ISONIC PA AUT

Portable Digital Platform for Automatic Ultrasonic Flaw Detection and Recording Combining Phased Array, TOFD, and Conventional Pulse Echo Techniques

Operating Manual – Inspection of Girth Welds

Revision 2.22

Sonotron NDT

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

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 PA AUT

Portable Digital Platform for Automatic Ultrasonic Flaw Detection and Recording Combining Phased Array, TOFD, and Conventional Pulse Echo Techniques

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

Safety

EN 61010-1:2001

EMC

EN 61326-1:2006
EN 61000-3-2:2006
EN 61000-3-3:1995

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 described is in conformity with National and International Codes as amended

ISONIC PA AUT

Portable Platform Digital for Automatic Ultrasonic Flaw Detection and Recording Combining Phased Array, TOFD, and Conventional Pulse Echo Techniques

The product identified above complies with the requirements of following National and International Codes:

- ASTM 1961– 06 – Standard Practice for Mechanized Ultrasonic Testing of Girth Welds Using Zonal Discrimination with Focused Search Units
- ASME Code Case 2541 – Use of Manual Phased Array Ultrasonic Examination Section V
- ASME Code Case 2557 – Use of Manual Phased Array S-Scan Ultrasonic Examination Section V per Article 4 Section V
- ASME Code Case 2558 – Use of Manual Phased Array E-Scan Ultrasonic Examination Section V per Article 4 Section V
- ASME Section I – Rules for Construction of Power Boilers
- ASME Section VIII, Division 1 – Rules for Construction of Pressure Vessels
- ASME Section VIII, Division 2 – Rules for Construction of Pressure Vessels. Alternative Rules
- ASME Section VIII Article KE-3 – Examination of Welds and Acceptance Criteria
- ASME Code Case 2235 Rev 9 – Use of Ultrasonic Examination in Lieu of Radiography
- Non-Destructive Examination of Welded Joints – Ultrasonic Examination of Welded Joints. – British and European Standard BS EN 1714:1998
- Non-Destructive Examination of Welds – Ultrasonic Examination – Characterization of Indications in Welds. – British and European Standard BS EN 1713:1998
- Calibration and Setting-Up of the Ultrasonic Time of Flight Diffraction (TOFD) Technique for the Detection, Location and Sizing of Flaws. – British Standard BS 7706:1993
- WI 00121377, Welding – Use Of Time-Of-Flight Diffraction Technique (TOFD) For Testing Of Welds. – European Committee for Standardization – Document # CEN/TC 121/SC 5/WG 2 N 146, issued Feb, 12, 2003
- ASTM E 2373 – 04 – Standard Practice for Use of the Ultrasonic Time of Flight iffraction (TOFD) Technique
- Non-Destructive Testing – Ultrasonic Examination – Part 5: Characterization and Sizing of Discontinuities. – British and European Standard BS EN 583-5:2001
- Non-Destructive Testing – Ultrasonic Examination – Part 2: Sensitivity and Range Setting. – British and European Standard BS EN 583-2:2001
- Manufacture and Testing of Pressure Vessels. Non-Destructive Testing of Welded Joints. Minimum Requirement for Non-Destructive Testing Methods – Appendix 1 to AD-Merkblatt HP5/3 (Germany).– Edition July 1989

FCC Rules

This **ISONIC PA AUT** Portable Digital Automatic Ultrasonic Flaw Detection and Recording System Combining Phased Array, TOFD, and Conventional Pulse Echo Techniques (hereinafter called **ISONIC PA AUT**) 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 PA AUT** has been built and tested according to the regulations specified in EN60950/VDE0805. It was in perfect working condition on leaving the manufacturer's premises

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

Depending on the power supply the **ISONIC PA AUT** 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 PA AUT** if the following safety regulations are closely observed:

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

- When positioning the equipment, external monitor, external keyboard, and external mouse take into account any local or national regulations relating to ergonomic requirements. For example, you should ensure that little or no ambient light is reflected off the external monitor screen as glare, and that the external keyboard is placed in a comfortable position for typing
- Do not allow any cables, particularly power cords, to trail across the floor, where they can be snagged by people walking past
- The voltage of the External DC Power Supply below 11 V is not allowed for the **ISONIC PA AUT** unit
- The voltage of the External DC Power Supply above 16 V is not allowed for the **ISONIC PA AUT** unit

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

1. Introduction

ISONIC PA AUT from Sonotron NDT represents cutting edge technology platform for high-speed automatic ultrasonic testing of welds, metals, composites, and the like combining phased array and conventional probes

Regular remote PC connected to instrument **ISONIC PA AUT** Ethernet provides full control, data acquisition and imaging in real time through the appropriate application software

ISONIC PA AUT is packed into rugged portable lightweight sealed case, which may be fitted onto the scanner's chassis avoiding the use of big, expensive, noisy, heavy, and vulnerable analogue umbilical: probes signals are sampled and pre-processed in real time right on the scanner; the digitised raw inspection data is transferred to remote PC for further processing, storage, and imaging. Fully digital through-Ethernet control and data transfer provide practically unlimited length of distance to remote PC enabling flexibility of creating control rooms or multiple monitor stations throughout the barge / factory / weld station, etc

ISONIC PA AUT platform fully complies with the requirements of National and International Codes:

- ASTM 1961– 06 – Standard Practice for Mechanized Ultrasonic Testing of Girth Welds Using Zonal Discrimination with Focused Search Units
- ASME Code Case 2541 – Use of Manual Phased Array Ultrasonic Examination Section V
- ASME Code Case 2557 – Use of Manual Phased Array S-Scan Ultrasonic Examination Section V per Article 4 Section V
- ASME Code Case 2558 – Use of Manual Phased Array E-Scan Ultrasonic Examination Section V per Article 4 Section V
- ASME Section I – Rules for Construction of Power Boilers
- ASME Section VIII, Division 1 – Rules for Construction of Pressure Vessels
- ASME Section VIII, Division 2 – Rules for Construction of Pressure Vessels. Alternative Rules
- ASME Section VIII Article KE-3 – Examination of Welds and Acceptance Criteria
- ASME Code Case 2235 Rev 9 – Use of Ultrasonic Examination in Lieu of Radiography
- Non-Destructive Examination of Welded Joints – Ultrasonic Examination of Welded Joints. – British and European Standard BS EN 1714:1998
- Non-Destructive Examination of Welds – Ultrasonic Examination – Characterization of Indications in Welds. – British and European Standard BS EN 1713:1998
- Calibration and Setting-Up of the Ultrasonic Time of Flight Diffraction (TOFD) Technique for the Detection, Location and Sizing of Flaws. – British Standard BS 7706:1993
- WI 00121377, Welding – Use Of Time-Of-Flight Diffraction Technique (TOFD) For Testing Of Welds. – European Committee for Standardization – Document # CEN/TC 121/SC 5/WG 2 N 146, issued Feb, 12, 2003
- ASTM E 2373 – 04 – Standard Practice for Use of the Ultrasonic Time of Flight iffraction (TOFD) Technique
- Non-Destructive Testing – Ultrasonic Examination – Part 5: Characterization and Sizing of Discontinuities. – British and European Standard BS EN 583-5:2001
- Non-Destructive Testing – Ultrasonic Examination – Part 2: Sensitivity and Range Setting. – British and European Standard BS EN 583-2:2001
- Manufacture and Testing of Pressure Vessels. Non-Destructive Testing of Welded Joints. Minimum Requirement for Non-Destructive Testing Methods – Appendix 1 to AD-Merkblatt HP5/3 (Germany).– Edition July 1989

2. Technical Data

Number of Channels:	**PA – 128 organized as 2 X 64:64 (typical); expandable up to 1024** **Conventional and TOFD – 16 (typical); expandable up to 64**
Pulse Type:	**Bipolar Square Wave**
Initial Transition:	**≤7.5 ns (10-90% for rising edges / 90-10% for falling edges)**
Pulse Amplitude:	**PA – Smoothly tunable (12 levels) 50V … 300 V peak to peak into 50 Ω - Probes** **Conventional and TOFD – Smoothly tunable (12 levels) 50V … 400 V peak to peak into 50 Ω**
Half Wave Pulse Duration:	**10…600 ns controllable in 10 ns step for both positive and negative half wave simultaneously**
Modes of Operation for Conventional and TOFD channels:	**Single / Dual**
PRF:	**10...5000 Hz controllable in 1 Hz resolution**
Analogue Gain:	**0...100 dB controllable in 0.5 dB resolution**
Advanced Low Noise Design:	**85 μV peak to peak input referred to 80 dB gain / 25 MHz bandwidth**
Frequency Band:	**0.2 … 25 MHz Wide Band**
Emitting aperture:	**1…N controllable in 1 element resolution, whereas N = 64 (typical) or 128 or 256 or 512 or 1024**
Phasing at Firing Stage:	**0…100 μs with 5 ns resolution**
Receiving Aperture:	**1…N controllable in 1 element resolution, whereas N = 64 (typical) or 128 or 256 or 512 or 1024**
A/D Conversion:	**100 MHz 16 bit Parallel for All Channels**
Signals Phasing and Superimposing at Receiving Stage:	**On-the-fly 0…100 μs with 2.5 ns resolution**
Digital Filters (for phased array and conventional pulse echo and TOFD channels):	**32-Taps FIR band pass with lower and upper frequency limits controllable with 0.1 MHz resolution**
Number of Focal Laws:	**8192**
On-Board (Satellite) Computer RAM: Internal Flash Memory - Quasi HDD: Interface: Operating System:	**AMD LX 800 - 500MHz** **512 Megabytes** **4 Gigabytes** **Ethernet** **Windows™XP Embedded**
Control and Data Storage: Method of data storage: Data presentation at inspection / postprocessing stage: Postprocessing features:	**Regular Remote PC** **100% raw data capturing** **Strip chart composed by an operator, depending on application software the following types of strips are possible:** • **Amplitude / TOF Pulse Echo Strip (PE)** • **Map (C-Scan, CB-Scan)** • **Map (C-Scan) combined with:** ▪ **True-to-Geometry Sector Scan** ▪ **True-to-Geometry B-Scan** • **TOFD** • **Coupling (Yes/No stroke)** • **A-Scan for any strip selected by an operator** **Play-back A-Scans** **Sizing of indications**
Linear Scanning Speed:	**20…100 mm/sec controllable in 1 mm/sec resolution**
Encoder interface:	**Incremental TTL encoder**
Motor Control Output:	**DC powering / RS 232 control - stepped motor**
Housing of Electronic Box:	**IP 67 rugged aluminum case mountable on scanner**
Dimensions of Electronic Box:	**295X174X346 mm (11.62"×6.85"×13.62")**
Weight of Electronic Box:	**6.8 kg (14.95 lbs)**

3. Operating ISONIC PA AUT Hardware

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

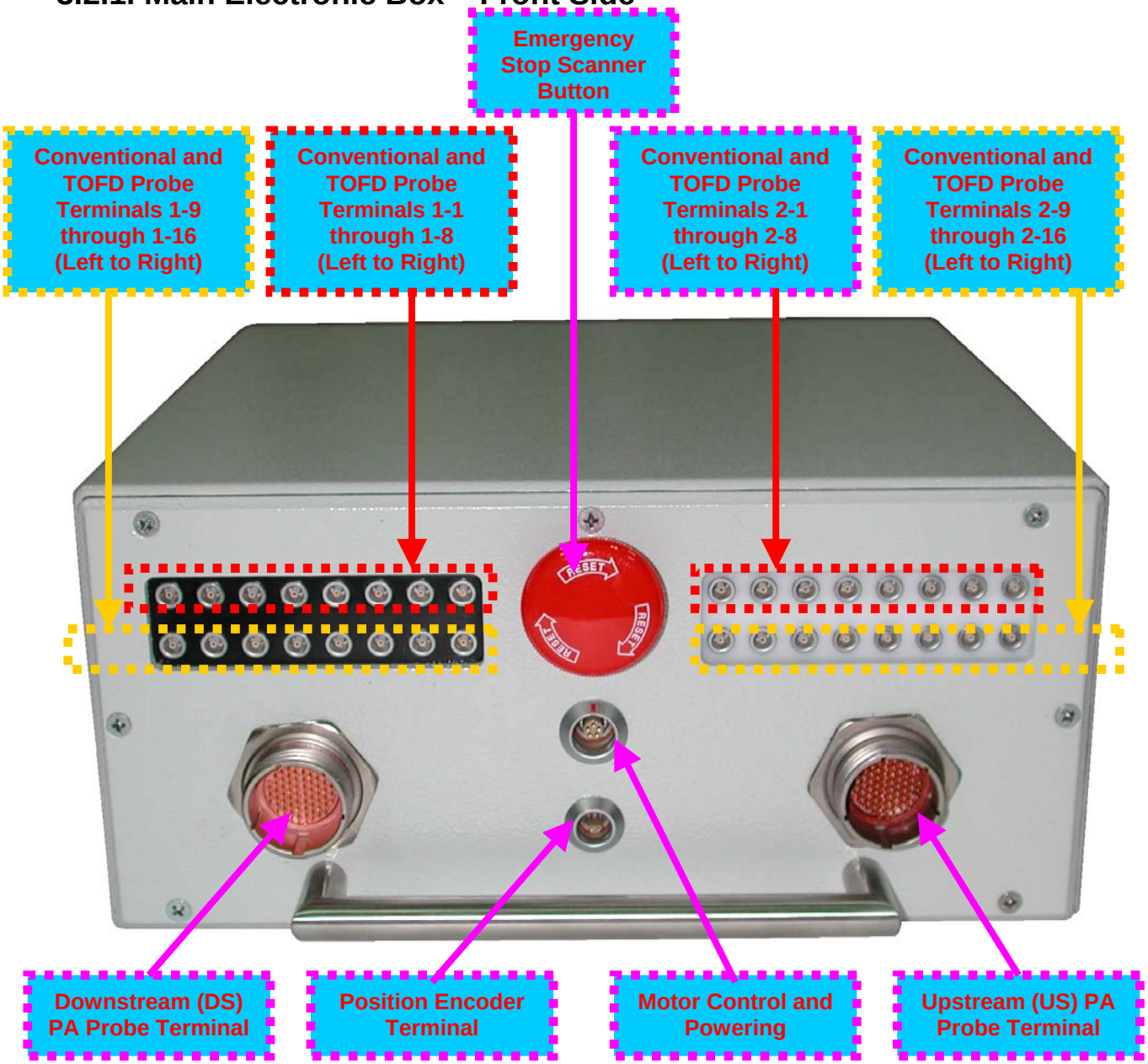
3.1. Preconditions for ultrasonic testing with ISONIC PA AUT

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

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

3.2. ISONIC PA AUT Controls and Terminals

3.2.1. Main Electronic Box – Front Side



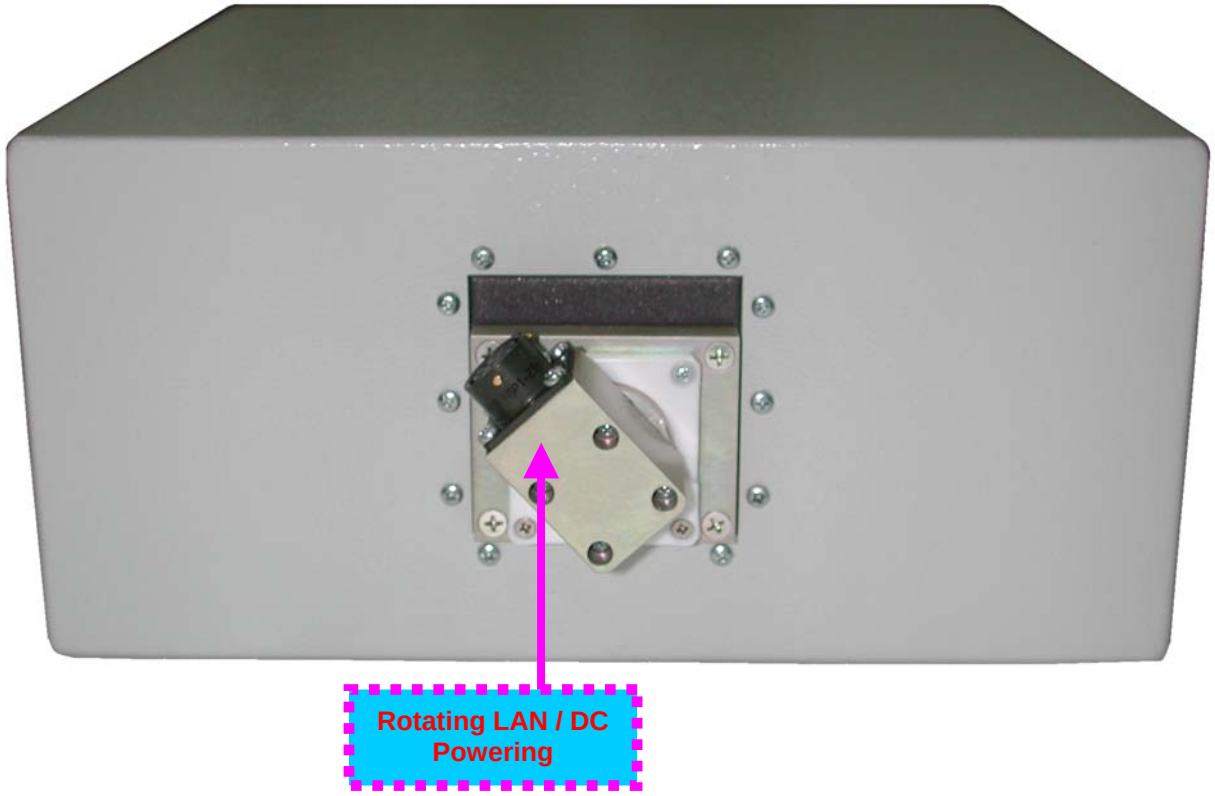
Probe Terminal	UDS 3-6 Pulser Receiver Channel #	Pulser Mode: DUAL	Pulser Mode: SINGLE
1-1	1	Receiver Input	Firing Output / Receiver Input
2-1	1	Firing Output	Not Used
1-2	2	Receiver Input	Firing Output / Receiver Input
2-2	2	Firing Output	Not Used
1-3	3	Receiver Input	Firing Output / Receiver Input
2-3	3	Firing Output	Not Used
1-4	4	Receiver Input	Firing Output / Receiver Input
2-4	4	Firing Output	Not Used
1-5	5	Receiver Input	Firing Output / Receiver Input
2-5	5	Firing Output	Not Used

