

# HM 332

## Pump characteristics for parallel and series configuration



screen mirroring is possible on up to 10 end devices

### Description

- operation of centrifugal pumps in parallel and series configuration
- plant control using an integrated PLC
- integrated router for operation and control via an end device and for screen mirroring on up to 10 end devices: PC, tablet, smart-phone

In practice, several pumps are often installed either in parallel or in series configuration for economic reasons. In parallel configuration the pumps operate in a common pipe. This requires that the pumps used in each case can achieve the same head. Parallel configurations offer the advantage that when demand is low only one pump works and other pumps are switched on as the flow rate increases. In series configuration pumps with equal flow rates are arranged in a row. This arrangement allows the bridging of large heads and is often more cost-effective than the use of a single pump with large head.

HM 332 studies the cooperation of two centrifugal pumps and illustrates the differences in parallel and series configuration.

The trainer has a closed water circuit and is equipped with two identical

centrifugal pumps. The rotational speed of the motors for the pumps can be adjusted via frequency converters. All motors are mounted on swivel bearings so that the drive torque can be measured via a force sensor, allowing the mechanical drive power to be determined. Sensors detect the pressures at inlet and outlet of the pumps. The flow rate is measured by an electromagnetic flow meter. The performance data of the pump and losses in the pipe are calculated and shown in the form of characteristics. Characteristic parameters of pumps are determined from the measured values. Furthermore, students are familiarised with the operating behaviour of centrifugal pumps and can practise the correct way to start up and shut down such a pump system.

The trainer is operated and controlled by the integrated PLC with touch screen. By means of an integrated router, the trainer can alternatively be operated and controlled via an end device. The user interface can also be displayed on up to 10 end devices (screen mirroring). Via the PLC, the measured values can be stored internally. Access to stored measured values is possible from end devices via WLAN with integrated router/ LAN connection to the customer's own network.

### Learning objectives/experiments

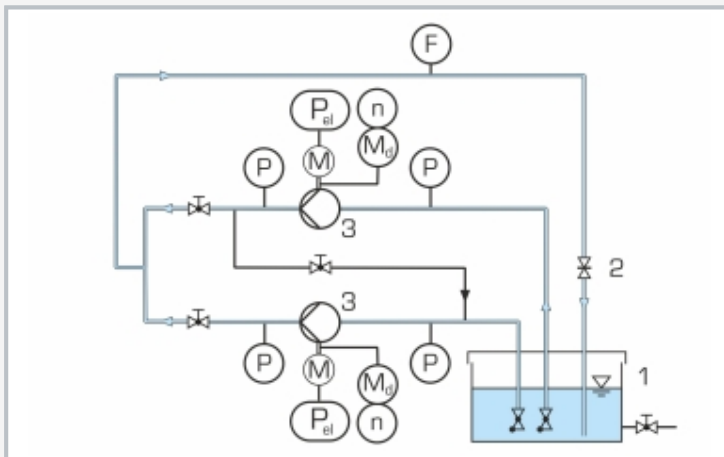
- investigate behaviour of centrifugal pumps in operation
- recording pump characteristics
- recording system characteristics
- determining efficiency
- investigation of series and parallel configuration of pumps
- starting up and shutting down pump systems
- screen mirroring: mirroring of the user interface on up to 10 end devices
  - ▶ menu navigation independent of the user interface shown on the touch screen
  - ▶ different user levels available on the end device: for observing the experiments or for operation and control

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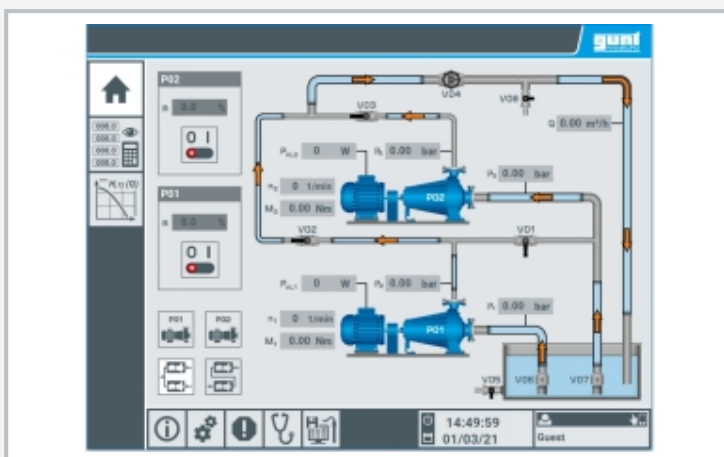
## Pump characteristics for parallel and series configuration



1 electromagnetic flow meter, 2 drive motor, 3 force sensor, 4 storage tank, 5 pump, 6 touch screen, 7 pressure sensor



Parallel configuration of pumps: 1 storage tank, 2 valve for adjusting the flow rate, 3 pump with drive motor; P pressure, F flow rate, n speed,  $M_t$  torque,  $P_{el}$  power



User interface on the touch screen: welcome screen with pumps in parallel configuration

### Specification

- [1] trainer with 2 centrifugal pumps which are operated in series or parallel configuration
- [2] plant control with PLC, operation via touch screen
- [3] integrated router for operation and control via an end device and for screen mirroring: possible to mirror the user interface on up to 10 end devices
- [4] closed water circuit
- [5] drive motors with adjustable speed
- [6] motor with pendulum bearing, torque measurement via lever arm and force sensor
- [7] inductive speed sensor on the motor
- [8] electromagnetic flow meter
- [9] data acquisition via PLC on internal USB memory, access to stored measured values via WLAN with integrated router/ LAN connection to customer's own network

### Technical data

PLC: Weintek cMT3092X

2 pumps

- max. flow rate:  $19,8\text{m}^3/\text{h}$
- max. head: 23m

2 drive motors

- power output: 1,1kW
- speed range:  $0\text{...}3000\text{min}^{-1}$

Storage tank: 280L

Measuring ranges

- pressure (inlet):
  - ▶ pump 1:  $-1\text{...}0,6\text{bar}$
  - ▶ pump 2:  $-1\text{...}3\text{bar}$
- pressure (outlet):
  - ▶ pump 1:  $0\text{...}2,5\text{bar}$
  - ▶ pump 2:  $0\text{...}6\text{bar}$
- flow rate:  $0\text{...}600\text{L}/\text{min}$
- speed:  $2 \times 0\text{...}3000\text{min}^{-1}$
- torque:  $2 \times 0\text{...}10\text{Nm}$
- power:  $2 \times 0\text{...}2,2\text{kW}$

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 230V, 60Hz, 3 phases

UL/CSA optional

LxWxH: 2260x790x1760mm

Weight: approx. 400kg

### Required for operation

PC with Windows recommended

### Scope of delivery

- 1 trainer
- 1 hose
- 1 set of tools
- 1 set of instructional material