ULTRASONIC FLAW DETECTOR

A1211 MINI

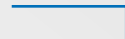**OPERATION MANUAL**

Acoustic Control Systems – ACS Group
Saarbrücken, Germany 2019

ACOUSTIC
CONTROL
SYSTEMS

CONTENTS

The current operation manual (hereinafter referred to as " operation manual") contains technical specifications, description of the design and operational principle, as well as information, required for proper operation of the ultrasonic flaw detector A1211 Mini (hereinafter referred to as flaw detector or instrument).
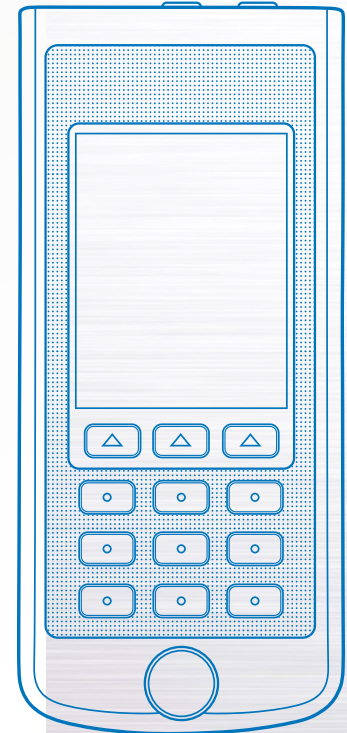
Prior to start using the instrument it is necessary to read the present manual and understand it.

The manufacturer continually improves the instrument, increasing its reliability and operation convenience. This can sometimes lead to some insignificant changes not mentioned in the present version of the manual and not worsening the technical specifications of the instrument.

The instrument is manufactured by:

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1.1 INTENDED USE

1.1.1 Intended use and area of application

The instrument is a handheld portable ultrasonic (US) instrument of general purpose.

The flaw detector is designed for search, definition of coordinates and estimation of various infringements sizes in the continuity and uniformity of a material in products made from metals and plastic.

The flaw detector allows to form, register and keep in non-volatile memory time realizations of echo signals, and also transfer saved data to a PC for further analyses and documentation.

The connection to a PC is done via a USB cable.

The flaw detector has the possibility to change the orientation of the image 90 degrees left and right.

The colored TFT display provides the representation of US signals in a form of an A-Scan.

Manual and automatic measurements of time intervals, signal amplitudes and automatic calculation of flaw coordinates can be performed using the instrument.

The instrument allows to perform measurements in severe climatic conditions at low temperatures..

1.1.2 Operating conditions

The instrument is designed for operation under the following environmental conditions:
- Operating temperature range: from -20 to +50 ˚C;
- Relative air humidity up to 95 % at +35 ˚C.

**DESCRIPTION
AND
OPERATION**

1.2 TECHNICAL SPECIFICATIONS

The main technical specifications of the instrument are listed in the Table 1.

Table 1

Parameter	Value
Ultrasound reconstruction range	from 1,000 to 14,999 m/s
Operating frequencies of transducers	from 0.5 to 15.0 MHz
Reconstruction range of the calibrated amplifier	from 0 to 80 dB

Measurement range of the depth of the flaw location (steel) with straight beam transducers:
     with S3568 2.5A0D10CL
     with D1771 4.0A0D12CL
	
	from 7 to 900 mm
	from 2 to 450 mm

Limits of permissible absolute measurement accuracy of the depth of the flaw location (steel) with the straight beam transducers, where H – measured depth of the flaw location in mm	$\pm(0.03{\cdot}H+1.00)$ mm

Measurement ranges of the flaw locations (steel) with angle beam transducers:
     S5182 2.5A65D12CS
     S5096 5.0A70D6CS
	
	from 2 to 200 mm
	from 2 to 90 mm

Limits of permissible absolute measurement accuracy of the flaw locations (steel) with angle beam transducers:
     -depth, where H is the measured depth of the flaw location in mm
     -length over the surface, where L is the measured length over the surface to the flaw in mm
	
	$\pm(0.03{\cdot}H+1.00)$ mm
	$\pm(0.03{\cdot}L+1.00)$ mm

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Figure 1

▼ Table 1

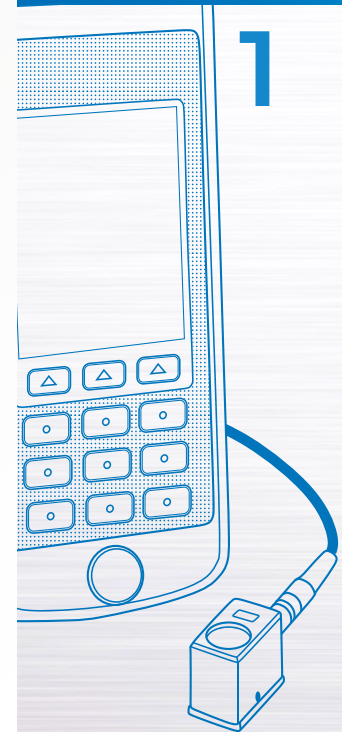| Parameter	Value
Limits of the permissible absolute set accuracy of the gain	±0.5 dB
Rated supply voltage	3.7 V
Minimal battery operation time, hours	9 hours
Overall dimensions of the electronic unit, max.	161X70X24 mm
Maximum weight of the electronic unit	210 g
Mean time between failures	18 000 hours
Average service life	5 years

Sockets for
connecting transducer

Colour TFT display

Membrane keyboard

Calibration sample

Figure 2
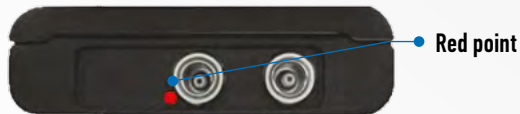
Red point

Figure 3
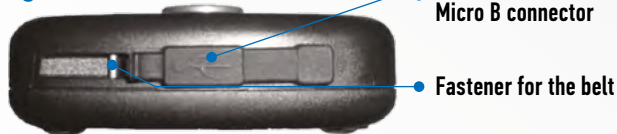
Figure 4

Plug of the USB
Micro B connector

Fastener for the belt

1.3 INSTRUMENT DESIGN AND OPERATION

1.3.1 Instrument design

The instrument includes an electronic unit (Figure 1), to which changeable piezoelectric transducers are connected via cables. In the upper part of the front panel a TFT display is situated, it displays the measurement results and service information, necessary for using the instrument. The display provides full visual control of the measurement process with colored indication.

Under the display a film keyboard is located used to control the instrument.

On the upper side of the electronic unit sockets are located for connection of US probes, one of the sockets is marked with a red dot (Figure 2).

On the lower side of the electronic unit a fastening and a USB Micro B socket are located. The USB Micro B socket is used for connection to a PC via a USB cable or for connection of an 220V adaptor for charging the battery (Figure 3).

The "Micro B" connector should be connected with the symbol ⟜ and/or letter "B" upwards (figure 4).

On the back of the instrument a magnetic holder is located, it provides secure fastening on metal surfaces and additional comfort while performing inspections in hard-to-reach places and on heights.

1.3.2 Operation principle

The instrument is an ultrasonic contact flaw detector for general purposes, e.g. for manual control with echo-method, through transmission method and mirror through transmission method. The ultrasonic contact of the US transducers with the tested object is provided by pressing the operating surface of the transducer to the surface of the tested object though a layer of contact liquid, which can be oil, glycerin or water.

The instrument with an ultrasonic transducer sends regular short impulses of ultrasonic waves into the tested object. The impulses of the ultrasonic waves reflected or passed through the material are transformed into electronic signals and come to the electronic unit of the instrument. After the amplification, digitalization and processing in the built-in processor, the signals are displayed on the screen.

The amplitude of the reflected signal carries the information about the size of the flaw in the tested object and of the "transparency". The signal time delay depends on the path length passed by the signal.

While working with the echo-method with a single crystal or a dual search transducer the temporary position of the echo-signal on the screen is in proportion to the distance from the reflector to the transducer.

1.3.3 Operating modes

The main operating mode is the FLAW DETECTOR mode, additional STOP and SETTINGS modes are present.

In the operating mode the emission pulse is formed, the measurements are made, the received echo-signal is amplified and displayed on the screen.

The STOP mode is used for freezing the signal realization (image) on the screen, saving it in the memory and also viewing and deleting previously saved images.

In the SETTING mode the setting parameter of the instrument are selected and changed. When using the instrument a new TO should be started in this mode.

1.3.4 Display

In all operation modes in the upper line of the display the battery level is shown.

The working space in every mode is divided into several functional fields.

The signal on the screen is always shown as a rectified filled one.

The view of the screen changes depending on the chosen orientation of the image:
- vertical;
- horizontal left;
- horizontal right.

On the Figure 5 the instrument is shown in the turned horizontal left orientation.

