

# BUILDING SERVICES

Building services engineering is an engineering discipline about the internal and environmental impact of a building. Building services engineers involves with the design, installation, operation and monitoring of the building which include all systems to ensure public health and safety. The **SOLTEQ®** range of products for Building Services Engineering will facilitate students learning on building related systems which include among others air-conditioning, ventilation, alarm, conveying, access, utilities, automation, etc.



## BUILDING SERVICES

### »»» Equipment List

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## BUILDING SERVICES

### Air Conditioning Laboratory Unit (Model: AC 01)

SOLDAS SOLCAL EI



This **Air Conditioning Laboratory Unit** is designed to demonstrate the working principles of air conditioning system.

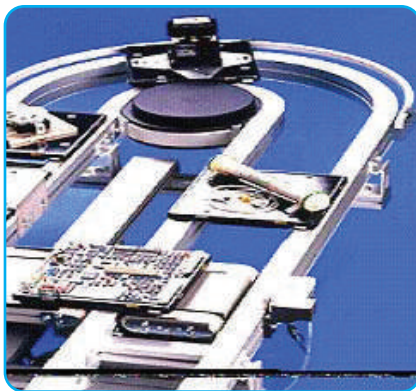
*This unit consists of:*

- Variable speed air blower
- Air humidifier
- Air pre-heater
- Air cooler/refrigerator
- Air re-heater

*Experimental capabilities:*

- Study of the end state properties of each air conditioning components
- Study of the vapour compression refrigeration system
- Determination of thermodynamic properties

### Conveyor Belt Trainer (Model: ACS 01)



This **Conveyor Belt Trainer** is designed to incorporate a conveyor, which carries material, components or assemblies on carrier plates call pallets. The conveyor has a continuously moving belt to transport the pallets to positioning stations where the pallet is stopped and locked into position, ready for work to be done with the material on the pallet. The closed loop pallet conveyor is fully compatible with the ranges of Robots, Machine Tools, ASRS and other hardware elements. It is integrated with the rest of the system software through the use of a special device driver program which supervise the movements of all pallets.

### CCTV System Demonstration (Model: CCTV 1000)



This **CCTV System Demonstration Unit** is designed to demonstrate the students a PC based Digital Surveillance system in the CCTV industry. The unit consists of a video surveillance card, a PC install with card's software, speed dome camera, PTZ camera and a fixed dome camera. It has the abilities to reduce and prevent crime, antisocial behaviours and assist in criminal investigation.

## Corrosion Study Unit

(Model: BP 01) **SOLDAS** **SOLCAL**



This **Corrosion Study Unit** is designed to demonstrate the science of corrosion in industrial processes

*This unit consists of:*

- Eight test cells made of glass with specially machined lids enabling samples to be mounted
- Test specimen pieces of steel, zinc, brass and copper
- Air pump
- pH meter and electrode
- Low voltage supply

*Experimental Capabilities:*

- Effect of pH and DO concentration on corrosion rate
- Study of galvanic action, cathodic protection, electrolytic corrosion and chemical inhibition

## Serial/Parallel Pump Test Rig

(Model: FM 07A) **SOLDAS** **SOLCAL** **EI**



This **Serial/Parallel Pump Test Rig** is designed to demonstrate to students the operating characteristic of centrifugal pump in single configuration, series configuration & parallel configuration. Basic instruments are included to monitor the pump speed, pump head and flow rate.

