



## De inrichting van een rijke en krachtige technische leeromgeving



HAPPÉ & VAN RIJN

Egelantiersgracht 213-215

1015 RJ Amsterdam

Tel: +31 (0)20 6254769

Email: [info@happevanrijn.com](mailto:info@happevanrijn.com)



Equipment for Engineering Education

**gunt**  
HAMBURG

## Service Document: Didactische leermiddelen Techniek

Service Document: Didactic teaching materials technique



# De inrichting van een rijke en sterke leeromgeving

The design of a rich and strong learning environment

In toenemende mate hebben technische onderwijsinstituten behoefte aan het inrichten van een leeromgeving die is afgestemd op de veranderende instroom van studenten. Er is behoefte aan een rijke interesse wekkende leeromgeving met een sterke didactiek. Ook stelt een nieuwe generatie docenten andere eisen aan hun leeromgeving die lang niet altijd door hen zelf ontwikkeld kan worden.

Technical education institutes increasingly need to set up a learning environment that is geared to the changing intake of students. There is a need for a rich, interesting learning environment with strong didactics. A new generation of teachers also makes different demands on their learning environment, which cannot always be developed by themselves.

Zowel in het universitair onderwijs als in het HBO is er daarom steeds meer behoefte aan een praktische ondersteuning van de theorie (theoreticum) en verificatie van de actuele technologie in een technologisch practicum en aan de hand van de toepassingspraktijk. Als argument wordt genoemd de opgelopen demotivatie en theoretische leerachterstand opgelopen in de Corona periode. Maar ook een nieuwe generatie studenten en docenten stelt andere eisen aan de leeromgeving.

Both in university education and in higher professional education there is therefore an increasing need for practical support for theory (theoretical) and verification of current technology in technological practicals and on the basis of application practice. As an argument, the demotivation and theoretical learning delay incurred during the Corona period is mentioned. But a new generation of students and teachers also make different demands on the learning environment

De inhaalslag die nu nodig lijkt, kan gemaakt worden door gebruik te maken van wereldwijde ontwikkeling van technische leermiddelen van het fabricaat G.U.N.T. Meer en meer worden deze ingezet vanwege hun zowel technisch als didactisch zeer hoogstaande uitvoering.

The catching up that now seems necessary can be made by making use of worldwide development of technical learning resources from the make G.U.N.T. These are used more and more because of their very high technical and didactic performance.

Honderden uiteenlopende objecten zijn op vrijwel alle studiegebieden beschikbaar in de vorm van multimediale theorie, practicumopstelling, beschreven experimenten, real time data-acquisitie en bedieningssoftware en een digitale leeromgeving.

Hundreds of diverse objects are available in almost all fields of study in the form of multimedia theory, practical set-up, described experiments, real-time data acquisition and operating software and a digital learning environment.

## De gewenste technische leeromgeving bestaat vaak uit:

The desired technical learning environment often consists of:

Theorie colleges	Theorie-practicum omgeving 1 Eigen vakdiscipline	Technologie practicum omgeving 2 Gemeenschappelijke leeromgeving voor meerdere (verwante) opleidingen	Praktijktoepassing Practicumomgeving 3/ Industriële omgeving Gemeenschappelijke leeromgeving voor meerdere (verwante) opleidingen
Theorie leerlijn Een of meer hoorcolleges	Werk-college's Theoreticum experiment/ opdracht	Technologie leerlijn Technologie experiment/ opdracht	Praktijk leerlijn Praktijk experiment/opdracht

Toelichting:

Practicumomgeving 1 : Theorie + ondersteuning in een theoreticum-/ practicum omgeving vormen de eigen vak-leeromgeving met vakspecifieke leermiddelen. (Bijv. voor thermodynamica)

Practicumomgeving 2: Het technologie practicum kan deel uitmaken van een meer vakoverstijgend gezamenlijke leeromgeving. (Bijv. leeromgeving voor mechanical engineering met practica- en praktijk.)

Explanation:

Practical environment 1 : Theory + support in a theoretical / practical environment form your own subject-learning environment with subject-specific teaching materials. (eg for thermodynamics)

Practical environment 2: The technology practical can be part of a more cross-curricular joint learning environment. (E.g. learning environment for mechanical engineering with practicals and practice.)

