PROCESS CONTROL

The subject of process control has became increasing important in recent years. Process control is essential industry for meeting global competition, more stringent environmental and safety regulations and tighter product quality specifications. The **SOLTEQ**® equipment allows students to have a good grasp of the fundamentals and principles of process control. Both theory and industrial practice are emphasized. Our product range covers testing and calibration of instruments, study of system dynamics, pneumatic control, single loop control, multiloop and multivariable control and advanced process control. The concepts of on/off control, proportional control, proportional/integral and proportional/integral/derivative (PID) control are demonstrated.

Physical processes are designed for control level, flow rate, pressure, temperature and pH. Students are introduced to the tuning methods of PID controller. Programmable logic controller (PLC), programmable automation controller (PAC) and distributed control system (DCS) are employed. Our product range covers both bench top and mini pilot plant study.

SOLTEQ®

PROCESS CONTROL

Equipment List

MODEL NO.	EQUIPMENT NAME	
Measurement & Calibration Trainer		
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SE 110-2	Smart Instrumentation Calibration Bench	1
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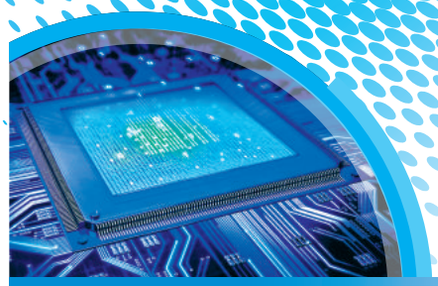


SOLTEQ®

PROCESS CONTROL

Equipment List

MEASUREMENT & CALIBRATION TRAINERS

Instrumentation Calibration Bench (Model : SE 110-1) EI

This **Instrumentation Calibration Bench** is a complete laboratory bench for test and calibration of various instrument signals such as pressure, voltage and mA. High accuracy instrumentations such as pressure regulators and test gauges, digital meters are provided.

This unit consists of:

a) Instrument workbench
b) In strument workbench console

- Pressure regulators
- Air supply regulator
- Source power
- Socket outlet
- Power supply
- Process panel meter
- Air supply
- Pressure test gauge

Smart Instrumentation Calibration Bench (Model : SE 110-2) EI

This **Smart Instrumentation Calibration Bench** is a complete laboratory bench for test and calibration of various instrument signals such as pressure, voltage and mA. High accuracy instrumentations such as pressure regulators and test gauges, digital meters are provided.

This unit consists of:

a) Instrument workbench
b) In strument workbench console

- Pressure regulators
- Air supply regulator
- Source power
- Socket outlet
- Power supply
- Process panel meter
- Air supply
- Pressure test gauge
- Calibration software for smart instruments

Optional:

Smart Calibrator for

- Hart
- Foundation Fieldbus

Experimental Stand For Flowmeters (Model : SE 111) SOLDAS SOLCAL EI

This **Experimental Stand For Flowmeters** is designed to introduce student to various types of flow meters commonly found in industrial applications.

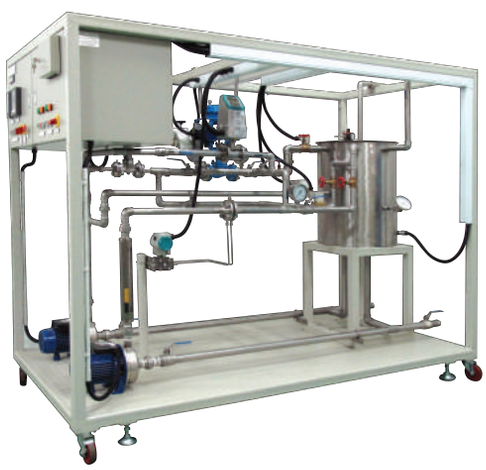
This unit consists of:

- Integral orifice with differential pressure transmitter
- Rotameter
- Magnetic flowmeter
- Coriollis flowmeter
- Flow control valve with controller and recorder
- Stainless steel sump tank and calibration tank
- Circulation pump

Experimental capabilities:

- Magnetic flowmeter
- Coriolis flowmeter
- Integral orifice with differential pressure transmitter
- Variable area flowmeter

Experimental Stand for Control Valves (Model : SE 112) SOLDAS SOLCAL EI



This **Experimental Stand for Control Valves** is designed for demonstration of typical control valves characteristics.

