

LOW-FREQUENCY ULTRASONIC TOMOGRAPH

A1020 MIRA Lite

OPERATION MANUAL



Acoustic Control Systems – ACS Group
Saarbrücken 2018

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The current operation manual (hereinafter referred to as "the operation manual") contains technical specifications, description of the design and operational principle, as well as information, required for proper operation of A1020 MIRA Lite Low-Frequency Ultrasonic Tomograph (hereinafter referred to as "the tomograph or "the device").

Please study the Operation Manual carefully prior to work with the device.

Only properly trained personnel familiarized with the operation manual is allowed to work with the device.

The company ACS-Solutions GmbH continuously upgrades the quality and the functions, enhances the safety and serviceability of its devices. Thus, some minor modifications can be introduced to the devices during the production process. These modifications do not affect the technical specifications, and they may be omitted in current version of the operation manual.

Manufacturer:

ACS-Solutions GmbH
Science Park 2

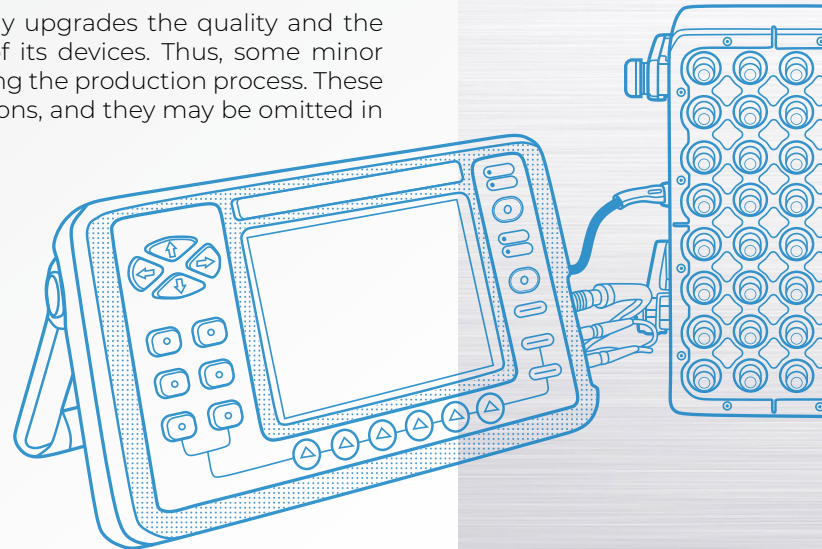
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1.1 THE INTENDED USE OF THE DEVICE

1.1.1 Intended use and application range

A1020 MIRA Lite Low-Frequency Ultrasonic Tomograph is designed to test the constructions of concrete, reinforced concrete and stone in order to search for cavities, channels, reinforcement, foreign inclusions, laminations, cracks and other cavities, empty, as well as filled with liquid or solid material, different from the surrounding concrete in its physical and mechanical properties.

The device is designed to inspect constructions made of concrete, reinforced concrete and stone with one-sided access for the purpose of evaluation of consistency of the construction, searching for foreign inclusions, cavities, misruns, laminations and cracks, as well as thickness measurement of the tested object.

The device allows for quick and efficient inspection of extensive objects along with documentation of results and the opportunity of their preliminary analysis.

Main application areas of the device:

- inspection of the reinforced-concrete buildings, facilities, bridges, tunnels, highways, landing areas under construction, as well as those ones under operation and maintenance in order to check their integrity and reliability;
- determination of thickness of walls and ceilings made of concrete;
- search for cavities, channels, reinforcement in the concrete constructions, and estimation of its thickness and dimensions;
- inspection of the state of inaccessible surfaces of concrete walls, rough estimate of the surrounding environment (air, ground and water);
- qualitative assessment of exploitable minerals in the mining industry.

1.1.2 Operating conditions

The device is designed for operation under the following environmental conditions:

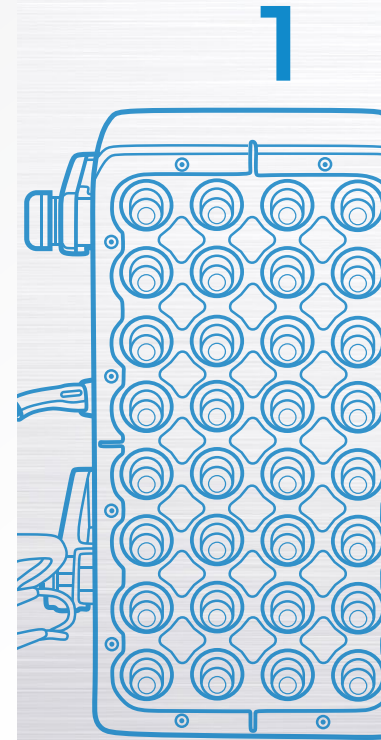
- air temperature from - 10 to + 50 °C;
- relative air humidity up to 95 % at +35 °C.

1.2 TECHNICAL SPECIFICATIONS

The main technical specifications of the device are listed in the Table 1

Table 1

Parameter	Value
Scanning device	Matrix antenna array
Number of transducers in the antenna array	32
Type of the transducers used in the matrix antenna array	low-frequency broadband transversal with dry point contact and ceramic wearproof tips
Operating frequencies of the transducers	from 10 to 100 kHz
Ultrasonic velocity range	from 1,000 to 10,000 m/s
Maximum view depth in concrete	800 mm
Maximum view depth in reinforced concrete	800 mm
Thickness measurement range	from 50 to 800 mm
Limits of permissible absolute measurement accuracy of the thickness, mm, where X-thickness is measured	$\pm(0.05 \cdot X + 10)$
Depth measurement range of the flaw location (an air pocket (cylinder) at least \varnothing 20 mm and at least 200 mm long)	from 50 to 400 mm
Limits of permissible absolute measurement accuracy of the depth of the flaw location, where H- is measured depth	$\pm(0.05 \cdot H + 10)$ mm





1



The main technical specifications of the device are listed in the Table 1

Table 1

Power supply	battery
Battery rated voltage	11.2 V
Period of continuous operation of the instrument powered from the battery under normal conditions, min.	10 hours
Maximum overall dimensions of the electronic unit	260×166×80 mm
Maximum overall dimensions:	
without handles	220'129'99 mm
with handles positioned horizontally	376'167'99 mm
with handles positioned vertically	220'184'167 mm
Maximum weight of the electronic unit	1.9 kg
Maximum weight of the antenna array	3.1 kg
Average time between failures	18,000 hours
Average service life, min.	5 years

1.3 DESIGN AND OPERATION

1.3.1 The design of the device

A1020 MIRA Lite tomograph is an electronic unit to which M4002 matrix antenna array is connected using a cable (Figure 1).



Figure 1

1.3.1.1 Electronic unit

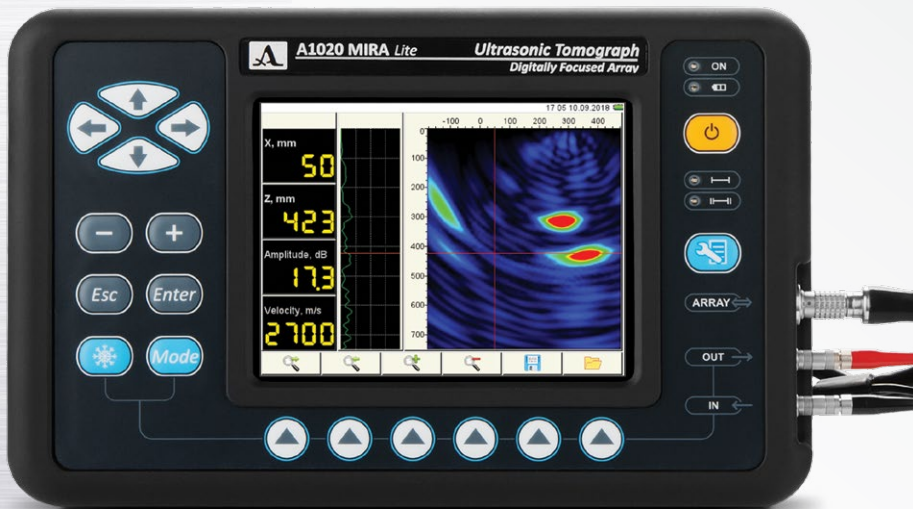
The appearance of the electronic unit is presented in the Figure 2. A membrane keyboard allows to control the device. All signals, measurement results and the state of the device are indicated on the display by means of LED lights on the housing of the device.

The matrix antenna array is connected to the ports located on the right side of the housing.

The device is powered by means of the removable battery or a power adapter included in the delivery kit. The battery or the power adapter is connected to the port on the back of the housing.

On the back of the housing there is also a USB port for PC-interfacing.

