

**OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL**

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Products
Products range
Units
5.-Energy



ISO 9000: Quality Management
(for Design, Manufacturing,
Commercialization and After-sales service)



European Union Certificate
(total safety)



**Certificates ISO 14000 and
ECO-Management and Audit Scheme**
(environmental management)



**Worlddidac Quality Charter
Certificate**
(Worlddidac Member)

Common items for the Energy Generation Modules type "EOMC"

①EOMC-UB. Base Service Unit and Waves Generator:

This unit is common for Energy Generation Modules type "EOMC" and can work with one or several modules.

Anodized aluminium structure and panels in painted steel (epoxy paint).

Main metallic elements in stainless steel.

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

The unit is mainly formed by:

Rectangular transparent tank, to be filled with water, where the different energy generation modules will be placed.

Waves generator:

The waves generator produce different types of waves. It is based on a blade which pulls the water, producing the waves. The waves frequency is modified by changing the blade rotating speed. The blade rotating speed can be regulated. The waves size changes according to the displaced water quantity. The displaced water quantity is modified by changing the water level in the tank or adjusting the blade in order to introduce it deeper into the tank.

Technical data:

Speed control from the computer (PC).

0-150 r.p.m.

Blade, adjustable in height.

6 Pressure sensors placed in the bottom of the tank for measuring the wave shape.

DC generator and DC loads module.

Power measurement from the computer (PC).

This unit is **supplied with 8 manuals**: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.



EOMC-UB. Unit

②EOMC/CIB. Control Interface Box :

This control interface is common for Energy Generation Modules type "EOMC" and can work with one or several modules.

Control interface box with process diagram in the front panel and with the same distribution that the different elements located in the unit, for an easy understanding by the student.

All sensors, with their respective signals, are properly manipulated from -10V. to +10V. computer output.

Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors.

Single cable between the control interface box and computer.

The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure.

Simultaneously visualization in the computer of all parameters involved in the process.

Calibration of all sensors involved in the process.

Real time curves representation about system responses.

Storage of all the process data and results in a file.

Graphic representation, in real time, of all the process/system responses.

All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process.

All the actuators and sensors values and their responses are placed in only one computer screen.

Shield and filtered signals to avoid external interferences.

Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process.

Real time computer control for pumps, compressors, resistances, control valves, etc.

Open control allowing modifications, at any time and in a real time, of parameters involved in the process simultaneously.

Three safety levels, one mechanical in the unit, other electronic in control interface and the third one in the control software.



EOMC/CIB

③DAB. Data Acquisition Board:

This board is common for Energy Generation Modules type "EOMC"

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: 250 KS/s (Kilo samples per second).

Input range (V)= $\pm 10V$. Data transfers=DMA, interrupts, programmed I/O. DMA channels=6.

Analog output:

Number of Channels=2. Resolution= 16 bits, 1 in 65536. Maxi.output rate up to: 833 KS/s.

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

Digital Input/Output:

Number of channels=24 inputs/outputs. D0 or DI Sample Clock frequency: 0 to 1 MHz.

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



DAB

Continue...

④ Energy Generation Modules to be used with the Base Service Unit and Waves Generator:**④.1 EOMC-1. Floating Buoy Module:**

A Floating Buoy system consists of a floating structure anchored to the seabed, which is used as the support of a cylinder which freely floats with an upwards and downwards vertical movement, following the waves. This cylinder slides by a central shaft joint to the immobile structure. The relative movement of the cylinder sliding through the shaft and the fixed structure serves to activate an energy converter which can be hydraulic or electromagnetic.

The module EOMC-1 is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of a floating buoy for energy generation.

This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This module is **supplied with 8 manuals**: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Floating Buoy Module (EOMC-1).

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.

Sampling velocity up to 250,000 data per second guaranteed.

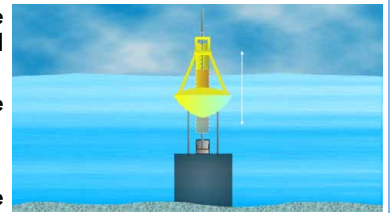
Calibration system for the sensors involved in the process.

It allows the registration of the alarms state and the graphic representation in real time.

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

Open software, allowing to the teacher to modify texts, instructions. **Teacher's and student's passwords** to facilitate the teacher's control on the student, and allowing the access at different work levels.

This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.