---continued---

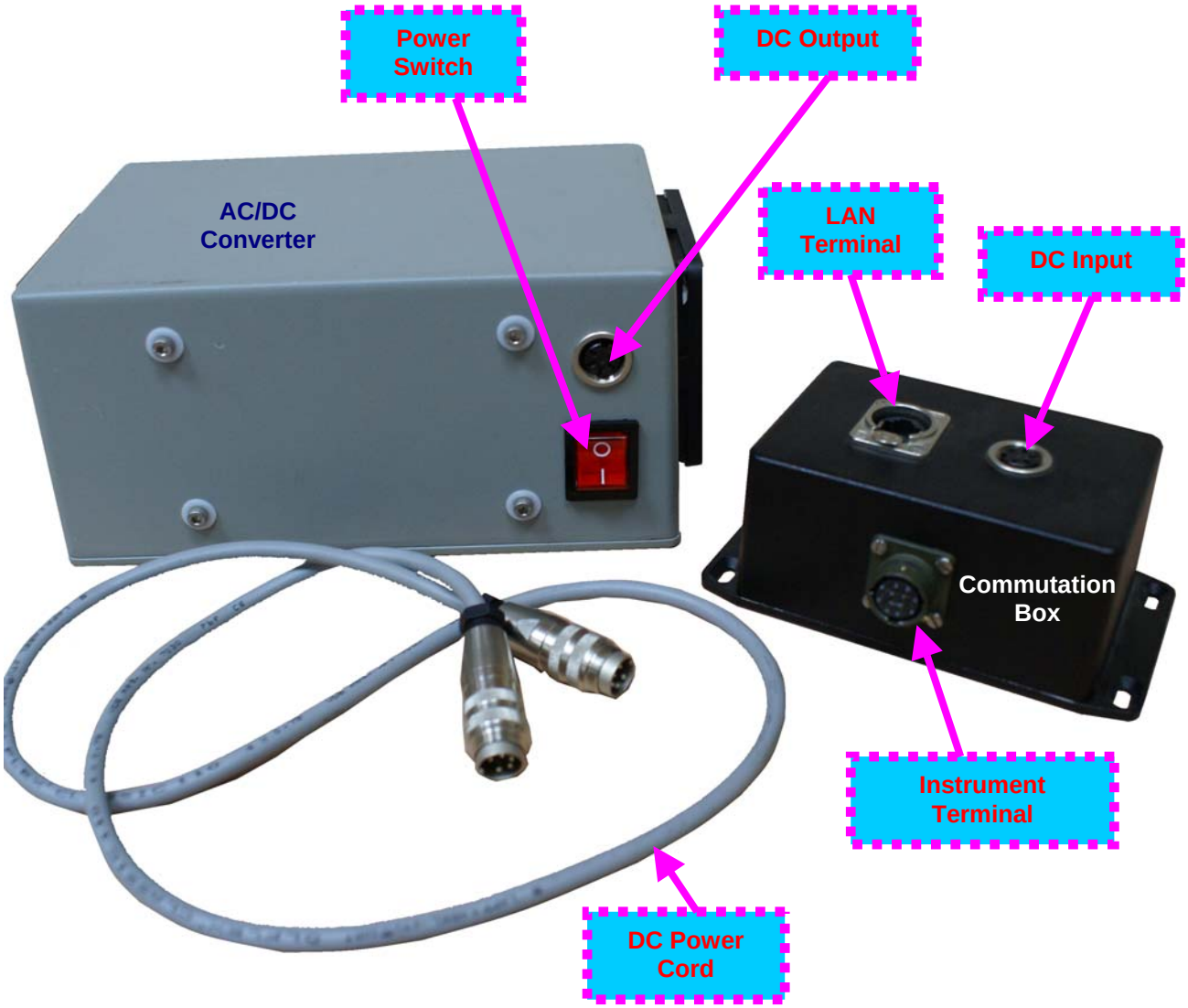
---continued---

Probe Terminal	UDS 3-6 Channel #	Pulser Mode: DUAL	Pulser Mode: SINGLE
1-6	6	Receiver Input	Firing Output / Receiver Input
2-6	6	Firing Output	Not Used
1-7	7	Receiver Input	Firing Output / Receiver Input
2-7	7	Firing Output	Not Used
1-8	8	Receiver Input	Firing Output / Receiver Input
2-8	8	Firing Output	Not Used
1-9	5	Receiver Input	Firing Output / Receiver Input
2-9	5	Firing Output	Not Used
1-10	6	Receiver Input	Firing Output / Receiver Input
2-10	6	Firing Output	Not Used
1-11	7	Receiver Input	Firing Output / Receiver Input
2-11	7	Firing Output	Not Used
1-12	8	Receiver Input	Firing Output / Receiver Input
2-12	8	Firing Output	Not Used
1-13	5	Receiver Input	Firing Output / Receiver Input
2-13	5	Firing Output	Not Used
1-14	6	Receiver Input	Firing Output / Receiver Input
2-14	6	Firing Output	Not Used
1-15	7	Receiver Input	Firing Output / Receiver Input
2-15	7	Firing Output	Not Used
1-16	8	Receiver Input	Firing Output / Receiver Input
2-16	8	Firing Output	Not Used

4.2.2. Main Electronic Box – Rear Side



3.2.3. AC/DC Converter and Commutation Box – Instruments Manufactured Before Dec 1, 2007



3.2.4. AC/DC Converter with Built-In Commutation Box – Instruments Manufactured On Dec 1, 2007 and Later

3.3. Turning On / Off

3.3.1. Electrical Connections and Mechanical Fittings Prior to Turn ON

Instruments manufactured BEFORE December 1, 2007 – refer to paragraph 4.2.3 of this Operating Manual

- ❑ Ensure that nothing is connected to AC/DC Converter and power switch in **O** position
- ❑ Ensure that control computer is switched OFF
- ❑ Connect DC Power Cord to the appropriate sockets on the AC/DC Converter and Commutation Box
- ❑ Connect umbilical to Instrument Terminal at the Commutation Box and to Rotating LAN/DC Terminal at the rear side of the instrument
- ❑ Provide LAN connections by one of the following ways:
    - o *Way # 1 – use of the existing local area network*: connect LAN Terminals of control computer and Commutation Box to Ethernet sockets belonging to the same DHCP-enabled local area network – use *regular Ethernet cables* (for details refer to paragraph 4.3.2.2 of this Operating Manual)
    - o *Way # 2 – use of mini-router*: connect LAN Terminals of control computer and Commutation Box to the sockets of DHCP-enabled mini-router – use *regular Ethernet cables* (for details refer to paragraph 4.3.2.3 of this Operating Manual)
    - o *Way # 3 – direct connection*: connect LAN Terminals of control computer and Commutation Box directly to each other using *crossover Ethernet cable* (for details refer to paragraph 4.3.2.4 of this Operating Manual)
- ❑ Fit instrument into scanner (refer to paragraph 4.3.3 of this Operating Manual)
- ❑ Connect motor, encoder, and probes to the appropriate sockets on the front panel of the instrument
- ❑ Connect AC Power cord to AC/DC Converter then plug it in to the mains
- ❑ Switch control computer ON and wait until boot up is completed

Instruments manufactured AFTER December 1, 2007 – refer to paragraph 4.2.4 of this Operating Manual

- ❑ Ensure that nothing is connected to AC/DC Converter and power switch in **O** position
- ❑ Ensure that control computer is switched OFF
- ❑ Connect umbilical to Instrument Terminal at the AC/DC Converter and to Rotating LAN/DC Terminal at the rear side of the instrument
- ❑ Provide LAN connections by one of the following ways:
    - o *Way # 1 – use of the existing local area network*: connect LAN Terminals of control computer and AC/DC Converter to Ethernet sockets belonging to the same DHCP-enabled local area network – use *regular Ethernet cables* (for details refer to paragraph 4.3.2.2 of this Operating Manual)
    - o *Way # 2 – use of mini-router*: connect LAN Terminals of control computer and AC/DC Converter to the sockets of DHCP-enabled mini-router – use *regular Ethernet cables* (for details refer to paragraph 4.3.2.3 of this Operating Manual)
    - o *Way # 3 – direct connection*: connect LAN Terminals of control computer and AC/DC Converter directly to each other using *crossover Ethernet cable* (for details refer to paragraph 4.3.2.4 of this Operating Manual)
- ❑ Fit instrument into scanner (refer to paragraph 4.3.3 of this Operating Manual)
- ❑ Connect motor, encoder, and probes to the appropriate sockets on the front panel of the instrument
- ❑ Connect AC Power cord to AC/DC Converter then plug it in to the mains
- ❑ Switch control computer ON and wait until boot up is completed

3.3.2. ISONIC PA AUT Network Connection

Network configurations described in this chapter to be managed by the local system administrator only. Improper re-configuration of on-board PC of ISONIC PA AUT instrument may affect further network access to it causing the need in interventional repair with extracting of its of flash memory and re-formatting it in the master stand at Sonotron NDT premises, said repair is no covered by warranty

3.3.2.1. General

On-board satellite computer of **ISONIC PA AUT** runs under *Windows XP Embedded* and it is configured to accept standard *Microsoft Windows Network Connections*

ISONIC PA AUT allows connection via **Remote Desktop Connection**, which is an integral part of *Microsoft Windows XP*. Use of **Remote Desktop Connection** is required only in limited number of cases when there is a need in full access to on-board satellite computer of **ISONIC PA AUT**

The following username and password should be used for any type of network connection to **ISONIC PA AUT**:

Username:	**`RDGuest`**
Password:	**`rdguest`**

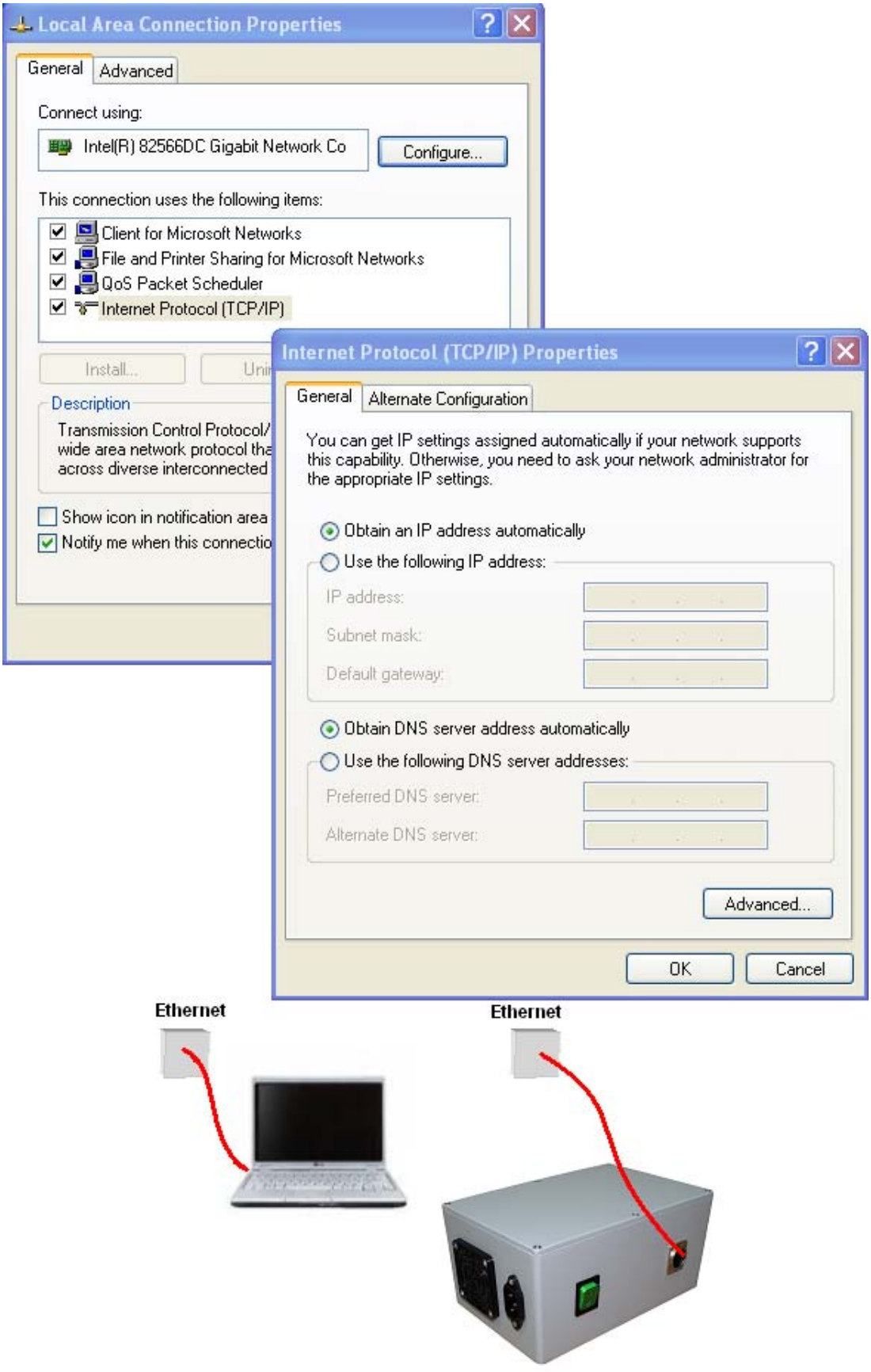
Primary TCP/IP Configuration of on-board satellite computer of **ISONIC PA AUT** is set to **DHCP client** – the IP Address is obtained automatically upon connection to DHCP Networks

Alternate TCP/IP Configuration on-board satellite computer of **ISONIC PA AUT** has the following parameters:

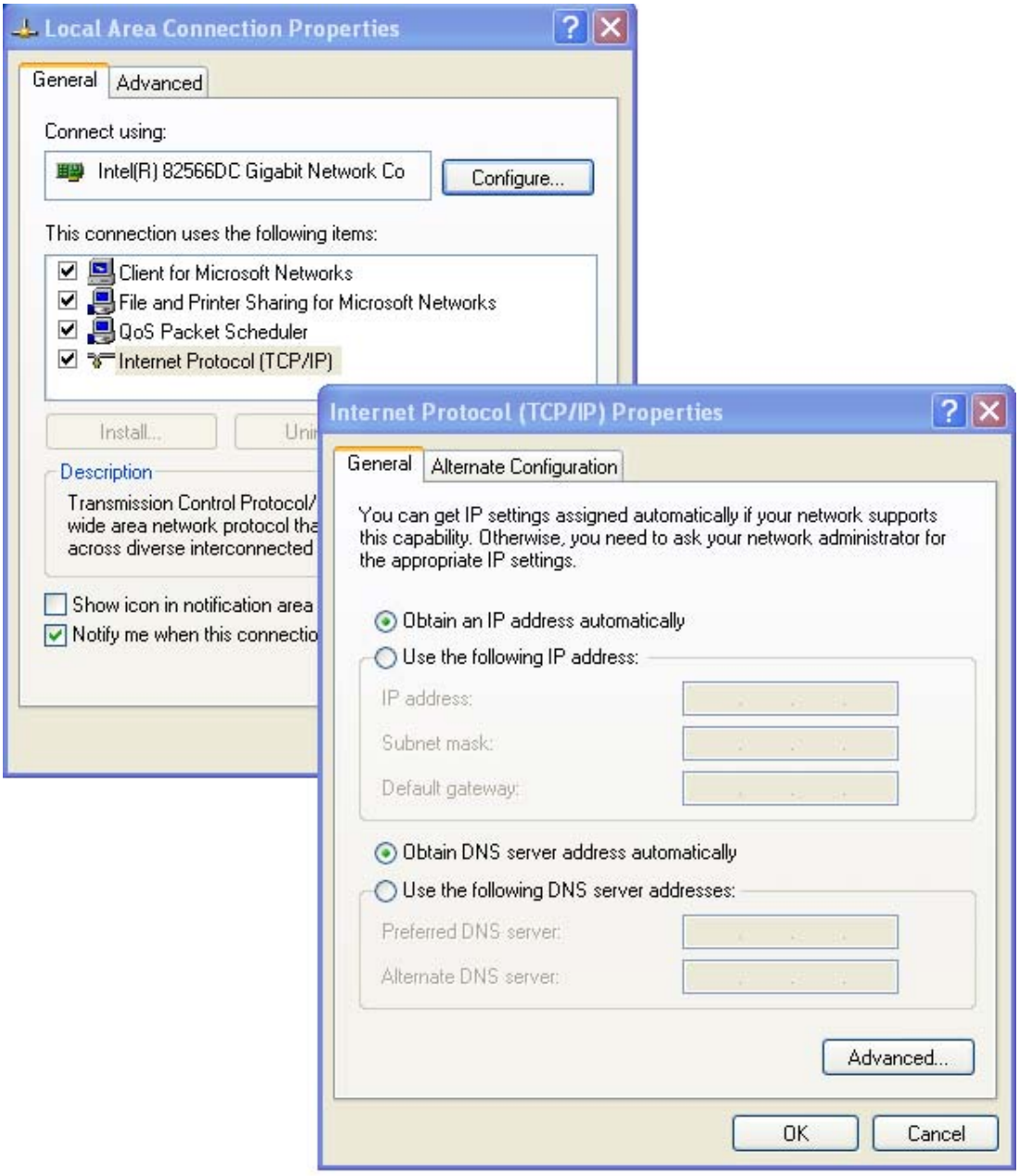
IP Address:	**`192.168.3.X`**
Subnet mask:	**`255.255.255.0`**
Default Gateway:	**`192.168.3.1`**