This unit consists of:

- Linear control valve
- Equal percentage control valve
- Quick opening valve
- Controller and recorder
- Stainless steel sump tank with circulation pump

Experimental capabilities:

- Linear
- Equal percentage
- Quick opening

Level Measurement and Calibration Experiment System (Model : SE 301) EI

This **Level Measurement and Calibration Experiment System** is designed for students to study the principles of level measurement and site calibration.

This unit consists of:
- Differential pressure transmitter
- Recorder

Experimental capabilities:
- Hydrostatic principle (bubbler tube)
- Direct mounted level transmitter
- Open/Closed tank

Density Measurement and Calibration Experiment System (Model : SE 302) EI

This **Density Measurement and Calibration Experiment System** is designed for students to study the principles of density measurement and site calibration.

This unit consists of:
- Differential pressure transmitter
- Recorder
- Stainless steel sump tank and density measurement tank
- Circulation pump

Experimental capabilities:
- Density measurement at different liquid composition
- Density measurement methods study
- Calibration of various density transmitter
- Configurations and parameters study of density transmitter
- Effects of temperature and pressure on density measurement
- Demonstration of instrumental set-up and installation
- ISO 9000 Standard Calibration Procedure

Water Flow Measurement and Calibration Experiment System (Model : SE 303) EI

This **Water Flow Measurement and Calibration Experiment System** is designed for students to study various types of flow measurement devices as well as site calibration.

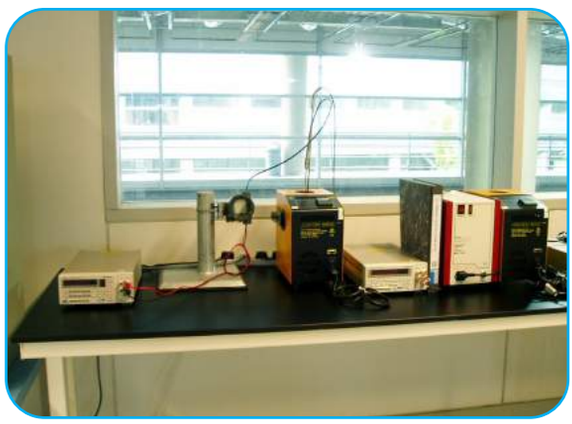
This unit consists of:

- Orifice flow meter
- Magnetic flow meter
- Variable flow meter
- Stainless steel sump tank and calibration tank
- Circulation pump
- Differential pressure transmitter
- Recorder

Experimental capabilities:

- DP transmitter across an orifice
- Electromagnetic flow meter
- Variable area flow meter

Temperature Measurement and Calibration Experiment System (Model : SE 304) EI



This **Temperature Measurement and Calibration Experiment System** is designed to study the principles of temperature measurement as well as hands on experience on the configuration and calibration of transmitter. It demonstrates various temperature measurement methods and calibration used by industries.

This unit consists of:

- Constant temperature bath
- Resistive temperature detector sensor
- Thermocouple sensors
- Temperature transmitters

Experimental capabilities:

- Temperature measurement using RTD sensor
- Temperature measurement using Thermocouple Type K
- Temperature measurement using Thermocouple Type J
- Temperature measurement using Thermocouple Type T
- Temperature measurement comparison study
- Configurations and parameters study of temperature transmitter
- Demonstration of instrumental setup and calibration

pH Measurement and Calibration Experiment System (Model : SE 306) EI

This **pH Measurement and Calibration Experiment System** is designed for students to study pH measurement and site calibration.

Experimental capabilities:

- pH measurement
- Configurations and parameters study of pH sensor/transmitter

Temperature Measurement Apparatus (Model : HE 151)

This **Temperature Measurement Bench** is a complete, self contained apparatus to demonstrate fundamental temperature measuring and calibration techniques.

The unit consists of:

- Thermocouples
- Mercury in glass thermometer
- Resistance temperature detector (RTD)
- Bimetalic temperature indicator
- Platinum resistance thermometer
- Thermistor
- Vapor pressure thermometer

Experimental capabilities:

- The Peltier and Seebeck thermoelectric effect
- Reference junctions
- The law of intermediate metals and temperatures

Pressure Measurement Bench (Model : FM 01B)

This **Pressure Measurement Bench** is a complete laboratory bench for test and calibration of different type of pressure measuring elements.

