

Contents

1 Intended use 2

2 Technical and metrological characteristics 2

3 Scope of delivery 4

4 Calibrator design and operating principle 4

5 Safety precautions 8

6 Preparation for operation 9

7 Operation 10

8 Maintenance 39

9 Transportation and storage 40

10 Troubleshooting 41

11 Verification methods 42

12 Warranty 42

13 Information on claims 42

14 Acceptance certificate 43

15 Packing certificate 44

16 Note 44

17 Information on precious metal content 44

This operating manual (hereinafter referred to as the OM) applies to the AGK pressure calibrator (hereinafter referred to as the calibrator). The OM is intended for rearing and using by persons operating this calibrator. The OM describes the intended use, technical characteristics, operating principle, design and operation of the calibrator, as well as contains information necessary for correct and safe operation of the calibrator, its maintenance, transportation and storage.

The calibrator must be operated by specially trained personnel with the necessary qualifications in strict accordance with its intended use and the requirements of this OM.

1 Intended use

1.1 The calibrator is intended for accurate creating and measuring excess and absolute pressure.

1.2 The calibrator is used as an exemplary measuring tool (hereinafter referred to as MT) for verification and calibration of measuring tools (hereinafter referred to as MTs), such as calibrators, measuring transducers (sensors), etc.

1.3 The calibrator must be operated under laboratory conditions at an ambient temperature of 15 to 28°C, a relative humidity of 20 to 80%, and an atmospheric pressure of 84 to 106.7 kPa.

2 Technical and metrological characteristics

Table 1 – Main technical characteristics

Characteristic name	Value
Control unit overall dimensions (length; width; height), mm, not more than	610; 450; 240
Power unit overall dimensions (length, width, height), mm, not more than	840; 280; 550
Control unit weight, kg, not more than	37
Power unit weight, kg, not more than	85
Operating environment: - for pressure transducers - for barometric module	water, transformer oil air, nitrogen
Filling volume, not more than, l	3.1
Useful volume, not less than, l	2

Characteristic name	Value
Power supply parameters - AC voltage, V - AC frequency, Hz	220±10 50±1
Power consumption, not more than, V·A	800
Operating conditions: - ambient temperature, °C - relative humidity, % - atmospheric pressure, kPa - shaking, vibration and impacts	from +15 to +28 from 20 to 80 from 84 to 106.7 not allowed

Table 2 – Metrological characteristics

Characteristic name	AGK characteristic value
Absolute pressure measurement ranges, MPa ⁽¹⁾⁽²⁾ - minimum - maximum	from 0.1 to 1.7 from 0.1 to 100.1
Excess pressure measurement ranges, MPa ⁽¹⁾⁽²⁾ - minimum - maximum	from 0 to 1.6 from 0 to 100
Range of absolute pressure measurement by barometric module, kPa ⁽¹⁾	от 80 до 120
Limits of allowable reduced error of excess (absolute) pressure measurements by standard version transducer, % MR ⁽³⁾⁽⁴⁾ :	±0.01; ±0.015; ±0.02; ±0.025; ±0.05; ±0.1
Limits of allowable error of excess (absolute) pressure measurements by MR-50 (IS-50) version transducer ⁽³⁾⁽⁴⁾ : - reduced (from 0 to 50% MR inclusive), % 0,5·MR - relative (from 50 to 100% MR), %	±0.01; ±0.015; ±0.02; ±0.025; ±0.05; ±0.1
Limits of allowable absolute error of excess (absolute) pressure measurements by MV-50 version transducer, MPa ⁽³⁾⁽⁴⁾	±(0.00005·MR + 0.00005·MV); ±(0.00075·MR + 0.000075·MV); ±(0.001·MR + 0.0001·MV); ±(0.000125·MR + 0.000125·MV); ±(0.00025·MR + 0.00025·MV); ±(0.0005·MR + 0.0005·MV)
Limits of allowable relative error of absolute pressure measurements by barometric module, %	±0.01

MR = measurement range, MPa; MV = measured value, MPa.

⁽¹⁾ It is allowed to select other measurement units approved for use in the Russian Federation.

⁽²⁾ In accordance with an order, the calibrator is completed with transducers with any measurement range lying in the specified measurement range from minimum to maximum inclusive.

⁽³⁾ The specific error value (accuracy class code) is indicated in the passport for the calibrator, as well as on the transducer housing and is displayed in the calibrator menu.

⁽⁴⁾ In case of measurements of excess (absolute) pressure using absolute (excess) pressure transducers and a barometric pressure module, to the error of measuring the pressure of transducers with upper measurement limits (UMLs) from 1.6 to 2.5 MPa g (from 1.7 to 2.6 MPa abs.) inclusive, one low order unit is added (+1 LO unit). For transducers with UMLs over 2.5 MPa g (2.6 MPa abs.) the error does not change.

3 Scope of delivery

Control unit	1 pce
Power unit	1 pce
Pressure transducers*	<i>on order</i>
Barometric module*	<i>on order</i>
Operating manual (AP.078.000.000.RE)	1 copy
Set of connecting cables	1 set
Verification method (AP-02-2021)	1 copy
Stainless pipe	2 m

* – Installed inside the control unit.

4 Calibrator design and operating principle

4.1 The appearance of the calibrator and its component parts is shown in Figure 1.

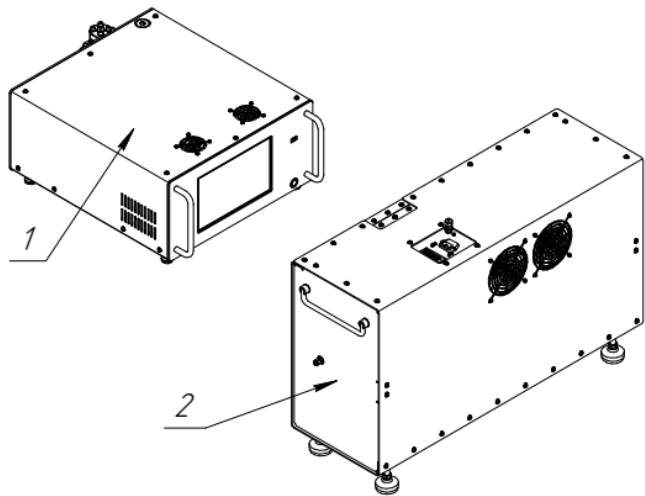


Fig. 1. Calibrator and its component parts
1 – control unit; 2 – power unit

4.2 The calibrator consists of two parts: a control unit and a power unit. It is advisable to install the control unit on a table, and the power unit on

the floor. These units are connected between each other via a stainless steel pipe and a control cable.

The control unit is shown in Figure 2.

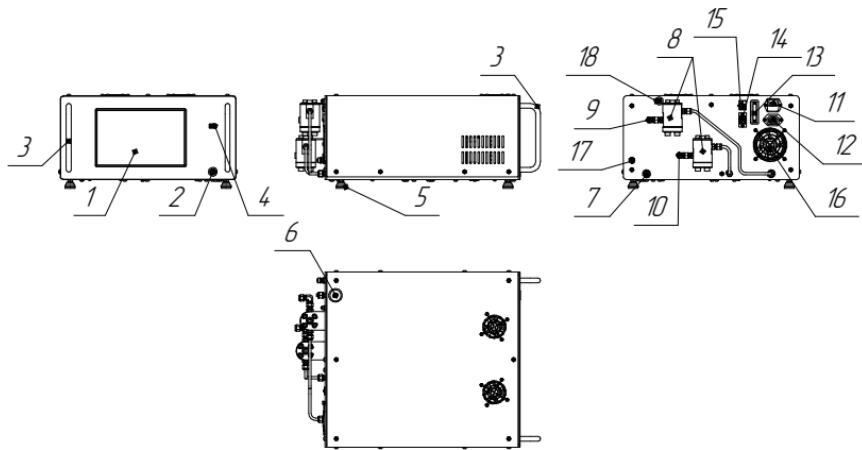


Fig. 2. Control unit

1 — display; 2 — on button; 3 — handle; 4 — USB connector; 5 — foot;
6 — filler neck plug; 7 — emptying fitting plug; 8 — filter; 9 — fitting for outlet
line connection; 10 — fitting for connection with power unit; 11 — 220 V power
supply connector; 12 — connector for power unit power supply;
13 — connector for control cable; 14 — Ethernet connector; 15 — USB connector;
16 — fan; 17 — barometer output; 18 — breather

4.3 The calibrator control unit is made in a desktop version. The housing is made of metal. On the front panel there are touch display 1 (Fig. 2), calibrator on button 2, USB connectors 4 and handles 3. The display shows readings of the calibrator and all the necessary data. In addition, the display is used to control the calibrator, enter data and change operating parameters. On top there is filler neck plug 6.

On the rear panel there are the working liquid drain fitting closed with plug 7, outlet fitting 9, fine filters 8, connector for connection of control cable 13, connector for connection of calibrator power supply to a 220 V network 11, connector for connecting power supply of power unit 12, breather 18 and fan 16. Fitting 10 is designed for connecting the power unit to the control unit.

The appearance and design of filter 8 are shown in Figure 3.

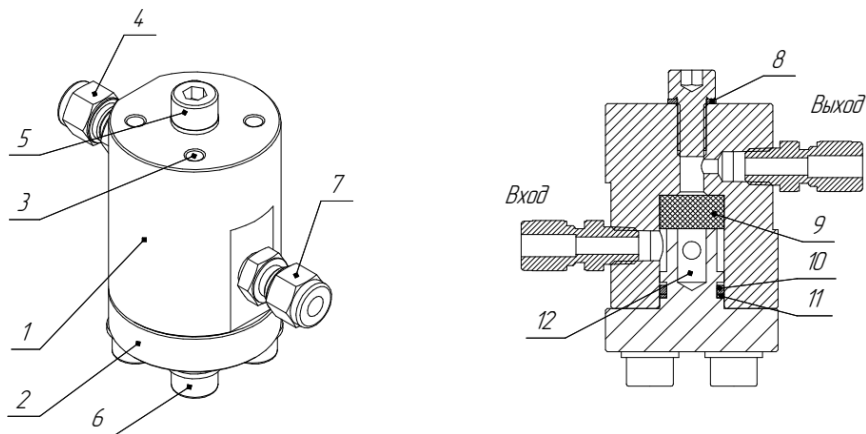


Fig. 3. Filter

- 1 — housing; 2 — cover; 3 — mounting holes; 4 — outlet fitting;
 5 — technologic screw; 6 — mounting screws; 7 — inlet fitting;
 8 — rubber-metal seal; 9 — filter element; 10 — rubber ring; 11 — retaining ring;
 12 — cavity for settling

4.4 Filter housing 1 (Fig. 3) and cover 2 are made of stainless steel. Filter element 9 made of thin pressed stainless wire is installed inside the housing. The filter element is compressed by the cover, which is sealed with circular section rubber seal 10. On top there is technologic screw 5 closing the technologic hole. The technologic hole is used for pushing out the filter element during its maintenance.

The appearance of the power unit is shown in Figure 4.

