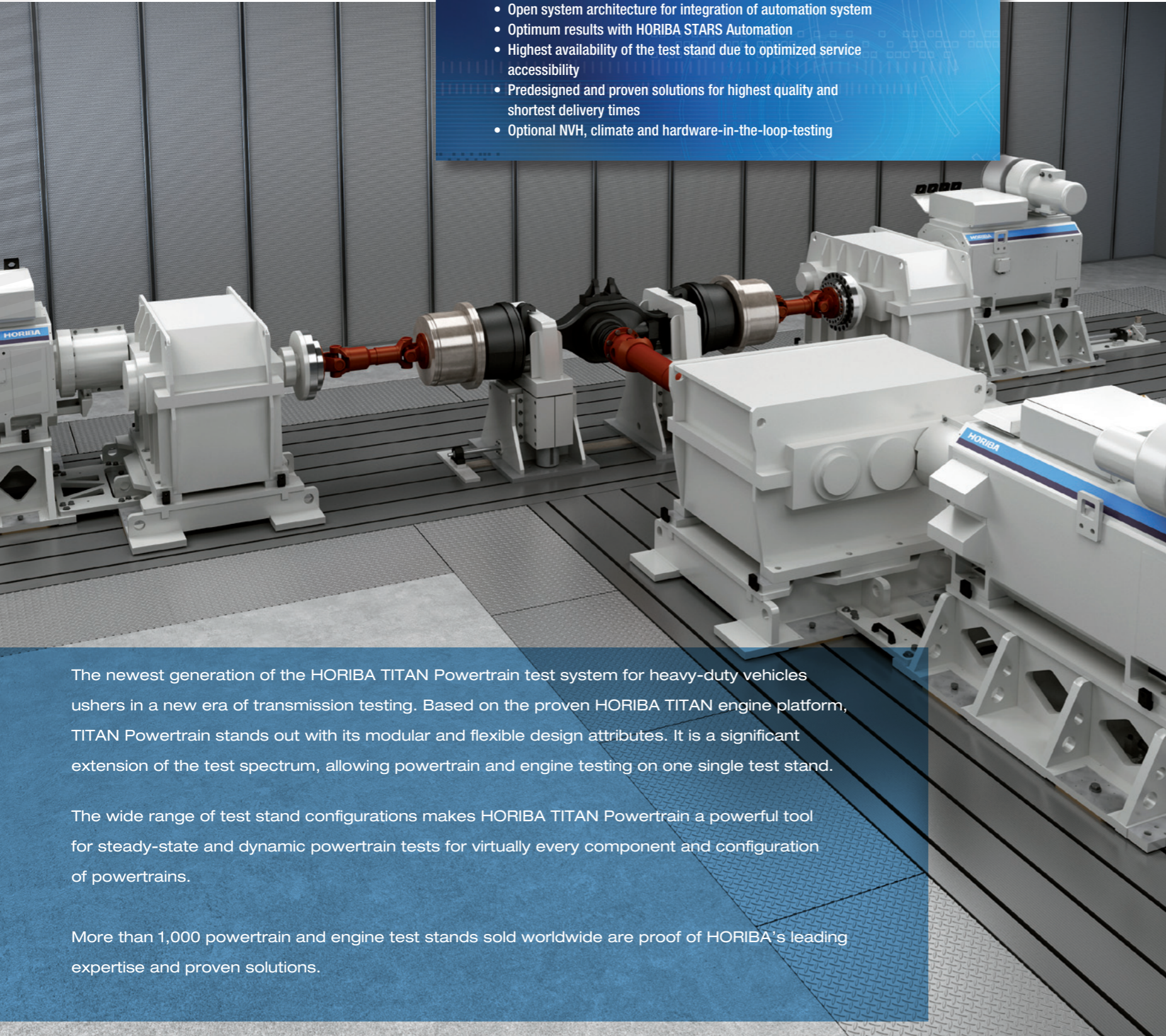


TITAN Powertrain

Advanced Powertrain Testing For Heavy-Duty Applications

Highlights and Benefits

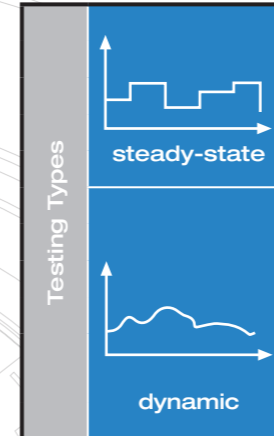
- Test engines and transmissions on a single test stand
- System architecture independent of specimen and configuration for easy integration of new specimen and applications
- Highly flexible modular components for customized solutions
- Longitudinal and transversal engine and gearbox testing
- Possibility to test virtually every component of a powertrain
- Open system architecture for integration of automation system
- Optimum results with HORIBA STARS Automation
- Highest availability of the test stand due to optimized service accessibility
- Predesigned and proven solutions for highest quality and shortest delivery times
- Optional NVH, climate and hardware-in-the-loop-testing



The newest generation of the HORIBA TITAN Powertrain test system for heavy-duty vehicles ushers in a new era of transmission testing. Based on the proven HORIBA TITAN engine platform, TITAN Powertrain stands out with its modular and flexible design attributes. It is a significant extension of the test spectrum, allowing powertrain and engine testing on one single test stand.