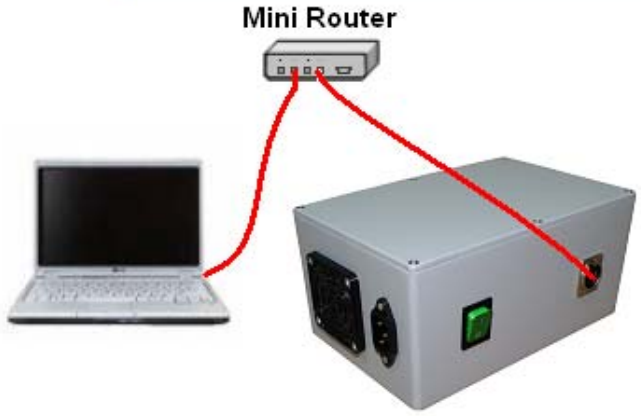
Where **`X`** bay be a number from **`10`** to **`19`**

3.3.2.2. Connection Via DHCP-Enabled Network – Settings of the Remote Control Computer

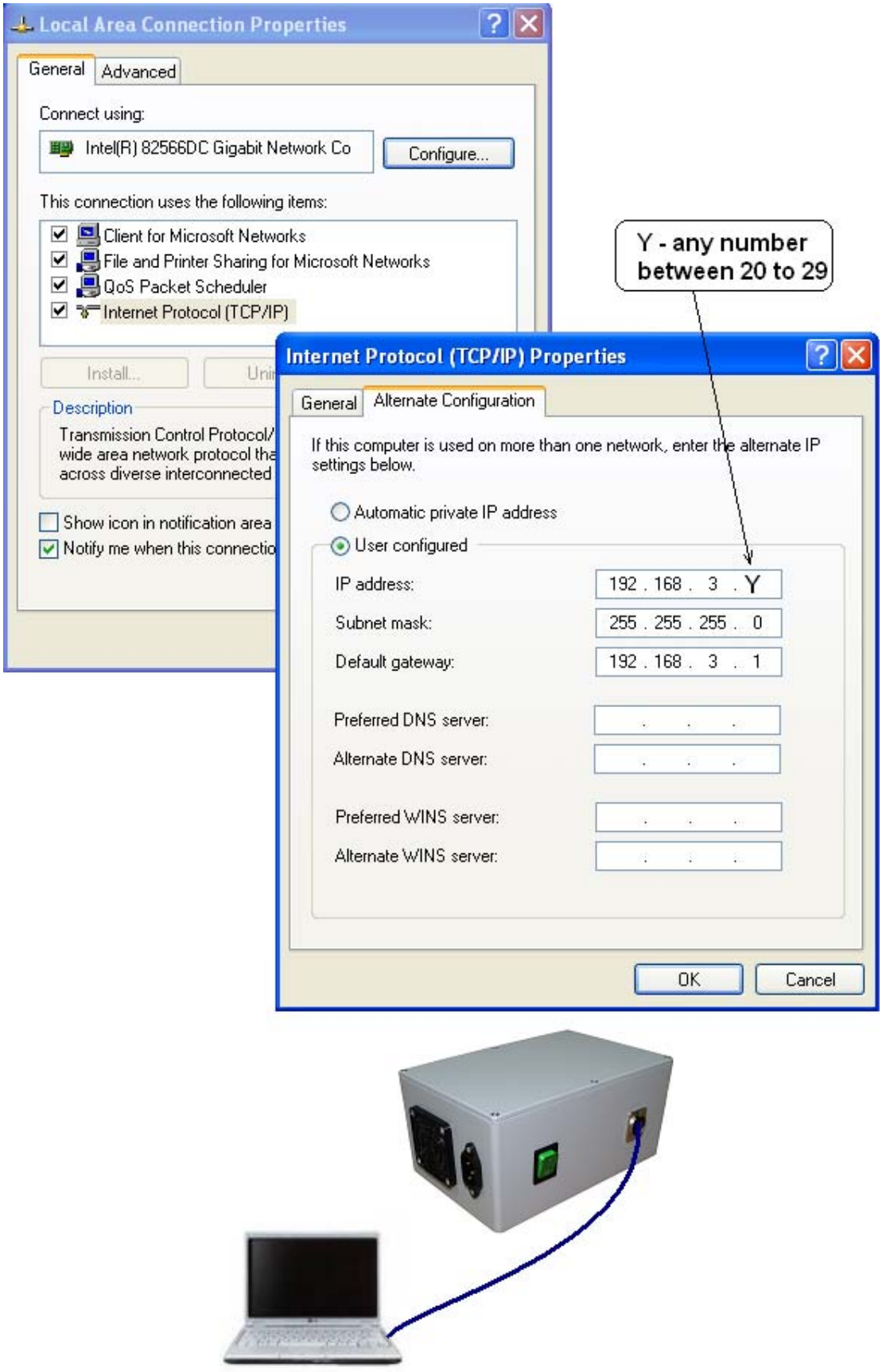


3.3.2.3. Connection Via DHCP-Enabled Mini Router – Settings of the Remote Control Computer





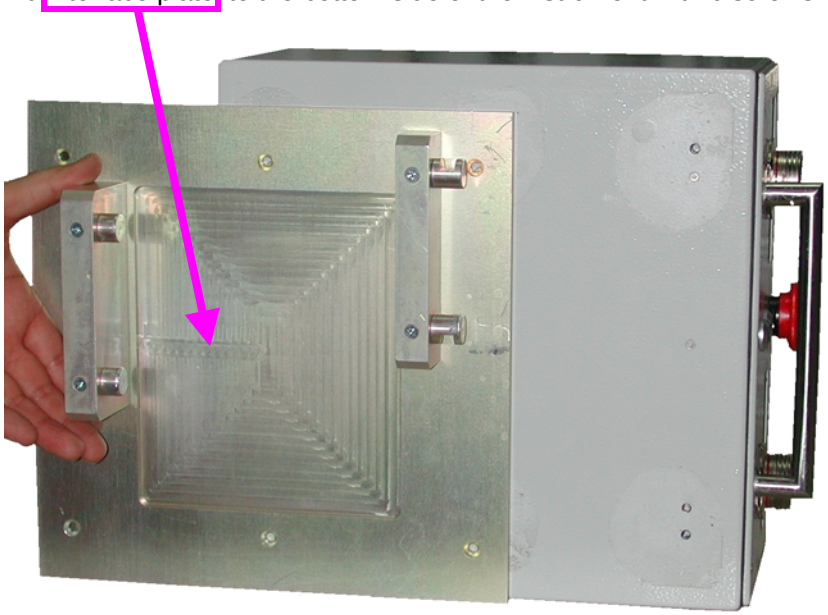
3.3.2.4. Connection Via Crossover Ethernet Cable – Settings of the Remote Control Computer