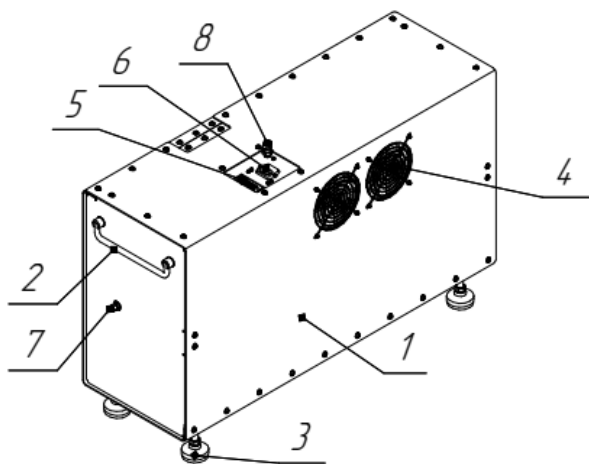


Fig. 4. Power unit

- 1 — housing; 2 — carrying handle; 3 — foot; 4 — vent holes;
 5 — connector for control cable; 6 — power connector; 7 — fitting for bleeding;
 8 — fitting for connection of power unit to control unit

4.5 All elements of the power unit are located in metal housing 1 (Fig. 4) equipped with handles 2 for carrying it and adjustable feet 3. To ensure normal thermal conditions, the housing has vent openings 4 and fans (located on the opposite side). For connection to the control unit, there is connector 5 for the control cable and connector 6 for the power cable on the upper side of the housing. Fitting 7 is intended for bleeding the system, while fitting 8 is intended for connecting the power unit to the control unit.

The connection layout is shown in Figure 5.

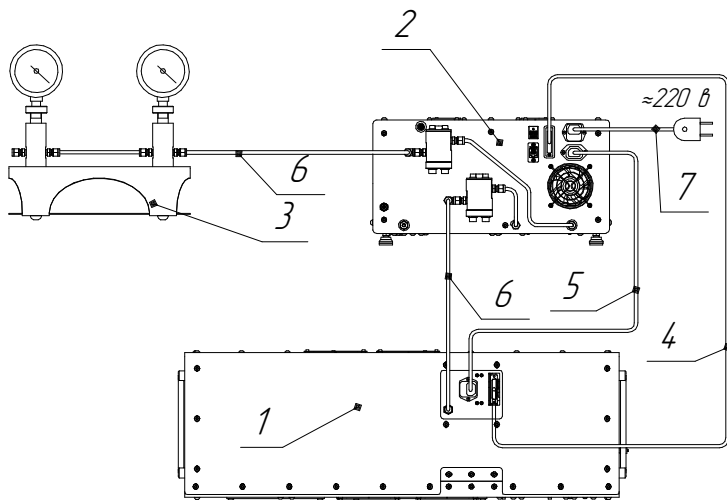


Fig. 5. Layout of calibrator connections

- 1 — power unit (top view); 2 — control unit (rear view);
 3 — manifold for MTs (not included); 4 — control cable; 5 — power cable;
 6 — connecting pipe (not included); 7 — calibrator power supply cable

5 Safety precautions

5.1 This section is aimed at ensuring the safe operation of personnel, as well as the safety of the calibrator and other equipment used together with it.

5.2 In some cases, the calibrator allows you to increase pressure up to 1000 bar very quickly, so you need to be very careful and not get distracted when working with it.

5.3 It is prohibited to use the calibrator for works not specified in this manual.

5.4 Before switching on the calibrator, carefully inspect it and make sure that there are no mechanical damages and that its elements are securely fastened.

5.5 It is forbidden to use the calibrator with faulty electrical wires and faulty plug of its power cord.

5.6 It is only permissible to connect the calibrator to an electrical network with a third, grounding contact. Appropriate specialists must confirm that this contact is grounded.

5.7 To avoid electric shock, connect the calibrator through a protective residual current circuit-breaker (RCCB) designed for operating currents of 10...16 A and a shut-off current of 10 or 30 mA

5.8 If the calibrator was exposed to a low temperature for a long time, it should be left without use at room temperature for at least 12 hours.

Caution

It is prohibited to troubleshoot the calibrator, if it is connected to an electrical network.

Caution

It is forbidden to work with the calibrator with its control unit or power unit open.

5.9 In case of occurring any foreign sounds and/or odors, immediately turn off the calibrator, disconnect it from the electrical network and consult a specialist.

5.10 The calibrator should only be repaired by specially trained personnel.

6 Preparation for operation

6.1 Unpack the calibrator and make sure that none of its parts is damaged.

6.2 Wipe all parts of it with clean cloths.

6.3 Install the control unit on a work surface (table). For connection of MTs to be verified, it is recommended to use a manifold of the KL series. It is advisable to install the collector on the same horizontal surface with the control unit.

6.4 Install the power unit on the floor. It is advisable to install the power unit lower than the control unit.

6.5 Connect the units together with electrical cables and hydraulic pipes as shown on the connection layout (Fig. 5).

6.6 Connect the calibrator to a 220 V electrical network. The used electrical network must have a grounding contact.

6.7 Turn on the calibrator and let it warm up for 15 minutes.

6.8 Fill in the working liquid. Unscrew filler neck plug 6 (Fig. 2) and pour the working liquid into the tank, while being guided by readings of the working liquid level sensors (before the upper level sensor is triggered).

6.9 Pump the hydraulic system (clause 7.3).

6.10 Perform the pressure creation test.

7 Operation

7.1 Upon switching on the calibrator, its firmware is automatically downloaded. After download completion, dialog box “Рекомендуется произвести калибровку штоков. Выполнить?” [It is recommended to calibrate the stocks. Execute?] appears on the screen. If you press the Да [Yes] button, the stocks will be calibrated (passage of both stocks from one end to the other with calculation of the number of steps and retraction of the stocks to their original positions). It is allowed not to calibrate the stocks by pressing the Нет [No] button, if the calibration was performed during the previous power-on, but the calibrator did not perform the setting and measurement functions.

7.2 Upon completing the calibration, the working screen looks as follows (Fig. 6).

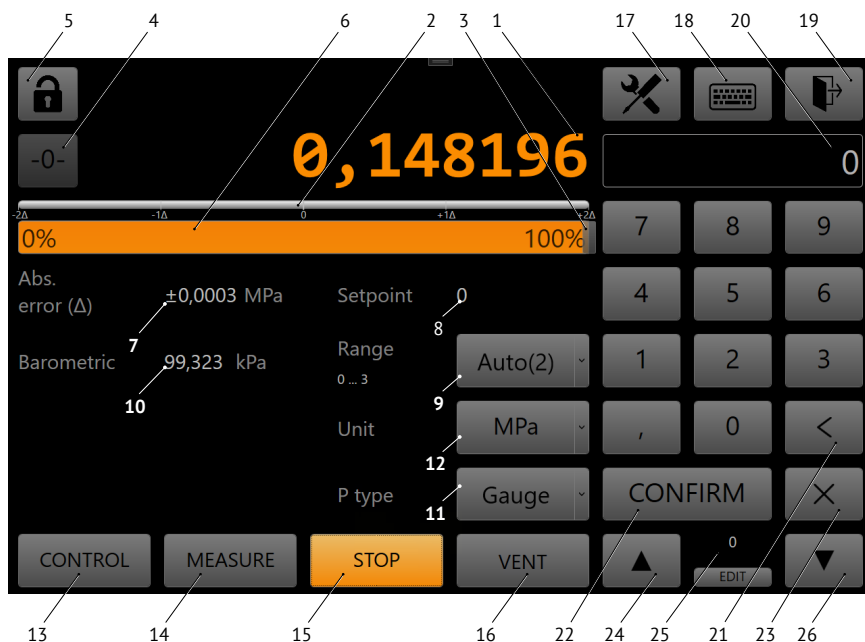




Fig. 6. Working screen elements

There are the following elements on the working screen:

- (1) — Field for output of the measured pressure for the selected pressure transducer (hereinafter referred to as the sensor) into (9)
- (2) — Indicator of deviation of the received pressure from setpoint (8)
- (3) — Setpoint marker on the pressure scale

- (4) — Button for resetting of sensors
- (5) — Screen lock button
- (6) — Pressure scale from 0 to 100% (from the maximum set in field 14)
- (7) — Error limit value output field
- (8) — Current setpoint value output field
- (9) — Sensor selection menu (1, 2, 3, Auto)
- (10) — Current barometric pressure output field
- (11) — Absolute/redundant operating mode selection menu
- (12) — Menu for selecting working units of pressure measurement
- (13) — Button for switching on “Setting” mode
- (14) — Button for switching on “Измерение [Measurement]” mode
- (15) — Button for switching on “Стоп [Stop]” mode
- (16) — Button for switching on “Сброс давления [Pressure relieve]” function
- (17) — Settings menu button
- (18) — Setpoint input type selection menu button
- (19) — Calibrator off button
- (20) — Setpoint input field
- (21) — Button for deleting the last digit from input field 20
- (22) — Button for setpoint entering and starting of pressure setting in “Задание [Setting]” mode
- (23) — Button for cleaning input field 20
- (24) — Button for setpoint increase by step size
- (25) — Setpoint change step input/output field
- (26) — Button for setpoint decrease by step size


7.2.1 Protection of the screen from accidental pressings is carried out via locking the screen by pressing button 5 (Fig. 6). The unlock password is “0000”.

7.3 Bleeding the system is a procedure for removing air from the working volumes of the calibrator. Bleeding is performed when the calibrator is switched on for the first time after filling with the working liquid or in case performance deteriorates (deceleration of pressure build-up due to air entering the working volume). The bleeding algorithm is started from the service menu; to do this: press the  button, select **Сервис → Функции [Service → Functions]** in the menu that opened, perform the bleeding algorithm (clause 7.8.3.3). Press the  button to return to the working screen. Press the **Сброс [Relieve]** button.

7.4 After bleeding the calibrator, external connected volumes should be filled with the working liquid and deaerated. To do this, leave open the

places of MTs connections (for example, the columns), press the **Задание [Setting]** button on the working screen, select a measurement unit (for example, **Бар [Bar]**), press the number **1** on the keyboard, press the **Ввод [Enter]** button. The algorithm for setting a pressure of 1 bar will start, the liquid from the calibrator will be fed to external volumes and displace air. When the liquid without the air comes out from all open points, press the **Стой [Stop]** button to stop pressure generation. After that, install MTs or plugs on the columns. Press the **Сброс [Relieve]** button on the working screen to return the stocks to their original positions and relieve pressure. Then perform zero calibration (clause 7.8.1). Upon completion of zero calibration, the calibrator is ready to operate in the pressure setting and measurement modes.

