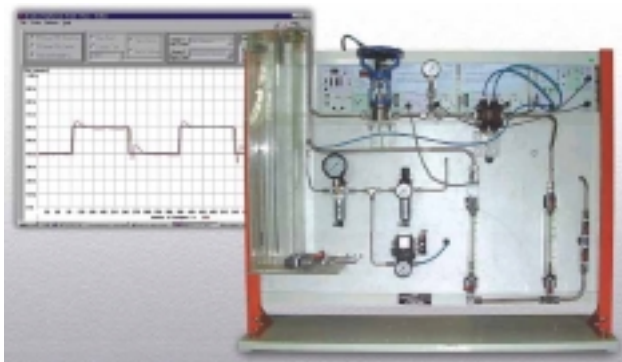


## Salient Features

- Lightweight, powder coated, tabletop, Aluminium flat panel structure, with SS (304/316) piping to facilitate easy understanding and wide angle view of every component in process. No hidden parts.
- Individual control loops as well as Advance control schemes like Ratio, Cascade, Feedforward made easy for student. Employs compact pneumatic control valve.
- Connection through polarized FRC connectors, sturdy 4mm Banana sockets & Patch cords enabling quick setting up of variety of process control experiments.
- P4/XP window based PID controller (DDC) software package with P, PI & PID control, Ratio & cascade control, three operating modes, Online graph drawing & data acquisition modes (SCADA). PC not in scope of supply



## Technical Specifications (Controller Section)

### Computer Interface panel (CIP/PCT1)

- § Connects to PC (P4/XP) parallel port through 25 pin M to F cable / 1.5mtr.
- § **4 ADC** channels I/P : 0 to 2.5V FS with 1no input simulation pot. **1 DAC** channel O/P 2.5V FS.
- § V to I function block : I/P 0 to 2.5V & O/P 0-20 or 4-20mA (100Ω load) switch setttable.
- § I to V function block : I/P 4 to 20mA & O/P 0 - 2.5V

### Instrumentation Power supply cum Multichannel DPM panel (EMT 8)

- § +/-12V/500 mA , +5V/300mA, Unregulated 17V dc/750 mA, line synchronizing signal, 13V / 3 Amp.,
- § Multi channel DPM for digital display of process parameters.
- § 20 pin FRC power bus to supply power to neighbouring panels.

### Thyristor Actuator cum signal conditioning panel (TAP) / CE2 x 2Nos.

- § Optional s : Thyristor bridge based 0-200V/3A using cosine firing circuit, I/P 0 to 2.5Vdc.
- § Supports signal conditioning for RTD, Pressure sensor with Instrumentation Amplifier & flow sensor (water / air) with F to V convertor to generate 0-2.5Vdc (FS).
- § Optionally facilitates closed loop control experiments based on temperature, light intensity, speed measurement using built in P/PI controller as well as external Analog / Digital PID controller.
- § 2No.panels may be needed to cover signal conditioning needs of the selected process.
- § Interface for AC motor driven electrical control valve with multiturn (10T) feedback pot.

### PC (P4/XP/ FAT32) based PID controller (PC not in scope of supply. But P4/XP with parallel port needed.)

#### • Online monitoring / Data acquisition / PID Software

Self extracting package (CD) works under 98, 2K, XP (PC is not in scope of supply).

#### • Operating modes

- a) **Simulator Mode** : Tests data stored in files (\*.txt) & Draw graph for all P,PI,PD & PID modes.
- b) **Process Monitoring Mode** : Draw graphs of analog data presented at CH 0 & CH 1 of CIP. Cursors for X & Y axis for measurement & online graphs saving for reproduction.
- c) **PID controller Mode**
  - PID controller with parameter like Integral Time  $T_i$  (1-64000) , Sampling Time  $T_s$ (0.1- 99.9) ,Derivative Time  $T_d$ (0.1-99.9) ,Proportional Band  $P_b$ (1-999) , Derivative Gain  $K_d$ (1-999) , Set Value  $R_n$ (0-99.9), PID output Upper Limit  $U_h$ (0-99.9), PID output Lower Limit  $U_l$  (0-99.9), Settable PWM output Cycle Time  $C_t$  (0.1-999).
  - Facility to set units for output viz. (%), V, mm, LPH, kg/cm<sup>2</sup>, °C. Optionally experiments with advance process control scheme viz; Ratio, Cascade, feedforward with Aux PID, Ratio station & FF transfer function calculator, Alarm setting, ON/OFF control, square root extractor, PWM output, etc.

