edibon

Engineering and Technical Teaching Equipment

Computer Controlled **Advanced Industrial Servosystem Unit (for DC Motors)**

SERIN/CC

www.edibon.com
PRODUCTS
2.- ELECTRONICS AND 6.- MECHATRONICS, AUTOMATION & COMPUMECHATRONICS

RTC.
EDIBON Real Time Control System

Teaching Technique used

② Software for:
- Computer Control
- Data Acquisition
- Data Management

Computer (not included in the supply)

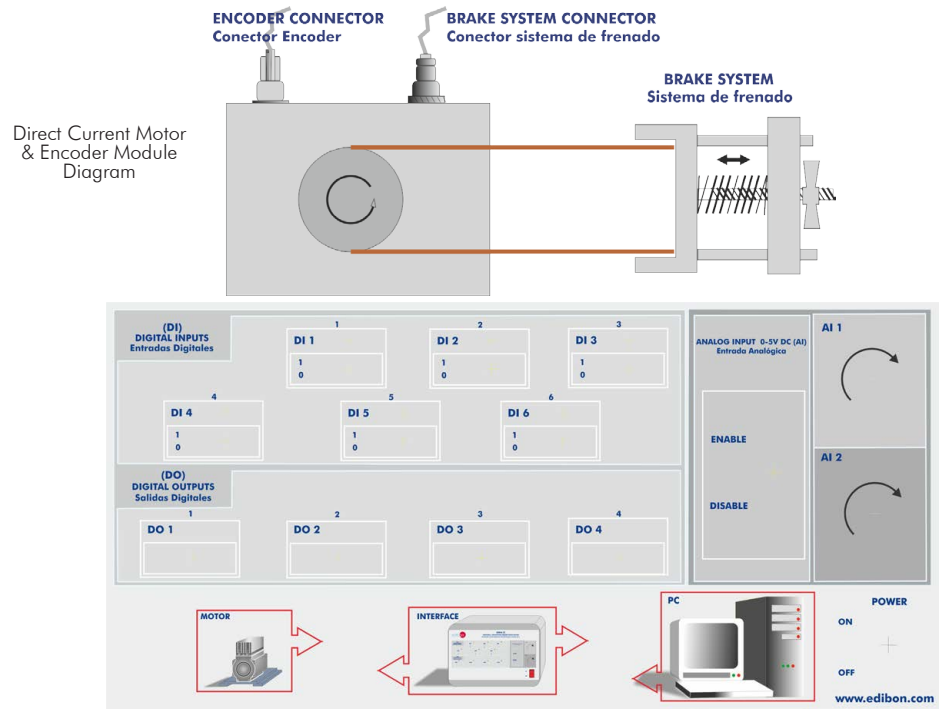
③ Cables and Accessories
④ Manuals

* **Minimum supply always includes: 1 + 2 + 3 + 4**
(Computer not included in the supply)

① Unit: SERIN/CC. Computer Controlled Advanced Industrial Servosystem Unit (for DC Motors)

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

Direct Current Motor & Encoder Module Diagram



OPEN CONTROL + MULTICONTROL + REAL TIME CONTROL

Control Interface Box FRONT PANEL

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

Nowadays, servo systems are used in CNC machinery, industrial automation, robotics and other applications. The main advantage of these systems over simple DC or AC motors is the addition of feedback of a certain variable such as speed, position, or torque, to ensure the accuracy of movement in a particular application.

Position control is used to move the load from one place to another. Position feedback is important for precise positioning. Speed control moves the load at a set speed. Torque control measures the input current to the motor with a known torque coefficient to develop a given torque.

The Computer Controlled Advanced Industrial Servosystem Unit (for DC Motors), "SERIN/CC", is a SERVO DC test unit designed by EDIBON, that allows students to learn the most important concepts of servomechanisms in a simple and fast way. The unit is supplied with a set of practices through which the student will understand how a servo driver works and how to set up different control methods.

GENERAL DESCRIPTION

The Computer Controlled Advanced Industrial Servosystem Unit (for DC Motors), "SERIN/CC", has been designed by EDIBON to allow to perform different practices related to servomotors to be carried out. The unit has different modules to develop different experiments. The modules included in the "SERIN/CC" unit are:

- Digital inputs and outputs: the unit contains six digital inputs and four digital outputs. The digital inputs can be used to trigger different defined standard functions as well as defined motion profiles. The digital outputs give all necessary information about the status of the motion.
- Analog inputs: The device has two analogue inputs that can be enabled or disabled using the switch. They have a voltage range of 0 – 5 VDC and have a resolution of 10 bits.
- DC motor: the motor is connected to a tensioning brake that can be used to load the motor.

The interface has a servomechanism controller for DC motors that controls the speed, position and current of the motor. A pulse encoder is used for this feedback control.

The RS-232 communication between the interface and the computer gives the "SERIN/CC" unit the possibility to control the motor from the computer and to display the most important signals of the motor.

The 4-quadrant servo controller controls the operation of the motor and braking in both clockwise and counterclockwise directions of rotation for correct positioning.

The controller is a pulse width modulator (PWM) in which the controller turns the motor on and off many times per second (several tens of thousands of times). If the switch-on interval is longer, the motor gains speed, but if the switch-on interval is shorter, the motor loses speed. The decisive average value of the voltage changes in relation to the time-on-off in one cycle of the PWM signal. This type of control has a higher efficiency and only a minimum of energy is converted into heat.

There are three types of controls performed by the controller:

Speed control: The speed function of the servo amplifier is to maintain a constant motor speed independent of load changes. For this purpose the set point (desired speed) is continuously compared with the actual value (actual speed) in the electronic control of the servomechanism of the amplifier. The controller difference determined in this way is used by the controller to regulate the pulse width of the servo amplifier in such a way that the motor reduces the controller difference. This represents a closed-loop speed regulation circuit.

Position control: Position control ensures that the position obtained from the current measurement matches the target position by providing the motor with corresponding correction values, just as the speed controller does. This position is usually obtained from a digital encoder.

Current or torque control: Current control provides the motor with a current proportional to the set point. Therefore the motor torque changes proportionally to the set point. Current control also improves the dynamics of an overriding positioning or speed control circuit.

The motor is equipped with a digital encoder providing 500 pulses per revolution. The direction of rotation is detected with the square pulses of channels A and B through an electrical 90-degree offset.

The digital encoder is used in position control to derive and measure the displacement or angle.

The encoder provides a simple square signal for further processing of the control system. Its pulses can be counted for exact positioning or velocity determination. Channels A and B generate out-of-phase signals, which are compared to determine the direction of rotation.

The so-called "home" pulse (channel I) provides a zero crossing and is used as a reference point to precisely determine the angle of rotation.

