GUNT experimental flumes

- open-channel flow at the laboratory scale
- open channels with a rectangular cross-section
- investigation of control structures, changes in cross-section, discharge measurement and waves

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Hydraulic engineering is a crucial part of engineering.
How do we achieve the necessary river depth for ships?
How does open-channel flow change during flooding?
How far upstream do measures such as control structures have an effect? How can the discharge at barrages be calculated?

In order to understand answers to these questions and develop possible solutions, experimental flumes are used in teaching and research. This demonstrates and investigates the phenomena of open-channel flow on a laboratory scale. For example, control structures for flow regulation and various methods of flow measurement are demonstrated.

GUNT experimental flumes with their extensive accessories offer a wide range of experiments and demonstrations on the topics of open channels, flowing waters, hydraulic engineering and coastal protection.

GUNT develops your solution when the standard does not lead to the goal.

- analysis of your needs with the help of our decades of experience and in-depth know-how
- together with you: development of a high-quality and individual solution
- internal examination of the technical feasibility by GUNT
- together with you: evaluation and planning of the implementation

Customised experimental flumes to suit your application.

To references: REF

About the flumes: www

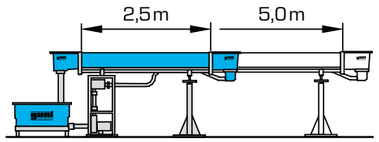
Overview of GUNT experimental flumes

GUNT experimental flumes and their accessories open up a wide range of experiments and demonstrations on the topics of open-channel flow, running waters, hydraulic engineering and coastal protection. They form the expandable foundation for custom investigations and research work. Experimental flumes from GUNT have been successfully put to use around the world for many years.

For each of the experimental flumes, there is a variety of models for discharge control, such as weirs, sills, stilling basins, as well as wave generators, beach elements and bridge piers. Technical solutions for sediment feed and removal are also available. In addition, we can also provide specially adapted instrumentation such as water level gauges, pitotstatic tubes, tube manometers and velocity meters.

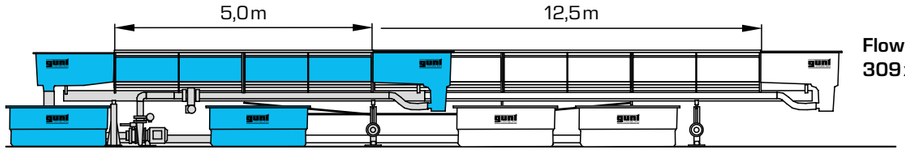
Design features

- rigidity against deformation
- side walls made of tempered glass
- all surfaces in contact with water are made of corrosion-resistant materials
- low-turbulence flow at the entrance to the experimental section



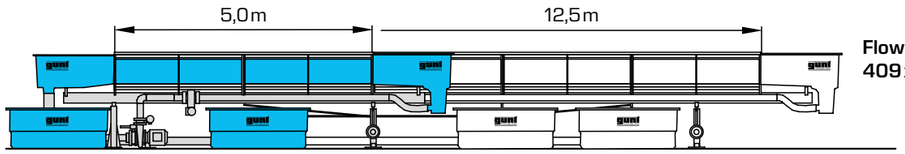
Flow cross-section 86 x 300 mm

HM 160



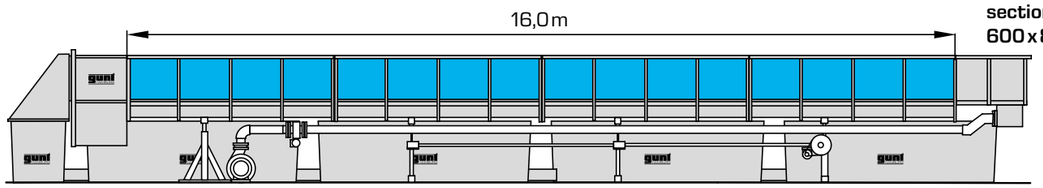
Flow cross-section 309 x 450 mm

HM 162



Flow cross-section 409 x 500 mm

HM 163



Flow cross-section 600 x 800 mm

HM 161

GUNT provides four experimental flumes with different cross-sections, depending on the purpose of use and the local conditions:

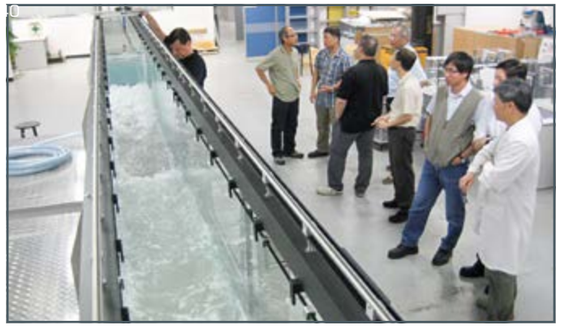
- HM 160 (86 x 300 mm)
- HM 162 (309 x 450 mm)
- HM 163 (409 x 500 mm)
- HM 161 (600 x 800 mm)

The experimental flumes have different lengths of experimental section to choose from:

- HM 160
  with experimental sections of 2,5 m or 5 m
- HM 162 and HM 163
  with experimental sections of 5 m, 7,5 m, 10 m or 12,5 m
- HM 161
  with an experimental section of 16 m

As a result, the length of the experimental section can be adjusted to the individual requirements of the laboratory.

The HM 160 flume is perfectly suited as an introduction to the topic of open-channel flow and the demonstration of many of the basic principles. This flume is compact and requires little space.

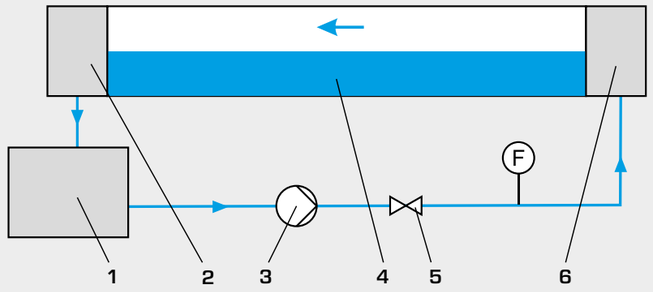


The HM 162 and HM 163 experimental flumes can be supplied in four different lengths. The “short” experimental flume, with an experimental section of 5m, can easily be set up even in smaller laboratories. As the length of the experimental section increases, the observation section upstream and downstream of obstacles increases.

The largest GUNT experimental flume HM 161 – with a cross-section of 600x800mm and a 16m long experimental section – offers a large number of possibilities for your own research projects.

Technical details for GUNT experimental flumes
The closed water circuit

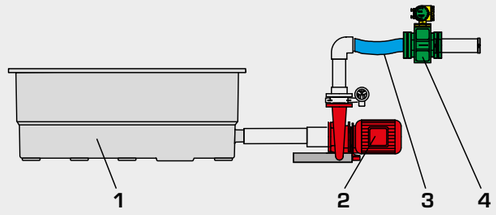
The water circuit



1 water tank,
2 outlet element,
3 pump,
4 experimental section,
5 shut-off valve,
6 inlet element,
F flow meter

All experimental flumes can be operated independently of the laboratory water supply and have a closed water circuit with water tanks, pump and flow meter. To protect against overfilling of the experimental section, level switches turn off the pump when the maximum level in the inlet or outlet element is exceeded.

