<W>** on the keyboard to open the **Probe Width** window



Apply the probe equipped with probe holder and double emitter of airborne ultrasound to the object under test in the **Scanning Area 1**:

- click on **New Setup** or press **<Alt>+<N>** on the keyboard – this resets probe location monitor and enables **Position 1** button
- click on **Position 1** or press **<Alt>+<1>** on the keyboard – this refers probe location monitor for scanning at parallel or at small angle to the weld in the **Scanning Area 1** and enables **Position 2** button



Apply the probe equipped with probe holder and emitters of airborne ultrasound to the object under test – **Scanning Area 2** then:

- click on **Position 2** or press **<Alt>+<2>** on the keyboard – this refers probe location monitor for scanning at parallel or at small angle to the weld in the **Scanning Area 2**

To return back to **ISONIC Setup** window click on **Close** or press **<Alt>+<C>** or press **Esc** on the keyboard

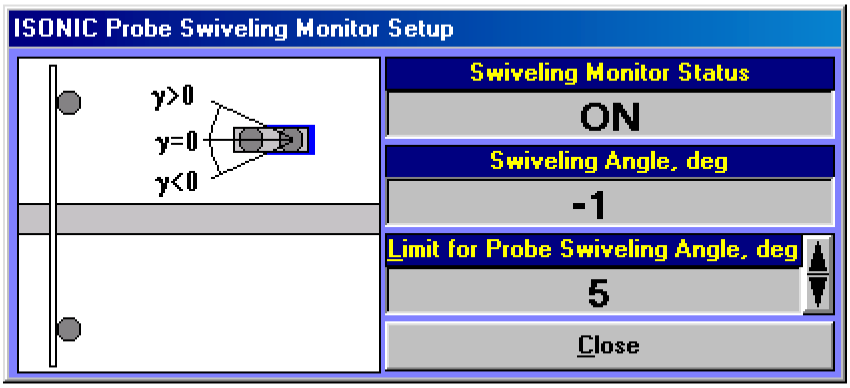
ⓘ

The described procedure also relates for welds with machined cup

Check Operation of the Probe Swiveling Monitor

Click on 

or press **<Alt>+<S>** on the keyboard to open the **ISONIC Probe Swiveling Monitor** window



It's impossible to negate Probe Swiveling monitor while running the **TRANSCAN** software package as well as to change the fixed **Limit for Probe Swiveling Angle** of **5°** for scanning the weld. The **ISONIC Probe Swiveling Monitor Setup** window allows just checking of the operation for this module

To setup the **Limit for Probe Swiveling Angle** at the checking stage the following manipulations applicable:

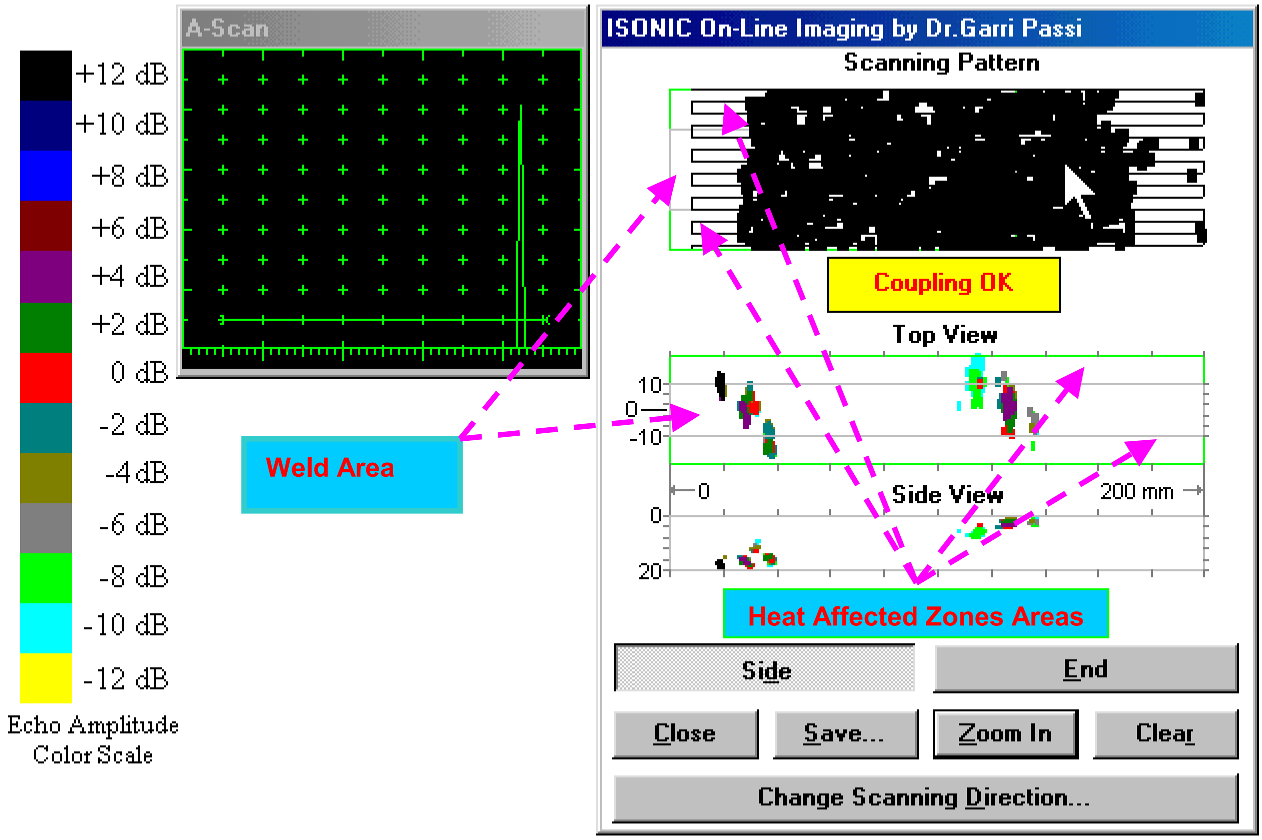
- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **Limit for Probe Swiveling Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Limit for Probe Swiveling Angle** area letter **L** is underlined)
- **Combined**
  - Click on **Limit for Probe Swiveling Angle** ⇒ **Limit for Probe Swiveling Angle** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

To return back to **ISONIC Setup** window click on 

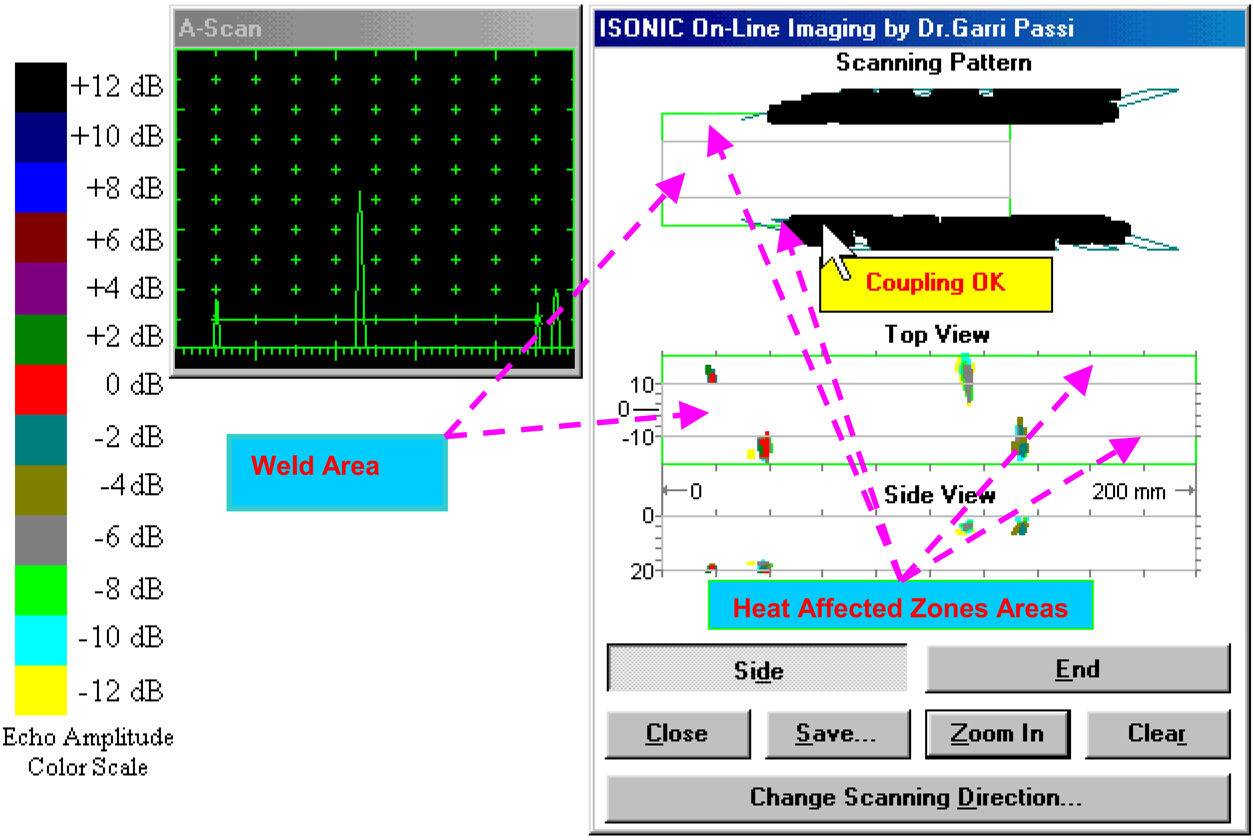
or press **<Alt>+<C>** or **Esc** on the keyboard

13.7. Inspection

Respect Angle = 0 (Scanning above the machined weld)



Respect Angle ≠ 0 (Scanning near the non machined weld)



The above screenshots illustrate the **ISONIC** screen while scanning using **TRANSCAN** software. Refer to the paragraphs 7.7 of this Operating Manual to get instructed on control **ISONIC** while scanning.

There is a possibility of changing the Scanning Direction with respect to the Zero Line. The defects images obtaining for both scanning directions are superimposed. To change the Scanning Direction click on Change Scanning Direction... or press **<Alt>+<D>** on the keyboard

13.8. Postprocessing

Refer to paragraph 7.8 of this Operating Manual

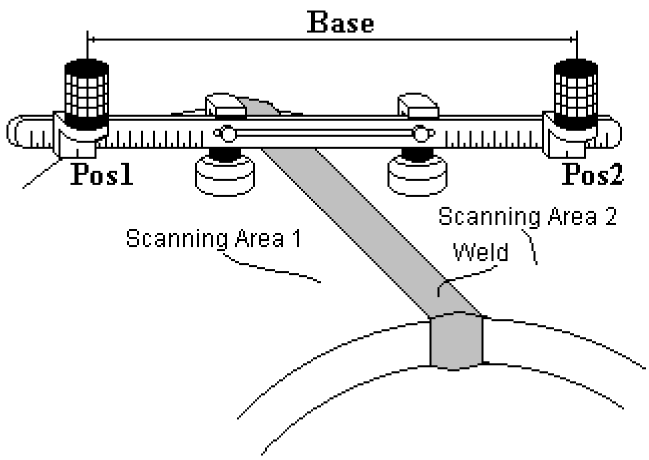
14. Operating 'LONGWELD' Software Package - ISONIC LongWeld Inspection (Inspection of the Longitudinal Welds in Pipes, Scanning from Both Sides)

The contents of this chapter is valid for the LONGWELD SW Package version 5.1.0.9 or higher

14.1. Preparing for the Inspection

14.1.1. Fixture

Refer to the paragraph 11.1.1 of this Operating Manual and to the figures below



Place the bar with the receivers of airborne ultrasound aside of the scanning area at rectangle to the weld. The center of the bar to be placed above the weld centerline. The distance between two receivers (**Base**) on the bar is defined as:

Base = **200** + **Pos1** + **Pos2**, *mm*

or

Base = **8** + **Pos1** + **Pos2**, *in*

Pos1 and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly. The value of **Base** must be set up according to the paragraph 14.6. Wrong determining of the **Base** causes mistakes in monitoring probe location and defects imaging.

Important:

- There are two Scanning Areas located at the both sides of the weld
- The start point and length for both areas must be setup according to the paragraph 14.6

14.1.2. Cabling

Refer to the paragraph 7.1.2 of this Operating Manual

14.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

14.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

14.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

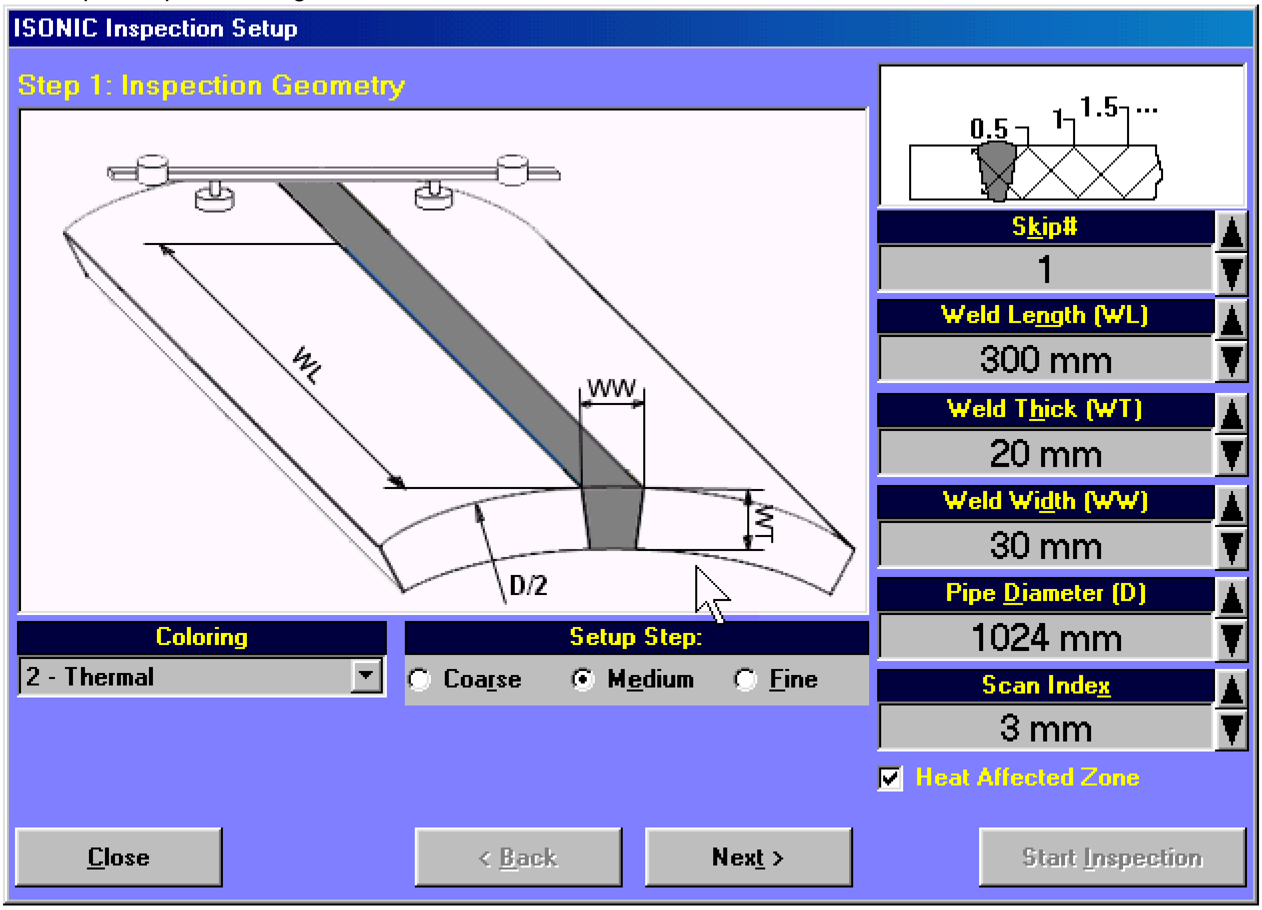
14.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

14.6. Pre-Inspection

14.6.1. Step 1: Inspection Geometry

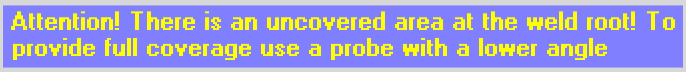
The **Step 1: Inspection Geometry** protocol appears in the **ISONIC Inspection Setup** window upon getting into the pre-inspection stage



For setting up the values of **Skip#**, **Weld Length**, **Weld Thick**, **Weld Width**, **Pipe Diameter**, and **Scan Index** refer to the paragraphs 7.6, 11.6, and 12.6 of this Operating Manual and to the note below

ⓘ

Skip#, **Weld Thick**, and **Pipe Diameter** values are synchronized with the value of **Probe Angle**. Sometimes if the selected **Probe Angle** is too high there is no complete insonification of the weld possible and the message as below appears:



On ignoring the above message the partial half skip scanning only will be possible:

<u>Region of Interest</u>

Check / Uncheck the appropriate box if the heat affected zone to be inspected along with the weld volume:

To return back to the **ISONIC Pre-Inspection…** window click on 

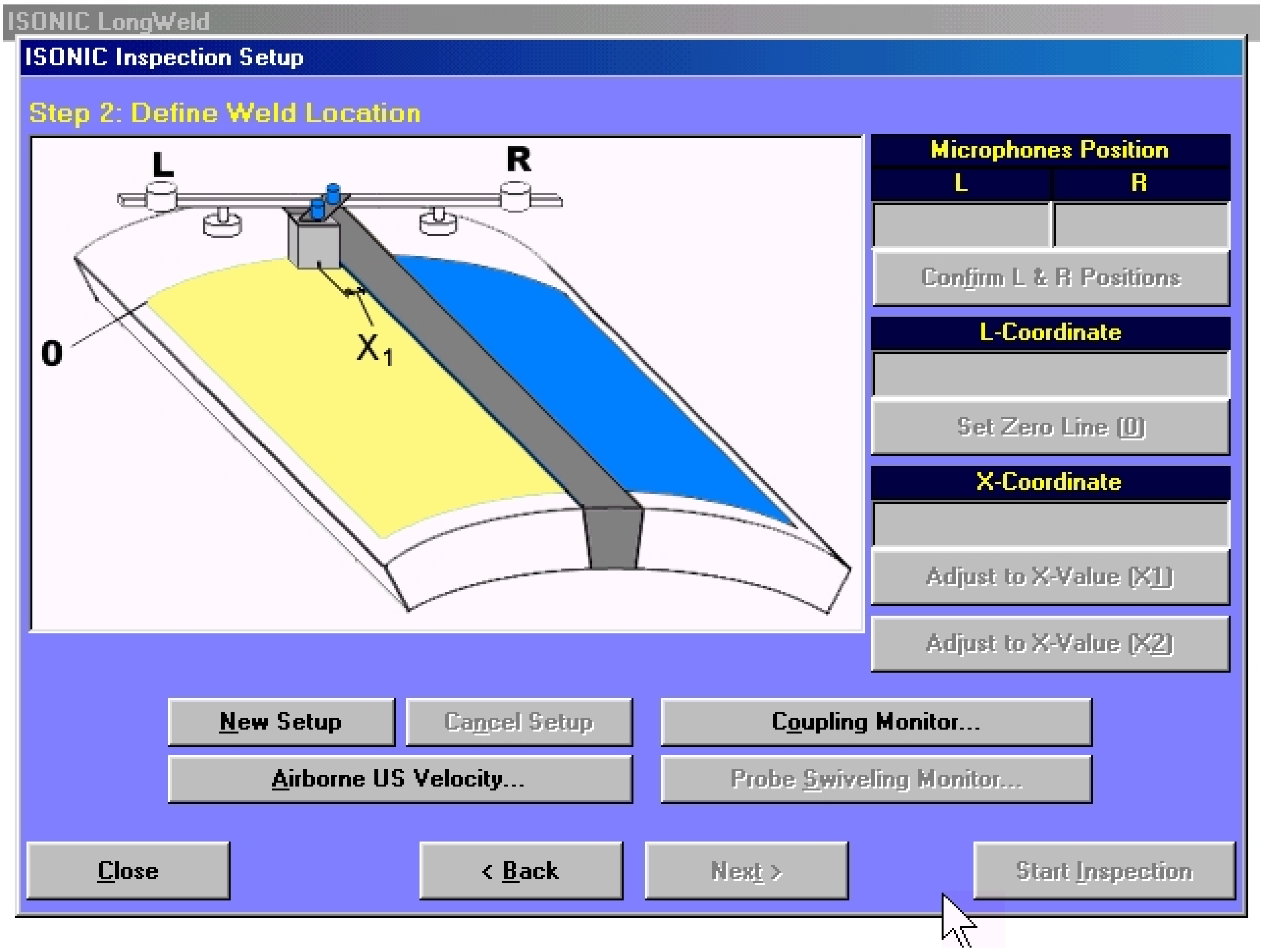
press **<Alt>+<C>** or **Esc** on the keyboard

To proceed further click on 

or press **<Alt>+<T>** on the keyboard - the **Step 2 ISONIC Inspection Setup window** appears upon

14.6.2. Step 2: Define Weld Location

The **Step 2: Defining Weld Location** protocol appears in the **ISONIC Inspection Setup** window



Coupling Monitor

Refer to the paragraph 7.6.5 of this Operating Manual

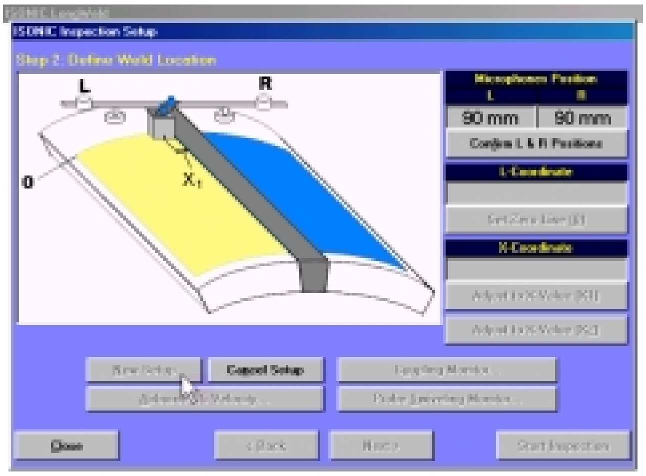
Airborne Ultrasound Velocity

Refer to the paragraph 7.6.5 of this Operating Manual

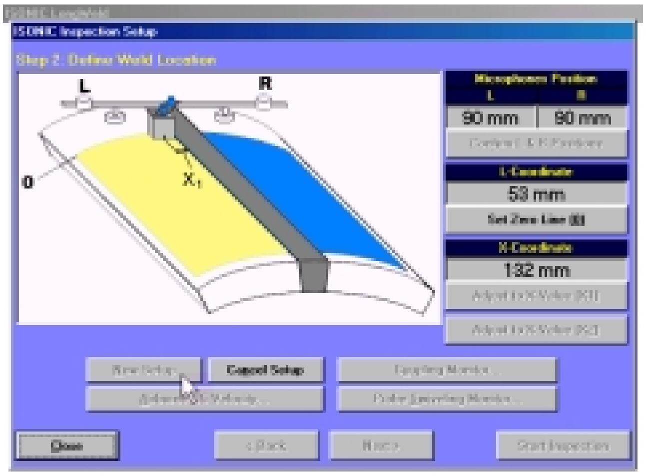
Probe Location Monitor

Apply the bar with the receivers of airborne ultrasound (microphones) aside of the scanning area at rectangle to the weld placing the center of the bar above the weld centerline then click on New Setup or press **<Alt>+<N>** on the keyboard.

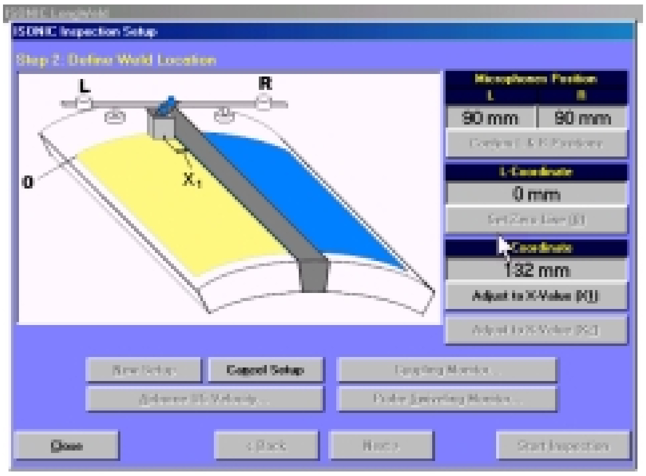
Based on the data keyed in during implementing of **Step 1: Inspection Geometry** protocol the required positions **L** and **R** of the microphones on the bar are determined automatically and displayed.



Place microphones into the required **L** and **R** positions in accordance with the left and right scales of bar correspondingly then click on **Confirm L & R Positions** or press **<Alt>+<F>** on the keyboard upon placing the microphones appropriately

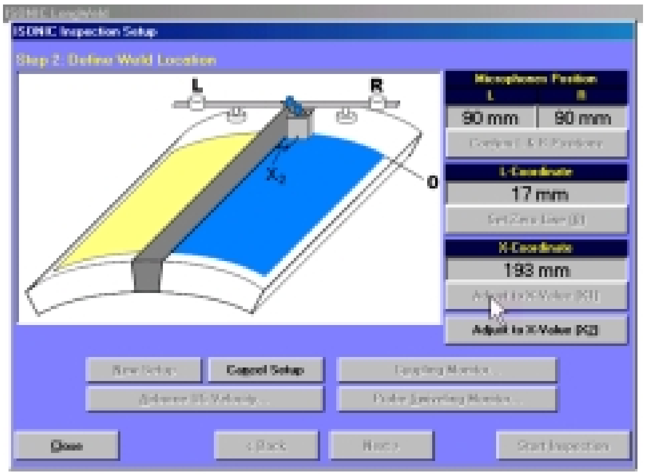


Place probe above closest to the bar above border of the scanning area according to the sketch currently shown in the **ISONIC Inspection Setup** window then click on **Set Zero Line (0)** or press **<Alt>+<0>** on the keyboard



This will reset **L-Coordinate** to **0** defining **Zero Line** and enable the **Adjust to X-Value (X1)** button.

Keeping probe in the same position click on **Adjust to X-Value (X1)** or press **<Alt>+<1>** on the keyboard



This will define weld edge in the yellow segment of the scanning area and enable the **Adjust to X-Value (X2)** button.

Place probe at the opposite side of the weld according to the sketch currently shown in the **ISONIC Inspection Setup** window then click on **Adjust to X-Value (X2)** or press **<Alt>+<2>** on the keyboard

This will end the probe location monitor calibration and activate validation of the received inputs
If the received inputs are not valid then the following warnings are possible:

The keying according to the above paragraph 14.6.1 to be double checked then probe location monitor procedure to be carefully repeated

The center of the bar with airborne ultrasound receivers to be placed above the weld centerline then probe location monitor procedure to be carefully repeated

The buttons **Probe Swiveling Monitor...** and **Start Inspection** will be enabled upon validation of the received inputs will be received

<u>Probe Swiveling Monitor</u>

Refer to the paragraph 10.6 of this Operating Manual

ⓘ

- The described procedure also relates to the machined welds
- If there is a need to interrupt the probe location monitor procedure without completing click on **Cancel Setup** or press **<Alt> + <N>** on the keyboard

To return back to **Step 1: Inspection Geometry** protocol click on < Back press **<Alt>+<B>** on the keyboard

To return back to the **ISONIC Pre-Inspection…** window click on Close press **<Alt>+<C>** or **Esc** on the keyboard

Flaw Imaging

Refer to the paragraph 10.7 of this Operating Manual

14.7. Inspection

Refer to the paragraphs 7.7 and 11.7 of this Operating Manual

14.8. Postprocessing

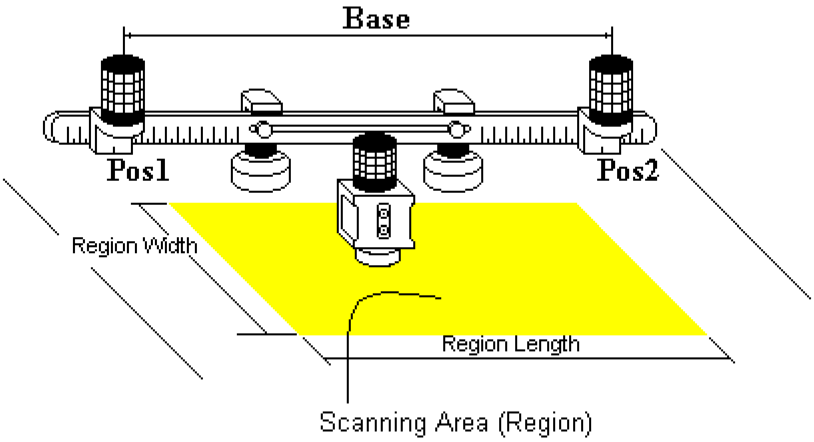
Refer to the paragraph 7.8 of this Operating Manual

15. Operating 'CORROMAP' Software Package - ISONIC Corrosion Mapping

The contents of this chapter is valid for the CORROMAP SW Package version 6.2.0.4 or higher

15.1. Preparing for the Inspection

15.1.1. Fixture



Apply the bar with the receivers of airborne ultrasound to the object under test at parallel to one of the scanning area sides. The distance between two receivers (**Base**) on the bar is defined as:

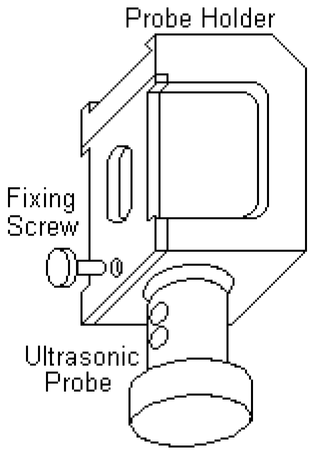
Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

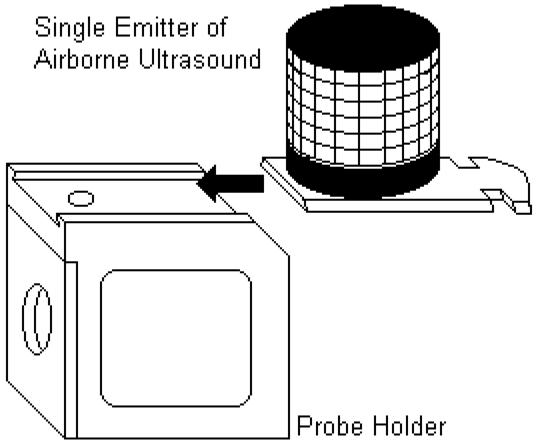
Pos1 and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly. The value of **Base** must be known prior to the scanning. Wrong determining of the **Base** causes mistakes in monitoring probe location and corrosion mapping

ⓘ

Region Length = Base

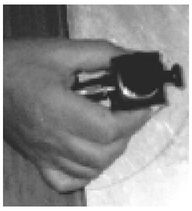
Insert ultrasonic probe into the appropriate probe holder then fix the single emitter of airborne ultrasound on the top of the probe holder:



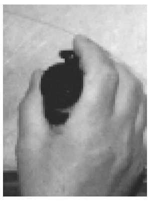


Remember!

✓ Accepted



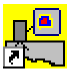
✗ Not Accepted



15.1.2. Cabling

Ultrasonic Flaw Detector PC Card	Applicable Cabling Scheme	Paragraph
UDS 3-3	A.4; A7	4.2.4
UDS 3-4	A.5; A8	4.2.4
USLT 2000	A.6; A9	4.2.4

15.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

15.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

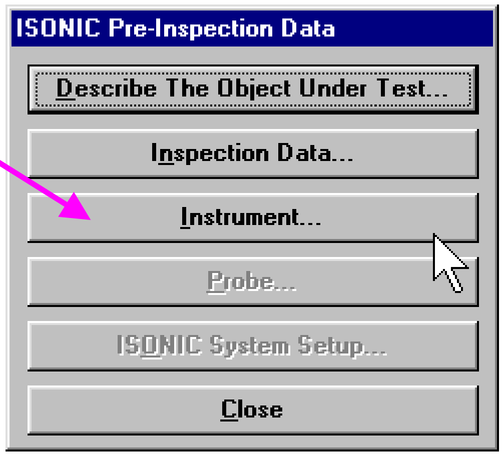
15.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

15.5. ISONIC Control Menu

Refer to the paragraph 7.5 of this Operating Manual and to the figures below

The following parameters must be setup upon clicking on



- **Gain** to ensure the receiving of the stable backwall echo and necessary sensitivity to the smallest thickness degradation areas to be detected
- **USVelocity** to match with this property of the object under test
- **Probe Delay** to match with this parameter of the probe
- **Gate A** – **aSwitch** must be setup to **ON**
- **Gate A** – **aStart** and **aWidth** parameters to correspond to the selected ***Region of Interest*** (refer to the below Paragraph 15.7.1 of this Operating Manual)
- **Display Delay** and **Range** to ensure presence of the **Gate A** entire the **A-Scan** (refer to the below Paragraph 15.7.1 of this Operating Manual)
- **Gate A** – **aThreshold** to observe the noise immunity and ensure the expected signals of interest will exceed that value

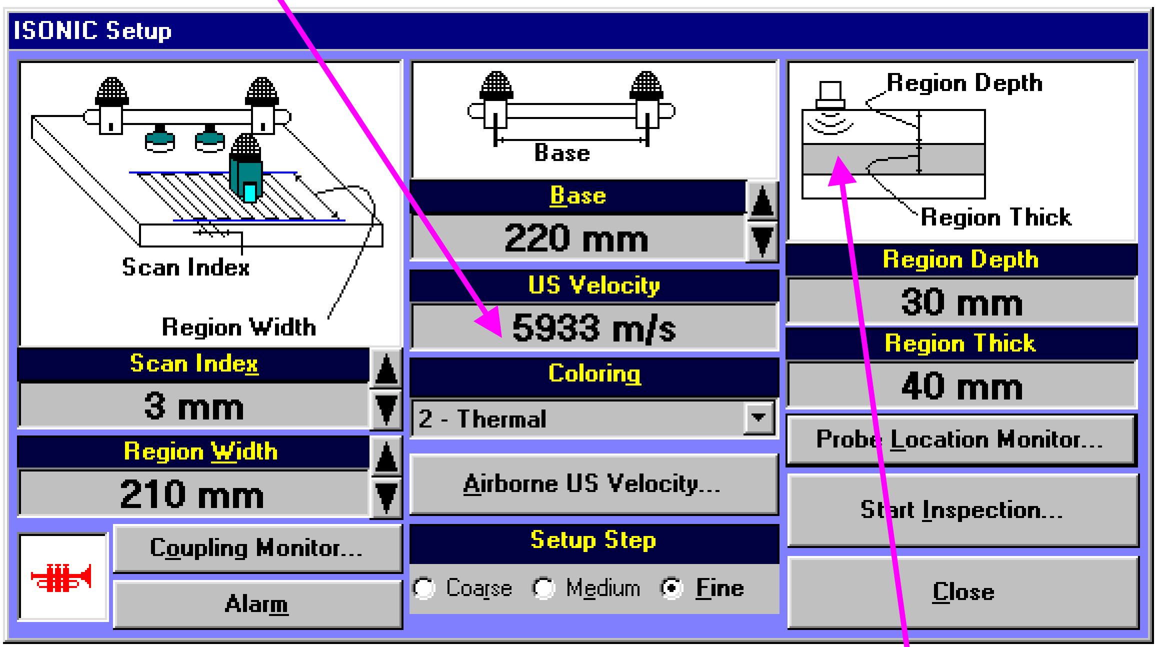
Setting the **aSwitch** to **OFF** or mismatch between **aStart** and **aWidth** on one hand and **Display Delay** and **Range** on the other hand (in other words nonappearance of the **Gate A** on the entire **A-Scan**) will cause the warning as below upon leaving **ISONIC Pulser Receiver** window

It will not be possible to proceed with the scanning before returning to the **ISONIC Pulser Receiver** window and observing the necessary settings

15.6. Pre-Inspection

Refer to the paragraph 7.6 of this Operating Manual and to the figures below

The values of **US Velocity** and **Probe Delay** keyed in the **ISONIC Pulser Receiver** window are valid for the scanning mode



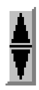
The **Region of Interest** (**Region**) to be designated prior to the scanning. The **Region** shown in the **ISONIC Setup** window is characterized by two parameters **Region Depth** and **Region Thick**, which are defined through the **Gate A** settings in the **ISONIC Pulser Receiver** window (refer to the paragraph 15.5 and paragraph 15.7.1 of this Operating Manual)

Region Length

The **Length of the Scanning Area** is defined through the setting up the **Base** (distance between microphones on the bar – refer to the paragraph 15.1.1 of this Operating Manual)

Region Width

Region Width defines the **Width of the Scanning Area** (refer to the paragraph 15.1.1 of this Operating Manual). To setup the value of **Region Width** the following manipulations are applicable:

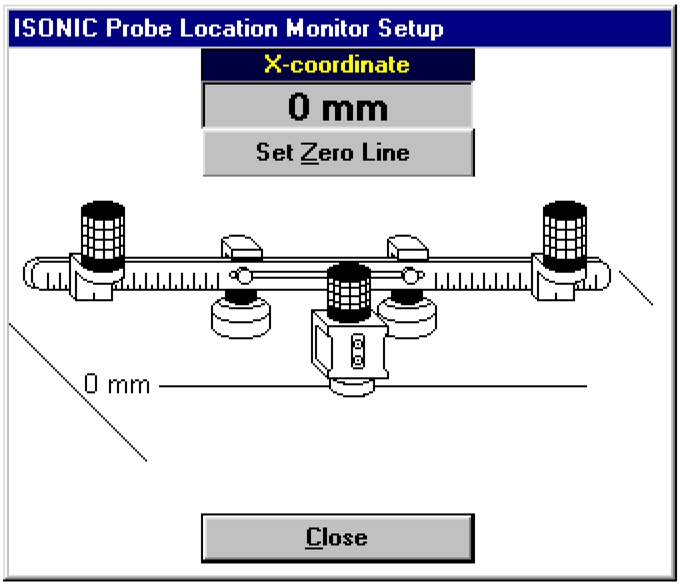
- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<W>** ⇒ **Region Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Region Width** area letter **W** is underlined)
- **Combined**
  - Click on **Region Width** ⇒ **Region Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **Region Width** is set in **mm** or **in***
*The possible values of increment / decrement for **Region Width** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*5 mm*	*0.1 in*
Coarse	*10 mm*	*0.5 in*

Zero Line (Referring Probe Location Monitor)

Click on **Probe Location Monitor...** or press **<Alt>+<L>** on the keyboard to open the **ISONIC Probe Location Monitor Setup** window



Apply the probe equipped with the probe holder and emitter of airborne ultrasound to the object under test as it is shown in the **ISONIC Probe Location Monitor Setup** window and click on the **Set Zero Line** or press **<Alt>+<Z>** on the keyboard.

To return back to **ISONIC Setup** window click on **Close** or press **<Alt>+<C>** or **Esc** on the keyboard

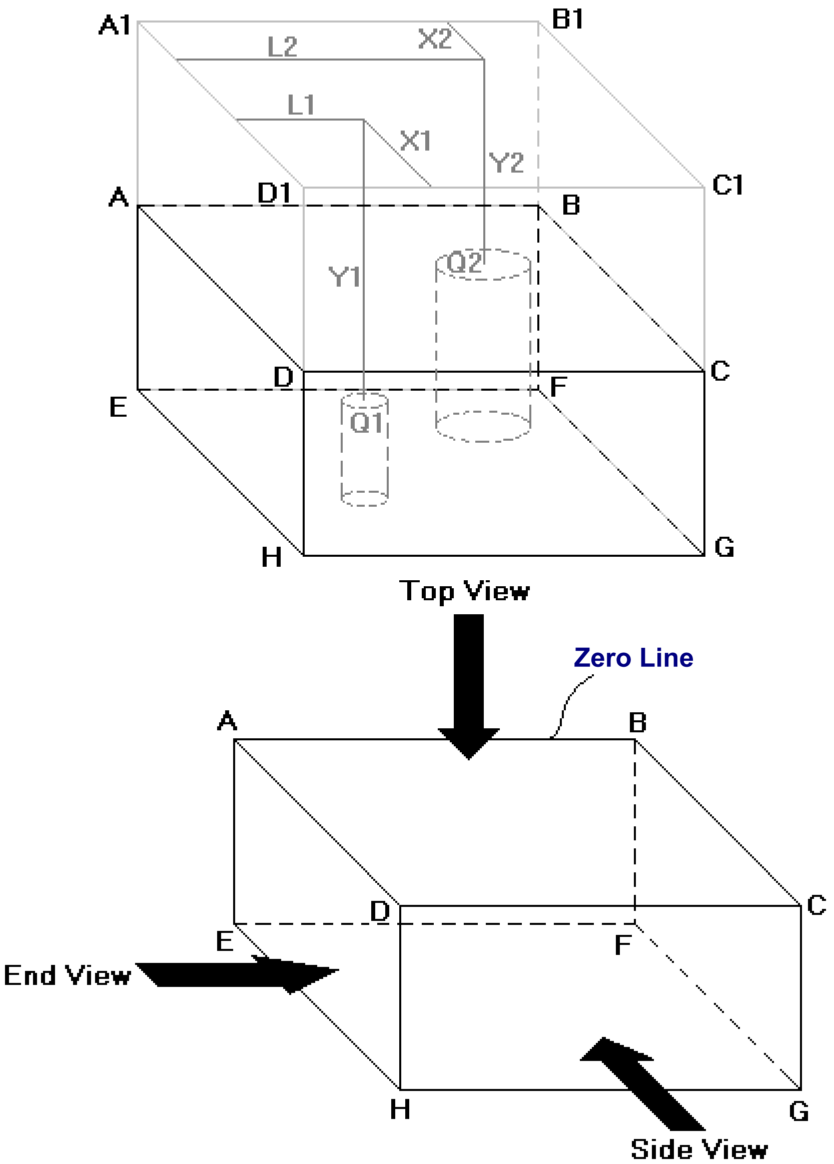
15.7. Inspection

15.7.1. Volume Under Test and Data Presentation

The sketches and accompanying notes below explain the principles of the **CORROMAP** Data Presentation

Sketch Note

1



- Q1 (L1, X1, Y1) – Center of the Drill # 1's Bottom Surface
- Q2 (L2, X2, Y2) – Center of the Drill # 2's Bottom Surface

General

(a) The Volume Under Test (**Region of Interest**) is located between the two parallel rectangles namely ABCD and EFGH

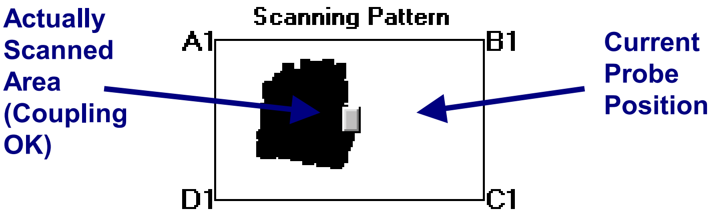
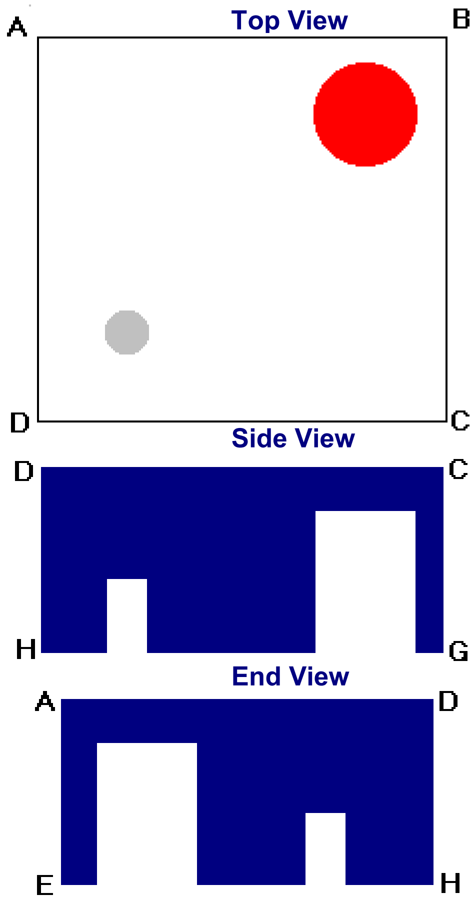
(b) The scanning is provided above the surface of the rectangle A1B1C1D1

(c) The lines A1B1 and AB are parallel to the line connecting the receivers of airborne ultrasound. The position of the lines A1B1 and AB with respect to the said receivers is defined by setting up the Zero Line while calibrating the Probe Location Monitor

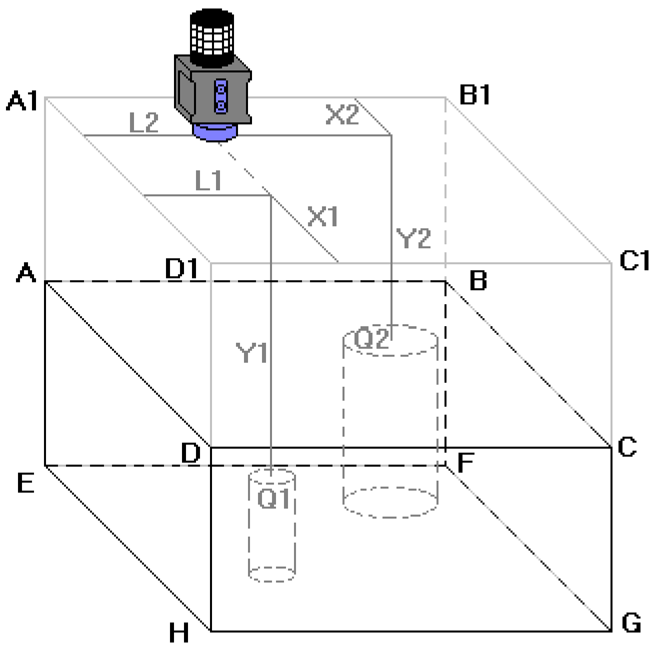
(d) Refer to the ISONIC Setup window:

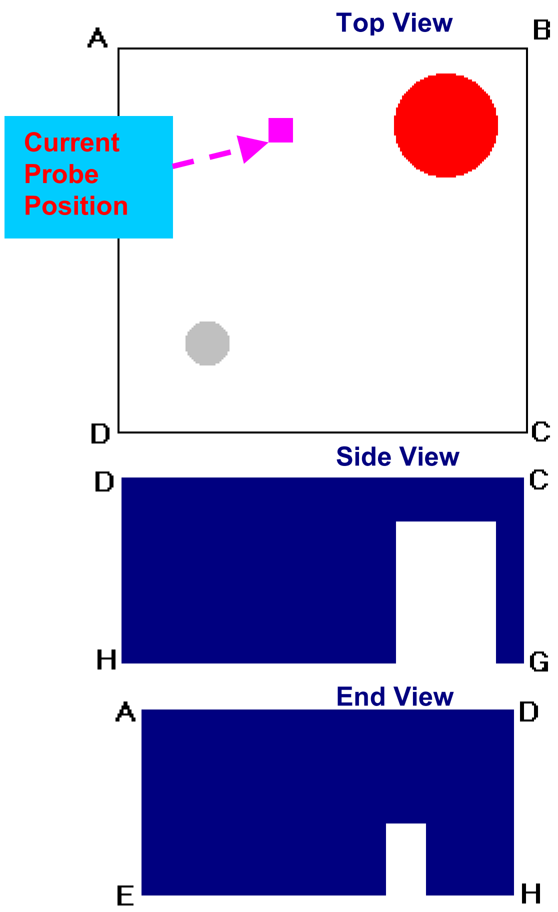
- **A1A = Region Depth**
- **AB = Region Length**
- **AD = Region Width**
- **DH = Region Thickness**
- **A1E = *Normal* Material Thickness**

(e) To give an example it is supposed that there are two drills in the object under test, said drills have different diameters, coordinates and depths of penetration into the **Region of Interest** and ended by the flat bottoms each

##	Sketch	Note
2	 	**<u>Testing Integrity</u>** The **Scanning Pattern** will be represented in the separate field if the coupling monitor was activated prior to the start of the inspection
3	 	**<u>Top View, Global Side and End Views</u>** Supposing that the scanning is performed completely the **Top View** generated by the **CORROMAP** software consists of 3 areas; each area is painted with the color corresponding to the remaining material thickness. Partially the area above the drill # 1 will be painted with **Y1**-color; the area above drill # 2 will be painted with **Y2**-color; the remaining part of the Top View will be painted with the **Material Thickness**-color The **Side View** and **End View** are the orthogonal images composed through the superimposing of the corresponding cross sectional profiles along and across the whole **Region of Interest**, said superimposing is performed by overwriting of the high value of the remaining material thickness with the lower value providing the representation of the least remaining thickness values All acquired data is stored into a 3D-matrix, so there is no any data loss – refer to the sketches ## 4-6 exampling the **Sectional Side View** and **End View**

##	Sketch	Note
4		

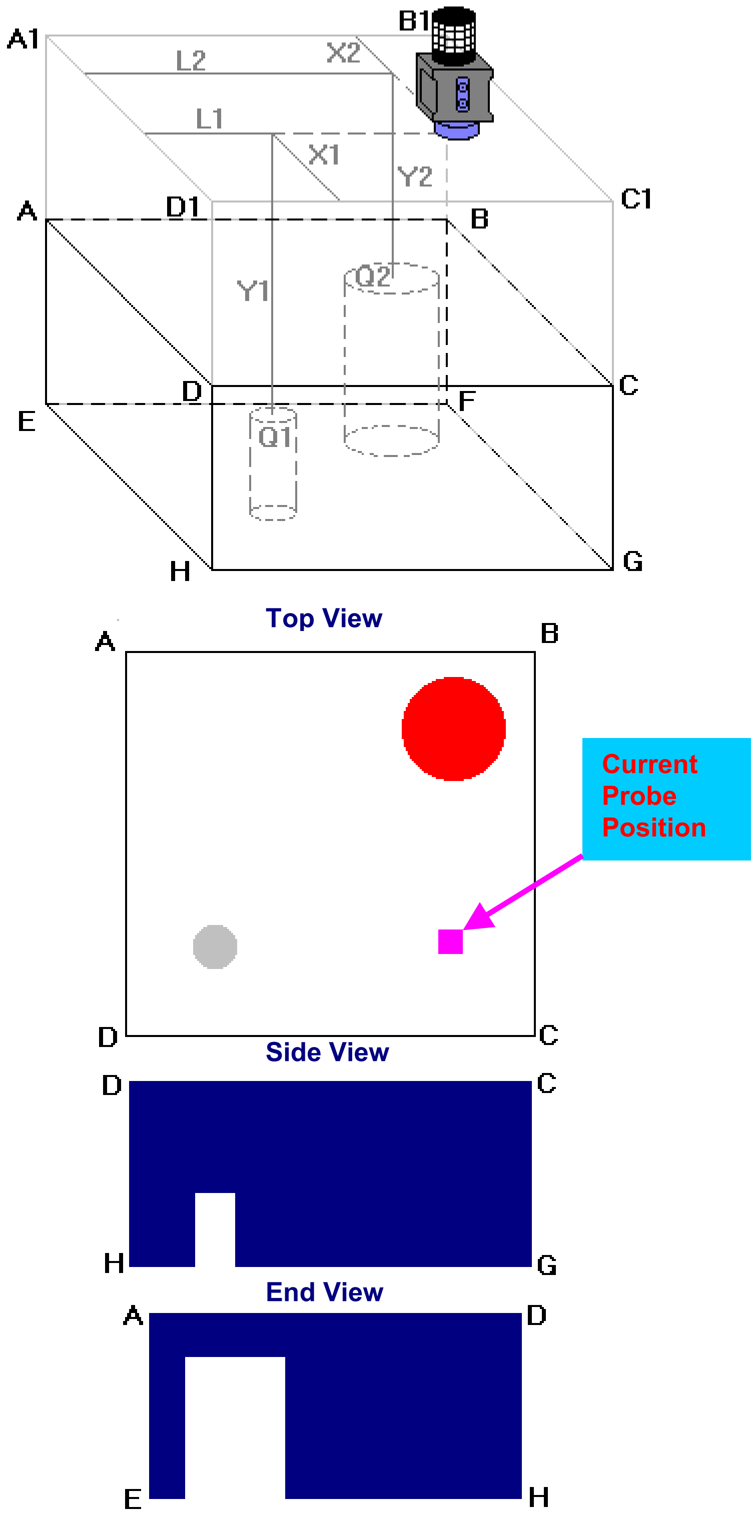




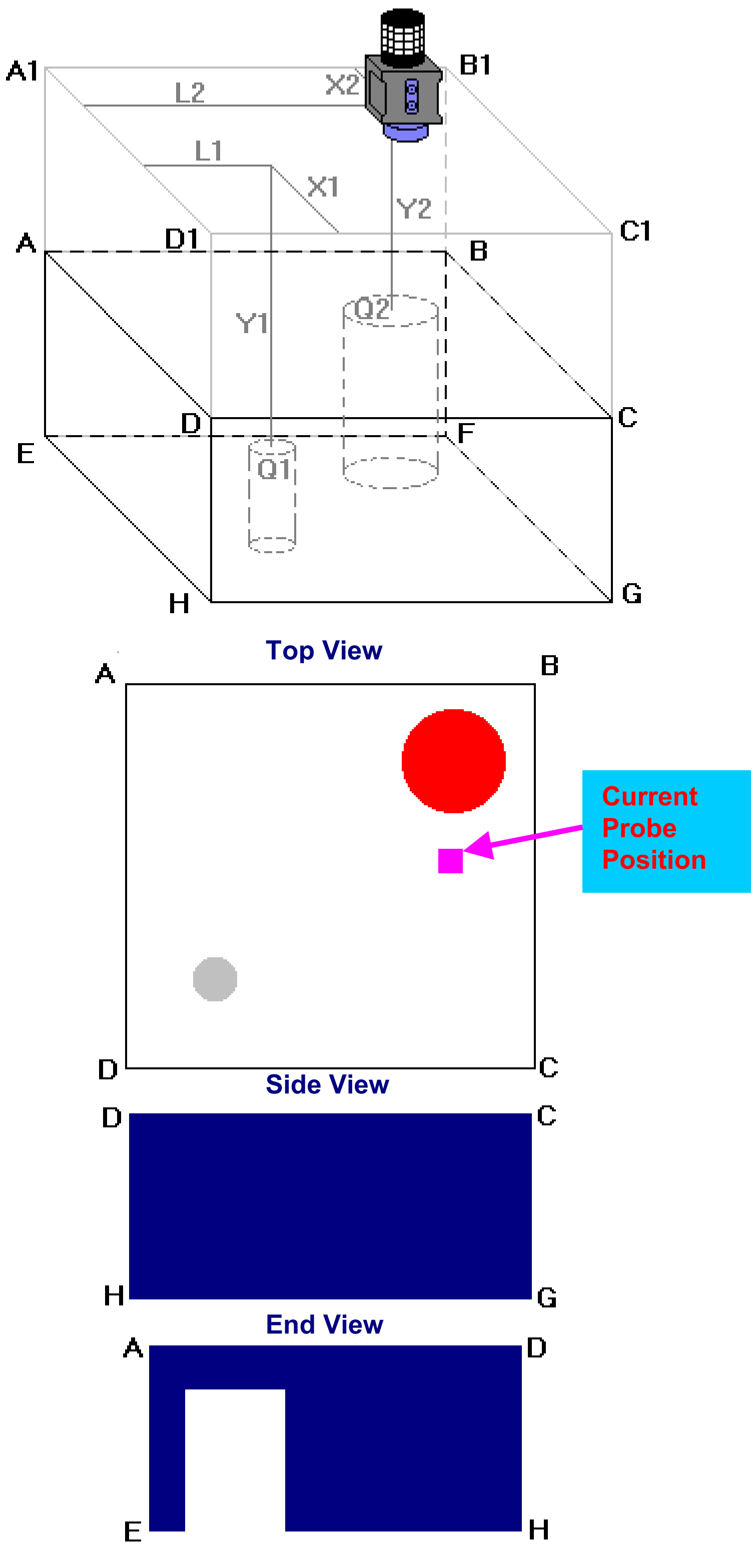
<u>Sectional Side View and End View</u>

Sketches ## 4 through 6 are the examples illustrating how the sectional **Side View** and **End View** are composed

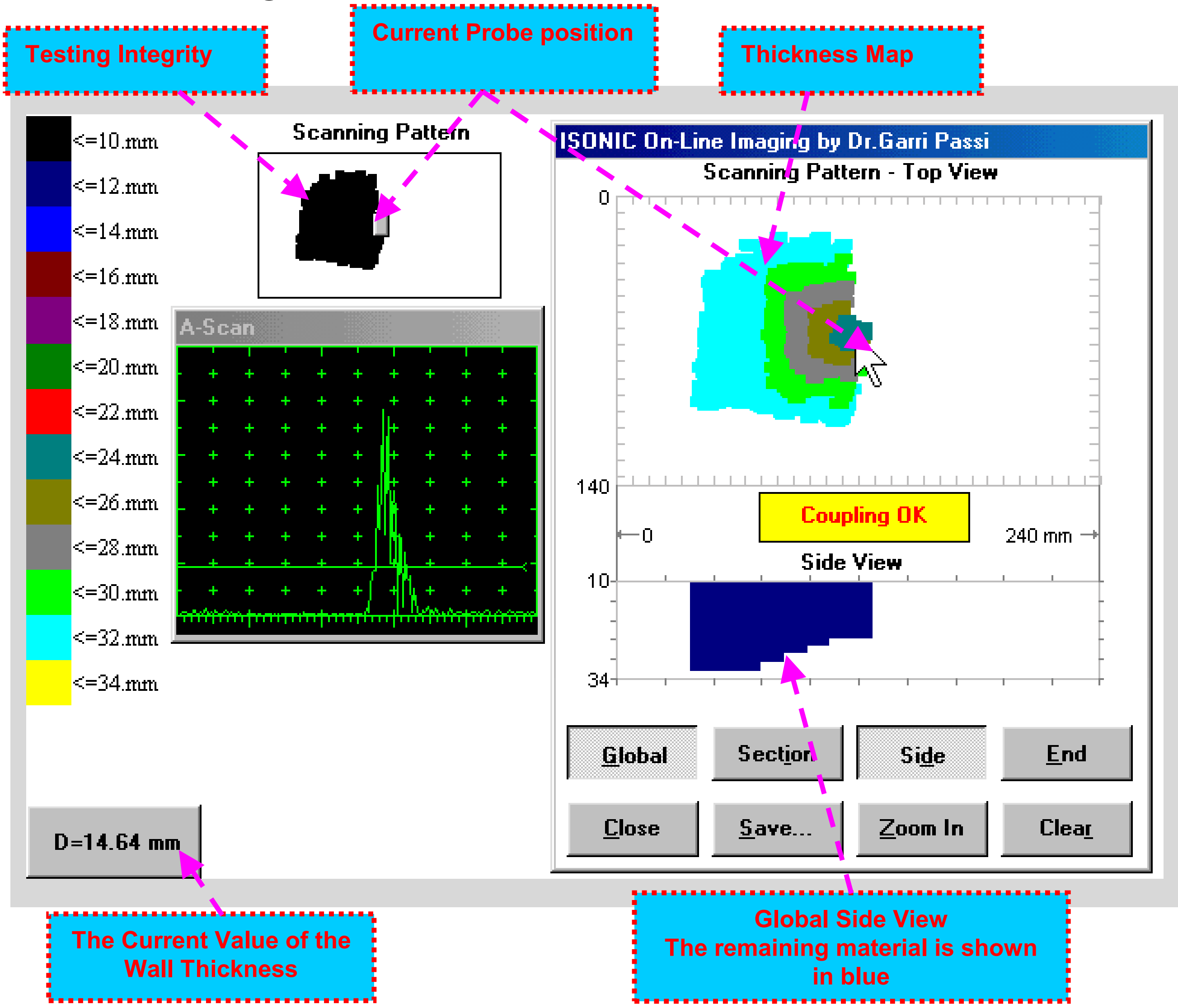
If the sectional viewing is selected by an operator then the section currently represented on the ISONIC screen will correspond to the current probe coordinate (X – for the sectional **Side View**; L – for the sectional **Top View**); replacement of the probe causes representation of the another sectional view

##	Sketch	Note
5		

##	Sketch	Note
6		



15.7.2. Scanning



The above screenshot illustrates the **ISONIC** screen while scanning using the **CORROMAP** software. The target of the operator is to completely "paint" over the *Scanning Pattern-Top View* area providing the necessary testing integrity. The thickness map and the backwall profile are recorded and imaged automatically in real time

Thickness Mapping Logic: The current lower value thickness reading (*dominating*) overwrites the already recorded higher value thickness reading if placing the probe above the same spot again. The higher value thickness reading does not overwrite the already recorded lower value thickness reading (*dominating*) if placing the probe above the same spot again

Thickness Map "Repair" Logic: The **Map Repair Function** is active while keeping pressed the **<Space>** button on the keyboard – the new thickness readings unconditionally overwrite already recorded data. This allows the map corrections after finding the non-relevant *dominating* data recorded

Thickness Map "Marks": Some eventually "unscanable" spots may exist on the scanning surface, for example the metal drops, deep surface corrosion, etc. or construction elements, such as rivets, bolts, etc. In order *to mark the said spots one by one*: place probe above each point to be marked and press **<Shift>+<Space>** on the keyboard. The corresponding marks appear over the *Top View*. To *erase a mark* use the **Map Repair Function**

It is possible to use the different styles of the back wall profile presentation while scanning:

- Click on Side or press **<Alt>+<D>** on the keyboard for the **Side View** back wall profile representing
- Click on End or press **<Alt>+<E>** on the keyboard for the End View back wall profile representing
- Click on Section or press **<Alt>+<I>** on the keyboard for the sectional back wall profile representing for the currently active **Side View** or **End View**
- Click on Global or press **<Alt>+<G>** on the keyboard for the global back wall profile representing for the currently active **Side View** or **End View**

There are another 4 controls available on the **ISONIC** screen while scanning:

Click on Save... or press **<Alt>+<S>** on the keyboard to save a file containing inspection data. Proceed according to the paragraph 5.4.19 of this Operating Manual

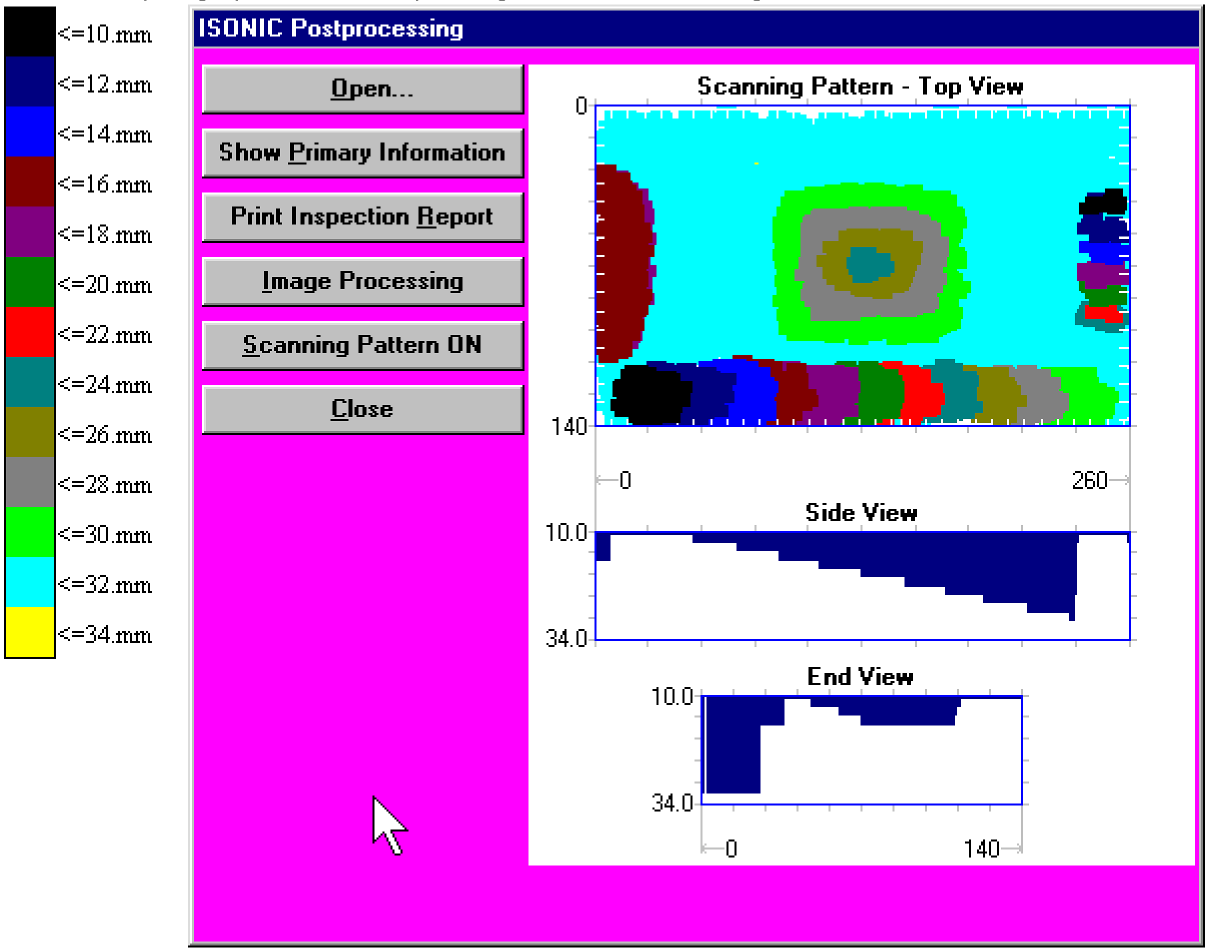
Click on Zoom In or press **<Alt>+<Z>** on the keyboard to zoom the **ISONIC On-Line Imaging** window

Click on Clear or press **<Alt>+<R>** on the keyboard to reset to background in the **ISONIC On-Line Imaging** window

Click on Close or press **<Alt>+<C>** or **Esc** on the keyboard to return back to the **ISONIC Setup** window

15.8. Postprocessing

Refer to the paragraph 7.8 of this Operating Manual and to the figures below



General

- o Both Global **Side View** and **End View** appear upon opening the **CORROMAP** results file
- o The thickness map appears with the palette (color scale), which was active entire the scanning
- o If the Coupling Monitor was active entire the scanning then the button Scanning Pattern ON becomes enabled upon opening the **CORROMAP** results file. To preview the separately recorded testing integrity plane click on the Scanning Pattern ON or press **<Alt>+<S>** on the keyboard. To return click on Scanning Pattern OFF or press **<Alt>+<S>** on the keyboard

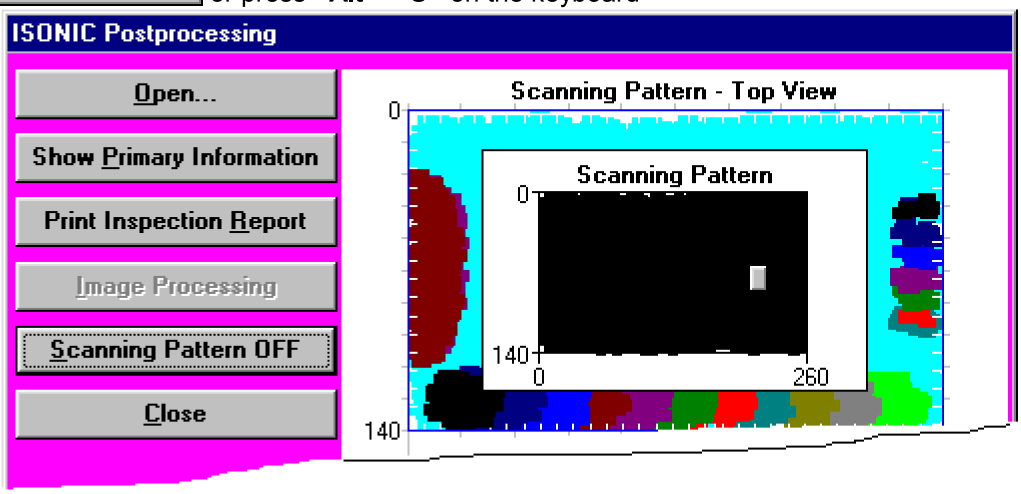
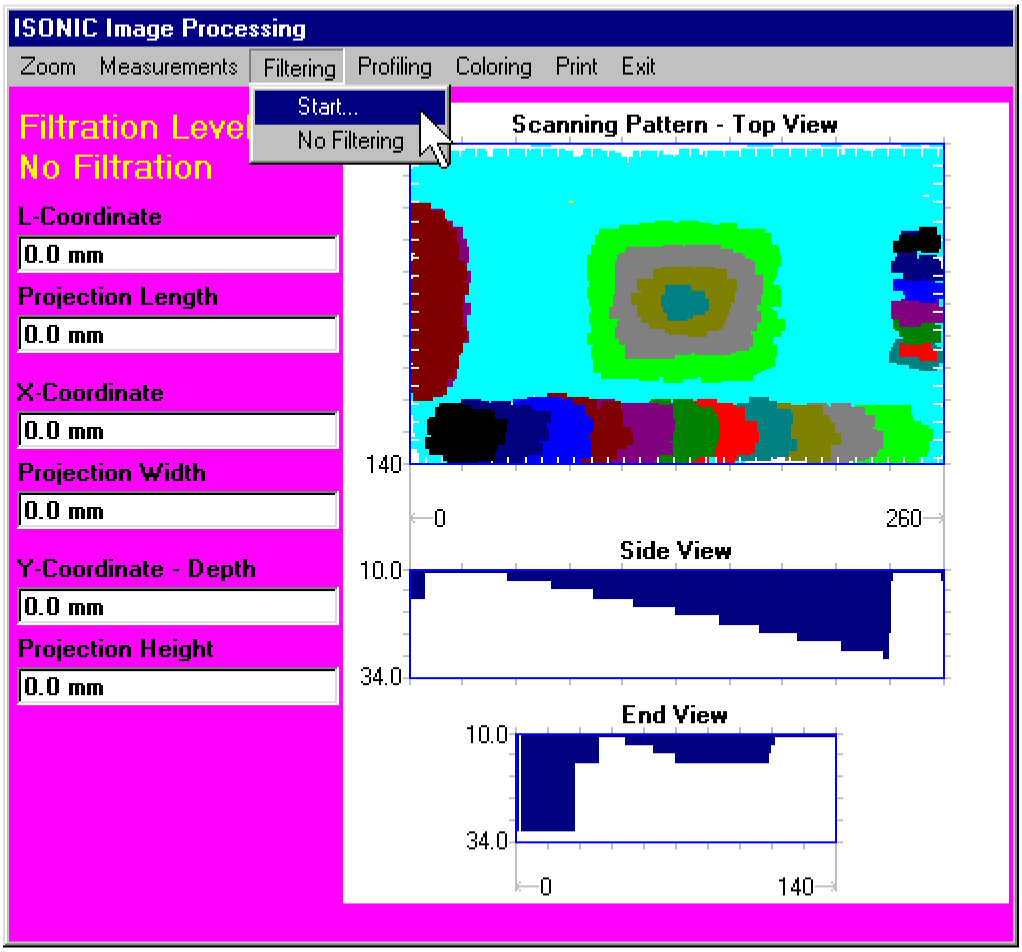


Image Processing

Filtering

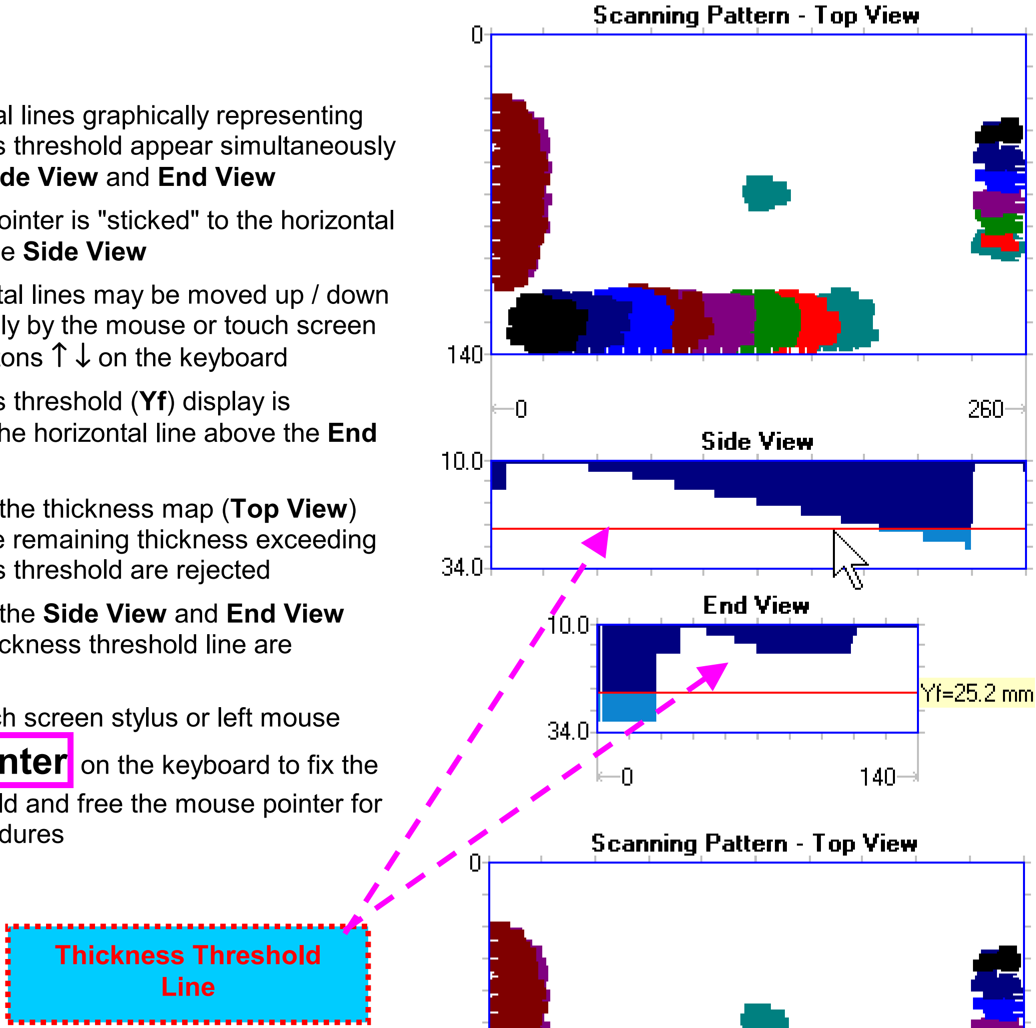
Filtering → Start…

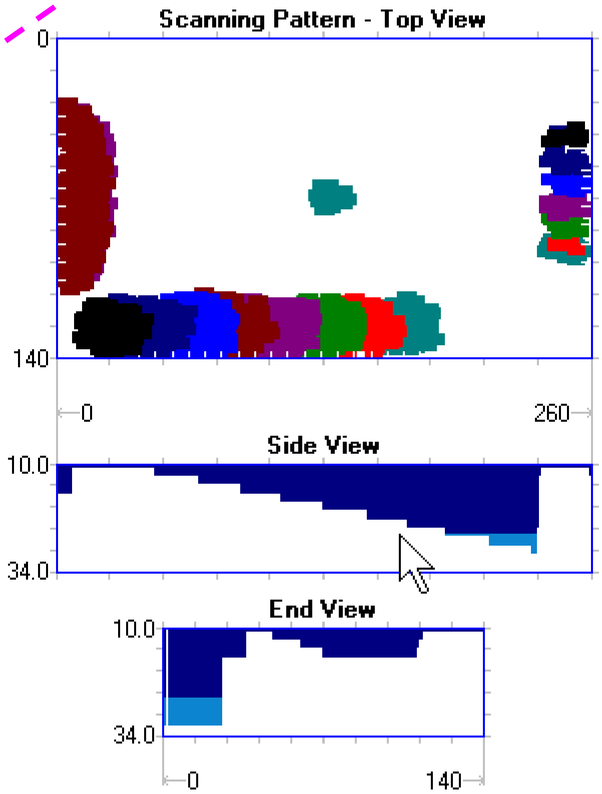


As a result:

- o two horizontal lines graphically representing the thickness threshold appear simultaneously above the **Side View** and **End View**
- o the mouse pointer is "sticked" to the horizontal line above the **Side View**
- o both horizontal lines may be moved up / down synchronously by the mouse or touch screen stylus or buttons ↑ ↓ on the keyboard
- o the thickness threshold (**Yf**) display is "sticked" to the horizontal line above the **End View**
- o the areas of the thickness map (**Top View**) related to the remaining thickness exceeding the thickness threshold are rejected
- o the areas of the **Side View** and **End View** under the thickness threshold line are lightened

Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the selected threshold and free the mouse pointer for the further procedures



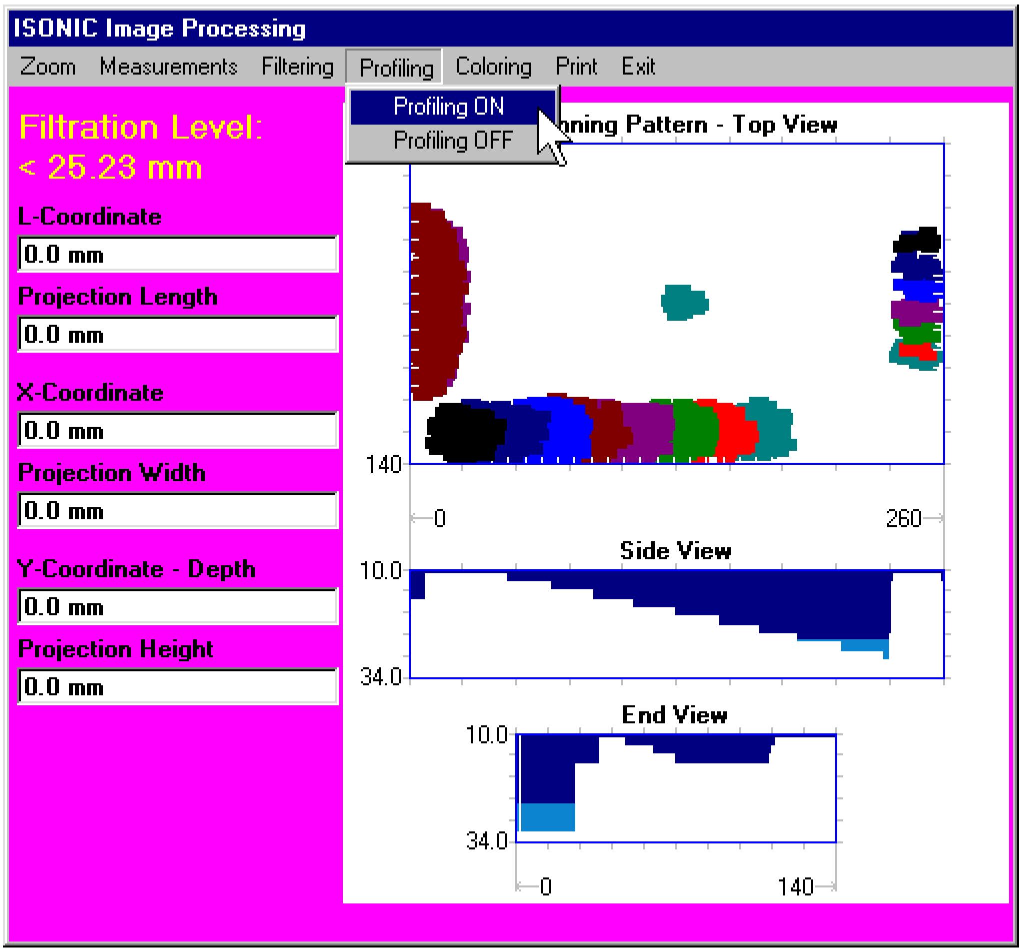


To interrupt the ***Filtering*** procedure right mouse click or press **Esc** on the keyboard

Filtering → No Filtering switches the active ***Filtering*** function off

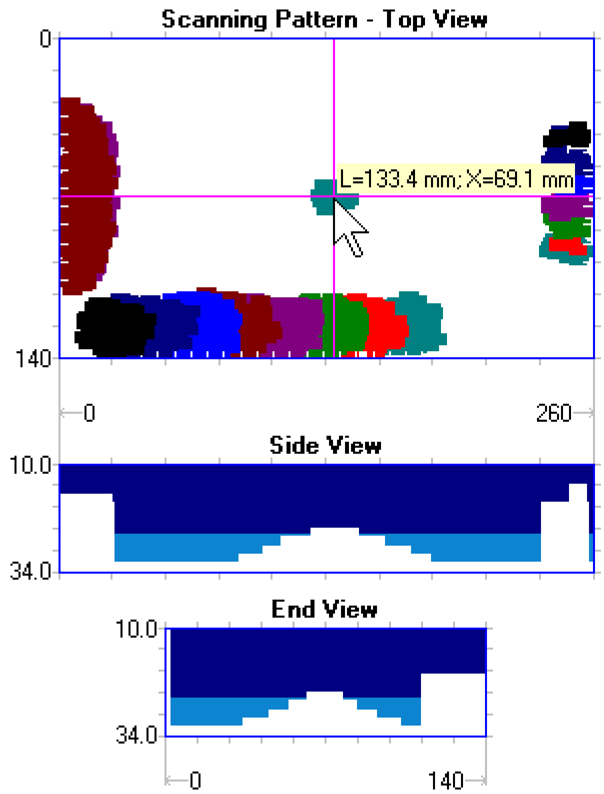
Profiling

Profiling → Profiling ON



As a result:

- two orthogonal lines appear above the **Top View**
- the mouse pointer is "sticked" to the crossing point of the said lines
- both lines may be moved up / down and left / right correspondingly by the mouse or touch screen stylus or buttons ↑ ↓ → ← on the keyboard
- the cross point coordinates display is "sticked" to the horizontal line
- the horizontal line and its X-coordinate provide representing of the corresponding sectional **Side View**
- the vertical line and its L-coordinate provide representing of the corresponding sectional **End View**



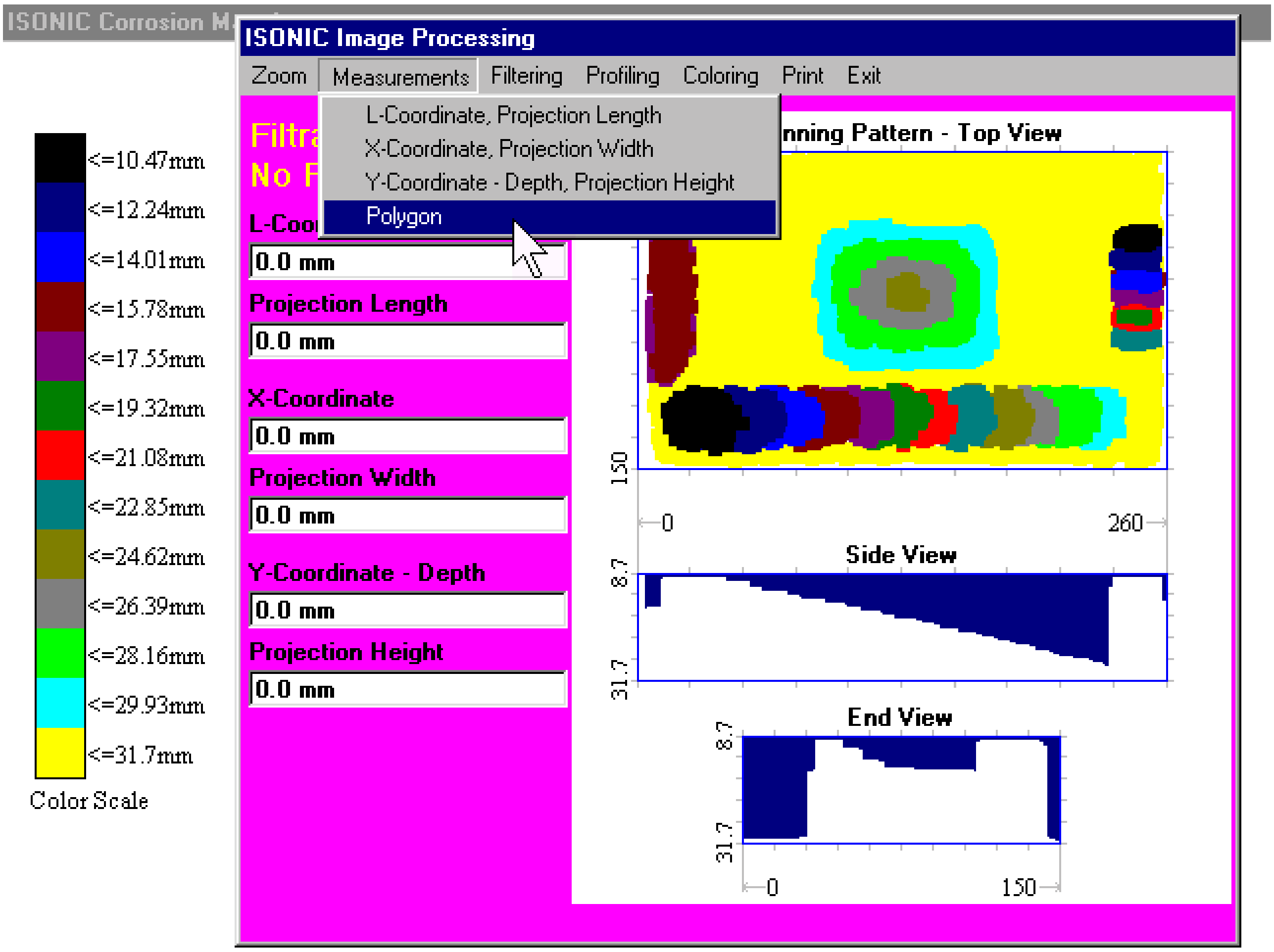
Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the obtained sectional **Side View** and **End View** and free mouse pointer for the further procedures

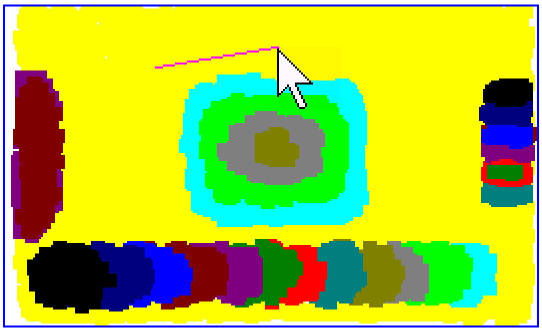
To interrupt the ***Profiling*** procedure right mouse click or press **Esc** on the keyboard

Profiling → Profiling OFF switches the active ***Profiling*** function off

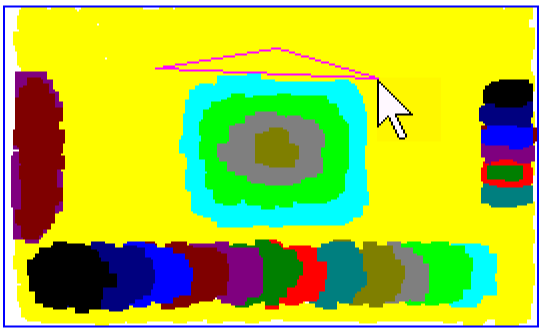
Polygons – Statistical Processing

Measurements → Polygon



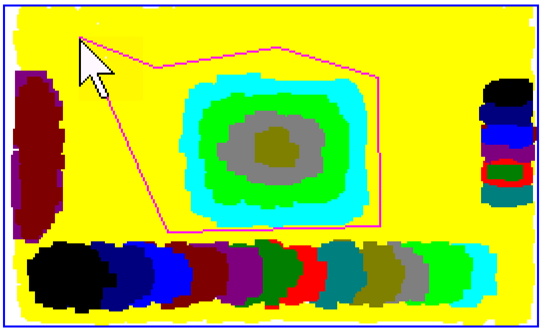


Use the mouse or touch screen stylus or buttons ↑ ↓ → ← on the keyboard to manipulate the cursor over thickness map. Release the touch screen stylus or left mouse click or press **Enter** on the keyboard upon placing the cursor over the first apex of the desired polygon. This makes it possible to designate the first polygon's rib through the appropriate manipulating of the cursor; said rib will connect the current cursor position and the first apex of the desired polygon. Place cursor over the next selected apex of the desired polygon and release the touch screen stylus or left mouse click or press **Enter** on the keyboard. As the result the next polygon's rib will be created

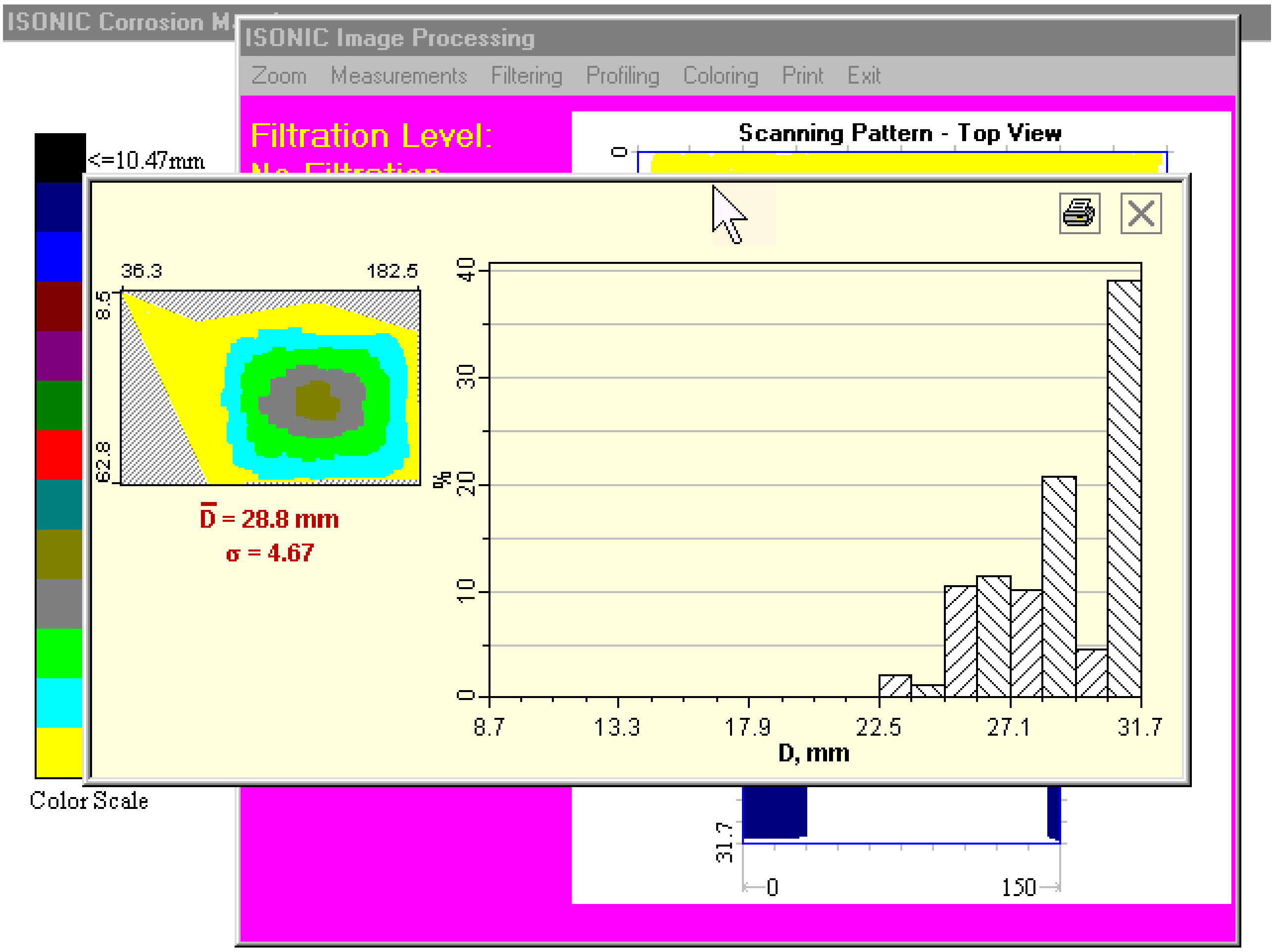


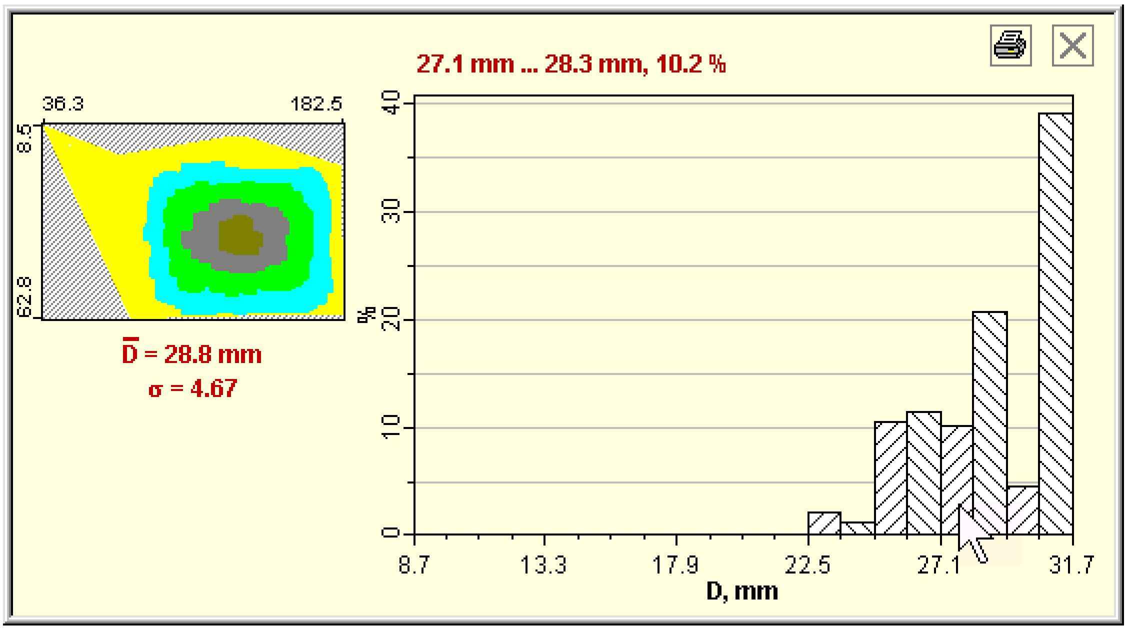
To interrupt the ***Polygon*** procedure right mouse click or press **Esc** on the keyboard

After designating the last tip of the desired polygon **double** left mouse click or **double** click with the touch screen stylus



The statistics window appears then on the screen highlighting the selected polygon and representing the thickness distribution histogram over the polygon:





Placement of the cursor over a column causes the indication of its value and rank; said indication appears above the upper left corner of the histogram

To print Postprocessing Page containing the image of the selected polygon and the corresponding histogram click on

To close the statistical window click on or press **Esc** on the keyboard

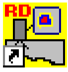
16. Operating 'CORROMAP RD' Software Package - ISONIC Corrosion Mapping (Complete Raw Data Acquisition)

The contents of this chapter is valid for the
CORROMAP RD SW Package version 1.0.0.1 or higher

16.1. Preparing for the Inspection

Refer to the Chapter 15.1 of this Operating Manual

16.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

16.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

16.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

16.5. ISONIC Control Menu

Refer to the paragraphs 7.5 and 15.5 of this Operating Manual

16.6. Pre-Inspection

Refer to the paragraphs 7.6 and 15.6 of this Operating Manual

16.7. Inspection

Refer to the paragraph 15.7.2 of this Operating Manual.