This unit consists of:

- Pressure gauge
- Vacuum gauge
- Differential pressure gauge
- U-tube manometer
- Single tube manometer
- Inclined tube manometer
- Pressure calibrator

Pressure/Vacuum pump and tanks are also provided.

Experiment capabilities:

- Pressure measurement comparison by manometer and bourdon gauges
- Error determination for gauges
- Pressure gauges calibration

Flowmeter Measurement Apparatus (Model : FM 101)

This **Flowmeter Measurement Apparatus** is designed to introduce students to the operating characteristics of various types of flometers. The flometers are installed in a series configuration to permit comparison.

This unit consists of:

- A rotameter
- A venturi
- An orifice meter

Experimental capabilities:

- Application of the Bernoulli's equation for incompressible fluids
- Determination of flow coefficient of venturi and orifice meter
- Establish the relationship between flow and differential pressure/fluid velocity for venturi meter and orifice plate

This equipment requires Hydraulic Bench (Model: FM 110) to operate.

BENCH TOP PROCESS CONTROL TRAINING UNITS

Demonstration 3-Term Controller (Model : SE 200)

This **Demonstration 3-Term Controller** unit is developed for introducing students to principles of pneumatic 3-term controller. The operations of differential bellows, feedback bellows, nozzle and flapper assembly, pneumatic relay are shown. A pressure process with control valve is included.

This unit consists of:

- Pneumatic control valve with pneumatic controller
- Mild steel pressure control tank
- Instrumentation for pressure and flow rate measurements

Experimental capabilities:

- Controller alignment
- Demonstration and calibration of controller gain (or proportional band)
- Integral action time
- Derivative action time
- PID loop tuning

Process Control Simulator (Model : SE 201) SOLDAS SOLCAL EI

This **Process Control Simulator** is designed to provide students with hands-on experience on control techniques. The unit will simulate a process containing three first order lags, two of which are changeable to pure integrators, plus an approximated distance velocity or transport lag. The unit consists of three main elements: the controller, the non-linear unit, and the process trainer unit.

This unit consists of:

- Heating element
- Fan
- Controller
- Orifice air flow meter

Experimental capabilities:

- Open loop 2-step control
- Open/Closed loop proportional P, PI, PID control
- Loop tuning
- Effects of deadband
- Non-linear control

Bench Top Process Control Trainer (Model : SE 202) SOLDAS SOLCAL EI

This **Bench Top Process Control Trainer** is designed to introduce students to basic control principles and theory of industrial process control system. The unit is a scaled down process model of an industrial process where flow, temperature and batch process control are commonly found. Optional level control and control valve can also be integrated into this system.

This unit consists of:

- Plexiglass reservoir vessel
- Circulation pump
- Control valve
- Controller
- Variable flow meter

Experimental capabilities:

- ON/OFF control
- Open loop control
- Closed loop control
- PID control
- Loop tuning

Bench Top Multiprocess Control Unit (Model : SE 229) EI

This **Bench Top Multiprocess Control unit** is designed to use water process for safe and practical experiments on flow, pressure, level and temperature control.

This unit consists of:

- Process vessel – with stirrer
- Level and pressure sensor
- Temperature sensor
- Vent valve
- Heat exchanger
- Heating loop
- Cooling loop

Experimental capabilities:

- Flow, level, pressure and temperature control
- Cascade control
- Ratio control loops
- Multi-loop control

Modular Flow Process Control Trainer (Model : SE 270-1) SOLDAS SOLCAL EI

This **Modular Flow Process Control Trainer** is designed for the demonstration of flow control.

This unit consists of:
- Water Pump Tank
- Centrifugal Pump
- Level Transmitter
- Control Valve
- Microprocessor Controller

Experimental capabilities:
- Demonstration of Proportional Control
- Demonstration of P + Integral Control
- Demonstration of PI + Derivative Control
- PID Loop Tuning for optimum Control

Modular Level Process Control Trainer (Model : SE 270-2) SOLDAS SOLCAL EI

This **Modular Level Process Control Trainer** is designed for the demonstration of level control.

This unit consists of:
- Water Pump Tank
- Centrifugal Pump
- Level Transmitter
- Control Valve
- Microprocessor Controller

Experimental capabilities:
- Demonstration of Proportional Control
- Demonstration of P + Integral Control
- Demonstration of PI + Derivative Control
- PID Loop Tuning for optimum Control

Modular Pressure Process Control Trainer (Model : SE 270-3) SOLDAS SOLCAL EI

This **Modular Pressure Process Control Trainer** is designed for the demonstration of pressure control.

This unit consists of:
- Water Pump Tank
- Centrifugal Pump
- Level Transmitter
- Control Valve
- Microprocessor Controller

Experimental capabilities:
- Demonstration of Proportional Control
- Demonstration of P + Integral Control
- Demonstration of PI + Derivative Control
- PID Loop Tuning for optimum Control

Modular Temperature Process Control Trainer (Model : SE 270-4) SOLDAS SOLCAL EI

This **Modular Temperature Process Control Trainer** is designed for the demonstration of temperature control.

This unit consists of:

- Water Pump Tank
- Centrifugal Pump
- Level Transmitter
- Control Valve
- Microprocessor Controller

Experimental capabilities:

- Demonstration of proportional control
- Demonstration of P + integral control
- Demonstration of P1 + deriviative control
- PID loop tuning for optimum control

Modular pH Process Control Trainer (Model : SE 270-5) SOLDAS SOLCAL EI

This **Modular pH Process Control Trainer** consists of a chemical waste treatment process where an alkaline is used to neutralize an acidic waste. The principles of pH measurement and control can be studied.

This unit consists of:

- Chemical Dosing Pump
- Circulation Pump
- pH Sensor/Monitor
- Agitator
- Tank
- Deionoser
- pH Controller

Experimental capabilities:

- To control the pH of the process by using the PID controller as an ON-OFF controller.
- Demonstrate the effect of the proportional band (PB) on the control of pH.
- To demonstrate the effect of proportional + intergral (P+1) action on the control of pH.
- To demonstrate further improvement by implementing linear control of pH in (optional)

BASIC PROCESS CONTROL TRAINERS

Pressure Control Trainer (Model :SE 101) SOLDAS SOLCAL EI

This **Pressure Control Trainer** is designed to provide students with hands on experience on a pressure control loop using a microprocessor based controller.

This unit consists of:

- Mild steel air receiver tank and control tank
- Controller with recorder
- Control valve
- Instrumentation for pressure measurements

Experimental capabilities:

- Demonstration of safety protection by using a pressure relief valve
- Calculation of control valve sizing
- Closed loop P, PI, PID control
- Loop tuning for optimum control

Flow Control Trainer (Model :SE 102) SOLDAS SOLCAL EI

This **Flow Control Trainer** is designed to provide students with hands on experience on a flow control loop using a microprocessor based controller.

This unit consists of:

- Stainless steel sump tank and calibration tank
- Circulation pump
- Control valve
- Controller with recorder
- Orifice flow meter
- Venturi flow meter
- Magnetic flow meter

Experimental capabilities:

- Various types of flowmeter measurement and accuracy check
- Control valve sizing
- Closed loop P, PI, PID control
- Loop tuning for optimum control

Level Control Trainer (Model :SE 103) SOLDAS SOLCAL EI

This **Level Control Trainer** is designed to provide students with a better understanding on tank level measurement and control using a microprocessor based controller.

This unit consists of:

- Stainless steel sump tank and level control tank
- Circulation pump
- Control valve
- Controller with recorder
- Level transmitter

Experimental capabilities:

- Level transmitter calibration
- Open and close tank level measurement
- Control valve sizing
- Closed loop P, PI, PID control
- Loop tuning for optimum control

Temperature Control Trainer (Model :SE 104) SOLDAS SOLCAL EI

This **Temperature Control Trainer** is designed for demonstration on how a temperature loop for a heat exchanger can be controlled using a microprocessor based controller.

This unit consists of:

- Stainless steel hot and cold water tank
- Circulation pump
- Plate heat exchanger
- Control valve
- Controller with recorder
- Temperature transmitter

Experimental capabilities:

- Control valve sizing
- Closed loop ON/OFF, P, PI, PID control
- Loop tuning for optimum control

Fire and Gas Detection System (Model :SE 109) SOLDAS SOLCAL EI

This **Fire and Gas Detection System** is packaged for classroom training and demonstration in Field devices section and Control section.