Figure 2



1.3.1.2 Power adapter

AC power supply adapter (15V) powers the device from external energy source and allows charging of the battery installed into the electronic unit of the device.

The battery charging time is up to 6 hours depending on the degree of its discharge. During charging the device remains fully operable.

To avoid damage of the device, always first connect the cable of the power adaptor to the electronic unit, then connect the network cable to the power adaptor, and then connect the network cable to the mains.

WARNING: THE DISASSEMBLING OF THE REMOVABLE BATTERY BY THE USER IS PROHIBITED!

1.3.1.3 Antenna array

The M4002B matrix antenna array M4002B is included into the delivery kit of the device.

Each handle of the antenna array bears the "START" button used to start the sounding procedure.

The position of the antenna array handles can be changed thus allowing convenient working with the device on the horizontal, vertical and ceiling surfaces of the tested object. To change the handle position, loosen its fasteners on both sides of the housing, set them in the required position and fasten (Figure 3).

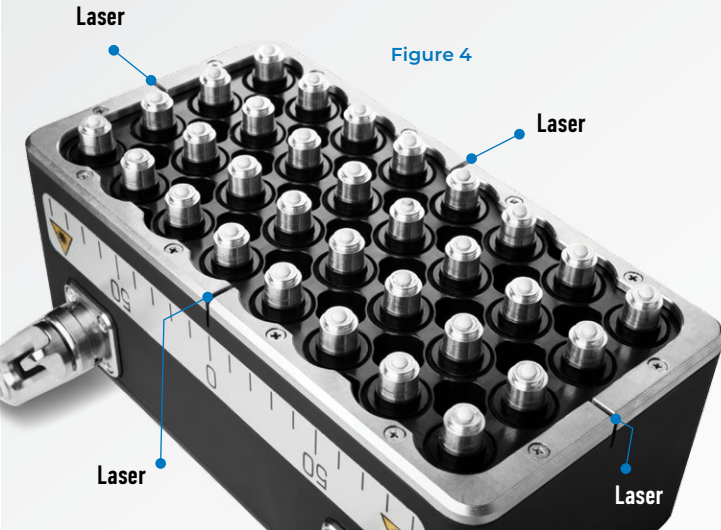


Figure 4

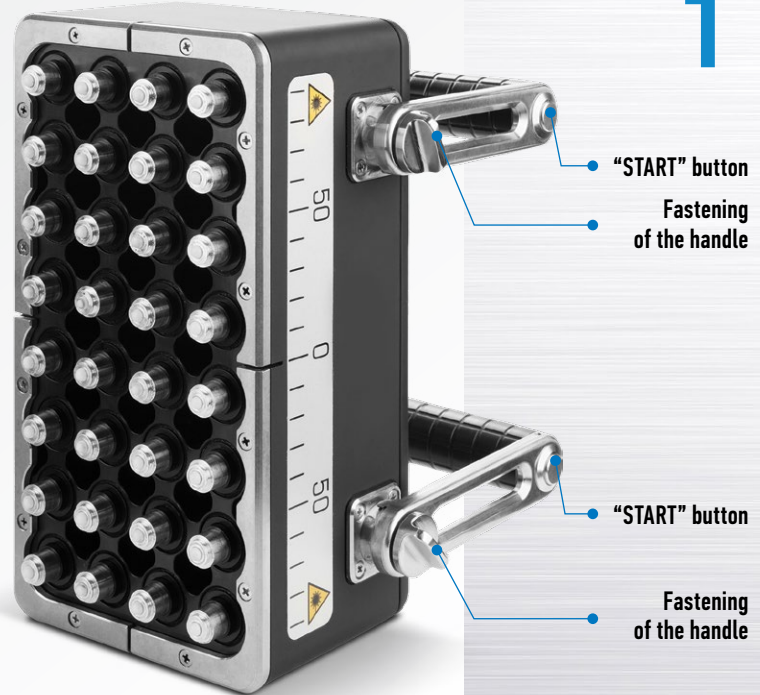


Figure 3

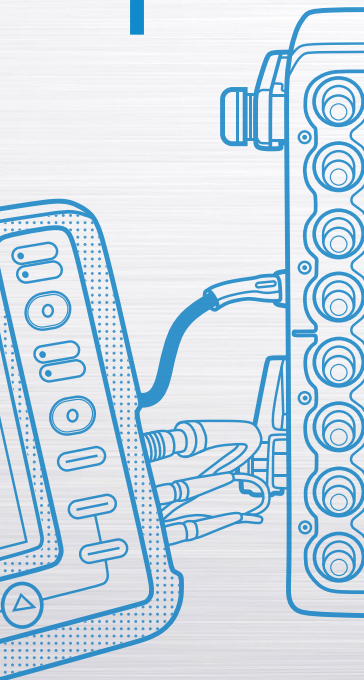
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"START" button
Fastening of the handle

"START" button
Fastening of the handle



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The matrix antenna array contains 32 (8 blocks containing 4 elements each) low-frequency broadband transversal transducers with dry point contact and ceramic wearproof tips (Figure 4) with four lasers. Laser beams are projected onto surface of the tested object. They allow the operator to correctly observe a shift distance of the device while performing the complete technical diagnostics of the tested object.

The antenna array consists of the transducers with a dry point contact, so the tests shall be carried out without the contact liquid. On the upper part of the antenna array there are lights indicating the scanning process "Scanning Process" and the state of the lasers (on/off) "Laser Enable" (Figure 5).

To collect and process the data the procedure of the synthesizing focused aperture is used. The procedure ensures a bright graphical image of the internal structure which can be further easily analyzed.

Figure 5



1.3.2 Indication of information on the screen

A color TFT screen (640x480) is used for indication.

In all operation modes the upper information line displayed on the screen indicates information on the current time and date, as well as the battery state. Icons which appearance and purpose depend on the operation mode of the device are located below.

Other information is displayed depending on the selected mode.

The appearance of the display in the RE-VIEW mode with A Scan is given in the Figure 6.

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Figure 6

B-Scan output field

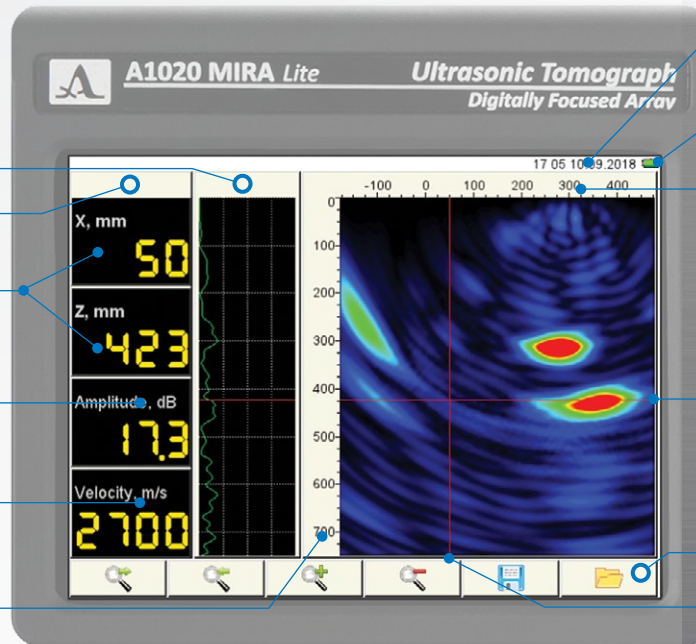
A-Scan output field

Position data of the crosspoint of the cursor

Amplitude at the crosspoint of the cursor

Measured velocity of shear waves in the material

Vertical scale Z



Current time and date

Battery level indicator

Horizontal scale X

Horizontal cursor

Stripe of icons


Vertical cursor

Operation Manual

1.3.3 Keyboard

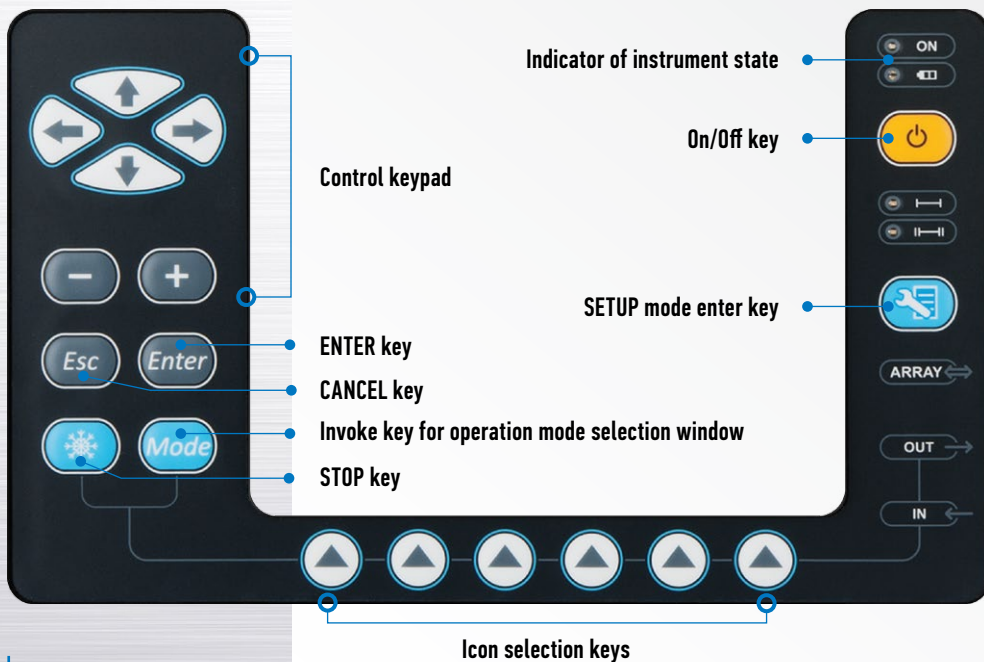
The keyboard appearance is given in the Figure 7.

