Noise & Vibration
Testing and Analysis Solutions
for Marine Industries
They trust OROS

> “With my OROS analyzer, I’m really confident during on-board measurements thanks to its toughness and its complete panel of functions.”

Noise and Vibration Maintenance Engineer, Propulsion Department.

1- Improve Efficiency
2- Maximize Uptime
3- Minimize Costs

Test Cells
- Prototype validation
- Factory acceptance

Improve Production Testing Efficiency
- Integrated & automated test process and report generation
- User-friendly operation
- Multichannel real-time processing and displays
- Universal and multiple sensor’s types: microphones, acceleration, temperature, strain, pressure…

On-board Testing
- On-board acceptance
- Maintenance operation
- Diagnostics and troubleshooting

Travel Light for Reliable Tests
- Versatile toolbox for all noise and vibration diagnostics applications
- Distributed acquisition systems over the ship
- Portable and rugged analyzers for field measurements
- Multichannel simultaneous acquisition
- Real-time analysis for field efficiency
- Distributed acquisition systems over the ship

Remote Monitoring
- Unpredictable & unrepeatable phenomena

Optimize Costs and Prevent Failure
- Alarm triggering warning via email, web dashboard, or sms
- Collect raw signal information for thorough office processing
Measuring your Ships and Propulsion Systems

Rotating Analysis

Roller Bearing Analysis

Damaged roller bearings are common vibration sources. Their vibration spectrum, measured with an accelerometer mounted on the casing, allows to determine mechanical failures on balls or races. Envelope demodulation and kinematics markers, part of FFT-Diagnostics module, are the key tools for that purpose.

Monitoring

On board ships, noise and vibration levels can often increase rapidly and unexpectedly. To achieve efficient countermeasures, you need detailed information and not only overall levels. No need to stay on site waiting for vibration levels to exceed unacceptable limits: the system operates autonomously triggering actions on alarms and can be accessed remotely for further diagnostics.

Torsional Analysis

Torsional vibration and torque fluctuation are usual phenomena especially on large internal combustion engines.

The OROS torsional software module utilizes a frequency to voltage converter for speed input providing the following information: the angular velocity profile displays RPM variations. In addition, a 2 pulse train combination allow to detect torsional resonances.

Reciprocating Machine Analysis

Reciprocating machines are complex installations. Generating specific vibration signatures, the objective is their performance optimization and faults detections.

For example, injection delay, valves faults, segmentation wear can be identified with EngineDiag.

This software module integrates the machine mechanical properties: number of cylinders, firing order and timing diagram, allowing to provide pertinent decision criteria on the field. Time signal, overall levels as well as angle-frequency representation on the machine cycle are efficient results for diagnostics.

Gear Analysis

Gear boxes on ships have to be silent and have a complex vibration signature, usually occurring at high frequencies.

The FFT-Diagnostics module, such as cepstrum, correlation, kurtosis and harmonic markers are necessary to describe and understand the generated vibrations.

In addition, the virtual tachometers management feature allows the analyst to achieve order tracking (magnitude, phase and speed) information based on the gear ratio.

On-Site Measurements & Applied Trainings

Experts from OROS may come on-site for applied trainings. They will help you using your OROS system. They can provide assistance in your measurement. They are also able to recommend optimization in your measurement process depending on your application and field requirements.

Structural Dynamics

ODS (Operating Deflection Shape)

A powerful analysis to solve problems related to forced vibrations. Only with few measurement points, determine the source of high vibration level and the structural modifications to be implemented on the machine.

Damping & Isolation

Absorbing and damping mounts are the components through which the vibration energy is transmitted between the engine and the rest of the ship, their properties, dimensions and positions should be determined with care. The techniques used are cross spectrum, transfer functions, damping, as well as ODS (Operating Deflection Shape).

Modal Analysis

Modal Analysis is one of the key steps when testing machines; it determines their structural characteristics and so, defines how they reacts to operating excitations. Shaker or impact hammer excitations can be used to capture the experimental datasets: the final stage is the actual OROS modal analysis.

Noise Analysis

Structure-Borne Noise Analysis

This technique uses acoustics tools, typically 1/3 octave analysis. The results allow to identify and reduce the transmission to structure-borne noise.

Underwater NAH (Near Field Acoustic Holography)

This technique offers highly accurate acoustic maps based on the sound pressure measured by a hydrophone array close to the hull. Together with the far-field radiated noise level prediction capability, it is the ideal tool for acoustic signature management and noise control of submarines and vessels.

TPA (Transfer Path Analysis)

This powerful solution allows the determination and ranking of the contributing noise and vibration sources and transfer paths to the targets. Targets can be set either inside the cabin in order to improve the comfort, or outside the hull to enhance the acoustic stealthiness or reduce the noise emission.
OROS Solutions
Enhance your Efficiency

SOFTWARE R&D, Acceptance, Diagnostics

Data Acquisition
- Recorder
- Time Domain Analysis

Rotating Analysis
- Spectral Based Diagnostics
- Torque and Twist
- Synchronous Order Tracking
- Reciprocating Machines
  Diagnostics: EngineDiag
- Balancing
- Monitoring

Structural Dynamics
- FFT
- ODS (Operating Deflection Shape)
- Modal analysis

Noise Analysis
- 1/3rd Octave
- Sound Intensity
- TPA (Transfer Path Analysis)
- Underwater Holography

INSTRUMENTS from 2 to 32 channels, distributed up to 1000+

Flexible Connection
- Mobile Analyzer
- Distributed Configuration
- Remote Access
- Large Channel Count Systems

Multioperations
- PC Free Recorder
- Online & Post-Analysis
- Multianalysis
- Handles Any Transducer

Made for the Field
- Portable
- Rugged
- Real-Time
- Multi-Channel

Accurate
- DSP-based
- 24 Bit – 40 kHz – 140 dB
- ± 40 V input range
- ±0.02 dB / ±0.02°

SERVICES Everywhere Close to You

Training
- Initial
- Advanced
- Webinar

Coaching
- Software customization
- Assistance in your measurements

Testing
- Expertise in diagnostics
- Troubleshooting
- Tools for automation

A Dedicated Team
- Dynamic and responsive Services department
- Worldwide hotline
- Global Accredited Maintenance Centers (worldwide coverage)
- Rentals
- Ready-to-go systems at any time

Maintenance and Contracts
- Premium contracts
- Software updates
- Hardware upgrades
- Calibration
OROS is a global manufacturer and solution provider of noise and vibration testing and analysis solutions.

OROS masters the latest technology of data acquisition, digital signal processing as well as user interface software.

OROS instruments are used in the major sectors of industry and research, for industrial acoustics, structural dynamics and rotating machinery applications. Hardware and software are totally designed in-house.

35-years in business, OROS instruments are renowned as being designed for the field but powerful enough for any lab.

<table>
<thead>
<tr>
<th>Software Modules</th>
<th>Rotating Analysis</th>
<th>Structural Dynamics</th>
<th>Data Acquisition</th>
<th>Noise Analysis</th>
<th>Instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORNV-SOA</td>
<td>Spectral Based Basing forward analysis plug-in</td>
<td>ORNV-FFT</td>
<td>ORNV-REC</td>
<td>Real-time FFT plug-in</td>
<td></td>
</tr>
<tr>
<td>ORNV-FFTDiag</td>
<td>Spectral Based Basing forward analysis Module (Envelope, Cepstrum, Pk, Pk-Pk, Crest factor, shaft view)</td>
<td>ORNV-IVO</td>
<td>ORNV-OCT</td>
<td>Real-time filter based 1/n octave plug-in</td>
<td></td>
</tr>
<tr>
<td>ORNV-IVC</td>
<td>Integrated Instantaneous angular Velocity Converter plug-in, allows on-line and offline torsional analysis</td>
<td>ORNV-IVC</td>
<td>ORNV-SI</td>
<td>Sound Intensity Solution</td>
<td></td>
</tr>
<tr>
<td>ORNVNS-ENG</td>
<td>EngineDiag, Reciprocating Machines Diagnostics Software Module</td>
<td>ORNVNS-MOD-IVC</td>
<td>ORNVNS-IVC</td>
<td>Integrated Instantaneous angular Velocity Converter plug-in, allows on-line and offline torsional analysis</td>
<td></td>
</tr>
<tr>
<td>ORNVNS-BAL</td>
<td>Single Dual Plane Balancing module</td>
<td>ORNVNS-MOD-DIS</td>
<td>ORNVNS-SI</td>
<td>Sound Intensity Solution</td>
<td></td>
</tr>
<tr>
<td>ORNVNS-MONI</td>
<td>Monitoring Solution</td>
<td>ORNVNS-MOD-DIS</td>
<td>ORNVNS-SI</td>
<td>Sound Intensity Solution</td>
<td></td>
</tr>
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**Specifications**

<table>
<thead>
<tr>
<th>Channels count</th>
<th>2 to hundreds of channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs</td>
<td>2 kS/s to 102.4 kS/s - 24 bits delta sigma ADC</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Phase ±0.02°, amplitude ±0.02 dB - Dynamic &gt; 140 dB</td>
</tr>
<tr>
<td>Conditioning</td>
<td>AC/DC/ICP/TEOS up to 40 V</td>
</tr>
<tr>
<td>Outputs</td>
<td>DC to 40 kHz - ±10 V range - 24 bits DAs -THD &lt; 0.002%</td>
</tr>
<tr>
<td>Ext. synch (Trigger / Tach)</td>
<td>DC channels*</td>
</tr>
<tr>
<td>DC channels*</td>
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</tr>
<tr>
<td>System</td>
<td>12 to 512 GB SSD</td>
</tr>
<tr>
<td>Hard disk</td>
<td>Up to 2h</td>
</tr>
<tr>
<td>Internal battery</td>
<td>1 Gb/s Ethernet</td>
</tr>
<tr>
<td>Link to PC</td>
<td>14 kg/3 lb to 10 kg/22 lb</td>
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</tbody>
</table>

* Optional features

Find out more on the OROS offer in the Range brochure.

Downloadable on www.oros.com