

CE 310

Supply unit for chemical reactors



Description

- supply unit for various reactors (CE 310.01 – CE 310.06)
- saponification reaction with conductivity measurement to determine the conversion
- preheating of the reactants

The reactor is the core element of a chemical production facility. In the reactor, the starting substances (reactants) react with each other to form a new substance (product). The reactor has to guarantee the conditions for an optimal reaction process. This primarily concerns the temperature in the reactor. Different types of reactors are used, depending on the requirements.

CE 310 serves as a supply unit for six different reactors. The reactor to be examined is mounted onto the supply unit and held by two pins in position.

For continuous operation of the reactors, two tanks for the reactants are arranged on the trainer. The supply unit and the reactor are hydraulically connected via hoses. The hoses are equipped with quick-release couplings for easy attachment. Two pumps convey the two reactants into the reactor. The retention time of the reactants in the reactor can be adjusted via the pump speed. In the reactor, the reactants react to form a product.

An additional tank and an additional pump for the product is provided.

The supply unit is equipped with a heating water circuit with pump, tank and heater to control the temperature in the reactor. The cold water circuit can be fed from the WL 110.20 water chiller.

Conductivity and temperature in the reactor are measured with a combined sensor. The switch cabinet contains the necessary controls to start the stirrers in the different reactors.

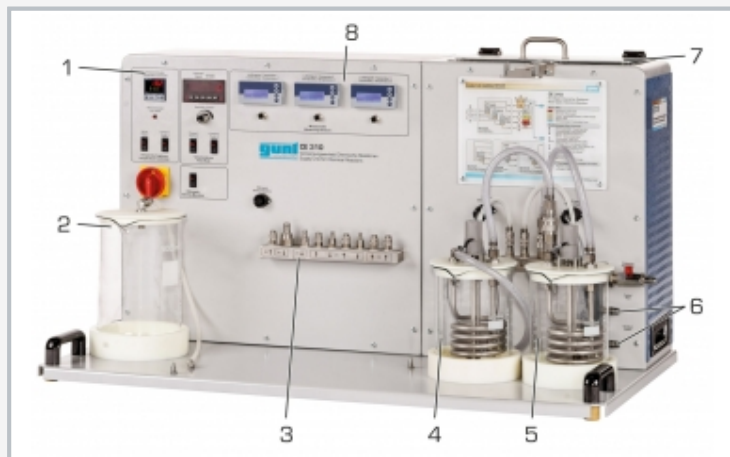
The measured values are digitally displayed on the switch cabinet. At the same time, they can also be transmitted directly to a PC via USB where they can be analysed with the data acquisition software included in the scope of delivery.

Learning objectives/experiments

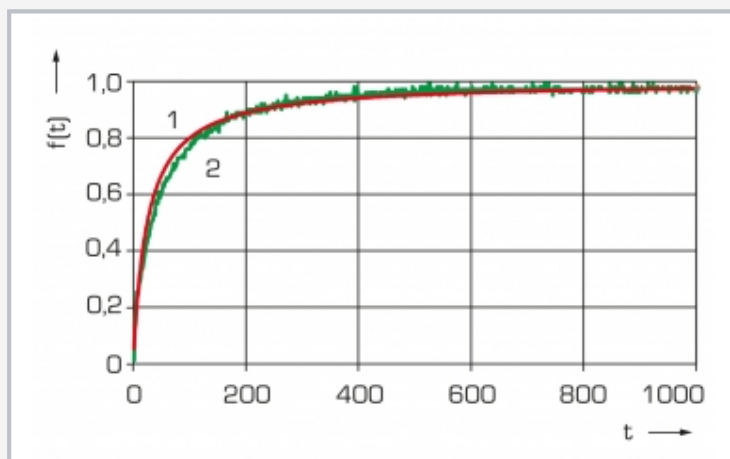
- learning the design and operation of different reactor types
- conversion depending on
 - ▶ reactor type
 - ▶ retention time in the reactor
 - ▶ temperature
 - ▶ concentration
- fundamentals of a saponification reaction
- determination of the retention time distribution

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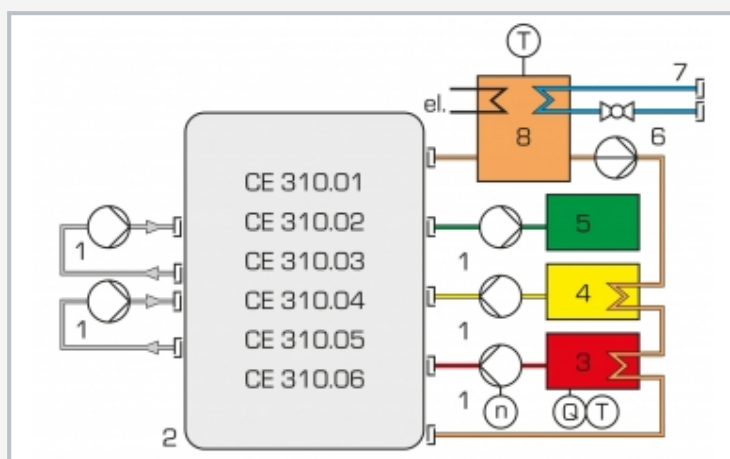
Supply unit for chemical reactors



1 displays and controls, 2 product tank, 3 connection block, 4 and 5 tanks for reactants, 6 water connection, 7 water tank, 8 display of conductivity and temperature



Course of conversion over time with discontinuous stirred tank reactor (CE 310.04)
1 theoretical conversion, 2 measured conversion; $f(t)$ conversion, t time



Process schematic with supply unit CE 310
1 peristaltic pump, 2 reactor, 3 reactant A, 4 reactant B, 5 product, 6 water pump, 7 water connection, 8 water tank; Q conductivity, n speed, T temperature

Specification

- [1] supply unit for 6 different chemical reactor types
- [2] connection of the reactors via hoses with quick-release couplings
- [3] water circuit with tank, heater, temperature controller, pump and low water cut-off for heating and cooling (with WL 110.20 water chiller)
- [4] temperature control of the reactants and reactors
- [5] 3 glass tanks for reactants and products
- [6] 5 peristaltic pumps to deliver the reactants and products
- [7] 2 combined sensors for measuring the conductivity and temperature
- [8] GUNT software for data acquisition via USB under Windows 7, 8.1, 10

Technical data

Peristaltic pump for reactants
 ■ max. flow rate: approx. 120mL/min
 ■ with hose 8,0x4,8mm

Peristaltic pump for products
 ■ max. flow rate: approx. 240mL/min
 ■ with hose 8,0x4,8mm

Water pump
 ■ max. flow rate: 10L/min
 ■ max. head: 30m
 ■ power consumption: 120W

Heater
 ■ power consumption: 3000W

Tanks
 ■ reactants: 2x 3L
 ■ product: 5L
 ■ heating water: 8L

Measuring ranges
 ■ conductivity: 0...100mS/cm
 ■ temperature: 0...60°C
 ■ speed of the peristaltic pumps: 1x 0...100min⁻¹

230V, 50Hz, 1 phase
 230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
 UL/CSA optional
 LxWxH: 1170x670x690mm
 Weight: approx. 82kg

Required for operation

water connection, drain / WL 110.20
 Ethyl acetate, caustic soda (for saponification reaction)
 PC with Windows recommended

Scope of delivery

- 1 experimental unit
- 2 combined sensors (conductivity and temperature)
- 1 GUNT software CD + USB cable
- 1 set of instructional material

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Optional accessories

083.31001	CE 310.01	Continuous Stirred Tank Reactor
083.31002	CE 310.02	Tubular reactor
083.31003	CE 310.03	Stirred Tanks in Series
083.31004	CE 310.04	Discontinuous Stirred Tank Reactor
083.31005	CE 310.05	Plug-Flow Reactor
083.31006	CE 310.06	Laminar flow reactor
060.11020	WL 110.20	Water Chiller
020.30009	WP 300.09	Laboratory trolley