ULTRASONIC PULSE VELOCITY TESTER

A1410 PULSAR

OPERATION MANUAL

ACS

Acoustic Control Systems – ACS Group
Saarbrücken, Germany 2019

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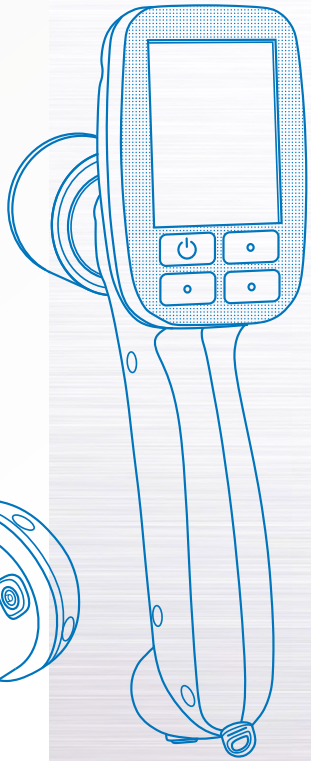
CONTENTS

ACOUSTIC CONTROL SYSTEMS

The present operation manual (hereinafter referred to as “Manual”) contains technical specifications, description of the instrument and its operating principle as well as information necessary for correct operation of the ultrasonic pulse velocity tester A1410 (hereinafter referred to as instrument).

Before starting to work with the instrument, please carefully read the manual.

The manufacturer continuously improves the functionality of the instrument, its reliability and operational comfort. This may result in some minor changes, not given in the current version of the manual. These changes do not affect the technical specifications of the instrument.



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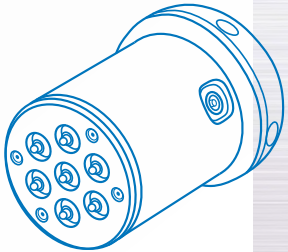


1.1 THE INTENDED USE

1.1.1 Intended use and range of application

Ultrasonic pulse velocity testers of the A1410 series are used for measuring the propagation time and velocity of the longitudinal ultrasonic waves inside the constructions made of concrete using direct, indirect and surface measurement arrangement.

Main areas of application of the instrument are:

- Searching for internal flaws e.g. cracks, cavities, inside of concrete constructions using the direct through transmission
- Measurement of the ultrasonic velocity in concrete according to relevant international standards (see chapter 1.3) for evaluating the concrete compressive strength;
- Evaluation of the concrete compressive strength in operated buildings using the method of “breaking and chipping”;
- Evaluation of the load bearing capacity of concrete saddles and pillars made of centrifugally cast concrete using the propagation velocity ratio of ultrasonic sound along and across the saddle axis.

Additional applications:

- Searching for near-surface flaws inside concrete constructions considering the abnormal velocity reduction or increase of the ultrasound propagation time in an unsound spot comparing to the areas without any flaws;
- Evaluation of the depth of surface cracks in concrete or stone;
- Evaluation of the porosity and rock fracturing, degree of anisotropy and texture of composites;
- Evaluation of the similarity and differences of elastic properties of materials or samples of one material and another, evaluation of the age of the material in case the properties change with time.

1.1.2 Operating conditions

The instrument is intended for operation under the following conditions:

- operating temperature range: from - 10 to + 55 °C;
- relative air humidity up to 95 % at + 35 °C.

1.2 TECHNICAL SPECIFICATIONS

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

Table 1

Parameter name	Value
Type of ultrasonic transducers	Undamped DPC transducers
Transducer configuration	Array of 7 x DPC transducers, daisy wheel pattern
Measurement modes	Wave form / Digital
Operating frequency, kHz	50
Ultrasonic wave mode	Longitudinal
Adjustable range of the base size, mm	50 to 2.500
Measurement range of sound propagation time, μs	0 to 10.000
Indication accuracy of the sound propagation time, μs	0.1
Measurement range of the sound velocity, m/s	1000 to 15000
Indication accuracy of velocity, m/s	1
Set delay range, μs	0 to 20
Averaging factor	1 - 64
Automatic Gain Control (AGC)	switchable
Maximum thickness of the inspection object, m	2.5
Max. inaccuracy of the propagation time measuring, μs, where t-is the measured time value, μs	±(0.02·t+0.1)

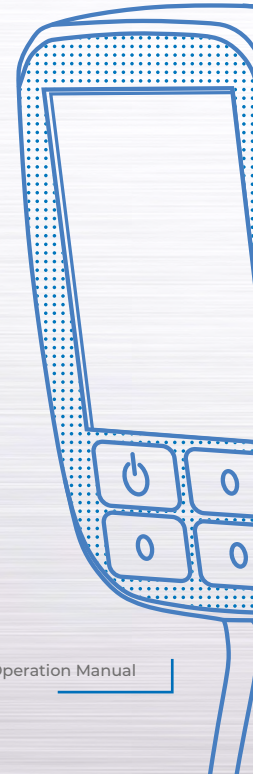


Table 1

Parameter name	Value
Max. inaccuracy of the propagation velocity measurement, m/s, where c-is the measured velocity value, m/s ε is the relative measurement inaccuracy of the base	±(0.02+ε)·c+10)
Rated supply voltage, V	3.3
Period of continuous operation with the display brightness 80%, temperature 25°C, h, min.	16
Display	2,8", 320×240 pixel
Overall dimensions of the electronic unit, mm., max.	230X125X65
Weight of the electronic unit, gr., max.	420
Mean time between failures, hours	18,000
Regular service life, years	5

1.3 VALID INTERNATIONAL STANDARDS

The given technical specifications comply with the following international standards:
- DIN EN 12504 4;
- BS 1881 : Part 203 : 1986;
- ASTM C597 16;
- IS 13311 1.

1.4 INSTRUMENT DESIGN AND OPERATION

1.4.1 Instrument design

The instrument consists of an electronic unit (Figure 1), mounted in a plastic casing. Inside the casing the receiving transducer containing 7 DPC transducers is rigidly installed. The transmitting transducer includes 7 capsules and is connected by cable with the electronic unit.

At the bottom end wall of the electronic unit there is a clamp for a belt and a USB micro B plug intended for connection to a PC as well as a 220 V USB power adapter for charging the built-in battery of the instrument.

The DPC transducers are protected by cone-type lids in which wear-proof ceramic head is installed.

Due to a nearly point-like contact area of the transducers and the surface of the tested material the acoustic coupling to the tested object (TO) can be provided without any contact fluids.

In the upper part of the front panel of the electronic unit the colored TFT display is located. The measurement results and the service information necessary to operate the instrument are displayed here. The display ensures a profound visual monitoring of the measurement process by means of color-coded indication.

Under the display there is a membrane keyboard to control the instrument.

At the opposite side of the enclosure there is a button "ENTER" (Figure 2).

Figure 2: Enter button

Figure 1: A1410 PULSAR

1.4.2 Operation of the instrument

The instrument operation is based on the measurement of the time needed for the ultrasonic pulse to propagate through the inspection object from the transmitting transducer to the receiving transducer. The ultrasonic velocity is defined by means of dividing the distance between the points of emission and receiving of the ultrasonic pulses by the measured time. In order to increase the accuracy of the measurements the ultrasonic pulses are emitted and received repeatedly. The value calculated by processing of several ultrasonic signals received successively is then shown on the display.

The ultrasonic pulses are generated at the surface of the inspection object and propagate in form of elastic waves of different types. The time of ultrasonic pulse arrival is measured from the start of the earliest elastic excitation. Therefore, the instrument measures the velocity of longitudinal ultrasonic waves that propagate with the highest velocity in the given material.

In order to ensure the proper functioning of the instrument, the Receiving transducer must always be held in the right hand and the Transmitting transducer in the left. The arrangement must be done according to the Figure 3.

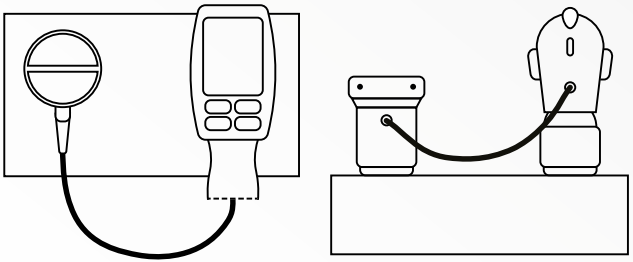


Figure 3: Correct arrangement of transmitter and receiver unit

1.4.3 Operating modes

The instrument can be operated using the following measurement modes:
- DIGITAL: the results are indicated as digits;
- WAVEFORM: the results are indicated in numeric and graphical forms with A scan.

The SETUP mode is a service mode used to install and select the measurement parameters.

1.4.4 Display

In the upper line on the display the information on the current measurement mode and the battery charge level are indicated in all modes. The mode tab icons are given in the Table 2.

Table 2

Tab	Mode
	DIGITAL
	WAVEFORM
	CRACK SIZING

The measurement mode tabs are located from top to bottom as follows: DIGITAL - WAVEFORM - CRACK the active mode tab is marked by black background (Figure 4).

When you enter the SETUP mode the icon  (Figure 5) appears near the battery charge level indicator.

In active measurement modes the icon  (Figure 6) appears near the battery charge level indicator.The information on the measurement units and the numeric value of the measurement results is always indicated in the measurement modes.

Additionally, in the DIGITAL mode the icon of the signal status and its level are indicated.

Figure 4

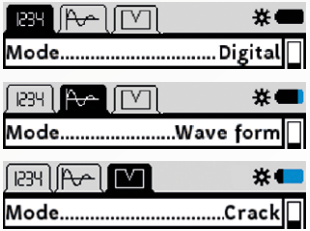


Figure 5

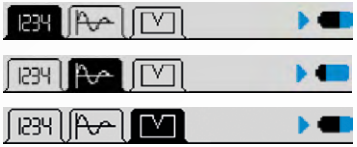
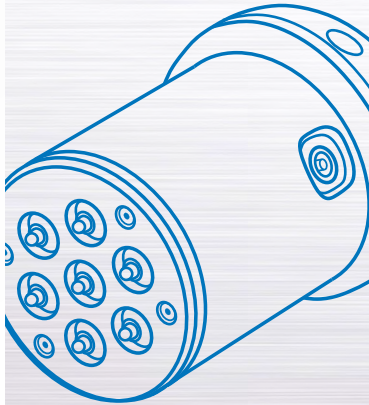


Figure 6



1

The description of the icons for acoustic contact characterisation is given in Table 3.
The display of the instrument in the DIGITAL mode (the type of the result: VELOCITY) is given in Figure 7.
The instrument in the WAVEFORM mode (the type of the result: VELOCITY) is given in Figure 8.
The instrument operation in CRACK SIZING mode is described in chapter 2.3.4

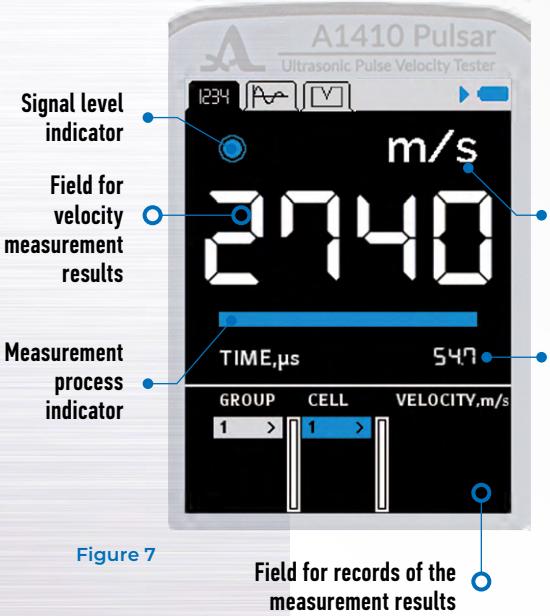


Figure 7

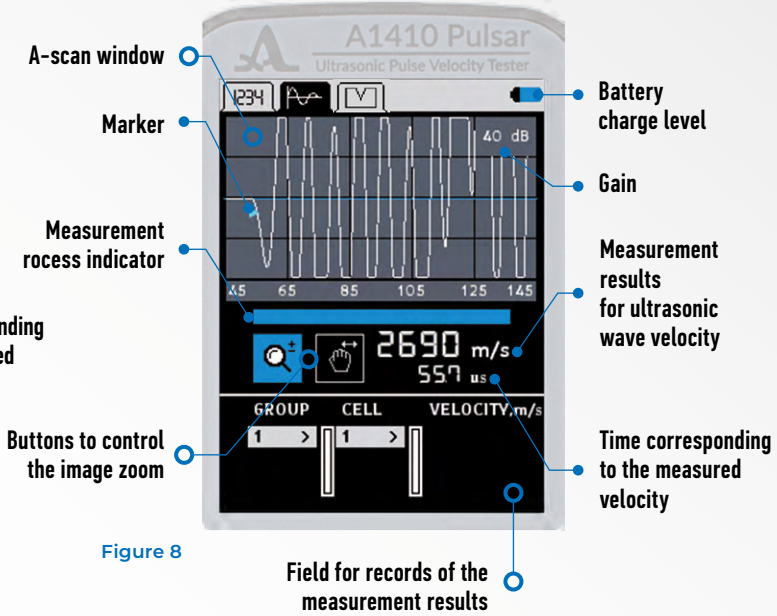


Figure 8

Table 3

Type of icon	Description
	Very high signal level (the AGC should be switched off)
	Maximum signal level (minimum gain of the receive path)
	Average signal level (average gain of the receive path)
	Minimum signal level (maximum gain of the receive path)
	No signal or the signal is too weak to perform measurements

1.4.5 Keyboard

The keyboard of the instrument (Figure 9) with three functional keys and the ON/OFF key.

The main key functions:

- The key  (ON/OFF) is used to switch the instrument on and off.

PLEASE NOTE: IF YOU TAKE THE INSTRUMENT FROM THE INSPECTION OBJECT UND DO NOT PRESS ANY KEY, THE DISPLAY BRIGHTNESS WILL BE REDUCED TO THE MINIMUM. AFTER 10 MINUETS THE INSTRUMENT WILL BE AUTOMATICALLY SWITCHED OFF.

- The key  is used to go between the measurement modes and the SETUP mode.
- The keys  /  are used to select or change the active parameters. The keys perform similar operations in different operating modes, their use is based on the instinctive understanding.

Figure 9

2

INTENDED USE

2.1 OPERATIONAL RESTRICTIONS

The instrument can only be used under the environmental conditions described under the S. 1.1.2.

2.2 PREPARING THE INSTRUMENT FOR USE

2.2.1 Surface preparation

Please clean the surface of the tested object from dirt and sand.

2.2.2 Switching the instrument on and off.

To switch the instrument on please press the key .

For several seconds you see the information on the instrument designation and the firmware version number on the screen (Figure 10).

The instrument automatically starts in the mode selected during the last measurement with appropriate settings.

The instrument is switched off manually by pressing the key or automatically, if no key was pressed or no measurement was performed for 10 minutes.

All instrument settings are saved when the instrument is switched off, if the instrument battery is loaded.

Figure 10

2.3 INTENDED USE OF THE ULTRASONIC PULSE VELOCITY TESTER

2.3.1 SETUP mode

In the SETUP mode there is a list of parameters accessible for editing and calibration.

In the SETUP mode in the bottom line the set date and time are indicated on the screen.

All instrument settings are saved when the instrument is switched off, if the instrument battery is charged.

The SETUP mode of the DIGITAL mode is shown in Figure 11 on the screen.

Keys [↓] / [↑]:

- Moving up and down the menu items, you can move in both directions cyclically. As soon as the active line highlights a parameter, it becomes accessible and can be selected and edited.

- Confirm entering the editing mode of the selected parameter;

- Change the value of the selected parameter.

ENTER button:

- Selecting parameter for editing;

- Saving new parameter value.

Menu items in the SETUP mode, the appropriate parameters (in the metric measurement system) and functions are given in the Table 4.

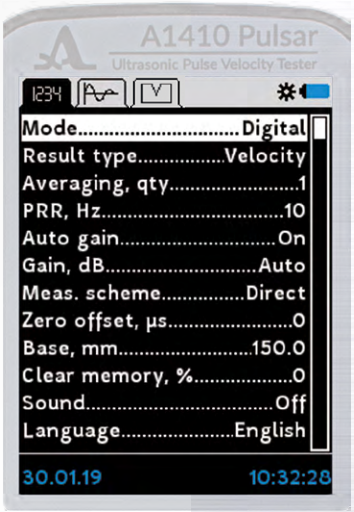


Figure 11

Table 4

Menu item (parameter)	Parameter value	Description
Mode	Digital / Waveform	Select the measurement mode
Result type	Velocity / Time	Selecting the type if the indicated result
Averaging, qty	1 / 2 / 4 / 8 / 16 / 32 / 64	Setting the averaging factor

2

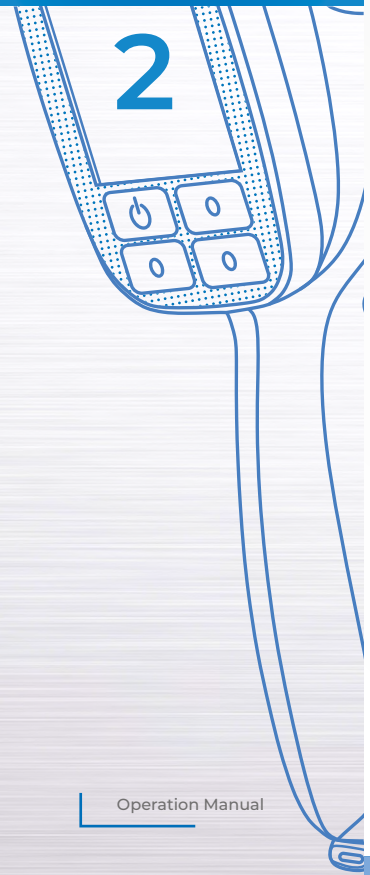


Table 4

Menu item (parameter)	Parameter value	Description
PRR, Hz	2 to 25	Pulse Reapetition Rate - repeat frequency of the sounding pulses
Auto gain	On / Off	Switching the system of automatic gain control (AGC) on/off
Gain, dB	From 40 to 80, step 2, or Auto if AGC is ON	Setting the instrument gain
Meas. scheme	Direct / indirect / surface	Selecting the measurement scheme
Auto zero offset	On / Off	Switching the initial measurement point auto detection
Zero offset, μs	From 0 to 500, pitch setting is 50	Shift of the initial measurement point
Base, mm	50 to 2500	Actual base distance between the transmitting and receiving transducers of the instrument
Delay calibration	–	Delay calibration on the reference specimen
Clear memory	Used memory space in %	Clear the memory of measurement data
Sound	On / Off	Controlling the indication sound
Language	Russian / English	Selecting the interface language
Unit of measure	mm/inches	Select the system of measurement
Brightness, %	From 10 to 100, step 10	Setting the screen brightness
Current time	Edit.	Setting the current date and time

2.3.1.1 Item MODE

Select the measurement mode:

- DIGITAL: measuring the velocity or the propagation time of the ultrasonic waves within the material and numeric indication of the result;
- WAVEFORM: measuring the velocity or the propagation time of the ultrasonic waves within the material and numeric indication of the result and the signal waveform (A Scan plot);
- CRACK: measuring the depth of surface open cracks;

The ENTER button: successive cyclical selection of operation modes.

The item MODE is indicated on the screen, see Figure 12.

2.3.1.2 Item RESULT TYPE

Selecting the type of the indicated result:

- TIME: measuring the time of the propagation of the ultrasonic waves within the material.
- VELOCITY: measuring the velocity of the propagation of the ultrasonic waves within the material.

The ENTER button: successive cyclical selection of result types.

The item RESULT TYPE is indicated on the screen, see Figure 13.

2.3.1.3 Item AVERAGING

Setting averaging factor.

Permitted values 1, 2, 4, 8, 16, 32, 64.

It is recommended to use averaging factor 16, as it is optimal in terms of measurement time in relation to reliable results. In order to increase the result accuracy and the reliability it is recommended to increase the averaging factor, especially when the signal-to-noise ratio is not sufficient (strong attenuation, structural material noise or other background noise).

The item AVERAGING is indicated on the screen, see Figure 14.

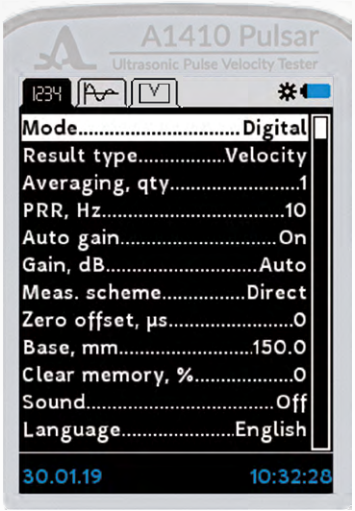


Figure 12

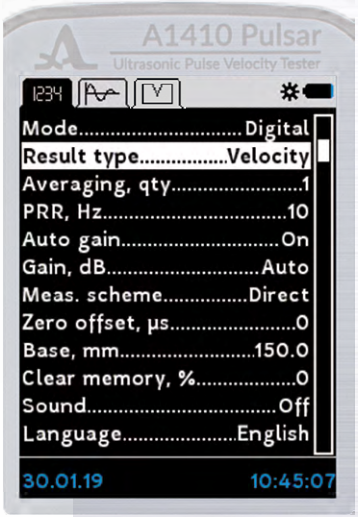


Figure 13

2.3.1.4 Item PRR

Setting the pulse repetition rate of the transmitted pulses.

Permitted values from 2 to 25 Hz.

The item PRR is indicated on the screen, see Figure 15.

For the increasing testing speed, please select the highest repetition rate of the transmitter pulses.

Note however, when inspection objects have small dimensions (the measurement base is less than half a meter) and low ultrasound attenuation value, the multiply reflected ultrasonic waves may cause ghost echoes and incorrect measurement values. In this case please reduce the repetition rate of the transmitter pulses, down to minimum.

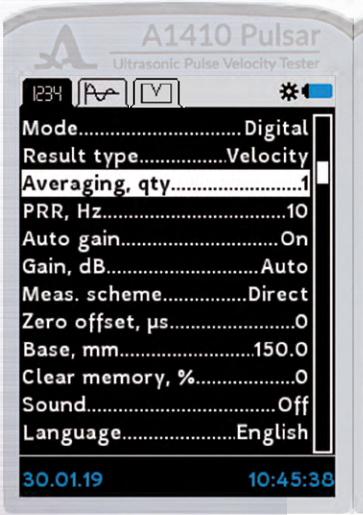


Figure 14

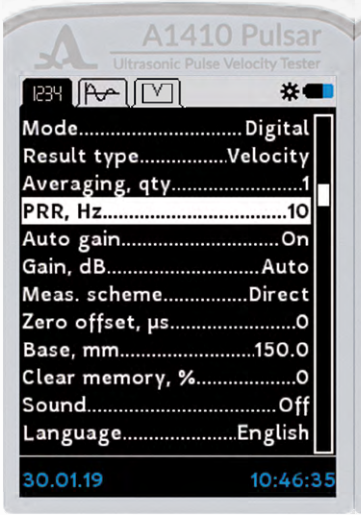


Figure 15

2.3.1.5 Item AUTO GAIN

Switching automatic gain control while measurement. Permitted value: On / Off
The item AUTO GAIN is indicated on the screen, see Figure 16.

2.3.1.6 Item GAIN (only when Auto GAIN switched OFF)

Setting the gain value. Permitted values from 40 to 80 dB.
The item GAIN is indicated on the screen, see Figure 17

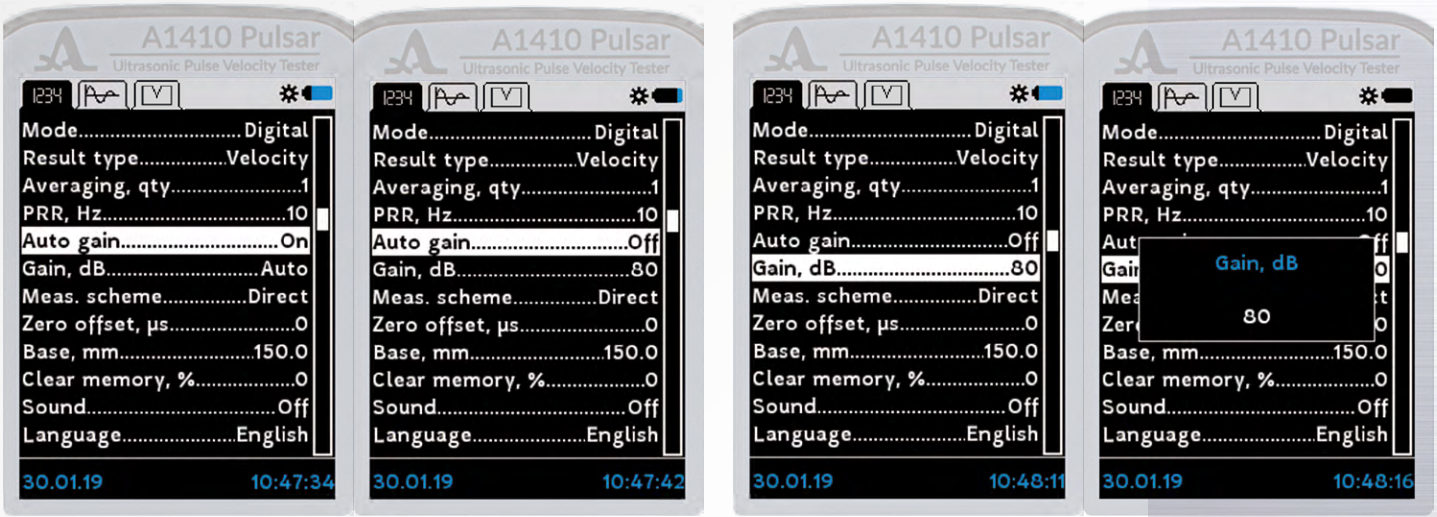
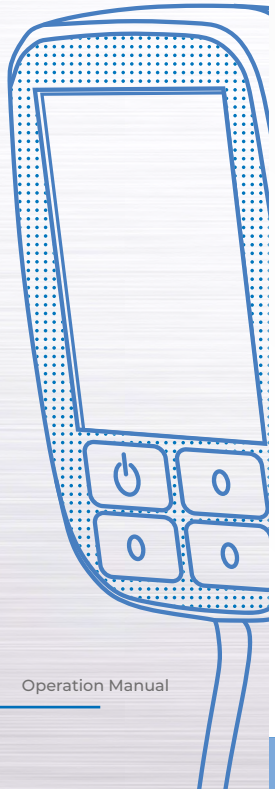


Figure 16

Figure 17

2



2.3.1.7 Item MEAS. SCHEME

Setting the measurement scheme:
- Direct / the transmitter and the receiver are located on the opposite sides of the inspection object;
- Indirect the transmitter and the receiver are located on adjacent sides of the inspection object;
- Surface the transmitter and the receiver are located on the same side of the inspection object.

The buttons ⬇ / ⬆ allow successive selection of measurement schemes.
The item MEAS. TYPES is indicated on the screen, see Figure 18.

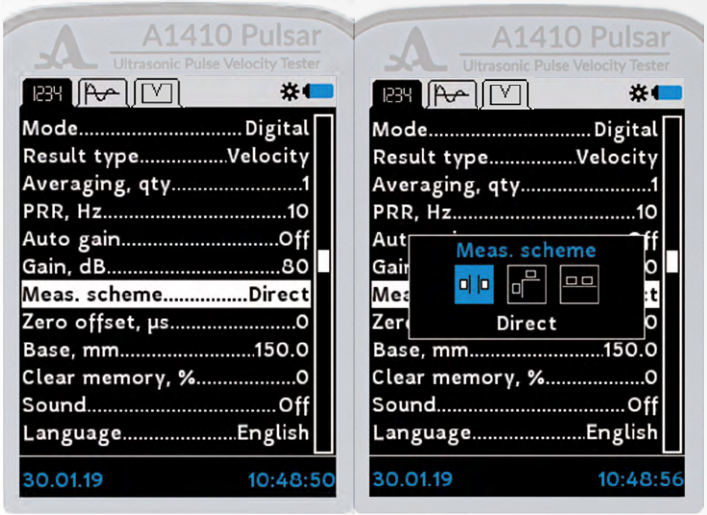


Figure 18

2.3.1.8 Item AUTO ZERO OFFSET

Item AUTO ZERO OFFSET is used for activating automatic detection of suitable initial point while measurement.

Permitted value: On / Off

The item AUTO ZERO OFFSET is indicated on the screen, see Figure 19.

In case the item AUTO ZERO OFFSET is switched on, the measurement is started with the automatic searching for the suitable starting measurement point in the range of 10000 µs, see Figure 20. This measurement mode can be recommended for most of regular application situations with normal “signal-to-noise” conditions.

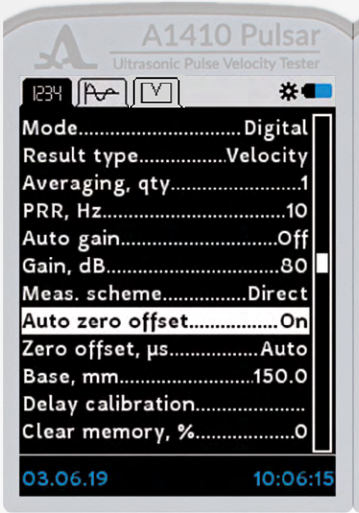


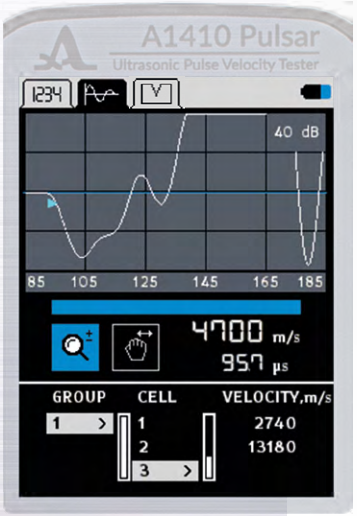
Figure 19

Figure 20

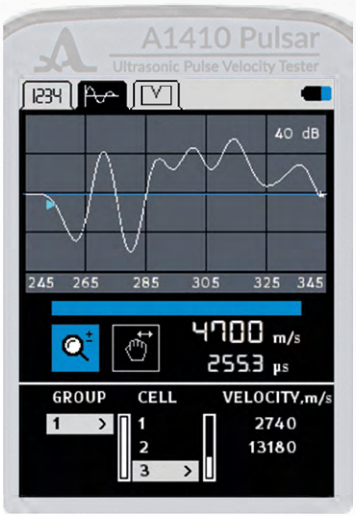
2.3.1.9 Item ZERO OFFSET

Item ZERO OFFSET is used for shifting initial measurement point.

The sampling range of the measured and visible signal in the Pulse Velocity Tester is 200 µs. It corresponds to 0.9 m for the average ultrasonic velocity in concrete (4500 m/s). Shifting the initial measurement point allows to see this range not only starting from the surface, but up to the through-transmission range of 2.500 meters. The following table gives recommended values for the offset depending on expected through-transmission depth:



1: Offset value 0 µs



2: Offset value 150 µs

Figure 21

Zero offset, µs	Depth range, m	
	from	to
0	0	0.9
50	0.225	1.125
100	0.45	1.35
150	0.675	1.575
200	0.9	1.8
250	1.125	2.025
300	1.35	2.25
350	1.575	2.475
400	1.8	2.7
450	2.025	2.925
500	2.25	3.125

These are two examples of measurement with different offset values on different through-transmission ranges.
1 – Zero offset = 0 µs and Base = 450 mm, 2 – Zero offset = 150 µs and Base = 1200 mm.

2.3.1.10 Item BASE

The item BASE is used to set the distance value between transmitter and receiver. The value can be set between 50.0 and 2,500.0 mm. The item BASE is indicated on the screen, see Figure 22.

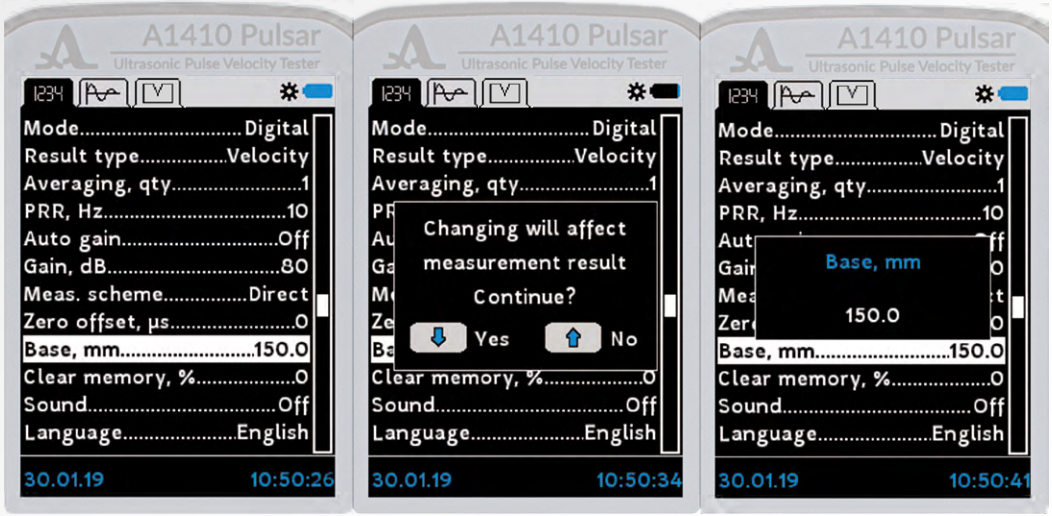
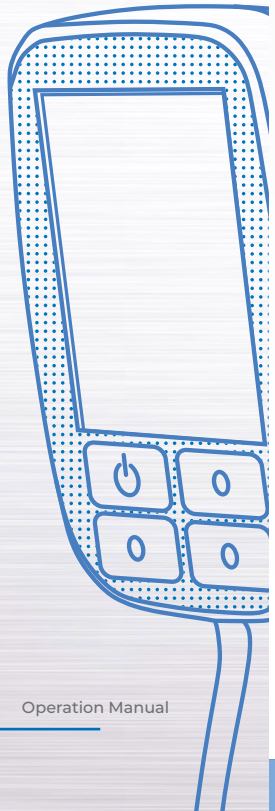


Figure 22



2.3.1.11 Item „DELAY CALIBRATION“

Item DELAY CALIBRATION is used to set hardware delay for the propagation time measurement.

The value can be set between 0,00 and 20,00 μs with the step of 0,01 μs.

The item DELAY CALIBRATION is indicated on the screen, see Figure 23.

The delay calibration must be conducted on the reference specimen supplied in the delivery set of A1410 (rexolite cylinder with Ø60 mm and height 100 mm).

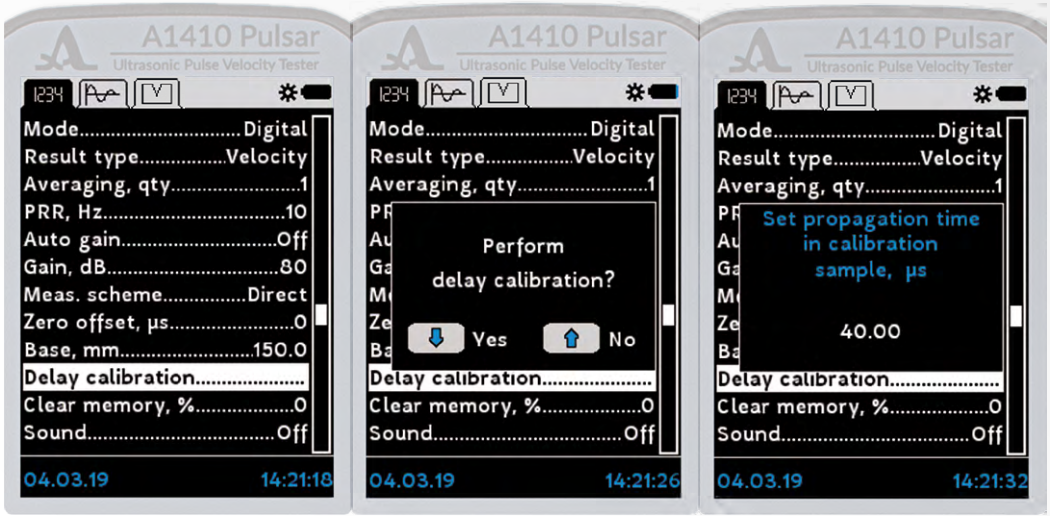


Figure 23

For performing the calibration following steps are needed:
- Choose “DELAY CALIBRATION” item;
- Press “ENTER” button;
- Set the propagation time in the reference specimen;
- Press “ENTER” button;
- Follow instruction on the instrument display.

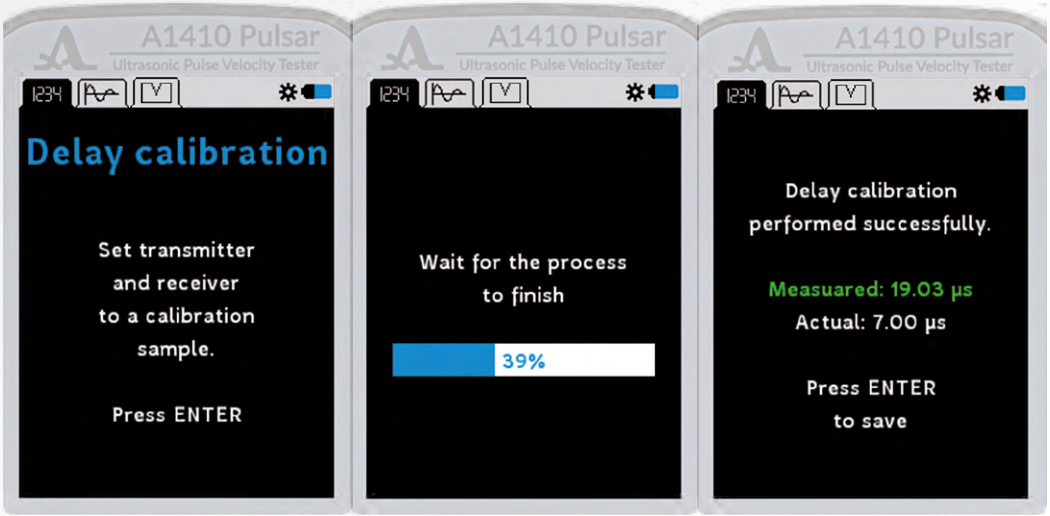


Figure 23

2.3.1.12 Item CLEAR MEMORY

Deleting the measurement results saved in the DIGITAL mode from the memory.

As the item parameter the percentage of the memory usage with the measurement results is displayed.

The item CLEAR MEMORY is indicated on the screen, see Figure 24.

After starting the memory clearing, the request to confirm the deletion of data is indicated on the screen "The saved data will be deleted. Continue?" (Figure 25).

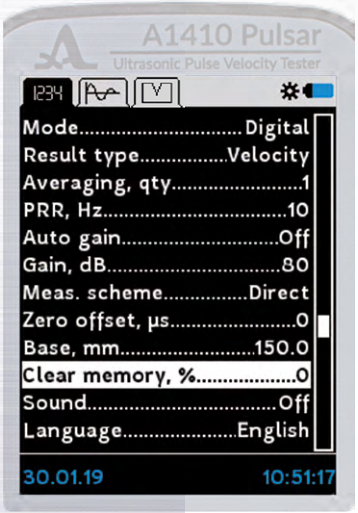


Figure 24

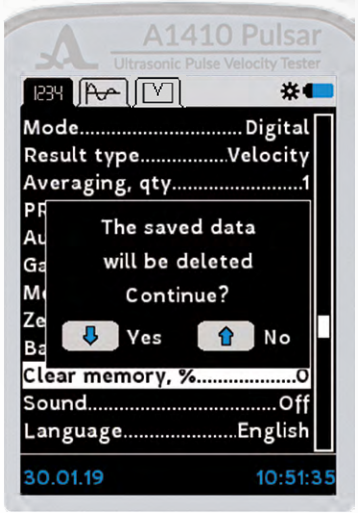


Figure 25

2.3.1.13 Item SOUND

Switching the sound indication of the instrument ON / OFF.

The main events when measuring, setting and pressing the keys of the instrument can be accompanied by sound indication. It is also used to monitor the receiving / detection of the ultrasonic signals acoustically. Additionally, the sound signals inform the operator bout ongoing measurement processes without influencing the measured results.

The item SOUND is indicated on the screen, see Figure 26.

2.3.1.14 Item LANGUAGE

Selecting the interface language of the instrument.
The item LANGUAGE is indicated on the screen, see Figure 27.

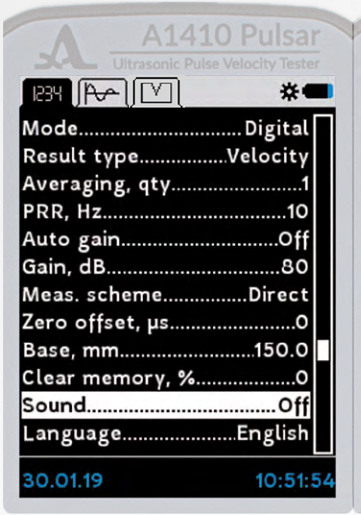


Figure 26

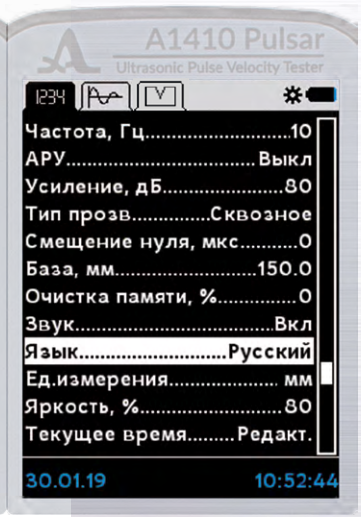


Figure 27

2.3.1.15 Item UNIT OF MEASURE

Selecting the system of measurement units:
- MM - metric;
- INCHES - Imperial;
The item UNIT OF MEASURE is indicated in Figure 28.

2.3.1.16 Item BRIGHTNESS

Setting the screen brightness from 10 to 100%. The item BRIGHTNESS is indicated on the screen, see Figure 29.

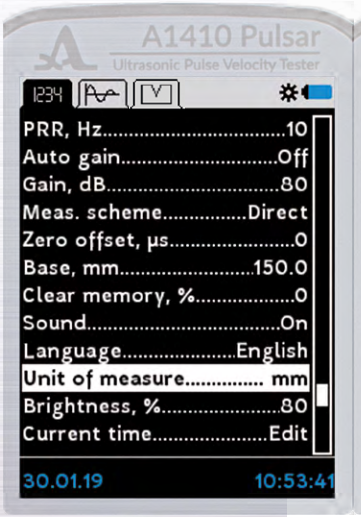


Figure 28

Figure 29

2.3.1.17 Item CURRENT TIME

Setting the date and time.

The item CURRENT TIME is indicated on the screen, see Figure 30.

The ENTER key: selecting a parameter for editing (highlighted in red); DAY→MONTH→YEAR→HOURS→MINUTES→exit the editing;

The keys [↓] / [↑] change the value of the selected parameter;

2.3.2 DIGITAL mode

In the DIGITAL mode the screen is divided into two parts. In the upper part the information on the measurements is displayed. In the lower part the information on the results saved previously is displayed, e.g. groups, groups of cells and the measurement results in m/s or in μs depending on the selected result type) (Figure 31). The instrument shall be installed on the inspection object so that both ultrasonic transducers are placed according to the selected measurement scheme. Immediately when the transducers touch the surface of the tested object the instrument switches from the standby mode, into the active mode. If the sound indication is switched on, the measurements are accompanied by short sound signals.

If no sound signals are heard, the instrument could not switch to the active mode, i.e. the ultrasonic velocity in the tested object material is lower than the minimum or higher than maximum measured velocities or there is a crack in the area between the transducers. The crack could prevent the ultrasonic signal propagation to the receiving transducer.

When the measurement process is finished and the instrument is removed from the inspection object the measurement result remains on the screen for 10–15 seconds, after that the horizontal strokes will appear.

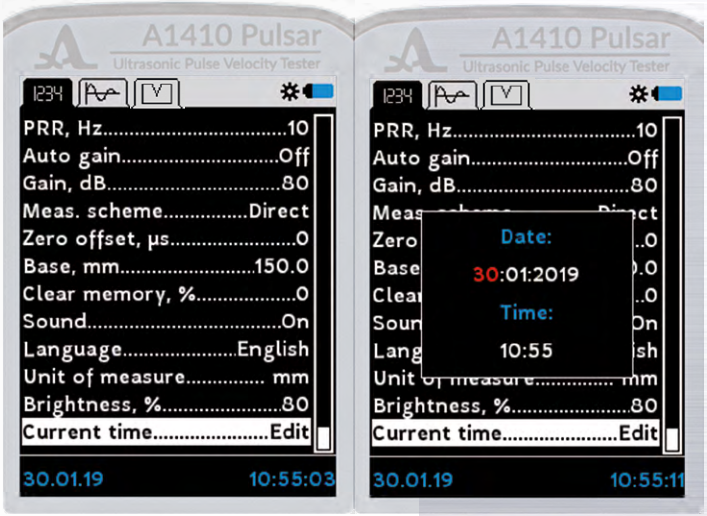
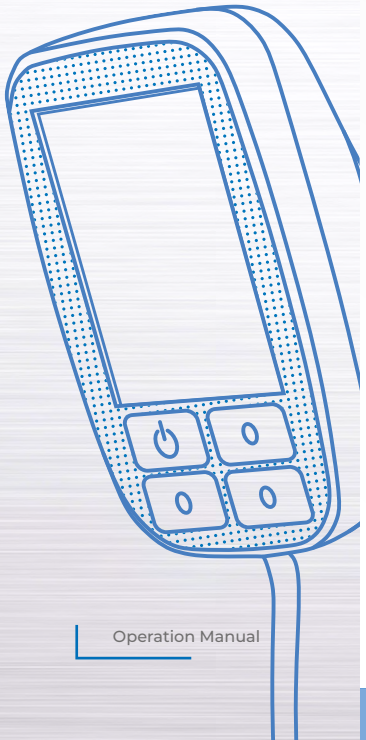


Figure 30



During the data acquisition please ensure that the transmitter and receiver do not move.

If the measurement results in the same place are significantly different, it is recommended to decrease the repetition rate of the sounding pulses. To reduce the repetition rate, select the item PRR in the SETTING mode and reduce the value. Then repeat the measurements at the given location of the tested object.

Active keys:

[↓] / [↑] **Hold** – moving up and down the columns GROUP-CELL-RESULT in the appropriate direction;

[↓] / [↑] **Shortly press** – moving up and down the lines of the active column in the appropriate direction.

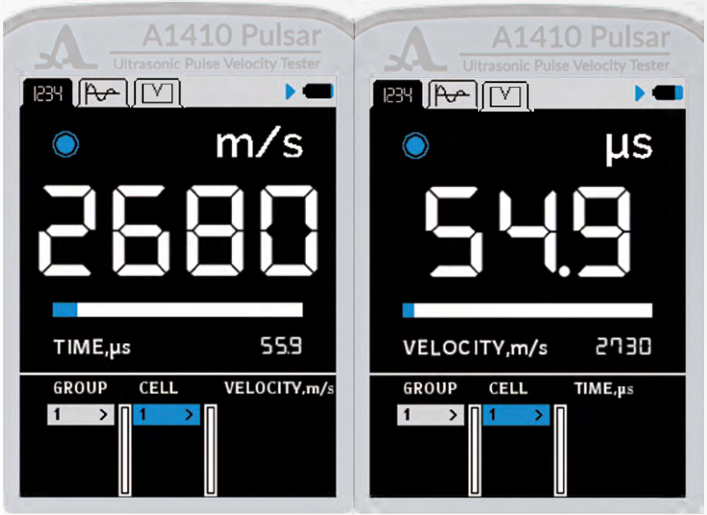


Figure 31

2.3.2.1 Adding a new last group.

Using the key [↓] move to the last group. The query to add a new group will appear. If the group is not empty, a group with the next index number will be added. If the last group is empty, the message “The last group is empty” will appear. No group will be added (Figure 32).

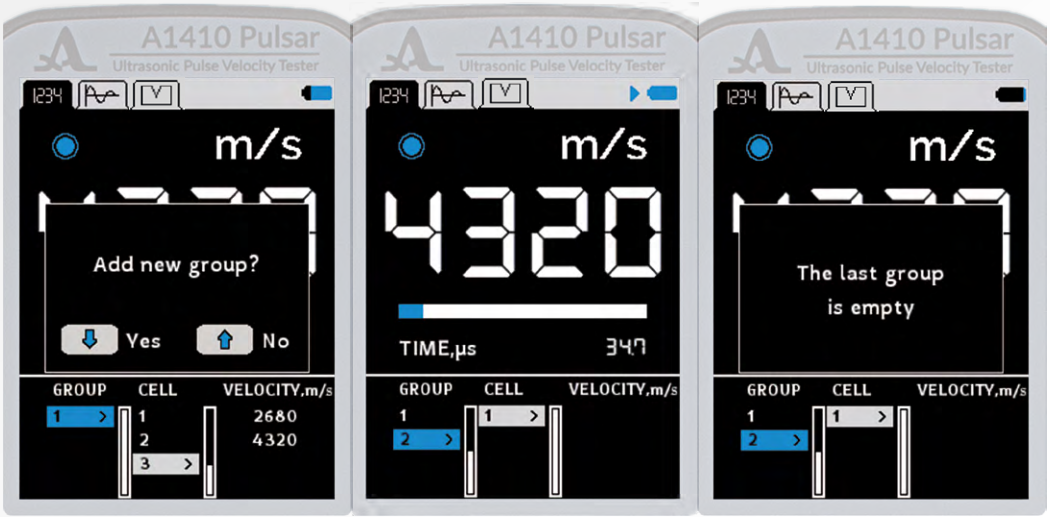


Figure 32

2.3.2.2 Saving the results

The measurement results are saved in the instrument memory in cells. Cells form groups. Groups and cells in the groups are identified by index numbers. Groups and cells in the groups are numbered beginning with one.

The maximum number of cells in a group is 500.

The maximum number of groups is 100.

When the maximum number of cells is reached in a group, the appropriate information is indicated on the screen of the instrument.

According to practice it is more comfortable to record the results in small groups consisting of several dozens of measurements. If necessary, you can return to any existing group and continue recording the results in that group.

To save a measurement please select any existing group or create a new one before you start the measurements. After the measurement process is finished please press ENTER. The measurement results will be saved in the first empty cell of the current (selected) group.

Note: when the measurement result does not conform with the permitted range, the measurement is regarded as incorrect. When you try to save the following window will be indicated on the screen (Figure 33).

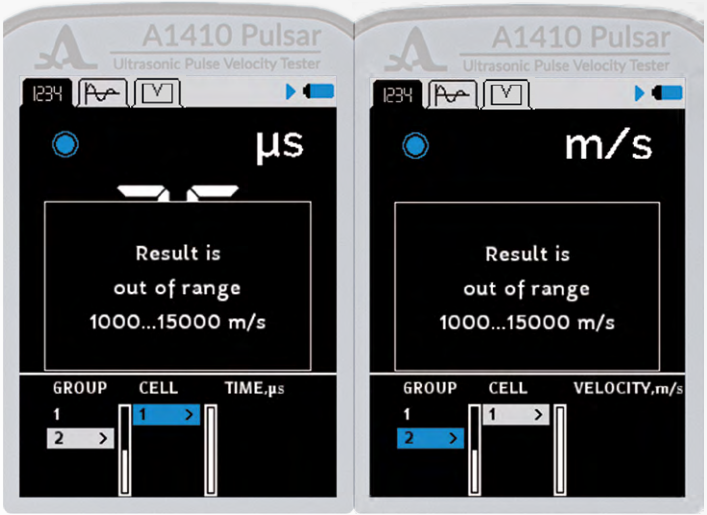


Figure 33

2.3.2.3 Viewing and correcting the measurement results

You can view any measurement results saved in the memory. If any questions regarding the accuracy of the result arise, it can be corrected by performing a new measurement at the same position and overwriting the doubtful values.

To view the results please go to the column CELL. In the upper screen line, a flashing icon will appear near the battery charge icon (Figure 34).

The navigation through the measurement results is done subsequently through the group cells according to the selected view direction. When the last or the first cell in the group is reached, the active group would change to the next or the former group of results accordingly.

To correct the result, please:

- Using the keys go to the cell where the result is recorded, which should be corrected;
- Hold the key ↓, go to the column RESULT. The icon for reviewing of the saved measurement results will be changed by the icon of the measurement mode.
- Perform the measurements and if you received a satisfactory result, press the ENTER button to save it in the selected cell. After recording the instrument will automatically return to the review mode.

Note: result remains in the instrument memory till a new value is saved in the selected cell. To return to the review mode without changing the former saved cell value please press the key ↑.

Figure 34

2.3.3 WAVEFORM mode

The measurement in the WAVEFORM mode is performed by means of analyzing the plotted form of the received signal, selecting analysis interval and calculating criteria. The measured time value is converted into the sound velocity value in the material using the base distance value.

In the WAVEFORM mode the screen is divided into two parts:

The upper part, where the graphic image of the signal is presented as an RF signal (A Scan), the horizontal axis unit is always in μs.

The lower part, where the numeric value of the measurement results is presented in m/s or μs (the result, selected in the item TYPE of RESULT, is given in bigger font size), as well as the button to control the image zoom of the WAVEFORM, the information on the previously saved results (groups, group cells, measurement results) (Figure 35).

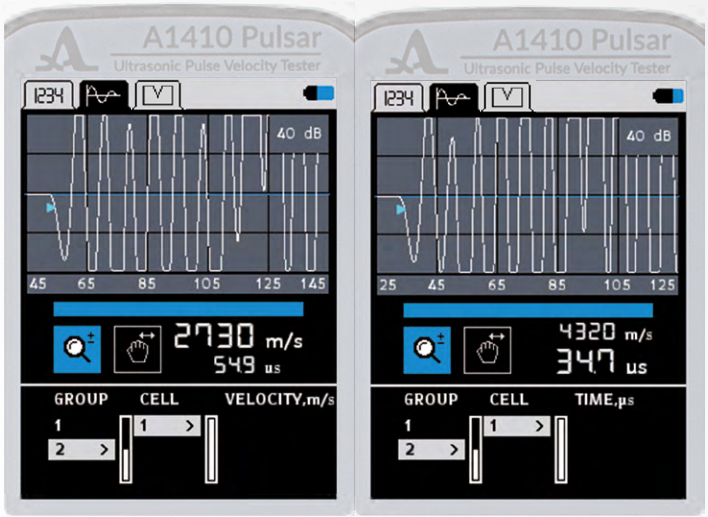


Figure 35

2.3.3.1 Performing measurements

In the WAVEFORM mode the work is divided into two stages.
The first stage is used to perform the measurements according to the parameters set in the SETUP mode.
The numeric values of the measurement results are given in the lower part of the screen.
The graphic plot of the signal is presented as an WAVEFORM (RF signal) in the upper part.
The marker ▷ stands at the position corresponding to the measurement results on the WAVEFORM.
Please note, that the zoomed scale for the WAVEFORM plot is reset automatically during the measurement process.
The second stage is used for a more detailed viewing of the received WAVEFORM.
The buttons for the A scan visualization on the screen become active:
MAGNIFYING LENS changing the zoom of the horizontal scale.
SHIFT shifting the signal along the horizontal axis.

Active keys:
Hold – moving from the button MAGNIFYING LENS to the button SHIFT;
Hold – moving from the button SHIFT to the button MAGNIFYING LENS;

/ **Short pressing** (the button MAGNIFYING LENS is active) – measuring the level of detail on the screen.
/ **Short pressing** (the button SHIFT is active) – shifting the signal on the screen along the horizontal axis.

2

2.3.3.2 Saving, viewing and correcting the measurement results

The process of saving and the subsequent reviewing of the saved numeric value of the measurement result in the WAVE-FORM mode is completely identical with the process of saving results in the DIGITAL mode. The process is described in 2.3.2.2.

Note: only a numeric value of the measurement result is saved in the instrument memory.

To record the measurement please select any existing group or create a new one before you start the measurements. After the measurement process is finished please press ENTER. The measurement results will be saved in the first empty cell of the current (selected) group (Figure 36).

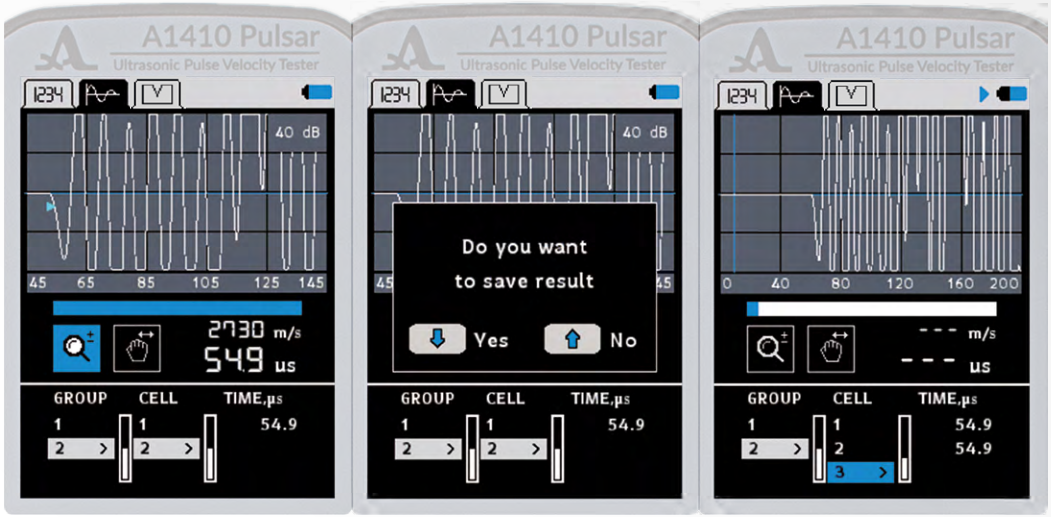


Figure 36

2.3.4 CRACK SIZING mode

PLEASE NOTE: This chapter describes the use of the crack sizing functionality for concrete inspection with the A1410 Pulsar for surface open cracks.

The crack sizing functionality is available form software release 3.2-33

PLEASE NOTE: Before using the Crack Sizing Mode make sure that your Base is set according to chapter 2.3.1.9

2.3.4.1 Switching to CRACK SIZING Mode

Press [⚙] setup to open setup menu.
Select Mode "Crack" by using the up [↑] and down [↓] arrows.
Press Enter.

2.3.4.2 Determination of Time of Flight and Velocity

Switch to measuring mode by pressing setup [⚙].
The screen is displayed according Figure 38

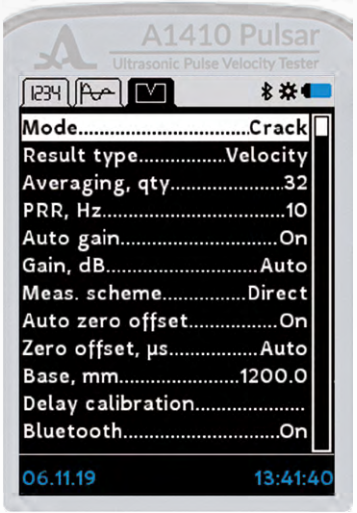


Figure 37: Choosing Crack Sizing mode

Figure 38: Crack Sizing Mode screen before calibration

Calibrate of time of flight and velocity on a concrete surface without crack indication like follows:
Place transmitter and receiver according Figure 39.
Press Enter The Display will change like shown in Figure 40
Press enter to open confirmation dialog.
Save data with ⬇ yes or deny with ⬆.
After storage of the data, the device is ready for crack measurements the screen changes according Figure 42:

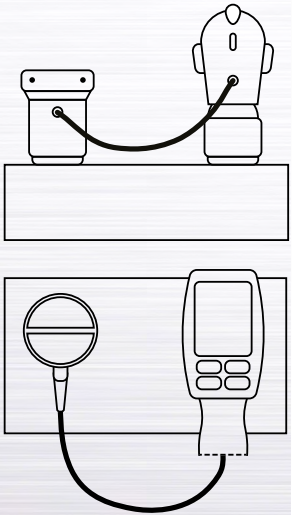


Figure 39: Transmitter and receiver in base distance

Figure 40: Screen alter measurement

Figure 41: Confirmation dialog

Figure 42: Device ready for crack measurements

2.3.4.3 Measurements in crack area

Move to area with open crack and place Transmitter and receiver According Figure 43 (Probe distance as set in Bae and crack in the middle between the probes)

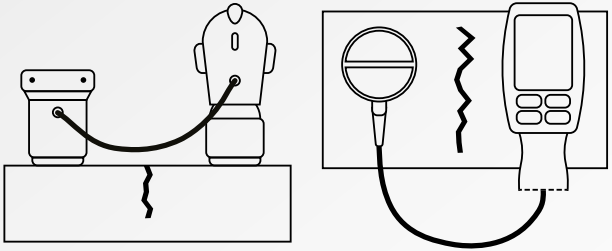


Figure 43: Probe position during measurement

For measurement press Enter.

After measurement the screen displays the following data:

2.3.4.4 Time Correction Instrument

In case of a weak signal, adjustment of the time of flight can be made by the operator. Pressing up arrow [↑] increases and pressing down arrow [↓] deceases the value.

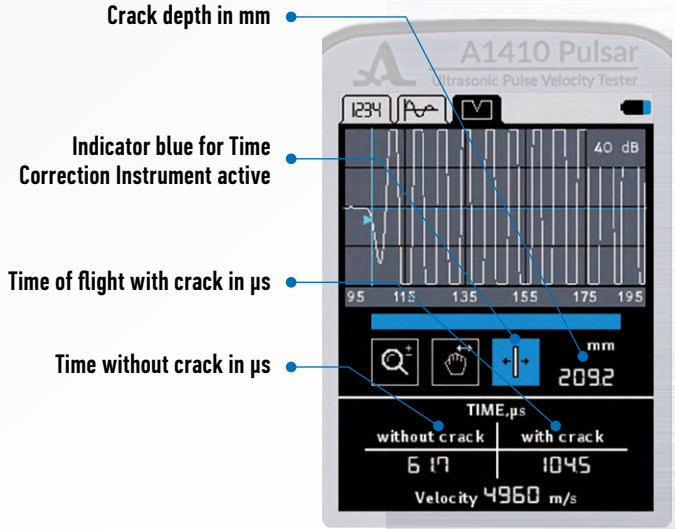


Figure 44: Displayed data after measurement

2.4 TRANSFER DATA TO PC

To transfer the data saved in the instrument to a PC, please connect the instrument to the PC using the USB A-Micro B cable from the scope of delivery.

The PC operating system will define the instrument as an external removable media under the name **ACSYS DISC**. You can open it using the program Windows Explorer or any file manager.

The data can be accessed directly from the instrument or after copying it to the PC:

When copying, you can assign the data file any name.

Numeric data is saved in the instrument in the **CSV** format (Comma Separated Values), as it is easy to export to different applications. It allows further analysis and the processing of the data in external programs, e.g. Microsoft® Excel® (Figure 45). The data is saved in a worksheet under the name **results** in the file named **results.csv**. In the file the results are located subsequently according to the group number.

	1	2	3	4	5	6
1	GROUP	CELL	Time, us	Velocity, m/s	Date of measuring	Time of measuring
2	1	1	65,9	2280	26.12.2018	13:46:13
3	1	2	65,9	2280	26.12.2018	13:46:16
4	1	3	65,9	2280	26.12.2018	13:46:20
5	2	1	65,6	2290	26.12.2018	13:46:45
6	2	2	65,6	2290	26.12.2018	13:46:18
7	2	3	65,5	2290	26.12.2018	13:46:51
8	3	1	65,8	2280	26.12.2018	13:47:45
9	3	2	65,8	2280	26.12.2018	13:47:51
10	3	3	65,8	2280	26.12.2018	13:47:56
11						
12						
13						
14						
15						

RESULTS

Figure 45

The maintenance of the instrument includes cleaning of the electronic unit from dirt and dust and charging the battery.

3.1 BATTERY

The instrument battery can be used in a wide temperature range. The battery capacity is lower at temperatures below zero centigrade. In the lower temperature range the battery capacity is approximately 15% lower than for normal temperatures.

When the battery is completely discharged the instrument will automatically switch off.

There is an internal overcharge protection, overcurrent protection and temperature protection inside the battery.

The battery lifetime is rated for the guaranteed service period of the instrument.

The battery can only be changed at a service center.

PLEASE NOTE: THE USER MAY NOT CHANGE THE BATTERY ON HIS OWN AS THIS LEADS TO THE TERMINATION OF THE WARRANTY FOR THE INSTRUMENT!

3.2 CHARGING THE BATTERY

The battery can be charged from an external charger or a PC using the USB port.

The loading time of the battery depends on the level of its discharge. Completely charge process for the battery would take 4 5 hours. Repeated recharging is allowed.

The instrument can be operated during the process of charging from an external charger, in this case the charge time will increase by 2 to 3 times.

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

3.3 POSSIBLE MALFUNCTIONS

When malfunctions occur during the instrument operation or if you have any questions on how to use the instrument, please contact the manufacturer representatives.

4

STORAGE

Please store the instrument in the rigid suitcase from the delivery. The storage conditions must conform with the relevant international standards (see chapter 1.3).

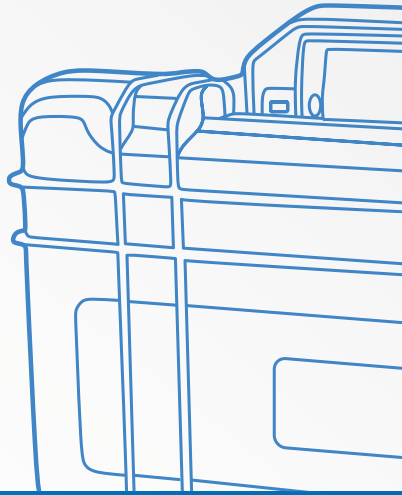
Please store the instrument on a shelf.

The arrangement of the instruments in warehouses shall enable their free movement and unrestricted access to them.

The distance between the instrument and the walls and floor of the warehouse shall be at least 100 mm.

The distance between heating units of the warehouse and the instrument should be minimum 0.5 m.

The storage room shall be free from current-conducting dust, aggressive gases and vapors which might be able to intensify corrosion of metal parts of the instrument.



5

TRANSPORTATION

Please transport the instrument in the rigid suitcase from the delivery set.

Packaged instruments can be transported at any distances and with any kind of vehicle without speed restrictions.

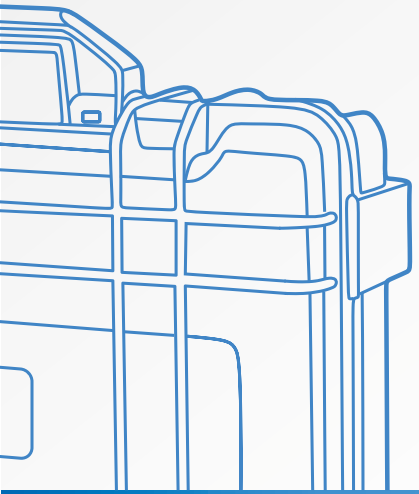
Packaged instruments should be properly and steadily fasted during transportation. When transported in open vehicles the instruments shall be protected from rain and water splashes.

The arrangement and fixation of the packed instruments in transportation vehicles should provide their stable position and exclude strokes against each other as well as against the walls of the transportation vehicles.

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

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

When instruments are transported under the temperatures different to their operating temperature, please put the instrument into the regular conditions and wait at least two hours before starting to use it.



NOTES

ACOUSTIC CONTROL SYSTEMS

ACS

NOTES

NOTES


ACS

ULTRASONIC PULSE VELOCITY TESTER

A1410 **PULSAR**

OPERATION MANUAL

Revision: March 2019