



INTRODUCTION

Nowadays, the accurate control is critical for each industrial process. The industrial controllers form a crucial part of every industrial process as a means of ensuring that tasks such as production, distribution and treatment processes are carried out under the right condition. The operator has to have the enough experience in the management of the industrial controller, for achieve a correct control process.

The Industrial Controllers Trainer, "CECI", designed by EDIBON, allows students to learn the principles about the many control techniques used in the industrial processes.

The "CECI" unit has the necessary components to simulate a complete process (Set point generator module and system generator module). But our design with configurable inputs and outputs delivered at lab jacks in the front panel of "CECI", allows unit to be integrated into a real process at any time.

The industrial controller parameters of "CECI" can be configured with computer, through the communication module and software of ABB industrial controller (both provided in the "CECI"), but also can configured with the industrial controller front panel. In this way "CECI" unit teaches students a complete formation in industrial controllers configuration that are using in the industries today.

The unit is provided with a set of practical exercises, through which the students will familiarize with a standard industrial controller. The students will understand the operation mode of an industrial controller. They will learn how to set up the controller to carry out different control schemes such as open loop control, closed loop control, PID control, etc.



ISO 9001:2015 Quality Management (for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate (total safety)



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



Certificate and Worlddidac Member

GENERAL DESCRIPTION

The Industrial Controllers Trainer, "CECI", is based on a modular design structure whose functionality is divided into different modules to allow the student a better understanding of the unit. The modules included in the unit are: industrial controller, digital voltmeter, set point generator, system simulator and communication module.

- Industrial Controller: the controller has two analog inputs and analog/digital output. The analog inputs plugs are used to connect the process value (PV) and set point value (SP) signals. The analog/digital output plug is used for the output process signal (OP). The controller also has two configurable relays. In addition of configuration through the software, the industrial controller parameters can also be configured with the industrial controller front panel.
- Digital Voltmeter: this module allows visualize the amplitude of a dc signal.
- Set Point Generator: this module allows to generate a step signal by switching between two different selectable voltages. The voltage levels can be adjusted using two potentiometers.
- System Simulator: this module represents a first order lag system. The time constant of the system is 20 s. The gain of the system can be adjusted using the corresponding potentiometer.
- Communication module: this module consists of an infrared to USB adapter mounted in a mobile structure. The structure allows us to fix the adapter in order to align it with the controller.

The software provided with the "CECI" unit is the commercial software ABB device type manager (DTM), configuration software for Control Master industrial controller versions. This software allows students learn with real industrial controller software.

The software allows selection of type of control, industrial controller parameters, setting of alerts and alarms, type of system loop, etc. The access to configuration of different parameters is through a comprehensible Blocks scheme of the system process.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

The diagram shows the CECI Industrial Controllers Trainer unit with the following labeled components:

- COMMUNICATION MODULE / Módulo de Comunicación
- INDUSTRIAL CONTROLLER / Controlador Industrial
- ANALOG INPUT 1 / Entrada Analógica 1
- ANALOG INPUT 2 / Entrada Analógica 2
- ANALOG/DIGITAL OUTPUT 1 / Salida Analógica/Digital 1
- RELAY 1 / Relé 1
- RELAY 2 / Relé 2
- DIGITAL VOLTMETER / Voltímetro Digital
- SET POINT GENERATOR / Generador de Consignas
- SYSTEM SIMULATOR / Simulador de Sistema

Two screenshots of the ControlMaster software interface are shown below the unit:

- The left screenshot shows the "Operator Page" screen, displaying three main parameters: PV (process value) at 61.8, ST (set point value) at 62.1, and OP (output signal from the industrial controller) at 61.3x. It also shows an activated alarm.
- The right screenshot shows the "Trend display" screen, which shows the evolution of the different parameters values and also displays the activated alarms.

SPECIFICATIONS

Main unit (in metallic box), including:

Industrial Controller:

ABB Controller Cm30.

Display: Color 1/4 VGA TFT, liquid crystal display (LCD) with built-in backlight.

Language: English, German, French, Italian and Spanish.

Operator keypad: six tactile membrane keys.

Password protection: Basic/Advanced user-assigned password protection.

Trend display:

Recording of two variables.

Configurable sample rate (1 second to 5 minutes).

Control parameters:

Proportional band: 0 – 999.9 %.

Integral: 0 – 10000 s.

