LLC “Chromos”

User’s Guide

“CHROMOS PGC-1000” Software

Dzerzhinsk
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Contents

Introduction

This user's guide describes the operation with the integrated software "CHROMOS PGC-1000" (hereinafter referred to as the software) intended to control chromatograph "Chromos PGC-1000" (hereinafter referred to as the chromatograph) and to process chromatographic data, keep the database for all analyzes.

The metrologically significant part of the integrated software allows to verify the acceptability of chromatographic data and calculate a molar fraction of natural gas components in accordance with GOST 31371.7-2008, as well as to calculate the physical and chemical parameters of natural gas on their basis according to GOST 31369-2008.

The metrologically insignificant part of the integrated software allows to control the chromatograph and external components, obtain, identify and interpret chromatographic data, to adjust the chromatograph operation mode in accordance with GOST 31371-2008, and to communicate with external devices.

Persons who have studied this user's guide, who have computer Internet browsers skills may operate the software. Each user must have the necessary knowledge in the subject field for proper operation with the data to be provided.

1 Preparation for operation

1.1 Connection methods

The chromatograph has communication channels via serial RS-485 interface and the Ethernet network.

Modbus TCP protocols are supported on the Ethernet network (the port is set in the software settings (item 4.2) and HTTP (port 80) – the Web interface.

Serial RS-485 interface provides supporting the Modbus RTU connection, the relevant parameters are set in the software settings (item 4.2).

1.2 Minimum system requirements for PC

To view and process chromatographic data, a remote personal computer (PC) may be used. Minimum system requirements for PC:

- Compatibility with IBM PC;
- Pentium IV processor;
- CD drive;
- 1280x1024 screen;
- 1 GB RAM;
- Mouse and keyboard;
- Windows operating system.

1.3 Startup of the “CHROMOS PGC-1000” software over Ethernet

When operating the “CHROMOS PGC-1000” software over Ethernet, the following procedures shall be performed at the user's workplace:

1. Start up one of the supported browsers (Internet Explorer, Google Chrome, Mozilla Firefox).
2. Specify the chromatograph network address in the browser’s address bar and click the navigation button.
3. Enter the login and password in the form of authentication. Click the "Sign in" button (Figure 1).

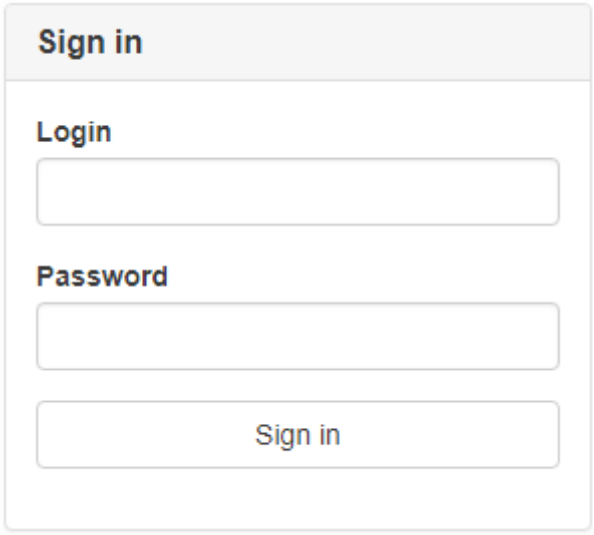


Figure 1 – Sign in

4. The user will go to the home page of the "CHROMOS PGC-1000" software (Figure 2).

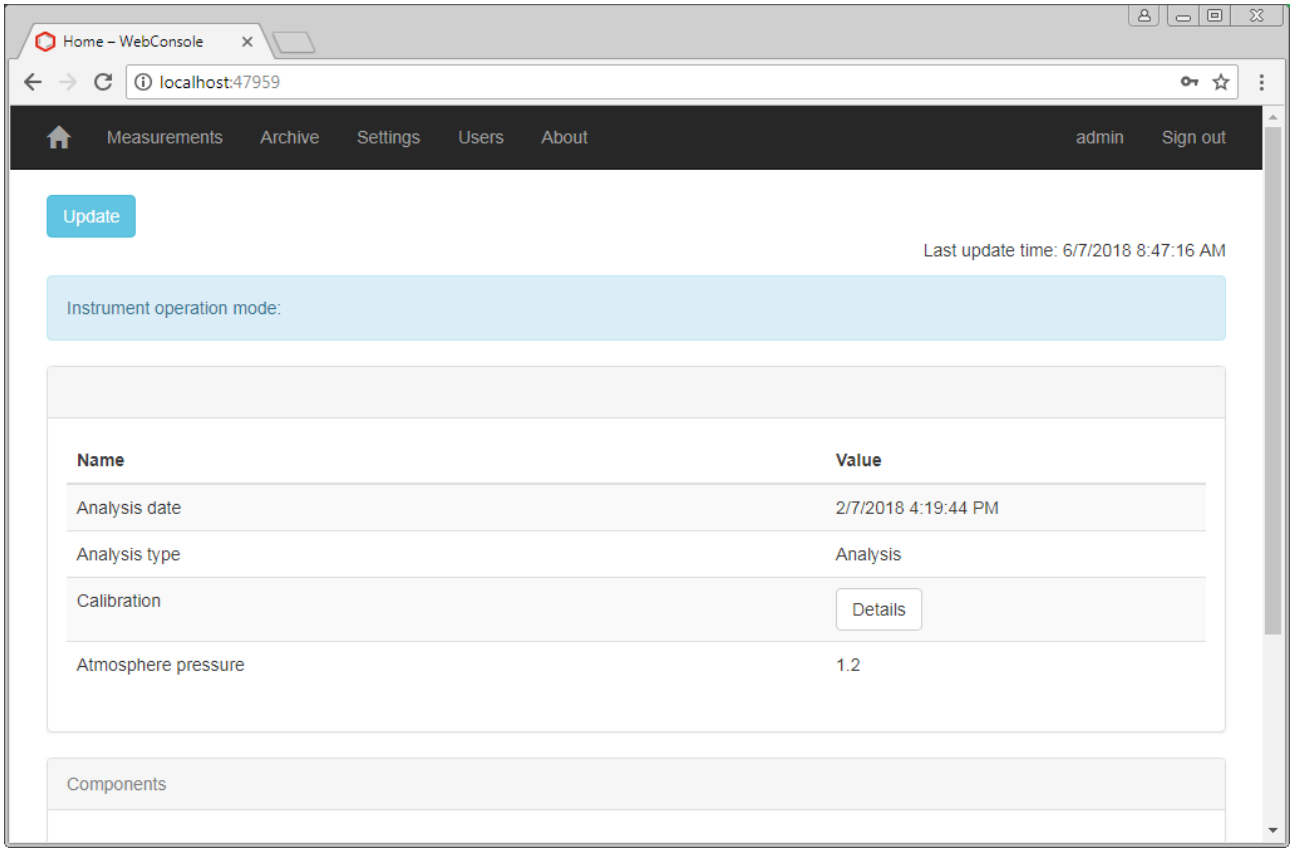


Figure 2 – Home page of the "CHROMOS PGC-1000" software

If the "CHROMOS PGC-1000" application does not start, please contact the User Support Service.

2 Chromatograph control

To control the chromatograph an integrated computer is used that allows the user to adjust the operating parameters in accordance with the specific process conditions. The chromatograph is controlled using the mouse mounted directly on the instrument. A measurement result is displayed on the instrument and can be transferred to the control system.

The chromatograph is automatically controlled in accordance with the software settings. Reference and sampled gas flows are automatically calibrated and changed over at the preset time (see item 4.3)

The analysis conditions, chromatograph assemblies temperature, carrier-gas flow rate and valves switching time are set by the manufacturer, contained in predefined methods and cannot be changed by the user.

3 Operations description

3.1 Authorization

For authentication in the application, the user shall enter the login and password (Figure 3).

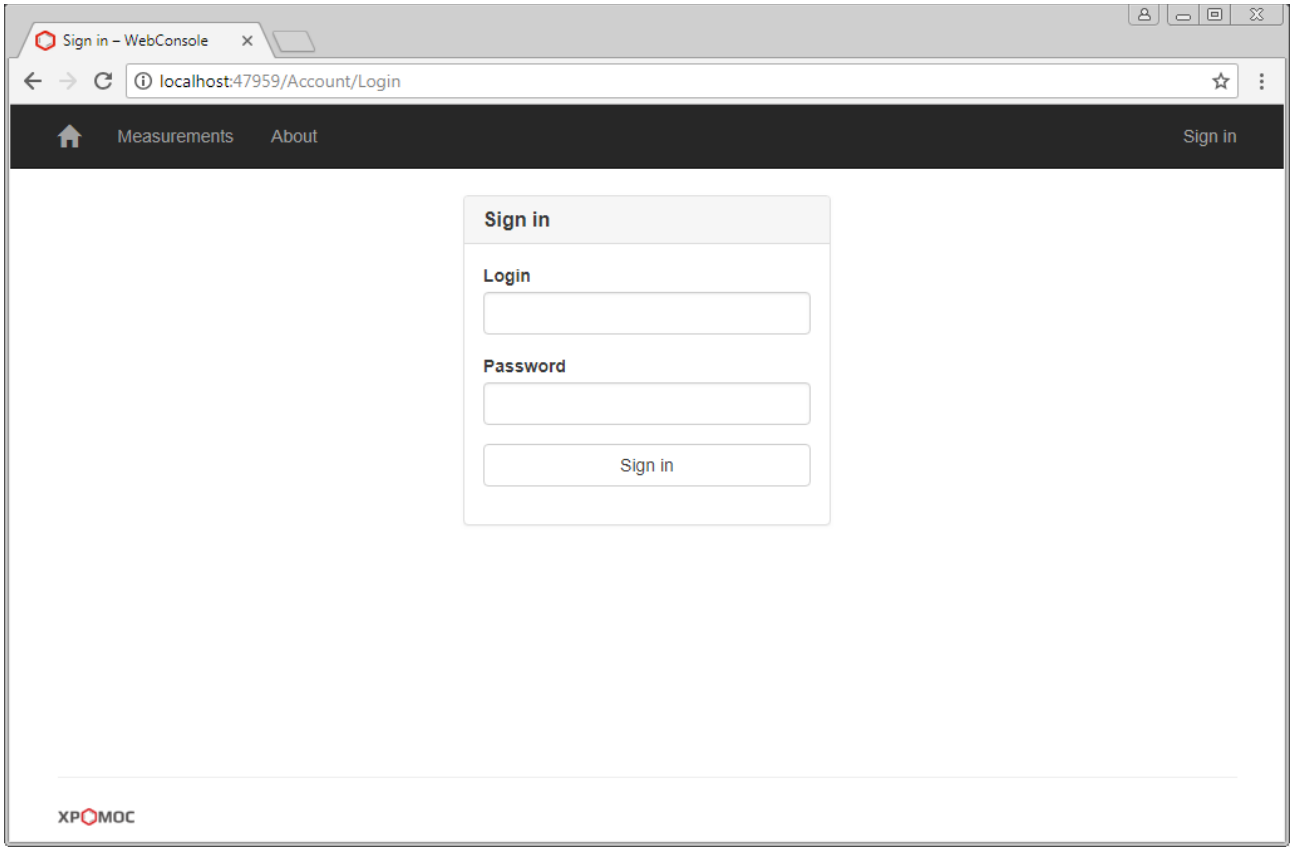


Figure 3 – Authorization

The following is set by default:

- login: admin;
- password: password.

It is recommended to change them when the program is firstly start up. To do this, sign in and click the Login button from the main menu. Now the form of password change is available (Figure 4). Enter the current password and new one doubly to exclude the invalid password entry.

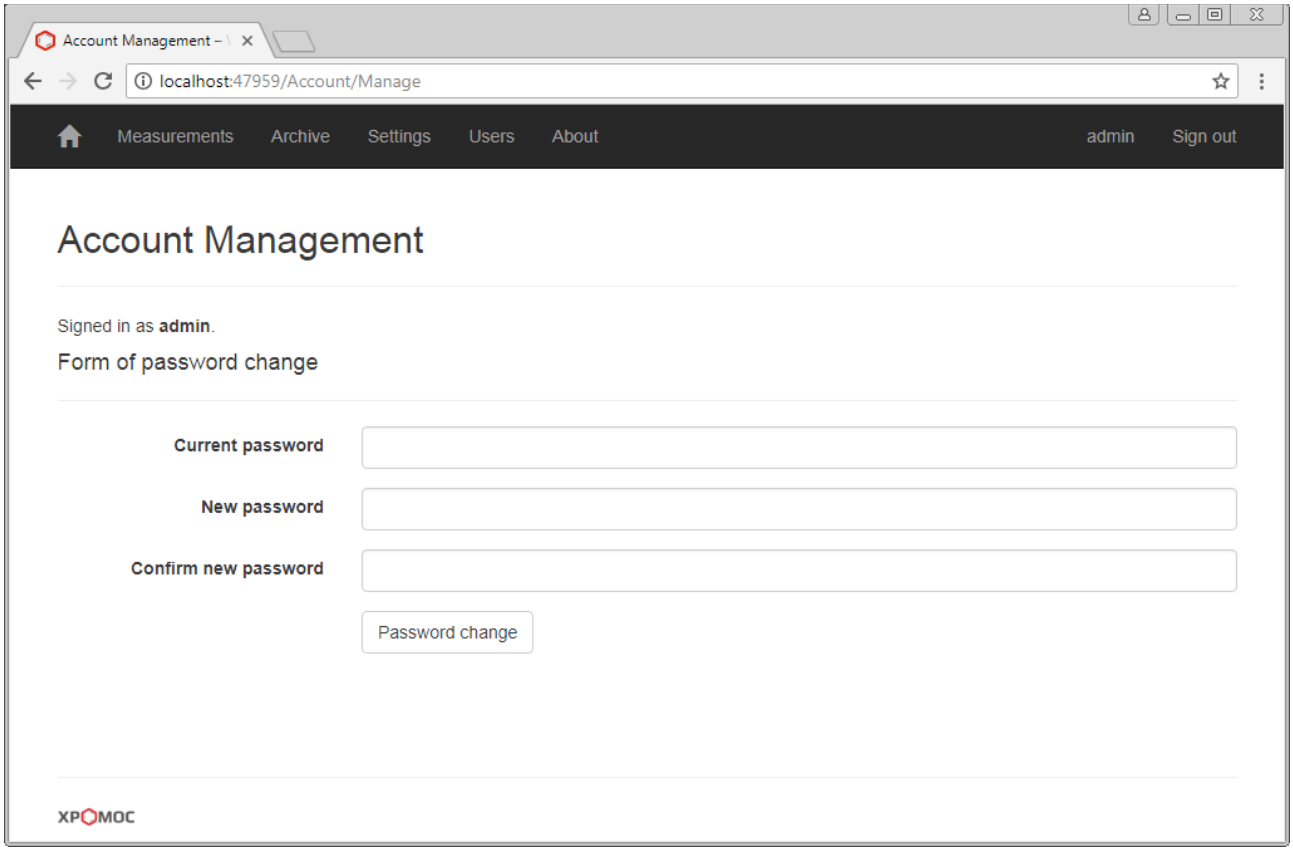


Figure 4 – Form of password change

3.2 New user registration

To register a new user, go to the user and access management page. Select the [Users] tab from the main menu (Figure 5) → click the [Create a New User] button (Figure 6), then enter the login and password (the password shall be of at least 6 characters), specify the user role on the next page (Figure 7).

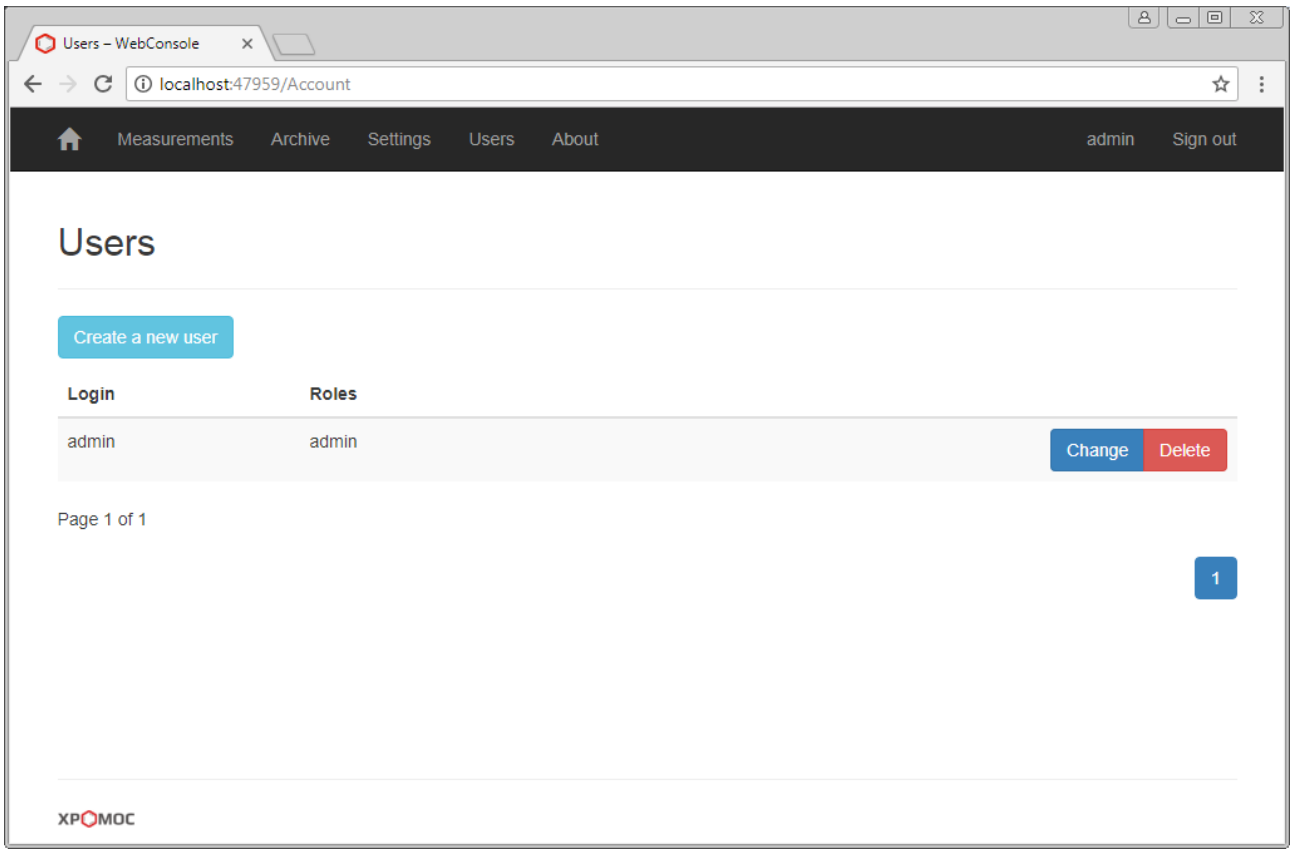


Figure 5 – Users

The software implements three types of roles: "guest", "operator" and "administrator". The "guest" role is used for all unauthorized users, they have the right only to view logs of measurement, calibrations and errors, with no right to make any changes. A user with the "operator" role can view all the logs and generate reports, but has no access to the software settings. The user having the "administrator" rights can view, generate all reports and make the necessary changes to the program settings.

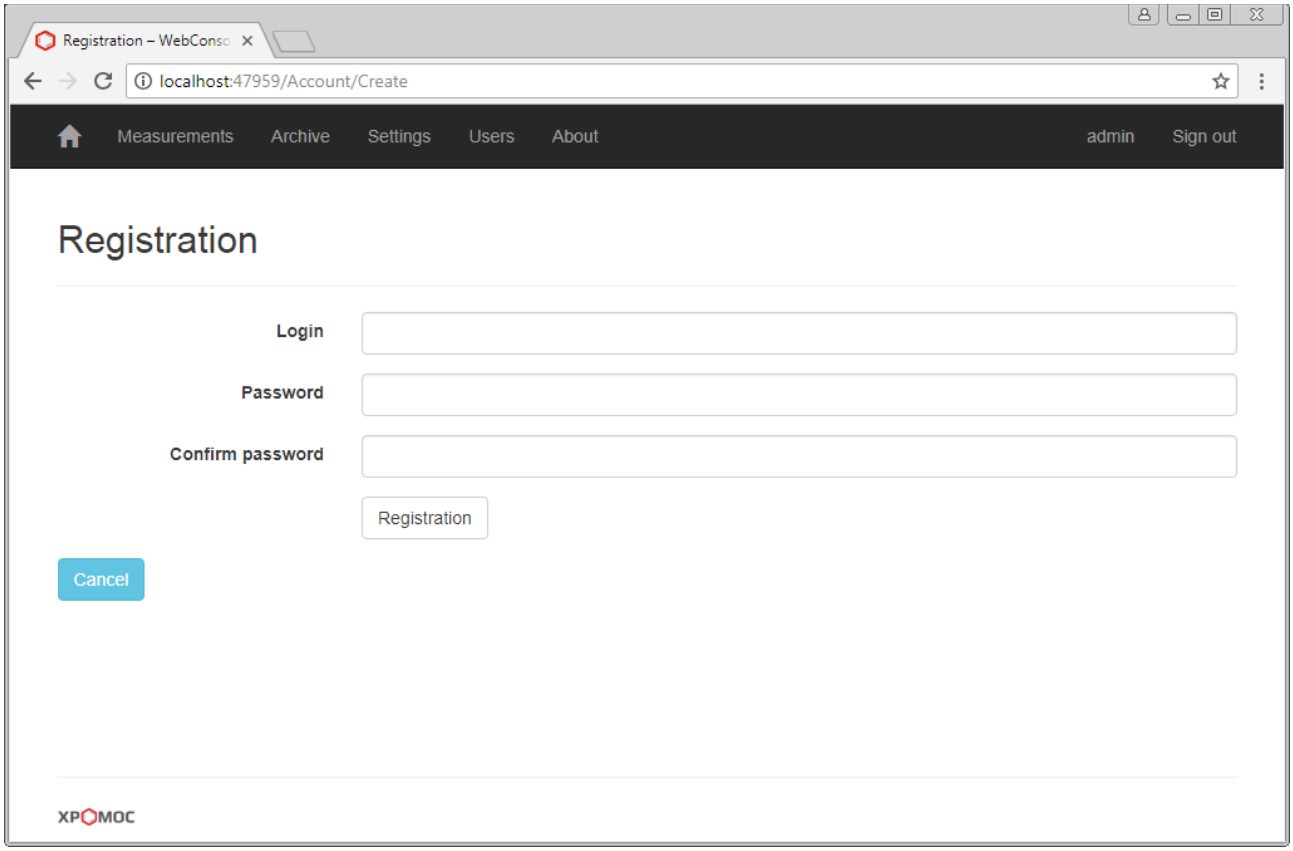


Figure 6 – Users. Registration

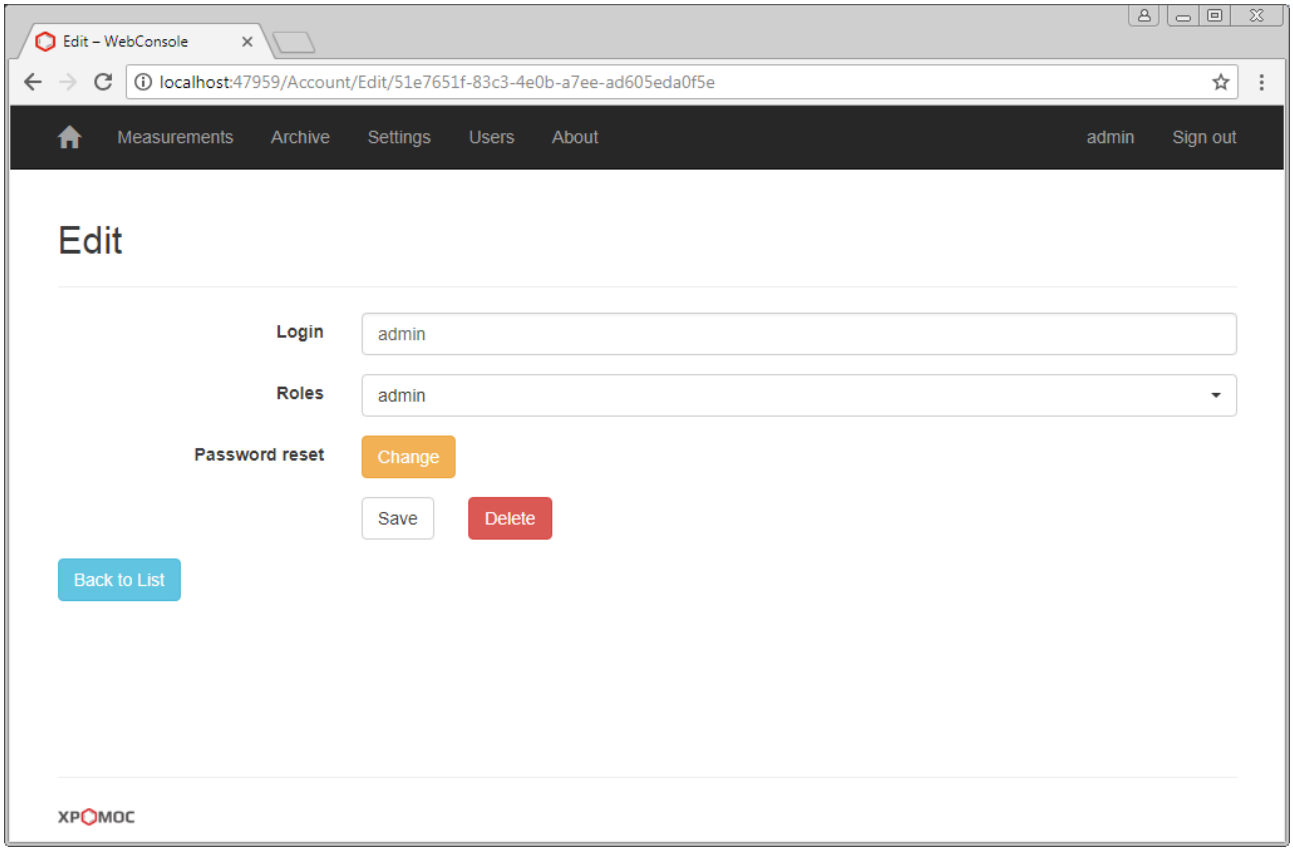


Figure 7 – Users. Edit

3.3 Status view

On the main page (Figure 8) the chromatograph status and the last analysis are displayed. The data are automatically updated every 5 seconds; click the [Update] button to request the latest data.

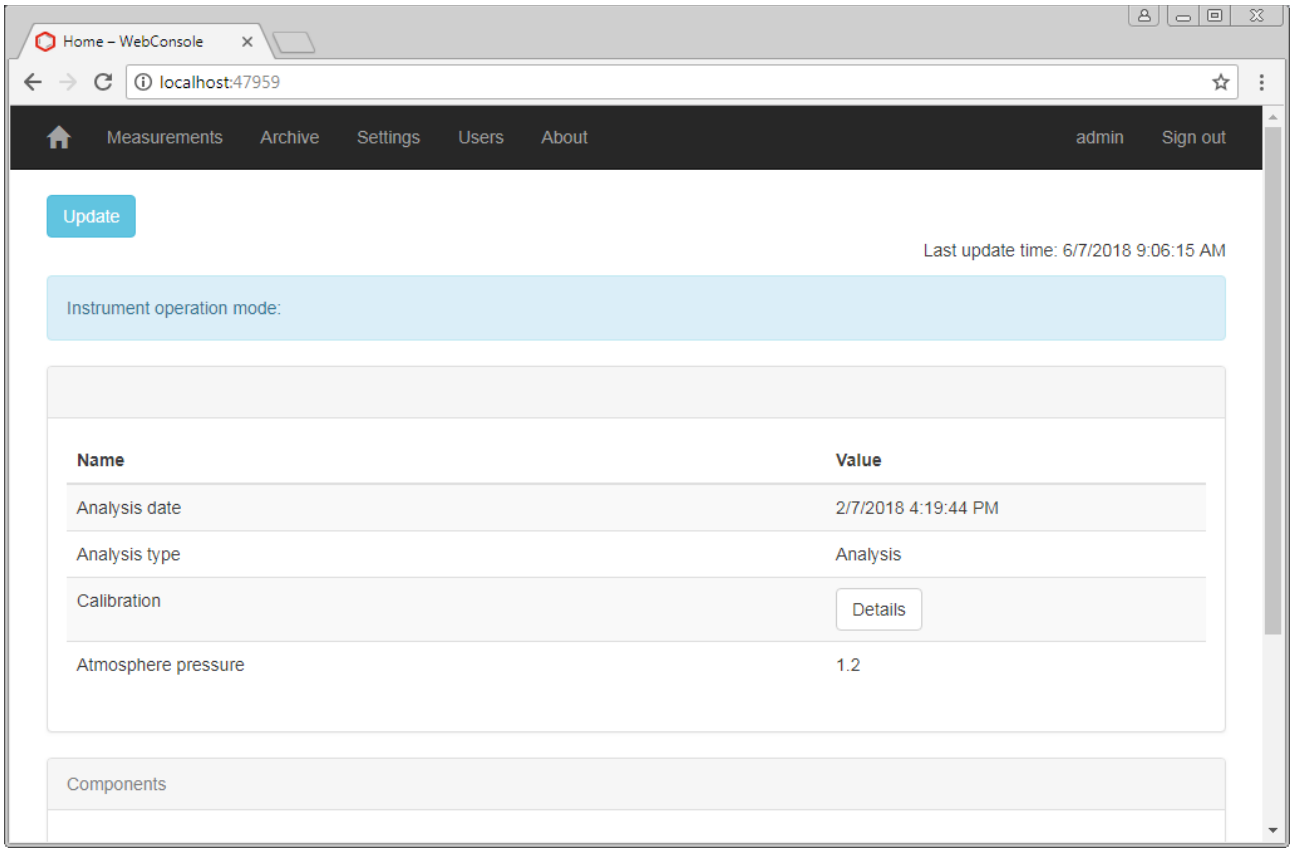


Figure 8 – Status

3.4 Operation logs

To view the Operation Logs, select [Archive] from the main menu, then select the corresponding item from the left menu of the program (Figure 9).

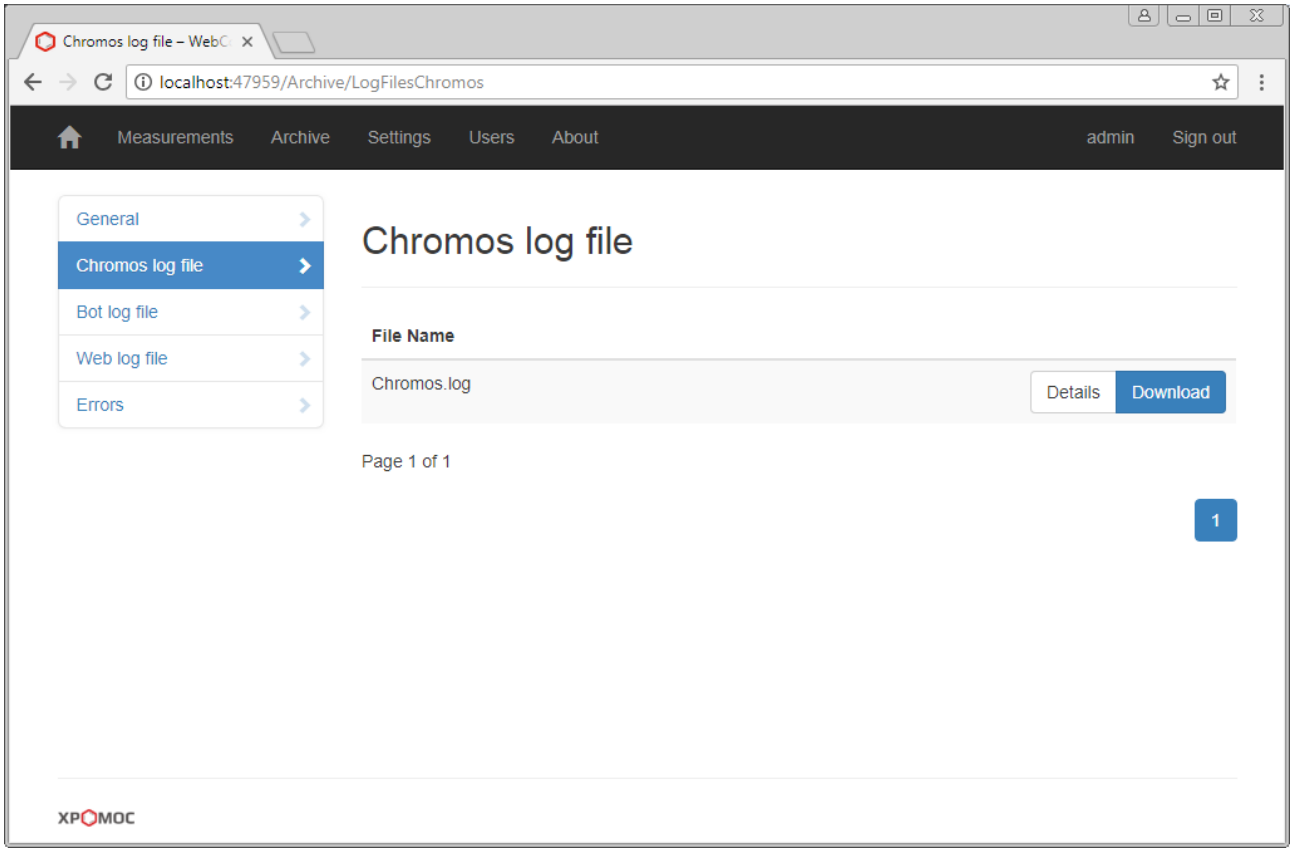


Figure 9 – Log file

A list of logs (including the archived ones) of the selected application is available for the user in the page.

- "File name" – log file name;
- "Details" – file viewing;
- "Download" – file saving.

After selecting [Details], one can see the log data, view this file, and save it as a text file (Figure 10).

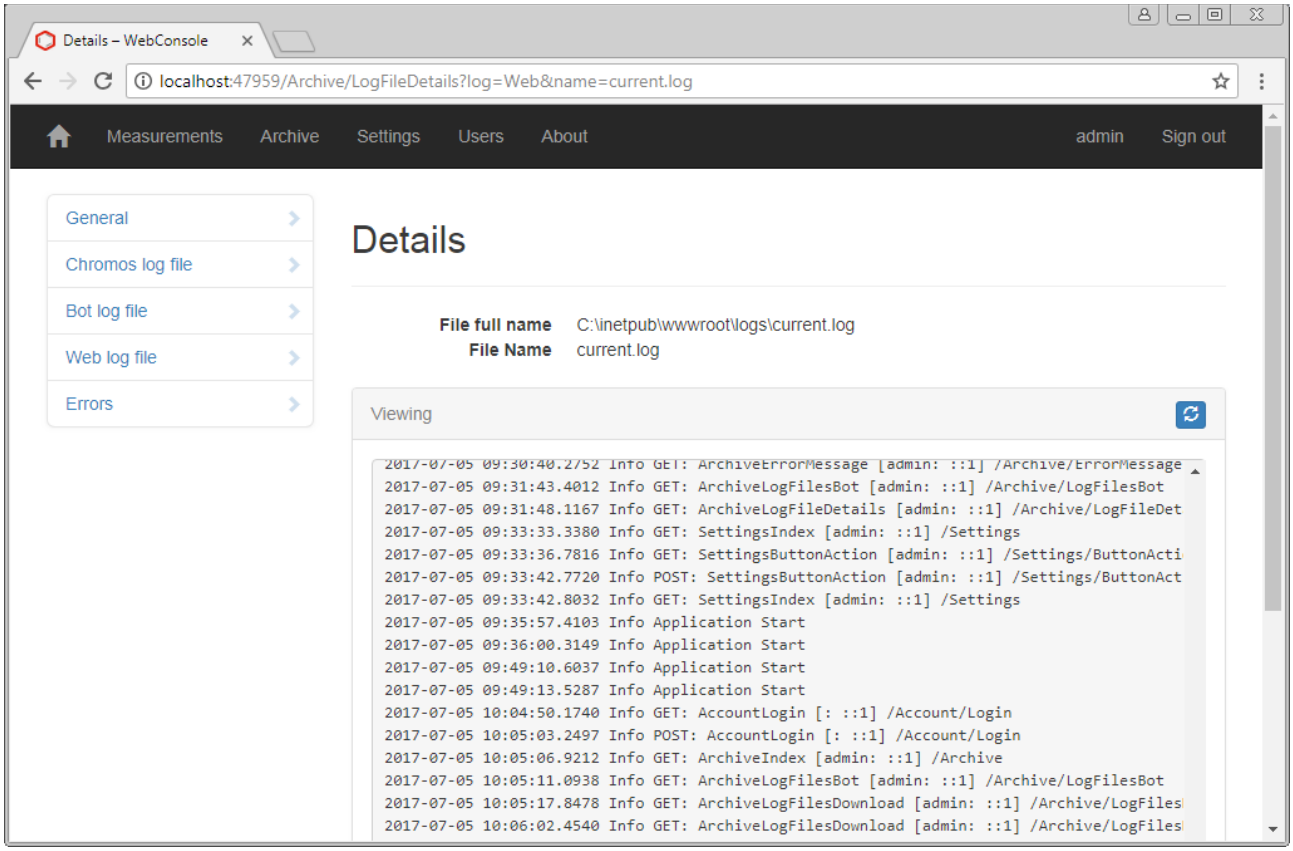


Figure 10 – Log file. Details

3.5 Error message log

To view the error message log, select [Archive] → [Errors] (Figure 11). The following information will be available for the user:

- "Date" – error date;
- "Type" – error type;
- "Code" – error code;
- "Message" – error description.

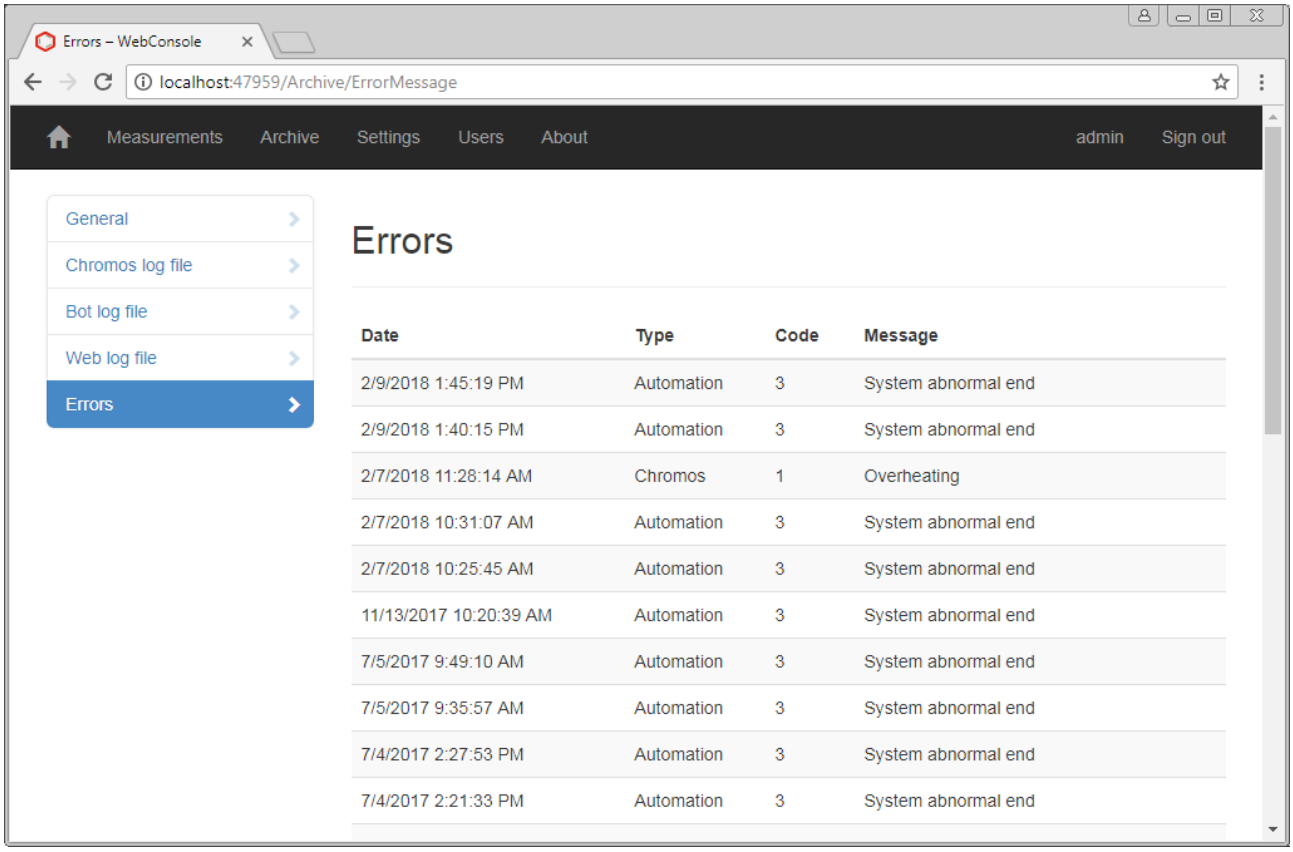


Figure 11 – Errors

3.6 Physical and chemical parameters (FCP) calculation setting

The "CHROMOS PGC-1000" software allows taking into account a molar fraction of components not detected with chromatograph "Chromos PGC-1000" and accepted as conditional-constant. A number of conditional-constant parameter components is unlimited.

To specify the conditional-constant components involved in the calculation, select [Settings] → [Calculation] (Figure 12). The table "Components" containing the following data will appear:

- "External component" – a name of conditional-constant component. Any of the components can be selected as a conditional-constant one;
- "Content (mol, %)" – a molar fraction of the external component in percentage.

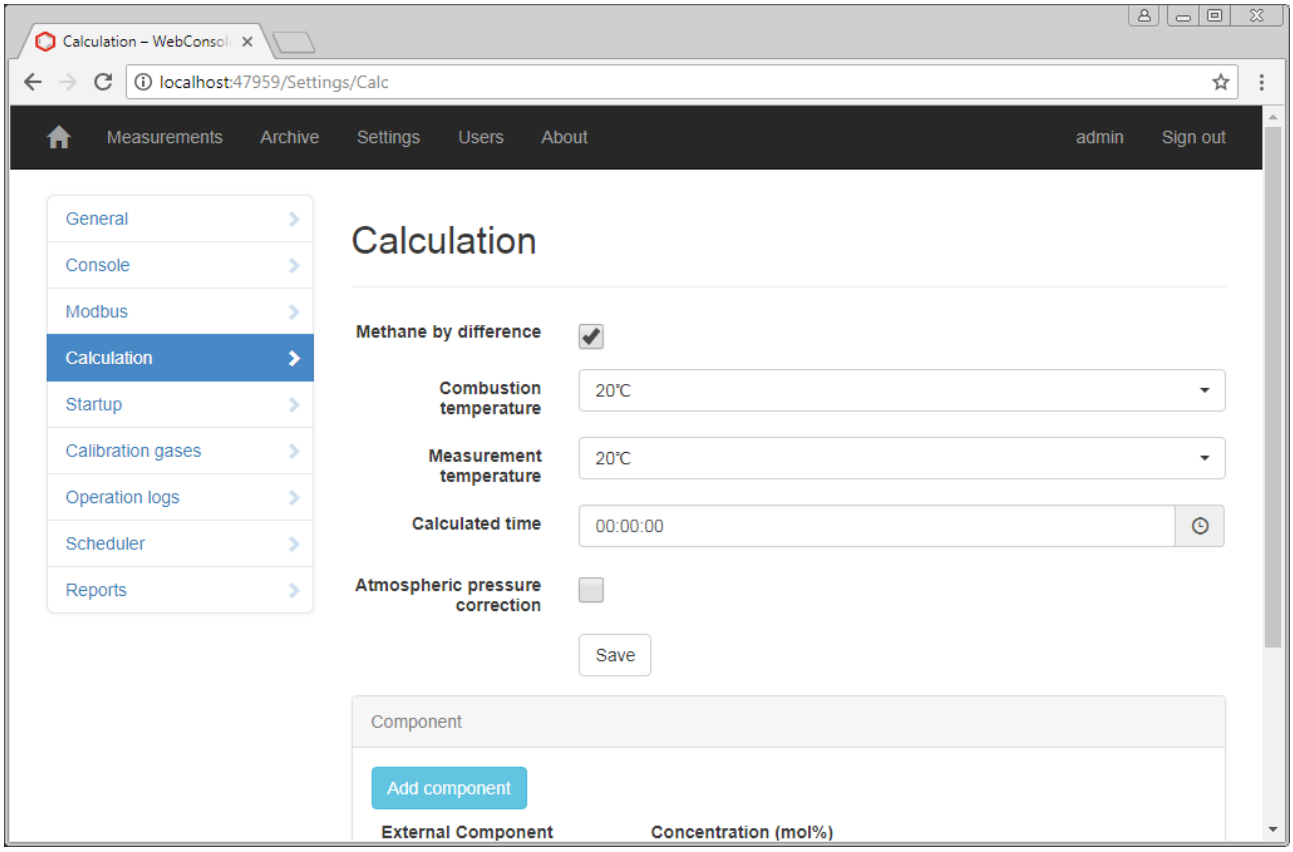


Figure 12 – Calculation

To add a conditional-constant component, select [Add component] and in the opened page (Figure 13) specify the component name from the drop-down list and its molar fraction content in percentage.

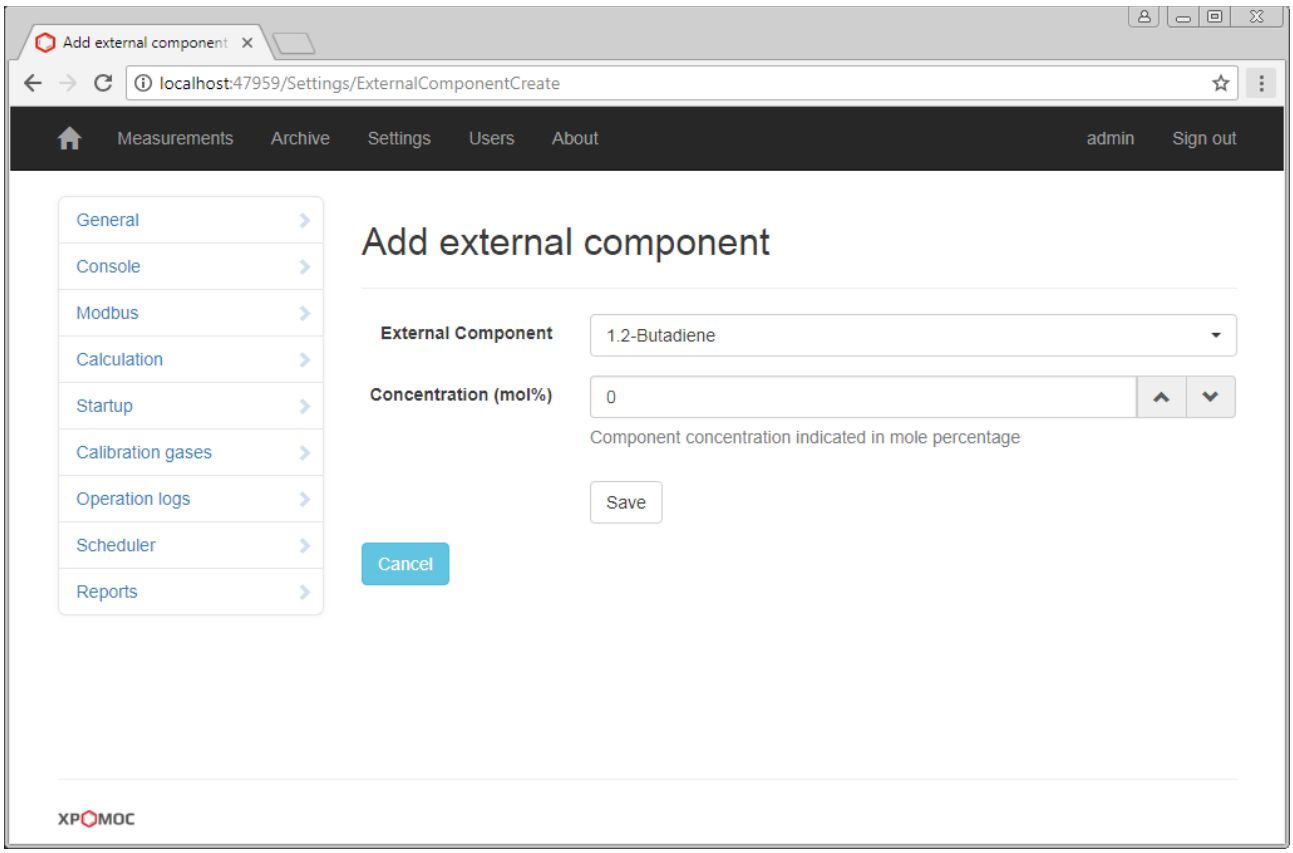


Figure 13 – Calculation Add an external component

To change the conditional-constant component content, select [Change] (Figure 14) opposite to it and specify a new molar fraction content in percentage in the opened page (Figure 15).

To delete a conditional-constant component, select [Delete] (Figure 14) opposite to it and confirm the action in the opened page (Figure 16).

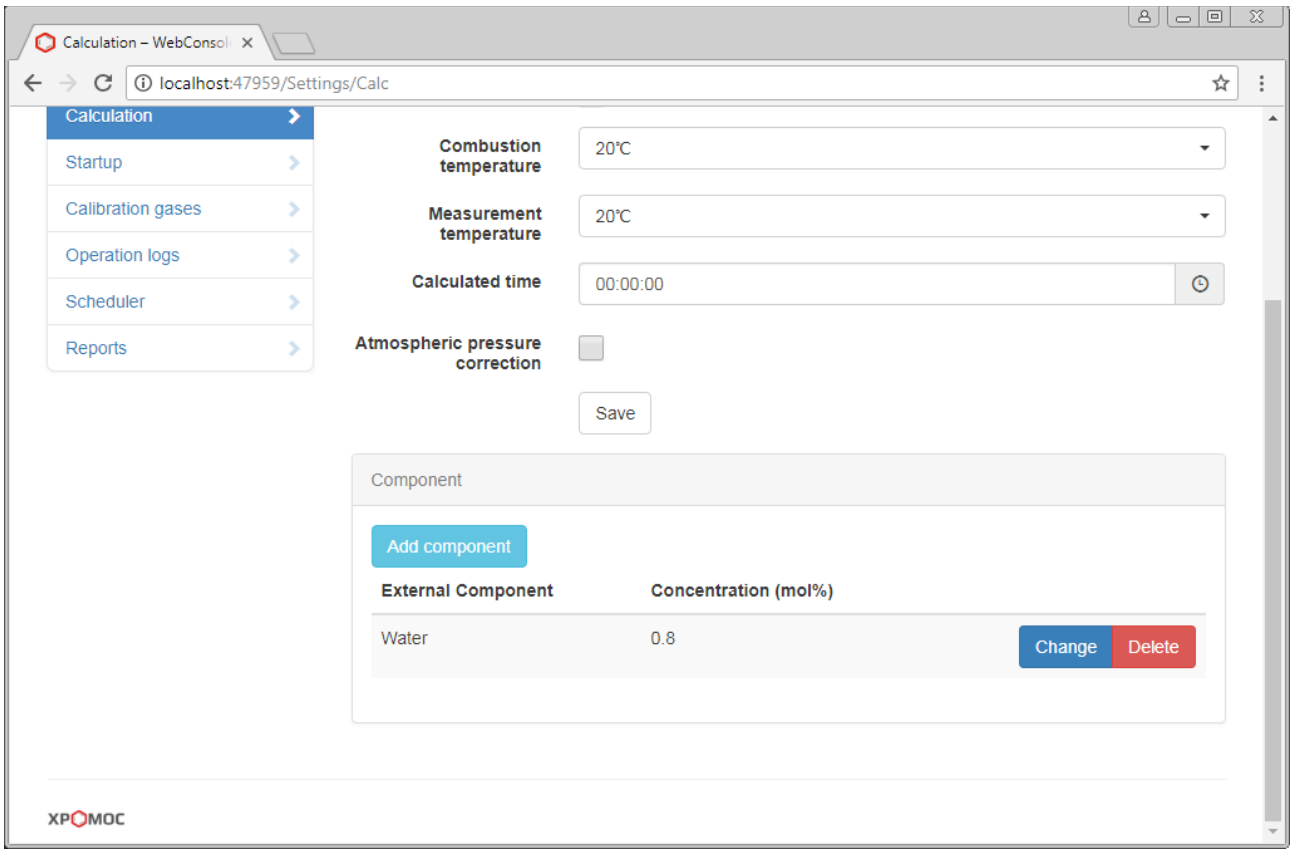


Figure 14 – Calculation. Components

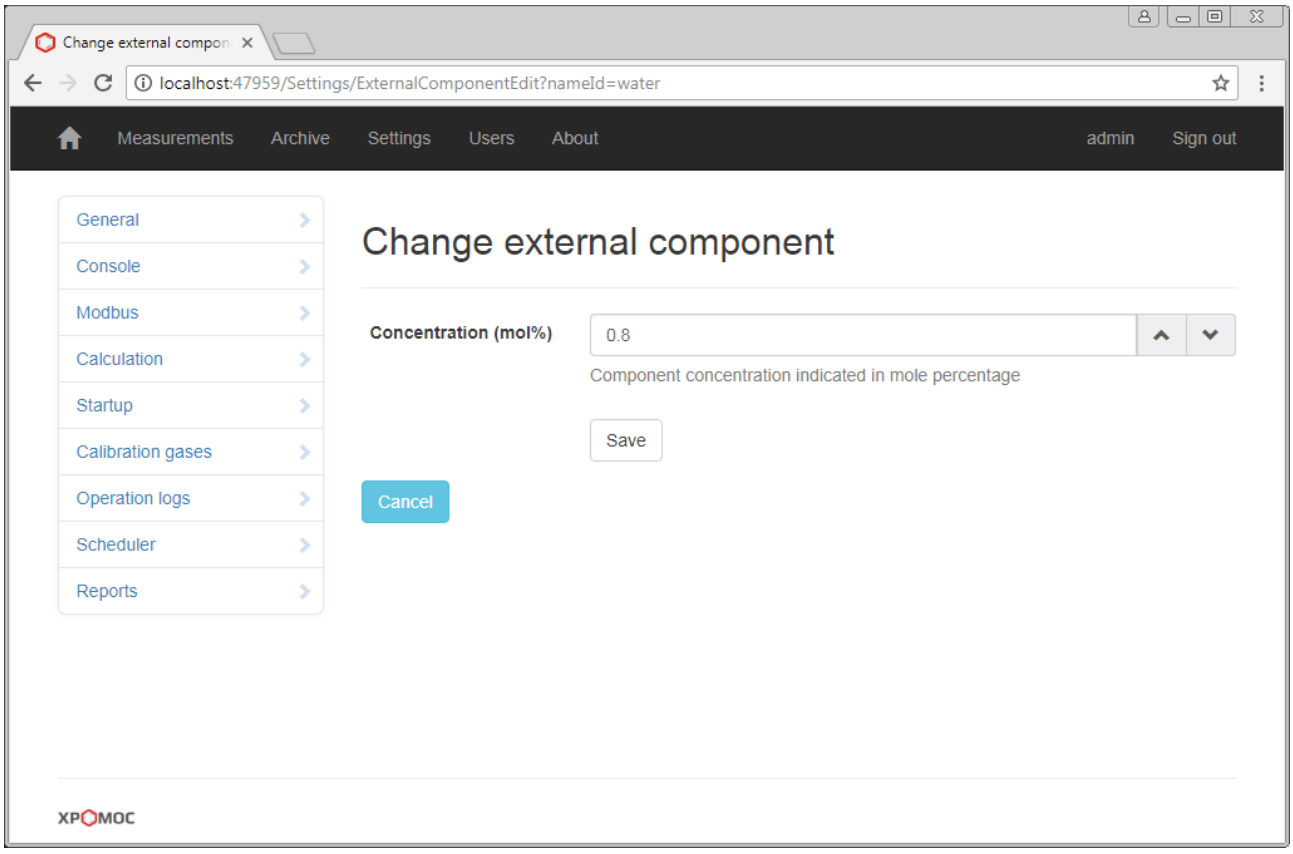


Figure 15 – Calculation. Change external component

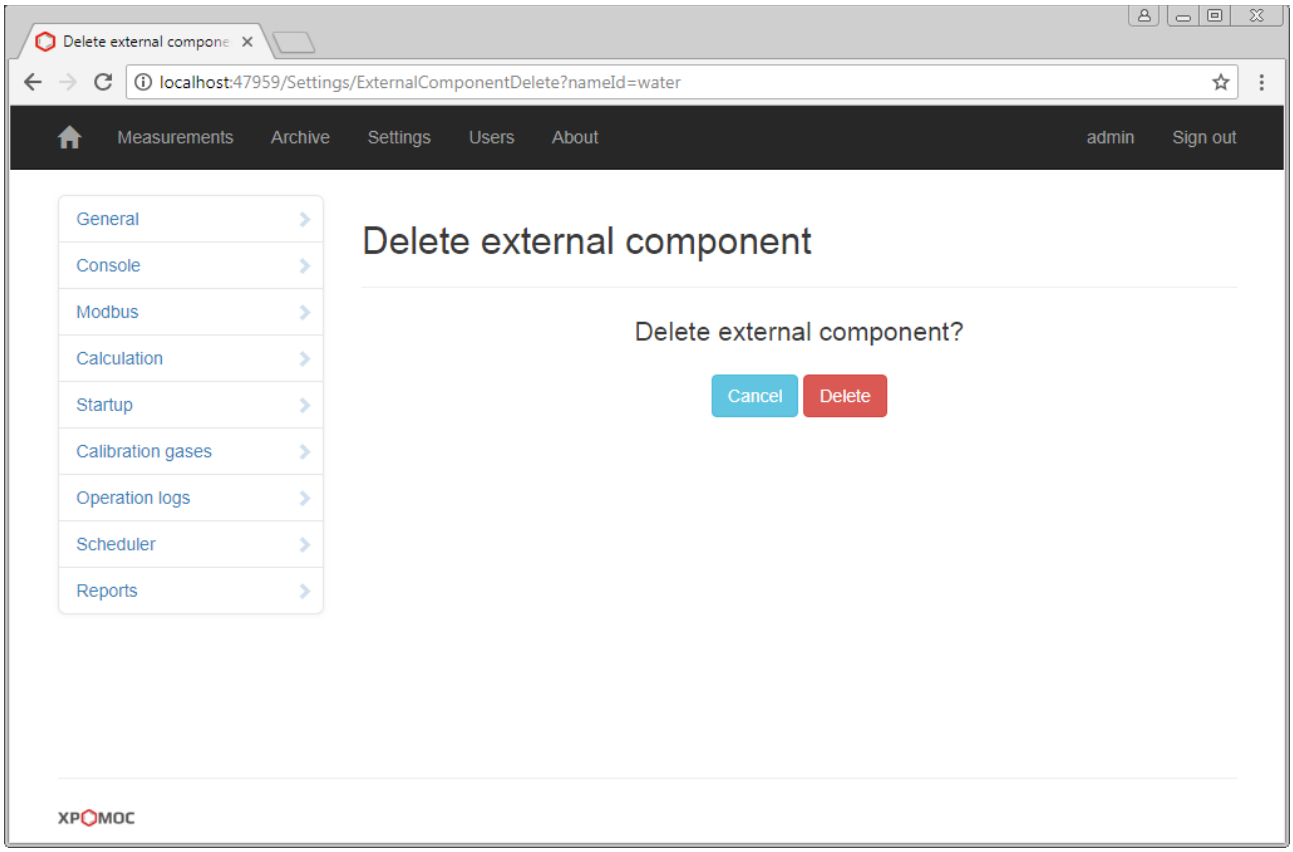


Figure 16 – Calculation. Delete external component

The molar fraction of conditional-constant components is set equal to the values indicated in the calculation settings.

To select a method for methane calculation, tick the "Methane by difference" item for calculation by difference or uncheck for calculation by analysis (Figure 12).

The standard combustion temperatures and measurements are selected from the drop-down lists of discrete values. The standard combustion temperature can be set to: 0, 15, 20, and 25 °C. The standard measurement temperature can be set to: 0, 15, and 20 °C.

To adjust the components content by atmospheric pressure, tick the "Atmospheric pressure correction".

3.7 Measurements log

To view the measurement log, select [Measurements] from the main menu (Figure 17). The following information will be available for the user:

- "Analysis date" – analysis date;
- "Analysis type" – possible values "Calibration" or "Analysis".

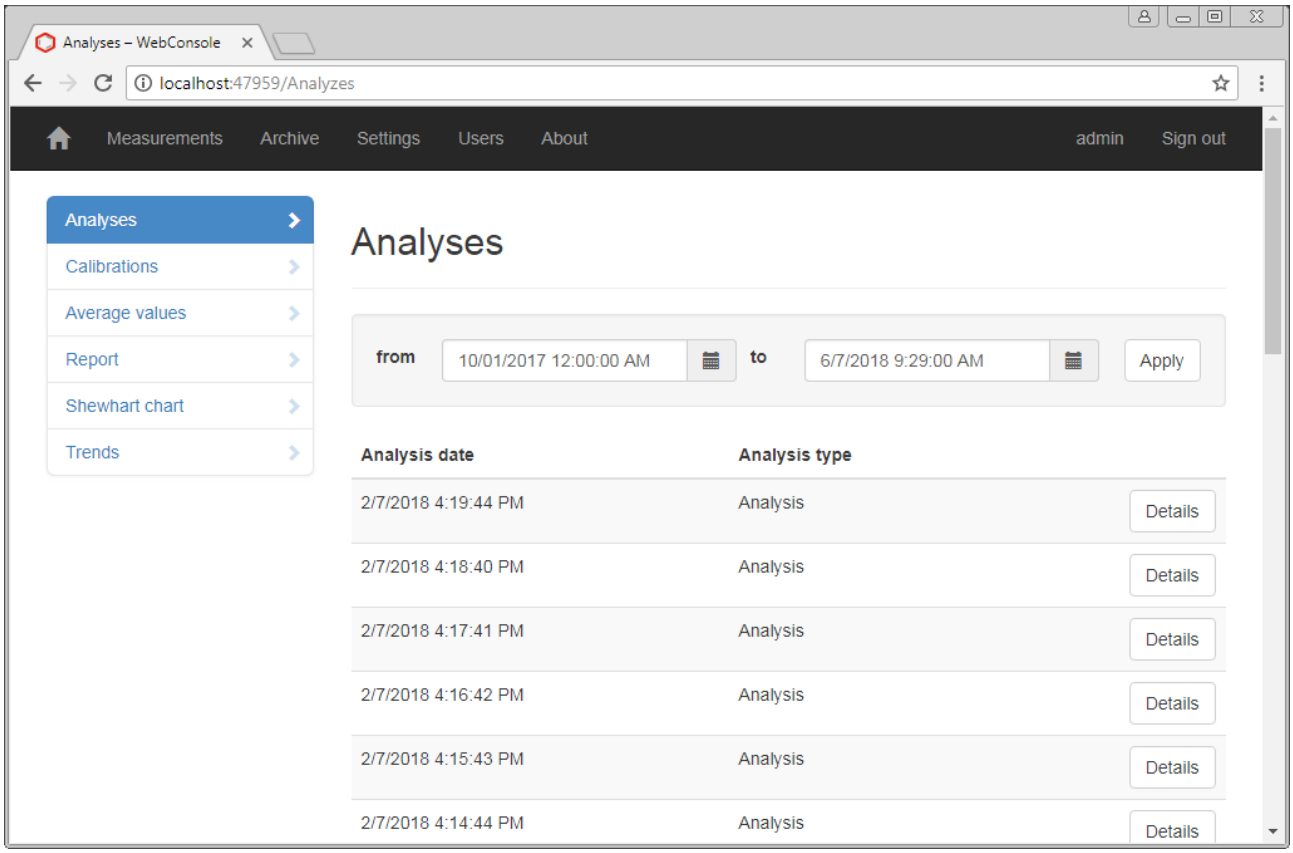


Figure 17 – Measurements

To view the detailed information about the chromatogram, select [Details] on the required entry in the analyses list. The following information will be available for the user in the opened page (Figure 18):

- "Analysis date" – measurements date;
- "Analysis type" – possible values "Calibration", “Manual”, "Analysis";
- "Calibration" – reference to the calibration;
- "Atmospheric pressure" – atmospheric pressure at the time of analysis beginning;
- "Methane by difference" – the flag indicates the method of methane calculation;
- "Combustion temperature" – the following values can be set to: 0, 15, 20, and 25 °C;
- "Measurement temperature" – the following values can be set to: 0, 15, and 20 °C;
- Analysis physical and chemical parameters and their absolute expanded uncertainty (Figure 19):
  - "Name";
  - "Value";
  - "Absolute expanded uncertainty";
- List of components (Figure 20):

- "Name" – component name;
- "Area" – peak area;
- "Height" – peak height;
- "Content" – component content is indicated in molar percentage;
- "Absolute expanded uncertainty" – measurement result uncertainty of the component molar fraction.

To export the measurement results, click the "Export" button. All analyses for the selected period but not more than 1000 entries will be saved in the exported file.

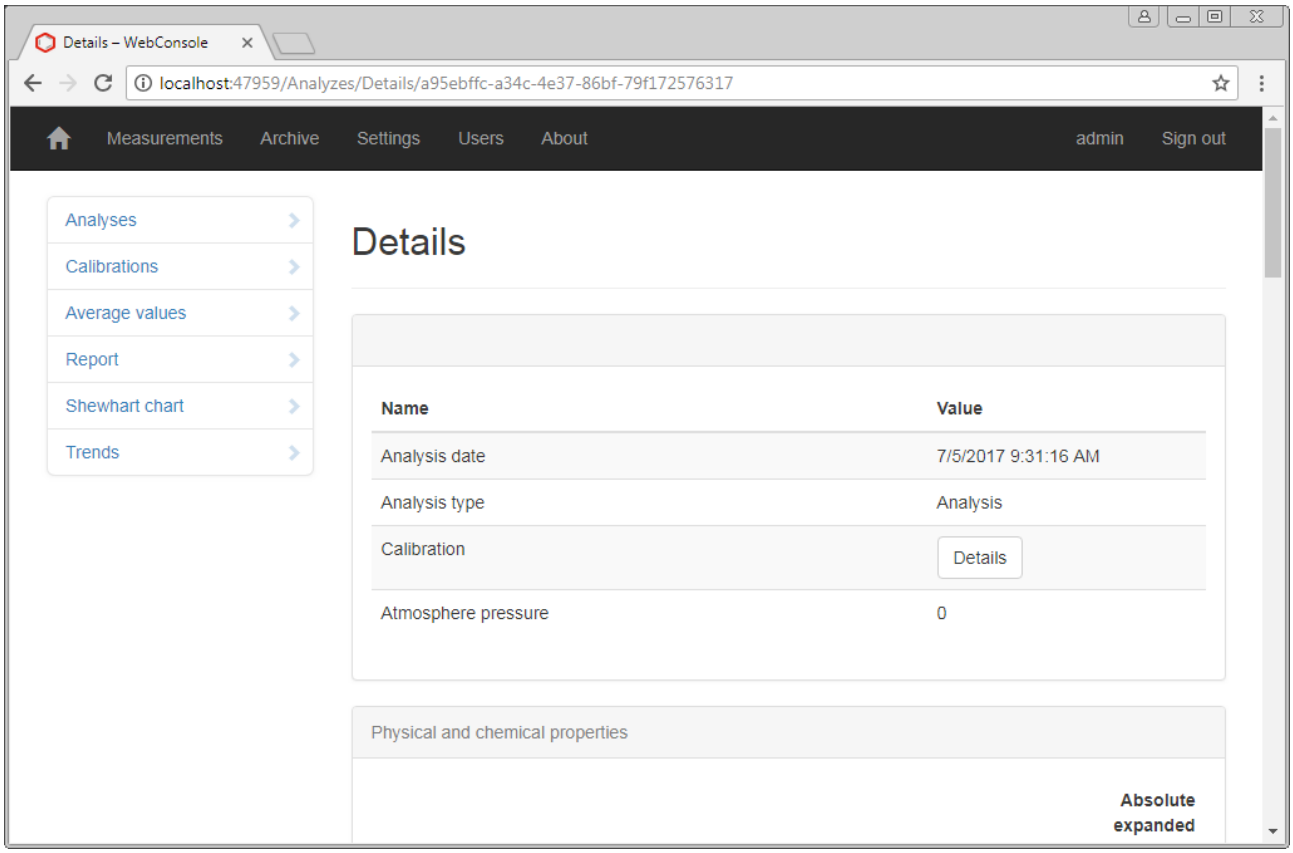
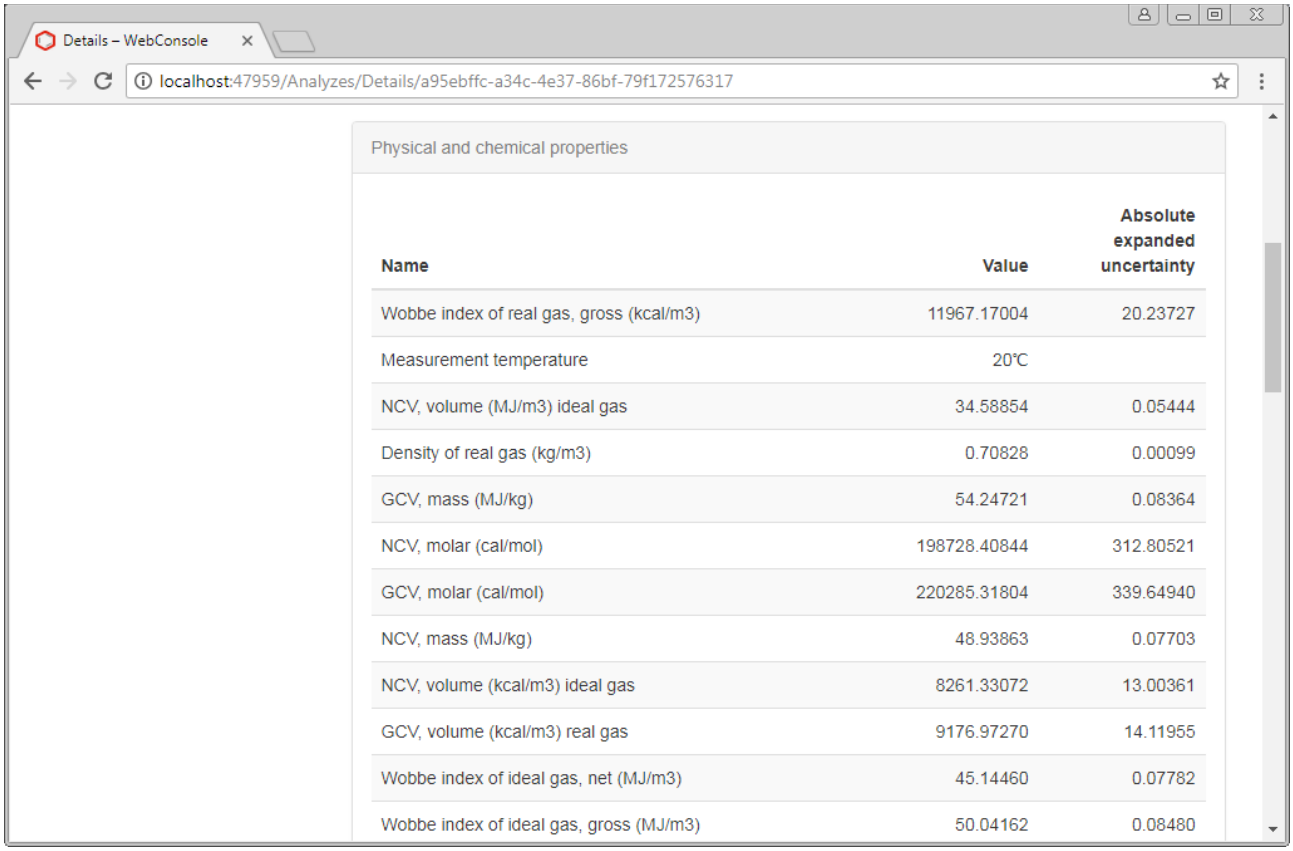


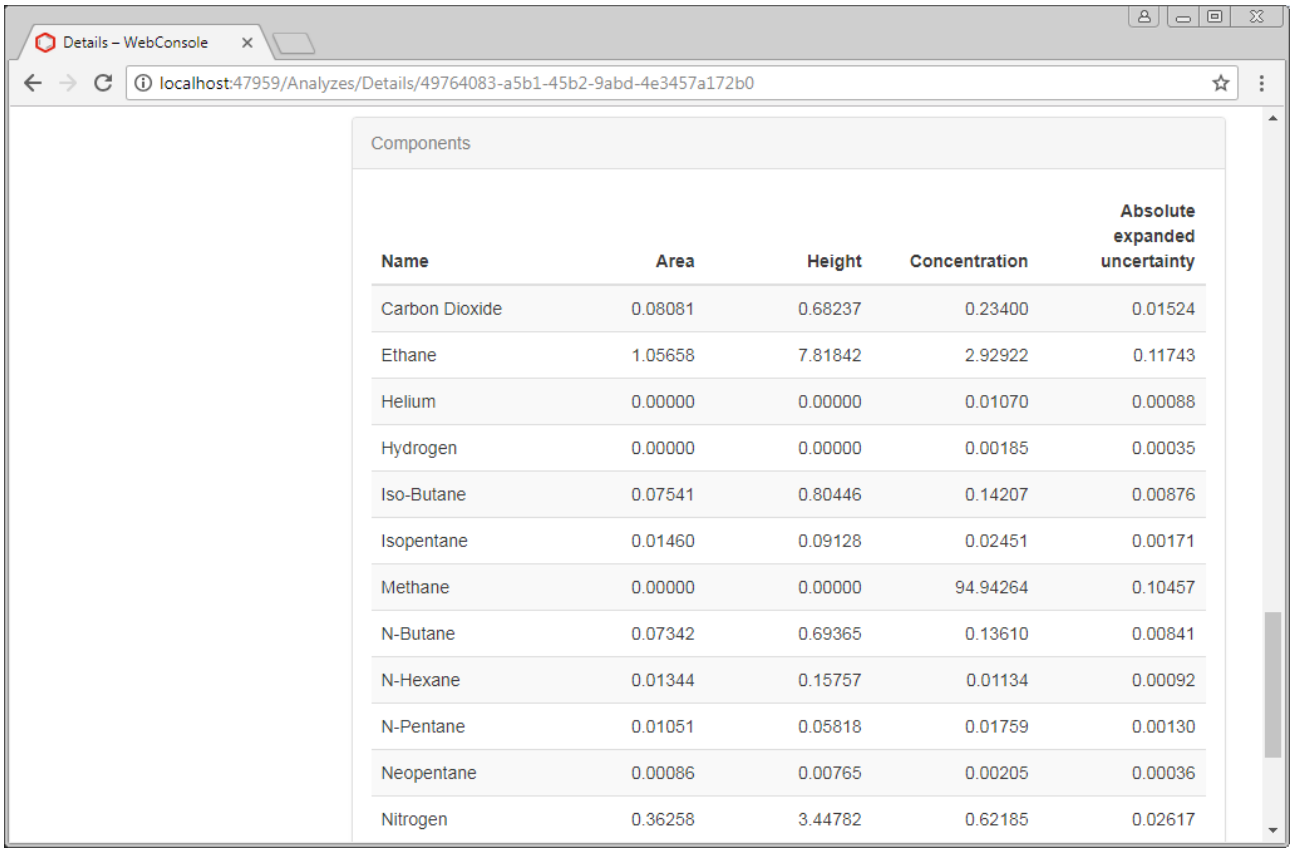
Figure 18 – Measurements. Details



Physical and chemical properties

Name	Value	Absolute expanded uncertainty
Wobbe index of real gas, gross (kcal/m3)	11967.17004	20.23727
Measurement temperature	20°C	
NCV, volume (MJ/m3) ideal gas	34.58854	0.05444
Density of real gas (kg/m3)	0.70828	0.00099
GCV, mass (MJ/kg)	54.24721	0.08364
NCV, molar (cal/mol)	198728.40844	312.80521
GCV, molar (cal/mol)	220285.31804	339.64940
NCV, mass (MJ/kg)	48.93863	0.07703
NCV, volume (kcal/m3) ideal gas	8261.33072	13.00361
GCV, volume (kcal/m3) real gas	9176.97270	14.11955
Wobbe index of ideal gas, net (MJ/m3)	45.14460	0.07782
Wobbe index of ideal gas, gross (MJ/m3)	50.04162	0.08480

Figure 19 – Measurements. Details (analysis physical and chemical parameters)



Components

Name	Area	Height	Concentration	Absolute expanded uncertainty
Carbon Dioxide	0.08081	0.68237	0.23400	0.01524
Ethane	1.05658	7.81842	2.92922	0.11743
Helium	0.00000	0.00000	0.01070	0.00088
Hydrogen	0.00000	0.00000	0.00185	0.00035
Iso-Butane	0.07541	0.80446	0.14207	0.00876
Isopentane	0.01460	0.09128	0.02451	0.00171
Methane	0.00000	0.00000	94.94264	0.10457
N-Butane	0.07342	0.69365	0.13610	0.00841
N-Hexane	0.01344	0.15757	0.01134	0.00092
N-Pentane	0.01051	0.05818	0.01759	0.00130
Neopentane	0.00086	0.00765	0.00205	0.00036
Nitrogen	0.36258	3.44782	0.62185	0.02617

Figure 20 – Measurements. Details (components list)

The software automatically calculates the expanded uncertainty of the components molar fraction measurement results in accordance with GOST 31371.7-2008 (Figure 20). These values are indicated in the "Absolute expanded uncertainty" column of the component table.

The expanded uncertainty of natural gas FCP calculated in accordance with GOST 31369-2008 are indicated in the "Absolute expanded uncertainty" column of the physical and chemical parameters table (Figure 19).

The software automatically calculates the relative deviation of components molar fraction in the calibration gas from the measured value of components molar fraction in the sampled gas, and compares the obtained value with the maximum permissible value specified in GOST 31371.6-2008. In case of standard value exceedance, the software issues the warning "Calibration and sampled gases differ" (Figure 21).

Figure 21 – Warning. Calibration and sampled gases differ.

3.8 Calibration gas

To enter and change entries on the calibration gas, select [Settings] → [Calibration gas] (Figure 22).

A list of calibration gases will be available for the user. The gas used for automatic chromatograph calibration will be highlighted in green. Here the user can delete, edit the selected gas or create a new one.

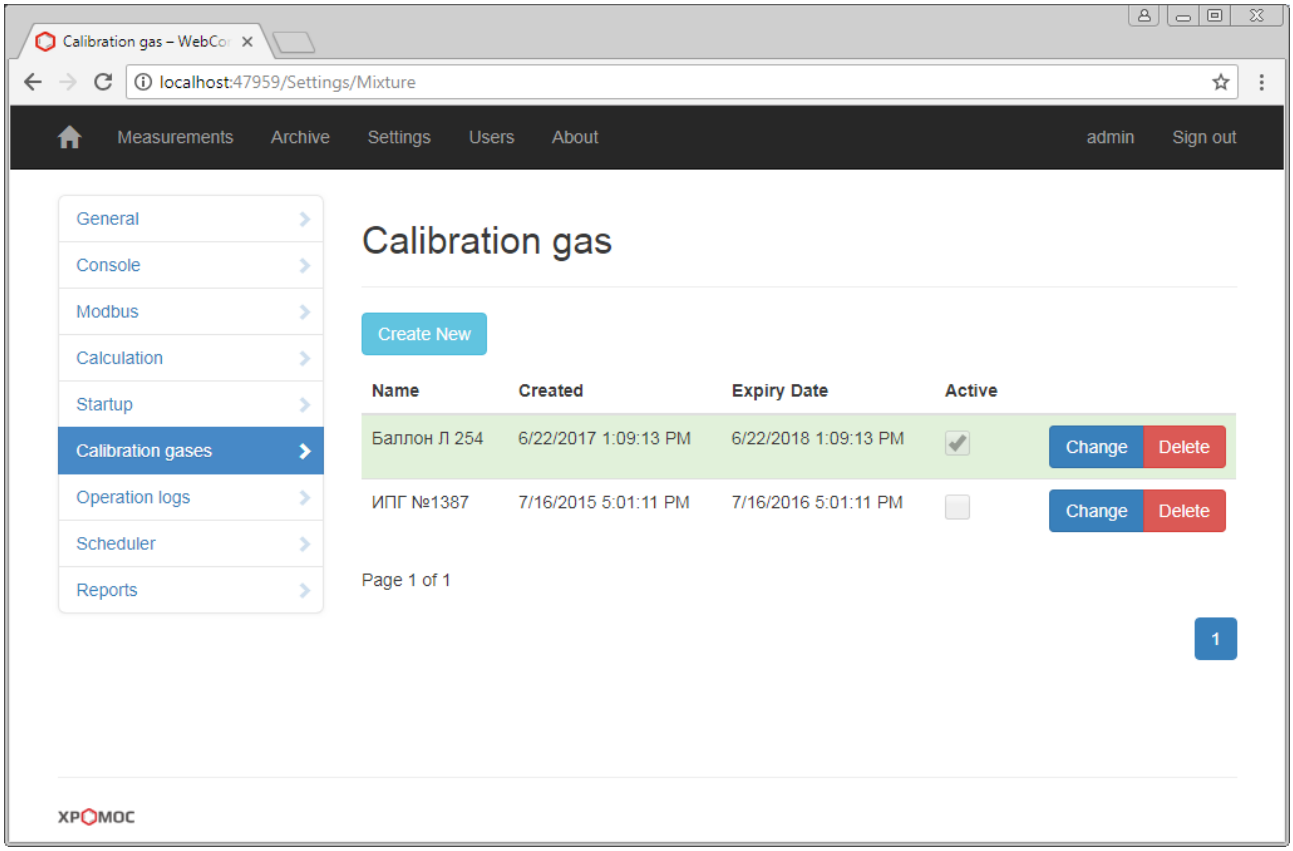


Figure 22 – List of calibration gases

Click the [Create] button to add a new gas. Specify a calibration gas name (Figure 23) and click the [Save] button. As a result, the page describing the calibration gas will be available (Figure 24).

- "Name" – calibration gas name;
- "Created" – entry date;
- "Expiry date" – calibration gas expiration date is indicated;
- "Active" – the flag indicates whether this gas is used during chromatograph calibration;
- "Components" – a list of components and their content in the gas:
  - "Name" – component name;
  - "Content" – component content (in molar percentage);

To change or edit the calibration gas description, go to the page describing the calibration gas (Figure 24).

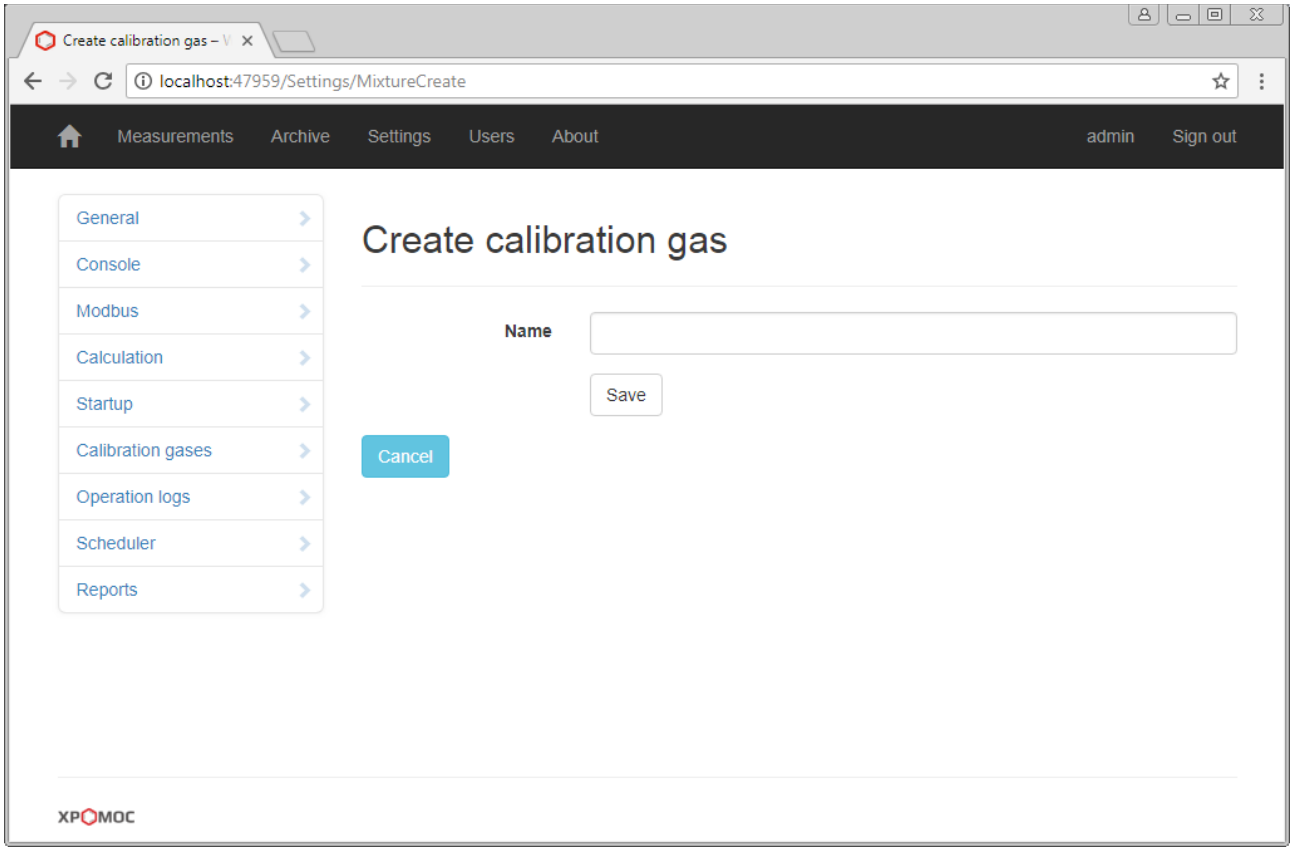


Figure 23 – Create calibration gas

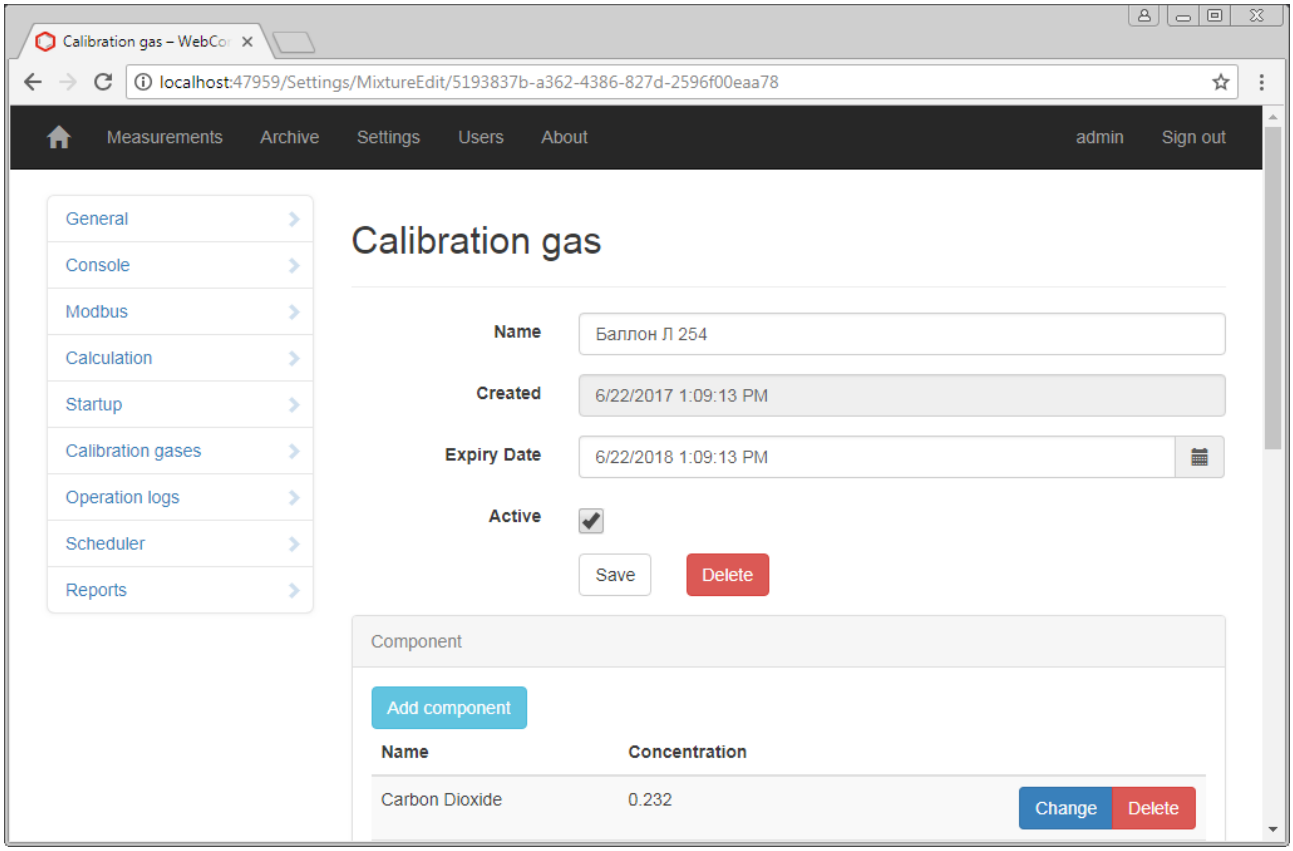


Figure 24 – Calibration gas

To add a component to the calibration gas, click the [Add component] button (Figure 24). Select a component name from the drop-down list and specify the component content in molar percentages (Figure 25).

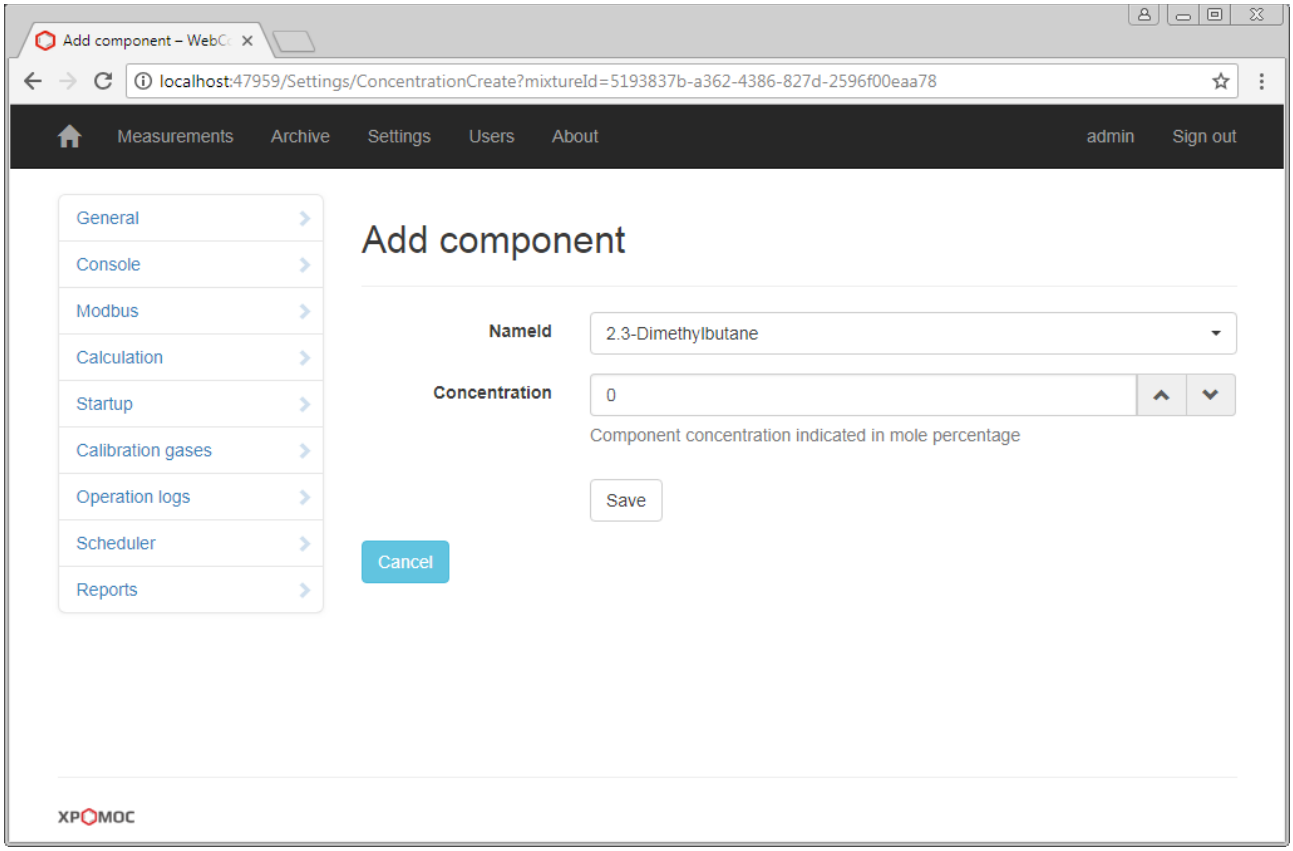


Figure 25 – Add component

3.9 Calibration log

To view the calibration log, select [Measurements] from the main menu→ [Calibrations] (Figure 26). The following information will be available for the user:

- "Creation date" – the date of calibration factors calculation;
- "Success" – operation status flag.

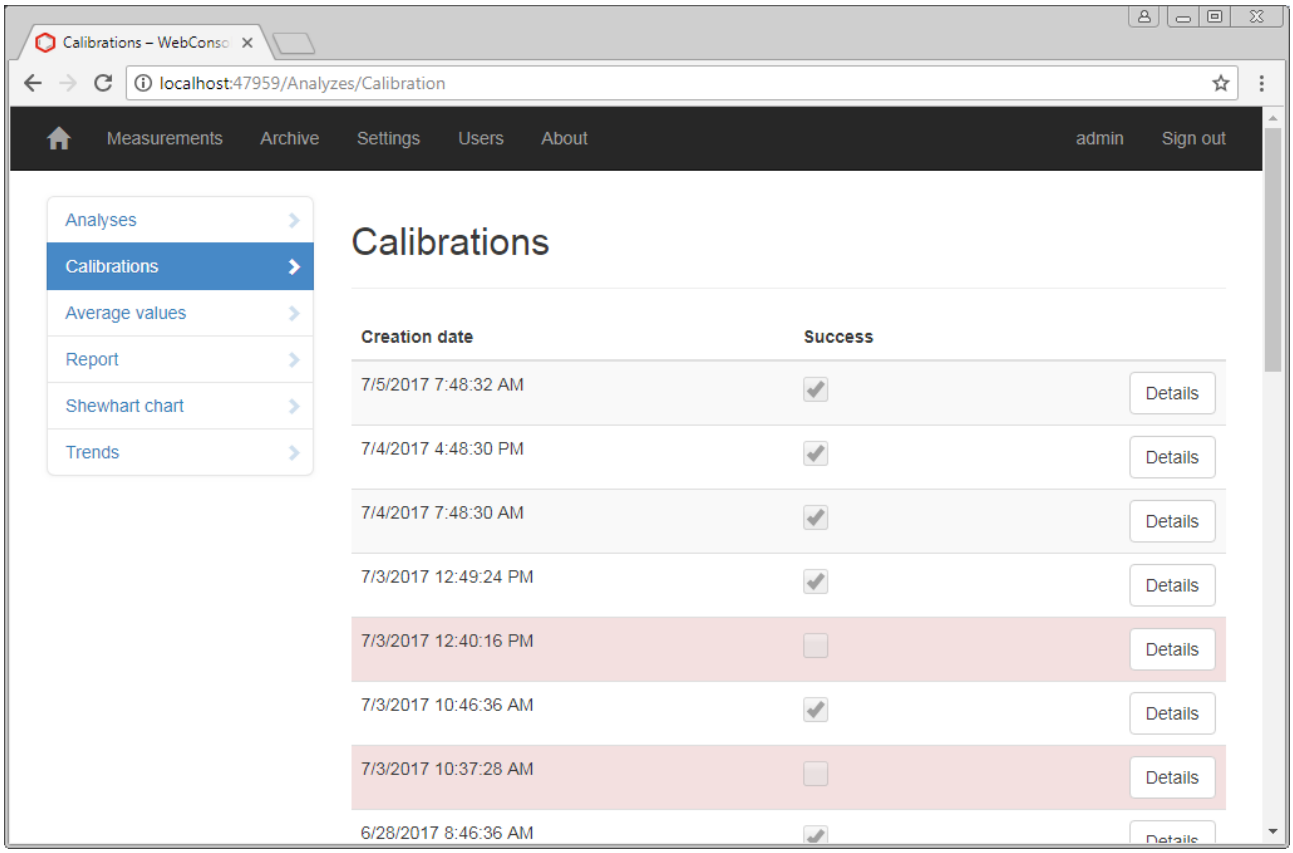


Figure 26 – Calibrations

3.10 Chromatograph calibration

The dataflow chromatograph is automatically calibrated according to the scheduler settings (item 4.5). Calibration factors can be only set by the software based on the calibration chromatograms.

Switching from the operating flow to the calibration one takes place in the automatic mode, and calibration chromatograms are registered, then the software calculates the calibration factors. Upon completion of calibration, the flow is changed to operating one.

The "CHROMOS PGC-1000" software calculates calibration factors for all components at each injection of the calibration gas and upon completion of calibration it calculates the final calibration factors as an average of the three values obtained during the calibration process.

In case of non-compliance with calibration acceptability criteria by any of the components, the software generates a warning (Figure 27). The final calibration report contains an error and to proceed calculating, the software takes the calibration factors obtained at the last calibration that meets the acceptability requirements.

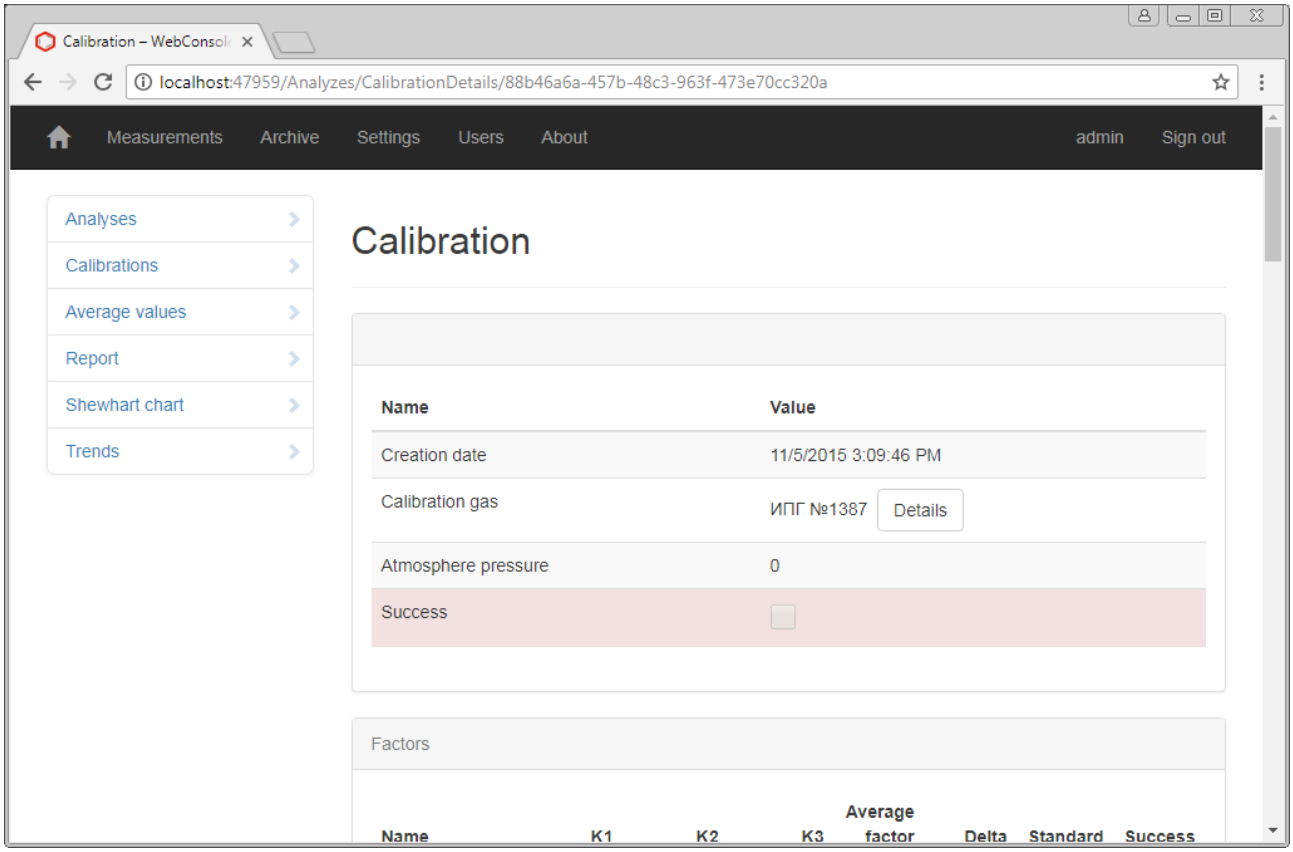


Figure 27 – Calibrations. Details (Failed)

To view the detailed information on the selected calibration, select [Details] in the calibration log (Figure 27). The following information will be available for the user (Figure 28):

- “Creation date" – the date of calibration factors calculation;
-
- “Graduation gas" – calibration cylinder name;
- “Atmospheric pressure" – atmospheric pressure at the time of calibration beginning;
- “Success" – operation status flag;

- "Factors" – calibration factors list:
  - "Name" – component name;
  - "K1" – calibration factor obtained from chromatogram 1;
  - "K2" – calibration factor obtained from chromatogram 2;
  - "K3" – calibration factor obtained from chromatogram 3;
  - "K" – an arithmetical average of the calibration factors obtained from three calibration chromatograms;
  - "Delta" – a deviation;
  - "Standard" – permissible deviation;
  - "Success" – operation status flag.
- “Chromatogram” – calibration chromatograms on which the calibration factors were calculated (Figure 29).

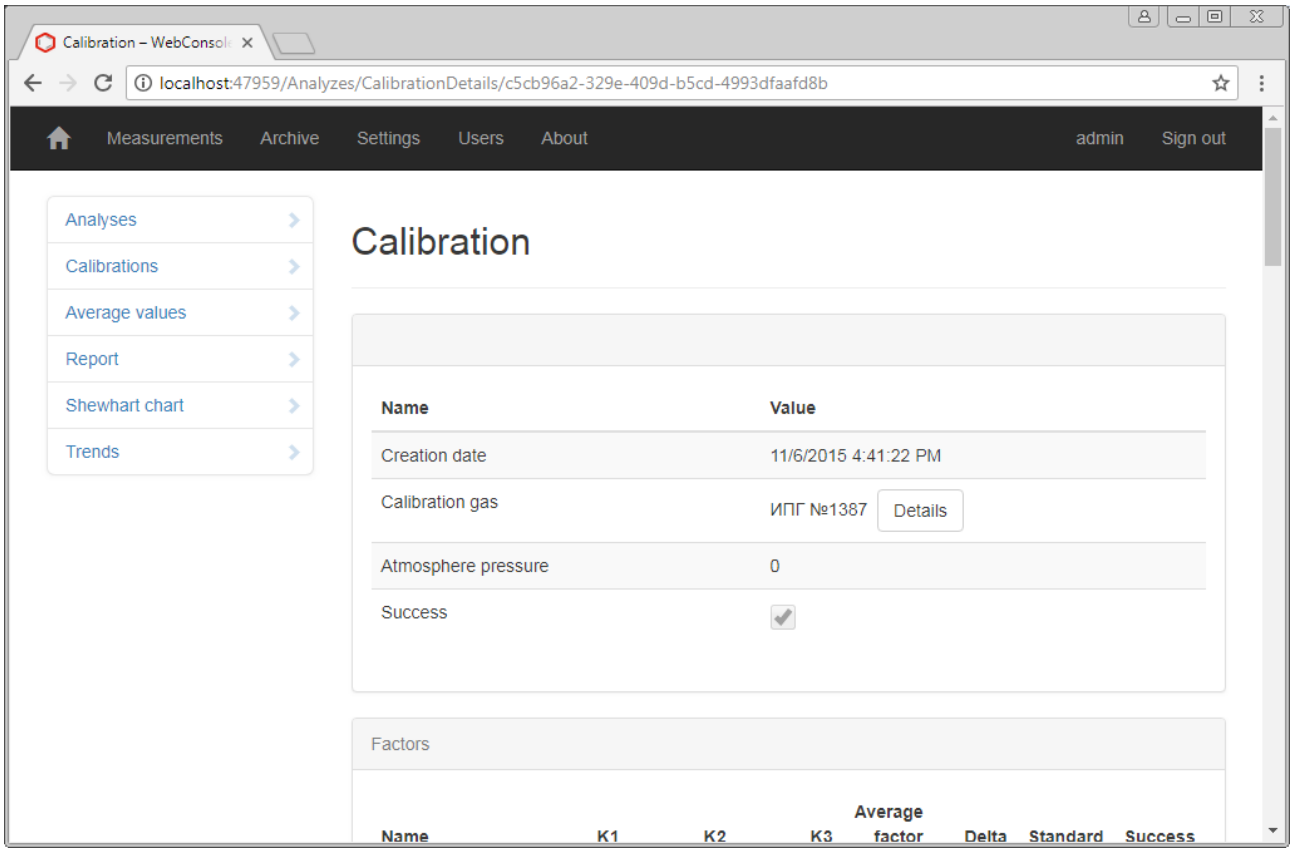


Figure 28 – Calibrations. Details

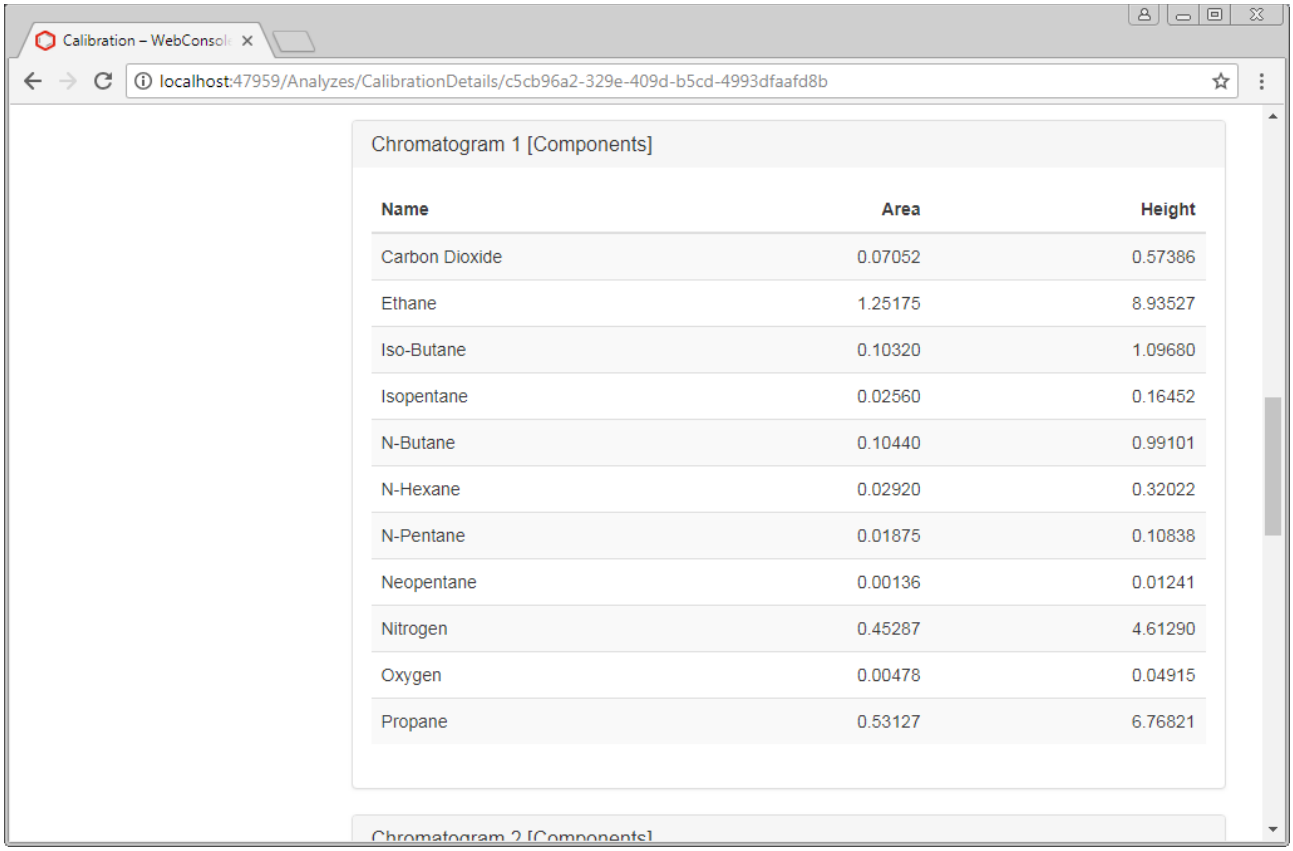


Figure 29 – Calibrations. Details (Calibration chromatograms)

3.11 Average values

To view an arithmetic average of the FCP determination result, select [Measurements] → [Average values] from the main menu and specify the measurement period (Figure 30). The following information will be available for the user:

- "Last hour" – one hour before the current time;
- "Today" – from the day beginning to the current time;
- "Last 7 days" – from the current moment for the last 7 days;
- “Last 30 days" – from the current moment for the last 30 days;
- "Last year" – all the measurements made this year;
- "Date range" – to specify an arbitrary time interval.

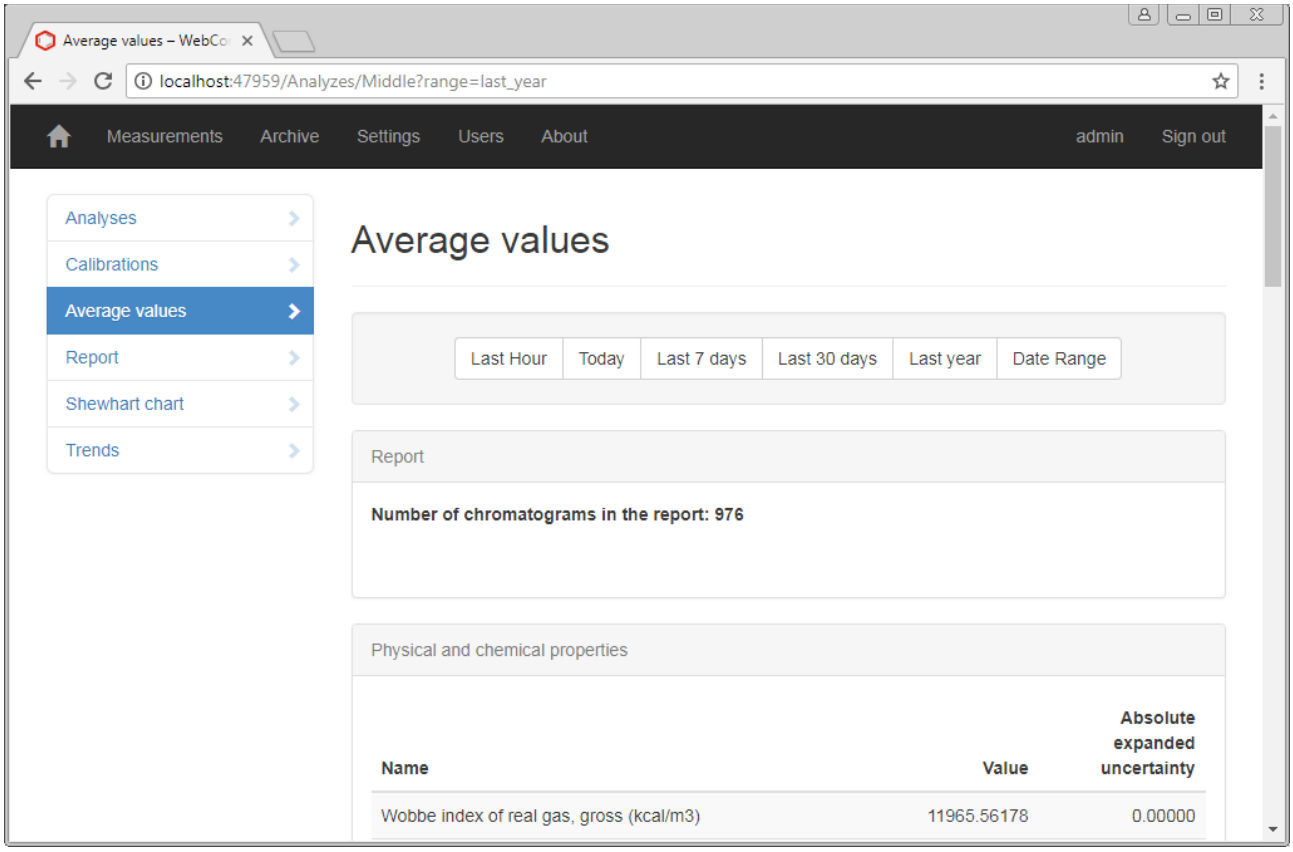


Figure 30 – Average values. Filter

3.12 Report

To view the report, select [Measurements] → [Report] from the program main menu and specify the measurement period and the period on which the analysis results are grouped (Figure 31):

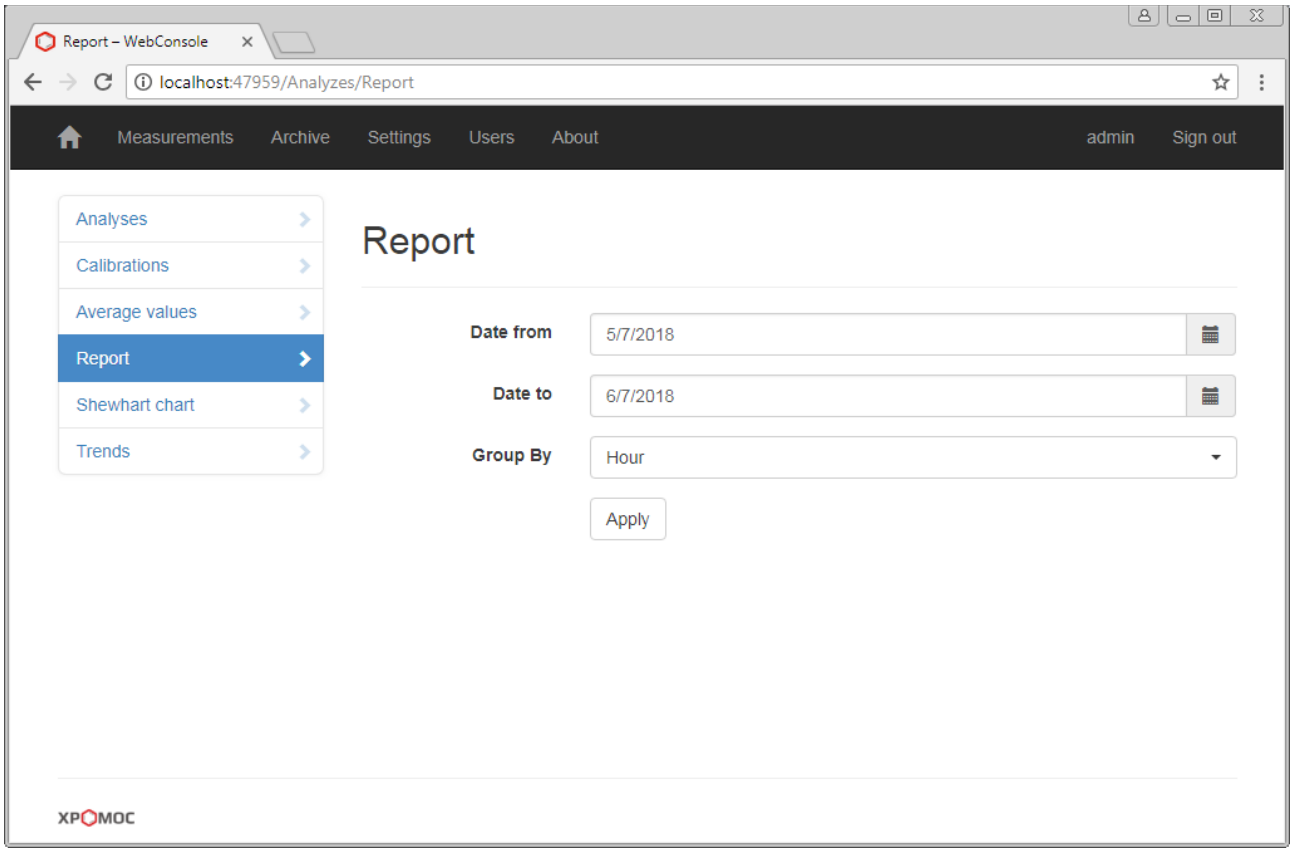


Figure 31 – Report

3.13 Shewhart chart

To view the Shewhart chart, select [Measurements] → [Shewhart chart] from the main menu and specify the measurement period and the component to be analyzed (Figure 32):

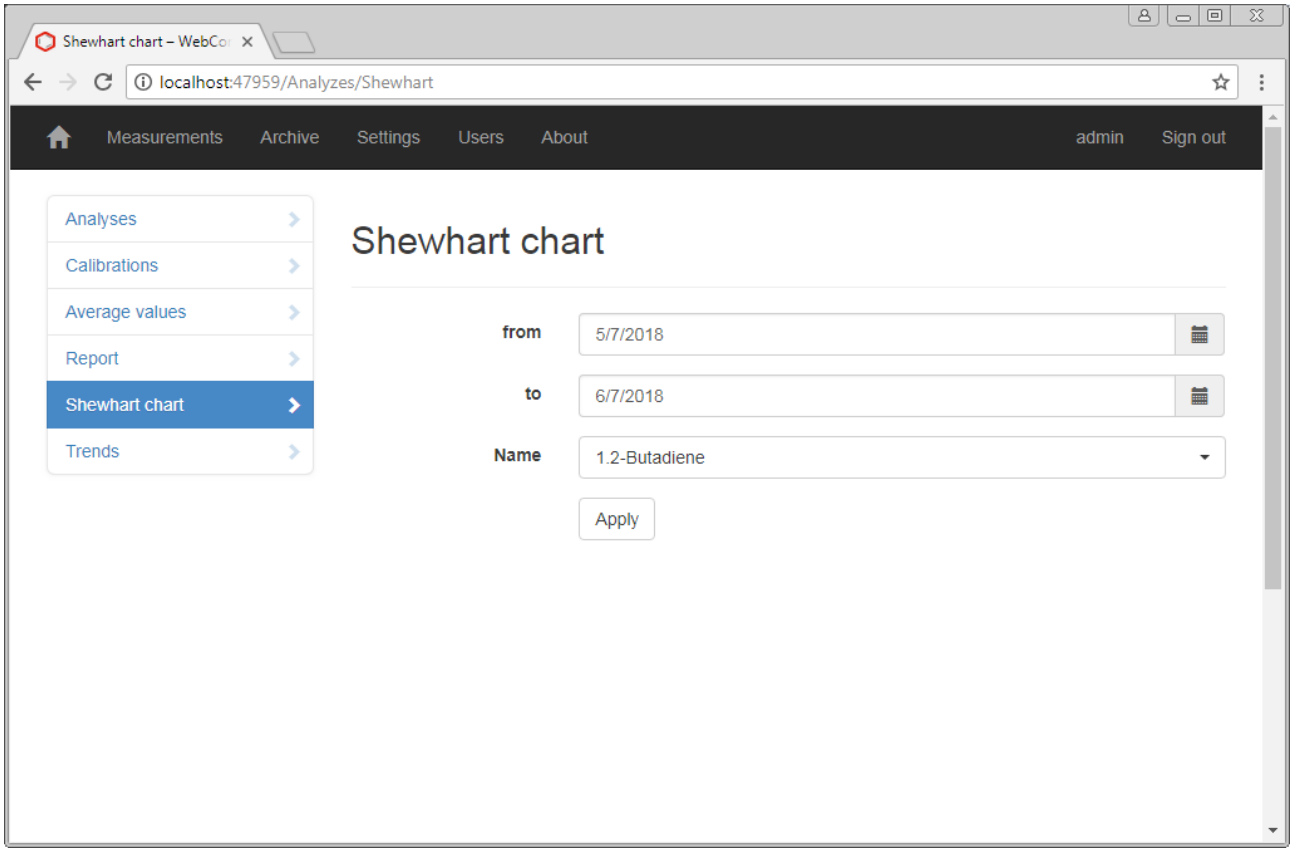


Figure 32 – Shewhart chart

3.14 Trends

To view the trend, select [Measurements] → [Trends] from the program main menu, and specify the measurement period on which the analysis results are grouped (Figure 33):

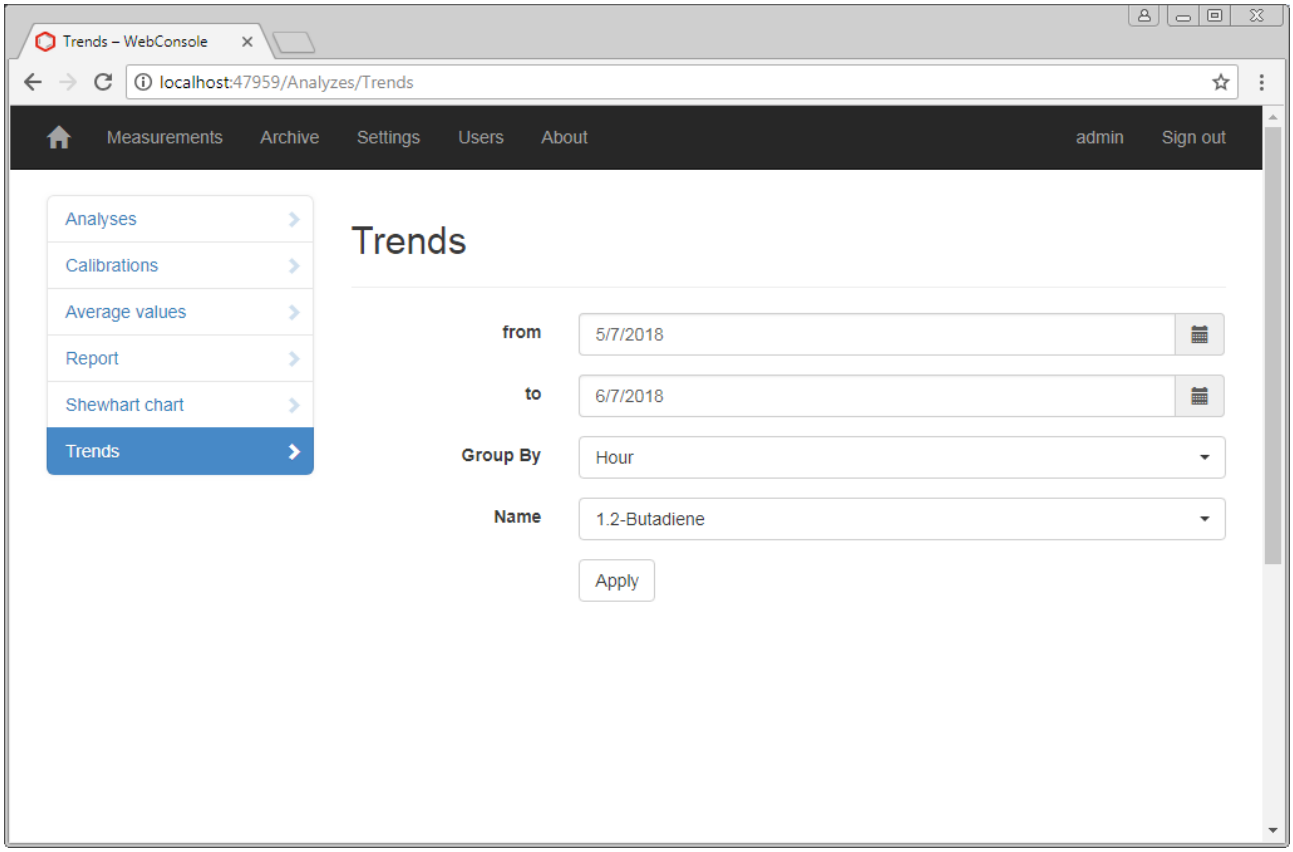


Figure 33 – Trends

4 Setting

To change the settings of the main program modules, select [Settings] from the main menu (Figure 34).

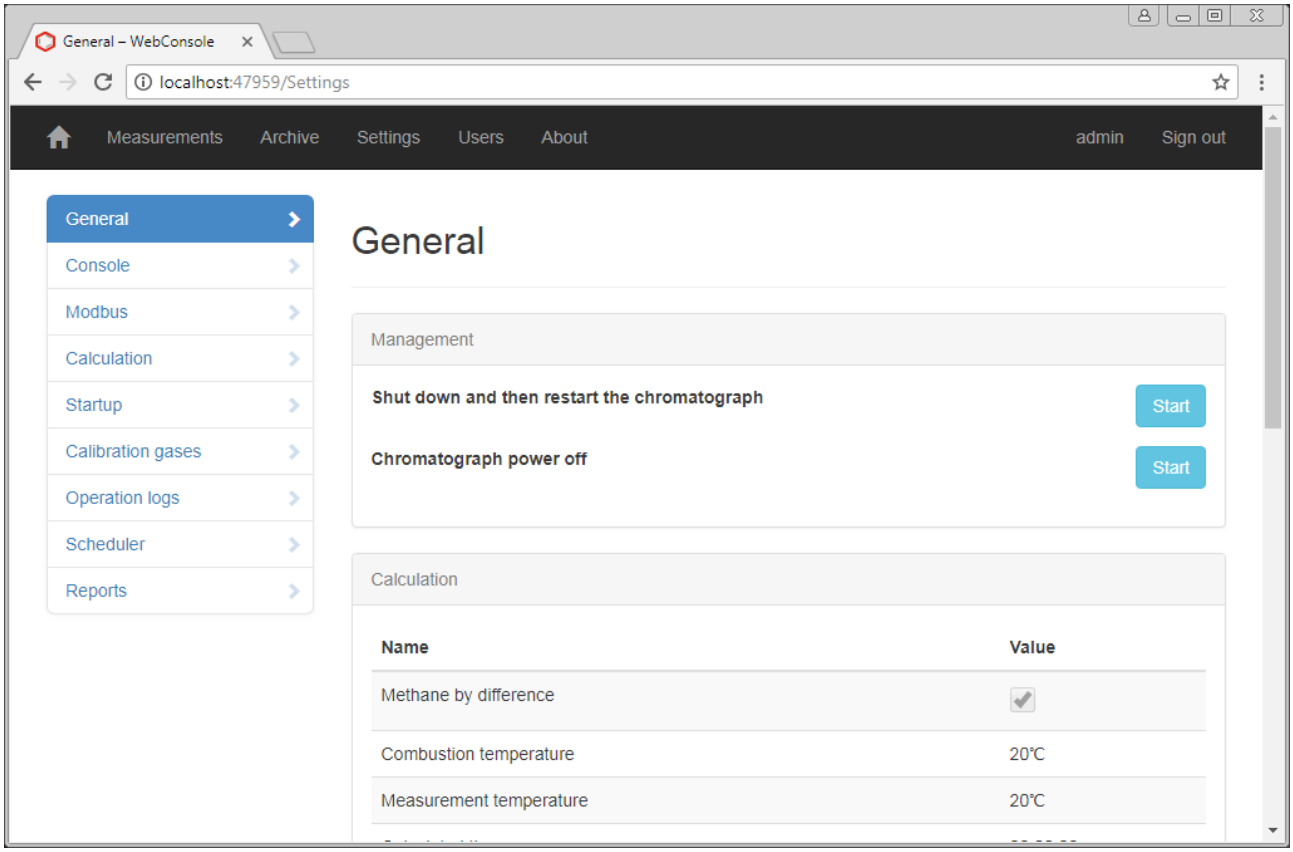


Figure 34 – Settings

Control:

- "Shut down and then restart the chromatograph" – when this action is selected, the entire software restarts without waiting for tasks completion;
- "Chromatograph power off" – when this action is selected, the automation system waits for completion of the current operation, changes over to the cooling mode, and turns off the system.

4.1 Console

To change a program interface language, select [Settings] → [Console] and specify one of the supported languages in the drop-down list, then click Save (Figure 35).

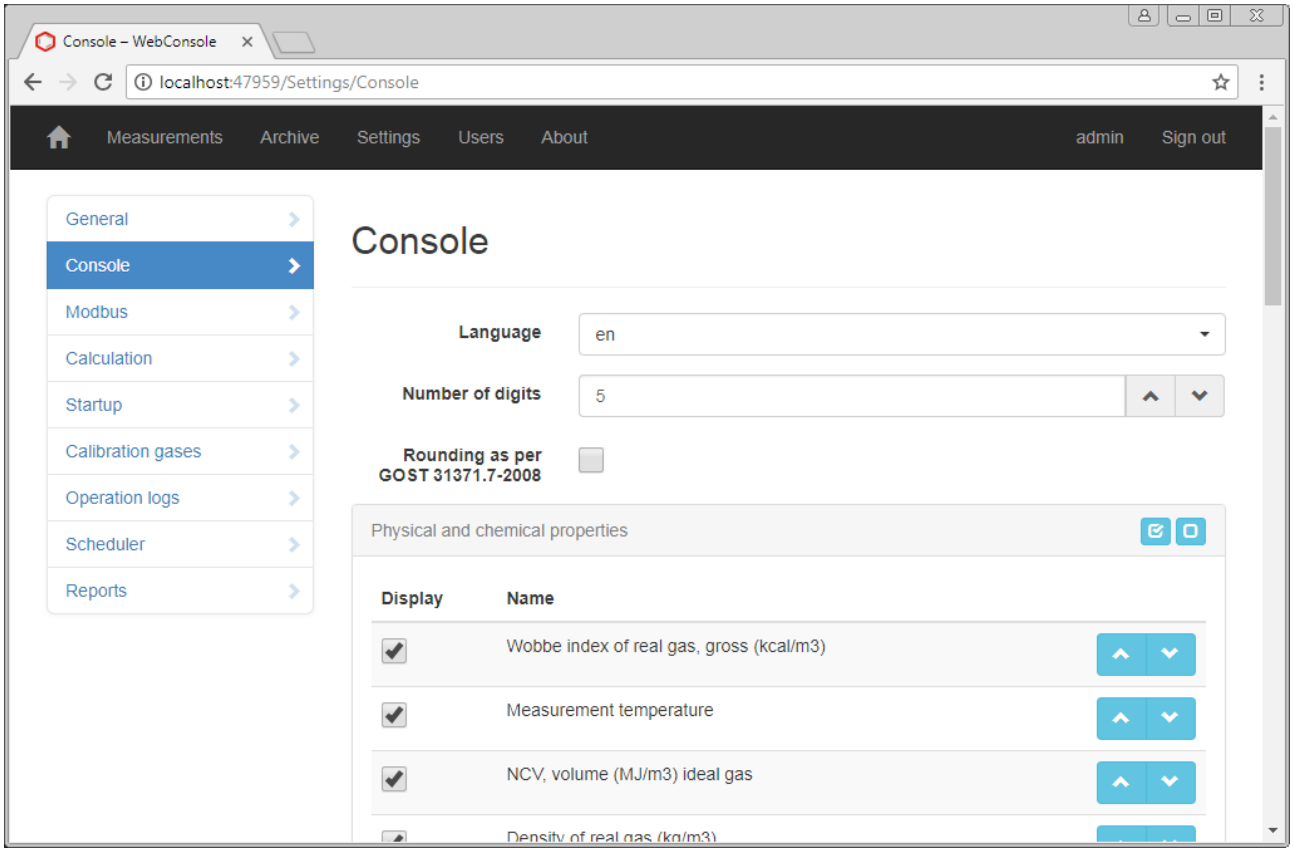


Figure 35 – Console

Change data display in the application by the options:

- “Number of digits" – setting a number of decimal places;
- “Rounding as per GOST 31371.7-2008" – rounding in accordance with GOST 31371.7-2008;
- Analysis physical and chemical parameters – to hide/display a parameter, check/uncheck a mark against the property;
- To change the order of displaying properties, click the up or down arrow against the property.

4.2 Modbus

The Modbus module can be used to transmit data via serial communication lines RS-485, and TCP/IP networks (Modbus TCP).

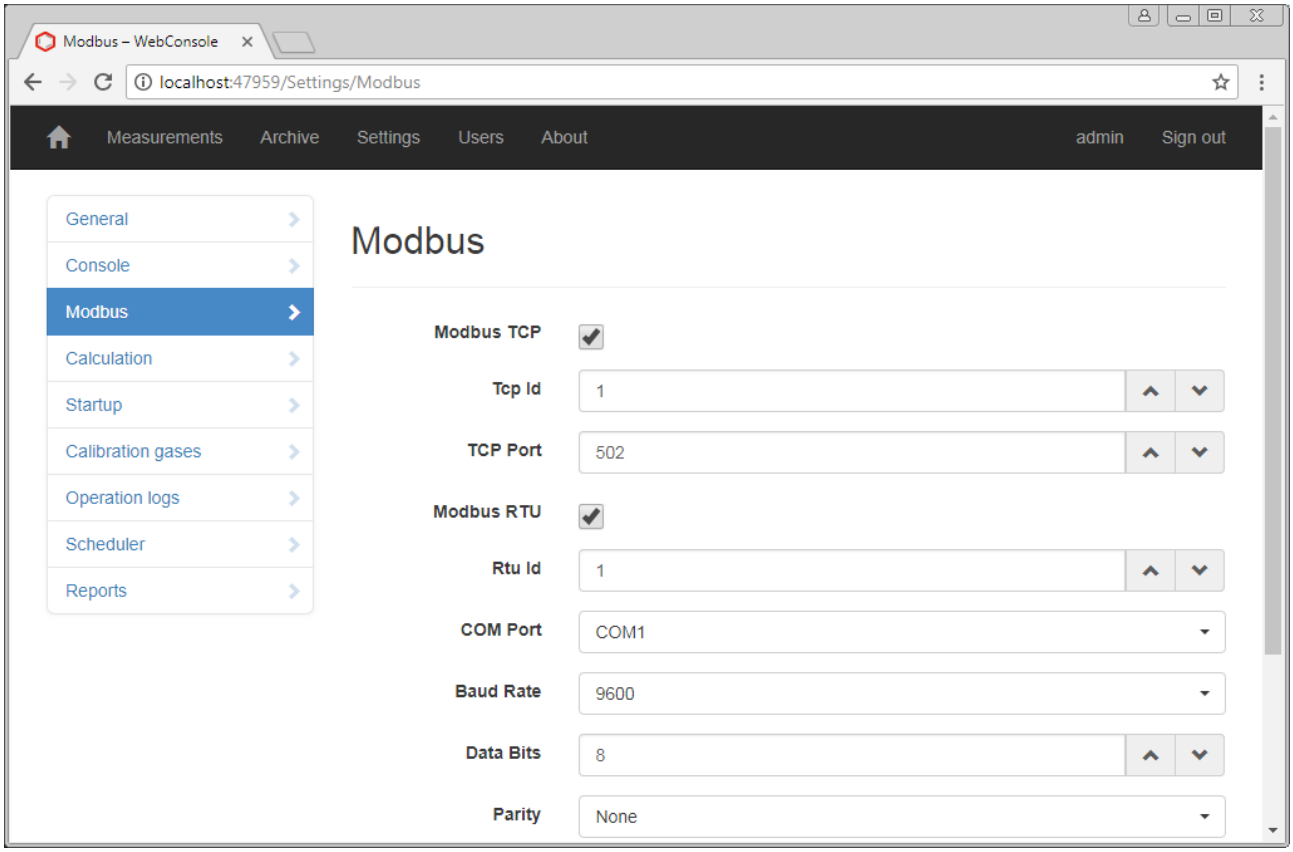


Figure 36 – Modbus

To change the parameters for starting up Modbus, select [Settings] → [Modbus]. The following information will be available for the user (Figure 36):

- "Modbus TCP" – start Modbus Slave TCP;
- "Modbus RTU" – start Modbus Slave RTU;
- "TCP Port" – port TCP number on which Modbus Slave TCP is started;
- "Com Port" – port COM number on which Modbus Slave RTU is started;
- "Baud Rate" – data transmission rate. The following transmission rate values may be indicated: 1200, 2400, 4800, 9600, 192000, 38400, 57600, 115200;
- "Data Bits" – defining a number of data bits in the transmitted and received bytes. A number of data bits may be within the range of 4 to 8;
- "Parity" – determines the choice of the even parity control diagram. This field shall contain one of the following values:
  - "None" – no parity bit;
  - "Odd" – addition to odd parity;
  - "Even" – addition to even parity;
  - "Mark" – parity bit, always 1;
  - "Space" – parity bit, always 0;
- "Stop bits" – setting a number of stop bits.

4.3 Automation setting

To change the automation system settings, select [Settings] → [Start] (Figure 37). The following information will be available for the user:

- "Started channels" – a number of measurement channels;
- "Automation" – indication to enable the automation system or not;
- "Sampled flow" – default sampled flow number;
- "Calibration flow" – default calibration flow number;
- "Purge time" – holding time after flow change.
- "Conditioning time" – column conditioning time.

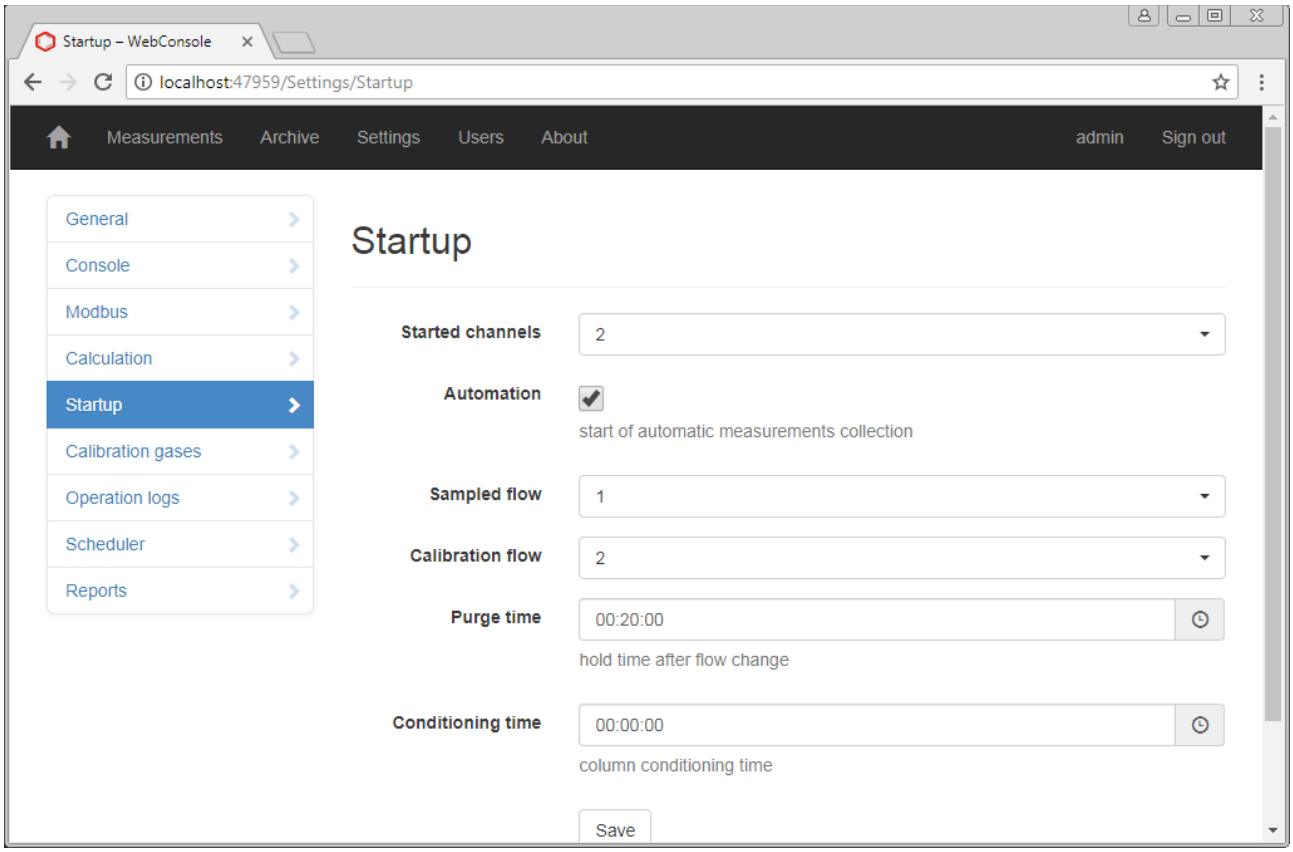


Figure 37 – Automation setting

4.4 Operation logs

Selection of [Settings] → [Operation logs] provides specifying the directories where the program operation logs are located (Figure 38).

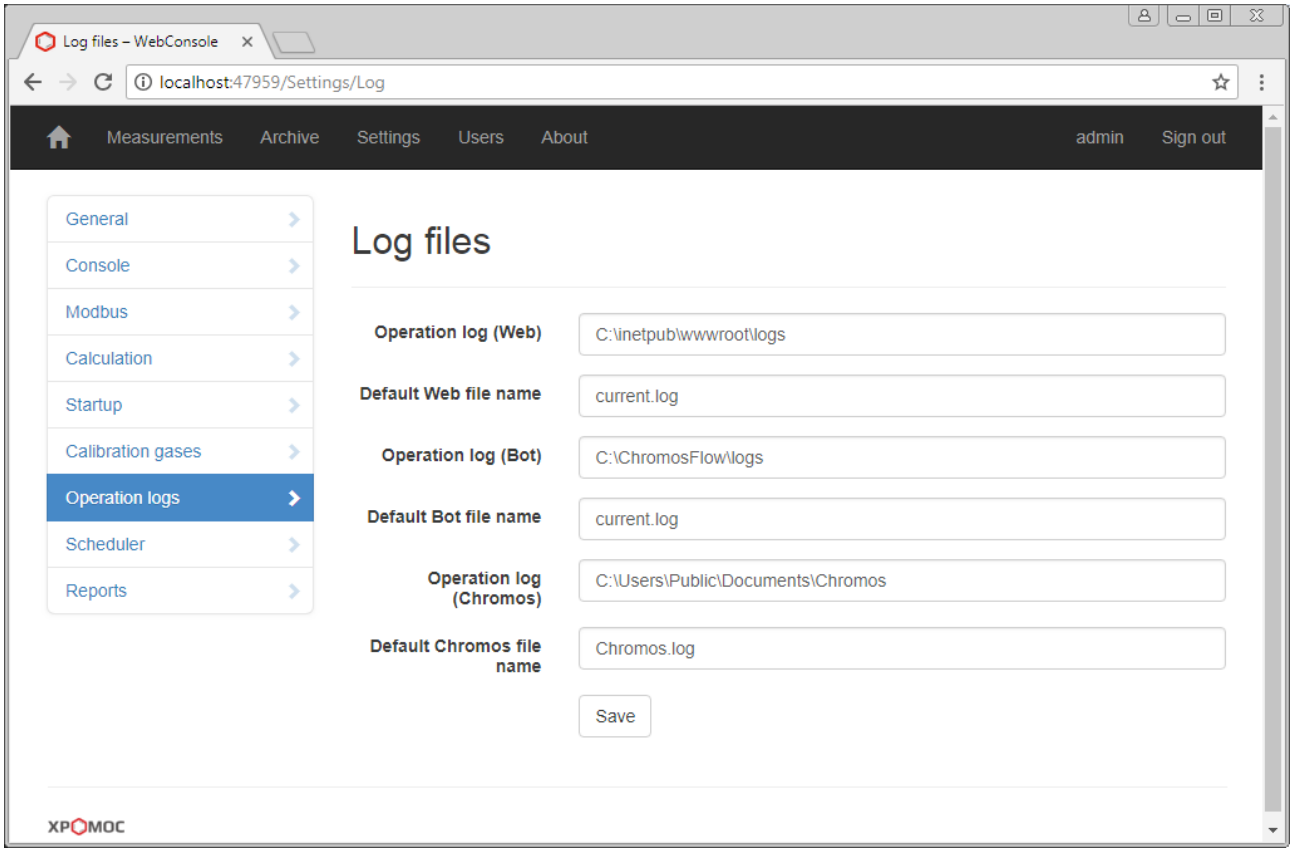


Figure 38 – Log files

4.5 Scheduler

Selection of [Settings] → [Scheduler] provides adding or deleting a task to/from the scheduler (Figure 39).

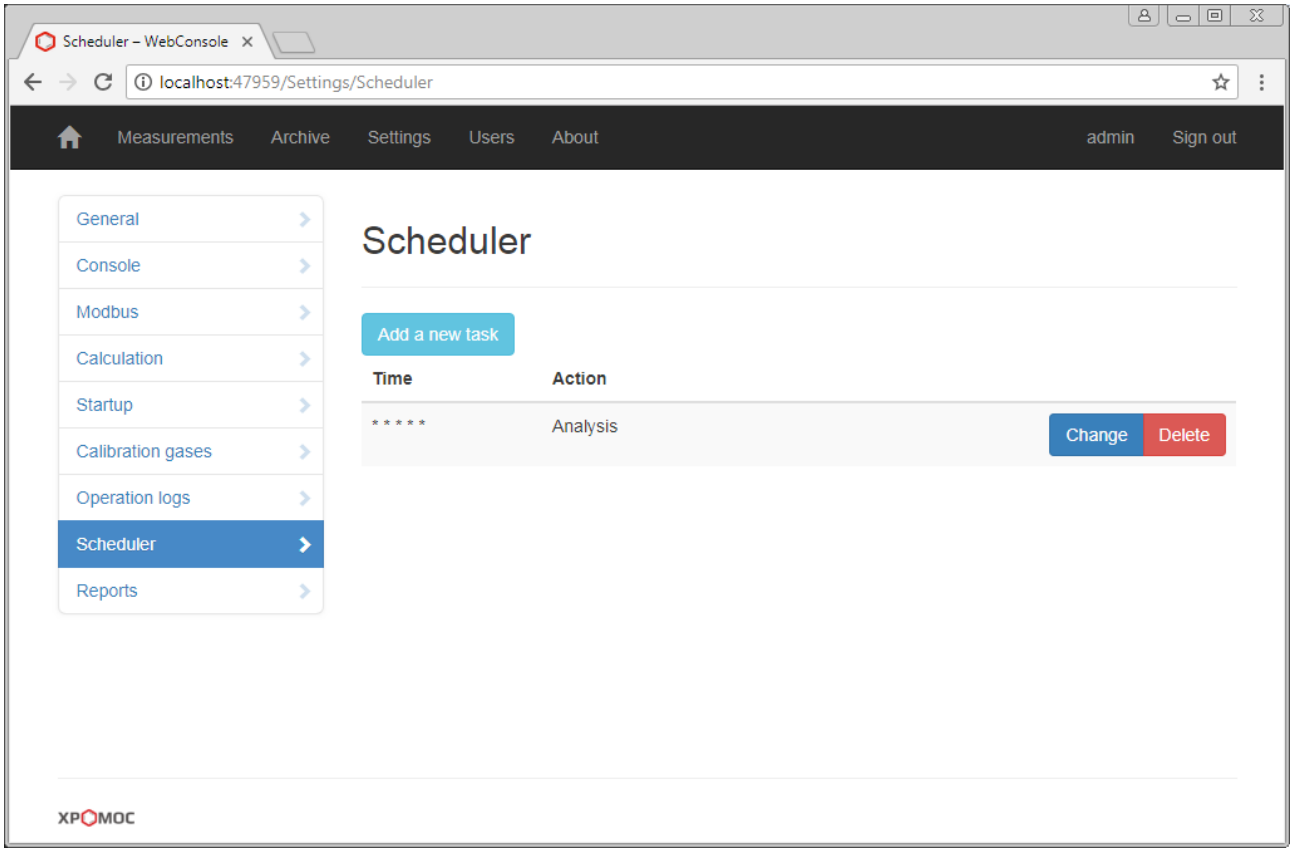


Figure 39 – Scheduler

Click the [Add a New Task] button to create a new task (Figure 40). The tasks edition form contains the following fields:

- "Minute";
- "Hour";
- "Day";
- "Month";
- "Day of week";
- "Action" – the action of which shall be done upon event occurrence:
  - "Analyze";
  - “Calibrate”.

Input is done either through pop-up dialogs or manually. The record format states that all values are entered with separation by a comma, and the symbol '*' means any value.

All conditions (start-up time) are checked by the "logical AND".

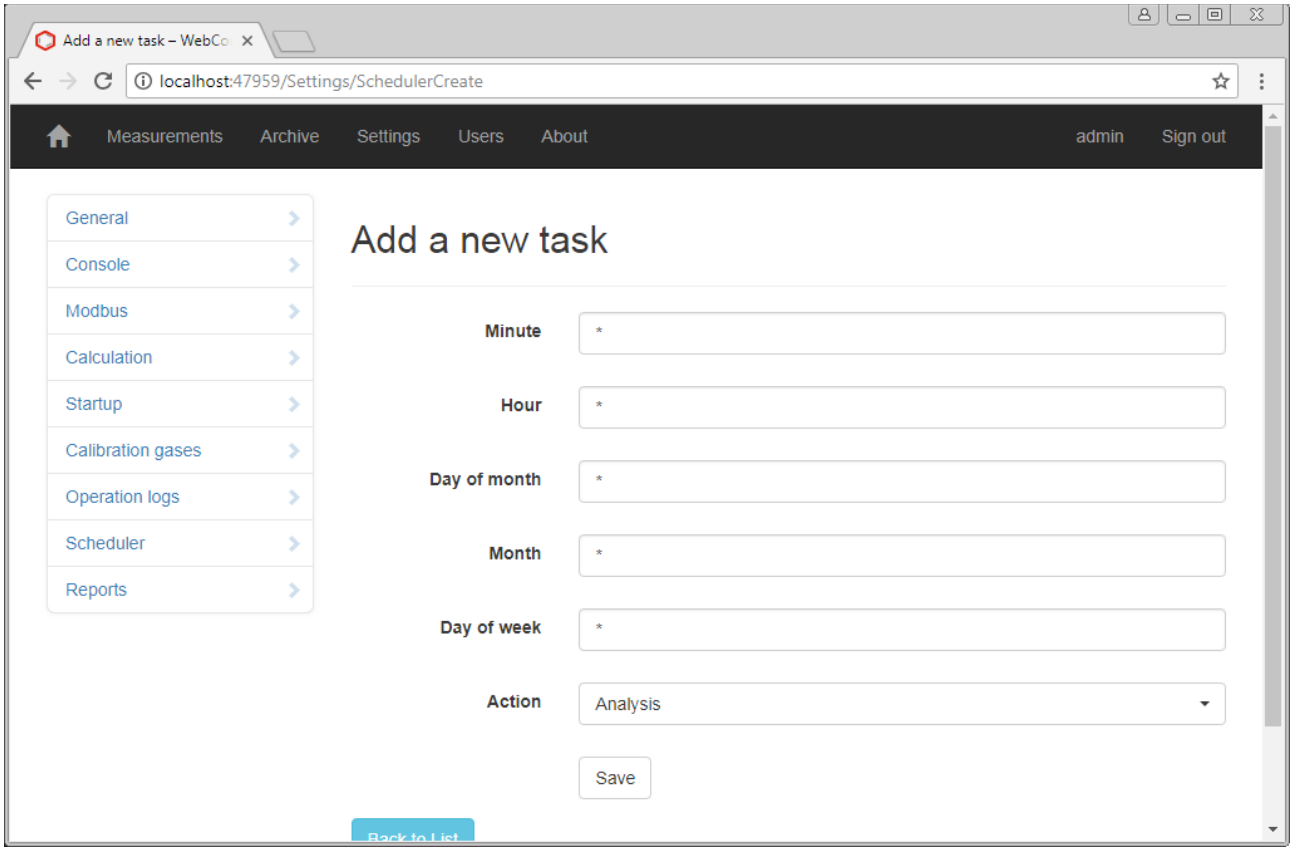


Figure 40 – Add a New Task

4.6 Reports

Selection of [Settings] → [Reports] provides specifying values for additional fields in the reports (Figure 41).

- "Header" – the line displayed at the beginning of the report;
- "Footer" – the line displayed at the end of the report.

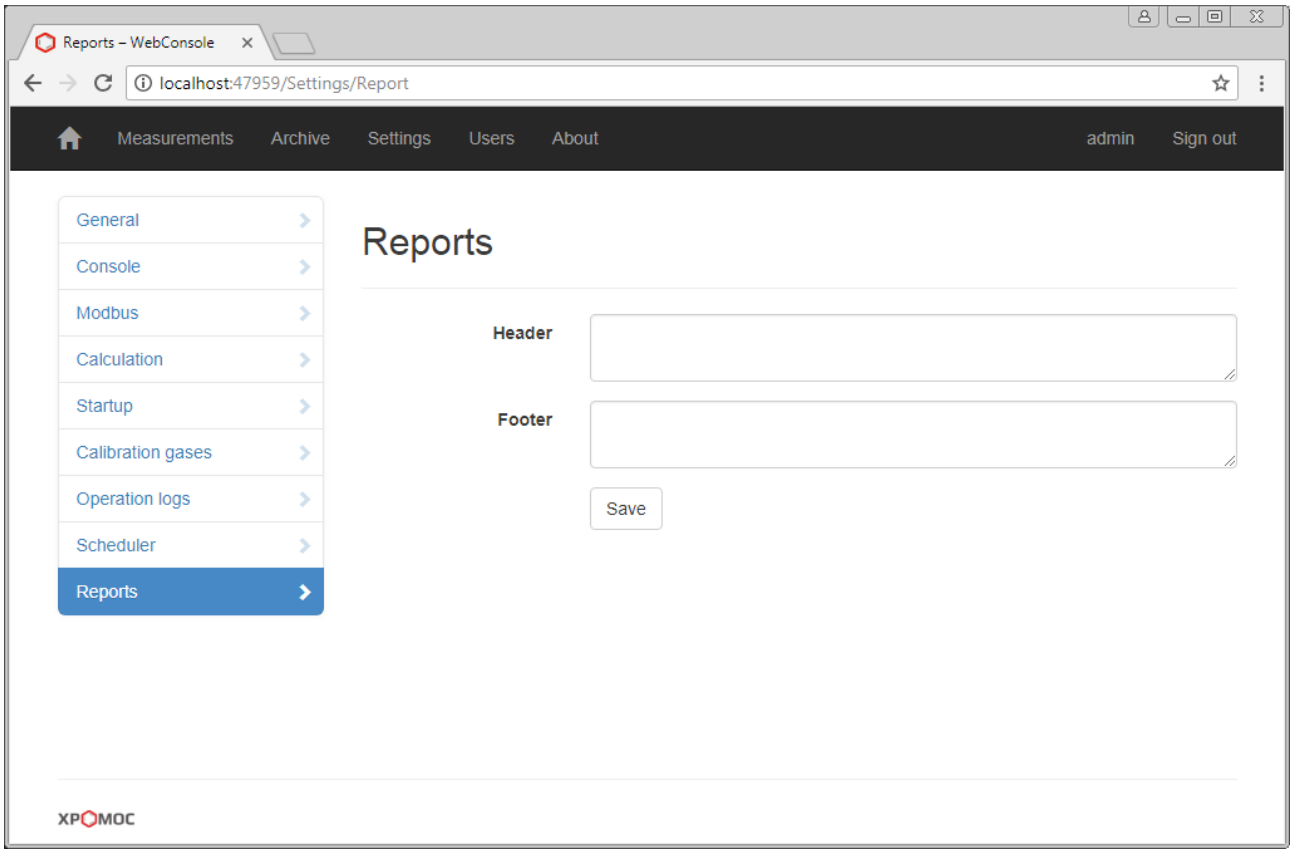


Figure 41 – Reports

When entering, substitutions may be used:

- #d0# – current time;
- #d1# – time of period start for which the counting is formed;
- #d2# – time of period end for which the counting is formed;

5 Program identification

To view the identification data of the “CHROMOS PGC-1000” software (version number and hash sum), select [About] from the main menu (Figure 42).

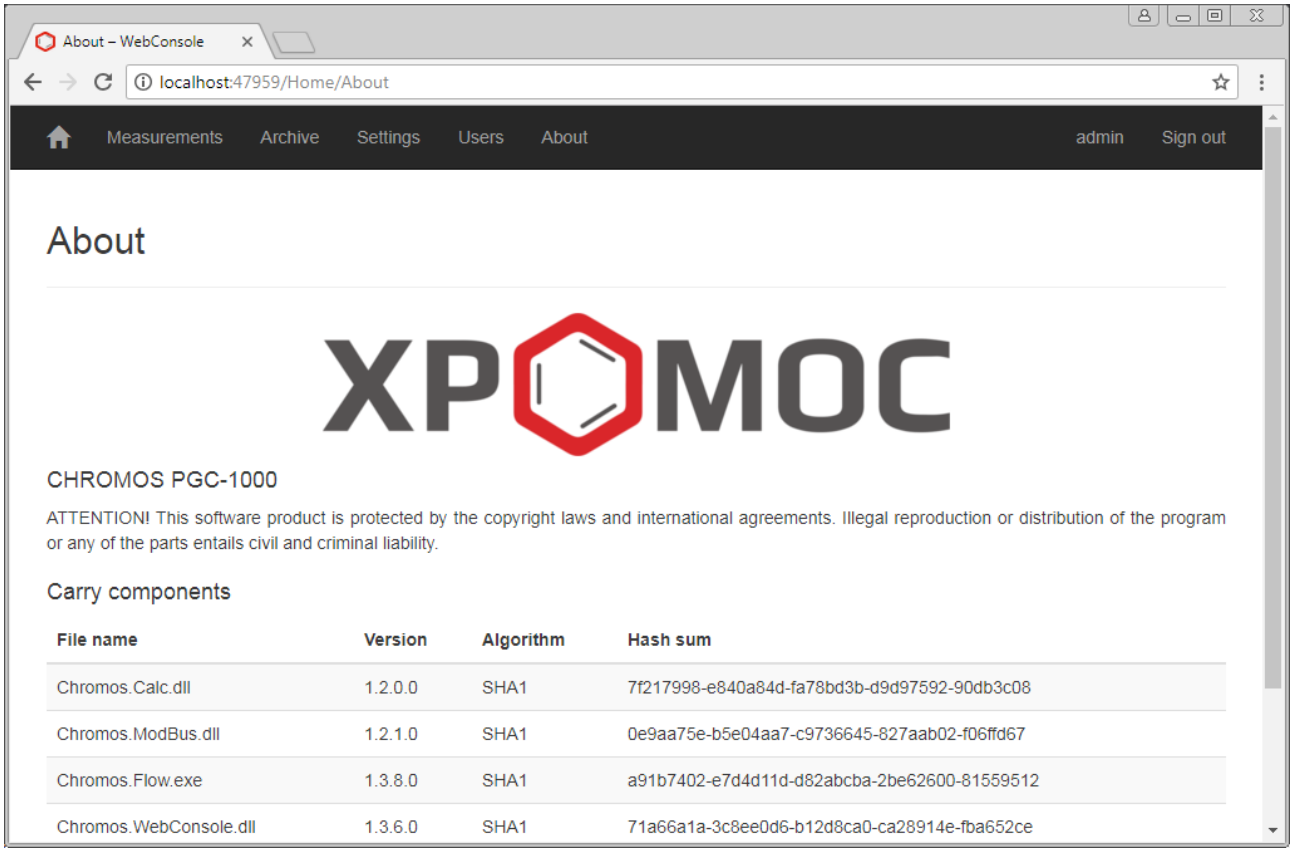


Figure 42 – About the program

The components list contains the following:

- "File name";
- "Version" – file version;
- "Algorithm" – the algorithm on which the hash sum was calculated;
- "Hash sum".

6 Data exchange

The main communication port for data exchange is the TCP/IP port. The Modbus RTU port is also available. The TCP/IP port (Gigabit Ethernet) is required to connect to the chromatograph control console via HTTP protocol (for configuration, diagnostics and reporting), but it can be used in combination with Modbus TCP/IP.

6.1 Modbus protocol

The Modbus map is adjustable in the "CHROMOS PGC-1000" software, it is possible to change the register addresses and the encoding method.

6.2 Modbus protocol. By default

In the MODBUS protocol, the FLOAT number is represented as two registers:

Register with address XXXX		Register with address XXXX+1	
Byte 3	Byte 4	Byte 1	Byte 2

	Function code:	4	READ IR
Address	Name	Component	Data type
0	Reserved		UINT (16-bit)
	Values:		
	Current protocol version 1		
1	Error Code #1		UINT (16-bit)
2	Error Code #2		UINT (16-bit)
3	Reserved		UINT (16-bit)
4	Reserved		UINT (16-bit)
5	Reserved		UINT (16-bit)
6	Reserved		UINT (16-bit)
7	Reserved		UINT (16-bit)
8	Reserved		UINT (16-bit)
9	Reserved		UINT (16-bit)
Final analysis			
Analysis date			
10	Year (Analysis date)		UINT (16-bit)
11	Month		UINT (16-bit)
12	Day		UINT (16-bit)
13	Hour		UINT (16-bit)
14	Minute		UINT (16-bit)

15	Second		UINT (16-bit)
16	Type (Analysis status)		UINT (16-bit)
	Values:		
	0 — Success		
	1 — Calibration		
	2 — Manual mode		
	3 — Calibration and sampled gases differ		
Physical and chemical parameters			
17	Zmix (Compressibility factor)		FLOAT
19	M (Molar mass)		FLOAT
21	HmolV (GCV, molar (real and ideal gas))		FLOAT
23	HmolV (NCV, molar (real and ideal gas))		FLOAT
25	HmassV (GCV, mass (real and ideal gas))		FLOAT
27	HmassV (NCV, mass (real and ideal gas))		FLOAT
29	HvolV0 (GCV, volume (ideal gas))		FLOAT
31	HvolN0 (NCV, volume (ideal gas))		FLOAT
33	HvolV (GCV, volume (real gas))		FLOAT
35	HvolN (NCV, volume (real gas))		FLOAT
37	Ro0 (density of ideal gas)		FLOAT
39	Ro (density of real gas)		FLOAT
41	D0 (relative density of ideal gas)		FLOAT
43	D0 (relative density of real gas)		FLOAT
45	WobbeV0 (Wobbe index of ideal gas, gross)		FLOAT
47	WobbeN0 (Wobbe index of ideal gas, net)		FLOAT
49	WobbeV (Wobbe index of real gas, gross)		FLOAT
51	WobbeN (Wobbe index of real gas, net)		FLOAT
53	IsMethaneByDifference (Methane by Difference)		UINT (16-bit)
54	BurnoutTemperature (Combustion temperature)		UINT (16-bit)
	Values:		
	0 — 0 deg. C		
	1 — 15 deg. C		
	2 — 20 deg. C		
	3 — 25 deg. C		
55	MeasureTemperature (Температура измерения)		UINT (16-bit)
	Values:		
	0 — 0 deg. C		
	1 — 15 deg. C		

	2 — 20 deg. C		
56	Reserved		UINT (16-bit)
57	Reserved		UINT (16-bit)
58	Reserved		UINT (16-bit)
59	Reserved		UINT (16-bit)
60	Reserved		UINT (16-bit)
61	Reserved		UINT (16-bit)
62	Reserved		UINT (16-bit)
63	Reserved		UINT (16-bit)
64	Reserved		UINT (16-bit)
65	Reserved		UINT (16-bit)
66	Reserved		UINT (16-bit)
67	Reserved		UINT (16-bit)
68	Reserved		UINT (16-bit)
69	Reserved		UINT (16-bit)
Components			
70	1 Molar fraction, %	Methane	FLOAT
72	2 Molar fraction, %	Ethane	FLOAT
74	3 Molar fraction, %	Propane	FLOAT
76	4 Molar fraction, %	n-Butane	FLOAT
78	5 Molar fraction, %	i-Butane	FLOAT
80	6 Molar fraction, %	n-Pentane	FLOAT
82	7 Molar fraction, %	i-Pentane	FLOAT
84	8 Molar fraction, %	neo-Pentane	FLOAT
86	9 Molar fraction, %	n-Hexane	FLOAT
88	10 Molar fraction, %	2-Methylpentane	FLOAT
90	11 Molar fraction, %	3-Methylpentane	FLOAT
92	12 Molar fraction, %	2·2-Dimethylbutane	FLOAT
94	13 Molar fraction, %	2·3-Dimethylbutane	FLOAT
96	14 Molar fraction, %	n-Heptane	FLOAT
98	15 Molar fraction, %	n-Octane	FLOAT
100	16 Molar fraction, %	n-Nonane	FLOAT
102	17 Molar fraction, %	n-Decane	FLOAT
104	18 Molar fraction, %	Ethylene	FLOAT
106	19 Molar fraction, %	Propylene	FLOAT
108	20 Molar fraction, %	1-Butene	FLOAT
110	21 Molar fraction, %	cis-2-Butene	FLOAT
112	22 Molar fraction, %	trans-2-Butene	FLOAT
114	23 Molar fraction, %	2-Methylpropene	FLOAT
116	24 Molar fraction, %	1-Pentane	FLOAT
118	25 Molar fraction, %	Propadiene	FLOAT
120	26 Molar fraction, %	1.2-Butadiene	FLOAT

122	27 Molar fraction, %	1.3-Butadiene	FLOAT
124	28 Molar fraction, %	Ethyne	FLOAT
126	29 Molar fraction, %	Cyclopentane	FLOAT
128	30 Molar fraction, %	Methyl cyclopentane	FLOAT
130	31 Molar fraction, %	Ethyl cyclopentane	FLOAT
132	32 Molar fraction, %	Cyclohexane	FLOAT
134	33 Molar fraction, %	Methylcyclohexane	FLOAT
136	34 Molar fraction, %	Ethyl cyclohexane	FLOAT
138	35 Molar fraction, %	Benzol	FLOAT
140	36 Molar fraction, %	Toluene	FLOAT
142	37 Molar fraction, %	Ethyl benzene	FLOAT
144	38 Molar fraction, %	o-Xylene	FLOAT
146	39 Molar fraction, %	Methanol	FLOAT
148	40 Molar fraction, %	Methanethiol	FLOAT
150	41 Molar fraction, %	Hydrogen	FLOAT
152	42 Molar fraction, %	Water	FLOAT
154	43 Molar fraction, %	Hydrogen sulphide	FLOAT
156	44 Molar fraction, %	Ammonia	FLOAT
158	45 Molar fraction, %	Hydrogen cyanide	FLOAT
160	46 Molar fraction, %	Carbon monoxide	FLOAT
162	47 Molar fraction, %	Carbonyl sulfide	FLOAT
164	48 Molar fraction, %	Carbon disulfide	FLOAT
166	49 Molar fraction, %	Helium	FLOAT
168	50 Molar fraction, %	Neon	FLOAT
170	51 Molar fraction, %	Argon	FLOAT
172	52 Molar fraction, %	Nitrogen	FLOAT
174	53 Molar fraction, %	Oxygen	FLOAT
176	54 Molar fraction, %	Carbon dioxide	FLOAT
178	55 Molar fraction, %	Sulfur dioxide	FLOAT
180	56 Molar fraction, %	Air	FLOAT

6.3 Modbus map setting

The Modbus map is set by editing the file: "C:\ChromosFlow\modbus.xml". The file can be edited manually by changing the XML-code using any text editor.

The root element "modbus.xml" is <modbus>. In addition to this element, the mandatory element is the <param> tag. Arrangement of elements of the same level is arbitrary. All values are set by means of the elements attributes.

<modbus> – the element is the root one. By default, the element contains two attributes:

<modbus xsi:noNamespaceSchemaLocation="http://office.has.ru/files/modbus.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

- xmlns:xsi – name space determination. It is always the same;
- xsi:noNamespaceSchemaLocation – reference to XSD schema in the document. It is alway the same.

<param> – the element determines an element type and location in the Modbus card.

<param addr="19" modbus_function="4" reverse_bytes="false" reverse_words="true" type="float" name="Property.Gost313692008M" />

Attributes:

- addr – address of the first parameter register in decimal form;
- modbus_function – read function (3-4);
- reverse_bytes – if "true", it changes byte order in each register to "high byte first";
- reverse_words – if "true", it changes register order to "high register first";
- type – what value type is to be written to the data block:
  - i16 – signed integer 16 bits;
  - ui16 – unsigned integer 16 bits;
  - i32 – signed integer 32 bits;
  - ui32 – unsigned integer 32 bits;
  - float – 32-bit floating-point number;
  - double – 64 bits floating-point number;
- name – parameter name:
  - Error.Chromos – instrument error code;
  - Error.Bot – automation error code;
  - AssayDate.Year – measurement time, year;
  - AssayDate.Month – measurement time, month;
  - AssayDate.Day – measurement time, day;
  - AssayDate.Hour – measurement time, hour;
  - AssayDate.Minute – measurement time, minute;
  - AssayDate.Second – measurement time, second;
  - AssayDate.UnixTime – measurement time, unix time format, 32 bits;
  - AssayType – measurement type:
    - 0 – normal measurement;
    - 1 – calibration;
    - 2 – manual start;

        - 3 – rejected measurement;
    - Property.Gost313692008BurnoutTemperature – combustion temperature;
    - Property.Gost313692008D – relative density of real gas (kg/m3);
    - Property.Gost313692008D0 – relative density of ideal gas (kg/m3);
    - Property.Gost313692008HmassN – NCV, mass (mJ/kg);
    - Property.Gost313692008HmassNKcal – NCV, mass (kcal/kg);
    - Property.Gost313692008HmassV – GCV, mass (mJ/kg);
    - Property.Gost313692008HmassVKcal – GCV, mass (kcal/kg);
    - Property.Gost313692008HmolN – NCV, molar (kJ/mol);
    - Property.Gost313692008HmolNCal – NCV, molar (kJ/mol);
    - Property.Gost313692008HmolV – GCV, molar (kJ/mol);
    - Property.Gost313692008HmolVCal – GCV, molar (kJ/mol);
    - Property.Gost313692008HvolN – NCV, volume (mJ/m3) real gas;
    - Property.Gost313692008HvolN0 – NCV, volume (mJ/m3) ideal gas;
    - Property.Gost313692008HvolN0Kcal – NCV, volume (kcal/m3) ideal gas;
    - Property.Gost313692008HvolNKcal – NCV, volume (kcal/m3) real gas;
    - Property.Gost313692008HvolV – GCV, volume (mJ/m3) real gas;
    - Property.Gost313692008HvolV0 – GCV, volume (mJ/m3) ideal gas;
    - Property.Gost313692008HvolV0Kcal – GCV, volume (kcal/m3) ideal gas;
    - Property.Gost313692008HvolVKcal – GCV, volume (kcal/m3) real gas;
    - Property.Gost313692008IsMethaneByDifference – methane by difference;
    - Property.Gost313692008M – Molar mass (kg/mol);
    - Property.Gost313692008MeasureTemperature – measurement temperature;
    - Property.Gost313692008Ro – density of real gas (kg/m3);
    - Property.Gost313692008Ro0 – density of ideal gas (kg/m3);
    - Property.Gost313692008WobbeN – Wobbe index of real gas, net (mJ/m3);
    - Property.Gost313692008WobbeN0 – Wobbe index of ideal gas, net (mJ/m3);
    - Property.Gost313692008WobbeN0Kcal – Wobbe index of ideal gas, net (kcal/m3);
    - Property.Gost313692008WobbeNKcal – Wobbe index of real gas, net (kcal/m3);
    - Property.Gost313692008WobbeV – Wobbe index of real gas, gross (mJ/m3); Property.Gost313692008WobbeV0 – Wobbe index of ideal gas, gross (mJ/m3);
    - Property.Gost313692008WobbeV0Kcal – Wobbe index of ideal gas, gross (kcal/m3);
    - Property.Gost313692008WobbeVKcal – Wobbe index of real gas, gross (kcal/m3);
    - Property.Gost313692008Zmix – compressibility factor;
    - Component.1_2_butadiene – 1.2-Butadiene;
    - Component.1_3_butadiene – 1.3-Butadiene;
    - Component.1_butene – 1-Buten;
    - Component.1_pentene – 1-Pentan;
    - Component.2_2_dimethylbutane – 2.2-dimethylbutane;
    - Component.2_3_dimethylbutane – 2.3-dimethylbutane;
    - Component.2_methylpentane – 2-methylpentane;
    - Component.3_methylpentane – 3-methylpentane;
    - Component.acetylene – acetylene;
    - Component.air – air;
    - Component.ammonia – ammonia;
    - Component.argon – argon;

- Component.benzene – benzene;
- Component.carbon_dioxide – carbon dioxide;
- Component.carbon_disulfide – Carbon disulfide;
- Component.carbon_monoxide – carbon monoxide;
- Component.carbonyl_sulfide – carbonyl sulfide;
- Component.cis_2_butene – cis-2-butene;
- Component.cyclohexane – cyclohexane;
- Component.cyclopentane – cyclopentane;
- Component.ethane – ethane;
- Component.ethylbenzene – ethylbenzene;
- Component.ethylcyclohexane – ethylcyclohexane;
- Component.ethylcyclopentane – ethylcyclopentane;
- Component.ethylene – ethylene;
- Component.helium – helium;
- Component.hydrocyanic_acid – hydrogen cyanide;
- Component.hydrogen – hydrogen;
- Component.hydrogen_sulphide – hydrogen sulfide;
- Component.iso_butane – i-butane;
- Component.2_methylpropene – 2-methylpropene;
- Component.isopentane – i-pentane;
- Component.methane – methane;
- Component.methanethiol – methanethiol;
- Component.methanol – methanol;
- Component.methylcyclopentane – methylcyclopentane;
- Component.methylcyclopentane – methylcyclopentane;
- Component.n_butane – n-butane;
- Component.n_decane – n-decane;
- Component.n_heptane – n-heptane;
- Component.n_hexane – C6+;
- Component.n_octane – n-octane;
- Component.n_pentane – n-pentane;
- Component.neon – neon;
- Component.neopentane – neopentane;
- Component.nitrogen – nitrogen;
- Component.nonane – n-nonane;
- Component.o_xylene – o-xylene;
- Component.oxygen – oxygen;
- Component.propadiene – propadiene;
- Component.propane – propane;
- Component.propylene – propylene;
- Component.sulphur_dioxide – sulfur dioxide;
- Component.toluene – toluene;
- Component.trans_2_butene – trans-2-butene;
- Component.water – water;