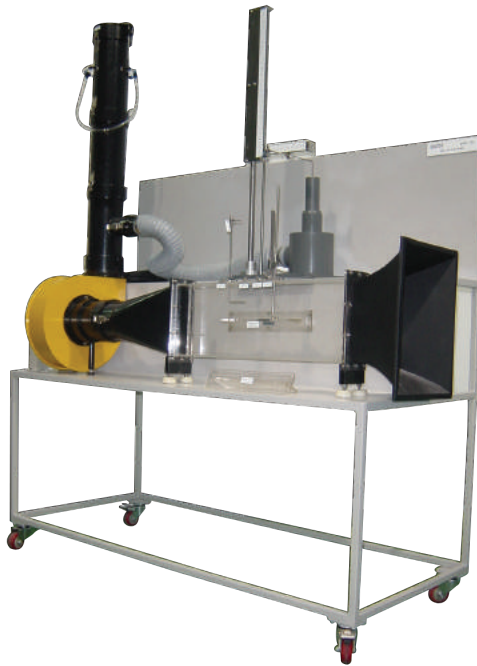
*This unit consists of:*

- 2 units of centrifugal pumps
- Transparent circulation tank
- Suction and delivery pressure gauge
- Rotameter

*Experimental capabilities:*

- Evaluation of inherent pump speed
- Evaluation of pump characteristic curves

## Air Flow Bench (Model : FM 21)



This **Air Flow Bench** Unit is designed to demonstrate the principles of compressible fluid flow, The basic unit comes with a motor driven centrifugal fan for studying air flow characteristics.

*This unit consists of:*

- Centrifugal Fan
- Differential Pressure Transmitter.

The unit can be used with the following accessories for more comprehensive experiments on air flow.

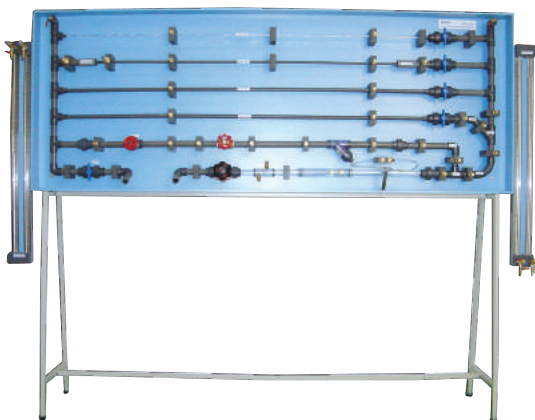
- FM 21A - Multitube manometer test board
- FM 21B - Venturi , orifice and pitot tube flow measurement test sets
- FM 21C - Bernuolli's theorem test set
- FM 21D - Flow around a bend
- FM 21E - Flow in pipes
- FM 21F - Jet dispersion test set
- FM 21G - Boundary layer growth test set
- FM 21H - Wind tunnel demonstration
- FM 21J - Smoke generation system
- FM 21K - Lift and drag forces

*Experimental capabilities*

- Characteristics of fan
- Flow rate measurements using venturi and orifice
- Bernoulli's theorem demonstrations
- Flow around a bend
- Pressure losses in pipes test set
- Jet dispersion measurements
- Determination of boundary layer growth
- Smoke Generation

## Fluid Friction Measurement Apparatus (Model : FM 100)

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This **Fluid Friction Measurement Apparatus** is designed for students to study the fluid friction head losses of an incompressible fluid flow.

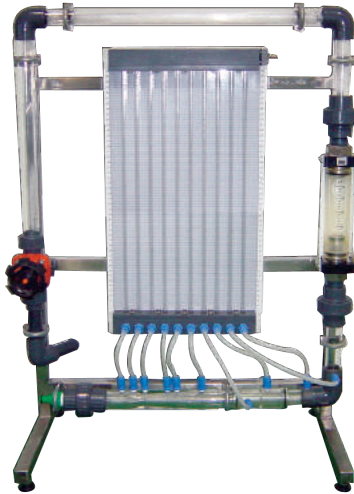
*This unit consists of:*

- Smooth bore pipes of various diameters
- An artificially roughened pipe
- 90° bend, elbow and T
- 45° elbow and Y
- Sudden enlargement and contraction
- Ball, gate and globe valve
- Inline strainer
- Venturi made of clear acrylic
- Orifice plate made of clear acrylic
- Pitot static tube section made of clear acrylic

*Experimental capabilities:*

- Friction losses
- Laminar to turbulent flow regimes on smooth bore pipe of various diameters and an artificially roughened pipe

## Flowmeter Measurement Apparatus (Model : FM 101)



This **Flowmeter Measurement Apparatus** is designed to introduce students to the operating characteristic of various types of flowmeters.

