PromServis

Product Catalogue

Metering Devices and Control Systems
Vibration Diagnostic and Monitoring Systems
Passenger counting system “POTOK”

2016
Vibration monitoring and diagnostic systems developed by ZAO “PromServis”

Portable automatic expert diagnostic system “DIAES”

Every industrial enterprise faces a necessity to reduce service and repair costs at maintenance of equipment. One of the best ways to solve this problem is periodical evaluation of machines’ state during exploitation (preferably without pauses in the production process) and prediction of changes in their state for extension of safe operation life.

Specialists of ZAO “PromServis” have developed the method that allows to use passport data of a machine for construction of mathematical model of defects in it, detected by the vibroacoustic noises, generated by machines in the course of operation.

After analysis of this state model of the object, the system generates a conclusion about existence of defects and their types.

The system “DIAES” is notable for a row of unique features, advantages and options for a customer. It has been successfully implemented at more than 100 enterprises in different industries.

Key functions:
- Periodic and permanent control of equipment state in standard operation mode without stops;
- Automatic diagnostics of equipment with indication of defective elements and type of defect;
- Prediction of trouble-free operation period and output of information about recommended date of repair and required actions;
- Generation of reports about condition of objects with list of required repair jobs.

Main tasks:
- Prevention of emergencies and sudden equipment failures;
- Increasing of reliability and service life of equipment;
- Conversion to maintenance, based on actual technical state of equipment.
Features and capabilities:

- **quick start** of operation after minimal training of personnel and without preliminary accumulation of statistic data;
- **large number of connected machines**, sometimes located at a considerable distance from each other and a control station, in hard-to-reach places;
- smart usage of highly efficient **specialists**;
- **analysis** of state of all blocks within a machine as a **complex**, taking into account their mutual influence and interaction; it allows not only to detect existing defects and to predict their development, but also determine their root cause by means of advanced analysis;
- possibility to work with **spectrum analyzers** produced by various manufacturers: OneProD (France), “DIAMECH” (Russia) and others;
- unlimited **archive** of measured acoustic characteristics, results of diagnostics and prediction – for comprehensive analysis of collected data;
- **customization** of list of diagnosable faults, rules and parameters of diagnostics;
- integration with **automatic control systems** applied at an enterprise: all measured data and results of diagnostics can be transmitted to informational, control and diagnostic systems, applied at an enterprise.

DIAES is compatible with various spectrum analyzers
The algorithm of diagnostics is as follows:

1) Prepare a route of measurements: set measuring points, required acoustic characteristics parameters of these functions. Upload the route to a spectrum analyzer;
2) Take measurements by means of the spectrum analyzer.
3) Upload the collected data from the device to PC.
4) After uploading of acoustic data to PC and automatic sorting by machines, an operator selects a machine and starts the process of diagnostics.

The “DIAES” system automatically detects the following faults (67 types of defects):

<table>
<thead>
<tr>
<th>Fault Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft imbalance</td>
<td></td>
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<tr>
<td>Shaft misalignment (angle and parallel)</td>
<td></td>
</tr>
<tr>
<td>Defects of sleeve bearings</td>
<td>ellipsoid bearing journal, oil whirl of shafts, bushing maladjustment, bushing wear</td>
</tr>
<tr>
<td>Defects of rolling bearings</td>
<td>outer/inner race wear, outer/inner race defect, cage wear, rollers wear, defects on rollers, irregular radial tightness, solidification or lack of lubrication, outer race misalignment, turning of bearing</td>
</tr>
<tr>
<td>Defects of couplings</td>
<td></td>
</tr>
<tr>
<td>Defects of electromagnetic system in electric machines</td>
<td>stator winding defect, lamination of active steel end blocs in stator core, shorting between plates of active steel in stator core, static/dynamic eccentricity of clearance between rotor and stator, axes or rotor misalignment, deviation of supply voltage from sinusoidal form, etc</td>
</tr>
<tr>
<td>Belt drives defects</td>
<td></td>
</tr>
</tbody>
</table>

Diagnostic results are represented in various forms:

- Information in a special window;
- Diagnostic report and archive;
- Flashing color icons and values of vibration velocities – in the picture or scheme of the machine;
- Color icons in the tree of machines;
- Order for repair of machines in a specified house or plant;
- Order for inspection of machines in a specified house or plant.
**Diagnostic report** contains:

- name and location of machine;
- calculated rotation frequency of drive at the moment of taking measurements;
- description of calculated state of the machine with indication of faults detected in every block;
- kinematic or functional diagram of the machine with indication of values of vibration velocity on bearing supports;
- recommended date of the next inspection.