All kinds of data presentation, the imaging modes, the **ISONIC** control functions, and the typical screen during scanning using the **CORROMAP RD** Inspection SW Package are identical to the same while using the **CORROMAP** Inspection SW Package. The **Thickness Mapping Logic**, **Thickness Map "Repair" Logic**, and **Thickness Map "Marks" Rule** valid for the **CORROMAP** Inspection SW Package are also valid for the **CORROMAP RD** Inspection SW Package

The only difference is that the ***unprocessed A-Scans are additionally captured*** while scanning using **CORROMAP RD** software. The **A-Scan Capturing Logic** for the **CORROMAP RD** is synchronized with the said **Thickness Mapping Logic** and **Thickness Map "Repair" Logic**:

A-Scan Capturing Logic

First placement of the probe above some spot on the scanning surface

A-Scan is recorded unconditionally if placing the probe above some spot on the scanning surface **at the first time**

Repeat scanning above the same spot – overwriting rules

(a) Map Repair Function is **not active**

Case 1. The **valid echo** for the thickness reading (echo matching with the gate and echo height exceeds the gate level) **was received** while pacing the probe above some spot on the scanning surface **earlier**

- If the valid echo **was received again** upon placing the probe above the same spot on the scanning surface **next time** and the new thickness reading is *dominating* (i.e. less then already recorded) then new **A-Scan** overwrites already recorded **A-Scan** otherwise there is no overwriting
- If the valid echo **was not received** upon placing the probe above the same spot on the scanning surface **next time** then there is no overwriting

Case 2. The **valid echo** for the thickness reading **was not received** while pacing the probe above some spot on the scanning surface **earlier**

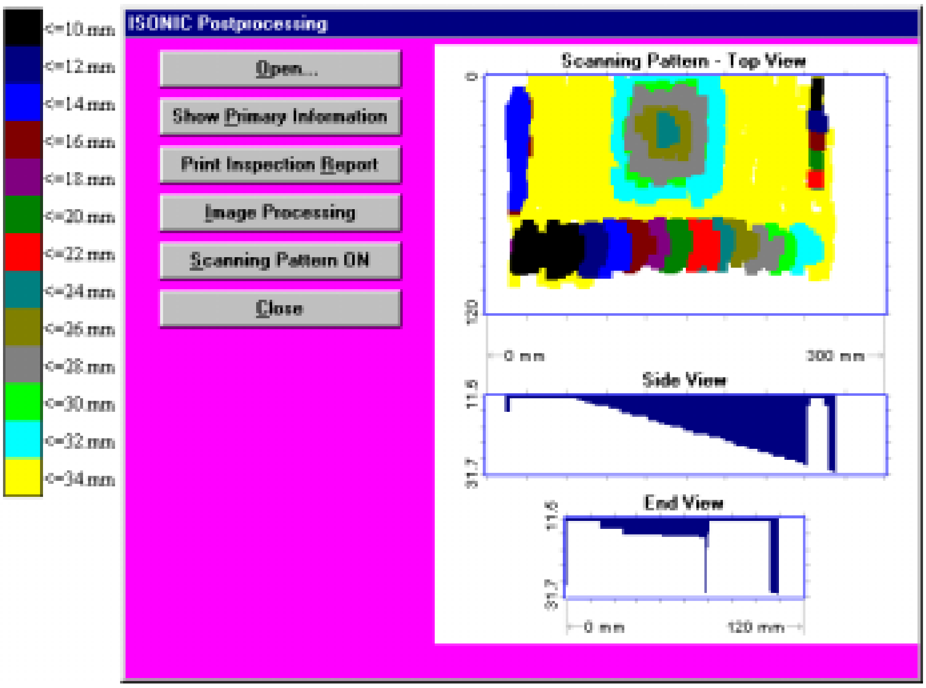
- If the valid echo **was received** upon placing the probe above the same spot on the scanning surface **next time** then new **A-Scan** overwrites already recorded **A-Scan**
- If the valid echo **was not received** upon placing the probe above the same spot on the scanning surface **next time** then there is no overwriting

(b) Map Repair Function is **active**

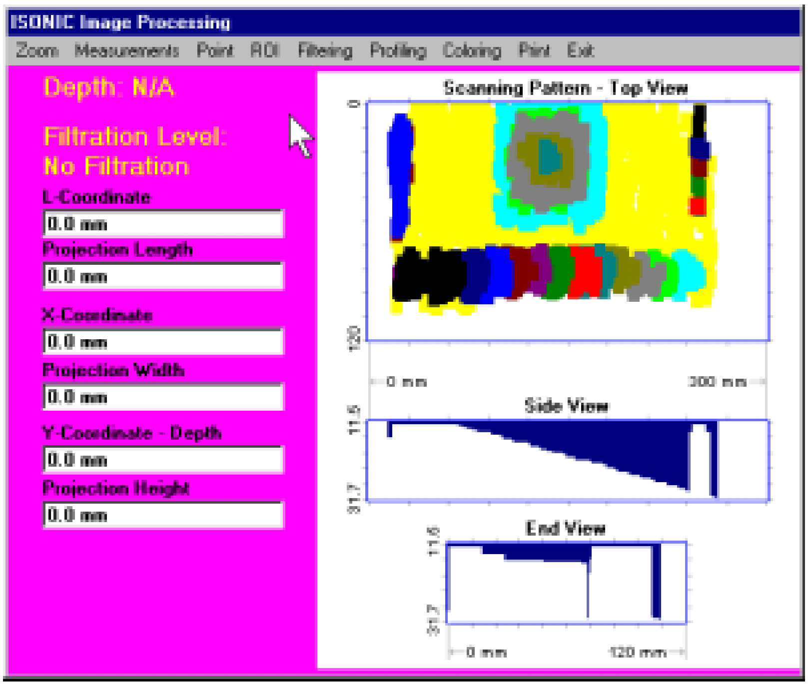
Each new **A-Scan** overwrites already recorded **A-Scan** unconditionally for each new placement of the probe above the same spot

16.8. Postprocessing

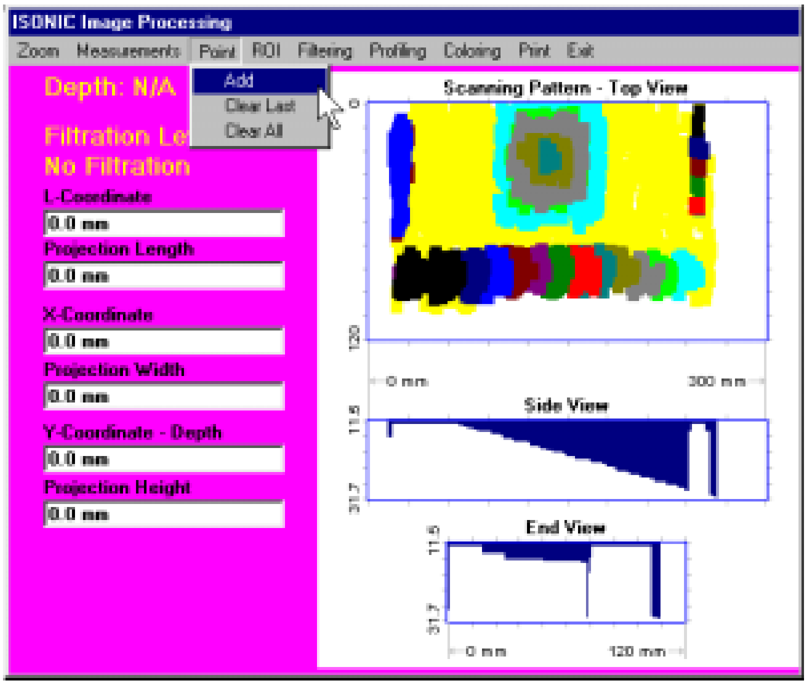
The typical screen appearing upon opening the **CORROMAP RD** file is shown below. All postprocessing procedures related to the graphical data analysis are identical to the same functions applied to the **CORROMAP** file – refer to the paragraph 15.8 of this Operating Manual

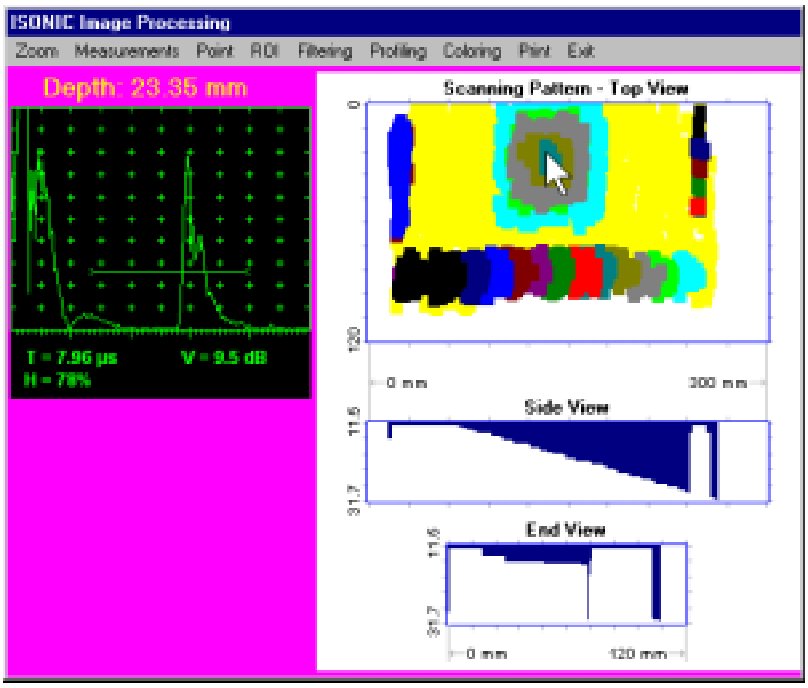


The off-line functions related to the A-Scan recovery, signal evaluation and thickness map transformations become available through the Image Processing Menu Bar where there are 2 additional topics with respect to the same bar related to the CORROMAP files postprocessing, said topics are **Point** and **ROI (Region Of Interest)**



Point by Point A-Scan Recovery and Evaluation





Point → Add

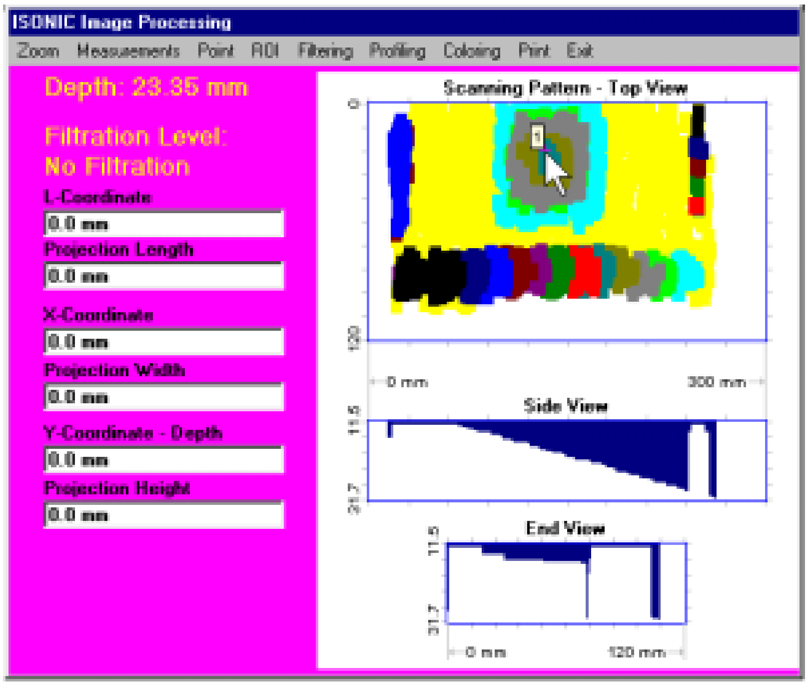
The cursor may be manipulated then over the **Scanning Pattern - Top View** area only using the touch screen stylus or mouse or buttons ↑ ↓ → ← on the keyboard. The **A-Scan** corresponding to the entire cursor position is recovered and accompanied with the signal evaluation data such as

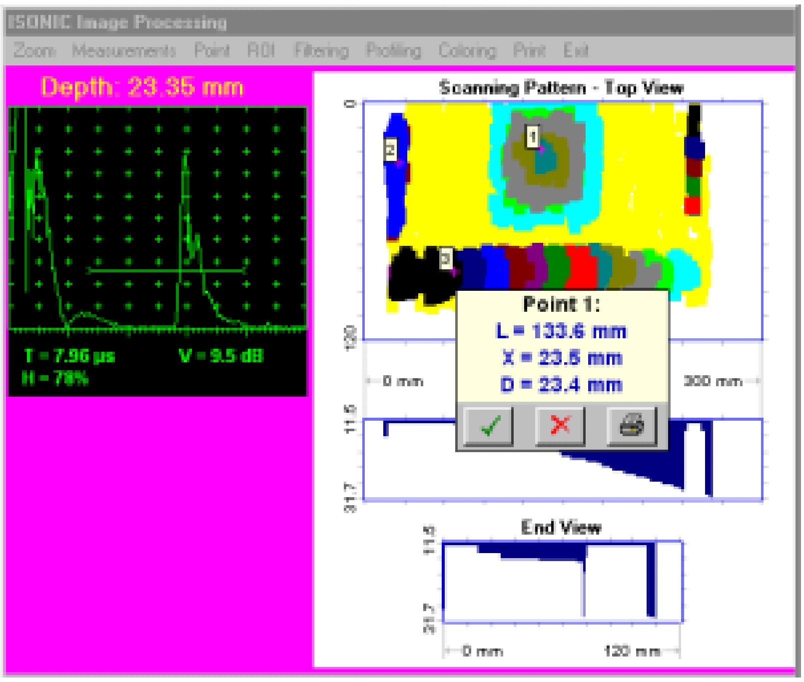
- **Depth, mm**
- **Time of Flight → T, µs**
- **Echo to Gate Level → V, dB**
- **Echo Height → H, %**
- **Echo to DAC → ΔV, db** (if applicable)

To place a mark N above some point of interest left mouse click or release touch screen stylus or press **Enter** on the keyboard (N is the mark ##)

Next selection **Point → Add** allows placing of the next, etc

To interrupt the ***Point by Point A-Scan Recovery and Evaluation*** procedure right mouse click or press **Esc** on the keyboard





Left mouse click or touch screen stylus click on the existing mark will highlight it's coordinates and matching thickness value along with the corresponding **A-Scan** and signal evaluation data

Click on to print the graphical data accompanied with the **A-Scan** and signal evaluation data for the selected mark

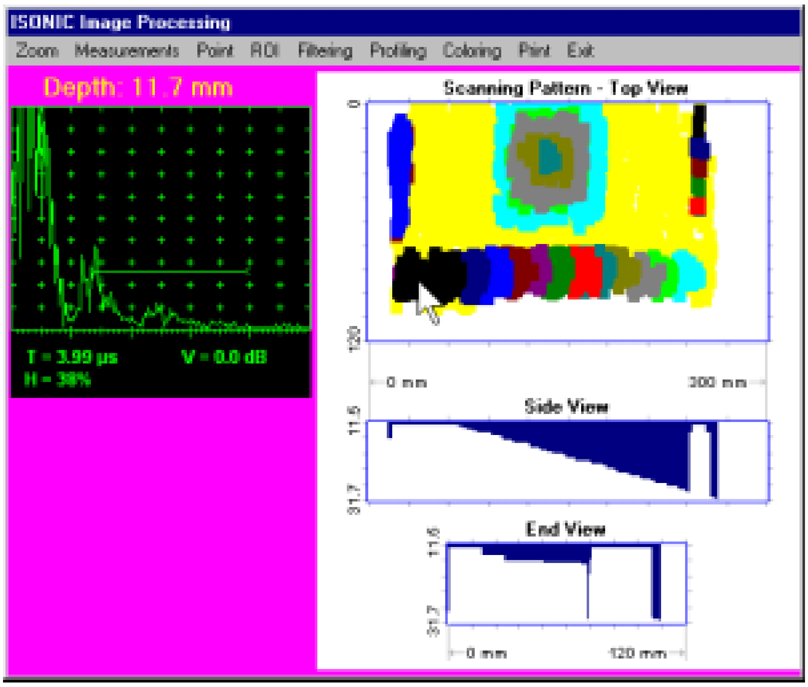
Click on to erase the selected mark

Click on to hide the mark's coordinates, the corresponding result, and the signal evaluation data

Point → Clear Last erases the last mark on the **Scanning Pattern – Top View**

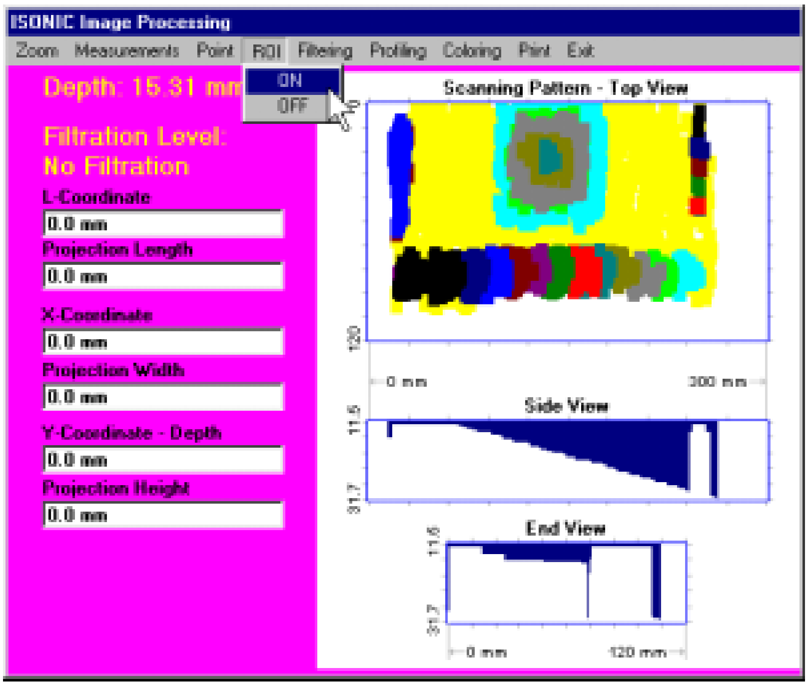
Point → Clear All erases all marks from the **Scanning Pattern – Top View**

Redefine the Region of Interest



Whilst effecting the ***Point by Point A-Scan Recovery and Evaluation*** procedure it may be realized that some signals received and recorded were not matching with the **Gate A** while scanning. It's possible to ***Redefine the Region of Interest*** in order to rebuilt and reevaluate the thickness map and the whole 3D array off-line without secondary scanning.

ROI → ON

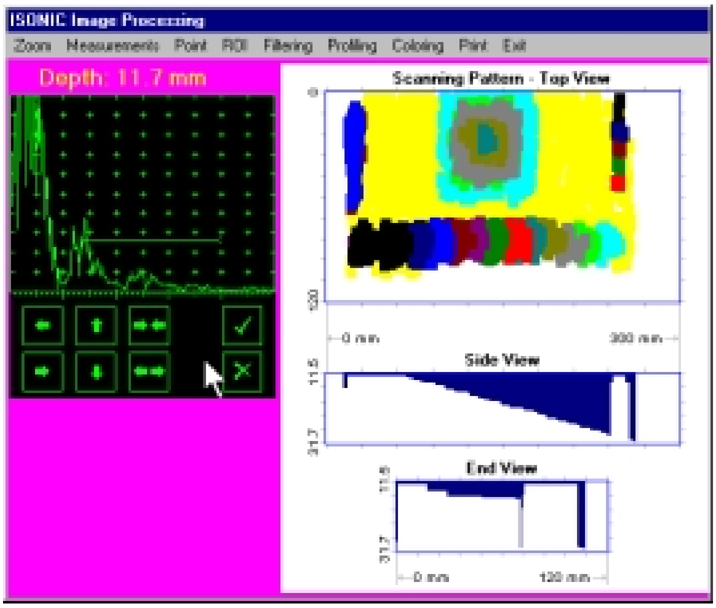


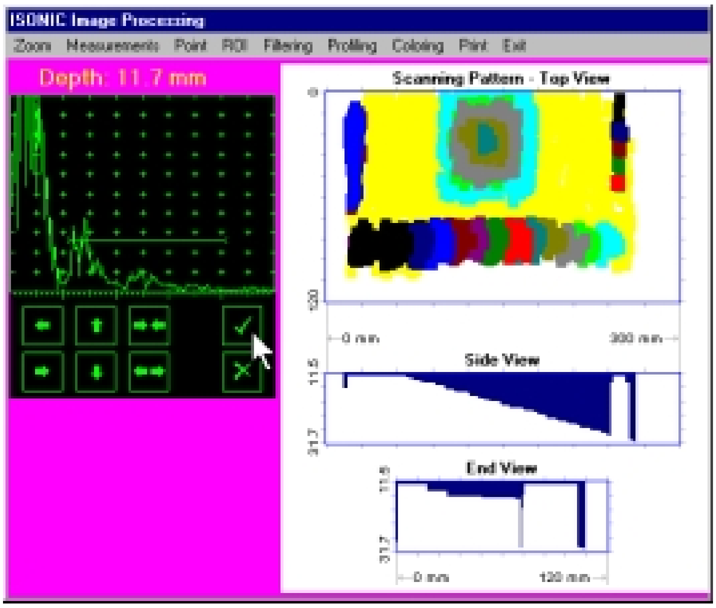
The cursor may be manipulated then over the **Scanning Pattern - Top View** area only using the touch screen stylus or mouse or buttons ↑ ↓ → ← on the keyboard. The **A-Scan** corresponding to the entire cursor position is recovered and accompanied with the signal evaluation data such as

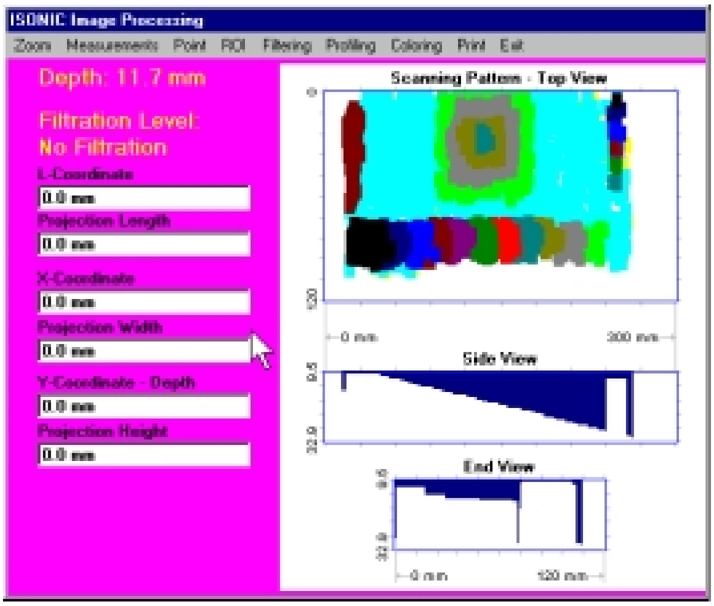
- **Depth, mm**
- **Time of Flight → T, µs**
- **Echo to Gate Level → V, dB**
- **Echo Height → H, %**
- **Echo to DAC → ΔV, db** (if applicable)

To redefine the **Region of Interest** place cursor into the position corresponding to the **A-Scan** representing the received signal not matching with the **Gate A** and left mouse click or release touch screen stylus or press **Enter** on the keyboard

To interrupt the ***Redefine the Region of Interest*** procedure right mouse click or press **Esc** on the keyboard







As a result the **A-Scan** representing the signal, for which the **Gate A – Region of Interest** settings to be changed becomes solid while the **Gate A – Region of Interest** manipulation buttons controllable through the left mouse click or touch screen stylus click appear:

- , - are the **aStart - Region Depth** controls
- , - are the **aThreshold** controls
- , - are the **aWidth – Region Thick** controls

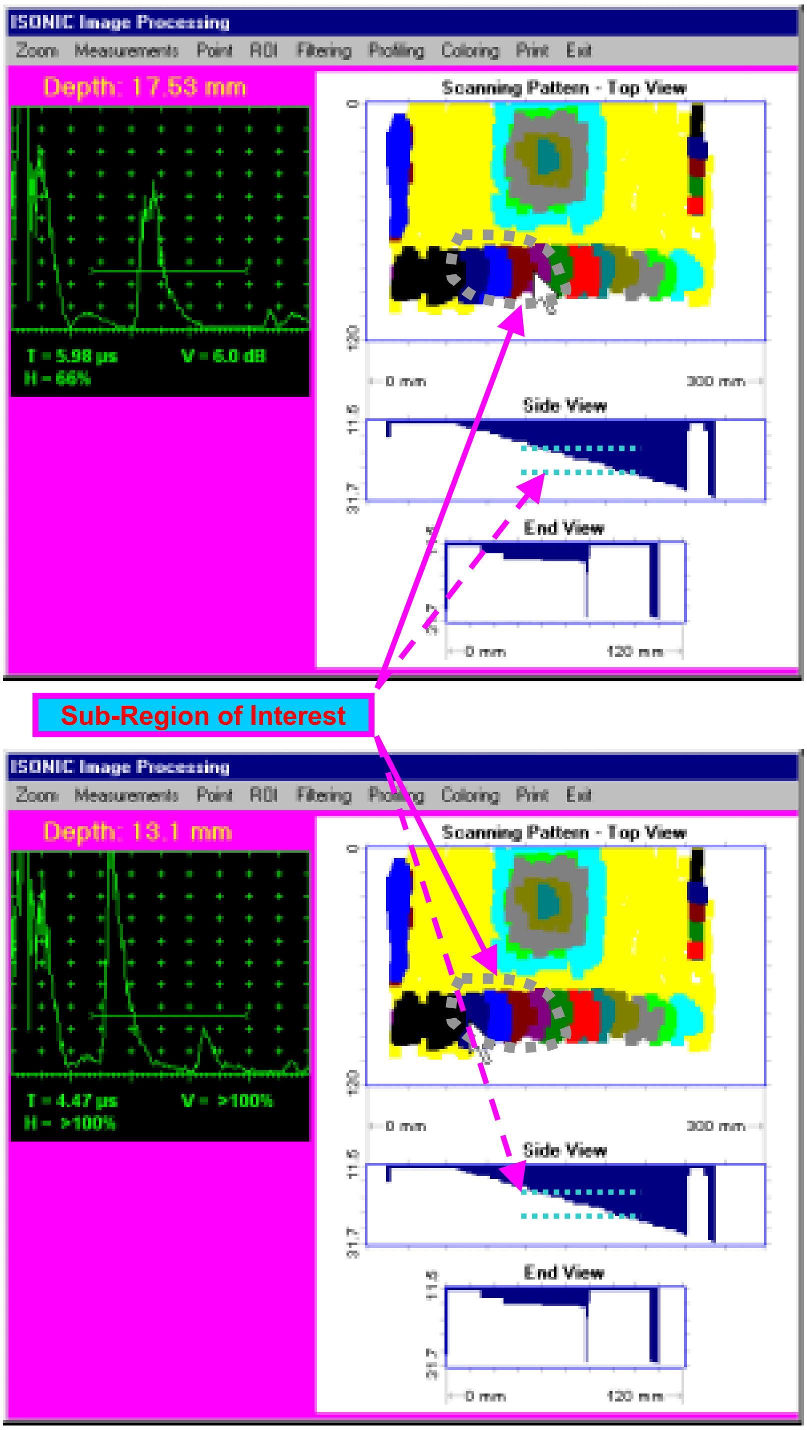
Clicking on will negate the changes in the **Gate A – Region of Interest** settings and switch off the ***Redefine the Region of Interest*** procedure

Clicking on will accept the new **Gate A – Region of Interest** and redraw the **Scanning pattern -Top View**, **Side View**, and the **End View** accordingly

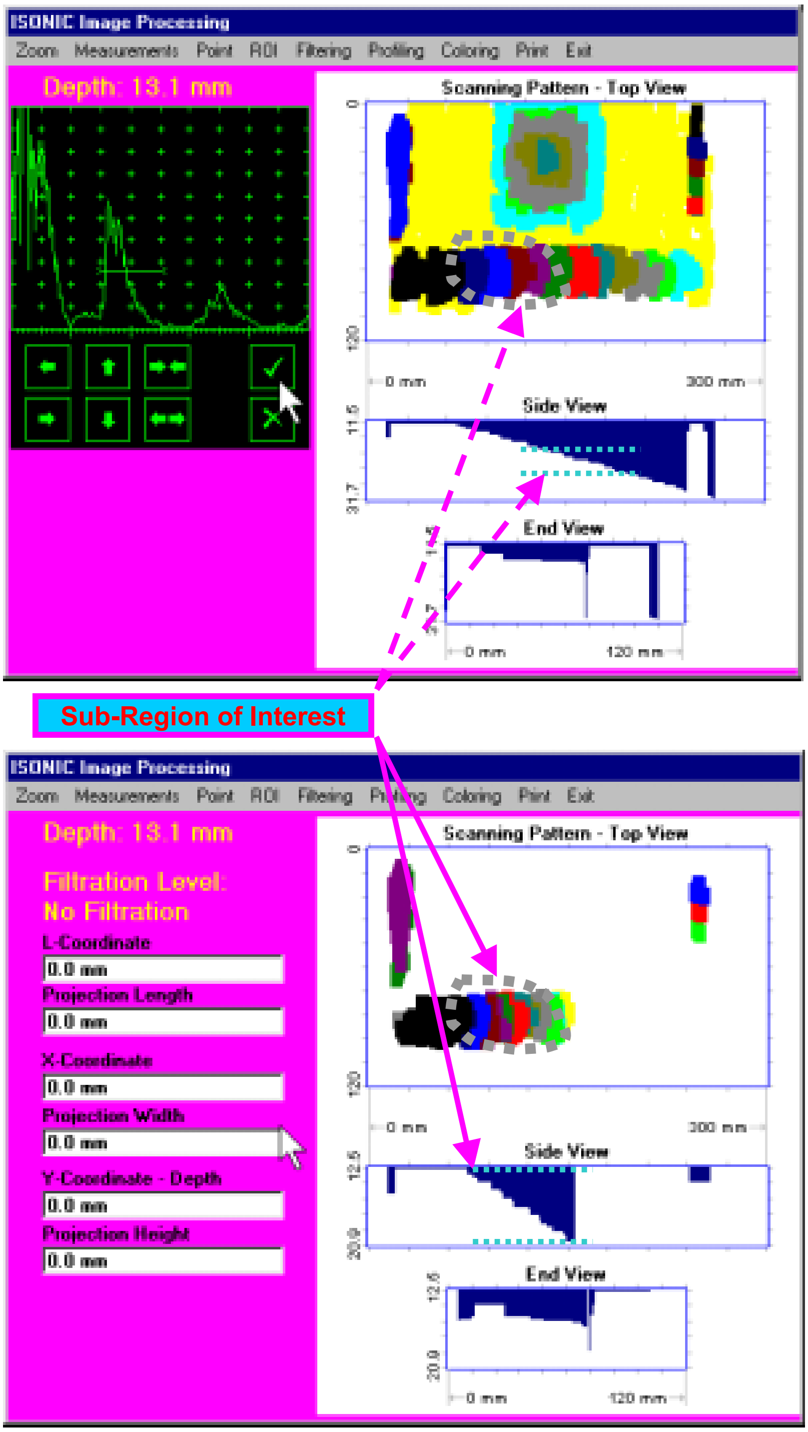
All postprocessing procedures may be applied then to the new **Scanning pattern -Top View**, **Side View**, and the **End View** data

ROI → ON will return the **Gate A – Region of Interest** settings to the original values used entire the scanning procedure

Redefine the Region of Interest – Application Tip



It's possible to observe virtual zoom through narrowing the **Gate A – Region of Interest** settings entire the ***Redefine the Region of Interest*** procedure



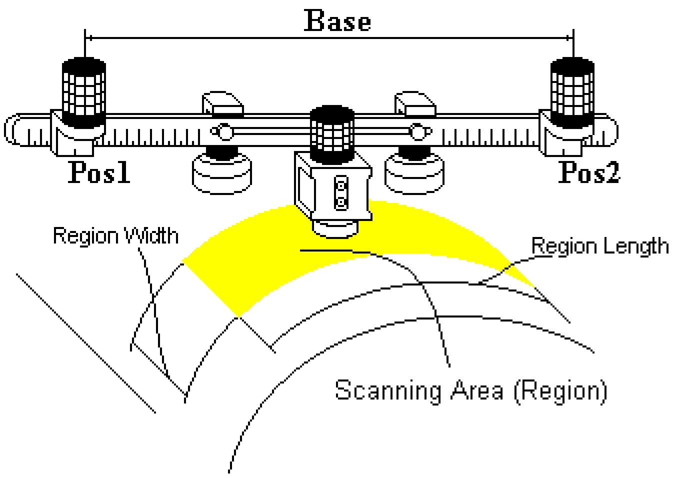
The required segment of the **Top View – Scanning Pattern** becomes represented using more ***Color-Thickness*** grades, while the **Side View** and the **End View** become zoomed then

17. Operating 'CORROMAP CU' Software Package - ISONIC Corrosion Mapping – Scanning on Curved Surfaces

The contents of this chapter is valid for the
CORROMAP CU SW Package version 2.2.0.4 or higher

17.1. Preparing for the Inspection

17.1.1. Fixture



Apply the bar with the receivers of airborne ultrasound to the object under test at parallel to one of the curved sides of the scanning area. Use the fixture **S 89000** ensuring the placement of the airborne ultrasound receivers on the small diameter objects, if it's found necessary – refer to the paragraph 9.1 of this Operating Manual.

The value of **Base** (the distance between two receivers of airborne ultrasound) may be from 100 to 300 *mm* or 4 to 12 *in*. The short bar is required if the value of **Base** is not exceeding 200 *mm* or 8 *in*. If this is a case then the distance between the receivers is defined as:

Base = **100** + **Pos1** + **Pos2**, *mm*
or
Base = **4** + **Pos1** + **Pos2**, *in*

The long bar is required if the value of **Base** is more than 200 *mm* or 8 *in*. If this is a case then the distance between the receivers is defined as:

Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

In the above formulas **Pos1** and **Pos2** are the coordinates of the receivers taken form the left and right scales of the bar correspondingly

The value of **Base** must be known prior to the scanning. Wrong determining of the **Base** causes the mistakes in monitoring probe location and corrosion mapping

ⓘ

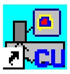
- The exact length of the inspected area (**Region Length**) depends on **Base** and **Curvature Diameter** and it is calculated automatically while running the **CORROMAP CU** Inspection SW package (refer to the paragraphs 17.6 and 17.7 of this Operating Manual)
- It may occur that the reducing of the preliminary selected **Base** value will be required entire the software flow (refer to the paragraph 17.6 of this Operating Manual)

Insert ultrasonic probe into the appropriate probe holder then fix the single emitter of airborne ultrasound on the top of the probe holder – refer to the paragraph 15.1 of this Operating Manual

17.1.2. Cabling

Refer to the paragraph 15.1.2 of this Operating Manual

17.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

17.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

17.4. Getting started...

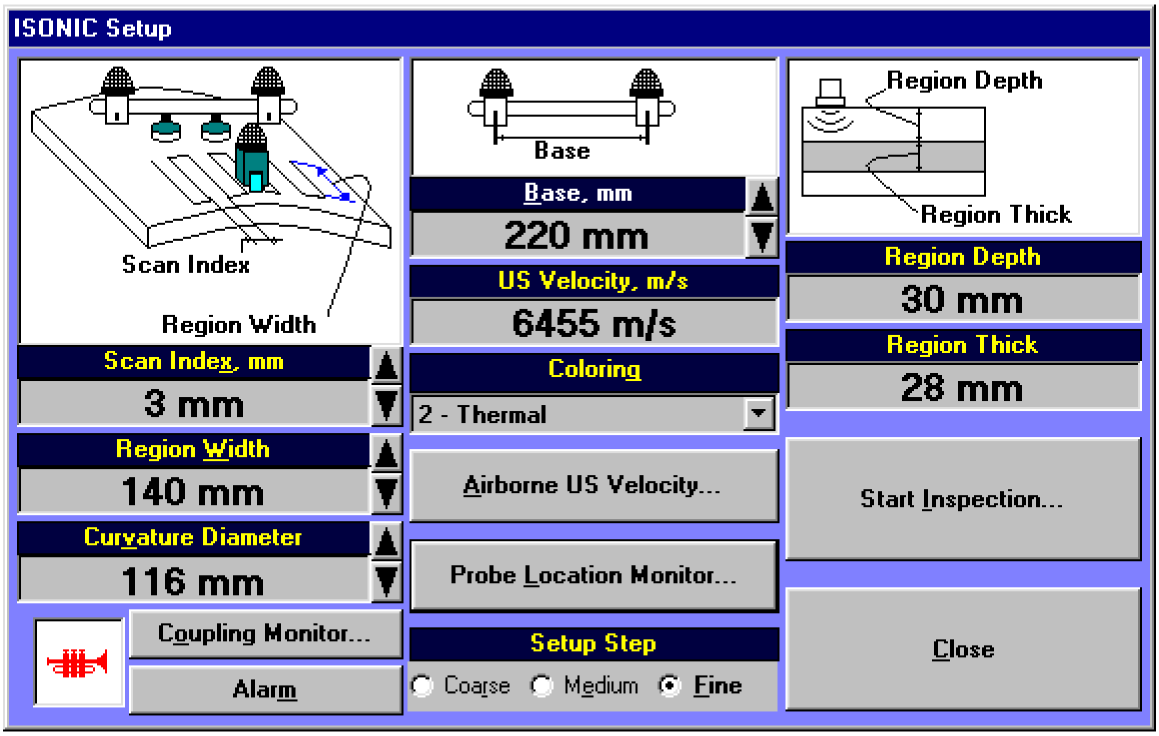
Refer to the paragraph 7.4 of this Operating Manual

17.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

17.6. Pre-Inspection

Refer to the paragraphs 7.6 and 15.6 of this Operating Manual and to the figures below



Curvature Diameter

To setup the value of **Curvature Diameter** the following manipulations applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard shortcuts**
  - Pressing **<Alt>+<V>** ⇒ **Curvature Diameter** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Curvature Diameter** area letter **v** is underlined)
- **Combined**
  - Click on **Curvature Diameter** ⇒ **Curvature Diameter** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **Curvature Diameter** is set in **mm** or **in***
*The possible values of increment / decrement for **Curvature Diameter** are:*

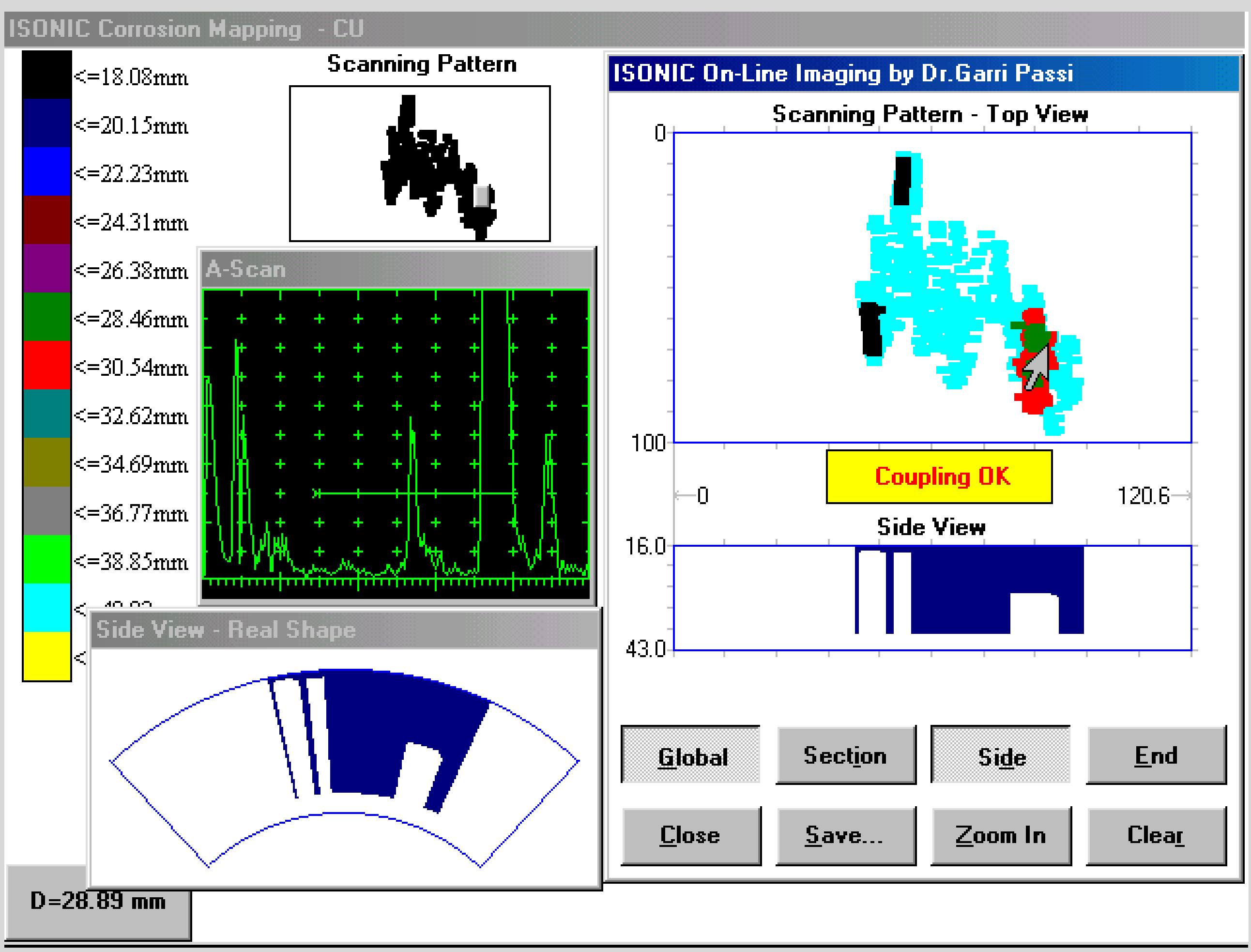
Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*5 mm*	*0.25 in*
Coarse	*10 mm*	*0.5 in*

ⓘ

- The length of the inspected area (**Region Length**) is defined by the **CORROMAP CU** Inspection SW package automatically with respect to the **Base** and **Curvature Diameter** values. Generally, the upper limit for **Base** is 300 mm, however it can be lower for some objects; hence the value of **Base** may be reduced automatically while keying in the **Curvature Diameter**. If this is a case then:
  - ❑ provide the distance between the receivers of airborne ultrasound equal to the value of **Base** recalculated and indicated by the **CORROMAP CU** software
  - ❑ re-refer probe location monitor as it is described in the paragraph 15.6 of this Operating Manual after each change of the distance between the receivers of airborne ultrasound
- The exact length of inspected area (**Region Length**) will be indicated in the **ISONIC On-Line Imaging …** window after starting inspection. It will be also stored in each file containing the inspection results and printed in the Inspection Report
- The settings of the **Gate A** (**aStart** and **aWidth**) define the minimal possible value for the **Curvature Diameter:**

Minimal Curvature Diameter = 2×(aStart + aWidth) = 2×(RegionDepth + RegionThick)

17.7. Inspection

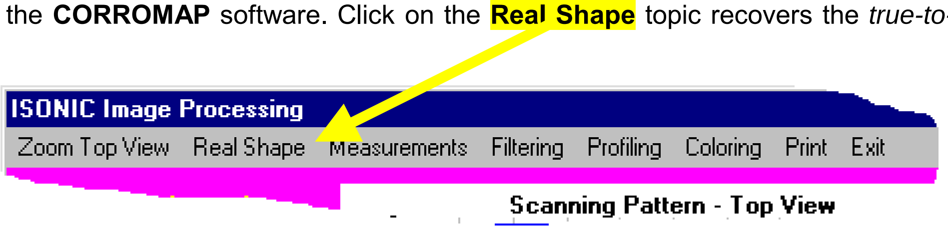


The above screenshot illustrates the typical **ISONIC** screen while scanning using the **CORROMAP CU** software. The exact **Region Length** is shown between **Top View** and **Side View** images in the **ISONIC On-Line Imaging …** window. The **Scanning Pattern**, **Top View** and **Side View** images are shown *unfolded* and the additional **Side View - Real Shape** window is generated simultaneously making it possible to monitor the thickness profile more precisely

All kinds of the data presentation, the imaging modes, the **ISONIC** control functions, and the typical screen while scanning using the **CORROMAP CU** Inspection SW Package are identical to the same while using the **CORROMAP** Inspection SW Package - refer to the paragraph 15.7 of this Operating Manual

17.8. Postprocessing

All postprocessing procedures related to the graphical data analysis are identical to the same functions applied to the **CORROMAP** file – refer to the paragraph 15.8 of this Operating Manual. **Real Shape** is the only one additional item in the **ISONIC Image Processing** menu of the **CORROMAP CU** not existing in the same menu of the **CORROMAP** software. Click on the **Real Shape** topic recovers the *true-to-scale curved* **Side View**



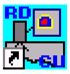
18. Operating 'CORROMAP CU RD' Software Package - ISONIC Corrosion Mapping – Scanning on Curved Surfaces (Complete Raw Data Acquisition)

The contents of this chapter is valid for the CORROMAP CU RD SW Package version 1.1.0.6 or higher

18.1. Preparing for the Inspection

Refer to the paragraph 17.1 of this Operating Manual

18.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

18.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

18.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

18.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

18.6. Pre-Inspection

Refer to the paragraphs 7.6, 15.6, and 17.6 of this Operating Manual

18.7. Inspection

Refer to the paragraphs 15.7, 16.7, and 17.7 of this Operating Manual

18.8. Postprocessing

Refer to the paragraphs 15.8, 16.8, and 17.8 of this Operating Manual

19. Operating 'MULTISCAN-COMBO-S' Software Package - ISONIC Multiscan-Combo-S Inspection

The contents of this chapter is valid for the
MULTISCAN COMBO S SW Package version 3.3.0.0 or higher

19.1. Preparing for the Inspection

Refer to the Chapter 15.1 of this Operating Manual

19.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

19.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

19.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

19.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

19.6. Pre-Inspection

Refer to the paragraphs 7.6 and 15.6 of this Operating Manual and to the figures below

Inspection Techniques

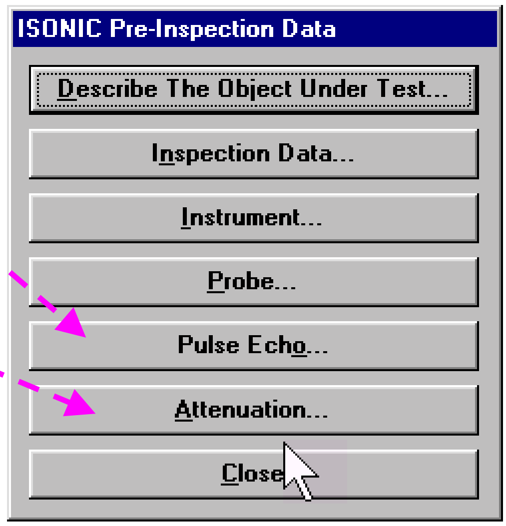
There are 2 inspection techniques available while running the **MUTISCAN COMBO S** Inspection SW Package:

- The ***Pulse Echo Inspection and Mapping*** based on the analysis and mapping of the amplitudes and time delays of all signals matching with the gate designating the region of interest. The ***Pulse Echo Inspection and Mapping*** allows to capture the multi-layer amplitude **C-Scans** compressed into the single compact 3D array and recover the depth/thickness **C-Scan** from the captured 3D array in real time and/or off-line at the postprocessing stage

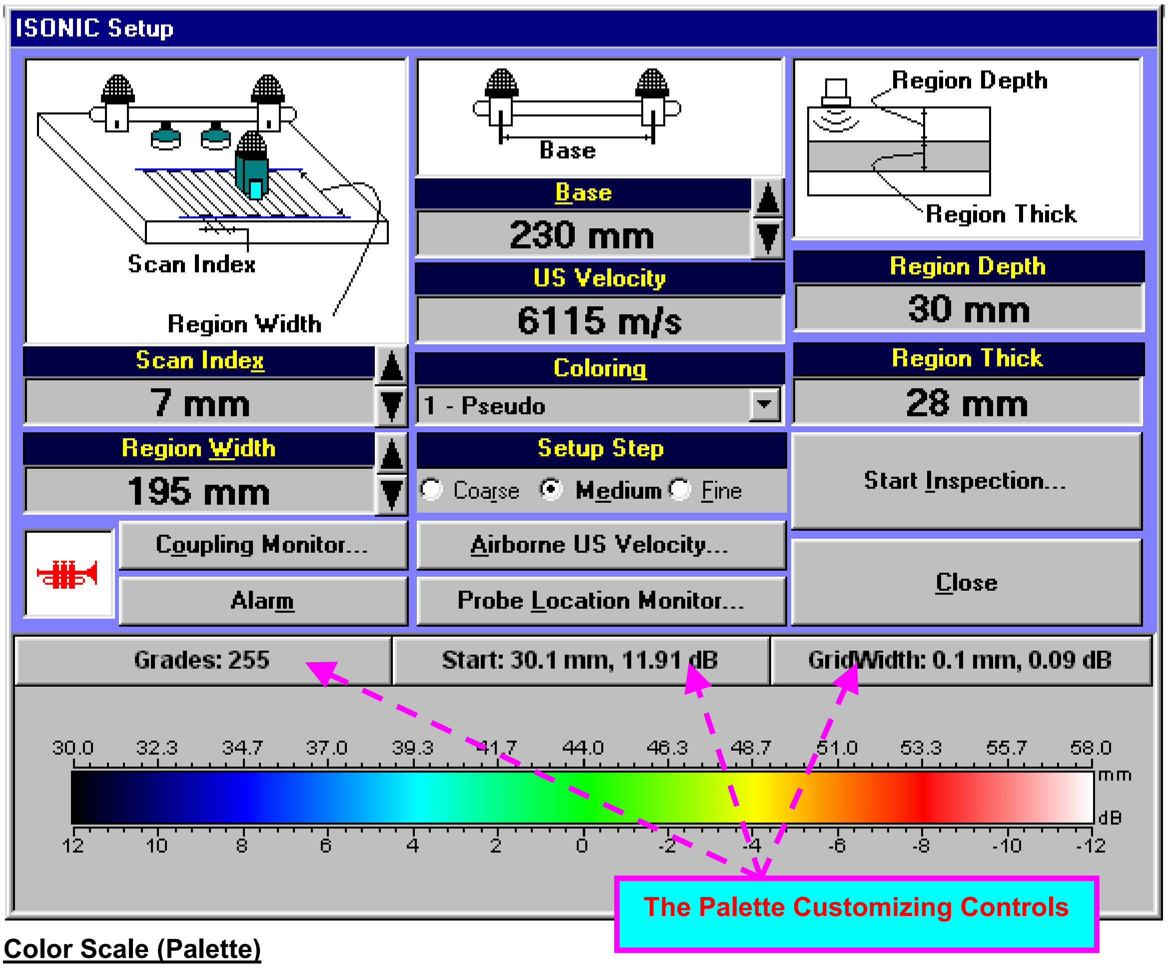
- The ***Attenuation Inspection*** based on the analysis and mapping of the amplitude of the signal located at the ***fixed time window*** determined by **Gate A**, said amplitude may be obtained through the getting of the backwall echo or through-transmitted signal. The ***Attenuation Inspection*** allows to capture the single-layer amplitude **C-Scan** representing the amplitude distribution for the single informative signal either backwall echo or through-transmitted captured over the scanning area. For the through transmission mode it's necessary to fit the probes into the appropriate yoke - refer to the paragraph 34.3 of this Operating Manual

To start with the **Pulse Echo Inspection** click on or press **<Alt> + <O>** on the keyboard

To start with the **Attenuation Inspection** click on or press **<Alt> + <A>** on the keyboard



Pulse Echo Inspection and Mapping – Pre-Scanning window

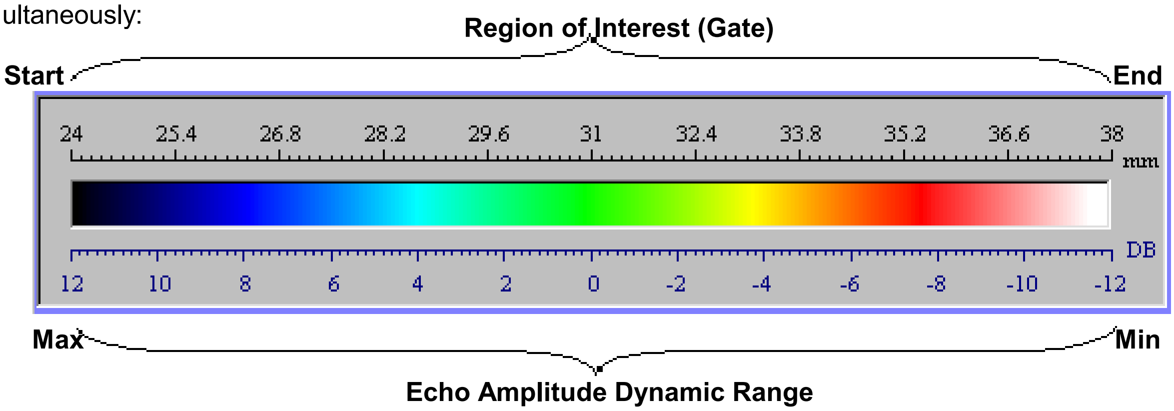


Color Scale (Palette)

The **MULTISCAN-COMBO-S**'s color scale (palette) may have up to 255 grades for the following palettes:

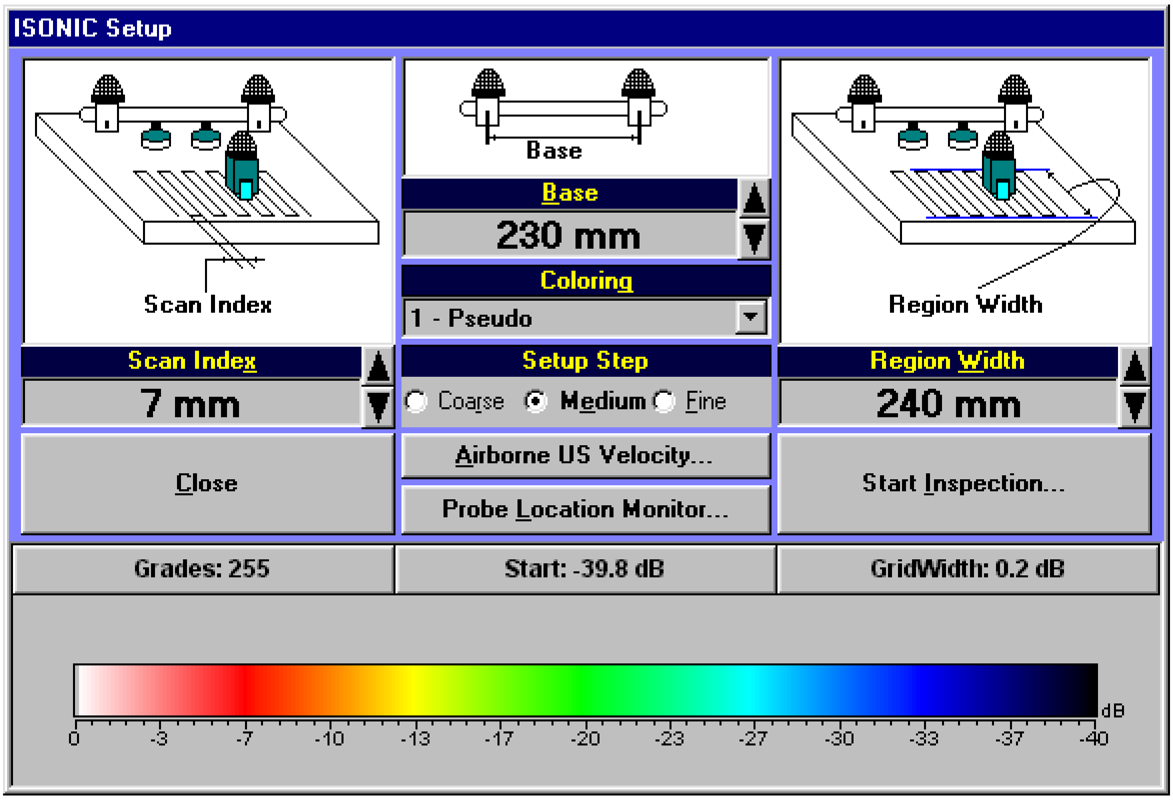
- Gray
- Thermo
- Pseudo-color

Ultrasonic data captured while scanning the object is stored by the following way: both the amplitude and time of flight for each signal received from the gated **Region of Interest** (**Region**) and exceeding the gate level is stored in connection with the corresponding probe coordinates. The palette has two meanings simultaneously:



The factory default quantity of the grades is 255 through the whole region of interest / dynamic range. The palette may be customized using the appropriate ***Palette Customizing Controls***. It's important that the volume and format of the data acquisition and storage are not affected if customizing the palette

Attenuation Inspection and Mapping – Pre-Scanning window



The coupling monitor is not optional for the **Attenuation Inspection and Mapping**

The dynamic range is 40 dB for the **Attenuation Inspection and Mapping**

High Resolution Scan Index

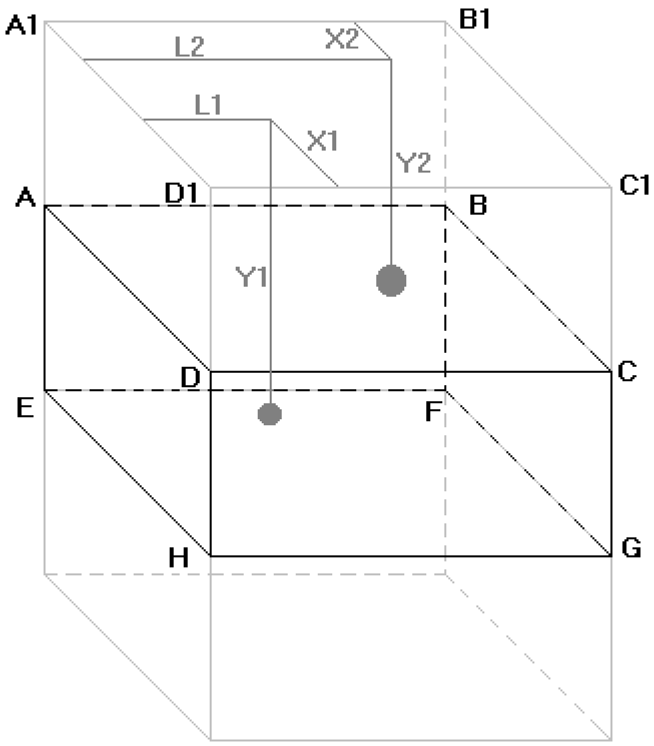
The high resolution value of **Scan Index** may be setup to 0.25 or 0.5 mm / 0.01 or 0.02 in for both **Pulse Echo** and **Attenuation** inspections provided that the value of **Base** is less than 200 mm / 8 in

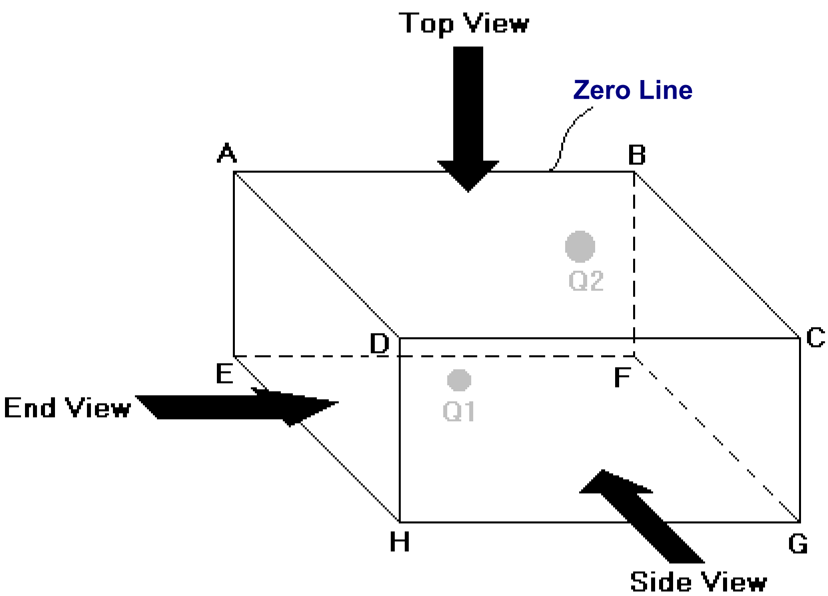
19.7. Inspection

19.7.1. Volume Under Test and Data Presentation – Pulse Echo

##	Sketch	Note

1





- **Q1 (L1, X1, Y1) – Internal Reflector 1**
- **Q2 (L2, X2, Y2) – Internal Reflector 2**

General

(a) The Volume Under Test (**Region of Interest**) is located between the two parallel rectangles namely ABCD and EFGH

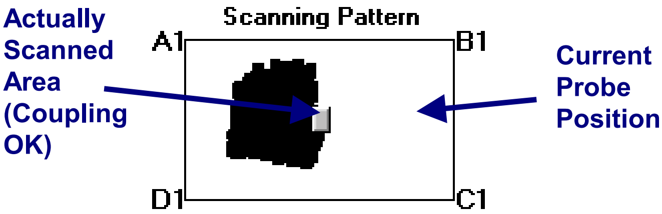
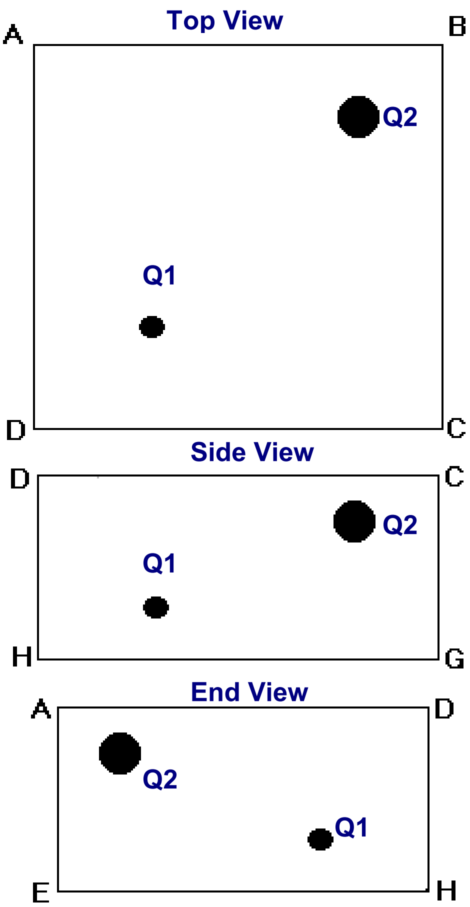
(b) The scanning is provided above the surface of the rectangle A1B1C1D1

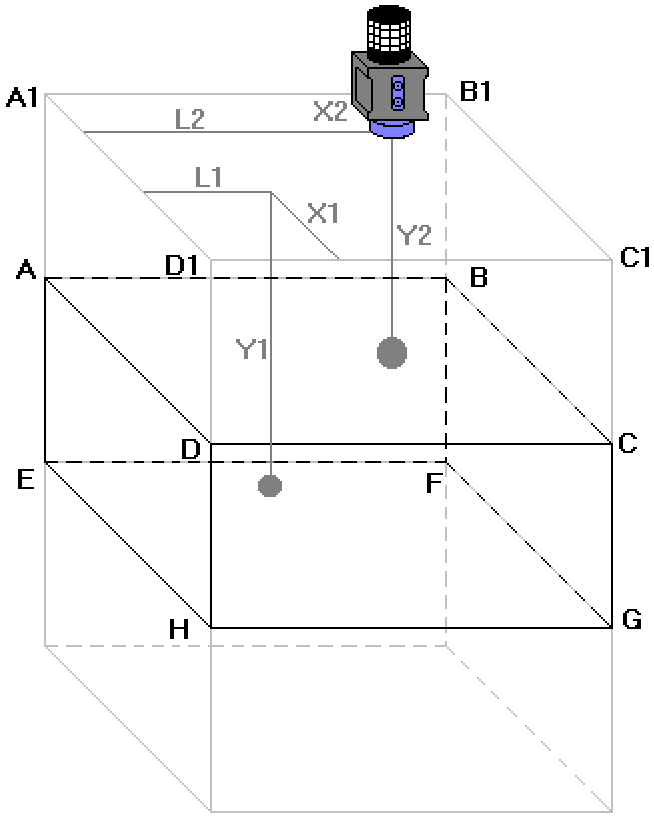
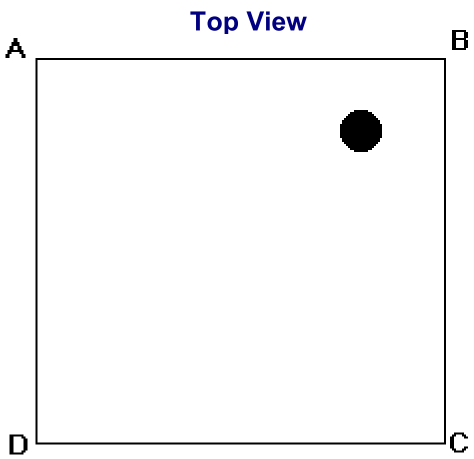
(c) The lines named A1B1 and AB are parallel to the line connecting the receivers of airborne ultrasound. The position of the lines A1B1 and AB with respect to the said receivers is defined by setting up the Zero Line while calibrating the Probe Location Monitor

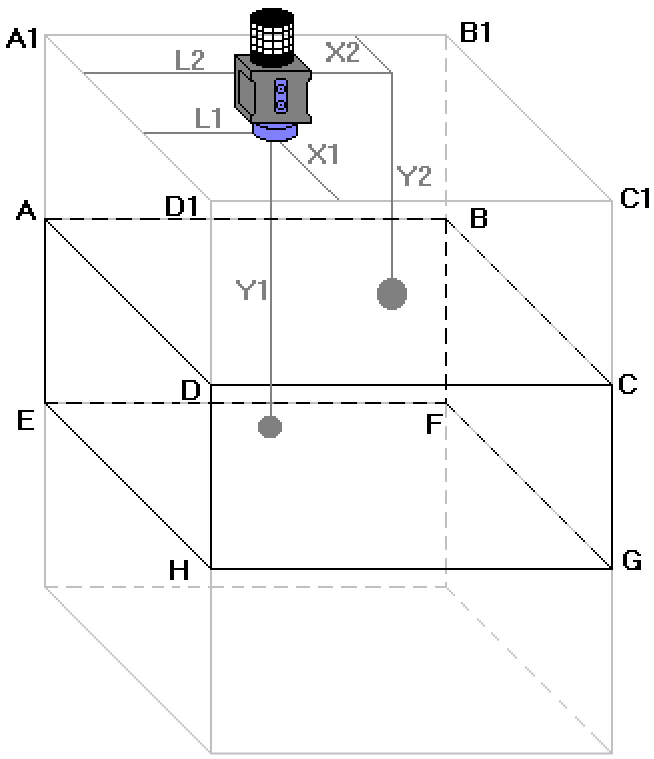
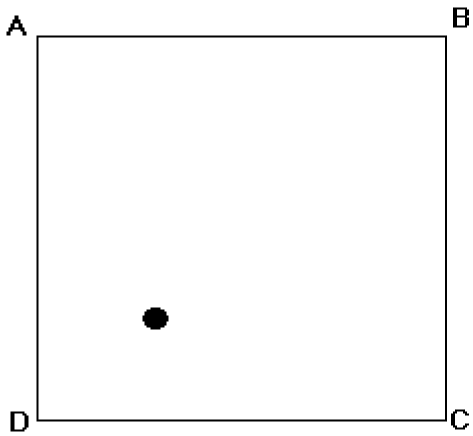
(d) Refer to the ISONIC Setup window:

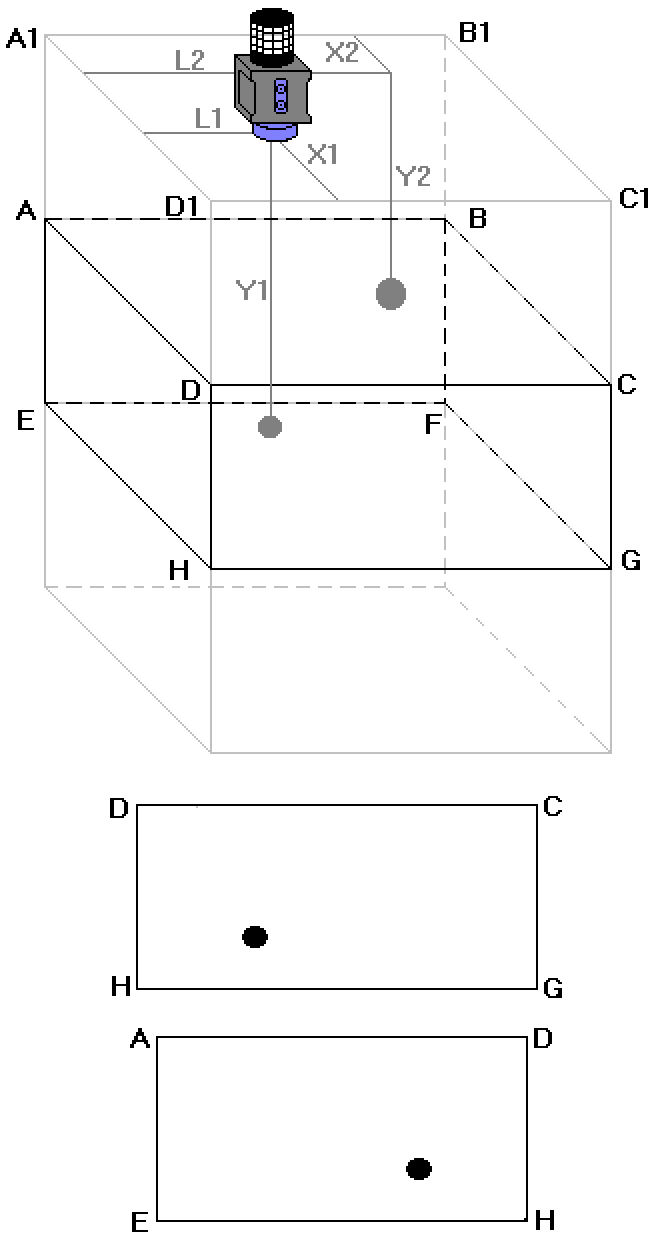
- **A1A = Region Depth**
- **AB = Region Length**
- **AD = Region Width**
- **DH = Region Thickness**

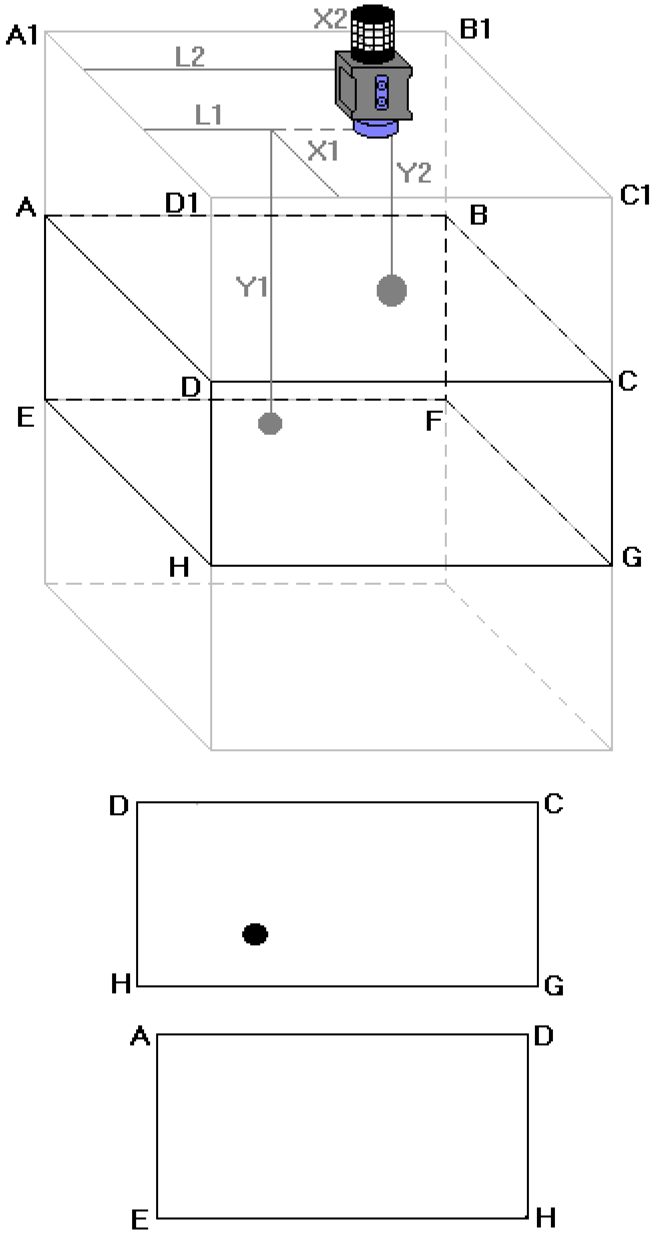
(e) To give an example it is supposed that there are two reflectors Q1 and Q2 in the object under test inside the **Region of Interest**, said reflectors have different dimensions and coordinates

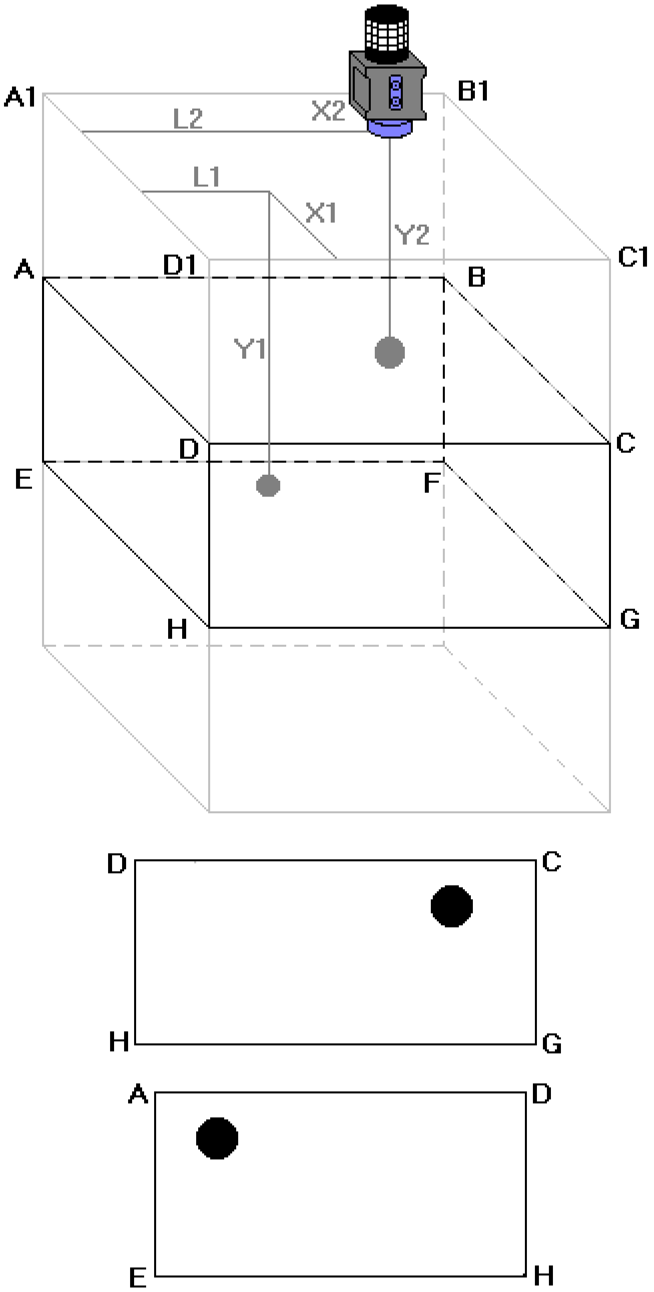
##	Sketch	Note
2		The **Scanning Pattern** will be represented in the separate field if the coupling monitor was activated prior to the start of the inspection
3		**Global Top View, Global Side and End Views** Supposing that the scanning is well completed the reflectors Q1 and Q2 will be then detected and represented on the global **Top View**, **Side View** and **End View** according to the current sketch. The global **Top View** is obtained through the superimposing of the parallel planes the rectangles ABCD and EFGH. The global **Top View** may be presented in two modes: Depth (Time of Flight – TOF) Map and Amplitude Map. The Amplitude Map is composed through the overwriting of the low value of the echo amplitude with the higher value, providing the representation of the highest amplitude values. The Depth (TOF) Map is composed through the overwriting of the high reflector's depth value with the lower reflector's depth value providing the representation of the reflectors closest to the scanning surface. Thanks to 3D-matrix storing of the acquired data it is possible to switch from one mode of the Top View presentation to another one while scanning The global **Side View** and **End View** are the orthogonal images obtained through the superimposing of the corresponding cross sectional views along and across the whole **Region of Interest**, said superimposing is performed by overwriting of the low value of the echo amplitude with the higher value. This provides registering of the highest amplitude values All acquired data is stored into a 3D-matrix, so there is no any data loss – refer to the below sketches ## 4-6 exampling the sectional **Top View, Side View** and **End View**

