

Balancing Solutions

Single, Dual and Multiplane Balancing

Introduction

OROS Balancing Solutions are software modules for balancing rigid and flexible rotors. These modules are well-suited for shop balancing or in-situ field balancing. They are designed to run on OROS analyzers.

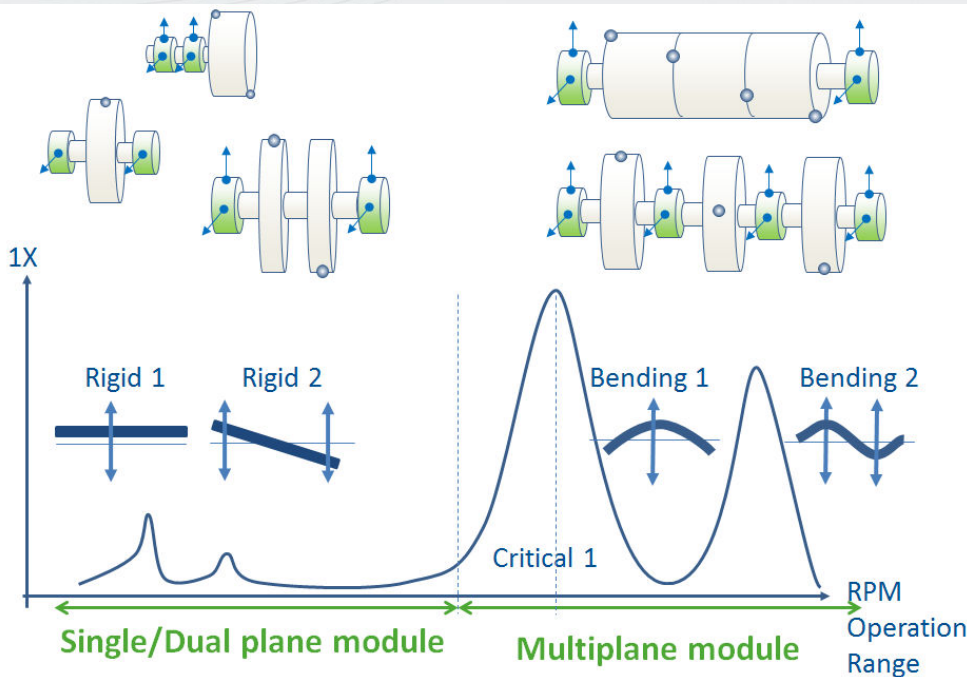
2 modules are available:

Single/Dual plane software module

It is particularly suited for shop or field balancing of rotors operating in their rigid body region (well below their first critical speed).

Multiplane software module

It is designed to balance rotors above the first critical speed: meaning in the region where the rotor deforms and reaches its first bending mode.



Industries

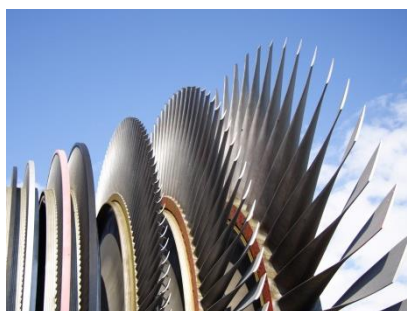
- > Energy & Process
 - o Power generation
 - o Oil & Gas
- > Marine
- > Aerospace
- > Automotive

Machines

- > Turbine & Compressor rotors
- > Motors & Generators
- > Gearbox axles
- > Engine crankshafts
- > Turbochargers
- > Fans

Applications

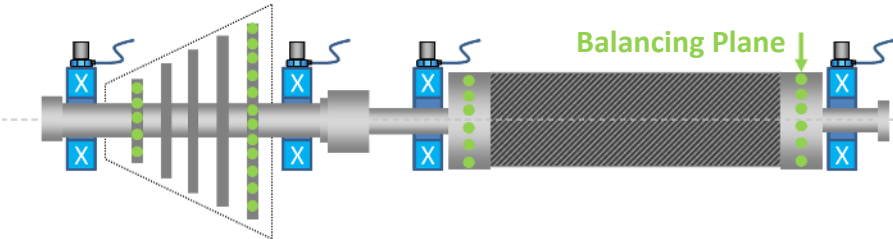
- > Shop balancing
- > Use of balancing machines
- > Field balancing
- > Production balancing
- > Low speed and high speed balance
- > Production acceptance tests
- > Acceptance and troubleshooting on the customer site
- > Overhung rotors



Main Features

Flexible acquisition

- > Acquisition from a wide choice of hardware platforms (sizes and weights) thanks to the OROS 3-Series instruments' range's flexibility.
- > **Accepts signals from accelerometers, velocimeters or proximity probes.**
- > Up to 32 sensors depending on the instrument platform.



Field balancing: typical multiplane balancing on a turbo generator

Accurate balancing

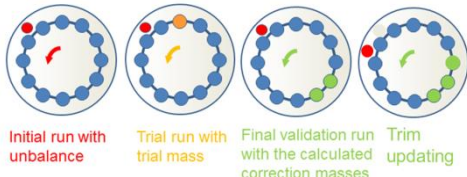
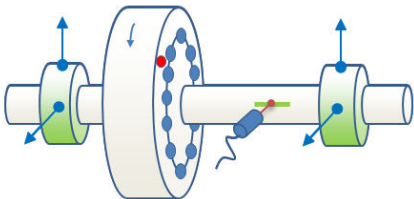
- > **Source data for the balancing operation (1X amplitude and phase) provided in real time** by the powerful OROS *Synchronous Order Analysis* plug-in analysis engine reputed for its high precision.
- > **Oversampled tach input at 6.4 MHz to provide the best phase accuracy.**
- > **High quality digital signal provided by the state of the art electronics of the OROS instruments.**



A flexible range of instruments from 2 to 32 channels for 1X (Amplitude and phase) acquisition

Designed for efficiency

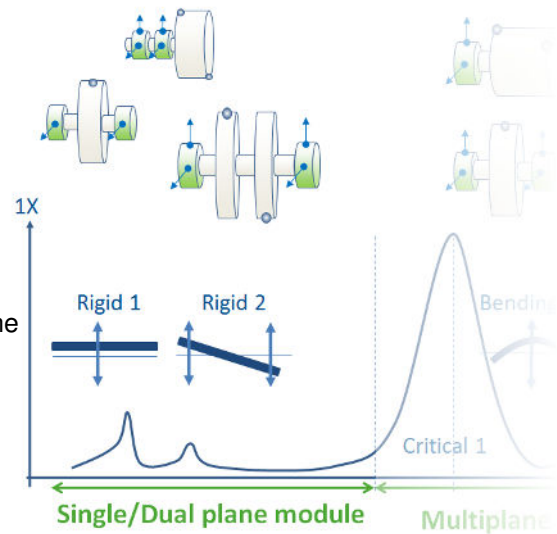
- > Correction planes and measurement planes managed independently and flexibly,
- > **Flexible weight map configuration with correction mass split or by step of 1°,**
- > Add or remove weight by drilling,
- > Keep or remove test mass,
- > **Prognostics of residual vibration (“what if” feature),**
- > Trim balancing,
- > Report generation,
- > Available in English, German, and French languages.



The trial mass test and trim updating

Single/Dual Plane Balancing (ORNVS-BAL-SDP)

- > 1 or 2 balancing planes
- > Rigid rotors
- > 1 to 4 sensors (1 or 2 per bearing)
- > Real time acquisition and 1X polar diagram (amplitude and phase).
- > Steady state speed acquisition
- > Acceptance of residual unbalance according to ISO 1940 / Balancing quality selection
- > Size and weight: optimum size with OR34. Runs on the OROS instruments' platform
- > Trim Balancing
- > Report generation
- > Designed for non-experts



Easy to set-up, fast to learn

Being guided by the wizard, the user can perform a balancing operation in a few clicks and without any special knowledge about balancing theory: **Training time is reduced.**

It is designed for shop or field balancing. Steps to the balancing report are optimized and guided. **Testing and correction time are minimized.**

Thanks to the dedicated interface, **the risk for errors is limited.**

Practical and applied tools for user ease and efficiency

Based on the acceptance circle the **residual unbalance is compared to the acceptable level required by ISO 1940** (based on rotor weight, balancing quality grade and operating speed should be provided).

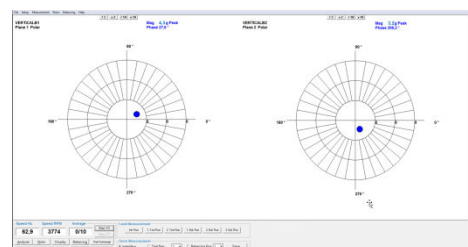
Using the unique **prognostics feature**, and providing the actual correction mass implemented, the residual unbalance can be easily estimated and compared to the acceptable level.

The history of **one rotor can be saved in the project and trim balancing** allows further balancing with no requirement for carrying additional trial tests.

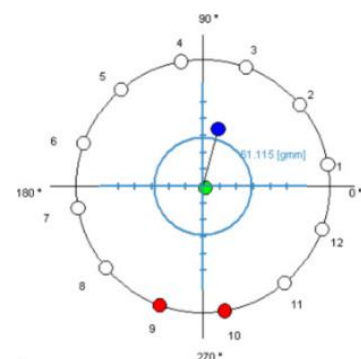
The report feature lets the user print a balancing report and keep track of the modifications made.



Typical shop balancing set-up with OR34

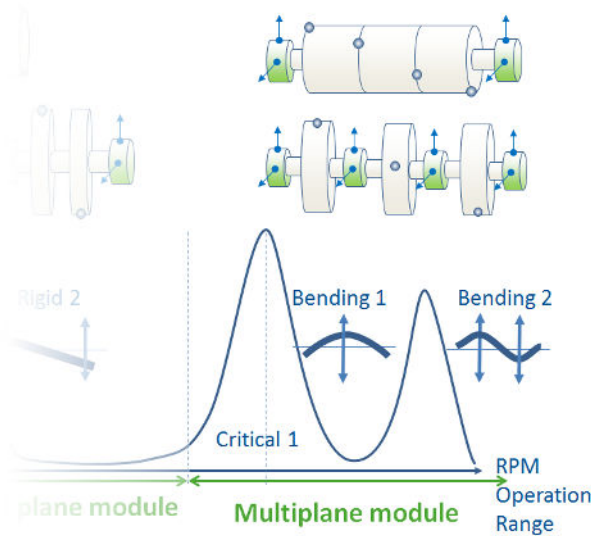


Live polar display of the 1X vibration



Correction chart with prognostic of residual unbalance and acceptance circle

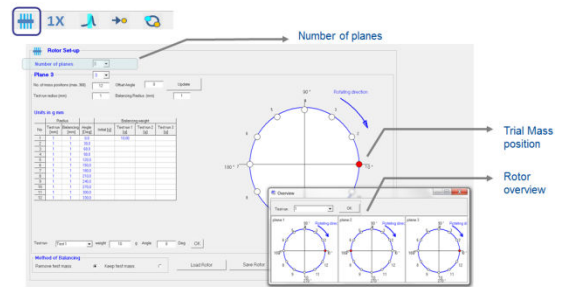
Multiplane Balancing (ORNVS-BAL-MP)



- > 1 to 14 planes
- > Flexible or rigid rotors
- > Up to 32 channels for 1X acquisition
- > Import 1X data (Amplitude and Phase vs. RPM from ORBIGate or from manual input from text files (csv template)).
- > Run-up, Coast-down, steady-state
- > Balance at multiple speeds or ranges of speeds
- > Calculate predicted Amplitude vs. RPM after balancing correction
- > Multiplane report generation

A simple solution for a complex problem

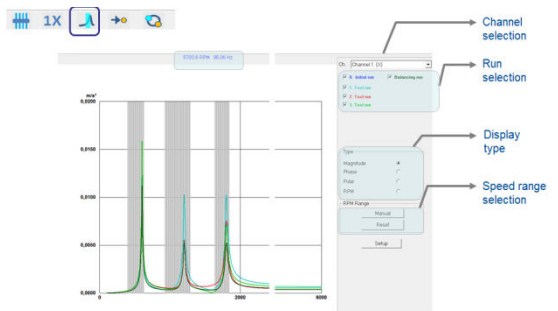
Multiplane balancing is a delicate operation that requires a high level of expertise from the user. The rotor is operated above its first critical speed and will be deformed. The purpose of OROS' multiplane balancing module is to bring a simple and dedicated tool to the fingertips of the user to solve this complex problem.



Rotor configuration

Transient 1X data acquisition

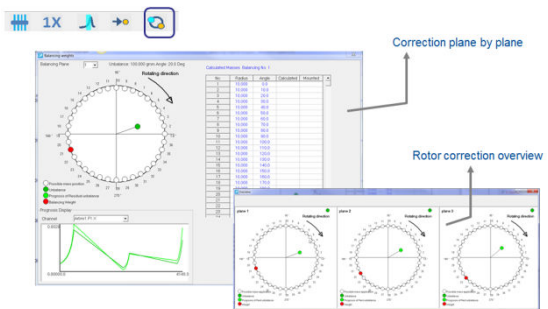
Based on the OROS multichannel instruments the 1X data are collected real-time during transients (run-up, coast-down) or steady-state phase at the different steps of the balancing operation (initial, trial, trim). At that stage, the data are displayed as Bode or Polar diagrams. Data can also be entered via other collecting sources including manual input.



Data display and speed range selection

Correction weights calculation

The data are then processed offline in the software after selection of the speeds for which unbalance should be reduced.



Correction weights

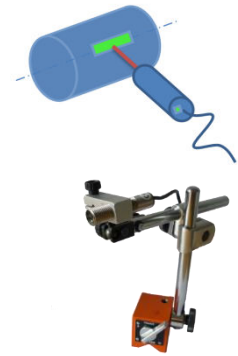
Residual unbalance prognostics

The residual unbalance after implementation of the correction masses can be calculated for the different speeds of the transient.

Accessories

OROS tachometer solution

The **RPM and Phase sensor** is particularly suited for 1 Pulse/rev signals. It is recommended for applications such as Keyphasor® applications, phase reference, balancing and RPM measurements. It is a versatile optical tachometer probe. The probe detects rotation pulses using a reflective tape placed on the studied shaft. OROS 3-Series analyzers or external 100-240V AC can power it. Based on the captured pulse signal, the OROS analyzer achieves the RPM computation or any other type of analysis such as Order tracking or FFT analysis.



A Powerful and Flexible Range for Your Needs

The Balancing solutions belong to the comprehensive OROS software suite that covers a wide range of applications:



Signal Processing and Data Acquisition
FFT, Recording, Time Domain Analysis, Monitoring



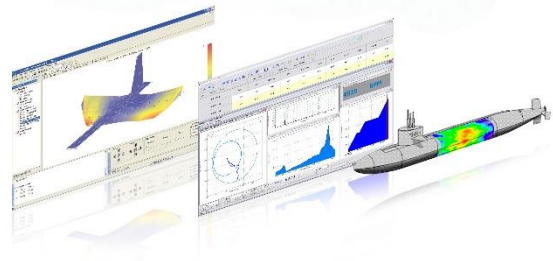
Structural Dynamics
Operating Deflection Shape, Modal Analysis, Bump Test, FRF & Cross-



Rotating
Synchronous Order Tracking, Torsion, Twist and angular resampling, Rotordynamics, Turbomachinery Vibration, Reciprocating Machines Diagnostics, Single, Dual and Multiplane Vibration Balancing



Acoustics
1/n Octave Analysis, Sound Level Meter, Sound Power, Sound Intensity, Sound Mapping & Source Localization, Sound Quality/Psychoacoustics, Near-field Acoustic Holography (Air or Underwater), Transfer Path Analysis



The Balancing solutions can analyze results from all OROS Teamwork instruments, providing flexibility in the choice of hardware platform size. The Teamwork technology enables the analyzers to be cascaded or distributed in order to measure up to 1000 channels. Instruments, conditioners and software licenses are exchangeable and flexible. Results are also easy to share thanks to the native Dataset Management technology. Based on the same platform, same technology and same software, OROS instruments are portable, rugged and real-time.

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 constraints.



Applied training: Balancing – Basic Principles and Procedures, Practical Case on Training Kit

Objective

Unbalance is the most common issue on a rotating system. From high speed small rotating system to heavy industries machinery, balancing a rotor system is a sensible task. OROS leads you to understand the method and principle for balancing: from the theory to a practical test.

Program

- > Balancing phenomena, cause and possible damage
- > Order analysis, how to setup an analysis for balancing
- > Rigid or dynamic balancing?
- > Our solution, a dedicated and easy to use interface
- > Number of planes and measurement points
- > How to start a good procedure?
- > Sequence for balancing, test run, correction and trim balancing

Who Should Attend

Technician or engineer who wants to get theoretical and practical basis for balancing

Duration 0.5 day

Specifications

ORNVS-BAL-SDP-4-I and ORNVS-BAL-SDP-4-FD

Feature	Description
Procedure	1 or 2 plane balancing for rigid rotors, trial weight method at steady state (not necessarily operating speed), trim balance
Analysis	1X amplitude and phase determination: based on Synchronous Order Analysis (SOA)
Inputs	1 or 2 sensors per plane. Proximity probes, velocimeters, accelerometers. Coupling: AC, DC, AC Float, DC Float, ICP®
Residual unbalance	Adding/retrieving weight, split correction weights on defined positions
Residual unbalance prognostic	ISO 1940-1 admissible residual unbalance determination at operating speed
Displays	Real-time polar diagram, correction display & correction chart
Report	Overview balancing report

ORNVS-BAL-MP-I and ORNVS-BAL-MP-FD

Features	Description
Machines	Up to 14 balancing planes
Data	Based on 1X data (Amplitude & Phase): Run-up, steady-state or shut-down
Data source	TXT (csv) file import: Easily exported from OROS ORBIGate or other sources including manual input
Calculations	Carried out in office mode with multiple speed selections
Displays	Rotating speed profile (RPM vs. time), 1X: Amplitude, Phase, Polar
Correction	Adding/retrieving weight, split correction weights on defined positions
Features	Residual unbalance prognostic as a function of RPM
Report	Overview balancing report

Instrument inputs

Features	Description
Physical quantities	Displacement, velocity, acceleration
Sensor library	Proximity probes, velocity probes, accelerometer(ICP® or standard)
Conditioning	Up to ±40 V on OR38, OR36 and Mobi-Pack (Up to ±10 V on OR34 and OR35), auto range
Accuracy	Amplitude ±0.02 dB – Dynamic > 120 dB
Input filter	Single or double integration filters with high-pass
Coupling	DC, AC, ICP®, AC floating, DC floating, TEDS
External sync	64 x oversampled – resolution < 160 ns (0.06° @ 1 kHz) ±40 V (±10 V on OR34, OR35)

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Ordering Information

The dual plane solution can be ordered based on one instrument (standard license) or any instrument of your float (floating license). The multiplane software module operates in office mode and therefore works independently of the analyzer license.

Typical instrument package configurations

Reference	Description
OR34-BAL-SDP-4	Single Dual Plane Balancing package – Based on OR34 Instrument
OR10-BAL-SDP-4	Single Dual Plane Balancing module – Based on OR10 Instrument

Software modules

Reference	Description
ORNVS-BAL-SDP-4-I	Single Dual Plane Balancing module – Instrument locked license
ORNVS-BAL-SDP-4-FD	Single Dual Plane Balancing module – Floating dongle locked license
ORNVS-BAL-MP-I	Multiplane Balancing module – Instrument locked license
ORNVS-BAL-MP-D	Multiplane Balancing module – Dongle locked license

Accessories

Reference	Description
6A613006	OROS Optical tachometer kit powered by 3-Series analyzer or 100-240V AC + 3m (10ft) cable* + magnetic base
6A613007	OROS Optical tachometer kit powered by 3-Series analyzer or 100-240V AC + 3m (10ft) cable* + base clamp

*Extension cables are available on demand.

OROS, Leadership through Innovation

About Us

Thanks to 30 years in business, OROS's designs and manufacturing capabilities are renowned for providing the best in noise and vibration testing systems, meeting the requirements and expectations of automotive, aerospace, marine energy & process, manufacturing and automation industries.

Our Philosophy

Reliability and efficiency are our constant ambition. We know you have the same requirements for your measurement instruments: comprehensive solutions providing guaranteed performance, designed to meet the challenges of your demanding environments.

Our Emphasis

Constantly in tune with your needs, OROS collaborates with a network of proven scientific affiliates to offer the latest in technology in this field, always based on innovation.

Global Presence

OROS products are marketed in more than 35 countries, through our authorized network of representatives, offices and accredited maintenance centers.

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