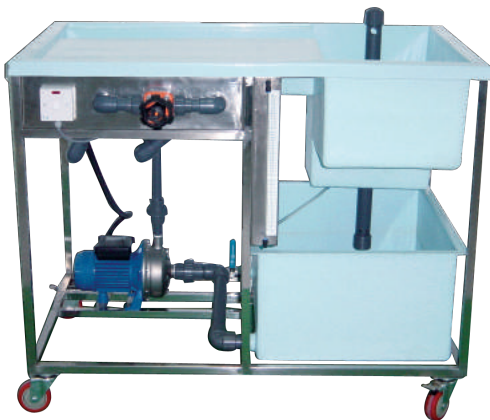
*This unit consists of:*

- A rotameter
- A venturi
- An orifice meter

*Experimental capabilities:*

- Apply Bernoulli equation for incompressible fluids
- Determine flow coefficients of venturi and orifice meter
- Establish the relationship between flow and differential pressure/fluid velocity for venturi meter and orifice plate.

## Hydraulic Bench (Model: FM 110)



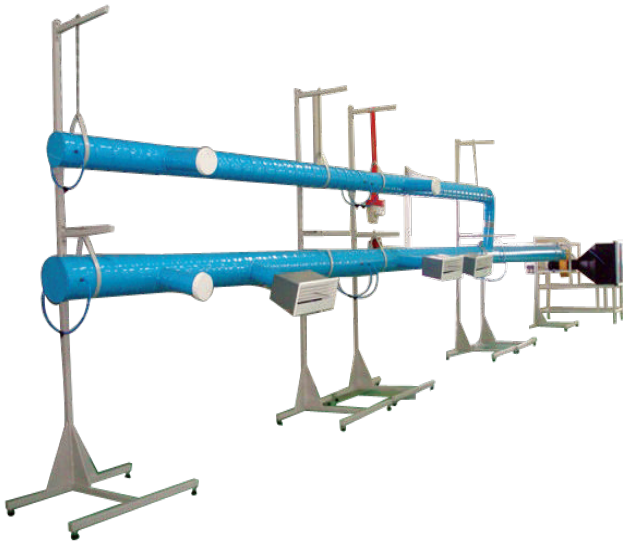
This **Hydraulic Bench** is designed to complement a wide range of accessories for experiments on the subjects of fluid mechanics. The unit consists of upper and lower mouldings mounted on a steel structure fitted with lockable wheels. The mouldings are made of fiberglass for lightweight and corrosion resistant features. An open channel and volumetric measuring tank are incorporated with the bench along with the means for mounting and connecting various accessories.

*This unit consists of:*

- Sump tank and volumetric tank made from fibreglass
- Centrifugal delivery pump

## Ventilation Training Unit (Model : FM 801)

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This **Ventilation Trainer** is designed to demonstrate the basic operation of air ventilation .

*This unit consists of:*

- A forward curved variable speed centrifugal fan
- Integral control panel together with a rectangular air intake and filter holder
- Ducting components (supplied with the unit to enable parallel branch and line balancing experiments to be undertaken)

*Experimental capabilities:*

- Examination of typical components , fabrication , installation and assembly techniques used in air handling systems
- Investigation of pressure losses in bends, branches , changes of section and over straight lengths of duct together with the variation in pressure drop with velocity
- Determination of the 'k' factor for the pressure loss of the above components in each particular configuration
- Investigation of the fan pressure and volume flow characteristics at various fan speed
- Examination of standard types of panel and bag filters and their pressure drop against face velocity
- Measurement of air flow rate using air velocity meter

## Gas Alarm Control Unit (Model: GA 102)



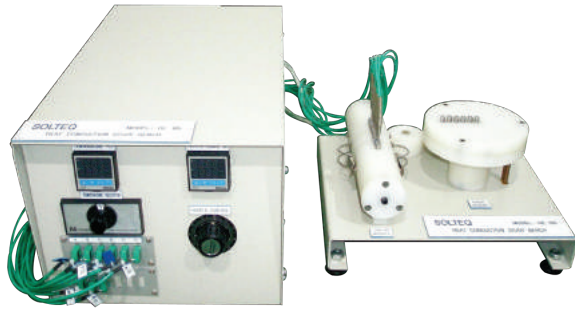
This **Gas Alarm Control Unit** is designed to demonstrate to students for monitoring the gas fire suppression system. It can be activated to demonstrate the sequent of events and alert warning leading to the gas discharge stage. This control panel can be used to activate all type of gases. Students can learn the important of this fire protection system which is commonly used and installed.

*Experimental Capabilities:*

- Demonstrate the process of gas fire alarm control panel activation
- Provides real time stimulation and activation of the gas fire alarm control system
- From these activation students are able to learn how to operate the fire control system
- Educate students the important of fire safety to save life, property and environment.
- Able to determine the actual course of activation from the control panel and safety procedure to be taken

## Heat Conduction Study Bench

(Model: HE 105) **SOLDAS** **SOLCAL** **EI**



This **Heat Conduction Study Bench** is designed to provide an introduction into the concepts of heat conduction using one-dimensional conduction modules. The linear test section is supplied with interchangeable samples of conductors and insulators.

*This unit consists of:*

- Linear conduction
- Radial conduction
- Instrumentations for temperature measurements

*Experimental capabilities:*

- Effects of area, insulation, material and surface contact on heat conduction
- Unsteady state conduction
- Thermal conductivity of various solid materials

## Water Cooling Tower

(Model: HE 152) **SOLDAS** **SOLCAL** **EI**



This **Water Cooling Tower** is designed to demonstrate the operation of a forced draught cooling tower.

*This unit consists of:*

- Load tank with water make-up tank
- Water circulation pump
- Water distributor
- Packed column
- Air blower
- Water collecting tray

*Experimental capabilities:*

- Water flow pattern and distribution
- End state properties of water and air on the psychometric chart
- Energy balance in the packed column
- Cooling tower performance at different cooling water flowrate or heat load

Optional columns are also available for more in-depth study and performance comparison such as packed columns with different densities and tower characteristics.



## Multi Alarm Control Unit (Model: MA 103)



This **Multi Alarm Control Unit** is designed to educate the students the functional aspect of each alarm system. This unit has a combination of the fire alarm and burglar

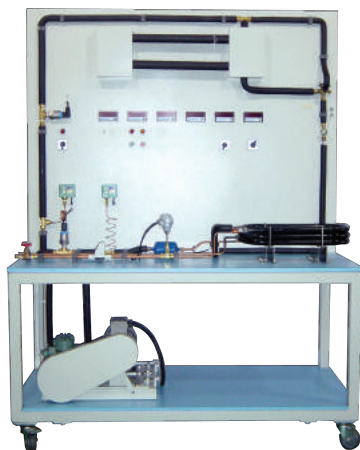
alarm system. The performance and reliable of this console unit incorporates a state of the art mother-board operating under most demand requirement. This simplicity of this design incorporates the activation of each device or sensor individually and stimulates different alarm mode indicating the actual system performance

### *Experimental capabilities:*

- Demonstrate the process of fire alarm control panel activation
- Provides real time stimulation and activation of the fire alarm control system.
- From these activation students are able to learn how to operate the fire control system.
- Educate students the important of fire safety to save life, property and environment.
- Able to determine the actual course of activation from the control panel and safety procedure to be taken.

## Refrigeration Laboratory Unit (Model: RF 01)

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This **Refrigeration Laboratory Unit** is designed to help students to study the performance of a vapour compression cycle under various conditions of evaporator load and condenser pressure.

### *This unit consists of:*

- Open-type refrigerant compressor
- Water cooled condenser
- Expansion valve
- Electrically heated evaporator

### *Experimental capabilities:*

- Vapour compression cycle diagram at various conditions
- Energy balance for the refrigerator
- Effect of different condensing temperatures on refrigerator duty or cooling ability
- Effect of different condensing temperatures on refrigerator coefficients of performance
- Effect of different motor power on coefficient of performance
- Overall heat transfer coefficient for the condenser cooling coil
- Performance of the thermostatic expansion valve
- Effect of different condensing temperatures on the heat delivered to the cooling water
- Effect of different condensing temperatures on coefficient of performance as a heat pump
- Power input study

## Fire And Gas Detection System (Model: SE 109)



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

## Demonstration 3-Term Controller (Model: SE 200) EI



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

*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

## Multi-Pump Test Rig

(Model: SE 701A-3) **SOLDAS** **SOLCAL** **EI**



This **Multi-Pump Test Rig** is designed for demonstrations of the operating characteristics of three different types of pumps. Sensors are included to monitor pump speed, power, pump head and flow rate, enabling students to produce pump characteristics curves.

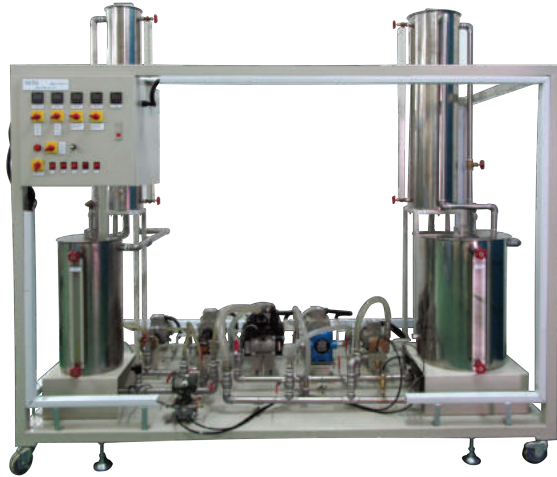
*This unit consists of:*

- Horizontal single stage centrifugal pump
- Vertical multistage centrifugal pump
- Gear pump
- Water tank
- Oil tank
- Instrumentations for measuring flowrates, pressures, pump speeds and motor power

*Experimental capabilities:*

- Pump characteristic curves for centrifugal pumps
- Series and parallel operation of pumps
- Determination of the capacity and efficiency of pumps

## Multi-Pump Test Rig (Model: SE 701B)



This **Multi-Pump Test Rig** is designed to help students understand the characteristic, performance and application of the various pumps found in the industry. A total of five pumps are presented in this test bed. All pumps are install with a suction and discharge pressure gauge and are permanently mounted to reduce the tedious task of removing, interchanging, retightening, plus the most important aspect of preventing accidents from occurring due to wrong installation and unnecessary losses of downtime in a limited laboratory lesson.

### *Experimental capabilities:*

- Measurement test of various pumps at different speeds.
- Electrical power input and eddiciency of various pumps.
- Mechanical power input and efficiency of the centrifugal pump:
- Characteristic curves of centrifugal pump.
  - a) Rotational Speed vs. Volume Flow
  - b) Motor Input Power vs. Volume Flow
  - c) Pump Total Heat vs. Volume Flow
  - d) Pump Power Output vs. Volume Flow
  - e) Pump Power Input vs. Volume Flow
  - f) Pump Efficiency vs. Volume Flow
  - g) Overall Efficiency vs. Volume Flow
- Characteristic curves of positive displacement pumps.
  - a) Rotational Speed vs. Output Pressure
  - b) Motor Input Power vs. Output Pressure
  - c) Volume Flow vs. Output Pressure
  - d) Pump Power Output vs. Output Pressure
  - e) Pump Power Input vs. Output Pressure
  - f) Pump Efficiency vs. Output Pressure
  - g) Overall Efficiency vs. Output Pressure
  - h) Volumetric Efficiency vs. Output Pressure
- Determination of NPSH.
- Operation test on various types of pumps.