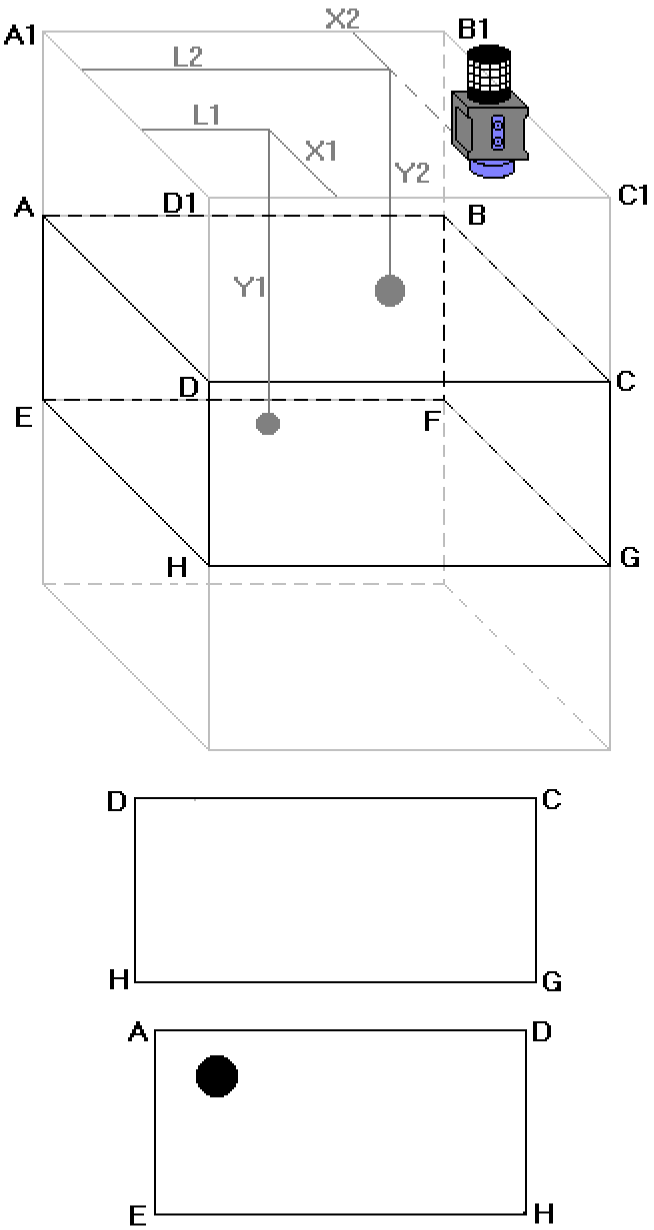
##	Sketch	Note
4		Sketches ## 4 and 5 are the examples illustrating how the sectional **Top View** is composed If the sectional viewing is selected by an operator then the **Top View** section currently represented on the ISONIC screen will correspond to the current probe coordinates on the scanning surface: the horizontal plane, which corresponds to the reflector closest to the probe and will be represented as an Amplitude Map; replacement of the probe causes representation of the another **Top View** section

##	Sketch	Note
5	 	

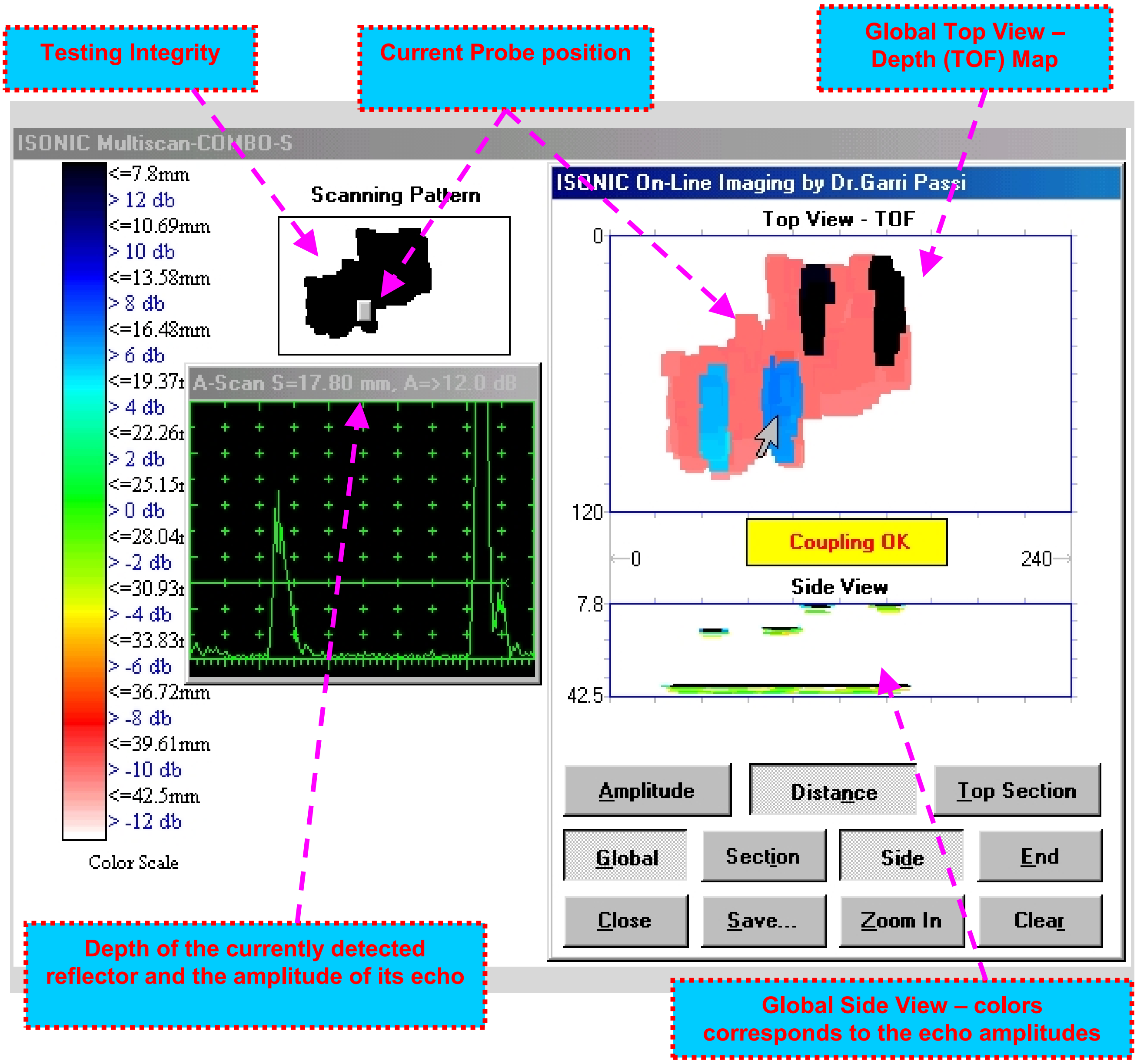
##	Sketch	Note
6		Sketches ## 6 - 9 are the examples illustrating how the sectional **Side View** and **End View** are composed If the sectional viewing is selected by an operator then the section currently represented on the ISONIC screen will correspond to the current probe coordinate (X – for the sectional **Side View**; L – for the sectional **Top View**); replacement of the probe causes representation of the another sectional view

##	Sketch	Note
7		

##	Sketch	Note
8		

##	Sketch	Note
9		

19.7.2. Scanning – Pulse Echo



The above screenshot illustrates the **ISONIC** screen while scanning using the **MULTISCAN-COMBO-S** software realizing the ***Pulse-Echo Inspection and Mapping***. The target of the operator is to completely "paint" over the *Scanning Pattern-Top View* area providing the necessary testing integrity. The data is recorded automatically and the corresponding viewing is observed in real time

Depth (TOF) Mapping Logic applied to the Global Depth (TOF) Top View Mode: The current lower value depth reading (*dominating*) overwrites the already recorded higher value depth reading if placing the probe above the same spot again. The higher value depth reading does not overwrite the already recorded lower value depth reading (*dominating*) if placing the probe above the same spot again

Amplitude Mapping Logic applied to the Global and Sectional Amplitude Top View Mode: The current higher amplitude reading (*dominating*) overwrites the already recorded lower amplitude reading if placing the probe above the same spot again. The lower amplitude reading does not overwrite the already recorded higher amplitude reading (*dominating*) if placing the probe above the same spot again

Top View "Repair" Logic: The **Map Repair Function** is active while scanning and keeping pressed the **<Space>** button on the keyboard – the new depth and amplitude readings unconditionally overwrite already recorded data. This allows the map corrections after finding the non-relevant *dominating* data recorded

Depth (TOF) Top View Map "Marks": Some eventually "unscanable" spots may exist on the scanning surface, for example the metal drops, deep surface corrosion, etc. or construction elements, such as rivets, bolts, etc. In order *to mark the said spots one by one*: place probe above each point to be marked and press **<Shift>+<Space>** on the keyboard. The corresponding marks appear over the *Top View*. To *erase a mark* use the **Map Repair Function**

It is possible to use the different styles of the data presentation while scanning:

- Click on Amplitude or press **<Alt>+<A>** on the keyboard for the **Amplitude Map Global Top View** representing
- Click on Distance or press **<Alt>+<N>** on the keyboard for the **Depth (TOF) Map Global top View** representing
- Click on Top Section or press **<Alt>+<T>** on the keyboard for the **Amplitude Map Sectional Top View** representing
- Click on Side or press **<Alt>+<D>** on the keyboard for the **Side View** representing
- Click on End or press **<Alt>+<E>** on the keyboard for the **End View** representing
- Click on Section or press **<Alt>+<I>** on the keyboard for the sectional representing of the currently active **Side View** or **End View**
- Click on Global or press **<Alt>+<G>** on the keyboard for the global representing of the currently active **Side View** or **End View**

There are another 4 controls available on the **ISONIC** screen while scanning:

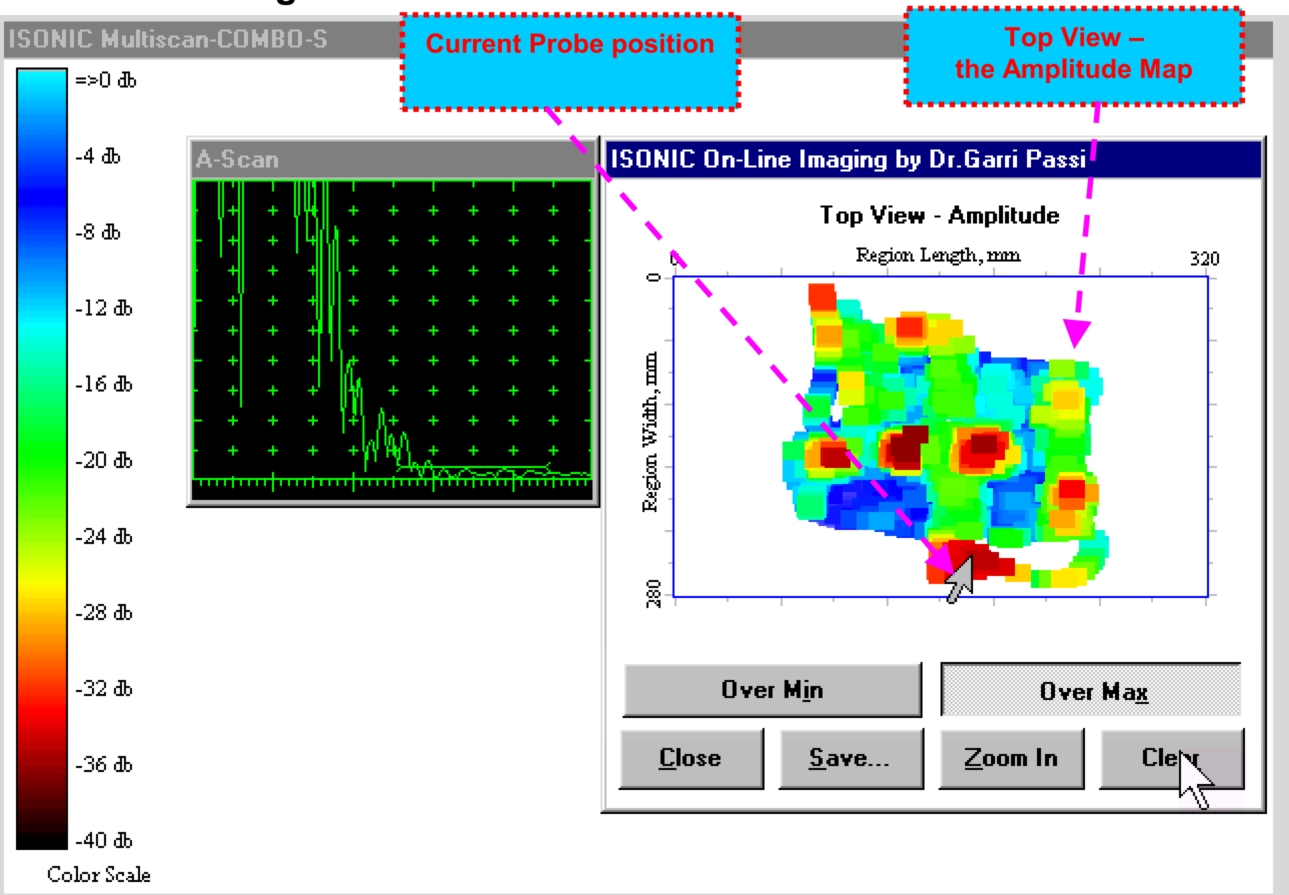
Click on Save... or press **<Alt>+<S>** on the keyboard to save a file containing inspection data. Proceed according to the paragraph 5.4.19 of this Operating Manual

Click on Zoom In or press **<Alt>+<Z>** on the keyboard to zoom the **ISONIC On-Line Imaging** window

Click on Clear or press **<Alt>+<R>** on the keyboard to reset to background in the **ISONIC On-Line Imaging** window

Click on Close or press **<Alt>+<C>** or press **Esc** on the keyboard to return back to the **ISONIC Setup** window

19.7.3. Scanning – Attenuation



The above screenshot illustrates the **ISONIC** screen while scanning using the **MULTISCAN-COMBO-S** software realizing the ***Attenuation Inspection and Mapping***. The target of the operator is to completely "paint" over the **Top View - Amplitude** area providing the necessary testing integrity. The data is recording automatically and the corresponding viewing is observed in real time

Amplitude Mapping Logic applied to the Top View - Amplitude Map: There are 2 (two) **Top View – Amplitude** maps **simultaneously recorded** while realizing the ***Attenuation Inspection and Mapping***:

- **Over Min** Map is created based on the following logic → the current lower amplitude reading (*dominating*) overwrites the already recorded higher amplitude reading if placing the probe above the same spot again. The higher amplitude reading does not overwrite the already recorded lower amplitude reading (*dominating*) if placing the probe above the same spot again
- **Over Max** Map is created based on the following logic → the current higher amplitude reading (*dominating*) overwrites the already recorded lower amplitude reading if placing the probe above the same spot again. The lower amplitude reading does not overwrite the already recorded higher amplitude reading (*dominating*) if placing the probe above the same spot again

Top View - Amplitude Map "Repair" Logic: The **Map Repair Function** is active while scanning and keeping pressed the **<Space>** button on the keyboard – the new depth and amplitude readings unconditionally overwrite already recorded data. This allows the map corrections after finding the non-relevant *dominating* data recorded

Top View - Amplitude Map "Marks": Some eventually "unscanable" spots may exist on the scanning surface, for example the metal drops, deep surface corrosion, etc. or construction elements, such as rivets, bolts, etc. In order *to mark the said spots one by one*: place probe above each point to be marked and press **<Shift>+<Space>** on the keyboard. The corresponding mark appears over the *Top View*. To *erase a mark* use the **Map Repair Function**

It's possible to switch between the maps while scanning by clicking on the Over Min and Over Max buttons or pressing **<Alt>+<I>** and **<Alt>+<A>** on the keyboard

Click on Save... or press **<Alt>+<S>** on the keyboard to save a file containing inspection data. Proceed according to the paragraph 5.4.19 of this Operating Manual

Click on Zoom In or press **<Alt>+<Z>** on the keyboard to zoom the **ISONIC On-Line Imaging** window

Click on Clear or press **<Alt>+<R>** on the keyboard to reset to background in the **ISONIC On-Line Imaging** window

Click on Close or press **<Alt>+<C>** or press **Esc** on the keyboard to return back to the **ISONIC Setup** window

19.8. Postprocessing

Refer to the paragraphs 7.8 and 15.8 of this Operating Manual and to the figures below

Data Point Preview

This mode becomes active immediately upon loading the file: place mouse pointer above the point of interest and read the result

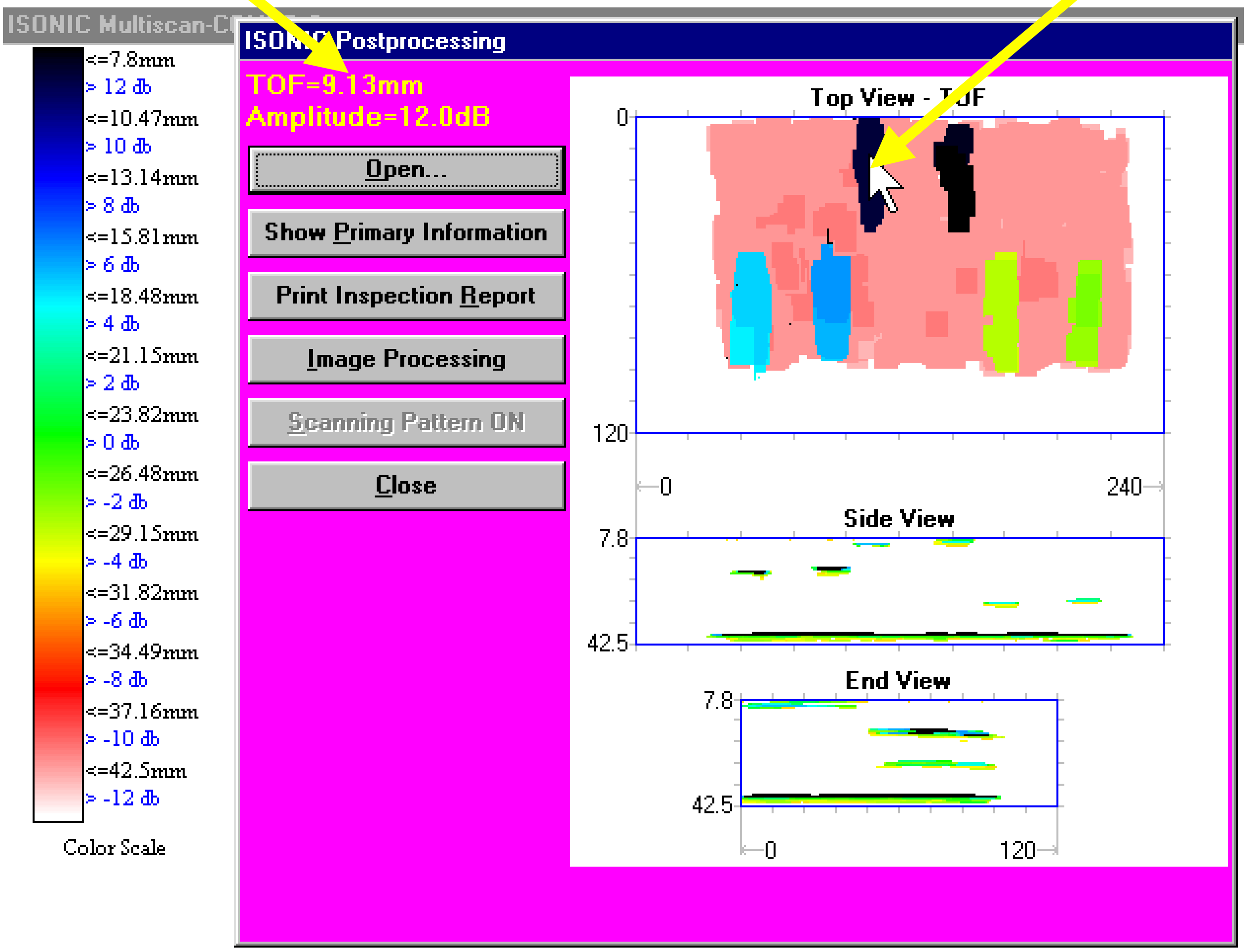
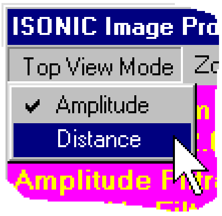


Image Processing – Pulse Echo Inspection

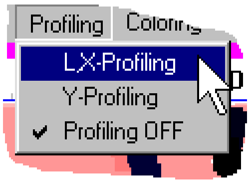
Top View: Switch Between the Amplitude and Depth (TOF) Map

The switching is implemented through the **Top View Mode** topic:



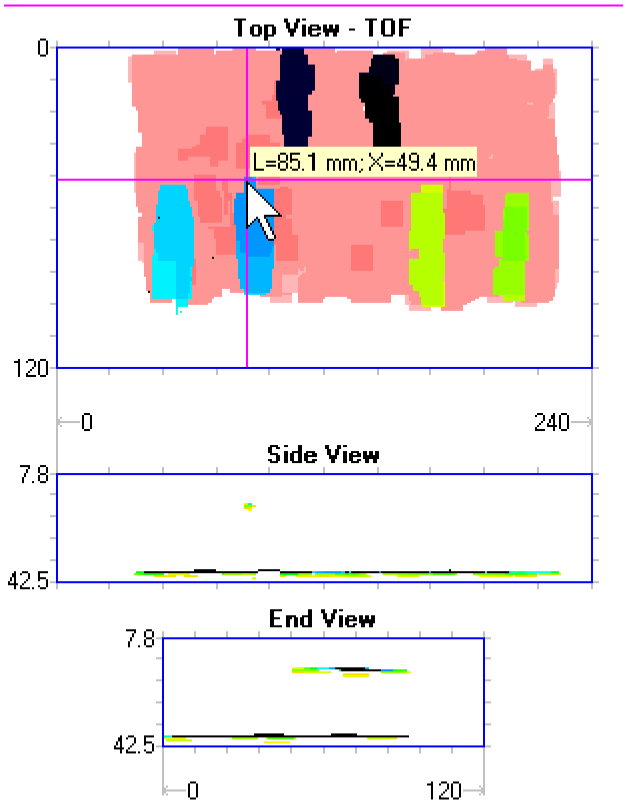
Top View: LX - Profiling

Profiling → LX-Profiling



As a result:

- o two orthogonal lines appear above the **Top View**
- o the mouse pointer is "sticked" to the crossing point of the said lines
- o both lines may be moved up / down and left / right correspondingly by the mouse or touch screen stylus or buttons ↑ ↓ → ← on the keyboard
- o the cross point coordinates display is "sticked" to the horizontal line
- o the horizontal line and its **X-coordinate** provide representing of the corresponding sectional **Side View**
- o the vertical line and its **L-coordinate** provide representing of the corresponding sectional **End View**

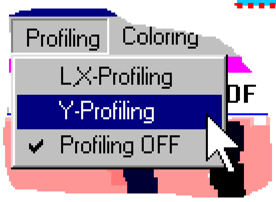


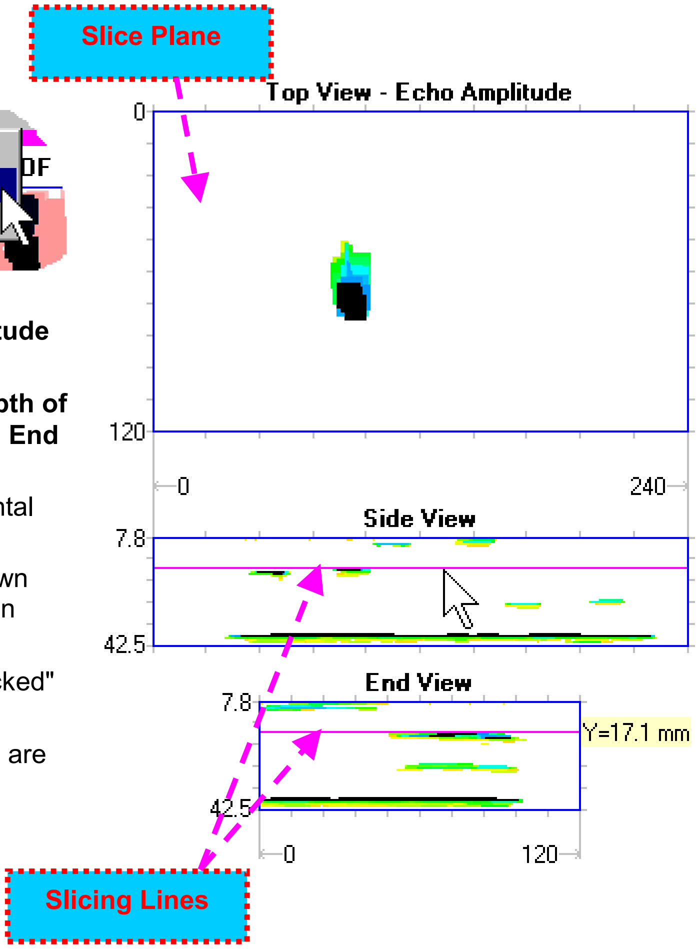
Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the obtained sectional **Side View** and **End View** and free mouse pointer for the further procedures

To interrupt the ***LX-Profiling*** procedure right mouse click or press **Esc** on the keyboard

Top View: Y – Profiling (Slicing Top View)

Profiling → Y-Profiling





As a result:

- **Top View** mode is switched into the **Amplitude Map** mode
- two horizontal slicing lines reflecting the **depth of the slice plane** appear above the **Side** and **End Views**
- the mouse pointer is "sticked" to the horizontal line above the **Side View**
- both horizontal lines may be moved up / down synchronously by the mouse or touch screen stylus or buttons ↑ ↓ on the keyboard
- the **depth of the slice plane** display is "sticked" to the horizontal line above the **End View**
- the reflectors matching with the **slice plane** are only visible in the sectional **Top View**

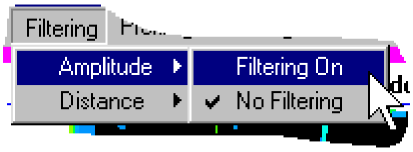
Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the selected threshold and free the mouse pointer for the further procedures

To interrupt the ***Y-Profiling (Top View Slicing)*** procedure right mouse click or press **Esc** on the keyboard

Profiling → Profiling OFF switches the active profiling function off

Filtering – Echo Amplitude

Filtering → Amplitude → Filtering On



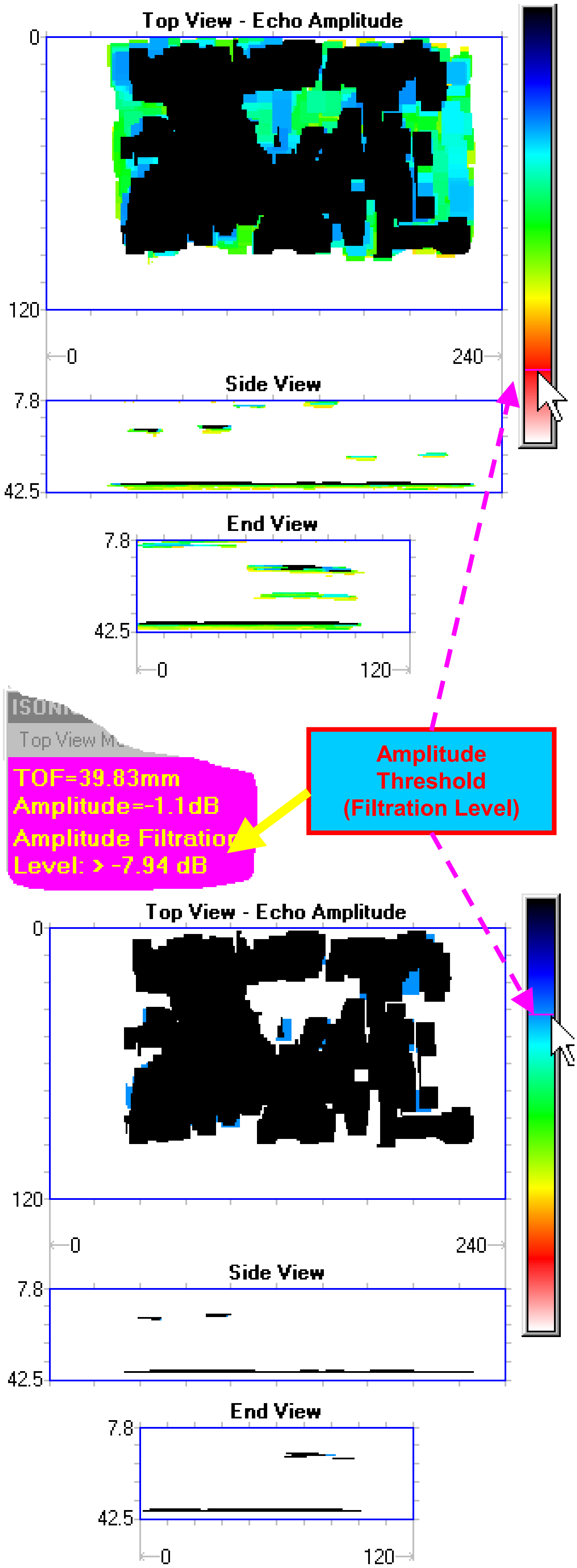
As a result:

- the **amplitude color scale (palette)** appears along with the horizontal **amplitude threshold line** above it
- the **amplitude threshold (filtration level)** value is displayed simultaneously
- the mouse pointer is "sticked" to the **amplitude threshold line**, which may be moved up / down by the mouse or touch screen stylus or buttons ↑ ↓ on the keyboard
- all reflectors produced the echo amplitudes below the **amplitude threshold (filtration level)** are erased from the images

Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the selected **amplitude threshold (filtration level)** and free the mouse pointer for the further procedures

To interrupt the ***Filtering – Echo Amplitude*** procedure right mouse click or press **Esc** on the keyboard

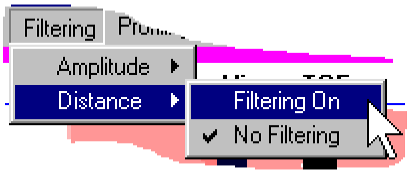
Filtering → Amplitude → No Filtering switches the active ***Filtering – Echo Amplitude*** function off



ⓘ If the **Top View** mode is **TOF (Depth)** then the effect of the ***Filtering – Echo Amplitude*** procedure is be visible on the **Side** and **End Views** only

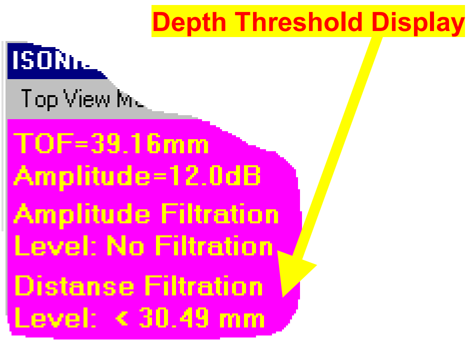
Filtering – Distance (Depth)

Filtering → Distance → Filtering On



As a result:

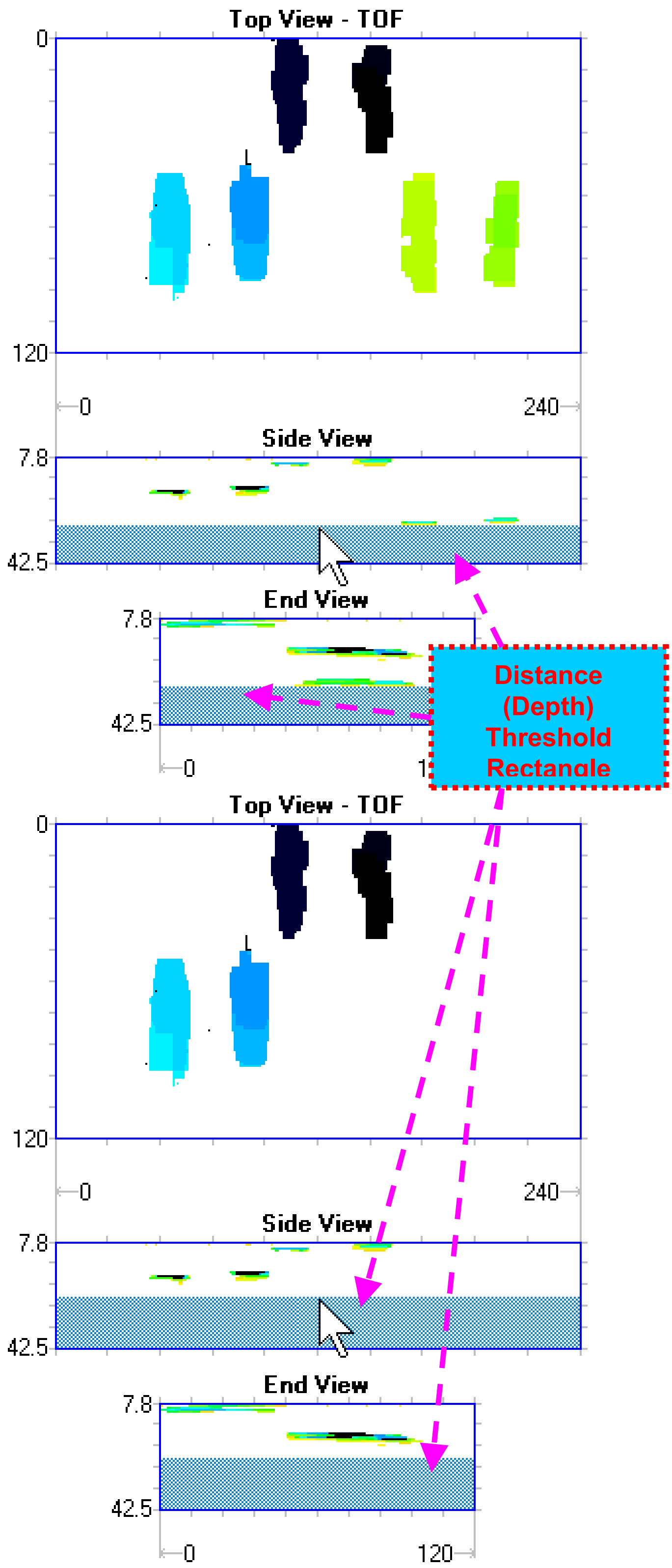
- o **Top View** mode is switched to **TOF (Depth)**
- o the horizontal **distance (depth) threshold rectangle** occupies the lower part of the **End View** and **Side View**
- o the **distance (depth) threshold** value is displayed simultaneously
- o the mouse pointer is "sticked" to the upper border of the **distance (depth) threshold rectangle**, which may be moved up / down by the mouse or touch screen stylus or buttons ↑↓ on the keyboard
- o all reflectors covered by the **distance (depth) threshold rectangle** in the **End** and **Side Views** are erased from the **Top View**



Release the touch screen stylus or left mouse click or press **Enter** on the keyboard to fix the selected **depth threshold (distance filtration level)** and free the mouse pointer for the further procedures

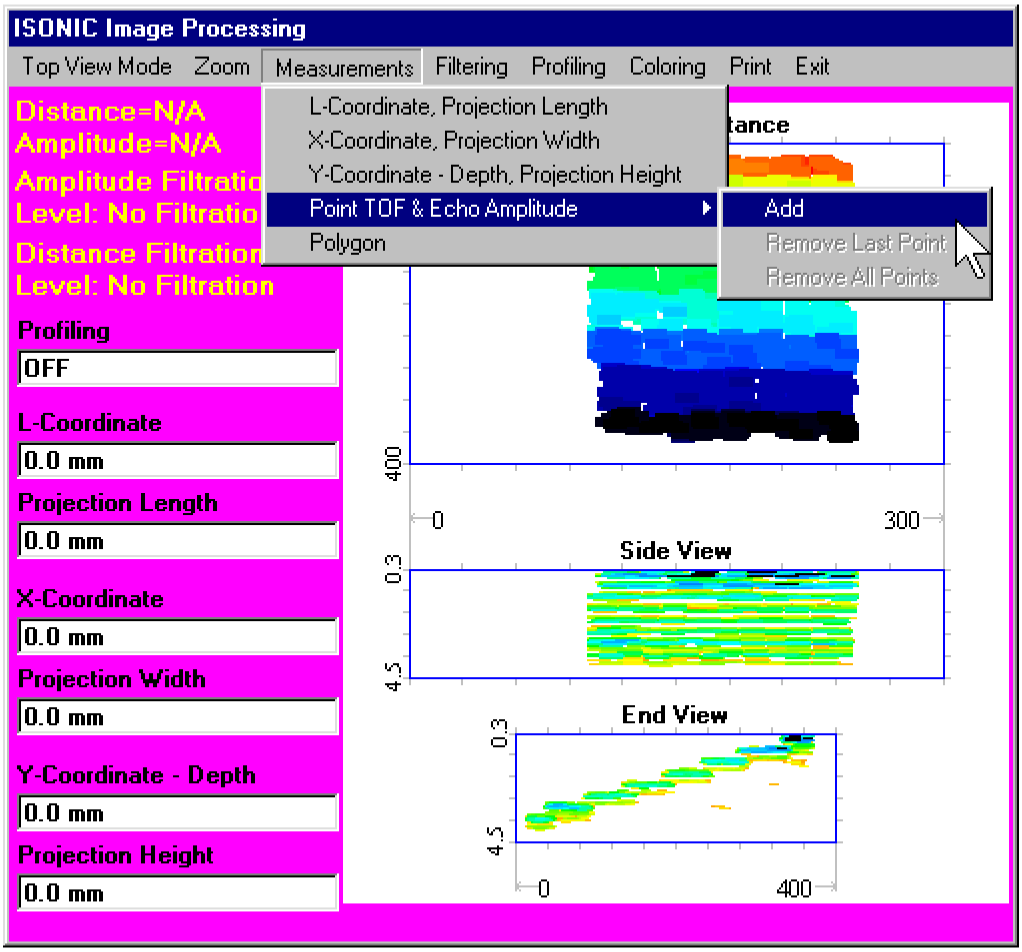
To interrupt the ***Filtering – Distance (Depth)*** procedure right mouse click or press **Esc** on the keyboard

Filtering → Distance → No Filtering switches the active ***Filtering – Distance (Depth)*** function off



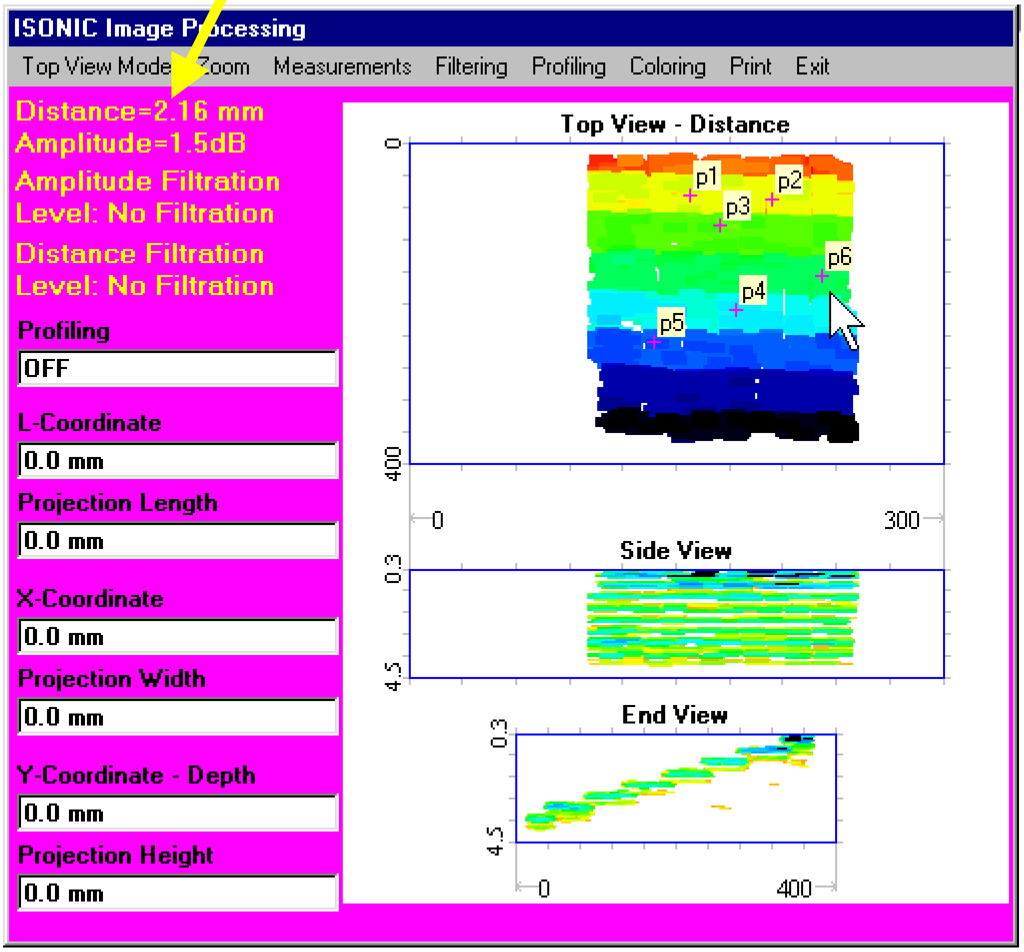
Mark Points of Interest

Measurements → Point TOF & Echo Amplitude → Add



As a result:

- o mouse pointer manipulation area becomes limited inside the **Top View** rectangle
- o mouse pointer may be moved by touch screen stylus or mouse or buttons ↑ ↓ → ← on the keyboard
- o to mark a **Point of Interest** place mouse pointer above it using either , then click on the touch screen or on the left mouse button or press **Enter** on the keyboard. This causes marking of the point as ***P****i* and **displays of the corresponding echo amplitude and depth (TOF)**



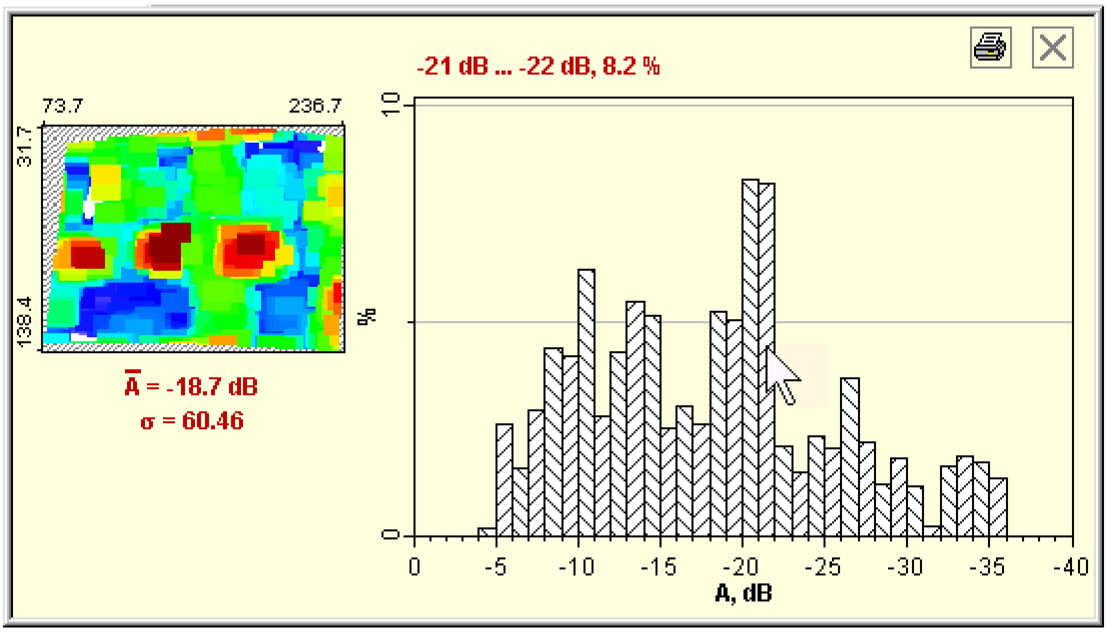
- o up to 10 (ten) marks may be placed on the **Top View**. After marking the last (tenth) point the ***Mark Points of Interest*** procedure terminates automatically. To interrupt ***Mark Points of Interest*** procedure unconditionally right mouse click or press **Esc** on the keyboard
- o the printout of the postprocessing page contains the list of **Points of Interest** if marked

Measurements → Point TOF & Echo Amplitude → Remove Last Point – removes the last mark placed over the **Top View**

Measurements → Point TOF & Echo Amplitude → Remove Last Point – removes all marks placed over the **Top View**

Polygons – Statistical Processing

The ***Polygon*** selection procedure is identical to the described above in the paragraph 15.8 of this Operating Manual. As an example the statistical window containing the image of the selected polygon on the **Amplitude Top View** and the amplitude distribution is shown below



Placement of the cursor over a column causes the indication of its value and rank; said indication appears above the upper left corner of the histogram

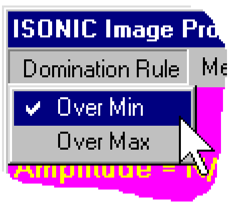
To print Postprocessing Page containing the image of the selected polygon and the corresponding histogram click on 

To close the statistical window click on  or press **Esc** on the keyboard

Image Processing – Attenuation Inspection

Top View: Switch Between the Over Max and Over Min Maps

The switching is implemented through the **Domination Rule** topic:



20. Operating 'MULTISCAN-COMBO-S RD' Software Package - ISONIC Multiscan-Combo-S RD Inspection (Complete Raw Data Acquisition)

The contents of this chapter is valid for the
MULTISCAN COMBO S RD SW Package version 1.0.0.3 or higher

20.1. Preparing for the Inspection

Refer to the Chapter 15.1 and 19.1 of this Operating Manual

20.2. Start Up

Double click on the icon 

located on the **ISONIC** desktop

20.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

20.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

20.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

20.6. Pre-Inspection

Refer to the paragraphs 7.6, 15.6, and 19.6 of this Operating Manual

20.7. Inspection

Refer to the paragraph 15.7, 16.7, and 19.7 of this Operating Manual and to the statements below

All kinds of data presentation, the imaging modes, the **ISONIC** control functions, and the typical screen during scanning using the **MULTISCAN-COMBO-S RD** Inspection SW Package are identical to the same while using the **MULTISCAN-COMBO-S** Inspection SW Package.

The **Depth (TOF) Mapping Logic applied to the Global Depth (TOF) Top View Mode**, **Amplitude Mapping Logic applied to the Global and Sectional Amplitude Top View Mode**, **Top View "Repair" Logic**, and **Depth (TOF) Top View Map "Marks" Logic** valid for the **MULTISCAN-COMBO-S** Inspection SW Package are also valid for the **MULTISCAN-COMBO-S RD** Inspection SW Package

The only difference is that the ***unprocessed A-Scans are additionally captured*** while scanning using **MULTISCAN-COMBO-S RD** software. The **A-Scan Capturing Logic** for the **MULTISCAN-COMBO-S RD** is synchronized with the said **Depth (TOF) Mapping Logic applied to the Global Depth (TOF) Top View Mode**, **Amplitude Mapping Logic applied to the Global and Sectional Amplitude Top View Mode**, **Top View "Repair" Logic**:

A-Scan Capturing Logic

First placement of the probe above some spot on the scanning surface

A-Scan is recorded unconditionally if placing the probe above some spot on the scanning surface **at the first time**

Repeat scanning above the same spot – overwriting rules

(a) Map Repair Function is **not active**

Case 1. The **valid echo** (echo matching with the gate and echo height exceeds the gate level) **was received** while pacing the probe above some spot on the scanning surface **earlier**

- If the valid signal **was received again** upon placing the probe above the same spot on the scanning surface **next time** and the new Depth (TOF) or Amplitude reading is *dominating* then new **A-Scan** overwrites already recorded **A-Scan** otherwise there is no overwriting
- If the valid echo **was not received** upon placing the probe above the same spot on the scanning surface **next time** then there is no overwriting

Case 2. The **valid echo** for the thickness reading **was not received** while pacing the probe above some spot on the scanning surface **earlier**

- If the valid echo **was received** upon placing the probe above the same spot on the scanning surface **next time** then new **A-Scan** overwrites already recorded **A-Scan**
- If the valid echo **was not received** upon placing the probe above the same spot on the scanning surface **next time** then there is no overwriting

(b) Map Repair Function is **active**

Each new **A-Scan** overwrites already recorded **A-Scan** unconditionally for each new placement of the probe above the same spot

20.8. Postprocessing

Refer to the paragraphs 7.8, 15.8, 16.8, and 19.8 of this Operating Manual

21. Operating 'MULTISCAN-COMBO-S CU' Software Package - ISONIC Multiscan-Combo-S CU Inspection – Scanning on Curved Surfaces

The contents of this chapter is valid for the
MULTISCAN COMBO S CU SW Package version 3.3.0.0 or higher

21.1. Preparing for the Inspection

Refer to the Chapter 16.1 of this Operating Manual

21.2. Start Up

Double click on the icon 

located on the **ISONIC** desktop

21.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

21.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

21.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

21.6. Pre-Inspection

Follow the instructions of paragraphs 15.6, 17.6 and 19.6 of this Operating Manual

21.7. Inspection

Follow the instructions of paragraph 15.7, 17.7 and 19.7 of this Operating Manual

21.8. Postprocessing

Follow the instructions of paragraph 15.8, 17.8 and 19.8 of this Operating Manual

22. Operating 'MULTISCAN-COMBO-S CU RD' Software Package - ISONIC Multiscan-Combo-S CU R Inspection – Scanning on Curved Surfaces (Complete Raw Data Acquisition)

The contents of this chapter is valid for the
MULTISCAN COMBO S CU RD SW Package version 1.0.0.1 or higher

22.1. Preparing for the Inspection

Refer to the Chapter 16.1 of this Operating Manual

22.2. Start Up

Double click on the icon 

located on the **ISONIC** desktop

22.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

22.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

22.5. ISONIC Control Menu

Follow the instructions of paragraph 7.5 of this Operating Manual

22.6. Pre-Inspection

Follow the instructions of paragraphs 15.6, 17.6 and 19.6 of this Operating Manual

22.7. Inspection

Follow the instructions of paragraph 15.7, 16.7, 17.7, 19.7, and 20.7 of this Operating Manual

22.8. Postprocessing

Follow the instructions of paragraph 15.8, 16.8, 17.8, 19.8, and 20.8 of this Operating Manual

23. Operating 'MULTISCAN-COMBO-SX' Software Package - ISONIC Multiscan-Combo-SX

The contents of this chapter is valid for the
MULTISCAN COMBO SX SW Package version 1.1.0.0 or higher

23.1. Preparing for the Inspection

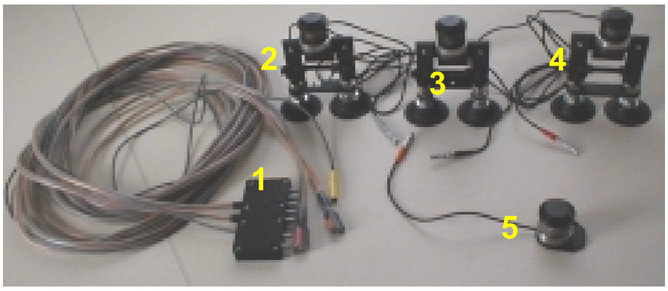
ISONIC MULTISCAN COMBO SX Inspection SW Package allows to perform pulse echo and attenuation inspection and mapping while scanning above the large planar or quasi-planar surfaces up to 2000×3000 mm using the straight beam single element or dual probes

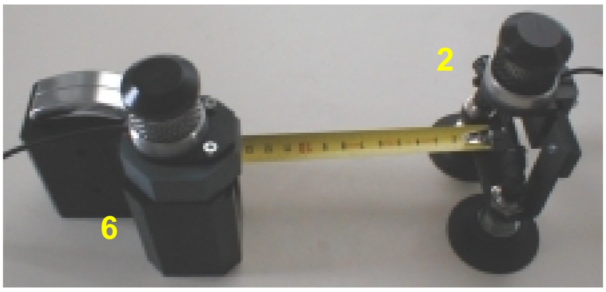
23.1.1. Hardware

In order to implement the large area scanning using the **MULTISCAN COMBO SX** Inspection SW Package the **ISONIC 2001** unit (all modifications) must be equipped either with the Rear Panel Commutation Box (order code SH 98C0202 or SH 98C0202M) or with the Rear Panel Commutation Adapter (order code SH 98C0203). The PC based ISONIC unit (all modifications) must be equipped with the Rear Panel Commutation Adapter (order code SH 98C0203)

It's also necessary to use the set of the additional fixtures and accessories required for the scanning of up to 2X3 m area in one shot (order code S 280766 LASC – vacuum attachments to the object under test or S 280766 LASCM – magnetic attachments to the object under test):

#	Description	Part #
1	Long umbilical cable system 3X2X1	S 280766-001
2	Left (IN X) receiver of airborne ultrasound – **X-Receiver**	S 280766-005
3	Central (IN Y) receiver of airborne ultrasound – **Y-Receiver**	S 280766-006
4	Right (IN Z) receiver of airborne ultrasound – **Z-Receiver**	S 280766-007
5	Power emitter of airborne ultrasound	S 280766-018
6	Airborne ultrasound velocity calibration fixture	S 280766-024





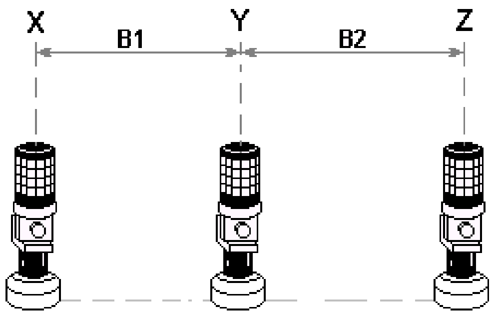
It's also necessary to use SE 20203 LASC card inside the **ISONIC 2001** unit instead of the regular SE 20203 card. *SE 20203 LASC card is suitable for all other ISONIC Inspection SW Packages*

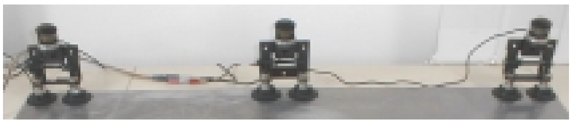
For the through transmission mode it's necessary to fit the probes into the appropriate yoke - refer to the paragraph 34.3 of this Operating Manual

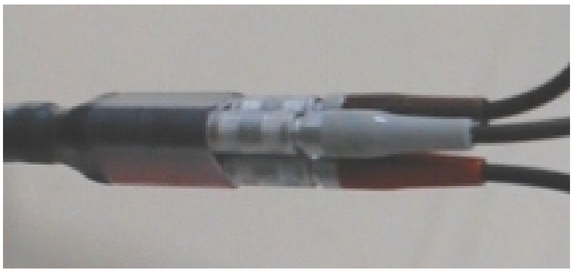
23.1.2. Software

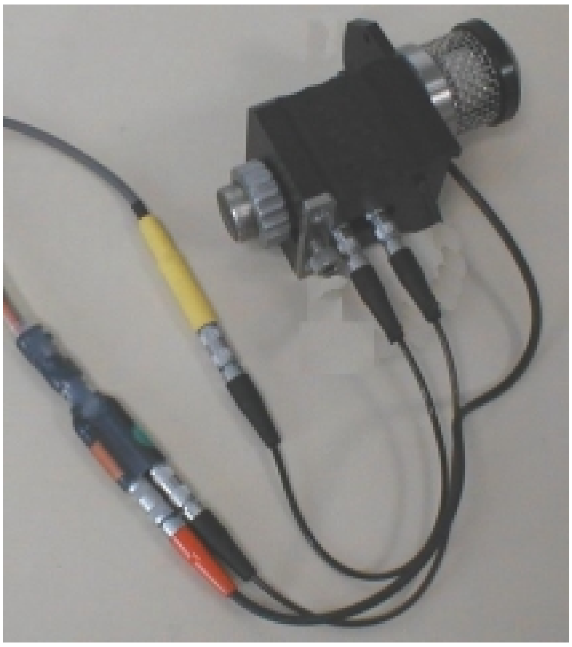
The **MULTISCAN COMBO SX** Inspection SW may run only in the units with ***already installed*** **MULTISCAN COMBO S** Inspection SW Package

23.1.3. Cabling and Fixture









Place the receivers of airborne ultrasound onto or close to the object under test by such a way that all of them will be situated on the same **straight** line. The *minimal* distance between the **X-Receiver** and **Z-Receiver** allowed is **500 mm** (or **20 in**); the *maximal* distance between the **X-Receiver** and **Z-Receiver** allowed is **3000 mm** (or **120 in**). The **Y-Receiver** to be placed between **the X-Receiver** and **Z-Receiver** approximately in the middle so that:

$$\mathbf{B_{1,2} = 0.45\ldots0.55\cdot(B_1 + B_2)}$$

The cables outgoing from each receiver of airborne ultrasound to be connected to the *correspondingly colored* sockets of the ***triple connector*** of the long umbilical cable system ***3X2X1 S 280766-001***

The probe to be fitted into the probe holder; the power emitter of airborne ultrasound to be fitted on the top of the probe holder

The cable outgoing from the power emitter of airborne ultrasound to be connected to the *correspondingly colored* socket of the ***dual connector*** of the long umbilical cable system ***3X2X1 S 280766-001***

For the ***single element probes***:

- the probe socket to be connected to the green colored socket of the ***dual connector*** of the long umbilical cable system ***3X2X1 S 280766-001***
- the yellow colored **single connector** of the of the long umbilical cable system ***3X2X1 S 280766-001*** to remain free

For the ***dual element probes***:

- the socket of the emitting crystal of the probe to be connected to the green colored socket of the ***dual connector*** of the long umbilical cable ***3X2X1 S 280766-001***
- the socket of the receiving crystal of the probe to be connected to the yellow colored **single connector** of the of the long umbilical cable system ***3X2X1 S 280766-001***

For the ***through-transmission technique***:

- the emitting probe to be connected to the green colored socket of the ***dual connector*** of the long umbilical cable system ***3X2X1 S 280766-001***
- the receiving probe be connected to the yellow colored **single connector** of the of the long umbilical cable system ***3X2X1 S 280766-001***

At the instrument side it's necessary to ensure that the **Out Ang** socket of the **ISONIC** unit is ***free***, while the yellow colored jumper is plugged into the **Rec** socket of the Pulser Receiver (refer to the Fig 4.1c – Chapter 4 of this Operating Manual) and then to plug-in the long umbilical cable system ***3X2X1 S 280766-001***

23.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

23.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

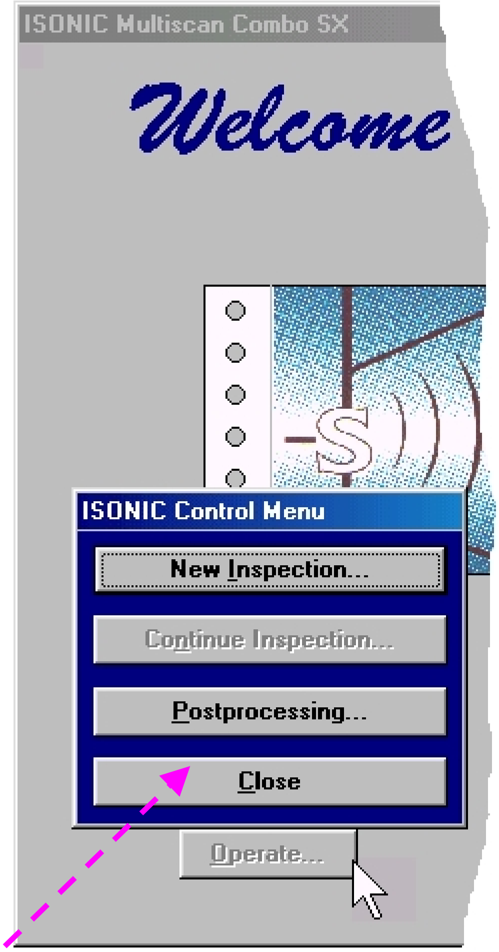
23.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

23.5. ISONIC Control Menu

23.5.1. Start New Inspection Procedure

Click on the **New Inspection...** or pressing **<Alt>+<I>** on the keyboard will cause the appearing of the **ISONIC Pre-Inspection Data** window leading to the ***New Scanning Procedure*** through the *necessary sequence of the preparations*



Clicking on this button or pressing **<Alt>+<C>** or **Esc** on the keyboard will close the **ISONIC Control Menu** and return to the welcome window

23.5.2. Continue the Paused Scanning

Scanning of the large areas is the time consuming procedure so it's often necessary to pause the scanning procedure with further continuation after some breakout time. For this purpose the **MULTISCAN COMBO SX** Inspection SW Package is featured with the special procedure of the scanning interrupt (refer to the below paragraph 23.7.4 of this Operating Manual). If the scanning was paused through the said procedure then the **Continue Inspection...** button becomes enabled in the **ISONIC Control Menu**. Click on this button or pressing **<Alt>+<N>** on the keyboard will lead *directly to the continuation of the paused scanning with the embedding the new data into the earlier stored file related to the incomplete scanning*

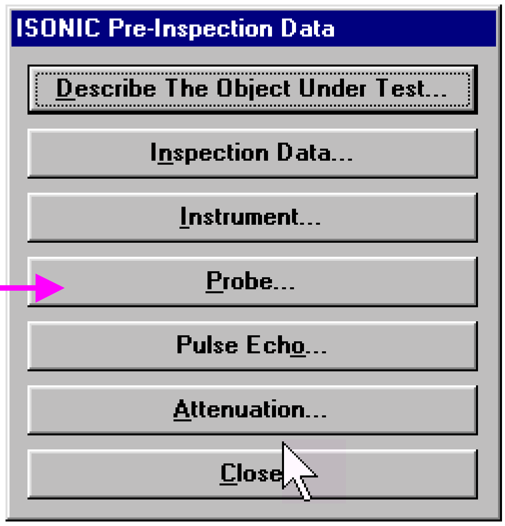
23.5.3. Start Postprocessing

Click on the **Postprocessing...** button or pressing **<Alt>+<P>** on the keyboard to start the posprocessing

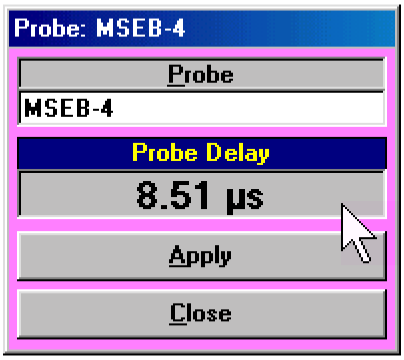
23.6. Pre-Inspection

Refer to the paragraphs 7.6, 14.6 and 16.6 of this Operating Manual and the specific notes below to provide the required settings

23.6.1. Probe Data



Click on or press **<Alt>+<P>** on the keyboard – the corresponding window appears:



The probe name to be keyed in or confirmed in the corresponding field, while the value of the probe delay is **just imported** from the **ISONIC Pulser Receiver** window (submenu **MEASURE**). Click on

or press **<Alt>+<A>** on the keyboard to confirm the probe name, then click on

or press **<Alt>+<C>** or Esc on the keyboard to return to the **ISONIC Pre-Inspection Data** window

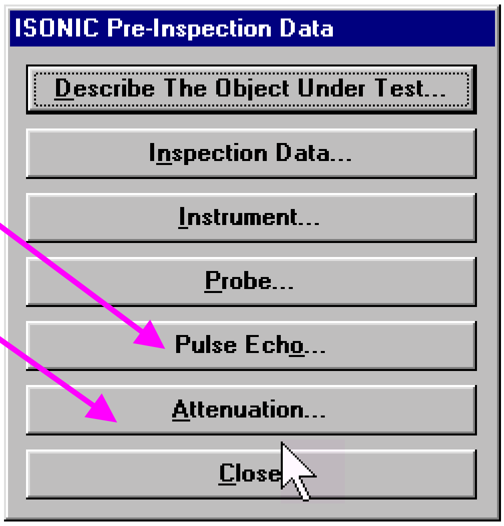
23.6.2. Inspection Techniques

There are 2 inspection techniques available while running the **MUTISCAN COMBO SX** Inspection SW Package:

- The ***Pulse Echo Inspection and Mapping*** based on the analysis and mapping of the amplitudes and time delays of all signals matching with the gate designating the region of interest. The ***Pulse Echo Inspection and Mapping*** allows to capture the multi-layer amplitude C-Scans compressed into the single compact 3D array and recover the depth/thickness C-Scan from the captured 3D array in real time and/or at the postprocessing stage
- The ***Attenuation Inspection*** based on the analysis and mapping of the amplitude of the signal located at the ***Fixed Time Window*** determined by **Gate A**, said amplitude may be obtained through the getting of the backwall echo or through-transmitted signal. The ***Attenuation Inspection*** allows to capture the single-layer amplitude C-Scan representing the distribution of the amplitude of the single informative signal *either backwall echo or through-transmitted* over the scanning area

To perform the **Pulse Echo** inspection click on or press **<Alt>+<O>** on the keyboard

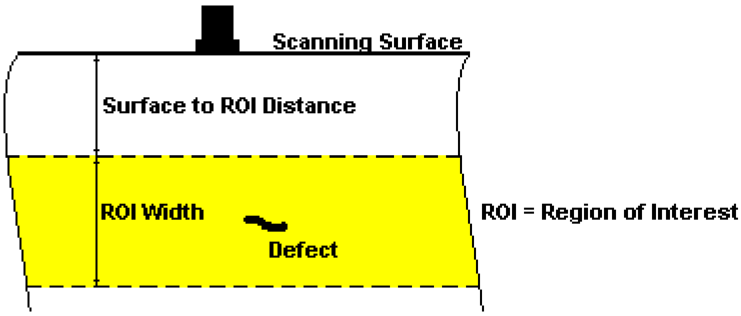
To perform the **Attenuation** inspection click on or press **<Alt>+<A>** on the keyboard



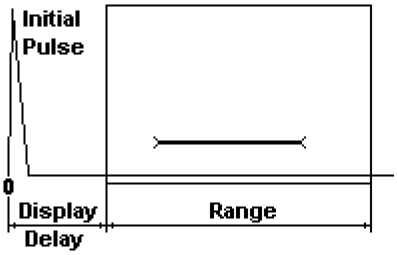
ⓘ

- o The implementation of the **Pulse Echo Inspection and Mapping** is possible only after getting the **Gate A**, **Probe Delay**, **US Velocity**, **Display Delay** and **Range** properly setup in the **Pulser Receiver** window - refer to the below table defining the ***Region of Interest*** Area. It's also necessary to setup **Probe Angle = 0°** in the submenu **MEASURE** of the **ISONIC Pulser Receiver** window
- o The implementation of the **Attenuation Inspection and Mapping** is possible only after getting the **Gate A**, **Probe Delay**, **US Velocity**, **Display Delay** and **Range** properly setup in the **Pulser Receiver** window - refer to the below table defining the ***Fixed Time Window***. It's also necessary to setup **Probe Angle = 0°** in the submenu **MEASURE** of the **ISONIC Pulser Receiver** window

MULTISCAN COMBO SX: Defining of the Region of Interest (ROI) / Fixed Time Window (FTW): **ROI = FTW**



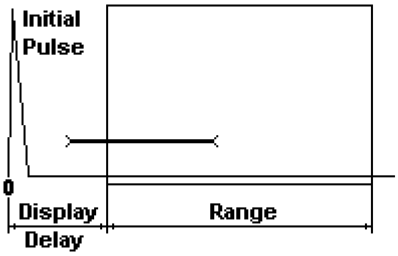
Case 1



$$SRD = aStart$$

$$RW = aWidth$$

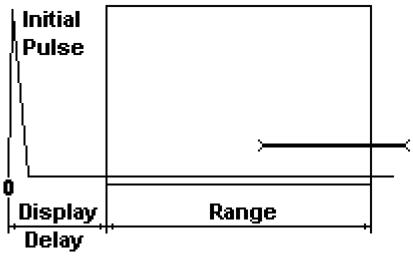
Case 2



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

$$RW = aStart + aWidth - SRD$$

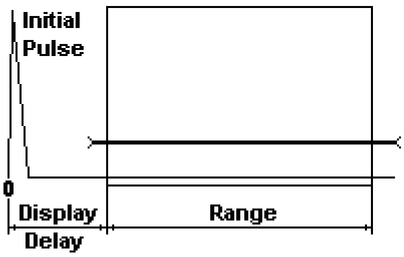
Case 3



$$SRD = aStart$$

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

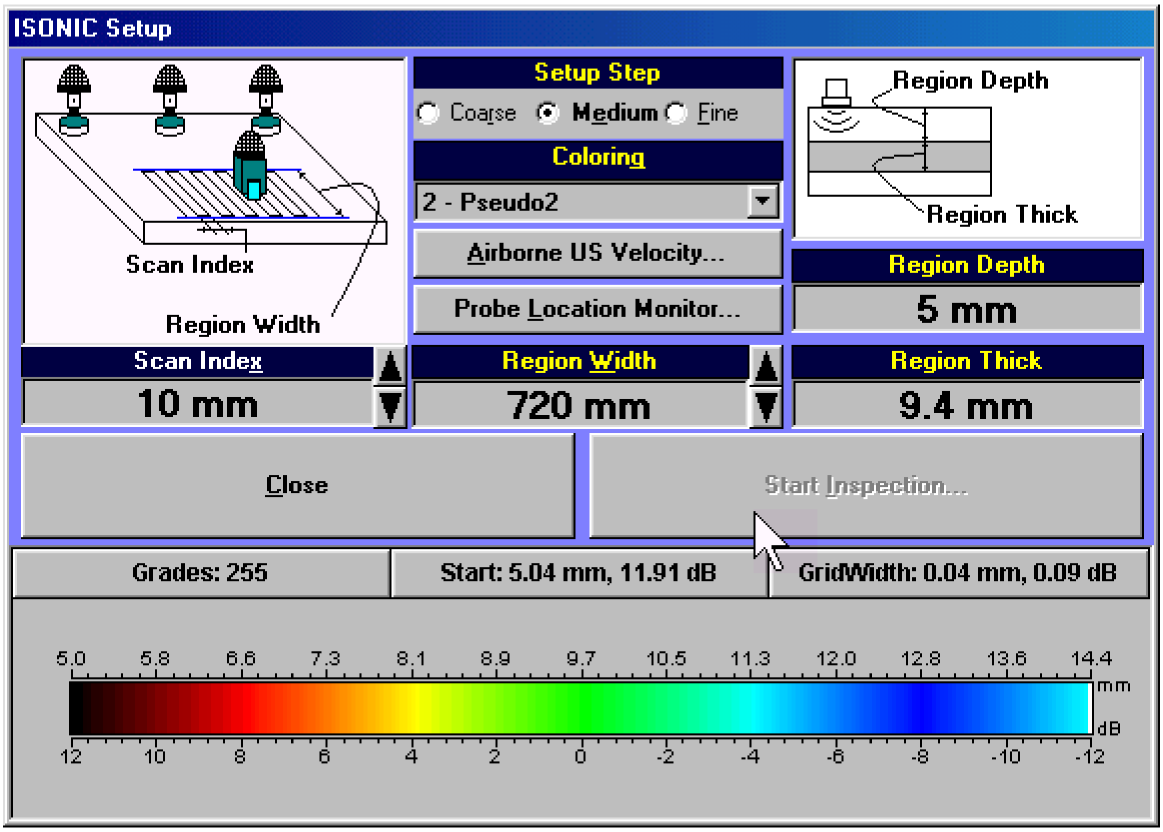
Case 4



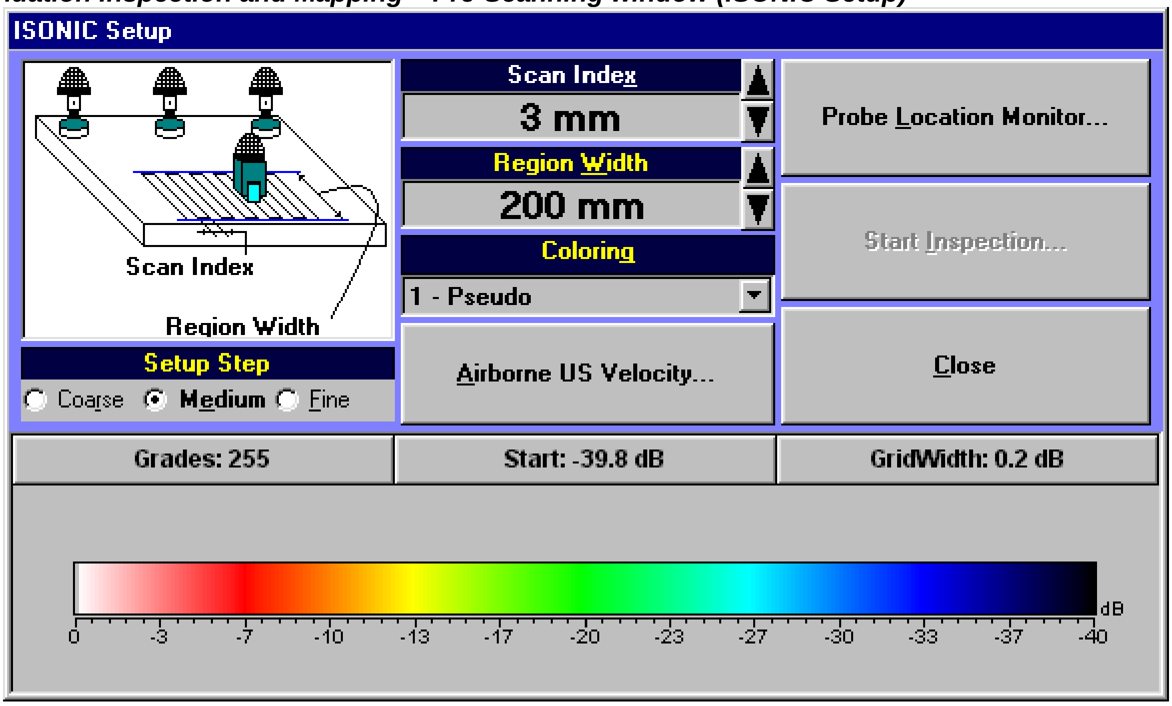
$$SRD = \frac{DisplayDelay}{2} \times USVelocity$$

$$RW = Range$$

Pulse Echo Inspection and Mapping – Pre-Scanning window (ISONIC Setup)



Attenuation Inspection and Mapping – Pre-Scanning window (ISONIC Setup)



The coupling monitor is not optional for both **Pulse Echo** and **Attenuation** inspection and mapping modes of the **MULTISCAN COMBO SX**

The dynamic range is 24 dB for the **Pulse Echo** and 40 dB for the **Attenuation** inspection and mapping mode

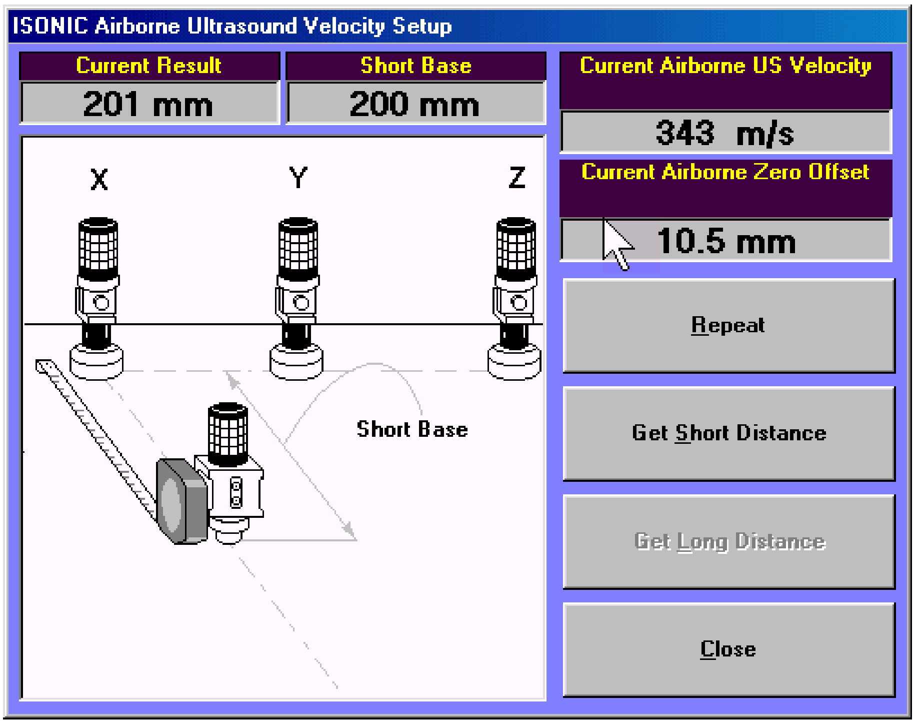
The 

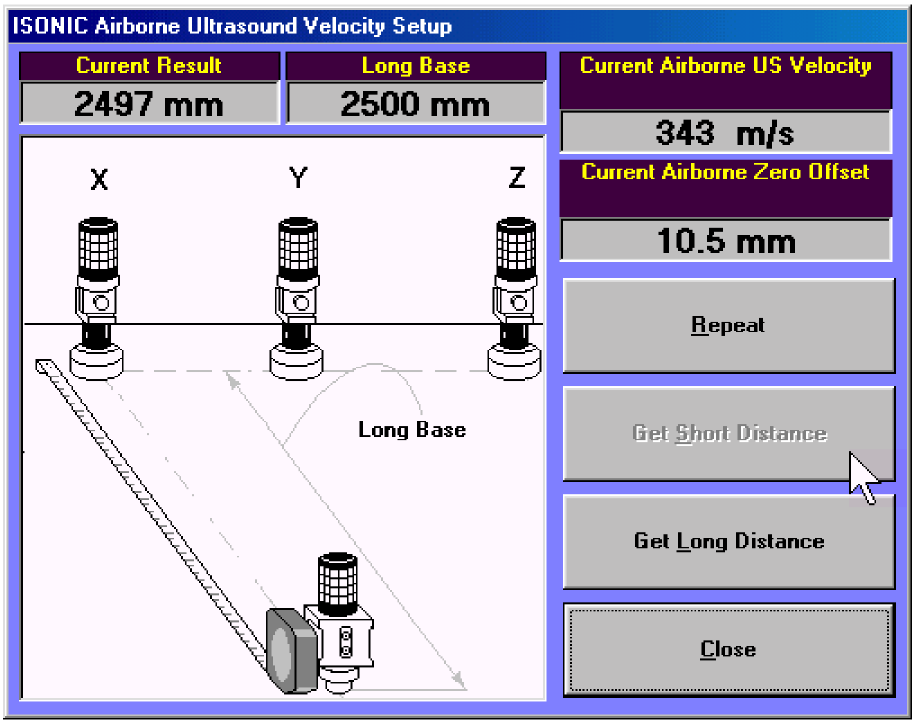
button causing the beginning of the ***New Scanning Session*** becomes enabled only after the proper completing of the **Probe Location Monitor Setup**

23.6.3. Airborne Ultrasound Velocity Setup

In the **ISONIC Setup** window click on the

or press **<Alt>+<A>** on the keyboard





Place the probe equipped with the probe holder and emitter of the airborne ultrasound on the object under test as it is shown on the *first sketch* appeared just after opening of the **ISONIC Airborne Ultrasound Velocity Setup** window at the **Short Base** distance of **200 mm** (**8 in**) from the **X-Receiver**; the said distance measured by the ISONIC is indicated in the **Current Result** box and its value may differ from the actual distance if the **Current Airborne US Velocity** and **Current Airborne Zero Offset** are not properly calibrated. Click on the

or press **<Alt>+<S>** on the keyboard upon the *distance reading at the meter* becomes equal to the required **Short Base** value. Move probe into the new position at the distance of **2500 mm** (**or 100 in**) from the **X-Receiver**; the said distance measured by the ISONIC is indicated in the **Current Result** box and its value may differ from the actual distance if the **Current Airborne US Velocity** and **Current Airborne Zero Offset** are not properly calibrated.

Click on the

or press **<Alt>+<L>** on the keyboard upon the *distance reading at the meter* becomes equal to the required **Long Base** value – this will automatically recalculate and setup the proper values for the **Current Airborne US Velocity** and **Current Airborne Zero Offset**

Click on 

or press **<Alt>+<R>** on the keyboard to repeat the above calibration procedure

Click on 

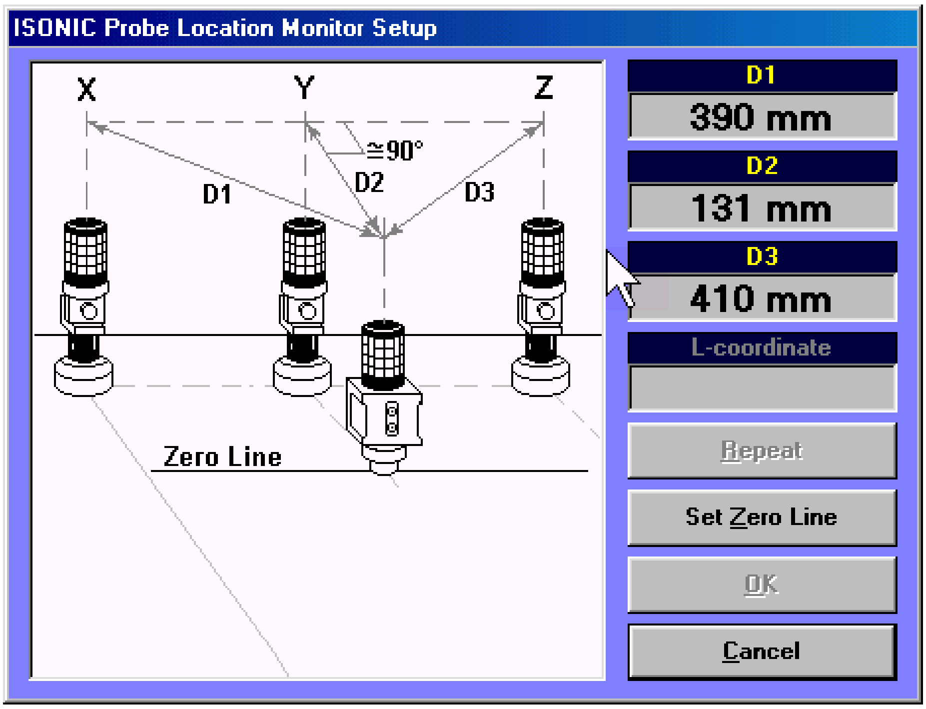
or press **<Alt>+<C>** or **Esc** on the keyboard to return to the ISONIC Setup window

ⓘ

Perform the *Airborne US Velocity Setup* at the beginning of the working shift and repeat it only in case of 10^{o}C change of the ambient temperature entire the working shift

23.6.4. Probe Location Monitor Setup

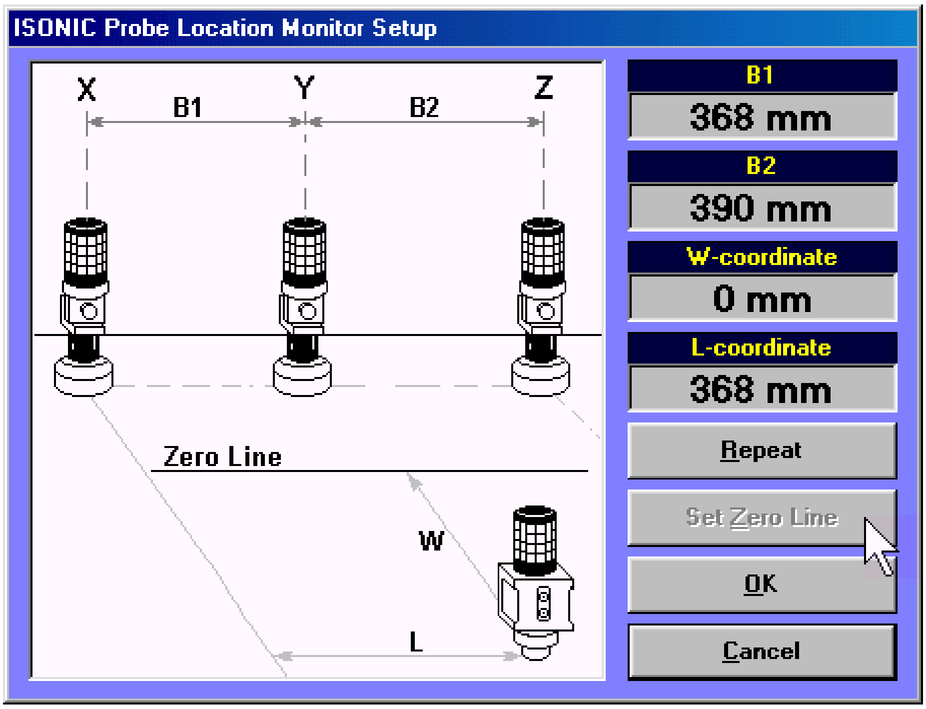
In the **ISONIC Setup** window click on the **Probe Location Monitor...** or press **<Alt>+<L>** on the keyboard



Place the probe equipped with the probe holder and emitter of the airborne ultrasound on the object under test as it is shown on the *first sketch* appeared just after opening of the **ISONIC Probe Location Monitor Setup** window. The **Zero Line** must be distanced from the **XYZ** line at **90 …150 mm** (**3.55 …5.9 in**), said distance is indicated in the **D2** box.

