ULTRASONIC
FLAW DETECTOR

A1212
MASTER

OPERATION MANUAL

Acoustic Control Systems – ACS Group
Saarbrücken, Germany 2019


ACS

CONTENTS

ACOUSTIC CONTROL SYSTEMS

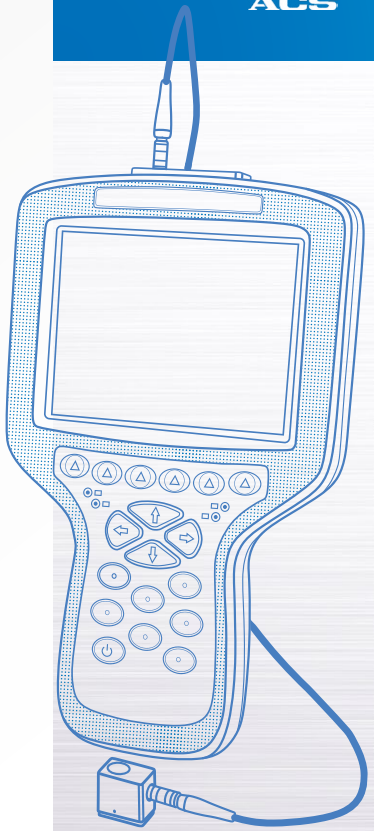
The current operation manual (hereinafter referred to as “Operation Manual”) includes information on the technical specifications, design and operation of the A1212 MASTER Ultrasonic Flaw Detectors (hereinafter referred to as “flaw detector” or “instrument”) and their operation principle, as well as information on the proper use of the instrument.

Please carefully read the operation manual prior to starting to work with the device.

Only properly trained personnel who carefully read the operation manual, and knows the general principles of the theory of ultrasonic vibrations should be allowed to work with the device.

For proper ultrasonic testing the following preparatory works shall be performed: the control tasks shall be defined, the testing schemes and the transducer shall be selected, and the inspection conditions of the given materials shall be evaluated and etc.

During the production of the instrument some modifications can be introduced to it due to the constant improvement of its reliability and serviceability. They do not affect the technical specifications of the instrument. Some of the modifications may not be described in current revision of the Operation Manual.



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1.1 INTENDED USE

1.1.1 Intended use and area of application

The instrument is a portable general-purpose ultrasonic device.

The instrument is designed for searching, evaluation and localization of various discontinuities, defects and irregularities in different objects made of metal and plastic.

The flaw detector allows generation, registration and recording of time realizations of pulse ultrasonic signals in its memory.

A color TFT display indicates the ultrasonic signals in form of A-Scans. The instrument provides both manual and automatic measurement of time intervals, signal amplitudes as well as automatic determination of locations of the flaws.

1.1.2 Operating conditions

The instrument is designed to operate under the following conditions:

- temperature from - 30 to +55 °C;
- relative air humidity up to 95 % at + 35 °C upper temperature limit.

1.2 TECHNICAL SPECIFICATIONS

1.2.1 Main parameters of the device

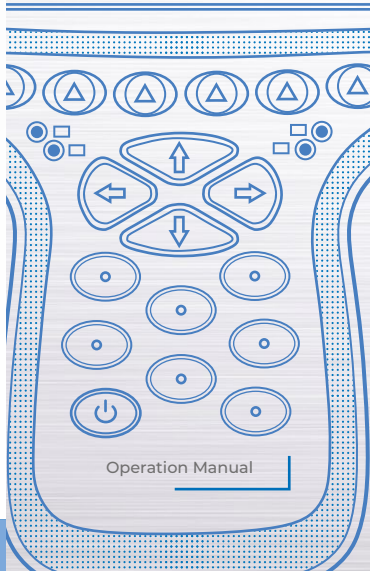
The main technical specifications of the instrument are presented in the Table 1.

Table 1

Name of the parameter	Value
Ultrasonic reconstruction range	from 500 to 14,999 m/s
Operating frequencies of transducers	from 0.5 to 15.0 MHz
Tuning range of amplification (gain) of the receiving transducer (gain regulation range)	from 0 to 100 dB
Gain deviation	±1.0 dB
Measurement range of the time intervals at frequency 2.5 MHz	from 0 to 1 900 μs
Limits of permissible absolute measurement errors of the time intervals, where $T_{meas.}$ – measured value of time interval	$\pm(0.1+0.0001 \cdot T_{meas.})$

Table 1

Parameter	Value
Measurement range of the depth of the flaw location (steel) with straight beam transducers: transducer S3568 2.5A0D10CL transducer D1771 4.0A0D12CL	 from 7 to 6,000 mm from 2 to 3,000 mm
Limits of permissible absolute measurement error of the depth of the flaw location (steel) with the straight beam transducers, where H is the measured depth of the flaw location in mm	±(0.02·H+1.00)
Measurement ranges of the flaw locations (steel) with angle beam transducers: transducer S5182 2.5A65D12CS transducer S5096 5.0A70D6CS	 from 2 to 1,300 mm from 2 to 500 mm
Limits of permissible absolute measurement errors 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	 ±(0.03·H+1.00) ±(0.03·L+1.00)
Power supply specifications	
Power supply source	battery
Rated supply voltage of the battery unit	11.1V
Period of continuous operation of the instrument powered from the battery under normal climatic conditions, min.	9.0 hours
Overall dimensions of the electronic unit	260×157×43 mm
Maximum weight of the electronic unit	0.8
Mean time between failures	18 000 hours
Average service life, min.	5 years
Operating conditions: – air temperature – relative air humidity at 35°C, max.	 from – 30 to 55 °C 95%



1.3 DESIGN AND OPERATION

1.3.1 Design

The flaw detector includes an electronic unit to which the removable piezoelectric transducers (PTs) are connected via cables.

1.3.1.1 Electronic unit

The electronic unit provides the generation of electrical impulses for excitation of the piezoelectric transducer, amplification of the signals received from the PT. The electronic unit generates and processes measurement results and provides their display in digitalized form, records data into nonvolatile instrument's memory and allows their transfer to the external PC.

The external design of the electronic unit is presented in the Figure 1.

The instrument is controlled by means of a membrane keyboard. The display and LEDs on the housing of the device indicate the signals, measurement results and state of the instrument.

The PT is connected via coaxial cables (included in the delivery kit) by means of the LEMO connectors.

The instrument is powered from the battery unit or a power adaptor included in the delivery kit.

Figure 1

1.3.1.2 Power adapter

The power adapter provides external power supply of the instrument and charging of the battery unit from AC mains (15 V).

The charge time depends on the depletion of the accumulator unit; it can last up to 3 hours. The instrument can be operated during charging of the battery.

Always connect the cable of the power adapter to the electronic unit first, then connect the network cable to the power adapter, and then connect the network cable to the AC mains to prevent damage of the instrument.

1.3.2 Transducers

The flaw detector is designed to operate with single crystal and double-crystal PTs with operating frequencies from 0.5 to 15.0 MHz.

Two cable types are used with the instrument depending on the type of the transducer. Hence, two connection ways of the PT exist:

Single crystal transducers (S type) shall be connected via LEMO-LEMO single cable to the unmarked connector (Figure 2).

Double-crystal transducers (D type) shall be connected via LEMO-LEMO double cable. The connector marked with a red dot is used for connection of the transmitting piezoelectric element, and the unmarked connector for the receiving piezoelectric element (Figure 3).

1.3.3 Interface

The instrument has an intuitive interface. The content-addressable icon menu in different modes, names and schematic indications of the keys allow quick understanding of instrument operation.

The display continuously indicates all information required for on-line inspection.

The library of configurations facilitates work with the instrument. The user can assign a unique name to each configuration. Consequently, the user can adjust the instrument to be operated under different conditions and for inspection of various objects in a good time. Then the only recourse the user has is to select the configuration from the list.

All settings of the device shall be saved if the instrument is switched off, stored without the battery unit or if the battery unit goes dead.

1.3.4 Operation modes

The main operation modes of the instrument are as follows: FLAW DETECTOR, provided additionally are STOP and SETTINGS modes.

In the operating mode the instrument generates the sounding impulses, amplifies the received echo signals and displays them, as well as performs measurements.

In the STOP mode the user can stop (freeze) the signal realizations (snapshots) displayed on the screen, record them into the memory, as well as view and delete saved snapshots.

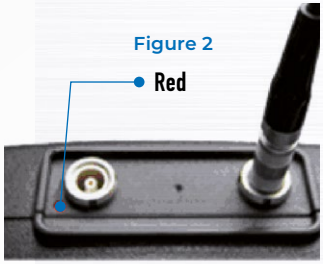


Figure 2

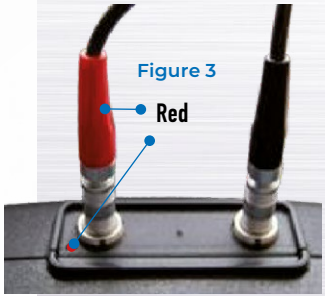


Figure 3

In the SETTING mode the user can select and configure the parameters of the instrument settings. Always start working with a new testing object in this mode.

1.3.5 Display of information on the screen

A color TFT display (640x480) indicates the measurement results and service information required to control the instrument.

The workspace of the screen is divided into several functional areas in each mode. In the Figure 4 the display in the FLAW DETECTOR operating mode is shown.

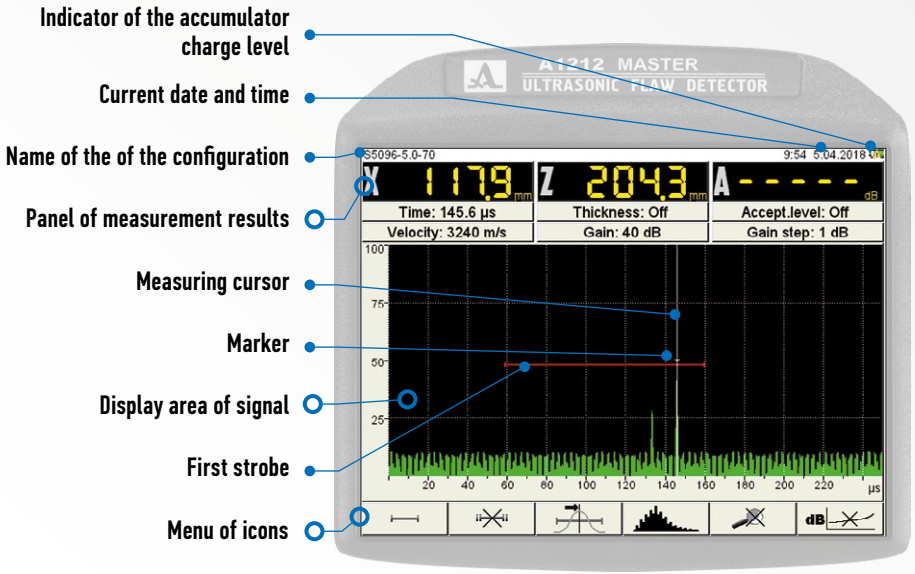


Figure 4

1.3.6 Keyboard

The keyboard is presented in the Figure 5.

The green LED ON informs the user that the flaw detector is switched On.

The below-located LED indicates the battery charging. The yellow light indicates that charging process is going on; the green light indicates that charging is completed.

Two red indicators show actuation of the automatic defect signalization function (AFAS) for the first and the second strobe correspondingly.

The keys bear characters describing their main functions. English symbol names of the keys are used for unification of the design and operating documentation on the instrument provided that it could be used in various countries.

The user controls the main functions and parameters by means of the icon selection keys, the functional keys (F), located just below the screen. The corresponding information icon is provided above each key.

The user selects active parameters and adjusts them by means of the keys of the control keypad. Their operating process is similar for different operating modes of the instrument in order to provide intuitive learning of the user. In other words, symbols on these keys describe the principle of the action carried out.

Some keys allow working in the auto repeat mode with acceleration provided that the key is being pressed and hold for longer than 1 second.

