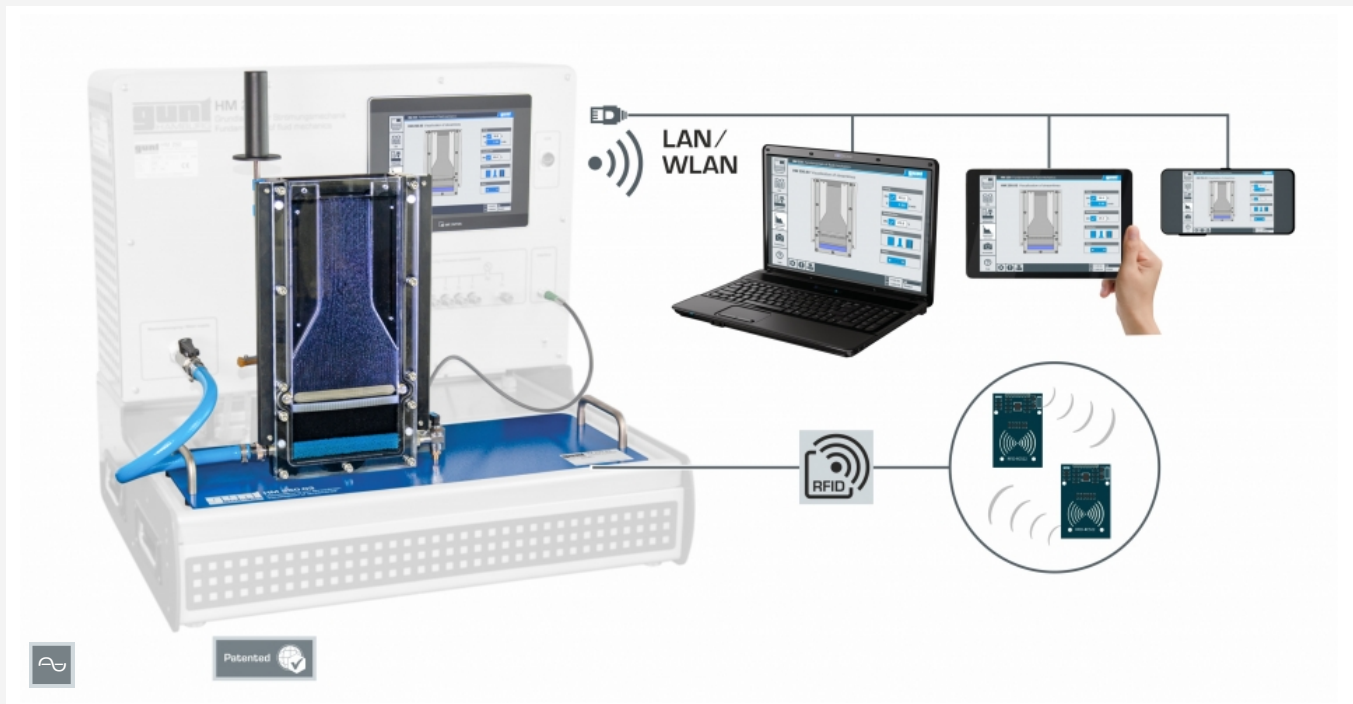


# HM 250.03

## Visualisation of streamlines



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

### Description

- **electrolytically generated hydrogen bubbles visualise streamlines**
- **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**

The laminar, two-dimensional flow in the HM 250.03 flow channel represents a good approximation to the flow of ideal fluids: the potential flow. Fine gas bubbles are ideal for visualising streamlines. Due to their small size, they are particularly well carried along the flow.

The HM 250.03 contains a vertical experimental section into which models are inserted to generate changes in cross-section. Water passes through the experimental section from bottom to top. Electrolytically generated hydrogen bubbles rise with the flow and thus visualise the streamlines by means of LED lighting.

The hydrogen bubbles are produced electrolytically at a cathode made of thin platinum wire. A stainless steel plate serves as the anode. The small bubbles that detach from the platinum wire are carried along by the flow and create flow lines. The flow lines follow the streamlines of the water.

In experiments, the concept of streamlines, flow lines and strike lines is developed on the basis of the different bubble sizes. The generated flow lines allow conclusions on the flow. If the flow velocity increases, the distance between the flow lines will decrease.

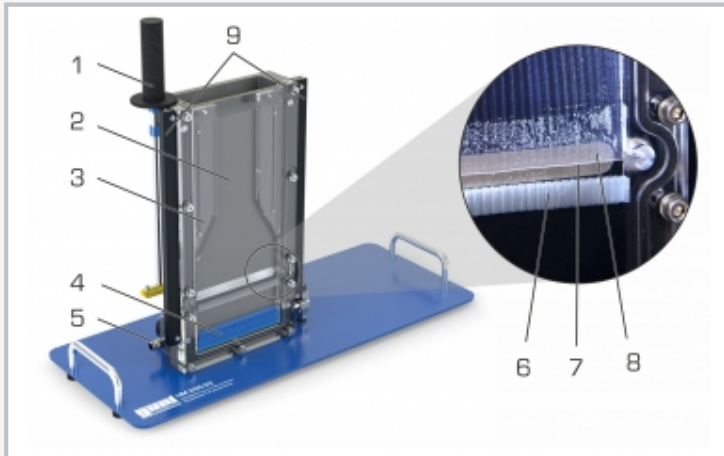
The accessory HM 250.03 is easily and safely positioned on the worktop of the HM 250 base module. Via RFID technology the accessories are automatically identified, the appropriate GUNT software is loaded and an automatic system configuration is performed. The intuitive user interface guides through the experiments. For tracking and evaluation of the experiments, up to 10 external workstations can be used simultaneously using the local network via LAN connection. HM 250 supplies the water and is used for flow rate adjustment and measurement. The current for electrolysis can also be adjusted via the base module.

### Learning objectives/experiments

- visualisation of two-dimensional flows
- learning the concept of streamlines, flow lines and strike lines
- streamline course through an experimental section with changes in cross-section
- limits of potential flow
  - ▶ friction
  - ▶ flow velocity
- 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 and parameters
  - ▶ data transfer via USB for versatile external use of measured values and screenshots e.g. evaluation in Excel
  - ▶ different user levels available

# HM 250.03

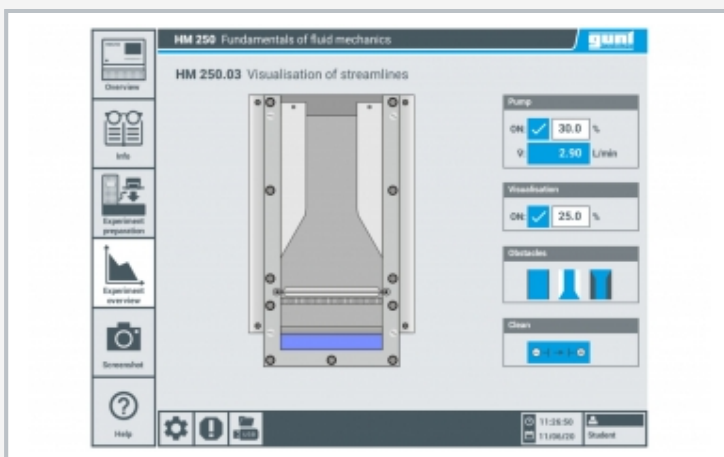
## Visualisation of streamlines



1 slider for cleaning the transparent surface, 2 flow channel, 3 models for change in cross-section, 4 foam inlay for settling the water, 5 water supply, 6 honeycomb rectifier, 7 platinum wire as cathode, 8 stainless steel plate as anode, 9 LED lighting



Visualisation of streamlines with hydrogen bubbles  
left: flow channel without change in cross-section, right: flow channel with inserted models for change in cross-section



Intuitive user interface on the touch screen: experiment overview with adjustment of the flow rate and current for electrolysis for visualisation

### Specification

- [1] electrolytically generated hydrogen bubbles visualise streamlines
- [2] insertable models generate a change in cross-section in the flow channel
- [3] low turbulence flow due to honeycomb rectifier
- [4] bubble generator: platinum wire as cathode and stainless steel plate in the experimental section as anode
- [5] current for electrolysis and flow rate can be adjusted via HM 250 base module
- [6] automatic identification of accessories via RFID technology and use of the corresponding GUNT software
- [7] experiment execution and display of the measured values via touch screen (HMI)
- [8] network capability: access to ongoing experiments and their results from up to 10 external workstations simultaneously via the local network
- [9] water and power supply via HM 250 base module

### Technical data

#### Flow channel

- depth: 10mm
- experimental section WxH: 150x290mm

#### Honeycomb rectifier

- material: polycarbonate
- shape: tubes  $\varnothing$  3,5mm

#### 2 symmetrically constructed, insertable models

- each model
  - ▶ LxWxH: 230x37,5x10mm
  - ▶ angle: 30°

#### Bubble generator

- max. current: 300mA
- cathode
  - ▶ material: platinum wire
  - ▶  $\varnothing$  0,2mm
- anode
  - ▶ material: stainless steel plate
  - ▶ LxWxH: 143,5x13,5x2mm

#### LED lighting

- colour temperature: 5500...7000K
- luminous flux: 550lm/m

#### Measuring ranges

- indicated measuring range flow rate: 0...15L/min

LxWxH: 650x260x530mm

Weight: approx. 7,8kg

### Scope of delivery

- 1 experimental unit
- 1 set of models
- 1 set of instructional material

# HM 250.03

## Visualisation of streamlines

### Required accessories

070.25000	HM 250	Fundamentals of fluid mechanics
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### Optional accessories

070.25090	HM 250.90	Laboratory shelf
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