Derivative: 0 – 999.9 s.

Manual Reset: 0.0 – 100 %.

Autotune: On-demand calculation of control settings.

Process alarms:

Number: 8.

Types: High/Low process and High/Low latch.

Acknowledgement: Via front panel keys or digital signals.

Source: Fully configurable (for example, PV, analog input, math block inbuilt, OP control loop deviation).

Hysteresis: Level and time.

Alarm enable: Enable/Disable of individual alarms via a digital signal.

Analog inputs:

Number: 2.

Complete configurable process input: voltage (V or mV), current (mA), resistance (ohms), Thermocouple, 3-Wire RTD, frequency, pulse, volt-free digital input and 24 V digital input.

Selectable set points via software (remote from the computer) or front panel.

Analog/Digital output:

Number: 1.

Type: Configurable as analog or digital pulse.

Analog range: 0 – 20 mA (programmable).

Control output types (Configurable through software):

Current proportioning/Voltage proportioning (using resistor).

Time proportioning.

On/Off.

Motorized valve with feedback.

Motorized valve without feedback.

Split output with combinations of relay digital O/P and current O/Ps.

Relays:

Number: 2.

Type: N/O.

Contact rating: 5 A, 240 V.

Digital Voltmeter:

Range: 0 – 10Vdc.

Resolution: 10 mVdc.

Set Point Generator:

Two voltages selectable through a switch, which allows generate a step signal.

Amplitude: 0 – 10 Vdc.

System Simulator:

Simulates a first order lag System.

Time constant (T): 20 s.

Gain 1 to 10 (clockwise direction).

Communication module:

Allows connect to computer using IrDA protocol.

Software: ABB device type manager (DTM), configuration software for Control Master industrial controller versions:

The software allows selection of type of control, industrial controller parameters, setting of alerts and alarms, type of system loop, etc.

The access to configuration of different parameters is through a comprehensible Blocks scheme of the system process.

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.- Installation, connection and familiarization with the software.
- 2.- Study of the transfer function (static and dynamic).
- 3.- Familiarize with the Set point generator, generation of a square signal using two analog signals.
- 4.- Familiarization with the navigation of an industrial controller (operator page screen, trend display screen, etc).
- 5.- Step-response of a first order system.
- 6.- Configuration of analog inputs/outputs signals of the industrial controller (electrical range, engineering units, fault detector, etc).
- 7.- Manual control of a first order system using an industrial controller (open-loop).
- 8.- Automatic PID control of a first order system using an industrial controller (closed loop).
- 9.- Obtaining the PID parameters automatically using autotuning.
- 10.-Setting alarms and diagnostics generation.
- 11.-Setting of an industrial controller using the front panel (configuration level, parameter level, operation control level, etc.).
- 12.-Remote setting of an industrial controller using the configuration software (configuration level, parameter level, operation control level, etc.).

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

CECI:

Main unit:

- 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.)

