UFD-50

Universal ultrasonic flaw detector

Operating manual

Salu*Tron* Messtechnik GmbH
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Important notes!

Please read the following notes before using your ultrasonic flaw detector.

General warning

The reliable testing with ultrasonic flaw detection equipment demands obligatory observance of three most important conditions, namely:

- knowledge of the specialized test requirements and limits
- selection of the appropriate test equipment
- the operator training

The principal purpose of this operating manual is to give instructions for operator in the basic set-up and functional operation with the UFD-50.
Other variable factors which affect the test results do not be explained in this manual.

Ultrasonic theory

Basic conceptions of sound wave propagation theory including the effects of sound velocity, attenuation, reflection, refraction and the limitation of the sound beam must be understood by the operator.

Operator training

The operator must be adequately trained in the field of ultrasonic test methods and how to operate with the test equipment.

Technical test requirements

Every ultrasonic test is subject to specific technical test requirements. These requirements include a definition of the scope of inspection, selection of suitable techniques, adequate transducers, evaluation of discovered conditions in the test material, and the determination of limits for recording and evaluation.

Flaw size evaluation

There are basically two different methods of flaw evaluation.

- Flaw boundary method: If the diameter of the sound beam is smaller than the extent of the flaw, then the beam can be used to explore the boundaries of the flaw and thus determine its area. The smaller the diameter of the probe's sound beam, the more accurately the boundaries can be determined by the flaw boundary method. If, however, the sound beam is relatively broad, the flaw area determined can substantially differ from the actual flaw area.
- Echo comparison method: If the diameter of the sound beam is greater than the size of the flaw, the maximum echo response from the flaw must be compared with the maximum echo response from an artificial flaw at the same depth provided for comparison purposes. The echo from a small natural flaw is usually smaller than the echo from an artificial comparison flaw of the same size. This fact due to indirect orientation or irregular shape of the flaw surface, and should be considered when evaluating flaw size to avoid underestimating size.

Test methods

The inspectors should know and understand ultrasonic test methods, developed for corresponding products.

Ultrasonic thickness measurement

Ultrasonic thickness measurements are the results of the mathematical multiplication of the velocity of sound in a material and the travel time of the signals through the material. Flaw detector provides accuracy measurement of travel time of the signals. The correct task of velocity depends on the operator.

Velocity of sound

The accuracy of thickness measurement and flaw location in considerably degree depends on the correct task of ultrasound velocity in a material. Velocity depends on physical characteristics of a material and its temperature.

Effect of temperature variations

The sound velocity varies of the material's temperature. This can cause appreciable errors in measurements. Such measurement errors can be avoided either by using a correction factor obtained from tables.

Contents

1. Description of keypad, menu and displays

The flaw detector UFD-50 is intended for ultrasonic testing and thickness measurement. Device's memory allow to record A-scan, B-scan, settings and measurement results. This chapter will help you to understand keypad and to inform about possibility of flaw detector. Here you'll learn:

- How to mount batteries
- Feature keys
- Menu structure and functions
- Symbols status displays
- Special features of the UFD-50

1.1 Mounting batteries

The flaw detector works from built-in LiOn battery delivered by supplier. To mount/ replace batteries you must first loosen the two screws at the cover of the battery compartment.
You can charge the battery directly when connected to the device the supply unit 220/15 V. It is recommended to use an original pulsing power supply.

Approximate level of the battery charge is specified on the indicator by the symbol . At entirely charged batteries, the symbol emerges as "full". When are discharged becomes "empty".

Figure 1-1 Backside view of the instrument

Note: When the batteries are discharged and to operate is impossible on the flaw detector indicator displays special symbols like crossed out display of the battery. You then will switch off device as soon as possible.

Note: *The flaw detector will be switched off automatically in two minutes after occurrence of discharge symbol. At the same time all parameters of set-up will be saved and will be restored at following inclusion.*

1.2 Device ports

At the instrument front are situated different interfaces for the connection of external units and for data exchange. The following figure gives an overview of the position of interfaces.

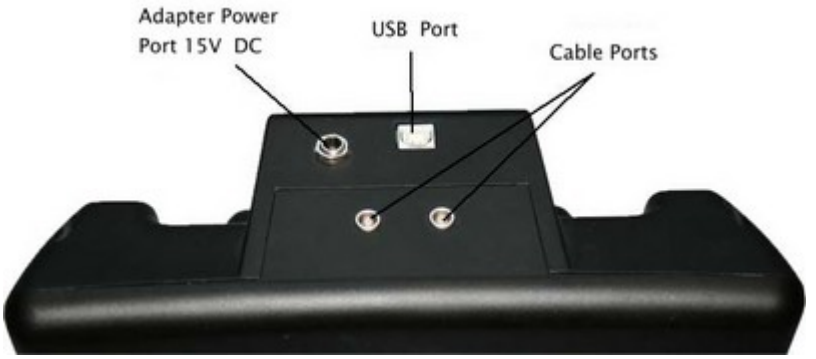


Figure 1-2. Front view of the instrument

1.3 Switching on/off

Press and hold key during 3 seconds for turning on/off instrument.

1.4 Function keys

Device's keypad allows to easy operating with any function.

For access to function:

- Press one of keys to navigate in main menu. The submenus across the right of the display will be immediately replaced with the submenus contained in the selected menu.
- Press a to move through submenu.
- Press to select function.
- Press to change operating.

  Press for exit from value changing mode or press one of keys to select another menu.

You'll also find these keys on the keypad (figure 1-3):

- Display freeze-Freezes display
- Zoom-in the signal in a-gate into full size of A-scan display
- Saving measurement results
- Enter to additional menu or service key
- Changes step size for the gain setting
- On/off full-screen mode.
- Switches the UFD-50 on and off

1.5 Menu and functions

The menu structure allows the operator to change a various settings and includes:

Main menu – menu items used to calibrate the instrument prior to test. Also used to change level of receiver, gain and set-up inspection zones, alarm mode, etc.

Additional menu - allows the operator to make special adjustments like a pulser repetition frequency, change preselected velocity and range values and other features.

Note: *Figure1-4 shows the device's main menu.*

Figure 1-3—Keypad

1.5.1 Main menu

The main menu consists from several items with four functions.

When no one function is selected:

- With ◀ ▶ you can to navigate in main menu
- With ▲ ▼ you can to move in submenu
- With ⊕ you can to select function
- With ⇕ you can to enter in additional menu

When function is selected:

- With ▲ ▼ you can to change values
- With ⇕ you can access additional function values (not for all functions, see 1.4.2)
- With ⊕ you can to close work mode
- With ◀ ▶ you can to move to another menu items

Note: *Gain function is present in all submenus. To change a gain step press ⇕ then function is active. Steps may set: 0,5 dB; 1 dB; 2 dB; 6 dB.*

Main menu	Functions			
BASIC	Velocity	Range	Delay	Reject
A-GATE	a-Thresh	a-Start	a-Width	a-Mode
B-GATE	b-Thresh	b-Start	b-Width	b-Mode
ALARM	ASD Mode	Sound	Led	
TCG	Point	Position	Gain	Enable
PLSRCVR	Band	Filter	Rectify	Input R
PULSER	Voltage	Pulse frequency	Pls.count	PRF
DAMPING	Output R	Dmp. width	Dmp. delay	Inductance
PULSE	Dual mode	Angle	Prb delay	
CALC	Reading	Time mode	Pulse mode	Test block
DISPLAY	Brightness	Grid	Fill	TGC plot
RESULTS	File	Save	File view	File erase
SETTINGS	Load settings	Save settings	Load working	Save working
MODE	B-Scan	Maximum	A-Scale	
COLOR 1	Fon	Table	Menu text	Curosor
COLOR 2	Grid	Plot	a-gate	b-gate
COLOR 3	Maximum	TGC plot	ARC plot	Result

Figure 1-4 Functions accessible from the main menu

MAIN MENU:

BASIC *menu:*

- **VELOCITY –** Allows entering ultrasound velocity. Press key when function is active and choose one of four preselected values from additional menu.
- **RANGE –** Adjusts the display range from 3 mm to 3000 mm (in steel). Press key when function is active and select one of four preselected values.
- **DELAY —** This allows you to shift the A-scan in window to the left or right.
- **REJECT –** Defines what percentage of the A-Scan height is displayed at 0% full screen height.

A-GATE *menu:*

- **a-THRESH** - Sets the height of the a-gate
- **a-START**– Selection the start point of the a-gate
- **a-WIDTH** – Adjustment of the gate width related to the start point of the a-gate
- **a-MODE**- Defines the operation of alarm if a signal crosses the gate or does not cross the gate

B-GAT *menu:*

- **b-THRESH** - Sets the height of the b-gate
- **b-START** – Sets the beginning position of the b-gate
- **b-WIDTH** – Sets the width on the a-gate
- **b-MODE** - Defines the operation of alarm if a signal crosses the gate or does not cross the gate

ALARM *menu:*

- **ASD MODE** – Defines the operation of alarm when signal only in a-gate, b-gate, simultaneously in both gates, at least in one of the gates or on DAC
- **SOUND** – Enables the audible warning alarm
- **LED** – Enables the visible warning alarm

TCG *menu:*

- **POINT**– Up to 10 reference point on the TGC curve may be stored
- **POSITION** – Adjusts situation for each point
- **GAIN** – Change gain value for each point
- **ENABLE** – Turning on/off TGC mode

PLSRCVR *menu:*

- **BAND**– Selects the bandwidth of the instrument
- **FILTER** – To select the analog filter
- **RECTIFY** – Selects the rectification mode for displays A-scan
- **INPUT R** – Turn on the damping when enter the receiver 50 Ohms

PULSER *menu:*

- **VOLTAGE** – Sets the amplitude of sound impulse 50V or 200V
- **PULSE FREQ** – Adjusts the pulse frequency
- **PLS. COUNT** – Adjusts the number periods of pulse (for optimal work with transducer)
- **PRF** – then press key is displayed real PRF

DAMPING *menu:*

- **OUTPUT R** - Allows damping enter of pulser 50 Ohms.
- **DMP. WIDTH** – Allows to select a duration electric damping of emission envelope
- **DMP. DELAY** – Allows to set delay before turn on the electric damping
- **INDUCTANCE** - Allows to pick up an inductive element for optimal excitation of transducer

***PROBE** menu:*

- **DUAL MODE** – Change the level for work with dual-element probes
- **ANGLE** – Angle of incidence
- **PRB DELAY** –Enter the delay time of signal in the transducer wedge, delay line, wear plate and etc.

***CALC** menu:*

- **READING** - Selects the measurement displazed in reading box
- **TIME MODE** – Selects the time on the peak of the signal or on front
- **PULSE MODE**– Chooses the measurement mode of the time from 0 to a-gate or between gates
- **TEST BLOCK**- Allows to enter thickness of the sample for sound velocity calculation

***DISPLAY** menu:*

- **BRIGHTNESS -** Changes the display's brightness from 0 to 100 %
- **GRID**– Includes display of grid on the screen
- **FILL** – Includes filling of the signal on A-scan
- **TGC plot**- Select which curve displays –TGC, DAC or no one.

***RESULTS** menu:*

- **FILE** - Selects one of 15 data files
- **SAVE RESULT**– Saved the measurement value in selected file
- **FILE VIEW** – Allows to review the saved files
- **FILE ERASE**- Deleting results saved in current file

***SETTINGS** menu:*

- **LOAD** - recalls the first data set from memory
- **SAVE SETTINGS** – records the data set in memory
- **LOAD WORKING**– recalls the working data set
- **SAVE WORKING**– records the current settings

***MODE** menu:*

- **B-SCAN**- turn on/off the displays signal like B-scan
- **MAXIMUM**– turn on/off the displays of pulse envelope
- **a-SCALE**– turn on/off the magnify of a-gate to full screen size

  You can use also this key.