Figure 5

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The display with the vertical orientation in FLAW DETECTOR mode is shown on the Figure 6.
On the Figure 7 the display is shown with horizontal left orientation in FLAW DETECTOR mode

Figure 6

Figure 7

Operation Manual
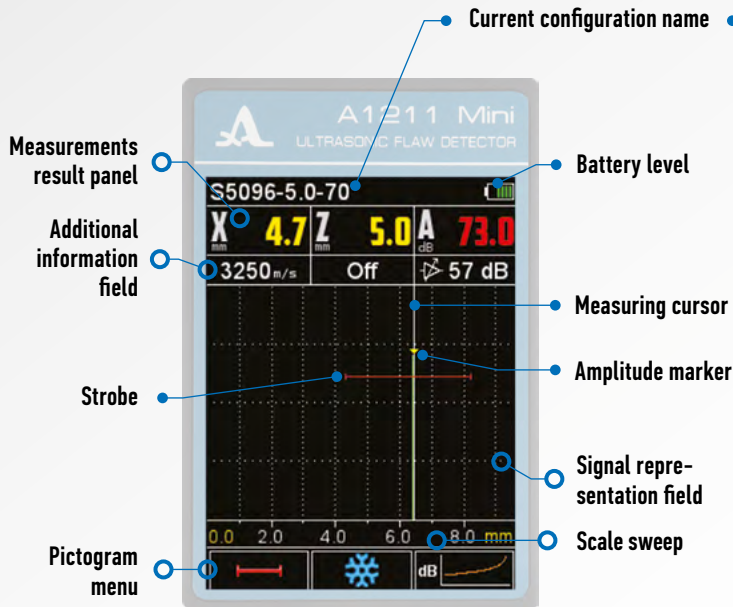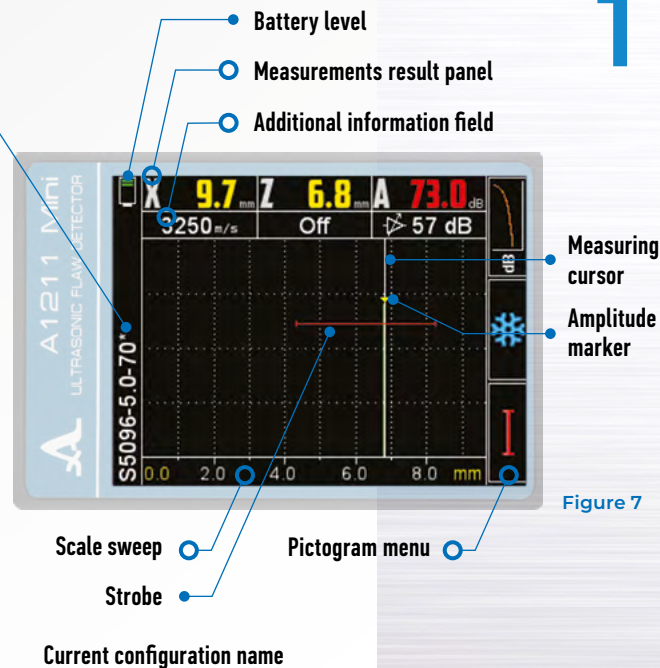
1.3.5 Keyboard

The keyboard of the instrument (Figure 8) has 11 functional keys and an on/off key. Main functions of the keys:

The key [⏻] (ON / OFF) is used for turning the instrument on/off.

NOTE: THE INSTRUMENT AUTOMATICALLY TURNS OFF AFTER 10 MINUTES WHEN NO KEY IS PRESSED AND NO MEASURING IS PERFORMED!

NOTE: AFTER 2 MINUTES THE ILLUMINATION OF THE SCREEN IS AUTOMATICALLY SET TO THE MINIMAL VALUE 20% IF NO KEY IS PRESSED AND NO MEASURING IS PERFORMED!

The functional keys [▲] (F) are used for different operations depending on the selected mode of the instrument. The name of the current function is shown on the screen above every key. In the current manual the functional keys numeration is from left to right: F1, F2, F3 (Figure 9).

The key [🔧] is used to switch between the modes FLAW DETECTOR and SETTINGS.

The key [⏎] (ENTER) performs different functions depending on the operating mode.

The keys [←] / [→], [↑] / [↓] and [−] / [+] are used to select and change the active parameters. Their actions are similar for different operating mde modes and are intended for intuitive understanding as the symbols conform to their actions.

NOTE: THE FUNCTIONS OF THE KEYS [←] / [→], [↑] / [↓] ARE DIFFERENT IN VERTICAL AND HORIZONTAL ORIENTATION OF THE SCREEN!

Figure 8

Figure 9

F1   F2   F3
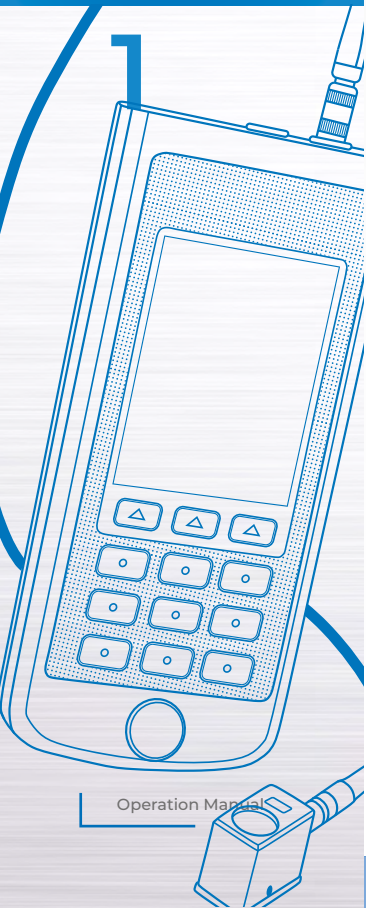
2.1 OPERATIONAL LIMITATIONS

The instrument is designed for operation under environmental conditions specified in the section 1.1.2.

2.2 PREPARING THE INSTRUMENT FOR USE

2.2.1 Preparation of the surface

The surface of the tested object should be cleaned from dirt and sand, if it is covered with corrosion, then remove the loose rust and apply more contact liquid on the smooth surface. Cleaning rough corroded surfaces improves the measurement certainty and provides a longer service life of the transducer.

2.2.2 Connecting the transducer

Dual search and single crystal transducers are used in the instrument.
The transducer should be connected as per marking.
Depending on the type of transducer, two types of cables are used, and accordingly there are two ways of connecting the PT.
Double transducers are connected with a double cable LEMO 00.
The cable, marked with a red end should be connected to the socket marked with a red dot (Figure 10).
Single crystal transducers are connected with single cables LEMO 00 to the unmarked socket.

Figure 10

Red

Red

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2.2.3 Switching the instrument ON/OFF

To turn the instrument on the key 🔴 should be pressed.

At the moment of turning on a short tuneful signal will ring. On the display of the instrument the main screen is shown for 2 seconds with the name of instrument and version of the firmware (Figure 11).

The instrument will automatically enter the mode, which was set at the moment of the last switching off, with corresponding settings.

Turning the instrument off is done by pushing the key 🔴 or automatically after 10 minutes when no key is pressed and no measuring is performed.

All settings are saved when the instrument is turned off or the battery is discharged.

2.3 THE OPERATING MODES

2.3.1 THE SETUP mode

The SETUP mode is used for instrument parameter setting.

All settings are saved when the instrument is turned off or the battery is discharged.

The screen of the SETUP mode is shown on the Figure 12.

The following keys are active in all points of the SETTINGS menu:

⬆️ ⬇️ - moving the active line between menu items, crossing is done cyclically, that is reaching the last items the line crosses to the first item and inversely. The parameter on which the line is on becomes active for selecting or editing;

➖ ➕ - increasing/decreasing the numerical value of the selected category.

↵ - entering the changed parameters marked with ▶;
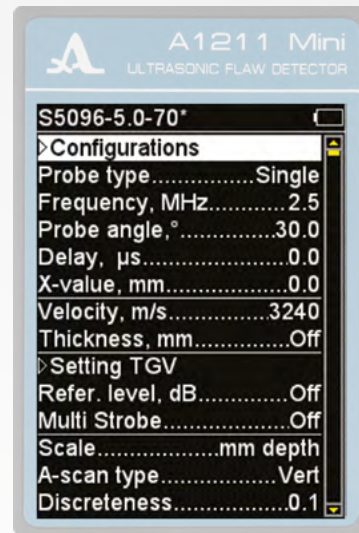
Figure 11

Figure 12

Menu items and their respective parameters and functions are given in the Table 2.

