Votum Joint-Stock Company
76 Decebal Str., Chisinau, Moldova, MD2038
Tel./fax: (3732) 76-18-30, tel. 56-00-47, e-mail: office@votum.md

DAMI-C HA01

PORTABLE DIGITAL SONIC BOND TESTER

User's manual

VTM990109РЭ

Chisinau, 2001

VOTUM is paying its permanent attention in order to improve DAMI-C HA01 facilities. Any kind of feedback containing opinions and suggestions concerning DAMI-C HA01 modernization as well as critical remarks are highly appreciated by DAMI-C HA01 developers.

VOTUM hot line is available at: **www.votum.md**
e-mail: office@votum.md**,**
tel: (373-2) 56-00-47, fax: (373-2) 76-18-30

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1. INTRODUCTION

1.1. WHICH BRANCHES OF INDUSTRY DAMI-C HA01 CAN BE USED

DAMI-C HA01 is a highly portable digital bond tester designed for COMPOSITES and HONEYCOMB NONDESTRUCTIVE TESTING.

DAMI-C HA01 is excellent in detecting & C-imaging disbonds, unbonds, delaminations, porosity and structure violations in metal or non-metal composite parts and honeycomb structure elements.

DAMI-C HA01 is intended for materials testing of the types as follows:

- **non-metallic laminate components**;
- **metallic and non-metallic sandwich honeycomb components**;
- **sandwich construction with various types of cores**;
- **multilayer components**;
- **other components having variable mechanical impedance or thickness**.

The components' skin thickness range, honeycomb core thickness range should be determined according to the Object Testing Technology in dependence of the applied test procedure.

DAMI-C HA01essentially simplifies all testing operations, it allows measuring equivalent square of a flaw, reconstructing flaw C-images, storing inspection results during testing process, rewriting or printing stored results after an inspection is over.

Light weight, compact handheld dimensions and supreme ease control make DAMI-C HA01 ideal for nondestructive testing in a variety of industries including aircraft, aerospace, automotive, etc.

Due to the liquid-repellent design (according to IP54 standard), light weight, embedded batteries with auto charge system (allowing approx. 7 hours of continuous work) and wide operating temperature range (0°…+50° Celsius), DAMI-C HA01 is convenient for in-service testing.

1.2. WHAT PARTS DAMI-C HA01 CONSISTS OF

DAMI-C HA01 consists of **Main Unit** and **Accessories**.

Main Unit contains:

- High contrast high speed graphic LCD **Display** with LED backlight;
- 7 key **Keypad;**
- Powerful **Central Processor Unit** (**CPU**) with necessary peripherals;
- **Transmitter;**
- **Receiver** including 2 step Amplifier, high speed 10 bits ADC;

Accessories are**:**

- **2-in-1 Transducer,** including ultrasonic source for position detection system
- **Microphones with holders** for position detection system
- **AC power pack**
- RS-232 **Cable**
- 4 A-size batteries

1.3. WHAT TESTING METHODS ARE USED

DAMI-C HA01 uses Mechanical Impedance Analysis (MIA) and flaw C-image reconstructing methods.

1.4. WHAT OPERATING MODES ARE USED

Point Check Mode

DAMI-C HA01 Point Check mode includes threshold testing method. Test principle is as follows: Generator creates pulses of the given form and duration at the transducer's input with pulse burst frequency ranged to 50-100 Hz. DAMI-C HA01 receiver accepts transducer's output signal. Output signal spectral and phase characteristics are compared with respective spectral and phase characteristics of non-loaded transducer as well as with the spectral and phase characteristics of the transducer, loaded to the flaw-free object-under-test area. When the difference is greater than admitted signal fluctuations (the predefined threshold), threshold indicator turns on (front panel red LED).

The distinctive feature of the above mentioned mode is the possibility of simultaneous testing using three calibrating presets with different pulse shape and frequency, different receiver gain and different frictional noise characteristics.

Threshold Flaw Image Reconstruction

One of the most important DAMI-C HA01 features is ultrasonic coordinates measuring system, that gives the coordinates of the transducer, placed on the object-under-test surface. Brand-new possibilities of data processing and results presentation are possible due to the transducer's current position information, obtained from the coordinates measuring system. Data processing in the threshold flaw image reconstruction mode is similar to that one in Point Check mode, except the fact that now the transducer current position is available. The process of transducer's movement along the object-under-test surface is displayed at DAMI-C HA01's screen. Those surface points in which the signal parameters difference exceeds the threshold value, predefined during the calibrating, are marked in black color else the trajectory points are marked in light gray. Thus, the flaw image projection and the probe trajectory are drawn on the screen. Flaw dimensions, area and flaw image configuration, correspond to those ones of the real flaw and can be measured. The time to obtain a 120x120 pixels image is not more than 1-2 minutes. This mode is convenient to be used when flaw-containing object-under-test area has constant or feebly marked variable characteristics. The threshold image can be stored into device's archive.

Complete Image Reconstruction

Often there are objects under test with rough sandwich honeycomb structure or with variable thickness. It is very difficult and sometimes just impossible to obtain precise calibration preset (tuning) for such objects as the difference in responses from flaw-free and flaw-containing surface areas is approximately the same as the difference between the surface areas containing and not containing honeycomb bond points. Complete image reconstruction mode fits best to test this kind of objects.

Data processing in the mode of complete image reconstruction mode is similar to that one in threshold flaw image reconstruction mode with the only difference that complete signal information is

stored in device's memory rather than threshold signal information. The process of transducer's movement along the object-under-test surface is displayed on DAMI-C HA01's screen.

Those points, in which the complete signal information is already collected, are marked black on the display. Thus, the operator has a possibility to supervise testing process in order not to leave some object-under-test surface areas untested. When desired area testing process is terminated, one can begin the complete image reconstruction process. The image is formed using the threshold principle, as before, but now the threshold value can be changed. Usually the threshold value is selected in that way when the surface impedance changing structure is clearly visualized on the screen, however, other considerations can exist while threshold value selection.

Flaw dimensions, flaw area and flaw image configuration, correspond to those ones of the real flaw and can be measured. The time of 120x120 pixels image obtaining is not more than 1-2 minutes.

Complete image can be stored in DAMI-C HA01's archive as well as threshold image.

1.5. HOW A TYPICAL TESTING PROCEDURE LOOKS LIKE

A typical Testing Procedure includes the following steps:

1. **Make sure the DAMI-C HA01 Time and Date are both correct.** If necessary, update these parameters in Settings mode;
2. **Choose the appropriate Transducer** according to the Object Testing Technology and connect it to DAMI-C;
3. **Depending on the task to be carried out,** enter the appropriate working mode (**Point check -** to detect the defects on the object under test; **Threshold check -** to detect the defects and build their threshold image on the screen; **Surface check –** to build the complete image);
4. **In the entered working mode select an appropriate tuning from the device archive.** In case the available tunings are not appropriate, make a new tuning in Tuning mode, save it into archive and repeat the step 3. For the **Threshold check** and **Surface check** – the scanner calibration is required too.
5. **Perform the inspection according to the selected working mode.** Store the inspection results into the device archive.

Step by step the Results' Archive is filled up with inspection Results. When necessary, operator can download testing results from DAMI-C HA01 to an external PC through RS232 port. The transmission is always performed at a rate of 19200 baud.

1.6. UNDER WHAT CONDITIONS DAMI-C HA01 SHOULD BE USED

DAMI-C HA01 should be protected from dust, moisture and corrosive medium direct effects.

Atmosphere **temperature** should be within the range from 0° to +50° Celsius. **Relative humidity** shouldn't be above 98% at +35° Celsius.

The tested Object should be **sufficiently illuminated** by artificial or natural light sources.

In case DAMI-C HA01 is going be used with the **AC Power Pack**, a power supply circuit 220V 50Hz should be installed.

In case the power supply circuit has **line interference**, a rejection filter should be used.

DAMI-C HA01 may be placed in **any position, convenient for the operator**.

In order to **prevent device sliding down from an inclined plane**, two rubber pads are provided. The pads may be screwed on the back battery compartment cover as shown in Fig. 4.

1.7. HOW DAMI-C HA01 SHOULD BE TRANSPORTED AND STORED

Packed DAMI-C HA01 should be protected from atmospheric precipitation, moisture and corrosive medium direct effects during all transporting operations.

Packed DAMI-C HA01 shouldn't be hit, pushed, turned over or thrown during all transporting operations.

Packed DAMI-C HA01 position should correspond to the special signs on the pack.

If transported by air, packed DAMI-C HA01 should be transported in a hermetic, heated cabin.

Carriage by sea conditions of packed DAMI-C HA01 should be the same as the Storage conditions for packed DAMI-C HA01.

Packed DAMI-C HA01 shouldn't be shipped in palettes.

Packed DAMI-C HA01 should be stored in a dry location, free from conductive dust, steams of acids, alkalis and other corrosive gases.

The storage temperature shouldn't be below -40° Celsius and above +70° Celsius. The storage relative humidity shouldn't be above 65% at +35° Celsius.

Batteries should be stored according to their own storage conditions.

If packed DAMI-C HA01 has been stored for 6 months it should be unpacked and stored according to the operating conditions excepting the relative humidity which shouldn't be above 65% at +35° Celsius.

1.8. HOW DAMI-C HA01 SHOULD BE MAINTAINED

Some preventive maintenance operations should be carried out in order to give DAMI-C HA01 a long life. The environment, in which DAMI-C HA01 is usually used, determines a period of such maintenance operations.

The following periods of preventive maintenance operations are recommended.

Visual inspection - each 3 months. During a visual inspection it is recommended to:

- Check up the bracing of DAMI-C HA01 strap.
- Check up and clean the plugs.
- Check up for cracks in plastic details of DAMI-C HA01 body.
- Clean DAMI-C HA01 body including the Keypad and the Display protecting seal.

Embedded batteries maintenance

Embedded Batteries should be maintained according to the Battery maintenance recommendations.

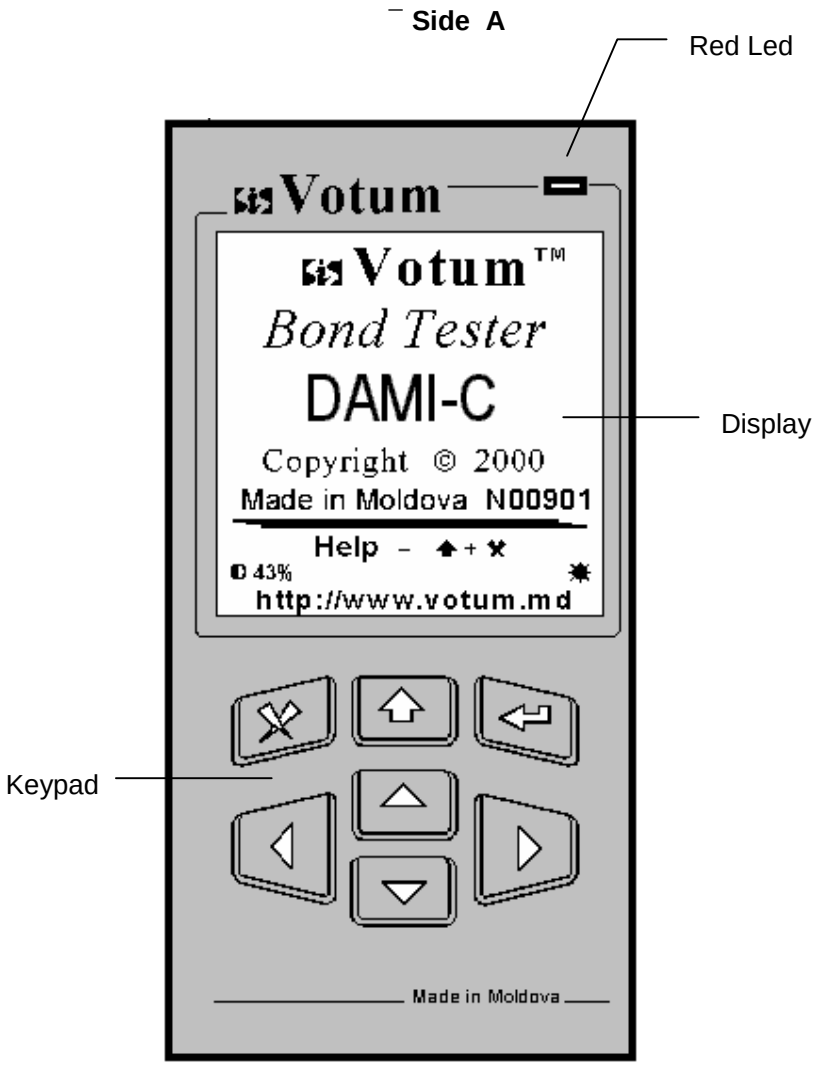
2. Standard DAMI-C HA01's TOOL KIT

№	Description	Product code	Qty.
1	Main unit "DAMI-C HA01"	BT/C	1
2	AC power pack	BT/PP	1
3	Wide-band search unit (transducer, supplied with sonic emitter for transducer's position estimation)	BT/SU	1
4	Acoustic scanner set (2 microphones + 2 microphone holders on common support)	BT/AS	1
5	PC/RS-232 Cable (2m, DB9)	BT/IC	1
6	Head phones	BT/HP	1
7	NiMH AA – Size rechargeable batteries	BT/BT	4
8	Testing specimen TS-1	BT/TS	1
9	Case for transportation	BT/TC	1
10	NDT Software Environment (Win 95-98 2000, Win NT)	BT/SW	1
11	DAMI-C HA01 User's manual Using Guide for NDT Software Environment	BT/DM	1

3. DAMI-C HA01 FEATURES

Controls, available on the **DAMI-C HA01 front panel** (Fig. 1)**:**

- **Keypad** with 7 keys, as follows:
  " r " - BREAK, "**é**" - SHIFT, "¿" - ENTER,
  "◄"- LEFT, "▲"- UP, "►"- RIGHT,
  "▼"- DOWN.
- **Display,**
- **Red Led** (Threshold **Alarm indicator**).