The wide range of test stand configurations makes HORIBA TITAN Powertrain a powerful tool for steady-state and dynamic powertrain tests for virtually every component and configuration of powertrains.

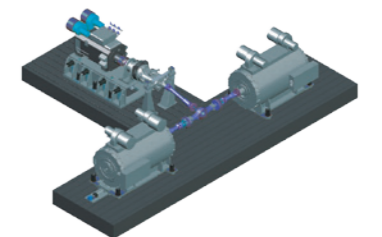
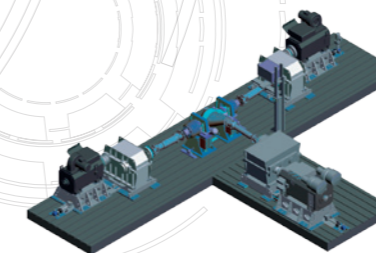
More than 1,000 powertrain and engine test stands sold worldwide are proof of HORIBA's leading expertise and proven solutions.



| Test-Specimen | | | |
|--|------------------------|-----------------------------|--|
| Manual Transmission | Automatic Transmission | Hybrid Electric Vehicles | Axles, Driveshafts & Transmission Components |
| Durability & wear test | | | |
| Performance & efficiency test | | | |
| Noise, Vibration & Harshness (NVH) / altitude & climate simulation | | | |
| Thermal & lubricant test | | | |
| Stall Tests | | | |
| General functional testing | | | |
| Shiftability / synchronization | | | |
| Shift calibration | | | |
| Durability test | | | |
| Convert test | | Energy & battery management | Simulation of cornering |
| NVH / altitude & climate simulation | | | |

With years of experience in the fields of engine and powertrain testing, HORIBA developed the TITAN Powertrain as a tool for both, steady-state and dynamic test applications. Thanks to the sophisticated and modular design, complete powertrains as well as