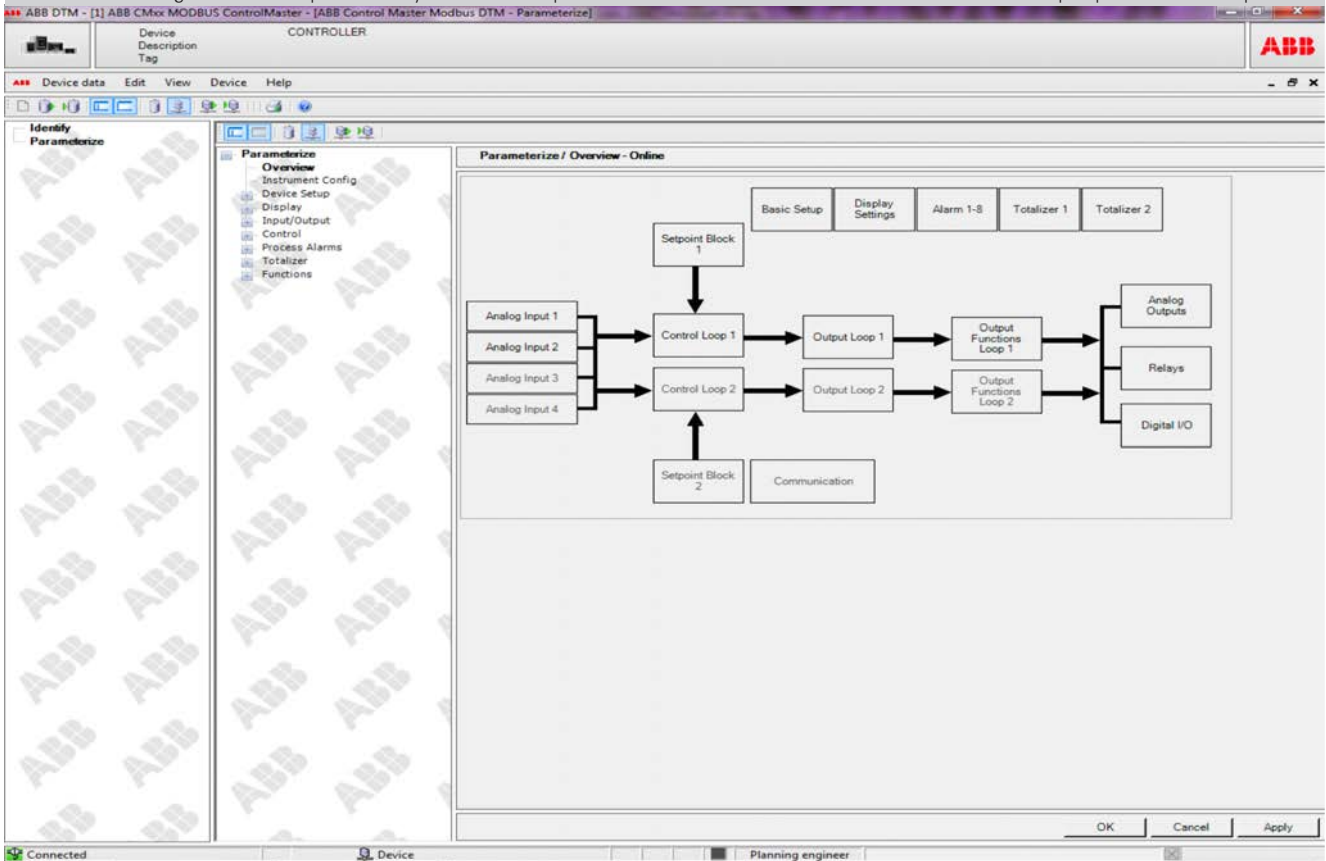
Communication Module:

- Dimensions: 100 x 100 x 310 mm approx.
(3.93 x 3.93 x 12.20 inches approx.)
- Weight: 1 Kg approx.
(2.2 pounds approx.)

SOFTWARE MAIN SCREENS

The following images shows the typically functions of ABB configuration software:

The image below shows the blocks scheme screen of the "CEC" unit for industrial process. Through a "click" on each block allows the students access to the configuration of this part of the system. This comprehensive block scheme allows the students have a wide perspective of all the process.



The image below shows the "basic setup" block. This block allows change the application template and the loop parameters.

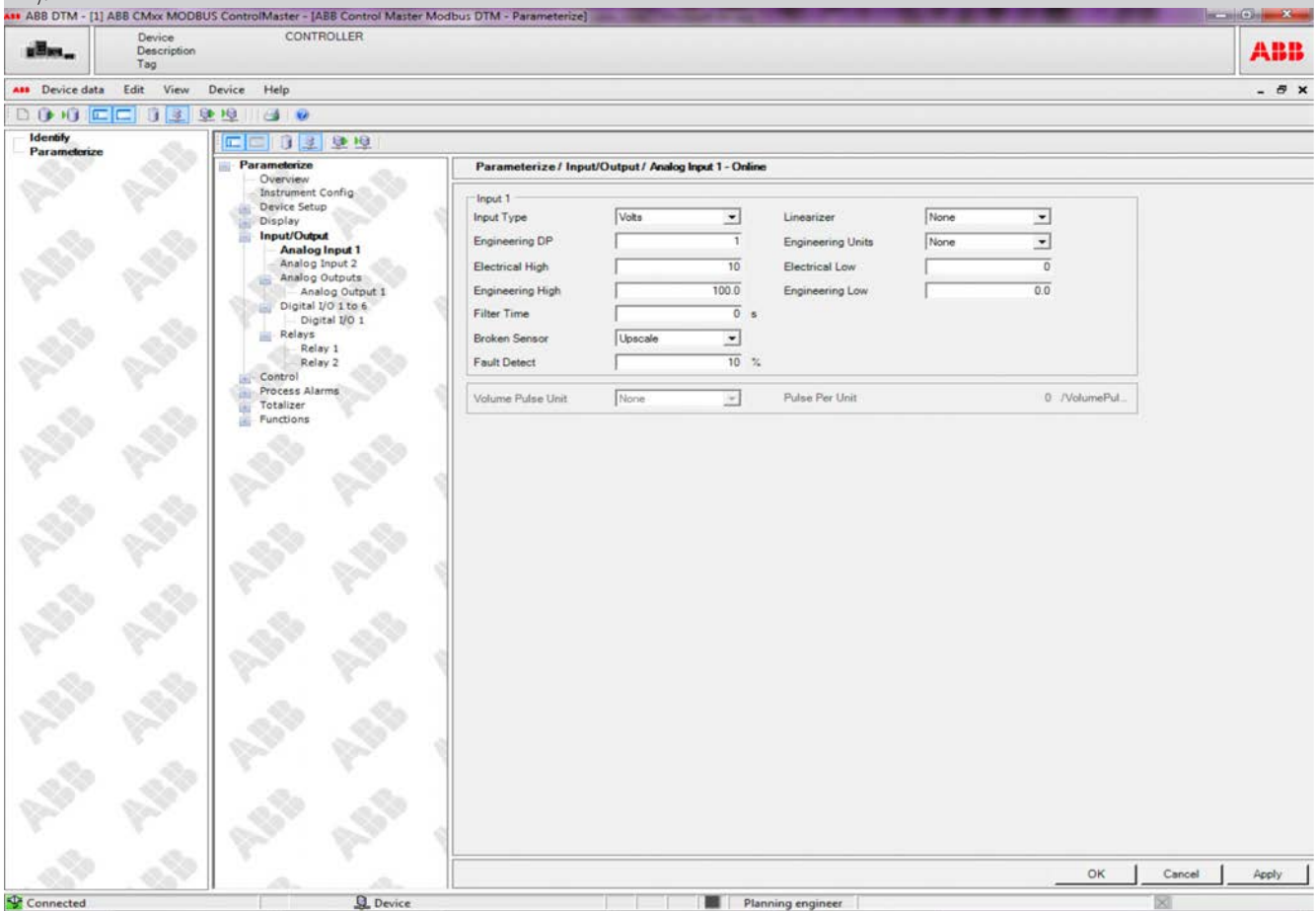
The screenshot displays the 'Parameterize / Device Setup / Basic Setup (Controller) - Online' screen. The left sidebar shows the 'Basic Setup (Controller)' tree view expanded. The main area contains a configuration form with the following sections:

- Setup:**
 - App Template: Single Loop - RSP (dropdown)
 - Instrument Tag: ControlMaster (text field)
 - Mains Frequency: 50Hz (dropdown)
 - Config Action: Continue (dropdown)
 - Custom template
- Loop 1:**
 - Output Type: Analog (dropdown)
 - Loop 1 Tag: Loop 1 (text field)
 - Split O/P Assign: Analog / Relay (dropdown)
 - Control Action: Reverse (dropdown)
- Loop 2:**
 - Output Type: Analog (dropdown)
 - Loop 2 Tag: Loop 2 (text field)
 - Split O/P Assign: Analog / Digital (dropdown)
 - Control Action: Reverse (dropdown)