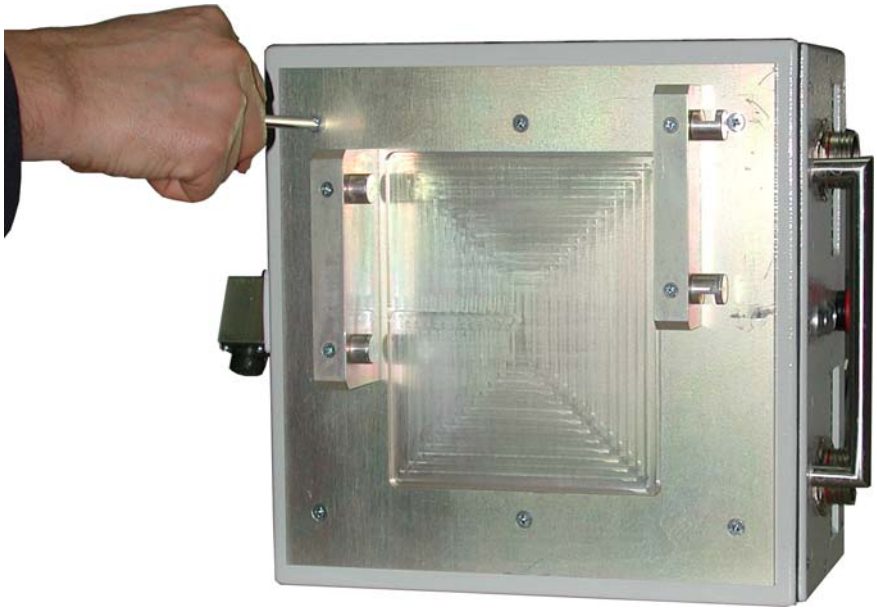


3.3.3. Mechanical Fittings

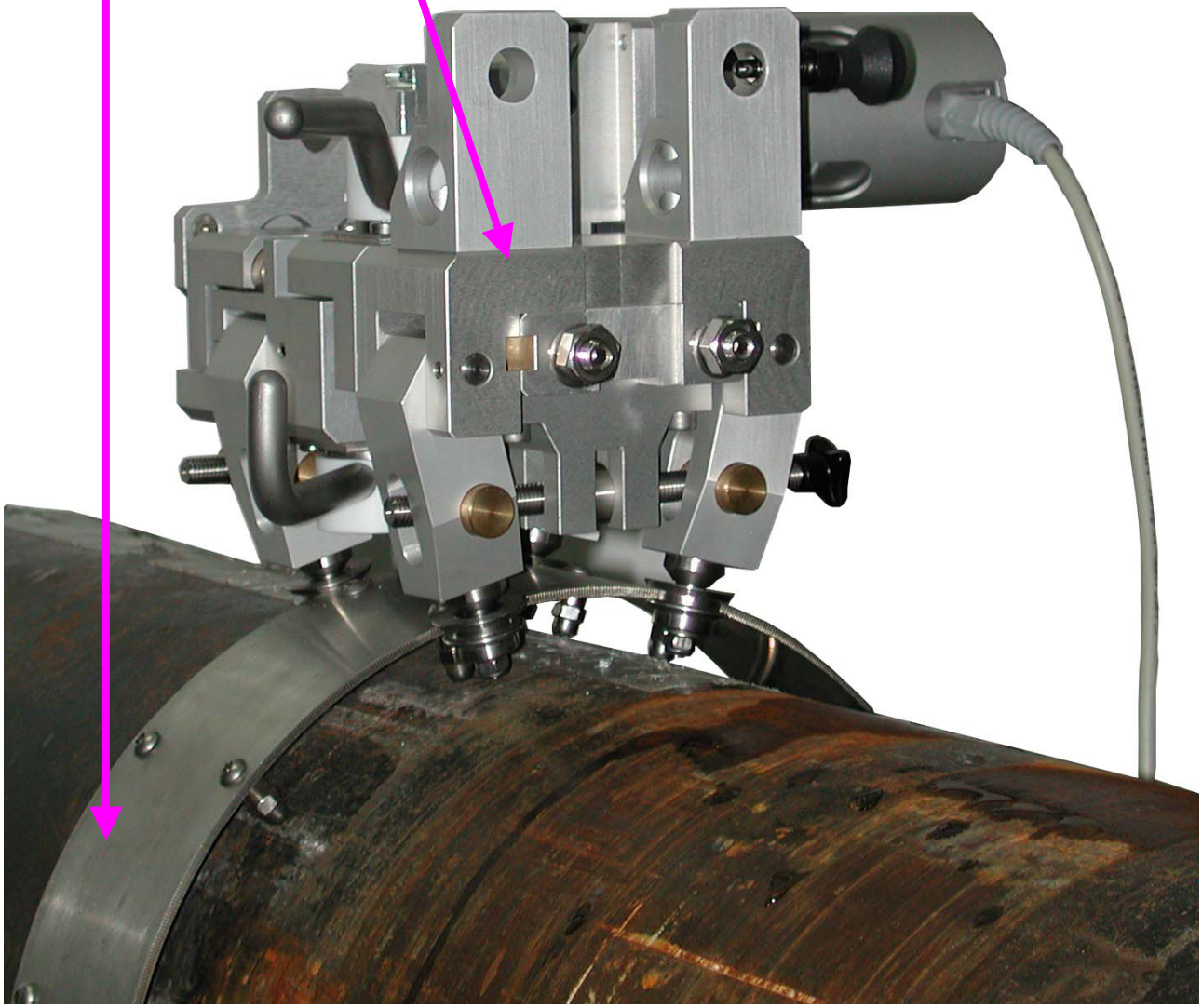
3.3.3.1 HMC-Type Scanners

Fit interface plate to the bottom side of the instrument with 6 screws

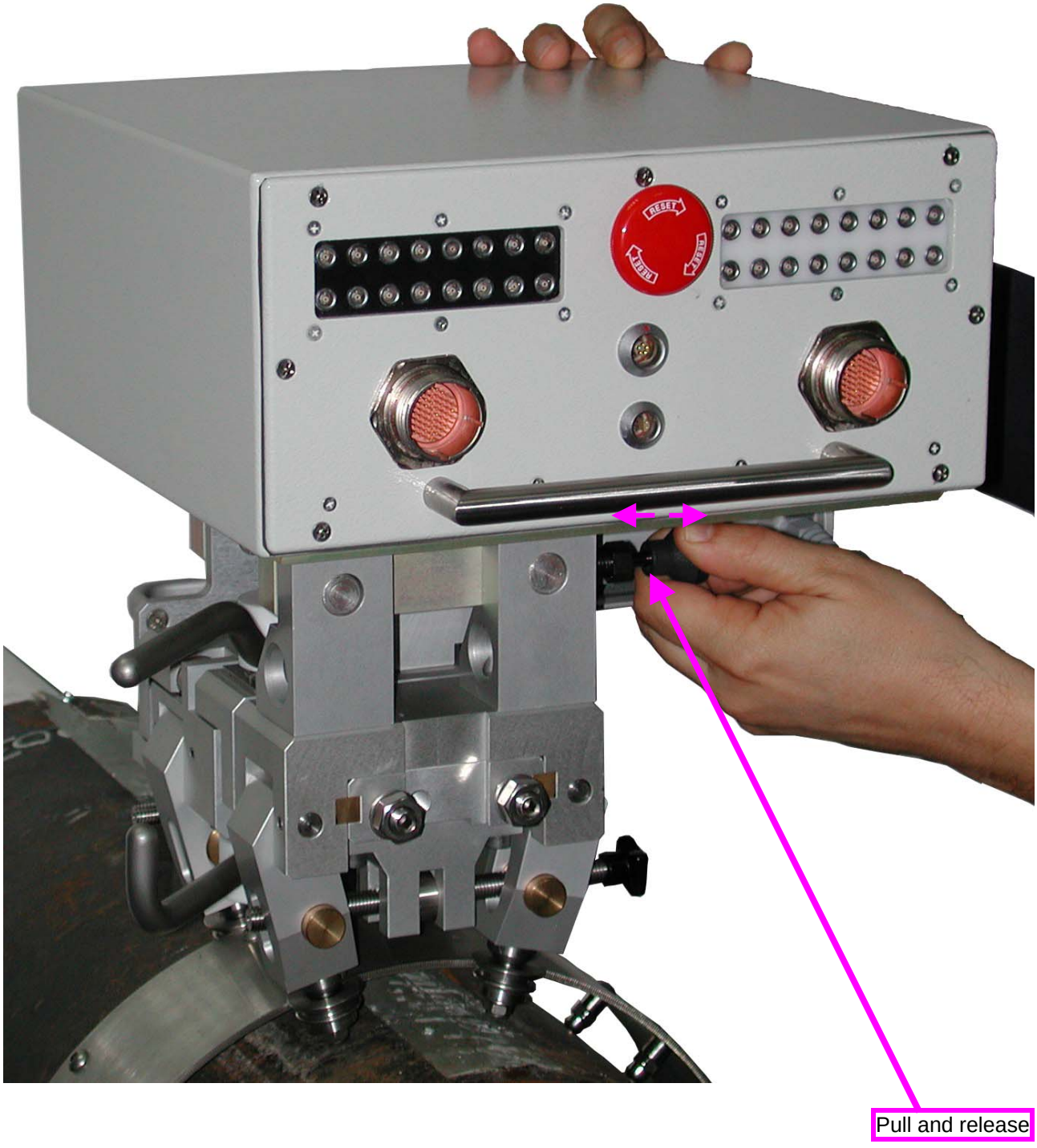




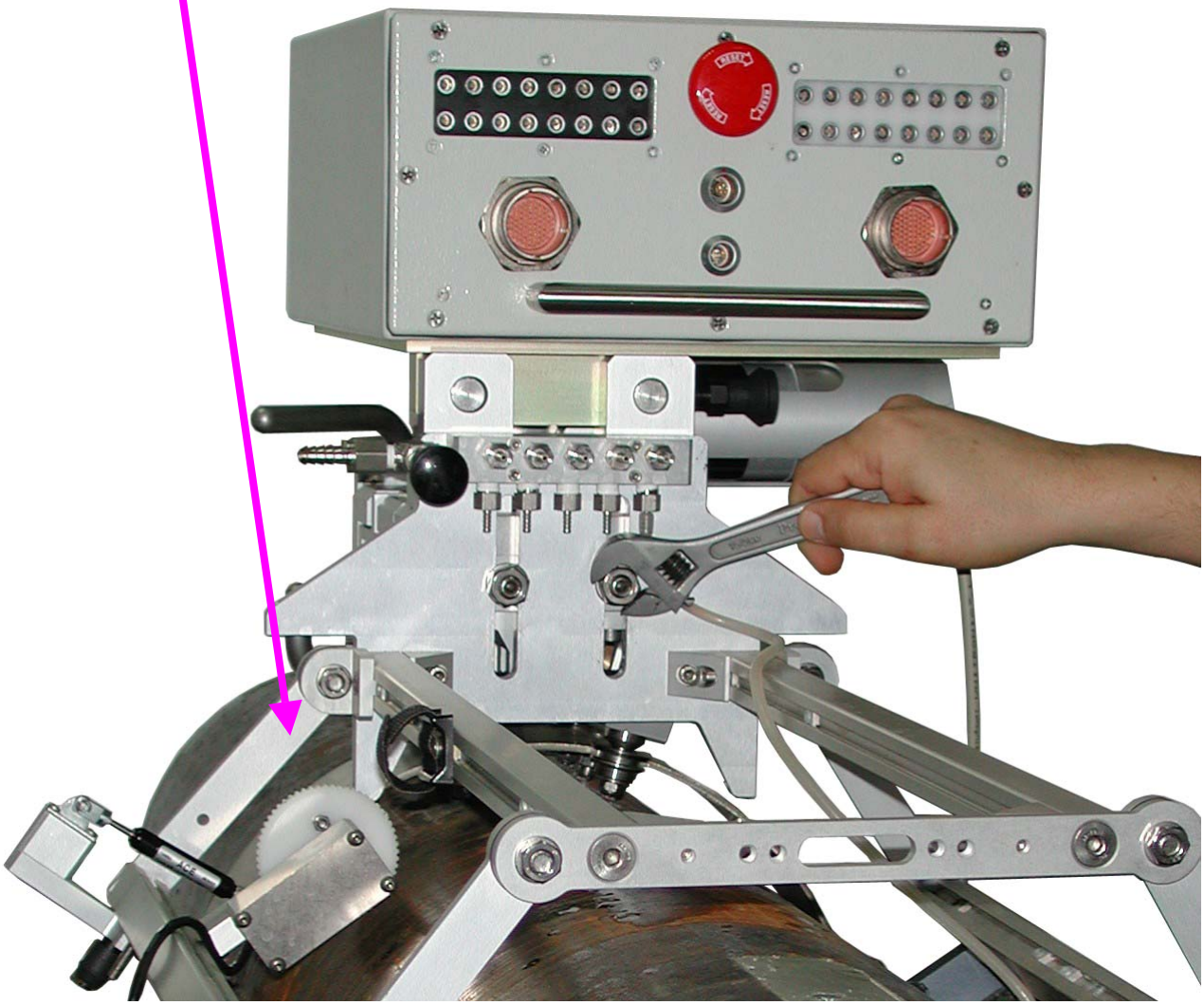
Fit travel band onto a pipe and scanner onto the travel band



Fit instrument into the scanner

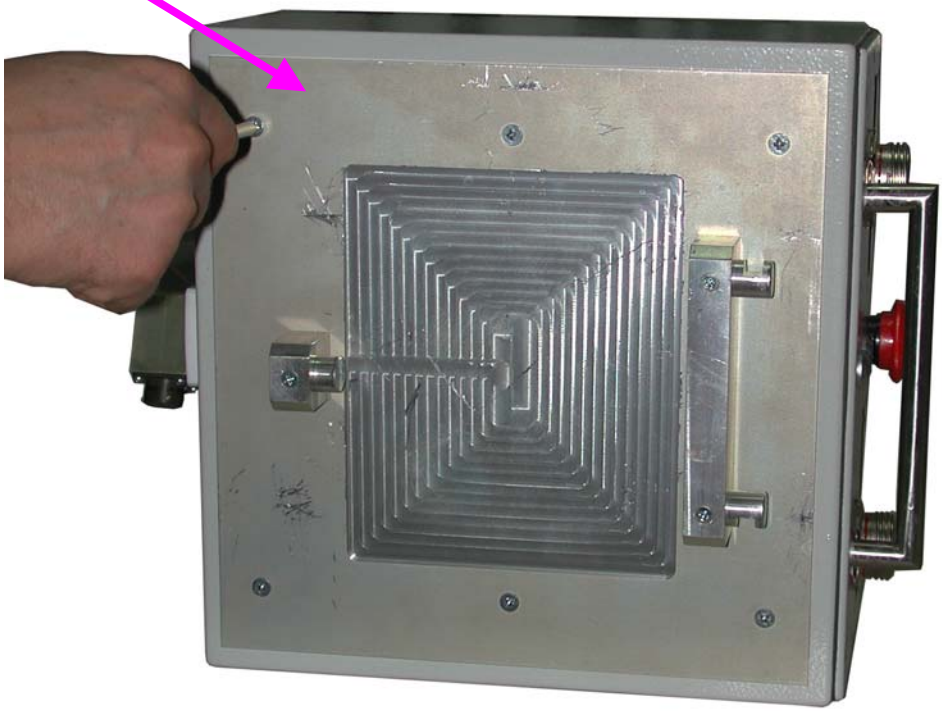


Fit the frame for carrying probes into the scanner

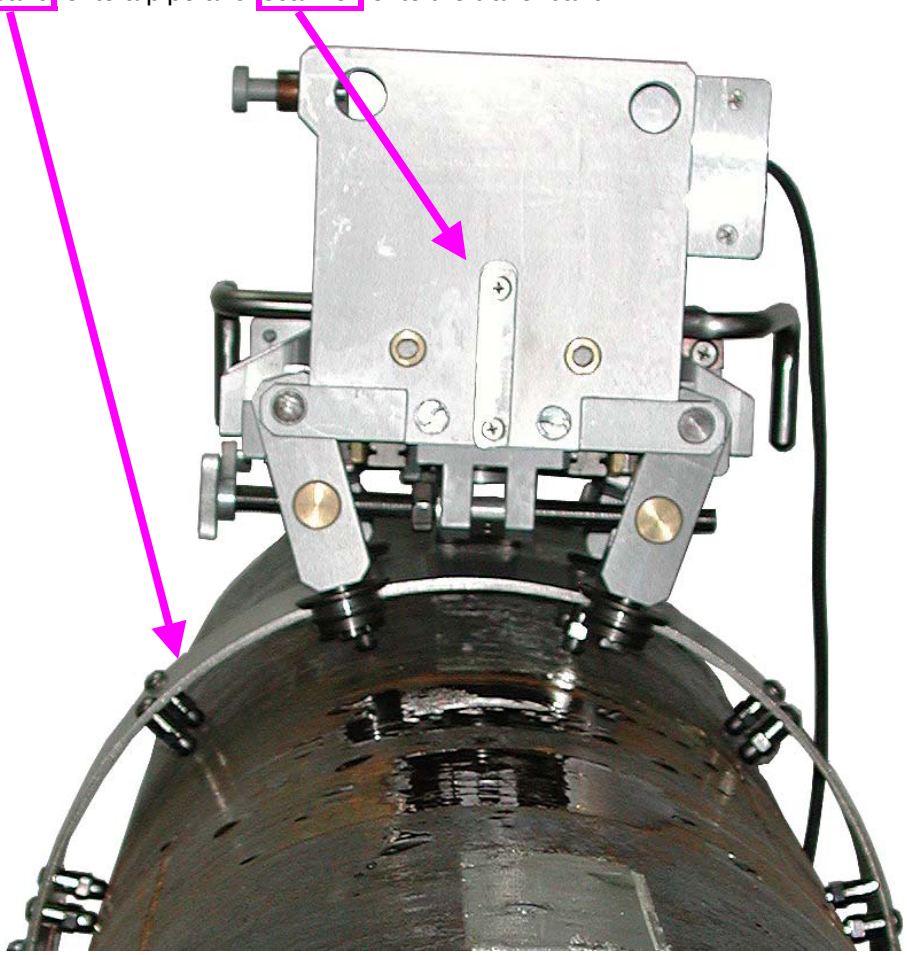


3.3.3.2 SM 80600702-Type Scanner

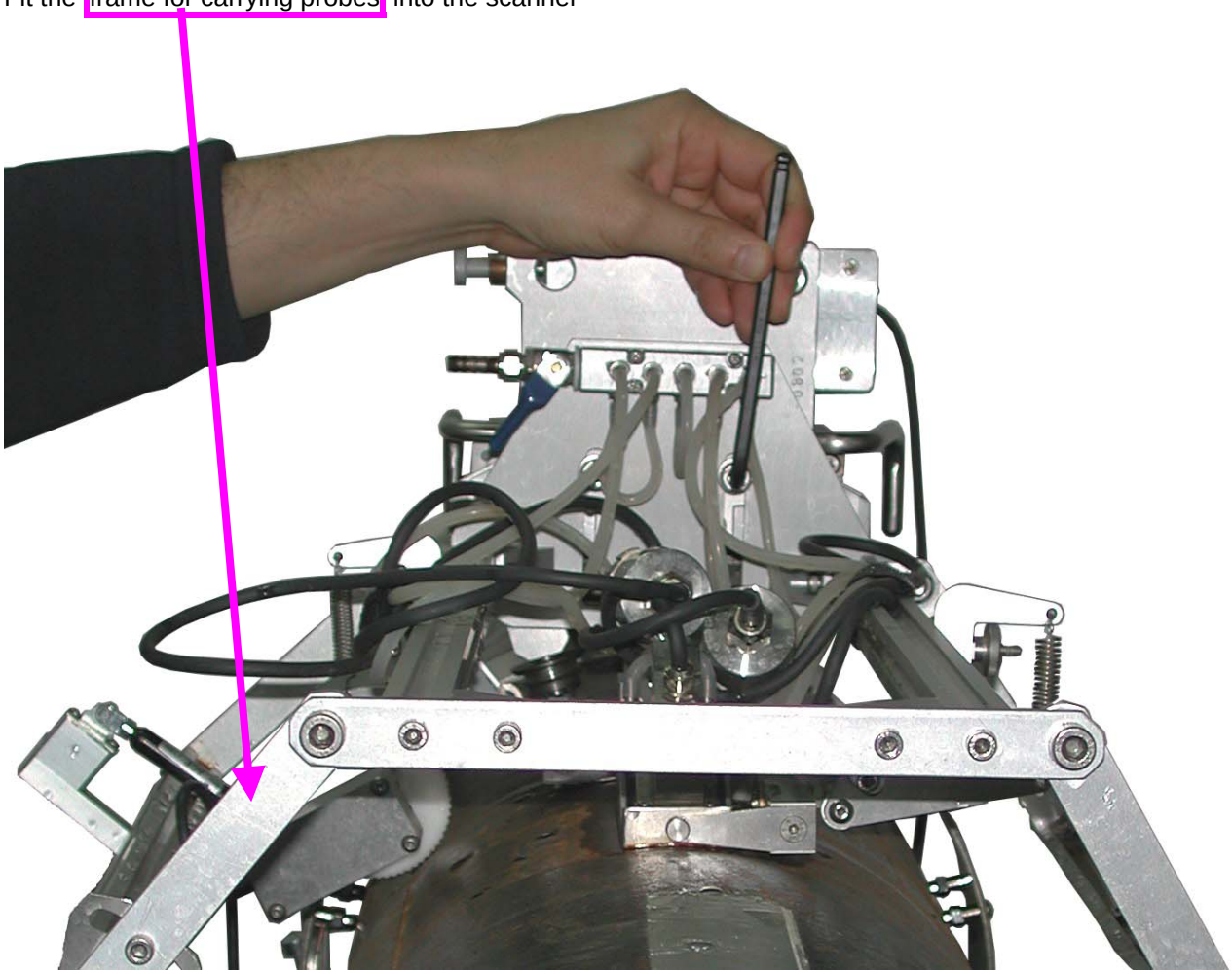
Fit interface plate to the bottom side of the instrument with 6 screws



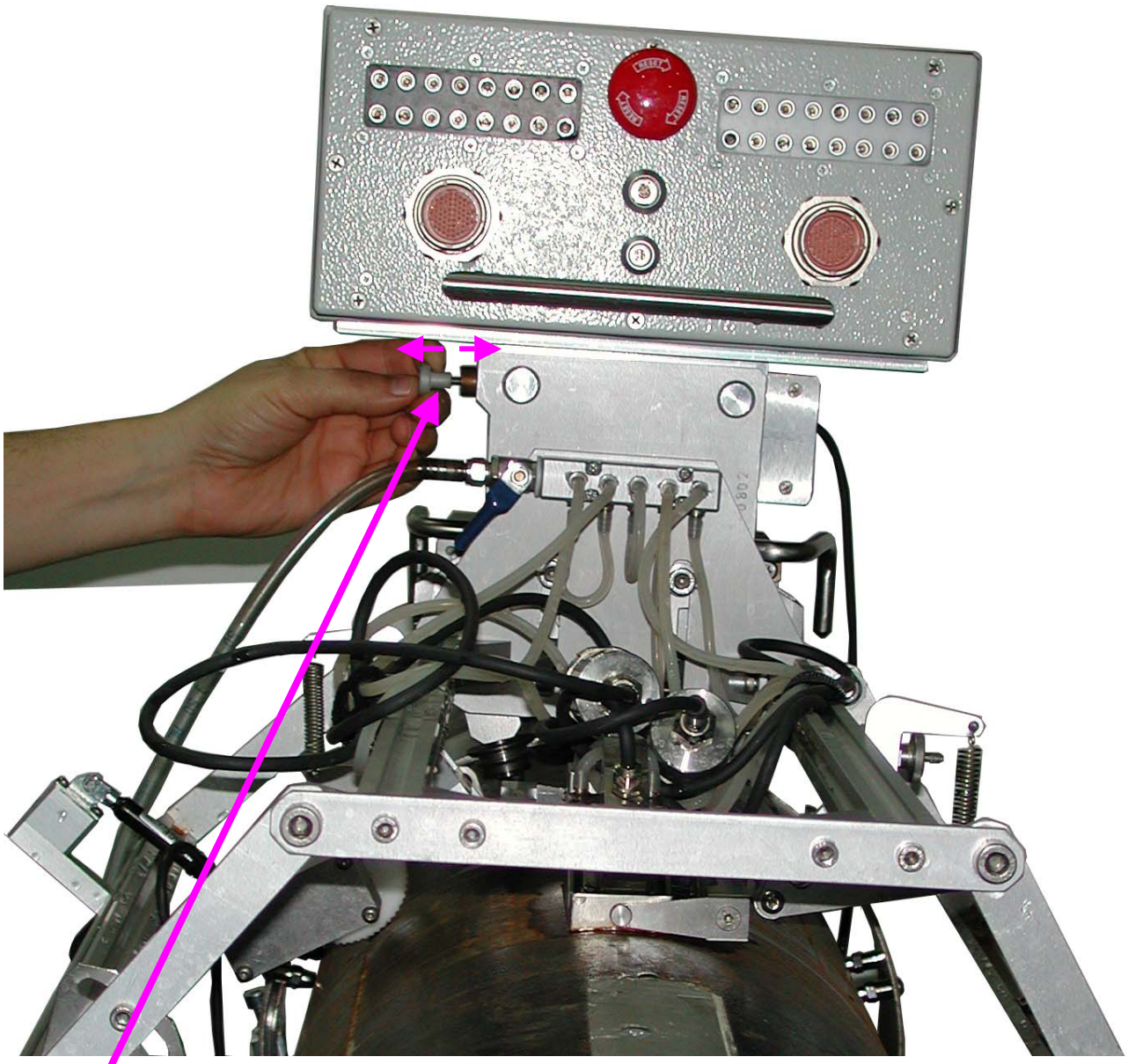
Fit travel band onto a pipe and scanner onto the travel band



