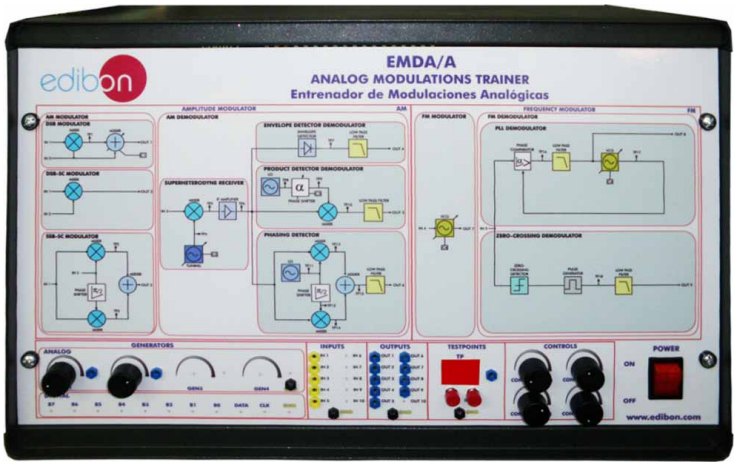
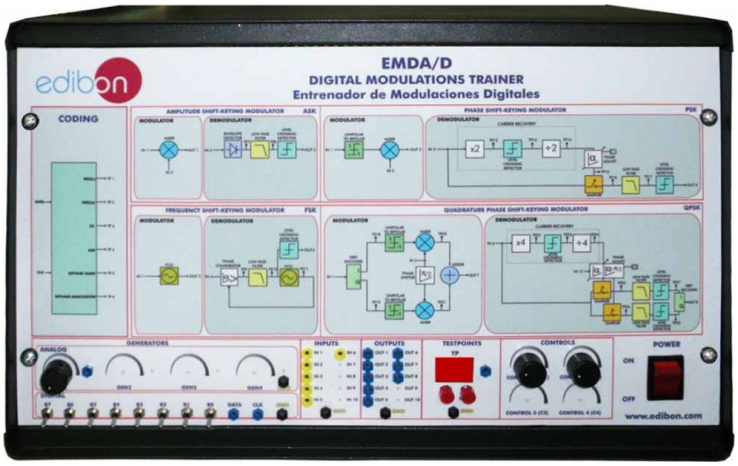
edibon

Technical Teaching Equipment

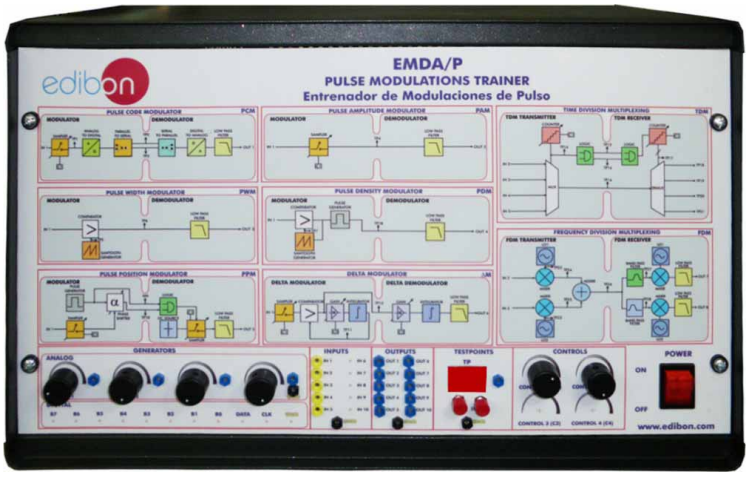
Analog Modulations Trainer
EMDA/A
Digital Modulations Trainer
EMDA/D
Pulse Modulations Trainer
EMDA/P



EMDA/A. **Analog Modulations Trainer**



EMDA/D. **Digital Modulations Trainer**



EMDA/P. **Pulse Modulations Trainer**

www.edibon.com
Products
Products range
Units
3.-Communications

INTRODUCTION

The EMDA/A. Analog Modulations Trainer, EMDA/D. Digital Modulations Trainer and EMDA/P. Pulse Modulations Trainer are a complete analog, digital and pulse communications trainer that allows the student to learn the basic concepts about modulation.

They cover the principles of many of the modulation and demodulation techniques used in modern analog and digital communication systems.

The units are provided with a set of practices, through which the user will understand how to work with different modulation and demodulation circuits.

ISO 9001:2000 Certificate of Approval

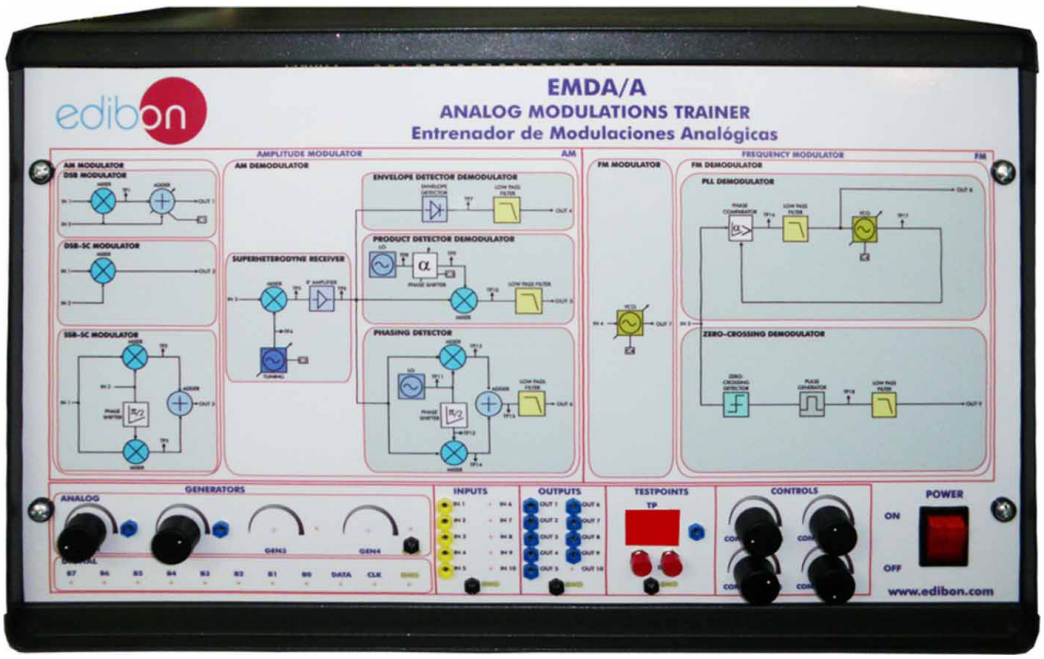
European Union Certificate

Certificates ISO 14001: 2004 and **ECO-Management and Audit Scheme**
(environmental management)

Worlddidac Quality Charter Certificate
Worlddidac Member

Analog Modulations Trainer

EMDA/A



GENERAL DESCRIPTION

EMDA/A is a complete analog communications trainer designed to explain the basic concepts of analog modulation. It covers the principles of many of the modulation and demodulation techniques used in modern analog communication systems.

It provides a basic understanding of the concepts behind analog techniques: Dual Side Band (DSB), Dual Side Band Suppressed Carrier (DSB-SC) and Single Side Band Suppressed Carrier (SSB-SC).

SPECIFICATIONS

All elements are mounted in a metallic box, with power supply and block diagram.

Functional blocks:

- Modulators and demodulators:
  - Amplitude Modulation (AM):
    - Double Side Band modulator (DSB).
    - Double Side Band Suppressed Carrier modulator (DSB-SC).
    - Single Side Band Suppressed Carrier AM modulator (SSB-SC).
    - Radio- Frequency Tuning.
    - Intermediate-Frequency (I.F) Mixer.
    - I.F Amplifier.
    - Envelope detector.
    - Product detector.
  - Frequency Modulation (FM):
    - Voltage Controlled Oscillator (VCO).
    - Phase-Locked Loop detector (PLL).
- Analog Generators:
  - Carrier and audio signals.
- 5 Analog Inputs.
- 9 Analog Outputs.
- 18 Test points.
- 2 Controls.

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.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Study of basic principles of AM modulation and demodulation technique.

2.- Basic principles of DSB modulation and demodulation.

3.- Basic principles of DSBSC modulation and demodulation.

4.- Basic principles of SSBSC modulation and demodulation.

5.- Comparison of the spectrum of AM, SSBSC and DSBSC signals.

6.- Basic principles of FM modulation and demodulation.

7.- Introduction to the PLL operation.

DIMENSIONS & WEIGHT

EMDA/A:

- Dimensions: 490 x 330 x 310 mm. approx.
- Weight: 20 Kg. approx.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110V./60Hz.

RECOMMENDED ACCESSORIES

- EDAS/VIS 0.25. EDIBON Data Acquisition System/Virtual Instrumentation System (sampling velocity 250,000 S/s). (See information in page 17)

or

- EDAS/VIS 1.25. EDIBON Data Acquisition System/Virtual Instrumentation System (sampling velocity 1,250,000 S/s). (See information in page 17)

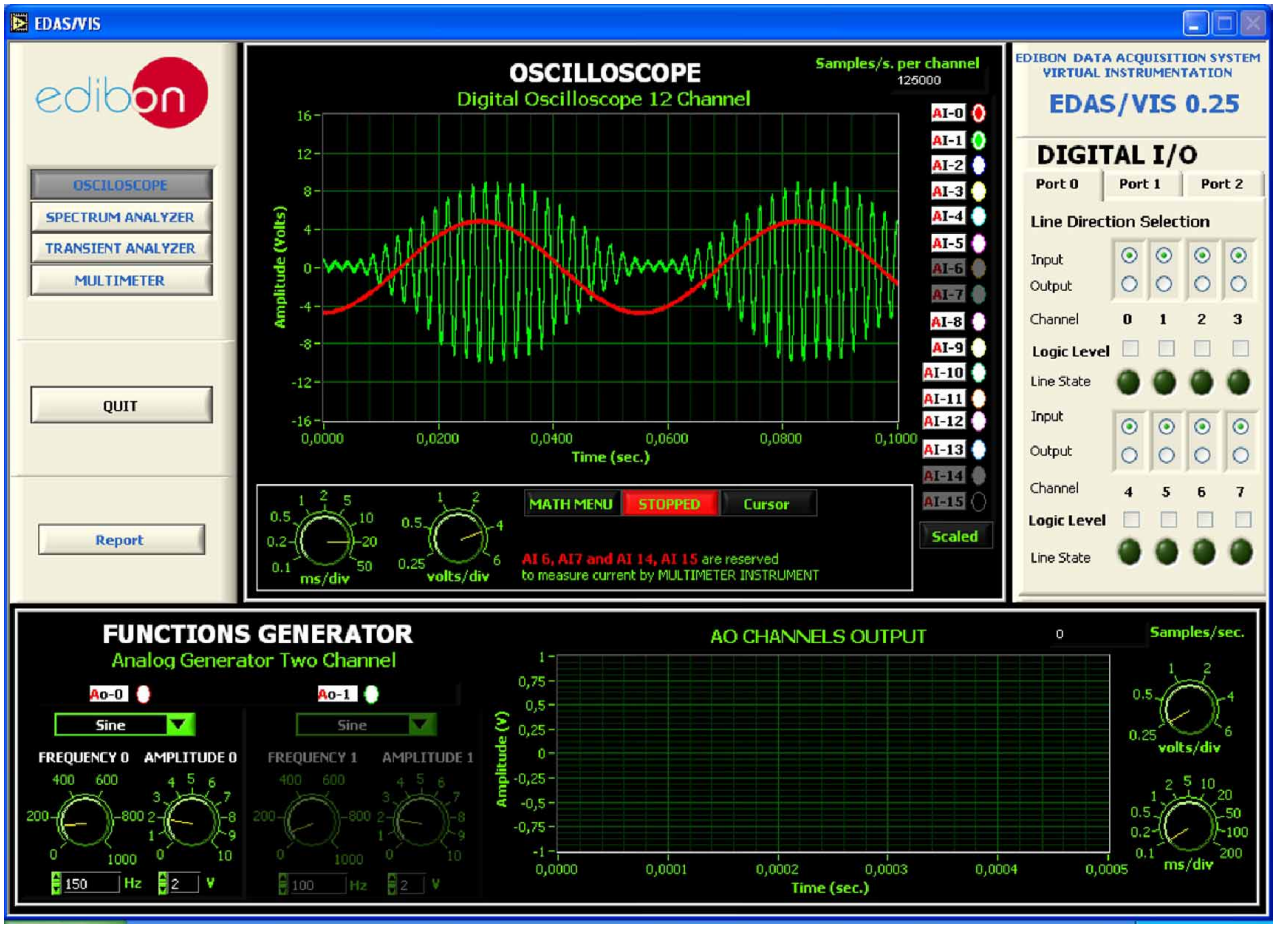
ADDITIONAL AND OPTIONAL

- CAI. Computer Aided Instruction Software System. (See information in page 18)
- EMDA/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (See information in page 19)

