ETHER
Engineering Educational Equipments
An ISO 9001 : 2015 Certified Co.

PROCUREMENT ERECTION & COMMISSIONING OF LAW OF CONSERVATION OF MASS & MOMENTUM

Make : ETHER

1. **BASE MODULE FOR EXPERIMENTS WITH ACCESSORIES (EE-1553 A)**
Description

The base module provides the basic equipment for individual experiments: the supply of water in the closed circuit; the determination of volumetric flow rate and the positioning of the experimental unit on the working surface of the base module and the collection of dripping water.
The closed water circuit consists of the underlying storage tank with a powerful submersible pump and the measuring tank arranged above, in which the returning water is collected.
The measuring tank is stepped, for larger and smaller volumetric flow rates. A measuring beaker is used for very small volumetric flow rates. The volumetric flow rates are measured using a stopwatch.
The top work surface enables the various experimental units to be easily and safely positioned. A small flume is integrated in the work surface, in which experiments with weirs are conducted.

Technical data

Pump
- power consumption: 250W
- max. flow rate: 150L/min
- max. head: 7,6m

Storage tank, capacity: 180L
Measuring tank
- at large volumetric flow rates: 60L
- at small volumetric flow rates: 10L

Flume ▪
- LxWxH: 530x150x180mm

Measuring beaker with scale for very small volumetric flow rates
- capacity: 2L

Stopwatch ▪
- measuring range: 0…9h 59min 59sec

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

2. **EXPERIMENTAL SETUP FOR ANALYZING MINOR LOSSES IN PIPING SYSTEM (EE-1553 B)**
Description

The unit can be used to investigate and visualise the pressure losses in pipe elements. The experimental unit can be used to assess how different pipe geometries affect the flow. The experimental unit comprises a pipe section containing several pipe elements with different flow resistances, as well as a contraction and enlargement piece. There is also a ball valve integrated in the pipe. There are pressure measuring points with annular chambers upstream and downstream of the pipe elements, which ensure accurate pressure measurement. The pressure measuring points can be connected in pairs to a 6 tube manometers in order to determine the pressure loss of a pipe element. The experimental unit is positioned easily and securely on the work surface of the base module for experiments in fluid mechanics unit . The water is supplied and the flow rate measured by base module for experiments in fluid mechanics unit

Learning objectives/ experiments

- investigate pressure losses and loss coefficients at
    - segment bend and bends
    - contraction and enlargement
    - a ball valve
- determination of a pipe characteristic

Specification

1. investigation of the pressure loss in flow through pipe fittings and in the ball valve
2. contraction and enlargement, pipe bend, segment bend, pipe angle and ball valve as measurement objects
3. annular chambers allow precise measurement of pressure
4. 6 tube manometers for displaying the pressures
5. Bourdon tube pressure gauge for pressure measurement
6. flow rate determined by base module for experiments in fluid mechanics unit
7. water supply base module for experiments in fluid mechanics unit

Technical data

Pipe, PVC
- inner diameter: 17mm

Pipe elements, PVC
Inner diameter: d
- contraction: from d=17 to d=9,2mm
- enlargement: from d=9,2 to d=17mm
- segment bend: d=17mm, 90°
- pipe angle: d=19mm, 90°
- narrow pipe bend: d=18mm, r=40mm, 90°
- wide pipe bend: d=17mm, r=100mm, 90°

Measuring ranges
- pressure:
    - 1x 0…0,6bar
    - 6x 0…290mmWC

3. EXPERIMENTAL SETUP FOR ESTIMATING PIPE FRICTION IN LAMINAR/TURBULANT FLOW (EE-1553 C)

DESCRIPTION

The unit enables the study of the relationship between pressure loss due to fluid friction and velocity in the pipe flow. Additionally, the pipe friction coefficient is determined. The experimental unit includes two pipe sections with different diameters. The large diameter pipe section is used to analyse turbulent flows and is supplied directly from the water supply. The pipe section for laminar flow is supplied via a tank with overflow. This ensures the constant inlet pressure required for laminar flow. A gate valve or flow control valve can be used to adjust the flow rate. The Reynolds number and the pipe friction coefficient are determined from the flow rate and pressure loss. The pressures in laminar flow are measured with twin tube manometers. In turbulent flow, the pressure is read on a dial-gauge manometer. The experimental unit is positioned easily and securely on the work surface of the base module for experiments in fluid mechanics unit. The water is supplied and the flow rate measured by base module for experiments in fluid mechanics unit (Not provided by us)

Learning objectives/experiments

- measurements of the pressure loss in laminar flow
- measurements of the pressure loss in turbulent flow
- determining the critical Reynolds number
- determining the pipe friction coefficient
- comparing the actual pipe friction coefficient with the theoretical friction coefficient

Specification

1. investigation of pipe friction using two pipe sections in laminar or turbulent flow
2. transparent tank with overflow ensures constant water inlet pressure in the pipe section for experiments with laminar flow
3. flow rate adjustment via gate valve or flow control valve
4. twin tube manometers for measurements in laminar flow
5. dial-gauge manometer for measurements in turbulent flow
6. flow rate determined by base module for experiments in fluid mechanics unit (Not provided by us)
7. water supply using base module for experiments in fluid mechanics unit (Not provided by us)

Technical Details

2 pipe sections
- length: 400mm
- Ø inner:
  - 1x 3-4mm
  - 1x 8-10mm

Tank: approx. 2L
Measuring ranges
- differential pressure:
  - 2x 370mmWC
  - 1x 0…0,25bar

4. EXPERIMENTAL SETUP FOR UNDERSTANDING THE MECHANISMS OF FREE & FORCED VORTEX FORMATION (EE-1553 D)

Description

The experimental unit allows you to produce and study free and forced vortices. The experimental unit has a transparent tank with nozzles, various inserts on the water drain,

an impeller and a point gauge for detecting the vortex profiles. To form the free vortex, water is introduced radially into the tank and flows through a ring to slow down. The vortex is created by the flow out of the tank. There are four easily replaceable inserts of various diameters available for the drain. To form a forced vortex, the water is introduced tangentially. The vortex is generated via an impeller driven by a water jet. The point gauges are used to measure the surface profiles of the vortices. The rotational speed is determined using a measuring ring.
The experimental unit is positioned easily and securely on the work surface of the base module for experiments in fluid mechanics unit. The water is supplied and the flow measured by base module for experiments in fluid mechanics unit.

Learning objectives/ experiments

- visualisation of various vortices
- investigation of free and forced vortices
- representation of surface profiles
- comparison between measured and calculated profiles
- determination of rotational speed

Specification

1. generation and investigation of vortices
2. transparent tank allows visualisation of vortex formation
3. two nozzles for radial water supply (free vortex)
4. two nozzles for tangential water supply (forced vortex)
5. different inserts for the water drain to generate free vortex
6. impeller for generating a forced vortex
7. measuring ring for determining the rotational speed
8. point gauges detect the surface profile
9. flow rate determined by base module for experiments in fluid mechanics unit
10. water supply using base module for experiments in fluid mechanics unit

Technical data

Tank
- Ø inner: 240mm
- height: 190mm

4 inserts for the water drain
- diameter: 8, 12, 16 and 24mm

Impeller with 3 blades
Vertical point gauge: 6 movable rods
Horizontal point gauge: 2 movable rods
Measuring tube, movable
- horizontal 0…90mm, vertical 70…190mm
- diameter: 4mm

VISUALISATION OF STREAMLINES (HELESHAW)

Description

The unit can be used to visualise streamline fields for flows around drag bodies and flow through changes in cross-section. The streamlines are displayed in colour by injecting a contrast medium (ink). Sources and sinks are generated via four water connections in the bottom plate. The streamlines can be clearly observed through the glass plate during flow around and flow through. The water flow rate and the quantity of contrast medium injected can be adjusted by valves. The water connections are also activated by valves and can be combined as required. Individual models can be cut out of a rubber plate that is included. The experimental unit is positioned easily and securely on the work surface of the base module for experiments in fluid mechanics. The water is supplied by base module for experiments in fluid mechanics.

Learning objectives/ experiments

visualisation of streamlines in
- flow around drag bodies
- flow through changes in cross-section
- influence of sources and sinks

Specification

1. visualisation of streamlines
2. water as flowing medium and ink as contrast medium
3. upper glass plate, hinged for interchanging models
4. bottom plate with water connections for generating sources/sinks
5. sources/sinks can be combined as required
6. different drag bodies and changes in cross-section included
7. rubber plate for creating your own models included
8. flow velocity, water supply and water drain in sources/sinks as well as dosage of the contrast medium can be adjusted by using valves
9. water supply using base module for experiments in fluid mechanics.

Technical data

Flow chamber contains two plates
- distance between the plates: 2mm
- upper plate made of glass
- bottom glass plate with four water connections for sources/sinks
- size experiment area: LxW: 400x280mm

10 drag bodies and changes in cross-section
Rubber plate for your own models
- LxH: 300x400mm
- thickness: 2mm

Injection of the contrast medium
- 15 holes

Tank for contrast medium: 500ml

5. EXPERIMENTAL SETUP FOR ESTIMATING PRESSURE DISTRIBUTION IN LIQUIDS (EE-1553 E)

Description

The experimental unit offers typical experiments to study hydrostatic pressure in liquids at rest. The effect of the hydrostatic pressure of water can be clearly shown at different water levels and angles of inclination.
The experimental unit consists of a transparent, tilting water tank with a scale for measuring volumes. Another scale is used to adjust the angle of inclination of the water tank. The device is balanced by a lever arm using different weights and the compressive force measured.

Learning objectives/ experiments

- pressure distribution along an effective area in a liquid at rest
- lateral force of the hydrostatic pressure
- determination of the centre of pressure and centre of area
- determination of the resulting compressive force

Specification

1. investigation of the hydrostatic pressure in fluids at rest
2. tiltable water tank with fill level scale
3. lever arm with different weights

Technical data

Water tank

- inclination angle: 0°…90°
- content: 0…1.8L
- scale: 0…250mm
- effective area, max. 75x100mm

Lever arm

- max. length: 250mm

Weights

- 1x 2.5N
- 1x 2N
- 2x 1N
- 1x 0.5N

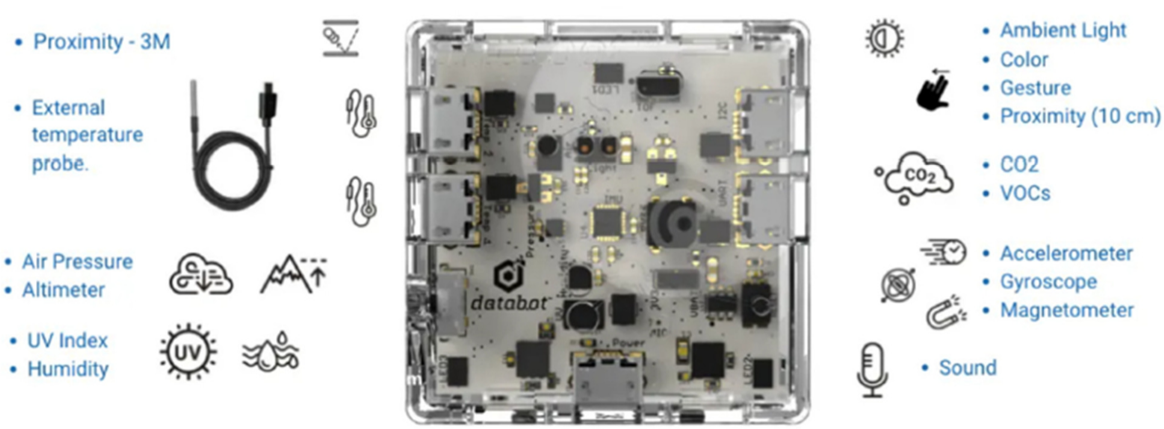
➢ All material that comes in contact with water are made of corrosion-resistant materials GRP/stainless steel as specified.

DATA ACQUISITION SYSTEM (DAQ) WITH INBUILT SENSORS

databot™2.0, an unstoppable STEMachine! Weighing in at just 1.2 oz and standing only ¾" high, databot™ is a power-packed wireless, remote-ready scientific tool that brings the world of data to life instantly! The most versatile multi-sensor tool imaginable, databot™ packs 16 different science sensors, light and sound outputs, and is completely programmable and AI & Machine Learning enabled! databot™ connects instantly to your smartphone, tablet, or Chromebook allowing data to be visualized and explored in real-time!
Paired with our smartphone app, Vizeey™, streaming and exploring data of all kinds begins with the tap of an icon – it's the easiest way to begin visualizing and exploring real data.

databot™2.0 Specs

Sensors



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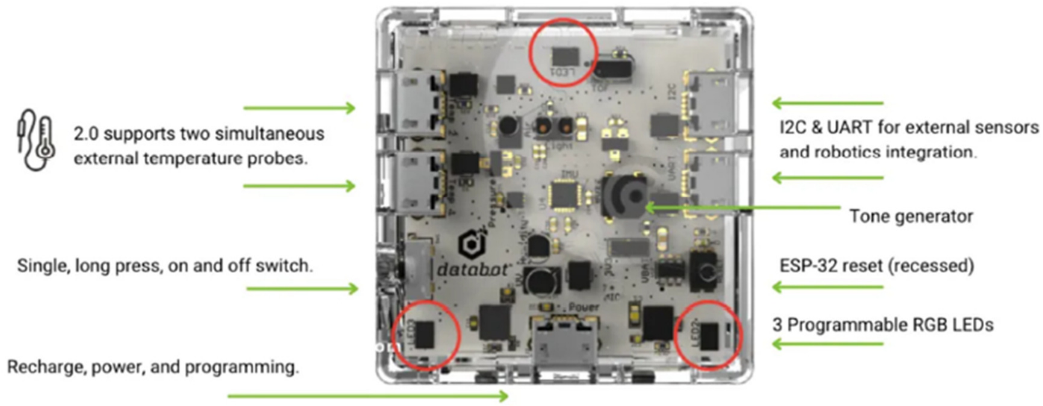
I/O & Design



Communications, Processor, and Power

- ESP-WROOM-32 Processor
- Edge Computing Capable (AI/ML)
- 4MB On Board Memory
- Wi-Fi Enabled for IOT
- Bluetooth Low Energy (BLE)
- 3.7v Low Power Sensors
- Rechargeable LiPo 3.7v 500 mAh
- Battery Run Time 4-6 Hours
- Charge Time 60 Minutes
- Coding: Python, Scratch, Arduino