Click on **Set Zero Line** or press **<Alt>+<Z>** on the keyboard upon

The **Base** distances **B1** between **X-Receiver** and **Y-Receiver** and **B2** between the **Y-Receiver** and **Z-Receiver** will be automatically defined after designating the **Zero Line** while two probe coordinates, namely **L** and **W**, will be determining the probe position on the object under test



Click on **Repeat** or press **<Alt>+<R>** on the keyboard to rearrange the **Zero Line** positioning

Click on **OK** or press **<Alt>+<O>** on the keyboard to confirm the **Zero Line** designation and to return to the ISONIC Setup window

Click on **Cancel** or press **<Alt>+<C>** or **Esc** on the keyboard to discard the **Zero Line** designation and to return to the ISONIC Setup window

23.7. Inspection

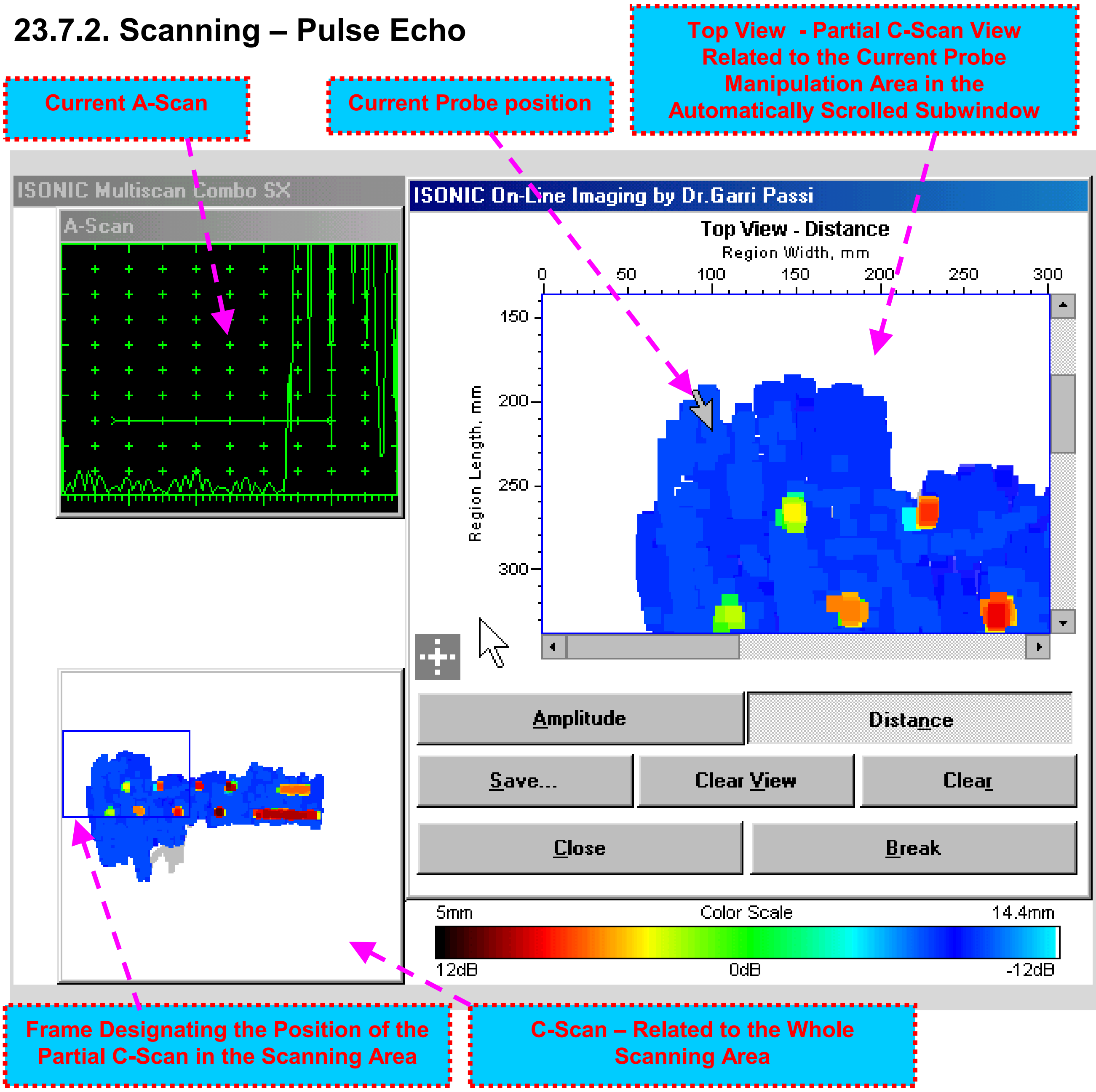
23.7.1. Volume Under Test and Data Presentation – Pulse Echo

Refer to the paragraph 16.7.1 of the this Operating Manual and to the note below

ⓘ

To use instrument screen rationally the **Side** and **End Views** are not reproduced while scanning, however all necessary data is captured and the said views are available at the postprocessing stage

23.7.2. Scanning – Pulse Echo



The above screenshot illustrates the **ISONIC** screen while scanning using the **MULTISCAN-COMBO-SX** software realizing the ***Pulse-Echo Inspection and Mapping***. The target of the operator is to completely "paint" over the *Whole Scanning Area* providing the necessary testing integrity. The data is recorded automatically and the corresponding viewing is observed in real time

Depth (TOF) Mapping Logic applied to the Global Depth (TOF) Top View Mode: The current lower value depth reading (*dominating*) overwrites the already recorded higher value depth reading if placing the probe above the same spot again. The higher value depth reading does not overwrite the already recorded lower value depth reading (*dominating*) if placing the probe above the same spot again

Amplitude Mapping Logic applied to the Global and Sectional Amplitude Top View Mode: The current higher amplitude reading (*dominating*) overwrites the already recorded lower amplitude reading if placing the probe above the same spot again. The lower amplitude reading does not overwrite the already recorded higher amplitude reading (*dominating*) if placing the probe above the same spot again

Top View "Repair" Logic: The **Map Repair Function** is active while scanning and keeping pressed the **<Space>** button on the keyboard – the new depth and amplitude readings unconditionally overwrite already recorded data. This allows the map corrections after finding the non-relevant *dominating* data recorded

Depth (TOF) Top View Map "Marks": Some eventually "unscanable" spots may exist on the scanning surface, for example the metal drops, deep surface corrosion, etc. or construction elements, such as rivets, bolts, etc. In order *to mark the said spots one by one*: place probe above each point to be marked and press **<Shift>+<Space>** on the keyboard. The corresponding marks appear over the *Top View*. To *erase a mark* use the **Map Repair Function**

It is possible to use the different styles of the data presentation while scanning:

- Click on **Amplitude** or press **<Alt>+<A>** on the keyboard for the **Amplitude C-Scan** representing
- Click on **Distance** or press **<Alt>+<N>** on the keyboard for the **Depth C-Scan** representing

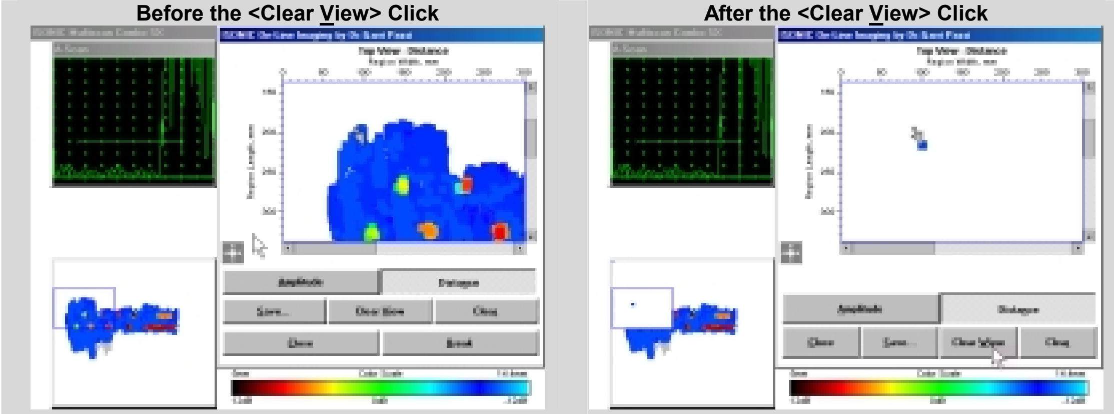
There are another 6 controls available on the **ISONIC** screen while scanning:

Click on  to scroll the **Partial C-Scan View Subwindow** related to the current probe manipulation area providing the presentation of the current probe position in the center of the said subwindow

Click on **Save...** or press **<Alt>+<S>** on the keyboard to save a file containing inspection data. Proceed according to the paragraph 5.4.19 of this Operating Manual

Click on **Clear View** or press **<Alt>+<V>** on the keyboard to reset to background the **Partial C-Scan View Subwindow** without affecting the other captured data – the effect of such action is illustrated below:

Before the <Clear View> Click **After the <Clear View> Click**

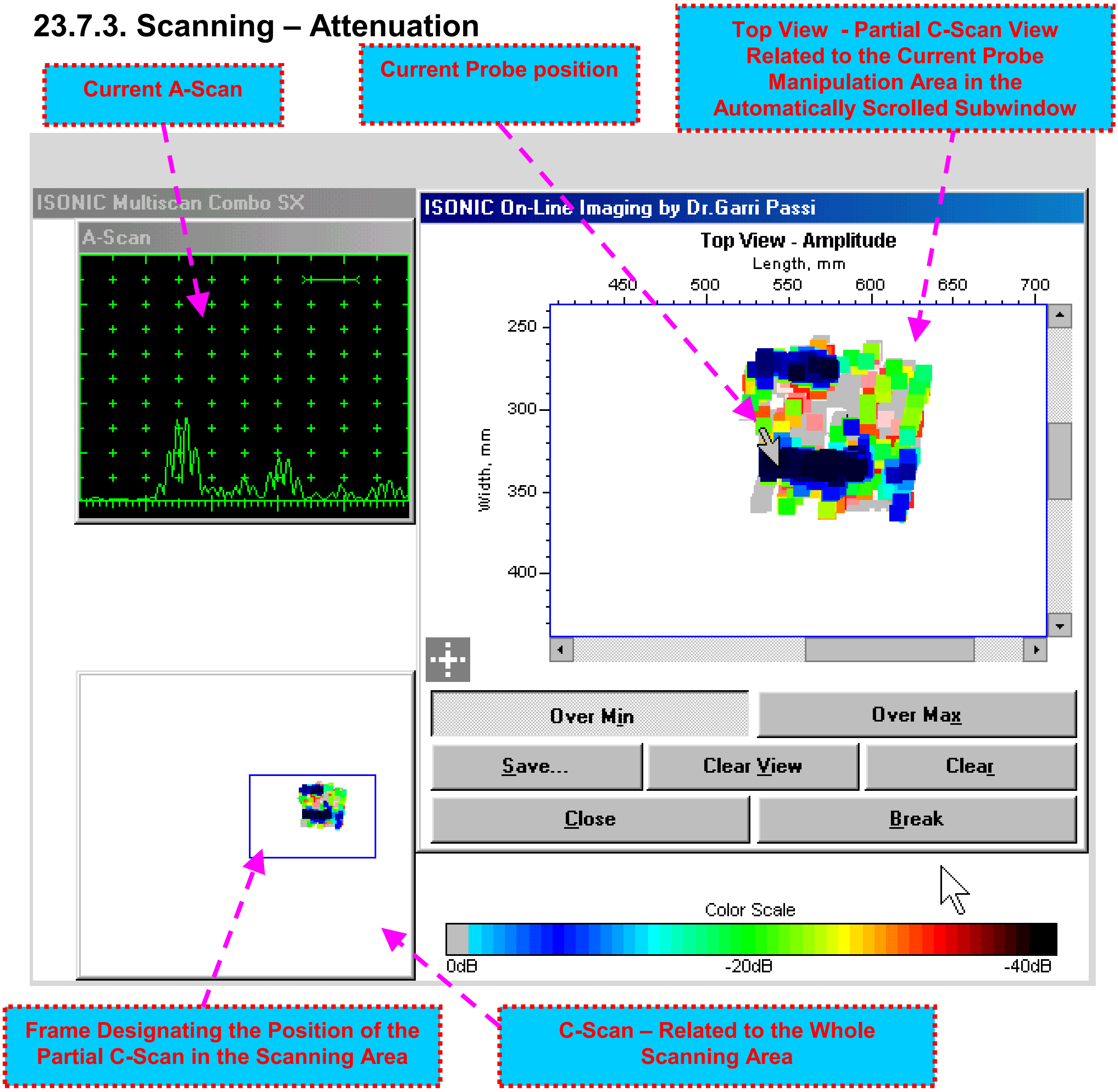


Click on **Clear** or press **<Alt>+<R>** on the keyboard to reset to background the whole **C-Scan**

Click on **Close** or press **<Alt>+<C>** or press **Esc** on the keyboard to return back to the **ISONIC Setup** window

Click on **Break** or press **<Alt>+<B>** on the keyboard to pause the scanning and data capturing – see below paragraph 23.7.4 of the present Operating Manual

23.7.3. Scanning – Attenuation



The above screenshot illustrates the **ISONIC** screen while scanning using the **MULTISCAN-COMBO-SX** software realizing the ***Attenuation Inspection and Mapping***. The target of the operator is to completely "paint" over the *Whole Scanning Area* providing the necessary testing integrity. The data is recorded automatically and the corresponding viewing is observed in real time

Amplitude Mapping Logic applied to the Top View - Amplitude Map: There are 2 (two) **Top View – Amplitude** maps **simultaneously recorded** while realizing the ***Attenuation Inspection and Mapping***:

- **Over Min** Map is created based on the following logic → the current lower amplitude reading (*dominating*) overwrites the already recorded higher amplitude reading if placing the probe above the same spot again. The higher amplitude reading does not overwrite the already recorded lower amplitude reading (*dominating*) if placing the probe above the same spot again
- **Over Max** Map is created based on the following logic → the current higher amplitude reading (*dominating*) overwrites the already recorded lower amplitude reading if placing the probe above the same spot again. The lower amplitude reading does not overwrite the already recorded higher amplitude reading (*dominating*) if placing the probe above the same spot again

Top View - Amplitude Map "Repair" Logic: The **Map Repair Function** is active while scanning and keeping pressed the **<Space>** button on the keyboard – the new depth and amplitude readings unconditionally overwrite already recorded data. This allows the map corrections after finding the non-relevant *dominating* data recorded

Top View - Amplitude Map "Marks": Some eventually "unscanable" spots may exist on the scanning surface, for example the metal drops, deep surface corrosion, etc. or construction elements, such as rivets, bolts, etc. In order *to mark the said spots one by one*: place probe above each point to be marked and press **<Shift>+<Space>** on the keyboard. The corresponding mark appears over the *Top View*. To *erase a mark* use the **Map Repair Function**

It's possible to switch between the maps while scanning by clicking on the 

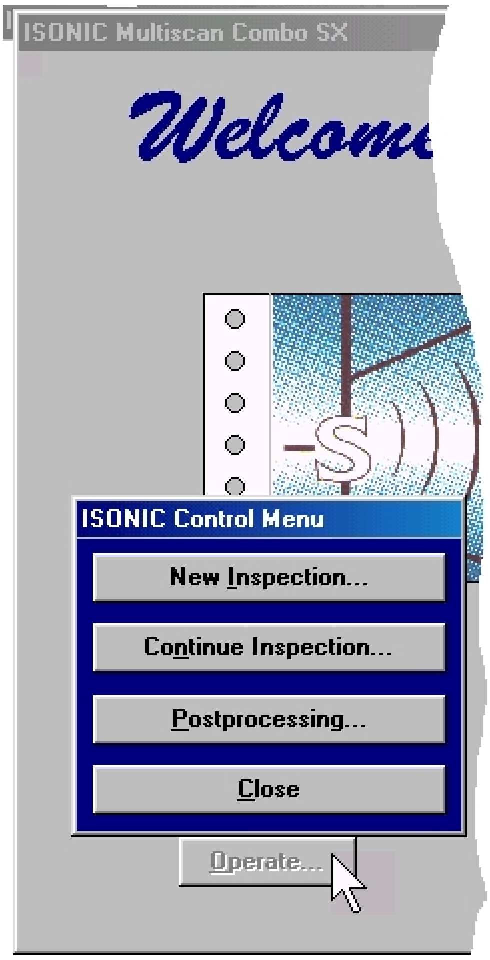
and 

buttons or pressing **<Alt>+<I>** and **<Alt>+<A>** on the keyboard

There are another 6 controls available on the **ISONIC** screen while scanning; their use is identical to the above described in the paragraph 23.7.2 of the present Operating Manual

23.7.4. Pause / Continue Scanning

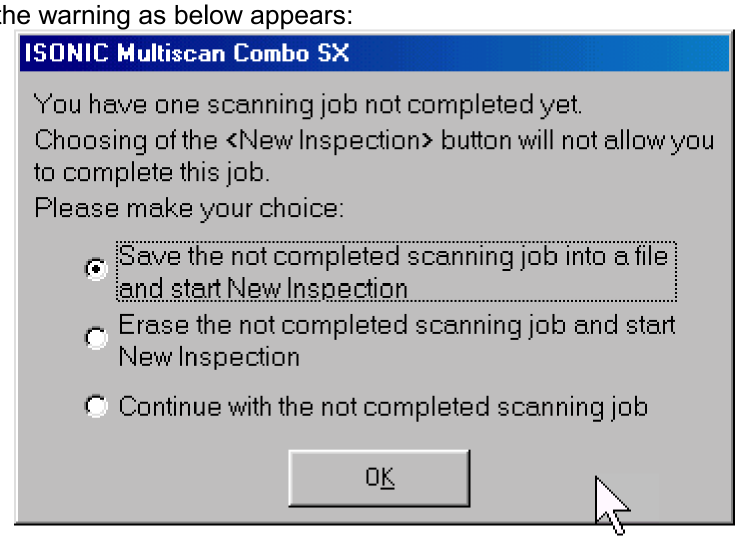
Scanning of the large areas is the time consuming procedure so it's often necessary to pause the scanning procedure with further continuation after some breakout time. For this purpose the **MULTISCAN COMBO SX** Inspection SW Package is featured with the special procedure allowing pausing of the scanning without losing already captured data, said procedure is activating automatically upon clicking on the **Break** button while scanning (see above paragraphs 23.7.2 and 23.7.3 of the present Operating Manual): the ***temporary swap file*** containing all data already captured entire the scanning will be stored on the ISONIC hard disk, said file is inaccessible through the procedures other then the provided while running the **MULTISCAN COMBO SX** Inspection SW Package. After the automatic saving of the ***temporary swap file*** there are few continuations becoming possible through the **ISONIC Control Menu** – refer to the above paragraph 23.5 of the present Operating Manual and to the below notes



Clicking on **Continue Inspection...** or pressing **<Alt>+<N>** on the keyboard will lead *directly to the continuation of the paused scanning with the embedding the new data into the earlier stored temporary swap file related to the incomplete scanning, so it is possible just to continue the scanning from the point where it was paused*. The obvious musts for that are:

- o **X-**, **Y-** and **Z-Receiver** to remain at the same positions as before pausing the scanning
- o The ultrasonic probe to be the same as it was used before pausing the scanning

If clicking on the **New Inspection...** or pressing **<Alt>+<I>** on the keyboard after the pausing the scanning then the warning as below appears:



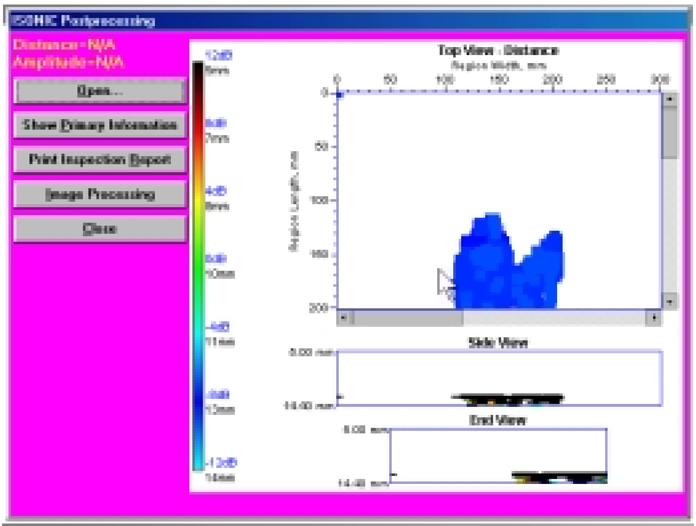
It's necessary to make the proper choice then

23.8. Postprocessing

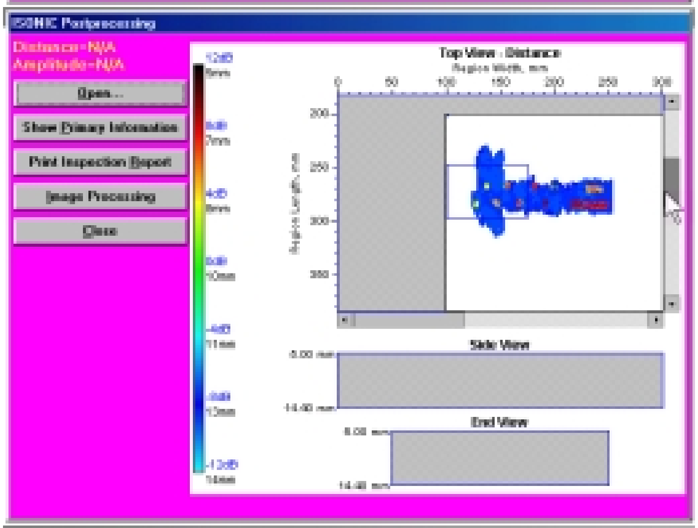
Refer to the paragraphs 7.8, 14.8 and 17.8 of this Operating Manual to get fully instructed on the off-line analysis of the scanning data for the **Partial C-Scan** area (**Top View**) accompanied with the **B-** and **D-Scans** (**Side** and **End Views**). To select the necessary portion of the scanned data use the scrolling bars as below:

Vertical Scrolling

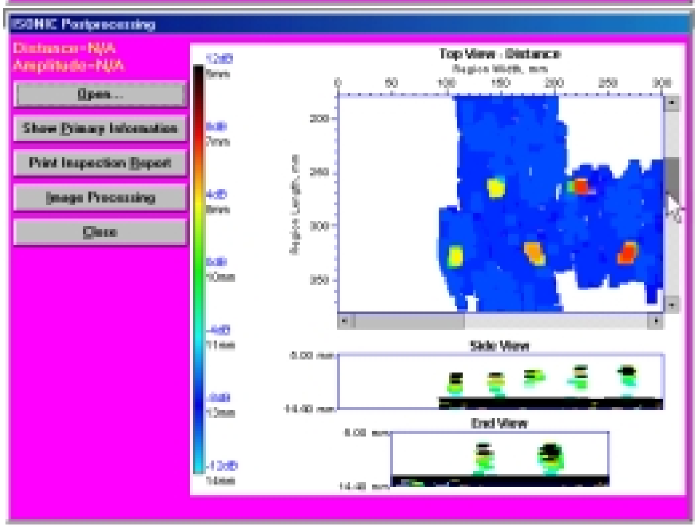
Before



Entire

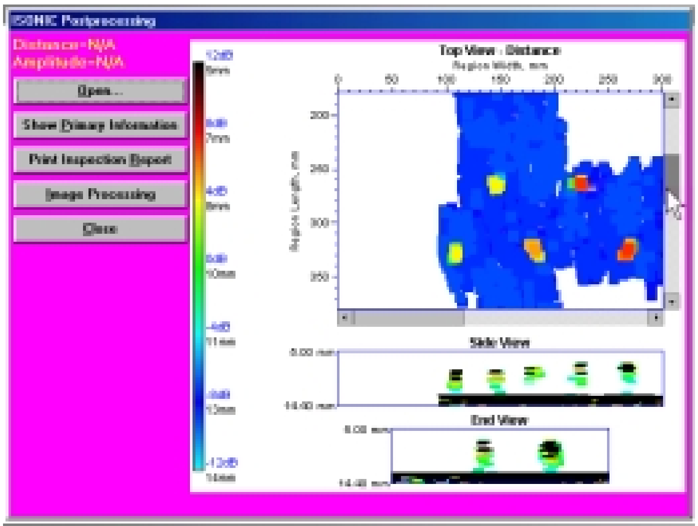


After

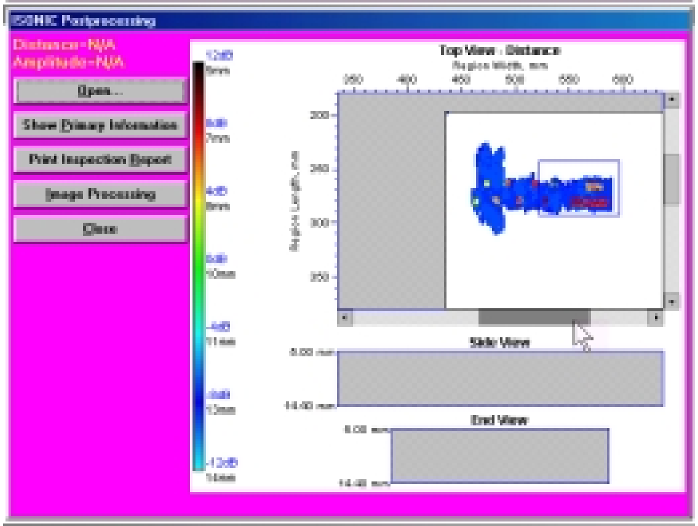


Horizontal Scrolling

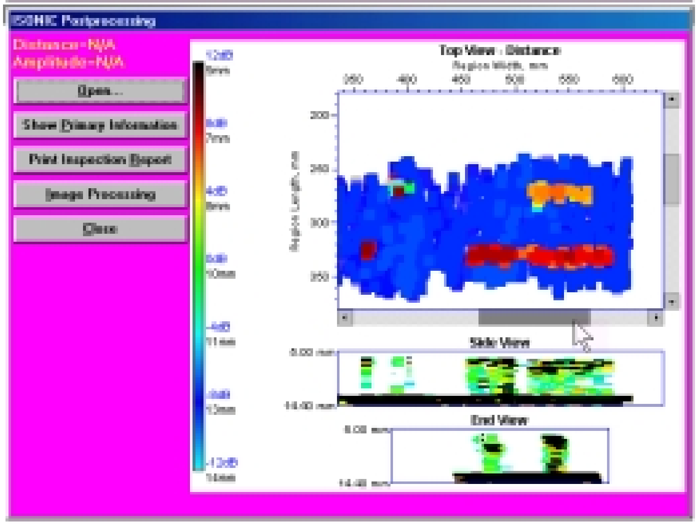
Before



Entire



After

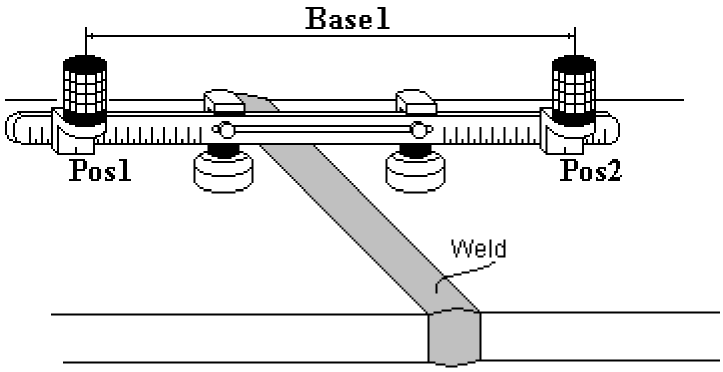


24. Operating 'TOFD' Software Package - ISONIC TOFD Inspection

The contents of this chapter is valid for the TOFD SW Package version 3.1.0.6 or higher

24.1. Preparing for the Inspection

24.1.1. Fixture



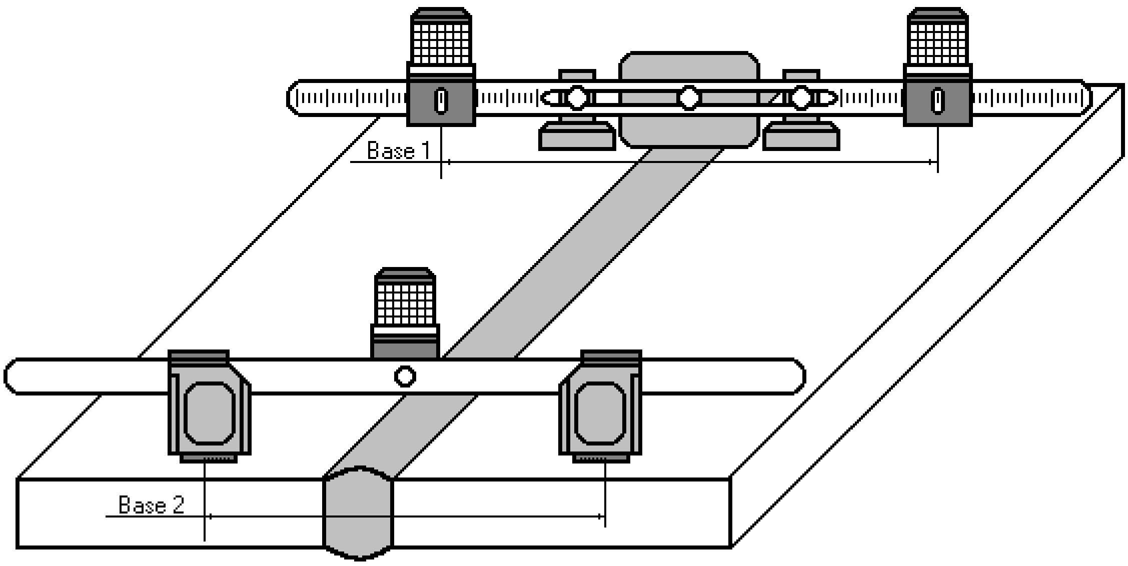
Place the bar with the receivers of airborne ultrasound aside of the scanning area at rectangle to the weld. The distance between two receivers (**Base**) on the bar is defined as:

Base1 = **200** + **Pos1** + **Pos2**, *mm*
or
Base1 = **8** + **Pos1** + **Pos2**, *in*

Pos1 and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly. Wrong determining of the **Base1** causes mistakes in monitoring probe location and defects imaging.

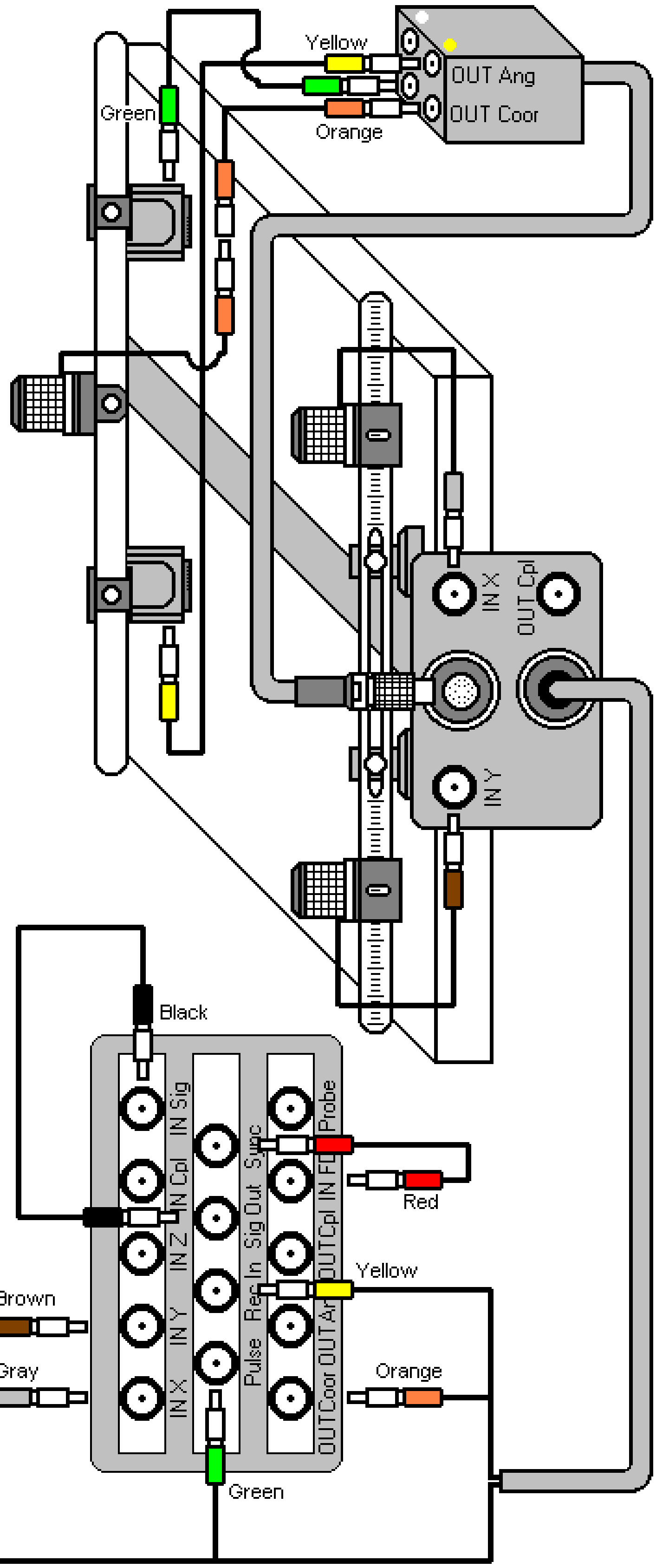
Insert ultrasonic probes into their probe holders then:

- fix the probe holders with the TOFD probes on the rail at the necessary **Base 2** distance (**Base 2** is the probes separation – refer to the paragraph 24.6.4 of this Operating Manual)
- fix the emitter of airborne ultrasound on the TOFD rail

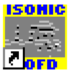


24.1.2. Cabling

Refer to the cabling scheme below



24.2. Start Up

Double click on the icon  located on the **ISONIC** desktop

24.3. Operating the software: general hints

Refer to the paragraph 7.3 of this Operating Manual

24.4. Getting started...

Refer to the paragraph 7.4 of this Operating Manual

24.5. ISONIC Control Menu

Refer to the paragraph 7.5 of this Operating Manual

24.6. Pre-Inspection

24.6.1. Describe the object under test…

Refer to the paragraph 7.6.1 of this Operating Manual

24.6.2. Inspection Data …

Refer to the paragraph 7.6.2 of this Operating Manual

24.6.3. Instrument …

Refer to the paragraph 7.6.3 of this Operating Manual

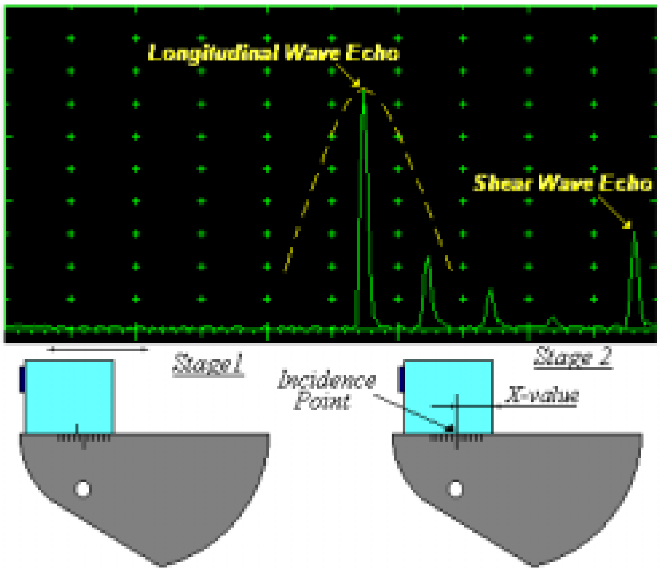
24.6.4. TOFD Inspection - Ultrasonic Flaw Detector Calibration

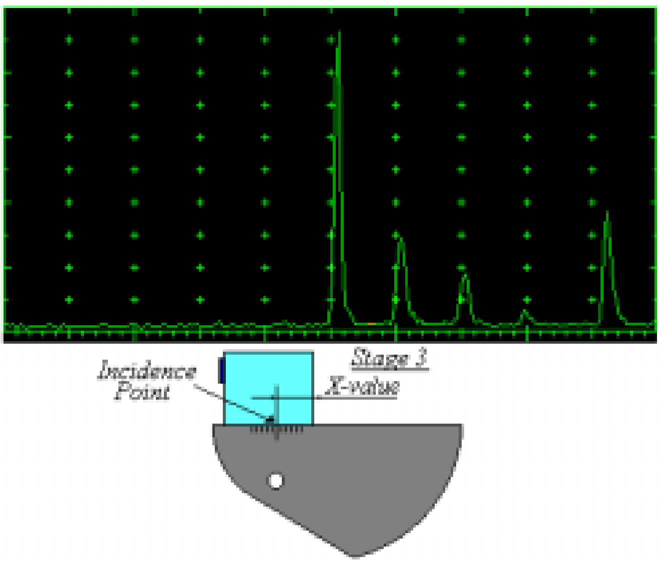
A number of parameters will be setup precisely prior to the implementation of the *TOFD Inspection*. The **important guidelines** below may be easy implemented with the reference to the paragraph 5 of this Operating Manual

Probe 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 (width of the contact face ≤12.5 mm / 0.5 in)





Cabling to be according to the above paragraph 24.1.2 without use of the **Out Ang** long LEMO 00 – LEMO 00 jumper or according to the appropriate scheme B.1 through B.5 as per paragraph 4.2.5 of the present Operating Manual

Activate the **PULSER** topic then set:

- **Pulser Mode** to **Single**
- **Energy** to **120 µJ** ▸ **UDS 3-3**
- **Energy** to **High** ▸ **USLT 2000**
- **Pulse Width** to **Spike (240 µJ)** for the probe having resonant frequency of 8 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for the probes having resonant frequency below 8 MHz ▸ **UDS 3-4**
- **Damping** to **333 Ω** ▸ **UDS 3-3**
- **Damping** to **500 Ω** ▸ **USLT 2000**
- **Damping** to **1000 Ω** ▸ **UDS 3-4**
- **Tuning** to **NO** ▸ **UDS 3-4**

Activate the **RECEIVER** topic then set:

- **Display** to **Full** or **RF**
- **Filter** to **BB** ▸ **UDS 3-4**
- **Frequency** to completely cover the probe's effective bandwidth

Activate the **BASICS** topic then set:

- **US Velocity** to **5920 m/s** (**233.1 in/ms**)
- **Range** to **100.0 mm** (**4 in**)
- **Display Delay** to **0 µs**
- **Reject** to **0%**

Stage 1: Manipulate the probe over the main working surface of the V-2 reference standard and maximize the longitudinal wave echo from 50 mm (2 in) radius concave surface

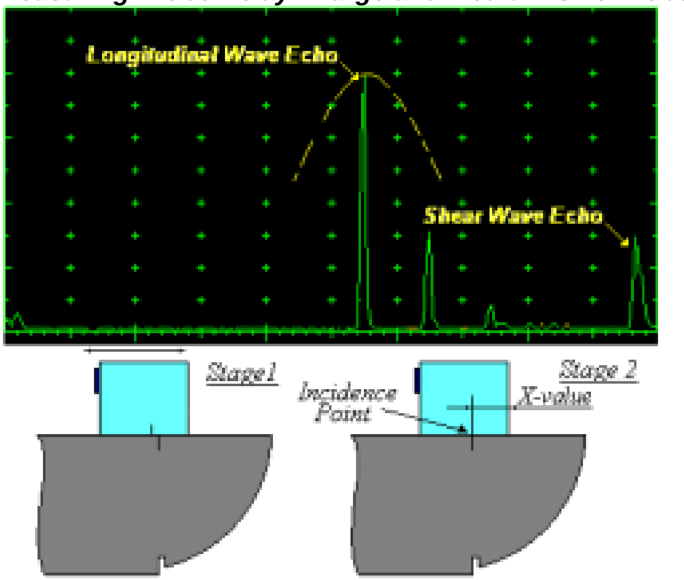
Stage 2: Fix the probe in the found position

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

ⓘ

- It's necessary to setup **Gain** bringing the height of the maximized echo to the level of **75-80%** of the **A-Scan** height
- For the units equipped with **UDS 3-4** Pulser Receiver Card it is recommended to optimize **Tuning** in the **PULSER** submenu upon obtaining the maximized echo. The goal of the optimization is increasing of the energy of ultrasonic excitation though the better matching between firing output and probe. Level of the energy of ultrasonic excitation is clearly represented by the echo amplitude. Upon completing optimization of the **Tuning** the **Gain** to be adjusted to bring the height of the maximized echo to the vertical level of **75-80%** of the **A-Scan** height

Measuring Probe Delay - Large and Medium Size Probes (width of the contact face ≥ 12.5 mm / 0.5 in)



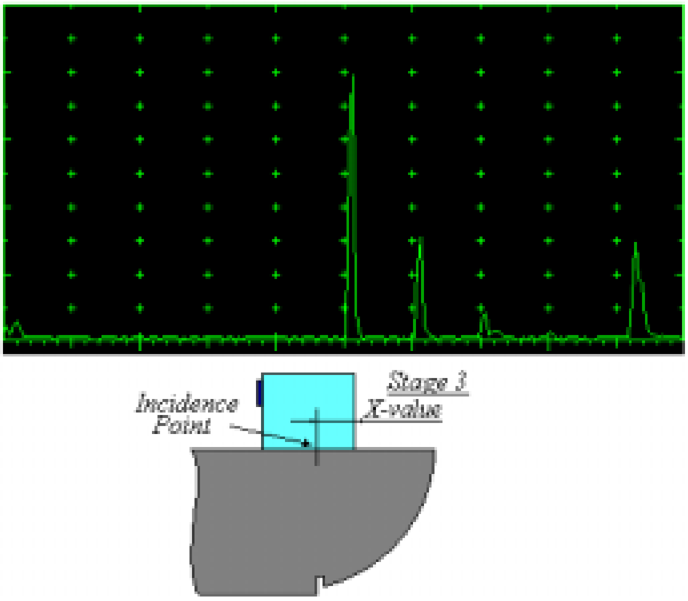
Cabling to be according to the above paragraph 24.1.2 without use of the **Out Ang** long LEMO 00 – LEMO 00 jumper or according to the appropriate scheme B.1 through B.5 as per paragraph 4.2.5 of the present Operating Manual

Activate the **PULSER** topic then set:

- ❑ **Pulser Mode** to **Single**
- ❑ **Energy** to **120 µJ** ▸ **UDS 3-3**
- ❑ **Energy** to **High** ▸ **USLT 2000**
- ❑ **Pulse Width** to **Spike (240 µJ)** for the probe having resonant frequency of 8 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for the probes having resonant frequency below 8 MHz ▸ **UDS 3-4**
- ❑ **Damping** to **333 Ω** ▸ **UDS 3-3**
- ❑ **Damping** to **500 Ω** ▸ **USLT 2000**
- ❑ **Damping** to **1000 Ω** ▸ **UDS 3-4**
- ❑ **Tuning** to **NO** ▸ **UDS 3-4**

Activate the **RECEIVER** topic then set:

- ❑ **Display** to **Full** or **RF**
- ❑ **Filter** to **BB** ▸ **UDS 3-4**
- ❑ **Frequency** to completely cover the probe's effective bandwidth



Activate the **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 the main working surface of the V-1 reference standard and maximize the longitudinal wave echo from 100 mm (4 in) radius concave surface

Stage 2: Fix the probe in the found position

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

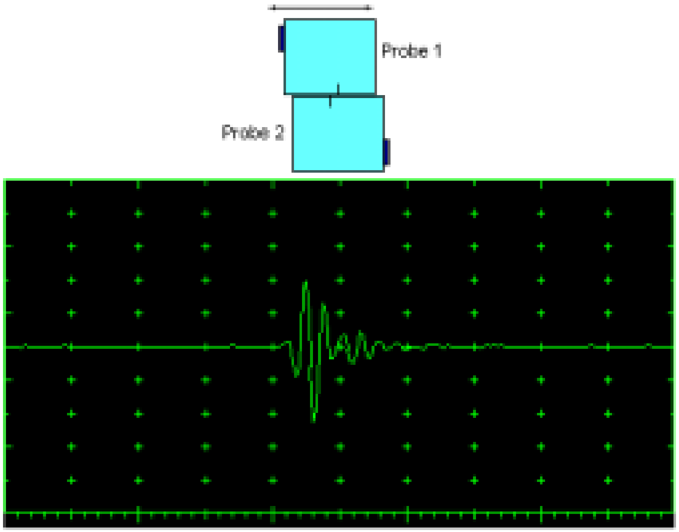
ⓘ

- ♦ It's necessary to setup **Gain** bringing the height of the maximized echo to the level of **75-80%** of the **A-Scan** height
- ♦ For the units equipped with **UDS 3-4** Pulser Receiver Card it is recommended to optimize **Tuning** in the **PULSER** submenu upon obtaining the maximized echo. The goal of the optimization is increasing of the energy of ultrasonic excitation though the better matching between firing output and probe. Level of the energy of ultrasonic excitation is clearly represented by the echo amplitude. Upon completing optimization of the **Tuning** the **Gain** to be adjusted to bring the height of the maximized echo to the vertical level of **75-80%** of the **A-Scan** height

Supposing the determined values of **Probe Delay** for the probes pair are **PD_1** and **PD_2** the ***Accumulated Probe Delay*** will be: **$PD = 0.5 \bullet (PD_1 + PD_2)$**

In the **MEASURE** topic the value of **Probe Delay** to setup equal to **PD**

Direct Measuring of the Accumulated Delay for a Probes Pair (all types of probes)



Cabling to be according to the above paragraph 24.1.2 or according to the appropriate scheme B.6 through B.10 as per paragraph 4.2.5 of the present Operating Manual

Activate the **PULSER** topic then set:

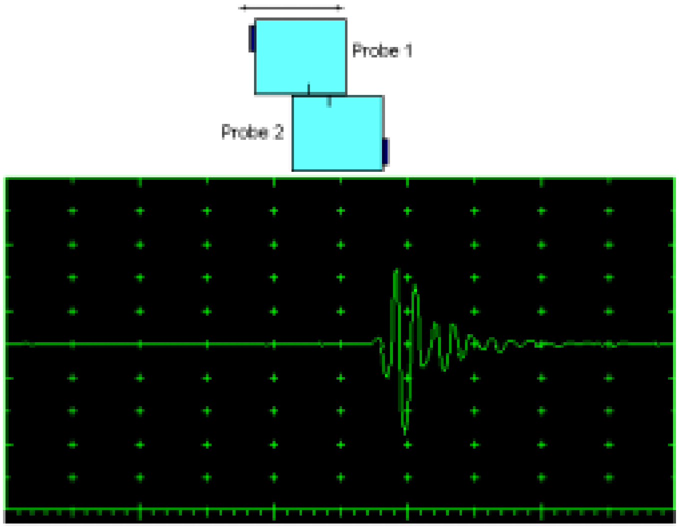
- **Pulser Mode** to **Dual**
- **Energy** to **120 µJ ▸ UDS 3-3**
- **Energy** to **High ▸ USLT 2000**
- **Pulse Width** to **Spike (240 µJ)** for the probe having resonant frequency of 8 MHz and higher or to **PW ns**, were **PW = 0.5 / F** (F is the probe resonant frequency) for the probes having resonant frequency below 8 MHz **▸ UDS 3-4**
- **Damping** to **333 Ω ▸ UDS 3-3**
- **Damping** to **500 Ω ▸ USLT 2000**
- **Damping** to **1000 Ω ▸ UDS 3-4**
- **Tuning** to **NO ▸ UDS 3-4**

Activate the **RECEIVER** topic then set:

- **Display** to **RF**
- **Filter** to **BB ▸ UDS 3-4**
- **Frequency** to completely cover the probe's effective bandwidth

Activate the **BASICS** topic then set:

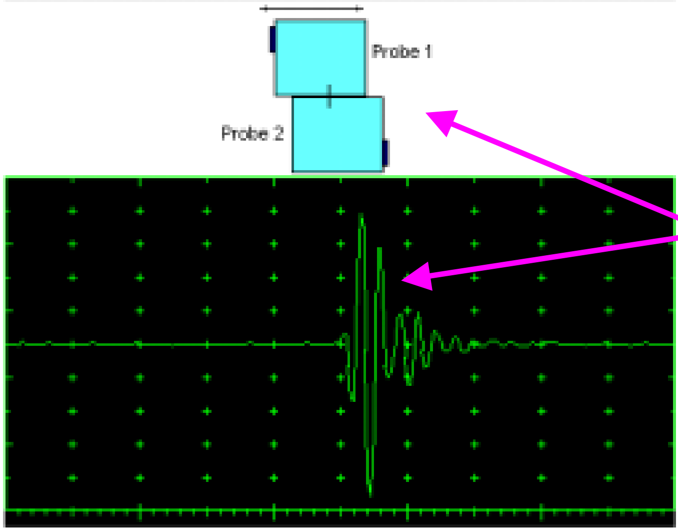
- **Display Delay** to **0 µs**
- **Reject** to **0%**



ⓘ

For the units equipped with **UDS 3-4** Pulser Receiver Card it is recommended to optimize **Tuning** in the **PULSER** to increase the energy of ultrasonic excitation though the better matching between firing output and probe. Level of the energy of ultrasonic excitation is clearly represented by the signal's amplitude. Upon completing optimization of the **Tuning**

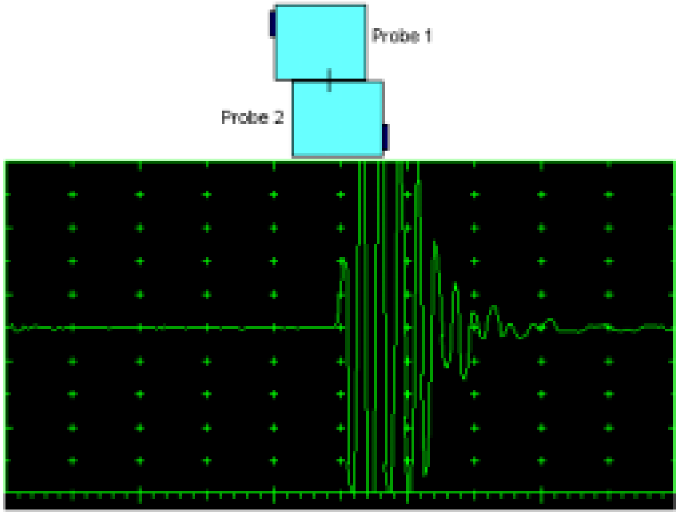
Stage 1: Manipulate probes over each other and setup of **Gain**, **Range**, and **USVelocity** providing firm indication of the signal propagating in the probes wedges from emitting to receiving crystal and maximize said signal



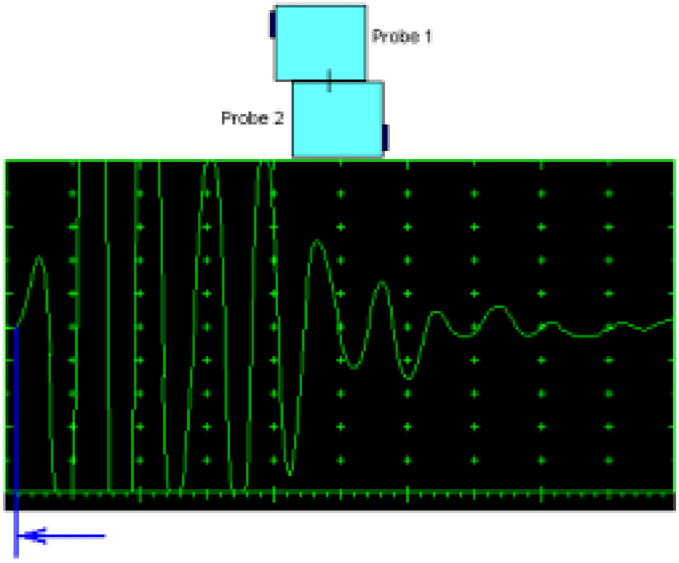
Stage 2: Fix the probe in the found position corresponding to the highest signal amplitude

ⓘ

It's necessary to setup **Gain** bringing the maximized signal's height to the level of **75-80%** of the **A-Scan** height



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

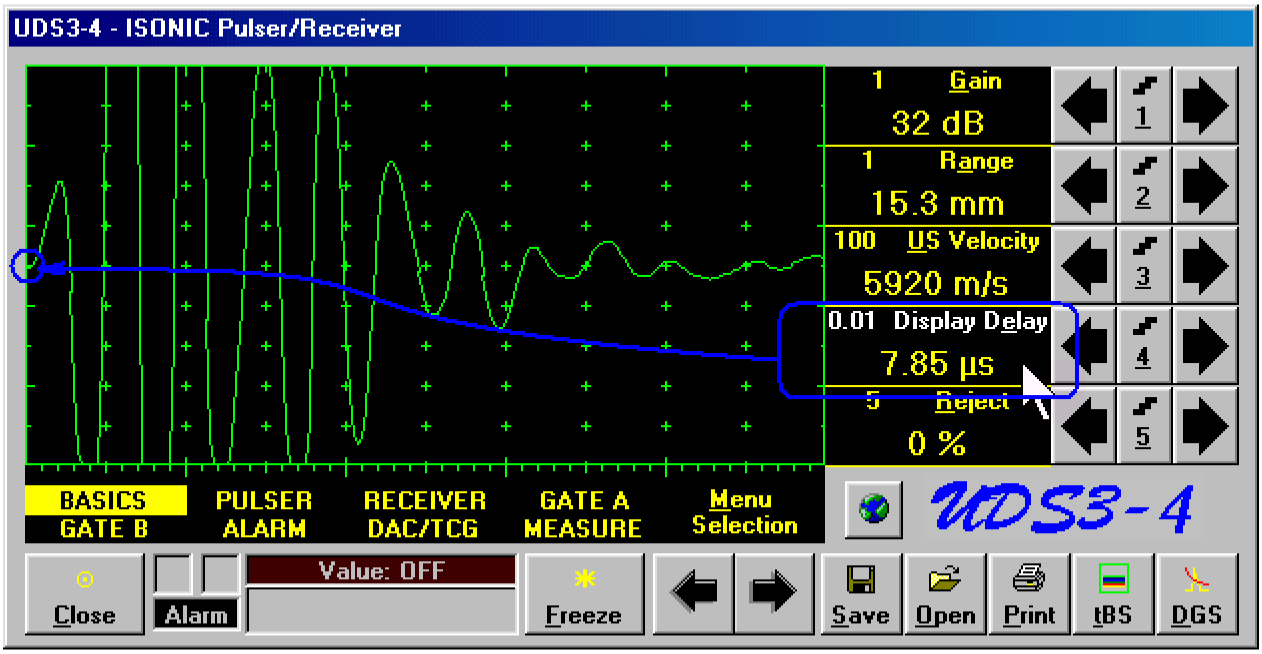


Stage 4: Decrease **Range** to provide ~ 50% of the A-Scan width occupied by the signal

Stage 5: Start increasing of the **Display Delay** aiming displacement of the signal's start to the beginning of the A-Scan area

Stage 6: Stop **Display Delay** manipulation upon reaching the target – the value of the **Display Delay** in the appropriate box becomes equal to the ***Accumulated Delay of the Probes Pair***

Activate the **MEASURE** topic and setup **Probe Delay** appropriately



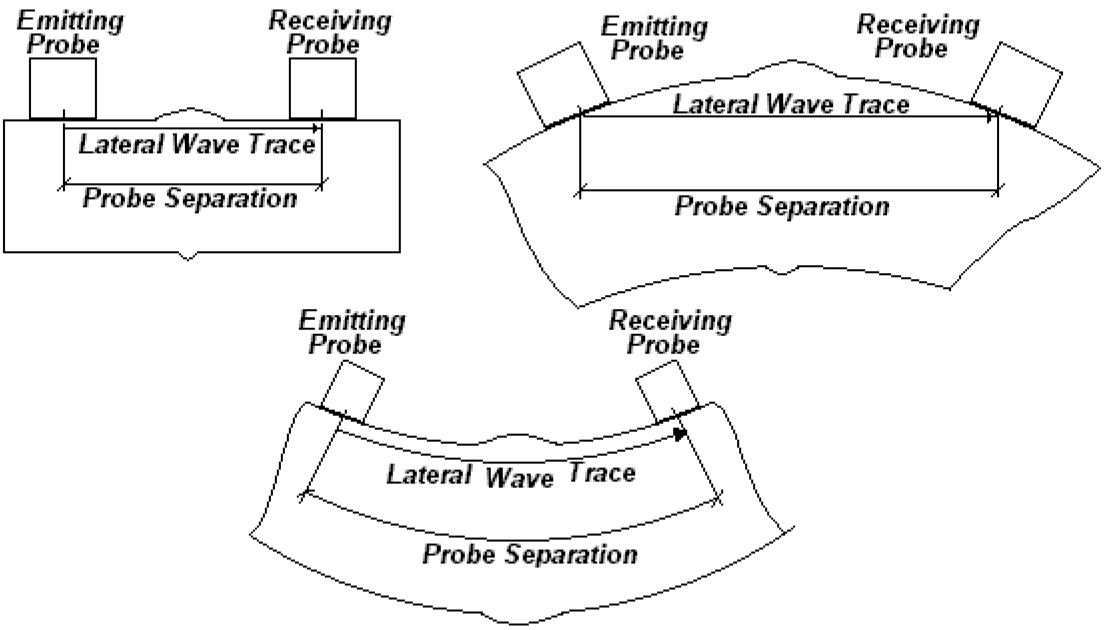
Display Delay

Display Delay to be setup through the submenu **BASICS** depends on the **Probe Delay**, **Probe Separation**, and **US Velocity**:

Display Delay = Probe Delay + Probe Separation / US Velocity

Here:

- **US Velocity** 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 selected based on the *TOFD Inspection Procedure*. In the *ISONIC TOFD Inspection SW Package* operating surface and in the *ISONIC TOFD Inspection Report* the **Probe Separation** is designated as **Base 2**

ⓘ

- It's recommended to determine **US Velocity** right on the object under test using the straight beam probe receiving the back echo at the known thickness area
- If the **Display Delay** is setup properly then A-Scan starts with the rising edge of the lateral wave signal
- After separating the probes the value of **Base 2** may be determining precisely provided that the values of **US Velocity** and **Probe Delay** are already setup properly. For that purpose:
  - **Gate A** (or **Gate B**) to be activated through the appropriate submenu
  - Lateral wave signal must match with the active **Gate A** (or **Gate B**)
  - The rising edge of the lateral wave signal must be the first one crossing the **Gate A** (or **Gate B**)
  - The **Meas Value** to be selected as **s(A)** or **s(B)** depending on the active gate (submenu **MEASURE**)
  - The **Meas Value** to be setup as **Flank** (submenu **MEASURE**)
  - The value of **Base 2** is determined as **0.5•s(A)** or **0.5•s(B)** where **s(A)** or **s(B)** is the digital readout generated in the **Value** box upon getting the rising edge of the lateral wave signal crossing the gate level: **Base 2** = **0.5•s(A)** or **Base 2** = **0.5•s(B)**

Range

Supposing that **US Velocity** setup of the *ISONIC Pulser Receiver* **matches** with the ***actual value of longitudinal wave velocity in the material***, the value of Range expressed in metric or imperial units must be setup as:

$$Range\_mm\_OR\_in = (0.51...0.55) \bullet \left(2 \bullet \sqrt{\frac{ProbeSeparation^2}{4} + Depth^2} - ProbeSeparation \right)$$

In the above equation the maximal reasonable value for the **Depth** is the **Thickness of the Object** under test. Actually the value of **Range** expressed in **mm** or **in** has no direct depth reading use due to the non-linearity of the beam angle spread. The **µs** expression for the **Range** may be found from the above as:

Range_µs = Range_mm_OR_in / US Velocity

ⓘ

The above way of the **Range** setup guarantees the receiving and recording of all pure longitudinal wave signals that may occur in the object under test. The representing and recording of the mode conversion signals is possible upon increasing the **Range** accordingly

Gain

Based on the Inspection Procedure (Inspection Specs) the **Gain** may be setup with the reference to the:

- representative flaw sample
- artificial diffractors in the form of EDM notches or V-shaped notches
- side drilled holes
- grain noise
- lateral wave signal amplitude

Pulser Setup (Sub Menu PULSER)

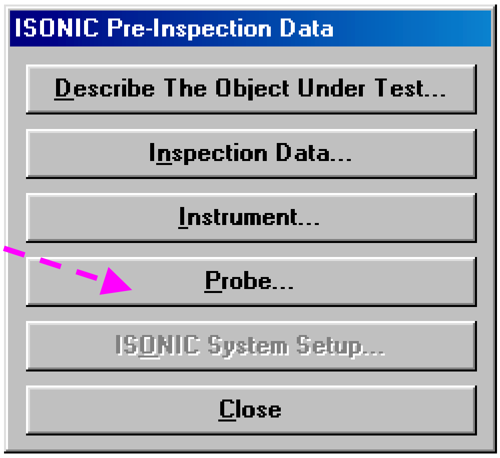
TOFD Inspection supposes using of 2 probes. Hence the obvious setup for the **Pulser Mode** is **Dual**. All other settings of the Pulser are as described above under **Probe Delay** sub-caption in this paragraph

Receiver Setup (Sub Menu RECEIVER)

TOFD Inspection supposes use of the RF signal presentation and recording. Hence the **Display** must be setup to **RF**. All other settings of the Receiver are as described above under **Probe Delay** sub-caption in this paragraph

24.6.5. Probe(s)

Click on



or press **<Alt>+<P>** on the keyboard – the corresponding window appears

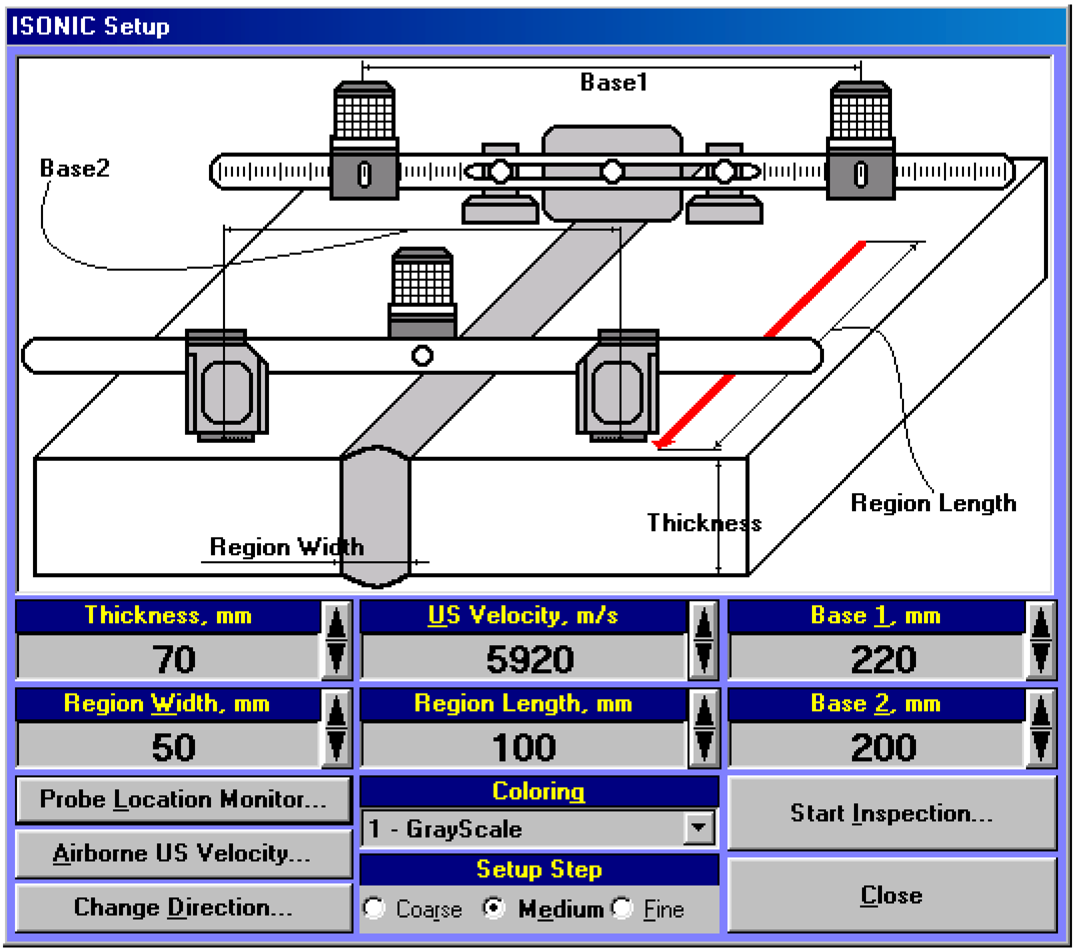
There are two probe names to be keyed in for the implementing of the **authentic TOFD mapping**. The window allowing to key in two probe names appears if the **Pulser Mode** in the **ISONIC Pulser Receiver** window was setup to **Dual**:

There are some inspections requiring capturing of the **RF B-Scan Map** using the single element probe. The window allowing to keying in just one probe name appears if the **Pulser Mode** in the **ISONIC Pulser Receiver** window was setup to **Single**:

Key in new probe name(s) using the simplest *word processing* rules for *Windows Applications*, new name must be not longer than 8 symbols. Click on Apply or press **<Alt>+<A>** on the keyboard.

Click on Close or press **Esc** or **<Alt>+<C>** on the keyboard upon completing

24.6.6. ISONIC System Setup…



<u>Base 1</u> – Distance between the microphones (airborne ultrasound receivers)

The value of **Base 1** must be selected providing the full coverage of the TOFD probe pair manipulation area. To setup or update the value of **Base 1** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<1>** ⇒ **Base <u>1</u>** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Base <u>1</u>** area digit **<u>1</u>** is underlined)
- **Combined**
  - Click on **Base <u>1</u>** ⇒ **Base <u>1</u>** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **Base** is set in **mm** or **in***
*The possible values of increment / decrement for **Base** are:*

Resolution	Metric	Imperial
Fine	*2 mm*	*0.25 in*
Medium	*10 mm*	*0.5 in*
Coarse	*100 mm*	*1 in*

<u>Base 2</u> – Probe Separation

To setup or update the value of **Base 2** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<2>** ⇒ **Base <u>2</u>** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Base <u>2</u>** area digit **<u>2</u>** is underlined)
- **Combined**
  - Click on **Base <u>2</u>** ⇒ **Base <u>2</u>** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **Base** is set in **mm** or **in***
*The possible values of increment / decrement for **Base** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.01 in*
Medium	*10 mm*	*0.1 in*
Coarse	*50 mm*	*1 in*

The value of **Base 2** (Probe Separation) will be stored along with all data in the TOFD Inspection results file and used for automatic calculations of the defects depth and heights in the ISONIC TOFD Postprocessing SW Package (TOFDPP). Hence it's **strictly recommended** to key in the proper value of the **Base 2**

Thickness – Material Thickness

To setup or update the value of **Thickness** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<H>** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Thickness** area letter **h** is underlined)
- **Combined**
  - Click on **Thickness** ⇒ **Thickness** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **Thickness** is set in **mm** or **in***
*The possible values of increment / decrement for **Thickness** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*2 mm*	*0.2 in*
Coarse	*5 mm*	*1 in*

Region Width – the Weld Width

To setup or update the value of **Region Width** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<W>** ⇒ **Region Width** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Region Width** area letter **W** is underlined)
- **Combined**
  - Click on **Region Width** ⇒ **Region Width** fore color changes to white - then use ↑, → , ←, ↓ buttons on the keyboard

*The value for the **Region Width** is set in **mm** or **in***
*The possible values of increment / decrement for **Region Width** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*2 mm*	*0.2 in*
Coarse	*5 mm*	*1 in*

ⓘ
The values of **Thickness** and **Region Width** will be stored along with all data in the TOFD Inspection results file and used for the informative purposes only

US Velocity

To setup the value of **US Velocity** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin
- **Keyboard**
  - Pressing **<Alt>+<U>** ⇒ **US Velocity** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **US Velocity** area letter **U** is underlined)
- **Combined**
  - Click on **US Velocity** ⇒ **US Velocity** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **US Velocity** is set in **m/s** or **in/ms***
*The possible values of increment / decrement for **US Velocity** are:*

Resolution	Metric	Imperial
Fine	*5 m/s*	*0.1 in/ms*
Medium	*100 m/s*	*1 in/ms*
Coarse	*500 m/s*	*10 in/ms*

ⓘ
The value of **US Velocity** must be setup **equally** with **actual longitudinal wave velocity in the object under test**

Region Length – the Scanning Path along / across the weld

To setup or update the value of **Region Length** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin
- **Keyboard**
  - Pressing **<Alt>+<N>** ⇒ **Region Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Region Length** area letter **N** is underlined)
- **Combined**
  - Click on **Region Length** ⇒ **Region Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

*The value for the **Region Length** is set in **m/s** or **in/ms***
*The possible values of increment / decrement for **Region Length** are:*

Resolution	Metric	Imperial
Fine	*1 mm*	*0.05 in*
Medium	*2 mm*	*0.2 in*
Coarse	*5 mm*	*1 in*

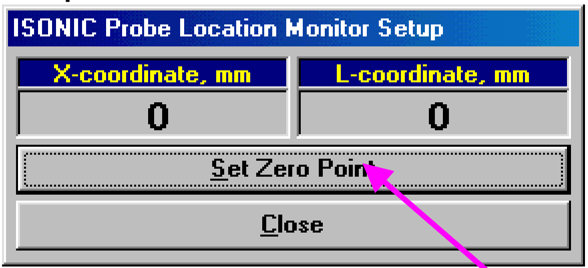
Setup Dynamic Parameters and Modes

Scanning Direction – Scanning across or along the weld

Click on **Change Direction** or press **<Alt>+<D>** on the keyboard to select scanning direction either along or across the weld. The corresponding indication is provided.

Selection of the scanning start point (Zero Point)

Click on **Probe Location Monitor...** or press **<Alt>+<L>** on the keyboard to open the **ISONIC Probe Location Monitor Setup** window



Place TOFD probe(s) into the start scanning position then click on or press **<Alt>+<S>** on the keyboard

To return back to **ISONIC Setup** window click on **Close** or press **<Alt>+<C>** or **Esc** on the keyboard

ⓘ
It's necessary to perform the above procedure **prior to each scanning**

Airborne Ultrasound Velocity

Refer to the paragraph 7.6.5 of this Operating Manual

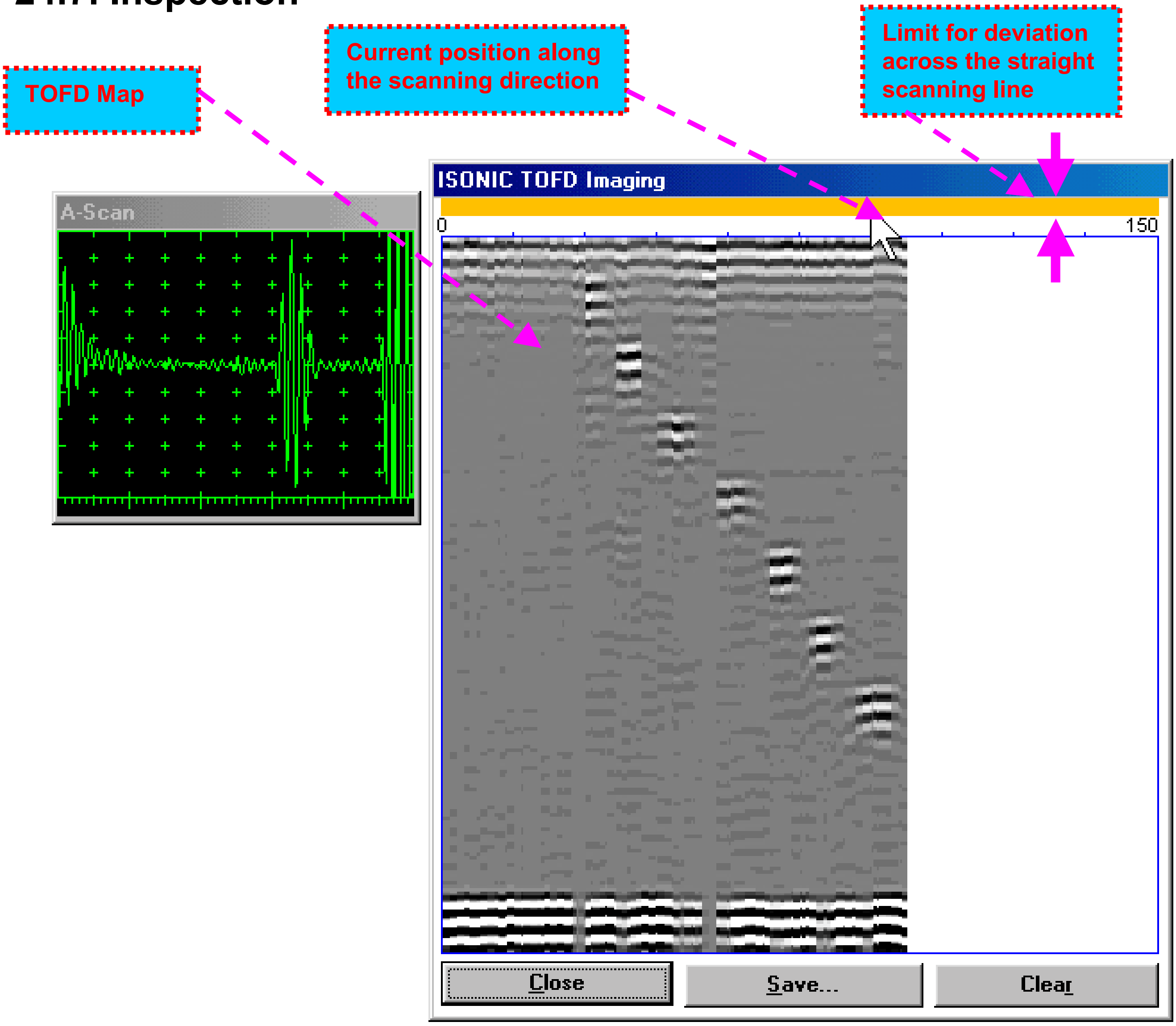
Coloring (palette)

To select the coloring protocol for the TOFD map – **Gray** or **Thermal** refer to the paragraph 7.6.5 of this Operating Manual

Start TOFD Inspection

Click on **Start Inspection...** or press **<Alt>+<I>** on the keyboard

24.7. Inspection



The above screenshot illustrates the typical screen while scanning using the **TOFD** software. The target of operator is to fill *TOFD Map* area completely providing the coupling integrity while scanning along the selected direction. It's possible to return to the areas, which were scanned with inadequate coupling and to rescan them

Refer to the paragraph 7.7 of this Operating Manual to get instructed on control **ISONIC** while scanning

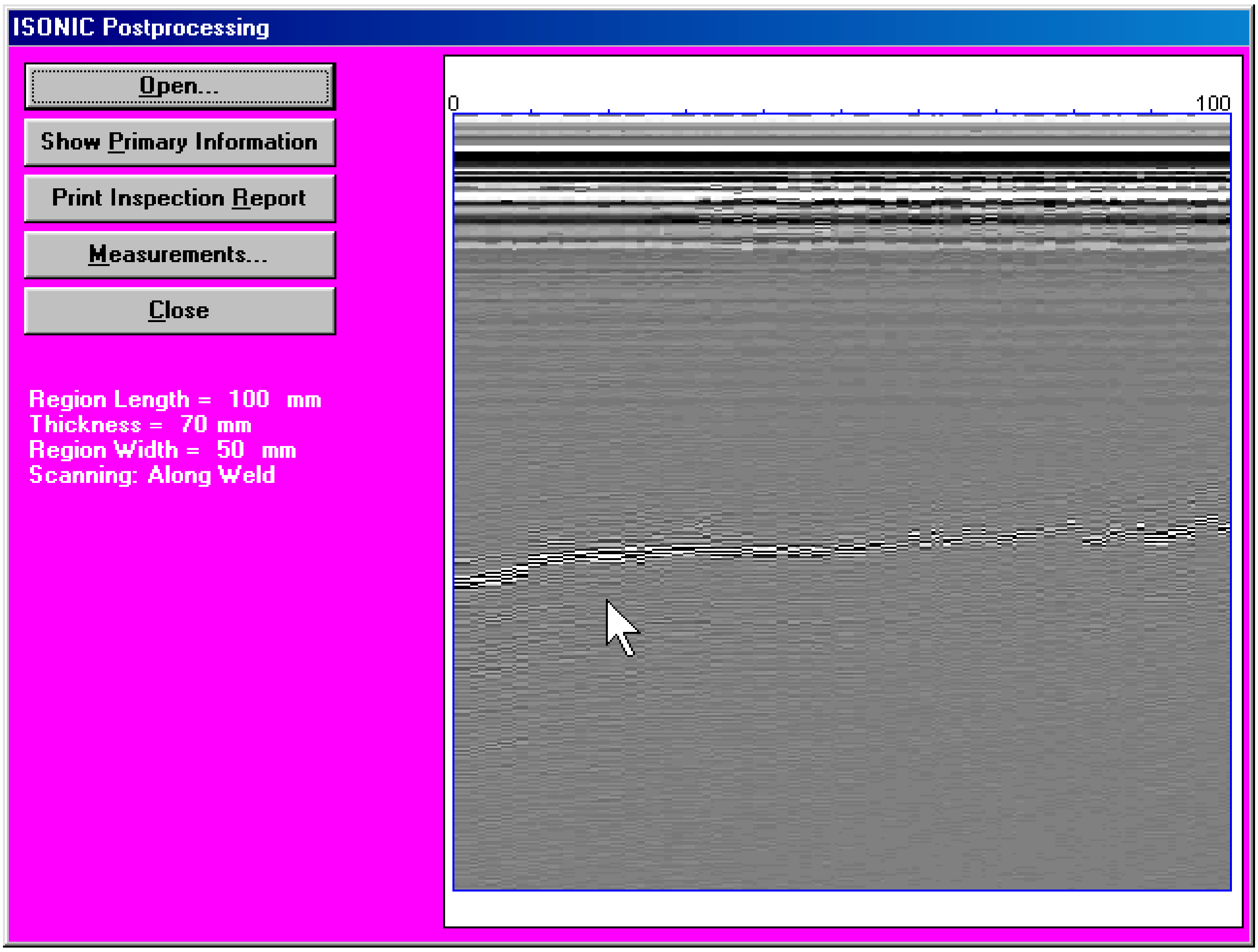
24.8. Postprocessing

Refer to paragraph 7.8 of this Operating Manual and to the figures below. For the off-line TOFD image processing and defects sizing refer to the Chapter 22 of this Operating Manual

TOFD Postprocessing hints

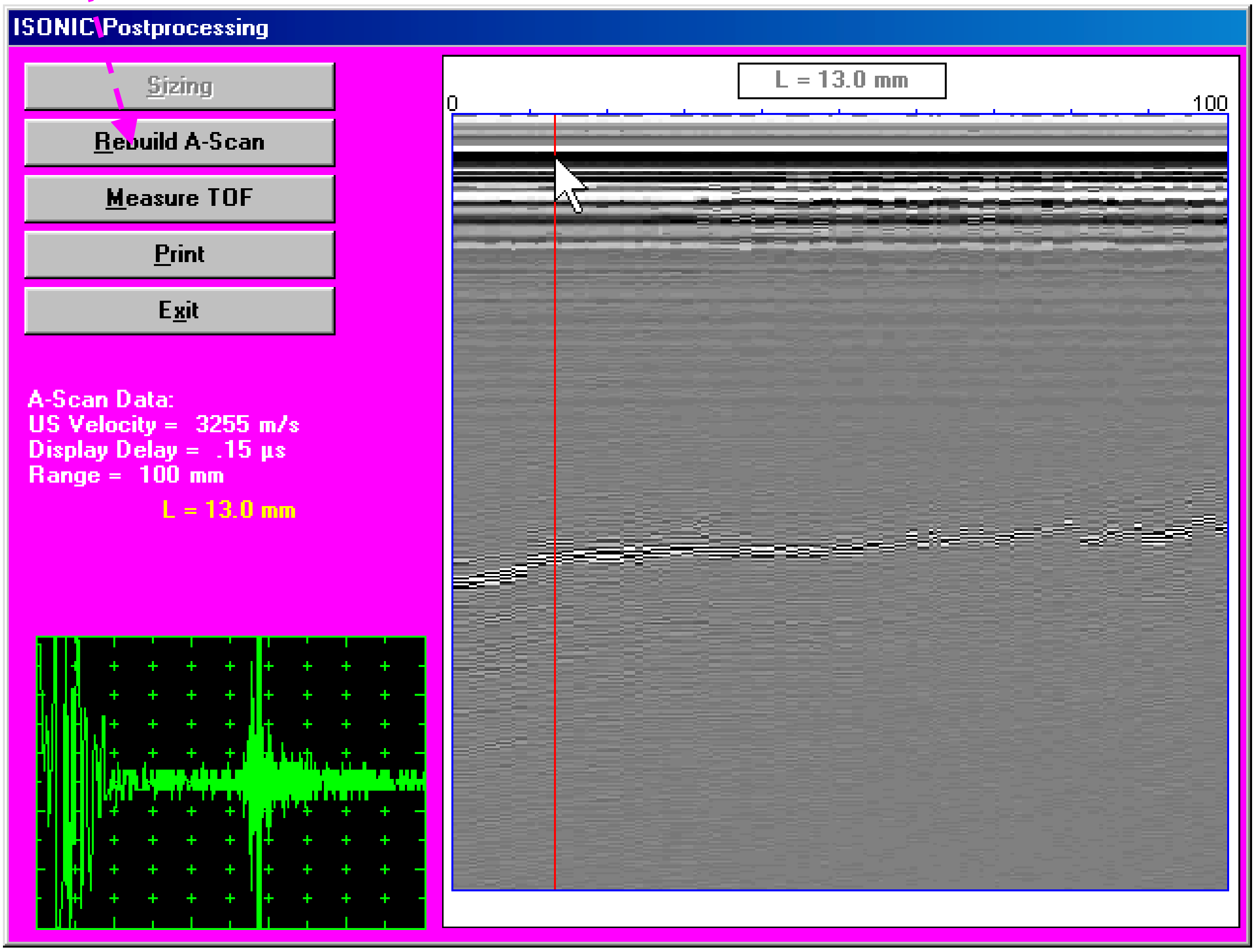
After loading results from a file the captured *TOFD Map* screen appears. Click on 

or or press **<Alt>+<M>** on the keyboard to start the off-line data analysis



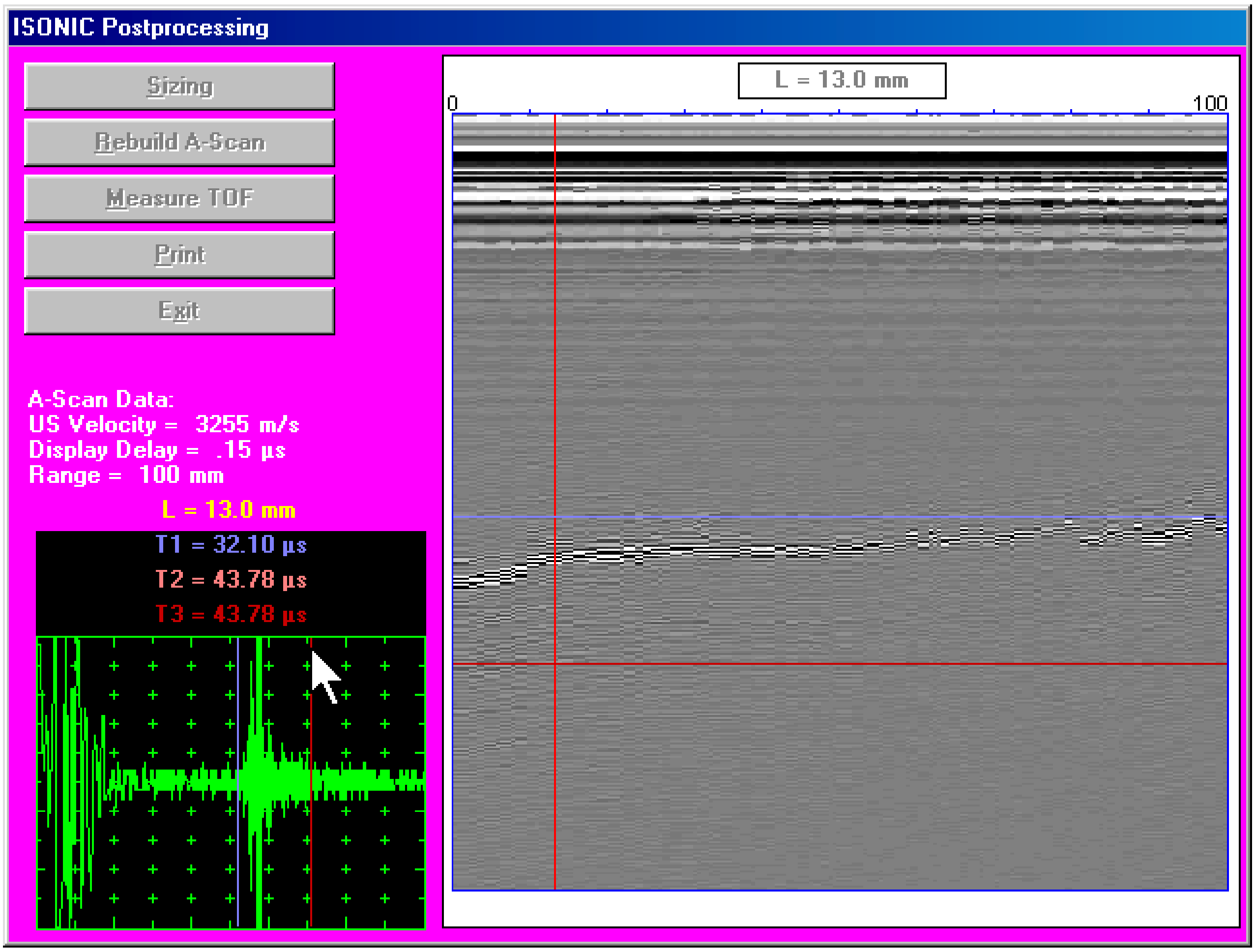
Rebuild the A-Scan observed along the scanning path

Click on or press **<Alt>+<R>** on the keyboard to rebuild the A-Scan



The mouse guided measuring line appears – place it at the selected place of TOFD Map and left mouse click – the recovered A-Scan appears

Click on **Measure TOF** or press **<Alt>+<M>** on the keyboard to place *Time of Flight Markers* on the recovered A-Scan and TOFD map – there are up to 3 markers available



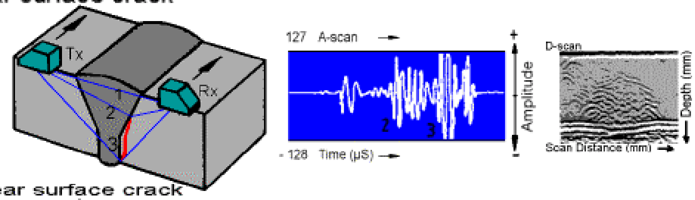
To zoom A-Scan just click on it

To print measurements results including TOFD Map and A-Scan with markers click on **Print** or press **<Alt>+<P>** on the keyboard

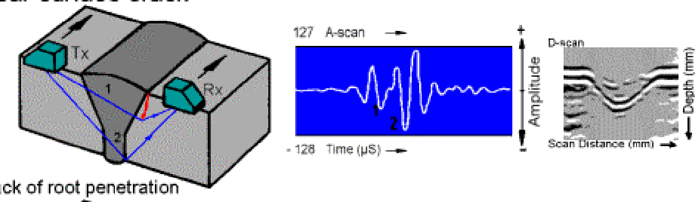
To end measurements click on **Exit** or press **<Alt>+<X>** or press **Esc** on the keyboard

Some typical *TOFD Images* are presented below (BS 7706):

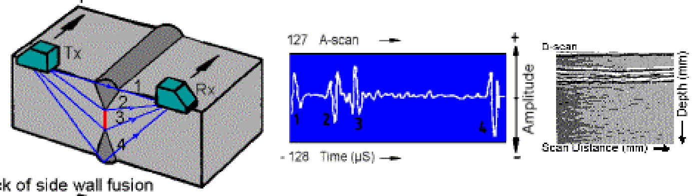
Far surface crack



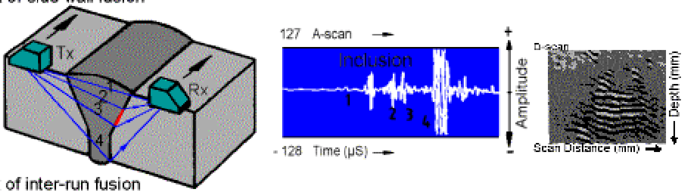
Near surface crack



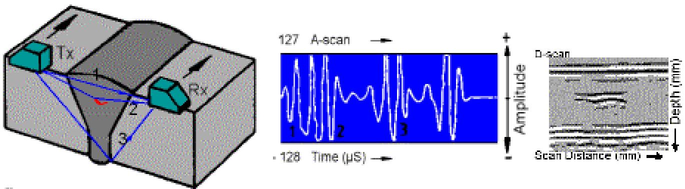
Lack of root penetration



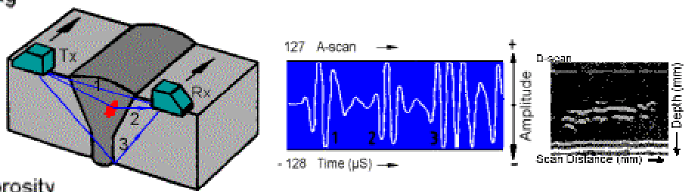
Lack of side wall fusion



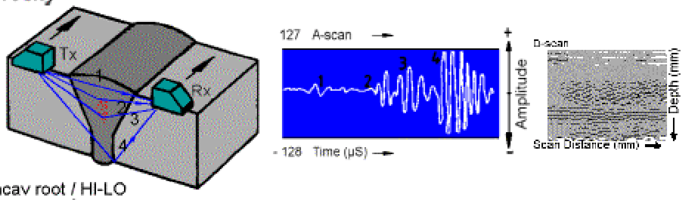
Lack of inter-run fusion



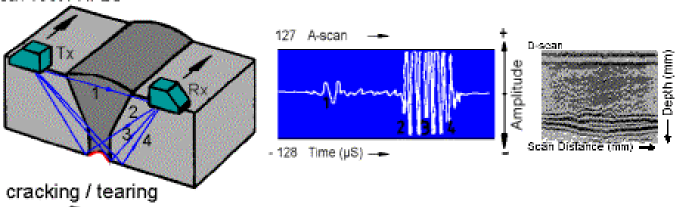
Slag



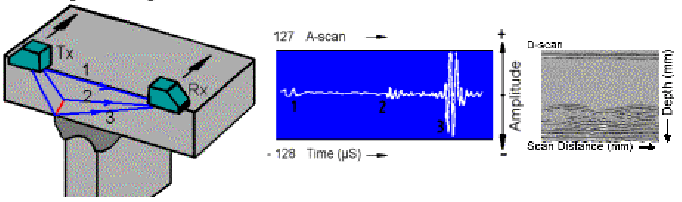
Porosity



Concav root / HI-LO



Toe cracking / tearing



25. Operating 'EasyTOFD' Software Package - ISONIC EasyTOFD

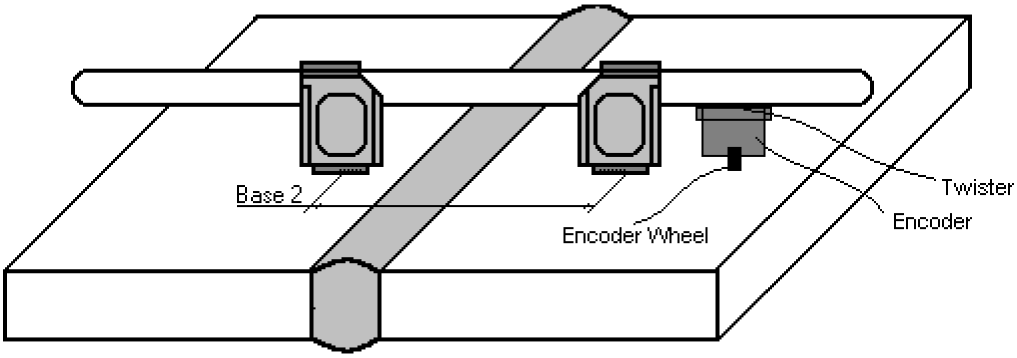
The contents of this chapter is valid for the EasyTOFD SW Package version 1.0.0.9 or higher

25.1. Preparing for the Inspection

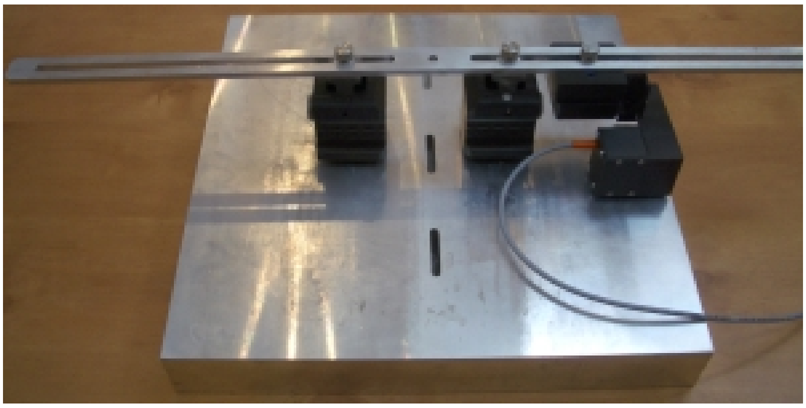
25.1.1. Fixture

Insert ultrasonic probes into their probe holders then:

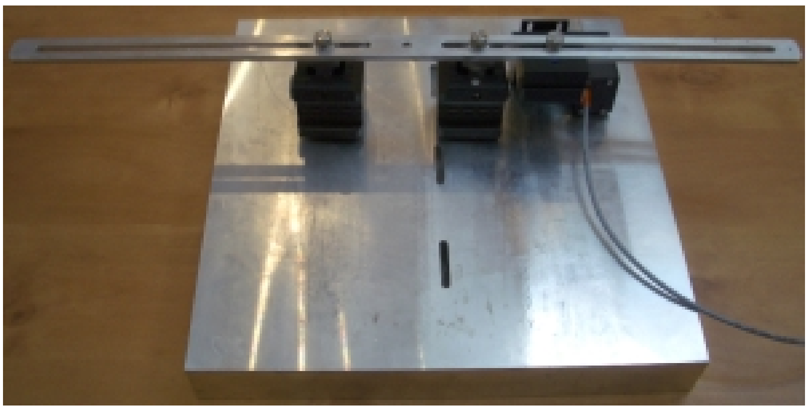
- fix the probe holders with the TOFD probes on the rail at the necessary **Base 2** distance (**Base 2** is the probes separation – refer to the below paragraph 20.6.4)
- fix the incremental encoder on the TOFD rail behind one of the TOFD probes. The encoder's wheel must be oriented at parallel to the desired probes' trace either along or across the weld using the twister



TOFD Fixture and encoder positioning for scanning along the weld



TOFD Fixture and encoder positioning for scanning across the weld



25.1.2. Cabling

Ultrasonic Flaw Detector PC Card	Applicable Cabling Scheme	Paragraph
UDS 3-4	B.6; B.7	4.2.5
UDS 3-3	B.8; B.9	4.2.5
USLT 2000	B.10	4.2.5

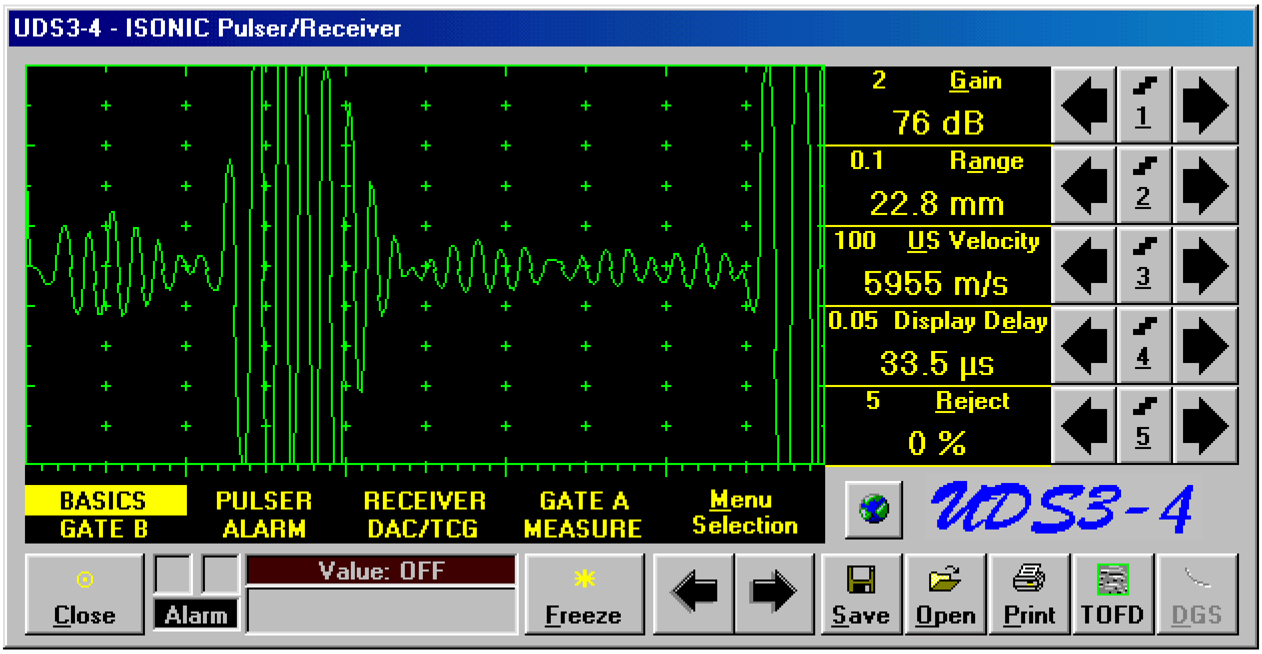
25.2. Start Up

Double click on the icon 

located on the **ISONIC** desktop

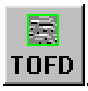
25.3. Getting started...