DBS (Dual Side Band Amplitude Modulation)

The screens below show the time and frequency representation of a DSB AM signal. As it can be seen in the frequency domain, a DSB contains both side bands and carrier components.

Time domain of a DSB signal

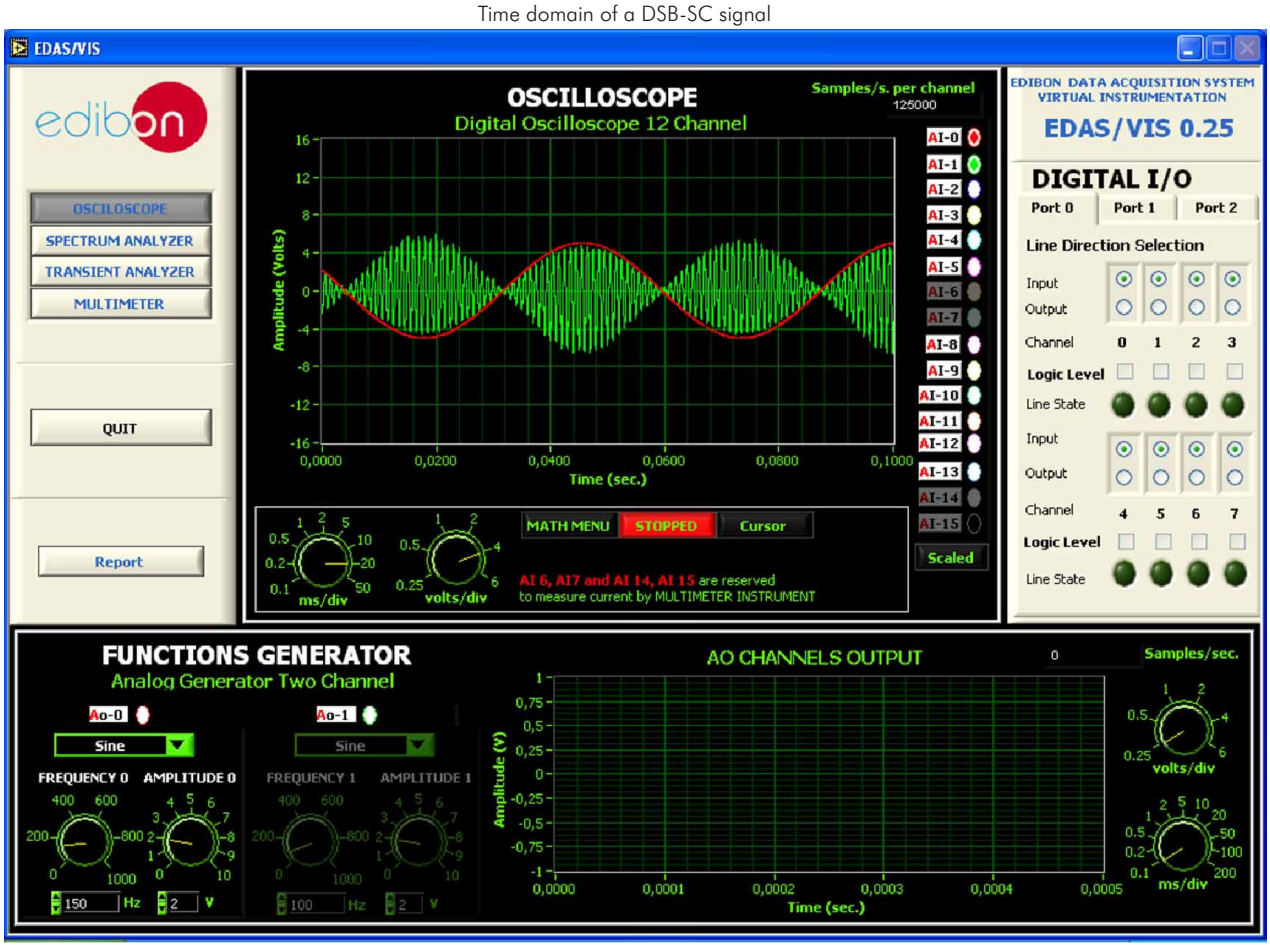


Frequency domain of a DSB signal

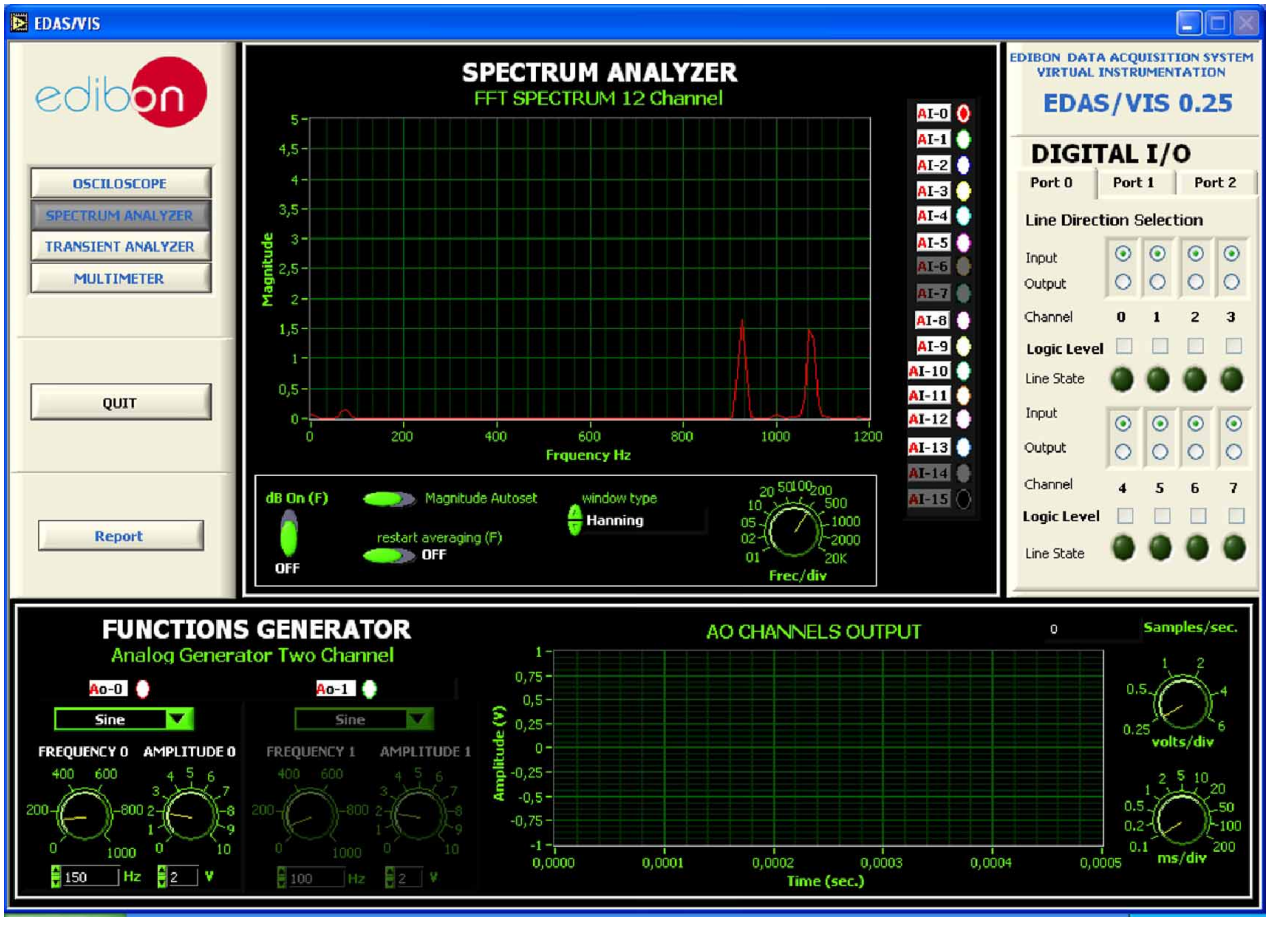
DBS-SC (Dual Side Band Suppressed Carrier Amplitude Modulation)

The screens below show the time and frequency representation of a DSB-SC AM signal. As it can be seen in the frequency domain, the signal contains both side bands components and the carrier is removed.

Time domain of a DSB-SC signal



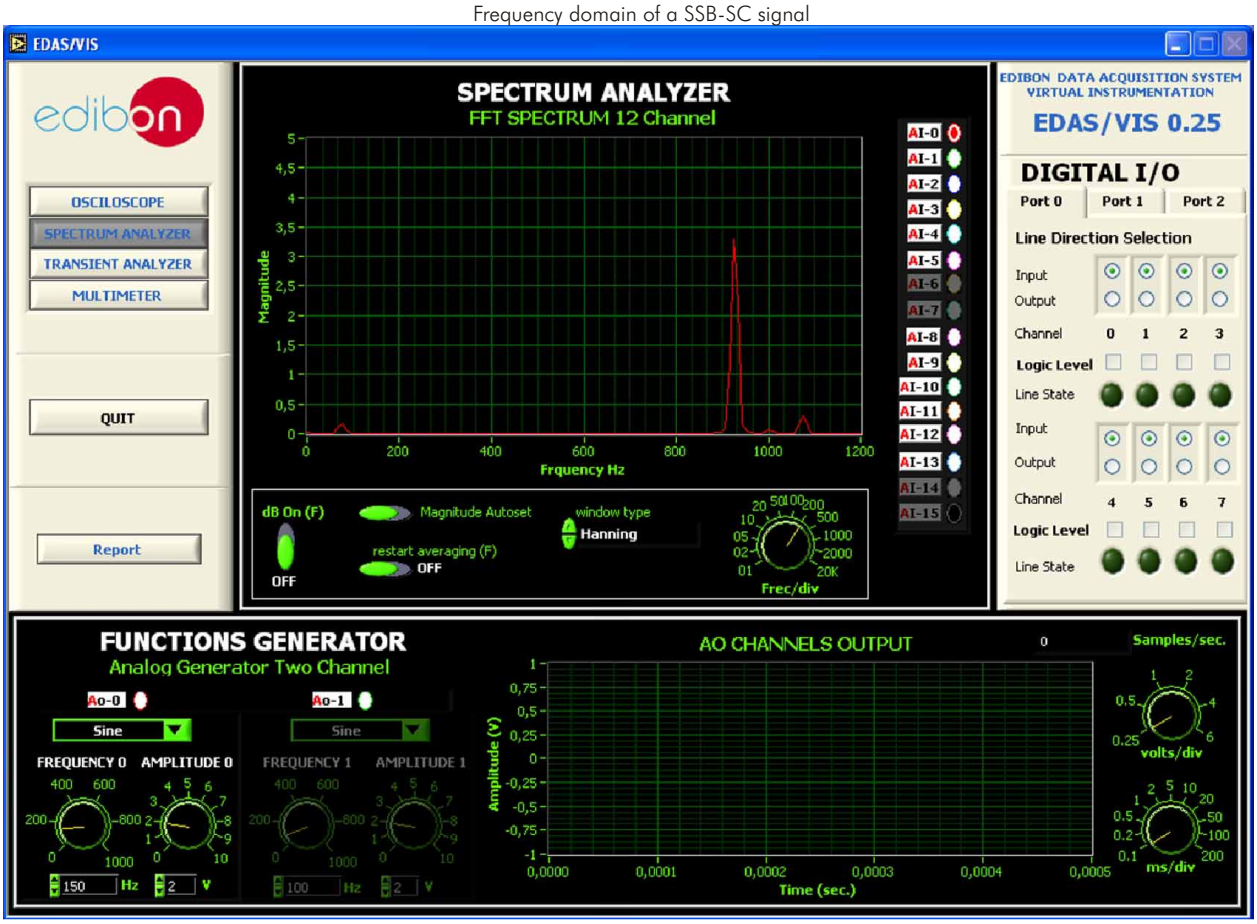
Frequency domain of a DSB-SC signal



SSB-SC (Single Side Band Suppressed Carrier Amplitude Modulation)

The sreen below shows the frequency representation of a SSB-SC AM signal. The signal only contains a single component.

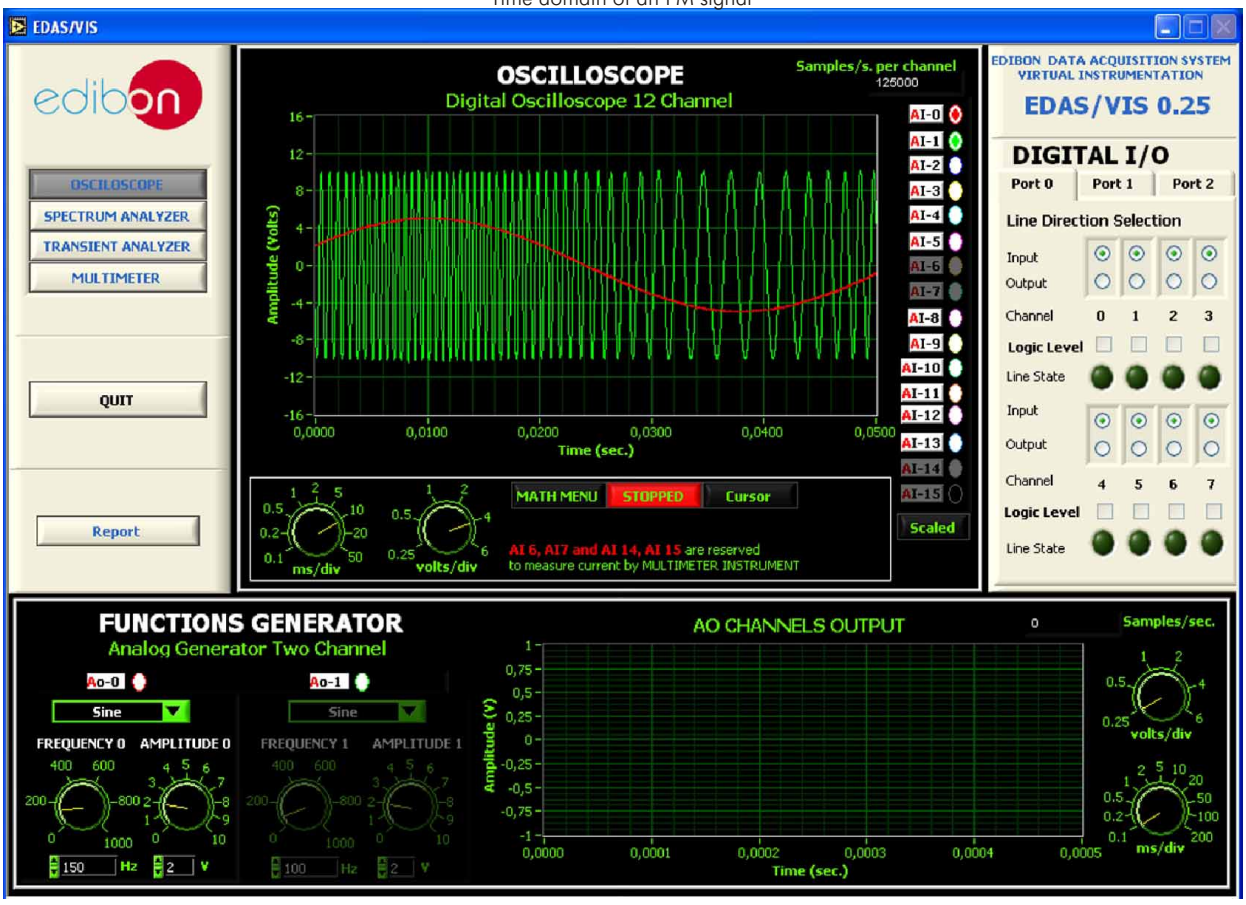
Frequency domain of a SSB-SC signal



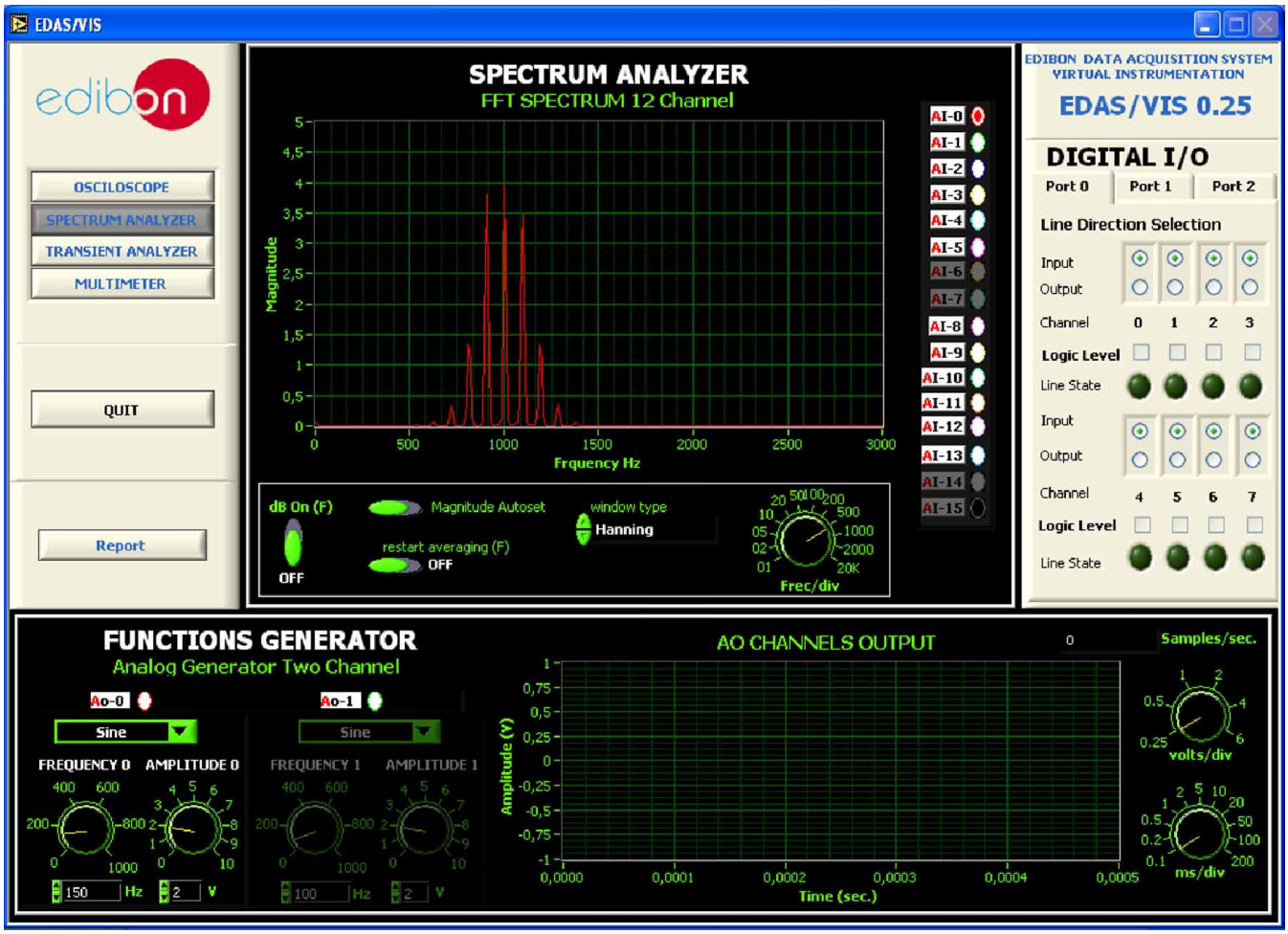
FM (Frequency Modulation)

The sreens below show the time and frequency representation of a FM signal. As it can be seen in the time domain, the frequency of the signal is varied according to the amplitude of the information signal.

Time domain of an FM signal

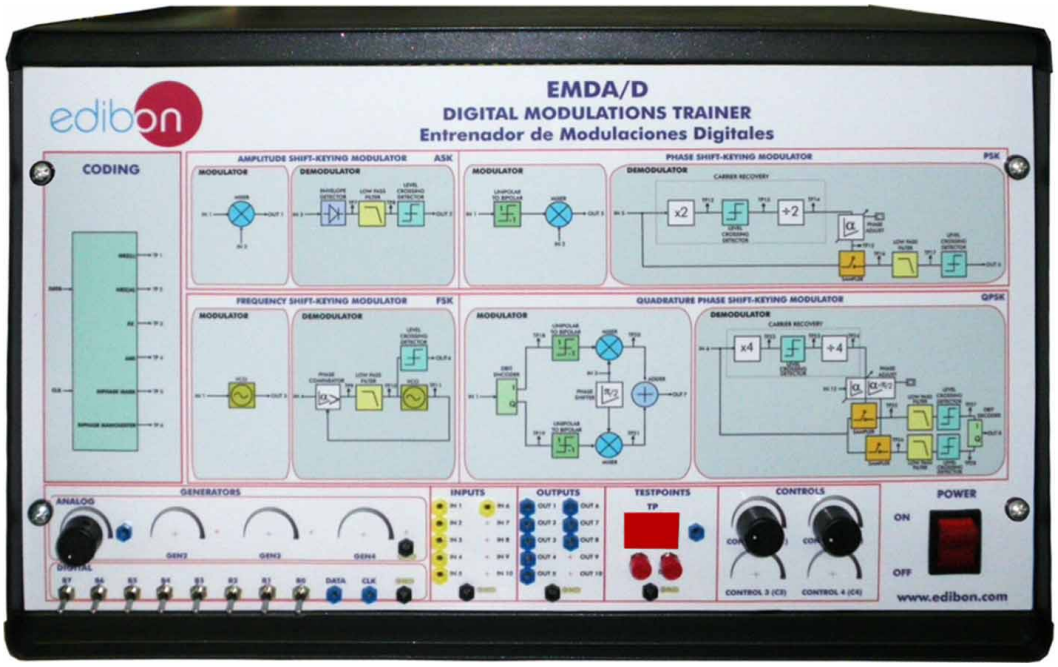


Frequency domain of an FM signal



Digital Modulations Trainer

EMDA/D



GENERAL DESCRIPTION

EMDA/D is a complete digital communications trainer designed to explain the basic concepts of digital modulation. It covers the principles of many of the modulation and demodulation techniques used in modern digital communication systems.

