

ELECTRO-MAGNETIC ACOUSTIC  
THICKNESS GAUGE WITH  
THE PULSE MAGNETIZATION



# A1270 EMAT

OPERATION MANUAL



Acoustic Control Systems – ACS Group  
Saarbrücken 2021



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The current Operation Manual (hereinafter referred to as “the operation manual”) contains technical specifications, description, and operation principle of the AI270 Electro-Magnetic Ultrasonic Thickness Gauge (hereinafter referred to as “the thickness gauge” or “the instrument”), as well as information required for proper operation of the instrument.

Carefully read the operation manual before starting to work with the instrument.

Only the personnel familiar with general principles of the ultrasonic waves propagation, having completed a corresponding training, and having read the operation documentation is allowed to work with the instrument.

To perform the correct ultrasonic inspection the inspection tasks must be determined, the inspection schemes must be selected, the transducers must be chosen and inspection conditions for such materials must be evaluated.

During the production process some modifications can be introduced to the instrument due to constant improvement of its reliability and serviceability. The modifications do not affect the technical specifications of the instrument and thus are not described in the present operation manual.

### The device is manufactured by:

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Operation Manual



# 1

## DESCRIPTION AND INSTRUMENT OPERATION

## 1.1 THE INTENDED USE OF THE INSTRUMENT

### 1.1.1 Intended use and application range

The instrument is a portable ultrasonic thickness gauge of general purpose.

The instrument is designed for measurement of thickness of parts and walks of steel tubes and objects made of steel and metal alloys without the use of coupling fluids; ultrasonic thickness measurements of flat rolled stock; ultrasonic thickness measurements of the ship bottom without pretreatment of the surface; evaluation of anisotropy degree of the material.

The instrument can be used under the laboratory, field and workshop conditions in various industries.

The A-SCAN mode allows the elimination of false readings, thus substantially increasing inspection reliability, express-searches for foreign inclusions and laminations, as well as getting true results of measuring through polymeric, varnish and paint and other types of insulated coating.

The instrument allows for rotation of the image layout by 90° to the right and left in the operation modes A-SCAN and B-SCAN.

The measurement results can be recorded in the memory of the instrument and then transferred to PC for processing, analysis and storage.

The instrument communicates with a PC via the USB port.

### 1.1.2 Operating conditions

The instrument is designed to work under the following conditions:

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

## 1.2 TECHNICAL SPECIFICATIONS

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

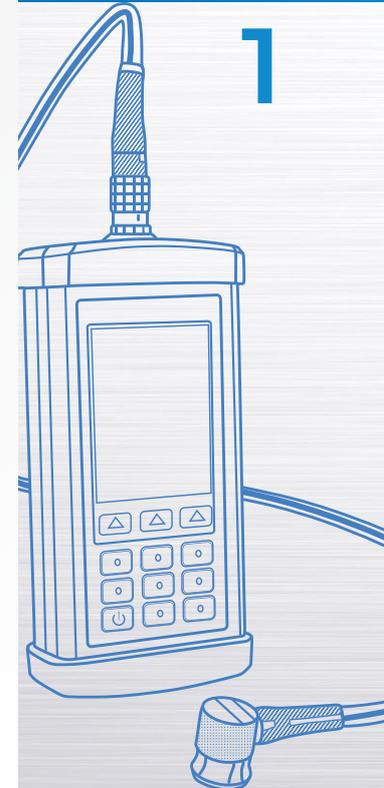
Table 1

Parameter	Value
Measurement range in steel with following transducers, mm:	
– S3850 5.0A0D8ES	from 1 to 100,0
– S3955 4.0A0D8ES	from 1 to 100,0
– S7392 4.0A0D10ES	from 1 to 100,0
– S7394 3.0A0R10x10ES	from 1 to 200,0
Measurement accuracy in steel depending on nominal thickness value d, mm	$\pm(0,01 \cdot d + 0,02)$ ,

The main technical specifications of the instrument are listed in the Table 2.

Table 2

Parameter	Value
Setting range of the ultrasonic sound velocity, m/s	from 500 to 15 000
Operating frequency range, MHz	from 2,5 to 5,0
Power source	Integrated accumulator
Rated supply voltage, V	13,2
Period of continuous operation of the instrument powered by the battery under normal environmental conditions, min, h	> 8
Overall dimensions of the electronic unit, mm	
– length	210
– width	100
– height	50
Weight of the electronic unit, g	1.100
Average service life, years	>5



## 1.3 DESIGN AND OPERATION

### 1.3.1 Design

The instrument is an electronic unit (Figure 1) to which replaceable electromagnetic ultrasonic transducers (EMAT) are connected via cables. Two rubber plugs are installed in the upper and lower end surfaces of the instrument.

A color TFT display is located in the upper part of the screen of the electronic unit. The measurement results and operation information required for the instrument control are shown on the display. The display is used for a visual monitoring of the measurement process via the color-coded indication.

A membrane keypad under the display allows to use the instrument functions.

The upper end surface of the electronic unit bears a connector for EMAT, and a 5 mm thick calibration sample D16T made of aluminum alloy D16T. The propagation velocity of ultrasonic waves in the calibration sample is 3120 m/s. The sample is used for adjustment of the instrument to the connected EMAT, as well as for quick evaluation of the instrument performance (Figure 2).



Figure 2

Figure 1

Calibration  
sample

Red mark on  
the connector

Red mark on  
the cable



On the lower end surface of the electronic unit there is a lug for the belt, USB Micro B connector used for the USB connection of the communication cable to a PC, and a connector for connection/disconnection of the power adapter to charge the built-in battery (Figure 3).

**Note:** During the charging no measurements are possible.

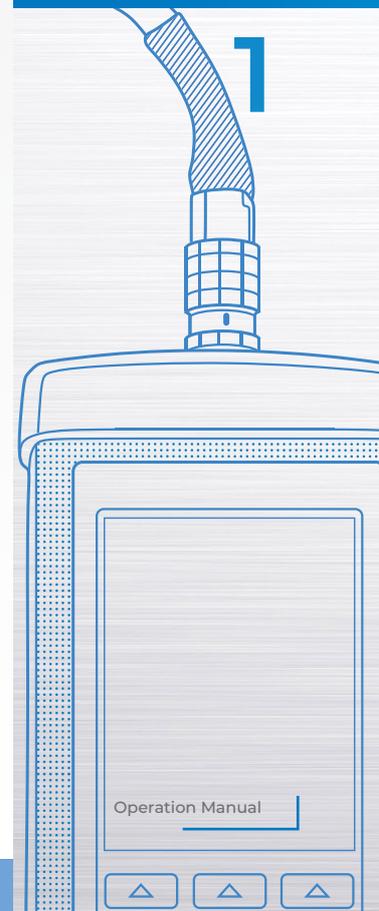
The "Micro B" connector of the USB cable shall be connected by the  symbol and/or the "B" letter facing upward (Figure 4)



Figure 3



Figure 4





### 1.3.2 Operation principle

The operation principle of the instrument is based on the measurement of time required for the double traverse of ultrasonic waves through the inspected object from one surface to another, which is further recalculated into the thickness value.

The EMAT is used to emit the ultrasonic pulses into the object being inspected and receive the reflected pulses. The EMAT shall be installed on the surface of the inspected object in the place where the thickness shall be measured. The EMAT has a pointed directional characteristic of irradiation direction and ultrasonic reception, so the thickness can be measured just below the installation place of the transducer. Provided there are cavities in the surface opposite to the surface with the installed EMAT, the ultrasonic pulses will be reflected from them and the thickness will be determined as the shortest distance from the external surface to the cavities.

### 1.3.3 Operation modes

The operation modes of the thickness gauge are as follows:

- MEMORY is the measurement mode with the indication of the recorded results;
- B SCAN is the measurement mode with the indication of the wall thickness profile;
- A SCAN is the measurement mode with the graphical signal indication;
- SETUP is the mode for settings and selection of the measurement parameters.

The instrument allows for recording of the results in its memory when operated in any of the measurement modes.

In the MEMORY mode the thickness gauge allows for the prompt detection of thickness of the inspected object; it allows the operator to view the recorded measurement results on the display, edit the recordings by means of additional measurements and record the obtained data in the correctable memory cells.

The A-SCAN mode allows the elimination of false readings caused by the presence of discontinuities in the material of the inspected object. In this mode the signals are displayed in the form of an A-SCAN, and measurement conditions and criteria are determined directly during the operation. Four measurement ways are possible: by the first signal exceeding the strobe threshold, by the maximum signal in the strobe, between two maximum signals in the strobe and ACF by the strobe. It is also possible to view

the selected sections of the signal, current parameters and settings, record the A-SCAN image together with the measurement result in the present mode.

The SETUP mode allows the adjustment of the required measurement conditions and parameters. A set of the editable parameters includes general parameters (common for all modes) and parameters specific for each measurement mode.

In all operation modes the measurement results can be saved in the internal memory of the instrument.

### 1.3.4 Display

In all operation modes the upper line on the display indicates the information on the current operation mode of the instrument and its battery charge level. Different icons of the operation mode are listed in the Table 3.

Table 3

Tab	Operation mode
	MEMORY
	B-SCAN
	A-SCAN
	SETUP

The icons of the measurement modes always go from left to right as follows: MEMORY–B-SCAN A SCAN. The icon of the active mode is highlighted (Figure 5).

When going to the SETUP mode, the setup icon is indicated on the display, the icon of the previous mode is no longer active, the parameters and settings of the mode can now be edited (Figure 6).

Figure 5

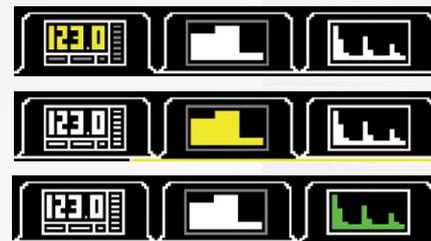
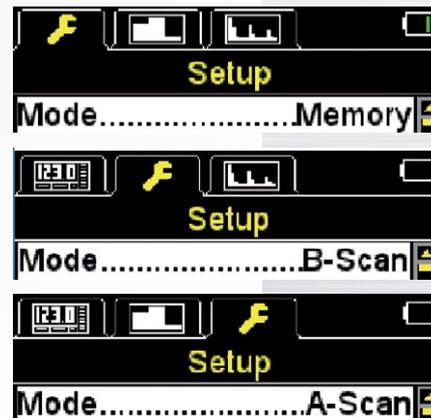


Figure 6





# 1



In the MEMORY mode below the symbols informing about the presence of the signal and its level, as well as the measurement method, measurement units and digital indication of the measurement results are always indicated.

Table 4 description of indicators of the ultrasonic contact and measurement method.

Table 4

Indicator	Description
	Maximum signal level, the amplification of the receiving channel is set to the minimum value
	Average signal level, the amplification of the receiving channel is set to the average value
	Minimum signal level, the amplification of the receiving channel is set to the maximum value
	The signal is missing or insufficient for measurements
	No measurements
	Measurement using the ACF method
	Measurement using the threshold method

The display of the thickness gauge in the MEMORY mode is shown in the Figure 7.

The display of the thickness gauge in the B-SCAN mode is shown in the Figure 8.

In the B-SCAN mode a cross-sectional representation of the signal amplitude values is displayed during the object scanning. Control command icons are displayed in the lower part of the display.

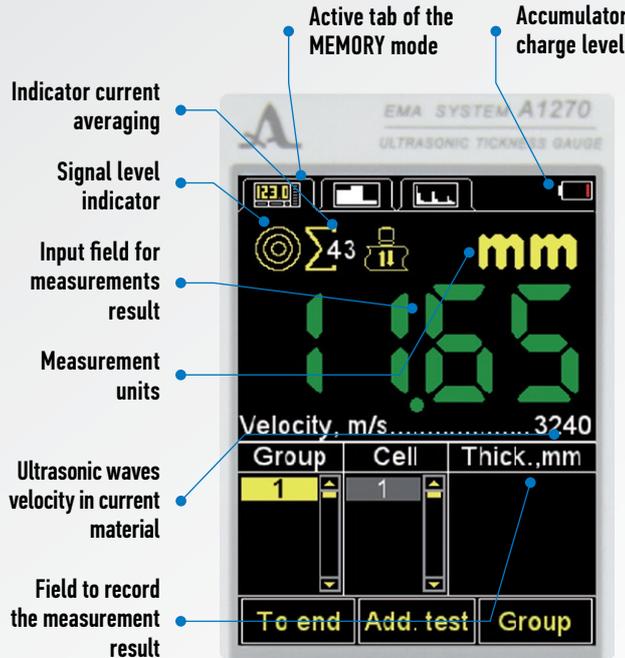


Figure 7

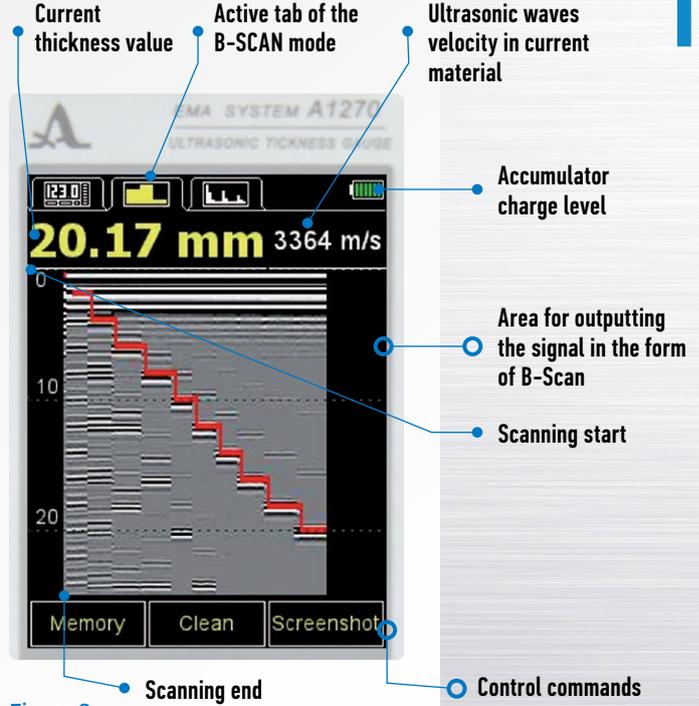


Figure 8

# 1

The display of the thickness gauge in the A-SCAN mode is shown in the Figure 9.

In the A-SCAN mode the graphic image of the echo-signal, digital value of the measurement result, information on the measurement units, applied gain and sound velocity values are displayed. The check icons are located in the lower part of the screen.

The instrument allows to rotate the image by 90° to the right or to the left in the operation mode in the A-Scan and B-Scan mode.

The display layout changes automatically depending on the instrument orientation, if the parameter "Orientation" is set to AUTO, or corresponds to the settings below:

- vertical;
- horizontal left;
- horizontal right.

The view of the display in the A-SCAN mode with an enabled horizontal left display layout (orientation) is shown in the Figure 10.

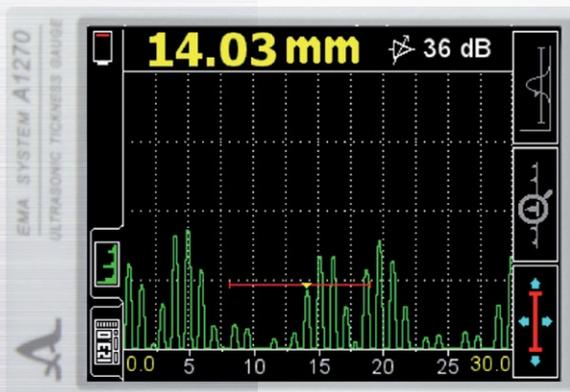


Figure 10

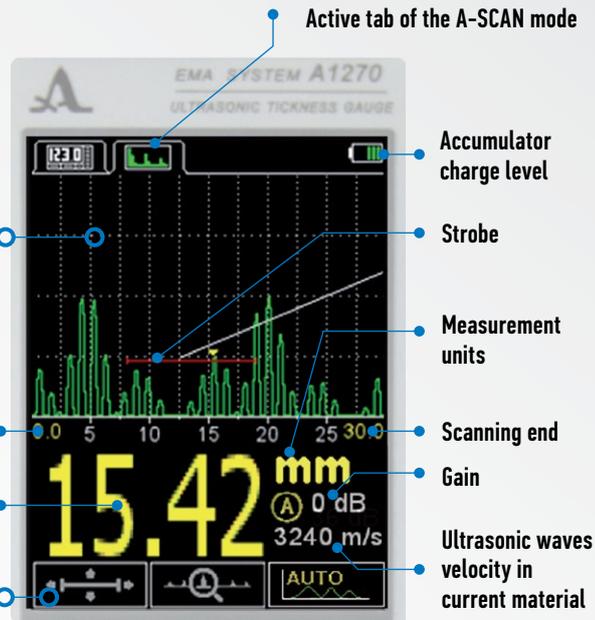


Figure 9

### 1.3.5 Keypad

The keypad (Figure 11) has 11 functional keys and the On/Off key.

Main functions of the keys:

- Key  (ON / OFF) is used to switch On/Off the instrument.

**ATTENTION: IF NO KEY IS PRESSED AND NO MEASUREMENT IS PERFORMED WITHIN 10 MINUTES THE INSTRUMENT WILL BE AUTOMATICALLY SWITCHED OFF.**

**ATTENTION: IN 2 MINUTES THE DISPLAY BRIGHTNESS WILL AUTOMATICALLY BE SET TO THE MINIMAL LEVEL – 5%, IF NO KEY IS PRESSED AND NO MEASUREMENT IS PERFORMED!**

- The functional keys  (F) perform various functions depending on the selected operation mode of the instrument. The name of the current function is displayed under each key. The number of the functional keys is as follows, from left to right: F1, F2, F3 (Figure 12).

- The  key switches between the operating modes and the SETUP mode and back.

- The  key (ENTER) can perform various functions depending on the operation mode and state of the thickness gauge.

- The  / ,  /  and  /  keys are used to select and edit the active parameters. Their functions are similar for various operation modes and are self-explanatory as their icons correspond to their functions.

Figure 12



Figure 11





# 2

## PROPER USE

## 2.1 OPERATING RESTRICTIONS

The instrument is designed to be operated under conditions listed in paragraph 1.1.2.

## 2.2 PREPARING THE INSTRUMENT FOR OPERATION

### 2.2.1 Connecting the transducers

EMAT is used to determine the thickness of the inspected object.

Two types of the transverse wave EMATs are used with the instrument - with a radial and linear polarization based on the pulsed electromagnet technology. EMAT S3850 5.0A0D8ES with the radial-type polarization and an electric solenoid are included in the basic delivery kit.

EMAT S7392 3.0A0D10ES and S7394 2.5A0R10x10ES with permanent solenoid can be connected to the electronic unit of the instrument using a special connector.

The transducers shall be connected observing the markings on the cable and connector (Figure 2).



Figure 13

## 2.2.2 Switching On/Off the instrument

Press the key  manually to switch On the instrument.

On the startup screen the name of the instrument and the hardware version will be displayed for several seconds (Figure 13).

The thickness gauge will automatically switch to the last active mode with corresponding settings before the instrument was switched off.

**Note:** In case the same transducer used prior to the last shutdown is connected to the instrument, the instrument is immediately ready for operation. If another transducer is connected, please adjust the instrument for operation using the new transducer.

Press the  key manually to switch Off the instrument. The instrument will also be automatically switched off, if no key is pressed for 10 minutes or no other measurements are performed.

All settings of the thickness gauge will be recorded upon switching off and if the accumulator goes dead.

## 2.2.3 Configuring and adjusting the instrument to the used EMAT parameters

**ATTENTION: PRIOR TO STARTING THE OPERATION AND IF THE TRANSDUCER IS CHANGED, CONFIGURE AND ADJUST THE INSTRUMENT TO THE INDIVIDUAL PARAMETERS OF THE USED EMAT!**

Otherwise the instrument will not operate. Any attempt to switch to one of the measurement modes will display the "Run probe test" warning message (Figure 14) on the screen.

2

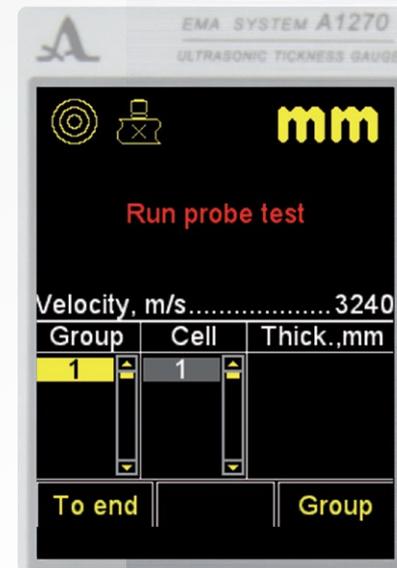


Figure 14

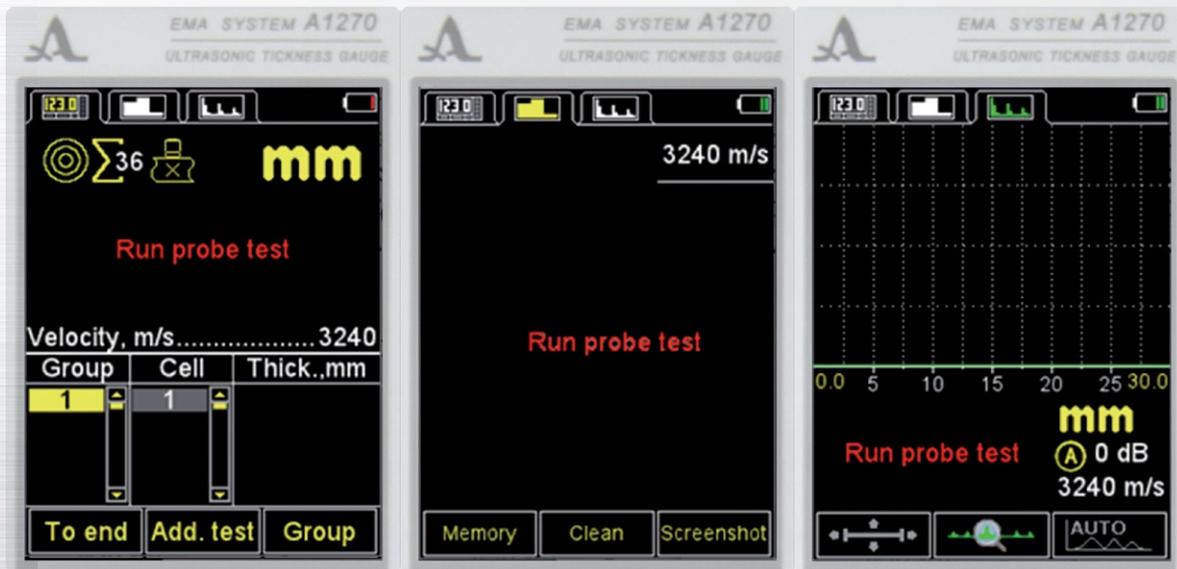


# 2

## 2.2.3.1 Selecting the transducer

Do the following to select the transducer:

- press the  key to enter the SETUP mode.
- using the keys   go to the Probe option and press the F3 key (Open) or  to enter the library of the transducers (probe) (Figure 15).



▶ Figure 14 Continue

- Using the keys   go to the line with the name of the connected probe (transducer) and press the key  to select it (Figure 16).

After the transducer is selected the adjustment of the probe testing process to its individual parameters will be automatically started.

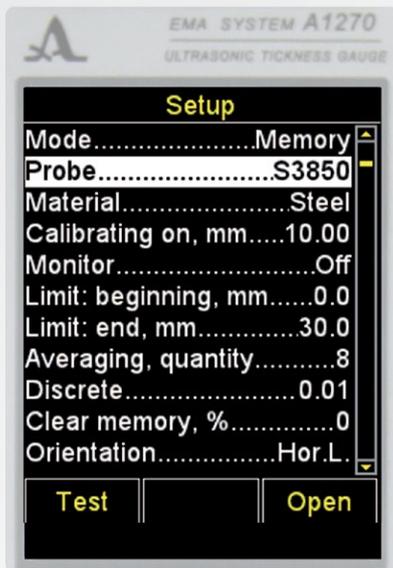


Figure 15

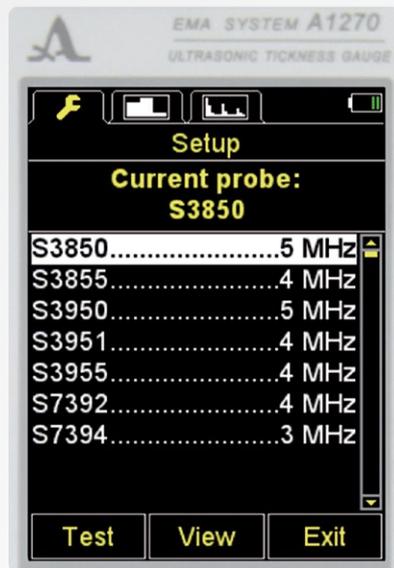


Figure 16

# 2

## 2.2.3.2 Adjusting the instrument to the parameters of the transducer being used

The adjustment is divided into two stages. At the first stage the instrument automatically analyses the characteristics of EMAT, at the second stage the instrument adjusts to them using a real echo-signal from the calibration sample integrated in the instrument.

- to adjust the instrument to the individual used EMAT parameters:
- Enter the SETUP mode.

- Select the "Probe" line and press the **F1** key (Test). The screen will display the message: **"PROBE ZEROING - Take the probe and holding it in your hands press ENTER"**.

- Not letting EMAT to contact the calibration sample, press the  key.

The message "Testing in process - Please wait..." is displayed on the screen.

Wait for the "Testing process - Place the probe on zeroing sample and press ENTER" to appear on the screen.

- Install EMAT on the calibration sample of the instrument and press the key .

The message "Testing in process - Please wait..." is displayed on the screen.

- Upon completion of the testing the message will be displayed informing on the results: a positive result with an indication of the thickness value of the calibration sample, or a negative result with the message "Testing failed".

- Remove the transducer from the calibration sample.

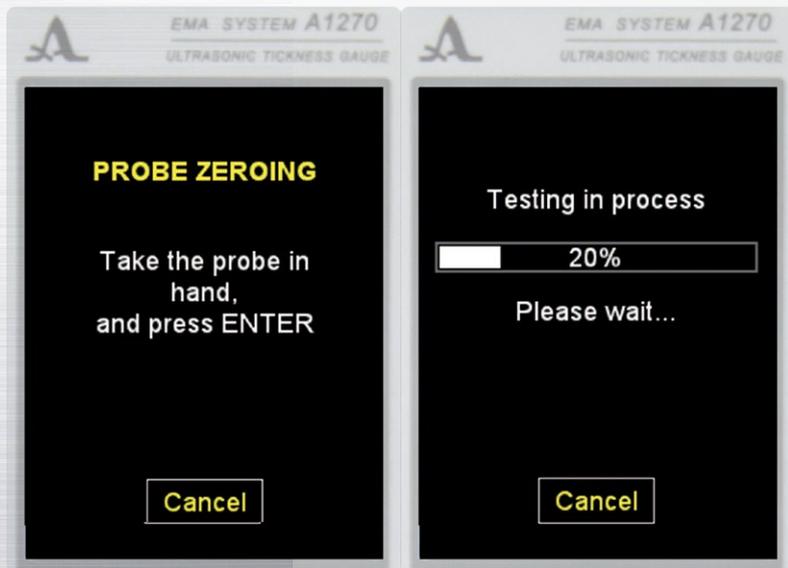


Figure 17

- Press the key **F2** (OK) or . If the test result is positive, the instrument will switch into the measurement mode, if the test result is negative, the instrument will return to the main window of the SETUP mode.

At any step the testing procedure can be cancelled by pressing the **F2** key (Cancel), in that case the instrument will return to the main window of the SETUP mode.

Figure 17 different window during adjustment with a positive result.

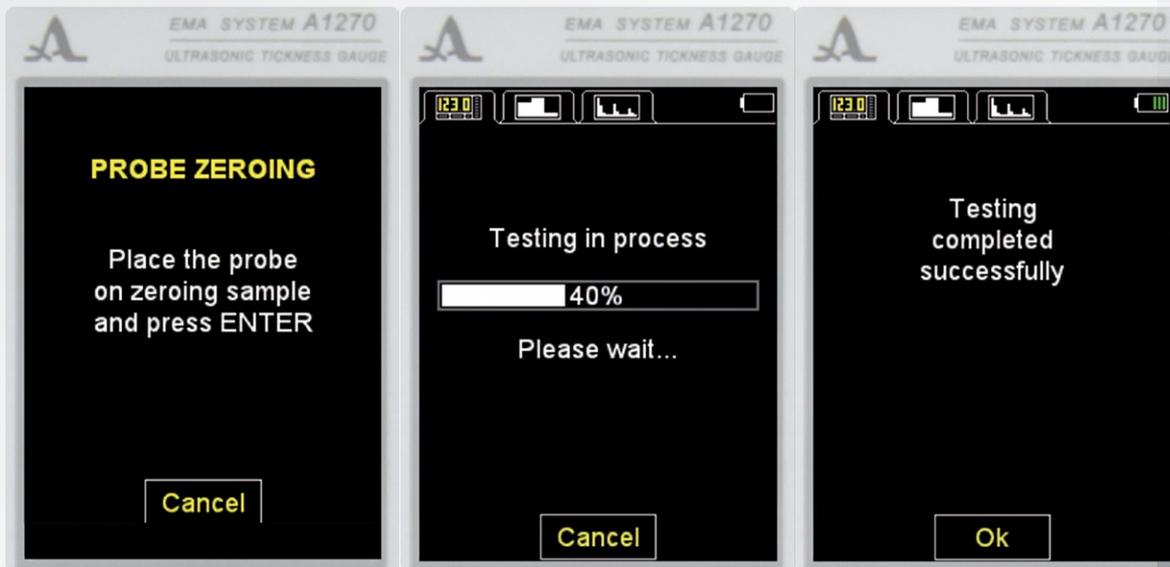
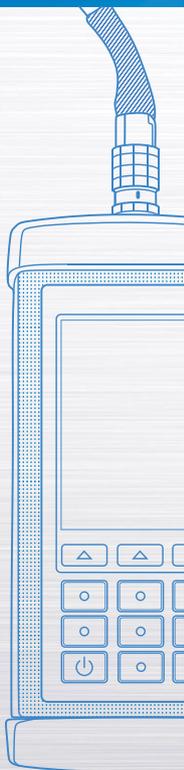


Figure 17 Continue



# 2



## 2.3 USING THE INSTRUMENT

### 2.3.1 Working with the instrument

During the inspection the temperature dependence between the ultrasonic propagation velocity in cooled or heated materials shall be considered. For the best measurement results the instrument must be adjusted to the ultrasonic velocity by the calibration sample with the same temperature as the temperature of the inspected object.

