MSR 3000 / MSR 5000
PERFORMANCE MEETS PRECISION

made by MAHA

made in Germany

MAHA SINGLE ROLLER DYNAMOMETERS

- From one-axle performance tester to cutting edge single roller 4WD dynamometer
- Capable of performance measurement, load simulation and drive cycles
- Precision measurement and reliable, reproducible measurement results
- The robust, safe design runs extremely smoothly, ensuring the most comfortable ride possible
- Compatible with the previous MSR 500 and LPS 3000 foundations (also with third-party foundations where required)
- Simulation of actual road conditions
- A unique combination of eddy-current brake and e-motor allows accurate road simulation
- High-performance electronic all-wheel synchronisation for all vehicle drive designs
- All drive types can be tested (electric, hybrid and combustion engine vehicles)

01

E-motor for all-wheel synchronisation:
tracking acceleration on the non-driven axle
MSR 3000: 1.5 m/s² up to 200 km/h (30 kW)
MSR 3000: 1.0 m/s² up to 240 km/h (30 kW)
MSR 5000: 3.0 m/s² up to 300 km/h (37 kW)

02

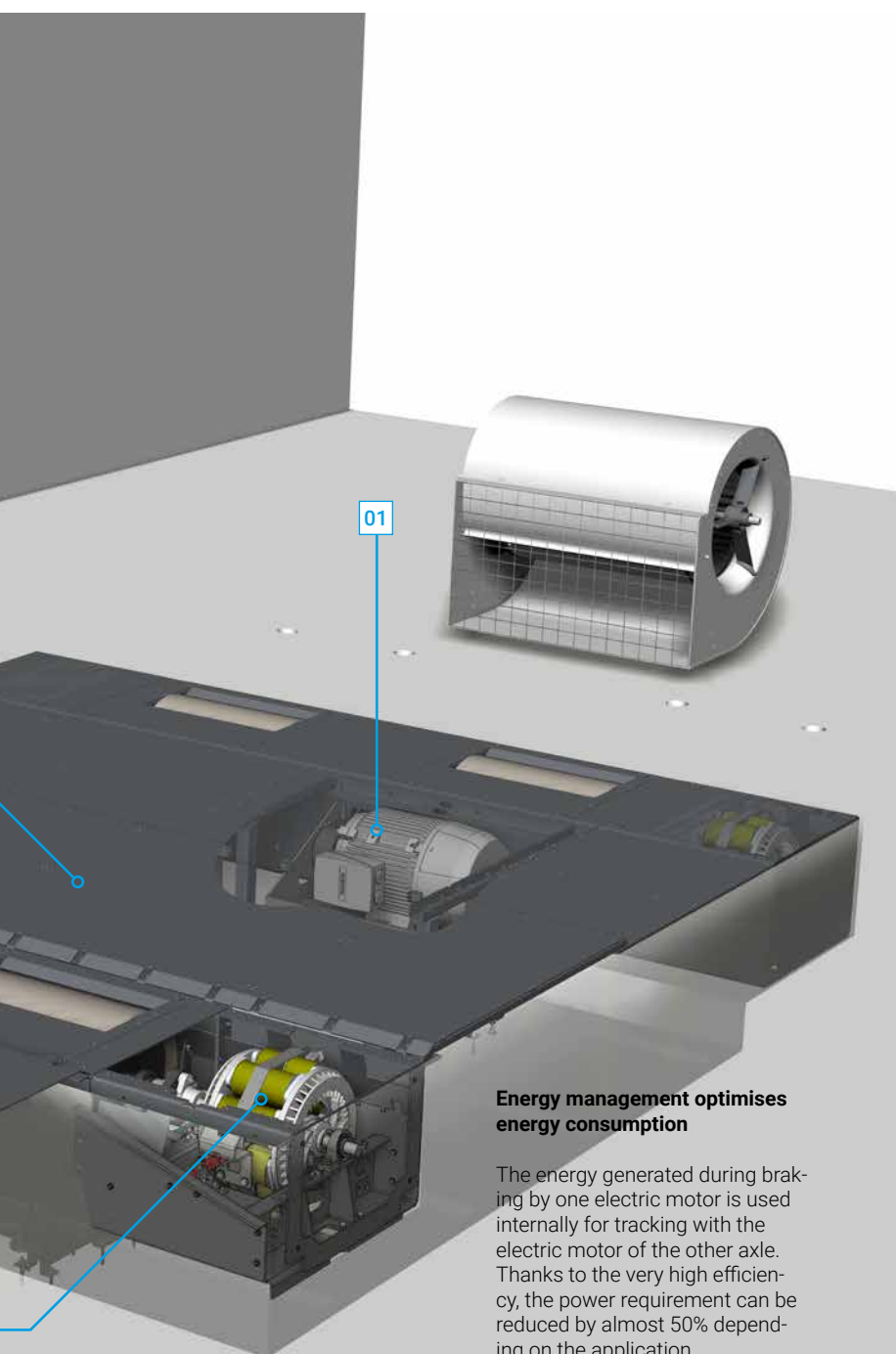Rollers are either painted or provided with an Ni/Cr coating for greater traction.

03

Eddy-current brake for performance measurement and load simulation:
maximum 7000 N tractive force per brake, 14,000 N per axle with two brakes, maximum expansion level is four brakes on the 4WD dynamometer.
Boost function including temperature monitoring on the brakes, especially for performance measurement on electric vehicles.
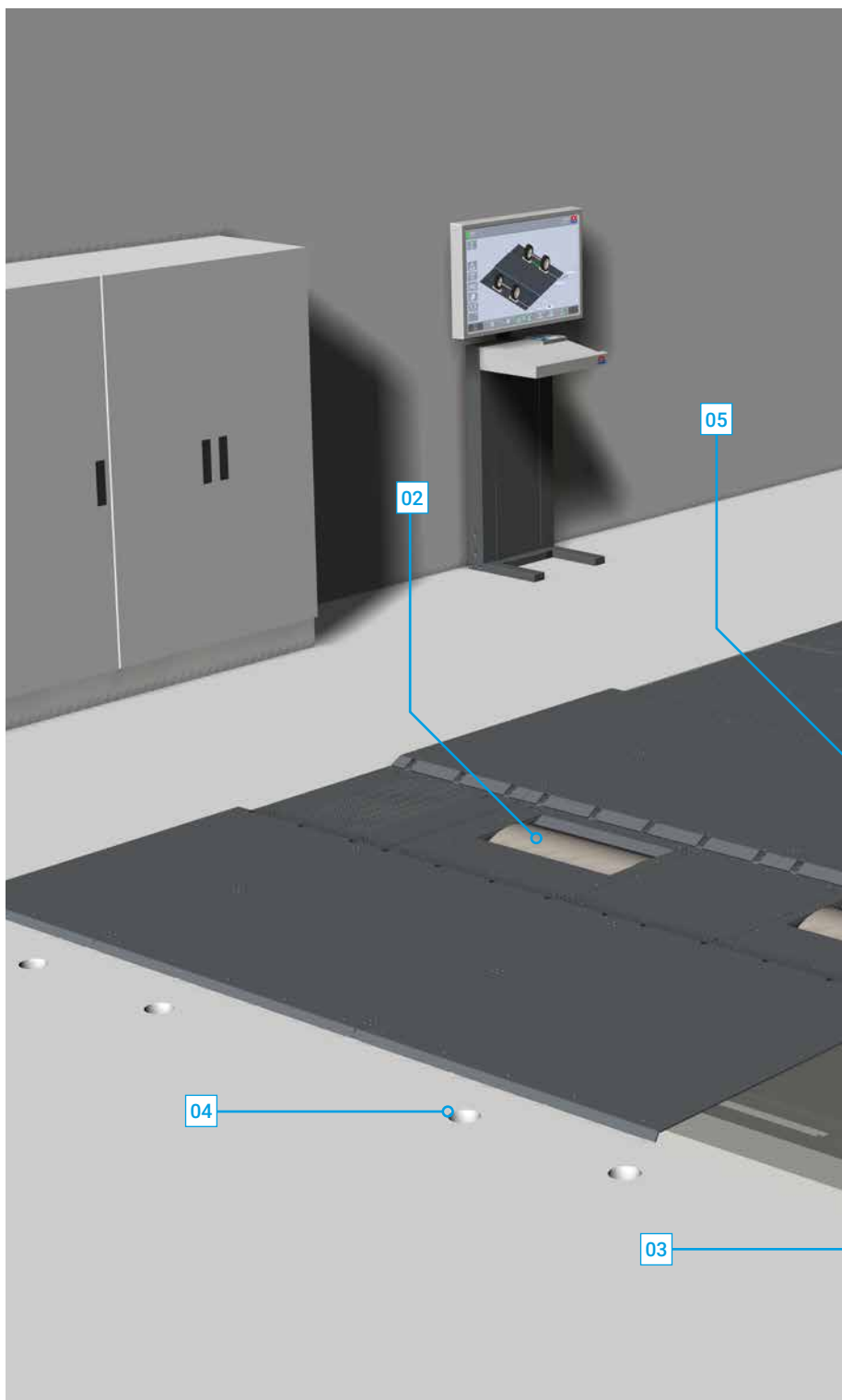
The MAHA MSR series single roller performance and function dynamometers have a wide range of applications, and are suitable for use in vehicle workshops and training centres, by testing organisations, and also in motor sports and by vehicle manufacturers themselves, as well as in universities, colleges and vocational schools. This dynamometer makes it easy to carry out measurements on vehicles with high engine performance, as well as tests of a long duration. The use of e-motors to drive the rollers, in combination with powerful eddy-current brakes, allows for a perfect synchronous running of the axles with the MSR 4WD version. This means that vehicles with widely different drive systems can be tested precisely and effectively. For vehicles with single-axle drive, the non-driven axle, which is powerd by the electric motor of the dynamometer can be run at the same speed as the driven axle. Furthermore, due to the individual control of the axles, the dynamometer is also suitable for testing hybrid and electric vehicles.
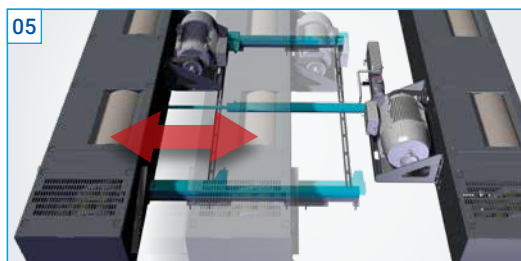

Professional vehicle fixing for the highest safety levels, as well as reproducibility of measurements.

Hydraulic roller set displacement
Wheelbase 2.2 m – 3.4 m, infinitely and stably adjustable. The optimised e-motor positioning makes it possible to install in existing MAHA dynamometer foundations without having to adapt the foundation.

Energy management optimises energy consumption

The energy generated during braking by one electric motor is used internally for tracking with the electric motor of the other axle. Thanks to the very high efficiency, the power requirement can be reduced by almost 50% depending on the application.
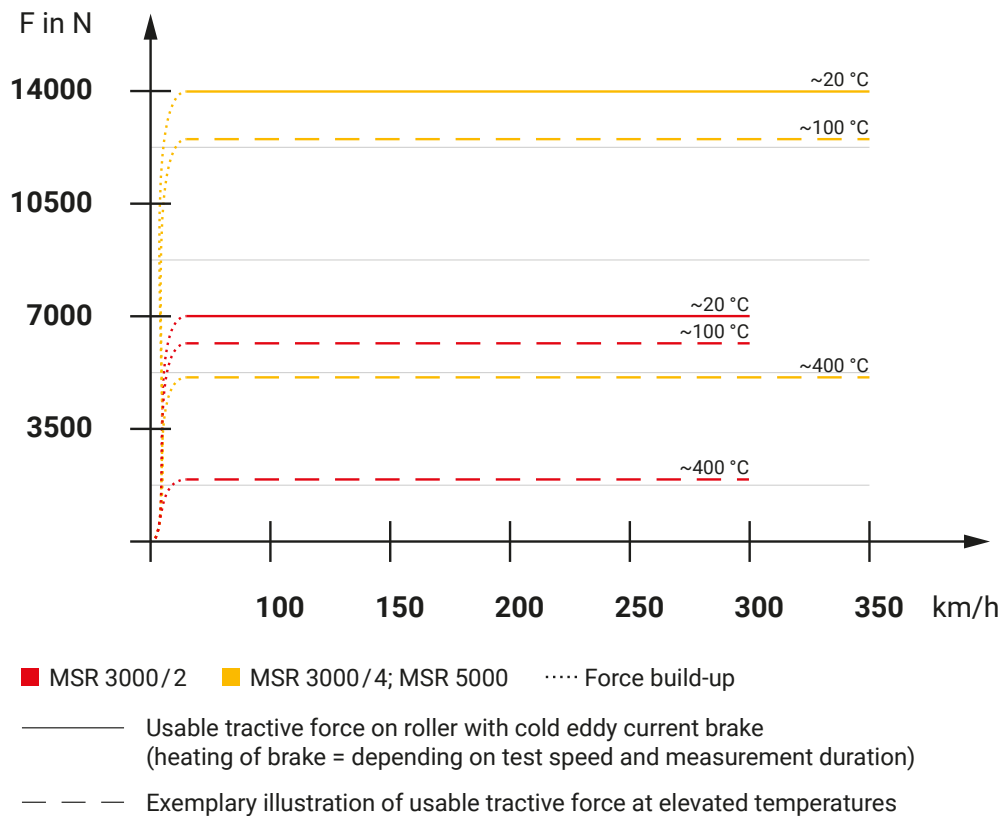
Dynamometer operation from the vehicle using a machine directive-compliant tablet – ideal for daily operation

TECHNICAL DATA

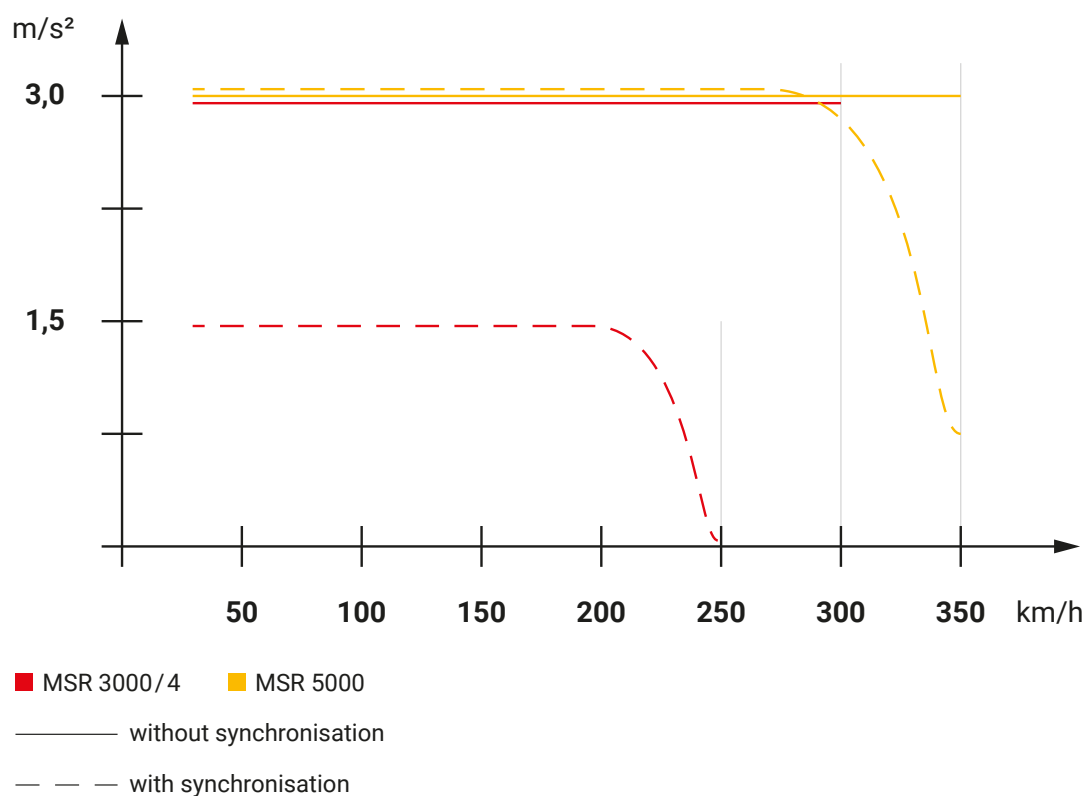|	MSR 5000 VP 230051	MSR 5000 (63A) VP 230051 + VZ 990532	MSR 3000/4 VP 230050	MSR 3000/2 VP 230049
Roller diameter	504 mm / 20"	504 mm / 20"	504 mm / 20"	504 mm / 20"
Track width	850−2200 mm	850−2200 mm	850−2200 mm	850−2200 mm
Roller coating	NiCr	NiCr	NiCr	painted (optional NiCr)
Wheelbase	2200−3400 mm	2200−3400 mm	2200−3400 mm	2200−3400 mm
Foundation dimensions L x W x D	4320 x 4090 x 690 mm	4320 x 4090 x 690 mm	4320 x 4090 x 690 mm	4320 x 3360 x 690 mm
Mech. flywheel mass	270 kg	270 kg	270 kg	250 kg
Rated maximum axle load	2500 kg	2500 kg	2500 kg	2500 kg
Maximum speed (option)	350 km/h	350 km/h	300 km/h (350 km/h)	300 km/h
Max. speed and acceleration with tracking[4]	300 km/h up to 3.0m/s²	300 km/h up to 3.0 m/s² (limited in Load simulation)	200 km/h up to 1.5 m/s² 240 km/h up to 1.0 m/s²	200 km/h up to 1.5 m/s² 240 km/h up to 1.0 m/s²
Electric motor nominal power / peak power at wheel	80 kW[1] / 111 kW[1/2]	80 kW[1/3] / 111 kW[1/3]	36 kW[1] / 60 kW[1/2]	36 kW[1] / 60 kW[1/2]
Nominal driving force Max. driving force (from 10 km/h)[4]	920 N[1] 1570 N up to 260 km/h[1/2]	920 N[1] / Load Sim 600 N[1] 1570 N up to 260 km/h [1/2]	600 N[1] 1150 N up to 180 km/h	600 N[1] 1150 N up to 180 km/h
Wheel braking power static / dynamic	520 kW / 1500 kW (Peak)	520 kW / 1500 kW (Peak)	520 kW / 1500 kW (Peak)	260 kW / 1000 kW (Peak)
Max. braking force of eddy current brake/s (from 30 km/h)[4]	14000 N	14000 N	14000 N	7000 N
Compressed air supply for parking brake	8 bar	8 bar	8 bar	8 bar
Power supply; Frequency; Fuse protection	3x 400 V+N+PE; 50/60 Hz; 125 A	3x 400 V+N+PE; 50/60 Hz; 63 A	3x 400 V+N+PE; 50/60 Hz; 63 A	3x 400 V+N+PE; 50/60 Hz; 63 A

TRACTIVE FORCE – EDDY CURRENT BRAKE

F in N

14000 — ~20 °C
~100 °C

10500

7000 — ~20 °C
~100 °C
~400 °C

3500

~400 °C

100   150   200   250   300   350   km/h

■ MSR 3000/2   ■ MSR 3000/4; MSR 5000   ····· Force build-up

——— Usable tractive force on roller with cold eddy current brake
(heating of brake = depending on test speed and measurement duration)

— — — Exemplary illustration of usable tractive force at elevated temperatures

[1]In overload mode with temperature monitoring of e-motor; [2]Derating of inverter in case of excess temperature; [3]Derating of fuse/power line; [4]see diagram

m/s²

3,0

1,5

50   100   150   200   250   300   350   km/h

■ MSR 3000 / 4   ■ MSR 5000

———————— without synchronisation

— — — with synchronisation

F in N

2000

1500

1000

500

100   150   200   250   300   350   km/h

■ MSR 3000   ■ MSR 5000

———————— Usable tractive force on roller without time limit

— — — Usable tractive force on roller with time limit
(temperature-dependent derating of e-motor/inverter)
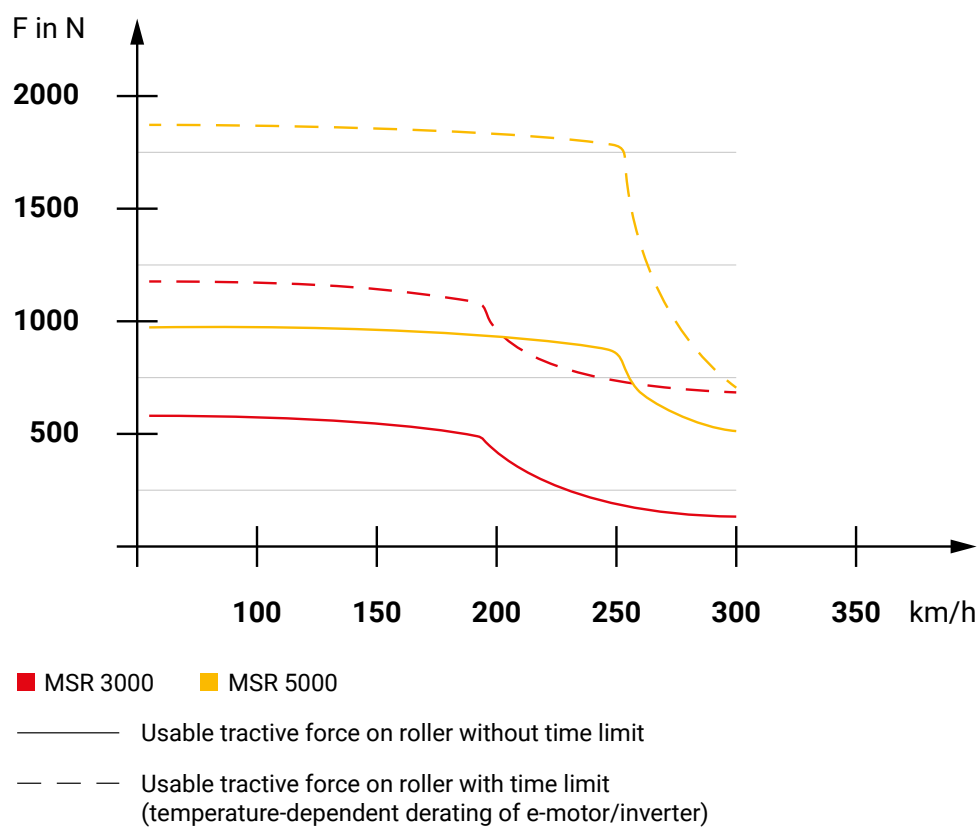
THE SOFTWARE
PERFORMANCE MEASUREMENT
COMBUSTION ENGINE / ELECTRIC CAR

Vehicle data selection
**Specification for electric or combustion engine vehicles possible**

- Drive axle selection
- Tablet connection
- Exhaust emission connection
- Lambda probe
- OBD port
- Fan
- Parking brake
- Dynamometer "controlled deceleration" mode

Automatic mass determination for all vehicle types

- Only possible with electric drive on the roller set
- Highly accurate mass determination separately for front and rear axle
- High-precision performance measurement possible
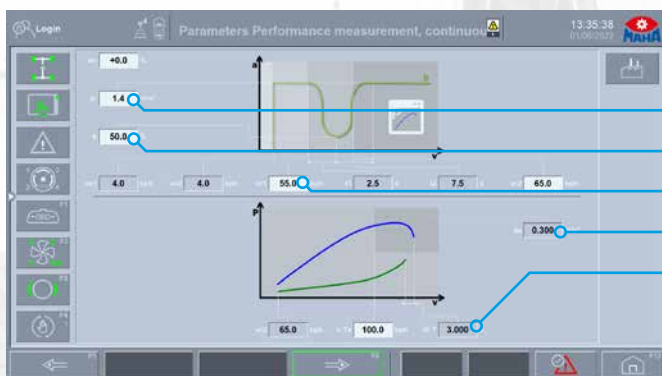
Special settings for customised dynamometer adaptation to the vehicle

Acceleration

Start ramp

Regulator start speed

Start speed for performance measurement

Trigger for recording drag resistance

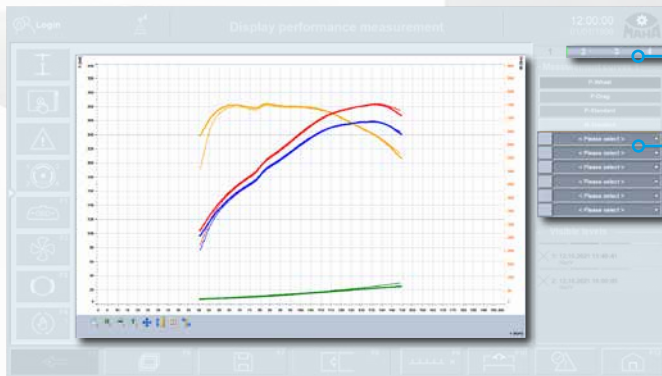**Selection of engine speed recording, user-friendly and clearly displayed**

Possible engine speed sources:
- Optical (laser light barrier);
  2 inputs for separate recording of wheel speeds
- OBD
- Test drive

In performance measurement mode, the maximum engine power of the vehicle is determined. With the MSR, you are also equipped for future electric vehicles, as is shown below in the example of an evaluation of a current electric vehicle. The menu-driven procedure has everything the user needs, making it easy to carry out reproducible measurements.

Total control of all relevant parameters during performance measurement

During performance measurement, additional values can be freely selected from a variety of display types

Active drag resistance measurement

Display for speed of both axles available in each screen

Power distribution between the two axles always displayed

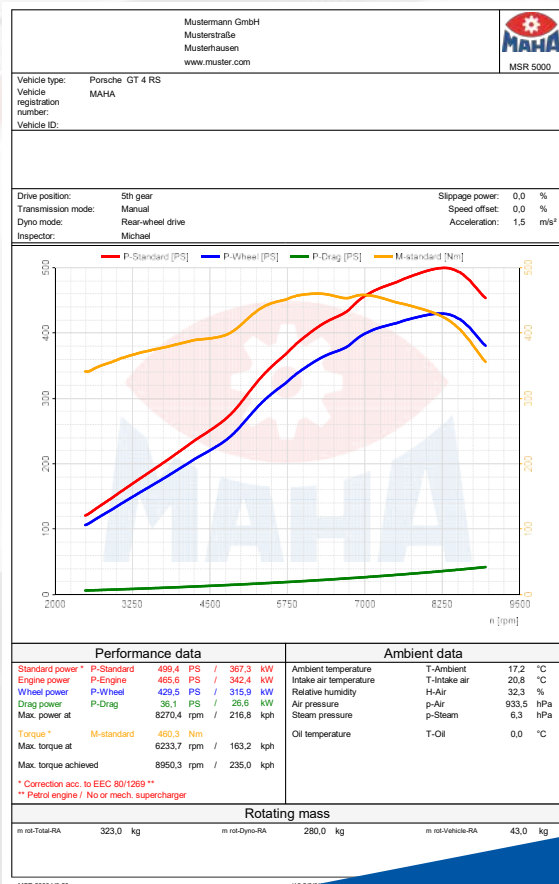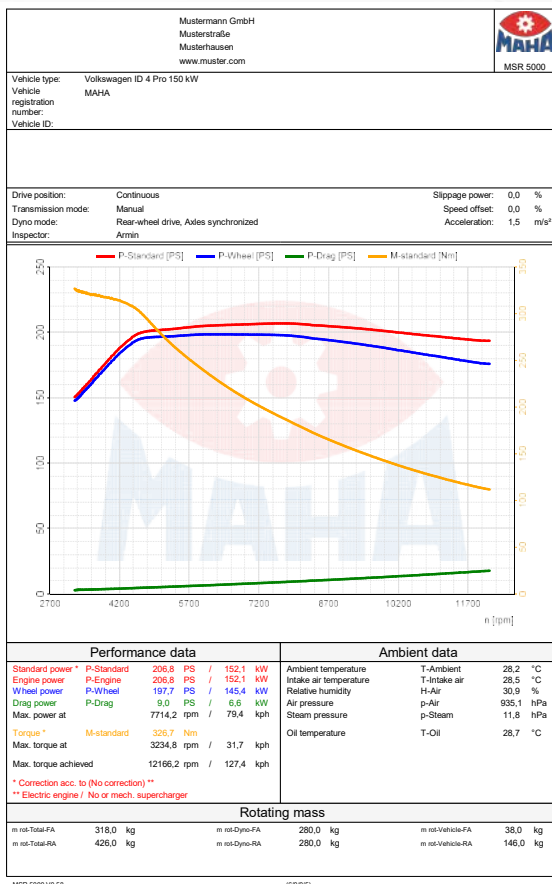Sidebar for fast access and overview of other dynamometer functions

Clear results screen

Excellent reproducibility when carrying out consecutive measurements. Up to 3 background measurements can be loaded for comparison.
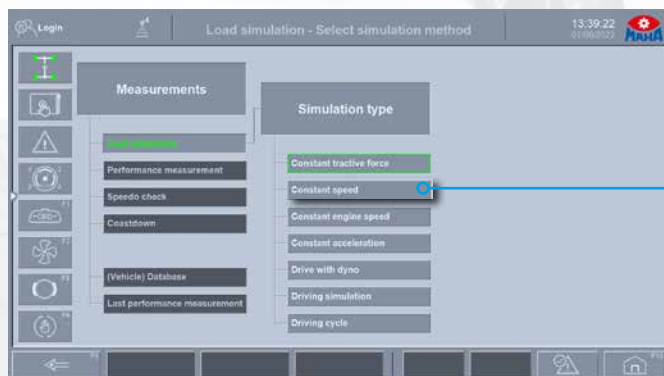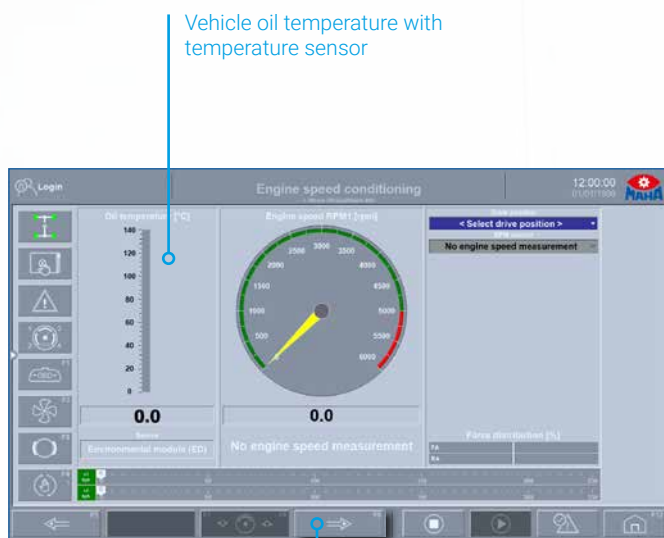
Additional values (up to 6 channels) can be imported via:

- OBD
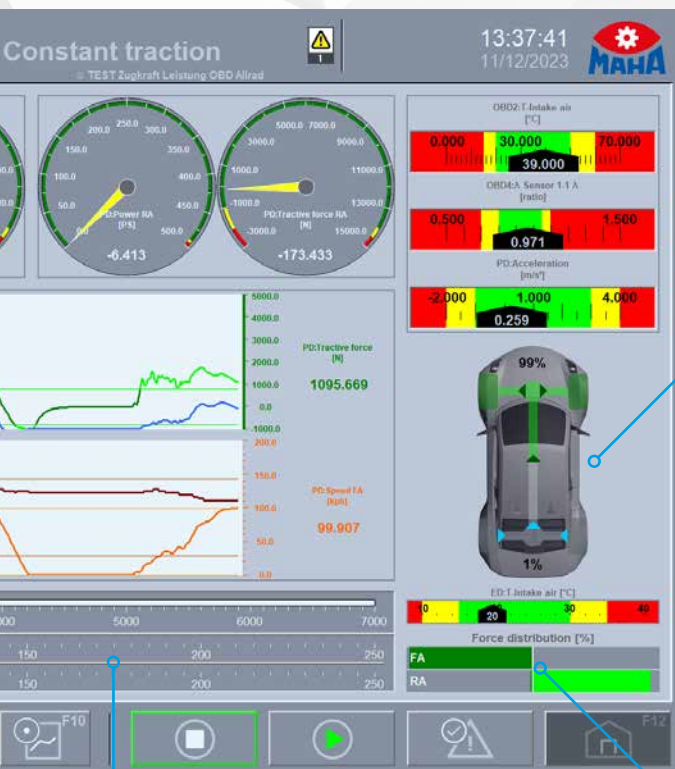- Environmental data
- Analogue inputs
- Lambda sensor

Mustermann GmbH
Musterstraße
Musterhausen
www.muster.com

MSR 5000

Vehicle type:	Volkswagen ID 4 Pro 150 kW
Vehicle registration number:	MAHA
Vehicle ID:	

Drive position:	Continuous	Slippage power:	0,0	%
Transmission mode:	Manual	Speed offset:	0,0	%
Dyno mode:	Rear-wheel drive, Axles synchronized	Acceleration:	1,5	m/s²
Inspector:	Armin			

P-Standard [PS] P-Wheel [PS] P-Drag [PS] M-standard [Nm]

Performance data

Standard power *	P-Standard	206,8	PS	/	152,1	kW
Engine power	P-Engine	206,8	PS	/	152,1	kW
Wheel power	P-Wheel	197,7	PS	/	145,4	kW
Drag power	P-Drag	9,0	PS	/	6,6	kW
Max. power at		7714,2	rpm	/	79,4	kph
Torque *	M-standard	326,7	Nm			
Max. torque at		3234,8	rpm	/	31,7	kph
Max. torque achieved		12166,2	rpm	/	127,4	kph

* Correction acc. to (No correction) **
** Electric engine / No or mech. supercharger

Ambient data

Ambient temperature	T-Ambient	28,2	°C
Intake air temperature	T-Intake air	28,5	°C
Relative humidity	H-Air	30,9	%
Air pressure	p-Air	935,1	hPa
Steam pressure	p-Steam	11,8	hPa
Oil temperature	T-Oil	28,7	°C

Rotating mass

| m rot-Total-FA | 318,0 | kg | m rot-Dyno-FA | 280,0 | kg | m rot-Vehicle-FA | 38,0 | kg |
| m rot-Total-RA | 426,0 | kg | m rot-Dyno-RA | 280,0 | kg | m rot-Vehicle-RA | 146,0 | kg |

MSR 5000 V0.58   (6/0/0/5)

Mustermann GmbH
Musterstraße
Musterhausen
www.muster.com

MSR 5000

Vehicle type:	Porsche GT 4 RS
Vehicle registration number:	MAHA
Vehicle ID:	

Drive position:	5th gear	Slippage power:	0,0	%
Transmission mode:	Manual	Speed offset:	0,0	%
Dyno mode:	Rear-wheel drive	Acceleration:	1,5	m/s²
Inspector:	Michael			

P-Standard [PS] P-Wheel [PS] P-Drag [PS] M-standard [Nm]

Performance data

Standard power *	P-Standard	499,4	PS	/	367,3	kW
Engine power	P-Engine	465,6	PS	/	342,4	kW
Wheel power	P-Wheel	429,5	PS	/	315,9	kW
Drag power	P-Drag	36,1	PS	/	26,6	kW
Max. power at		8270,4	rpm	/	216,8	kph
Torque *	M-standard	480,3	Nm			
Max. torque at		6233,0	rpm	/	163,2	kph
Max. torque achieved		8950,3	rpm	/	235,0	kph

* Correction acc. to EEC 80/1269 **
** Petrol engine / No or mech. supercharger

Ambient data

Ambient temperature	T-Ambient	17,2	°C
Intake air temperature	T-Intake air	20,8	°C
Relative humidity	H-Air	32,3	%
Air pressure	p-Air	933,5	hPa
Steam pressure	p-Steam	6,3	hPa
Oil temperature	T-Oil	0,0	°C

Rotating mass

| m rot-Total-RA | 323,0 | kg | m rot-Dyno-RA | 280,0 | kg | m rot-Vehicle-RA | 43,0 | kg |

MSR 5000 V0.58   (12,5/0

LOAD SIMULATION
OPERATING MODE

The load simulation operating mode is ideally suited for tuning work on the vehicle. The load simulation menu allows the user the choice of different load conditions which, for example, enable a precise engine diagnosis or make it possible to determine the climbing performance of a vehicle. Different load conditions can be simulated, depending on requirements. These include, for example, a constant tractive force, speed and engine speed, or a driving simulation. Recuperation tests can be carried out with, for example, a simulation of downhill driving by propulsion of the vehicle.

Vehicle oil temperature with temperature sensor

Reference setting dependent on type of load simulation

Monitoring of environmental data:
- Temperature of intake air
- Relative humidity
- Ambient temperature

Individually adjustable display of all relevant values for vehicle and dynamometer

Display of vehicle's power distribution and power flow
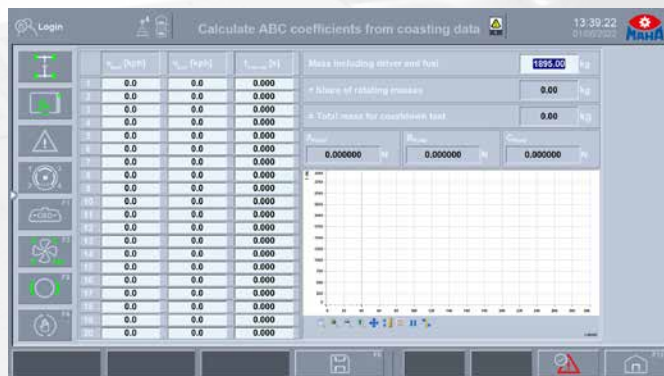
Engine speed and speed of both axles

Display and monitoring of intervention by the eddy-current brake(s) or the e-motor(s) for synchronisation of the dynamometer

LOAD ADJUSTMENT
OPERATING MODE

Using the load adjustment operating mode, the roller coefficients can be determined in accordance with ECE / SAE J2264 standards. In so doing, the specific road coefficients of the vehicle serve as a reference to compare the vehicle and the dynamometer. The specific roller coefficients determined can be saved in the database and called up at any time for a driving cycle.
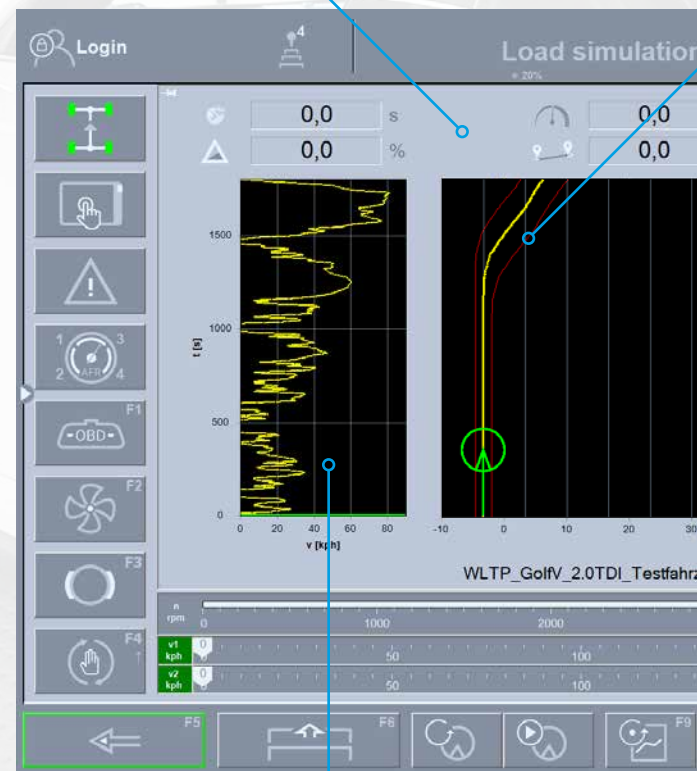
DRIVING CYCLE
OPERATING MODE

In the driving cycle operating mode, a driving profile with defined time and speed development can be simulated on the dynamometer. A realistic simulation of road travel is possible using the values (roller coefficients) from the load adjustment. The combination of e-motor and eddy-current brakes makes it possible to simulate the vehicle mass for any conceivable driving situation. It is possible both to run standardised profiles and to create and run individual driving cycles.

Cycle time, gradient, current speed and distance covered can be read on the display

Load adjustment with determination of the dynamometer coefficients. The vehicle's real values can be used and transmitted to the dynamometer

Calculation of ABC coefficients from the vehicle's roll-out data on the dynamometer

Full cycle profile over the speed

10

Driving cycle

- User-friendly, menu-driven procedure

- Information on speed level and gear selection integrated into cycle sequence

- Cycle profile can be selected from database

- Coefficients for driving simulation for specific vehicles can be saved in the database

- Connection to adjustable fan possible

Speed tolerance limits constantly displayed

Individual displays: Option to monitor the dynamometer or data relevant to testing

Driver display with driver information and gear shifting instructions

INTERFACE BOX

Handover of additional vehicle values to the dynamometer control system using a range of sensors.
Supplied with VESA mount as standard for installation on wall, stand, support arm etc.

Analogue input module

Module for current/voltage-based sensors (8 channels) and temperature sensors (4 channels)

Universal holder

for practical storage of cables, for example.
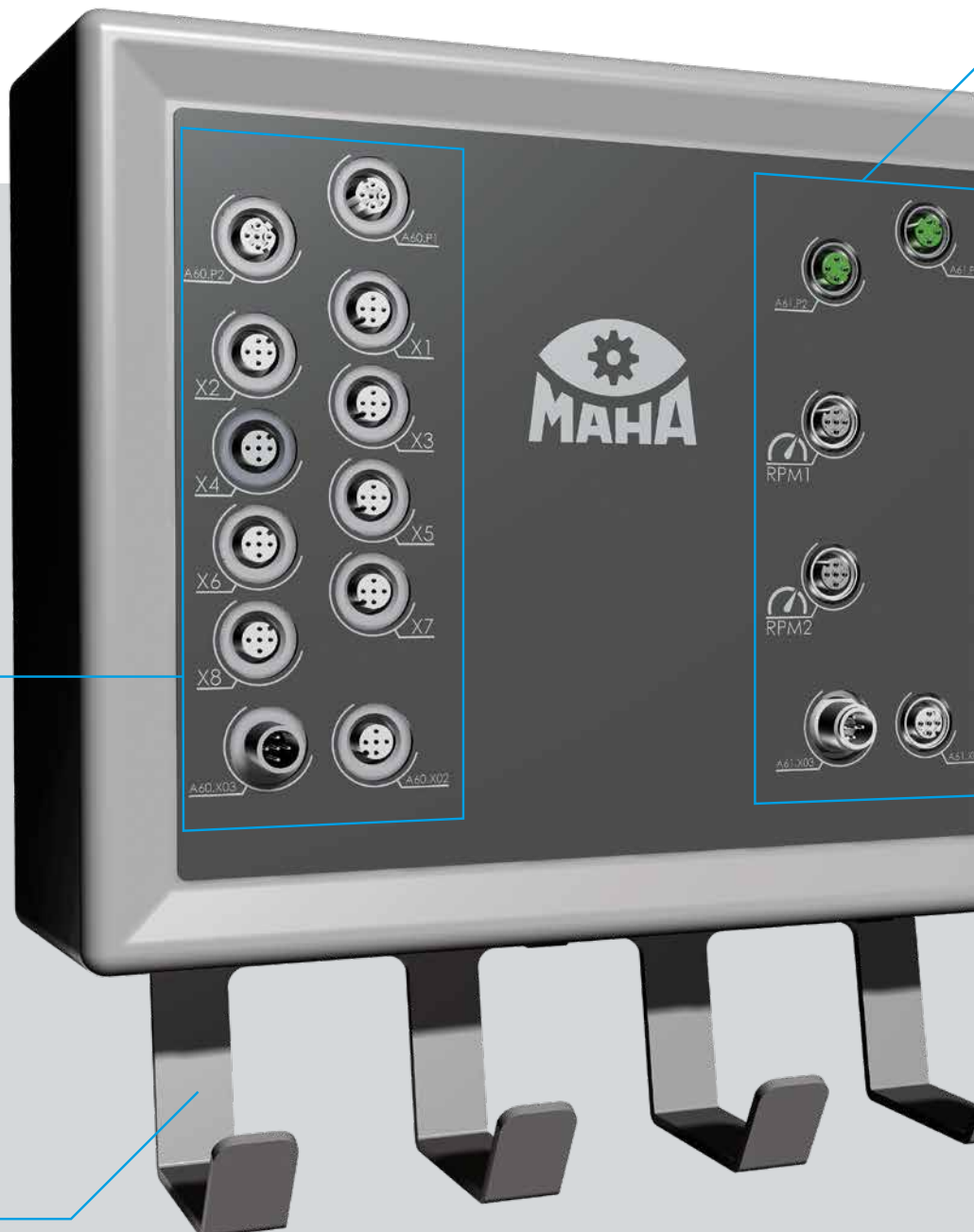
Engine speed module

Engine speed input for optical sensor

Laser light signalling unit:

- Exact speed detection up to 20,000 rpm through precise laser technology, as well as definable ratios of pulse number/revolution or transmission ratio
- Speed measurement on the wheel, also possible for electric vehicles, 2-channel separate on FA/RA
- Speed detection on rotating engine/transmission components
- Reliable application thanks to special reflectors, even on reflective surfaces (e.g. chrome rims)

Environment module

Provides data for extrapolation according to the standards DIN 70020, EWG 80/1269, ISO 1585, SAE J1349, JIS D1001 using the following sensors: intake air temperature, ambient air temperature, air pressure, air humidity.

OTHER FITTING OPTIONS

Lambda module ((·))

- Exact lambda values, transmitted very fast
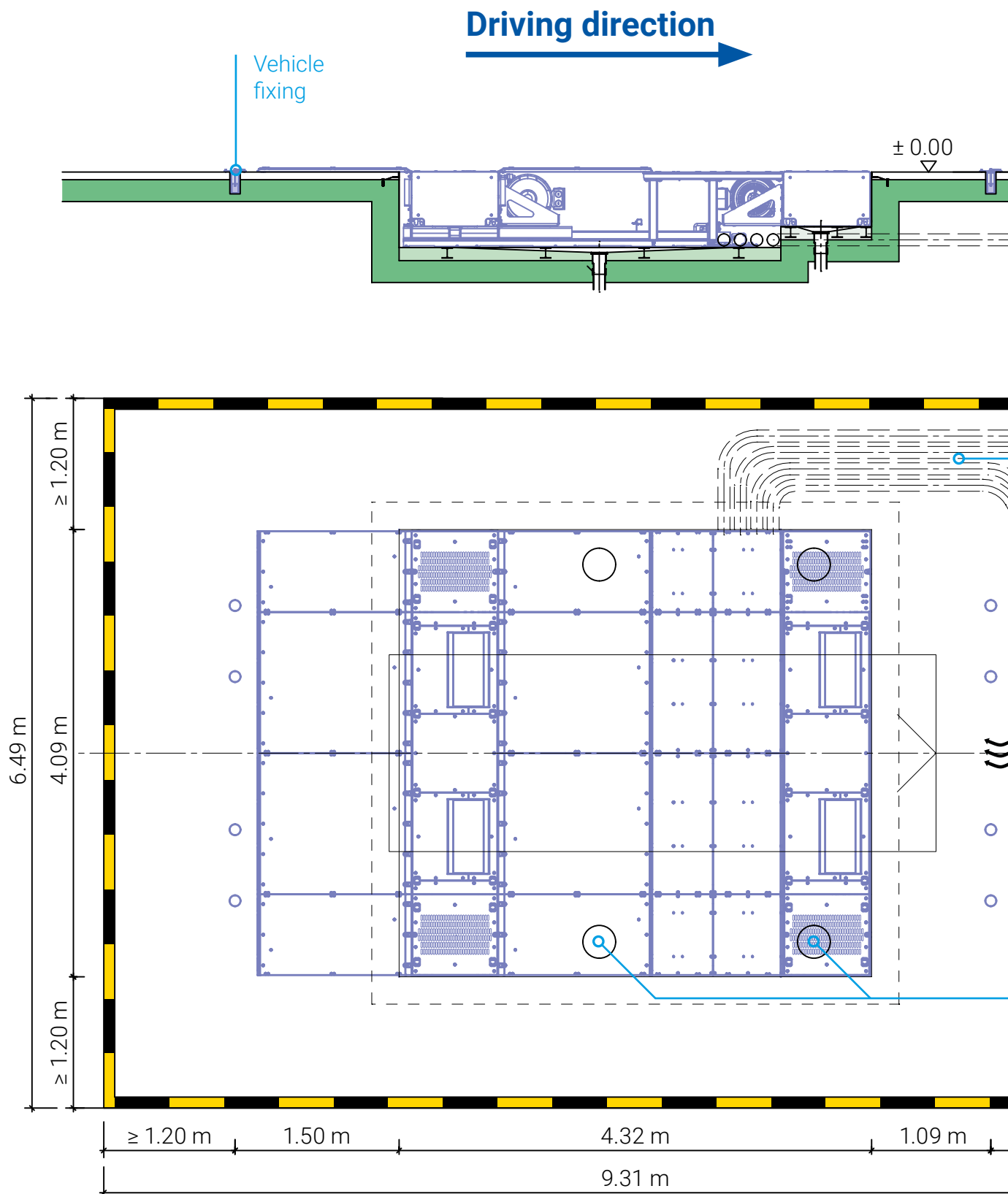- Recording of load simulation or performance measurement

OBD ∗

- OBD II port in accordance with standard and WWH OBD GTR implemented
- Free selection of OBD Bluetooth adapters
- Individual selection of PID possible
- Data regarding engine speed, lambda, ignition time, temperatures etc.
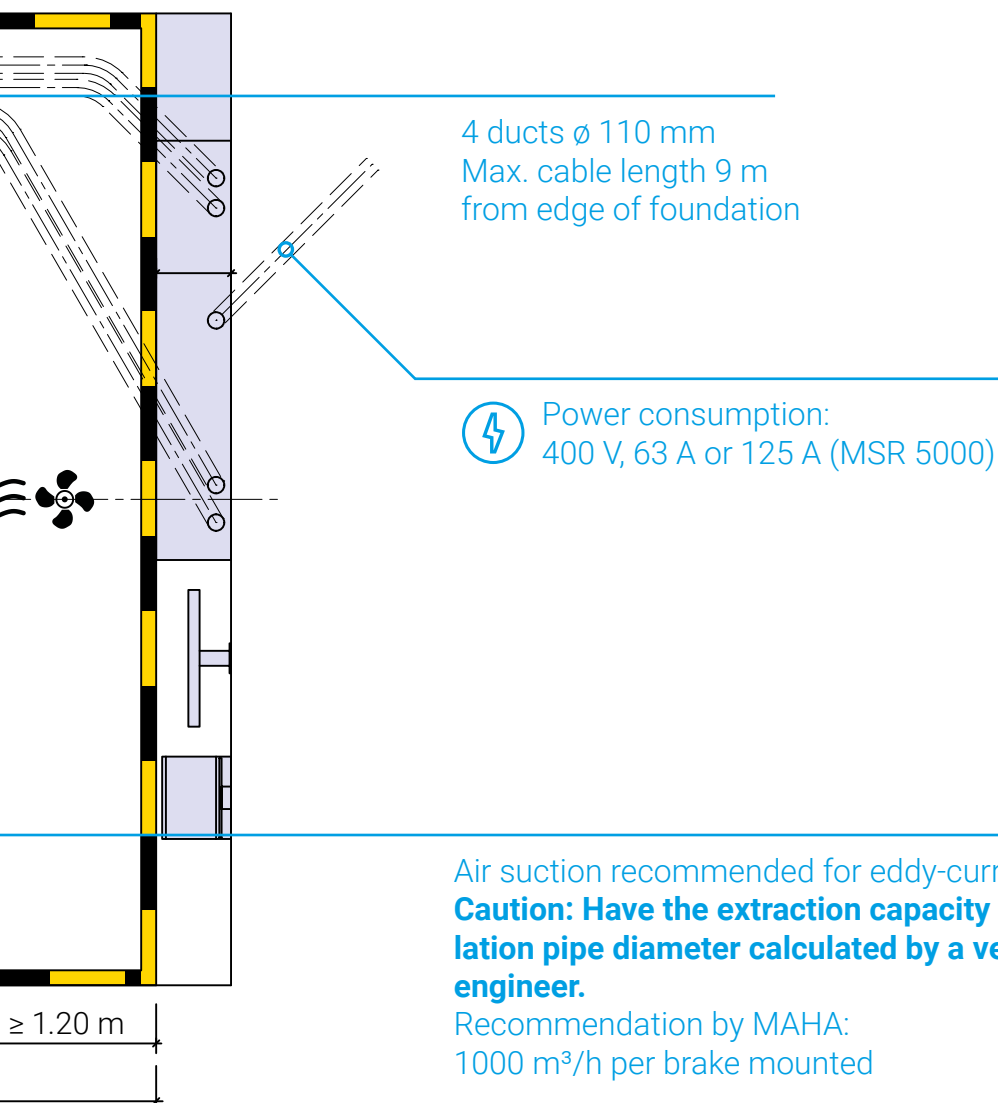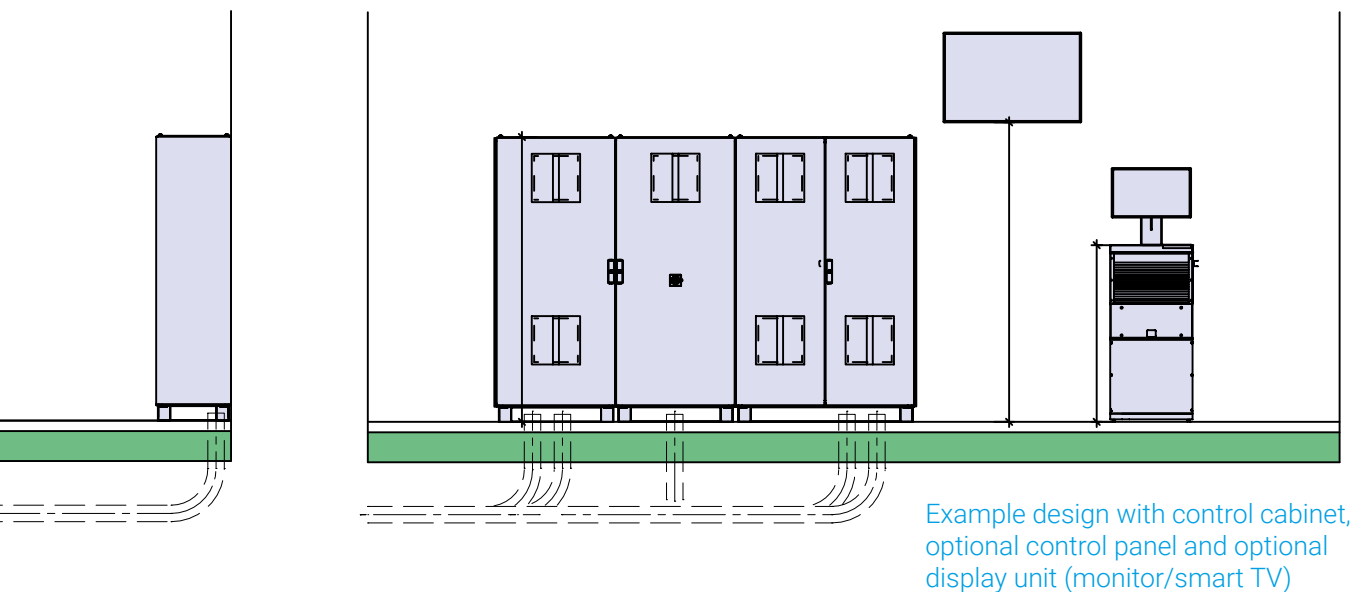
Emission tester MET 6.3 ((·))

- Testable gas values: CO, CO_2, HC, NO, NO_x, O_2, Lambda and turbidity K-value
- Connection via WiFi
- Suitable for full load due to high-temperature resistant temperature probe

FOUNDATION PLAN
EXEMPLARY VISUALISATION

Driving direction

Vehicle fixing

± 0.00

≥ 1.20 m

6.49 m

4.09 m

≥ 1.20 m

≥ 1.20 m   1.50 m   4.32 m   1.09 m

9.31 m

Example design with control cabinet, optional control panel and optional display unit (monitor/smart TV)

4 ducts ø 110 mm
Max. cable length 9 m
from edge of foundation

⚡ Power consumption:
400 V, 63 A or 125 A (MSR 5000)

Air suction recommended for eddy-current brake.
Caution: Have the extraction capacity and ventilation pipe diameter calculated by a ventilation engineer.
Recommendation by MAHA:
1000 m³/h per brake mounted

≥ 1.20 m

Technology partners

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Germany

maha.de