The trainer provides a basic understanding of the concepts behind digital communications techniques: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) , Phase Shift Keying (PSK) and Quadrature Phase Shift Keying (QPSK). It allows students to study some of the line coding techniques like NRZ(L), NRZ(M), RZ, RB, etc.

SPECIFICATIONS

All elements are mounted in a metallic box, with power supply and block diagram.
Functional blocks:
- Line Coding:
  - Non Return to Zero Level line coding circuit (NRZL).
  - Non Return to Zero Mark line coding circuit (NRZM).
  - Biphase Manchester line coding circuit.
  - Biphase Mark circuit line coding circuit.
  - Return to Zero line coding circuit (RZ).
  - Return to Bias line coding circuit (RB).
  - Alternate Mark Inversion line coding circuit (AMI).
- Modulators and demodulators:
  - Amplitude-Shift Keying (ASK):
    - Mixer.
    - Filter.
  - Frequency-Shift Keying (FSK):
    - Phase-Locked Loop detector (PLL).
  - Phase-Shift Keying (PSK):
    - Unipolar to Bipolar converter.
    - Mixers.
    - Carrier recovery circuit:
      - Multiplier and divider circuits.
      - Squarer circuit.
      - Voltage Controlled Oscillator (VCO).
    - Sampler.
    - Filter.
    - Level-Crossing detector.

Continue...

Quadrature Phase-Shift Keying (QPSK):
- Dbit encoder circuit.
- Unipolar to Bipolar converters.
- Mixers.
- Carrier recovery circuit:
  - Multiplier and divider circuits.
  - Squarer circuit.
  - Voltage Controlled Oscillator (VCO).
- Samplers circuits.
- Filter.
- Level-Crossing detectors.
- Dbit decoder circuit.

Analog Generators:
- Carrier signal.

Digital Generators:
- 1 byte (8 bits, serial).

6 Analog Inputs.
8 Analog Outputs.
28 Test points.
2 Controls.
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.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Study of the data coding techniques.
2.- Study of basic principles of ASK modulation and demodulation technique.
3.- Study of basic principles of FSK modulation and demodulation technique.
4.- Study of basic principles of PSK modulation and demodulation technique.
5.- Study of basic principles of QSK modulation and demodulation technique.

DIMENSIONS & WEIGHT

EMDA/D:
- Dimensions: 490 x 330 x 310 mm. approx.
- Weight: 20 Kg. approx.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110V./60Hz.

RECOMMENDED ACCESSORIES

- EDAS/VIS 0.25. EDIBON Data Acquisition System/Virtual Instrumentation System (sampling velocity 250,000 S/s). (See information in page 17)

or

- EDAS/VIS 1.25. EDIBON Data Acquisition System/Virtual Instrumentation System (sampling velocity 1,250,000 S/s). (See information in page 17)

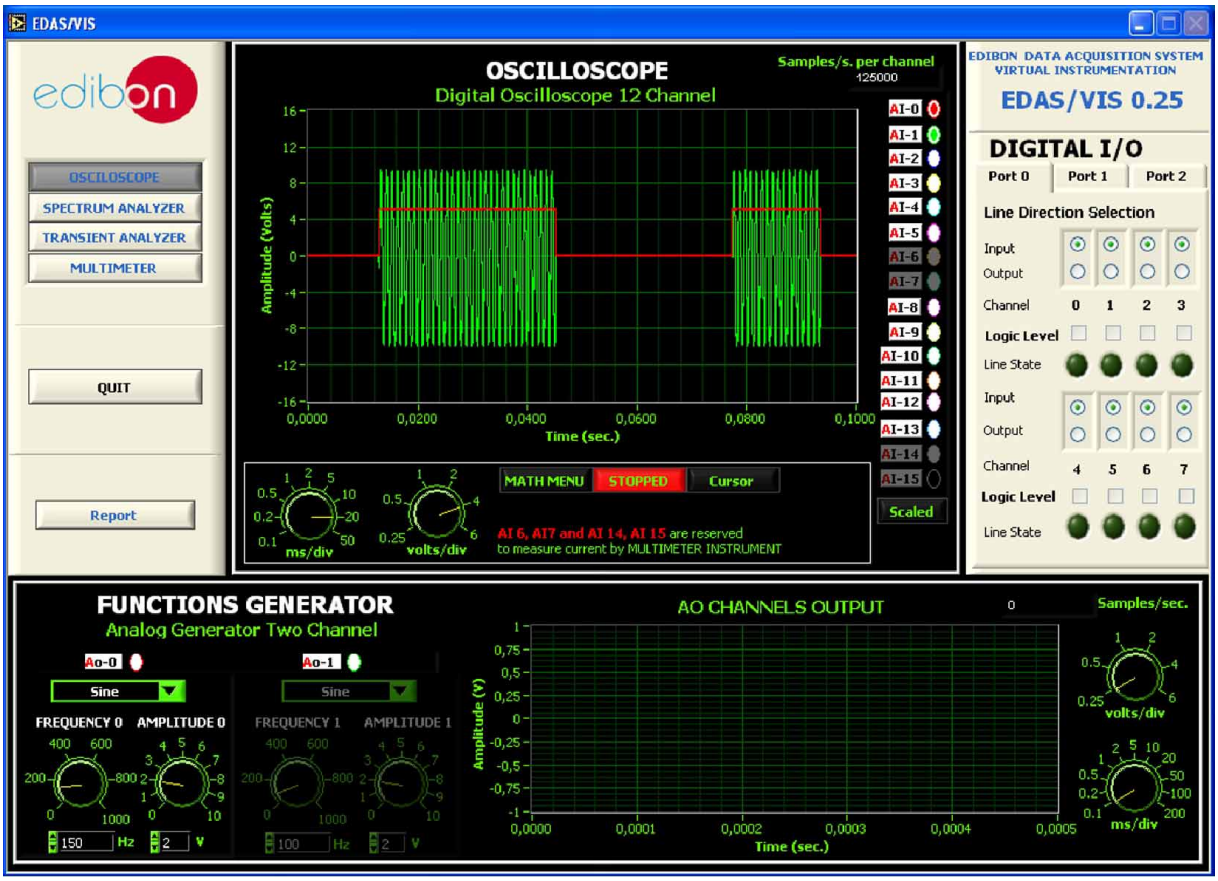
ADDITIONAL AND OPTIONAL

- CAI. Computer Aided Instruction Software System. (See information in page 18)
- EMDA/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (See information in page 19)

ASK (Amplitude Shift Keying)

The screen below shows the time representation of an ASK signal. As it can be seen, the carrier signal is transmitted as long as the information signal is at high logic level and it is suppressed when it is at low level.

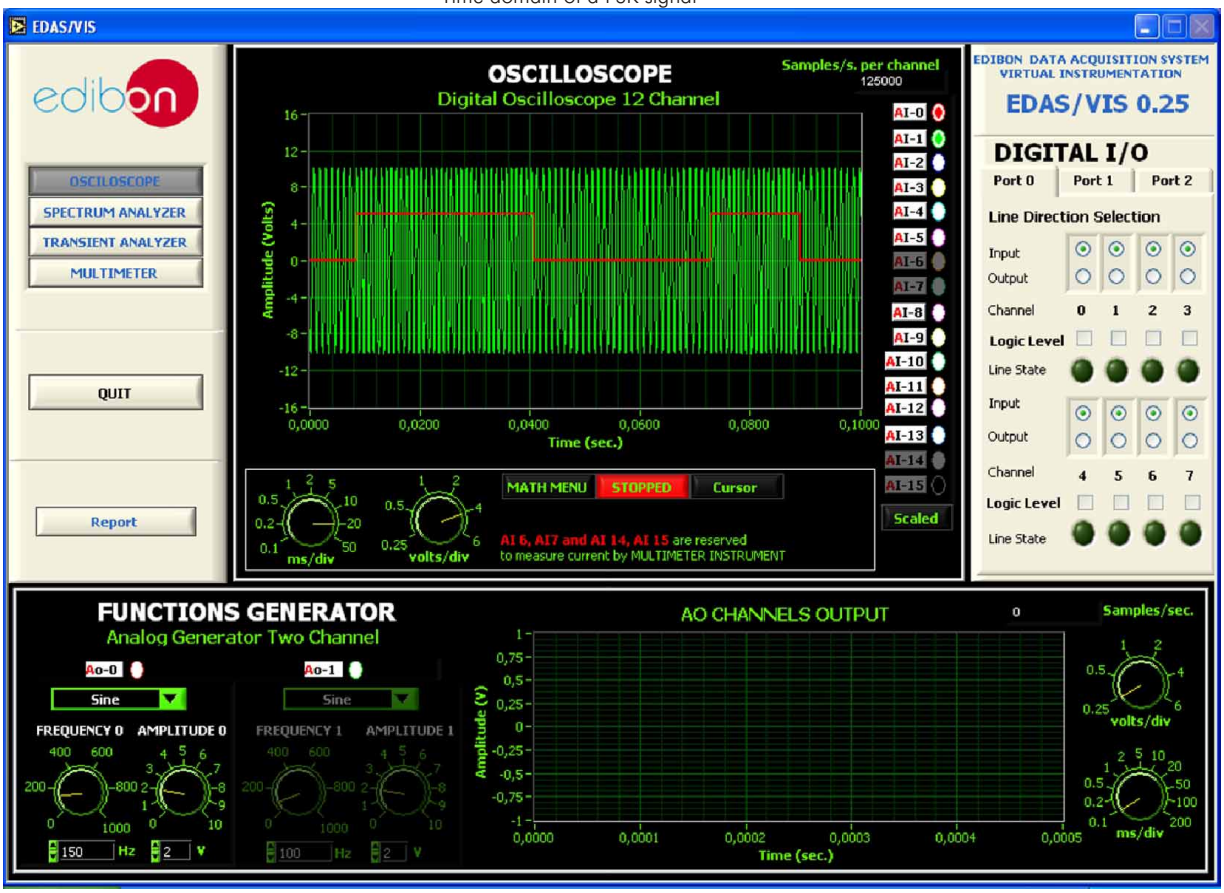
Time domain of an ASK signal



FSK (Frequency Shift Keying)

The screen below shows the time representation of a FSK signal. As it can be seen, the frequency of the carrier signal is changed according to the logic level of the information signal.