The green LED light in the upper right corner  ON informs that the device is switched ON.

The LED light located below  indicates the charging process of the battery. If the color is yellow it means the battery is charging, if the color is green the charging process is finished.

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Figure 7



On the keys there is a schematic marking of their main functions. To provide a unique design and standards of the operational documentation in different countries the keys are all given English markings.

The main functions and parameters are controlled by means of the keys with icons. The functional keys (F) are located under the screen. A corresponding explanatory icon is located above each key.

The control keys located to the left of the screen are used to select and readjust the active parameters. Their actions are similar for different operation modes of the device. They are intuitive since they bear the symbols corresponding to the nature of the action performed.

Some keys allow the auto repeat mode with acceleration when pressing and holding the key for more than one second.

1.3.4 Tomograph controls and indication of the state

The left and right handles of the antenna array have two buttons for ultrasonic testing (the "START" buttons). Press any key to start the process of transmission and reception of signals.

NOTE: TO RECEIVE THE CORRECT TEST RESULTS DO NOT MOVE AND DO NOT RELEASE THE HOLD-DOWN LEVER WHILE COLLECTING DATA!

1.3.4.1 Using the icon

The interface of the device is structured as an associative icon menu located in six rectangular windows at the bottom of the screen. The icons are symbolic images associated with the object or the function they control. Every mode has its own icon set.

The icons can be either active or passive. In the active state it is possible to adjust the functions or parameters of the device associated with the active icon.

ATTENTION: HEREINAFTER WE USE THE ENUMERATION OF THE ICON WINDOWS AND THEIR ASSOCIATED FUNCTIONAL KEYS FROM 1 TO 6, FROM LEFT TO RIGHT!

1.3.5 Operation modes

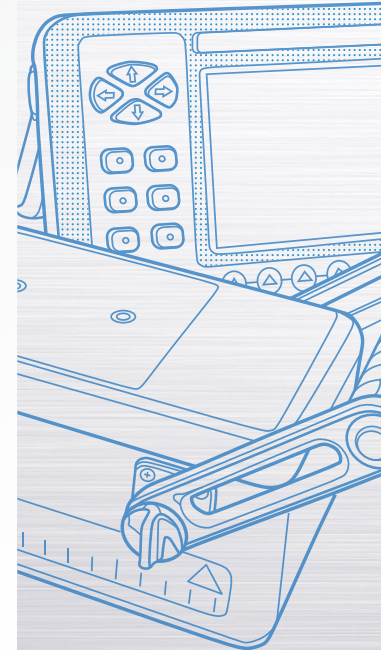
The device has two operation modes: REVIEW and MAP, and the service SETUP mode.

The REVIEW mode is used for on-line viewing of the internal structure of the object in the selected places. The B Scan is displayed on the screen.

Additionally, in this mode, the following is possible:

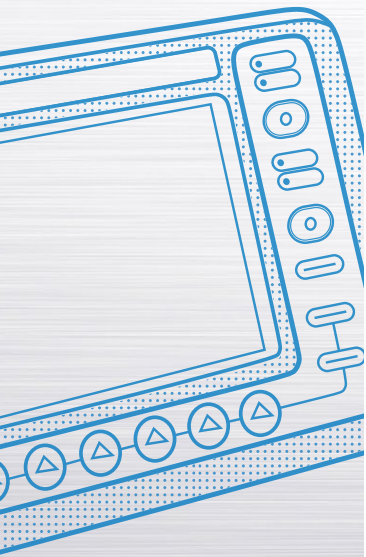
- automatic detection of ultrasonic wave propagation velocity in the surface layer of the material;
- measurement of coordinates and levels of images in a tomogram;
- thickness measurement of the object;
- viewing the A Scans.

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The MAP mode is used for generation of the data array of the B Scan type set of the tested object (perpendicular to the surface) when scanning along the previously marked lines with a fixed-length step. The image of every B-Scan can be displayed on the screen from the accumulated three-dimensional data set.


The SETUP mode is used for selection and adjustment of the device parameters.

1.3.6 Data processing and indication on the screen of the tomograph

The procedure of the synthesizing focused aperture with combinational sounding (SAFT K) is used in the device in which the ultrasound is focused at each point of the half-space. The data sets (arrays) are formed by collecting information from all measuring pairs of the tomograph antenna assembly. In the course of work the internal computer processes the signals received by the antenna array in the real time. Thereupon the data received are displayed on the screen and further stored in the device memory. As a result, a cross-sectional image of the tested object (B Scan) is formed. The reflecting property of each point of the visualized section is encoded in different colors. The data collection and indication of the cross-sectional image on the screen in one array position takes 5 seconds.

1.4 DESCRIPTION OF THE OPERATION MODES

1.4.1 The SETUP mode







The SETUP mode is used for adjustment and configuration of the device parameters. Always start the device in this mode when dealing with a new inspected object. To switch to the the SETUP mode or to leave the mode, press the  key.

The main screen in the SETUP mode is given in the Figure 8.

The left column contains the list of the parameters; the right column contains their values.

The functions of the icons in the SETUP mode are listed in the Table 2.

Table 2

Key	Icon	Purpose
F1		Parameter setting
F2		Selection of analogue gain and functional checkout of the antenna array
F3		System settings of the device
F4	 	Absence of saved B Scans / View the parameters of the recorded B Scans in the memory
F5		View the existing maps and create new maps

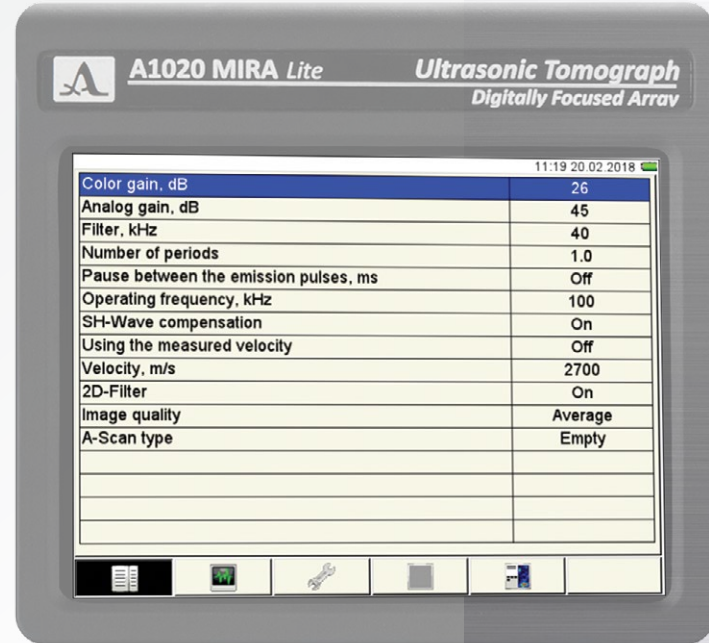







Figure 8

1.4.1.1 Editing parameters

All parameters of the SETUP mode can be configured.

The functions of the keys for configuring the parameters are listed in the Table 3.

Table 3

Icon	Purpose
 	Scroll the rows to select a parameter to be configured
 	Change the parameter value
	Exit the SETUP mode

The parameter description and their permissible values are listed in the Table 4.

