



ET 915

HSI Training System for Refrigeration and Air Conditioning Technology

Overall didactic concept to specifically teach the fundamentals of refrigeration and air conditioning technology.

- real-world components
- modular
- software controlled
- training software

The system for a simple introduction to a complex subject.

Overall Didactic Concept

Refrigeration and air conditioning technologies are among the most challenging apprenticeship trades (mechatronics for refrigeration) and disciplines of technical courses. In particular, the concept of multiple phase transitions at unusual temperatures and pressures represents a hurdle in the course of studies.

Furthermore, many apprentices and students can only really understand the link between tediously learned knowledge of formulae and real world processes when they come into contact with the subject again in a professional context.

We speak from experience and, with our educationally beneficial overall concept, we want to help you to teach this complex subject.

The ET 915 HSI Training System for Refrigeration and Air Conditioning Technology provides basic experiments for the different areas of refrigeration and air conditioning technology.

The term HSI refers to our overall didactic concept:

- Hardware
- Software
- Integration

The hardware contains genuine refrigeration and air conditioning technology components. Many of the components have a transparent design to allow student to see inside the equipment. Heat and cold can be felt directly on the device and are partially visible. The actual processes, however, are not visible and take place within closed systems.

In order to visualise these processes, our innovative and powerful software is an integral part of the training system. The software enables a unique form of representation and helps students to conduct and evaluate experiments. The software deliberately helps create a link between practice and theory.

To complete our overall didactic concept, ET 915 includes a multimedia training software programme which supports students in the preparation and follow-up of experiments. The training software enables independent learning of the theoretical fundamentals and, through explanatory texts, illustrations and moving images, contributes to understanding of the topic.



Design

Refrigeration

Air Conditioning



The ET 915 base unit contains the main compressor and condenser components

ET 915 Base Unit



ET 915.01 Refrigerator Model



ET 915.02 Model of a Refrigeration System with Refrigeration and Freezing Stage



ET 915.06 Model of a Simple Air Conditioning System

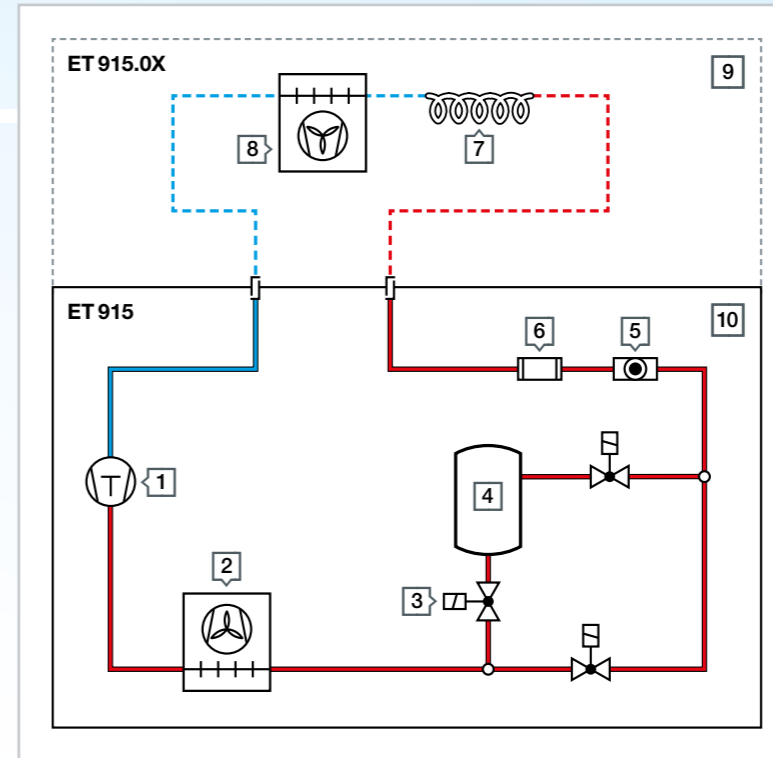


ET 915.07 Air Conditioning Model

All models include expansion element and evaporators



Comprehensive modular training system for refrigeration and air conditioning technology



- 1 compressor
- 2 condenser
- 3 solenoid valve
- 4 refrigerant collector
- 5 sight glass
- 6 filter/dryer
- 7 expansion element
- 8 evaporator
- 9 model
- 10 base unit

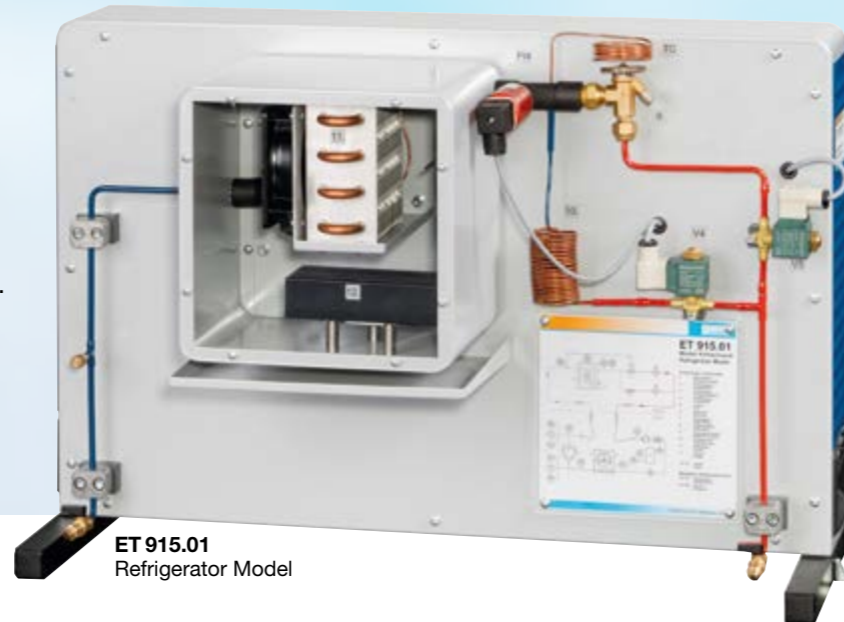
The different models are placed on the base unit and connected hydraulically and electrically



The different models can be exchanged in a few simple steps and without tools

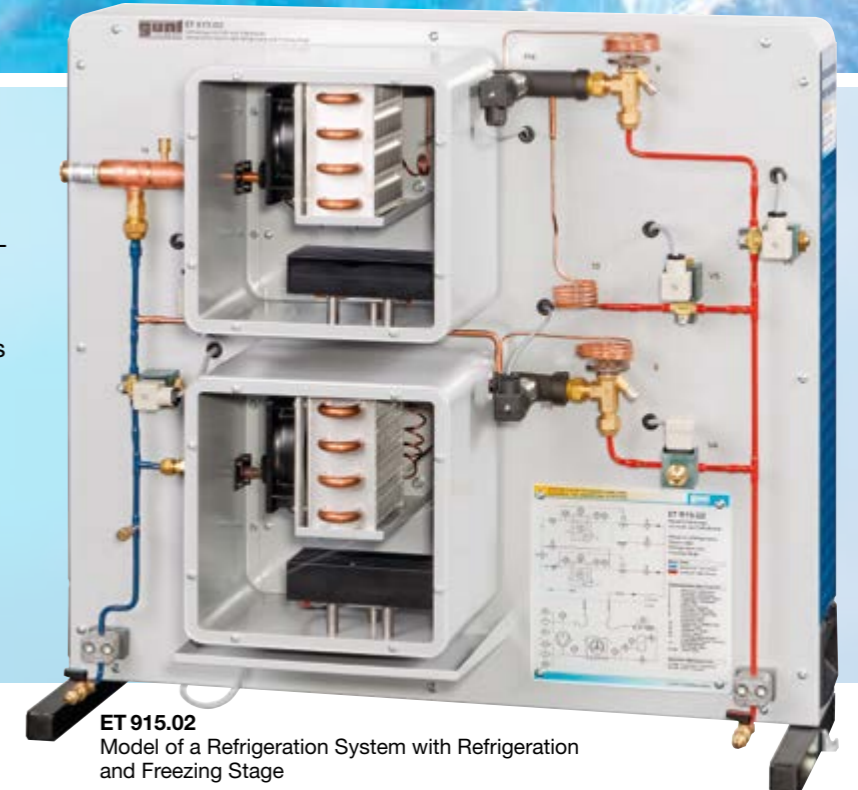
Refrigeration Technology

The model **ET 915.01**, combined with the base unit, forms a functioning refrigerator. Two different expansion elements are used. You can choose between a thermostatic expansion valve (TEV) or a capillary tube. Both expansion elements are used to expand the liquid refrigerant to a lower pressure level. Experiments focus on the properties of the capillary tube and thermostatic expansion valve. An electric heater can be used to simulate an additional cooling load.

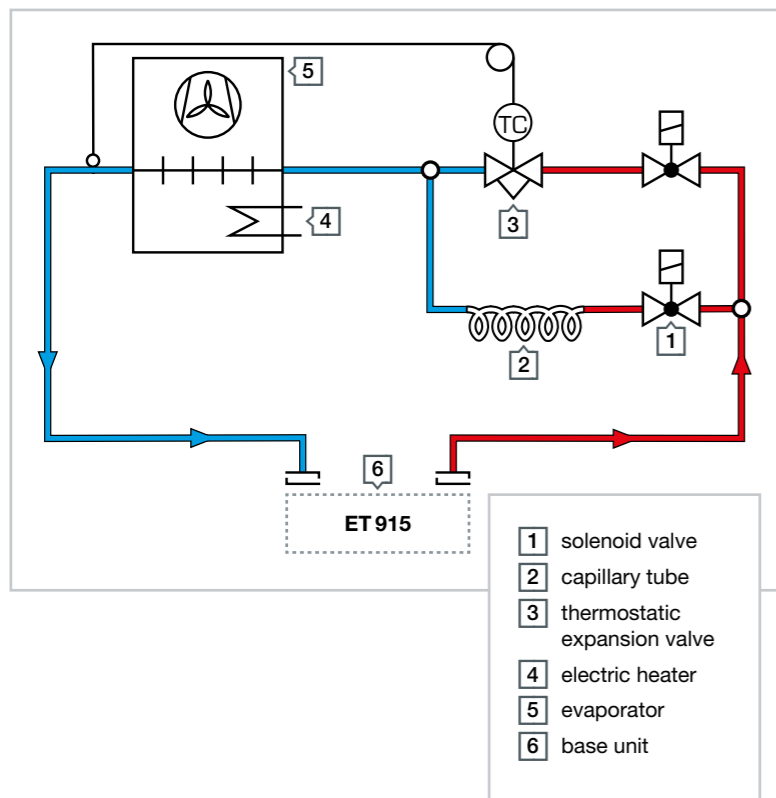


ET 915.01
Refrigerator Model

ET 915.02 includes two separate refrigeration chambers with evaporators and expansion elements. The evaporators can be optionally operated connected in series or in parallel. Two fans in the refrigeration chambers help achieve an even temperature distribution. Additional cooling loads can be simulated via electric heaters. The model also has an evaporation pressure controller.



ET 915.02
Model of a Refrigeration System with Refrigeration and Freezing Stage

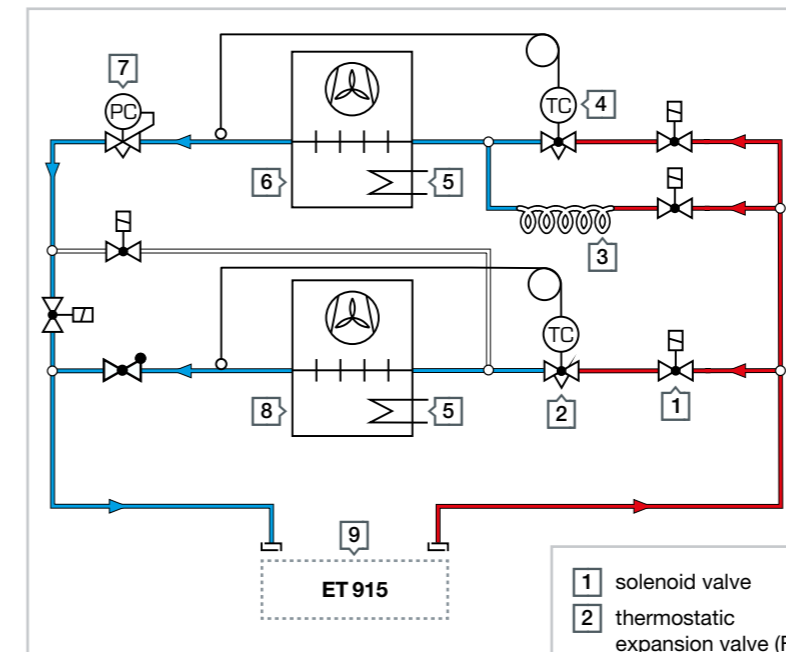


Learning objectives / experiments

- understanding of and familiarisation with the design and operation of a simple refrigeration system
- functional principle of an evaporator
- different expansion elements
 - ▶ operation with capillary tube
 - ▶ operation with expansion valve
- function of a temperature control system
- operating behaviour under load
- refrigeration cycle in the log p-h diagram
- fault simulation

Product No.
061.91501

More details and technical data:
gunt.de/static/s4644_1.php



Learning objectives / experiments

- design and function of a refrigeration system with two evaporators
- series and parallel connected evaporators
- function of a temperature control system
- operating behaviour under load
- refrigeration cycle in the log p-h diagram
- influence of the evaporation pressure
- fault simulation

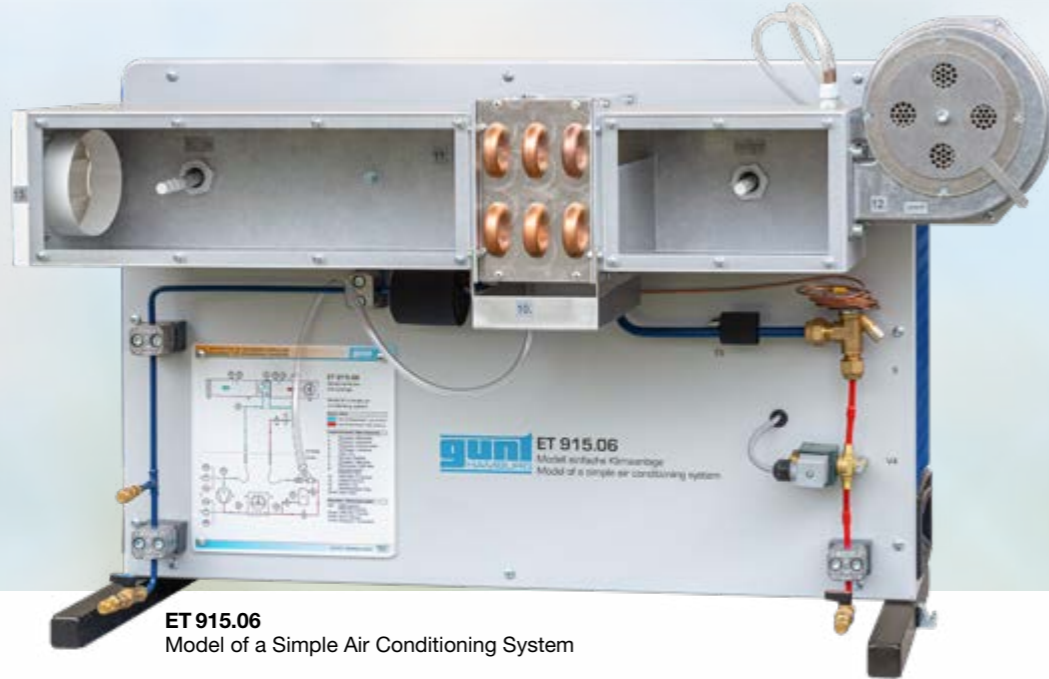
RC: refrigeration chamber
FC: freezing chamber

Product No.
061.91502

More details and technical data:
gunt.de/static/s4624_1.php

Air Conditioning Technology

The model **ET 915.06**, combined with the base unit, forms a functioning air conditioning system. The air to be cooled is sucked in from the room by a fan, cooled and fed back into the room. This model demonstrates the principles of convection cooling and the components of an air conditioning system.

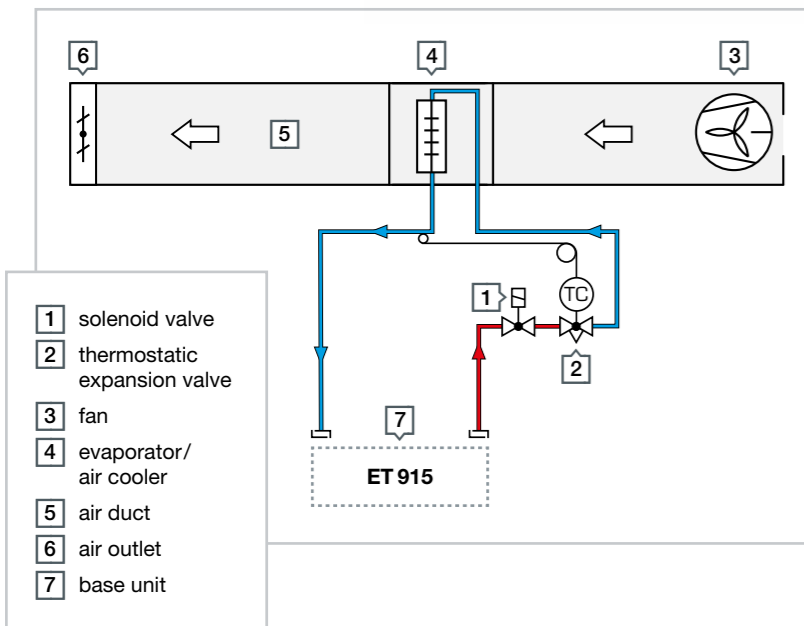


ET 915.06
Model of a Simple Air Conditioning System

The model **ET 915.07**, combined with the base unit, forms an air conditioning system for room cooling. The model includes various components for regulating the temperature and humidity of the room air. This model demonstrates the operation of an air conditioning system and the recirculating air and fresh air operating modes.



ET 915.07
Air Conditioning Model

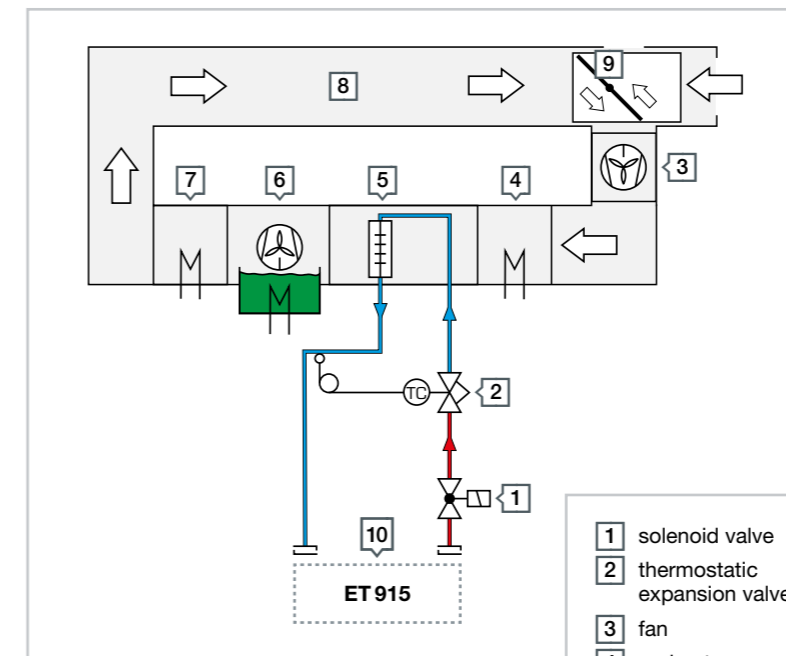


Learning objectives / experiments

- air conditioning system for room cooling and its main components
- temperature control system
- operation of an evaporator as an air cooler
- fault simulation

Product No.
061.91506

More details and technical data:
gunt.de/static/s4623_1.php



Learning objectives / experiments

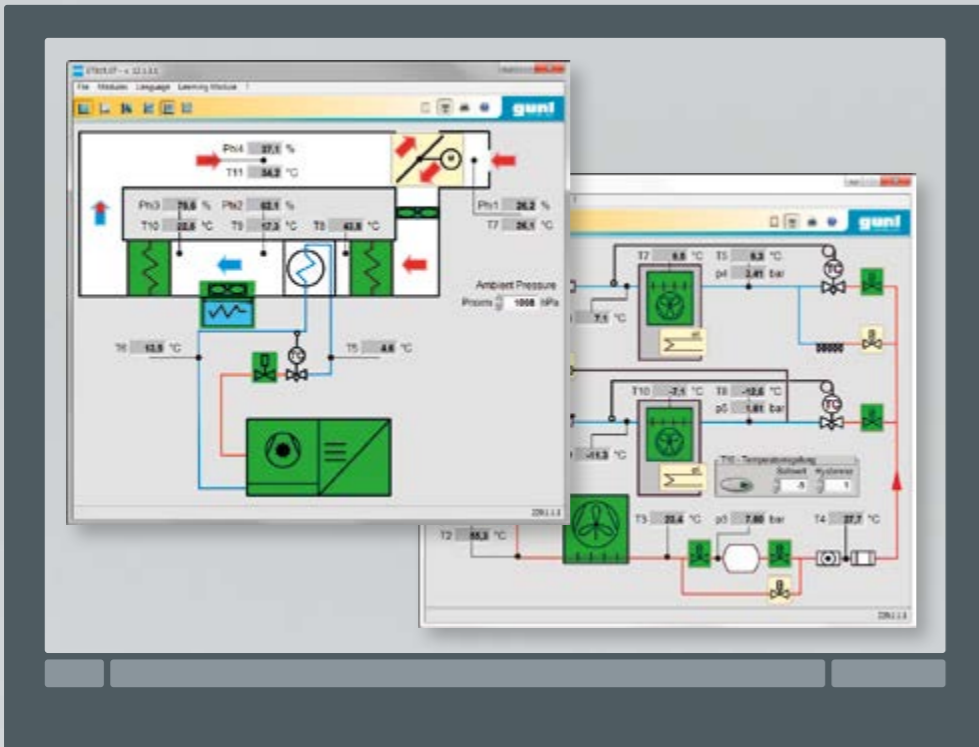
- full air conditioning system and its main components
- operation of an evaporator for air cooling and dehumidification
- operation of an electric air heater
- functional principle of a steam humidifier
- heating and cooling in the h,x diagram
- fresh air and recirculating air mode
- fault simulation

Product No.
061.91507

More details and technical data:
gunt.de/static/s4646_1.php

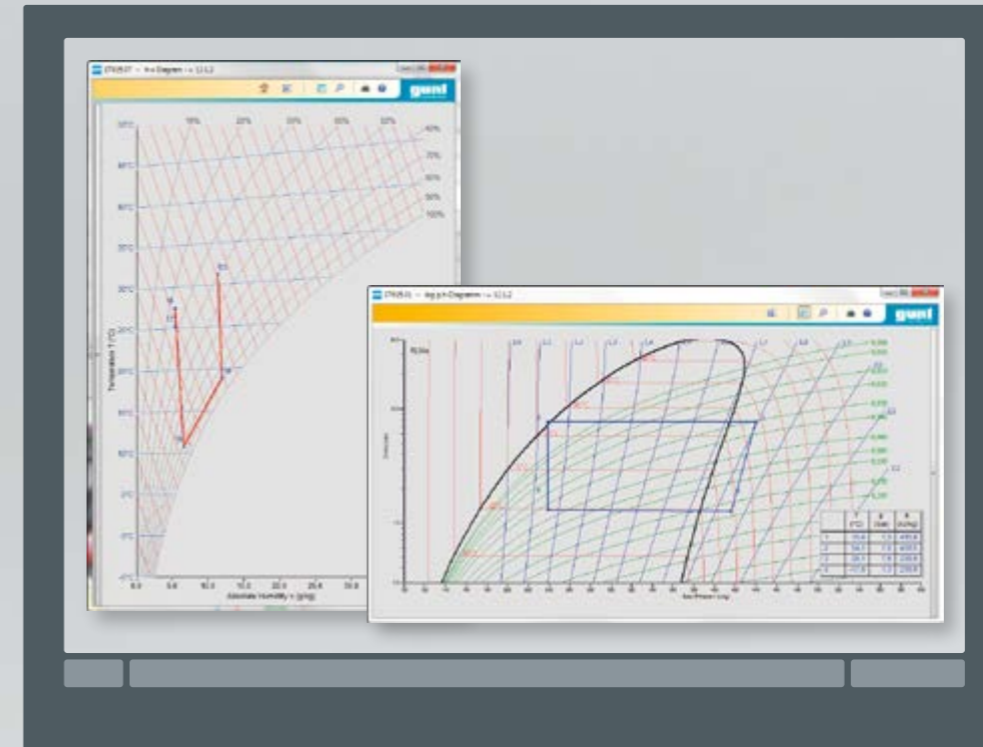
Software for Operation and Data Acquisition

Intuitive operation via selectable buttons in the process schematic



Process schematic

- simple operation of the system via the software
- direct control of the individual components via respective button icons in the process schematic
- visualisation of the selected operating modes
- real-time display of all relevant measured values

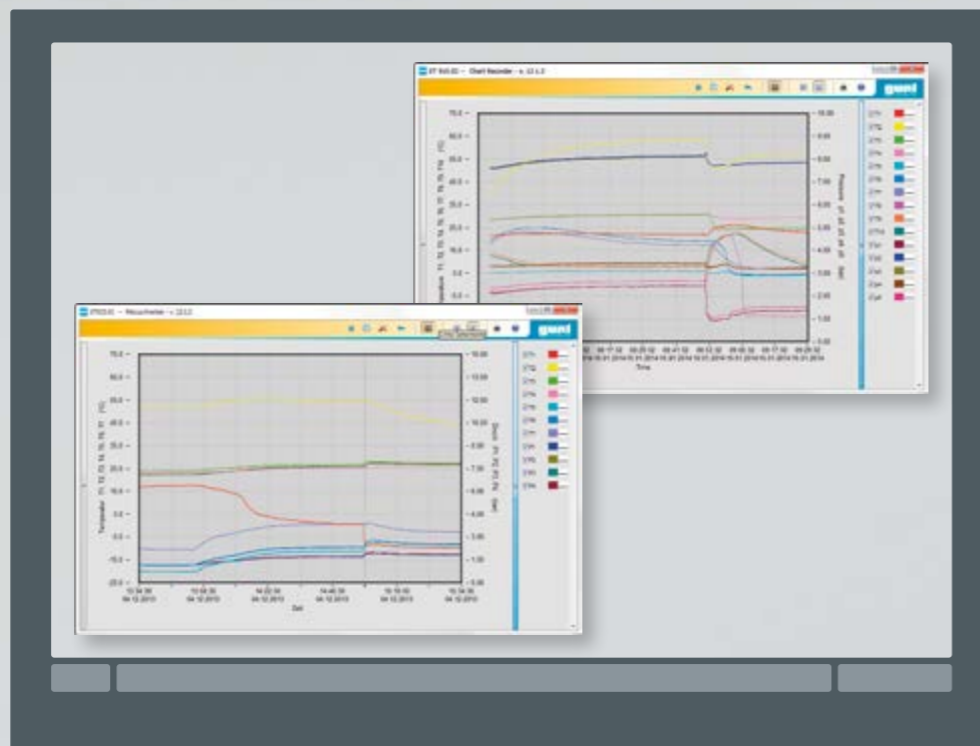


Process diagrams

- real-time representation of the state of humid air in the Mollier h,x diagram
- real-time representation of the refrigeration cycle in the log p-h diagram

Time curve

- representation of the measured values as a function of time
- detection of transient conditions such as start-up and change in the load
- recording and archiving the system's own operating characteristics
- freely selectable display mode
 - ▶ measured values selection
 - ▶ resolution
 - ▶ colour
 - ▶ time intervals



Unique real-time representation of the refrigeration and air conditioning processes

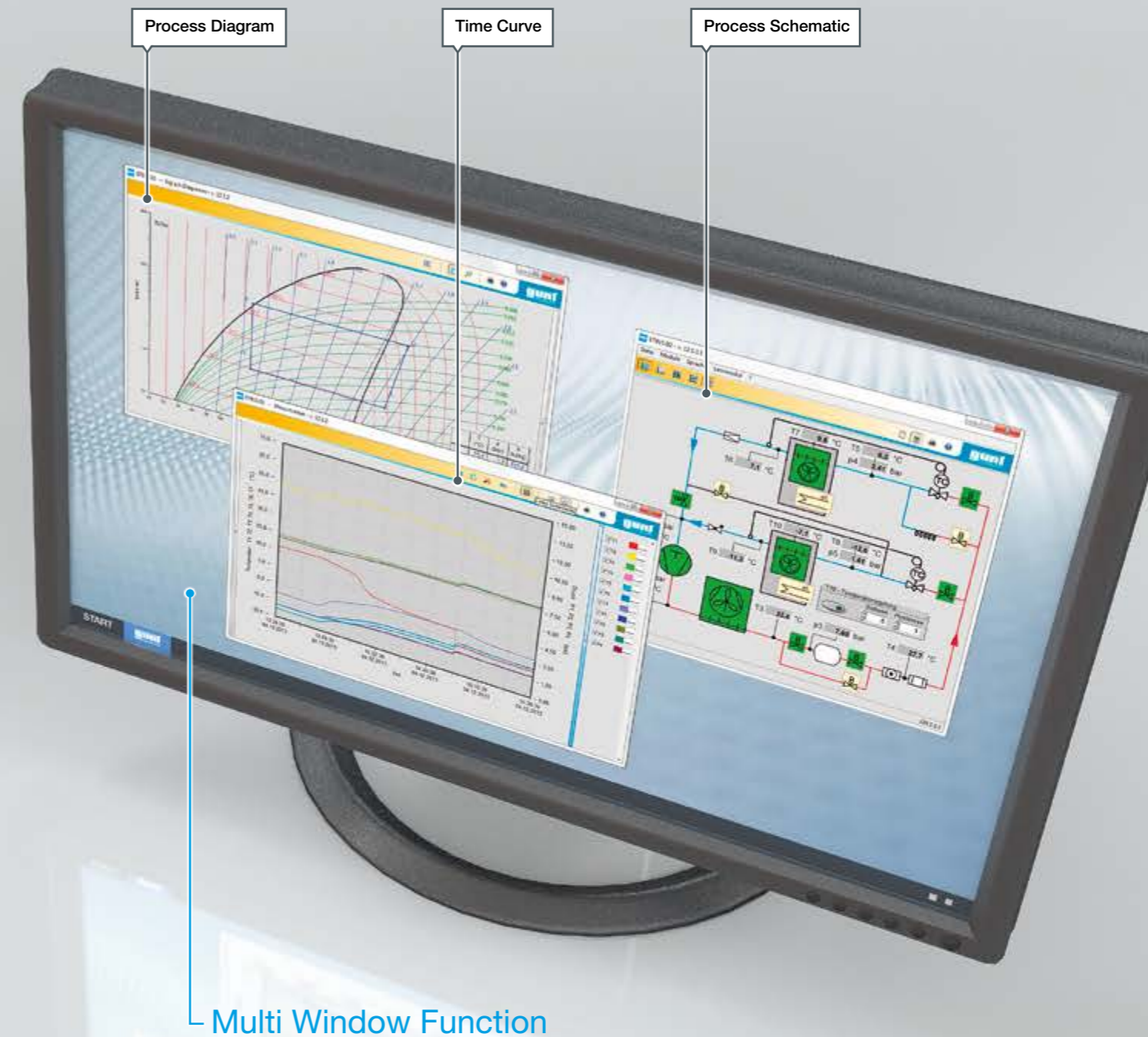
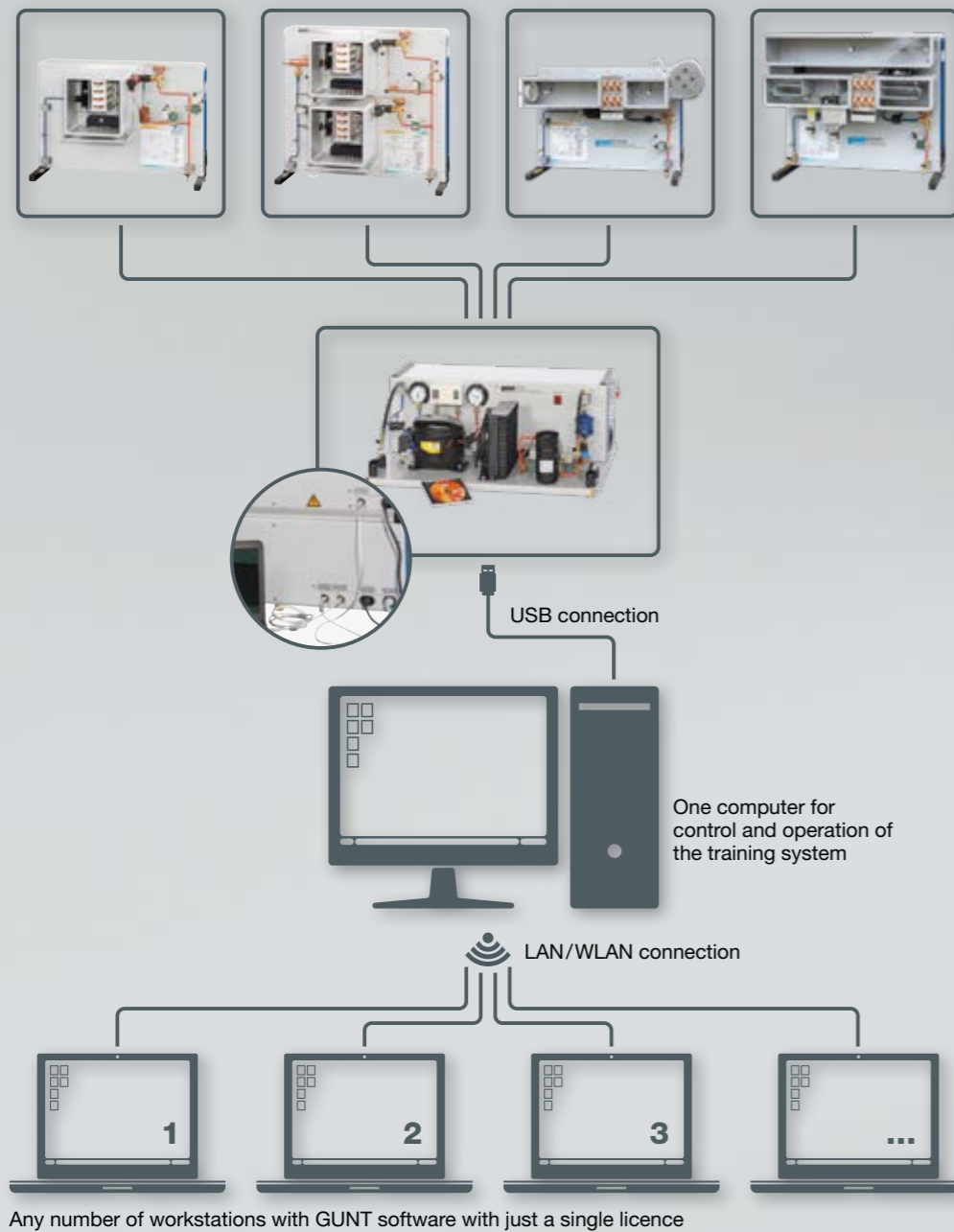
- changes in operating parameters can be seen directly in the respective process diagram
- real-time display of the processes allows students an insight into how the thermodynamic states arise, which are otherwise only considered statically
- visual communication of the functional relationship between the individual components of the machines and the thermodynamic processes



Software for Operation and Data Acquisition

Network capability

- full network access to ongoing experiments by any number of external workstations
- experiments can be independently followed and evaluated by students at all workstations when using a single training system



Display

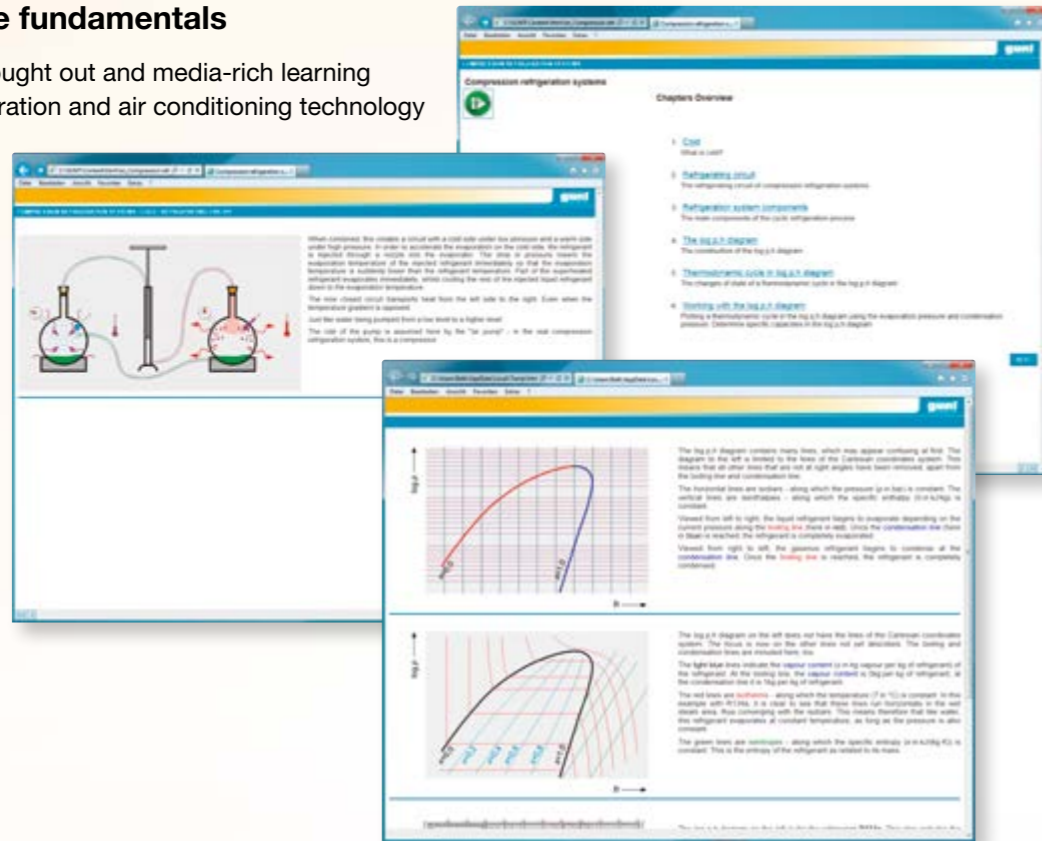
- flexibility in position and arrangement of the various programme windows
- as many windows as required, visualising the operating behaviour of the system at the same time

Training Software

An important component in addition to operation and data acquisition

Course in the fundamentals

Educationally thought out and media-rich learning content in refrigeration and air conditioning technology



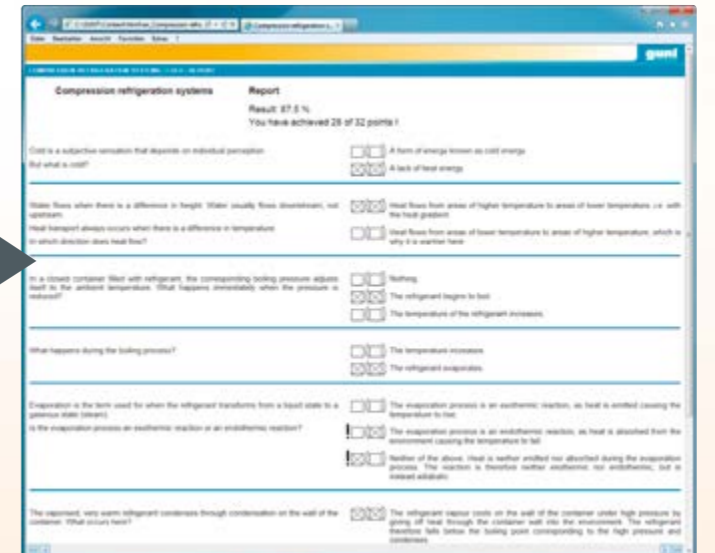
Detailed description of the equipment

- independent preparation for handling the equipment
- explanation of how the equipment works
- function description of the individual components



E-learning

- multimedia course on home PC
- flexibility thanks to learning at your own pace, anywhere and at any time
- increased motivation through originality and playful approach to learning material
- ideal complement to the classroom

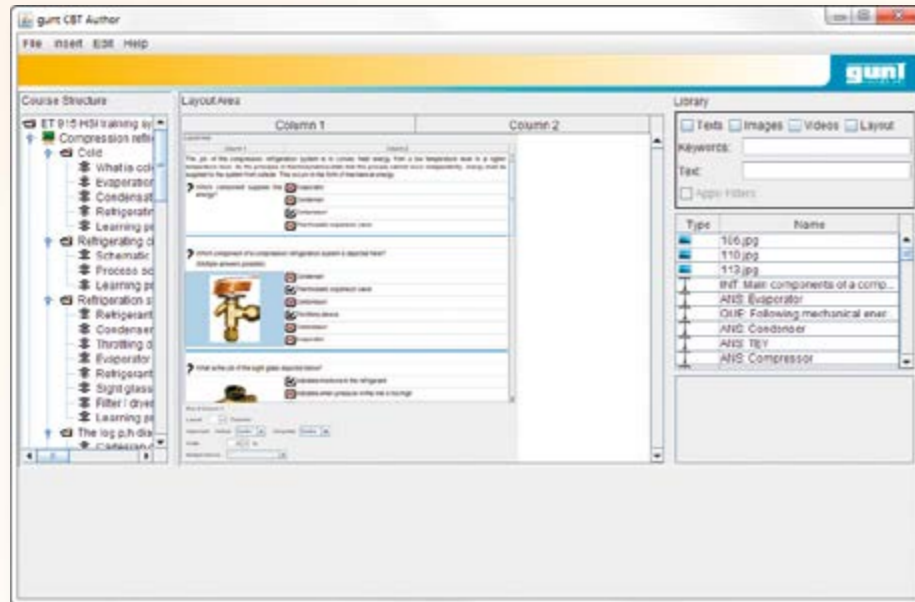


Targeted review of the learning content

- allows learning progress to be checked discreetly and automatically
- identification of weaknesses and targeted encouragement

Training Software

An important component in addition to operation and data acquisition



Design freedom with integration of your own learning content via the authoring system

- no HTML knowledge required
- separate editor for creating the learning content
- intuitive operation
- targeted integration of specific learning content in the software structure
- creation of individual performance assessments
- integration of video clips and animated graphics



Not everyone is able to learn complex topics from books alone...

Benefits at a glance!

- flexibility due to self-determination of the time, duration and location of the learning unit
- allows learning progress to be checked discreetly and automatically
- focus points can be repeated as often as required
- improves the workstation capacity of schools and colleges
- targeted integration of your own learning content in the software structure
- integration of multimedia learning methodology in your students' routine

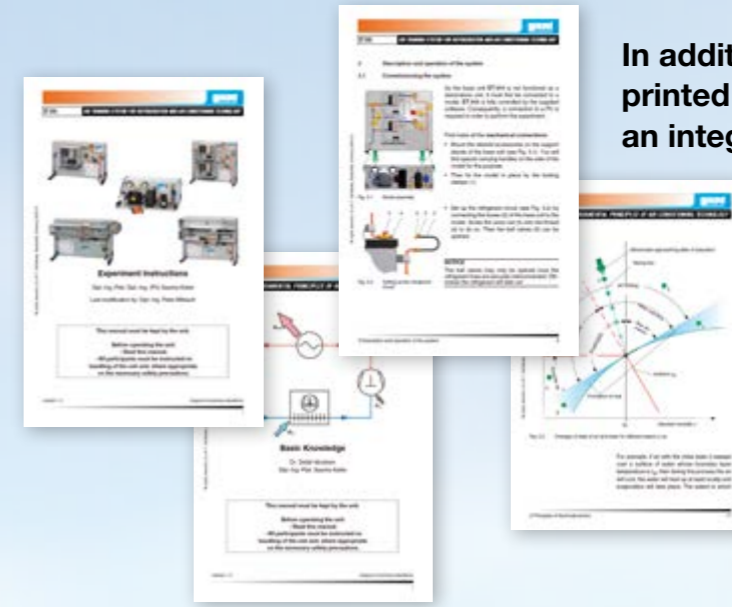
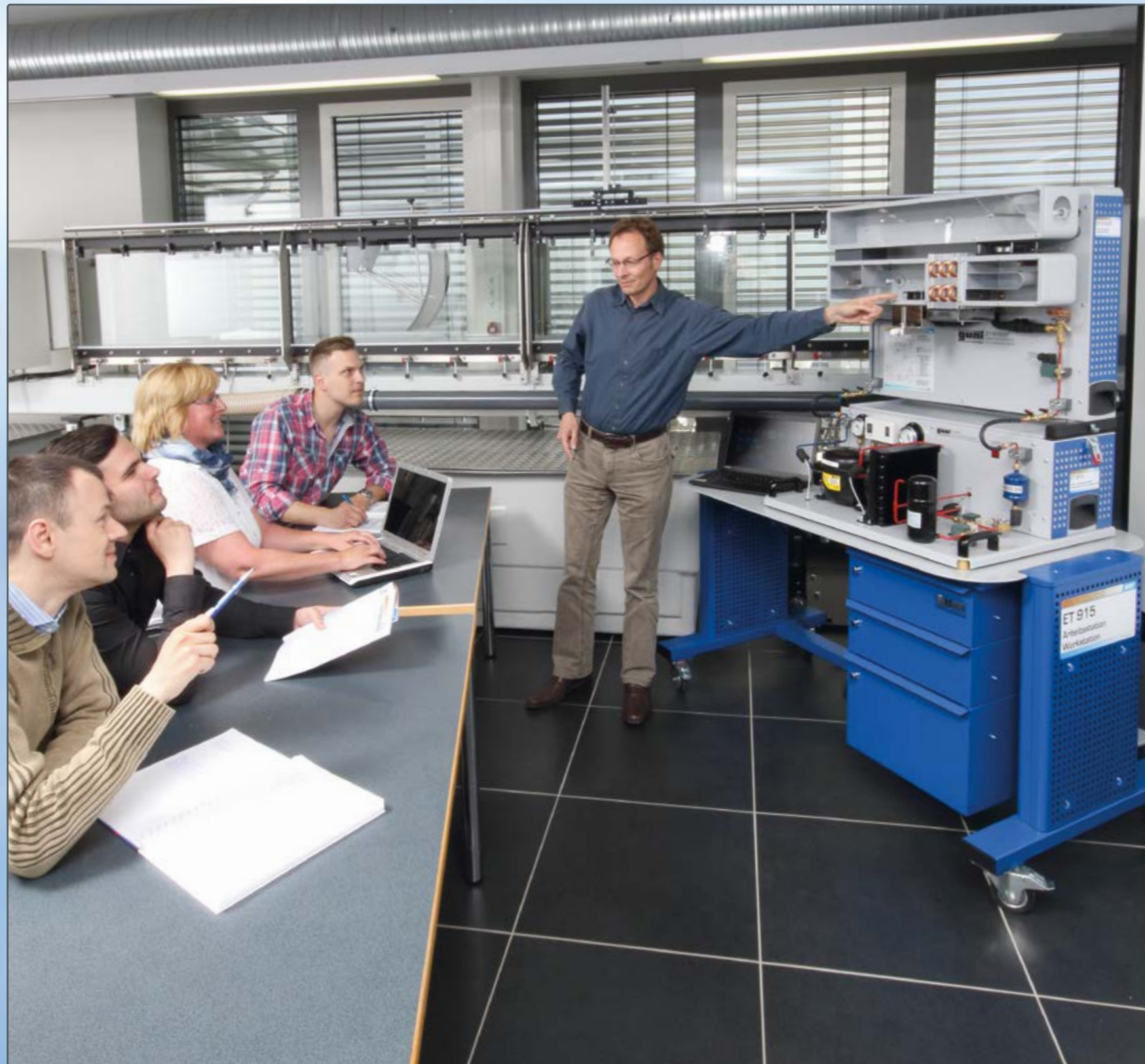


For years we have stood for the highest quality of our devices and the associated instructional material.

Join us to take another step towards the future.

A Few Impressions

An impression from the GUNT training centre



In addition to the software, the printed instructional material forms an integral part of our concept:

- basic principles of refrigeration technology
- basic principles of air conditioning technology
- experiment instructions for ET 915 HSI Training System for Refrigeration and Air Conditioning Technology
- authoring system operating instructions

Laboratory Trolley WP 300.09

Forms a perfect base for a mobile training and experiment device.



Do you need more in the field of refrigeration and air conditioning technology?



» Refrigeration



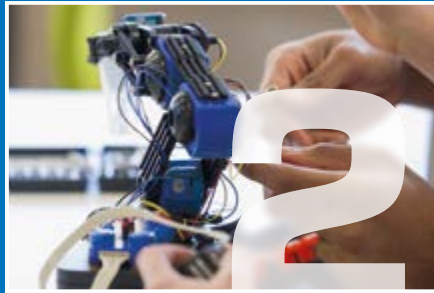
» Air conditioning technology

The complete GUNT programme



Engineering mechanics and engineering design

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



Mechatronics

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



Thermal engineering

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



Fluid mechanics

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



Process engineering

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



2E Energy & Environment

- | Energy | Environment |
|----------------------------------|-------------|
| ■ solar energy | ■ water |
| ■ hydropower and ocean energy | ■ air |
| ■ wind power | ■ soil |
| ■ biomass | ■ waste |
| ■ geothermal energy | |
| ■ energy systems | |
| ■ energy efficiency in buildings | |

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