EOMC-1

④.2 EOMC-2. Oscillating Water Column Module:

An Oscillating Water Column system is a structure with an opening for the wave.

When the water enters in the enclosure, it displaces the existing air into the enclosure and forces the air to exit by a duct where a turbine is installed. The air makes the turbine coupled to a generator to rotate. When the wave retires, the air enters in the enclosure through the same duct, at this moment in the reverse direction.

The module EOMC-2 is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of an oscillating water column for energy generation.

This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This module is **supplied with 8 manuals**: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Oscillating Water Column Module (EOMC-2).

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.

Sampling velocity up to 250,000 data per second guaranteed.

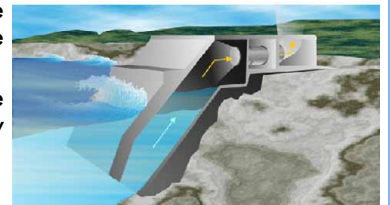
Calibration system for the sensors involved in the process.

It allows the registration of the alarms state and the graphic representation in real time.

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

Open software, allowing to the teacher to modify texts, instructions. **Teacher's and student's passwords** to facilitate the teacher's control on the student, and allowing the access at different work levels.

This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.



EOMC-2

④ **Energy Generation Modules** to be used with the Base Service Unit and Waves Generator:

④.3 **EOMC-3. Pelamis Module:**

The "Pelamis" is an attenuating type device. It consists on a longitudinal chain of cylinders linked each one with the others and anchored to the seabed, so that they are correspondingly aligned to the waves direction. A cylinders nodding is produced because of the wave height and this movement is used by the pistons connected between each cylinder to impulse the fluid in an hydraulic circuit to produce electric energy.

The module EOMC-3 is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of a pelamis device for energy generation.

This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This module is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Pelamis Module (EOMC-3).

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.

Sampling velocity up to 250,000 data per second guaranteed.

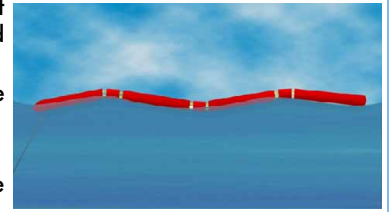
Calibration system for the sensors involved in the process.

It allows the registration of the alarms state and the graphic representation in real time.

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

Open software, allowing to the teacher to modify texts, instructions. **Teacher's and student's passwords** to facilitate the teacher's control on the student, and allowing the access at different work levels.

This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.



EOMC-3

④.4 **EOMC-4. Tapered Channel Module:**

The Tapered Channel is a channel built on the coast in the direction of the incident wave. The channel progressively narrows to the inside of the coast. When the wave enters the channel, it goes to a every time less section, which makes it to take a every time higher height to enter in a tank placed at the end of the channel.

Thus, there is water at a bigger height which can be used to turbine.

Summarizing, it concentrates the waves and guides them up a tapered ramp into a tank, from which a turbine extracts energy.

The module EOMC-4 is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of a tapered channel for energy generation.

This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This module is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Tapered Channel Module (EOMC-4).

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.

Sampling velocity up to 250,000 data per second guaranteed.

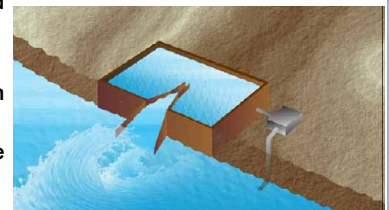
Calibration system for the sensors involved in the process.

It allows the registration of the alarms state and the graphic representation in real time.

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

Open software, allowing to the teacher to modify texts, instructions. **Teacher's and student's passwords** to facilitate the teacher's control on the student, and allowing the access at different work levels.

This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.



EOMC-4

④ Energy Generation Modules to be used with the Base Service Unit and Waves Generator:

④.5 EOMC-5. Salter's Duck Module:

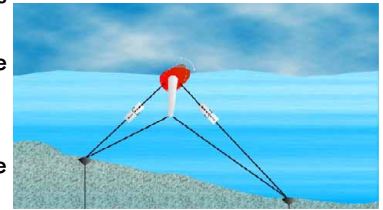
Salter's Duck is a small buoy anchored to the seabed in a particular way which seems a duck moves in a swinging way when receiving the waves. This rotation is used to move, by means of mechanisms, a system connected to a generator.

The EOMC-5 module is designed for simulating this energy generation system, allowing the study and tests of the operation and performance of a salter's duck for energy generation.