Fit the frame for carrying probes into the scanner



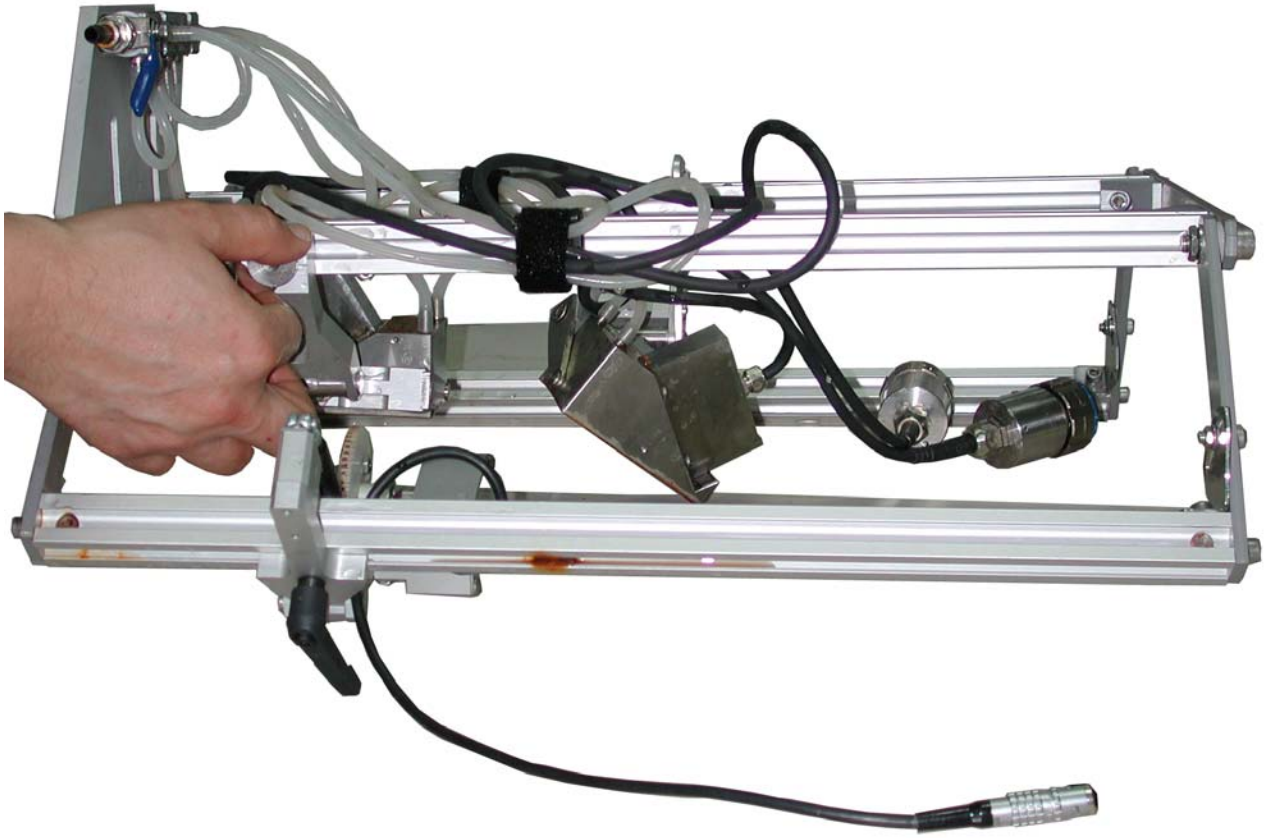
Fit instrument into the scanner



3.3.3.3 Fitting Probes and Position Encoder into the Frame

Each probe to be fitted into it's own probe holder. Probes and encoder to be fitted into the frame according to the planned scanning strategy; irrigation piping to be provided for each probe holder

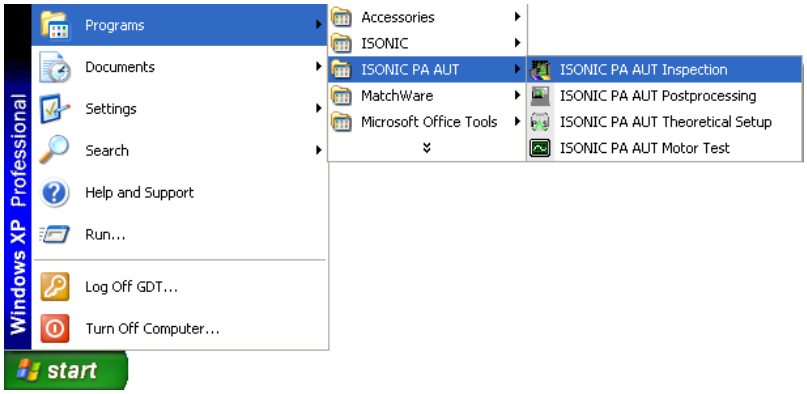
Encoder to be fitted into the frame by such a way that it's wheel will be oriented at parallel to the travel band



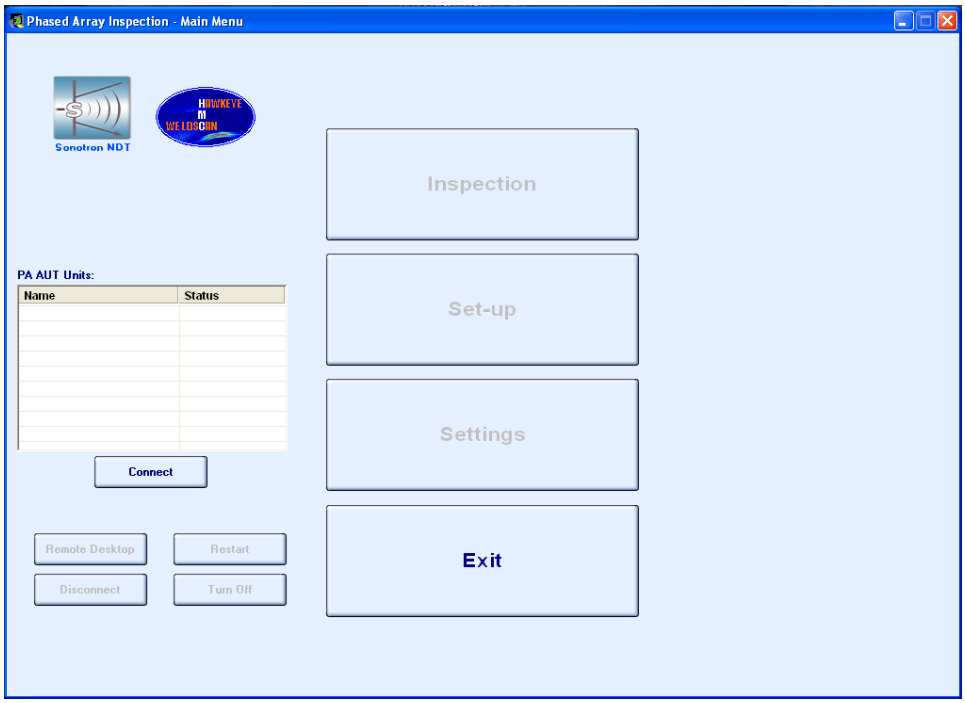
3.3.4. Turning ISONIC PA AUT On

Complete preparations as per chapters 3.3.1 through 3.3.3 of this Operating Manual then set power switch on the AC/DC converter into **I** position – an automatic boot up of the on-board satellite computer of **ISONIC PA AUT** will start, it may take 40…120 seconds

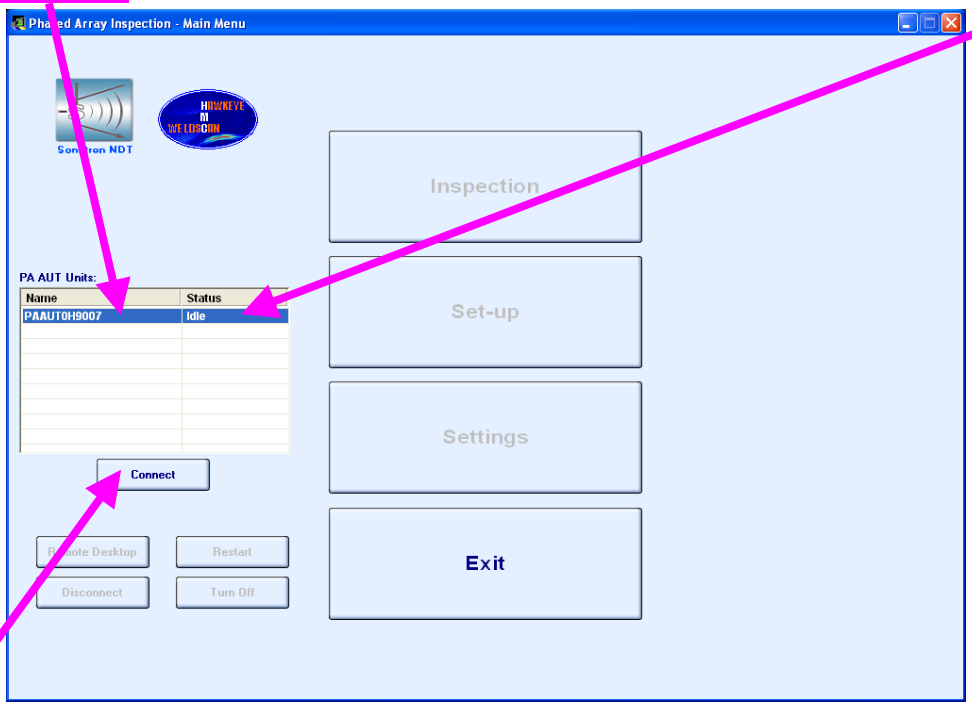
In the remote control computer start **ISONIC PA AUT Inspection** software through:



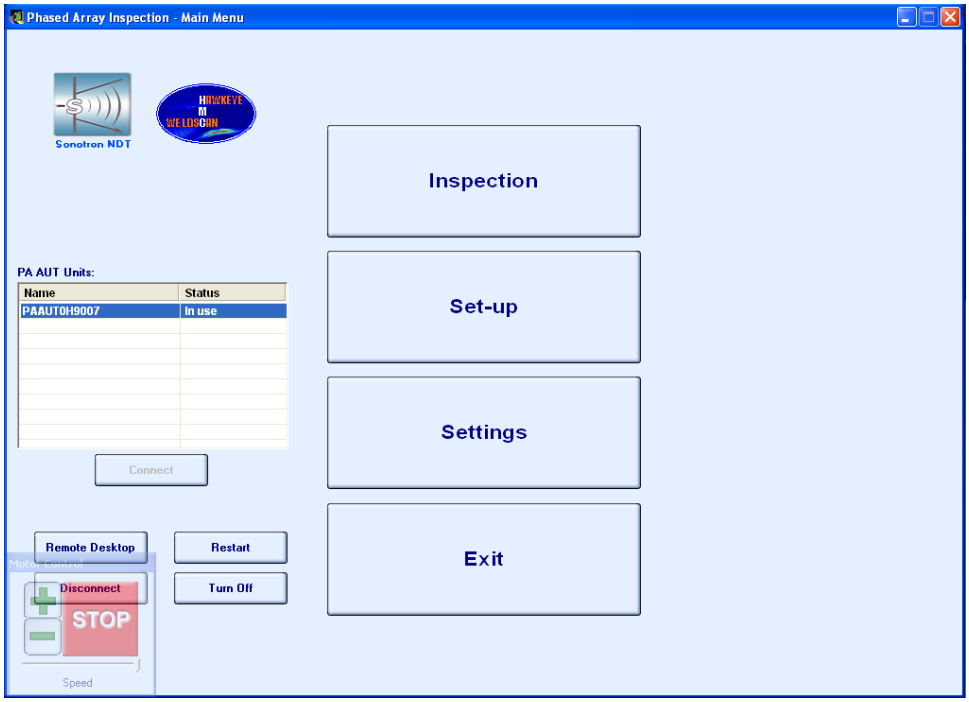
The screen as below appears:



Upon on-board satellite computer of **ISONIC PA AUT** boots up and the hardware initialization is completed the name of the instrument appears in the list and it's status of readiness for the operation is indicated as **Idle**

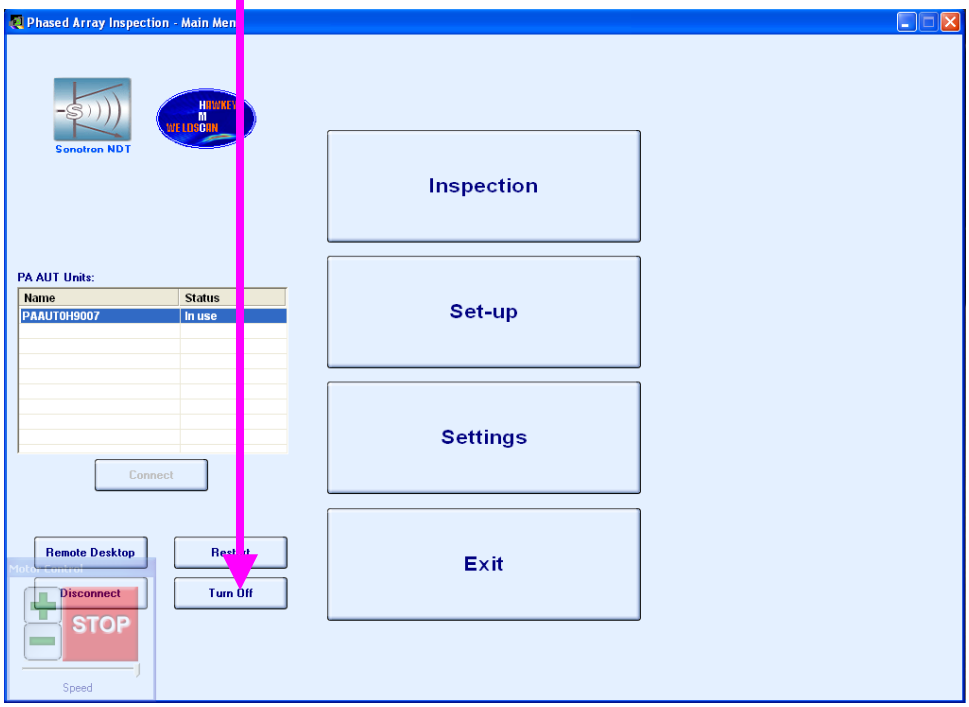


Click on to establish communication between remote control computer and **ISONIC PA AUT**, the start-up screen appears then:



3.3.5. Turning ISONIC PA AUT Off

To turn off **ISONIC PA AUT** click on



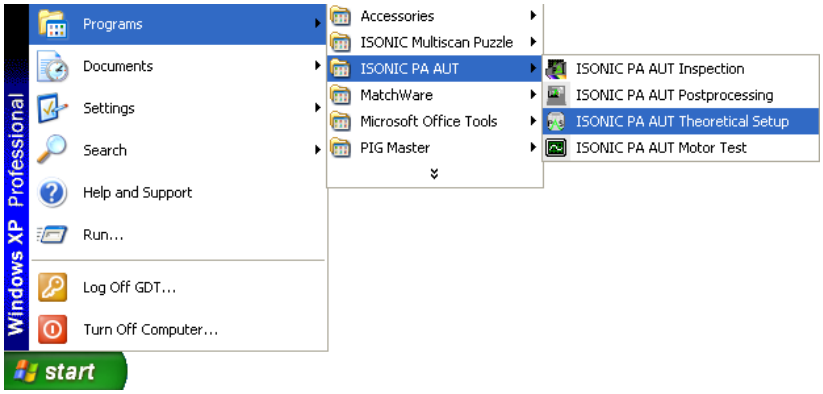
Wait until name of **ISONIC PA AUT** instrument disappears from the list, then set power switch on the AC/DC converter into **O** position

Remote control computer screenshots related to paragraphs 3.3.4 and 3.3.5 of present Operating Manual have been made with use of Inspection SW Package for ISONIC PA AUT "Automatic Mechanized Ultrasonic Examination of Girth Welds Using Zonal Discrimination according to ASTM E-1961". For other SW packages the ON/OFF procedure is identical

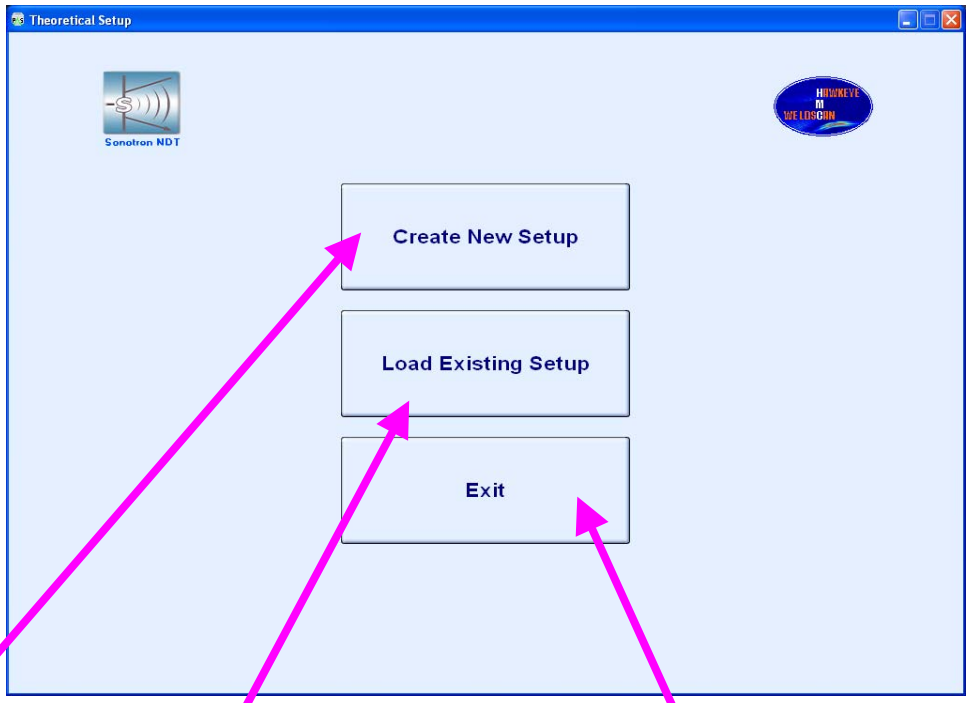
4. Inspection SW Package: Automatic Mechanized Ultrasonic Examination of Girth Welds Using Zonal Discrimination according to ASTM E-1961

4.1. Pre-scanning Routine – Stage 1: Theoretical Setup Wizard

Theoretical setup wizard is the special SW package that may run in the remote control computer or any other PC. Theoretical rays tracing is necessary to ensure complete insonification of girth weld to be inspected, it is started through:



The screen as below appears then



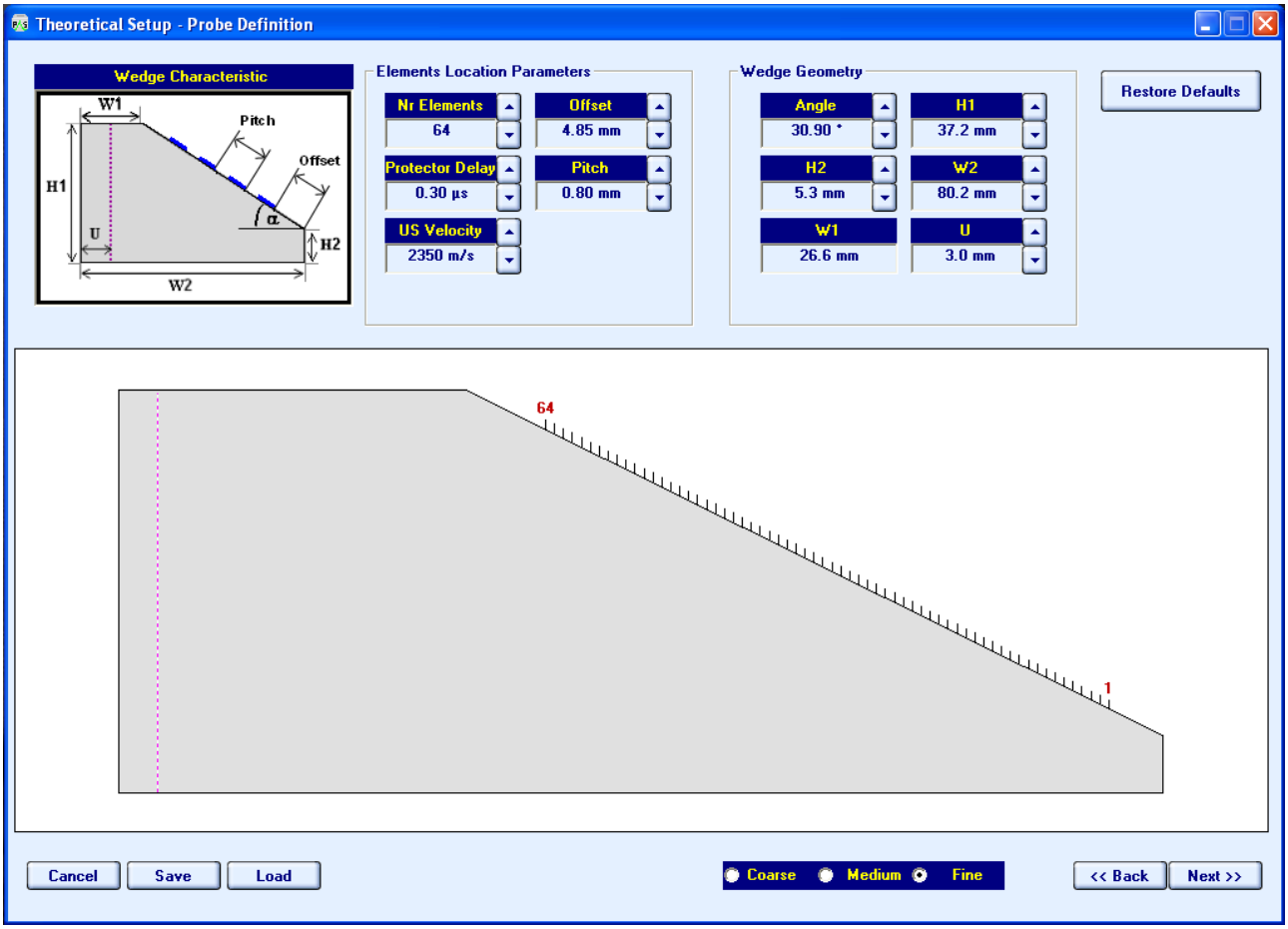
Click on to start new ray tracing routine

Click on to upload data from ray tracing file for previewing / editing

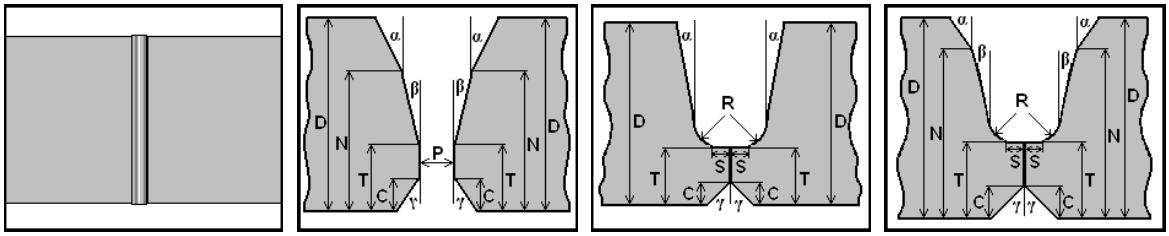
Click on to exit without saving newly created / edited theoretical setup file

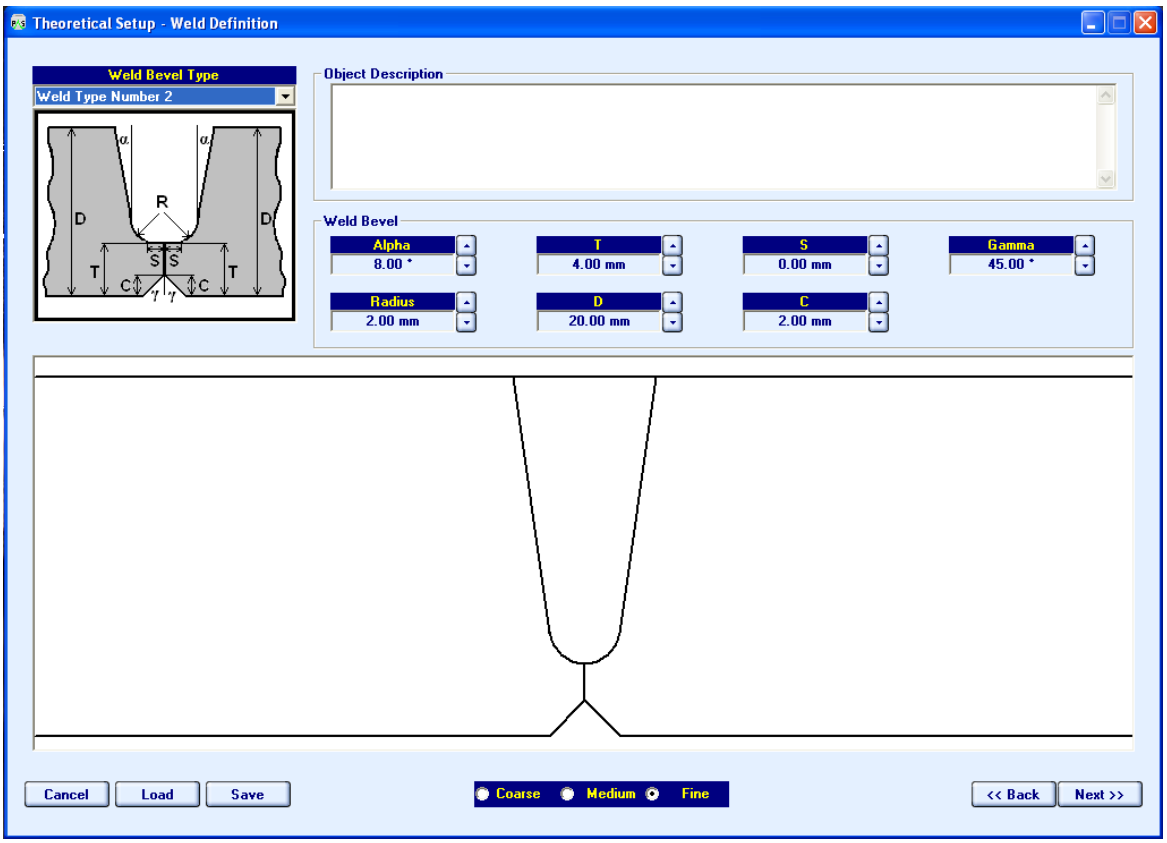
Further operation is performed through intuitive graphic user interface, the stages include:

- *Probe Definition* dialogue for entering parameters of PA probes and wedges

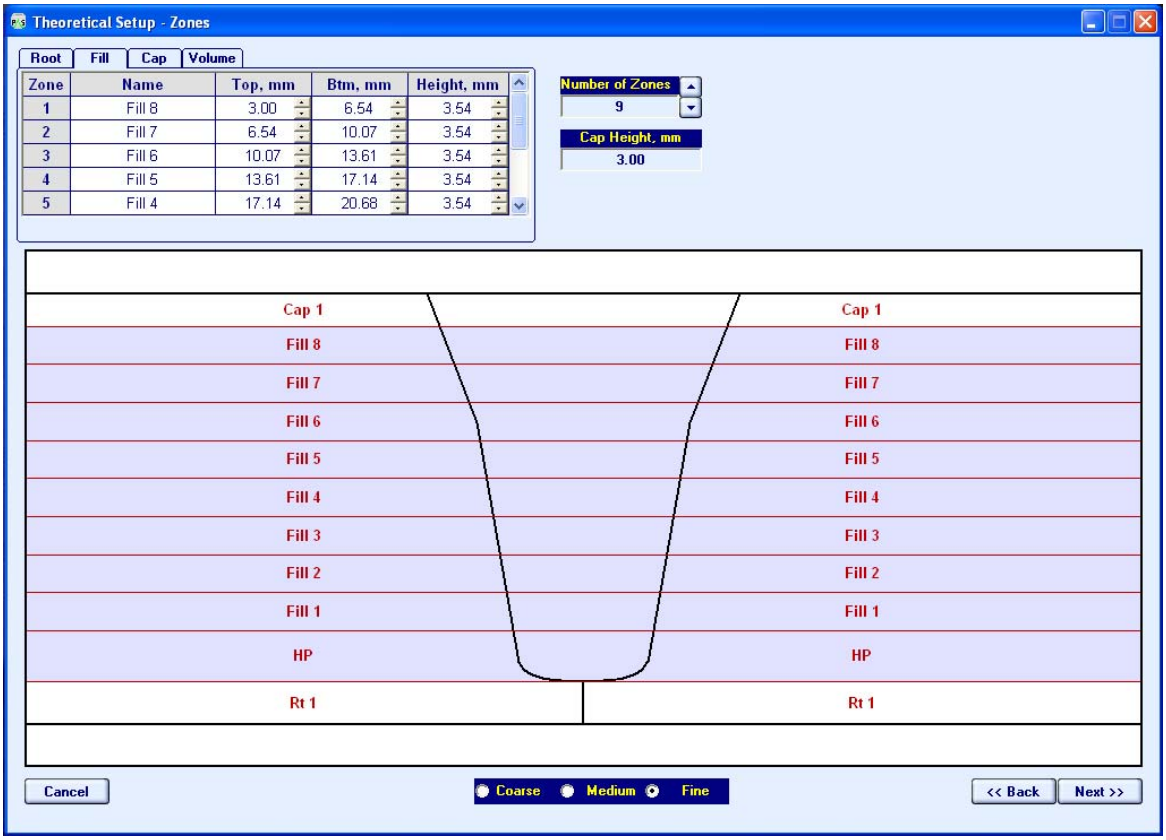


- *Weld Definition* dialogue for selection of appropriate weld bevel from data base and entering related geometry and dimensions

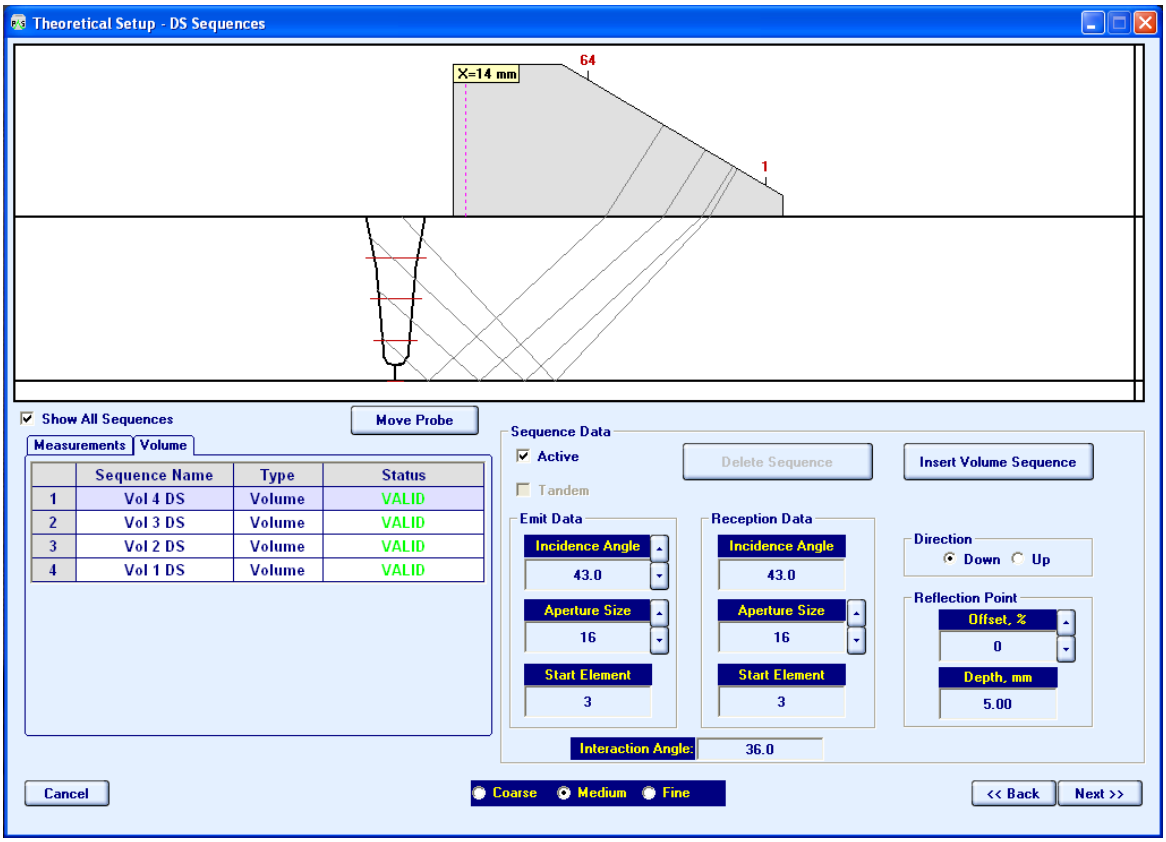


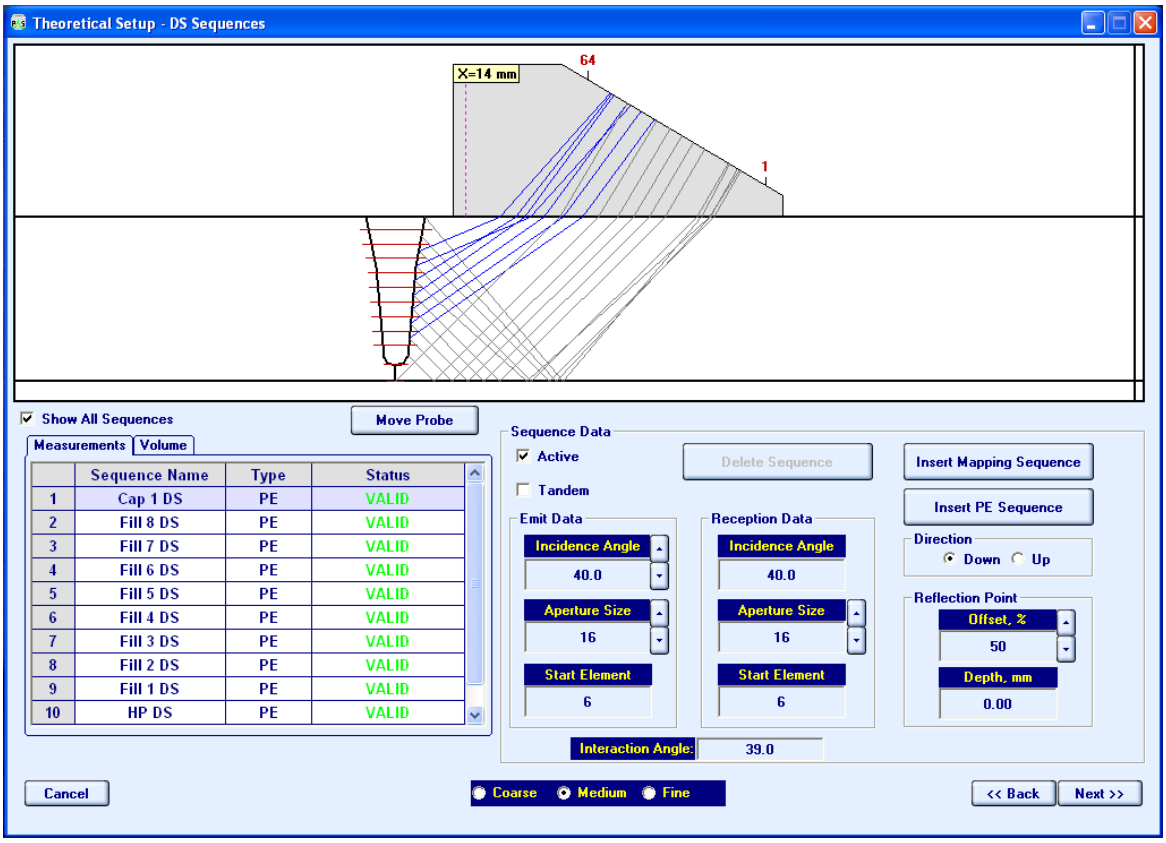


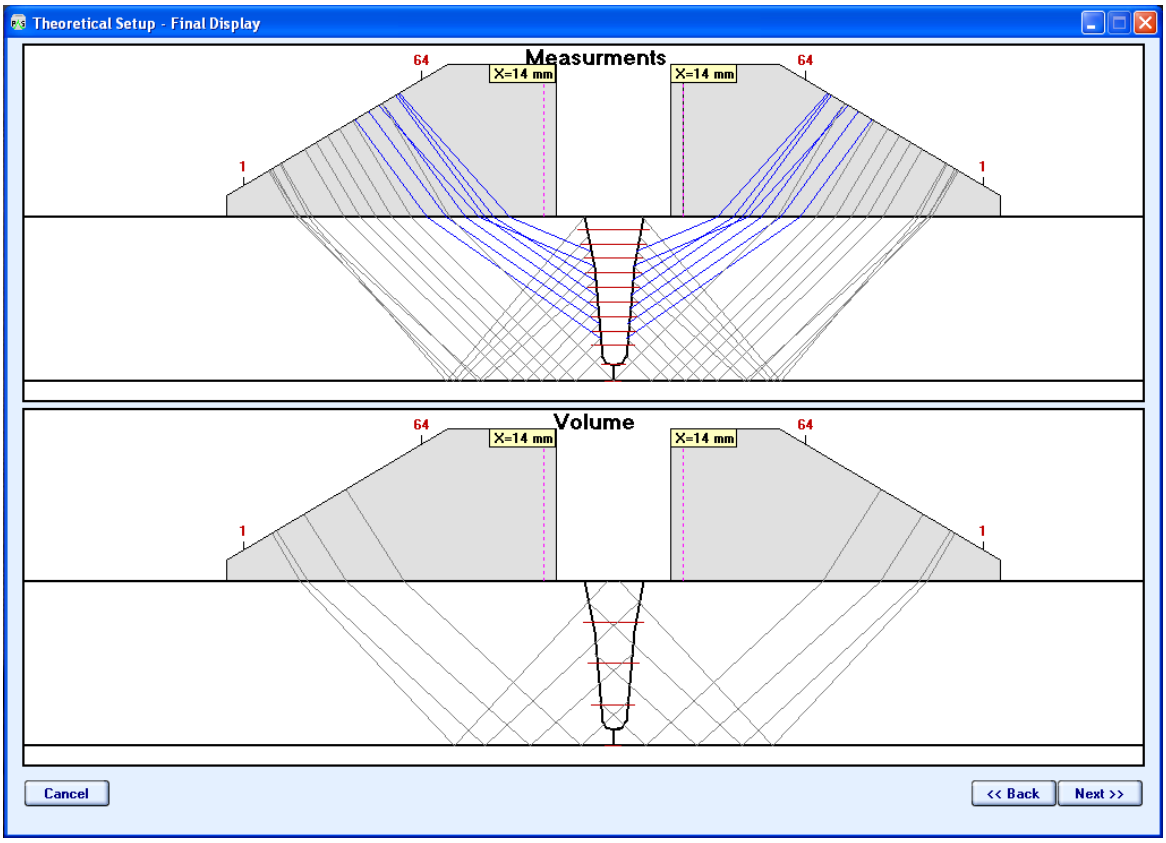
- *Zones Definition* dialogue for "slicing" of weld volume, cap, hot pass, and root areas into zones to be insonified in each qualified position of PA probe:



- *Ray Tracing* dialogue for determining of zone-by-zone insonification scheme (pulse echo or tandem; incidence angles; emitting and receiving aperture; focal distance) and appropriate positions for PA probes from both sides of the weld (Upstream – Downstream)







On completion theoretical setup file is stored

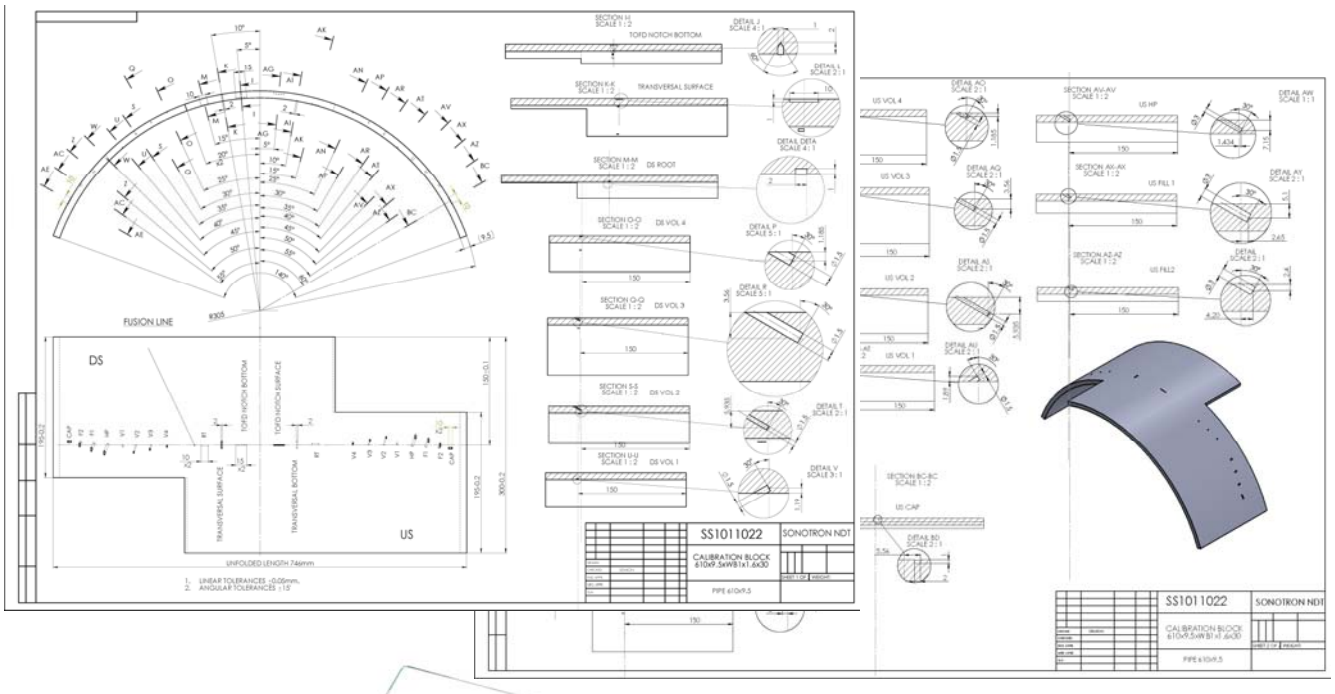
Movies illustrating examples of the ray tracing routine are available for download at:

http://www.sonotronndt.com/RepInfo/IPAAUT/TS.wmv

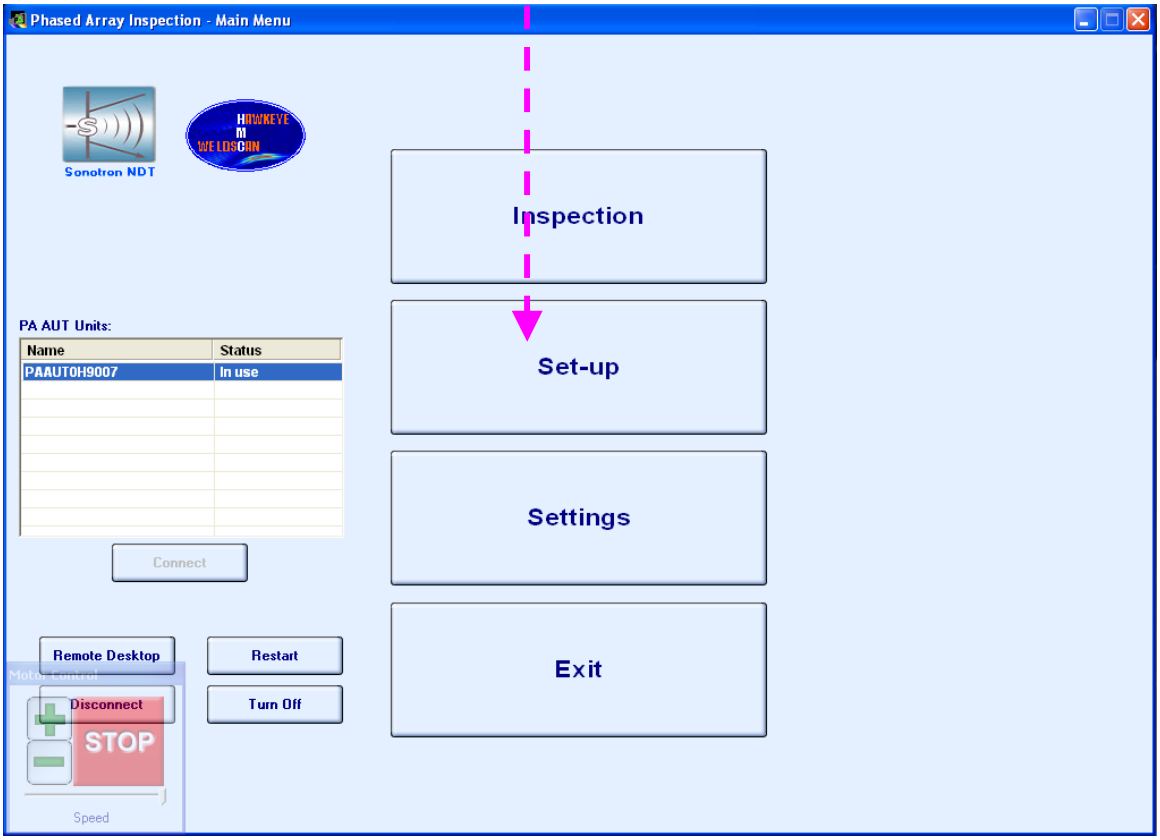
http://www.sonotronndt.com/RepInfo/IPAAUT/TS30deg.wmv

4.2. Pre-scanning Routine – Stage 2: Ultrasonic Setup Wizard

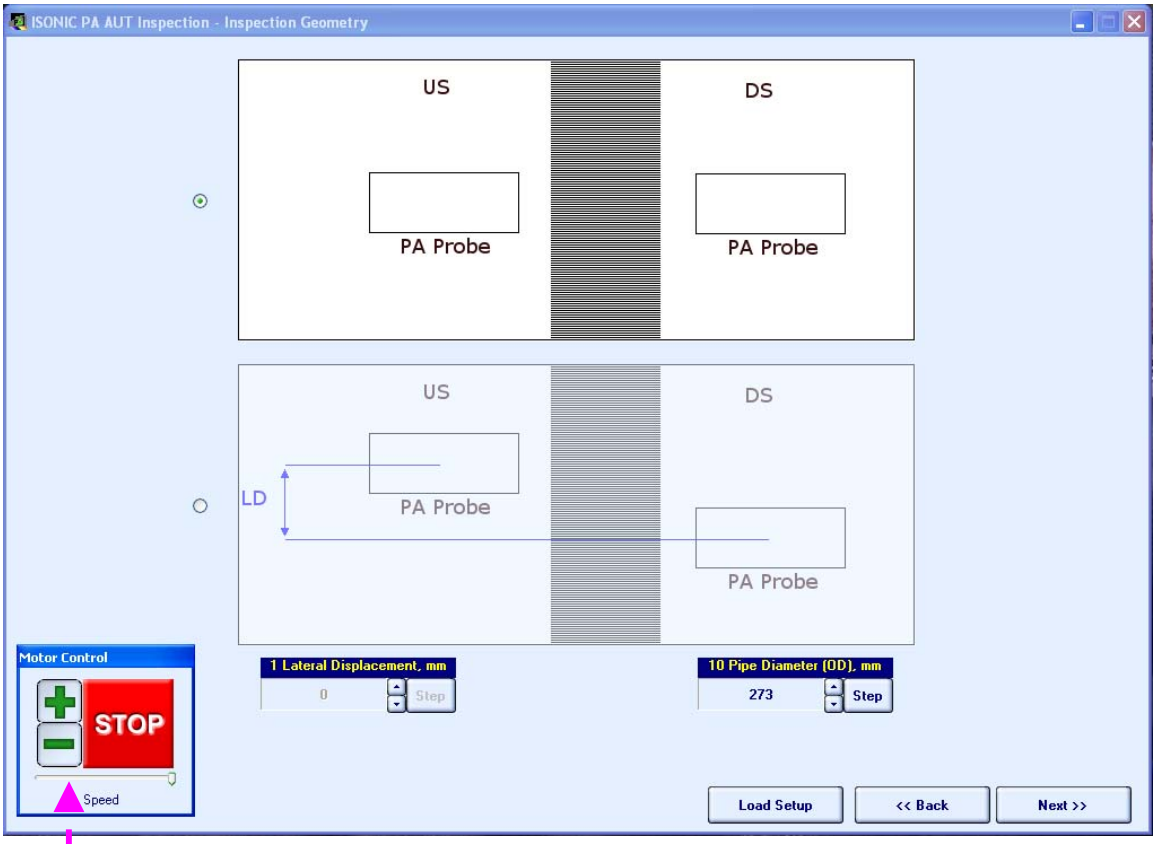
Ultrasonic setup is performed on specially manufactured calibration block including a number of artificial reflectors, which's location, orientation, shape, and dimensions represent variety of flaws to be sensed and recorded. Calibration blocks are manufactured for each pipe diameter, wall thickness, weld bevel, etc. by such a way that all defects may be detected and recorded through one revolution scan along the hypothetic fusion line. Typically calibration block is shaped as piece of pipe allowing setup of complete scanning stuff; each section containing artificial defect is appropriately marked on the OD surface of the pipe