Table 2

Menu item	Parameter	Description
▶ Configurations	–	Entering the configuration base
PT type	SC. / DS.	Selecting the PT type: Single crystal; Dual search
Frequency, MHz	0.5 / 1.0 / 1.25 / 1.8 / 2.5 / 4.0 / 5.0 / 7.5 / 10.0	PT frequency is selected according to material properties
Input angle, °	from 0.0 to 90.0 with step 0.5	Setting the PT input angle
Delay, ms	from 0.0 to 100.0 with step 0.1	Setting the delay in the PT prism
Pitch, mm	from 0.0 to 50.0 with step 0.1	Setting the PT pitch
Speed, m/s	from 1 000 to 14 999 with step 1	Setting the ultrasonic speed in the material of the TO
Thickness, mm	Off / from 2.00 to 100.00 with step 0.01	Turning off/ Setting the thickness of the TO (using angled PT) –allows automatically indicate depth of the reflector from the surface, not depending whether it was found with a straight or reflected beam. Switching by ⏎ .
▶ Setting TCG	–	Starting TCG setup
Refer. level, dB	Off / from 0 to 200 with step 1	Sensitivity level set by the reflection from a reference reflector. Switching by ⏎
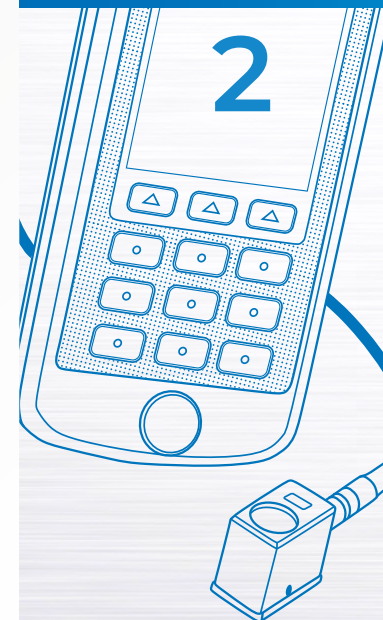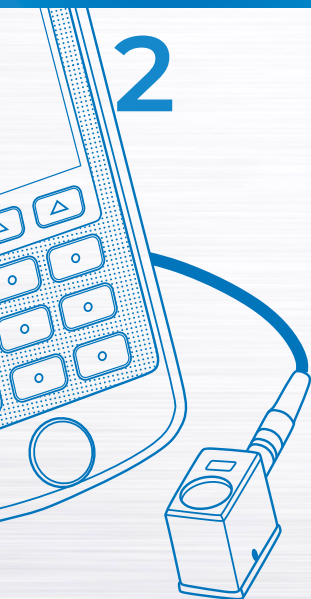
▼ **Table 2**

Menu item	Parameter	Description
Corr. by stand., dB (when refer. level is on)	From minus 40 to plus 40	Sensitivity rate. Difference between acceptance and reference levels (indicated in the documentation). Shows how much the acceptance level shall be moved relatively to the reference level.
Corr. for rough., dB (when refer. level is on)	from 0 to 12	Correction for roughness. Correction to the sensitivity level, taking into account the difference in roughness and waviness of the surface
Accept. level, dB (when refer. level is on)	from minus 52 to plus 240	Acceptance level. Not available for manual editing. Is defined automatically as a sum of values of the reference level, sensitivity rate and correction of roughness
Multi strobe	On / Off	Multilevel strobe. Three strobe levels are shown on the screen: examination, reporting and acceptance. Switching by ⏎
Report. level, dB (when multi strobe is on)	from - 12 to 0	Reporting level. Setting the reporting level sensitivity relative to the acceptance level
Exam. monitor, dB (when multi strobe is on)	from - 12 to 0	Examination monitor. Setting the examination monitor relative to the acceptance level

▼ **Table 2**

Menu item	Parameter	Description
Scale	mm depth. / ms	Scan-out scale. Choosing the units of the horizontal scale, defining the signal representation parameter
A-Scan type	Vert / Hor. L. / Hor.R.	Choosing the A-Scan image orientation on the screen
Discreteness	0.1 / 1	Reading discreteness. Choosing the discreteness of the shown values
Cursor	On / Off	Controlling the representation of the measuring cursor (vertical line, indicating the place, where measuring is taken of the signal parameters) on the screen Switching by ⏎
▶ Setting the time	-	Starts the time setting procedure
▶ Memory cleaning	-	Starts the memory cleaning procedure
Sound	On / Off	Turning on / off vibroindication Switching by ⏎
Language	Russian / English	Selecting the interface language
Brightness, %	from 5 to 100	Setting the screen brightness
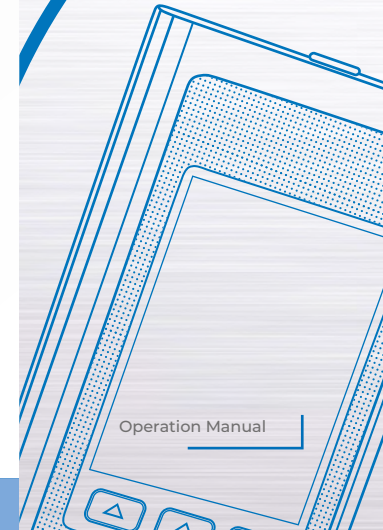
2.3.1.1 ITEM CONFIGURATIONS

Entering the configuration framework for:
- Choosing previously saved configurations from a list;
- Deleting previously saved configurations, except for basic ones;
- Creating new configurations with parameters, values of which were set in the other item of the SETTING mode.

Viewing and deleting configurations.

Entering the current configuration highlighted and marked with ✓ into the item CONFIGURATIONS in the list of configurations (Figure 13).

NOTE: in the list of configurations basic configurations set by the manufacturer are always present.

Active keys:

F1 (✔) – selecting the configuration for further work;
F2 (🗑) – selecting configurations, previously saved by the user;
F3 (↩) – exit without choosing a new configuration.

To continue with another configuration from the list one should choose its name with the keys (⬆) (⬇) and press F1. To return to the main window of SETTINGS without changing the configuration press F3.

WARNING: IT IS IMPOSSIBLE TO DELETE A BASIC OR A CURRENT CONFIGURATION!

To delete a previously saved configuration one should choose its name with the keys (⬆) (⬇) and press F2, at that a confirmation window will open (Figure 14).

Active keys:

F1 (✔) – confirms deleting a configuration;
F3 (✖) – denies deleting a configuration.
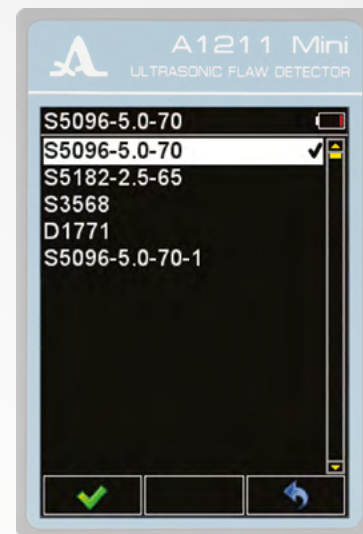
Figure 13

Saving a new configuration

Upon changing a configuration parameter in the SETTING mode to the name of the configuration taken as a basis the * automatically is added and the changed configuration becomes current (Figure 15). At that the configuration taken as a basis remains unchanged. To enter a new configuration in the list it should be named.

Active keys:

F1 ( ) assign a unique name to a configuration and save it in the list of configurations;

F3 ( ) exit without entering a new configuration in the list of saved ones.

Figure 14

Figure 15

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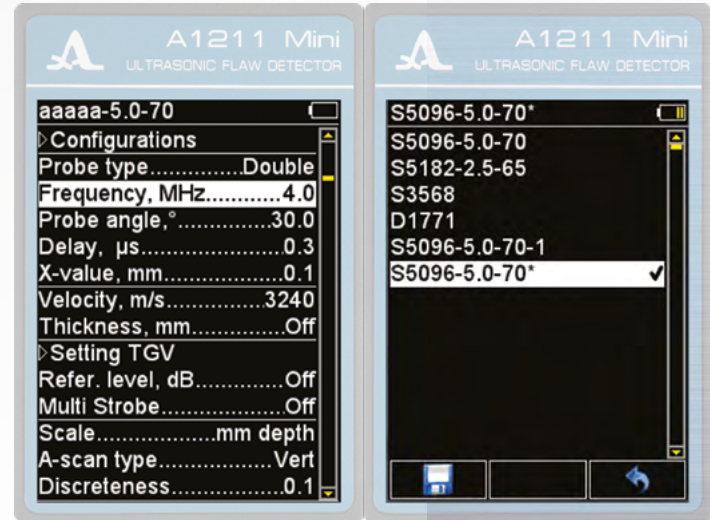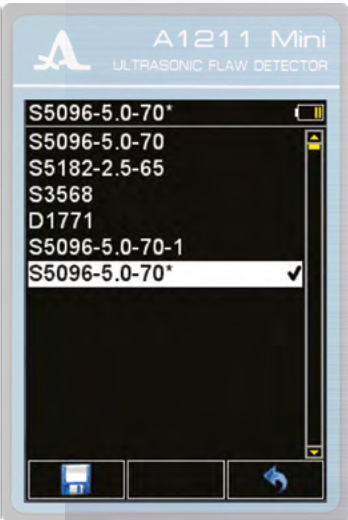
Pushing F1 a name editing window will open (Figure 16).

Active keys:

F1 ( ) exit editing and saving a new configuration;

F2 (абс) switching symbols in the letter table;

F3 ( ) exit editing without saving changes.