The *Pulser Receiver Setup* screen appears upon starting the **EasyTOFD** software package. The operating surface is identical to the **PULREC – ISONIC Pulser Receiver** software package, which is explained in details in the Chapter 5 of this Operating Manual

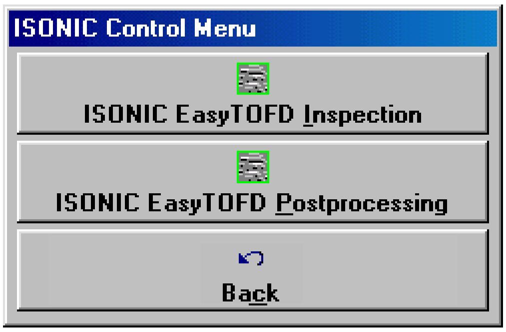


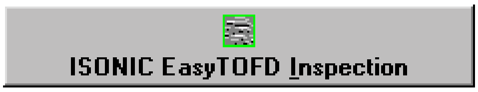
Provide the necessary settings according to the instructions of the paragraph 20.6.4 of this Operating Manual

25.4. Inspection and Postrocessing

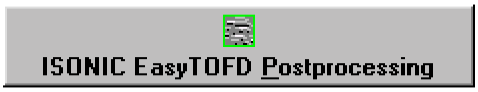
Click on 

. The following intermediate window appears:

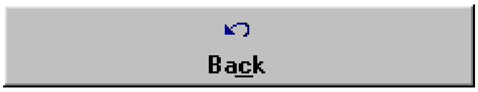


To proceed further with the scanning click on 

or press **<Alt>+<I>** on the keyboard

For the off-line analysis of the stored data click on 

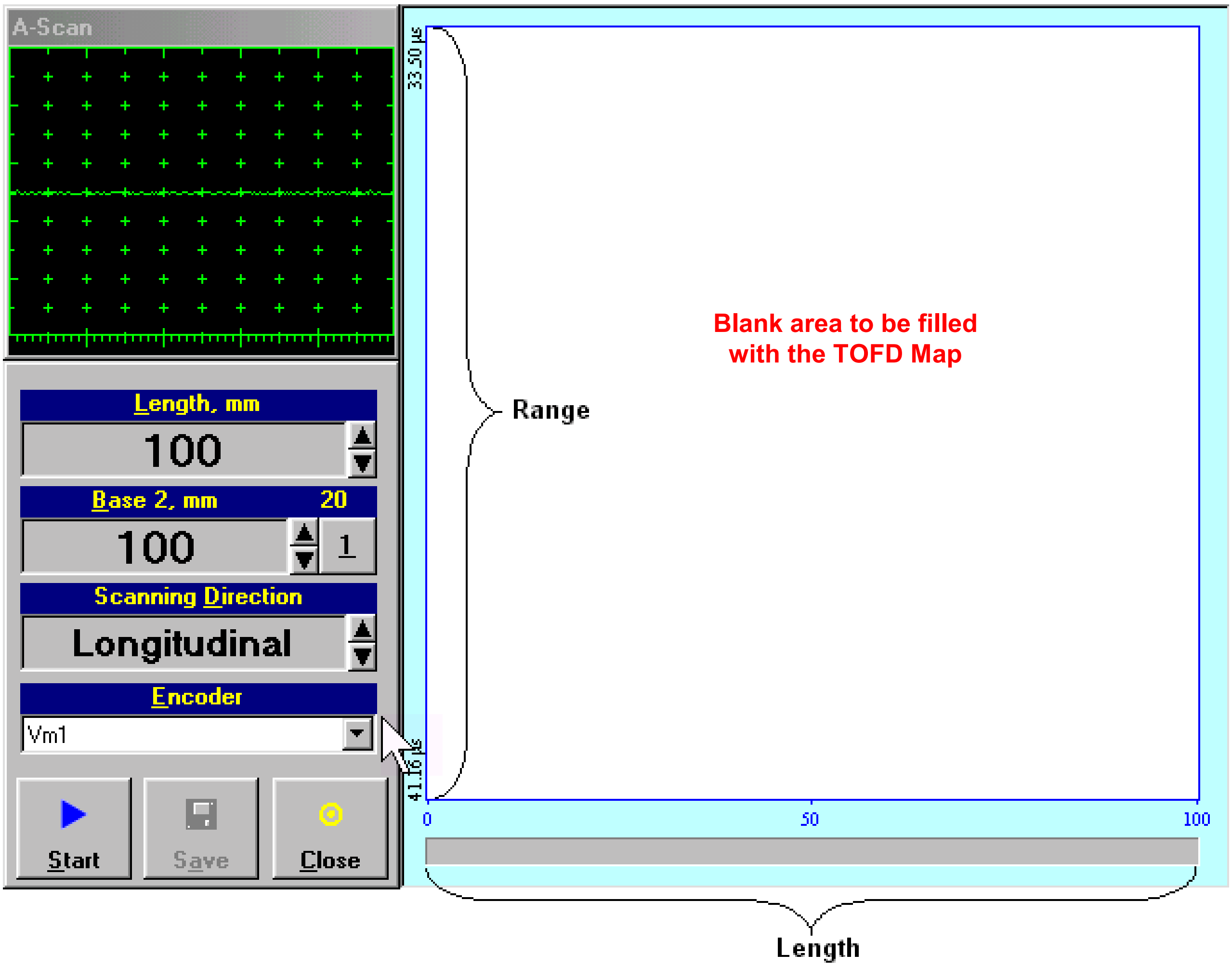
or press **<Alt>+<P>** on the keyboard

To return to **ISONIC Pulser Receiver** window click on 

or press **<Alt>+<C>** or **Esc** on the keyboard

25.4.1. Scanning

The following screen appears prior to the first EasyTOFD scanning session



Length

The **Length** of the scanning line may be setup through the following manipulations

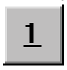
- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<L>** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (due to the letter **L** is underlined)
- **Combined**
  - Click on **Length** ⇒ **Length** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of the **Length** may vary from **100** to **1000 mm** (or **4** to **40 in**) in **50 mm** (or **2 in**) resolution

Base 2 (Probes Separation)

The value of **Base 2** may be setup through the following manipulations

- **Mouse**
    - Click on the corresponding spin 
- **Keyboard**
    - Pressing **<Alt>+<B>** ⇒ **Base 2** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (due to the letter **B** is underlined)
- **Combined**
    - Click on **Base 2** ⇒ **Base 2** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of the **Base 2** may vary from **25** to **500 mm** (or **1** to **20 in**) in **1 mm** (or **0.05 in**) resolution. The increment of the **Base 2** modifying may be selected through the clicking on 

or pressing **<Alt>+<1>** on keyboard

Scanning Direction

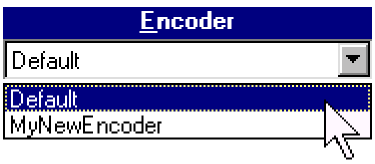
The **Scanning Direction** may be selected through the following manipulations

- **Mouse**
    - Click on the corresponding spin 
- **Keyboard**
    - Pressing **<Alt>+<D>** ⇒ **Scanning Direction** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (due to the letter **D** is underlined)
- **Combined**
    - Click on **Scanning Direction** ⇒ **Scanning Direction** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

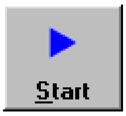
There are two possible **Scanning Directions – Longitudinal** (along the weld) and **Transversal** (across the weld)

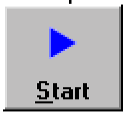
Encoder Selection

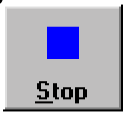
Select the encoder to be used and mouse click on its name:

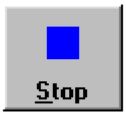


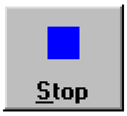
Scanning

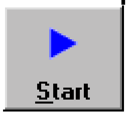
Clicking on 

or pressing **<Alt>+<S>** on the keyboard starts scanning and recording of the **EasyTOFD Map**. The 

button becomes invisible since the recording of the **EasyTOFD Map** starts. The 

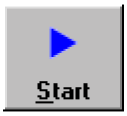
button occupies its position. Clicking on 

or pressing **<Alt>+<S>** on the keyboard will complete recording of the **EasyTOFD Map**. The 

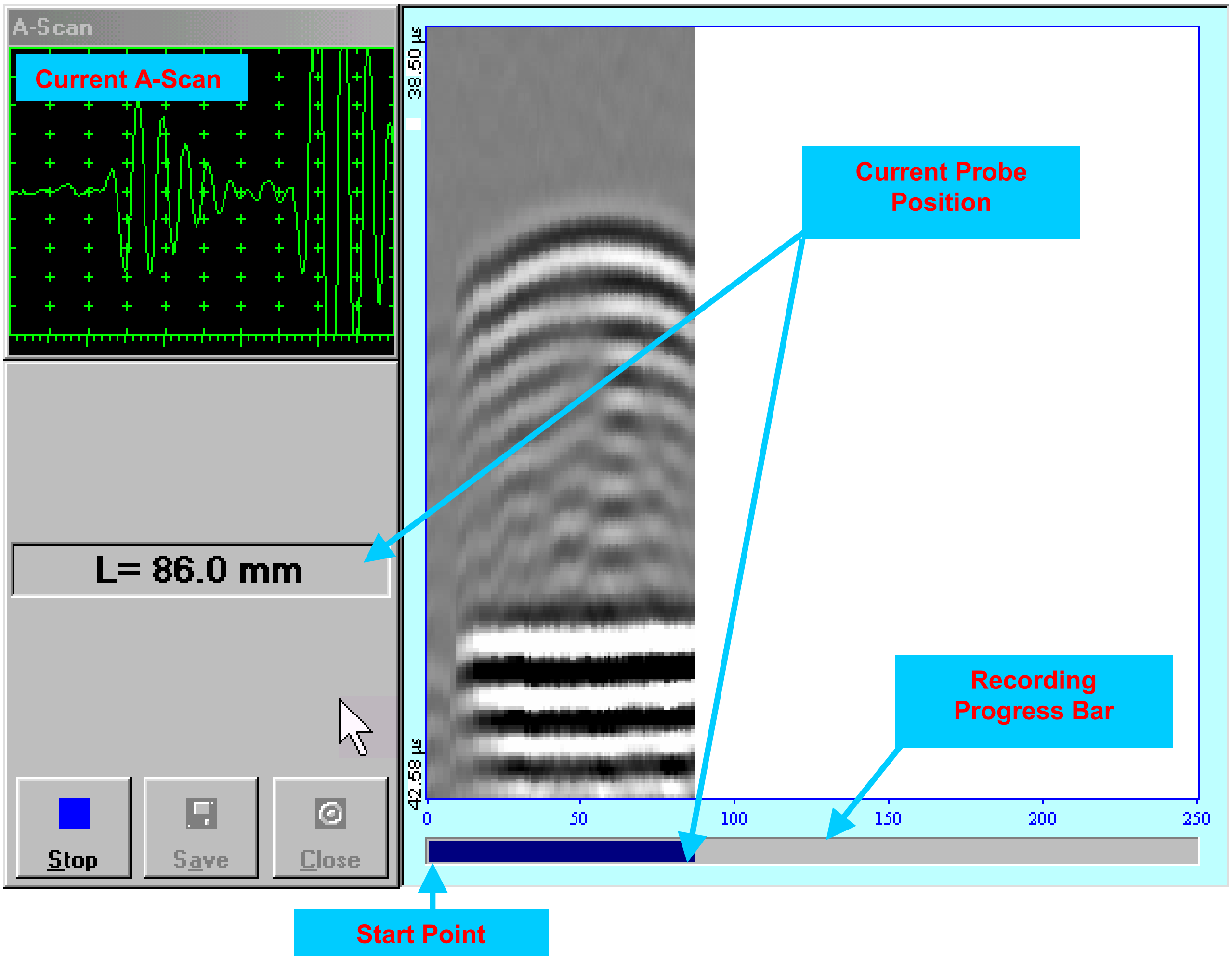
button becomes invisible after completion of the **EasyTOFD Map** recording. The 

button returns to its position

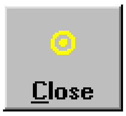
To capture the **EasyTOFD Map**:

- Place the *TOFD Probes Pair* equipped with the encoder onto the start point of the selected scanning line and click on 

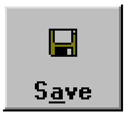
or press **<Alt>+<S>** on the keyboard
- Guide the *TOFD Probes Pair* over the scanning line: the recording progress bar moves synchronously with the probes in both directions – the typical display during the scanning is shown and explained below



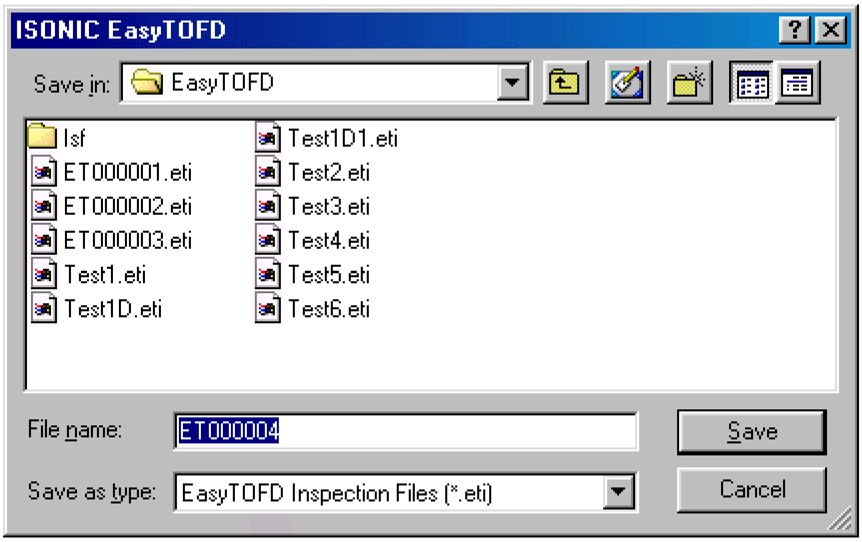
Other Controls

Click on 

or press **<Alt>+<C>** or **Esc** on the keyboard to return to the **ISONIC Pulser Receiver** window

Click on 

or press **<Alt>+<A>** on the keyboard to save the inspection results. The saving procedure corresponds to the regular Windows protocols:



25.4.2. Postprocessing

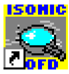
The off-line analysis and (postprocessing) of the inspection results is implemented in the **EasyTOFD** SW Package identically to the **TOFDPP** SW Package → refer to the Chapter 22 of this Operating Manual

26. Operating 'TOFDPP' Software Package - ISONIC TOFD Postprocessing

The contents of this chapter is valid for the
TOFDPP SW Package version 2.0.0.2 or higher

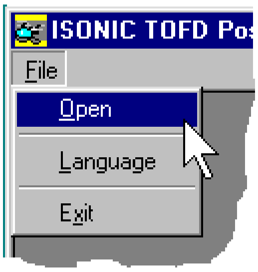
TOFDPP - ISONIC TOFD Postprocessing software package may run either in the **ISONIC** unit or in the regular PC equipped with Windows™ 98, 2000 or XP operating system

26.1. Start Up

Double click on the icon 

located on the **ISONIC** desktop or click on *Start* then select *Programs* ➪ *ISONIC* ➪ *ISONIC TOFD Postprocessing*

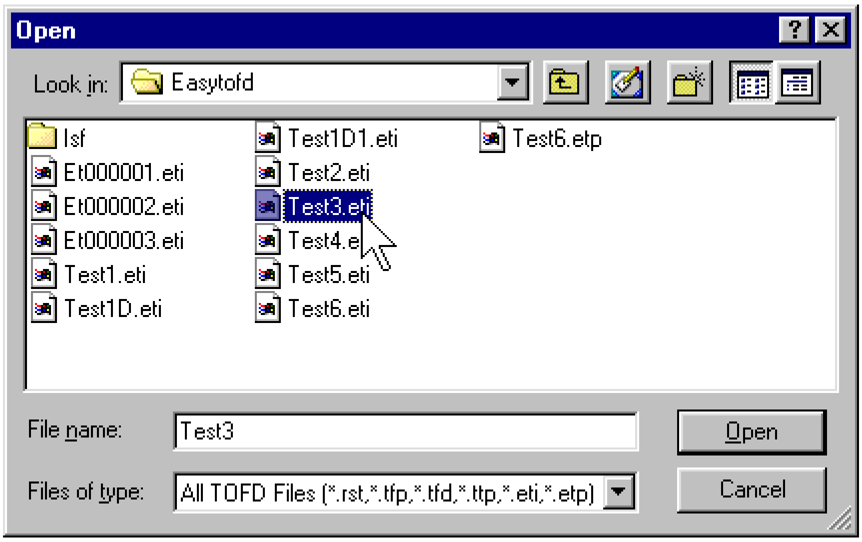
26.2. Opening ISONIC TOFD File (*.rst) / TOFD Postprocessing File (*.tfp) / EasyTOFD File (*.eti) / EasyTOFD Postprocessing File (*.etp)/ t-TOFD file (*.tfd) / t-TOFD Postprocessing file (*.ttp)



Select **File** then **Open** to open the file

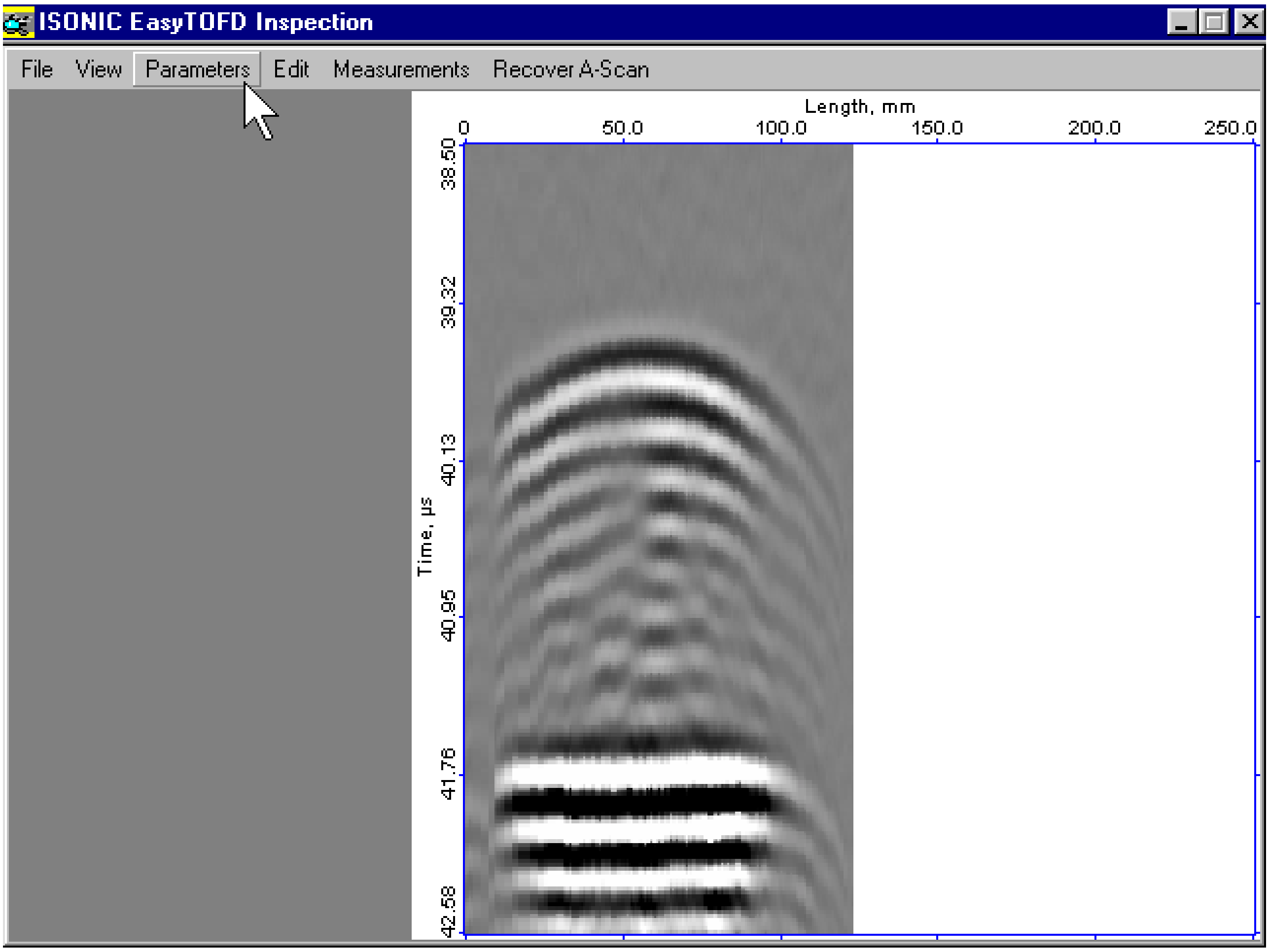
Click on **Language** to select the User Interface language

Select **Exit** to end the **TOFD Postprocessing**

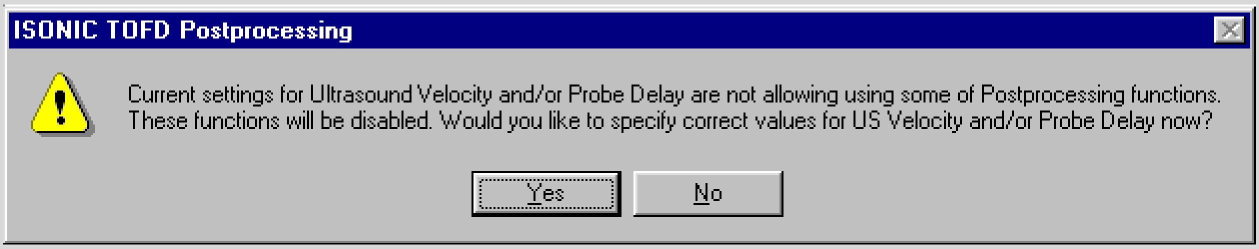


Select the file to open: the files located on the local disks or on the disks of the remote computers and **ISONIC** units connected to the local area networking and having the shared directories are available for the download. To open the file double click on its name

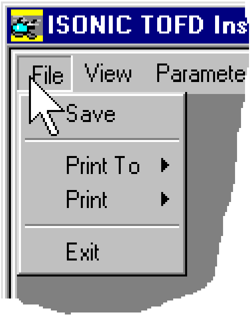
The **TOFD Map** appears and the **TOFD Postprocessing Menu** becomes active



Depending on the **ISONIC** setup whilst capturing the TOFD map the following notice may be generated upon opening the file:

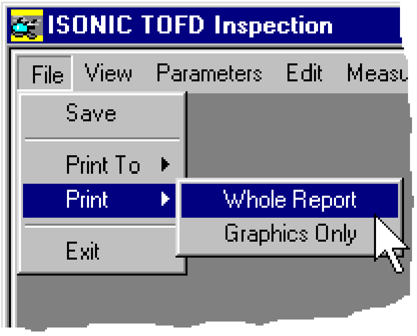


26.3. Submenu 'File'



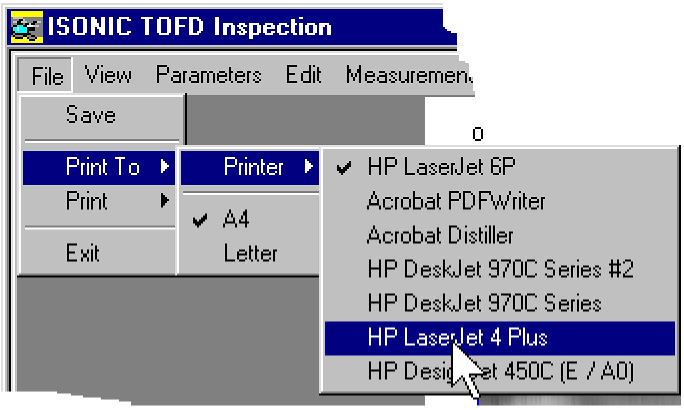
Submenu **File** of the **TOFD Postprocessing Menu** allows the following operations:

- **Save** – saving the **TOFD** Postprocessing file (***.tfp**) or **EasyTOFD** Postprocessing file (***.etp**) or **t-TOFD** Postprocessing file (***.ttp**) created entire the postprocessing session - follow the regular rules for saving files in Windows™ environment
- **Print To** – selection of the printer and paper size
- **Print** – print the results of postprocessing procedures
- **Exit** – exit to the **ISONIC TOFD Postprocessing** startup window



Print ➪ Whole Report prints out the graphical page including the current **TOFD Map** on the screen accompanied with measurements marks and results and appropriate **A-Scan** if existing along with inspection and setup data

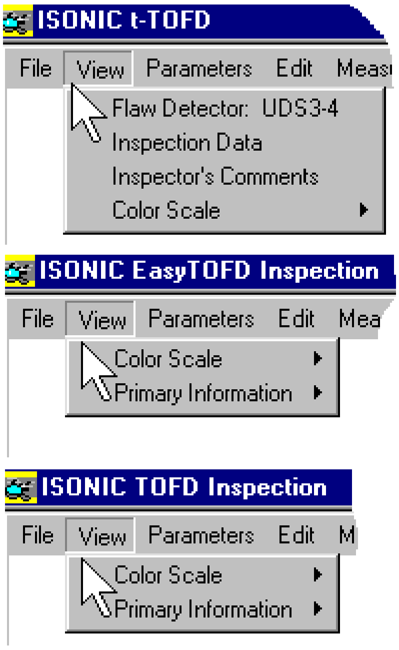
Print ➪ Graphics Only prints out only the graphical page including the current **TOFD Map** on the screen accompanied with measurements marks and results and appropriate **A-Scan** if existing



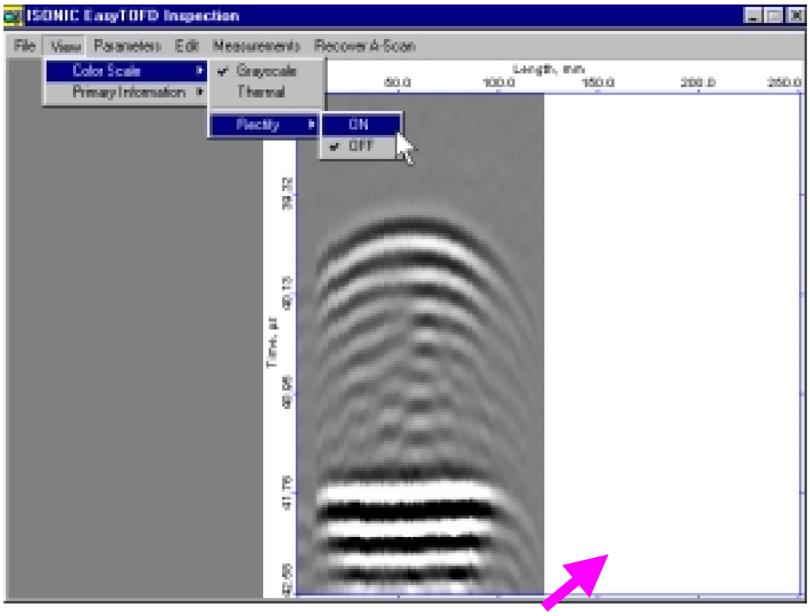
Print ➪ Print To allows printer and paper size selection

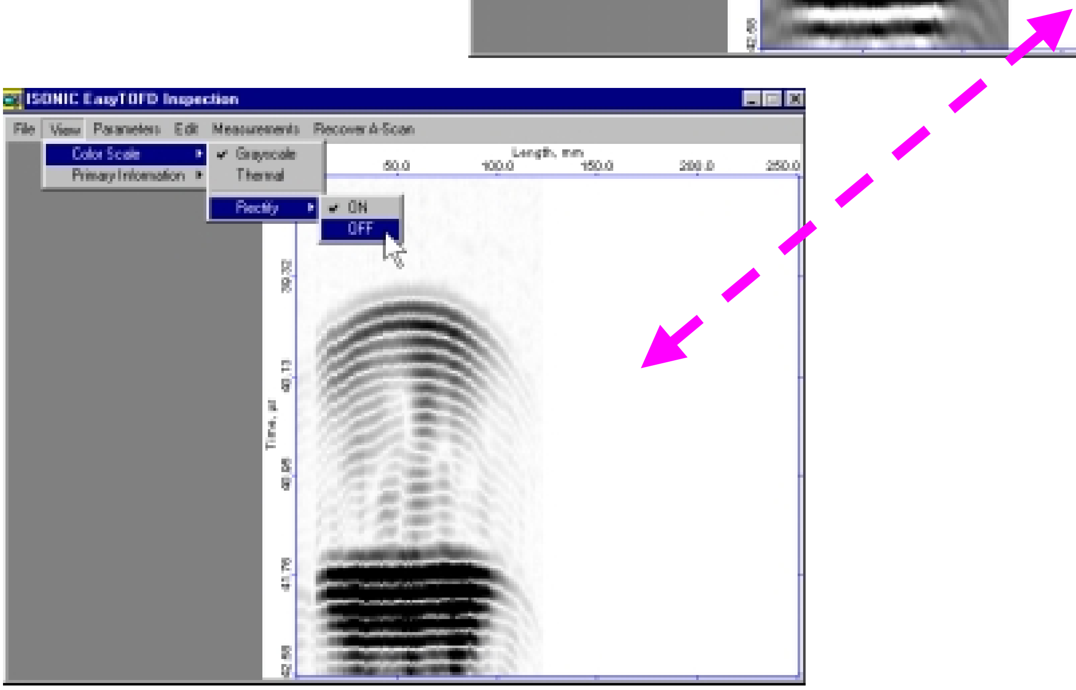
26.4. Submenu 'View'

Depending on the SW Package used for capturing of the **TOFD Map** the Submenu **View** may look as below:

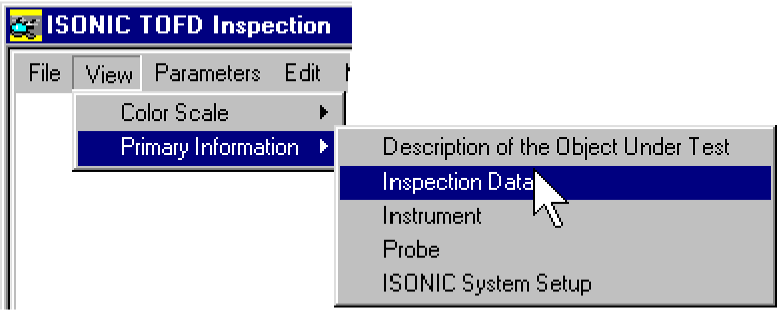


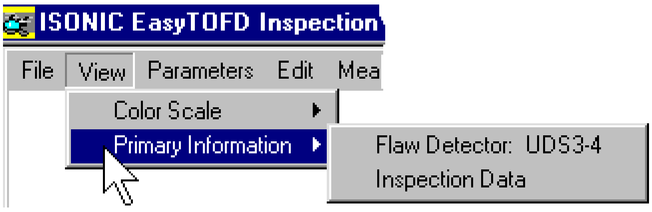
The **Color Scale** topic allows selecting between **Grayscale** and **Thermal** representation of the **TOFD Map** as well as to present it either in RF (i.e. raw) or rectified form. The screenshot below illustrates an example of the **TOFD Map** rectifying observed for the file captured using **EasyTOFD** SW Package





The rectifying may be useful for better resolving of the **TOFD Map** segments corresponding to the *weakest signals*





Primary Information – allows to preview all data related to the captured **TOFD Map**

- **Description of the Object Under Test** (keyed in prior to scanning – **TOFD** SW Package; ***.rst** and ***.tfp** files)
- **Inspection Data** (keyed in prior to scanning – **TOFD** SW Package; ***.rst** and ***.tfp** files)
- Ultrasonic **Instrument** setup made prior to scanning – all SW Packages and kinds of files
- **Probe**(s) name(s) (keyed in prior to scanning – **TOFD** SW Package; ***.rst** and ***.tfp** files)
- **ISONIC System Setup** predecessing the scanning (keyed in prior to scanning – **TOFD** SW Package; ***.rst** and ***.tfp** files)
- **Inspector's Comments** (keyed in prior to scanning – **PULREC** SW Package – **t-TOFD** mode; ***.tfd** and ***.ttp** files)

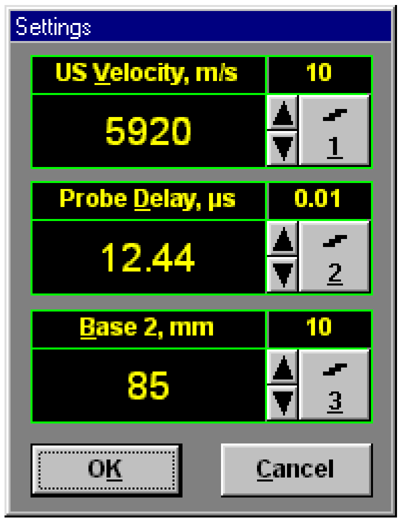
ⓘ
Access to the **Primary Information** data is available directly through the **View** Submenu for the ***.tfd** and ***.ttp** files related to the **PULREC** SW Package – **t-TOFD** Mode

26.5. Submenu 'Parameters'

Click on the **Parameters** → the **Settings** subwindow appears allowing to vary the following 3 parameters:

- **US Velocity** (Ultrasonic Wave Velocity in the Object Under Test – Longitudinal Waves)
- **Probe Delay** – refer to the paragraph 19.6.4 of this Operating Manual
- **Base 2** (Probes separation)

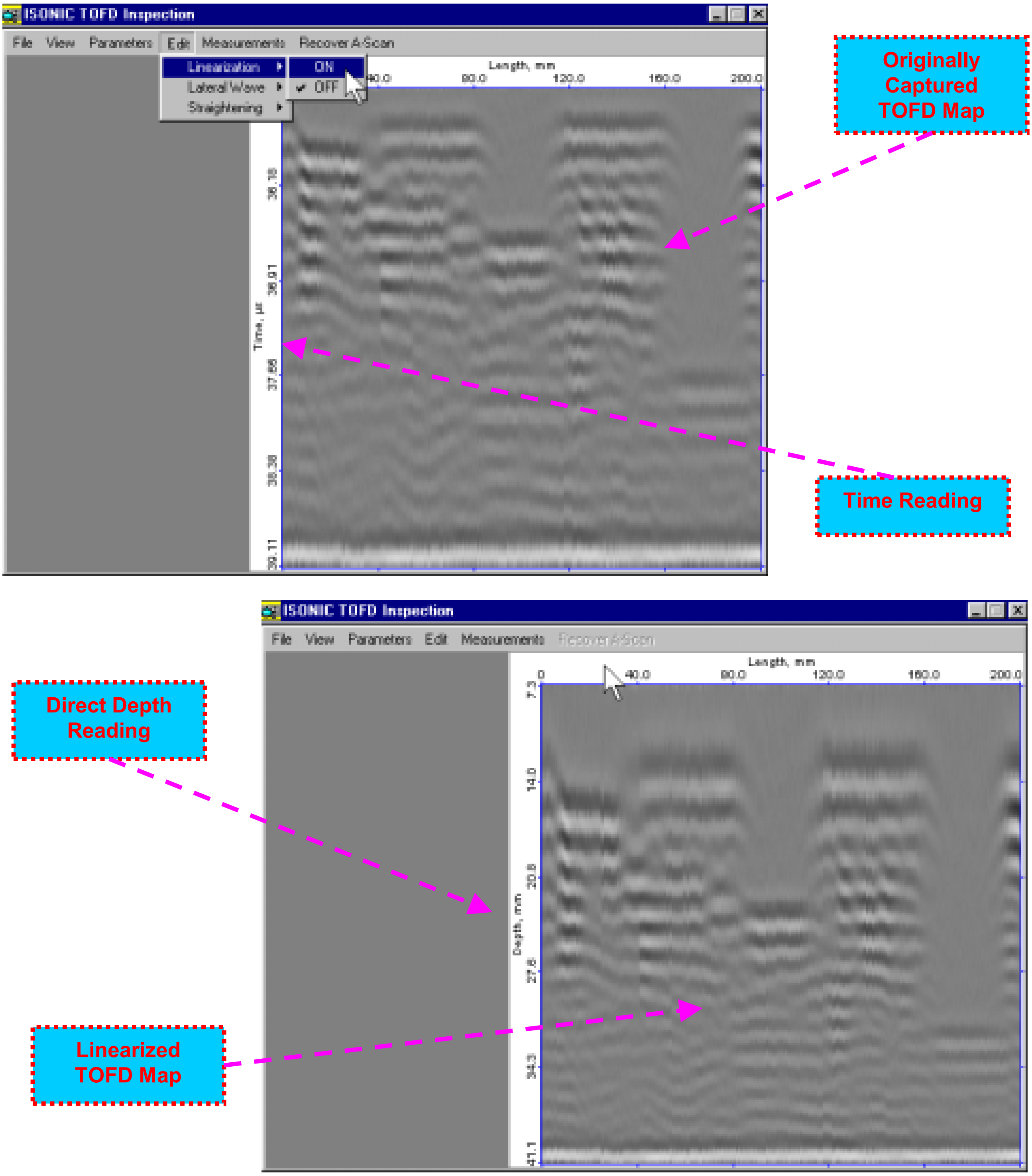
The varying of these parameters may be necessary for the procedures belonging to the **Edit** and **Measurements** submenus. The target of such varying is eliminating of the inaccuracies in the defining and keying in of the said parameters that could occur at the pre-inspection stage



26.5. Submenu 'Edit'

26.5.1. Linearization

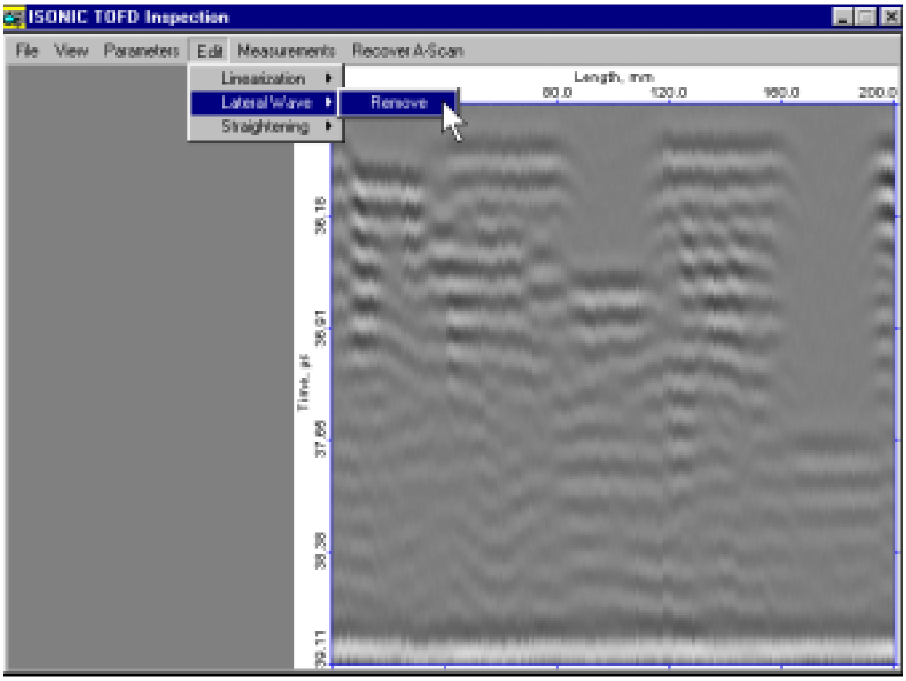
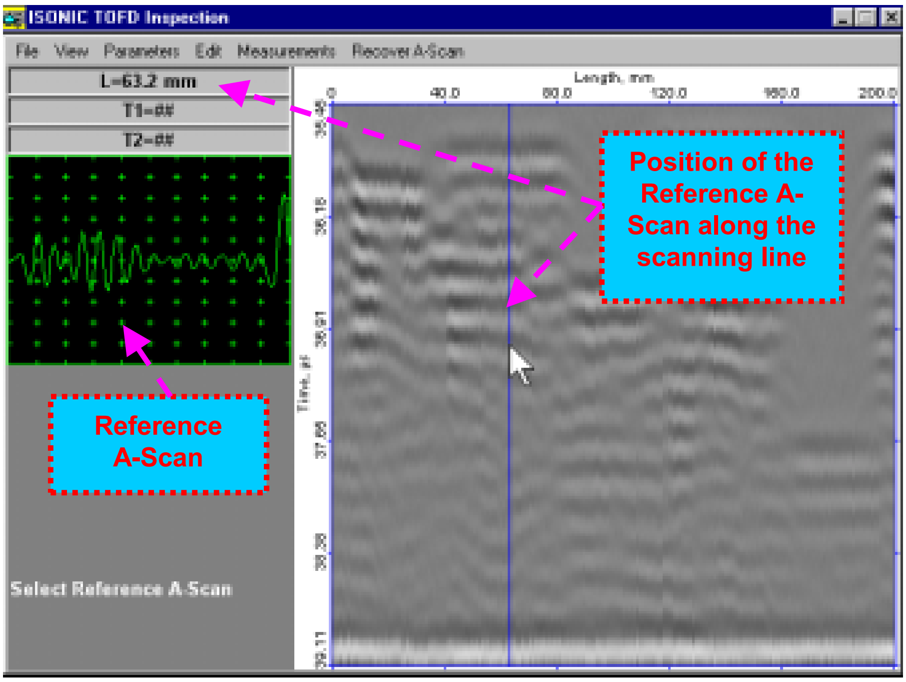
To correct for the non-linearity of the beam angle spread this function converts the vertical axis and the whole **TOFD Map** so that a direct depth reading becomes available. To invoke this function select **Edit ➪ Linearization ➪ On**

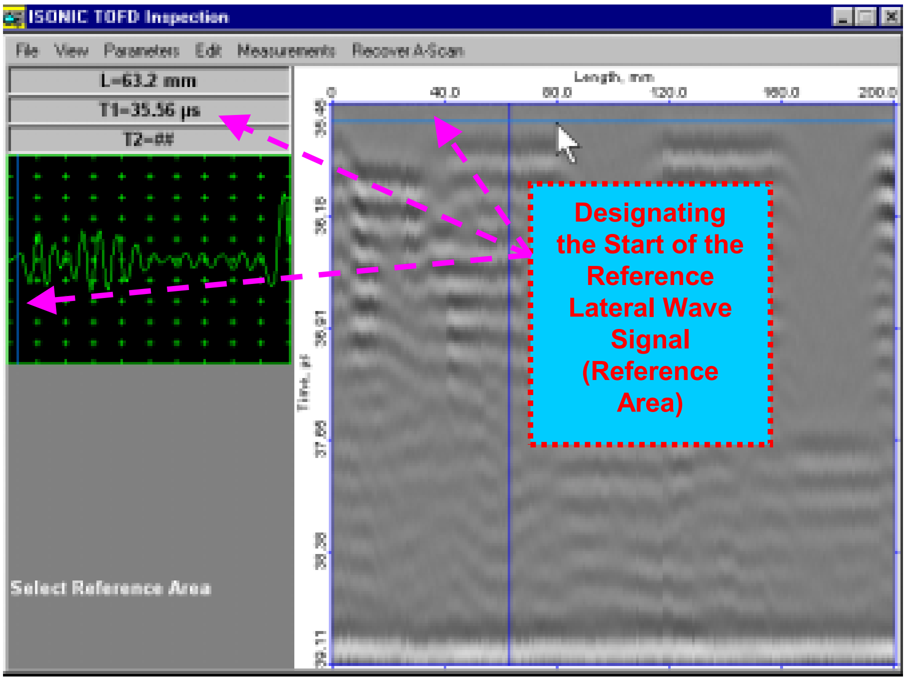
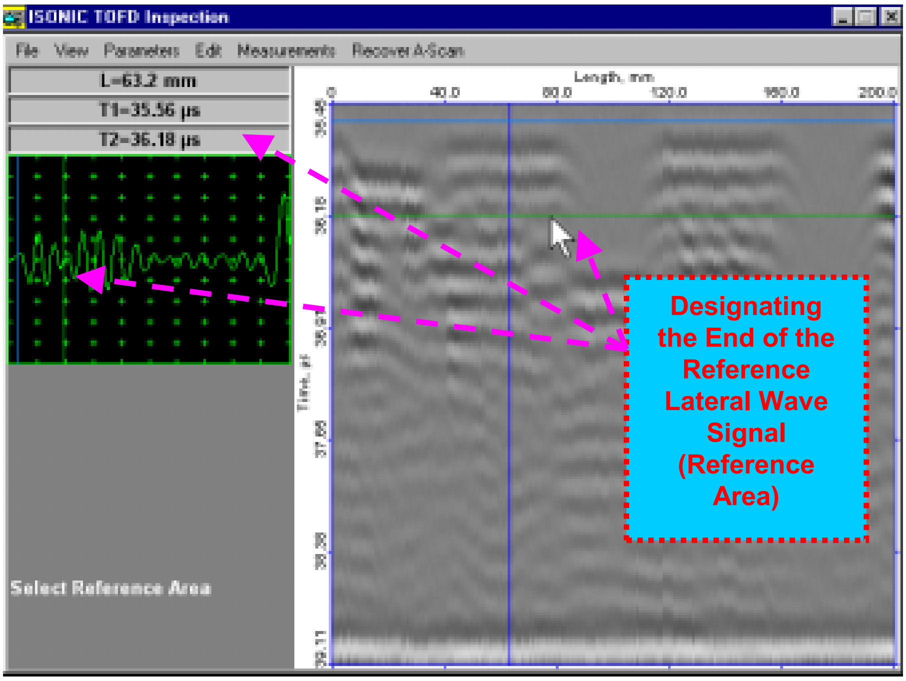


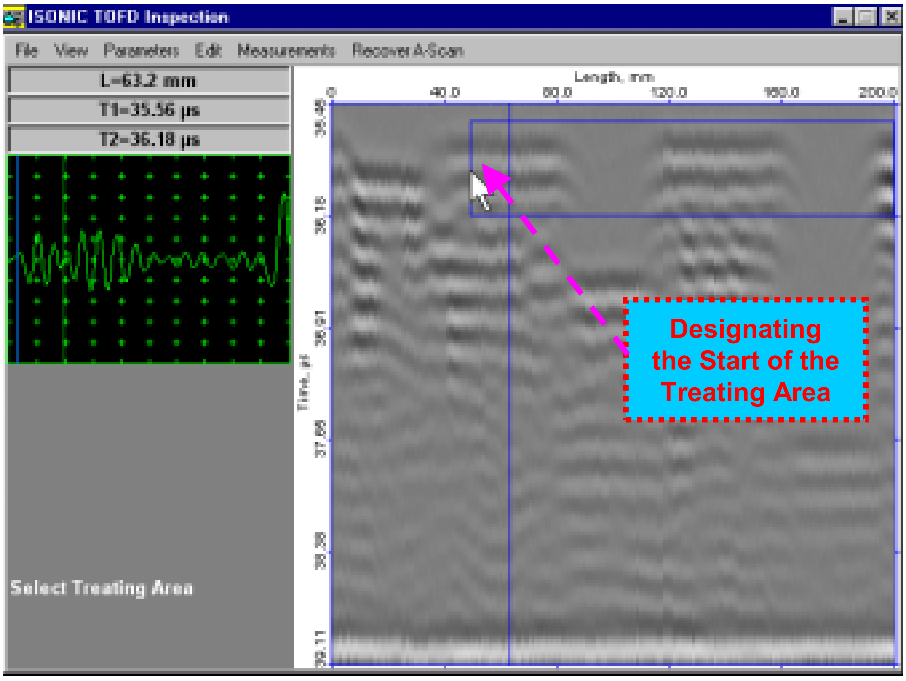
To negate this function select **Edit ➪ Linearization ➪ Off**

26.5.2. Lateral Wave Treating

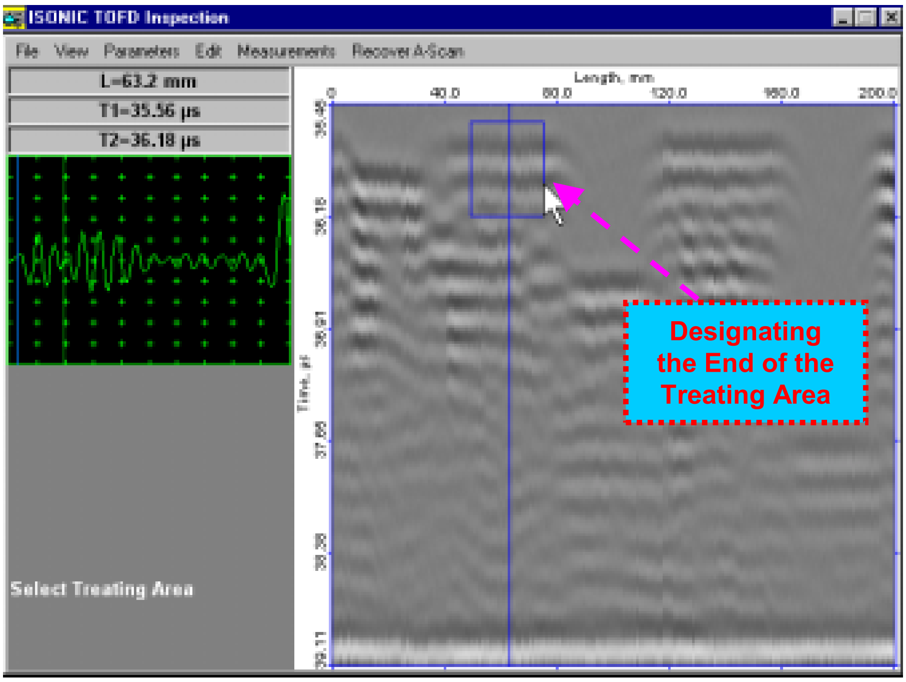
The removal of the *Lateral Wave* allows detection of near surface cracks/defects, which may have been obscured by the *Lateral Wave* itself. To start the *Lateral Wave Treating*, select **Edit ➩ Lateral Wave ➩ Remove…**. A series of horizontal and vertical cursors appear allowing selecting of the reference **A-Scan**, the *Reference Area* (i.e. the *Reference Lateral Wave Signal*), and the *Treating Area*. The sequence of the screenshots below illustrates all manipulations related to the *Lateral Wave Treating*

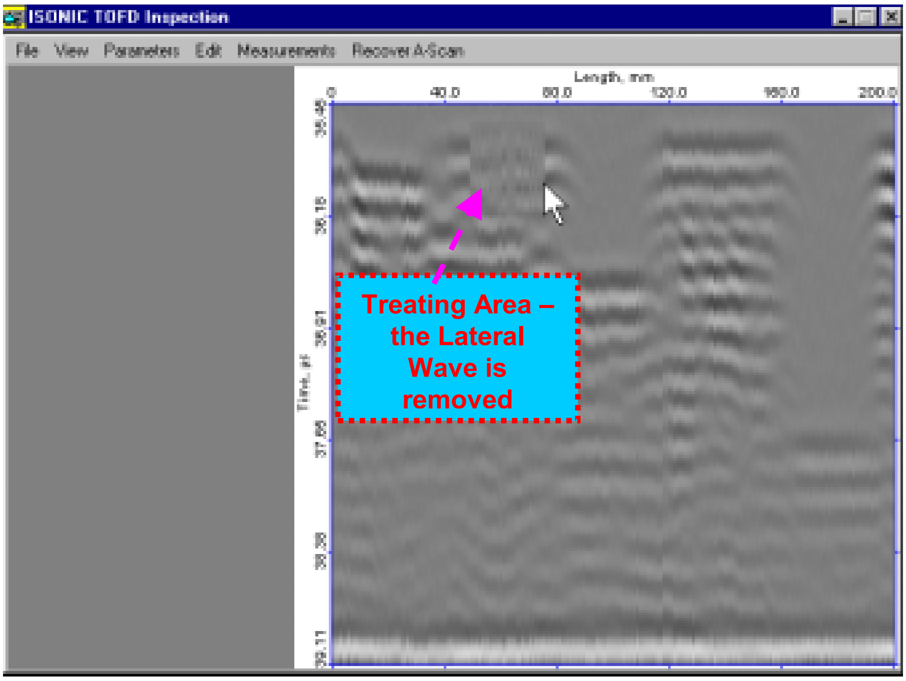
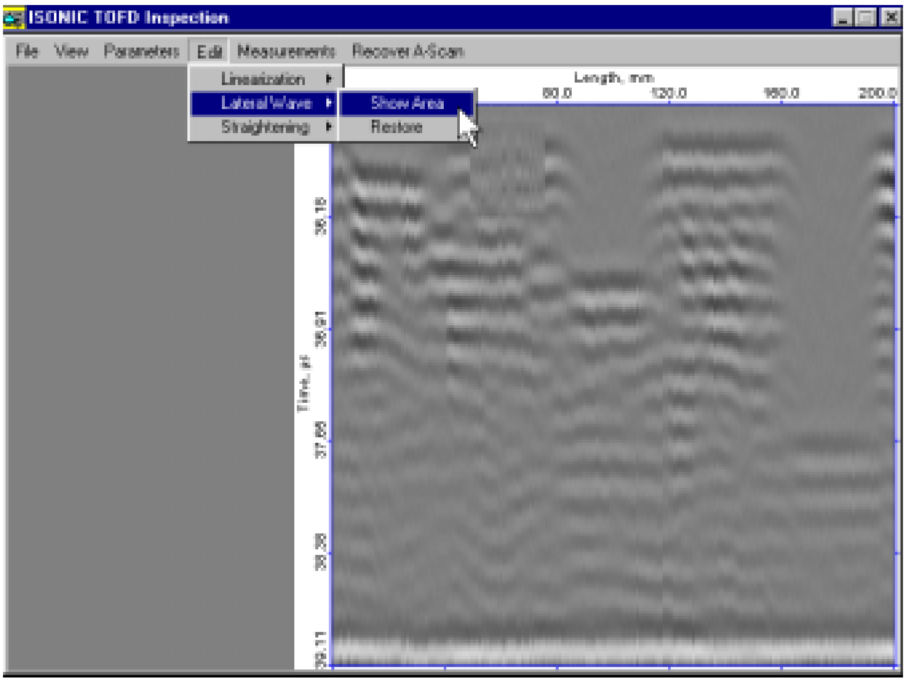
#	Screenshot	Note
1		Start *Lateral Wave Treating*: **Edit ➩ Lateral Wave ➩ Remove…**
2		Selection of the reference **A-Scan**: Manipulate the vertical cursor over the **TOFD Map** using mouse or touch screen stylus or arrow keys of the keyboard. Left mouse click or release touch screen stylus or press **Enter** upon completing Right mouse click or press **Esc** to interrupt the *Lateral Wave Treating*

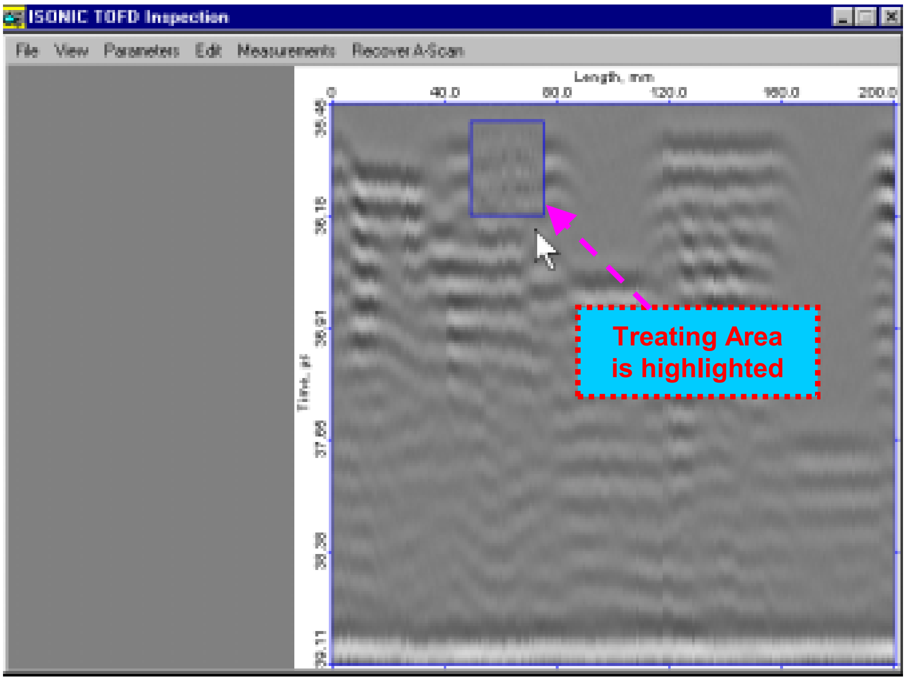
#	Screenshot	Note
3		Selection of the *Reference Area* (the start and the end of the *Reference Lateral Wave Signal* to be designated): Manipulate the horizontal cursor over the **TOFD Map** using mouse or touch screen stylus or arrow keys of the keyboard. The corresponding cursor synchronously moves above the reference **A-Scan**, based on which the start and end of the *Reference Lateral Wave Signal* to be determined and designated through the left mouse click or release touch screen stylus or pressing **Enter** on the keyboard Right mouse click or press **Esc** to interrupt the *Lateral Wave Treating*
4		

<table>
<tr><th>#</th><th>Screenshot</th><th>Note</th></tr>
<tr><td>5</td><td>
</td><td rowspan="2">Selection of the Treating Area (the start and the end of the Treating Area along the scanning line to be designated):

Manipulate the vertical cursor over the TOFD Map using mouse or touch screen stylus arrow keys of the keyboard. Left mouse click or release touch screen stylus or press Enter upon completing

Right mouse click or press Esc to interrupt the Lateral Wave Treating</td></tr>
<tr><td>6</td><td>
</td></tr>
</table>

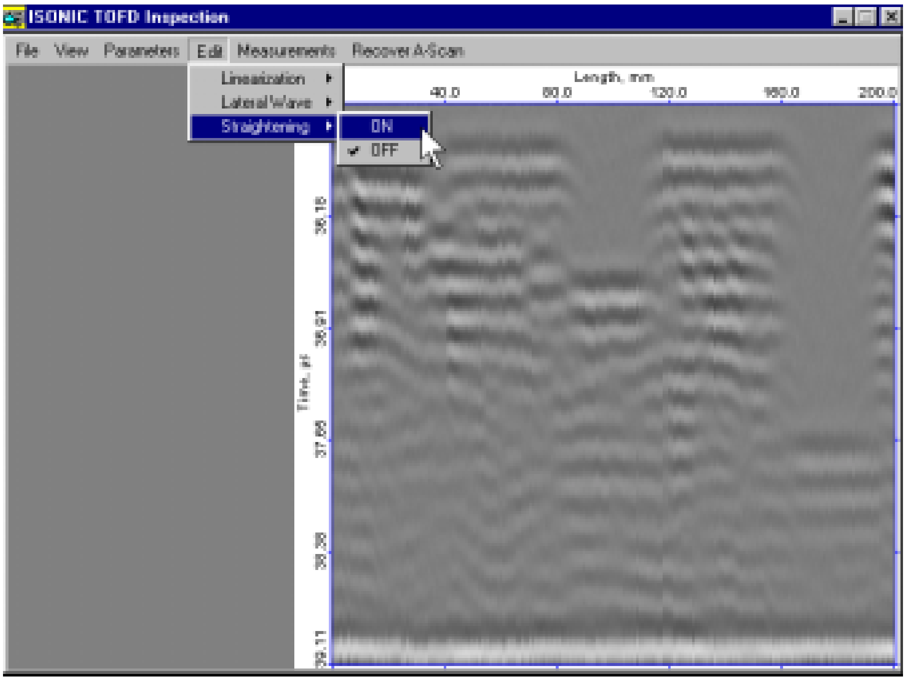
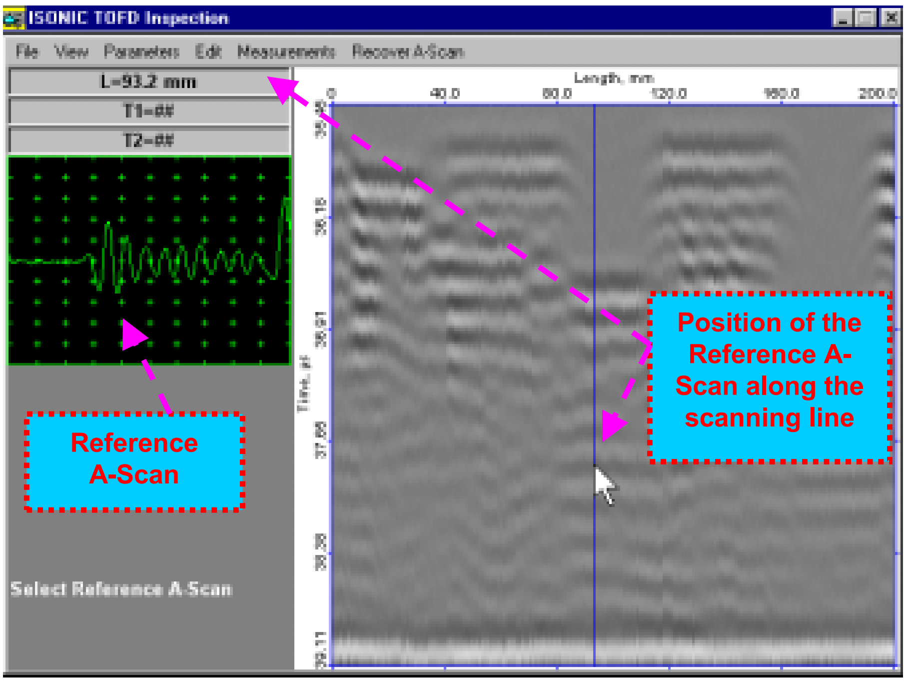
#	Screenshot	Note
7		The *Lateral Wave Removal* is effected immediately upon completing the designating of the end of the *Treating Area*
8		Highlight the *Treating Area*: **Edit ➪ Lateral Wave ➪ Show Area…**

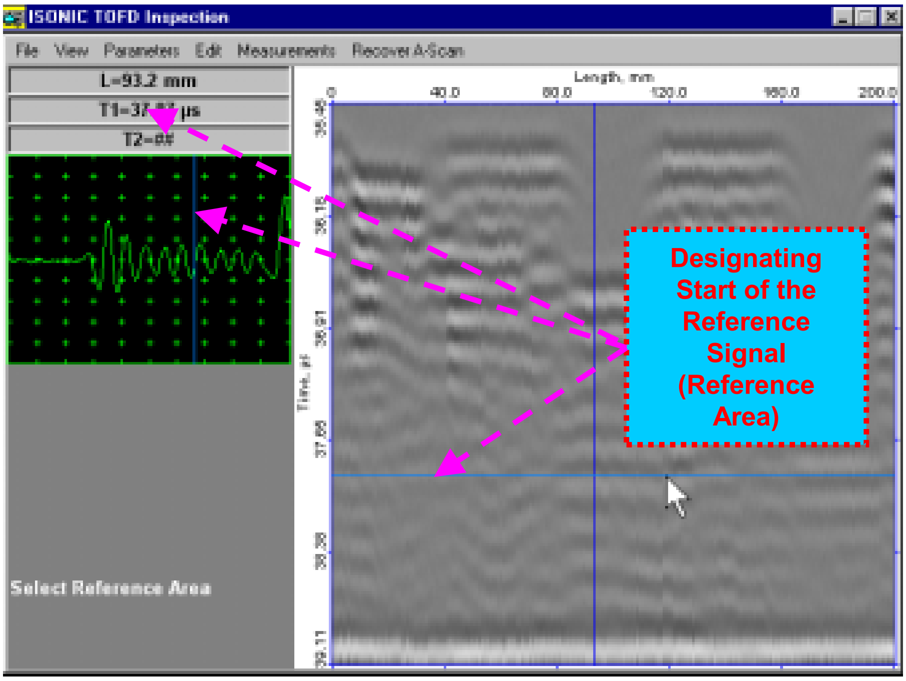
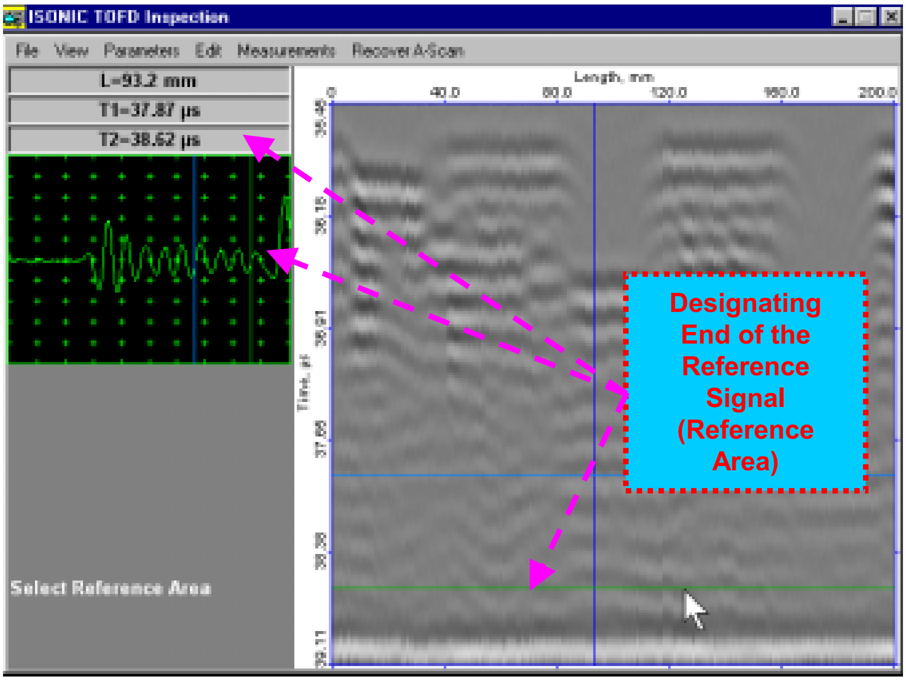
#	Screenshot	Note
9		Undo highlight of the Treating Area: **Edit** ➪ **Lateral Wave** ➪ **Hide Area…**

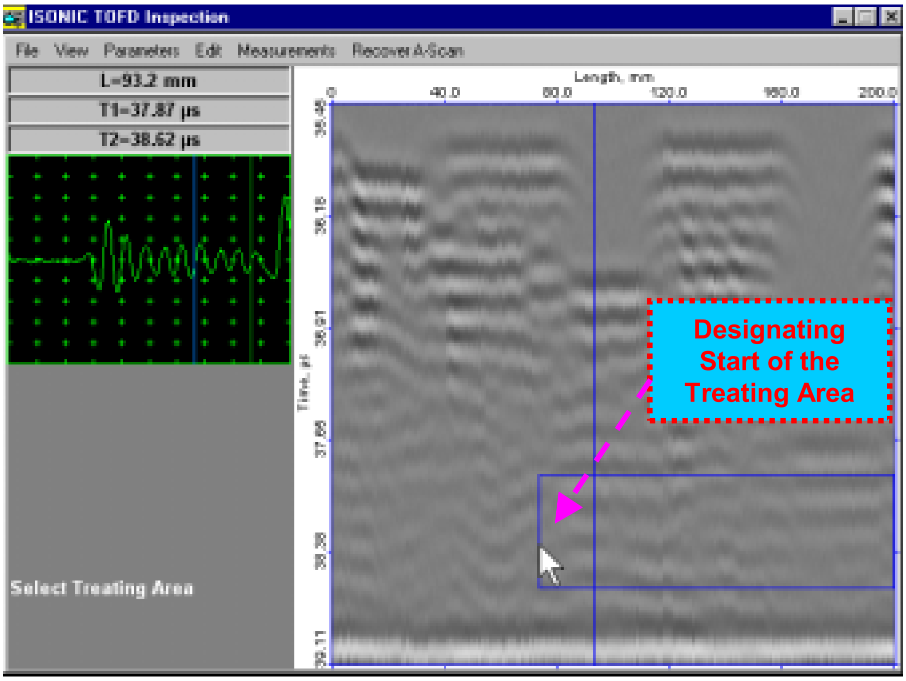
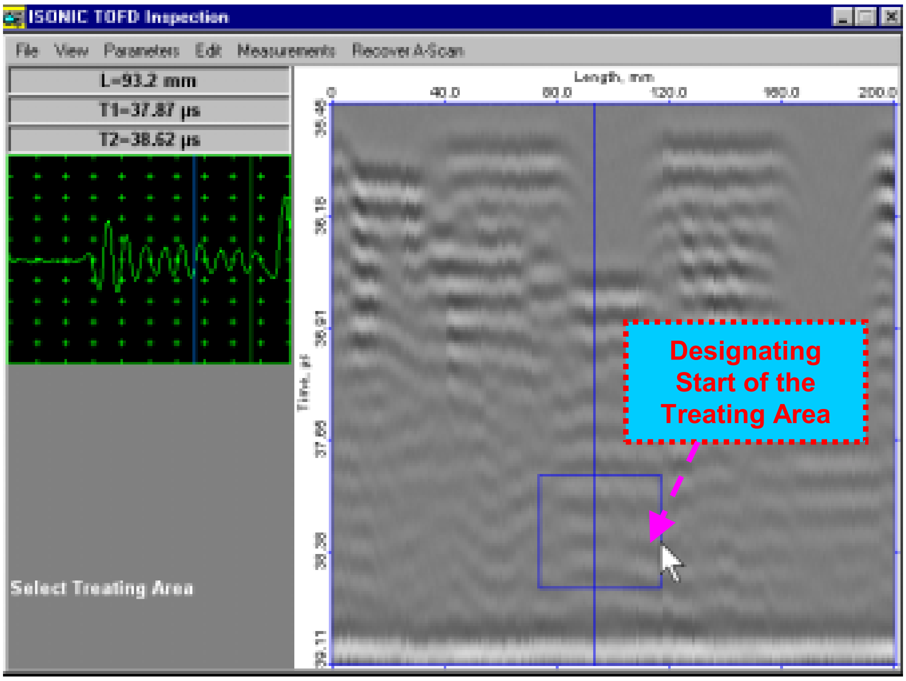
Recover the removed *Lateral Wave Signal*: **Edit** ➪ **Lateral Wave** ➪ **Restore**

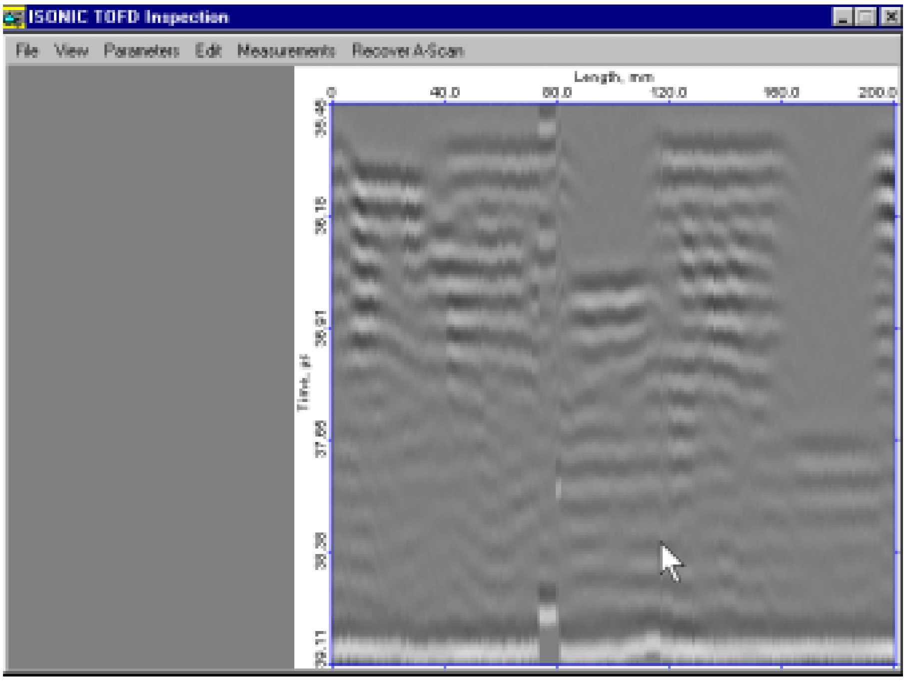
26.5.3. Straightening

To reduce the effects of uneven surfaces, the image may be straightened. To proceed with the *Straightening* select **Edit** ➪ **Straightening** ➪ **ON**. A series of horizontal and vertical cursors appear allowing selecting of the reference **A-Scan**, the *Reference Area*, and the *Treating Area*. The sequence of the screenshots below illustrates all manipulations related to the *Straightening*

#	Screenshot	Note
1		Start Straightening: **Edit** ➪ **Straightening** ➪ **On**
2		Selection of the reference **A-Scan**: Manipulate the vertical cursor over the **TOFD Map** using mouse or touch screen stylus or arrow keys of the keyboard. Left mouse click or release touch screen stylus or press **Enter** upon completing Right mouse click or press **Esc** to interrupt the *Straightening*

#	Screenshot	Note
3		Selection of the *Reference Area* (the start and the end of the *Reference Signal* to be designated): Manipulate the horizontal cursor over the **TOFD Map** using mouse or touch screen stylus or arrow keys of the keyboard. The corresponding cursor synchronously moves above the reference **A-Scan**, based on which the start and end of the *Reference Signal* to be determined and designated through the left mouse click or release touch screen stylus or pressing **Enter** on the keyboard
4		Right mouse click or press **Esc** to interrupt the *Straightening*