The pump



1 water tank, **2** pump, **3** hose, **4** flow meter

The centrifugal pump is separated from the experimental section in the experimental flumes HM 162, HM 163 and HM 161 and is mounted on its own foundation. It is connected to the piping to the inlet element via a hose. This ensures that there is no transmission of vibrations between the experimental section and the pump. In the small experimental flume HM 160 the vibrations that occur are negligible, so the pump is integrated in one of the experimental flume's supports.

Pump (HM 162) with shut-off valve with manual actuation in the delivery side for adjusting the flow rate (above the pump). The pump's delivery line also contains the hose and the electromagnetic flow meter. The shut-off valve is only needed for wave experiments.

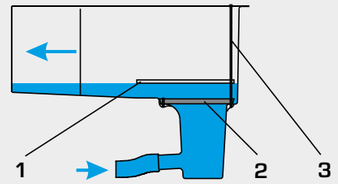
Methods for adjusting the flow rate in the inlet to the experimental section

All experimental flumes allow adjusting the flow rate. The speed of the pump used in HM 161, HM 162 and HM 163 is infinitely adjustable by using a frequency converter until the desired flow rate is achieved. In HM 160, a valve is used to adjust the flow rate. The flow rate in HM 160 is measured by a rotameter, while HM 161, HM 162 and HM 163 are both equipped with an electromagnetic flow meter.

The inlet element

In all experimental flumes, the inlet element is designed for optimum flow so that the flow is less turbulent as it enters the experimental section.

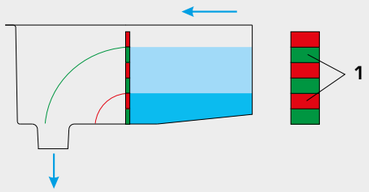
The water enters from below through a flow straightener. A damping plate calms the water further. The damping plate floats on the water and is mounted on a guide.



1 damping plate,
2 flow straightener,
3 guide

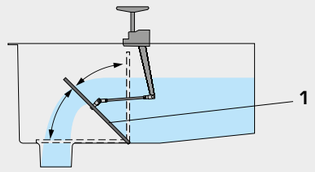
The outlet element

The outlet element of all experimental flumes contains a plate weir. The plate weir included in HM 160 consists of six elements that can be removed, so that six damming heights are available to choose from. If all elements are removed, it corresponds to free discharge without a weir. The plate weir included in HM 161, HM 162 and HM 163 is mounted to rotate around a fixed point and can thus be lowered completely. As such, any desired top water level can be set (see illustrations).



Principle of the plate weir with elements

1 removable element



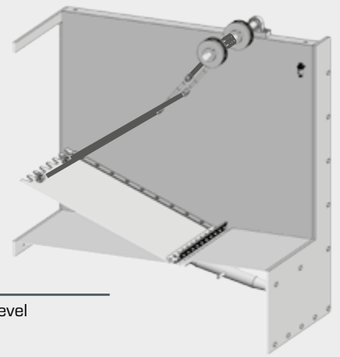


Plate weir **1** with full damming height in different positions to adjust the top water level in the outlet of the experimental section.

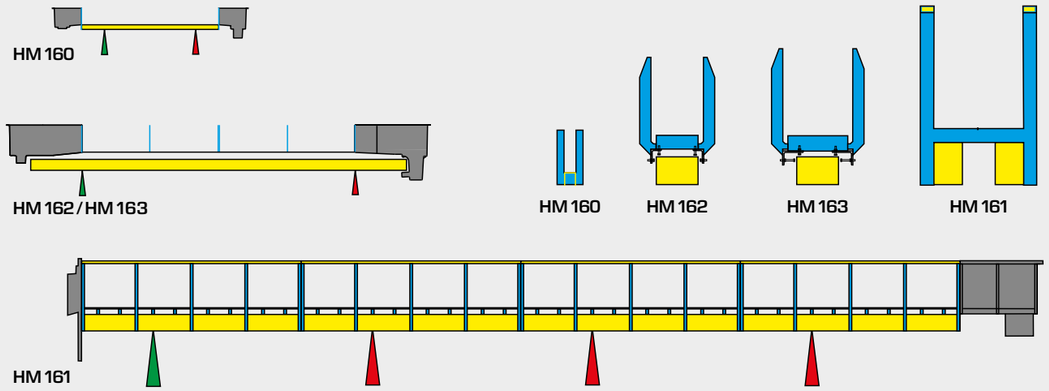
Technical details for GUNT experimental flumes
Structural features

Rigidity against deformation

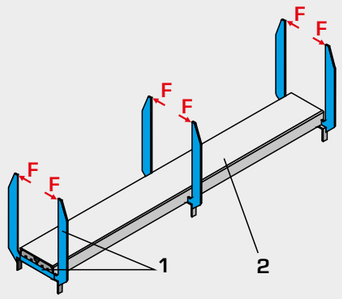
The experimental section of HM 162 and HM 163 is available in several lengths. The components used are essentially the same (modular design). In order to realise different lengths with the modular design, while maintaining inclination adjustment, the experimental flume is supported by an auxiliary carrier with two supports. In the version with long experimental section, the inevitable deformations are absorbed by the supports. The individual adjustability of the elements enables precise alignment of the experimental section.

The elements of the self-supporting experimental section in HM 161 are mounted on four supports, so that there is only ever a minimal deformation.

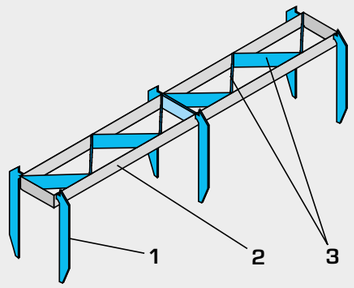
In HM 160 the stresses that occur in comparison to HM 162 are small, so that doubling the length of the experimental section does not pose a problem for the rigidity of the self-supporting experimental flume with two supports.



carrier (rigidity against bending), frame (rigidity against water pressure), fixed support,
height-adjustable support (flume inclination adjustment), experimental section, inlet and outlet element



The rigidity of the elements of the experimental section against water pressure is ensured by the welded frame. The frames support the glass side walls.



Bottom element of an element of the HM 162 / HM 163 experimental section, reinforced with diagonal ribs to increase stiffness against bending and torsion.

1 welded frame, **2** bottom element of an element of the experimental section, **3** diagonal rib, **F** water pressure force

Inclination adjustment

All experimental flumes can be inclined, which means that the slope is adjustable. The current slope can be read directly on a scale (HM 160, HM 162, HM 163) or a touch screen (HM 162, HM 163, HM 161).

Inclination adjustment in HM 160 is manual and electrical in HM 161.

In HM 162 and HM 163 the inclination can be adjusted either manually or electrically. With an experimental section above 7,5 m we recommend electrical inclination adjustment HM 162.57.

Inclination adjustment in HM 162 and HM 163:
left manual, **right** electrical inclination adjustment HM 162.57

Manual inclination adjustment in HM 160

Electrical inclination adjustment in HM 161

Materials used

In all experimental flumes, the bottom of the experimental section is made of stainless steel. Tempered glass is used for the side walls of the experimental section. It is scratch resistant, does not age and does not deform. The water tank, inlet and outlet elements are made of corrosion-resistant GRP (glass reinforced plastic) or steel. The piping is PVC. The models used in the experimental flumes consist of aluminium, stainless steel, PVC or Plexiglas.