7.5 Pressure setting mode.

7.5.1 The pressure setting mode is switched on by the **Задание [Setting]** button on the main screen. For protecting the equipment connected to the calibrator, it is recommended to set the “maximum pressure” parameter (the **Ред. [Edit]** button under (14), Fig. 6) corresponding to the allowable operating pressure of this equipment. Then select the *absolute/excess pressure mode, units of measurement and sensor (Авто [Auto], 1, 2, 3)* on the main screen. If the *Авто* sensor is selected, the calibrator sets the pressure according to the sensor, within the range of which the set value lies, i.e. automatically. If a specific sensor (1, 2, or 3) is selected, the calibrator sets the pressure according to the selected sensor. If the setpoint is higher than the UML of the selected sensor, the calibrator goes into the *Авто* mode. On the numeric keypad, enter the desired setpoint value and press the **Ввод [Enter]** button. The pressure setting algorithm will start. When the pressure reaches the error margin (stabilization) limits, the color of the displayed pressure value in the output field (1 from clause 7.2) will change to green, and when these limits are exceeded, the color will turn orange again. Error margin (stabilization) limits are edited in menu  **Калибратор [Calibrator] → Предел стабилизации [Stabilization margin]** (clause 7.9.1).

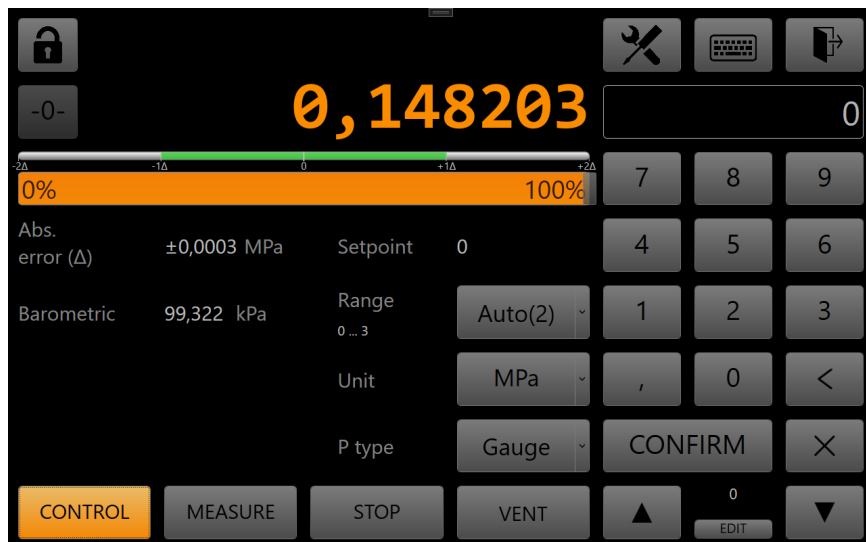



Fig. 7. The working screen in the setting mode

7.5.1.1 When the calibrator is operating in the absolute (excess) pressure setting mode with the use of excess (absolute) pressure transducers and a barometric pressure module, a low-order unit is added (+1 LO unit) to the absolute (excess) pressure setting error (only for transducers with upper measurement limits from 1.6 to 2.5 MPa g (from 1.7 to 2.6 MPa abs.); for other measurement ranges, the error limit remains unchanged).

7.5.2 The setting can also be changed by pressing the corresponding buttons by one step up ▲ or down ▼, and the step can be edited by pressing the **Edit** button under the numeric keypad.

7.5.3 When the  button is pressed, the setpoint input type menu appears with the following items: **Ручной ввод, Задан. процент, Программа** [Manual input, Set percentage, Program]. The numeric input keyboard corresponds to the **Manual input** item. When selecting the **Задан. процент** item for the input type, the digital input panel takes the form shown in Fig. 8.

Dividing the working range from the minimum to the maximum set pressure into points is carried out automatically (the number of points is selected). Correction of each point is also available. It is possible to “move” the points up and down by one step with the corresponding ▲ and ▼ buttons.

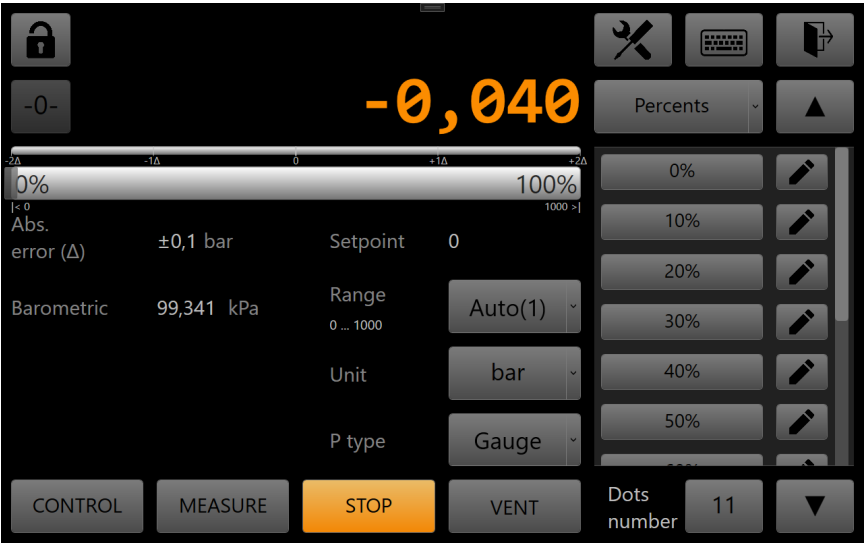


Fig. 8. Entering the percentage setpoint

7.5.3.1 When selecting the **Πporpamma** item for the input type, the screen takes the following form (Fig. 9).

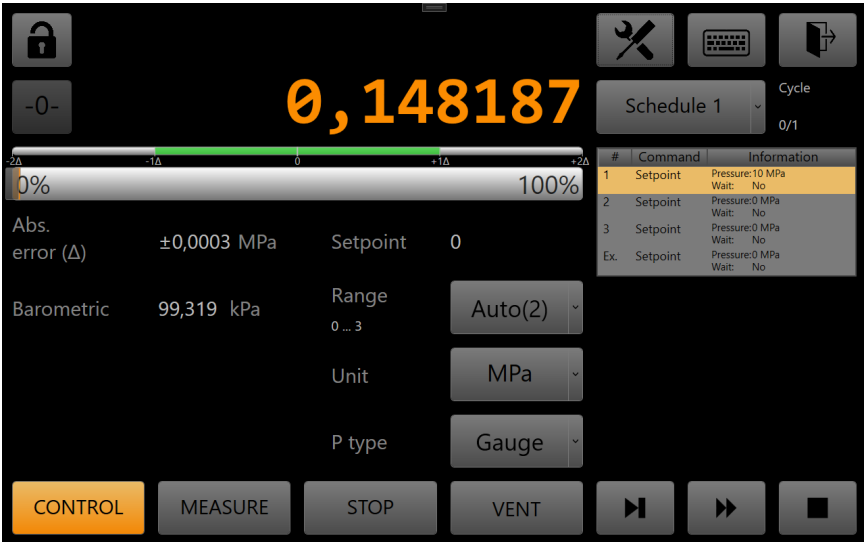







Fig. 9 Pressure setting according to a program


The program selection menu is displayed in the program field (**Πporpamma 1** [Program 1] by default). The list of commands displays the

program number (column № [No.]), the command name (column Команда [Command]) and the function being performed (column Информация [Information]). After pressing the  button, the selected program starts working from the first command, and then performs a sequential transition to the next one. The current command is highlighted in color. If transition to the next command is to be carried out by pressing the  button, this button blinks. In the Цикл [Cycle] field, values “текущий цикл/максимальное число циклов [current cycle/maximum number of cycles]” are indicated. If “∞” is indicated in the Цикл field, the number of cycles is infinite.

After passing each cycle, the commands start to be executed anew, starting from the first one.

When the maximum number of cycles is completed, the Выход [Exit] command is executed.

To stop executing commands, press the  button. To pause executing commands, press the  button; pressing this button again resumes execution of the program. In the pause mode, the  button blinks.

7.5.3.2 Editing programs is carried out in the  Программы [Programs] menu (clause 7.11).

7.6 Pressure measurement mode

7.6.1 The measurement mode is switched on by the Измерение [Measurement] button on the main screen (Fig. 10). Then select the *absolute/excess pressure mode, units of measurement and sensor (Авто [Auto], 1, 2, 3)* on the main screen. If the Авто sensor is selected, the calibrator outputs the pressure value of the sensor, in the range of which the measured pressure lies. Sensors with low ranges are cut off by valves. If a specific sensor is selected, a pressure value is output from this sensor. A strikethrough pressure value means that the selected sensor is currently cut off from the measured volume by the valve due to the fact that the current pressure exceeds the UML of the selected sensor. When approaching the UML of the selected sensor, it is recommended to increase pressure smoothly or in the Auto mode.

7.6.2 Before operation in the measurement mode, it is recommended to perform *Zero calibration* (clause 7.8.1).

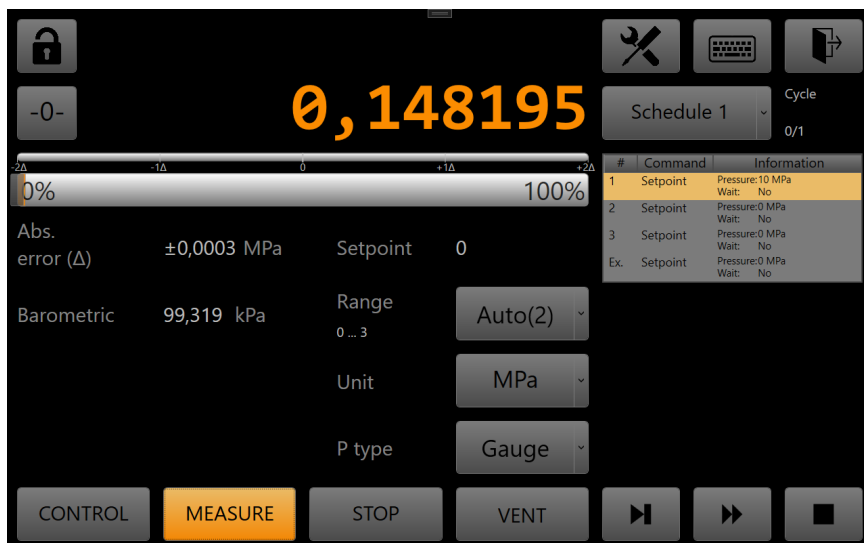



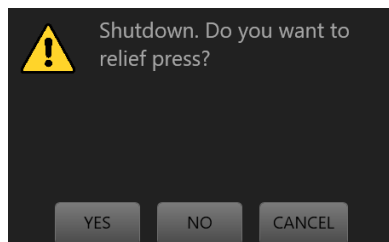
Fig. 10. Pressure measurement mode

7.7 Switching off the calibrator


For switching off the calibrator, press the  button.

Pop-up message *“Выключение. Произвести сброс давления?”* [Switching off. To relieve pressure?]

will appear. If pressure relieve has already been performed earlier, press **Нет** [No], and the calibrator will switch off. If pressure relieve has not been performed earlier, press **Да** [Yes]; pressure will be relieved and the calibrator will switch off. After switching off the calibrator, it is recommended to disconnect it from the 220 V network.



7.8 Service menu

7.8.1 If after pressure relieve readings of sensors significantly differ from the zero value (more than the accuracy class), zero calibration of sensors is required. For zero calibration:  **Сервис** → **Калибровка нуля** [Service → Zero calibration].