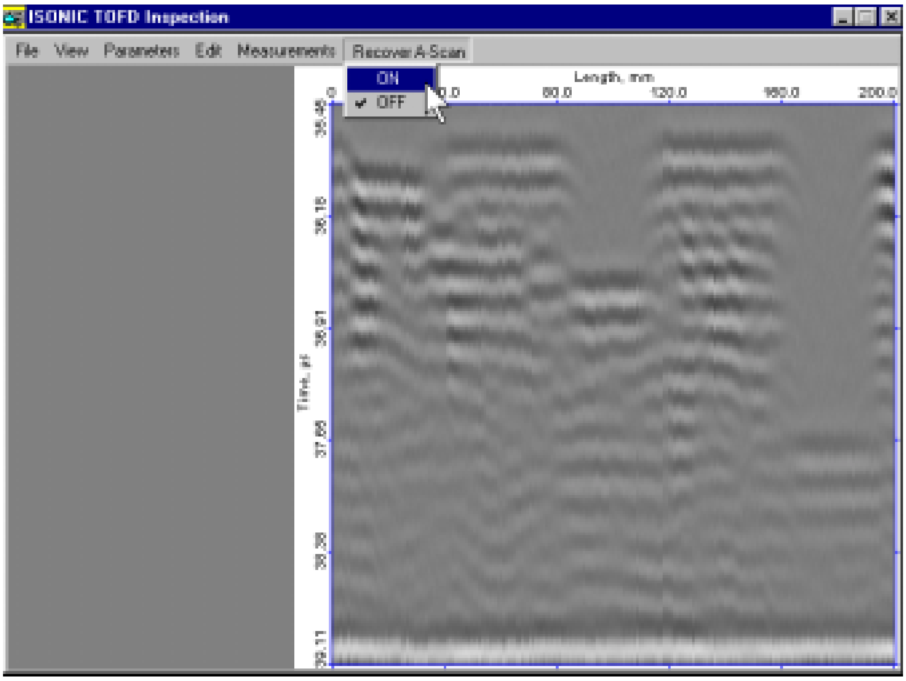
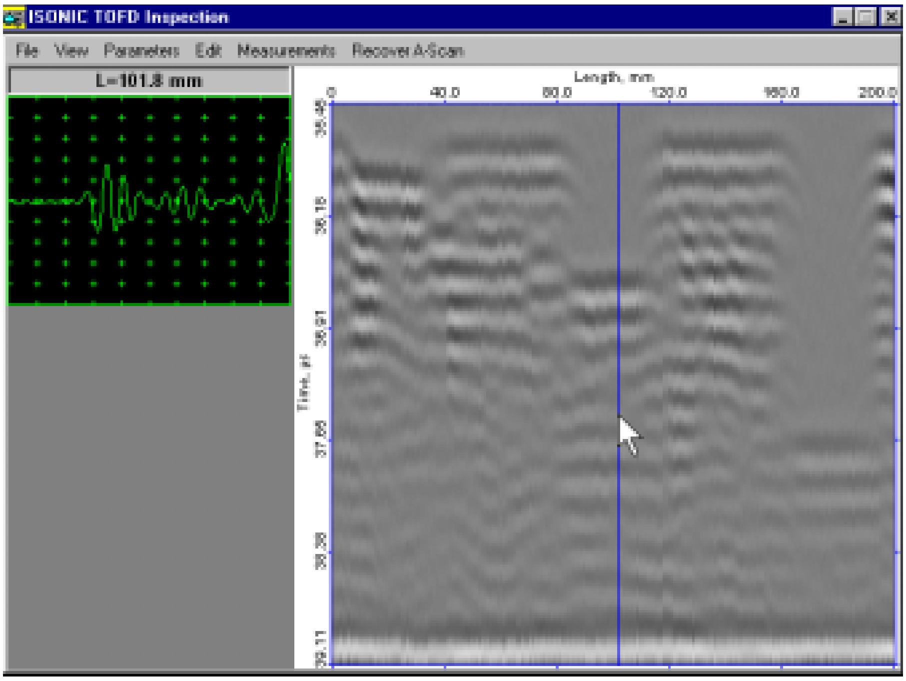
#	Screenshot	Note
5		Selection of the *Treating Area* (the start and the end of the *Treating Area* along the scanning line to be designated): Manipulate the vertical cursor over the **TOFD Map** using mouse or touch screen stylus arrow keys of the keyboard. Left mouse click or release touch screen stylus or press **Enter** upon completing Right mouse click or press **Esc** to interrupt the *Straightening*
6		

#	Screenshot	Note
7		The *Straightening* is effected immediately upon completing the designating of the end of the *Treating Area*

Switch off Straightening: **Edit ➪ Straightening ➪ OFF**

26.6. Submenu 'Recover A-Scan'

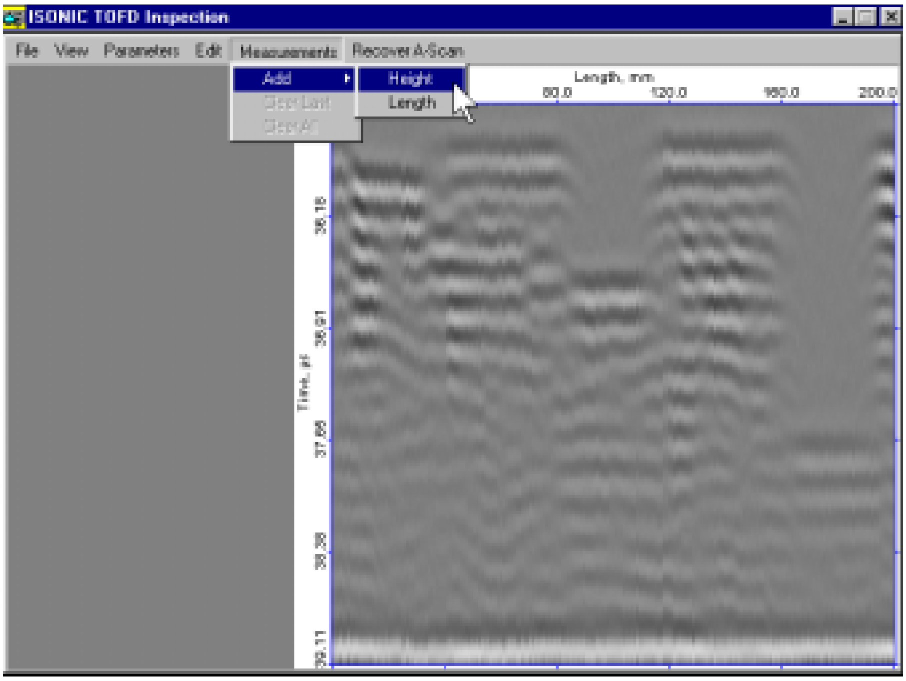
The **A-Scan** recovery along the captured **TOFD Map** may be useful for the off-line scanning and visual analysis of the suspected image segments

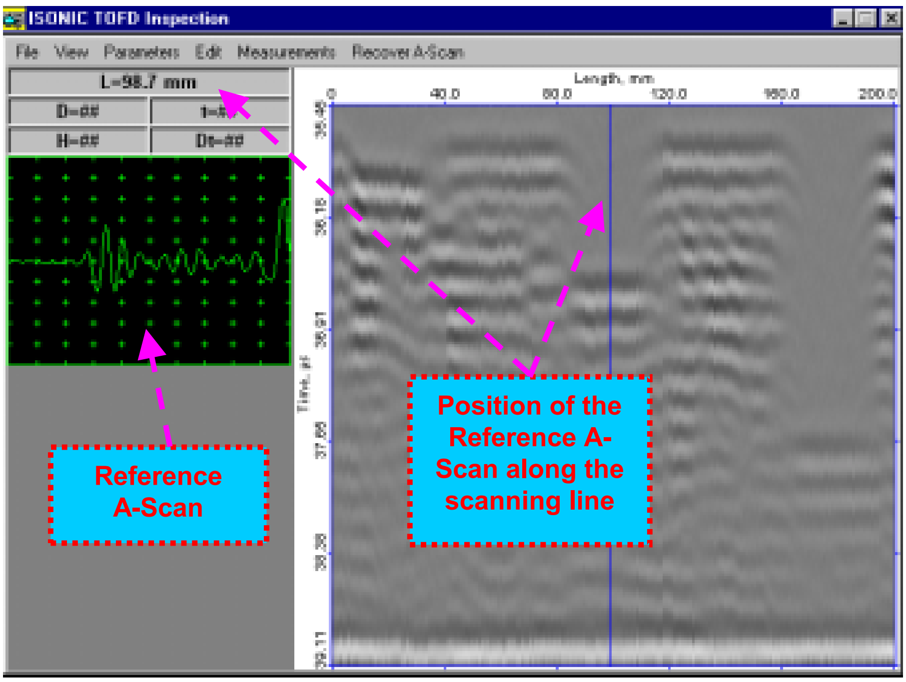
#	Screenshot	Note
	 	To proceed select: **Recover A-Scan ➪ ON** Manipulate the vertical cursor over the **TOFD Map** using mouse or touch screen stylus arrow keys of the keyboard. Left mouse click or release touch screen stylus or press **Enter** upon selecting the **A-Scan** of interest Right mouse click or press **Esc** to interrupt the **A-Scan** *Recovery*

Negate the **A-Scan** *Recovery* mode: **Recover A-Scan ➪ OFF**

26.7. Submenu 'Measurements'

Each indication found on the **TOFD Map** may be highlighted and evaluated – the *Position* and the *End-to-End Distance* along the scan line; the *Depth* and *Height* of each defect may be determined. To proceed with Measurements select **Measurements** ⇨ **Add…** on the keyboard. The sequence of the screenshots below illustrates all manipulations related to the **Measurements** procedures

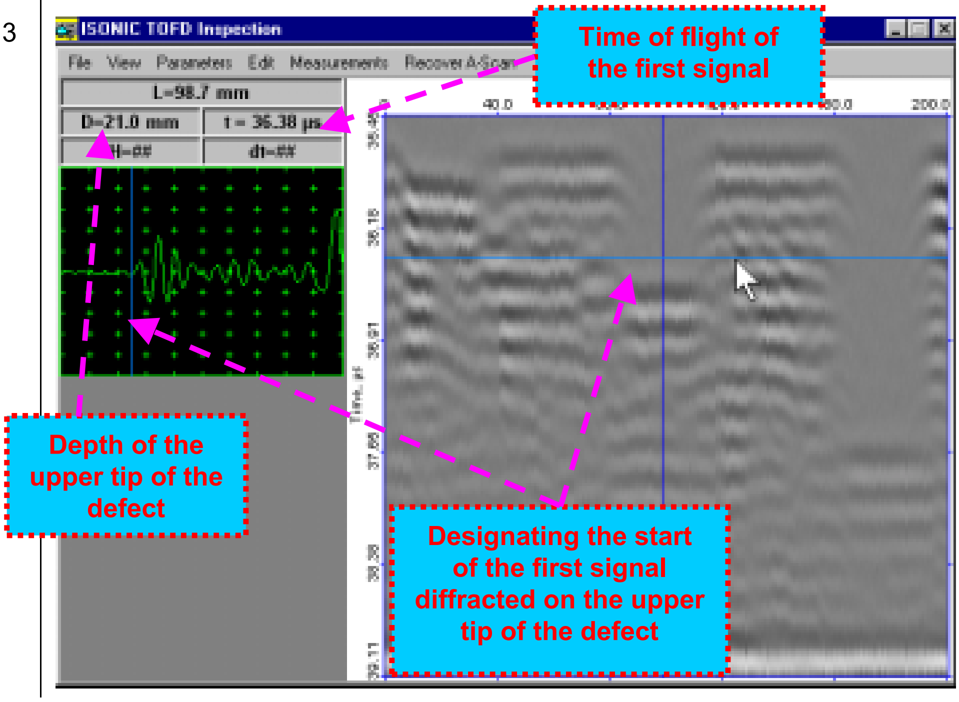
<table>
<tr><th>#</th><th>Screenshot</th><th>Note</th></tr>
<tr><td>1</td><td>


</td><td>For the determining of the defect Depth and Height select Measurements ⇨ Add ⇨ Height</td></tr>
<tr><td>2</td><td>


</td><td>Selection of the reference A-Scan:

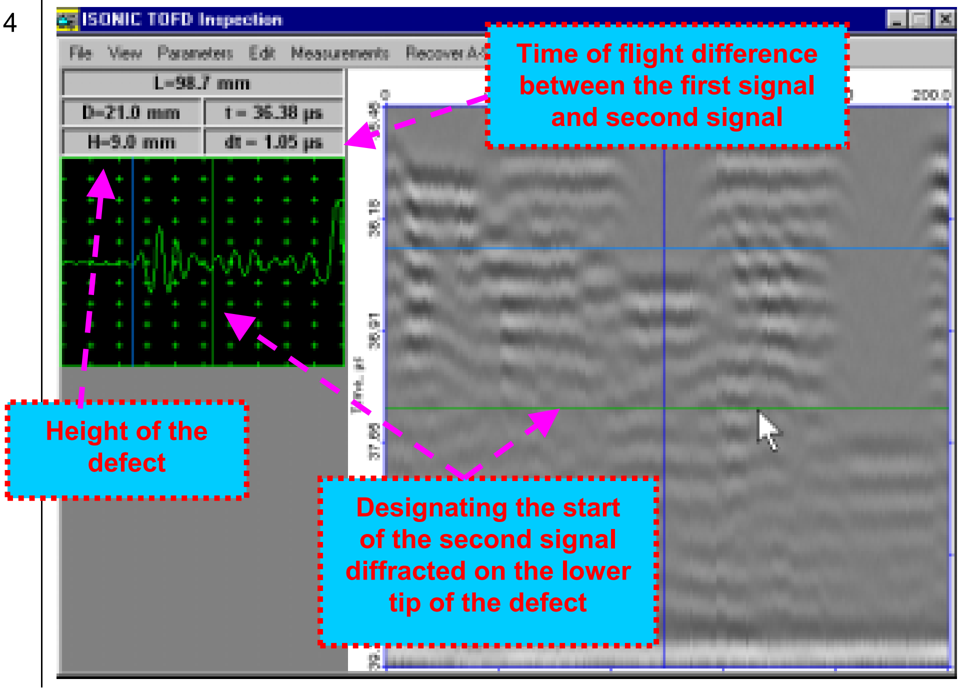
Manipulate the vertical cursor over the TOFD Map using mouse or touch screen stylus arrow keys of the keyboard. Left mouse click or release touch screen stylus or press Enter upon completing

Right mouse click or press Esc to interrupt the Measurements</td></tr>
</table>

#	Screenshot	Note
3		Finding the upper tip of the defect (the start of the first signal diffracted on the upper tip of the defect to be determined): Manipulate the horizontal cursor over the **TOFD Map** using mouse or touch screen stylus arrow keys of the keyboard. The corresponding cursor synchronously moves above the reference **A-Scan**, based on which the first signal diffracted on the upper tip of the defect to be determined. Left mouse click or release touch screen stylus or press **Enter** upon completing

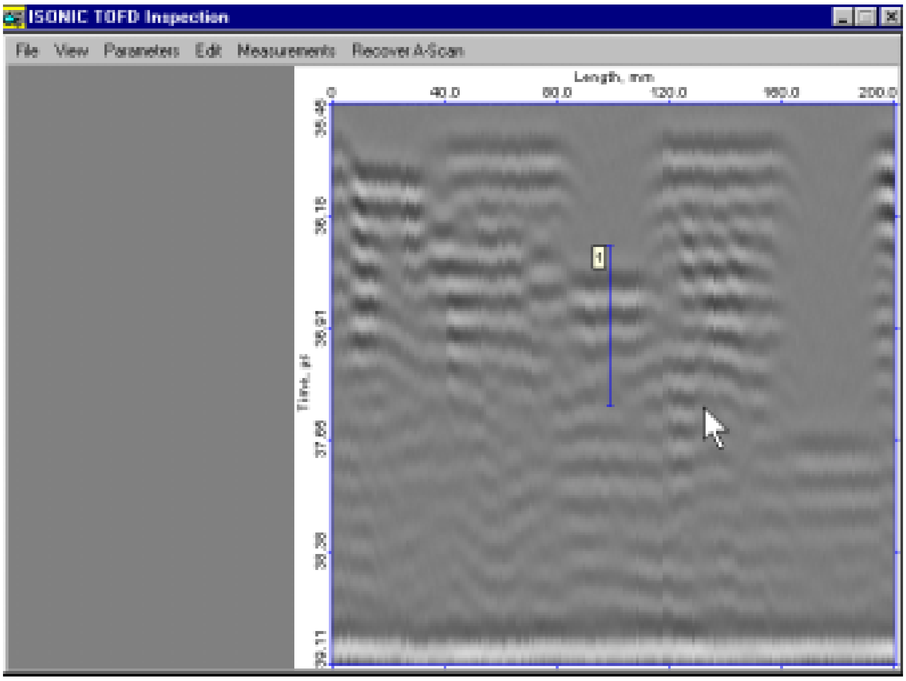
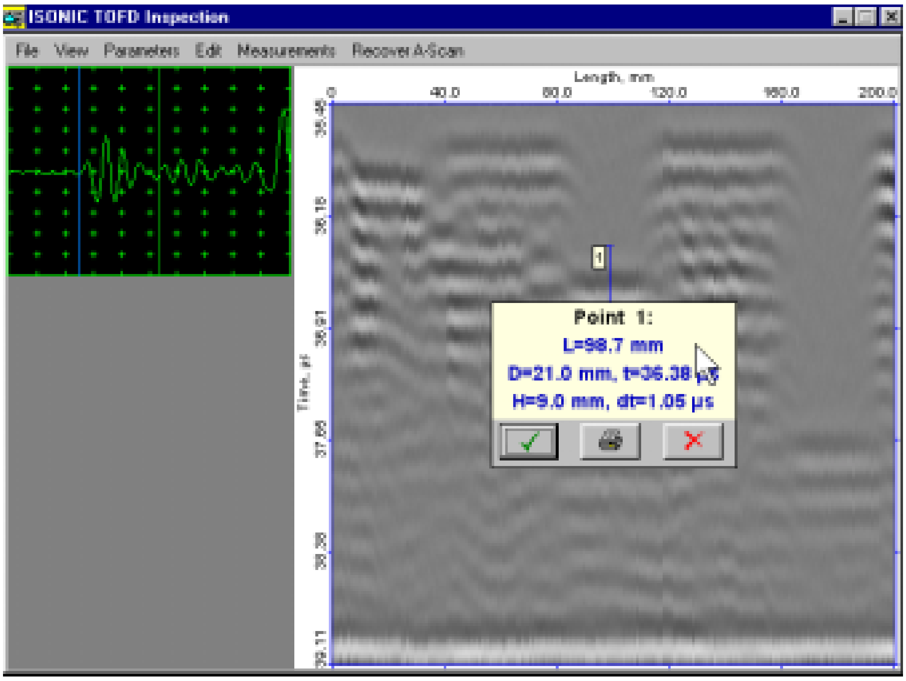
Based on the time of flight of the first signal the depth of the upper tip is calculated automatically

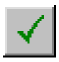
Right mouse click or press **Esc** to interrupt the **Measurements**

#	Screenshot	Note
4		Finding the lower tip of the defect (the start of the second signal diffracted on the lower tip of the defect to be determined): Manipulate the horizontal cursor over the **TOFD Map** using mouse or touch screen stylus arrow keys of the keyboard. The corresponding cursor synchronously moves above the reference **A-Scan**, based on which the second signal diffracted on the lower tip of the defect to be determined. Left mouse click or release touch screen stylus or press **Enter** upon completing

Based on the time of flight of the second signal the height of the defect tip is calculated automatically with relate to the early calculated depth of the upper tip

Right mouse click or press **Esc** to interrupt the **Measurements**

#	Screenshot	Note
5		The indication is highlighted immediately upon designating the start of the second signal diffracted on the lower tip of the defect
6		Double click on the highlighted indication (point number) recovers the corresponding **A-Scan** with the designated start edges of the first and second diffracted signals. The subwindow containing the measurements results appears: ❑ **L** – position of the indication along the scanning line ❑ **D** – depth of the upper tip of the defect ❑ **t** – time of flight of the first signal ❑ **H** – height of the defect ❑ **dt** – time of flight difference between the first signal and second signal

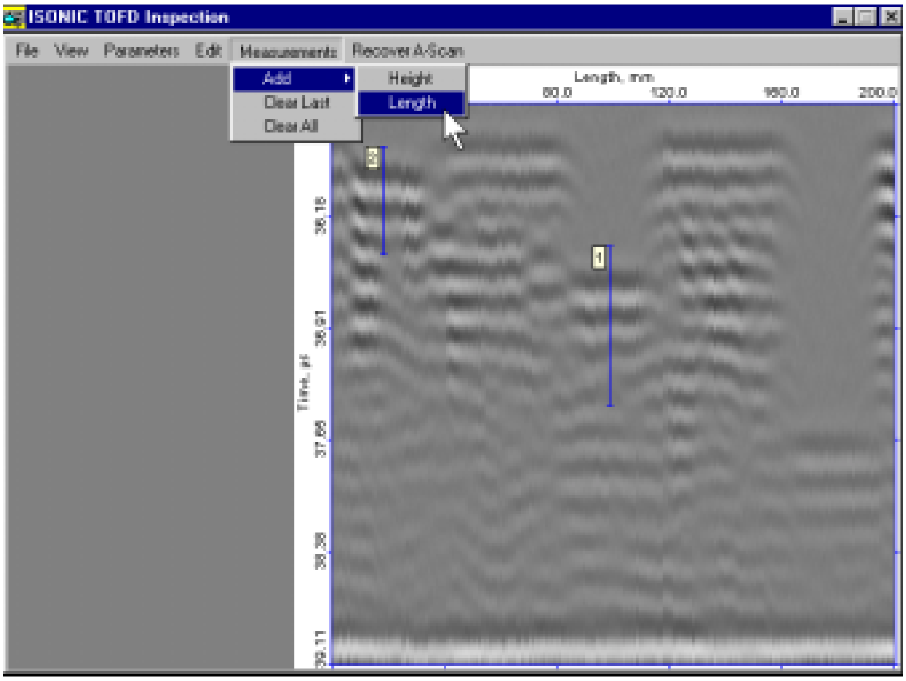
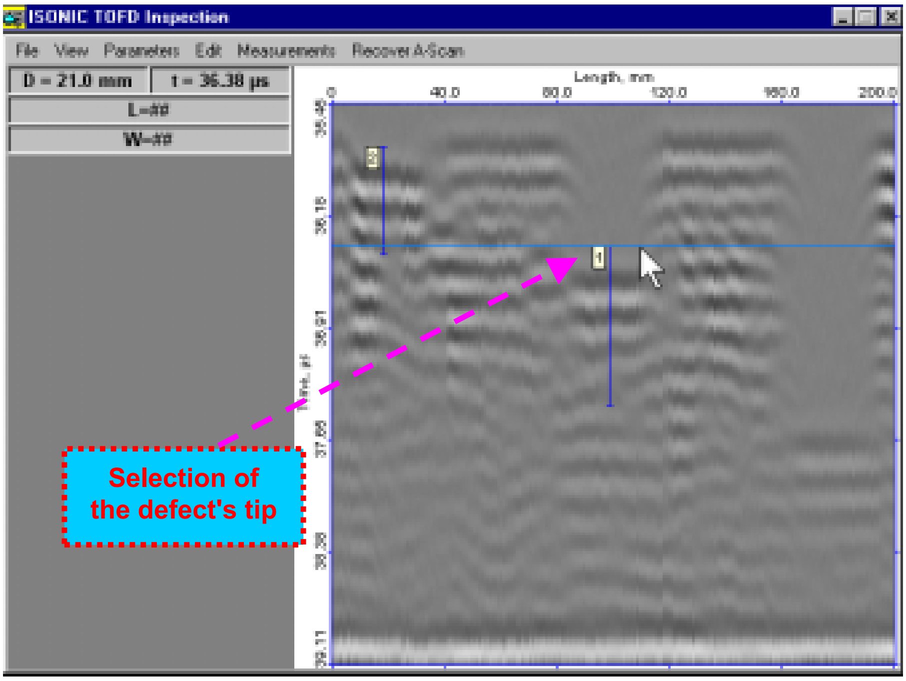
➢ Click on  to closes the subwindow

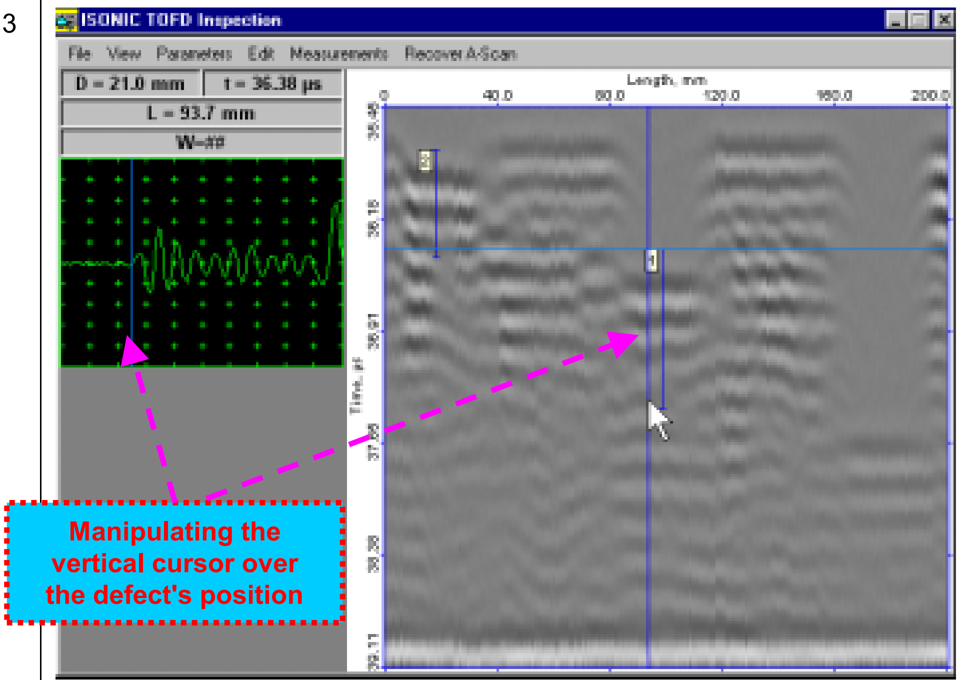
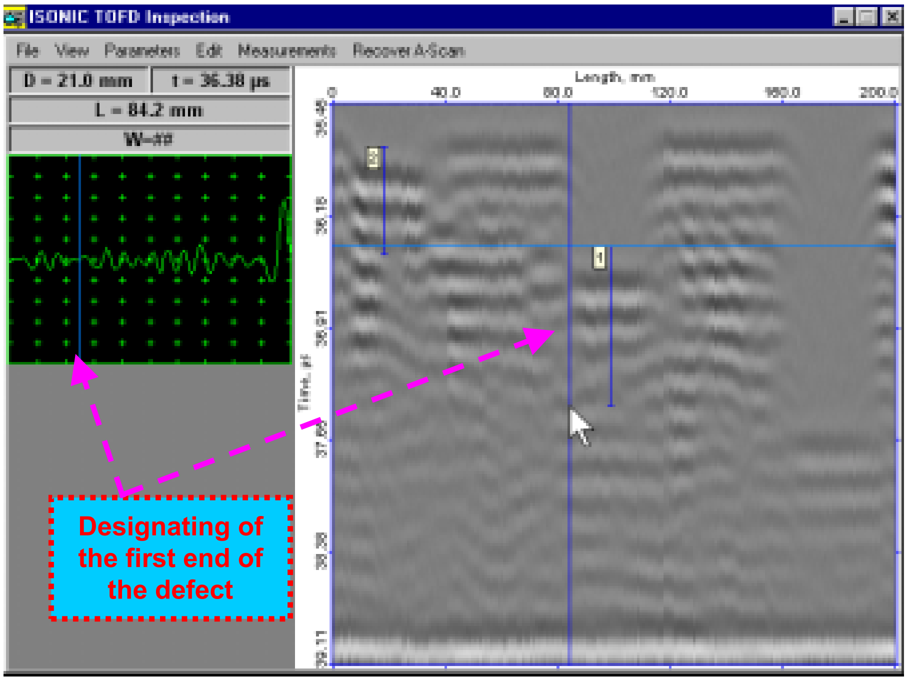
➢ Click on  to print out the **A-Scan** corresponding to the highlighted point, the measurements results, and the TOFD Map

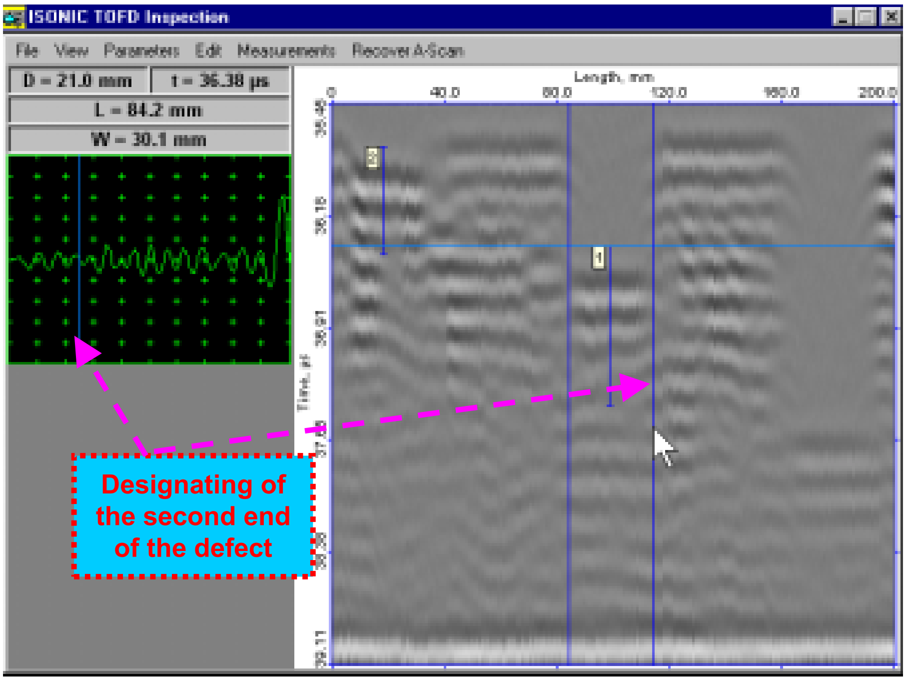
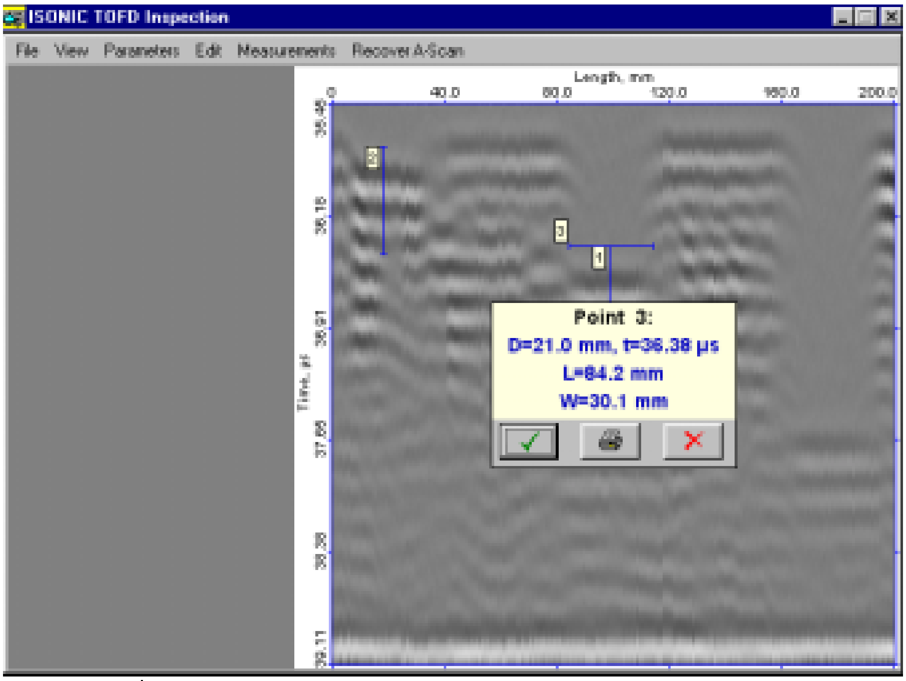
➢ Click on  to erase the highlighted point

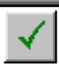
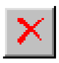
ⓘ

Up to 10 indications may be highlighted on the **TOFD Map** simultaneously. **Measurements** ➪ **Clear Last** erases last made highlighted indication and related measurements. **Measurements** ➪ **Clear All** erases all existing highlighted indications and related measurements

#	Screenshot	Note
1		For the determining of the defect's *Position* and the *End-to-End Distance* along the scan line select **Measurements ➪ Add ➪ Length**
2		Selection of the defect: Manipulate the horizontal cursor over the **TOFD Map** using mouse or touch screen stylus arrow keys of the keyboard. The defect may be selected through the placement of the said horizontal cursor above the upper or lower tip of the defect. Left mouse click or release touch screen stylus or press **Enter** upon completing Right mouse click or press **Esc** to interrupt the **Measurements**

#	Screenshot	Note
3		Determining of the defect's insonification area along the scanning line: Manipulate the vertical cursor over the **TOFD Map** using mouse or touch screen stylus arrow keys of the keyboard to determine the left and right edges of the defect on the **TOFD Map** through reproducing the **A-Scan** sequence through the off-line scanning. The ends of the defect are characterized by appearance / disappearance of the defect's signal Right mouse click or press **Esc** to interrupt the **Measurements**
4		Left mouse click or release touch screen stylus or press **Enter** upon placing the vertical cursor over the first defect's end either left or right Right mouse click or press **Esc** to interrupt the **Measurements**

#	Screenshot	Note
5		Left mouse click or release touch screen stylus or press **Enter** upon placing the vertical cursor over the second defect's edge either left or right Right mouse click or press **Esc** to interrupt the **Measurements**
6		The indication of the defect's longitudinal *Position* an *End-to-End Distance* is highlighted immediately upon designating the second defect's edge Double click on the highlighted indication (point number) → the measurements results appear in the subwindow as: ❑ **D** – depth of the selected tip of the defect ❑ **t** – time of flight of the appropriate signal ❑ **L** – coordinate of the left defect's edge of the defect (longitudinal *Position*) ❑ **W** – length of the defect (*End-to-End Distance*)

- Click on  to closes the subwindow
- Click on  to print out the **A-Scan** corresponding to the highlighted point, the measurements results, and the TOFD Map
- Click on  to erase the highlighted point

ⓘ

Up to 10 indications may be highlighted on the **TOFD Map** simultaneously. **Measurements** ⇨ **Clear Last** erases last made highlighted indication and related measurements. **Measurements** ⇨ **Clear All** erases all existing highlighted indications and related measurements

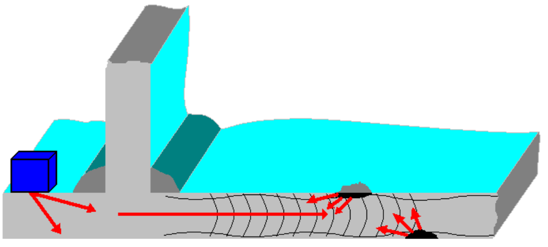
27. Operating 'FLOORMAP-L' Software Package - ISONIC FLOORMAP-L

The contents of this chapter is valid for the FLOORMAP-L SW Package version 2.1.0.10 or higher

27.1. General

FLOORMAP-L is the software package providing the express ultrasonic inspection and mapping of the pitting (corrosion) in the large metallic plates either flat or curved. The ultrasonic coverage of the whole plate is provided without scanning above the whole surface of the plate. The typical objects under test are:

- Annular plates of the storage tank - inspection from outside
- Shell and walls of the storage tank - inspection from outside
- Floor plates of the storage tank - inspection from inside
- Inaccessible pipe walls – inspection from outside (for example the pipe walls above the concrete support, coated pipes, etc.)
- Walls of the underground storage tanks – inspection from outside



The specially designed probe emits the ultrasonic beam having the width, duration of the wave package and basic wavelength comparable with the thickness of the plate. The components of the emitted wave package interfere between the plate's surfaces. The probe's dead zone is located under the fillet weld, so the probable echoes from the welding area are significantly suppressed. After passing through the fillet weld area the ultrasonic wave package saturates the volume of the plate while propagating. Pitting and corrosion damage if any returns an echo picked up by the probe.

The echo height correlates with the depth and surface dimensions of the pitting (corrosion damage), so *the degree of the damage may be evaluated through the referring to the amplitude of the received signal*.

The defects located on both surfaces of the plate may be detected, however it's impossible to distinguish between echoes obtained from the defects belonging to the different surfaces

FLOORMAP-L software package provides the pitting (corrosion damage) mapping of the plate through the *linear scanning along the plate edge* with capturing, processing and storing of all received ultrasonic signals (A-Scans). The mapping procedure may be either time-based (timed) or encoded (true-to-scale)

The described principle of the pitting (corrosion damage) detection and mapping is usually applicable for the *overall inspection range up to 1…1.5 m (40 – 60 in)* providing that there is no another weld or plate wedge on the way of wave package propagation beside the fillet weld

ⓘ
The high degree of the average scattered plate corrosion, inter-crystal corrosion dropping the elastic properties of the plate material and plate coatings of some types may reduce the overall inspection range significantly

Summary:

Restrictions	***Scope of Applications***
• No discrimination between top and reverse side corrosion is possible • The scanning surface must be free of impurities, welding droplets, surface corrosion and coating (well bonded paint or coating is acceptable) • Poor annular plate condition may decrease the inspection range	FLOORMAP_L is not restricted to Storage Tank Inspection, other applications for the technique constantly evolve: • Pipe support areas • Sleeved pipes • Under clamp regions • Under reinforcing plates

27.2. Hardware

Probes

The following specially designed ultrasonic probes are required for the inspection with the **FLOORMAP-L** software package:

- Special Probe for the Fast Tank Floor / Wall Inspection for Pitting and Deep Corrosion Damages - Thickness Range 6 - 16 mm (0.25 – 0.64 in)– order code S 544007
- Special Probe for the Fast Tank Floor / Wall Inspection for Pitting and Deep Corrosion Damages - Thickness Range 12 - 30 mm (0.5 – 1.25 in) – order code S 544008
- Other special probes recommended by Sonotron NDT

Encoder

To observe the encoded (true-to-scale) pitting (corrosion) mapping the below specified encoder must be interfaced to the **ISONIC**:

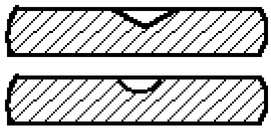
- Simplest One-Axis Mechanical Encoder with the Probe Clamping Unit - order code SK 2001108 or SK 2001108 FM

Alternatively the incremental encoders of other manufacturers may be in use provided that they're compatible with the ISONIC. For the details contact Sonotron NDT

Reference plate

It is necessary to provide and check the calibration of the unit prior to each inspection session. The reference plate containing the artificial defects simulating the different types of the pitting is recommended, said reference plate must have the 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%.

For the compact pitting representation it's recommended to use conically and/or spherically shaped drills having different depth and opening:



For the elongated pitting representation it's recommended to prepare the slits in the reference plate, said slits must be parallel to one of the plate edges and may have different depth and, for example, the cylindrical bottom shape and spherically shaped edges

The EDM notches are not applicable

27.3. Cabling and Fixture

Ultrasonic Flaw Detector PC Card	Applicable Cabling Scheme	Paragraph
UDS 3-4	B.1; B.2	4.2.5
UDS 3-3	B.3; B.4	4.2.5
USLT 2000	B.5	4.2.5

For the encoded (true-to-scale) mapping:

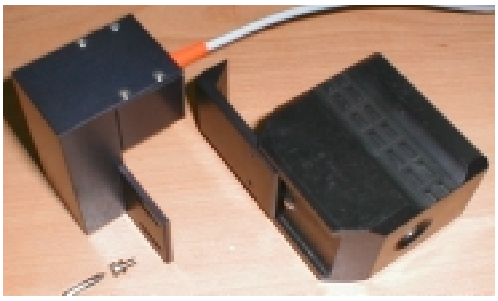
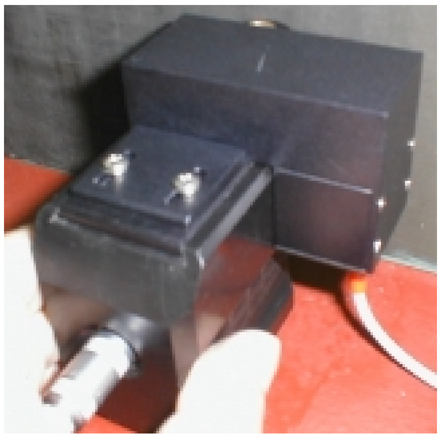
- o clamp the probe into encoder
- o connect the encoder's cable to its input on the rear panel of the **ISONIC**

<table>
<tr><th>Encoder Type and notes</th><th>Fitting probe into encoder</th><th>Ready to scan</th></tr>
<tr><td>SK 2001108

This encoder has the fixed frame. Encoder's wheel and probe contact face are situated on the same surface (scanning surface) This encoder is not manufactured by Sonotron any more since the advanced SK 2001108 FM model appeared</td><td>
</td><td>
</td></tr>
<tr><td>SK 2001108 FM

The encoder has the frame allowing two ways of fitting the probe into it:

<u>First way</u>
The encoder's wheel and probe contact face are situated on the same surface (scanning surface)

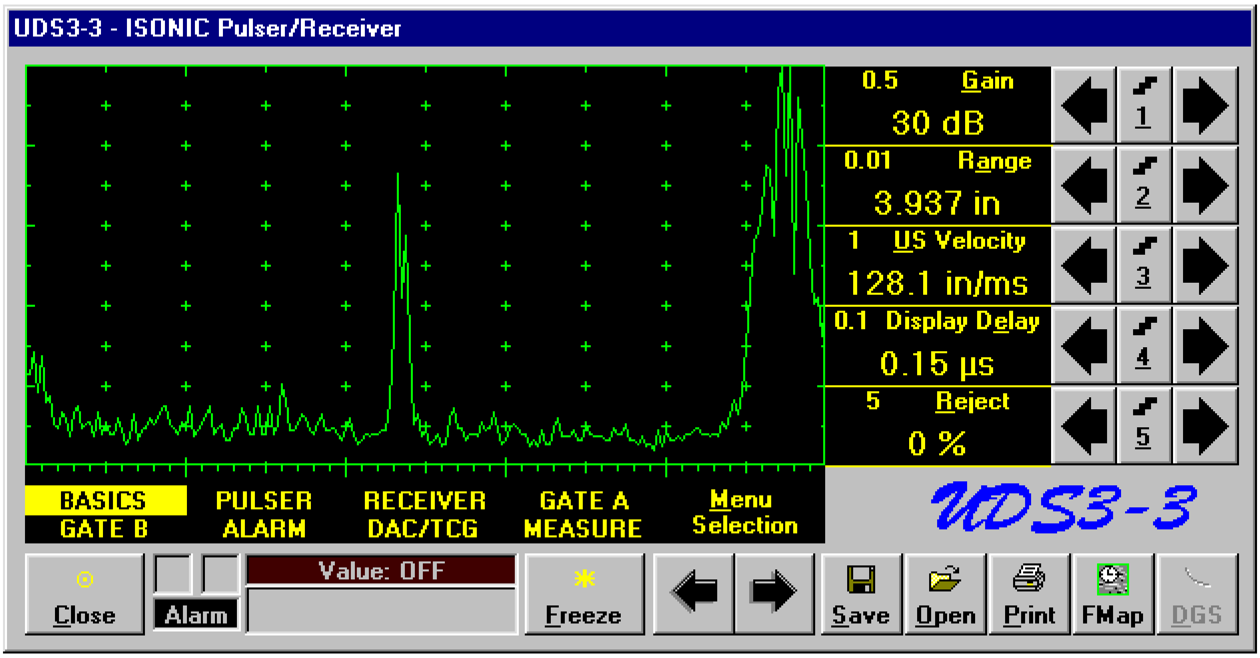
<u>Second way</u>
The encoder's wheel is situated on the surface rectangular to the scanning surface to which the probe contact face is applied. Actually this allows to apply the encoder's wheel to the shell while scanning along the annular plate's lip</td><td>
</td><td>
</td></tr>
</table>

27.4. Start Up

Double click on the icon  located on the **ISONIC** desktop

27.5. Getting started...

The *Pulser Receiver Setup* screen appears upon starting **FLOORMAL-L** software package. The operating surface is identical to the **PULREC – ISONIC Pulser Receiver** software package, which is explained in details in the Chapter 5 of this Operating Manual



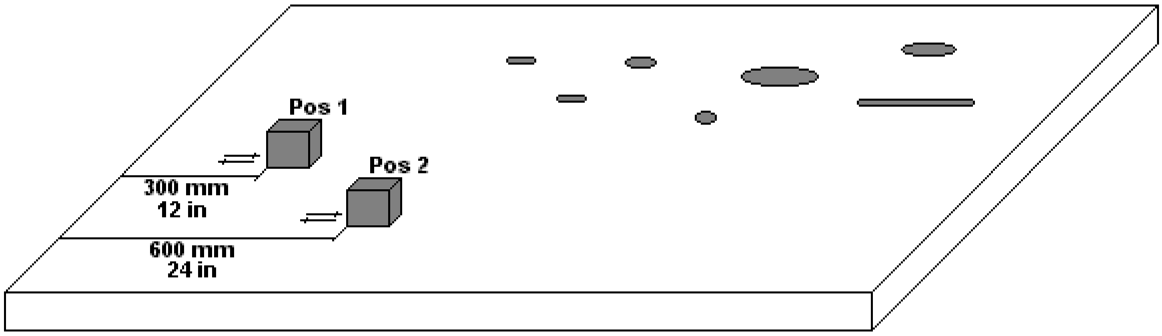
The operating surface is required for the *pre-scanning setup* of the following parameters / modes:

- **Gain**
- **DAC or TCG (Optionally)**
- **Range**
- **US Velocity**
- **Display Delay**

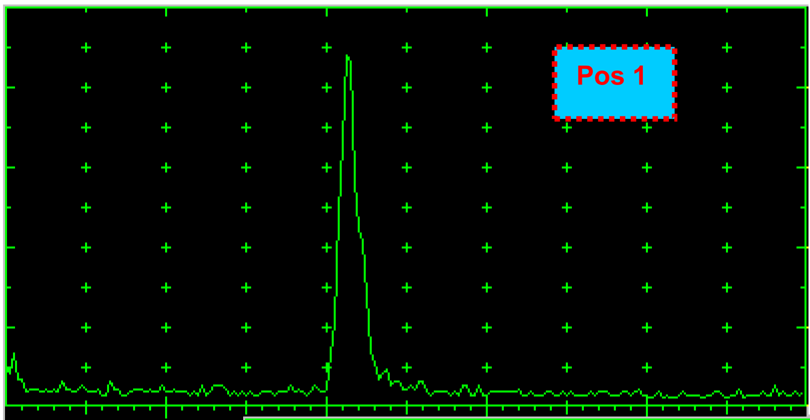
The setup of the listed parameters determines the sensitivity and the overall inspection range

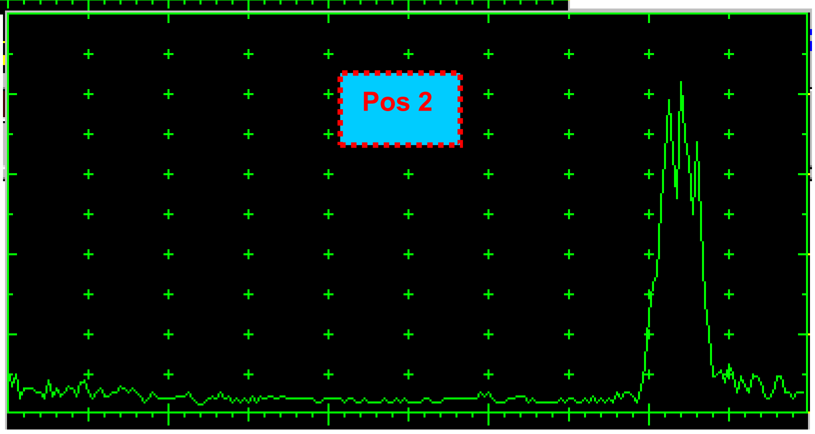
27.5.1. US Velocity and Display Delay

The following procedure is recommended for the setup of the **Display Delay** and **US Velocity**



(a) Setup the **Range** to **750 mm** or **30 in**
(b) Setup the **US Velocity** to **3000 m/s** or **120 in/ms** (preliminary value)
(c) Place the probe into position **Pos 1** on the reference plate so that the distance between the front edge of the probe and the reference plate's edge will be **300 mm** or **12 in**
(d) Tune the **Gain** to provide the height of the echo pulse from the plate's edge **80-90%** of the **A-Scan** screen height
(e) Tune the **Display Delay** until the rising edge of the plate's edge echo will match with **40%** grid on the horizontal **A-Scan** screen scale
(f) Place the probe into position **Pos 2** on the reference plate so that the distance between the front edge of the probe and the reference plate's edge will be **600 mm** or **24 in**
(g) Tune the **US Velocity** until the rising edge of the plate's edge echo will match **80%** grid on the horizontal **A-Scan** screen scale
(h) Place the probe into position **Pos 1** on the reference plate so that the distance between the front edge of the probe and the reference plate's edge will be **300 mm** or **12 in**
(i) Repeat steps (e) to (h) until the tuning will not be necessary, i.e. placement of the probe into positions **Pos 1** and **Pos 2** causes the echoes in the positions **40%** and **80%** on the horizontal scale correspondingly. Since that moment the **Display Delay** and **US Velocity** are calibrated and setup properly:





27.5.2. Gain

Place probe onto the reference plate into the position providing detection of the artificial defect representing the smallest defect to be detected observing the distance of **400 – 600 mm** (**16 – 24 in**) between the front edge of the probe and the artificial defect. Tune the gain until providing the appropriate echo height of **at least 60%** of the A-Scan screen height

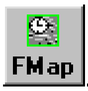
27.5.3. DAC or TCG

Place probe onto the reference plate into the position providing detection of the selected reflector either real or artificial defect or the reference plate edge to be detected observing the minimal travel distance between the front edge of the probe and the reflector. Follow the instructions of the paragraph 5.4.12 of this Operating Manual to store the received signal as the first **DAC** sequence echo. Move the probe away from the reflector keeping it's echo maximized for each new echo to be recorded into the **DAC** sequence

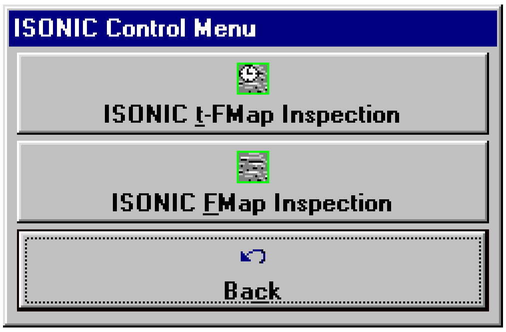
27.5.4. Range

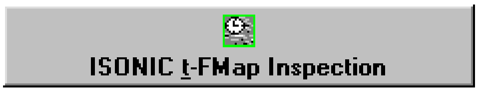
FOORMAP-L software package provides the creation of 2D map. **Range** determines the first dimension and the **Scan Length (L)** determines the second dimension of the map to be created. Setup the **Range** value to the required map dimension

27.6. Inspection and Postrocessing

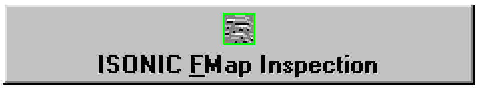
Click on 

. The following subwindow appears:

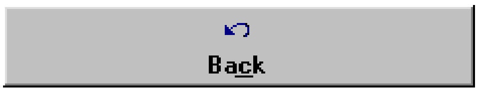


To proceed further with the time-based mapping click on 

or press **<Alt>+<T>** on the keyboard

To proceed further with the encoded mapping click on 

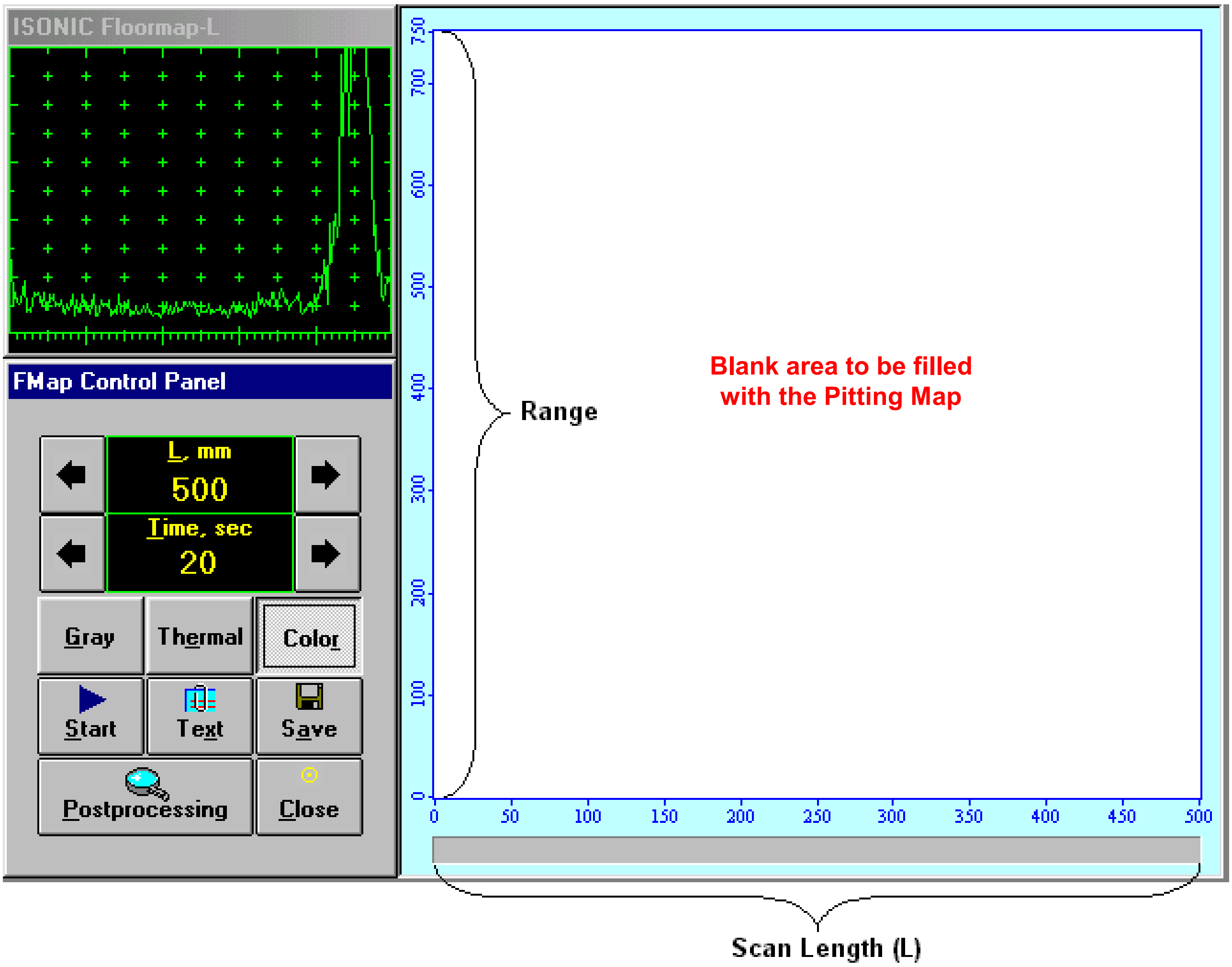
or press **<Alt>+<F>** on the keyboard

To return to **ISONIC Pulser Receiver** window click on 

or press **<Alt>+<C>** or **Esc** on the keyboard

27.6.1. Timed Mapping - tFMap

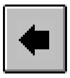
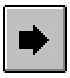
The following screen appears upon starting timed-based mapping



Scan Length and Scan Time

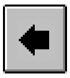
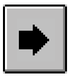
The **Scan Length** (**L**) is the length of the section of the plate to be displayed, over one side of which the probe must be driven during the measurement period. **Time** (**Scan Time**) is the duration of the said measurement period.

To select the required value of **Scan Length** (**L**) the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<L>** - **L** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (due to the letter **L** is underlined)
- **Combined**
  - Click on **L** - **L** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

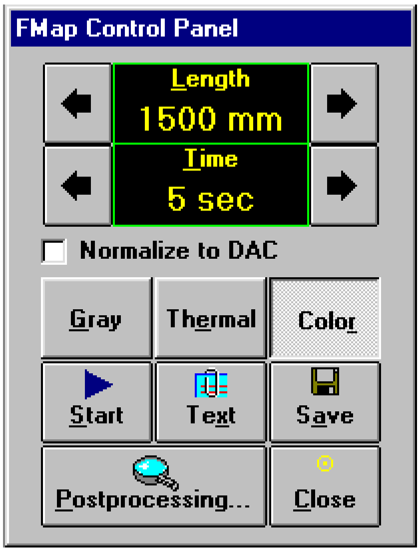
The value of the **Scan Length** (**L**) may vary from **100** to **2000 mm** (**4** to **80 in**) in **100 mm** (**4 in**) resolution

To select the required value of Scan Time – **Time** the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding button  or 
- **Keyboard**
  - Pressing **<Alt>+<T>** - **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Time** area letter **T** is underlined)
- **Combined**
  - Click on **Time** - **Time** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of the **Scan Time** – **Time** may vary from **5** to **60 sec**; setup is **1 sec** resolution

DAC Normalization

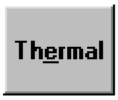


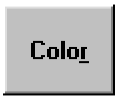
If the **DAC** was active prior to switching to the scanning mode then the corresponding checkbox appears in the **Fmap Control Panel**. Depending on the selection made the map may be represented either normalized to the **DAC** or not while capturing, said selection may be changed entire the scanning without losing the data

Echo Amplitude Palette (Color Scale)

The color coding of echo amplitudes is observed ***over 48 dB range*** (**- 6 dB** to **+ 42 dB**). There are three palettes (color scales) available:

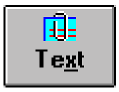
- Clicking on 

 or pressing **<Alt>+<G>** on the keyboard will activate the Gray-Level coloring of echo amplitudes
- Clicking on 

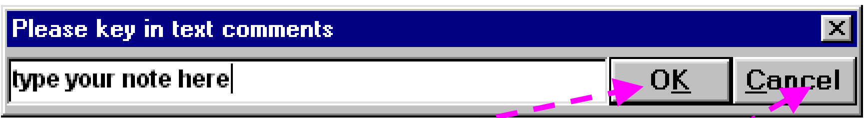
 or pressing **<Alt>+<E>** on the keyboard will activate the Thermo-Level coloring of echo amplitudes
- Clicking on 

 or pressing **<Alt>+<R>** on the keyboard will activate the Rainbow-Level coloring of echo amplitudes

Insert Text Note

A text note may be keyed in to accompany the **tFMap** record. To proceed click on 

 or press **<Alt>+<X>** on the keyboard:



Click on or press **<Alt>+<K>** or **Enter** on the keyboard to end typing and storing of the note

Click on or press **<Alt>+<C>** or **Esc** on the keyboard to discard the new note / comments

Scanning

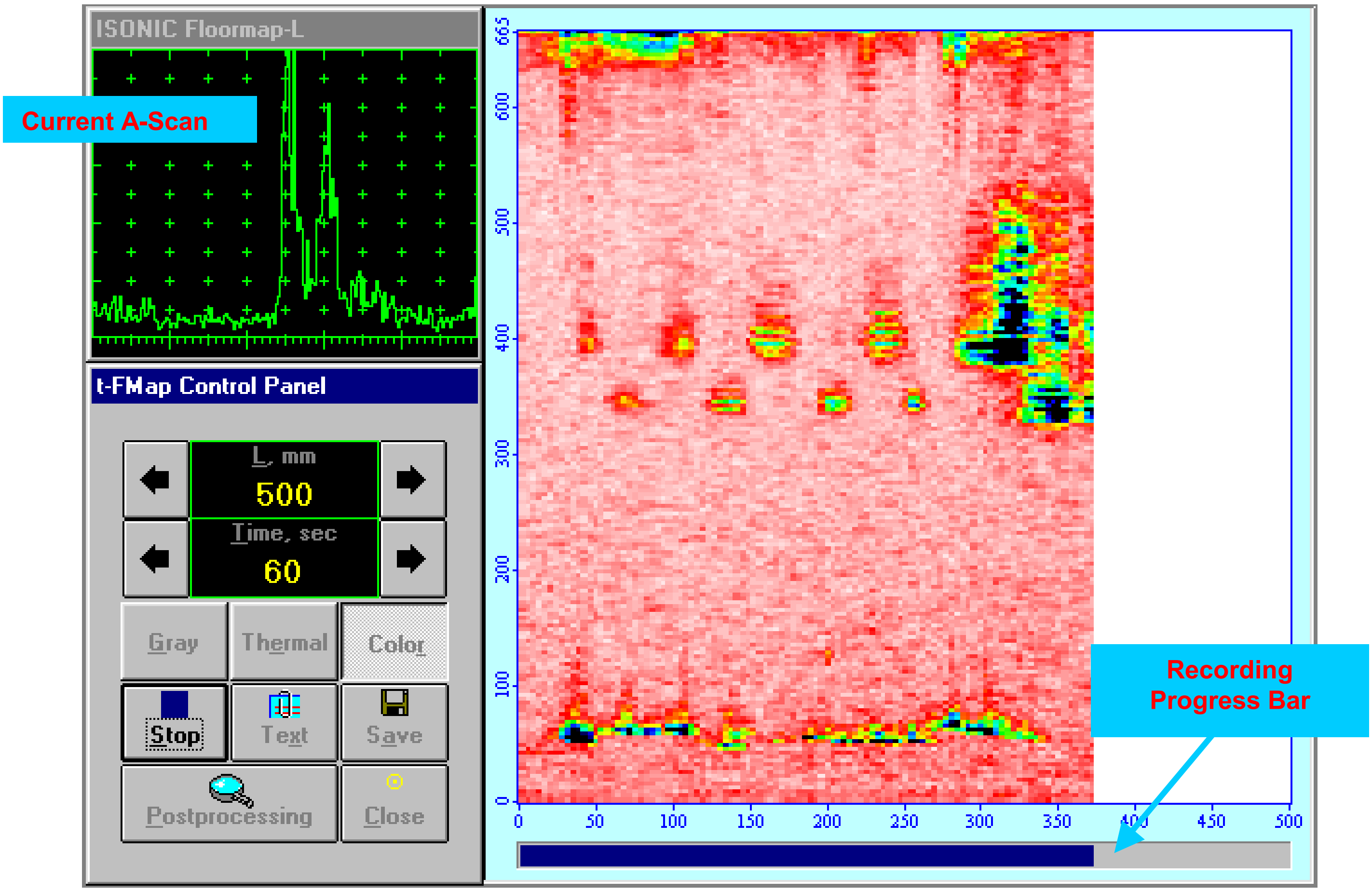
Clicking on **Start** or pressing **<Alt>+<S>** on the keyboard starts the **tFMap** recording

The **Start** button becomes invisible since the recording of **tFMap** starts. The **Stop** button occupies its position. Clicking on **Stop** or pressing **<Alt>+<S>** on the keyboard will terminate the recording of **tFMap** prior to the automatic completion

The **Stop** button becomes invisible after completion / termination of the **tFMap** recording. The **Start** button returns to its position.

To capture **tFMap**:

- Place the probe onto the start point of the selected scanning line
- Click on **Start** or press **<Alt>+<S>** on the keyboard
- Guide the probe over the scanning line synchronously with the recording progress bar – the typical display during the scanning is shown and explained below



Storing the Results

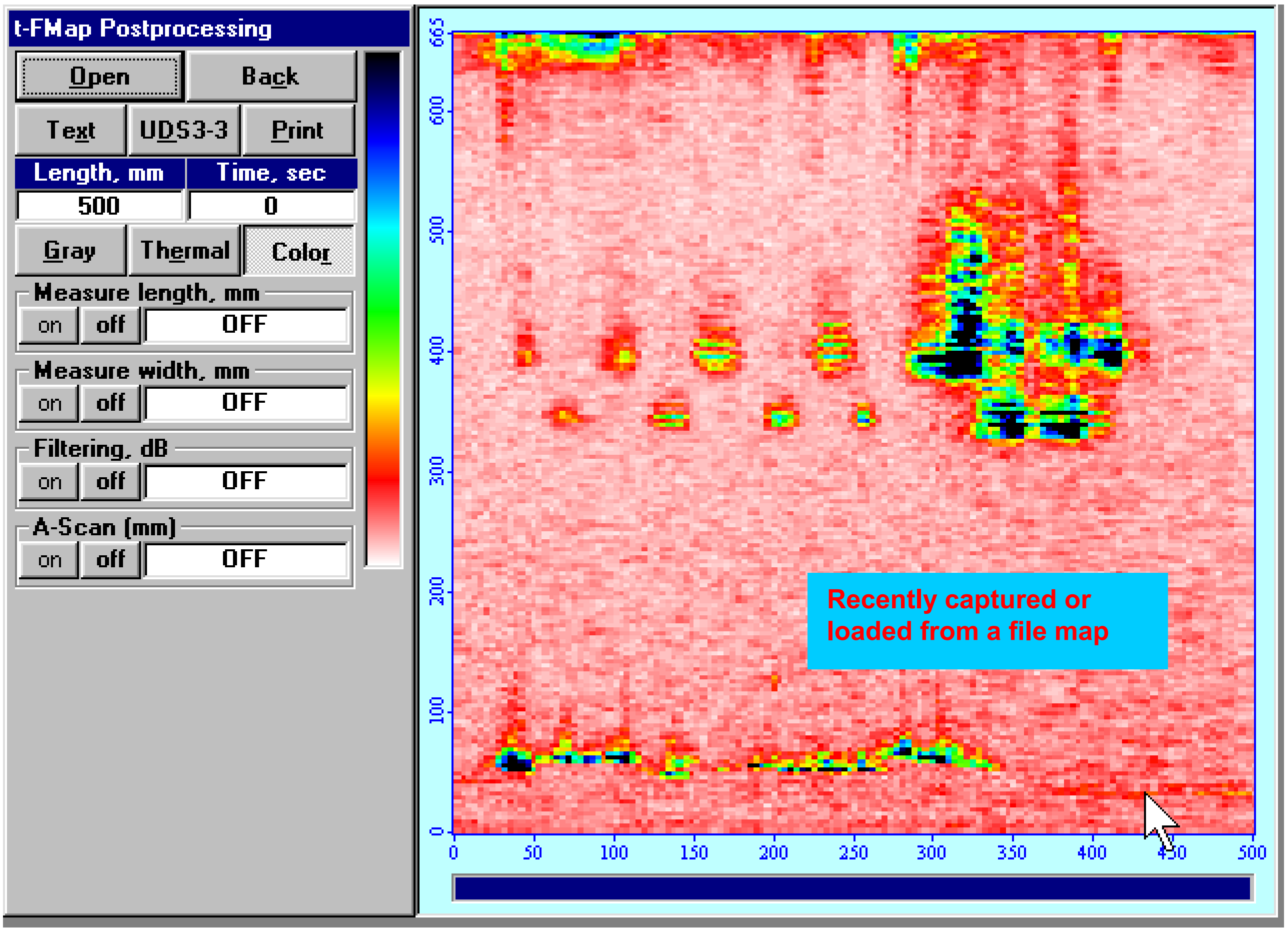
Clicking on Save or pressing **<Alt>+<A>** on the keyboard will save the once captured **tFMap** data and accompanying instrument calibration dump into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

Return to the *Pulser Receiver Setup* screen

Click on Close or press **<Alt>+<C>** or **Esc** on the keyboard

Postprocessing

The postprocessing procedure may be applied either to the recently captured map or to the map loaded from a file. To start postprocessing click on Postprocessing or press **<Alt>+<P>** on the keyboard. The *Postrpocessing* screen appears:

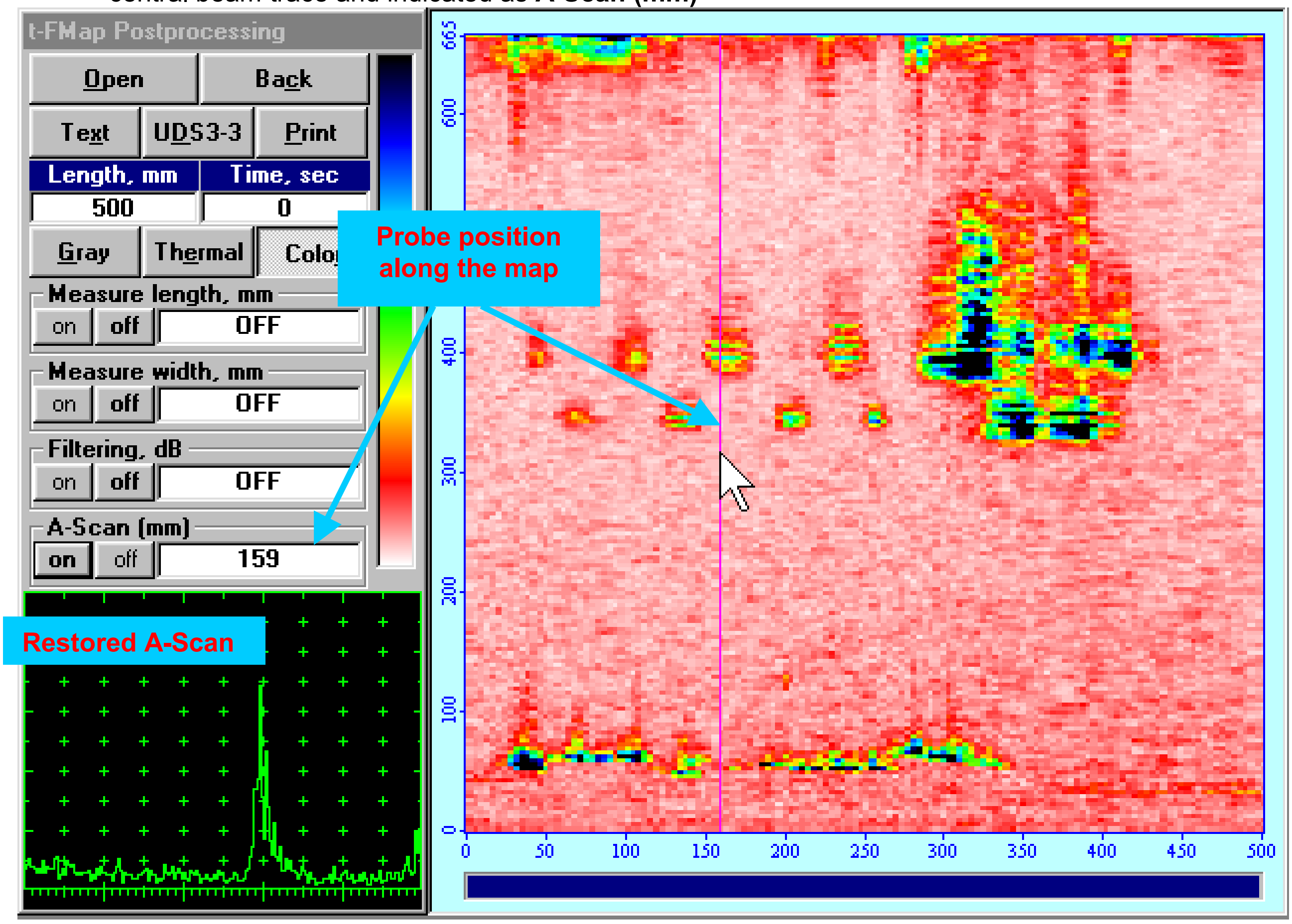


The following controls allow managing of the postrocessing procedures:

- Open - opening once captured **tFMap** data and accompanying instrument calibration dump from a file. Refer to the paragraph 5.4.20 of this Operating Manual to proceed with opening a file
- Text - previewing the comments made at the **tFMap** capturing time

- UDS3-3 or UDS3-4 - previewing the instrument calibration dump actual for the captured **tFMap**
- Print - printing the *Floormap-L Report*
- Back or pressing **Esc** on the keyboard - return to the scanning screen
- Gray - redrawing the map using the Gray-Level coloring
- Thermal - redrawing the map using the Thermo-Level coloring
- Color - redrawing the map using the Rainbow-Level coloring
- A-Scan (mm) on off OFF - Off-line virtual scanning with A-Scan recovery

Clicking on on will place the cursor above the "scanning line" line allowing the *off-line virtual scanning*. The cursor position matching with the probe's excitation center is accompanied with its central beam trace and indicated as **A-Scan (mm)**



The virtual scanning may be controlled by the touch screen stylus or mouse or ← and → buttons on the keyboard. *The A-Scans are recovered and represented dynamically for each cursor position*

Upon completing the virtual scanning and selection of the necessary A-Scan (for example – representing the maximal echo) release the stylus from the touch screen or click or press **Enter** on the keyboard – this will free the cursor for further procedures

To switch off the restored A-Scan click on off

ⓘ

It's possible to interrupt the **A-Scan** recovery by pressing **Esc** on the keyboard o 

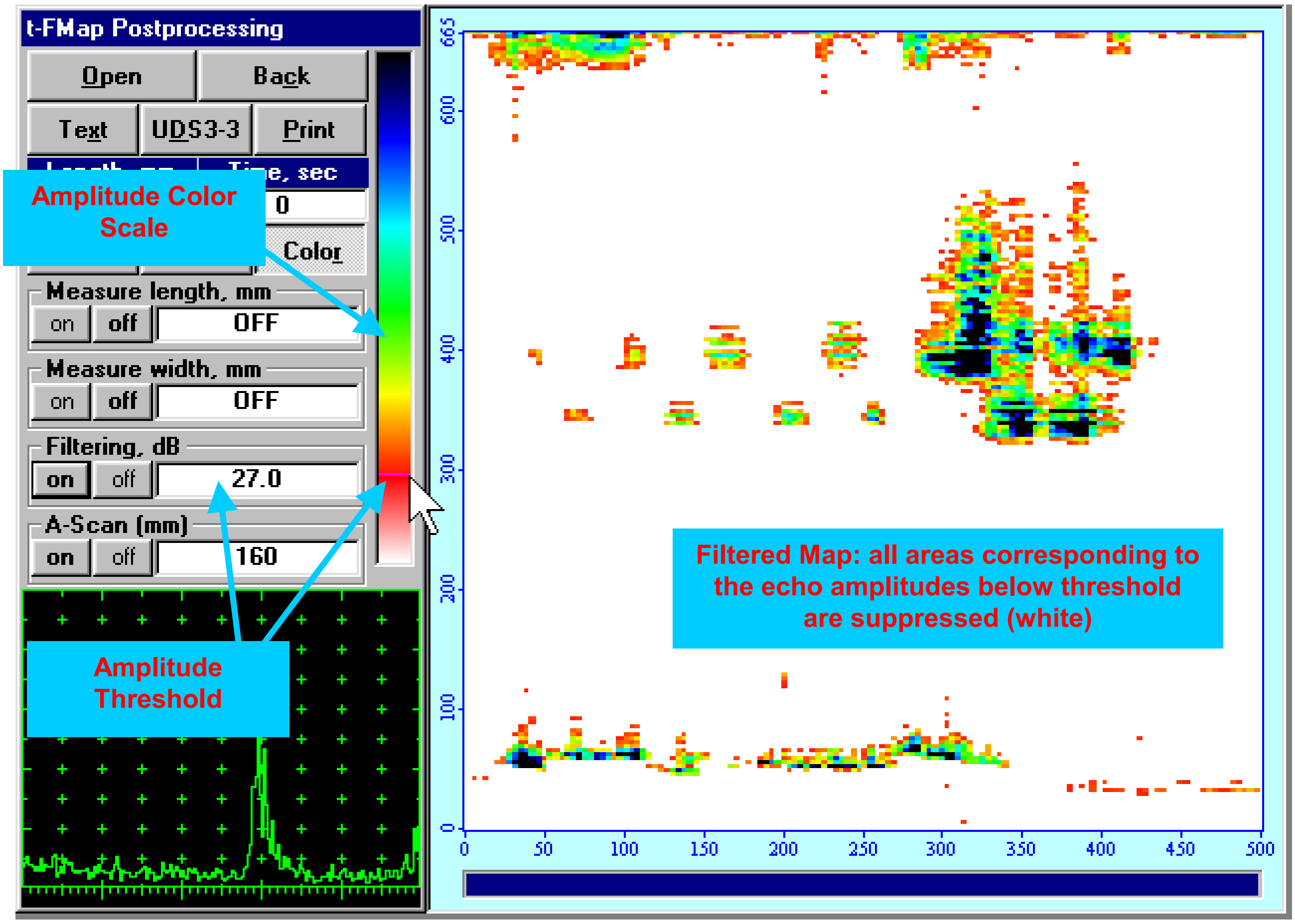
- Filtering the **FLOORMAP_L** record through the suppressing of the echo amplitudes below the selected **threshold level**

To proceed click on on. As a result:

- The **amplitude threshold line** representing the **threshold level** appears above the palette; the cursor is "sticked" to the **amplitude threshold line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard
- The value of the **amplitude threshold** is displayed as **Filtering, dB**
- Images of the reflectors returning the echo amplitudes below the **amplitude threshold** are erased from the **FLOORMAP_L** record i.e. rejected

To fix the **threshold level** left mouse click or release the stylus from the touch screen.

To switch back to the unfiltered **FLOORMAP_L** record representation click on off



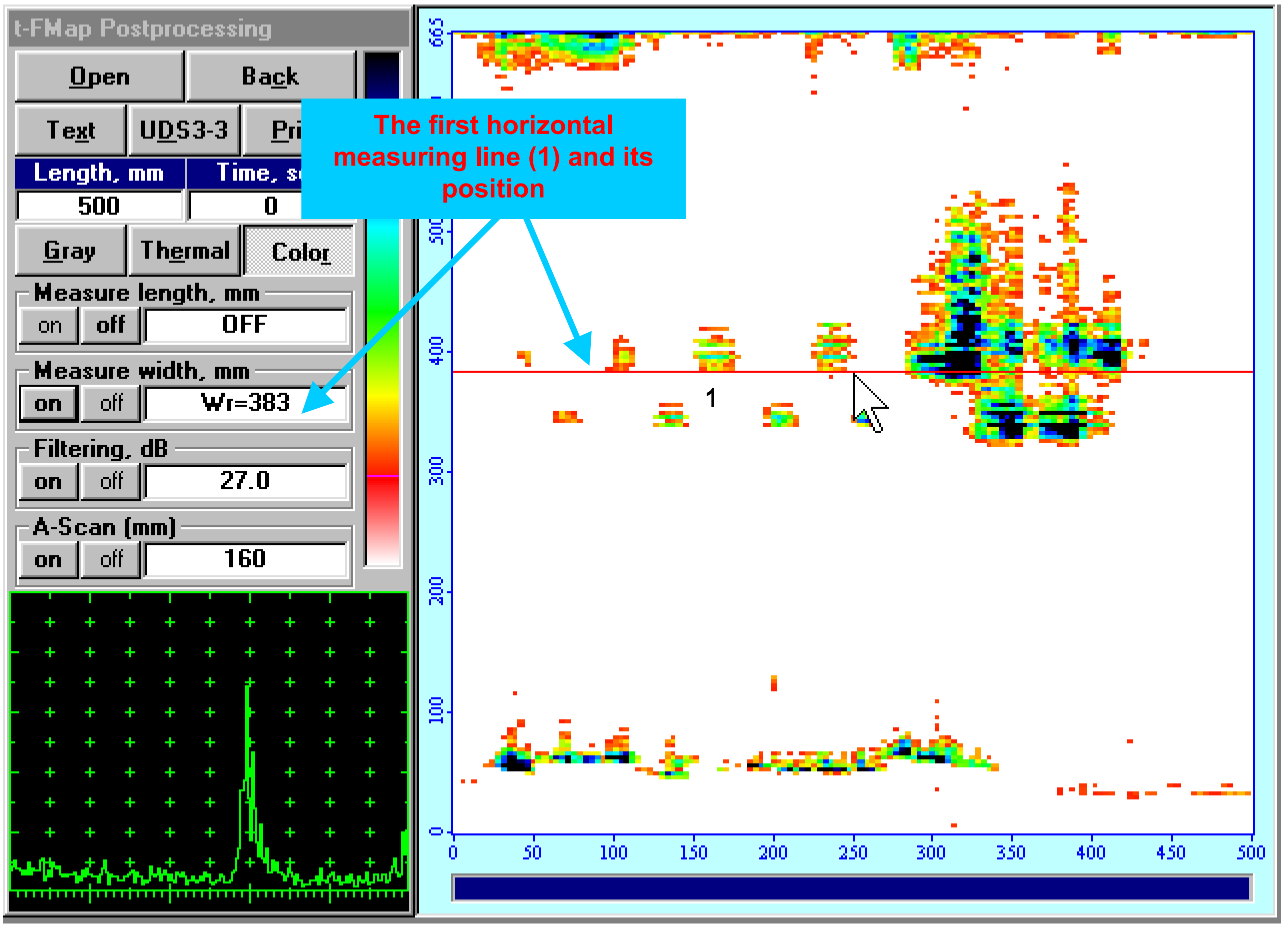
o 

 - measuring defect's coordinate and width along the vertical map axis.