The encoder of the "SERIN/CC" unit evaluates the rising and falling edges of the signal. In consideration of the number of encoder pulses, this result gives four times more accurate positioning.

①SERIN/CC. Unit:

The "SERIN/CC" unit consists on a control interface box and a direct current motor and encoder module.

The control interface box has a four quadrants servo amplifier for DC motors that controls the motor speed, position and current of the motor. In order to do this control the feedback is done thanks to an encoder.

The RS-232 communication between the control interface box and the computer provides the possibility of commanding the motor from the computer and to visualize the most important signals of the motor.

The four quadrant servo amplifier controls the motor operation and the braking operation in both rotation directions clockwise and counterclockwise.

Velocity, position and torque control.

It allows predefined moves and programming.

Control Interface Box:

Front panel:

Six user programmable digital inputs with the following functions:

- Negative limit switch.
- Positive limit switch.
- Home switch.
- Position marker.
- Drive enable.
- Quick stop.
- General A – H.

Each input is controlled by a switch.

Four user-programmable digital outputs with the following functions:

- Ready/Fault.
- Position compare.
- Holding brake.
- General A – H.

Each output is connected to an LED.

Two analogue inputs with voltages in a range of 0 – 5 V.

Two potentiometers to adjust the values of the analogue inputs (0 – 5 VDC). These potentiometers are enabled by a switch placed next to them.

Two analog inputs with voltages in the range of 0 – 5 V.

Two potentiometers to select the value of the analog inputs (0 – 5 VDC), these potentiometers are enabled by a commuting switch placed next to them.

Ignition switch. When the unit is on, the red LED is active and lighting.

Back panel:

Voltage supply. There is a voltage supply that feeds the unit with 220 V of alternating current.

Motor power supply. It is a 24 VDC motor power supply (it is a three wires connection motor +, motor - ,and one taking to earth).

Connection port in series. It is a connection plug to connect the Control Interface with the PC by the RS-232 port, in order to allow the software to manage the motor.

Connection with the Feedback. It is a connection with the motor Feedback. It allows the encoder to manage the motor.

Direct Current Motor and Encoder Module:

DC Motor, 90 W. Position, speed and current are controlled by the control interface.

Digital encoder, 500 pulses per revolution, with RS-232 communication port.

Two power supply wires (one for the motor and other for the control interface).

Two communication RS-232 wires (one from the Control Interface to the computer and other from the Control Interface to the encoder).

②SERIN/CC/CCSOF. Computer Control + Data Acquisition + Data Management Software:

Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. **Compatible with the industry standards.**

Registration and visualization of all process variables in an automatic and simultaneously way.

Flexible open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

Management, processing, comparison and storage of data.

Comparative analysis of the obtained data, after to the process and modification of the conditions during the process.

③Cables and Accessories, for normal operation.

④Manuals:

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

∗References 1 to 4: SERIN/CC + SERIN/CC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling a normal and full operation.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Autotuning.
2.- Manual tuning of the position regulator.
3.- Motion commands in MPBUS RS-232 mode.
4.- Signals graph, transient analysis.
5.- Batch commands.
6.- User´s parameters, position value, velocity value, acceleration value.
7.- Digital inputs and outputs in I/O mode.
8.- Load and braking simulation.
9.- Searching reference.
10.- Input/Output functions.
11.- State commands and exception.
12.- Velocity, position and torque control.

REQUIRED SERVICES

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

REQUIRED ELEMENTS (Not included)

- AEL-PC. Touch Screen and Computer.

or

- PC. PC to work with the unit.

DIMENSIONS AND WEIGHTS

SERIN/CC:
Control Interface Box:
- Dimensions: 490 x 330 x 310 mm approx. (19.29 x 12.99 x 12.20 inches approx.)
- Weight: 40 Kg approx. (88 pounds approx.)

Direct Current Motor + Encoder Module:
- Dimensions: 300 x 300 x 120 mm approx. (11.81 x 11.81 x 4.72 inches approx.)
- Weight: 5 Kg approx. (11 pounds approx.)

SIMILAR UNITS AVAILABLE

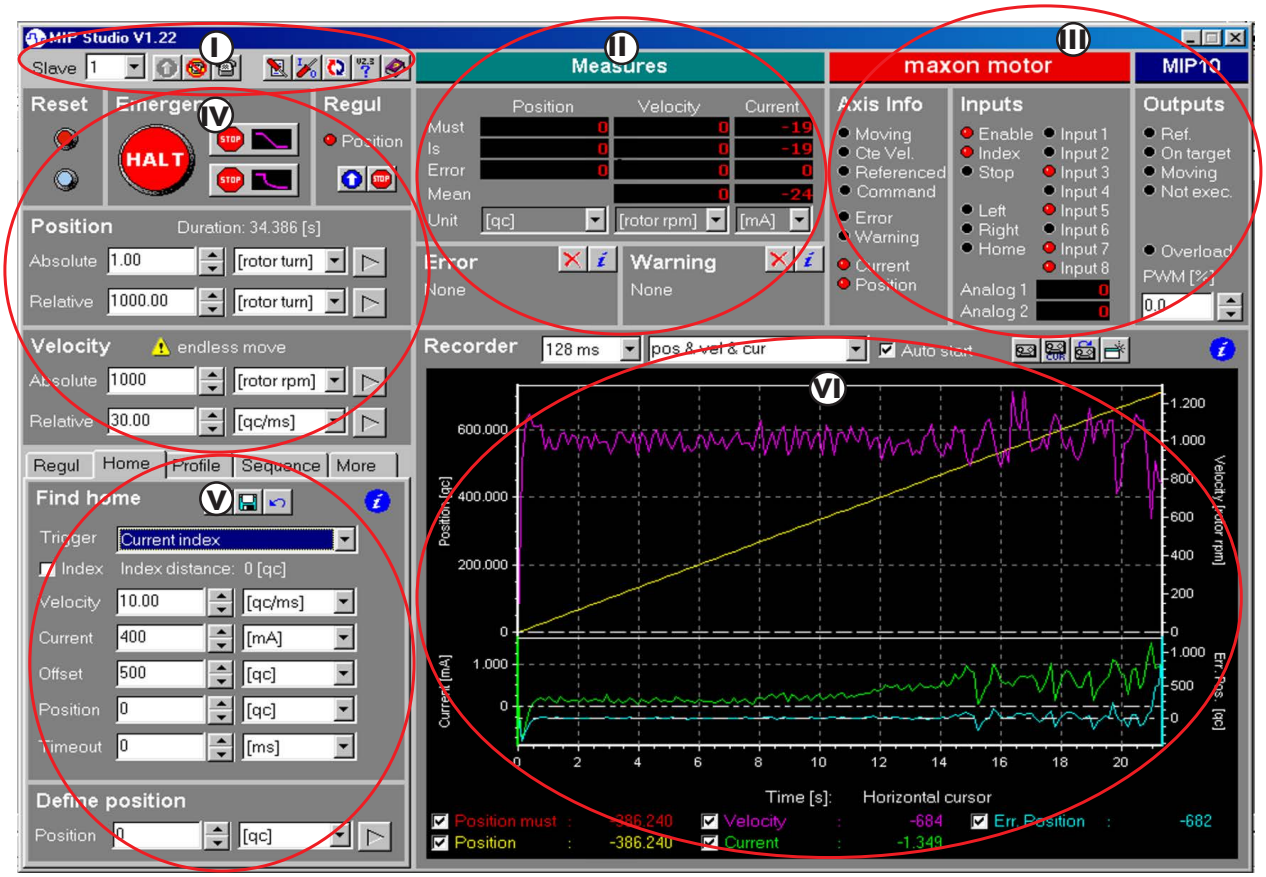
Offered in this catalog:

- SERIN/CC. Computer Controlled Advanced Industrial Servosystem Trainer (for DC Motors).

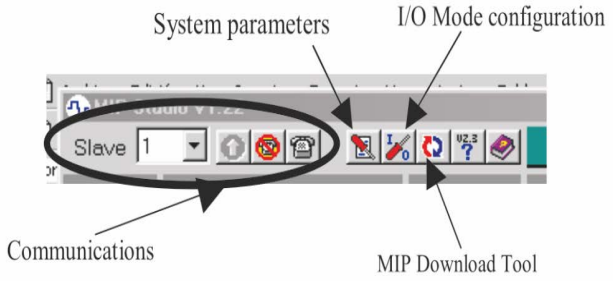
Offered in other catalogs:

- AEL-SERIN/CA-1KW. 1 kW AC Industrial Servomotor Application.
- SERIN/CCB. Servosystems Basic Unit for DC Motors.
- SERIN/CA. Computer Controlled Advanced Industrial Servosystems Unit (for AC Motors).
- BMI-UB. Brushless Motor Base Unit.
- SMI-UB. Servomotor Base Unit.

RTC (Real Time Control System)
Main screens



Ⓘ Menu section.



Ⓘ Measures section.

Ⓘ Inputs, Outputs and Axis info section.

Ⓘ Reset, Halt, Position Regulation, Position Control and Velocity section.

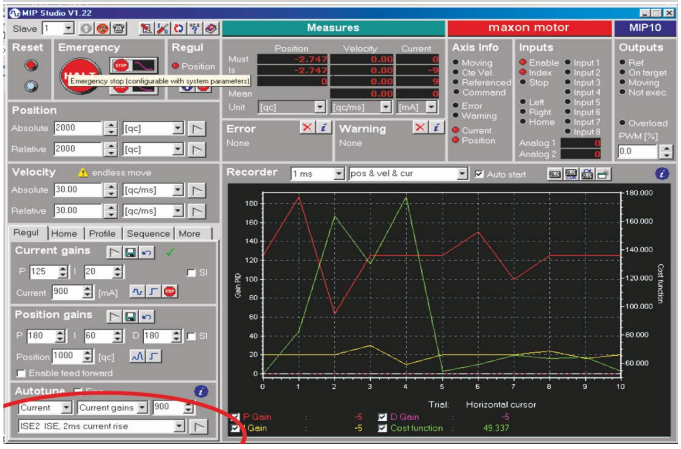
Ⓘ Section of Regulation, Reference, Sequence, etc.

Ⓘ Graphics section.

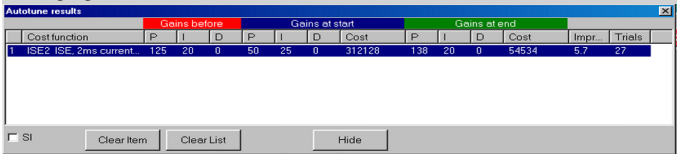
Autotuning

Gains Tuning

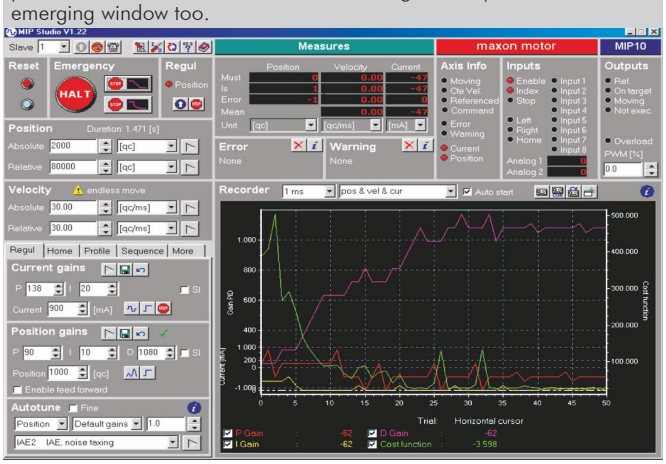
1.- In the lower left corner of the screen there is the autotuning function. Once the autotuning is done we can see the parameters on the emerging window.



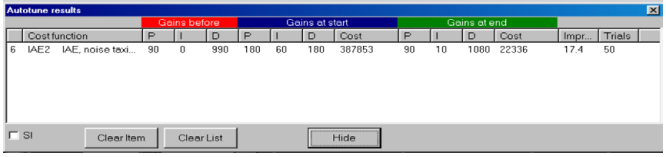
Emerging window:



2.- We can, as well, develop the position autotuning choosing the POSITION option (where before CURRENT were chosen) with the parameters used. We can observe the regulation parameters on the emerging window too.



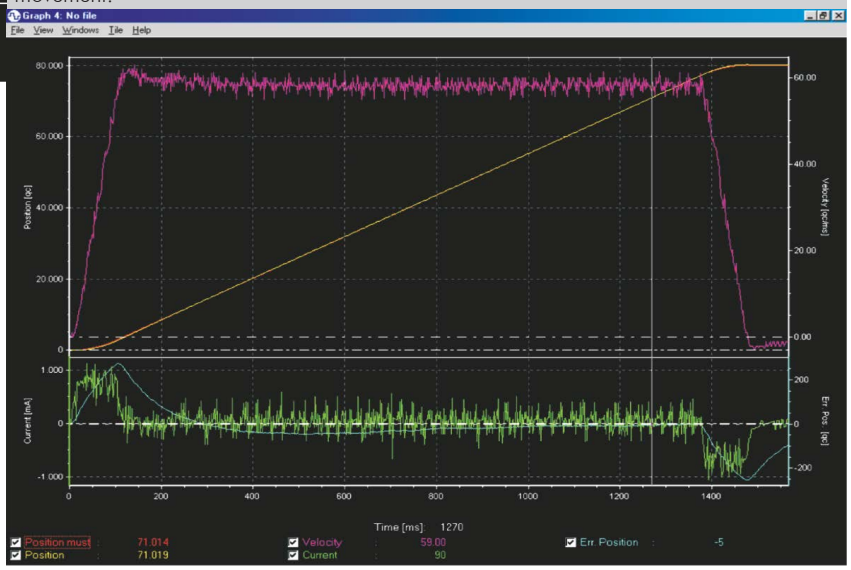
Emerging window:



3.- We will have both graphics: firstly the current regulation and then the position regulation graphic after to make a relative movement (on the right upper side we find the options for the movements in position and speed).