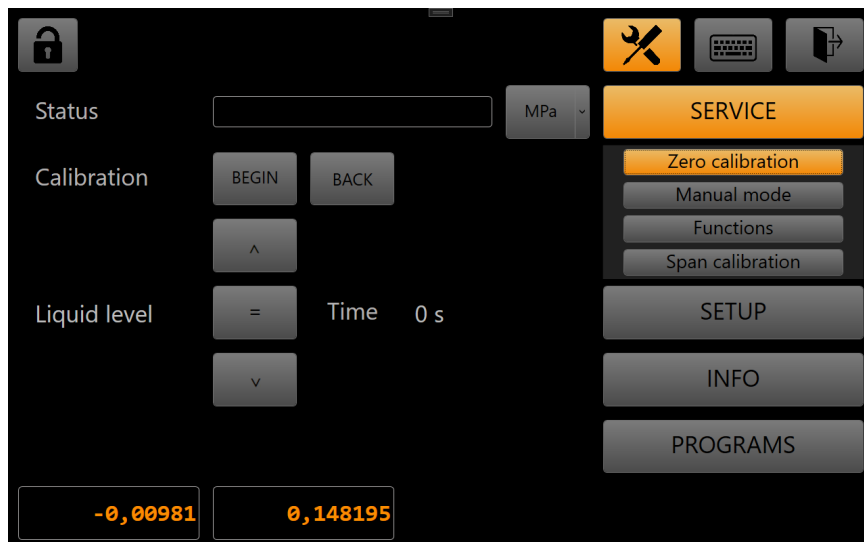






Fig. 11. Zero calibration of sensors

7.8.1.1 For correct calibration, it is necessary to bring the liquid level under the connection cut (for example, a column) of an external appliance — it should be controlled visually. To do this, in the **Калибровка нуля [Zero Calibration]** window, use the  button to raise the liquid level, the  button to lower the level, the  button to stop changing the level. It is also possible to change the liquid level with an external device, if it is present in a connected external volume. When the liquid level in height corresponds to the connection cut of the MT, press the **Начать [Start]** button. The zero calibration process lasts 10 seconds, and pressure values from connected sensors are displayed in the corresponding output fields at the bottom of the window. Calibration reset (“rollback”) is carried out by the **Откат [Rollback]** button.

7.8.2 Calibration of sensors is required after installing new pressure transducers (sensors) into the calibrator or for improving the measurement accuracy of the previously installed ones. To do this, select  **Сервис → Калибровка датчиков [Service → Calibration of sensors]** (Fig. 12).

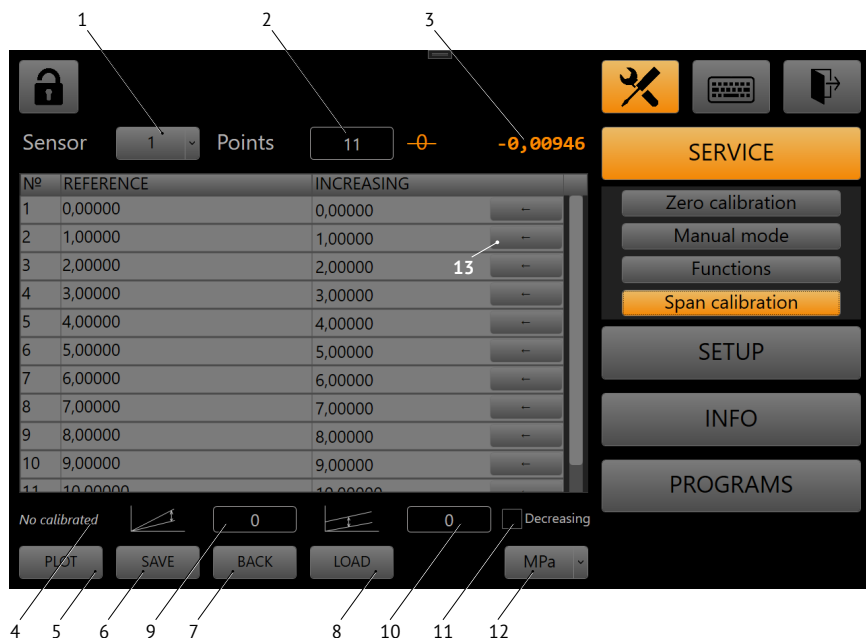


Fig. 12. Calibration of sensors

Access to this section is carried out using the password “814507”, which is a service one.

7.8.2.1 The following elements are available to the user in the sensor calibration window:

- (1) selection of the sensor for which calibration will be performed N (N = 4 = “Бар” [Bar]);
- (2) entering the number of smooth points (**Точки [Points]**);
- (3) current calibrated pressure (with the account for the last calibration);
- (4) indication of the current calibration (**Не калиброван/Заводская/Пользовательская [Not calibrated/Factory/User-defined]**);
- (5) button for switching to graph display **ГРАФИК/ТАБЛИЦА [Graph/Table]**;
- (6) button for saving the current calibration **СОХРАН. [Save]**;
- (7) button for rollback to the previous saved calibration **ОТКАТ [Rollback]**;
- (8) button for uploading calibration coefficients from a file **ЗАГРУЗ. [Upload]**;
- (9) editing the calibration characteristic slope;
- (10) editing the calibration characteristic linear offset;
- (11) activating back stroke (**Обр. ход [Back stroke]**);
- (12) button for selecting current units of measurement;
- (13) button for entering the current pressure into the table line.

In the central part of the window, a table is shown in which the following values are displayed:

- **№ [No.]** — calibration point number (line number);
- **Эталон [Reference]** — pressure values given by an external reference pressure source;
- **Прямой ход [Forward stroke]** — verified values from a sensor when pressure increases;;
- **Обратный ход [Back stroke]** — verified values from a sensor when pressure decreases. Reference pressure values are uniformly distributed in interval [0 UML]. When changing the sensor or the number of points, reference, verifiable values are recalculated for the current UML (N).

7.8.2.2 It is possible to edit reference, verifiable values or the number of points by clicking on the corresponding box or by pressing the Точки [Points] button. This will open an input window.

There are some restrictions on input values for the column of reference values:

- for the first point: limits from LML - L to LML + L, where $L = 0.25 * 0.01 * \text{UML}$.
- for subsequent points: from Pref - Pst to Pref + Pst, where Pst is a step of pressure change calculated automatically for K points.

For columns of verifiable values, restrictions on input values: from Pref - L to Pref + L.

7.8.2.3 If the **Обр. ход [Back stroke]** function is switched on, the values by which smoothing is executed are calculated by the formula: $P_{av} = (P_{f.str} + P_{b.str})/2$. If the **Обр. ход** function is switched off, the values by which smoothing is executed are calculated by the formula: $P_{av} = P_{f.str}$.

7.8.2.4 To view the reduced error graph, press the **ГРАФИК [Graph]** button (Fig. 13).

The graph shows the following dependencies:

- | | | |
|---------------------------|--|------------|
| - error at forward stroke | $E = (Pref - P_{f.str}) * 100 / \text{UML} [\%]$ | (orange) |
| - error at back stroke | $E = (Pref - P_{b.str}) * 100 / \text{UML} [\%]$ | (lilac) |
| - averaging error | $E = (Pref - P_{av}) * 100 / \text{UML} [\%]$ | (sky blue) |
| - smoothing error | $E = (Pref - P_{corr}) * 100 / \text{UML} [\%]$ | (green) |
| - error margin | D [%] | (red) |

where D is a function of the error limit, depending on the sensor version:

- | | |
|-----------------------------------|--|
| - for the standard sensor version | $D = \pm KT,$ |
| - for the IS-50 version | $D = \pm KT * 0.5$ (at $Pref < 0.5 * \text{UML}$),
$D = \pm KT * Pref$ (at $Pref \geq 0.5 * \text{UML}$), |
| - for the MV-50 version | $D = \pm KT * 0.5 * (\text{UML} + Pref).$ |

If the **Обр. ход [Back stroke]** function is switched off, lilac and sky blue graphs are not displayed.

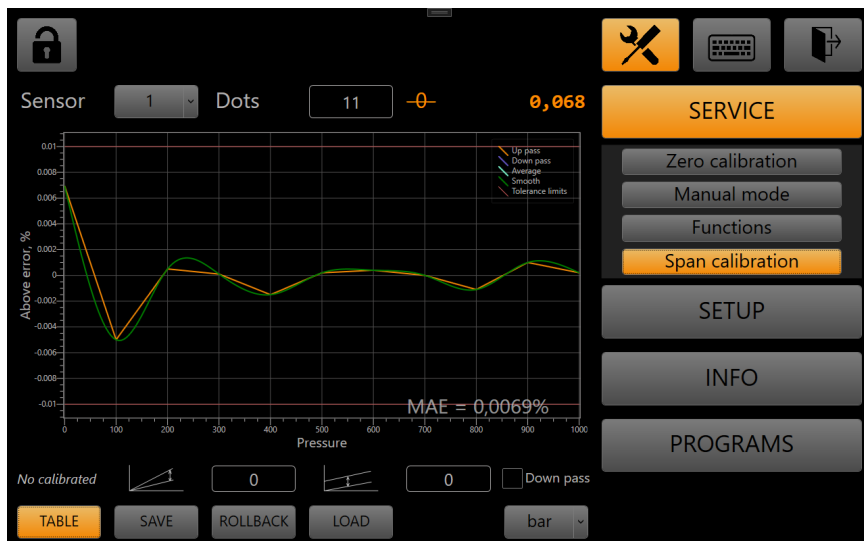


Fig. 13. Graphs of calibration of sensors

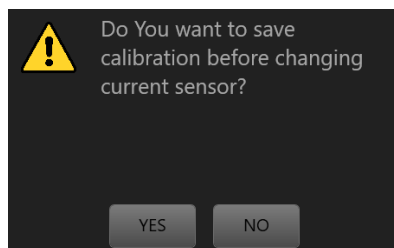
The values of the points of reference pressures in set measurement units correspond to the horizontal axis. The values of the reduced error as a percentage of the UML of a sensor correspond to the vertical axis.

If the currently selected sensor is changed or the back stroke function is switched on/off, the graphs are rebuilt automatically.

The **МПО [MRE]** field displays the maximum deviation of the reduced error for all calculated points.

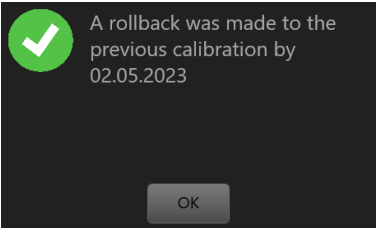
You can return to the table by pressing the **ТАБЛИЦА [Table]** button.

7.8.2.4.1 When making changes to calibration settings, the **СОХРАН. [Save]** button begins blinking to indicate that saving is needed. When changing the currently selected sensor, the number of points or switching off the calibrator, it is proposed to save the current changes. For example, when changing the current sensor, a box with the following text is displayed: “Save the values before changing the current sensor?”. To confirm saving the values, press the **ДА [Yes]** button.



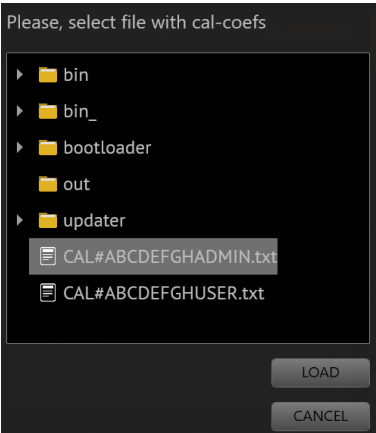
7.8.2.4.2 Upon pressing the **СОХРАН. [Save]** button, the current coefficients will be recorded to the corresponding file of sensor configuration. From now forth, these coefficients will always be applied to the sensor with this serial number. Upon saving, the button stops blinking.

7.8.2.4.3 For restoring previously recorded calibration parameters, press the **ОТКАТ [Rollback]** button. You can select the type of calibration parameters to roll back to the parameters of this type (Заводские [Factory] or Пользовательские [User-defined]). In case the operation is successfully completed, a confirmation box is displayed.

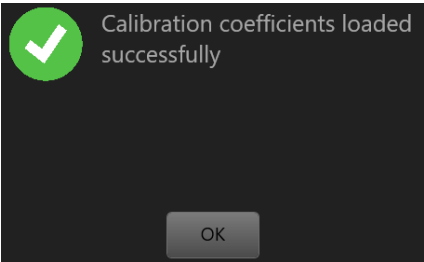
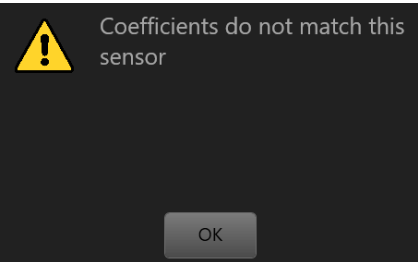


7.8.2.4.4 For uploading calibration coefficients from a file, press the **ЗАГРУЗ. [Upload]** button, then select a file from the connected flash drive and upload for the current sensor. If no flash drive is founded, a box with the corresponding message appears.

In such a case, it is necessary to select **Настройки [Settings] → Обновления [Updates]** and change option “Путь расположения обновлений” [Path of updates location]. If the specified disk is connected, the box shown on the right will be displayed.



If the serial number of the current sensor does not match the serial number of the file of coefficients, the message box shown on the bottom left appears. In case of successful upload, the message box shown on the bottom right appears.



7.8.3 Menu **Функции [Functions]**

7.8.3.1 Сброс давления [Pressure relieve] is the algorithm for pressure relieve in the calibrator and a working volume connected to it to zero (atmospheric pressure). At the first stage, the stocks retreat to their initial positions; when the pressure drops below 0.5 bar, the liquid is drained into the tank; upon draining, the calibrator switches to the **Стоп [Stop]** mode. To start relieving, press the **Начать [Start]** button in the **Сброс давления** line. To stop relieving, press the **Остановить [Stop]** in the **Сброс давления** line.

7.8.3.2 Слив жидкости [Liquid drain] is the algorithm for draining liquid from the calibrator. To drain, you need to open the drain plug of the tank. To start draining, press the **Начать** button in the **Слив жидкости** line. To stop draining, press the **Остановить** button in the **Слив жидкости** line.

7.8.3.3 Прокачка [Bleeding] is the algorithm for filling the internal volumes of the calibrator with the working liquid, divided into two stages — bleeding the lower (power) unit and bleeding the upper (control) unit. An algorithm for checking the degree of filling the calibrator with the working liquid (the bleeding degree) is also provided.

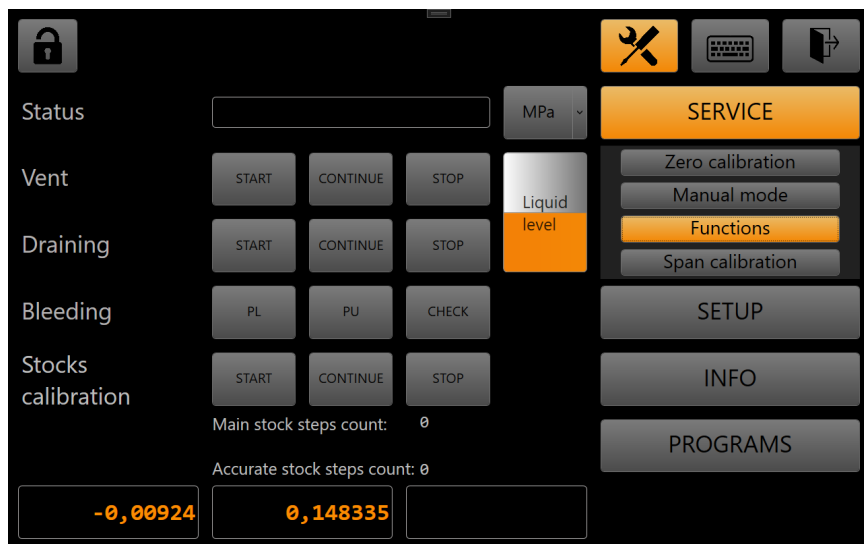
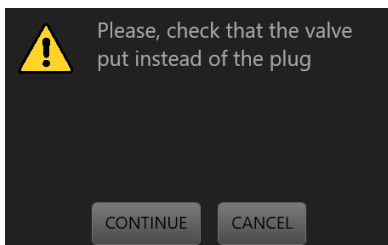


Fig. 14. Service function menu

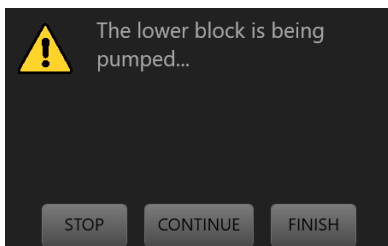
When the calibrator is switched on for the first time after filling in the working liquid, it is required to conduct a complete bleeding (first of

the lower unit and then of the upper one). Subsequently, it is allowed to separately bleed the lower unit, bleed the upper unit or check the degree of filling the calibrator.

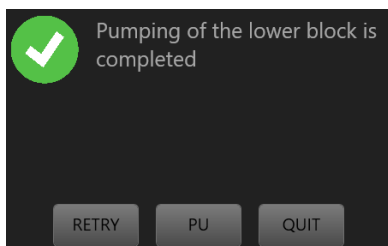
7.8.3.3.1 Bleeding the lower (power) unit. Preliminarily, it is required to unscrew the plug on the side of the power unit, install a special valve in its place, and then press the **ПН [BL]** button (Fig. 14). Message “Проверьте, что клапан установлен вместо заглушки” [Check that the valve is installed instead of the plug] will appear; press the **Продолжить [Continue]** button. The bleeding algorithm will start; air and the working liquid will come out of the valve.



The following message will appear: “Выполняется прокачка нижнего блока...” [Bleeding the lower unit is being performed...]. During bleeding, it is necessary to visually assess the presence of air in the outgoing liquid. If the liquid comes out without air, press the **Завершить [Finish]** button. The algorithm executes 10 cycles, upon which it terminates. The **Стоп [Stop]** button pauses the bleeding algorithm, which can be resumed by pressing the **Продолжить [Continue]** button.



Upon completion of 10 bleeding cycles or pressing the **Завершить** button, message “Прокачка нижнего блока выполнена” [Bleeding the lower unit is completed]. If it was visually established that air continued to escape from the valve along with the working liquid, press the **Повтор [Repeat]** button and execute bleeding the lower unit again. To finish bleeding and return to the menu, press **Выход [Exit]**. To start bleeding the upper unit, press **ПВ [BU]**. Upon completion bleeding the lower unit, dismantle the valve and install the plug in its place.



7.8.3.3.2 Bleeding the upper (control) unit.

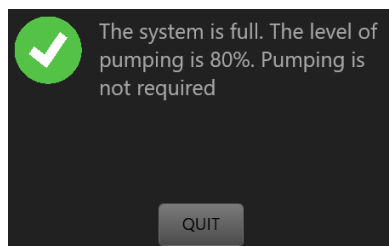
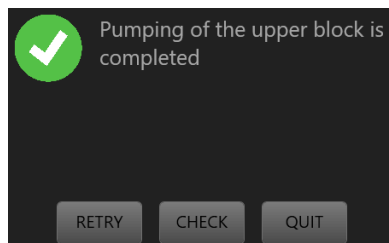
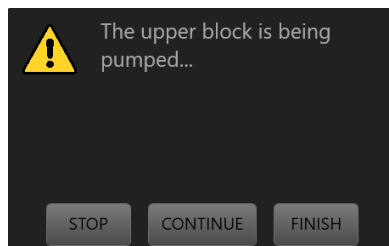
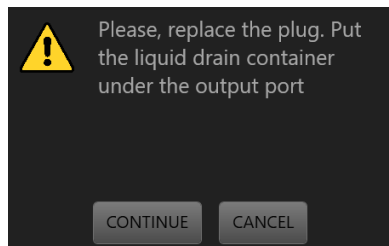
After pressing the **ПВ** button (Fig. 14), the following message appears: “Проверьте, что заглушка установлена на место. Установите емкость для сброса жидкости под выходной порт” [Check that the plug is installed

in place. Install a container for liquid drain under the outlet port]”. Follow these instructions, then press the **Продолжить [Continue]** button. You can cancel the bleeding algorithm and return to the menu by pressing the **Отмена [Cancel]** button.

Pressing the **Продолжить** button starts the algorithm of bleeding the upper unit, i.e. pressure generation on different sensors with subsequent liquid drain into the tank or through the output port of the calibrator. The following message will appear: “Выполняется прокачка верхнего блока...” [Bleeding the upper unit is being performed...]. The **Стоп [Stop]** button pauses the bleeding algorithm, which can be resumed by pressing the **Продолжить** button. The **Завершить [Finish]** button cancels bleeding the upper unit. Upon completion of the algorithm of bleeding the upper unit, the following message appears: “Прокачка верхнего блока выполнена” [Bleeding the upper unit is completed]. For repeating the algorithm, press the **Повтор [Repeat]** button. For finishing the bleeding operation and returning to the menu, press the **Выход [Exit]** button. Upon completion of the bleeding operation, it is recommended to check the degree of filling the calibrator with the working liquid.

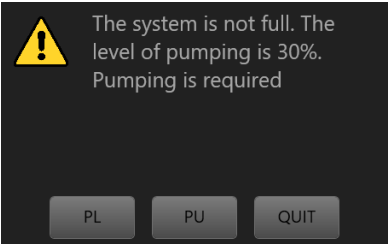
7.8.3.3.3 Checking the degree of filling the calibrator with the working liquid.

The check is performed to determine whether the calibrator needs to be bled. For performing the check, the plug must be installed in its place on the side of the power unit. To start the check, press the **Проверка [Check]** button in the **Прокачка [Bleeding]** line of the **Сервис [Service]** → **Функции [Functions]** menu (Fig. 14). The



check algorithm will start, upon ending of which the following message will appear: “Система заполнена. Степень прокачки 80%. Прокачка не требуется. [System is filled. Bleeding degree is 80%. Bleeding is not required.]”. For returning to the menu, press **Выход [Exit]**. The greater the bleeding degree (BD), the faster the calibrator generates pressure. BD allowable values: 50-100%.

If the BD is lower than 50%, the following message will appear: “Система не заполнена. Степень прокачки 30%. Требуется прокачка. [System is not filled. Bleeding degree is 30%. Bleeding is required.]”. Press **ПН [BL]** or **ПВ [BU]** to perform bleeding the lower or upper unit, respectively. If the lower unit has already been bled earlier, it is recommended to bleed the upper unit. The **Выход [Exit]** button is used for return to the menu.



7.8.4 Service section **Ручной режим [Manual mode]** is not available to the user.

7.9 Menu **Настройки [Settings]**

7.9.1 Item **Калибратор [Calibrator]**.

Settings of calibrator operation parameters are available in this section of settings.

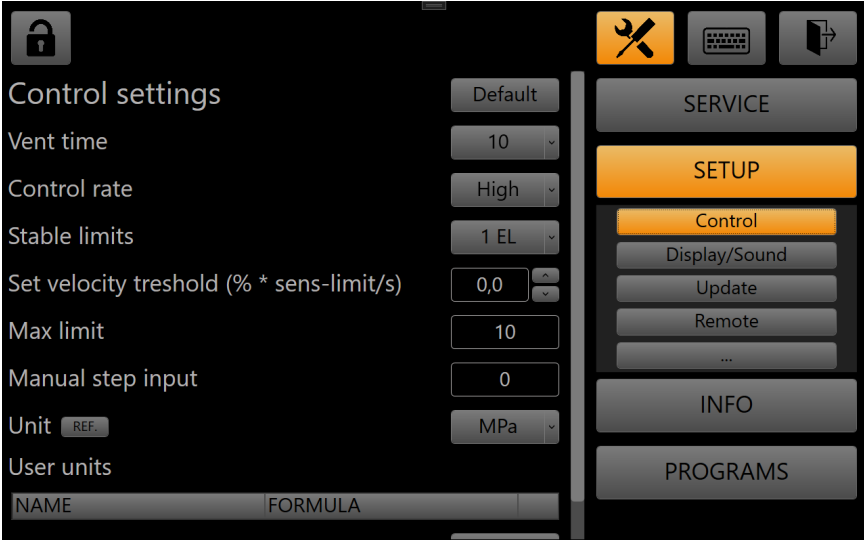


Fig.15. Calibrator settings

The following settings are available:

Table 4

Parameter	Restrictions	Comments
Усреднение значений давления [Averaging of pressure values]	Откл. [Off] Низкое [Low] Среднее [Middle] Высокое [High]	To refine readings of the sensors, it is possible to select the necessary averaging.
Скорость задания давления [Pressure setting velocity]	Низкая [Low] Средняя [Middle] Высокая [High]	The lower the setting velocity, the less possible overshoot. It is recommended to select the parameter based on the connected volume. The larger the volume, the higher the required velocity.
Предел стабилизации [Stabilization margin]	½, 1, 2, 5, 10, 100 sensor accuracy classes	Changes the "green zone" on the main screen.
Орп. скорости задания (% от ВПИ) [Setting velocity restriction (% of UML)]	0.1 – 25.5 %*	To protect connected devices, the pressure setting velocity is limited in % of the UML per second.
Максимальное давление [Maximum pressure]	0...ВПИ основного датчика [0...UML of the main sensor]*	It is recommended to set a value equal to or lower than the operating pressure limit of the connected devices.
Шаг ручного ввода [Manual input step]	0...Максимальное давление [0...Maximum pressure]*	
Единицы измерения [Measurement units]	кПа [kPa] МПа [MPa] Бар [Bar] Psi кгс/см² [kgf/cm²]	
Пользовательские единицы измерения [User-defined measurement units]		Allows you to add new measurement units.

* When editing parameters having numerical values, a window with an input keyboard appears. Enter the desired value (the range for input values is indicated under the input line) and confirm it by pressing the **Ввод** [Enter] button. For erasing the last entered digit, press the < button; for clearing the input line, press X. For cancelling the value adjustment and returning to the settings menu, press **Отмена** [Cancel].



7.9.2 Item **Отобр./звук [Displaying/sound]**

This section of settings is used to change parameters of displaying information on the screen, as well as sound parameters.

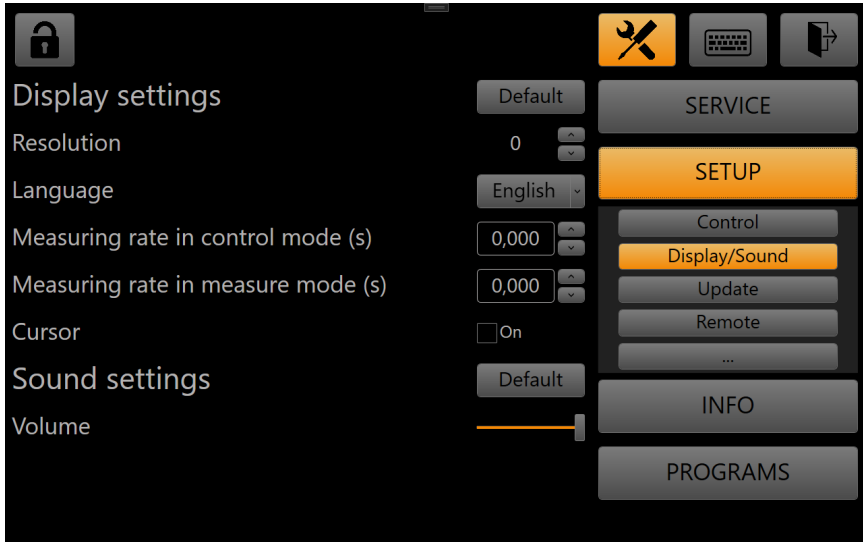


Fig. 16. Settings of displaying and sound

The following settings are available:

Table 5

Parameter	Restrictions	Comments
Коррекция числа значащих цифр [Correcting the number of significant figures]	0 (Авто [Auto]) -3...+5	Adding/subtracting the number of digits of significant figures in displayed pressure values.
Язык [Language]	Русский [Russian] English	
Период обн. при выходе на уставку [Setpoint update time]	0.075...10.05 с [s]	A set time of updating pressure values on the display does not affect the operation algorithm of the calibrator and allows you to slow down output of information to the display for easier reading.
Период обн. в режиме "Измерение" [Update time in "Measurement" mode]	0.075...10.05 с [s]	
Курсор [Cursor]	Вкл [On] Откл [Off]	Cursor (mouse movement pointer) enabling/disabling.

Parameter	Restrictions	Comments
Громкость [Volume]		Sound level adjustment.
Озвучивание нажатия кнопок [Beep when buttons are pressed]	Вкл [On] Откл [Off]	

7.9.3 Item **Обновления [Updates]**

This section of settings allows you to set the path to the calibrator software update files stored on an external flash drive.



Fig. 17. Settings of updates

7.9.4 Item **Удаленн. управл. [Remote control]**

This section of settings allows you to set the Ethernet or the Serial port parameters for remote control of the calibrator.

By default, the network settings are as follows:

IP-адрес [IP address]	192.168.32.2
Порт [Port]	8888
Маска [Mask]	255.255.255.255.0
Шлюз [Gateway]	192.168.32.1

Ethernet

Interface

Commands

DHCP

IP-address

Mask

Main Gateway

Port

Mac-address

Default

Ethernet

Alfapascal

☐ On

192.168.32.2

255.255.255.0

192.168.32.1

8888

7486E2085E81

Save

SERVICE

SETUP

Control

Display/Sound

Update

Remote

...

INFO

PROGRAMS

Fig. 18. Ethernet remote control settings

Serial

Interface

Commands

Baudrate

Parity

Default

Serial

Alfapascal

9600

None

Save

SERVICE

SETUP

Control

Display/Sound

Update

Remote

...

INFO

PROGRAMS

Fig. 19. Serial port remote control settings

The following commands are available in the remote control mode:

Table 6 (C – command, X – index, V – value)

No.	Command	Explanation	Parameter
1	set_press=V; (уст_давл=V;)	To set pressure	V – pressure in floating point format in set measurement units (set_sys_units) <u>example:</u> set_press=4.22; (уст_давл=4.22;) to set a pressure of 4.22 [set meas. unit]
2	set_mode=C; (уст_режим=C;)	To set a mode of the AGK	C=stop (C=стоп) – “stop”; C=set (C=уст) – “setting”; C=meas (C=изм) – “measurement”; <u>example:</u> set_mode = meas; (уст_реж=изм;) to set “Measurement” mode
3	set_accuracy=V; (уст_точн=V;)	To set an accuracy of the AGK	V – accuracy (% * 100), an unsigned integer in the range of 0...255 <u>example:</u> set_accuracy = 5; (уст_точн=5;) to set an accuracy of 0.05%
4	set_velocity=C; (уст_скор=C;)	To set a movement velocity of stocks	C=high (C=выс) – high velocity; C=middle (C=сред) – middle velocity; C=low (C=низк) – low velocity; <u>example:</u> set_velocity=high; (уст_скор=выс;) to set high movement velocity of stocks
5	set_liquid=C; (уст_жидк=C;)	To set increasing/ decreasing the liquid level	C=up (C=вверх) – to increase the liquid level; C=down (C=вниз) – to decrease the liquid level; C=stop (C=стоп) – to stabilize the liquid level; <u>example:</u> set_liquid=up; (уст_жидк=вверх;) to increase the liquid level
6	set_tr_velocity=V; (уст_орг_скор=V;)	To set a restriction of pressure setting velocity	V – velocity (% / s * 10), an unsigned integer in the range of 0...255 <u>example:</u> set_tr_velocity=8; (уст_орг_скор=8;) to set a restriction of pressure setting velocity of 0.8%/s

No.	Command	Explanation	Parameter
7	set_filter=C; (уст_фильтр=C;)	To set a filtration mode	C=off (C=откл) – off; C=low (C=низк) – low filtration; C=middle (C=сред) – middle filtration; C=high (C=выс) – high filtration; <u>example:</u> set_filter=high; (уст_фильтр=выс;) to set high filtration mode
8	set_cal_stocks=C; (уст_кал_шток=C;)	To set a stock calibration mode	C=start (C=старт) – to start C=cont (C=прод) – to continue C=stop (C=стоп) – to stop
9	set_dat=X; (уст_дат=X;)	To select an operating sensor	X – sensor 1, 2 or 3 X=0 – automatic selection of sensor
10	set_rst_press=C; (уст_сбр_давл=C;)	To set a pressure relieve mode	C=start (C=старт) – to start C=cont (C=прод) – to continue C=stop (C=стоп) – to stop <u>example:</u> set_rst_press=start; (уст_сбр_давл=старт;) to start pressure relieve
11	set_stock=C; (уст_шток=C;)	(For experienced users!) To set movement of either stock	C=b-stop (б-стоп) – to stop the big stock; C=b-left (б-влево) – the big stock to the left (forward); C=b-right (б-вправо) – the big stock to the right (backward); C=s-stop (м-стоп) – to stop the small stock; C=s-left (м-влево) – the small stock to the left (backward); C=s-right (м-вправо) – the small stock to the right (forward); <u>example:</u> set_stock=b-Left (уст_шток=б-влево); to set movement of the big stock to the left
12	set_valve=X#C; (уст_клап=X#C;)	(For experienced users!) To set a valve state	X – valve 1...5 C – open/closed (1/0) <u>example:</u> set_valve=3#1; (уст_клап=3#1;) to open the third valve
13	get_pg_id; (запр_дд_номер;)	Querying numbers of sensors	

No.	Command	Explanation	Parameter
14	get_pg_type; (запр_дд_тип;)	Querying types of sensors	
15	get_pg_limits; (запр_дд_впи;)	Querying UMLs of sensors	
16	get_pg_units; (запр_дд_едизм;)	Querying measurement units of sensors	
17	get_pg_press; (запр_дд_давл;)	Querying pressures of sensors	
18	get_pg_id#X; (запр_дд_давл#X;)	Querying the number of a sensor	X – sensor number, 1...4 X=1; – first (main) sensor (with max. UML) X=2; – second sensor X=3; – third sensor (with min. UML) X=4; – barometer <u>example:</u> get_pg_type=#1; (запр_дд_тип=#1;) <i>to query the type of the 1st sensor</i>
19	get_pg_type#X; (запр_дд_тип#X;)	Querying the type of a sensor	
20	get_pg_limits#X; (запр_дд_впи#X;)	Querying the UML of a sensor	
21	get_pg_units#X; (запр_дд_едизм#X;)	Querying the measurement unit of a sensor	
22	get_pg_press#X; (запр_дд_давл#X;)	Querying the pressure of a sensor	
23	get_status; (запр_стат;)	Querying the status of the device	
24	get_valves; (запр_клар;)	Querying the state of valves	
25	get_stocks_pos; (запр_шток_поз;)	Querying the position of stocks	

7.9.5 Settings section ... is not available to the user.

7.10 Menu **Инфо [Info]**

This window displays information on the date of manufacture of the

calibrator and its running hours, on its software versions (there are two levels: app software and controller software) and on connected sensors.

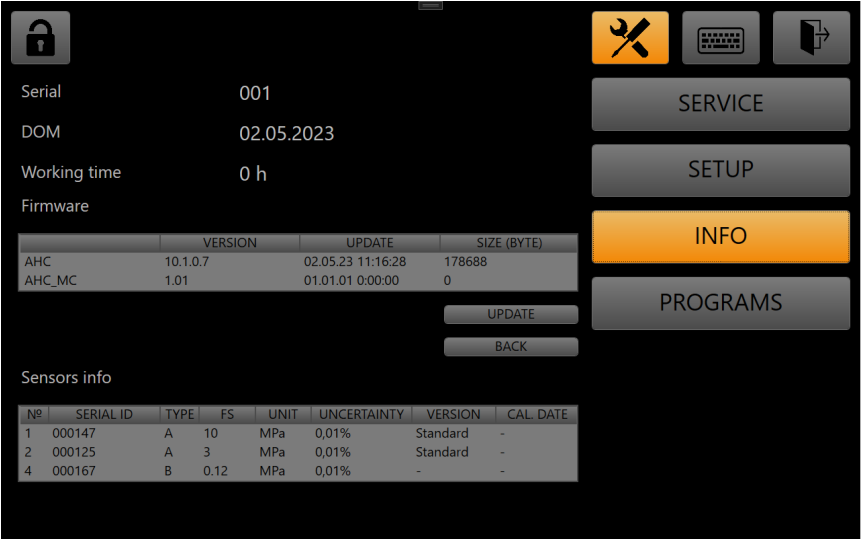
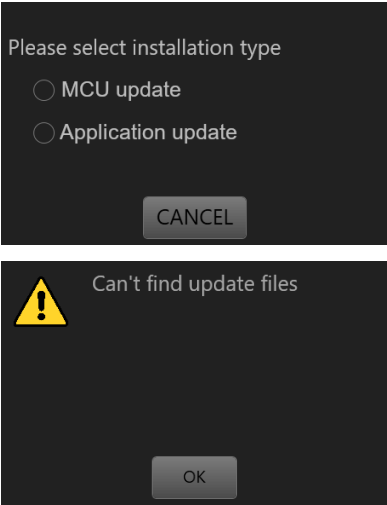


Fig.20. Меню Инфо

7.10.1 Software updates

7.10.1.1 You can run a software update to a newer version by pressing the **Обновить [Update]** button. As a result, a message box is displayed, where you are prompted to select whether to update software of the MK (controller) or app software (user interface).

Upon selecting option “Обновление ПО приложения” [App software update] or “Обновление ПО МК” [MK software update] and pressing the **Далее [Next]** button, searching for update files (bin. zip and version.xml for the app or AHC_MK_VX_Y.hex for the MK) starts on the path specified in the settings. If no update files are found, a box with the corresponding warning appears.



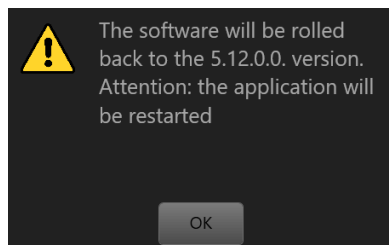
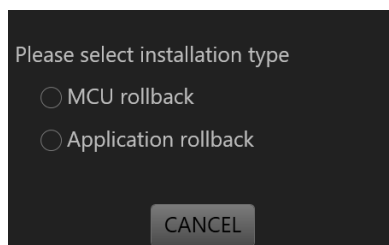
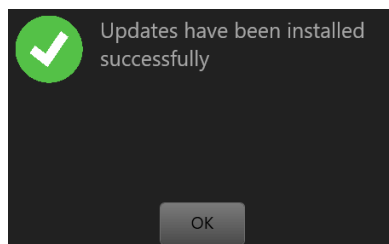
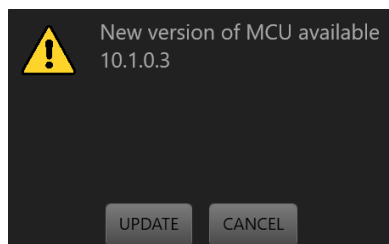
If a newer version is located on the specified update path, you are prompted to install it by pressing the **Установить [Install]** button. To cancel updating and return to the **Инфо** menu, press the **Отмена [Cancel]** button. If the available version is not newer than the already installed one, the message says: “Нет доступных обновлений” [No updates available].

Pressing the **Установить** button starts installation of updates and closes the app. Upon completion of installing updates, a box with message “Обновление успешно установлено” [Update successfully installed] appears, and after pressing the **Ок** button, the app of the updated version is launched.

7.10.2 Rolling back software updates (return to a previous version)

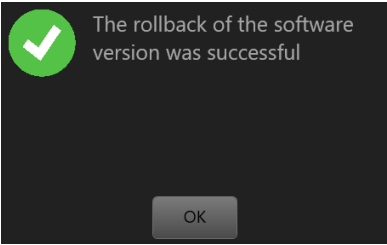
The **Откатить [Roll back]** button is used to launch rolling back to a previous version of the app software or controller software. After pressing the **Откатить** button, a message box is displayed, where you are prompted to select whether to roll back controller software or app software.

After selecting option “Откат ПО приложения” [App software rollback] or “Откат ПО МК” [MK software rollback] and subsequent pressing the **Далее [Next]** button, a box with message “Будет произведен откат ПО к версии... [Software rollback to version ... will be executed]” appears. Pressing the **Откатить** button starts



rollback to the previous software version. For cancelling rollback, press **Отмена [Cancel]**.

Upon completion of rollback, a box with message “Откат к предыдущей версии ПО прошел успешно [Rollback to the previous software version went well]”, and after pressing **Ok**, the previous app version starts.



7.11 Menu **Программы [Programs]**

This section describes compilation and editing of calibrator operation programs.



Fig. 21. Programs editing menu



Five programs are available for selection/editing. Each of them allows you to add up to 255 commands + 1 cycle exit command.



The program settings are located at the top of the tab.

When the **Циклы [Cycles]** checkbox is checked, the program is completely repeated the number of times corresponding to the number of cycles.

The following items are arranged in columns in the list of commands:

- **Доб. [Add]** — the **+** button — add a new command in the current line;
- **№ [No.]** — command number in program execution order;

- **Команда [Command]** — command name (drop-down list);
- **Параметр [Parameter]** — command parameter (drop-down list);
- **Значение [Value]** — value of a parameter selected in field “Parameter”;
- **Вкл [On/Off]** — command execution disabling/enabling checkbox;
- **Инф. [Inf.]** — the  button — brief information on the current command;
- **Удал. [Del.]** — the  button — command deletion.


For the **Выход [Exit]** command, there are no  and  buttons.

For deleting all commands of the current program, press the **Удалить всё [Delete all]** button.

In the command field, the following values are available:

- **Уставка [Setpoint]** — pressure setting and maintaining;
- **Задержка [Delay]** — delay in set units;
- **Режим [Mode]** — setting an operating mode of the calibrator.

a) For the **Уставка** command, the following parameters are available:

- **Значение [Value]** — pressure value (in bar);
- **Ожидание [Standby]** — mode of waiting for pressing the 

button after executing a command.

Maximum and minimum values of pressure (not more than **Максимальное давление**) set in the settings (clause 7.9.1). Available values for commands **Ожидание: Нет [Standby: No]** (without standby) and **Наж>> [Press>>]**.

b) For the **Задержка** command, the following parameters are available:

- **Секунды [Seconds]** — entering values in seconds;
- **Минуты [Minutes]** — entering values in minutes.

The maximum value for the delay field is 1000. The minimum value is 1.

c) For the **Режим** command, the following values are available (there are no parameters):

- **Задание [Setting]** — setting the **Задание** command for the calibrator;
- **Измерение [Measurement]** — setting the **Измерение** command for the calibrator;

- **Стоп [Stop]** — setting the **Стоп** command for the calibrator;

- **Сброс [Relieve]** — setting the **Сброс** command for the calibrator.

7.12 Errors and malfunctions.



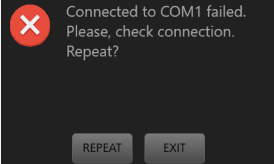
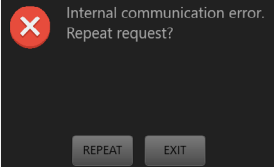
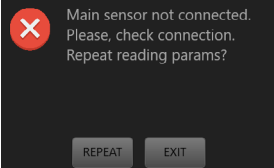
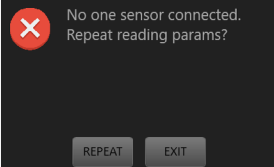
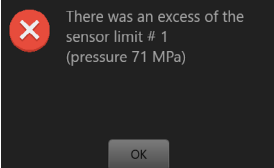
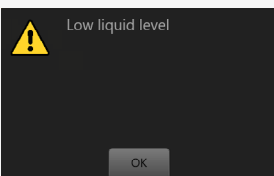
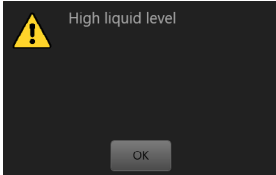
During operation of the calibrator, pop-up messages may appear. Messages marked with the  symbol mean the presence of an error or malfunction making further operation impossible. Messages with the  symbol are informational in nature, but some of them may recommend that you take certain actions.

Table 7

No.	Error/malfunction	Cause	Action
1	 	Lack of communication between the controller board and the computer.	<ol style="list-style-type: none"> 1. Press the Повтор [Repeat] button. 2. If the problem persists, press the Выход [Exit] button, wait for shutdown and disconnect the calibrator from the 220V network for 30 sec. Switch on the device again and check if the error is resolved. 3. If the problem still persists, it is required to check the electrical connection between the controller board and the computer.
2		Lack of communication with the main (first) pressure sensor.	<ol style="list-style-type: none"> 1. Press the Повтор [Repeat] button. 2. If the problem persists, press the Выход [Exit] button, wait for shutdown and disconnect the calibrator from the 220V network for 30 sec. Switch on the device again and check if the error is resolved.
3		Lack of communication with all pressure sensors.	<ol style="list-style-type: none"> 3. If the problem still persists, it is required to check the electrical connection between the controller board and pressure sensors.
4		Overpressure of the sensor. The calibrator automatically relieves pressure and switches to the Cron [Stop] mode.	Press Ок . Select the Задание [Setting] or Измерение [Measurement] operation mode and resume operation. In the Измерение mode, it is recommended to more gradually increase measured pressure when approaching the sensor's UML.
5		Low level of the working liquid in the tank.	<p>Operation is allowed, but air may enter the working volume of the calibrator.</p> <p>It is recommended to top up the working liquid in the tank. The recommended liquid level is half the tank. The current level is displayed in menu Сервис [Service] → Функции [Functions] (7.8.2).</p>

No.	Error/malfunction	Cause	Action
6		High level of the working liquid in the tank.	Operation is allowed.

7.13 Dismantling and installation of pressure transducers

The calibrator supports operation with one, two or three pressure transducers, as well as with a barometric module. If there are more transducers, the user has access to operations for changing transducers as part of the calibrator. In case of using the calibrator with one pressure transducer, plugs are installed on free columns of the calibrator. No plug for a barometric module is provided.

For changing a pressure transducer (installing a new one or dismantling an old one), the following operations should be performed:

7.13.1 Relieve pressure, switch off the calibrator and disconnect it from the power supply network.

7.13.2 Remove the upper cover of the control unit.

7.13.3 On the right side of the control unit there are columns for installing pressure transducers. Disconnect the electrical connector in the top part of the transducer housing. Using a wrench No. 27, unscrew the connecting nut counterclockwise, holding the pressure transducer with your hand so that it does not turn.

7.13.4 Remove the transducer; check the seal in the column. Replace if necessary.

7.13.5 Installation of a new transducer is performed in the sequence reverse to that described in clause 7.13.3. In case of complete dismantling a transducer without replacing it with another one, it is necessary to install a plug on the column.

Caution!

The order in which pressure transducers are installed is important. The trammel columns for pressure transducers are numbered from 1 to 3. The transducer with the highest upper measurement limit must be installed onto column 1, the transducer with the middle UML must be installed onto column 2, and the transducer with the lowest UML must be installed onto column 3. If the procedure for installation of transducers is violated, then at the self-diagnosis stage after switching on the calibrator, the valves will be blocked and an error message will appear on the screen with a description of the discrepancy between upper measurement limits of pressure transducers.

7.13.6 Check the procedure for connection of transducers. In case of using only one transducer, plugs must be installed onto columns 2 and 3; and if two transducers are used, a plug must be installed onto column 3.

7.13.7 Connect the calibrator to a power supply network and switch it on.

7.13.8 Follow the procedures described in clauses 7.3 and 7.4, monitoring the tightness of installed pressure transducers. In case of leaks, interrupt work and fix the malfunction.

7.13.9 In the pressure setting mode, generate the pressure corresponding to the upper measurement limit on the connected transducer. Switch to the measurement mode and check the system tightness.

7.13.10 In case of successful completing clause 7.13.9, perform the full pressure relieve again. Switch the calibrator off. Install the cover of the control unit.

7.13.11 If tightness cannot be achieved, it is necessary to replace the seal and/or check the degree of tightening of the transducer on the calibrator column. Repeat the procedures described in clauses 7.13.3-7.13.10.

8 Maintenance

8.1 For keeping the calibrator in good working order, it is necessary to conduct daily and routine maintenance.

8.2 Daily maintenance.

8.2.1 Inspect the device and clean it from dirt and dust with a dry clean cloth.

8.2.2 Check the working liquid level. Top up the working liquid if necessary.

8.3 Routine maintenance.

8.3.1 Perform the operations described in clause 8.2

8.3.2 Wash (or replace) the filter element.

8.3.2.1 Using a wrench No. 5, unscrew 4 screws 6 (Fig. 3) fixing cover 2 and disconnect the cover from the filter housing.

8.3.2.2 Using a wrench No. 5, unscrew technologic screw 5.

8.3.2.3 Using a blunt plastic rod with a diameter of about 6 mm, push the filter element through the technologic hole until it exits the filter housing.

8.3.2.4 Wash the filter element in clean gasoline (B 70 – TU 38.101913-82, Galosha – TU 38.401-67-108-92, Nefras – GOST 8505-80). Dry the filter element.

8.3.2.5 Insert the filter element into the filter housing.

8.3.2.6 Install the filter cover and technologic screw after checking the integrity of the rubber ring and rubber-metal seal.

8.3.2.7 Replace the filter element as needed.

8.3.3 Power unit routine maintenance.

8.3.3.1 Switch off the calibrator and disconnect it from the electrical network;

8.3.3.2 Remove the cover of the power unit;

8.3.3.3 Using a clean soft rag, remove old grease from the screws of the ball-and-screw units (ballscrews);

8.3.3.4 Apply new Shell GADUS grease on the screws (it is allowed to use LITOL – 24 GOST 21150-87 grease).

8.3.3.5 Check the guide bushings of the volumetric regulator stocks for the absence of leaks of the working liquid. Appearing of traces of the working fluid indicates wear of the seals of the stocks and wear of the guide bushings. In this case, it is necessary to contact a service center of the manufacturer to replace the worn parts.

8.3.3.6 Install the cover of the power unit.

9 Transportation and storage

9.1 Transportation.

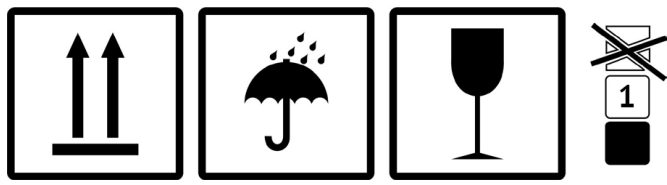
9.1.1 The calibrators must be transported by all types of transport in covered vehicles (including air transport — in heated and sealed compartments) in accordance with the rules of cargo transportation applicable to specific types of transport.

9.1.2 Transportation must be carried out in a shipping container from

the manufacturer or other container that ensures safety of the calibrators during their transportation.

9.1.3 During loading and unloading operations and transportation of the calibrators packed in shipping containers, they should not be exposed to shocks and atmospheric precipitation. The method of laying into a shipping container must exclude the possibility of movement of the calibrators.

9.1.4 Bins (boxes) with the calibrators must be transported and stored in accordance with the manipulation signs on them.



9.2 Storing the calibrator in laboratory conditions.

9.2.1 Before storing the calibrator in laboratory conditions, it is necessary to wipe it with a clean cloth and cover with a polyethylene cover.

9.2.2 Before long-term storage in a laboratory, it is necessary to drain the working liquid and cover the calibrator with a polyethylene cover.

9.3 Storing the calibrator at a warehouse.

9.3.1 Before placing the calibrator in storage, it is necessary to drain the working fluid and conduct the routine maintenance.

9.3.2 Wipe the calibrator with a clean cloth and pack it in its original packaging (or similar).

9.3.3 The calibrator must be stored in a dry heated room at a temperature not lower than +5°C and a relative humidity not more than 80%.

10 Troubleshooting

Malfunction	Cause of malfunction	Remedy
The calibrator does not switch on	No mains voltage	Check the voltage and find out the reason of its absence.
	The fuse has blown	Replace the fuse.
	The control unit has failed	Contact an authorised technician.

Malfunction	Cause of malfunction	Remedy
Pressure is not generated	There is a lot of air in the working liquid	Bleed the working fluid.
	There is a leak	Check the reliability of connections.
	Filter elements are clogged.	Wash or replace filters.
Screen data does not change, touch input does not work	A system hang has occurred	Reboot the calibrator: switch it off, disconnect from the power supply network, wait for 30 seconds and switch on again.

11 Verification methods

11.1 Verification of AGK calibrators of all modifications is executed in accordance with the verification procedure MP AP-02-2021 “AGK pressure calibrators. Verification method” approved by the Federal State Unitary Enterprise “VNIIM im. D. I. Mendeleev” on August 20, 2021.

11.2 AGK calibrators are subject to state verification. The verification frequency is once a year.

12 Warranty

12.1 The manufacturer guarantees that the AGK calibrator meets the requirements of TU 26.51.52-017-91357274-2021 AP. 078.000.000 provided that the conditions of transportation, storage and operation are met.

12.2 The guaranteed service life is 18 months from the date of shipment of the calibrator to the consumer.

12.3 Average service life is at least 8 years.

12.4 The warranty does not cover seals of all kinds and defects resulted from intensive operation and the presence of mechanical damage.

13 Information on claims

In the event of a malfunction of the AGK, the consumer must draw up an act on the need for repair and send it to the manufacturer at the following address: Alfapascal LLC, 36, 2nd Paveletskaya str., Chelyabinsk, 454047. Phone: (351) 725 74 50, e-mail: q@alfapascal.ru.

14 Acceptance certificate

14.1 Преобразователи давления

[illegible]

Example of the designation of transducers:

AHC	G	10	0,01	IS-50
1	2	3	4	5

1 – designation of the name of pressure transducers (barometric module);
2 – pressure kind code (G – gauge (excess), A – absolute, B – barometric);
3 – upper measurement limit code expressed in MPa (not specified for a barometric module);
4 – accuracy class code;
5 – version code (not specified for a standard version).

14.2 The AGK pressure calibrator

The AGK pressure calibrator, serial number _____, complies with TU 26.51.52-017-91357274-2021 and is found fit for service.

Production date

Person in charge _____
Signature Surname

Stamp here

The calibrator was tested and verified on

15 Packing certificate

The AGK pressure calibrator, serial number _____, is packed in accordance with TU 26.51.52-017-91357274-2021.

Packing date

Person in charge

Signature

Surname

Stamp here

16 Note

The manufacturer reserves the right to make changes to the design of the calibrator that do not affect its basic characteristics without further notice.

For more information on the calibrator, please visit

<https://alfapascal.ru/products/agk>

17 Information on precious metal content

This equipment does not contain precious metals and alloys based on them.

Information on maintenance and repair

No.	Date	Notes on maintenance and repair

Special notes