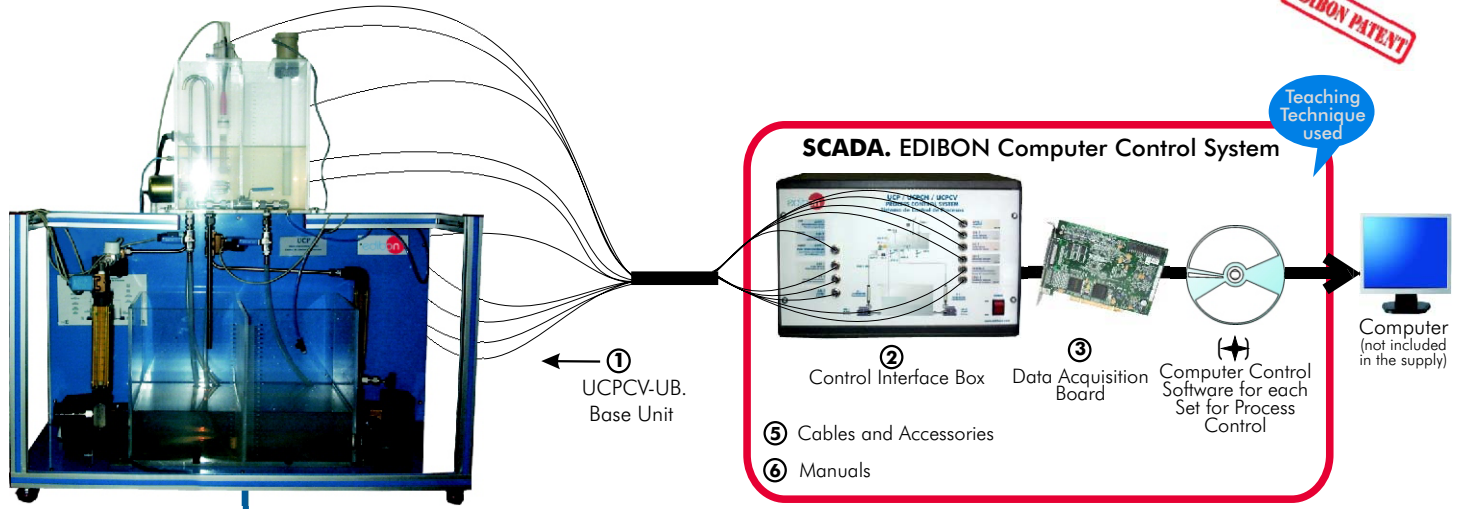




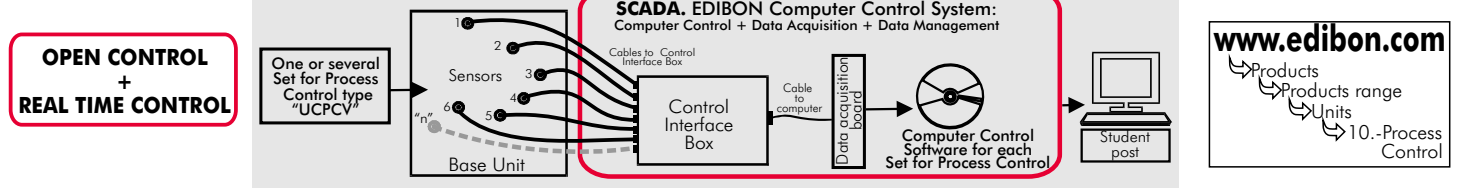
Teaching Technique used



④ Sets (sensor and elements + computer control software) used in the base unit:

<p>Sensor and elements</p> <p>+ Computer Control Software for Temperature Process Control (↔)</p> <p>④.1 UCPCV-T. Set for Temperature Process Control</p>	<p>Sensor and elements</p> <p>+ Computer Control Software for Flow Process Control (↔)</p> <p>④.2 UCPCV-C. Set for Flow Process Control</p>	<p>Sensor and elements</p> <p>+ Computer Control Software for Level Process Control (↔)</p> <p>④.3 UCPCV-N. Set for Level Process Control</p>	<p>Sensor and elements</p> <p>+ Computer Control Software for Pressure Process Control (↔)</p> <p>④.4 UCPCV-PA. Set for Pressure Process Control</p>	<p>Sensor and elements</p> <p>+ Computer Control Software for pH Process Control (↔)</p> <p>④.5 UCPCV-PH. Set for PH Process Control</p>	<p>Sensor and elements</p> <p>+ Computer Control Software for Conductivity and TDS (Total Dissolved Solids) Process Control (↔)</p> <p>④.6 UCPCV-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process Control</p>
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### Unitary Process Configuration



### Some Typical Control Software screens

**PID CONTROL**

proportional gain (Kc) 0.400  
integral time (Ti, min) 0.000  
derivative time (Td, min) 0.010

Parameters PID (A)

Feedback on AVP-1

PID output (AVP-1) 2.78

**Common items for all Process Control parameters**

① **UCPCV-UB. Base Unit:**

Bench-top unit.

This unit is common for all Sets for Process Control type "UCPCV" and can work with one or several sets.

Anodized aluminium structure and panels in painted steel.

Main metallic elements in stainless steel.

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

A transparent main tank and collector with an orifice in the central dividing wall (2x25 dm<sup>3</sup>), and drainage in both compartments.

A transparent dual process tank (2x10 dm<sup>3</sup>), interconnected through an orifice and a ball valve and an overflow in the dividing wall; a graduate scale and a threaded drain of adjustable level with bypass.