This is what we get with the current regulation:

Once the position autotuning is done, this is the graphic for the same 80.000 qc relative movement:



Some **real** results obtained from this unit

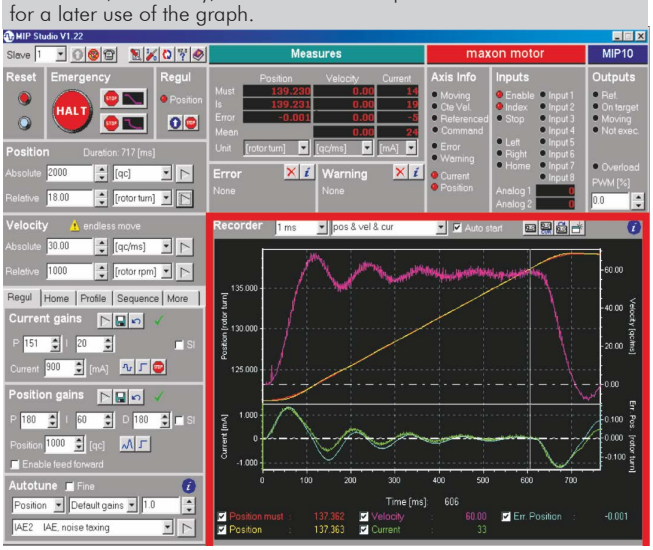
Signals Graph, Transient Analysis

Recorder function

(this function provides graphs for the parameters used on the movement of the motor. We have included values for each parameter, that allow the transient analysis)

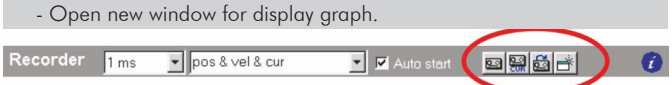
1.- Values for each parameter (position, current, velocity) are included, that allow the transient analysis. Firstly, the position graph is shown versus the velocity and the current.

Autostart is selected, 1ms is introduced and position & velocity & current are chosen, in this way, these data of these parameters will be recorded for a later use of the graph.

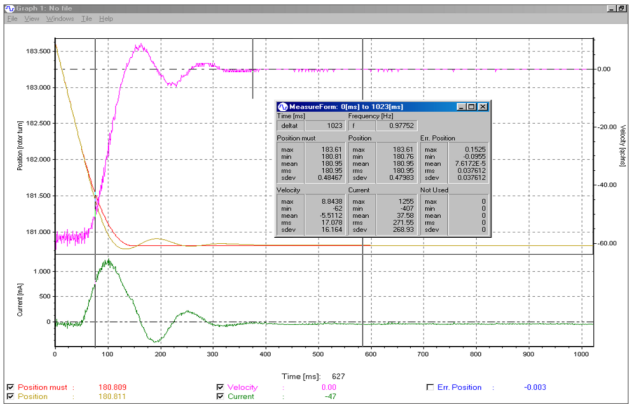


2.- In this zone of the main screen corresponding to RECORDER, there are 4 buttons:

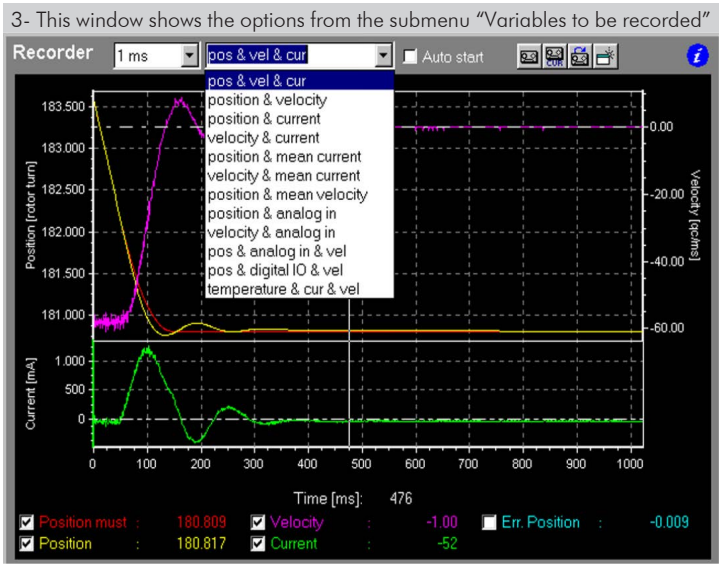
- Start recording.
- Start recording current and duty cycle.
- Reload recorded data.
- Open new window for display graph.



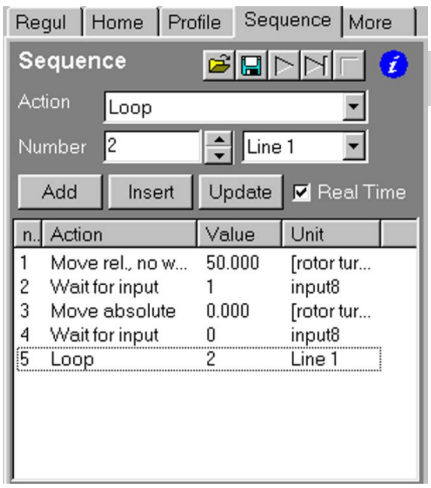
Example of a graph: In this graph we can analyze measures values, during the execution of other functions.