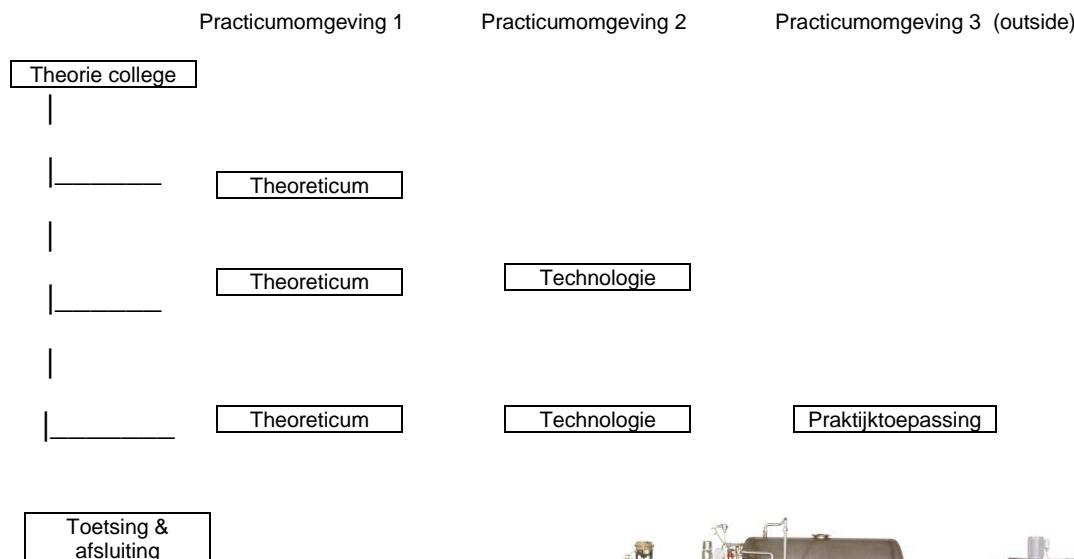


Fig. Example Learning environment 3:  
Practice/Praktijk

ET 833 Steam power plant 1,5kW  
with process control system cooling tower ET 833.01



## Voorbeelden van ‘good praxis’ met toepassing van G.U.N.T. technische leermiddelen

### Examples of good practice with the application of G.U.N.T. technical learning resources

<b>Onderwerp Subject</b>	<b>Leeromgeving/ learning environment:</b>		<b>Practicum</b>	<b>Practical</b>
	<b>Theoreticum 1</b>	<b>leeromgeving 1</b>	<b>Technologie</b>	<b>leeromgeving 2</b>
		Leeromgeving voor eigen vakdiscipline <i>Learning environment for your own discipline</i>	Gemeenschappelijke leeromgeving voor meerdere (verwante) opleidingen <i>Common learning environment for multiple (related) courses</i>	
<b>Thermal engineering</b>	- Gas PVT toestand - State of gas	- Warmtepompprincipe - Heat pump principle	- Warmtewisselaars - Heat exchangers	- Warmtepomptoepassing - Heat pump application
	- Warmteoverdracht (Systeem labline) - Heat transfer (System labline)		- Koude techniek, luchtbehandeling - Cold technique, air treatment	
<b>Mechanical engineering</b>	- Dimensionering en meettechniek - Dimensioning and measurement technology		- Industrie 4.0 - Industry 4.0 (System integration and digitization )	
<b>Proces engineering</b>	- Vloeistof mechanica, elementaire wetten - Fluid mechanics, elementary laws	- Chemie basis - Chemistry basics	- Toepassingen Vloeistof Mechanica - Applications Fluid Mechanics	- Chemie toepassingen - Chemistry applications
<b>Multiple disciplines</b>	- Elementaire Meet en regeltechniek - Elementary Measurement and Control Systems		- Toepassing Control Systems - Application Control Systems /Control Engineering	

