

# HM 150.13

## Methods of flow measurement



The illustration shows the device and the GUNT Science Media Center, tablet not included

### Description

- different methods of flow rate measurement
- determining the pressure distribution in Venturi nozzle or measuring orifice/measuring nozzle
- flow visualisation using CFD technology
- multimedia teaching material on-line in the GUNT Science Media Center: E-Learning course, prepared CFD simulations, worksheets, videos

Measuring the flow rate is an important aspect in measurement technology. There are several ways to measure the flow of fluids in pipes.

With HM 150.13 students can familiarise themselves with various methods for measuring flow in the pipe system and apply them in practice.

The experimental unit contains different measuring instruments to determine the flow rate. These instruments are designed with transparent cases in order to visualise how they operate and function. The methods include, for example, rotameters, a Venturi nozzle or orifice plate flow meter and measuring nozzle.

Six tube manometers is used in order to determine the pressure distribution in the Venturi nozzle or the orifice plate flow meter and measuring nozzle. The total pressure is measured by a Pitot tube. The experimental unit is positioned easily and securely on the work surface of the HM 150 base module. The water is supplied and the flow rate measured by HM 150. Alternatively, the experimental unit can be operated by the laboratory supply.

In order to perform a virtual analysis of flow behaviour, CFD simulations are often used in practice. Such simulations allow, for example, flow visualisations in areas that cannot be visualised experimentally. In the GUNT Science Media Center, flow visualisations based on CFD calculations are available online. There are also multimedia teaching materials including E-Learning courses on basic knowledge and calculations. Videos show a complete experiment with preparation, execution and evaluation. Worksheets with solutions supplement the teaching material.

### Learning objectives/experiments

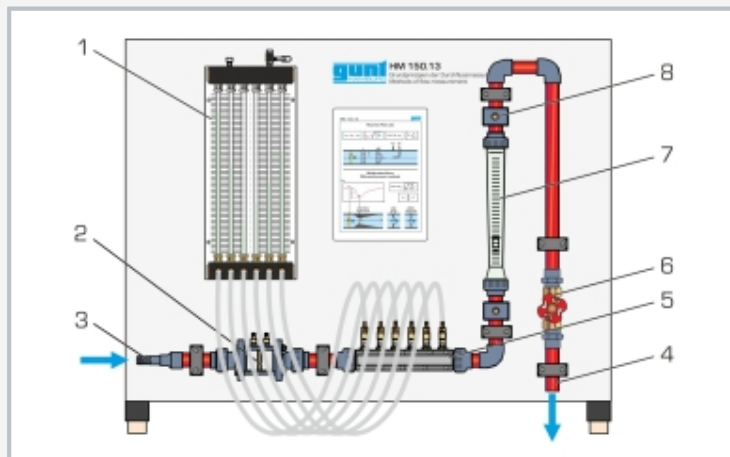
- flow measurement with
  - ▶ orifice plate flow meter and measuring nozzle
  - ▶ Venturi nozzle
  - ▶ rotameter
- pressure measurement with Pitot tube
- comparison of different instruments for flow measurement
- determining the corresponding flow coefficients
- calibrating measuring instruments

GUNT Science Media Center, develop digital skills

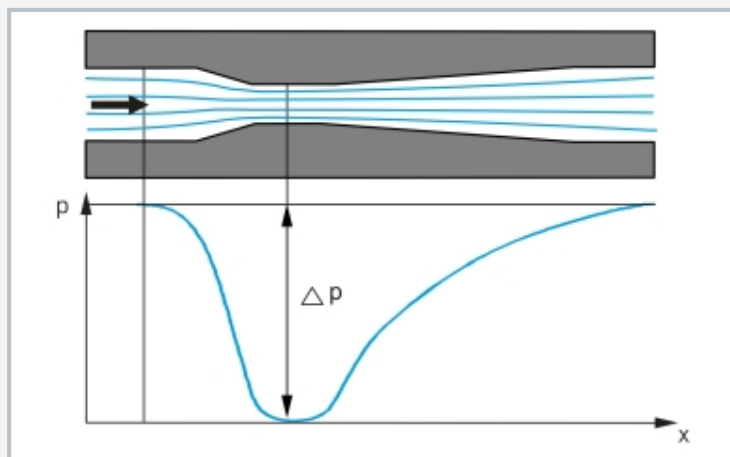
- E-Learning course with fundamental knowledge and calculations
- prepared CFD simulations for flow visualisation
- videos with detailed demonstration of the experiments: preparation, execution, evaluation
- assured learning success through digital worksheets
- retrieve information from digital networks

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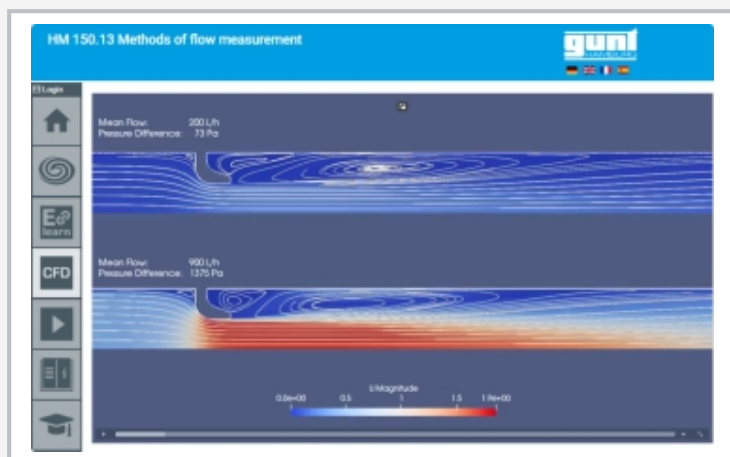
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1 6 tube manometers, 2 orifice plate flow meter and measuring nozzle, 3 water supply, 4 water drain, 5 Venturi nozzle, 6 valve for adjusting the flow rate, 7 rotameter, 8 measuring inlet



Pressure curve in a Venturi nozzle: p pressure, x section



Screenshot of the GUNT Science Media Center

### Specification

- [1] different methods of flow rate measurement
- [2] measuring instruments: orifice plate flow meter/measuring nozzle, Venturi nozzle and rotameter
- [3] 6 tube manometers to determine the pressure distribution in Venturi nozzle, orifice plate flow meter and measuring nozzle
- [4] measurement of the total pressure with Pitot tube
- [5] flow rate determined by HM 150 base module
- [6] water supply via HM 150 or via laboratory supply
- [7] flow visualisation using prepared CFD simulations
- [8] digital multimedia teaching material online in the GUNT Science Media Center: E-Learning course, prepared CFD simulations, worksheets, videos

### Technical data

Venturi nozzle:  $A=84...338\text{mm}^2$

■ angle at the inlet:  $10,5^\circ$

■ angle at the outlet:  $4^\circ$

Orifice plate flow meter:  $\varnothing 14\text{mm}$

Measuring nozzle:  $\varnothing 18,5\text{mm}$

Rotameter: max.  $1700\text{L/h}$

Measuring ranges

■ pressure:  $6 \times 0...390\text{mmWC}$

LxWxH:  $1100 \times 672 \times 900\text{mm}$

Weight: approx.  $30\text{kg}$

### Required for operation

HM 150 (closed water circuit) or water connection, drain;  
PC or online access recommended

### Scope of delivery

- 1 experimental unit
- 1 set of measuring instruments
- 1 set of hoses
- 1 set of tools
- 1 set of instructional material
- 1 online access to GUNT Science Media Center

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Optional accessories

HM 150      Base module for experiments in fluid mechanics