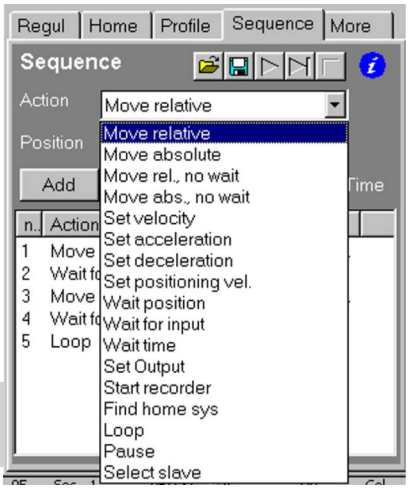
3- This window shows the options from the submenu "Variables to be recorded"



Batch Commands



The "sequence" menu allows us to put one action after another one (series connection)



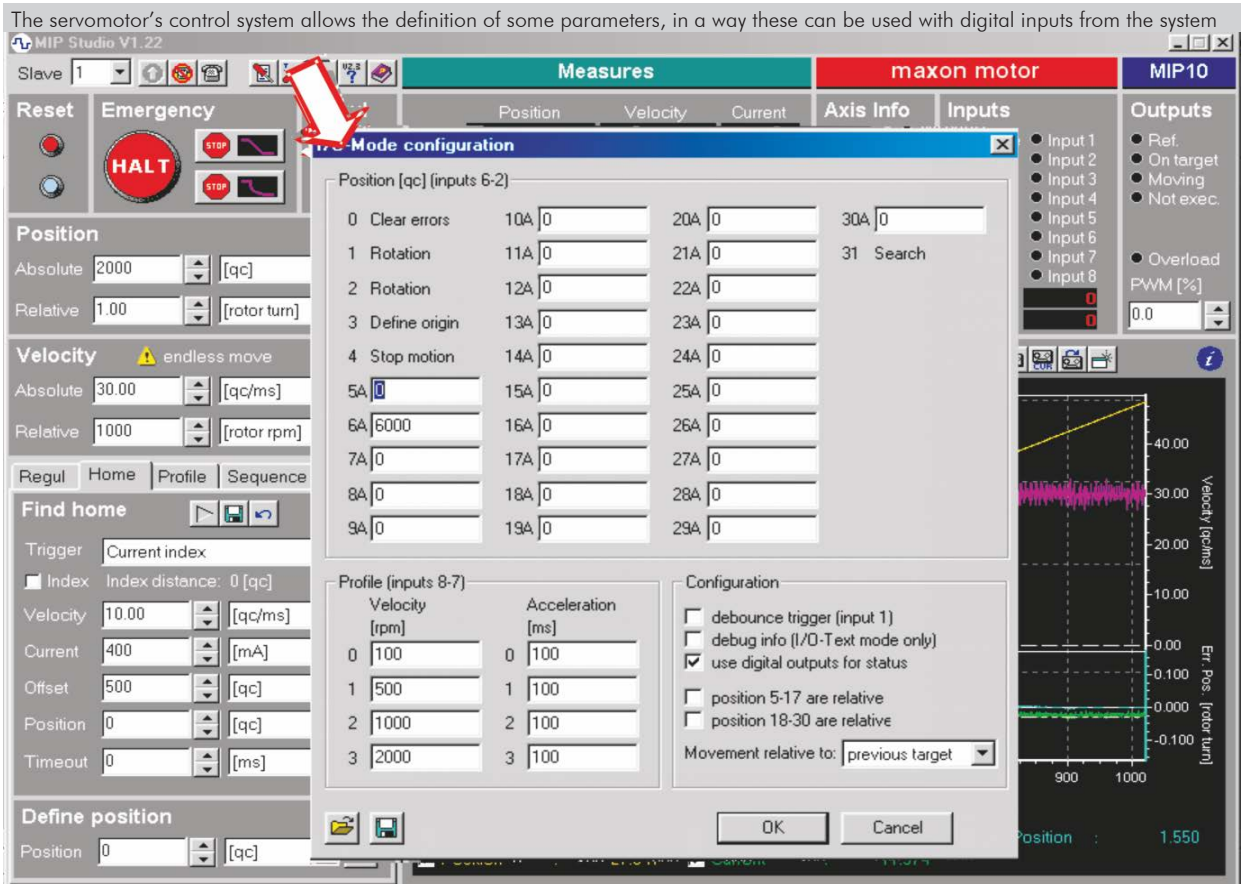
This is the list of available options.

With these instructions we can develop useful sequences for industrial purposes.

Some **real** results obtained from this unit

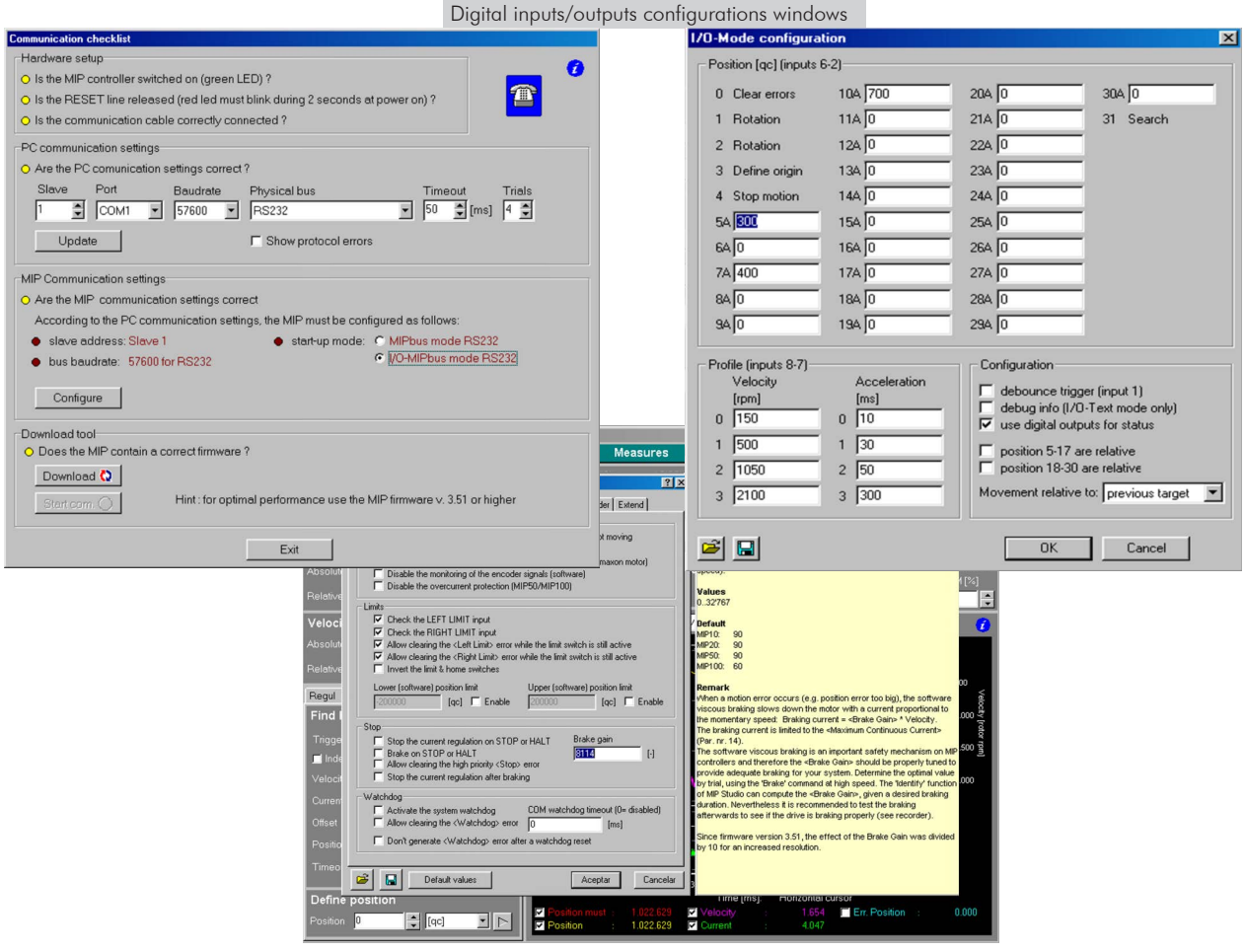
User's Parameters, Position Val, Velocity Val, Acceleration Val

The servomotor's control system allows the definition of some parameters, in a way these can be used with digital inputs from the system



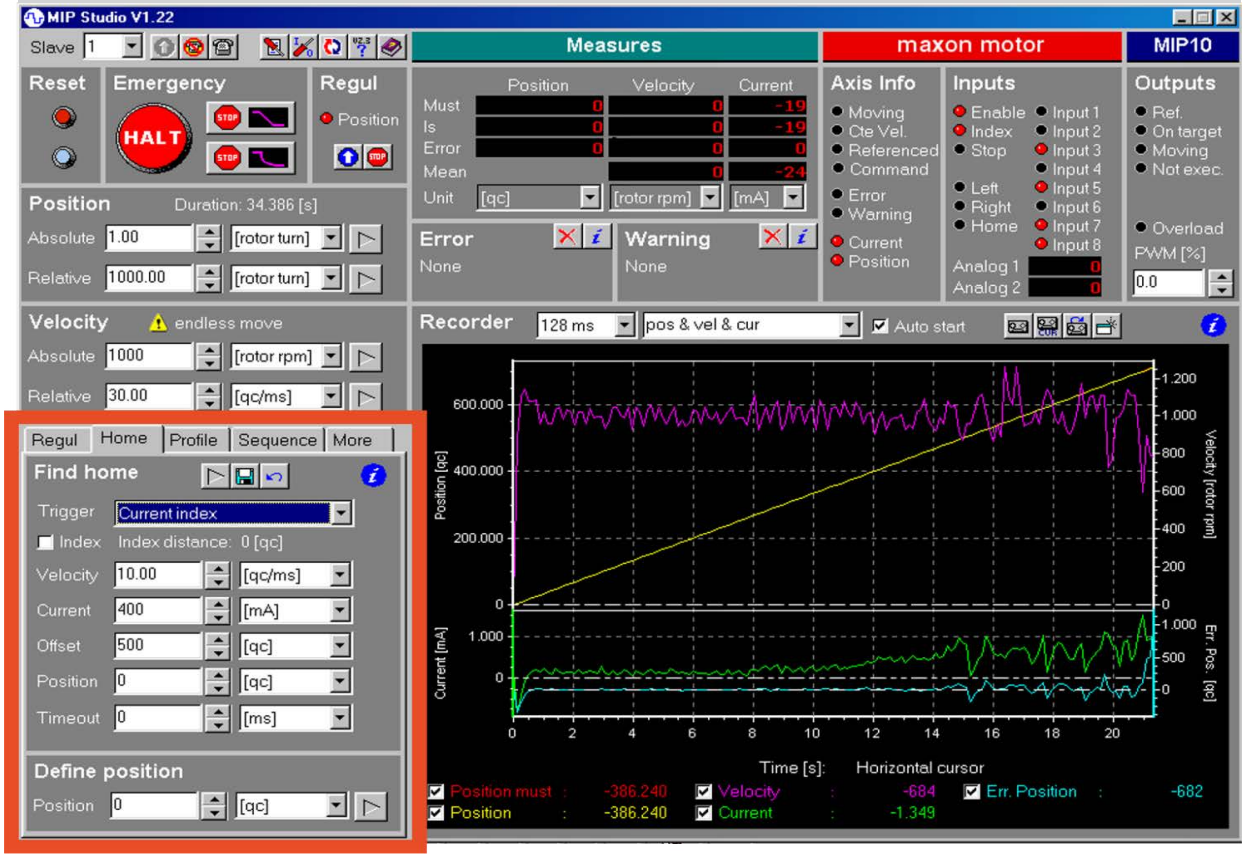
Digital inputs and outputs in I/O mode

Digital inputs/outputs configurations windows

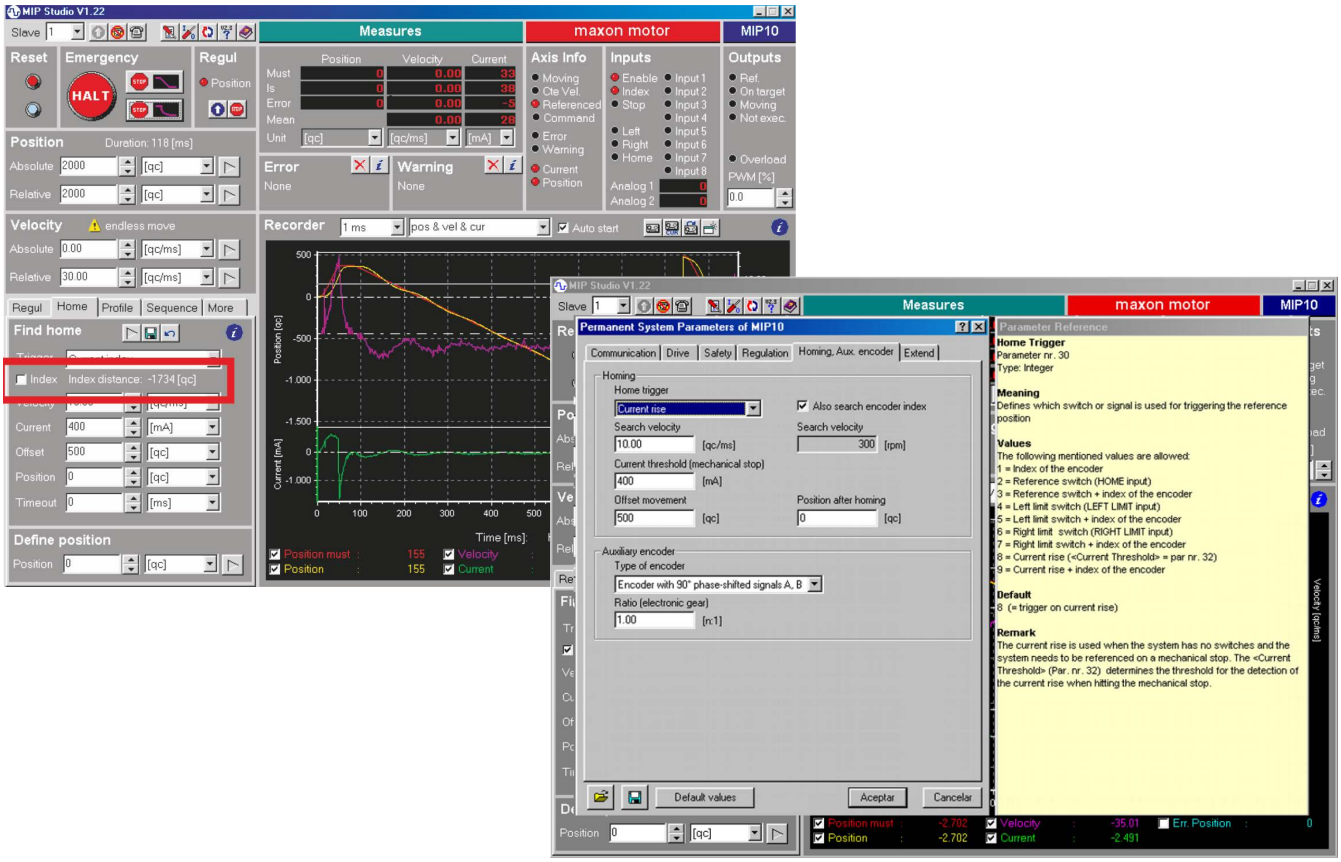


Load and braking simulation

We use the braking system, connected to the servomotor to simulate a load or braking the servo due to a course