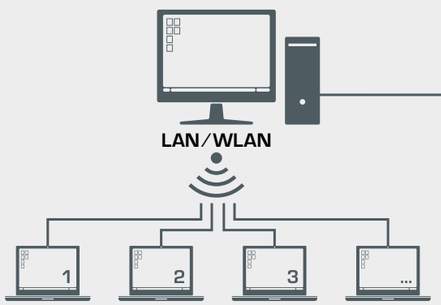
Automated operation and data acquisition for HM 162 / HM 163 and HM 161

The experimental flumes HM 162, HM 163 and HM 161 are controlled by a PLC via touch screen. PLC-supported accessories are automatically identified and displayed. By means of an integrated router, these two experimental flumes can alternatively be operated via end device. The user interface can also be displayed on other end devices (screen mirroring). Via the PLC, the measured values can be stored internally.

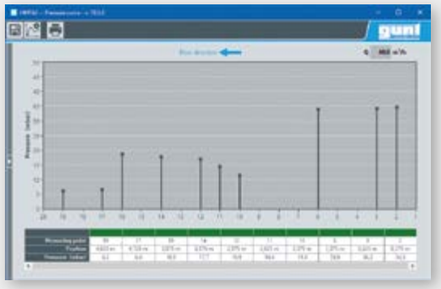
Screen mirroring

- mirroring of the user interface on other end devices: PC, tablet, smartphone
- selection of different user levels on the end device, for tracking experiments or for control and operation
- transmitting stored measured values from the experimental unit to end devices

GUNT software



- connection of any number of end devices (Windows-based) via the customer's own network
- individually record, graphically display and evaluate measured values from pressure measurement on each end device



Curve of the pressure heads along the experimental section

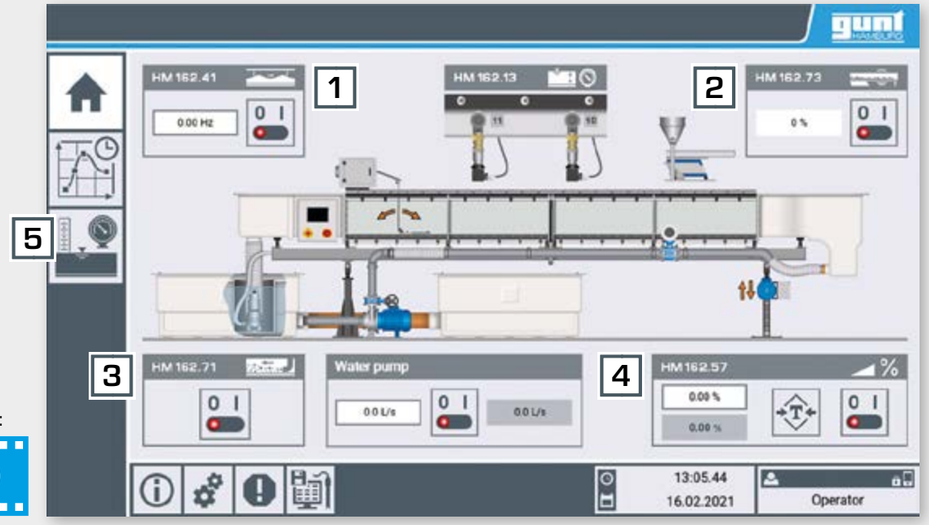
External operation

HM 161 is equipped with two freely positionable touch panels. They display measured values and operating states and enable system operation.

At the same time, the measured values can be transmitted directly to a 32" monitor for distant reading and to a PC via LAN where they can be analysed with the software.

For experiment observation in remote learning, the use of a camera is necessary.

PLC-supported accessories



To video:

1 Wave generator HM 162.41 / HM 163.41 / HM 161.41

With the wave generator surface waves are generated by a paddle that swings back and forth. Flow rate, inclination adjustment and frequency of the displacement plate are set and displayed directly on the experimental flume using the touchscreen.

2 Sediment feeder HM 162.73 / HM 163.73 / HM 161.73

The feeder is operated and the vibration intensity is set via the touch screen of the PLC.

3 Closed sediment circuit HM 162.71 / HM 163.71 / HM 161.71

The sediment pump is operated via the touch screen of the PLC.

4 Electrical inclination adjustment HM 162.57

The electrical inclination adjustment is operated via the touch screen of the PLC of HM 162 / HM 163. The HM 161 experimental flume has motorised inclination adjustment, which is also operated via touchscreen. HM 162.57 is used with the experimental flumes HM 162 and HM 163.

5 Electronic pressure measurement HM 162.13 / HM 161.13

With the electronic pressure measurement, the discharge depth along the experimental section in HM 162, HM 163 and HM 161 can be recorded with pressure sensors and displayed in the form of the pressure height in the GUNT software. Depending on the experiment, up to ten selected measuring points can be connected along the experimental section. Additionally, the flow rate is recorded and displayed on the touch screen of the PLC.

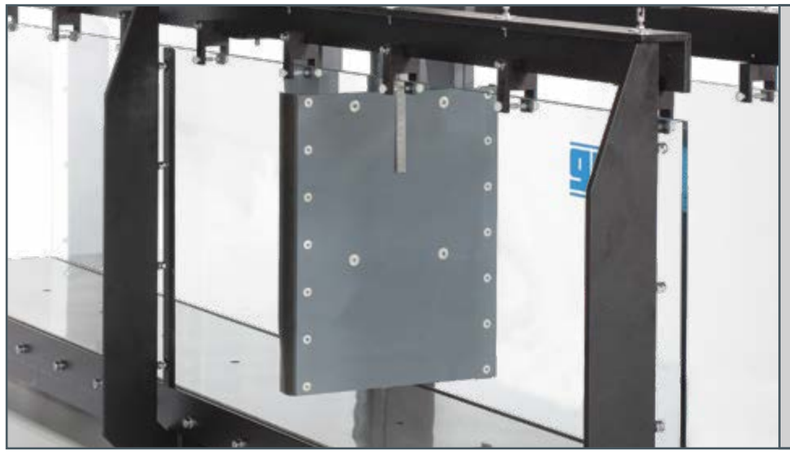
A second measuring amplifier HM 162.13 / HM 161.13 can be used simultaneously to display the pressure heads of 20 measuring points of the experimental section.

HM 162.13 is used with the experimental flumes HM 162 / HM 163

Accessories for experimental flumes HM 160, HM 161, HM 162 and HM 163

Over the following pages we will present the complete range of accessories available for the GUNT experimental flumes, using HM 162 as an example. The accessories for the other experimental flumes are similar.

Control structures



Sluice gate

HM 160.29
Sluice gate

HM 161.29
Sluice gate

HM 162.29
Sluice gate

HM 163.29
Sluice gate

Radial gate

HM 160.40
Radial gate

HM 161.40
Radial gate

HM 162.40
Radial gate

HM 163.40
Radial gate

Sharp-crested weirs / plate weirs

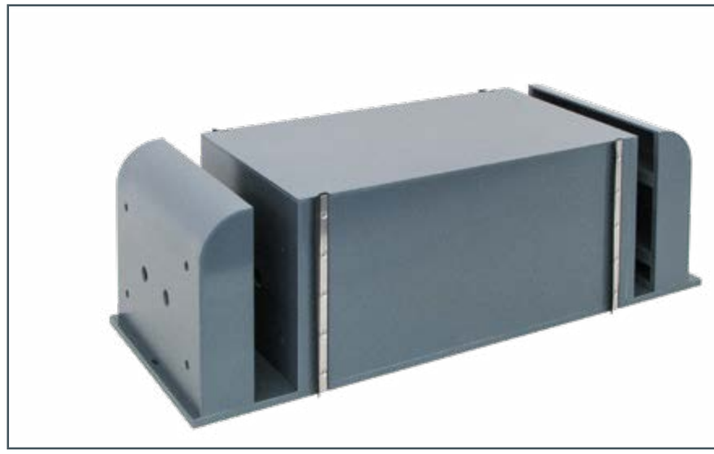
Rehbock, Cipoletti, Thomson; rectangular weir without contraction

