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Vibrobit Web.Net.Monitoring

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This Manual describes structure, operating principle, basic concepts and interface of “Vibrobit Web.Net.Monitoring” software, and also determines conditions, necessary for the software effective operation and specifies sequence of operator actions at program start-up and execution.

The “Operator Manual” document was executed according to the USPD (Unified System for Program Documentation) requirements (GOST 19.101-77[1], GOST 19.103-77[2], GOST 19.104-78[3], GOST 19.105-78[4], GOST 19.106-78[5], GOST 19.505-79[6], GOST 19.604-78[7]).

Authors and developers:

Ivashchenko V.E.
Kharin R.A.
Orlov A.P.
Bystrov K.A.
Volkov G.A.
Nalivaiko G.G.

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1 GOST 19.103-77 USPD. Types of programs and program documents

2 GOST 19.103-77 USPD. Designation of programs and program documents

3 GOST 19.104-78 USPD. Basic inscriptions

4 GOST 19.105-78 USPD. General requirements for program documents

5 GOST 19.106-78 USPD. General requirements for printed program documents

6 GOST 19.505-79 USPD. Operator Manual Requirements for contend and execution

7 GOST 19.604-78 USPD. Printed program documents amendment rules

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List of notation conventions

OPC – OLE for Process Control
AW – automated workstation.
CVMS – Condition and Vibration Monitoring Systems.
APCS – Automatic Process Control System.
ISVM – Integrated System of Vibration Monitoring.
SW – software.

Definitions

JavaScript — object-oriented scripting programming language. JavaScript is usually used as a built-in language for programming access to application objects. It is extensively used in browsers as a scripting language to confer interactivity to web-pages.

Modbus — communication protocol based on “client-server” architecture. It is widely used in industrial sector to arrange communication between two electronic devices. It can transmit data via serial communication lines RS-485, RS-422, RS-232, and also TCP/IP networks (Modbus TCP).

OPC (also **OLE for Process Control**) — software technologies family, providing unified interface to control automation objects and technological processes.

OPC DA (Data Access) – main and most popular standard. Describes data exchange functions set in real-time with PLC (programmable logic controller), DCS (distributed control system), HCI (human-computer interface), NC (numerical control) and other devices.

PDF (**Portable Document Format**) — cross-platform format of electronic documents, created by Adobe Systems company using some capabilities of PostScript language. In the first place it is intended to present printed products in electronic format – a substantial number of modern professional printing equipment can directly process PDF. As a viewer can be used Adobe Reader free program, and also programs of 3-rd party developers.

RS-485 – data transfer standard over double-wire semiduplex multipoint serial communication channel. RS-485 standard often uses single wire twisted pair to transfer and receive data. Data are transferred using differential signals. Voltage difference between one polarity conductors means logical one, difference of another polarity – zero.

ZIP — popular format of data compressing and files archiving. File in this format usually have .zip extension and stores one or several files in compressed or uncompressed form, which can be extracted from it by unpacking using special program.

APCS (Automatic Process Control System) – complex solution, providing automation of main technological processes at production site as a whole or at its any part, manufacturing relatively complete product. Term automated instead of term automatic emphasizes possibility of human participation in specific operations, both to retain human control over process and due to complexity and impracticality of specific operations automation.

CVMS (Condition and Vibration Monitoring Systems) – complex solution for continuous fixed measurement, control, monitoring, mechanical status parameters of steam and gas turbines, turbocompressors, centrifugal pumps and other bearing-mounted machines during their operation.

Media converter – is a device converting signal propagation medium from one type to another. Signal propagation medium typically is copper wires and optical cables. Aerial environment is also called signal propagation medium, although it is not, because air is not directly involved in high frequency electromagnetic waves signal propagation.

Firewall – hardware or software system, controlling and filtering network packets passing through it on OSI model different levels according to the established rules.

Firewall main purpose is to protect computer networks or separate nods from unauthorized access. Firewalls are also often called filters, because their main purpose – to block (filter) packets not compliant with criteria established in configuration.

Data Base Management System (DBMS) – complex of programming and linguistic means of general and special purpose to control data base creation and application.

Trend (tendency) – general tendency at differently directed movement, apparent general parameters change direction of any time series. Actual graph type is established basing on time series data graphic indication by averaging series dynamics parameters, basing on statistical testing of hypothesis on graph parameters consistency. Trend in industrial automation – event log containing time value and programmable logic controller every input and output value at that moment. Graph plotted according to these values allows for accessing technological process dynamics.

Japanese candlesticks – interval graph type and technical indicator, method to present parameter movement for specific time period. Graph of “Japanese candlesticks” type is also called a combination of interval and linear graphs in the sense that its every element indicates parameter change range during specific time. “Candle” consists of black of white body and upper/lower shadow (sometimes called wicking). Upper and lower shadow limits indicate parameter minimum and maximum value fr the corresponding period. Body limits indicate parameter value at opening and closing.

1 Software purpose

Software (hereinafter SW) “Vibrobit Web.Net.Monitoring” is an upper level software of Condition and Vibration Monitoring Systems (hereinafter CVMS), based on web-technologies.

“Vibrobit Web.Net.Monitoring” software has multilevel distributed architecture of client-server type, enabling “Vibrobit Web.Net.Monitoring” equally efficient application both in small projects using only one server, and in large ones, with task distribution for several servers.

“Vibrobit Web.Net.Monitoring” software provides Internet network remote users with access to any unit status in company network, particularly enables the following:

- continuous information reading from measurement equipment;
- data reception via standard digital communication protocols from CVMS, APCS systems;
- received data primary processing;
- saving data in data base with saving period from 0.5 seconds;
- information visualization on work stations of serviced units and work stations of remote users connected to Internet network using web-browser (Chrome, Internet Explorer, Firefox, Opera, Safari);
- forecasting of specified parameter values level reaching;
- measurement results and events archiving;
- automatic detection of emerging defects (option);
- balancing works carrying out (option);
- sending measurement results to APCS using digital communication protocols.

SW present information on the following parameters:

- bearing supports vibration;
- shaft vibration displacement;
- shaft speed;
- shaft axial shifts;
- relative rotor expansion;
- cylinder absolute expansion;
- shaft deformation;
- linear displacement of mechanisms;
- cylinder “seats” slope;
- operational parameters (temperature, pressure, power, current and voltage, tank filling levels and other process parameters).

“Vibrobit Web.Net.Monitoring” software can operate with equipment “Vibrobit” and any other CVMS and APCS, supporting the following protocols: OPC DA, Modbus RTU, Modbus TCP, IEC 60870-5-104, DCON, SNMP, SSH.

2 Software and hardware requirements

2.1 Hardware requirements

2.1.1 Hardware server part requirements

“Vibrobit Web.Net.Monitoring” SW specified minimum and recommended requirements to hardware server part are given in Table 1.

Table 1. Hardware server part requirements

Requirements	Processor	RAM	HDD	Additional parameters
Minimum	32-bit (x86)	2 Gb	40 Gb	USB, RS-485, Ethernet 100 Mbit/sec
	64-Bit (x64) dual core processor with clock frequency 1.2 GHz	4 Gb		
Recommended	64-Bit (x64) quad-core processor with clock frequency 3 GHz	8 Gb	1 Tb	USB, RS-485, RAID-controller, Ethernet 1 Gbit/sec

2.1.2 Hardware client part requirements

“Vibrobit Web.Net.Monitoring” SW specified minimum and recommended requirements to hardware client part are given in Table 2.

Table 2. Hardware client part requirements

Requirements	Processor	RAM	HDD	Additional parameters
Minimum	32-bit (x86)	1 Gb	20 Gb	Ethernet 100 Mbit/sec
	64-Bit (x64) dual core processor with clock frequency 1.2 GHz	2 Gb		
Recommended	64-Bit (x64) dual core processor with clock frequency 2 GHz	4 Gb	120 Gb	printer, Ethernet 1 Gbit/sec

2.2 Software requirements

2.2.1 Software server part requirements

“Vibrobit Web.Net.Monitoring” SW specified minimum and recommended requirements to software server part are given in Table 3.

Table 3. Software server part requirements

Operating system	Additional SW
Windows XP Professional	Net. Framework 3.5, Net. Framework 4
Windows 7 Professional (32, 64-bit) Windows Server 2012 R2 Standard Edition	Net. Framework 3.5, Net. Framework 4.51

2.2.2 Software client part requirements

Computer with web-browser is necessary to connect to system.

Operating system type is of no importance.

Browser main requirements:

- graphics mode;
- JavaScript support.

3 Software content

“Vibrobit Web.Net.Monitoring” SW visualizes measurement data and presents measurement means using web-technologies.

consists of the following parts:

- data acquisition and processing service WNMServer;
- WNM Database;
- data visualization web-application WNM Website;
- data base configuration editing utility DatabaseEditor;
- data acquisition and analysis service configuration editing utility Server.Configurator;
- data acquisition and analysis service work-in-progress viewing utility Server.Monitor.

3.1 WNMServer service

WNMServer service functions depends on set of configured roles. Roles are configured depending on technical specification requirements and “Web.Net.Monitoring” system topology. There is a prescribed list of role types, which combination and configuration instances perform a specified task. WNMServer service is installed on data acquisition and analysis server.

WNMServer main functions:

- instrumentation “Vibrobit 300” control modules data acquisition;
- reading data from CVMS systems and APCS unit;
- keeping measurement results archive;
- keeping event log;
- interaction with APCS (sending/receiving measurement results);
- interaction with other WNMServer service instances;
- interaction with data visualization web-application;
- executing different diagnostic algorithms;

3.2 WNM Database

Created for each monitoring object is separate data base storing data acquisition configuration, measurement results archive and event log. It is possible to join several monitoring objects into one logic group and serve it by one data base.

Data bases are created on data base server.

3.3 Data visualization web-application WNM Website

Web-application is arranged at web-server. Operates under IIS control. Presented to system users as a site, which address is determined by customer.

Web-application main functions:

- information visualization on work stations of serviced unit and work stations of remote users connected to Internet network using web-browser ;
- plotting parameter trends;
- plotting orbits;
- indicating measurement channels signals;
- indicating measurement channels signals spectra;
- Nyquist plot plotting

- viewing event logs.

3.4 Data base configuration editing utility DatabaseEditor

Data base configuration editing utility DatabaseEditor enables editing the following information set, necessary to arrange data acquisition:

- connection types and parameters;
- measurement modules types and instances;
- acquisition parameters;
- recorded events;
- parameter hierarchy setup.

3.5 Data acquisition and analysis service configuration editing utility Server.Configurator

Data acquisition and analysis service configuration editing utility executes the following functions:

- viewing service current configuration;
- adding/editing role instances;
- editing role instances setup.

3.6 Data acquisition and analysis service work-in-progress viewing utility Server.Monitor.

Data acquisition and analysis service work-in-progress viewing utility provides the following information on service operation:

- list of active roles;
- service querying statistics;
- measurement results acquisition status;
- data acquirer operation statistics;
- signal spectra reading status;
- and other information on active roles operation.

4 Software execution

4.1 System login sequence

To login into “Vibrobit Web.Net.Monitoring” SW proceed as follows:

- launch Internet browser;
- input web-application address into address line;
- after monitoring system login page opening, input login[8], password and press “Enter” button (Ref. Fig.1).

In case of repeated login during 15 minutes after “Vibrobit Web.Net.Monitoring” system last visit, then it is not necessary to repeatedly input login and password: system will automatically switch to section “Monitoring” on front page.

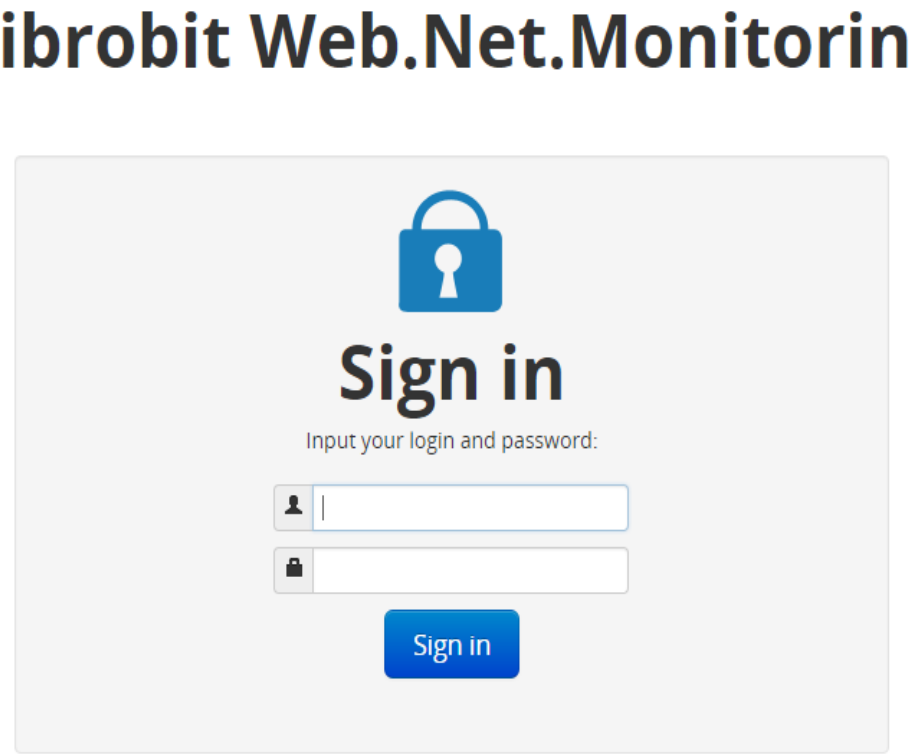


Figure 1 – Front page. Monitoring system login

4.2 Monitoring

4.2.1 General

Monitoring – section where presented is current information on vibration, mechanical and other unit parameters as a mnemonic diagram, table or in graphic form.

System provides two monitoring levels:

- on system front page by all units;
- in specific unit section by this unit.

If there is one unit, front page is absent.

8 Refer to administrator for login and password.

4.2.2 Front page

Front page indicates summary information on units, for example:

- unit general status;
- operating mode;
- maximum vibration;
- maximum temperature;
- number of event alarms;
- number of diagnostic alarms.

Number of output parameters varies according to the project.

Active units images on system front page mnemonic diagram are emphasized with color, inactive – gray color. Upon controlled parameter setpoints overrange it is emphasized with color:

- blue - prepare setpoint;
- yellow - warning setpoint;
- red - alarm setpoint.

4.2.3 Unit monitoring

4.2.3.1 General

“Monitoring” section includes several subsections available via drop-down menu “Monitoring”.

Parameters, which values are in permissible range, are indicated on white background. If parameter background is red and there are dashes instead of value – no module response (Ref. Fig. 2).

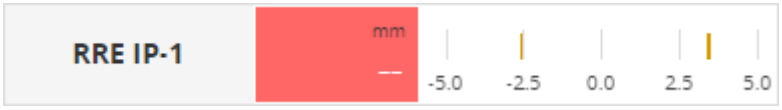


Figure 2 – Electrical signal levels control

Setpoints can be established for every parameter. Maximum number of displayed setpoints – 4. Setpoints can be of several types: prepare, warning and alarm.

Active prepare setpoints are indicated with blue, warning are indicated with yellow, alarm – with red color (Ref. Fig. 3, 4).

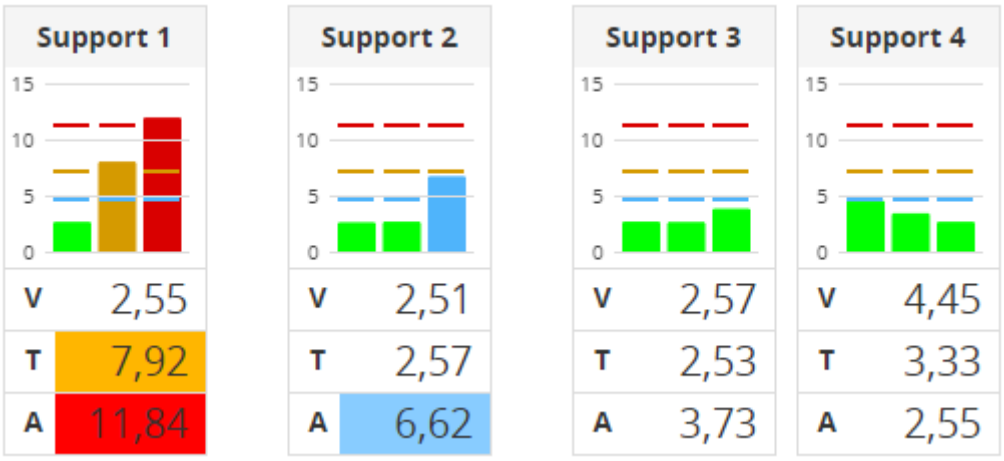


Figure 3 – Setpoints actuation indication on mnemonic diagram

	01	02	03	04	05	06
V	2,56	2,56	2,60	4,51	2,53	2,55
T	7,86	2,50	2,53	3,35	2,61	2,56
A	11,87	6,87	4,56	2,65	2,62	2,68

Figure 4 – Setpoints actuation indication as a table

Parameters are controlled by electrical signal levels for their authenticity (Ref. Fig. 5). If electrical signal level exceeds upper or lower electric range, then red arrow starts blinking near parameter value, upward when exceeding upper range, downward – when exceeding lower one.



Figure 5 – Electrical signal levels control

A panel with main parameters can be arranged in every subsection. Content of these parameters doesn’t change when switching between section windows (Ref. Fig. 6).

Number and content of section subsections and their functional purpose are determined by customer technical specification and in different projects may vary from specified in this Manual.

All system-controlled parameters are refreshed periodically. Refresh period is set up in user settings (Ref. p. 4.8). When pressing parameter (e.g. power) pop-up window appears (mini-graph) where parameter change can be observed for the specified time period (Ref. Fig. 7). Mini-graph automatically refreshes and shifts along time axis. Mini-graph is provided with cursors to precisely determine point of interest value on the graph.

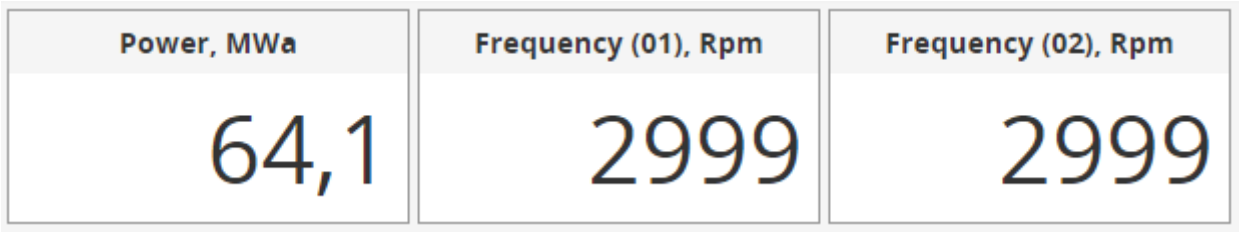


Figure 6 – Main parameters panel

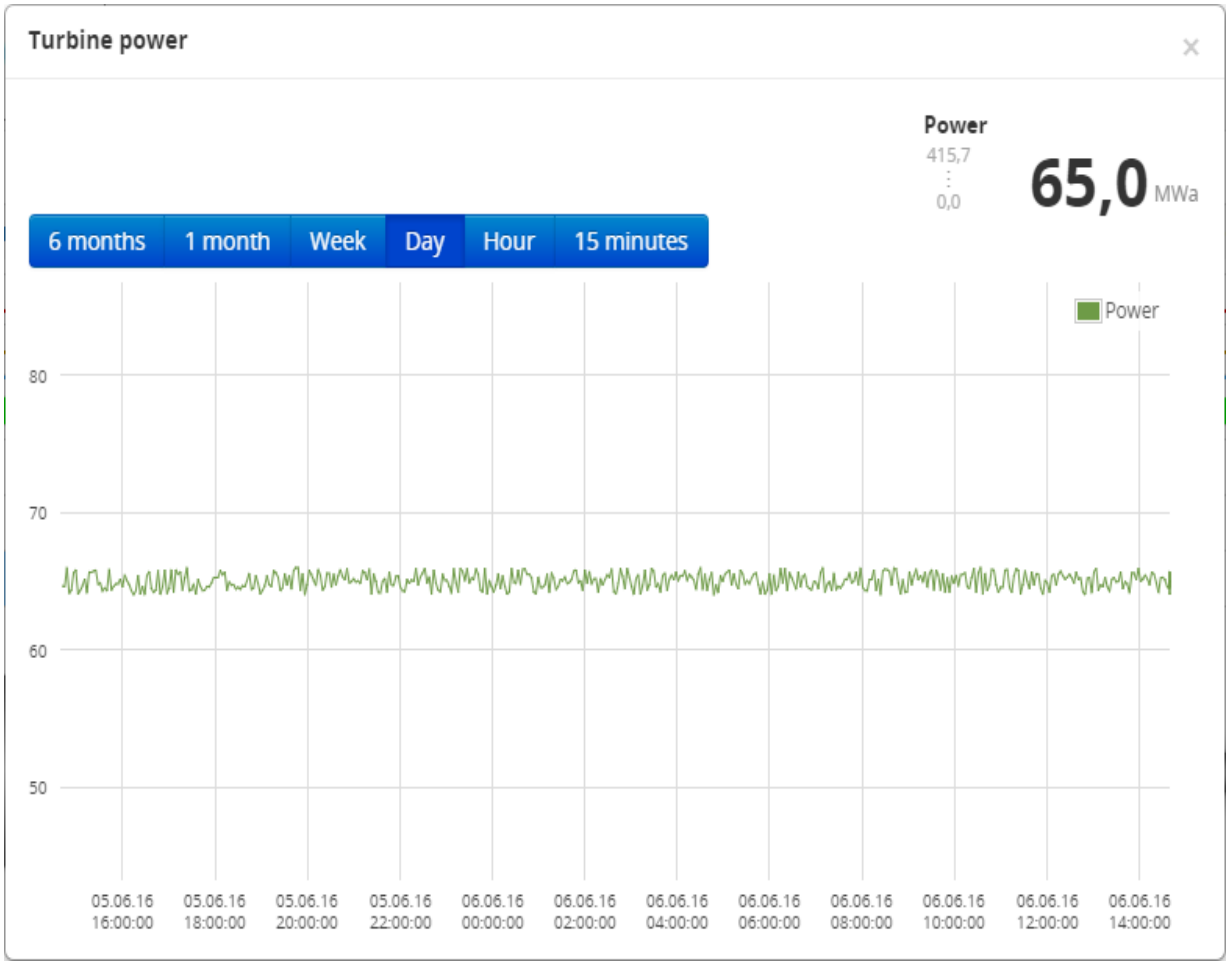


Figure 7 – Power change mini-graph per week

“Monitoring” section lower part indicates section control elements (Ref. Fig.8, 10). Section control elements are intended to setup previously saved parameter sets indication on mini-graph and control monitoring results retro-mode. Date and time of these measurements last reading are also displayed here.

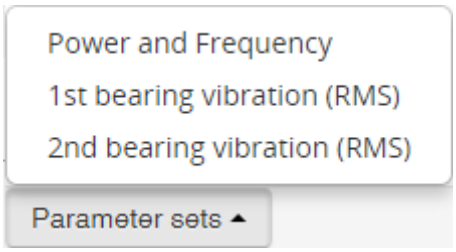


Figure 8 – Selecting parameter set for mini-graph

List of parameter sets is setup in “Trends” section (Ref. p. 4.3). When pressing a set displayed is mini-graph of selected parameter set (Ref. Fig 9).

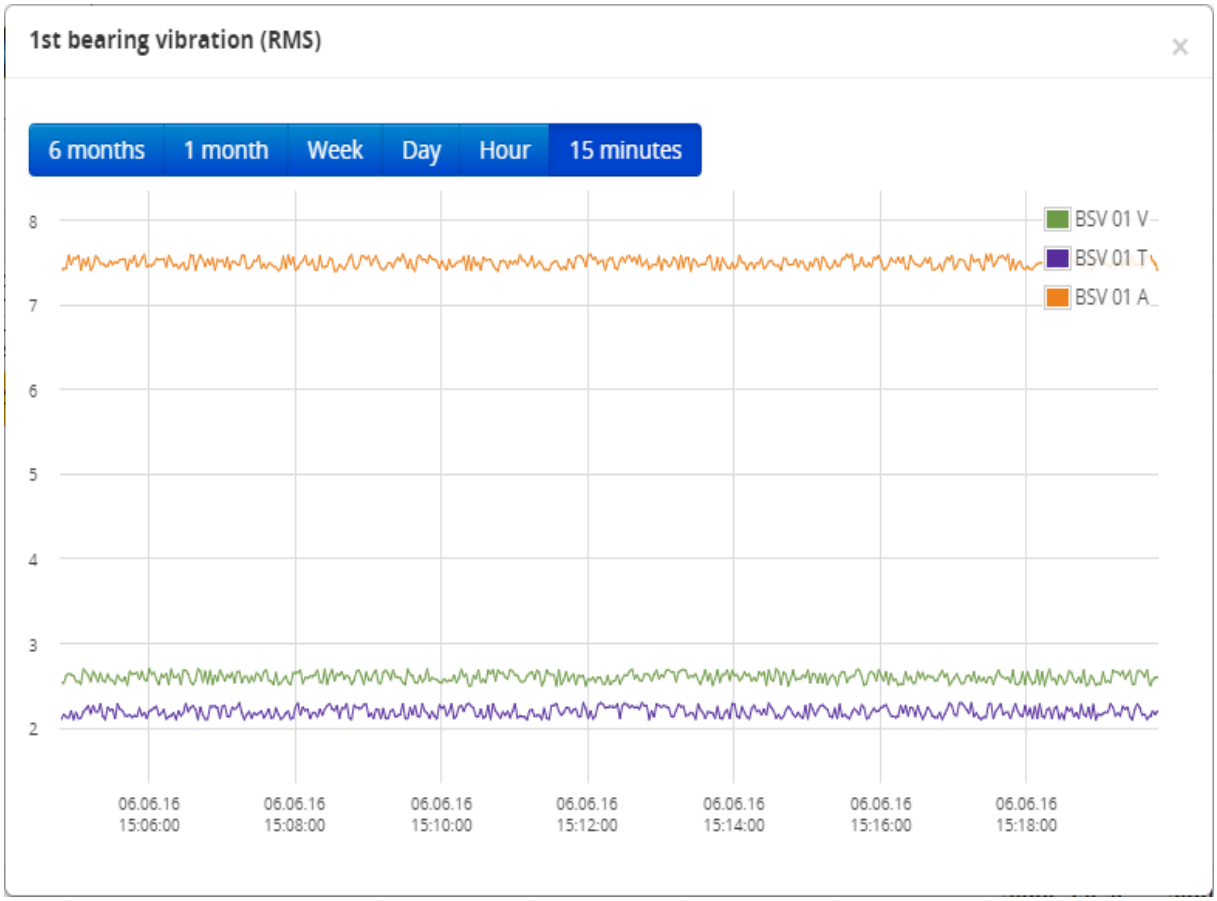


Figure 9 – Mini-graph of parameter set

“Retro-mode” by default is in “Current data indication” mode (Ref. Fig. 10). To view archive data press “Pause” button (Ref. Fig. 11) and use calendar to select necessary date and then press “Archive” button. In “Archive data indication” mode the parameter values are displayed in blue color. Use control buttons (Ref. Fig. 12) to change archive data viewing speed, stop and exit this mode.

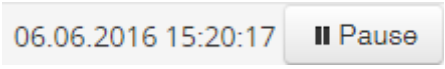


Figure 10 – “Current data indication” mode

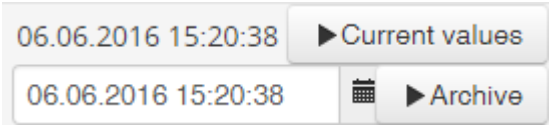


Figure 11 – “Pause” mode



Figure 12 – “Archive parameters indication” mode

4.2.3.2 Mnemonic diagrams

This subsection displays unit general view on a mnemonic diagram and in sensors arrangement place indicated are monitored parameters (Ref. Fig. 13).

A system can have several subsections with mnemonic diagrams, e.g. mnemonic diagram for RMS and mnemonic diagram for LF vibration. Number of displayed mnemonic diagrams is determined during project development stage.

Current data on mnemonic diagram are shows as vertical histograms and horizontal illuminating lines.

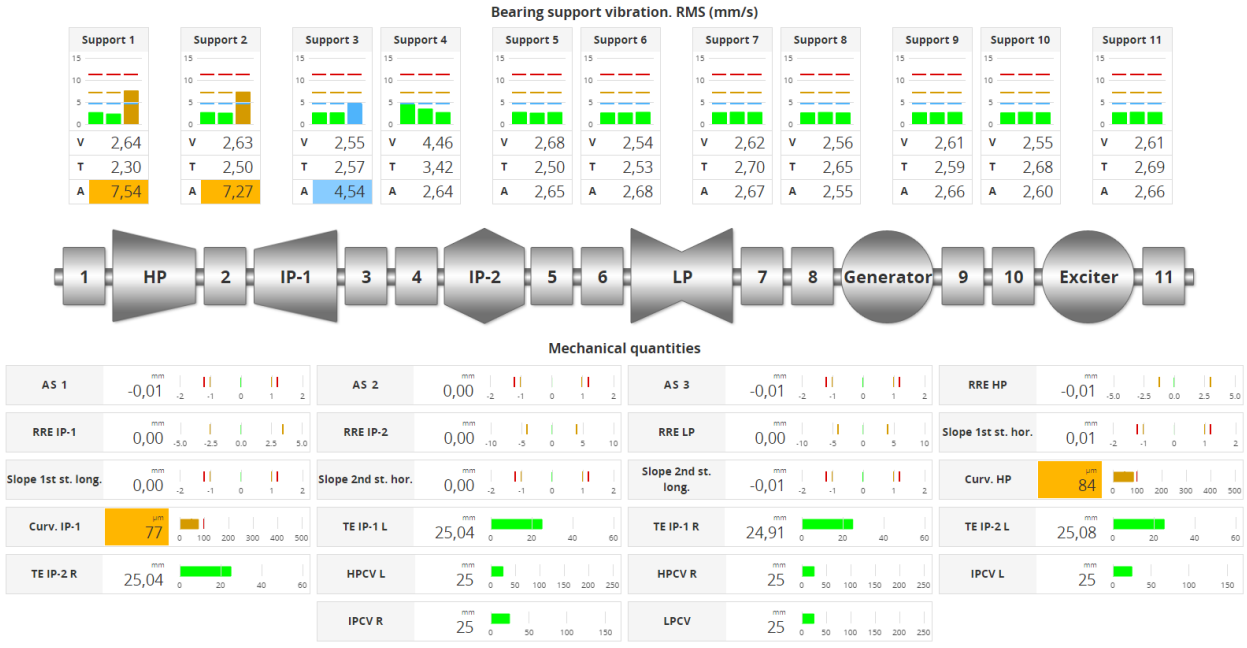


Figure 13 – Turbine generator parameters monitoring mnemonic diagram

4.2.3.3 Table view

This section presents information on monitored parameters as a table (Ref. Fig. 14).

Bearing support vibration. RMS (mm/s)

	01	02	03	04	05	06	07	08	09	10	11
V	2,69	2,59	2,69	4,54	2,66	2,56	2,59	2,56	2,52	2,54	2,51
T	2,88	2,68	2,55	3,42	2,63	2,58	2,68	2,63	2,57	2,63	2,56
A	7,06	7,46	4,46	2,67	2,55	2,61	2,57	2,65	2,54	2,55	2,53

Figure 14 – Table view of vibration presentation

Mechanical quantities

AS 01, mm	AS 02, mm	AS 03, mm	RRE HP, mm	RRE IP-1, mm	RRE IP-2, mm	RRE LP, mm	Slope 1st st. hor., mm/m	Slope 1st st. long., mm/m	Slope 2nd st. hor., mm/m	Slope 2nd st. long., mm/m
0,00	0,00	-0,01	0,00	-0,01	0,00	0,01	0,00	0,00	0,00	0,00

Curv. HP, µm	Curv. IP-1, µm	TE HP, mm	TE IP-1 L, mm	TE IP-1 R, mm	TE IP-2 L, mm	TE IP-2 R, mm	HPCV L, mm	HPCV R, mm	IPCV L, mm	IPCV R, mm	LPCV, mm
78	66	25,05	24,95	24,93	24,95	25,03	25	25	25	25	25

Figure 15 – Table view of mechanical values presentation

4.2.3.4 Shaft or support vibration

This section presents detailed information on shaft or supports vibration as a table (Ref. Fig. 16).

		01	02	03	04	05	06
V	RMS velocity, mm/s	2,70	2,59	2,56	4,43	2,53	2,61
	LF velocity, mm/s	0,08	0,04	0,07	0,29	0,02	0,15
	HF velocity, mm/s	1,93	1,39	1,67	2,49	1,70	1,88
	RMS 1X velocity, mm/s	1,88	2,19	1,94	3,65	1,88	1,80
	Phase 1X velocity, °	132	251	194	268	231	115
	RMS 2X velocity, mm/s	1,25	0,30	0,90	0,66	0,40	1,22
	Phase 2X velocity, °	209	85	359	202	77	334
	PP 1X displacement, µm	17	20	17	33	17	16
	Phase 1X displacement, °	222	341	284	358	321	205
	PP 2X displacement, µm	6	1	4	3	2	5
	Phase 2X displacement, °	299	175	89	292	167	64

Figure 16 – Supports vibration

If project presents spectra acquisition by vibration and envelope spectra, they are also shown in this table (Ref. Fig. 17).

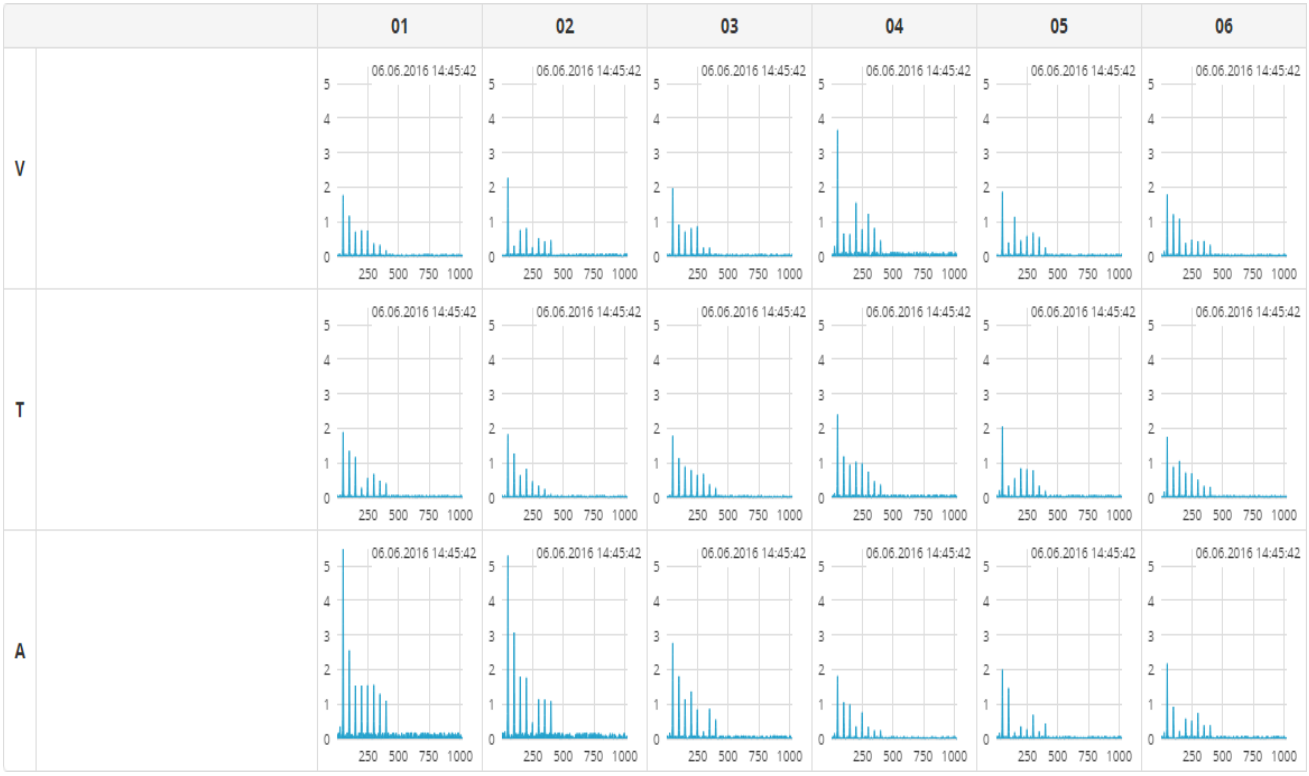


Figure 17 – Unit supports vibration spectra

Parameters displayed in table and spectra indication frequency range can be selected upon pressing button in upper left corner.

With hovering cursor over support spectrum n graph near absciss and ordinate axes, displayed in yellow boxes are values at cursor location area. When pressing support spectrum it will be open in new window (Ref. Fig. 18, 19).

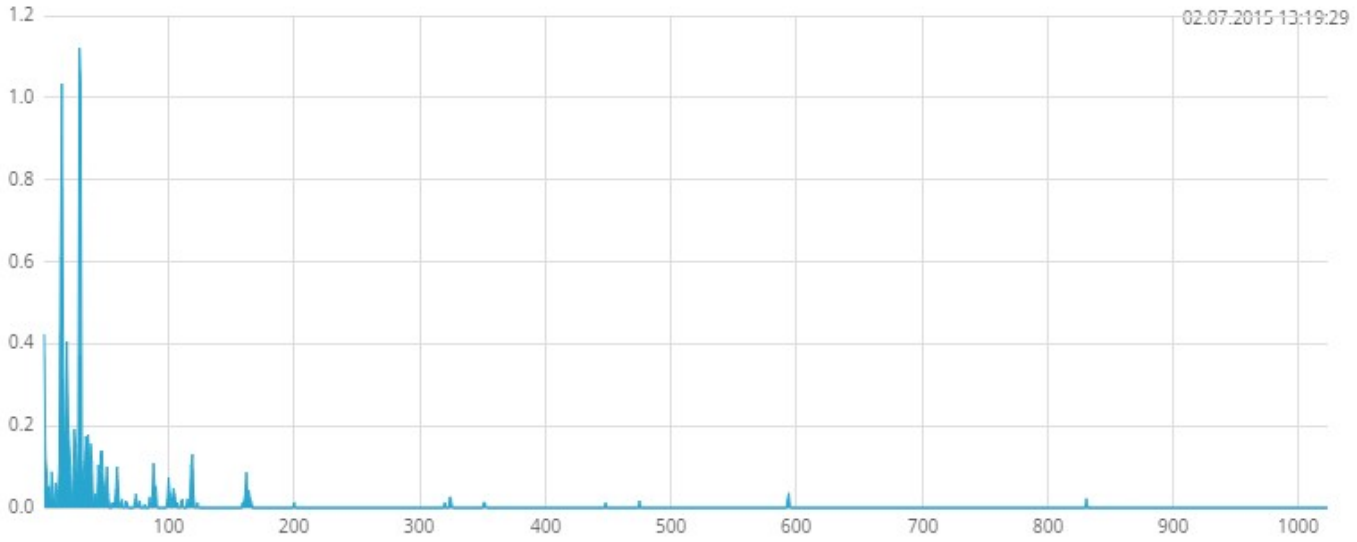


Figure 18 – Support vibration spectrum

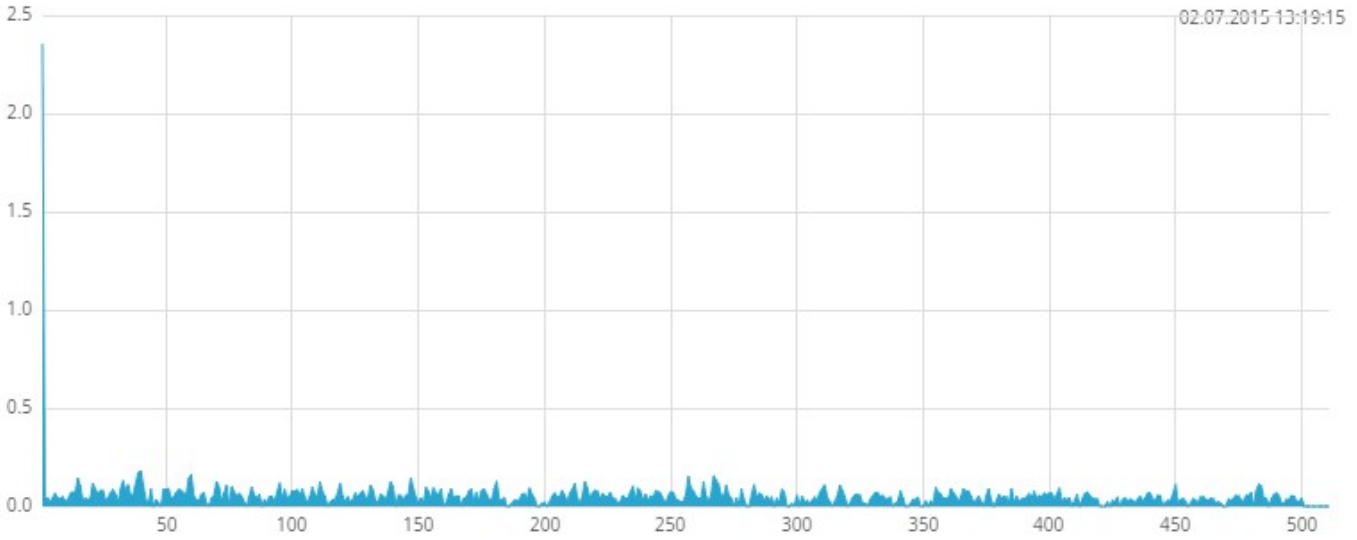


Figure 19 – Support envelope vibration spectrum

4.2.3.5 Support vibration harmonics

This subsection presents information in table view and as histograms by harmonic components (harmonics) of monitoring object shaft or support vibration in real-time mode (Ref. Fig. 20).

To select harmonics beyond the specified vibration amplitude, press button and use slider to specify necessary level. Necessary harmonic values in table will remain black and harmonics with lesser vibration amplitudes will become gray.

Harmonic support vibration. 1-6 supports, mm/s

	01			02			03			04			05			06		
	V	T	A	V	T	A	V	T	A	V	T	A	V	T	A	V	T	A
RMS	2,56	2,13	7,58	2,62	2,53	7,12	2,69	2,69	4,23	4,45	3,41	2,54	2,65	2,54	2,60	2,53	2,61	2,60
1/2	0,08	0,06	0,38	0,04	0,07	0,21	0,07	0,07	0,19	0,29	0,13	0,15	0,02	0,19	0,16	0,14	0,18	0,18
1	1,79	1,42	5,93	2,21	1,82	5,45	2,04	1,81	2,94	3,67	2,46	1,83	1,96	2,00	1,95	1,74	1,80	2,12
2	1,18	1,01	2,76	0,30	1,27	3,16	0,95	1,16	1,91	0,66	1,22	1,07	0,42	0,33	1,43	1,18	0,91	0,90
3	0,72	0,88	1,66	0,74	0,64	1,84	0,74	0,91	1,21	0,64	0,97	0,99	1,20	0,53	0,18	1,05	1,08	0,22
4	0,76	0,21	1,66	0,79	0,82	1,82	0,84	0,81	1,45	1,55	1,06	0,36	0,48	0,82	0,35	0,37	0,73	0,56
5	0,75	0,42	1,67	0,26	0,46	0,48	0,89	0,66	0,89	0,78	1,01	0,76	0,61	0,79	0,27	0,46	0,72	0,50
6	0,37	0,51	1,68	0,51	0,34	1,18	0,27	0,69	0,22	1,23	0,76	0,34	0,72	0,77	0,67	0,42	0,53	0,72
7	0,33	0,36	1,40	0,42	0,24	1,17	0,26	0,38	0,91	0,82	0,48	0,24	0,58	0,33	0,20	0,43	0,34	0,37
8	0,18	0,31	1,19	0,45	0,10	1,11	0,08	0,28	0,58	0,46	0,38	0,24	0,27	0,18	0,43	0,32	0,32	0,38
9	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

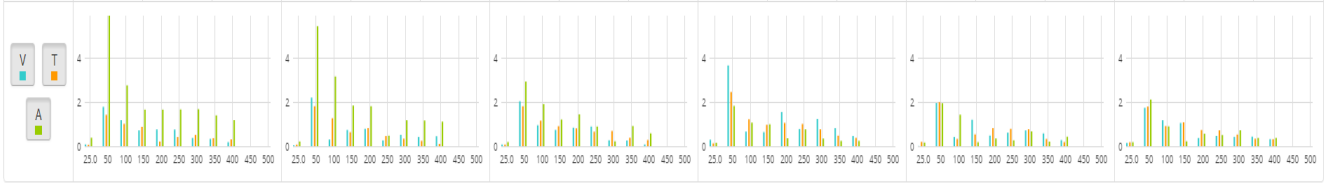


Figure 20 – Vibration harmonics

By default a system displays histograms by three harmonic components. To view histogram of one or several harmonic components disable indication of unnecessary components by pressing buttons of these components (Ref. Fig. 21). 

.

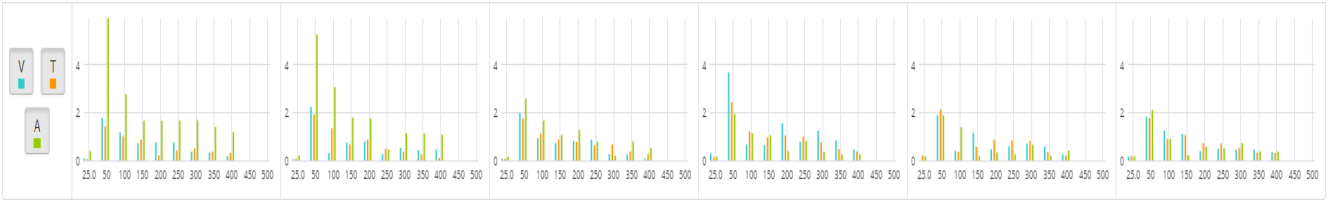


Figure 21 – Vertical component harmonics

When pressing indicated parameter value, new window will show mini-graph of this parameter for a specified time period.

4.3 Graphs

4.3.1 General

Graphs – section where a trend can be plotted of turbine-generator set any vibration or thermal-mechanical parameter specified by customer and also one parameter dependence on another.

Select menu item “Trends” to plot and view graphs. Arranged to the left in this section is control panel of graph plotting parameters (Ref. Fig. 22).

To plot trends proceed as follows:

- specify graph plotting time range by establishing starting and ending dates or select necessary operating modes;
- select parameters by which trends to be plotted from parameter set or create necessary parameter set.

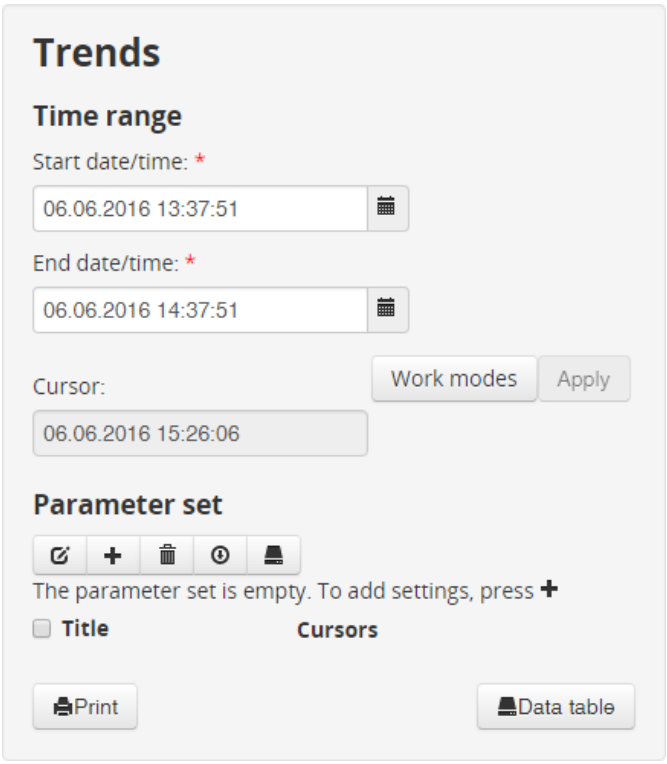


Figure 22 – Parameters control panel

4.3.2 Date setup

Date and time of parameter indication period can be established manually in input field or using calendar (Ref. Fig. 23) and time input element (Ref. Fig. 24). To switch between them press the corresponding symbol.

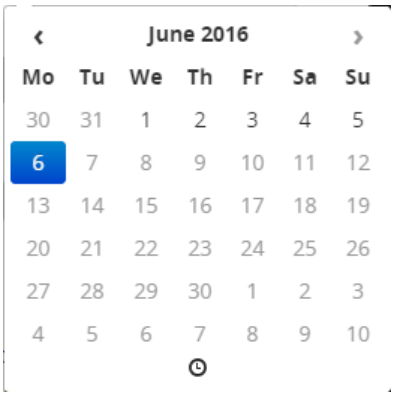


Figure 23 – Date setup using calendar



Figure 24 – Time setup using time input element

Input starting and ending date values are checked according to effective permissions (Ref. p. 4.7). Starting date should not be less than the oldest data base record. Ending date should not exceed the current date.

“Operating modes” button enables to select and view graphs of unit specific operating periods (Ref. Fig. 25)

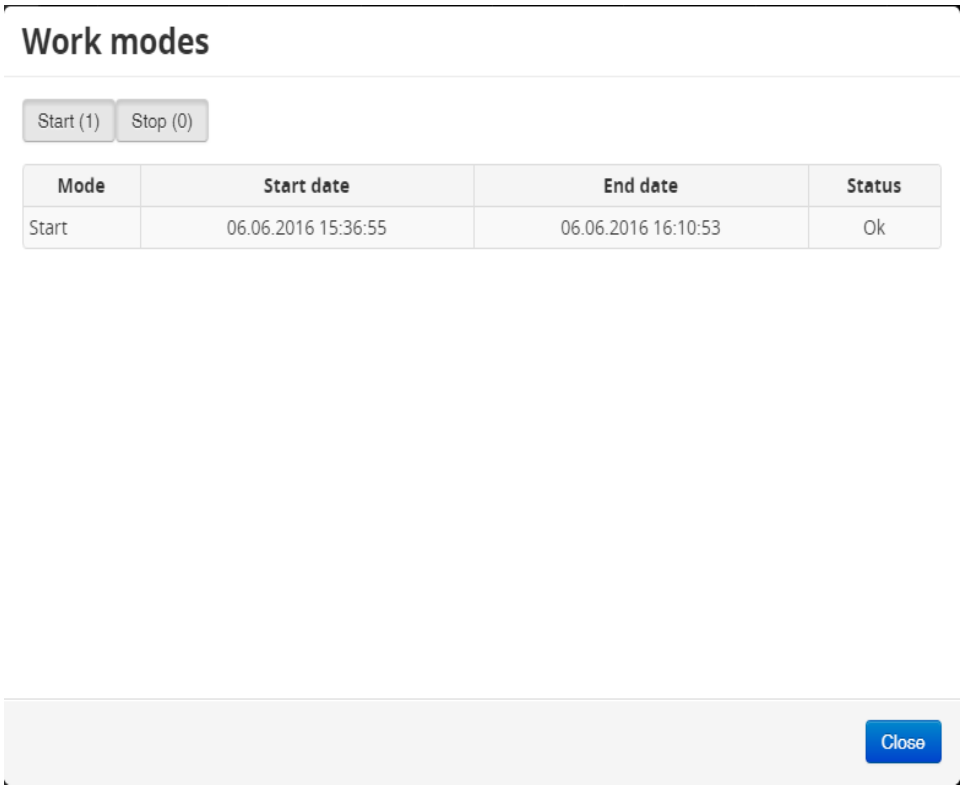


Figure 25 – Unit operating periods

4.3.3 Parameter list

Parameters list (set) includes those parameters, that would be plotted in a graph (Ref. Fig. 22).

When displaying parameter in parameter list the following information is indicated:

- trend color on graph;
- parameter name;
- range limit minimum value;
- range limit maximum value;
- parameter value in cursor area.

Number of points to plot a graph (discretisation) is established in user settings (Ref. p. 4.8).

Press parameter name to edit the parameter.

To remove parameter, mark the parameter and press button on panel above parameter list.

4.3.4 Parameter adding

To add new parameter press button on panel above parameter list, then window “Parameter adding” opens (Ref. Fig. 26).

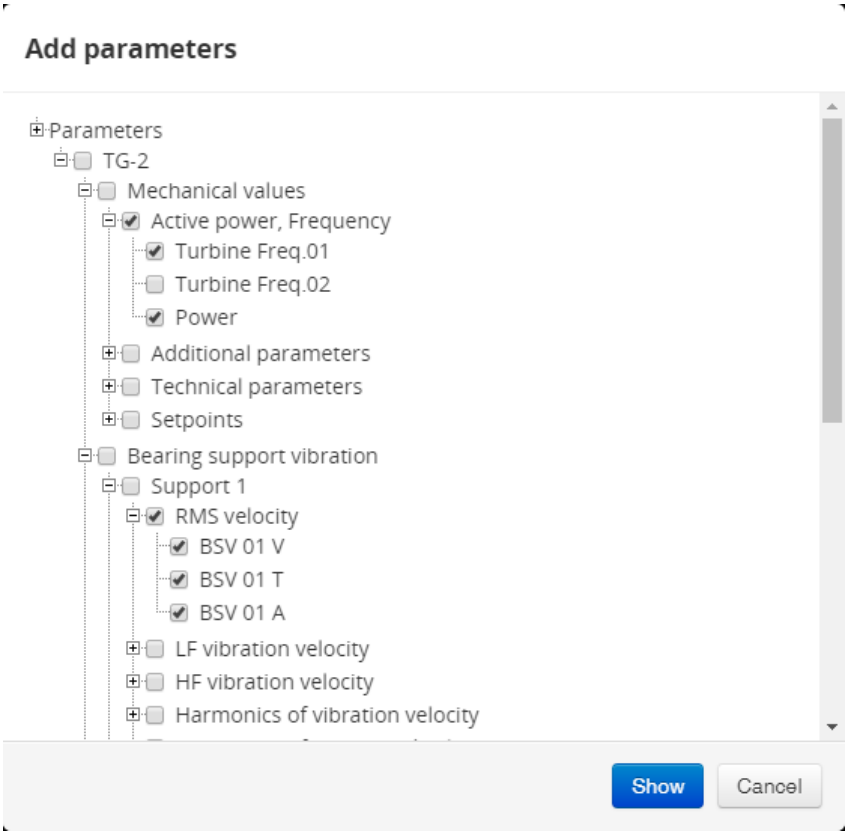


Figure 26 – Parameter adding window

Parameter adding window consists of:

- sections;
- groups;
- parameter list for adding;
- two control buttons.

To select parameters to be added to the list proceed as follows:

- select parameter section;
- select group;
- check or uncheck parameters;
- press “Show” button.

If parameter is already in the list it will not be added.

Parameter color is assigned automatically but it can be changed later.

4.3.5 Parameter editing

To edit parameter, mark the parameter and press button on panel above parameter list.

The following settings are available for editing (Ref. Fig. 27):

- trend color;
- range lower limit;
- range upper limit;
- data presentation (line, Japanese candlesticks, OHLC-graph-).

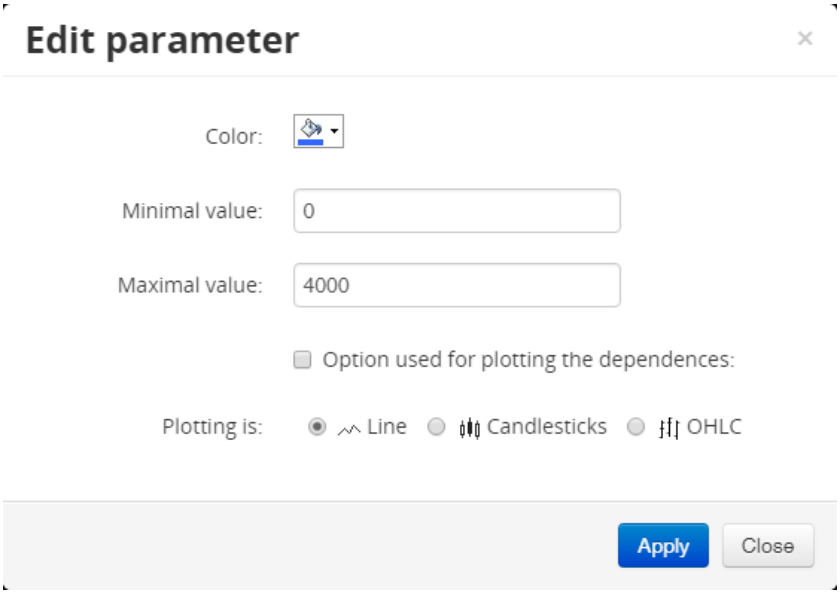


Figure 27 – Parameter editing window

To apply changes press “Apply” button.

System permits single and group parameters editing. For groups parameter editing select necessary parameters and press button.

4.3.6 Parameter sets

Created parameter list can be saved as parameter set and later can be loaded for viewing.

To save parameter set, press button on panel above parameter list. Input set name, if necessary – commentary and press “Save” button (Ref. Fig. 28).

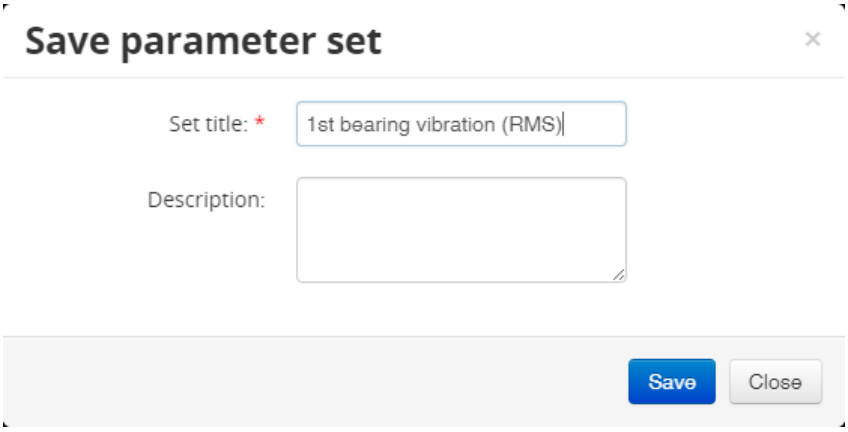


Figure 28 – Parameter set saving

To load parameter set, press button on panel above parameter list.

To load set from saved list press “Load” button, to delete set – “Delete” button (Ref. Fig. 29).

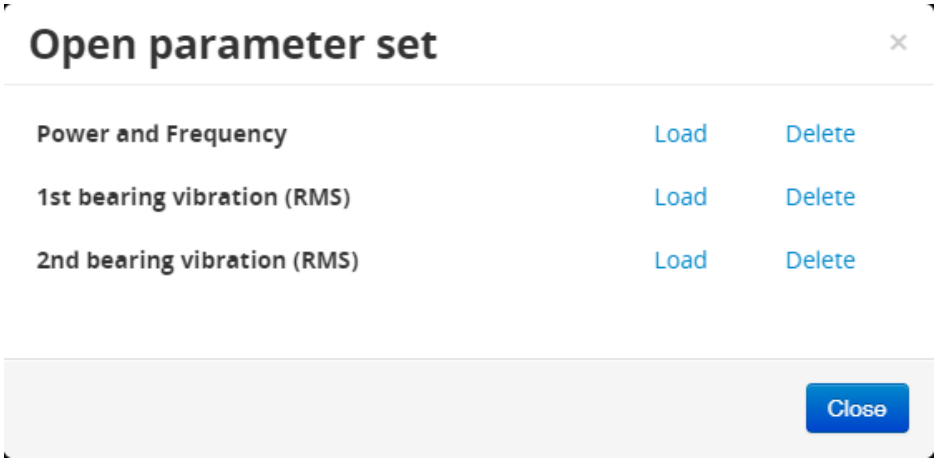


Figure 29 – Parameter set loading

4.3.7 Graphs plotting

Graph is plotted straight after adding a parameter. Plotting can take a long time and depends on number of parameters added for plotting and sampling frequency.

Plotted parameters values can be viewed after plotting using cursor.

Cursor – vertical yellow line, indicating parameter values in intersection point with this line. To fix cursor press mouse left button in graph necessary place. Up to three immovable cursors can be fixed on a graph.

4.3.8 Navigation

After plotting a graph, to navigate a graph use arrow buttons to scroll a graph by time. One arrow – graph displacement by 10%, two arrows – by 95%.



Figure 30 – Trends graph navigation

To scale down and scale up a graph by 2 or 4 times, press the corresponding buttons.

Besides the graph relative scale, the absolute scale can be established: week, day, hour.

4.3.9 Graphs export

To save results the plotted graph can be exported into Excel spreadsheet, to this end press “Data table” button or PDF document for further printing by pressing “Print” button.

4.4 Events

4.4.1 General

Event – phenomenon occurred during operation of monitored object. Monitoring system records occurrence, confirmation and deactivation of event. All events have their own name, type, description and importance level.

To view occurred event select drop-down menu “Events” on the panel.

Events can be indicated in two ways as:

- event log;
- events report.

4.4.2 Event log

Event log – is a table where each line is one event showing when the event occurred, when it was deactivated and also when and who confirmed its deactivation (Ref. Fig. 32).

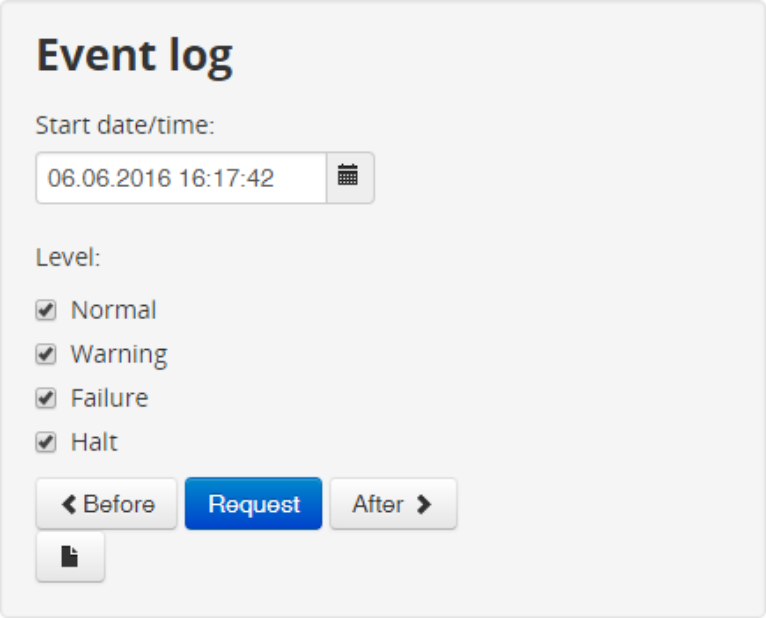


Figure 31 – Events filtering

To display events (Ref. Fig. 31) specify the following parameters:

- time range;
- event importance level;
- event type;

Date and time can be established manually in input field or using calendar (Ref. Fig. 23) and time input element (Ref. Fig. 24). To switch between them press the corresponding symbol.

When selecting event importance level and type check or uncheck the corresponding items.

After setting up all parameters, press “Request” button.

By default selected are events all types and importance levels, established is time range displaying events for the last hour.

Level	Event	Start date	End date	Confirm date
Warning	Activation setpoint "BSV 04 V - setpoint. 1"	06.06.2016 16:17:41		
Failure	Activation setpoint "BSV 02 A - setpoint. 2"	06.06.2016 16:17:41	06.06.2016 16:17:47	
Warning	Activation setpoint "BSV 04 V - setpoint. 1"	06.06.2016 16:17:35	06.06.2016 16:17:37	
Warning	Activation setpoint "BSV 04 V - setpoint. 1"	06.06.2016 16:17:31	06.06.2016 16:17:33	
Failure	Activation setpoint "BSV 02 A - setpoint. 2"	06.06.2016 16:17:31	06.06.2016 16:17:37	
Failure	Activation setpoint "BSV 02 A - setpoint. 2"	06.06.2016 16:17:25	06.06.2016 16:17:29	
Warning	Activation setpoint "BSV 03 A - setpoint. 1"	06.06.2016 16:17:19	06.06.2016 16:17:21	
Warning	Activation setpoint "BSV 04 V - setpoint. 1"	06.06.2016 16:17:17	06.06.2016 16:17:27	
Failure	Activation setpoint "BSV 02 A - setpoint. 2"	06.06.2016 16:17:17	06.06.2016 16:17:19	
Warning	Activation setpoint "BSV 03 A - setpoint. 1"	06.06.2016 16:17:13	06.06.2016 16:17:15	
Warning	Activation setpoint "BSV 04 V - setpoint. 1"	06.06.2016 16:17:11	06.06.2016 16:17:15	

Figure 32 – Event log

4.4.3 Events report

Events report – is a table where each line is an event statistical information, that is information on when the event occurred for the first time and when it was deactivated for the last time, for how long the event was active till deactivation (Ref. Fig. 34).

To create report select at least one event set and specify starting and ending dates (Ref. Fig. 33).

Except the available event sets “All events” it is possible to create a new set (Ref. p. 4.7.3).

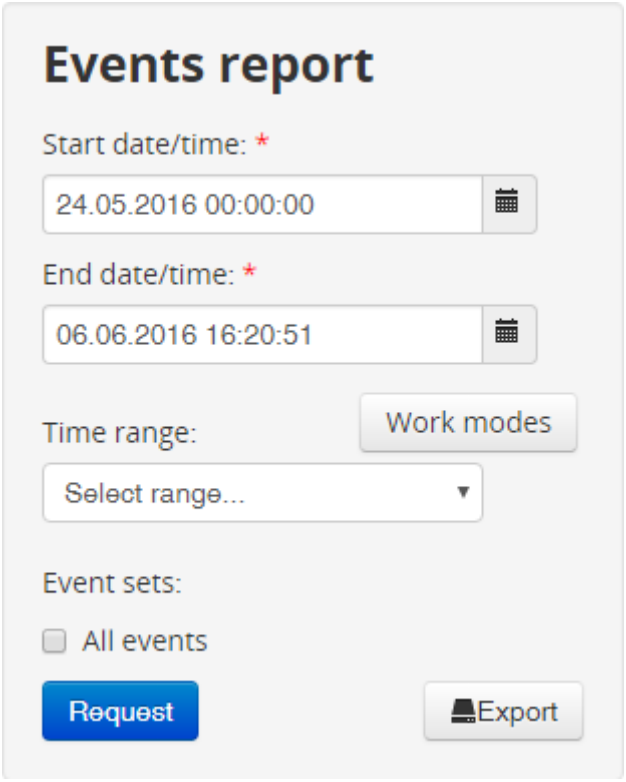


Figure 33 – Events selection

Event	Count	Date of first activate	Total active time	Date of last deactivate
Activation setpoint "BSV 04 V - setpoint. 1"	147442	24.05.2016 01:01:05	5 17:00:31	06.06.2016 16:20:49
Activation setpoint "BSV 01 A - setpoint. 2"	146540	24.05.2016 01:01:11	5 17:28:49	06.06.2016 15:04:34
Activation setpoint "BSV 02 A - setpoint. 2"	143380	24.05.2016 01:01:09	4 16:39:45	06.06.2016 16:20:47
Activation setpoint "BSV 03 A - setpoint. 1"	94188	24.05.2016 01:01:17	2 04:30:57	06.06.2016 16:20:41
Activation setpoint "BSV 01 A - setpoint. 3"	2	06.06.2016 15:02:18	00:02:10	06.06.2016 15:04:34
Activation setpoint "Curv. IP-1 - setpoint. 2"	2	06.06.2016 15:07:02	13 15:18:17	06.06.2016 15:07:20

Figure 34 – Events report

Events report can be exported to spreadsheet in CSV format. To this end press “Export” button.

4.5 Alarms

Alarms – messages on occurred events, such as setpoints actuation, system messages (Ref. Fig. 35).

To confirm the specific alarm press the confirmation button in the table corresponding line. To confirm all alarms press the confirmation button in the table header.

Level	Title	Nonconfirm alarms	Last date activation	
Warning	Curv. IP-1 - Break	1	06.06.2016 15:06:08	
Failure	Activation setpoint "Curv. IP-1 - setpoint. 2"	2	06.06.2016 15:07:52	
Failure	Activation setpoint "BSV 01 A - setpoint. 2"	146572	06.06.2016 15:04:36	
Halt	Activation setpoint "BSV 01 A - setpoint. 3"	2	06.06.2016 15:02:24	
Halt	Activation setpoint "BSV 01 A - LF setpoint. 1"	1	06.06.2016 15:02:14	
Failure	Activation setpoint "BSV 01 T - setpoint. 2"	1	06.06.2016 15:02:22	
Failure	Activation setpoint "BSV 02 A - setpoint. 2"	143426	06.06.2016 16:27:14	

Figure 35 – Alarms

4.6 Analysis

4.6.1 General

Analysis – section intended to analyze unit status. This section enables to carry out the unit primary diagnostics.

Number and content of section subsections and their functional purpose is determined by customer technical specification and in different projects may vary from specified in this Manual.

Analysis section consists of the following subsections:

- vibration analysis in supports area;
- vibration analysis in shaft area;
- shaft and supports vibration harmonics cascade;
- shaft and supports vibration spectra cascade;
- Nyquist plot of starts and stops;
- shaft and supports vibration statistics.

To view “Analysis” menu select drop-down menu “Analysis” on the panel.

4.6.2 Vibration analysis in supports area

“Supports vibration” section is intended to analyze supports area vibration and includes the following units:

- shaft movement orbit in supports area;
- restored signal;
- orbit deviation maximum vector value (amplitude and angle).

When entering the page an orbit is plotted automatically by the first support for the current time with step of 1 sec. Later it is possible to select other supports for display, to change number of vibration signal design periods, which are used to carry out analysis, to select harmonics used to analyze and scale the display (Ref. Fig. 36).

To view archive data since specified date press button “Pause”, then “Archive data viewing”, specify necessary date and time, establish step (1, 2, 4 sec.) and depress “Pause” button.

Except for orbit graph output, calculated are maximum amplitude and angle of vibration vector on graph and as a table. Also displayed are graphs of support vibration displacement vertical and horizontal components signal (Ref. Fig. 37).

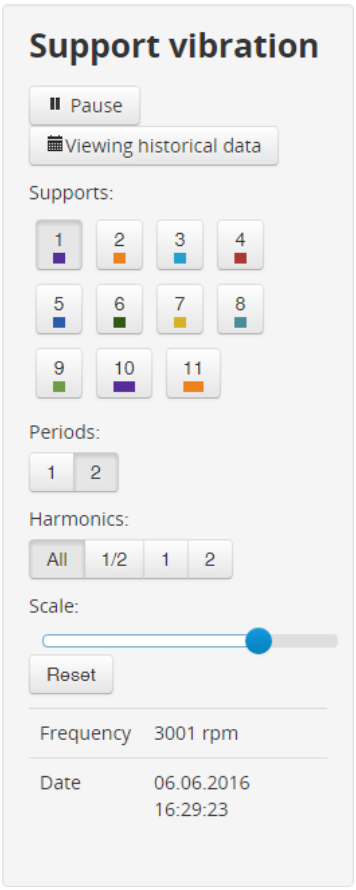


Figure 36 – Support vibration analysis parameters setup

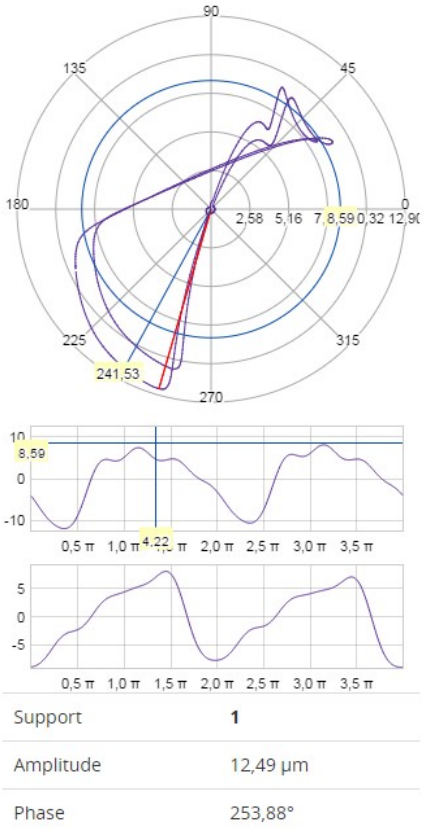


Figure 37 – Support orbit

4.6.3 Vibration analysis in shaft area

“Shaft vibration” section is intended to analyze shaft vibration and includes the following units:

- shaft floating and displacement;
- shaft position in bearing;
- shaft movement orbit;
- restored vibration signals in vertical and horizontal directions;
- orbit deviation maximum vector value (amplitude and angle).

When entering the page an orbit is plotted automatically by the first support for the current time with step of 1 sec. Later it is possible to select other supports for display, to change number of vibration signal design periods, which are used to carry out analysis, to select harmonics used to analyze and scale the display (Ref. Fig. 38).

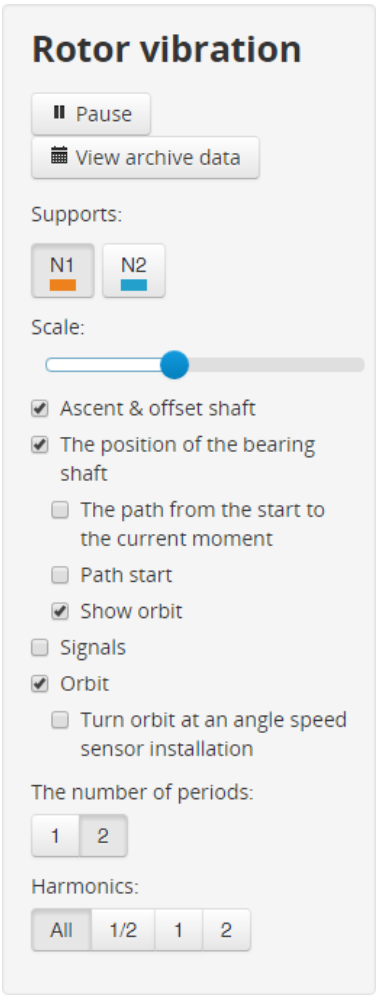
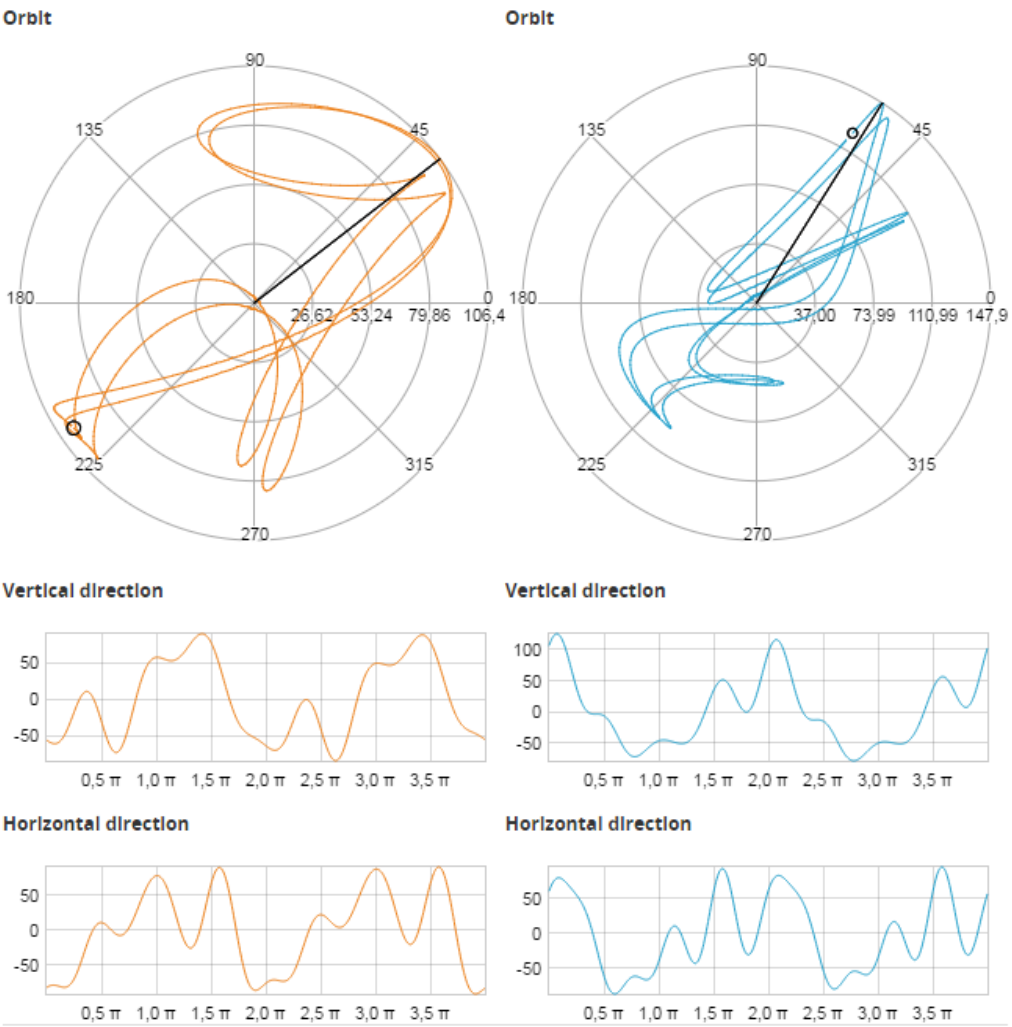


Figure 38 – Shaft vibration analysis parameters setup

To view archive data since specified date press button “Pause”, then “Archive data viewing”, specify necessary date and time, establish step (1, 2, 4 sec.) and depress “Pause” button.

Graphical presentation of shaft position in bearing can be observed on shaft floating and displacement graphs (Ref. Fig. 40, 41)

Except for orbit graph output, calculated are maximum amplitude and angle of vibration vector on graph and as a table. Also displayed are graphs of shaft vibration displacement vertical and horizontal components signal form (Ref. Fig. 39).



Support	**N1**	Support	**N2**
Amplitude	106,48 µm	Amplitude	147,99 µm
Phase	37,43°	Phase	57,50°
Offset shaft	0,00 µm	Offset shaft	0,00 µm
Ascent shaft	0,00 µm	Ascent shaft	0,00 µm

Figure 39 – Shaft vibration analysis

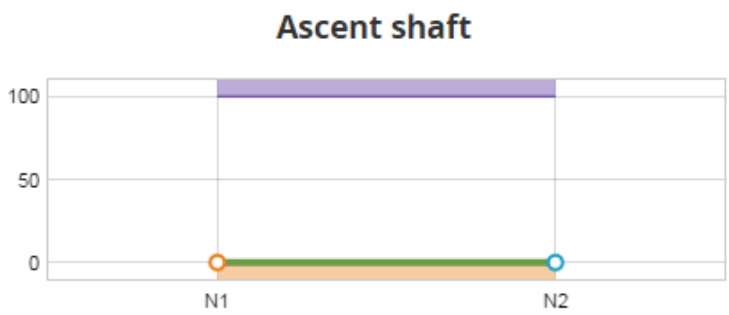


Figure 40 – Shaft floating

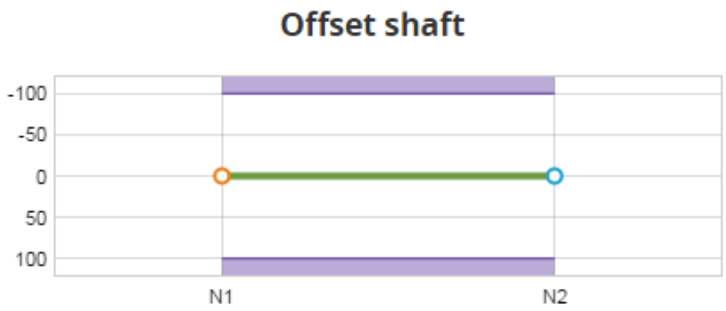


Figure 41 – Shaft displacement

4.6.4 Shaft and supports vibration harmonics cascade

Shaft and supports vibration harmonics cascade is intended to analyze harmonics change in time (Ref. Fig. 42).

To plot vibration harmonics cascade specify the following parameters:

- date range with range selection by start/stop events (button “Operating modes”):
- support number and vibration plane.

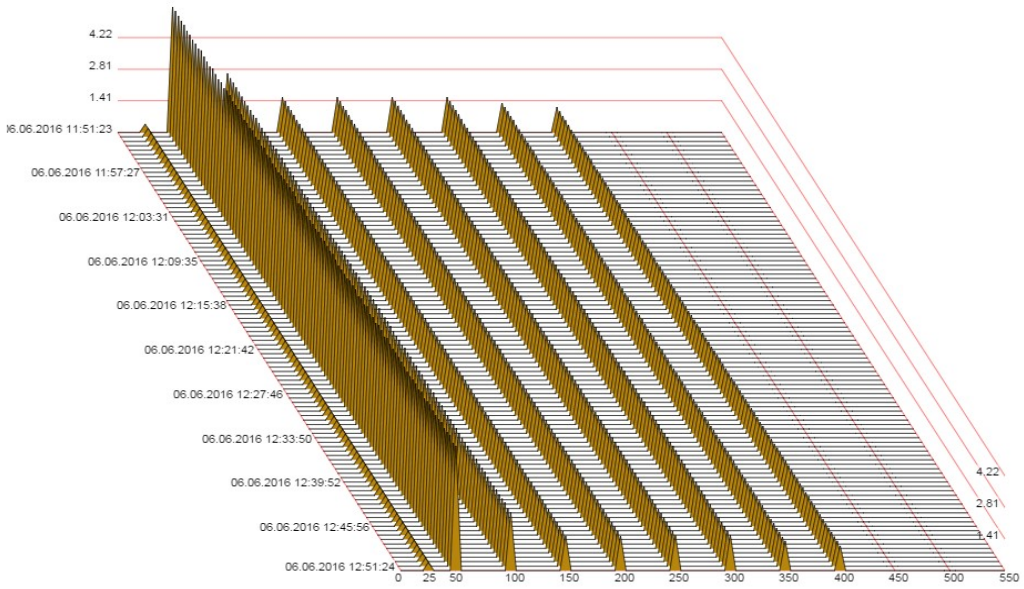


Figure 42 – Supports vibration harmonics cascade

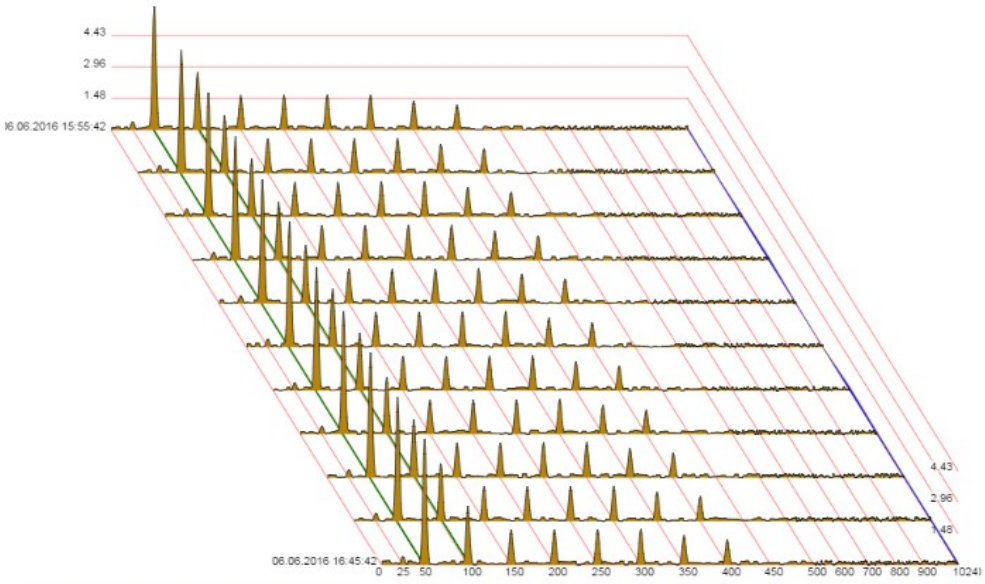
4.6.5 Shaft and supports vibration spectra cascade

Shaft and supports vibration spectra cascade is intended to analyze signal spectra change in time (Ref. Fig. 43).

Opposed to supports vibration harmonics cascade, the spectra cascade is plotted by full signal spectra. Provided it is possible to plot a table with data for the period by selected frequency by pressing the selected frequency on a graph.

To plot spectra cascade specify the following parameters:

- date range with range selection by start/stop events (button “Operating modes”):
- support number and vibration plane.



Date	49 Hz	102 Hz
06.06.2016 15:55:42	5.12	1.64
06.06.2016 16:00:42	5.11	1.64
06.06.2016 16:05:42	5.16	1.65
06.06.2016 16:10:42	5.16	1.65
06.06.2016 16:15:42	5.17	1.65
06.06.2016 16:20:42	5.21	1.67
06.06.2016 16:25:42	5.13	1.64
06.06.2016 16:30:42	5.12	1.64
06.06.2016 16:35:42	5.20	1.66
06.06.2016 16:40:42	5.16	1.65

Figure 43 – Supports vibration spectra cascade

4.6.6 Nyquist plot of starts and stops

Displayed in this section in graphical form are vibration displacement amplitude and phases values of bearing supports selected rotational component for the specified rotor speed values for the unit start/stop time.

To output graphs it is necessary to (Ref. Fig. 44):

- select start or stop time range;
- select vibration plane;
- select RMS output mode of first or second rotational component;
- select supports to plot graphs by;
- press button “Query graphs” (Ref. Fig. 45).

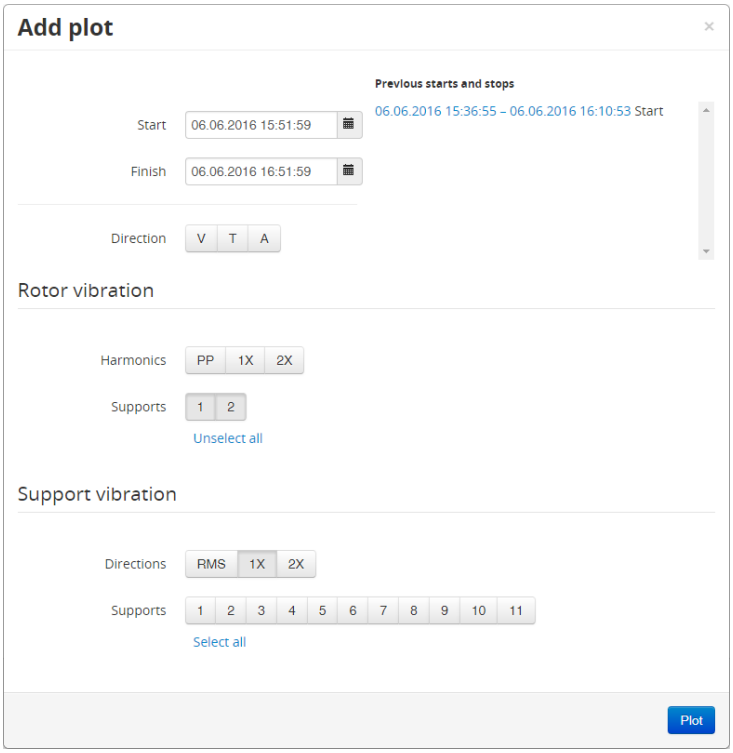


Figure 44 – Nyquist plot. Adding graphs

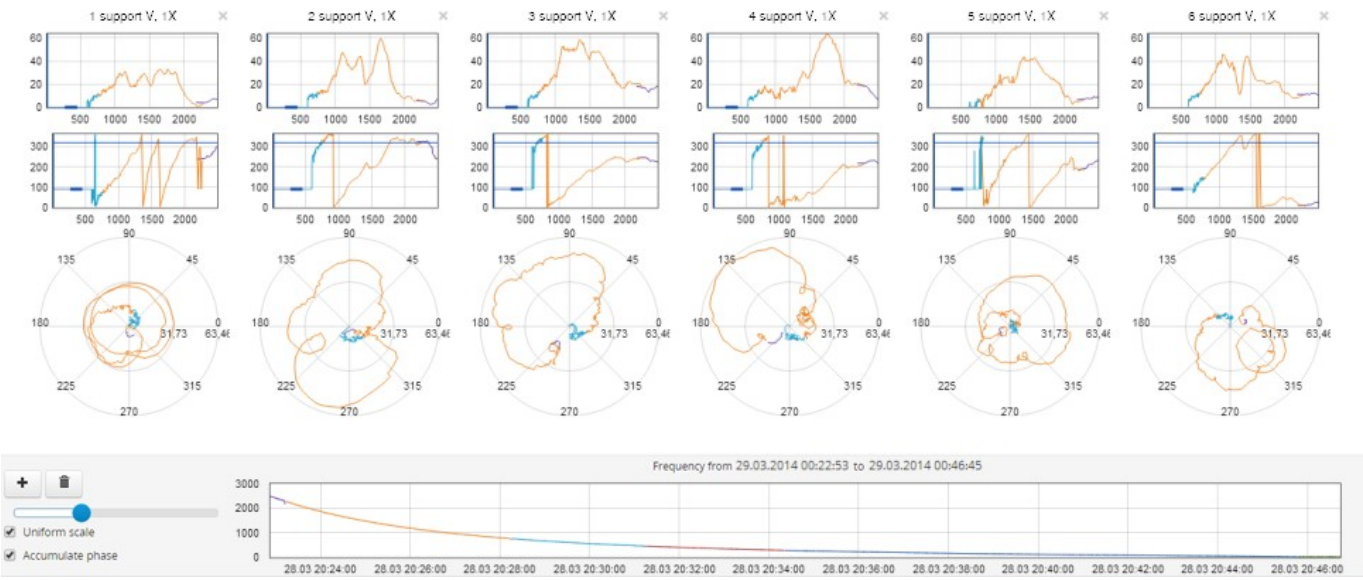


Figure 45 – Nyquist plot. FR, PFR (phase frequency response) and Nyquist plot graphs

4.6.7 Supports vibration statistics

Vibration statistics consists of two tables (Ref. Fig. 46, 47):

- vibration rates exceeding time per month;
- number of vibration steps per month.

Time exceedances vibration supports (per month)

	Bearing support	1	2	3	4	5	6	7	8	9	10	11
V	Number of exceedances per month prepare setpoint	0	0	0	154802	0	0	0	0	0	0	0
	Total time exceeding per month prepare setpoint	--	--	--	5d 23h 52m	--	--	--	--	--	--	--
	Number of exceedances per month warning setpoint	0	0	0	0	0	0	0	0	0	0	0
	Total time exceeding per month warning setpoint	--	--	--	--	--	--	--	--	--	--	--
	Number of exceedances per month alarm setpoint	0	0	0	0	0	0	0	0	0	0	0
	Total time exceeding per month alarm setpoint	--	--	--	--	--	--	--	--	--	--	--
	Short trend of vibration (%)	0	0	0	0	0	0	0	0	0	0	0
	Long trend of vibration (%)	0	0	0	0	0	0	0	0	0	0	0

Figure 46 – Supports vibration statistics

Analytical data are presented in a table by the following factors:

- number of vibration rates exceeding time per month;
- total vibration rates exceeding time per month;
- vibration tendency for a short period;
- vibration tendency for a long period

Number of exceeding per month shows number of vibration setpoint actuations.

Total vibration rates exceeding time per month shows total time period during which the vibration setpoint is active.

Vibration tendency for a short and long time shows probability of vibration trend appearance.

The number jumps vibration supports (per month)

Event	Count
Jump on support T02_Vs01	0
Jump on supports T02_Vs01-02	0
Jump on support T02_Vs02	0
Jump on supports T02_Vs02-03	0

Figure 47 – Supports vibration steps statistics

4.7 Administration

4.7.1 General

Drop-down menu “Administration” on panel is available for users from “Administrators” group. Menu controls users and event sets.

4.7.2 Users control

Menu section “User control” enables to add, delete, activate, deactivate, unblock users (ref. Fig. Ошибка: источник перекрёстной ссылки не найден).

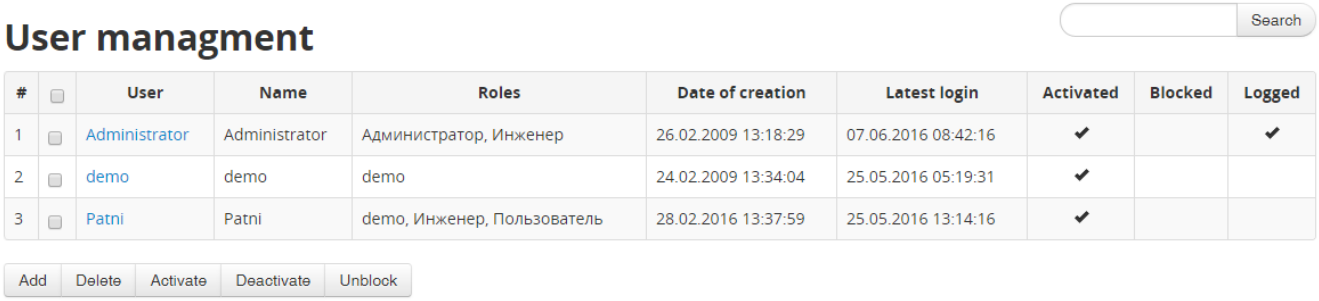


Figure 48 – User control

System divides users by access levels to system resources into groups.

List of groups and list of permissions for groups participants are given in Table 4.

Table 4. User groups permissions

Section description	Group description		
	Administrator	Engineer	User
Monitoring	✔	✔	✔
Diagrams	✔	✔	✔
Events	✔	✔	
Alarms	✔	✔	
Analysis	✔	✔	
Diagnostics	✔	✔	
Administration	✔		
Help	✔	✔	✔
User settings	✔	✔	✔

4.7.3 Event sets

Section “Event sets” allows for creation of any event set for further implementation in “Event reports”.

Press “Add” button to create a set. A window will open with list of all possible events. Assign name to event set on panel (Ref. Fig. 49). Then select events importance level, mark necessary events in list (Ref. Fig. 50) and press button “Apply”.

Use search window in upper right corner to filter events.

Ready sets are displayed in a list (Ref. Fig. 51).

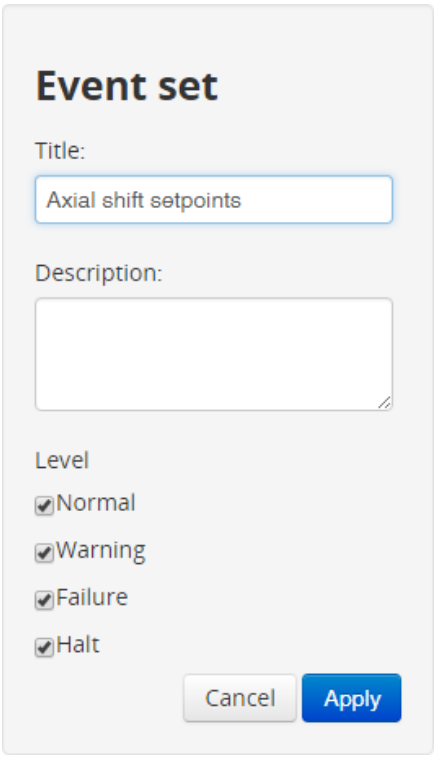


Figure 49 – Event sets panel

☑	E_T02_MqSasr01_tp01	Activation setpoint "AS 01 - setpoint. 1"	Failure
☑	E_T02_MqSasr01_tp02	Activation setpoint "AS 01 - setpoint. 2"	Failure
☑	E_T02_MqSasr01_tp03	Activation setpoint "AS 01 - setpoint. 3"	Halt
☑	E_T02_MqSasr01_tp04	Activation setpoint "AS 01 - setpoint. 4"	Halt
☑	E_T02_MqSasr02_tp01	Activation setpoint "AS 02 - setpoint. 1"	Failure
☑	E_T02_MqSasr02_tp02	Activation setpoint "AS 02 - setpoint. 2"	Failure
☑	E_T02_MqSasr02_tp03	Activation setpoint "AS 02 - setpoint. 3"	Halt
☑	E_T02_MqSasr02_tp04	Activation setpoint "AS 02 - setpoint. 4"	Halt
☑	E_T02_MqSasr03_tp01	Activation setpoint "AS 03 - setpoint. 1"	Failure
☑	E_T02_MqSasr03_tp02	Activation setpoint "AS 03 - setpoint. 2"	Failure
☑	E_T02_MqSasr03_tp03	Activation setpoint "AS 03 - setpoint. 3"	Halt
☑	E_T02_MqSasr03_tp04	Activation setpoint "AS 03 - setpoint. 4"	Halt
☐	E_T02_MqSrcCSD01_tp02	Activation setpoint "Curv. IP-1 - setpoint. 2"	Failure
☐	E_T02_MqSrcCSD01_tp04	Activation setpoint "Curv. IP-1 - setpoint. 4"	Halt
☐	E_T02_MqSrcCVD_tp02	Activation setpoint "Curv. HP - setpoint. 2"	Failure
☐	E_T02_MqSrcCVD_tp04	Activation setpoint "Curv. HP - setpoint. 4"	Halt
☐	E_T02_MqSrerCND_tp01	Activation setpoint "RRE LP - setpoint. 1"	Failure
☐	E_T02_MqSrerCND_tp02	Activation setpoint "RRE LP - setpoint. 2"	Failure
☐	E_T02_MqSrerCSD01_tp01	Activation setpoint "RRE IP-1 - setpoint. 1"	Failure
☐	E_T02_MqSrerCSD01_tp02	Activation setpoint "RRE IP-1 - setpoint. 2"	Failure
☐	E_T02_MqSrerCSD02_tp01	Activation setpoint "RRE IP-2 - setpoint. 1"	Failure

Figure 50 – List of events for set

List of Event sets

	Title	Events
☐	Axial shift setpoints	E_T02_MqSasr01_tp01, E_T02_MqSasr01_tp02, E_T02_MqSasr01_tp03, E_T02_MqSasr01_tp04, E_T02_MqSasr02_tp01, E_T02_MqSasr02_tp02, E_T02_MqSasr02_tp03, E_T02_MqSasr02_tp04, E_T02_MqSasr03_tp01, E_T02_MqSasr03_tp02, E_T02_MqSasr03_tp03, E_T02_MqSasr03_tp04

Add Delete

Figure 51 – Event sets list

4.7.4 Shaft sensor clearances editing

To calculate shaft displacement floating and shaft position in bearing, it is necessary to setup shaft sensor clearances (Ref. Fig. 52).

Clearances data can be input repeatedly. Recorded are date and time of clearances input.

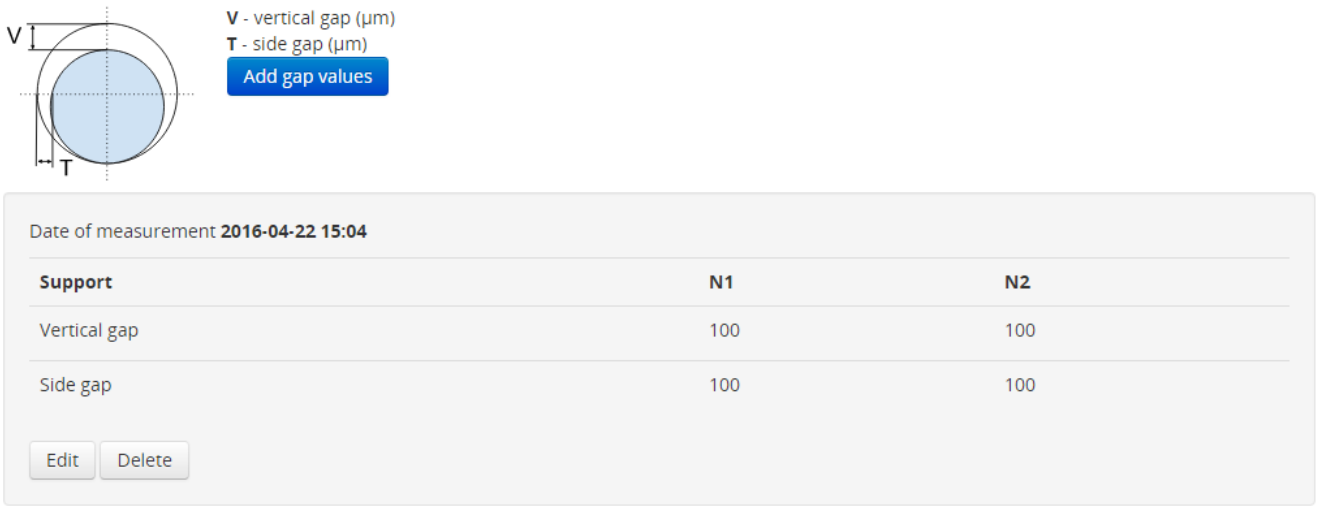


Figure 52 – Shaft sensor clearances setup

4.8 User settings

User settings can be changed by selecting menu item “My settings” upon hovering cursor over user name in screen upper right corner.

The following settings are available for changing:

- data refresh time, sec;
- number of points to plot graphs;
- number of candles to plot graphs;
- number of lines in table.

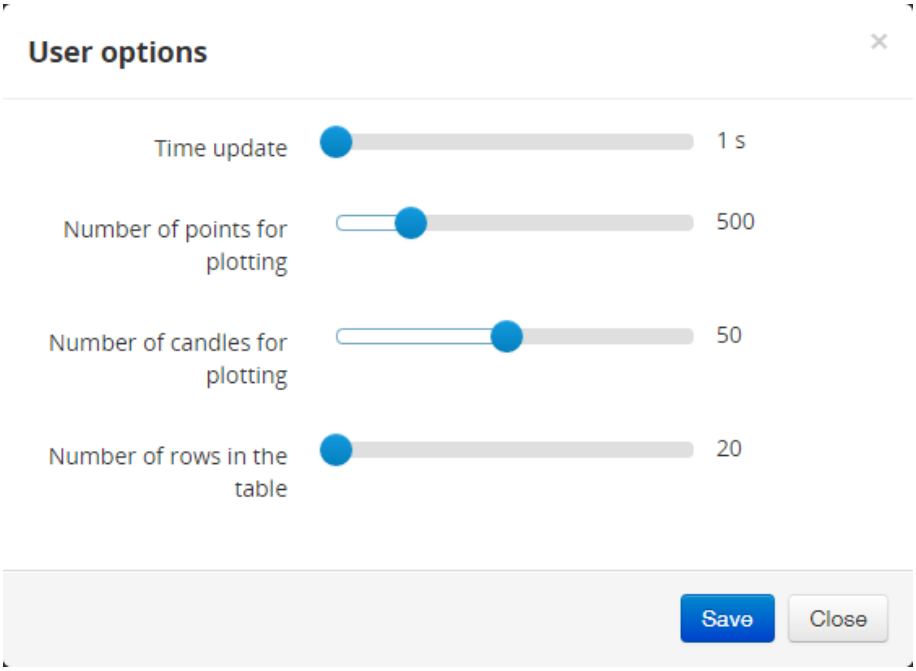


Figure 53 – User settings

Parameters are individual for each user and are saved till the next session.

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Additional information sources

Should you have any issues remained unanswered in this Manual, please refer to the following information sources:

Site: http://www.vibrobit.ru

Developer’s site contains large amount of reference information on system operation, frequently asked questions, developers feedback.

Product Support Services:

email: support@vibrobit.ru

tel. +7 (863) 218-24-79

Record of revisions

Revision	Numbers of sheets (pages)				Total pages in document	Document number	Signature	Date
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Notes

Tel./Fax: +7 (863) 218-24-75
Tel./Fax: +7 (863) 218-24-78
Email: support@vibrobit.ru
Site: www.vibrobit.ru