end. In this windows we observe that the simulation of an course end begins at the home option, adjusting the menu parameters.



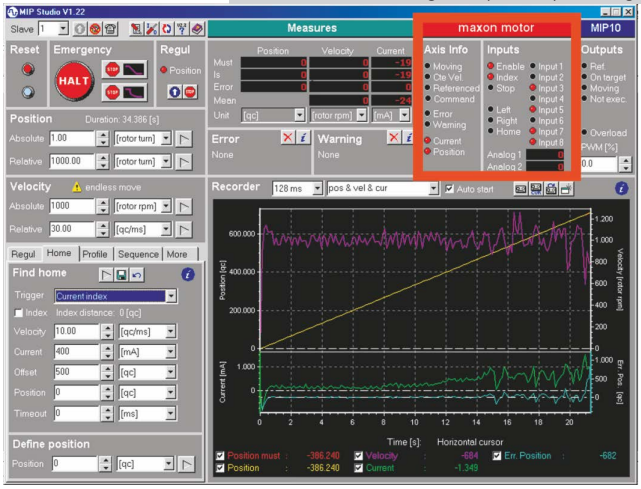
Searching reference

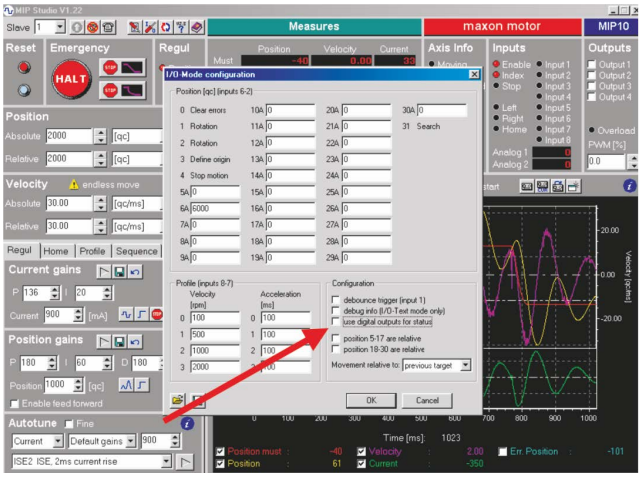


Some **real** results obtained from this Unit

Input/Output functions

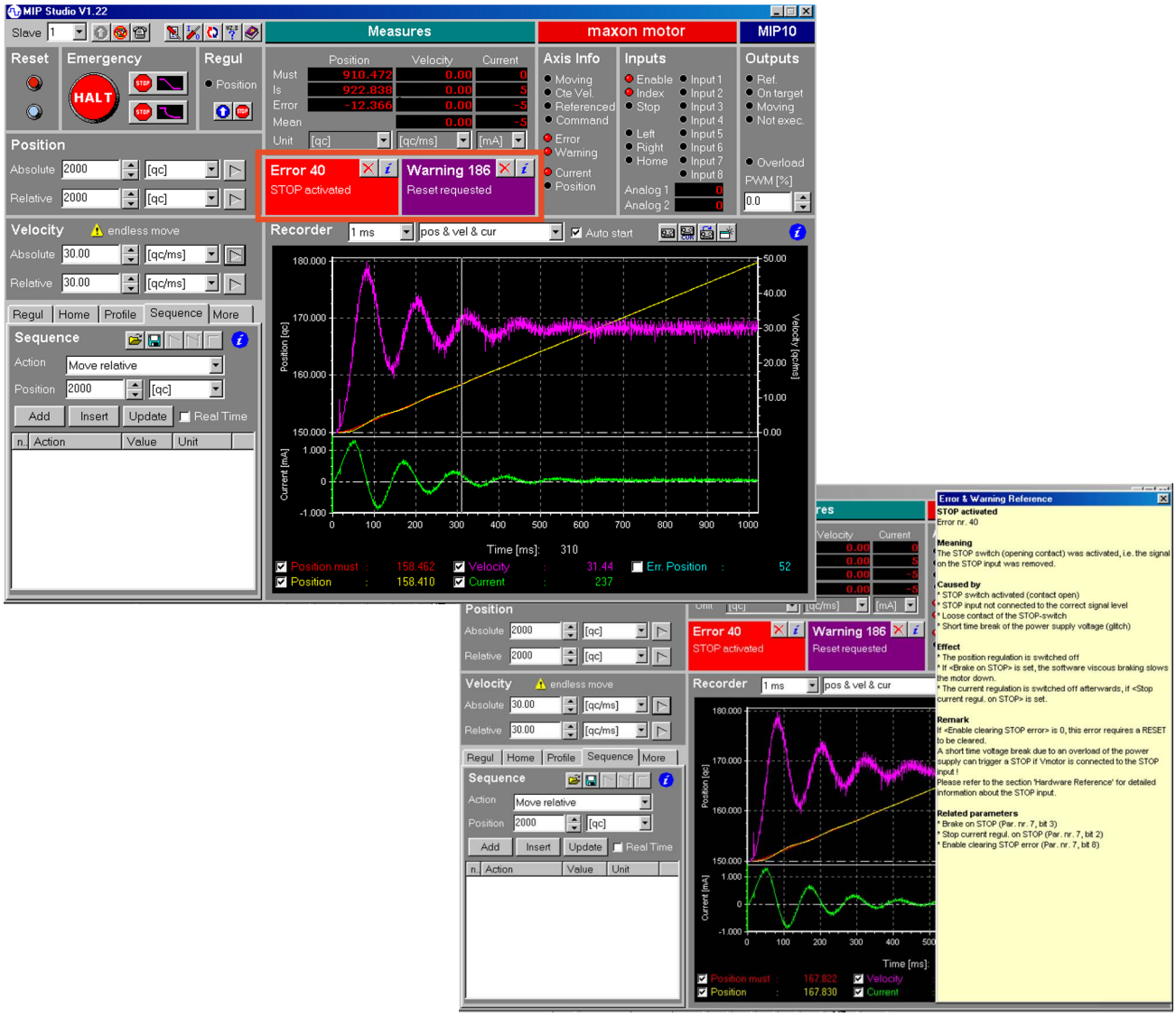
Visualization of the digital inputs anytime. Lights on (red) or off (black), the input's state (1 or 0)