***COLOR 1** menu:*

- **FON** - Selects the color for display mode
- **TABLE**– Selects the color of screen's tabs
- **TEXT MENU** – Selects the color for menu's text
- **CUROSOR** - Selects the color for chosen item menu

***COLOR 2** menu:*

- **GRID** - Choose the color for screen's grid
- **PLOT**– Choose the color for signal
- **a-gate** – Choose the color for a-gate
- **b-gate** - Choose the color for b-gate

***COLOR 3** menu:*

- **MAXIMUM** - Choose the color of envelope pulse
- **TGC plot**– Choose the color for TGC's graphic
- **ARC plot** – Choose the color for DAC's graphic
- **Result** - Selects the color for all displays of measured digital values

1.5.2 Additional menu

The additional menu consists from functions which always aren't used.

To enter in additional menu press key when no one functions is active.

To use additional menu:

Press keys to navigate in additional menu or change value.

Press to select functions or to cancel

Press or to close additional menu

Function	Description
DATE	Setting the current date like **day.month.year.** and - setting the day, the month, the year; and - changing value.
TIME	Setting the current time like **hour.minutes.seconds.** and - setting the hour, the minutes or seconds; and - changing value.
MENU LANGUAGE	**РУССКИЙ / ENGLISH** Selecting the language
CONTROL MODE	**ECHO / SHADOW** To select the inspection methods– echo or shadow method (using two probes on differently sides of the test object)
PRF	**40 Hz / MAXIMUM** To select the pulse repetition frequency: 40Hz or can maximal 800 Hz
REFERENCE A, dB c	Input reference amplitude value – for «A, dBc» measurement mode
DAC AMPLITUDE, %	Input DAC position in % of the screen height
DAC1, dB	Input the difference of amplitude for additional curve or basic DAC (up – 12 to +12 dB with step 1dB)
DAC1, dB	Input the difference of amplitude for additional curve or basic DAC (up – 12 to +12 dB with step 1dB)
VELOCITY 1	Input 1-st preselected velocity value
VELOCITY 2	Input 2-nd preselected velocity value
VELOCITY 3	Input 3-d preselected velocity value
VELOCITY 4	Input 4-th preselected velocity value
RANGE 1	Input 1-st preselected range value
RANGE 2	Input 2-nd preselected range value
RANGE 3	Input 3-d preselected range value
RANGE 4	Input 4-th preselected range value
ADDITION +dB	To add dB for key's +dB (up 0 to 40dB with step 0.5dB)
TEST FREQUENCY	Special function for calibration of instrument. Sends impulses to the pulser cable port with 20 KHz frequency

1.6 Status Symbols

On the indicator of flaw detector UFD-50 is displayed A-Scan, B-Scan, menu, measurement results and a series of special graphic symbols.

Description of symbols

✳	-Display memory is enabled (freeze), display is stored
	- To zoom the a-gate is active
	- Single-element mode is active
	-Dual mode is active
	- Function TGC is active;
+dB	- Gain magnifying has been activated by pressing +dB key;
	- Batteries charge indicator
✳	- To device set-up from memory is loaded. To deblocking screen press ❄.

1.7 Features of the UFD-50

- Colour TFT indicator 640 x 480 pixels with analog dynamic impulse. Possibility to change colour for each items on screen
- Weight only 2 kg with built-in batteries
- Two independent inspection zones with individual logic detects flaws
- Frequency range from 500 KHz to 15 MHZ with four working mode for reliable test
- Special operating mode with lowered PRF 40 Hz and range up to 6000 cm (in the echo-mode up to 3000 cm on steel) allow to inspect the objects with big attenuation without displays “parasitic echo-signals”
- Pulse repetition frequency up to 800 Hz for a safe inspection and use in automatic testing.
- TCG up to 90 dB with 10 pixels and DAC mode with two additional curves.
- Works with 70 % backlight not less than 8 hours using standard batteries
- Seven built-in inductances for optimal work with the divers probes which doesn't have agreeing elements
- Peak freez mode
- B-scan mode for easy to view testing operation
- Three selectable damping levels: 50 Ohms pulser damping, 50 Ohms receiver damping or 25 Ohms only in single mode
- The automatically calculation of trigonometric functions to determine the flaw's depth, surface distance to it and distance on beam
- Real radio-signal for accuracy of thickness measurement
- Minimal range– 4 mks for testing thin objects
- Function to change gain steps.
- Record 1000 test reports with A-scan, 40 reports with B-scan, measurement value, all settings, name, date and time when saved.
- Memory: 1000 settings with A-scan
- CD with software to realize all opportunities of the flaw detector
- 15 analog filters for signal-to-noise ratio improve
- Simultaneous display of signal amplitude and flaw co-ordinates
- Full-screen operating mode with resolution 640x480 pixels

2. Set-up and calibrating the UFD-50

In this chapter do you will know how:

- To make initial start-up and to calibrate instrument
- To connect transducer and to adjust pulser, receiver for optimal work with it.
- To adjust A-scan display

A lot of items in this chapter are described by steps which need to do by every user with new instrument.

Is recommended to read each items before to calibrate the instrument for first time.

2.1 Initial start-up

Below actions on configuration of the display and the main functions are described. Follow those procedures for turn on device and set-up work parameters. As the device saves set-up in the memory at switching off and resumes them at turn on, you it is unnecessary to repeat given procedures.

Press the switch-on key in the operator's control panel.

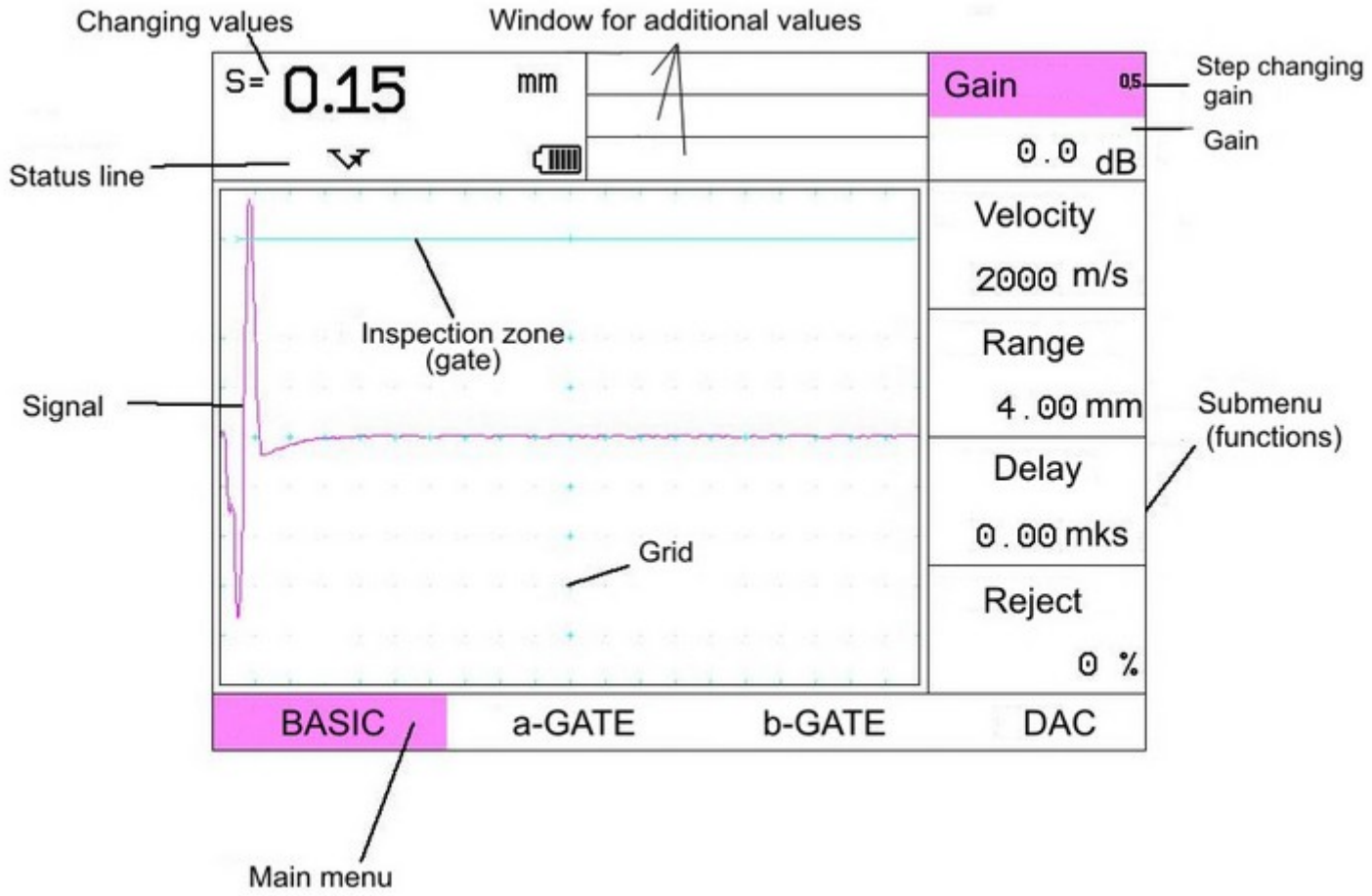


Figure 2-1 —Screen

The device's main menu is situated at the bottom of the screen and the items (functions) at the right. To move in main menu you can use keys .

2.1.1 Basic settings of the display

Next procedures are intended to adjust display. For this is necessary to select Display menu in main menu.

Adjusting the display brightness (DISPLAY - BRIGHTNESS)

Step 1. Select **DISPLAY** menu with ◀ ▶ and choose **BRIGHTNESS** function by pressing ▲▼

Step 2. Enter in change values mode of function **BRIGHTNESS** to press.

Step 3. Adjust the brightness with ▲▼ keys. Brightness levels from 0 to 100 %.

Step 4. Close by press key.

Setting the display grid (DISPLAY - GRID)

Step 1. Find the **DISPLAY** menu with the aid to press ◀ ▶ and select **GRID** by pressing ▲▼

Step 2. Activate the **GRID** function be pressing key.

Step 3. Establish screen grid display variant with the aid of keys▲▼. Accessible values: **FULL**, **CENTRE** (only the central), **OFF** (the grid is switched-off). Horizontal and vertical lines.

Step 4. Close by press key.

Setting A-scan style (DISPLAY - FILL).

Step 1. Enter in menu **DISPLAY** by press ◀ ▶ and with ▲▼ go to the function **FILL**

Step 2. Activate **FILL** function be pressing key.

Step 3. With ▲▼ you change function value. Available values are **YES** or **NO**.

Step 4. Close by press key

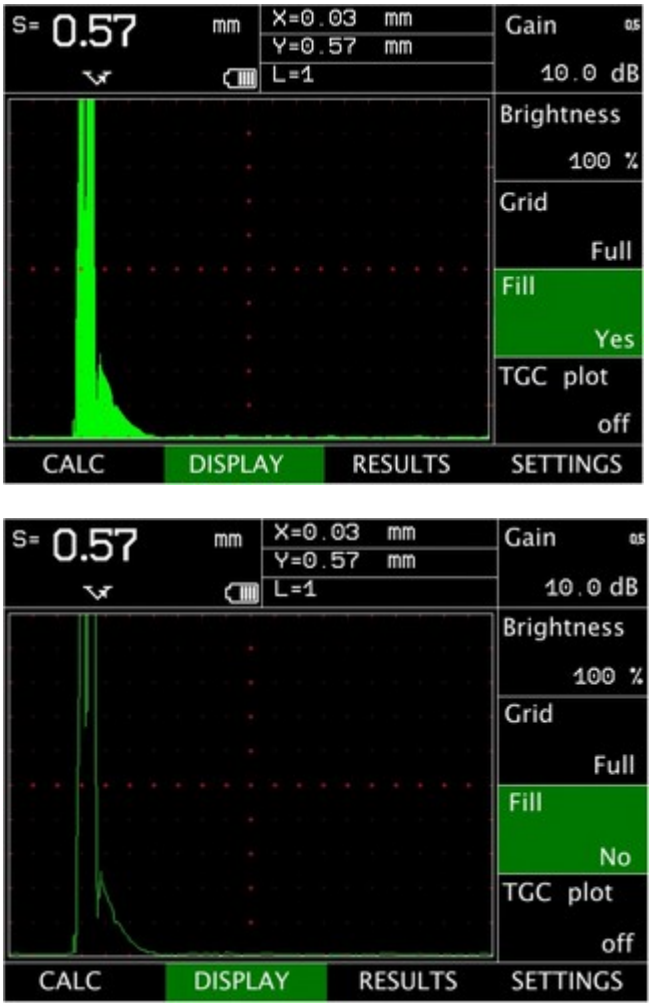


Figure 2-2 View the signal with filling and without

Changing color of displays elements

The user can set sixteen colors for each elements of UFD-50 display: display, signal, tabs, menu text, grid, displays of examination zones and graphics.