# Equipment for Engineering Education: Our product programme



Engineering mechanics and  
engineering design



Mechatronics



Thermal engineering

Informatie op de website <https://gunt.de>

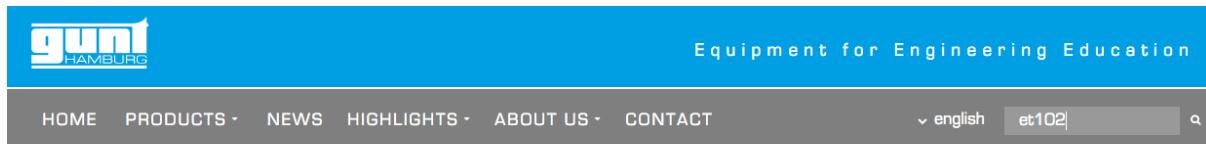
Information on website <https://gunt.de>

GUNT offers more than 500 devices for hands-on teaching engineering. The new [» catalogue](#) provides a quick overview of all the devices - clearly structured by product range.

All devices can be quickly accessed via the integrated navigation. Further information on our devices is available via direct links in the PDF.

A large number of the G.U.N.T devices are equipped with SMART features. In this way, learning can take place according to the model of **hybrid learning objective development**. Traditional subject-specific learning objectives are achieved in parallel and integratively with the development of digital skills. Always in a practical environment. Smart GUNT devices include a selection of smart components, smart applications and smart communication via interfaces. Matching the devices of a chapter, the most important available SMART features are illustrated with the help of icons.

Entire programme



The screenshot shows the GUNT Hamburg website. At the top, there's a blue header bar with the GUNT logo on the left and the text "Equipment for Engineering Education" on the right. Below the header is a dark grey navigation bar with links for "HOME", "PRODUCTS", "NEWS", "HIGHLIGHTS", "ABOUT US", and "CONTACT". To the right of the navigation bar are language and search options: "english" and "et102" in a dropdown menu, and a magnifying glass icon for search. The main content area has a light blue background and displays a search results page for "et102".

Search keys

[Cancel search ▾](#)

## Search result for products: 2

found with: [et102]



**ET 102**

Heat pump

Utilisation of ambient heat for water heating



found with: [et102]

**ET 102W**

Web Access Software

Device-specific software required for the connection of ET 102 with the Web Access Box GU 100

Products: 1-2 / 2 - Page: 1 / 1

Refrigeration / Heat pumps and ice store / Heat pumps /

Refrigeration Heat pumps and ice store Heat pumps ET 102 Advanced search ▾

**ET 102 Heat pump**



**Description** **Technical details** **Media**

A heat pump usually extracts the energy from the environment. Common energy sources are air, groundwater, ground or river water. An energy source temperature which is as high and constant as possible is the key for high efficiency.

With the air-to-water heat pump ET 102 the ambient heat of the air is used to heat water. The heat pump circuit consists of a compressor, an evaporator with ventilator, a thermostatic expansion valve and a coaxial coil heat exchanger as condenser. All components are clearly arranged in the trainer. The compressed refrigerant vapour condenses in the outer pipe of the condenser and thereby discharges heat to the water in the inner pipe. The liquid refrigerant evaporates at low pressure in the finned tube evaporator and thereby absorbs heat from the ambient air. The air flow is adjustable via a powerful EC ventilator.



show all

**Learning objectives/experiments**

**Scope of delivery**

**Features**

**Accessories**

## Onderwerp Thermodynamica

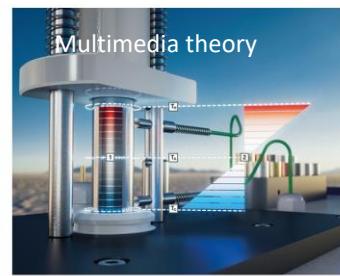
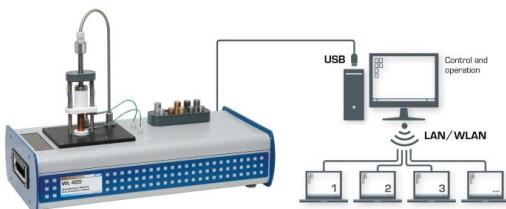
## Subject Thermodynamics

Voorbeelden Practicumomgeving 1 Theoreticum  Examples Practical environment 1 Theoretician	Voorbeelden Practicumomgeving 2: Technicum  Examples Practical environment 2: Technicum
WL 110 Modular heatexchanger + tabular/ plate/ shell&tube/ jacked vessel with stir- coil	WL 320 Wet Cooling Tower Principes/h-x diagram/ energy balanse/ process parameters
ET 350 Changes of States in Refrigeration Circuit	ET 411C Compression refrigeration system



