

DEPARTMENT OF CHEMICAL ENGINEERING
University of Engineering & Technology, Lahore

Instrumentation and Control Lab

Introduction

Instrumentation and Control laboratory provides a “hands-on” environment that is crucial for developing students’ understanding of theoretical concepts. Instrumentation and Control laboratory is housed with different instruments like temperature measurement, level detection, pressure measurement, flow measurement etc and different types of valves, e.g., solenoid valves, servo valves, etc. On different panels or rigs these are arranged in different control configurations to achieve specific control objectives.

List of Equipment

1. pH process rig
2. Basic process rig
3. Temperature process rig
4. Dead weight calibrator
5. Iron-constantan thermocouple
6. Instrument air preparation unit
7. Temperature control apparatus
8. Pressure process rig
9. Process plant trainer

Details of Equipment

pH Process Rig

pH process rig is designed to demonstrate the problems associated with the control of processes for treatment of industrial effluents. It is a self-contained educational platform for the teaching of pH level control and effluent treatment methods. The pH rig comprises two independently pumped fluid circuits mounted on a bench-top panel which allows the study of the principles of process control using the pH of the mixed effluent and reagent fluids as the process variable. The system is suitable for individual student work or for group demonstrations.



Basic Process Rig

Basic process rig is a dual compartment tank, linked to a sump tank by manual and solenoid operated valves. Water is pumped through the system via a variable flow meter and servo valve. Level is measured in the process tank. Flow is measured by a pulse flow sensor.



Temperature Process Rig

Temperature process rig uses water as both a process fluid and a secondary cooling circuit. Rig comprises of a bench-mounted temperature rig with temperature sensors, process interface and controllers. It can be used with level and flow rig.



Dead-Weight Calibrator

Dead weight calibrator works on the principle of Pascal's Law. A Bourdon gauge is supplied for calibration.



Iron-Constantan Thermocouple

Iron-constantan thermocouples are low cost devices used to measure temperatures up to 800 °C. These iron-constantan thermocouples are often referred to as J-type thermocouples. Time constant for these types of thermocouples is determined on lab scale.



Instrument Air Preparation Unit

Instrument air preparation unit is used for the preparation of dust-free and moisture-free air that should also be at a regulated pressure. For these purposes filters, adsorption columns and pressure control valves are provided.



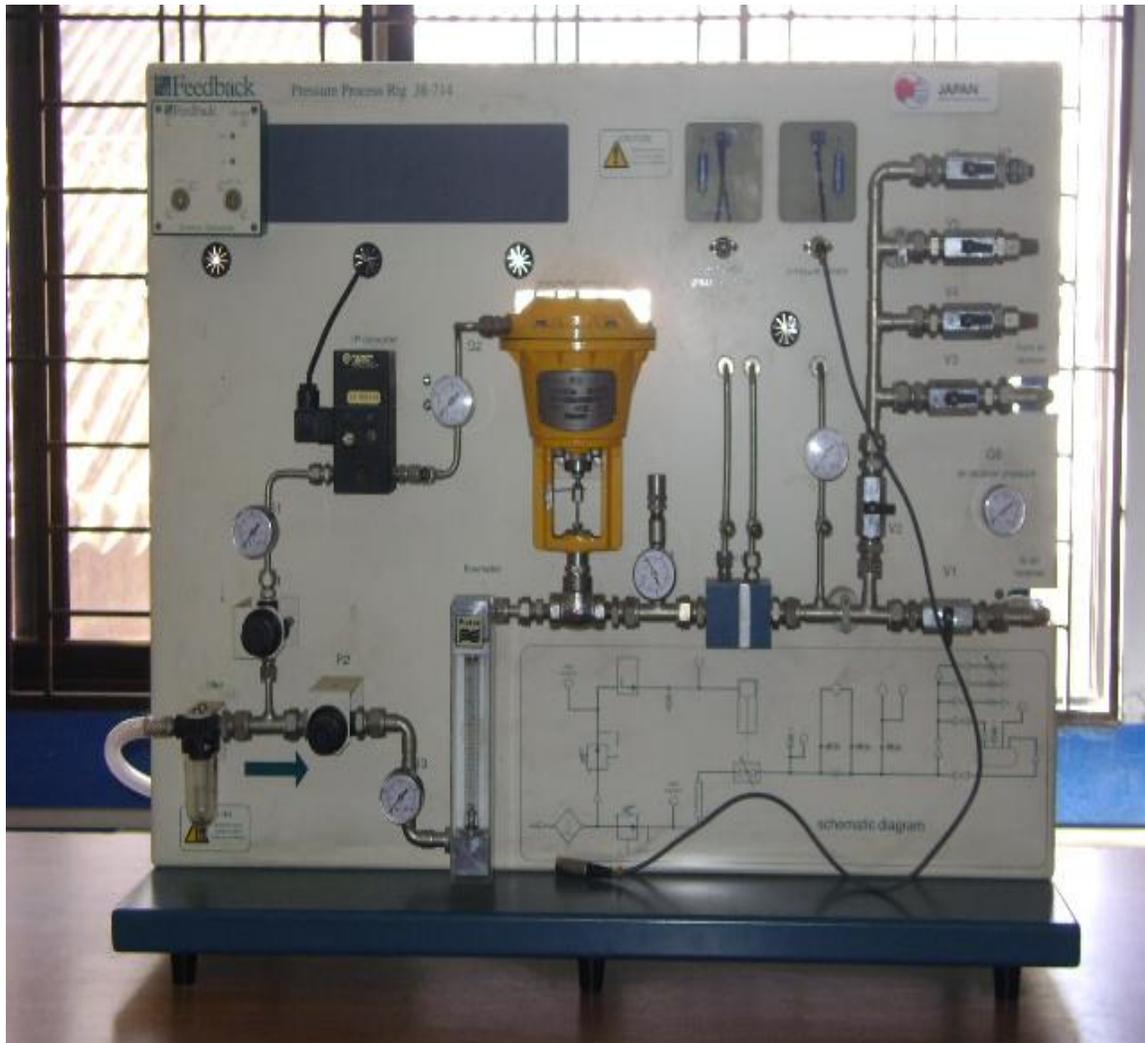
Temperature Control Apparatus

Temperature control apparatus is using water as the process fluid. It allows us to manually control the outlet temperature of process fluid by controlling the hot and cold water flow rates.



Pressure Process Rig

Pressure Process rig is a pneumatic control system which allows study of the principles of process control pressure as the process variable to be controlled. Calibration as well as linearity & hysteresis of pressure sensors and transmitter were conducted.



Process Plant Trainer

Process Plant Trainer can be used to demonstrate a complete range of process control methods and strategies. Manual control, single feedback loops, through to sophisticated cascade loops, etc. are available. The student is presented with real process control problems, with realistic dynamic behavior and instabilities. The process plant incorporates a three-stage plate heat exchanger heated from a hot water circulator, two independent feed tanks, a holding tube with product divert valve and two variable-speed peristaltic pumps. Temperature, level, flow and conductivity control loops are also provided to effects of dead time.



List of Experiments

1. To calibrate the pH probe and pH transmitter.
2. To manually control the pH in the process tank by controlling the flow rates of reagent and effluent.
3. To study the operation of solenoid and servo control valves.
4. To study the operation of Centrifugal pump, Manual valve, Visual flow meter and Servo valve.
5. Calibration of a pressure gauge using a dead weight calibrator.
6. To determine the time constant of a typical Iron-Constantan thermocouple.
7. Preparation of instrument air, free of dust and moisture to control the operation of instruments. The instrument air should be at a regulated pressure.
8. Manual control of process fluid outlet temperature.
9. To calibrate the pressure sensor and pressure transmitter and to investigate the linearity and hysteresis of the sensor/transmitter.
10. Calculating heat transfer coefficients for the heating section of the plate heat exchanger.