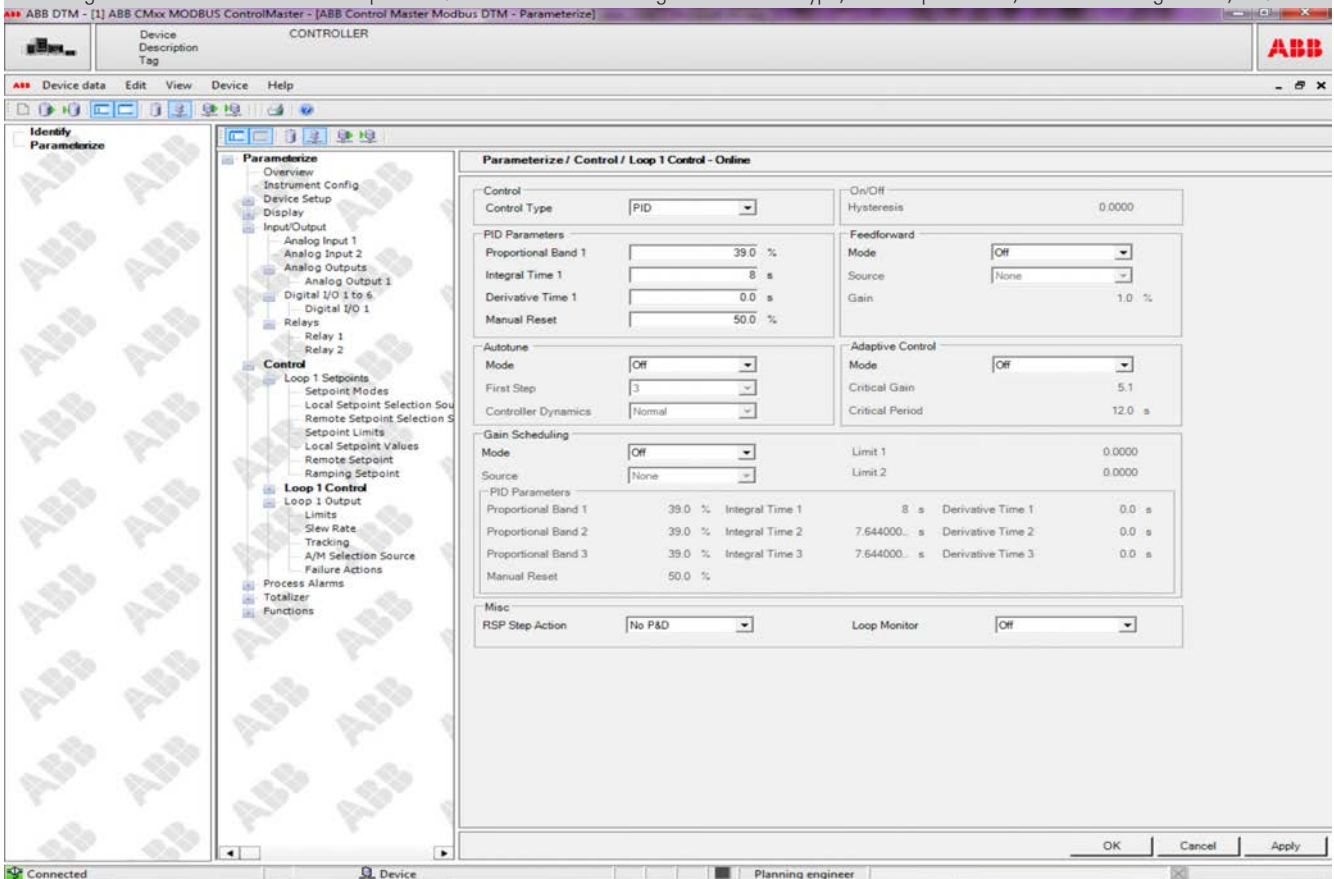
The status bar at the bottom shows 'Connected' and 'Planning engineer'.

Software main screens

The image below shows the "CECI" screen for Analog Input which allows to configured the analog input parameters (the type of input, range of input, etc).

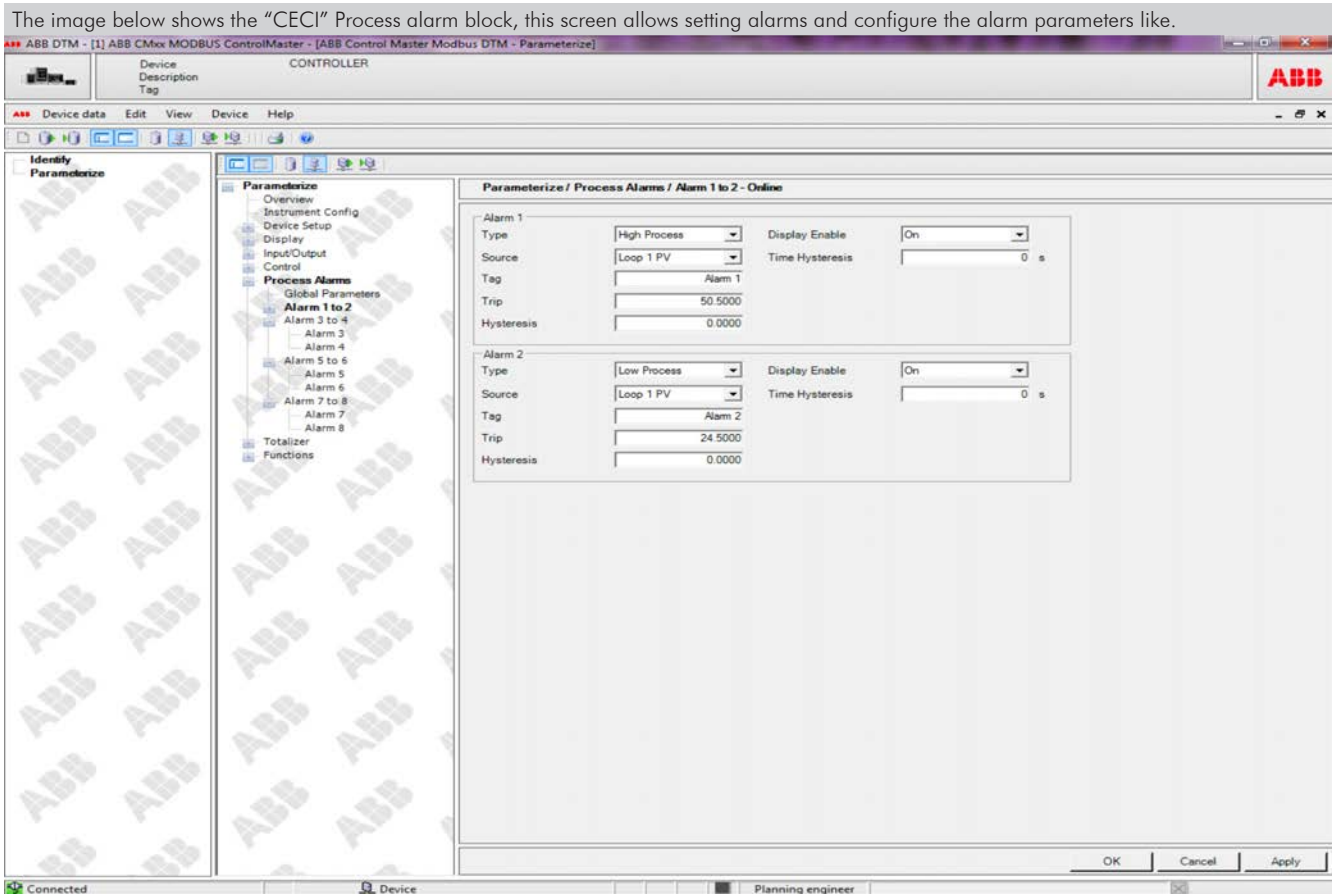


The image below shows the "control loop" block. This block allows configure the control type, the PID parameter, autotune configuration, etc.

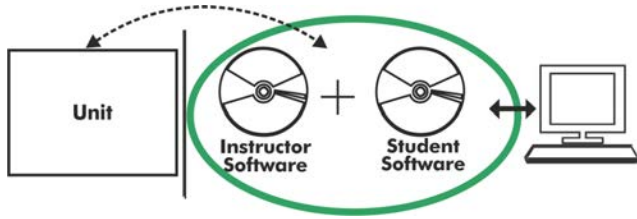


Software main screens

The image below shows the "CECI" Process alarm block, this screen allows setting alarms and configure the alarm parameters like.



CECI/ICAI. Interactive Computer Aided Instruction Software System:



With no physical connection between unit and computer (PC), 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.

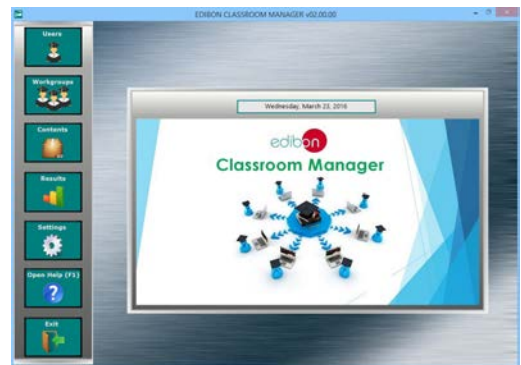
Instructor Software

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

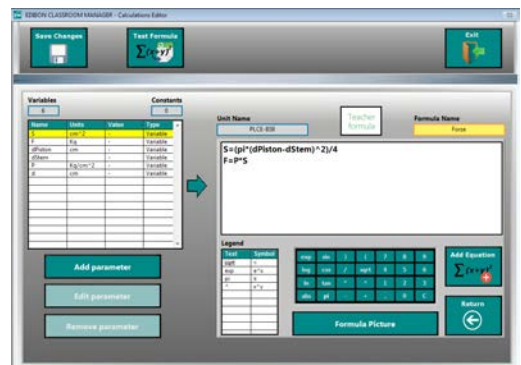
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

