

## Hydraulic Power Unit

Highly dynamic hydraulic power unit for setting and controlling hydraulic circuits in test specimens

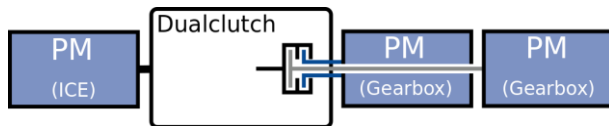
- Pressure control up to 150 Hz
- Oil temperatures of up to 120 °C
- Two independent oil circuits with up to 70 bar and 25 l/min



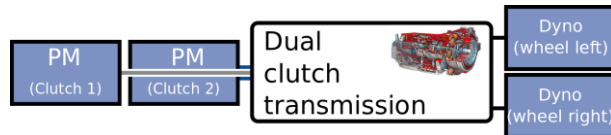
## Modularity

The test bench offers a very high degree of modularity, allowing a large number of arrangements of motors and test specimens. Below you will find three examples.

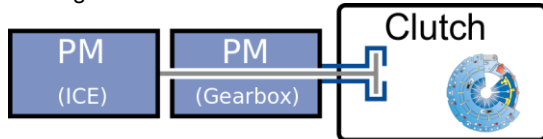
- Double clutch validation



- Dual clutch transmission validation



- Single disc clutch validation



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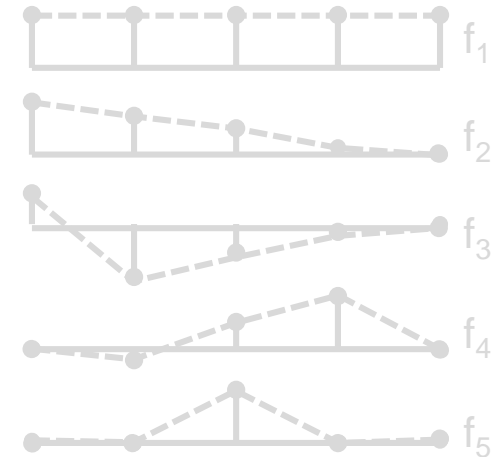
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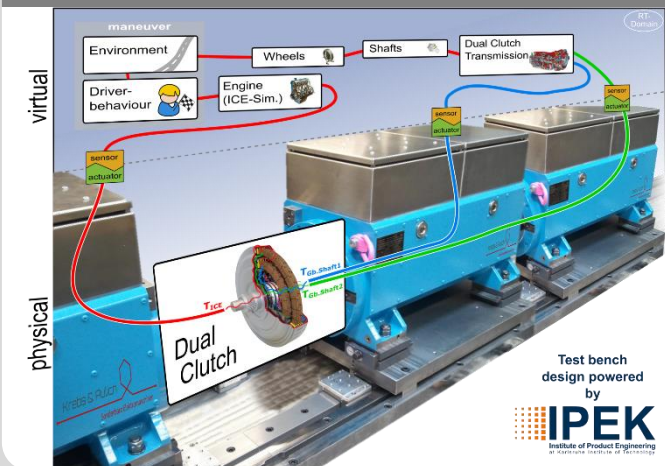


## MCP

### Multi Component Test Bench



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## Technical specifications

### High Dynamic Motors

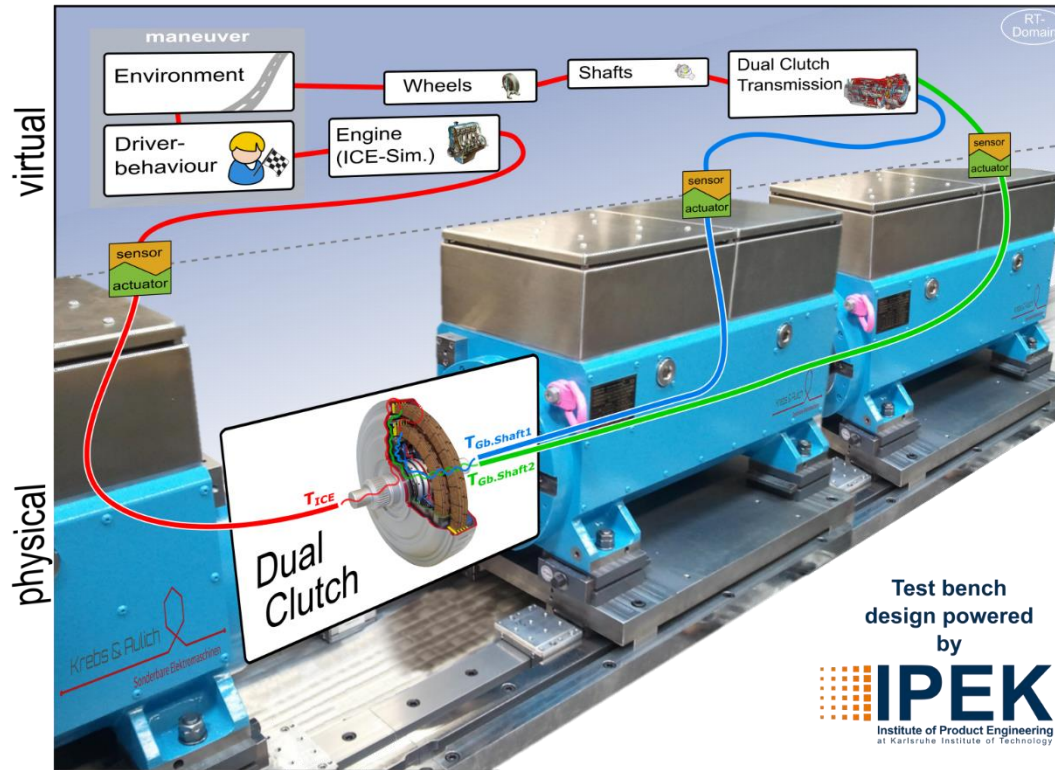
- Power: 3 x 367 kW
- nom. speed: 5.000 min<sup>-1</sup>
- max. speed: 10.000 min<sup>-1</sup>
- torque: 700 / 1.200 Nm
- torque excitation up to 500 Hz
- Rotor inertia: 0,175 kgm<sup>2</sup>
- Hollow shaft design / Tandem operation

### EtherCAT® Fieldbus

- Real-time Ethernet
- Cycle time: 1/8000 s
- Flexible EtherCAT® topology
- Wide range of I/O components
- EtherLab® Master

### Real-Time Environment

- Jäger ADwin-Pro II: Powertrainsimulation, digital signal processing up to 50 kHz
- Test bench control using flexible MATLAB®/Simulink®-Models
- Automatic mode, e.g. endurance run
- Analog und digital I/O interfaces
- FPGA programming



Visualization of the IPEK XiL-framework with transition from physical to virtual subsystem using a dual clutch as an example

### Key Specifications

- Modular motor concept - short set-up time for conversion of the test assembly
- Topology variability: coaxial motor arrangement, parallel motor arrangement, and much more.
- Hollow shaft design of highly dynamic motors for modern validation methods (see exemplary investigations)
- Motor coupling for double power output (tandem operation)
- Simple integration of sensors

## Investigation examples

### Dual Clutch-in-the-Loop

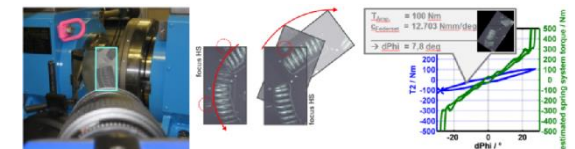
Investigation of the overlapping phases of dual-clutch systems under conditions similar to those of the real system, e.g. by mapping the combustion engine rotational uniformity or the downstream drive train interaction (Fig. left).

### Gearbox-in-the-Loop

Analysis of the overall driveline dynamics using individual physical components with virtually available residual driveline to determine judder and shuffle sensitivity.

### Subsystem-in-the-Loop

Optical investigation of the spring behaviour of vibration isolators under near operational interactions through improved one-sided accessibility in twin-engine operation.



### WorkingSurfacePair-in-the-Loop

Investigation of the oil flow in wet clutch systems using particle image velocimetry under highly dynamic system excitation.