Table 4

Parameter	Value	Description
Color gain, dB	from 0 to 60 in increments of 1	Changes the brightness scale for the synthesized image
Analog gain, dB	from 0 to 100 in increments of 1	Selects the gain coefficient in the path of the device to provide maximum dynamic range without the signal limitation
Filter, kHz	10 / 20 / 40 / 100	Sets the high-frequency filter

Table 4

Parameter	Value	Description
Number of periods	from 0.5 to 2.0 in increments of 0.5	Is selected depending on the material properties
Pause between the emission pulses, ms	Off / from 0.2 to 20.0 in increments of 0.2	It affects reverberation to eliminate after-sound
Operating frequency, kHz	from 10 to 100 in increments of 5	Is selected depending on the material properties
SH-Wave compensation	On / Off	Switching On/Off the surface wave
Using the measured velocity	On / Off	Selects the velocity for formation of SAFT. On – measured velocity of transversal waves Off – velocity value set in the SETUP mode
Velocity, m/s	from 1,000 to 10,000 in increments of 1	Manual velocity adjustment. Parameter is not active when the parameter “Using the measured velocity” is On
2D-Filter	On / Off	Switching On/Off the 2D-Filter
Image quality	Low / Medium / High	Selects the quality of the image received. Determines the data acquisition rate and data size when saving them.
A-Scan type	Off / Filling / Contour	Switches off field mapping of the A-Scan on the screen / Switches between the display types of A-Scan



1.4.1.2 Selection of analogue gain and functional checkout of the antenna array

The screen when selecting the analogue gain and testing performance of the antenna array is shown in the Figure 9. The signal from the transmitter and the receiver is displayed on the screen.

The key functions when selecting the analogue gain and testing the performance of the antenna array are listed in the Table 5.

1 Figure 9

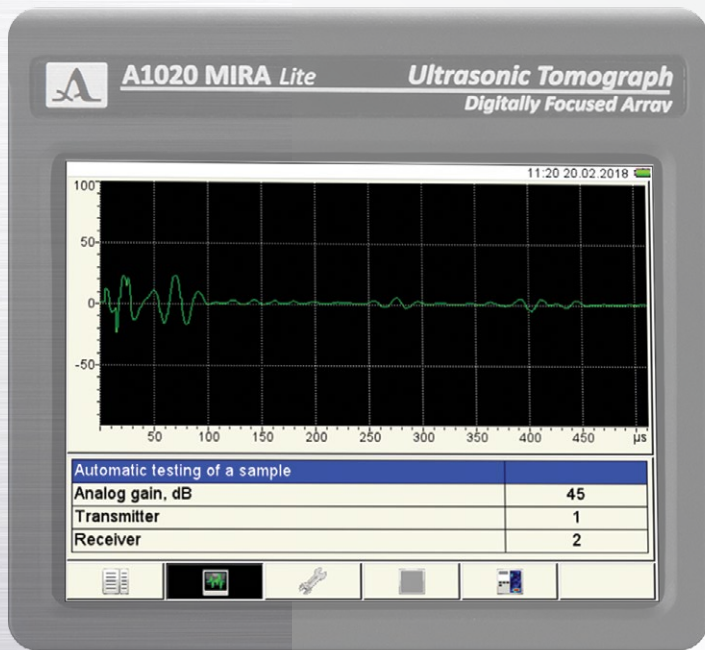







Table 5

Icon	Purpose
 	Scroll the rows to select a parameter to be configured
 	Change the parameter value
	Exit the SETUP mode

The parameter description and their permissible values are listed in the Table 6.

Table 6

Parameter name	Value	Description
Automatic testing of the sample	-	To start the automatic testing on the sample, place the device on the sample and press the "START" key. The device will start collecting the data resulting in an information window displaying the states of the transducers (Figure 10)

Table 6

Analog gain, dB	from 0 to 100 in increments of 1	Selects the gain coefficient in the path of the device to provide maximum dynamic range without the signal limitation
Transmitter	from 1 to 8	Selects the transducer which acts as a transmitter. Cannot be the same as the number of the receiver
Receiver	from 1 to 8	Selects the transducer which acts as a receiver. Cannot be the same as the number of the transmitter

The order of the transducers enumeration on the antenna array is presented in the Figure 11.

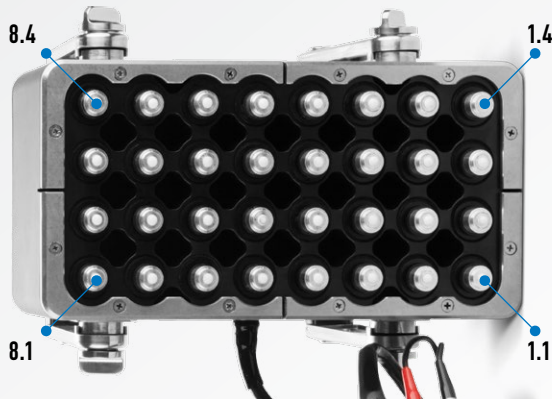


Figure 11

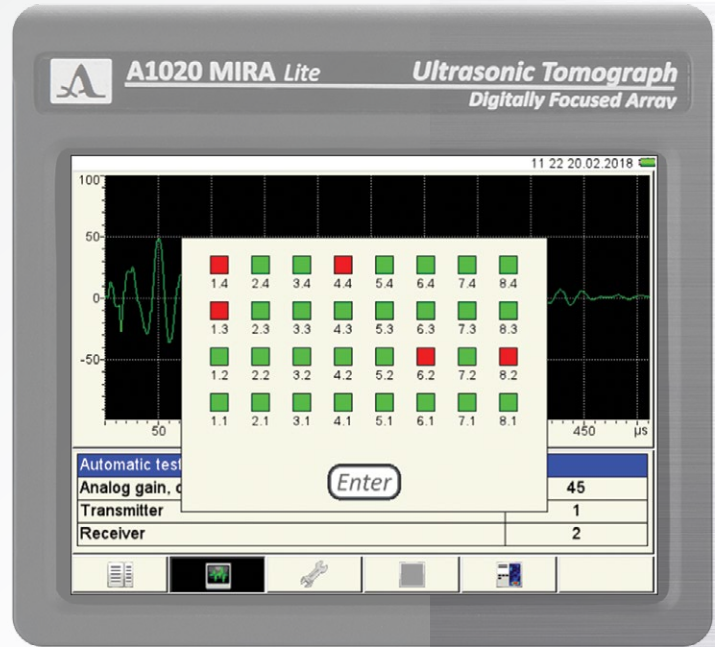


Figure 10

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1.4.1.3 System settings

The screen for adjustment of the system settings of the device is shown in the Figure 12. The parameter description and their permissible values are listed in the Table 7.

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Figure 12

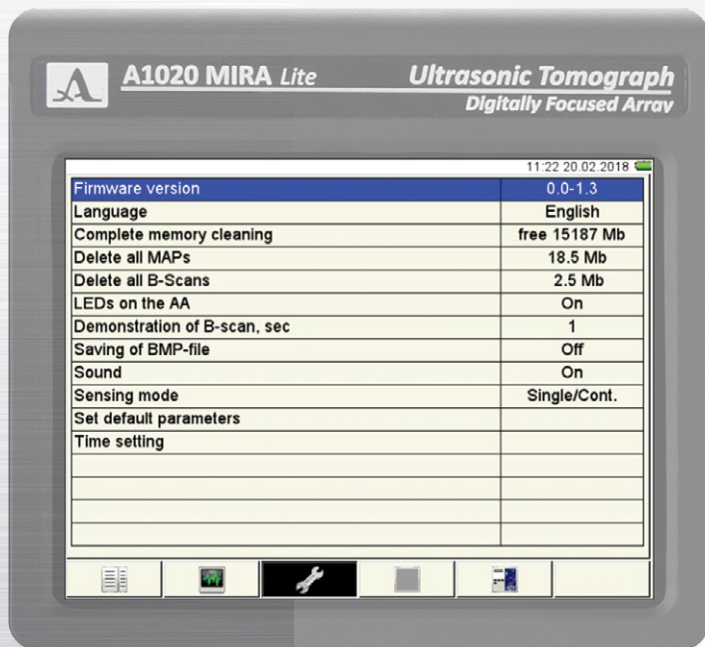


Table 7

Parameter name	Value	Description
Firmware version	-	Current firmware version of the device
Language	Russian / English / ...	Selects interface language
Complete memory cleaning	free XXXX MB	The amount of free memory will be displayed. Starts the memory cleaning procedure by pressing the Enter key.
Delete all MAPs	X.X MB	The amount of the memory occupied with maps will be displayed. Starts the deletion procedure of all saved maps by pressing the Enter key.

NOTE: COMPLETE MEMORY CLEANING. ALL SETTINGS AND DATA WILL BE DELETED!

