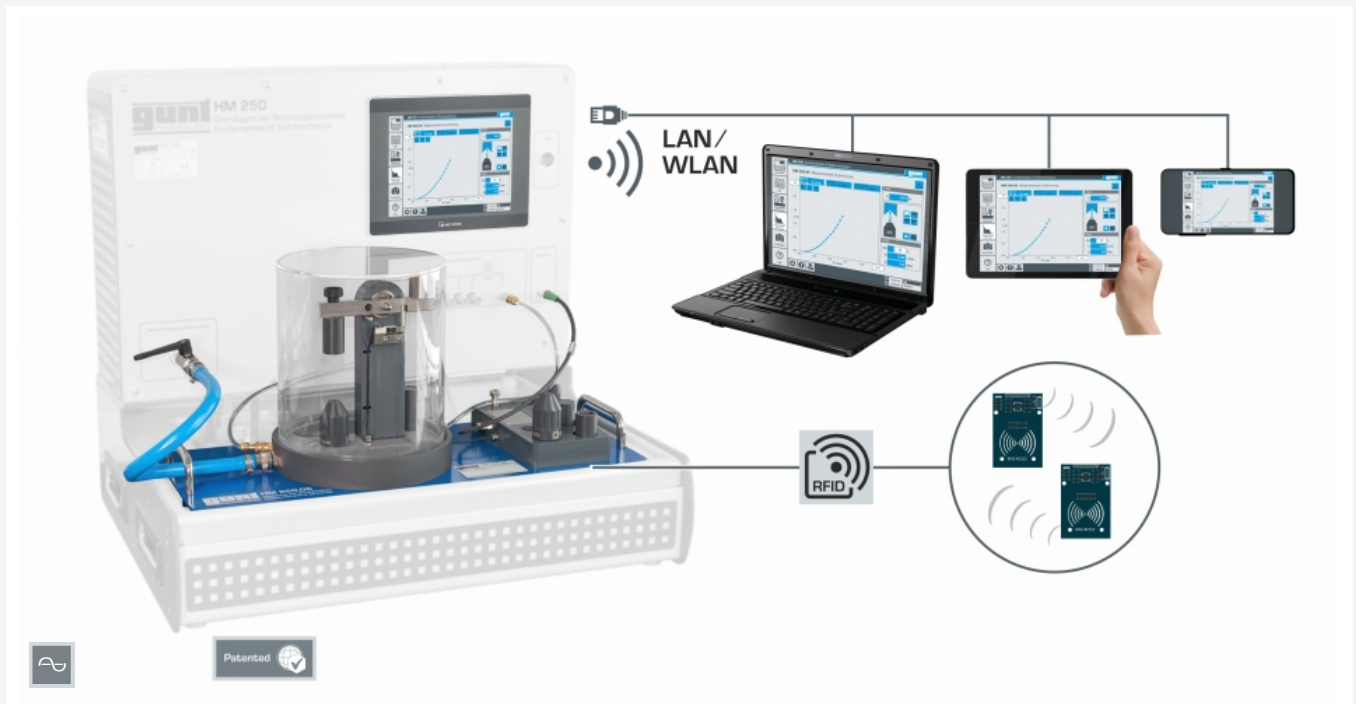


# HM 250.05

## Measurement of jet forces



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

### Description

- investigation of jet forces on deflectors with different deflection angles
- 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

Every change in the velocity of a fluid by deflection, deceleration or acceleration is related to a change in momentum. The change in momentum simultaneously causes a force effect. In practice, this is used, for example, to drive a Pelton turbine.

HM 250.05 contains two interchangeable nozzles, for generating a water jet which hits a deflector. Four different deflectors are available. The water jet generates jet forces at the deflectors, which are measured by a bending beam. A transparent splash guard ensures a clear view of the experiments.

The nozzle pre-pressure is measured via a pressure connection in the inlet of the nozzle. The base module is used to measure flow rate, pressure and force. Thus, the influence of nozzle pre-pressure, different deflection angles, flow velocity as well as flow rate are investigated. The theoretical forces are calculated using the momentum equation and compared with the measured values from the experiments.

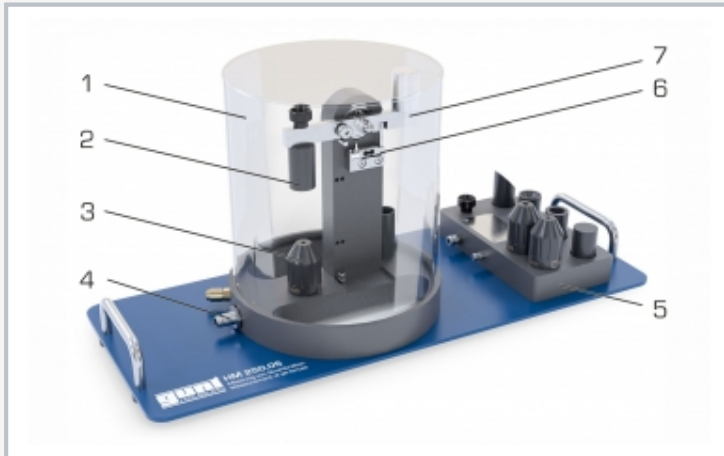
The accessory HM 250.05 is easily and securely positioned on the worktop of the HM 250 base module. Via RFID technology the accessories are automatically identified, the appropriate GUNT software is loaded and an automatic system configuration is performed. The intuitive user interface guides through 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. HM 250 supplies the water and is used to adjust the flow rate.

### Learning objectives/experiments

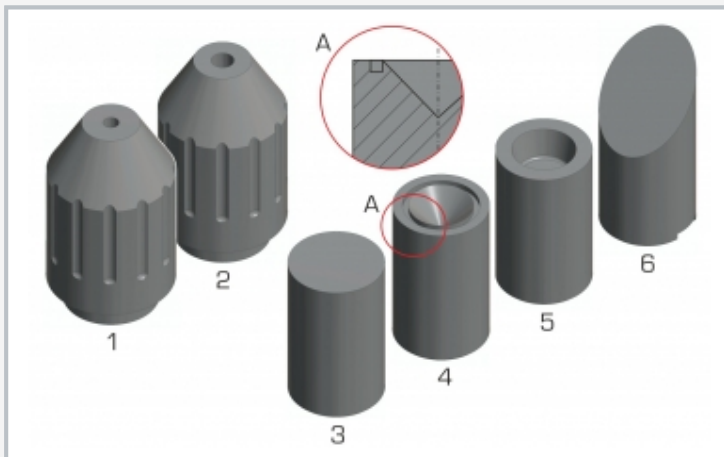
- application of the momentum equation
- measurement of the jet forces
- investigate influencing variables of jet forces
  - ▶ deflection angles
  - ▶ nozzle pre-pressure
  - ▶ flow velocity
  - ▶ flow rate
- apply Bernoulli's equation
- GUNT software specifically adapted to the accessories used
  - ▶ learning module with theoretical fundamentals
  - ▶ device description
  - ▶ guided experiment preparation
  - ▶ execution of the experiment
  - ▶ graphical representation of force curves
  - ▶ data transfer via USB for versatile external use of measured values and screenshots e.g. evaluation in Excel
  - ▶ different user levels available

# HM 250.05

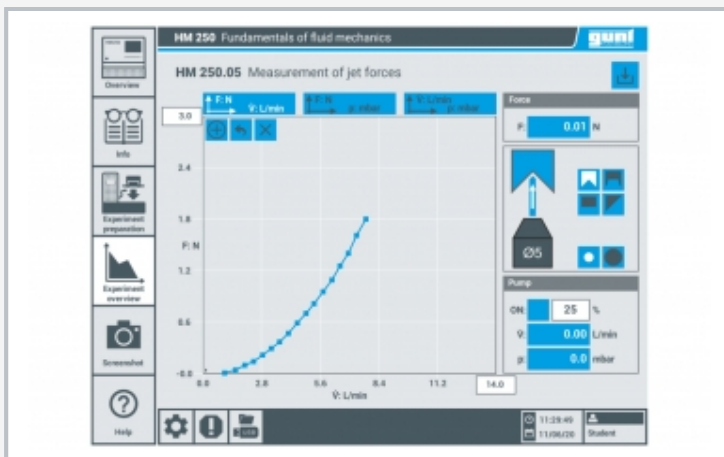
## Measurement of jet forces



1 transparent splash guard, 2 deflector, 3 nozzle, 4 water supply, 5 storage tray for nozzles and deflectors, 6 bending beam, 7 lever



Nozzles with different diameter and differently shaped deflectors  
 1 nozzle  $\varnothing$  5mm, 2 nozzle  $\varnothing$  7,1mm, 3 deflector flat surface, 4 deflector deepening in form of a cone, 5 deflector deepening in form of a truncated cone, 6 deflector inclined surface, A detail view



User interface in the touch screen: graphical representation of the measured values, jet force as a function of flow rate for the deflector with deepening in form of a cone and nozzle  $\varnothing$  5mm

### Specification

- [1] investigation of jet forces and application of the momentum equation
- [2] 2 interchangeable nozzles for generating the water jet
- [3] 4 differently shaped deflectors: flat surface, inclined surface, deepening in form of a truncated cone, deepening in form of a cone
- [4] splash guard made of transparent material for observation of experiments
- [5] measurement of jet forces via bending beam
- [6] nozzle pre-pressure measurement via a pressure connection in the inlet of the nozzle
- [7] water jet can be adjusted via selection of the nozzle and flow rate on the HM 250 base module
- [8] automatic identification of accessories via RFID technology and use of the corresponding GUNT software
- [9] experiment execution and display of the measured values via touch screen (HMI)
- [10] network capability: access to ongoing experiments and their results from up to 10 external workstations simultaneously via the local network
- [11] water supplied via HM 250 base module

### Technical data

#### Nozzles

- material: PVC
- $\varnothing$  5mm
- $\varnothing$  7,1mm

#### Deflectors

- material: PVC
- distance between nozzle and deflector: 80mm
- flat surface:  $90^\circ$
- inclined surface:  $45^\circ / 135^\circ$
- deepening truncated cone:  $170^\circ$
- deepening cone:  $135^\circ$

#### Transparent splash guard

- material: PMMA
- $\varnothing$  outer: 230mm
- height: 250mm

#### Measuring ranges

- indicated measuring range force: 0...3,3N
- indicated measuring range flow rate: 0...12L/min
- indicated measuring range pressure: 0...0,39bar

LxWxH: 650x260x300mm

Weight: approx. 8kg

### Scope of delivery

- 1 experimental unit
- 2 nozzles
- 4 deflectors
- 1 set of instructional material

# HM 250.05

## Measurement of jet forces

### 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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