

ET 611

Air conditioning system with chamber



Description

- real air conditioning system with water chiller and climatic chamber
- chamber for comfort investigations, suitable for test persons to be inside
- air conditioning controller with integrated PLC
- data acquisition by software

Comfort is of great importance in the air conditioning of rooms and buildings. The comfort depends on the temperature, the relative humidity and the flow velocity of the air. According to DIN 13779 a so-called "comfort zone" has been defined which specifies the values an air conditioning system should achieve.

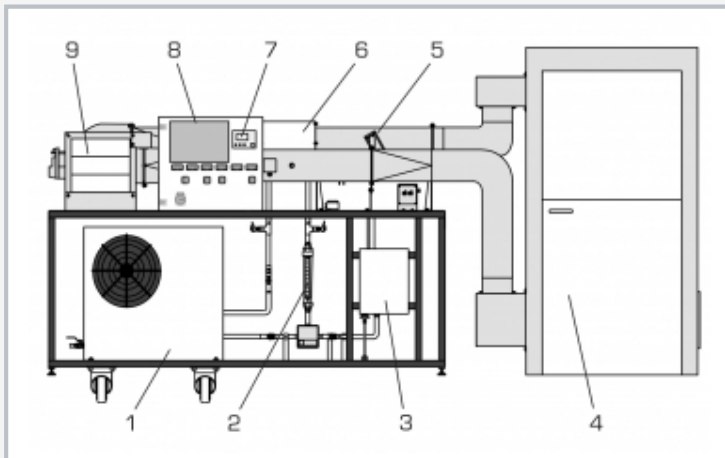
ET 611 is a full air conditioning system with comprehensive test options. The effect of the air humidity and temperature on the comfort is examined. The system has a climatic chamber designed for test persons to be inside. This allows the trainee to study the effect of different system operating states on his own well-being. The components used, such as radial fan, electric air heater, steam humidifier and water chiller are all used in commercial air conditioning and ventilation technology. A PLC air conditioning controller monitors and controls all functions. In addition to the automatic operation it also enables the manual operation of the system.

Learning objectives/experiments

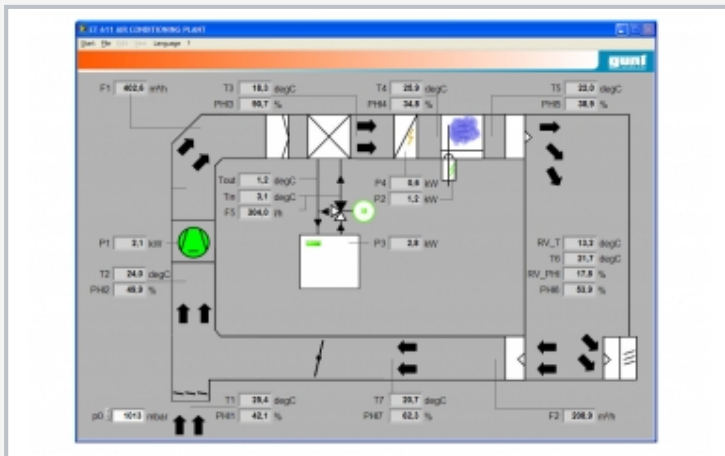
- design, operation and operating behaviour of a real air conditioning system
- recirculating and outer air operation
- changes of state in the h-x diagram for humid air: heating, cooling, humidifying or dehumidifying, mixing
- application of the mixing line
- comfort studies, limit of comfortable humidity
- energy balance in the Sankey diagram
- PLC air conditioning controller
 - ▶ humidity control
 - ▶ temperature control
 - ▶ manual or automatic operation

ET 611

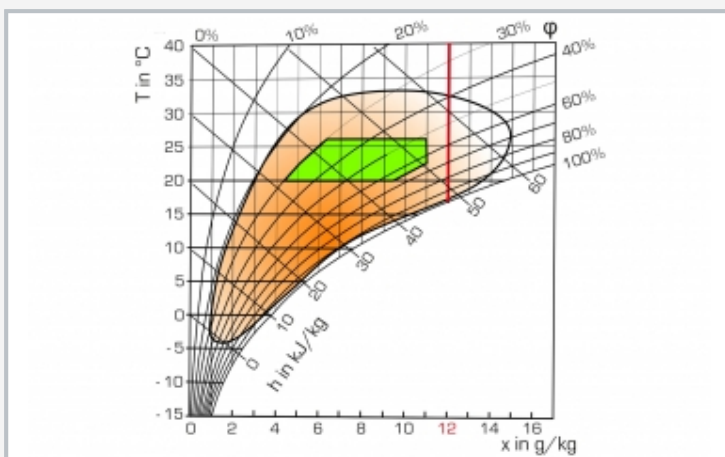
Air conditioning system with chamber



1 water chiller, 2 flow meter, 3 steam humidifier, 4 climatic chamber, 5 steam distributor (humidifier), 6 air cooler, 7 PLC air conditioning controller, 8 switch cabinet with process schematic, displays and controls, 9 outer air inlet with fan; covered: air heater



Software screenshot: process schematic



h-x diagram with comfort zone (green) and limit of comfortable humidity (red; $x=12\text{g/kg}$); h enthalpy, x absolute air humidity, T temperature, ϕ relative air humidity

Specification

- [1] air conditioning system with chamber for conditioning and air technology investigations
- [2] chamber suitable for test persons to be inside
- [3] PLC air conditioning controller, manual and automatic operation
- [4] industrial components: fans, air-cooled water chiller, air cooler, air heater, steam humidifier
- [5] digital displays for air temperature, air humidity, air velocity, temperature of the cold water, power
- [6] refrigerant R407C, CFC-free
- [7] GUNT software for data acquisition via USB under Windows 7, 8.1, 10

Technical data

PLC air conditioning controller

- 17 universal inputs, 4 analogue outputs, 10 switching outputs

Radial fan

- power consumption: 0,75kW
- max. flow rate: $39\text{m}^3/\text{min}$
- pressure difference: 450Pa

Air heater: 6x 250W each

Steam humidifier

- steam capacity: 6kg/h
- power consumption: 4,5kW

Water chiller

- power consumption: 2,1kW
- refrigeration capacity: 6,2kW at 32°C , $\Delta T=5\text{K}$
- fan, volumetric air flow rate: $3500\text{m}^3/\text{h}$
- compressor, power consumption: 2kW
- pump, power consumption: 550W

Air cooler, capacity: 4,84kW

Measuring ranges

- flow rate: 0...1500L/h
- temperature: 8x 0...50°C
- humidity: 6x 0...100%
- flow velocity: 2x 0...20m/s (air)
- power: 4x 0...6kW

400V, 50Hz, 3 phases

400V, 60Hz, 3 phases

LxWxH: 2700x1480x1450mm (system)

LxWxH: 1550x1270x2250mm (chamber)

LxWxH: 1400x600x900mm (water chiller)

Total weight: approx. 830kg

Required for operation

water connection, drain

PC with Windows recommended

Scope of delivery

- 1 trainer, filled with refrigerant
- 1 GUNT software CD + USB cable
- 1 set of instructional material