To proceed on connection to the instrument click on

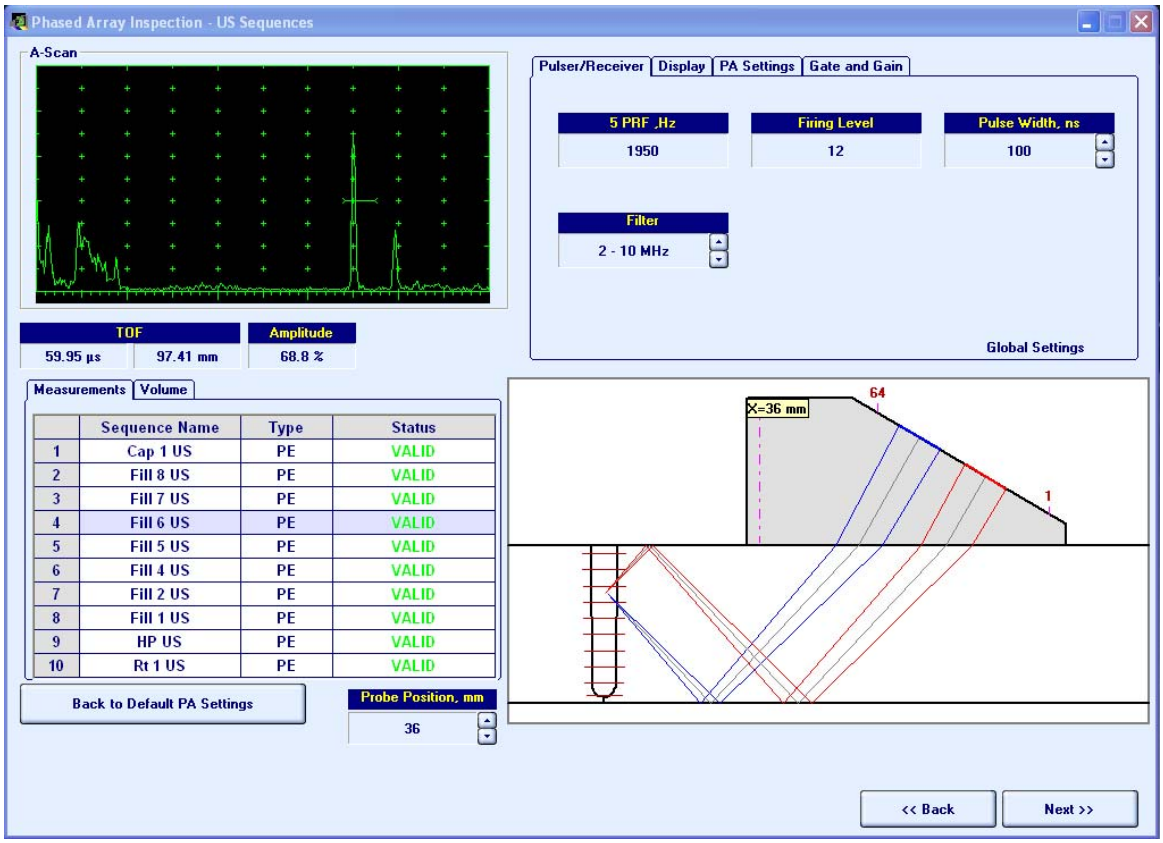


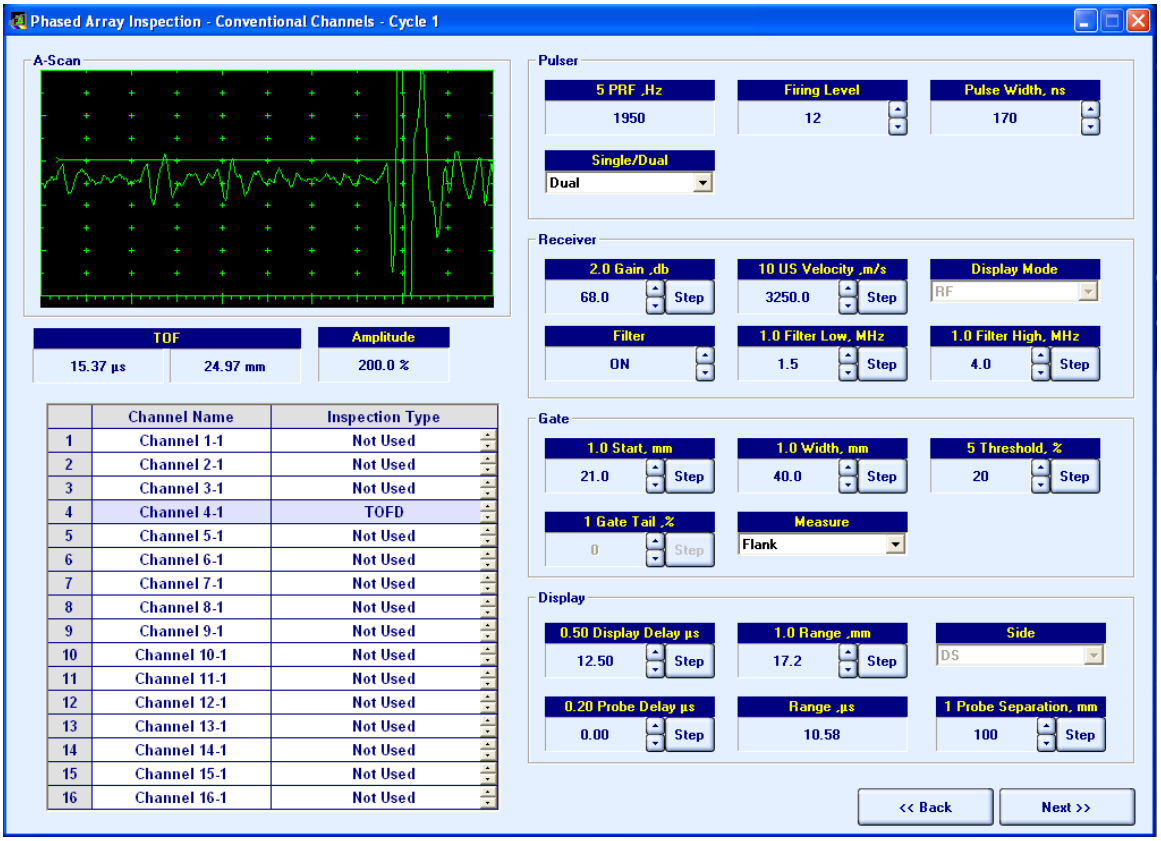
It is necessary to key in OD (outside diameter) of the pipe then and to define positioning of PA probes from both sides of the weld either with or without lateral displacement (LD) and key in LD value if applicable



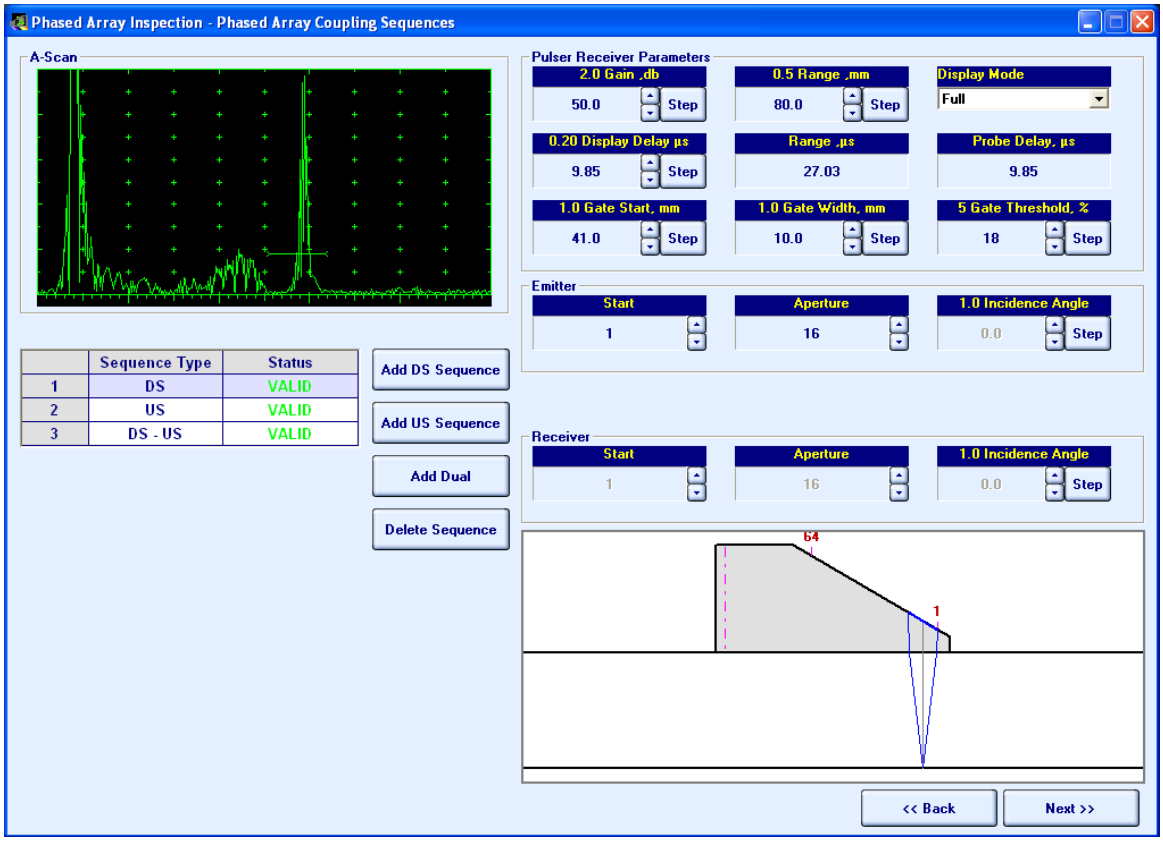
Virtual joystick semi-transparent control is used to place probes into cross sections containing reference reflectors precisely

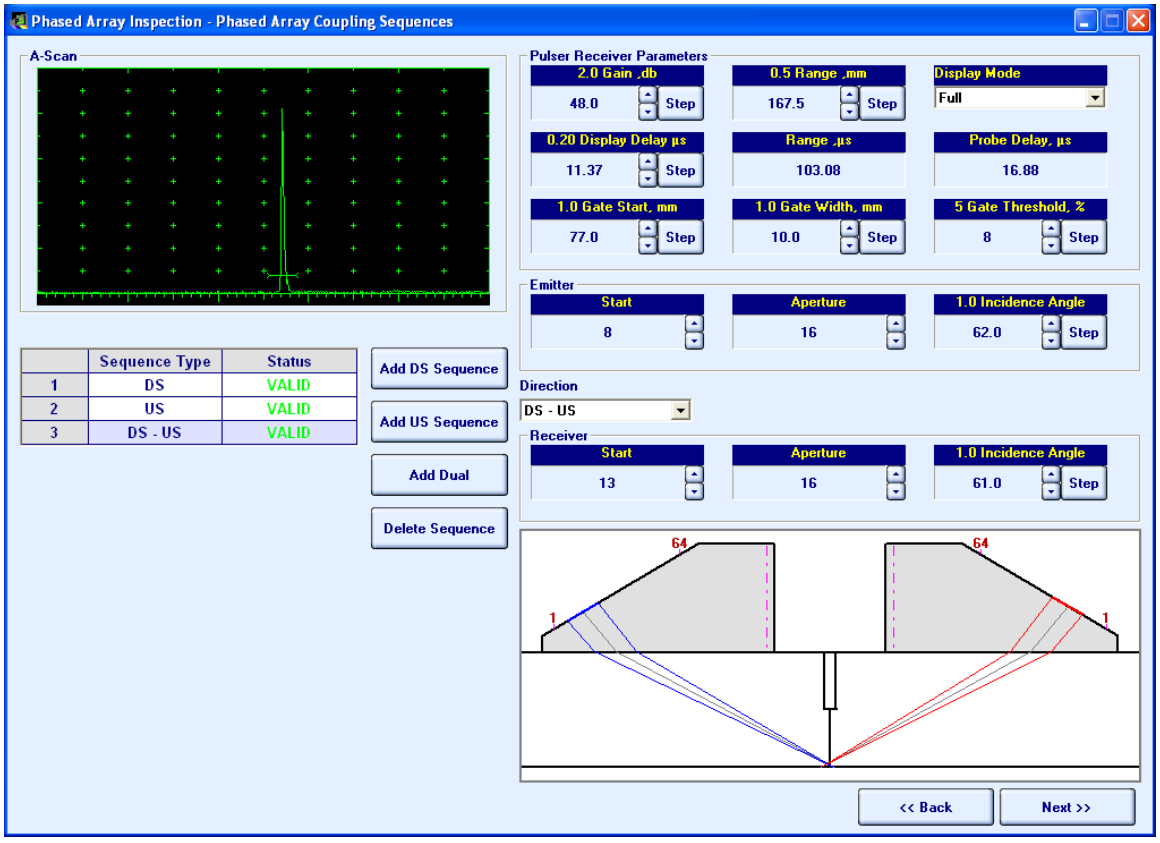
The goal of ultrasonic is of appropriate probe either PA, TOFD, or conventional into every predefined position and providing necessary settings (Gain, Gate, Aperture, etc) ensuring detection and resolving of all artificial defects



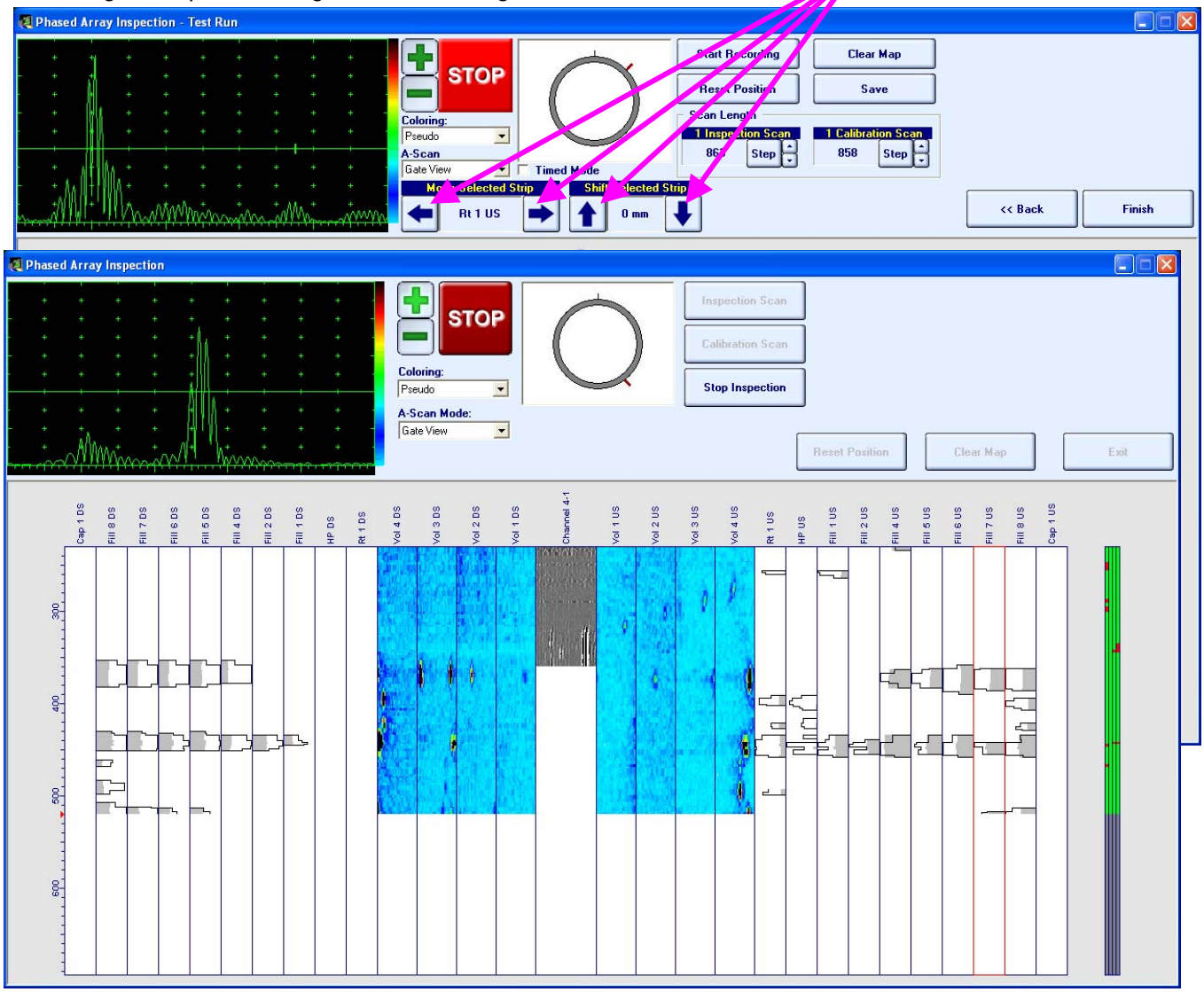


It is also necessary to calibrate several focal laws for continuous coupling monitoring for PA and conventional probes as well. For PA probes it is possible to use as coupling reference either longitudinal wave back wall echo or through-transmitted signal between or combination of above techniques, the appropriate dialogue is provided





Final screen of *Ultrasonic Setup Wizard* relates to configuration of the *strip chart*. *Strip chart* is a method of AUT data presentation whereas each pulsing-receiving shot is continuously recorded into corresponding strip. Reshaping of *Strip Chart* is possible through manipulating position / lateral displacement of each strip according to the probes fitting into the scanning frame:



Calibration scanning is performed then in automatic mode to ensure that all artificial defects are sensed, resolved, and recorded at proper locations. *Ultrasonic Setup Wizard* is finished with creation of complete *Inspection Setup File*; inspection becomes possible at any moment after said file is uploaded into scanning routine. The exemplary sequence of operations for ultrasonic setup wizard is illustrated by the movie available for download at: **http://www.sonotronndt.com/PDF/OMPAAUT/U_SETUP.wmv**

Movie illustrating example of scanning of calibration block for 273 mm OD pipe is available for download at:
http://www.sonotronndt.com/RepInfo/IPAAUT/IPAAUTCalBlockScan01.wmv

Movie illustrating example of screen of remote PC controlling ISONIC PA AUT whilst scanning of calibration block for 273 mm OD pipe is available for download at:
http://www.sonotronndt.com/RepInfo/IPAAUT/IPAAUTCalBlockScanScreen01.wmv

Movie illustrating example of scanning of calibration block for 1219 mm OD pipe is available for download at:
http://www.sonotronndt.com/RepInfo/IPAAUT/IPAAUTCalBlockScan02.wmv

Movie illustrating example of screen of remote PC controlling ISONIC PA AUT whilst scanning of calibration block for 1219 mm OD pipe is available for download at:
http://www.sonotronndt.com/RepInfo/IPAAUT/IPAAUTCalBlockScanScreen02.wmv

4.3. Scanning and Postprocessing

Movies illustrating scanning of girth weld on site are available for download at:

http://www.sonotronndt.com/RepInfo/IPAAUT/IPAUT_70MM_SEC.wmv - for 273 mm OD pipe

http://www.sonotronndt.com/RepInfo/IPAAUT/OD1219.wmv - for 1219 mm OD pipe

Whilst scanning the raw A-Scan data obtained by PA, conventional, and TOFD probes is transferred to remote PC along with corresponding position encoder data. Remote PC provides raw data recording and forms strip chart in real time. Whilst scanning operator may monitor live A-Scans for every strip through clicking on the desired one. Inspection results file compressing complete raw data bulk is created automatically on scanning completed

At the postprocessing stage it is possible to play back captured A-scans, to mark, size, and evaluate defects, to create defects list, etc