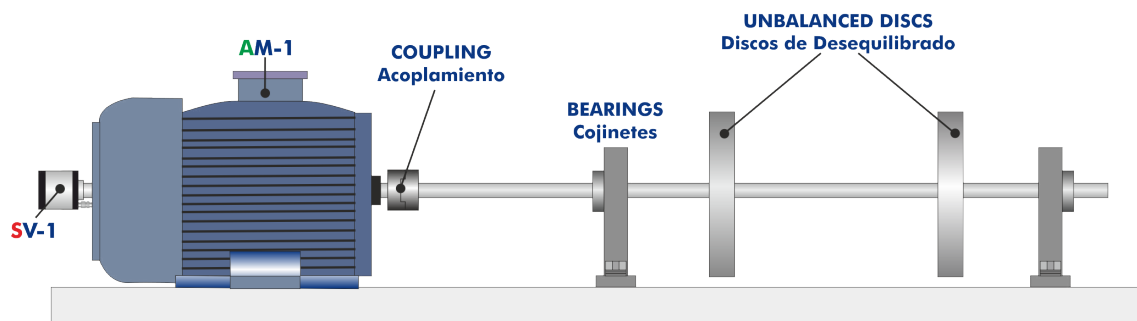




Electronic console

## PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

### MDU-UB



AM- MOTOR  
Motor

SV- SPEED SENSOR  
Sensor de Velocidad



Certificate of Approval of the  
Quality Management System



European Union Certificate  
(total safety)



UL and CSA Regulations  
(All our products are manufactured according  
to current UL and CSA regulations)



Certificate of Approval of the  
Environmental Management System



Worlddidac Association  
Certificate of Membership

## INTRODUCTION

To extend the operation time of a machine, prevent serious damage and correctly perform the maintenance tasks, it is essential to know the machine state.

In general, the state of a machine or its parts can be measured by analyzing the type and magnitude of the vibrations generated.

With the family Machine Diagnosis, "MDU", is possible to simulate certain faults and study the effects caused in the vibration spectrum.

## GENERAL DESCRIPTION

The family of Machine Diagnosis Unit, "MDU", of EDIBON, allows you to perform vibration measurement practical exercises, measuring the displacement, velocity and acceleration of vibrations in the time-frequency range.

The MDU Base Unit, "MDU-UB", components are mechanical elements such as: flexible couplings for compensating misalignments, bearings with easily removable roller bearings, two rotor shafts of different lengths, two flywheels with replaceable counterweights and an asynchronous drive motor connected to a frequency converter and a tachometer generator.

All the elements can be mounted on an aluminum frame of 1100 x 770 mm with longitudinal grooves for displacement. They can be easily adjusted using screws.

The unit electronic console makes it possible to show on digital displays the speed and power of the motor, to adjust the motor speed using a potentiometer, and to select the direction of rotation of the motor.

The drive motor is mounted on a sliding carriage that includes two micrometer for precise alignment.

Specific cases of machine faults may be studied with the additional recommended elements, such as: shaft bending vibrations, shaft fissures, roller bearing faults, coupling vibrations, belt drive vibrations, gear faults, pump cavitation, blower vibration, and electromechanical vibrations. Furthermore, with the Bread and Load Unit, "MDU-BLU", ranges of two loading moments may be generated as well as two speed ranges.

The Software, Sensors and Control for MDU Unit, "MDU-SSC" is required to perform all measurements and analyze vibrations.

The MDU Base Unit, "MDU-UB", requires the following to be assembled:

- Mobile Structure for MDU, "MDU-MLB", or
- Top Table Structure for MDU, "MDU-SM".

We also offer the Computer Controlled Machine Diagnosis Unit, "MDUC", which includes the following components:

- MDU Base Unit, "MDU-UB".
- Software, Sensors and Control for MDU Unit, "MDU-SSC".
- Displacement Sensors for MDU Unit, "MDU-SD".

Required elements (Not included):

- **MDU-SSC. Software, Sensors and Control for MDU Unit:**

The aim of the vibration analyzer is to assess the machine diagnosis testing with the different kits related to the vibration interface technology.

The system consists of two acceleration sensors, a speed sensor, a measuring amplifier with adjustable amplification degree, a USB box and the analysis software.

The analysis software has the following features: two-channel oscilloscope (studies in the time domain), two-channel spectrum analyzer (studies in the frequency domain), vibration intensity gauge, analysis of shock effects and damage in roller bearings, filter for acceleration curve recording, orbit representation and module for single or dual plane balancing of rigid rotors in operation.

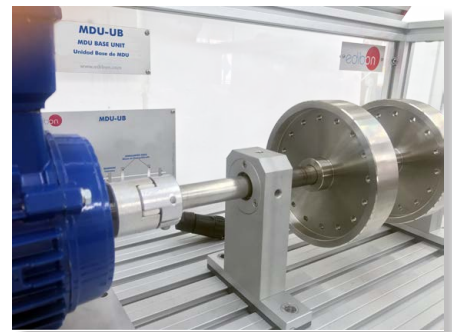
Thanks to the software, it is possible to compare the effectiveness of vibration signals by applying various analysis methods and by determining the advantages and disadvantages of different techniques. Each connection unit includes a 1x, 10x, 100x amplifier, with 16 analog input channels, 4 analog output channels, 4 digital input channels and 4 output channels, which will make possible the coupling of the sensors.

The optional connection of the additional recommended element, the Displacement Sensors for MDU Unit, "MDU-SD".

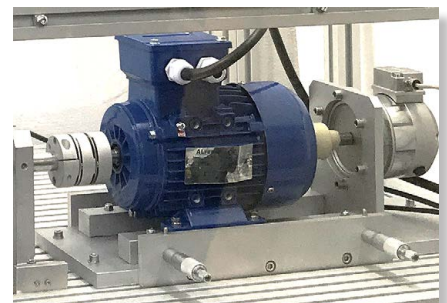
This unit is connected via USB.

It can be used both in a laptop or a computer.

Motor control (MDU-UB) and brake control (MDU-BLU) are optional.



MDU-UB detail



MDU-UB detail

Required elements (only one) (Not included):

**- MDU-MLB. Mobile Structure for MDU:**

The Mobile Structure for MDU, "MDU-MLB", is a robust structure designed to quickly and easily assemble the various elements of the MDU Base Unit, "MDU-UB" or the Computer Controlled Machine Diagnosis Unit, "MDUC", and thus assemble a mobile test bench for machine diagnosis.

This structure consists of a slotted table with anodized aluminum frames of 1100 x 770 x 820 mm.

It has three levels, where the two shelves at the bottom can be used to support the electronic unit and other accessories.

It also has four steering wheels for easy movement, with brakes on two of them and a transparent protective cover that protects against the rotating parts and allows us to observe the different experiments. The cover includes a safety switch for automatic stop if opened.

Mobile Structure for MDU, "MDU – MLB" includes:

MDU-SM. Top Table Structure for MDU.

TF-WLB. Wheeled Laboratory Bench.

**- MDU-SM. Top Table Structure for MDU:**

A bench-top structure consisting of a slotted table with anodized aluminum frames of 1100 x 770 x 820 mm.

It has a transparent protective cover that protects against the rotating parts and allows us to observe the different experiments. The cover includes a safety switch for automatic stop if opened.

Additional recommended elements (Not included):

**- MDU-BLU. Break and Load Unit:**

The Break and Load Unit, "MDU-BLU", of EDIBON is a magnetic particle brake, a display unit and an electrical control. It is possible to precisely adjust the braking moment. The excitation current is used as a measurement of the braking moment and it can be displayed through a console.

The braking unit consists of an integrated drive belt and a second projecting shaft, thus it has two speed ranges and two moment ranges.

The power generated is converted into heat by the brake and evacuated to the outside through a fan.

**- MDU-SES. Set of Elastic Shaft:**

The Set of Elastic Shaft, "MDU-SES", of EDIBON allows to study the behavior of an elastic rotor subjected to imbalance and balance of elastic rotors in operation. It is possible to study the resonance and the phenomena occurred in subcritical and supercritical regimes with the Displacement Sensors for MDU Unit, "MDU-SD".

The Set of Elastic Shaft, "MDU-SES", includes some oscillating ball bearings that guarantee the total shaft movement, and the protective bearings limit the amplitude in areas close to the resonance to non-hazardous values.

**- MDU-SRS. Set of Rotating Shaft with Crank:**

It is important that fissures resulting from material fatigue in rotating machines are detected in good time before the breakage occurs, which usually leads to fatal consequences.

The Set of Rotating Shaft with Crank, "MDU-SRS", consists of two shafts with different lengths, the short shaft simulates a projecting shaft end and the load is transmitted with the belt drive of the Set of Belt Drive, "MDU-SBD", whereas the long shaft is used with a protective bearing of the Set of Elastic Shafts, "MDU-SES", and a flywheel in order to study a shaft fissure in the case of an elastic rotor.

With the Set of Rotating Shaft with Crank, "MDU-SRS", a fissure with very close to real behaviors is simulated. By clamping the flange joint tightly with different forces, small temporary openings in the joint are achieved.

**- MDU-SRBF. Set of Roller Bearings with Faults:**

To determine the remaining life cycle of a roller bearing and decide on its replacement, the slow variation of the vibration spectrum is analyzed. The spectral distribution will enable to draw accurate conclusions about the type of defect and its location.

The Set of Roller Bearings with Faults, "MDU-SRBF", has six roller bearings with which to check and explain several faults in roller bearings, such as: damaged outer ring, damaged inner fault, damaged rolling element, combined damage, very used and new and non-faulty.

The radial bearing load may be adjusted within certain limits through the Set of Belt Drive, "MDU-SBD".



**- MDU-SCO. Set of Couplings:**

The Set of Couplings, "MDU-SCO", allows to compare the properties of different couplings such as curved tooth, bolt, flange and claw couplings.

The vibrational behavior of the different types of couplings is important to draw conclusions about faults or defects in the manufacturing or assembly of rotating machines. The usual faults are eccentricity, oscillation and pitch errors.

The Set of Couplings, "MDU-SCO", consists of different couplings to make shaft connections, allowing the study of different types of couplings, faulty and non-faulty.

**- MDU-SBD. Set of Belt Drive:**

The belt drives are noiseless drive devices, have a long life and require little maintenance provided that its design, assembly and adjustment are correct. The Set of Belt Drive, "SBD", allows to study the conditions that cause vibrations or slip in belts.

The set consists of three belts, three pulleys and a set of tensioning rollers and a belt pre-tension meter.

**- MDU-SSDG. Set to Study Damage in Gears:**

The Set to Study Damage in Gears, "MDU-SSDG", allows to study the vibrational behavior of gears with typical defects. For that purpose, gears with tooth defects and gears without defects are included, so a comparative study can be carried out. The gears included in the set are helical and straight-toothed gears. Due to the importance of lubrication in the vibrational signal of the unit, this may be lubricated with grease and gear oil.

The system allows to vary the gear distance and clearance between the teeth.

**- MDU-SCM. Set of Crank Mechanism:**

The compressors and pumps frequently use crank and connecting rod mechanisms. The force and mass oscillations cause vibrations in the units.

The Set of Crank Mechanism, "MDU-SCM", allows to adjust the stroke, mass compensation and bearing clearance, as well as the speed, to simulate vibrations.

The load is exerted by springs..

When you want to simulate the force obtained by a gas compression, a higher torque is required, for which it is recommended to use the Set of Belt Drive, "MDU-SBD", or the Set to Study Damage in Gears, "MDU-SSDG".

**- MDU-SSCP. Set to Study Cavitation in Pumps:**

Pump cavitation is produced when steam cavities are created within a fluid in which forces act responding to the pressure differences. Cavitation causes noise, damage to components and loss of performance.

The Set to Study Cavitation in Pumps, "MDU-SSCP", allows to produce the cavitation phenomenon and study its vibrational response.

The Set to Study Cavitation in Pumps, "MDU-SSCP", consists of a single-stage centrifugal pump connected to flexible tubes with a tank. It is possible to adjust different operating conditions with valves and manometers. Furthermore, it is possible to observe the inside of a pump in operation through the plastic casing.

The pump can be driven directly through an elastic coupling or the Set of Belt Drive, "MDU-SBD".

**- MDU-SSVF. Blower Vibration Set for MDU:**

In the Blower Vibration Set for MDU, "MDU-SSVF", the vibrations are magnetically induced. It is possible to study three impellers with a different number of movable vanes. It is also possible to study the gyroscopic effect by mounting the flywheel plate at an oblique angle. A regular fault in the rotation of the roller is induced by the action of a magnet.

The blower can be driven directly through an elastic coupling or the Set of Belt Drive, "MDU-SBD".

**- MDU-SEV. Set of Electromechanical Vibrations:**

Among the drive systems are the asynchronous motors, which generate vibrations in machines.

This is the case with an asymmetric air gap (space between rotor and stator), in which the magnetic vibrational forces induce torsional and bending vibrations. In the event of a partial failure of the electrical windings, mechanical vibrations are produced in the asymmetrical magnetic field.

The Set of Electromechanical Vibrations, "MDU-SEV", is an adjustable unit that allows to adjust an asymmetric air gap or to disconnect a winding, generating an electromagnetic asymmetry and thus it is possible to study its vibrational behavior.



Assembly of Set of Electromechanical Vibrations, "MDU-SEV", in the MDU Base Unit, "MDU-UB", with the Break and Load Unit, "MDU-BLU".

**- MDU-SD. Displacement Sensors for MDU Unit:**

Two displacement sensors which, together with the Set of Elastic Shaft, "MDU-SES", and the Software, Sensors and Control for MDU Unit, "MDU-SSC", allow you to represent subcritical and supercritical shaft orbits in resonance.

## SPECIFICATIONS

### - MDU-UB. MDU Base Unit.

Main metallic elements made of stainless steel.

Asynchronous motor with frequency variator, with sliding support and two micrometres:

Drive power: 0,37 kW.

Nominal speed: 2800 rpm.

Adjustable power and speed.

Two shafts:

Short, diameter: 20 mm, length: 300 mm.

Long, diameter: 20 mm, length: 500 mm.

Three flexible motor-shaft couplings in order to compensate possible misalignments.

Two bearing sawhorses:

Ball bearings 6204-SKF.

Two unbalanced flywheels with removable counterweights (screws), thus allowing the balancing in one or two plane:

Diameter: 150 mm, 1700 g each.

Tachometer for recording the speed.

Toolkit and screws for assembly of all components.

Storage case.

Electronic console:

Metal box.

Main switch.

Speed sensor connector.

Motor connector.

Motor start switch.

Motor stop switch.

Motor rotation switch.

Motor controller by potentiometer.

Digital display for motor speed.

Digital display for motor power.

Cables and accessories, for normal operation.

Manuals:

This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices manuals.

Required elements (Not included):

- MDU-SSC. Software, Sensors and Control for MDU Unit.

Required elements (only one) (Not included):

- MDU-MLB. Mobile Structure for MDU, or

- MDU-SM. Top Table Structure for MDU.

Additional recommended elements (Not included):

- MDU-BLU. Break and Load Unit.

- MDU-SES. Set of Elastic Shaft.

- MDU-SRS. Set of Rotating Shaft with Crank.

- MDU-SRBF. Set of Roller Bearings with Faults.

- MDU-SCO. Set of Couplings.

- MDU-SBD. Set of Belt Drive.

- MDU-SSDG. Set to Study Damage in Gears.

- MDU-SCM. Set of Crank Mechanism.

- MDU-SSCP. Set to Study Cavitation in Pumps.

- MDU-SSVF. Blower Vibration Set for MDU.

- MDU-SEV. Set of Electromechanical Vibrations.

- MDU-SD. Displacement Sensors for MDU Unit.

### Required elements (Not included)

#### **MDU-SSC. Software, Sensors and Control for MDU Unit**

Two acceleration sensors for recording oscillation travel, oscillation speed and acceleration:

Frequency range: 1 – 10 kHz, sensitivity: 100 mV/g.

Resonance frequency of about 32 kHz.

Optical tachometer sensor:

Range: 100 – 60000 rpm.

Optical range: up to 2 m.

Class 2 laser of 675 nm.

USB connection.



Additional recommended elements (Not included):

- MDU-SD. Displacement Sensors for MDU Unit.

### Required elements (only one) (Not included)

#### **MDU-MLB. Mobile Structure for MDU**

Mobile table for the MDU Base Unit, "MDU-UB" or for the Computer Controlled Machine Diagnosis Unit, "MDUC", with the dimensions of 1100 x 770 x 820 mm.

The Mobile Structure for MDU, "MDU-MLB", includes:

MDU-SM. Top Table Structure for MDU:

Anodized aluminum frames.

Aluminum frame assembly without mechanization.

Transparent protective cover with safety switch.

Diagram in the front panel with distribution of the elements similar to the real one.

TF-WLB. Wheeled Laboratory Bench.

Anodized aluminum frames.

Aluminum frame assembly without mechanization.

Four steering wheels with brakes on two of them.

Two shelves for the accessories.



#### **MDU-SM. Top Table Structure for MDU**

Anodized aluminum frames.

Aluminum frame assembly without mechanization.

Transparent protective cover with safety switch.

Diagram in the front panel with distribution of the elements similar to the real one.





## Additional recommended elements (Not included)

### MDU-BLU. Break and Load Unit

The set consists mainly of:

Magnetic particle brake (adjustment and measurement of the braking torque):

Speed range: 200 – 2000 rpm.

Braking torque: 10 Nm.

Adjustment and measurement of the braking torque.

Integrated belt drive for the second speed range and the moment range:

Gear ratio between brake shafts:  $i = 3$ .

Speed range: 600 – 6000 rpm.

Braking torque: 3.3 Nm.

Axial fan for heat discharge.

Electric protection against superheating

Electronic console:

Main switch.

Brake switch.

Brake controller.

Digital display of brake excitation current.



### MDU-SES. Set of Elastic Shaft

This set consists primarily of:

Two elastics shafts made of high-grade steel (long length and small diameter):

Diameter: 10 mm.

Length: 550 mm.

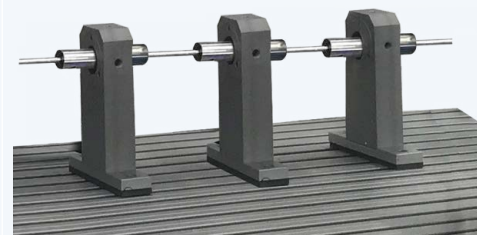
Nominal length between bearings: 450 mm.

Three bearings with holes for sensor housing.

Two bearing supports with oscillating ball bearings.

Vibration amplitude limitation bearing, diameter: 20 mm.

Storage case.



Required elements (Not included):

- MDU-SD. Displacement Sensors for MDU Unit.

### MDU-SRS. Set of Rotating Shaft with Crank

The set consists mainly of:

Taker-in plate.

Flange with short shaft (additional recommended element Set of Belt Drive, "MDU-SBD"):

Diameter: 90 mm.

Flange with long shaft (for flywheel).

Diameter: 90 mm.

Six screws:

Hexagon head screw for flange M8 x 20.

Clamping kit.

Two shafts:

Diameter: 20 mm.

Short shaft for "projecting shaft end" simulation:

Length: 85 mm.

Max. allowable bending moment: 15.9 Nm.

Long shaft for "elastic rotor" simulation:

Length: 200 mm.

Max. allowable bending moment: 3.9 Nm.

Centering mandrel for shaft alignment during the test assembly.



Required elements (Not included):

- MDU-SES. Set of Elastic Shaft.

and

- MDU-SBD. Set of Belt Drive.

### MDU-SRBF. Set of Roller Bearings with Faults

The set consists mainly of:

Six oscillating ball bearings:

Inner diameter: 20 mm.

Outer diameter: 47 mm.

Width: 14 mm.

Number of balls: 12.

Bearings:

Bearing with damaged outer ring.

Bearing with damaged inner ring.

Bearing with damaged rolling element.

Bearing with combined damage.

Widely used bearing.

New and non-faulty bearing

Roller bearing bracket.

Retaining rings.

Tool for retaining rings.



Additional recommended elements (Not included):

- MDU-SBD. Set of Belt Drive.

### MDU-SCO. Set of Couplings

The set consists mainly of:

Curved tooth coupling.

Non-faulty flange coupling.

Flange coupling with eccentricity fault:

Eccentricity fault (non-centering): 0.2 mm.

Flange coupling with oscillation fault:

Oscillation fault:  $0.4 \pm 0.1$  mm.

Bolt coupling with variable pitch fault:

Non-eccentric bolt.

Eccentric bolt:

Bolt eccentricity: 1 mm.

Max. pitch error:  $180^\circ \pm 1.909^\circ$ .

Four stars for claw coupling:

98 Shore A (red).

92 Shore A (yellow).

64 Shore D (green).

80 Shore A (blue).

Roller bearing bracket with elastic support.



Additional recommended elements (Not included):

- MDU-BLU. Break and Load Unit.

### MDU-SBD. Set of Belt Drive

The set consists mainly of:

Rubber V-belt:

SPX profile, approx. 10 mm wide.

Belt length: 915 mm.

Damaged rubber V-belt:

SPX profile, approx. 10 mm wide.

Belt length: 915 mm.

Small drive pulley:

Diameter: 63 mm.

Small pulley with eccentricity fault for the V-belt:

Diameter: 63 mm.

Large pulley:

Diameter: 125 mm.

Distance between shafts: 300 mm.

Clamping kit.

Belt pre-tension meter: 0 – 150 N.

Belt tensioning device.

Individually adjustable tensor rollers.

V-belt tension adjustment.



Required elements (Not included):

- MDU-BLU. Break and Load Unit.



### MDU-SSDG. Set to Study Damage in Gears

The set consists mainly of:

Transparent box cover to observe the gear in operation.

Holes for vibration sensors.

Sets of straight-toothed gears, with fault:

Sprocket wheel: 75 teeth each,  $m = 2$ .

Pinion: 25 teeth each,  $m = 2$ .

Sets of straight-toothed gears, without fault:

Sprocket wheel: 75 teeth each,  $m = 2$ .

Pinion: 25 teeth each,  $m = 2$ .

Sets of helical-toothed gears, with fault:

Sprocket wheel: 75 teeth each,  $m = 2$ .

Pinion: 25 teeth each,  $m = 2$ .

Sets of helical-toothed gears, without fault:

Sprocket wheel: 75 teeth each,  $m = 2$ .

Pinion: 25 teeth each,  $m = 2$ .

Gear fixing shafts.

Variable wheelbase.

Motor oil SAE 10 W – 40, 1 l for lubricating the gears.

Storage case.



Required elements (Not included):

- MDU-BLU. Break and Load Unit.

### MDU-SCM. Set of Crank Mechanism

The set consists mainly of:

Crank and connecting rod mechanism with adjustable stroke:

Stroke: 50 – 75 – 100 mm.

Two balance weight masses: Total 490 g, designed to operate with a 50 mm stroke.

Bearing set adjustment:

Bearing clearance: 0 – 1 mm.

Two pressure springs:

Length without tension: 170 mm.

Spring ratio:  $R = 0.55 \text{ N/mm}$ .



Additional recommended elements (Not included):

- MDU-SBD. Set of Belt Drive.

or

- MDU-SSDG. Set to Study Damage in Gears.

### MDU-SSCP. Set to Study Cavitation in Pumps

The set consists mainly of:

Centrifugal pump:

Max. flow rate: 17 l/min ( $3300 \text{ min}^{-1}$ ).

Max. lift height: 12 m ( $3300 \text{ min}^{-1}$ ).

Three-vane impeller.

Minimum speed for cavitation:  $2240 \text{ min}^{-1}$  approx. (choked suction side).

Two manometers:

Pressure side: 0 – 4 bar.

Suction side: -1 – 1.5 bar.

Casing cap.

Knurled screw to open the casing cap.

Suction side tube.

Two ball valves.

Set of flexible tubes.

Tank:

Material: HDPE.

Capacity: 20 l.



Additional recommended elements (Not included):

- MDU-SBD. Set of Belt Drive.

#### MDU-SSVF. Blower Vibration Set for MDU

The set consists mainly of:

Steel plate impeller with three movable vanes:

Diameter: 204 mm.

Max. speed: 3000 min<sup>-1</sup>.

Steel plate impeller with five movable vanes:

Diameter: 204 mm.

Max. speed: 3000 min<sup>-1</sup>.

Steel plate impeller with seven movable vanes:

Diameter: 204 mm.

Max. speed: 3000 min<sup>-1</sup>.

Flywheel plate to simulate axial forces.

Protective cover.

Roller bearing bracket.

Aluminum protective plate, diameter: 220 mm.

Permanent magnet.



Additional recommended elements (Not included):

- MDU-SBD. Set of Belt Drive.

#### MDU-SEV. Set of Electromechanical Vibrations

The set consists mainly of:

Asynchronous motor with variable speed:

Drive power: 0.37 kW.

Nominal speed: 2800 rpm.

Adjustable power and speed.

Variable air gap due to stator displacement.

Winding disconnect switch.

Current clamp. Adjustable magnet-vane distance.



Required elements (Not included):

- MDU-BLU. Break and Load Unit.

#### MDU-SD. Displacement Sensors for MDU Unit

Two inductive displacement sensors:

Range: 1 – 10 mm.



## EXERCISES AND PRACTICAL POSSIBILITIES

- 1.-Assessment of the vibration state of a machine.
- 2.-Measuring the vibrations caused by unbalanced operation of rigid rotors in 1 and 2 planes.
- 3.-Study of the basic essentials of the vibration measurement in shafts and bearings.
- 4.-Study of the basic magnitudes and parameters.
- 5.-Use of measuring sensors and instruments.
- 6.-Understanding the influence of speed and shaft and recorder arrangements.
- 7.-Learning to balance rigid shafts in operation and alignment between motor and bearing.
- 8.-Understanding and interpreting the frequency spectra.
- 9.-Learning about the different vibration signals.
- 10.-Applying the FFT analysis correctly.
- 11.-Measuring the speed, oscillation travel, oscillation speed and acceleration.
- 12.-Learning about the effects of alignment on different types of couplings.
- 13.-Learning about the effects of speed on vibration behavior.
- 14.-Learning about the effects of the balanced and unbalanced elastic rotor (MDU-SES kit is required).
- 15.-Study of the variation of a typical vibration behavior (vibration velocity, frequency, amplitude, and phase) due to a fissure (MDU-SRS kit is required).
- 16.-Identifying cracks and fissures in shafts through acceleration curves and order analysis (MDU-SRS is required).
- 17.-Identifying a fissure through the variation of a vibration spectrum (MDU-SRS is required).
- 18.-Estimating the life cycle of a roller bearing (MDU-SRBF is required).
- 19.-Identifying faulty roller bearings (MDU-SRBF required).
- 20.-Checking the effects of roller bearing faults on outer and inner ring, or the roller bearing body on the vibration spectrum (MDU-SRBF is required).
- 21.-Understanding the effect of ring gear hardness on claw couplings (MDU-SCO is required).
- 22.-Comparing the curved tooth, bolt, flange or claw couplings (MDU-SCO is required).
- 23.-Understanding the importance of belt tension in vibration behavior (MDU-SBD is required).
- 24.-Checking the effect of the eccentricity in pulleys and the speed in vibration behavior (MDU-SBD is required).
- 25.-Comparison between defective and non-defective belts (MDU-SBD is required).
- 26.-Understanding and interpreting the frequency spectra in order to differentiate between defective and non-defective belts (MDU-SBD is required).
- 27.-Identifying defects in the gears according to their vibration behavior (MDU-SSDG is required).
- 28.-Learning about the effect of the toothed gear, the lubrication used and the wheelbase and the backlash (MDU-SSDG is required).
- 29.-Identifying wear on the rod and piston (MDU-SCM is required).
- 30.-Learning about the effect of bearing clearance and impacts (MDU-SCM is required).
- 31.-Study of the vibrations of a centrifugal pump in operation (MDU-SSCP is required).
- 32.-Understanding the cavitation phenomenon in a centrifugal pump (MDU-SSCP is required).
- 33.-Identifying vibrations caused by the movable vanes in the vibration spectrum (MDU-SSCP is required).
- 34.-Measuring the pitch frequency between movable vanes (MDU-SSCP is required).
- 35.-Measuring the blower vibrations (MDU-SSCP is required).
- 36.-Learning about the effect of an asymmetric air gap on the vibration behavior and the electromagnetic and performance losses (MDU-SEV is required).
- 37.-Learning about the effect of the electrical windings on vibration behavior (MDU-SEV is required).

## REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.

## DIMENSIONS AND WEIGHTS

### MDU-UB:

#### Unit:

- Dimensions: 1 100 x 700 x 400 mm approx.  
(47.24 x 27.55 x 15.74 inches approx.)
- Weight: 20 Kg approx.  
(44 pounds approx.)

#### Control Interface Box:

- Dimensions: 490 x 330 x 310 mm approx.  
(19.29 x 12.99 x 12.20 inches approx.)
- Weight: 10 Kg approx.  
(22 pounds approx.)

### MDU-MLB:

- Dimensions: 1 100 x 770 x 820 mm aprox.  
(43.30 x 30.31 x 32.28 inches approx.)
- Weight: 35 Kg aprox.  
(77 pounds approx.)

### MDU-SM:

- Dimensions: 1 100 x 770 x 260 mm aprox.  
(43.30 x 27.55 x 15.74 inches approx.)
- Weight: 10 Kg aprox.  
(22 pounds approx.)

### MDU-BLU:

- Dimensions: 600 x 400 x 320 mm approx.  
(23.62 x 15.74 x 12.59 inches approx.)
- Weight: 30 Kg approx.  
(66.13 pounds approx.)

### MDU-SES:

- Dimensions: 600 x 400 x 120 mm approx.  
(23.62 x 15.74 x 4.72 inches approx.)
- Weight: 6 Kg approx.  
(13.22 pounds approx.)

### MDU-SRS:

- Dimensions: 400 x 300 x 120 mm approx.  
(15.74 x 11.81 x 4.72 inches approx.)
- Weight: 3 Kg approx.  
(6.61 pounds approx.)

### MDU-SRBF:

- Dimensions: 400 x 300 x 120 mm approx.  
(15.74 x 11.81 x 4.72 inches approx.)
- Weight: 4 Kg approx.  
(8.81 pounds approx.)

### MDU-SCO:

- Dimensions: 400 x 300 x 170 mm approx.  
(15.74 x 11.81 x 6.69 inches approx.)
- Weight: 6 Kg approx.  
(13.22 pounds approx.)

### MDU-SBD:

- Dimensions: 600 x 400 x 170 mm approx.  
(23.62 x 15.74 x 6.69 inches approx.)
- Weight: 6 Kg approx.  
(13.22 pounds approx.)

### MDU-SSDG:

- Dimensions: 600 x 400 x 320 mm approx.  
(23.62 x 15.74 x 12.59 inches approx.)
- Weight: 25 Kg approx.  
(55.11 pounds approx.)

### MDU-SCM:

- Dimensions: 600 x 400 x 170 mm approx.  
(23.62 x 15.74 x 6.69 inches approx.)
- Weight: 8 Kg approx.  
(17.63 pounds approx.)

### MDU-SSCP:

- Dimensions: 600 x 400 x 320 mm approx.  
(23.62 x 15.74 x 12.59 inches approx.)
- Weight: 16 Kg approx.  
(35.27 pounds approx.)

### MDU-SSVF:

- Dimensions: 400 x 300 x 320 mm approx.  
(15.74 x 11.81 x 12.59 inches approx.)
- Weight: 6 Kg approx.  
(13.22 pounds approx.)

### MDU-SEV:

- Dimensions: 400 x 300 x 320 mm approx.  
(15.74 x 11.81 x 12.59 inches approx.)
- Weight: 11 Kg approx.  
(24.25 pounds approx.)

### MDU-SD:

- Dimensions: 400 x 300 x 320 mm approx.  
(15.74 x 11.81 x 12.59 inches approx.)
- Weight: 6 Kg approx.  
(13.22 pounds approx.)

## REQUIRED ELEMENTS (Not included)

- MDU-SSC. Software, Sensors and Control for MDU Unit.

Required (only one):

- MDU-MBL. Mobile Structure for MDU.  
or
- MDU-SM. Top Table Structure for MDU.

## ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- MDU-BLU. Break and Load Unit.
- MDU-SES. Set of Elastic Shaft.
- MDU-SRS. Set of Rotating Shaft with Crank.
- MDU-SRBF. Set of Roller Bearings with Faults.
- MDU-SCO. Set of Couplings.
- MDU-SBD. Set of Belt Drive.
- MDU-SSDG. Set to Study Damage in Gears.
- MDU-SCM. Set of Crank Mechanism.
- MDU-SSCP. Set to Study Cavitation in Pumps.
- MDU-SSVF. Blower Vibration Set for MDU.
- MDU-SEV. Set of Electromechanical Vibrations.
- MDU-SD. Displacement Sensors for MDU Unit.

## SIMILAR UNITS AVAILABLE

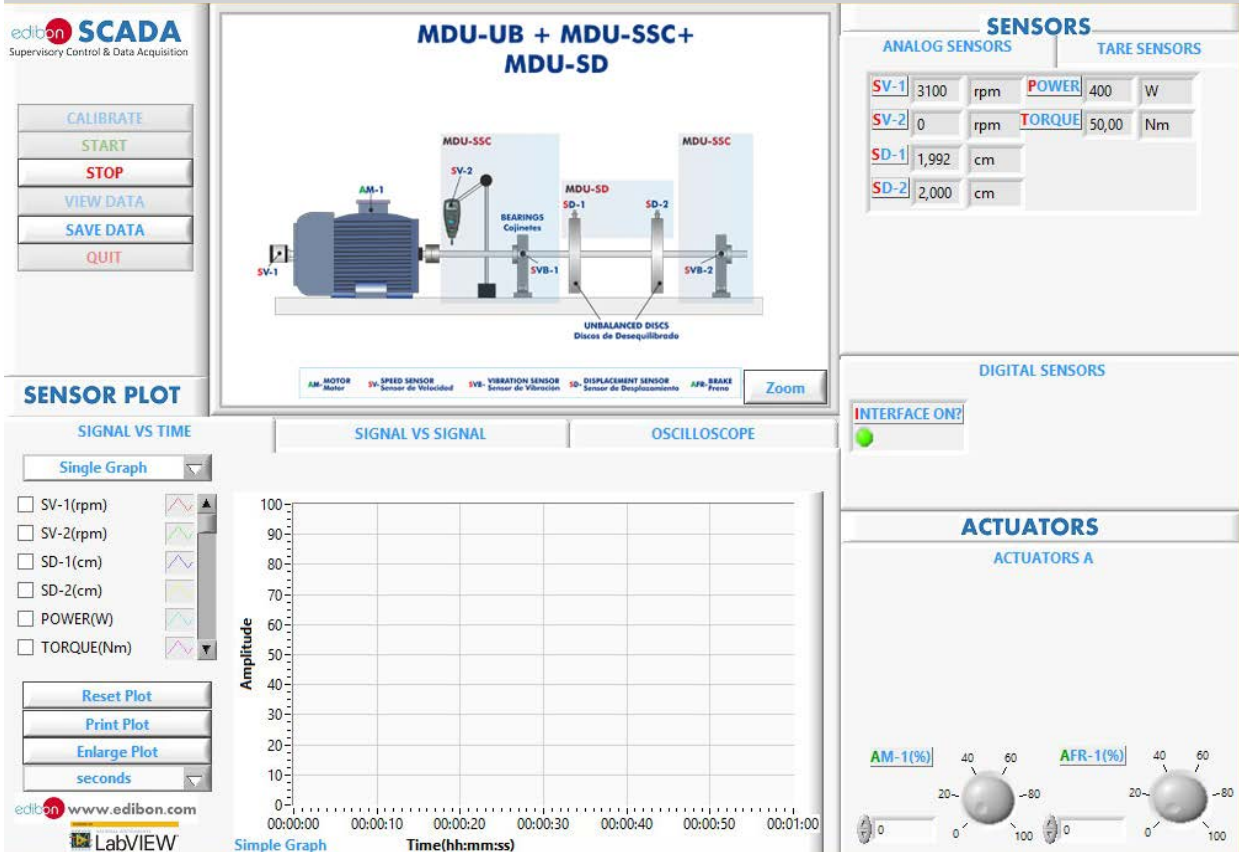
Offered in this catalog:

- MDU. Machine Diagnosis.

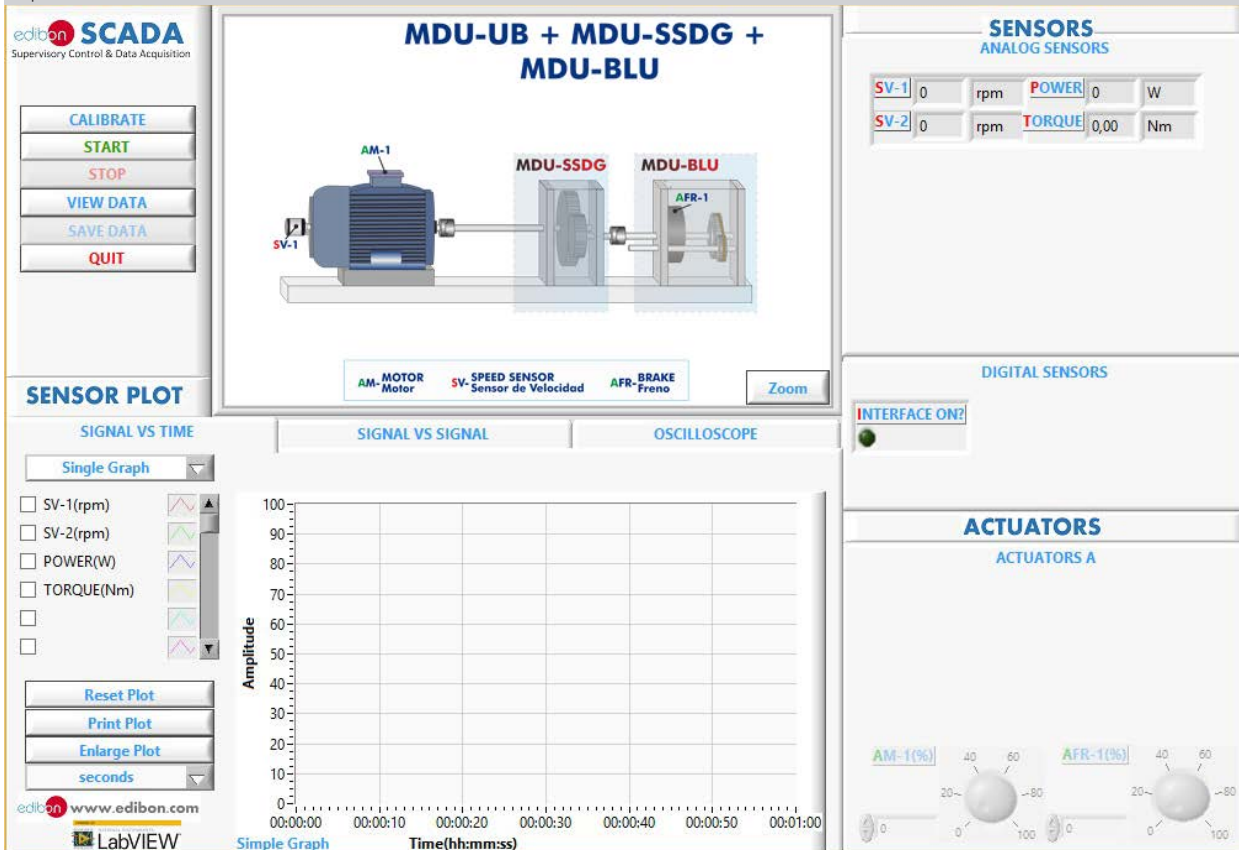
Offered in others catalogs:

- MDUC. Computer Controlled Machine Diagnosis Unit.

Operation with "MDU-SSC".

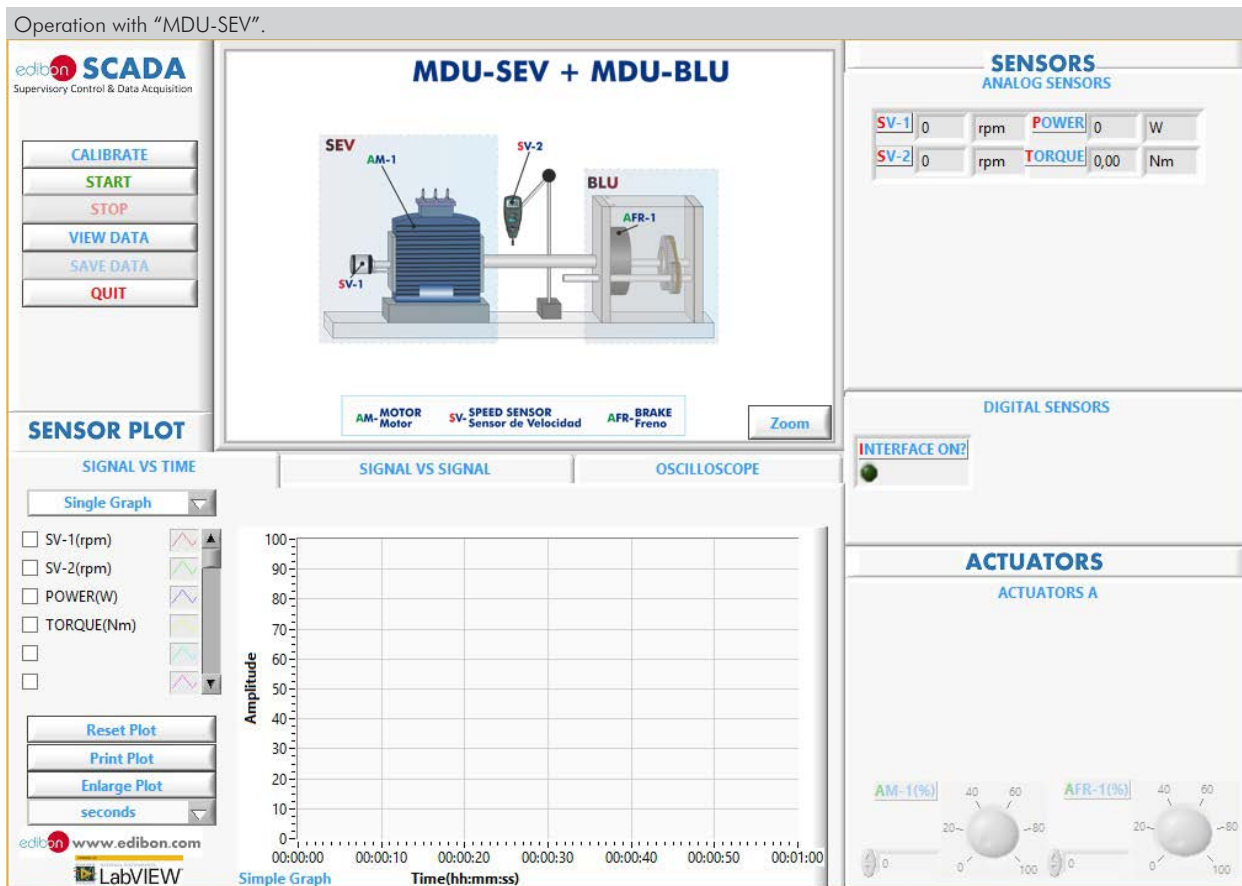


Operation with "MDU-SSDG".

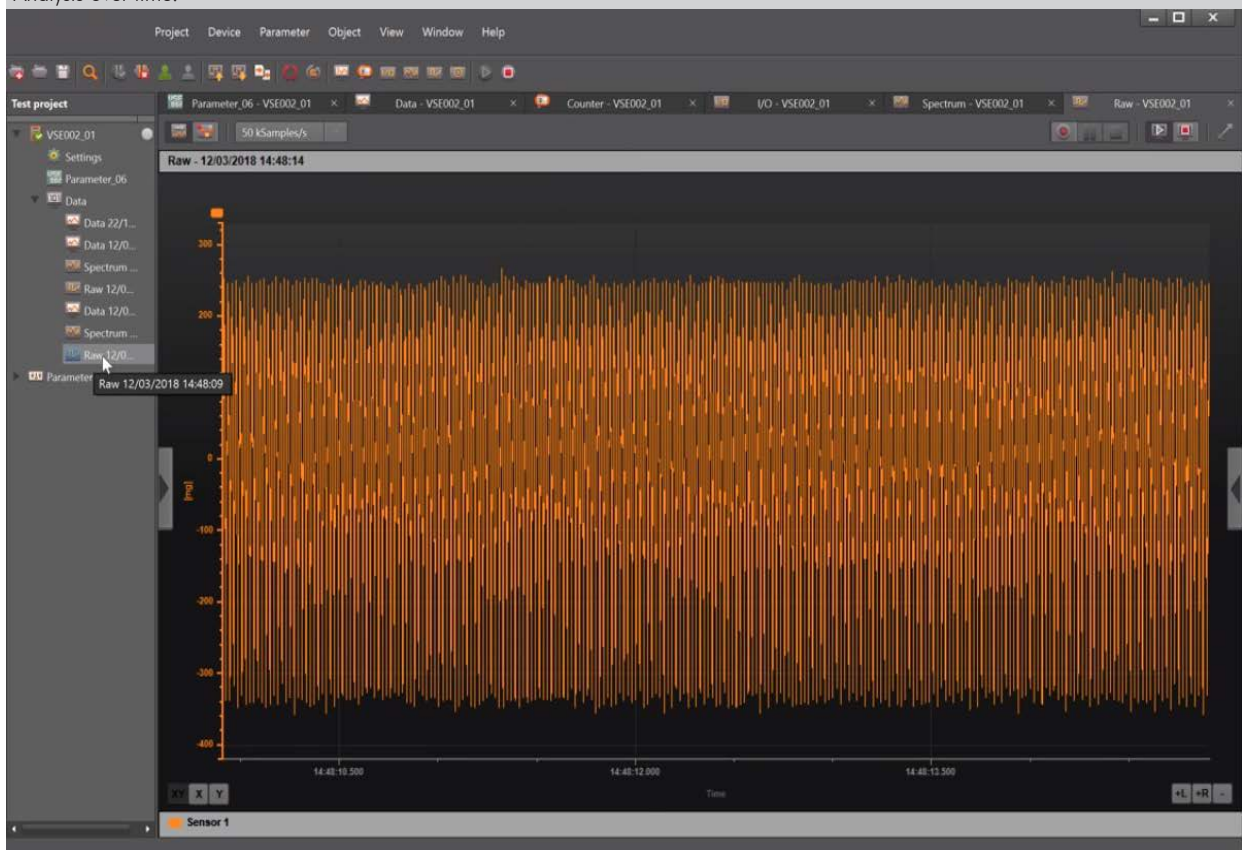




Some **real** results obtained from this unit

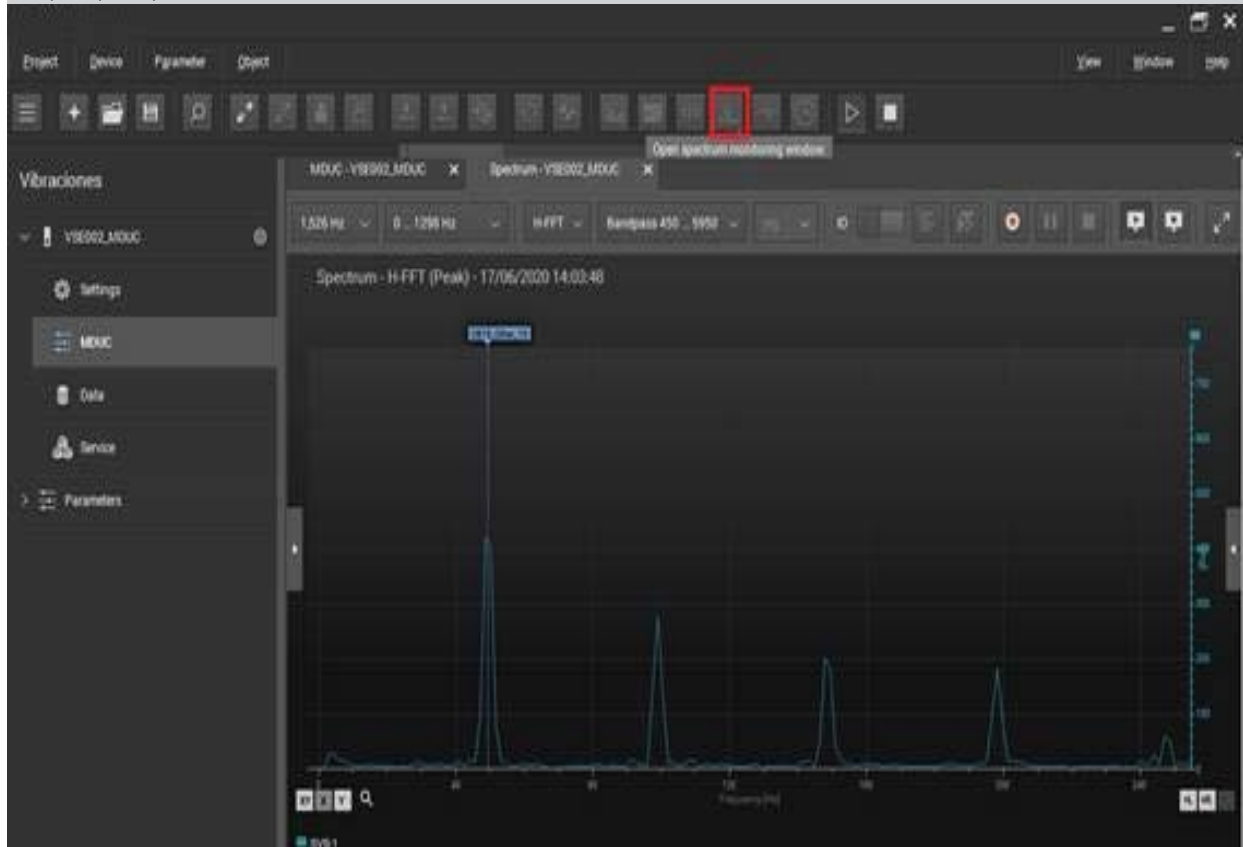


Analysis over time.

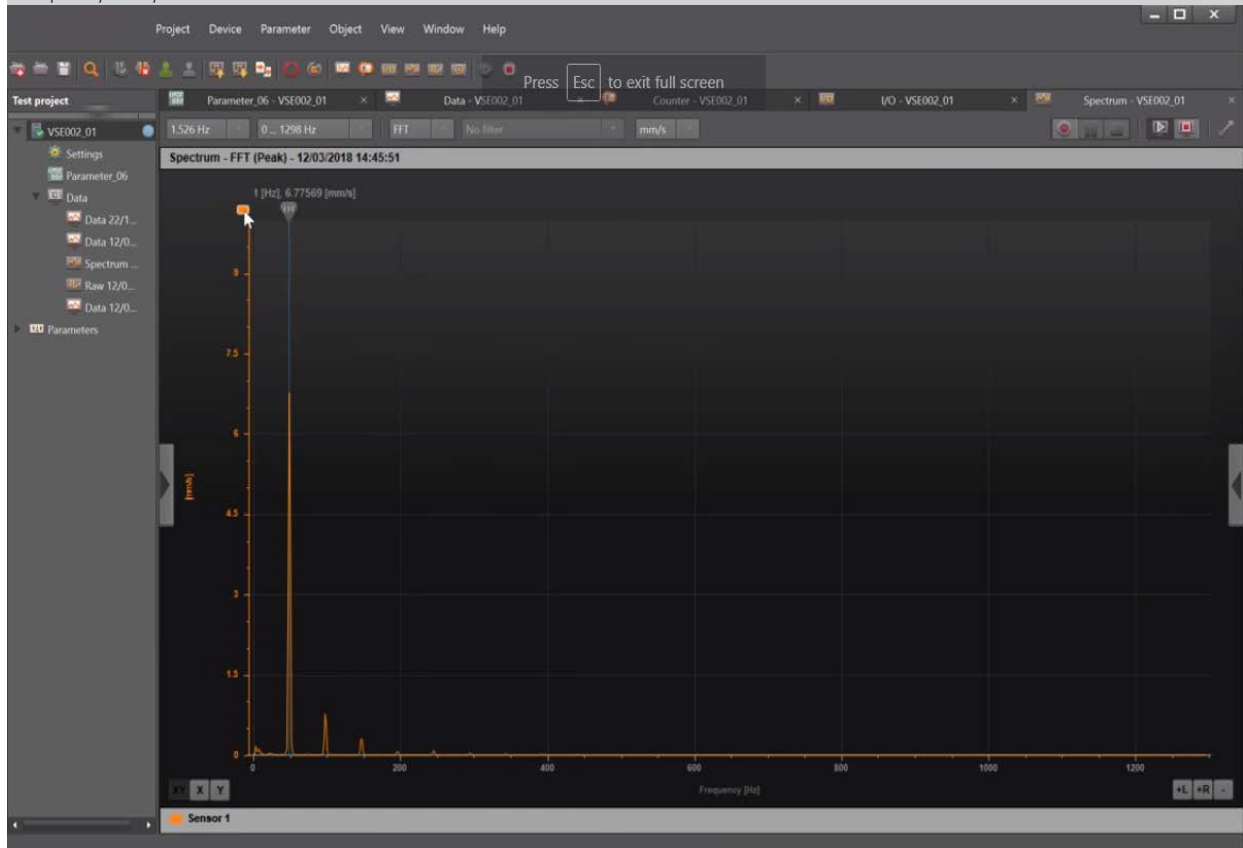


Some **real** results obtained from this unit

Frequency analysis.

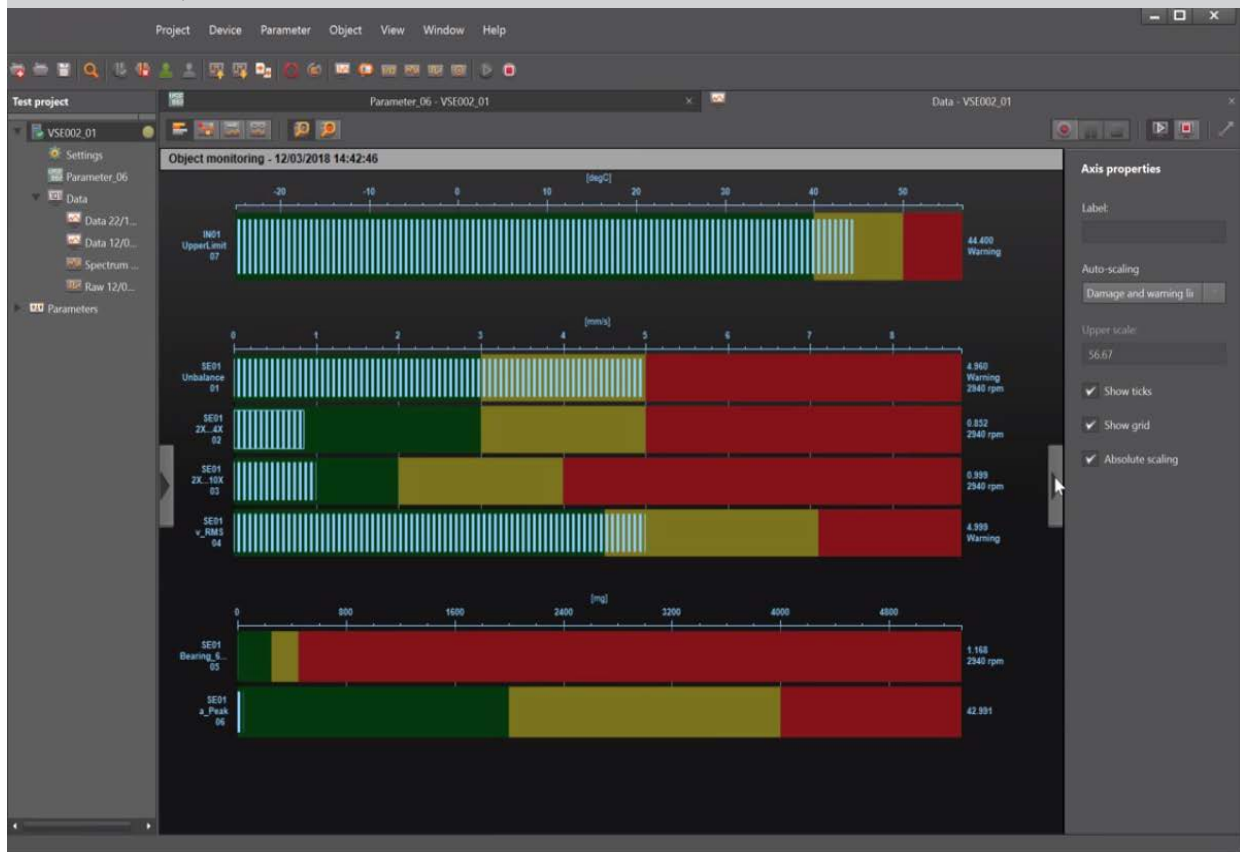


Frequency analysis.



Some **real** results obtained from this unit

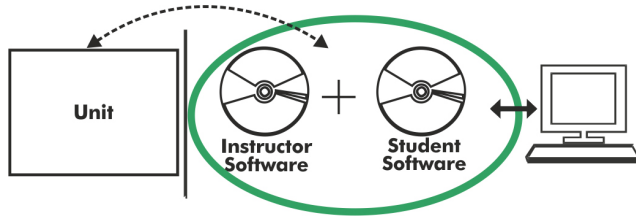
Values with alarms.



Instantaneous values.

Object monitoring - 12/03/2018 14:43:02

Name	Value	Timestamp	State
SE01_Unbalance_01	4.947 mm/s	12/03/2018 14:43:02	Warning - 2940 rpm
SE01_2X_4X_02	0.859 mm/s	12/03/2018 14:42:56	2940 rpm
SE01_2X_10X_03	1.005 mm/s	12/03/2018 14:42:59	2940 rpm
SE01_v_RMS_04	4.987 mm/s	12/03/2018 14:43:02	Warning - 6000 rpm
SE01_Bearing_6210_05	1.531 mg	12/03/2018 14:43:01	2940 rpm
SE01_a_Peak_06	52.767 mg	12/03/2018 14:43:02	6000 rpm
IN01_UpperLimit_07	44.400 degC	12/03/2018 14:43:02	Warning - 6000 rpm

**MDU-UB/ICAI. Interactive Computer Aided Instruction Software:**

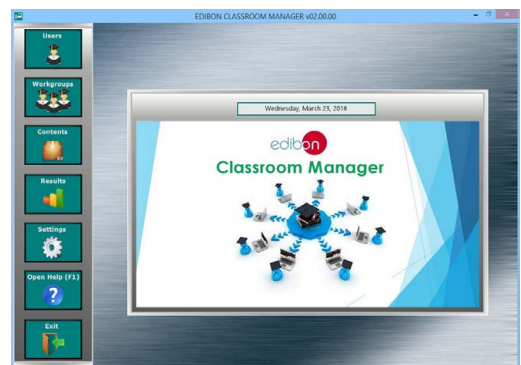
With no physical connection between unit and computer, this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

Instructor Software**- ECM-SOF. EDIBON Classroom Manager (Instructor Software).**

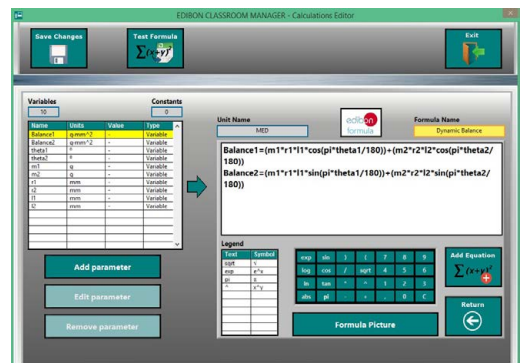
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

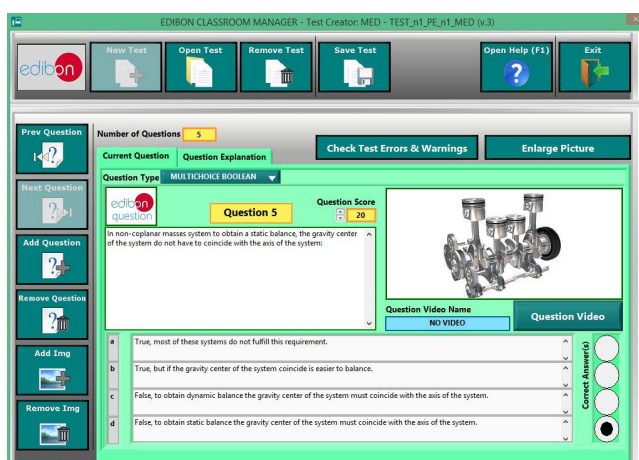
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.



ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram



Optional  
Student Software

- **ESL-SOF. EDIBON Student Labsoft (Student Software).**

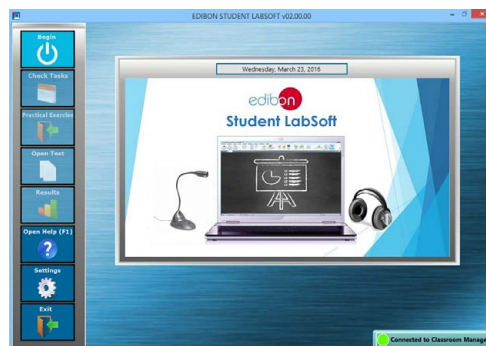
ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

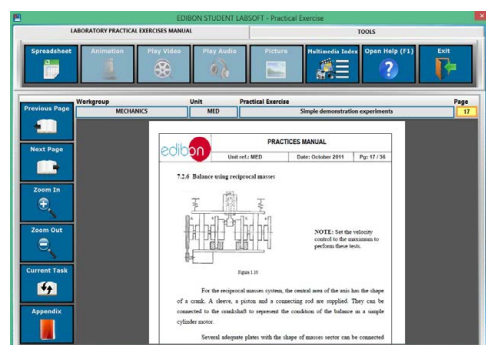
- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge and progression.**
- **Test self-correction.**
- **Calculations computing and plotting.**
- **Equation System Solver Engine.**
- **User Monitoring Learning & Printable Reports.**
- **Multimedia-Supported auxiliary resources.**

For more information see ICAI catalogue. Click on the following link:

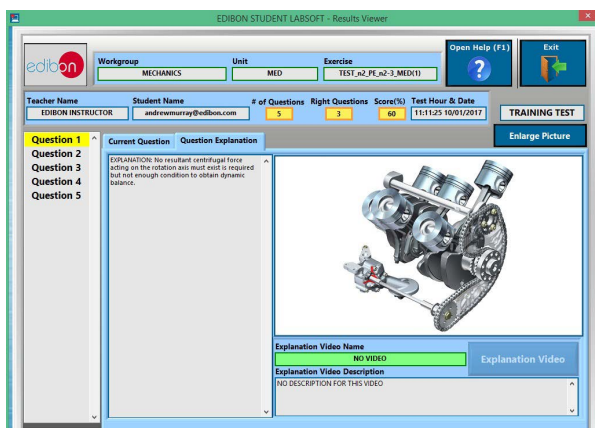
[www.edibon.com/en/interactive-computer-aided-instruction-software](http://www.edibon.com/en/interactive-computer-aided-instruction-software)



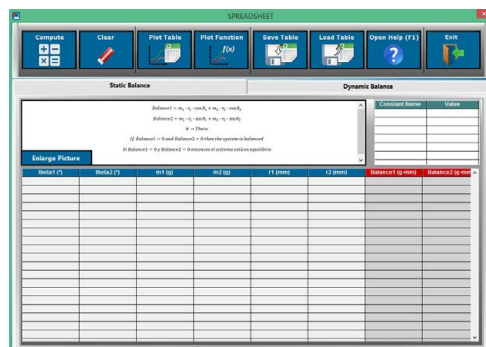
ESL-SOF. EDIBON Student LabSoft (Student Software)  
Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

\* Specifications subject to change without previous notice, due to the convenience of improvement of the product.



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REPRESENTATIVE:

