EMEC PROTOTYPING

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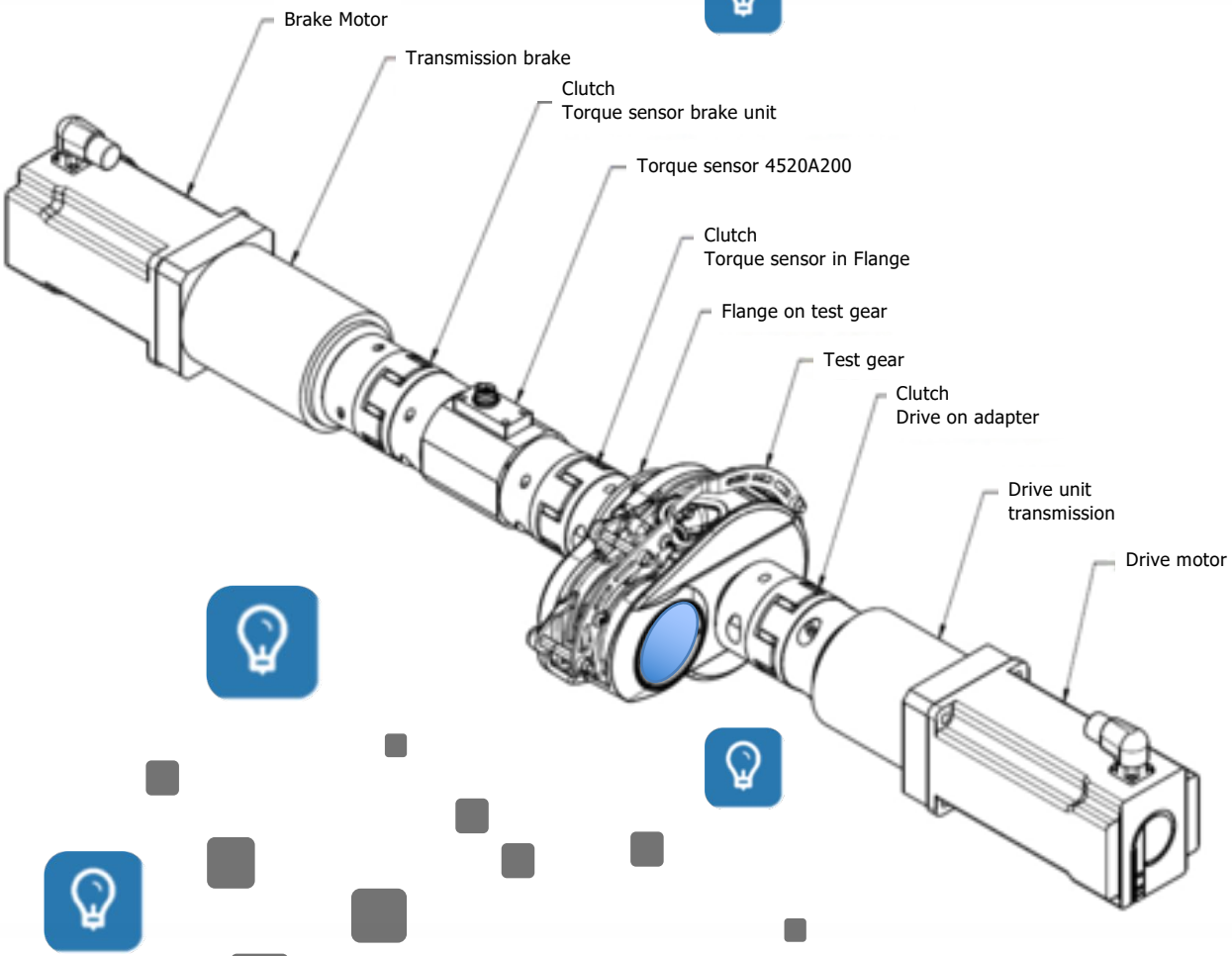


Engine Test for test and evaluation of Pedelec drives

- **Scalable**
- **Adaptive**
- **Dynamic**

System Test for E-Bikes

02

Introduction

The most important indicators in the concept phase, the planning and development of electric bicycles are quality and safety. Due to the short development cycles are the indicators that demand a high degree of flexibility during testing and verification.
The system test for drive unit is compact and built on industry standards. It allows you to perform a reliable and comprehensive endurance test and analysis of your quality requirements and the applicable safety standards of E-bikes, Pedelecs and S-Pedelecs.
EMEC prototyping offers you a highly dynamic, adaptive and scalable system test that grows with your needs along the value chain. In addition, you can perform with a upgrade the same software on following test: component testing, Hardware-in-the-Loop testing and End-of-Line testing.

Range of Application

- Efficiency measurement and power consumption determination
- Durability from mechanical and electrical components
- Maximum performance check according to EPAC-Standard
- Power curve determination from a drive system
- Overheating investigation under high load (uphill ride)
- Quality and Research & Development test
- Deal and customer feedback implementation
- Verification of safety standard **DIN EN 15194**
- Hardware-in-the-loop components validation

Deployment Scenarios

Drive Units durability

Full automised End of Line system test

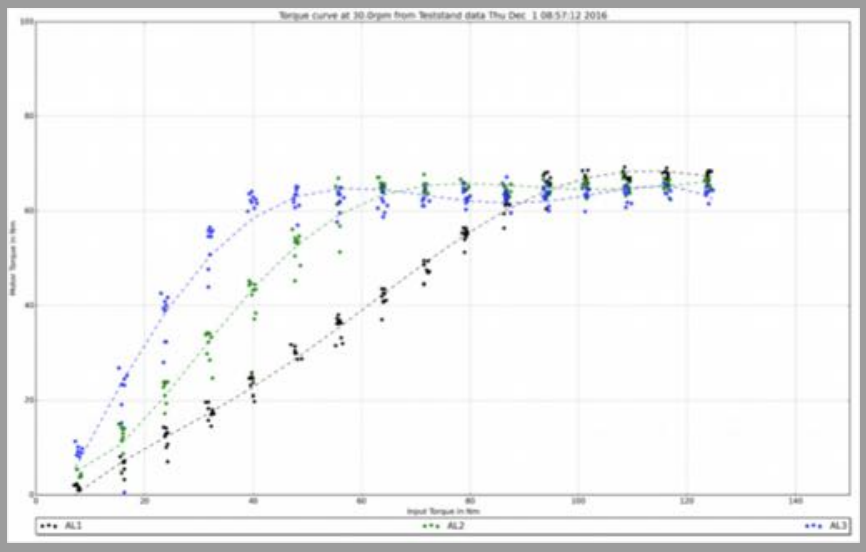
Laboratory and Development Tests

Hardware-in-the-Loop System Test with CAN-bus analysis

Technical Design

Hardware

The test drive unit is driven on the bracket by one Servodrive. The motor can either simulate a sinusoidal saddle or apply a constant, uniform torque. On the drive's chainring, a Servodrive is braking or accelerating along the output side. The rpms an torques can be measured at the drive unit and the output. The control system can simulate brake effects such as slope or air friction. Those are modelled as dynamic load. The test bench consists of two test stations that can be upgraded up to four. The test stations can also be subjected to a climate cycle.



Automatic determination from the drive characteristic in different steps

General

Dimensions of test bench (max.)	L = 1.800 mm H = 1.100 mm B = 0.600 mm
Drive Adapter	Cranket adapter according to customer specifications (Square, Multi-Tooth, Holowtech II, ISIS-Drive, Customers specifications)
Input torque (Torque of simulated cyclist)	Weighing ride simulation with predefined forms (sine-wave form) Free programmable wave forms
Drive	Up to 2100 Watt continuous rated power Up to 200 Nm rated torque Single-sided input torque

Technical Design

Brake Performance (realtime environment simulation)

Max. Output rpm	Up to 200 rpm
Braking characteristics at chainring	2400 Watt continuous rated power 180 Nm continuous brake torque 240 Nm brake torque (Peak)
Dynamic acceleration simulation	Realistic specifiable acceleration characteristic

Torque & RPM of input drive and brake

Sample rate	10 ms
Resolution*	Torque: 0,1 Nm | Rotation speed: 0,1 rpm
Repetition accuracy*	Up to 1%

Electricity and voltage of Pedelec drive

Measurement frequency	10 ms 1 ms for 1 minute for analysis ((Scope-functionality)
Resolution	0,1 V ; 0,1 A
Electricity supply	Internal from power supply Cycle's battery 24 - 54 Volt

Temperature Measurement

Resolution	1 °C
Quantity	Up to 4 sensors (optional 8)

Safety Standard DIN 15194

Machinery Directive 2006/42/EG

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*depend of measurement method

Operating Modes

Manual operation

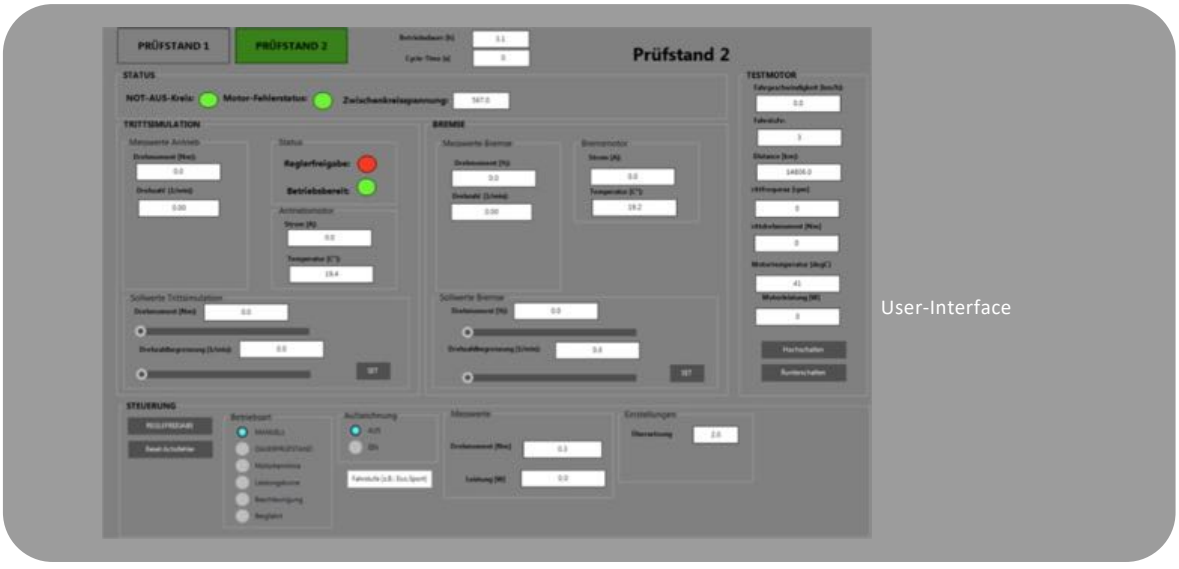
Description	**Laboratory and Development**
Requirement	User-specific adjustment possibilities of all parameters
Analyzation	Storage of measured data in .csv-files Display of measurement data in user interface Scripts for the analysis and parameterisation comprehensive testing cycle

Automatic mode

Description	Automatically test evaluation by calling preassembled testing programs
Requirement	Specification of test routine in the log file
Analyzation	Storage of measured data in .csv-files

Series Evaluation

Description	End-of-line validation by automated test procedure
Requirement	Automated functionality tests with limit checking
Analyzation	Detection of limit checking and protocol creation



User-Interface

Messgrößen

Drive Torque	Resolution : 0,1 Nm
Drive rotational speed	Resolution: 0,1 rpm
Drive Power	[Watt]
Brake performance (rear wheel)	[Watt/Nm]
Pedelec Motor actual support performance	In % or as drive-power factor
Pedelec Power consumption	[mA]
Pedelec Voltage	[V]
Pedelec Power Output	[Watt]
Actual Pedelec Efficiency Drive Unit (calculated	[Watt] %
Pedelec Drive Torque	at chainwheel or rear wheel. Calculated with input specification Instantaneous and r.m.s. value (selectable)
System friction	Calculated with calibration move, effective value
Drive Total Distance	Remains saved after switching off the system, manually resettable
Driven Tour Distance	Auto-reset at system reboot, or manually reset
Temperature	Min. 3 engine sensors, battery ambient temperature (can be extended upon customer request)
Quantity completing test cycles	Depending on test program with repetitive test cycles
Flexibility	(Upon customer request, the measured variable or the resolution can be customised)

Einstellparameter

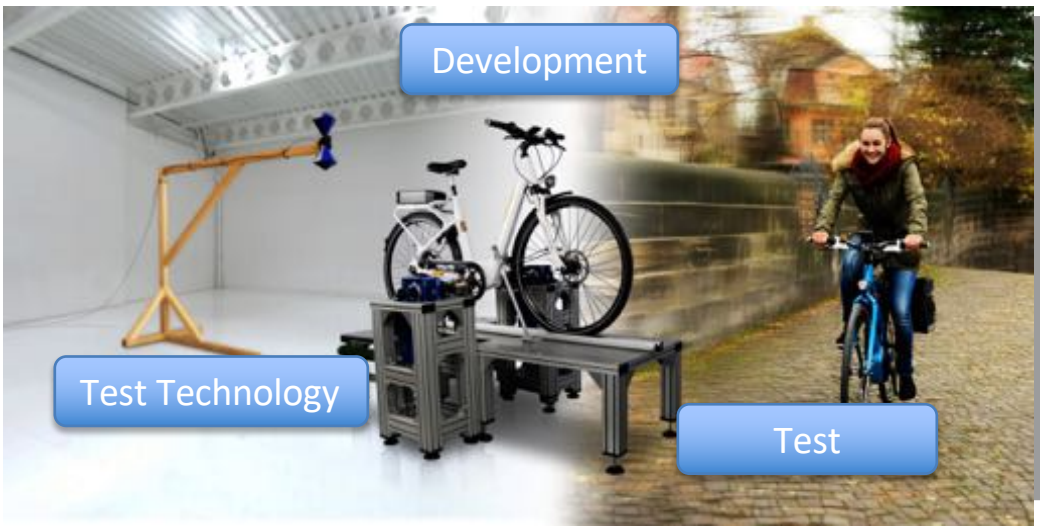
Torque control	Standardprogramm simulation
RPM-/ Speed Control	via Programm value input
Power Control	Dynamic acceleration procedure with adjustable settings
Weight force on seat post	Electronic pressure regulation valve and automatic pneumatic cylinder settings

Updates

- Motor test-rig for drive unit evaluation
- Battery test-rig with cycles charge/stop monitoring
- CAN-Bus evaluation as HiL - Test Rig

Service range

- Test services implementation
- Global system EMV-Measurement
- Power drive benchmark
- Real test drive for practical test
- Environmental Test Systems
- Custom test setups



Full-Service

*optional

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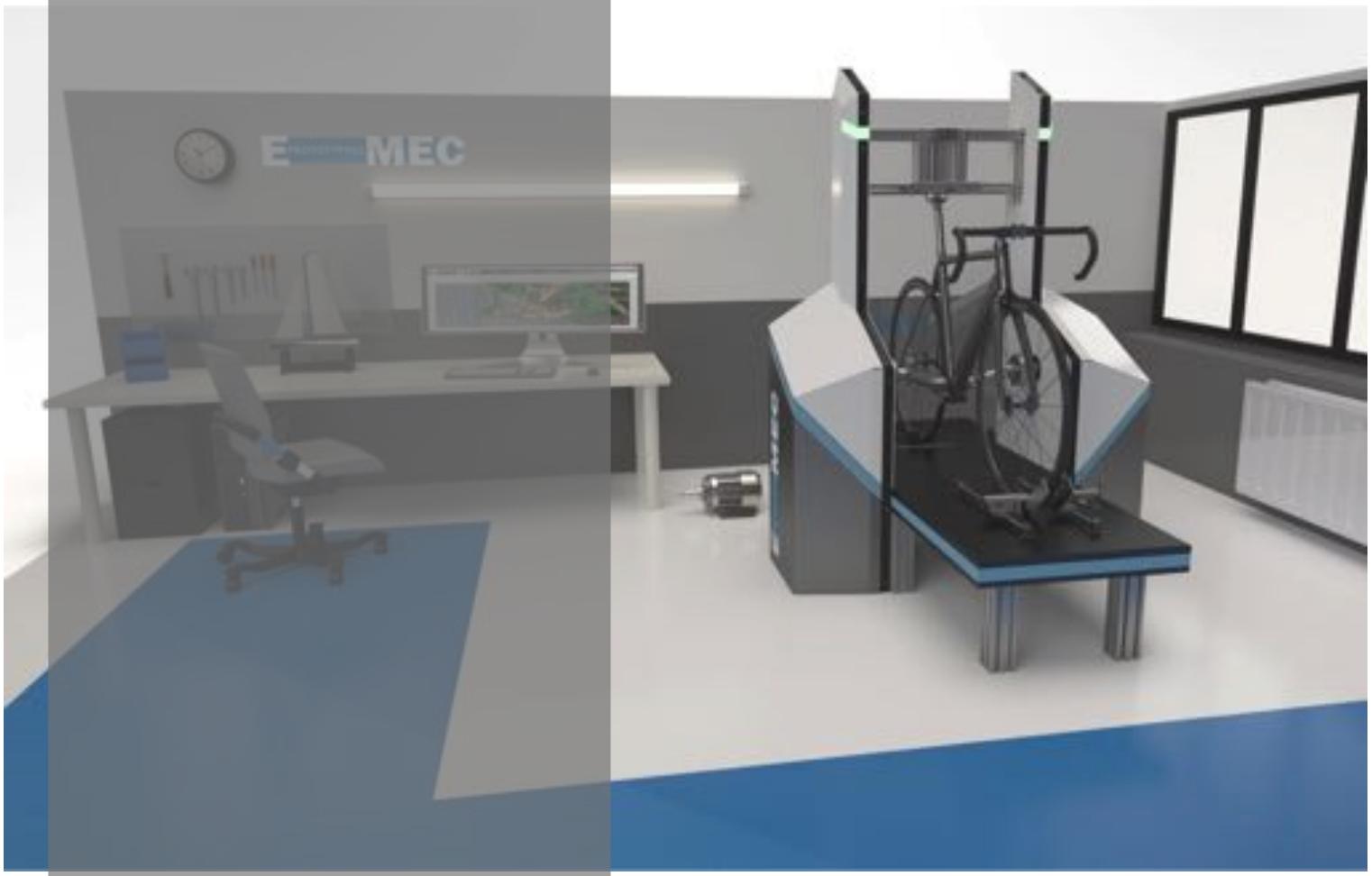

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