The report can be customized also: a customer can adjust its form, content, add notes and recommendations. The diagnostic report can be printed out.

Top managers and senior specialists can receive the reports on their PC by means of network connection.
Multifunctional analyzer

The program includes a powerful graphic analyzer of spectra, signals and trends. It is possible to view, study and analyze data in the form of various diagrams there. Experienced specialists can also use this instrument for extended survey and analysis of equipment state.

Using the accumulated measurement and diagnostic data about a machine an operator can execute the retrospective analysis of the machine state:
- to view trends of vibration velocities in all measurement directions;
- to trace dynamics of every defect development;
- to research trends of any parameter on the basis of archival or manually collected values (this function is an innovation of the “DIAES” program).
Price and delivery set includes initial setup of the system in compliance with characteristics of customer’s equipment. Thus, to start operation it is required only to take measurements, upload them into a computer and launch the diagnosing process. After that you can receive a document with results of diagnostics (report) and recommendations regarding maintenance and repair.

Considerable economic effect From “DIAES” application is achieved owing to:
- earlier malfunction detection and timely taking measures to prevent their progress;
- refusal of performing scheduled work on serviceable equipment;
- proper repair jobs and spare parts purchase planning;
- prevention of sudden failures and break downs;
- extension of life time of diagnosed objects.

The expert diagnostic system “DIAES” allows to start service equipment on the basis of its actual state, instead of maintenance “upon failure” or “according to schedule”.
On-line condition monitoring system “SADKO” for industrial rotary equipment

The automatic system "SADKO" is intended for on-line monitoring and diagnostics of the industrial equipment condition on the ground of vibroacoustic noises and technological parameters analysis.

**Application:** Control of technical condition of motors, pumps, compressors, fans, gear units, turbines, smoke exhaustors and other types of rotating equipment. Diagnostics in continuous mode helps to exclude sudden equipment failures.

**Main tasks:**
- process monitoring in continuous mode;
- detection of equipment faults and timely notification of personnel;
- execution of automatic diagnostics and localization of fault source at initial stage of fault progress as well as detection of its occurrence reasons;
- help in making decision to eliminate dangerous situations;
- accumulation and archiving of equipment measured parameters.

![Structure of the system](image)

**System structure** consists of the following main blocks:
- transducers - piezoaccelerometers;
- blocks that calculate root-mean-square values of vibration velocity and commutate acceleration signals;
- process parameter transducers;
- tachometers for measuring frequencies and variations of shaft rotation;
- computer with installed special software and multichannel measuring board.
The "SADKO" system allows to perform perfect diagnostics and to detect various failures:
- rolling and sleeve bearing defects,
- imbalance and misalignment of joint shafts,
- incorrect gear engagement and gear defects,
- lack of support rigidity,
- coupling defects,
- occurring of cavities,
- friction between rotary and stationary parts,
- occurrence of self-excited oscillations and resonances, etc.

Analyzing tendencies of process parameter changes in cause of time, "SADKO" is able to predict failure progress and evaluate technical condition of mechanisms in future.

Main functions:
- detection and conversion of signals from transducers and sensors of vibration, temperature, pressure, flow and other technological parameters;
- equipment starting and transient mode monitoring;
- comparison of current parameters with settings of pre-alarm and emergency conditions;
- detection of faults in machines according to methods developed by ZAO "PromServis";
- generation of light and audible signals;
- generation of reports about values of parameters and state of machines;
- prediction of defects progress;
- generation of operation sequence lists at off-optimum situation.