### WL 420 Heat conduction in metals

Heat transfer (System labline)



## Example specifications WL 420 Heatconduction in metals (theoretican)

### Learning objectives/experiments

- time dependency until the steady state is reached
- calculate the thermal conductivity  $\lambda$  of different metals
- calculate the thermal resistance of the sample
- heat transfer with different samples connected in series
- effect of sample length on heat transfer
- GUNT-E-Learning
  - multi-media online course, which enables learning independent of time and place
  - access via Internet browser
  - educational software including different learning modules
  - course in the fundamentals
  - detailed thematic courses
  - check through targeted review of the learning objectives
  - authoring system with editor that enables you to integrate your own, local content into the educational software

### Features

- effect of different metals on heat conduction
- network capability: network access to ongoing experiments by any number of external workstations
- GUNT software: operation and control of the experimental unit, data acquisition and educational software
- E-Learning: multi-media didactic materials accessible online

## Description

Heat conduction is one of the three basic forms of heat transfer. According to the second law of thermodynamics, heat is always transferred from the higher energy level to the low energy level. If the temperature of a body does not change despite continuous addition or removal of heat, this is known as steady-state heat conduction.

WL 420 offers basic experiments for targeted teaching on the topic of heat conduction through various metals. To this end, one of eleven samples is used. The upper region of the sample is heated by an electrical heater and the lower section cooled by a Peltier element. Heat conduction occurs through the respective sample from top to bottom. Two samples can be inserted into the experimental unit at the same time, in order to investigate thermal conductivity through multi-layered metals. Perfectly matched components ensure rapid heating and trouble-free measurements.

The temperature of the metal samples is taken on the top and bottom by means of thermocouples. The microprocessor-based instrumentation is well protected in the housing. The GUNT software consists of a software for system operation and for data acquisition and an educational software.

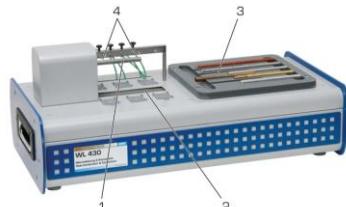
With explanatory texts and illustrations the educational software significantly aids the understanding of the theoretical principles. The operation and control of the experimental unit is carried out via a PC (not included in the scope of delivery) connected via a USB interface. Any number of workstations with the GUNT software can be used for observation and evaluation of the experiments via LAN/WLAN connection using only one licence.

### Other examples

#### WL422 Heat conduction in fluids



#### WL430 Heat conduction and convection



#### WL 440 Free and forced convection



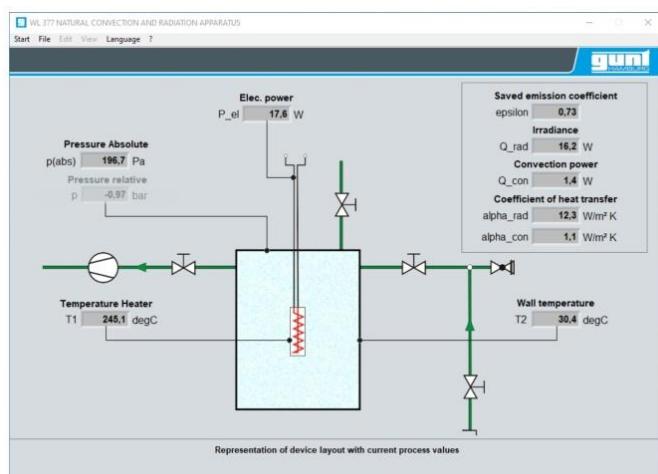
#### WL 460 Heat transfer by radiation



#### WL 377 Convection and radiation



#### Software / Data acquisition



## Onderwerp Mechatronica Subject Mechanical engineering

PT 500 Machinery diagnostic system	MT 174 Sorting Plant	PT 105 Dimensional metrology
 <ul style="list-style-type: none"> <li>introduction to vibration measuring methods on rotating machinery systems</li> <li>fundamentals of measurement of shaft and bearing vibrations</li> <li>basic variables and parameters</li> <li>sensors and measuring devices</li> <li>influences of speed and shaft layout</li> <li>influence of sensor positioning</li> <li>field balancing of rigid shafts</li> <li>influence of alignment between motor and coupling</li> <li>understanding and interpreting frequency spectra</li> <li>use of a computerised vibration analyser</li> </ul>	 <p>Onderdelen van deze opstelling zijn object van demontage en montage, van testen en het plegen van onderhoud. Hiervoor is tekensoftware en een multimediale leeromgeving beschikbaar.</p> <p>Parts of this set-up are subject to disassembly and assembly, testing and maintenance. Drawing software and a multimedia learning environment are available for this.</p>	 <ul style="list-style-type: none"> <li>fundamentals of metrology: testing/measuring/gauging</li> <li>familiarisation with basic test equipment</li> <li>measure specified lengths, depths and diameters</li> <li>dimension test with slip gauge</li> <li>compare specified thread with gauge</li> <li>keep measuring log</li> <li>estimate/assess measurement deviations</li> <li>familiarisation with general tolerances according to ISO 2768-1</li> <li>recognise typical errors</li> <li>develop digital skills</li> </ul>

## Overzicht Procestechniek Overview Process engineering

### Theoreticum (Theorie practicum) Theoretical (Theory practicum)

#### Theoretische grondslagen Theoretical foundations

Thermodynamica (zie ook Warmtetechniek/ Thermal engineering and HVAC ) - warmte transport - warmte wisselaar - stromingsleer/ vloeistofmechanica - meet- en regeltechniek - meetmethoden

Thermodynamics (see also Warmtetechniek/ Thermal engineering and HVAC ) - heat transport - heat exchanger - fluid mechanics / fluid mechanics - measurement and control technology - measurement methods

#### Practicum Practicum

#### Praktische grondslagen / installatie onderdelen Practical foundations / installation parts

Pompen en compressoren – montage- en uitsnede modellen van installatie componenten o.a. kleppen en pompen – onderhoud – pijpen en fittingen – testopstellingen: supply-unit (aandrijven en remmen) voor pompen

Pumps and compressors – mounting and cut-out models of installation components, including valves and pumps – maintenance – pipes and fittings – test setups: supply unit (drive and brakes) for pumps

## Mechanische processen Mechanical processes

- scheidingsmethoden - vergruizen – mengen – opslag - vloeistof -en luchtgedragen transport
- separation methods - crushing - mixing - storage - liquid and airborne transport

## Thermische processen Thermal Processes

- drogen en verdampen – distillatie en refractie - absorptie en adsorptie – cristalliseren en membraamscheiding - extractie
- drying and evaporation - distillation and refraction - absorption and adsorption - crystallization and membrane separation – extraction

## Chemische processen Chemical Processes

- thermische activatie - catalytische- en fotochemische activatie
- thermal activation - catalytic and photochemical activation Biological processes

## Biologische processen Biological processes

- aerobische processen – anerobische processen
- aerobic processes – anaerobic processes

## Praktijk Practice

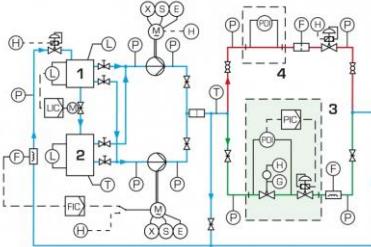
**Procesopstellingen** Bovengenoemde opstellingen zijn doelgericht: Onderzoek, demo, training, etc. met een bepaald specifiek leer- doel. Hieronder de procesopstellingen waarin meerdere facetten van de procestechniek samenkomen. Soms uit bovenstaande specifieke opstellingen maar ook andere.

**Process constellations** The above constellations are goal-oriented: Research, demo, training, etc. with a certain specific learning objective. Below are the process setups in which several facets of process technology come together. Sometimes from the above specific setups, but also others.

**Water behandeling** - mechanische processen – biologische processen – fysische en chemische processen – gecombineerde processen.