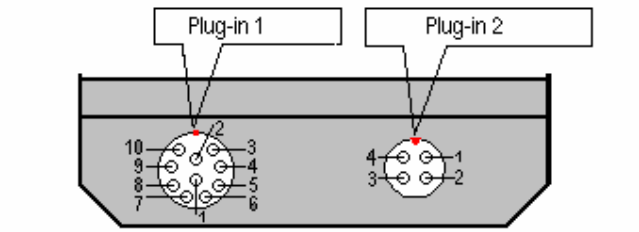


- **Side B**

Fig. 1

The **rear DAMI-C HA01's panel** marked as Side A (Fig. 1) contains the following plugs (Fig. 2)**:**

- **plug-in 1** – to be connected with a Transducer
- **plug-in 2** – to be connected with Microphones



Plug-in 1:

1,2 - Symmetrical Output of Coordinate Measuring System Generator
3,4 - Symmetrical Output of Work Channel Generator
5 - Red Led Pin '+' (Defective area indicator)
6 - GND
7 - WORK Channel Receiver input
8 - Red Led Pin '-' (Defective area Indicator)
9,10- Not used

Plug-in 2:

2,4 - GND
1 - Left Microphone Receiver input
3 - Right Microphone Receiver input

Fig. 2

The **rear DAMI-C HA01's panel** marked as Side B (Fig. 1) contains the following plugs and LEDs (Fig. 3):

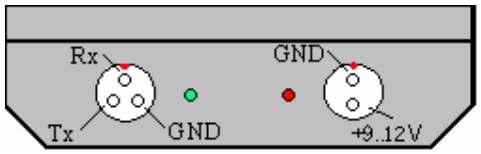


Fig. 3

- **2 pin plug-in** – power input, should be connected to the external power supply unit's output. External power supply unit should provide non-stabilized voltage within the range +9..+12 V;
- **3 pin plug-in** – RS232 interface for data exchange between the device and an external PC; This plug-in is also used to connect the headphones for listening the sound signalling on the defect area when working;
- **green LED** – external power pack – in – use indicator;
- **red LED** – fast charge indicator.

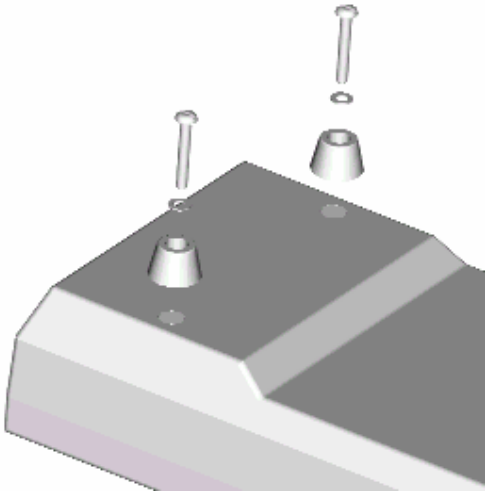


Fig. 4

4. OPERATING PROCEDURE

4.1. GENERALITIES

How to turn DAMI-C HA01 on using the AC power pack

- Connect the rear panel plug-in 5 with the AC Power Pack (Fig. 2).
- Connect the AC Power Pack with a power supply circuit 220V 50Hz. Press SHIFT key and hold it down during 1-2 seconds (Fig. 5).

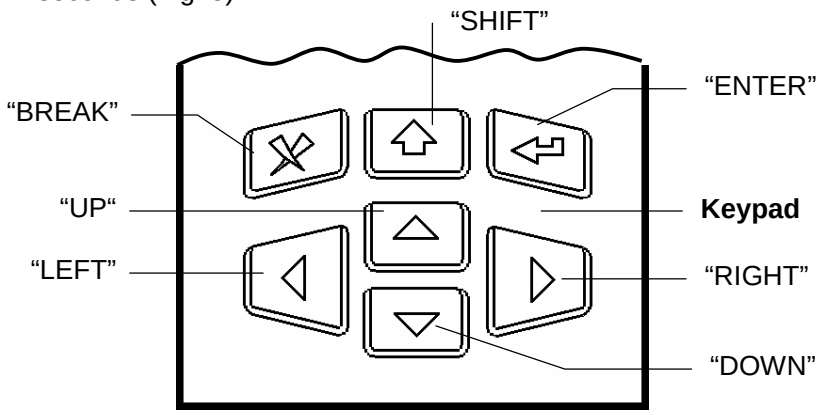


Fig. 5

The initial splashscreen appears on the Display (Fig. 6). It contains the manufacturer's name and the DAMI-C HA01's serial number. DAMI-C HA01 is ready to operate.

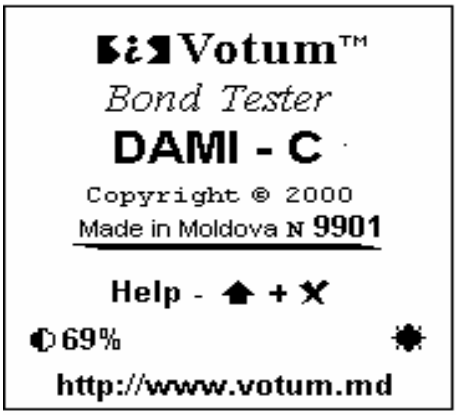


Fig. 6

How to turn DAMI-C HA01 on using Embedded Batteries

- In case DAMI-C HA01 is not used with AC Power Pack and embedded batteries are properly installed and charged, then device is ready to work.
- Press SHIFT key and hold it down during 1-2 seconds (Fig. 5). The initial splashscreen given by Fig. 6 appears on the Display. It contains the manufacturer's name and the DAMI-C HA01's serial number. DAMI C HA01 is ready to operate.

How to turn DAMI-C HA01 off

- Escape from operating modes by pressing BREAK key (Fig. 5) possibly several times until you reach the initial screenshot given by Fig. 6.
- Press the SHIFT+DOWN keys, DAMI-C HA01 is turned off.
- **In case DAMI-C HA01 is used with the AC Power Pack**, first, disconnect the AC Power Pack from 220V 50Hz power supply circuit and second, disconnect the plug-in from the device rear panel (Fig. 3).
- DAMI-C HA01 **can be turned off on any operating duty**, excepting within an external PC communication session.

How to charge embedded batteries

- Connect the rear panel plug-in 5 with the AC Power Pack (Fig. 2).
- Connect the AC Power Pack with a power supply circuit 220V 50Hz. Batteries are being charged if necessary. Rear panel Red LED (Fig. 3) is ON when actual charging is in progress.

How to connect a Transducer

- Single and Dual Transducers always have their own cables.
- Transducer cable has one 10-pin connector. Connect the 10–pin connector with the rear panel plug-in 1 (Fig. 2). Note, that Red mark on cable's connector should fit the Red mark at the rear panel plug-in 1.

How to connect Microphones

- Microphones cable has one 4-pin connector. Connect the Microphones cable with the rear panel plug-in 2 (Fig. 2). The Red mark on Microphones cable connector should fit the Red mark at the rear panel plug-in 2.

How to adjust Display's contrast

- The Display's contrast can be changed from the initial splashscreen only. Escape from operating modes by pressing BREAK key (Fig. 5) possibly several times until you reach the initial screenshot given by Fig. 6 if necessary.
- Press the UP (DOWN) key (Fig. 5) to increase (decrease) the contrast value.
- Look at the Display and change the contrast value until the most convenient result has been reached. Selected contrast value remains the same even after the power has been turned off, until the next contrast adjusting operation.

How to turn on/off Display's backlight

- The Display backlight can be changed from the initial splashscreen only. Escape from operating modes by pressing BREAK key (Fig. 5) possibly several times until you reach the initial screenshot given by Fig. 6 if necessary.
- Press the RIGHT (LEFT) key (Fig. 5) to change the state of Display's backlight.

What does “PRESS A+B KEYS” means

- “Press A+B keys” asks you to press A key and while the A key is being pressed to press B key. Keys can be released in an arbitrary order.

How to edit a number

- Editing a number is always performed in a dialogue mode. Select using UP (DOWN) key, the row in which the number starting value is shown. When selected, the number starting value is shown in inverted color.
- Press and release the SHIFT key. The number color changes to normal and the cursor under the less significant digit appears (Fig. 7).

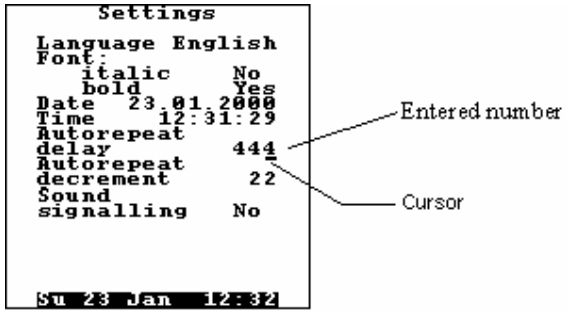


Fig. 7

- While the UP (DOWN) key is being pressed now, the digit at the cursor position is incremented (decremented) by 1.
- Set the less significant digit of the edited number by pressing the UP (DOWN) key.
- Move the cursor to the next digit by pressing LEFT (RIGHT) key and set it by pressing the UP (DOWN) key.
- Enter the number by pressing the ENTER key as soon as all digits of the entered number have been set correctly or press BREAK key to escape operation without number value changing.

How to enter a name

- Entering a name is always performed in a dialogue mode. The cursor is always displayed in the first character position.
- While the UP (DOWN) key is being pressed, the character’s value in the current position (given by blinking cursor) increases (decreases) on the Display. Select the first character in the name by pressing the UP (DOWN) key (Fig. 8).

Fig. 8

- Move the marker to the next position by pressing the LEFT (RIGHT) key and set a new character using the UP (DOWN) key.
- Enter the name by single pressing the ENTER key as soon as all characters in the name have been set correctly or press BREAK key to escape operation without number value changing.

How to select an operating mode

- DAMI-C HA01 uses dialog menus to interact with operator. Menu appears on the Display in the form of text lines. Each line is associated with an operating mode. Selected menu line is shown in inverted color. Operator should press UP (DOWN) key until appropriate menu line is selected.
- To enter an operating mode means to select the line associated with required operating mode and after the line has been selected, to press and release the ENTER key.
- To escape means to press and release the BREAK key.
- Every time when any operating mode menu is on the Display, the CPU shows current Timer/Calendar data on the bottom of the screen, as follows:

dow DD MMM HH:MM

"dow" means the current day of the week (MON, TUE, WEN, THU, FRI, SAT, SUN). DD MMM means the current Day of the month and the Month of the year. HH:MM means the current Hour of the day, the Minute of the hour.

How to get help

- DAMI-C HA01 is supplied with internal help system. Help topics consist of general and context-sensitive help. General help provides brief information concerning DAMI-C HA01 operating. Context-sensitive help provides information concerning current operating mode.
- The general help can be got from the initial splashscreen by pressing the SHIFT+BREAK keys. The first page of the general help appears on the Display. If necessary, press the BREAK key to quit viewing.
- Use UP(DOWN) key to switch between general help pages.
- Context-sensitive help can be got from the menu. Chose the necessary Menu line and press the SHIFT+BREAK keys. Context-sensitive help appears on the Display. If necessary, press the BREAK key to quit viewing.
- Use UP(DOWN) key to switch between pages of context-sensitive help.

4.2. OPERATING MODES

The schematic diagram of DAMI-C HA01's general operating modes is given below by Fig. 9.

