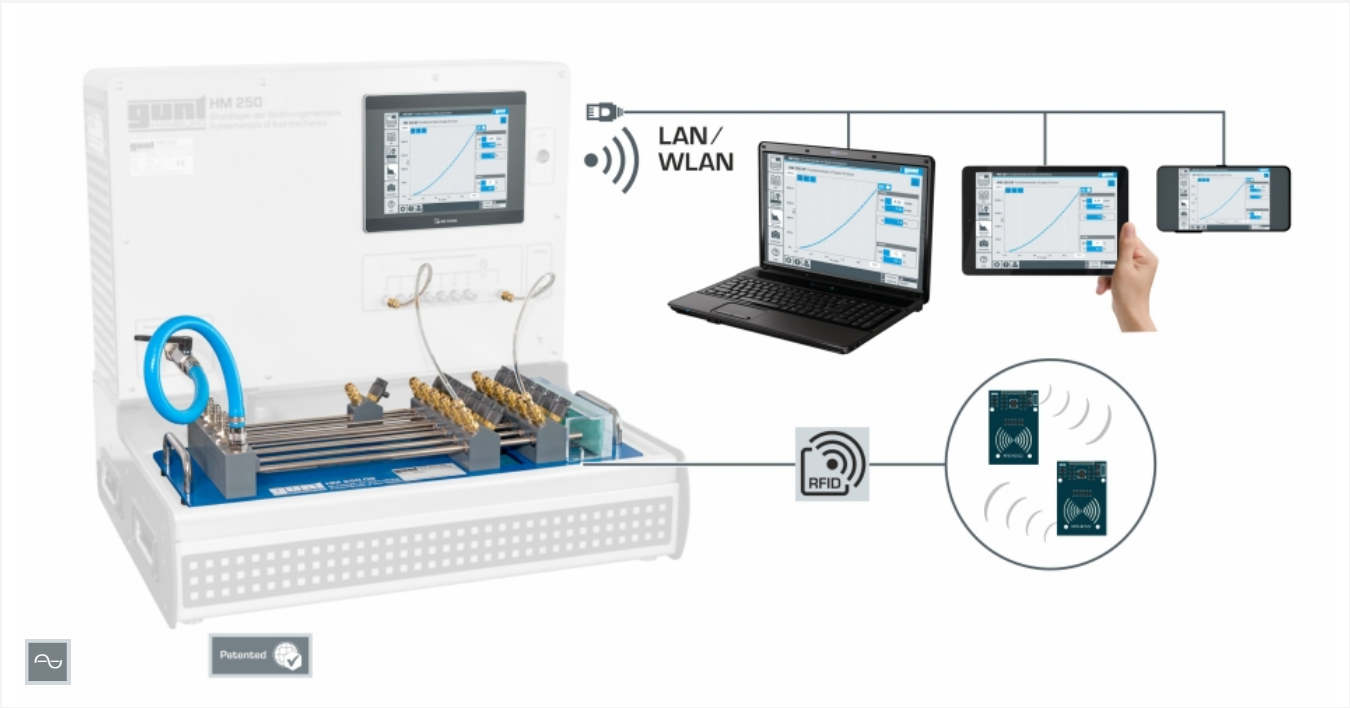
HM 250.09
Fundamentals of pipe friction



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

Description

- **calculation of pressure losses and determination of the Reynolds number and pipe friction coefficient**
- **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**

Due to internal friction, differences in velocity occur in the flow of fluids. Energy is needed in the form of pressure to overcome these differences. This results in pressure losses in the pipe flow. The internal friction is the decisive factor determining whether the flow in the pipe is laminar or turbulent. The pipe friction factor, a dimensionless number, is used to calculate pressure losses. The friction factor is determined with the aid of the Reynolds number, which describes the ratio of inertial forces to friction forces. The two numbers are related to each other and are shown in the Moody chart.

HM 250.09 is used to measure pressure loss and flow rate in various pipe sections. Four pipe sections consist of pipe bundles and two pipe sections of single pipes.

In the experiment, the water flows over an inlet section into the selected pipe section and the flow is formed. The pressure is measured in the formed flow area. The water then emerges from the pipe section as a free jet. Differences in the flow formation can be observed on the surface of the water jet. In addition, the influence of viscosity on the flow formation can be investigated. For this purpose, the water is heated with a heater integrated in the base module, thus changing viscosity.

The accessory HM 250.09 is easily and securely 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 and displays the measured values graphically. 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 to adjust the flow rate and temperature. Flow rate, pressure and temperature measurements are also carried out via the base module.

Learning objectives/experiments

- using the Reynolds number in pipe flow
- determine critical Reynolds number
- calculate the Reynolds and pipe friction coefficient from measured data
- compare theoretical values with measured values
- investigate the influence of temperature
- similarity relationships in pipe flow
- using the Moody chart
- distinction between laminar and turbulent flow
- determine pressure loss in laminar and turbulent flow
- 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 pressure curves
  - 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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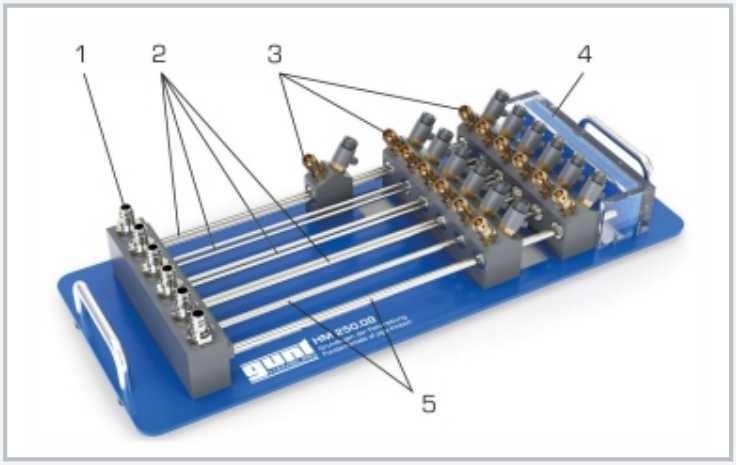
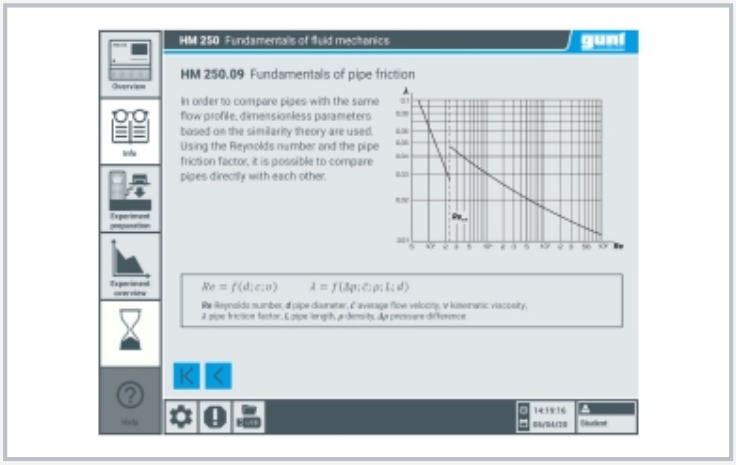
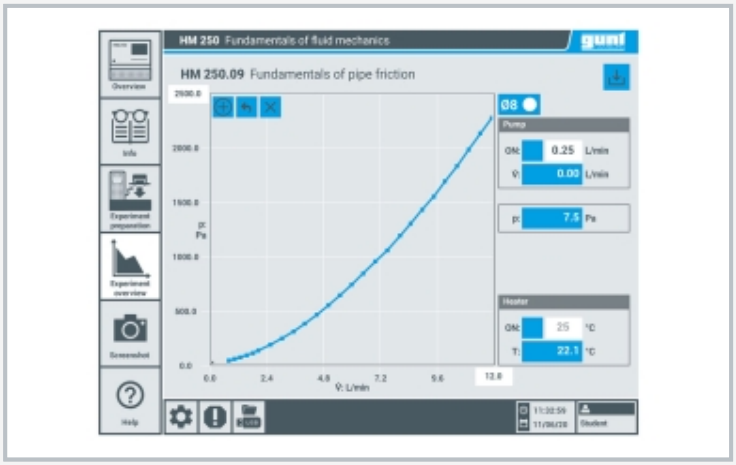


1 water supply, 2 four pipe sections with pipe bundles, 3 pressure connections, 4 open discharge with foam insert as splash guard, 5 two pipe sections with single pipes



Touch screen: experiment description, theoretical fundamentals



Intuitive user interface in the HM 250 touch screen: pressure measuring at pipe section (single pipe Ø 8mm) and graphic display of the measured values, pressure curve in the pipe section

Specification

[1] investigation of pipe friction in laminar or turbulent flow
[2] observation of the free jet to distinguish between laminar and turbulent flow
[3] measurement of the pressure loss after an inlet section
[4] flow rate and temperature in the pipe section can be adjusted via HM 250 base module
[5] automatic identification of accessories via RFID technology and use of the corresponding GUNT software
[6] experiment execution and display of the measured values via touch screen (HMI)
[7] network capability: access to ongoing experiments and their results from up to 10 external workstations simultaneously via the local network
[8] water supplied via HM 250 base module

Technical data

Pipe bundle of 6 tubes
- Ø inner 1mm +/-0,12mm
- inlet section: length 220mm
- measurement of pressure at 100mm and 200mm

Pipe bundle of 4 tubes
- Ø inner 2mm +/-0,12mm
- inlet section: length 320mm
- measurement of pressure at 200mm

Pipe bundle of 4 tubes
- Ø inner 3mm +/-0,12mm
- inlet section: length 320mm
- measurement of pressure at 200mm

Pipe bundle of 2 tubes
- Ø inner 4mm +/-0,12mm
- inlet section: length 220mm
- measurement of pressure at 200mm

Single pipe
- Ø inner 6mm +/-0,12mm
- inlet section: length 320mm
- measurement of pressure at 200mm

Single pipe
- Ø inner 8mm +/-0,16mm
- inlet section: length 320mm
- measurement of pressure at 200mm

Material: brass, nickel-plated

Measuring ranges
- pressure: 0...520mbar (at Ø 1mm, L=200mm)
- flow rate: 0...12L/min (at Ø 8mm, L=200mm)
- temperature: 0...50°C

LxWxH: 650x260x105mm
Weight: approx. 7,6kg

Scope of delivery

1 experimental unit
1 set of instructional material

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Required accessories

HM 250	Fundamentals of fluid mechanics

Optional accessories

HM 250.90	Laboratory shelf