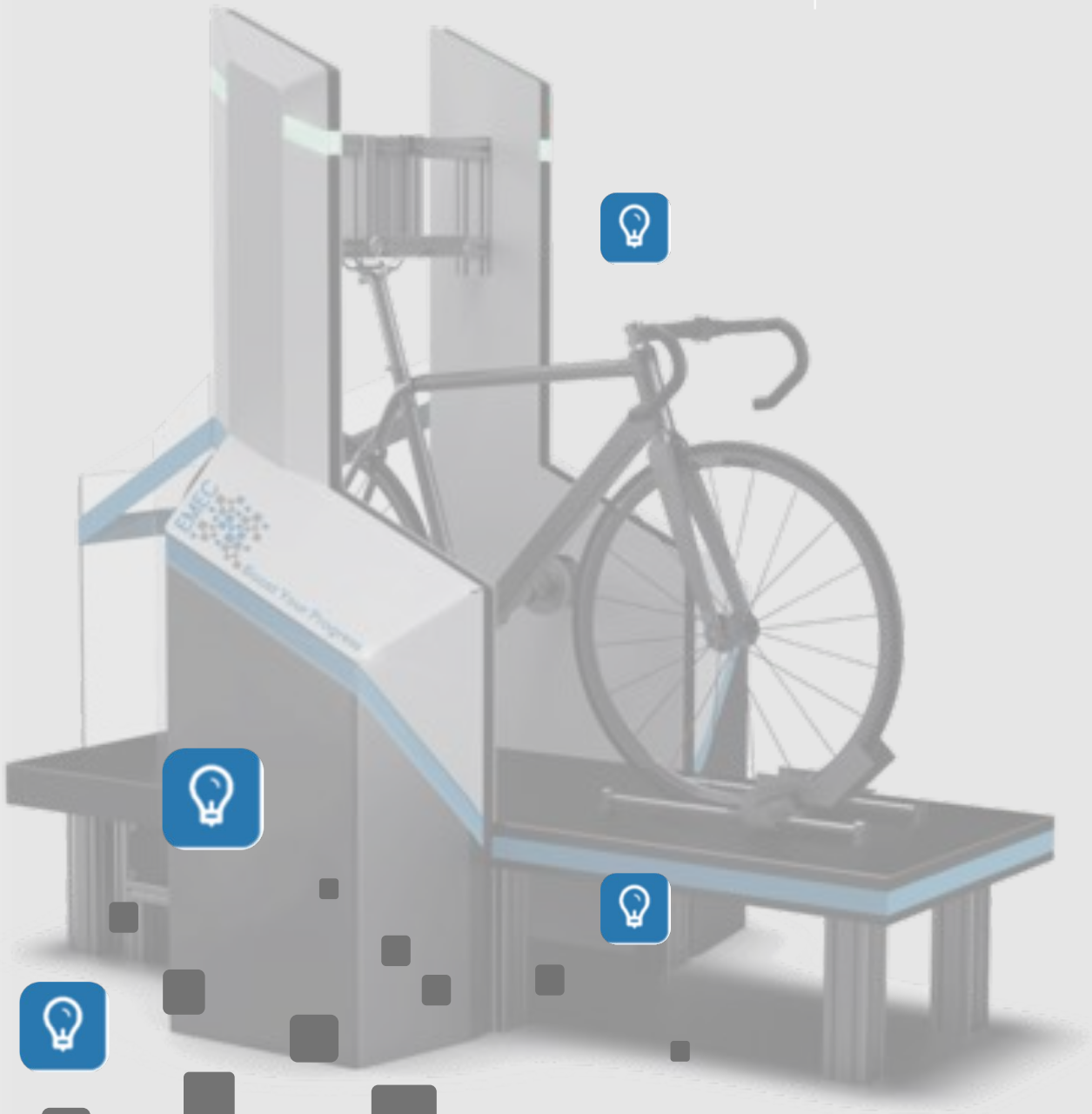
EMEC PROTOTYPING

01



System Test for test and evaluation of electric bicycles

- Scalable
- Adaptive
- Dynamic

System Test of electric Bicycles

02

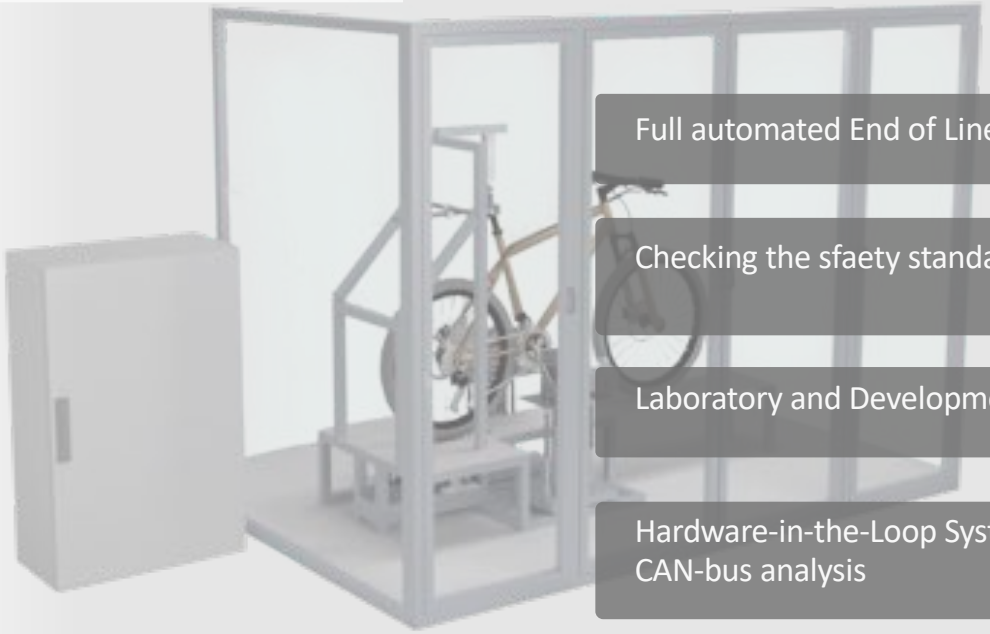
Introduction

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 is compact and built on industry standards. It allows you to perform a reliable and comprehensive review 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

- Determining the Range/Efficiency Measurement
- Check of max. von max. support performance to EPAC-Norm
- Determining of the power curve
- Investigation of overheating behavior under high load (driving uphill)
- Fatigue strength of all components before series start
- Test for quality assurance/ Research & Development
- Implementation of dealer/customer feedback
- Verification & Assurance of safety standard **DIN EN 15194**
- Hardware-in-the-loop validation of components

Deployment Scenarios



Full automated End of Line System test

Checking the sfaety standard of external assemblies

Laboratory and Development Tests

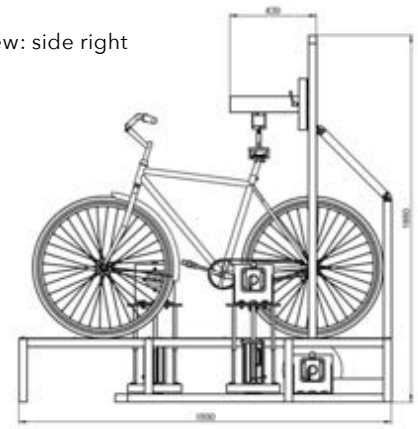
Hardware-in-the-Loop System Test with CAN-bus analysis

Technical Design

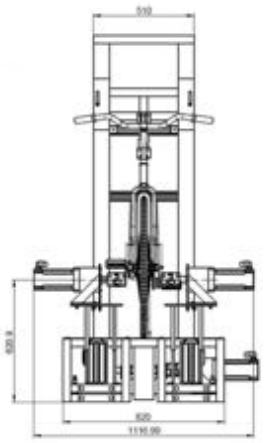
Hardware

The test bicycle is driven on the bottom bracket by one or two servomotors. The motors can either simulate a sinusoidal saddle or apply a constant, uniform torque. The rear wheel of the bike runs on a caster, which can be braked and accelerated. Thus, braking effects can be simulated by environmental influences such as slope or air friction. The weight of the driver can also be applied by means of a variable pressure cylinder on the saddle of the bicycle. All components are made according to your wishes.

View: side right



View: front



Generell

Size of Bicycle	Wheelbase	= 900 – 1.900 mm
	Wheel size	= 400 - 770 mm
	Tyre width	= 30 - 85 mm
Dimensions of test bench (max.)	H = 2.100 mm L = 2.800 mm W = 1.400 mm	
Drive Adapter	Crankset adapter according to customer specifications (Square, Multi-Tooth, Holowtech II, ISIS-Drive, Customer Spezification)	
Input torque (torque of simulated cyclist)	Weighing ride stimulation with predefined forms (sine-wave from) Free programmable wave forms	
Drive	Up to 2100 Watt continuous rated power Up to 200 Nm rated torque Single-sided or double-sided input torque	

Technical Design

Brake Performance (realtime enviroment simulation)

Max. Speed	Up to 45 km/h continuous RPM
Braking characteristics according to 28 inch wheel	2100 Watt continuous rated power 150 Nm continuous brake torque 200 Nm brake torque (Peak)
Dynamic Acceleration simulation	realistic, specifiable acceleration characteristic

Torque & RPM of input drive and brake

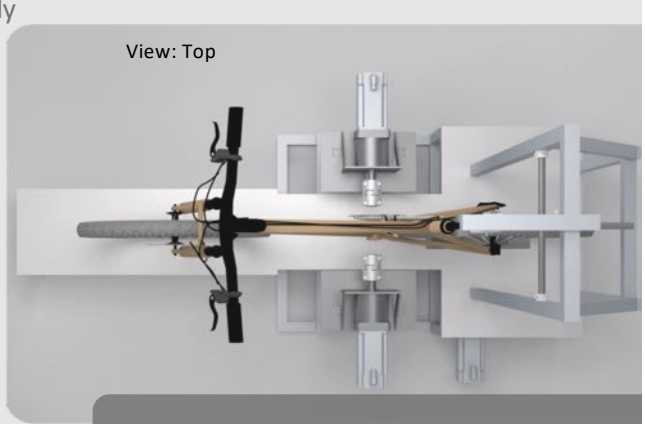
Sample rate	10 ms
Resolution*	Torque: 0,1 Nm | rotation speed: 0,1 rpm
Repetition accuracy*	Up to 1%

Electricity and voltage of E-Bike 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 Battery of the. cycle

Temperature Measurement

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



Safety Standard DIN 15194

Machinery Directive 2006/42/EG

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*depend of measurement method

Operating Modes

Manual operation

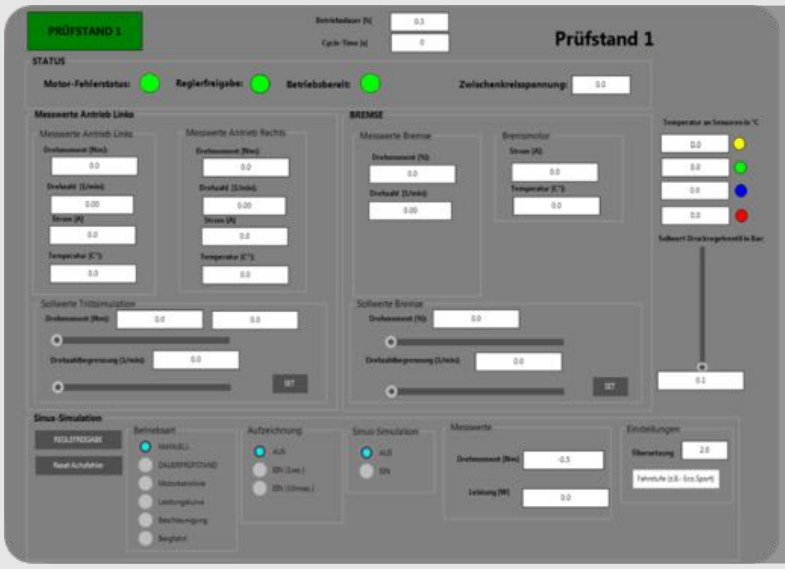
Description	**Laboratory and Development**
Requirement	User-specific adjustment possibilities of all parameters
Analyzation	Storage of measured data in .csv-files Display of measurement data in user interface Scripts for the analysis and parameterization comprehensive testing cycle

Automatic mode

Description	Automatically test evaluation by calling preassembled testing programms
Requirement	Spezification 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

Measured Quantities

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)

Setting Parameters

Torque control	Standardprogramm simulation
RPM- / Speedcontrol	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 für evaluation of the drive unit
- Battery test rig with charge/stop cycles monitoring
- CAN-Bus evaluation as HiL – test rig

Range of Services

- Implementation of test services
- EMV-Measurement of complete systems
- Drive benchmark test
- Real test drives for practical testing
- Environmental Test Systems
- Custom test setups

*optional

09

EMEC-Prototyping GmbH
Reisewitzer Straße 80
01159 Dresden/Germany
Managing Director: Dr.-Ing. René Beckert

Phone: +49 (0) 351 42442588
Fax: +49 (0) 351 42442586
E-Mail: ebike@emec-prototyping.com

For further questions please contact us!

www.emec-prototyping.com

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