You can use three menus for change colors: COLOR 1, COLOR 2 and COLOR 3.

Example:
Changing color for signal A-scan
(COLOR 2 - PLOT)

Step 1. Enter in **COLOR 2** menu pressing ◀ ▶ keys and select **PLOT** function with ▲▼

Step 2. Activate **PLOT** function be pressing key.

Step 3. Change color of signal by press keys ▲▼. In this function you can select between 16 colors: **BLACK, BLUE, GREEN, CYAN, RED, MAGNETA, BROWN, LIGHT GRAY, DARK GRAY, LIGHT BLUE, LIGHT GREEN, LIGHT CYAN, LIGHT RED, LIGHT MAGNETA, YELLOW, and WHITE.**

Step 4. Close by press key.

Repeat analog steps for rest elements of display.

> ***Note.*** *All changes of colors are saved when will store settings.*

> ***Attention!*** *If color of text is set like black you can't set the black display during when you change again color.*

Figure 2-3 Shows changing colors of screen elements

2.2 Selection of probe's parameters

2.2.1 Connecting a probe

Is very important if the device is correct calibrating for work with transducers. The UFD-50 works with single-element, dual, angle transducers.

To install single-element transducer first connect the probe cable to either of the two ports on the top of the instrument. When two transducer, or a dual-element transducer is connected to the instrument, the RECEIVE probe connector should be installed in the left port and the TRANSMIT probe connector in the right port.

2.2.2 Calibrating the instrument for work with probe

Any settings of device depend directly on the type transducers which are connected. Its need to change every time when connecting other type transducer.

Selecting probe type
(PROBE-DUAL MODE)

Step 1. Choose the **PROBE** menu by pressing ◀ ▶ and with ▲▼ go to **DUAL MODE** function. Press key to activate change levels mode.

Step 2. Change level for transducer which is connected pressing ▲▼.
NO – for dual transducer (the symbol ±± are displays), **Yes** – for single-element transducer (the symbol are displays)

Step 3. Exit from change levels mode press

Specifying the probe frequency
(PLSRCVR - BAND)

Step 1. Select the **PLSRCVR** menu by press ◀ ▶ keys and go to **BAND** function with ▲▼. Press key to enter in change levels mode.

Step 2. Choice between next frequency ranges 1,5MHz/ 3,5 MHz / 7MHz / 15MHz according with your connecting transducer pressing ▲▼.

Step 3. Exit from change levels mode press

Than more you choose the frequency than measurement results are reliable and accuracy.

Note. *When set 15 MHz the flaw detector works in a broadband mode and the operating frequencies are from 0,4 MHz to 15 MHz (on level—6dB).*

2.2.3 Optimum excitation of the transducer

Setting the frequency of emission pulse (PULSER - PULSE FREQ)

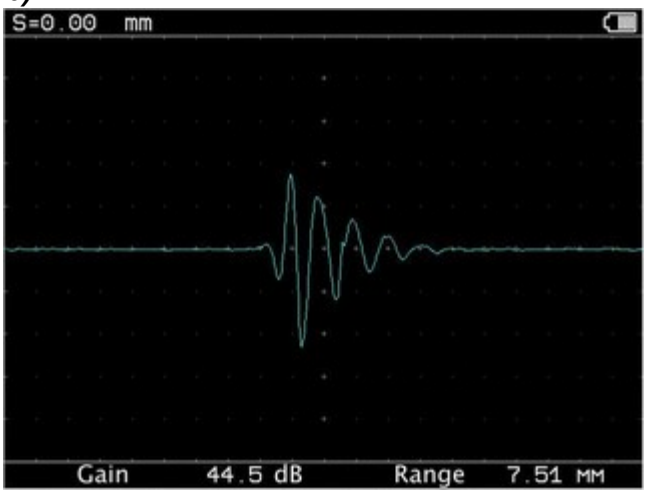
Step 1. In **PULSER** menu with go to the function group **PULSE FREQ.** Activate the function by pressing key.
Step 2. Set the value of emission pulse frequency (from 10 MHz to 20 MHz) according to connecting transducer use keys.

Note. *The frequency of emission pulse influences not on frequency of the transducer but more on the form and the display signal amplitude.*

Note. *The device generator allows exciting transducer by short pulse with frequency 20MHz for increase of resolution. The number of the times is no more than 1.*

a)

b)



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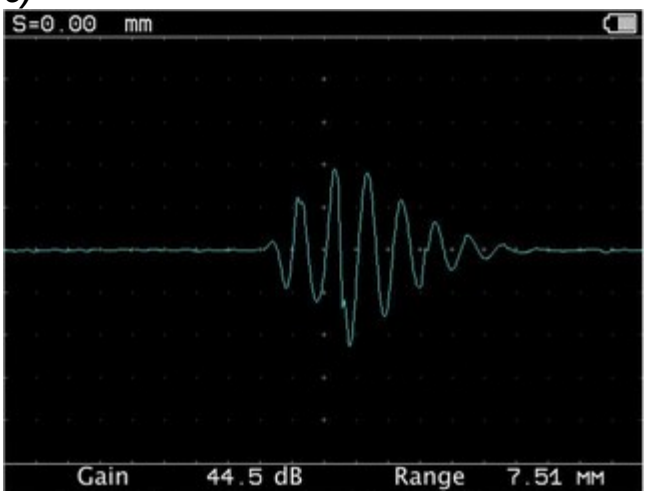


Figure 2-4 Adjustment results of the emission pulse frequency (transducer P111-5-K6)
a) 5MHz–optimum frequency
b) 10 MHz – high frequency range
c) 1,25 MHz – low frequency range

Changing the number of times emission pulse (PULSER – PLS. COUNT)

In any inspections for to obtain the maximum echo-signal need to multiple number of times of the emission pulse frequency.

Step 1. Select the **PULSER** menu by pressing ◀▶ and go to the **PLS. COUNT** function with ▲▼. Press key ⏎ to activate this function.

Step 2. Change the level from 0,5 to 5 using keys ▲▼.

Step 3. Exit press ⏎.

Note. The number of the times of excitation pulse effective on low frequencies, on frequencies 5 and 10 MHz can't give positive result and also the resolution decreased.

Changing the excitation pulse amplitude (PULSER – VOLTAGE)

The UFD-50 allows adjusting the pulser voltage between 50V and 200V. Mode 50V is effective for measurement of small thickness, there where overvoltage leads in increase of blind zone.

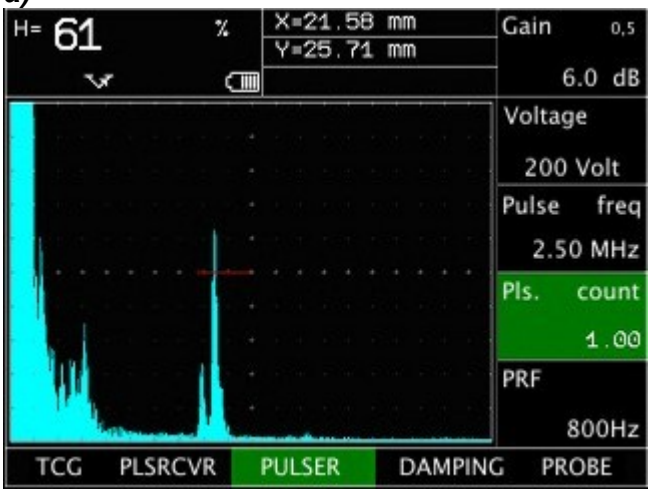
For changing the pulser voltage:

Step 1. Select the **PULSER** menu using ◀ ▶ keys and go to **VOLTAGE** function with ▲▼. Press key ⏎ to activate this function.

Step 2. Use ▲▼ to choose the required setting **(50V or 200V)**.

Step 3. Exit press ⏎.

a)



b)

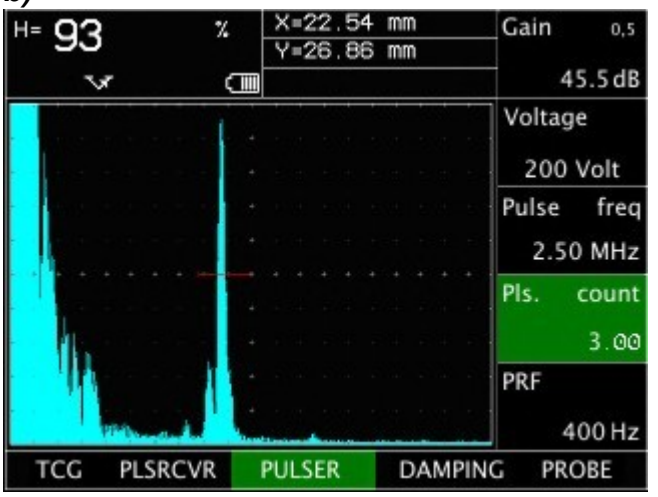


Figure 2-5 Shows the adjustment result of the number of the times of excitation pulse (transducer P121-2,5-40)

a) 1 time – signal amplitude 61% of the screen height
b) 3 times – signal amplitude 93% of the screen height

Modifying signal ratio to noise be changing the damping level

There are four damping levels provided by the instrument:

- No damping (600 Ohms)
- Pulser Damping (50 Ohms)
- Probe (Receiver) damping (50 Ohms)
- Both Pulser and Receiver damping (25 Ohms in single mode)

Pulser damping
(PLSRCVR - INPUT R)

Step 1. Activate the **INPUT R** function in **PLSRCVR** submenu by pressing key.

Step 2. Change pulser damping be pressing keys. You can choose between two settings **50 Ohms** or **OFF**.

Step 3. Exit from change levels mode press

Probe (receiver) damping
(DAMPING - OUTPUT R)

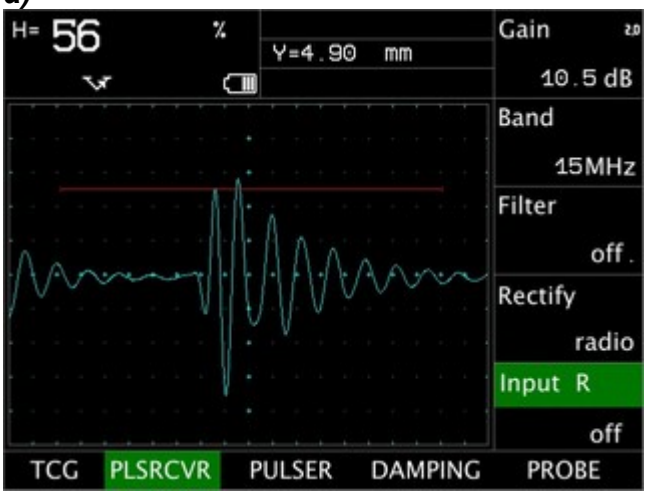
Step 1. Activate the **OUTPUT R** function in **DAMPING** submenu by pressing key.

Step 2. Change pulser damping be pressing keys. Available values are **OFF** or 50 **Ohms**.

Step 3. Exit from change levels mode press.