To proceed click on on. As a result:

- ➢ The **first horizontal measuring line** appears on the **FLOORMAP_L** record; the mouse pointer is "sticked" to the **first horizontal measuring line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard
- ➢ The position of the **first horizontal measuring line** is indicated as $\mathbf{W_r}$

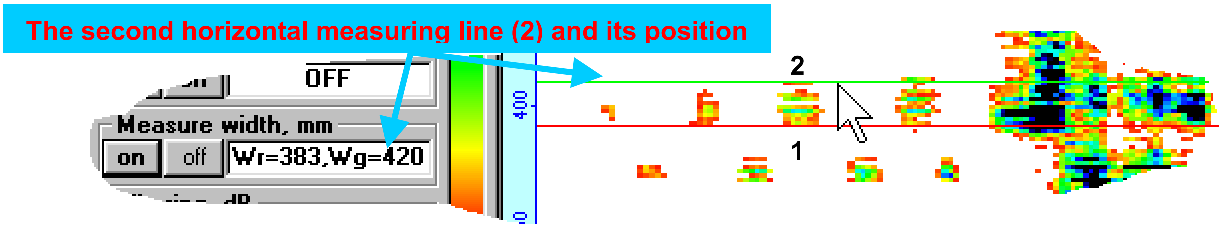
To fix the position of the **first horizontal measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard



As a result:

- The **second horizontal measuring line** appears on the **FLOORMAP_L** record; the mouse pointer is "sticked" to the **second horizontal measuring line**, which may be moved up / down either by the touch screen stylus or by the mouse or by the ↑ , ↓ buttons on the keyboard
- The position of the **second horizontal measuring line** is indicated as $\mathbf{W_g}$

To fix the position of the **first horizontal measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard



To negate the horizontal measuring lines click on off

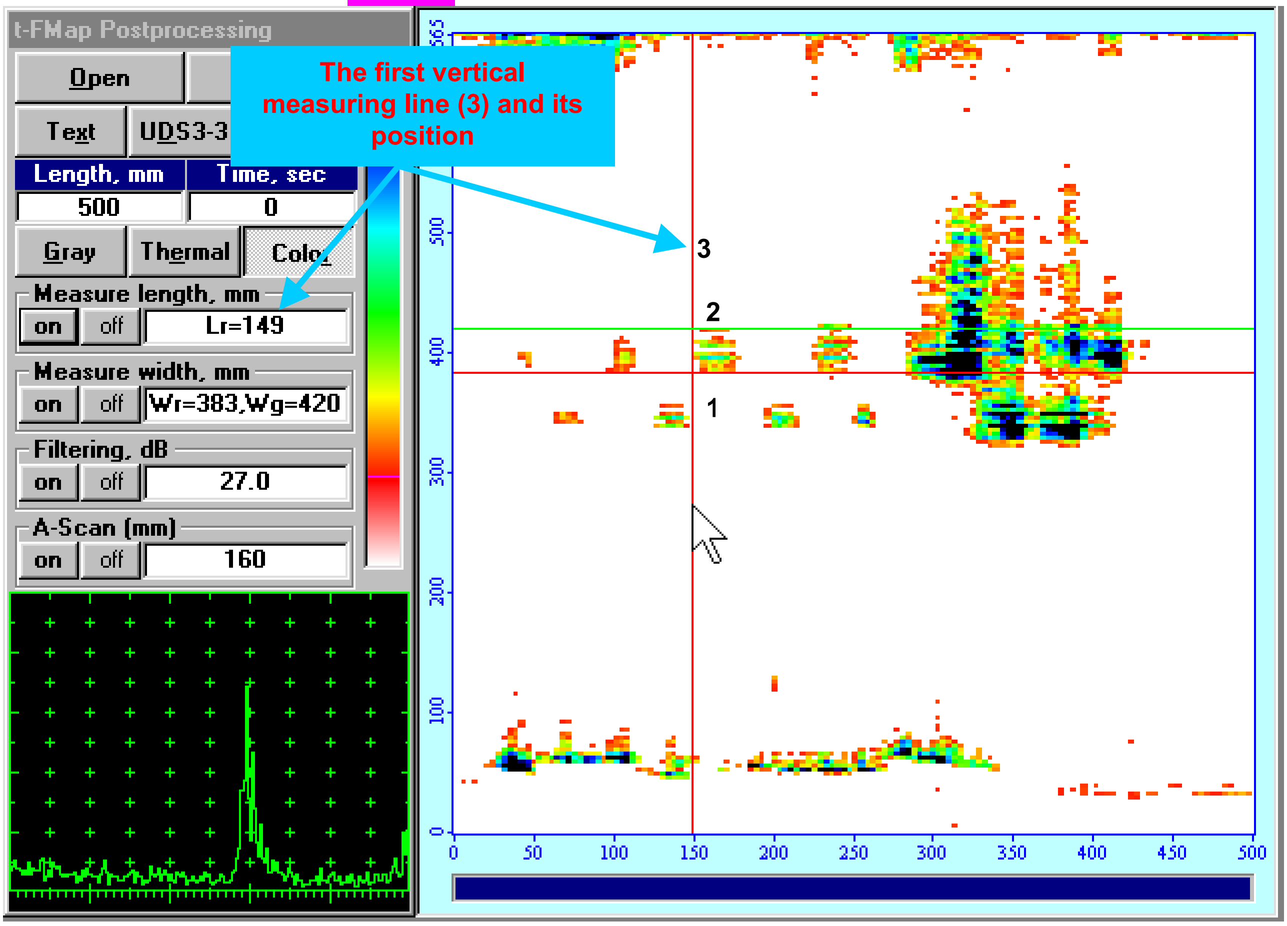
ⓘ

It's possible to interrupt measuring procedure by pressing **Esc** on the keyboard o 

- measuring defect's coordinate and length along the scanning line (horizontal axis of the map). To proceed click on on. As a result:

- ➢ The **first vertical measuring line** appears on the **t-ABIScan** (**ABIScan**) record; the cursor is "sticked" to the **first vertical measuring line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ← , → buttons on the keyboard
- ➢ The position of the **first vertical measuring line** is indicated as $\mathbf{L_r}$

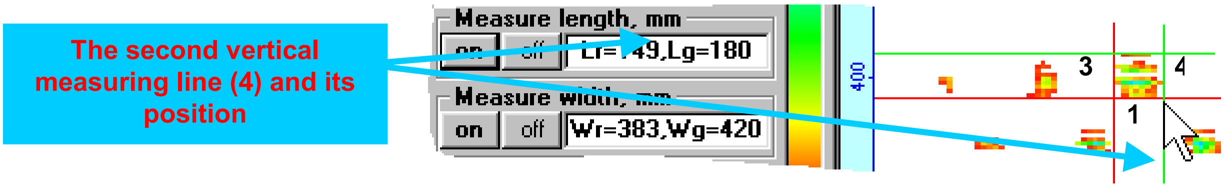
To fix the position of the **first vertical measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard



As a result:

- The **second vertical measuring line** appears on the **FLOORMAP_L** record; the mouse pointer is "sticked" to the **second vertical measuring line**, which may be moved left / right either by the touch screen stylus or by the mouse or by the ← , → buttons on the keyboard
- The position of the **second vertical measuring line** is indicated as $\mathbf{L_g}$

To fix the position of the **second vertical measuring line** release the stylus from the touch screen or left mouse click or press **Enter** on the keyboard



To negate the vertical measuring lines click on off

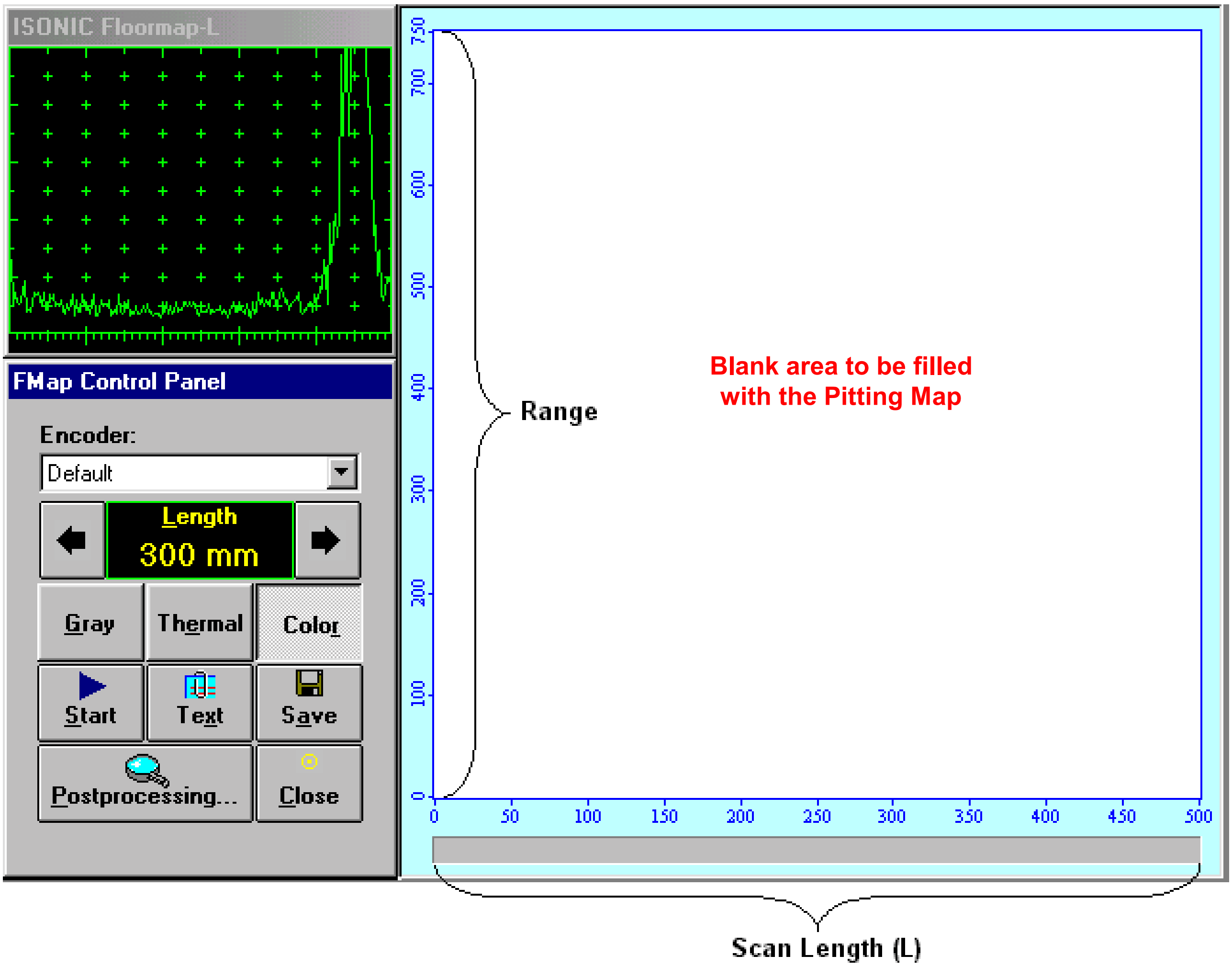
It's possible to interrupt measuring procedure by pressing **Esc** on the keyboard

DAC Normalization

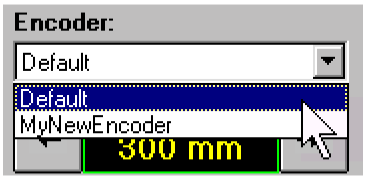
If the **DAC** was active while scanning then the corresponding checkbox appears in the **Fmap Control Panel** upon opening the captured file.. Depending on the selection made the map may be represented either normalized to the **DAC** or not

27.6.2. True-to-Scale (Encoded) Mapping - FMap

The following screen appears upon starting the encoded mapping



Encoder Selection
Select the encoder to be used and click on its name:



Scan Length

Refer to the paragraph 27.6.1 of this Operating Manual

Echo Amplitude Palette (Color Scale)

Refer to the paragraph 27.6.1 of this Operating Manual

Insert Text Note

Refer to the paragraph 27.6.1 of this Operating Manual

Scanning

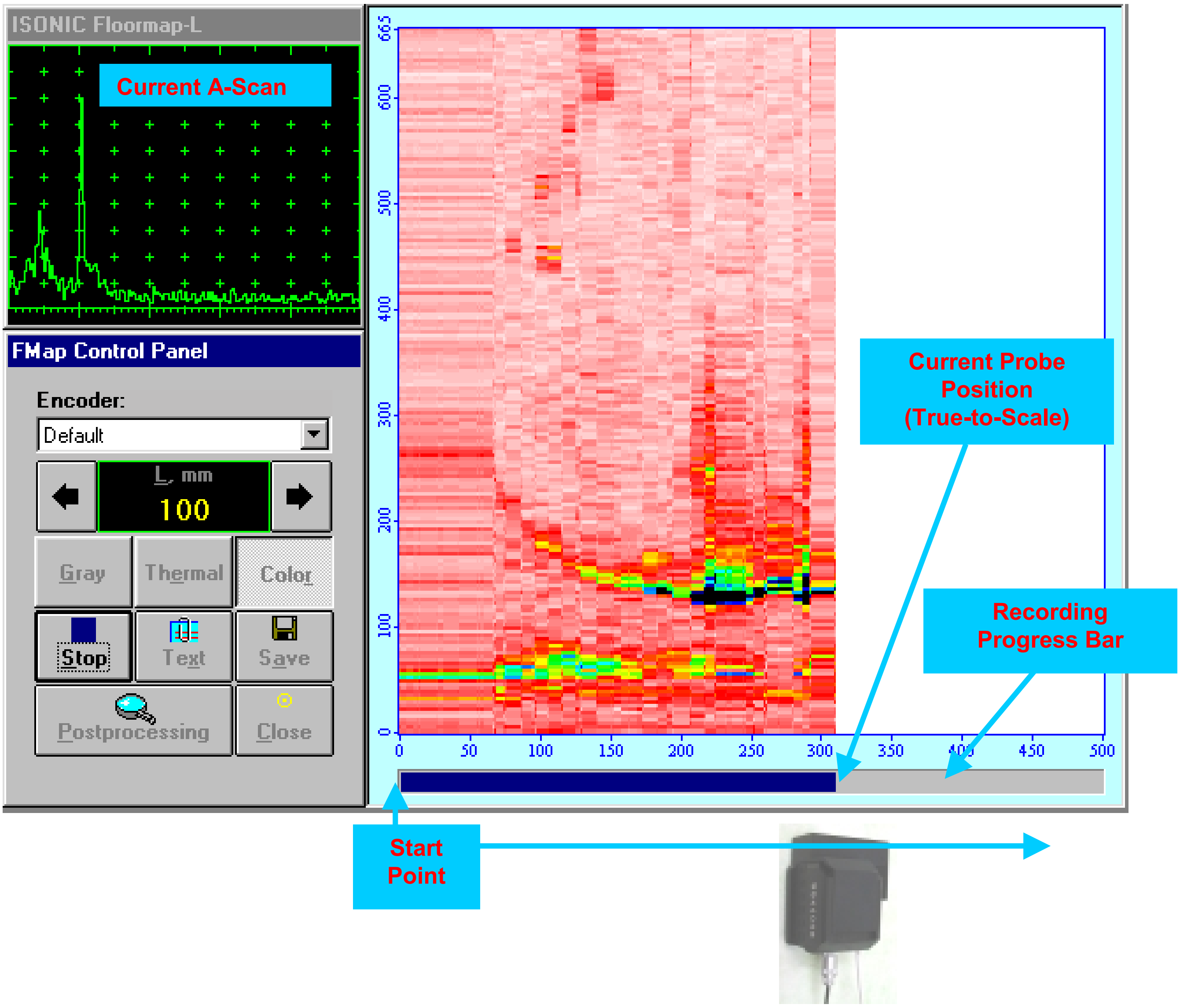
Clicking on **Start** or pressing **<Alt>+<S>** on the keyboard starts the **FMap** recording

The **Start** button becomes invisible since the recording of **FMap** starts. The **Stop** button occupies its position. Clicking on **Stop** or pressing **<Alt>+<S>** on the keyboard will terminate the **FMap** recording

The **Stop** button becomes invisible after completion / termination of the **FMap** recording. The **Start** button returns to its position.

To capture **FMap**:

- Place the probe equipped with encoder onto the start point of the selected scanning line (refer to the screenshot and accompanying graphics below to understand the probe and encoder orientation with relate to the Recording Progress)
- Click on **Start** or press **<Alt>+<S>** on the keyboard
- Guide the probe over the scanning line: the recording progress bar moves synchronously with the probe in both directions – the typical display during the scanning is shown and explained below



Storing the Results

Refer to the paragraph 27.6.1 of this Operating Manual

Return to the *Pulser Receiver Setup* screen

Refer to the paragraph 27.6.1 of this Operating Manual

Postprocessing

Refer to the paragraph 27.6.1 of this Operating Manual

DAC Normalization

Refer to the paragraph 27.6.1 of this Operating Manual

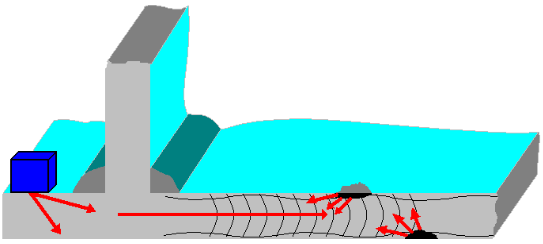
28. Operating 'FLOORMAP' Software Package - ISONIC FLOORMAP

The contents of this chapter is valid for the FLOORMAP SW Package version 3.3.0.7 or higher

28.1. General

FLOORMAP is the software package providing the express ultrasonic inspection and mapping of the pitting (corrosion) in the large metallic plates either flat or curved. The ultrasonic coverage of the whole plate is provided without scanning above the whole surface of the plate. The typical objects under test are:

- Annular plates of the storage tank - inspection from outside
- Shell and walls of the storage tank - inspection from outside
- Floor plates of the storage tank - inspection from inside
- Inaccessible pipe walls – inspection from outside (for example the pipe walls above the concrete support, coated pipes, etc.)
- Walls of the underground storage tanks – inspection from outside



The specially designed probe emits the ultrasonic beam having the width, duration of the wave package and basic wavelength comparable with the thickness of the plate. The components of the emitted wave package interfere between the plate's surfaces. The probe's dead zone is located under the fillet weld, so the probable echoes from the welding area are significantly suppressed. After passing through the fillet weld area the ultrasonic wave package saturates the volume of the plate while propagating. Pitting and corrosion damage if any returns an echo picked up by the probe.

FLOORMAP software package provides the pitting (corrosion damage) mapping of the plate through the:

- continuous linear scanning with the probe along the plate edge / reservoir shell
- probe swiveling near the shell at one or few points in front of mapping area
- combination between linear scanning and swiveling

The true-to-scale map is created using the capturing, processing and storing of all received ultrasonic signals in correlation with the probe position and swiveling angle, which are encoded non-mechanically using the typical ISONIC airborne ultrasound technique

The described principle of the pitting (corrosion damage) detection and mapping is usually applicable for the *overall inspection range up to 1…1.5 m (40 – 60 in)* providing that there is no another weld or plate wedge on the way of wave package propagation beside the fillet weld

ⓘ

The high degree of the average scattered plate corrosion, inter-crystal corrosion dropping the elastic properties of the plate material and plate coatings of some types may reduce the overall inspection range significantly

Summary:

Restrictions	***Scope of Applications***
• No discrimination between top and reverse side corrosion is possible • The scanning surface must be free of impurities, welding droplets, surface corrosion and coating (well bonded paint or coating is acceptable) • Poor annular plate condition may decrease the inspection range	FLOORMAP is not restricted to Storage Tank Inspection, other applications for the technique constantly evolve: • Pipe support areas • Sleeved pipes • Under clamp regions • Under reinforcing plates

28.2. Hardware

Probes

The following specially designed ultrasonic probes are required for the inspection with the **FLOORMAP** software package:

- o Special Probe for the Fast Tank Floor / Wall Inspection for Pitting and Deep Corrosion Damages - Thickness Range 6 - 16 mm (0.25 – 0.64 in)– order code S 544007
- o Special Probe for the Fast Tank Floor / Wall Inspection for Pitting and Deep Corrosion Damages - Thickness Range 12 - 30 mm (0.5 – 1.25 in) – order code S 544008
- o Other special probes recommended by Sonotron NDT

Encoder

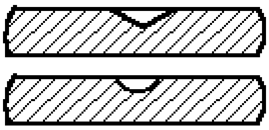
To observe the pitting (corrosion) mapping it is required the standard set of acoustic sensors for mechanics free monitoring location and swiveling angle of manually manipulated ultrasonic probe; said set is included into the scope of supply of **ISONIC** and **ISONIC 2001** workstation. The following components of the set are required to implement the mapping:

- ❑ Double or Single Emitter of Airborne Ultrasound
- ❑ 2 Airborne Ultrasound Receivers
- ❑ Holder for Airborne Ultrasound Receivers – the Bar with Magnetic Attachments to the Object Under Test
- ❑ Long Single Cable System

Reference plate

It is necessary to provide and check the calibration of the unit prior to each inspection session. The reference plate containing the artificial defects simulating the different types of the pitting is recommended, said reference plate must have the 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%.

For the compact pitting representation it's recommended to use conically and/or spherically shaped drills having different depth and opening:



For the elongated pitting representation it's recommended to prepare the slits in the reference plate, said slits must be parallel to one of the plate edges and may have different depth and, for example, the cylindrical bottom shape and spherically shaped edges

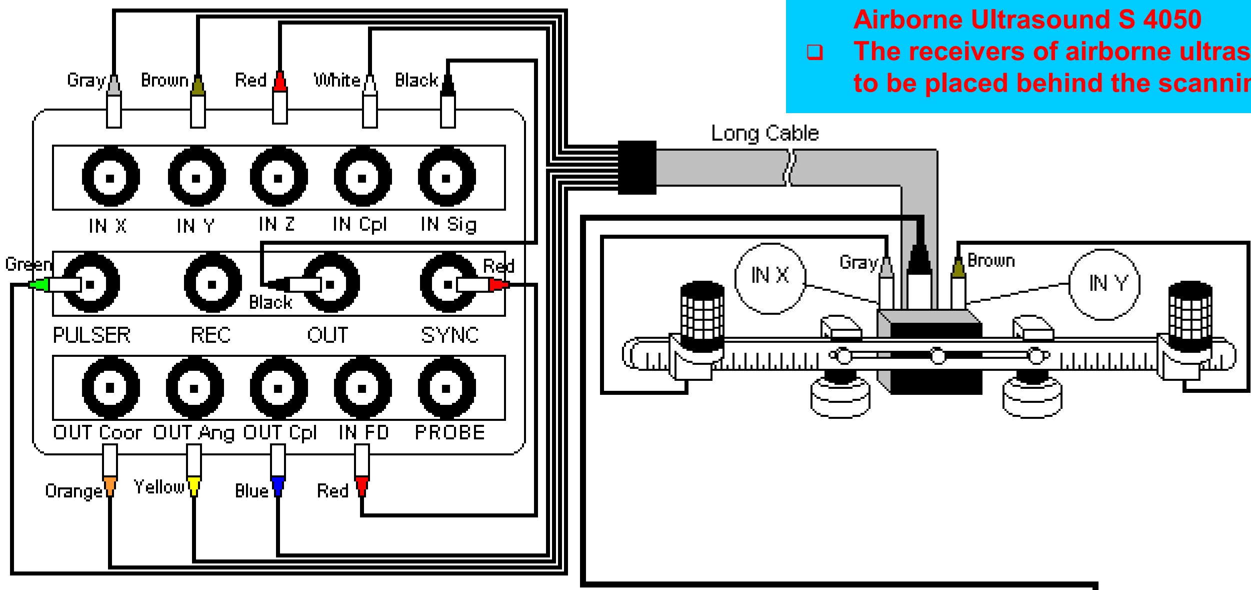
The EDM notches are not applicable

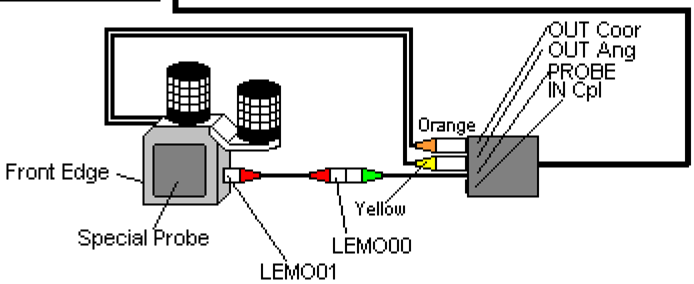
28.3. Cabling and Fixture

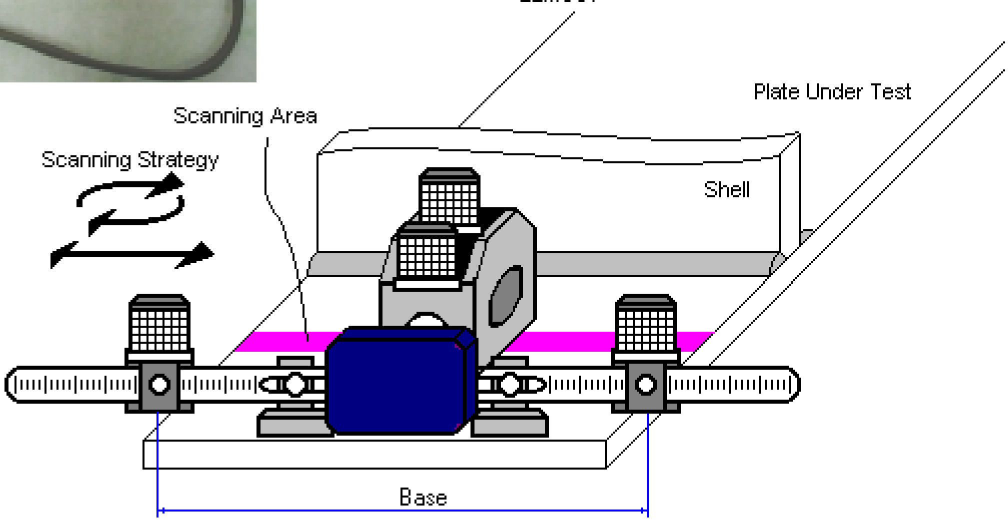
The probes designed for the implementation of the **FLOORMAP** software package are equipped with the clamper for the airborne ultrasound emitters. Refer to the below sketches to provide the required cabling and fixture:

CASE 1

- **All kinds of scanning**
- **Use of the Double Emitter of Airborne Ultrasound S 4050**
- **The receivers of airborne ultrasound to be placed behind the scanning**

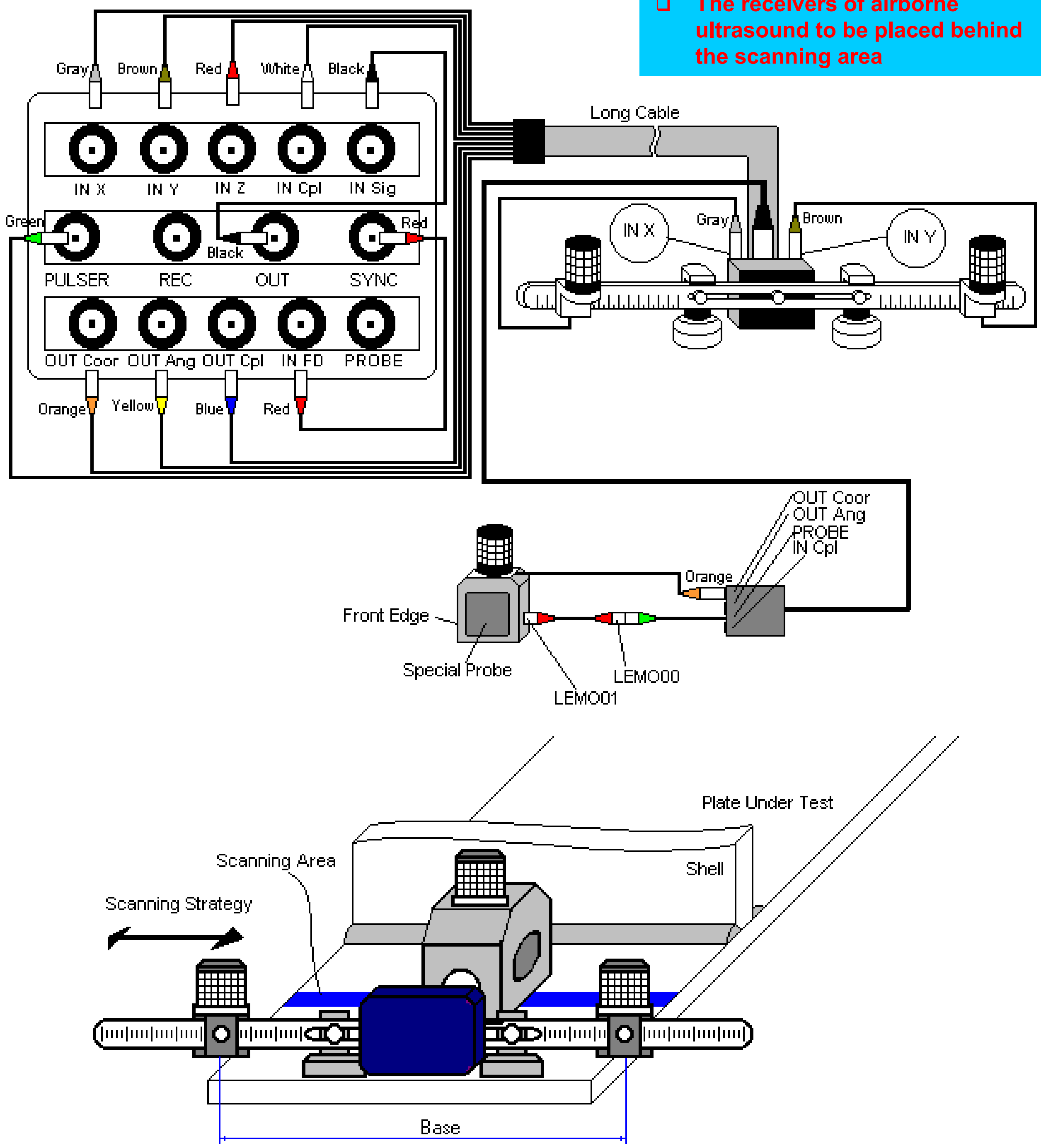






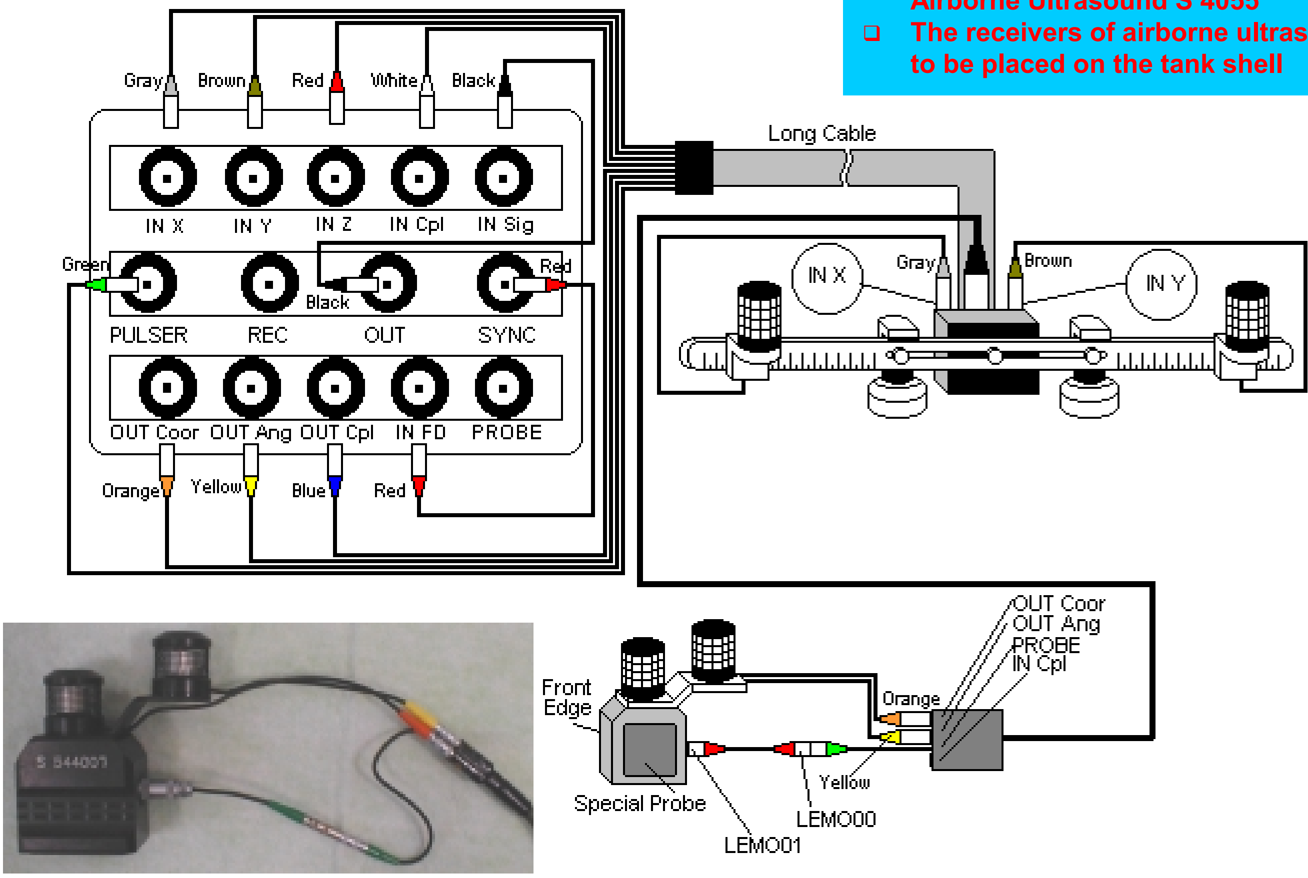
CASE 2

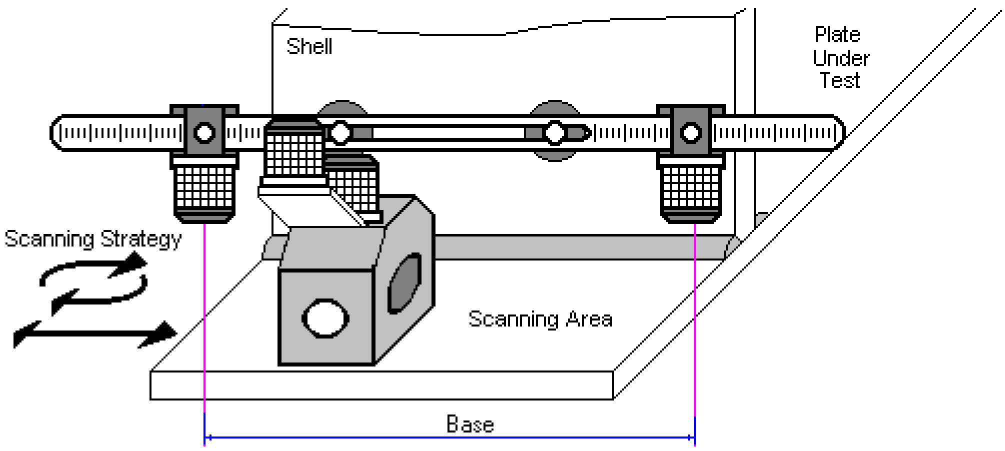
- **Linear scanning only**
- **Use of the Single Emitter of Airborne Ultrasound**
- **The receivers of airborne ultrasound to be placed behind the scanning area**



CASE 3

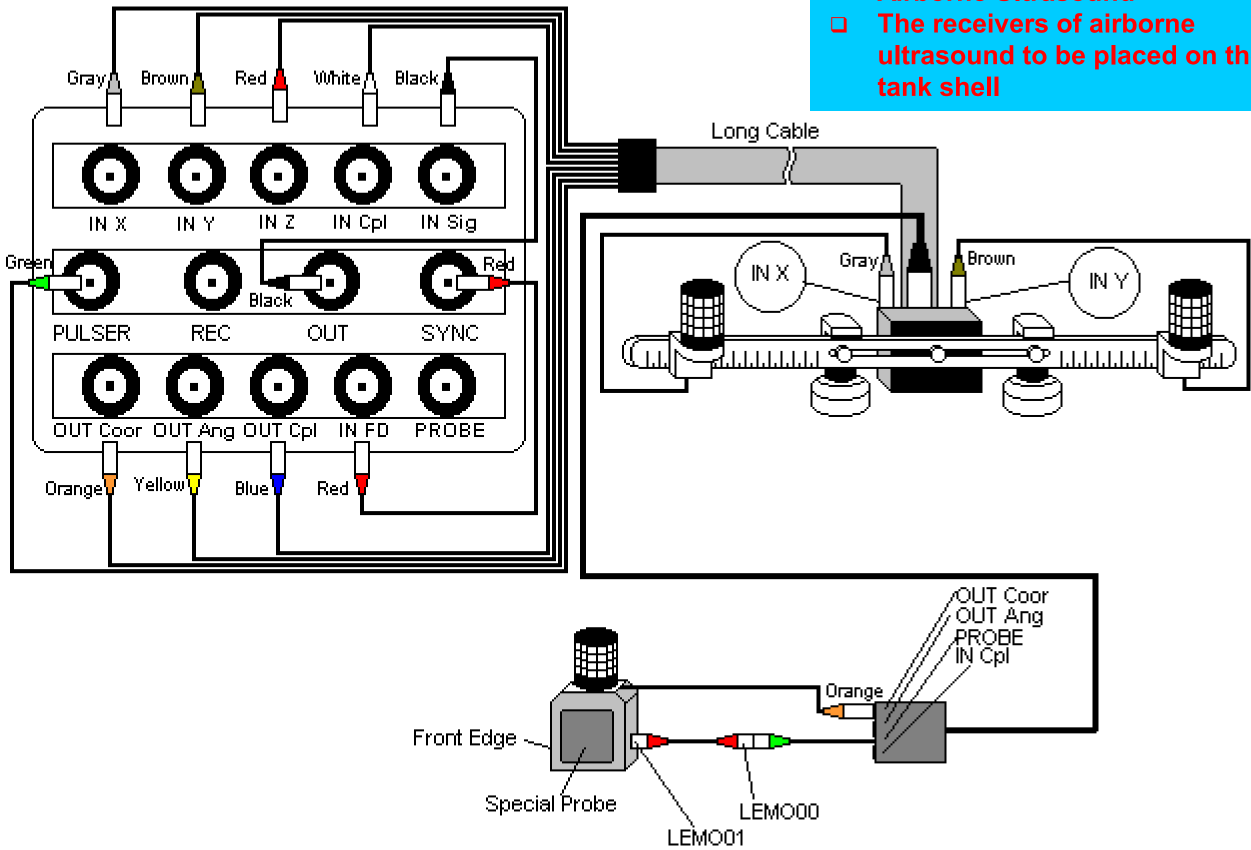
- **All kinds of scanning**
- **Use of the Double Emitter of Airborne Ultrasound S 4055**
- **The receivers of airborne ultrasound to be placed on the tank shell**

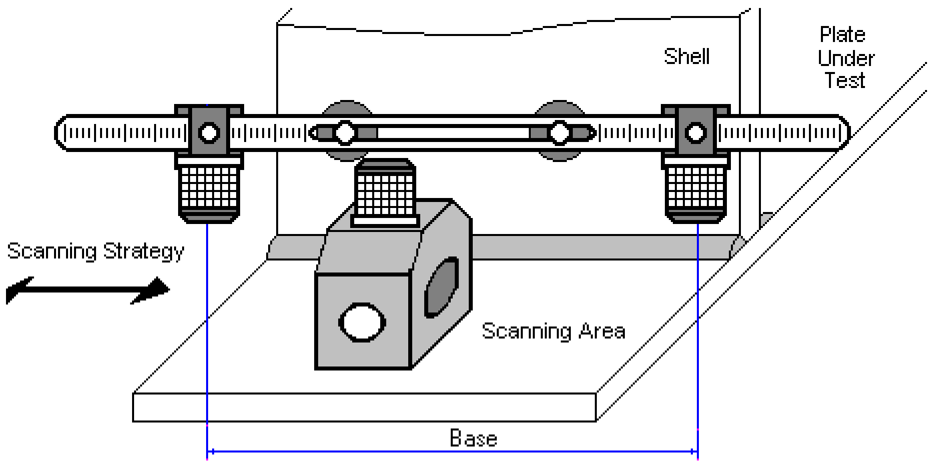




CASE 4

- **Linear scanning only**
- **Use of the Single Emitter of Airborne Ultrasound**
- **The receivers of airborne ultrasound to be placed on the tank shell**

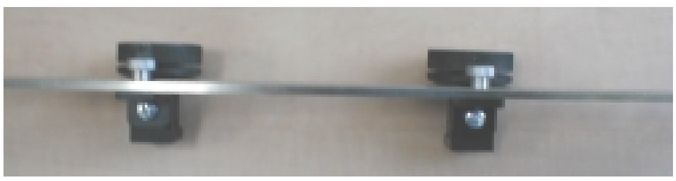




In order to place the receivers of airborne ultrasound on the tank shell the special fixture S 2045B is required. The placement of the receivers of airborne ultrasound on the tank shell and the accompanying manipulations are explained below

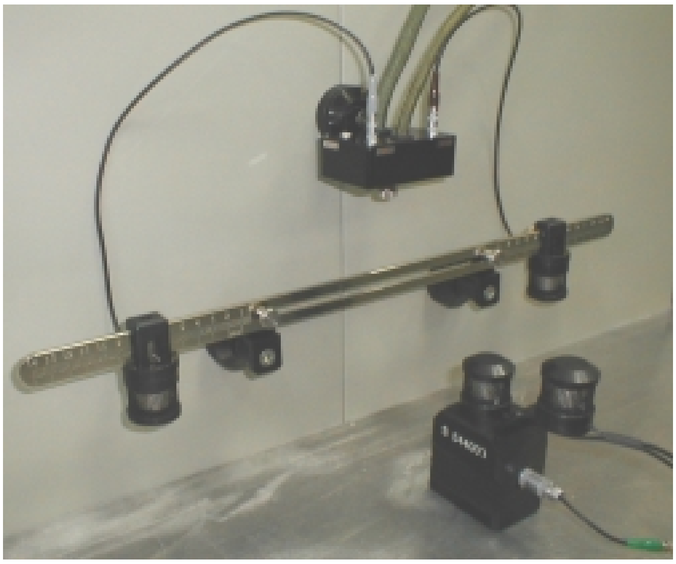
1. Equipping 2 magnetic legs with elbow

2. Fitting the legs into the receivers bar



4. Equipping the cable box with the separate magnetic leg

5. Placement of the bar with the receivers and cable box on the shell

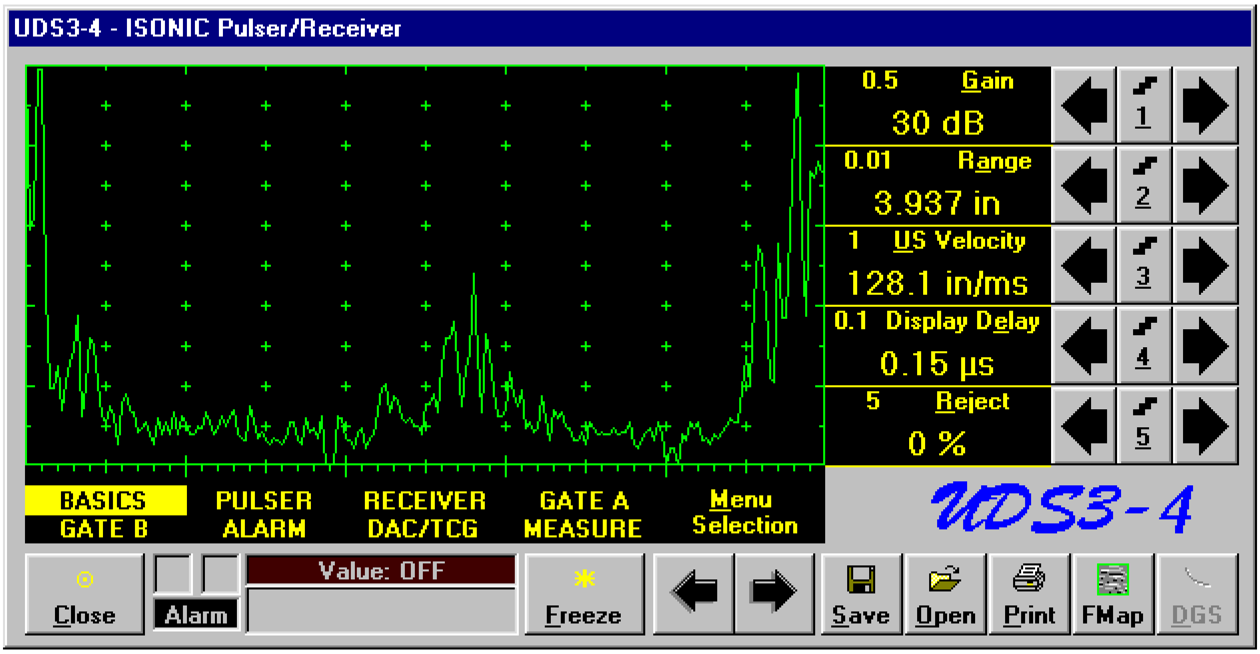


28.4. Start Up

Double click on the icon  located on the **ISONIC** desktop

28.5. Getting started...

The *Pulser Receiver Setup* screen appears upon starting **FLOORMAP** software package. The operating surface is identical to the **PULREC – ISONIC Pulser Receiver** software package, which is explained in details in the Chapter 5 of this Operating Manual



The operating surface is required for the *pre-scanning setup* of the following parameters:

- o **Gain**
- o **DAC or TCG (Optionally)**
- o **Range**
- o **US Velocity**
- o **Display Delay**

The setup of the listed parameters determines the sensitivity and the overall inspection range

28.5.1. US Velocity and Display Delay

Refer to the paragraph 27.5.1 of this Operating Manual

28.5.2. Gain

Refer to the paragraph 27.5.2 of this Operating Manual

28.5.3. DAC or TCG

Refer to the paragraph 27.5.4 of this Operating Manual

28.5.4. Range

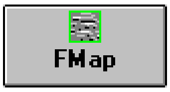
FOORMAP software package provides the creation of 2D map. **Range** determines the first and the **Scan Length (L)** determines the second dimension of the map to be created. Setup the **Range** value as below:

- o For all kinds of scanning (linear + swiveling) or swiveling:

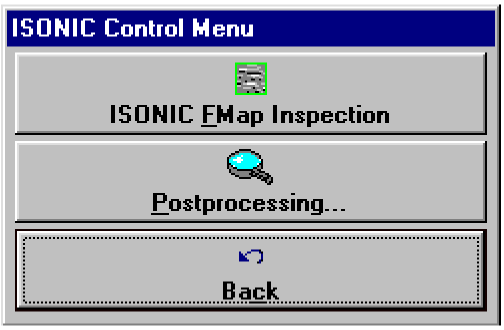
  Range = Y / cos (Maximal Swiveling Angle Allowed)

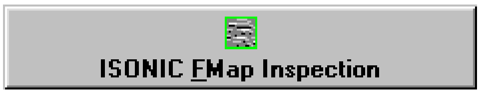
  here **Y** is the vertical size of the map to be created
- o For the linear scanning only: **Range = Y**

28.6. Inspection and Postrocessing

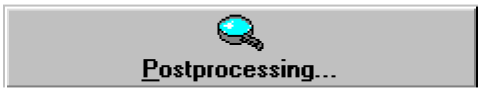
To start click on the 

button: the subwindow appears on the **ISONIC** screen:

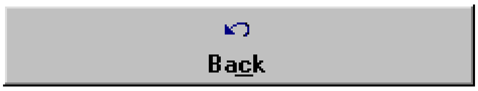


To start the inspection click on 

or press **<Alt>+<F>** on the keyboard

To start the postprocessing click on 

or press **<Alt>+<P>** on the keyboard

To return to **ISONIC Pulser Receiver** window click on 

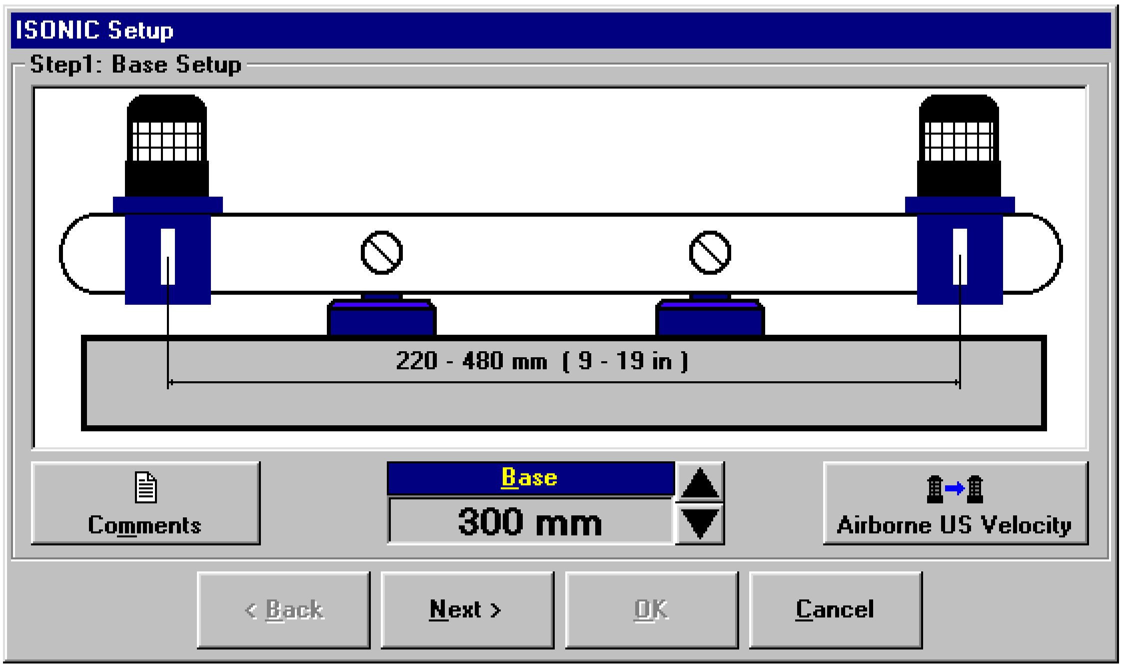
or press **<Alt>+<C>** or **Esc** on the keyboard

28.6.1. Inspection

At the *first pre-inspection stage* the value of **Base** must be keyed in. The distance between two receivers (**Base**) on the bar is defined as:

Base = **200** + **Pos1** + **Pos2**, *mm*
or
Base = **8** + **Pos1** + **Pos2**, *in*

Pos1 and **Pos2** are the coordinates of the receivers taken form the left and right scales of bar correspondingly. The value of **Base** must be known prior to the scanning. Wrong determining of the **Base** causes mistakes in monitoring probe location and swiveling angle and in the defects imaging



To setup the value of **Base** the following manipulations are applicable:

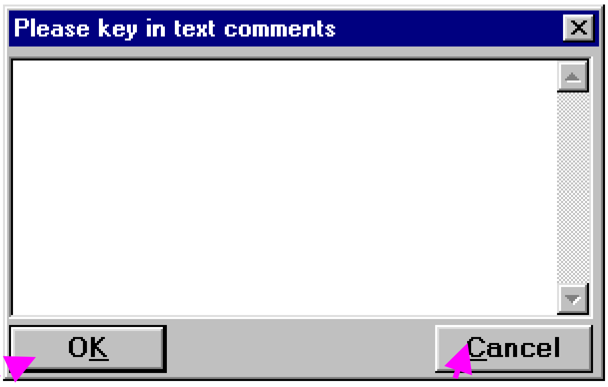
- **Mouse**
  - Click on the corresponding spin 
- **Keyboard**
  - Pressing **<Alt>+<B>** ⇒ **Base** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Base** area letter **B** is underlined)
- **Combined**
  - Click on **Base** ⇒ **Base** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The value of the **Base** may be vary from **220** to **480 mm** (or **9** to **19 in**) in **1 mm** (or **0.25 in**) resolution

The value of **Base** determines the X-size (Length) of the map to be obtained

The procedure of **Airborne US Velocity** calibration must be performed at the *first pre-inspection stage* at the beginning of working shift; it also must be repeated only in case of 10^{o}C change of the ambient temperature during the shift. To activate the procedure click on the Airborne US Velocity button or press **<Alt>+<A>** on the keyboard: the **Airborne Ultrasound Velocity Setup** window appears – refer to the paragraph 7.6.5 of this Operating Manual to get instructed on how to proceed

A text note may be keyed in to accompany the **FLOORMAP** record. To proceed click on Comments or press **<Alt>+<M>** on the keyboard



Click on or press **<Alt>+<K>** or **Enter** on the keyboard to end typing and storing of the note

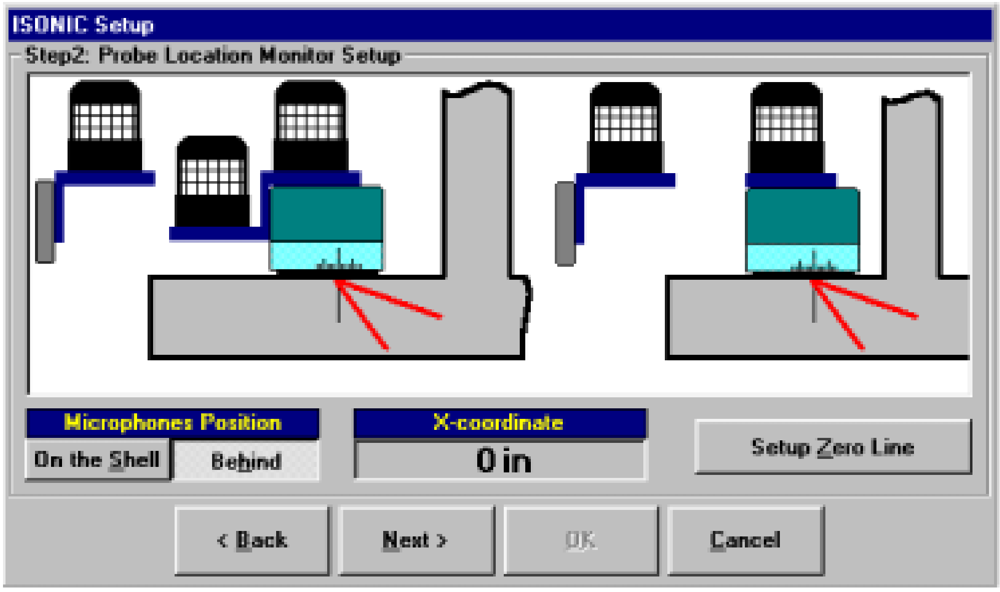
Click on or press **<Alt>+<C>** or **Esc** on the keyboard to discard the new note / comments

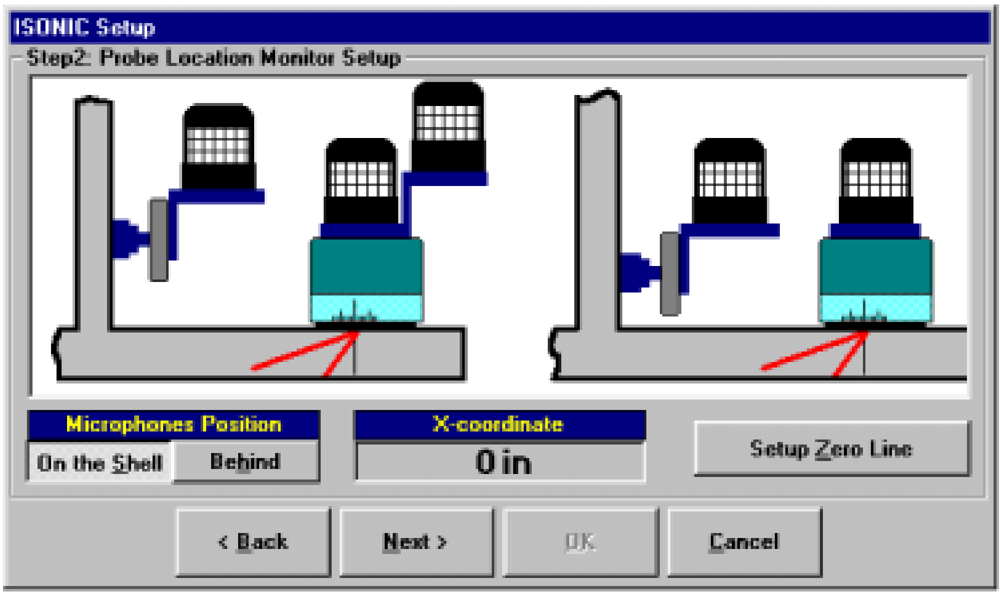
To proceed further to the *second pre-inspection stage* click on Next > or press **<Alt>+<N>** on the keyboard

To return to **ISONIC Pulser Receiver** window click on Cancel or press **<Alt>+<C>** or **Esc** on the keyboard

At the *second pre-inspection stage* the probe location monitor must be referred to the *Scanning Area*. The placement of the airborne ultrasound receivers (**Microphones Position**) must be defined through the click on On the Shell (or pressing **<Alt>+<S>** on the keyboard) or through the click on Behind (or pressing **<Alt>+<H>** on the keyboard)

After defining the **Microphones Position** place the probe approximately in the middle of the *Scanning Area* and click on Setup Zero Line or press **<Alt>+<Z>** on the keyboard.



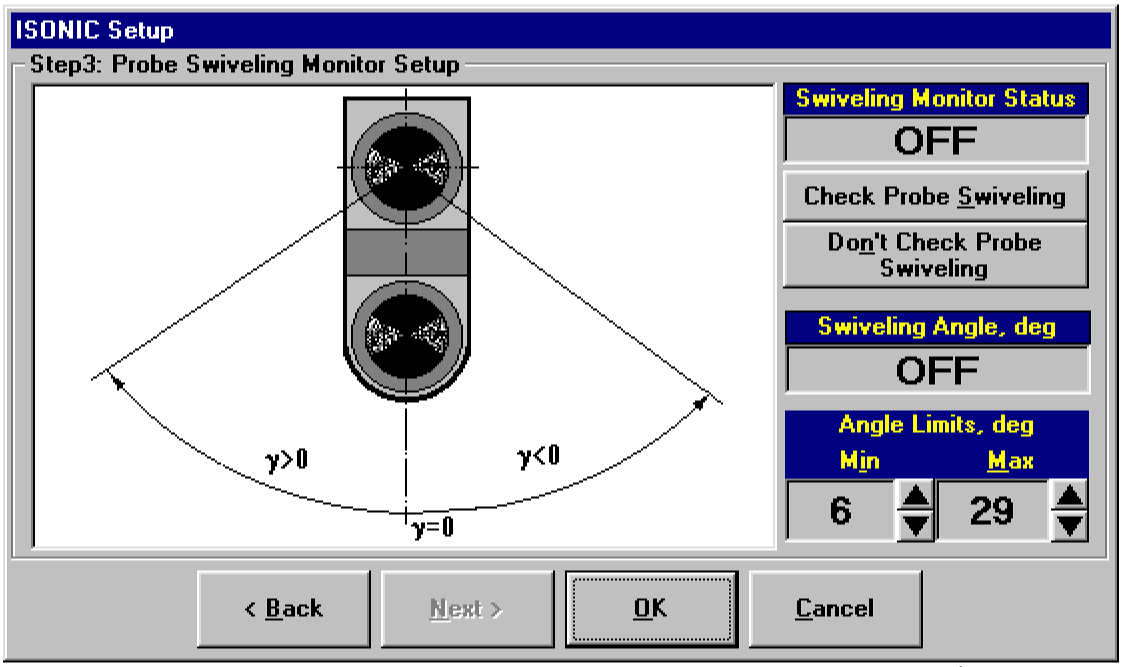


To proceed further to the *third pre-inspection stage* click on Next > or press **<Alt>+<N>** on the keyboard

To return to the *first pre-inspection stage* click on < Back or press **<Alt>+<A>** on the keyboard

To return to **ISONIC Pulser Receiver** window click on the Cancel button or press **<Alt>+<C>** or **Esc** on the keyboard

At the *third pre-inspection stage* the *Probe Swiveling Angle* monitor must be switched on or off depending on the scanning strategy selected



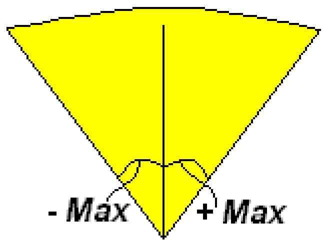
- To negate the *Probe Swiveling Angle* monitor click on 

or press **<Alt>+<N>** on the keyboard

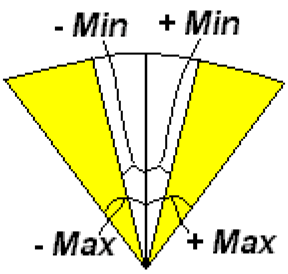
- To activate the *Probe Swiveling Angle* monitor click on 

or press **<Alt>+<S>** on the keyboard

There are *two limits* for the Probe Swiveling Angle to be settled (**Angle Limits**). If the **Min** limit is setup to **0 deg** then the whole sector defined through the **Max** limit will be imaged whilst just swiveling the probe in the range of **[- Max … + Max]**:



If the **Min** limit is not **0 deg** then there are two sectors in the range of **[- Max … - Min]** and **[+ Min … + Max]** to be imaged while the sector **[- Min … + Min]** will remain not imaged:



Setup **Min** limit to the **non 0 deg** allows to avoid recording of the echoes from the fillet weld between the shell and annular plate, which may mask the close to shell pitting (corrosion damage). If the effect of the fillet weld echo is not found prior to the inspection it's recommended to setup **Min** limit to **0 deg**.

To setup the **Min** limit the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin
- **Keyboard**
  - Press **<Alt>+<I>** ⇒ **Min** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Min** area letter **i** is underlined)
- **Combined**
  - Click on **Min** ⇒ **Min** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

The **Min** limit may vary from **0** to **{ Max Limit – 5 °}** in **1 °** resolution

To setup the **Max** limit the following manipulations are applicable:

- **Mouse**
  - Click on the corresponding spin
- **Keyboard**
  - Press **<Alt>+<M>** ⇒ **Min** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard (In the **Max** area letter **M** is underlined)
- **Combined**
  - Click on **Max** ⇒ **Max** fore color changes to white - then use ↑ , → , ← , ↓ buttons on the keyboard

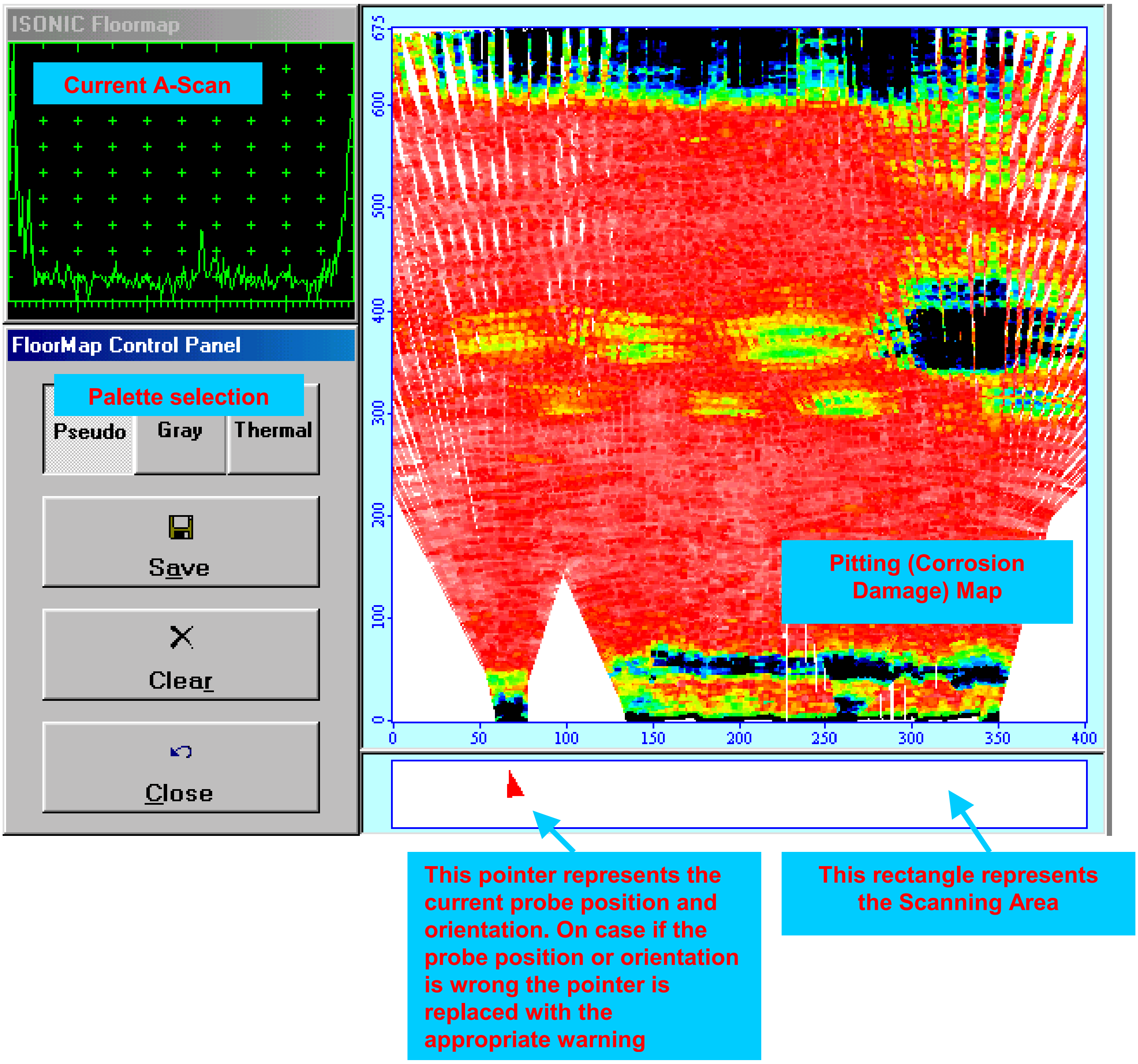
The **Max** limit may vary from **10 °** or **{ Min Limit + 5 °}** to **30°** in **1 °** resolution

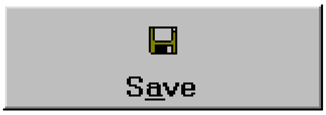
To return to the *second pre-inspection stage* click on **< Back** or press **<Alt>+<A>** on the keyboard

To return to **ISONIC Pulser Receiver** window click on **Cancel** or press **<Alt>+<C>** or **Esc** on the keyboard

To start scanning procedure click on **OK** or press **<Alt>+<K>** or **Enter** on the keyboard

The typical **FLOORMAP** screen is shown and explained below

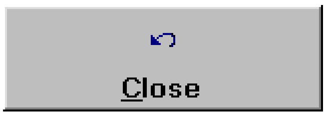


Click on 

or press **<Alt>+<A>** on the keyboard to save the once captured data and accompanying instrument calibration dump into a file. Refer to the paragraph 5.4.19 of this Operating Manual to proceed with saving a file

Click on 

or press **<Alt>+<R>** on the keyboard to erase the captured map freeing the field for a new data

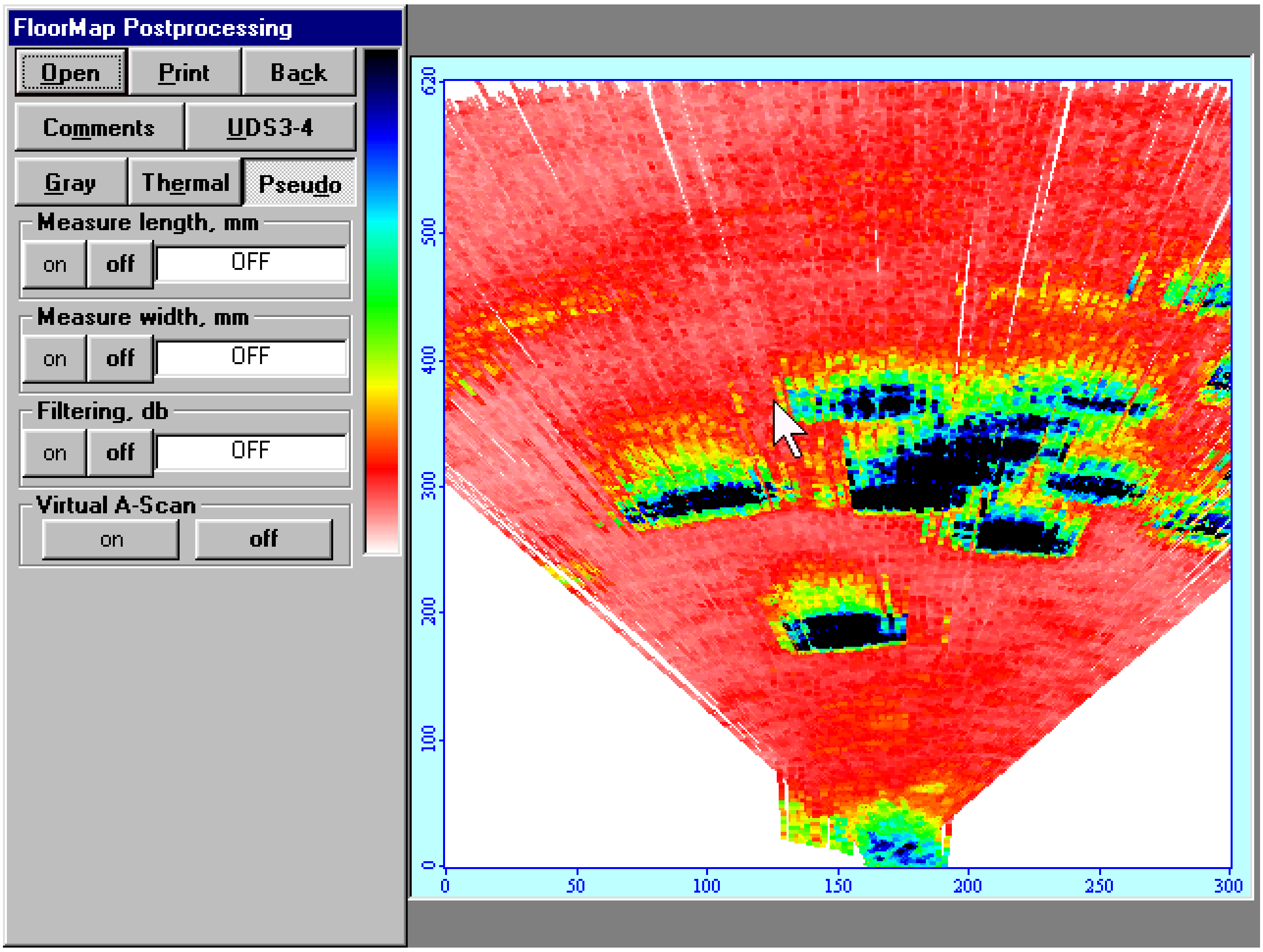
Click on 

or press **<Alt>+<C>** or **Esc** on the keyboard to terminate the scanning procedure and return to the **ISONIC Pulser Receiver** window

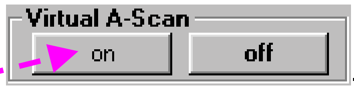
DAC Normalization

Refer to the paragraph 27.6.1 of this Operating Manual

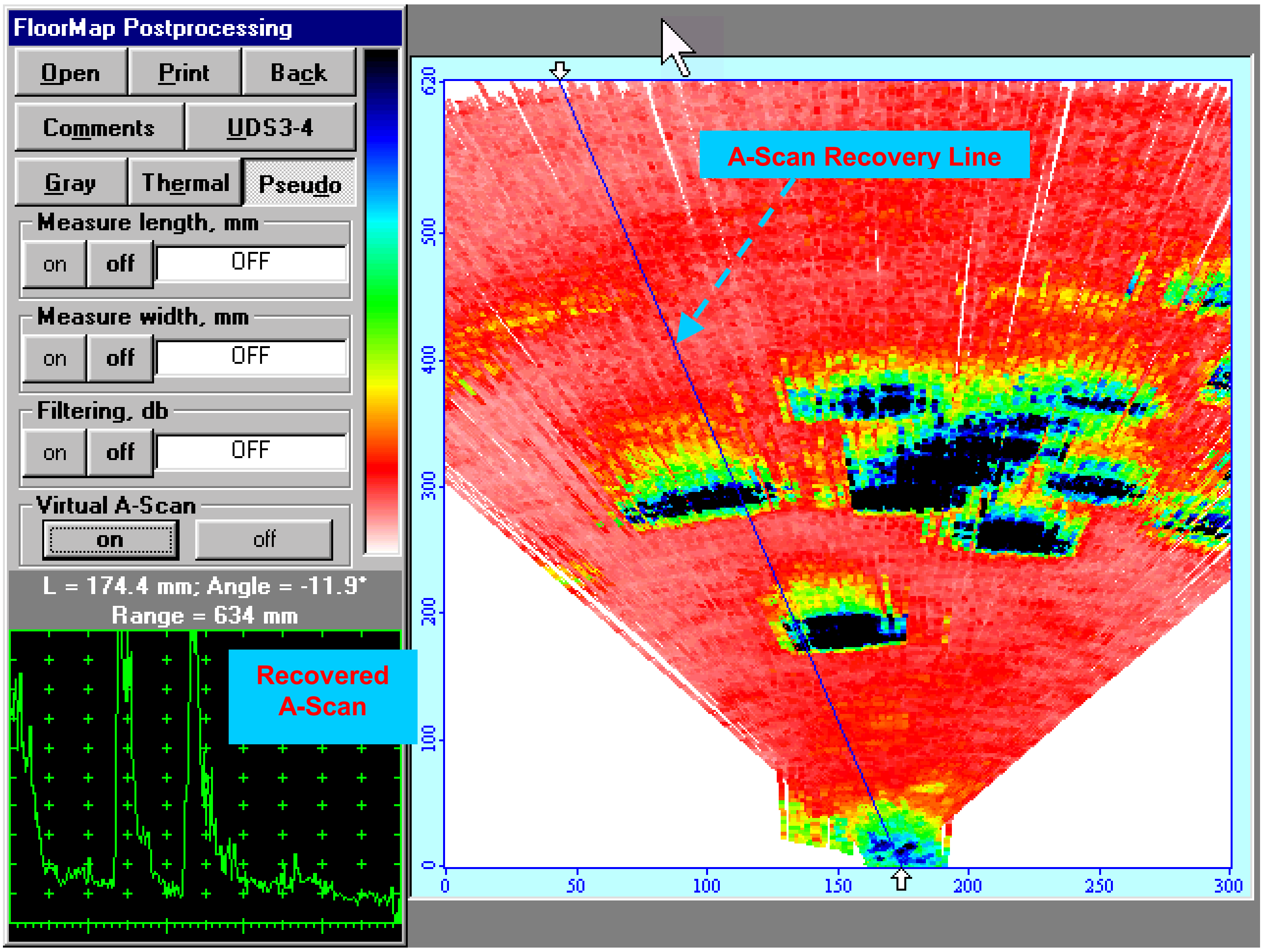
28.6.2. Postprocessing



The typical **FLOORMAP** postprocessing window is shown above. Most of the postprocessing procedures are identical with the described above in the paragraph 27.6 of this Operating Manual related to **FLOORMAP_L** software package. To proceed with the **FLOORMAP** postprocessing just refer to the said paragraph and to the below A-Scan recovery instruction

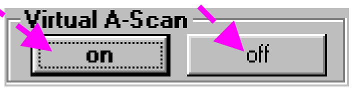
To start the off-line virtual scanning with A-Scan recovery click on 

. The vertical A-Scan recovery line appears above the map; the position of the lower (starting) point of the said line along the map provides the selection of the probe's excitation center position. The cursor is initially "sticked" to the map zero line and may be controlled by the touch screen stylus or by mouse. The touch screen stylus release or left mouse click will fix the selection of the probe's excitation center position selected for the A-Scan recovery. After that the cursor becomes "sticked" to the opposite end of the A-Scan recovery line, which position now may be controlled by the touch screen stylus or by mouse allowing varying of the insonification direction, over which the A-Scan will be recovered - the *off-line virtual probe rotation*. The touch screen stylus release or left mouse click will fix the probe orientation selected for the A-Scan recovery



For the new selection of the A-Scan recovery line click on

To terminate the A-Scan recovery line click on



DAC Normalization

Refer to the paragraph 27.6.1 of this Operating Manual

29. Operating 'DSheet' Software Package - ISONIC D-Spreadsheet Creator

The contents of this chapter is valid for the DSheet SW Package version 1.1.0.1 or higher

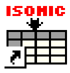
29.1. General Information

ISONIC D-Spreadsheet Creator software allows representing of the inspection results obtained using **CORROMAP**, **CORROMAP CU**, **CORROMAP RD**, **MULTISCAN-COMBO-S**, **MULTISCAN-COMBO-S CU** SW Package in the format of the ***Depth Spreadsheet*** in Microsoft® Excel

ⓘ
Microsoft® Excel must be installed on the computer prior to running the **ISONIC D-Spreadsheet Creator**

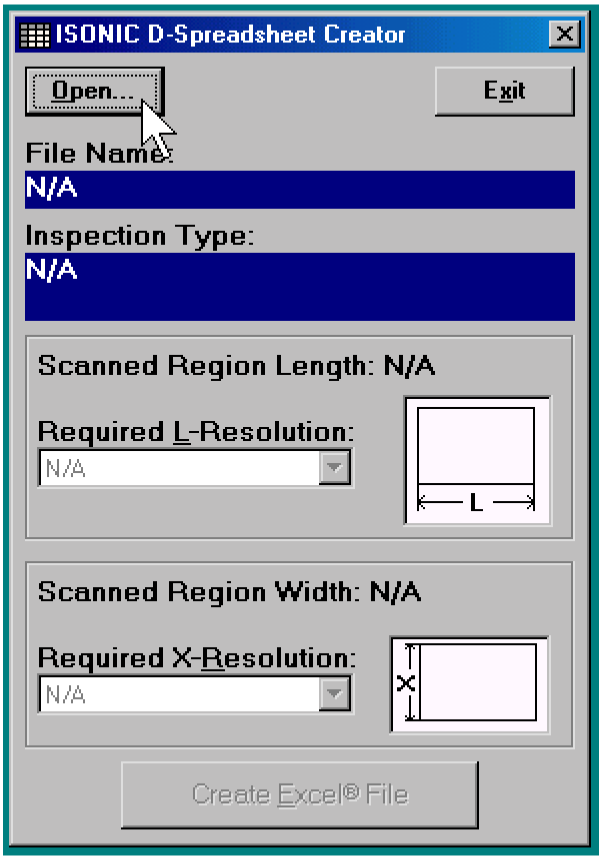
29.2. Conversion of ISONIC Inspection Results into a Depth Spreadsheet

The steps for the conversion of the inspection results into the Microsoft® Excel are as follows:

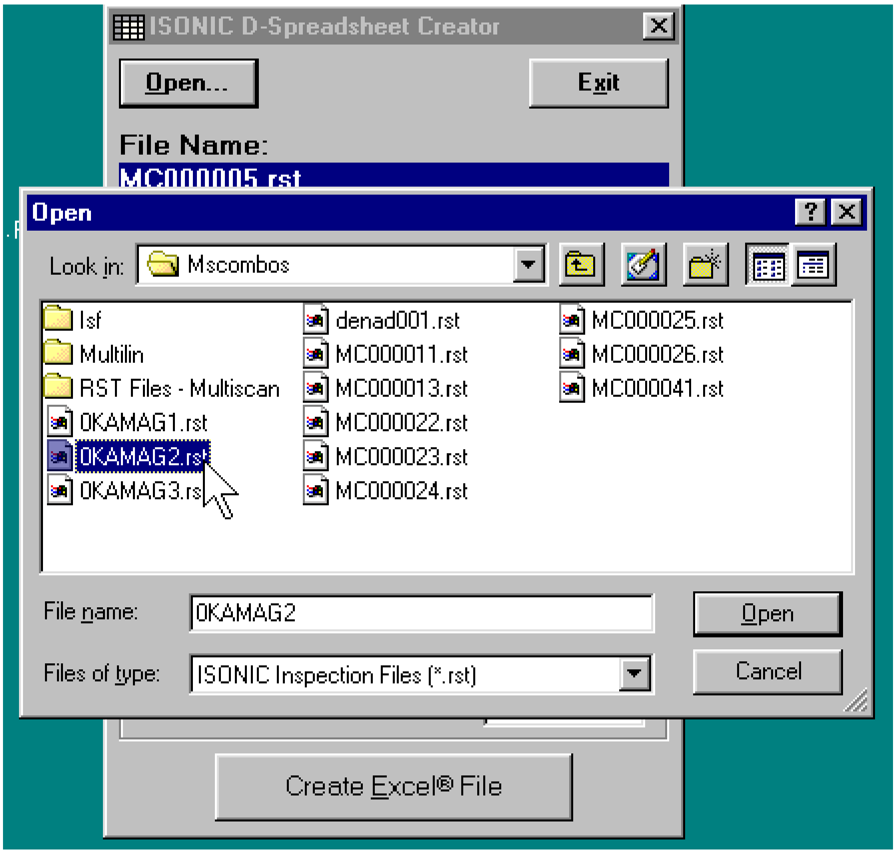
- Start the **ISONIC D-Spreadsheet Creator** by double click on its icon 

located on the desktop or through the Windows Programs Menu (*Start ➩ Programs ➩ ISONIC ➩ ISONIC D-Spreadsheet Creator*)
- In the appearing **ISONIC D-Spreadsheet Creator** window click on the 

button or press **<Alt>+<O>** on the keyboard



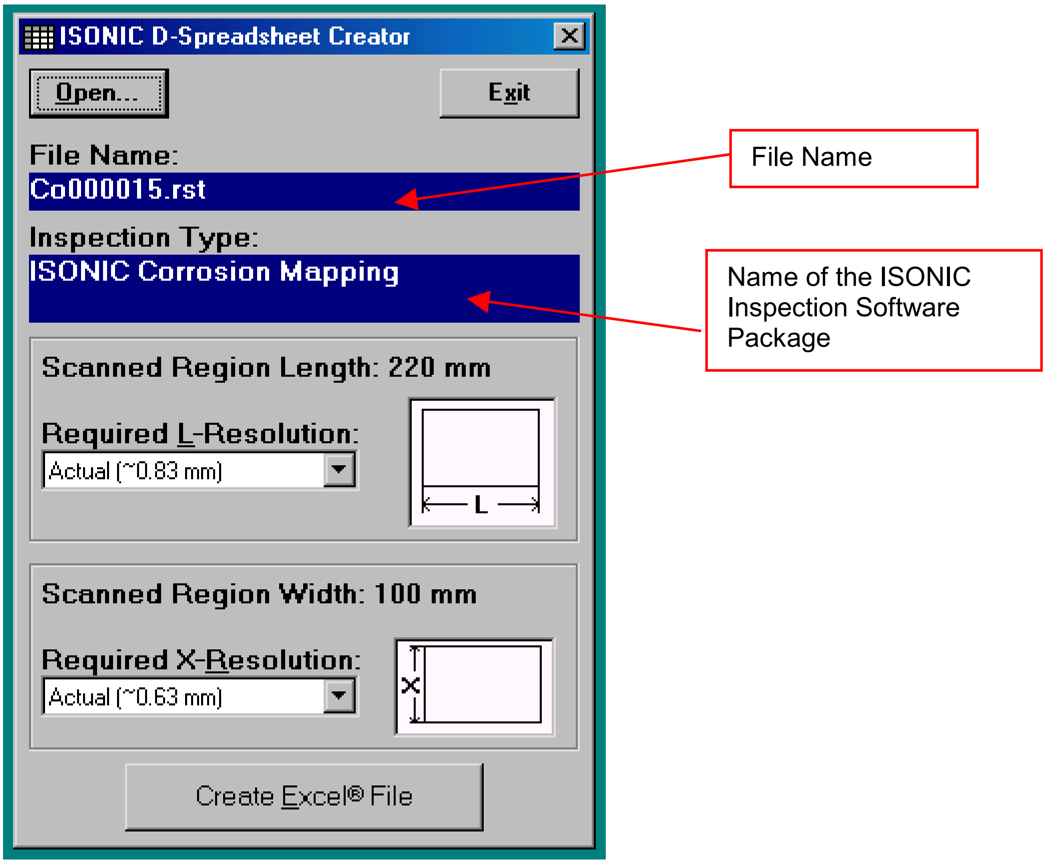
The standard *Windows file selection dialog* appears:



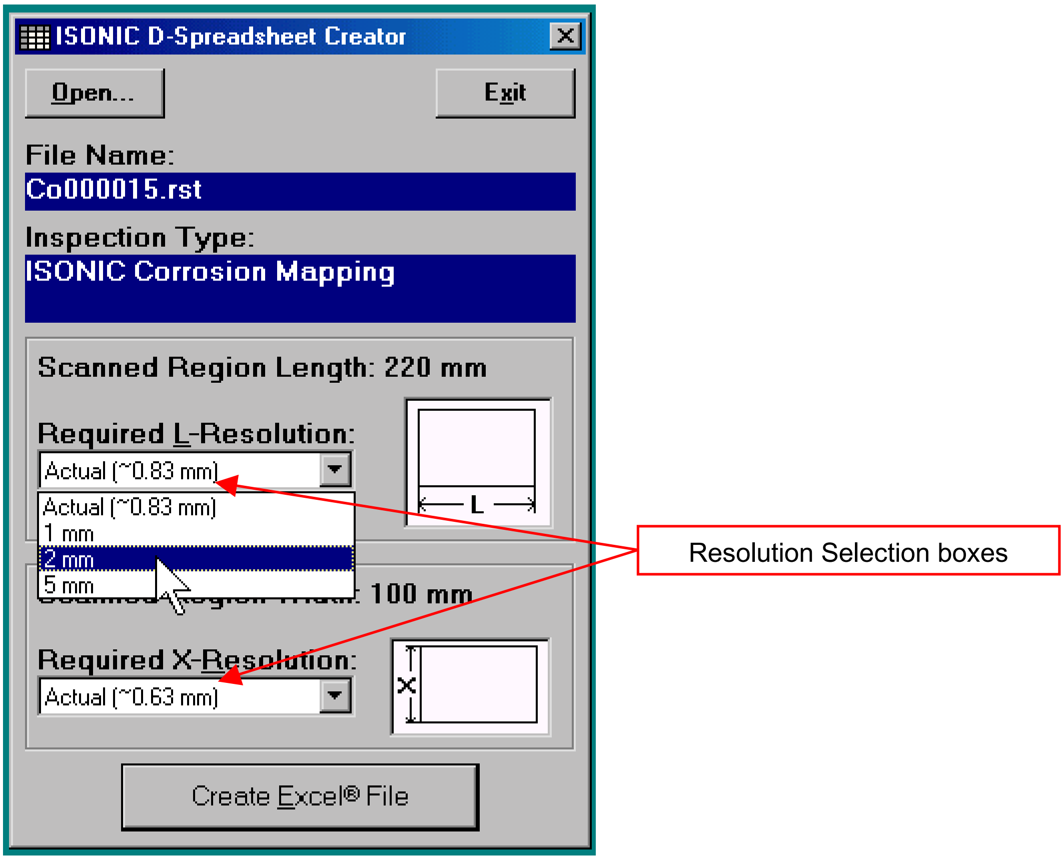
- Select the file to be converted and click on the Open button or press **<Alt>+<O>** on the keyboard

ⓘ

ISONIC D-Spreadsheet Creator recognizes only the files created by **CORROMAP**, **CORROMAP CU**, **CORROMAP RD**, **MULTISCAN-COMBO-S**, **MULTISCAN-COMBO-S CU** software packages o Upon the successful opening of the file its name and the name of Inspection Software Package, which was used to create this file appear in the window:



- Select the required conversion resolution for map dimension. The finest resolution (designated as “Actual” in the resolution selection boxes) is a resolution of data capturing while creating the file to be converted



- Upon selection of both conversion resolutions click on 

button or press **<Alt>+<E>** on the keyboard. The conversion starts then accompanied with the progress bar. After conversion ends the Microsoft® Excel software runs automatically and the just created Depth Spreadsheet will appears on the screen

29.3. Understanding the Depth Spreadsheet

- The *Depth Spreadsheet* is a table of the inspected object thickness (for the cases when the original file was created using the **CORROMAP** or **CORROMAP CU** or **CORROMAP RD** software package) or a table of the minimal reflectors' depths (for the cases when the original file was created using the **MULTISCAN-COMBO-S** or **MULTISCAN-COMBO-S CU** software package)

- Each value in the first numerical row designates the **L-Coordinate**, in **mm** or **in**, for the corresponding column.

- Each value in the first numerical column designates the **X-Coordinate**, in **mm** or **in**, for the corresponding row.