The system is based on real time monitor TRACE MODE (or WinCC etc.). Graphic interface is widely used in this system.

Multiport structure allows to trace general condition of the whole listed equipment with indication of main and additional technical parameters of each machine. The whole operation data are displayed in a digital form, in the form of a semaphore and functional graphs.

Alarm system: sound, light and color signals. If a parameter value is not within the setting, the corresponding sensor on the user interface changes its color into yellow or red and a warning is displayed.

All reports and archives are accessible for viewing in the local net.
Putting "SADKO" into operation allows considerably increase equipment reliability and reduce repair and maintenance costs due to prevention of emergency situations, as well as tracing defect progress and eliminate the reasons of their occurrence.

Experience of the “SADKO” systems implementation at enterprises of our customers shows that period of the investments return is from 1 month to 1 year. Experts estimations of the diagnostic effectiveness at the objects of nuclear power industry show that their return is 10-15 dollars per each spent dollar.
PRAMER-01
Spectrum Analyzer/Rotor Balancer

PRAMER-01 is an ideal instrument for vibration analysis and field balancing with built-in rechargeable battery.

The device performs a broad-band measurement of absolute bearing vibrations and provides information about machine state.

All results can be stored along with a description of the machine, sensor position, date and time, and downloaded to a PC or laptop computer.

Functions

The device can assist you in the following tasks:

- Eliminating high vibrations through **field balancing** of rotors
- **Evaluation** the overall machine condition
- **Analyzing** the overall machine condition

Four **operation modes**:

- Balancer mode
- Analyzer mode
- Collector mode
- Bearing Condition Monitoring

The **balancer mode** of the instrument enables static (single plane) and dynamic (two-plane) balancing of rotating equipment using up to 4 measuring points.

The **spectrum analyzer mode** enables measurements of:

- Overall vibration level,
- Amplitude/phase of the rotational frequency vibration during steady state and during run up or coast down (tracking function),
- Vibration spectrum and Waveform (oscilloscope function) of the sensor signal.

The analyzer mode measurement results are used for **vibration diagnostics** of a machine state both prior to and after the balancing.

The data obtained in **analyzer mode** may be saved in the instrument’s memory loaded into the database for the subsequent viewing, analysis and storage.
Features

- Frequency range: 2 Hz – 10 KHz
- A unique vibration analyzer, data collector and field balancer in one instrument
- High reliability of rotational frequency measurement thanks to the use of a laser reference sensor and unique trigger setup function
- Real 2-channel simultaneous measurement plus speed in tracking function
- FFT analysis with constant absolute and relative bandwidth
- Static/dynamic balancing
- Diagnostics of rolling bearing defects
- Bump test measurements
- User-friendly interface in English
- Brilliant, high-contrast graphic display with back-lit
- Data transfer into PC via USB
- Explosion proof modification is available with 2ExnLIICT4X protection
- Compact aluminum housing, rugged and shockproof design
- **Smart, light-weight, hand held instrument with numerous functions**

Delivery set

- Device PRAMER-01
- Accelerometer AC102-1A (2 pcs)
- Short sensor probe
- Holding magnet for curved surfaces
- Holding magnet for flat surfaces
- Connecting cable for accelerometer, 6 m long
- Connecting cable for accelerometer, 1.5 m long
- Laser optic reference sensor
- Magnetic stand for reference sensor
- Connecting cable for reference sensor, 6 m long
- Set of reflective tape
- Electromagnetic reference sensor
- BNC-converter for electromagnetic reference sensor
- Modal hammer
- Power / Charger unit
- Data transfer cable (USB), 1.8 m long
- Soft carrying case
# Technical Data

## Frequency range, Hz
2 - 10000

## Measurement channels
- 2 simultaneous vibration
- 1 for rotor speed and reference signal

## Measurement values
- Vibration displacement: µm
- Vibration velocity: mm/s
- Vibration acceleration: m/s²

## Signal detection types
- RMS value, Peak-to-peak value, Peak value

## Field balancing
- Easy-to-understand operation dialog, integrated balancing calculator, polar presentation of unbalance and test run vectors and printed balancing reports via PC/Laptop

- Balancing rotor speed: 120 to 60,000 rpm
- Number of balancing planes: 1 or 2
- Number of measuring points: up to 4 (enables optimized balancing procedures)

Archiving of rotor influence coefficients to enable simplified balancing procedures in repeat situations

## Measurement of overall vibration
- Broadband vibration measurement in pre-selectable frequency ranges

<table>
<thead>
<tr>
<th>High-pass steps</th>
<th>2/5/10/20/50/100/200/500/1000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-pass steps</td>
<td>100/200/500/1000/2000/5000/10000 Hz</td>
</tr>
<tr>
<td>Number of averages:</td>
<td>0 up to 100</td>
</tr>
</tbody>
</table>

## Frequency analysis
- Narrow band measurement for separation of the machine vibration into their harmonic portions
- FFT analysis, either without external trigger (free run) or with rotor-synchronous data acquisition

<table>
<thead>
<tr>
<th>High-pass steps:</th>
<th>5/10/20/50/100/200/500/1000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-pass steps:</td>
<td>100/200/500/1000/2000/5000/10000 Hz</td>
</tr>
</tbody>
</table>

2/5/10/20 harmonic with rotor-synchronous data acquisition

<table>
<thead>
<tr>
<th>Resolution:</th>
<th>100/200/400/800 lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of averages:</td>
<td>0 to 100</td>
</tr>
<tr>
<td>Windowing functions:</td>
<td>Hanning and Uniform (Rectangular)</td>
</tr>
</tbody>
</table>

FFT analysis in the frequency range 5 to 10,000 Hz by means of 33 frequency bands with a constant relative bandwidth (26%) and with logarithmic graphical display

## Start-up and run-down analysis
- Measurement, archiving and graphical display of the amplitude and the phase angle of the first harmonic in pre-selectable rotor speed ranges

<table>
<thead>
<tr>
<th>Max. rotor speed range:</th>
<th>120 to 9,000 rpm</th>
</tr>
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<tbody>
<tr>
<td>Resolution:</td>
<td>100 lines</td>
</tr>
<tr>
<td>Overall vibration and first harmonic vs. time</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Measurement, archiving and graphical display of the characteristic values for overall vibration as well as for amplitude and phase angle of the first harmonic in pre-selectable time ranges</td>
<td></td>
</tr>
<tr>
<td>Number of averages:</td>
<td>0 to 100</td>
</tr>
<tr>
<td>Number of depictable data sets:</td>
<td>5 to 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vibration time-signature</th>
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<tbody>
<tr>
<td>Visualization of the vibration waveform</td>
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<tr>
<td>Frequency range:</td>
</tr>
<tr>
<td>Sampling period:</td>
</tr>
<tr>
<td>Number of samples:</td>
</tr>
<tr>
<td>Number of averages with rotor-synchronous data acquisition:</td>
</tr>
<tr>
<td>Number of depictable data sets:</td>
</tr>
<tr>
<td>Resolution:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display:</td>
</tr>
<tr>
<td>A/D-converter:</td>
</tr>
<tr>
<td>Storage capacity of the internal EEPROM memory:</td>
</tr>
<tr>
<td>Accuracy of the indicator unit:</td>
</tr>
<tr>
<td>PC connecting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power supply</th>
</tr>
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<tbody>
<tr>
<td>With built-in rechargeable battery, storage capacity:</td>
</tr>
<tr>
<td>Typical battery operation period:</td>
</tr>
<tr>
<td>Battery charge time:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical construction of the indicator unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium housing, rugged and shockproof design</td>
</tr>
<tr>
<td>Protection class:</td>
</tr>
<tr>
<td>Operating temperature range:</td>
</tr>
<tr>
<td>Relative air humidity:</td>
</tr>
<tr>
<td>Dimensions of the device:</td>
</tr>
<tr>
<td>Weight of the device:</td>
</tr>
<tr>
<td>Dimensions of the case:</td>
</tr>
<tr>
<td>Weight of standard delivery set:</td>
</tr>
</tbody>
</table>

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