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Specifications subject to change without notice.



## Choice of Process set up : Must select one the following options :

Sr. No.	Process loops parameters	1. Flow / Level with pneumatic control valve Model : FL	2. Flow / Level with variable speed pump Model : FLE	3. Pressure / Temp./Flow Model : PTF	4. Coupled tank level & Flow Model : 2TF	5. pH/conductivity Model : ChemPCT	
1	Controlled medium	Water	Water	Air for pressure, Flow Water for heating & air (air bubbler) for temp. cooling	Water	Water	
2	Storage tank material /Capacity	1 no. 50 ltr, plastic/PVC.	1 no. 50 liters, plastic/PVC.	NA	1 no. 50 liters, plastic/ PVC.	1 no. 50 liters, plastic/ PVC.	
3	Process tank Capacity / material	Vertically mounted tank, 1 no. 20 ltr, acrylic (130 X 130 X 700) mm	Vertically mounted tank, 1 no. 20 liters, acrylic (130 X 130 X 700) mm	1 no. 5 liter, stainless steel with temp, pressure sensors attachment.	2Nos. of 20Ltr, acrylic (130x130x700) tanks, coupled at bottom using manual valves	Reaction Vessel	
4	Electronic sensor Type / Output / Range	<ul style="list-style-type: none"> <li>Flow: turbine flow sensors 1 no. + 1 no. (Optionally 1 no. Orifice plate with DP sensor, (0-5 PSI), O/P = 0 to 2.5V, 0-200LPH.</li> <li>Level: WC pressure sensor 0 to 500mm, level measurement by bubbler method, O/P = 0 to 2.5V(optionally capacitive level sensor needs additional panel MIT2.)</li> </ul>	<ul style="list-style-type: none"> <li>Flow: turbine flow sensors 2 no.</li> <li>Level: WC pressure sensor 0 to 500mm, level measurement by bubbler method, O/P = 0 to 2. Pressure supplied through small compressor &amp; AFR</li> </ul>	<ul style="list-style-type: none"> <li>Pressure: piezo-resistive pressure sensor 0 to 15PSI, O/P = 0 to 2.5V</li> <li>Temp: PT100, O/P = 0 to 2.5V, ambient to 100°C</li> <li>Flow – Turbine flow sensor 1No,O/P=0 to 2.5V, 0-150LPM</li> </ul>	<ul style="list-style-type: none"> <li>Flow turbine sensor 1no, O/P 0-2.5V, 0-200LPH.</li> <li>2Nos. Level sensors WC pressure sensor 0 to 500mm, O/P 0 to 2.5V.</li> </ul>	<ul style="list-style-type: none"> <li>pH sensor using combine glass electrode, for indicating pH between 0 to 14pH, &amp; PID control between 3 to 6pH, with conditioning circuitry with PH transmitter / O/P 4 – 20mA.</li> <li>Conductivity sensor consisting of using dual plate glass electrode conductivity cell, conductivity transmitter O/P 4 to 20mA</li> </ul>	
5	Control Valve	Pneumatically operated air to close, linear type, 1/2" size Diaphragm operated, CV = 0.4 with I to P. Converter I/P 4 to 20mA O/P 3 to 15 psi.	Fraction HP universal motor operated variable speed pump driven from TAP panel, I/P 0 to 2.5V O/P 0 to 195Vdc, 0-3000RPM	Pneumatically operated air to close, linear type, 1/2" size Diaphragm operated, C = 0.4 with I to P. Converter I/P 4 to 20mA O/P 3 to 15 psi. TAP panel : Phase controlled full bridge (200Vdc) Thyristorised actuator of 750W for temp. control. I/P 0 to 2.5Vdc.	2Nos of variable speed motorized pump driven from TAP panel(2Nos.) I/P 0 to 2.5 V O/P 0 to 195Vdc 0 to 4000RPM	Pneumatically operated air to close, linear type, 1/2" size Diaphragm operated, CV = 0.4 with I to P. Converter I/P 4 to 20mA O/P 3 to 15 psi.	
6	Rotameter	2 nos., Acrylic body 1/2" size 0 to 200LPH	2 nos.,Acrylic body 1/2" size 0 to 200LPH	2 nos., Acrylic body 1/4" size 0 to 50LPM	1No, Acrylic body 1/2" size 0 to 200LPH	-	
8	Generation & Distribution pump	1 no. 0.062KW, 1/12HP, 2800RPM, 1/2" outlet, 500 LPH. Head 9 meters, with brass impeller	1 no. 0.062KW, 1/12HP, 2800RPM, 1/2" outlet, 500 LPH. Head 9 meters, with brass impeller + 1no. AC motor pump (8 mtr head ) for wild flow .	230VAC 10W submersible water pump (optional) with 1/4" pvc pipe to fill in process vessel for temp. Control expt. (optional)	2No. 0.06KW, 1/12 HP, 2800RPM	1 no. 0.062KW, 1/12HP, 2800RPM, 1/2" outlet, 500 LPH. Head 9 meters, with brass impeller + 1no. AC motor pump (8 mtr head ) for wild flow .	
9	Bourdon pressure gauges	4 Nos.(0 to 2 bars = 3 nos., 0 to 500mm of water column= 1no.)	4 Nos.(0 to 2 bars = 4 nos., 0 to 500mm of water column= 1no.)	2 Nos. 0 to 2 bars, 2Nos 0 to 10 bar	4 Nos.(0 to 2 bars = 4 nos., 0 to 500mm of water column= 1no.)	2 Nos.(0 to 2 bars)	
10	Manual SS valve	1/2" size =6 nos., 1/4" size = 3 nos.	1/2" size =6 nos., 1/4" size = 3 nos.	1/4" size = 7 nos.	1/2" size =6 nos., 1/4" size = 3 nos.	-	
11	Piping material/size	Stainless steel 1/2" for water, 1/4" for air	Stainless steel 1/2" for water, 1/4" for air	Stainless steel , 1/4" for air	Stainless steel 1/2" for water, 1/4" for air	Stainless steel 1/2" size for water 1/4" for air	
12	Air filter and regulators (AFR)	2 nos, 0 to 10 bars, size 1/4", Oil catcher (1/4" size max. pressure = 10 bars) – 1No.	1 nos, 0 to 10 bars, size 1/4"	3 nos , 0 to 10 bars size 1/4" Oil catcher (1/4" size max. pressure = 10 bars)-1No.	3 nos, 0 to 10 bars, size 1/4"	1 nos, 0 to 10 bars, size 1/4", Oil catcher (1/4" size max. pressure = 10 bars) – 1No.	
13	Air compressor	0 to 7 bars, 1/2 HP, 230VAC supply (optional)	--	0 to 7 bars, 1/2 HP, 230VAC supply (optional)	--	0 to 7 bars, 1/2 HP, 230VAC supply (optional)	
14	Mech. size/wt	940(W) X 1176(H) X 305(D)mm 55kg.					
15	Advance Control Experiments -uRatio -Cascade -Feedforward	Transfer function determination Ziglor Nicholas PID tuning.  Between 2 water flows Inner (fast) loop flow, outer (slow) loop level Water flow disturbance on level loop.				Transfer function determination Ziglor Nicholas PID tuning.	1) Provision to change/disturb the pH in the reaction tank from 3 to 6pH.  2) Provision to change/Disturb the conductivity of the water in the REACTION tank from 200uSi/cm to 500uSi/cm & its PID control.
16	List of Optional experiment's *Ask for quotation	1) Study of different control valves (equal %, quick opening) using S/W based gain scheduler. 2) Study of V to I & I to P converters. 3) 10 segment gain scheduler & split phase control.	-	1)Study of different control valves (equal %, quick opening) using S/W based gain scheduler. 2) Study of V to I & I to P converters. 3) 10 segment gain scheduler & split phase control.	-		