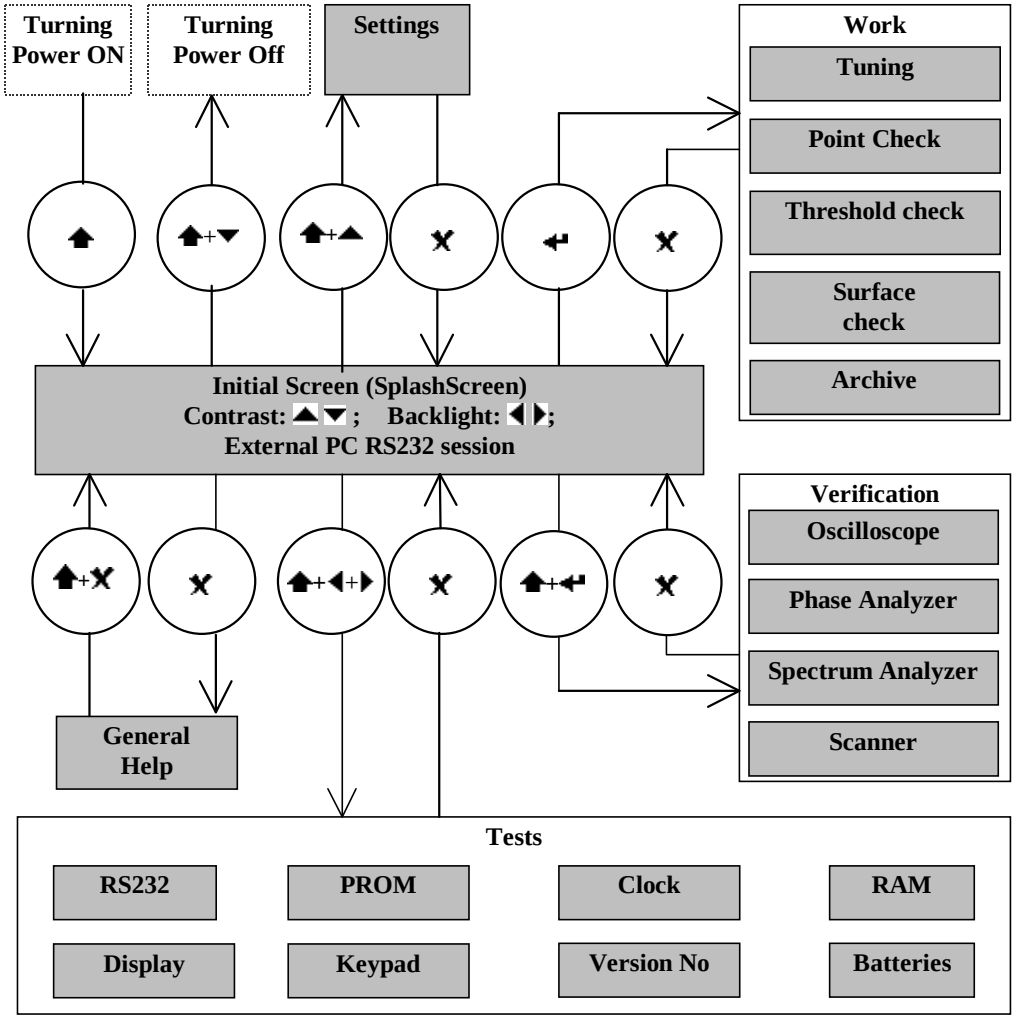


Fig. 9

Work mode is intended for performing all inspection operations, stipulated by DAMI-C HA01's functional designation. Verification mode consists of different sub-modes, such as oscilloscope, phase analyzer and spectrum analyzer. Test mode provides user with a quick DAMI-C HA01 test possibility. Settings mode is intended for setting of Date, Time, User Interface Language (English or Russian), Font Size, keypad autorepeat settings and sound signalling option.

The WORK mode can be got from the initial splashscreen. To enter WORK mode press and release the ENTER key. WORK menu appears on the Display (Fig. 10).

Fig. 10

- To escape from WORK menu, press and release the BREAK key. The initial Splashscreen appears on the Display.
- The SETTINGS mode can be got from the initial splashscreen. To enter SETTINGS mode press and release the SHIFT+UP keys. SETTINGS menu appears on the Display (Fig. 11).

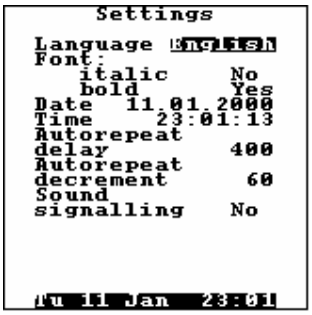


Fig. 11

- To escape from SETTINGS mode press and release the BREAK key. The initial Splashscreen appears on the Display.
- The VERIFICATION mode can be got from the initial splashscreen. To enter VERIFICATION mode press and release the SHIFT+ENTER keys. VERIFICATION menu appears on the Display (Fig. 12).

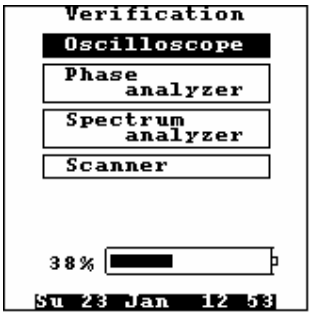


Fig. 12

- To escape from VERIFICATION mode press and release the BREAK key. The initial Splashscreen appears on the Display.
- The SELF-TESTING mode can be got from the initial splashscreen. To enter SELF-TESTING mode press and release the SHIFT+RIGHT+LEFT keys. SELF-TESTING menu appears on the Display (Fig. 13).

- To escape from SELF-TESTING mode, press and release the BREAK key. The initial Splashscreen appears on the Display.

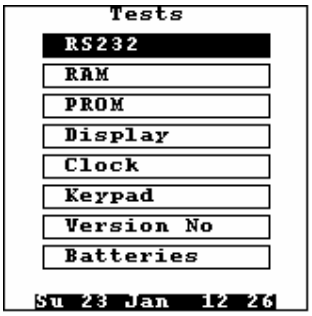


Fig. 13

4.3. HOW TO ADJUST DAMI-C HA01's SETTINGS

SETTINGS operating mode is intended for selecting the Dialog language and font type, setting the date, time, the values of auto-repeat delay, auto-repeat decrease and enabling or disabling the sound signalling.

1. Turn DAMI-C HA01 on. The initial Splashscreen appears on the display.
2. Enter SETTINGS operating mode by pressing the SHIFT+UP keys. SETTINGS mode menu appears on the Display (Fig. 11).
3. Choose the parameter to be adjusted by pressing UP (DOWN) key.
4. Press the SHIFT key and then release it. A marker appears under the parameter value to be adjusted.
5. Set the parameter value by repeatedly pressing UP (DOWN) key. Save changed value by pressing the ENTER key. To leave parameter's value without changing press the BREAK key.
6. To escape from SETTINGS mode press BREAK key. The initial Splashscreen appears on the Display.

4.4. SOUND SIGNALLING

DAMI-C HA01 provides the sound signalling when detecting defects on the object under test. The sound signalling is driven to the embedded buzzer and to the headphones. The embedded buzzer can be switched off using the Settings operating mode (See the Sound signalling parameter). The headphones sound signalling is always on. Headphones can be connected to the RS232 3-pin plug-in (Fig. **3**).

4.5. HOW TO TUNE DAMI-C HA01 ON THE SPECIMEN TS-1

1. Connect the Transducer to DAMI-C HA01.
2. Turn DAMI-C HA01 on. The initial Splashscreen appears on the display.
3. Enter WORK operating mode by pressing ENTER key. WORK mode menu appears on the display (Fig. 10).

4. Select TUNINGS mode and press ENTER key. Four options are available here – **Manual, Auto, Based** and **Phase** (Fig. 14). Tunings may be performed in four modes: in manual mode the optimal tuning parameters are selected by operator; in auto mode the optimal signal frequency are set by the device; in based mode the new tuning parameters are selected from a previously saved tuning; in phase mode the information about the phase of the received signal is used only.

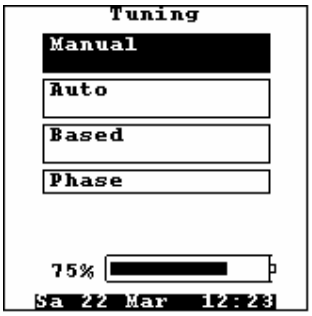


Fig. 14

5. Manual mode is recommended for the majority of cases and does not require specific skills from the operator. All other tuning modes are supplemental.

Manual Tuning Mode

1. Select **Manual** mode and press ENTER key.
2. The **Tuning parameters selection** submode with the gain-phase plane appears on the Display (Fig. 15). "+" marker shows the current impedance value on the gain-phase plane. A menu to select **Spectrum analyser** and **Oscilloscope** appears at the bottom of the screen. The last string shows the **Attenuation** parameter and its current value.
3. In order to ensure a high sensitivity, manual tuning mode requires the adjustment of the signal, driven to the transducer as well as the signal, received from the transducer.

   There are two adjustable parameters of the signal, driven to the transducer:

   - Frequency - adjusts signal's frequency (4.11, **Spectrum analyser** paragraph).

   - Pulse - adjusts the number of pulses in the signal pattern (4.11, **Oscilloscope** paragraph).

and three parameters of the signal, received from the transducer:

   - Gain - adjusts signal's gain (4.11, **Oscilloscope** paragraph).

   - The interval of time, the signal is processed in which. The beginning and the end of this time interval are adjusted by **Left** and **Right Marker** in **Oscilloscope** submode (4.11, **Oscilloscope** paragraph).

   - Attenuation - gives the ratio of reduction for the processed signal values in order to fit the screen space. To increase(decrease) the **Attenuation** value press LEFT(RIGHT) keys.

Manual adjustment for **Frequency**, **Pulse** and **Gain** is available in **Tuning parameters selection** submode only.

4. The appropriate frequency for current tuning can be found using **Spectrum analyser** submode. To enter **Spectrum analyser** submode, select the string **Spectrum Analyser** using UP key, put the transducer on the flaw containing area of the specimen TS-1, press and release ENTER key (4.11, **Spectrum analyser** paragraph). In one-two seconds the amplitude-frequency response diagram for the flaw containing area appears on screen in black color. Put the transducer on the flaw free area, press and release ENTER key. In one-two seconds the amplitude-frequency response diagram for the flaw free area appears on screen in black color and the previous diagram is shown in gray color. A vertical marker indicates the frequency, on which these two diagrams are of maximal difference. This frequency will be used with current tuning. To exit the **Spectrum**

analyser submode press BREAK key. **Tuning parameters selection** submode appears on screen. The value of **Frequency** parameter can be changed manually in **Oscilloscope** submode (4.11, **Oscilloscope** paragraph), but it is recommended to use the frequency, obtained from **Spectrum Analyser**.

5. In **Tuning parameters selection** submode move the transducer from flaw containing area to flaw free area and vice-versa without detaching it from the surface and watch the movement of the “+” marker on the gain-phase plane on screen. Increase (decrease) the **Attenuation** value by pressing LEFT (RIGHT) keys if necessary, in order to increase the difference between the position of "+" marker when the transducer is on the flaw-free and flaw-containing areas. DAMI-C HA01 sensitivity can be widely varied by changing the **Attenuation** value. In order to prevent marker displacement to the saturation zone, it can be positioned in the point of origin (axes intersection) by pressing DOWN key.

6. **Pulse**, **Gain**, the beginning and the end of the time interval in which the signal is processed, may be adjusted if necessary, in **Oscilloscope** submode (4.11, **Oscilloscope** paragraph). To enter **Oscilloscope** submode, select the string **Oscilloscope** using UP key, press and release ENTER key. The **Oscilloscope** submode appears on screen. To adjust the beginning (end) of time interval select **Left marker** (**Right marker**) using LEFT (RIGHT) keys. Press UP (DOWN) key to move the selected marker right (left). To adjust **Pulse** and **Gain**, select the corresponding parameter using LEFT (RIGHT) keys and press UP (DOWN) key to change the value. To exit the **Oscilloscope** submode press BREAK key. **Tuning parameters selection** submode appears on screen.

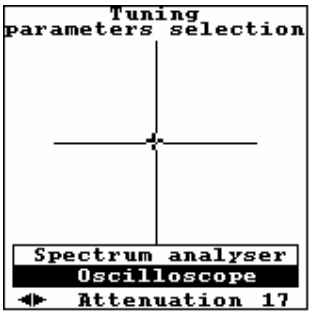


Fig. 15

7. When completing the parameters' adjustment, put the transducer on the flaw free area (tuning based on flaw free area) and press SHIFT key. DAMI-C HA01 turns to **Threshold** tuning submode.
8. Move the Transducer along the flaw free area at any appropriate speed (up to 100 mm/s) during 0.5 – 1min. The marker on the screen will be moving, drawing a specific trajectory on the gain-phase plane – the admissible impedance zone. This trajectory shows the impedance value in the different points of the flaw free area, taking into consideration the friction noises (Fig. 16). The **Threshold** tuning submode permits to change the **Attenuation** value using LEFT, RIGHT keys. The drawn zone may be deleted from screen by pressing the UP key. The marker may be positioned to zero by pressing DOWN key. These features permit to adjust the device sensitivity and build the most appropriate admissible impedance zone for the current tuning.

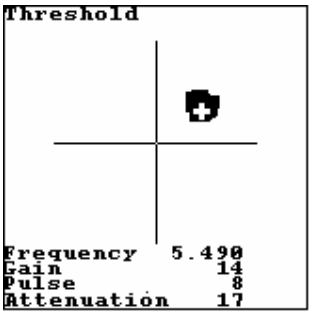


Fig. 16

9. Without detaching transducer from the flaw free area, press the SHIFT key. DAMI-C HA01 will fill the region in which the obtained trajectory is contained and will go to the Check submode (Fig. 17). This submode allows the current tuning to be checked and modified, if necessary. The filled admissible impedance zone is eight-sided adjustable. Move the transducer from flaw free area to flaw containing area and vice-versa. The marker deviation out of admissible impedance zone is considered as a defect and in such a situation the front panel red led turns on. Adjust the admissible impedance zone to ensure the proper indication of artificial defects on the TS-1specimen. The octagon in the bottom right corner indicates the direction in which the admissible impedance zone may be increased (decreased). Press RIGHT key to change the direction of increasing. Press UP (DOWN) keys to increase (decrease) the filled region. The LEFT key permits to invert the filled zone, so that the points in which the deviation of the impedance is out of initially filled region (before inverting) will be considered as flaw free points. This feature permits to make a tuning, based on flaw containing area (all surface points, in which the impedance deviation exceeds the filled zone, are considered as flaw free points) as opposed to tuning based on flaw free area.