A brief description of the keys in the main modes is presented in the Table 2

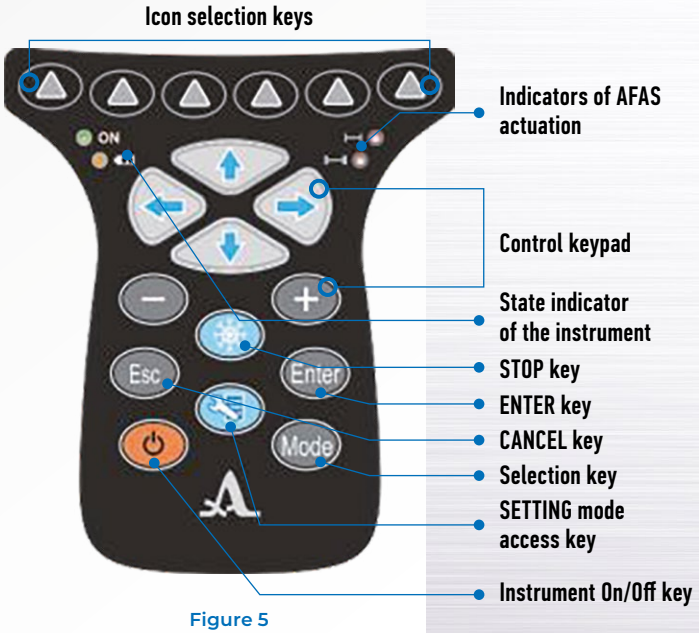


Figure 5

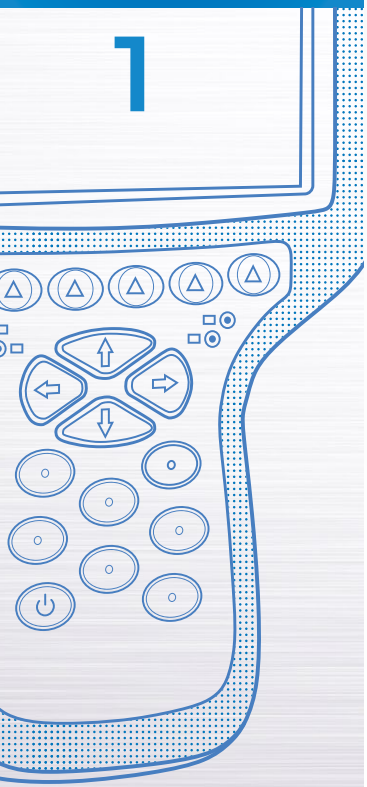


Table 2

Key	Key functions in the modes	
	FLAW DETECTOR	SETTINGS
	Turning On/Off the instrument. Press and hold the key for at least 0.5 s	
	Enter the SETTING mode	Exit the SETTING mode
Mode	Inactive	
	Cursor movement	Edit value of the active parameter
Esc	Cancel the operation	
	Change the length of the sweep (horizontal arrows)	Select the parameter for configuring (vertical arrows)
	Change the amplifier (gain) value (vertical arrows)	
	Enter the STOP mode	Delete the configuration
Enter	Switch On/Off the reference level	Start configuration of the parameters marked with the ▶ sign. Start memory cleaning procedure in the process of editing of the system parameters
	Icon selection and control keys	

1.3.7 Working with icons

Content-addressable icon menu is a characteristic property of the interface. The icons are located in six rectangular windows at the bottom of the screen. The icons represent symbols associated with a tested object or property. Each mode has its own icon set.

The icons can be either in passive or active state. Active state allows configuration of those instrument settings/parameters which correspond to the active icon.

Note: Further as the text goes a conventional numbering of the icon windows and corresponding functional keys is used from left to right – from 1 to 6 (Figure 6).

Figure 6

2

INTENDED USE

2.1 OPERATING LIMITATIONS

The instrument is designed to be operated under conditions specified in the section 1.1.2.

2.2 PREPARING THE DEVICE FOR USE

The protection glass against cracks during manufacturing and transportation is protected with a polyethylene film. Remove the polyethylene film prior to work with the instrument so that to see brighter images rich in contrast.

Figure 7

2.2.1 Turning the device on/off

2.2.1.1 Turning on

To turn ON the instrument, press the key. At that the state indicator of the instrument will light green. In a few seconds the screen will display a start-up window with the name, firmware version and a corporate logo of the ACS (Figure 7). In the next in 5 to 10 seconds the instrument will automatically enter the mode being active before it was switched off, al the corresponding settings are saved.

2.2.1.2 Turning off

To turn OFF the instrument, press the key.

ATTENTION: THE INSTRUMENT WILL AUTOMATICALLY SWITCH OFF AFTER TIME PERIOD SET IN THE SYSTEM SETTINGS EXPIRES, IF NO KEY IS PRESSED AND NO MEASUREMENT IS PERFORMED!

2.2.2 Selecting the transducer

The testing is performed using the flaw detector as followings:

echo, echo-mirror, mirror-through-transmission (echo-shadow) and through-transmission. Different transducers are used in the instrument to realize these inspection methods: straight beam, angle beam, single crystal and double-crystal PTs with operating frequencies from 0.5 to 15.0 MHz.used;

Straight beam single crystal PTs are used for non-destructive inspection and thickness measurement of the objects of big thickness.

The maximum testing depth depends on the operational frequency of the transducer, diameter of its working surface and attenuation of ultrasonic waves in the material of the tested object. The dead area at that is defined by damping the quality of the ultrasonic transducer.

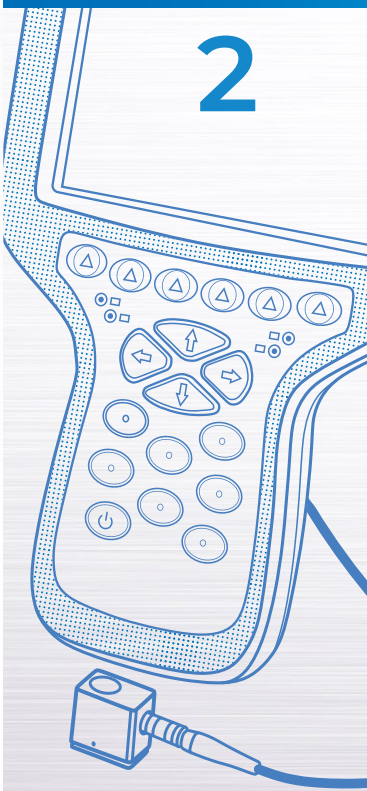
Straight beam single crystal PTs provide high wear resistance due to ceramic protector. These transducers are well suited for thickness measurement of the objects made of polymer materials due to their electroacoustic properties.

Straight beam double-crystal PTs are used for inspection of objects of moderate thickness with greatest possible sensitivity. Typically, these transducers are used to inspect thicknesses from 0.8 to 50.0 mm.

Angle beam PTs are used for non-destructive testing of the objects and their segments at the spots with no access to the surface above the inspection area.

Angle beam transducers with an angle of incident from 400 to 900 and operational frequency from 1 to 5 MHz can be as well used depending on the geometrical dimensions of the object, the most probable position and direction of the flaw, acoustic properties of the material and testing procedure.

Table 3 contains general recommendations for choosing values of frequency, angle of incident and other parameters of the angle beam transducers used for testing of the carbon steel welding seams of various thicknesses.



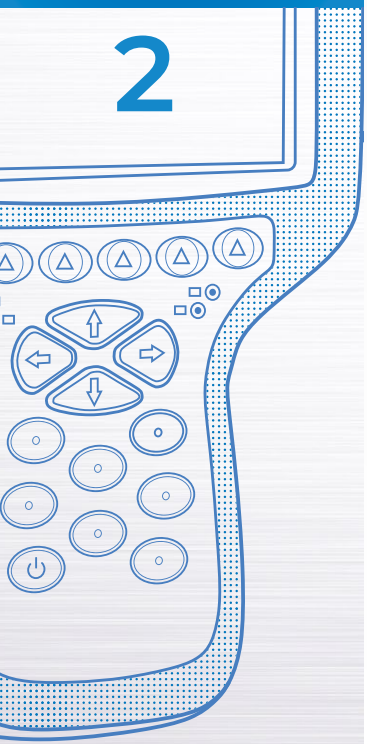


Table 3

Thickness of the seam, mm	Frequency, MHz	Maximum size of the piezoelectric-crystal plate, mm	Minimum X-value, mm	Angle of incident, 0 during inspection	
				direct beam	reflected beam
4 – 8	5	6	5	70	70
8 – 12	2.5; 5	8 – 12	8	65; 70	65; 70
12 – 20	2.5	8 – 12	12	65	65
20 – 40	2.5	12	12	65	50
40 – 70	1.8	18	22	50	40
70 – 120	1.8	18	22	50	

Detailed guidelines of selection of the ultrasonic transducers are described in specific methods, documents and other guidance materials on the ultrasonic non-destructive testing of the objects, see Appendix A.

2.3 OPERATING MODES

2.3.1 SETTING mode

The SETTING mode is used for correction and adjustment of the parameters. The main screen of the SETTING mode is presented in the Figure 8. An active icon is always presented in the icons menu.

A list of configurations is contained in the left column list; names of the parameters and their values are contained on the right.

Press the → key for editing of the parameter values.

Functions of the icons in the SETTINGS mode are presented in the Table 4

Table 4

Key	Icon	Description
F1		Adjustment of PT's parameters
F2		Adjustment of signal parameters
F3		Adjustment of parameters of the tested object
F4		Adjustment of the amplitude correction parameters
F5		Adjustment of imaging parameters
F6		Adjustment of the system settings

The functions of the keys applicable for parameter editing are presented in the Table 5.

Table 5

Key	Description
	Line-by-line scrolling to select the parameter to be edited
	Change the parameter value
	Exit the editing mode of parameters
	Exit the SETTING mode
Enter	Activate/deactivate some parameters. Start adjustment of the parameters marked with the "▶" sign

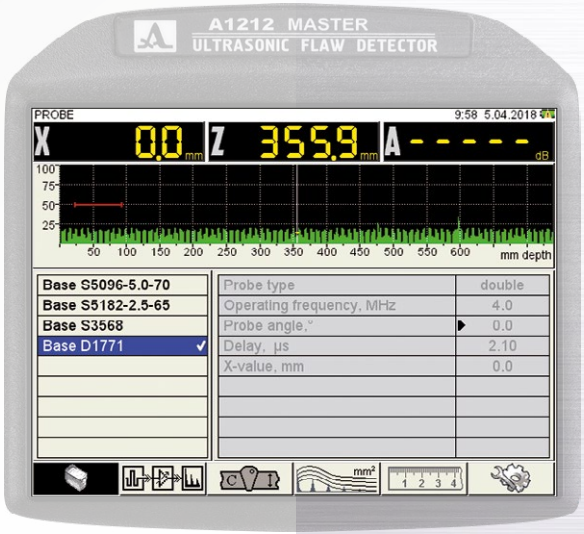
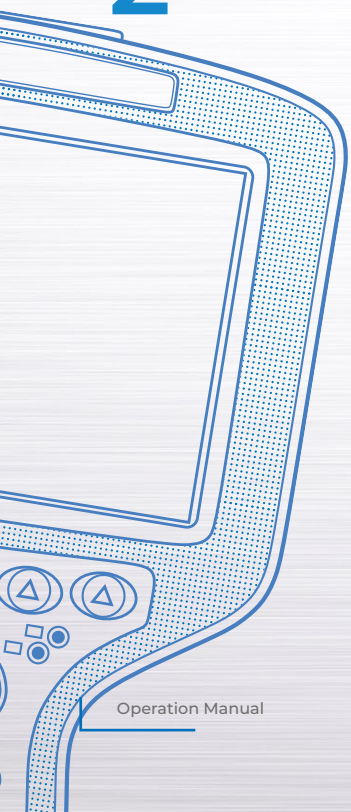


Figure 8



2.3.1.1 Parameters of PT

In the figure 8 the screen of the instrument when setting the parameters of PT is shown.
Names of the parameters of PT and their permissible values are presented in the Table 6.

Table 6

Parameter name	Value	Description
Type of PT	single-crystal / double-crystal	Selecting the type of PT being used: single-crystal; double-crystal
Operating frequency, MHz	0.5 / 0.8 / 1.0 / 1.25 / 1.5 / 1.8 / 2.0 /2.25 /2.5 /3.5 / 4.0 / 5.0 / 6.0 / 7.5 / 10.0 / 15.0	Frequency of the PT shall be selected depending on the properties of the material
Angle of incident, ˚	from 0.0 to 90.0 with step 0.5	Setting an angle of incident of the PT. If zero value is set, then the THICKNESS (section 0) parameter value of the tested object will be automatically set into OFF state. Press the Enter key to start calibration with the V2/25 sample
Delay, μs	from 0.00 to 100.00 with step 0.01	Setting the delay value in the PT's prism
X-value, mm	from 0.0 to 50.0 with step 0.1	Setting an X-value of the PT

Automatic calibration of the angle beam PT

A refractive prism is being deteriorated while the angle beam transducer is in operation. Consequently, the angle of incident and signal delay in the PT's prism change. An automatic calibration procedure with the V2/25 sample is provided for on-line correction of the angle of incident.

The calibration consists of two stages: determination of the delay in the PT's prism and calculation of the angle of incident of the PT.

Note: do not severely offset the PT relative to the guidelines of the corresponding angle to prevent false measurement results.

Prior to entering the calibration mode always set the certified value of the angle of incident of the transducer.

Do the following to calibrate with the V2/25 sample:

- select the "Angle of incident" parameter line and press the Enter key;
- to determine the delay in the transducer's prism, scan the radial part (R50) of the V2/25 sample on the side of the longer edge (Figure 9); receive the time envelope of the signals (Figure 10) and press the Enter key;
- scan the hole in the sample (Figure 11), get the time envelope of the signals (Figure 12) and press the key Enter;

Figure 9

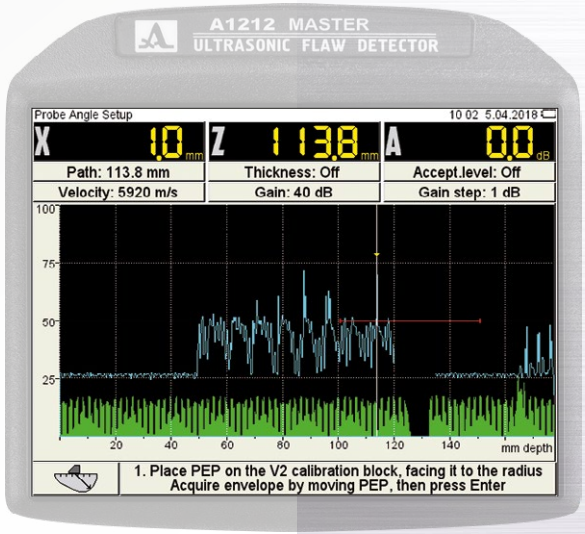
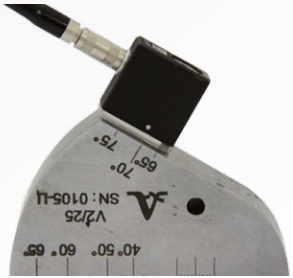


Figure 10

Figure 11

Angle of the PT being calibrated is less than or equal to 62°



Angle of the PT being calibrated is more than 62°

Note: If an angle of the PT being calibrated is less than or equal to 620., the scanning of the hole shall be performed by the large contact surface of the V2/25 sample. If the angles exceed 620, the scanning shall be performed by the small contact surface of the V2/25 sample. At that by means of the amplifier make the envelope to exceed the strobe though do not go off the top edge of the screen.

- to accept the calibration results press Enter or to cancel them press Esc (Figure 13).

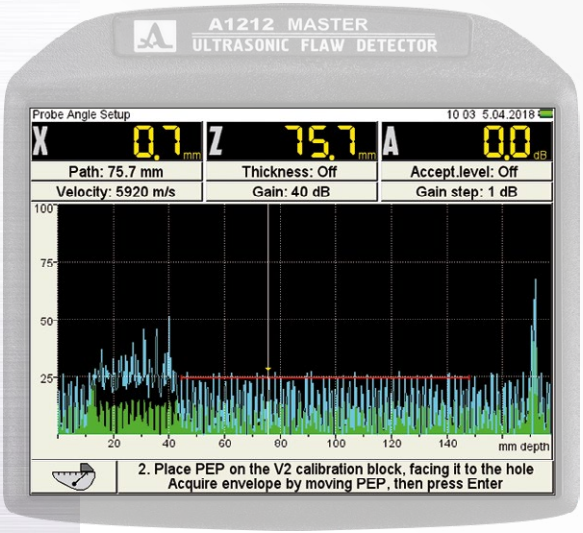


Figure 12

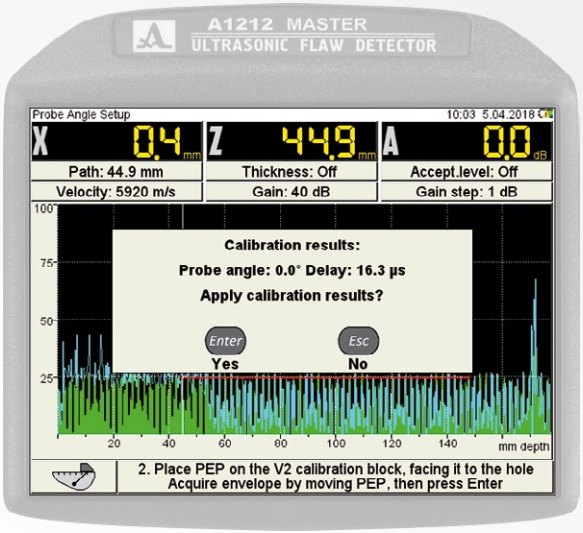


Figure 13

2.3.1.2 Parameters of the signal

The screen when setting the signal parameters is presented in the Figure 14.

The names of the signal parameters and their permissible values are presented in the Table 7.

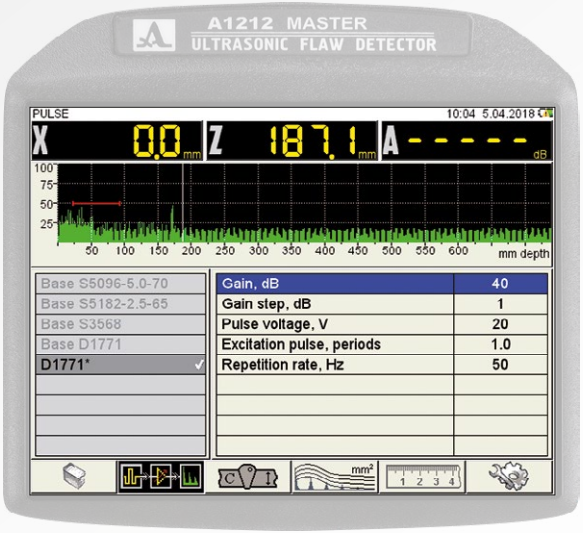


Figure 14

Table 7

Parameter	Value	Description
Gain, dB	from 0 to 100	Select the gain in the receive path
Gain step, dB	1 / 6 / 10	Select the gain step
Impulse, V	20 / 100 / 200	Select amplitude of the sounding impulse
Excitation impulse, period	from 0.5 to 5.0 with step 0.5	Model the sounding signal
Frequency of the snapshots, Hz	25 / 50 / 250 / 500 / 1000	Select the regularity of information visualisation on the screen

2.3.1.3 Parameters of the tested object

The screen when setting the parameters of the tested object is presented in the Figure 15. The names of the parameters of the tested object and their permissible values are presented in the Table 8.

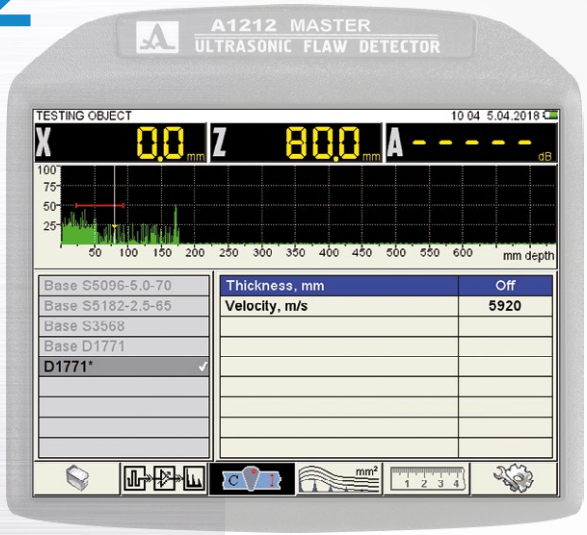


Figure 15

Table 8

Parameter name	Value	Description
Thickness, mm	Off / from 2.00 to 100.00 with step 0.01	Switching off / Setting the thickness of the tested object (if the angle beam PTs are used) allows automatic indication of the location depth of the reflector relative to the surface irrespective of which beam (direct or reflected beam) it was detected. Switches when the Enter key is pressed. The parameter value will automatically switch into OFF state if the "Angle of incident" parameter value of the PT is set to zero
Ultrasonic velocity, m/s	from 1 000 to 14 999 with step 1	Setting the ultrasonic velocity in the material of the tested object

2.3.1.4 Parameters of amplitude correction

The instrument provides three ways of the amplitude correction:
- TCG – time corrected gain (TCG);

- DGS – an amplitude distance correction. Graphical representation of dependence between the amplitude of the reflected signal and the depth of the discontinuity location considering its size.

- DAC – distance-amplitude-correction. A curve line connecting the peak values of echo-signals from similar reflectors, located at various levels of depth.

2.3.1.4.1 Configuration of amplitude correction – TCG

The instrument uses the TCG function to balance the amplitudes of the echo-signals from similar reflectors, located at various levels of depth.

The screen when setting the TCG parameters with the switched On reference level and multilevel strobe is presented in the Figure 16.

The reference sample of the material for which a size of the reference reflectors is set – the nearest and the distant (for that purpose the notches are used. The signal is detected using these notches by means of the direct or once reflected beam) is required for adjustment of TCG.

The names of the TCG parameters and their permissible values are presented in the Table 9.

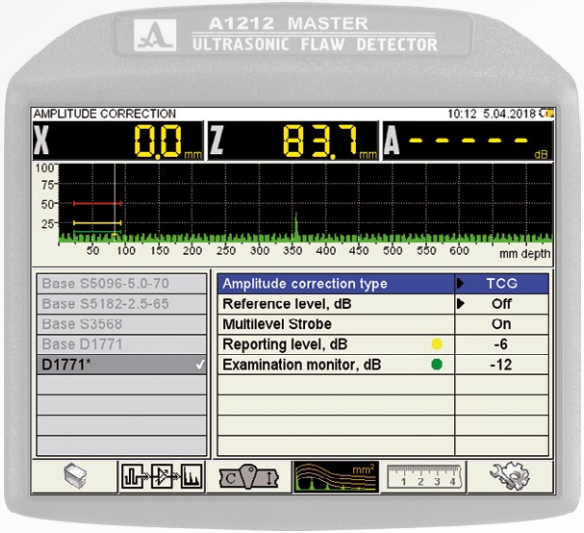


Figure 16

Table 9

Parameter name	Value	Description
Type of the amplitude correction	TCG	TCG was selected in the function of amplitude correction

Table 9

Parameter name	Value	Description
Reference level, dB	Off / from 0 to 200 with step 1	Sensitivity level being set by the signal from the reference reflector. Setting the reference level by means of the Enter key
Correction by standard, dB (if the reference level is On)	from - 40 to + 40	Difference between acceptance and reference levels (specified in the documentation). It shows how much less/more shall the acceptance level be shifted relative to the reference level
Correction for roughness, dB (if the reference level is On)	from 0 to + 12	Correction of the sensitivity level, considering the difference between roughness and undulation of the surface
Acceptance, dB (if the reference level is On)	from – 40 to + 252	Not available for manual correction. It is determined automatically as a sum of values of the reference level, sensitivity standard and correction for roughness
Multilevel strobe	On/Off	Three levels of the strobe will be displayed on the screen: search, reference and acceptance
Reference, dB	from – 12 to 0	Setting the actual sensitivity level relative to the acceptance level
Search AFAS, dB	from – 12 to 0	Setting the searched sensitivity level relative to the acceptance level

1 stage: preparing for setting

Set the sweep in the FLAW DETECTOR so that the screen displays the signals from all the flaws in the suggested inspection area.

2 stage: adjustment of the reference level

Enter the SETTING mode.

Do the following to adjust the reference level at switched On multilevel strobe:

- select the "Multilevel strobe" parameter and activate it by pressing the Enter key;
- select the "Reference level" parameter and activate it by pressing the Enter key. A configuration window of the reference level will be opened (Figure 17);

- generate the time envelope of the signal from the nearest reflector. The measuring cursor will automatically go to the peak value of the signal and its value will be displayed in the result panel.

Note: During generation of the envelope false signals can appear within limits of the strobe with amplitude values exceeding the signal amplitude from the nearest reflector. To delete the false signal, relocate the strobe by means of the − + keys.

- press the Enter key. A confirmation window will be opened (Figure 18);

If the settings are confirmed, the configuration window of the reference level will be closed, and the value of the maximum amplitude of the signal will be set in the function of the reference level and will correspond to red level of the strobe.

Note: If values of the "Correction by standard" and "Correction for roughness" parameters are other than zero, then their values will be considered during calculation of the red (acceptance) level, and all three levels will be shifted by the correction value. At high correction values the red level can go beyond the 50 80 % range of the screen. If so, exit the SETTINGS-mode and edit the position of the red strobe level.

To exit the configuration window without change of the reference level value, press the Esc key.

Adjustment of the reference level at **switched off** multilevel strobe shall be performed in the same manner.