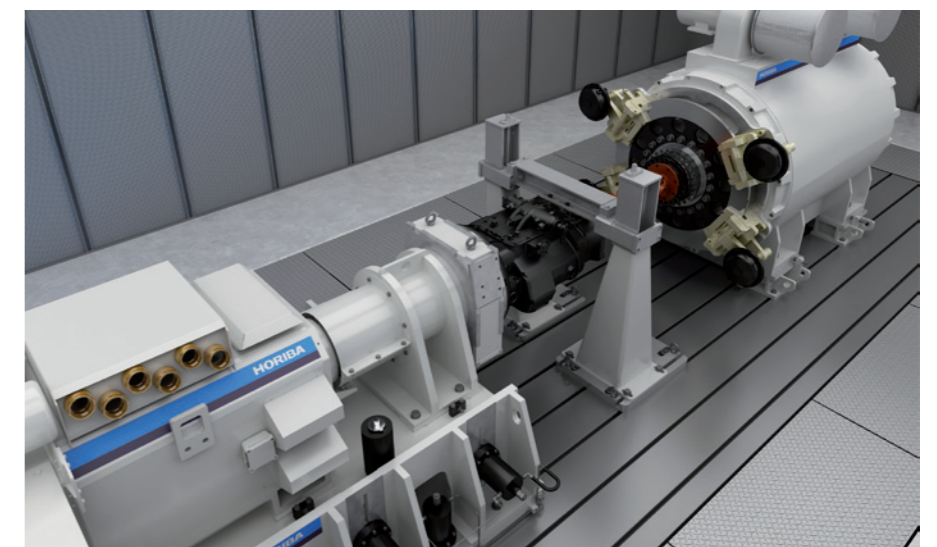
components such as axles, power take-offs, torque converters and retarders can be tested in various configurations, thus ensuring tests on virtually every heavy-duty application.



TITAN Powertrain in axle (l.) and powertrain (r.) testing configuration.



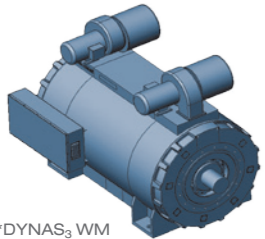
The pictures show possible configurations for rear-wheel-driven vehicles. A second driven axle for all-wheel and rear-wheel-drive configuration can be simulated by either two DYNAS₃ WM wheel output units or one DYNAS₃ PT propshaft unit.

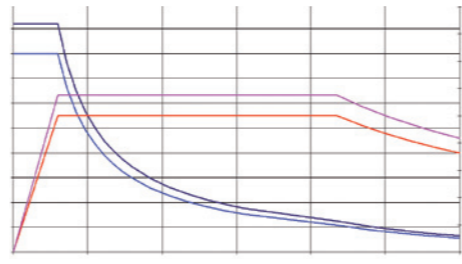


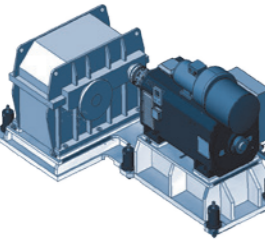
Mechanical Elements

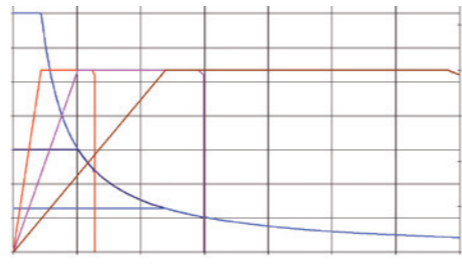
To ensure a high degree of testing flexibility, HORIBA offers several input and output propshaft and wheel output DYNAS machines. In addition to the proven DYNAS₃ machines, the new DYNAS_{PACK}, combinations of a DYNAS₃ machine and a shifttable test stand gearbox, are available as wheel and propshaft units. These units provide for individual test stand configurations, including tests of one or two rear axles and all-wheel-driven vehicles. Furthermore, the input unit can be realized using the original internal combustion engine.

Examples for possible DYNAS Units:

| DYNAS ₃ products for TITAN Powertrain | | Type | Torque [Nm] | Speed [rpm] | Power [kW] |
|--|---------|----------------|-------------|-------------|------------|
|  | PT32000 | Propshaft Unit | 32,000 | 3,000 | 800 |
| | WM40000 | Wheel Unit | 40,000 | 1,200 | 500 |
| | HD860 | Input Unit | 5,000 | 3,000 | 860 |

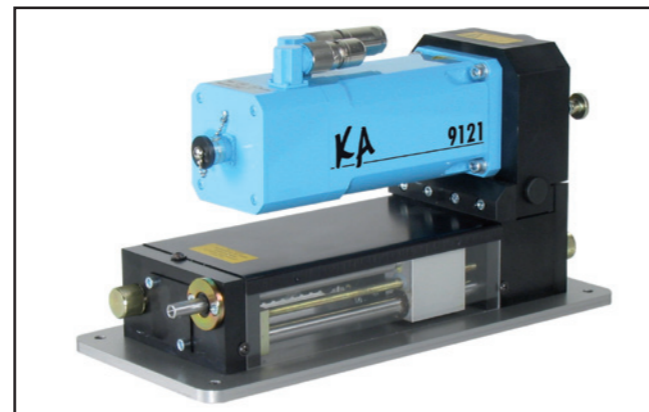
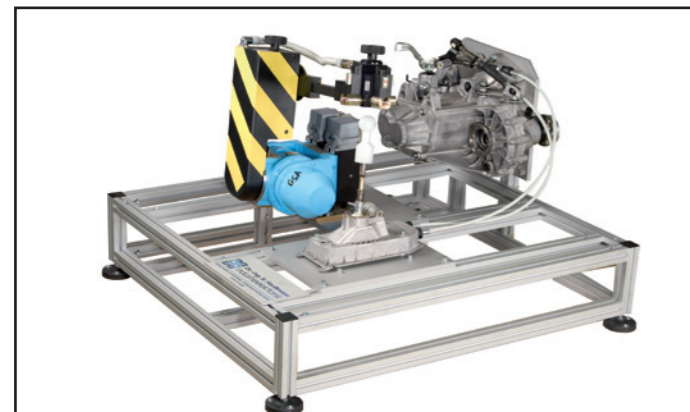


| DYNAS _{PACK} products for TITAN Powertrain | | Type | Torque [Nm] | Speed [rpm] | Power [kW] |
|---|---------|----------------|-------------|-------------|------------|
|  | PT35000 | Propshaft Unit | 35,000 | 3,500 | 800 |
| | WM50000 | Wheel Unit | 50,000 | 1,200 | 500 |



Thanks to an optimized ratio spread, there are no power output gaps with the DYNAS_{PACK} units.

In standard configuration, TITAN Powertrain is delivered with HAUSMANN shift actuators. However, GIF actuators are also supported on customer's demand.



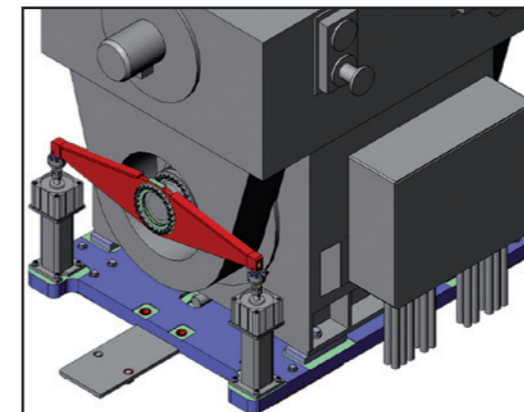
Platform Highlights:

- Modular frame adjustment for quick realization of various applications
- Optional automatic fixation for frame adjustments
- DYNAS₃ input and output units for increased testing variety
- DYNAS_{PACK} output units with minimized power output gap
- Support for HAUSSMANN and GIF shift actuators
- Possible input units: electrical dyno or combustion engine

Calibration Highlights

- Rapid calibration with time savings of up to 60 % per motor
- Highly accurate HBM torque measuring flanges

The HORIBA TITAN product platform is characterized by its modularity and flexibility attributes. On the mechanical side, there are many options for enhancing the setup of the specimen, for example electrical adjustment, automatic fixation etc. The modular design maximizes the technical availability of the test stand and reduces down-times during service and installation in comparison with previous HORIBA products.



A highly accurate calibration device for torques up to 50,000 Nm adjusts the HBM measuring flanges and supports the operator to reach the highest quality of fine-tuning.