2 Centrifugal pumps, range: 0-10 l./min.

2 Variable area flow meters (0.2-2 l./min, and 0.2-10 l./min), and with a manual valve.

Line of on/off regulation valves (solenoid). Usually one is normally opened, and the other two are normally closed, and manual drainage valves of the upper tank.

Speed controller of the centrifugal pump AB-1 (located into the Control Interface Box). Range: 0-50 Hz.

Any Set for Process Control type "UCPCV" will be supplied installed in the Base Unit and ready for working.



UCPCV-UB

② **UCPCV/CIB. Control Interface Box :**

This unit is common for all Sets for Process Control type "UCPCV" and can work with one or several sets.

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 PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process. Real time PID and on/off control for pumps, compressors, resistances, control valves, etc. Real time PID control for parameters involved in the process simultaneously.

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

Proportional control, integral control and derivative control, based on the real PID mathematical formula, by changing the values, at any time, of the three control constants (proportional, integral and derivative constants).

Possibility of automatization of the actuators involved in the process.

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



UCPCV/CIB

③ **DAB. Data Acquisition Board:**

This board is common for all Sets for Process Control type "UCPCV".

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)= ±10V.

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

Analog output:

Number of channels=2. Resolution= 16 bits, 1 in 65536.

Maximum output rate up to: 833 KS/s.

Output range(V)= ±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

**④ Sets (sensor and elements + computer control software) used in the base unit:**

**4.1 UCPCV-T. Set for Temperature Process Control:**

This Set will be supplied and installed in the Base Unit and ready for working.

**a) Sensor and elements:**

Temperature sensor "J type", range: -40 to 750 °C.

Electric resistor (0.5 KW), with thermostat (70 °C).

Helix agitator, range: 0-300 r.p.m.

On/off level switch; safety element that permits the resistance to operate just when the level of water is sufficient.

**b) Computer Control Software:**

**Computer Control + Data Acquisition + Data Management Software for Temperature Process Control.**

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

Analog and digital PID control. Menu for PID and set point selection required in the whole work range.

**Management, processing, comparison and storage of data.**

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

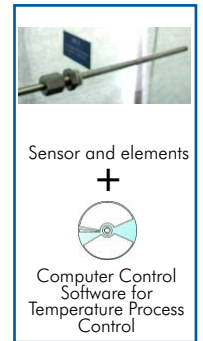
**Student calibration system for all sensors involved in the process.**

**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.**



UCPCV-T

**4.2 UCPCV-C. Set for Flow Process Control:**

This Set will be supplied and installed in the Base Unit and ready for working.

**a) Sensor and elements:**

Turbine type flow sensor, range: 0.25-6.5 l./min.

**b) Computer Control Software:**

**Computer Control + Data Acquisition + Data Management Software for Flow Process Control.**

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

Analog and digital PID control. Menu for PID and set point selection required in the whole work range.

**Management, processing, comparison and storage of data.**

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

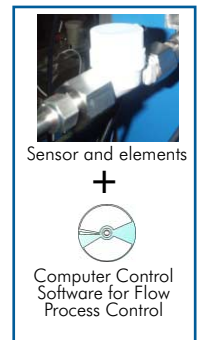
**Student calibration system for all sensors involved in the process.**

**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.**



UCPCV-C

**4.3 UCPCV-N. Set for Level Process Control:**

This Set will be supplied and installed in the Base Unit and ready for working.

**a) Sensor and elements:**

0-300mm level sensor (of capacitive immersion, 4-20mA), made with teflon to avoid any corrosion.

**b) Computer Control Software:**

**Computer Control + Data Acquisition + Data Management Software for Level Process Control.**

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

Analog and digital PID control. Menu for PID and set point selection required in the whole work range.

**Management, processing, comparison and storage of data.**

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

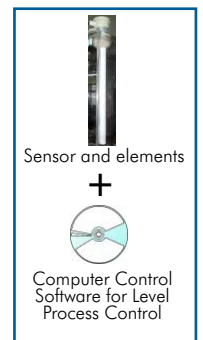
**Student calibration system for all sensors involved in the process.**

**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.**



UCPCV-N

**④ Sets (sensor and elements + computer control software) used in the base unit:**

**4.4 UCPCV-PA. Set for Pressure Process Control:**

This Set will be supplied and installed in the Base Unit and ready for working.

a) **Sensor and elements:**

Pressure sensor, range: 0-1 psi.

b) **Computer Control Software:**

**Computer Control+Data Acquisition+Data Management Software for Pressure Process Control.**

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

Analog and digital PID control. Menu for PID and set point selection required in the whole work range.

**Management, processing, comparison and storage of data.**

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

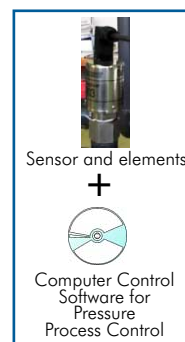
**Student calibration system for all sensors involved in the process.**

**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.**



UCPCV-PA

**4.5 UCPCV-PH. Set for pH Process Control:**

This Set will be supplied and installed in the Base Unit and ready for working.

a) **Sensor and elements:**

pH sensor:

Simple electrode Ag/AgCl.

Accuracy: ± 0.2 pH.

Resolution: 0.1 pH.

Range: 0-14.