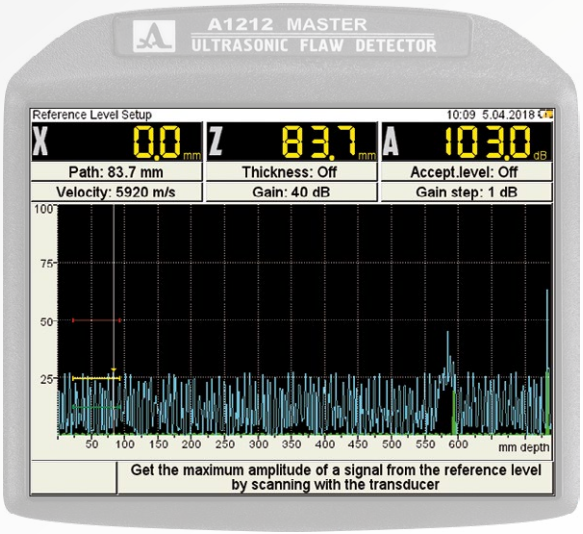


Figure 17

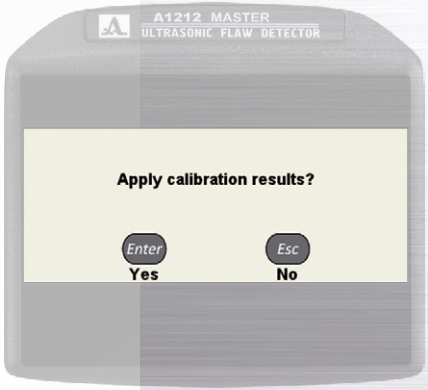
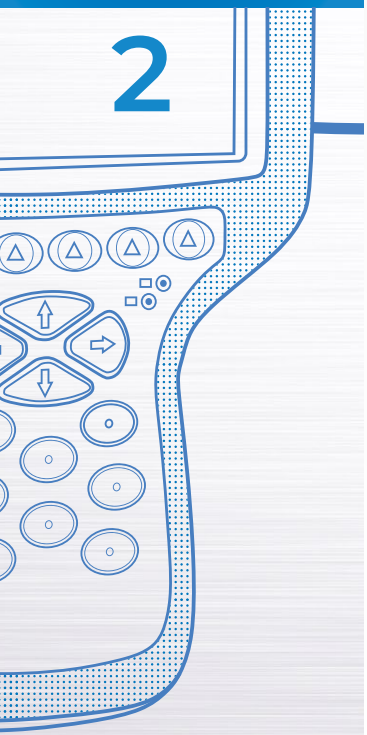


Figure 18



But since a single-level strobe is used in this case, then only one sensitivity level can be set. E.g., acceptance. At that the second strobe can be used to set the reporting level; and the search level shall be set by increasing the amplification.

Note:if the reference level is On, then the level of the strobe will be changed at changing the amplification value.

3 stage: TCG configuration

Do the following to configure the TCG:

- press the Enter key to enter the TCG settings;

Note: the strobe is centered on the screen in vertical direction. The strobe can be moved in horizontal direction; its size is editable.

- find the maximal signal from the first reference reflector and adjust the amplification and position of the strobe consequently, so that to make the signal to cross the strobe and to make the cursor to measure this the signal;
- automatically generated envelope of the signal will remember the level of the signal. To "reset" the envelope, change the amplification by pressing the or key;
- measuring cursor will be automatically set to the maximum;
- create an anchor point by means of the key.

Note: an anchor point moves in vertical direction when the amplification (gain) is changed.

- repeat the creation procedure of the anchor point for the distant reflector.
- if the sample has more than two reference reflectors, then create anchor points from each of them using the above-described algorithm.

To delete the anchor point, press the key F6.

Note: Several anchor points will be deleted according to their creation sequence.

- press the Enter key.
- confirm or cancel the received TCG curve.

To save the settings, press the Enter key. Press the Enter key to exit the configuration window not saving the settings.

The following will appear on the display upon exiting the SETTING mode after TCG is adjusted.

The functions of the keys applicable for TCG configuration are presented in the Table 10.

Table 10

Key	Description
	Change gain (amplification)
	Change the length of the strobe with reference to its left boundary
	Move the strobe to the left/right
	Add the anchor point in the cursor position
F6 	Delete the anchor point
	Confirm new TCG settings
	Exit the TCG settings mode

2.3.1.4.2 Adjustment of amplitude correction DGS

The instrument is equipped with an option of generation of the specific DGS diagrams of the single-crystal transducers.

DGS diagrams are designed to adjust the sensitivity of the device during testing and for automatic calculation of the equivalent area of the flaw.

The screen when setting the DGS parameters is presented in the Figure 19.

The names of the DGS parameters and their permissible values are presented in the Table 11.

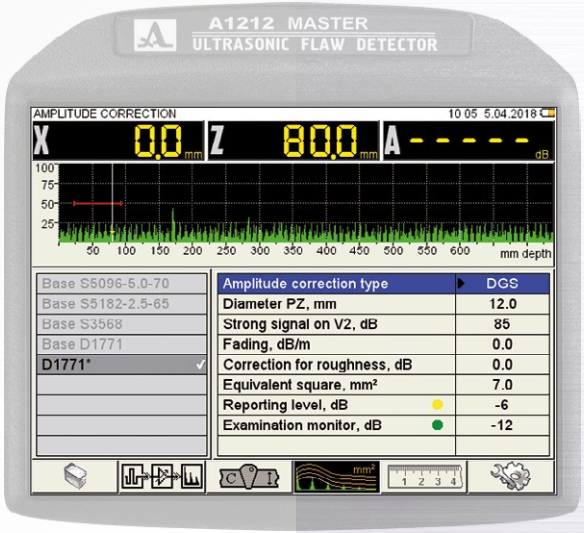


Figure 19

Table 11

Parameter name	Value	Description
Type of the amplitude correction	DGS	DGS was selected in the function of amplitude correction

Figure 20

Table 11

Parameter name	Value	Description
Diameter of piezoelectric element, mm	from 0.0 to 25.0 with step 0.1	Diameter of the piezoelectric element is presented in the Certificate on the PT or shall be measured independently by the user
Reference signal for V2, dB	from 0 to 200 with step 1	For **angle beam** PTs the amplitude of the signal from the cylindrical 5 mm hole in the V2/25 sample shall be determined (Figure 11): -by large contact surface, if angle of incident is less than or equal to 62°; - by small contact surface, if angle of incident exceeds 62°
		For **straight beam** PTs the amplitude of the bottom signal, when the PT is set on the side surface of the V2/25 sample, shall be determined (Figure 20)
Attenuation, dB/m	from 0.0 to 99.9 with step 0.1	Setting the attenuation coefficient in the material (specified in the ultrasonic testing guidelines)
Correction for roughness, dB	from 0.0 to + 12.0 with step 0.1	Correction for sensitivity level, considering the difference between roughness and undulation of the surface
Equivalent area, mm^2	from 0.0 to 25.0 with step 0.1	Value of acceptance equivalent area of the reference reflector determines the DGS curve of the acceptance level (specified in the ultrasonic testing guidelines)
Reference, dB 🟡	from – 12 to 0	Setting the reporting sensitivity level with reference to the acceptance level
Search AFAS, dB 🟢	from – 12 to 0	Setting the reporting sensitivity level with reference to the acceptance level

Adjustment of DGS

Do the following to adjust DGS:

- select the line with required type of DGS amplitude correction and press Enter. A DGS configuration window will be opened (Figure 21).

- install the PT onto the V2/25 sample and direct it to the hole, make the guide line of the angle of incident of the PT on the sample to coincide with the beam index of PT.

- move the PT with reference to the guide line and generate the time envelope of the signal from the hole. Adjust amplification and move the strobe on the screen so that to make the envelope to cross the strobe and be within the limits of the top edge of the screen. At that the measuring cursor will automatically go to the maximum amplitude and its value will be displayed in the result panel.

- to save the settings, press the Enter key. A confirmation window will be opened (Figure 22).

Upon pressing the key Esc the instrument exits the configuration window of DGS, and the settings will not be saved.

If parameters are set correctly, then the three DGS curves will be displayed on the screen after exiting

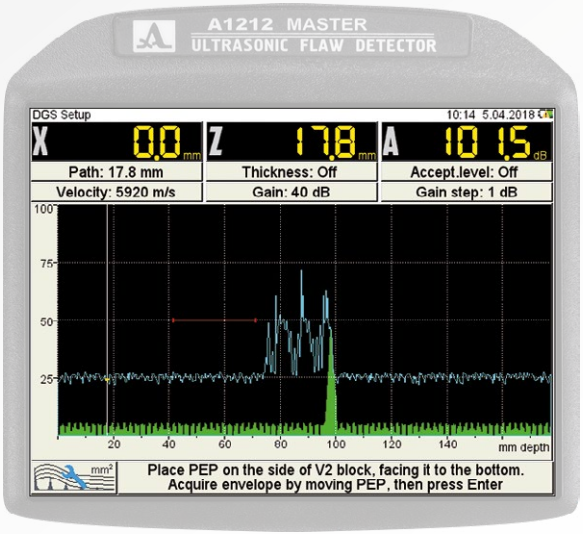


Figure 21

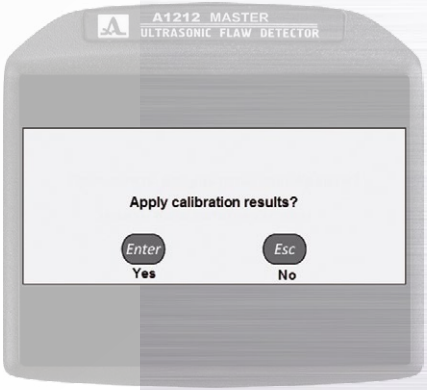


Figure 22

the SETTING mode and after calculations are made, these correspond to acceptance, reporting and search levels (Figure 23).

When the amplitude of the signal exceeds the reporting /search level of the DGS curve and the signal is in the strobe interval, AFAS will be actuated.

The displayed value of the signal amplitude (considering the sign) will be indicated with reference to the acceptance level, namely:

- "plus" sign means the signal exceeds the acceptance level by the given value;
- "minus" sign means the signal is below the acceptance level by the given value.If parameters for calculation are not correct, then an information window will appear (Figure 24) and the icon will change to  . If so, check correctness of the set parameter values.

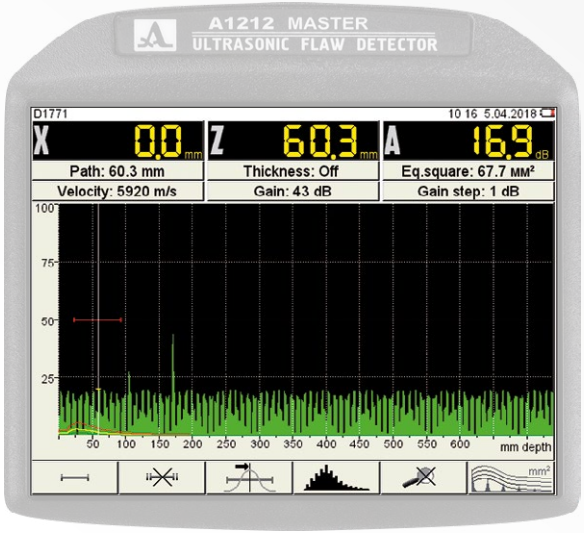


Figure 23

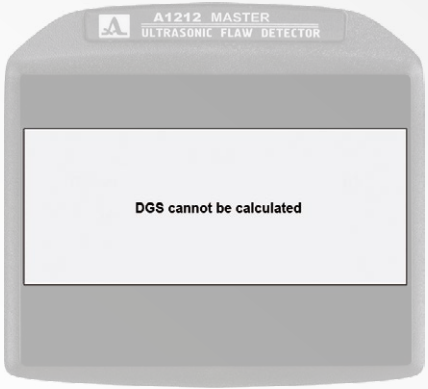


Figure 24

The following parameters are used for calculations as well: OPERATIONAL FREQUENCY, ANGLE OF INCIDENT, DELAY, and ULTRASONIC VELOCITY. If some parameter used for calculation of the DGS diagram changes, then the diagram will be automatically recalculated.

Functions of the keys applicable for DGS adjustment are presented in the Table 12.

Table 12

Key	Description
	Adjustment of gain (amplification)
	Move the strobe to the left/right
	Changes the length of the strobe with reference to its left boundary
	Exits the DGS settings mode
	Opens a confirmation window of new DGS settings

2.3.1.4.3 Adjustment of the amplitude correction – DAC

The DAC curve is used to adjust the sensitivity and estimate the size of the flaws by the amplitude.

The screen when setting the DAC parameters is presented in the Figure 25.

The names of the DAC parameters and their permissible values are presented in the Table 13.

Table 13

Parameter name	Value	Description
Type of amplitude correction	DAC	DAC was selected in the function of amplitude correction

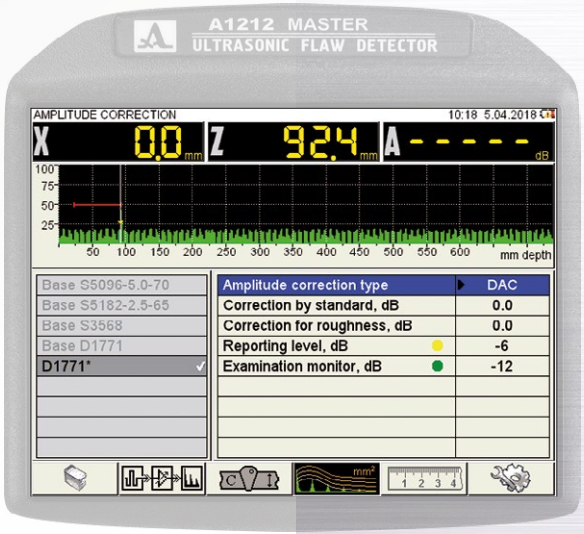


Figure 25

Table 13

Parameter name	Value	Description
Correction by standard (sensitivity standard), dB	from – 40 to +40	Difference between acceptance and reference levels (specified in the documentation). It shows how much less/more shall the acceptance level be shifted relative to the reference level
Correction for roughness, dB	from 0 to + 12	Correction for sensitivity level, considering the difference between roughness and undulation of the surface
Reference, dB 🟡	from – 12 to 0	Setting the reporting sensitivity level relative to the acceptance level
Search AFAS, dB 🟢	from – 12 to 0	Setting the search sensitivity level relative to the acceptance level

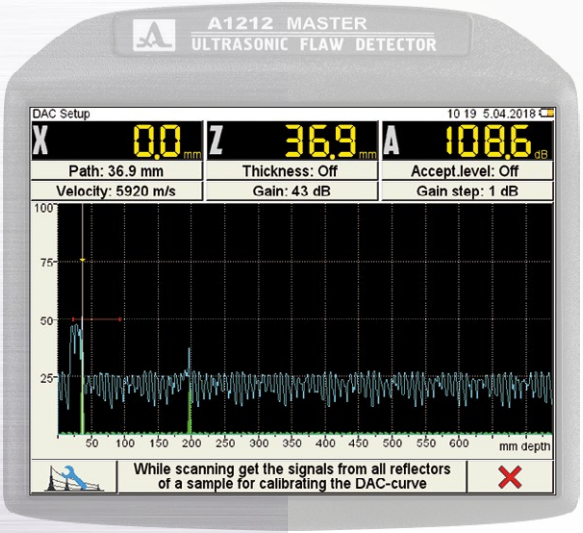


Figure 26

Adjustment of DAC

DAC adjustment procedure:

- select the line with required type of the DAC amplitude correction and press Enter. A DAC configuration window will be opened.

- find the maximum signal from the first reference reflector and adjust the position of the strobe consequently, so that to make the signal to cross the strobe and the cursor to make the cursor to measure this signal.

- press the key, at that the first anchor point will appear on the peak value of the signal (Figure 26);

- find the maximal signal from the second reference reflector and adjust it in the same manner, at that the first anchor point shall be out of the strobe field (Figure 27);

- press the key, at that the second anchor point will appear on the peak value of the signal;To delete the anchor point, press the F6 key.

Note: several anchor points will be deleted according to their creation sequence.

- create the anchor points for all reference reflectors;

- press the Enter key;

- confirm or cancel the DAC curve (Figure 28).

Press the Esc key to exit the configuration window not saving the settings.

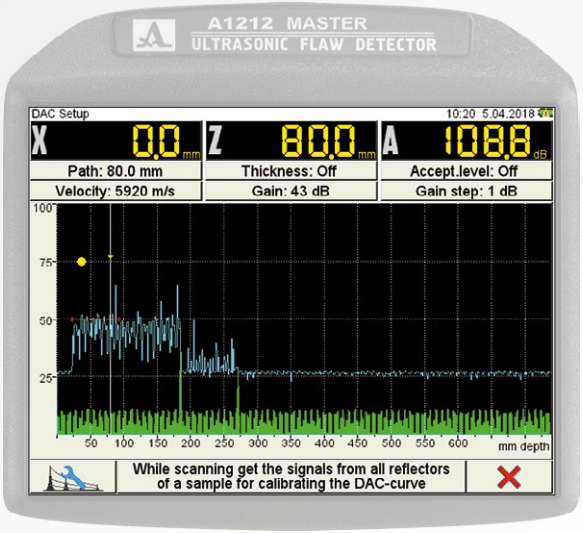


Figure 27

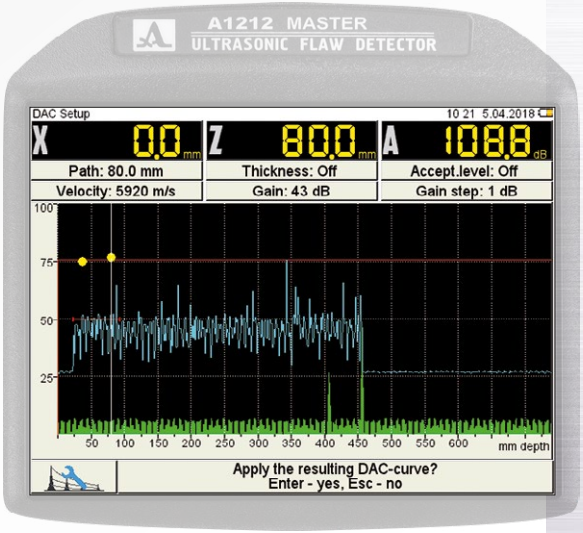
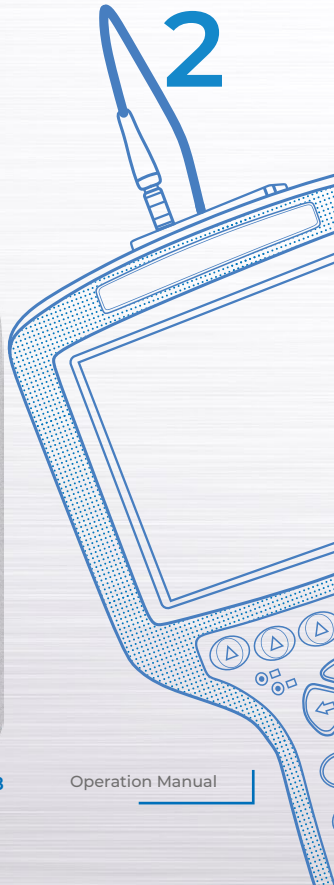


Figure 28



2

To save the settings, press the Enter key. Confirmation window of new DAC settings will be opened (Figure 29).

If new settings are confirmed, then three DAC curves will be displayed on the screen after exiting the SETTING mode, these correspond to acceptance, reporting and search levels (Figure 30).

The functions of the keys applicable for DAC adjustment are presented in the Table 14.

Figure 29

Table 14

Key	Description
	Adjustment of gain (amplification)
	Move the strobe to the left/right
	Change the length of the strobe with reference to its left boundary
	Set the anchor point
F6	Delete the anchor point
Enter	Exits the DGS settings mode
Esc	Opens a confirmation window of new DGS settings

2.3.1.5 Editing the imaging parameters

The screen when setting the imaging parameters is presented in the Figure 31.

The names of the parameters of the tested object and their permissible values are presented in the Table 15.

Table 15

Parameter name	Value	Description
Sweep scale	mm / mm depth / μs	Selects units of the horizontal scale which determine the signal display parameter

Table 15

Parameter name	Value	Description
Discreteness of the readings	0.1 / 1	Selects the displayed discreteness of the results
Cursor	On/Off	Controls the display of the measuring cursor (vertical line pointing at the place of measurement of the signal parameters) on the screen (Enter key).
Cut-off, %	Off / from 1 to 100 with step 1	Level of the cut-off when the signal is displayed on the screen. Cut-off removes the noise signals from the screen. Amplitude of these noise signals is below the selected threshold value

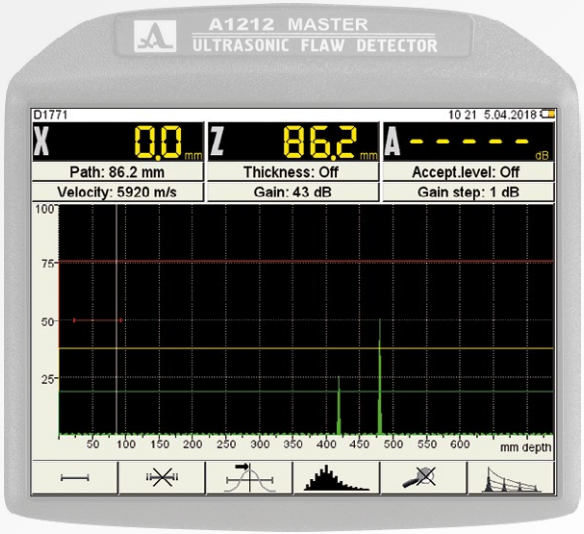


Figure 30

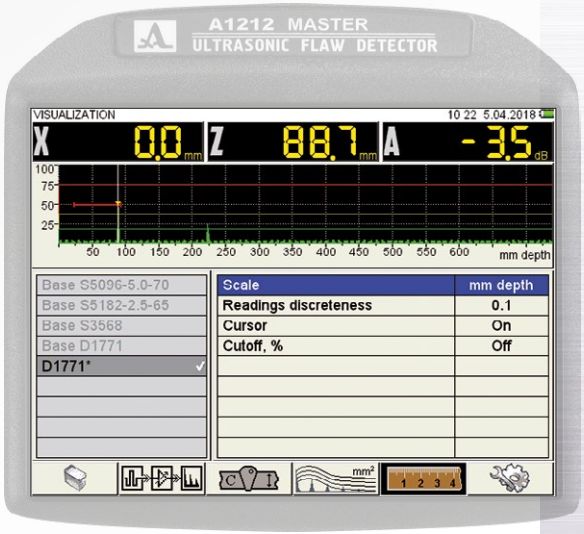


Figure 31

2.3.1.6 System instrument settings

The system settings are common for all operating modes of the instrument.
The screen used for the system settings is presented in the Figure 32.
The names of the parameters and their permissible values are presented in the Table 16.

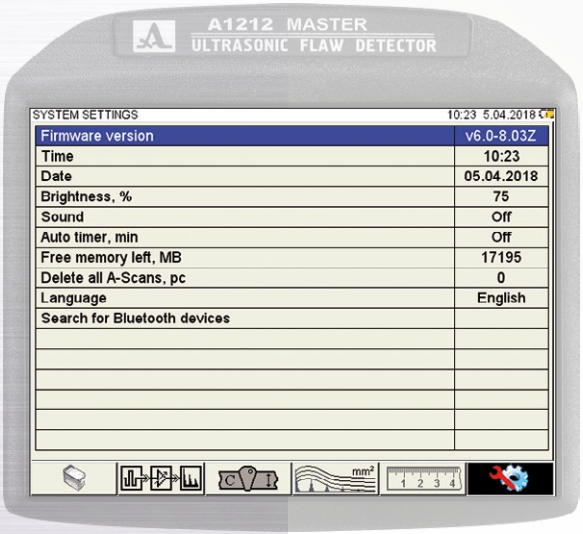


Figure 32

Table 16

Parameter name	Value	Description
Firmware version	X.X.X	Current firmware version
Time	HH:MM	Current time in HOURS:MINUTES 24 hour format. Enters the editing mode - Enter
Date	DD.MM.YYYY	Current date in DAY.MONTH.YEAR format. Enters the editing mode - Enter
Brightness	from 5 to 100 with step 5	Setting image brightness of the instrument's screen
Sound	On/Off	Switch On/Off the accompanying sound of AFAS actuation by the instrument and connected Bluetooth headset
Auto-shutdown timer, min	5 / 10 / 15 / 30 / 60	Selecting a time interval at the end of which the instrument will switch off automatically if neither key is pressed nor measurements are performed within this period.
Free memory, Mb	XXXX	Free memory volume

Table 16

Parameter name	Value	Description
Delete all A Scans, pcs.	XXX	Displays quantity of the saved snapshots. Starts memory cleaning procedure of the instrument - Enter **WARNING: THE MEMORY WILL BE TOTALLY CLEANED – ALL THE SETTINGS AND DATA WILL BE DELETED!**
Language	Russian / English	Select the interface language
Search for the Bluetooth devices	–	Start searching and connection of the Bluetooth devices - Enter

The functions of the keys applicable for configuration of the system settings are presented in Table 17.

Table 17

Key	Description
	Line-by-line scrolling to select the parameter to be edited
	Change the parameter value
	Exits the DGS settings mode
	Opens a confirmation window of new DGS settings

Editing the "Time" or "Date" parameters

Do the following to edit the "Time" or "Date" parameters:

- select the required parameter and press the Enter key ;
- in the opened editing window (Figure 33) select the value to be edited by means of the  keys;
- edit the parameter value by means of the  or  keys;

- to confirm new settings, press the Enter key, or press Esc to cancel.

Memory cleaning

A warning window will be displayed prior to start of the "Memory cleaning" procedure (Figure 34).

Bluetooth function

Only one headset can be connected to the instrument at a time.

First connection of the Bluetooth headset

Do the following to connect the Bluetooth headset to the instrument:

- turn On the Bluetooth headset;
- at initial usage switch the Bluetooth headset into the interfacing mode according to its Operation Manual;
- select the SEARCH FOR BLUETOOTH DEVICES parameter and press the Enter key;

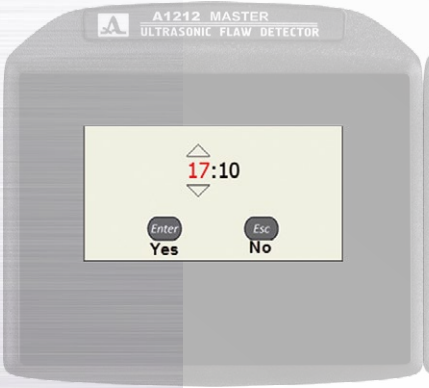


Figure 33

Figure 34

- an information window will be opened (Figure 35).
- a window listing found Bluetooth devices will be opened when the searching is completed (Figure 36).

If no Bluetooth devices are detected, then information message NO DEVICES FOUND will appear on the screen. In such a case, as well as if the required Bluetooth headset misses in the list of the found devices, make sure that the headset is connected and is in the interfacing mode. After that restart searching for devices.

- select the line the headset being connected (e.g., PLT_M20) and press .
- a window for digital password entry will be opened (Figure 37). Default password is four “zero” characters (0000).

Figure 35

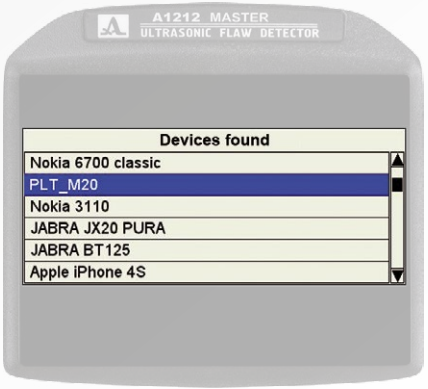


Figure 36

Figure 37

Editing the password is similar to editing processes of the "Time" or "Date" parameters.

- to confirm the password, press Enter. A confirmation window of device interfacing will be opened (Figure 38).

The list of the system parameters will be populated with a line with the name of the connected headset (upon pressing the key), and a corresponding icon – will appear in the upper information line.

Switching Off Bluetooth

To switch off the Bluetooth function in the instrument, select the line with the name of the connected headset and press Enter, the line with the headset name will be changed. The absence of the icon in the upper information line indicates the switched off Bluetooth function.

Repeated connection of the Bluetooth headset

For repeated connection of the headset, select the "Connect to" line and press Enter. The instrument will automatically switch on the Bluetooth mode, start searching for the headset and connect it when found.

Figure 38

2.3.1.7 View, create and delete configurations

A line is highlighted in the list of the configuration names when you enter the SETTING mode. This is the line of the currently used configuration, i.e. current configuration. At that all parameters of this configuration will be displayed (Figure 39) to the right in the view mode. The current configuration is marked with the "✓"sign.

Viewing the parameters of the configuration

To view the parameters of the configuration, select its name by means of the keys.

Selecting the configuration

To work with another configuration from the list, just select its name by means of the keys and press the Enter key. To go back to the measurement mode using the selected configuration, press .

Deleting the configuration

To delete the saved configuration, press the key. At that a confirmation window will be opened (Figure 40).

Note: the following basic configurations are always present in the list of configurations by default:

- "Basic S5096 5.0 70";
- "Basic S5182 2.5 65";
- "Basic S3568";
- "Basic D1771".

WARNING: YOU CANNOT DELETE A BASIC OR A CURRENTLY USED (CURRENT) CONFIGURATION!

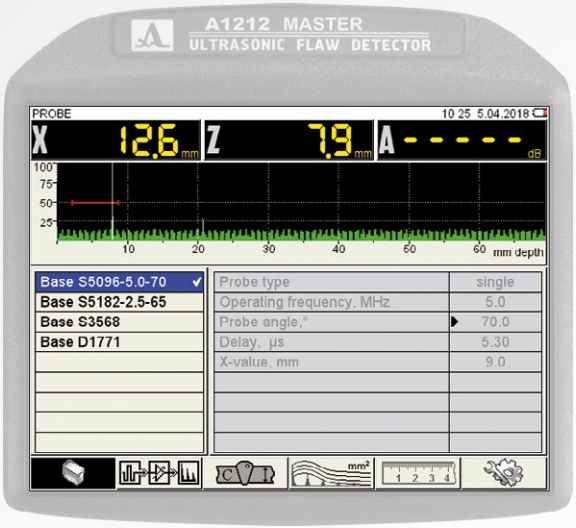


Figure 39

Figure 40

If the user attempts to delete the above-mentioned configurations, a corresponding information window will be opened (Figure 41). Press the key to go back to the measurement mode not changing the current configuration.

Creation of new configuration

To create a new configuration based on the current one, select the line with the configuration for editing by means of the keys, e.g.: "Basic D1771", and make it a current one by pressing the key (Figure 39).

Press the key to change the values of the configuration parameters. Parameter values will become editable (Figure 42).

A new line will be automatically added to the end of the names list of the configurations when you change the parameter of the configuration. This new line consists of the name of the configuration being edited with addition of the "*" character. At

Figure 41

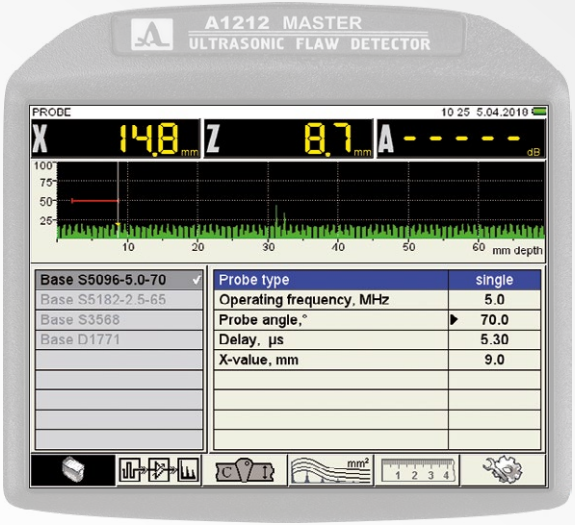


Figure 42

that the configuration taken as a basic one will remain the same.

Note: The word "basic" is not used in the process of the automating naming when a new configuration is being created based on the any basic configuration.

Figure 43 presents the display when you edit the configuration with the name "Basic S5096 5.0 70".

Press the Enter key to exit the configuration of parameters when all required settings are adjusted.

A left column listing the configuration names will become active. An automatically generated temporary name of new configuration (Figure 44) is highlighted.

New configuration becomes a current one by default.

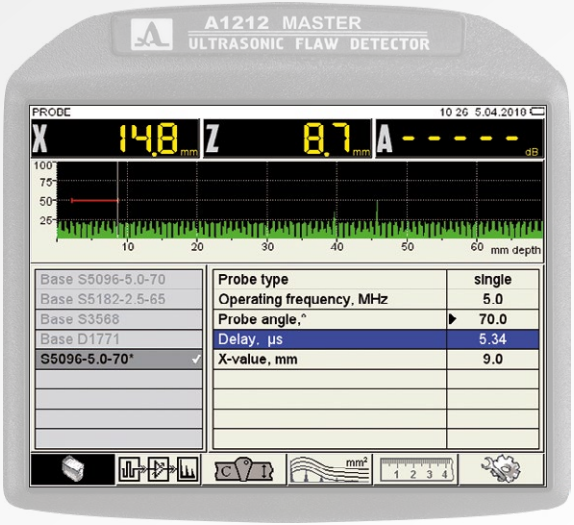


Figure 43

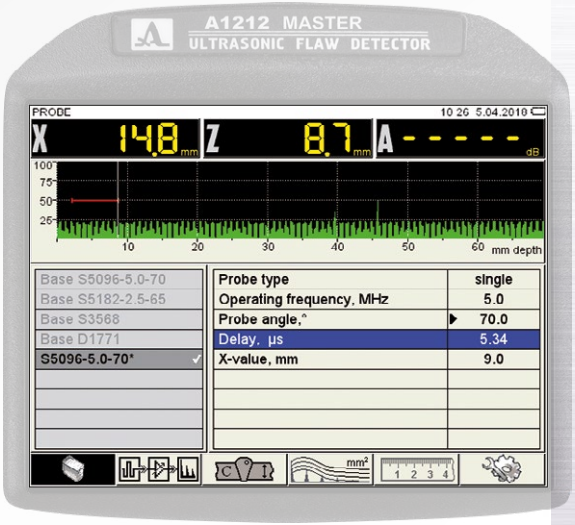


Figure 44

Name the configuration to enter it in the list of saved configurations. Press the Enter key to do it. A name editing window will be opened (Figure 45).

By default a serial number in parentheses will be added to the name of the configuration taken as a basic one.

If the name of the configuration taken as a basic one terminates with the number in parentheses, then the value within brackets will be increased by 1 by default. If the next number in numerical order is already in the list, then by default a number following the last existing one will be assigned.

Configuration can be assigned any name (Figure 46).

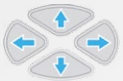
To save new name, press F1 key ().

Figure 45

Figure 46

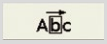
Configuration with the new name will appear in the list and will be set as a current one (Figure 47).
The functions of the keys used for editing of the name are presented in the Table 18.

Table 18

Key	Description
	Navistrob select the keyboard field on the screen
	Move the cursor in the name field to the left/right
	Enter a symbol/confirms highlighted action in the name field of the screen keyboard field
	Exit the name editing window and enters the SETTINGS mode window, the name will not be saved

The functions of the icons when editing the name are presented in the Table 19.

Table 19

Key	Icon	Description
F1		Save the new name
F2		Move the cursor in the name field to the left
F3		Move the cursor in the name field to the right
F4		For capital letters entry
F5		Delete the character located leftward of the cursor

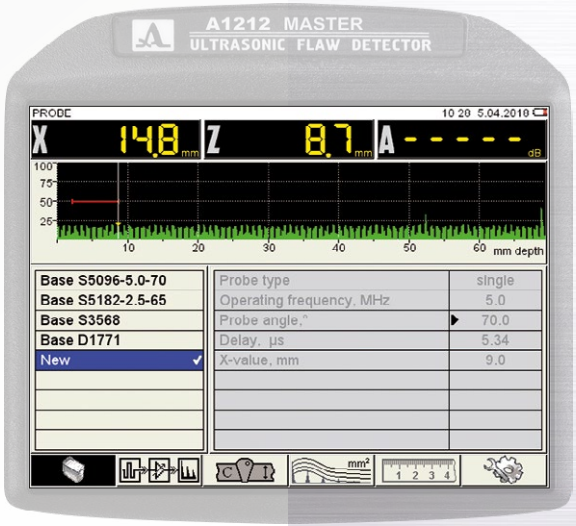


Figure 47

2.3.2 FLAW DETECTOR mode

The instrument allows to operate with two strobes.

The strobes are used for setting the inspection zones, sensitivity levels, AFAS actuation, measurement of the flaw locations and signal amplitudes from the reflectors the required intervals.

Measurements can be performed both in automatic and manual modes.

Automatic mode is a measurement mode with one or two active strobes. The measurement of amplitude value of the point above the level of the strobe with the maximum amplitude within the strobe is being performed. When the echo-signal gets into the strobe time interval and when the amplitude of the signal exceeds the level of the strobe, the cursor will be automatically set into the actuation place and indication of the measured parameters will be performed. Additionally event of the signal exceeding the strobe level is accompanied by the sound signal and red LED blinking on the front panel of the instrument. If the signal is below the strobe, then neither registration nor measurement will be performed.

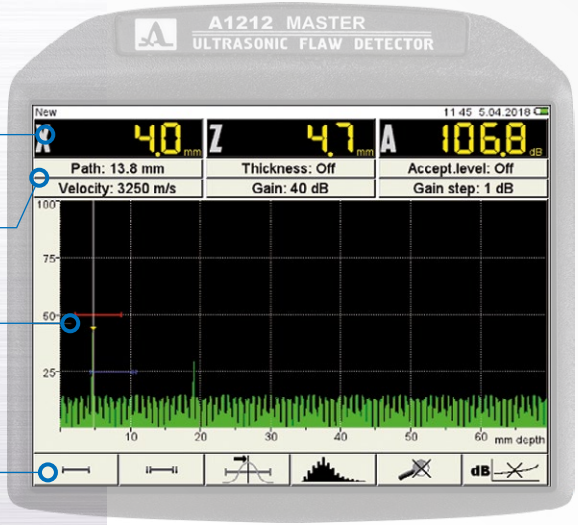


Figure 48

Manual mode is a measurement mode with the inactive strobes. The signal measurement is performed by moving the cursor by means of the − + keys.

A marker having a shape of the shaded triangle will be displayed on the screen besides the cursor. The marker is always automatically set onto the maximum amplitude value amplitude of the signal within the strobe.

2.3.2.1 The screen in the FLAW DETECTOR mode

The screen in the FLAW DETECTOR mode is presented in the Figure 48.

The measurement results panel consists of three blocks (Figure 49)

Parameters displayed in the blocks depend on the operation mode of the instrument.

The following is displayed in the operating mode:

- in the first block: distance from the front edge of the PT to the reflector on the surface of the object under inspection;
- in the second block: depth of location of the fault. If the angle beam PT is used and when the thickness value of the object under inspection is entered (see Chapter 0) a real fault location depth will be displayed considering the rereflections of the ultrasonic wave;
- in the third block: amplitude of the signal being measured.

In the area of **auxiliary quantities** the following parameters are displayed:

- Length, mm is the distance from the beam index of the PT to the reflector by the central beam.
- Thickness, mm is the thickness value of the object under inspection and the quantity of rereflections of the central beam. It shall be set in the SETTING mode for the angle beam PTs.
- Acceptance level is a value of the acceptance level calculated automatically in the SETTINGS mode. If DGS is On this filed displays the "Equivalent area" parameter is a value of acceptance equivalent area of the flat-bottomed hole.
- Velocity, m/s is the velocity value of the ultrasonic wave, set in the SETTING mode.
- Gain, dB is the amplification value, set in the SETTING mode.
- Gain step, dB is the switching step of the amplifier, selected in the SETTING mode.

In the area of **A Scan** besides the A Scan the following is displayed: a grid, vertical and horizontal scale, strobes, if switched On, the cursor and the marker. The software renews the cursor and the marker when the measurement results are renewed.

The horizontal scale of the instrument toggles between microseconds and millimeters.

The **icon area** is located below. Each icon is controlled by the corresponding key on the panel. The main functions of the keys and corresponding icons in the FLAW DETECTOR mode:

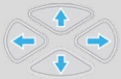
- F1 control the first strobe;
- F2 control the second strobe;
- F3 selection of the AFAS actuation type;
- F4 selection of the form of the displayed signal;
- F5 switch On/Off the LOOP mode;
- F6 switch On/Off the amplitude correction.

Figure 49

2.3.2.2 Functions of the keys in the FLAW DETECTOR mode

The functions of the keys applicable for the FLAW DETECTOR mode are presented in the Table 20.

Table 20

Key	Function
	Turn On/Off the instrument
	Move the measuring cursor
	Up/down – Change the attenuator value. Right/left – Change the length of the sweep
	Open a window to confirm switching Of/On the reference level
	Enter the STOP mode
	F1 - F6 – edit a corresponding parameter
	Enter the SETTINGS mode

2.3.2.3 Functions of the control icons

The functions of the keys applicable for the FLAW DETECTOR mode are presented in the Table 20.

F1 (First strobe)

F2 (Second strobe)

Strobes are used to set the testing areas, sensitivity levels and actuation of the AFAS system, measurement of the flaw locations and signal amplitudes from the reflectors in the required intervals.

The instrument allows operation with two strobes.

When the signal exceeds the level of the strobe, the cursor will be automatically set onto the point of exceedance (or to

the maximum), corresponding parameters of the cursor in this point will be indicated on the screen; sound and light indication is produced (AFAS actuates).

If the strobe is beyond the range displayed on the screen, then a pointer will appear at the right boundary of the range. The pointer allows determination of the strobe threshold level (a single red arrow for the first strobe and a double blue arrow for the second strobe).

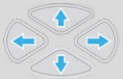
ATTENTION: IF THE SIGNAL AMPLITUDE EXCEEDS THE LEVEL OF THE STROBE RANGE DISPLAYED ON THE SCREEN, THEN AFAS WILL BE ACTUATED BUT THE CURSOR AND THE MARKER WILL NOT BE DISPLAYED!

Each strobe has two modes: a single-level and a multilevel strobe. The multilevel strobe allows simultaneous setting of three sensitivity levels: acceptance, reference and search.

ATTENTION: IF THE REFERENCE LEVEL IS ON, THEN THE STROBE CANNOT BE MOVED IN VERTICAL DIRECTION!

The functions of the keys applicable for active icon  or  for the first strobe, and  or  for the second strobe, are presented in the Table 21.

Table 21

Key	Function
	Move the strobe in the appropriate direction. When moving the multilevel strobe in vertical direction, the acceptance level will be moved; at that the reference and search levels will be moved relative to the acceptance level according to the settings
	Change the length of the strobe relative to its left boundary
	Switch Off the strobe and exit the settings. To switch Off the strobe, enter the settings of the corresponding strobe by means of the F1 or F2 keys correspondingly
	F1 or F2 exit the editing mode F2 or F1. F3 – F5 exit the editing mode, functions of the enabled key will be performed
	Enter the SETTING mode

In the panel of the measurement results in the first block is start of the strobe (X1), in the second block it is the end of the strobe (X2), in the third block it is the level of the strobe (A) (Figure 50).

Figure 50

F3 (Actuation type)

Selecting the type of AFAS actuation:

 - by first signal excess over the level of the strobe for the first time;

 - by the signal peak value in the strobe;

 - between the peak values (maximums) of the signals in the strobes (if both strobes are On).

In the measurement mode to the maximum the positions of the cursor and the marker coincide.

F4 (Form of the signal)

Switching between the signal forms in the A Scan area:

 - detected contoured;

 - detected shaded;

 - dimensional envelope (except the LOOP mode);

 - radiofrequency signal (except the DAC mode).

F5 (Loop)

 - LOOP mode is Off;

 - LOOP mode is On.

If the LOOP mode is ON, then two images of the signal are simultaneously displayed on the screen.

Prior to switching On the LOOP mode, always switch On the first strobe. After the mode is switched On, the upper graphical window will display an A Scan with the strobes, and the lower window will display an extended time interval corresponding to the first strobe. The presence of the lower window allows detailed estimation of the form of the part of the signal time realization within the limits of the first strobe.

The display in the LOOP mode is presented in the Figure 51.

F6 (switching On the amplitude correction)

dB / dB the TCG curve is On/Off;

mm² / the DGS curve is On/Off;

/ the DAC curve is On/Off.

The information on selecting the type and adjustment of the amplitude correction parameters is presented in the section 0.

2.3.3 The STOP mode

Upon pressing the key the instrument enters the mode of saving and viewing of previously saved A Scans (Figure 52).

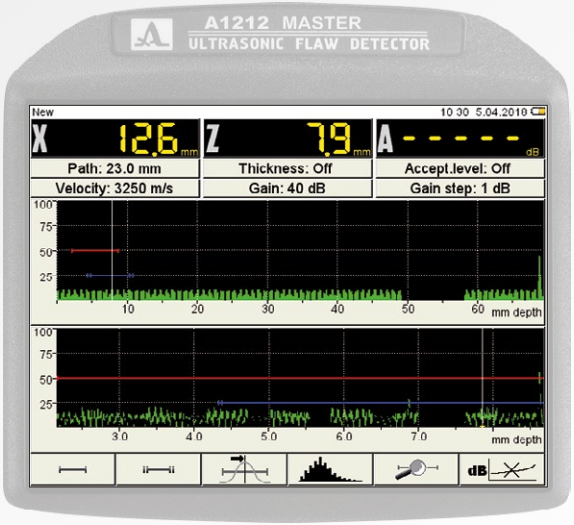


Figure 51

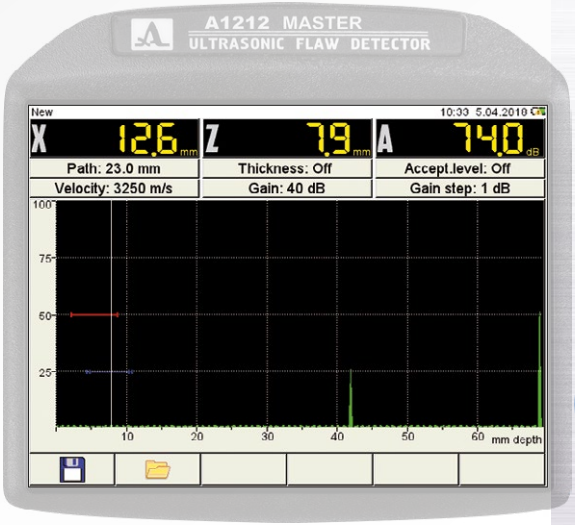
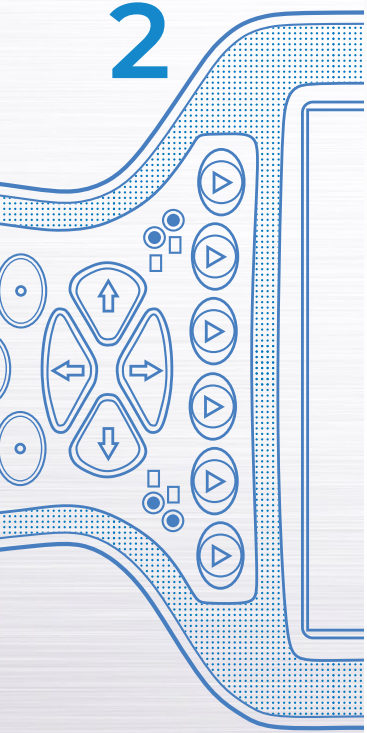


Figure 52



The functions of the icons applicable for the STOP mode are presented in the Table 22.

Table 22

Key	Icon	Description
F1		saving the snapshot in the STOP mode
F2		go to view the saved snapshots
F3	-	-
F4 (only if Bluetooth is On)		record the voice comment for the snapshot being saved
F5 (only if Bluetooth is On)		listen to the voice comment for the snapshot being saved
F6 (only if Bluetooth is On)		delete the voice comment for the snapshot being saved

2.3.3.1 Saving current snapshot

Upon pressing the key F1 the instrument enters the editing mode of the new snapshot name (Figure 53).

By default the snapshot name is generated on the basis of the “Snapshot” word with a hyphen of the appropriate serial number.

If the name of the last snapshot of the saved ones ends with any character or digit without a hyphen in front of it, then a hyphen and a serial number will be added to the name by default.

If the name of the last snapshot of the saved ones ends with a hyphen and a digit, then by default the digit value will be increased by 1.

Any name can be assigned to the snapshot. The mode of the snapshot name editing is similar to the editing mode of the configuration name (Chapter 0).

2.3.3.2 Working with previously saved snapshots

Upon pressing the key F2 the instrument will enter the mode of viewing and deleting of the saved snapshots (Figure 54). The functions of the icons in the STOP mode are presented in the Table 23.

Table 23

Key	Icon	Description
F1	◀	Go to the previous saved snapshot

Figure 53

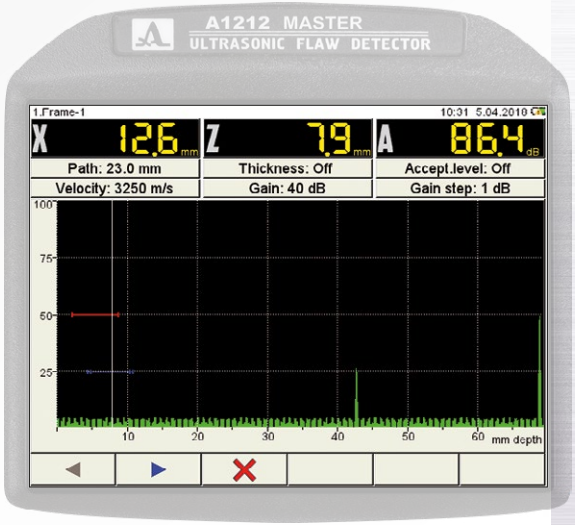


Figure 54

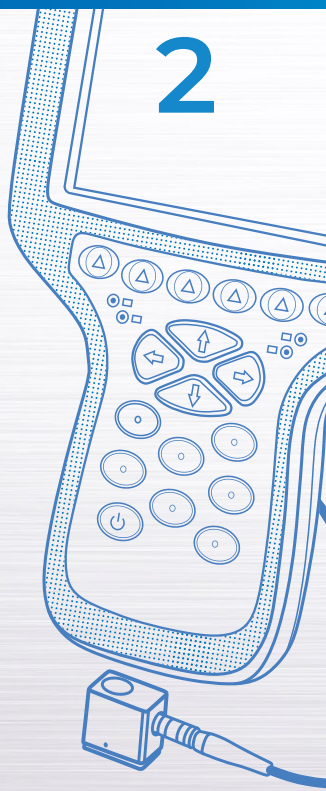


Table 23

F2	▶	Go to the next saved snapshot
F3	✖	Delete the saved snapshot
F4 (only if Bluetooth is On)		Record the voice comment for the saved snapshot
F5 (only if Bluetooth is On)		Listen to voice comment for the saved snapshot
F6 (only if Bluetooth is On)		Delete the voice comment for the saved snapshot

Upon pressing the key F3 a window will be opened for confirmation of deletion containing the name of the snapshot being deleted (Figure 55).

Upon pressing the key F4 the instrument will start recording the voice comment to previously saved snapshot. If the snapshot has a saved comment already, then you will have to delete this comment in order to record a new one.

Upon pressing the key F5 the instrument will start playing the voice comment to the saved snapshot.

Upon pressing the key F6 the recorded voice comment to the saved snapshot will be deleted.

The detailed functional description of the F4 F6 keys is given further in the sections 0 0.

The functions of the keys applicable for the STOP mode are presented in the Table 24.

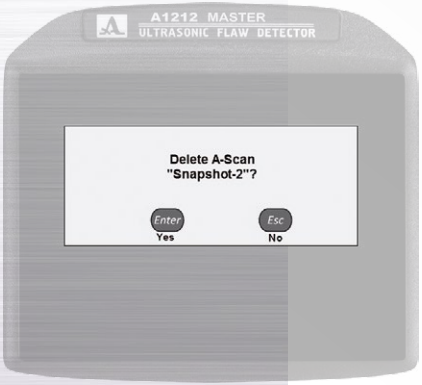


Figure 55

Table 24

Key	Description
− +	Move the measuring cursor prior to saving the snapshot
❄	Exit the STOP mode

2.3.3.3 Recording the voice comment for the snapshot being saved

Upon pressing the F4 key the instrument will start recording the voice comment for the snapshot being saved (Figure 56). The software allows recording a short voice comment (up to 20 seconds).

ATTENTION: REPEATED PRESSING OF THE F4 KEY RESULTS IN RERECORDING OF THE ALREADY RECORDED COMMENT!

2.3.3.4 Playing the voice comment for the snapshot being saved

Upon pressing the key F5 the instrument will start playing the recorded voice comment for the snapshot being saved (Figure 57).

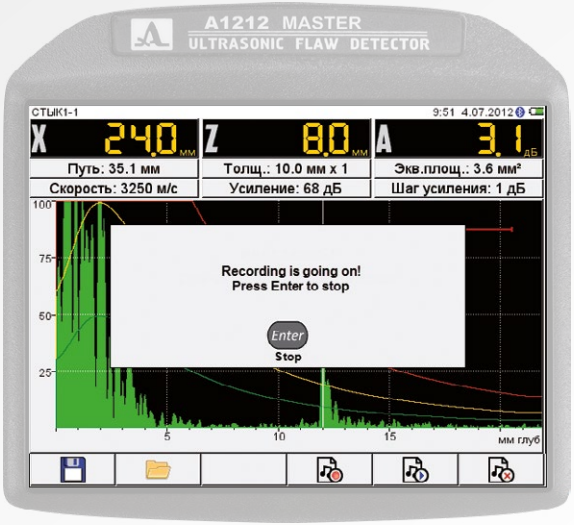


Figure 56

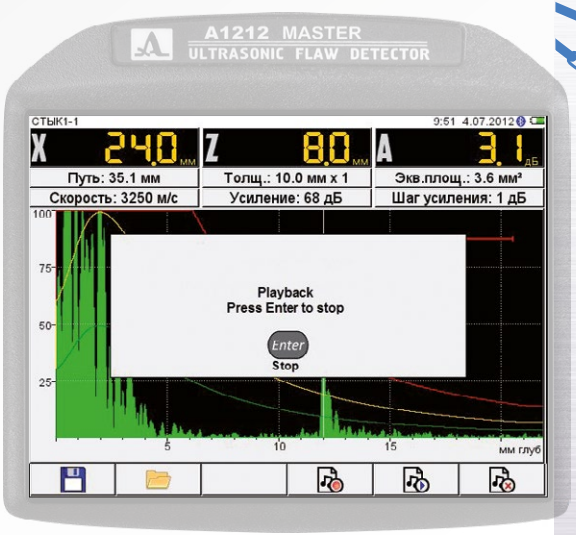
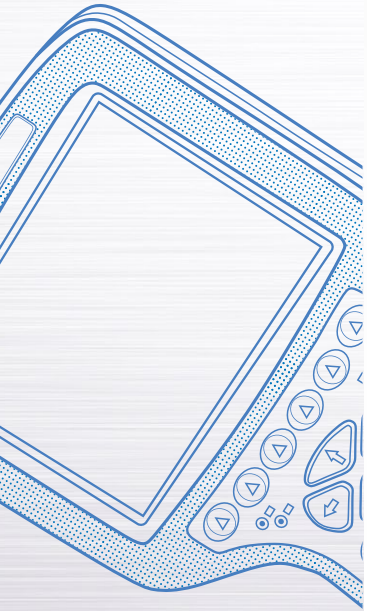


Figure 57

2



2.3.3.5 Deleting the voice comment for the snapshot being saved

Upon pressing the F6 key the recorded voice comment for the snapshot being saved will be deleted.

ATTENTION: SOFTWARE WILL NOT ASK FOR CONFIRMATION TO DELETE THE VOICE COMMENT!

2.4 SURFACE PREPARATION FOR MEASUREMENTS

Low density and exfoliating scale, corrosion, flash spatter or dirty surface of the tested object influence the penetration of the ultrasonic sound into the material. Hence, prior to measurements, clean such surfaces and remove the foreign matter, wipe the surfaces and remove abrasive particles, apply some coupling fluid onto the surface.

Cleaning rough corrosive surfaces provides service life extension of the ultrasonic transducers and the improvement of the measurement accuracy. It is particularly significant for the double-crystal transducers.

The requirements for permissible roughness and surface preparation are specified in the technical rules and regulations on testing of certain types of objects.

3.1 ELECTRIC POWER SUPPLY AND POWER CONSUMPTION

3.1.1 Checking the power source

While the flaw detector is in operation, its embedded discharge controller monitors the state of charge of the power source. This state is displayed as a battery icon in the upper right corner of the instrument's display. The battery icon will be filled according to the degree of charge. Completely filled green battery icon means that the accumulator battery is charged completely. As far as the battery discharges the filling degree decreases and the icon changes it s color from orange to red. The instrument will be automatically switched off when the battery is critically discharged. At that all the settings and recorded information will be saved.

The instrument produces corresponding warnings when the battery charge level drops to 10% and prior to automatic switching off the instrument when the battery is critically discharged.

3.1.2 Checking of the power adapter

If a malfunctioning power adapter is connected to the instrument:

– if the instrument is On, then a blinking message "Charging device is faulty!" ("Проблема с зарядным устройством!») will appear on the screen.

– if the instrument is Off, then the battery charge level icon  will not light, and a blinking message "Charging device is faulty!" ("Проблема с зарядным устройством!») will appear on the screen when the instrument is switched On.

In such cases disconnect faulty power adaptor and replace it with a properly functioning one.

3.2 REGULAR MAINTENANCE

While in service, regularly clean the body of the device, remove dirt and dust using cleaning agent for plastic products.

If the protective glass of the display becomes dirty, wipe it with a soft tissue wetted with some common plastic glass care product.

Dirty keypad can be wiped with a soft tissue wetted with alcohol.

The instrument may be cleaned with soap solution and special cleaning agents.

If dirt and foreign matter get into the connectors, then clean them using a soft brush.

3.3 MALFUNCTIONS

Always contact the manufacturer representatives (contact information is given in the certificate) if there are any malfunctions or questions about instrument operation.

4

STORAGE

The instrument shall be stored in the transportation bag included in the delivery kit. The storage conditions shall correspond to GOST 15150 69.

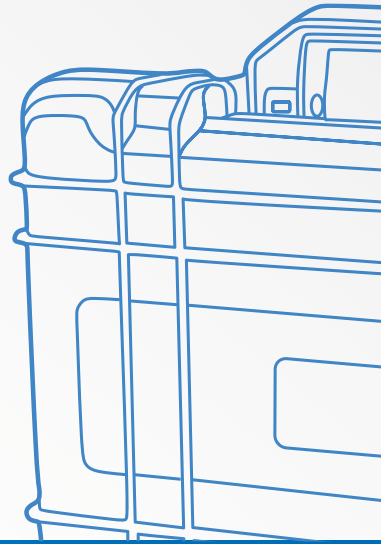
The instruments shall be stored on shelves.

The arrangement of the instruments in warehouses shall enable their free movement 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.

Distance between the heating units in the warehouses and the instruments shall be at least 0.5 m.

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



The instrument shall be transported in the transportation bag included in the delivery kit.

The transportation conditions with regard to the impact of the external environment climatic factors should correspond to storage conditions (placement category 5) according to GOST 15150 69.

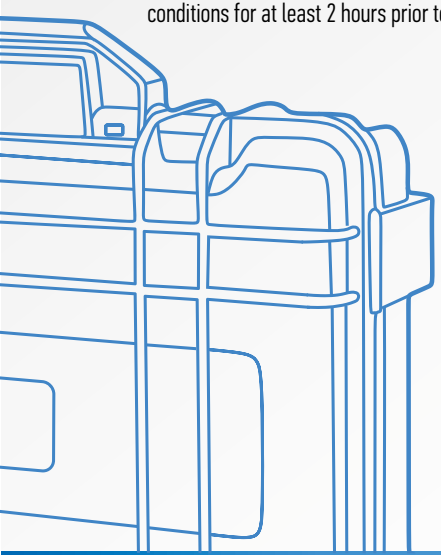
The packaged devices can be transported in any vehicles at any distances without speed limits.

Packaged instruments should be properly and steadily fixed to prevent their hitting against one another and against vehicle walls during transportation. When transported in open vehicles the instruments shall be protected from rain and water splashes.

The transportation conditions of the instruments shall correspond with the technical requirements and standards valid for the given type of the transport.

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

If transportation conditions differ from the operation conditions, then the instruments shall be kept under normal climatic conditions for at least 2 hours prior to operation.



A

APPENDIX (REFERENCE)

LITERATURE ON ULTRASONIC TESTING

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2 Non-destructive testing and diagnostics: reference book / edited by V.V.Kluev and colleagues. – 3rd ed., updated and revised. – M.: Mechanical industry, 2005. – 656 p.

3 Non-destructive testing: reference book: in 8 v / edited by V.V.Kluev. V. 3: I.N.Ermolov, Yu.V.Lange. Ultrasonic testing. – 2nd ed., revised. – M.: Mechanical industry, 2006. – 864 p.: picture.

4 I.N.Ermolov, M.I. Ermolov Ultrasonic testing. Work-book for professionals possessing 1st and 2nd skill levels. – 5th ed., stereotype edition M.: Azimut, 2006. 208 p.: 77 picture.

5 V.G.Scherbinskiy. Technology of ultrasonic testing of welding joints. – 2nd ed., revised – M.: Tisso, 2005. – 326 p.

6 E.F.Kretov. Ultrasonic non-destructive testign in power plant engineering. Work-book / 3rd ed., updated and revised. – St.Petersburg.: Sven, 2011. – 305 p.

ACOUSTIC CONTROL SYSTEMS

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NOTES

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ULTRASONIC FLAW DETECTOR

A1212 **MASTER**

OPERATION MANUAL

Revision: January 2019