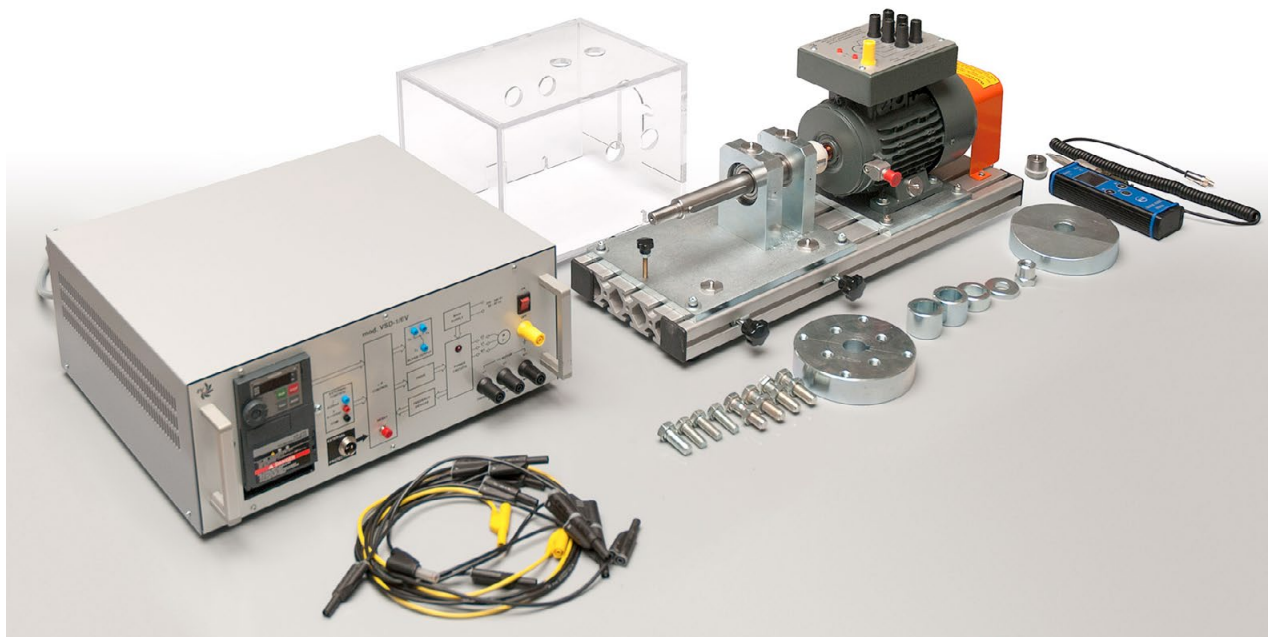


TRAINER FOR THE STUDY OF MECHANICAL VIBRATIONS

Mod. VBR-01/EV



INTRODUCTION

Vibration diagnosis is a technique for checking the condition of rotating machines (e.g. mechanical).

By performing this procedure regularly, you will be informed in advance about potential failures before the machine reaches the breakdown condition (that is, before having to apply corrective maintenance).

This is of a great advantage for large motors and generators, avoiding expensive overhauls. It is also very important for those critical machines (sometimes even low power machines) that can stop a complex and costly industrial process.

The periodical measurement, recording the values and evaluating the collected data performs one of the most important functions of PREVENTIVE MAINTENANCE.

Briefly, with the information supplied by this technique, you decide the optimum moment to stop the machine for repairs; you control the situation, instead of being "controlled" by the machine condition.

Vibration diagnostic measurements means:

- Diagnosis of bearings condition and their lubrication,
- Diagnosis of mechanical faults (axes misalignment, unbalance of rotating masses, detection of machine looseness and the dangerous mechanical resonances).

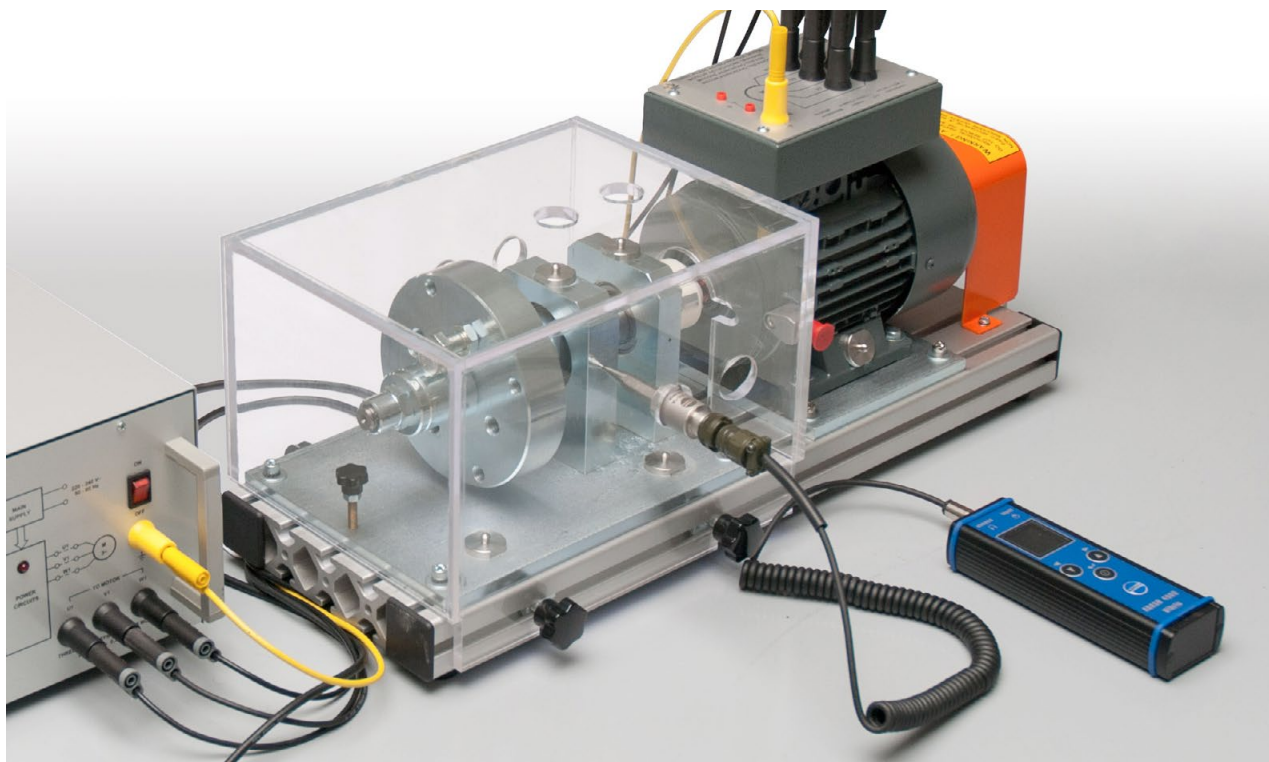
This technique can be applied in:

- The machine manufacturing stage, to check the design,
- Factories, at the production stage, to improve the performance of the rotating parts.
- Maintenance, to keep machines under control
- Workshops, to control the repaired rotating parts.

COMPOSITION:

The proposed system is composed by:

- **A Machines Set**, including:
 - A 3-ph asynchronous motor
 - An electronic drive for the motor, to vary the motor speed, and therefore, to examine the effect of this parameter over the vibration analysis.
 - A set of mechanical loads, modified to simulate the "failures" to be measured with the Vibration Measurement Instrument.
 - A support base for the motor and the mechanical load. The base has been designed to insert some "failures" to be measured with the Vibration Measurement Instrument.
 - The motor, the mechanical load, and the base includes the measuring points; these points are ready to apply the vibration sensor.
- **A Vibration Measurement Instrument.**



TRAINING PROGRAM:

- The importance of vibration measurement.
- Study of the factors that can cause vibration of the rotating parts.
- The vibration measuring parameters used in industry: overall RMS and PEAK velocity, overall RMS and PEAK acceleration, overall RMS and PEAK displacement, bearings fault detection, acceleration enveloping measurement.
- Influence of the RPM on the measured parameters.
- Selecting the optimum machine points for the vibrations checks.
- Preparing the surface of the measuring points. Precautions to be taken.
- The vibration measurement instrument: input sensors, outputs, measured parameters.
- Classical industrial measures on rotating machines related with mechanical vibrations: unbalanced masses, axis misalignment, machine looseness.
- Evaluation of the collected data and further actions to be taken.

TECHNICAL SPECIFICATIONS:

The MACHINES SET includes:

- 3-ph asynchronous motor with drive, with the following technical characteristics:
 - Motor: 3-phase squirrel-cage asynchronous motor; 3x230 V; synchronous speed: 3000 RPM (2 poles machine), power: 0.5 kW. Double end shaft, with orange safety cover in the back end. Dimensions and weight (including support base, without transparent cover and inertia disks): approx. 600 x 300 x 200(h) mm, 16 kg

- Drive: microprocessor-controlled, bi-directional speed, for max. 0.75 kW 3-ph squirrel cage motor. Speed set-point through potentiometer. Digital display (7 segments, 4 figures) with programmable parameters. Power supply: 230 V single-phase. Max. power: 1.8 kVA. Freq. Limits: 0.5 to 400 Hz, with settable freq. limits. Power section: 3-phase inverter with 6 * IGBT transistors; sinusoidal PWM modulation. Control modes: V/f constant, variable torque, vectorial control, Programmable acceleration / deceleration ramp times (0 to 3600 sec). Protections: over/under current, over temperature, short-circuit. Including the braking resistance and the respective clamping circuit. The drive has a safety control connected to the limit switch in the load support base. Dimensions: approx. 400 x 395 x 170(h) mm
- Set of Mechanical Loads, with the following technical characteristics:
 - One inertia heavy disk, to be coupled to the motor above. This disk has two concentric set of holes to screw bolts at different positions and angles to simulate low unbalances on a rotating mass.
 - One inertia heavy disk partially bevelled to simulate a heavy unbalanced load.
 - Support base, with the shaft to couple the heavy disks. The shaft is coupled to the motor. The base is ready to insert different "axes misalignments" between the motor and the mechanical Load.
 - Transparent, heavy plastic cover, with the holes to insert the instrument sensor. The safety limit switch placed in the base makes mandatory the use of this cover to run the motor drive.
 - The base includes the little metal pads to apply the instrument sensor.

The VIBRATION MEASUREMENT INSTRUMENT:

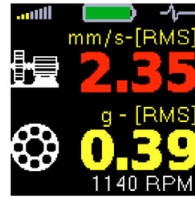
- Instrument following ISO 10816 standard.
- It is a lightweight, manual portable instrument, designed to be a standard for plant engineers and maintenance staff.
- Despite being a powerful instrument, it is of easy use, a great advantage for educational purposes, mainly when dealing with beginners.
- The instrument automatically performs multiple measurements: determining the bearings condition, including insufficient lubrication; finding and measuring the level of rotating unbalanced masses, machine looseness and axis misalignment;

• Measuring ranges:

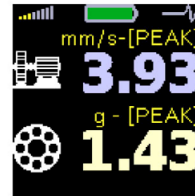
DETECTION	UNIT	FREQUENCY RANGE	DISPLAY
RMS	mm/s, ips	10-1000 Hz	0-999
PEAK	mm/s, ips	10-1000 Hz	0-999
RMS	g	500-16000 Hz	0-999
RMS	g	1500-16000 Hz	0-999
RMS	g	5000-16000 Hz	0-999
RMS	um, mil	2-200 Hz	0-999
PEAK u	m, mil	2-200Hz	0-999
Time Signal	g	500-16000 Hz	0-999
Spectrum (200 lines)	mm/s, ips	4-200Hz	0-999
Temperature	°C, °F		0-380°C (32-716°F)

- Display: color OLED display 128 x 128 pixels, diagonal 1.5" (38mm)
- Sensor: 1x external piezoelectric accelerometer; input: 60g PEAK with standard 100mV/g sensor
- Further functions: LED stroboscope (0.17 Hz – 300 Hz, equivalent to 10 RPM – 18000 RPM), LED torch
- Audible output: 1x AC signal 8 Ω / 0,5 W for external headphones.
- Power: 2 x AA 1.5V batteries (alkaline, NiMH, LiFe)
- Temp: Operating: -5 to 50, Storage: -20 to 65 (Degrees Celsius)
- Dimensions: 150 x 60 x 35 mm; Weight: 350 g including batteries (without cable, sensor and magnet). 540 g including batteries, cable, sensor and magnet
- Uses metric and English units.
- Only three keys for programming all the functions.

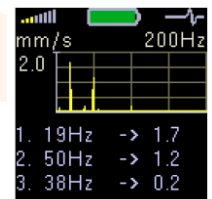
Some displays of the instrument



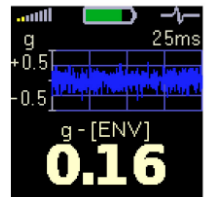
Overall RMS values



Overall PEAK values



Spectrum 200 Hz



Time signal for roller bearing diagnosis

SUPPLIED ACCESSORIES:

- For the machine set:
 - Set of 10 cables (different colors and lengths) with 4 mm safety connectors.
- For the instrument:
 - vibration sensor with coiled cable,
 - magnetic base,
 - earphones,
 - recording cable with 3.5 mm jacks,
 - measuring tip for manual pressure on the sensor,
 - 1.5V alkaline batteries, transport case, CD with the manual

THEORETICAL-EXPERIMENTAL HANDBOOKS

Application handbook with exercises.