Table 7

Parameter name	Value	Description
Delete all B-Scans	X.X MB	The amount of the memory occupied with B Scans will be displayed. Starts the deletion procedure of all saved maps by pressing the Enter key
LEDs on the AA	On / Off	Switching On/Off the laser beams on the antenna array
Demonstration of B-Scan, sec	1 / 2 / 3	Demonstration time of a B Scan
Saving of BMP-file	On / Off	Switching On/Off a received image recording to a .bmp file
Sound	On / Off	Switching On/Off the acoustic signals
Sensing mode	Local/ Continuous/ Local	Selects the sounding mode
Set default parameters	-	Sets the default parameters. Starts the procedure by pressing the Enter key
Time setting	-	Starts the date and time setting procedure by pressing the Enter key

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The functions of the keys used for adjustment of the system settings are listed in the Table 8

Table 8







Icon	Purpose
 	Scroll the rows to select a parameter to be configured
 	Change the parameter value
	Starts the corresponding procedures (see Table 7)
	Exit the SETUP mode

Figure 14

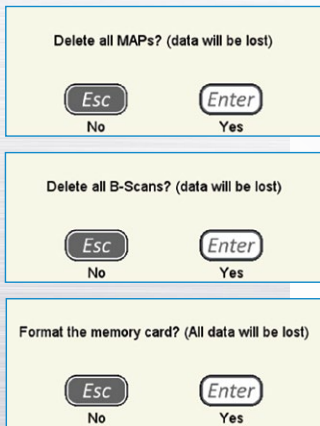
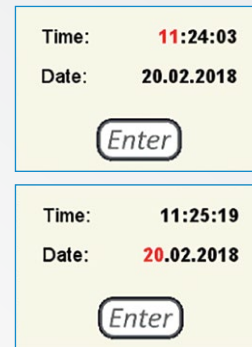










Figure 13




- To edit the "Time" or "Date" parameters, please do the following:
- select the "Set time" parameter and press the  key;
 - the editing window is opened (Figure 13). Use the   keys to select the "Time" or "Date" parameter to be edited;
 - Use the   keys to select a position of the selected parameter to be edited;
 - Configure the parameter value, using the   keys;
 - To save the changes, press the  key.

When the "Full memory cleaning", "Delete all maps", "Delete all B-Scans" procedures are started, a corresponding warning window appears (Figure 14).

1.4.1.4 View the parameters of saved B Scans

When entering the mode, the first line with the name of previously saved B-Scan in the REVIEW mode is highlighted in the list. All parameters of the given B Scan (Figure 15) are displayed on the right (Figure 15).



To view the parameters of the saved B Scan, do the following: go to its name using the   keys.


To view of the saved B Scan on the screen, do the following: go to its name in the list, press the  key, and press the "START" key.

To delete any saved B Scan, press the **Del** key F6.

1.4.1.5 View and create maps

When entering the mode for the first time, the first line "Create map..." will be highlighted in the list of the names. At that the default parameters (Figure 16) are displayed to the right in the view mode.

To view the parameters of the saved map, do the following: go to its name using the   keys.

To view the saved map of the B Scans on the screen, do the following: go to its name in the list and press the  key.

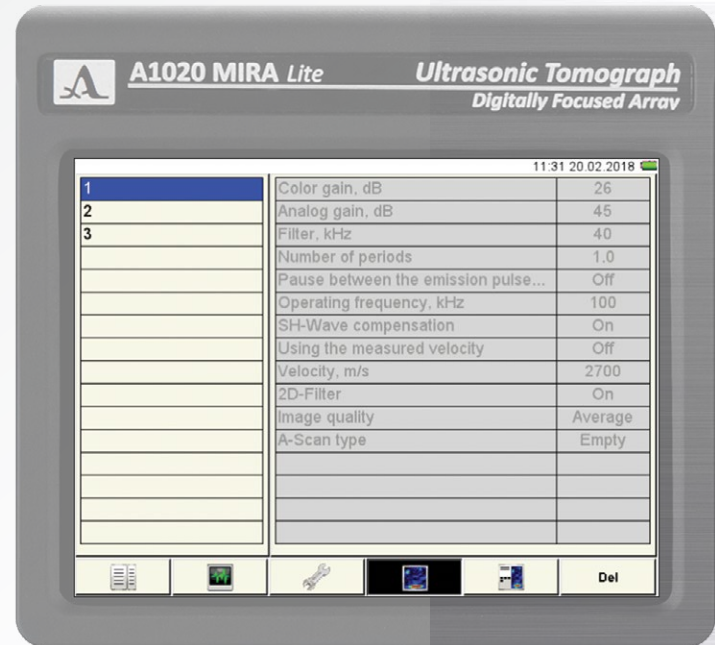




Figure 15



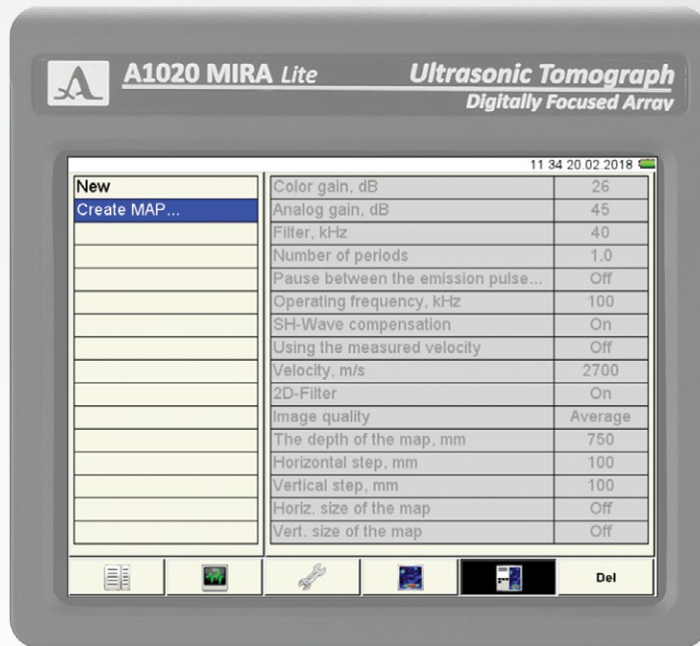
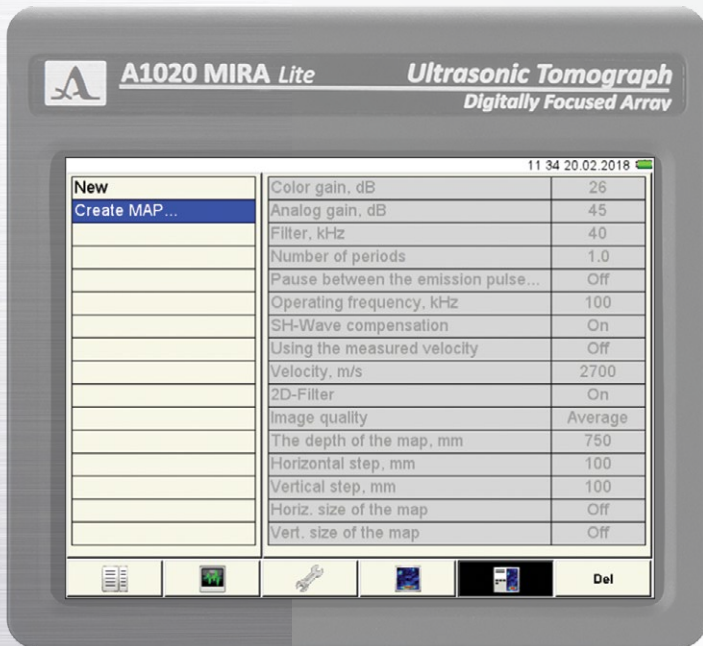
To delete any saved map of B Scans, press the **Del** key F6.

To create a new map, do the following: go to the "Create map..." line using the   keys (Figure 17).

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Figure 16

Figure 17





To edit the values, press the  key. The values for the parameters become editable (Figure 18).
After making the necessary configurations, exit the editing mode, by pressing the  key (Figure 19).

Figure 18

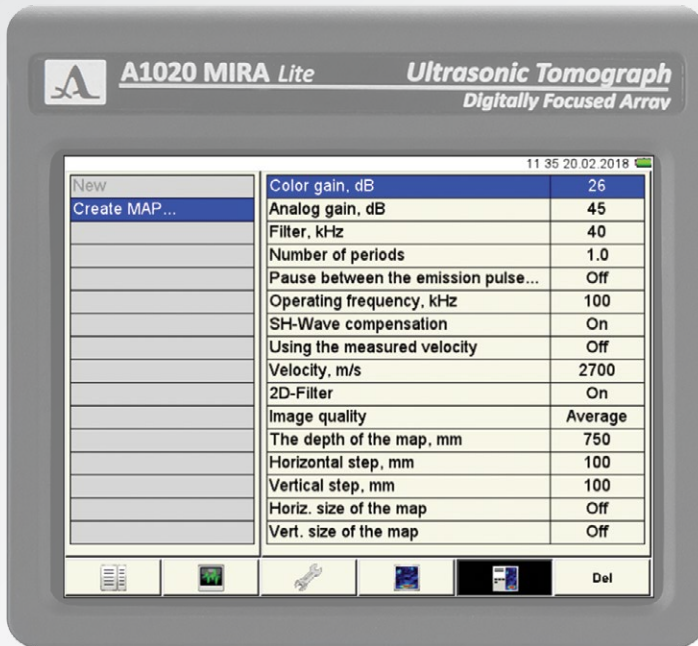
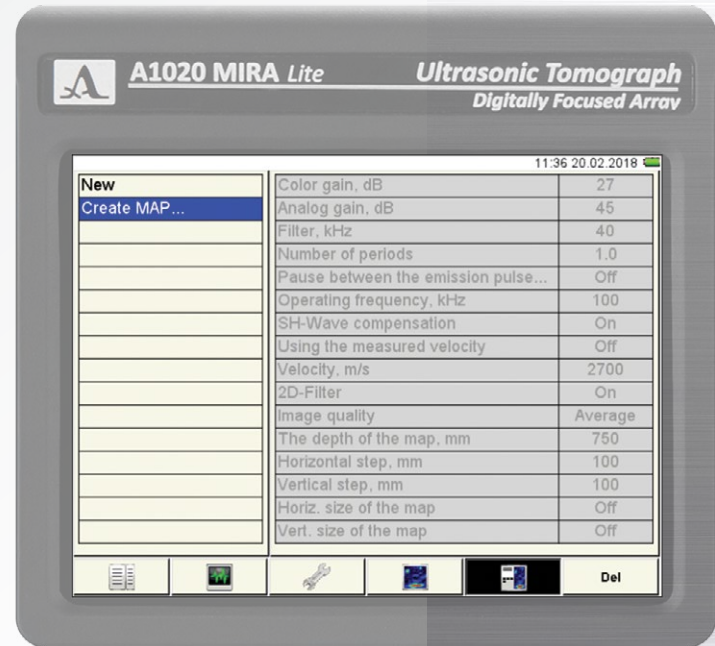


Figure 19





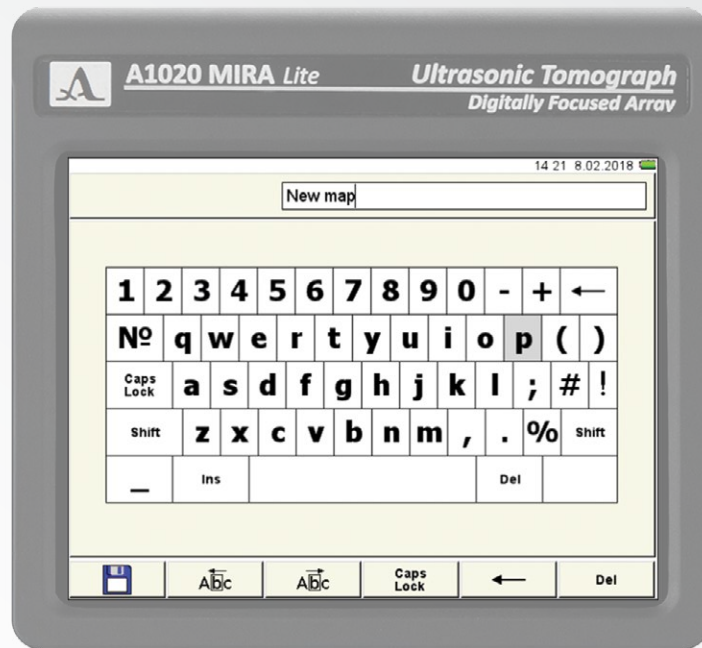
Please, name the map to save it. To do it, press the **Enter** key. The window for map name change will open (Figure 20). The map can be given any name (Figure 21).

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Figure 20



Figure 21



To save the name, press the  key F1. The map will be listed under a new name (Figure 23).

By default, it is offered to save the new map under the name of the map on the basis of which it was created with a serial number added (Figure 23). Here a new map was created on the basis of the "New map" map.

Figure 22

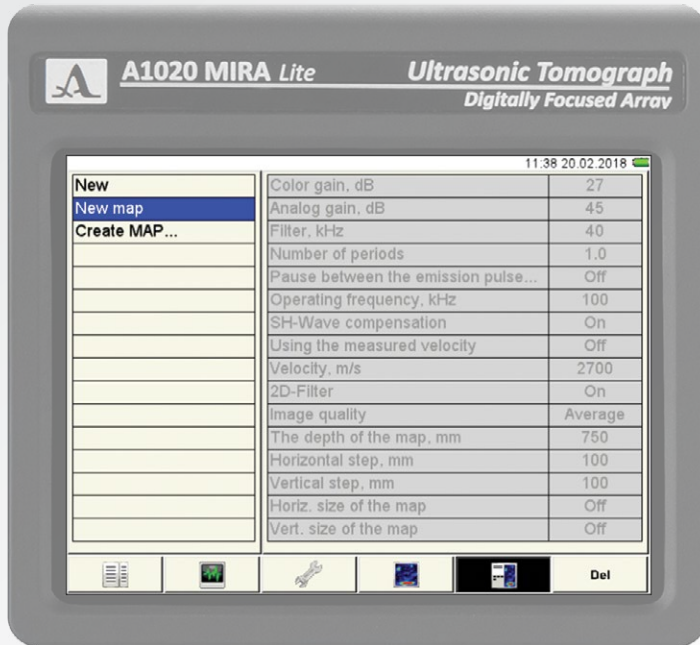
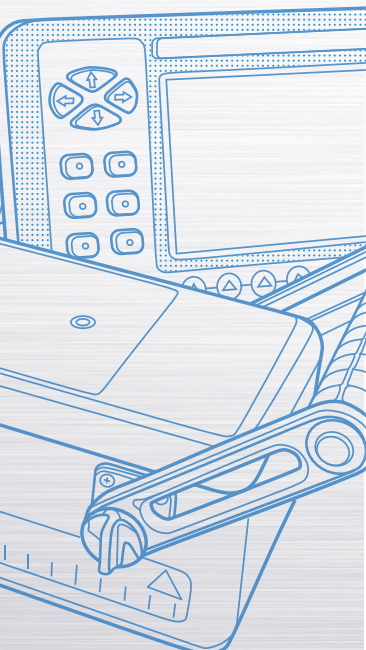


Figure 23







1








The functions of the keys when editing the name are listed in the Table 9.

Table 9

Icon	Purpose
	Moving on the keyboard field on the screen
	Cursor moving in the field of the name to the left / to the right
	Entering the name of the symbol/performance of the action
	Exit the name edit mode and go to the SETUP mode window not saving the name

The functions of the icons in the SETUP mode when editing the name are listed in the Table 10.

Table 10

Key	Icon	Purpose
F1		Saves the generated name
F2 F3		Moving the cursor in the field of the name to the left / to the right
F4		Enter capital letters
F5		Delete the symbol located to the left of the cursor
F6		Delete the symbol located to the right of the cursor

1.4.2 The REVIEW mode

The mode is used for on-line viewing of the internal structure of the inspected object in any place. The B-scans makes it is possible to estimate the correctness of options of the device.

The mode is used before consecutive data collection in the MAP mode.

The mode operates as follows: when the antenna array is set onto the area of the inspected object, the result is displayed on the screen in the form of a B-Scan generated image. To check the settings of the device, do the following: place the antenna array in the places where the internal structure of the inspected object is already inspected, so you can check the correctness of the generated cross-section image. These actions can be repeated any number of times.

The appearance of the screen with included display of an A-Scan is shown in the Figure 24.