- Cells containing “**##**” designate the areas with no data captured

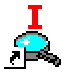
30. Operating 'MULTIPP' Software Package - ISONIC Multiscan Evaluation

The contents of this chapter is valid for the MULTIPP SW Package version 2.0.0.3 or higher

30.1. General Information

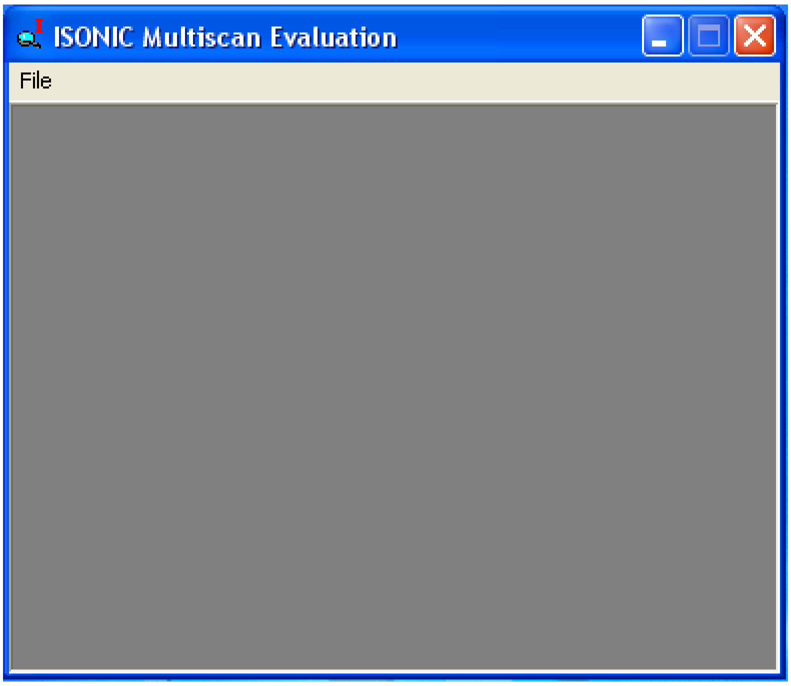
ISONIC MultiScan Evaluation software allows to perform postprocessing of the ISONIC Inspection results obtained with **CORROMAP**, **CORROMAP CU**, **CORROMAP RD**, **MULTISCAN-COMBO-S**, **MULTISCAN-COMBO-S CU** either in the office computer or in the instrument

30.2. Start ISONIC Multiscan Evaluation

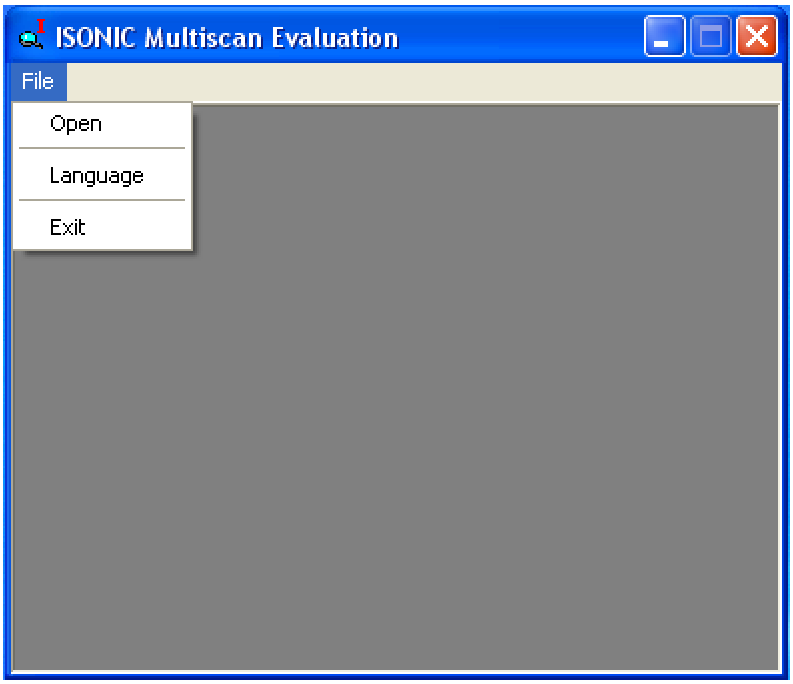
Start the **ISONIC MultiScan Evaluation** by double click on its icon  located on the desktop or through the Windows Programs Menu (*Start ⇨ Programs ⇨ ISONIC ⇨ ISONIC MultiScan Evaluation Package*)

30.3. Getting Started

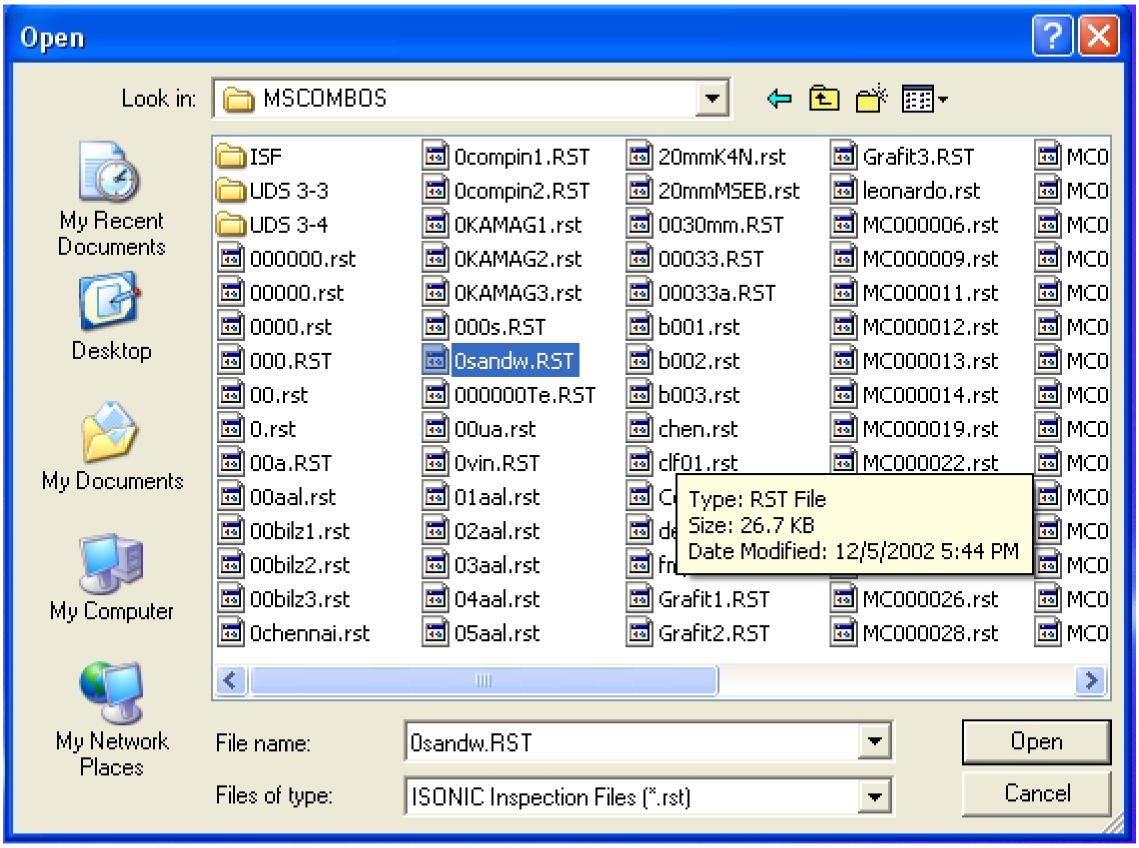
The following startup window appears upon starting



Click on **File** then select the necessary topic to proceed with either file *Opening*, *Language Selection* or *Exit* the program:



The files located on the local disks or on the disks of remote computers and ISONIC units connected to the local area networking and having the shared directories are available for the downloading:

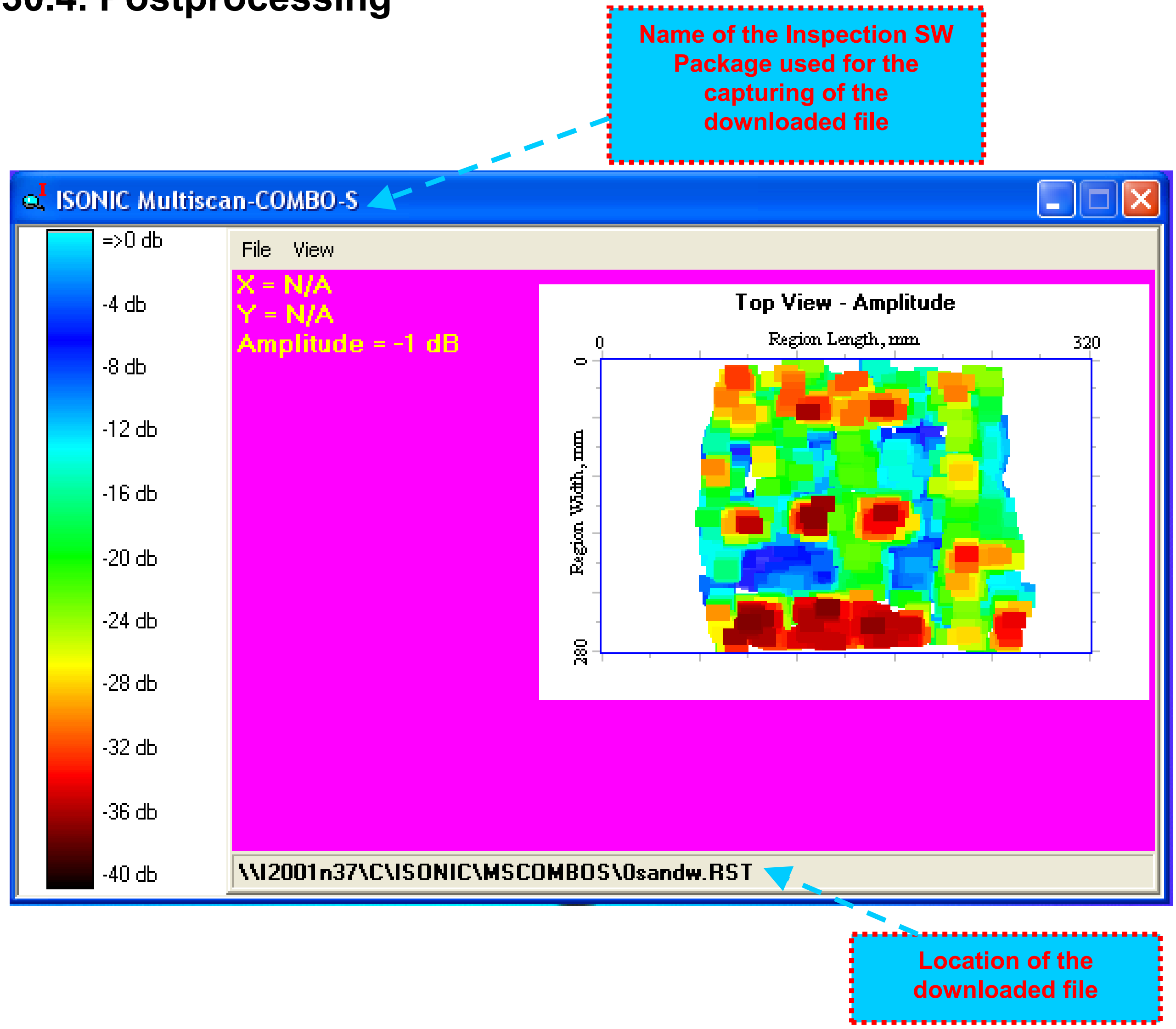


In the appeared standard *Windows file selection dialog* select the file for the postprocessing and double click on it

ⓘ

ISONIC Multiscan Evaluation recognizes only the files created by **CORROMAP**, **CORROMAP CU**, **CORROMAP RD**, **MULTISCAN-COMBO-S**, **MULTISCAN-COMBO-S CU** software packages

30.4. Postprocessing



Follow the instructions of the paragraphs 7.8, 14.8, 15.8, 16.8, 17.8, and 18.8 of this Operating Manual

31. Operating 'IOFFICE' Software Package - ISONIC Office

The contents of this chapter is valid for the IOFFICE SW Package version 2.0.0.4 or higher

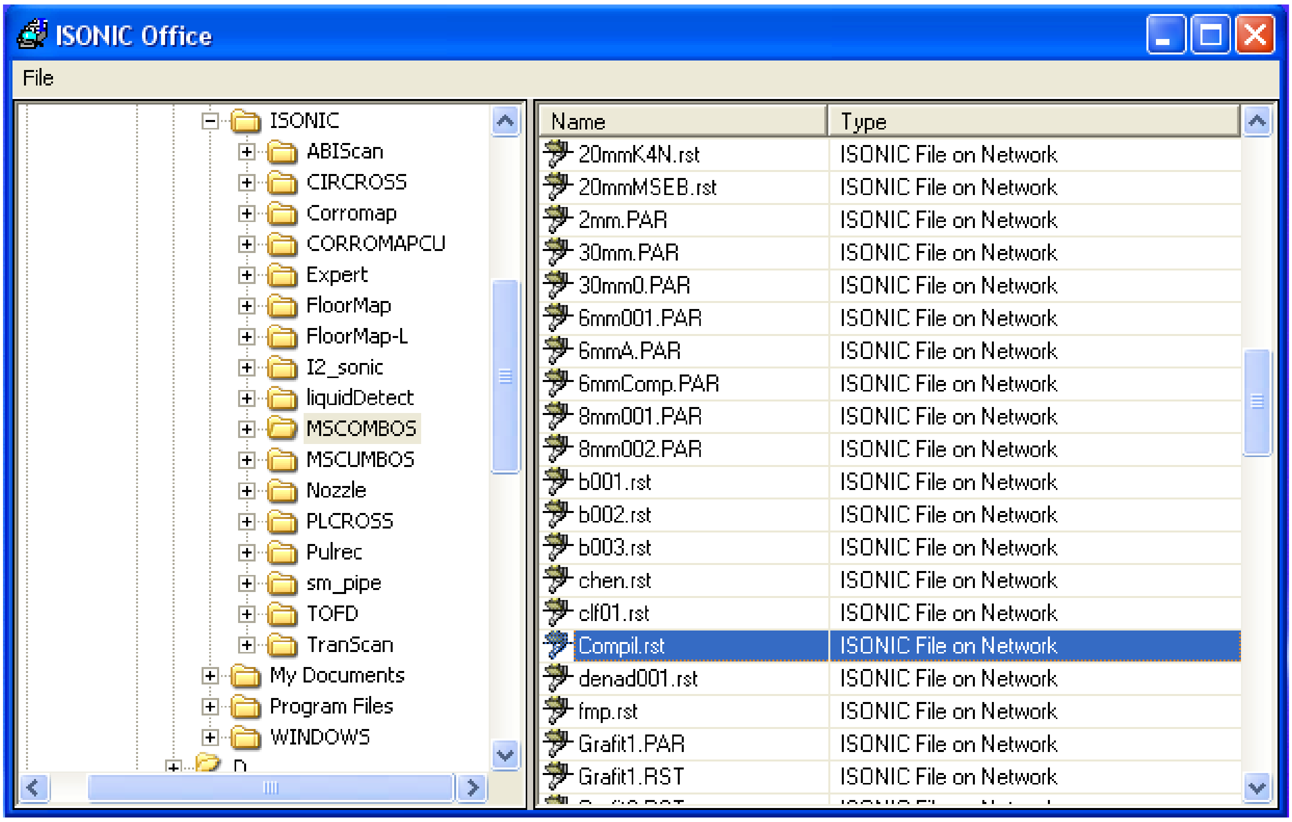
31.1. General Information

ISONIC Office software allows observing all-function postprocessing for all types of the uinspection files captured using the ISONIC Inspection SW Packages: all postprocessing procedures described in the corresponding paragraphs of the Chapters 5 through 24 of this Operating Manual may be implemented in the office PC. If the Microsoft® Word is installed in the office PC then at any moment the postprocessing screenshot including all graphichs and accompanying setup and / or measurement data may be converted into the Microsoft® Word (.doc) file

31.2. Start Up

Start the **ISONIC Office** by double click on its icon  located on the desktop or through the Windows Programs Menu (*Start ⇨ Programs ⇨ ISONIC ⇨ ISONIC Office*)

31.3. ISONIC Office explorer window

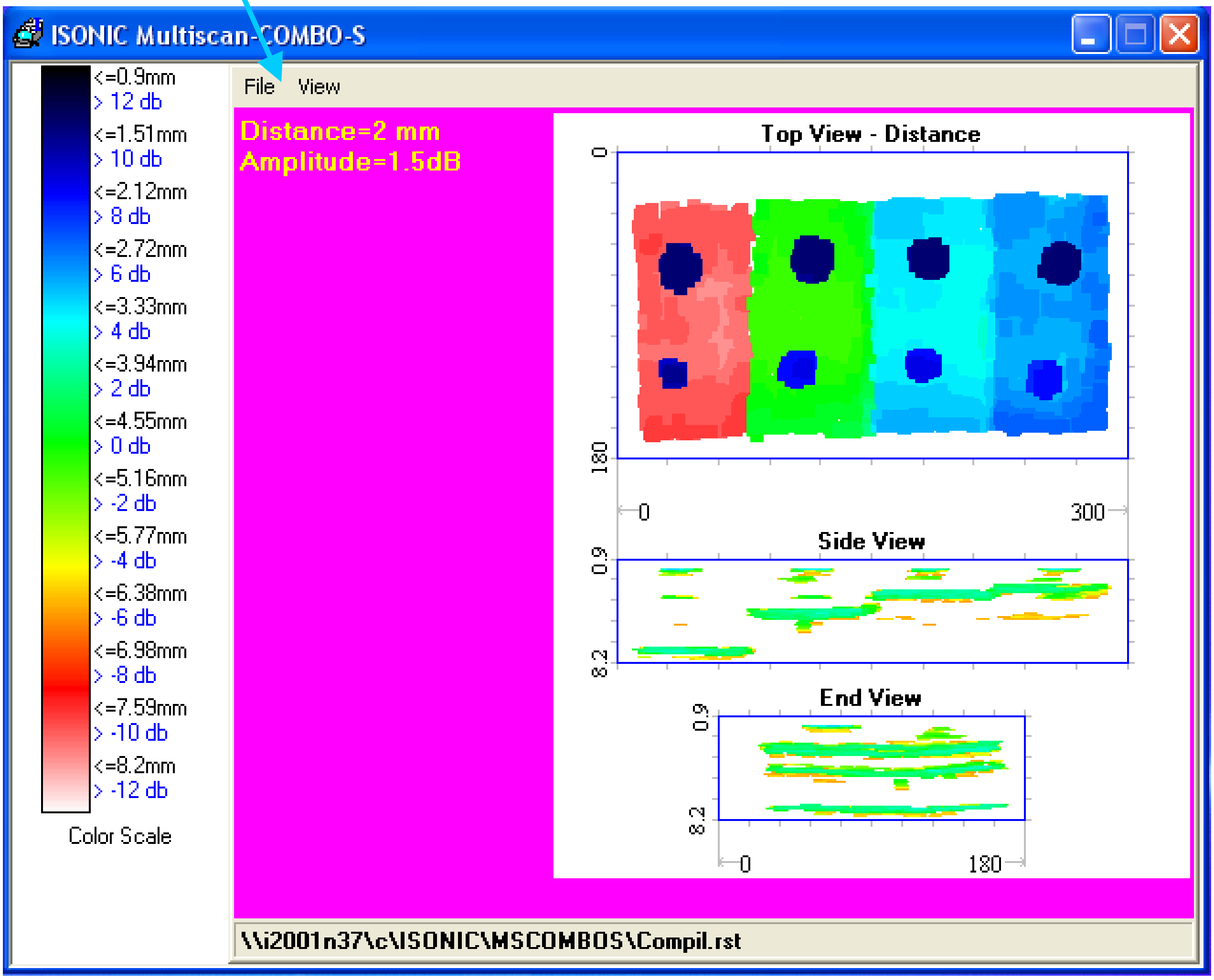


The left panel of the **ISONIC Office** explorer window allows selecting of the required directory (folder), which may be located as on the local disk as on the remote computer or the ISONIC unit **provided that the remote devices have shared directories allow the Full Access (Not Read Only)**. The right panel represents all readable files from the selected folder. The inspection files located on the local disk are accompanied with the name of the Inspection SW Package, which was used for the file creation, and the appropriate icon. The Microsoft® Word (**.doc**) files if existing in the selected folder will be also represented if the Microsoft® Word is installed in the office PC

Double click on the file name to open it. Clicking on the Microsoft® Word (**.doc**) file name runs Microsoft® Word opening it above the **ISONIC Office** explorer window. Clicking on the inspection file causes transforming of the **ISONIC Office** explorer window into the corresponding **ISONIC Postprocessing** window

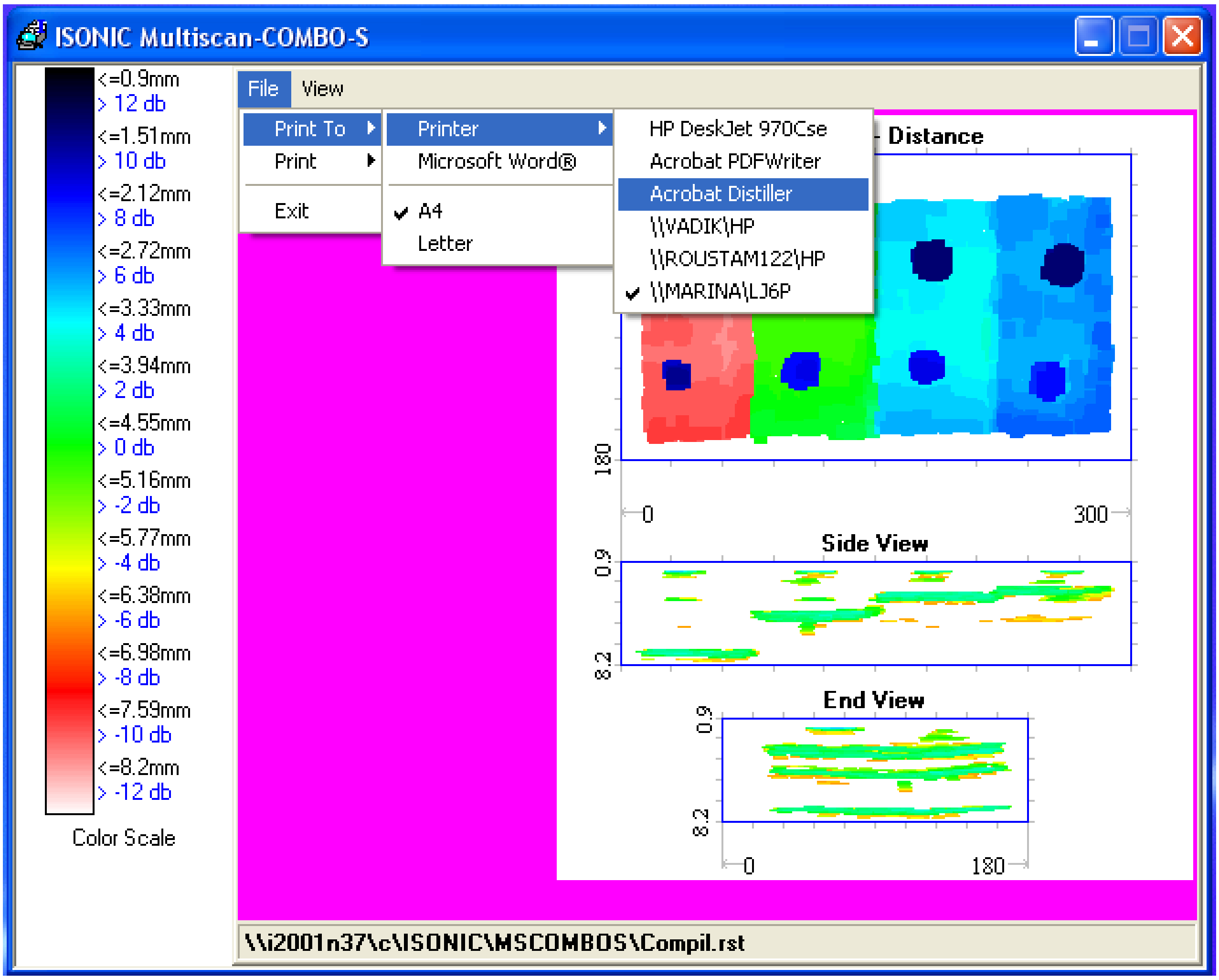
31.4. ISONIC Office Postprocessing window

ISONIC Office Postprocessing window allows all-functions postprocessing of the uploaded file though the **Postprocessing Menu**



The contents of the **Postprocessing Menu** depend on the type of inspection stored in the file. The same rules and principles of the off-line data analysis as described above in the corresponding paragraph of the Chapters 5 through 24 of this Operating Manual are applicable

At any moment the comprehensive Inspection Report or Postprocessing Page including the graphics, setup and off-line processing and measurement data may be printed out or converted into the word file:



- Select *File* ⇨ *Print To* ⇨ *Printer…* to designate the necessary printer and paper size
- Selection of *File* ⇨ *Print To* ⇨ *Microsoft® Word* will designate the Microsoft® Word as the default
- Selection *File* ⇨ *Print* depending on the selected printer will print the Inspection report or Postprocessing page or convert it into the Microsoft® Word (.doc) file. If so you'll be prompted to key in the file name and select the folder for the file creation
- Selection *File* ⇨ *Exit* will return to the ISONIC Office explorer window

32. Operating 'CSMAN' Software Package - ISONIC Color Scale Manager

The contents of this chapter is valid for the
CSMAN SW Package version 1.0.0.0 or higher

32.1. General Information

CSMAN - ISONIC Color Scale Manager software utility allows to create / import / export / setup the palette for the mapping and imaging defects / corrosion using the following software packages:

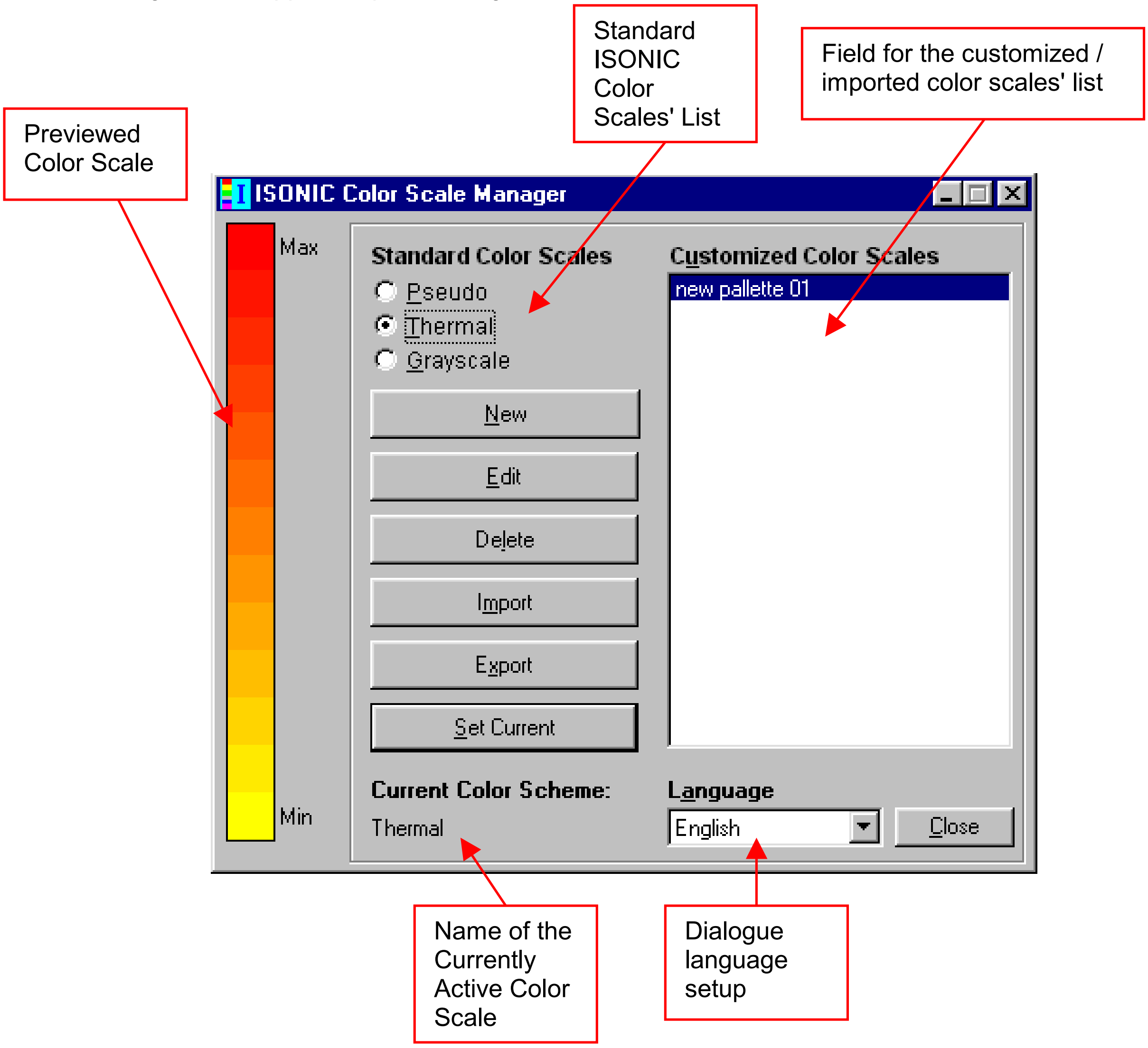
- **I2-SONIC** - Inspection of Planar Butt Joints, scanning from One Side
- **PLCROSS** - Inspection of Planar Butt Joints, scanning from Both Sides
- **LONGWELD** - Inspection of the Longitudinal Welds in Pipes, Scanning from Both Sides
- **CIRCROSS** - Inspection of Circumferential or Spiral Butt Joints, scanning from Both Sides, weld diameters 400 mm and more
- **SM_PIPE** - Inspection of Small Diameter Welds (80 to 400 mm)
- **TRANSCAN** - Inspection of Butt Joints for Defects Transversal to the Weld as per HP5/3 Standard, scanning from Both Sides and/or Above Machined Weld Enforcement
- **CORROMAP** – Inspection with Sraight Beam Ultrasonic Probes for Corrosion Mapping and Internal Defects, for Example, Delaminations
- **CORROMAP - CU** – Inspection with Sraight Beam Ultrasonic Probes for Corrosion Mapping and Internal Defects, for Example, Delamination - Scanning above Cylindrical or Quasi-Cylindrical Surface (Curvature Radius 40 - 200 mm)
- **EXPERT** – High Resolution Scanning of Welds (Frontal Resolution - 0.25 mm)
- **NOZZLE** – Inspection of Nozzle Welds

32.2. Start ISONIC Color Scale Manager

Start the **ISONIC Color Scale Manager** by double click on its icon located on the desktop or through the Windows Programs Menu (*Start ⇨ Programs ⇨ ISONIC ⇨ ISONIC Color Scale Manager*)

32.3. Getting Started and Operating

The following window appears upon starting:



Click On	Keyboard Shortcut	Action
New	<Alt> + <N>	Open dialogue for creating a new customized palette
Edit	<Alt> + <E>	Open dialogue to edit the existing customized palette selected in the **Customized Color Scales** field
Delete	<Alt> + <L>	Delete the existing customized palette selected in the **Customized Color Scales** field
Import	<Alt> + <M>	Import of the customized palette from a disc or network device
Export	<Alt> + <X>	Export of the customized palette selected in the **Customized Color Scales** field to a disc or network device
Set Current	<Alt> + <S>	Activation of the palette selected in the **Customized Color Scales** field or among the **Standard Color Scales** field
Close	<Alt> + <C> or **Esc**	End of the **ISONIC Color Scale Manager** session

33. Operating 'Par2Txt' Software Package - ISONIC Par2Txt Coverter

The contents of this chapter is valid for the Par2Txt SW Package version 1.0.0.0 or higher

33.1. General Information

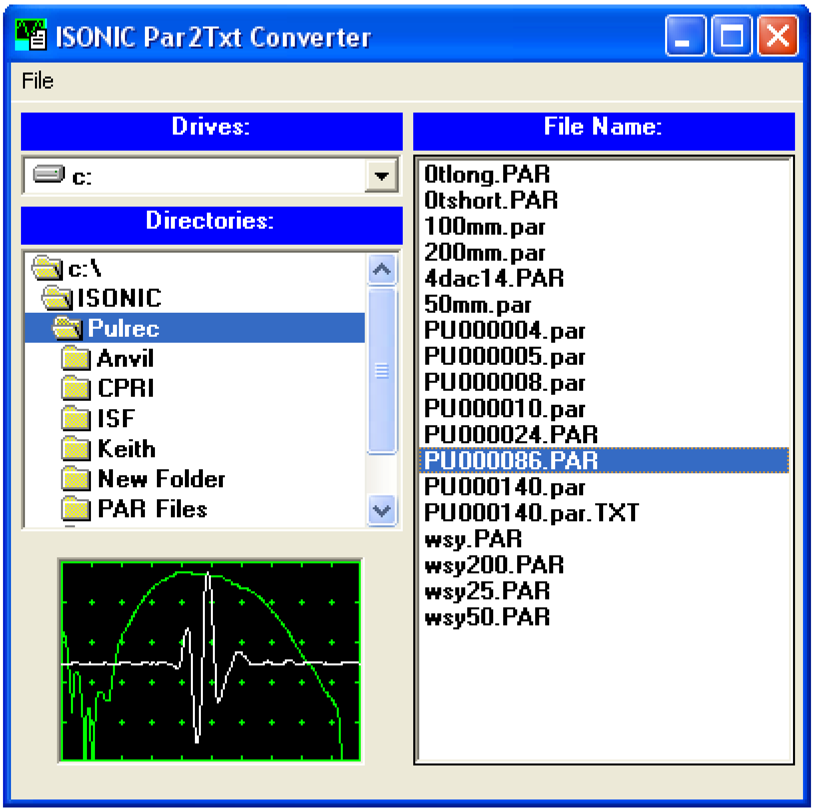
ISONIC Par2Txt Manager software utility allows to create the ***.txt** files from the ***.par** files storing either pure **A-Scans** or **A-Scans** accompanied with the frequency domain (**FFT**) graph. Both the **A-Scan** and **FFT** graphs are data are presented in the ASCII format in the ***.txt** files. This allows further off-line signal analysis using the popular **Mathlab**, **Labview**, and the like software packages

33.2. Start ISONIC Color Scale Manager

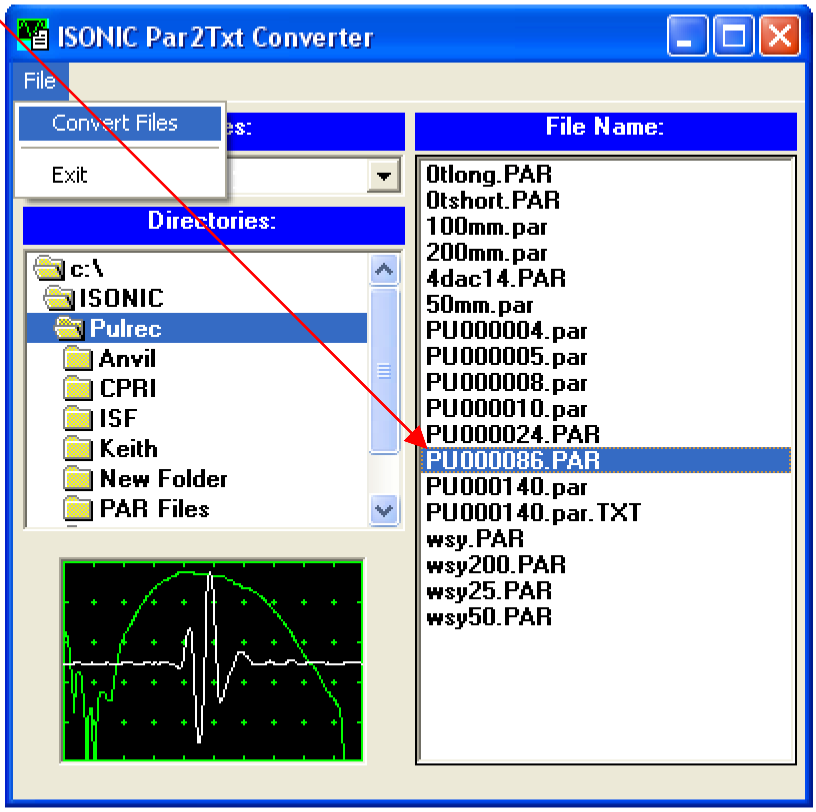
Click on *Start* then select *Programs* ➪ *ISONIC* ➪ *ISONIC Par2Txt Converter*

33.3. Getting Started and Operating

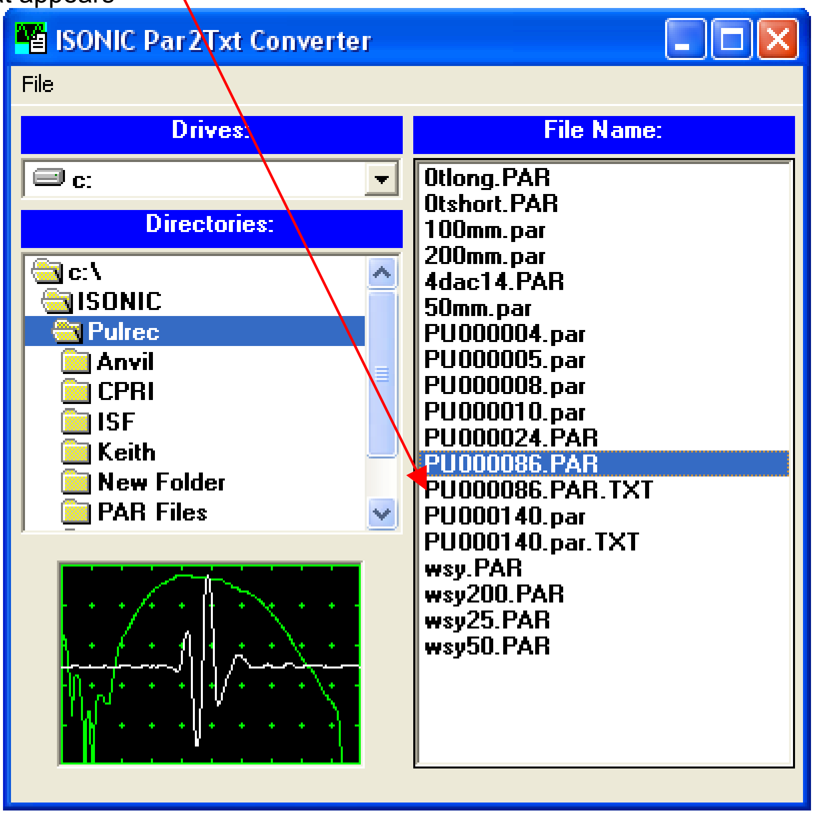
The window as below appears upon starting



Select the file of interest then select **File ➪ Convert Files**:



As a result the corresponding *.txt file containing the **A-Scan** graph (and the **FFT** graph if existing) converted into the ASCII format appears



34. ISONIC Workstation – Servicing Issues

34.1. Software Upgrade

34.1.1. Software upgrade for the ISONIC Workstations equipped with an internal or external CD ROM / Writer

Internal CD-ROM / Writer

- Insert the CD into the drive
- Insert the CD into the drive
- On the **ISONIC Workstation** double click **My Computer** icon and then double click the CD drive icon
- Double click the icon of **Software Packages Setup** folder
- For each application to be upgraded perform the following sequence of operations:
  - Double click the icon of the corresponding folder
  - Run **setup.exe** program placed in this folder
  - The prompt to delete previous installation of application will appear. Click on **Yes** button and follow the instructions appearing on the screen, confirming all requests by clicking on **Yes**, **OK** or other corresponding buttons
  - Upon uninstall procedure completed run **setup.exe** program again
  - Follow the instructions appearing on the screen, confirming all requests by clicking on **Yes**, **OK** or other corresponding buttons

External CD-ROM / Writer

- Connect External CD ROM / Writer Drive to the **ISONIC Workstation**
- Insert the CD into the drive
- On the **ISONIC Workstation** double click **My Computer** icon and then double click the CD drive icon
- Double click the icon of **Software Packages Setup** folder
- For each application to be upgraded perform the following sequence of operations:
  - Double click the icon of the corresponding folder
  - Run **setup.exe** program placed in this folder
  - The prompt to delete previous installation of application will appear. Click on **Yes** button and follow the instructions appearing on the screen, confirming all requests by clicking on **Yes**, **OK** or other corresponding buttons
  - Upon uninstall procedure completed run **setup.exe** program again
  - Follow the instructions appearing on the screen, confirming all requests by clicking on **Yes**, **OK** or other corresponding buttons

34.1.2. Software upgrade for the ISONIC Workstations equipped with an Ethernet (Network) connection

- Connect the **ISONIC Workstation** to your local network
- Switch on the local computer, which is also connected to the local network and equipped with the CD drive
- Provide sharing for the CD drive, i.e. the CD drive must become accessible from the **ISONIC Workstation** via the local network
- Insert the CD into the drive
- On the **ISONIC Workstation** double click **Network Neighborhood** icon and then find the shared CD drive in the network and double click on its icon
- Double click the icon of **Software Packages Setup** folder
- For each application to be upgraded perform the following sequence of operations:
  - Double click the icon of the corresponding folder
  - Run **setup.exe** program placed in this folder
  - The prompt to delete previous installation of application will appear. Click on **Yes** button and follow the instructions appearing on the screen, confirming all requests by clicking on **Yes**, **OK** or other corresponding buttons
  - Upon uninstall procedure completed run **setup.exe** program again
  - Follow the instructions appearing on the screen, confirming all requests by clicking on **Yes**, **OK** or other corresponding buttons

34.1.3. Software upgrade for the ISONIC Workstations not equipped with an Ethernet (Network) connection and / or internal or external CD ROM / Writer - Using the FastLynx Package

What is required

- A desktop or a laptop computer (hereinafter – local computer) equipped with CD-ROM drive and parallel port
- ISONIC Workstation (hereinafter – remote computer)
- Parallel File Transfer Cable (hereinafter – PFTC, said cable was included into your first upgrade package that you received in past)
- ISONIC Software Upgrade CD-ROM (included into the first upgrade package)

Upgrade the ISONIC Software

The procedure of ISONIC Software Upgrade consists of two stages:
- Transferring of setup files from the local computer to the remote computer, with the replacing of previous files on the remote computer's HD
- Installation of new versions of ISONIC Applications on the ISONIC Workstation

Transferring of setup files

ⓘ
All images shown below are for illustration purposes only. The actual content of the disks may differ from the content shown on the images

*Starting the **FastLynx** program*

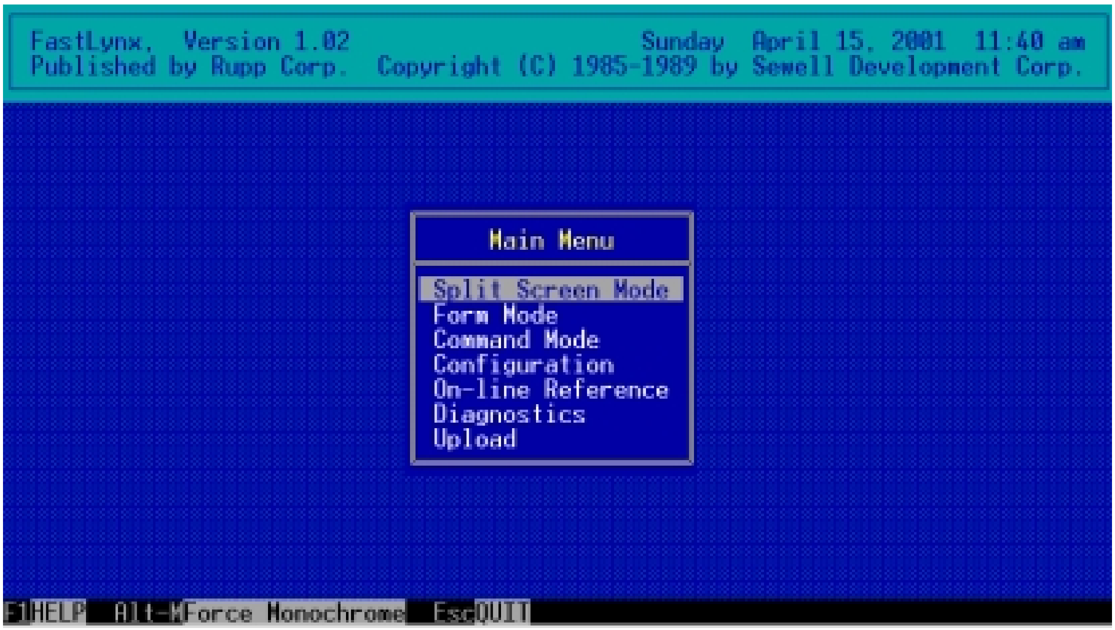
The file transfer program **FastLynx** must be started in the following order:
- Shut down and turn off at least one computer, either local or remote
- Connect computers using the PFTC

☞

At least on of the computers should be turned off prior to connecting the PFTC. Leaving both computers turned on while connecting them with PFTC may cause a damage

- Turn on both computers and wait while the Windows starts
- Insert the **ISONIC Software Upgrade CD-ROM** into the CD drive of the local computer
- On the remote computer: click on the **Start** button then click on **Run…**. Key in "**d:\fx\fx.exe**" in the "**Open:**" field and click on the **OK** button
- On the local computer: click on the **Start** button then click on **Run…**. Key in the path to the **fx.exe** program on the **ISONIC Software Upgrade CD-ROM** in the "**Open:**" field and click on the **OK** button. For example, if the letter designating the CD-ROM drive is "**e:**" then key in "**e:\fx\fx.exe**"

- o At the first stage both local and remote computer will indicate the identical screens as below:



- o On the local computer press **Enter** key - the following screen appears on the local computer:

- o Since this moment all file transfers can be operated from the local computer only. The remote computer will just indicate files transfer progress

Operating the FastLynx program on the local computer

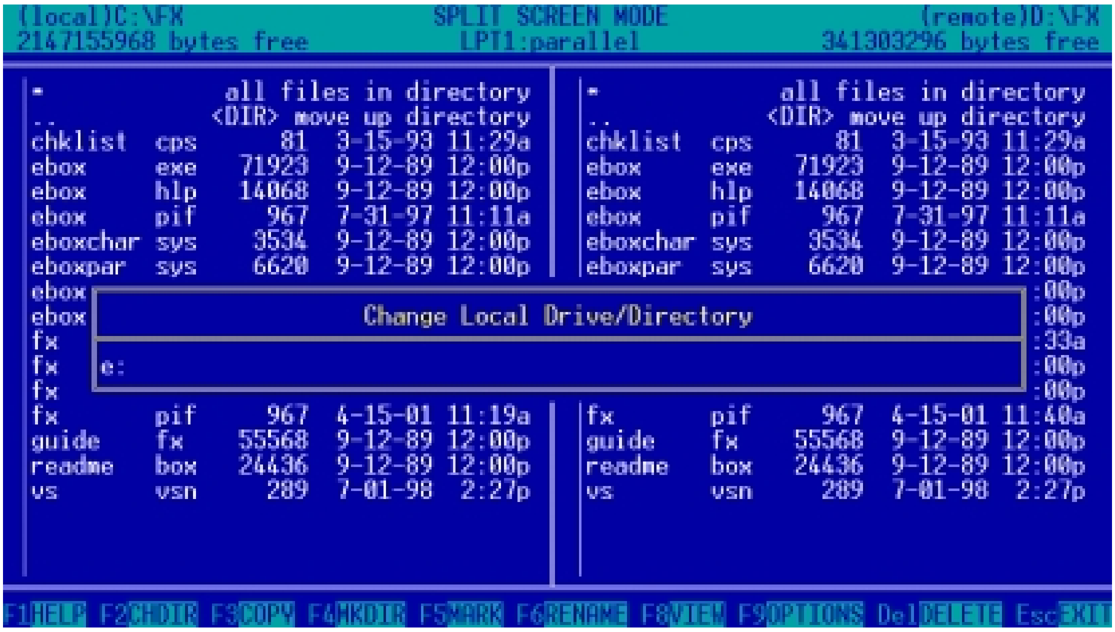
- The **FastLynx** screen is divided into 2 panels. The left panel shows the content of the current directory on the local computer. The right panel shows the content of the current directory on the remote computer. The file transfer is always performed between current directories, e.g., from left to right panel or vice versa
- There is a gray line (hereinafter – cursor) that controlled by arrows keys on the keyboard. The panel containing the cursor is recognized as the active panel. The up and down arrows keys will move the cursor up and down inside the active panel. The right and left arrows keys will move the cursor from one panel to another

> Mouse manipulations are impossible

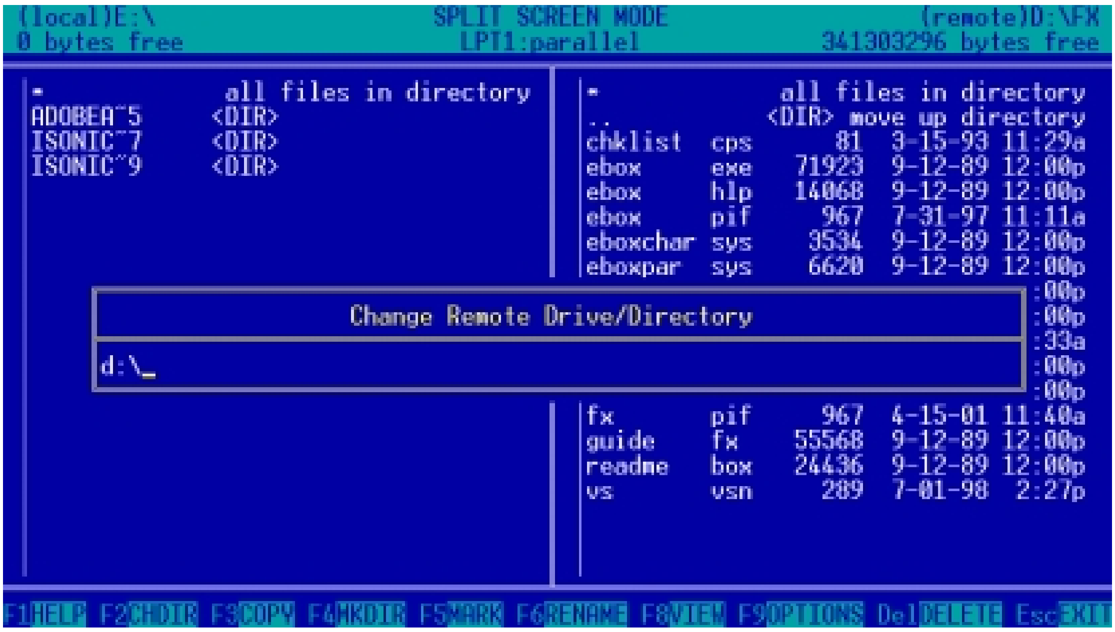
- Each panel has at least two rows. The first row, "***   all files in directory**", is used for selection of all files in the current directory at once. The second row, "**..   <DIR> move up directory**" is used for moving up into the parent directory. If the cursor is placed over this row, the parent directory will become current directory upon pressing the **Enter** key
- Other rows in panels show the names of files and directories contained in current directory. The directories are shown in capital letters, the files are shown in small letters.
- To enter directory, place cursor over its name and press **Enter** key.
- To change current directory or drive directly, press **F2**, key in the path and press **Enter**
- To select multiple files, perform the following procedure for each file:
  - Place cursor over file name
  - Press **F5** key
  - Selected files will appear in yellow color
- To start file transfer, press **F3** key. To delete selected file(s) press **Delete** key

> **FastLynx** is DOS-based program, which does not support long filenames

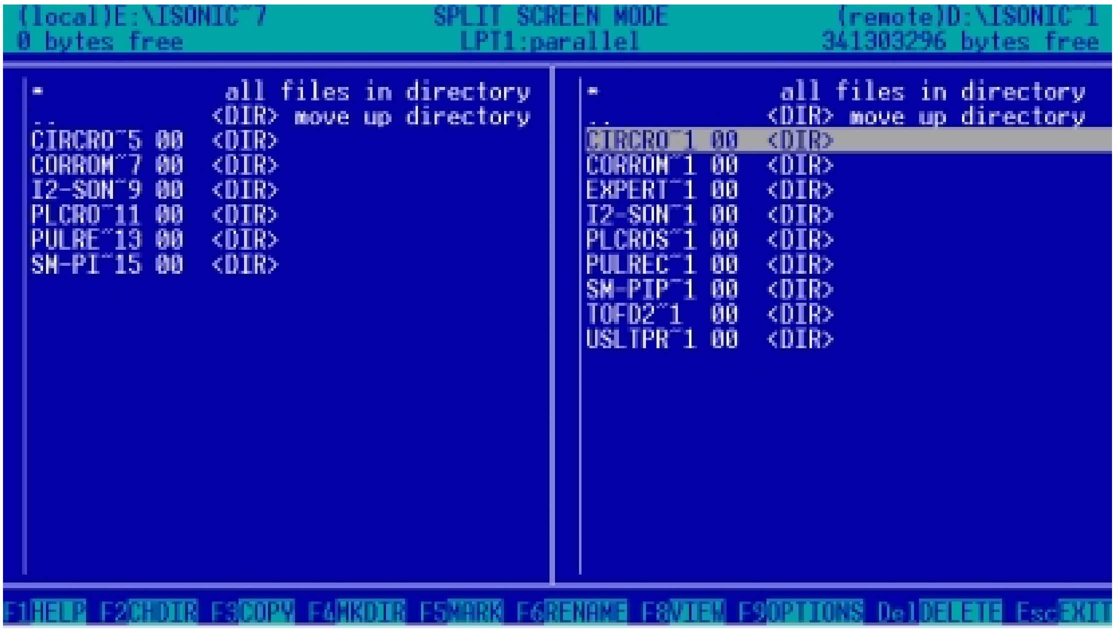
- Make the left panel active then press **F2** key
- Key in the letter of CD-ROM drive of local computer followed by colon and backslash symbols (for example “**e:**”) then press Enter



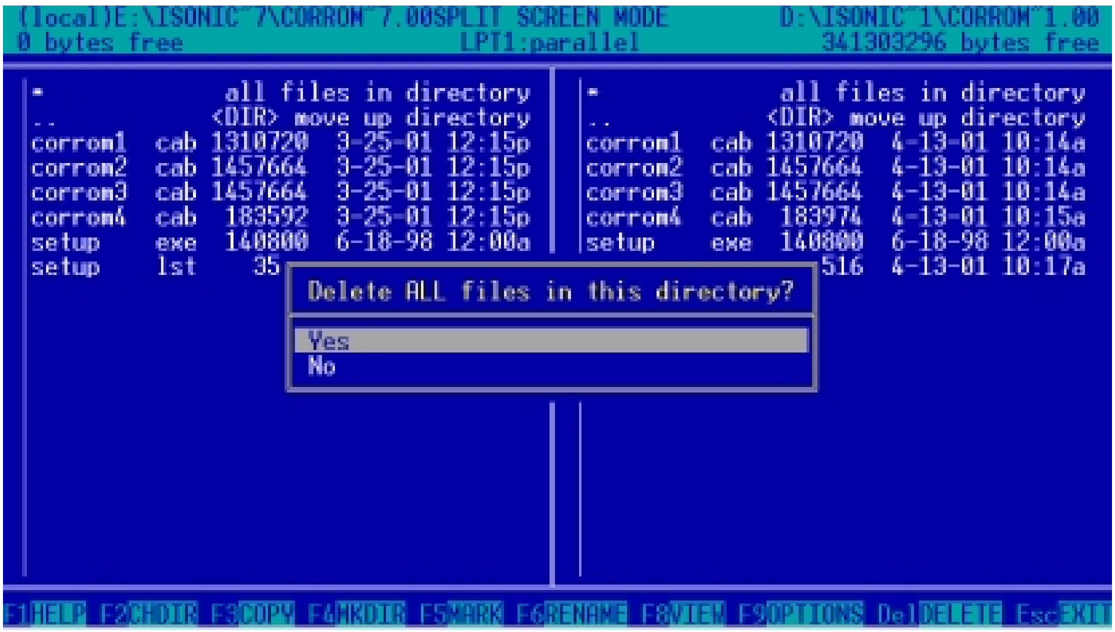
- Make the right panel active then press **F2** key
- Key in “**d:**” then press **Enter**



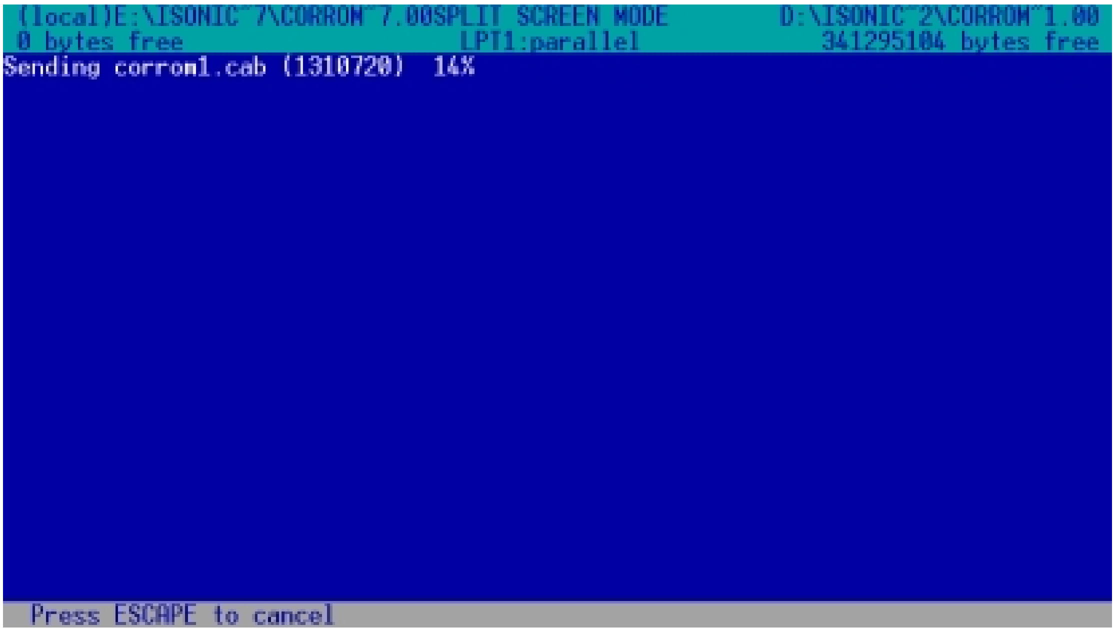
- In the local computer panel: enter the directory named **ISONIC~X**, where **X** is a digit. This directory will contain directories with setup files of all ISONIC applications to be upgraded.
- In the remote computer panel: enter the directory named **ISONIC~X**, where **X** is a digit. This directory will contain directories with setup files of all currently installed **ISONIC applications**



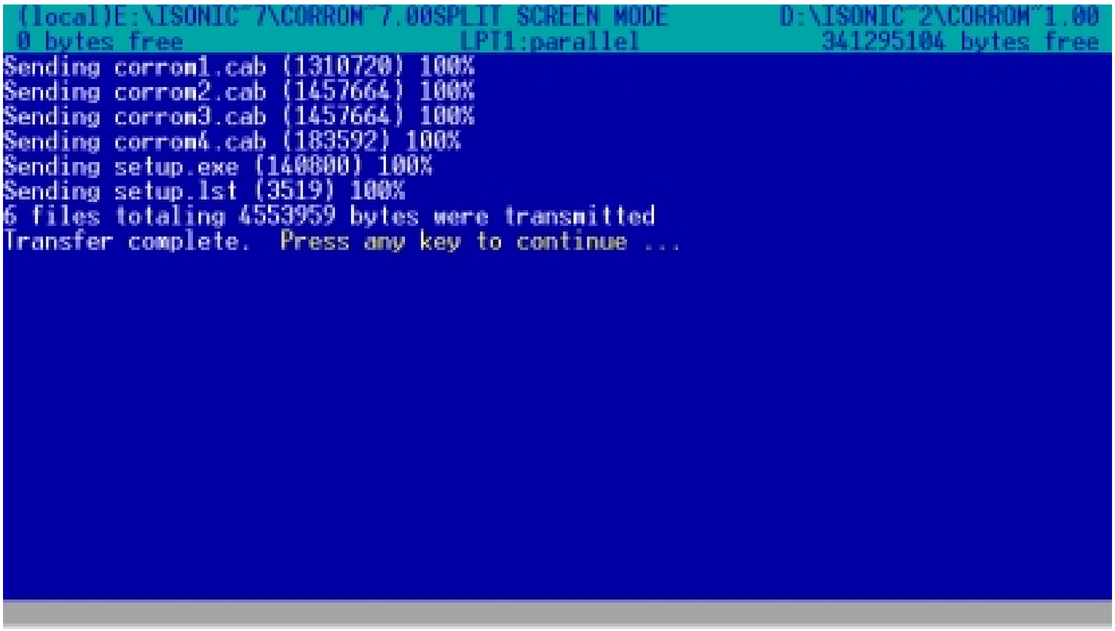
- For each **ISONIC Application** to be upgraded perform the following sequence of operations:
  - ❑ On the local and remote computer: enter the directories containing setup files of corresponding **ISONIC application**
  - ❑ On the remote computer: select the first row in the panel (e.g., select all files). Press **Del** key. Select **Yes** then press **Enter**



- In the local computer panel: select the first row in the panel (e.g., select all files). Press **F3** key. The file transfer will start and the file transfer progress will be indicated on the screen:



- Wait until the "**Press any key to continue …**" prompt appears then press any key



- In the local and remote computer panels: select the second row in the panel then press **Enter** (e.g. return to the parent directory)
- Repeat the procedure for the remaining **ISONIC Software Setup Packages**

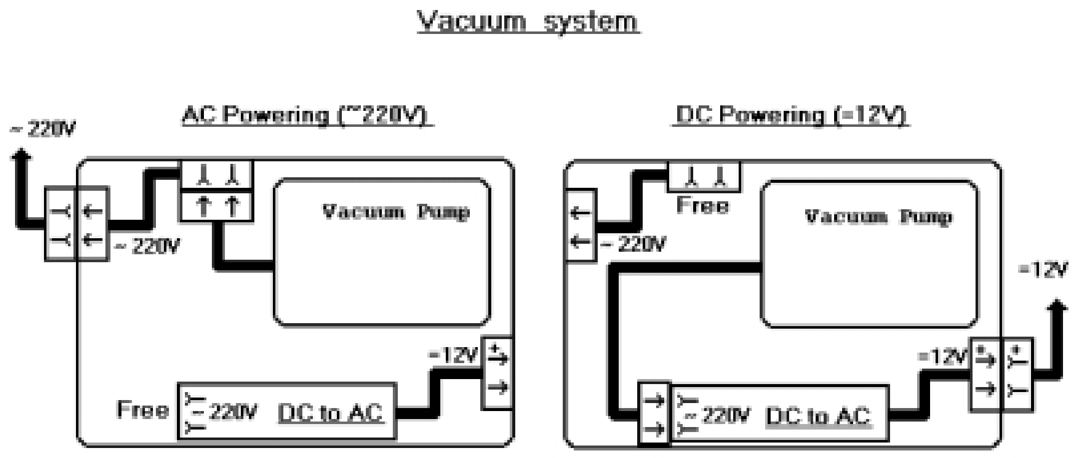
Disconnecting the computers

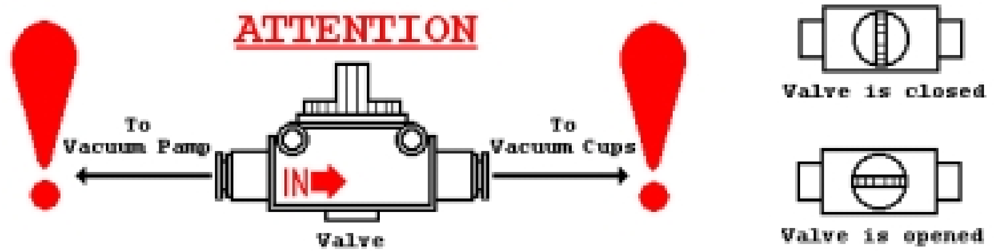
- o On both computers press **Esc** key several times until the prompt to exit the **FastLynx** appears
- o Select **Yes** then press **Enter**
- o Shut down and turn off at least one computer, either remote or local
- o Disconnect PFTC

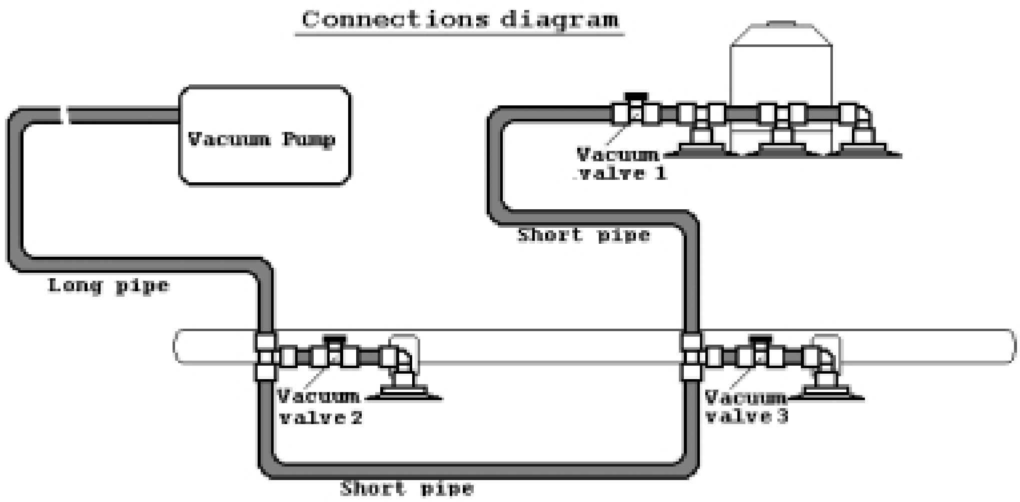
Installation of new versions of ISONIC Applications

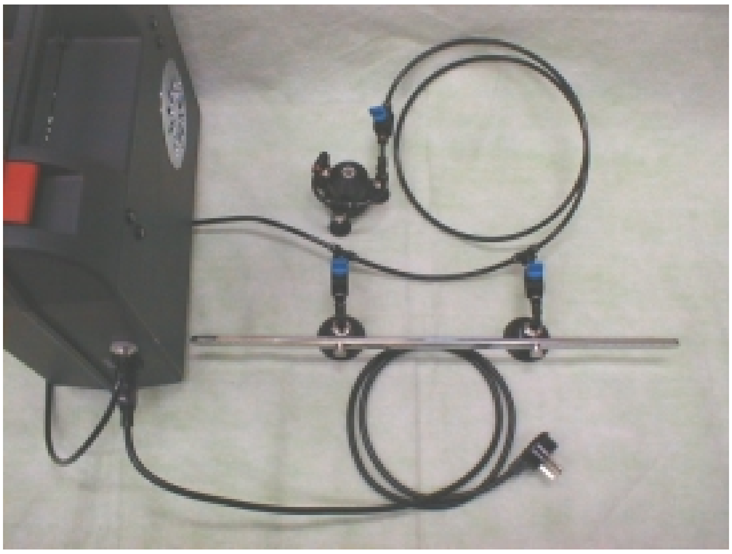
- o On the **ISONIC Workstation** double click **My Computer** icon and then double click the icon of the disk **D**
- o Double click the icon of **ISONIC Setup** folder
- o For each application to be upgraded perform the following sequence of operations:
  - ❑ Double click the icon of the corresponding folder
  - ❑ Run **setup.exe** program placed in this folder
  - ❑ The prompt to delete previous installation of application will appear. Click on **Yes** button and follow the instructions appearing on the screen, confirming all requests by clicking on **Yes**, **OK** or other corresponding buttons
  - ❑ Upon uninstall procedure completed run **setup.exe** program again
  - ❑ Follow the instructions appearing on the screen, confirming all requests by clicking on **Yes**, **OK** or other corresponding buttons

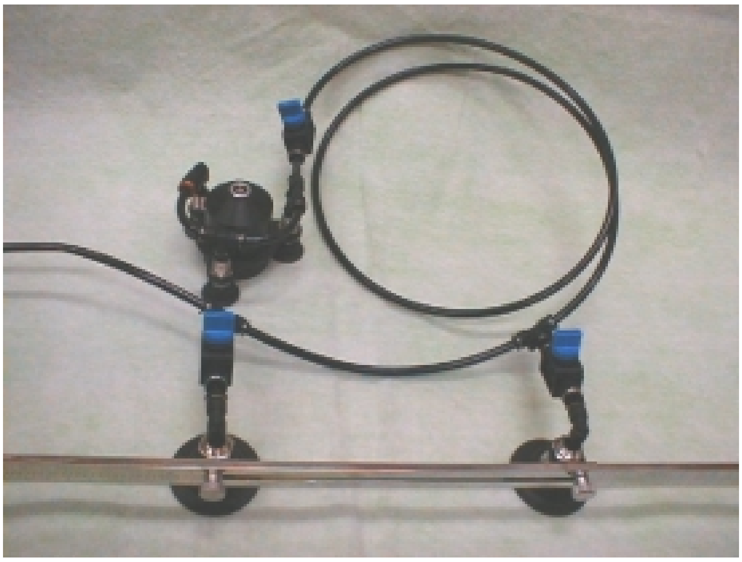
34.2. How to use the vacuum attachment system





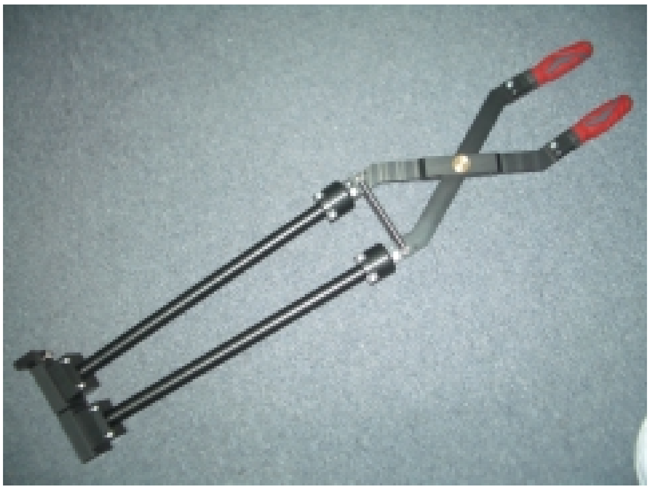






34.3. Use of Yokes

34.3.1. Short Yoke (0.5 m)



Assembling - Step 1

Assembling - Step 2

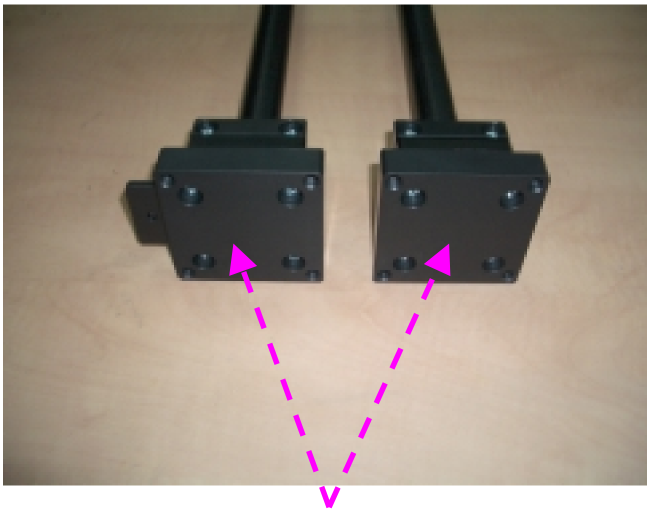
Assembling - Step 3

Assembling - Step 4

Assembling - Step 5

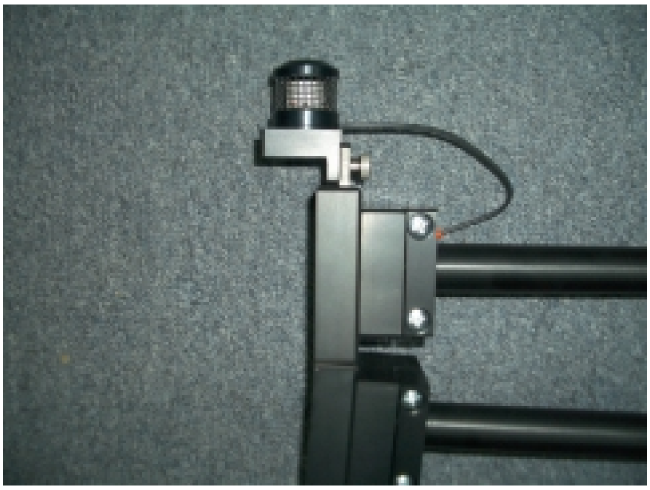
Assembling - Step 6

Assembling - Step 7



Probe Fitting Preparation – 4 X M6

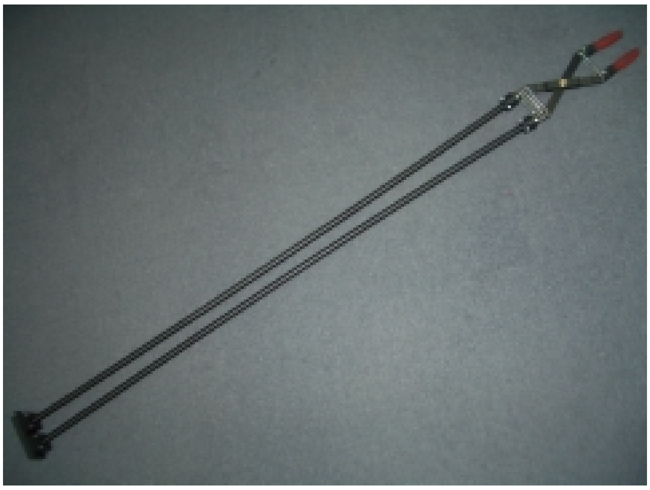
Assembling - Step 8



The emitter of airborne ultrasound to be placed above the center of the emitting or receiving probes, said probes to be oriented coincidentally

Handling yoke while scanning

34.3.2. Long Yokes (>0.5 m)



Assembling - Step 1

Assembling - Step 2

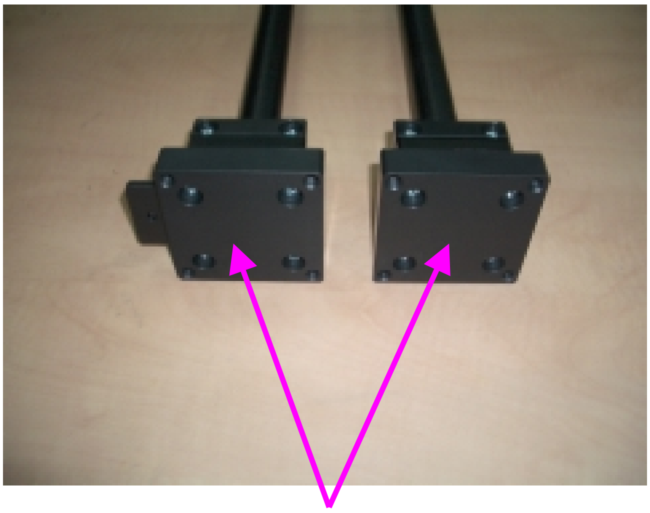
Assembling - Step 3

Assembling - Step 4

Assembling - Step 5

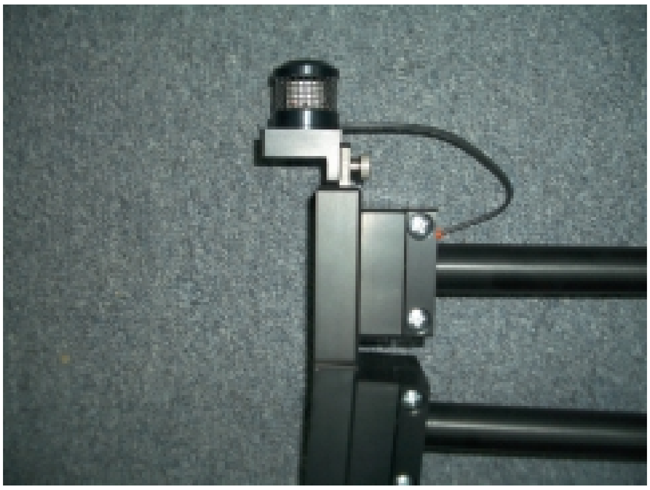
Assembling - Step 6

Assembling - Step 7



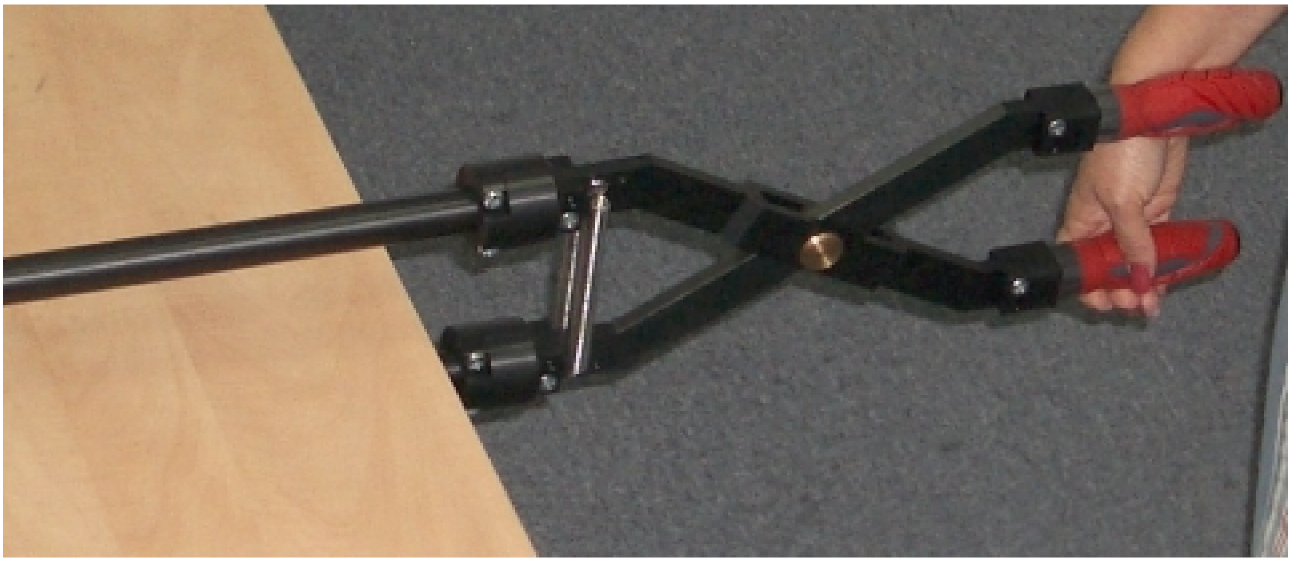
Probe Fitting Preparation – 4 X M6

Assembling - Step 8



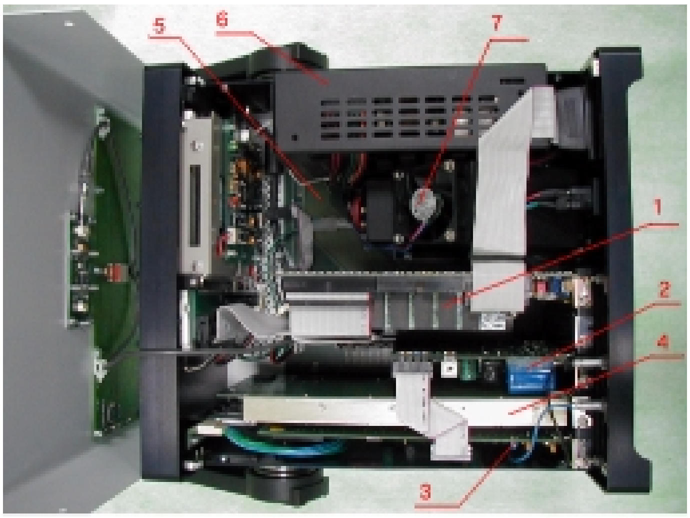
The emitter of airborne ultrasound to be placed above the center of the emitting or receiving probes, said probes to be oriented coincidentally

Handling yoke while scanning

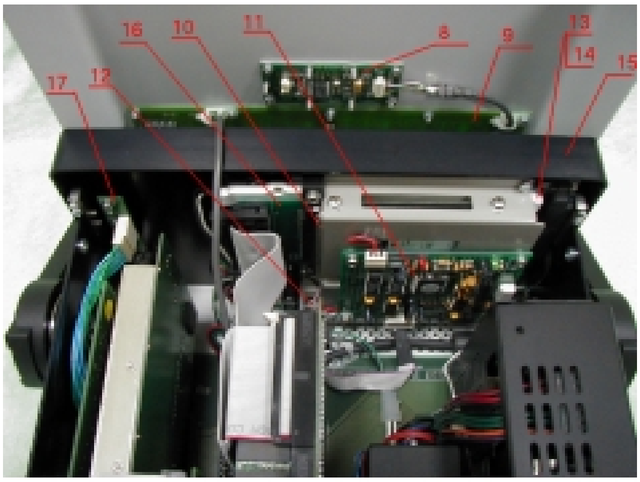


34.4. Assembling and spare parts

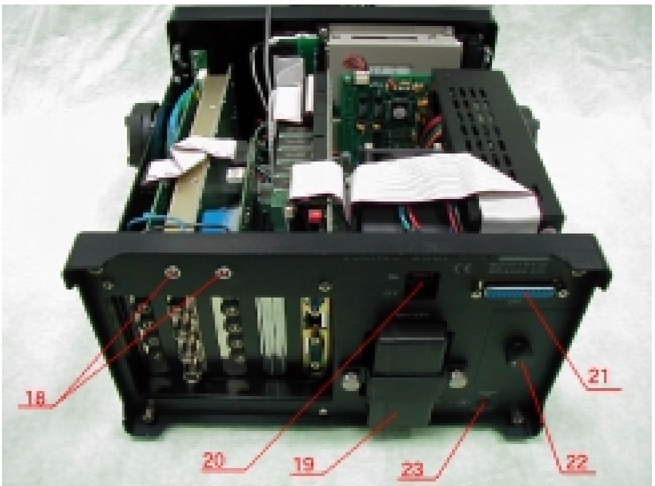
SC 1000



SC1000 1/3



SC1000 2/3

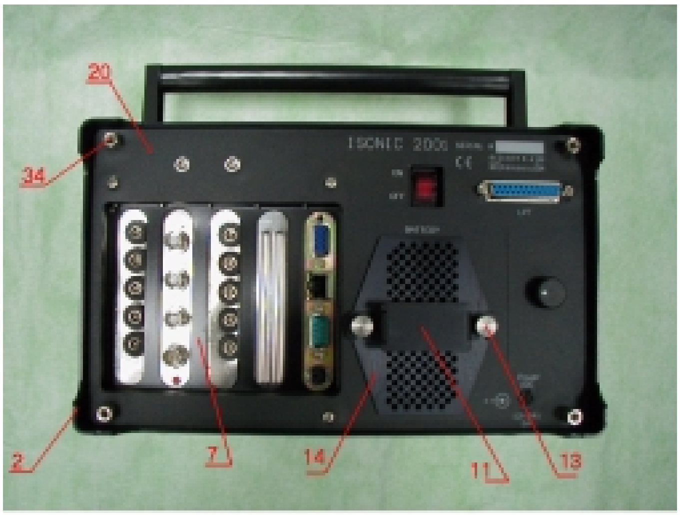


SC1000 3/3

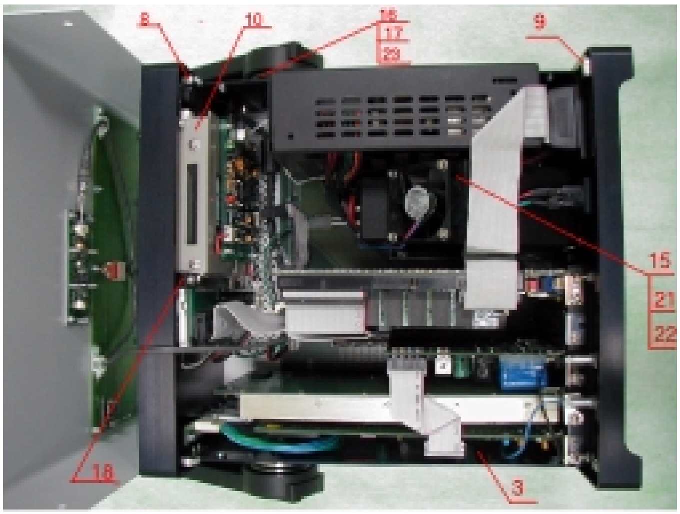
#	DRW #	Title	Q-ty	Note
1	S 80400	Single Card PC	1	
2	SE 20101	Emitters Card	1	
3	SE 20203	Receivers Card	1	
4	S 112000	Pulser Receiver Card	1	
5	SE 20212	Mother Board	1	
6	PD65-40LC	DC/DC Adapter	1	
7	512 311-1532	Fan	1	
8	OEM VP110	Micr4omodule - mouse pointer	1	
9	S GF1009	Keyboard	1	
10	23BA-10	Hard disk	1	
11	TA1024	Touch Screen Adapter	1	
12	ZZZCXA-0214	DC/DC Converter	1	
13	SHDLQ64D343	LCD Screen	1	
14	GNZ-24	Touch screen panel	1	
15	SC 1010	Ironwork assy	1	
16	SC 1063	Hard disk adapter	1	
17	SC 1062	Leds holder	1	
18	PSA 00.250. CTL C 22	Connector	2	LEMO SA
19	SK 2001102	Rechargeable Battery	1	
20	SW DPSR	Power switch	1	
21	170M25S	Connector	1	Amphenol
22	350-679	Potentiometer with knob 47 k	1	Vishay
23	719 09-9765-30-04	Socket	1	Binder

SC 1010

SC1010 1/3



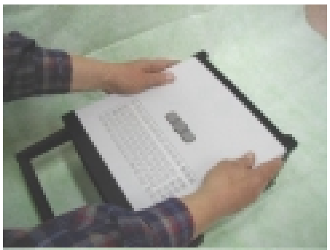
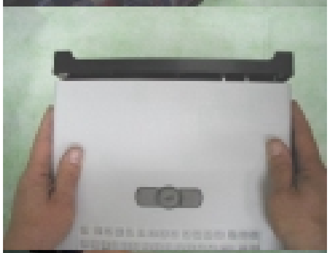
SC1010 2/3



SC1010 3/3

#	DRW #	Title	Q-ty	Note
1	SC 1020	Front Panel	1	
2	SC 1021	Rear Panel	1	
3	SC 1022	Right Tie	1	
4	SC 1023	Left Tie	1	
5	SC 1024	Cover	1	
6	SC 1025	Bottom	1	
7	SC 1027	Panel	1	
8	SC 1028	First Lath	2	
9	SC 1029	Corner	1	
10	SC 1030	Cramp	1	
11	SC 1031	Cramp	1	
12	SC 1032	Screw	8	
13	SC 1034	Screw	2	
14	SC 1035	Plate	1	
15	SC 1038	Casing	1	
16	SC 1045	Support	2	
17	SC 1046	Link	2	
18	SC 1057	Detent	1	
19	SC 1047	Fals-Panel	1	
20	SC 1048	Fals-Panel	1	
21	SC 1058	Filler	1	
22	SC 1060	Stop	1	
23	SC 1026	Washer	2	
31	61-160-60	Side Arm Assembled	1	Elma
32	66-308-21	Handle Extrusion	1	Elma
33	048 2500 114 07	Leg	4	Skiffy
34	304 4100 400 50	Spacer M4X10X6	4	Skiffy
36	005 3182 000 02	Spacer	8	Skiffy

Remove Cover – Sequence of Moves

#	Move
1	
2	
3	
4	
5	
6