

Equipment for engineering education

Entire programme

Innovative sustainable efficient

The complete GUNT programme with more than 650 devices from all programme areas



PDF version of
the catalogue



GUNT Quality Made in Germany

Our excellent product quality, high productivity and extensive know-how means that GUNT is making a significant contribution worldwide in technology education.

At our headquarters in Barsbüttel, near Hamburg 150 highly qualified employees work in a 10,000 m² production and office space. From development and design to production and shipping, everything is located under one roof.

Germany is recognized for its excellent structure for education in technical professions and in engineering. Since 1979 our motto has been:

From Germany to anywhere in the world

Imprint

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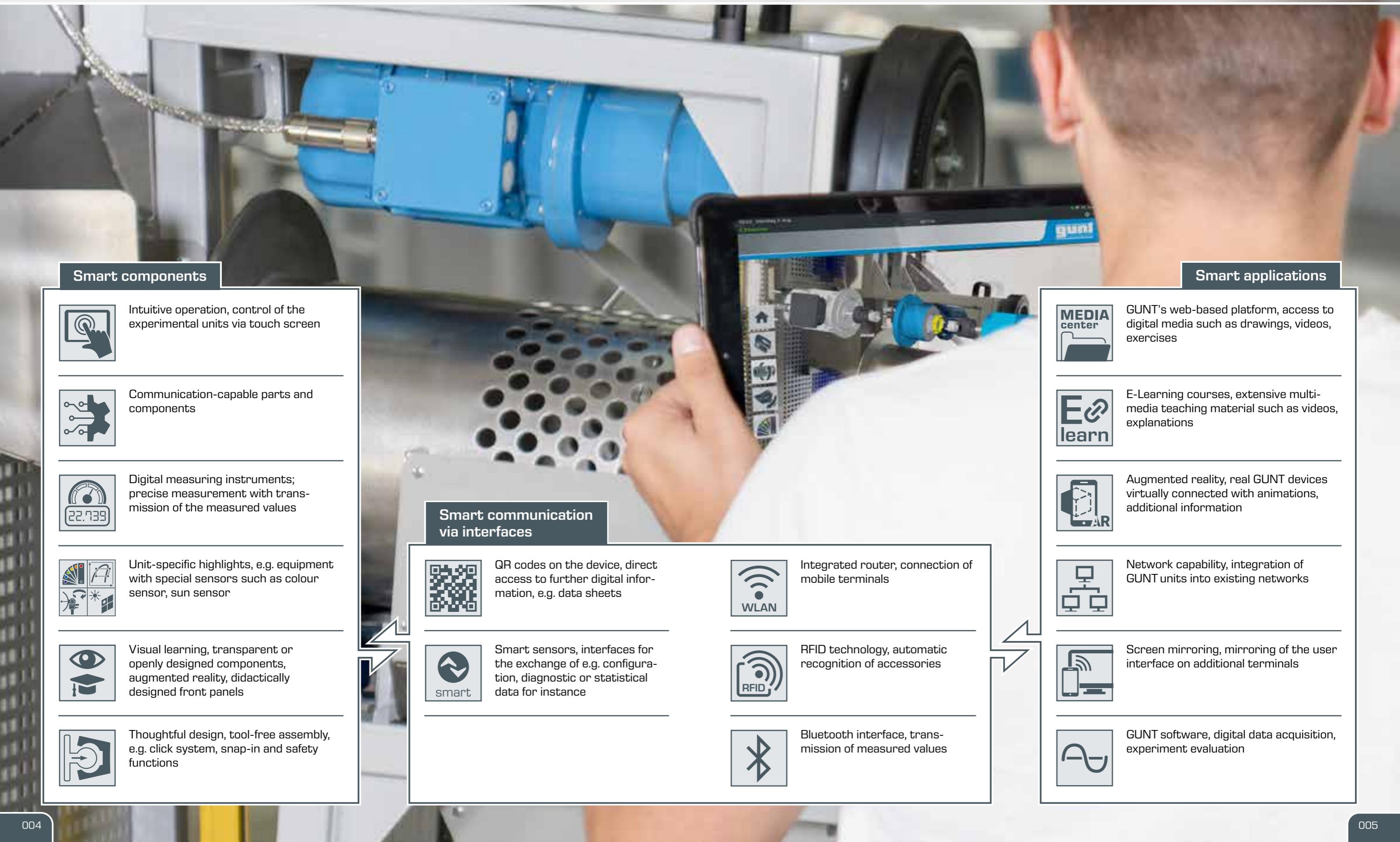
Visit our website: www.gunt.de

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Hands-on teaching engineering – with GUNT's **SMART** features



Digitisation of traditional learning content



Smart components



Intuitive operation, control of the experimental units via touch screen



Communication-capable parts and components



Digital measuring instruments;
precise measurement with trans-
mission of the measured values



Unit-specific highlights, e.g. equipment with special sensors such as colour sensor, sun sensor



Visual learning, transparent or openly designed components, augmented reality, didactically designed front panels



Thoughtful design, tool-free assembly,
e.g. click system, snap-in and safety
functions

Smart applications



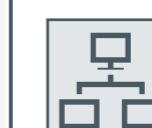
GUNT's web-based platform, access to digital media such as drawings, videos, exercises



E-Learning courses, extensive multi-media teaching material such as videos, explanations



Augmented reality, real GUNT devices virtually connected with animations, additional information



Network capability, integration of GIINT units into existing networks

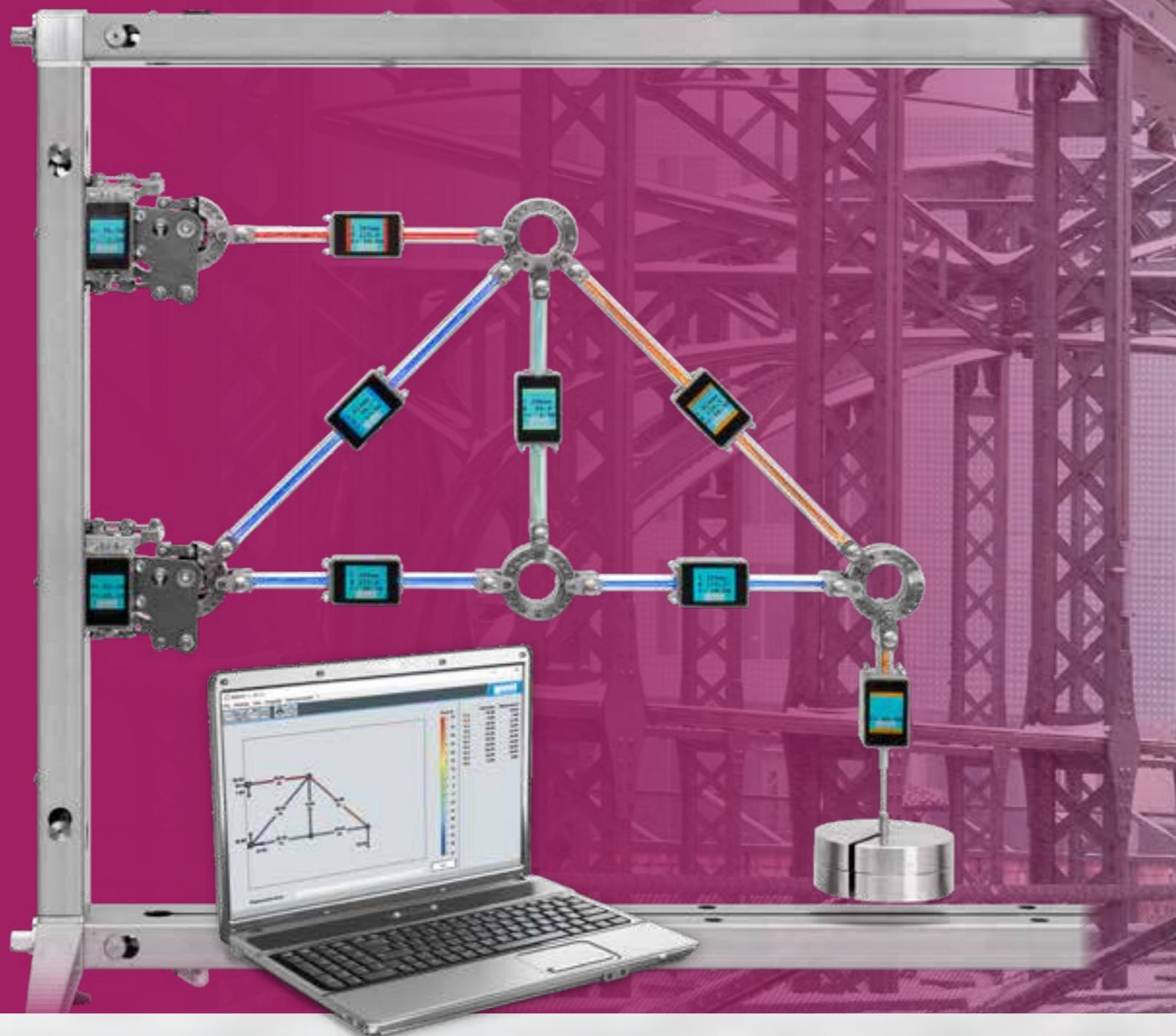


Screen mirroring, mirroring of the user interface on additional terminals



GUNT software, digital data acquisition,
experiment evaluation

Hands-on teaching engineering – with GUNT's SMART features



About the product:



1 | Engineering mechanics and engineering design



Engineering mechanics – statics

Forces and moments	008
Bridges, beams, arches, cables	009
Internal reactions and methods of section	010
Forces in a truss	011
Static and kinetic friction	012



Engineering mechanics – strength of materials

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Engineering mechanics – dynamics

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Fatigue of materials	035
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Engineering mechanics and engineering design



Engineering mechanics – statics Forces and moments

TM 110 Fundamentals of statics

Demonstration of force and moment equilibrium in a mechanical force system



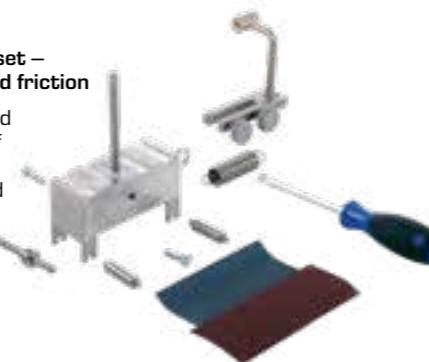
TM 110.02 Supplementary set – pulley blocks

Construction and mode of operation of three different pulley blocks



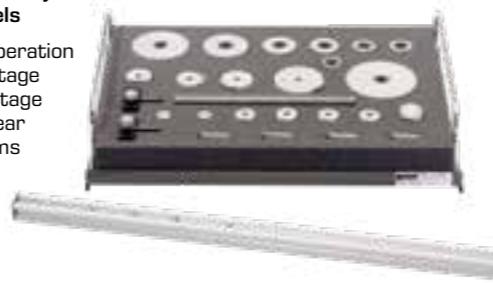
TM 110.01 Supplementary set – inclined plane and friction

Measurement and demonstration of spring deflection, inclined plane and mechanical friction



TM 110.03 Supplementary set – gear wheels

Mode of operation of single-stage and multistage toothed gear mechanisms



TM 115 Forces in a crane jib

Graphical and experimental determination of forces in a planar central force system



EM 049 Equilibrium of moments on a two-arm lever

Investigation of applied forces, generated moments and equilibrium



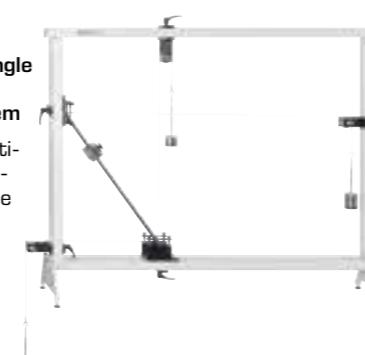
SE 112 Mounting frame

Base unit for clear and simple set-up of experiments on statics, strength of materials and dynamics



SE 110.53 Equilibrium in a single plane, statically determinate system

Experimental investigation of the important principle of free vectors in statics



TM 121 Equilibrium of moments on pulleys

Clear demonstration of the equilibrium of moments



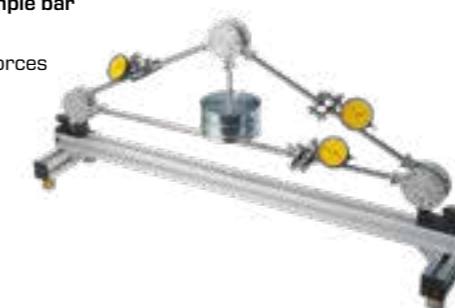
TM 122 Equilibrium of moments on a differential pulley block

Equilibrium of forces and moments and the demonstration of the force reduction on a differential pulley block



FL 111 Forces in a simple bar structure

Resolution of forces in a simple bar structure



Engineering mechanics – statics Bridges, beams, arches, cables

SE 110.18 Forces on a suspension bridge

Supporting cable force and demonstration of bending moments between the roadway support and supporting cables

SE 112 Mounting frame required



SE 110.12 Lines of influence on the Gerber beam

Using methods of section and conditions of equilibrium of statics to determine support forces

SE 112 Mounting frame required



Engineering mechanics – statics Bridges, beams, arches, cables

SE 110.17**Three-hinged arch**

Symmetric and asymmetric arch subjected to point, distributed or moving loads

SE 112 Mounting frame required

**SE 110.16****Parabolic arch**

Differences between statically determinate and statically indeterminate arches under load

SE 112 Mounting frame required



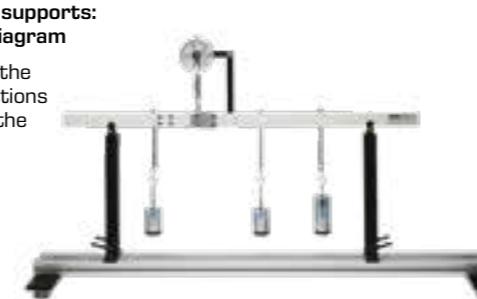
Engineering mechanics – statics Internal reactions and methods of section

WP 960**Beam on two supports:
shear force & bending
moment diagrams**

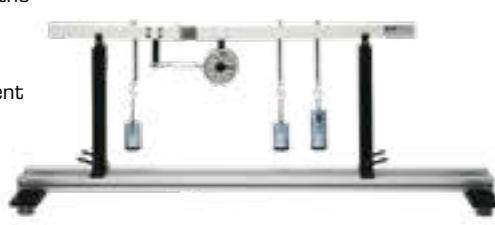
Application of the method of sections to determine internal reactions of the beam

**WP 961****Beam on two supports:
shear force diagram**

Application of the method of sections to determine the shear force

**WP 962****Beam on two supports:
bending moment diagram**

Application of the method of sections to determine the bending moment

**SE 110.50****Cable under
dead-weight**

Catenary of a free-hanging cable under dead-weight

SE 112 Mounting frame required

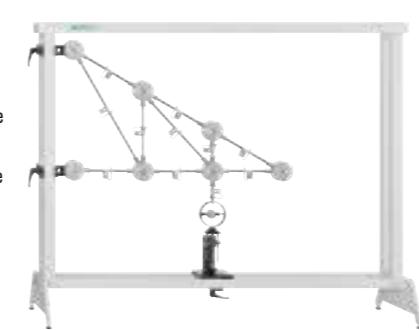


Engineering mechanics – statics Forces in a truss

SE 110.21**Forces in various
single plane trusses**

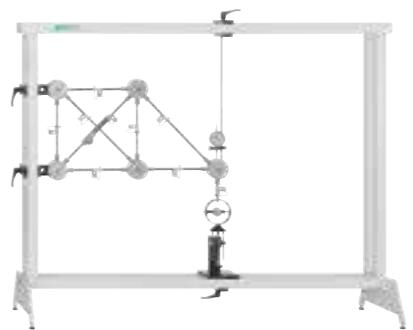
Using strain gauge technology to measure bar forces

SE 112 Mounting frame required

**SE 110.22****Forces in an
indeterminate truss**

Comparison of forces in statically determinate and statically indeterminate trusses

SE 112 Mounting frame required

**SE 130****Forces in a Howe truss**

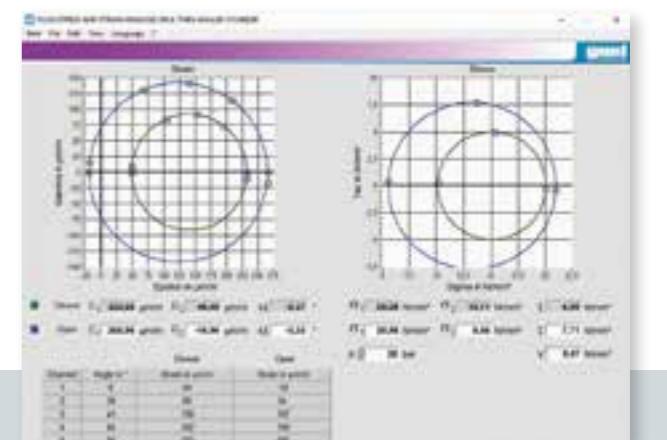
Investigation of bar forces under different load cases

**SE 130.01****Truss beam: Warren girder**

Bars with strain gauge full bridges to measure bar stress

**FL 152****Multi-channel
measuring amplifier**

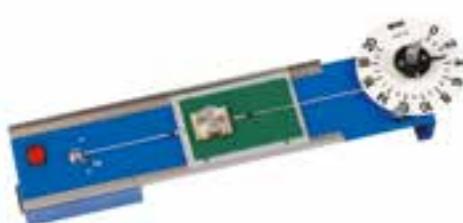
Processing of analogue measuring signals for stress and strain analysis FL 120 – FL 140 and for GUNT trusses



Engineering mechanics – statics Static and kinetic friction

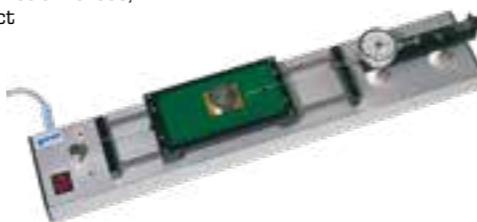
TM 200 Fundamentals of mechanical friction

Stationary friction body, uniformly moving friction plate



TM 210 Dry friction

Force gauge with adjustable air damper to determine friction forces; slip/stick effect



TM 225 Friction on the inclined plane

Experiments to understand the fundamentals of mechanical friction on an inclined plane



TM 220 Belt drive and belt friction

Influence of the angle of contact, coefficient of friction and belt force (Eytelwein's belt friction formula)



Engineering mechanics – strength of materials Elastic deformations

SE 110.14

Elastic line of a beam

Demonstration of Maxwell-Betti theorem

SE 112 Mounting frame required



WP 950

Deformation of straight beams

Elastic lines of statically determinate and indeterminate beams under various clamping conditions



SE 110.47

Methods to determine the elastic line

Determination of elastic lines of a beam under load using the principle of virtual work and Mohr's Analogy

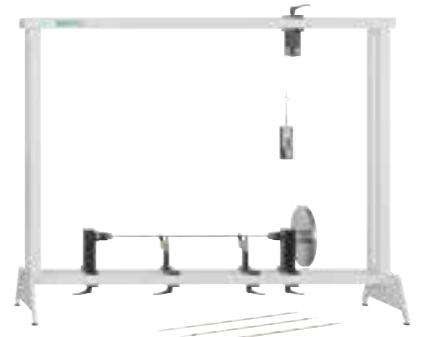
SE 112 Mounting frame required



SE 110.29 Torsion of bars

Investigation of elastic torsion of bars with open and closed cross-section

SE 112 Mounting frame required



WP 100

Deformation of bars under bending or torsion

Influence of material, cross-section and clamping length on deformation

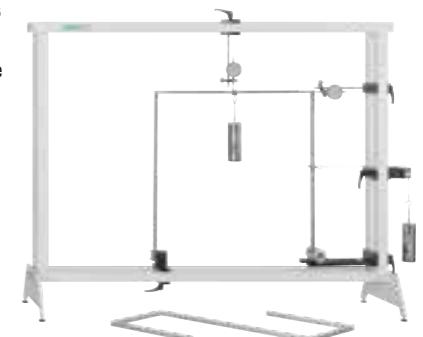


SE 110.20

Deformation of frames

Elastic deformation of a statically determinate or indeterminate frame under point load

SE 112 Mounting frame required



FL 170

Deformation of curved-axis beams

Principle of virtual forces (the force method) for calculating deformation



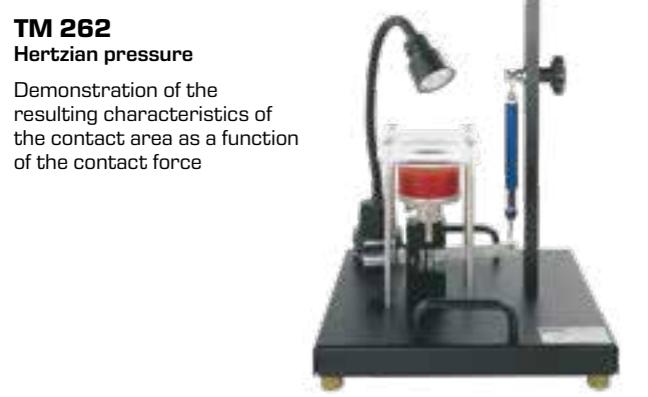
SE 110.44 Deformation of trusses

Application of Castigliano's first theorem

SE 112 Mounting frame required



Engineering mechanics – strength of materials Elastic deformations



TM 262
Hertzian pressure

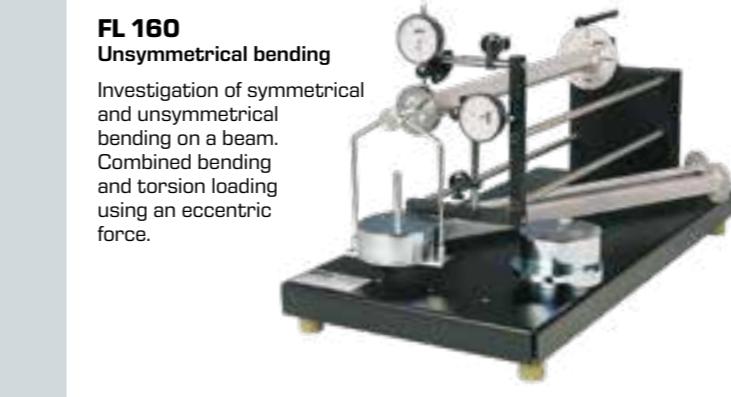
Demonstration of the resulting characteristics of the contact area as a function of the contact force



TM 400
Hooke's law

Elastic behaviour of tension springs under load

Engineering mechanics – strength of materials Compound stress



FL 160
Unsymmetrical bending

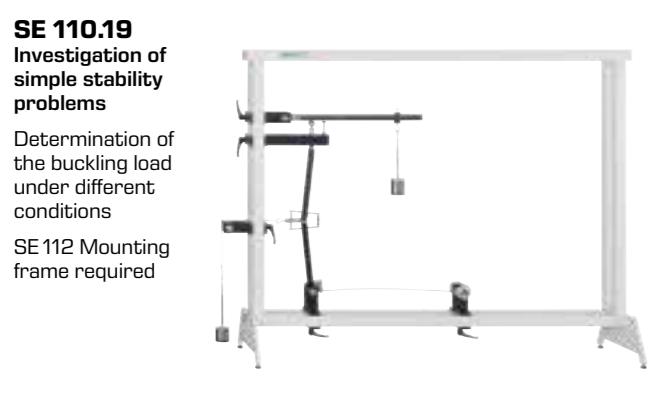
Investigation of symmetrical and unsymmetrical bending on a beam. Combined bending and torsion loading using an eccentric force.



WP 130
Verification of stress hypotheses

Multiaxial loading of samples by bending and torsion

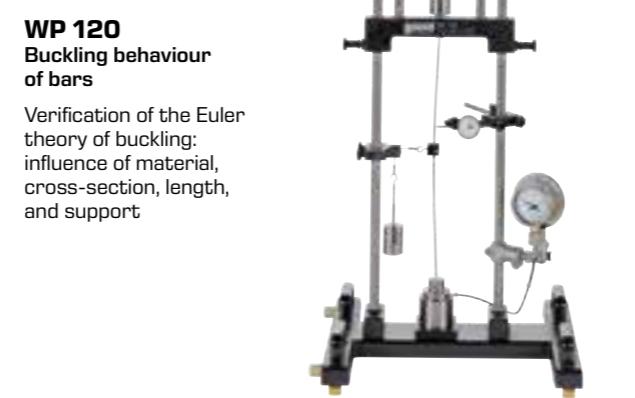
Engineering mechanics – strength of materials Buckling and stability



SE 110.19
Investigation of simple stability problems

Determination of the buckling load under different conditions

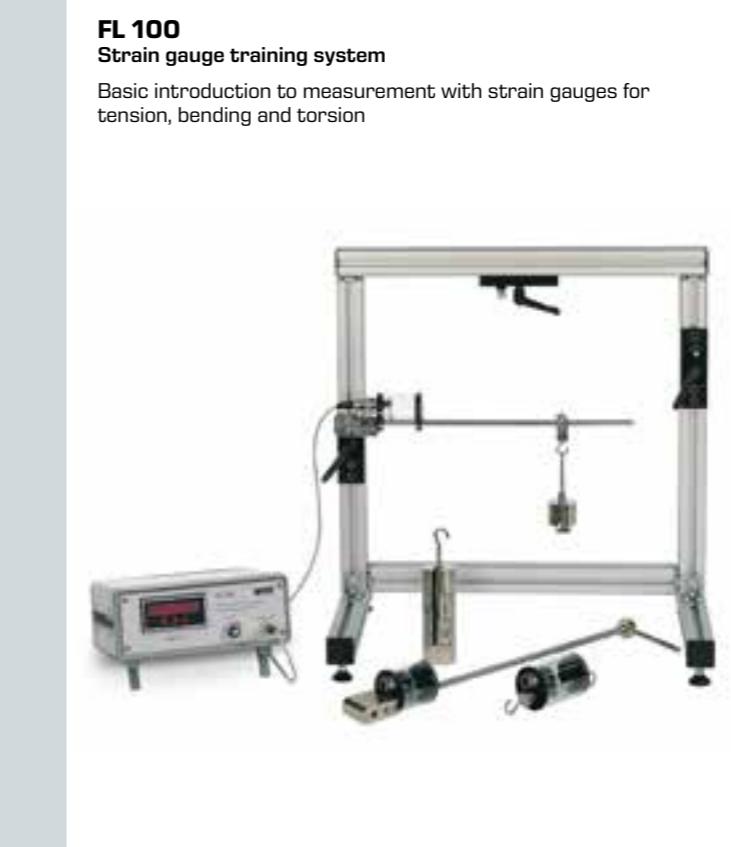
SE 112 Mounting frame required



WP 120
Buckling behaviour of bars

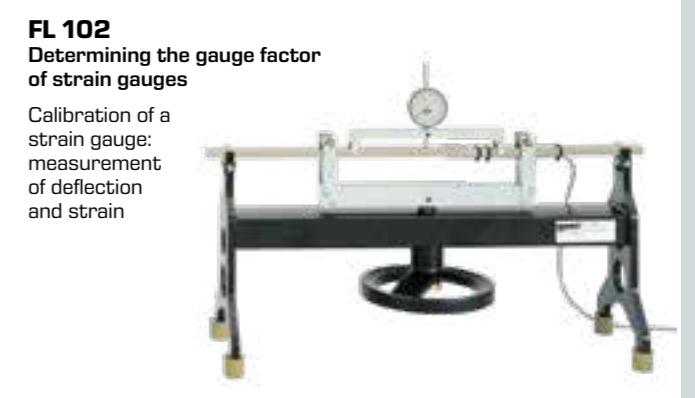
Verification of the Euler theory of buckling: influence of material, cross-section, length, and support

Engineering mechanics – strength of materials Experimental stress and strain analysis



FL 100
Strain gauge training system

Basic introduction to measurement with strain gauges for tension, bending and torsion



FL 102
Determining the gauge factor of strain gauges

Calibration of a strain gauge: measurement of deflection and strain



WP 121
Demonstration of Euler buckling

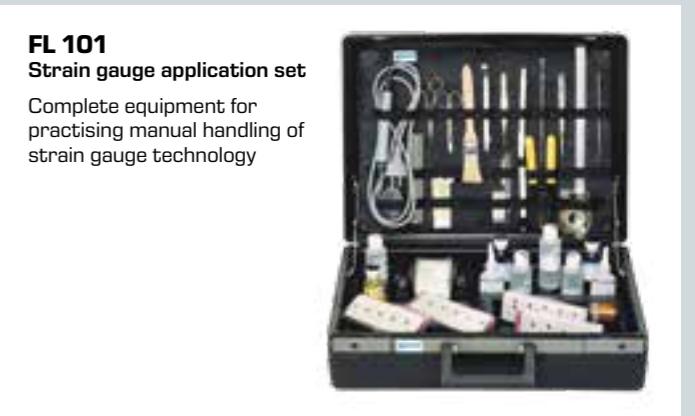
Correlation between buckling length, buckling load and various methods of support



SE 110.57
Buckling of bars

Determination of the buckling load: influence of material, support, and shear force

SE 112 Mounting frame required



FL 101
Strain gauge application set

Complete equipment for practising manual handling of strain gauge technology

Engineering mechanics – dynamics

Kinetics: basic experiments on dynamics and moment of inertia**TM 610**

Rotational inertia

Moments of inertia of different mass arrangements and bodies

**TM 612**

Kinetic model: flywheel

Experimental determination of the moment of mass inertia of a flywheel

**TM 611**

Rolling disk on inclined plane

Determining moment of inertia on rotating masses by rolling down an inclined plane and by performing a pendulum test

**GL 210**

Dynamic behaviour of multistage spur gears

Investigation of the dynamics of rotation of one-, two- and three-stage spur gear units

**GL 212**

Dynamic behaviour of multistage planetary gears

Investigation of rotational dynamics of a two-stage epicyclic gear with three planetary gears each



Engineering mechanics – dynamics

Kinetics: dynamics of rotation**TM 600**

Centrifugal force

Laws on the behaviour of centrifugal forces on rotating masses

**TM 605**

Coriolis force

Demonstration of the Coriolis force in rotating reference systems

**TM 632**

Centrifugal governor

Characteristic curves of different centrifugal force governors

**TM 630**

Gyroscope

Experimental verification of the laws of gyroscopes



Engineering mechanics – dynamics Vibrations

TM 150 Vibration trainer

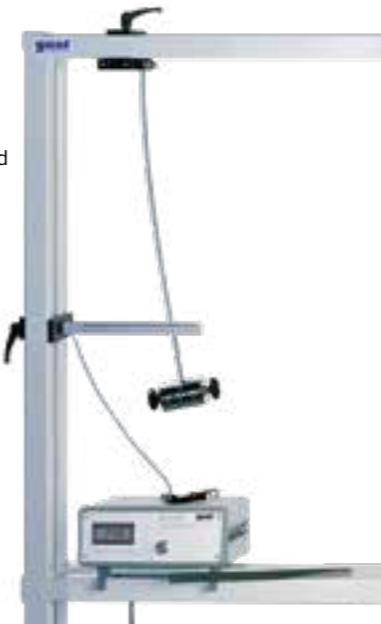
Experiments on damping, resonance and absorber effects in forced vibrations



SE 110.58 Free vibrations in a bending beam

Investigation of the free vibration of a bar and using the Rayleigh method to evaluate the natural frequency of a bar

SE112 Mounting frame required



TM 161 Rod and gravity pendulum

Comparison of physical and mathematical pendulum



TM 162 Bifilar/trifilar suspension of pendulums

Moments of inertia of different bodies in a rotary pendulum experiment



TM 163 Torsional vibrations

Determination of the oscillation period depending on torsion wire length, diameter and rotating mass



TM 164 Coil spring vibrations

Investigation of vibrations on a spiral spring rotating mass system



Machine dynamics Vibrations in machines

TM 155 Free and forced vibrations

Basic experiments on mechanical vibration theory



TM 150.02 Free and damped torsional vibrations

Influence of mass, torsional rigidity and damping on the behaviour of a rotary oscillator. Vibrations are recorded on the TM 150 / TM 155 recorder.



TM 140 Free and forced torsional vibrations

Illustrative experiments on a torsion test bar with varying masses; multiple mass oscillator



HM 159.11 Ship vibration apparatus

Dynamic behaviour of a ship structure; experiments in air and in water



Machine dynamics Rotor dynamics

TM 620 Bending elasticity in rotors

Investigation of bending vibrations and resonance of a rotating shaft



TM 625 Elastic shafts

Determination of critical speeds and investigation of natural modes of a shaft



Machine dynamics Balancing

TM 170 Balancing apparatus

Demonstration of the fundamentals of static and dynamic balancing



PT 502 Field balancing

Measurement of imbalance vibrations



Machine dynamics Vibration isolation

TM 182.01

Piston compressor for TM 182

Used for generating vibrations for the TM 182



Machine dynamics Mass forces and mass balance

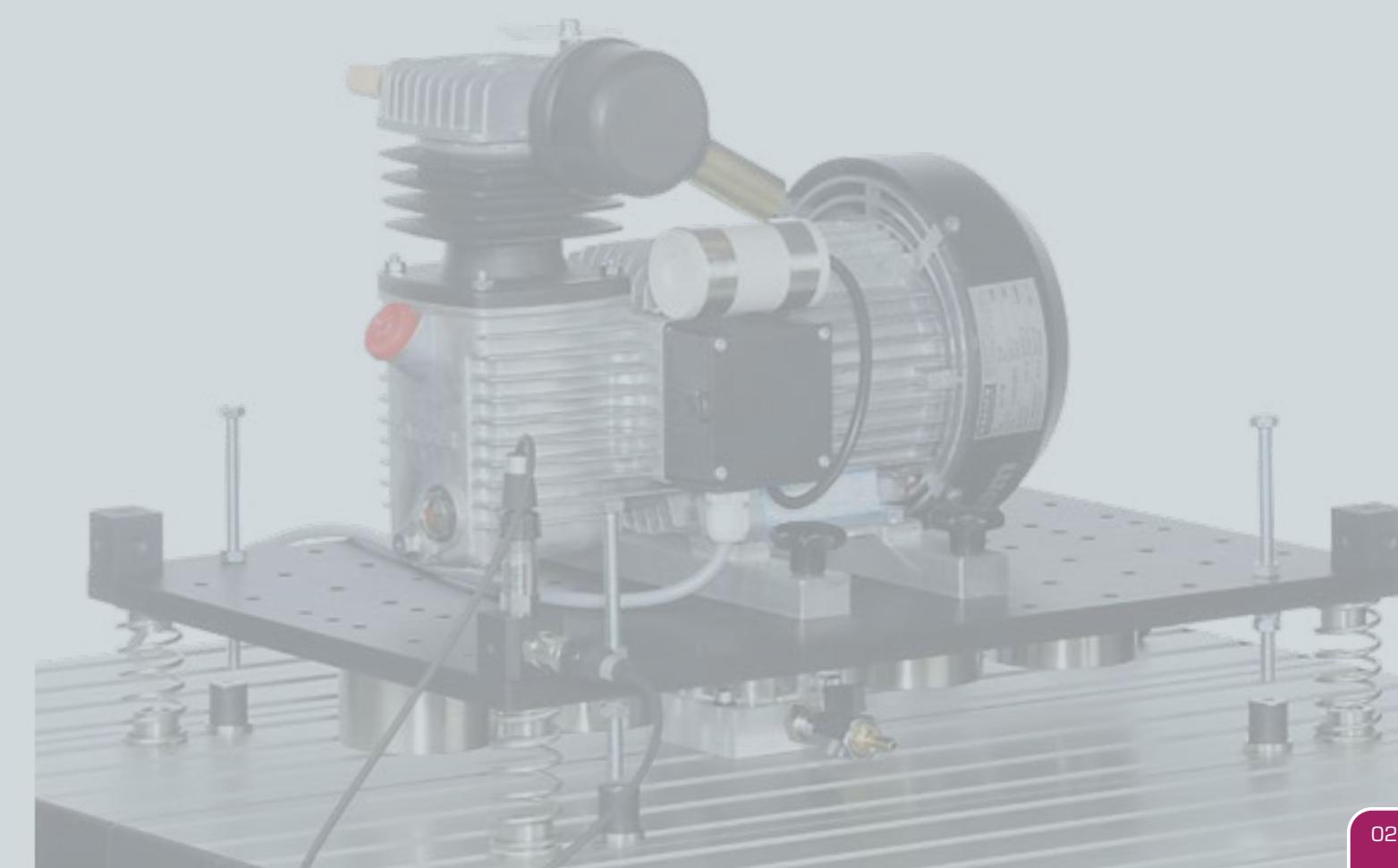
TM 180 Forces in reciprocating engines

Investigation of mass forces on a reciprocating piston machine

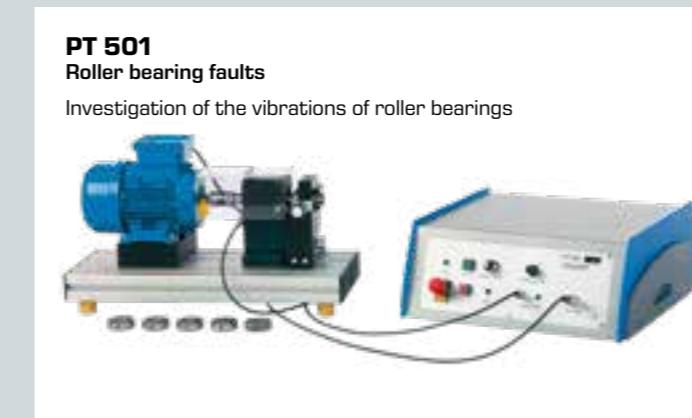
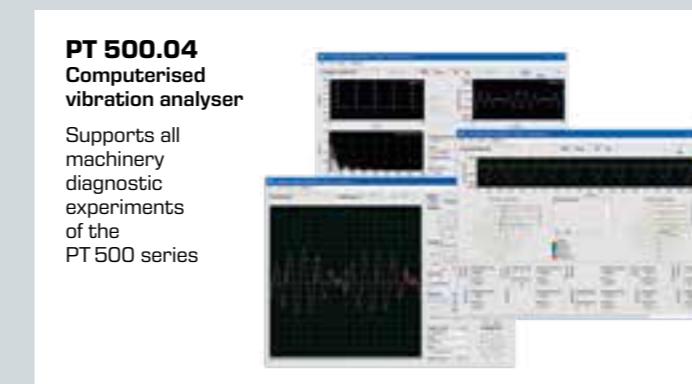
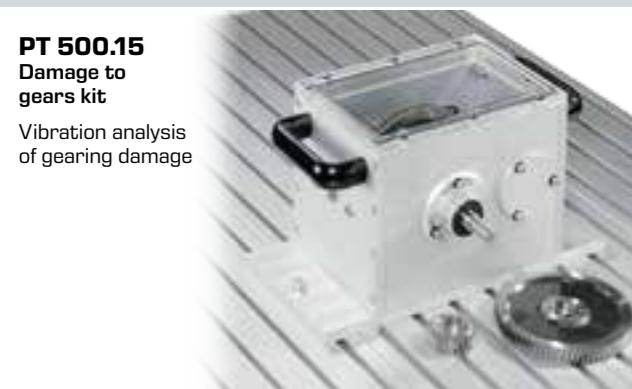


GL 112 Investigation of cam mechanisms

Comparison of different cam members; recording elevation curves



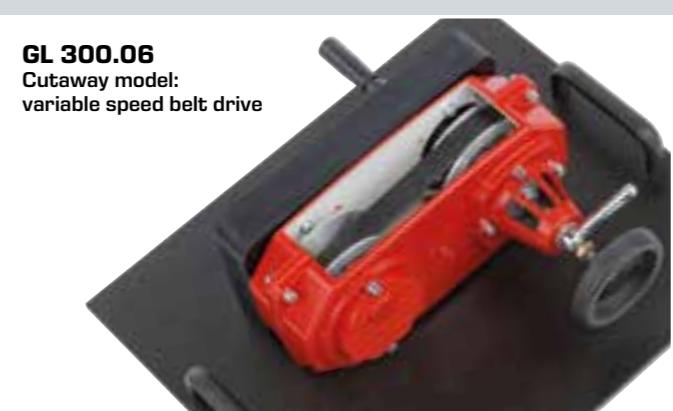
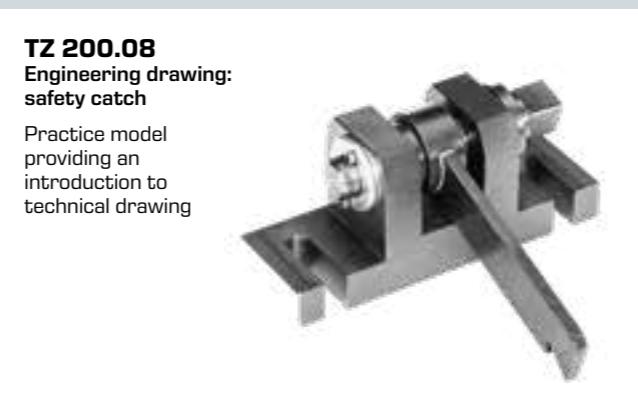
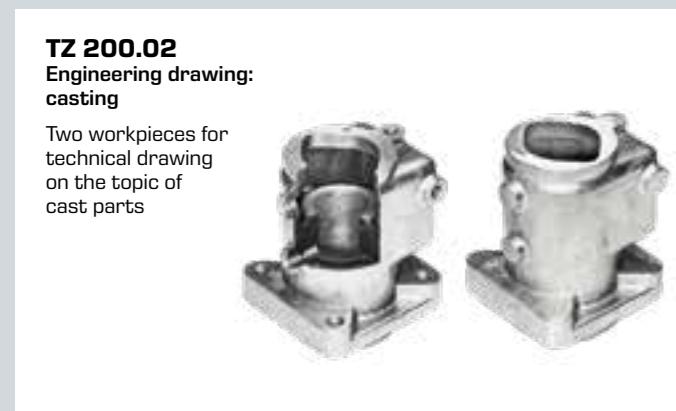
Machine dynamics Machinery diagnosis



Engineering design
Engineering drawing

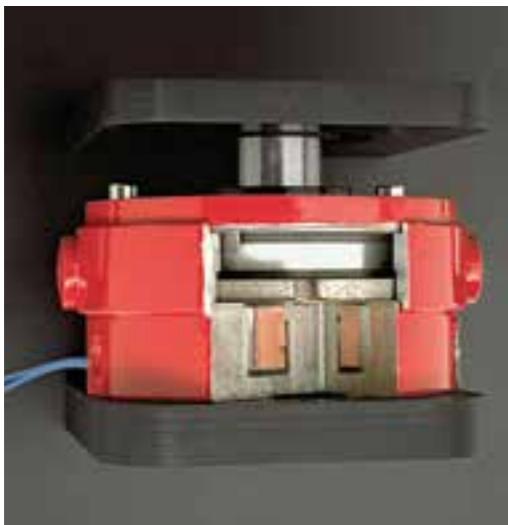


Engineering design
Cutaway models



Engineering design Cutaway models

GL 300.10
Cutaway model:
electromagnetic single disk brake



GL 300.12
Cutaway model:
pedestal bearing



TM 320
Screw connections testing
Correlation between tightening torque and tension force
on standardised bolts



TM 310
Thread testing
Thread efficiencies for different pairs of materials and
thread pitches



Engineering design Machine elements: fasteners

MG 901
Nuts and bolts kit

Comprehensive
instructional kit of
the main nuts and
bolts used in
engineering



MG 905
Thread types kit

Standardised designa-
tions, terms and
specific applica-
tions of different thread
types, determina-
tion of the thread type
with the thread
gauge



MG 903
Screw-locking devices kit

Standardised designations, terms and graphical representation
of different screw-locking devices



Engineering design Machine elements: bearings

MG 911
Roller bearings kit

Familiarisation with the most important roller bearing types and
their specific applications



Engineering design Machine elements: transmission elements

GL 100 Principle of gear units

Fundamental principles of belt drives, wheel and disc drives, and gear trains



GL 110 Cam mechanism

Demonstration and measurement of the displacement curves for cam mechanisms



TM 123 Spur gear unit

Mode of operation and layout of toothed gearing mechanisms



TM 124 Worm gear unit

Mode of operation and layout of a worm gear



TM 125 Cable winch

Using force equilibrium considerations to determine load transmission and efficiency



TM 220 Belt drive and belt friction

Influence of the angle of contact, coefficient of friction and belt force (Eytelwein's belt friction formula)



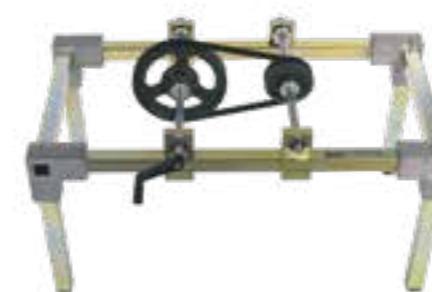
AT 200 Determination of gear efficiency

Test system for determining mechanical drive and braking efficiency for spur and worm gears



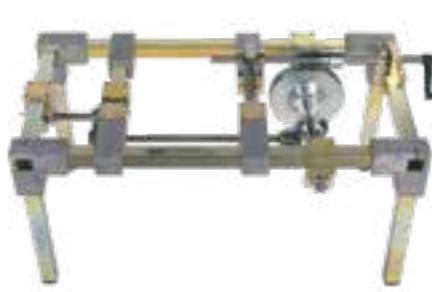
GL 410 Assembly simple gears

Versatile assembly exercise for simple drives using a belt, chain sprockets or a roller chain



GL 420 Assembly combined gears

Versatile assembly exercise for combined drives



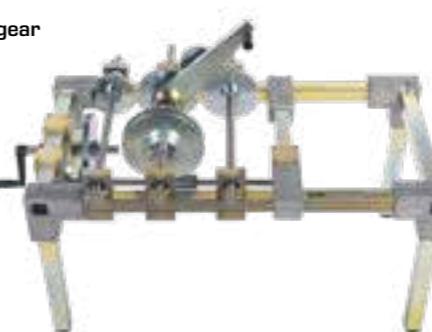
GL 200 Lathe gear

Safe and clear demonstration of function of the gears on a conventional lathe



GL 430 Assembly control gear

Versatile assembly exercise for various step and gear units



Engineering design Assembly exercises

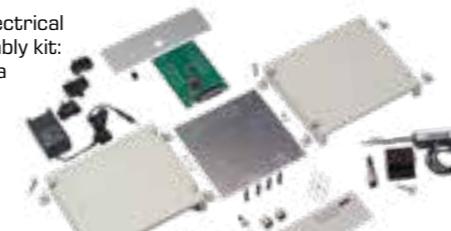
MT 190 Assembly materials tester

Study project with extensive practical relevance for training in metal working professions by constructing a hydraulic tensile/compression testing device



MT 190.01 Assembly data acquisition for materials tester

Mechanical and electrical engineering assembly kit: fully functional data acquisition for the materials tester MT 190



MT 120 Assembly exercise: spur gear

Design and function of a spur gear with helical gear wheels; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 121 Assembly exercise: mitre gear

Design and function of a mitre gear; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 122 Assembly exercise: planetary gear

Design and function of a planetary gear; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 123 Assembly exercise: spur and worm gear

Design and function of a spur and worm gear; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 173 Test stand for gears

Test system for determining the mechanical efficiency of different gear types, system control via PLC



MT 174 Sorting plant

Preventive maintenance based on the example of a separation process, system control via PLC



How to achieve the digital transformation to Industry 4.0





Materials testing Tensile, compression, bending and hardness testing

WP 300
Materials testing, 20 kN

Training unit for basic experiments on materials testing: tensile tests, Brinell hardness tests, stress-strain diagrams


WP 310
Materials testing, 50 kN

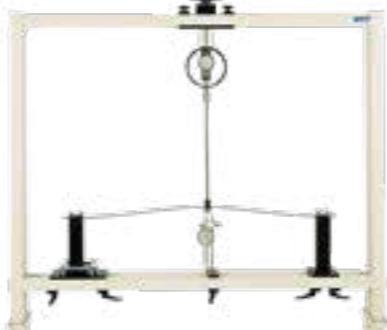
Direct generation of tensile and compressive forces


SE 100
Frame for load testing, 400 kN

Load tests on components from steelwork and civil engineering; size allows measurements on real components


SE 110.48
Bending test, plastic deformation

Observation and determination of the transition from elastic to plastic deformation
SE 112 Mounting frame required



Materials testing Torsional test

WP 500

Torsion test, 30 Nm

Manual torsion testing of different materials to fracture



Materials testing Impact bending test

WP 400
Impact test, 25 Nm

Classic Charpy notched-bar impact test; specimens with different cross-sections and materials


WP 410
Impact test, 300 Nm

Charpy notched-bar impact test with increased work capacity



Materials testing Fatigue of materials

WP 140

Fatigue strength test

Fatigue strength of bars subject to cyclic bending load; stress-number (S-N) diagram


WP 600
Creep rupture test

Demonstration of typical creep phenomena in various materials



Materials testing Tribology and corrosion

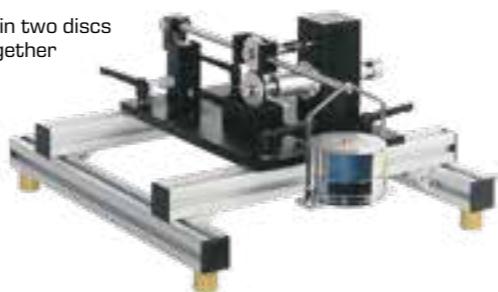
TM 260 Drive unit for tribological investigations

Modular experimental system for sliding and rolling friction



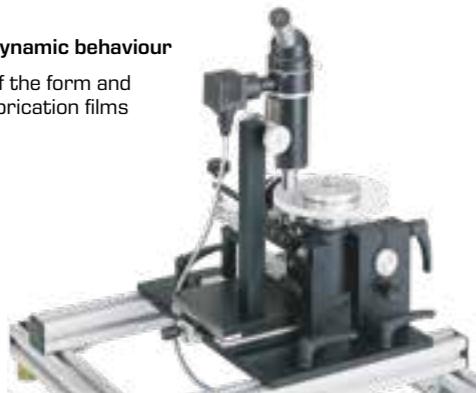
TM 260.01 Rolling friction in friction wheels

Slip forces in two discs rubbing together



TM 260.02 Elasto-hydrodynamic behaviour

Investigation of the form and thickness of lubrication films



TM 260.03 Dynamic friction in pin – disk

Investigations into wear on pairs of friction materials with surface contact



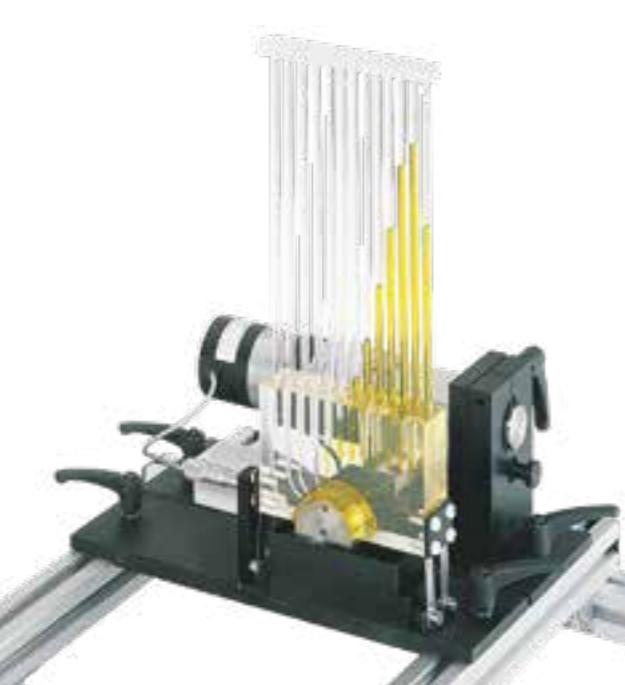
TM 260.04 Frictional vibrations

Differences between static and sliding friction, instability



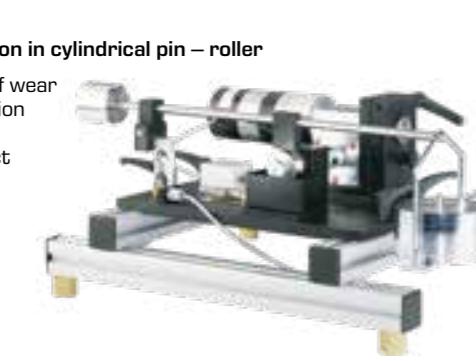
TM 260.06 Pressure distribution in journal bearings

Demonstration of pressure distribution in a plain bearing with hydrodynamic lubrication



TM 260.05 Dynamic friction in cylindrical pin – roller

Investigation of wear in pairs of friction materials with point of contact



TM 232 Bearing friction

Sliding bearing friction with different bearing material pairings and comparison with rolling bearing friction



TM 282 Friction in journal bearings

Learning the fundamentals of hydrodynamic lubrication by experimentation



TM 280 Pressure distribution in journal bearings

Illustrates the principle of hydrodynamic lubrication



TM 290 Journal bearing with hydrodynamic lubrication

Investigation of friction in a hydrodynamically lubricated journal bearing



CE 105 Corrosion of metals

Parallel investigation of different influencing factors on different metal samples



Hands-on teaching engineering – with GUNT's SMART features



About the product:



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Engineering design

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Assembly technology

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2

Mechatronics



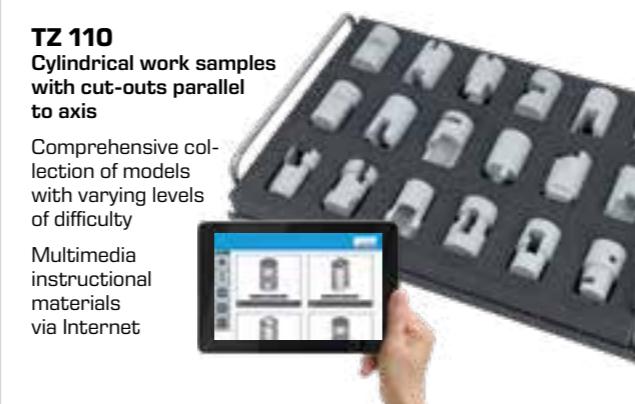
 Engineering design
Engineering drawing



TZ 100
Engineering drawing:
three-dimensional display

Set of models for
fundamentals of technical
drawing

Multimedia
instructional
materials
via Internet



TZ 110
Cylindrical work samples
with cut-outs parallel
to axis

Comprehensive col-
lection of models
with varying levels
of difficulty

Multimedia
instructional
materials
via Internet



TZ 200.01
Bending device

Steel bending device as the basis for
extensive technical drawing course

Multimedia
instructional
materials
via Internet



TZ 200.07
Lever shear

Functional lever shear:
drawing, measurement,
assembly

Multimedia
instructional
materials
via Internet



TZ 120
Prismatic work samples
with slanted cut-outs

Comprehensive col-
lection of models
with varying levels
of difficulty

Multimedia
instructional
materials
via Internet



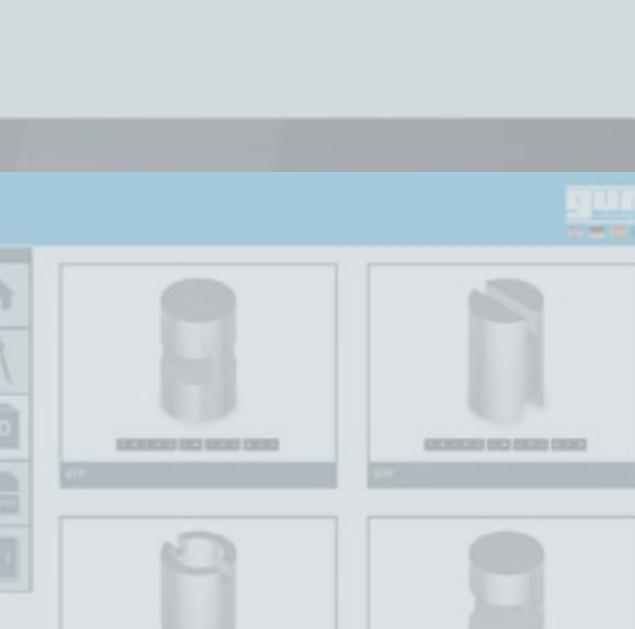
TZ 200.04
Drilling jig for a casting

Steel drilling jig as the basis for extensive technical
drawing course



TZ 200.06
Drilling jig for an annular disc

Steel drilling jig as the
basis for extensive
technical drawing
course



TZ 140
Prismatic work samples
with slanted cut-outs

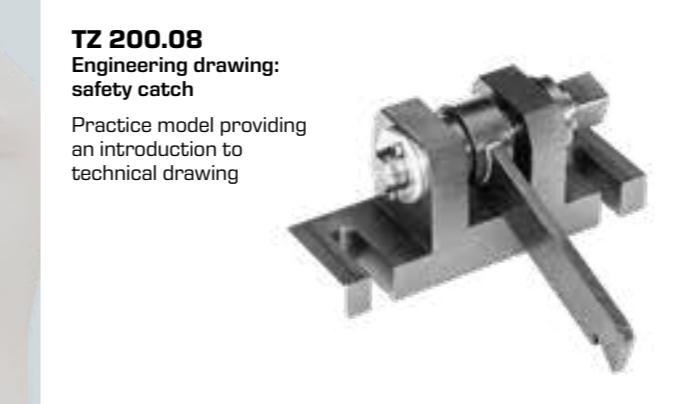
Comprehensive col-
lection of models
with varying levels
of difficulty

Multimedia
instructional
materials
via Internet



TZ 200.09
Drilling jig for flat part

Complete technical
drawing course
using a drilling jig
as an example



TZ 200.08
Engineering drawing:
safety catch

Practice model providing
an introduction to
technical drawing



TZ 200.02
Engineering drawing:
casting

Two workpieces for
technical drawing
on the topic of
cast parts

Engineering design Engineering drawing

TZ 200.11
Assembly of bending device

For drawing, measurement and assembly exercises

Multimedia instructional materials via Internet



TZ 200.61
Engineering drawing:
rotationally symmetrical components

Technical drawing course for the representation of rotationally symmetrical parts



TZ 200.71
Assembly of lever shears

Complex course for drawing and assembly exercises

Multimedia instructional materials via Internet



TZ 300
Assembly of lever press

Functional lever press for drawing, measurement and assembly exercises

Multimedia instructional materials via Internet



Engineering design Cutaway models: gear and drive elements

GL 300.01
Cutaway model:
worm gear



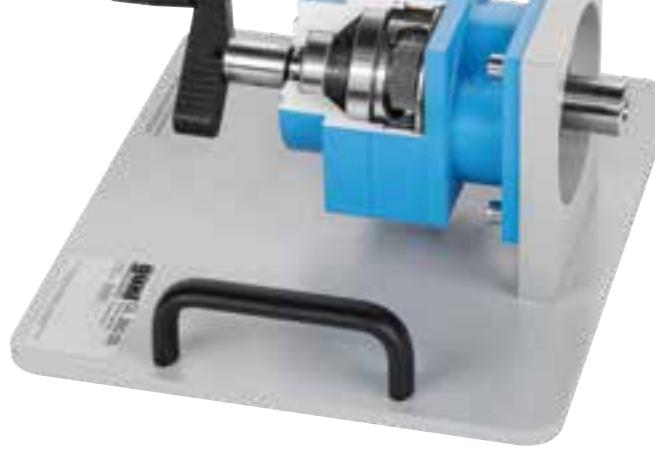
GL 300.02
Cutaway model:
mitre gear



GL 300.03
Cutaway model:
spur gear



GL 300.04
Cutaway model:
two-stage spur gear



Order No.:
030.30004

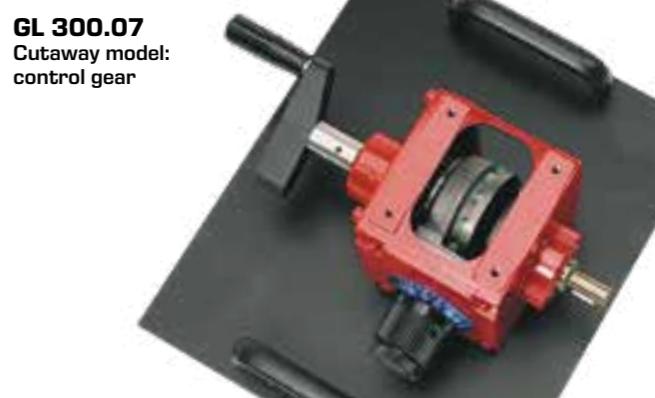
GL 300.06
Cutaway model:
variable speed belt drive



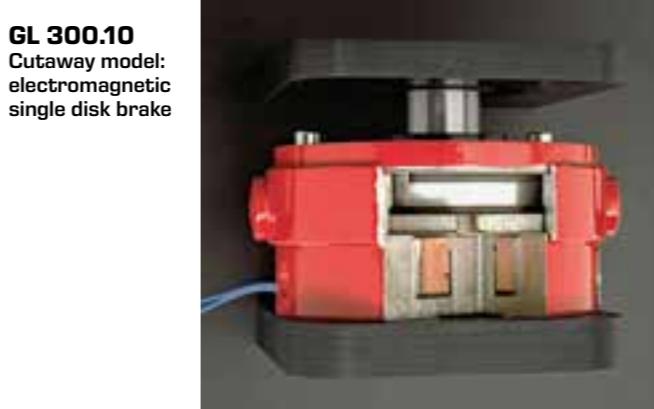
GL 300.08
Cutaway model:
multiple-disc clutch



GL 300.07
Cutaway model:
control gear



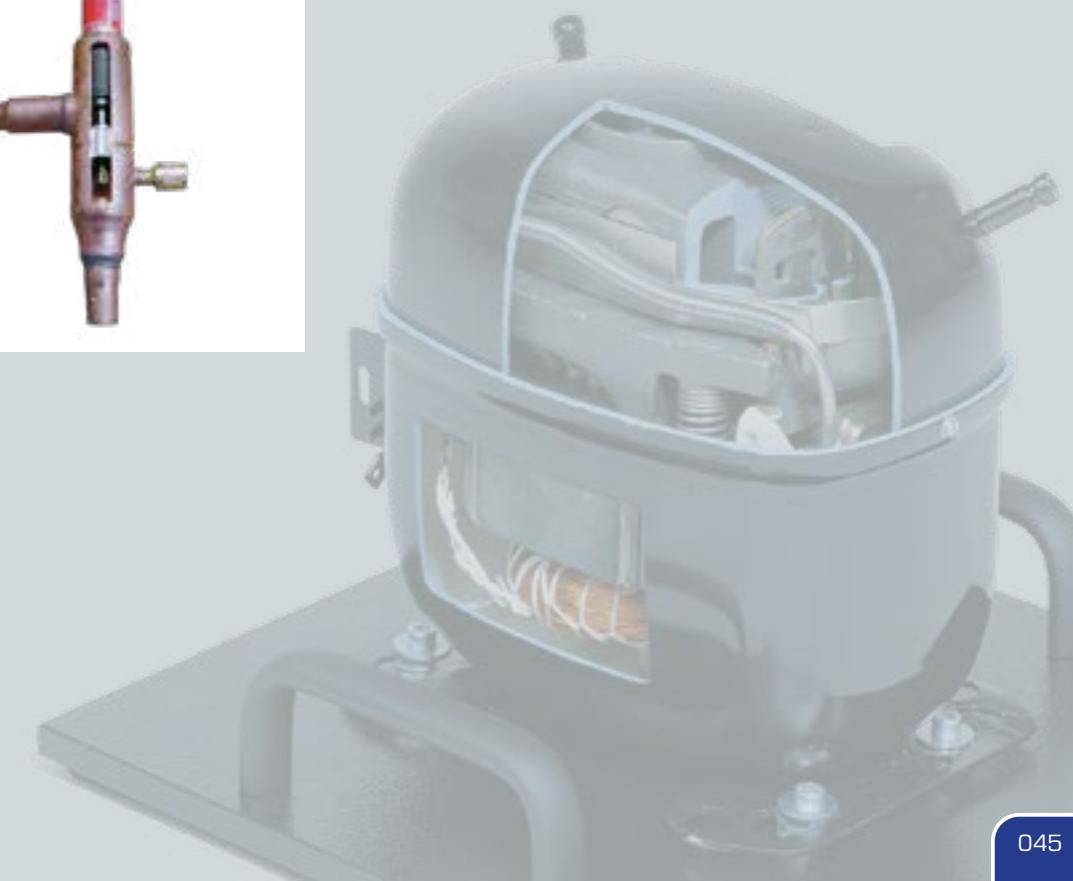
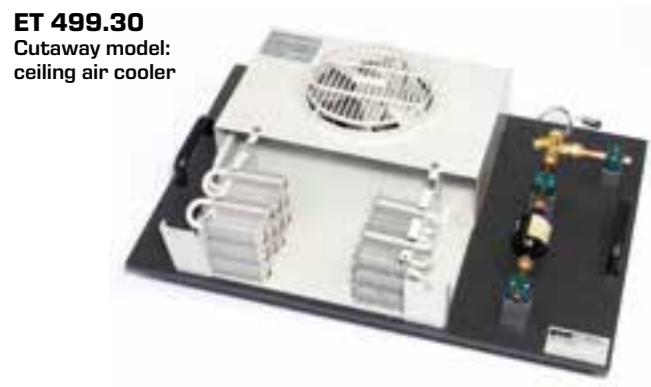
GL 300.10
Cutaway model:
electromagnetic single disk brake



GL 300.12
Cutaway model:
pedestal bearing



Engineering design
Cutaway models: refrigeration components



Engineering design
Cutaway models: components in piping systems

HM 700.01
Cutaway model:
standard orifice plate



HM 700.02
Cutaway model:
flow nozzle



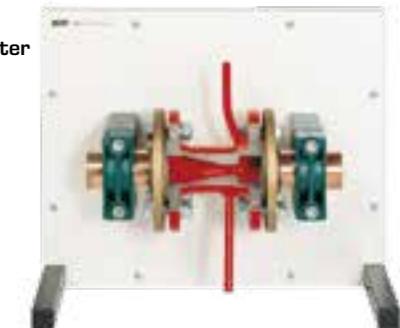
HM 700.09
Cutaway model:
strainer



HM 700.10
Cutaway model:
gate valve



HM 700.03
Cutaway model:
standard Venturi meter



HM 700.04
Cutaway model:
straight-way valve



HM 700.11
Cutaway model:
straight-way plug valve



HM 700.12
Cutaway model:
three-way plug valve



HM 700.05
Cutaway model:
corner valve



HM 700.06
Cutaway model:
angle seat valve



HM 700.13
Cutaway model:
ball valve



HM 700.14
Cutaway model:
safety valve



HM 700.07
Cutaway model:
non-return valve



HM 700.08
Cutaway model:
pressure reducing valve



HM 700.15
Cutaway models:
various screwed pipe connections



HM 700.16
Cutaway models:
pressure gauges



Engineering design
Cutaway models: components in piping systems

HM 700.17
Cutaway model:
centrifugal pump



HM 700.20
Cutaway model:
piston pump



VS 106
Cutaway model:
backflow preventer



VS 107
Cutaway model:
non-return butterfly
valve



HM 700.22
Cutaway model:
gear pump



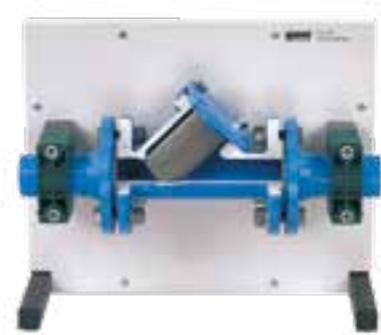
VS 101
Cutaway model:
underground hydrant



VS 108
Cutaway model:
water meter



VS 109
Cutaway model:
strainer



VS 102
Cutaway model:
resilient seated
gate valve



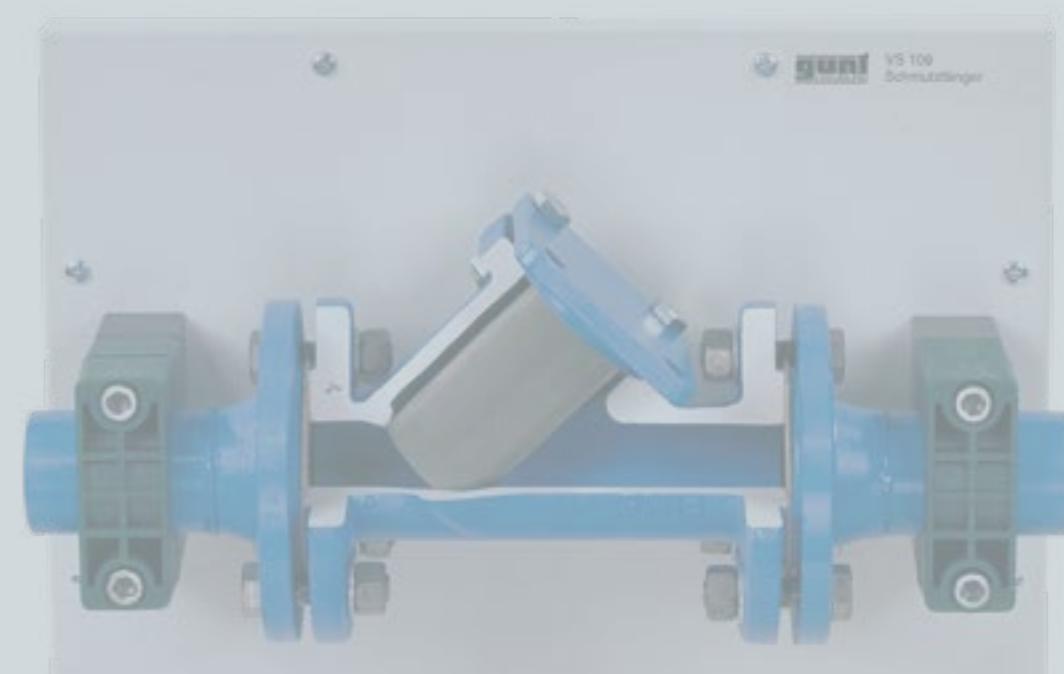
VS 103
Cutaway model:
screw down valve



VS 104
Cutaway model:
changeover valve



VS 105
Cutaway model:
gas meter



Engineering design Machine elements: fasteners

MG 100
Instructional kit:
assembly with dowel pins



Familiarisation with various pin types, their special features and applications

MG 110
Instructional kit:
assembly with keys



Familiarisation with various feather keys, their production, special features and applications

MG 120
Instructional kit:
assembly with taper keys



Familiarisation with various taper keys, their production, special features and areas of application

MG 200
Instructional kit:
threaded fasteners and lock washers



Practical workshop exercises on the topic of threaded fasteners, tightening and breakaway torques

MG 905
Thread types kit

Standardised designations, terms and specific applications of different thread types, determination of the thread type with the thread gauge



TM 320
Screw connections testing

Correlation between tightening torque and tension force on standardised bolts



MG 901
Nuts and bolts kit

Comprehensive instructional kit of the main nuts and bolts used in engineering



MG 903
Screw-locking devices kit

Standardised designations, terms and graphical representation of different screw-locking devices

Engineering design Machine elements: bearings

MG 911
Roller bearings kit

Familiarisation with the most important roller bearing types and their specific applications



Engineering design Machine elements: transmission elements

GL 100 Principle of gear units

Fundamental principles of belt drives, wheel and disc drives, and gear trains



GL 110 Cam mechanism

Demonstration and measurement of the displacement curves for cam mechanisms



GL 200 Lathe gear

Safe and clear demonstration of function of the gears on a conventional lathe



AT 200 Determination of gear efficiency

Test system for determining mechanical drive and braking efficiency for spur and worm gears



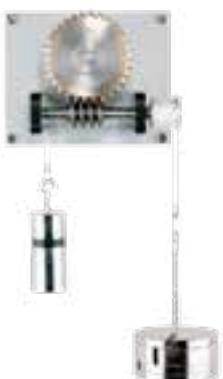
TM 123 Spur gear unit

Mode of operation and layout of a spur gear



TM 124 Worm gear unit

Mode of operation and layout of a worm gear



TM 125 Cable winch

Using force equilibrium considerations to determine load transmission and efficiency



TM 232 Bearing friction

Sliding bearing friction with different bearing material pairings and comparison with rolling bearing friction



TM 220 Belt drive and belt friction

Investigating the influence of the angle of contact, coefficient of friction and belt force on belt drives and belt friction



TM 282 Friction in journal bearings

Learning the fundamentals of hydrodynamic lubrication by experimentation



Assembly technology
Assembly kits
MT 190
Assembly materials tester

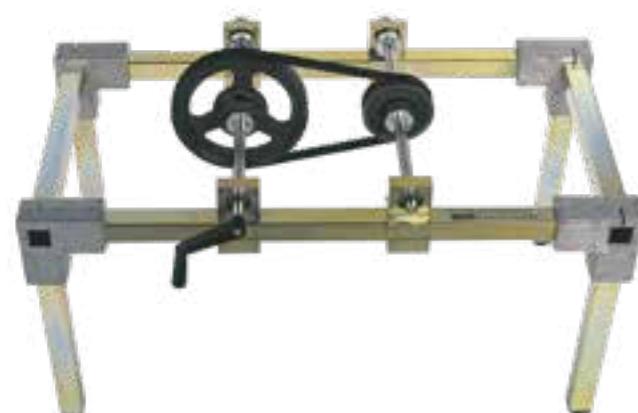
Study project with extensive practical relevance for training in metal working professions by constructing a hydraulic tensile / compression testing device


MT 190.01
Assembly data acquisition for materials tester

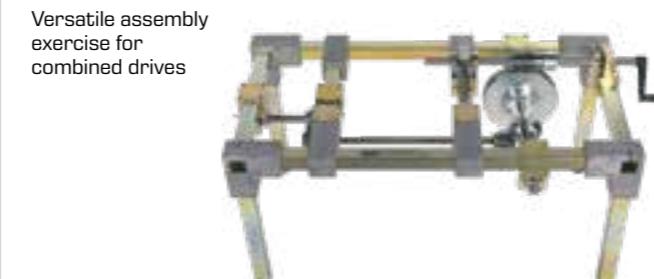
Mechanical and electrical engineering assembly kit: fully functional data acquisition for the materials tester MT 190


Assembly technology
Drive elements and gears
GL 410
Assembly simple gears

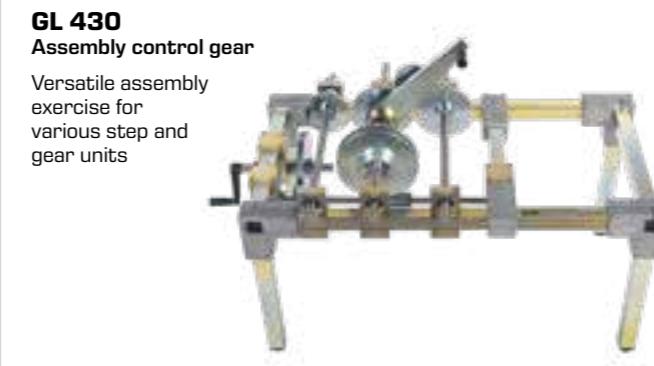
Versatile assembly exercise for simple drives using a belt, chain sprockets or a roller chain


GL 420
Assembly combined gears

Versatile assembly exercise for combined drives


GL 430
Assembly control gear

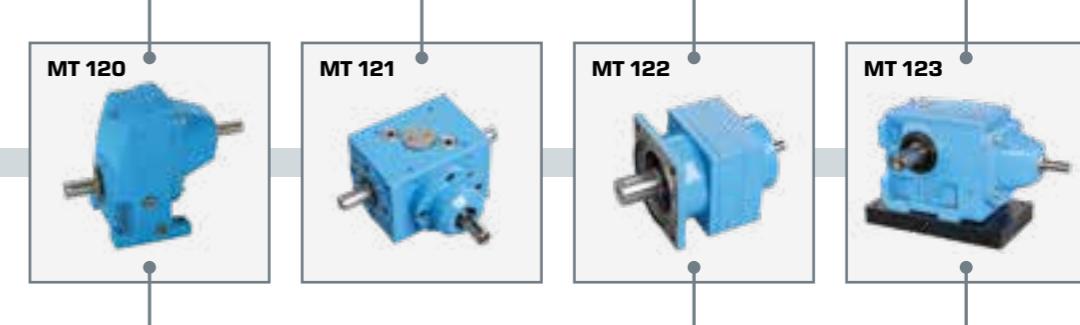
Versatile assembly exercise for various step and gear units


Assembly technology
Drive elements and gears
MT 173
Test stand for gears

Test system for determining the mechanical efficiency of different gear types, system control via PLC



How to achieve the digital transformation to Industry 4.0


MT 174
Sorting plant

Preventive maintenance based on the example of a separation process, system control via PLC



Assembly technology Drive elements and gears

MT 171
Assembly hydro-dynamic journal bearing

Understanding components and function; assembly and maintenance



MT 120
Assembly exercise: spur gear

Design and function of a spur gear with helical gear wheels; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 122
Assembly exercise: planetary gear

Design and function of a planetary gear; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 136
Assembly exercise: gear pump

Design and function of a gear pump; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 110.10
Cutaway model: spur and worm gear

Manually operated cutaway model of a spur and worm gear



MT 121
Assembly exercise: mitre gear

Design and function of a mitre gear; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 123
Assembly exercise: spur and worm gear

Design and function of a spur and worm gear; planning, assembly and disassembly

Multimedia instructional materials via Internet



Assembly technology Fittings

MT 154
Assembly exercise: shut-off valve

Planning, assembly, disassembly: function and design of a shut-off valve



MT 156
Assembly exercise: wedge gate valve and angle seat valve

Assembly, disassembly and maintenance of industrial fittings



MT 157
Assembly exercise: butterfly valve and non-return valve

Assembly, disassembly and maintenance of industrial fittings



MT 158
Assembly exercise: ball valve and shut-off valve

Assembly, disassembly and maintenance of industrial fittings



MT 101
Assembly exercise: pneumatically driven control valve

Design and function of a pneumatically driven control valve; planning, assembly and disassembly

Multimedia instructional materials via Internet



MT 162
Hydraulic valves and fittings test stand

Pressure test for GUNT assembly kits MT 154, MT 156, MT 157 and MT 158



MT 102
Assembly exercise: electrically driven control valve

Design and function of an electrically driven control valve; planning, assembly and disassembly

Multimedia instructional materials via Internet



Assembly technology Compressors

MT 141 Assembly exercise: piston compressor

Function and design of a piston compressor; planning, assembly, disassembly

Multimedia instructional materials via Internet



MT 140.01 Assembly exercise piston compressor: functional test

Installation of the compressor MT 141 for operational check



Maintenance System components: valves, pumps, pipes

MT 180 Assembly & maintenance exercise: centrifugal pump

Understanding design and function of the pump; planning and executing assembly, disassembly and maintenance



MT 181 Assembly & maintenance exercise: multistage centrifugal pump

Understanding design and function of the pump; planning and executing assembly, disassembly and maintenance



MT 182 Assembly & maintenance exercise: screw pump

Understanding design and function of the pump; planning and executing assembly, disassembly and maintenance



MT 183 Assembly & maintenance exercise: diaphragm pump

Understanding design and function of the pump; planning and executing assembly, disassembly and maintenance



MT 184 Assembly & maintenance exercise: piston pump

Understanding design and function of the pump; planning and executing assembly, disassembly and maintenance



MT 185 Assembly & maintenance exercise: in-line centrifugal pump

Understanding design and function of the pump; planning and executing assembly, disassembly and maintenance



Assembly technology Piping

HL 960 Assembly station pipes and valves and fittings

Assembly of real piping and plant installations; together with HL 960.01: operational testing on a pipe network



HL 960.01 Assembly and alignment of pumps and drives

Installation and removal of pumps in plants; water supply for HL 960



MT 186 Assembly & maintenance exercise: gear pump

Understanding design and function of the pump; planning and executing assembly, disassembly and maintenance



MT 136 Assembly exercise: gear pump

Design and function of a gear pump; planning, assembly and disassembly

Multimedia instructional materials via Internet



Maintenance System components: valves, pumps, pipes

HL 962
Assembly stand for pumps

Base unit when constructing a complex piping system



HL 962.01
Standard chemicals pump

Typical pump as used in process engineering



HL 962.02
Canned motor pump

Hermetic centrifugal pump, particularly suitable for pumping liquid gases



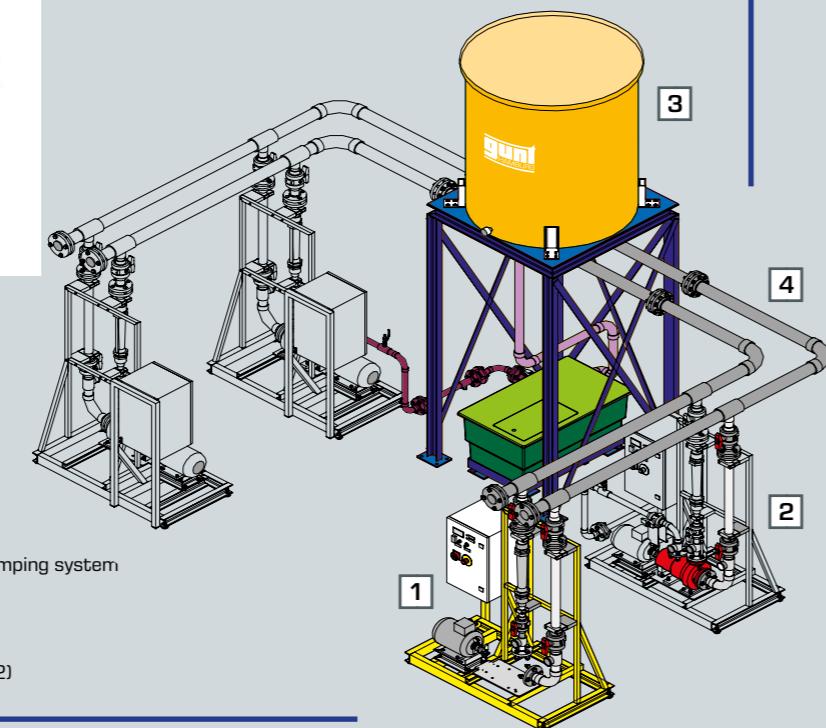
HL 962.03
Side channel pump

Self-priming three-stage pump



HL 962.04
Standard chemicals pump with magnetic clutch

Hermetic centrifugal pump according to ISO 5199



Possible combination of individual components into a functional pumping system

- 1 assembly stand for pumps (HL 962)
- 2 pumps, various types (HL 962.01 – HL 962.04)
- 3 tank installation (HL 962.30)
- 4 piping system to interconnect the plant components (HL 962.32)

Maintenance Test stands for valves and fittings and actuators

RT 396
Pump and valves and fittings test stand

Recording characteristic curves of industrial fittings and a centrifugal pump



RT 395
Maintenance of valves and fittings and actuators

Maintenance and operational check: four different fittings and actuators



Maintenance Complex projects on experimental plants

MT 210
Assembly & maintenance exercise: refrigeration

Study project with high practical relevance for training in metal and electrical professions: assembly of a refrigeration system from individual components



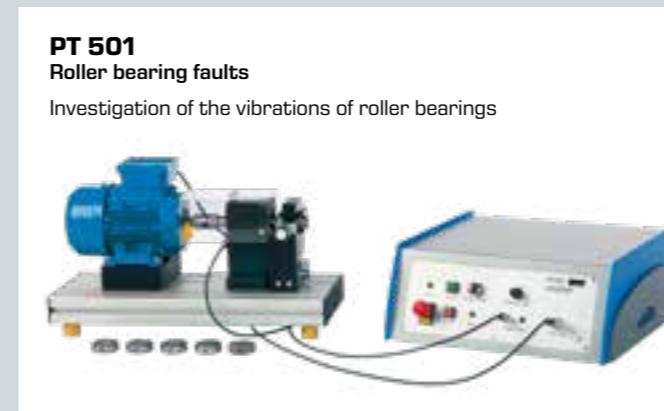
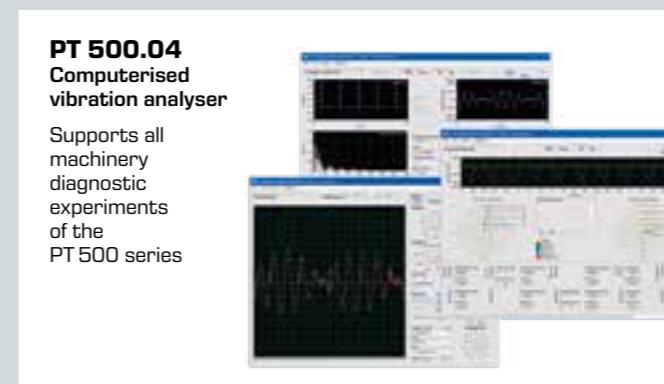
MT 174
Sorting plant

Preventive maintenance based on the example of a separation process, system control via PLC



Skill Level
1 2 3 4 5
GUNT-DigiSkills

Maintenance Machinery diagnosis



Production technology
Dimensional metrology

PT 102
Dimensional metrology,
spacer plate

Measurement exercises
on 10 spacer plates
with digital and analog
calliper, depth calliper
and depth micrometer



PT 104
Dimensional metrology,
angle piece

Measurement exercises
on 10 angle pieces with
analog calliper, depth
calliper, universal
goniometer and
radius gauge



PT 105
Dimensional metrology, shaft

Measurement exercises
on 10 shafts with calliper,
depth calliper, external
micrometer, slip gauges
and thread gauge



PT 107
Dimensional metrology,
flange housing

Measurement exercises
on a real-world machine
element; testing of a
flange housing with
calliper, three-point
internal micro-
meter, thread
limit plug gauge
and surface
comparison
plates



PT 108
Dimensional metrology,
output shaft

Measurement exercises
on a real-world machine
element; testing of an
output shaft with cali-
per, depth calliper,
digital external
micrometer and
surface com-
parison plates



PT 109
Dimensional metrology,
hub

Measurement exercises
on 10 hubs with analog
calliper, depth calliper,
three point internal
micrometer and
limit plug gauge



How to achieve the
digital transformation
to Industry 4.0



PT102 – PT109 are part of the
GUNT DigiSkills 2 learning project.

In addition to versatile learning objectives of dimensional
metrology, comprehensive digital skills are developed
with GUNT-DigiSkills 2.

Production technology
Tools

FT 901
Drilling kit

Various drilling tools:
cutting geometry,
incorrect cutter
profiles



FT 903
Countersinking kit

Collection of counter-
sinking tools: standard
designations



FT 905
Reaming kit

Checking a hole with
the limit plug gauge;
various reaming
tools



FT 907
Grinding kit

Teaching collection of traditional grinding tools
and abrasives

Order No.: 054.90700



FT 909
Turning kit

Familiarisation with different lathe tools (shape, application) and
reversible carbide tips (cutting geometry)



FT 913
Milling kit

Familiarisation with
various types of
milling cutters



Production technology Technological experiments

FT 100

Cutting forces during drilling

Measurement of feed force and torque

**FT 102**

Cutting forces during turning

Measuring the forces acting on a lathe tool; three-component force measuring device

**FT 200**

Forming by bending

Vice experiment: permanent deformation of flat bars



Automation and process control engineering Sensors / measurement technology

IA 120

Principles of industrial sensors

Familiarisation with key sensors: mode of operation and application

**RT 306**

Adjustment of level sensors

Familiarisation with different industry standard components with a 4-20mA current loop interface using the example of level measurement

**IA 110**

Calibrating a pressure sensor

Test-pressure generated with dead-weight piston manometer

**WL 202**

Fundamentals of temperature measurement

Experimental introduction to temperature measurement: methods, areas of application, characteristics

**FL 100**

Strain gauge training system

Basic introduction to measurement with strain gauges for tension, bending and torsion



Automation and process control engineering
PLC and PLC applications

RT 800
PLC application: mixing process

Experiments using PLC to control discontinuous mixing processes



IA 210
PLC application:
materials handling process
Basic system of automation:
transporting and sorting workpieces

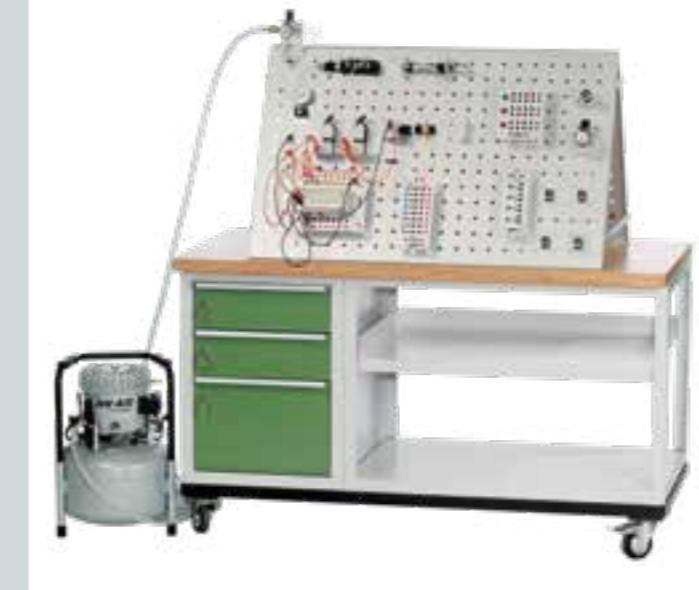


IA 130
PLC module
Self-contained PLC module for basic exercises;
also suitable for IA 210 and RT 800

Automation and process control engineering
Fundamentals of pneumatics and hydraulics

RT 770
Training system:
pneumatics, electro-pneumatics and PLC

Complete training system providing an experimental introduction to the fundamentals of pneumatics and electro-pneumatics, also with PLC



RT 700
Training system:
fundamentals of hydraulics

Complete training system providing an experimental introduction to the fundamentals of hydraulics



RT 710
Hydraulic servo system
Hydraulic position control circuit with adjustable load conditions



Automation and process control engineering
Controllers, controlled systems, networking

RT 350
Operation of industrial controllers

Simulation of controlled systems; digital controller with freely selectable parameters



RT 380
Optimization of control loops

Tuning the controller to the controlled system; software simulation of the most common controlled systems



Automation and process control engineering

Process control systems with simple controlled variables

RT 010
**Training system
level control, HSI**

Fundamentals of control engineering using the example of a level control system with integral behaviour


RT 020
Training system flow control, HSI

Fundamentals of control engineering using the example of a rapid flow control system


RT 614
**Level control
demonstration unit**

Experimental introduction to control engineering using an example of level controlled system


RT 624
**Flow control
demonstration unit**

Experimental introduction to control engineering using an example of flow controlled system


RT 030
Training system pressure control, HSI

Fundamentals of control engineering using the example of a pressure control system with first order lag


RT 040
Training system temperature control, HSI

Fundamentals of control engineering using the example of a temperature control system with dead time


RT 634
**Pressure control
demonstration unit**

Experimental introduction to control engineering using an example of second order pressure controlled system


RT 644
**Temperature control
demonstration unit**

Experimental introduction to control engineering using an example of temperature controlled system


RT 050
Training system speed control, HSI

Fundamentals of control engineering using the example of a speed control system with first order lag


RT 060
Training system position control, HSI

Fundamentals of control engineering using the example of a position control system with integral behaviour


RT 674
**Flow/level control
demonstration unit**

Experimental introduction to control engineering using an example of a controlled system for flow rate, level and level via flow rate (cascade control)



Automation and process control engineering

Process control systems with simple controlled variables**RT 451**

Level control

Level controlled system based on standard industrial components, smart level sensor, system control via PLC

**RT 452**

Flow control

Flow controlled system based on standard industrial components, smart flow rate sensor, system control via PLC

**RT 453**

Pressure control

First order and second order pressure controlled system based on standard industrial components, smart pressure sensors, system control via PLC

**RT 454**

Temperature control

Temperature controlled system based on standard industrial components, controller configurable as a continuous or a switching device, smart temperature sensors, system control via PLC

**RT 455**

pH value control

pH value controlled system based on standard industrial components, smart pH sensors, system control via PLC



Automation and process control engineering

Process control systems with multiple controlled variables**RT 586**

Control of water quality

Control of pH-value, redox potential, oxygen concentration and electrical conductivity

**RT 578**

Control of four variables from process engineering

Practical control of level, flow rate, pressure and temperature

**RT 580**

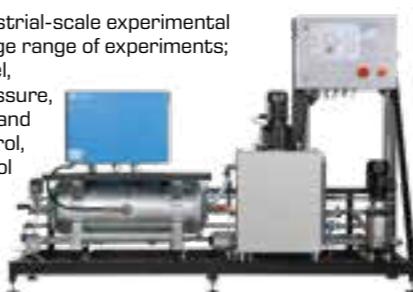
Fault finding in control systems

Control of level, flow rate, temperature and cascade control; plant control and configuration via touch screen and PLC

**RT 590**

Process control engineering experimental plant

Complex industrial-scale experimental plant with large range of experiments; control of level, flow rate, pressure, temperature and cascade control, system control via PLC



Automation and process control engineering Modular process automation training system



The image shows a fully assembled pressure control system after planning and execution of the piping and wiring.

RT 450

Process automation training system: base module

Basis for the modular setup of the different process automation experiments, including electrical power supply and water supply with tank and pump



RT 450.01

Controlled system module: level

Together with further components this is the main element for the setup of a level control loop



RT 450.02

Controlled system module: flow

Together with further components this is the main element for the setup of a flow control loop



RT 450.03

Controlled system module: pressure

Together with further components this is the main element for the setup of a pressure control loop



RT 450.04

Controlled system module: temperature

Together with further components this is the main element for the setup of a temperature control loop



Automation and process control engineering CNC and robotics

IA 520

Computer integrated manufacturing and handling system

Two CNC machines, one robot and one magazine as the main elements; PLC and process control software for process monitoring in an automated manufacturing process



Automation and process control engineering Remote Learning with GUNT

GU 100

Web Access Box

Accessory for selected GUNT devices enables practice-oriented distance teaching and learning: experiment observation via web browser with streaming of live images

For each GUNT device to be upgraded with the Web Access Box, a device specific software is available: Web Access Software. The software must be purchased separately for each device.

Information on this you will find on our
[>> website](#)



Hands-on teaching engineering – with GUNT's SMART features



About the product:



3 | Thermal engineering

Fundamentals of thermodynamics

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Heat exchangers

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3

Thermal engineering



Fundamentals of thermodynamics
Thermodynamic state variables

WL 201
Fundamentals of humidity measurement

Climatic chamber with adjustable humidity; comparison of four measuring methods



WL 203
Fundamentals of pressure measurement

Measurement of positive and negative pressure with different measuring devices



WL 202
Fundamentals of temperature measurement

Experimental introduction to temperature measurement: methods, areas of application, characteristics



WL 103
Expansion of ideal gases

Determination of the adiabatic exponent according to Clément-Desormes



WL 102
Change of state of gases

Isothermal and isochoric change of state of air



Fundamentals of thermodynamics
Phase transition

WL 210
Evaporation process

Different forms of evaporation in an externally heated pipe



WL 204
Vapour pressure of water – Menzert boiler

Pressure and temperature measurement in a steam boiler



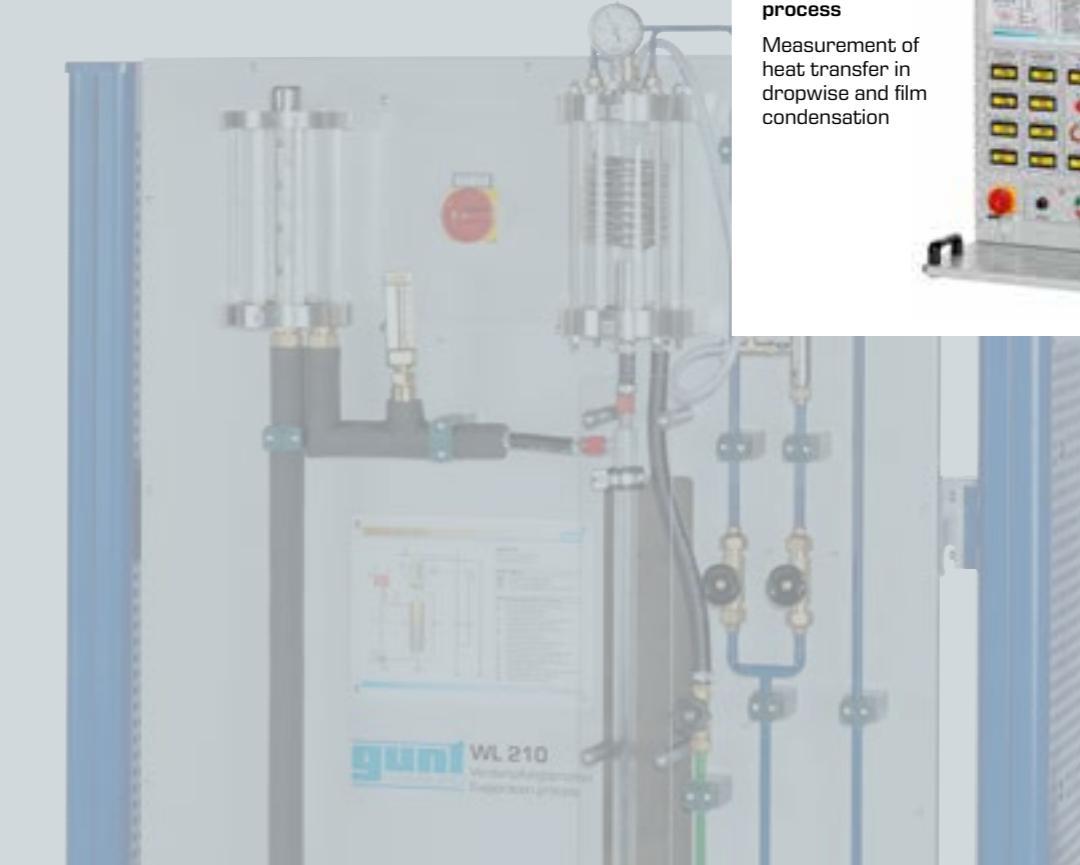
WL 220
Boiling process

Visualisation of different forms of evaporation in a transparent pressure vessel



WL 230
Condensation process

Measurement of heat transfer in dropwise and film condensation



Fundamentals of thermodynamics

Principles of heat transfer

WL 362**Energy transfer by radiation**

Investigation of thermal and light radiation; thermal radiator and thermopile for the investigation of thermal radiation

**WL 460****Heat transfer by radiation**

Effect of different surfaces on heat transfer

**WL 372****Radial and linear heat conduction**

Study of heat conduction in solids

**WL 900****Steady-state and non-steady-state heat conduction**

Linear heat conduction in metals; non-steady state temperature distribution

**WL 377****Convection and radiation**

Heat transport between heating element and vessel wall by convection and radiation

**WL 440****Free and forced convection**

Calculation of convective heat transfer at different geometries: flat plate, cylinder, tube bundle

**WL 420****Heat conduction in metals**

Investigation of the thermal conductivity of different metals

**WL 430****Heat conduction and convection**

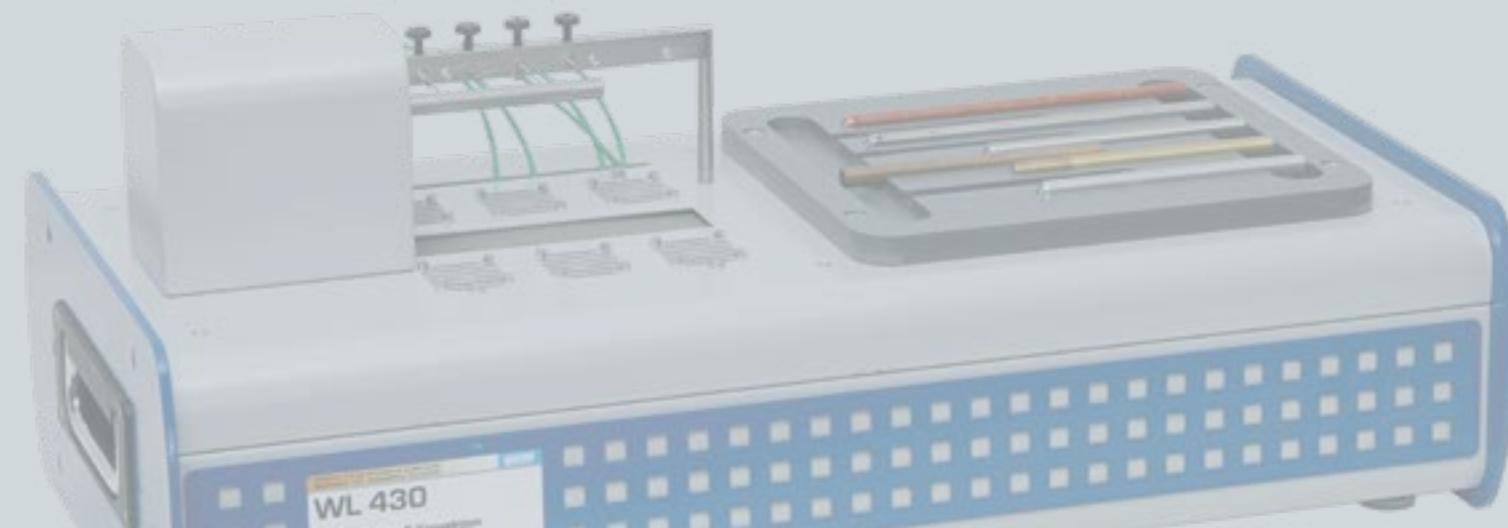
Investigation of heat conduction and convection using the example of a cooling fin

**WL 422****Heat conduction in fluids**

Determination of the coefficient of thermal conductivity for gaseous and liquid fluids

**WL 376****Thermal conductivity of building materials**

Investigation of the insulation properties of typical materials from the building materials sector




Heat exchangers
Heat transfer
WL 314
Convective heat transfer in air flow

Convective heat transfer in heat exchangers with different geometries


WL 314.01
Heat transfer in pipes in parallel flow

Heat transfer from the tube wall to the flowing medium


WL 314.02
Heat transfer in pipes in mixed flow

Heat transfer in a shell and tube heat exchanger in cross-flow operation


WL 314.03
Heat transfer in a tube

Tubular heat exchanger; heat transfer in the inner pipe


Heat exchangers
Recuperators
WL 110
Heat exchanger supply unit

Measuring the transfer characteristics of five different heat exchanger models, system control via PLC


WL 110.01
Tubular heat exchanger

Transparent heat exchanger with additional temperature measuring point after half of the transfer section; parallel flow and counterflow operation


WL 110.02
Plate heat exchanger

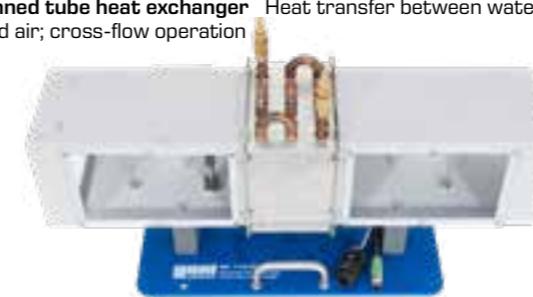
Typical plate heat exchanger in parallel flow and counterflow operation


WL 110.03
Shell & tube heat exchanger

Transparent shell and tube heat exchanger in cross parallel flow and cross counterflow operation


WL 110.04
Stirred tank with double jacket and coil

Heating using jacket or coiled tube; stirrer for improved mixing of medium


WL 110.05
Finned tube heat exchanger Heat transfer between water and air; cross-flow operation

WL 308
Heat transfer in pipe flow

Heat exchanger with measurement of the fluid and wall temperature; operation in parallel flow and counterflow



Heat exchangers Recuperators

WL 302

Heat transfer in the tubular heat exchanger

Heat transfer in pipe flows and determination of heat flux; parallel flow and counterflow operation



WL 315.01

Shell & tube heat exchanger steam/water

Heat transfer process between steam and water, determination of heat flux of steam and water



ET 300

Finned tube heat exchanger water/air

Function of the heat exchanger as an air heater or water cooler



WL 312

Heat transfer in air flow

Convective heat transfer using shell & tube and finned tube heat exchangers



WL 315C

Comparison of various heat exchangers

Comparison of plate heat exchanger, tubular heat exchanger, shell and tube heat exchanger, finned cross-flow heat exchanger, and stirred tank with double jacket and coiled tube



Heat exchangers Direct-contact heat exchangers

WL 320

Wet cooling tower

Principle of operation and characteristic variables of a wet cooling tower with forced ventilation



WL 320.01 - WL 320.04

Cooling columns

Cooling columns with different wetting areas



Heat exchangers Fluidisation and heat transfer



WL 225

Heat transfer in the fluidised bed

Heat transfer from a heating element to the fluidised bed



Thermal fluid energy machines Steam power plants

ET 860
Safety devices on steam boilers

Familiarisation with boiler safety devices such as pressure and water level monitors


ET 810
Steam power plant with steam engine

Single-cylinder piston steam engine with gas-fired boiler for steam generation


ET 830.01/02, ET 833.01/02
Cooling tower

Wet cooling tower for steam power plant ET 830 / ET 833 for re-cooling the cooling water (115kW or 140kW)


ET 813
Two-cylinder steam engine

Single-acting steam engine with condensation for determining mechanical power and efficiency


HM 365
Universal drive and brake unit

Core component for experiments on various driving and driven machines


ET 830
Steam power plant, 1,5kW

Oil-fired boiler, single-stage small industry turbine, condenser and feed water treatment and monitoring via PLC


ET 805.50
Determination of the vapour content

Determination of the vapour content using a separating calorimeter with cyclone water separator or a throttling calorimeter with vapour depressurisation

Experimental plant with two-cylinder steam engine ET 813, steam generator ET 813.01 and brake unit HM 365


ET 850
Steam generator

Laboratory scale gas-fired steam generator for wet or superheated steam; integrated condenser


ET 833
Steam power plant 1,5kW with process control system

Steam turbine system like ET 830, with additional monitoring and control via control station with touch screen panel


ET 851
Axial steam turbine

Single-stage steam turbine with power output measurement; steam supply via ET 850, gas-fired or ET 852, electrical


ET 852 Steam generator, electrical

Laboratory scale electrical steam generator for superheated steam; integrated condenser; alternative to the gas-fired steam generator ET 850 for the supply of the steam turbine ET 851


ET 805
Steam power plant 20kW with process control system

Steam turbine with synchronous generator for grid-connected or stand-alone operation. Fully equipped with oil-fired or gas-fired boiler, condenser, cooling tower, feed water treatment and modern synchronisation device (PPU)



Thermal fluid energy machines Gas turbines

ET 792

Gas turbine

Operation with power turbine or as jet engine with propelling nozzle using liquid gas

**ET 796**

Gas turbine jet engine

Small single-shaft gas turbine with thrust measurement using either kerosene or petroleum

**ET 794**

Gas turbine with power turbine

Two-shaft arrangement with high-pressure turbine and power turbine using liquid gas



Thermal fluid energy machines Piston compressors

ET 500

Two-stage piston compressor

Recording the characteristic of an industrial two-stage compressor, system control via PLC

**ET 508**

Simulation of a two-stage air compressor

Simulated operation of a two-stage compressor plant with intermediate and aftercooling

**ET 513**

Single-stage piston compressor

Investigations on an air compressor including the determination of the mechanical power consumption



Single-stage compressor ET 513 with drive unit HM 365

HM 365

Universal drive and brake unit

Core component for experiments on various driving and driven machines

**ET 512**

Compressed air generation plant with piston compressor

Function test on a single-stage piston compressor

**ET 432**

Behaviour of a piston compressor

Investigations in an open two-cylinder piston compressor from refrigeration



Thermal fluid energy machines Internal combustion engines



Modular test stand for single cylinder test engines CT 159, test engine CT 151 and brake unit HM 365

CT 150 Four-stroke petrol engine for CT 159

Air-cooled overhead valve four-stroke petrol engine



CT 151 Four-stroke diesel engine for CT 159

Air-cooled four-stroke diesel engine with direct injection



CT 153 Two-stroke petrol engine for CT 159

Air-cooled two-stroke petrol engine



CT 159 Modular test stand for single-cylinder engines, 3kW

Mounting the engine, supply with fuel and air; measurement of characteristic engine data



HM 365 Universal drive and brake unit

Core component for experiments on various driving and driven machines

CT 110 Test stand for single-cylinder engines, 7,5 kW

Control and load unit, supply with fuel and air; measurement of characteristic engine data



CT 100.22 Four-stroke diesel engine for CT 110

Air-cooled four-stroke diesel engine with direct injection



CT 100.20 Four-stroke petrol engine for CT 110

Air-cooled four-stroke petrol engine with external carburation



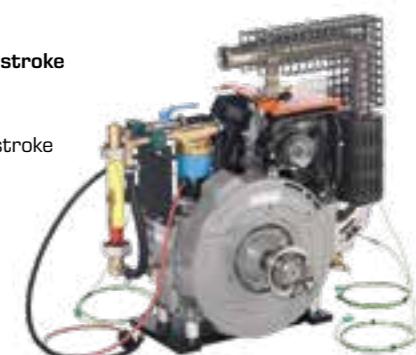
CT 100.21 Two-stroke petrol engine for CT 110

Air-cooled two-stroke petrol engine with reverse scavenging



CT 100.23 Water-cooled four-stroke diesel engine for CT 110

Water-cooled four-stroke diesel engine using the swirl chamber principle



Thermal fluid energy machines
Internal combustion engines

CT 300
Engine test stand, 11kW

Test stand for industrial two-cylinder engines



CT 300.04
Two-cylinder petrol engine for CT 300

Air-cooled four-stroke petrol engine with external carburation



CT 300.05
Two-cylinder diesel engine for CT 300

Water-cooled four-stroke diesel engine with indirect injection



CT 400
Load unit, 75kW, for four-cylinder engines

Load unit with air-cooled eddy-current brake and instruments



CT 400.01
Four-cylinder petrol engine for CT 400

Water-cooled petrol engine with controlled catalytic converter, max. 75kW



CT 400.02
Four-cylinder diesel engine for CT 400

Diesel engine with direct injection, max. 41kW



Fundamentals of refrigeration
Principles of cold production

ET 400

Refrigeration circuit with variable load

Compression refrigeration system with water-cooled evaporator



ET 352

Vapour jet compressor in refrigeration

Cold production using thermal energy. Transparent condenser and evaporator allow the view into the inner workings.



ET 120

Cooling using the Peltier effect

Demonstration of the thermo-electric effect



ET 122

Vortex cooling device

Cooling and heating using compressed air



ET 480

Absorption refrigeration system

Thermally driven refrigeration system without compressor that can be heated with either gas or electrically



Fundamentals of refrigeration Compression refrigeration system

ET 350 Changes of state in the refrigeration circuit



Energetic analyses of the refrigeration cycle; transparent components offer insights into the changes of state

ET 102 Heat pump

Utilisation of ambient heat for water heating



Fundamentals of refrigeration Refrigeration applications

ET 915.01 Refrigerator model

Simple model of a domestic refrigerator for connection to ET 915



ET 915.02 Model of a refrigeration system with refrigeration and freezing stage

Series and parallel connection of evaporators; connection to ET 915



ET 915 HSI training system refrigeration and air conditioning technology, base unit

Modern learning environment through hardware/software integration (HSI)



HSI training system refrigeration with ET 915 and ET 915.02



Thermodynamic applications in supply engineering: HVAC Hot water generation

HL 352 Test stand for oil, natural gas and propane gas burners

Design and operating behaviour of a heating boiler with hot water storage



ET 202 Principles of solar thermal energy

Determining characteristic parameters of a solar thermal system; model fitted with artificial radiation source



ET 262 Geothermal probe with heat pipe principle

Transparent components allow observing how the state of the heat transfer medium changes



HL 313 Domestic water heating with flat collector

Demonstration of the conversion of the sun's radiation energy into heat and the storing of that heat



HL 314 Domestic water heating with tube collector

Familiarisation with the functions of the evacuated tube collector and the solar circuit



ET 203 Parabolic trough collector with solar tracking

Function and operating behavior of a parabolic trough collector, astronomical and sensor-based sun tracking, system control via PLC



Thermodynamic applications in supply engineering: HVAC Hot water generation

ET 102

Heat pump

Utilisation of ambient heat for water heating

**ET 264**

Geothermal energy with two-well system

Use of geothermal energy in an open system without thermal repercussion

**ET 405**

Heat pump for cooling and heating operation

Heat pump with various heat exchangers for air and water

**ET 420**

Ice stores in refrigeration

Industrial refrigeration system with ice store, dry cooling tower and wet cooling tower



Thermodynamic applications in supply engineering: HVAC Air conditioning technology and ventilation

ET 915.06

Model of a simple air conditioning system

Model of a simple air conditioning system for room cooling; connection to ET 915

**ET 915.07**

Air conditioning model

Model of a full air conditioning system with outer and recirculating air operation; connection to ET 915

**ET 915**

HSI training system refrigeration and air conditioning technology, base unit

Modern learning environment through hardware/software integration (HSI)

**ET 605**

Air conditioning system model

Climatic chamber with latent and sensitive heat source as cooling load; recirculating and outer air operation

**HL 720**

Ventilation system

Design and operation of a ventilation system; measuring the pressure curve within the ventilation system

**ET 620**

Air conditioning and ventilation system

Manual or automatic operation by PLC; use of real components



Thermodynamic applications in supply engineering: HVAC
GUNT-RHLine Renewable Heat



HL 320.01
Heat pump

Heat pump for operation with different sources, operating the heating controller via web browser



HL 320.02
Conventional heating

Electric complementary heater for the HL 320 modular system



HL 320.03
Flat collector

Pivotal flat collector for converting solar energy into heat



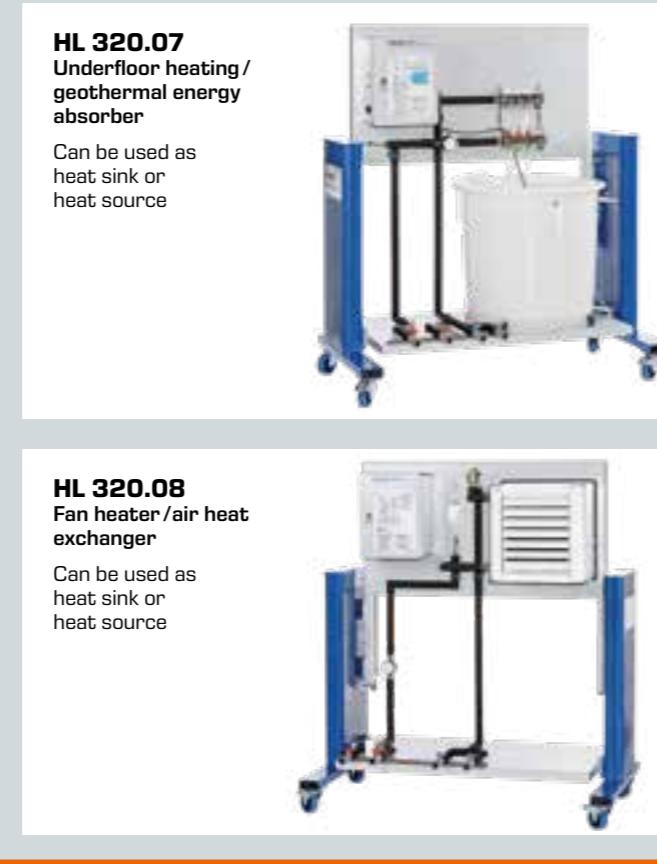
HL 320.04
Evacuated tube collector

Conversion of solar energy into heat in the evacuated tube collector



HL 320.05
Central storage module with controller

Module with buffer storage and bivalent storage for heating systems with renewable energies, operating the heating controller via web browser



HL 320.07
Underfloor heating /
geothermal energy absorber

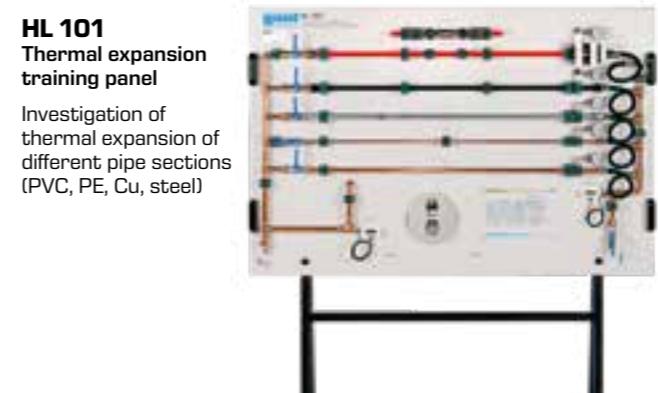
Can be used as heat sink or heat source



HL 320.08
Fan heater / air heat exchanger

Can be used as heat sink or heat source

Heating
Fundamental experiments on heating – training panels



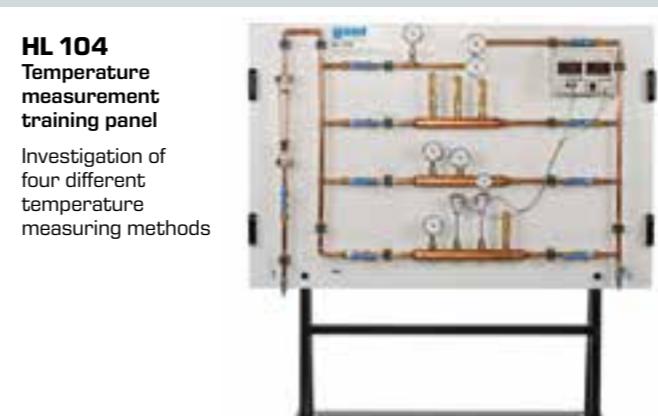
HL 101
Thermal expansion training panel

Investigation of thermal expansion of different pipe sections (PVC, PE, Cu, steel)



HL 105
Three-way mixing valve training panel

Effect of mixing ratio on feed flow and circulating flow temperature



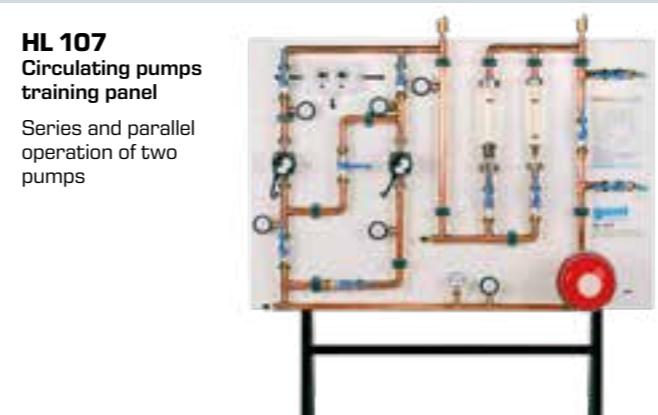
HL 104
Temperature measurement training panel

Investigation of four different temperature measuring methods



HL 106
Four-way mixing valve training panel

Effect of mixing ratio on feed flow and circulating flow temperature



HL 107
Circulating pumps training panel

Series and parallel operation of two pumps



HL 110
Expansion vessel training panel

Displacement volume of an expansion vessel as a function of the pressure



HL 109
Safety devices training panel

Function of safety valves against excess pressure and excess temperature

Heating Fundamental experiments on heating – training panels

HL 112
Radiator training panel



Familiarisation with a hot water heating system

HL 108
Domestic heating circuit training panel



Model of a central heating system with radiators, circulating pump and four-way mixing valve

HL 353
Hot water generator

Setup of a complete domestic heating system together with HL 353.01 and/or HL 353.02



Heating Heating systems in buildings

HL 620
Domestic heating system control training panel
Operation of a modern heating controller



HL 360
Oil tank safety trainer
Investigation of tank safety devices and their function



HL 353.02
Heat distribution and control in heating systems

Two independent heating circuits with control devices:
heating circuit with one subcircuit and with two subcircuits



HL 353.01
Comparison of different heating types

Two independent heating circuits: floor heating or forced convector with fan and two radiators



HL 350
Oil burner demonstrator
Heating boiler with viewing window for observing the flame



HL 351
Domestic heating boiler
Heating boiler with an oil burner; hot water generator for other trainers from the HL series



HL 300
Central heating system
Function and operating behaviour of a hot water heating system with digital heating controller



HL 392C
Safety & control in heating systems
Function and operating behaviour of safety valve, safety pressure cut-out, temperature controller, flow switch and much more



Heating Heating systems in buildings

HL 510
Domestic gas supply
training panel



Simulation of leaks
in pipes

HL 500
Instantaneous gas heater

Methods of gas burner adjustment; simulation of twelve faults

Order No.: 065.50000



HL 358
Forced air gas burner
training panel

Nominal load
adjustment and fault
finding on a gas burner;
hazard-free due to
operation with air



HL 356
Demo unit, gas burner

Electronic simulation of the operation of a forced air gas burner



HL 530
Training panel function of gas heater

Functioning of a typical combination boiler; separate circuits for room heating and domestic water heating



F Sanitary systems

ST 210
Sanitation fittings
training panel

Investigation of function-
and operating behaviour:
two handle mixers, flushing valve



ST 330
Protection of drinking
water training panel

Safety and hygiene of
drinking water pipes



ST 320
Pipe cleaning training
panel

Pipe flushing according
to DIN 1988 standards;
contaminants can be
introduced



ST 310
Drinking water instal-
lation demonstrator

Drinking water
installation in domestic
setting with all
common components



ST 510
Full-scale sewerage system

Demonstration of key aspects
of wastewater technology.
Transparent piping system
allows view of the inside to
observe the flow conditions.



Hands-on teaching engineering – with GUNT's SMART features



About the product:



3a | Refrigeration and air conditioning technology



Refrigeration

Principles of refrigeration:

- principles of cold production 106
- compression refrigeration system 107
- training systems 108

Thermodynamics of the refrigeration cycle 110

Components of refrigeration:

- compressors 111
- evaporators and condensers 112
- primary and secondary controllers 112
- piping 113
- assembly, fault finding, maintenance 113
- cutaway models 114

Heat pumps and ice store 116

Solar cooling 117



Air conditioning technology

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Principles of air conditioning technology 118

Practical air conditioning systems 120

Ventilation 121



Electrical engineering in refrigeration and air conditioning technology

Refrigeration controls 124

Control of refrigeration systems 124

Fault finding 125



3

Refrigeration and
air conditioning technology




Refrigeration
Principles of refrigeration: principles of cold production

ET 101
Simple compression refrigeration circuit
 Cooling and heating of the heat exchangers directly tangible



ET 120
Cooling using the Peltier effect
 Demonstration of the thermo-electric effect



ET 122
Vortex cooling device
 Cooling and heating using compressed air



ET 480
Absorption refrigeration system
 Thermally driven refrigeration system without compressor that can be heated with either gas or electrically



ET 352
Vapour jet compressor in refrigeration

Cold production using thermal energy. Transparent condenser and evaporator allow the view into the inner workings.


Refrigeration
Principles of refrigeration: compression refrigeration system

ET 411C
Compression refrigeration system
 Comparison of different expansion elements, investigation of the effects of over- and underfilling with refrigerant



ET 400
Refrigeration circuit with variable load
 Compression refrigeration system with water-cooled evaporator



ET 350
Changes of state in the refrigeration circuit
 Energetic analyses of the refrigeration cycle; transparent components offer insights into the changes of state

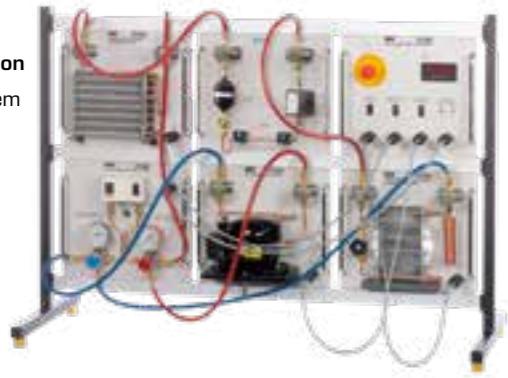


Refrigeration Principles of refrigeration: training systems

ET 900

Introduction to refrigeration

Training system with interchangeable modules



ET 910

Refrigeration training system, base unit

Set-up of various refrigeration circuits using modular component kits; includes refrigeration chamber and condensing unit



ET 910.10

Refrigeration components for basic experiments

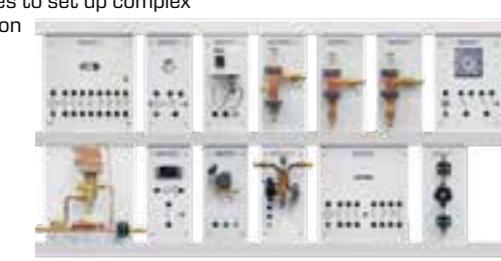
Accessories to set up simple refrigeration circuits



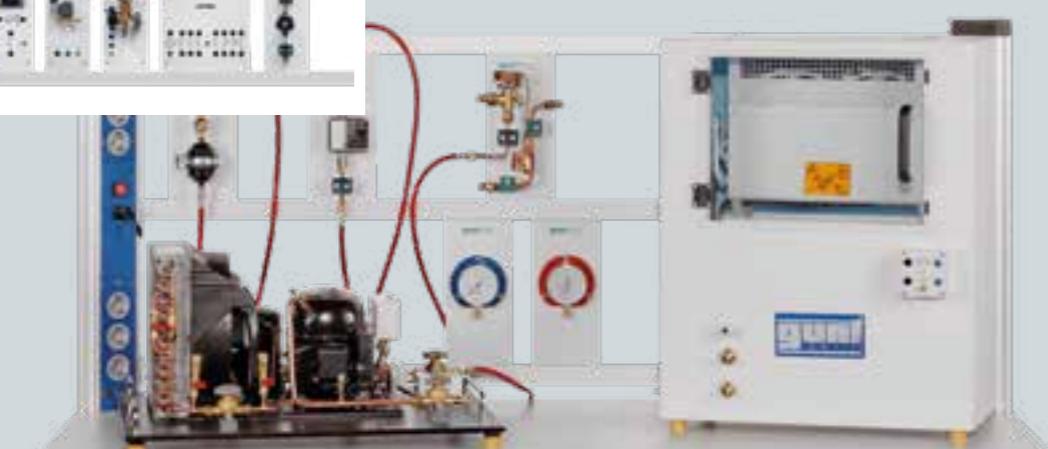
ET 910.11

Refrigeration components for advanced experiments

Accessories to set up complex refrigeration circuits



Experimental setup capacity control with post injection with ET 910, ET 910.10 and ET 910.11



ET 915.01

Refrigerator model

Simple model of a domestic refrigerator for connection to ET 915



ET 915.02

Model of a refrigeration system with refrigeration and freezing stage

Series and parallel connection of evaporators; connection to ET 915



ET 915

HSI training system refrigeration and air conditioning technology, base unit

Modern learning environment through hardware/software integration (HSI)



HSI training system refrigeration with ET 915 and ET 915.02

Refrigeration Thermodynamics of the refrigeration cycle

ET 441**Refrigeration chamber and defrosting methods**

Climatic investigations in cooling and freezing chambers; frosting and defrosting of the evaporator

**ET 351C****Thermodynamics of the refrigeration circuit**

Compression refrigeration system for thermodynamic investigations, measurement of the mechanical compressor output

**ET 430****Refrigeration system with two-stage compression**

Low temperature refrigeration system; compression with injection intercooler and additional refrigerant supercooling

**ET 412C****Refrigeration system with refrigeration and freezing chamber**

Simulation of 18 electrical and hydraulical faults



Refrigeration Components of refrigeration: compressors

ET 165**Refrigeration system with open compressor**

Capacity measurement at the open compressor with variable speed; refrigeration chamber with adjustable cooling load

**HM 365****Universal drive and brake unit**

Core component for experiments on various driving and driven machines

**ET 432****Behaviour of a piston compressor**

Investigations in an open two-cylinder piston compressor from refrigeration

**ET 428****Energy efficiency in refrigeration systems**

Refrigeration system with three compressors in interconnected operation; adaptation to the capacity requirement



Refrigeration

Components of refrigeration: evaporators and condensers

ET 431

Heat exchangers in the refrigeration circuit

Properties of different heat exchangers and their use in refrigeration; effect of superheating and supercooling



ET 405

Heat pump for cooling and heating operation

Heat pump with various heat exchangers for air and water



Refrigeration

Components of refrigeration: piping

ET 460

Oil return in refrigeration systems

Transport of lubricants soluble in refrigerant in refrigeration systems; transparent pipes



Refrigeration

Components of refrigeration: primary and secondary controllers

ET 182

Secondary controllers in refrigeration systems

Demonstration of the principle of operation of the various secondary controllers in the refrigeration circuit



ET 180

Pressure switches in refrigeration

Protection against overpressure and negative pressure in the refrigeration circuit; display of switching states via lamps



ET 426

Capacity control in refrigeration systems

Investigation of different capacity control methods



Refrigeration

Components of refrigeration: assembly, fault finding, maintenance

MT 210

Assembly & maintenance exercise: refrigeration

Study project with high practical relevance for training in metal and electrical professions: assembly of a refrigeration system from individual components



ET 192

Replacement of refrigeration components

Service and repair exercises: replacement of compressor, pressure switch, filter/drier, solenoid valve and expansion valve



ET 422

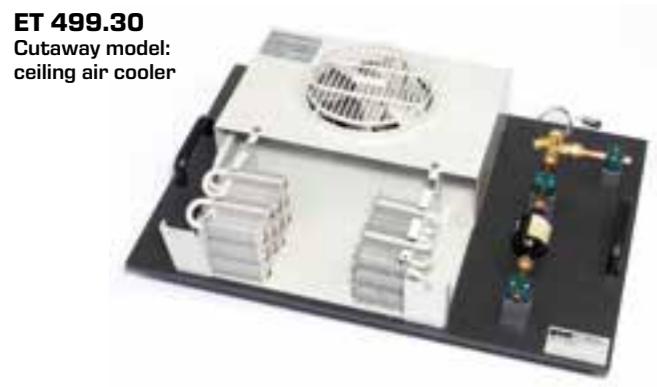
Capacity control and faults in refrigeration systems

Investigation of different methods for capacity control; fault simulation



Refrigeration

Components of refrigeration: cutaway models



Refrigeration Heat pumps and ice store

ET 102
Heat pump

Utilisation of ambient heat for water heating

**ET 405**
Heat pump
for cooling and
heating operation

Heat pump with various heat exchangers for air and water

**ET 420**
Ice stores in refrigeration

Industrial refrigeration system with ice store, dry cooling tower and wet cooling tower

**HL 320.01**
Heat pump

Heat pump for operation with different sources, operating the heating controller via web browser

**HL 320.07**
Underfloor heating /
geothermal energy
absorber

Can be used as heat sink or heat source

**HL 320.08**
Fan heater /
air heat exchanger

Can be used as heat sink or heat source



Refrigeration Solar cooling

ET 256
Cooling with solar electricity

Compression refrigeration system for operation with solar current from ET 250



ET 256 together with the optional artificial light source HL 313.01 and solar modules ET 250

ET 352.01
Solar heat
for refrigeration

Solar thermal operation of a vapour jet compressor

**ET 352**
Vapour jet compressor
in refrigeration

Cold production using thermal energy. Transparent condenser and evaporator allow the view into the inner workings.

**HL 313**
Domestic water heating
with flat collector

Demonstration of the conversion of the sun's radiation energy into heat and the storing of that heat, operating the solar controller via web browser

**HL 313**
Domestic water heating
with tube collector

Familiarisation with the functions of the evacuated tube collector and the solar circuit, operating the solar controller via web browser

**ET 480**
Absorption refrigeration
system

Thermally driven refrigeration system without compressor that can be heated with either gas or electrically



Air conditioning technology
States of the air

WL 320
Wet cooling tower

Principle of operation and characteristic variables of a wet cooling tower with forced ventilation



WL 320.01 - WL 320.04
Cooling columns

Cooling columns with different wetting areas



WL 201
Fundamentals of humidity measurement

Climatic chamber with adjustable humidity; comparison of four measuring methods



ET 915
HSI training system refrigeration and air conditioning technology, base unit

Modern learning environment through hardware/software integration (HSI)



ET 915.06
Model of a simple air conditioning system

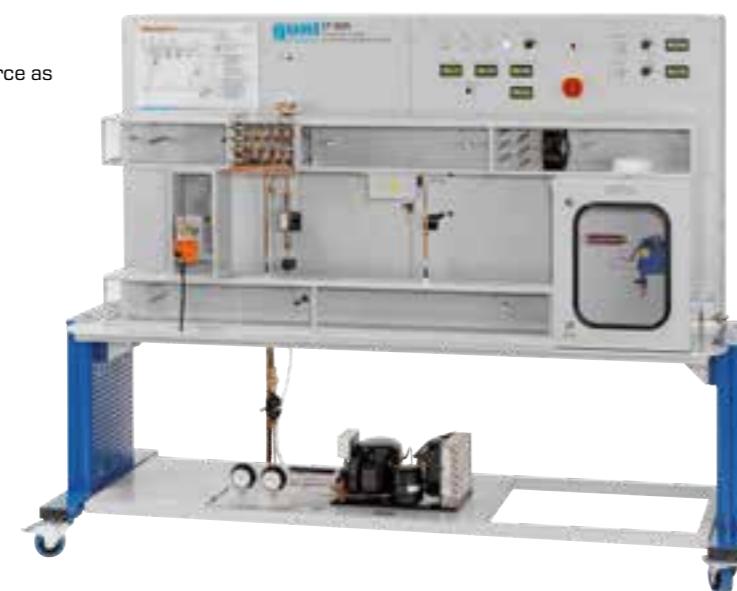
Model of a simple air conditioning system for room cooling; connection to ET 915



Air conditioning technology
Principles of air conditioning technology

ET 605
Air conditioning system model

Climatic chamber with latent and sensitive heat source as cooling load; recirculating and outer air operation



HSI training system air conditioning technology with ET 915 and ET 915.07



Air conditioning technology Practical air conditioning systems

ET 611**Air conditioning system with chamber**

Chamber for comfort studies, suitable for occupation by test individuals.
Air conditioning system with water chiller and vapour humidifier.

**ET 600****Conditioning of room air**

Air conditioning system consisting of industrial components including direct evaporator and vapour humidifier

**ET 630****Split system air conditioner**

Modern air conditioning unit with heat pump function: cooling or heating

**ET 450****Vehicle air conditioning**

Vehicle air conditioning system for cooling the vehicle interior; use of typical components from automotive technology

**ET 620****Air conditioning and ventilation system**

Manual or automatic operation by PLC; use of real components



Air conditioning technology Ventilation

HM 280**Experiments with a radial fan**

Operating behaviour and characteristic variables of a radial fan; two interchangeable rotors

**HM 282****Experiments with an axial fan**

Operating behaviour and parameters of an axial fan

**HM 210****Characteristic variables of a radial fan**

Determination of flow rate via iris diaphragm or Venturi nozzle

**HL 720****Ventilation system**

Design and operation of a ventilation system; measuring the pressure curve within the ventilation system

**HL 710****Air duct systems**

Planning and setup of simple and complex air duct systems



Air conditioning technology Ventilation

HM 240

Principles of air flow

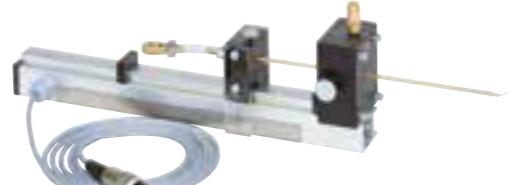
Determining the fan characteristic curve



HM 240.03

Electronic total pressure sensor

Measurement of the velocity distribution in the intake tube on HM 240



HM 240.04

Pressure distribution on a cylinder

Cylinder in transverse incident flow; record pressure distribution in the wake of the cylinder in conjunction with HM 240.03



HM 240.05

Pressure losses in pipe elements

Measurement of pressure losses in straight pipe sections, in a 90° pipe bend, and in a 90° pipe angle



HM 240.06

Heat transfer at a cylinder in transverse flow

Investigation of heat transfer from a heated rod to an air flow



HM 220

Air flow experimental plant

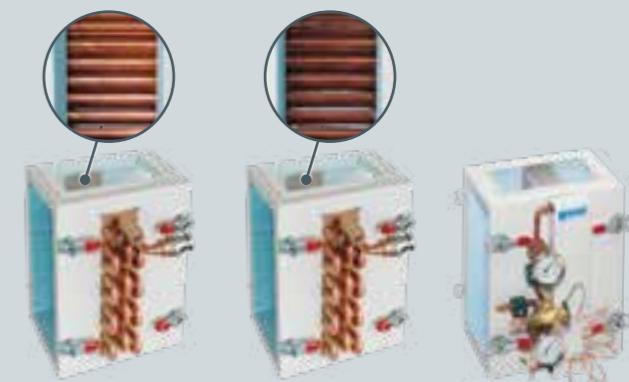
Determining pressure loss and velocity profiles; different measuring objects



WL 312

Heat transfer in air flow

Convective heat transfer using shell & tube and finned tube heat exchangers



Accessories for the trainer:
WL 312.01 Heat transfer with plain tubes,
WL 312.02 Heat transfer with finned tubes,
WL 312.03 Heat transfer on refrigerant evaporator



Electrical engineering in refrigeration and air conditioning technology Refrigeration control

ET 144

Electrical installation in refrigeration systems

Design and wiring of typical electrical circuits from refrigeration

**ET 171**

Electrical connection of refrigerant compressors

Use of a real refrigerant compressor



Electrical engineering in refrigeration and air conditioning technology Fault finding

ET 172

Electrical faults in refrigerant compressors

Investigation of important electrical components from refrigeration

**ET 170**

Electrical faults in simple air conditioning systems

Simulation of a simple air conditioning system with compressor, fan and thermostat

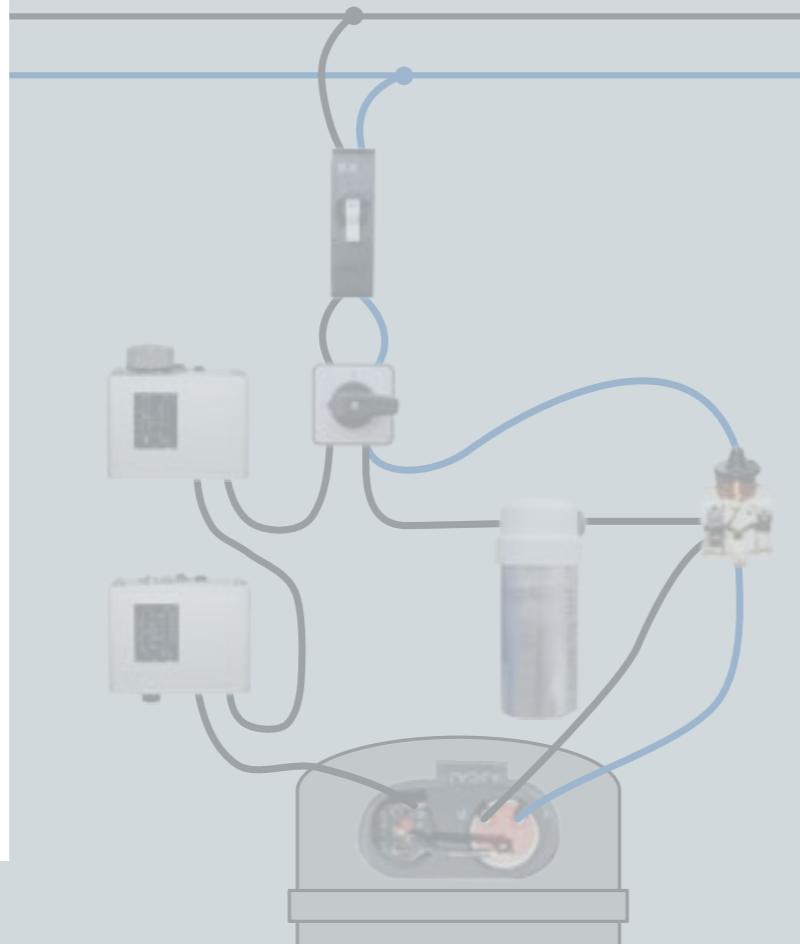


Electrical engineering in refrigeration and air conditioning technology Control of refrigeration systems

ET 930

Evaporator control with electronic expansion valve

Practical programming of a modern refrigeration controller

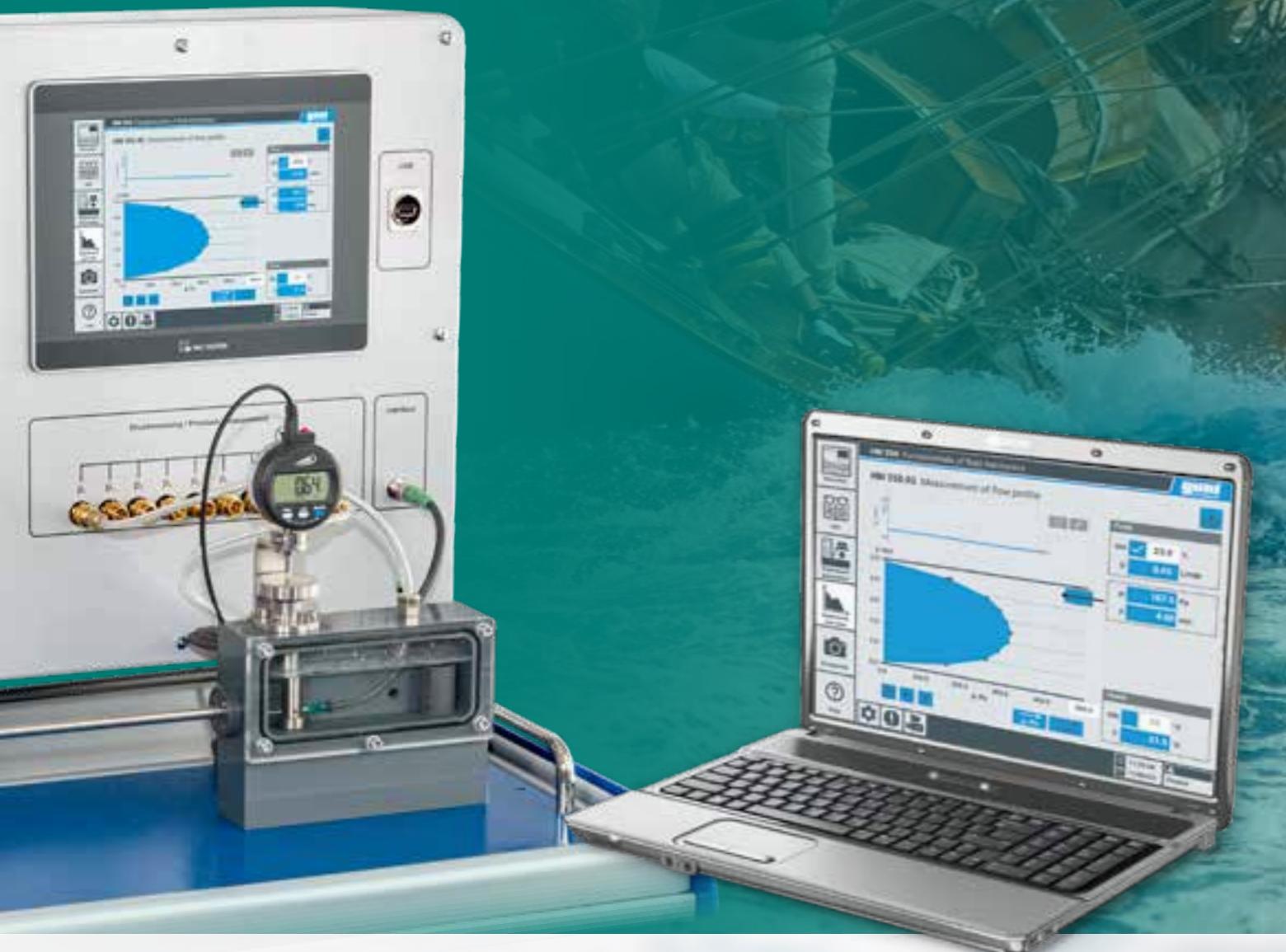
**ET 174**

Electrical faults in full air conditioning systems

Simulation of the electrical circuit of a complex conditioning system with humidifying and heat pump function



Hands-on teaching engineering – with GUNT's SMART features



About the product:



4 | Fluid mechanics



Fundamentals of fluid mechanics

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Steady flow

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Examples of transient flow



Flow around bodies

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Components in piping systems and plant design

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Design of complex piping and plant systems	156



Fluidic experimental plants

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4

Fluid mechanics



 Fundamentals of fluid mechanics
Physics and properties of fluids

WL 202
Fundamentals of temperature measurement

Experimental introduction to temperature measurement:
methods, areas of application, characteristics



WL 203
Fundamentals of pressure measurement

Measurement of positive and negative pressure with different measuring devices



Fundamentals of fluid mechanics
Fundamentals of hydrostatics

HM 115
Hydrostatics trainer

Experiments on buoyancy, density, capillarity etc.; various methods of pressure measurement



HM 150.05
Hydrostatic pressure in liquids

Investigation of fluid pressure on vessel walls



WL 102
Change of state of gases

Isothermal and isochoric change of state of air



WL 204
Vapour pressure of water – Marcet boiler

Pressure and temperature measurement in a steam boiler



Fundamentals of fluid mechanics
Flow around bodies

HM 150.10
Visualisation of streamlines

Investigation of flow around models in laminar, two-dimensional flow using ink as contrast medium

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 135
Determination of the settling velocity

Vertically falling body in liquid using specimens of different sizes and different materials



Fundamentals of fluid mechanics Fundamentals of hydrodynamics

HM 150.18 Osborne reynolds experiment

Visualisation of laminar and turbulent flow
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.07 Bernoulli's principle

Static pressure and total pressure distribution along the Venturi nozzle
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.08 Measurement of jet forces

Demonstration of the principle of linear momentum and impact forces on interchangeable deflectors with different deflection angles
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



TM 605 Coriolis force

Demonstration of the Coriolis force in rotating reference systems



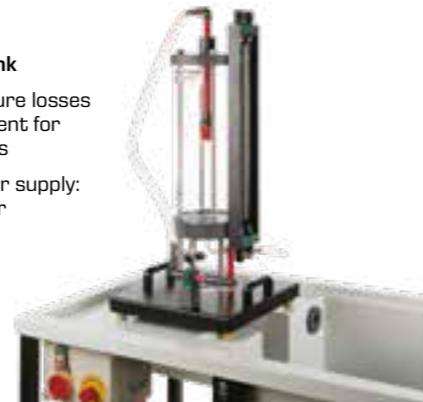
HM 150.09 Horizontal flow from a tank

Recording the trajectory of the water jet at different outlet velocities
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.12 Vertical flow from a tank

Determination of pressure losses and contraction coefficient for different outlet contours
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.14 Vortex formation

Free and forced vortex; point gauges to detect surface profiles
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150 Base module for experiments in fluid mechanics

Volumetric flow measurement for large and small flow rates



Fundamentals of fluid mechanics Flow in pipes

HM 150.01 Pipe friction for laminar/turbulent flow

Determining the critical Reynolds number
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.29 Energy losses in piping elements

Pressure losses in various pipe fittings and in the ball valve
Recommended for water supply: HM 150 Base module for experiments in fluid mechanics



HM 150.11 Losses in a pipe system

Influence of flow velocity on pressure loss
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



Fundamentals of fluid mechanics Methods of flow rate measurement

HM 150.13 Methods of flow measurement

Comparison of different measuring methods and determining the flow coefficients
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



Fundamentals of fluid mechanics Compact fluid mechanics: Fluidtutor

HM 241 Fundamentals of water flow

Experiments on water flow in open flumes and in pipes.
Transparent design allows observation of the flow processes.



Fundamentals of fluid mechanics Open-channel flow

HM 150.03

Plate weirs for HM 150

Discharge measurement in open channels using two measuring weirs

HM 150 Base module required for experiments in fluid mechanics

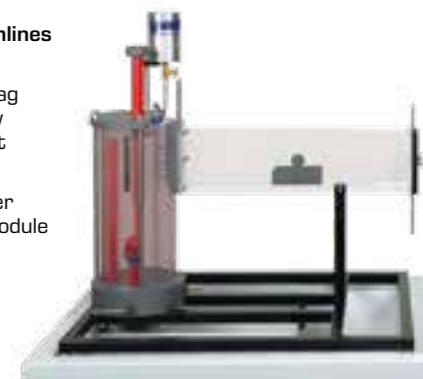


HM 150.21

Visualisation of streamlines in an open channel

Flow around various drag bodies and incident flow of weirs; ink as contrast medium

Recommended for water supply: HM 150 Base module for experiments in fluid mechanics



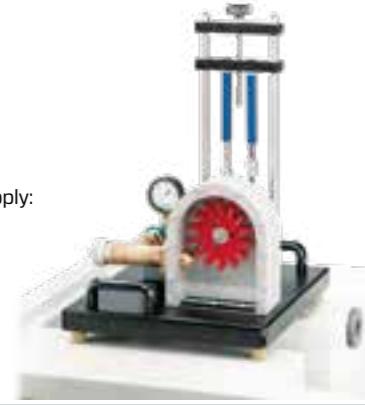
Fundamentals of fluid mechanics Turbomachines

HM 150.19

Operating principle of a Pelton turbine

Model of an impulse turbine with adjustable nozzle; determination of efficiency

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.20

Operating principle of a Francis turbine

Model of a reaction turbine with adjustable guide vanes and determination of the efficiency

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 164

Open channel and closed channel flow

Flow processes on different structures in open and closed channel flows; losses at inlet and outlet



HM 150.04 Centrifugal pump

Determining the characteristics of a typical centrifugal pump

HM 150 Base module required for experiments in fluid mechanics



HM 150.16

Series and parallel configuration of pumps

Characteristic curves and hydraulic power; comparison of operating modes

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 160

Experimental flume 86x300 mm

Experimental section lengths of 2,5 m or 5 m available, closed water circuit and inclination adjustment



Fundamentals of fluid mechanics

Compact + digital: HM 250 Fundamentals of fluid mechanics

HM 250 Fundamentals of fluid mechanics

Base module for experiments in fluid mechanics, system control via PLC



Patented

HM 250.01 Visualisation of pipe flow

Visualisation of laminar and turbulent flow



HM 250.02 Measurement of flow profile

Measurement of laminar and turbulent flow



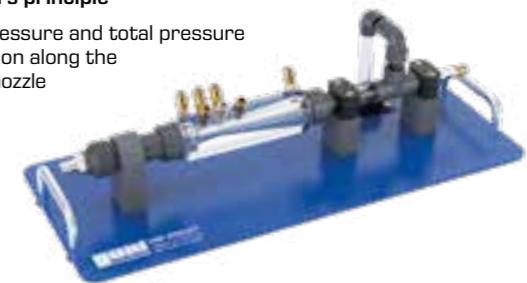
HM 250.06 Free discharge

Recording the trajectory of the water jet and discharge coefficients at different outlet velocities



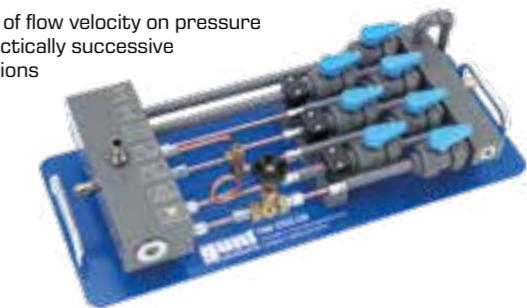
HM 250.07 Bernoulli's principle

Static pressure and total pressure distribution along the Venturi nozzle



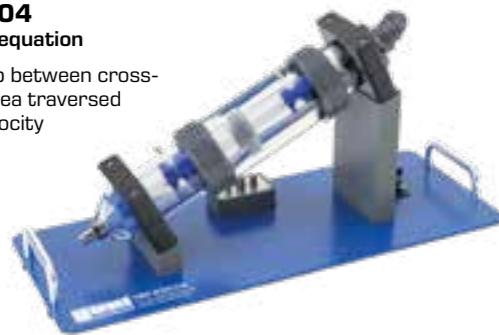
HM 250.08 Losses in pipe elements

Influence of flow velocity on pressure loss, didactically successive pipe sections



HM 250.04 Continuity equation

Relationship between cross-sectional area traversed and flow velocity



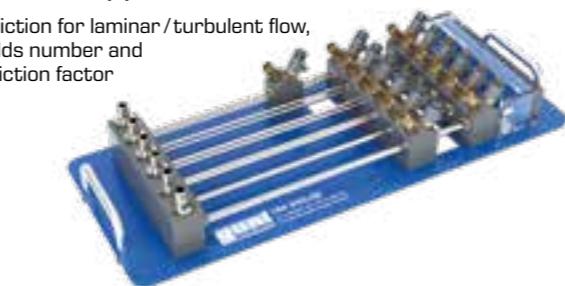
HM 250.03 Visualisation of streamlines

Investigation of cross-sectional changes in laminar, two-dimensional flow; visualisation using electrolytically generated hydrogen bubbles



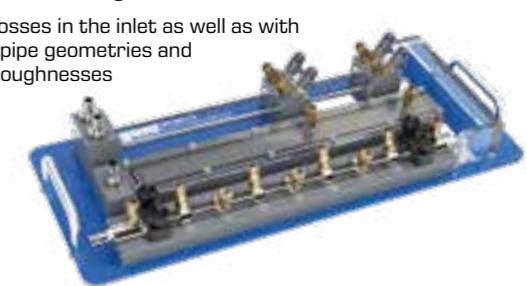
HM 250.09 Fundamentals of pipe friction

Pipe friction for laminar/turbulent flow, Reynolds number and pipe friction factor



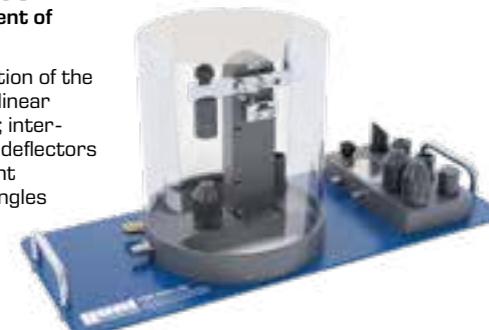
HM 250.10 Pressure curve along the inlet section

Friction losses in the inlet as well as with different pipe geometries and surface roughnesses



HM 250.05 Measurement of jet forces

Demonstration of the principle of linear momentum; interchangeable deflectors with different deflection angles



HM 250.11 Open channel

Flow around various drag bodies and incident flow of weirs



HM 250.90 Laboratory shelf

Shelf with extendable shelves, for stowing accessories for HM 250



Steady flow
Fundamentals of steady flow
HM 240
Principles of air flow

Recording the fan characteristic


HM 240.04
Pressure distribution on a cylinder

Cylinder in transverse incident flow; record pressure distribution in the wake of the cylinder in conjunction with HM 240.03


HM 240.05
Pressure losses in pipe elements

Measurement of pressure losses in straight pipe sections, in a 90° pipe bend, and in a 90° pipe angle


HM 241
Fundamentals of water flow

Experiments on water flow in open flumes and in pipes. Transparent design allows observation of the flow processes.


HM 240.03
Electronic total pressure sensor

Measurement of the velocity distribution in the intake tube on HM 240


HM 240.06
Heat transfer at a cylinder in transverse flow

Investigation of heat transfer from a heated rod to an air flow


HM 220
Air flow experimental plant

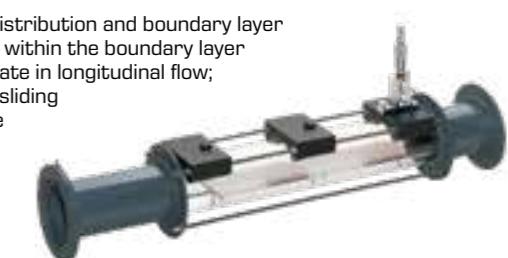
Determining pressure loss and velocity profiles; different measuring objects


HM 220.01
Venturi tube

Examination of the continuity equation and Bernoulli's principle; representation of the pressure curve


HM 220.02
Measurement of boundary layers

Velocity distribution and boundary layer thickness within the boundary layer of a flat plate in longitudinal flow; vertically sliding Pitot tube


HM 225
Aerodynamics trainer

For experiments from the fields of flow around bodies and steady incompressible flow


HM 225.03
Bernoulli's principle

Demonstration of the continuity equation and Bernoulli's equation


HM 225.05
Flow in a pipe bend

Determination of the static pressure at 29 pressure measuring points


HM 225.07
Free jet

Investigation of flow from nozzles



Steady flow Steady flow of compressible fluids

HM 230
Flow of compressible fluids

Subsonic and sonic flow through different measuring objects



HM 172
Supersonic wind tunnel with Schlieren optics

Schlieren optics for visualisation of Mach lines and shock waves on drag bodies; interchangeable walls in the measuring section produce velocities up to Mach 1,8



HM 260
Characteristics of nozzles

Measuring the impact or thrust force for determining the discharge velocity and the nozzle efficiency



HM 261
Nozzle pressure distribution

Measuring the pressure curves in a convergent nozzle and in Laval nozzles



Steady flow Flow in pipe systems

HL 102
Installation technology: losses in different pipes

Investigation of the pressure difference in four equal-length pipe sections made of different materials



HL 103
Installation technology: losses in pipe bends

Investigation of the pressure loss at pipe elements with different changes in pipe direction and materials



HL 113
Installation technology: losses in valves and fittings

Investigation of the pressure loss of standard valves and fittings



HL 210
Installation technology: losses in a pipe system

Investigation of pressure losses at contractions, pipe angles, pipe bends, valves and fittings and pipe elements



HL 111
Installation technology: losses in straight pipes

Determining the pressure loss in an open pipe section



HM 222
Air flow in pipes and pipe elements

Resistances and losses in laminar and turbulent pipe flow



HM 120
Losses in pipe elements

Investigation of flow and pressure losses in different pipe sections



HM 112
Fluid mechanics trainer

Interchangeable measuring objects and different pipe sections



Steady flow Flow in pipe systems

HM 111

Pipe networks

Pressure losses at various piping elements and pipe networks;
parallel and series connection of pipe sections



HM 124

Fluid mechanics experimental plant

Investigations on centrifugal pumps, control valves, piping and fittings.
Large scale industrial components and high-quality instrumentation deliver realistic measurement results.



HM 122

Pressure losses in pipes

Experimental determination of important coefficients related to pressure loss in various pipe systems



Steady flow Flow in valves

RT 390

Test stand for control valves

Design and function of control valves;
determination of the Kv value



RT 396

Pump and valves and fittings test stand

Recording characteristic curves of industrial fittings and a centrifugal pump



Steady flow Methods of flow rate measurement

HM 500

Flow meter trainer

Comparison and calibration of different flow meters



Different flow meters HM 500.01-HM 500.16 are available as accessories.

Steady flow **Cavitation**

HM 380

Cavitation in pumps

Visualisation of cavitation effects in a transparent pump; how speed, inlet pressure, flow rate and temperature affect cavitation



ST 250

Cavitation

Visualisation of the formation of vapour bubbles in a Venturi nozzle



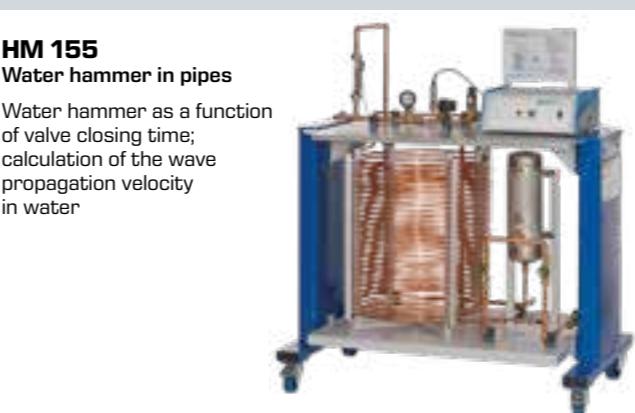
Examples of transient flow



HM 156

Water hammer and surge chamber

Investigation of formation, effect and function



HM 155

Water hammer in pipes

Water hammer as a function of valve closing time; calculation of the wave propagation velocity in water

HM 143

Transient drainage processes in storage reservoirs

Demonstration of the function of a rainwater retention basin and a storage lake



HM 150.15

Hydraulic ram – pumping using water hammer

Formation and effect of water hammer

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics





Flow around bodies

HM 170

Open wind tunnel

Experiments from the field of aerodynamics and fluid mechanics with an "Eiffel" type wind tunnel



HM 170.70

Wind power plant with rotor blade adjustment

Extension to wind tunnel HM 170



Drag bodies
HM 170.01 – HM 170.11

HM 170.22

Pressure distribution on an aerofoil NACA 0015

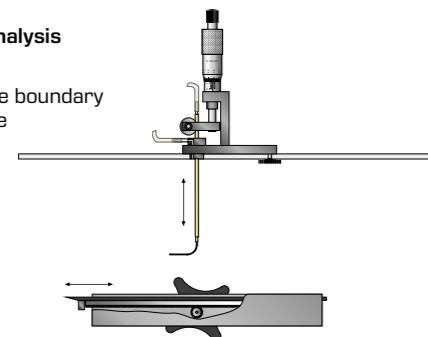
Experiments with different aerofoil angles of attack



HM 170.24

Boundary layer analysis with Pitot tube

Investigation of the boundary layer on a flat plate with flow along the plate; two different surfaces



HM 170.28

Wake measurement

Investigation of the pressure distribution behind a cylinder subject to surrounding flow



HM 225

Aerodynamics trainer

For experiments from the fields of flow around bodies and steady incompressible flow



HM 225.02

Boundary layers

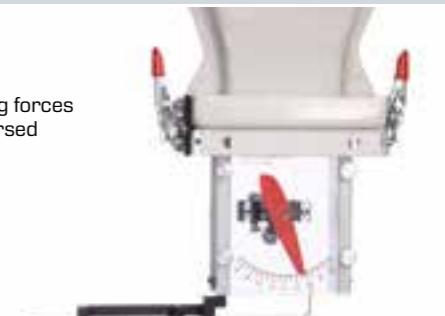
Investigation of boundary layers on a flat plate with flow along the plate



HM 225.04

Drag forces

Determining drag forces on models immersed in a flow



HM 225.06

Coanda effect

Investigation of wall-guided airflow and familiarisation with the principle of pneumatic logic elements



HM 225.08

Visualisation of streamlines

Flow patterns in real fluids at different models; visualisation using fog



HM 152

Potential flow

Visualisation of streamlines in a Hele-Shaw cell using ink as contrast medium



HM 153

Visualisation of different flows

Visualisation of flow around bodies and flow phenomena in open channels and pipes



Flow around bodies

HM 226

Wind tunnel for visualisation of streamlines

Illuminated test section, various models, fog generator included



HM 133

Visualisation of flow fields

Visualisation of laminar and turbulent flow processes in a water channel using electrolytically generated hydrogen bubbles



HM 136

Flow through packed columns

Comparison of different modes of operation; water and/or air, parallel flow or counterflow mode



CE 220

Fluidised bed formation

Investigation of fluidised bed formation of solids in air and water



HM 132

Vertical visualisation of flow fields

Visualisation using electrolytically generated hydrogen bubbles



Hydraulic fluid energy machines
Hydraulic turbines

HM 450C

Characteristic variables of hydraulic turbomachines

Determination of output and efficiency of turbines and pumps; demonstration of a pumped storage plant



HM 450.01

Pelton turbine

Model of an impulse turbine with speed and torque measurement



HM 450.02

Francis turbine

Model of a reaction turbine with speed and torque measurement; adjustable guide vanes



HM 450.03

Propeller type turbine

Six-bladed propeller type turbine with guide vane adjustment for varying power; measurement of speed and torque



HM 450.04

Kaplan turbine

Five-bladed Kaplan turbine with blade and guide vane adjustment for varying power; measurement of speed and torque



HM 287

Experiments with an axial turbine

Record characteristics of an axial reaction turbine



HM 405

Axial-flow turbomachines

Function of a turbomachine; configuration as pump or turbine with interchangeable rotor/impeller and stator/guide vane system



Hydraulic fluid energy machines Hydraulic turbines

HM 288
Experiments with a reaction turbine

Record characteristics of a turbine based on the reaction force



HM 289
Experiments with a Pelton turbine

Record characteristics of a free jet turbine



HM 291
Experiments with an action turbine

Record characteristics of an axial impulse turbine



HM 290
Base unit for turbines

Water supply for HM 288, HM 289 and HM 291



Hydraulic fluid energy machines Driven machines

HM 299
Comparison of positive displacement machines and turbomachines

Interchangeable driven machines: three pump types, two compressor types



Hydraulic fluid energy machines Centrifugal pumps

HM 283
Experiments with a centrifugal pump

Determination of characteristic pump variables



HM 284
Series and parallel configuration of pumps

Demonstration of series, parallel and the individual operation of centrifugal pumps



HM 332
Pump characteristics for parallel and series configuration

Investigation of the behaviour of two identical centrifugal pumps in operation, system control via PLC



HM 300
Hydraulic circuit with centrifugal pump

Measurement of pressure conditions in valves and fittings and a pump



Hydraulic fluid energy machines Positive displacement pumps

HM 285
Experiments with a piston pump

Record characteristics of a reciprocating positive displacement pump



HM 286
Experiments with a gear pump

Record characteristics of a rotary positive displacement pump



Components in piping systems and plant design
Cutaway models

HM 700.01
Cutaway model:
standard orifice plate



HM 700.02
Cutaway model:
flow nozzle



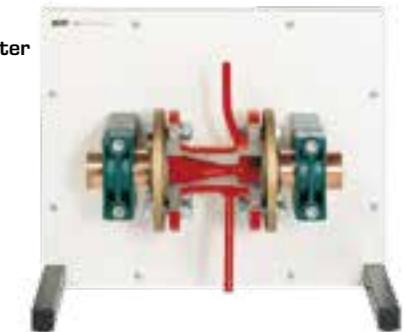
HM 700.09
Cutaway model:
strainer



HM 700.10
Cutaway model:
gate valve



HM 700.03
Cutaway model:
standard Venturi meter



HM 700.04
Cutaway model:
straight-way valve



HM 700.11
Cutaway model:
straight-way plug valve



HM 700.12
Cutaway model:
three-way plug valve



HM 700.05
Cutaway model:
corner valve



HM 700.06
Cutaway model:
angle seat valve



HM 700.13
Cutaway model:
ball valve



HM 700.14
Cutaway model:
safety valve



HM 700.07
Cutaway model:
non-return valve



HM 700.08
Cutaway model:
pressure reducing valve



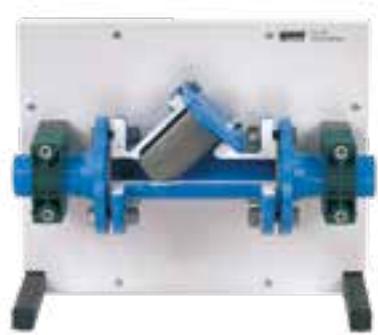
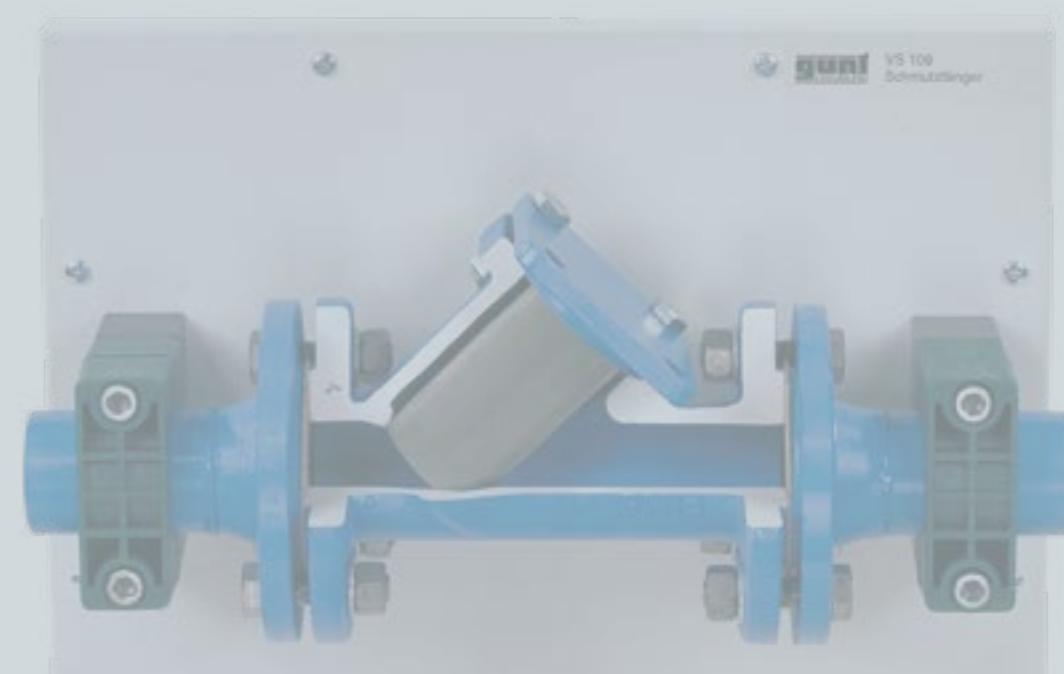
HM 700.15
Cutaway models:
various screwed pipe connections



HM 700.16
Cutaway models:
pressure gauges



Components in piping systems and plant design

Cutaway models**HM 700.17**
Cutaway model:
centrifugal pump**HM 700.20**
Cutaway model:
piston pump**VS 106**
Cutaway model:
backflow preventer**VS 107**
Cutaway model:
non-return butterfly
valve**HM 700.22**
Cutaway model:
gear pump**VS 101**
Cutaway model:
underground hydrant**VS 108**
Cutaway model:
water meter**VS 109**
Cutaway model:
strainer**VS 102**
Cutaway model:
resilient seated
gate valve**VS 103**
Cutaway model:
screw down valve**VS 104**
Cutaway model:
changeover valve**VS 105**
Cutaway model:
gas meter

Components in piping systems and plant design
Assembly exercises: valves and fittings

MT 154
Assembly exercise:
shut-off valve

Planning, assembly,
 disassembly; function and
 design of a shut-off valve



MT 156
Assembly exercise:
wedge gate valve and
angle seat valve

Assembly, disassembly
 and maintenance of
 industrial fittings



MT 157
Assembly exercise:
butterfly valve and
non-return valve

Assembly, disassembly
 and maintenance of
 industrial fittings



MT 158
Assembly exercise:
ball valve and
shut-off valve

Assembly, disassembly
 and maintenance of
 industrial fittings



MT 101
Assembly exercise:
pneumatically driven control valve

Design and function of a pneumatically driven control valve;
 planning,
 assembly and
 disassembly

Multimedia
 instructional
 materials
 via Internet



MT 162
Hydraulic valves and fittings test stand

Pressure test for GUNT assembly kits
 MT 154, MT 156, MT 157 and MT 158



MT 102
Assembly exercise:
electrically driven control valve

Design and function of an electrically driven control valve;
 planning,
 assembly and
 disassembly

Multimedia
 instructional
 materials
 via Internet



Components in piping systems and plant design
Assembly & maintenance exercises: pumps

MT 180
Assembly & mainte-
nance exercise:
centrifugal pump

Understanding design
 and function of the pump;
 planning and executing
 assembly, disassembly
 and maintenance



MT 181
Assembly & mainte-
nance exercise:
multistage
centrifugal pump

Understanding
 design and function
 of the pump;
 planning and executing
 assembly, disassembly
 and maintenance



MT 182
Assembly & mainte-
nance exercise:
screw pump

Understanding
 design and function
 of the pump;
 planning and executing
 assembly, disassembly
 and maintenance



MT 183
Assembly & mainte-
nance exercise:
diaphragm pump

Understanding
 design and function
 of the pump;
 planning and executing
 assembly, disassembly
 and maintenance



MT 184
Assembly & mainte-
nance exercise:
piston pump

Understanding
 design and function
 of the pump;
 planning and executing
 assembly, disassembly
 and maintenance



MT 185
Assembly & mainte-
nance exercise:
in-line centrifugal pump

Understanding
 design and function
 of the pump;
 planning and executing
 assembly, disassembly
 and maintenance



MT 186
Assembly & mainte-
nance exercise:
gear pump

Understanding
 design and function
 of the pump;
 planning and executing
 assembly, disassembly
 and maintenance



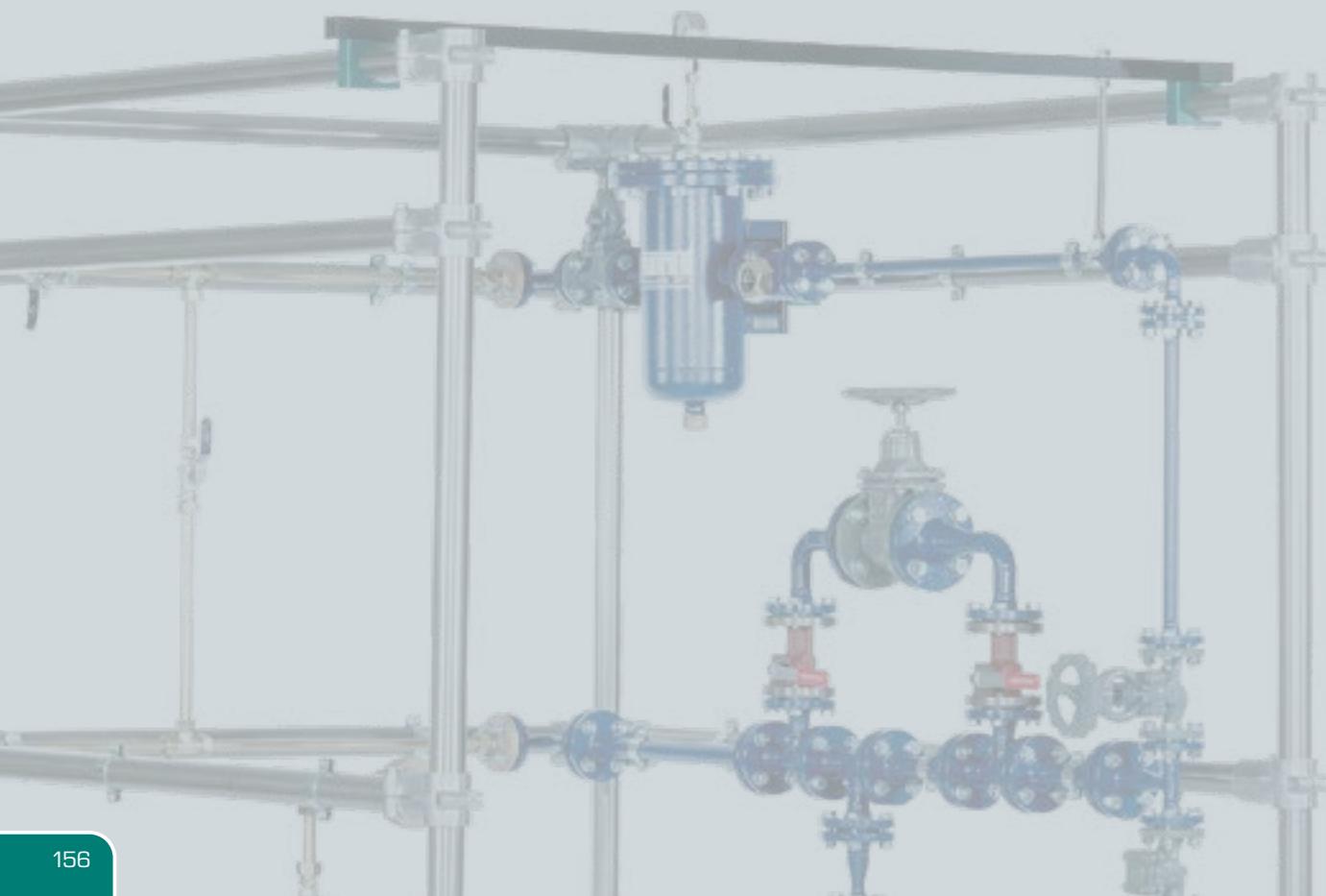
Components in piping systems and plant design
Design of complex piping and plant systems

HL 960**Assembly station pipes and valves and fittings**

Assembly of real piping and plant installations; together with HL 960.01: operational testing on a pipe network

**HL 960.01****Assembly and alignment of pumps and drives**

Installation and removal of pumps in plants;
 water supply for HL 960

**Fluidic experimental plants****HM 124****Fluid mechanics experimental plant**

Investigations on centrifugal pumps,
 control valves, piping and fittings.
 Large scale industrial components and
 high-quality instrumentation deliver
 realistic measurement results.

red = pipe section
 green = control panel
 orange = pump
 blue = supply tank*

*if there is enough space, a second tank
 can be installed on a lower level below the
 experimental system.

HM 362**Comparison of pumps**

Investigate operating behaviour of centrifugal pumps, piston pump
 and side
 channel pump,
 system
 control via PLC

**HM 405****Axial-flow turbomachines**

Function of a turbomachine; configuration as pump or turbine
 with interchangeable rotor/impeller and stator/guide
 vane system





Fluidic experimental plants

HL 962
Assembly stand for pumps

Base unit when constructing a complex piping system



HL 962.01
Standard chemicals pump

Typical pump as used in process engineering



HL 962.02
Canned motor pump

Hermetic centrifugal pump, particularly suitable for pumping liquid gases



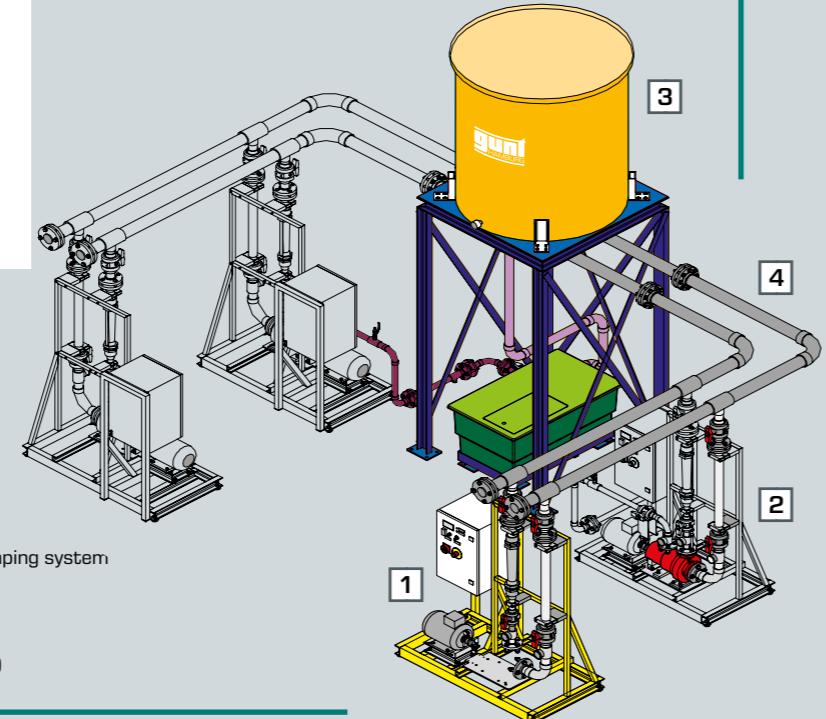
HL 962.03
Side channel pump

Self-priming three-stage pump



HL 962.04
Standard chemicals pump with magnetic clutch

Hermetic centrifugal pump according to ISO 5199



Possible combination of individual components into a functional pumping system

- 1 assembly stand for pumps (HL 962)
- 2 pumps, various types (HL 962.01 – HL 962.04)
- 3 tank installation (HL 962.30)
- 4 piping system to interconnect the plant components (HL 962.32)

HM 215
Two-stage axial fan

Determining the characteristics of a two stage axial fan



HL 710
Air duct systems

Planning and setup of simple and complex air duct systems



ST 510
Full-scale sewerage system

Demonstration of key aspects of wastewater technology. Transparent piping system allows view of the inside to observe the flow conditions.



Hands-on teaching engineering – with GUNT's SMART features



About the product:



4a | Fluid machinery

Fundamentals

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4

Fluid machinery



**Fundamentals
Fluid mechanics**
HM 115**Hydrostatics trainer**

Experiments on buoyancy, density, capillarity etc.; various methods of pressure measurement

**HM 112****Fluid mechanics trainer**

Interchangeable measuring objects and different pipe sections

**HM 230****Flow of compressible fluids**

Subsonic and sonic flow through different measuring objects

**HM 122****Pressure losses in pipes**

Experimental determination of important coefficients related to pressure loss in various pipe systems

**HM 380****Cavitation in pumps**

Visualisation of cavitation effects in a transparent pump; how speed, inlet pressure, flow rate and temperature affect cavitation

**ST 250****Cavitation**

Visualisation of the formation of vapour bubbles in a Venturi nozzle

**HM 150.09****Horizontal flow from a tank**

Recording the trajectory of the water jet at different outlet velocities

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics

**HM 250****Fundamentals of fluid mechanics**

Base module for experiments in fluid mechanics, system control via PLC



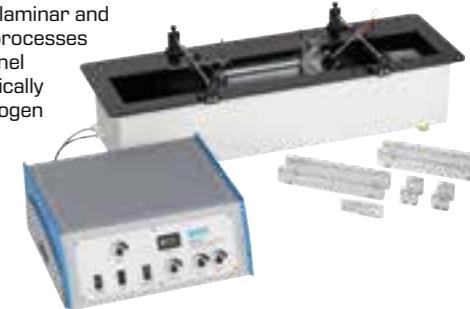
Extensive selection of accessories enables a complete course in the fundamentals of fluid mechanics

**HM 152****Potential flow**

Visualisation of streamlines in a Hele-Shaw cell using ink as contrast medium

**HM 133****Visualisation of flow fields**

Visualisation of laminar and turbulent flow processes in a water channel using electrolytically generated hydrogen bubbles

**HM 260****Characteristics of nozzles**

Measuring the impact or thrust force for determining the discharge velocity and the nozzle efficiency

**HM 261****Nozzle pressure distribution**

Measuring the pressure curves in a convergent nozzle and in Laval nozzles

**HM 226****Wind tunnel for visualisation of streamlines**

Illuminated test section, various models, fog generator included

**HM 241****Fundamentals of water flow**

Experiments on water flow in open flumes and in pipes. Transparent design allows observation of the flow processes.



Fundamentals Thermodynamics

WL 102
Change of state
of gases

Isothermal and
isochoric change of
state of air



ET 351C
Thermodynamics of the
refrigeration circuit

Compression refrigeration
system for thermodynamic
investigations, measurement
of the mechanical compressor
output



WL 204
Vapour pressure of water –
Marcel boiler

Pressure and temperature
measurement in a steam boiler



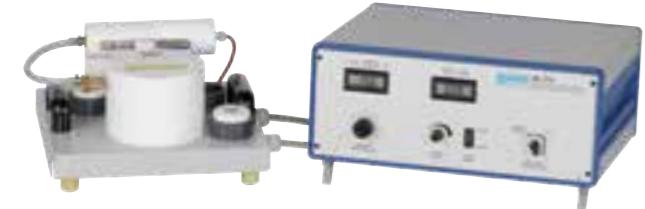
WL 440
Free and forced convection

Calculation of convective
heat transfer at different
geometries: flat plate,
cylinder, tube bundle



WL 372
Radial and linear heat conduction

Study of heat conduction in solids



WL 210
Evaporation process

Different forms of evaporation
in an externally heated pipe



WL 220
Boiling process

Visualisation of
different forms
of evaporation
in a transparent
pressure vessel



WL 230
Condensation
process

Measurement of
heat transfer in
dropwise and film
condensation



WL 110
Heat exchanger supply unit

Measuring
the transfer
characteristics
of five different
heat exchanger
models, system
control via PLC



WL 110.02
Plate heat exchanger

Typical plate heat exchanger in parallel flow and
counterflow operation



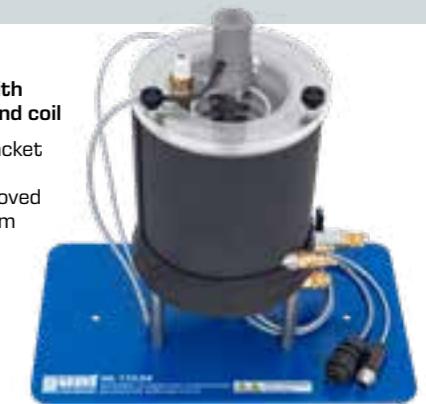
WL 110.01
Tubular heat exchanger

Transparent heat exchanger with additional temperature
measuring point after half of the transfer section;
parallel flow and
counterflow
operation



WL 110.04
Stirred tank with
double jacket and coil

Heating using jacket
or coiled tube;
stirrer for improved
mixing of medium



WL 110.03
Shell & tube heat exchanger

Transparent shell and tube heat exchanger in cross parallel
flow and cross counterflow operation



WL 110.05
Finned tube heat exchanger Heat transfer between water
and air; cross-flow operation



WL 320
Wet cooling tower

Principle of operation and
characteristic variables of
a wet cooling tower with
forced ventilation



WL 320.01 - WL 320.04
Cooling columns

Cooling columns with
different wetting areas



Fundamentals Dynamics of machinery

RT 050
Training system speed control, HSI

Fundamentals of control engineering using the example of a speed control system with first order lag

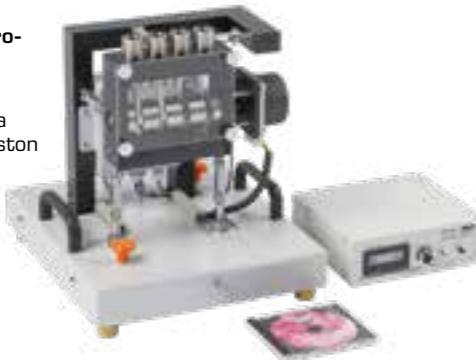


TM 632
Centrifugal governor

Characteristic curves of different centrifugal force governors



TM 180
Forces in reciprocating engines
Investigation of mass forces on a reciprocating piston machine



TM 620
Bending elasticity in rotors
Investigation of bending vibrations and resonance of a rotating shaft



Driving machines Gas turbines

HM 270
Impulse turbine

Investigation of a compressed air driven axial impulse turbine



HM 272
Reaction turbine

Investigation of a compressed air driven radial reaction turbine



ET 794

Gas turbine with power turbine

Two-shaft arrangement with high-pressure turbine and power turbine using liquid gas



ET 792
Gas turbine

Operation with power turbine or as jet engine with propelling nozzle using liquid gas



Driving machines Air turbines

ET 220
Energy conversion
in a wind
power plant

Conversion of
kinetic wind
energy into
electrical energy



ET 220.01
Wind power plant

Connection to ET 220
or ET 220.10;
outdoor installation
allows practically relevant
investigations



ET 220.10
Control unit for wind power plant ET 220.01

Use of wind energy
in stand-alone
operation under
real weather
conditions



ET 270
Wave energy converter

Turbine unit with
Wells turbine
and electric
generator; configura-
ble wave generator



ET 224
Operating behaviour of wind turbines

Characteristic and control on a wind power drive train



ET 210
Fundamentals of
wind power plants

Wind power plant with
rotor blade adjustment and
yaw angle adjustment



ET 222
Wind power drive train

Experiments on conversion of rotational energy
into electrical energy



Driving machines Hydraulic turbines

HM 150.19
Operating principle
of a Pelton turbine

Model of an impulse turbine
with adjustable nozzle;
determination of efficiency

Recommended for water supply:
HM 150 Base module for
experiments in fluid
mechanics



HM 150.20
Operating principle
of a Francis turbine

Model of a reaction turbine with
adjustable guide vanes and deter-
mination of the efficiency

Recommended for water supply:
HM 150 Base module for
experiments in fluid
mechanics



HM 287
Experiments with an
axial turbine

Record character-
istics of an axial
reaction turbine



HM 405
Axial-flow turbomachines

Function of a
turbomachine;
configuration as
pump or turbine
with interchange-
able rotor/impeller
and stator/guide
vane system



Driving machines Hydraulic turbines

HM 450C

Characteristic variables of hydraulic turbomachines

Determination of output and efficiency of turbines and pumps; demonstration of a pumped storage plant



HM 450.01

Pelton turbine

Model of an impulse turbine with speed and torque measurement



HM 450.02

Francis turbine

Model of a reaction turbine with speed and torque measurement; adjustable guide vanes



HM 450.03

Propeller type turbine

Six-bladed propeller type turbine with guide vane adjustment for varying power, measurement of speed and torque



HM 450.04

Kaplan turbine

Five-bladed Kaplan turbine with blade and guide vane adjustment for varying power, measurement of speed and torque



HM 430C

Francis turbine trainer

Characteristics of a powerful Francis turbine with adjustable guide vanes



HM 421

Propeller type turbine trainer

Four-bladed propeller type turbine with guide vane adjustment for varying power



HM 288

Experiments with a reaction turbine

Record characteristics of a turbine based on the reaction force



HM 289

Experiments with a Pelton turbine

Record characteristics of a free jet turbine



HM 291

Experiments with an action turbine

Record characteristics of an axial impulse turbine



HM 290

Base unit for turbines

Water supply for HM 288, HM 289 and HM 291



HM 365.31

Pelton and Francis turbine

Comparison of impulse and reaction turbines



HM 365.32

Turbine supply unit

Water supply for HM 365.31



Trainer for turbines with Pelton turbine HM 365.31, supply unit HM 365.32 and brake unit HM 365

Driving machines Internal combustion engines



Modular test stand for single cylinder test engines CT 159, test engine CT 151 and brake unit HM 365

CT 150 Four-stroke petrol engine for CT 159

Air-cooled overhead valve four-stroke petrol engine



CT 151 Four-stroke diesel engine for CT 159

Air-cooled four-stroke diesel engine with direct injection



CT 153 Two-stroke petrol engine for CT 159

Air-cooled two-stroke petrol engine



CT 159 Modular test stand for single-cylinder engines, 3kW

Mounting the engine, supply with fuel and air; measurement of characteristic engine data



HM 365 Universal drive and brake unit

Core component for experiments on various driving and driven machines



Driven machines Centrifugal pumps

HM 150.04 Centrifugal pump

Determining the characteristics of a typical centrifugal pump

HM 150 Base module required for experiments in fluid mechanics



HM 150.16 Series and parallel configuration of pumps

Characteristic curves and hydraulic power; comparison of operating modes

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 450C

Characteristic variables of hydraulic turbomachines

Determination of output and efficiency of turbines and pumps; demonstration of a pumped storage plant



HM 283 Experiments with a centrifugal pump

Determination of characteristic pump variables



HM 284 Series and parallel configuration of pumps

Demonstration of series, parallel and the individual operation of centrifugal pumps



HM 300 Hydraulic circuit with centrifugal pump

Measurement of pressure conditions in valves and fittings and a pump



HM 305 Centrifugal pump trainer

Pressure, flow rate, speed, torque and pump power available as measurement values



Driven machines Centrifugal pumps

HM 365.11 Centrifugal pump, standard design



HM 365.12 Centrifugal pump, self-priming

Self-priming pumps are able to suck in and transport air and water



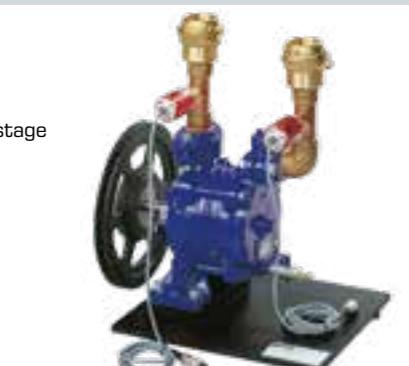
HM 365.13 Centrifugal pump, multistage

In centrifugal pumps with multiple stages several impellers are arranged in series



HM 365.15 Side channel pump

Investigation of a self-priming, single-stage side channel pump



HM 365.14 Centrifugal pumps, series and parallel connected

Investigation of the pump characteristic of series and parallel configurations of two centrifugal pumps



HM 365.10 Supply unit for water pumps

Water supply for HM 365.11 to HM 365.19



HM 332 Pump characteristics for parallel and series configuration

Investigation of the behaviour of two identical centrifugal pumps in operation, system control via PLC



HM 362 Comparison of pumps

Investigate operating behaviour of centrifugal pumps, piston pump and side channel pump, system control via PLC



Driven machines
Axial-flow pumps

HM 365
Universal drive and
brake unit

Core component for experiments on various driving and driven machines



HM 365.45
Axial-flow pump

Operating behaviour of an axial propeller pump



Trainer for an axial pump
with axial pump HM 365.45
and drive unit HM 365

HM 405
Axial-flow turbomachines

Function of a turbomachine;
configuration as pump or turbine with interchangeable
rotor/impeller and stator/guide vane system



Driven machines
Positive displacement pumps

HM 285
Experiments with a piston pump

Record characteristics of a reciprocating positive displacement pump



HM 286
Experiments with a gear pump

Record characteristics of a rotary positive displacement pump



Driven machines Positive displacement pumps



Trainer for positive displacement pumps with supply unit HM 365.10, piston pump HM 365.17 and drive unit HM 365

HM 365.16 Lobe pump

Lobe pumps are used for delivering highly viscous and highly abrasive media



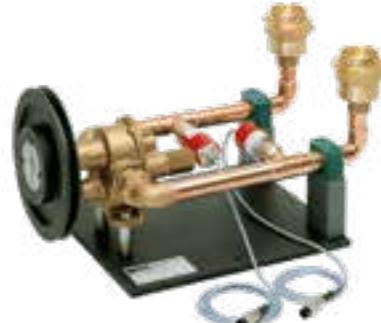
HM 365.17 Reciprocating piston pump

The most simple type of reciprocating piston pump consists of a piston that moves in a cylinder with one inlet and one outlet valve



HM 365.18 Gear pump

A gear pump is characterised by a steady flow rate



HM 365.19 Vane pump

Vane pumps can be used both for liquid and gaseous media



HM 365.10 Supply unit for water pumps

Water supply for HM 365.11 to HM 365.19



HM 365 Universal drive and brake unit

Core component for experiments on various driving and driven machines



HM 365.21 Screw pump

Screw pumps are able to provide continuous delivery of even viscous media without pulsation or turbulence



HM 365.22 External gear pump

The pumping medium is transported between the gears and the housing



HM 365.23 Vane pump

Vane pumps can be used both for liquid and gaseous media



HM 365.24 Internal gear pump

Operating behaviour of an internal gear pump



HM 365.20 Oil pump supply unit

Supply of oil pumps HM 365.21 to HM 365.24



HM 365 Universal drive and brake unit

Core component for experiments on various driving and driven machines



Driven machines Fans and compressors

HM 280 Experiments with a radial fan

Operating behaviour and characteristic variables of a radial fan; two interchangeable rotors



HM 210 Characteristic variables of a radial fan

Determination of flow rate via iris diaphragm or Venturi nozzle



HM 292 Experiments with a radial compressor

Two-stage compressor: recording of the compressor curve for both stages



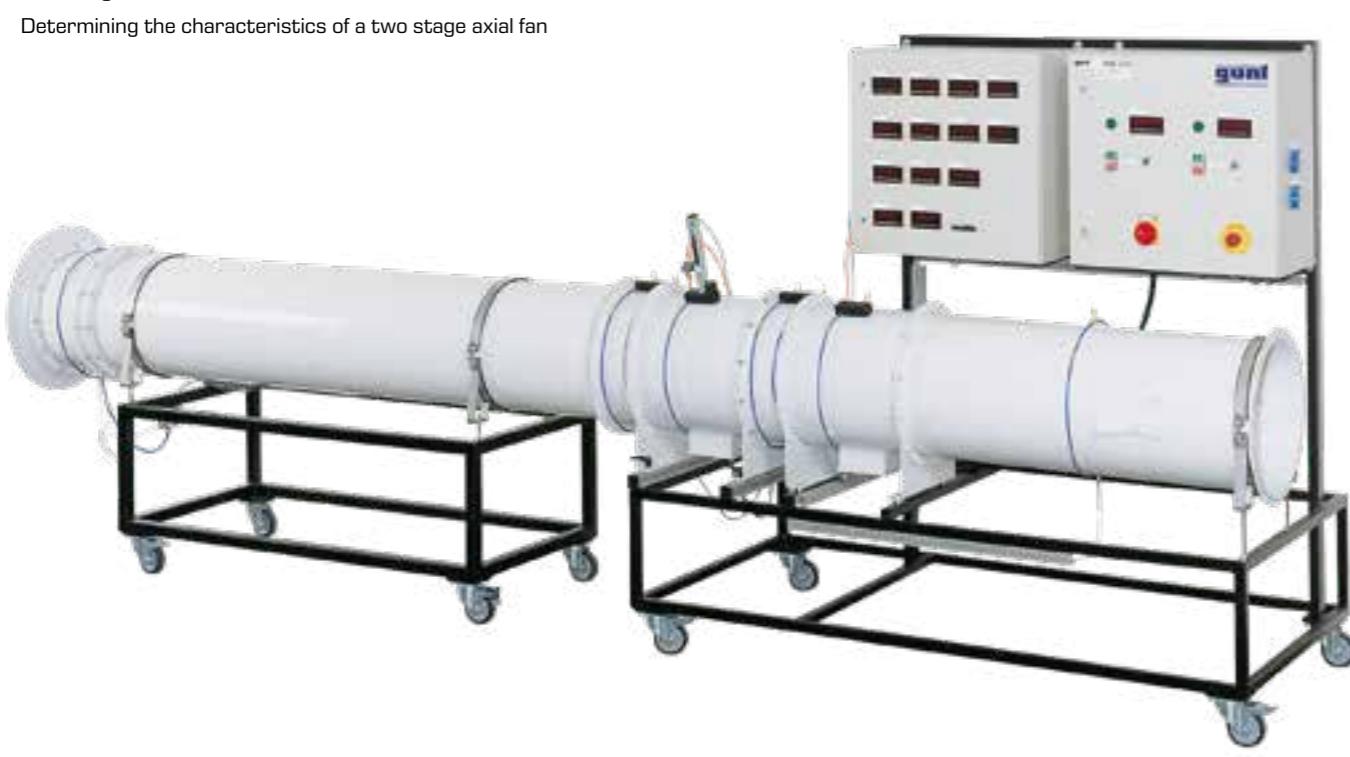
HM 282 Experiments with an axial fan

Operating behaviour and characteristic variables of an axial fan



HM 215 Two-stage axial fan

Determining the characteristics of a two stage axial fan



Single-stage compressor ET 513 with drive unit HM 365

ET 513 Single-stage piston compressor

Investigations on an air compressor including the determination of the mechanical power consumption



HM 365 Universal drive and brake unit

Core component for experiments on various driving and driven machines



HM 299 Comparison of positive displacement machines and turbomachines

Interchangeable driven machines: three pump types, two compressor types



ET 500 Two-stage piston compressor

Recording the characteristic of an industrial two-stage compressor, system control via PLC





Power plants and applied cyclic processes

ET 810

Steam power plant with steam engine

Single-cylinder piston steam engine with gas-fired boiler for steam generation



ET 850

Steam generator

Laboratory scale gas-fired steam generator for wet or superheated steam; integrated condenser



ET 851

Axial steam turbine

Single-stage steam turbine with power output measurement; steam supply via ET 850, gas-fired or ET 852, electrical



ET 852 Steam generator, electrical

Laboratory scale electrical steam generator for superheated steam; integrated condenser; alternative to the gas-fired steam generator ET 850 for the supply of the steam turbine ET 851



Experimental plant with two-cylinder steam engine ET 813, steam generator ET 813.01 and brake unit HM 365

ET 813

Two-cylinder steam engine

Single-acting steam engine with condensation for determining mechanical power and efficiency



HM 365

Universal drive and brake unit

Core component for experiments on various driving and driven machines



ET 830

Steam power plant, 1,5kW

Oil-fired boiler, single-stage small industry turbine, condenser and feed water treatment and monitoring via PLC



ET 830.01/02

Cooling tower

Wet cooling tower for steam power plant ET 830 for re-cooling the cooling water (115kW or 140kW)



ET 794

Gas turbine with power turbine

Two-shaft arrangement with high-pressure turbine and power turbine using liquid gas



ET 796

Gas turbine jet engine

Small single-shaft gas turbine with thrust measurement using either kerosene or petroleum



Power plants and applied cyclic processes



Compression refrigeration system ET165
with drive unit HM 365

ET 165
Refrigeration system
with open compressor

Capacity measurement
at the open compressor
with variable speed;
refrigeration chamber
with adjustable cooling
load



HM 365
Universal drive and
brake unit

Core component for
experiments on various
driving and driven machines



ET 352
Vapour jet compressor in refrigeration

Cold production using thermal energy. Transparent condenser
and evaporator allow the view into the inner workings.



ET 430
Refrigeration system with two-stage compression

Low temperature refrigeration system; compression with
injection intercooler and additional refrigerant supercooling



Training for laboratory and teaching staff

Just as important as reliable and modern equipment

We provide support that is perfectly tailored to your needs:

- general handling of the equipment
 - how the equipment and its components work
 - safety instructions for operating the equipment
 - aspects of commissioning, starting the equipment and its maintenance
 - introduction to the software (if available)
 - explanation of the various experiments and details about the operating manual
- Our experienced team is available at any time, anywhere.
- Get in touch!

**Equipment series
GUNT-Labline**
HM 288
Experiments with a reaction turbine

Record characteristics of a turbine based on the reaction force


HM 289
Experiments with a Pelton turbine

Record characteristics of a free jet turbine


HM 291
Experiments with an action turbine

Record characteristics of an axial impulse turbine


HM 290
Base unit for turbines

Water supply for HM 288, HM 289 and HM 291


HM 287
Experiments with an axial turbine

Record characteristics of an axial reaction turbine


HM 283
Experiments with a centrifugal pump

Determination of characteristic pump variables


HM 284
Series and parallel configuration of pumps

Demonstration of series, parallel and the individual operation of centrifugal pumps


HM 285
Experiments with a piston pump

Record characteristics of a reciprocating positive displacement pump


HM 280
Experiments with a radial fan

Operating behaviour and characteristic variables of a radial fan; two interchangeable rotors


HM 282
Experiments with an axial fan

Operating behaviour and characteristic variables of an axial fan


HM 286
Experiments with a gear pump

Record characteristics of a rotary positive-displacement pump


HM 292
Experiments with a radial compressor

Two-stage compressor: recording of the compressor curve for both stages



Equipment series **GUNT-FEMLine: water pumps**

HM 365.11
Centrifugal pump,
standard design



HM 365.12
Centrifugal pump,
self-priming

Self-priming pumps are able to suck in and transport air and water



HM 365.13
Centrifugal pump,
multistage

In centrifugal pumps with multiple stages several impellers are arranged in series



HM 365.15
Side channel pump

Investigation of a self-priming, single-stage side channel pump



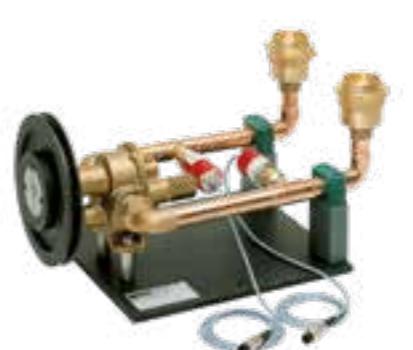
HM 365.14
Centrifugal pumps, series and parallel connected

Investigation of the pump characteristic of series and parallel configurations of two centrifugal pumps



HM 365.18
Gear pump

A gear pump is characterised by a steady flow rate



HM 365.10
Supply unit
for water pumps

Water supply for HM 365.11 to HM 365.19



HM 365.16
Lobe pump

Lobe pumps are used for delivering highly viscous and highly abrasive media



HM 365.17
Reciprocating piston pump

The most simple type of reciprocating piston pump consists of a piston that moves in a cylinder with one inlet and one outlet valve



HM 365.45
Axial-flow pump

Operating behaviour of an axial propeller pump



HM 365.19
Vane pump

Vane pumps can be used both for liquid and gaseous media



HM 365
Universal drive and
brake unit

Core component for experiments on various driving and driven machines



Equipment series **GUNT-FEMLine: oil pumps**



Trainer for positive displacement pumps with supply unit HM 365.20, screw pump HM 365.21 and drive unit HM 365

HM 365.21 Screw pump

Screw pumps are able to provide continuous delivery of even viscous media without pulsation or turbulence



HM 365.22 External gear pump

The pumping medium is transported between the gears and the housing



HM 365.23 Vane pump

Vane pumps can be used both for liquid and gaseous media



HM 365.24 Internal gear pump

Operating behaviour of an internal gear pump



HM 365.20 Oil pump supply unit

Supply of oil pumps HM 365.21 to HM 365.24



HM 365 Universal drive and brake unit

Core component for experiments on various driving and driven machines



Equipment series **GUNT-FEMLine: turbines**

HM 365.31 Pelton and Francis turbine

Comparison of impulse and reaction turbines



HM 365.32 Turbine supply unit

Water supply for HM 365.31



Trainer for turbines with Pelton turbine HM 365.31, supply unit HM 365.32 and brake unit HM 365

Equipment series **GUNT-FEMLine: engines**



Modular test stand for single cylinder test engines CT 159, test engine CT 151 and brake unit HM 365



CT 159
Modular test stand for single-cylinder engines, 3kW

Mounting the engine, supply with fuel and air; measurement of characteristic engine data



HM 365
Universal drive and brake unit

Core component for experiments on various driving and driven machines



CT 150
Four-stroke petrol engine for CT 159

Air-cooled overhead valve four-stroke petrol engine



CT 151
Four-stroke diesel engine for CT 159

Air-cooled four-stroke diesel engine with direct injection



CT 153
Two-stroke petrol engine for CT 159

Air-cooled two-stroke petrol engine

Equipment series **GUNT-FEMLine: plants**



Experimental plant with two-cylinder steam engine ET 813, steam generator ET 813.01 and brake unit HM 365



ET 813
Two-cylinder steam engine

Single-acting steam engine with condensation for determining mechanical power and efficiency



HM 365
Universal drive and brake unit

Core component for experiments on various driving and driven machines

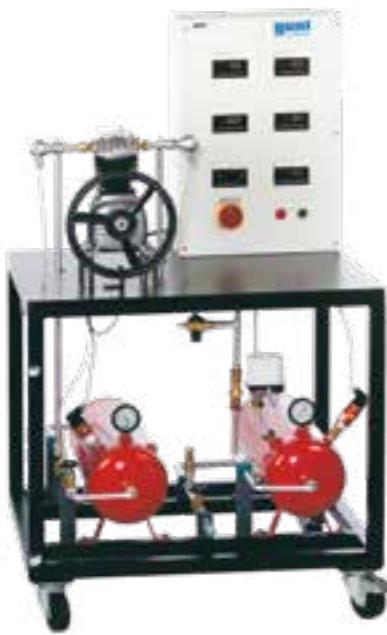
Equipment series
GUNT-FEMLine: plants



Single-stage compressor ET 513
with drive unit HM 365

ET 513
Single-stage piston compressor

Investigations on an air compressor including the determination of the mechanical power consumption



Compression refrigeration system ET 165
with drive unit HM 365

ET 165
Refrigeration system with open compressor

Capacity measurement at the open compressor with variable speed; refrigeration chamber with adjustable cooling load



First-rate handbooks



GUNT's policy is simple:
high quality hardware and clearly developed instructional material ensure successful teaching and learning about an experimental unit.

The core of this material are detailed reference experiments that we have carried out. The description of the experiment contains the actual experimental setup right through to the interpretation of the results and findings. A group of experienced engineers develops and maintains the instructional material.

Nevertheless, we are here to help should any questions remain unanswered, either by phone or – if necessary – on site.

Hands-on teaching engineering – with GUNT's SMART features



About the product:



4b | Hydraulics for civil engineering



Fundamentals of fluid mechanics

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Hydraulic engineering

Open-channel flow	206
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Seepage flow	209



4

Hydraulics for
civil engineering



Fundamentals of fluid mechanics Hydrostatics

HM 115

Hydrostatics trainer

Experiments on buoyancy, density, capillarity etc.; various methods of pressure measurement

**HM 150.06**

Stability of floating bodies

Determining metacentre and buoyancy using a rectangular hull cross-section

**HM 150.39**

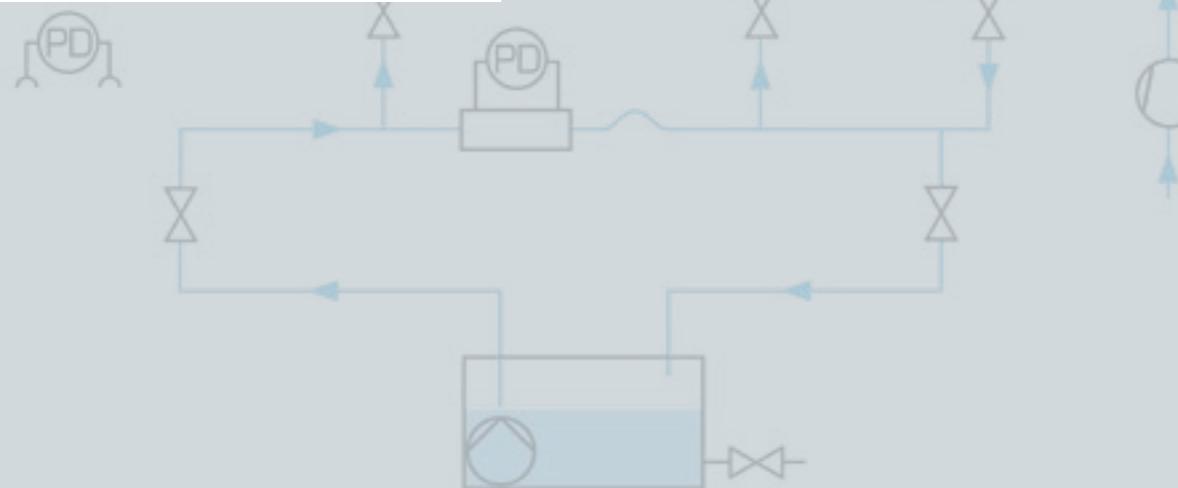
Floating bodies for HM 150.06

Comparison of two different frame shapes: hard chine and round bilge

**HM 150.02**

Calibration of pressure gauges

Operation of a Bourdon tube pressure gauge and a piston manometer



Fundamentals of fluid mechanics Discharge

HM 250.06

Free discharge

Recording the trajectory of the water jet and discharge coefficients at different outlet velocities

**HM 250**

Fundamentals of fluid mechanics

Base module for experiments in fluid mechanics, system control via PLC



Patented

HM 150.09

Horizontal flow from a tank

Recording the trajectory of the water jet at different outlet velocities

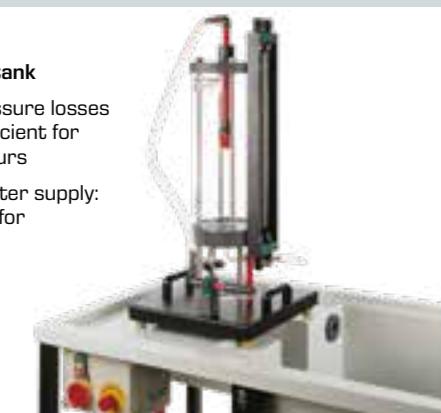
Recommended for water supply:
HM150 Base module for experiments in fluid mechanics

**HM 150.12**

Vertical flow from a tank

Determination of pressure losses and contraction coefficient for different outlet contours

Recommended for water supply:
HM150 Base module for experiments in fluid mechanics



Fundamentals of fluid mechanics Hydrodynamics

HM 150.18

Osborne Reynolds experiment

Visualisation of laminar and turbulent flow

Recommended for water supply:
HM 150 Base Module for
experiments in fluid mechanics



HM 150.07

Bernoulli's principle

Static pressure
and total pressure
distribution along the
Venturi nozzle

Recommended for
water supply:
HM 150 Base module
for experiments
in fluid mechanics



HM 150.08

Measurement of jet forces

Demonstration of the principle of linear
momentum and impact forces on in-
terchangeable deflectors with different
deflection angles

Recommended for water supply:
HM 150 Base module for
experiments in fluid
mechanics

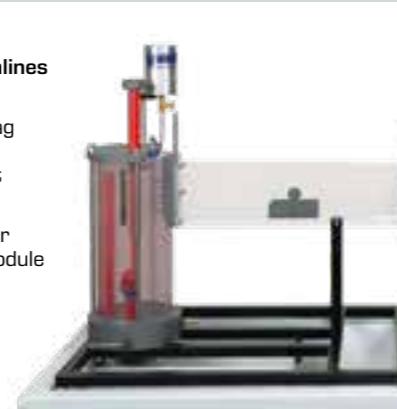


HM 150.21

Visualisation of streamlines in an open channel

Flow around various drag
bodies and incident flow
of weirs; ink as contrast
medium

Recommended for water
supply: HM 150 Base module
for experiments in
fluid mechanics



HM 150.10

Visualisation of streamlines

Investigation of flow around models
in laminar, two-dimensional flow
using ink as contrast
medium

Recommended for
water supply:
HM 150 Base module
for experiments in
fluid mechanics



HM 150

Base module for experiments in fluid mechanics

Volumetric flow
measurement
for large and small
flow rates



HM 250

Fundamentals of fluid mechanics

Base module for experiments in fluid mechanics,
system control via PLC



HM 250.04

Continuity equation

Relationship between cross-
sectional area traversed
and flow velocity



HM 250.03

Visualisation of streamlines

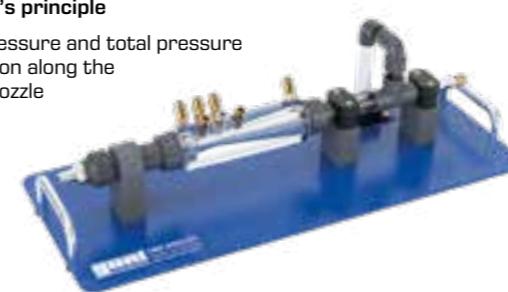
Investigation of cross-sectional changes in laminar,
two-dimensional flow; visualisation using electrolytically
generated hydrogen bubbles



HM 250.07

Bernoulli's principle

Static pressure and total pressure
distribution along the
Venturi nozzle



HM 250.05

Measurement of jet forces

Demonstration of the principle of linear momentum;
interchangeable deflectors with different deflection angles



Fundamentals of fluid mechanics Pipe flow

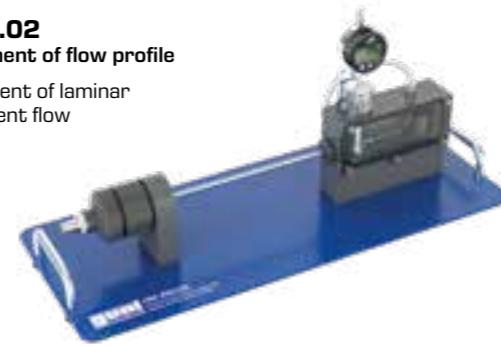
HM 250.01
Visualisation of pipe flow

Visualisation of laminar and turbulent flow



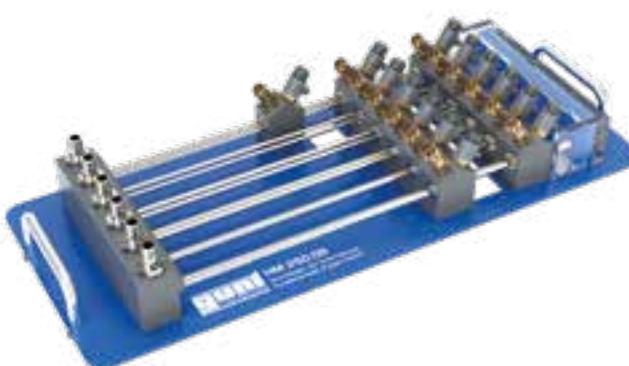
HM 250.02
Measurement of flow profile

Measurement of laminar and turbulent flow



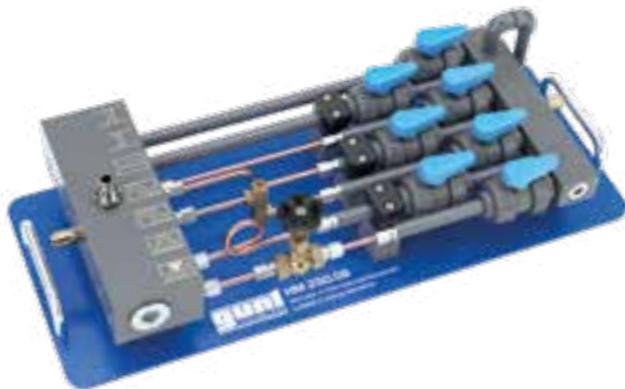
HM 250.09
Fundamentals of pipe friction

Pipe friction for laminar/turbulent flow, Reynolds number and pipe friction factor



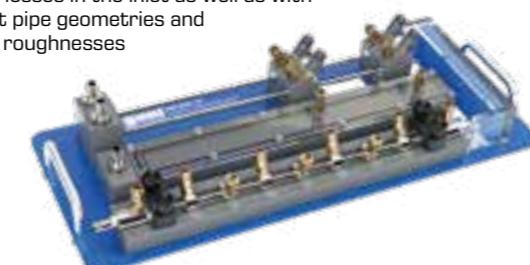
HM 250.08
Losses in pipe elements

Influence of flow velocity on pressure loss, didactically successive pipe sections



HM 250.10
Pressure curve along the inlet section

Friction losses in the inlet as well as with different pipe geometries and surface roughnesses



HM 150.01
Pipe friction for laminar/turbulent flow

Determining the critical Reynolds number

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.11
Losses in a pipe system

Influence of flow velocity on pressure loss

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 164
Open channel and closed channel flow

Flow processes on different structures in open and closed channel flows; losses at inlet and outlet



HM 111
Pipe networks

Pressure losses at various piping elements and pipe networks; parallel and series connection of pipe sections



Fundamentals of fluid mechanics Transient flow

HM 156
Water hammer and surge chamber

Investigation of formation, effect and function



HM 143
Transient drainage processes in storage reservoirs

Demonstration of the function of a rainwater retention basin and a storage lake



Fundamentals of fluid mechanics Turbomachines

HM 150.19

Operating principle
of a Pelton turbine

Model of an impulse turbine
with adjustable nozzle;
determination of efficiency

Recommended for water supply:
HM 150 Base module for
experiments in fluid
mechanics



HM 150.20

Operating principle
of a Francis turbine

Model of a reaction turbine with
adjustable guide vanes and deter-
mination of the efficiency

Recommended for water supply:
HM 150 Base module for
experiments in fluid
mechanics



HM 150.04

Centrifugal pump

Determining the characteristics of a typical
centrifugal pump

HM 150 Base module
required for
experiments in
fluid mechanics



HM 150.16

Series and parallel configuration of pumps

Characteristic curves and hydraulic power; comparison of
operating modes

Recommended for
water supply:
HM 150 Base module
for experiments in
fluid mechanics



Installation and commissioning



Guaranteed trouble-free by professional GUNT staff

Have your new equipment commis-
sioned by trained expert personnel.
Our highly qualified staff will gladly
assist you.

Commissioning of the equipment
includes the following services:

- **setup of equipment in the laboratory**
- **connection to the laboratory's supply systems**
- **commissioning the equipment**
- **testing the equipment**




Hydraulic engineering
Open-channel flow
HM 160

Experimental flume 86x300 mm

Experimental section lengths of 2,5m or 5m available, closed water circuit and inclination adjustment

**HM 162 / 163**

Experimental flume

Experimental section for performing flow experiments in open flumes with lengths of 5m, 7,5m, 10m or 12,5m available, closed water circuit and inclination adjustment

Flow cross-section WxH:
309x450 mm (HM162) /
409x500 mm (HM 163)

**HM 161**

Experimental flume 600x800 mm

Experimental section for performing flow experiments in open flumes of 16m length, closed water circuit, inclination adjustment

**HM 250.11**
Open channel

Flow around various drag bodies and incident flow of weirs

**HM 250**

Fundamentals of fluid mechanics

Base module for experiments in fluid mechanics, system control via PLC

**HM 162.30**

Set of plate weirs, four types

Flow over different sharp-crested weirs, investigations on an aerated overshoot weir

**HM 162.32**

Ogee-crested weir with two weir outlets

2 ogee-crested weirs for the experimental flume, different weir outlets (chute only and chute with ski jump)

**HM 162.41**

Wave generator

Generation of surface waves via paddle swinging back and forth

**HM 162.46**

Set of piers, seven profiles

Simulation of bridge pillars in a river, lateral reduction of cross-section in the flume



Hydraulic engineering Sediment transport

HM 166
Fundamentals of sediment transport

Starting conditions for bed-load transport



HM 140
Open-channel sediment transport

Observation of bed formation; visualisation of flow with contrast medium



HM 142
Separation in sedimentation tanks

Solid/liquid separation in a sedimentation tank; visualisation of flow conditions



HM 144
Formation of river courses

Compact experimental flume for modelling small river courses; inclination of the experimental flume adjustable



HM 168
Sediment transport in river courses

Investigation of sediment migration with and without structures



Hydraulic engineering Seepage flow

HM 152
Potential flow

Visualisation of streamlines in a Hele-Shaw cell using ink as contrast medium



HM 167
Groundwater flow

Three-dimensional investigations; demonstration of lowering of groundwater; investigation of excavation pits



CE 116
Cake and depth filtration

Fundamentals of filtration: Darcy's equation



HM 165
Studies in hydrology

Investigation of precipitation-discharge relationships, storage capacity of soils, seepage flows and groundwater flows



HM 145
Advanced hydrological investigations

Seepage flows and groundwater flows in soils; sediment transport and obstacles in running waters



HM 141
Hydrographs after precipitation

Correlations between precipitation and seepage; various drainage methods



HM 169
Visualisation of seepage flows

Graphical determination of flow nets; investigation of water pressure on structures



Hands-on teaching engineering – with GUNT's SMART features



About the product:



5 | Process engineering



Fundamentals of process engineering

Theory:

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- heat and mass transfer 213
- fluid mechanics 215
- fundamentals of control engineering 217
- measuring methods 218

Practice:

- tanks and materials 219
- pumps and compressors 220
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- heat exchangers and steam generators 229
- applications of control engineering 229



Mechanical process engineering

Separation methods:

- classifying and sorting 231
- separation in a gravity field 233
- filtration 234
- separation in a centrifugal force field 235

Comminution

Mixing and agglomeration

Storage and flow of bulk solids

Fluidised beds and pneumatic transport



Chemical process engineering

Thermal activation

Catalytic and photochemical activation



Thermal process engineering

Drying and evaporation

240

Distillation / rectification

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Absorption and adsorption

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Crystallisation and membrane separation processes

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Biological process engineering

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Anaerobic processes

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Mechanical processes

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Combined processes

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Process engineering



Fundamentals of process engineering
Theory: thermodynamics

WL 204
Vapour pressure of water –
Marctet boiler
Pressure and temperature
measurement in a steam boiler



WL 102
Change of state
of gases
Isothermal and
isochoric change
of state of air



WL 210
Evaporation process
Different forms of evaporation
in an externally heated pipe



WL 220
Boiling process
Visualisation of
different forms
of evaporation
in a transparent
pressure vessel



WL 230
Condensation process
Measurement of
heat transfer in
dropwise and film
condensation



ET 805.50
Determination of the
vapour content
Determination of the vapour
content using a separating
calorimeter with cyclone
water separator or a
throttling calorimeter with
vapour depressurisation



ET 850
Steam generator
Laboratory scale gas-fired
steam generator for wet
or superheated steam;
integrated condenser



ET 350
Changes of state
in the refrigeration
circuit
Energetic analyses
of the refrigeration
cycle; transparent
components offer
insights into the
changes of state



Fundamentals of process engineering
Theory: heat and mass transfer

CE 110
Diffusion in liquids
and gases
Use of Fick's law



WL 440
Free and forced
convection
Calculation of convective
heat transfer at different
geometries: flat plate,
cylinder, tube bundle



WL 372
Radial and linear heat conduction
Study of heat conduction in solids



WL 422
Heat conduction in fluids
Determination of the
coefficient of thermal
conductivity for
gaseous and liquid
fluids



WL 377
Convection and
radiation
Heat transport
between heating
element and vessel
wall by convection
and radiation



WL 225
Heat transfer in the
fluidised bed
Heat transfer from
a heating element to
the fluidised bed



WL 320
Wet cooling tower
Principle of operation and
characteristic variables of
a wet cooling tower with
forced ventilation



WL 320.01 - WL 320.04
Cooling columns
Cooling columns with
different wetting areas



Fundamentals of process engineering Theory: heat and mass transfer

WL 110 Heat exchanger supply unit

Measuring the transfer characteristics of five different heat exchanger models, system control via PLC



WL 110.01 Tubular heat exchanger

Transparent heat exchanger with additional temperature measuring point after half of the transfer section; parallel flow and counterflow operation



WL 110.02 Plate heat exchanger

Typical plate heat exchanger in parallel flow and counterflow operation



WL 110.03 Shell & tube heat exchanger

Transparent shell and tube heat exchanger in cross parallel flow and cross counterflow operation



WL 110.04 Stirred tank with double jacket and coil

Heating using jacket or coiled tube; stirrer for improved mixing of medium



WL 110.05 Finned tube heat exchanger Heat transfer between water and air; cross-flow operation



Fundamentals of process engineering Theory: fluid mechanics

HM 115 Hydrostatics trainer

Experiments on buoyancy, density, capillarity etc.; various methods of pressure measurement



HM 135 Determination of the settling velocity

Vertically falling body in liquid using specimens of different sizes and different materials



HM 155 Water hammer in pipes

Water hammer as a function of valve closing time; calculation of the wave propagation velocity in water



HM 136 Flow through packed columns

Comparison of different modes of operation; water and/or air; parallel flow or counterflow mode



Fundamentals of process engineering Theory: fluid mechanics

HM 150.18 Osborne Reynolds experiment

Visualisation of laminar and turbulent flow

Recommended for water supply: HM 150 Base module for experiments in fluid mechanics



HM 150.07 Bernoulli's principle

Static pressure and total pressure distribution along the Venturi nozzle

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.01 Pipe friction for laminar/turbulent flow

Determining the critical Reynolds number

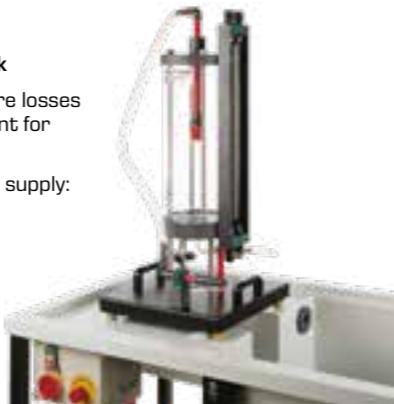
Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.12 Vertical flow from a tank

Determination of pressure losses and contraction coefficient for different outlet contours

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



HM 150.11 Losses in a pipe system

Influence of flow velocity on pressure loss

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics



Fundamentals of process engineering Theory: fundamentals of control engineering

RT 010 Training system level control, HSI

Fundamentals of control engineering using the example of a level control system with integral behaviour



RT 020 Training system flow control, HSI

Fundamentals of control engineering using the example of a rapid flow control system



RT 030 Training system pressure control, HSI

Fundamentals of control engineering using the example of a pressure control system with first order lag



RT 040 Training system temperature control, HSI

Fundamentals of control engineering using the example of a temperature control system with dead time



RT 800 PLC application: mixing process

Experiments using PLC to control discontinuous mixing processes



RT 050 Training system speed control, HSI

Fundamentals of control engineering using the example of a speed control system with first order lag

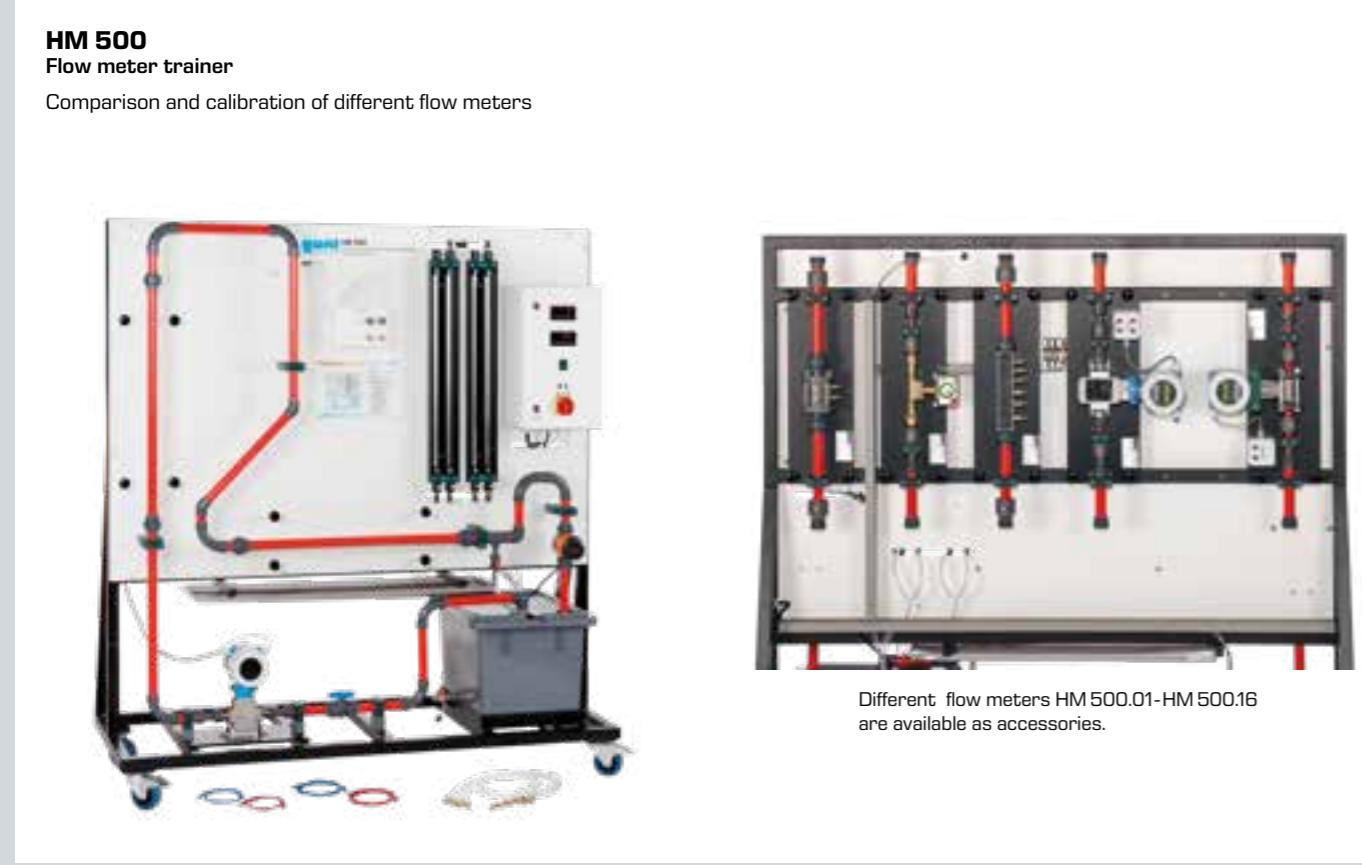
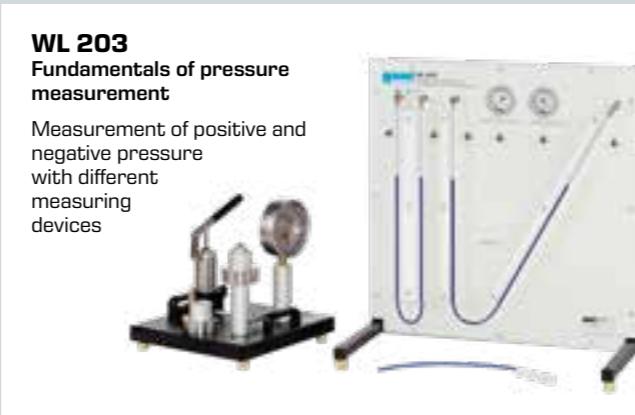
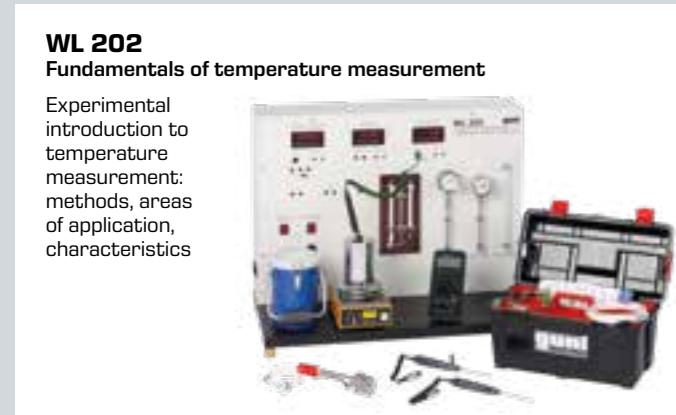


IA 130 PLC module

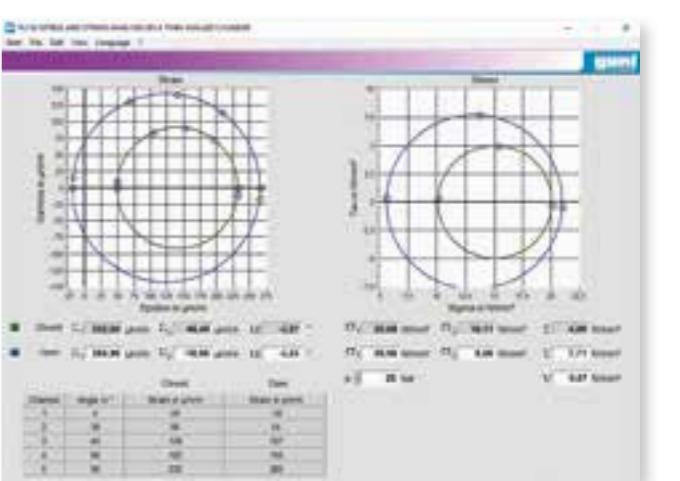
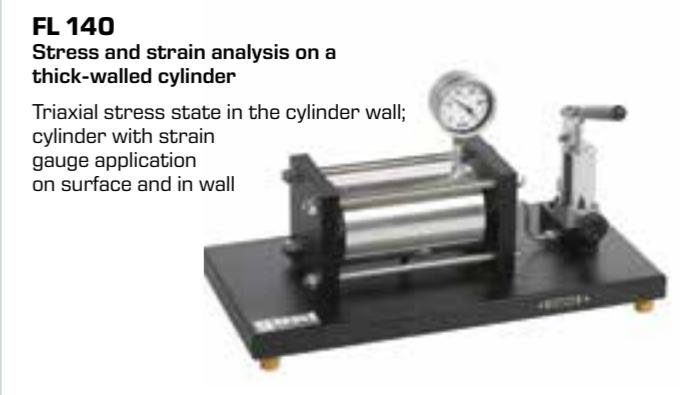
Self-contained PLC module for basic exercises; also suitable for IA 210 and RT 800



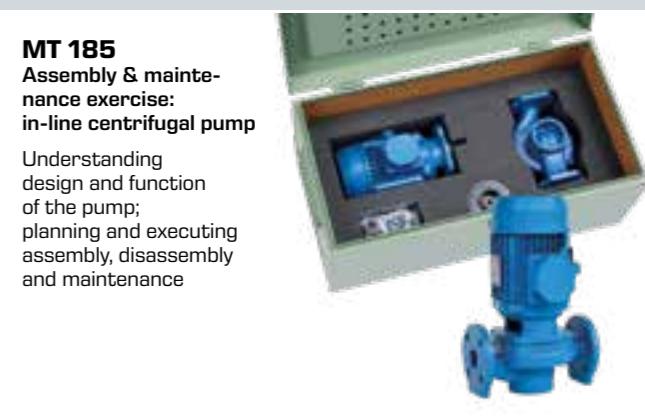
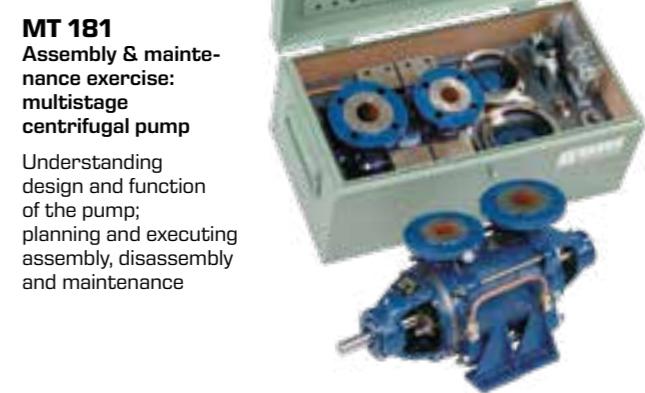
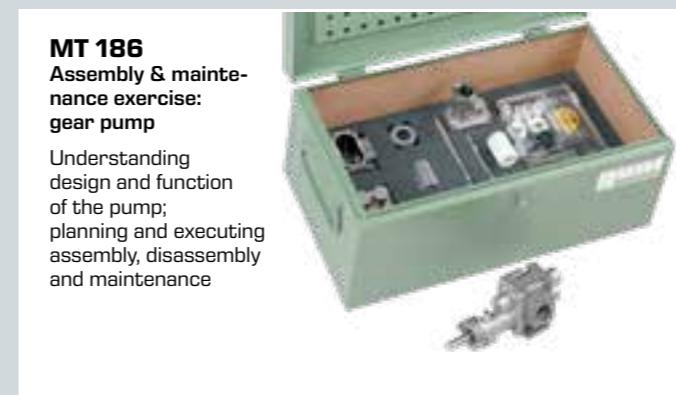
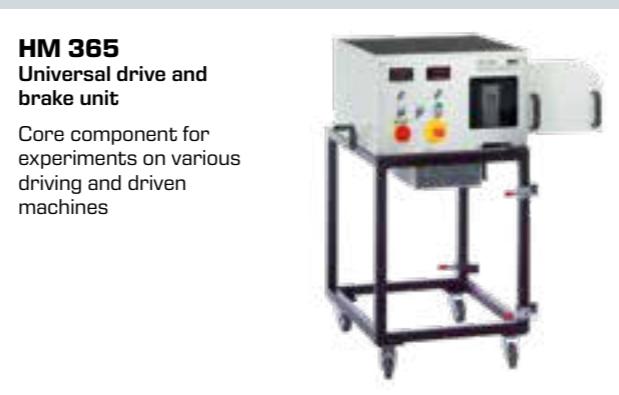
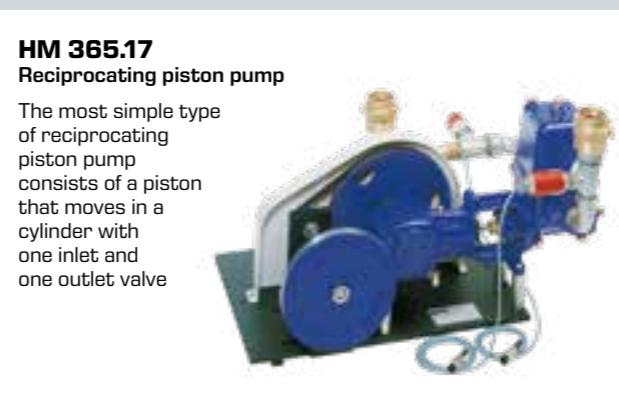
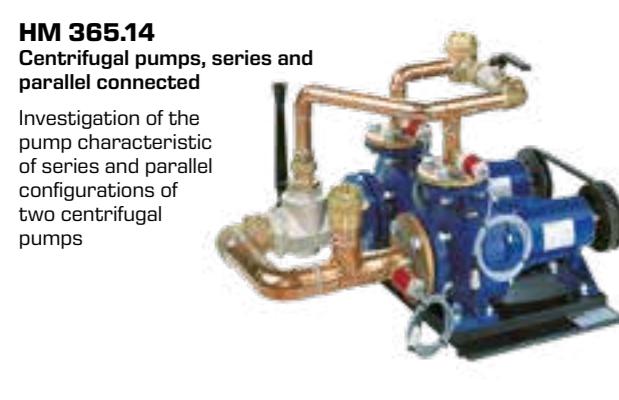
Fundamentals of process engineering Theory: measuring methods



Fundamentals of process engineering Practice: tanks and materials



Fundamentals of process engineering Practice: pumps and compressors



Fundamentals of process engineering

Practice: piping elements and valves and fittings

HM 700.09
Cutaway model:
strainer**HM 700.10**
Cutaway model:
gate valve**VS 102**
Cutaway model:
resilient seated
gate valve**VS 103**
Cutaway model:
screw down valve**HM 700.11**
Cutaway model:
straight-way plug valve**HM 700.12**
Cutaway model:
three-way plug valve**VS 104**
Cutaway model:
changeover valve**VS 106**
Cutaway model:
backflow preventer**HM 700.13**
Cutaway model:
ball valve**HM 700.14**
Cutaway model:
safety valve**VS 107**
Cutaway model:
non-return butterfly
valve**VS 109**
Cutaway model:
strainer**HM 700.15**
Cutaway models:
various screwed pipe
connections

Fundamentals of process engineering Practice: piping elements and valves and fittings

MT 156
Assembly exercise:
wedge gate valve and
angle seat valve
Assembly, disassembly
and maintenance of
industrial fittings



MT 157
Assembly exercise:
butterfly valve and
non-return valve
Assembly, disassembly
and maintenance of
industrial fittings



MT 158
Assembly exercise:
ball valve and
shut-off valve
Assembly, disassembly
and maintenance of
industrial fittings



MT 162
Hydraulic valves and fittings test stand
Pressure test for GUNT assembly kits
MT 154,
MT 156,
MT 157 and
MT 158



MT 101
Assembly exercise: pneumatically driven control valve

Design and function of a pneumatically driven control valve;
planning,
assembly and
disassembly

Multimedia
instructional
materials
via Internet



MT 102
Assembly exercise: electrically driven control valve

Design and function of an electrically driven control valve;
planning,
assembly and
disassembly

Multimedia
instructional
materials
via Internet



HL 960
Assembly station pipes and valves and fittings
Assembly of real piping and plant installations; together with
HL 960.01: operational testing on a pipe network



HL 960.01
Assembly and alignment of pumps and drives
Installation and removal of pumps in plants;
water supply for HL 960



RT 395
Maintenance of valves and fittings
and actuators
Maintenance and operational check:
four different fittings and actuators



RT 396
Pump and valves and fittings test stand
Recording characteristic curves of
industrial fittings and a centrifugal pump



Fundamentals of process engineering Practice: piping elements and valves and fittings

HL 962
Assembly stand for pumps

Base unit when constructing a complex piping system


HL 962.01
Standard chemicals pump

Typical pump as used in process engineering


HL 962.02
Canned motor pump

Hermetic centrifugal pump, particularly suitable for pumping liquid gases


HL 962.03
Side channel pump

Self-priming three-stage pump

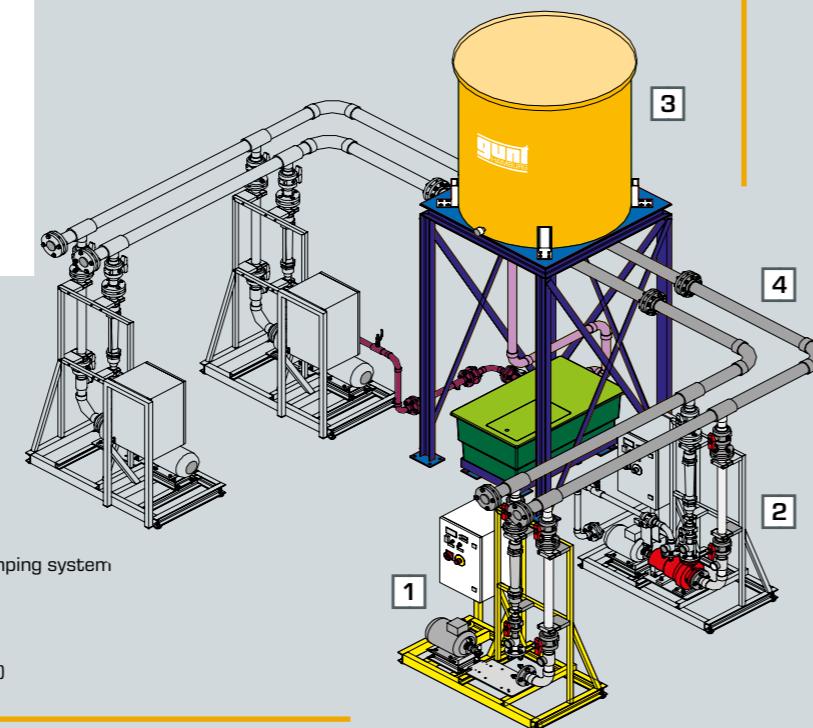

HL 962.04
Standard chemicals pump with magnetic clutch

Hermetic centrifugal pump according to ISO 5199



Possible combination of individual components into a functional pumping system

- 1 assembly stand for pumps (HL 962)
- 2 pumps, various types (HL 962.01 – HL 962.04)
- 3 tank installation (HL 962.30)
- 4 piping system to interconnect the plant components (HL 962.32)



Fundamentals of process engineering Practice: heat exchangers and steam generators

ET 860
Safety devices on steam boilers

Familiarisation with boiler safety devices such as pressure and water level monitors


WL 315C
Comparison of various heat exchangers

Comparison of plate heat exchanger, tubular heat exchanger, shell and tube heat exchanger, finned cross-flow heat exchanger, and stirred tank with double jacket and coiled tube



Fundamentals of process engineering Practice: applications of control engineering

RT 586
Control of water quality

Control of pH value, redox potential, oxygen concentration and electrical conductivity


RT 681
Multivariable control: vacuum degassing

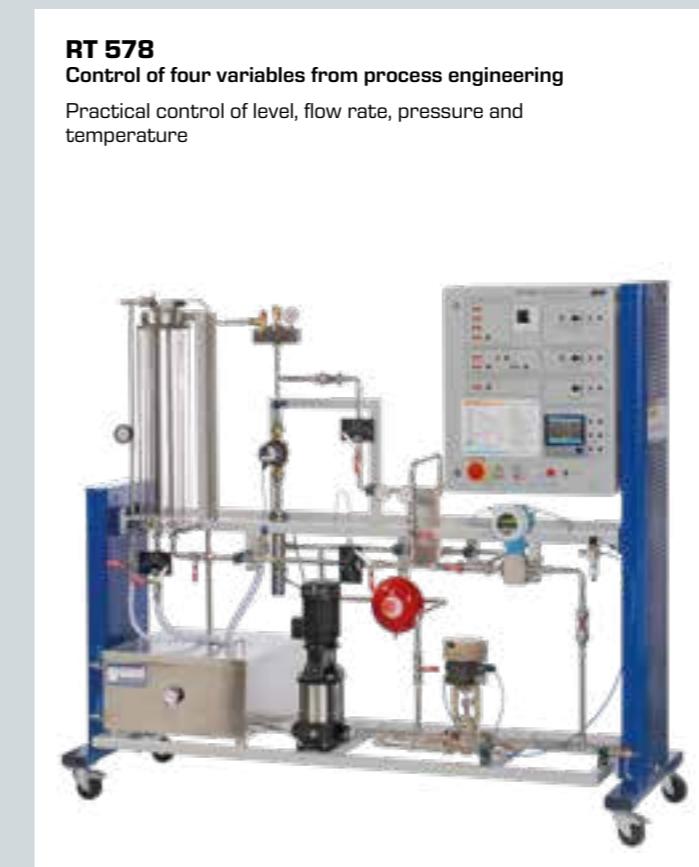
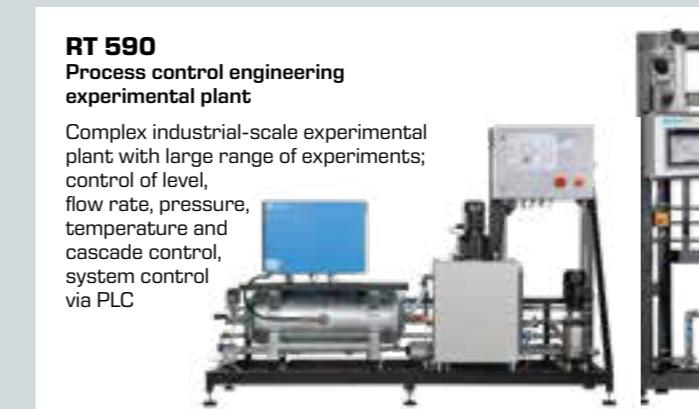
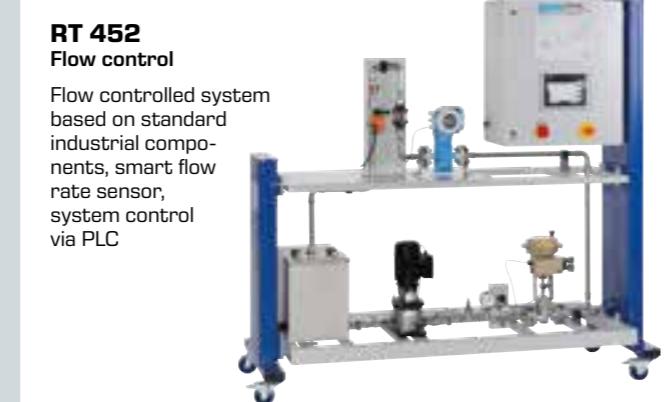
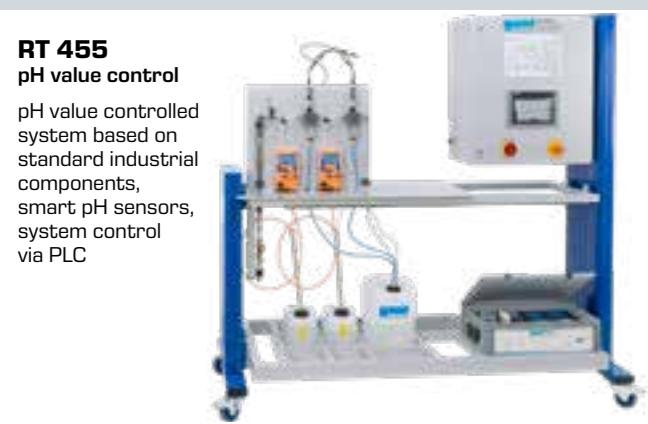
Model of "degassing of fluids": coupled level and pressure control in one vacuum tank


RT 682
Multivariable control: stirred tank

Heated stirrer tank with heat recovery as model: coupled level and temperature control



Fundamentals of process engineering Practice: applications of control engineering





Mechanical process engineering
Separation methods: classifying and sorting

MT 174
Sorting plant

Preventive maintenance based on the example of a separation process, system control via PLC



CE 275
Gas flow classification

Zigzag sifter to separate solid compounds



CE 280
Magnetic separation

Sorting with a drum-type magnetic separator



Mechanical process engineering
Separation methods: separation in a gravity field

HM 142
Separation in sedimentation tanks

Solid/liquid separation in a sedimentation tank, visualisation of flow conditions



CE 115
Fundamentals of sedimentation

Separation of suspensions



CE 587
Dissolved air flotation

Removal of solids from raw water using dissolved air flotation



Mechanical process engineering Separation methods: filtration

CE 116
Cake and depth filtration
Fundamentals of filtration:
Darcy's equation



CE 117
Flow through particle layers
Investigation of the properties
of fixed and fluidised beds
subjected to liquid flow



CE 287
Plate and frame filter press
Discontinuous cake filtration for sepa-
rating solids out
of suspensions



CE 283
Drum cell filter
Continuous cake
filtration for
separating solids
from suspensions



CE 284
Nutsche vacuum filter
Discontinuous cake filtration
by negative pressure



CE 286
Nutsche pressure filter
Discontinuous cake filtration
by positive pressure



CE 285
Suspension
production unit
Supply unit for
experimental
filtration units
CE 284 and
CE 286



CE 579
Depth filtration
Demonstra-
tion of depth
filtration and
backwashing
of filters



Mechanical process engineering Separation methods: separation in a centrifugal force field

CE 282
Disc centrifuge
Continuous separation of emulsions



CE 225
Hydrocyclone
Separation of solids from liquids by using a centrifugal force



CE 235
Gas cyclone
Solid separation from gases using a cyclone



Mechanical process engineering Comminution

CE 245
Ball mill
Observation of the
milling process:
comminution
of solids



Mechanical process engineering Mixing and agglomeration

CE 320

Stirring

Visualization of flow fields when using various stirrer types

**CE 322**

Rheology and mixing quality in a stirred tank

Stirring machine with direct torque measurement to determine the power curves

**CE 255**

Rolling agglomeration

Dish granulator with adjustable speed and angle of inclination



Mechanical process engineering Fluidised beds and pneumatic transport

CE 220

Fluidised bed formation

Investigation of fluidised bed formation of solids in air and water

**CE 250**

Pneumatic transport

Pneumatic pressure-lifting of solids in a vertical transparent tube



Mechanical process engineering Storage and flow of bulk solids

CE 210

Flow of bulk solids from silos

Influence of wall material and inclination of hopper wall on flow profile and outflow time

**CE 200**

Flow properties of bulk solids

Using a ring shear tester to record the shear force characteristics of bulk solids; basic principle of silo design

**CE 222**

Comparison of fluidised beds

Two transparent columns with different diameters for observation of fluidised bed formation in gases



 Chemical process engineering
Thermal activation

CE 310
Supply unit for chemical reactors

Basic unit for investigation and comparison of different reactors during a saponification reaction



CE 310.01
Continuous stirred tank reactor

Tank for continuous or batch operation with agitator, heat exchanger and overflow



CE 310.02
Tubular reactor

Tube coil as a reaction tube in a water bath for continuous reaction operation



CE 310.03
Stirred tanks in series

Series connection of three stirred tank reactors



CE 310.04
Discontinuous stirred tank reactor

Dewar vessel with stirrer and heat exchanger for isothermal saponification reaction



CE 310.05
Plug-flow reactor

Continuously operated tubular reactor; fixed bed with glass spheres



CE 310.06
Laminar flow reactor

Continuously operated tubular reactor



CE 100
Tubular reactor

Demonstration of the influence of temperature and reaction period on the alkaline saponification reaction



Chemical process engineering
Catalytic and photochemical activation

CE 380
Fixed bed catalysis

Investigation of catalytic reactions



CE 380.01
Flow injection analysis

Professional analysis unit for CE 380: detection of glucose



CE 584
Advanced oxidation

Oxidation of organic substances with hydrogen peroxide and UV light



CE 650
Biodiesel plant

Chemical transesterification of vegetable oils, system control via PLC



Thermal process engineering
Drying and evaporation

CE 715
Rising film evaporation

Concentration of temperature-sensitive solutions



CE 130
Convection drying

Drying curves for granular solids



Thermal process engineering
Distillation / rectification

CE 600
Continuous rectification

Continuous and discontinuous rectification with packed, sieve tray and bubble cap tray column, system control via PLC



CE 602
Discontinuous rectification

Comparison of packed and sieve tray columns in rectification



CE 610
Comparison of
rectification columns

PLC controlled continuous rectification with packed and sieve tray column



Thermal process engineering Absorption and adsorption

CE 400 Gas absorption

Separating a carbon dioxide / air mixture by absorption in counterflow



CE 405 Falling film absorption

Separation of oxygen from an air flow by absorption in a falling film column



Thermal process engineering Crystallisation and membrane separation processes

CE 520 Cooling crystallisation

Investigation of crystal growth in a fluidised bed



CE 530 Reverse osmosis

Membrane separation process for obtaining solvent from a salt solution, system control via PLC



CE 540 Adsorptive air drying

Basic principle of adsorption and desorption



CE 583 Adsorption

Adsorption of dissolved substances on activated carbon



Thermal process engineering Extraction

CE 620 Liquid-liquid extraction

Separation of a two-component liquid mixture by extraction in counterflow with a solvent



CE 630 Solid-liquid extraction

Continuous and discontinuous extraction of the soluble components of a solid



Biological process engineering
Aerobic processes

CE 701
Biofilm process

Biological, aerobic water treatment by the biofilm process: trickling filter



CE 730
Airlift reactor

Aerobic submerged reactor



CE 705
Activated sludge process

Wastewater treatment plant in laboratory scale: aerobic biological degradation of organic substances, system control via PLC



Biological process engineering
Anaerobic processes

CE 702
Anaerobic water treatment

Anaerobic degradation of organic substances in the stirred tank and UASB reactor for biogas production (UASB: Upflow Anaerobic Sludge Blanket)



CE 640
Biotechnical production of ethanol

Batch conversion of starch-based raw materials into ethanol, system control via PLC



CE 642
Biogas plant

Two-stage continuous degradation of organic substances. First stage: hydrolysis and acidification, second stage: anaerobic degradation, system control via PLC



 Water treatment
Mechanical processes

CE 587
Dissolved air flotation

Removal of solids from raw water using dissolved air flotation



CE 579
Depth filtration

Demonstration of depth filtration and backwashing of filters



HM 142
Separation in sedimentation tanks

Solid/liquid separation in a sedimentation tank, visualisation of flow conditions



CE 588
Demonstration of dissolved air flotation

Basic function and visualisation of the process



Water treatment
Biological processes

CE 701
Biofilm process

Biological, aerobic water treatment by the biofilm process: trickling filter



CE 702
Anaerobic water treatment

Anaerobic degradation of organic substances in the stirred tank and UASB reactor for biogas production (UASB: Upflow Anaerobic Sludge Blanket)



CE 705
Activated sludge process

Wastewater treatment plant in laboratory scale: aerobic biological degradation of organic substances, system control via PLC



CE 704
SBR process

Sequencing batch reactor



Water treatment Physical / chemical processes

CE 583
Adsorption

Adsorption of dissolved substances on activated carbon



CE 300
Ion exchange

Softening and desalination of water by ion exchange



CE 584
Advanced oxidation

Oxidation of organic substances with hydrogen peroxide and UV light



CE 530
Reverse osmosis

Membrane separation process for obtaining solvent from a salt solution, system control via PLC



CE 586
Precipitation and flocculation

Removal of dissolved substances by precipitation, flocculation and sedimentation of the flocs in the lamella separator



Water treatment Combined processes

CE 581
Water treatment plant 1

Three basic procedures of water treatment: depth filtration, adsorption and ion exchange, system control via PLC



CE 582
Water treatment plant 2

Two basic procedures of water treatment: depth filtration and ion exchange



Hands-on
teaching engineering –
with GUNT's SMART features



About the product:



6 | 2E Energy & Environment

Energy

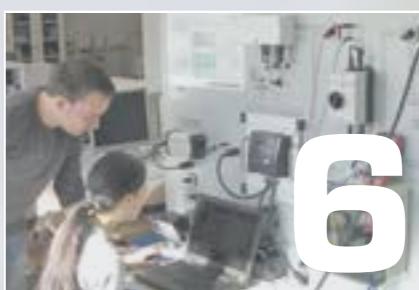
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Energy



Environment





Energy Solar energy: photovoltaics

ET 252

Solar cell measurements

Investigation of the properties of solar cells; objective measurements by extensive temperature control of solar cells



ET 255

Using photovoltaics: grid-connected or stand-alone

Electrical components of a real life photovoltaic system



ET 250

Solar module measurements

Determining the characteristic parameters of a photovoltaic system



ET 250.02

Stand-alone operation of photovoltaic modules

Expansion module for ET 250 with components for independent use of electricity from solar panels



ET 250.01

Photovoltaic in grid-connected operation

Expansion module for ET 250 with components for feeding solar power into a public grid



Energy Solar energy: solar thermal energy

ET 203

Parabolic trough collector with solar tracking

Function and operating behavior of a parabolic trough collector, astronomical and sensor-based sun tracking, system control via PLC



ET 202

Principles of solar thermal energy

Determining characteristic parameters of a solar thermal system; model fitted with artificial radiation source



HL 320.03

Flat collector

Pivotal flat collector for converting solar energy into heat



WL 377

Convection and radiation

Heat transport between heating element and vessel wall by convection and radiation



HL 320.04

Evacuated tube collector

Conversion of solar energy into heat in the evacuated tube collector



HL 313

Domestic water heating with flat collector

Demonstration of the conversion of the sun's radiation energy into heat and the storing of that heat



HL 314

Domestic water heating with tube collector

Familiarisation with the functions of the evacuated tube collector and the solar circuit



HL 320.05

Central storage module with controller

Module with buffer storage and bivalent storage for heating systems with renewable energies, operating the heating controller via web browser



Energy Solar energy: solar cooling

ET 256**Cooling with solar electricity**

Compression refrigeration system for operation with solar current from ET 250

**ET 250****Solar module measurements**

Determining the characteristic parameters of a photovoltaic system



Energy Geothermal energy: heat exchangers

WL 110**Heat exchanger supply unit**

Measuring the transfer characteristics of five different heat exchanger models, system control via PLC

**WL 110.02****Plate heat exchanger**

Typical plate heat exchanger in parallel flow and counterflow operation

**WL 110.01****Tubular heat exchanger**

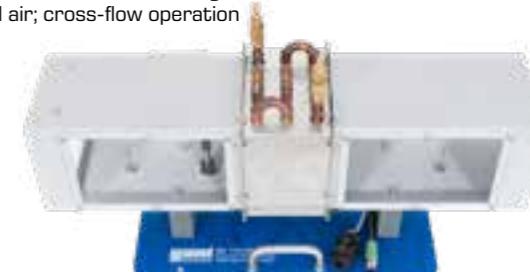
Transparent heat exchanger with additional temperature measuring point after half of the transfer section; parallel flow and counterflow operation

**WL 110.04****Stirred tank with double jacket and coil**

Heating using jacket or coiled tube; stirrer for improved mixing of medium

**WL 110.03****Shell & tube heat exchanger**

Transparent shell and tube heat exchanger in cross parallel flow and cross counterflow operation

**WL 110.05****Finned tube heat exchanger** Heat transfer between water and air; cross-flow operation**ET 352.01****Solar heat for refrigeration**

Solar thermal operation of a vapour jet compressor

**ET 352****Vapour jet compressor in refrigeration**

Cold production using thermal energy. Transparent condenser and evaporator allow the view into the inner workings.

**HL 313****Domestic water heating with flat collector**

Demonstration of the conversion of the sun's radiation energy into heat and the storing of that heat, operating the solar controller via web browser

**HL 314****Domestic water heating with tube collector**

Familiarisation with the functions of the evacuated tube collector and the solar circuit, operating the solar controller via web browser

**WL 315C****Comparison of various heat exchangers**

Comparison of plate heat exchanger, tubular heat exchanger, shell and tube heat exchanger, finned cross-flow heat exchanger, and stirred tank with double jacket and coiled tube



Energy

Geothermal energy: shallow geothermal energy**ET 101****Simple compression refrigeration circuit**

Demonstration of a heat pump: cooling and heating of the heat exchangers directly tangible

**ET 262****Geothermal probe with heat pipe principle**

Transparent components allow observing how the state of the heat transfer medium changes

**ET 264****Geothermal energy with two-well system**

Use of geothermal energy in an open system without thermal repercussion



Energy

Geothermal energy: deep geothermal energy**ET 850****Steam generator**

Laboratory scale gas-fired steam generator for wet or superheated steam; integrated condenser

**ET 851****Axial steam turbine**

Single-stage steam turbine with power output measurement; steam supply via ET 850, gas-fired or ET 852, electrical

**HL 320.01****Heat pump**

Heat pump for operation with different sources, operating the heating controller via web browser

**HL 320.07****Underfloor heating / geothermal energy absorber**

Can be used as heat sink or heat source

**HL 320.08****Fan heater / air heat exchanger**

Can be used as heat sink or heat source

**ET 852****Steam generator, electrical**

Laboratory scale electrical steam generator for superheated steam; integrated condenser; alternative to the gas-fired steam generator ET 850 for the supply of the steam turbine ET 851





Energy Wind power: fundamentals of wind energy technology

ET 220
Energy conversion
in a wind
power plant

Conversion of
kinetic wind
energy into
electrical energy



ET 220.10
Control unit for wind power plant ET 220.01

Use of wind energy
in stand-alone
operation under
real weather
conditions



ET 220.01
Wind power plant

Connection to ET 220
or ET 220.10;
outdoor installation
allows practically relevant
investigations



ET 224
Operating behaviour of wind turbines

Characteristic and control on a wind power drive train



ET 210
Fundamentals of
wind power plants

Wind power plant with
rotor blade adjustment
and yaw angle adjustment



ET 222
Wind power drive train

Experiments on conversion of rotational energy
into electrical energy



HM 170
Open wind tunnel

Experiments from the field of aerodynamics and
fluid mechanics with an "Eiffel" type wind tunnel



HM 170.70
Wind power plant with rotor blade adjustment

Extension to wind tunnel HM 170



HM 170.05
Drag body
square plate



HM 170.09
Lift body
aerofoil NACA 0015



HM 170.22
Pressure distribution on an
aerofoil NACA 0015



Experiments with
different aerofoil
angles of attack

Energy

Wind power: application technology for wind power plants

GL 210

Dynamic behaviour of multistage spur gears

Investigation of the dynamics of rotation of one-, two- and three-stage spur gear units

**GL 212**

Dynamic behaviour of multistage planetary gears

Investigation of rotational dynamics of a two-stage epicyclic gear with three planetary gears each

**PT 500.11**

Crack detection in rotating shaft kit

Vibrational behaviour of a shaft with a radial crack

**PT 500.12**

Roller bearing faults kit

Assessment of bearing condition by vibration analysis

**PT 500.15**

Damage to gears kit

Vibration analysis of gearing damage

**PT 500.19**

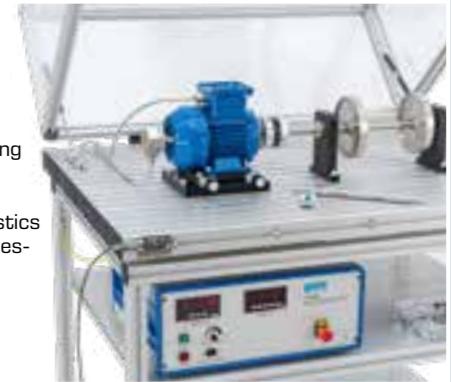
Electromechanical vibrations kit

Investigation of vibrational behaviour of an electric motor

**PT 500**

Machinery diagnostic system, base unit

Base unit for setting up wide ranging experiments in machinery diagnostics using modular accessory sets

**AT 200**

Determination of gear efficiency

Test system for determining mechanical drive and braking efficiency for spur and worm gears



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On our website you will find all you need to know, including all the latest news.

**Energy
Hydropower and ocean energy**
HM 150.19

**Operating principle
of a Pelton turbine**

Model of an impulse turbine with adjustable nozzle; determination of efficiency

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics

**HM 150.20**

**Operating principle
of a Francis turbine**

Model of a reaction turbine with adjustable guide vanes and determination of the efficiency

Recommended for water supply:
HM 150 Base module for experiments in fluid mechanics

**HM 365.31**

Pelton and Francis turbine

Comparison of impulse and reaction turbines

**HM 365.32**

Turbine supply unit

Water supply for HM 365.31



Trainer for turbines with Pelton turbine HM 365.31, supply unit HM 365.32 and brake unit HM 365

HM 421

Propeller type turbine trainer

Four-bladed propeller type turbine with guide vane adjustment for varying power

**HM 430C**

**Francis turbine
trainer**

Characteristics of a powerful Francis turbine with adjustable guide vanes

**HM 450C**

Characteristic variables of hydraulic turbomachines

Determination of output and efficiency of turbines and pumps; demonstration of a pumped storage plant

**HM 450.01**

Pelton turbine

Model of an impulse turbine with speed and torque measurement

**HM 450.02**

Francis turbine

Model of a reaction turbine with speed and torque measurement; adjustable guide vanes

**HM 450.03**

Propeller type turbine

Six-bladed propeller type turbine with guide vane adjustment for varying power; measurement of speed and torque

**HM 450.04**

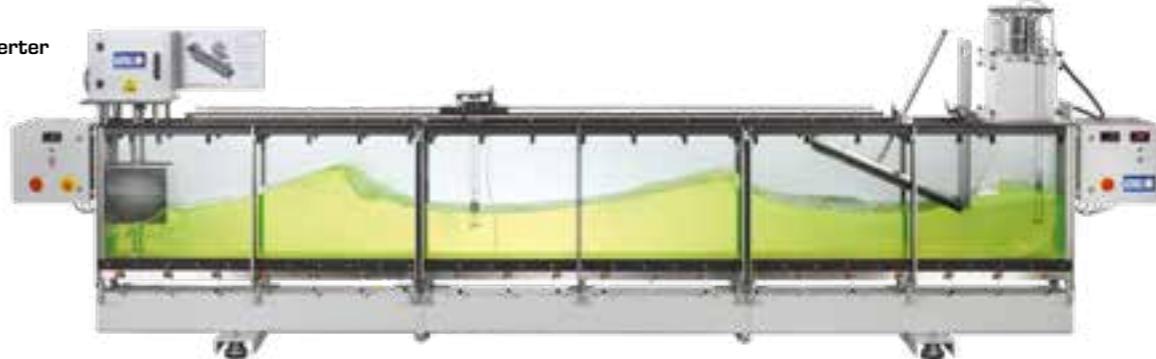
Kaplan turbine

Five-bladed Kaplan turbine with blade and guide vane adjustment for varying power; measurement of speed and torque

**ET 270**

Wave energy converter

Turbine unit with Wells turbine and electric generator; configurable wave generator



**Energy
Biomass**
CE 640**Biotechnical production of ethanol**

Batch conversion of starch-based raw materials into ethanol,
system control via PLC

**CE 642****Biogas plant**

Two-stage continuous degradation
of organic substances.

First stage: hydrolysis and acidification,
second stage: anaerobic degradation,
system control via PLC

**CE 650****Biodiesel plant**

Chemical transesterification
of vegetable oils,
system control via PLC


Energy**Energy systems: storage in energy systems****ET 513****Single-stage piston compressor**

Investigations on an air
compressor including
the determination of
the mechanical power
consumption



Single-stage compressor ET 513
with drive unit HM 365

HM 143**Transient drainage processes in storage reservoirs**

Demonstration of the function
of a rainwater retention basin
and a dam

**ET 255****Using photovoltaics:
grid-connected
or stand-alone**

Electrical components
of a real life photovoltaic
system

**ET 420****Ice stores in refrigeration**

Industrial refrigeration system
with ice store, dry cooling
tower and wet cooling tower



Energy Energy systems: storage in energy systems

ET 220
Energy conversion
in a wind
power plant

Conversion of
kinetic wind
energy into
electrical energy



ET 220.10
Control unit for wind power plant ET 220.01

Use of wind energy
in stand-alone
operation under
real weather
conditions



ET 220.01
Wind power plant

Connection to ET 220
or ET 220.10;
outdoor installation
allows practically relevant
investigations



Energy Energy systems: conversion in energy systems

ET 292
Fuel cell system

Water-cooled polymer-
membrane fuel cell
combined heat and power



ET 102
Heat pump

Utilisation of ambient
heat for water heating



ET 794
Gas turbine with
power turbine

Two-shaft arrangement
with high-pressure turbine
and power turbine using
liquid gas



HL 320.03
Flat collector

Pivotal flat collector for converting solar energy into heat



HL 320.05
Central storage module with controller

Module with buffer storage and bivalent storage
for heating systems with renewable energies,
operating the heating controller via web browser



HL 320.01
Heat pump

Heat pump for operation
with different sources,
operating the heating
controller via web browser



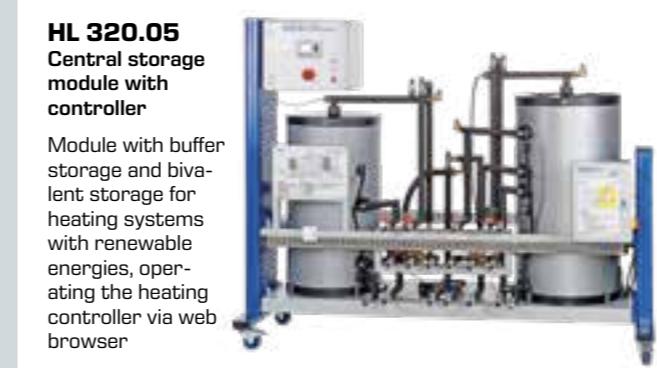
HL 320.07
Underfloor heating /
geothermal energy
absorber

Can be used as heat
sink or heat source



HL 320.05
Central storage
module with
controller

Module with buffer
storage and biva-
lent storage for
heating systems
with renewable
energies, oper-
ating the heating
controller via web
browser



HL 320.08
Fan heater/air heat
exchanger

Can be used as heat
sink or heat source





Energy Energy efficiency in buildings: business and industry

ET 420

Ice stores in refrigeration

Industrial refrigeration system with ice store, dry cooling tower and wet cooling tower



ET 428

Energy efficiency in refrigeration systems

Refrigeration system with three compressors in interconnected operation; adaptation to the capacity requirement



RT 682

Multivariable control: stirred tank

Heated stirrer tank with heat recovery as model: coupled level and temperature control



RT 396

Pump and valves and fittings test stand

Recording characteristic curves of industrial fittings and a centrifugal pump



Energy

Energy efficiency in buildings: heat supply and air conditioning

WL 376

Thermal conductivity of building materials

Investigation of the insulation properties of typical materials from the building materials sector



WL 110

Heat exchanger supply unit

Measuring the transfer characteristics of five different heat exchanger models, system control via PLC



WL 110.02

Plate heat exchanger

Typical plate heat exchanger in parallel flow and counterflow operation



WL 110.01

Tubular heat exchanger

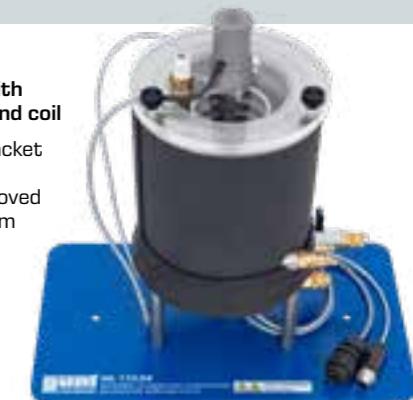
Transparent heat exchanger with additional temperature measuring point after half of the transfer section; parallel flow and counterflow operation



WL 110.04

Stirred tank with double jacket and coil

Heating using jacket or coiled tube; stirrer for improved mixing of medium



WL 110.03

Shell & tube heat exchanger

Transparent shell and tube heat exchanger in cross parallel flow and cross counterflow operation



WL 110.05

Finned tube heat exchanger

Heat transfer between water and air; cross-flow operation



Energy

Energy efficiency in buildings: heat supply and air conditioning**HL 305****Hydronic balancing of radiators**

Hydronic balancing of a heating system: three heating subcircuits with radiators, thermostatic valves and circulation pump

**HL 630****Efficiency in heating technology**

Basic principles of energy efficient heating technology with a computer-supported learning process

**ET 630****Split system air conditioner**

Modern air conditioning unit with heat pump function: cooling or heating

**HM 283****Experiments with a centrifugal pump**

Determination of characteristic pump variables



Energy

Energy efficiency in buildings: inclusion of renewable energies**HL 320.01****Heat pump**

Heat pump for operation with different sources, operating the heating controller via web browser

**HL 320.02****Conventional heating**

Electric complementary heater for the HL 320 modular system

**HL 320.03****Flat collector**

Pivotal flat collector for converting solar energy into heat

**HL 320.04****Evacuated tube collector**

Conversion of solar energy into heat in the evacuated tube collector

**HL 320.05****Central storage module with controller**

Module with buffer storage and bivalent storage for heating systems with renewable energies, operating the heating controller via web browser

**HL 320.07****Underfloor heating / geothermal energy absorber**

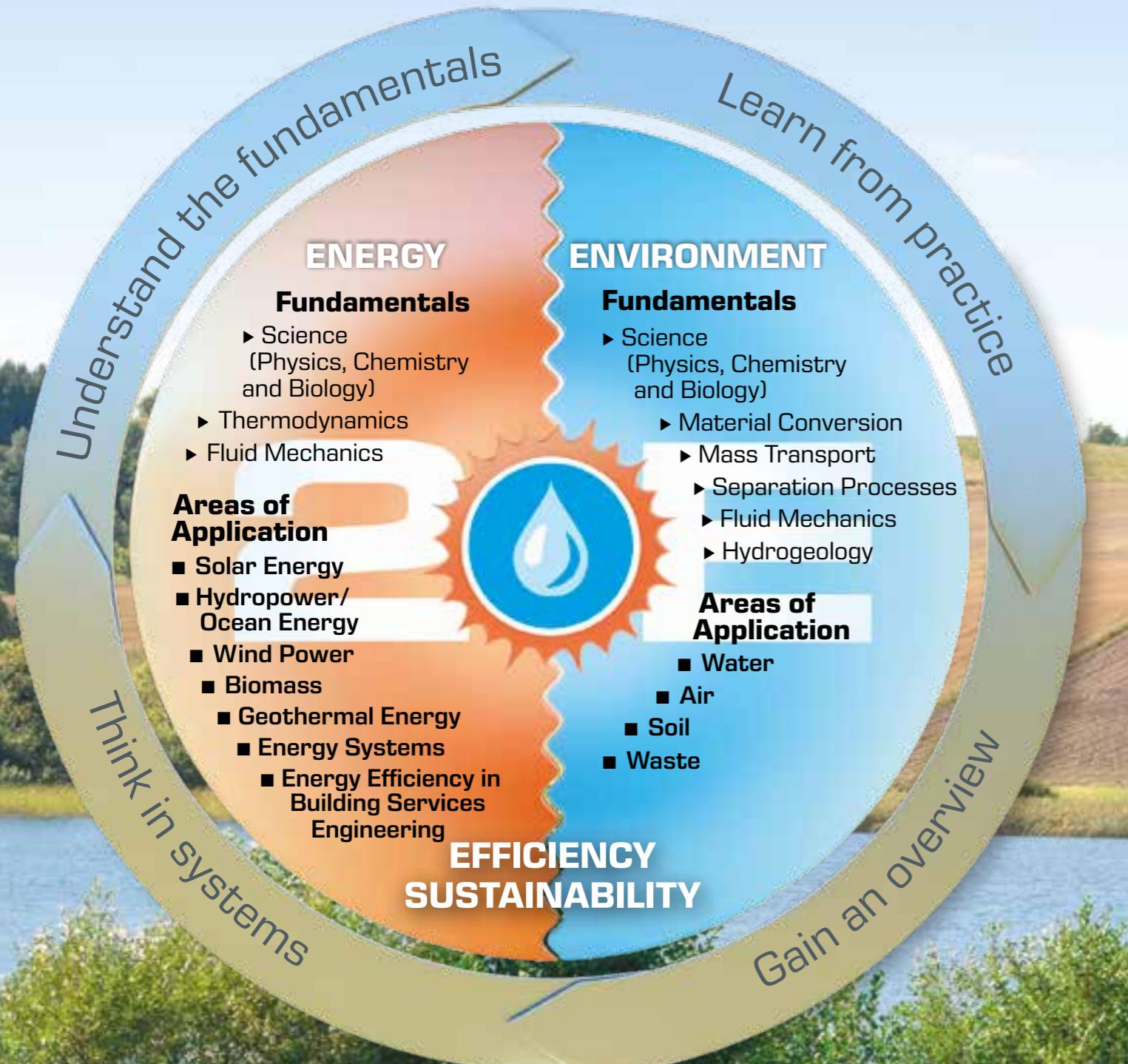
Can be used as heat sink or heat source

**HL 320.08****Fan heater/air heat exchanger**

Can be used as heat sink or heat source



The 2E Curriculum



Environment
Air: mechanical waste air purification

CE 235
Gas cyclone

Solid separation from gases using a cyclone



Environment
Air: thermal waste air purification

CE 400
Gas absorption

Separating a carbon dioxide/air mixture by absorption in counterflow



CE 540
Adsorptive air drying

Basic principle of adsorption and desorption





Environment Water: mechanical water treatment

CE 587

Dissolved air flotation

Removal of solids from raw water using dissolved air flotation



CE 579

Depth filtration

Demonstration of depth filtration and backwashing of filters



HM 142

Separation in sedimentation tanks

Solid / liquid separation in a sedimentation tank, visualisation of flow conditions



CE 588

Demonstration of dissolved air flotation

Basic function and visualisation of the process



Environment Water: biological water treatment

CE 705

Activated sludge process

Wastewater treatment plant in laboratory scale:
aerobic biological degradation of organic substances, system control via PLC



CE 701

Biofilm process

Biological, aerobic water treatment by the biofilm process: trickling filter



CE 702

Anaerobic water treatment

Anaerobic degradation of organic substances in the stirred tank and UASB reactor for biogas production (UASB: Upflow Anaerobic Sludge Blanket)



CE 730

Airlift reactor

Aerobic submerged reactor



CE 704

SBR process

Sequencing batch reactor



Environment
Water: physical/chemical water treatment

CE 583
Adsorption

Adsorption of dissolved substances on activated carbon



CE 300
Ion exchange

Softening and desalination of water by ion exchange



CE 584
Advanced oxidation

Oxidation of organic substances with hydrogen peroxide and UV light



CE 530
Reverse osmosis

Membrane separation process for obtaining solvent from a salt solution, system control via PLC



CE 586
Precipitation and flocculation

Removal of dissolved substances by precipitation, flocculation and sedimentation of the flocs in the lamella separator



Environment
Water: multistage water treatment

CE 581
Water treatment plant 1

Three basic procedures of water treatment:
depth filtration, adsorption and ion exchange,
system control via PLC



CE 582
Water treatment plant 2

Two basic procedures of water treatment:
depth filtration and ion exchange



Environment
Soil: hydrogeology

HM 165
Studies in hydrology

Investigation of precipitation-discharge relationships, storage capacity of soils, seepage flows and groundwater flows



HM 141
Hydrographs after precipitation

Correlations between precipitation and seepage; storage capacity and drainage methods



HM 167
Groundwater flow

Three-dimensional investigations; demonstration of lowering of groundwater; investigation of excavation pits



HM 169
Visualisation of seepage flows

Graphical determination of flow nets; investigation of water pressure on structures



Environment
Soil: soil treatment

CE 225
Hydrocyclone

Separation of solids from liquids by using a centrifugal force



CE 630
Solid-liquid extraction

Continuous and discontinuous extraction of the soluble components of a solid



Environment
Waste: separation processes

MT 174
Sorting plant

Preventive maintenance based on the example of a separation process, system control via PLC



CE 275
Gas flow classification

Zigzag sifter to separate solid compounds



CE 280
Magnetic separation

Sorting with a drum-type magnetic separator



Environment
Waste: comminution

CE 245
Ball mill

Observation of the milling process: comminution of solids



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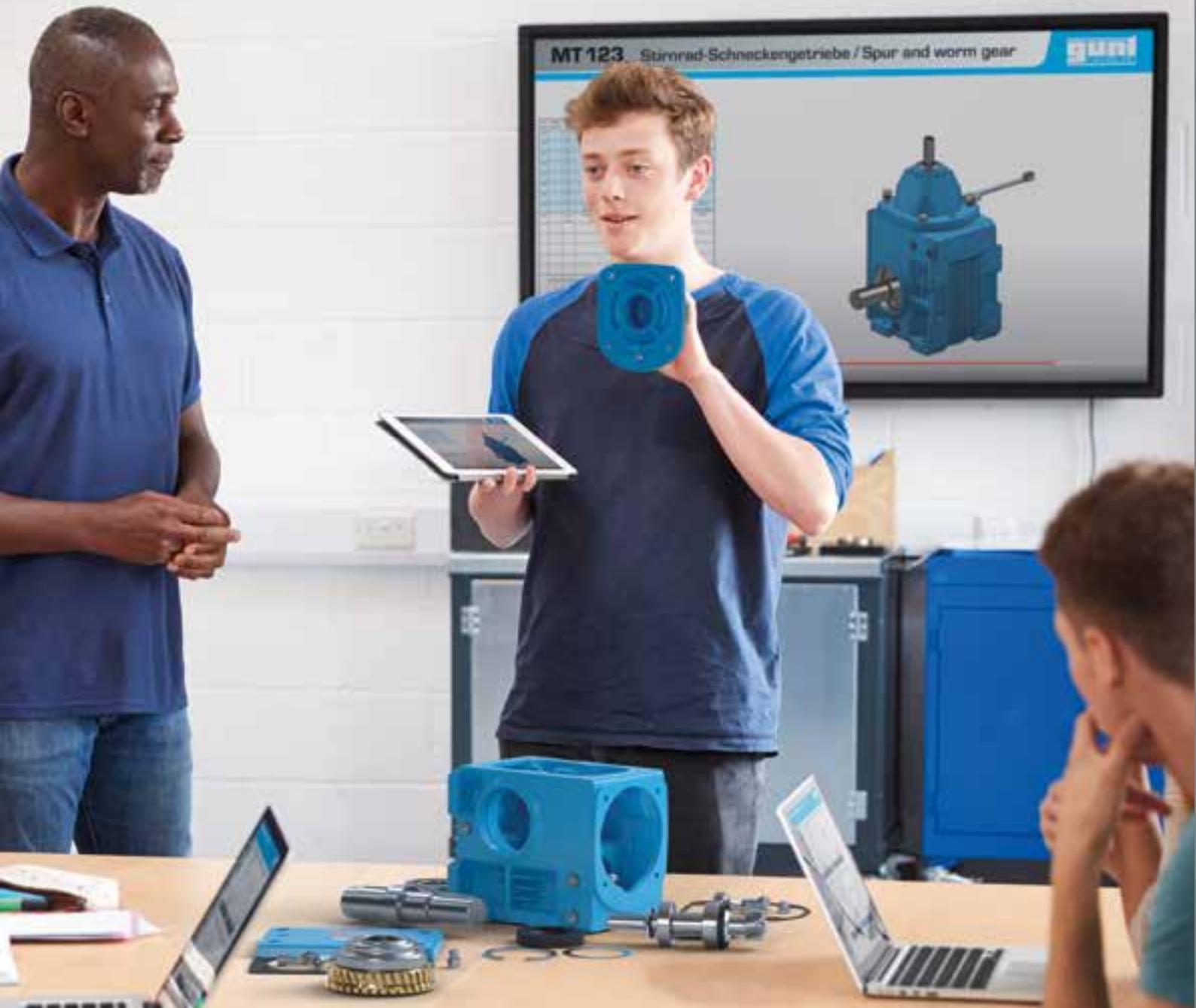
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Contact

G.U.N.T. Gerätebau GmbH
Hanskampring 15-17
22885 Barsbüttel
Germany

+49 40 670854-0
sales@gunt.de
www.gunt.de



Visit our website
www.gunt.de