Note. *The expediency of the dampers application should be evaluated for each inspection methods and the transducer, since it is inevitable it compromise between reduction of the pulse length and drop of his amplitude. For the frequencies lower than 5 the damping generally cannot lead to any results, except a drop in the amplitude of echo signal.*

a)



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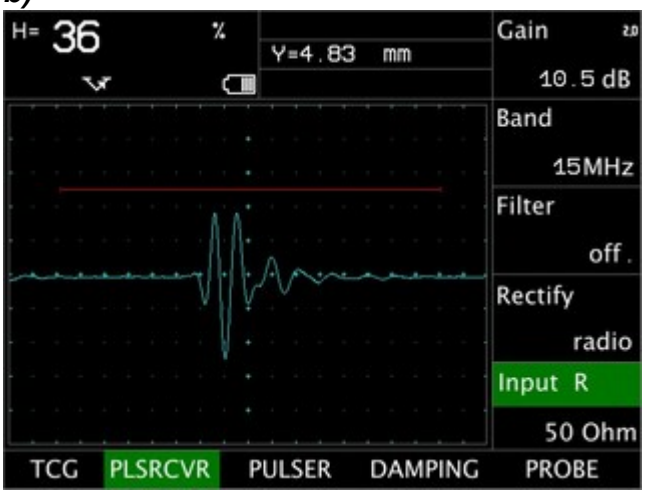

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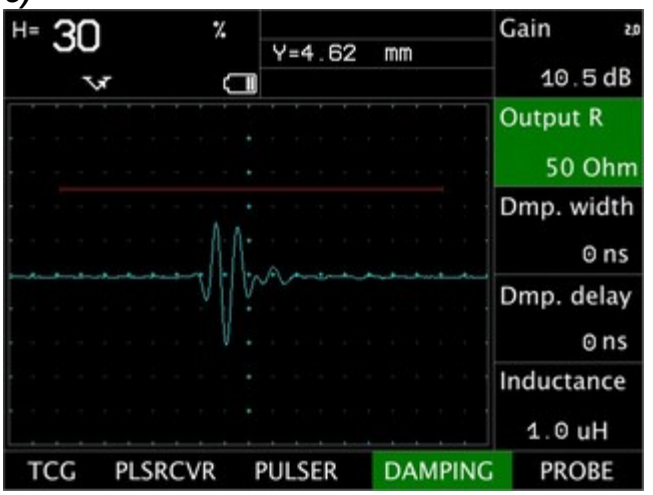


Figure 2-6 Shows application results of damping on unmatched transducer 5MHz

a) No damping (600 Ohms)
b) Pulser Damping (50 Ohms)
c) Pulser and Receiver damping (50 Ohms)

Matching transducer without the built-in matching elements

The device UFD-50 has seven built-in inductive matching elements for optimum work with any transducers.

Selecting the inductance for matching transducer (DAMPING – INDUCTANCE)

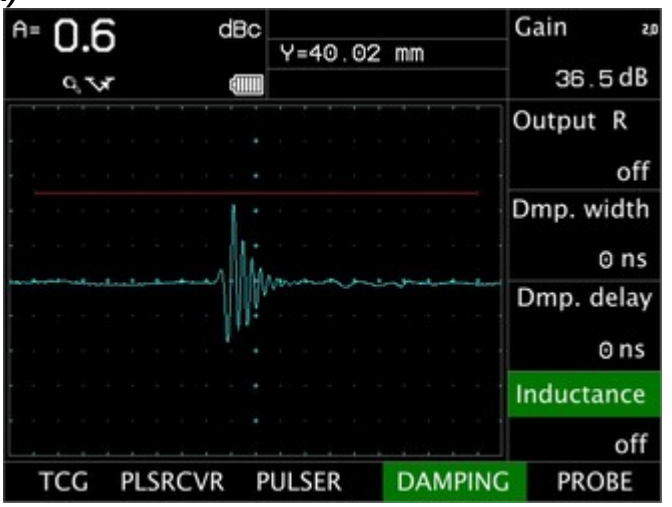
Step 1. Activate the **INDUCTANCE** function in **DAMPING** menu with key.

Step 2. Use the keys to setting inductance for optimal inductance on signal amplitude or pulse width. You can choose: **no, 0.66 µH, 1.0 µH, 2.2 µH, 3.3 µH, 4.7 µH, 6.8 µH, 15 µH**.

Step 3. De-active **INDUCTANCE** function by pressing key.

Note: *All Kropu's probes have built-in inductance elements for matching instrument cable ports. Connection of additional matching elements to them isn't necessary.*

a)



b)

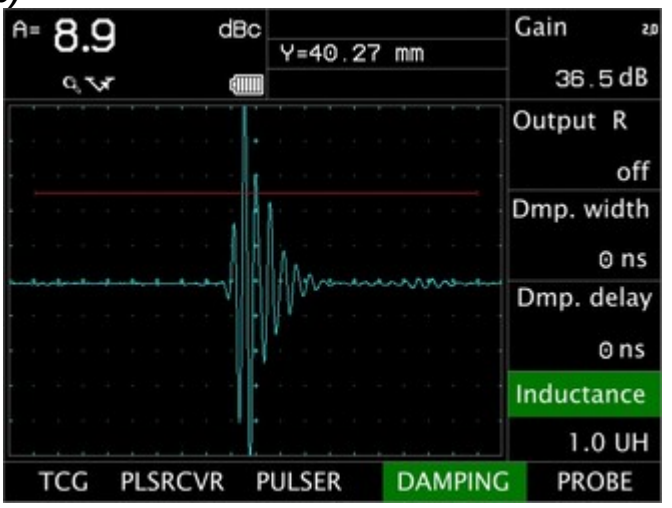


Figure 2-7 Connection result of matching inductance
(transducer P121-5-70)
a) without matching
b) with matching 1 µH - additions of amplitude on 8,3 dB

Using the electric damping of emission pulse

In the flaw detector there is a special opportunity on electric damping of emission pulse for reduction of dead zone.

Selecting the electric damping duration (DAMPING – DMP. WIDTH)

Step 1. Activate the **DMP. WIDTH** function in **DAMPING** menu with key.

Step 2. Use the keys to setting duration for choose optimal damping signal. Available values are **0 –2500 ns with step 25 ns**.

Step 3. De-active this function by pressing key.

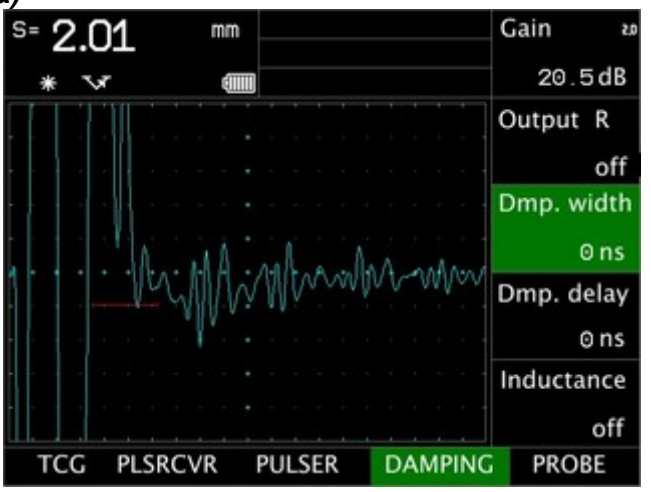
Selecting the delay of electric damping (DAMPING – DMP. DELAY)

Step 1. Activate the **DMP. DELAY** function in **DAMPING** menu with key.

Step 2. Use the keys to setting duration for choose optimal damping signal. Available values are **0 –2500 ns with step 25 ns**.

Step 3. De-active this function by pressing key.

a)



b)

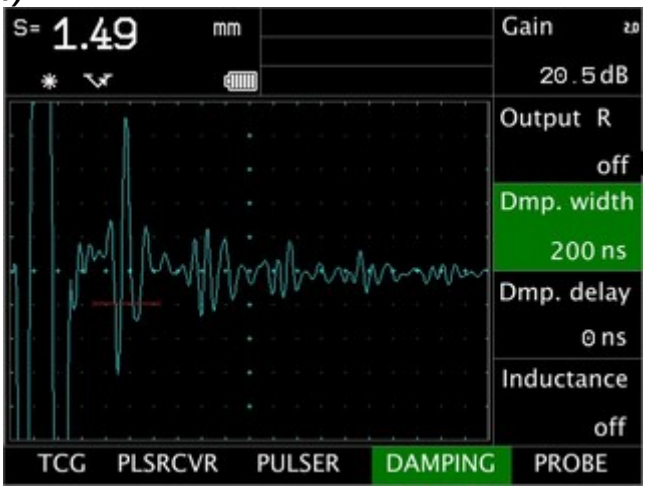


Figure 2-8 Shows the effect after application of electric damping of emission pulse
(transducer P111-10-K4 on sample 1,5mm)
a) without damping
b) with damping 200ns

Changing the correlation of signal / noise with the aid of filters application.

The UFD-50 has built-in analog filters sometimes allows to raise correlation signal / noise.

> ***Note.*** *For the most of standard applications filters use is necessary not. Expediency of the filters application should be determined at development of special testing techniques.*

Set up the analog filter
(PLSRCVR- FILTER)

Step 1. Select the maximal frequency of path **(PLSRCVR- FILTER)** according with connect probe.

Step 2. Activate **FILTER** function in **PLSRCVR** submenu be pressing key.

Step 3. Select necessary filter by pressing keys.

Next analog filters are accessible:

1,5 MHz	3,5 MHz	7 MHz	15 MHz
no	no	no	no
0,8 ... 2,1	0,8 ... 2,1	0,8 ... 2,1	0,8 ... 2,1
1,1 ... 2,2	1,1 ... 2,2	1,1 ... 2,2	1,1 ... 2,2
1,2 … 4,6	1,2 … 4,6	1,2 … 4,6	1,2 … 4,6
1,5 … 3,0	1,5 … 3,0	1,5 … 3,0	1,5 … 3,0
1,8 ... 2,8	1,8 … 2,8	1,8 … 2,8	1,8 … 2,8
2,4 … 4,7	2,4 … 4,7	2,4 … 4,7	2,4 … 4,7
2,6 … 3,6	2,6 … 3,6	2,5 … 8,6	2,5 … 8,6
2,7 … 4,1	2,7 … 4,1	2,6 … 3,6	2,6 … 3,6
2,9 … 3,8	2,9 … 3,8	2,7 … 4,1	2,7 … 4,1
		2,9 … 3,8	2,9 … 3,8
		3,1 … 4,3	3,1 … 4,3
		3,7 … 6,6	3,7 … 6,6
		4,0 … 6,0	4,0 … 6,0
			5,1 … 9,3
			5,5 … 13,0

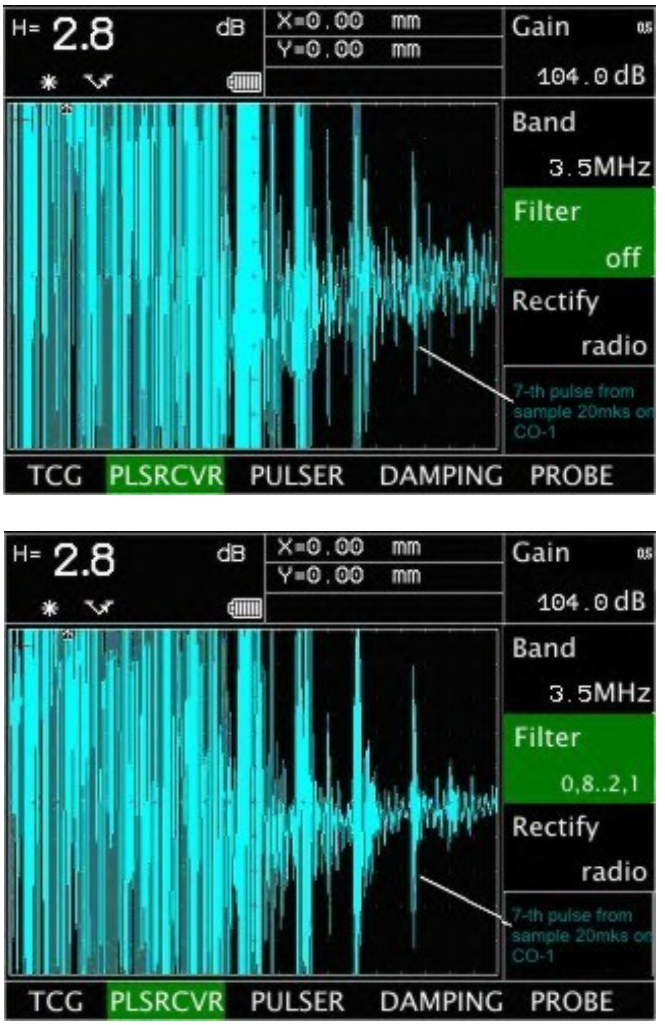


Figure 2-8 Shows the effect of application analog filter.

Transducer P111-1,8-K12 with wedge 20mks (sample CO-1).

a) without filter - 7th pulse is seen in noise

b) with filter 0,8-2,1 MHz

2.3 Adjustment of the signal display

2.3.1 Range adjustment (BASIC - RANGE)

Step 1. Activate **RANGE** function by pressing key.
Step 2. Select one of four preselected range value by pressing key or adjust range manually by pressing . Overall range can changes from 4 to 1000 µs or from 11 mm to 2975 mm with step 1mm.

Note: *The more frequency set up in* ***PLSRCVR-BAND*** *box the more accuracy may be achieved then range changing.*

Step 3. Exit from change levels mode press .

Note*: The overall range value depends from RECEIVER-FREQUENCY value.*

Frequency	15 MHz	7 MHz	3,5 MHz	1,5 MHz
Minimum range	4µs	8µs	16µs	32µs
Maximum range	250µs	500µs	1000µs	1000µs
Maximum delay	246µs	492µs	984µs	968µs

2.3.2 Setting delay range (BASIC-DELAY)

The display delay function shifts the displayed A-Scan to the left or right and is used to adjust the UFD-50 viewing window. To set the display delay:
Step 1. Select the **BASIC** menu using keys and go to **DELAY** function with . Press key to activate this function.

Step 2. Adjust delay value pressing keys. Overall range can changes from **–0,5 µs** to **maximal path and range.**

Step 3. Exit from change levels mode press .

Specified value of delay range is preserved in set-up of the flaw detector.

2.3.3 Adjusting the reject (BASIC-REJECT)

A part from A-scan can't be displayed on the screen. To select the reject level it is necessary to indicate this level in percentages from full-screen height.

To select a reject level:

Step 1. Activate the **REJECT** function located in the **BASIC** submenu by pressing key.

Step 2. Using next keys you can change the percentage of reject. Full reject range of A-scan is from 0 to 80 % of the screen height.

Note. *The reject don't work in radio-signal mode.*

2.3.4 Selecting the rectification mode (PLSRCVR-RECTIFY)

The rectification type changes representation of the pulse on the display screen.

A-Scan represents an echo pulse which backs from test object and accepted by the device. In reality pulse represents a bipolar radio signal with positive component above the axis and negative below the axis.

Note: In radio mode the A-GATE or B-GATE can be positioned above or below the central axis for measurement positive or negative component of signal.

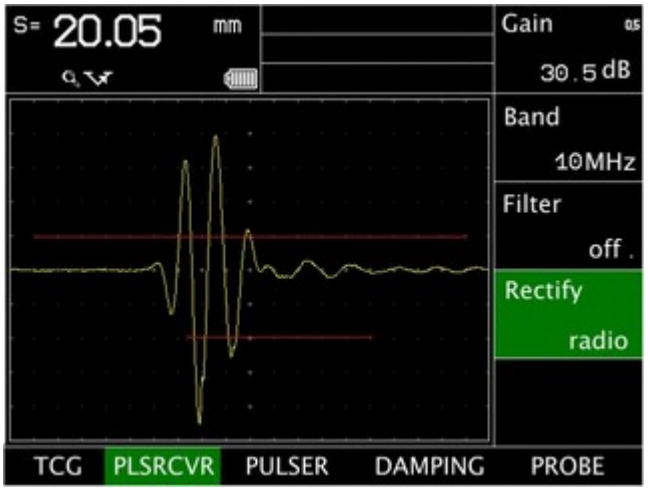


Figure. 2-9 Radio-frequency signal

Positive half-wave rectification– only positive half-waves are displayed.
Negative half-wave rectification– only negative half-waves are displayed.

Note: *The negative and positive half-waves are displayed on A-scan at rectification for easy to understand.*

Full-wave rectification only half-waves are displayed above the baseline.

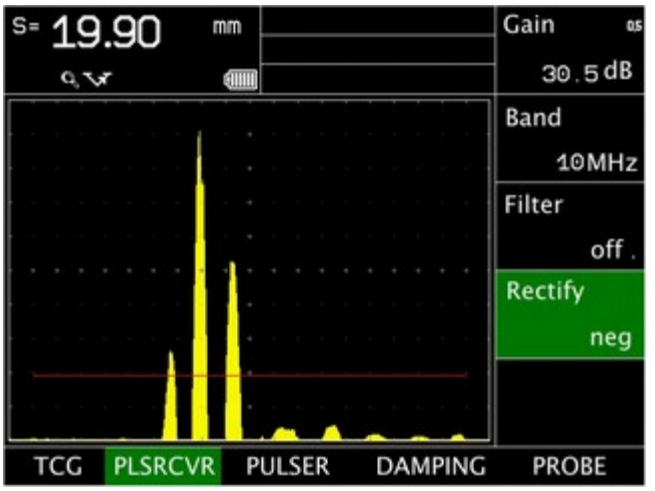


Figure. 2-10 Negative ½ wave rectification

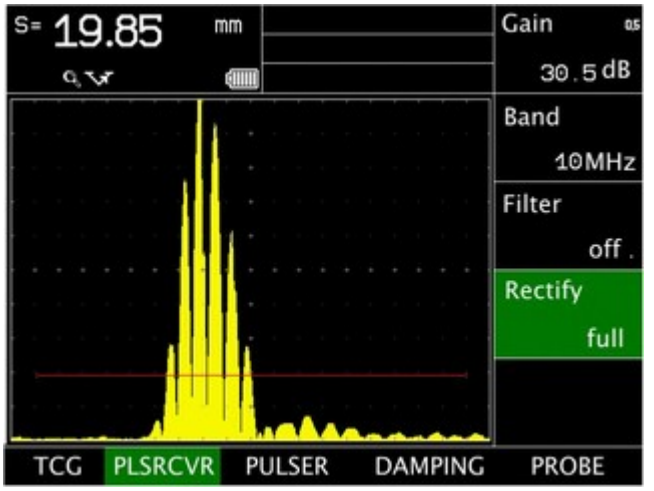


Figure. 2-11 Full wave rectification

To select the rectification mode:

Step 1. Select the **PLSRCVR** menu using ◀ ▶ keys and go to **RECTIFY** function with ▲▼. Press key ⏎ to activate this function.

Step 2. Select the required setting in rectification mode with ▲▼. You have the following possibilities:

- **NEG** — only negatives half-waves are displayed.
- **POS**— only positive half-waves are displayed.
- **FULL**— all half-waves above the base line are displayed
- **RADIO**— all signals are displayed in their original form.

2.3.5 Selecting the pulser repetition frequency mode (ADDITIONAL PARAMS– PRF)

The pulser triggered ultrasonic pulse from frequency which can be set manually or automatically. Maximal pulse repetition is 800 Hz. With **PRF** function from **PULSER** menu you can know the real pulse repetition.

To select the PRF mode:

Step 1. Enter in additional menu with until no one function is active.
Step 2. Navigate through menu be pressing by keys.

Step 3. Activate **PRF** function by pressing key.
Step 4. Adjust the required value. Available values are **40 Hz** or **MAXIMUM**. In **MAXIMUM** mode will be available the maximum value for PRF setting.

2.3.6 Calculation the real pulser repetition frequency (PULSER– PRF)

In the maximum frequency mode the pulser sends emission pulse with frequency greatest possible for given set-up parameters. To real frequency influences such parameters as extent of examination zones and frequency of the path.

Because pulse repetition frequency has the most influence to inspection and his reliability for this reason it is necessary to know her real size.
To calculate the real pulser repetition frequency:

Step 1. Select the **PULSER** menu using keys and go to **PRF** function with.
Step 2. Press key to activate this function.

Under functions the device will show really pulse repetition frequency for given settings.

3. Preparing the instrument for measurement

This chapter describes how to calibrate your flaw detector for amplitude evolution, to determine flaw area and thickness measurement.

Here you learn how to:

• Adjust a-gate, b-gate and to active alarm

• Select a mode for determine the coordinates

• Set the amplitude measurements units

• Calibrate the instrument with dual-element probes

3.1 Configuring the inspection zones

Setting the position and characteristics of the A and B-gates is the first step to configure the UFD-50 for flaw detecting and thickness measurement.

3.1.1 Positioning gates

Use the following procedures to set the vertical and horizontal position of the A and B-Gates. The gate position has the following effects on instrument performance:

- A-Scan echoes on the right side of the display screen represent features that occur at a greater depth from the test-material surface than those on the left of the display screen. Therefore, moving a gate to the right means that the gate is evaluating a deeper portion of the test material.

- A wider gate will simply span the equivalent of more test-material depth.

- Increasing the vertical height of a gate means that only reflected signals of sufficiently large amplitude will cross the gate.

Starting points of the gates
(A-GATE - a-Start) or
(B-GATE - b-Start)

Step 1. Activate the function **a-Start** or **b-Start** in the menu **A-GATE** by pressing key.

Step 2. Use the keys to adjust the starting point. Remember that: the value of function can be adjusted in coarse and fine mode. Modes are selected by pressing key then function is active.

- When **"a-Start"** or "**b-Start"** written to menu by small letters press keys for accurate adjustment modes.
- When **"a-Start"** or **"b-Start"** displayed by capital letters press keys for rapidly changes.

Width of the gates
(A-GATE - a-Width) or
(B-GATE - b-Width)

Step 1. Activate the function **a-Width** or **b-Width** with the aid of key.

Step 2.You can adjust the gate width using next keys. You'll note that **a-Width** or **b-Width** function can be adjusted in coarse and fine mode. Modes are selected by pressing key then function is active.

- When **"a-Width"** or "**b-Width"** written to menu by small letters press keys for accurate adjustment modes.
- When **"a-Width"** or **"b-Width"** displayed by capital letters press keys for rapidly changes.

Note: *The accuracy setting start and width of gate depends on selected receiver frequency.*

Frequency	10 MHz	5 MHz	2,5 MHz	1,25/1,8 MHz
Min. step of gates position and width changing	0,025 µs	0,05 µs	0,1 µs	0,2 µs

Response and measurement threshold of the gates
(A-GATE - a-Thresh) or
(B-GATE - b- Thresh)

Step 1. Activate **A-GATE** or **B-GATE** function by pressing key.

Step 2. Set the required value using the keys. You can adjustment the threshold value of gates within the range of **–95%** to **95%** in radio signal mode or from **0** to **95%** screen height in rectification mode.

3.1.2 Select a mode to determine coordinates

A–Scan signals crossing the A or B-Gate are evaluated for the purposes of flaw detection and material-thickness evaluation. When the signal crosses the A or B-Gate, either the gate-crossing point of the signal, or the maximum point of the signal is used for evaluation purposes. The TIME-MODE function allows the user to specify which A-Scan feature is used to evaluate the signal in a-gate.

Setting the A-Scan signal detection mode
(CALC-TIME MODE)

Step 1. Activate the function **TIME- MODE** in menu **CALC** with key.

Step 2. Change level mode **ON PEAC** or **ON FRONT** by pressing keys.

3.1.3 Activating alarm mode

In this function, you can set an alarm of flaws for each gate. When a gate alarm is activated, one or more of the following will occur:

• A light gate indicator lights up at the front of instrument
• An sound alarm (horn) comes into action

Turning on/off the alarm indicator light
(ALARM-LED)

Step 1. Activate **LED** function by pressing key.

Step 2. Press to turn on or turn off the alarm indicator light.

Turning on/off the alarm sound
(ALARM-SOUND)

When any gate's alarm is triggered, an audible horn will sound. Use the following procedure to turn this horn off or on:

Step1. Activate **SOUND** function by pressing key.

Step 2. Press to turn on or turn off the alarm sound.

Defining gate alarm logic

The independent alarm for each gate's can be triggered when an A-Scan echo crosses the gate or when no echo crosses the gate.

Step 1. Activate **A-MODE** or **B-MODE** functions in the menu **A-GATE** or **B-GATE** by pressing key.

Step 2. Change the gate logic level with . There are three setting options available:

- - flaw if the signal cross the gate
- - flaw if the signal not cross the gate
- **NO** – gate alarms turned off

3.1.4 Activating the sound alarm mode
(ALARM - a,b-MODE)

This feature determines when the sound signal will trigged.

Step 1. Activate **MODE** function in **ALARM** submenu by pressing key.

Step 2. Set function value with keys.

- **A-GATE –** flaw in only a-gate
- **A-GATE** - flaw in only b-gate
- **A and B-GATE**– flaw in both gates
- **A or B-GATE** – flaw in any one gates
- **On DAC**– echo signal crosses the DAC curve

3.1.5 Setting the measured size (CALC-READING)

The flaw detector can calculate five types of measures but only two-four from them are displayed on the screen. To set measure:

Step 1. Activate **READING** function by pressing.
Step 2. Press to change measure type.
Measured size:

- **S, mm** – sound path.

> ***Note:*** *If the function **PROBE-ANGLE** more than zero instrument will calculate the number of beam and X, Y coordinates for testing by angle-beam transducers. To calculate the number of beam L it is necessary to specify sample thickness from zero in menu **CALC-TEST BLOCK**.*

- **V, m/s** – velocity of sound.

> ***Note:*** *To calculate ultrasound velocity it's necessary to set thickness of the sample in the function **CALC-TEST BLOCK**.*

- **H, %** -amplitude in % of screen height
- **H, dB** – displays amplitude readings as a dB difference between the echo's peak and the a-gate threshold
  A, dBc - difference in dB between the peak of the echo-signal in the a-gate and amplitude of reference echo-signal preserved in Additional Menu.

> ***Note.*** *If **PROBE-ANGLE** value more than zero instrument will displayed coordinates and amplitude simultaneously, if it is equal with zero will displayed only the Y coordinate.*

3.1.6 Mode measuring set (CALC-PULSE MODE)

This feature defines how the time will be measured: from IP to A-gate, or between a-gate and b-gate.

Step 1. Activate the function **PULSE MODE** with the aid of key.

Step 2. Change the mode by pressing keys. Available modes are: «0→a-gate» or «a->b-gate».

3.2 Calibration with angle-beam probes

When using an angle-beam probe for correct calculation of flaw coordinates is very important to set:

- Angle of incidence in menu **PROBE-ANGLE**
- Thickness of the sample in menu **CALC-TEST BLOCK**
- Delay in wedge **PROBE-PRB DELAY**

3.2.1 Set-up of ultrasound incidence angle (PROBE-ANGLE)

Step 1. Activate **ANGLE** function be pressing key.

Step 2. Change function value with keys. Available angles of incidence from 0 to 85° with step 0.1°.

> ***Note:*** *Angle of incidence is indicated on marking or in the probe passport. Given angle is for concrete material.*

3.2.2 Enter of the sample thickness (CALC-BLOCK)

At the inspecting of plates beams extend with repeated reflection from sides. For correct evaluate flaw depth should be specified plate thickness. Then the number of the beam will be displayed as L=1 (for direct beam), L=2 (for once reflected).
Step 1. Activate the function **TEST BLOCK** by pressing key.
Step 2. Press keys to change thickness of sample. Available values are from 0 to 1000 mm with step 0,05mm.

Zeroing of the sample thickness
To quick dump the sample thickness to zero, use key, when function is active.

3.2.3 Enter of the wedge (PROBE – PRB DELAY)

As a principle probe piezo element transmits mechanical oscillations in the test object material not directly, but through certain protective element (protector, delay circuit, angle wedge). At accurate calculate co-ordinates of flaw and thickness the time of dissemination of oscillations in such element should be taken into account and to be subtracted from common arrival time of pulse.

To set the time of delay in wedge:
Step 1. Activate the function **PRB DELAY** in menu **PROBE** with the aid of key.
Step 2. Use keys to change mode. You can choose between 0-100 µs with step 0,01 µs.

3.3 Choose of inspection methods

To set the inspection methods (ADDITIONAL MENU-CONTROL MODE)

Step 1. When no one of function is active enter with key in **ADITIONAL MENU.**
Step 2. With keys go to the required function table.

Step 3. Use key to activate **CONTROL MODE** function.
Step 4. Select the **ECHO** or **SHADOW** with keys. If you connect single-element or dual probes use **ECHO**, but if you work with probes in shadow mode use **SHADOW**.

Note: *This function influence only on calculation time mode of coming pulse. In echo mode the coming time of pulse is divided with two.*

Step 5. Deactivate the function by pressing key.
Step 6. To exit from ADDITIONAL MENU press key.

3.4 Storing and recalling of sets

All settings can be saved in memory. At recall settings the current parameters are replaced with parameters from device memory and on the screen is displayed saved with parameters of A-Scan. At the same time automatically function of “freeze" enters, for target image holding A-Scan on the screen and in condition line symbol emerges .

Saving settings
(SETTINGS-SAVE settings)

Step 1. Activate **SAVE settings** function in submenu **SETTINGS** with the aid of key.

NOTE:
When the function SAVE FREEZING is active on the screen is displayed one hundred names of settings. The saved dates have symbol , empty - .

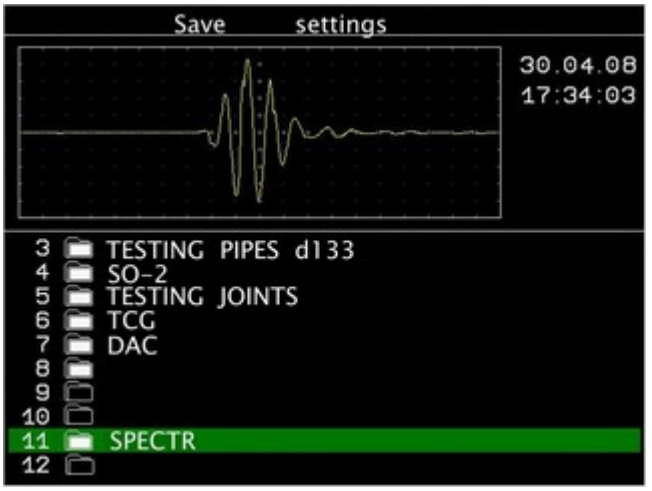


Figure 3-1 Shows the saved settings

Step 2. Use the next keys to select the position of setting.

Step 3. Press to save data set in present position or press to change name.

Loading settings
(SETTINGS-LOAD settings)

Step 1. Activate **LOAD settings** function by pressing key.

NOTE: When the function LOAD SETTINGS is active on screen is displayed 99 names of settings. The saved dates have symbol , empty - .

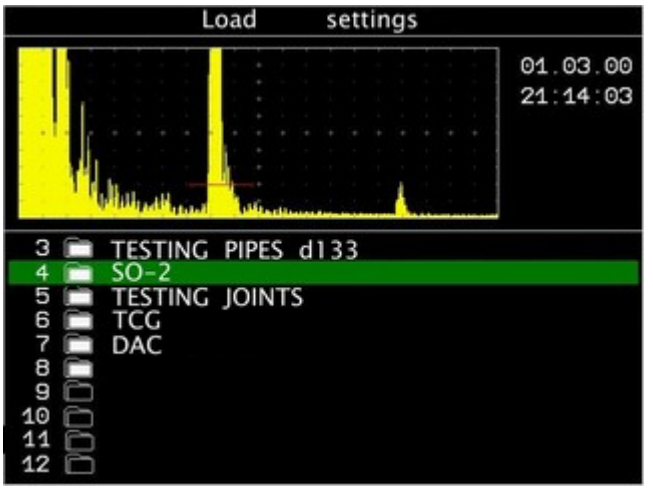


Figure 3-2 Loading settings

Step 2. Use the key to choose required data set.

Step 3. Press for loading data set or press for renaming.

Renaming the data set

When the functions **SAVE settings** or **LOAD settings** are activated you can change name of data set with device's keypad.

Step 1. Use for selecting data set.

Step 2. Press to enter in renaming mode.

Step 3. In changing symbols mode use keys. With keys you can select the next symbol in name of data set.

Press to cancel.

To save and exit press key.

NOTE: *In renaming mode is available only English and Russian letters, ciphers from 0-9 and any special symbols. But you have possibility to use UdPar software for PC with a wide ASCII symbols.*

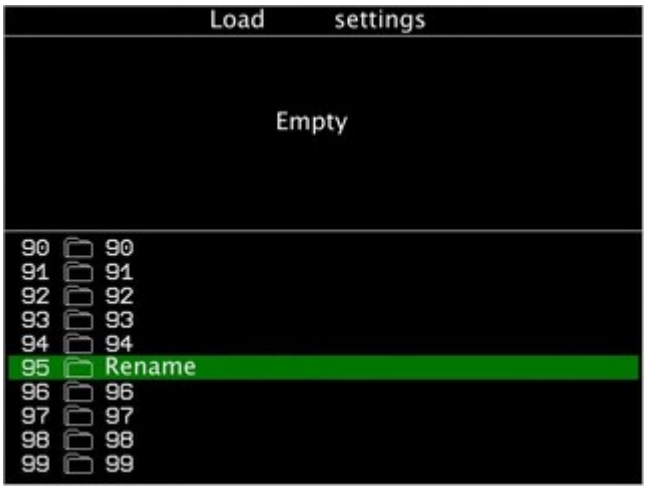


Figure 3-2 Renaming data set

Note: *Name can be formatted from 37 symbols.*

Step 4. If you need to select another data set use keys.

Or press on of keys to close.

Or press key to save/load settings.

Working settings

Beside 99 saved dates the flaw detector UFD-50 has one working data set which automated is saved when switch on device by pressing.
It automatically loading when switching.

Loading the working data set (SETTINGS-LOAD working)

If do you need cancel changes in working data set may loading first version.

Step 1. Select in menu **SETTINGS** the function **LOAD working** with the aid of keys.

Step 2. Activate the function be pressing key. Now sound signal is audible which confirm finish of operation.

Saving the working data set (SETTINGS-SAVE working)

If do you need to save the changes in data set not switch off device may it again manually save.

Step 1. Select in menu **SETIINGS** the item **SAVE working** with the help of key.

Step 2. Activate the function by pressing. Now sound signal is audible which confirm finish of operation.

4. Use the instrument features during test operations

4.1 Changing gain

Device's gain is available from any menu and may increases or reduces the height of A-Scan. Use this function GAIN to adjust them.

4.1.1 Setting changing step of gain

When **GAIN** function is active with ▲▼ you can select a certain incrimination for setting gain in dB steps. You have a choice to more steps:

Step 1. Use the key to activate **GAIN** function.

Step 2. Press to change between the four steps: **0,5dB**; **1dB**; **2dB** and **6dB**.

4.1.2 Defining the dB incrementation for gain with special key +dB (ADDITIONAL MENU – ADDITION +dB)

The UFD-50 instrument has a special key +dB which allows adding more dB early then using steps from Additional Menu.

To adjust gain with key +dB:

Step 1. Enter in Additional Menu with when no one function is active.

Step 2. Navigate through menu be pressing ▲▼ keys.

Step 3. Activate **ADDITION +dB** function by pressing key

Step 4. Use ▲▼ keys to set required values. Available range is from **0** to **40 dB with** step **0,5 dB.**

4.2 Amplitude measurements relative to reference signal

When the function **A, dB** is active the amplitude of the echo in A-Gate will compare with the reference echo recorded in Additional Menu **A, dBc function**.

This value means the gain at which the reference signal is 100% screen height.