Helix agitator, range: 0-300 r.p.m.

b) **Computer Control Software:**

**Computer Control+Data Acquisition+Data Management Software for pH Process Control.**

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

Analog and digital PID control. Menu for PID and set point selection required in the whole work range.

**Management, processing, comparison and storage of data.**

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

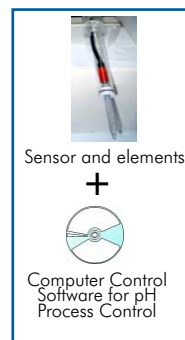
**Student calibration system for all sensors involved in the process.**

**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.**



UCPCV-PH

**4.6 UCPCV-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process Control:**

This Set will be supplied and installed in the Base Unit and ready for working.

a) **Sensor and elements:**

Conductivity and TDS (Total Dissolved Solids) sensor:

Conductivity range: 0-1999 µs/cm.

Accuracy: ± 2% µs/cm.

Resolution: 10 µs/cm.

TDS range: 0-1999 ppm.

Accuracy: ± 2% ppm.

Resolution: 10 ppm.

Helix agitator, range: 0-300 r.p.m.

b) **Computer Control Software:**

**Computer Control+Data Acquisition+Data Management Software for Conductivity and TDS (Total Dissolved Solids) Process Control.**

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

Analog and digital PID control. Menu for PID and set point selection required in the whole work range.

**Management, processing, comparison and storage of data.**

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

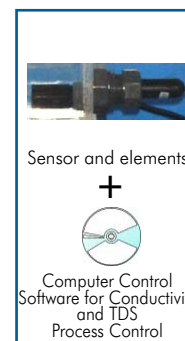
**Student calibration system for all sensors involved in the process.**

**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.**



UCPCV-CT

**⑤ Cables and Accessories**, for normal operation.

**⑥ Manuals:**

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

Continue ...



**Complementary items**

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

**⑦ PLC-PI. PLC Module:**

This module is common for all Sets for Process Control type "UCPCV" and can work with one or several sets.

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.

Inside:

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

**Panasonic PLC:**

**High-speed scan of 0.32 μsec.** 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 V A 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 UCPCV/PLC-SOF. PLC Control Software:**

For each particular control process, always included with PLC supply.

**⑨ UCP/FSS. Faults Simulation System:**

The "FAULTS" mode consists on provoking several faults in the unit normal operation. The student must find them and, if possible, solve them.

There are several kinds of faults that can be grouped in three sections:

**Faults affecting the sensors measure:**

- **An incorrect calibration is applied to them.**

In this case, the student should proceed to calibrate the affected sensor through the values collection.

- **Non-linearity.**

When we have the measures taken by the sensor, a quadratic or inverse function is applied to them. Thus, the value measured will not be the real one, as in the case above mentioned, but when we calibrate again, the sensor will not operate linearly and we will not be able to calibrate it by best squares fits.

**Faults affecting the actuators:** (These do not admit solutions. The student must just realise it and notify it.)

- **Actuators canals interchange at any time during the program execution.**

This error does not admit any solution.

- **Response reduction of an actuator.**

By the reduction of the output voltage in analog outputs, we can get an response with a fraction of what it should be, either with a manual execution or with any control type (ON/OFF, PID...).

**Faults in the controls execution:**

- **Inversion of the performance in ON/OFF controls.**

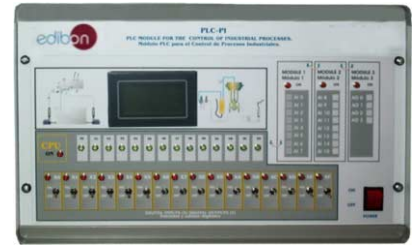
The state of some actuator is inverted, when it should be ON is OFF instead, and vice versa. The student should provide the correct operating logic.

- **Reduction or increase of the calculated total response.**

We multiply by a factor the total response calculated by the PID, provoking, thus, the reduction or increase of the action really applied to the actuator, and the consequent instability of the control. The student should notify it and try to calculate this factor.

- **The action of some controls is annulled.**

For example, in a PID control, the derivative action is annulled, becoming thus in a PI control. The student will be able to realise it if for some moments, calculates the PID action and check that the calculations are not correct. In this case, he should say what is the real control applied (PI,PD, etc...).

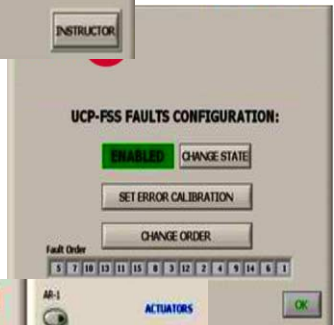


PLC-PI



(1) Welcome screen.  
From the instruction button (with instructor's password) the faults mode is activated.

(2) Faults Configuration Menu screen



(3) Sensors Calibration/Descalibration screen



(4) Faults Navigation screen




(5) Faults order screen



(6) Practice access screen

Software Main Screens

Control Modes screens for any Process Control

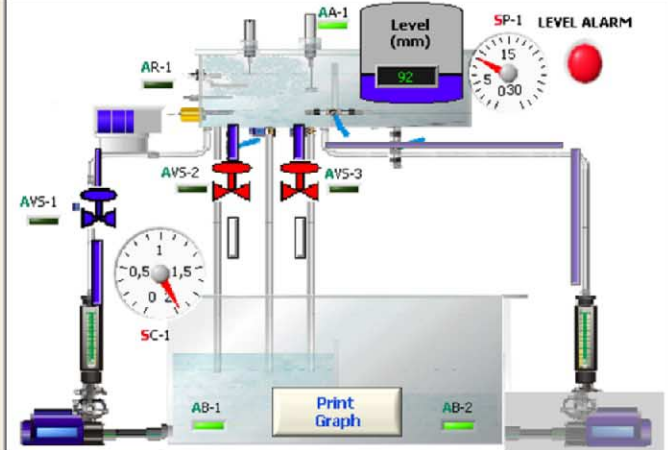


START STOP

START SAVING

**CONTROL1**

OPEN LOOP CONTROL  
MANUAL MODE



Level (mm) 92

SP-1 LEVEL ALARM

Print Graph

**SENSORS**

SPH-1 13,8 SN-1 92 mm  
ST-1 24,3 °C SC-1 1,97 l/min  
SP-1 94 mmH2O 9,2 mBar

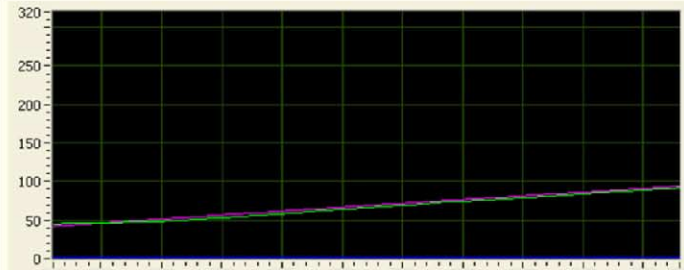
**CONTROLS**

AVV-1 (%)

AA-1 AR-1  
AB-1 AB-2  
ON ON

AVS1 AVS2 AVS3  
OPEN CLOSED CLOSED

**PID CONTROL**




Sensor to plot

SPH-1 SN-1 SC-1 ST-1 SP-1

1 GRAPH

Reset Plot Enlarge Plot

SPH-1	Gain	-0,683	Offset	6,576	Volts	-10,606
SN-1	Gain	199,119	Offset	346,645	Volts	2,204
SC-1	Gain	0,419	Offset	-0,083	Volts	4,897
ST-1	Gain	91,217	Offset	2,134	Volts	0,243
SP-1	Gain	-85,05	Offset	-21,8	Volts	-1,361



START STOP

START SAVING

**CONTROL2**

FEEDBACK CONTROL  
ON/OFF MODE

ON-OFF 1 ON-OFF 2

PRESSURE

Set Point SP-1 16 mbar

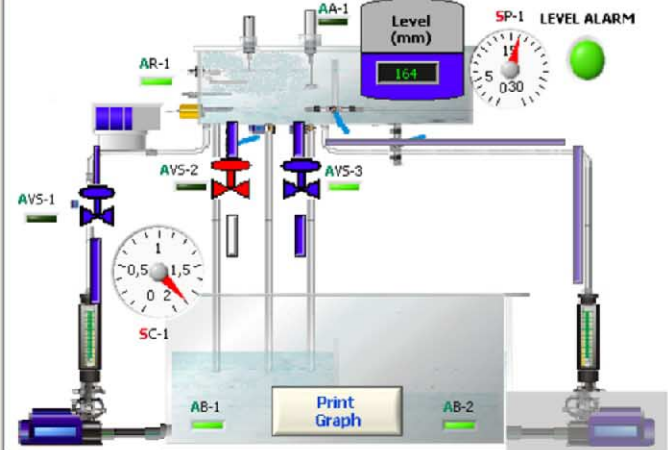
On/Off CONTROLS  
(Tolerance Band)

ACTION AVS-1  
 Activate 1

ACTION AVS-2  
 Activate 0,5

ACTION AVS-3  
 Activate 0,2

ACTION AB-2  
 Activate 0,3



Level (mm) 164

SP-1 LEVEL ALARM

Print Graph

**SENSORS**

SPH-1 7,6 SN-1 164 mm  
ST-1 25,2 °C SC-1 1,86 l/min  
SP-1 166 mmH2O 16,3 mBar

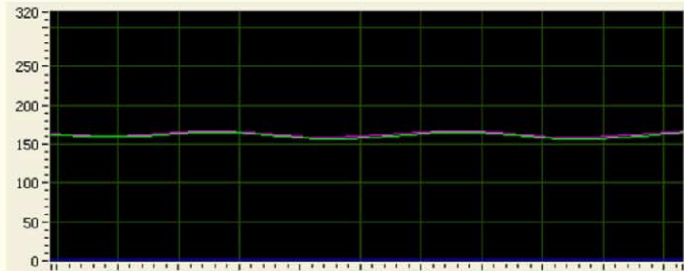
**CONTROLS**

AVV-1 (%)

AA-1 AR-1  
AB-1 AB-2  
ON ON

AVS1 AVS2 AVS3  
OPEN CLOSED OPEN

**PID CONTROL**



Sensor to plot

SPH-1 SN-1 SC-1 ST-1 SP-1

1 GRAPH

Reset Plot Enlarge Plot


SPH-1	Gain	-0,683	Offset	6,576	Volts	-1,437
SN-1	Gain	199,119	Offset	346,645	Volts	2,567
SC-1	Gain	0,419	Offset	-0,083	Volts	4,650
ST-1	Gain	91,217	Offset	2,134	Volts	0,253
SP-1	Gain	-85,05	Offset	-21,8	Volts	-2,213

Note: SPH=pH sensor. SN=Level sensor. ST=Temperature sensor. SC=Flow sensor. SP=Pressure sensor. AVV=Speed controller. AA=Agitator. AB=Pump. AR=Heating resistance. AVS=Solenoid valve.

Continue...



**Software Main Screens**  
Control Modes screens for any Process Control



START STOP

START SAVING

**CONTROL3**

FEEDBACK CONTROL  
PID MODE

PID 1 | PID 2

FLOW

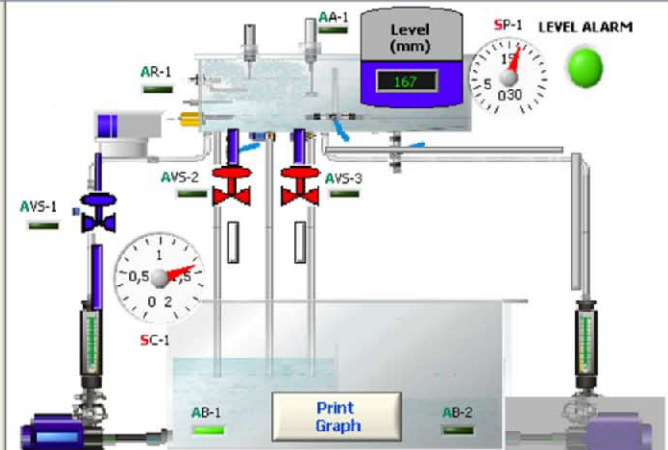
Set Point SC-1 1,4 l/min

proportional gain (Kc) 2,000

integral time (Ti, min) 0,000

derivative time (Td, min) 0,000

PID1 ON



Level (mm) 167

SP-1 LEVEL ALARM

Print Graph

**SENSORS**

SPH-1 7,4 SN-1 167 mm

ST-1 25,1 °C SC-1 1,44 l/min

SP-1 170 mmH2O 16,7 mBar

**CONTROLS**

AVV-1 (%)

AA-1 AR-1

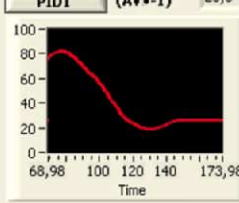
AB-1 ON AB-2 OFF

AVS1 AVS2 AVS3

OPEN CLOSED CLOSED


**PID CONTROL**

Parameters PID1 PID output (AVV-1) 25,8



Sensor to plot

SPH-1	Gain -0,683	Offset 6,576	Volts -1,161
SN-1	Gain 199,119	Offset 346,645	Volts 2,582
SC-1	Gain 0,419	Offset -0,083	Volts 3,632
ST-1	Gain 91,217	Offset 2,134	Volts 0,251
SP-1	Gain -85,05	Offset -21,8	Volts -2,260



START STOP

START SAVING

**CONTROL4**

SIMULTANEOUS  
PID

LEVEL | PID1 ON

Set Point SC-1 175 mm

proportional gain (Kc) 3,500

integral time (Ti, min) 0,000

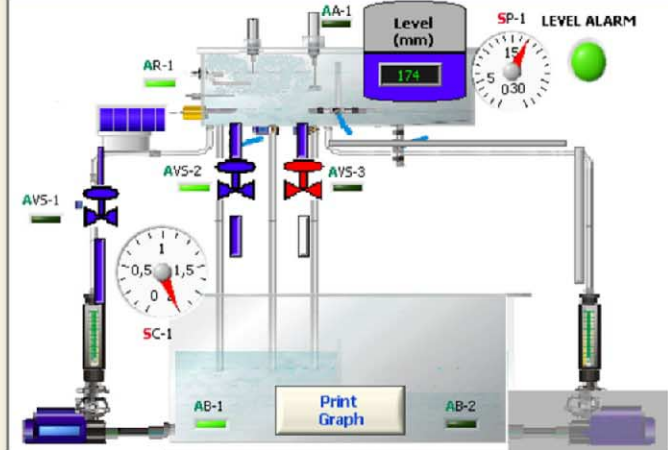
derivative time (Td, min) 0,000

S.P. ST-1 30 °C | PID2 ON

proportional gain (Kc) 0,250

integral time (Ti, min) 1,000

derivative time (Td, min) 0,010



Level (mm) 174

SP-1 LEVEL ALARM

Print Graph

**SENSORS**

SPH-1 7,3 SN-1 174 mm

ST-1 28,0 °C SC-1 2,15 l/min

SP-1 177 mmH2O 17,4 mBar

**CONTROLS**

AVV-1 (%)

AA-1 AR-1

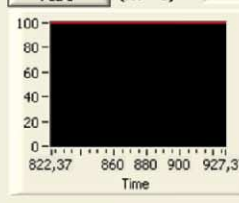
AB-1 ON AB-2 OFF

AVS1 AVS2 AVS3

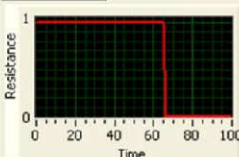
OPEN OPEN CLOSED

**PID CONTROL**

Parameters PID1 PID output (AVV-1) 100,0



Parameters PID2 PID output (Resistance) 0,00



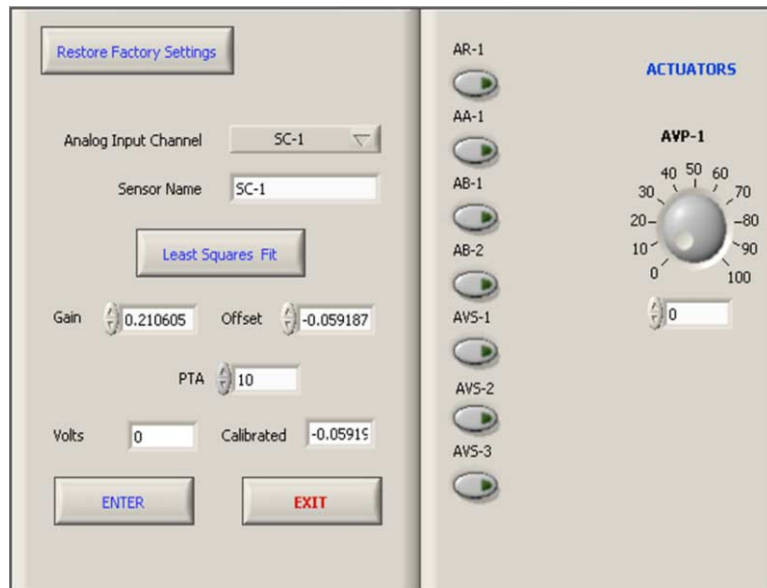
Sensor to plot

SPH-1	Gain -0,683	Offset 6,576	Volts -1,088
SN-1	Gain 199,119	Offset 346,645	Volts 2,617
SC-1	Gain 0,419	Offset -0,083	Volts 5,342
ST-1	Gain 91,217	Offset 2,134	Volts 0,283
SP-1	Gain -85,05	Offset -21,8	Volts -2,339

Note: SPH=pH sensor. SN=Level sensor. ST=Temperature sensor. SC=Flow sensor. SP=Pressure sensor. AVW=Speed controller. AA=Agitator. AB=Pump. AR=Heating resistance. AVS=Solenoid valve.

Continue...

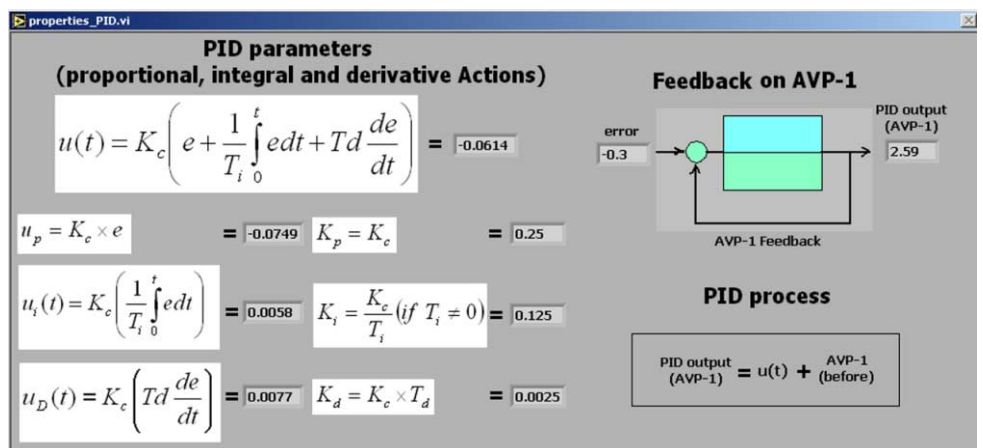
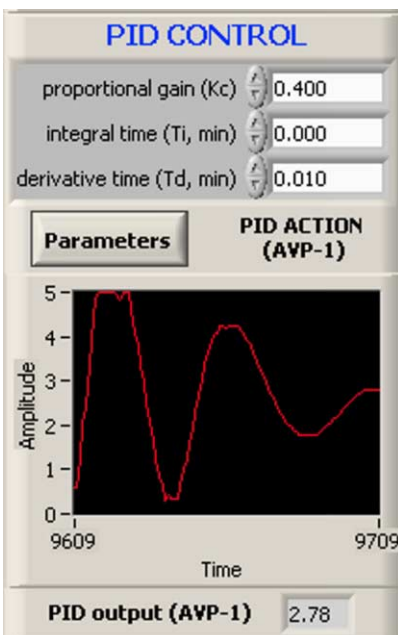
Example of Sensors Calibration screen



Example of On/Off Controls screen



Examples of PID Control screens





**Some Practical Possibilities of the System**

**Temperature Process Control:**

- 1.- Temperature control loops(Manual).
- 2.- Temperature control loops(On/Off).
- 3.- Temperature control loops(Proportional).
- 4.- Temperature control loops (Proportional + Integral).
- 5.- Temperature control loops (Proportional + Derivative).
- 6.- Temperature control loops (Proportional + Derivative +Integral).
- 7.- Adjustment of the constant of a controller of temperature (Ziegler-Nichols).
- 8.- Adjustment of the constant of a controller of temperature (Reaction Curves).
- 9.- Temperature sensor calibration.

**Flow Process Control:**

- 10.- Flow control loops (Manual).
- 11.- Flow control loops (On/Off).
- 12.- Flow control loops (Proportional).
- 13.- Flow control loops (Proportional + Integral).
- 14.- Flow control loops (Proportional + Derivative).
- 15.- Flow control loops (Proportional + Derivative + Integral).
- 16.- Adjustment of the flow controller constants (Ziegler-Nichols).
- 17.- Adjustment of the flow controller constants (Reaction Curves).
- 18.- Flow sensor calibration.

**Level Process Control:**

- 19.- Level control loops (Manual).
- 20.- Level control loops (On/Off).
- 21.- Level control loops (Proportional).
- 22.- Level control loops (Proportional + Integral).
- 23.- Level control loops (Proportional + Derivative).
- 24.- Level control loops(Proportional + Derivative + Integral).
- 25.- Adjustment of the constants of a flow controller (Ziegler-Nichols).
- 26.- Adjustment of the constants of a flow controller (Reaction Curves).
- 27.- Level sensor calibration.

**Pressure Process Control:**

- 28.- Pressure control loops (Manual).
- 29.- Pressure control loops(On/Off).
- 30.- Pressure control loops (Proportional).
- 31.- Pressure control loops (Proportional + Integral).
- 32.- Pressure control loops (Proportional + Derivative).
- 33.- Pressure control loops (Proportional + Derivative + Integral).
- 34.- Adjustment of the constant of a Pressure controller (Ziegler-Nichols).
- 35.- Adjustment of the constant of a Pressure controller (Reaction Curves).
- 36.- Pressure sensor calibration.

**pH Process Control:**

- 37.- pH control loops (Manual).
- 38.- pH control loops(On/Off).
- 39.- pH control loops (Proportional).
- 40.- pH control loops (Proportional + Integral).
- 41.- pH control loops (Proportional + Derivative).
- 42.- pH control loops (Proportional + Derivative + Integral).
- 43.- Adjustment of the constant of a pH controller (Ziegler-Nichols).
- 44.- Adjustment of the constant of a pH controller (Reaction Curves).
- 45.- pH sensor calibration.

**Conductivity and TDS (Total Dissolved Solids) Process Control:**

- 46.- Conductivity control loops (Manual).
- 47.- Conductivity control loops(On/Off).
- 48.- Conductivity control loops (Proportional).
- 49.- Conductivity control loops (Proportional + Integral).
- 50.- Conductivity control loops (Proportional + Derivative).
- 51.- Conductivity control loops (Proportional + Derivative + Integral).
- 52.- Adjustment of the constant of a Conductivity controller (Ziegler-Nichols).
- 53.- Adjustment of the constant of a Conductivity controller (Reaction Curves).
- 54.- TDS control loops (Manual).
- 55.- TDS control loops(On/Off).
- 56.- TDS control loops (Proportional).
- 57.- TDS control loops (Proportional + Integral).
- 58.- TDS control loops (Proportional + Derivative).
- 59.- TDS control loops (Proportional + Derivative + Integral).
- 60.- Adjustment of the constant of a TDS controller (Ziegler-Nichols).
- 61.- Adjustment of the constant of a TDS controller (Reaction Curves).
- 62.- Conductivity and TDS sensor calibration.

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

(These practices to be able done with each Process Control)

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> <li>1.- Control of the unit process through the control interface box without the computer.</li> <li>2.- Visualization of all the sensors values used in the unit process.</li> <li>3.- Calibration of all sensors included in the unit process.</li> <li>4.- Hand on of all the actuators involved in the unit process.</li> <li>5.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).</li> <li>6.- 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).</li> <li>7.- PLC hardware general use and manipulation.</li> <li>8.- PLC process application for unit.</li> <li>9.- PLC structure.</li> </ol> | <ol style="list-style-type: none"> <li>10.- PLC inputs and outputs configuration.</li> <li>11.- PLC configuration possibilities.</li> <li>12.- PLC program languages.</li> <li>13.- PLC different programming standard languages (literal structured, graphic, etc.).</li> <li>14.- New configuration and development of new process.</li> <li>15.- Hand on an established process.</li> <li>16.- To visualize and see the results and to make comparisons with the unit process.</li> <li>17.- Possibility of creating new process in relation with the unit.</li> <li>18.- PLC Programming Exercises.</li> <li>19.- Own PLC applications in accordance with teacher and student requirements.</li> </ol> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Practices to be done by Faults Simulation System (UCP/FSS)**

Incorrect Calibration:

- 1.- Load the calibration error of the PH sensor.
- 2.- Load the calibration error of the Level sensor.
- 3.- Load the calibration error of the Flow sensor.
- 4.- Load the calibration error of the Temperature sensor.

Non Linearity:

- 5.- Non inverse linearity of the pH sensor.
- 6.- Non quadratic linearity of the Level sensor.
- 7.- Non quadratic linearity of the Flow sensor.
- 8.- No inverse linearity of the Temperature sensor.

Interchange of actuators:

- 9.- Interchange the bombs AB-1 and AB-2 between them during the operations of the controls ON/OFF and PID. (Affected sensor: Level sensor)

Reduction of an actuator response:

- 10.- In the PID, the real response of the proportional valve is half the amount

calculated by the PID control. Thus, the maximum real opening that will be able to reach is 50%. (Affected sensor: Flow sensor).

Inversion of the performance in ON/OFF controls:

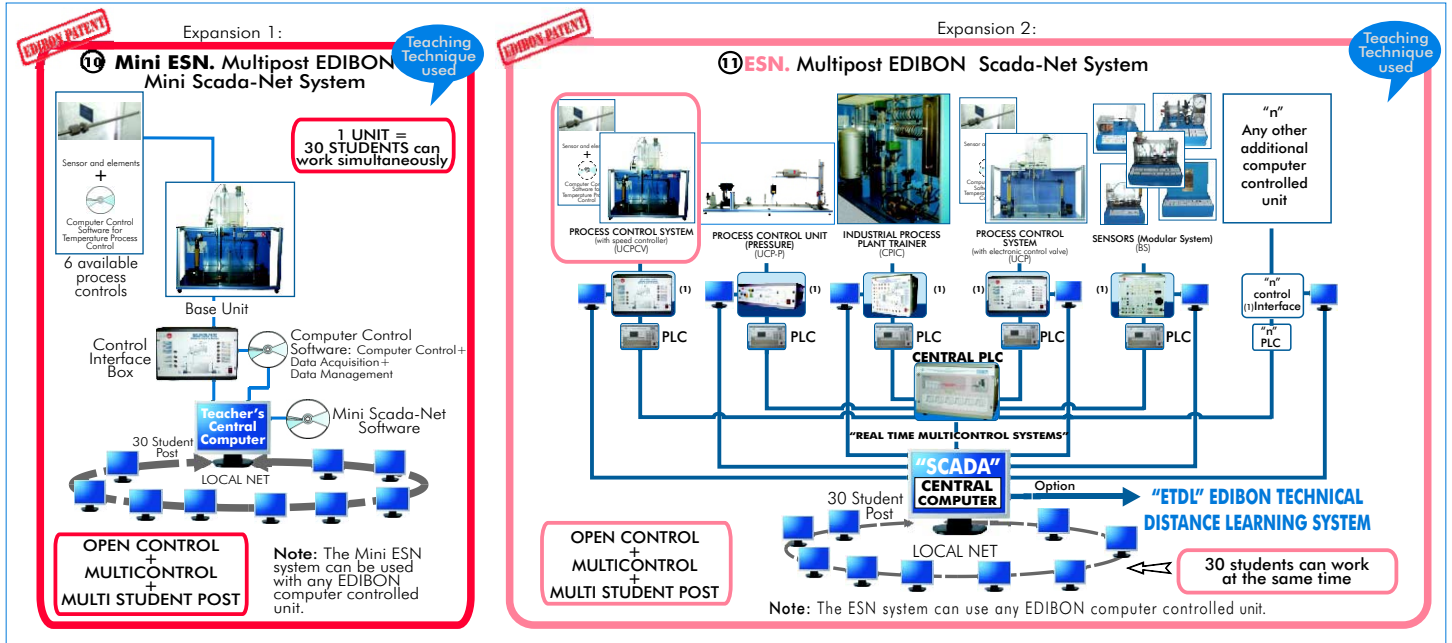
- 11.- In the ON/OFF control, the actuation sensr of the AVS-1 is inverted, acting, thus, on the same way as the others 2 valves (for a good control, it should operate the other way around to how the others 2 do it). (Affected sensor: pH).

Reduction or increase of the calculated total response:

- 12.- In the PID, the real action in the resistance is half of the total calculated. (Affected sensor: Temperature sensor).

The action of some controls is annulled:

- 13.- The Integral control does not work. It is reduced to a PD control (Proportional-Derivative).
- 14.- The Derivative Control does not work. It is reduced to a PI Control (Proportional-Integral).
- 15.- The Integral and Derivative controls do not work. They are reduced to a Proportional Control.



ORDER INFORMATION

Items always supplied as minimum configuration

- Common items for all Process Control parameters:
- ① UCPCV-UB. **Base Unit.** (Common for all Sets for Process Control type "UCPCV")
  - ② UCPCV/CIB. **Control Interface Box.** (Common for all Sets for Process Control type "UCPCV")
  - ③ DAB. **Data Acquisition Board.** (Common for all Sets for Process Control type "UCPCV")
  - ④ Sets (sesor and elements + computer control software) used in the base unit:
    - ④ UCPCV-T. Set for **Temperature Process Control**, and / or
    - ④ UCPCV-C. Set for **Flow Process Control**, and / or
    - ④ UCPCV-N. Set for **Level Process Control**, and / or
    - ④ UCPCV-PA. Set for **Pressure Process Control**, and / or
    - ④ UCPCV-PH. Set for **pH Process Control**, and / or
    - ④ UCPCV-CT. Set for **Conductivity and TDS (Total Dissolved Solids) Process Control.**
  - ⑤ **Cables and Accessories**, for normal operation.
  - ⑥ **Manuals.**

Complementary items

- PLC. Industrial Control using PLC (7 and 8):
  - ⑦ PCL-PI. PLC Module. (Common for all Sets for Process Control type "UCPCV").
  - ⑧ UCPCV/PLC-SOF. PLC Control Software. (Particular for each Set for Process Control type "UCPCV").
  - ⑨ UCP/FSS. Faults Simulation System.
- Expansions
- ⑩ Mini ESN. Multipost EDIBON Mini Scada-Net System.
  - ⑪ ESN. Multipost EDIBON Scada-Net System.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110V./60Hz.
- Water supply and drainage.
- Computer (PC).

DIMENSIONS & WEIGHTS

- UCPCV-UB Base Unit: -Dimensions: 500 x 1000 x 1000 mm. approx. -Weight :40 Kg. approx.
- Control Interface Box: -Dimensions: 490 x 330 x 310 mm. approx. -Weight: 12 Kg. approx.
- PLC Module (PLC-PI): -Dimensions: 490 x 330 x 310 mm. approx. -Weight: 30 Kg. approx.

AVAILABLE VERSIONS

Offered in this catalogue:

- UCPCV. **Computer Controlled Process Control System** (with speed controller).

Offered in other catalogues:

- UCP. **Computer Controlled Process Control System** (with electronic control valve).
- UCPCN. **Computer Controlled Process Control System** (with pneumatic control valve).

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



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REPRESENTATIVE:

