italtec
Technical Training Systems
Company with Quality Management System
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CDP300
INDUSTRIAL PROCESS CONTROL TRAINER

CDP300

CDP300 series

Models:

- **CDP301/L: System for Level control**

- **CDP302/P Pressure control**

- **CDP303/F for Flow control**

- **CDP304/T for Temperature control**

- **CDP305/C: Comprehensive system for**

>   Level,
>
>   Pressure,
>
>   Flow and
>
>   Temperature control

CE

EDUCATIONAL TRAINING SYSTEM
FOR
AUTOMATED CONTROL OF INDUSTRIAL PROCESSES

CDP300 series a highly innovative solutions for the study of the techniques of industrial process control e regulations based on open and modular structures featured by:
- Reduced purchasing costs
- High reliability thorough the years
- Best modularity and expandability
- Full hardware and software functions
- Wide operative possibilities
- Extreme educational effectiveness
- Comprehensive formative support

To fully satisfy every experimental need, the CDP300 range of products has been appositely designed and developed for an easy understanding of all the main topics related to industrial regulation.

Each model is supplied "ready for use" to be immediately operative and includes:

a) Bench-top metallic structure
b) Electric and Hydraulic circuits dedicated to the specific kind of control installed
c) Electric pumps driven by DC motors.
d) Linear drives to control the DC motors
e) Electric, electronic and hydraulic dedicated components
f) Control and regulation dedicated panel
g) Dedicated precision sensor with signal transmitter
h) PID microprocessor dedicated control
i) Built-in system for data acquisition
j) RS-232 interface for PC connection
k) Control and Monitoring software running on Windows environment
l) Fault simulation
m) User and Exercises manuals
n) Accessories and basic spare parts

The different models can be either purchased separately because they are especially designed to satisfy specific educational needs or combined among them.

CDP300

CDP300 series

It is also possible integrate each one of the PCS 300 series models with the following customized kits available as options to realize complex process controls:

• **K-301/L: Kit for level control**

• **K-302/P: kit for Pressure control**

• **K-303/F: kit for Flow control**

• **K-304/T: kit for Temperature control**

The following diagram illustrates, for instance, the CDP301/L system's expandability:

Level Control (Base-Unit)

Pressure Control Flow Control Temperature Control
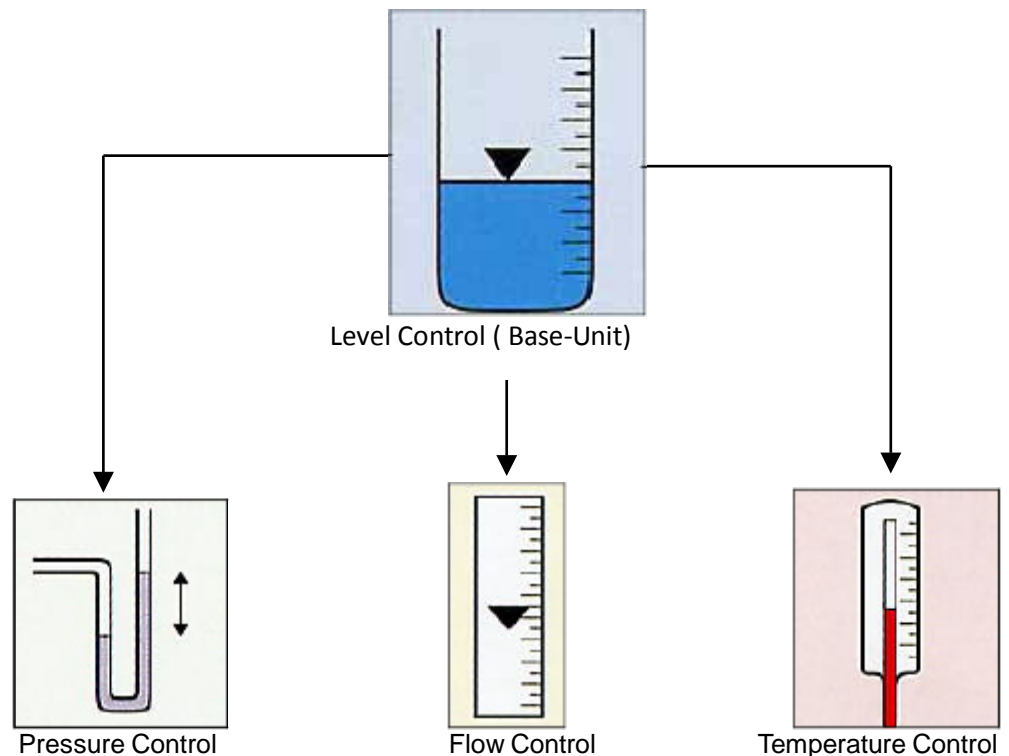
However it is given the possibility to purchase the kits as a single unit or as a whole system.

It's very easy to realize how big is the variety of combinations to be achieved and how interesting is the costs optimisation due to the fact that it is possible to built a CDP300 configuration at pleasure according to the personal educational need and budget availability.

Each kit is supplied already assembled and tested on its own base-unit and the supply includes the accessories as described from points e) to n) of the previous list.

Main Educational topics:

- **Process Control fundamentals**
- **Curve detection of the transducers employed**
- **Pumps curve detection**
- **PID controller employ**
- **Determination of the Closed-loop system characteristics with ON/OFF regulation and with PID regulation**
- **Study of the Cascade regulation systems**
- **Fault-Finding exercises**

- **Verification on the separate effect of the three PID regulation actions**
- **Study of the system stability**
- **Study of the system response to the different kind of disturbances**
- **Study of the process data transmission to the PC**
- **Study of the data acquisition software**
- **Connection to the external regulation systems**

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The series of CDP300 is completed by the following controls:

• **CDP306/P: Tank Air-pressure control**

• **CDP307/T: Oven Temperature control**

• **CDP308/H: PH control**

Differently from the previous models, these last solutions are proposed solely as a stand-alone version so they can't be expanded with any customizing kit.

These controls are described in separate related leaflets.

CE

MAIN TECHNICAL FEATURES

Except for the three above listed models (CDP306/P, CDP307/T and CDP308H) all the other control systems included in the CDP300 series have the following main features:

a) Mechanical:
- Strong bench-top bearing structure
- Steel-sheet oven painted body
- Adjustable resting feet
- Anodized aluminium upper and lateral panels
- Silk-screens of electric, hydraulic and control circuits on the unit
- Rotating-base system to support different integrated processes
- Dimensions: cm. 70 x 70 x 90 h.
- Base unit weight: Kg. 35 approx.

b) Electrical
- Main supply 230V/50-60 Hz. (other voltages available on request)
- External power supply separated from the control unit
- Quick joint connections between the base unit and power supply
- Permanent magnets low voltage DC motors
- Low voltage AC and DC power supply
- Internal signals terminated on safety bushes Ø 4mm
- Protections and design up the CE safety rules

c) Regulations and Controls
- 3 different autonomous regulation possibilities:
  - Internal control
  - External control
  - PC control
- 5 kinds of controls:
  - First and second order PID control
  - ON/OFF control
  - Open-loop control
  - Cascade control
  - Fuzzy control (announced)
- Precision sensor with normalised signal transmitter
- 16 bit microprocessor industrial PID controller
- 16 bit A/D and D/A converters
- 3 analog independent PID loops regulations
- 3 digital independent (by software) PID loops regulations
- Manual or programmable regulation of the set-point
- Manual or programmable disturbance regulation
- Direct visualization on digital meter of the regulated quantity
- RS-232-C standard interface for the PC connection
- 2 linear drives to control the DC pumps motors
- Light indication of the pumps status
- Light indication for the too high level of fluid
- Faults simulation activable by switches
- Level, pressure, flow and temperature controlled liquid: 4 litres
- Possibility of external control from any kind of controller (PLC, microprocessors, etc)

d) Hydraulic
- Process fluid: water
- Hydraulic water-tight circuits with industrial type components
- Swift joint hydraulic connections
- Filter for water cleaning
- Rear taps for water inlet-outlet from the system
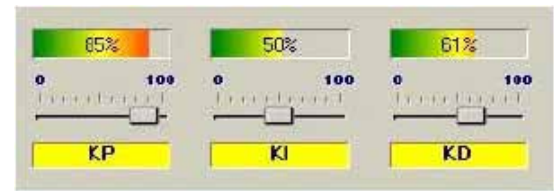
CDP300

CDP300 series

Accessories included in the supply

- 230V/ 12-5 Vdc power supply separated from the unit for a better operational safety

- 2 mt cable with special connectors for the power supply regulation unit connection

- special tool for the hooking/release of the quick coupling connectors

- fitting and pipe terminated on funnel for main tank water inlet

- fitting and pipe for water outlet

- graduated tank for water feeding

- water dye

- Modular and certified hydraulic components
- Transparent main tank (lexan), 7 lt. capacity with extra full sensor
- Transparent controlled graduated tank (lexan), 5 lt. capacity (other capacities on request)
- Main transparent pipe (lexan) for water feeding
- Max. pump's delivery: 3,5 lt. / min.

e) CDPSWM Software

The CDPSWM software (running on Windows allows to perform the monitoring, control and process supervision functions and precisely:

- dynamic visualisation of the process during the regulation (internal or PC control)
- graphical display of the process trend with selection of the graphs
- setting and display of the set-point value with three different kinds of visualisation
- setting of the kind of disturbance signal chosen (continuos, slope, pulse or sinusoidal)
- real-time visualisation of the tracking error trend from the system
- visualisation of the actual level, pressure, flow or temperature values in percentage
- real-time setting of the regulation constants of any PID loop separately
- visualisation of the kind of control which has been set (ON/OFF or PID)
- visualisation of the kind of control under work (internal, external or PC)
- real-time visualisation of the following parameters:
  • PID constant set values
  • PID functions results $Yp = f (error, P)$ $Yi = f (error, I)$ $Yd = f (error, D)$
  • Process error
  • Process variable
  • Regulated quantity
  • Full result of the PID action
- Storing or printing of the obtained graphs (BMP or JPEG format)
- Storing or printing of the process parameters (ASCII format with delimeter for any external data base or electronic work spread sheet)

The CDPSWM software may be employed also with the PID internal regulator in order to acquire and display the process data independently from the external PC regulation.
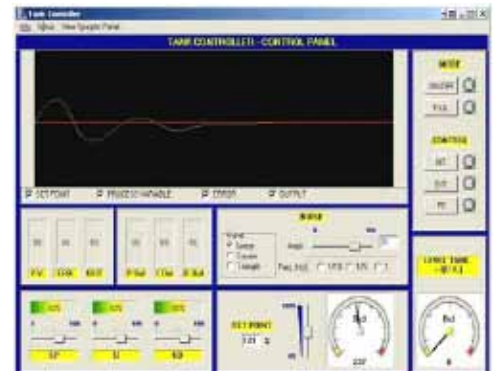
f) Working Modes

The units are supplied as stand-alone one so perfectly autonomous and can be immediately operated without any further accessory. Once the fluid has been floated in the main tank, the unit is ready to work and the operator may choose which control has to be employed to perform the regulation among the five ones presently available:

1) Internal Control: the process is entirely managed by the internal PID with possibility of working both with PID and ON/OFF regulation. Thanks to the software included in the supply of the different models, during the regulation it is possible to acquire all the process data directly from the PC. The PID parameters, set-point and disturbance level are set manually in an analog way through the suitable potentiometers placed on the panel.

2) PC Control: the process is entirely managed through the CDPSWM software and a common PC (not included in the supply). The analog commands on the panels are automatically disabled and any regulation is interactive through the related controls on the monitor. Like it happens with the Internal Control, all the process variables are automatically acquired and visualised on the screen.

3) External Control: the control may be made through any kind of external regulation device (PLC, controllers, microprocessors and so on) already owned by the Customer. In fact all the main controls and signals inside the unit (like the signals coming from the sensors and pumps) are made available on safety bushes Ø 4 mm on the panel in such way that the external regulation is immediately ready to manage directly such quantities.

CDP300

CDP300 series

Main Educational topics:

- **Process Control fundamentals**

- **Curve detection of the transducers employed**

- **Pumps curve detection**

- **PID controller employ**

- **Determination of the Open-loop system characteristics**

- **Determination of the Closed-loop system characteristics with ON/OFF regulation**

- **Determination of the Closed-loop system characteristics with PID regulation**

- **Study of the Cascade regulation systems**

- **Verification on the separate effect of the three PID regulation actions**

- **Study of the system stability**

- **Study of the system response to the different kind of disturbances**

- **Study of the process data transmission to the PC**

- **Study of the data acquisition software**

- **Connection to the external regulation systems**

- **Fault-Finding exercises**

4)	Open Loop Control: with the use of the safety bushes on the panel, it is possible the manual conditioning of the process under test without having to apply any internal or external control and regulation. Obviously the signals coming from the different sensors are not taken into consideration and the regulations is therefore mainly bound to the operator competence.

5)	Cascade Control: if a system is integrating a level and flow control it is thus possible to get a cascade control which controls both the process with a so called "parallel" cascade control in which one regulation doesn't make any interference with another one or a "serial" cascade in which the whole regulation depends on both process.

As already stated, a further control employing the regulation technology named "Fuzzy" will be implemented in the near future on all the unit of the CDP300 series and the related customized Kits.