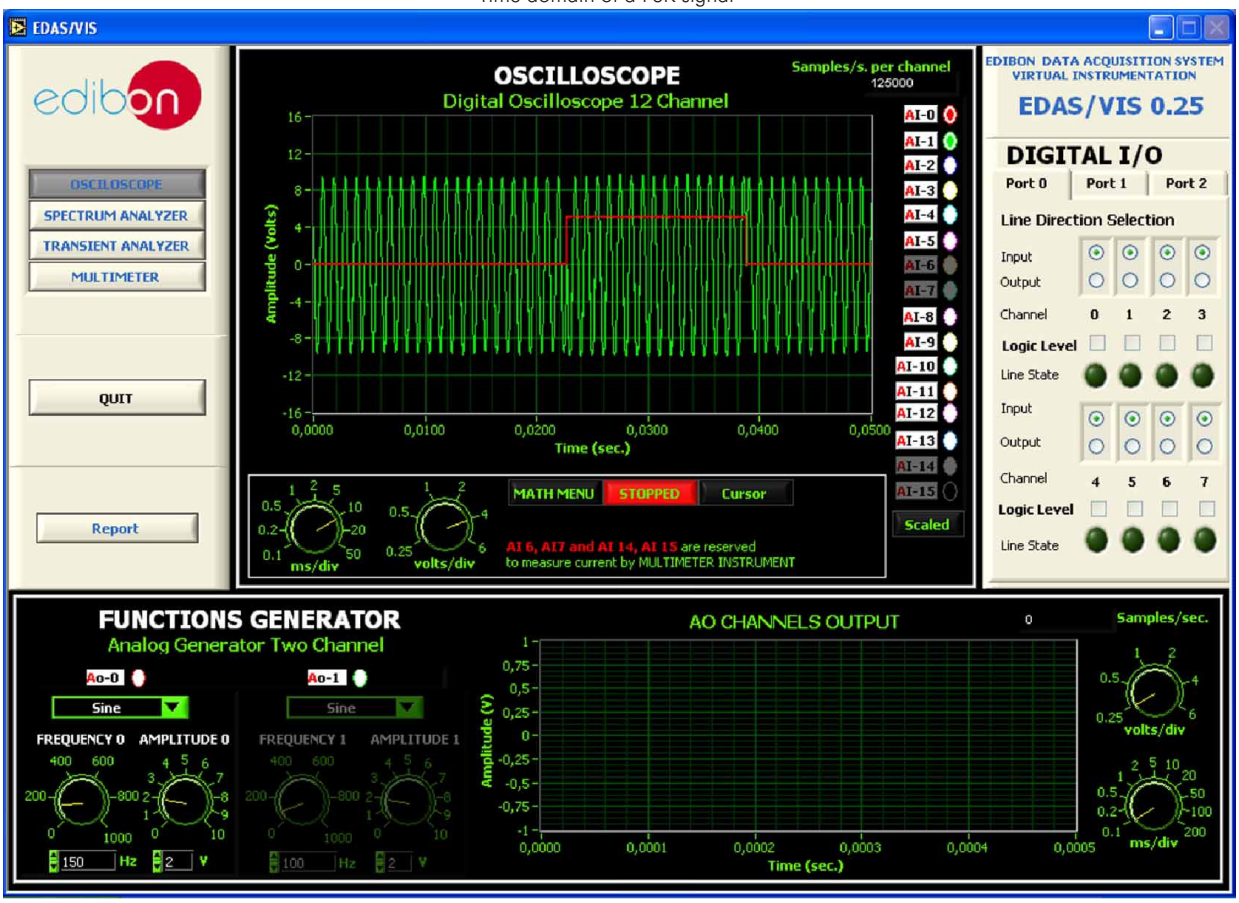
Time domain of a FSK signal



PSK (Phase Shift Keying)

The screen below shows the time representation of a PSK signal. As it can be seen, the phase of the carrier signal is changed according to the logic level of the information signal.

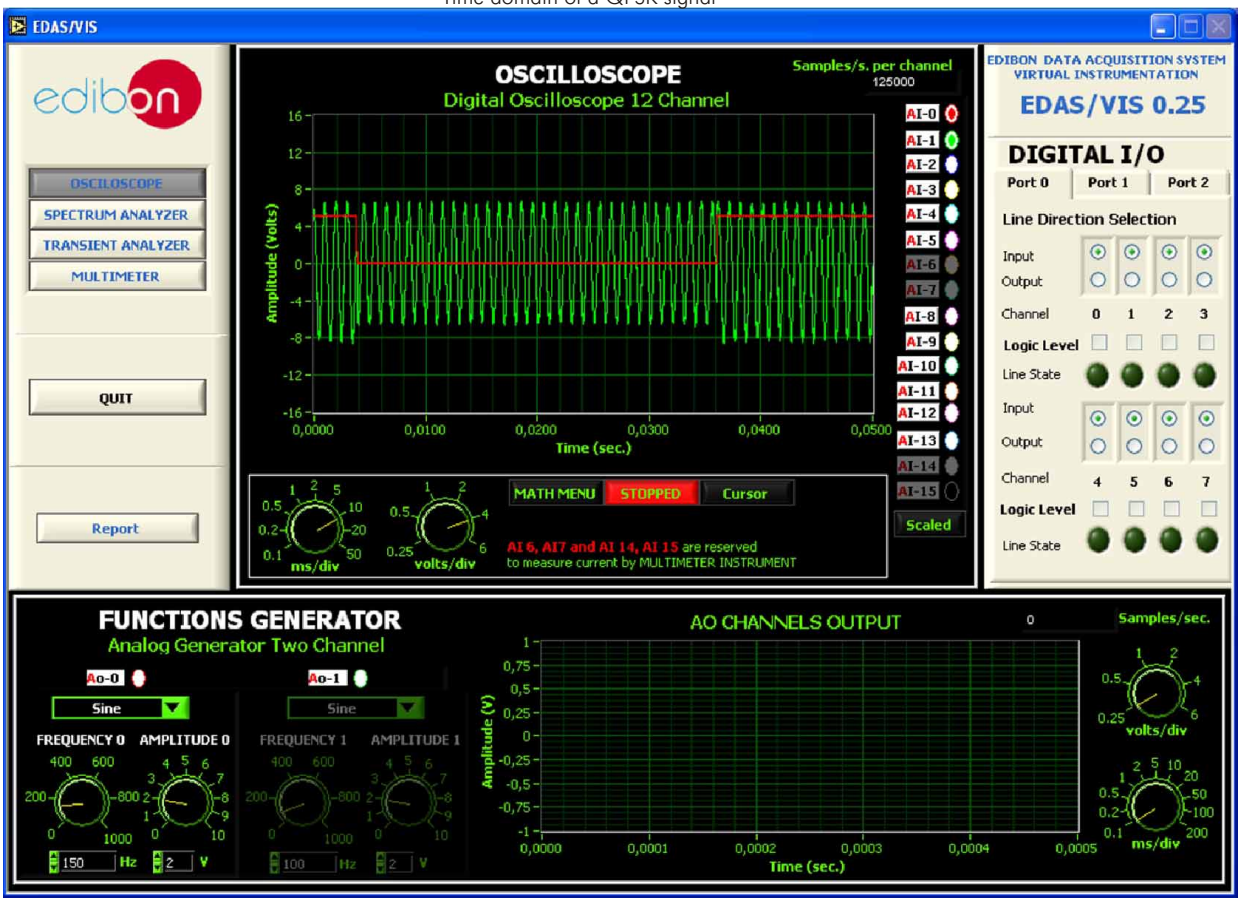
Time domain of a PSK signal



QPSK (Quadrature Phase Shift Keying)

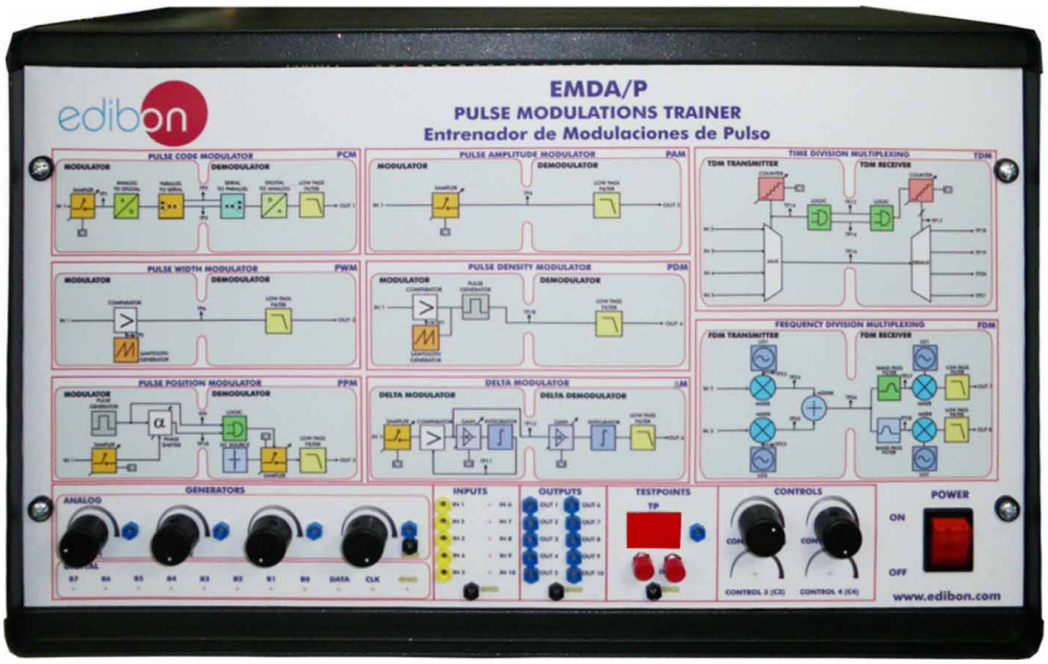
The screen below shows the time representation of a QPSK signal. As it can be seen, the phase of the carrier signal is changed according to the logic level of the information signal.

Time domain of a QPSK signal



Pulse Modulations Trainer

EMDA/P



GENERAL DESCRIPTION

The EMDA/P is a complete modulations trainer designed to explain the basic concepts of pulse modulation. It covers the principles of many of the modulation and demodulation techniques used in modern communication systems.

The trainer provides a basic understanding of the concepts behind pulse communications techniques: Pulse Code Modulation (PCM), Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Density Modulation (PDM), Pulse Position Modulation (PPM). Finally, it allows students to study the basic principles of Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM) are introduced.

SPECIFICATIONS

All elements are mounted in a metallic box, with power supply and block diagram.
Functional blocks:
- Modulators and demodulators:
  - Pulse Code Modulation (PCM):
    - Sample & Hold circuit.
    - Analog to Digital Converter (ADC).
    - Parallel to Serial circuit.
    - Serial to Parallel circuit.
    - Digital to Analog Converter (DAC).
    - Filter.
  - Pulse Amplitude Modulation (PAM):
    - Sampler circuit.
    - Filter.
  - Pulse Width Modulation (PWM):
    - Sawtooth Generator circuit.
    - Comparator circuit.
    - Filter.
  - Pulse Density Modulation (PDM):
    - Sawtooth Generator circuit.
    - Comparator circuit.
    - Filter.
  - Pulse-Position Modulation (PPM):
    - Pulse Generator circuit.
    - Samplers circuits.
    - Phase Shifter.
    - Filters.

Continue...

Delta Modulation (ΔM):
- Sample Generator circuit.
- Comparator circuit.
- Integrators circuit.
- Amplifiers.
- Filters.

Time Division Multiplexing (TDM):
- Multiplexer and Demultiplexer.
- Synchronization circuits.

Frequency Division Multiplexing (FDM):
- Local Oscillators.
- Mixers.
- Adder circuit.
- Band-Pass Filters.
- Low Pass Filters.

Analog Generators:
- 2 Audio signals.
- 2 Carrier signals.

5 Analog Inputs.
10 Analog Outputs.
28 Test points.
2 Controls.

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.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

1.- Basic principles of PCM modulation and demodulation.
2.- Basic principles of PAM modulation and demodulation.
3.- Basic principles of PWM modulation and demodulation.
4.- Basic principles of PPM modulation and demodulation.
5.- Basic principles of PDM modulation and demodulation.
6.- Basic principles of Delta modulation and demodulation.
7.- Introduction to the work principle of TDM.
8.- Introduction to the work principle of FDM.

DIMENSIONS & WEIGHT

EMDA/P:

- Dimensions: 490 x 330 x 310 mm. approx.
- Weight: 20 Kg. approx.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110V./60Hz.

RECOMMENDED ACCESSORIES

- EDAS/VIS 0.25. EDIBON Data Acquisition System/Virtual Instrumentation System (sampling velocity 250,000 S/s). (See information in page 17)

or

- EDAS/VIS 1.25. EDIBON Data Acquisition System/Virtual Instrumentation System (sampling velocity 1,250,000 S/s). (See information in page 17)

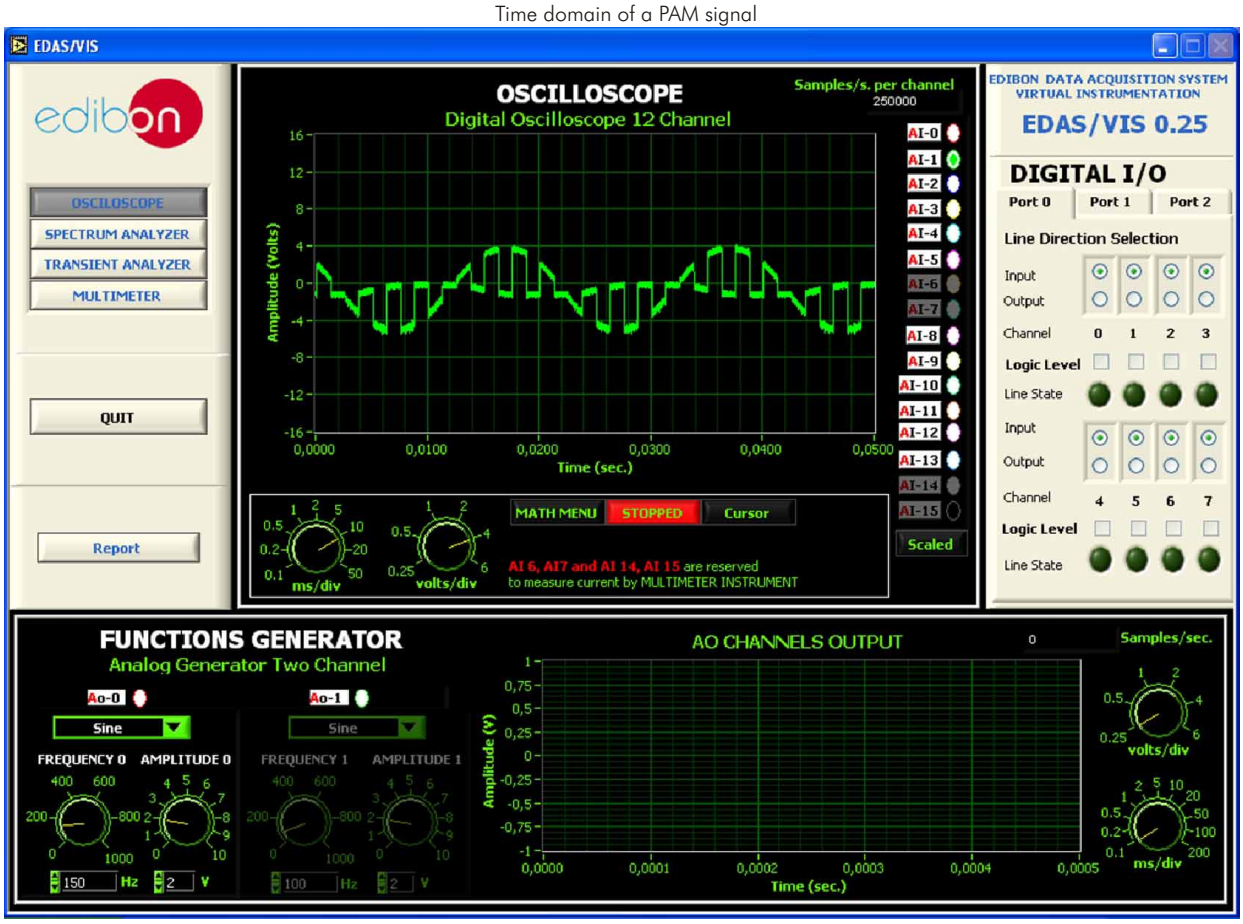
ADDITIONAL AND OPTIONAL

- CAI. Computer Aided Instruction Software System. (See information in page 18)
- EMDA/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (See information in page 19)

PAM (Pulse Amplitude Modulation)

The screen below shows the time representation of a PAM signal. As it can be seen, the PAM signal is obtained by sampling the information signal.

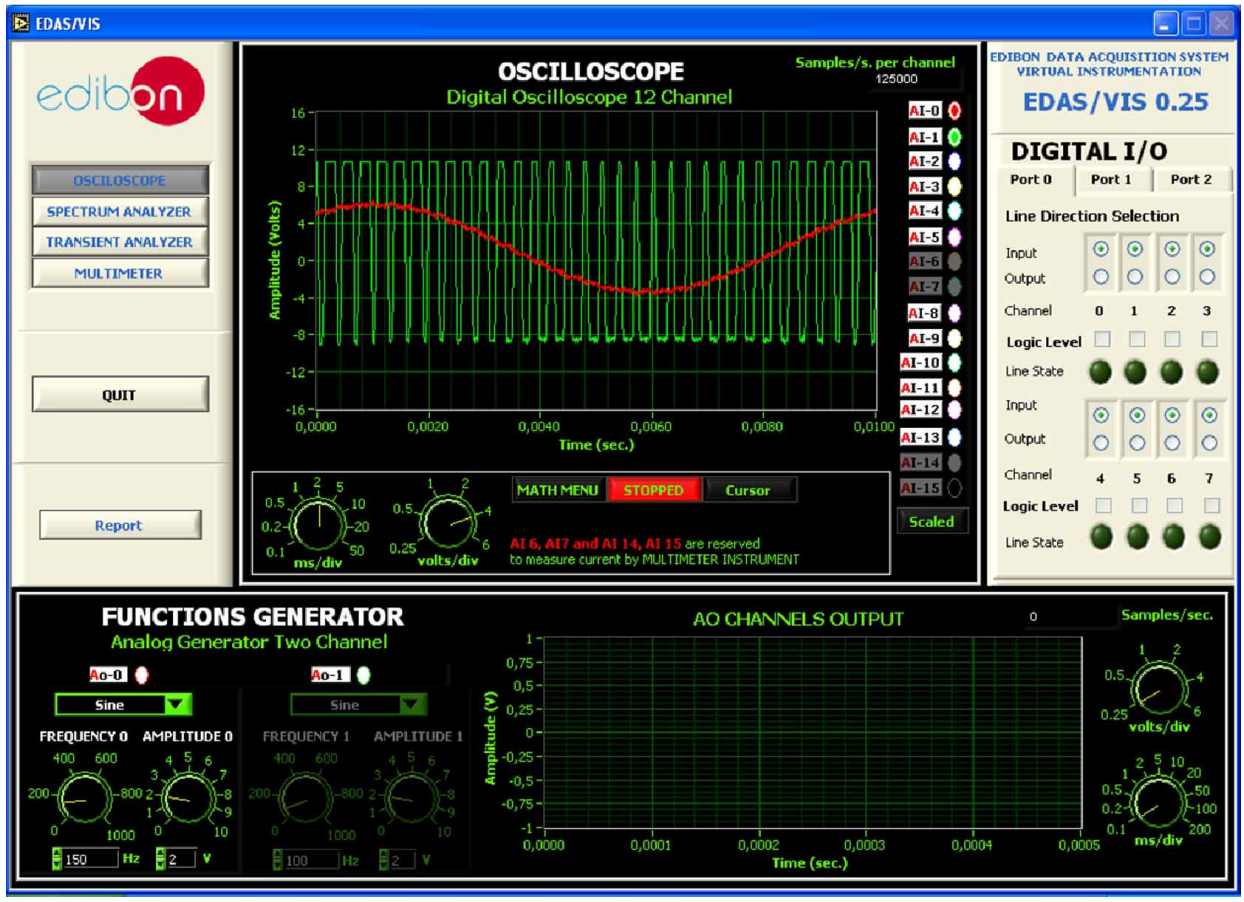
Time domain of a PAM signal



PWM (Pulse Width Modulation)

The screen below shows the time representation of a PWM signal. As it can be seen, the width of the carrier signal is changed according to the amplitude of the information signal.

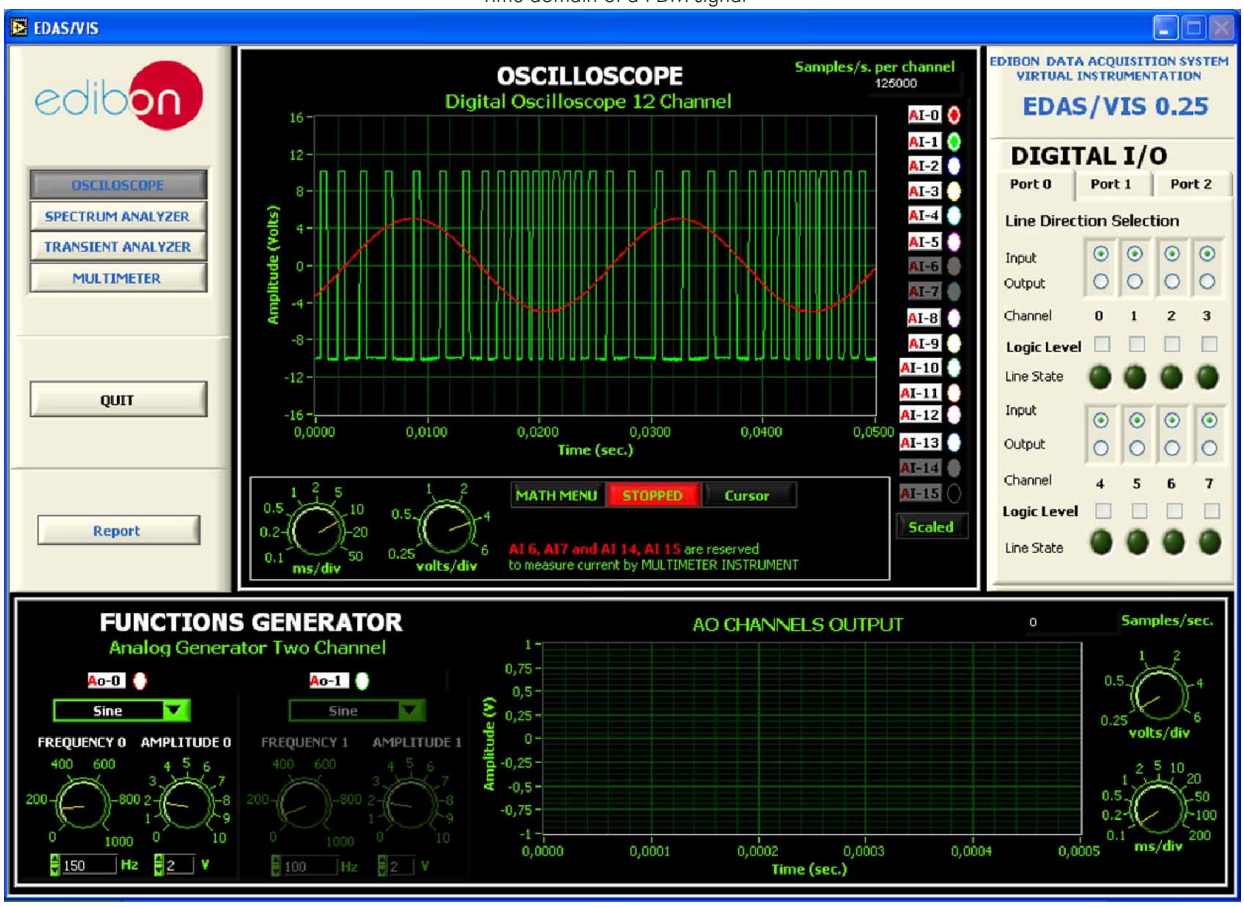
Time domain of a PWM signal



PDM (Pulse Density Modulation)

The screen below shows the time representation of a PDM signal. As it can be seen, the density of the carrier signal is changed according to the amplitude of the information signal.

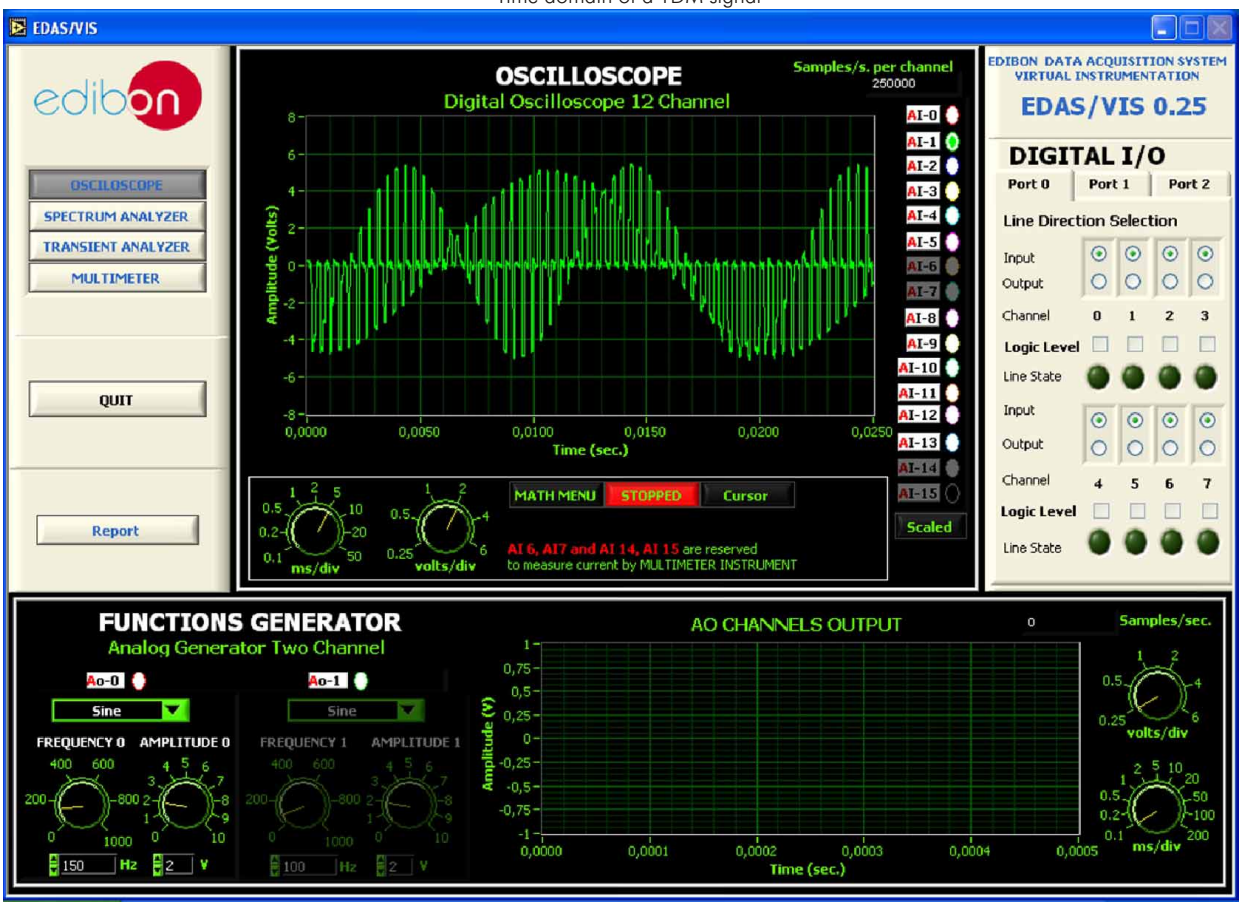
Time domain of a PDM signal



TDM (Time Division Multiplexing)

The screen below shows the time representation of a TDM signal. As it can be seen, the TDM signal intercalates different signals samples within a sampling interval.

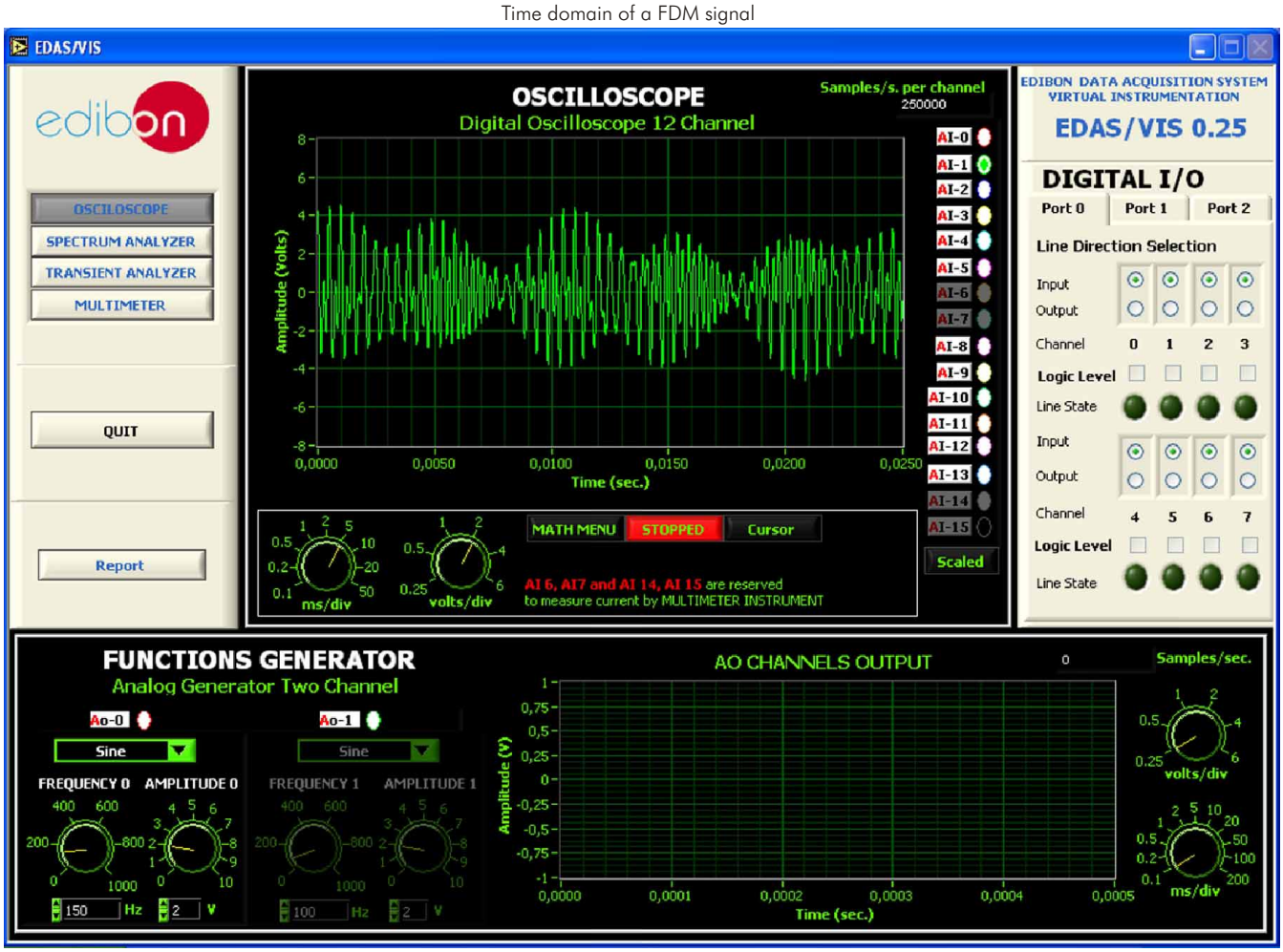
Time domain of a TDM signal



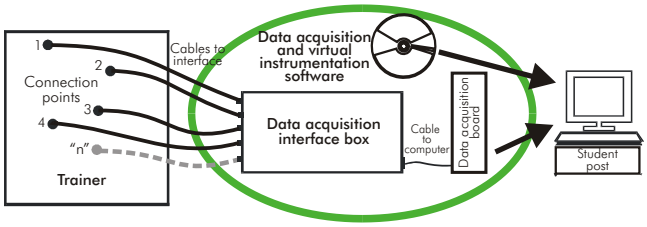
FDM (Frequency Division Multiplexing)

The screen below shows the time representation of an FDM signal. As it can be seen, the FDM signal contains different signals of different frequencies.

Time domain of a FDM signal



EDAS/VIS. EDIBON Data Acquisition System/Virtual Instrumentation System:



EDAS/VIS is the perfect link between the trainer and the PC. With the EDAS/VIS system, information from the trainer is sent to the computer. There, it can be analyzed and represented.
We easily connect the Data Acquisition Interface Box (DAIB) to trainer with the supplied cables (connection points are placed in the trainer). Like any other hardware, the DAIB is connected to the PC through the Data Acquisition Board (DAB), and by using the Data acquisition and Virtual Instrumentation Software, the student can get the results from the undertaken experiment/practice, see them on the screen and work with them.

This EDAS/VIS System includes DAIB + DAB + EDAS/VIS-SOF:

1)Hardware:

1.1)**DAIB. Data Acquisition Interface Box:**

Metallic box. Dimensions: 310 x 220 x 145 mm. approx.
Front panel:
16 Analog inputs (1 block with **12 voltage channels** and 1 block with **2 current channels** (4 connections)).
Sampling velocity **1,250,000 samples per second** for **EDAS/VIS 1.25 Version.**
Sampling velocity **250,000 samples per second** for **EDAS/VIS 0.25 Version.**
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 0-5V. 2 Analog signal potentiometers ±12V.
Main ON/OFF switch.
Inside: Internal power supply of 12 and 5 V. Potentiometer.
Back panel: Power supply connector. SCSI connector (for data acquisition board).
Connecting cables.

DAIB

+

1.2) **DAB. Data Acquisition Board:**

For EDAS/VIS 1.25 Version:
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)=±10V. Data transfers=DMA, interrupts, programmed I/0. DMA channels=6.
Analog output: Number **channels=2. Resolution=16 bits**, 1 in 65536. **Max. output rate up to: 833KS/s.** Output range(V)=±10V. Data transfers=DMA, interrupts, programmed I/0.
Digital Input/Output: Numbers 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:
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.

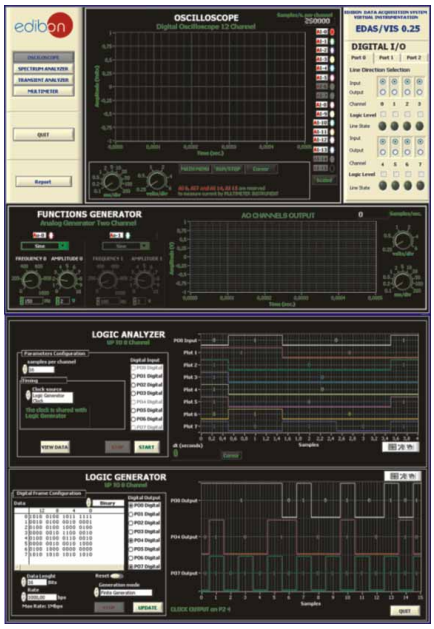
DAB

+

2) **EDAS/VIS-SOF. Data Acquisition and Virtual Instrumentation 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: ±10V.
  All 12 input channels could be scaled to compare signal with different voltage levels.
  "Math Menu" with operations as Addition, Subtraction, Multiplication and Division, between any of the 12 oscilloscope channels.
- **Function Generator:**
  Two independent signal generators, for sinusoidal, triangular, saw tooth and square.
  Channels: 2 (allowing working simultaneously). Maximum output voltage: ±10V.
  It includes a graph where an output signal for each channel is shown.
- **Spectrum Analyzer:**
  Channels: 12 (simultaneous). Max. voltage: ±10V. Spectrum analyzer: based on the FFT.
- **Multimeter:**
  Voltmeter (**Channels: 12** (simultaneous). Max. voltage: ±10V RMS).
  Ammeter (**Channels: 2** (simultaneous). Max. Ampere: 500 mA rms per channel).
- **Transient Analyzer.**
- **Logic Analyzer:**
  Number of Input channels: 8. TTL Voltage Level. **Clock Source: 3 different sources.**
  This instrument allows receiving as far as 8 digital signal simultaneously at 1 or 8 Mbps (depending the version).
- **Logic Generator:**
  Number of transmission channels: 8. TTL voltage level.
  This instrument allows generating up to 8 digital simultaneous signals of 1 or 8 Mbps (depending of the version).

Sampling velocity 1,250,000 samples per second for EDAS/VIS 1.25 Version.
Sampling velocity 250,000 samples per second for EDAS/VIS 0.25 Version.
Manuals: This system **is supplied with the following manuals**: Required Services, Assembly and Installation, Interface and Software, Starting-up, Safety, Maintenance & Practices Manuals.

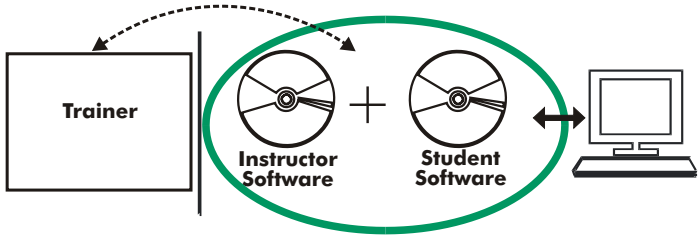


EDAS/VIS-SOF

For more information see **EDAS/VIS** catalogue. Click on the following link:

www.edibon.com/products/catalogues/en/units/communications/digital/EDAS-VIS.pdf

CAI. Computer Aided Instruction Software System:



With no physical connection between trainer and computer, **this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student Software (EMDA/SOF).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

INS/SOF. Classroom Management Software (Instructor Software):

The instructor can:

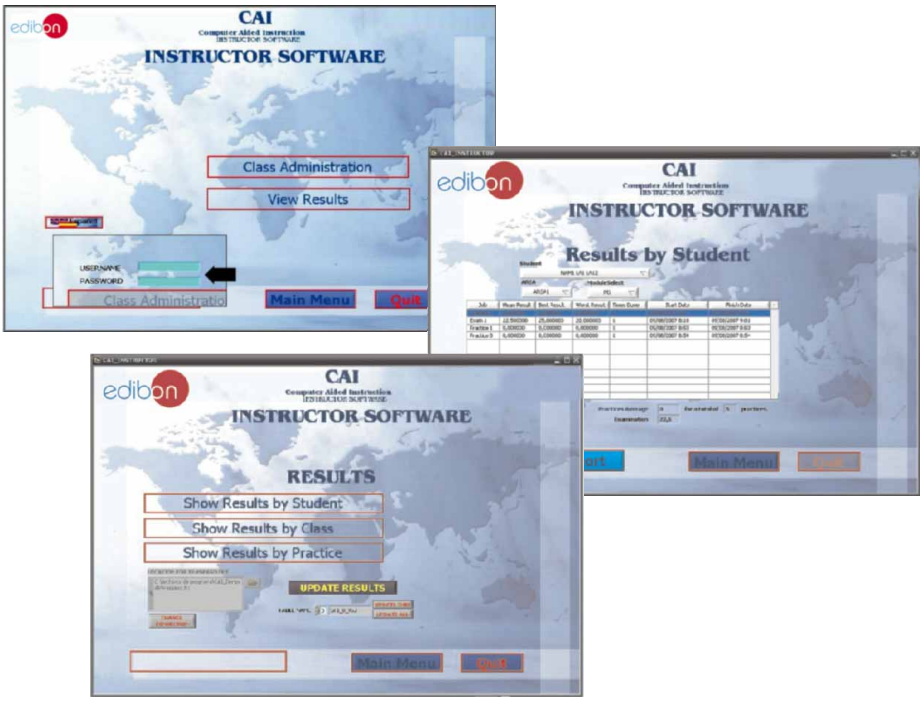
- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Print reports.
- Develop own examinations.
- Detect student's progress and difficulties.

...and many other facilities.

This software working in network configuration allows controlling all the students in the classroom.

Example of software screens

Instructor Software



EMDA/SOF. Computer Aided Instruction Software (Student Software):

It explains how to use the trainer, run the experiments and what to do at any moment.

- This software contains:

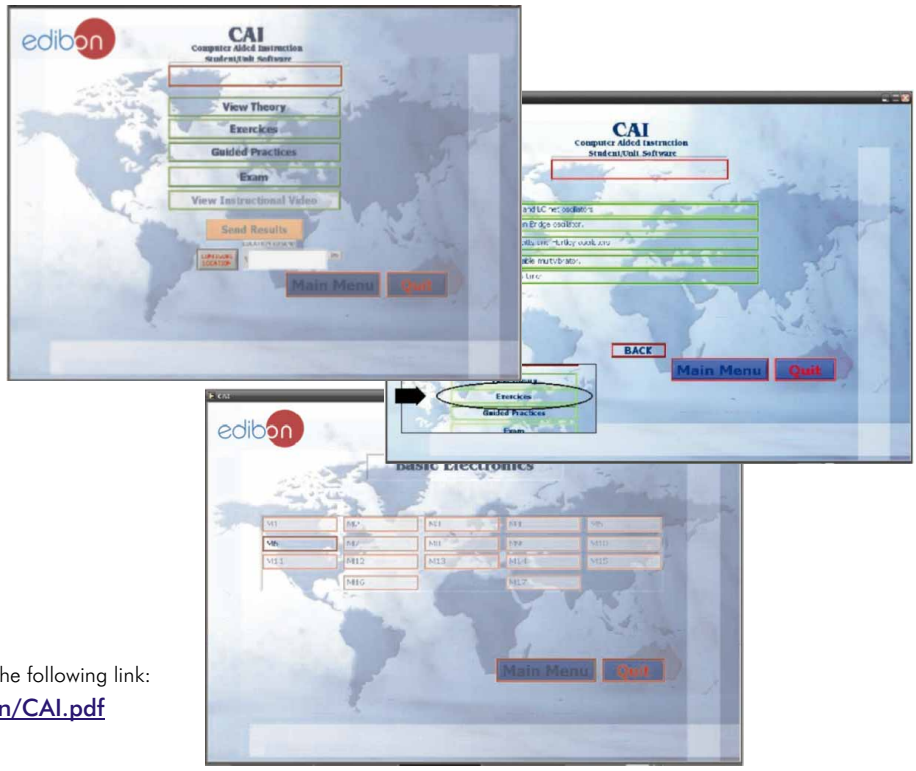
  Theory: gives the student the theoretical background for a total understanding of the studied subject.

  Exercises: divided by thematic areas and chapters to check out that the theory has been understood.

  Guided Practices: presents several practices to be done with the trainer, showing how to complete exercises and practices.

  Exams: set of questions presented to test the obtained knowledge.

Student Software



For more information see **CAI** catalogue. Click on the following link:
www.edibon.com/products/catalogues/en/CAI.pdf

EMDA/CAL. Computer Aided Learning Software (Results Calculation and Analysis):

This Computer Aided Learning Software (CAL) is a Windows based software, simple and very easy to use, specifically developed by EDIBON.

CAL is a class assistant that helps in making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.

CAL will perform the calculations.

CAL computes the value of all the variables involved.

It allows to plot and print the results. Between the plotting options, any variable can be represented against any other.

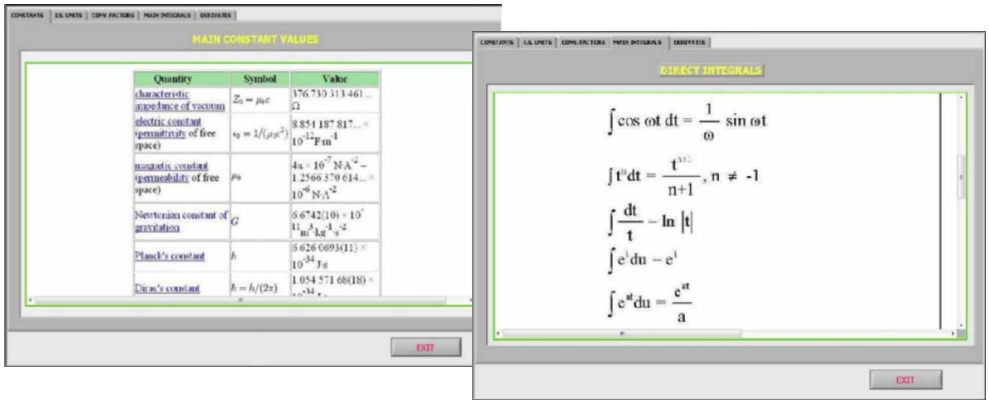
Different plotting displays.

It has a wide range of information, such as constant values, unit conversion factors and integral and derivative tables.

Calculations

Plotting options

Information of constant values, unit conversion factors and integral and derivative tables



For more information see **CAL** catalogue. Click on the following link:
www.edibon.com/products/catalogues/en/CAL.pdf

✱Specifications subject to change without previous notice, due to the convenience of improvements of the product.

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