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**BINOM3 – MULTIFUNCTIONAL REVENUE ENERGY METER
AND POWER QUALITY ANALYZER**

Web Server Operator's Manual

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Version 3

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1 Introduction

The Web server of BINOM3 series multifunctional meters - electric energy quality characteristics measurement devices (hereinafter BINOM3) is created in order to provide access to the device troubleshooting, viewing reports and technological parameters, as well as for the device parameterization.

2 Working with the Web Server

2.1 Requirements for the Web Browser

The Web server supports the following browsers:

- Google Chrome;
- Yandex Browser

It is recommended to use the actual version Google Chrome browser.

2.2 Web Server Access

2.2.1 Web Server Access via Communication Channels

Open your web browser and enter the IP address of your device in the address bar. BINOM3 IP address by default is 192.168.150.31. The device IP address can be viewed on the screen via System Parameters menu item.

The web browser will open an authorization page

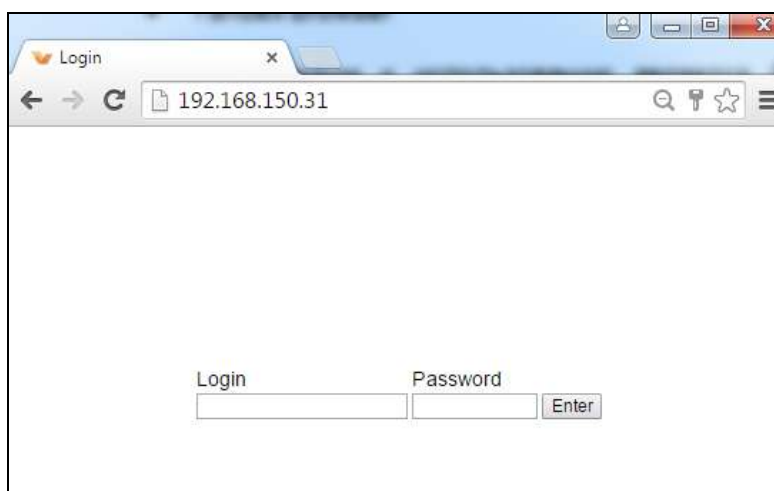


Fig. 2.1 Authorization Page

2.2.2 Access to Web Server via Optical Port

In order to obtain access to the device web server via optical port, it is necessary to create a new modem connection.

2.2.2.1 Install the optical head into the operation system as a modem (Fig. 2.2)

Open "Start - Control Panel - System - Device Manager".

Select "Add legacy hardware" in the "Action" menu (Fig. 2.2)

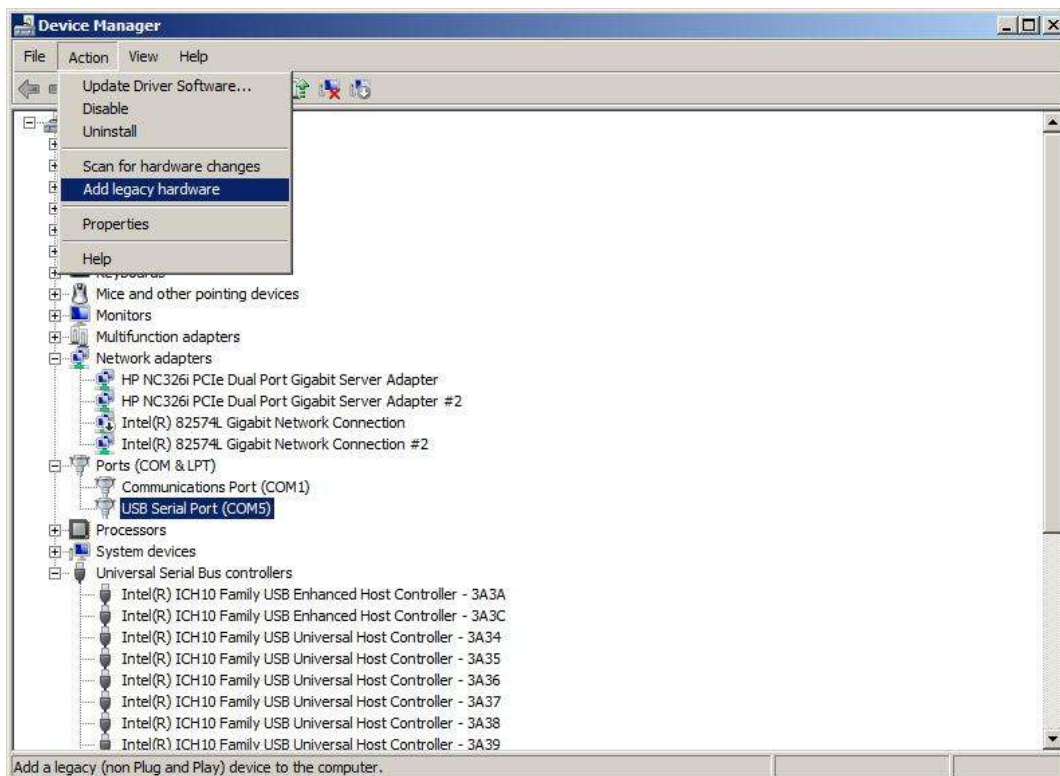


Fig. 2.2

Select "Installation the hardware that I manually select from a list" (Fig. 2.3). Click "Next".

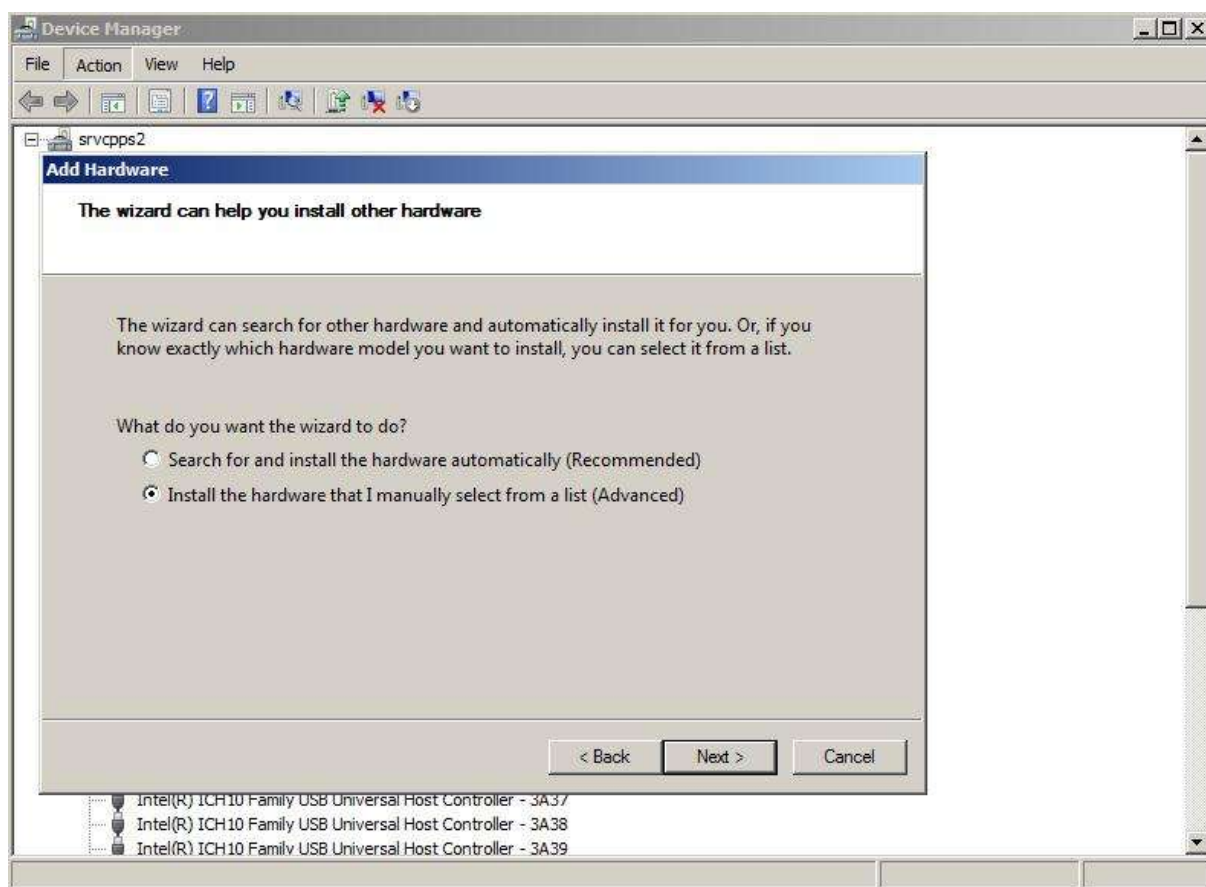


Fig. 2.3

Select "Modems" as a hardware type (Fig. 2.4). Click "Next".

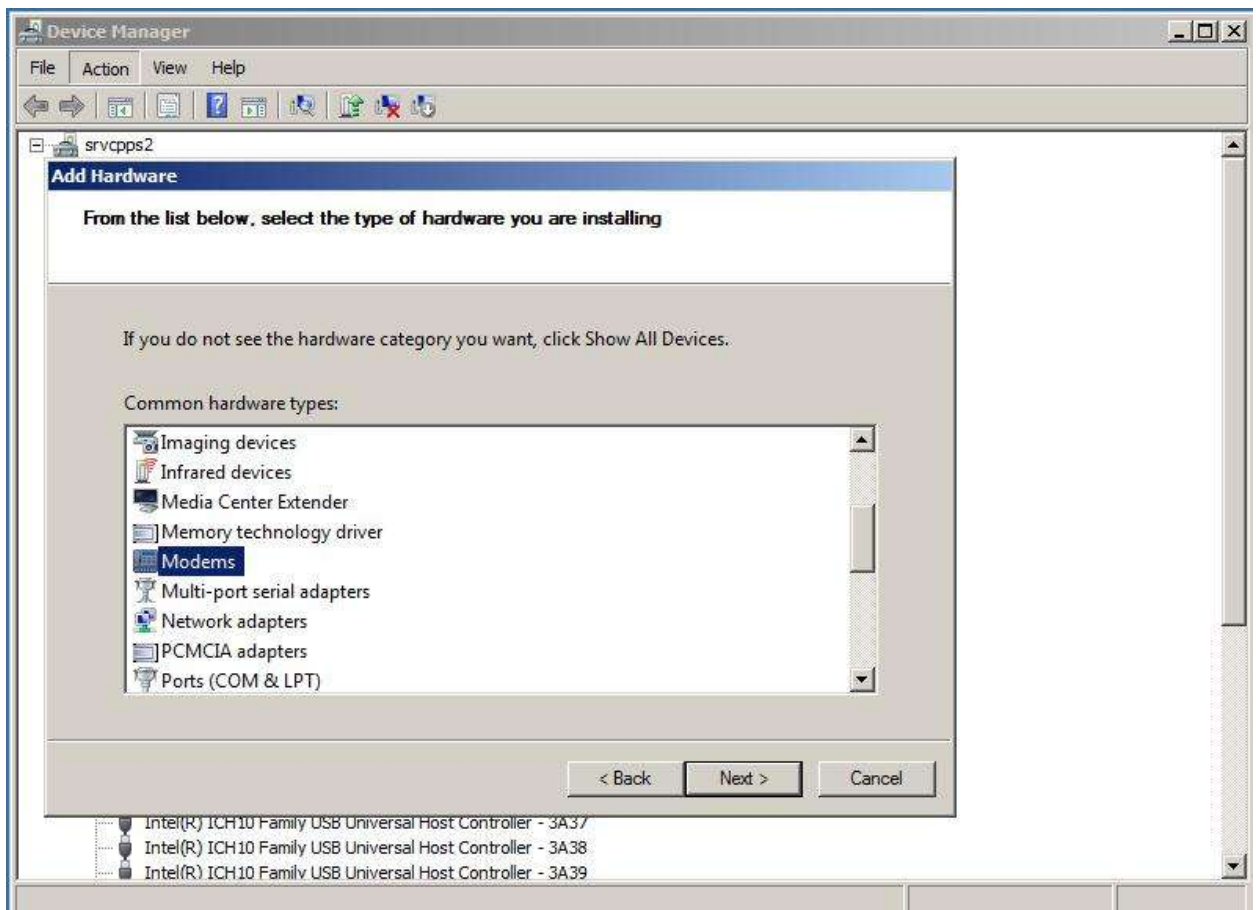


Fig. 2.4

Tick "Do not define modem type (select from the list)" (Fig. 2.5). Click "Next".

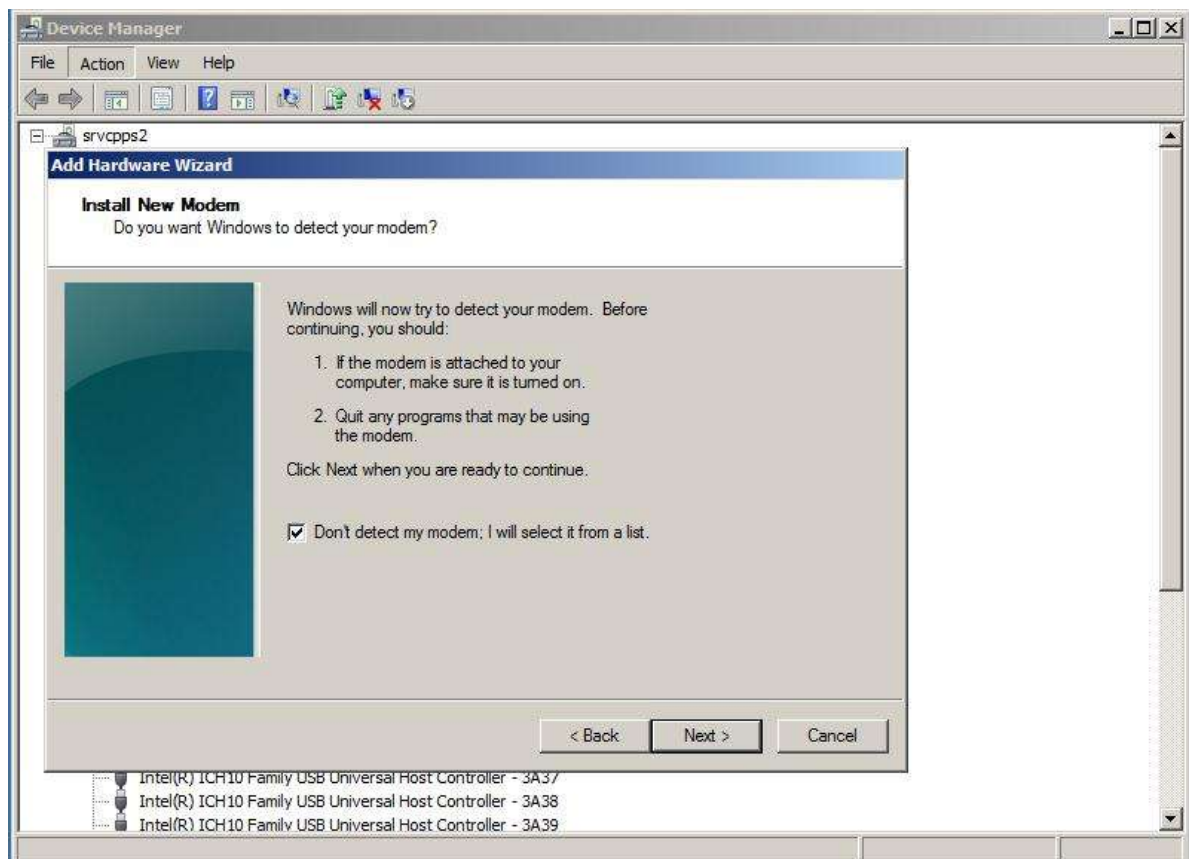


Fig. 2.5

Select "Serial port for computer connection (Fig. 2.6). Click "Next".

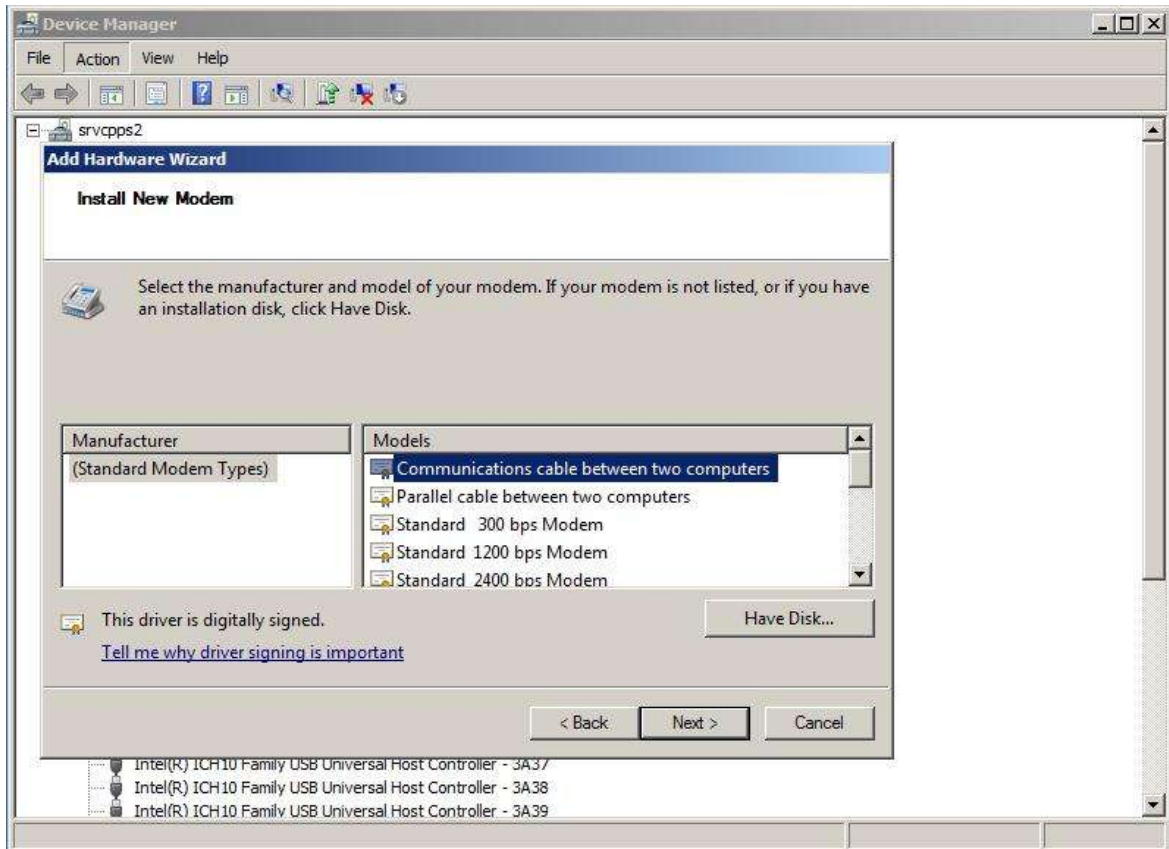


Fig. 2.6

Select the COM port to which the optical head is connected (Fig. 2.7). Click "Next".

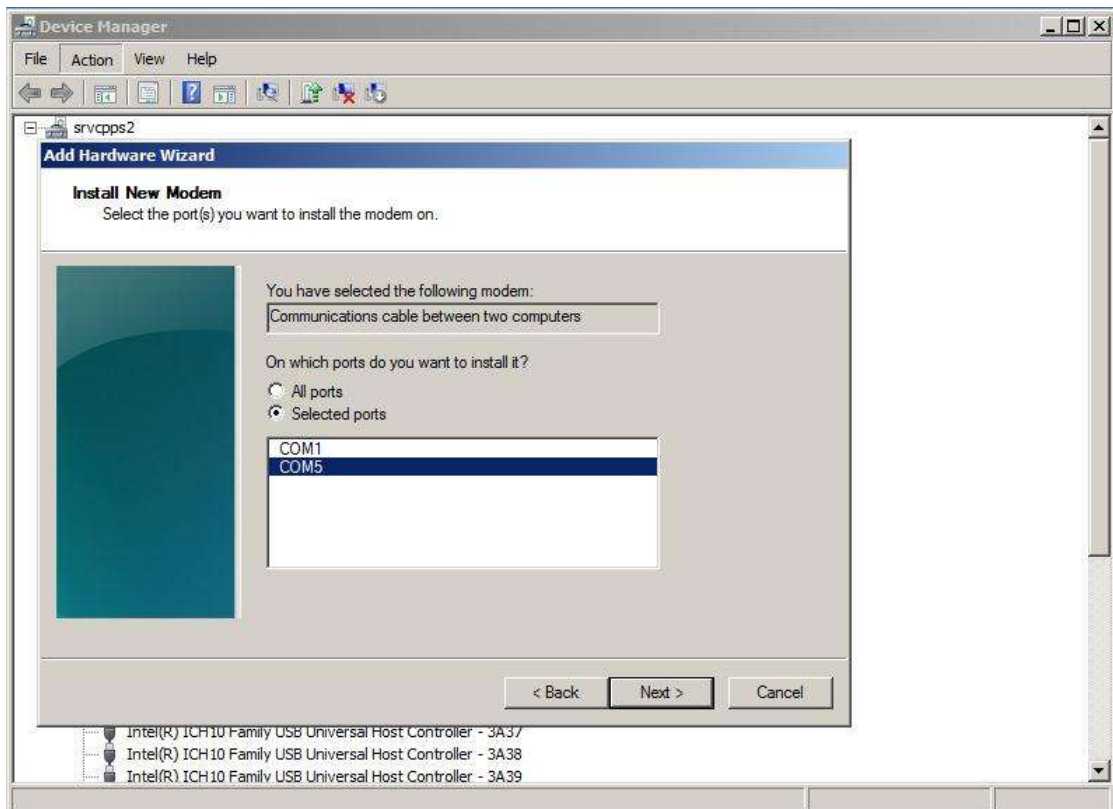


Fig. 2.7

A new device will appear in the list of installed hardware, tab "Modems" (Fig. 2.8).

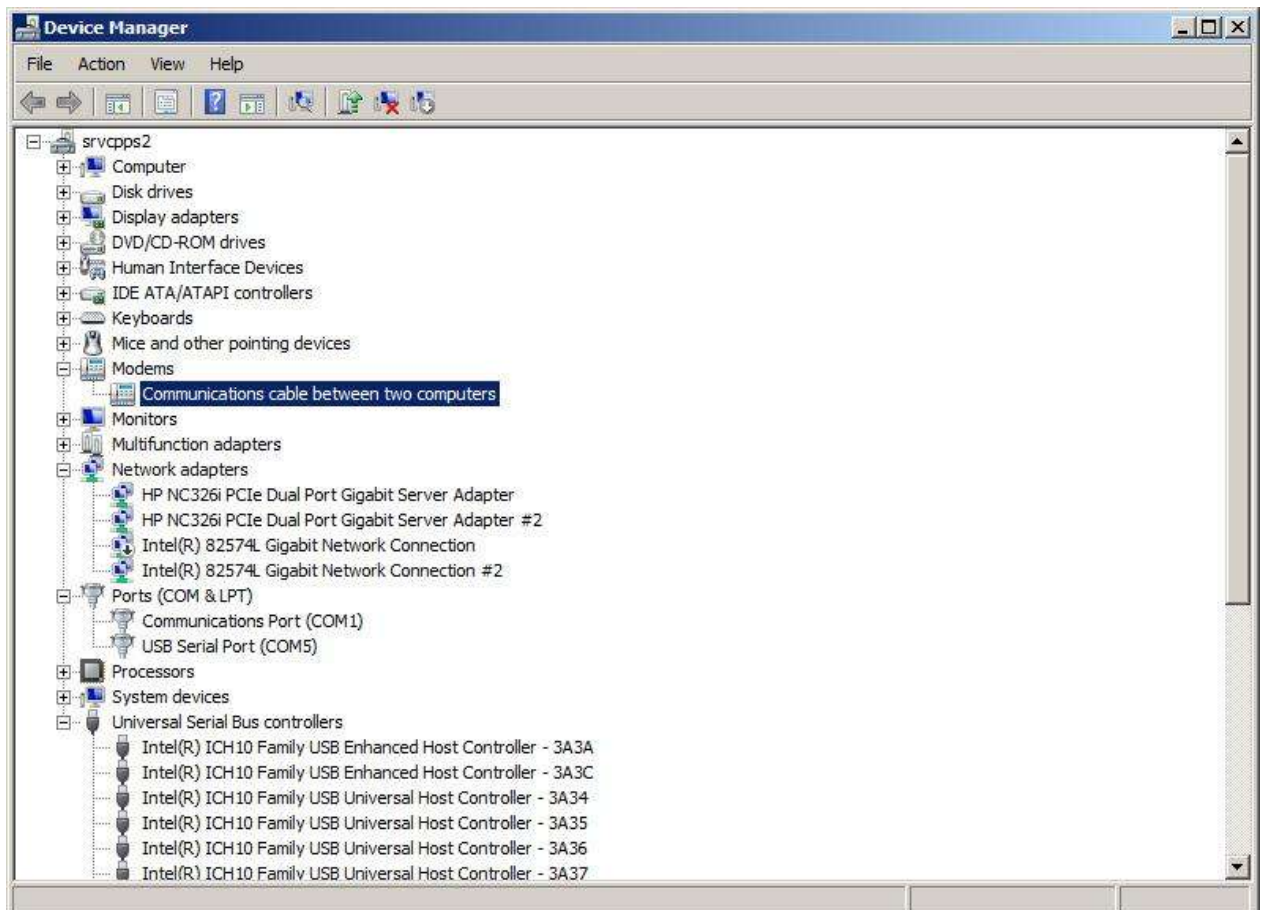


Fig. 2.8

Browse to "Control Panel - Networks and Sharing Center". Select "Set up a new connection or network" (Fig. 2.9)



Fig. 2.9

Select «Set up a dialup connection» (Fig. 2.10). Click "Next".

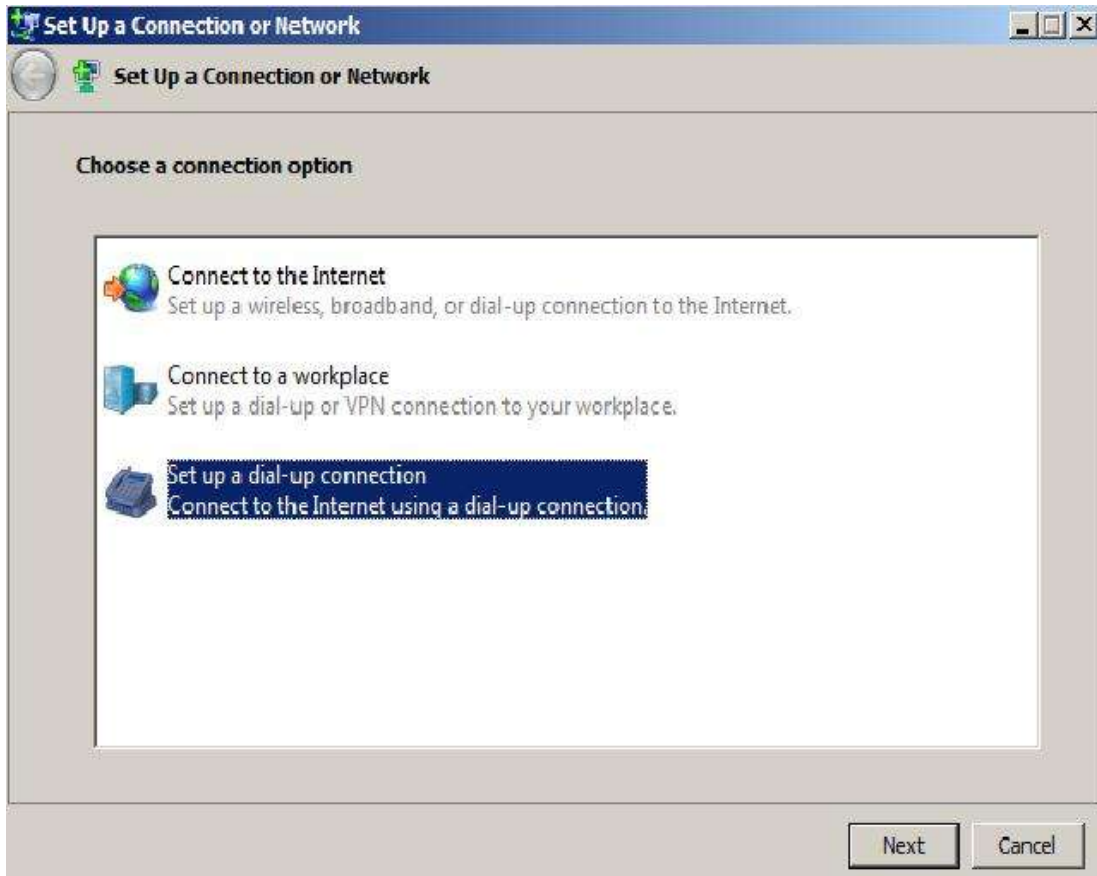


Fig. 2.10

Select the newly install modem type (Fig. 2.11).



Fig. 2.11

Enter connection name (e.g., BINOM3) and the dialed number, user name and password - all parameters shall be equal to 1 (Fig. 2.12).

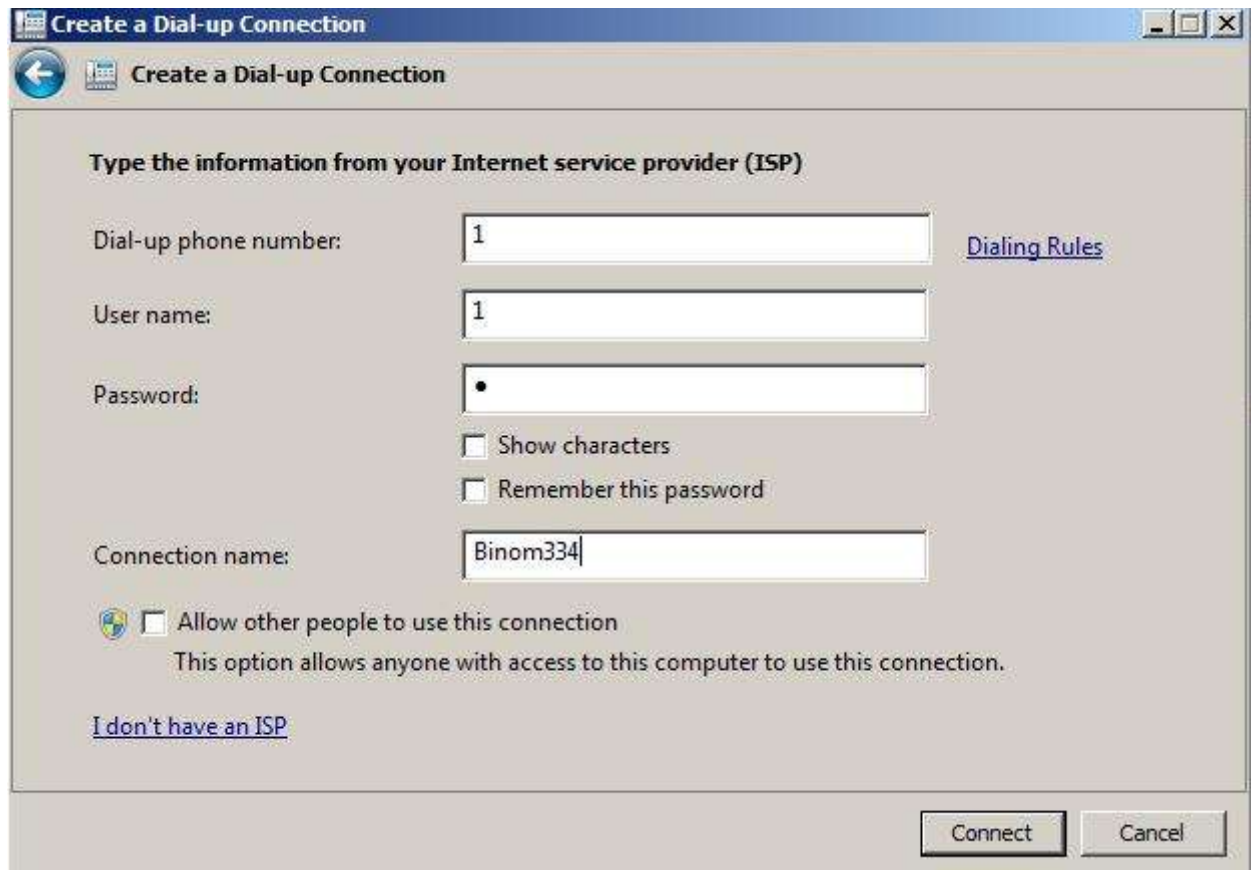


Fig. 2.12

In the "Control Panel - Networks and Sharing Center" menu select "Change adapter settings" (Fig. 2.13).

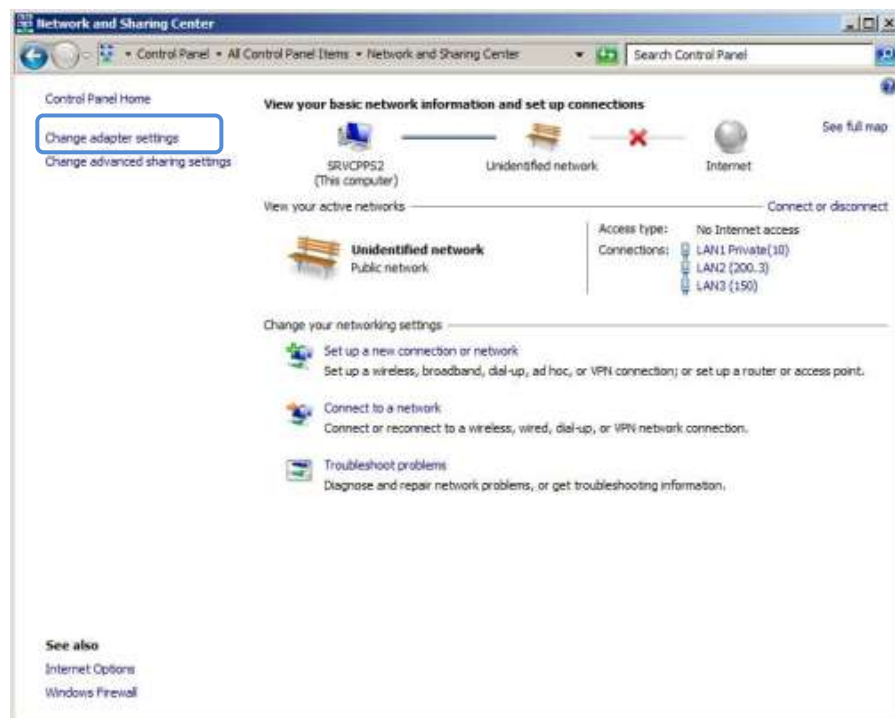


Fig. 2.13

Right-click on the icon with the connection name, choose "Properties" in the dropdown list. Click "Set" in the menu "General" in the opened window.

Set 57600 bit/s connection speed, untick hardware parameters as shown in Figure 2.4. Click "OK".

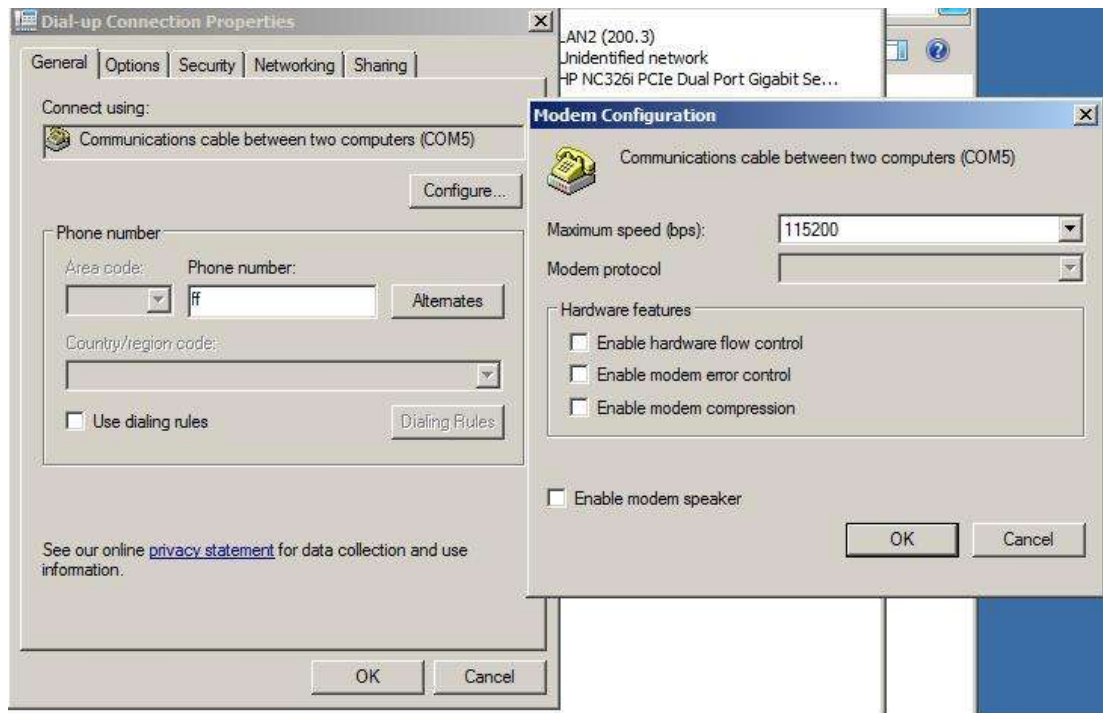


Fig. 2.14

Browse to the "Options" menu and untick all items as shown in Fig. 2.15.



Fig. 2.15

Browse to the "Networking" menu. Untick the "Version 6 Internet protocol (TCP/IPv6)" item. (Fig. 2.16)

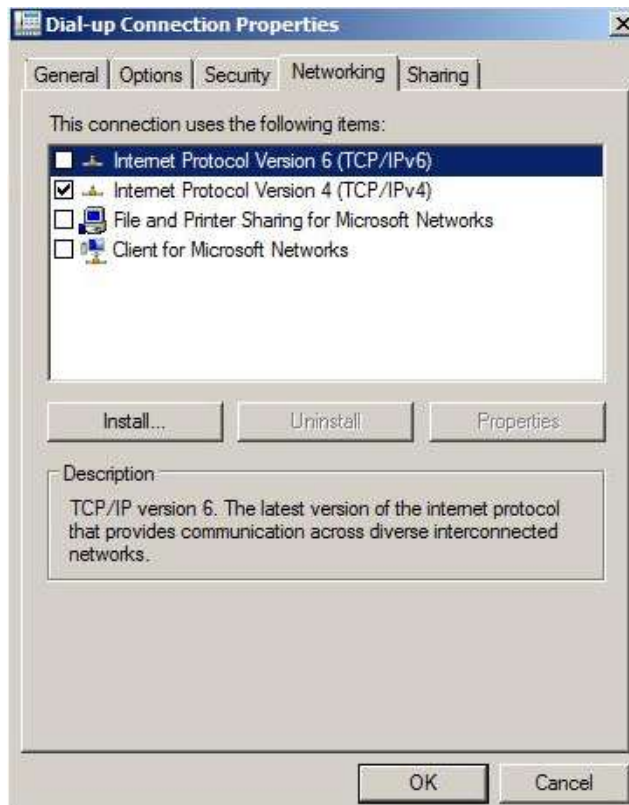


Fig. 2.16

Select "Version 4 Internet Protocol (TCP/IPv4)" by a single left click. Click "Properties". Click "Advanced..." in the opened window. The set parameters as shown in Fig. 2.17.

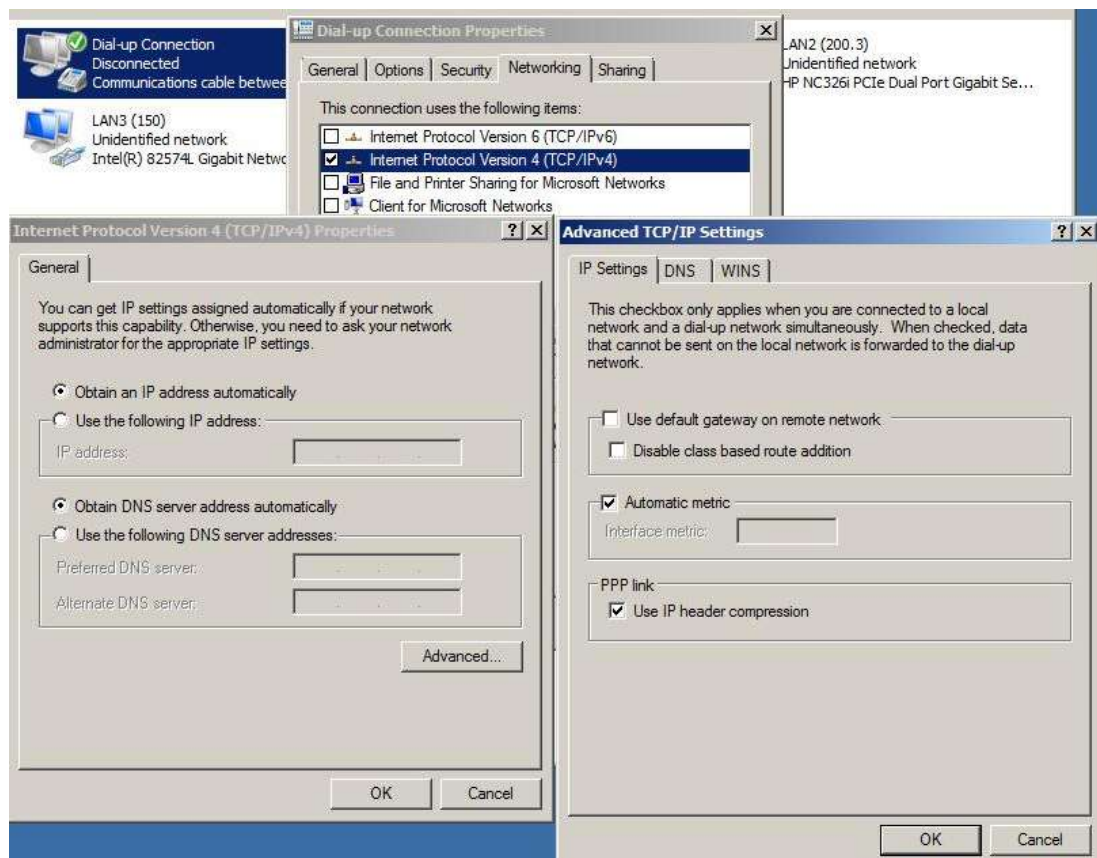


Fig. 2.17

Set the connection. By default, the meter IP-address when accessed via optical port is **10.10.0.1**.

Then, as in cl. 2.2.1, enter the device IP-address in the Web browser address bar.

The authorization page will open (Fig. 2.1).

2.3 Authorization

For authorization in the system, it is necessary to enter a user name and a password.

Every user is assigned an access level depending on which he or she will be allowed to access and edit a certain set of device parameters.

The list of users and their access right levels are formed by the manufacturer.

2.4 Data Access Levels

2.4.1 User Level

Provides access to the minimum set of configuration data needed to configure the meter for operation as a part of Algorithm hardware set. Those data are as follows:

- System parameter settings
- Power metering task settings: metering intervals
- Basic communication protocol settings

By default:

login **user** password **1**

2.4.2 Telemechanic Level

Provides access to an expanded set of configuration parameters including:

- System parameter settings;
- Real time task settings;
- Communication protocol settings;
- Power metering task settings: rate cards, loss calculation.

By default:

login **telem**, password **1**.

2.4.3 Administrator Level

Provides access to the parameters defining the meter calculation algorithms, as well as finer tuning of the scope and composition of meter data transmitted via communication channels.

By default:

login **admin** password **1**

Note:

The information set forth in Cl. 3 of this description conforms to the possible access levels, from minimum to maximum.

2.4.4 Operator Level

Provides access to viewing all parameters at the Administrator level without allowing to make any changes to the meter settings or Web server updates.

By default:

login **alg** password **1**

2.5 Web Server Main Page

After a successful attempt to enter the meter Web server, the Web server main page opens (Fig. 2.18).

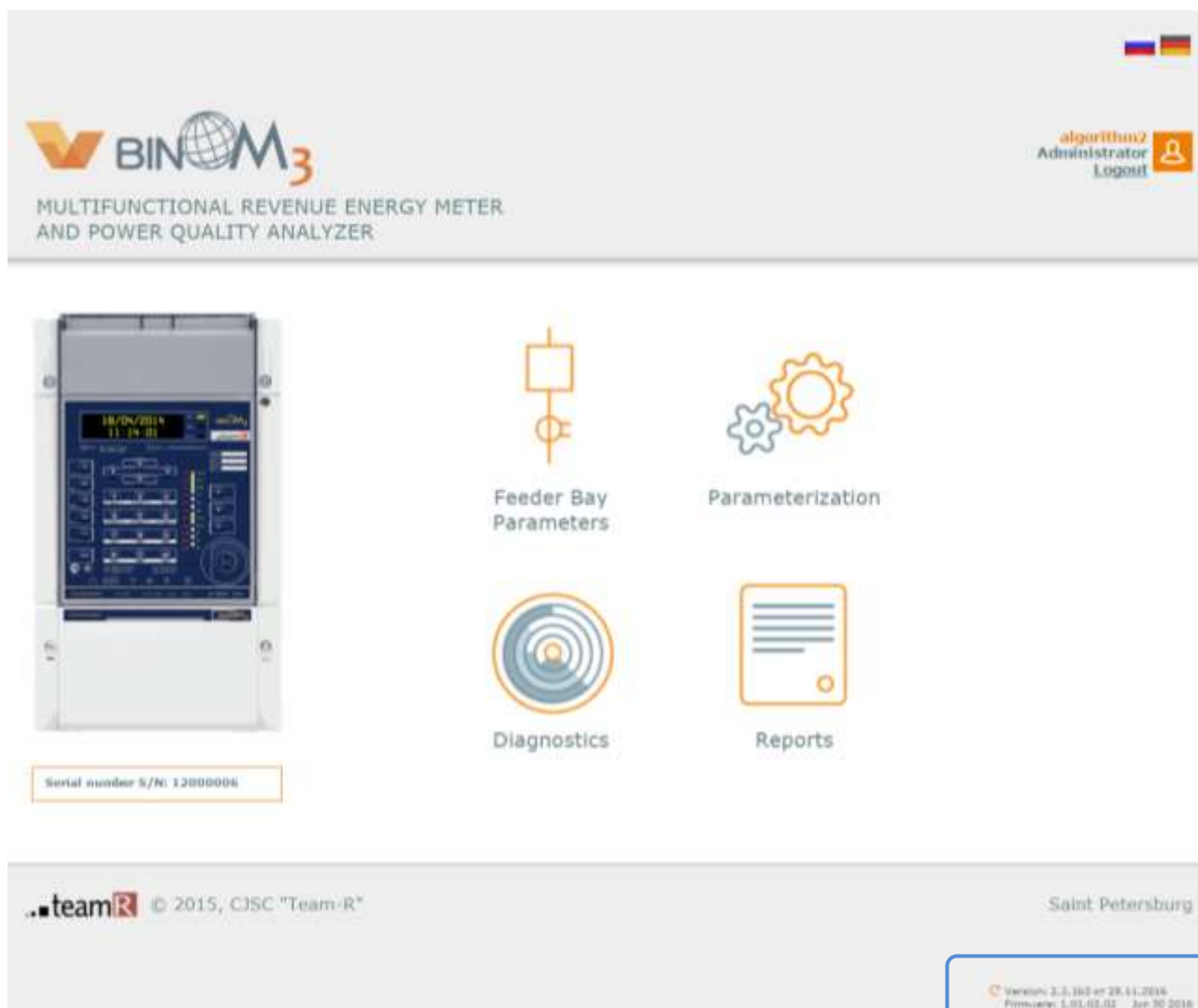


Fig. 2.18. Web Server Main Page


The following menu items are accessible for further work with the Web server:

- 1) Feeder Bay Parameters;
- 2) Parameterization;
- 3) Diagnostics;
- 4) Reports.

The current user name, access level and the Web pages language selection button are displayed in the top right corner of the Web server window.

The version of the BINOM3 meter Web server is displayed in the bottom right corner.

2.6 BINOM3 Web Server Software Update

In order to renew the BINOM3 Web server software, on bottom the Web server main page (fig. 2.18) click on the  button located to the left of the software version.

Select updated interface in update parameters in the opened window (Fig. 2.19):

- primary - metered parameters, parameterization, etc. access interface;
- system - changes the startup page, error messages and other information messages.

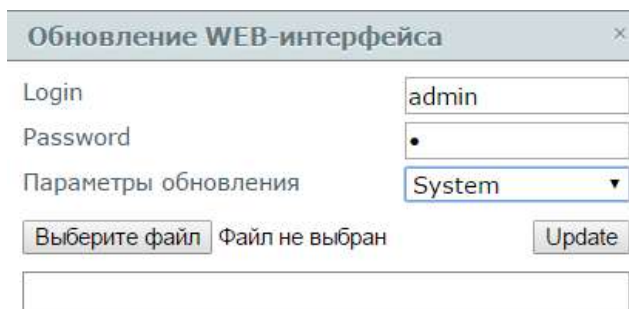


Fig. 2.18. Web Server Main Page

Then, select the Web server directory image file (the file extension is *.img) and click the "Update" button. The image file may be provided by the manufacturer's specialists upon request.

Web server software updates take effect immediately upon completion of the update procedure. In this case, BINOM3 need not be rebooted.

3 BINOM3 PARAMETERIZATION

Note:

Configurable meter parameters are stored in config.xml file on the SD card (or in the device memory - for the BINOM334iL version). The user may make changes to the configuration with the help of the web server or download a ready-made configuration.

3.1. General Appearance of the Parameterizer

The parameterizer includes the following components:

- 1 – main menu access;
- 2 – parameterizer pages navigation panel;
- 3 – control panel access;
- 4 – parameterization section display area.

For example the System Parameters section is presented in the figure.

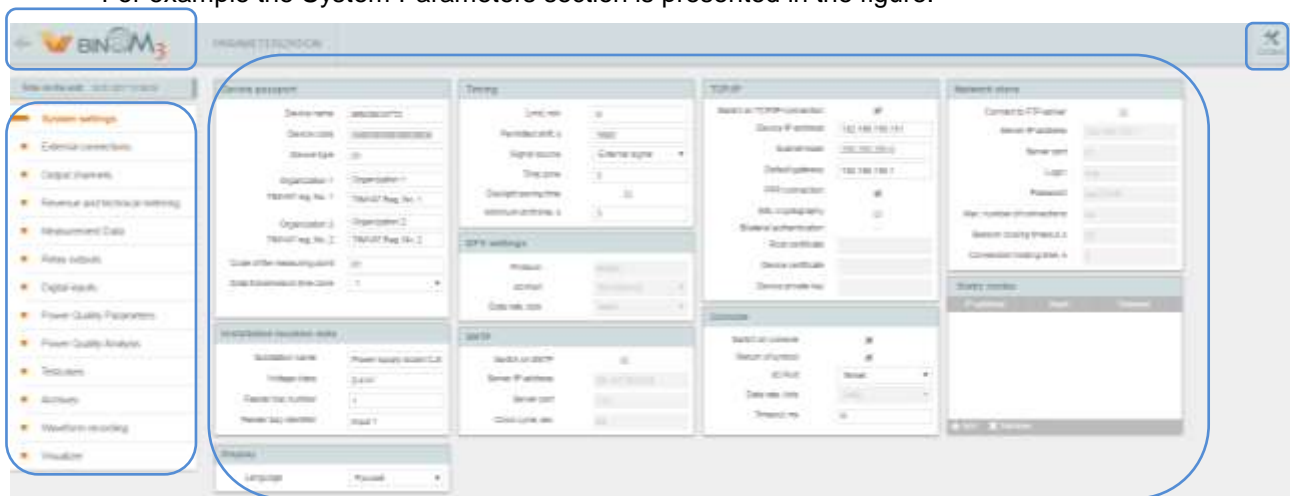


Fig. 3.1 - General Appearance

3.2. Control Panel

Opened by clicking the Control icon in the top right corner of the screen.

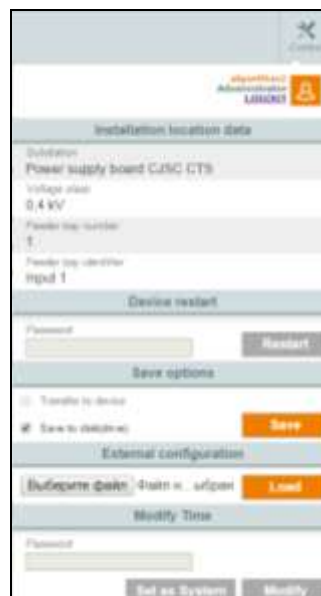


Fig. 3.2 - Control Panel

The panel consists of five blocks:

- 1) User authorization parameters;
- 2) Installation location data - information about the device installation site;
- 3) Device restart. After entry of a correct password and clicking the Restart button, the device will be restarted (it is necessary for application of the changes made to the configuration);
- 4) Save options. Used for saving the changes made by the user. Allows to transfer the changed configuration into the device or to save it on the user computer ("Save on Disk" option).
- 5) External configuration allows to load a previously formed configuration file into the Web server.

Note:

When using the option of loading a file from the user computer, the file is loaded in the Web server only! For loading the file into the device, it is necessary to use the Transfer to Device option after loading the configuration file into the Web server.

To apply changes after loading a new configuration into the device, it is necessary to restart the device.

3.3 "System Parameters" Section

This section considers:

- Editing the device datasheet;
- Synchronization settings;
- Console setting;
- TCP/IP connection setting;
- SSL coding setting;
- SNTP setting.

3.3.1 Device Datasheet

This section is identical for all access level. Setting must be performed in compliance with the document "Format and Specifications of Measurement Results, Conditions of Measurement Facilities and Objects in JSC «TSA», «SO UPS» OJSC and Related Subjects".

The following parameters are editable:

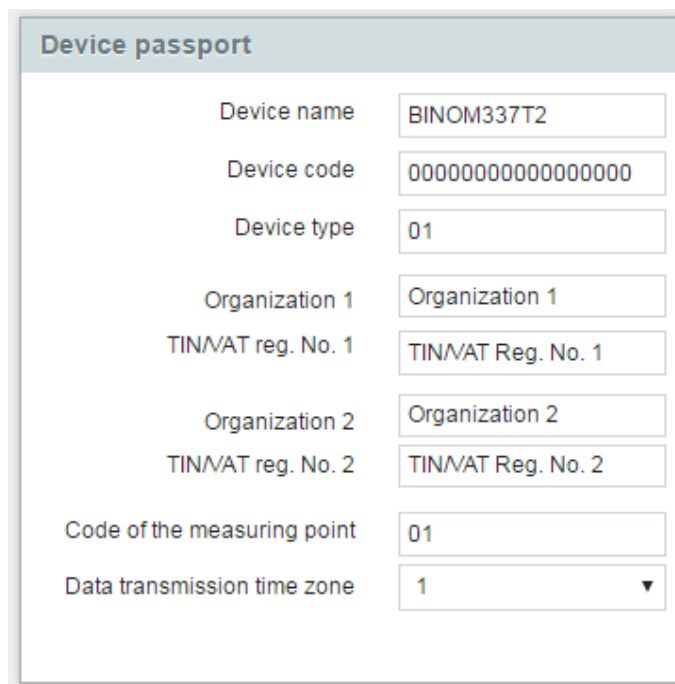
- 1) Device Name - Measurement device name (e.g., BINOM337)
- 2) Device Type - a code assigned to this measurement facility when registering the record-keeping system in the JSC «TSA»:
 - 01 – Meter
 - 03 – Data Acquisition and Transmission Device
- 3) Organization 1 – Power Supplier Organization Name. Name length up to 250 characters.
- 4) Organization 2 – Power Purchaser organization name. Name length up to 250 characters.
- 5) Organization 1 Taxpayer Identification Number. - Power supplier organization taxpayer identification number. Name length up to 10 characters.
- 6) Organization 2 taxpayer identification number. - Power Purchaser Organization Taxpayer Identification Number. Name length up to 10 characters.

7) Data Transmission Time Zone - Determines in which time zone data is transmitted, may have the following values:

- 1 – for the first and the second price zones, for the first and the third non-price zones;
- 3 – for the second non-price zone.

8) Device Code - A unique code assigned to the measurement facility or data acquisition and transmission device by Joint-stock company «Trading System Administrator of Wholesale Electricity Market Transactions» (JSC «TSA») - length up to 17 characters.

9) Measurement Point Code - a code assigned to this measurement point when registering the record-keeping system in the JSC «TSA».

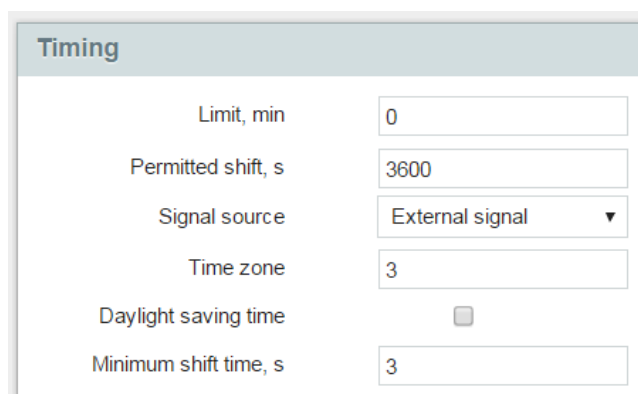


The image shows a web form titled "Device passport". It contains several input fields for device information:

Field	Value
Device name	BINOM337T2
Device code	0000000000000000
Device type	01
Organization 1	Organization 1
TIN/VAT reg. No. 1	TIN/VAT Reg. No. 1
Organization 2	Organization 2
TIN/VAT reg. No. 2	TIN/VAT Reg. No. 2
Code of the measuring point	01
Data transmission time zone	1

Fig. 3.3 – Device Datasheet Setting

3.3.2 Synchronization Setting



The image shows a web form titled "Timing". It contains several input fields for synchronization settings:

Field	Value
Limit, min	0
Permitted shift, s	3600
Signal source	External signal
Time zone	3
Daylight saving time	<input type="checkbox"/>
Minimum shift time, s	3

Fig. 3.4 – Timing

1) Signal Source - set by the synchronization signal source. May have the following values: "Internal Clock", "External Signal" (by communication channels) and GPS. The "External Signal" value is set by default. The "Internal Clock" value is used when external signal synchronization is impossible for some cause. "GPS" value is set in case a GLONASS/GPS receiver is directly connected to the device.

External signal synchronization mode is used in operation as a part of an automated system (AS). It allows to adjust clock rate as per IEC 60870-5-101/104 protocol with accuracy up to 10 ms. To ensure synchronization with less than 5 μ s error for BINOM334i and less than 1 μ s for other BINOM3 versions in BINOM3 joint operation with "TM3com" control center telemechanic device. 1PPS impulse is fed to the meter impulse input; then a synchronization command is sent via the communication channel used for the meter integration in the AS; this command corresponds to the pulse leading edge passage time. A special frame containing a time mark in a format having a 1 nanosecond resolution is used as the command.

2) Time Zone - Sets the time zone number.

3) Daylight Saving Time - when this option is selected, switching to daylight saving time is permitted.

At least "Telemechanic" access level is required to set the 3.3.2.4 – 3.3.2.6 parameters.

4) Restriction - Setting restrictions on the frequency of time synchronization commands receipt over communication channel. May take the following values:

- 0 – no restrictions (value by default)
- - 1 – daily synchronization
- > 0 – minimum time in minutes between synchronization commands.

5) Permissible Shift - Sets the maximum permissible meter time shift as a synchronization command is received. Measured in seconds.

Value "0" - no restrictions (by default).

6) Minimum Shift - Minimum shift recorded in the events log, measured in seconds.

The Administrator access level is required to set parameters 3.3.3 - 3.3.5.

3.3.3 Console Settings

Console	
Switch on console	<input checked="" type="checkbox"/>
Return of symbol	<input checked="" type="checkbox"/>
I/O Port	Telnet ▼
Data rate, kb/s	2400 ▼
Timeout, ms	0

Fig. 3.5 – Console Setting

Console is a multifunctional device for device parameters monitoring, diagnostic and adjustment.

"Administrator" access level is required for setting the console.

1) Switch on console – setting this flag activates the console. It is advisable to activate the console at the commissioning stage. During industrial operation, the console must be deactivated.

2) Return of symbol – activates a check of the device communication channel. It is recommended to remove this flag only in case the terminal program is unable to deactivate the option of displaying entered characters on the screen (in order to avoid displaying redundancy).

3) I/O Port – the port through which the console is connected. By default, the console is accessible through Ethernet (Telnet). The console may be transferred from the Ethernet port to a free RS-232 or RS-485 port.

Note:

The console supports the "?" command. This command performs output of all commands supported by the device.

4) Data rate, kb/s – Set only for UART ports. Determines data transfer speed. Standard speed values are allowable (2400, 9600, 57600, 115200).

5) Time-out – sets communication failure detection timeout. Relevant only for a Telnet connection.

3.3.4 GPS Settings

BINOM3 may be switched directly to standard time signal receivers (e.g., DF01) in the NMEA protocol. For that purpose it is necessary to select GPS as a synchronization source and specify port exchange speed (9.6 kbit/s by default)



GPS settings	
Protocol	NMEA
I/O Port	RS-485/422 ▼
Data rate, kb/s	9600 ▼

Fig. 3.6 – GPS settings

Note:

The port specified as the one connected to GLONASS/GPS must not be used to transmit information in IEC 60870-5-101.

3.3.5 TCP/IP

This section describes Ethernet port settings

1) Switch on TCP/IP-connection – in case this flag is removed, the device will not be able to access the Ethernet.

2) Device IP-address – contains device address in the Ethernet.

3) Subnet Mask – contains the sub network mask to which the device is connected.

4) Default gateway – contains the router address in the Ethernet to which a packet must be sent if it is impossible to define the route.

5) PPP-Connection.

TCP/IP	
Switch on TCP/IP-connection	<input checked="" type="checkbox"/>
Device IP-address	192.168.150.151
Subnet mask	255.255.255.0
Default gateway	192.168.150.1
PPP-connection	<input checked="" type="checkbox"/>
SSL-cryptography	<input type="checkbox"/>
Bilateral authentication	<input type="checkbox"/>
Root certificate	
Device certificate	
Device private key	

Fig. 3.7 - TCP/IP

Note:

PPP (Point-to-Point Protocol) – OSI model channel level point to point protocol. Usually used to establish direct communication between two network nodes; it can ensure connection authentication, data coding and compression.

A PPP connection is intended to ensure TCP/IP connection between two devices or a device and a computer in order to access a device via communication channels different from Ethernet.

Note:

Simultaneous deactivation of the PPP connection and Ethernet will render work with Web interface impossible. Apply to the manufacturer's technical support service in order to restore access to the meter Web server.

3.3.6 SSL Coding

Note:

SSL (Secure Sockets Layer) – a cryptographic protocol ensuring communication security. It allows a client to communicate with a network server preventing data interception or falsification.

SSL activation is needed to ensure connection safety. For SSL operation, it is necessary to load certificate files supplied by the manufacturer. These files are used for checking communication security. Whereupon authentication may be both unilateral (when security is checked by the computer only) and bilateral (when security is checked by both the computer and the certificate).

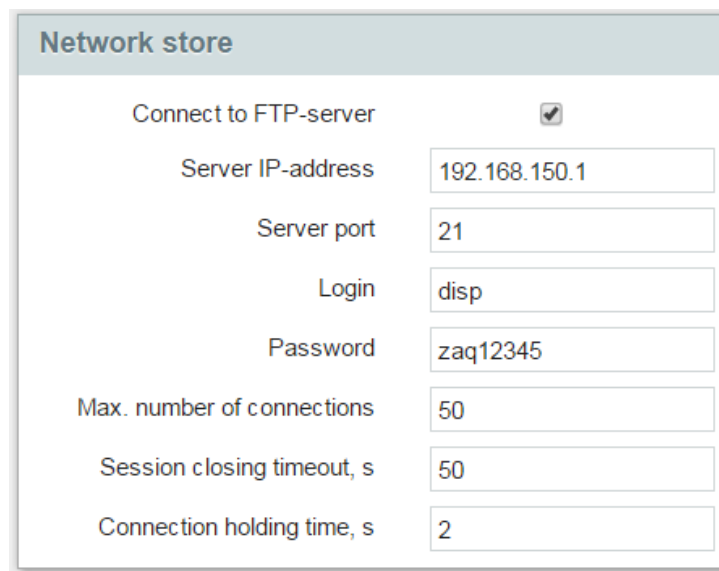
To install certificates, the user must select in his browser: **Settings -> Certificates Management -> Trusted Root Certification Authorities -> Import** After this, follow the installation wizard instructions, using all default settings.

After installing this file, select in the browser again: **Settings -> Certificates Management -> Personal** and select a file with *.p12 extension in the opened dialog box. After this, follow the installation wizard instructions, using all default settings. The installation wizard will ask a password supplied together with the certificate files.

3.3.6.1 Bilateral authentication parameters set at the factory (if necessary):

- 1) Root certificate;
- 2) Device certificate;
- 3) Device private key.

3.3.7. Network Storage (FTP Server)



The screenshot shows a configuration window titled "Network store". It contains several settings for connecting to an FTP server:

Parameter	Value
Connect to FTP-server	<input checked="" type="checkbox"/>
Server IP-address	192.168.150.1
Server port	21
Login	disp
Password	zaq12345
Max. number of connections	50
Session closing timeout, s	50
Connection holding time, s	2

Fig. 3.8 - Network store

The following parameters are set when setting the network storage

- 1) Server IP-address – the server network address.
- 2) Server port – standard port 21.
- 3) Login – server authorization data.
- 4) Password – server authorization data.
- 5) Max. number of connections – the number of connections possible simultaneously. Recommended value: 20 connections.
- 6) Session closing timeout – time upon expiry whereof the user authorization data are dumped if there are no server queries.
- 7) Call holding time – time upon expiry whereof the server connection will be closed if there are no server queries. By default, the value is 0 (the parameter is ignored).

3.3.8 Display



The screenshot shows a configuration window titled "Display". It contains a single setting for the display language:

Parameter	Value
Language	English ▼

Fig. 3.9 – Display Settings

The display has the following settings: Display Language – selection of the language in which information is displayed.

3.3.9 Static Network Routes Setting

This form presents a routing table used by TCP/IP stack that describes correspondence between destination addresses and interfaces through which a data packet should be sent.

Routes are added and removed with the help of "Add" and "Remove" buttons in the left bottom corner of the form.



IP-address	Mask	Gateway
192.168.151.0	255.255.255.0	192.168.150.0

+ Add X Remove

Fig. 3.10 - Static Routes

- 1) IP-Address – contains the network or destination node address.
- 2) Mask – contains the destination network mask.
- 3) Gateway – designates the router network address to which a packet sent to a specified destination address must be sent.

3.4 Section "External Connections"

This section considers external connection parameters.

Connected may be effected through various physical interfaces and various exchange protocols. Buttons in the top left corner of the section are used for interface selection.

3.4.1 IEC 60870-5-104 Protocol Parameters

Several (not more than 5) IEC 60870-5-104 protocols opened on different ports and transmitting data via Ethernet interface may function in the meter.

A new protocol is added by clicking the "IEC" button in the top left corner of the form. If it is impossible to add a new protocol, the button will change its color to gray and will be unclickable. In case of several protocols are defined, they must have different "Port" parameter values.



- button is provided for creating a copy of an existing protocol. Whereupon not only an additional port with analogous settings but also data transmission channels will be created.

The screenshot displays the configuration window for the IEC 60870-5-104 protocol over an Ethernet interface. The 'IEC' sub-tab is active, showing a list of protocols. The selected protocol is 'IEC104' on port '2404'. The configuration parameters are as follows:

Parameter	Value
Type	IEC104
Role	Server
Synchronization by protocol	Enable
Local time	Disable
Pulsed synchronization	<input type="checkbox"/>
ASDU address	1
ASDU size	253
Port	2404
Unacknowledged frames	50
File transfer waveforms	<input type="checkbox"/>

Fig. 3.11 - IEC 60870-5-104 Settings

1) Type – determines the protocol type. An in editable field because only the IEC 60870-5-104 protocol can function on Ethernet interface.

2) Role – has "Server" value for the IEC 60870-5-104 protocol implemented in the meter.

3) Synchronization by protocol – may take "On", "Off" and "Backup" values. The meter may not be configured to have more than one protocol with activated synchronization and one with "Backup" value. Setting this flag will allow to receive the internal clock synchronization via this connection.

4) Pulsed Synchronization – when this flag is set, the time synchronization mark transmitted by the protocol corresponds to the impulse trailing edge on the meter synchronization input. The flag is used when an additional synchronization method is used: from the "TM3com" control center telemechanic device using a 1PPS impulse. When the "Impulse Signal Synchronization" flag is set, standard protocol frame synchronization is impossible.

5) ASDU Size - determines the maximum user data length in the frame in compliance with the IEC 60870-5-101 protocol.

6) Port – TCP port number. Must have a unique value for each IEC 60870-5-101 protocol set in the device.

3.4.2 IEC 60870-5-101 Protocol Parameters

The following physical data transmission interfaces are defined for this protocol (depending on the BINOM3 version, their composition may differ from the specified one):

- *UART0* (RS485/SYNC)
- *UART2* (RS485/RS422)
- *UART3* (RS232)

Note:

Only one protocol can be installed on each physical interface. It is impossible to activate an interface used both for the console and for GPS signalization.



Fig. 3.12 - Message about a Port Occupied by the Console

- 1) Type – determines the protocol type. An in editable field because only the IEC 60870-5-101 protocol can function.
- 2) Operation Mode "Slave" value is set for the IEC 60870-5-101 protocol. In editable.
- 3) Format - determines the port settings (number of bits – 8, evenness - Even, stop bits - 1). In editable.
- 4) Protocol Synchronization – may take "On", "Off" and "Backup" values. The meter may not be configured to have more than one protocol with activated synchronization and one with "Backup" value. Setting this flag will allow to receive the internal clock synchronization via this connection.
- 5) Local Time – Synchronization marks receipt and data transmission in the local time zone or by GMT.
- 6) Impulse Signals Synchronization – when this flag is set, the time synchronization mark transmitted by the protocol corresponds to the impulse trailing edge on the meter synchronization input. The flag is used when an additional synchronization method is used: from the "TM3com" control center telemechanic device using a 1PPS impulse. When the "Impulse Signal Synchronization" flag is set, standard protocol frame synchronization is impossible.
- 7) Channel Address – physical device address in the data highway used in the FT.1.2 frame format.

Protocol IEC101 interface UART0

Type

IEC101

Role

Slave

Format

8, e, 1

Synchronization by protocol

Disable

Local time

Disable

Pulsed synchronization

☐

Channel address

1

ASDU address

1

ASDU size

253

Data rate

460800

Connection lost timeout, ms

150

"Transmission cause" field size

1

"ASDU address" field size

1

"Object address" field size

2

File transfer waveforms

☐

Fig. 3.13 - IEC 60870-5-101 Settings

8) ASDU Size - determines the maximum user data length in the frame in compliance with the IEC 60870-5-101 protocol.

9) Remote Station ASDU Address – the field must be filled in when the PPP connection mode is activated during joint operation with the "TM3com" control center telemechanic device

10) Transmission Speed – permissible values: 19200, 38400, 57600, 115200, 230400, 460800 (default value).

11) Communication Loss Timeout, ms – sets the communication loss detection timeout. In the Slave mode this value is determined by the number of highway stations and transmission speed. Recommended value – not less than the time needed to transmit 5000 bytes. Timeout recommendations for various transmission speeds are presented in Table 3.1.

Transmission Speed	Timeout
19200	3000
38400	1500
57600	1000
115200	500
230400	250
460800	150

Table 3.1 Timeout Recommendations for Various Transmission Speeds

12) "Transmission Cause" field size – takes values 1 (by default) or 2.

13) "ASDU Address" field size – takes values 1 (by default) or 2.

14) "Object Address" field size – takes values: 1, 2 (by default), 3.

3.5 "Output Channels" Section

This section considers the issues of parameterization of the device output channels transmitted via communication channels in IEC 60870-5-101/104 protocols.

Note:

All information processed by the device is stored in the database (DB). The DB is also needed to tie information streams between various system processes.

The database is a data cell array. Each DB cell stores both the current value of a technological parameter and a certain number of previous states known as an event queue.

An output channel is a named group of DB cells for data and events reading. Output channels allow to group parameters on a certain ground, e.g., on refresh rate.

When the "Output channels" tab is opened, the main parameters of all output channels registered in the system are displayed on the screen. Only output channels for the selected exchange protocol are displayed simultaneously. In order to view output channels for other exchange protocols, it is necessary to choose the respective address of the protocol in a list in the top part of the screen.

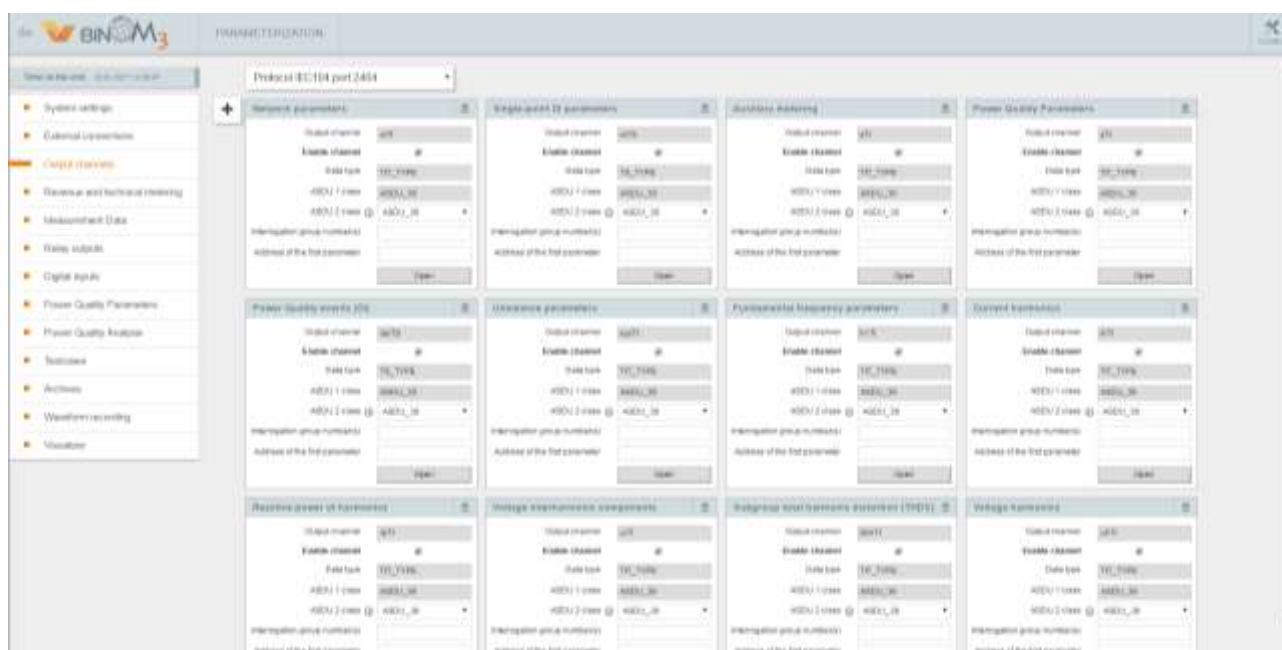


Fig. 3.14 - Output Channels

A dropdown list of all channels related to the protocol appears under the "Output Channels" menu button. As the user navigates through this list, he may display only information about the selected channel.

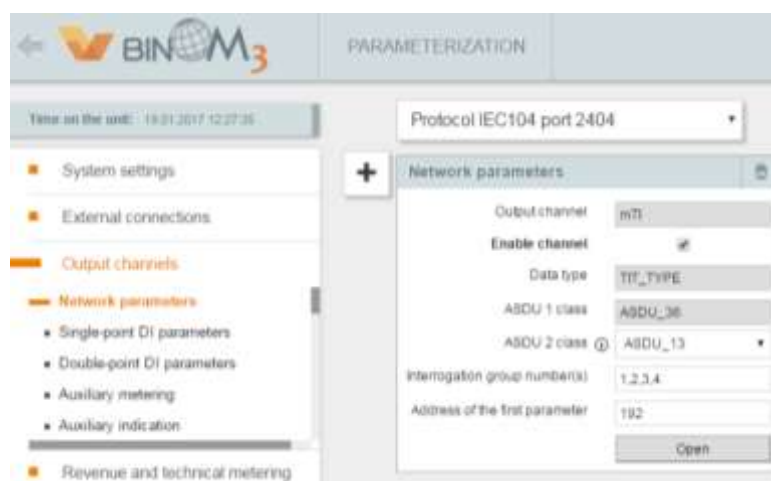


Fig. 3.15 - Information about the Selected Output Channel

3.5.1 Setting Output Channels on the User Access Level

On the User access level, it is possible to view output channels configuration and to set the following parameters:

1) Channel activation – as the checkbox is activated, data will be transmitted into the channel. Channel deactivation will cease transmission of this technological group data through the communication channel (the data will be saved in the meter itself).

2) ASDU 2 class – **determines** frame format during cyclical transmission of data and data transmission upon query.

Possible values of this parameters differ depending on the channel data type:

For remote measurements:

ASDU_36 – Floating point RM with a 7-byte time mark.

ASDU_13 – Floating point RM.

For integral remote measurements:

ASDU_37 – Floating point IRM with a 7-byte time mark.

ASDU_15 – IRM without time mark.

For remote signaling:

ASDU_39 – RS with a 7-byte time mark.

ASDU_1 – RS without time mark.

For two-bit remote signaling:

ASDU_31 – RS with a 7-byte time mark.

ASDU_3 – RS without time mark.

3.5.2 Setting Output Channels on the Telemechanic and Administrator Access Level

An expanded set of output channels settings is open for the Telemechanic (Telecontrol) and Administrator access levels.

3.5.2.1 The address of the first parameter indicates address as per IEC 60870-5-101/104 starting from which the respective data output channel will be transmitted into the channel.

3.5.2.2 Scan group numbers – depending on the value of this parameter, the channel will be enquired when some group is enquired. Groups enquiry schedule is set at the device performing the enquiry.

3.5.2.3 Test cases - there is an "Open" button in the parameters of each channel. After clicking on this button, a window with the list of all channel elements is opened.



The screenshot shows a window titled "Power Quality events statistics" with a close button (X) in the top right corner. Inside the window, there is a section labeled "Channel testcases" with a sub-header "Select required testcases". Below this is a table with four columns: "Addc", "Parameter name", "n", and "Testcases". The table lists 10 testcases, each with a checkbox in the "Addc" column and a corresponding parameter name and range in the "Parameter name" column. The "n" column is empty for all entries, and the "Testcases" column is also empty.

Addc	Parameter name	n	Testcases
<input checked="" type="checkbox"/>	4128 Voltage dip statistics 10-15%		
<input checked="" type="checkbox"/>	4129 Voltage dip statistics 15-30%		
<input checked="" type="checkbox"/>	4130 Voltage dip statistics 30-60%		
<input checked="" type="checkbox"/>	4131 Voltage dip statistics 60-90%		
<input checked="" type="checkbox"/>	4132 Voltage dip statistics 90-100%		
<input checked="" type="checkbox"/>	4133 Voltage swell statistics 1.1 - 1.2		
<input checked="" type="checkbox"/>	4134 Voltage swell statistics 1.2 - 1.4		
<input checked="" type="checkbox"/>	4135 Voltage swell statistics 1.4 - 1.6		
<input checked="" type="checkbox"/>	4136 Voltage swell statistics 1.6 - 1.8		
<input checked="" type="checkbox"/>	4137 Voltage interruption statistics		

Fig. 3.16 - Channel Elements List

It is possible to define a set of test cases for each channel and each of its cell. A test case is a database cell values control module recording changes in the output channel status, i.e. generating events in the DB cell event queue.

Test cases allow to form a set of conditions whose fulfillment will generate events intended for the respective output channel.

Note:

More detailed information about test cases and their types can be found in the Test Cases section.

3.5.2.3.1. Adding and Removing Test Cases.

To add a new test case to a channel as a whole, right click in the "Test Cases. Channels" field in the top part of the window and select the necessary test case in the dropdown list.

To add a new test case to a cell, right click on the "Test Cases" field of the respective cell. After that, a dropdown list will open, containing all test cases accessible in this configuration. Left-click on a test case in the list will add it to the cell test cases.

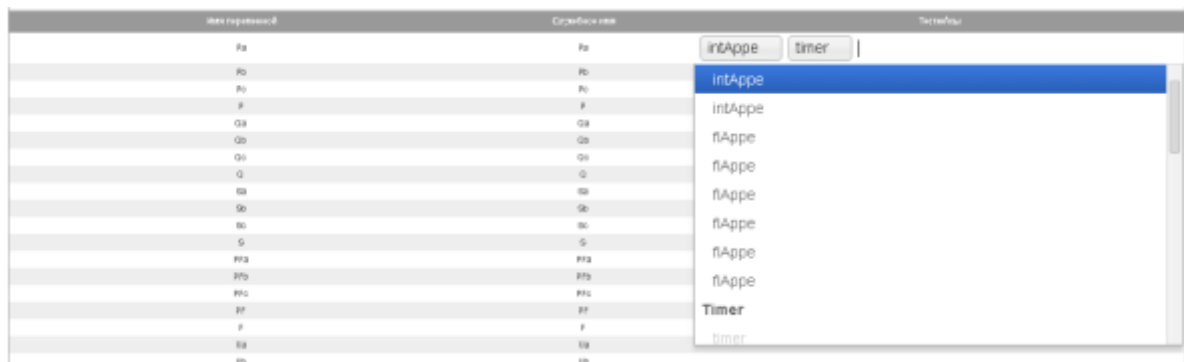


Fig. 3.17 - Installing an Individual Test Case

Test cases assigned to a channel elements are presented as a form with the respective test case name located in the "Test Cases" field of this element. For removing a test case, left-click on the X icon on the form assigned to the test case.

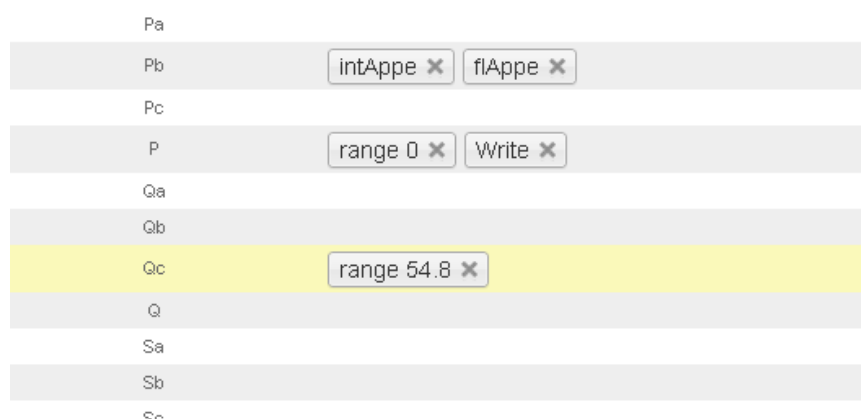


Fig. 3.18 - Channel Element Test Cases

Note:

Should there be no test cases in an output channel, information about the parameters of such a channel will be transmitted to the upper level only upon request.

3.6 "Revenue and technical metering" Section

This section describes setting various electric energy metering parameters.

Note:

An automated power supply monitoring and control system allows to meter electric energy consumption at residential, commercial and industrial purpose facilities.

3.6.1 Common settings

Registered electric energy metering parameters are stored in two different load profiles. Recording interval (data saving interval) for the first load profile is usually longer than the second profile recording interval.

Comment:

As a rule, the first load profile is used for commercial accounting, and the second profile, for technical metering.



Common settings	
Profile 2 interval, min	3 ▼
Profile 1 interval, min	30 ▼
Local time in «T» frame	<input type="checkbox"/>
Disable tariff schedule	<input type="checkbox"/>

Fig. 3.19 - Automated Power Supply Monitoring and Control System General Parameters

Recording interval is changed by choosing a value from a drop-down list.

Possible load profile interval: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60.

To set a tariff schedule, it is necessary to untick the respective checkbox.

3.6.2 Meter readings

Meter readings		
Active energy (supplied)	+W _a	0
Active energy (received)	-W _a	1
Reactive energy (supplied)	+W _r	2
Reactive energy (received)	-W _r	3
Active energy (supplied) loss	+W _{al}	4
Active energy (received) loss	-W _{al}	5
Reactive energy (supplied) loss	+W _{rl}	6
Reactive energy (received) loss	-W _{rl}	7
Active energy of the 1st harmonic (supplied)	+W _{ah1}	8
Active energy of the 1st harmonic (received)	-W _{ah1}	9
Reactive energy of the 1st harmonic (supplied)	+W _{rh1}	10
Reactive energy of the 1st harmonic (received)	-W _{rh1}	11
Positive sequence active energy (supplied)	+W _{ad}	12
Positive sequence active energy (received)	-W _{ad}	13
Positive sequence reactive energy (supplied)	+W _{rd}	14
Positive sequence reactive energy (received)	-W _{rd}	15

Fig. 3.20 - Meter Readings

The "Meter Readings" form contains a list of registered parameters and their sequence number in the data array to be transmitted. Editing this data is impossible irrespective of access level.

3.6.3 Tariff rates

Tariff rates

Season 0

Description

Day Monday

00:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00
2	2	2	2	2	2	2	2
04:30	05:00	05:30	06:00	06:30	07:00	07:30	08:00
2	2	2	2	2	2	1	1
08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00
1	1	3	3	3	3	3	3
12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00
1	1	1	1	1	1	1	1
16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00
3	3	3	3	3	3	3	3
20:30	21:00	21:30	22:00	22:30	23:00	23:30	00:00
3	3	1	1	1	1	2	2

Add season

Delete season

Fig. 3.21 - Tariff rates

At least "Telemechanic" access level is needed to work with this form.

Electric energy tariffs depend on the time of the day, the day of the week, the country region, etc. Therefore it is feasible to draw up a tariff schedule according to which tariff numbers will be switched automatically.

Note:

Daily schedule – procedure of tariff number changing during a day.

Tariff season – a sequence of days during which daily tariff schedules are not changed.

A tariff schedule is formed by seasons. The "Tariff Schedule" form has "Add Season" and "Remove Season" buttons and a drop-down list where it is possible to choose a season for editing.

After selecting a season, it is necessary to select the day of the week for which a daily schedule will be formed. Then a tariff number is selected for each half-hour interval.

00:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00
2	2	2	2	2	2	2	2
04:30	1	05:30	06:00	06:30	07:00	07:30	08:00
2	2	2	2	2	1	1	1
08:30	2	09:30	10:00	10:30	11:00	11:30	12:00
1	3	3	3	3	3	3	3
12:30	4	13:30	14:00	14:30	15:00	15:30	16:00
1	1	1	1	1	1	1	1
16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00

Fig. 3.22 - Tariff Number Selection for a Half-Hour Interval

In the process of intervals selection, the batch selection (+Ctrl) and range selection (+Shift) options are supported.

Analogous actions must be performed for the rest of the days of the week.

3.6.4 Tariff season change

Tariff season change		
01.01	Every Year	Season 0
<div>+ Add</div> <div>✕ Remove</div>		

Fig. 3.23 - Tariff seasons change

At least "Telemechanic" access level is needed to work with this form.

In the "Switching Tariff Seasons" form, the date of switching from one season to another is set.

An existing switching table line is performed by a double left-click on a selected line. The line accessible for editing at the moment in question is selected in bold face.

Tariff season change		
19.01	2017	Season 0
28.01	2019	
<div>+ Add</div> <div>✕ Remove</div>		

Record with the specified date already exists. Please select a different date or the record will be deleted. 2017

Fig. 3.24 - Switching Tariff Seasons, Line Editing

To change the value of field of this line, it is necessary to left-click on the selected field. Whereupon a dropdown window will open, permitting to change the date and year of switching or a season number.

Fig. 3.25 - Tariff seasons change, Changing Season Date

To select the year of switching from a list, it is possible to set a specific value or to choose the "Every Year" option.

Fig. 3.26 - Choosing a Season Switching Date

A new switching is added by clicking the "Add" button in the top left corner of the form. Whereupon a line with the current date, current year and the first season in the list will appear in the table. Then by a double click on the added line, the user may switch into the editing mode and to perform setting of this switching.

A switching date is removed by the "Remove" button in the left bottom corner of the form.

3.6.5 Transferred days

Transferred days		
23.02	2017	Holiday
08.03	2017	Holiday
01.05	2017	Holiday

Fig. 3.27 - Transferred days

Transferred days are the days whose schedule does not correspond to the schedule set in the tariff season (e.g., because of a holiday). Days are added and removed in a similar manner with the "Tariff Season Switching" form.

To determine the year of switching from a list, it is possible to set a specific value or to choose the "Every Year" option.

For appointing a day type from a list, a specific week day or the "Holiday" option may be chosen:

The screenshot shows the 'Transferred days' form. At the top, there is a header 'Transferred days'. Below it, there is a table with three columns: Date, Year, and Day Type. The first row is highlighted in yellow and contains the date '23.02', the year '2017', and the day type 'Holiday'. A dropdown menu is open for the 'Day Type' column, showing a list of options: Monday, Tuesday, Wednesday, Thursday (highlighted in blue), Friday, Saturday, Sunday, and Holiday. At the bottom of the form, there are two buttons: '+ Add' and 'X Remove'.

Fig. 3.28 - Choosing a Transferred Day Date Type

3.7 "Measurements" Section

In the "Measurements" section, a user may set transformation rates, load and rotational loss factors, as well as choose the measurement units in which parameters will be registered.

3.7.1 Transformation Rates

In this form, a user sets transformation rate values, agreed voltage level reduced to voltage measuring transformer secondary winding, as well as the connection diagram – three- or four-wire (by default).

Ratio factors	
Voltage transformer ratio factor	1.
Current transformer ratio factor	15.
Matched voltage supplied to the secondary winding of ITN, V	<i>i</i> <input type="text"/>
Diagram	Four-conductor ▼
Energy metering with considering the transformation coefficients	<input checked="" type="checkbox"/>

Fig. 3.24 – Ratio factors

Note:

Agreed voltage reduced to secondary voltage measurement transformer winding - Voltage different from standard nominal mains voltage as per GOST 29322-2014 (IEC 60038:2009, MOD) agreed for a specific electric mains user upon technological connection as power voltage. Interphase (line) voltage is specified for three-wire connection, phase voltage, for four-wire voltage.

At least "Telemechanic" access level is required to set the other section parameters.

3.7.2. Load and permanent loss ratio

Phase	A	B	C
Active power line losses ratio	0	0	0
Reactive power line losses ratio	0	0	0
Active power transformer losses ratio	0	0	0
Reactive power transformer losses ratio	0	0	0
Permanent active power transformer losses ratio	0	0	0
Permanent reactive power transformer losses ratio	0	0	0

Fig. 3.30 - Load and permanent Loss ratio

In this form, the user sets load and rotational loss factor values.

1) Load electric energy loss is loss in electric equipment and electric transmission lines and other electric mains elements depending on the load value.

Load electric energy loss are as follows:

- electric transmission line wire loss;
- power autotransformer and transformer loss.

2) Semi-constant electric energy loss is loss arising in energized equipment during its normal operation.

Semi-constant loss is as follows:

- power mains equipment (autotransformers, transformers, arc suppression coils) idling loss;
- adjustable power factor correction unit loss;
- loss in the equipment whose parameters remain unchanged under various electric mains load.

Comment:

The methods of load and semi-constant loss calculations are presented in the "Guideline for Calculation of Electric Energy Technological Loss in the Process of Its Transmission Over Electric Mains during the Base Period) being Appendix 1 to the Manual for Organization of Work Aimed at Calculation and Substantiation of Electric Energy Technological Loss Norms during its Transmission over Electric Mains.

If it is not necessary to meter electric energy loss, zero values are set in this form (by default).

3.7.3 Units of measure

The screenshot shows a form titled "Units of measure". It contains three dropdown menus: "Voltage" set to "V", "Current" set to "A", and "Power". The "Power" dropdown is open, showing three options: "W", "var", and "VA".

Fig. 3.31 - Measurements, Measurement Units

In this form, the user may choose voltage, current and power measurement units in which those parameters will be recorded by the meter.

The user shall choose possible options from a dropdown list.

The screenshot shows the same "Units of measure" form, but the "Power" dropdown is expanded to show a list of units. The units are organized into three columns: Active (W, kW, MW, GW), Reactive (var, kvar, Mvar, Gvar), and Apparent (VA, kVA, MVA, GVA). The "MW", "Mvar", and "MVA" units are highlighted in blue.

Fig. 3.32 - Choosing Power Measurement Units

3.8 Remote Control

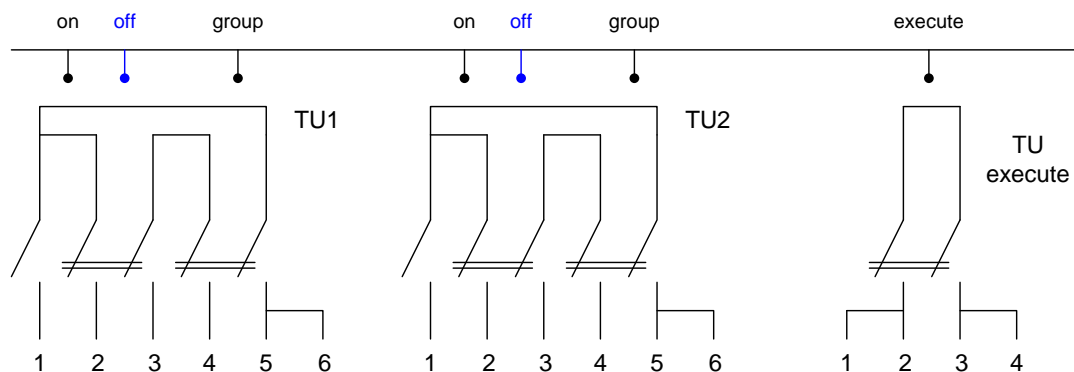


Fig. 3.33 - RC Diagram

The RC module includes from one to four relay groups. Each group consists of a closing relay, a tripping relay and a group relay. According to the device requirements, control action must pass through two groups of sequentially closed contacts. The closing relay or the tripping relay is selected as the first group, the group relay, as the second one. Then the executive relay (a structural relay common for the RC block and intended for high-current circuit switching) closes.

Fig. 3.34 - Remote Control Form

3.8.1 Settable Parameters

- 1) First RC Address - determines the object address of the first remote control channel. Default value - 4500.
- 2) Number of RC Channels - depending on the TE37R2 (3, 4) version, may take values: 2, 3, 4.
- 3) Permissible time between the "Preparation" and "Execution" commands
 - time during which the RC block is in the "Preparation" state. If the "Execution" command was not received during this period of time, the "Preparation" state will be canceled and the "Execution" command will not be executed.
- 4) Duration of "on/off" relay and "group" relay operation
 - sets the duration of "on/off" relay and "group" relay operation in milliseconds. Permissible values from 10 to 10000, 3000 by default.

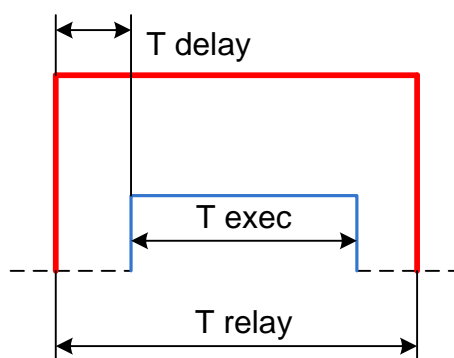


Fig. 3.35 - Relay Closing Timing Diagram

5) "Exec" relay operation delay – sets the "exec" relay delay in relation to the "on/off" relay and "group" relay operation. This delay is needed to prevent influence of transient processes on "on/off" and "group" relay contacts. The minimum permissible value is 125 ms.

3.9 Remote Signaling

This section is intended for setting the parameters of signal processing task on the meter discrete input (remote signaling, RS).

3.9.1. Major DI (teleindication) parametrs

The image shows a software configuration window titled "Major DI (teleindication) parameters". It contains three main settings:

- Enable DI status update cycle:** A checkbox that is currently unchecked.
- DI status update cycle in the database, ms:** A text input field containing the value "2000".
- Debouncing filter supported value of t , μ s:** A text input field containing the value "5000".
- Default DI status:** A dropdown menu with "N.O." (Normally Open) selected.

Fig. 3.36 - Form "Major DI (teleindication) parametrs"

1) Activate RS Update Cycle - allows RS forced cyclical rewriting mode in DB.

2) RS Update Cycle in DB - sets the RS data update period. The default value and the minimum possible one is equal to 2000, measured in ms.

3) debouncing filter τ – sets debouncing filter time constant (in microseconds) – the time during which input signal must retain an unchanged state in order to be recorded. This value is applied to all RS inputs except those for which this parameter has been set individually. Default value 5000. Permissible value range 200...100 000.

4) Default Contact Position:

- N.O. - normally open;
- N.C. - normally closed.

3.9.2 Individual RS Parameterization

The screenshot shows four panels for RS parameterization. Each panel contains a table with 8 columns representing different RSs. The first two panels are for 'single point' groups, and the last two are for 'double point' groups. Each RS entry includes a 'Debounce filter supported value (Hz)' and a 'Default status' (e.g., N.O., N.C., N.O./N.C.).

Fig. 3.37 – RS Parameters Setting

The RS task operation mode settings set above are applicable to all RS in the system except those selected in this form (by checking the checkbox). Individual settings are applied to the RSs selected in this section.

RS in each group may be used as single-bit or double-bit (multiposition) ones. By default, all the RSs are single-bit.

When parameterizing double-bit RS, one must remember that there are 4 double-bit RSs in a group of 8 RSs. Default position of all contacts: normally open.

3.10 "Electric Energy Quality Indicators Calculation" Section

The parameters of this section can be viewed and edited only at the "Administrator" access level.

In this section, a user may set the time interval for which averaged quality indicator values will be calculated. Indicator values will be recorded according to this interval with reference to astronomical time.

By default, according to IEC 61000-4-30:2008, frequency parameters averaging interval is equal to 10 s, voltage parameters averaging interval is equal to 10 minutes.

The screenshot displays the 'PARAMETERIZATION' section of the software. It features a sidebar with navigation links like 'System settings', 'External connections', 'Output channels', etc. The main area is divided into four panels, each for a different quality indicator: Frequency deviation, Voltage unbalance, Voltage deviation, and Voltage dips, swells and interruptions. Each panel contains a table with columns for 'Parameter name', 'Symbol', and 'Value'.

Fig. 3.38 - Electric Energy Quality Indicators Calculation

Note:

Electric energy quality is conformity of the principal power system parameters to the norms adopted in the process of electric energy generation, transmission and distribution.

Principal electric energy quality indicators are as follows:

Frequency deviation - basic power voltage frequency deviation from its nominal value. Frequency reduction occurs because of a shortage of power of power plants operating in the system. Frequency augmentation occurs in case of an acute load shedding in the electric power supply system.

Voltage unsymmetry - inequality of line and phase voltages by amplitude and shift angle between them. The main cause of its occurrence are consumers with unsymmetrical phase power consumption. They are as follows: single-phase consumers using phase or interphase voltage; three-phase consumers with unsymmetrical phase power consumption (in particular, arc steel smelting furnaces, welding units). Voltage unsymmetry may also be caused by mains phase resistance unsymmetry.

Voltage deviation - difference between the actual voltage value and its nominal value. Voltage deviation is caused by voltage loss changes caused by load power changes.

Voltage unsinusoidality - voltage curve sinusoidal shape distortion. Voltage unsinusoidality arises because the voltage curve, apart from basic frequency harmonic, includes harmonics of other supreme frequency divisible by the basic frequency. The cause of voltage unsinusoidality is presence of electric power consumers with a non-linear volt-ampere response.

3.10.1 Voltage dips, swells and interruptions

Voltage dips, overvoltages and interruptions are set in this form.

Voltage dips, swells and interruptions	
Dip start threshold value, %	90
Dip end threshold value, %	90
Swell start threshold value, %	110
Swell end threshold value, %	110
Hysteresis dip end threshold value, %	2
Hysteresis swell end threshold value, %	2
Interruption start threshold value, %	5
Interruption end threshold value, %	5
Hysteresis interruption end threshold value, %	2

Fig. 3.39 - Voltage dips, swells and interruptions

Note:

Under IEC 61000-4-30:2008, **voltage dip threshold value** is set at the level of 90 % from the agreed or nominal value. **Threshold overvoltage value** – at the 110 % level, **Threshold voltage interruption value** – 5 %.

3.11 "Electric Energy Quality Indicators Analysis" Section

Configuration Fields:

- Voltage class: 0.38 kV
- Analysis interval: day
- Storage duration, days: 364

Frequency deviation analysis

Parameter name	standard limit	threshold limit
Frequency deviation	0.2	0.4

Voltage deviation analysis

Parameter name	standard limit	threshold limit
Voltage deviation	10	10
Voltage deviation (maximum load)	10	10
Voltage deviation (minimum load)	10	10

Load duty schedule

Is Power Quality control point in supply point? ☒ Yes

00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00
Min	Min	Min	Min	Min	Min	Min	Min	Min
Max	Max	Max	Max	Max	Max	Max	Max	Max
Min	Min	Min	Min	Min	Min	Min	Min	Min
Max	Max	Max	Max	Max	Max	Max	Max	Max
Min	Min	Min	Min	Min	Min	Min	Min	Min
Max	Max	Max	Max	Max	Max	Max	Max	Max
Min	Min	Min	Min	Min	Min	Min	Min	Min
Max	Max	Max	Max	Max	Max	Max	Max	Max
Min	Min	Min	Min	Min	Min	Min	Min	Min
Max	Max	Max	Max	Max	Max	Max	Max	Max
Min	Min	Min	Min	Min	Min	Min	Min	Min
Max	Max	Max	Max	Max	Max	Max	Max	Max
Min	Min	Min	Min	Min	Min	Min	Min	Min
Max	Max	Max	Max	Max	Max	Max	Max	Max
Min	Min	Min	Min	Min	Min	Min	Min	Min
Max	Max	Max	Max	Max	Max	Max	Max	Max

Voltage non-sinusoidality analysis

Parameter name	standard limit	threshold limit
Voltage subgroup total harmonic distortion	8	12

Voltage unbalance analysis

Parameter name	standard limit	threshold limit

Power Quality events statistic

	0.01	0.2	0.5	1	5	20	60
Voltage dip	0.01	0.2	0.5	1	5	20	60
Voltage swell	0.01	0.2	0.5	1	5	20	60
Voltage interruption	0.01	0.5	1	5	20	60	180

Harmonic distortion analysis

Parameter name	standard limit	threshold limit
Voltage harmonic distortion KU(2)	2	3
Voltage harmonic distortion KU(3)	5	7.5
Voltage harmonic distortion KU(4)	1	1.5
Voltage harmonic distortion KU(5)	6	9
Voltage harmonic distortion KU(6)	0.5	0.75
Voltage harmonic distortion KU(7)	5	7.5
Voltage harmonic distortion KU(8)	0.5	0.75
Voltage harmonic distortion KU(9)	1.5	2.25
Voltage harmonic distortion KU(10)	0.5	0.75
Voltage harmonic distortion KU(11)	3.5	5.25
Voltage harmonic distortion KU(12)	0.2	0.3
Voltage harmonic distortion KU(13)	3	4.5
Voltage harmonic distortion KU(14)	0.2	0.3
Voltage harmonic distortion KU(15)	0.3	0.45
Voltage harmonic distortion KU(16)	0.2	0.3
Voltage harmonic distortion KU(17)	2	3
Voltage harmonic distortion KU(18)	0.2	0.3
Voltage harmonic distortion KU(19)	1.5	2.25
Voltage harmonic distortion KU(20)	0.2	0.3
Voltage harmonic distortion KU(21)	0.2	0.3
Voltage harmonic distortion KU(22)	0.2	0.3

Interharmonic distortion analysis

	standard limit	threshold limit

Fig. 3.40 - Electric Energy Quality Indicators Analysis

The parameters of this sections can be viewed and edited only at the "Administrator" access level.

In this section, a user may set the interval for quality indicators analysis and forming a report of quality indicators conformity to the established norms as per GOST 32144-2013 (EN 50160:2010, NEQ).

By default, as per GOST 32144-2013 (EN 50160:2010, NEQ), statistics analysis interval is equal to one week.

When a mains voltage class is chosen from a dropdown list, normal and threshold limit values of electric energy quality parameters as per GOST 32144-2013 (EN 50160:2010, NEQ) are filled in automatically. If necessary, these values may be set as different from GOST (EN) requirements by a double left click on the respective field and entering the required value of controlled limit.

3.12 "Testcases" Section

The parameters of this sections can be viewed and edited only at the "Administrator" access level.

Test case is a database cell values control module recording changes in output channel status.

Test cases allow to form a set of conditions whose fulfilment will generate events intended for the respective output channel.

A set of test cases may be determined both for any output channel as a whole and for any output channel element.

Testcases		
Testcase name	Type	Parameters
Aperture 5	Aperture	5 ()
Aperture 10	Aperture	10 ()
Aperture 5.0	Aperture	5.0 ()
Aperture 0.1	Aperture	0.1 ()
Aperture 1	Aperture	1 ()
Aperture 5% min 0.5	Aperture	1.5 / 0.5
Timer 1 hour	Timer	3600000
Validity	Quality	80 ()
Timer 30 sec	Timer	30000
Update	By update	
Timer 1 sec	Timer	1000
Aperture 1% min 0.1	Aperture	1.1 / 0.1
Aperture 0.01	Aperture	0.01 ()
Timer 1 min	Timer	60000

Fig. 3.41 - List of Testcases

Presented in this section is a list of all test cases registered in the system by default. The list displays test case names, types and parameters. A test case's parameters depend on its type. A set of parameters for each test case is written through a vertical dividing line "|".

3.12.1 Test Case Editing

To edit a test case, left-click on it; whereupon editable parameters and an explanatory diagram to this test case type will be displayed in the form to the right of the list.

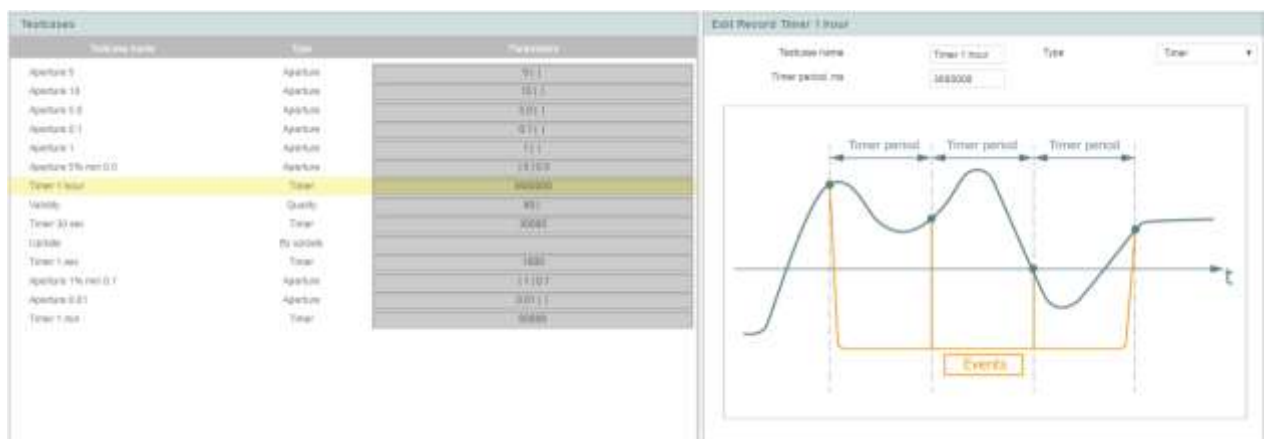


Fig. 3.42 - Test Case Editing

3.12.2 Adding a Test Case

To add a new test case, click the "Add Test Case" button in the left bottom corner of the test case list.

Whereupon a test case with "Write" name and "By Update" type will be added. Then the user must choose the needed test case type from a drop-down list. Whereupon the test case parameters that the user must define will be displayed. The set of parameters depends on the test case type.

3.12.3 Test Case Types

There are the following types of test cases.

3.12.3.1 Aperture



Fig. 3.43 - Aperture Type Test Case

Forms an event when the DB cell value changes by an amount equal to or exceeding the above aperture. The aperture value may be specified either in measurement units ("Aperture" field) or in percent of the current value (Fields "Percent of Value" and "Minimum Value").

If the aperture value is specified in measurement units, the test case operates when the cell value changes by an amount exceeding or equal to the aperture.

If the aperture value is specified in percent, the necessary change in DB cell value changes dynamically. After an event formation, the aperture is calculated again as a specified percent of the current DB cell value but not less than the specified minimum value.

If the user has set the aperture value in measurement units, the "Percent of Value" and "Minimum Value" fields become inaccessible for editing, and vice versa, the "Aperture" field becomes inaccessible at specified percentage of the value and minimum value.

3.12.3.2 Timer

Up to 10 timer type test cases are provided in the system.

The timers are synchronized with day beginning time (00:00:00.00). The time of the next timer operation is calculated as the nearest whole number of periods that passed since the beginning of the day. E.g., if a timer was set with a 15 minutes period, the timer operation time will always be at 0, 15, 30 and 45 minutes of every hour.

If the timer operation occurred since the last DB entry, an event will be formed upon the next DB entry. The DB timer period is specified in milliseconds.



Fig. 3.44 - Timer Type Test Case

Timer operation accuracy: ± 1 ms.

3.12.3.3 Level

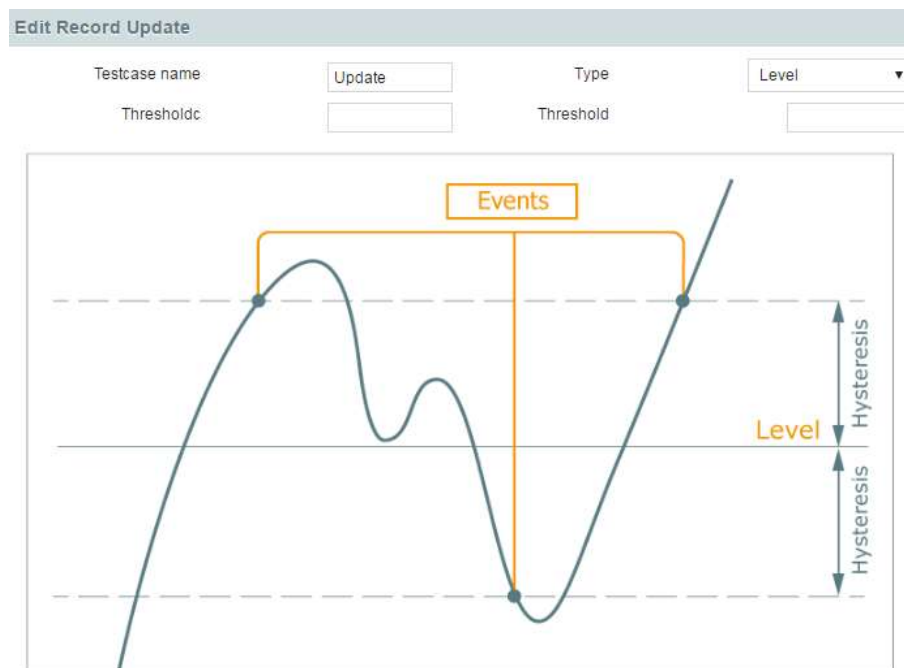


Fig. 3.45 - Level Type Test Case

Forms an event when a DB cell value crosses a specified level ("Operation Threshold" field), upwards or downwards, in view of the specified hysteresis value ("Hysteresis" field).

3.12.3.4 Range

Forms an event when a DB cell value crosses the specified minimum and maximum level upwards or downwards in view of the set hysteresis value.



Fig. 3.46 - Range Type Test Case

3.12.3.5 Gate




Fig. 3.47 - Gate Type Test Case

A totality of two ranges, internal and external.

This type test cases are intended for forming pre-alarm and emergency setpoints. Whereupon crossing the internal minimum and maximum forms pre-alarm events, and crossing the external minimum and maximum forms emergency events.

3.12.3.6 Quality



Edit Record Quality 4000 2	
Testcase name	Quality 4000 2
Bits (hex)	4000
Front	2
Type	Quality ▼

Fig. 3.48 - Quality Type Test Case

Events are formed as quality bits are changed according to the mask set in the "Bits" field. The following values are mainly used:

0x0080 – invalid value

0x2000 – marked data

0x4000 – uncertain time

0x8000 – end of measurement interval , the beginning of a new interval (applicable to the data from the "Electric Energy Quality Indicators Analysis").

Note:

Marked data - a term used to designate the results of electric energy quality indicator measurements averaged over time intervals within the limits whereof interruptions, voltage dips or overvoltages took place (IEC 61000-4-30:2008)

The "Front" field defines at which change of a controlled quality bit an event will be generated. Whereupon three value options are possible:

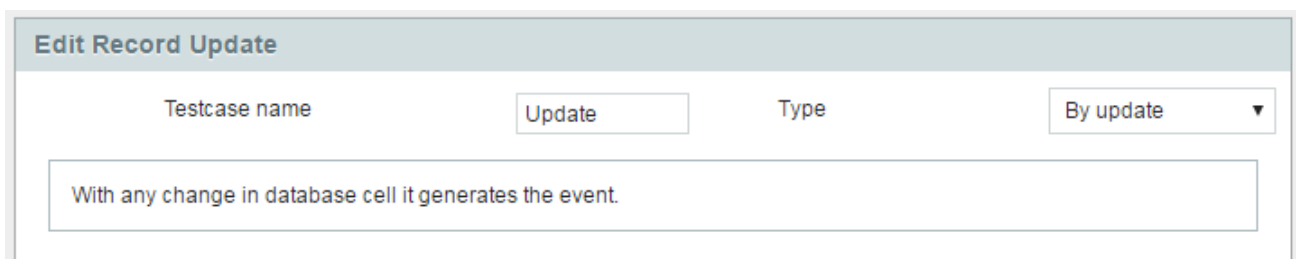
1 – generate an event as a quality bit changes from 0 to 1;

2 – generate an event as a quality bit changes from 1 to 0;

Any other value or absence of a value is to generate events upon any quality bit change.

3.12.3.7. Upon Update

Forms an event upon any DB cell entry to which such type test case has been assigned.



Edit Record Update	
Testcase name	Update
Type	By update ▼
With any change in database cell it generates the event.	

Fig. 3.49 - Update Type Test Case

3.12.4 Test Case Removal

To remove a test case, select a test case in the list by left clicking on it, then click the "Remove" button in the left bottom corner of the test case list.

3.13 Archives



Fig. 3.51 - Archives

The purpose of archiving is saving data/events from DB cells.

Archived BINOM3 data channels:

- 1) Results of electric energy quality indicators statistical analysis (incl. harmonic coefficients and accidental events). Storage depth by default: 1 year. Set in the "Electric Energy Quality Indicators Analysis" tab.
- 2) Principal mains parameters (I, U, P, Q, S, f, $\cos\phi$). Storage depth by default: 90 days.
- 3) Symmetrical components (I, U, P, Q, S, ϕ). Storage depth by default: 90 days.
- 4) Averaged electric energy quality indicators and voltage unbalance values. Storage depth by default: 90 days.
- 5) Remote signaling. Storage depth by default: 90 days.

Each archive is represented by a set of elements where an element is a single file limited by the set archiving time and the number of events. The file is closed by the limitation that occurs first.

3.13.1 Settable Parameters

3.13.1.1. Archive recording path – path to the directory for writing on SD/FTP.

3.13.1.2. Archiving channel data storage depth in days.

3.13.2 Archiving Conditions Editing

Viewing and setting archive parameters archiving conditions is carried out by clicking on the "Edit Conditions" button (not accessible for system archives).

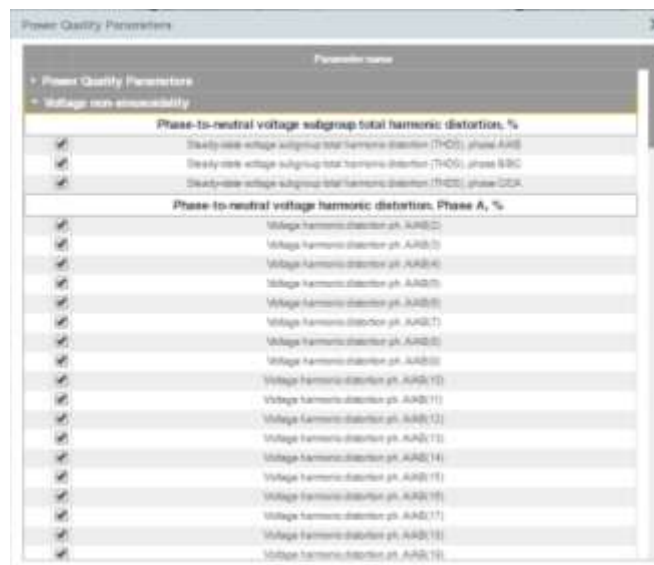


Fig. 3.52 - Archiving Conditions Editing

In the opened window, parameters are broken into groups, a group of parameters is accessed by clicking on its name.

When a parameters exceeds set limits, the aperture recording test case will operate; the test case operation time is 5 sec. since the parameter excess time.

3.14 Waveform recording

Waveform recording (oscillography) is recording of ADC reports by current and voltage currents and the DB events generated at that time, beginning from the *start moment* to the depth known as *oscillogram duration*. The *prehistory* containing data before the start moment may be saved as well. Oscillogram is written to files on a storage media (SD, FTP).



Fig. 3.53 – Waveform Setting

3.14.1 Settable Parameters

- 1) Waveform Name – the identifier used to address the oscillograph via WEB and console.
- 2) Waveforms Recording Path – File system path to the directory for writing on SD/FTP.
- 3) Prehistory - Time of saving ADC data and DB events that occurred before the start condition occurrence; measured in ms.
- 4) Waveform Duration - Time of saving ADC data and DB events that occurred after the start condition occurrence; measured in ms.
- 5) Maximum Waveform Recording Time - In case new recording conditions arise at the moment of the Waveform recording, Waveform duration is counted again from the last occurred start event, the total Waveform duration (consisting of the prehistory and the time that passed since the first start event arose) cannot exceed the maximum recording time. Maximum value - 120 seconds.
- 6) Maximum number of stored waveforms - determines the number of waveform stored by the device. When the records quantity limit is reached and a new waveform record condition arises, the oldest oscillogram is deleted.

3.14.2 Waveform Record Start Conditions

After clicking on the button "Edit Record Start Conditions", the waveform start conditions parameterization form will open.

Grid parameters drift		
Parameter name	By lowering (below the setpoint)	By exceeding (above the setpoint)
Frequency		
F	0	0
Phase-to-neutral voltage		
Ua	0	0
Ub	0	0
Uc	0	0
Phase-to-neutral current		
Ia	0	0
Ib	0	0
Ic	0	0

Digital inputs		
Parameter name	0	1
Power Quality events		
Voltage dip	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage swell	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage interruption	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Teleindication		
Teleindication 00	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 01	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 02	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 03	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 04	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 05	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 06	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 07	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 08	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 09	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 10	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 11	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 12	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 13	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 14	<input type="checkbox"/>	<input type="checkbox"/>
Teleindication 15	<input type="checkbox"/>	<input type="checkbox"/>

Fig. 3.54 – Waveform recorder triggering conditions

One or several conditions defined below can be a start conditions:

- 1) Electric energy quality indicator events: "Interruption", "Dip", "Overvoltage"
- 2) Mains frequency f change (above or below setpoint)
- 3) One of phase/interphase voltages change (above or below setpoint)
- 4) One of phase current excess (above setpoint).
- 5) Status change of any RS discrete signal (closing, opening, status change).

3.15 "Visualizer" Section

The parameters of this sections can be viewed and edited only at the "Administrator" access level.

HTTP server and SVG output setting are parameterized in this section.

Note:

HTTP (HyperText Transfer Protocol) – an applied level data transfer protocol. The HTTP is based on the "client to server" technology, i.e. it presumes the existence of consumers (clients) initiating a connection and sending an enquiry and suppliers (servers) expecting a connection in order to receive an enquiry, perform necessary actions and return a message with the result.

The screenshot displays the 'PARAMETERIZATION' section of the BINOM3 software. On the left is a sidebar menu with various system settings, with 'Visualizer' highlighted at the bottom. The main area is titled 'HTTP settings' and contains the following parameters:

HTTP settings	
SSL Operation	<input type="checkbox"/>
Port	80
Max. number of connections	5
Connection holding time, s	0
Session closing timeout, s	300
WEB-server files	ad/www_min/

Below the HTTP settings is a section titled 'SVG-processes' with one parameter:

SVG-processes	
Connection time-out, sec	300

Fig. 3.55 - "Visualizer" Section, HTTP Settings

3.15.1 HTTP Settings

The following parameters are accessible for editing in the "HTTP Settings" form:

1) HTTP Activation Flag - When this option is deactivated, the HTTP server will be deactivated, the rest of HTTP settings will be inaccessible.

Note:

HTTP deactivation will make it impossible to work with the WEB interface. Whereupon access to the meter WEB server may be restored only by installing a configuration with activated HTTP setting.

2) Work with SSL - SSL ensures connection security by coding transferred data.

Note:

More information about SSL settings may be found in the "System Parameters" section.

3) Port - By default, port 80 is used for the Web server operation without SSL, port 443 for operation with SSL.

4) Maximum Number of Connections – The number of simultaneously possible Web server connections. Recommended value: 2 connections.

5) Session Closing Timeout – When a user is authorized, a Web server connection is opened and a session storing the user authorization parameters is created.

Session closing timeout is the time upon expiry whereof the user authorization data are dumped if there are no server queries.

Setting a closing timeout is feasible from the security point of view. If the user closes the browser without clicking on the "Exit" button, upon expiry of the timeout the session will be dumped and the user will be ought to reenter authorization data in order to access the device. This reduces the probability of unauthorized access to the device web server. Recommended values: 100 - 200 s.

6) Call Holding Time – time upon expiry whereof the server connection will be closed if there are no server queries.

Activating this option allows to use a single connection for sending and receiving multiple HTTP enquiries and responses instead of opening a new connection for each enquiry-response pair.

Setting a call holding time allows to use system resources optimally.

Recommended values: 2-10 s.

3.15.2. SVG Processes

The following parameters are accessible for editing in the "SVG Processes" form:



Fig. 3.57 - "Visualizer" Section, SVG Processes

Connection Timeout – holding time upon expiry whereof the SVG connection is closed down. Setting this time allows to use system resources optimally, since if the user leaves a page with an SVG chart, upon expiry of this timeout the connection will be closed down and the server will not process SVG channel data.

Note:

1) SVG connection is a connection realized on the basis of HTTP protocol for providing the user access to SVG charts.

2) SVG (Scalable Vector Graphics) is a scalable vector graphics markup language. Display of electric diagrams in which the meter is used is implemented on the basis of these graphics. These charts are known as svg charts.

3.16 Working with a Parameterizer

3.16.1 Configuration Change

To make changes to the existing BINOM3 configuration, perform the following actions:

- 1) Access the device Web server by entering the login and password on the authentication page;
- 2) Access the "Parameterization" section from the main page;
- 3) Make necessary corrections in compliance with the recommendations of Cl. Cl. 3.3-3.15;
- 4) Click on the "Control" button in the top right corner of the parameterizer (Fig. 3.58);

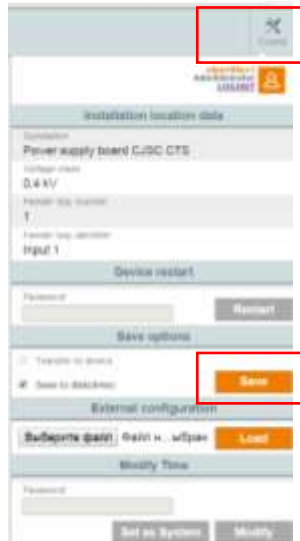


Fig. 3.58 - Control Menu

- 5) Click the "Save" button in the opened popup window (Fig. 3.59).

If it is necessary to save the configuration on the PC as well, set the flag "Save to disk";

- 6) The BINOM3 must be reloaded for the changes to take effect. The device can be reloaded by entering the device restart password (by default, 1) and then clicking on the "Restart" button (Fig. 3.60).

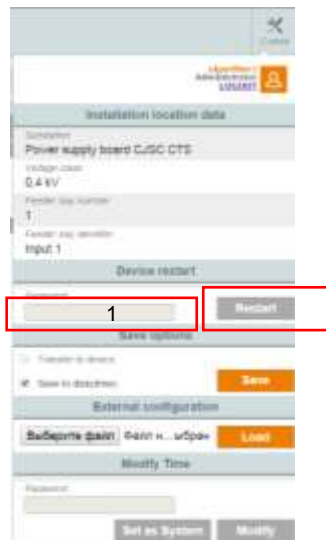


Fig. 3.59 - BINOM3 Restart Via Web Configurer

3.16.2 Loading a Configuration from the PC

If it is necessary to install on BINOM3 a previously created configuration from the PC, act as follows:

- 1) Access the device Web server by entering the login and password on the authentication page;
- 2) Access the "Parameterization" section from the main page;
- 3) Make necessary corrections in compliance with the recommendations of Cl. Cl. 3.3-3.15;
- 4) Click on the "Control" button in the top right corner of the parameterizer (Fig. 3.58);
- 5) Click on the "Choose File" button in the opened popup; window and select the file that must be loaded into the device (Fig. 3.60). Then click on the "Load" button.

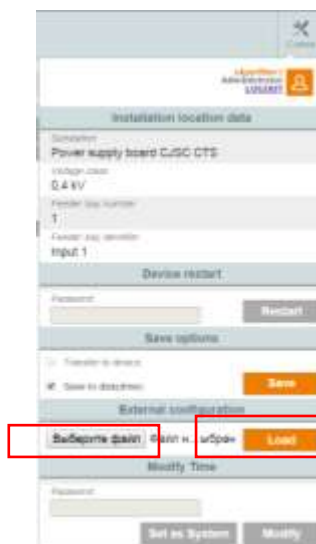


Fig. 3.60 - Loading an External Configuration

- 6) Then click the "Save" button (Fig. 3.58). If it is necessary to save the configuration on the PC as well, set the flag "Save to disk";
- 7) The BINOM3 must be rebooted for the changes to take effect. The device can be reloaded by entering the device restart password (by default, 1) and then clicking on the "Restart" button (Fig. 3.60).

4. Diagnostic Information

The "Diagnostics" section displays information intended for analyzing the operation of the devices internal software and assessing the computing core resource.

4.1 Service Information

This section displays the results of BINOM3 functional units:

- 1) Ethernet communication channel top level complex connection presence bit;
- 2) Number of device restarts;
- 3) Amount of the device internal clock adjustments during the latest time synchronization;
- 4) Device power supply unit temperature;
- 5) Measuring circuits connection control, incl.:
 - Current failure (below the threshold value);
 - Voltage failure (below the threshold value);
 - Distortion attempt (indicates incorrect direction of phase powers - all phase powers must have the same signs, or a drop of one or several active phase powers below the threshold level);
 - Negative phase sequence;
 - Incorrect phase connection (unsymmetry of three-phase mains phase voltage vectors: mains phases must be correctly connected, angle between phase voltage vectors must be close to 120°);
- 6) GLONASS/GPS connection presence bits (subject to direct NMEA bus connection);
- 7) Correct 1PPS impulse presence bit;
- 8) Serviceability of remote signaling and remote control functional units;
- 9) Power supply system monitoring:
 - Mains/battery operation;
 - Battery loading/unloading;
 - Battery voltage;
 - Battery load current (only when powered from the mains)
 - Battery operation time (only in case of mains power failure);
 - Remaining battery operation time (only in case of mains power failure).



Fig. 4.1 - Service Information

4.2 Diagnostics Log

Diagnostics subsystem information is displayed, such as:

- 1) Power on/off;
- 2) SD card detected/lost;
- 3) Configuration errors, etc.;

Enquiry depth - 250 entries.

Fig. 4.2 - Diagnostics Log

4.3 Task List

A list and characteristics of current started processes are displayed, as well as the current device time, device CPU and memory load, etc. Updated in real time mode.

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DIAGNOSTICS

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Fig. 4.3 - Task List

4.4 Network condition

A list of open session is displayed, specifying the user name and the remote IP address from which the connection was effected, as well as network connections established on the device interfaces.



DIAGNOSTICS

Time on the task: 20:01:2017 12:16:46

- Diagnostic log
- Auxiliary information
- Task list
- Network condition

Sessions

Name	Address	Timeout	SVG
algorithm1	192.168.150.1	300	[svg14] db:SVG-Systeminfo

Interface

Interface	IP address	Mask	Gateway
eth1	192.168.150.151	255.255.255.0	192.168.150.1
lo0	127.0.0.1	255.0.0.0	127.0.0.1

Fig. 4.4 - Network condition

5 FEEDER BAY PARAMETERS

In the "Feeder Bay Parameters" section, measurement and calculation results are presented in the form of tables, graphs, histograms and logs.

When the "Feeder Bay Parameters" are accessed, a page is opened with general information about the menu items accessible in this section.

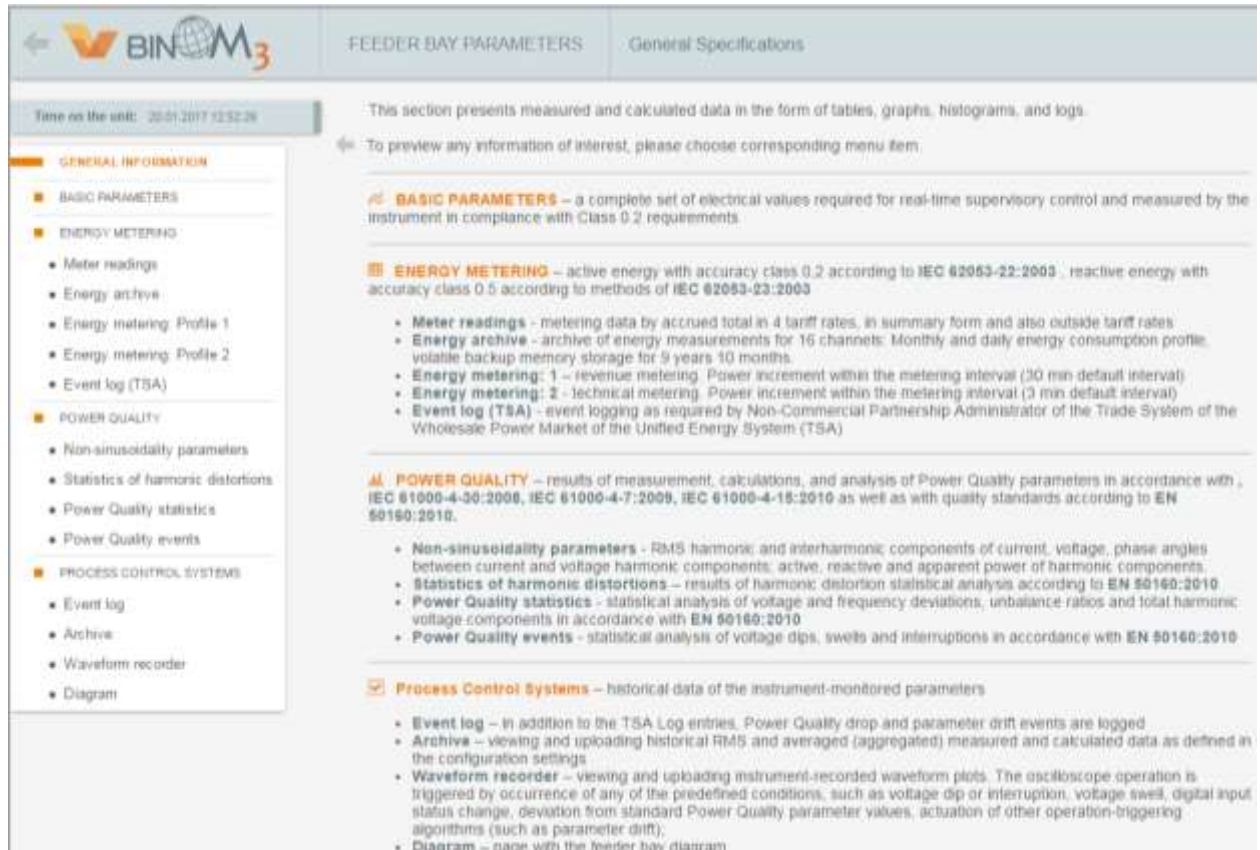


Fig. 5.1 - General Information

5.1 Basic Parameters

The "Basic Parameters" page displays in real time the values of basic electric quantities measured and calculated by the meter - in tabulated form, separately for each of three phases "A", "B" and "C" and input average and total. All parameters are scaled to actual physical values in view of the transformation ratios set during parameterization. The digit capacity of measurement results presentation is chosen in view of accuracy class and the meter resolution for each measured value.



Fig. 5.2 - Basic Parameters

There are vector diagrams of phase currents and voltages and full input power located on the right side of the page. The vector diagram of phase currents and voltages presents in a schematic form voltage (long arrows) and current (short arrows) vector directions for each phase. The arrows are painted in standard phase colors: yellow for phase "A", green for phase "B" and red for phase "C". Full power vector diagram presents relative active and reactive power values and full input power vector direction. There is a trend window under the parameter table. It can present up to 8 graphs of behavior of any measured values at the same time.

5.1.1 Adding and Removing a Graph

To add any parameter to or remove from a graph, it is enough to click on the table cell with the respective value. As a parameter is added, the table cell will be painted gray and the respective parameter will be display in the trend window. When the parameter is removed, the cell will be restored to its usual status (white background). By default, average phase current and active input power are installed in the trend window. When a parameter is added to the trend window, a respective axis of values is added and the graph is automatically scaled for the size of the visible area. Automatic axis and graph scaling is also performed each time when the value exceeds the limits of trend window visible area. For convenience of viewing trends, the graph of each parameter is displayed in its own color. A legend with color samples, parameter names, their current values and the latest update time is placed directly above the graphs.

5.1.2 Moving a Graph

For raising or lowering one of the graph in relation to the others, press and hold the left mouse button and drag the ordinate axis values of the respective parameter.

5.1.3 Graphs Scaling

Scaling the vertical visualization of a parameter is performed by rotating the mouse scroll wheel when the cursor is pointing to the ordinate axis values of this parameter. Scaling the vertical visualization of all parameters on the time axis is performed by rotating the mouse scroll wheel when the cursor is pointing to the time axis values.

5.1.4 Reading Parameter Values from a Graph

Graph nodes correspond to the data update moments. When the mouse cursor is pointed at them, the parameter value in this graph point is displayed. To view visualized parameter values at a given moment of time, click at the respective graph point in order to move the red line (scroll box) to it and view the time and parameter values in the legend.

5.1.5 Scrolling Graphs

There are control keys under the graph; they allow to move graphs to the right and to the left at large and small increments, to move to the beginning and the end of the graph and to perform their forced autoscaling. Stepless scrolling of the graph is performed by pressing and holding the left mouse button and moving time axis values.

5.2 Electric Energy Meter Readings

There is the meter electric energy reading table located in the "Electric Energy Meter Readings". The readings are grouped by types of metered electric energy:

- active imported (+Wa);
- active exported (-Wa);
- reactive imported (+Wr);
- reactive exported (-Wr);
- active imported loss energy (+WI);
- active exported loss energy (-WI);
- reactive imported loss energy (+Wrl);
- reactive exported loss energy (-Wrl);
- active imported basic frequency energy (+Wah1)
- active exported basic frequency energy (-Wah1)
- reactive imported basic frequency energy (+Wrh1)
- reactive exported basic frequency energy (-Wrh1)
- active imported positive sequence energy (+Wad);
- active exported positive sequence energy (-Wad);
- reactive imported positive sequence energy (+Wrd);
- reactive exported positive sequence energy (-Wrd);

as well as separately for each of four tariff zones, total values and non-tariff values.

FEEDER DAY PARAMETERS						
Tariffs summary						
		Tariff rate 1	Tariff rate 2	Tariff rate 3	Tariff rate 4	Outside tariff zone
Energy						
+W _Σ	21372.980 kW h	5856.000 kW h	8326.340 kW h	5825.820 kW h	3340.180 kW h	224.540 kW h
-W _Σ	53.580 kW h	0.000 kW h	0.000 kW h	0.000 kW h	0.000 kW h	53.580 kW h
+W _Σ	67.230 kvar h	0.000 kvar h	0.000 kvar h	0.010 kvar h	0.000 kvar h	67.190 kvar h
-W _Σ	5056.680 kvar h	1292.350 kvar h	1570.730 kvar h	1367.520 kvar h	807.040 kvar h	21.020 kvar h
Energy loss						
+W _Σ	73.530 kW h	0.000 kW h	0.000 kW h	0.000 kW h	0.000 kW h	73.530 kW h
-W _Σ	21.890 kW h	0.000 kW h	0.000 kW h	0.000 kW h	0.000 kW h	21.890 kW h
+W _Σ	73.530 kvar h	0.000 kvar h	0.000 kvar h	0.000 kvar h	0.000 kvar h	73.530 kvar h
-W _Σ	21.890 kvar h	0.000 kvar h	0.000 kvar h	0.000 kvar h	0.000 kvar h	21.890 kvar h
Energy of the 1st harmonic						
+W _{Σ1}	21567.650 kW h	5719.900 kW h	8308.300 kW h	5801.450 kW h	3363.550 kW h	224.420 kW h
-W _{Σ1}	53.480 kW h	0.000 kW h	0.000 kW h	0.000 kW h	0.000 kW h	53.480 kW h
+W _{Σ1}	67.250 kvar h	0.000 kvar h	0.010 kvar h	0.010 kvar h	0.010 kvar h	67.180 kvar h
-W _{Σ1}	4836.180 kvar h	1195.740 kvar h	1486.890 kvar h	1240.570 kvar h	745.940 kvar h	21.030 kvar h
Positive sequence energy						
+W _{Σ1}	7203.340 kW h	1911.240 kW h	2132.640 kW h	1866.290 kW h	1123.870 kW h	60.080 kW h
-W _{Σ1}	10.260 kW h	0.000 kW h	0.000 kW h	0.000 kW h	0.000 kW h	10.260 kW h
+W _{Σ1}	22.130 kvar h	0.000 kvar h	0.000 kvar h	0.000 kvar h	0.000 kvar h	22.110 kvar h
-W _{Σ1}	1535.910 kvar h	380.470 kvar h	483.000 kvar h	411.420 kvar h	248.150 kvar h	6.850 kvar h

Fig. 5.3 - Electric Energy Meter Readings

Tabulated values present the total amount of energy measured by the meter from the moment of its manufacture or zeroing its readings by the service department. Tariff metering zones and the share of loss are set during the meter setting and stored there. The total number of supported tariff zones is 4. These readings are displayed in different colors in the table. Tariff zones display colors and time intervals are specified in the legend under the table. The same colors are used for displaying the respective tariff zones on other site pages ("Energy Archive", "Profile 1", "Profile 2").

To the right above the table, there are buttons saving the presented information in Excel and Printing/Saving in «*.pdf».

To the right, there are enquiry mode selection buttons:

- 1) Current Values – current meter readings are displayed in an online mode;
- 2) Request Archive Data – a request for meter readings for the beginning of the day selected in a popup calendar.

5.3. Daily Energy Consumption Archive for a Day/Month

The "Daily Energy Consumption Archive for a Day/Month: page allows to read and display in a tabular and graphic forms the measured energy values for past periods saved in the meter.

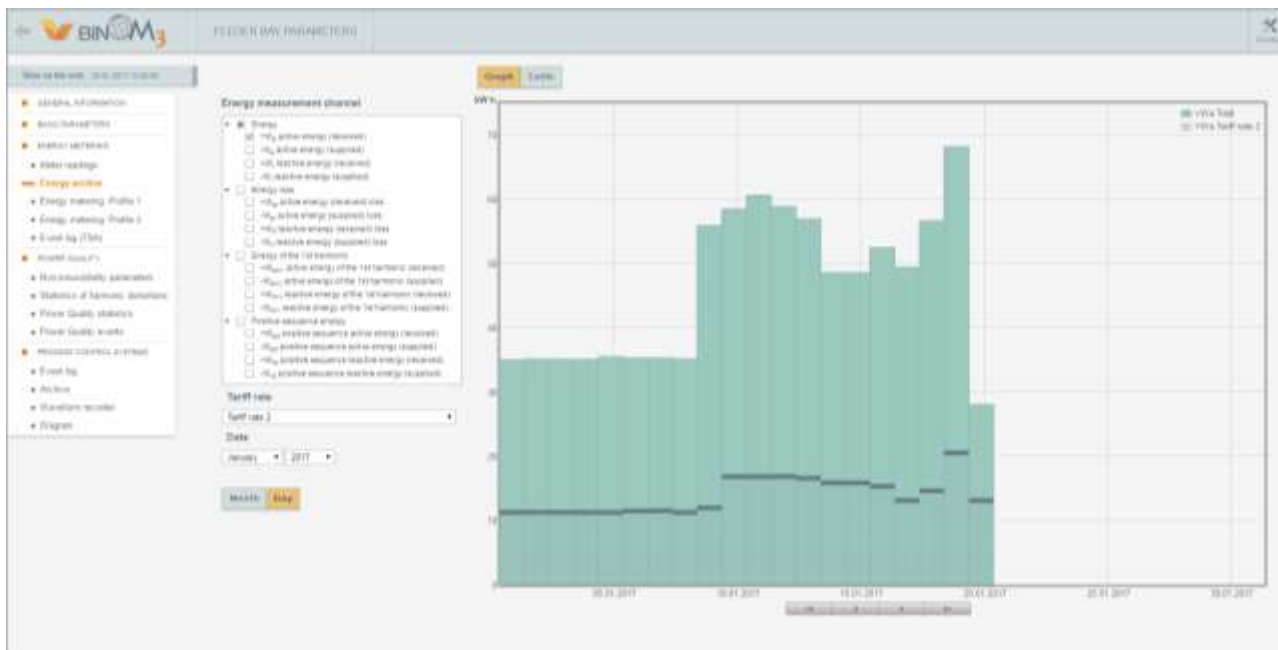


Fig. 5.4 - Daily Energy Consumption Archive for a Day/Month (Histogram)

5.3.1 Display Type Selection

Archive data may be displayed in two forms:

- as a histogram;
- in tabular form.

The choice between those modes is effected by the "Graph" and "Table" buttons located in the left top part of the page. If there are no date on the screen, click on the "Enquiry" button in the left bottom part of the data display window. The histogram of imported active energy metering channel (+Wa) is displayed on the page by default. As the mouse cursor is pointed at any histogram element, the metering interval and the measured energy value for that interval are displayed in an opened information window. In the table form, measured energy is displayed as a table whose lines specify the interval and columns, energy values in the selected metering channels.

In tabular display form, the functions of saving presented information in Excel and its Printing/Saving in «*.pdf» are accessible as well

5.3.2 Metering Channel Selection

To display the state of a single metering channel, it is enough to select the respective line in the "Metering Channel" menu. For simultaneous display of the status of several metering channels, several lines are chosen using "Shift" or "Ctrl" keyboard keys. When several metering channels are selected, their values are displayed:

- in graphic mode - as separate histogram columns situated next to each other and colored according to the legend;
- in tabular form – in the respective table columns.

5.3.3 Display Period Selection

It is possible to select two display modes:

- monthly, for a year;
- daily, for a month.

Modes are switched by "Month" and "Day" buttons in the left bottom part of the page. In the monthly display mode, it is possible to select metering data for the required year with the help of the "Year" menu. In the daily display mode, it is possible to select metering data for the required month and year with the help of

the "Month" and "Year" menus. In the graphic mode, it is possible to scroll the histogram incrementally to the left and to the right with the help of the control buttons located under it. It is possible to perform scrolling both by a single metering interval (day, month) and by the whole set viewing period (month, year).

5.3.4 Tariff Data Viewing

By default, the page displays data about total indicators on the specified metering channel. To display the required tariff data, select the respective line in the "Tariff" menu. The selected tariff data will be displayed on the histogram as columns of the color corresponding to the tariff superimposed on the total indicators histogram. In a tabular mode, the table cells will be painted the color corresponding to the selected tariff.

5.4 "Electric Energy Metering Profile 1" and "Electric Energy Metering Profile 2"

The "Electric Energy Metering Profile 1" and "Electric Energy Metering Profile 2" pages display current energy value profiles for all active tariffs measured at various metering intervals:

- profile 1 – at 30 min intervals;
- profile 2 – at 3 min intervals.

Metering interval values are set during the BINOM3 setting and may be chosen from the 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 or 60 minutes range.

5.4.1 Display Type Selection

Profiles may be displayed in two forms:

- as a histogram;
- in tabular form.

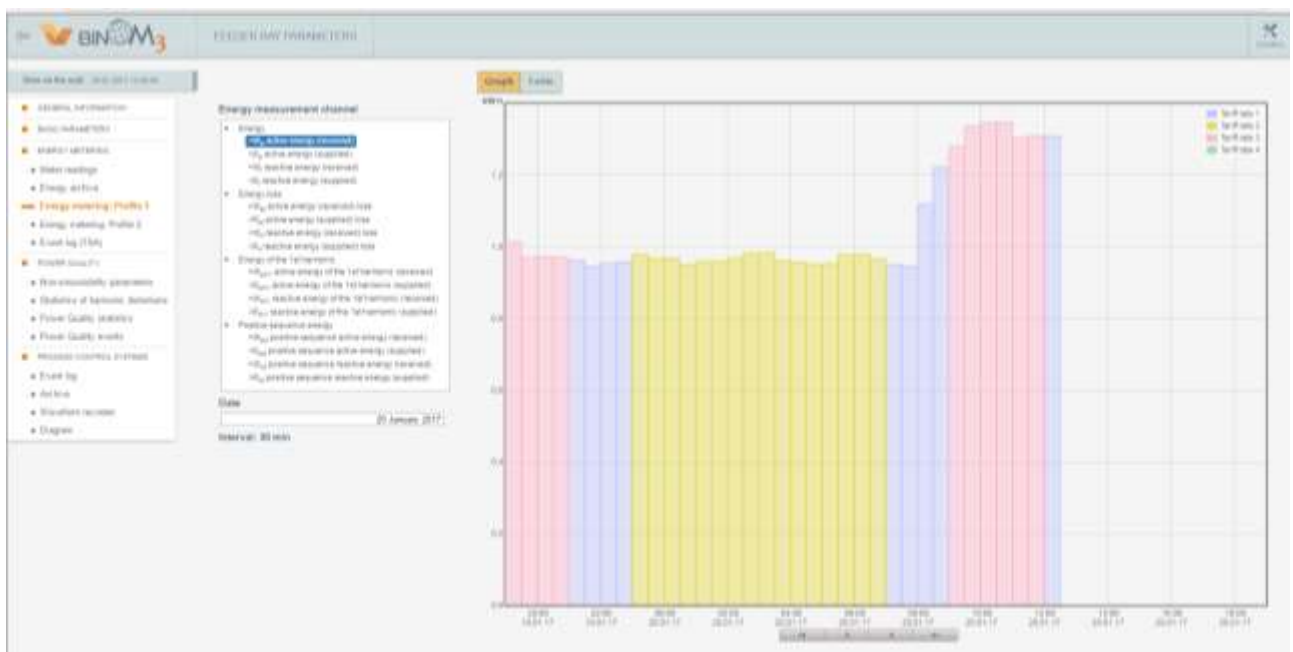


Fig. 5.5 - Electric Metering Profile 1 (Graph)

The choice between those modes is effected by the "Graph" and "Table" buttons located in the left top part of the page. The histogram of imported active energy metering channel (+Wa) is displayed on the page by default. Energy profile for various tariffs is displayed in the respective colors in the histogram.

As the mouse cursor is pointed at any histogram element, the metering interval and the measured energy value for that interval are displayed in an opened information window. In tabular mode, measured energy is displayed as a table each line whereof represents an interval expiry time, date and measured energy in the specified interval and cell color corresponds to the number of the tariff by which metering was performed in this interval.

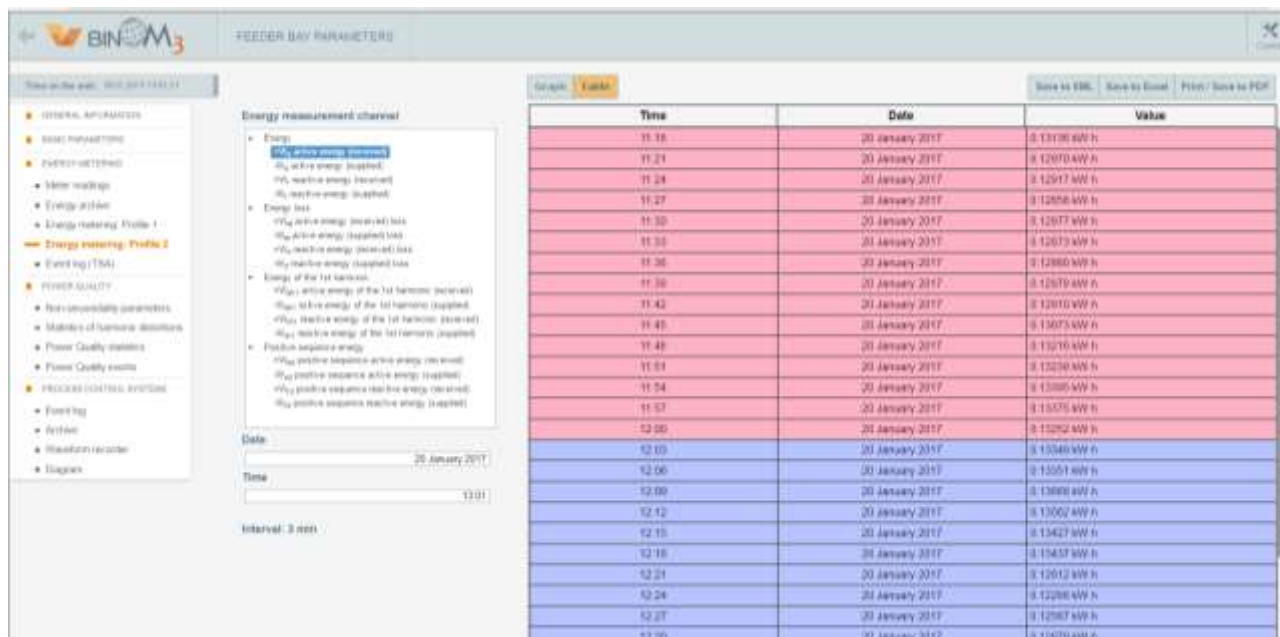


Fig. 5.6 - Electric Energy Metering Profile 2 (Tabular Form)

5.4.2 Metering Channel Selection

To display the state of a single metering channel, it is enough to select the respective line in the "Metering Channel" menu. The selected channel data will immediately be displayed on a histogram or in a table.

5.4.3 Display Mode Selection

Load profiles are displayed in two modes:

- upon request;
- continuously, in monitor mode.

The default display mode is upon request. As a page is opened, data for the whole metering period are automatically requested from the meter. A part of them for the current day is immediately displayed in the page information window on the histogram. To update data, it is necessary to click on the "Request" button in the left bottom part of the data display window.

For continuous monitoring of measured energy change, it is necessary to activate the monitor mode by clicking on the respective "Monitor" button in the left bottom part of the data display window. In the monitor mode, data will be automatically requested from the meter from time to time and displayed on a histogram or in a table; whereupon it will be possible to view only the current profile displayed on the screen.

5.4.4 Viewing Data for the Whole Metering Period

It is possible to view data for the whole metering period only in a request mode. To view information for the current day (metering intervals being 3 and 30 min.) or hours (metering interval being 3 min.) it is necessary to select the respective date and time in the menu to the right of the data display window. Whereupon the viewing area will be moved to the needed part of the histogram or table. Further scrolling of the histogram to the left or to the right is effected with the help of the control buttons located under it.

Scrolling is possible both in metering interval increments (3 min., 30 min.) and in viewing window increments (approx. 1.5 hours, a day). A table is scrolled with the help of a standard scroll bar located to the right of it.

5.4.5 Saving Metering Profile on PC

The selected electric energy metering profile is saved on PC in the "Table" display mode by clicking on the respective button located in the top part. As a "Save in XML" button is clicked, a metering profile file will be saved on the PC to the "Downloads" folder in standard 80020 format (*.xml).

The functions of saving presented information in Excel and its Printing/Saving in *.pdf are accessible as well

5.5. "TSA Log" and "Event Log".

"TSA Log" and "Event Log" pages are intended for obtaining events from the respective logs stored inside the BINOM3 and their displaying on the screen.

When pages are opened, an automatic request for the latest fifty events from logs are requested and displayed on the screen in tabular form. For requesting and displaying log entries to a depth that is of interest to you, specify request depth (the number of log entries, starting from the latest one) and click on the button "Request the Latest" located under the table. For selecting entries by a date and time range, it is necessary to fill in the respective selection range beginning and end date and time and to click on the "Request" button located to the right of the fields.

No	Date	Time	Code	Description	Parameters
1	20.01.17	12:01:42	0001	Remote access	IP-address = 192.168.1.1, username = administrator
2	20.01.17	12:11:45	0001	Remote access	IP-address = 192.168.1.1, username = administrator
3	20.01.17	12:58:35	0001	Remote access	IP-address = 192.168.1.1, username = administrator
4	20.01.17	11:40:41	0001	Remote access	IP-address = 192.168.1.1, username = administrator
5	20.01.17	11:30:16	0001	Remote access	IP-address = 192.168.1.1, username = administrator
6	20.01.17	11:02:12	0001	Remote access	IP-address = 192.168.1.1, username = administrator
7	20.01.17	10:30:32	0001	Remote access	IP-address = 192.168.1.1, username = administrator
8	20.01.17	10:00:14	0001	Remote access	IP-address = 192.168.1.1, username = administrator
9	19.01.17	18:34:40	0001	Remote access	IP-address = 192.168.1.1, username = administrator
10	19.01.17	18:14:21	0001	Remote access	IP-address = 192.168.1.1, username = administrator
11	19.01.17	15:53:25	0001	Remote access	IP-address = 192.168.1.1, username = administrator
12	19.01.17	14:30:00	0001	Remote access	IP-address = 192.168.1.1, username = administrator
13	19.01.17	14:30:21	0001	Remote access	IP-address = 192.168.1.1, username = administrator
14	19.01.17	13:55:30	0001	Remote access	IP-address = 192.168.1.1, username = administrator
15	19.01.17	13:40:07	0001	Remote access	IP-address = 192.168.1.1, username = administrator
16	19.01.17	13:21:21	0001	Remote access	IP-address = 192.168.1.1, username = administrator
17	19.01.17	12:52:00	0001	Remote access	IP-address = 192.168.1.1, username = administrator
18	19.01.17	12:39:41	0001	Remote access	IP-address = 192.168.1.1, username = administrator
19	19.01.17	12:32:38	0001	Remote access	IP-address = 192.168.1.1, username = administrator
20	19.01.17	11:20:15	0001	Remote access	IP-address = 192.168.1.1, username = administrator
21	19.01.17	10:44:10	0001	Remote access	IP-address = 192.168.1.1, username = administrator
22	19.01.17	10:10:41	0001	Remote access	IP-address = 192.168.1.1, username = administrator
23	19.01.17	09:59:01	0001	Remote access	IP-address = 192.168.1.1, username = administrator
24	19.01.17	10:04:50	0001	Remote access	IP-address = 192.168.1.1, username = administrator
25	19.01.17	09:55:35	0001	Remote access	IP-address = 192.168.1.1, username = administrator
26	19.01.17	09:53:46	0001	Remote access	IP-address = 192.168.1.1, username = administrator

Fig. 5.7 - TSA Event Log

No	Date	Time	Code	Name	Parameters
1	20.01.17	12:43:40	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
2	20.01.17	12:41:44	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
3	20.01.17	12:39:36	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm2
4	20.01.17	11:40:41	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
5	20.01.17	11:38:14	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
6	20.01.17	11:02:12	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
7	20.01.17	10:50:20	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
8	20.01.17	10:50:14	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
9	19.01.17	19:14:40	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
10	19.01.17	19:14:21	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
11	19.01.17	15:53:20	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
12	19.01.17	14:30:00	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm2
13	19.01.17	14:30:21	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
14	19.01.17	13:55:38	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
15	19.01.17	13:40:01	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm2
16	19.01.17	13:21:21	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
17	19.01.17	12:53:00	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
18	19.01.17	12:38:47	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm2
19	19.01.17	12:22:38	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
20	19.01.17	11:22:18	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
21	19.01.17	10:44:10	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
22	19.01.17	10:33:47	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
23	19.01.17	10:09:01	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm2
24	19.01.17	09:04:50	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
25	19.01.17	08:30:30	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1
26	19.01.17	08:53:46	0011	Harmonic distortion	IP-address = 192.168.1.1, username = algorithm1

Fig. 5.8 - Event Log

Event data are displayed in a table in the columns:

- "No" (Number) - sequential event number;
- "Date" - event occurrence date;
- "Time" - event occurrence time;
- "Code" - conventional event code. TSA log event codes correspond to the codes recommended by the JSC «TSA» electric energy wholesale market regulations;
- "Event Name" - occurred event description;
- "Parameters" - clarifying or supplementary event information.

Detailed information about event log entries can be found in the document "BINOM3 Multifunctional Electric Energy Quality Meters". Interaction Protocols. TLAS.411152.002 D1». Vertical table data scrolling is performed by the mouse wheel after pointing the cursor at any part of the table or with the help of a scroll bar to the right of the table. Horizontal scrolling is performed with a help of a scroll bar located under the table.

In the right top part of the screen, there are buttons saving the presented information in Excel and Printing/Saving in *.pdf.

5.6 Non-sinusoidality Parameters

The "Non-sinusoidality parameters" page displays root mean square harmonic and interharmonic components of currents and voltages calculated in compliance with GOST 30804.4.7-2013 (IEC 61000-4-7:2009, MOD).

5.6.1 Display Type Selection

Parameters may be displayed in two forms:

- in graphic mode - as separate histogram columns situated next to each other and colored according to the legend;
- in tabular form – in the respective table columns.

The choice between those modes is effected by the "Graph" and "Table" buttons located in the left top part of the page. When the mouse cursor is pointed to any histogram element, the parameter name and

measured value are displayed in the opened information window. In the tabular mode, measured parameters are displayed in tabular form.

Histogram/table parameter values are updated in a real time mode.

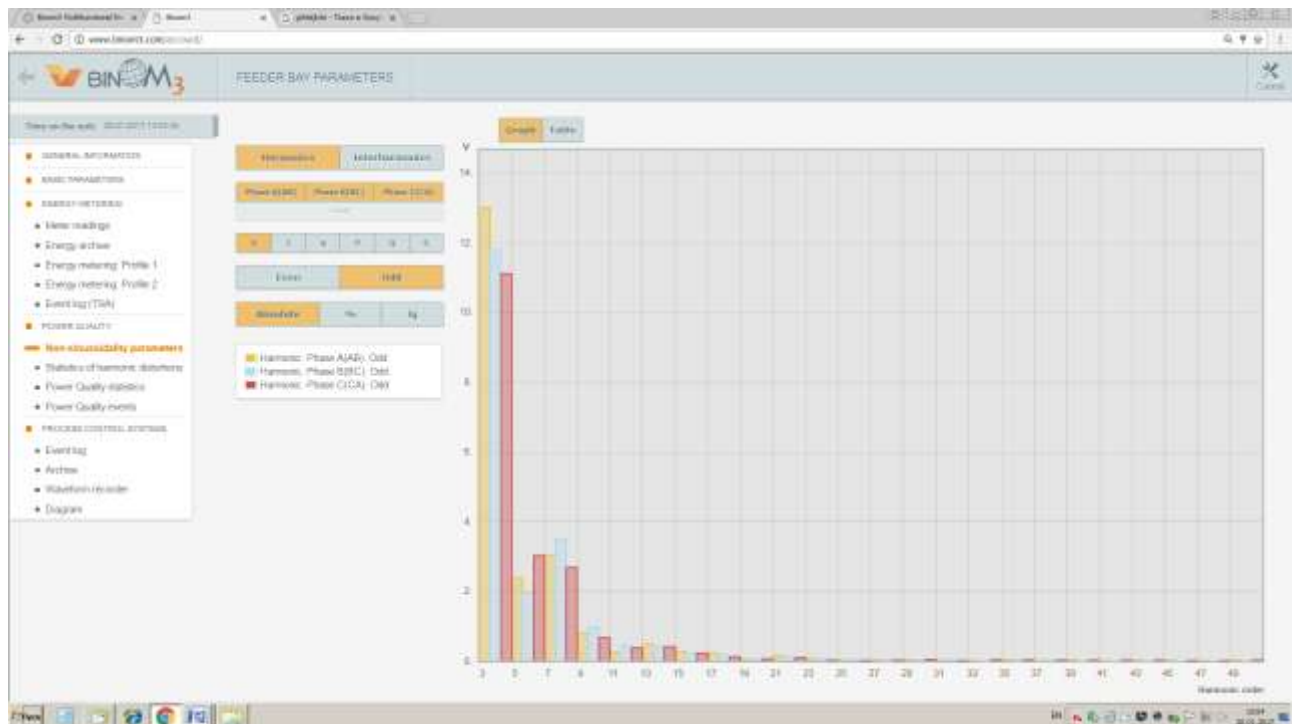


Fig. 5.9 Non-sinusoidality Parameters (Histogram)

		Voltage										Current						Power factor angle		
		Harmon V	THDv %	Harmon V	THDv %	Harmon V	THDv %	Harmon V	THDv %	Harmon V	THDv %	I _a A	THD _i %	I _b A	THD _i %	I _c A	THD _i %	φ _{U_a} °	φ _{U_b} °	φ _{U_c} °
1	220.972	100.000	219.535	100.000	217.444	100.000	7.34381	100.000	1.44852	100.000	1.01035	100.000	13.0	2.1	2.8					
5	0.192	0.001	0.237	0.004	0.125	0.005	0.00863	0.017	0.01898	0.598	0.01015	1.078	15.1	23.5	0.0					
7	13.521	5.585	12.355	5.488	11.710	5.268	3.20048	44.364	2.12613	61.964	0.34677	35.001	-121.7	-120.0	-101.0					
9	0.117	0.045	0.034	0.031	0.096	0.037	0.02088	0.281	0.01240	0.303	0.00718	0.425	124.6							
11	2.228	1.105	1.837	0.818	2.838	1.374	1.75858	24.880	1.14348	53.942	0.24166	24.925	-110.7	-120.0	-121.3					
13	0.044	0.025	0.140	0.032	0.078	0.025	0.00987	0.197	0.00679	0.230	0.00000	0.418		0.0						
15	3.843	1.454	9.270	1.583	2.223	1.104	0.60424	8.533	0.20262	9.527	0.00525	10.370	-122.7	-148.0	-146.4					
17	0.015	0.019	0.041	0.027	0.071	0.018	0.00877	0.128	0.00000	0.002	0.00000	0.184								
19	0.035	0.352	0.052	0.371	0.579	0.336	0.10942	1.664	0.10640	2.532	0.02837	4.262	-112.2	-96.0	-113.1					
21	0.015	0.011	0.041	0.007	0.015	0.007	0.00877	0.100	0.00679	0.073	0.00000	0.093								
23	0.370	0.183	0.350	0.308	0.261	0.171	0.29836	3.868	0.21364	5.748	0.03067	4.657	-20.9	-138.0	-112.4					
25	0.015	0.004	0.038	0.006	0.006	0.002	0.00000	0.054	0.00000	0.029	0.00000	0.084								
27	0.487	0.224	0.452	0.297	0.428	0.218	0.10889	1.505	0.10908	5.671	0.04541	4.915	101.1	76.7	37.5					
29	0.000	0.001	0.000	0.001	0.000	0.002	0.00000	0.042	0.00007	0.041	0.00000	0.053								
31	0.268	0.135	0.180	0.089	0.242	0.119	0.13260	1.844	0.13278	3.867	0.03129	2.983	-145.1	-108.0	-131.1					
33	0.000	0.003	0.000	0.003	0.000	0.002	0.00000	0.053	0.00007	0.023	0.00000	0.047								
35	0.305	0.124	0.193	0.085	0.154	0.080	0.07342	0.672	0.00000	0.675	0.03046	3.009	-73.8		-152.2					
37	0.000	0.000	0.000	0.000	0.000	0.000	0.00000	0.011	0.00000	0.014	0.00000	0.032								
39	0.000	0.005	0.000	0.005	0.006	0.028	0.00273	1.182	0.08194	2.150	0.01688	2.324			43.3					
41	0.000	0.000	0.000	0.000	0.000	0.000	0.00000	0.048	0.00000	0.003	0.00000	0.027								
43	0.168	0.048	0.106	0.047	0.084	0.038	0.10651	1.335	0.00360	2.631	0.01830	1.191	-123.8	-133.3	0.0					
45	0.008	0.000	0.000	0.000	0.000	0.000	0.00000	0.027	0.00000	0.018	0.00000	0.051								
47	0.083	0.029	0.072	0.028	0.041	0.019	0.07185	0.819	0.05648	1.894	0.00718	0.793	-98.3	-167.3						
49	0.000	0.000	0.000	0.000	0.000	0.000	0.00000	0.024	0.00000	0.000	0.00000	0.028								

Fig. 5.10 Non-sinusoidality Parameters (Table)

5.6.2 Display Parameters Choice

The following non-sinusoidality parameters are accessible for displaying on the page:

- Parameter Type - harmonics and interharmonics (may be chosen simultaneously);
- phases – A (AB), B (BC), C (CA) and total (may be chosen simultaneously);
- by voltage, current, phase angle, active, reactive and full power (cannot be chosen simultaneously);

- even and odd (cannot be chosen simultaneously);
- scale – absolute, in percent (%) or logarithmic (lg) (one value is chosen for displaying on the histogram)

Displaying parameters are chosen by clicking on the respective buttons located in the field to the right of the histogram/table. The histogram legend specifying correspondence of histogram column colors to parameters type is located below this field.

By default, the page is loaded with displaying parameters - odd harmonic voltage components in three phases in percentage scale of histogram display.

5.7 Voltage Harmonic Component Distortion Factor Statistics

The page is a table formed on the basis of voltage harmonic component distortion factor analysis as per GOST 32144-2013 (EN 50160:2010, NEQ).

Displayed above the table is the loaded interval of harmonic component distortion factor analysis. The latest saved analysis interval is loaded by default.

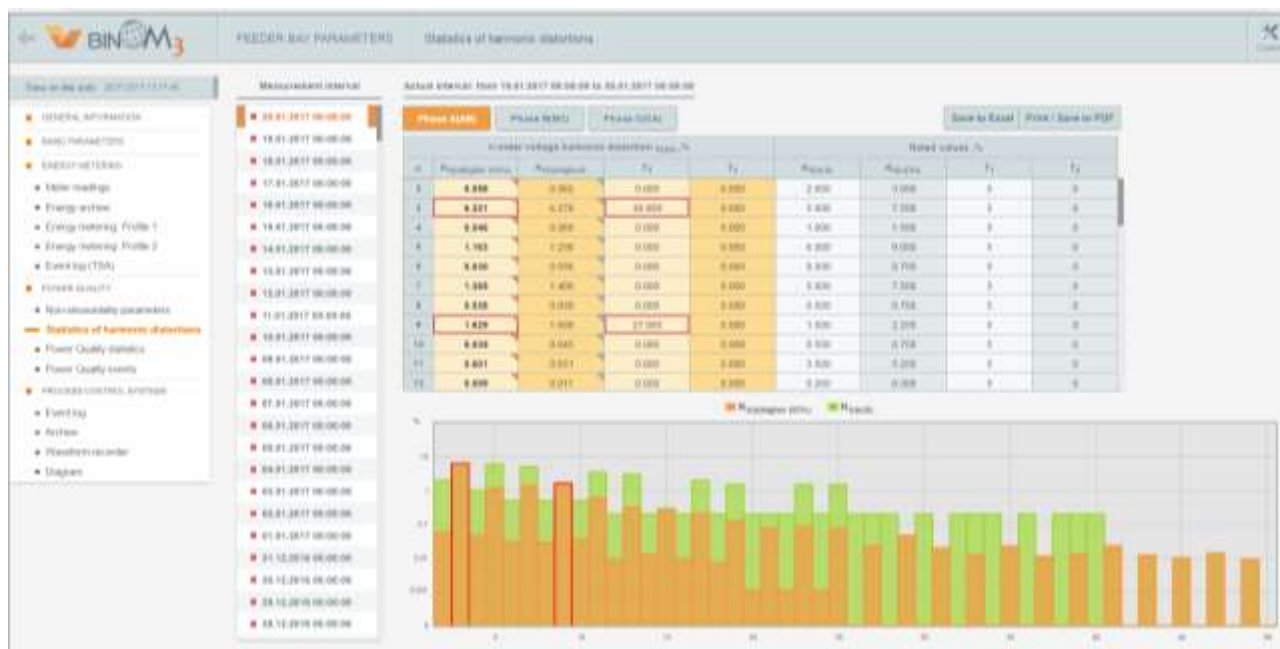


Fig. 5.11 Statistic of harmonic distortion

The table consists of three tabs – Phase A (AB), Phase B (BC), Phase C (CA). Only one tab is accessible for viewing at a time. Switching between tabs is effected by left-clicking on the respective tab in the top part of the table.

Table lines are harmonic component numbers, columns are the respective harmonic component distortion factor values.

Logically, the table is divided in two parts:

- the left part is the result of electric energy quality indicators analysis for compliance to the requirements of regulatory documents;
- the right part consists of standard harmonic distortion factor values specified in the configuration.

The table contains the following columns:

- the top limit value of the range in which 95% of measured values are located $K_{U(n)t(95\%)}$;

- the maximum value $K_{U(n)max}$;
- relative time of standard permissible value excess T1 %;
- relative time of limit permissible value excess T2 %;
- standard permissible value (95%) $K_{U(n)sp}$;
- maximum permissible value (100%) $K_{U(n)max}$;

When some parameter analysis result deviates from the standard value, the border of the respective table cell is painted red.

5.7.1 Analysis Interval Choice

The list of analysis intervals accessible for viewing is displayed to the left of the table. A red square opposite the analysis interval means inconformity of the electric energy quality parameters to their standard values in this analysis interval.

5.8. Electric Energy Quality Indicator Statistics

The "Electric Energy Quality Indicator Statistics" page presents the results of frequency and voltage deviations and unbalance factors statistical analysis as per GOST 32144-2013.

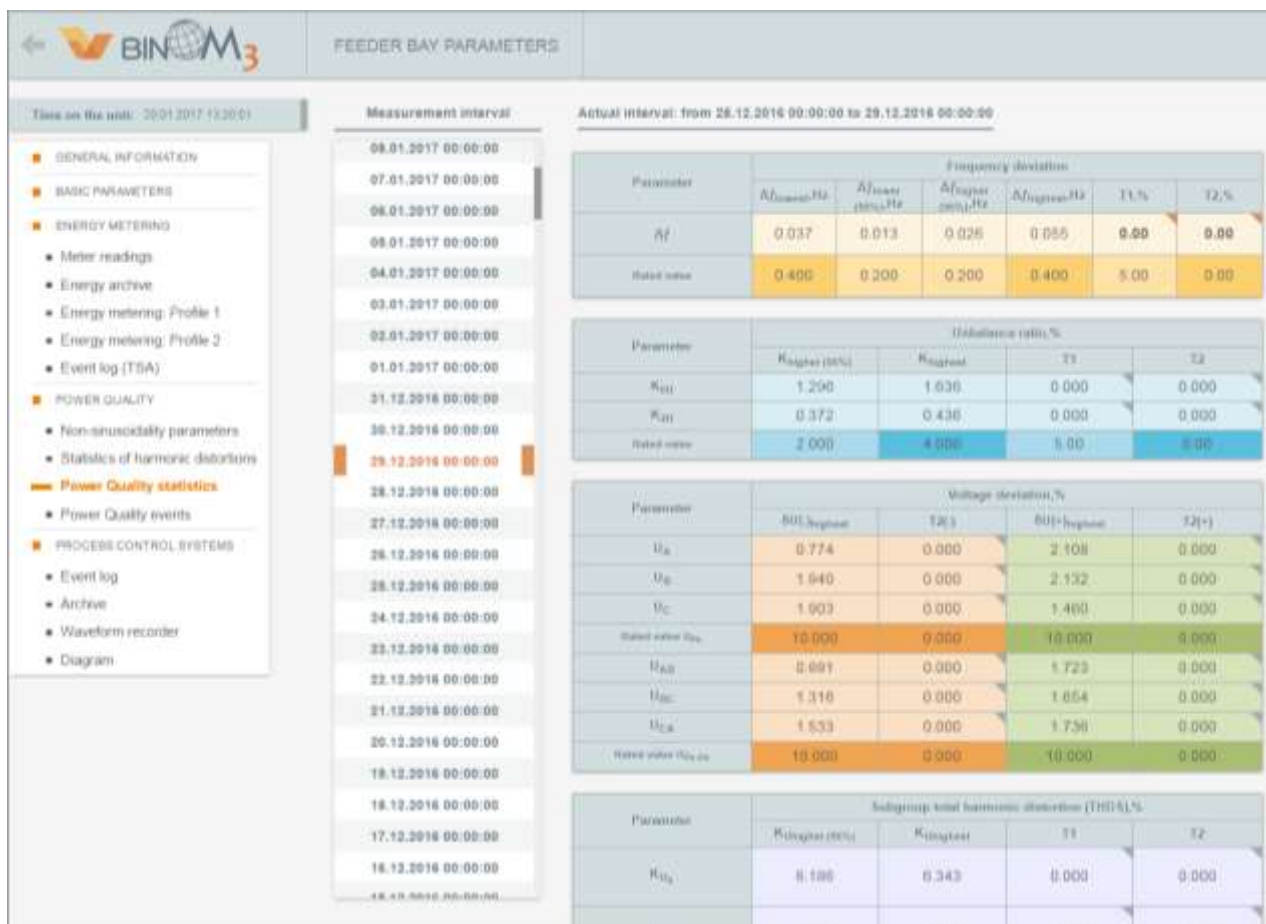


Fig. 5.12. Electric Energy Quality Indicator Statistics

Information is presented on the page both in tabular form and as a histogram. The loaded electric energy quality indicators analysis is specified in the top part of the page. The latest saved analysis interval is loaded by default.

The table consists of four subsections - results of statistical analysis for compliance to regulatory documentation requirements by the following parameters:

- Frequency deviation;
- Voltage deviation;
- Unbalance factors;
- Total harmonic components distortion factor.

When some parameter analysis result deviates from the standard value, the border of the respective table cell is painted red.

A histogram built in the bottom part of the screen displays T1 and T2 values for the selected parameters. The parameter is selected by selecting T1 or T2 time opposite the respective electric energy quality indicator by mouse click and assigning a respective color shades on the histogram to it.

5.8.1 Frequency Deviation

The frequency deviation statistical analysis results table contains the following columns:

- the maximum value $K_{U_{max}, \%}$;
- the top limit value of the range in which 95 % of measured values are located $K_{Ut(95\%)}$;
- the minimum value $K_{U_{min}, \%}$;
- the bottom limit value of the range in which 95 % of measured values are located $K_{Ub(95\%)}$;
- relative time of standard permissible value excess T1, %;
- relative time of limit permissible value excess T2, %.

5.8.2 Voltage Deviation

Voltage harmonic components total distortion factor statistical analysis results table contains the following columns:

- the maximum positive voltage deviation value $\delta U_{(+)\max, \%}$;
- the maximum negative voltage deviation value $\delta U_{(-)\max, \%}$;
- relative time of positive voltage deviation limit permissible value excess T2(+), %;
- relative time of negative voltage deviation limit permissible value excess T2(-), %.

5.8.3 Unbalance Factors

The unbalance factors statistical analysis results table contains the following columns:

- the maximum value $K_{U_{max}, \%}$;
- top limit value of the range in which 95 % of measured values are located $K_{Ut(95\%)}$, %;
- relative time of standard permissible value excess T1, %;
- relative time of limit permissible value excess T2, %.

5.8.4 Total Voltage Harmonic Components Distortion Factor

Voltage harmonic components total distortion factor statistical analysis results table contains the following columns:

- the maximum value $K_{U_{max}, \%}$;
- top limit value of the range in which 95 % of measured values are located $K_{Ut(95\%)}$, %;

- relative time of standard permissible value excess T1, %;
- relative time of limit permissible value excess T2, %.

5.8.5 Analysis Interval Choice

The list of analysis intervals accessible for viewing is displayed to the left of the table. A red square opposite the analysis interval means inconformity of the electric energy quality parameters to their standard values in this analysis interval.

5.8.5.1 Histogram Viewing

After a click on the analysis interval of interest to the user, the view area will move to the needed part of the histogram and the table will be filled by data from the archive file for the selected range. Further scrolling of the histogram to the left or to the right is effected with the help of the control buttons located on its sides.

5.9. Accidental Events

The "Accidental Events" page presents the results of overvoltages, voltage dips and interruptions statistical analysis as per GOST 32144-2013 (EN 50160:2010, NEQ).

The page consists of three tables:

- voltage dips analysis results;
- voltage interruptions analysis results;
- overvoltage analysis results,

as well as a histogram located in the bottom part of the page.

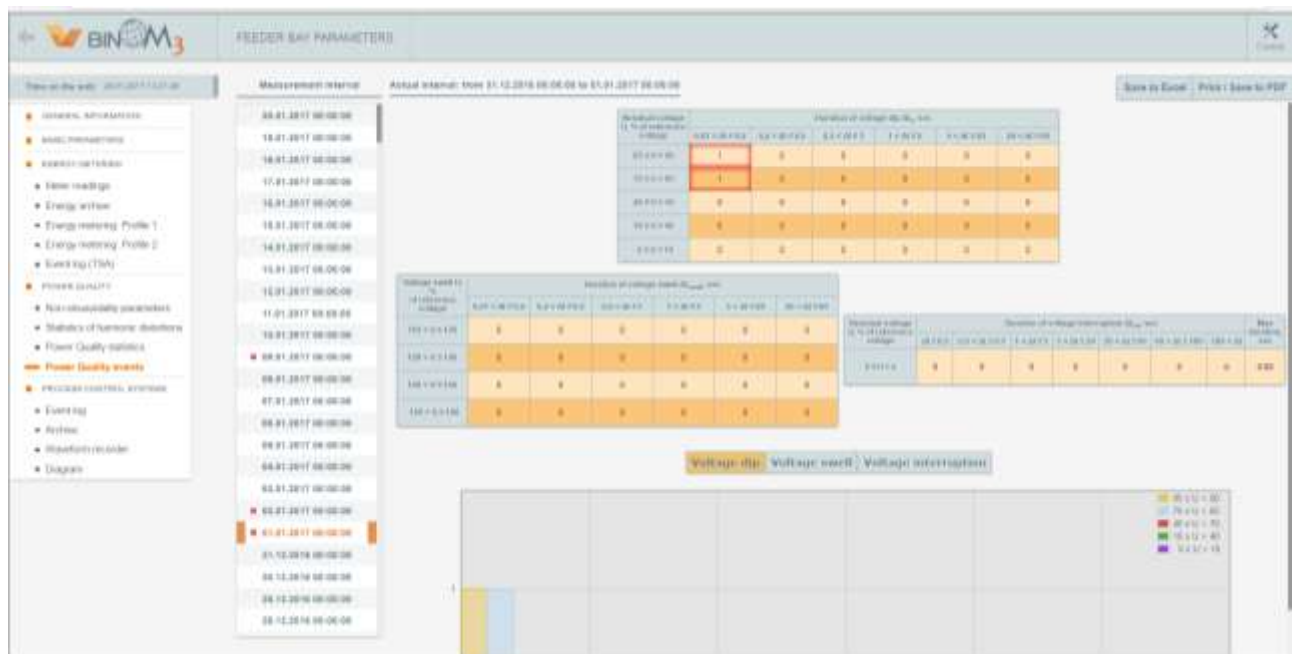


Fig. 5.13. Accidental Events

5.9.1 Voltage Dips Analysis Results

The "Voltage Dips Analysis Results" table is a matrix whose lines are residual voltage levels during a dip and columns are voltage dip durations. Cells at the intersections of columns and lines specify the number of dips with their respective durations and depths.

5.9.2 Voltage Interruptions Analysis Results

The "Voltage Interruptions Analysis Results" table is a classification of interruptions by their duration. The cell specify the number of interruptions with their respective durations and the maximum interruption duration.

5.9.3 Overvoltages Analysis Results

The "Overvoltages Analysis Results" table is a matrix whose lines are overvoltage levels and columns, overvoltage durations. Cells at the intersections of columns and lines specify the number of overvoltages with their respective durations and levels.

5.9.4 Accidental Events Histogram

The histogram contains three tabs:

- Dips;
- Overvoltages;
- Interruptions.

When one of the tabs is selected, the number of the specified type accidental events is displayed in view of duration (abscises scale) and electric energy quality indicators value (coloring).

5.9.5 Analysis Interval Choice

The list of analysis intervals accessible for viewing is displayed to the left of the table. A red square opposite the analysis interval means inconformity of the electric energy quality parameters to their standard values in this analysis interval.

5.10 Archives

The "Archive" application is intended for recording and displaying the DB cell events.

5.10.1 Files Structure

Each archive is represented by a set of elements where an element is a single file limited by the set archiving time and the number of events. The file is closed by the limitation that occurs first.

5.10.2 General Appearance of the Application

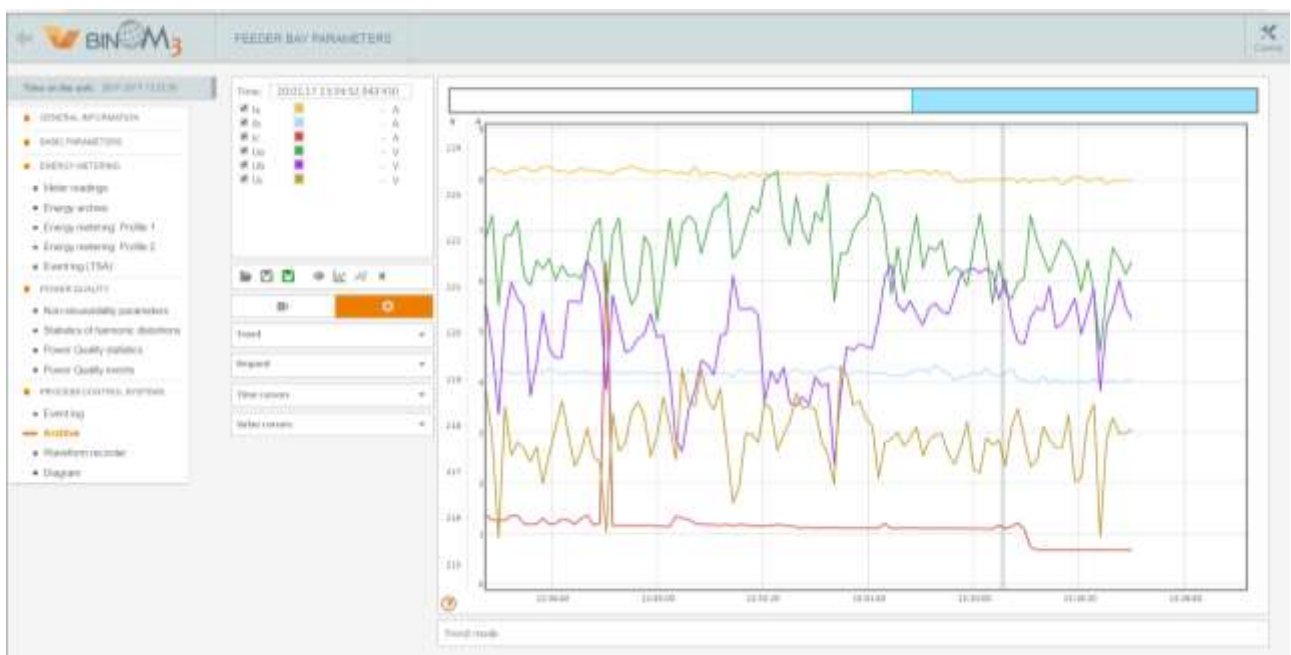


Fig. 5.3 - General Appearance of the "Archive" Application

The "Archive" application working space consists of the following components:

- 1 – display legend area;
- 2 – graphs display area;
- 3 – display settings area;

5.10.3 Graphs Display Legend

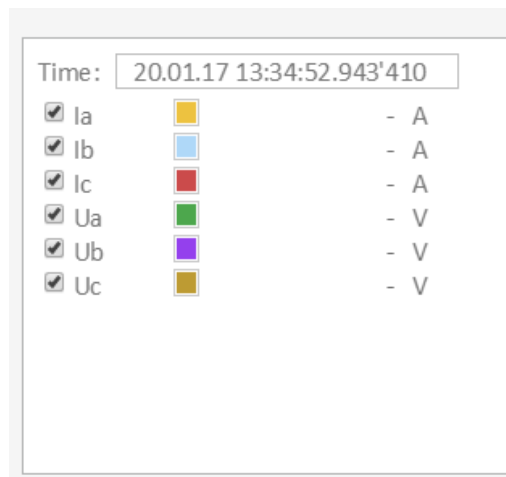


Fig. 5.14 – Display Legend Area

The display legend area presents data about the names and line colors of all the displayed graphs, as well as the value of each graph corresponding to the time specified on the main cursor.

The time corresponding to the main cursor is shown in the top part of the tab.

The graphs with removed flags opposite their names are not displayed.

5.10.4 Graphs Display

10 parameters graphs may be displayed simultaneously in the display area. All graphs have a common time axis (abscissa axis), there may be several value axes (ordinate axes) depending on the displayed parameters measurement units.

1) Axial Graph Shifting

For axial graph shifting, it is necessary to point the cursor to the graphs display area (if it is necessary to scroll all graphs) or the needed axis (if a single parameter must be scrolled), press and hold the left mouse button and scroll (shift) graphs by moving the mouse.

2) Graph Scaling

For axial graph scaling, it is necessary to point the mouse cursor to an axis and to perform scaling by turning the mouse scroll wheel.

3) Cursors

Moving the mouse over the graphs display area is always accompanied by moving the main cursor along the time axis.

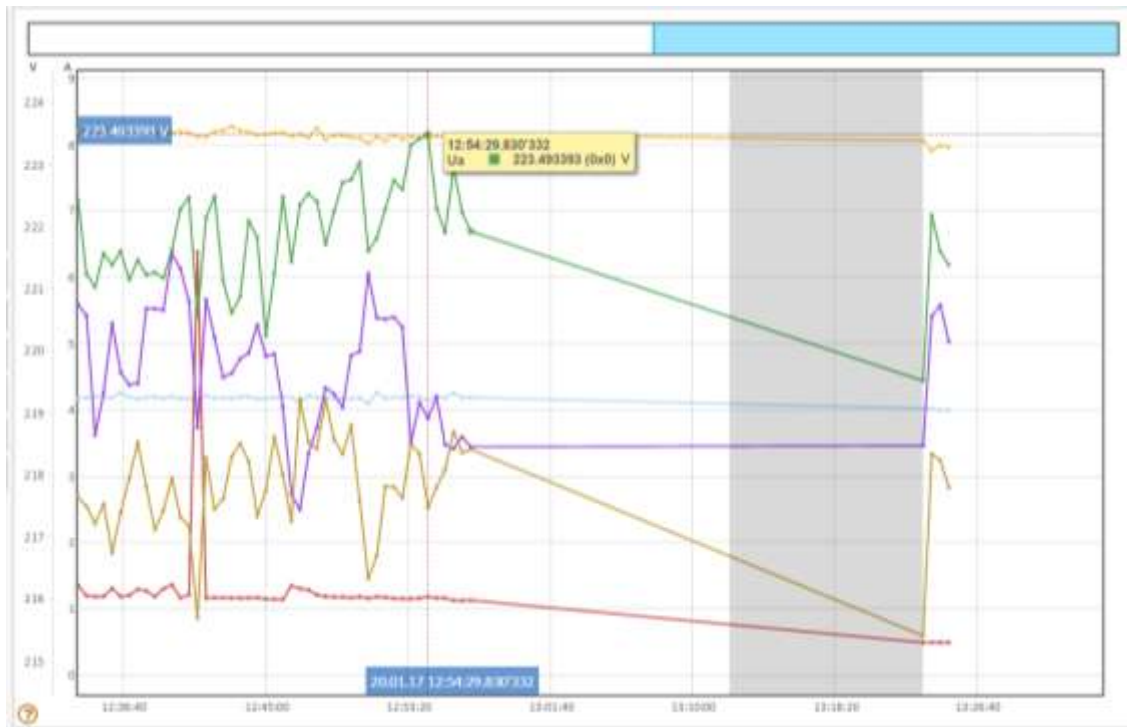


Fig. 5.15 - The Main Cursor

When the mouse cursor is pointed to a graph point, a pop-up tip appears with the parameter name, its value and quality at the selected point. For displaying all the graph parameters at the time moment at which the main cursor is located it is necessary to press and hold the right mouse button.

Besides the main cursor, the user can create additional time and value cursors. For that, the user must left click on the time axis or on the values axis (for the values axis, the cursor is pointed with the Ctrl key pressed and held).

Added cursors are displayed on graphs as black dashed lines.

Graph values in respect of the cursor setting time are displayed in the display settings panel ("Cursors" tab).

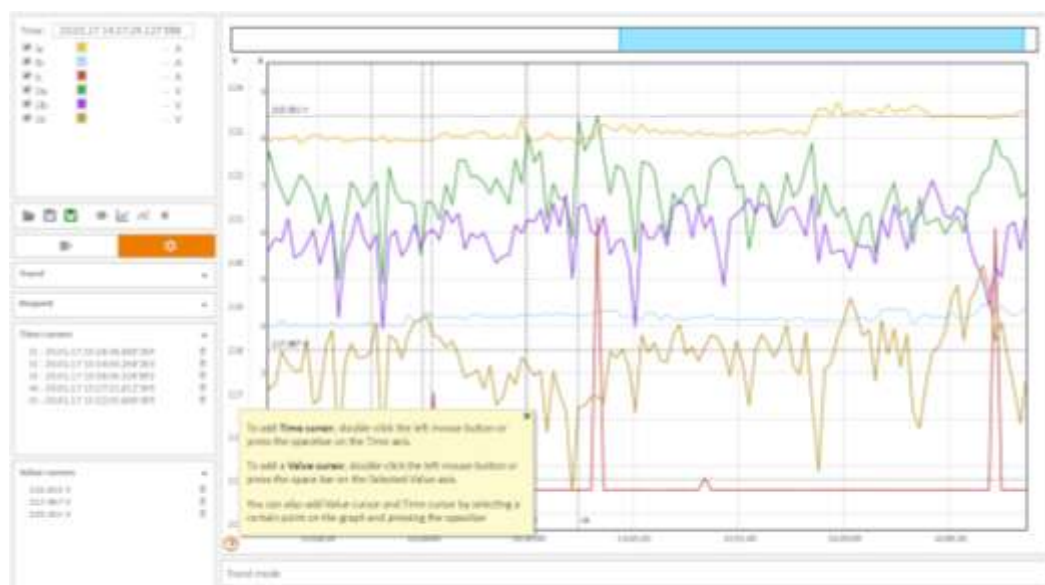


Fig. 5.16 – "Cursors" Tab

To remove a cursor, select a cursor in the list and click on a button with the basket icon ("Remove").



Fig. 5.17 – Removing a Cursor

For time cursors: after a left-click on a cursor in the list, this cursor will be put in the center of the display area.

5.10.5 Display Settings

5.10.5.1 Function Buttons



Fig. 5.18 – Function Buttons

The following function buttons are provided for loaded archives control (left to right):

- Download Archive;
- Save Archive in Excel;
- Activate/Deactivate Quality Areas;
- Activate/Deactivate Displaying Selected Points;
- Align by Maximum/Minimum;
- Moving to the end of the graph and auto scrolling activation;

5.10.5.2 Archive Saving

After clicking on the "Save Archive" button, the saving interval choice popup window opens.

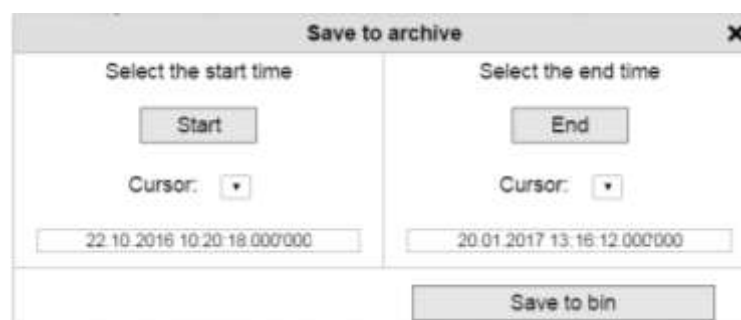


Fig. 5.19 - Archive Saving Window

The saving interval beginning and end time corresponding to the actual archive size are loaded in this window by default. If need be, it is possible to use additional cursors set on the archive graphs as beginning and end time and to set time manually.

After setting time, click on the "Save in *.bin Format" button; whereupon the archive for the specified interval will be saved on the PC.

5.10.5.3 Archive Saving in Excel

After clicking on the "Save in Excel" button, the saving interval choice popup window opens.

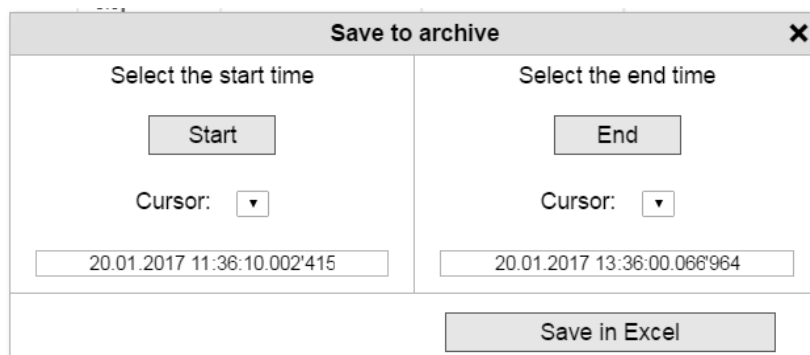


Fig. 5.20 - Archive Saving in Excel Window

The saving interval beginning and end time corresponding to the actual archive size are loaded in this window by default. If need be, it is possible to use additional cursors set on the archive graphs as beginning and end time and to set time manually.

After setting time, click on the "Save in Excel Format" button; whereupon the archive for the specified interval will be saved on the PC.

5.10.5.4 Activate/Deactivate Quality Areas

Clicking on this button allows to display or not to display the background color of the display area depending on the reliability of the received data:

- Red - no quality (the data is unreliable);
- Yellow - marked data (as per GOST 32144-2013);
- Blue - no data;
- Gray - the current archive file is not closed.

5.10.5.5 Activate/Deactivate Displaying Selected Points

Clicking on the button activates/deactivates selection of points on the displayed graphs.

5.10.5.6 Align by Maximum/Minimum

Clicking on the button auto scales all graphs by value.

5.10.5.7 Moving to the end of the graph and auto scrolling activation

After clicking on this button, the time scale moves to the end of the interval displayed on the graph, and the automatic time scrolling mode is activated when new data are received (for the "Trend" mode).

5.10.6 Graphs display Configurations Management

After clicking on button 1 (Fig. 5.21), the configuration setting menu becomes accessible

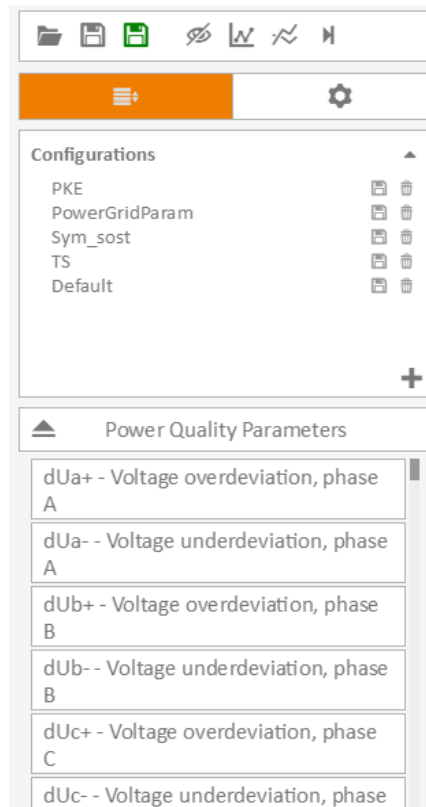


Fig. 5.21 - Graphs display Configuration Setting

1) Opening a Configuration

The parameters of a saved configuration are loaded by left-clicking on the respective configuration.

2) Saving Configuration Parameters

A new configuration is added by clicking on the "+" button; whereupon the current display parameters will be recorded in the newly created configuration.

Saving current display parameters in an existing configuration is performed by clicking on the "Save" button opposite the respective configuration.

3) Selection of Parameters for display

The field of selection of parameters displayed on the graph is located under the list of saved configurations. The parameters that are already displayed on the graph are colored.

5.10.7. Display Mode

Accessible display setting parameters are opened after clicking on 1 button (Fig. 5.22).

It is possible to select the following graphs display modes:

- "Trend" mode;
- "Request" mode.

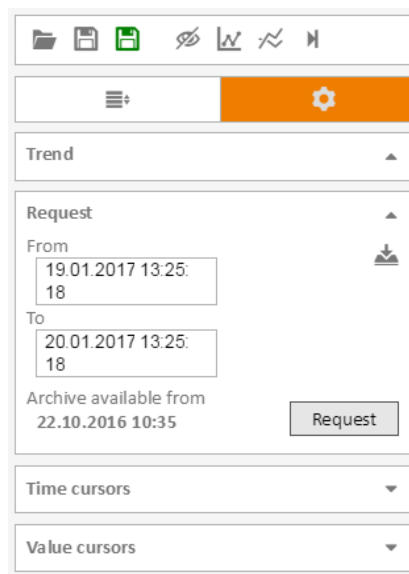


Fig. 5.22 - Display Mode Setting

5.10.7.1 "Trend" Display Mode

When selecting the "Trend" display mode, it is necessary to set the depth to which graphs will be displayed and click on the "Require" button.

In the "Trend" mode, graphs will be updated automatically in real time mode.

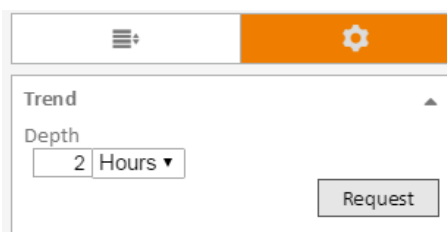


Fig. 5.23 - "Trend" Mode Setting

5.10.7.2 "Request" Display Mode

When selecting the "Request" display mode, it is necessary to set the depth to which graphs will be displayed and click on the "Require" button.

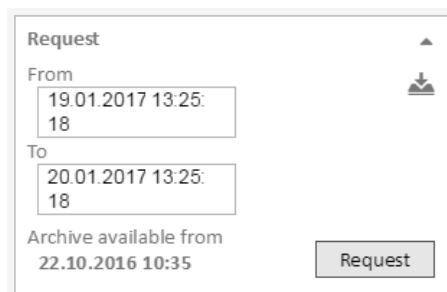


Fig. 5.24 - "Request" Mode Setting

5.10.7.3 Cursors

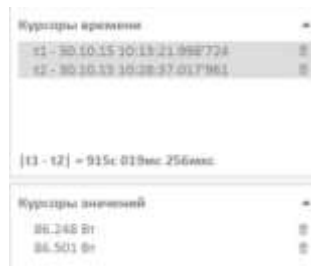


Fig. 5.25 Cursors

The time cursors and value cursors set on the graphs are displayed. To remove a cursor, click on the "Remove" button to the right of the respective cursor.

When two time cursors are selected in the bottom part of the field, time difference between those cursors will be counted automatically.

5.11 Waveform recorder

The waveform recorder - "Oscillograph" application is intended for recording ADC readings by current and voltage channels and DB events generated since the start moment to the depth known as the waveform length. The prehistory containing data before the start moment is saved as well.

5.11.1 Files Structure

Waveform is written to files on a storage media (SD, FTP). One waveform record consists of four files:

- an XML format files (*.osc extension) containing the waveform headline and the system status cross-section as of the moment of start;
- a DB cells events file (*.bd extension) may be absent if the respective output channel is not configured;
- a binary file (*.bin extension) containing ADC data;
- a binary file (*.tm extension) containing information about time settings.

5.10.2 General Appearance of the Application

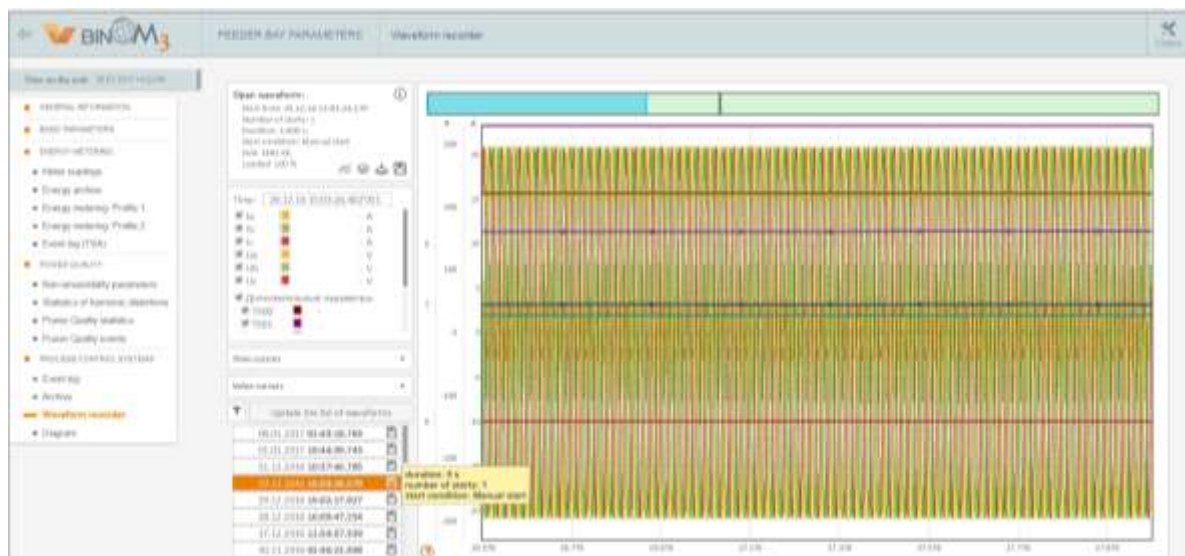


Fig. 5.33 - General Appearance of the "Waveform recorder" Application

The application consists of the following components:

- 1 – display settings area;
- 2 – graphs display area.

The list of accessible waveform is displayed under the display settings panel. To open an waveform you need, left-click on it.

5.11.3 Graphs Display Area

Data are recorded from 6 ADC channels for each waveform; DB cells events are recorded optionally as well. The DB output channel with start conditions and the output channel for the data requiring waveform are set in the parameterization file. All waveform graphs have a common time axis (abscissa axis), there may be several value axes (ordinate axes) depending on the displayed parameters measurement units.

1) Axial Graph Shifting

For axial graph shifting, it is necessary to point the cursor to the graphs display area (if it is necessary to scroll all graphs) or the needed axis (if a single parameter must be scrolled), press and hold the left mouse button and scroll (shift) graphs by moving the mouse.

2) Graph Scaling

For axial graph scaling, it is necessary to point the mouse cursor to an axis and to perform scaling by turning the mouse scroll wheel. Time scaling may be performed by turning the mouse scroll wheel at any graph area.

3) Cursors

When the mouse cursor is pointed to a graph point, a pop-up tip appears with the parameter name, its value and quality at the selected point. For displaying all the graph parameters at the time moment at which the main cursor is located it is necessary to press and hold the right mouse button.

Besides the main cursor, the user can create additional time and value cursors. For that, the user must left click on the time axis or on the values axis (for the values axis, the cursor is pointed with the Ctrl key pressed and held).

Added cursors are displayed on graphs as black dashed lines.

Graph values in respect of the cursor setting time are displayed in the display settings panel ("Cursors" tab).

Moving the mouse over the graphs display area is always accompanied by moving the main cursor along the time axis.

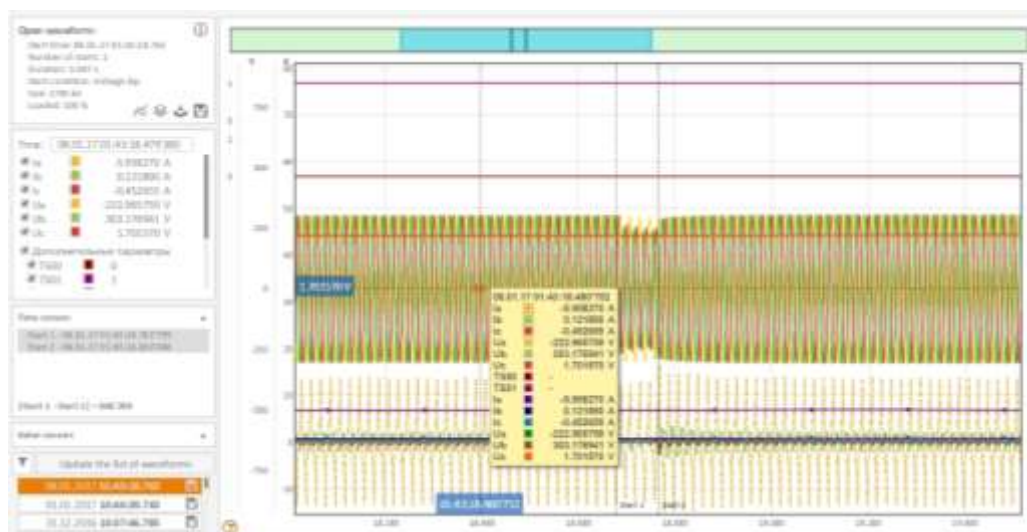


Fig. 5.34 - Cursors

In case waveform start conditions arise, an additional fixed cursor bearing the mark "Start" and the sequential number of the start will be installed automatically (Fig. 5.35).

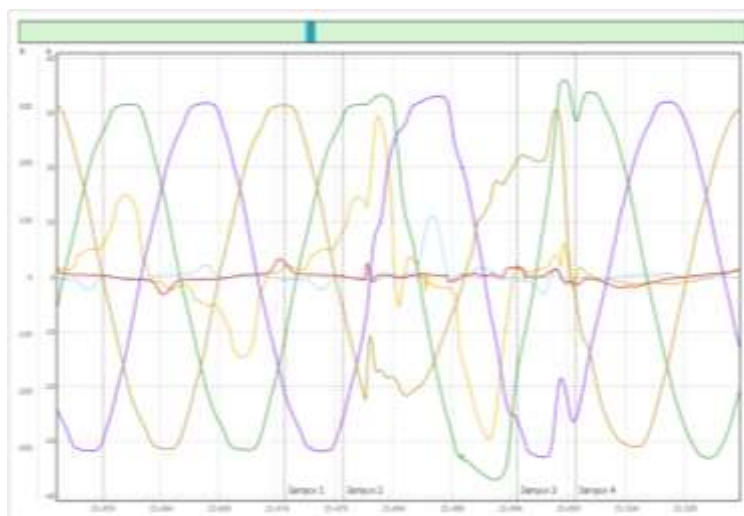


Fig. 5.35 - "Start" Cursor

4) Waveform Navigation Panel

The oscillogram navigation panel is located directly above the oscillogram graph.



Fig. 5.36 Oscillogram Navigation Panel

The following elements are present on this panel:

- the green background area indicates the oscillogram loading degree (when the oscillogram is loaded);
- the blue area shows which part of the oscillogram is displayed on the screen at present;
- gray vertical lines - the time of recording oscillogram starting conditions;

When the blue area is moved to the right/left by pressing and holding the left mouse button, the displayed part of the oscillogram is moved along the time axis.

5.11.4 Display Settings Panel

The panel includes the following elements:

- opened waveform processing panel;
- display legend;
- cursors;

5.11.4.1 Opened Waveform Processing Panel

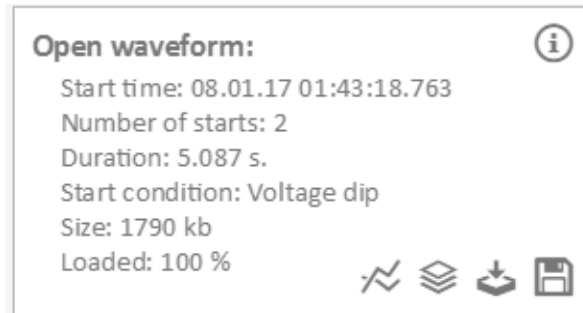


Fig. 5.37 Opened Oscillogram Processing Panel

The following information is displayed on the panel:

- 1) Waveform start time;
- 2) The number of starts recorded in the loaded waveform;
- 3) Duration of waveform;
- 4) The condition on which the waveform was started for the first time. Such conditions may be as follows:
 - a) Start on RS operation(TS00...TS15);
 - b) Start on detection of a voltage dip, overvoltage, voltage interruption detection;
 - c) Start on deviation of the monitored parameter from the preset limits (record type: [NameParam] (event) & [NameParam] \geq or \leq [NameParam value], where NameParam is the monitor parameter name);
 - d) Manual start:
 - Loaded waveform size;
 - Extent of waveform loading from the device.

After clicking on the "i" button in the top right corner of the panel, an additional information window will open. That window contains the following data:

- 5) Prehistory and after start history lengths;
- 6) List of all waveform starts specifying the times of their generation.

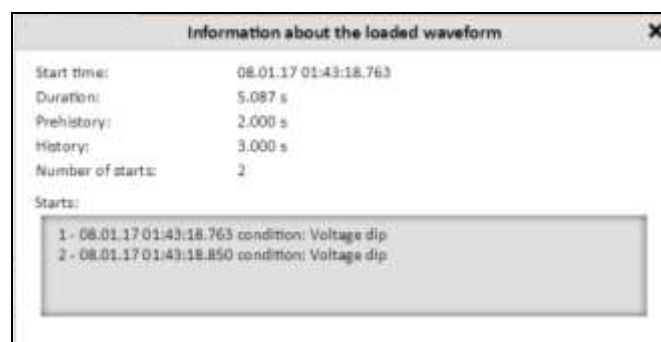


Fig. 5.38 Information about the Loaded Oscillogram

The following functional buttons are accessible in the bottom part of the panel:



Fig. 5.39 - Function Buttons

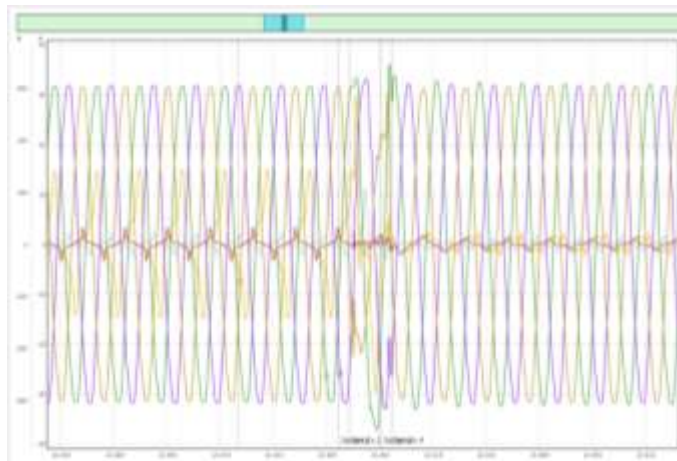


Fig. 5.40 - Graphs Plotted on a Common Zero

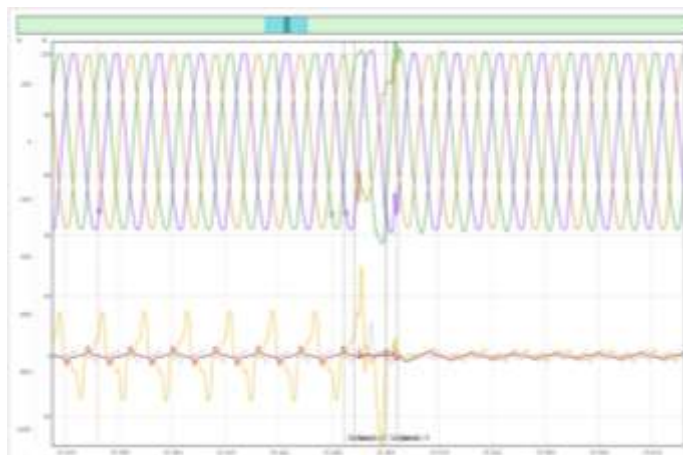


Fig. 5.41 - Graphs with Spaced Zeros

- Plot Graphs with a Common Zero;
- Plot Graphs with Spaced Zeros;
- Write Waveform (Manual Start);
- Save Waveform.

Fig. 5.42 - Waveform Saving

After clicking on the "Save" button, an oscillogram saving parameters window is opened. Oscillogram writing start and end times are loaded in the window by default. If need be, it is possible to use additional cursors set on the oscillogram graphs as beginning and end times and to set time manually.

There are two options of saving an oscillogram on the PC:

- 1) Saving in the Comtrade format (IEEE Std C37.111-1999);

2) Saving in the Excel format.

5.11.4.2 Display Legend

The display legend area presents data about the names and line colors of all the displayed graphs, as well as the value of each graph corresponding to the time specified on the main cursor.



Fig. 5.43 - Legend

The time corresponding to the main cursor is shown in the top part of the tab.

The graphs with removed flags opposite their names are not displayed.

6 Reports

Upon entry to the "Reports" section, a page is loaded displaying the list of report templates implemented in the meter at the left of the screen.

To start forming a report, left-click on the report name.

6.1 Electric Energy Quality Indicators Test Report

The content of this report is as per the recommendations of GOST 33073-2014.

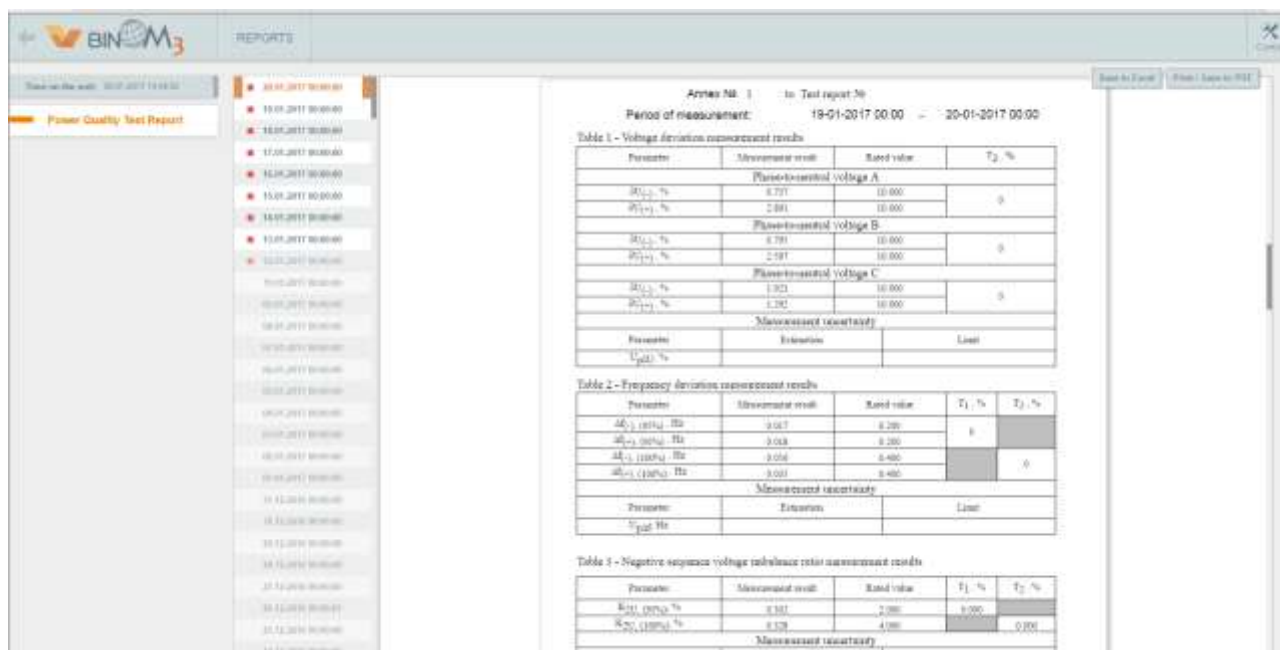


Fig. 5.48 "Electric Energy Quality Indicators Test Report" Report

6.1.1 Choice of Analysis Interval

The list of analysis intervals accessible for viewing is displayed to the left of the report. The latest completed analysis interval is loaded by default. A red square opposite the analysis interval means inconformity of the electric energy quality parameters to their standard values in this analysis interval.

6.1.2 Saving a Report to the Computer

For saving the loaded report in the Excel format, click on the "Save in Excel" button. The file will be saved in the «*.xml» format in the "Downloads" folder. It may be opened by MS Excel facilities.

For printing out the loaded file and for saving it in the *pdf format (Print to a File), click the "Save PDF/Print" button.

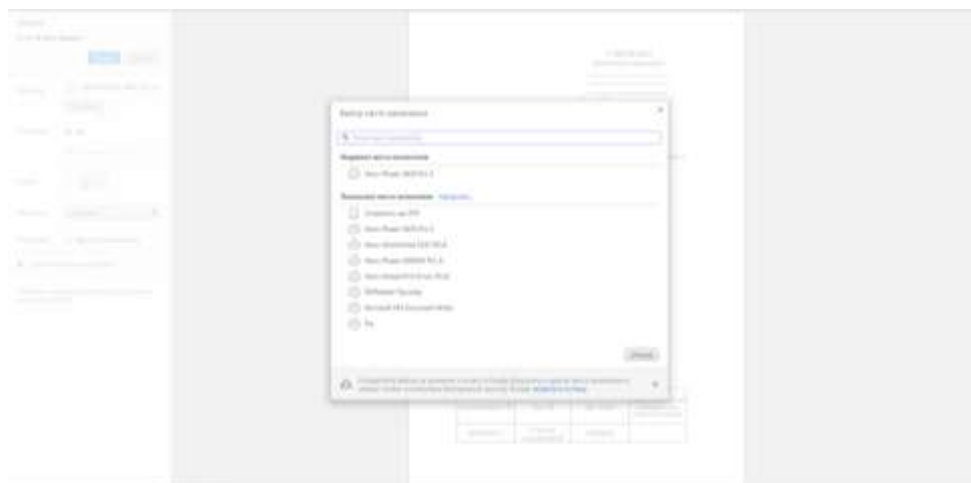


Fig. 5.49 Selection of Report File Print Option

Select the printer type in the opened dialog box:

- 1) For hardcopy printing - specify the printer connected to the PC;
- 2) For saving the report in a «*.pdf» file - select the "Save as PDF" item.