HM 160.30
Set of plate weirs, four types

HM 161.30
Set of plate weirs, four types

HM 162.30
Set of plate weirs, four types

HM 163.30
Set of plate weirs, four types



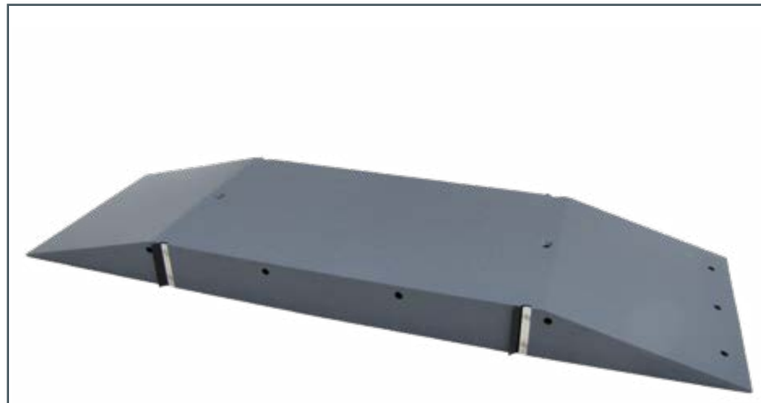
Broad-crested weir

HM 160.31
Broad-crested weir

HM 161.31
Broad-crested weir

HM 162.31
Broad-crested weir

HM 163.31
Broad-crested weir



Sill

HM 160.44
Sill

HM 161.44
Sill

HM 162.44
Sill

HM 163.44
Sill

Crump weir

HM 160.33
Crump weir

HM 161.33
Crump weir

HM 162.33
Crump weir

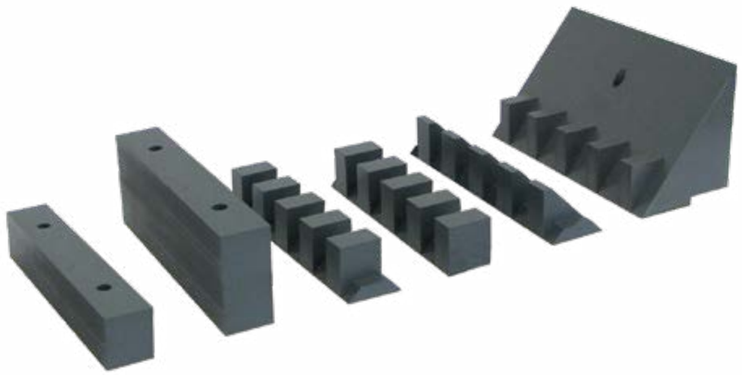
HM 163.33
Crump weir

Accessories for experimental flumes HM 160, HM 161, HM 162 and HM 163

Control structures

Ogee-crested weir

- HM 160.32 Ogee-crested weir with two weir outlets
- HM 161.32 Ogee-crested weir with two weir outlets
- HM 162.32 Ogee-crested weir with two weir outlets
- HM 163.32 Ogee-crested weir with two weir outlets



Optional expansion for the ogee-crested weir:

Energy dissipation elements

including chute block and sills

- HM 160.35 Elements for energy dissipation
- HM 161.35 Elements for energy dissipation
- HM 162.35 Elements for energy dissipation
- HM 163.35 Elements for energy dissipation

Ogee-crested weir with pressure measuring points along the weir downstream side

- HM 160.34 Ogee-crested weir with pressure measurement
- HM 161.34 Ogee-crested weir with pressure measurement
- HM 162.34 Ogee-crested weir with pressure measurement
- HM 163.34 Ogee-crested weir with pressure measurement

Siphon weir

- HM 160.36 Siphon weir
- HM 161.36 Siphon weir
- HM 162.36 Siphon weir
- HM 163.36 Siphon weir

Rake

- HM 161.38 Rake
- HM 162.38 Rake
- HM 163.38 Rake

Accessories for experimental flumes HM 160, HM 161, HM 162 and HM 163

Discharge measurement

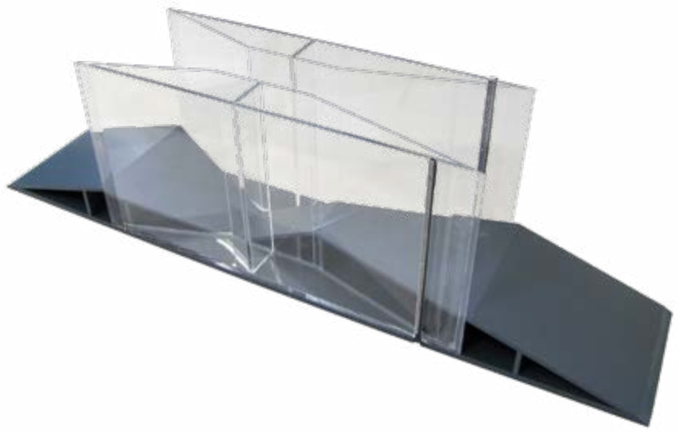
Sharp-crested weirs / plate weirs

Rehbock, Cipoletti, Thomson; rectangular weir without contraction

HM 160.30	Set of plate weirs, four types
HM 161.30	Set of plate weirs, four types
HM 162.30	Set of plate weirs, four types
HM 163.30	Set of plate weirs, four types

Venturi flume

HM 160.51	Venturi flume
HM 161.51	Venturi flume
HM 162.51	Venturi flume
HM 163.51	Venturi flume



Parshall flume

HM 161.55	Parshall flume
HM 162.55	Parshall flume
HM 163.55	Parshall flume

Discharge measurement

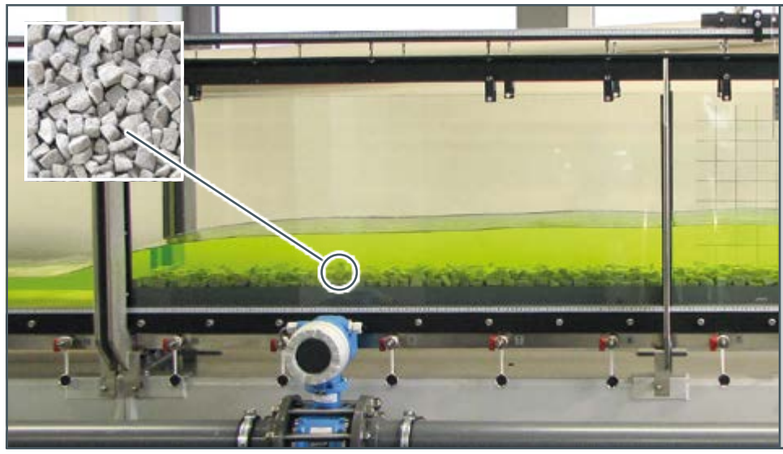
Trapezoidal flume

HM 161.63	Trapezoidal flume
HM 162.63	Trapezoidal flume
HM 163.63	Trapezoidal flume

Change in cross-section

Sill

HM 160.44	Sill
HM 161.44	Sill
HM 162.44	Sill
HM 163.44	Sill



Flume bottom with pebble stones

HM 160.77	Flume bottom with pebble stones
HM 161.77	Flume bottom with pebble stones
HM 162.77	Flume bottom with pebble stones
HM 163.77	Flume bottom with pebble stones

Accessories for experimental flumes HM 160, HM 161, HM 162 and HM 163

Change in cross-section

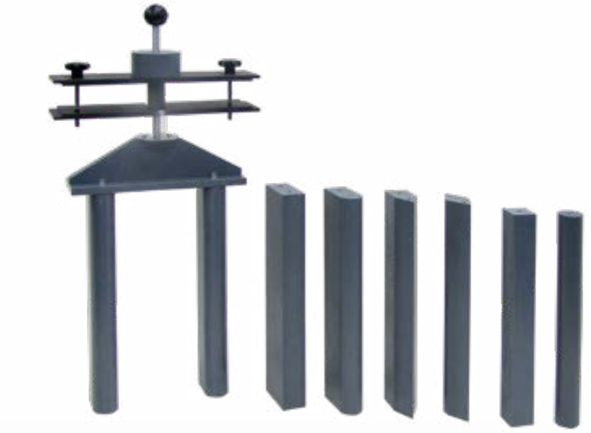
Crump weir

HM 160.33
Crump weir

HM 161.33
Crump weir

HM 162.33
Crump weir

HM 163.33
Crump weir



Piers

7 profiles: rectangular, square, circular, rounded (one end or both ends), pointed-nosed (one end or both ends)

HM 160.46
Set of piers, seven profiles

HM 161.46
Set of piers, seven profiles

HM 162.46
Set of piers, seven profiles

HM 163.46
Set of piers, seven profiles

Culvert

HM 160.45
Culvert

HM 161.45
Culvert

HM 162.45
Culvert

HM 163.45
Culvert

Wave generator

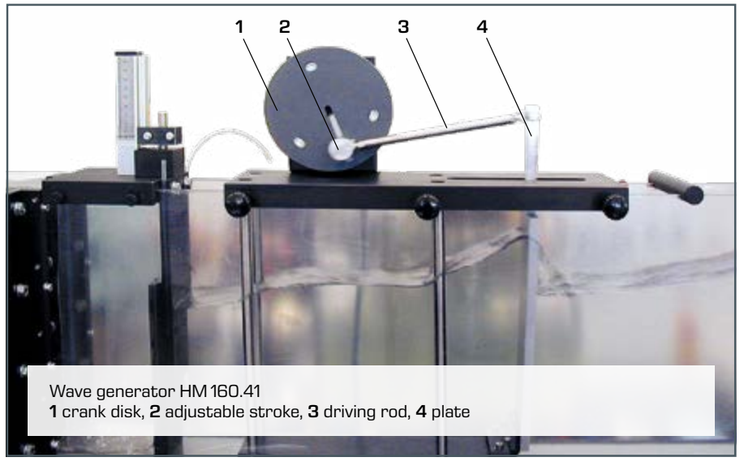
The wave generator HM 16x.41 is available as an accessory for all experimental flumes and generates periodic, harmonic waves with different wavelengths and/or wave heights.

An electric motor drives a crank disk, which is connected to a plate via a driving rod. The plate performs a harmonious stroke movement. The speed of the crank disk, in other words the frequency, with which the plate is moved back and forth can be adjusted, therefore affecting the wavelength of the generated waves. Furthermore, the stroke is finely adjustable, so that the wave height (amplitude) can be varied.

The speed of the crank disk is set differently:
- at HM 160.41 on the included control unit
- at HM 162.41 / HM 163.41 / HM 161.41 via touch screen at the experimental flume

Wave generator HM 162.41

Touch screen



Wave generator HM 160.41
1 crank disk, **2** adjustable stroke, **3** driving rod, **4** plate

Wave generator

HM 160.41
Wave generator

HM 161.41
Wave generator

HM 162.41
Wave generator

HM 163.41
Wave generator

Accessories for experimental flumes HM 160, HM 161, HM 162 and HM 163

Beaches

Plain beach

HM 160.42 Plain beach

Set of beaches

3 beaches: plain, rough, permeable

HM 161.80 Set of beaches
HM 162.80 Set of beaches
HM 163.80 Set of beaches

Flow-induced vibrations

Vibrating piles

HM 160.61 Vibrating piles
HM 161.61 Vibrating piles
HM 162.61 Vibrating piles
HM 163.61 Vibrating piles

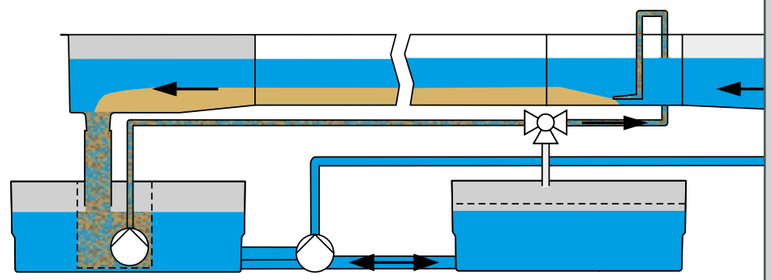
Sediment transport

Sediment trap

HM 160.72 Sediment trap
HM 161.72 Sediment trap
HM 162.72 Sediment trap
HM 163.72 Sediment trap

Sediment feeder

HM 160.73 Sediment feeder
HM 161.73 Sediment feeder
HM 162.73 Sediment feeder
HM 163.73 Sediment feeder



Closed sediment circuit

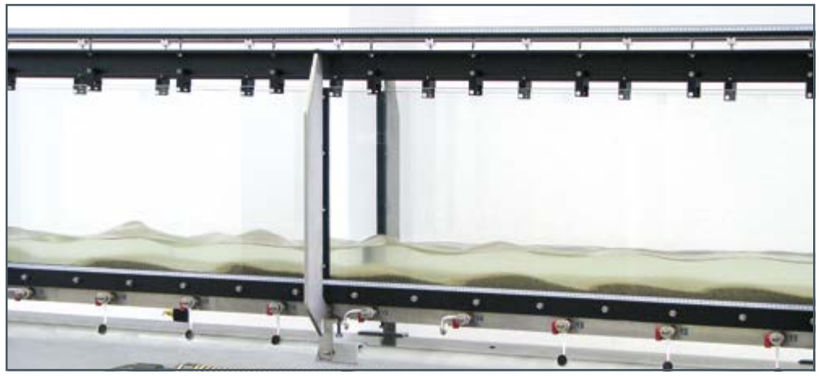
HM 161.71 Closed sediment circuit
HM 162.71 Closed sediment circuit
HM 163.71 Closed sediment circuit

Accessories for experimental flumes HM 160, HM 161, HM 162 and HM 163

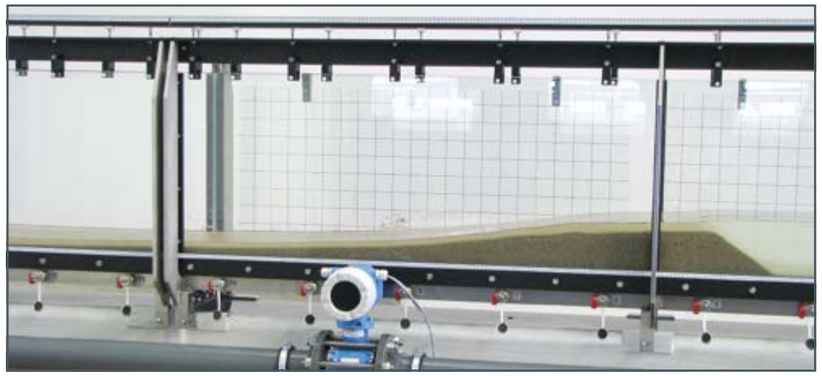
Sediment transport

Flows in rivers, canals and coastal areas are often associated with sediment transport. Bed-load transport is the main transport mechanism. During bed-load transport, solids are moved along the flume bottom.

The described accessories for the GUNT experimental flumes consider bed-load transport only. The used sediment is sand with a grain size of 1...2 mm. The sediment is introduced at the inlet of the experimental section.
At the end of the experimental section, a sediment trap separates the sediment.



Dune migration

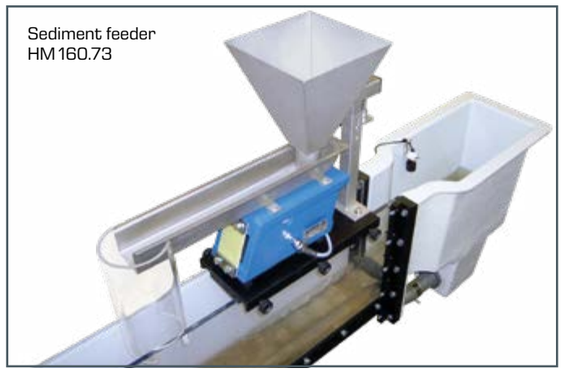


Sediment transport in running waters

Sediment feed

The sediment is added manually with a shovel or a bucket included in the scope of delivery of the sediment trap HM 16x.72.

Alternatively, the sediment feeder HM 16x.73 can be used. This feeder essentially consists of a vibrating conveyor, via which sediment is introduced into the experimental section. The feeder is mounted above the inlet of the experimental section.



Sediment feeder HM 160.73

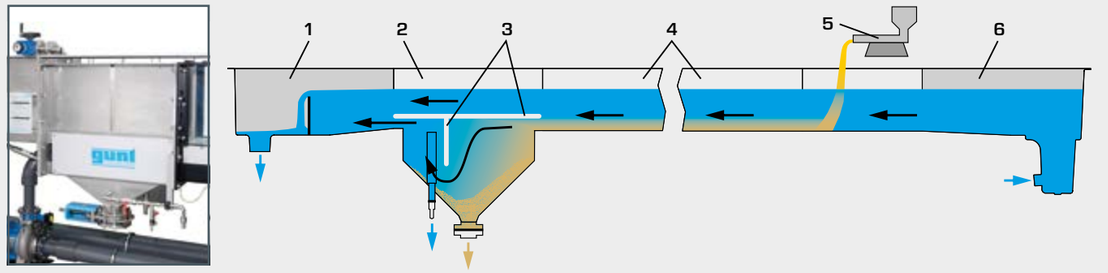
Sediment trap

The purpose of the sediment trap is to separate sediment from the flow to prevent sediment from entering the pump or the flow meter. The flow near the bottom of the flume contains the sediment.

The sediment trap HM 160.72 is inserted in the water tank after the outlet element. It consists of a fine mesh screen and serves to collect the sediment.

For the larger experimental flumes HM 162, HM 163 and HM 161, the sediment trap HM 162.72 / HM 163.72 / HM 161.72 is permanently mounted between the experimental section and the outlet element. The flow near the bottom is fed into this sediment trap. In the trap, the sediment sinks to the bottom and accumulates. The sediment-free water continues to flow into the outlet element. The sediment is removed manually from the trap and delivered back to the feed.

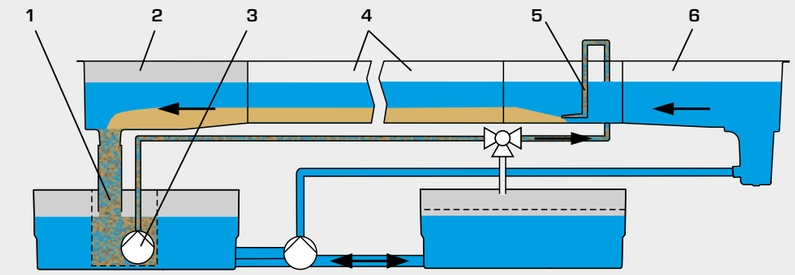
Sediment trap HM 160.72 in the water tank of HM 160 for collecting the sediment



Sediment trap HM 162.72 / HM 163.72 / HM 161.72

1 outlet element, **2** sediment trap, **3** separator, **4** experimental section with sediment, **5** sediment feed (either manually with a bucket or with sediment feeder HM 16x.73), **6** inlet element; sediment, water

For HM 162 / HM 163 / HM 161, the closed sediment circuit HM 16x.71 is available as an alternative to the sediment trap. The accessory is automatically identified by the PLC and displayed on the touch screen of the experimental flume. The sediment pump is operated via touchscreen of HM 162 / HM 163 / HM 161.



Touch screen

Closed sediment circuit HM 162.71 / HM 163.71

1 screen basket, **2** outlet element, **3** pump, **4** experimental section with sediment, **5** sediment feeder, **6** inlet element; sediment, water

Accessories for experimental flumes HM 160, HM 161, HM 162 and HM 163

Measuring instruments

Level gauge
analogue or with digital display

HM 160.52 Level gauge
HM 160.91 Digital level gauge

HM 161.52 Level gauge
HM 161.91 Digital level gauge

HM 162.52 Level gauge
HM 162.91 Digital level gauge

HM 163.52 Level gauge
HM 163.91 Digital level gauge

Velocity measurement
via pitotstatic tube

HM 160.50
Pitotstatic tube

HM 161.50
Pitotstatic tube

HM 162.50
Pitotstatic tube

HM 163.50
Pitotstatic tube

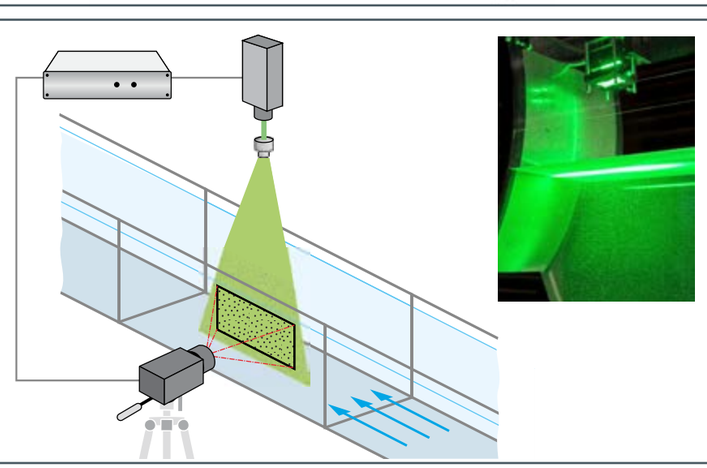
Velocity measurement
via velocity meter

HM 160.64
Velocity meter

HM 161.64
Velocity meter

HM 162.64
Velocity meter

HM 163.64
Velocity meter



PIV-System

HM 161.81 PIV-System
HM 161.82 Instrument carrier
HM 161.83 Glass cut-out

HM 162.81 PIV-System
HM 162.82 Instrument carrier
HM 162.83 Glass cut-out

HM 163.81 PIV-System
HM 163.82 Instrument carrier
HM 163.83 Glass cut-out

Instrument carrier
accessory required for the level gauge and the velocity measurement

HM 161.59
Instrument carrier

HM 162.59
Instrument carrier

HM 163.59
Instrument carrier

Accessories for experimental flumes HM 160, HM 161, HM 162 and HM 163

Measuring instruments

Pressure measurement

HM 160.53
Ten tube manometers

HM 161.53
20 tube manometers

HM 162.53
Ten tube manometers

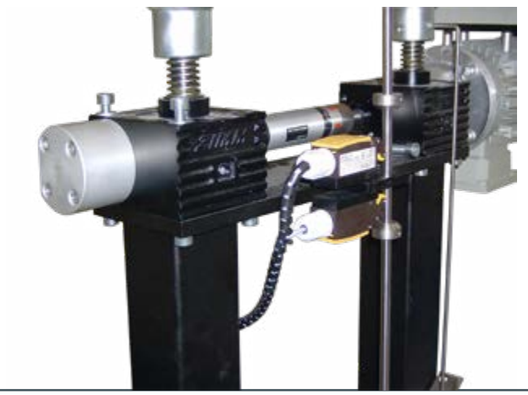
HM 163.53
Ten tube manometers

Electronic pressure measurement

HM 161.13 Electronic pressure measurement, 10x 0...100 mbar

HM 162.13 Electronic pressure measurement, 10x0...50 mbar
also suitable for HM 163

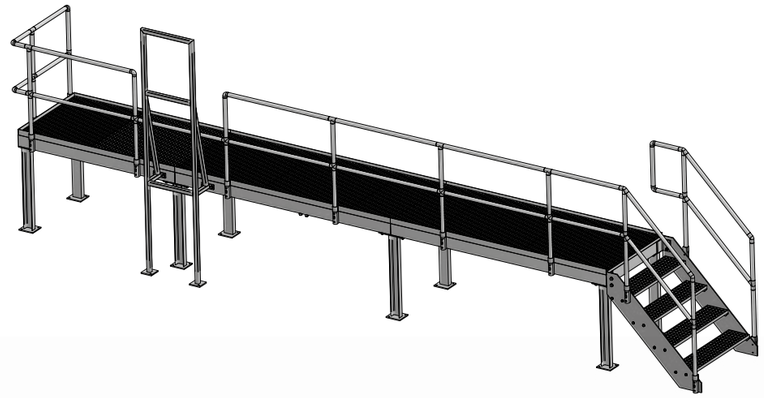
Electrical inclination adjustment



recommended for experimental sections larger than 7,5 m

HM 162.57
Electrical inclination adjustment
also suitable for HM 163

Other accessories



Gallery

HM 162.14
Gallery

HM 163.14
Gallery

Gallery extension element, 2,5 m

HM 162.15
Extension element of the gallery

HM 163.15
Extension element of the gallery

Experimental flume extension element, 2,5 m

for longer experimental sections

HM 160.10 Extension element of the experimental flume

HM 162.10 Extension element of the experimental flume

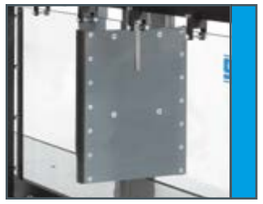
HM 163.10 Extension element of the experimental flume

Water tank, 1100 L

HM 162.20
Water tank

HM 163.20
Water tank

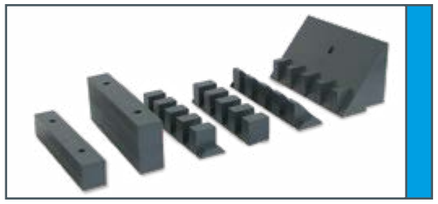
Open-channel flow in the lab


HM 162.29 Sluice gate

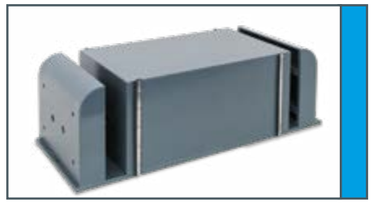

HM 162.40 Radial gate

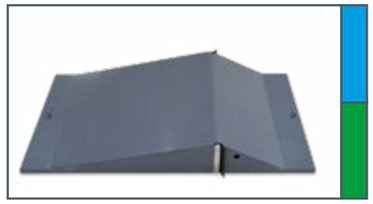

HM 162.36 Siphon weir


HM 162.32 Ogee-crested weir with two weir outlets

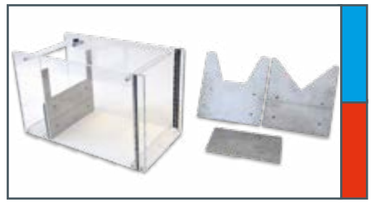

HM 162.35 Elements for energy dissipation


HM 162.38 Rake


HM 162.31 Broad-crested weir

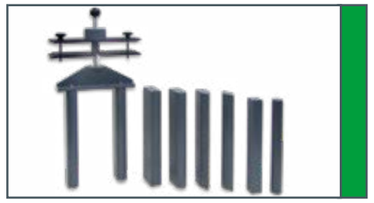

HM 162.33 Crump weir


HM 162.34 Ogee-crested weir with pressure measurement

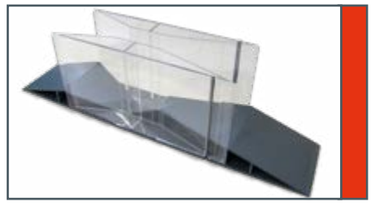

HM 162.30 Set of plate weirs, four types


HM 162.63 Trapezoidal flume

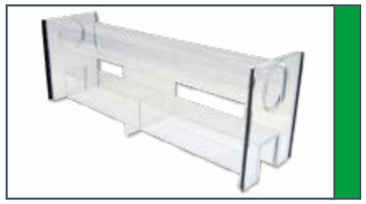

HM 162.44 Sill

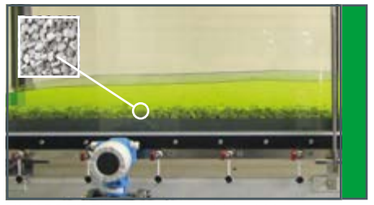

HM 162.46 Set of piers, seven profiles

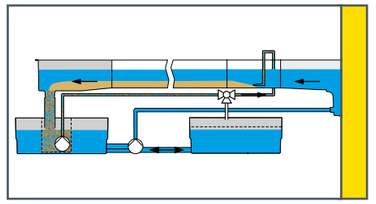
HM 162 with an experimental section of 7,5 m


HM 162.55 Parshall flume


HM 162.51 Venturi flume


HM 162.45 Culvert


HM 162.77 Flume bottom with pebble stones

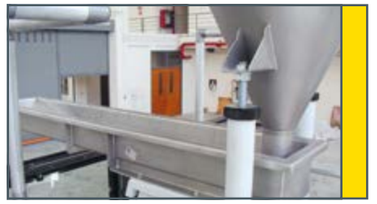

HM 162.71 Closed sediment circuit


HM 162.61 Vibrating piles

HM 162.80 Set of beaches


HM 162.41 Wave generator

HM 162.72 Sediment trap

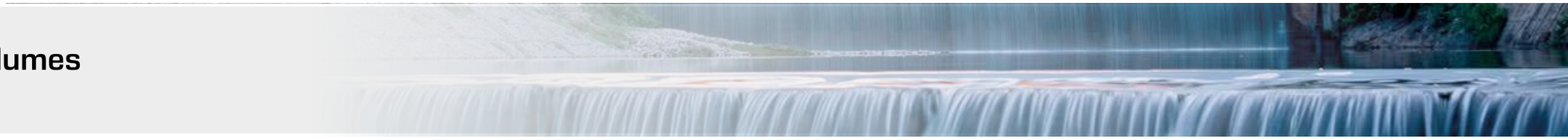

HM 162.73 Sediment feeder

A wide range of typical models allows the user to design a broad and individual programme of experiments with GUNT experimental flumes. The programme of experiments shown in this catalogue for HM 162 applies, in principle, for all GUNT experimental flumes.

The models of the other GUNT experimental flumes are similar.

- Control structures
- Changes in cross-section (losses, flow formulae)
- Discharge measurement
- Other experiments: including waves, sediment transport

The appropriate instrumentation for measuring the discharge depth and the flow velocity is also available as additional accessories.



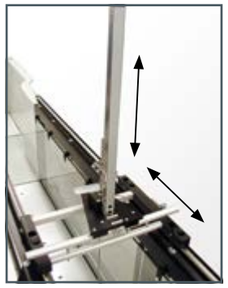
GUNT experimental flumes
Instrumentation

Instrument carrier for HM 162, HM 163 and HM 161

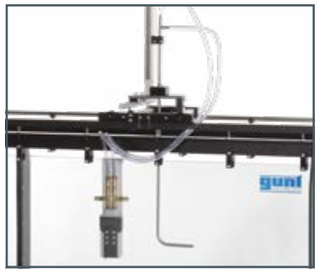
The experimental flumes HM 162, HM 163 and HM 161 extend above the side wall guide rails. An instrument carrier can be placed on the rails and moved. The different instruments are mounted on the instrument carrier, for example a level gauge or a pitotstatic tube. Using the carrier, the instruments can be moved to nearly every point of the flow. The carrier can be locked during the measurements with fixing devices. The position of the carrier along the experimental section is read on a scale (see photo). On the carrier itself is another scale, used to determine the position transverse to the direction of flow.

In the small experimental flume HM 160 no instrument carrier is necessary. The instruments are placed directly on the top of the experimental section and clamped in place.

Scale along the experimental section



Instrument carrier with level gauge



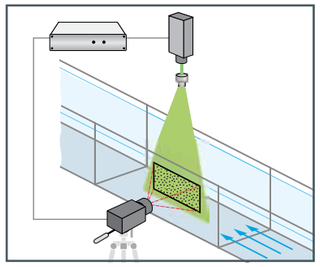
Pitotstatic tube HM 162.50 with instrument carrier

Flow velocity

GUNT offers two methods of measuring the flow rate in all experimental flumes: the traditional pitotstatic tube or a digital velocity meter. The pitotstatic tube HM 16x.50 measures the static pressure and the total pressure at any point of the flow. A digital pressure gauge displays the difference between the two pressures. The pressure difference corresponds to the dynamic pressure, from which the flow velocity can be calculated.

The core element of the velocity meter HM 16x.64 is an impeller that is rotated by the flow. The speed of the impeller is proportional to the flow velocity. The flow velocity is read directly from the digital display.

Velocity meter HM 16x.64



PIV-System HM 162.81

PIV-System

A PIV system (Particle Image Velocimetry) is used to record velocity fields in the experimental flume. HM 16x.81 includes a complete system with light sectioning optics, camera and synchronizer. This system is suitable for two-dimensional flow measurements.

For experiments where the light source is to be mounted above the flume, the HM 16x.82 instrument carrier can be used as an option. If the light source is to be positioned under the flume, a HM 16x.83 glass cut-out is available for the base of the flume.

Level gauge HM 162.52 with instrument carrier

Discharge depth

To measure the discharge depth, the level gauge HM 16x.52 or HM 16x.91 with digital display is used. The tip of the probe is moved to the surface of the water from above.

Digital level gauge HM 162.91 with instrument carrier

Measuring methods in your laboratory

Of course, you can also use your own laboratory measuring methods to determine the flow velocity, such as PIV (Particle Image Velocimetry) or LDA (Laser Doppler Anemometry) and ultrasound to determine the discharge depth.

Pressure measurement along the experimental section

All experimental flumes are equipped with pressure measuring points in the flume bottom, distributed over the length of the experimental section. To read these pressures, the pressure measuring points are connected to the optional manometer panel HM 16x.53 via hoses.

The elements of the experimental section of HM 160 contain ten pressure measuring points over a length of 2,5 m. The manometer panel HM 160.53 contains ten tubes.

The elements of the experimental section of HM 162 / HM 163 each contain ten pressure measuring points, which are uniformly distributed over the length of the 2,5 m element.

In HM 161, 48 pressure measuring points are evenly distributed over the experimental section with 16 m length. The manometer panel HM 161.53 contains 20 tubes.

Example

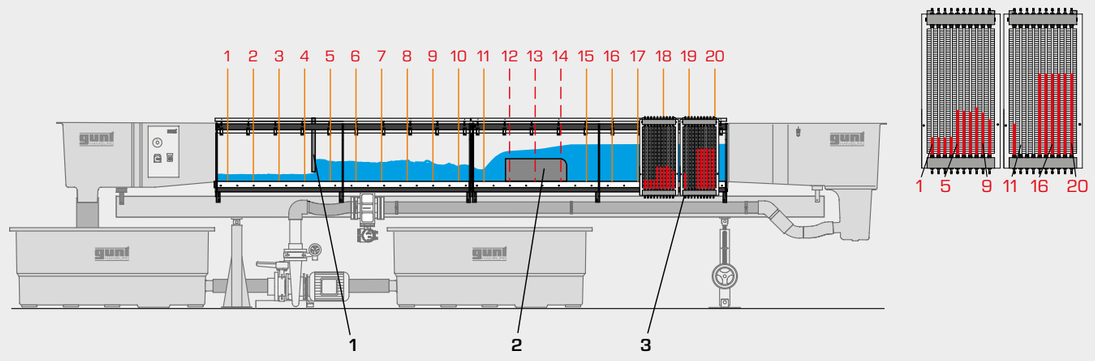
A broad-crested weir (HM 162.31) and a sluice gate (HM 162.29) have been inserted in the 5 m long experimental section of HM 162.

The pressure at these measuring points is called the pressure head and corresponds to the discharge depth. The pressure heads are displayed on the manometer panel HM 162.53.

When the experimental section is inclined, i.e. open-channel flow with a slope, it is more accurate to measure the discharge depth via the pressure head than via a level gauge.

The manometer panel HM 162.53 contains ten tubes. Depending on the length of the experimental section, we can either represent selected points on a panel or use multiple panels to show all pressures.

Tube manometers HM 162.53



HM 162 with sluice gate **1**, broad-crested weir **2** and manometer panels **3**. The manometer panels are enlarged so they can be clearly seen.

The complete GUNT programme

Engineering mechanics and engineering design

- statics
- strength of materials
- dynamics
- machine dynamics
- engineering design
- materials testing

Mechatronics

- engineering drawing
- cutaway models
- dimensional metrology
- fasteners and machine parts
- manufacturing engineering
- assembly projects
- maintenance
- machinery diagnosis
- automation and process control engineering

Thermal engineering

- fundamentals of thermodynamics
- heat exchangers
- thermal fluid energy machines
- internal combustion engines
- refrigeration
- HVAC

Fluid mechanics

- steady flow
- transient flow
- flow around bodies
- components in piping systems and plant design
- turbomachines
- positive displacement machines
- hydraulic engineering

Process engineering

- mechanical process engineering
- thermal process engineering
- chemical process engineering
- biological process engineering
- water treatment

2E Energy & Environment

Energy

- solar energy
- hydropower and ocean energy
- wind power
- biomass
- geothermal energy
- energy systems
- energy efficiency in buildings

Environment

- water
- air
- soil
- waste

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