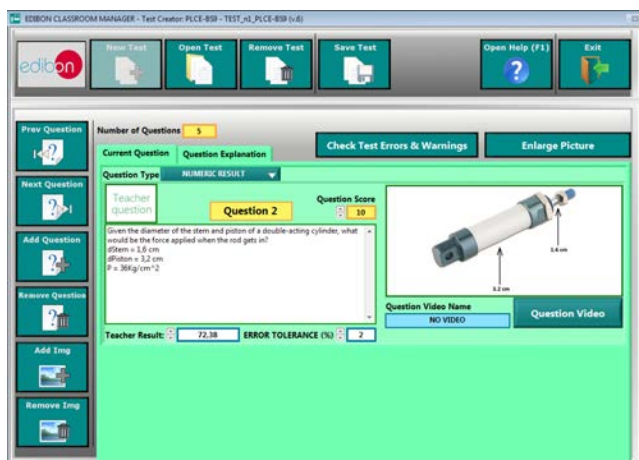
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.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



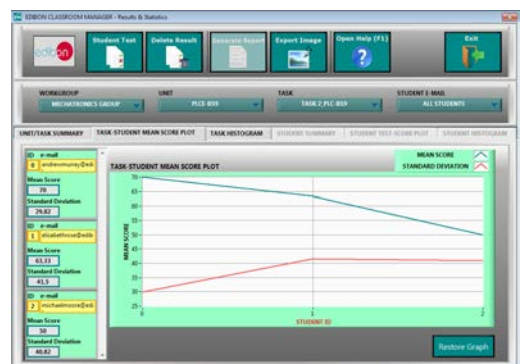
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



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:

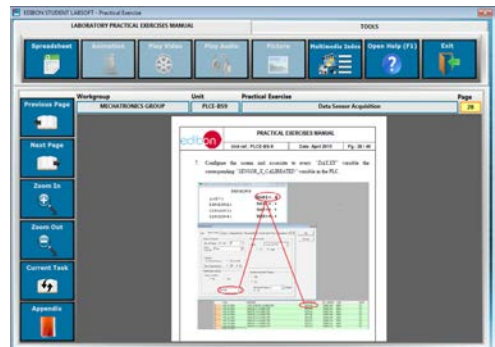
- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.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

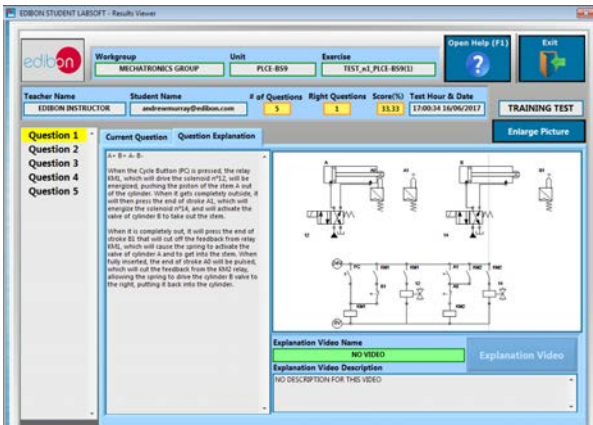
www.edibon.com/en/files/expansion/ICAI/catalog



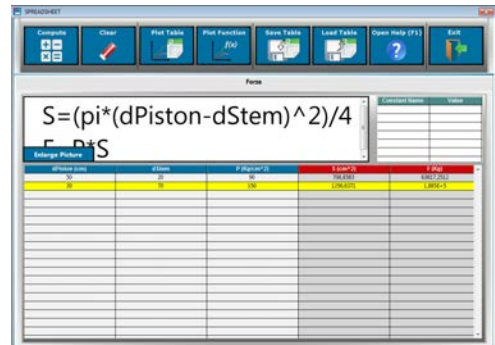
ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen



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:

