V R E M Y A – C H
Joint Stock Company

PASSIVE HYDROGEN MASER

User Guide

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Table of contents

1 Overview

The program "Passive Hydrogen Maser" (PHM) described in this User guide (hereinafter referred to as the Program) is designed to control and to monitor passive hydrogen masers (hereinafter referred to as the Device) produced by Vremya-CH. Supported Devices: VCH-1008, VCH-1008C, VCH-1008M.

Key features of the program:

– monitoring the current state of the Device (status and parameters);

– the Device parameters control;

– saving parameter values and viewing records in the form of tables and graphs for the selected time interval.

2 Program execution conditions

2.1 Operating system and connection interfaces

For the Program to work, the Windows or Linux operating system must be installed on the computer (the supported versions are specified in paragraphs 2.2 and 2.3).

Connection to the Device can be established via RS-232C interface, USB interface or via a local area network (LAN) over TCP protocol. To operate the Program via RS-232C, the computer must be connected to the Device directly by cable via a COM port or via a converter (LAN/RS-232C or USB/RS-232C). When using the converter, you may need to install the appropriate driver. To operate via USB the driver FTDI should be installed in the system. To connect to the Device via LAN a network cable with RJ-45 connectors is used.

2.2 Installation on Windows

The program runs on Windows 7 or later version of Windows. By default, the software is installed from a CD: you should launch the executable file of the distribution package PHM_setup_xxxxx.exe (xxxxx is the version number). The installer creates a shortcut on the desktop and the corresponding item in the Start menu.

2.3 Installation on Linux

The program works on the Linux operating systems with kernel version 2.6.0 and higher (list of supported ones: https://doc.qt.io/archives/qt-5.13/linux.html).

To get a distributive package of the Program for Linux, you need to send a corresponding request: admin@vremya-ch.com.

To install on Ubuntu and Debian, run the command "sudo dpkg -i (Program).deb" in the console. To install in openSUSE, RedHat and CentOS, run the command "sudo rpm -i (Program).rpm" in the console. (Program) – the name of the distribution's installation file.

3 Program execution, messages to the operator

3.1 Getting started with the Program, connecting the Device

When the Program is started for the first time, an empty window opens up (Figure 3.1) with the option to add a Device. After clicking on the "Add device" button, the window for adding a device is displayed (Figure 3.2).

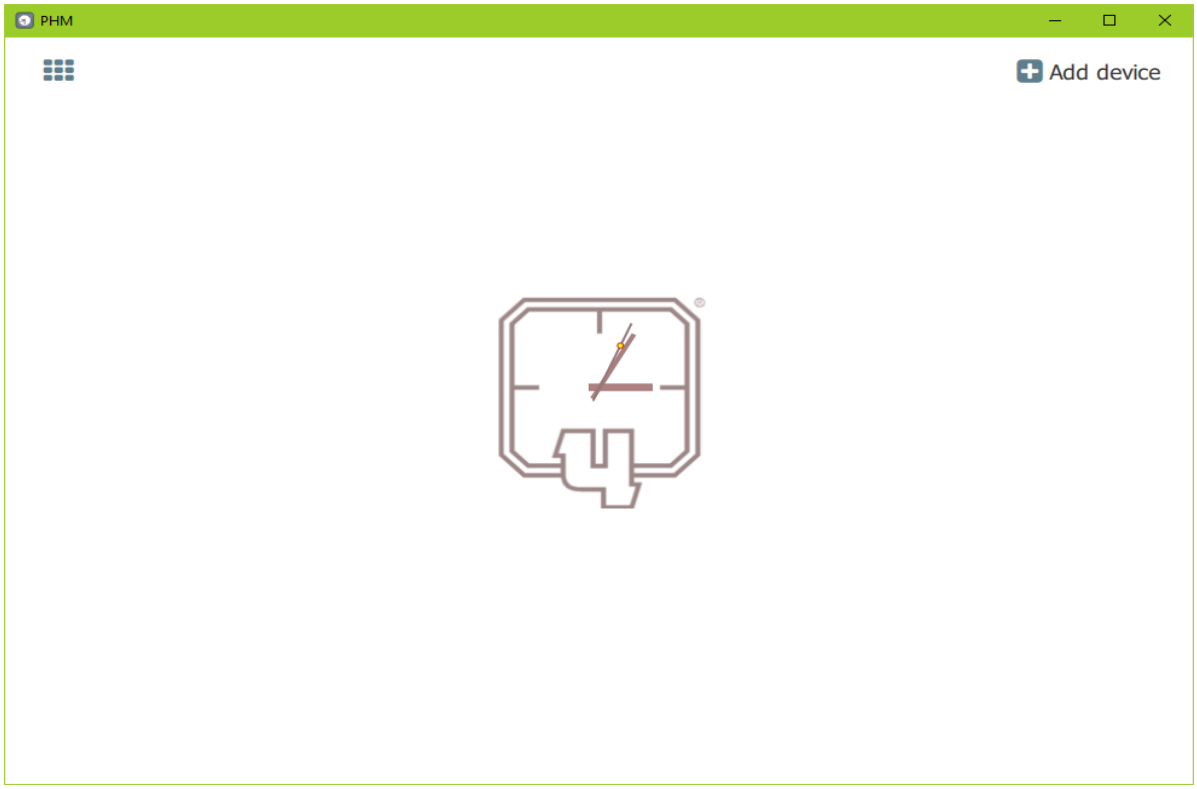
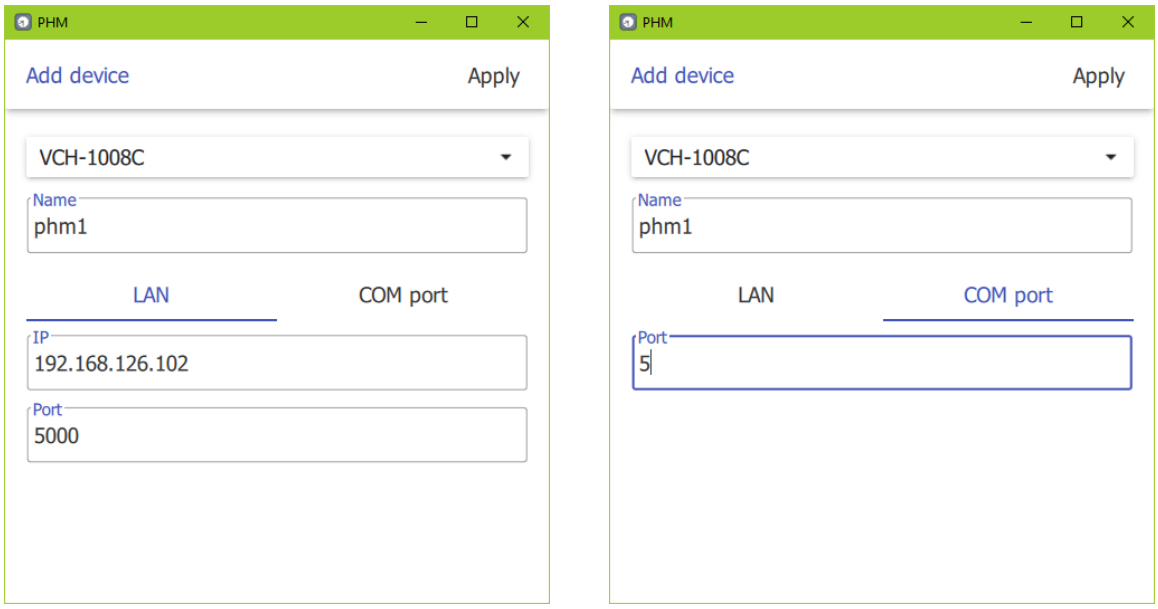


Figure 3.1 – The main window of the Program at the first start

There are two possible options for connecting to the Device: via LAN (Figure 3.2-a) or via COM (USB) port (Figure 3.2-b). To connect via LAN (TCP protocol), you must enter the IP-address, port number and Device name. To connect via RS-232C or USB, enter the COM port number and the Device name.

ATTENTION! Using a LAN/RS-232C converter or connecting via LAN simultaneous connection to the Device from multiple computers is forbidden.



а) LAN connection б) connection via COM port

Figure 3.2 – The window for adding a Device

After the "Apply" button is pressed, the Program will try to set up a connection with the Device. If the connection is successfully established, the main window will switch to the status display mode of the added Device (Figure 3.3).

At each subsequent launch, the Program will try to set up a connection with all the Devices that have been added to the list of Devices. Connection parameters are saved in the Program's ini-file (PHM.ini), which is located in the "config" subdirectory of the Program's working folder.

3.2 Main window of the Program

3.2.1 Content options

The main window of the Program can display status information (Figure 3.3) or the current values of the Device parameters (Figure 3.4). Switching the display mode is performed by the "Parameters" / "Status" button located in the upper left part of the window. By default, the main window contains a set of status lines for the selected Device.

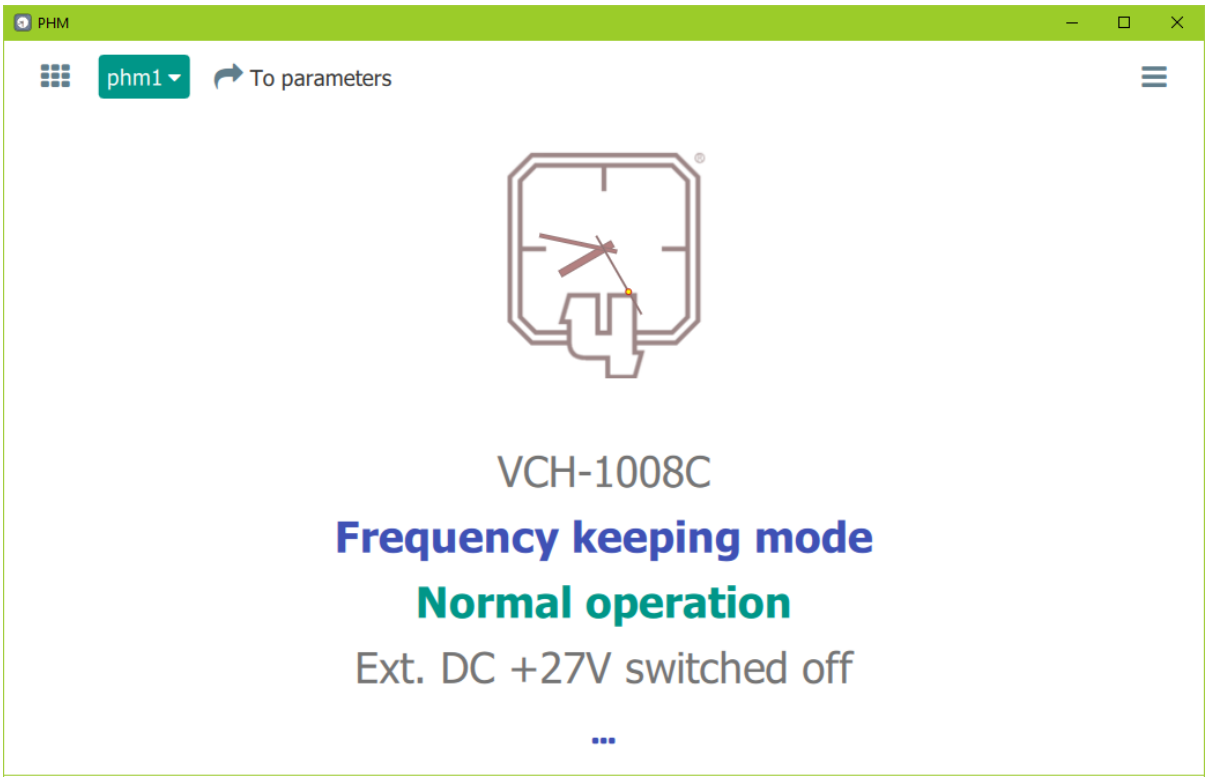


Figure 3.3 – The main window of the Program: status display mode

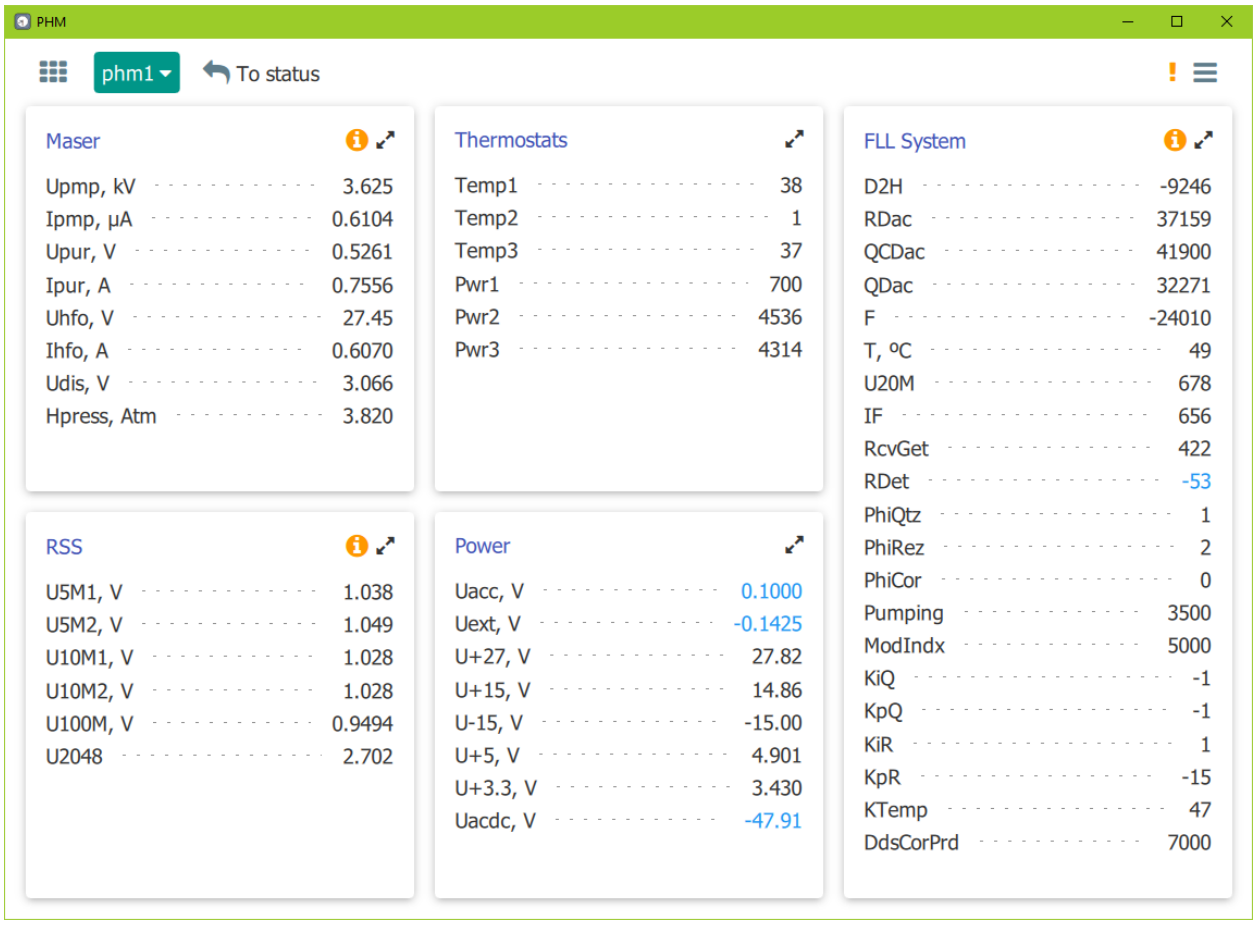


Figure 3.4 – The main window of the Program: parameter display mode

3.2.2 List of Devices

When you click on the icon (three horizontal bars), a panel with a list of added Devices appears along the left side of the main window (Figure 3.5). The "Add device" button on the panel allows you to add a new Device – the corresponding window for setting the Device and connection parameters is called (Figure 3.2). If you click on the icon (three vertical dots) on the panel with the list in the row of a specific Device, then a pair of buttons is displayed: ("Information" and "Delete"). The button is used to remove the Device from the list. The button opens a window with the Device connection information (Figure 3.6). After clicking the "Change" button, the connection parameters become editable.

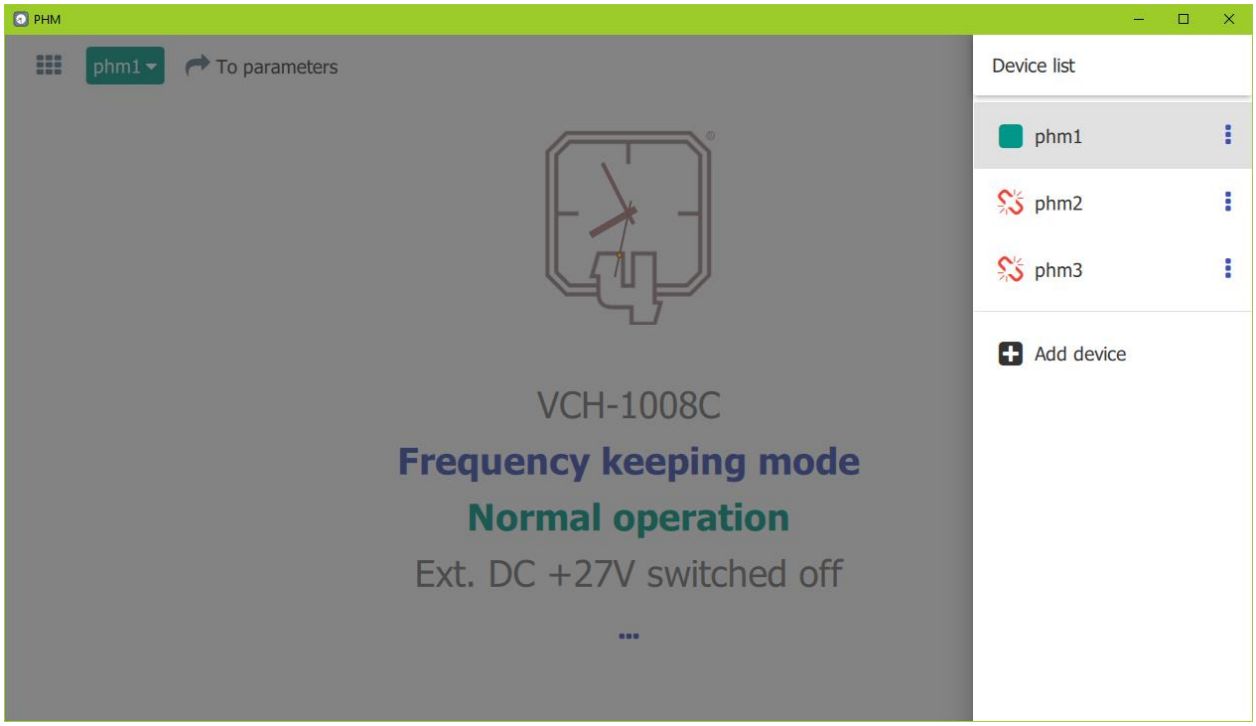


Figure 3.5 – The main window of the Program: Device list

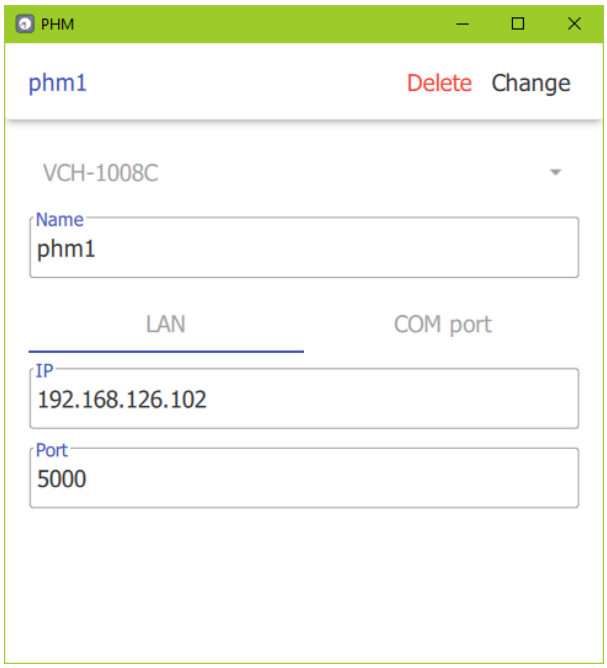


Figure 3.6 – Device connection parameters

3.2.3 Device status

Information about the status of the Device is represented by a set of lines with a specified format. The most priority lines are displayed in the center of the main window, the rest are available for viewing after clicking on the icon ••• (three dots horizontally) under the main lines (Figure 3.3). In addition, all status information, as well as the name, serial number and type of the Device are contained in a separate window (Figure 3.7), which is called by pressing the button with the Device name and the down arrow: phm1 ▾.

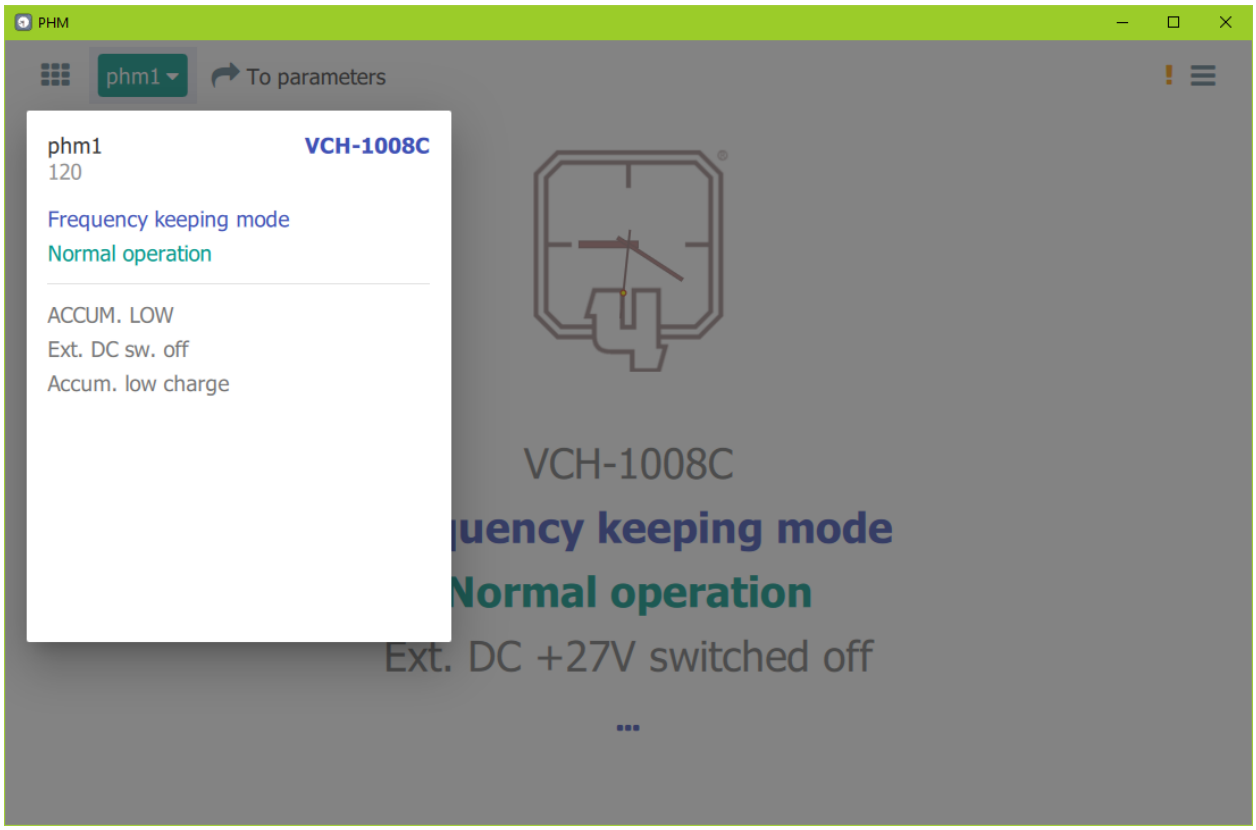


Figure 3.7 – Status information and Device identification data

3.2.4 Device parameters

The Device parameters are divided into 5 blocks (Figure 3.4):

1) "Maser";
2) "Thermostats";
3) "Power";
4) "RSS" (Reference Signals Source);
5) "FLL System" (Frequency Locked Loop).

ATTENTION! The list of parameters differs for different types of Devices. Only basic parameters are described below!

When the mouse pointer hovers over a parameter, its brief description is displayed. The software version of processor (or PLD – for RSS unit) of a particular block is displayed when the mouse pointer hovers over the icon ("Information"). Clicking on the icon ("Expand") allows you to increase the size of the block panel.

The "**Maser**" block displays the parameters of the quantum hydrogen discriminator and the state of the molecular hydrogen source.

1) **"Upump"** – supply voltage of ion-pump, kV;
2) **"Ipump"** – ion-pump current, μA;
3) **"Upur"** – power voltage of molecular hydrogen purifier, V;
4) **"Ipur"** – purifier current, A;
5) **"Hpress"** – pressure in the source of molecular hydrogen, atm;
6) **"Ihfo"** – consumption current of HFO, A;
7) **"Uhfo"** – power supply voltage of HFO, V;
8) **"Udis"** – voltage of photodetector measuring brightness of discharge in discharge bulb, V.

The parameter group **"Thermostats"** contains the following information:

1) **"temp1"** – temperature mismatch of cavity side surface, arbitrary units, 1 unit ≈ $6 \cdot 10^{-6}$ ºC;
2) **"temp2"** – temperature mismatch of cavity base, arbitrary units, 1 unit ≈ $6 \cdot 10^{-6}$ ºC;
3) **"temp3"** – temperature mismatch of hydrogen source, arbitrary units, 1 unit ≈ $6 \cdot 10^{-6}$ ºC;
4) **"pwr1"** – cavity side surface heater power, arbitrary units;
5) **"pwr2"** – cavity base heater power, arbitrary units;
6) **"pwr3"** – hydrogen source heater power, arbitrary units.

The "**Power"** unit displays the controlled voltages of the Device's power supply, built-in batteries and an external DC source.

1) **"Uacc"** – built-in batteries voltage, V;
2) **"Uext"** – external DC source voltage, V;
3) **"U+27"** – +27 V internal converter voltage, V;
4) **"U+15"** – +15 V internal converter voltage, V;
5) **"U-15"** – –15 V internal converter voltage, V;
6) **"U+5"** – 5 V internal converter voltage, V;
7) **"U+3.3"** – 3.3 V internal converter voltage, V;
8) **"Uacdc"** – AC/DC internal converter voltage, V.

The group of parameters **"RSS"** displays the levels (RMS) of sinusoidal signals (5 MHz, 10 MHz, 100 MHz) and the control voltage of the PLL system of the pulse signal 2.048 MHz.

1) **"U5M1"** – 5 MHz output signal voltage, output #1, V, RMS;
2) **"U5M2"** – 5 MHz output signal voltage, output #2, V, RMS;
3) **"U10M1"** – 10 MHz output signal voltage, output #1, V, RMS;
4) **"U10M2"** – 10 MHz output signal voltage, output #2, V, RMS;
5) **"U100M"** – 100 MHz output signal voltage, V, RMS;
6) **"U2048"** – PLL control voltage of pulse signal 2.048 MHz, V.

The **"FLL System"** block displays the parameters of the FLL system.

1) **"D2H"** – Second harmonic level of mismatch signal, measured in arbitrary units, can take both positive and negative values;
2) **"rDac"** – Discriminator resonator tuning DAC code, arbitrary units;
3) **"qCDac"** – Crystal oscillator coarse tuning DAC code, arbitrary units;
4) **"F"** – Output signal frequency code, measured in units of 1.e−15;
5) **"T"** – Temperature measured on the FLL processor board, ºC;
6) **"u20M"** – 20.40575168 MHz synthesizer DAC code, arbitrary units;
7) **"IF"** – Receiver intermediate frequency signal level, arbitrary units;
8) **"rcvGet"** – Receiver heterodyne (oscillator) signal level, arbitrary units.

Digital indicators display the values of the monitored parameters (black by default). The color of the indicator changes if the parameter is out the defined limits: red – exceeding the maximum allowable value; blue – the value of the parameter is below the specified minimum. The boundary values can be set via the main menu of the Program (see section 3.3.3, Figure 3.27) or by the method described below (see Figure 3.8).

Right-mouse-button click on the parameter name opens menu (Figure 3.8), which allows plotting this parameter for the selected time interval, as well as set the boundary values for the parameter.

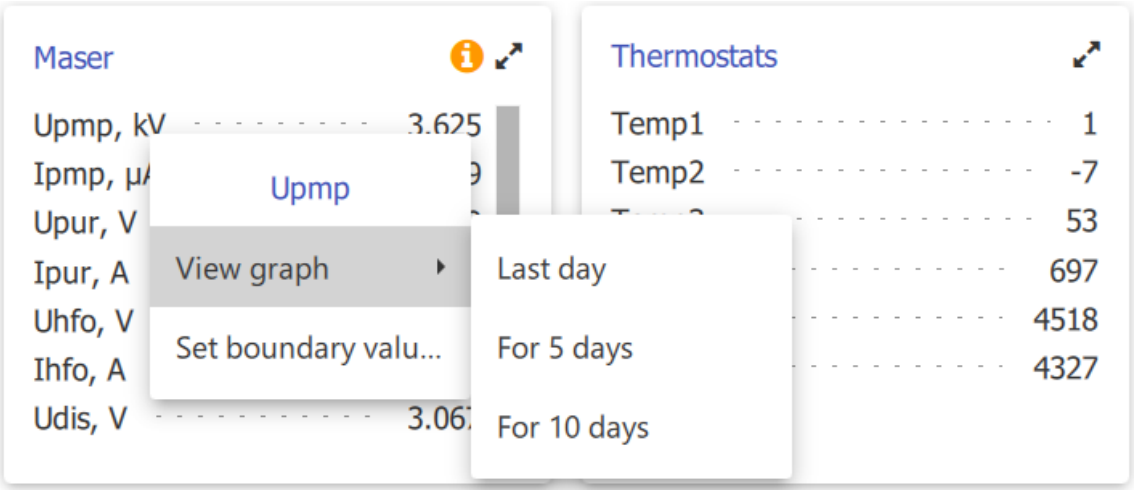


Figure 3.8 – Menu for selecting history time interval of "Upmp" parameter

When selecting an interval in the context menu (Figure 3.8), the parameter graph is displayed in the "Log data" window. "Log data of the Program" section is described in more details below (see section 3.3.2.1, Figure 3.19).

3.3 Main menu of the Program

Figure 3.9 shows the main menu of the Program, which appears after clicking on the icon  (table) in the upper left corner of the main window of the Program (Figures 3.3, 3.4). By default, reduced menu is displayed, which contains items for viewing and analyzing saved data and for configuring the Program (Figure 3.9, left). To access the full menu (Figure 3.9, right), click the "Advanced" button and go through the authentication procedure (see paragraph 5, Figure 5.1). The full menu contains an additional section with items for controlling and configuring the Device. The version number of the Program is displayed at the bottom of the menu.

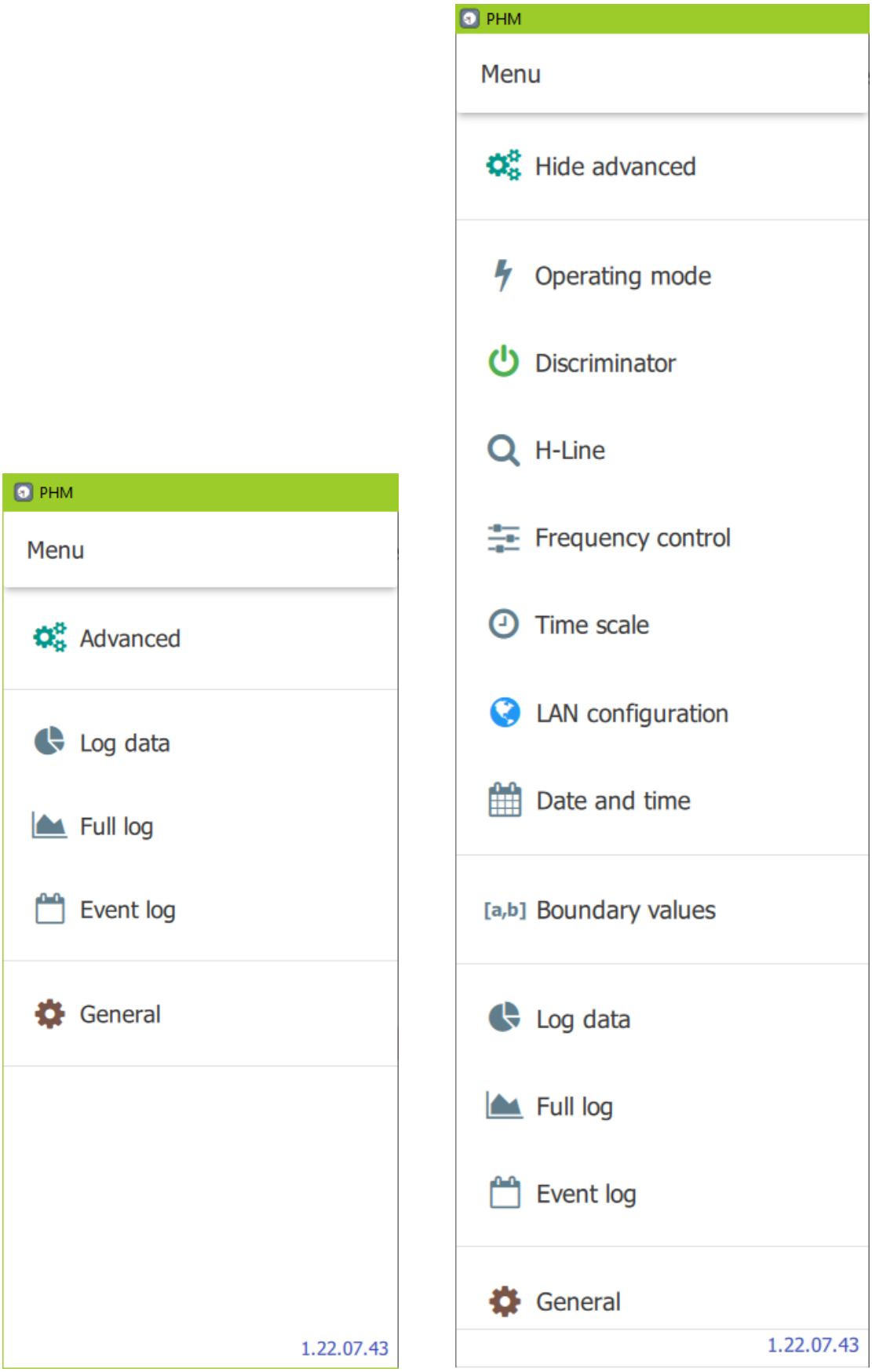


Figure 3.9 – Main menu of the Program (short and full versions)

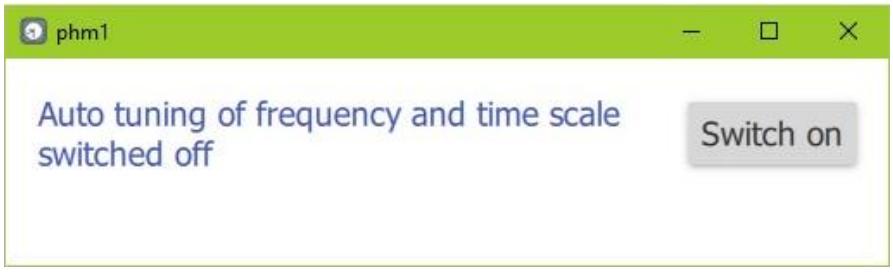
3.3.1 Device control and configuration

Note – If there is no connection with the Device ("Device not available" status), the functionality of this section of the main menu is disabled.

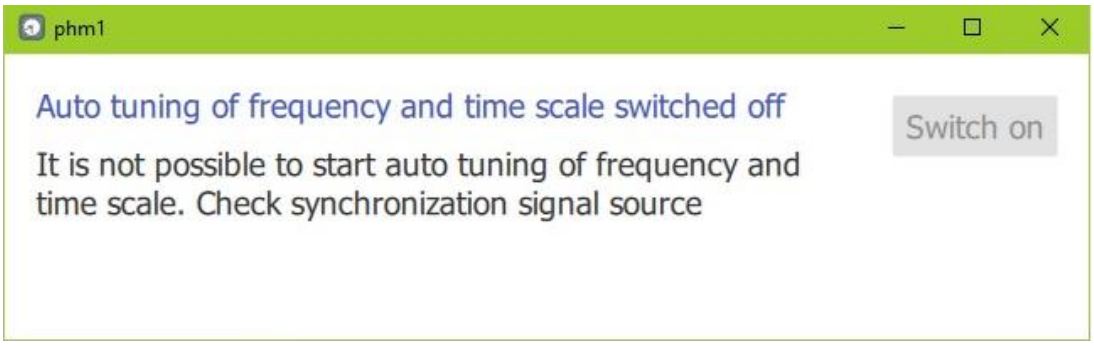
3.3.1.1 "Operating mode"

For VCH-1008C the window "Operating mode" may differ from the below description.

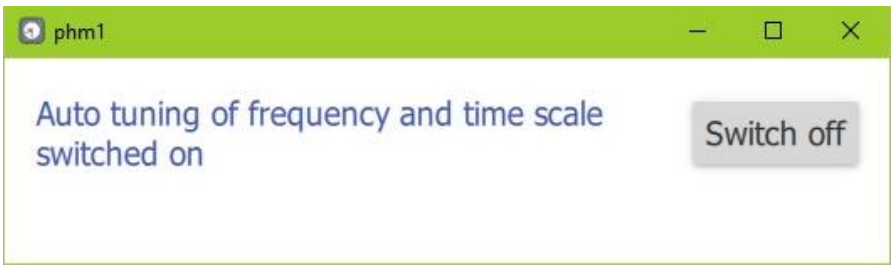
This main menu item is designed to select operating mode between “frequency keeping” mode and “auto tuning frequency and time scale” mode. The window for enabling auto tuning (correction) mode contains status and information lines and the "Switch on" / "Switch off" button (Figure 3.10). The activity of the "Switch on" button is determined by the presence of a reference signal. Status of reference (synchronization) signal can be checked in the "Time scale"–>"Synchronization source" tab (see Figures 3.15-a, 3.15-b).



a) auto tuning is off, the sync signal is present



b) auto tuning is off, there is no sync signal



c) auto tuning is on

Figure 3.10 – Auto tuning mode of frequency and time scale

To activate the auto tuning mode, click on the "Switch on" button (Figure 3.10-a). After that, the screen displays a request to send the appropriate command to the Device. In case of sending confirmation, after a short pause the result "Command completed successfully" or "Command failed" is displayed. Such a feedback appears after any command sent to the Device using the section "Device control and configuration".

If auto tuning is on, the main window of the Program displays the status: "Ext. 1PPS tracking mode" or "Nav. sys. tracking mode" depending on the selected sync signal source.

3.3.1.2 "Discriminator"

A window, appearing if item “Discriminator” is selected, is shown in Figure 3.11, it describes current state of the discriminator.

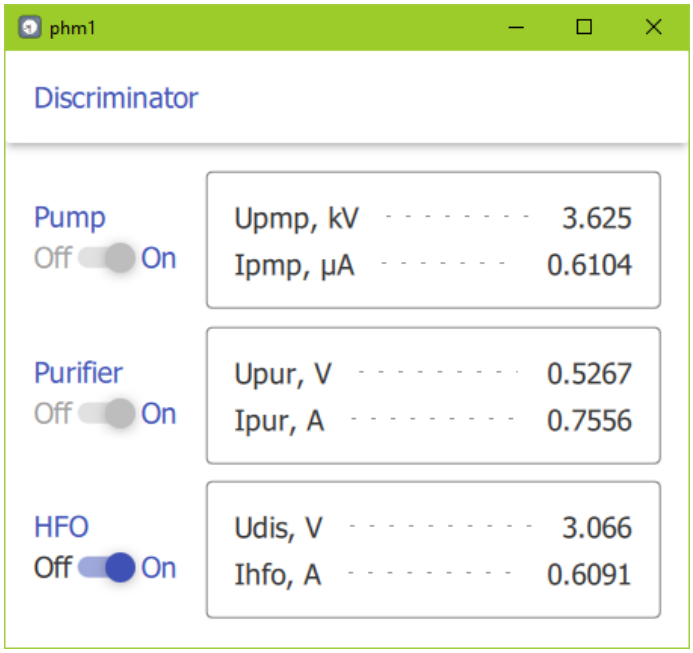


Figure 3.11 – Discriminator control

The discriminator modules are controlled by shifting the corresponding sliders in compliance with the sequential algorithm of switching on and off modules according to the logic of the discriminator operation.

3.3.1.3 "H-Line"

This menu item allows to automatically search for the control voltage of the quartz oscillator to adjust its frequency to the frequency of hydrogen atoms emission. This operation is automatically performed when the Device is switched on, but may also be controlled by an operator if the Device is turned on in manual mode. The "H-line" window (see Figure 3.12) contains the main parameters of the FLL system and the "Search" button to start the operation.

After starting the search for H-line (the operating point of the FLL system), the corresponding procedure is activated in the Device with the status indication "H-line searching" in the main window of the Program (see Figure 3.12).

ATTENTION! The H-line searching procedure lasts 5 – 10 minutes and it can not be interrupted until its completion.

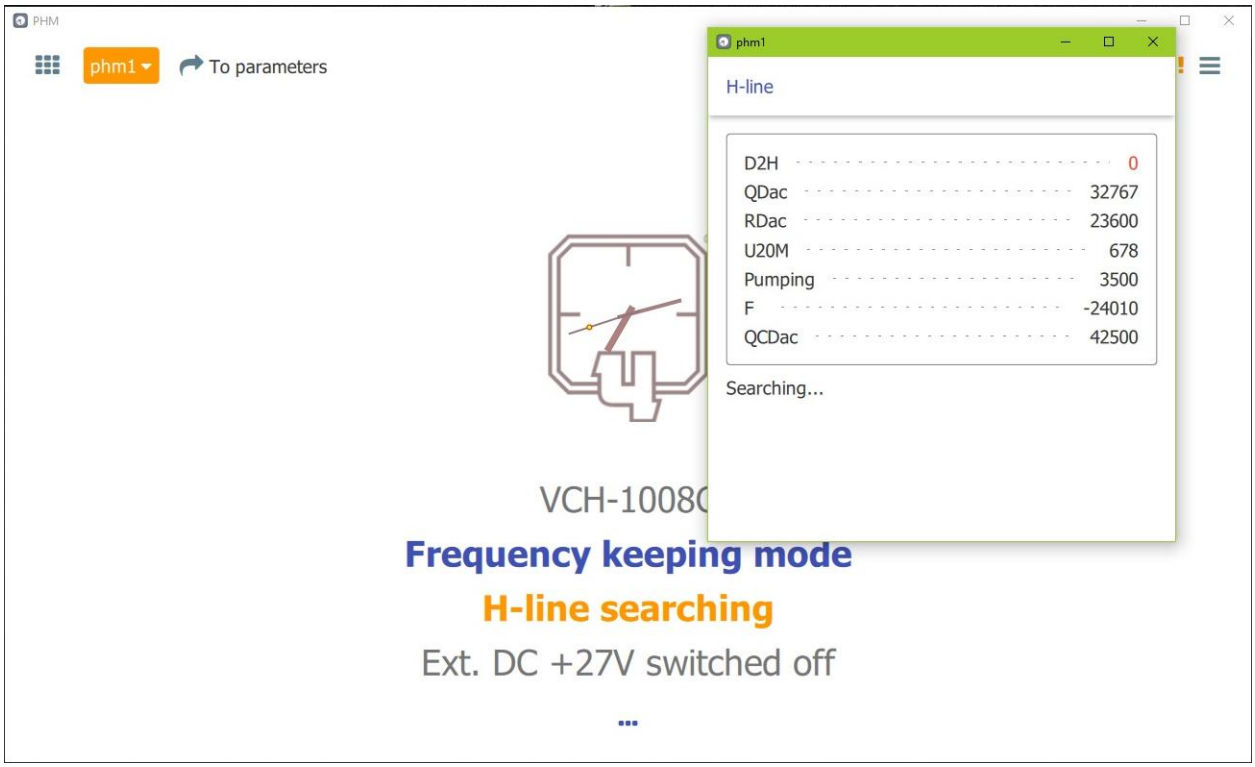


Figure 3.12 – H-line searching

3.3.1.4 "Frequency control"

This menu item opens a window (Figure 3.13) which allows changing the frequency synthesizer code and correcting the daily frequency drift. The value of the output frequency of the Device is set in relative units of the 15th decimal place in the range from -99999 to +99999 (the field *"Frequency, e-15"*). The drift value is set in relative units per day (the field *"Drift correction value per day"*). Editing the values is available after clicking the "Change" button.

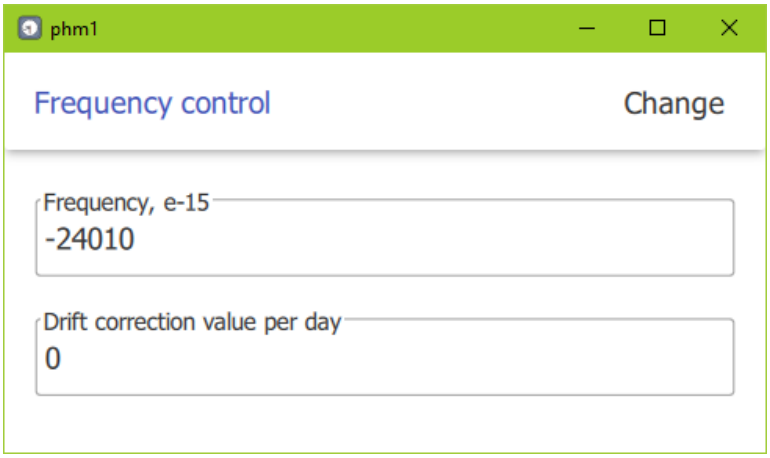


Figure 3.13 – Frequency control

3.3.1.5 "Time scale"

This menu item opens a window with three tabs (Figures 3.14 – 3.16).

The *"Signal Parameters"* tab (Figure 3.14) allows to set pulse widths of 1 Hz and 1/60 Hz pulses in microseconds by checking the box next to the selected value.

Instead of 1 PPM output Device can have a second 1 PPS output.

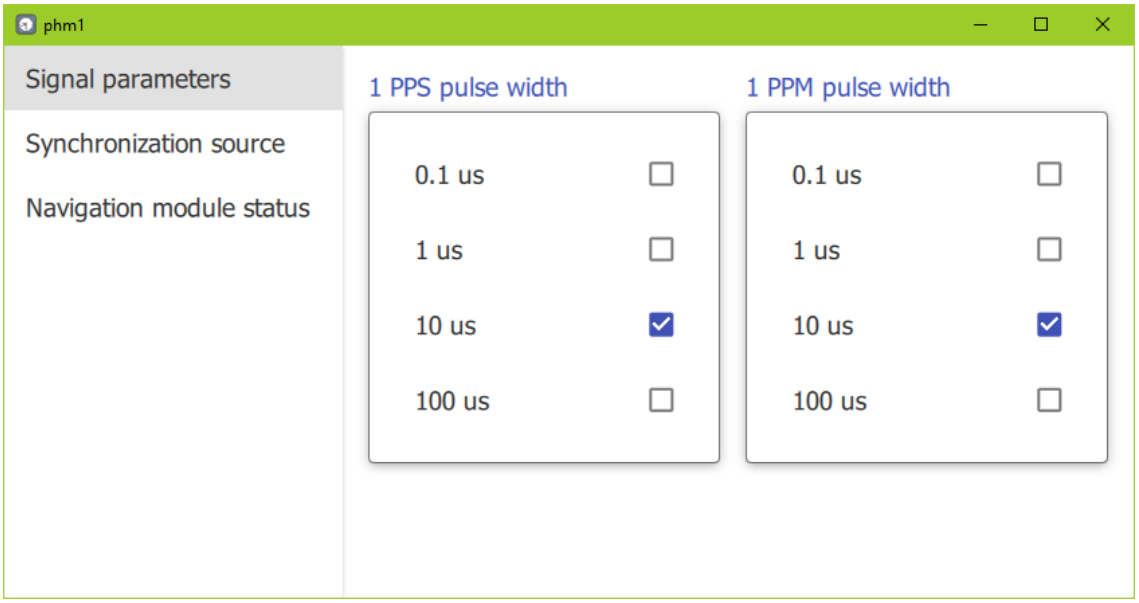
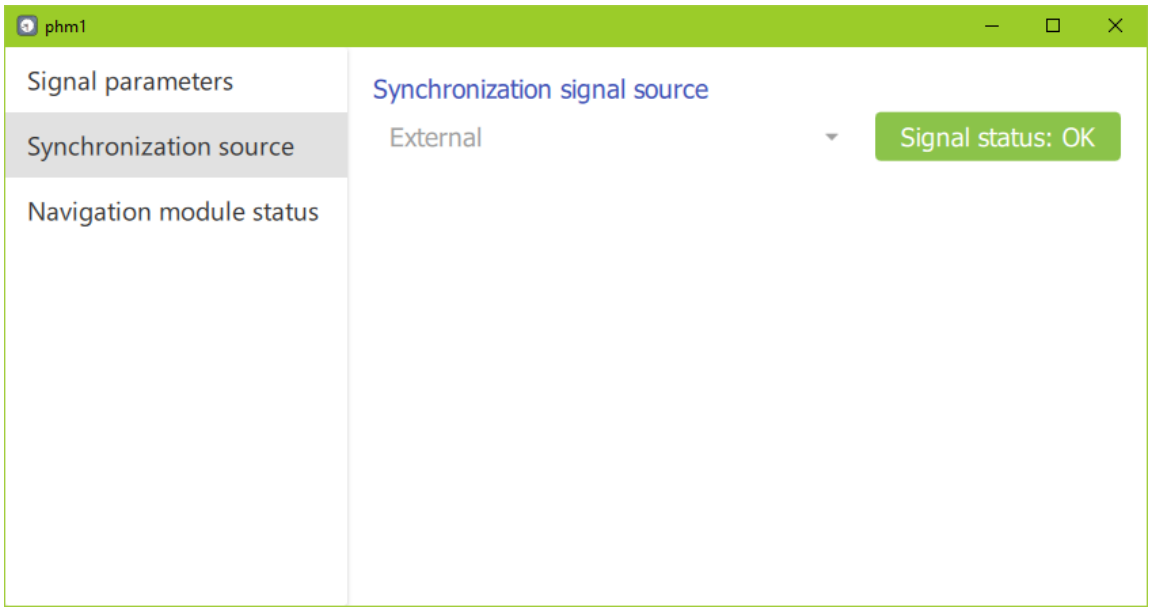


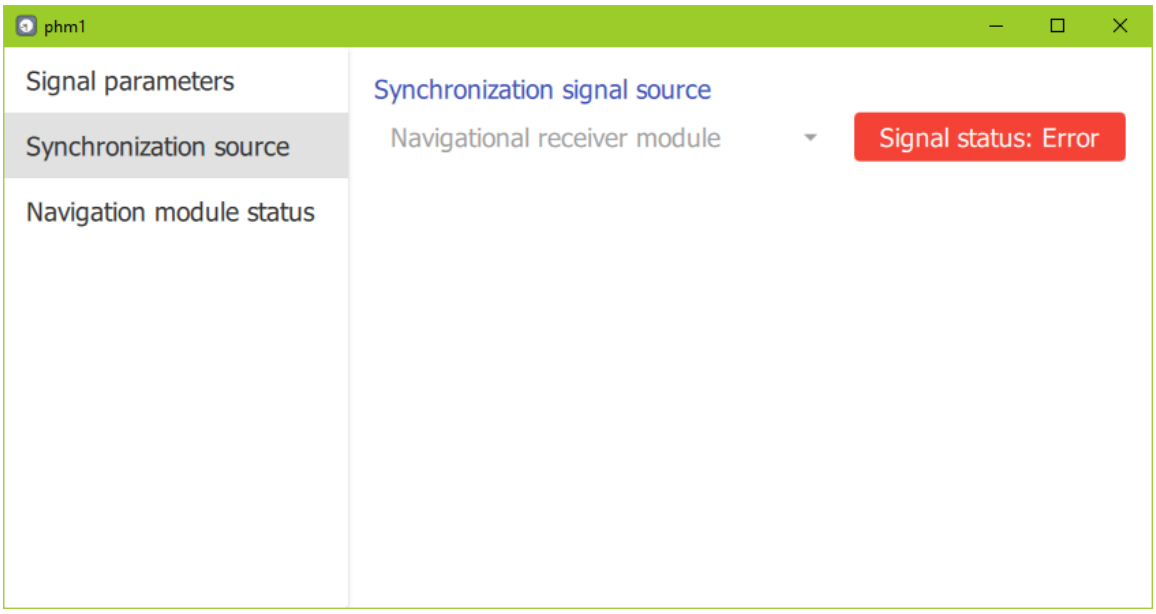
Figure 3.14 – Time scale: signal parameters

The *"Synchronization source"* tab allows to select a synchronization signal source: an external high-stable 1 Hz signal source (Figure 3.15-a) or a navigation receiver module (Figure 3.15-b).

The navigation module state can be checked and changed on the "Navigation module status" tab (see Figure 3.16).



a) external source, signal is available



b) navigation module, no signal

Figure 3.15 – Time scale: synchronization source

The *"Navigation module status"* tab (Figure 3.16) contains status information and controls for the navigation module (GPS/GLONASS signal processing unit).

This tab can be different depending on navigation module and software version.

The module status bar is located in the upper left corner of the tab and displays one of the following options:

1) "Navigation module is not set" – there is no navigation module installed in the Device (determined by the product composition);

2) "Navigation module switched OFF" – the module is installed, but turned off;

3) "Navigation module is ON" – the module is on;

4) "Navigation module is ON (meas.)" – the module is in operation, measurement is running;

5) "Navigation module operating errors" – errors in the module operation.

Attention! Before using the navigation module make sure that antenna is connected and positioned properly.

After turning the navigation module on it begins searching for available satellites. The results of the search are displayed on the panel with the GPS and GLONASS fields: the number of satellites found for each of the specified navigation system is displayed. The search may take several minutes.

The "Switch on" / "Switch off" button allows you to control the activity of the module.

The "Synch. with nav. module" button is designed to synchronize the value displayed in the "Current device time" field with the navigation module time.

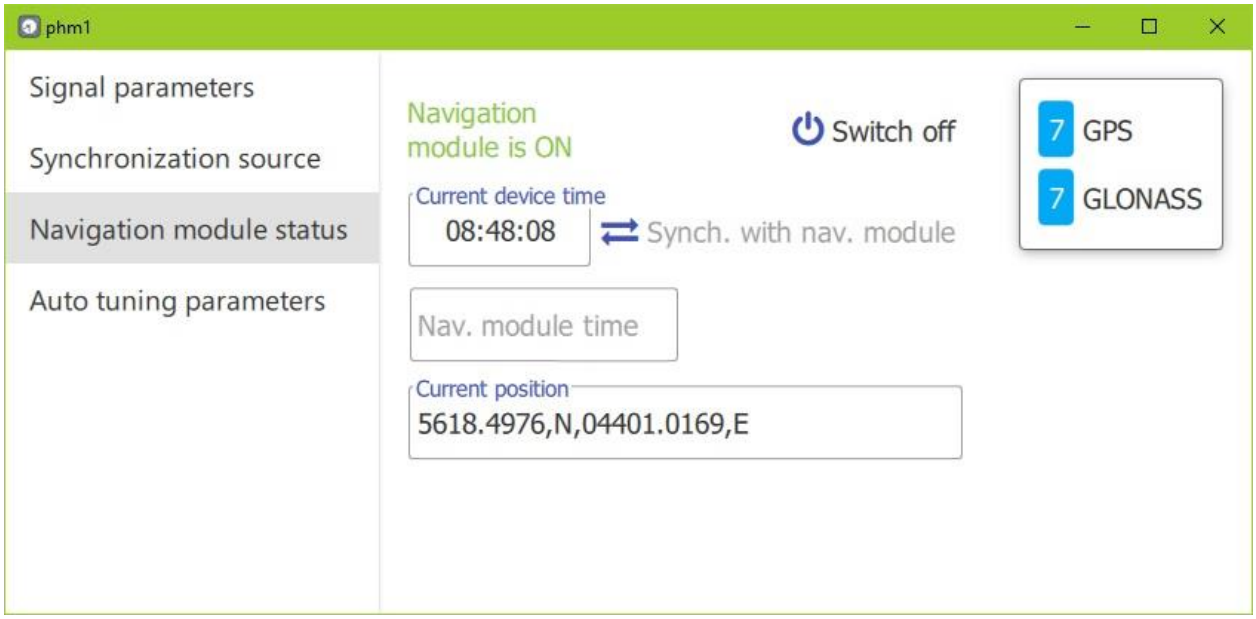


Figure 3.16 – Time scale: navigation module status

3.3.1.6 "LAN configuration"

When this item is selected in the main menu, a window appears (Figure 3.17) showing the current network parameters of the Device. After clicking on the "Change" button, the connection parameters become editable. When the values are changed, the "Apply" button is activated to send a new configuration to the Device.

Note – If the Device is connected via LAN, the connection will be lost after changing the network configuration (the main window of the Program will display the Device's unavailability status after a short pause). To restore the connection, it is necessary to

reconnect the Device in the Program with new network parameters (see section 3.2.2, Figure 3.6).

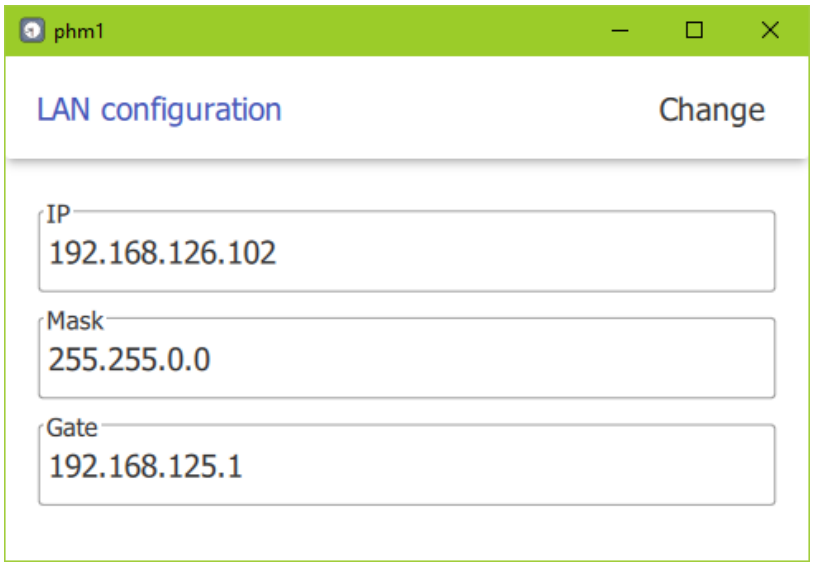


Figure 3.17 – LAN configuration

3.3.1.7 "Date and time"

This menu item opens a window (Figure 3.18) where you can set the date and time of the Device manually after clicking the "Change" button or adjust the values by clicking the "Synchronize with computer" button.

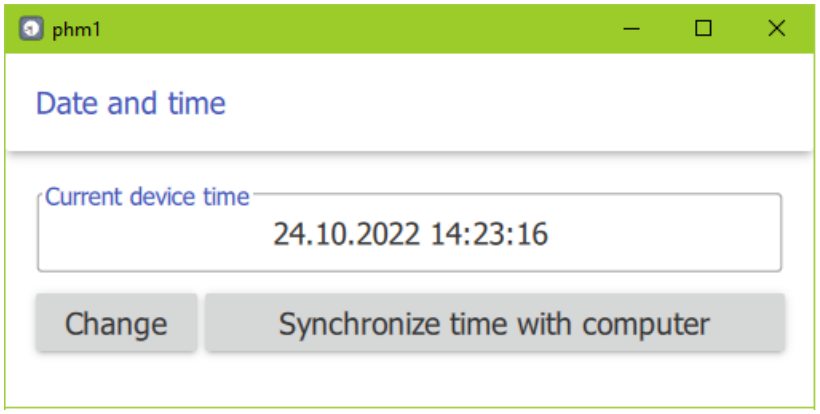


Figure 3.18 – Date and time correction

3.3.2 Data viewing

3.3.2.1 Log data of the Program

When selecting the menu item *"Log data"*, a window opens (Figure 3.19) designed to display the parameter records of the selected Device for a specified time interval in the form of graphs or tables. The time interval is set in the corresponding fields at the top of the window.

The list of parameters is located along the right border of the window and is divided into five blocks (according to clause 3.2.4). It can be hidden and displayed again by clicking the  (cross) and  (list) buttons, respectively.

One or more parameters can be marked in the list by clicking the left mouse button, the selected elements are highlighted (Figures 3.19, 3.20). For each of the specified parameters, a graph or table will be displayed in the log data panel: the type of display is determined by the activity of the buttons  (graphic) or  (tabular). By clicking on the parameter name with a color label, you can hide or show a specific graph (Figure 3.19). In tabular form (Figure 3.20), data can be scrolled using the keyboard, mouse wheel or scroll button; and when right-mouse-button on the parameter column is clicked, the suggestion "Save to csv" appears.

Figure 3.19 – Log data of the Program, graphs

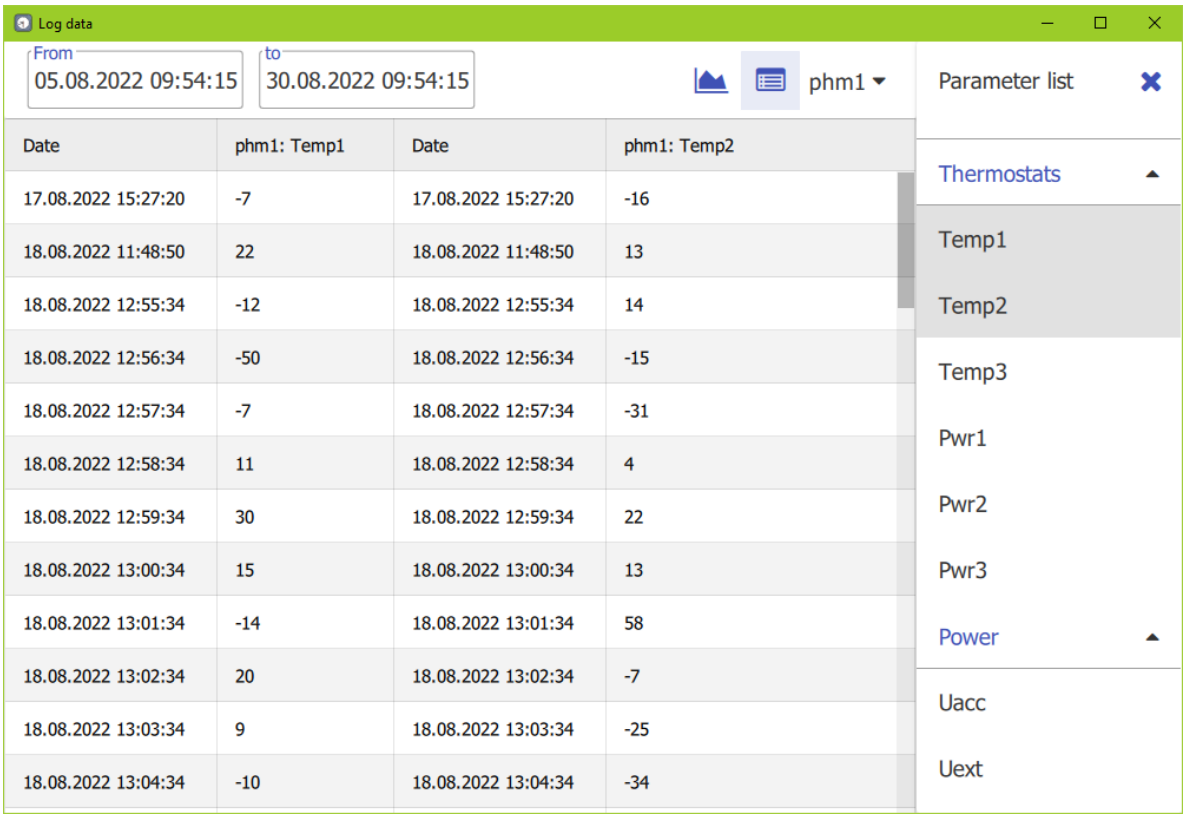


Figure 3.20 – Log data of the Program, table

When you double-click on the horizontal axis of the graph field, the window pops up (Figure 3.21) where the averaging interval in seconds can be set.

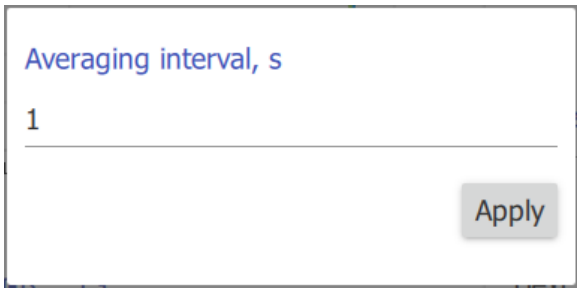


Figure 3.21 – Averaging interval for the X-axis

There is a toolbar along the lower border of the "Log data" window for interactive work with graphs. Clicking the left mouse button on a specific icon of the panel leads to activating the corresponding tool, which allows to perform the actions described below.

– scaling or shifting of graphs (right or left mouse button, respectively).

– marker. To track the exact coordinates of a point along the axes, click the left or right mouse button. The horizontal and vertical values for the point will be displayed under the X-axis. Using a marker, the distance between two points on the graph can be measured. To do this, click on the button , then mark the first point by pushing the mouse button and, while holding

the button down, move the cursor to the second point and release the mouse button. The measured horizontal and vertical differences values will be displayed (Figure 3.22).

– printing the contents of the graphics area.

– saving the graph field to a separate file.

– calling up the *"Graph settings"* panel (Figure 3.23).

– returning to the original state.

Figure 3.22 – Using a marker

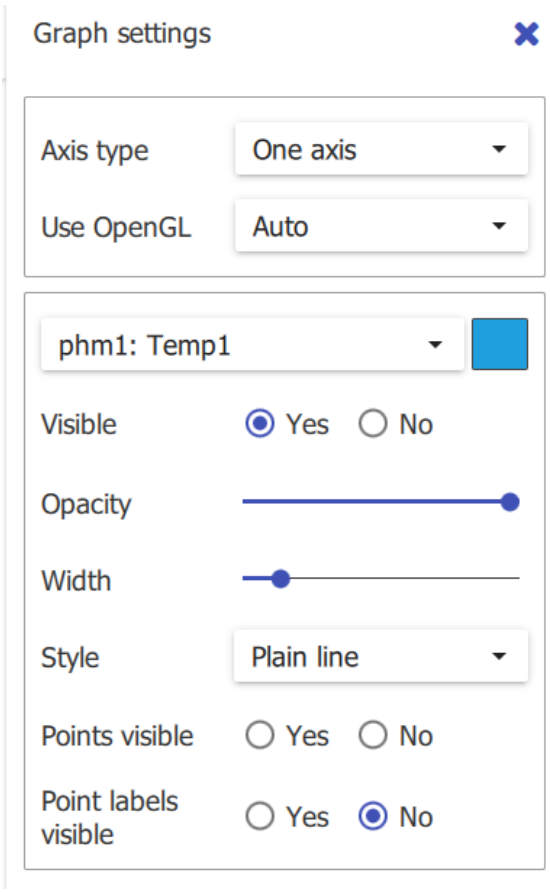


Figure 3.23 – Graph settings panel

3.3.2.2 Full log of the Program

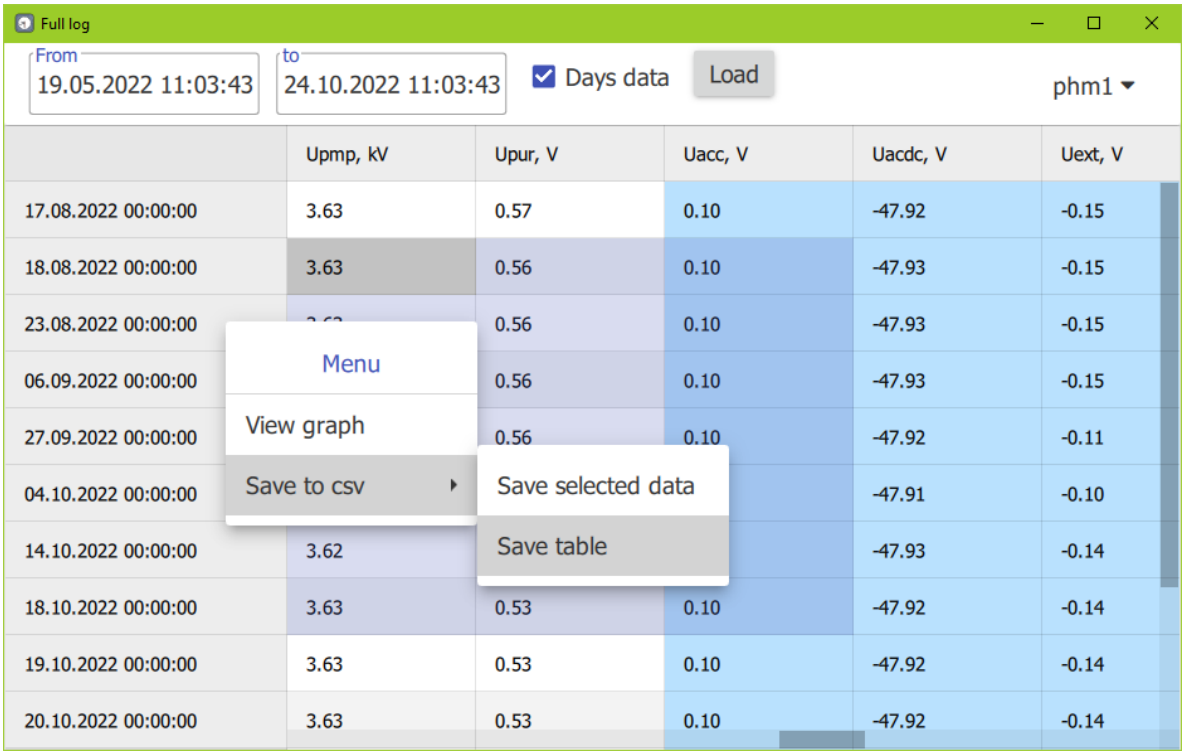
To view all records of the Device parameters for the specified time interval, the menu item *"Full log"* should be selected. It calls a window, where the data is displayed in a tabular form after clicking the "Load" button (Figure 3.24).

To thin out the history by day, the box on the left of the "Days data" label should be checked before clicking the "Load" button.

In the table with loaded data a range of values for one or more parameters can be selected by mouse. Selected values can be plotted or saved to csv-file. The context menu for choosing an operation is opened by clicking right-mouse-button on the selected cells (Figure 3.25).

	Upmp, kV	Upur, V	Uacc, V	Uacdc, V	Uext, V
19.10.2022 11:04:05	3.63	0.53	0.10	-47.92	-0.14
19.10.2022 11:05:05	3.63	0.53	0.10	-47.92	-0.14
19.10.2022 11:06:05	3.63	0.53	0.10	-47.91	-0.14
19.10.2022 11:07:05	3.63	0.53	0.10	-47.91	-0.15
19.10.2022 11:08:05	3.63	0.53	0.10	-47.91	-0.14
19.10.2022 11:09:05	3.63	0.53	0.10	-47.92	-0.14
19.10.2022 11:10:05	3.63	0.53	0.10	-47.91	-0.15
19.10.2022 11:11:05	3.63	0.53	0.10	-47.92	-0.14
19.10.2022 11:12:05	3.63	0.53	0.10	-47.91	-0.15
19.10.2022 11:13:05	3.63	0.52	0.10	-47.91	-0.15

Figure 3.24 – Full log of the Program



	Upmp, kV	Upur, V	Uacc, V	Uacdc, V	Uext, V
17.08.2022 00:00:00	3.63	0.57	0.10	-47.92	-0.15
18.08.2022 00:00:00	3.63	0.56	0.10	-47.93	-0.15
23.08.2022 00:00:00		0.56	0.10	-47.93	-0.15
06.09.2022 00:00:00		0.56	0.10	-47.93	-0.15
27.09.2022 00:00:00		0.56	0.10	-47.92	-0.11
04.10.2022 00:00:00				-47.91	-0.10
14.10.2022 00:00:00	3.62			-47.93	-0.14
18.10.2022 00:00:00	3.63	0.53	0.10	-47.92	-0.14
19.10.2022 00:00:00	3.63	0.53	0.10	-47.92	-0.14
20.10.2022 00:00:00	3.63	0.53	0.10	-47.92	-0.14

Figure 3.25 – Full log of the Program with thinning by days

3.3.2.3 Device log

All the time while the Device is operating, the CPU embedded software controls the parameters of the Device. During normal operation of the Device some controlled parameters may change and go beyond the acceptable limits (do not be confused with the boundary values set in the Program). In this case, the CPU program must determine whether further operation is possible or maintenance is necessary. There is a special event log in non-volatile memory of the Device, that provides recording of changes in parameters. Events are saved in the log in the following cases:

– the parameter value has exceeded the acceptable limits;

– the parameter value has returned to the acceptable interval;

– one of the discriminator units was turned on or off;

– the device was controlled manually.

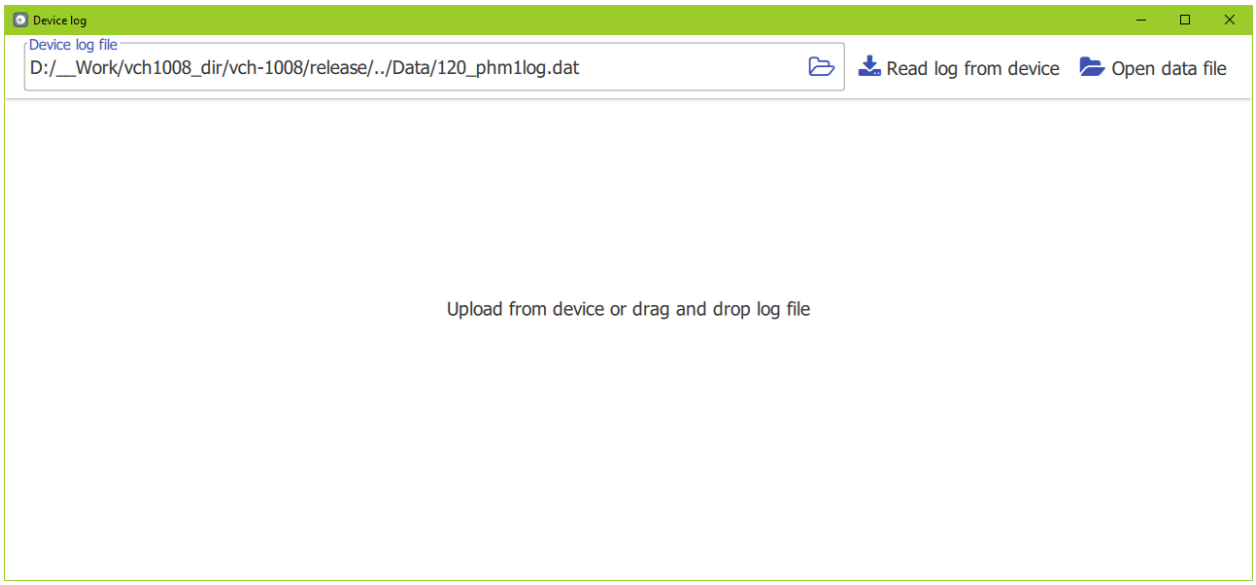
In addition, the values of all the main monitored indicators are recorded in the log (not only parameters with violation of permissible limits), since changing some parameters may affect the others.

Selecting the main menu item *"Event log"* opens a window (Figure 3.26) that allows:

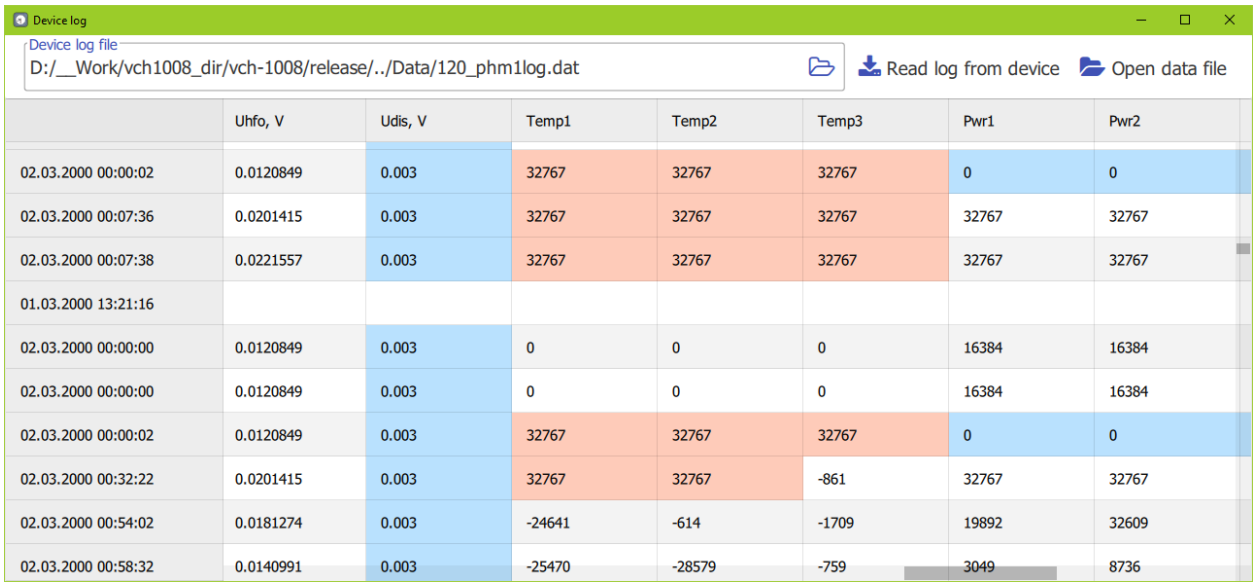
– to read the log from the Device by clicking on the "Read log from device" button;

– to open a previously saved log file by clicking on the "Open data file" button or by dragging the file with the mouse to a free area of the window.

The log file is loaded by default into the "Data" subdirectory of the Program's working folder. The file name is formed from the name and serial number of the Device: "name" + "serial number" + "log" + ".dat". The full path with the file name is displayed in the "Device log file" field, where the user can also choose a different location and another name for the downloaded log file by setting them manually in the field line or using the button  that opens the file manager dialog box.



a) before loading the log



	Uhfo, V	Udis, V	Temp1	Temp2	Temp3	Pwr1	Pwr2
02.03.2000 00:00:02	0.0120849	0.003	32767	32767	32767	0	0
02.03.2000 00:07:36	0.0201415	0.003	32767	32767	32767	32767	32767
02.03.2000 00:07:38	0.0221557	0.003	32767	32767	32767	32767	32767
01.03.2000 13:21:16							
02.03.2000 00:00:00	0.0120849	0.003	0	0	0	16384	16384
02.03.2000 00:00:00	0.0120849	0.003	0	0	0	16384	16384
02.03.2000 00:00:02	0.0120849	0.003	32767	32767	32767	0	0
02.03.2000 00:32:22	0.0201415	0.003	32767	32767	-861	32767	32767
02.03.2000 00:54:02	0.0181274	0.003	-24641	-614	-1709	19892	32609
02.03.2000 00:58:32	0.0140991	0.003	-25470	-28579	-759	3049	8736

b) after loading the log

Figure 3.26 – "Device log" window

3.3.3 Boundary values

The *"Boundary Values"* menu item calls a window, where the permissible limits of parameters can be set separately for each Device (Figure 3.27). To edit the values, click on the "Change" button, then save the results with the "Apply" button or return to the original values by pressing the "Cancel" button.

The parameter in the main window of the Program is indicated in blue or red if its value is less than the lower or greater than the upper threshold, respectively.

ATTENTION! The boundary values are set during the tuning process by the manufacturer and should not be changed by user.

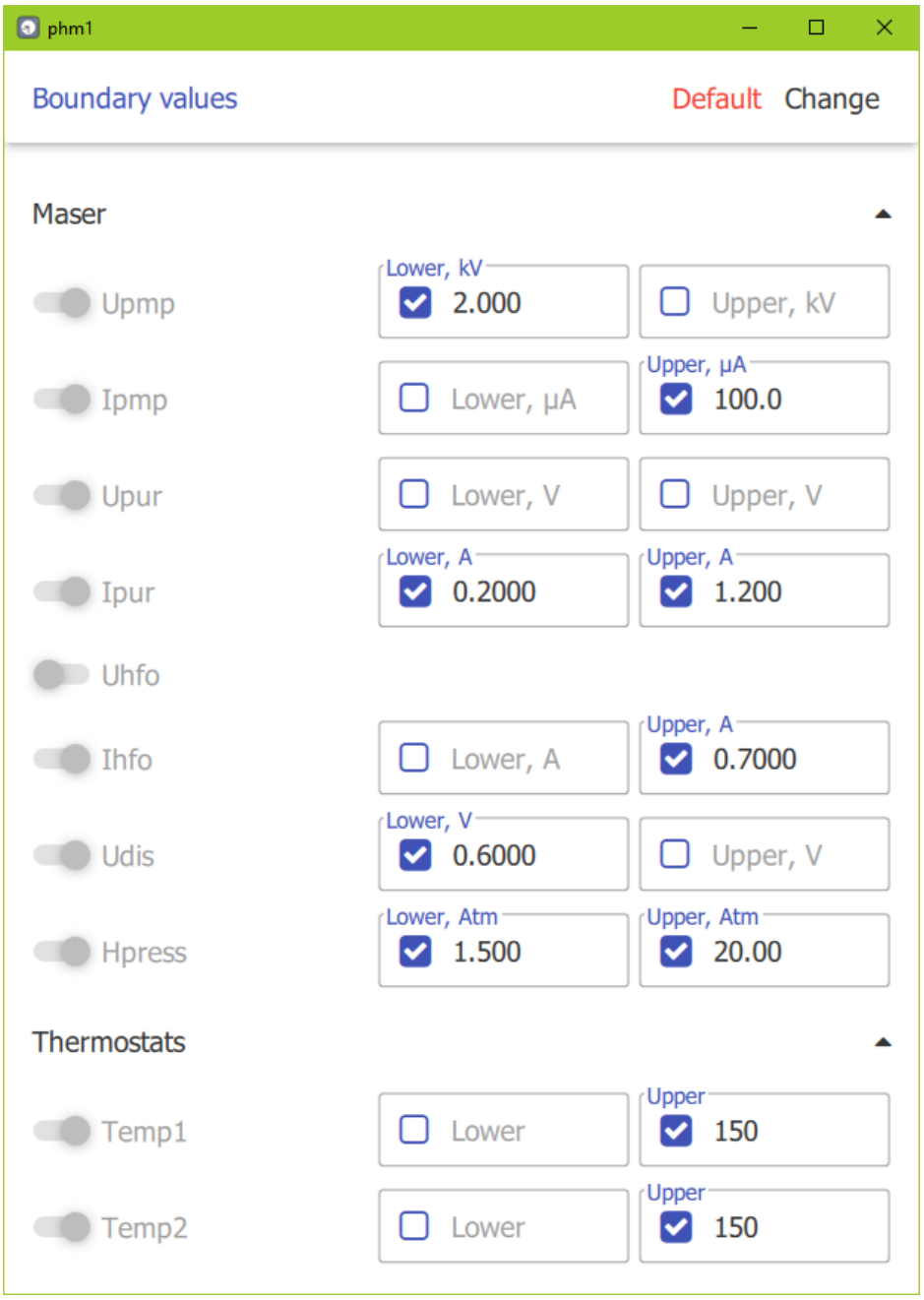


Figure 3.27 – Viewing and setting boundary values

3.3.4 Program settings

When the item *"General"* is selected, a window opens (Figure 3.28) which allow to set:

1) Polling period of the Device parameters in seconds;
2) Size of the Program elements and text;
3) The Program interface language (Russian/English);
4) Time display – time zone (UTC/Local time/Offset from UTC);
5) Date and time format.

"Apply" button appears in the upper right corner to save the changes.

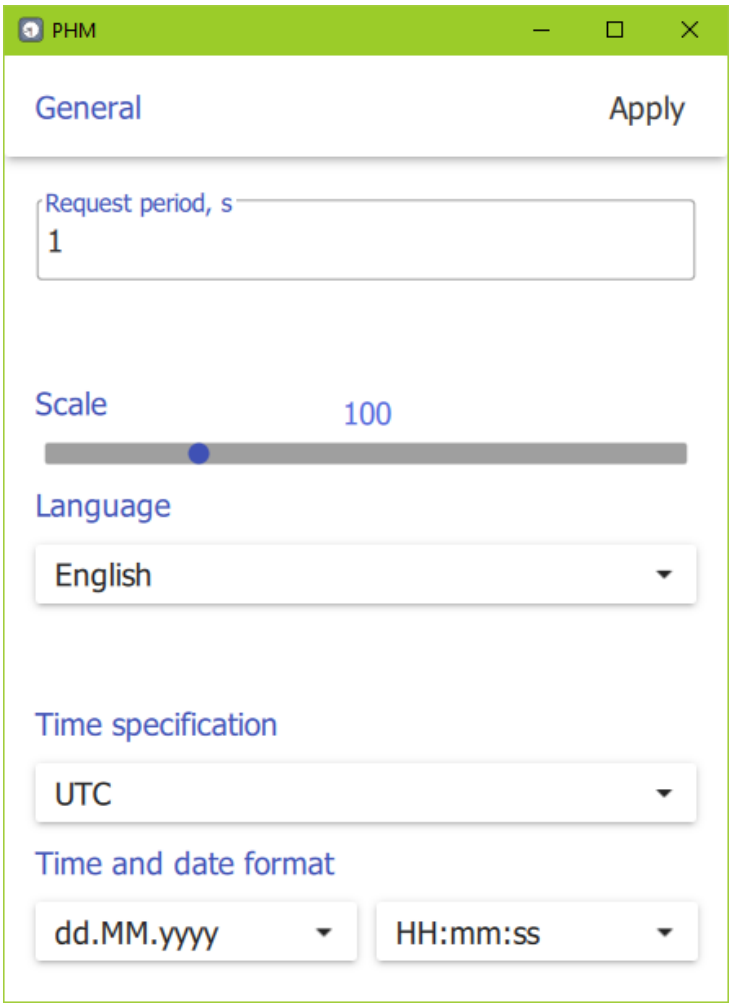


Figure 3.28 – General Program settings

4 Data records

The Program captures all controlled parameters, by default, to the "Data" subdirectory of its working folder. Records related to a specific Device are stored in ASCII encoding in a separate catalogue named in the format *SN_Name*, where *Name* is the assigned name of the Device, *SN* is the serial number. For each parameter, the Program creates a directory of the same name, and daily files are added to it without an extension and with a name in the format YYYYMMDD, where YYYY is the year, MM is the month, DD is the day. In addition, all parameters data are collected to a general table in daily files YYYYMMDD.csv, which are formed in the "Common" directory. The parameter values are separated by a semicolon in each line. A file of this format can be opened in the Microsoft Excel application or Analyser program.

Figure 3.29 shows an example of a file with the recorded values of the Ipur parameter. The first column contains the measurement time, the second – parameter value. The time format is defined in the PHM.ini file in the *[Time]* section by the value of the *UtcOrLocal* key: 0 – UTC, 1 or more – local time. If there is no section or key, the default format is UTC.

20220818

	UTC_time	Ipur
1	12:55:34	0.75
2	12:56:34	0.75
3	12:57:34	0.75
4	12:58:34	0.75
5	12:59:34	0.75
6	13:00:34	0.75
7	13:01:34	0.75
8	13:02:34	0.75
9	13:03:34	0.75
10	13:04:34	0.75
11	13:05:34	0.75
12	13:06:34	0.75
13	13:07:34	0.75
14	13:08:34	0.75
15	13:09:34	0.75

Figure 3.29 – Parameter data record example

The program logs significant events (starting or closing the application, communication or configuration errors, etc.). By default, the entry is made to the "log/PHM" folder of the Program's working directory to a file named in the format Common_YYYYMMDD.log. The path for logging can be set in the PHM.ini file in the *Log (Path=...)* section.

5 Authentication

Access to the full version of the main menu of the Program (Figure 3.9, right) is provided after passing the authentication procedure. To do this, select "Advanced" in the short version of the main menu (Figure 3.9, left), and a window for entering the username and password will be displayed on the screen (Figure 5.1).

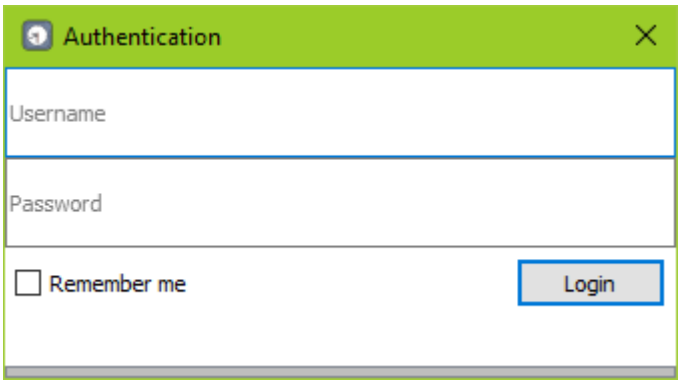


Figure 5.1 – Window for entering username and password

Default authentication parameters (username / password): user / 1.

Information about users and passwords is stored in the *passwords.ini* file (Figure 5.2), which is located in the "config" subdirectory of the Program's working folder.

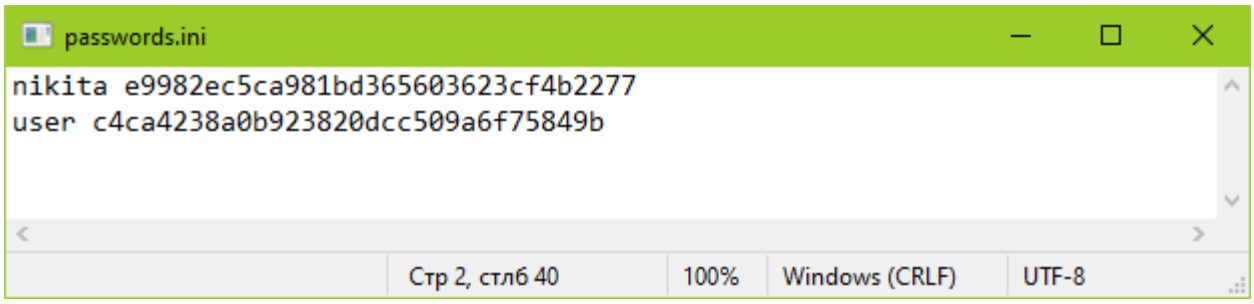


Figure 5.2 – File with authentication parameters

The file consists of a set of lines, which contain usernames and hash-codes of passwords (md5).

Usernames are editable directly in the passwords.ini file. To change the password of a particular user, it is necessary to generate the value of the md5 hash function of the new password (online services are available, e.g. md5hashgenerator.com). After that the existing hash code should be replaced with a new value and saved in the file. The changes will take effect next time the Program is started.

6 List of abbreviations and special terms

CPU – central processing unit;

DAC – digital to analog converter;

FLL – frequency locked loop;

GLONASS – global navigation satellite system;

GPS – global positioning system;

HFO – high frequency oscillator;

LAN – local area network;

PLD – programmable logic device;

PLL – phase locked loop;

RMS – root mean square value;

RSS – reference signals source;

TCP – transmission control protocol.