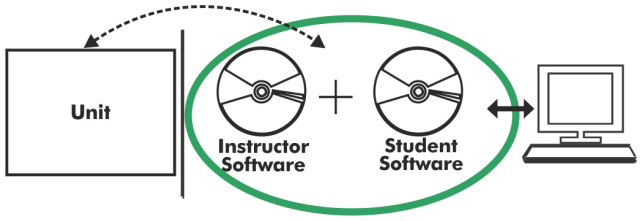


State commands and Exceptions

Example of windows of errors and warning signals



⑤SERIN/CC/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.

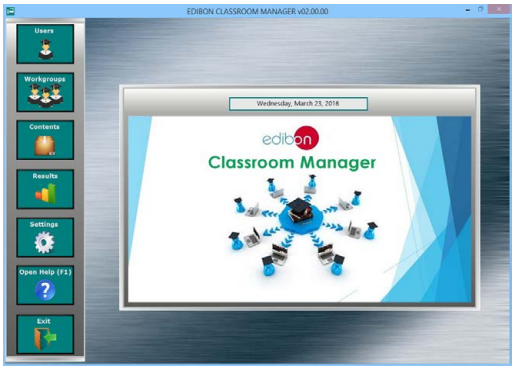
Instructor Software

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

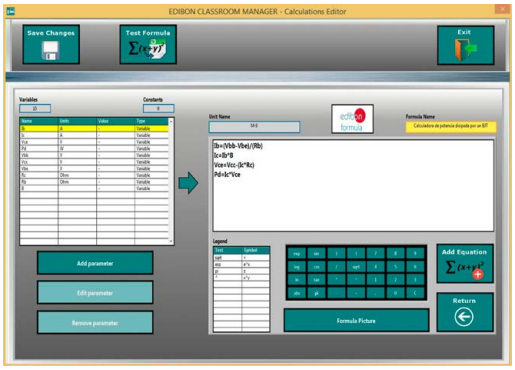
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

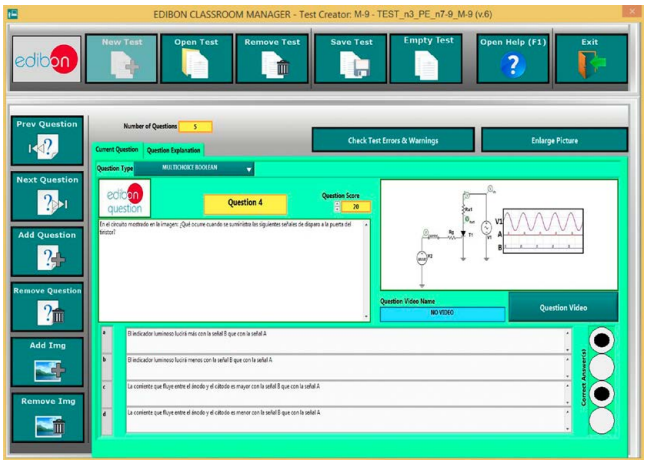
- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation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



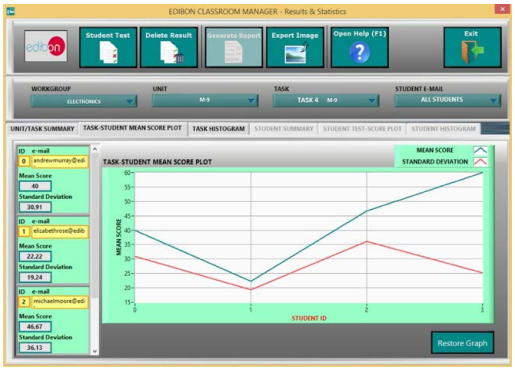
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



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).

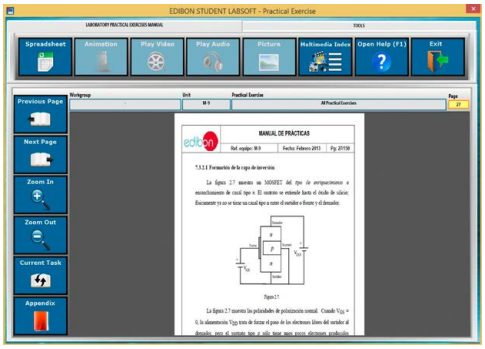
ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are 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:

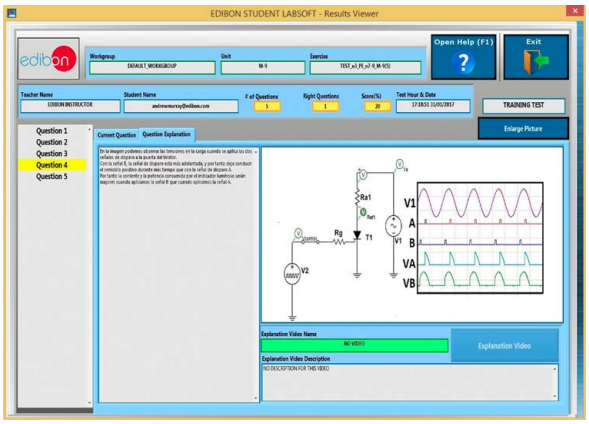
- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge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

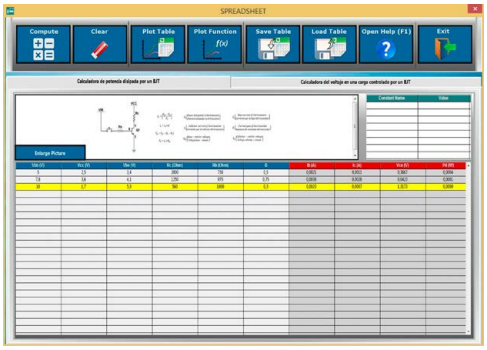
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



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: