Computer Controlled Process Control System (with electronic control valve + pneumatic control valve + speed controller), with SCADA and PID Control

UCPCNCV

EDIBON SCADA System and PID Control included

Key features:

- Advanced Real-Time SCADA and PID Control.
- Open Control + Multicontrol + Real-Time Control.
- Specialized EDIBON Control Software based on LabVIEW.
- National Instruments Data Acquisition board (250 KS/s, kilo samples per second).
- Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.
- Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to the entire class at one time.
- Capable of doing applied research, real industrial simulation, training courses, etc.
- Remote operation and control by the user and remote control for EDIBON technical support, are always included.
- Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).
- Designed and manufactured under several quality standards.
- Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user’s knowledge and progress reached.
- This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

For more information about Key Features, click here
Variables such as temperature, pressure or flow often have to be fixed on systems or large machines. For instance, the temperature of a reactor may be controlled to maintain a consistent product output. These fixed variables should not change when faults occur. Process control is a discipline that deals with several mechanisms, algorithms, etc... to maintain the output of a process within a desired range. The controlled system has an input variable and an output variable. Its response is described in terms of dependence of the output variable on the input variable. These responses between one or several variables can normally be described using mathematical equations based on physical laws.

The controlled variable is first measured and a signal is created to allow a controller to control the variable. The measured value in the controller must then be compared with the desired value. The result of this comparison determines the action that needs to be taken. The Computer Controlled Process Control System (with electronic control valve + pneumatic control valve + speed controller), “UCPCNCV”, allows to use several control loops in measuring and controlling experiments for temperature, flow, level, pressure, pH, and conductivity and TDS (total dissolved solids) process control. The unit includes the necessary instruments for the physical simulation of the corresponding dynamic systems.

The Computer Controlled Process Control System (with electronic control valve + pneumatic control valve + speed controller), “UCPCNCV”, consists of a hydraulic circuit with a bottom main tank and an upper process tank, both duals. Two centrifugal pumps allow to impeller water in both tanks. Each pump includes a flowmeter with manual control valve.

The “UCPCNCV” unit incorporates three controls:
- Through a proportional valve (electronic control valve), situated in the outlet of one of the pumps.
- Through a pneumatic control valve, situated in the outlet of one of the pumps.
- Through a speed controller, situated in one of the pumps.

There are several additional fixed elements included:
- A temperature sensor located in the process tank together with a heating element and a level switch.
- A flow sensor that is installed in the upward lines of flow.
- A pressure sensor situated in the process tank.

The interchangeable additional elements in the unit are a stirrer, a capacitive level sensor located in the process tank and a pH, conductivity and TDS sensor which can be placed in the process tank or in the main tank to study the effect of the time out.

This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), and includes: The unit itself + a Control Interface Box + a Data Acquisition Board + Computer Control, Data Acquisition and Data Management Software Packages, for controlling the process and all parameters involved in the process.

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**INTRODUCTION**

**GENERAL DESCRIPTION**

**PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION**
With this unit there are several options and possibilities:
- Main items: 1, 2, 3, 4, 5 and 6.
- Optional items: 7, 8, 9, 10 and 11.

Let us describe first the main items (1 to 6):

1. **UCPCNCV-UB. Base Unit:**
   Bench-top unit.
   This unit is common for all Sets for Process Control type “UCPCNCV” and can work with one or several sets.
   Anodized aluminum frame and panels made of painted steel.
   Main metallic elements made of stainless steel.
   Diagram in the front panel with distribution of the elements similar to the real one.
   Transparent main tank and collector with an orifice in the central dividing wall (2 x 25 dm³), and drainage in both compartments.
   Transparent dual process tank (2 x 10 dm³), 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.
   Two centrifugal pumps, range: 0 – 10 l/min.
   Two 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.
   Proportional valve: a motorized control valve:
      Brass valve G 1/2”.
      Pmax. 4 bar. 24 volts. Control: 12 – 24 V, 200 – 1000 mA.
      Temperature: -10 – 60 ºC.
   Pneumatic control valve:
      Pneumatic valve with positioner regulator.
      Body in stainless steel connection G 1/2”, orifice 6 mm.
   The I/P converter transforms the electric signal sent from the computer into a proportional pressure that acts over the valve.
   Speed controller of the centrifugal pump AB-1 (located into the Control Interface Box); range: 0 – 50 Hz.
   Any Set for Process Control type “UCPCNCV” will be supplied installed in the Base Unit and ready for working.

The complete unit includes as well:
- **Advanced Real-Time SCADA and PID Control.**
- **Open Control + Multicontrol + Real-Time Control.**
- Specialized EDIBON Control Software based on LabVIEW.
- National Instruments Data Acquisition board (250 KS/s, kilo samples per second).
- Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.
- Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.
- Capable of doing applied research, real industrial simulation, training courses, etc.
- Remote operation and control by the user and remote control for EDIBON technical support, are always included.
- Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).
- Designed and manufactured under several quality standards.
- Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc. Apart from monitoring user’s knowledge and progress reached.
- This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.
UCPCNCV/CIB. Control Interface Box:
This unit is common for all Sets for Process Control type “UCPCNCV” and can work with one or several sets.

The Control Interface Box is part of the SCADA system.

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.

Simultaneous 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 displayed on only one screen in the computer.

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, heating elements, control valves, etc.

Real time PID control for 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).

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

Possibility of automatization of the actuators involved in the process.

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

DAB. Data Acquisition Board:
This board is common for all Sets for Process Control type “UCPCNCV”.

The Data Acquisition board is part of the SCADA system.

PCI Express Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI Express.

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)= ±10 V. Data transfers=DMA, interrupts, programmed I/O. DMA channels=6.

Analog output:
Number of channels=2. Resolution=16 bits, 1 in 65536.
Maximum output rate up to: 900 KS/s.
Output range(V)= ±10 V. Data transfers=DMA, interrupts, programmed I/O.

Digital Input/Output:
Number of channels=24 inputs/outputs. DI or DO Sample Clock frequency: 0 to 100 MHz.
UCPCNCV-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:

Temperaturesensor, “J” type.

Immersion heating element of 500 W with thermostat (30 – 90 °C).

Horizontal float type level switch. This switch determines the performance of the heating element.

A helix stirrer. Max. speed: 330 rpm.

b) Computer Control Software:

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

The three softwares are part of the SCADA system.

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 simultaneous way.

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

Analog and digital PID control.

PID menu and set point selection required in the whole work range.

Management, processing, comparison and storage of data.

Sampling velocity up to 250 KS/s (kilo samples per second).

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 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 to different work levels.

This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

UCPCNCV-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:

Flow sensor, fixed. Range: 0.25 – 6.5 l/min.

b) Computer Control Software:


The three softwares are part of the SCADA system.

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 simultaneous way.

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

Analog and digital PID control.

PID menu and set point selection required in the whole work range.

Management, processing, comparison and storage of data.

Sampling velocity up to 250 KS/s (kilo samples per second).

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 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 to different work levels.

This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
Sets (sensor and elements + computer control software) used in the base unit:

UCPCNCV-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:
   Capacitive level sensor. Length range: 0 – 300 mm.

b) Computer Control Software:
   PID Computer Control+Data Acquisition+Data Management Software for Level Process Control.
   The three softwares are part of the SCADA system.
   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 simultaneous way.
   Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
   Analog and digital PID control.
   PID menu and set point selection required in the whole work range.
   Management, processing, comparison and storage of data.
   Sampling velocity up to 250 KS/s (kilo samples per second).
   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 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 to different work levels.
   This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

UCPCNCV-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:
   Differential pressure sensor. Range: 0 – 1 psi.

b) Computer Control Software:
   PID Computer Control+Data Acquisition+Data Management Software for Pressure Process Control.
   The three softwares are part of the SCADA system.
   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 simultaneous way.
   Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
   Analog and digital PID control.
   PID menu and set point selection required in the whole work range.
   Management, processing, comparison and storage of data.
   Sampling velocity up to 250 KS/s (kilo samples per second).
   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 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 to different work levels.
   This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
Sets (sensor and elements + computer control software) used in the base unit:

UCPCNV-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 (Glass electrode, ddp (V)). Range: 0 – 14.
  A helix stirrer. Max. speed: 330 rpm.

b) Computer Control Software:
  PID Computer Control+Data Acquisition+Data Management Software for pH Process Control.
  The three softwares are part of the SCADA system.
  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 simultaneous way.
  Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
  Analog and digital PID control.
  PID menu and set point selection required in the whole work range.
  Management, processing, comparison and storage of data.
  Sampling velocity up to 250 KS/s (kilo samples per second).
  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 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 to different work levels.
  This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

UCPCNV-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 sensor:
  Conductivity range: 0 – 1990 ms.
  Ph range: 0 – 14.
  TDS range: 0 – 1990 ppm.
  A helix stirrer. Max. speed: 330 rpm.

b) Computer Control Software:
  PID Computer Control+Data Acquisition+Data Management Software for Conductivity and TDS (Total Dissolved Solids) Process Control.
  The three softwares are part of the SCADA system.
  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 simultaneous way.
  Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
  Analog and digital PID control.
  PID menu and set point selection required in the whole work range.
  Management, processing, comparison and storage of data.
  Sampling velocity up to 250 KS/s (kilo samples per second).
  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 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 to different work levels.
  This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

Cables and Accessories, for normal operation.

Manuals:
This unit 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.
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:
11. Flow control loops (On/Off).
13. Flow control loops (Proportional + Integral).
14. Flow control loops (Proportional + Derivative).
15. Flow control loops (Proportional + Derivative + Integral).
17. Adjustment of the flow controller constants (Reaction Curves).
18. Flow sensor calibration.

Level Process Control:
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:
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. Pressure sensor calibration.

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

Conductivity and TDS (Total Dissolved Solids) Process Control:
44. Conductivity control loops (Manual).
45. Conductivity control loops (On/Off).
46. Conductivity control loops (Proportional).
47. Conductivity control loops (Proportional + Integral).
48. Conductivity control loops (Proportional + Derivative).
49. Conductivity control loops (Proportional + Derivative + Integral).
50. TDS control loops (Manual).
51. TDS control loops (On/Off).
52. TDS control loops (Proportional).
53. TDS control loops (Proportional + Integral).
54. TDS control loops (Proportional + Derivative).
55. TDS control loops (Proportional + Derivative + Integral).
56. Conductivity and TDS sensor calibration.

Other possibilities to be done with this Unit:
57. Many students view results simultaneously. To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
58. Open Control, Multicontrol and Real Time Control. This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc. in real time.
59. The Computer Control System with SCADA and PID Control allow a real industrial simulation.
60. This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
61. This unit can be used for doing applied research.
62. This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
63. Control of the UCPCNCV unit process through the control interface box without the computer.
64. Visualization of all the sensors values used in the UCPCNCV unit process.
- By using PLC-PI additional 19 more exercises can be done.
- Several other exercises can be done and designed by the user.

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. Non 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 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.
### DIMENSIONS AND WEIGHTS

**UCPCNCV-UB:**
- **Unit:**
  - Dimensions: 500 x 1000 x 1000 mm approx.
  - Weight: 50 Kg approx.
- **Control Interface Box:**
  - Dimensions: 490 x 330 x 310 mm approx.
  - Weight: 12 Kg approx.

### AVAILABLE VERSIONS

**Offered in this catalog:**
- UCPCNCV. Computer Controlled Process Control System (with electronic control valve + pneumatic control valve + speed controller).

**Offered in other catalogs:**
- UCP. Computer Controlled Process Control System (with electronic control valve).
- UCPCN. Computer Controlled Process Control System (with pneumatic control valve).
- UCPCV. Computer Controlled Process Control System (with speed controller).

### REQUIRED SERVICES

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

### DIMENSIONS AND WEIGHTS

**UCPCNCV-UB:**
- **Unit:**
  - Dimensions: 500 x 1000 x 1000 mm approx.
  - Weight: 50 Kg approx.
- **Control Interface Box:**
  - Dimensions: 490 x 330 x 310 mm approx.
  - Weight: 12 Kg approx.
**SOFTWARE MAIN SCREENS**

**SCADA and PID Control**

**Main screens**

Main screen of the UCPCNV software, UCP module.

Main screen of the UCPCNV software, UCPCN module.

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Note:

- **SN** = Level sensor
- **SCON** = Conductivity sensor
- **SC** = Flow sensor
- **STDS** = TDS sensor
- **ST** = Temperature sensor
- **SP** = Pressure sensor
- **AVP** = Proportional valve
- **AR** = Heating element
- **AB** = Pump
- **AVS** = Solenoid valve
- **AA** = Stirrer
Software main screens

SCADA and PID Control

Main screens

Note:
SN = Level sensor. SCON = Conductivity sensor. SC = Flow sensor. STD = TDS sensor. ST = Temperature sensor. SPH = pH sensor. SP = Pressure sensor. AVP = Proportional valve. AR = Heating element. AB = Pump. AVS = Solenoid valve. AA = Stirrer.
Software main screens

Control Modes screens for any Process Control

Note:
Software main screens

Control Modes screens for any Process Control

Note:
SN=Level sensor.  SCON=Conductivity sensor.  SC=Flow sensor.  STDS=TDS sensor.  ST=Temperature sensor.  SPH=pH sensor.
SP=Pressure sensor.  AVP=Proportional valve.  AR=Heating element.  AB=Pump.  AVS=Solenoid valve.  AA=Stirrer.
Software main screens

Example of Sensors Calibration screen

Examples of On/Off Controls screens

Examples of PID Control screens

PID constants

proportional gain (Kc) 0.400
integral time (Ti, min) 0.000
derivative time (Td, min) 0.030

PID1 ON
SOME REAL RESULTS OBTAINED FROM THIS UNIT

Example of PID Control on Level

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**Actions:**
1. We establish the set point for level on 280 mm.
2. We turn on PID.

**Effects:**
1. The system turns on the AB-1 pump.
2. It opens the proportional valve.
3. The level increases.

---

**Effects:**
1. When the water level reaches the set point value, the system closes the AVP-1 valve, in order to close the water inlet.

---

**Effects:**
1. As the level is higher than what we are looking for (observed in the screen above) the system opens the AVS-2 solenoid valve in order to decrease the level.
Some real results obtained from this Unit

Example of PID Control on Temperature

**Actions:**
1. We establish the set point for temperature on 35°C.
2. We turn on PID.

**Effects:**
1. The electrical resistance (AR-1) turns on.
2. The resistance starts to heat the water in the tank.

**Effects:**
When the temperature is near the set point value, the resistance is turned off automatically.

**Effects:**
The system is not able to reach the set point value with the resistance turned off, so the system turns on the resistance again in order to reach the set point value.
Additionally to the main items (1 to 6) described, we can offer, as optional, other items from 7 to 11.

All these items try to give more possibilities for:

- a) Industrial configuration. (PLC)
- b) Technical and Vocational Education configuration. (ICAI and FSS)
- c) Multipost Expansions options. (MINI ESN and ESN)

| 7 | PLC. Industrial Control using PLC (it includes PLC-PI Module plus PLC-SOF Control Software):
<table>
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<tr>
<td>PLC-PI. PLC Module:</td>
<td>Metallic box.</td>
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</table>
| Circuit diagram in the module 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 (-10 V. to + 10 V.) (through SCSI connector).
| Analog outputs block: | 4 Analog outputs (-10 V. to + 10 V.) (through SCSI connector).
| Back panel: | Power supply connector. Fuse 2A. RS-232 connector to PC. USB 2.0 connector to PC.
| 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.
| Power supply input (100 to 240 V AC). | DC input: 16 (24 V DC).
| Multi-point PID control. | Digital inputs/outputs and analog inputs/outputs Panasonic modules.
| Communication RS232 wire to computer (PC). | Dimensions: 490 x 330 x 310 mm. approx. (19.29 x 12.99 x 12.20 inches approx.). Weight: 30 Kg. approx. (66 pounds approx.).
| -UCPCNCV/PLC-SOF. PLC Control Software:
| For this particular unit, always included with PLC supply. Each particular Process Control has its own Software. The software has been designed using Labview and it follows the unit operation procedure and linked with the Control Interface Box used in the Computer Controlled Process Control System (with electronic control valve+pneumatic control valve+speed controller) (UCPCNCV).
| Practices to be done with PLC-PI:
| 1.- Control of the particular unit process through the control interface box without the computer. | 13.- PLC different programming standard languages (ladder diagram (LD), structured text (ST), instructions list (IL), sequential function chart (SFC), function block diagram (FBD)).
| 2.- Visualization of all the sensors values used in the particular unit process. | 14.- New configuration and development of new process.
| 3.- Calibration of all sensors included in the particular unit process. | 15.- Hand on an established process.
| 4.- Hand on of all the actuators involved in the particular unit process. | 16.- To visualize and see the results and to make comparisons with the particular unit process.
| 5.- Realization of different experiments, in automatic way, without having in front the particular unit. (These experiments can be decided previously). | 17.- Possibility of creating new process in relation with the particular unit.
| 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). | 18.- PLC Programming Exercises.
| 7.- PLC hardware general use. | 19.- Own PLC applications in accordance with teacher and student requirements.
| 8.- PLC process application for the particular unit. |
Complete Technical Specifications (for optional items)

b) Technical and Vocational Education configuration

UCPCNCV/ICAI. Interactive Computer Aided Instruction Software System.

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.

This software is optional and can be used additionally to items (1 to 6).

- 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 Database 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.

- 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
MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.

The MINI ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA and PID Control integrated in a local network. This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit. Then, the number of possible users who can work with the same unit is higher than in an usual way of working (usually only one).

Main characteristics:
- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA and PID Control, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing “real time” control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:
- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

For more information see MINI ESN catalogue. Click on the following link:

For more information see MINI ESN catalogue. Click on the following link:

MINI ESN. EDIBON Mini Scada-Net System

Faults Simulation System (FSS) is a Software package that simulates several faults in any EDIBON Computer Controlled Unit. It is useful for Technical and Vocational level.

The “FAULTS” mode consists in causing several faults in the unit normal operation. The student must find them and solve them. There are several kinds of faults that can be grouped in the following sections:
- Faults affecting the sensors measurement:
  - An incorrect calibration is applied to them.
  - Non-linearity.
- Faults affecting the actuators:
  - Actuators channels interchange at any time during the program execution.
  - Response reduction of an actuator.
- Faults in the controls execution:
  - Inversion of the performance in ON/OFF controls.
  - Reduction or increase of the calculated total response.
  - The action of some controls is annulled.
- On/off faults:
  - Several on/off faults can be included.

For more information see FSS catalogue. Click on the following link:

Faults Simulation System (FSS)  is a Software package that simulates several faults in any EDIBON Computer Controlled Unit. It is useful for Technical and Vocational level.

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  - Reduction or increase of the calculated total response.
  - The action of some controls is annulled.
- On/off faults:
  - Several on/off faults can be included.

For more information see FSS catalogue. Click on the following link:

UCPCNCV/FSS. Faults Simulation System.

The MINI ESN system can be used with any EDIBON computer controlled unit.
**ORDER INFORMATION**

<table>
<thead>
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<th><strong>Main items</strong> (always included in the supply)</th>
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<td>Minimum supply always includes:</td>
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<tr>
<td>1. <strong>Unit</strong>: UCPCNCV-UB. <strong>Base Unit</strong>. (Common for all Sets for Process Control type “UCPCNCV”).</td>
</tr>
<tr>
<td>2. <strong>UCPCNCV/CIB. Control Interface Box</strong>. (Common for all Sets for Process Control type “UCPCNCV”).</td>
</tr>
<tr>
<td>3. <strong>DAB. Data Acquisition Board</strong>. (Common for all Sets for Process Control type “UCPCNCV”).</td>
</tr>
<tr>
<td>4. <strong>Sets</strong> (sensor and elements + computer control software) used in the base unit:</td>
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<tr>
<td>5. <strong>UCPCNCV-T. Set for Temperature Process Control</strong>, and / or</td>
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<td>6. <strong>UCPCNCV-C. Set for Flow Process Control</strong>, and / or</td>
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<td>7. <strong>UCPCNCV-N. Set for Level Process Control</strong>, and / or</td>
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<td>8. <strong>UCPCNCV-PA. Set for Pressure Process Control</strong>, and / or</td>
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<td>9. <strong>UCPCNCV-PH. Set for pH Process Control</strong>, and / or</td>
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<td>10. <strong>UCPCNCV-CT. Set for Conductivity and TDS (Total Dissolved Solids) Process control</strong>.</td>
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<td>11. <strong>Cables and Accessories</strong>, for normal operation.</td>
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<td>12. <strong>Manuals</strong>.</td>
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*IMPORTANT:* Under UCPCNCV we always supply all the elements for immediate running as 1, 2, 3, 4, 5 and 6.

<table>
<thead>
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<th><strong>Optional items</strong> (supplied under specific order)</th>
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<td><strong>a) Industrial configuration</strong></td>
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<td>7. <strong>PLC. Industrial Control using PLC</strong> (it includes PLC-PI Module plus PLC-SOF Control Software):</td>
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<tr>
<td>- <strong>PCL-PI. PLC Module</strong>.</td>
</tr>
<tr>
<td>- <strong>UCPCNCV/PLC-SOF. PLC Control Software</strong>.</td>
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| 8. **UCPCNCV/ICAI. Interactive Computer Aided Instruction Software System**. |
| 9. **UCPCNCV/FSS. Faults Simulation System**. |

<table>
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<tr>
<th><strong>c) Multipost Expansions options</strong></th>
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<tr>
<td>10. <strong>MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units</strong>.</td>
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<tr>
<td>11. <strong>ESN. EDIBON Scada-Net Systems</strong>.</td>
</tr>
</tbody>
</table>
TENDER SPECIFICATIONS (for main items)

1. **UCPCNCV-UB. Base Unit:**
   - Bench-top unit.
   - This unit is common for all Sets for Process Control type “UCPCNCV” and can work with one or several sets.
   - Anodized aluminum frame and panels made of painted steel.
   - Main metallic elements made of stainless steel.
   - Diagram in the front panel with distribution of the elements similar to the real one.
   - Transparent main tank and collector with an orifice in the central dividing wall (0.2 – 25 dm³), and drainage in both compartments.
   - Transparent dual process tank (2 x 10 dm³), 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.
   - Two centrifugal pumps, range: 0 – 10 l/min.
   - Two 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.
   - Proportional valve: a motorized control valve:
     - Brass valve G 1/2”.
     - Max. 4 bar, 24 volts. Control: 12 – 24 V, 2000 – 1000 mA. Temperature: -10 – 60 °C.
   - Pneumatic proportional control valve:
   - Body in stainless steel connection G 1/2”, orifice 6 mm.
   - The I/P converter transforms the electric signal sent from the computer into a proportional pressure that acts over the valve.
   - Speed controller of the centrifugal pump AB-1 (located into the Control Interface Box), range: 0 – 50 Hz.
   - Any Set for Process Control type “UCPCNCV” will be supplied installed in the Base Unit and ready for working.
   - The complete unit includes as well:
     - Advanced Real-Time SCADA and PID Control.
     - Computer Control + Multicontrol + Real-Time Control.
     - Specialized EDIBON Control Software based on LabVIEW.
     - National Instruments Data Acquisition board (250 KS/s, kilo samples per second).
     - Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.
     - Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.
   - Open control allowing modifications, at any moment and in 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 coefficients.
   - Real time PID control for parameters involved in the process simultaneously.
   - Real time PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process.
   - Open control allowing modifications, at any moment and in real time, of parameters involved in the process simultaneously.
   - Three safety levels, one mechanical in the unit, another electronic in the control interface and the third one in the control software.

2. **UCPCNCV/CIB. Control Interface Box:**
   - This unit is common for all Sets for Process Control type “UCPCNCV” and can work with one or several sets.
   - The Control Interface Box is part of the SCADA system.
   - Control interface box with process diagram in the front panel.
   - The unit control elements are permanently computer controlled.
   - Simultaneous 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.
   - All the actuators’ values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process.
   - Shield and filtered signals to avoid external interferences.
   - Real time PID control with facility of modifications from the computer keyboard of the PID parameters, at any moment during the process.
   - Real time PID control for 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.
   - Open control allowing modifications, at any moment and in real time, of parameters involved in the process simultaneously.
   - Three safety levels, one mechanical in the unit, another electronic in the control interface and the third one in the control software.

3. **DAB. Data Acquisition Board:**
   - This board is common for all Sets for Process Control type “UCPCNCV”.
   - The Data Acquisition board is part of the SCADA system.
   - PCI Express Data acquisition board (National Instruments) to be placed in a computer slot.
   - Analog input: Channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536. Sampling rate up to: 250 KS/s (kilo samples per second).
   - Analog output: Channels= 2. Resolution=16 bits, 1 in 65536.
   - Digital Input/Output: Channels=24 inputs/outputs.

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

5. **UCPCNCV-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.
     - Immersion heating element of 500 W with thermostat (30 – 90 °C).
     - Horizontal float type level switch. This switch determines the performance of the heating element.
   - **b) Computer Control Software:**
     - PID Computer Control + Data Acquisition + Data Management Software for Temperature Process Control.
     - These three softwares are part of the SCADA system.
     - PID controller for the heaters and PID menu and set point selection required in the whole work range.
     - Management, processing, comparison and storage of data.
     - Sampling velocity up to 250 KS/s (kilo samples per second).
     - Calibration system for the sensors involved in the process.
     - It allows the registration of the alarms state and the graphic representation in real time.
     - Open software, allowing 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 to different work levels.
     - This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

6. **UCPCNCV-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:**
     - Flow sensor, fixed. Range: 0.25 – 6.5 l/min.
   - **b) Computer Control Software:**
     - The three softwares are part of the SCADA system.
     - Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
     - Analog and digital PID control. PID menu and set point selection required in the whole work range.
     - Management, processing, comparison and storage of data.
     - Sampling velocity up to 250 KS/s (kilo samples per second).
     - Calibration system for the sensors involved in the process.
     - It allows the registration of the alarms state and the graphic representation in real time.
     - Open software, allowing 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 to different work levels.
     - This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
4.6 Cables and Accessories

It allows the registration of the alarms state and the graphic representation in real time.
Calibration system for the sensors involved in the process.
Sampling velocity up to 250 KS/s (kilo samples per second).
Management, processing, comparison and storage of data.
Calibration system for the sensors involved in the process.
It allows the registration of the alarms state and the graphic representation in real time.
Open software, allowing 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

4.7 UCPCNV-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:
Differential pressure sensor. Range: 0 – 1 psi.

b) Computer Control Software:
PID Computer Control+Data Acquisition+Data Management Software for Pressure Process Control.
The three softwares are part of the SCADA system.
Compatible with the industry standards.
Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
Analog and digital PID control. PID menu and set point selection required in the whole work range.
Management, processing, comparison and storage of data.
Sampling velocity up to 250 KS/s (kilo samples per second).
Calibration system for the sensors involved in the process.
It allows the registration of the alarms state and the graphic representation in real time.
Open software, allowing 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

4.8 UCPCNV-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 (Glass electrode, ddp (V)). Range: 0 – 14.

b) Computer Control Software:
PID Computer Control+Data Acquisition+Data Management Software for pH Process Control.
The three softwares are part of the SCADA system.
Compatible with the industry standards.
Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
Analog and digital PID control. PID menu and set point selection required in the whole work range.
Management, processing, comparison and storage of data.
Sampling velocity up to 250 KS/s (kilo samples per second).
Calibration system for the sensors involved in the process.
It allows the registration of the alarms state and the graphic representation in real time.
Open software, allowing 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

4.9 UCPCNV-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 sensor:
  Conductivity range: 0 – 1990 ms.
  pH range: 0 – 14.
  TDS range: 0 – 1990 ppm.
A helix stirrer. Max. speed: 330 rpm.

b) Computer Control Software:
PID Computer Control+Data Acquisition+Data Management Software for Conductivity and TDS (Total Dissolved Solids) Process Control.
The three softwares are part of the SCADA system.
Compatible with the industry standards.
Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
Analog and digital PID control. PID menu and set point selection required in the whole work range.
Management, processing, comparison and storage of data.
Sampling velocity up to 250 KS/s (kilo samples per second).
Calibration system for the sensors involved in the process.
It allows the registration of the alarms state and the graphic representation in real time.
Open software, allowing 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 to different work levels.
This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

Cables and Accessories, manuals for normal operation.

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.
Tender Specifications (for main items)

Exercises and Practical Possibilities to be done with the Main Items

**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:**
11. Flow control loops (On/Off).
13. Flow control loops (Proportional + Integral).
14. Flow control loops (Proportional + Derivative).
15. Flow control loops (Proportional + Derivative + Integral).
17. Adjustment of the flow controller constants (Reaction Curves).
18. Flow sensor calibration.

**Level Process Control:**
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:**
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. Pressure sensor calibration.

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

**Conductivity and TDS (Total Dissolved Solids) Process Control:**
44. Conductivity control loops (Manual).
45. Conductivity control loops (On/Off).
46. Conductivity control loops (Proportional).
47. Conductivity control loops (Proportional + Integral).
48. Conductivity control loops (Proportional + Derivative).
49. Conductivity control loops (Proportional + Derivative + Integral).
50. TDS control loops (Manual).
51. TDS control loops (On/Off).
52. TDS control loops (Proportional).
53. TDS control loops (Proportional + Integral).
54. TDS control loops (Proportional + Derivative).
55. TDS control loops (Proportional + Derivative + Integral).
56. Conductivity and TDS sensor calibration.

Other possibilities to be done with this Unit:
57. Many students view results simultaneously.
58. Open Control, Multicontrol and Real Time Control.
59. The Computer Control System with SCADA and PID Control allow a real industrial simulation.
60. This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
61. This unit can be used for doing applied research.
62. This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
63. Control of the UCPCNCV unit process through the control interface box without the computer.
64. Visualization of all the sensors values used in the UCPCNCV unit process.

- By using PLC-PI additional 19 more exercises can be done.
- Several other exercises can be done and designed by the user.
Practices to be done by Faults Simulation System (UCPCNCV/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 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.
TENDER SPECIFICATIONS (for optional items)

a) Industrial Configuration

PLC. Industrial Control using PLC

-PLC-PI. PLC Module:
  - Metallic box.
  - Circuit diagram in the module front panel.
  - Digital inputs (X) and Digital outputs (Y) block: 16 Digital inputs. 14 Digital outputs.
  - Analog inputs block: 16 Analog inputs.
  - Analog outputs block: 4 Analog outputs.
  - Touch screen.
  - Panasonic PLC:
    - High-speed scan of 0.32 µsec. Program capacity of 32 Ksteps. High-speed counter. Multi-point PID control.
    - Digital inputs/outputs and analog inputs/outputs Panasonic modules.

-UCPCNCV/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply. Each particular Process Control has its own Software.

Practices to be done with PLC-PI:

1. Control of the particular unit process through the control interface box without the computer.
2. Visualization of all the sensors values used in the particular unit process.
3. Calibration of all sensors included in the particular unit process.
4. Hand on of all the actuators involved in the particular unit process.
5. Realization of different experiments, in automatic way, without having in front the particular unit. (These experiments can be decided previously).
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).
7. PLC hardware general use.
8. PLC process application for the particular unit.
9. PLC structure.
10. PLC inputs and outputs configuration.
11. PLC configuration possibilities.
12. PLC program languages.
13. PLC different programming standard languages (ladder diagram (LD), structured text (ST), instructions list (IL), sequential function chart (SFC), function block diagram (FBD)).
14. New configuration and development of new process.
15. Hand on an established process.
16. To visualize and see the results and to make comparisons with the particular unit process.
17. Possibility of creating new process in relation with the particular unit.
18. PLC Programming Exercises.
19. Own PLC applications in accordance with teacher and student requirements.

b) Technical and Vocational Education Configuration

UCPCNCV/ICAI. Interactive Computer Aided Instruction Software System.

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.

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

- 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:

- User 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.
MINI ESN. EDIBON Mini Scada-Net System for being used with EDIBON Teaching Units.

MINI ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously. The MINI ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA and PID Control integrated in a local network. This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit.

Main characteristics:
- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA and PID Control, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing “real time” control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:
- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

The system basically will consist of:
- This system is used with a Computer Controlled Unit.
- Instructor’s computer.
- Students’ computers.
- Local Network.
- Unit-Control Interface adaptation.
- Unit Software adaptation.
- Webcam.
- MINI ESN Software to control the whole system.
- Cables and accessories required for a normal operation.

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