

## ANALYSE TO OPTIMIZE



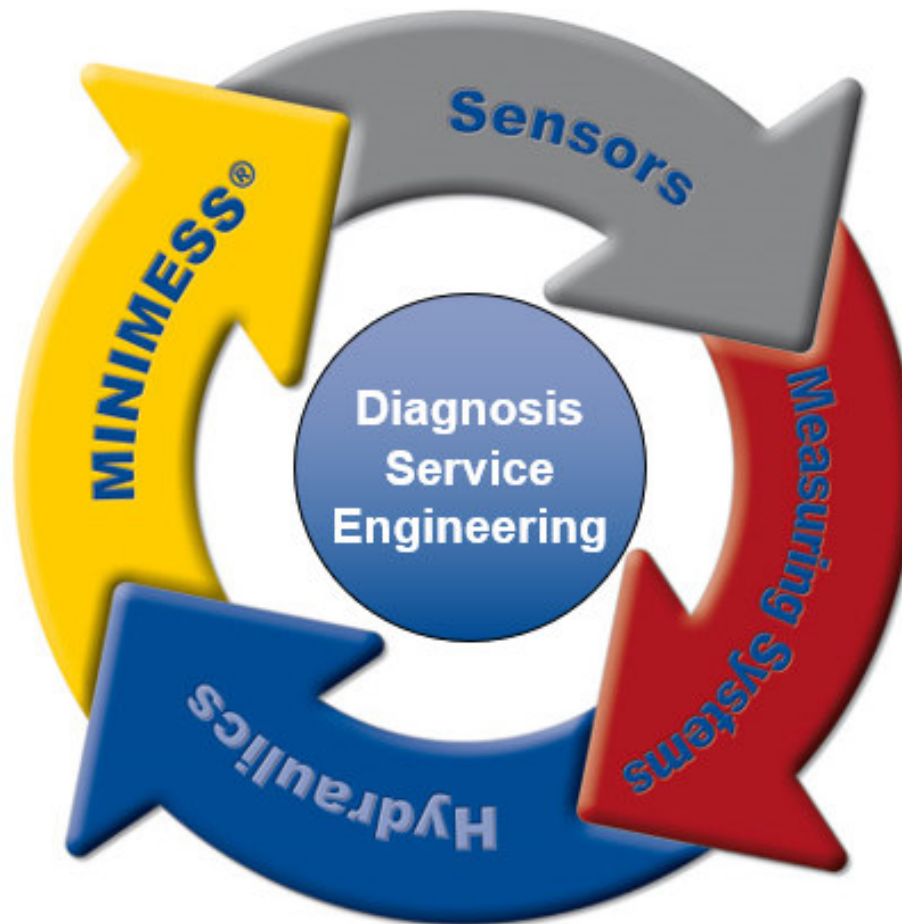
Limburg



**HYDROTECHNIK**  
ANALYSE TO OPTIMIZE

**HYDROTECHNIK**

# Covering the complete Measuring Chain



## Minimess® Test Points

- mechanical interface to high-pressure systems



## HySense® Sensors

- reliable recording of numerous physical quantities



## Measuring Systems

- data collection, evaluation and process control



# Gym machine application

Training or strength machines are available in a wide variety of designs, but with one thing in common: All of them generate a resistance / load that has to be moved in order to load and train the desired muscle group. For most machines, this load force takes place using external or integrated weight disks.



A much more compact and simpler solution is to generate and regulate this load hydraulically - with the aid of cylinders and throttle valves. Our customer specializes in this type of hydraulic fitness machines and uses our pressure sensors for load setting and monitoring during training.





# Gym machine application

The function of such hydraulic training machines is quite simple. One or more cylinders are firmly connected to the frame on one side and to the unit to be moved on the other side. During the training, the free-moving unit is moved and thus the cylinder is also subject to tension or pressure. With the integrated throttle valve in the cylinder, the flow resistance can be regulated, and thus the load intensity can be adjusted. The disadvantage of this design is that the load depends on the temperature and the speed of execution. If the oil heats up during use, the load decreases linearly. If the speed of movement is varied during the exercise, the load also varies quadratically.

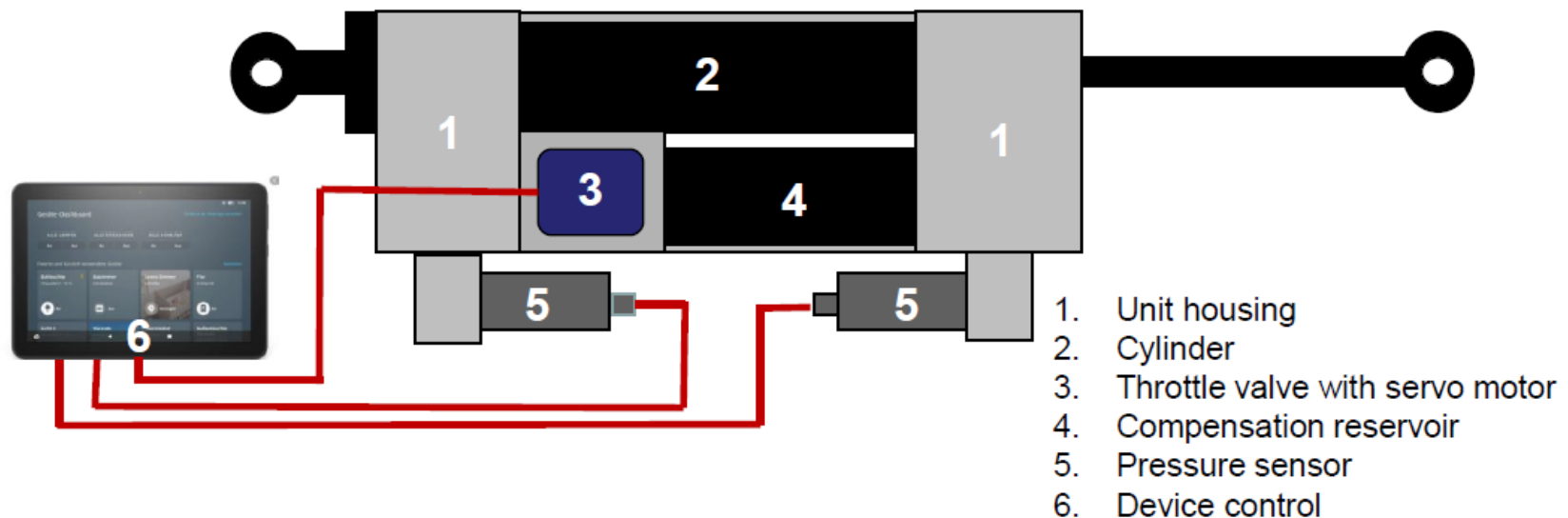


# Gym machine application

In order to eliminate these dependencies, our customer modified this design with a control loop. The modified design of the load unit looks like following.

Two pressure sensors are installed on the cylinder, which record the cylinder pressures (piston and piston rod side). The throttle valve is equipped with a servomotor, which can increase or decrease the flow resistance as required. The change in temperature and movement speed is compensated by regulating the throttle valve, so the applied load remains constant during training. Everything is controlled via the integrated device control.

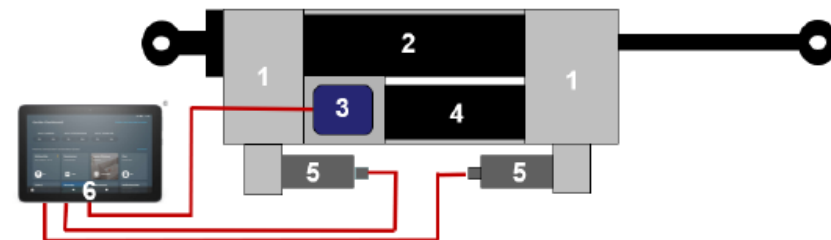
*Schematic figure*



# Gym machine application

**With this solution, our customer can offer the following advantages:**

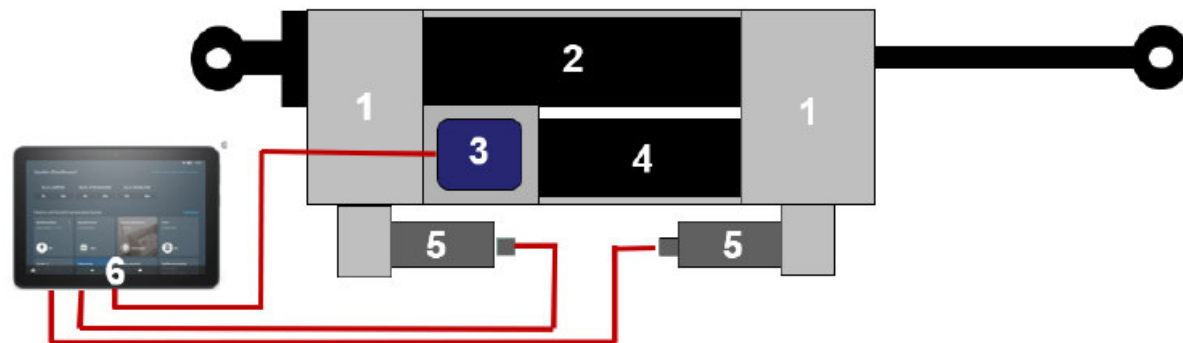
- load can be adjusted electronically and continuously
- oil temperature has no influence on the set load
- load remains constant, even when the speed of movement varies
- number of repetitions are automatically counted
- Training sequences (load & repetitions) are automatically recorded. In this way, the training progress (important for health insurance companies, rehabilitation centers, etc.) is documented automatically



# Gym machine application

## Standard HySense® PR 130

- electrical connector M12 4 pol.
- mechanical connector G 1/4"
- pressure range: 0 ... 250 bar
- signal : 0 ... 10 V



# Gym machine application

## Case Study - Pressure Sensors in fitness machines

Measuring the pressure in exercise equipment

- electronic and stepless load regulation
- load independent of the oil temperature
- load independent of the movement speed
- automatic recording of repetitions
- automatic documentation of the training progress





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Tel.: 037/ 7777 911 Email: [sale@bibus.sk](mailto:sale@bibus.sk)  
Fax.: 037/ 7777 999 <http://www.bibus.sk>

## Hydrotechnik GmbH

Holzheimer Str. 94-96  
D-65549 Limburg

Tel.: +49 6431 4004-633

Mob.: +491622722450

[davide.scaffidi@hydrotechnik.com](mailto:davide.scaffidi@hydrotechnik.com)