This module will generate mechanical and/or electrical energy.

The module is prepared to be installed in the Base Service Unit and it is supplied with the suitable sensors and instrumentation for the most representative measurements.

This module is **supplied with 8 manuals**: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.



EOMC-5

Computer Control Software:

Computer Control+Data Acquisition+Data Management Software for Salter's Duck Module (EOMC-5).

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.

Sampling velocity up to 250,000 data per second guaranteed.

Calibration system for the sensors involved in the process.

It allows the registration of the alarms state and the graphic representation in real time.

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

Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access at different work levels.

This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

This unit is **supplied with 8 manuals**: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

Complementary items

PLC. Industrial Control using PLC (7 and 8):

⑦ PLC-PI. PLC Module:

Circuit diagram in the front panel.

Front panel:

Digital inputs(X) and Digital outputs (Y) block:

16 Digital inputs, activated by switches and 16 LEDs for confirmation (red).

14 Digital outputs (through SCSI connector) with 14 LEDs for message (green).

Analog inputs block:

16 Analog inputs (-10V. to + 10V.) (through SCSI connector).

Analog outputs block:

4 Analog outputs (-10V. to + 10V.) (through SCSI connector).

Touch screen:

High visibility and multiple functions.

Display of a highly visible status.

Recipe function.

Bar graph function.

Flow display function.

Alarm list.

Multi language function.

True type fonts.

Back panel:

Power supply connector.

Fuse 2A.

RS-232 connector to PC.

USB 2.0 connector to PC.

Inside:

Power supply outputs: 24 Vdc, 12 Vdc, -12 Vdc, 12 Vdc variable.

Panasonic PLC:

High-speed scan of 0.32 μ sec. for a basic instruction.

Program capacity of 32 Ksteps, with a sufficient comment area.

Free input AC voltage(100 to 240 V AC).

DC input: 16 (24 V DC).

Relay output: 14 (250 VA AC/2 A).

High-speed counter.

Multi-point PID control.

Digital inputs/outputs and analog inputs/outputs Panasonic modules.

Communication RS232 wire, to computer (PC).

⑧ EOMC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.



PLC-PI

Items available on request

⑨ EOMC/CAL. Computer Aided Learning Software (Results Calculation and Analysis).

⑩ EOMC/FSS. Faults Simulation System.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

- 1.- Study of the different waves energy generation systems.
- 2.- Study of the operation and performance of the different waves energy generation systems.
- 3.- Energy available from a wave.
- 4.- Buoyancy and Archimedes principle.
- 5.- Relationship between wave form and buoyancy.
- 6.- Potential Energy in a fluid.
- 7.- Float shape in determining energy extraction.
- 8.- Effect of wave shape on its breaking characteristics.
- 9.- Effect of slope on wave shape and breaking.
- 10.- Effect of width contraction on wave shape.
- 11.- Measures and Controls.

Other possible practices:

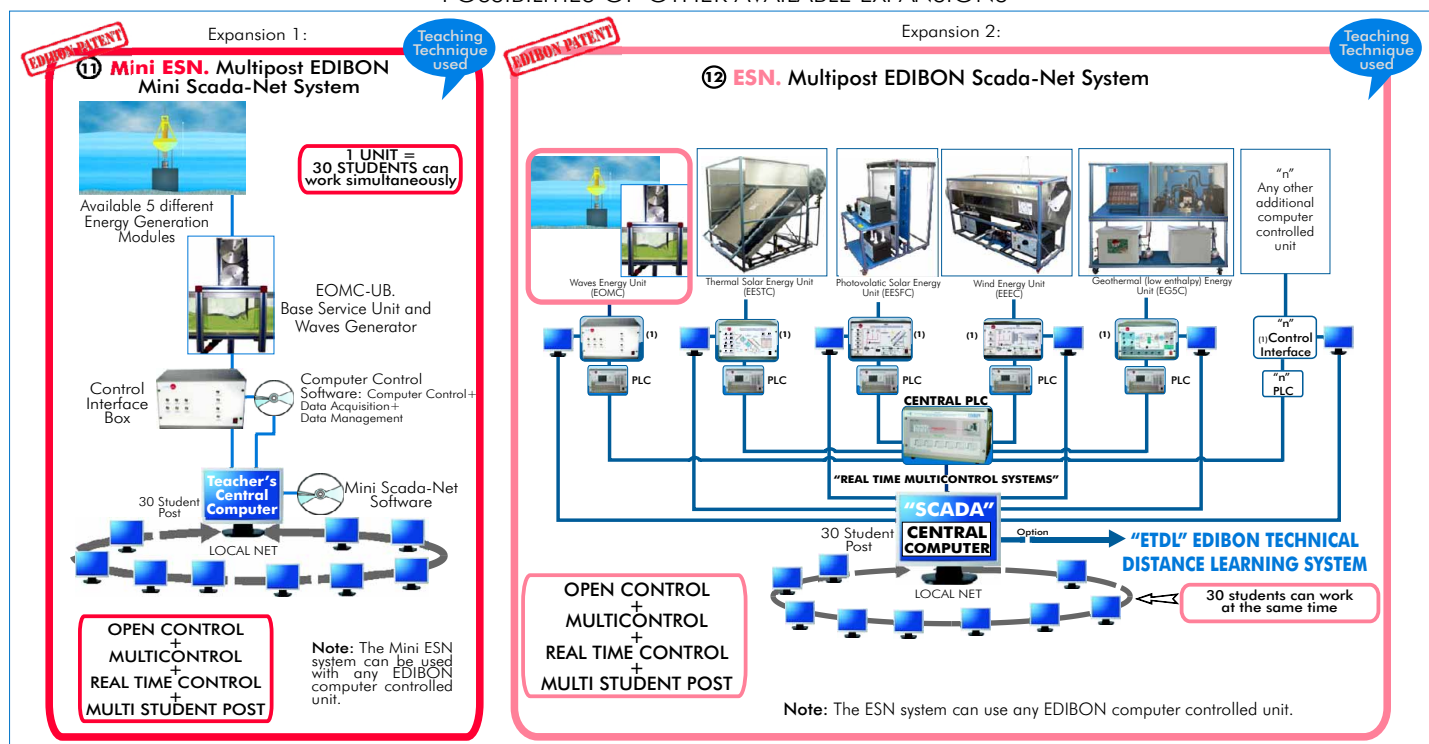
- 12.- Sensors calibration.

Practices to be done by PLC Module (PLC-PI) + PLC Control Software:

- 13.- Control of the EOMC unit process through the control interface box without the computer.
- 14.- Visualization of all the sensors values used in the EOMC unit process.
- 15.- Calibration of all sensors included in the EOMC unit process.
- 16.- Hand on of all the actuators involved in the EOMC unit process.

- 17.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
- 18.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrial environment to the process to be studied, etc).
- 19.- PLC hardware general use and manipulation.
- 20.- PLC process application for EOMC unit.
- 21.- PLC structure.
- 22.- PLC inputs and outputs configuration.
- 23.- PLC configuration possibilities.
- 24.- PLC program languages.
- 25.- PLC different programming standard languages.
- 26.- New configuration and development of new process.
- 27.- Hand on an established process.
- 28.- To visualize and see the results and to make comparisons with the EOMC unit process.
- 29.- Possibility of creating new process in relation with the EOMC unit.
- 30.- PLC Programming Exercises.
- 31.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS



ORDER INFORMATION

Items always supplied as minimum configuration

Common items for Energy Generation Modules type "EOMC":

- 1 EOMC-UB. Base Service Unit and Waves Generator.
- 2 EOMC/CIB. Control Interface Box.
- 3 DAB. Data Acquisition Board.
- 4 Available Energy Generation Modules to be used with the Base Service Unit:
 - 4.1 EOMC-1. Floating Buoy Module, and/or
 - 4.2 EOMC-2. Oscillating Water Column Module, and/or
 - 4.3 EOMC-3. Pelamis Module, and/or
 - 4.4 EOMC-4. Tapered Channel Module, and/or
 - 4.5 EOMC-5. Salter's Duck Module.
- 5 Cables and Accessories, for normal operation.
- 6 Manuals.

Complementary items

- PLC. Industrial Control using PLC (7 and 8):
- 7 PCL-PI. PLC Module.
 - 8 EOMC/PLC-SOF. PLC Control Software.
 - 9 EOMC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).
 - 10 EOMC/FSS. Faults Simulation System. (Available on request).

Expansions

- 11 Mini ESN. Multipost EDIBON Mini Scada-Net System.
- 12 ESN. Multipost EDIBON Scada-Net System

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./150Hz or 110V./60Hz.
- Water supply.
- Computer (PC).

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



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REPRESENTATIVE:

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