



INTRODUCTION

Instrumentation transducers play a key role for converting physical parameters like temperature, pressure, and strain into electrical signals. These signals are essential for monitoring and controlling processes in various applications such as manufacturing, healthcare, aerospace, and environmental monitoring.

By providing real-time and accurate data, transducers enable informed decision-making, quality assurance, and safety. As technology advances, these devices continue to evolve, offering enhanced functionalities and broader applications across industries in any application.

GENERAL DESCRIPTION

The Transducers and Instrumentation Unit, "SAIT", has been designed by EDIBON to show most of the devices used in the industry that allow the electronic systems to communicate with the real world, to measure physical variables and to control industrial processes.

It is a unit with a logical distribution of its components that facilitates the rapid comprehension of the elements that form it, all housed in a solid robust with the power supply incorporated.

Input Transducers:

These convert an analog signal into an electrical one and permit us to make an evaluation of these transducers, with their characteristics, adjustments and practical applications.

Output Transducers:

These convert an electrical signal into an analog one permit us to make an evaluation of these transducers, their characteristics, adjustments and practical applications.

Signal Conditioning Circuits:

These allow us to carry out a profound study and analysis of the numerous circuits and included signal conditioners, in addition to the particular properties of: amplifiers, signal converter circuits, comparators, filters and circuits that carry out mathematical operations.

The student must wire the circuit to carry out the practices. The connections are of 2 mm. The student will become familiar with the connections of these traducers.

SPECIFICATIONS

The Transducers and Instrumentation Unit, "SAIT", shows didactically the function principles of the transducers most used in industry. It is divided into two parts: the lower part, in which all the input and output transducers are found, while in the upper part, the system of signal conditioning and those of instrumentation are found; the electrical and pneumatic power supplies are housed in its interior.

Input transducers:

Resistance transducers for applications in angular or linear position:

Linearly sliding potentiometer. Rotary carbon-track potentiometer. Rotary coil potentiometer.
Precision servo-potentiometer.

The Wheatstone bridge circuit.

Applications of temperature:

NTC Thermistors (Negative Temperature Coefficient). RTD Sensor (Platinum Transducer with Temperature dependent Resistance).
Temperature sensor IC "Integrated Circuit LM 335". Thermocouples type "K".

Applications of light:

Photovoltaic cell. Phototransistor. Photodiode PIN. Photoconductive cell.

Linear position and force:

LVDT (Linear Variation Differential Transformer). Extensiometric transducer.

Environmental measurements:

Air flow sensor (flowmeter). Air pressure sensor. Humidity sensor.

Rotational speed and position control:

Slotted optoelectronic sensor. Opto-reflective sensor. Inductive sensor. Hall effect sensor. Permanent DC magnet tachogenerator.

Sound measurements:

Dynamical microphone. Ultrasonic receiver.

Visualization devices:

Timing device/counter with LED display.

Graphic bar visualizer.

Mobile coil voltmeter.

Output transducers:

Electrical resistance.

Incandescent lamp.

Applications for the sound output:

Buzzing (Buzzer). Mobile coil loud speaker. Ultrasonic transmitter.

Applications of linear or angular motion:

DC Solenoid. DC Relay. Solenoid valve. Permanent magnet DC motor.

Signal conditioners:

DC Amplifiers.

AC Amplifier.

Power amplifier

Current amplifier.

Buffers.

Inverting amplifier.

Differential amplifier.

V/F and F/V Converters.

V/I and I/V Converters.

Full wave rectifier.

Hysteresis convertible comparator.

Electronic switch.

Oscillator 40 kHz.

Filter 40 kHz.

Time-constant convertible low pass filter.

Circuit with mathematical operation:

Adding amplifier.

Integrator with different time constants.

Differentiator with different time constants.

Instrumentation amplifier.

Circuit SAMPLE & HOLD.

Amplifiers with gain control and offset.

Furthermore it contains **a linearly mounted system of a DC motor, tachodynamo, reflective, slotted opto-sensors to detect the absolute and incremental position.**

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.

Additional recommended elements (only one) (Not included):

- EDAS/VIS-0.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s).

- EDAS/VIS-1.25. EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s).

Additional recommended elements (only one) (Not included):

EDAS/VIS. EDIBON Data Acquisition System and Virtual Instrumentation

16 Analog inputs (1 block with 12 voltage channels and 1 block with 2 current channels (4 connections)).

EDAS/VIS-0.25, sampling velocity 250,000 samples per second.

EDAS/VIS-1.25, sampling velocity 1250,000 samples per second.

2 analog outputs.

24 digital inputs/outputs, configurable as inputs or outputs, with 24 state LED indicators. These digital inputs/outputs are grouped in three ports of eight channels (P0, P1 and P3).

4 digital signal switches 0 - 5 V.

2 analog signal potentiometers 12 V.

Main ON / OFF switch.

Inside: internal power supply of 12 V and 5 V. Potentiometer.



DAB. Data Acquisition Board:

The Data Acquisition board is part of the SCADA system.

For EDAS/VIS-1.25 Version EDIBON Data Acquisition System and Virtual Instrumentation (speed: 1,250,000 samples/s):

PCI Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI.

Analog input:

Number of channels= 16 single-ended or 8 differential. Resolution= 16 bits, 1 in 65536.

Sampling rate up to: 1,250,000 S/s (samples per second). Input range (V)= ±10 V.

Data transfers=DMA, interrupts, programmed I/O. Number of DMA channels=6.

Analog output:

Number of channels=2. Resolution=16 bits, 1 in 65536. Max. output rate up to: 900 KS/s.

Output range(V)= ±10 V. Data transfers=DMA, interrupts, programmed I/O.

Digital Input/Output: Number of channels=24 inputs/outputs. Port 0 up to 8 MHz.

Timing: Counter/timers=2. Resolution: Counter/timers: 32 bits.

For EDAS/VIS-0.25 Version EDIBON Data Acquisition System and Virtual Instrumentation (speed: 250,000 samples/s):

Sampling rate up to: 250,000 S/s (samples per second).

Analog output: Max. output rate up to: 10 KS/s.

Digital Input/Output: Number of channels=24 inputs/outputs. Port 0 up to 1 MHz.

Rest of characteristics are the same than EDAS/VIS 1.25 Version.

The Data Acquisition board model may change at any moment, providing the same or better features than those required for the unit.



EDAS/VIS/CCSOF. Computer Control + Data Acquisition + Data Management Software:

Compatible with actual Windows operating systems. Amicable graphical frame.

Configurable software allowing the temporal/frequency representation of the different inputs and outputs. Visualization of a voltage of the circuits on the computer screen.

It allows data store in a file, print screens and reports of the signals at any time.

Measurement, analysis, visualization, representation and report of results.

Set of virtual instruments:

Oscilloscope:

Channels: 12 simultaneous. Maximum input voltage: 10 V.

All 12 input channels could be scaled to compare signal with different voltage levels.

Maximum sampling velocity: 1000 samples per second.

"Math Menu" with operations as add, rest, multiplication and division, between any of the 12 oscilloscope channels.

Function generator:

Two independent signal generators, for sinusoidal, triangular, sawtooth and square.

Channels: 2 (allowing working simultaneously). Maximum output voltage: 10 V.

Maximum output rate: 1000 samples per second.

It includes a graph where an output signal for each channel is shown.

Spectrum analyzer:

Channels: 12 (simultaneous). Maximum voltage: 10 V. Digital spectrum analyzer: based on the FFT.

Maximum sampling velocity: 1000 samples per second.

Multimeter:

Voltmeter, channels: 12 (simultaneous). Maximum voltage: 10 V RMS.

Ammeter, channels: 2 (simultaneous). Maximum ampere: 500 mA RMS per channel.

Transient analyzer.

Logic analyzer:

Number of input channels: 8. TTL Voltage level.

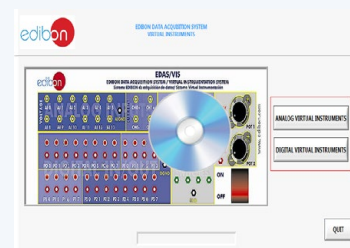
Clock source: 2 different sources.

This instrument allows receiving as far as 8 digital signal simultaneously.

Logic generator:

Number of transmission channels: 8. TTL voltage level.

This instrument allows generating up to 8 digital simultaneous signals.



EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Basic control systems description.
Characteristics of the control system:
- 2.- Characteristics of an ON/OFF temperature control system.
- 3.- Characteristics of an ON/OFF lighting system.
- 4.- Investigation of the characteristics of a positional control system.
- 5.- Proportional control.
- 6.- Proportional+integral control.
- 7.- Proportional+derivate control.
- 8.- Proportional+integral+derivate control.
- 9.- Characteristics of a speed control system.
- 10.- Operation in open loop.
- 11.- Operation in closed loop, proportional control.
- 12.- Proportional+integral control.
- 13.- Proportional+integral+derivate control.
- Display devices:
- 14.- Application of the timer/counter as a meter of time.
- 15.- Application of the timer/counter as a simple counter.
- 16.- Application of the timer/counter as rev-counter or frequency-meter.
- 17.- Characteristics of an L.E.D. bargraph display unit.
- 18.- Characteristic of a mobile coil meter.
- 19.- Comparison of digital, bargraph and mobile coil meters.
- 20.- To widen the voltage index of the B.M. meter.
- Variable resistance transducers in angle or linear arrangement:
- 21.- Variation of the output voltage for a potentiometer used as a position transducer.
- 22.- The buffer as compensator for the effect of the load on the output voltage of a potentiometer.
- 23.- Servo potentiometer. Variation of the output voltage with respect to its position.
- 24.- Measuring the resistance using a Wheatstone bridge circuit.
- 25.- Measuring the voltage using "Null Balance" procedures (Method 1).
- 26.- Measuring voltages using "Null Balance" procedures (Method 2). Measuring voltages smaller than the normal available voltage.
- 27.- Measuring voltages using "Null Balance" procedures (Method 2). Measuring voltages greater than the normal voltage.
- Transducers for applications of temperature measurement:
- 28.- Characteristics of an integrated temperature circuit.
- 29.- Construction of a digital thermometer using the facilities of the transducer unit.
- 30.- Characteristics of a platinum Temperature Dependent Resistance (RDT) transducer.
- 31.- The NTC thermistor (Negative Temperature Coefficient).
- 32.- Characteristics of an NTC thermistor (Negative Temperature Coefficient).
- 33.- Characteristics of the NTC thermistor used in an alarm circuit (double thermistor).
- 34.- Characteristics of a type "K" thermocouple.
- Transducers for light measuring applications:
- 35.- Characteristics of a photovoltaic cell.
- 36.- Characteristics of a photo-transistor.
- 37.- Luminous intensity detector.
- 38.- The P.I.N. photodiode.
- 39.- Characteristics of a P.I.N. photodiode.
- Linear position transducers.
- 40.- Characteristics of a Linear Variation Differential Transformer (LVDT).
- 41.- Characteristics of a variable resistance.
- 42.- Characteristics of a strain gauge transducer.
- Transducers for environmental measurement applications:
- 43.- Characteristics of a air flow transducer.
- 44.- Characteristics of a pressure sensor.
- 45.- Characteristics of a humidity sensor.
- Rotational velocity transducers and position measuring applications:
- 46.- Characteristics of a slotted opto-transducers and its applications for counting and speed measurement.
- 47.- Characteristics of the reflective opto-transducers and Gray code disk.
- 48.- Characteristics of an inductive transducer.
- 49.- Characteristics of a all effect transducer.
- 50.- Characteristics of a DC permanent magnet tachogenerator.
- Transducers for measuring Sound:
- 51.- Characteristics of a dynamic microphone.
- 52.- Characteristics of an ultrasonic receiver.
- Transducers for sound output:
- 53.- Characteristics of the mobile coil loudspeaker.
- 54.- Characteristics of a buzzer.
- Output transducer for linear or angular movement:
- 55.- Characteristics of a DC solenoid.
- 56.- Characteristics of a DC relay.
- 57.- Characteristics of a solenoid air valve.
- 58.- Characteristics of a permanent magnet motor.
- Signal conditioning circuits:
- 59.- Characteristics of the direct current amplifiers 1, 2 and x100.
- 60.- Characteristics of a current amplifier and application of a buffer amplifier.
- 61.- Characteristics of power and buffer amplifiers.
- 62.- Characteristics of an inverter amplifier.
- 63.- Characteristics of a differential amplifier.
- Signal Converter Circuits:
- 64.- Characteristics of a voltage to current converter.
- 65.- Characteristics of a current to voltage converter.
- 66.- Characteristics of a voltage to frequency converter.
- 67.- Characteristics of a frequency to voltage converter.
- 68.- Characteristics of a full wave rectifier.
- Comparators, oscillator and filters:
- 69.- Characteristics of a comparator.
- 70.- Characteristics of an alarm oscillator circuit.
- 71.- Characteristics of an electronic switch.
- 72.- Characteristics of the oscillator of 40 kHz.
- 73.- Characteristics of filters.
- Circuits that carry out mathematical operations:
- 74.- Characteristics of a adding amplifier.
- 75.- Characteristics of an integrator.
- 76.- Characteristics of a differentiator circuit.
- 77.- Characteristics of a sample and hold circuit.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

- SAIT:
- Dimensions: 400 x 400 x 300 mm approx.
 - Weight: 10 kg approx.

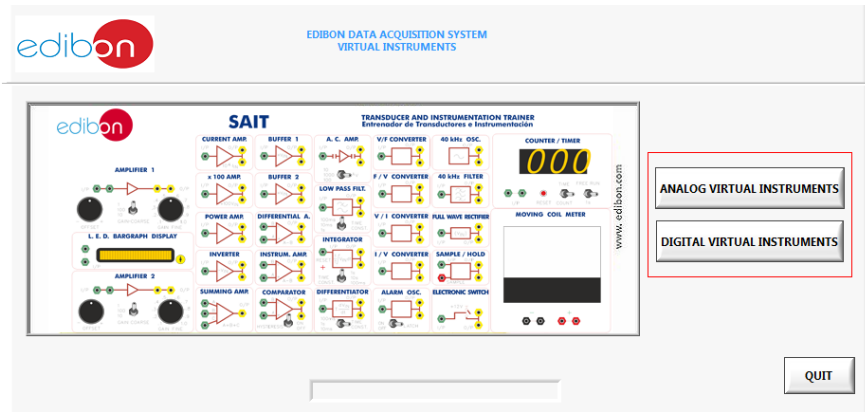
ADDITIONAL RECOMMENDED ELEMENTS (Not included)

Recommended (only one):

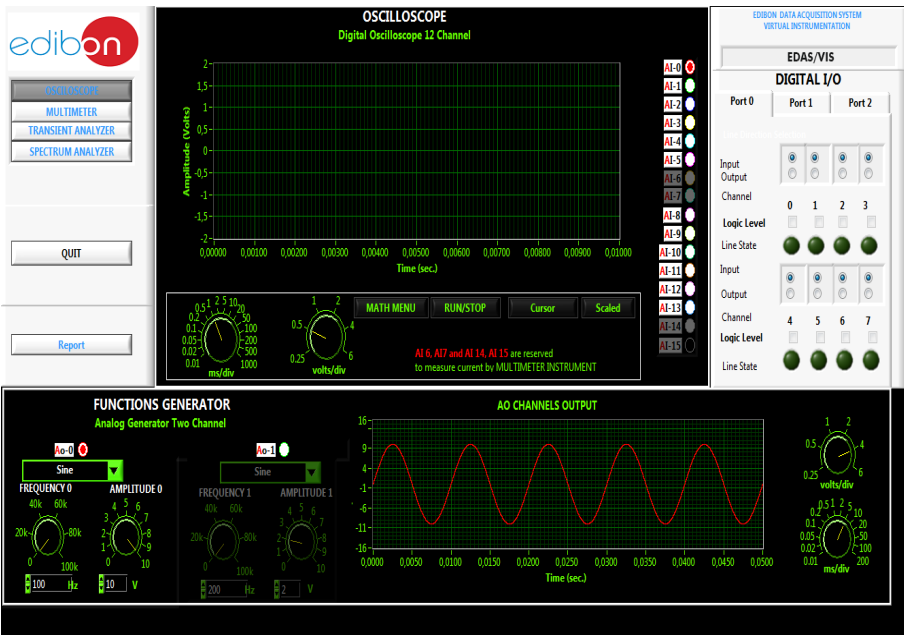
- EDAS/VIS-0.25. EDIBON Data Acquisition System / Virtual Instrumentation System (250.000 samples per second).
- EDAS/VIS-1.25. EDIBON Data Acquisition System / Virtual Instrumentation System (1.250.000 samples per second).

SOFTWARE MAIN SCREENS

Main screen



Experimental Windows



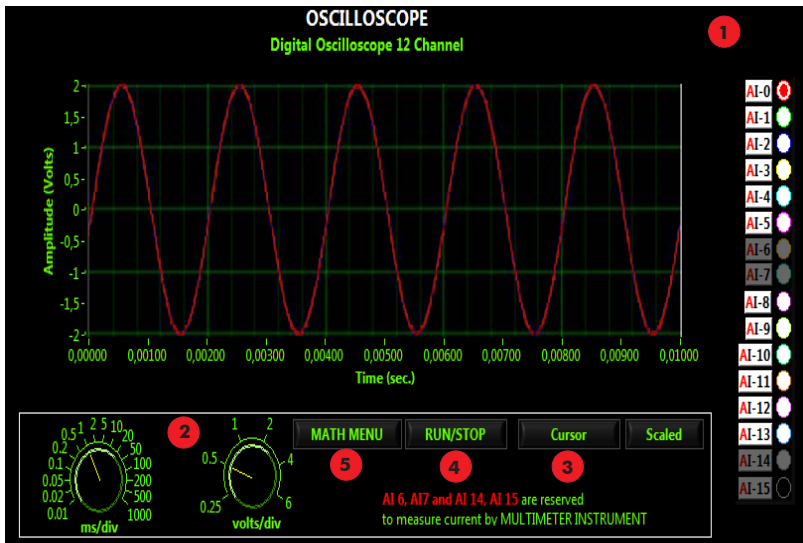
Main screen of analog virtual instruments

Main screen of digital virtual instruments



Analog Virtual Instruments Screens

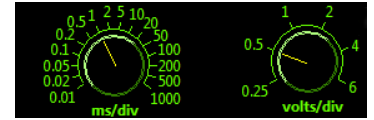
Oscilloscope



1 Channels selector

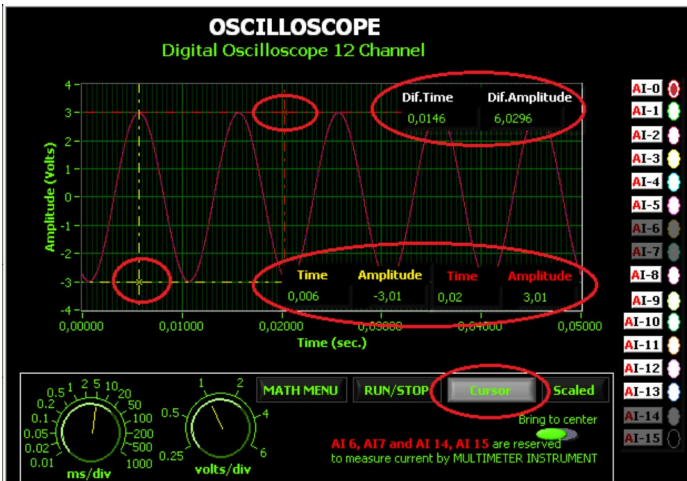


2 Handler control axis:

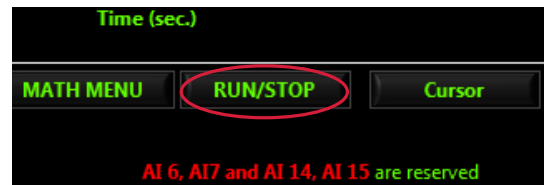


Let us to change the volts per division (volts-axis) and milliseconds per division (time-axis).

3 Cursors



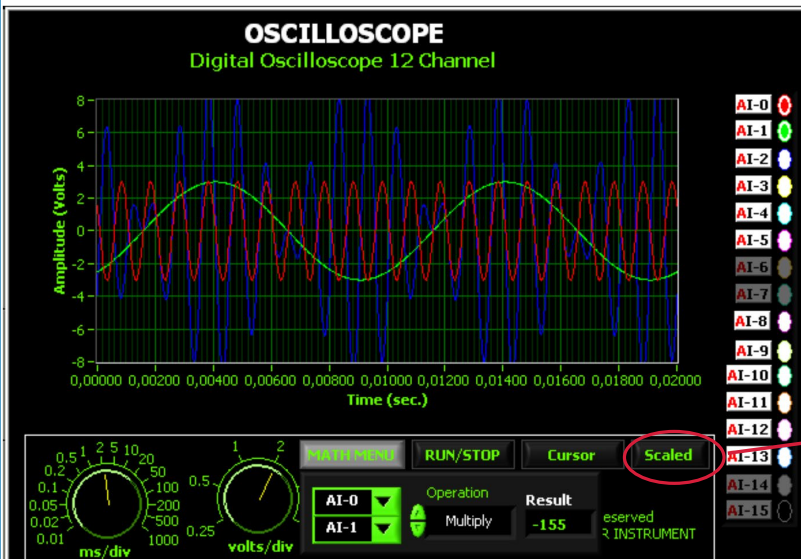
4 Run/Stop:



The Run/Stop button lets us to hold the signal on the screen until pressing this button again. This option lets us to improve the accuracy when you work the with cursors.

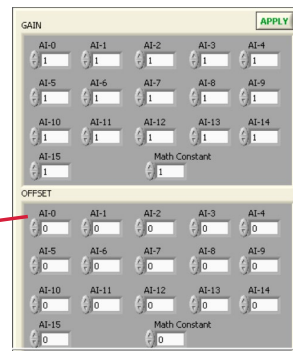
Two cursors appear if you press "Cursor" button on oscilloscope's screen. Also several displays appear on the screen that show the volts shift, the time shift and the difference between both. The "Bring to center" button allows us bringing the cursors to center of graph.

5 MATH MENU:



If you press the MATH MENU button a box appears. This chart contains two channel selectors and an operation selector to apply between the selected channels. The result of the operation will be shown in a display and on the graph. The available operations are ADD, REST, MULTIPLICATION and DIVISION among any of the 12 channels of the oscilloscope.

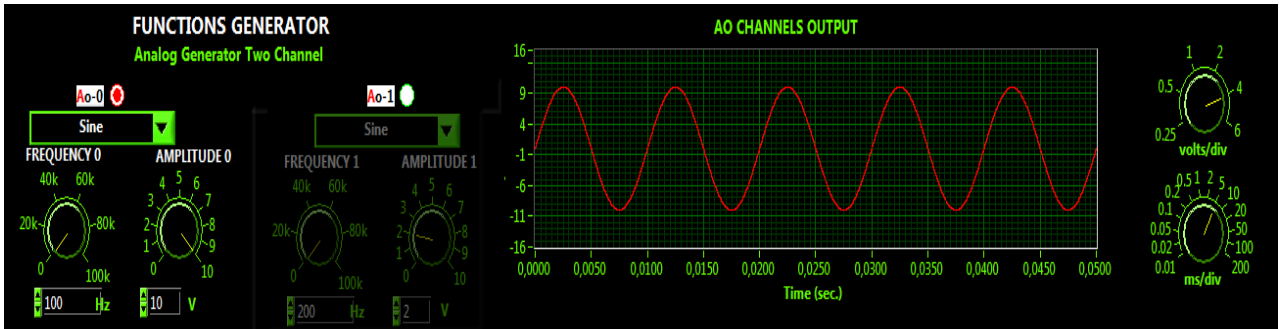
In this screen we can see an example of multiplication between the red signal (AI-0) and green (AI-1). The blue signal of the graph is the result of the operation.



This instrument allows to scale independently each one of the channels. Like wise, the user could scale the result signal of the math operation.

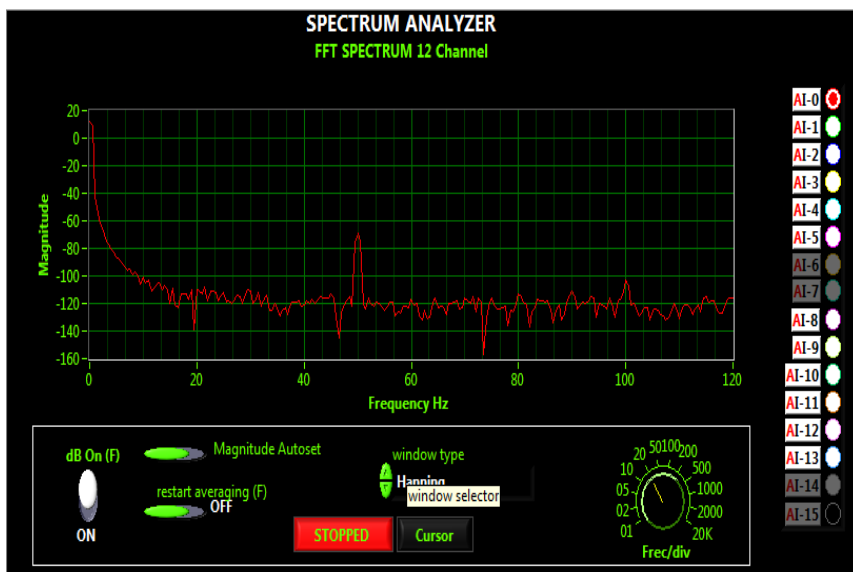
Analog Virtual Instruments Screens

Functions Generator



It has 2 channels and 4 type of functions.

Spectrum Analyzer



Digital spectrum analyzer: based in FFT, Fourier fast transformer.

It lets us to change the frequency per division through a control placed under the graph, it can show magnitude in dB, auto magnitude scaled and it can apply several windows types, (Nothing, Hanning, Hamming, Blackman-harris, exact Blackmann, Blackman, flat top, 4 term B-harris, 7 term B-harris or low sidelobe).

Multimeter

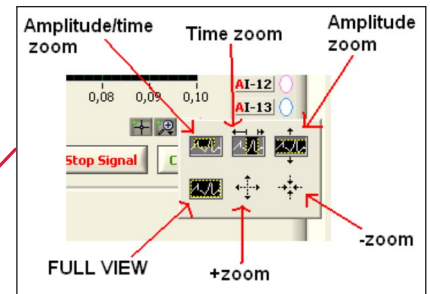
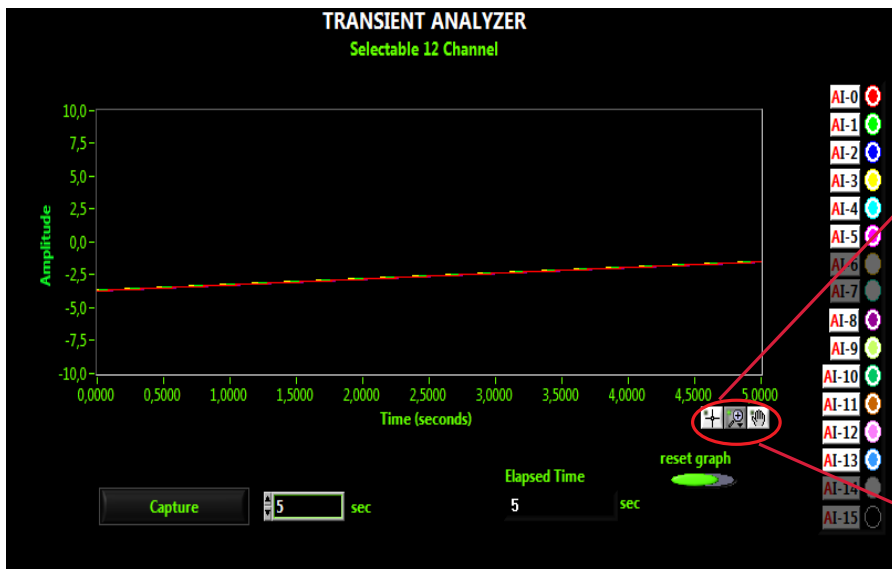


Voltmeter

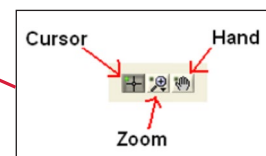


Ammeter

Transient Analyzer

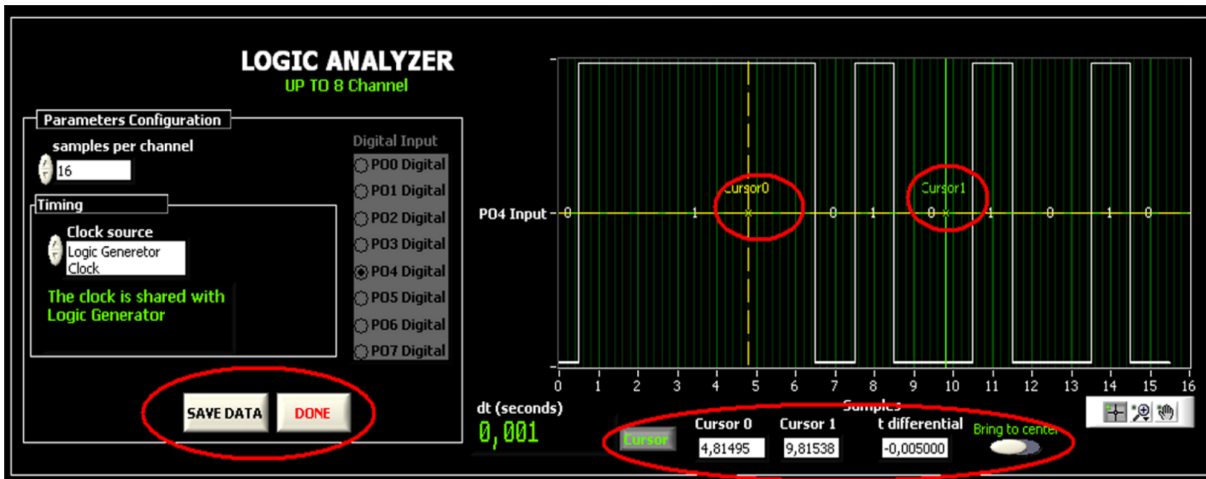
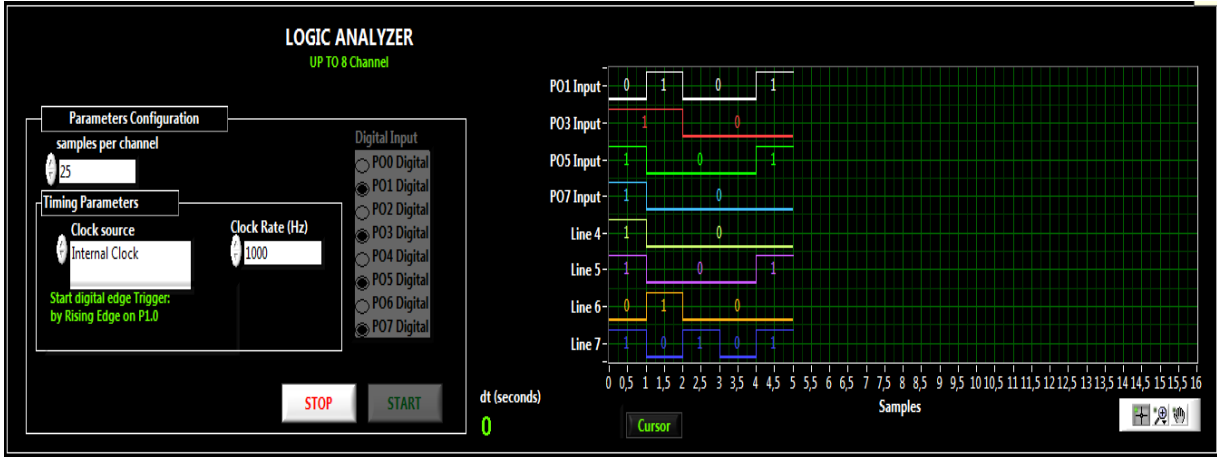


The palette is essential to manipulate the graph. This palette has three actuation modes to act on the graph.



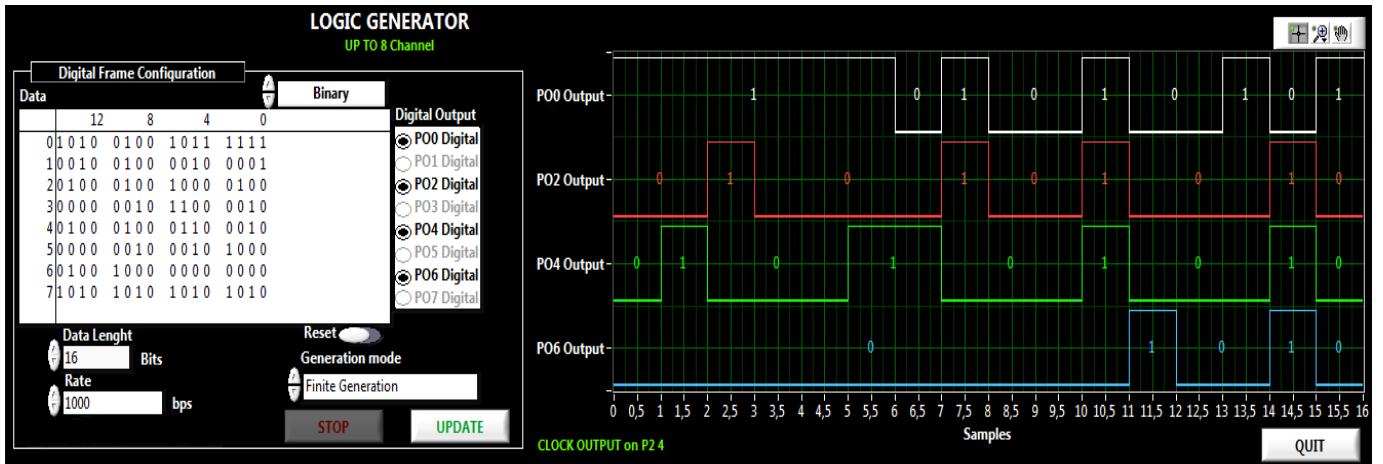
Software Main Screens
Digital Virtual Instruments Screens

Logic Analyzer

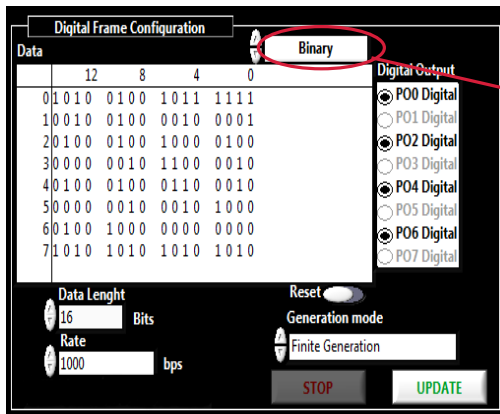


Software Main Screens
Digital Virtual Instruments Screens

Logic Analyzer

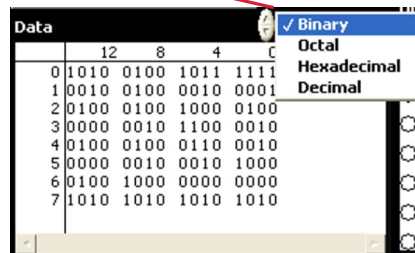


It has two generation types: finite generation and continuous generation.

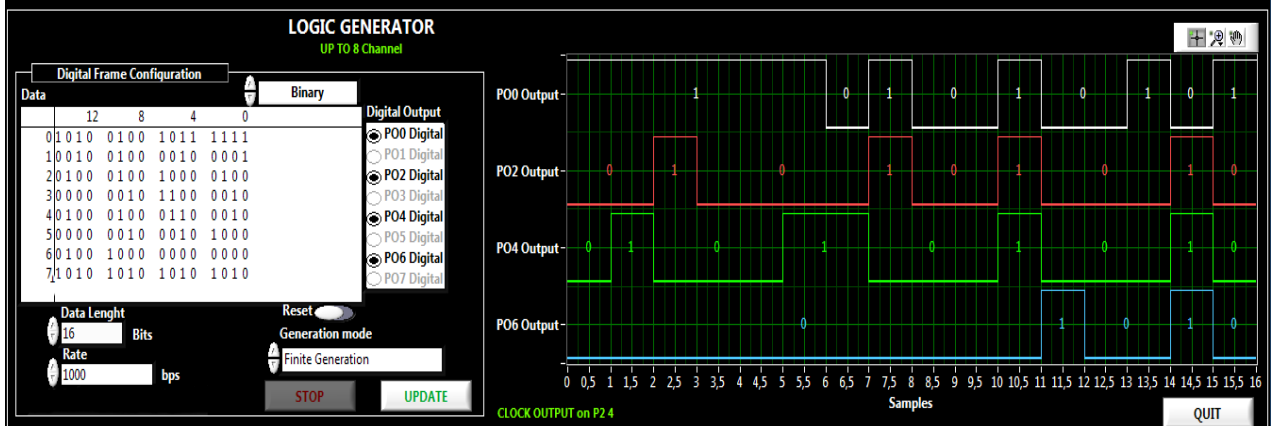
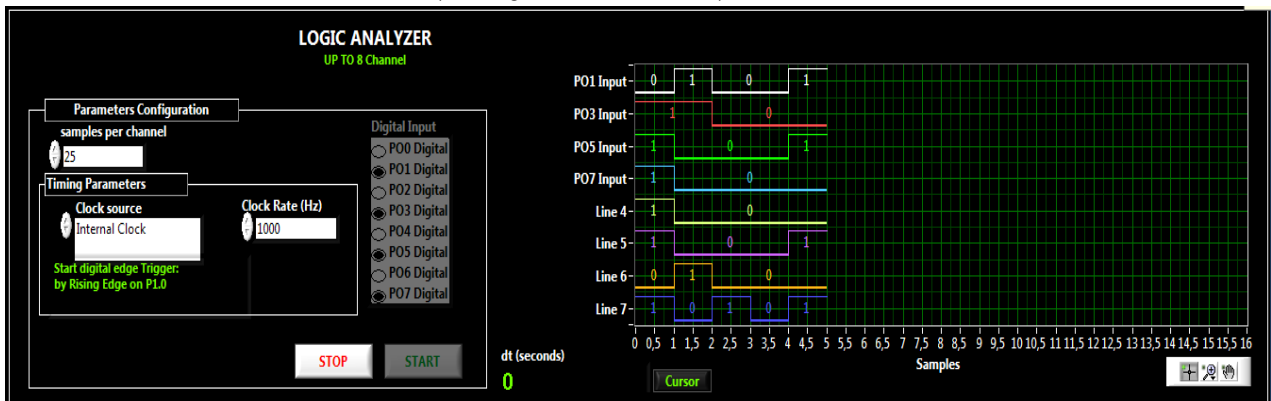


Several numeric bases:

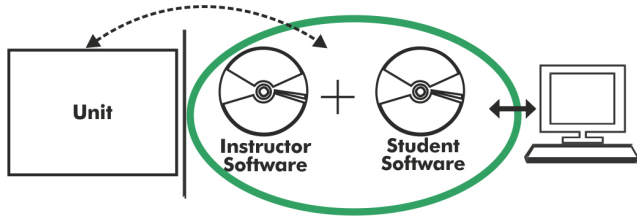
- Binary.
- Octal.
- Hexadecimal.
- Decimal.



Example of digital transmission - Reception, LOOPBACK



SAIT/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.

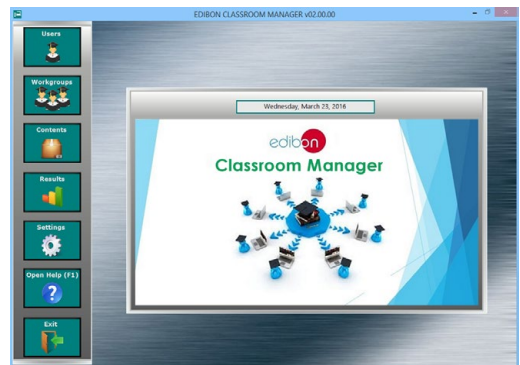
Instructor Software

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

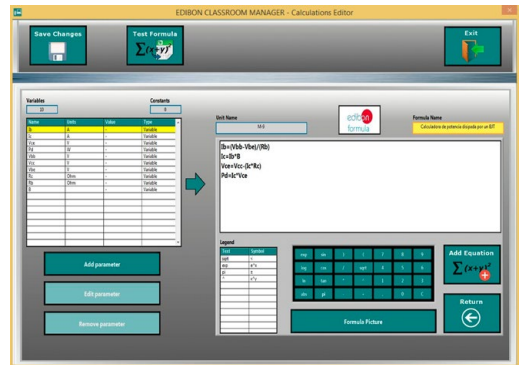
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

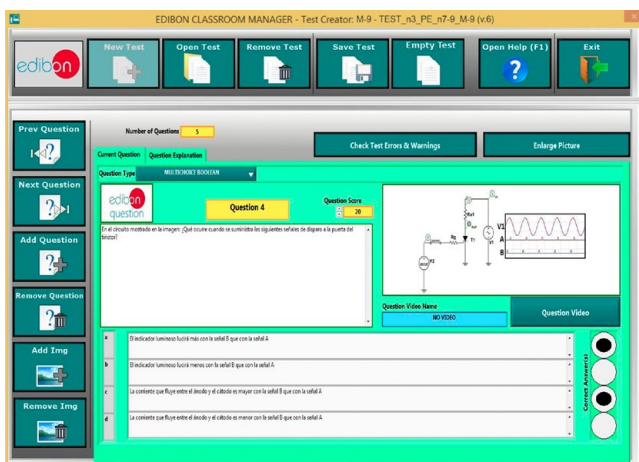
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.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



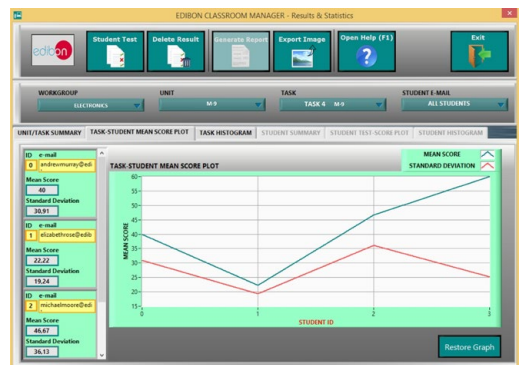
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



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:

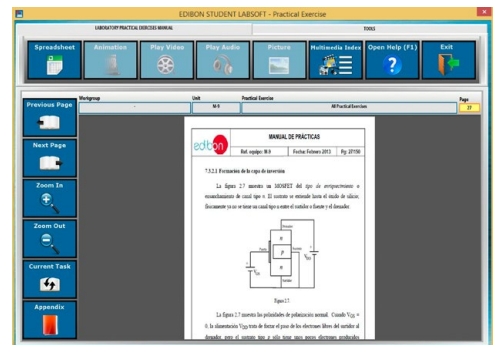
- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- 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:

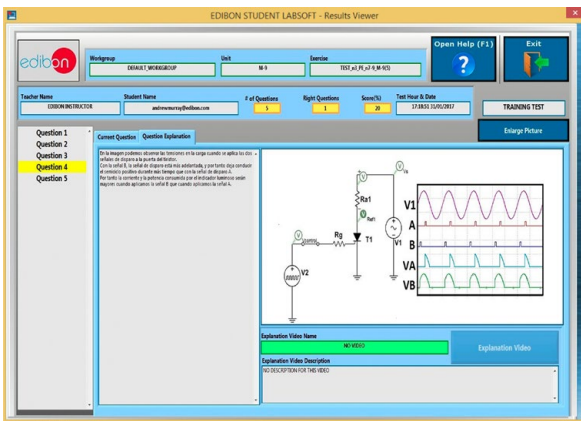
<https://www.edibon.com/en/interactive-computer-aided-instruction-software/catalog>



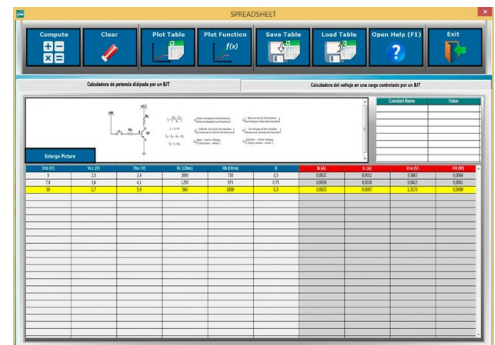
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



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:

