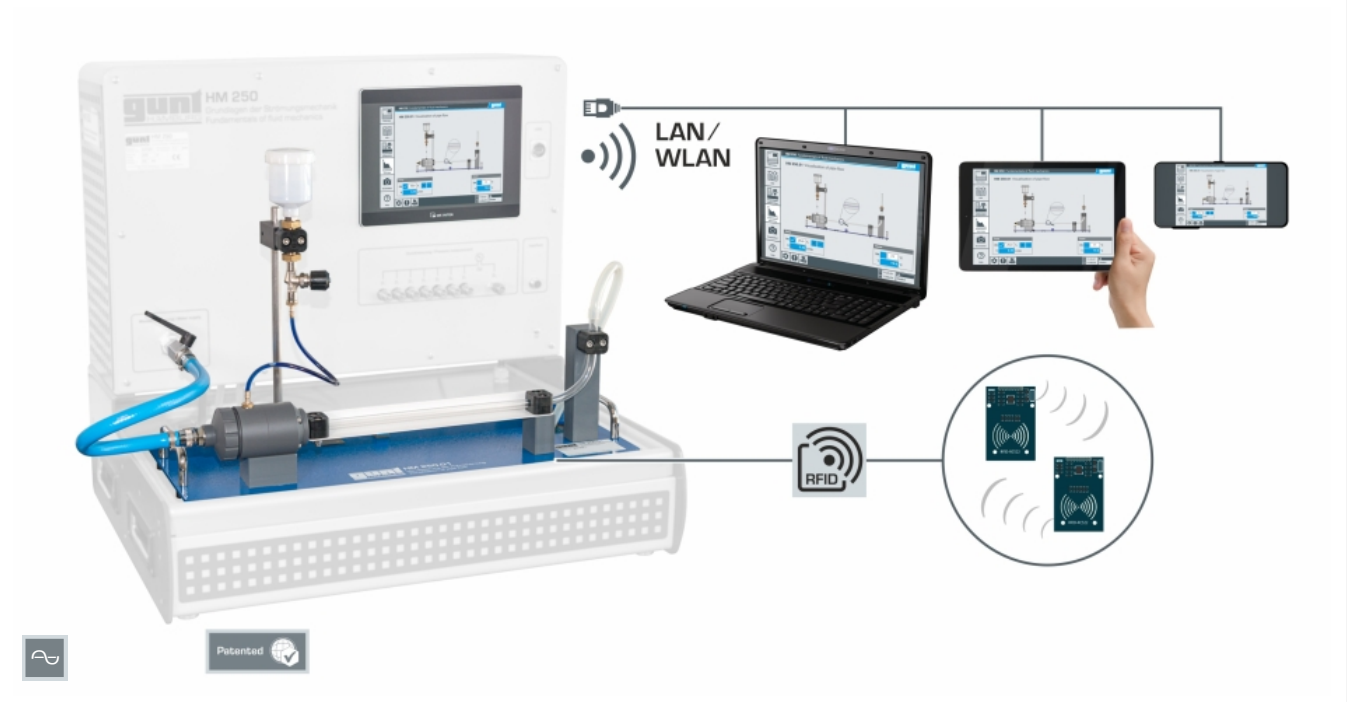
HM 250.01
Visualisation of pipe flow



Complete experimental setup with the HM 250 base module, screen mirroring is possible on up to 10 end devices

Description

- **visualisation of laminar, turbulent and secondary flow using ink as a contrast medium**
- **intuitive experiment execution via touch screen (HMI)**
- **integrated router for operation and control via an end device and for screen mirroring on up to 10 end devices: PC, tablet, smartphone**
- **network capability: access to ongoing experiments from external workstations via the local network**
- **automatic identification of accessories via RFID technology**

To visualise laminar and turbulent flow, the Osborne Reynolds experiment is used. The transition from laminar to turbulent flow can be observed above a limiting velocity.

In the HM 250.01 unit, the streamlines at different flows are represented in colour using ink as a contrast medium.

The experimental unit consists of a transparent pipe section with streamlined inlet and a honeycomb rectifier. The pipe section contains a horizontal, straight pipe and a 90° pipe bend. At the end of the experiment, the working medium water is returned to the base module. Alternatively, the water can be collected separately to avoid turbidity during the experiment. A heater for heating the water is controlled via the base module and causes a change in viscosity.

In the experiment, ink is introduced into the flowing water as a contrast medium. Formation of the flow can be clearly observed. As the flow velocity increases, the first vortices are formed. These vortices increase with increasing flow velocity until ultimately the ink jet can no longer be detected. The formation of a secondary flow can be observed at the pipe elbow, especially with laminar flow.

The accessory HM 250.01 is easily and safely positioned on the worktop of the HM 250 base module. Via RFID technology the accessories are automatically identified, the appropriate GUNT software is loaded and an automatic system configuration is performed. The intuitive user interface guides through the experiments. For tracking and evaluation of the experiments, up to 10 external workstations can be used simultaneously using the local network via LAN connection. The base module supplies the water and is used for flow rate adjustment and measurement.

Learning objectives/experiments

- visualisation of
  - laminar flow
  - transition zones
  - turbulent flow
  - secondary flow in a pipe elbow
- investigation of the influencing variables of the Reynolds number
  - flow rate
  - viscosity as a function of temperature
- investigation of the critical Reynolds number
- GUNT software specifically adapted to the accessories used
  - learning module with theoretical fundamentals
  - device description
  - guided experiment preparation
  - execution of the experiment
  - graphical representation of the experimental section with measured values for flow rate and temperature
  - data transfer via USB for versatile external use of measured values and screenshots e.g. evaluation in Excel
  - different user levels available

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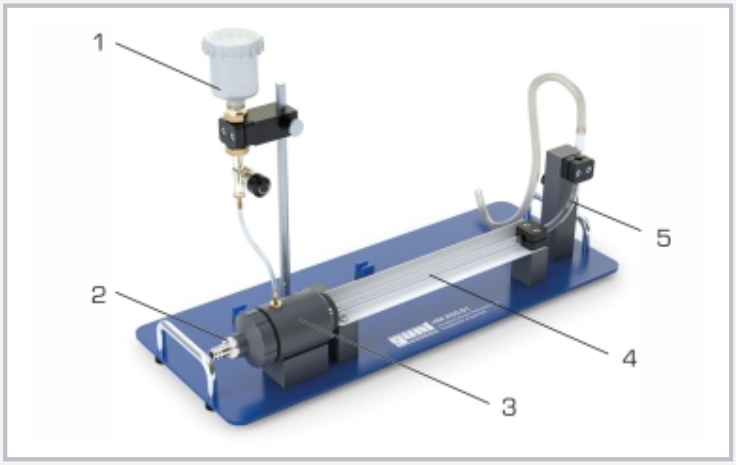
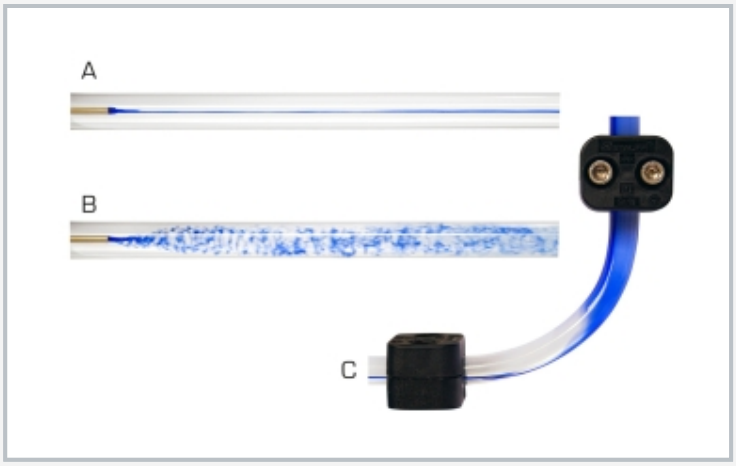
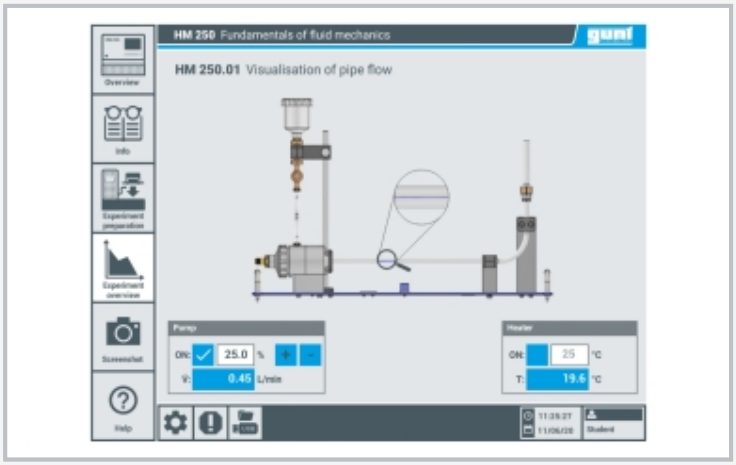


1 tank for ink, 2 water supply, 3 inlet tank, 4 straight pipe, 5 pipe elbow



Flow formations in the pipe section
A laminar flow, B turbulent flow, C secondary flow in the pipe elbow, with laminar flow



Intuitive user interface on the touch screen: experiment overview with adjustment of the flow rate and the temperature in the pipe section

Specification

[1] visualisation of laminar and turbulent flow in the Osborne Reynolds experiment
[2] visualisation of secondary flow in a pipe elbow
[3] water as flowing medium and ink as contrast medium
[4] streamlined inlet and honeycomb rectifier to settle the flow
[5] horizontal, straight pipe and 90° pipe elbow made of transparent material
[6] flow rate and temperature in the pipe section can be adjusted via HM 250 base module
[7] automatic identification of accessories via RFID technology and use of the corresponding GUNT software
[8] experiment execution and display of the measured values via touch screen (HMI)
[9] network capability: access to ongoing experiments and their results from up to 10 external workstations simultaneously via the local network
[10] water supply and heating via HM 250 base module

Technical data

Inlet tank
- content: approx. 80mL

Pipe section
- material: acrylic glass
- Ø inner: 10mm
- straight pipe:
  - length: 380mm
- 90° pipe elbow:
  - radius: 60mm

Honeycomb rectifier
- material: polycarbonate
- shape: tubes Ø 3,5mm

Tank for ink
- content: 125mL
- material: plastic
- thread: M41x1

Measuring ranges
- indicated measuring range flow rate: 0...15L/min
- indicated measuring range temperature: 0...50°C

LxWxH: 650x260x250mm
Weight: approx. 5,2kg

Scope of delivery

1 experimental unit
1 hose
2 collecting tank
1L ink
1 set of instructional material

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Required accessories

HM 250	Fundamentals of fluid mechanics

Optional accessories

HM 250.90	Laboratory shelf