This document provides an overview of the available facilities and instrumentation at the laboratory.

Some instruments listed in this document can also be used for measurements performed outside of our facilities or for outdoor measurements.

This infrastructure and instrumentation can be used for research projects inside the BFH as well as for customer's purpose.

Please feel free to contact us for further information.

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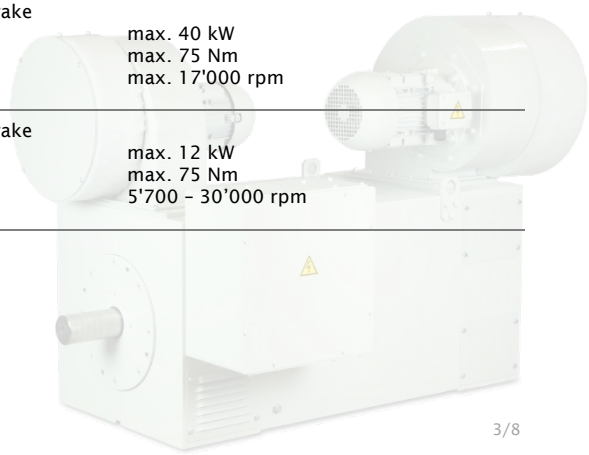
Infrastructure

1. **Dynamometers**

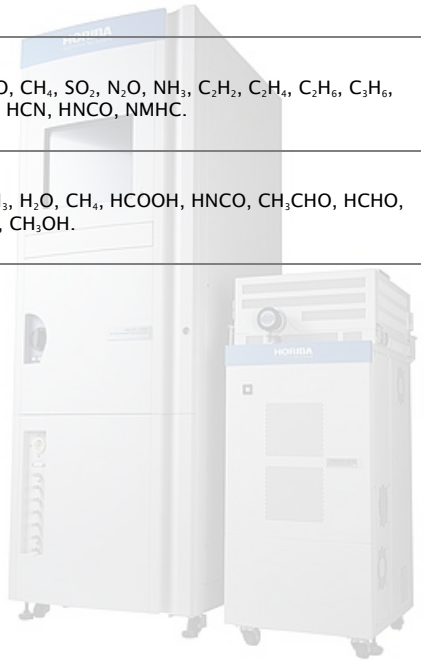
Chassis dynamometer 1 *4-wheels drive* *Light duty vehicles*	Designed for legal exhaust gas measurements for light duty vehicles m < 2'500 kg	Max. speed: wheelbase: max. axle load: location:	180 km/h 1'600 – 4'200 mm 2'000 kg Nidau
Chassis dynamometer 2 *2-wheels drive* *Light duty vehicles, motorcycles*	Designed for legal exhaust gas measurements for light duty vehicles and 2-wheelers	Max. speed: max. axle load: location:	200 km/h 2'000 kg Nidau
Chassis dynamometer 3 *4-wheels drive* *Light duty vehicles, motorcycles*	Designed for power measurements, tachometer verification (METAS calibrated) for light duty vehicles and 2-wheelers	Max. speed: power: wheelbase: max. axle load: location:	300 km/h 740 kW 2'100 – 3'300 mm 2'000 kg Vauffelin
Chassis dynamometer 4 *4-wheels drive* *Heavy-Duty and off-road vehicles*	Designed for power measurements & road simulation for Heavy duty vehicles	Max. speed: power: wheelbase: roller diameter: max. axle load: location:	100 km/h 500 kW / 320 kW (continuous run) 1'600 – 4'200 mm 4x 2m 12'000 kg Vauffelin
Engine dynamometer A *diesel*	Schenk W450	Eddy current brake power: torque: speed:	 max. 450 kW max. 1'750 Nm max. 5'500 rpm
Engine dynamometer B *diesel*	ABB	Asynchronous load machine power: torque: speed:	 max. 200 kW max. 970 Nm max. 4'500 rpm
Engine dynamometer C *gasoline/gas*	Schenk W40	Eddy current brake power: torque: speed:	 max. 40 kW max. 75 Nm max. 17'000 rpm
Small engine dynamometer D *chain saw*	Vibrometer 2WB65	Eddy current brake power: torque: speed:	 max. 12 kW max. 75 Nm 5'700 – 30'000 rpm



2. **Gas Analyzers**

Exhaust Gas Analyzer (diluted gases, CVS)	Horiba MEXA One C1	Measured components: CO_2, CO, NO_x, NO, THC, CH_4.
Exhaust Gas Analyzer (diluted gases, CVS)	Horiba Mexa 7200	Measured components: CO_2, CO, NO_x, NO, THC, CH_4.
Exhaust Gas Analyzer (raw gases)	Horiba misc.	Measured components: CO_2, CO, O_2, NO_x, NO, THC, CH_4.
Exhaust Gas Analyzer (raw gases)	Horiba / Siemens misc.	Measured components: CO_2, CO, O_2, NO, THC, N_2O.
Chemiluminescence Detector	Ecophysics CLD800	Measured components: NO_x, NO_2, NH_3.
Chemiluminescence Detector	Ecophysics CLD700	Measured components: NO_x, NO_2.
FTIR spectrometer	AVL SESAM FTIR	Measured components: CO, CO_2, NO, NO_2, NO_x, H_2O, CH_4, SO_2, N_2O, NH_3, C_2H_2, C_2H_4, C_2H_6, C_3H_6, C_4H_6, C_3H_8, HCHO, HCOOH, HCN, HNCO, NMHC.
FTIR spectrometer	A&D BOB-1000FT (PEMS)	Measured components: CO, CO_2, NO, NO_2, N_2O, NH_3, H_2O, CH_4, HCOOH, HNCO, CH_3CHO, HCHO, C_2H_2, C_2H_4, C_2H_6, C_3H_6, C_3H_8, CH_3OH.

CVS Constant Volume Sampling
FTIR Fourier Transform Infrared spectroscopy
PEMS Portable Emissions Measurement System



3. **Portable Emissions Measurement System (PEMS)**

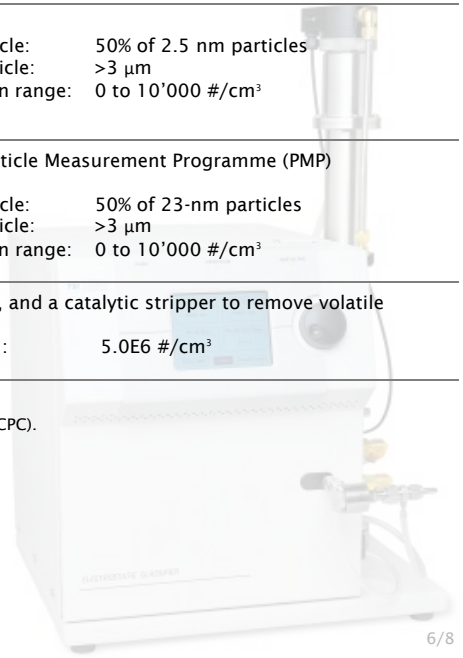
Gas PEMS	HORIBA OBS-ONE GS02 / GS12	Measured components: CO, CO_2 - heated NDIR, NO_x, NO, NO_2 – heated dual CLD, THC – heated FID, pitot flow meter for engine for exhaust flow measurements, CAN-Interface.
Gas PEMS	HORIBA OBS-ONE GS02 / GS22	Measured components: CO, CO_2 - heated NDIR, NO_x, NO, NO_2 – heated dual CLD, THC / CH4 – heated dual FID, pitot flow meter for engine for exhaust flow measurements, CAN-Interface.
Gas PEMS	A&D BOB-1000FT (FTIR)	Measured components: CO, CO_2, NO, NO_2, N_2O, NH_3, H_2O, CH_4, HCOOH, HNCO, CH_3CHO, HCHO, C_2H_2, C_2H_4, C_2H_6, C_3H_6, C_3H_8, CH_3OH.
PN - PEMS	Horiba OBS-ONE PN	PEMS for Nanoparticle counting. concentration: 0 – 5.0E7 #/cm^3 size: 23 – 1000 nm
PN - PEMS	Testo NanoMet 3	PEMS for Nanoparticle counting. concentration: 1.0E4 – 3.0E8 #/cm^3 size: 10 – 700 nm
Rugged Enclosure	HORIBA OBS-ONE RE	Rugged Enclosure for off-road measurements.
Portable Analyzer	Anapol EU-5000	Measured components: CO_2, CO, NO_2, HC, SO_2, temperatures.

FTIR Fourier Transform Infrared spectroscopy
PEMS Portable Emissions Measurement System
PN Particle Number

4. **Particle Counters and Classifier**

SMPS 3936	EC 3080 / DMA 3081 / CPC 3010	Particle type: Solids and non-volatile liquids particle size range: 10 to 1000 nm
SMPS 3936	EC 3080 / DMA 3081A / CPC 37**72**	Particle type: Solids and non-volatile liquids particle size range: 10 to 1000 nm
SMPS 3938	E**C 3082 /** DMA 3085A / CPC 377**6**	Particle type: Solids and non-volatile liquids particle size range: 2.5 to 150 nm
Condensation Particle Counter (CPC)	TSI CPC 3010	Particle size range min. detectable particle: 50% of 10 nm particles max. detectable particle: >3 µm particle concentration range: 0 to 10'000 #/cm³
Condensation Particle Counter (CPC)	TSI CPC 3772	Particle size range min. detectable particle: 50% of 10 nm particles max. detectable particle: >3 µm particle concentration range: 0 to 10'000 #/cm³
Condensation Particle Counter (CPC)	TSI CPC 377**6**	Particle size range min. detectable particle: 50% of 2.5 nm particles max. detectable particle: >3 µm particle concentration range: 0 to 10'000 #/cm³
Condensation Particle Counter (CPC)	TSI CPC 3790	Conform to GRPE Particle Measurement Programme (PMP) particle size range min. detectable particle: 50% of 23-nm particles max. detectable particle: >3 µm particle concentration range: 0 to 10'000 #/cm³
Nanoparticle Emission Tester	TSI NPET 3795	Built-in 10:1 dilution, and a catalytic stripper to remove volatile particles. max. concentrations : 5.0E6 #/cm³

CPC Condensation Particle Counter
SMPS Scanning Mobility Particle Sizer Spectrometers - consist of an Electrostatic Classifier (EC) with a Differential Mobility Analyzer (DMA) coupled with a Condensation Particle Counter (CPC).



5. **Combustion Analysis**

Kislter KiBox	KiBox To Go / 2893A	Onboard combustion analysis – mobile cylinder pressure indication system for real-time data
Cylinder pressure sensors		Various piezoelectric pressure sensors, spark plug with pressure sensors, glow plug adapter for cylinder pressure sensors.
Crank angle sensor		

6. **Simulation and Hardware in the Loop (HiL)**

IPG Automotive Carmaker	Software	Real-time car simulation.
IPG Automotive Truckmaker	Software	Real-time truck simulation.
IPG Automotive Xpack4	Hardware	Hardware platform implemented on engine dynamometer.
Typhoon HIL406	Software + hardware	For use with components.

7. **Weighing Facilities**

Scale A	Mettler Toledo XP64001L	Maximum Capacity: 64100 g readability: 0.1 g application: weighing of DPF (soot load)
Scale B	Mettler Toledo Micro Balance XP2U with climatic chamber	Max. capacity: 2.1 g readability: 0.0000001 g / 0.1 µg application: weighing of filters (PM emissions)

8. **Miscellaneous**

PC Oscilloscopes	PicoScope 4425 with automotive diagnostic kit	
CAN-interfaces	Vector, CSS-electronics, PEAK	
GPS-Logger	Racelogic VBox-Micro	
Network analyzer, power meter	GMC Instruments PQ-Box 100	Electric vehicles measurements
Power Meter	E-MobilBox	Electric vehicles measurements