Upon entering the name editing mode the screen shows the configuration name, which was taken as a basis with an inverse active symbol and a symbol table.

In the letter table the following symbols are available:

абв – Russian small letters;

АБВ – Russian capital letters:

abc – English small letters;

ABC – English capital letters.

The key functions in the name editing mode are described in the Table 3.

Figure 16

Figure 17

Table 3

Key	Description
← → ↑ ↓	Moving in the symbol table in the conforming direction
− +	Choosing the symbol for editing in the configuration name field
↵	Changing the active symbol to the symbol from the table. After changing the next symbol becomes active

A configuration can be given any name (Figure 17).

To save the formed name press F1. If the list has a configuration with such a name a warning window will open (Figure 18).
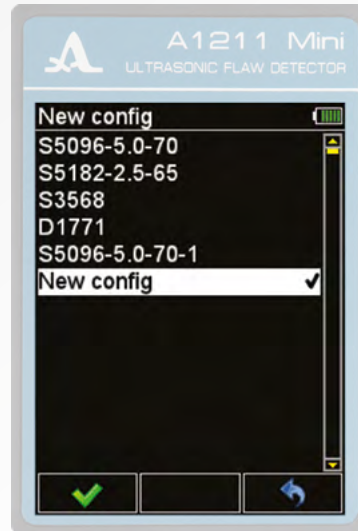
Active keys:

F1 (   ) rewrite a previously saved configuration with a new name;

F2 (абс) switching symbols in the letter table;

F3 (   ) return to the name editor without saving.

After saving a configuration under a selected name it will appear in the list and set as current (Figure 19).

Figure 18

Figure 19

2

Operation Manual
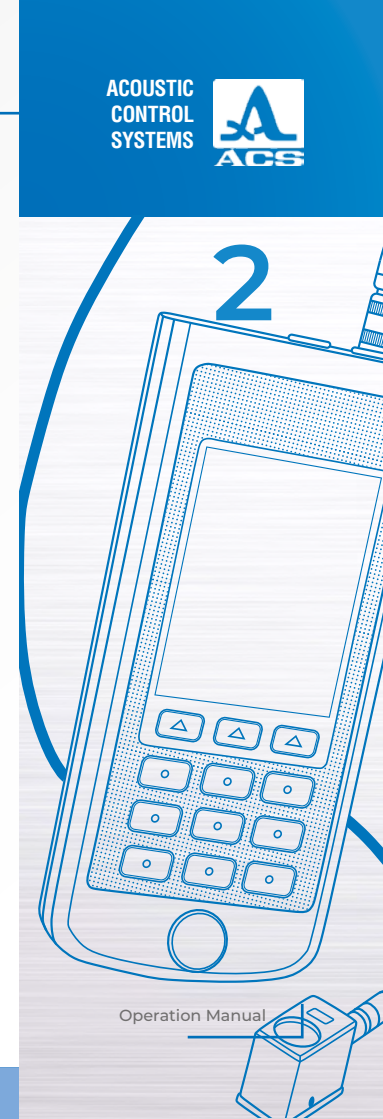
2.3.1.2 Point PT type.

Choosing the type of used PT:
SINGLE – single crystal;
DOUBLE – dual search.
The screen in item PT TYPE in shown on the Figure 20

2.3.1.3 Item frequency

Setting the frequency of the used PT.
The frequency of the PT is selected according to the properties of the material. It is possible to use PT with the following frequencies: 0,5; 1,0; 1,25; 1,8; 2,5; 4,0; 5,0; 7,5; 10.
Active keys:
⊟ ⊞ selecting the frequency from the list.
Screen view in the item FREQUENCY is shown on the Figure 21.

Figure 20
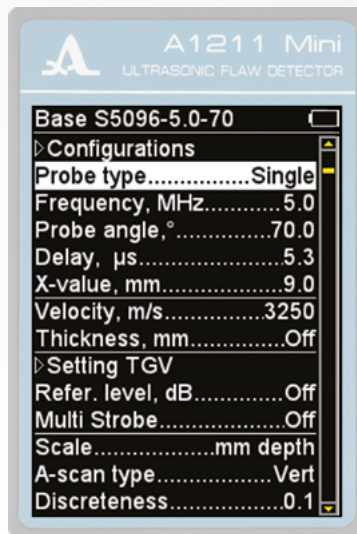
Figure 21
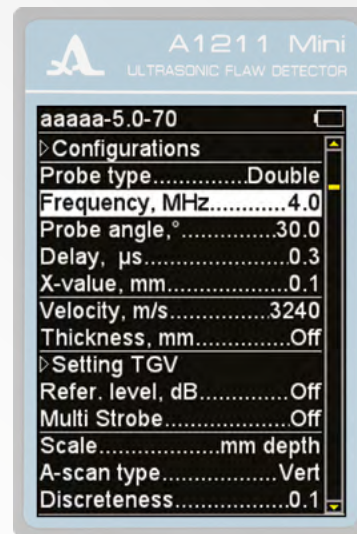
2.3.1.4 Item Probe angle.

Setting the input angle of the PT. Acceptable values: from 0 to 90°.
Screen view in the item PROBE ANGLE is shown on the Figure 22.
Active keys:
[−] [+] increasing / decreasing the input angle value.

2.3.1.5 Point DELAY

Setting the delay in the prism of the PT.
Acceptable values: from 0 to 100 ms.
Active keys:
[−] [+] increasing / decreasing the delay value.
The screen view in the item DELAY is shown on the Figure 23.

2.3.1.6 Item X-value

Setting the x-value of the PT.
Acceptable values: from 0 to 50 mm.
Active keys:
[−] [+] – increasing / decreasing the x-value.
The screen view in the item X-VALUE is shown on the Figure 24.

2.3.1.7 Item VELOCITY

Setting the ultrasonic velocity in the material of the tested object.
Acceptable value: from 1 000 to 14 999 m/s.
Active keys:
[−] [+] – increasing / decreasing the speed value.
The screen view in the item VELOCITY is shown on the Figure 25.

Figure 22
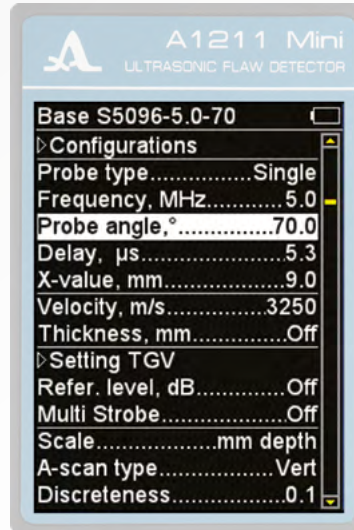
Figure 23
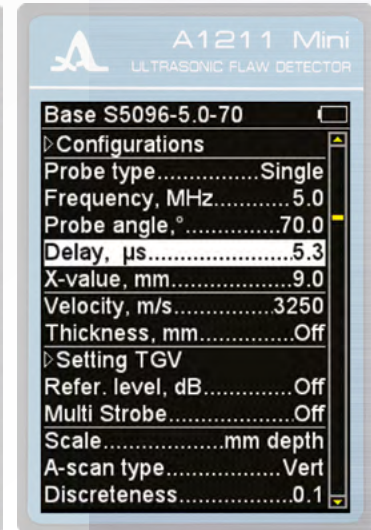
2.3.1.8 Item THICKNESS

Turning off / Setting the thickness of the TO (using angled PTs) allows to automatically indicate the depth of the reflector, regardless whether it was found with a straight or reflected beam. Permissible values: from 2 to 100 mm.

Active keys:

⏎ – turning on / off the thickness of the TO.

− + – increasing / decreasing the thickness value.

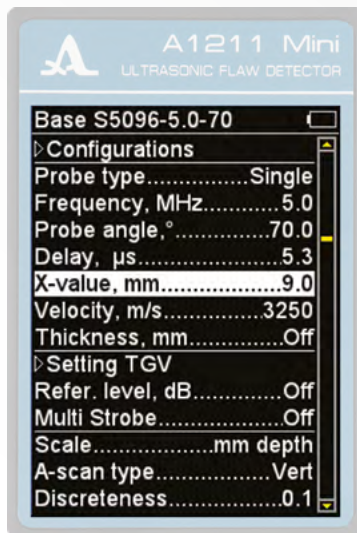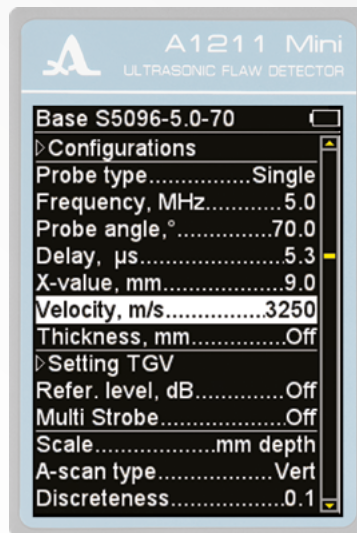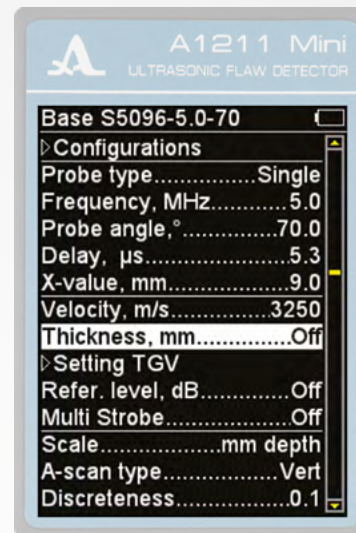The screen view in the item THICKNESS is shown on the Figure 26.