### 2.3.2 SETUP mode

The SETUP mode includes a list of parameters accessible for editing in the current operating mode (in white font). If the parameter editing is not accessible in the current operating mode, the font is grey. The testing procedures EMAT and sample velocity calibration, viewing of the transducer base and the work with the material bank are also grey.

All settings of the instrument will be saved after it is switched Off or the accumulator goes dead.

The screen in the SETUP mode is shown in the Figure 18.

The active keys in any of the menus of the SETUP mode:



-scrolling the active line through the menu options, transition is carried out cyclically in both directions. The parameter highlighted by the active line becomes available for selection or editing depending on the current operating mode;



-decrease/increase the digital value of the selected parameter. The menu options of the SETUP mode are common for all measurement modes, their corresponding parameters (in the metric measurement system) and functions are shown in the Table 5.

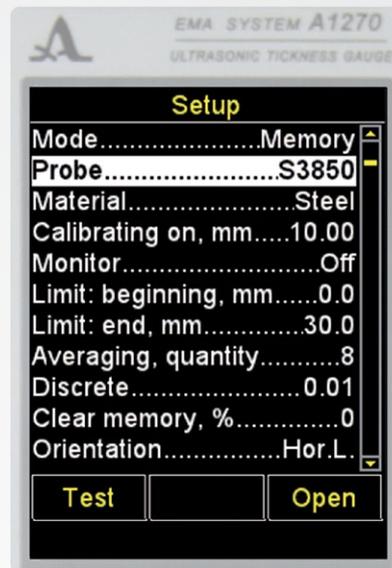


Figure 18

Table 5

Menu option (parameter)	Parameter value	Description
Mode	MEMORY / B-SCAN/ A SCAN	Selects the measurement mode
Probe	name of EMAT	Enters the library of the transducers. Starts the testing procedure of EMAT
Material	name of the material	Enters the library with materials
Calibrating on, mm	from 2 to 50	Sets the thickness of the sample. Starts the procedure of velocity calibration with the sample of a defined thickness
Monitor / automatic flaw alarm (available in MEMORY mode only)	Off / outside / inside	Off – the automatic flaw alarm (AFA) is turned off. Inside /Outside – setting the AFA actuation criterion (color and audible alarm when finding the measurement result within the set boundaries (inside) or beyond them (outside))
Limit: from, mm (available in MEMORY mode only)	from 0.0 to „limit to“ minus 1	Setting the lower limit of the AFA actuation
Limit: to, mm (available in MEMORY mode only)	from 1.0 to the value automatically calculated based on the set ultrasonic velocity	Setting the upper limit of the AFA actuation
Averaging factor (available in modes MEMORY and A-SCAN)	from 1 to 60	Setting of the maximum current average during the measurement process
Measuring frequency, Hz	from 1 to 10	Setting the measurement repetition rate. The value depends on the set averaging factor



# 2

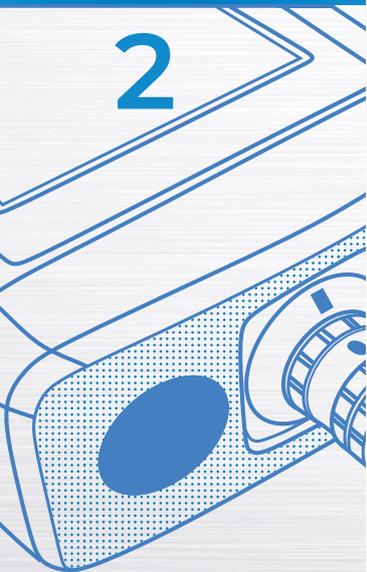


Table 5 ▼

Menu option (parameter)	Parameter value	Description
Discrete	0.01 / 0.1	Setting the result display discreteness
Scan beginning, mm (B-SCAN und A-SCAN modes)	from 0.0 to 295.0	Setting the beginning of the measurement range
Scan end, mm (B-SCAN und A-SCAN modes)	from 5.0 to 300.0	Setting the end of the measurement range
Gate beginning: from, mm (A-SCAN only)	from 0.0 to 299.0	Setting the left gate limit
Gate end: to, mm (A-SCAN only)	from 1.0 to 300.0	Setting the right gate limit
Gain, dB (A-SCAN only when measuring manually)	Auto / from 0 to 40	Setting the gain value
B-SCAN contrast, dB (B-SCAN only)	from 0 to 40	Setting the contrast value
View of the A-SCAN (A-SCAN only)	Filling / key line	Select the type of signal representation
Orientation (B-SCAN und A-SCAN modes)	auto / Hor.L. / Vert / Hor.R.	Selects an orientation (layout) of the image on the display
Memory cleaning, %	from 0 to 100	Indication of the storage size occupied by the results saved on the modes MEMORY and A-SCAN. Start the process of deleting the measurement results from the memory
Screen shot cleaning, %	from 0 to 100	Indication of the storage size occupied by the screenshots taken in the B-SCAN mode. Start the process of screenshot deletion

Table 5

Menu option (parameter)	Parameter value	Description
Measurement in the B-SCAN	On / Off	Controlling the gauge image in the B-SCAN mode
Sound	On / Off	Monitoring of the sound indication
Vibration	On / Off	Monitoring of the vibration indication
Language	Russian / English / ...	Selecting the interface language
Meas. unit	mm / inches	Selecting the measurement unit system
Brightness, %	from 20 to 100	Setting the display brightness level
Date	DD.MM.YYYY	Date setting
Time	HH.MM	Time setting

### 2.3.2.1 The MODE option

Select the operating mode:

- MEMORY: the measurement results stored in the MEMORY and A-SCAN modes are displayed on the screen;
- B-SCAN: the testing object profile is displayed;
- A-SCAN: the signal in form of an A-Scan is displayed on the screen.

Active keys:

F1 (Memory): selects the MEMORY mode;

F2 (B-Scan): selects the B-SCAN mode

F3 (A-Scan): selects the A SCAN mode;

 subsequent switching between the modes.

The MODE option is shown on the screen, Figure 19.

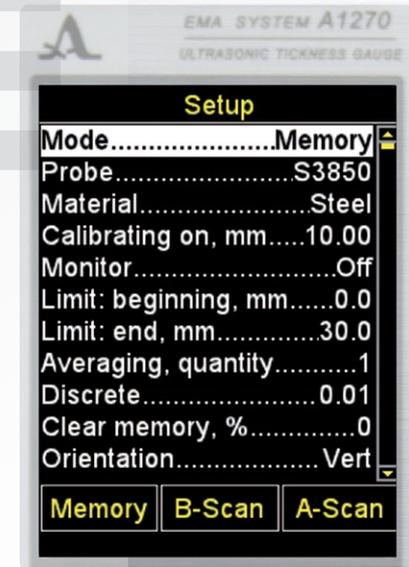


Figure 19



# 2



### 2.3.2.2 Probe option

- Enters the library with transducers.

Active keys:

**F1** (Test): starts the testing procedure of EMAT adjustment of the instrument to the selected transducer;

**F3** (Open) or : enters the library with transducers.

The Probe option is shown on the screen, Figure 20.

- Viewing the library with transducers.

The window header will show information on the currently used EMAT "Current probe:".

**ATTENTION: USERS MAY NOT ADD THE TRANSDUCERS (PROBES) TO THE LIBRARY AND EDIT THE LIBRARY INDEPENDENTLY!**

Active keys:

**F1** (Test): starts the procedure of adjustment of the EMAT individual parameters.

**F2** (View): provides viewing of the detailed information on a transducer. The name, type (integrated) and frequency of the EMAT is displayed on the screen.

**F3** (Exit): returns to the main window of the SETUP mode.

 selects the transducer from the list. The testing procedure of EMAT adjustment to the parameters of the instrument will be started automatically. The detailed description of the procedure is given in the paragraph 2.2.3.2.

Upon exiting the library, the instrument will remember the last active line and will set it upon the next library entry. Upon switching Off the instrument information on the active line of the library will be set to zero.

Figure 21: the screen of the instrument when viewing the library with transducers.

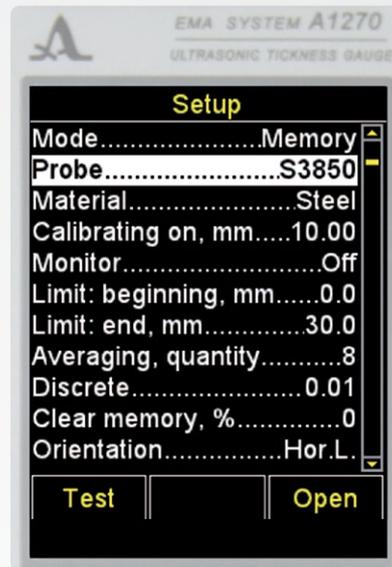


Figure 20

### 2.3.2.3 MATERIAL option

- Enters the library with materials.

Active keys:

**F2** (Open) or  enters the library with materials to record new materials into the memory and edit the existing and to select the material for operation.

The screen of the MATERIAL option is shown in the Figure 22.

- Working with the library of materials.

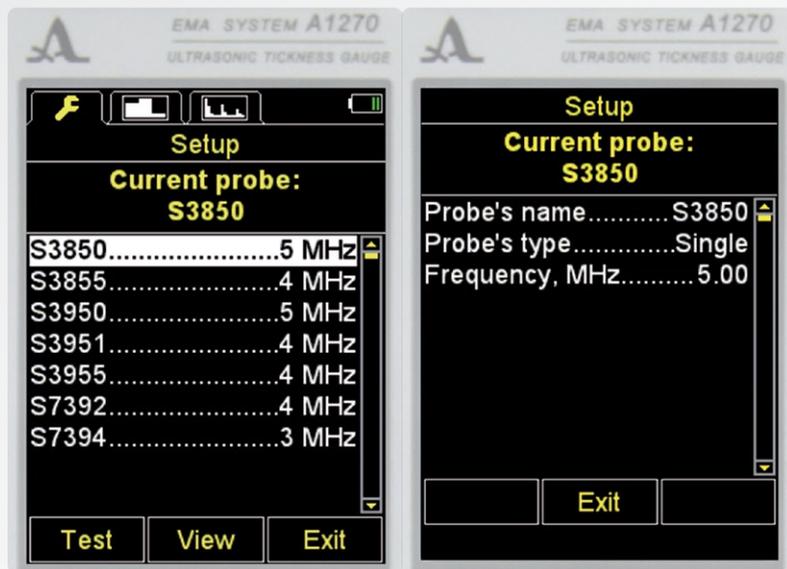


Figure 21

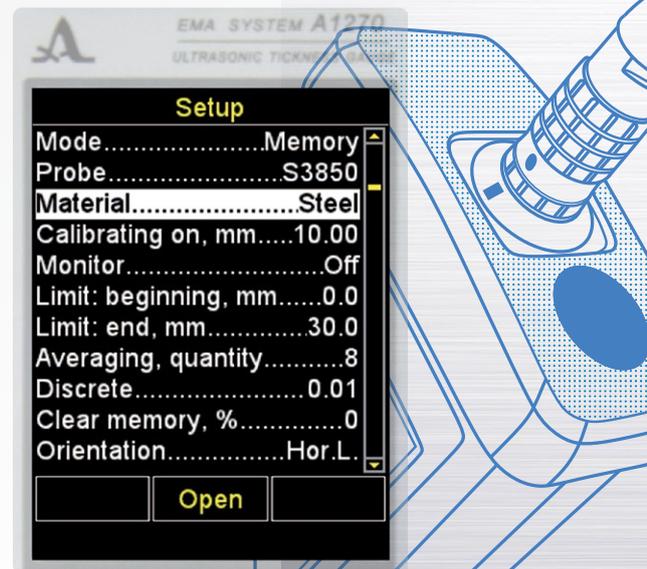


Figure 22

# 2

The memory contains information on 32 types of materials.

The window header shows information on the currently used material (current) and ultrasonic velocity in it.

### Creating new material.

The menu option NEW is listed in the menu first, followed by the following: names and propagation velocity of ultrasonic waves in the material types recorded in the memory (Figure 23). Active keys:

**F1** (Create): opens the editor of the material name (Figure 24).

**F3** (Exit): returns to the main window of the SETUP mode.

Figure 23

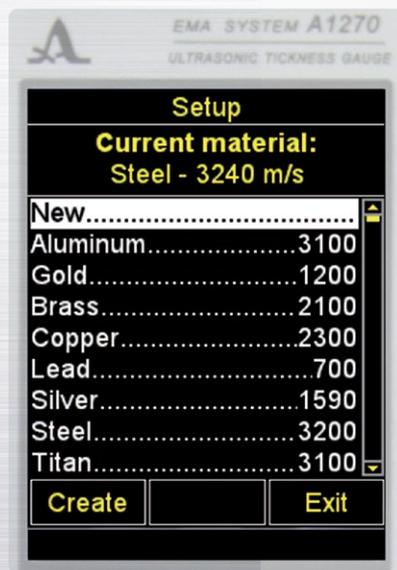


Figure 24

Main active keys:

 - changing between the material editing and the ultrasonic velocity in it

**F1** (): exits the editor saving the changes.

**F2** (XXX): switching between the characters in the letter table: aбв – Russian small letters, АБВ – Russian capital letters, abc – English small letters, ABC – English capital letters.

**F3** (): exits the editor saving the changes.

When the material is created or the existing material recorded in the memory is edited, the screen will show the current name of the material with an inverse active character on the red background in the material field name, the propagation velocity of ultrasonic waves in the material and tables with the available characters.

To create a new material entry please select the item “New” and press the key **F1** (create). The material editor opens, in the fields name and velocity the parameters of the current material are indicated.

To change the name of the material:

- Using the key  switch to the editing mode for editing the material name, the red cursor bar is in the name field.

- Using the keys   select the character to be deleted or changed in the name of the material, for example "S" -  ;

- use the **F2** key to select the language and character case;

- Using the keys    and  select a new character in the table of characters (letter, number, special symbol or space), delete the highlighted character -  or a character prior to the highlighted one - , and press the key .

To change the ultrasonic propagation velocity in the material:

- Using the key  switch to the editing mode for editing the ultrasonic velocity in the material, the red cursor bar is in the velocity field. In the velocity field you can only enter numbers.

- Using the keys  or  select a number you want to change, for example "2".

- Using the keys    and  select a new number in the number field;

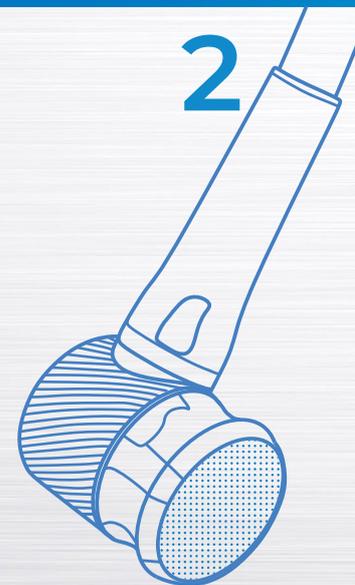
- Press the key .

The functions of some keys during the work in the material name editor are described in the Table 6.



Table 6

Tab	Purpose
   	Scrolling through the table with characters and numbers
 	Selects a character to be edited in the material field name. Changes the velocity value
	Switching between the editor of material and the ultrasonic velocity in it





# 2

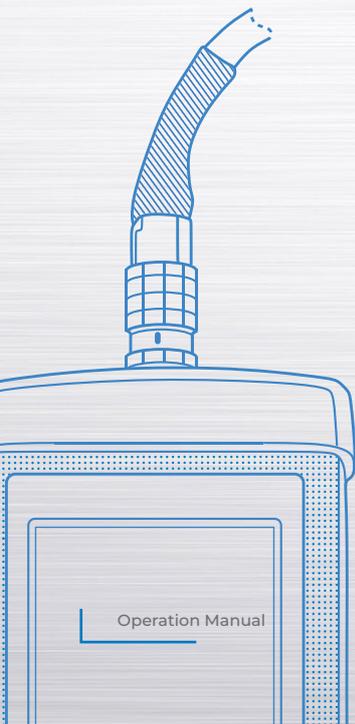


Table 6 ▼

Tab	Purpose
	Substitutes the active character with the character from the table. The next character will be active after substitutio
F1	Exits the editor saving the changes
F2 (XXX)	Switching between the characters in the letter table, where XXX: абв – Russian small letters АБВ – Russian capital letters abc – English small letters ABC – English capital letters
F1	Exits the editor saving the changes

### Editing the information on the material.

Active keys:

**F1** (Edit): switches to the information edit mode of the selected material. The editing process is similar to the process of entering a new material, described above.

**F2** (Delete): deletes the material from the memory.

**F3** (Exit): returns to the main window of the SETUP mode.



: selects the material for operation and returns to the main window of the SETUP mode.

Upon exiting the library, the instrument will remember the last active line and will set it upon the next library entry. Upon switching Off the instrument the information on the active line of the library will be set to zero.

The library with materials is shown on the screen, Figure 25.

Upon pressing the key **F2** (Delete) the following message will be displayed: "Remove material?" (Figure 26). You can confirm deletion by pressing **F1** (Yes), or cancel it by pressing **F3** (No).

### 2.3.2.4 The CALIBRATING ON Option

The CALIBRATING ON option is used for the determination of the ultrasonic wave velocity in the material of known thickness.

The thickness of the calibration sample can be set within the interval from 2 to 50 mm

The CALIBRATING ON option is shown on the screen, Figure 27.

Active keys:

 /  decreasing / increasing the thickness value of the calibration sample.

**F2** (editing) – opening the table with numbers to set the thickness of a sample.

# 2

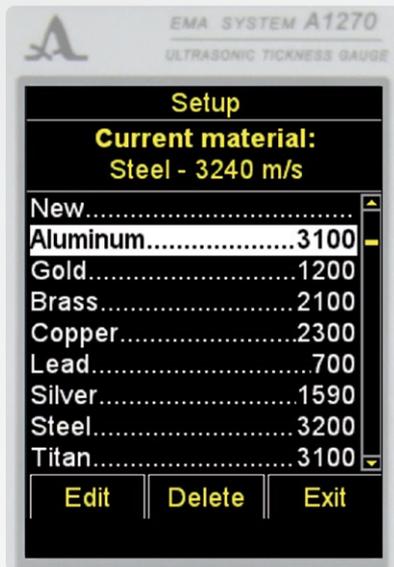


Figure 25



Figure 26

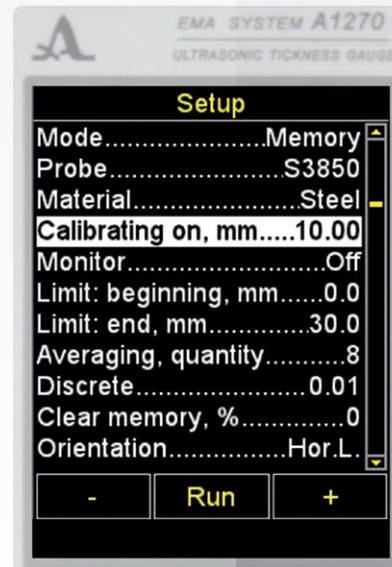


Figure 27

# 2

**F3** (run) or  – starting the process of velocity calibration on a sample.

Setting the thickness of the calibration sample and a procedure of the velocity calibration with the sample.

To set the sample thickness:

- Press the key **F2** (edit). The table with numbers opens (Figure 28).
- Using the keys  /  select the category for changing;
- Using the keys , ,  and  go to the new number;

- Using the key  select a new number;

- Press the key **F1** (save) to exit the editing and save the new value, **F3** (cancel) without saving.

### Calibration on a sample

To perform the calibration on a sample with a known thickness, please:

- Select the velocity calibration procedure on a sample – **F3** (run);

- The message will appear on the screen: „Place EMAT on the calibration sample and press ENTER“;

- Place the EMAT on the sample and press .

The message will appear on the screen: „Data retrieval on the sample with XX.XX thickness is running“, where XX.XX mm is the set sample thickness.

The current result of the velocity measurement is shown on the screen.

- After the data is retrieved the message will appear on the screen: „Save the result?“

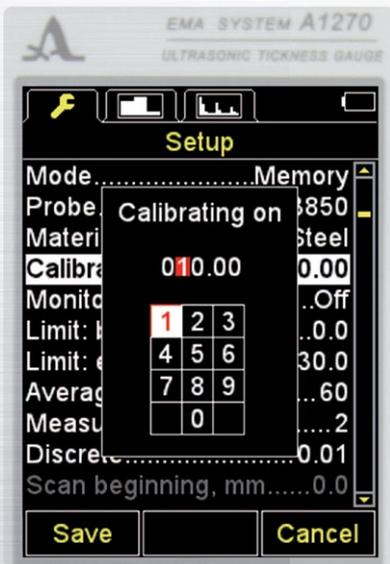


Figure 28



Figure 29

The screen layouts (orientation) of the instrument during the calibration on the sample with known thickness are shown subsequently in the Figure 29.

### Saving the velocity value obtained during calibration.

Active keys:

**F1** (Yes): saving the obtained velocity value for the material existing in the library which shall be selected from the list of the materials, (Figure 30) or for the new material: select the “New” option, set the name of the material and press the key **F1** (Save) (Figure 31).

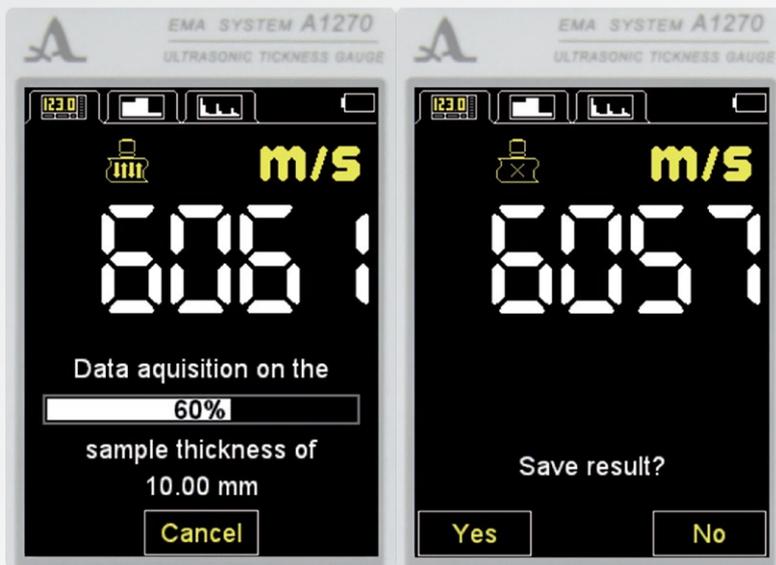


Figure 29 Continue



Figure 30



- To create a new material:
- Select the item "New";
  - Press the key **F1** (save);
  - On default the current name of the material will be suggested as the name of the new material- you can change it to any name;
  - Enter the name of the material;



Figure 31

- Press the key **F1** (  );
  - The new material will be placed in the end of the material list.
- F3** (No): exits without saving the result.

### 2.3.2.5 Monitor option (only for the MEMORY mode)

Setting the actuation conditions for color, sound and vibro-alarms during measurements.

Selecting the actuation condition:

INSIDE: the measurement result is within the specified range;

OUTSIDE: the measurement result is out of the specified range;

OFF: the monitor is Off.

The Monitor option of the instrument is shown in the Figure 32.

Active keys:

**F1** (Inside): selecting the actuation condition INSIDE;

**F2** (Off): the Monitor is Off;

**F3** (Outside): selecting the actuation condition OUTSIDE;

 switching between the INSIDE / OFF / OUTSIDE options.



Figure 31 Continue

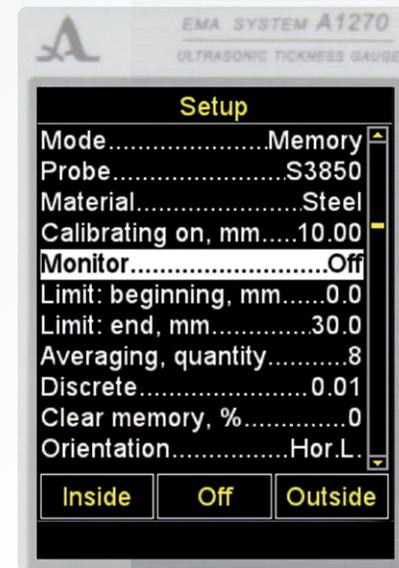


Figure 32

# 2

# 2

## 2.3.2.6 The LIMIT: BEGINNING option (only for the MEMORY mode)

Sets the lower limit of actuation of the Monitor.

Permissible values vary from 0 mm to the value one unit lower than the value of the Limit parameter: T0.

The LIMIT of the instrument: the beginning option is presented in the Figure 33.

Active keys:

**F1** (-) or  – decreasing the value of the lower actuation boundary of the AFA.

**F2** (edit) or 

– open the table with numbers to set of the lower actuation boundary of the ASD (Figure 34).

**F3** (+) or  – increasing the value of the lower actuation boundary of the AFA.

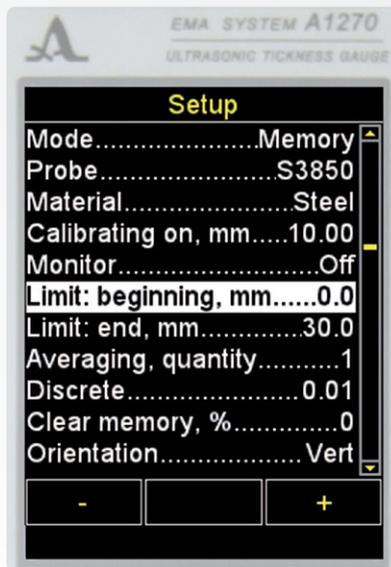


Figure 33

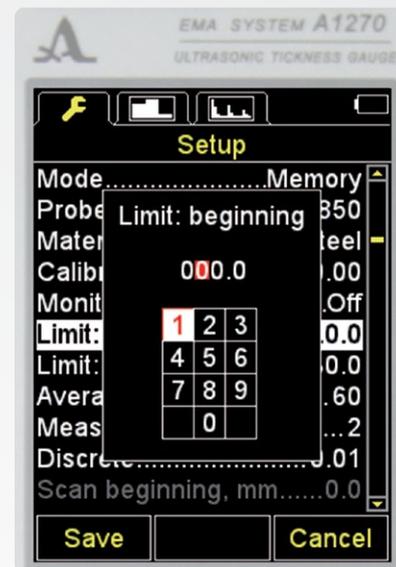


Figure 34

### 2.3.2.7 The LIMIT: end (only for the MEMORY mode)

Sets the upper limit of actuation of the Monitor.

Permissible values vary from 1 to the calculated value, that depends on the set ultrasonic velocity in the material.

The LIMIT of the instrument: the end option is shown in the Figure 35.

Active keys:

**F1** ( - ) or  – decreasing the value of the upper actuation boundary of the AFA.

**F2** ( edit ) or  – open the table with numbers to set of the upper actuation boundary of the AFA (Figure 36).

**F3** ( + ) or  – increasing the value of the upper actuation boundary of the ASD.

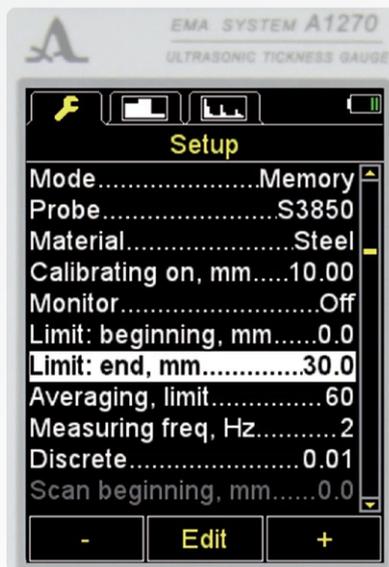


Figure 35

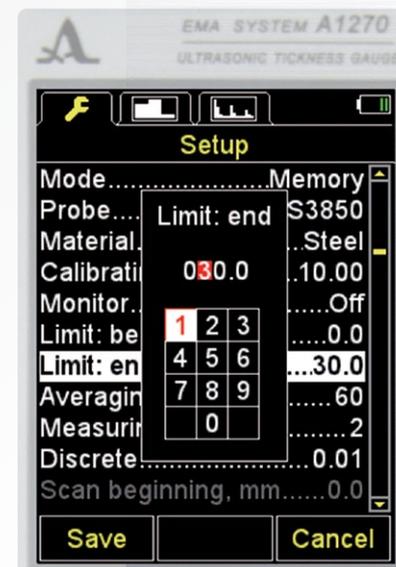


Figure 36

# 2

# 2

## 2.3.2.8 Item AVERAGING, LIMIT (MEMORY and A-SCAN modes)

Setting the maximum value of the current average of the signal for the MEMORY and A-SCAN modes during measurements. Permissible values from 1 to 60.

**Note:** when setting the value „1“ it is permissible to perform measurements via scanning the surface of the tested object. Screen appearance of the instrument's AVERAGING, Limit option is presented in Figure 37.

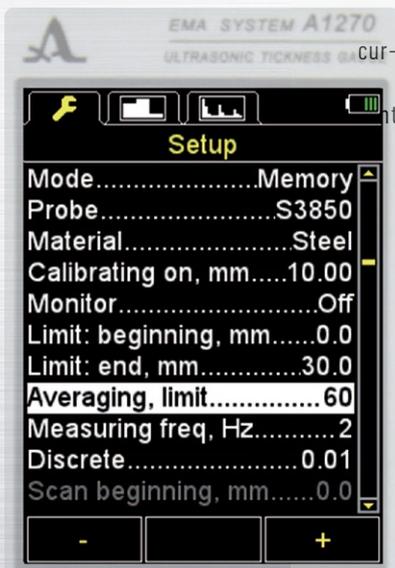


Figure 37

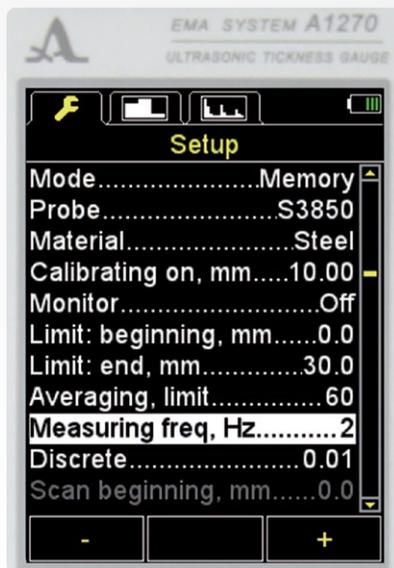


Figure 38

Active keys:

F1 (-) or  - decreasing the maximum value of the rent averaged valued.

F2 (+)  - increasing the maximum value of the cur-averaged value.

## 2.3.2.10 Item MEASURING FREQUENCY

The screen of the device with the item MEASURING FREQUENCY is shown on the Figure 38.

Active keys:

F1 (-) or  - decreasing the frequency value.

F3 (+) or  or  - increasing the frequency value.

### 2.3.2.9 The DISCRETE option

Setting the discreteness of the image indication on the screen. The screen DISCRETE option (for the metric measurement system) is shown in the Figure 39. Active keys:

- F1** (0.1): setting the display of the measurement results with one decimal place;
- F3** (0.01): setting the display of the measurement results with two decimal places;
-  switching between the discrete values from 0.1 to 0.01.

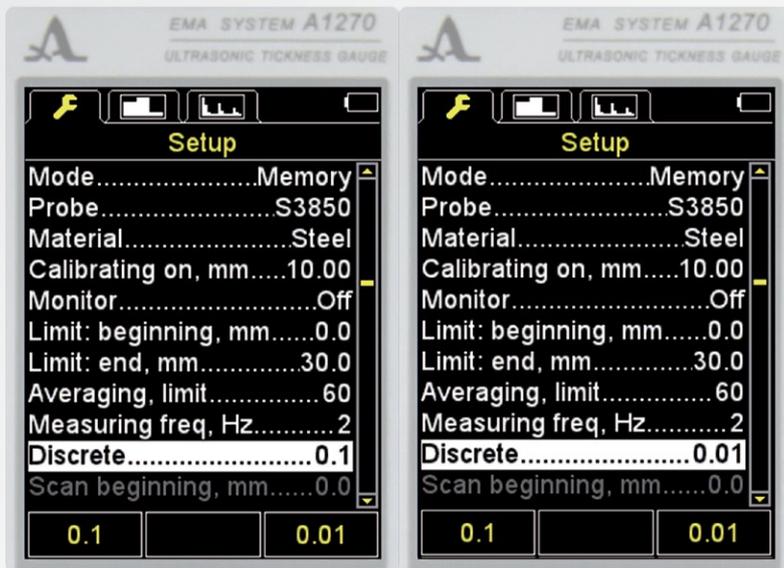


Figure 39

# 2

## 2.3.2.11 The SCAN BEGINNING (A-SCAN and B-SCAN modes)

The option SCAN BEGINNING is used to set the start point of the image area on the screen.

The value of the scan beginning can be set within the range from 0 to 295.0 mm.

The screen SCAN BEGINNING option is shown in the Figure 40.

Active keys:

**F1** (-) or : decreases the value of the scan beginning.

**F2** (edit) or  -

open the table with numbers to set of the value to start the scanning (Figure 41).

**F3** (+) or  increasing the value of the scanning start.

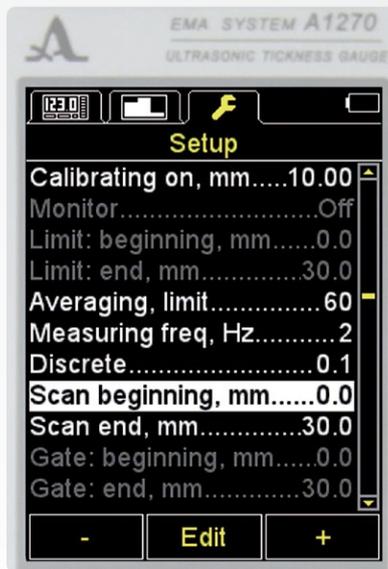


Figure 40



Figure 41

### 2.3.2.12 The SCAN END option (A-SCAN and B-SCAN modes)

The option SCAN BEGINNING is used to set the end point of the image area on the screen.

The value of the scanning (scan) end can be set within the range from 5.0 to 300 mm.

The screen SCAN END option is shown in the Figure 42.

Active keys:

**F1** (–) or : decreases the value of the scanning (scan) end.

**F2** (edit) or  – open the table with numbers to set of the value for the end of scanning (Figure 43).

**F3** (+) or  – increase the value for the end of scanning.

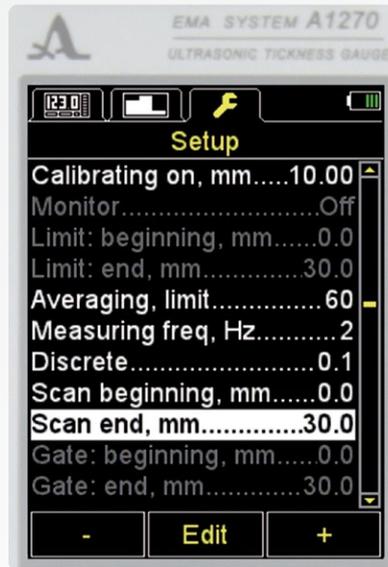


Figure 42

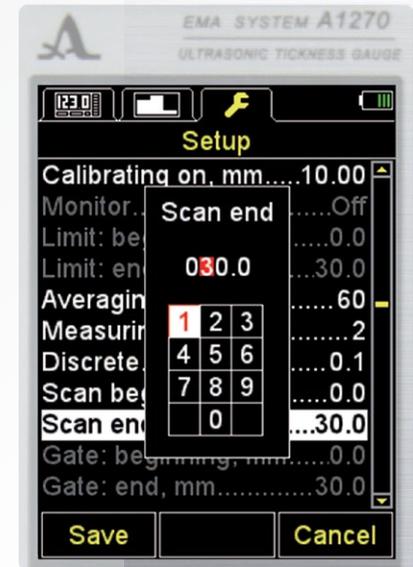


Figure 43

# 2

# 2

### 2.3.2.13 The GATE: BEGINNING (only for the A SCAN mode when measuring manually)

The GATE: BEGINNING option is used for setting the left limit of the strobe.

Values can be set within the range from 0 to 299 mm.

The screen GATE: BEGINNING option is shown in the Figure 44.

Active keys:

**F1** (-) or  : decreases the value of the lower limit of the strobe (gate).

**F2** (edit) or  -

open the table with numbers to set of the left strobe boundary (Figure 45).

**F3** (+) or  - increasing the value of the left strobe boundary.



Figure 44

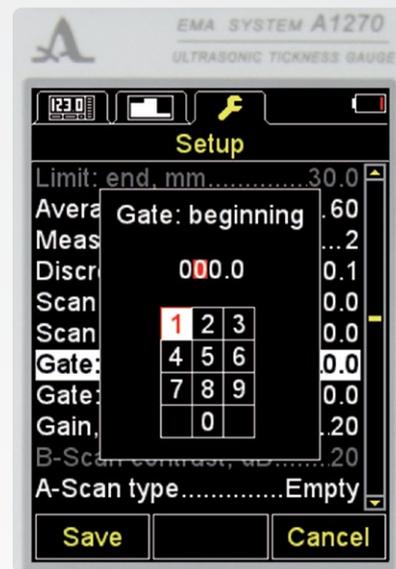


Figure 45

### 2.3.2.14 The OPTION GATE: END (only for the A SCAN mode when measuring manually)

The option Gate: end is used for setting the right limit of the strobe.

The gate end values (end of the strobe) can be set within the range from 1 to 300 mm.

The screen option Gate: end is shown in the Figure 46.

Active keys:

F1 ( - ) or  : decreases the value of the upper limit of the strobe.

F2 (edit) or  - open the table with numbers to set of the right strobe boundary (Figure 47).

F3 ( + ) or  - increasing the value of the right strobe boundary.

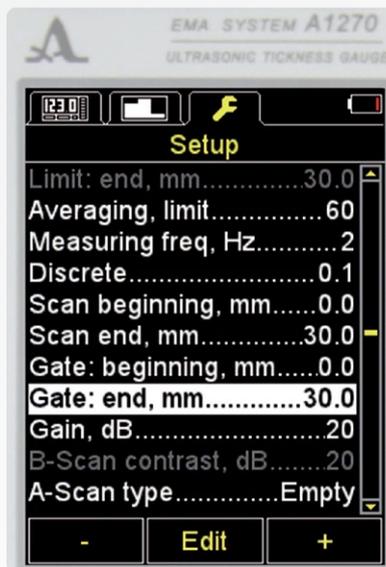


Figure 46

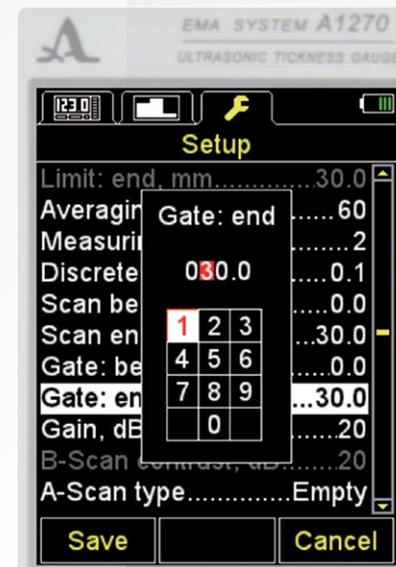


Figure 47

# 2

# 2

## 2.3.2.15 The GAIN OPTION (only for the A SCAN mode when measuring manually)

The Gain option is used for setting the amplification value of the receiving channel.

The Gain value can be set within the range from 0 to 40 dB.

The screen Gain option is shown in the Figure 48.

Active keys:



Figure 48

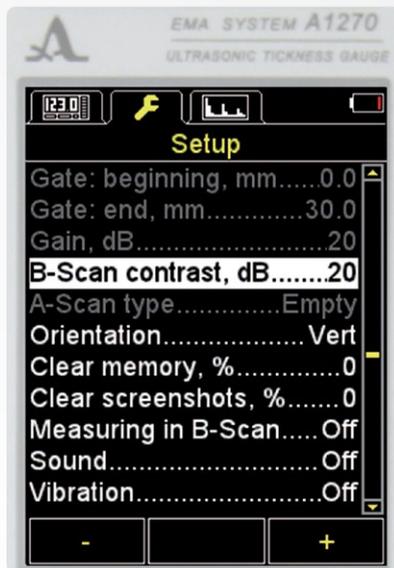


Figure 49

- F1 (-) or  : decreases the gain value.
- F2 (auto) or  – switching the automatic amplification setting on and off.
- F3 (+) or  – increasing the amplification value.

## 2.3.2.16 Item B-SCAN CONTRAST (for the B-SCAN mode only)

The item B-SCAN CONTRAST is used to set the contrast of the B-Scan image.

The value can be set from 0 to 40 dB.

The view of the device screen of the item B-SCAN CONTRAST is shown in the Figure 49.

Active keys:

- F1 (-) or  – decreasing the value.
- F3 (+) or  – increasing the value.

### 2.3.2.17 The A-SCAN TYPE option (only for the A SCAN mode)

Selecting the type of the signal indication in the A SCAN mode and when viewing the recorded A Scans in the MEMORY mode – FILLING / CONTOUR.

The screen A SCAN TYPE option is shown in the Figure 50.

Active keys:

**F1** (Filling): the detected signal is displayed in the filled form.

**F3** (Contour): the detected signal is displayed as an outline.

 : switching between the signal display types.

### 2.3.2.18 The ORIENTATION option (A-SCAN and B-SCAN modes)

Selecting the image orientation type – AUTO/Hor.R./Vert/Hor.L.

The screen ORIENTATION option is shown in the Figure 51.

Active keys:

**F1** (Hor.L.): horizontal left.

**F2** (Vert): vertical.

**F2** (auto) – switching to the mode of automatic image orientation change depending on the device position.

**F3** (Hor.R.): horizontal right.

 : switching between the formerly set and the automatic screen orientation.

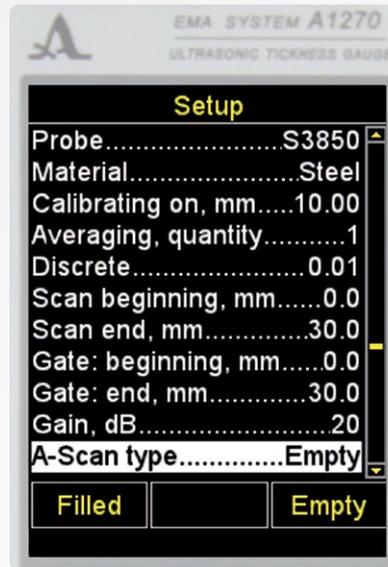


Figure 50

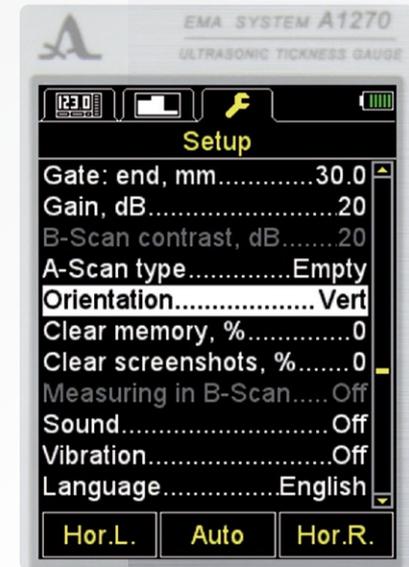


Figure 51

# 2

# 2

## 2.3.2.19 The CLEAR MEMORY option (only for the MEMORY mode)

Deleting the measurement results saved in the modes MEMORY and A-SCAN from the storage. As the parameter of the item the percentage of the storage filling with the measurement results is indicated. The screen CLEAR MEMORY option is shown in the Figure 52.

Active keys:

**F2** (Run) or : starts the procedure of memory cleaning.

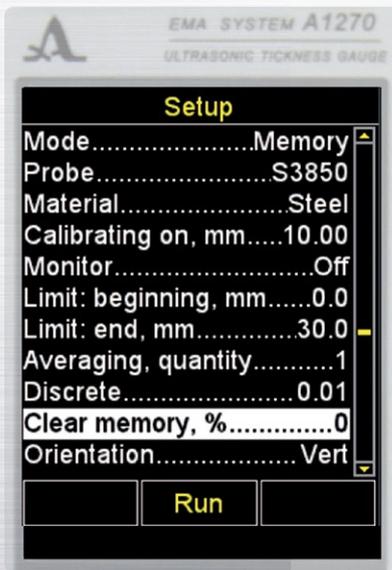


Figure 52

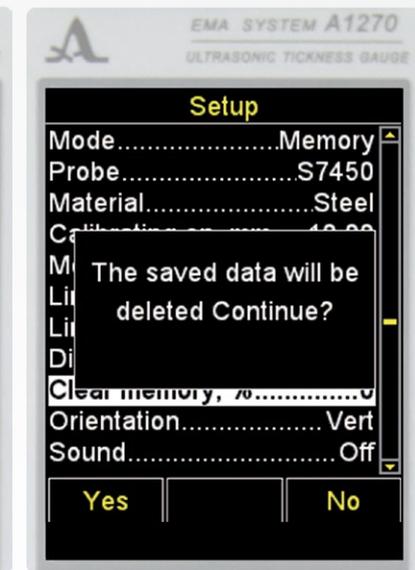


Figure 53

Upon starting the memory cleaning procedure the "Saved data will be deleted. Continue?" message is displayed on the screen (Figure 53).

Active keys:

**F1** (Yes): confirms data deletion.

**F3** (No): cancels data deletion.

### 2.3.2.20 Item SCREENSHOT CLEANING

Deleting the screenshots saved in the B-SCAN mode from the storage.

As the parameter of the item the percentage of the storage filling with the screenshots is indicated.

The view of the screen of the device item SCREENSHOT CLEANING is indicated in the Figure 54.

Active keys:

**F2** (run) or  – start the process of screenshot cleaning.

After starting the memory cleaning the following message appears on the screen: “Screenshots will be deleted. Continue?” (Figure 55).

Active keys:

**F1** (yes) – confirm the deletion.

**F3** (no) – cancel the deletion.

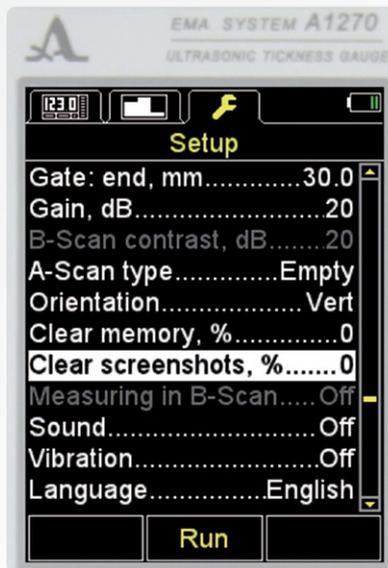


Figure 54

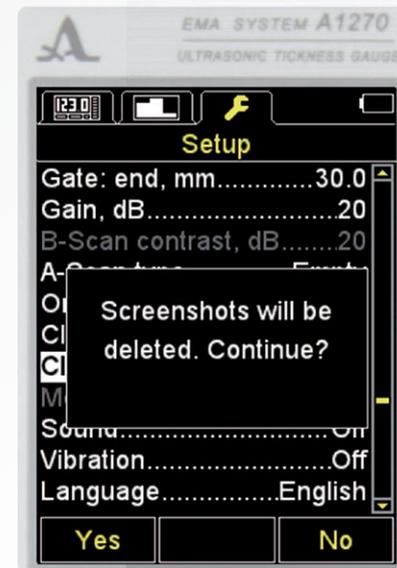


Figure 55

# 2

# 2

## 2.3.2.21 Item MEASURING IN THE B-SCAN

Switching the image of the gauge ON / OFF in the B-SCAN mode.

The view of the device screen in the item MEASURING IN THE B-SCAN is indicated on the Figure 56. Active keys:

**F1** (On) – switching the gauge image on.

**F3** (Off) – switching the gauge image off.

 – switching the gauge image on / off.

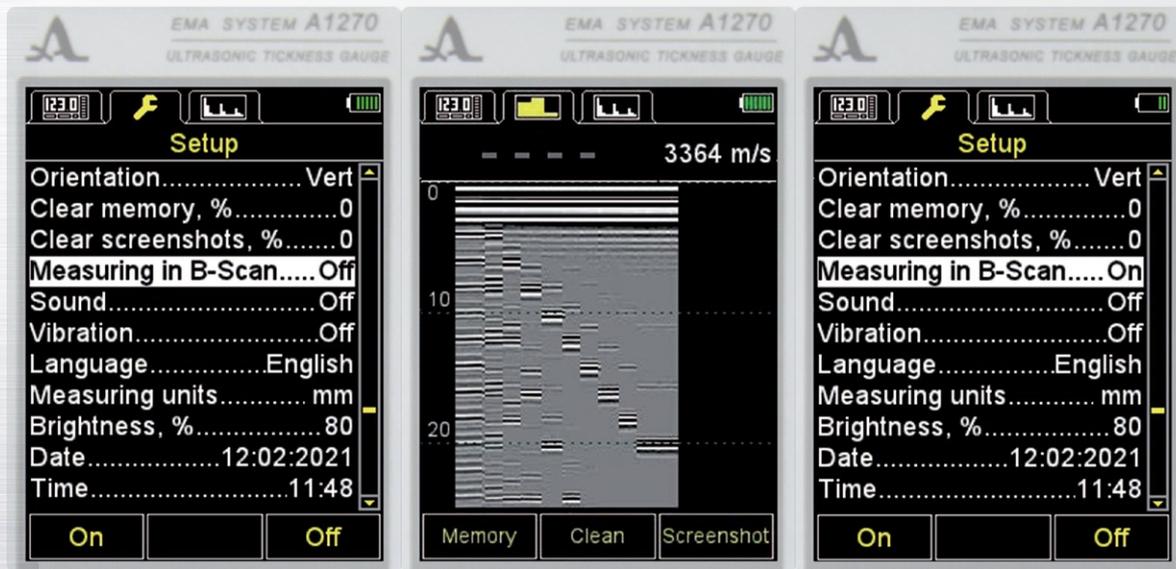


Figure 56

### 2.3.2.22 The SOUND option

Switching On/Off the sound indication of the instrument.

For the convenient operation of the thickness gauge the main events of the thickness gauge during measurements, adjustment and key pressing are accompanied by sounds. The sound indication is also used for the acoustic monitoring of reception of ultrasonic signals. The acoustic signals inform the operator on the current processes without influencing the measurement results.

The screen SOUND option is shown in the Figure 57.

Active keys:

**F1** (On): switching On the sound indication.

**F3** (Off): switching Off the sound indication;

 : switching On/Off the sound indication.



Figure 56 Continue

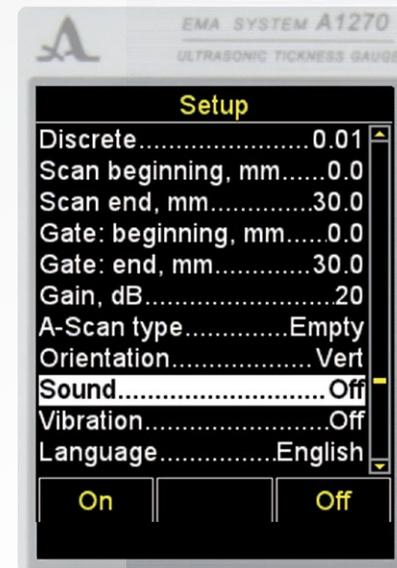


Figure 57

# 2

## 2.3.2.23 The VIBRATION option

Switching On/Off the vibration indication.

For the convenient operation of the thickness gauge the main events of the thickness gauge during measurements, adjustment and key pressing can be accompanied by vibration. The vibration also informs the operator on the current processes without influencing the measurement results.

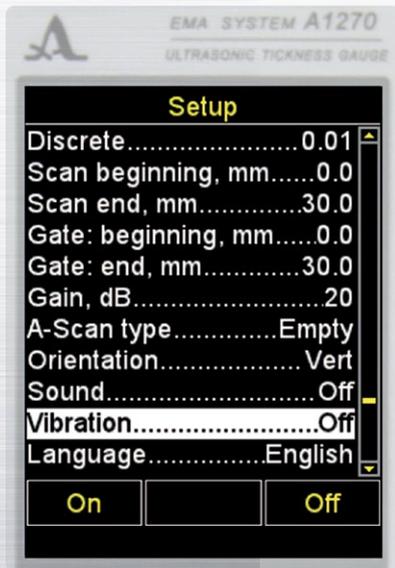


Figure 58

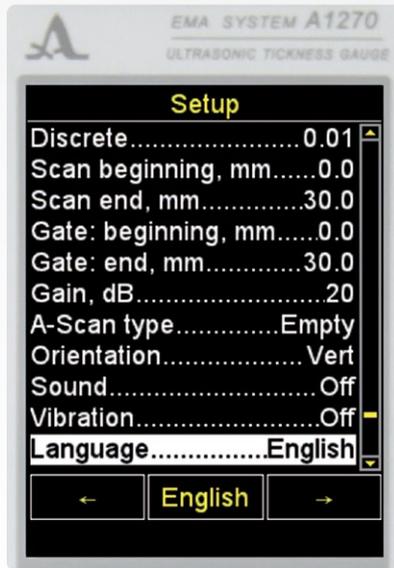


Figure 59

The screen VIBRATION option is shown in the Figure 58.

Active keys:

**F1** (On): switching On the vibration.

**F3** (Off): switching Off the vibration;

: Switching On/Off the vibration indication.

## 2.3.2.21 The LANGUAGE option

Switching between the interface languages of the instrument:

- Russian / English / German / French / Italian / Portuguese / Spanish / Chinese.

The screen LANGUAGE option is shown in the Figure 59.

Active keys:

**F1** (←): selects the language indicated on the pictogram;

**F2** (Russian): current language;

**F3** (→): selects the language indicated on the pictogram;

: subsequent selection of the available interface languages.

### 2.3.2.22 The MEASURING UNITS option

Selects the measurement unit system - MM / INCHES.

The screen MEASURING UNITS option is shown in the Figure 60.

Active keys:

**F1** (mm): the metric measurement units. The thickness is displayed in mm, the velocity is displayed in m/s.

**F3** (inches): the British measurement units. The thickness is displayed in inches; the velocity is displayed in inch/micro-second;

: switching between the measurement unit systems.

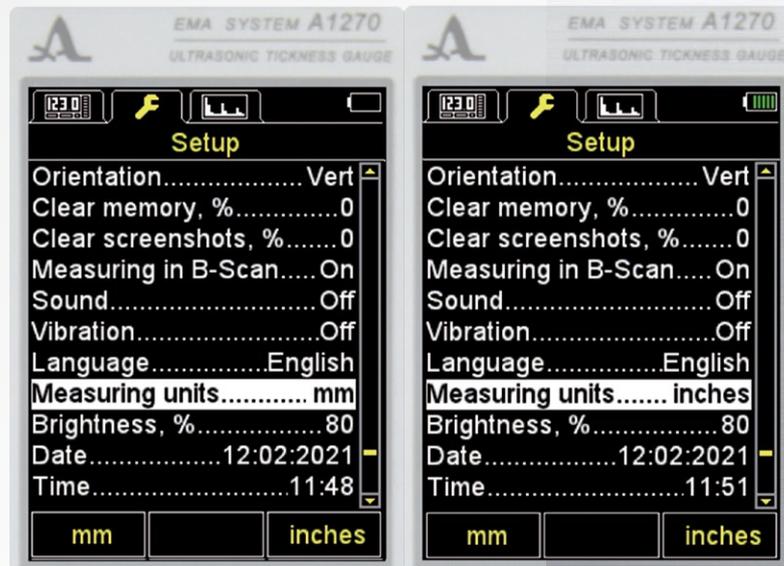


Figure 60

# 2

## 2.3.2.23 The BRIGHTNESS option

Setting the screen brightness within the range from 20 to 100 %.

The screen BRIGHTNESS option is shown in the Figure 61. Active keys:

F1 (-) or : decreases the screen brightness.

F3 (+) or : increases the screen brightness.



Figure 61



Figure 62



Figure 63

### 2.3.2.24 DATE option

Setting the date.

The menu item DATE is shown in the Figure 62.

Active keys:

**F2** (Edit) or  : start the date editing procedure.

The screen during the DATE editing procedure is shown in the Figure 63.

Active keys:

 /  ,  /  : selection of parameter for editing

 /  : changing the the value of selected parameter;

**F1** (Save): save changes and exit the editing procedure;

**F3** (Cancel): exit the editing procedure without saving changes.

 - cancel the entered changes.

### 2.3.2.25 TIME option

Setting the time.

The menu item TIME is shown in the Figure 64.

The TIME editing procedure is similar to the DATE editing (p. 2.3.2.24).



Figure 64

# 2

## 2.3.3 The MEMORY mode

**WARNING: PRIOR TO START THE WORK PLEASE PERFORM AN ADDITIONAL EMAT TEST IN THE AIR BY PRESSING THE F2 KEY!**

In the MEMORY mode the screen is divided into two parts: the upper part indicates the information on measurement (the result of the measured thickness, the signal level, the measurement method, the velocity of the US wave in the current material). The lower part indicates the information on the previously saved measurement results in the modes MEMORY and A-SCAN (groups, group cells and results of the measured thickness).

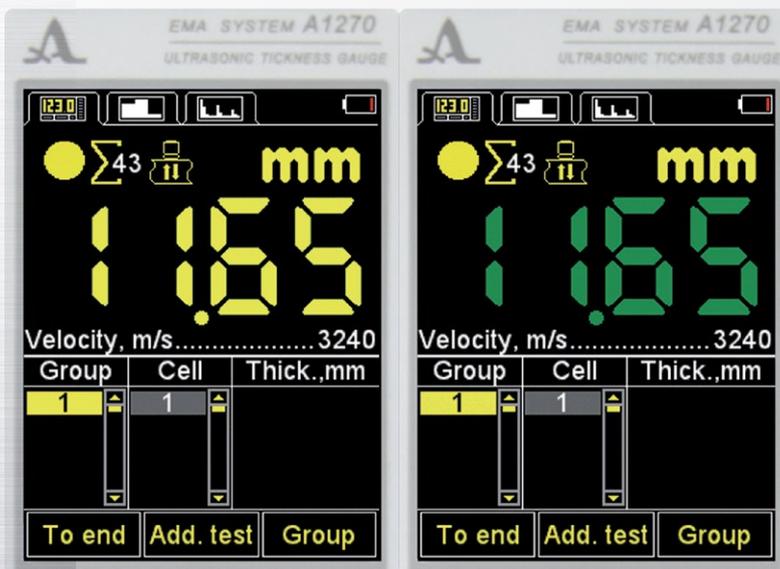


Figure 65

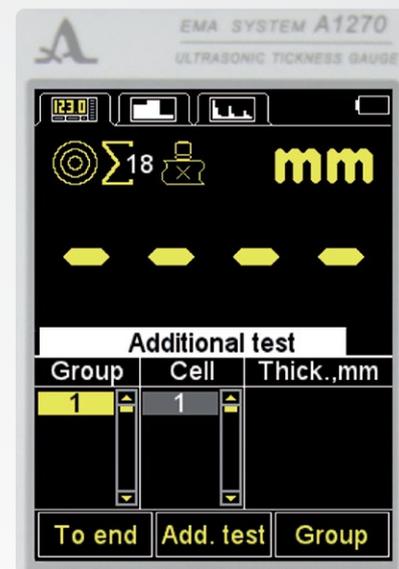


Figure 66

To perform the measurements, please install the EMAT on the object you intend to inspect. In the left corner you will see the indicator of the acoustic contact level, the indicator of the current average value and the indicator of the measurement method. During the initial installation of the EMAT on the inspected object the measurement result is indicated in yellow. As soon as the result becomes stable, the color changes to green (Figure 65).

**Note:** to reset the current average value and to prevent the EMAT from overheating, please regularly perform an additional EMAT test in the air. To start an additional test please take the EMAT from the inspected object and press the F2 key (addit. test). The running line „Additional test“ will appear. The number of the current averages and the result will be reset. (Figure 66). When the ASD is on, the color indication of the selected actuation condition will be on. If the acoustic indication is on in the menu of the Monitor, the changes of the readings will be accompanied by quick signals.

The screens Monitor-INSIDE or Monitor OUTSIDE are shown in the Figure 67 (the measurement result is displayed in red if the actuation condition of the monitor is fulfilled. The result is indicated in green or yellow, if the actuation condition of the monitor is not fulfilled).

Active keys:

  : changes the velocity of ultrasonic waves in the material.

If acoustic signals are emitted and the reading is not stable, keep the EMAT calm for 2-3 seconds and wait for stable readings.

**ATTENTION: WHEN EMAT IS REMOVED FROM THE INSPECTED OBJECT, THE MEASUREMENT RESULT WILL CHANGE TO THE HORIZONTAL STROKES IN SEVERAL SECONDS!**

 : saves the result.

**Note:** the result will be recorded into the first free cells of the selected group.

You can correct the value recorded in the memory according to the instructions given in the paragraph 0.

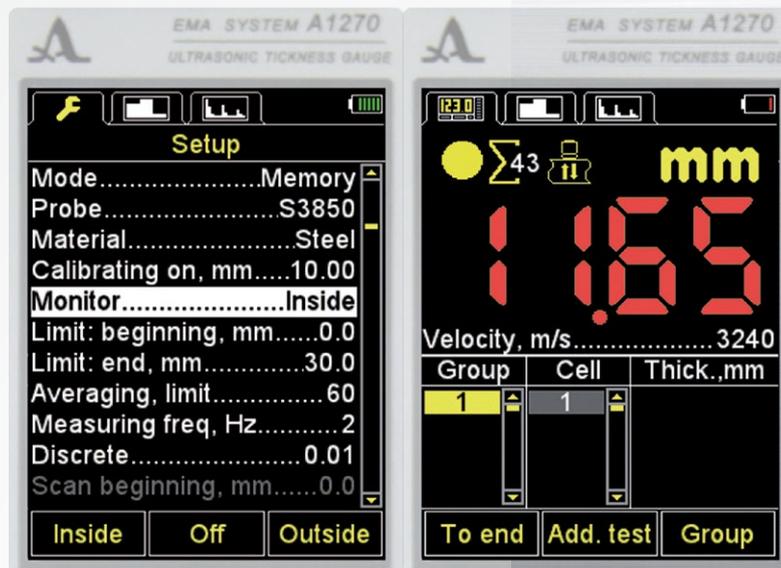


Figure 67



# 2

## 2.3.3.1 Adding a new/deleting the last group

Upon pressing the key **F3** the message "Add new or remove the last group?" will be displayed on the screen (Figure 68).

Active keys:

**F1 (-)**: deletes the last group.

**F2 (Cancel)**: exits the procedure.

**F3 (+)**: adds a new group provided that the last existing group is not empty..



Figure 67 Continue

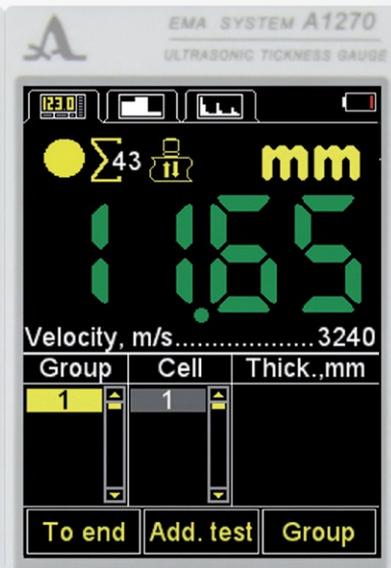


Figure 68

### 2.3.3.2 Saving the result

The measurement results are stored in the memory of the instrument in its cells. The cells are organized into the groups. The groups and cells in the groups are identified by the item No.. The groups and cells in each group are numbered starting with "1".

The maximum quantity of the cells in the group is 500.

The maximum quantity of the groups is 100.

A corresponding explanatory text "Impossible to create a group" / "The current group is full" will be displayed by the instrument when the maximum number of groups or cells is reached in the group.

In practice recording the results in small groups can be more convenient (by several tens of values). You can create a new group if necessary (paragraph 2.3.3.1). If required, you can go back to any existing group and continue recording the results in it.

Viewing and adjusting the measurement results

All results recorded in the memory can be viewed and corrected if there are any doubts about their reliability. To correct the result, you have to conduct another measurement in the same point and re-record the low-quality value.

The key  is used to enter the mode to view and edit the results. Upon pressing the  key, the ❄ character (Figure 69) will appear on the screen.

The key  is used to return to the MEMORY mode. Use the   keys to view the recorded results. Scrolling through the measurement results is done using the group cells, according to the selected view direction. When the last/first cell in the group is reached, the scrolling will go to the next/previous group of the results correspondingly.



Figure 69

# 2

Do the following to correct the result:

By means of the keys   go to the cell with the result you want to correct; press the key , the  character will disappear, the instrument changes to the CHANGE mode.

**Note:** In practice the result remains in the memory up to the moment a new value is recorded in the selected cell. To go back to the view mode without changing the value recorded in the cell, press the  key.

Perform the measurement and press the  key when the result is satisfactory to record it into the cell selected to be corrected. Upon recording the instrument will automatically return to the view mode.



Figure 70

## 2.3.4 The B-SCAN mode

The B-Scan mode is used to search for corrosion damage when scanning a test object.

The graphical B-SCAN is formed from the results of the measurements received during scanning, each subsequent measurement is added to the current B-Scan and is displayed on the screen.

In the B-SCAN mode the signal is displayed on the screen as a B-SCAN. If the parameter MEASUREMENT IN THE B-SCAN is activated in the settings, apart from the ultrasonic wave velocity in the material of the inspected object the current measurement result is indicated above the B-SCAN. The measurement results on the B-SCAN are marked with a red line (Figure 70).

Active keys:

**F1** (memory) – a quick change to the MEMORY mode.

**F2** (clean) – cleaning the current B-SCAN.

**F3** (screenshot) – the screenshot of the current B-SCAN.

**Note:** To reset the current measurement result and to prevent the EMAT from overheating, please regularly perform an additional EMAT test in the air. To start an additional test please take the EMAT from the inspected object and press the F2 key (clean). The running line „Additional test” will appear. The result will be reset.

Screenshot of the current B-Scan

When pressing the F3 key (screenshot) a screenshot of the visible screen area will be made. An informational window on the file name will appear. Here the screenshot of the current B-SCAN is saved in the device memory (Figure 71). The file name of the screenshot includes the serial number and the date of screenshot creation in the following format: DAYMONTH.

**Note:** the screenshot numbering in the device starts with “000”.

The screenshot in Figure 72 is saved under the number “002” on the 12th of February. Later the saved screenshots can be viewed on a PC.

### 2.3.5 The A SCAN mode

The thickness measurement in the A SCAN mode is the analysis of the image shape of the obtained echoed signal, a selection of the analysis interval and criteria for calculation of propagation time of the ultrasonic pulses through the material of the object from one surface to another one. This time is recalculated into the thickness value of the inspected object using the propagation velocity of ultrasonic pulses in the material.

In the A SCAN mode when working with the vertical orientation the screen is split into two parts: in the upper part the signal is shown as an A Scan, in the lower part the digital values of parameters and checking icons are shown. During the initial setting of the EMAT on the inspected object the measurement result is indicated in yellow. The color changes to green as soon as the reading becomes stable (Figure 72).

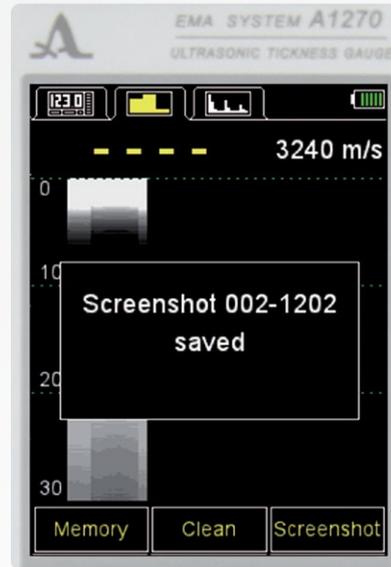
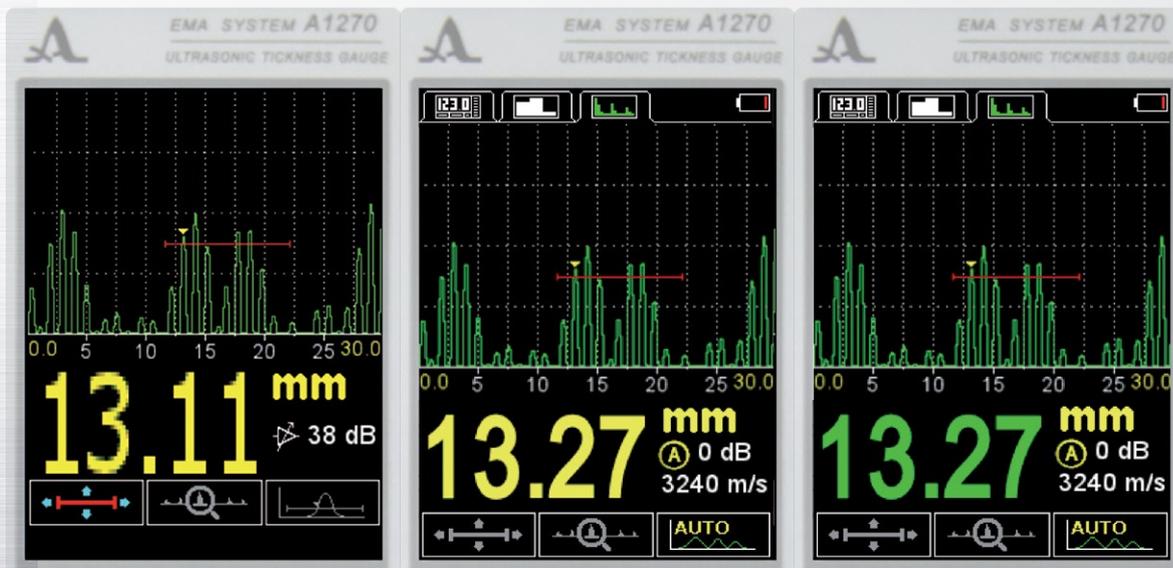


Figure 71

# 2

Main active keys:

- F1 : monitoring the size and position of the strobe when using manual measurements.
- F2  – monitoring the signal display when using manual measurements.
- F3  /  /  / : selecting the manual measurement method: by the maximal value in the strobe / by the first exceeding of the strobe by the signal / between two maximum values of the signal/ ACF by the strobe.
- F4  – automatic measurement: the icon  is indicated in the additional information field, the strobe control and the signal amplification are inaccessible.



 : saving the measurement result.

**Note:** Note: to reset the current measurement result and to prevent the EMAT from overheating please regularly perform an additional EMAT test in the air. To start an additional test please go to the automatic measurement mode, take the EMAT from the inspected object and press the key  or . The running line „Additional test” will appear. The result will be reset. (Figure 73).

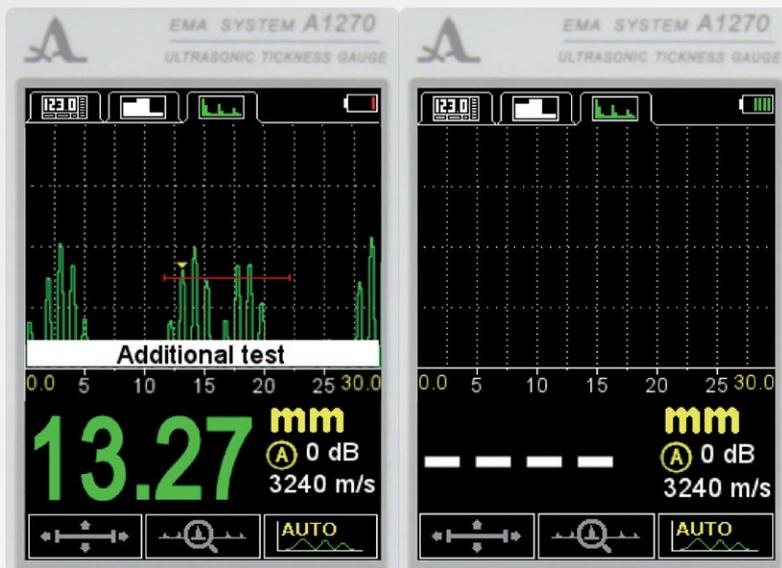


Figure 73

## 2

# 2

Table 7 contains the description of the keys for the first active icon.

Table 7

Key	Designation
 	Changes the length of the strobe relative to its left boundary
 	Vertical movement of the strobe
 	Horizontal movement of the strobe

Table 8 contains the description of the keys for the second active icon.

Table 8

Key	Designation
 	Changing the scanning length
 	Changing the amplification value (when using manual measurement)
 	Horizontal scrolling of the signal on the screen

Table 9 contains the description of the keys for the third active icon.

Table 9

Key	Designation
 	Changing the amplification value (when using manual measurement)

### 2.3.5.1 Saving the A-Scan

Upon pressing the  key the message is displayed on the screen: "Save current A-Scan?" here you shall confirm (Figure 74).

Note: The result will be recorded in the first empty cell of the last existing group created in the MEMORY mode. To select the group and to view the recorded value, go to the MEMORY mode.

Active keys:

**F1** (Save): save the digital value of the measurement result and its A Scan.

**F2** (addit.test) – starting an additional EMAT test in the air to prevent it from overheating.

**F3** (Cancel): cancel saving.

### 2.3.5.2 Viewing and editing the saved A Scans

To view and edit the saved A Scans and their corresponding measurement results, go to the MEMORY mode. The data with the A Scans saved in the measurement result column are specified by the  character. The character is in front of the numeric result value (Figure 75).

Press the  key to enter the view and editing mode, using the keys   go to the saved value and press the F2 key (A Scan) to view and have the possibility to edit subsequently or press the key F3 (edit) to go to editing immediately (Figure 76).

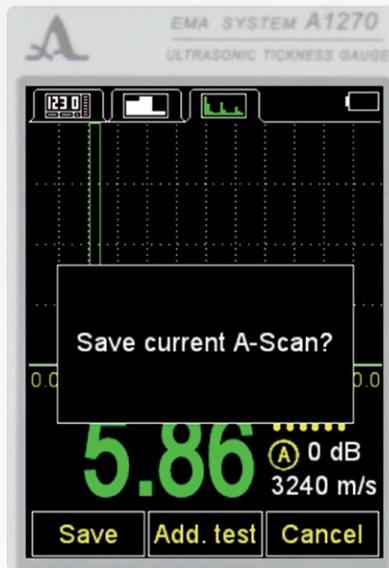


Figure 74

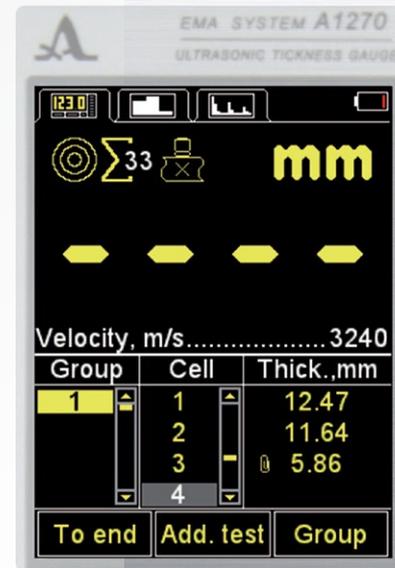


Figure 75



# 2

When selecting the viewing the A Scan saved for the selected result will be displayed in the upper part of the screen (Figure 77).

Active keys:

**F1** (exit) – exit the mode of viewing the saved results.

**F2** (A-Scan) – return to the mode of viewing the saved results.

**F3** (edit) – correct the saved A-Scan.

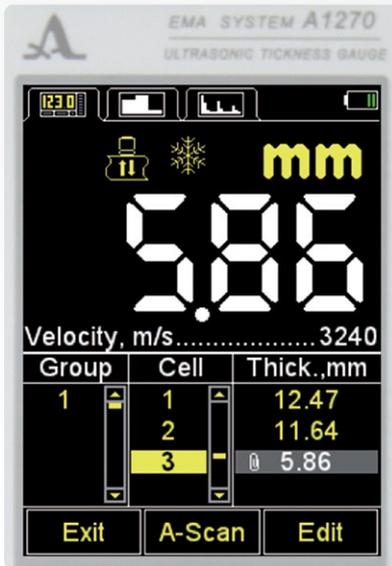


Figure 76

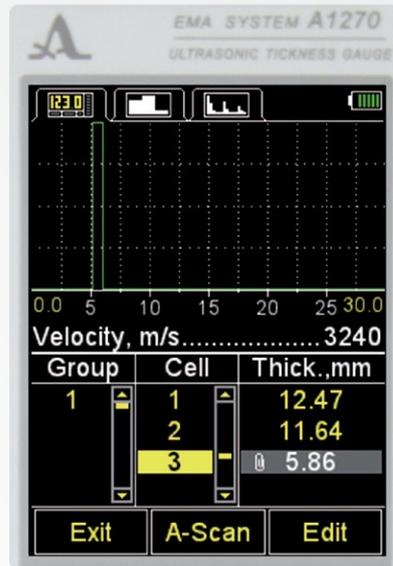


Figure 77

**WARNING: WHEN CORRECTING THE SAVED A-SCAN ONLY THE NUMERIC VALUE IS EDITED. THE GRAPHIC SIGNAL IMAGE (A-SCAN) WILL BE LOST!**

To correct the saved A-SCAN please press the key F3 (edit), perform the measurements again and if you receive satisfactory results press the key F2 (apply). The instrument returns to the viewing mode of the saved results. However, the graphic image of the A-Scan will be lost. The missing icon  in front of the numeric results confirms that (Figure 78).

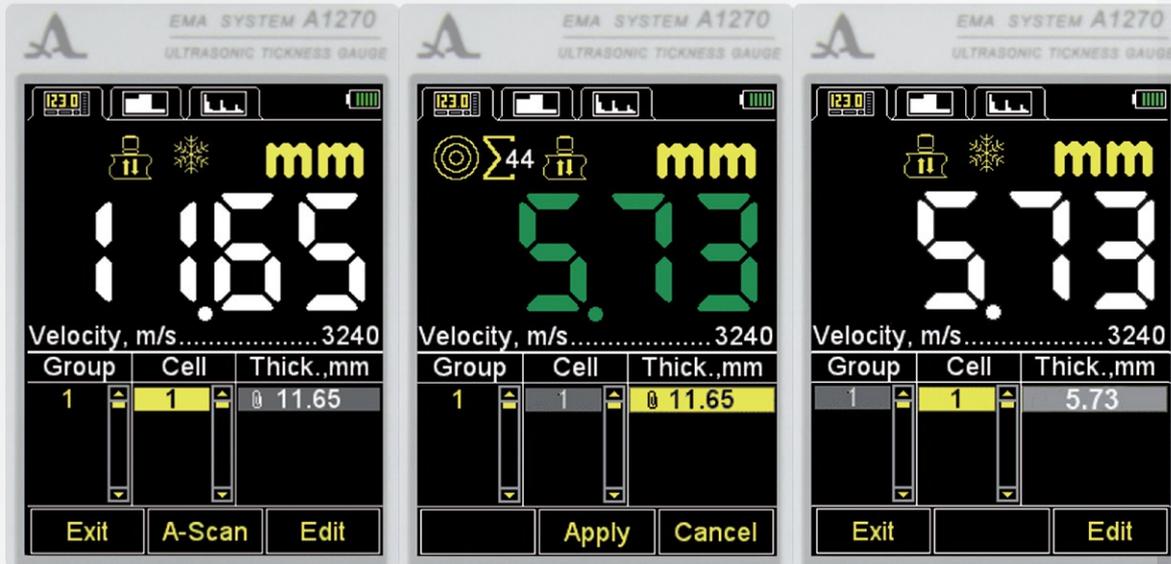


Figure 78



# 2

## 2.4 PERFORMING MEASUREMENTS

Prior to thickness measurement select a transducer from the library, adjust the instrument and chose the material for measurement. If the set propagation velocity in the material differs from the actual value, adjust the velocity manually or perform the calibration on a sample with known thickness.

The accuracy of the settings influences the measurement accuracy directly. You can use the library of materials if the evaluation measurements are allowed.

If accurate results are required, then take the sample made of the same material as the inspected object, and adjust the velocity using this sample. You have to adjust the velocity with the EMAT you will use for measurements. A plane parallel sample with smooth surfaces will be the best. Note that the highest thickness value of the sample (within the available range) and the best quality of its surface possible allow the best adjustment of the instrument to the ultrasonic velocity in it.

The place where the transducer is installed shall be clean, without local defects hindering the installation of the transducer on the surface. It is not possible to receive measurement results from a cavity if the transducer cannot be placed on its bottom.

The EMAT shall be installed perpendicular to the plane of the inspected object.

When the EMAT touches the surface of the inspected object a reliable ultrasonic contact of the transducer with the object is reached in a fraction of a second as a rule. Now, readings are displaed on the screen of the instrument. The readings can slightly deviate when inspecting small-diameter pipes and if the transducer is shaking a little. The redings remain stable when inspecting flat objects.

Wait for their stability, the measurement result becomes green. Afterwards leave the transducer on the surface of the object being inspected and read the measurement results on the screen or record them in the memory.

## 2.5 DATA TRANSFER TO PC

To transfer the data recorded in the instrument to a PC, connect the instrument to a PC by means of the USB A – Micro B cable from the delivery kit.

The operation system will detect the connected instrument as an external removable disk under the name **ACSYS DISC**. You can open its contents using the MS Windows Explorer or any file manager.

You can view the data opening the files directly from the instrument or copy the data to a PC for further viewing.

You can name the copied data file as you like.

The **digital data** shall be stored in the instrument in the **CSV** format which is convenient for export to various applications. **CSV** means comma-separated values. The files allow for further analysis and data processing by means of external programs, e.g. MS Excel (Figure 79). The data shall be stored into a file under the name results.csv. The results in the file are arranged sequentially according to the group number. If an **A-SCAN** is saved in the cell, the path to this **A-SCAN** is indicated.

A-Scans shall be stored in the files under the name of the **aXXX-YYY.bmp** type, where **XXX** is a sequence number of the group, and **YYY** is a sequence number of the measurement in the group.

	A	B	C	D	E	F	G	H	I
1	Group	Cell	Thickness(mm)	Speed(m/s)	Date	Time			
2	1	1	3.99	3355	2/12/2021	14:28:12			
3	1	2	4.99	3355	2/12/2021	14:28:15			
4	1	3	5.98	3355	2/12/2021	14:28:18			
5	2	1	12.12	3355	2/12/2021	14:28:27			
6	2	2	30.09	3355	2/12/2021	14:28:30			
7	2	3	35.05	3355	2/12/2021	14:29:01	ASCANS\a002-003.bmp		
8	2	4	40.09	3355	2/12/2021	14:29:06	ASCANS\a002-004.bmp		
9	2	5	45.03	3355	2/12/2021	14:29:13	ASCANS\a002-005.bmp		
10									
11									

Figure 79



A-Scans are saved in the folder ASCANS as graphic files (Figure 80) with the type name aXXX YYY.bmp, where XXX is the serial number of the group and YYY is the serial number of the measurement in the group.

Name	Date modified	Type	Size
000-1601	16.01.2018 6:37	Файл "JPG"	32 КБ
001-1202	12.02.2021 10:58	Файл "JPG"	32 КБ
002-1202	12.02.2021 10:59	Файл "JPG"	32 КБ
003-1202	12.02.2021 11:00	Файл "JPG"	32 КБ
004-1202	12.02.2021 11:01	Файл "JPG"	32 КБ
005-1202	12.02.2021 11:02	Файл "JPG"	32 КБ
006-1202	12.02.2021 11:03	Файл "JPG"	32 КБ
007-1202	12.02.2021 11:04	Файл "JPG"	32 КБ
008-1202	12.02.2021 11:04	Файл "JPG"	32 КБ

Figure 81

Figure 80 – image of the A-Scan saved in the group 9, cell 4, the result is 4.99 mm

B-Scans are saved as screenshots in the folder SCRNSHOT as graphic files with the type name XXX DDMM.jpg, where XXX is an open-ended screenshot serial number and DDMM is the date and month of screenshot taking (Figure 81).

Screenshots can be viewed in the external programs for viewing of graphical images (Figure 82).

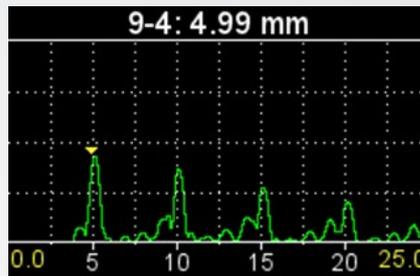


Figure 80

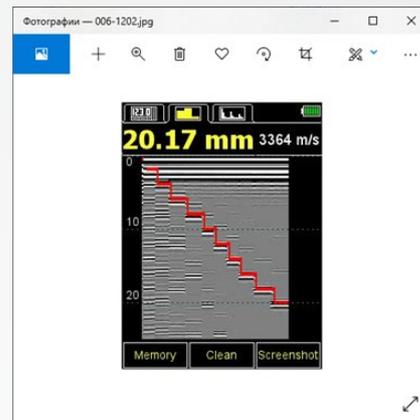


Figure 82

The maintenance of the thickness gauge includes cleaning the electronic unit from dust and dirt and charging the rechargeable battery.

### 3.1 ACCUMULATOR

The rechargeable battery is designed to be operated in a broad temperature range. At negative temperatures battery capacity decreases. At lower temperatures the battery capacity is 15% less as compared to the normal temperature conditions.

If the rechargeable battery goes dead the instrument will be switched off automatically.

The rechargeable battery has a built-in protection against overcharge, over discharge, over current and overheating.

The battery service life is designed for the whole guaranteed service life of the instrument.

The battery must be replaced by the service centers only.

**ATTENTION: THE WARRANTY WILL BE VOIDED IF THE USER REPLACES THE BATTERY INDEPENDENTLY!**

### 3.2 CHARGING THE BATTERY

The battery shall be charged via an external charger.

The battery charging time depends on the discharge level. The complete charging takes maximum 2 hours. Multiple recharging is allowed.

**Note:** You cannot conduct the measurements during battery charging.

**ATTENTION: TO AVOID THE BATTERY DAMAGE DON'T STORE THE INSTRUMENT WITH THE DISCHARGED ACCUMULATOR!**

### 3.3 TROUBLESHOOTING

Contact the representatives of the manufacturer if you have questions about operation of the thickness gauge to get assistance and consult the experts.



# 4

## STORAGE

The instruments should be shelf stored.

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

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

The distance between the heating units in a warehouse 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.





# 5

## TRANSPOR- TATION

The thickness gauge should be transported in the case included in the delivery kit.

The packaged instruments can be transported by any vehicle types for any distances without speed restrictions.

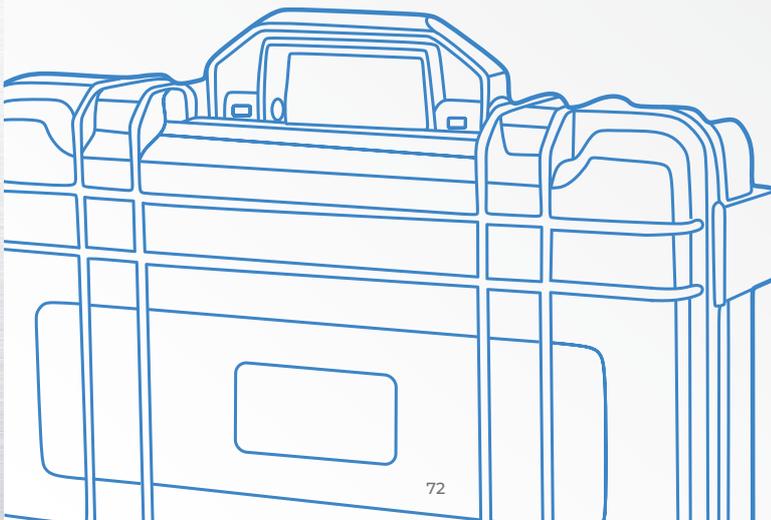
The packaged instruments shall be properly fastened in the transport vehicle. The packaged instruments shall be protected from precipitation and water splashes if the instruments will be transported in an open transport vehicle.

The packaged instruments should be properly and steadily fixed to prevent shocks of devices against each and against vehicle walls during the transportation.

The transportation conditions should confirm to the requirements of the technical conditions and regulations applicable to each type of transportation.

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

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





## NOTES





# ELECTRO-MAGNETIC ACOUSTIC THICKNESS GAUGE WITH THE PULSE MAGNETIZATION

A1270 EMAT



**OPERATION MANUAL**

Revision: February 2021