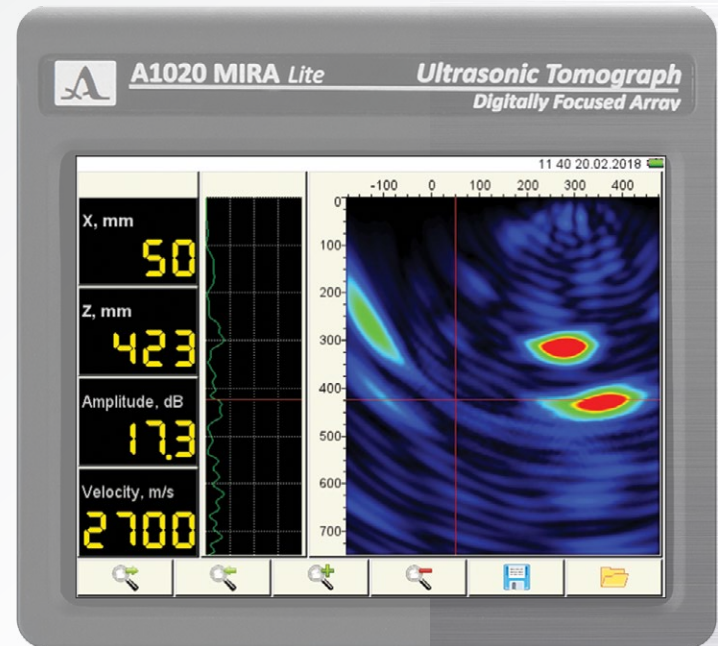
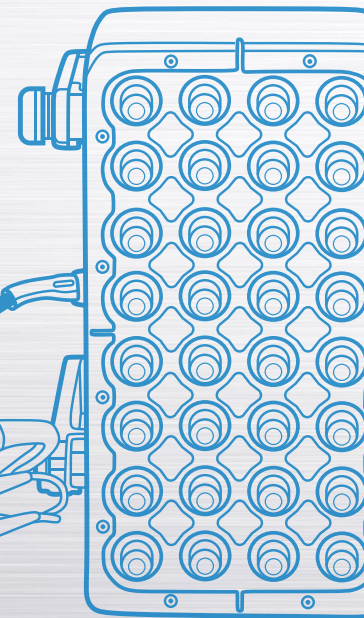


Figure 24



1



The functions of the keys in the REVIEW mode are listed in the Table 11.

Table 11

Icon	Purpose
	Moves the cursor up and down
	Decreases/increases the gain value
	Enters the MAP mode
	Enters the SETUP mode

The functions of the icons in the REVIEW mode are listed in the Table 12.

Table 12

Key	Icon	Purpose
F1 F2		Saves the generated name
F3 F4		Moving the cursor in the field of the name to the left / to the right
F5		Enter capital letters
F6		Delete the symbol located to the left of the cursor

1.4.3 The MAP mode

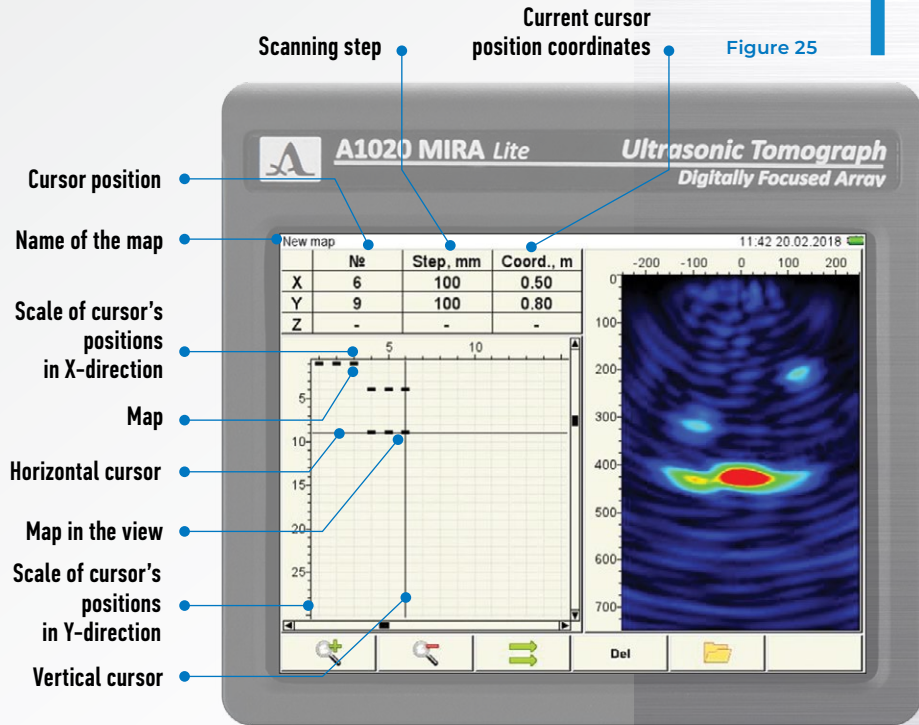
The mode is used for data collection on the inspected object. The data are saved automatically along with current system settings. The user can visually control the B-Scans images generated on the basis of the received data.

The mode should be used after confirming the correctness of the received images in the REVIEW mode.

On the screen only the images of the B-Scans received in the current position of the antenna array will be displayed. The received signals and system settings will be automatically recorded in the memory.





To switch to the MAP mode from the REVIEW mode, press the key.

After the mode is turned on, a window with graphical display of the results of the MAP mode similar to the window of the REVIEW mode is displayed. Here the B Scan images as well as the control panel of the MAP mode are displayed (Figure 25).












The functions of the keys in the MAP mode are listed in the Table 13

Table 13

Icon	Purpose
	Moves the cursor up and down
	Decreases/increases the gain value
	Enters the MAP mode
	Enters the SETUP mode

The functions of the icons in the MAP mode are listed in the Table 14.

Table 14

Key	Icon	Purpose
F1 F2	 	Zoom in / Zoom out
F3	   	Change scanning direction
F4		Delete the current B Scan from the map
F5	 	No saved maps / Open the maps of the B Scans saved into the memory and view them on the screen

1.4.4 Viewing the saved data


To view the saved data, do the following: in the REVIEW mode or the MAP mode press the  key F6. The display appearance when viewing the saved B Scans in the REVIEW mode is shown in the Figure 26. The functions of the keys when viewing the saved B-Scans are listed in the Table 15. The functions of the icons when viewing the saved B-Scans are listed in the Table 16.

Table 15









Icon	Purpose
	Moving the cursor up and down on the B-Scan field
	Exit the view mode

Table 16

Key	Icon	Purpose
F1		Move to the first saved B Scan
F2		Move to the previous saved B Scan
F3		Move to the next saved B Scan
F4		Move to the following saved B Scan
F5		Delete the current B Scan
F6		Exit the viewing mode of the saved B Scans

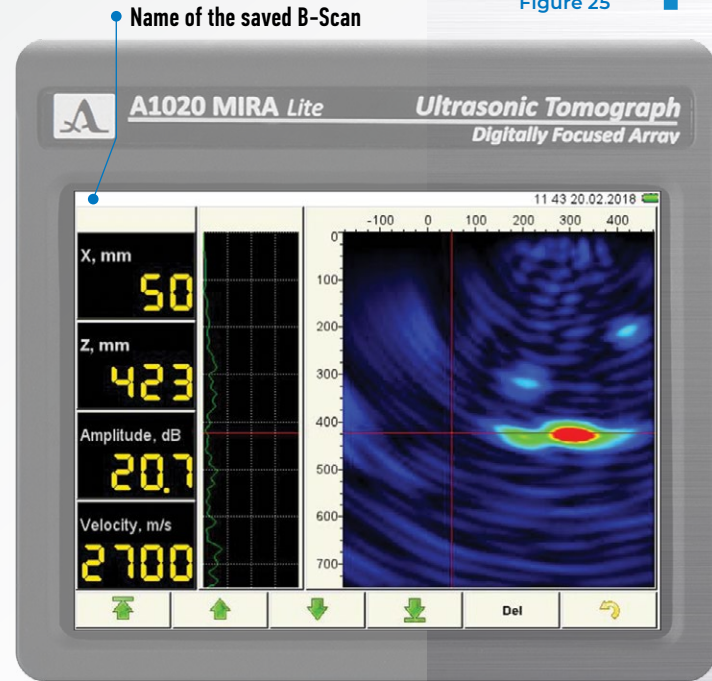


Figure 25



2

PROPER USE

2.1 OPERATING RESTRICTIONS

The device is designed to operate in the conditions listed in the Section 1.1.2.

2.2 PREPARING FOR OPERATION

2.2.1 Getting started with the device

Prior to working with the device always check that a card for recording of the results is in the slot. Charge the battery. The device is delivered ready for use, no additional adjustment is required.

2.2.2 Preparation of the surface of the inspected object

The surface (places of proposed installation of the instrument) of the inspected object must clean from dirt and sand. Remove the materials that prevent the penetration of low-frequency ultrasonic waves from the surface. The operation of the device can be affected by coatings, other than concrete in their physical properties (polymer coatings, waterproofing, thick layers of paint).

Coupling liquid is not used during inspection.

The smooth and even surface of the inspected object increases the quality of ultrasonic contact of the antenna array system with the surface, thus improving the image quality. Hence, it is recommended to choose smooth and even surfaces, if possible.

2.2.3 Create the scanning pattern and mark the surface of the inspected object

Prior to performing the inspection, it is necessary to develop the scanning pattern of the object. The scanning pattern indicates the operator where and how to place the antenna array on the surface of the inspected object during scanning. The correct pattern accelerates the process of data collection and simplifies the understanding of inspection results.

