ET 220

Energy conversion in a wind power plant

Network capable GUNT software for data acquisition: observation, acquisition, analysis of the experiments at any number of workstations via the customer's own LAN/ WLAN network.

Description

- **conversion of kinetic wind energy into electrical energy**
- **practical experiments in laboratory scale**
- **network capability: observe, acquire, analyse experiments via customer's own network**

ET 220 is used to study how kinetic wind energy is converted into electrical energy.

The experimental plant consists of a wind tunnel and a control unit. The wind tunnel contains a wind power plant in laboratory-scale and an axial fan. A rotor and a generator are the core elements of a wind power plant. The control unit includes the control elements for the axial fan, the storage components for the electrical energy and the electrical consumers.

The axial fan generates the air flow required to set the rotor of the wind power plant in rotational motion. A flow straightener ensures the flow is consistent and low in turbulence. A generator converts the rotor's kinetic energy into electrical energy. The electrical energy is fed into a stand-alone system that is not connected to the mains grid. A charge controller in an accumulator provides intermediate storage of the electrical energy. The electrical energy can be used by means of an electrical load. There are two bulbs that can be used as consumers. Optionally, it is also possible to connect an external consumer (such as a heater). There is no provision to feed into a public power grid.

The wind velocity is varied by changing the rotational speed of the fan. The following measurements are captured: wind velocity in front of and behind the rotor, speed of the rotor, voltage and current. The measurements are read off digital displays and can simultaneously be transmitted directly to a PC via USB and analysed there using the GUNT software included. The network capable GUNT software makes it possible to observe, acquire, and analyse the experiments at any number of workstations via the customer's own network with just one licence.

A circuit diagram printed on the control unit makes it easy to assign all components within the isolated network.

Alternatively, in order to conduct experiments under real wind conditions, a larger wind power plant (ET 220.01) can be connected to the control panel. This wind power plant is designed to be set up outside in the open air.

Learning objectives/experiments

- conversion of kinetic wind energy into electrical energy
- function and design of an stand-alone system with a wind power plant
- determining the power coefficient as a function of tip speed ratio
- energy balance in a wind power plant
- determining the efficiency of a wind power plant

- GUNT-E-Learning
  - multi-media online course on the fundamentals of wind power
  - learning independent of time and place
  - access via Internet browser
  - check through targeted review of the learning objectives

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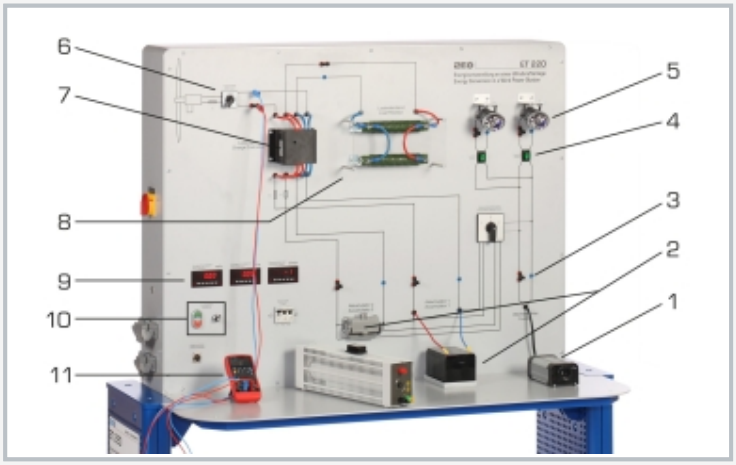
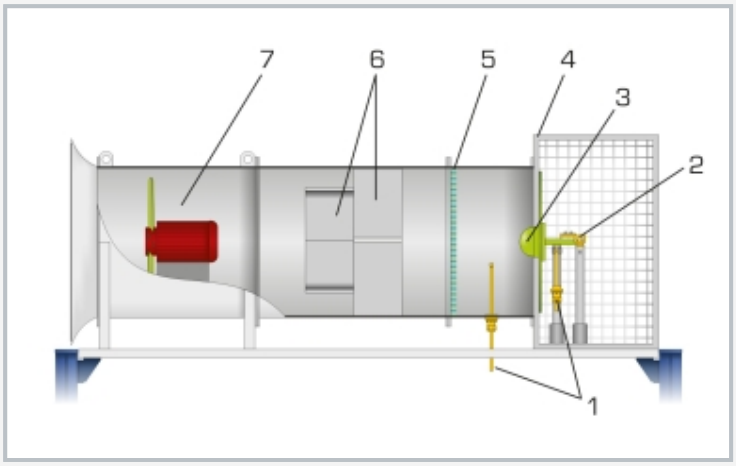
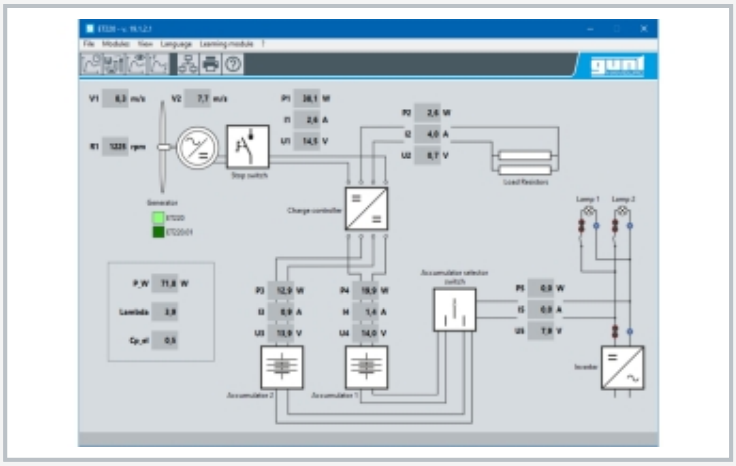


1 inverter, 2 accumulators, 3 current and voltage measuring point, 4 switch for electrical load, 5 bulbs as consumers, 6 wind power plantbrake switch, 7 charge controller, 8 load resistances, 9 displays for wind velocities and speed, 10 control elements for axial fan, 11 multimeter



1 wind velocity sensor, 2 rotor speed sensor, 3 wind power plant, 4 protection cage, 5 flow straightener, 6 guide plates, 7 axial fan



Screenshot GUNT software for data acquisition

Specification

[1] converting kinetic wind energy into electrical energy
[2] laboratory-scale wind power plant, stand-alone operation
[3] axial fan with continuously variable speed (wind velocity)
[4] flow straightener for consistent wind conditions
[5] generator for converting the kinetic energy into electrical energy
[6] accumulator for storing the electrical energy
[7] two bulbs as electrical load (consumers)
[8] measurement of wind velocity in front of and behind the rotor, rotational speed of the rotor, current and voltage
[9] digital displays for the measured values
[10] remote learning: detailed E-Learn course on the basics of wind power accessible online
[11] network capability: observe, acquire, analyse experiments at any number of workstations with GUNT software for data acquisition via the customer's own LAN/WLAN network
[12] GUNT software for data acquisition via USB under Windows 8.1, 10

Technical data

Axial fan
- max. volumetric flow rate: $5 m^3/s$
- max. power: 1,5kW

Rotor: Ø 510mm

Generator
- max. output: 60W
- voltage: 12VDC
- max. charging current: 5A

Accumulator
- voltage: 12VDC
- capacity: 8Ah

Electrical load (bulbs)
- voltage: 12VDC
- power: 55W each

Measuring ranges
- wind velocity: 0,3...50m/s
- speed: $0...3000 min^{-1}$
- voltage: 0...20VDC
- current: 0...35A

400V, 50Hz, 3 phases; 400V, 60Hz, 3 phases
230V, 60Hz, 3 phases; UL/CSA optional
LxWxH: 2600x880x1650mm (wind tunnel)
LxWxH: 1500x800x1750mm (control unit)
Total weight: approx. 380kg

Required for operation

PC with Windows recommended

Scope of delivery

1 wind tunnel, 1 control unit
1 set of measuring instruments
1 GUNT software + USB cable
1 set of instructional material

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Optional accessories

for Remote Learning		
010.10000	GU 100	Web Access Box
with		
061.22000W	ET 220W	Web Access Software

Other accessories		
061.22001	ET 220.01	Wind power plant