Figure 24

Figure 25

Figure 26

2.3.1.9 Point SETTING TCG

To align echo-signal amplitudes from similar reflectors, situated on different depths, the instrument has a time correction gain (TCG) function. To set the TCG a control sample is needed which is a far and a close reflector of similar size. TCG setting can be done in vertical and horizontal screen orientation.

Active keys:

⏎ – starts TCG setting.

The screen view in the item SETTING TCG is shown on the Figure 27.

Preparing for setting

Before setting the following operations should be done in the FLAW DETECTOR mode:

- Set a sweep so that signals from all defects in a prospective test area have been presented on the screen;
- Place the strobe on 50 80 % screen height;
- Define the testing area by the strobe limits;
- Place the PT to the sample and find the maximal signal from the close and far reflector;
- Set the peak of the impulse to 50 80 % screen height.

Setting TCG

In the current mode:

- Above the signals a TCG curve is present with knot points;
- The measuring cursor line is always present;
- coordinates X and Z in the results panel indicate the position of the cursor;
- in the results panel the amplitude of TCG in the point of crossing with the cursor line is indicated.
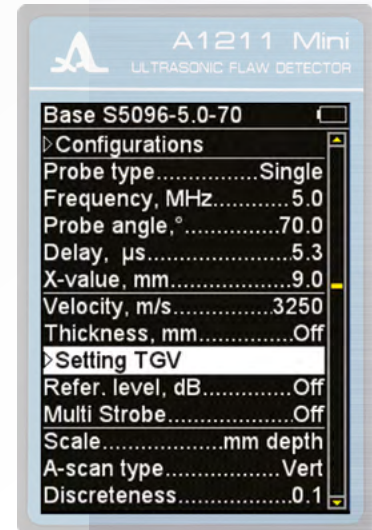
Active keys:

- F1 (✔) exit editing to FLAW DETECTOR mode saving the TCG line;
- F3 (↩) exit editing to the main window of SETTINGS mode recovering previous TCG parameters.

Figure 27

Figure 27

After pushing ⏎ a TCG setting window opens (Figure 28).

To set TCG one should:

- Find the signal maximum from the close reflector.

- Set the measuring cursor on it and set a knot point by pressing ⏎ (Figure 29).

- Repeat the procedure of making a knot point for the far reflector (Figure 30). Correct the vertical position of the point, so that the signal amplitudes from the far and close reflectors stay on the red level of the strobe.
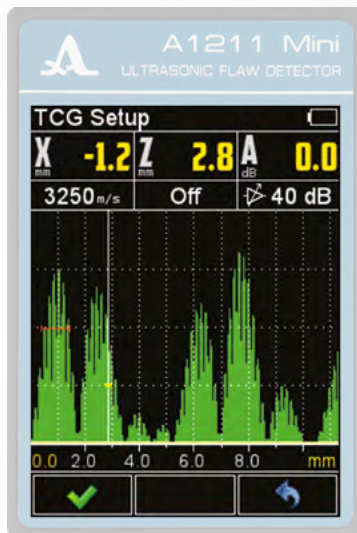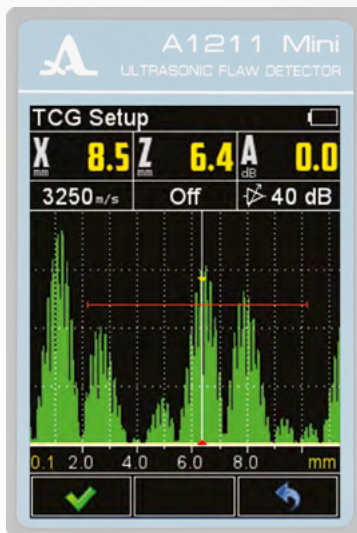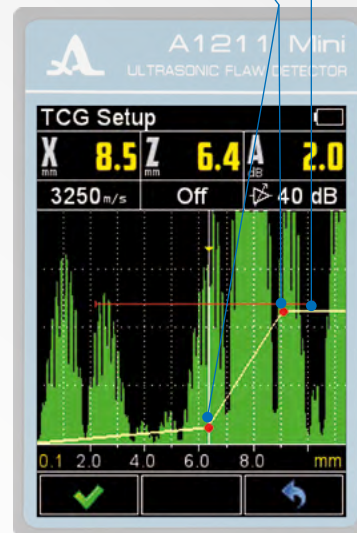
TCG curve

Knot points

Figure 28

Figure 29

Figure 30

- If the sample has more than two control reflectors, knot points should be created for all of them.

- Moving the cursor along the knot points, correct the position of the newly made knot points so that amplitudes from the far and close reflectors are at the same level.

To delete a knot point place the cursor on it and press ⏎.

To exit TCG setting saving the settings press F1.

ATTENTION: TCG CURVE IS NOT SHOWN IN THE FLAW DETECTOR MODE!

Key functions in TCG setting are described in the Table 4.

Table 4

| Key	Description	
	Vertical screen	**Horizontal screen**
− +	Moving the measuring cursor	
← →	Switching to the next / previous knot point	If the cursor is on a knot point – moving it in a conforming direction. No functions in other positions
↑ ↓	If the cursor is on a knot point – moving it in a conforming direction. No functions in other positions.	Switching to the next / previous knot point
⏎	If the cursor is on a knot point deleting it. In other positions – setting a knot point.	

2.3.1.10 REFERENCE LEVEL ITEM

Turning off / setting the value of the reference level.

Acceptable values: from 0 to 200 dB.

Active keys:

⏎ – turning on / off the reference level.

− + – increasing / decreasing the value of the reference level.
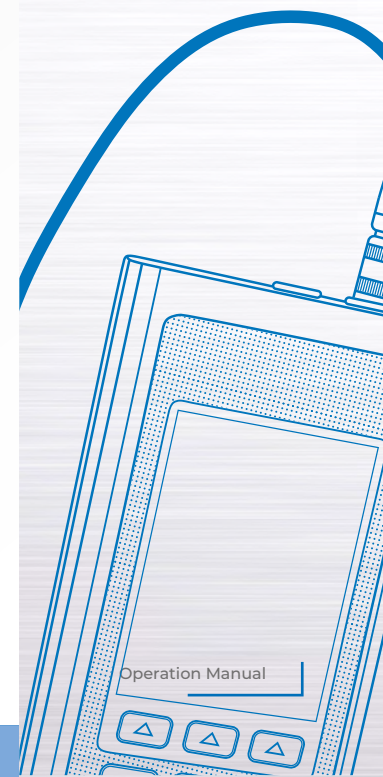
Screen view in the item REFERENCE LEVEL is shown on the Figure 31.

NOTE: if the parameters "Corr. by stand" and "Corr. for rough" differ from zero, their values are taken into account when calculating the red (acceptance) level (when the multi strobe is on, all three levels shift on the value of correction). If the correction values are high, the red revel can exit the 50 80 % screen range, in this case exit the SETTING mode and correct the position of the red strobe.

2.3.1.11 MULTI STROBE ITEM

Controlling the multi strobe.
Acceptable values: On / Off.
Active keys:
⮐ - turning on / off the multi strobe.
The screen view in the item MULTI STROBE is shown on the Figure 32.

2.3.1.12 Item Scale

Select the figures of the horizontal scale, define the signal representation parameters.
Acceptable values: mm depth / ms.
Active keys:
⊟ ⊞ - switching between figures.
The screen view in the item SCALE is shown on the Figure 33.
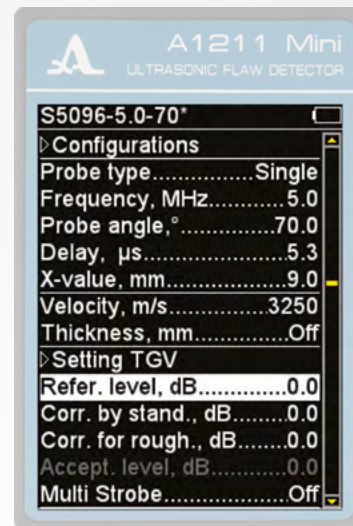
2.3.1.13 Item A-scan type

Changing the orientation of the A-scan on the screen.
When the orientation of the A-scan is changed:
- The scale dimension doesn`t change, only the compression ratio of the signal;
- Arrow key functions change conforming to the orientation of the screen.