Mark the places for proposed installation of the antenna array, as well as search limits when doing local inspection.

The complete inspection requires more detailed marking. Divide the whole surface of the object into zones (sections) of the same width and of desired length. One zone can be inspected in one passage of the device. So, it will be better to have a smaller number of sections, though their length is longer. For example, when inspecting narrow and extended objects, locate

the sections along them. Each next section must be adjacent to the previous one so that they cover the entire surface of the inspected object. After selecting the location of the sections, mark the places for installation of the antenna array for inspection. To do it, take a strip with the scaled intervals corresponding to the selected scanning step, and fix it in the center of the section.

You can fix the marked ribbon in another manner, as well as mark the surface of the inspected object differently.


NOTE: THE RIBBON SHALL BE FIXED SO THAT THE PROTECTORS OF EACH TRANSDUCER DON'T TOUCH THE RIBBON WHEN THE ANTENNA ARRAY IS PLACED. IT IS REQUIRED TO PREVENT THE SIGNAL DISTORTION FROM THIS ELEMENT!

Start scanning after the object is marked.

2.2.4 Switching On/Off the device

Press the key  key to switch on the device, the LED above the key will turn green.

The device will automatically enter the mode being active before switching off, preserving the corresponding settings.

Press the key  key to switch off the device.

2.2 PREPARING FOR OPERATION

The objects can be inspected using the tomograph by two ways: local inspection and continuous inspection.

2.3.1 Local inspection

When performing the local inspection the antenna array is placed on the desired surface of the inspected object; and the structure of the section of the inspected object in the given place is analyzed. The result allows the operator to have required information immediately. Or, select the direction to which it is better to move the antenna array for better results.

2.3.2 Continuous inspection

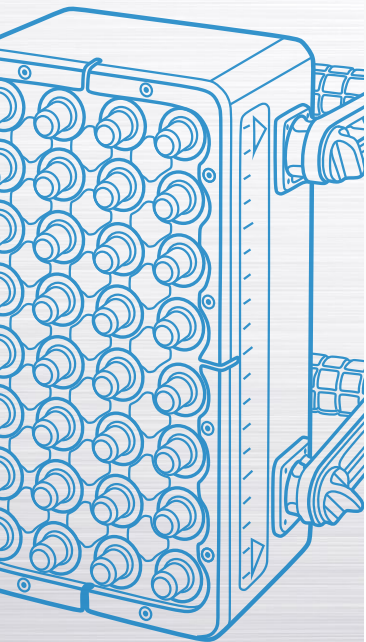
When performing the continuous inspection the antenna array is subsequently placed on the inspected surface of the object, data are obtained and automatically saved. The operator determines the direction and displacement step of the antenna array in advance; the direction and step shall remain the same during inspection regardless of the images received on the screen.

2





2



The continuous inspection is done when a certain area of the surface of the inspected object must be thoroughly examined; along with the possibility of constructing the object model and recording all retrieved data. The continuous inspection takes more time. This procedure requires a corresponding marking of the inspected object with a required step.

Prior to continuous inspection check the operation of the tomograph by performing a local inspection to verify that the given object can be inspected.

2.4 PERFORMING INSPECTION

2.4.1 Performing a local inspection

The REVIEW mode is used for a local inspection. The antenna array shall be installed in the required place of the surface of the inspected object, and the sounding button shall be pressed. Further carefully study the received sectional image and draw a conclusion from it whether the retrieved data are enough for taking a decision. Or, select another position for the antenna array to receive more accurate information. The data received in this inspection mode are recorded automatically. Hence, the operator shall record them manually, if required, as separate frames. You can view the saved data in the REVIEW mode.

After all information that is needed to make a decision is obtained, the operation in this mode can be finished.

2.4.2 Performing a continuous inspection

The MAP mode is used for a continuous inspection.

Place the antenna array into a position marked as the first one for the inspected object and press the sounding key. Further, the antenna array is placed into the next position. The current marked section is inspected this way. Inspect all marked sections like that.

The operator can only make preliminary conclusions about the object based on the images displayed on the screen. The final conclusions are made using the PC after all required data are obtained.

3.1 POWER SUPPLY AND ENERGY CONSUMPTION

3.1.1 Monitoring the state of the power source

A built-in discharge controller monitors the degree of discharge of the power source during the operation of the device. The degree of discharge is indicated by the battery icon in the upper right corner of the screen. A completely filled green color battery icon indicates a completely charged battery. The battery icon becomes empty while the battery discharges and changes its color from orange to red. At a critical degree of battery discharge the device will automatically switch off. At that all settings and recorded, the information is preserved.

If the degree of discharge is down to 10%, and prior to the device to be switched off, the corresponding warning messages are displayed.

NOTE: NEVER STORE THE INSTRUMENT WITH A COMPLETELY DISCHARGED BATTERY TO PREVENT THE BATTERY FAILURE!

3.2 ROUTINE MAINTENANCE

While in service, clean the housing of the device from dirt and dust using a cleaner for cleaning plastics.

Wipe the dirty protective glass of the screen with a soft cloth wetted with cleaner for cleaning plastics.

A dirty keyboard can be cleaned with alcohol (spirit).

Clean the device with soapy water if you have no indicated cleaners.

Clean the connectors with the soft brush if dirt and foreign particles get into them.

Dirty transducers of the antenna array can affect the ultrasonic contact with the inspected object. So, periodically inspect the transducers. Clean the ceramic protectors of the transducers, if required, with a cloth wetted in alcohol; clean the transducers with a vacuum cleaner periodically (especially when working in a dusty environment).

3.3 POSSIBLE MALFUNCTIONS

Contact the manufacturer (phone numbers are listed in the certificate on the device) if there are any malfunctions or questions about the device operation.

3

TECHNICAL MAINTENANCE



4

STORAGE

The device should be shelf stored in the hard case included in the delivery kit.

The arrangement of instruments in warehouses shall enable their free movement by the personnel and unrestricted access to them.

The distance between the instruments and the walls, floor of the warehouse and other warehoused instruments shall be at least 100 mm.

The distance between the heating units in the warehouses and the device shall be at least 0.5 m.

The storage room shall be free from the current-conducting dust, mixtures of aggressive gases and corrosive vapors able to attack the device.

Prior to operation the device shall be stored in the original packaging.



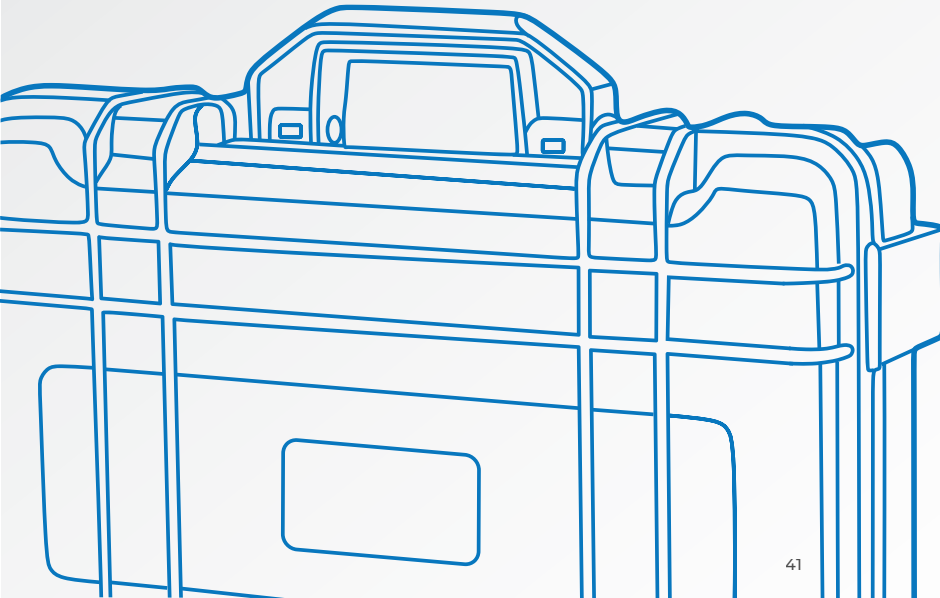
The device shall be transported by all types of closed transport in the hard case included in the delivery kit.

The packaged devices can be transported in any vehicles at any distances without speed limits.

The packaged devices should be properly and steadily fixed to prevent shocks of devices against each and against vehicle walls during the transportation. When transported in open vehicles the device shall be protected against rain and water splashes.

If shipped by air transport, properly packed instruments should be placed in hermetically sealed and heated compartments.

In case the transportation conditions differ from the operation conditions, the instruments shall be kept under normal environmental conditions for at least 2 hours prior to operation.





NOTES

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A1020 **MIRA** Lite **Low-Frequency Ultrasonic Tomograph**



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