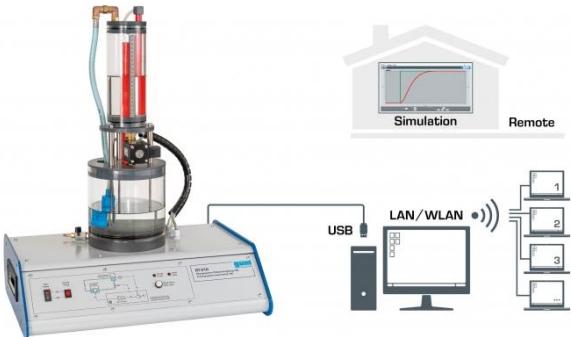
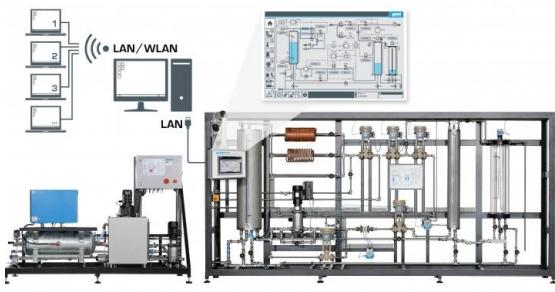
**Water treatment** - mechanical processes - biological processes - physical and chemical processes - combined processes

## Voorbeelden Procestechniek Examples Process engineering

<p><b>Voorbeelden Practicumomgeving 1 Theoreticum</b> <b>Examples Practical environment 1 Theoretician</b></p> <p>Vloeistof mechanica, elementaire wetten Fluid mechanics, elementary laws</p>	<p><b>Voorbeelden Practicumomgeving 2: Technicum</b> <b>Examples Practical environment 2: Technician</b></p> <p>Toepassingen Vloeistof Mechanica Applications Fluid Mechanics</p>
<p><b>HM 250 Fundamentals of fluid mechanics</b></p>  <p>Objects</p> <ul style="list-style-type: none"> <li>HM 250.01 Visualisation of pipe flow</li> <li>HM 250.02 Measurement of flow profile</li> <li>HM 250.03 Visualisation of streamlines</li> <li>HM 250.04 Continuity equation</li> <li>HM 250.05 Measurement of jet forces</li> <li>HM 250.06 Free discharge</li> <li>HM 250.07 Bernoulli's principle</li> <li>HM 250.08 Losses in pipe elements</li> <li>HM 250.09 Fundamentals of pipe friction</li> <li>HM 250.10 Pressure curve along the inlet section</li> <li>HM 250.11 Open channel</li> </ul>	<p><b>HM 124 Fluid mechanics experimental plant</b></p>  
<p><b>Chemie basis Chemistry basics</b></p> <p><b>CE 310 Supply unit for chemical reactors</b></p>  <p>Objects</p> <ul style="list-style-type: none"> <li>CE 310.01 Continuous stirred tank reactor</li> <li>CE 310.02 Tubular reactor</li> <li>CE 310.03 Stirred tanks in series</li> <li>CE 310.04 Discontinuous stirred tank</li> <li>CE 310.05 Plug-flow reactor</li> </ul>	<p><b>Chemie toepassingen Chemistry applications</b></p> <p><b>CE 702 Anaerobic water treatment</b></p> 

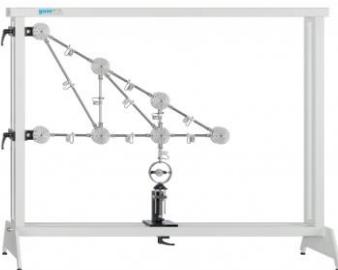
## Voorbeelden Algemene toepassing

## Examples Multiple disciplines

Voorbeelden Practicumomgeving 1 Theoreticum  Examples Practical environment 1 Theoretician	Voorbeelden Practicumomgeving 2: Technicum  Examples Practical environment 2 Technician
<p>Elementaire Meet en regeltechniek Elementary Measurement and Control Systems</p> <p>RT 010 t/m RT 060 Fundamentals of control engineering</p>   <p> <b>RT010 Level control</b>  <b>RT020 Flow control</b>  <b>RT030 Pressure control</b>  <b>RT040 Temperature control</b>  <b>RT050 Speed control</b>  <b>RT060 Position control</b> </p> 	<p>Toepassing Control Systems Application Control Systems /Control Engineering</p> <p>Practice-oriented learning with RT451- RT455</p>   <p>Industrial scale for advanced users with RT 590</p>  <p>E-Learn course: basic knowledge, videos and manuals accessible online</p> 

## Voorbeelden Examples

Greep uit meer dan 1000 opstellingen Select from more than 1000 setups

<b>SE 110.21 Forces in various single plane trusses</b> 	<b>WP 300 Materials testing 20kN</b> 	<b>RT 396 Pump &amp; valves &amp; fittings test stand</b> 
<b>WL 230 Condensation process</b> 	<b>WL 377 Convection &amp; radiation</b> 	<b>ET 794 Gas turbine with power turbine</b> 
<b>ET 252 Solar cell measurements</b> 	<b>ET 220 Energy conversion in a wind power plant</b> 	<b>ET 600 Conditioning of room air</b> 
<b>RT 580 Fault finding in a control system</b> 	<b>HM 170 Open wind tunnel</b> 	<b>HM 161 Experimental flume</b> 

Wilt u kennismaken met het gehele programma van GUNT gebruik dan de volgende toegang naar de verschillende catalogi: <https://gunt.de/en/>

Met doorklikken op de hoofdrubrieken in de catalogi 1 t/m 6 kunt u alle informatie van alle producten bereiken.

Wilt u van een productnummer de details weten dan kunt u op de website <https://gunt.de/en/> in het zoekvenster het betreffende nummer invoeren en met doorklikken alle onderwijskundige en technische details bekijken.

Wij zien onze rol als adviseur en als 'makelaar' tussen uw wensen en ons aanbod aan mogelijkheden. Graag maken wij met u een afspraak om in een zo vroeg mogelijk stadium van uw inrichtingsplannen ons brede aanbod met u te bespreken.

Drs. Caroline D. Happé – directeur  
06-53957531

Ing. Paul Ballhaus - consultant  
06-22961367



Equipment for Engineering Education:  
Our product programme





G.U.N.T. Hamburg

## WERKTUIGBOUWKUNDE, MACHINEBOUW

Statica, Dynamica  
Materiaalbeproeing  
Machine Dynamica  
Machine Onderdelen  
Ontwerpen, Teken  
Assemblage



G.U.N.T. Hamburg

## MECHATRONICA

Ontwerpen, Teken  
Meettechniek  
Opgewerkte Appendages  
Productie Ontwerpen  
Assemblage  
Maintenance  
Automatisering  
Ontwerp Procestechniek



G.U.N.T. Hamburg

## WARMTE TECHNIEKEN, THERMODYNAMICA

Principes Thermodynamica  
Warmtewisselaars  
Stoom- en Gasturbines  
Energieopwekking  
Compressietechniek  
Verbrandingsmotoren  
Koel- en Klimaattechniek  
Luchtbehandelingstechniek  
Drinkwaterinstallaties  
Rioleringstechniek  
Waterzuiveringstechniek



G.U.N.T. Hamburg

## STROMINGSLEER (LUCHT & WATER)

Principes Stromingsleer  
Vloeistofmechanica  
Luchtstroming, Windtunnel  
Installatietechniek  
Industriële Installaties  
Turbines, Hydraulisch & Gas  
Pompen & Compressoren



G.U.N.T. Hamburg

## PROCESTECHNIEK

Warmte Processen  
Mechanische Processen  
Chemische Processen  
Biochemische Processen  
Waterzuivering  
Principes Meet- en  
Regeltechniek  
Componenten & Calibratie



G.U.N.T. Hamburg

## DUURZAME ENERGIE EN MILIEU

Energie Techniek  
Milieu Techniek  
Stoom- en Gasturbines  
Energieopwekking  
Compressietechniek  
Verbrandingsmotoren  
Koel- en Klimaattechniek  
Luchtbehandelingstechniek  
Drinkwaterinstallaties  
Rioleringstechniek  
Waterzuiveringstechniek



HPS SystemTechnik

## HPS SYSTEMTECHNIK

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Digitale Techniek  
Installatie Techniek  
Contactor Control  
Elektrische Machines &  
Transformatoren  
Control Engineering  
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Telecommunicatie  
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Supplies  
Accessoires



Mechatronics International Ltd

## MECHATRONICS

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Hydrauliek  
Programmable Logic Control  
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Modulair Training Systeem  
Mechanische Transmissie