> ***Note**: For properly compare echo in A-Gate will must be in 30-100% of screen height.*

To record reference echo:

Step 1. Entre in Additional Menu with when one of function isn't active.

Step 2. Navigate on menu with next keys ▲▼.

Step 3. Activate the function **REFERENCE A, dBc** by pressing

Step 4 Use the keys ▲▼ to set gain at which reference echo reaches 100% of the screen height.

Step 5. Deactivate **REFERENCE A, dBc** function pressing key.

Step 6. Close Additional Menu with.

> ***Note:*** Usually at comparison of signals on opportunity amplitude they are limited of screen sizes. Further it is necessary to correct results to size of changing gain. At measurement A, dBc it is unnecessary to store at what gain you work - it is possible to compare signals within the range of 110 dB.

4.3 Storing measured values

The measurement results may be stored in data logger files. Totally may be stored 500 test results (20 data logger file with 25 test results for each file). When save a result automatically is saved and full test results, all settings, date and time of test.

4.3.1 Saving the results (RESULTS-SAVA RESULTS)

Step 1. To save a result use key or select **SAVE RESULT** function in menu **RESULTS**. The flaw detector automatically will give the set-up name for present results.

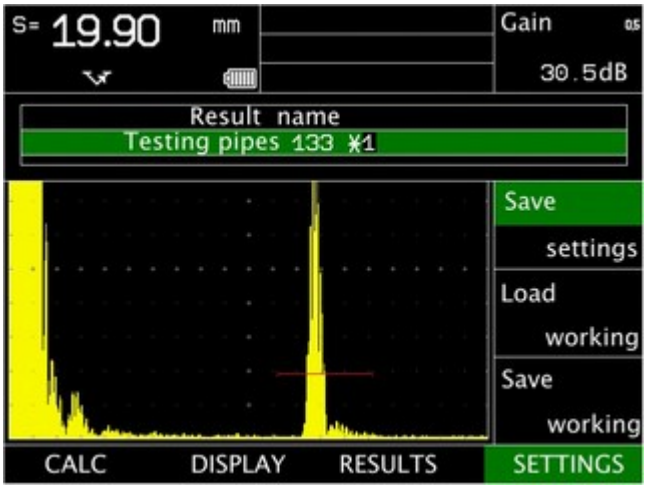


Figure 4-1 **Saving the results**

Step 2. You can save results by given name (or key) or rename, cancel (key).

Step 3. To rename results press key and use to choose a symbol, may change them with keys. After press to save result name.

Note: *The results name can't be more of 28 symbols.*

4.3.2 Selecting a file to save results (RESULTS-FILE)

To press key for save the test result in present file, but when file is full automatically is saved in the next. To select one file use **RESULTS-FILE** function.

Step 1. Activate the function **FILE** in menu **RESULTS** by pressing key.

Step 2. Use the key to change present file.

Each file can contain 25 A-Scans and 2 B-Scans.

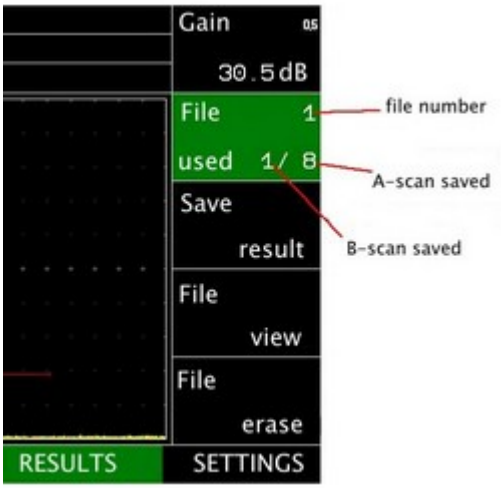


Figure. 4-2 Shows the file designation

4.3.3 Viewing stored readings (RESULTS-FILE VIEW)

Step 1. Activate the function **FILE VIEW** by pressing key.

Step 2. To move on results use . On screen are displayed saved results, date and time, result name of A-Scan or B-Scan. To rename file follow earlier described operations (see step 3 in 4.3.1.).

Step 3. To exit press.

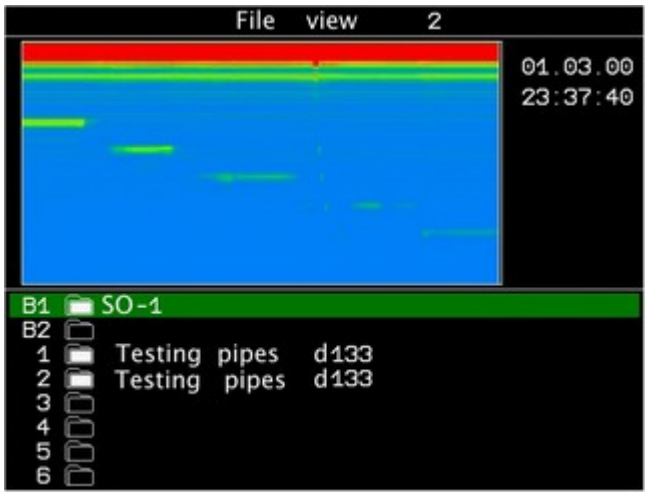


Figure. 4-3 Viewing the results

4.3.4 Delete the results (RESULTS-FILE ERASE)

Step 1. Select the function **FILE ERASE** with ▲▼ in menu **RESULTS**.

Step 2. Press and keep the key for this function no more than 5 seconds and when two times the audible signal works the file is deleting.

4.4 Full-screen mode

In full-screen mode the A-Scan takes all screen of flaw detector 640x425 pixels.

To enter in full-screen mode press. To exit press one more present key.

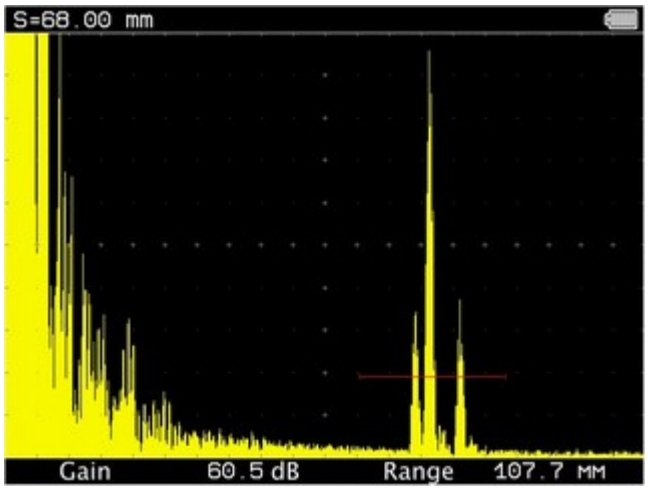


Figure. 4-4 Full-screen mode

In full-screen mode you can:

- To change the gain with ▲▼.
- To adjust gain with key +dB.
- To set the range using ◀ ▶ .
- To freez - ❄
- To zooming a-gate

4.5 Maximum mode (MODE - MAXIMUM)

In this mode the flaw detector record a schedule of maximum signal located in the a-gate. Using the maximum allows to evaluate form and extents of flaws.

To use the Maximum mode:

Step 1. Select **MAXIMUM** function in menu **MODE** by pressing ▲▼keys.

Step 2. Press to change values.

Step3. With ▲▼ keys you can activate or deactivate the maximum.

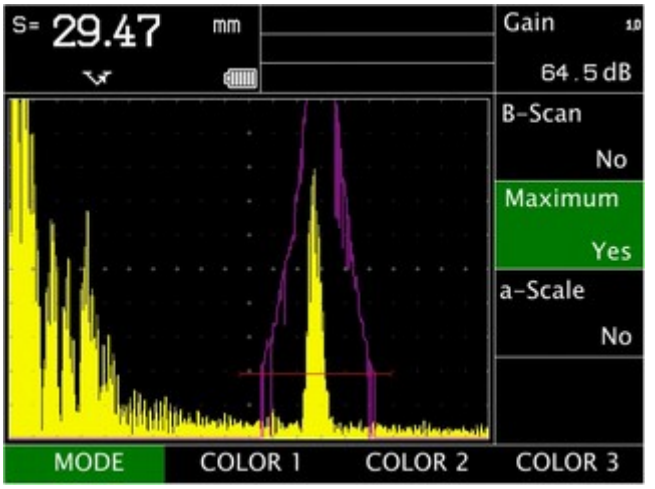


Figure. 4-5 Maximum mode

Note. The maximum always stored with test result.

4.6 Zooming the A-Gate (MODE- A-SCALE)

The a-gate enlargers to full size of A-Scan when press. Analogically you can use **A-SCALE** function in menu **MODE**.
The level of magnification depends on a-gate width.

In present mode:

- To displacement the screen contents to the left or right you will change value of A-START in menu A-GATE. As well it is possible to use function DELAY.
- To increase or reduce the magnification change value A-WIDTH in menu A-GATE.
- Press one more key to close.

Note. *All rest functions work as well as in ordinary mode. BASIC-RANGE function changes its value but the view of a-scale display is too.*

4.7 Activating the B-Scan (MODE- B-SCAN)

The device can displayed signals in B-Scan that allows evaluating visually echo-signals during scanning. Also B-Scan shows information about location of flaws in the test object, thickness of objects.

To use the B-Scan mode:

Step 1. Select the function **B-SCAN** in menu **MODE** by pressing.
Step 2. Press key to set the required value.
Step 3.Press to activate/deactivate function.

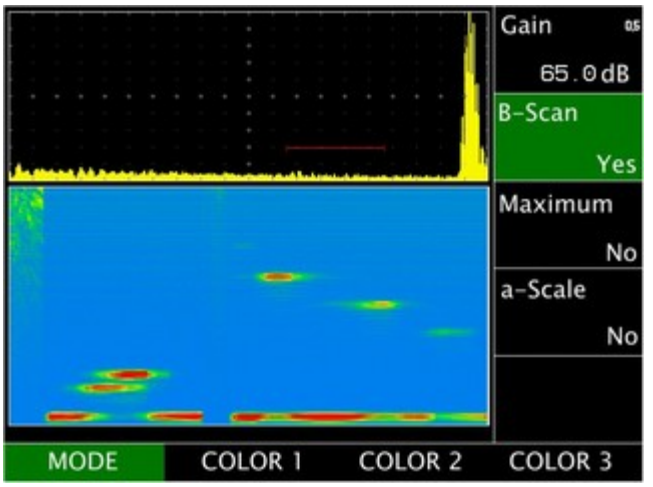


Figure. 4-6 B-Scan mode

During B-Scan mode is displayed compressed A-Scan in the top of screen and you can simultaneously doing all the same actions as in ordinary mode, besides activation of full-screen mode.

5. DAC/TCG features

The UFD-50 is supplied with Time Corrected Gain (TCG) and Distance Amplitude Correction (DAC) functions with two additional curves ± 1-12dB from basic. Both the TCG and DAC functions operate based on a set of user-recorded data points.

The TCG function displays reflectors of equal size at equal A-Scan amplitudes, regardless of the reflector's depth in the test material. It accomplishes by adjusting the gain at different locations in the A-Scan display, corresponding to different material depths, to compensate for signal loss due to attenuation, beam spread, or other factors. When TCG is activated icon appears in the status bar.

The DAC function display all echoes at their true amplitude. However, when operating in DAC mode, Distance Amplitude Correction curve are superimposed on the A-Scan display.

5.1 TCG mode

When the TGC function is in use, echoes from equally sized reflectors appear as the same height on the A-Scan display.

Before using the TGC function do the following:

Step 1. Do calibration with probe and set all parameters of pulser, receiver and etc. Changing these settings after the TGC reference points are input will affect the accuracy of measurement.

Step 2. Record TGC reference points (from 2 to 10). This process allows the UFD-50 to calculate and compensate for the effect on material depth on reflector-echo height.

The dynamic range of the TGC function is up to 90 dB. Maximum curve slope is to 12 dB per microsecond.

Attention. *Use of automatic attenuator superimposes some limitations to changing range of the TCG. Maximum range (90 dB), is possible only at gain 20dB.*

5.1.1 Record of TCG's reference points

Reference points for TCG and DAC is identical. Usually reference points are recorded on standard sample with the reflectors of identical size located on different depth. The first reflection from each of these reflectors and should be recorded.

Only one sequence of reference points can be recorded in one set-up:

Important note. *Before record reference points you will make sure if TCG is deactivated.*

Step 1. Establish gauge and find a maximum reflection from the first reflector. Use functions a-start and a-thresh in a-gate menu to adjust the a-gate so that it is broken by the primary echo. If necessary adjust the gain so that the echo crosses the a-gate and the highest peak in gate is at approximately 80% of full-screen height. The highest peak must not higher than 100% full-screen height.

Step 2. In menu **TGC** activate the function **POINT** by pressing key. While the gate is lined up over the first reference echo record the first point by pressing key. The **"1"** value will appear opposite **"count"** title in the bottom line of **POINT** function box.

Step 3: Repeat step 1 and 2 to take additional reference points. Maximum number of points is no more than 10.

Important note. *To construct the TCG curve are required two points.*

Step 4: Note that stored TCG reference points can be edited as described in Section 5.3.

Note: *Reference points of TCG, curve and status are saved with set-up.*

5.1.2 Working with TCG

In TCG mode the UFD-50 uses the recorded reference points to calculate an amount of gain correction required to display each from same size reflectors at the same amplitude. The recorded reference point data is stored until replaced or edited.
To use the stored reference points and operate in CG mode:

Step 1: Access the TCG menu and activate ENABLE function by pressing key.

Step 2. Select YES or NO with add of keys. (The symbol will appear if TCG is active).

To display recorded TCG or DAC curve:

Step1. With the DISPLAY menu accessed, select the TCG PLOT function by pressing key.

Step 2. Change function value by pressing keys. Available values are:
TCG – to display TCG curve
DAC – to display DAC curve
NO – to not display any curves.

Note: *The TCG CURVE graphically represents the level of gain applied at each of the user-input reference points. This compensating gain is represented by the height of the TCG curve while the material depth of each reference point is represented by its horizontal position on the display screen*

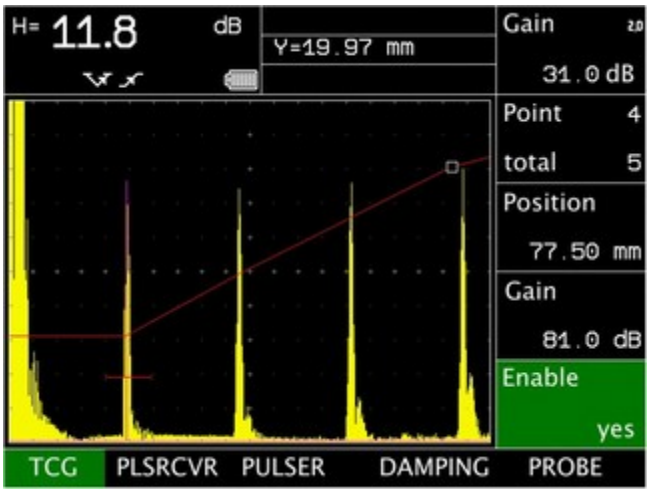


Figure. 5-1 Working with TCG

5.2 DAC mode

When displayed the DAC curve visually represents a line of constant peaks over a range of material depths. So DAC curve is upturned TCG curve display.

Note: *In DAC mode, the only deviation from traditional display and operation is the appearance of the DAC curve. All A-Scan echoes are displayed at their non-compensated height.*

DAC curve can be based on up 10 data points. A DAC curve is programmed using a series of same reflector echoes at various depths covering the range of depths to be inspected in the test material. Because near field and beam spread vary according to transducer size and frequency, and materials vary in attenuation and velocity, DAC must be programmed differently for different application.
The dynamic range of the DAC is to 90 dB. Minimal curve slope is 12dB/microsecond.

5.2.1 Recording the Distance-Amplitude Curve

DAC curve points are recorded exactly like TCG curve points. Usually reference points are recorded on standard sample with the reflectors of identical size located on different depth. The first display from each of these reflectors and should be recorded.
To record DAC curve points:

Important note. *Before record reference points you will make sure if TCG is deactivated.*

Step 1. Establish gauge and find a maximum reflection from the first reflector. Use functions a-start and a-thresh in a-gate menu to adjust the a-gate so that it is broken by the primary echo. If necessary adjust the gain so that the echo crosses the a-gate and the highest peak in gate is at approximately 80% of full-screen height. The highest peak must not higher than 100% full-screen height.

Step 2. In menu **TGC** activate the function **POINT** by pressing key. While the gate is lined up over the first reference echo record the first point by pressing key. The **"1"** value will appear opposite **"count"** title in the bottom line of **POINT** function box.

Step 3: Repeat step 1 and 2 to take additional reference points. Maximum number of points is no more than 10.

Important note. *To construct the DAC curve are required two points.*

Step 4: Note that stored DAC reference points can be edited as described in Section 5.3.

Note: *Reference points of DAC, curve and status are saved with set-up.*

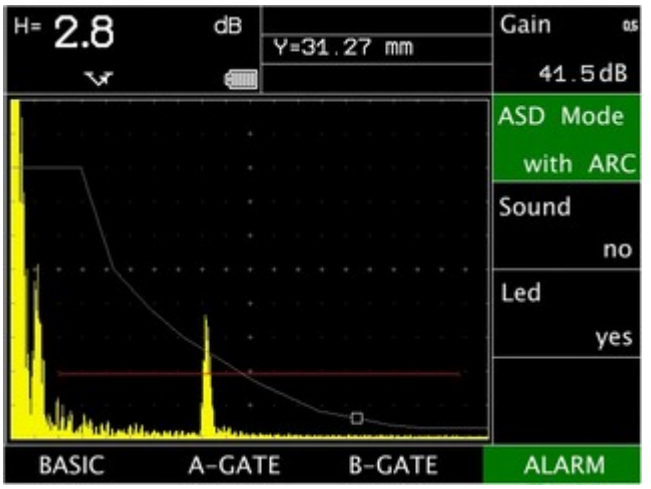


Figure. 5-2 **Working with DAC curve**

5.2.2 Working with DAC

In DAC mode the device uses the user-input reference points to create a curve representing the amplitudes of echoes representing same size reflectors at varying material depth. The recorded reference point data is stored until replaced or edited.
To operate in DAC mode:

Step 1. Be sure that TCG mode is deactivated. (The symbol is not displayed).

Step 2. With the DISPLAY menu accessed select the function TCG PLOT by pressing key.

Step 3. Select the required value for DAC with . Available values are:
TCG – to display TCG curve
DAC– to display DAC curve
NO – to not display any curves

The DAC curve is appears on display. The DAC maximum amplitude will be equal DAC AMPLITUDE function value, which set up in Additional Menu.

5.2.3 Changing the level of DAC (ADDITTIONAL MENU- DAC AMPLITUDE,%)

Step 1. Enter in **ADDITIONAL MENU** with key, when one of function isn't activated.

Step 2. Use keys to move in menu.

Step 3. Activate the function **DAC AMPLITUDE,%** by pressing key.

Step 4. With keys set the maximum DAC amplitude in % of screen height.

Step 5.Press key and close this mode.

Step 6. Exit from **ADDITIONAL MENU** with.

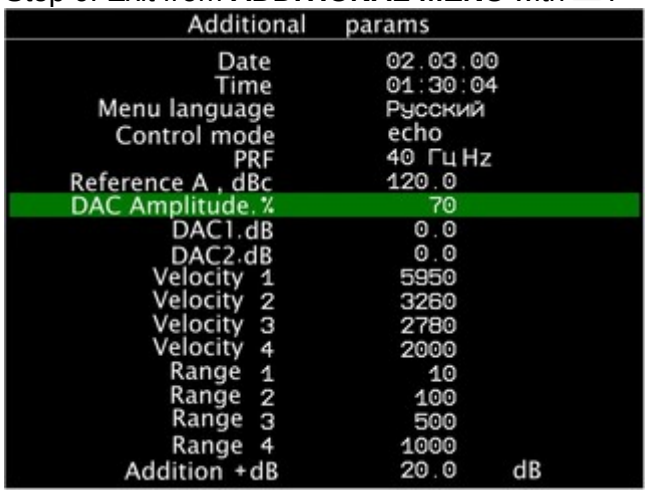


Figure. 5-3 **Changing the level of DAC**

5.2.4 Activating alarm mode to DAC (ALARM - ASD-MODE)

Step 1: In menu **ALARM** by pressing key activate the function **ASD-MODE.**

Step 2. Select «**on DAC»** with keys.

5.2.5 Amplitude measurements to DAC

Current mode is used to measure amplitude of echo signals on DAC curve.

Step 1. Be sure that the **ASD MODE** is sited on DAC.

Step 2. Activate in menu **CALC** the function **READING** by pressing.

Step 2. Change value of function in **H, dB** with keys.

Note. *Signal amplitude measurement on DAC is possible only in a-gate.*

5.2.6 Setting the additional DAC (ADDITIONAL MENU- DAC1 (DAC2))

In the flaw detector there is opportunity to set two additional curves of the DAC locating from base line on given amount dB (from -12 to + 12dB).

Step 1. Enter in **Additional Menu** by pressing key.

Step 2.Be moved in menu using keys.

Step 3. Activate the function **DAC** by pressing key.

Step 4. Set with keys the size in dB to which given curve will be assert from base DAC (from **–12** to **+12 dB** with step **0,5** dB).

Step 5. Deactivate the mode by pressing key.

Step 6. If necessary repeat steps 1-2 for **DAC2** function.

Step 7. Exit from Additional menu with key.

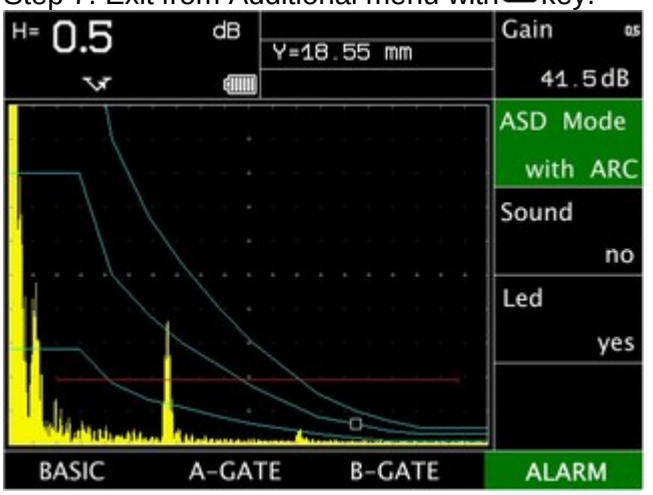


Figure. 5-4 Using additional DAC curves

5.3 Editing DAC and TCG reference points

After reference points are recorded, their values may be changed. Also can be added new points reference (maximum points number is 10).
To edit points:

Step 1. Activate the POINT function in TCG menu by pressing key and select the point number using next keys. Exit from mode with.

Step 2. Activate **POSITION** function by pressing key and correct point position with key. Use key to deactivate.

Step 3. Activate GAIN function by pressing key and correct point gain by pressing keys. Deactivate GAIN function with key.

Step 4. Repeat steps 1-3 for other points if needed.

To create new point:

Step 1. Activate the function POINT in menu TCG by pressing key.
Step 2. Add new point by pressing key.

Note: *If no echo in a-gate or TCG is on appended new point will automatically have 10 microseconds more position and 5 dB more TCG gain then last reference point.*

To delete point:

Step 1. Activate the POINT function in menu TCG by pressing key.
Step 2. Select the required point with keys.
Step 3. Press and keep key not less 3 seconds to delete point. Horn will sound than point will deleted.

To delete all reference point:

Step1. Activate the function POINT in menu TCG be pressing key.
Step 2. Delete all points by pressing and keeping the key during at least 10 sec. Horn will sound than point will deleted.

Salu*Tron* Messtechnik GmbH