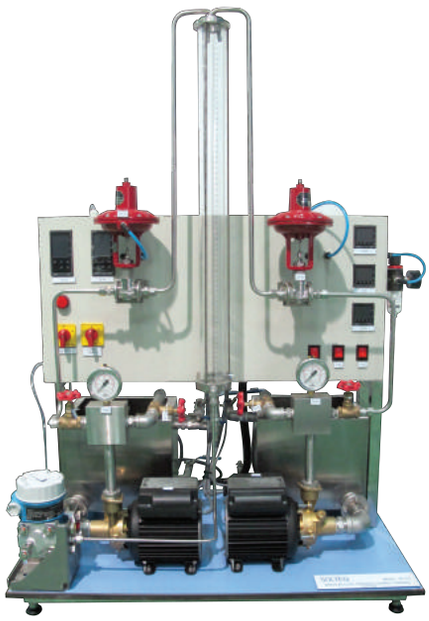
This unit consists of:

- Microprocessor Controlled Alarm System
- Catalytic Gas Detector
- Smoke Detector
- Heat Detector
- Breakglass Detector Station
- Control Potentiometer
- Solenoids A and B

Experimental capabilities:

- Demonstrating gas detection
- Demonstrating heat detection
- Demonstrating smoke detection
- Demonstrating breakglass detection
- Demonstrating 4-20 mA detection
- Demonstrating suppressant system
- Demonstrating internal fault detection of battery or main supply failure and electrical open detector circuits and open alarm circuits

Modular Process Control Trainer (Model : SE 271) SOLDAS SOLCAL EI



This **Modular Process Control Trainer unit** is designed to use water process for safe, practical experiments on water level control, and temperature control. The control processes can either be carried individually or combined for MIMO control study.

This unit consist of:

- Process tank
- Heating loop
- Cooling loop

Experimental capabilities:

- Demonstration of proportional control
- Demonstration of P + integral control
- Demonstration of PI + derivative control
- PID loop tuning for optimum control
- MIMO process control

The following models are the more compact version for basic process control trainer:

Pressure Control Trainer (Model : SE 401) SOLDAS SOLCAL EI

Flow Control Trainer (Model : SE 402) SOLDAS SOLCAL EI

Level Control Trainer (Model : SE 403) SOLDAS SOLCAL EI

Temperature Control Trainer (Model : SE 404) SOLDAS SOLCAL EI

pH Control Trainer (Model : SE 405) SOLDAS SOLCAL EI

This **pH Control Trainer** is designed to study principles of pH measurement and provide students with hands-on experience on how a pH loop can be controlled using a microprocessor based controller.

This unit consists of:

a) Acrylic / PVC feed tanks and mixing tank
b) Dosing pump and circulation pump
c) pH sensor
d) Controller with recorder

Experimental capabilities:

- To control pH of process with an ON-OFF controller
- To demonstrate effect of proportional band (PB) on control of pH
- To demonstrate effect of proportional + integral (P+I) action on control of pH
- To demonstrate further improvement by implementing non-linear control

ADVANCED PROCESS CONTROL TRAINERS

Analytical Control Trainer (Model : SE 105) SOLDAS SOLCAL EI

This **Analytical Control Trainer** consists of an acid-alkali process and a self-contained chemical waste treatment process. It is designed to study the principles of measurement of typical industrial analytical parameters such as pH, ORP, conductivity and dissolved oxygen. This plant also allows for the control of pH and conductivity.

This unit consists of

- Process tanks with process pumps
- Controller with recorder
- Instrumentation for pH. ORP, dissolved oxygen and conductivity measurements

Experimental capabilities:

- pH, ORP, conductivity and dissolved oxygen measurement
- ON/OFF, PID, self-tuning, non-linear gain for pH control
- Effects of air sparging and variation of mixer speed on DO measurement
- Fault simulation

Boiler Heating Batching Control Trainer (Model : SE 107) SOLDAS SOLCAL EI

This **Boiler Heating Batching Control Trainer** consists of a liquid based process system design to study a simulated boiler drum producing hot water to heated the product water from a batching tank via a shell and tube heat exchanger.

This unit consists of:

- Process tanks with process pumps
- Control valve
- Controller with recorder
- Shell and tube heat exchanger
- Instrumentation for pressure, level, differential pressure and temperature measurements

Experimental capabilities:

- 1, 2 and 3 elements boiler drum level control
- Single and cascade heat exchanger temperature control
- Level tank control
- Fault simulation

Experimental Stand for Ratio Control (Model : SE 113) SOLDAS SOLCAL EI

This **Experimental Stand for Ratio Control** is designed to introduce students to ratio control in relation to a single loop flow control.

This unit consists of:

- Stainless steel sump tank
- Circulation pump
- Control valve
- Controller with recorder
- Orifice flow meter with differential pressure transmitter

Experimental capabilities:

- Closed loop P, P1, PID flow control
- Loop tuning for optimum control
- Ratio control
- Fault simulation

Air Pressure Control Trainer (Model : SE 121) SOLDAS SOLCAL EI

This **Air Pressure Control Trainer** is designed to provide student with hands-on experience on how a pressure loop can be controlled using a microprocessor-based controller.

This unit consists of:

- Mild steel receiver tank and pressure control tank
- Control valve
- Controller with recorder
- Pressure transmitter

Experimental capabilities:

- Closed loop P, PI, PID control
- Loop tuning for optimised control
- Control valve sizing
- Fault simulation

Air Flow Control Trainer (Model : SE 122) SOLDAS SOLCAL EI

This **Air Flow Control Trainer** is designed to provide students with hands-on experience on how an air flow loop can be controlled using a microprocessor based controller.

This unit consists of:

- Mild steel receiver tank and buffer tank
- Control valve
- Controller with recorder
- Instrumentation for flow rate, pressure and temperature measurements

Experimental capabilities:

- Volumetric air flow measurement using rotameter and orifice meter
- Mass flow measurement with pressure and temperature compensation
- Closed loop P, PI, PID control
- Loop tuning for optimum control
- Control valve sizing calculation
- Fault simulation

Air Temperature Control Trainer (Model : SE 124) SOLDAS SOLCAL EI

This **Air Temperature Control Trainer** is designed to provide students with hands-on experience on how a temperature loop of an air heat exchanger can be controlled using a microprocessor based controller.

This unit consists of:

- Air heater / exchanger
- Mild steel receiver tank
- Controller with recorder
- Instrumentation for pressure and temperature measurements

Experimental capabilities:

- Air temperature measurement using RTD sensor and thermocouple
- ON/OFF, P, PI, PID, auto selector control
- Loop tuning for optimum control
- Fault simulation

Air Pressure Control Trainer (Model: SE 121), Air Flow Control Trainer (Model: SE 122) and Air Temperature Control Trainer (Model: SE 124) can be interconnected to form a bigger plant.

Heat Exchanger Control Trainer (Model : SE 134) SOLDAS SOLCAL EI

This **Heat Exchanger Control Trainer** is designed to provide students with hands-on experience on how product temperature of a shell and tube heat exchanger can be controlled using a microprocessor based controller.

This unit consists of:

- Stainless steel hot and cold water tank
- Shell and tube heat exchanger
- Circulation pump
- Control valve
- Controller with recorder
- Instrumentation for temperature and flow rate measurements

Experimental capabilities:

- Control valve sizing
- Closed loop ON/OFF, P, PI, PID control
- Loop tuning for optimum control
- Fault simulation
- Flow/Temperature cascade control

Steam Condensation Unit (Model : SE 182) SOLDAS SOLCAL EI

This **Steam Condensation Unit** is designed to allow students to have an overview on the effect of cooling water flowrate on the condensation of steam. The flow of cooling water will be regulated by using a control valve with PID input. Fuzzy Logic controller is optional for the equipment with additional requirement MATLAB and Fuzzy Logic Toolbox.

This unit consists of:

- Sell and tube heat exchanger
- Steam generator
- Control Valve

Experimental capabilities:

- Effect of cooling water flowrate on the condesation of steam

Flow and Pressure Control Trainer (Model : SE 664) SOLDAS SOLCAL EI

This **Flow and Pressure Control Trainer** is designed for demonstration of the functionality of microprocessor based controller. The equipment exhibits a realistic working environment of a typical flow process using various types of industrial grade instruments and control strategy.

This unit consists of:

- Stainless steel sump tank and calibration tank
- Control valve
- Controller with recorder
- Instrumentation for flow rate and pressure measurements

Experimental capabilities:

- Flowmeter measurement and accuracy check
- Closed loop P, PI, PID control
- Flow and pressure cascade control
- Split range control

Level and Flow Control Trainer (Model : SE 665) SOLDAS SOLCAL EI

This **Level and Flow Control Trainer** is designed to provide students with a better understanding on control studies of level and flow control. It can also be coupled with a flow metering loop to enable cascade control studies.

This unit consists of:

- Stainless steel sump tank and level control tank
- Circulation pump
- Control valve
- Controller with recorder
- Orifice differential pressure transmitter

Experimental capabilities:

- Level transmitter calibration
- Open/Closed tank level measurement
- Closed loop P, PI, PID control
- Level and flow cascade control studies
- Loop tuning on level/flow control loop

Flow and Temperature Control Trainer (Model : SE 666)

SOLDAS SOLCAL EI

This **Flow and Temperature Control Trainer** is designed to provide students with a better understanding on how flow and temperature processes can be controlled.

This unit consists of:

- Stainless steel hot and cold water tank
- Circulation pump
- Control valve
- Controller with recorder
- Plate heat exchanger
- Flow meter
- Temperature transmitter

Experimental capabilities:

- Closed loop P, PI, PID control
- Flow/Temperature cascade control
- Loop tuning on flow/temperature control loop

Continuous Distillation Column with Process Control (Model : SE 999)

SOLDAS SOLCAL EI

This pilot scale **Continuous Distillation Column** is designed and constructed with the intention of exploring the behaviour and performance of various control strategies employed in a distillation process.

This unit consists of:

- Distillation column with reboiler
- Stainless steel feed tank and product tanks
- Condenser with reflux drum
- Feed pump
- Product pumps
- Vacuum pump

Experimental capabilities:

- Determination of number of theoretical stages
- Effect of reflux ratio
- Various control strategies for level, flow, temperature as well as advanced control strategies for cascade, feedforward and optimisation studies
- Various control strategies to optimise the distillation of binary and complex mixtures typically found in petrochemical refineries

DISTRIBUTED CONTROL SYSTEM AND SCADA

A **Distributed Control System** (DCS) refer to a control system usually of a manufacturing system, process or any kind of dynamic system, in which the controller elements are not central in location but are distributed throughout the system with each component sub-system controlled by one controller.

The entire system may be networked for communication and monitoring. The computer network and field buses will connect the distributed controllers with the central controller and finally to the Human-Machine Interface (HMI) or control consoles.

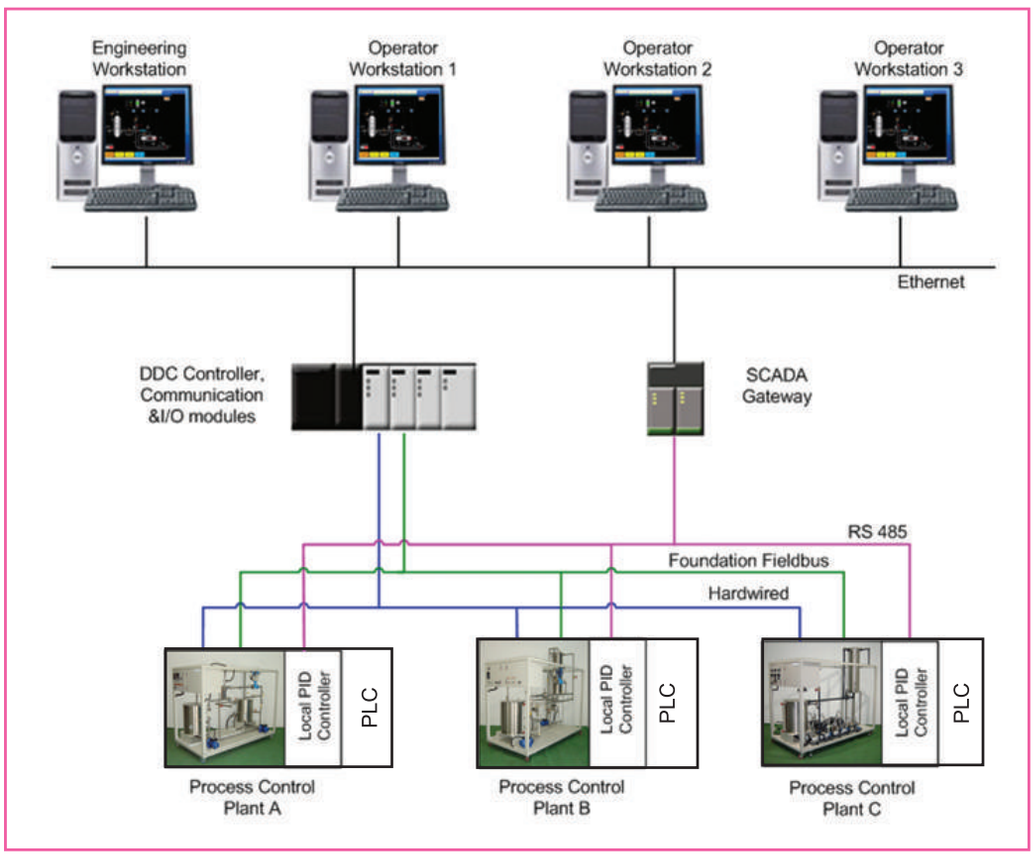


Figure 1: DCS SCADA Architecture

Distributed Control Systems (DCSs) are used in industry to monitor and control distributed equipment with or without remote human intervention; the nomenclature for the former 'manual control' and the latter "automated control'.

DCS may employ one or several workstations and can be configured at the workstation or by an off-line personal computer. Local communication is handled by a control network with transmission over twisted pair, coaxial, or fiber optic cable. A server and/or applications processor may be included in the system for extra computational, data collection, and reporting capabiity

A typical DCS consists of functionally and/or geographically distributed digital controllers capable of executing from 1 to 256 or more regulatory control loops in one control box. The input/output devices (I/O) can be integral with the controller or located remotely via a field network. Instead of being hardwired, field devices can also be connected via the latest communication protocols such as Foundation Fieldbus or Profibus. Today's controllers have extensive computational capabilities and, in addition to proportinal, integral, and derivative (PID) control, can generally perform logic and sequential control.

DCS Operating Modes

There are 3 operating modes in which the prosess plants can be operated, namely:

a) DDC mode
b) SCADA mode
c) Standalone mode

a) DDC Mode

In DDC mode all the PID loops, logic and sequential controls are executed in the DDC controller. The operator stations serve as a Human Machine Interface which can control and monitor the plants remotely.

b) SCADA Mode

In SCADA mode all the PID loops are executed at the local PID controllers. The SCADA gateway serves to communicate with the PID controllers and the operator stations serve as a Human Machine Interface which can control and monitor the plants remotely.

i) SCADA mode PID
ii) SCADA mode PLC

c) Standalone Mode

In standalone mode, the communication linked to the DCS are not established and the PID controllers and panel swithes operate the process plant in standalone mode.

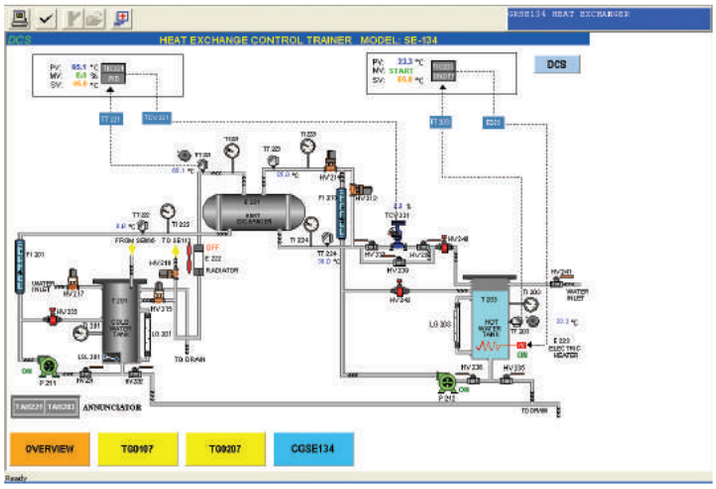


Figure 2: Snapshot of a DCS Graphic Screen

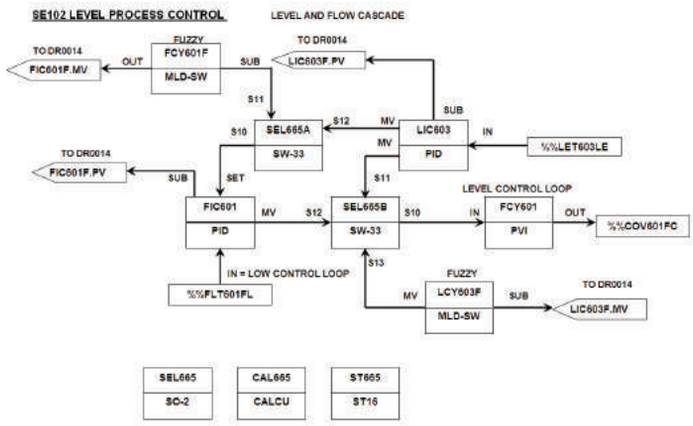


Figure 3: Snapshot of DCS Control Strategy