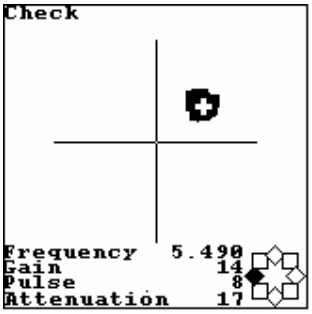


Fig. 17

10. To return to the Threshold submode (item 8) press SHIFT. To save TUNING parameters into Archive press ENTER key. Request for tuning name and transducer number appears on the Display (Fig. 18).

Fig. 18

11. Enter the Tuning name, press ENTER key, enter transducer number and press ENTER key again to save tuning parameters into Archive.

12. To escape TUNING mode without saving, press BREAK key. Request for saving appears on the Display (Fig. 19);

13. Press BREAK key again to leave tuning parameters without saving. DAMI-C HA01 exits from TUNING mode. TUNING menu appears on screen.

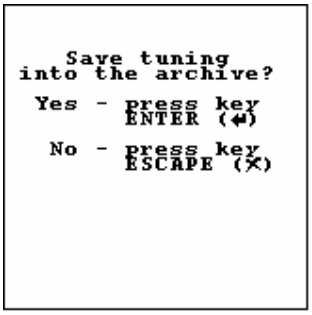


Fig. 19

Automatic Tuning Mode

Automatic tuning mode provides the operator with a possibility of tuning the device without knowing any information about the resonance frequency, gain value and number of pulses. All these parameters are set automatically in order to fit the best way maximum difference criterion between the impedance value of intact zone and flaw-containing zone.

In order to perform an automatic tuning, operator should follow the procedure given below:

1. Connect the transducer to DAMI-C HA01
2. Turn DAMI-C HA01 on.
3. Enter the WORK operating mode by pressing ENTER key. WORK mode menu appears on the display (Fig. 10).
4. Enter the TUNINGS mode of WORK menu. TUNINGS mode menu appears (Fig. 14). Select **Auto** mode and press ENTER.
5. During the automatic tuning mode DAMI-C HA01 processes information, obtained from the transducer when it is placed to the flaw-containing and flaw-free areas of the object under test. These actions (i.e. placing the transducer on the appropriate area) should be done by operator. DAMI-C HA01 leads operator through the tuning process by successive showing the messages given by Fig. 20 and Fig. 21 and beeping when respective action should be done. The algorithm of automatic tuning is figuring out the value of gain, necessary for testing procedure and the “best” frequency for the current object under test. Parameters chosen during this procedure are “the best” because they are selected to maximize the difference between 2 signals (obtained from flaw-loaded transducer and from transducer loaded on the intact zone respectively).

Fig. 20

Fig. 21

6. After figuring out parameters, such as gain, frequency and the number of pulses, DAMI-C HA01 asks operator to perform uniform motion by moving transducer along the flaw-free area of the object under test. This procedure allows DAMI-C to include the information about friction noise to the current tuning and thus to avoid taking friction noise into consideration while undertaking the decision about flaw existence or absence. The following message appears on the screen (Fig. 22):

Fig. 22

7. Operator should put the transducer on the flaw free area and press ENTER key. DAMI-C HA01 turns to **Threshold** tuning submode. Follow all the requirements given by pp.8-13 in the manual tuning mode chapter.
8. Save the tuning obtained into the archive as it was described in the manual tuning mode chapter or escape from the automatic tuning mode by pressing BREAK key several times until WORK mode menu appears on the display (Fig. 10).

Based Tuning Mode

In based tuning mode the new tuning parameters are selected from a previously saved tuning. In order to perform a based tuning, operator should follow the procedure given below:

1. Connect the transducer to DAMI-C HA01
2. Turn DAMI-C HA01 on.
3. Enter the WORK operating mode by pressing ENTER key. WORK mode menu appears on the display (Fig. 10).
4. Enter the TUNINGS mode of WORK menu. TUNINGS mode menu appears (Fig. 14). Select **Based** mode and press ENTER. The parameters of the first saved tuning into archive appears on screen (Fig. 23).

Fig. 23

5. To view the admissible impedance zone of current tuning press SHIFT key. To return tuning parameters on screen press SHIFT key again. Use Right (Left) keys to move to the next (previous) tuning in the archive.
6. When the appropriate tuning is found press Enter key. DAMI-C enters the Check submode (Fig. 17). Press SHIFT key to turn DAMI_C to **Threshold** tuning submode. In **Threshold** submode the following steps are recommended:
   - put the transducer on the flaw free zone;
   - delete the existing admissible impedance zone by pressing the UP key;
   - position the marker to zero by pressing DOWN key;
   - follow the items 8-13 in the manual tuning chapter.

Phase Tuning Mode

The informative parameter used in Phase Tunung submode is the phase deviation between the signals received from the transducer loaded on the flaw free area and from the transducer loaded on the flaw containing area. In order to perform a phase tuning, operator should follow the procedure given below:

1. Connect the transducer to DAMI-C HA01
2. Turn DAMI-C HA01 on.
3. Enter the WORK operating mode by pressing ENTER key. WORK mode menu appears on the display (Fig. 10).
4. Enter the TUNINGS mode of WORK menu. TUNINGS mode menu appears (Fig. 14). Select **Phase** mode and press ENTER. The **Phase** Tuning parameter selection mode including the

axes of coordinates and the menu with the **Phase analyser** and **Oscilloscope** submodes appear on screen (Fig. 24).

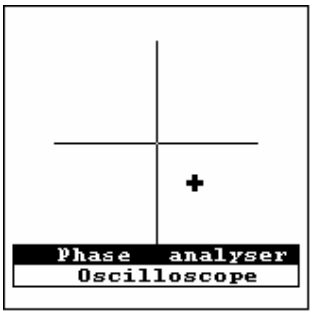


Fig. 24

5. **Phase analyzer** submode is used to find the optimal frequency for the signal driven to the transducer that permits to distinguish maximally the flaw free zone from the defective zone on the surface under test using the signal's phase deviation as informative parameter. To enter **Phase analyser** submode, select the string **Phase Analyser** using UP key, place the transducer on the flaw containing area of the specimen TS-1, press and release ENTER key (4.11, **Phase analyser** paragraph). In one-two seconds a straight horizontal line appears on the screen. PLace the transducer on the flaw free area, press and release ENTER key. In one-two seconds the phase deviation diagram appears on screen. A vertical marker indicates the frequency, on which the deviation is maximal. This frequency will be used with current tuning. To exit the **Phase analyser** submode press BREAK key. **Oscilloscope** submode is used to select the **gain, pulse, frequency** parameters' values and to set the processing interval of the received signal using the **left marker** and the **right marker** parameters. To enter the **Oscilloscope** submode, use the Up, Down keys to set the menu marker on it and press the Enter key. To exit from it press the Break key.
6. In the **Phase tuning parameters selection** mode move the transducer from flaw containing area to flaw free area and vice-versa without detaching it from the surface and watch the movement of the "+" marker on the gain-phase plane on screen. Change the selected parameters using repeatedly the **Phase analyzer** or **Oscilloscope** submodes if necessary, in order to increase the difference between the position of "+" marker when the transducer is on the flaw-free and flaw-containing areas.
7. When the optimal parameters' values are selected, put the transducer on the flaw free area and press Shift key. The device enters the forming admissible impedance zone submode (Fig. 25).

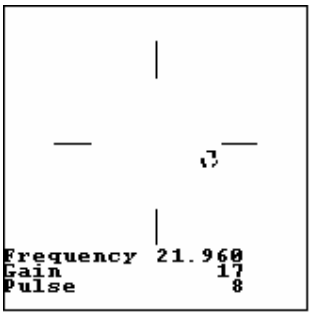


Fig. 25

8. The Phase admissible impedance zone is arc shaped. Use Up, (Down) keys to increase (decrease) the zone clockwise and Right (Left) keys to increase (decrease) it counterclockwise (Fig. 26).

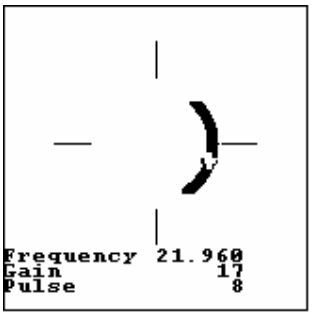


Fig. 26

9. Move the transducer from flaw free area to flaw containing area and vice-versa without detaching it from the surface and watch the movement of the "+" marker on the gain-phase plane on screen. The deviation of the marker out of admissible impedance zone is considered as a defect and in such a situation the front panel red led turns on. Adjust the admissible impedance zone to ensure the proper indication of artificial defects on the TS-1specimen.
10. To save TUNING parameters into Archive press ENTER key. Request for tuning name and transducer number appears on the Display (Fig. 18) Follow the items 11-13 in Manual Tuning chapter to save the tuning into device archive.

4.6. POINT CHECK

DAMI-C HA01 **Point Check** mode includes threshold testing method. Test principle is as follows: Generator creates pulses of the given form and duration at the transducer's input according to the previously selected tuning. Up to three tunings may be used simultaneously. As a rule, a single tuning is sufficient to detect all the possible defects in the material to be tested. But in the case the material requires different tunings for different types of defects, three tunings with different pulse shape and frequency, different receiver gain and different admissible impedance zones can be used.

DAMI-C HA01 receiver accepts transducer's output signal. Output signal spectral and phase characteristics are compared with respective spectral and phase characteristics contained in used admissible impedance zones. When the difference is greater than admitted signal fluctuations (the predefined threshold), threshold indicator turns on (front panel red LED) and the marker exits from the admissible impedance zone on the device screen. The following steps are required in order to operate in Point Check mode:

1. Connect DAMI-C HA01 with the necessary transducer.
2. Turn DAMI-C HA01 on. The initial splashscreen appears on screen.
3. Enter WORK operating mode by pressing ENTER key. WORK mode menu appears on the display (Fig. 10).
4. Enter POINT CHECK mode. Request for Tuning numbers for each layer appears on the Display (Fig. 27).
5. Chose the layer by pressing the UP (DOWN) key, press the SHIFT key and enter the number of Tuning to be loaded from DAMI-C HA01's Archive.

Fig. 27

To view tuning parameters press SHIFT, blinking cursor will appear. Then press SHIFT+ENTER keys. Tuning parameter values appear on the Display (Fig. 28). Press SHIFT key to see the set of all admissible impedance values for intact zone, given by their position, marked as black dots at the gain-phase plain, Fig. 29

Fig. 28

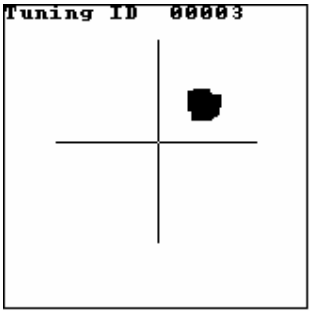


Fig. 29

6. To escape viewing press ENTER or BREAK key.
7. After the Tuning numbers for necessary layers are entered, press ENTER key. DAMI-C HA01 is ready for POINT CHECK execution. Tested layer number, gain-phase plane, layer flaw indicator, admissible impedance zone, current impedance marker (+ symbol), tuning ID for displayed zone and impedance deviation appear on the Display (Fig. 30).
8. Put the transducer on the surface of the object under test and move the transducer along the object surface at any appropriate speed (up to 100 mm/s). Take care to ensure good contact between the transducer and the object surface. In this mode, parallel inspecting up to three layers is provided. One of the layers is being shown on the Display. To switch between layers, press LEFT (RIGHT) key.

9. As far as defects are not detected, the current impedance marker will move inside the admissible impedance zone. In case a flaw is detected, the current impedance marker exits the admissible impedance zone, the front panel Red Led turns on and the number of defect layer appears on the Display in the top right corner (Fig. 30).

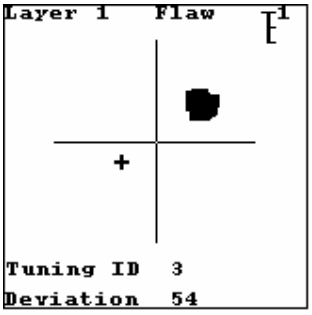


Fig. 30

10. To finish testing press Break key.

4.7. THRESHOLD CHECK

One of the most important DAMI-C HA01 features is ultrasonic coordinates measuring system, that gives the coordinates of the transducer, placed on the object-under-test surface. Brand-new possibilities of data processing and results presentation are possible due to the transducer's current position information, obtained from the coordinates measuring system. Data processing in the threshold flaw image reconstruction mode is similar to that one in Point Check mode, except the fact that now the transducer current position is available. The process of transducer's movement along the object-under-test surface is displayed at DAMI-C HA01's screen. Those surface points in which the signal parameters difference exceeds the threshold value, predefined during the tuning, are marked in black color else the trajectory points are marked in light gray. Thus, the flaw image projection and the probe trajectory are drawn on the screen. Flaw dimensions, area and flaw image configuration, correspond to those ones of the real flaw and can be measured. The time to obtain a 120x120 pixels image is not more than 1-2 minutes. This mode is convenient to be used when flaw-containing object-under-test area has constant or feebly marked variable characteristics. The threshold image can be stored into device's archive. The following steps are required in order to operate in Threshold Check mode:

1. Attach transducer to DAMI-C HA01.
2. Attach Microphones of position measuring system to DAMI-C HA01.
3. Turn DAMI-C HA01 on. The initial splashscreen appears on display.
4. Mark out the tested object surface. Max tested area size should not exceed 360x360 mm.
5. Fix the microphones on the tested object surface (Fig. 32). The Microphones should be set at the distance of 100-200 mm from tested area corner points and at the height 200-300 mm. It is important to set each microphone in conformity with the inscription on it: the left microphone – on the left side of tested area and the right microphone – on the right side. Microphones should be oriented to the middle of tested area.
6. Enter the WORK operating mode by pressing ENTER key. WORK mode menu appears on the display (Fig. 10).

7. Enter THRESHOLD CHECK mode. Request for Tuning numbers for each layer, testing area (rectangle) size and quantification value appear on the Display (Fig. 33).
8. Enter the information requested and press ENTER key. Ultrasonic scanner is ready to be self-calibrated. The quality of position estimation directly depends on the thoroughness, performed by operator during this operation. Request for placing the transducer to the upper left corner (point 0) appears on the Display (Fig. 34). Corners should be bypassed in the following order: upper left (point 0), upper right (point 1), bottom right (point 2), bottom left (point 3)
9. Fix the transducer on corner 0 of testing area and press ENTER key. In a 1-2 seconds the request to enter the next corner point appears on the Display. Please pay attention in order to NOT perform any shifting or moving the transducer during pressing ENTER key. Please, don't introduce any obstacles on the way of sonic waves, such as operator's hands, testing specimens, other objects. Any source of alternative voltage generator (such as power supply units for computers, monitors, etc.) with the frequency 40 kHz can introduce unwanted interference and should be turned off.
10. Perform the indications of the previous item (9) for the rest of corners. Device will self-calibrate the position estimation system according to the given settings and turn the threshold check mode on (Fig. 35). In the case if:
    - microphones are not connected to DAMI-C HA01;
    - transducer is not connected to DAMI-C HA01;
    - left and right microphones are mismatched and are not corresponding to the left and right sides of the object under test;
    - microphones and object under test are not placed as it is recommended at the scheme given by Fig. 32.
    - calibration process is accompanied by unwanted shifts and movements of the transducer or microphones;

    then the message asking to redo the calibration appears (Fig. 31)

Fig. 31

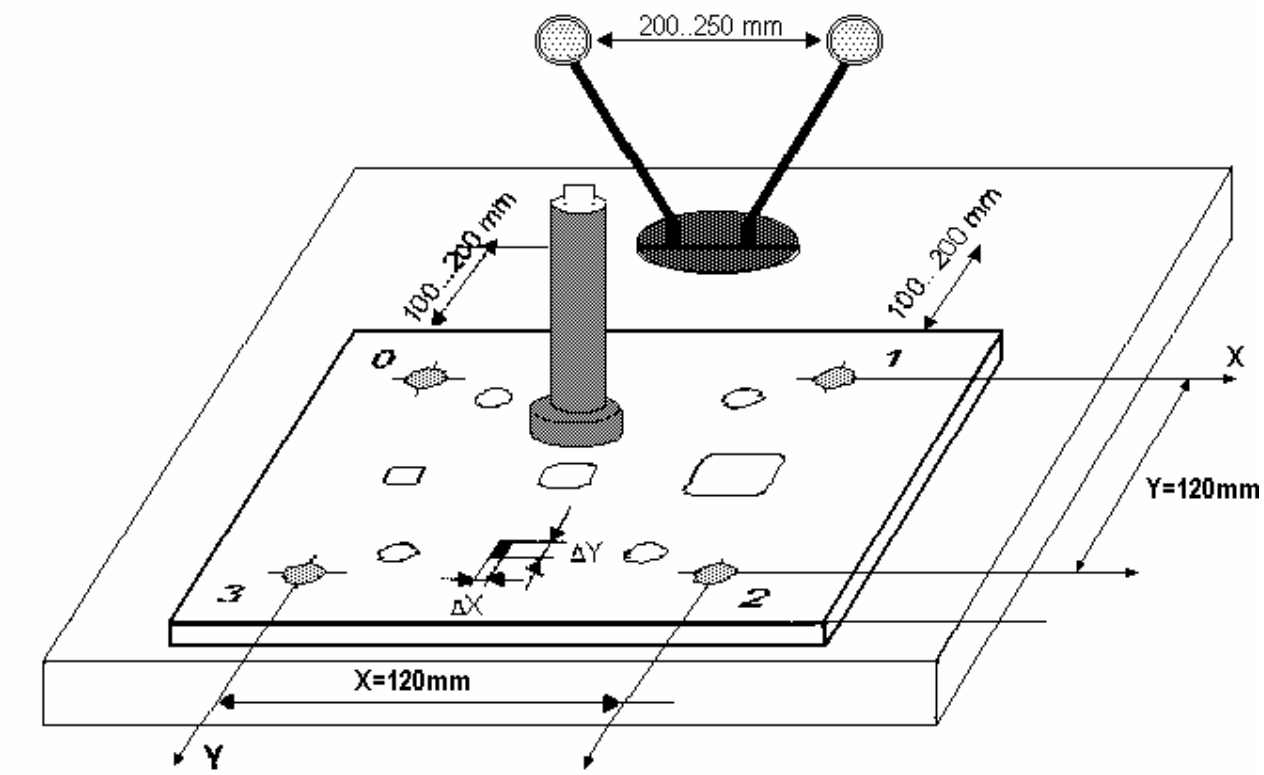


Fig. 32

Fig. 33

11. Place the transducer on the object under test and move it along the object surface at any appropriate speed (up to 100 mm/s). Pay special attention to provide good contact between the transducer and the object's surface. At the end of scanning process the threshold image of all flaws detected is drawn in black on the screen. The trajectory of transducer movement is drawn in light gray. DAMI-C HA01 allows parallel inspecting of up to three layers. One of the layers is shown on the Display (Fig. 35). To switch between layers, press LEFT (RIGHT) key.

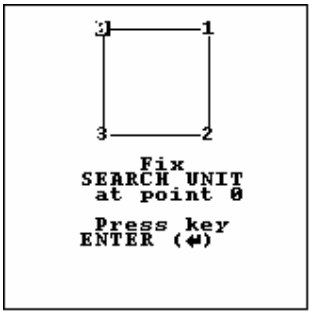


Fig. 34

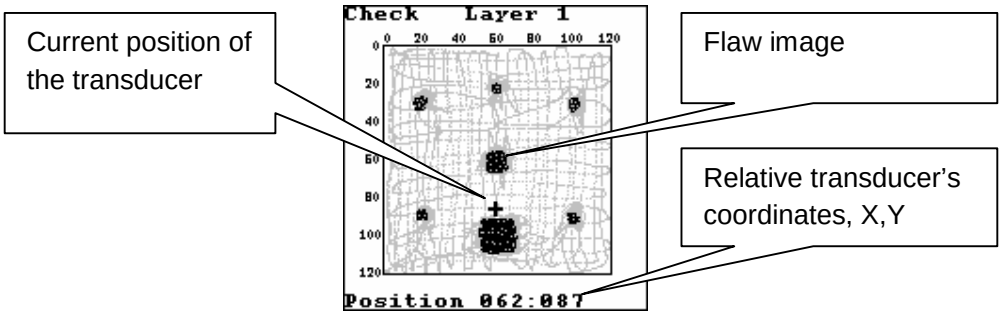


Fig. 35

12. Press the SHIFT key. DAMI-C HA01 goes to the SELECT submode (Fig. 36). The operator can select necessary layer to be displayed on the screen by pressing the LEFT (RIGHT) keys. To return to the Threshold Check mode press the SHIFT key.

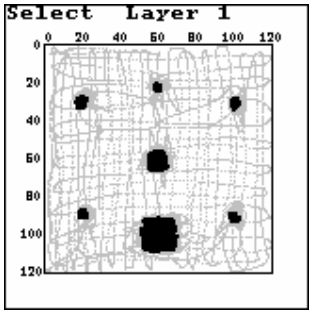


Fig. 36

13. In order to measure the detected flaw square, it is necessary to turn from Threshold Check mode to the SELECT submode and press the keys combination SHIFT+ENTER. DAMI-C HA01 will turn in the area measuring submode.
14. To perform the flaw square measurement use the left upper marker on the screen. This marker can be moved up and down and left and right using the corresponding UP, DOWN, LEFT and RIGHT keys. These keys can also be used to change the marker size. The functionality of these keys (marker moving or modifying the marker size) is switching after each pressing of the SHIFT key.
15. Extend the marker size in order to cover the needed flaw image. The covered image becomes inverted. The area of the inverted image is displayed in the line S-mm2. The area of all other flaw images, the operator is interested in, may be measured similarly.
16. In order to measure the linear dimensions of the flaw image use the coordinates of the left upper and right down corners of the extended marker. These coordinates are displayed in the last screen line. For example, the flaw image given by the Fig. 37 has the following dimensions:
17. on the X-axis: 76,0-41,0=35mm,
18. on the. Y-axis: 117,0-82,0=35mm.

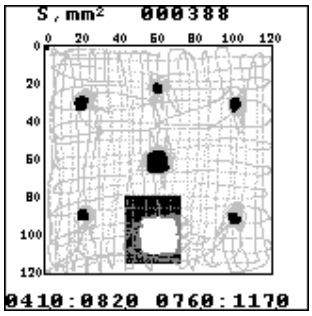


Fig. 37

19. There is an alternative way of measuring the square of the flaw. This way is of a great convenience when there are a lot of flaws at the image of complex configuration and it is impossible to mark out a single flaw without marking a part of the other flaw. In this case operator should press SHIFT + BREAK keys from the SELECT submode (Fig. 36). Two crossed axes appear with the crossed point (marker), belonging to the flaw (Fig. 38). Press ENTER key and the square of the selected flaw will be displayed at the bottom of the display (Fig. 38). By successive pressing ENTER key you can bypass all the flaws and to find out respective squares. DAMI-C HA01 recognizes visible flaws at the image automatically and operator shouldn't indicate or mark out the flaw, he must only press ENTER key and jump from one flaw image to another.
20. The opportunity to manually move each axis is also provided. For this purpose, the LEFT, RIGHT and UP, DOWN keys should be used. When the crossed point intersects a flaw, its square will appear in the bottom of the display.

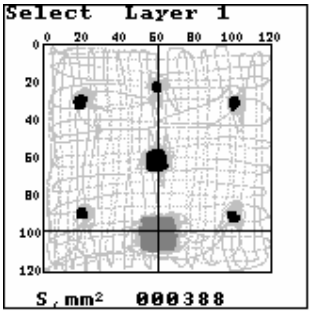


Fig. 38

21. To save the threshold image and data into Archive turn DAMI-C HA01 into Threshold Check mode and press ENTER key. The request for test result saving appears on the Display (Fig. 39). Enter the name for this testing result and press ENTER key to save it into Archive, otherwise press BREAK key.
22. To escape Threshold Check mode press BREAK key. In case the results were not saved, the request for saving appears on the Display (Fig. 40). Press BREAK key again and DAMI-C HA01 will exit from Threshold Check mode without result saving. WORK mode menu appears on the Display.

Fig. 39

Fig. 40

4.8. SURFACE CHECK

1. Follow the instructions 1-6 from THRESHOLD CHECK paragraph.
2. Enter SURFACE CHECK mode. Request for Tuning numbers for each layer, testing area (rectangle) size and quantification value appear on the Display (Fig. 33).
3. Follow the instructions 8-10 from THRESHOLD CHECK paragraph.
4. Place the transducer on the object under test and move it along the object surface at any appropriate speed (up to 100 mm/s). Pay special attention to provide good contact between the transducer and the object surface. At the end of scanning process the rectangle will be colored entirely in black. Here the parallel inspecting of up to three layers is also provided. One of the layers is being shown on the Display. To switch between layers press LEFT (RIGHT) key.
5. While scanning, the corresponding elementary areas on the display are filled in black color. Each elementary area has the width and height equal with the Step X and Step Y in the request (Fig. 33). The full signal information for each elementary area is stored in the memory of DAMI-C HA01.
6. When the whole testing area is scanned (filled in black) press the SHIFT key. DAMI-C HA01 turns into SELECT submode (Fig. 41). To switch between the layouts use the LEFT and RIGHT keys.
7. In order to obtain the flaw image of the current layout, change the threshold signal value by pressing the DOWN (UP) key. The current value of the threshold is displayed in the line **Deviation** at the bottom of the screen (Fig. 42).

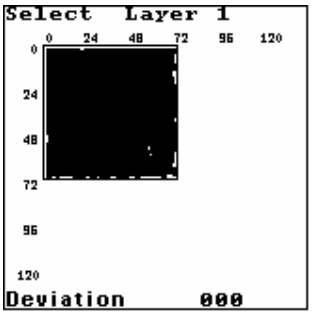


Fig. 41

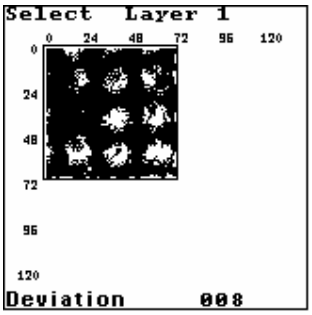


Fig. 42

8. In order to measure the detected flaw surface it is necessary to turn from Surface Check mode to the SELECT submode and press the keys combination SHIFT+ENTER or SHIFT+BREAK (depending on what method of square measuring is more convenient for the operator). DAMI-C HA01 will turn in to the area measuring submode (Fig. 37, Fig. 38). The measurement should be performed as it is described by instructions 14-20 from THRESHOLD CHECK paragraph.
9. In order to obtain the linear dimensions of the flaw, follow the instruction 16 from THRESHOLD CHECK paragraph.
10. To save the inspection results into Archive turn the DAMI-C HA01 from Surface Check mode to Selection submode and press ENTER key. The Save Image menu appears on the screen (Fig. 43). The flaw image can be saved either as a threshold image or a complete image (a full signal information). Select the necessary menu item using the UP (DOWN) keys and press ENTER key.
11. The request for inspection results saving appears on the Display (Fig. 44). Enter the name for this testing result and press ENTER key to save it into Archive, otherwise press BREAK key.
12. To escape the Surface Check mode press BREAK key. In case the result was not saved, the request for saving appears on the Display (Fig. 43). Press BREAK key again and DAMI-C HA01 will exit from Surface Check mode without result saving. WORK mode menu appears on the Display.

Fig. 43

Fig. 44

4.9. WORKING WITH DAMI-C HA01's ARCHIVES

- If necessary, escape TESTING or TUNING modes. WORK menu appears on the Display. Enter ARCHIVES mode. ARCHIVES menu appears on the Display (Fig. 45).

Fig. 45

How to view / delete saved tunings

- Enter VIEW TUNING mode of ARCHIVES menu. The first record appears on the Display. Press the RIGHT (LEFT) key to increase (decrease) the ID number of the tuning record to be displayed. The first page of the selected record appears on the Display (Fig. 46). The percentage of free space in the archive of tunings (100% is the total room for tuning records) is indicated in the string **Free room** at the screen bottom. If necessary, press ENTER key to delete the current tuning. To execute this operation, the operator confirmation is required however (Fig. 47).

Fig. 46

Fig. 47

- Press SHIFT key. The second page of the current record, containing the admissible impedance zone appears on the Display (Fig. 48). If necessary, press the SHIFT key to return to the first page of current record. Press ENTER key to delete the current tuning. Press BREAK key to quit viewing.

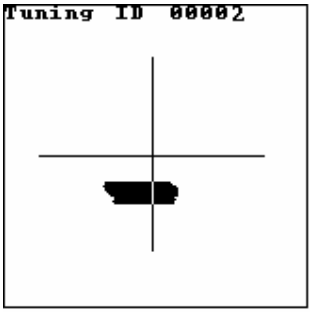


Fig. 48

- To continue viewing press the RIGHT (LEFT) key to increase (decrease) the identifier of the record to be viewed. The corresponding record appears on the Display. Press the BREAK key to quit viewing. ARCHIVES menu appears on the Display.
- Press BREAK key to escape ARCHIVES mode. WORK menu appears on the Display.
- The tuning record structure is as follows:

N	Field Name	Description
1	Tuning ID	Integer value within the range 1-43 that explicitly identifies the tuning record
2	Name	Symbolic name which can help operator to navigate through tunings (40 symbols max.)
3	Transducer number	Integer value that explicitly identifies the transducer, used during the tuning creation process
4	Date	Tuning creation date DD.MM.YYYY
5	Time	Tuning creation time HH:MM:SS
6	Frequency	The value of the frequency for the current tuning
7	Gain	The value of the gain for the current tuning
8	Pulses	The number of generator's repetition pulses for the current tuning
9	Start point	The beginning of the time interval in which transducer signal will be processed when using the current tuning.
10	End point	The end of the time interval in which transducer signal will be processed when

N	Field Name	Description
		using the current tuning.
11	Attenuation	The attenuation value applied to the transducer signal when using the current tuning.

How to delete all saved tunings at once

You can completely erase the archive of tunings by doing the following:

- press SHIFT+LEFT+RIGHT from the Splashscreen, DAMI-C HA01 will be turned to TESTS mode;
- select VERSION NUMBER submenu by successive pressing UP or DOWN keys;
- press SHIFT+LEFT to delete tunings;

How to view / delete saved images

- Enter VIEW IMAGE mode of ARCHIVES menu. The first saved image record appears on the Display.
- Press the RIGHT (LEFT) key to increase (decrease) the identifier of the record to be viewed. The first page of the current record appears on the Display (Fig. 49). The percentage of free space in the archive of images (100% is the total room for image records) is indicated in the string **Free room** at the screen bottom. If necessary, press ENTER key to delete the current image. To execute this operation, the operator confirmation is required however (Fig. 47).

Fig. 49

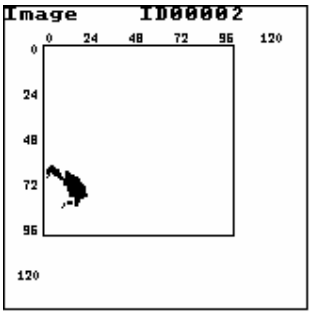


Fig. 50

- Press the SHIFT key. The second page of the current record appears on the Display (Fig. 50). If necessary, press the SHIFT key to return to the first page of current record or press the BREAK key to quit viewing.
- In order to measure the flaw square on the displayed image it is necessary to press the keys combination SHIFT+ENTER. DAMI-C HA01 will turn in the area measuring submode (Fig. 37). This submode is described in (4.7, 13 - 18). Press BREAK to quit the area measuring mode. The alternative area measuring submode (4.7, 19) is also available. It can be activated by pressing the keys combination SHIFT+BREAK (Fig. 38). Press BREAK to quit the alternative area measuring mode
- To continue viewing press the LEFT (RIGHT) key to increase (decrease) the ID number of the record to be viewed. The current page of the record appears on the Display. Press the BREAK key to quit viewing. ARCHIVES menu appears on the Display.
- Press the BREAK key to escape ARCHIVES mode. WORK menu appears on the Display.
- An image record contains the following fields:

N	Field Name	Description
1	Image ID	Integer value within the range 1-279 which explicitly identifies the image record
2	Tuning number	The number of the tuning record, which was used during inspection, resulting in the current image
3	Name	Symbolic name of current image record, which can help operator to navigate through images (40 symbols max.)
4	Date	Image record creation date DD.MM.YYYY
5	Start	The timestamp for the start of the inspection process HH:MM:SS
6	Finish	The timestamp for the end of the inspection process HH:MM:SS
7	Size X	Image width in mm
8	Size Y	Image height in mm
9	Step X	The width of elementary area, used while forming an image
10	Step Y	The height of elementary area, used while forming an image
11	Type	Surface or Threshold; • Surface type means that all the data concerning mechanical impedance value for each of the points scanned during the testing process are saved. While retrieving Surface Type image (i.e. complete image) from an archive, operator has a possibility to select Deviation parameter in order to view flaws with feebly marked impedance differences between flaw zone and intact zone; • Threshold type means only the image with indicated deviation value will be stored in the archive; This option saves room in the image archive, but it leaves no opportunity to change deviation parameter.

How to delete all saved images at once

You can completely erase the archive of images by doing the following:

- press SHIFT+LEFT+RIGHT from the Splashscreen, DAMI-C HA01 will be turned to TESTS mode;
- select VERSION NUMBER submenu by successive pressing UP or DOWN keys;
- press SHIFT+RIGHT to delete images;

How to transfer stored inspection results to PC

The Archive transferring process to an external PC is controlled by NDT Software Environment. See Using Guide for NDT Software Environment for more information.

- At the beginning of the transferring procedure both **DAMI-C HA01 and external PC should be turned off**.
- Connect DAMI-C HA01 to the external PC using RS 232 cable.
- Turn the external PC on.
- Turn DAMI-C HA01 on. The Splashscreen appears on the display.
- Run the NDT Environment Software with plug-in DAMI-C HA01 Data Management and follow the instructions of the Using Guide for NDT Software Environment. When transferring data from the device, the screen becomes empty and the front panel green led is blinking.
- Turn the DAMI-C HA01 off.
- Disconnect the DAMI-C HA01 from the PC.
- Disconnect RS232 cable from DAMI-C HA01.

4.10. HOW TO LOAD FIRMWARE INTO DAMI-C HA01

Manufacturer provides DAMI-C HA01 users with an opportunity of upgrading embedded firmware by the means of serial port communication with an external PC with launched NDT Software Environment program. This feature allows to be up-to-date with the latest versions of embedded firmware, available from VOTUM JSC, www.votum.md . The process of firmware rewriting should be performed with care, because in the case of failure during this procedure device becomes dead until successful rewriting procedure takes place.

NDT software environment supports the mode of firmware rewriting. Firmware is contained in a single file “dami.bin”. Download the latest version of “dami.bin” from www.votum.md or use the file “dami.bin”, provided in DAMI-C HA01 tool kit.

- At the beginning of firmware rewriting procedure both **DAMI-C HA01 and external PC should be turned off**.

- Connect DAMI-C HA01 to the external PC using RS 232 cable.
- Turn the external PC on.
- **DO NOT** Turn DAMI-C HA01 on!
- Press ENTER + SHIFT keys. Pay attention to press ENTER key first, as if you press SHIFT first, DAMI-C HA01 will be turned ON rather than will be turned into firmware-rewriting mode. Device will turn to the firmware-rewriting mode, it will beep shortly and will flash front panel LED once.
- Run the NDT Environment Software with plug-in DAMI-C HA01 Data Management and follow the instructions of the Using Guide for NDT Software Environment.
- The process of firmware loading is accompanied with successive turnings ON and OFF of green LED on the front panel.
- On successful firmware loading DAMI-C HA01 will be automatically turned ON and ready to operate.
- Explore new features of DAMI-C HA01 if necessary.
- Turn DAMI-C HA01 off.
- Disconnect the DAMI-C HA01 from the PC.
- Disconnect RS232 cable from DAMI-C HA01.

4.11. VERIFICATION MODE

This mode provides a set of auxiliary functions, such as:

- displaying the signal oscillogram obtained from the main channel transducer as well as the signal oscillogram obtained from scanner channels (**OSCILLOSCOPE**);
- displaying the signal phase deviation diagram built on the basis of two signals: the signal received from the transducer loaded on the flaw free area and from the transducer loaded on the flaw containing area (**PHASE ANALYSER**);
- displaying the amplitude-frequency response diagram of the **transducer + object-under-test** system (**SPECTRUM ANALYSER**);
- displaying the transducer's current position on the screen (**SCANNER**).

In order to enter **VERIFICATION** mode, operator should press ⇧ + ↵ keys when the splashscreen is on the Display (Fig. 6). **VERIFICATION** menu appears on the display (
Fig. 12). Choose the needed submode in the menu using the ▲ (▼) keys and press ↵.

OSCILLOSCOPE

In the OSCILLOSCOPE submode the operator can see the oscillogram of the signal, received from the transducer (Fig. 51) as well as the oscillogram of the signals from coordinate measuring system receivers (Fig. 52). Press ⇧ + ◀ or ⇧ + ▶ to switch between these oscillograms. When the transducer signal's oscillogram is displayed (Fig. 51) then the following signal parameters can be modified:

Frequency - adjusts signal's frequency;

Gain - adjusts signal's gain;

Pulse - adjusts the number of pulses in the signal pattern;

Latency - adjusts the time interval between actual signal start and the signal displaying start;

Compress - adjusts compressing coefficient for the displayed signal.

Left and **Right Markers** - select the beginning and the end of the time interval in which the signal, received from transducer, will be processed. The signal out of the selected interval is ignored. The active marker is indicated by a small triangle at its bottom.

When the oscillogram of the signal from coordinate measuring system receivers is displayed on the screen (Fig. 52) then the **Gain**, **Latency** and **Compress** parameters can be modified only. Vertical line at scanner's oscillogram indirectly indicates the distance from main transducer to Left or Right microphone.

To switch between indicated parameters press ◄ (►);

To change the value of the selected parameter press ▲ (▼);

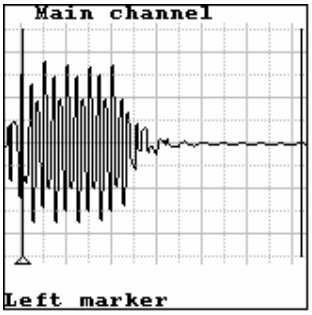


Fig. 51

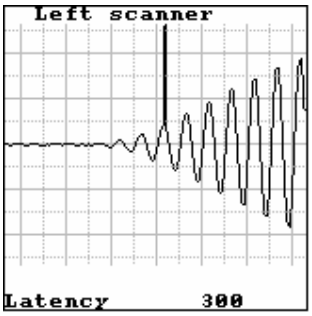


Fig. 52

PHASE ANALYSER

The Phase Analyzer is widely used in Phase Tuning submode to find the optimal frequency for the signal driven to the transducer that permits to distinguish maximally the flaw free zone from the defective zone on the surface under test The informative parameter used in Phase Tunung submode is the phase deviation between the signals received from the transducer loaded on the flaw free area and from the transducer loaded on the flaw containing area. The phase deviation diagram is displayed on the screen. The cursor is automatically set at the frequency on which the phase deviation value is maximal.

Before entering the **Phase Analyzer** submode from **Verification** mode, place the thansducer on the flaw free area and press ↵ key. In 1-2 seconds a straight horizontal line appears on the screen (Fig. 53). In order to build the phase deviation diagram, place the transducer on the flaw containing area and press the ↵ key again. The phase deviation diagram in the full range of frequencies from 0.4

to 40 kHz by step 156Hz is displayed on the screen. A vertical cursor is automatically placed at the frequency on which the phase deviation value is maximal. The frequency value will be displayed on the bottom of the screen and the deviation value - on the top of the screen. To find the deviation value for the needed frequency, use the cursor movement keys ◀ (▶). This feature permits the operator to find the frequency at which the device is able to distinguish maximally the flaw free zone from the defective zone on the surface under test using the phase deviation informative parameter.

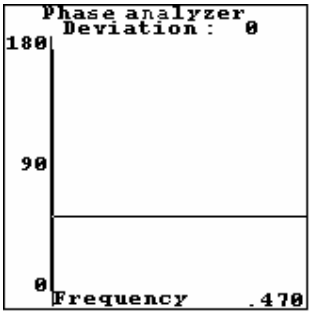


Fig. 53

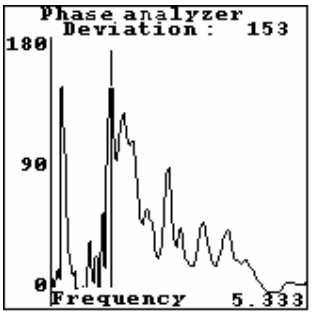


Fig. 54

The amplitude-frequency response diagram in the full range of frequencies for 0.4 to 40 kHz by step 156Hz is displayed on the screen. To find the amplitude value for the needed frequency, use the cursor movement keys ◀ (▶). The frequency value will be displayed on the bottom of the screen and the amplitude value - on the top of the screen. This submode permits to display two diagrams simultaneously: one in black color - for the current transducer position and the other one in gray color - for the previous transducer position on the surface under test. The cursor is automatically placed at the frequency on which the amplitude values of these two diagrams are of the maximal difference. This feature permits the operator to find the frequency at which the device is able to distinguish maximally the flaw free zone from the defective zone on the surface under test (Fig. 54).

SPECTRUM ANALYSER

The Spectrum Analyzer is widely used in Manual Tuning submode to find the optimal frequency for the signal driven to the transducer that permits to distinguish maximally the flaw free zone from the defective zone on the surface under test. Two informative parameters are used in Manual Tunung submode: the amplitude and phase deviations between the signals received from the transducer loaded on the flaw free area and from the transducer loaded on the flaw containing area. The amplitude-frequency response diagram of the **transducer + object-under-test** system is built on the screen. This submode permits to display two diagrams simultaneously: one in black color - for the current transducer position and the other one in gray color - for the previous transducer position on the

surface under test. The cursor is automatically set at the frequency on which the amplitude values of these two diagrams are of the maximal difference.

Before entering the **Spectrum Analyzer** submode from **Verification** mode, place the thansducer on the surface under test and press ↵ key. The amplitude-frequency response diagram in the full range of frequencies for 0.4 to 40 kHz by step 156Hz is displayed on the screen. To find the amplitude value for the needed frequency, use the cursor movement keys ◄ (►). The frequency value will be displayed on the bottom of the screen and the amplitude value - on the top of the screen. This submode permits to display two diagrams simultaneously: one in black color - for the current transducer position and the other one in gray color - for the previous transducer position on the surface under test. The cursor is automatically placed at the frequency on which the amplitude values of these two diagrams are of the maximal difference. This feature permits the operator to find the frequency at which the device is able to distinguish maximally the flaw free zone from the defective zone on the surface under test using both amplitude and phase deviation as informative parameters. (Fig. 55, Fig. 56).

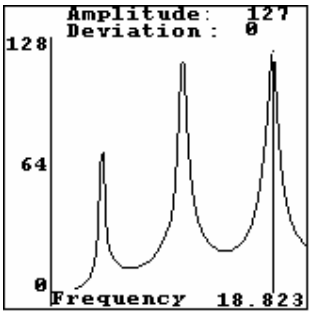


Fig. 55

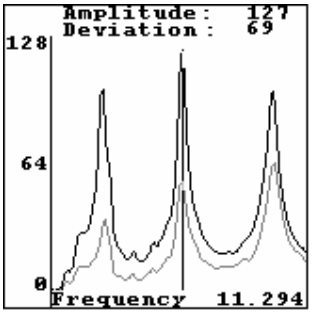


Fig. 56

SCANNER

This submode is used for checking the coordinate measuring system (ultrasonic scanner). It permits to specify a square area of 120mmx120mm on the plane surface by setting consecutively the transducer in square corners and pressing ENTER key. Such procedure calibrates the coordinate measuring system and at completion, the conventional image of the specified square and the transducer position appear on the device screen. The transducer current coordinates are displayed at the bottom of the screen. The operator can move the transducer on the square and watch the corresponding movement on screen. In case the calibration fails, DAMI-C HA01 displays a message with a request to repeat the procedure. The operator can accept new calibration or exit in the VERIFICATION menu.

When moving the transducer on the square, the operator can choose a particular position of the transducer, relatively to which the distance will be measured and press the ENTER key. The distance

between the transducer current position and the chosen position appears in the last but one line on the screen (Fig. 57). To return from distance measuring submode press the ENTER key again. To exit in the VERIFICATION menu press the BREAK key.

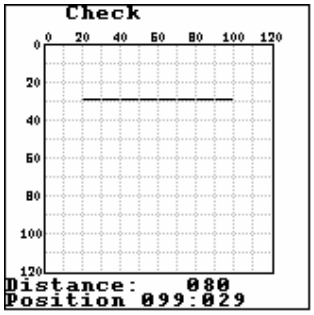


Fig. 57

4.12. TESTS

Several embedded tests are provided in DAMI-C HA01 in order to make an express estimate of device working ability. These tests should be used when device malfunction is suspected and operator wants to test device using these tests prior to making request to the manufacturer.

Test mode can be selected by pressing SHIFT+LEFT+RIGHT from the Splashscreen (Fig. 58);

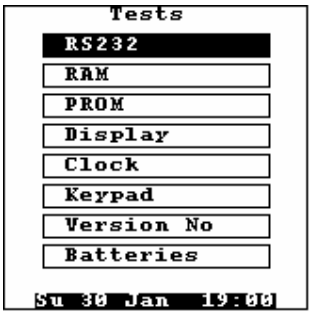


Fig. 58

DAMI-C HA01 includes embedded tests as follows:

- RS232 – serial port communication test. Should be used when problems occurred during the session with an external PC;
- RAM test – tests embedded Random Access Memory. The only sufficient test result is as given by Fig. 59:

Fig. 59

- PROM test – tests the checksum for the firmware, stored in the device in 3 FLASH MEMORY pages, in the case of error you can see the following screenshot, given by Fig. 60.

Fig. 60

- Display test – visually shows different brightness levels and display's resolution (Fig. 61).

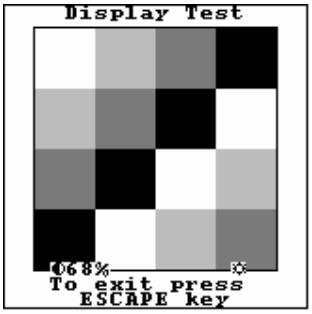


Fig. 61

- Clock test – tests internal clock memory;
- Keypad – tests DAMI-C HA01 keypad;
- Version No – gives information about the firmware, loaded to the device (Fig. 62) and offers the opportunity to delete all tunings (pressing SHIFT+LEFT keys) as well as all images (pressing SHIFT+RIGHT keys) into the archive and built the transducer amplitude-frequency response diagram (pressing SHIFT+ENTER keys). When deleting tunings or images, the corresponding inscription on the screen is displayed in inverted color (white symbols on black background) while the deletion process is in progress. When the process is completed, the symbols become black.

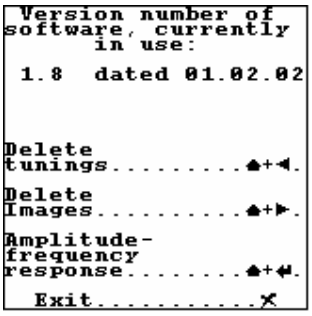


Fig. 62

Fig. 63

- Batteries - shows the current state of embedded batteries.

5. DAMI-C HA01 TECHNICAL DATA

Sensitivity to be shown with testing specimen TS-1	DAMI-C HA01 effectively brings out flaws 20, 12
Main channel generator's operation frequency range	1.098 - 40 kHz
The number of channels of ultrasonic position detector (scanner)	2
Ultrasonic scanner generator's operation frequency	40 kHz ± 1 kHz
Main channel's sensitivity	no more than 10 mV
Scanner's channel sensitivity	no more than 10 mV
Testing performance	• not less than 100 testing measurements per second in the "point check" mode • not less than 50 testing measurements per second in "threshold check" and "surface check" modes
Coordinate measurement range (parameters of the selected area within the object under test where ultrasonic scanner correctly detects the position of the main transducer)	• for X coordinate: 36…360 mm; • for Y coordinate: 36…360 mm;
Basic absolute coordinate measurement error at normal temperature conditions (20 °C)	± 1.5 mm
Basic absolute square measurement error at normal temperature conditions (20 °C)	± 30%
Main channel receiver gain range	not less than 32 dB
Scanner channel receiver gain range	not less than 32 dB
Archive capacity for tunings	• 43 records
Archive capacity for images	• 36 records for complete images; • 279 records for threshold images
Admissible number of data saving operations in the archive	not less than 1000000, according to technical data for Flash Memory, warranted by manufacturer
Continuous storage time for archive data at lack of power supply	not less than 20 years, according to technical data for Flash Memory, warranted by manufacturer
Admissible power supply sources for DAMI-C HA01	• AC mains supply (220±22) V, (50±1) Hz • 4 embedded batteries, with total nominal voltage 4.8V and power capacity 1.8 A x h
DAMI-C HA01's power consumption including batteries charger	not more than 12 VA

Continuous operation time when using DAMI-C HA01 with AC power supply unit	24 hours
Consumption current when supplied from embedded batteries with nominal voltage 4.8 V	not more than 250 mA
Embedded batteries switching-off voltage value	(3.5 ± 0.15) V
Continuous operation time when used with fully charged embedded batteries	not less than 7 hours
Time of data transmitting to external PC (for 10 records)	no more than 10 seconds
Screen resolution	160 x 160 pixels
The number of screen brightness levels	4
Screen size	55mm x 55mm
Weight (without transducers and batteries)	no more than 1000 g
Dimensions	195mm x 100 mm x 45 mm

6. MANUFACTURER WARRANTIES

1. The **Manufacturer guarantees the DAMI-C HA01 availability** according to the specifications of this **USER'S MANUAL** if the regulations of transport, storage and the operating instructions established by the document are **exactly kept by the Owner**.
2. **The Warranty period of the DAMI-C HA01 storage is 6 months** from the date when the DAMI-C HA01 was manufactured.
3. **The Warranty period of the DAMI-C HA01 operation is 18 months** from the date when DAMI-C HA01 was putting into operation during the warranty period of the DAMI-C HA01 storage. The Manufacturer Warranties could be modified according to a mutual agreement with Owner.
4. **The warranty service is not realized** in the following evident cases of the instruction violations:
   - Mechanical damages of DAMI-C HA01 Main Unit
   - Mechanical damages of the front panel and back panel plugs
   - Mechanical damages of the Scanner body
   - Mechanical damages of the LCD Display
   - Damages of the LCD Display in a cause of violations of the temperature range
   - Damages of the built-in power supply unit in a cause of incorrect connection of the built-in Battery contacts
5. **The warranty service cannot be applied** for:
   - transducers
   - Batteries
   - Cables

Appendix A. Impact Method

The impact method is used for the fast scanning of wide areas with the resolution of 1 measurement per 1 cm^2. It uses a IPU-1 transducer that produces equidistant normalized hits on the tested object surface and receives the response. This method permits to scan wide areas line-by-line, detects flaws over 1 cm^2 size, and displays their interpolated image.

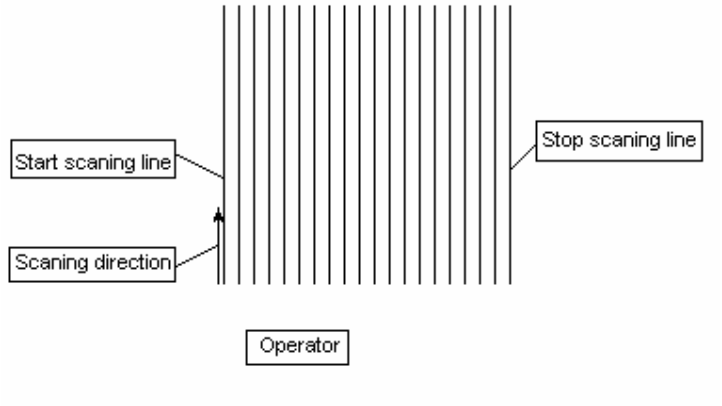


Fig. 64

1. Mark a rectangular area on the surface under test and rule it lengthwise line by line with a 1 cm step. The start scanning line is the extreme left one and the stop scanning line is the extreme right one. The scanning must be performed from the operator along each marked line (Fig. 64).
2. Connect the IPU-1 transducer to DAMI-C HA01
3. Turn DAMI-C HA01 on. The initial splash screen mode appears on the display.
4. From the initial splash screen mode press the Shift + Right keys. "**Other methods**" menu will be displayed (Fig. 65).

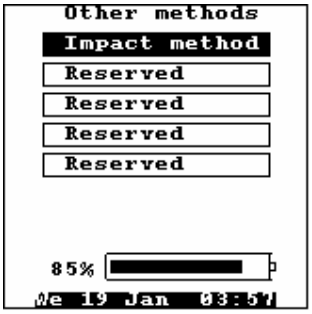


Fig. 65

5. Set the menu marker to the "**Impact method**" menu item and press the Enter key. On the display will appear the "**Impact method**" mode, containing two rectangles and key functions description (Fig. 66).

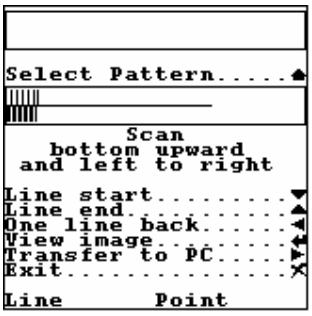


Fig. 66

6. Initially, a signal oscillogram from a flawless zone should be taken, which will be used as a pattern to compare it with the signal oscillogram received from the object under testing. To get the pattern oscillogram press the Shift key (select pattern function). The device displays the oscillogram input submode (Fig. 67).

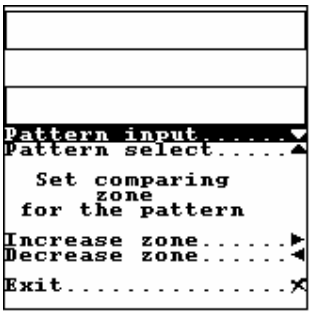


Fig. 67

7. In this submode the transducer should be moved along the flawless surface. The signal oscilogram from every hit on the flawless surface is displayed in the lower rectangle (Fig. 68). As far as the tested object characteristics don't vary, the signal oscillogram doesn't change from hit to hit.

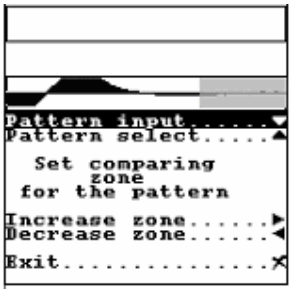


Fig. 68

8. To save the pattern oscilogram press the Up button (pattern select function).
9. Using the Left and Right keys, set the required oscillogram analysis zone (Fig. 68). The left (start) oscillogram side is the most informative one, that's why DAMI-S provides the possibility of width selection of the analysis zone. The analysis zone is used to compare and analyze the differences between the signals from the flawless zone and from the tested object, both received as a result of the hits on their surfaces. The light gray band in the right side of the lower rectangle marks the uninformative oscillogram site.
10. After setting the analysis zone press the ✘ button. The device enters the scanning submode (Fig. 69) and is ready to scan the ruled rectangular area of the object under test. The start scanning line is the extreme left line. The scanning is performed from the operator, along each marked line.

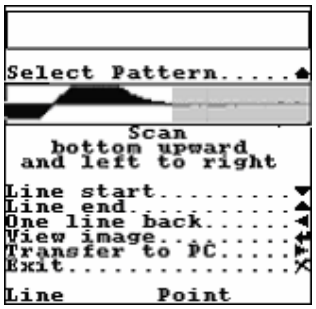


Fig. 69

11. Place the impact transducer on the beginning of the first line.
12. Press the Down key (line start function). Move the transducer along the marked line from the beginning of the line to the end. While moving, it produces a series of hits with the 1 cm step through the traversed path. In is very important when moving the transducer to hold it pressed to the object surface in order to ensure that the hits are produced equidistantly and cover all the line. The oscillogram of the signal received on each hit is displayed in the upper rectangle (Fig. 70). When reaching the end press the Up key (line end function).

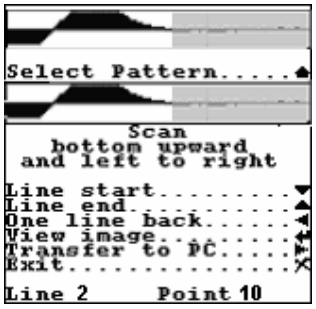


Fig. 70

13. Place the transducer on the beginning of the next line. Repeat the 12-th step for all the lines successively. There is the possibility to repeat the scanning of the current line. To do that finish the current line scanning by pressing the Up key (line end function) and press the Left key (one line back function), and repeat the 12-th step for the same line.
14. At the end of each line scanning, starting with the second, the scanned image visualization submode may be entered, pressing the Enter key (view image function). The interpolated image of the scanned lines will be displayed (Fig. 71).

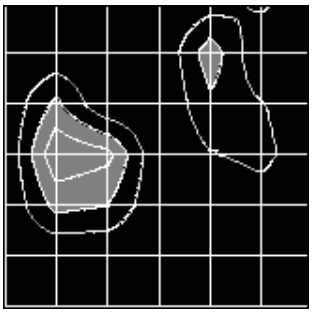


Fig. 71

15. Press Up (Down) key to increase (reduce) the image size (Fig. 72). Press Right (Left) key to increase (reduce) the number of isolines on the image (Fig. 73).

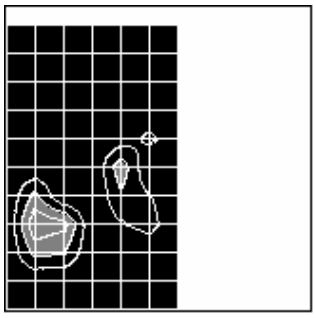


Fig. 72

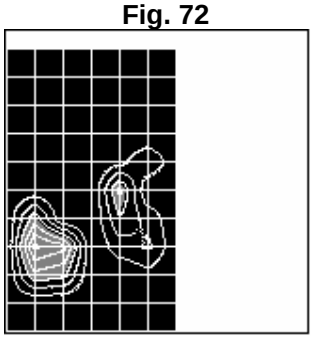


Fig. 73

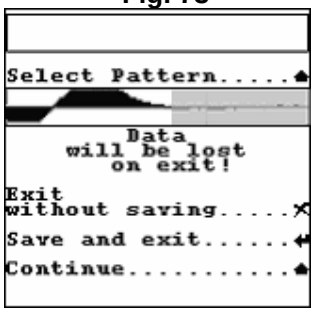


Fig. 74

16. After pressing the Shift button, the function of the Up, Down and Right, Left keys is changing. Now with the Up, Down keys the image may be shifted vertically and with the Right, Left keys - horizontally. Pressings the Shift key once again returns the keys their previous functions. To return to scanning mode press the Break key. Now the scanning of the tested object may be continued. To end the scanning, press the Break key. The request for test results saving will be displayed (Fig. 74). To exit without saving test results press the Break key, to save them into device archive press the Enter key.

17. When saving the test results, the request for the impact image name and the transducer number will be displayed (Fig. 75). Enter the impact image name and the transducer number and press the Enter key. The image will be stored into the impact images archive.

Fig. 75

Appendix B. Marker position correction in Point Check, Threshold Check and Surface check modes

1. In case the material of the specimen used for tuning and the material of the object under testing have identical physical properties, the marker position relative to the admissible impedance zone are the same for the transducer on the flaw free area of specimen and on the flaw free area of the object under test. But in practice there are situations when the properties of the object under testing slightly differ from the properties of the specimen used for tuning. A typical example – the painted object under testing and a bright, not painted specimen. In such a situation the dry point contact properties between the transducer and the specimen differ from the properties of the contact between the transducer and the painted surface of the object under testing. This results in a change of marker position relative to the admissible impedance zone for the transducer on the flaw free area of the object under test (Fig. 77) in comparison with the marker position for the transducer on the flaw free area of the specimen (Fig. 76).

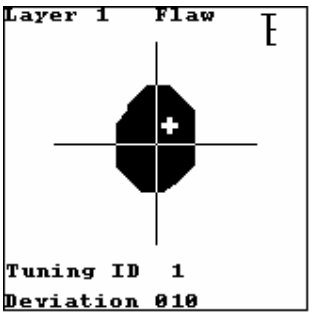


Fig. 76

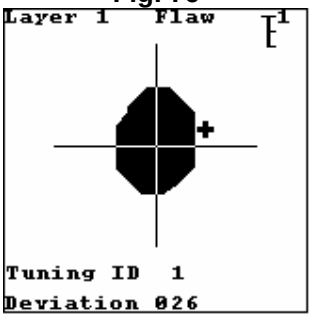


Fig. 77

2. DAMI-C provides the operator with the capability to correct the marker position relative to the admissible impedance zone for **Point Check**, **Threshold Check** and **Surface Check** modes.

Marker position correction in Point Check mode

3. To enter the marker position correction submode when working in Point Check mode press Shift key. A small rectangle containing the text **Move Marker** and the symbols of the keys Up Down, Left, Right appear in the bottom right side of screen (Fig. 78).

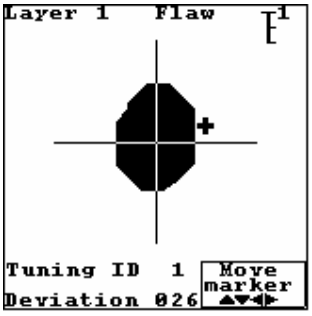


Fig. 78

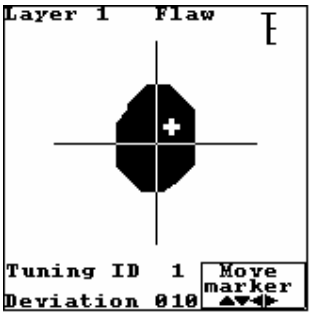


Fig. 79

4. Using the keys Up Down, Left, Right move the marker inside the admissible impedance zone so that it will remain inside until the transducer is moving on the flaw free area of the object under testing (Fig. 79).

5. Exit the marker position correction submode by pressing Shift key again. In case when more than one tuning are used in **Point Check** mode (up to three tunings) the marker position correction for each of them (if necessary) will be done similarly after displaying the admissible impedance zone for needed tuning on screen.

Marker position correction in Threshold Check and Surface Check modes

6. In the Threshold Check mode DAMI-C displays the defect imaging process (Fig. 80). To activate the marker position correction when working in this mode press Up key. The screen is switching to the Point check mode and the needed marker position correction may be carried out as is stated in pp. 3-5. To return to the defect imaging process press Break key.

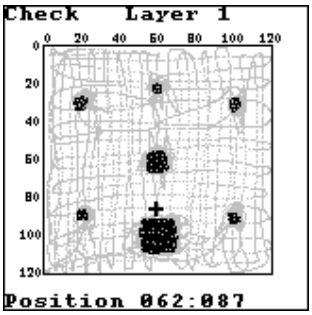


Fig. 80

7. The marker position correction in Surface Check mode may be carried out similarly to the described above correction in the Threshold Check mode.

Remark. The marker position correction in Point Check, Threshold Check and Surface Check modes is available for all tuning types including phase tuning too.

Appendix C. DAMI-C Tuning features in Eddy Current mode

The Eddy Current transducer VTP-1S is designated for corrosion detection on the reverse side of aluminium (or other non-ferromagnetic) alloy plate (plate maximal thickness: 5mm, corrosion minimal thickness: 0.2 mm on the reverse side).
In order to obtain a tuning for VTP-1S transducer, an aluminium alloy specimen containing artificial defects is required. The recommended procedure is as follows:

1. Connect the VTP-1S Eddy Current transducer to DAMI-C HA01.
2. Turn DAMI-C HA01 on.
3. Enter the WORK operating mode by pressing ENTER key. WORK mode menu appears on the display (Fig. 10).
4. Enter the TUNINGS mode of WORK menu. TUNINGS mode menu appears (Fig. 14). Select **Manual** mode and press ENTER. DAMI-C turns to **Tuning parameters selection** submode.
5. Put the transducer on the aluminium alloy specimen in the flaw free area. Enter the Spectrum Analyzer. In one-two seconds the amplitude-frequency response diagram for the flaw free area appears on screen.
6. Using Left (Right) keys set the frequency value to 1.725 kHz (the recommended frequency range for corrosion detection is 1,5 – 2,0 kHz).
7. Exit the Spectrum Analyzer by pressing Break key. DAMI-C returns to **Tuning parameters selection** submode.
8. Using Down key set the marker (‘+’ simbol) in the origin of coordinates.
9. In **Tuning parameters selection** submode move the transducer from flaw containing area to flaw free area and vice-versa without detaching it from the surface and watch the movement of the “+” marker on the gain-phase plane on screen.
10. Increase (decrease) the **Attenuation** value by pressing LEFT (RIGHT) keys if necessary, in order to increase the difference between the position of "+" marker when the transducer is on the flaw-free and flaw-containing areas. DAMI-C HA01 sensitivity can be widely varied by changing the **Attenuation** value. The recommended **Attenuation** values should be in the range from 15 down to 10.
11. In order to prevent marker displacement to the saturation zone, it should be positioned in the origin of coordinates (axes intersection) by pressing DOWN key. This operation should be done when the transducer is in the flaw free area.
12. Build the admissible impedance zone and save the tuning into the device archive.

The saved Eddy Current tuning may be used in the Point Check as well as in the Threshold Check or Surface Check working modes similarly to the tunings for the Mechanical Impedance transducers.

ABOUT THE MANUFACTURER

Votum

***** **76 Decebal Street**
Chisinau
Moldova
MD2038

(**(3732) 56-00-47, 77-84-63**
Fax (3732) 76-18-30,

: **http://www.votum.md**
E-mail: office@votum.md