Figure 31

Acceptable values:

VERT – vertical orientation of the screen;

HOR.L. – left horizontal orientation of the image on the screen (the screen is on the left of the keyboard);

HOR.R. – right horizontal orientation of the image on the screen (the screen is on the right of the keyboard).

Active keys:

⊟ ⊞ – changing the orientation of the screen.

The screen view in the item A-SCAN TYPE is shown on the Figure 34.
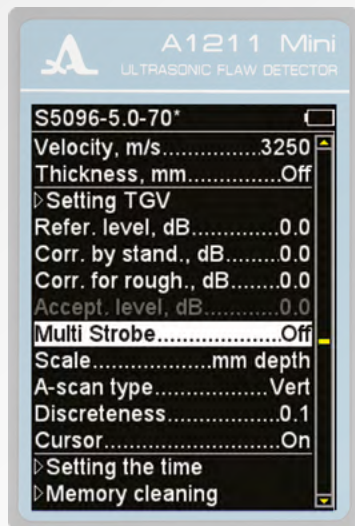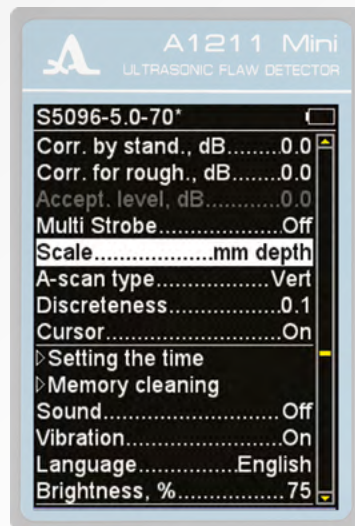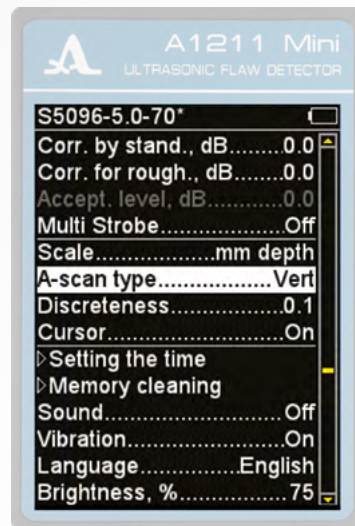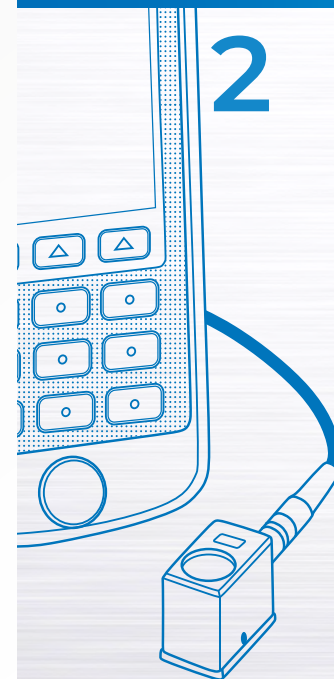
Figure 32


Figure 33

Figure 34

2.3.1.14 ITEM DISCRETENESS

Choosing the discreteness of the results. Acceptable values: 0.1; 1.
Active keys:
[−] [+] – choosing the discreteness of the results.
The screen view in the item DISCRETENESS is shown on the Figure 35.

2.3.1.15 ITEM CURSOR

Controlling the representation of the measuring cursor (vertical line, showing the place where signal measuring is done) on the screen. Acceptable values: On / Off.
Active keys:
[↵] - turning on / off the measuring cursor on the screen.
The screen view in the item CURSOR is shown on the Figure 36.

2.3.1.16 ITEM SETTING THE TIME

Starts the time and date setting procedure.
NOTE: the time and date are not shown on the screen, but are saved with A-Scans in the STOP mode. When viewing A-Scans on the PC time and date can be seen.
Active keys:
[↵] starts the time and date setting procedure.
The screen view in the item SETTING THE TIME is shown on the Figure 37
After pushing [↵] the editing window opens (Figure 38).
Active keys:
F1 (✔) confirmation of the input changes;
F3 (✖) denial of the input changes.
The position available for editing is highlighted with red color.
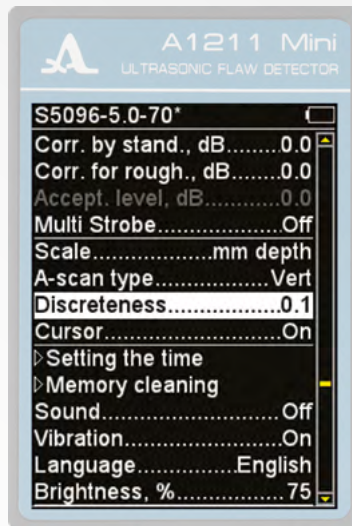The key functions in time setting are described in the Table 5.

Figure 35

Table 5

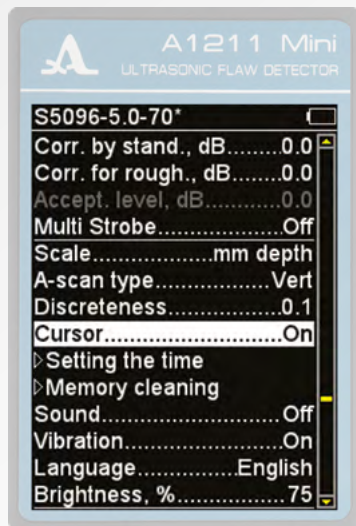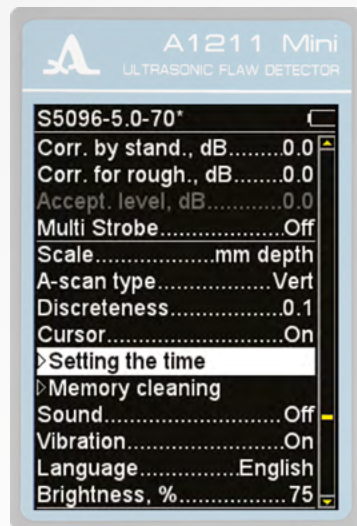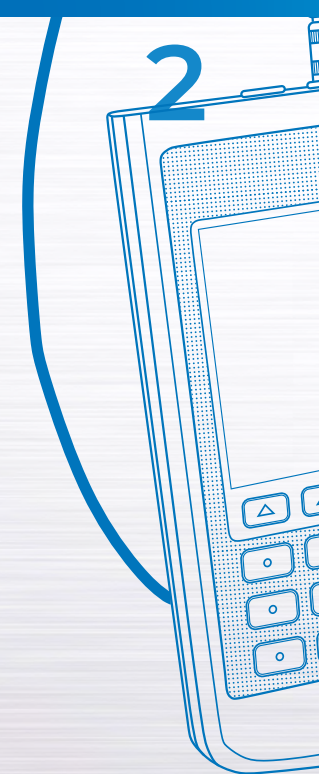| Key	Description
← →	Changing between the time and date parameters
↑ ↓	Selecting the time and date parameter for editing
− +	Changing the value of the chosen parameter

Figure 36

Figure 37

Figure 38
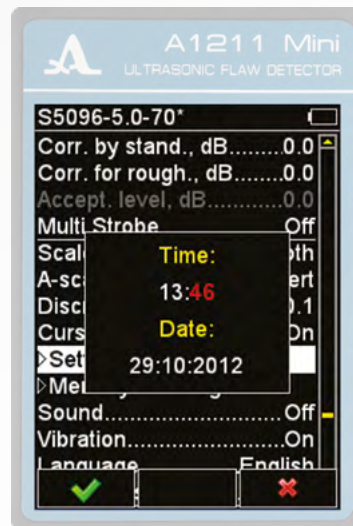
2.3.1.17 ITEM MEMORY CLEANING

Starts the memory cleaning procedure.
Active keys:
[⏎] starts the memory cleaning procedure.
The screen view in the item MEMORY CLEANING is shown on the Figure 39.
After pressing [⏎] a warning window opens (Figure 40).
Active keys:
F1 (✔) confirms deleting saved data;
F3 (✖) denies deleting.

2.3.1.18 ITEM SOUND

Turning on / off the sound indication.
To increase the convenience main actions, happening in the instrument when measuring, setting and pressing keys, are accompanied with a sound. Sound indication also serves for acoustic control of the received US signals. Sound signals additionally inform the operator of the performed processes not influencing the measuring results.
Active keys:
[⏎] - turning on / off the sound indication.
The screen view in the item SOUND is shown on the Figure 41.

Figure 39

Figure 40

2.3.1.19 ITEM VIBRATION

Turning on / off the vibroindication.

To increase the convenience main actions, happening in the instrument when measuring, setting and pressing keys are accompanied with vibroindication. Vibroindication additionally informs the operator of the performed processes not influencing the measuring results.

Active keys:

⏎ – turning on / off the vibroindication.

The screen view in the item VIBRATION is shown on the Figure 42.

Figure 41   **Figure 42**   **Figure 43**

2

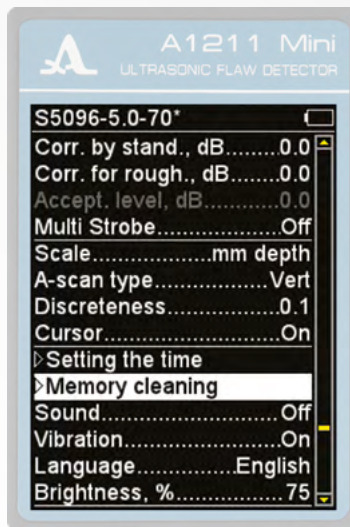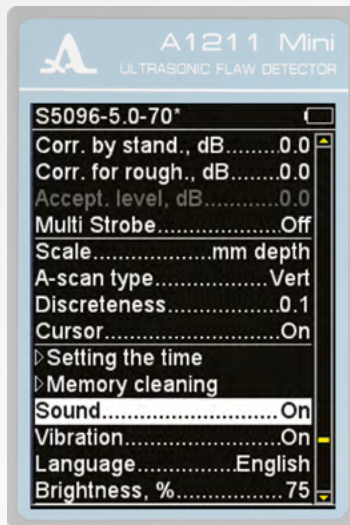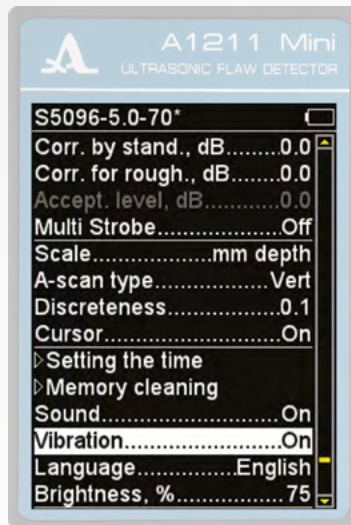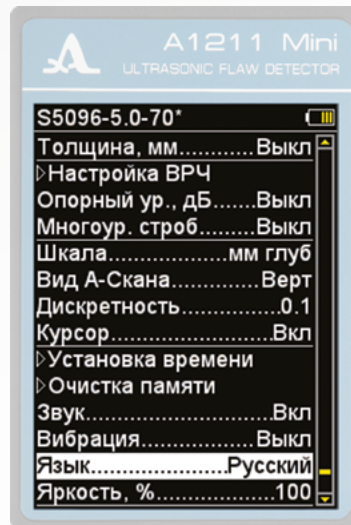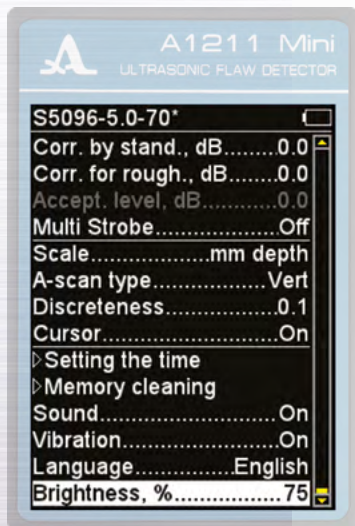### 2.3.1.20 ITEM LANGUAGE

Selecting the interface language: RUSSIAN / ENGLISH. The screen view in the item LANGUAGE is shown on the Figure 43.
Active keys:

〔 − 〕〔 + 〕 – switching between languages.

2.3.1.21 ITEM BRIGHTNESS

Setting the brightness of the screen. Acceptable values: from 20 to 100 %.

Active keys:

〔 − 〕〔 + 〕 – changing the brightness value.

The screen view in the item BRIGHTNESS is shown on the Figure 44.

Figure 44

2.3.2 THE FLAW DETECTOR mode

The instrument can operate with one strobe. The strobe is used for setting the testing area, sensitivity levels, monitor activation and defect coordinate calibration and signal amplitudes from reflectors with specified period.

The strobe cannot be turned off, it is always on the screen.

In the FLAW DETECTOR mode measurements are done in the automatic mode only.

Manual measurements can only be done in the STOP mode.

The automatic mode: the point amplitude measurement is done, exceeding the strobe level and having the maximal amplitude inside the strobe. When the echo-signal hits the time interval of the strobe, the cursor is automatically placed to the place of actuation, the indication of measured parameters is done. If the signal is lower than the strobe, its fixing and measuring isn`t done.

Besides the cursor the screen shows a marker in a form of a triangle, which is always automatically placed on the maximal value of the amplitude inside the strobe.

The screen view in the item FLAW DETECTOR mode is shown on the Figure 45.

The results panel consist of three blocks (Figure 46).

The indicated parameters in blocks change depending on the operating mode.

In the operating mode are represented:

- In the first: distance from the front cut of the PT to the reflector along the surface of the OC;

- In the second: depth of the flaw. When using an angled PT and entered thickness parameter (p. 2.3.1.8) the actual depth of the flaw is indicated taking into account the rereflections of the US wave;

- In the third:the amplitude of the measured signal.

When the signal exceeds the strobe level the amplitude is indicated in red ![A dB 73.0].

When the reference level is on amplitude can be with a minus ![A dB -2.2].

In the additional information field (Figure 47) the following parameters are shown:

- Speed, m/s – US speed value in the TO material, set in the SETTING mode.

- OFF or thickness, mm TO thickness value and the number of rereflections of the central beam. Set in the SETTING mode for angled PT.

- Amplification, dB – amplification level in the channel.

In the signal representation field besides the A-Scan, the grid, the horizontal scale, the strobe (single or multi), the cursor, if it is turned on, and the marker are shown. The cursor and the maker are redrawn when measuring results are renewed.

NOTE:

1 A-Scan is always rectified and filled.

2 Strobe cannot be turned off.

3 Monitor actuation is always on the maximum in the strobe.

4 When TCG is on, the TCG curve isn`t shown on the A-Scan, it can be seen only in the TCG editor in the SETTING mode.
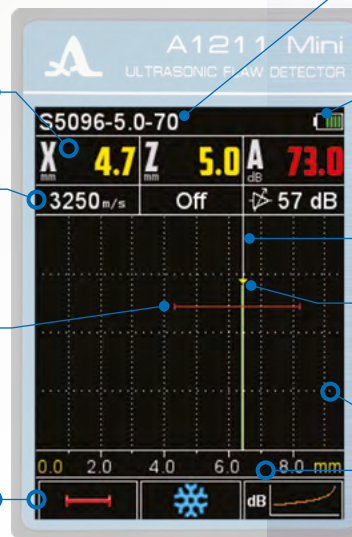
Figure 46

Figure 47

Figure 45

- Measurements result panel
- Additional information field
- Strobe
- Pictogram menu
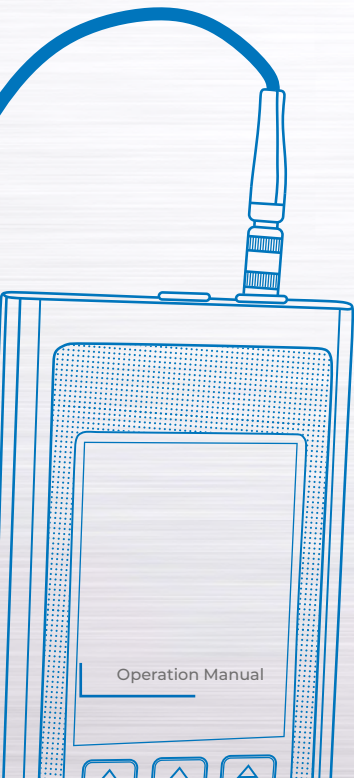- Current configuration name
- Battery level
- Measuring cursor
- Amplitude marker
- Signal representation field
- Scale sweep

The scale sweep of the instrument is switched between microseconds and millimeters of depth. The selected figures are shown in the first two blocks of the measurements panel.

The field with icons is situated in the bottom. Every icon is controlled by the corresponding key on the panel of the instrument, key functions and appropriate icons are shown in the FLAW DETECTOR mode:

- F1 ( ) controlling the strobe;
- F2 ( ) enter the STOP mode;
- F3 ( ) turning on / off TCG;

The key functions in the FLAW DETECTOR mode are described in the Table 6.

Table 6

Key	Description	
	Vertical screen	**Horizontal screen**
− +	Changing the sweep length	
↑ ↓	Changing the amplification value	Moving the sweep in a conforming direction
← →	Moving the sweep in a conforming direction	Changing the amplification value
↵	Calling the confirmation window and setting the value, corresponding to the amplitude of the signal / turning off the reference level	
🔧	Entering the SETTING mode	
⏻	Turning on / off the instrument	

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2.3.2.1 Functions of the controlling icons

F1 (First strobe)

The strobe is used for setting the control area, apprehensibility level and monitor actuation, measuring the flaw coordinates and signal amplitudes from the reflectors in the interested interval.

When the signal exceeds the strobe level, the cursor is automatically placed to the maximum point, corresponding cursor parameters are indicated on the screen, and sound indication is done (monitor actuates).

In case the strobe is situated beyond the range shown on the screen, near the border of the range a pointer is shown, indicating the level of the strobe.

NOTE: When signal amplitude exceeds the strobe situated beyond the screen range the monitor is turned on, but the cursor and the marker are not displayed!

The strobe has two modes: single layer and multi layer strobe. The multi layer strobe allows setting three sensitivity layers: acceptance, reporting and examination (Figure 48).

Figure 48

The key functions when icon ◄▬▬► is active, are described in the Table 7.

Table 7

Key	Description	
	Vertical screen	**Horizontal screen**
[−] [+]	Changing the strobe length relative to its left side	
[↑] [↓]	Moving the strobe vertically. When multi strobe is moved vertically, the reporting level is moved, the testing and acceptance levels are moved relatively to the reporting level according to the settings	Moving the strobe horizontally
[←] [→]	Moving the strobe horizontally	Moving the strobe vertically. When the multi strobe is moved vertically, the reporting level is moved, the testing and acceptance levels are moved relatively to the reporting level according to the settings
[🔧]	Entering the SETTING mode	
[⏻]	Turning on / off the instrument	

On the results panel (Figure 49) are displayed:
- In the first: coordinate of the strobe beginning;
- In the second: coordinate the strobe end;
- In the third: the level of the strobe.

Figure 49

F2 (STOP mode)

Upon pressing F2 (❄) you enter the A-Scan saving and viewing the mode (Figure 50).

Active keys:

F1 (💾) save A-Scans;

F2 (❄) exit STOP mode;

F3 (📁) go to viewing the saved A-Scans.

When there are no saved A-Scans the icon looks as followings 📁 .

NOTE: AFTER SWITCHING TO THE VIEWING MODE YOU CAN NOT SAVE THE CURRENT A-SCAN!

The key functions in the STOP mode are described in the Table 8.

Table 8

Key	Description
− +	Changing the strobe length relative to its left side

Pressing F1 the instrument enters name editing mode of a new A-Scan (Figure 51).

By default the name is formed from the word "Frame" and a number after it.

The image can be given any name. The name editing mode fully corresponds to the configurations name editor.

Figure 50
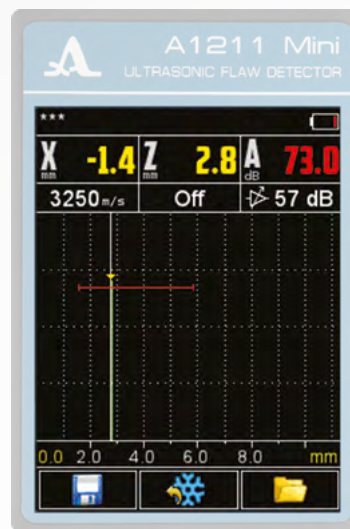
Figure 51

Upon pressing F3 the instrument enters viewing and deleting mode of the saved A-Scans (Figure 52). In the upper line the automatically formed number and the name are shown.

Active keys:

F1 (   ) to the previous A-Scan;

F2 (   ) exit the viewing mode;

F3 (   ) to the next A-Scan.

The key functions in the viewing mode are described in the Table 9.

Table 9

Key	Description	
	Vertical screen	**Horizontal screen**
⬅️ ➡️	Switching to the first / last A-Scan	No functions
⬆️ ⬇️	No functions	Switching to the first / last A-Scan
↵	Deleting the current A-Scan	
⏻	Turning on / off the instrument	

Upon pressing ↵ the confirmation window opens (Figure 53).

Active keys:

F1 (   ) confirm deleting;

F3 (   ) deny deleting.

F3 (Turning on / off TCG)

dB ✕ TCG curve is off;

dB TCG curve is on.

Figure 52

Figure 53

Technical maintenance of the instrument consists of cleaning the electronic unit from dust and dirt and charging the battery.

3.1 BATTERY

The battery unit is designed to operate over a wide temperature range. At negative temperatures, the battery capacity is reduced because at a lower temperature range the capacity is reduced by about 15% comparing to normal temperatures.

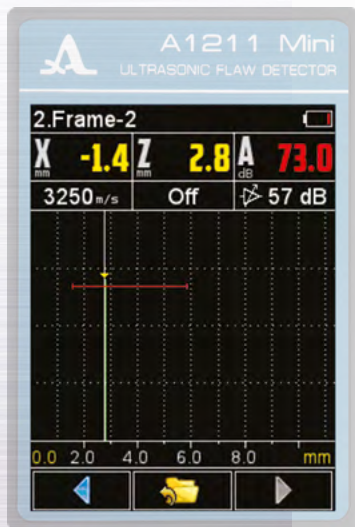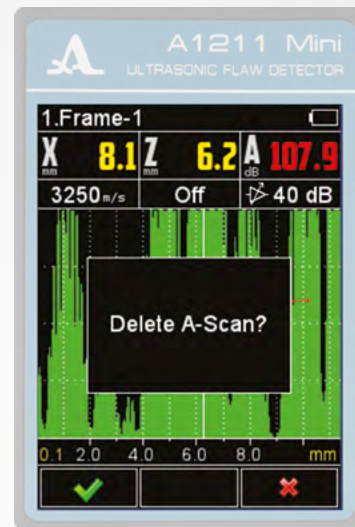When the battery is discharged the instrument turns off automatically.

The battery has a recharge, high temperature and voltage protection.

The service life of the battery is made to cover the whole warranty period of the instrument.

The battery can only be changed by service centers.

ATTENTION: CHANGING THE BATTERY ON ONE`S OWN LEADS TO THE LOSS OF THE WARANTY!

3.2 CHARGING THE BATTERY

Charging the battery can be done via an external charger or from a PC using a USB.

The battery charging time depends on the degree of discharge. The full charging time is 4 5 hours. The repeated charging is acceptable.

When charging the instrument is operable, but the charging time will increase by 2 to 3 times.

ATTENTION: TO AVOID THE BATTERY FAILURE NEVER STORE THE INSTRUMENT WITH BATTERY DISCHARGED.

3.3 MALFUNCTIONS

In case of any malfunctions or any questions on the instrument operation, please, contact the company representatives by phones indicated in the instrument data sheet.

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The instrument should be shelf stored.

The instruments shall be placed in warehouses providing 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 instrument shall be at least 0.5 m.

Avoid any conductive dust, corrosive gas and vapor admixture causing material corrosion in the storage area.

STORAGE

5
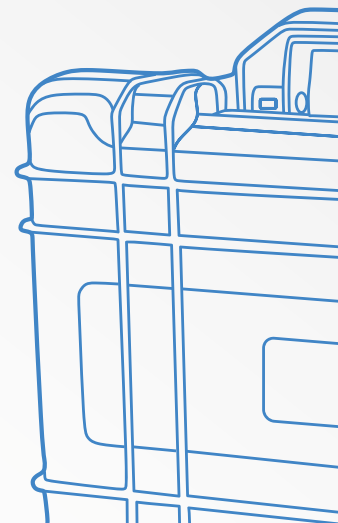
The instrument should be transported in the transportation bag provided.

The packaged instruments can be transported in any vehicles at any distances without speed limitation.

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

The instrument transportation conditions should meet the requirements of specifications and standards corresponding for each type of transport.

During delivery by air the packed instruments should be placed in the pressurized and heated compartments.

After transportation at the temperatures deviating from operation conditions, prior to the instrument operation leave it at ambient environmental conditions at least for two hours.

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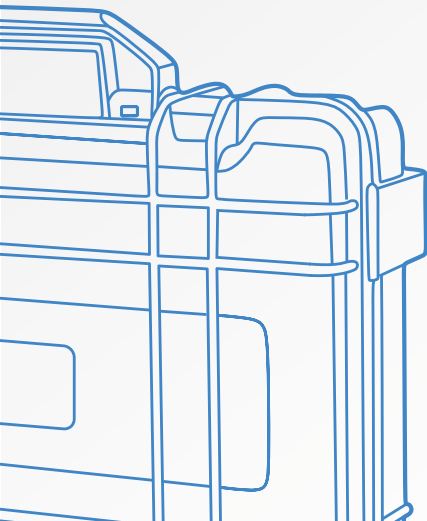
Recommended literature on ultrasonic tests

1. Non-destructive tests and diagnostics: The manual edited by V.V. Kliuev
2. Non-destructive testing. Handbook. V.3. Ultrasonic Testing. Yermolov I.N., Lange Y.V.
3. Ultrasonic Testing: Tutorial for first and second qualification levels experts / Yermolov I.N., Yermolov M.I.N.
4. Technology of ultrasonic testing of welded joints / V.G. Scherbinsky
5. Ultrasonic flaw detection in mechanical engineering: Tutorial /Y.F.Kretov

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APPENDIX A (reference)

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ULTRASONIC THICKNESS GAUGE

A1211 MINI

OPERATION MANUAL

Revision: March 2019