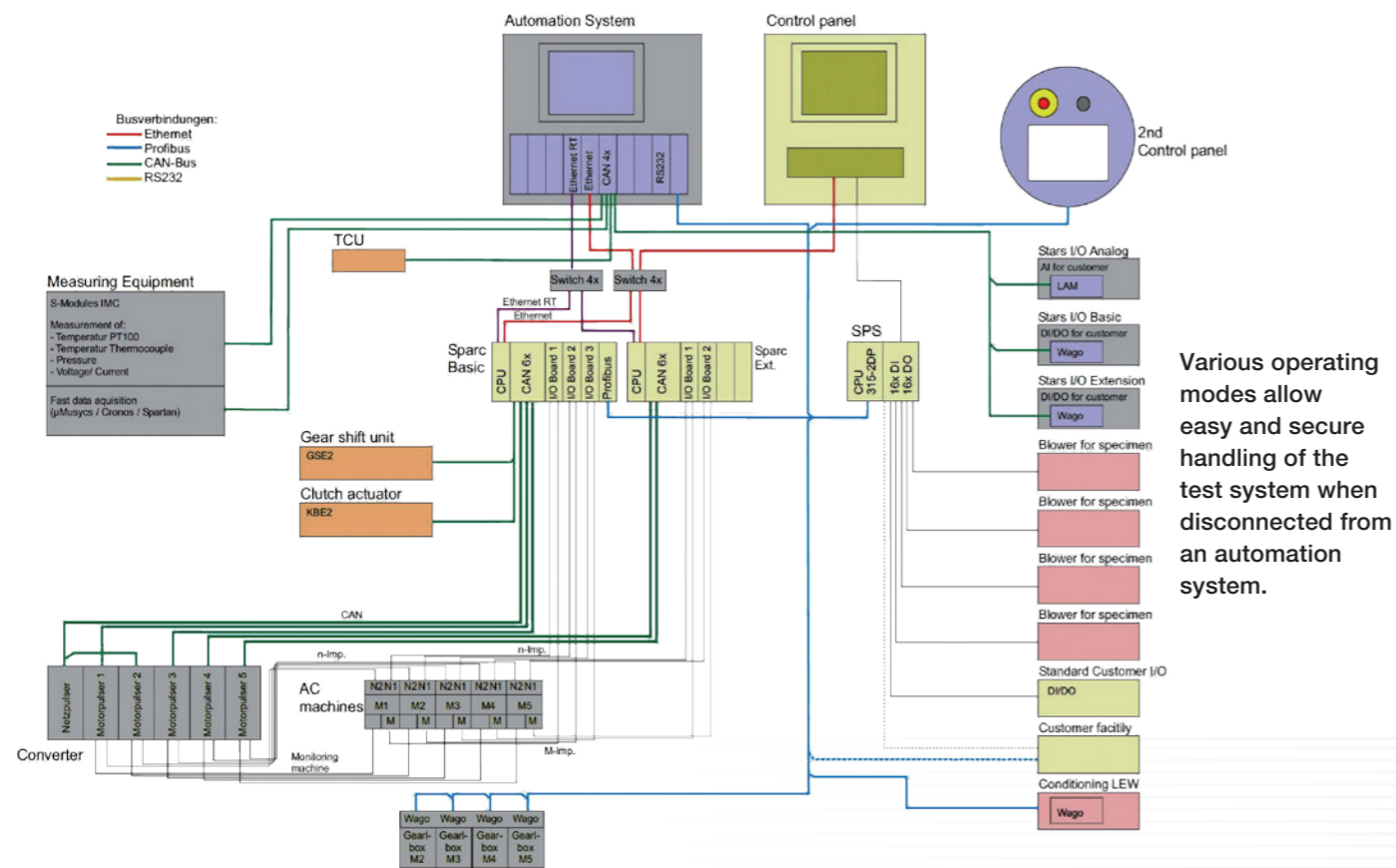
Two pneumatic actuators load the calibration lever with a high degree of accuracy and significantly shorten the adjustment process.

Open and Flexible System Architecture

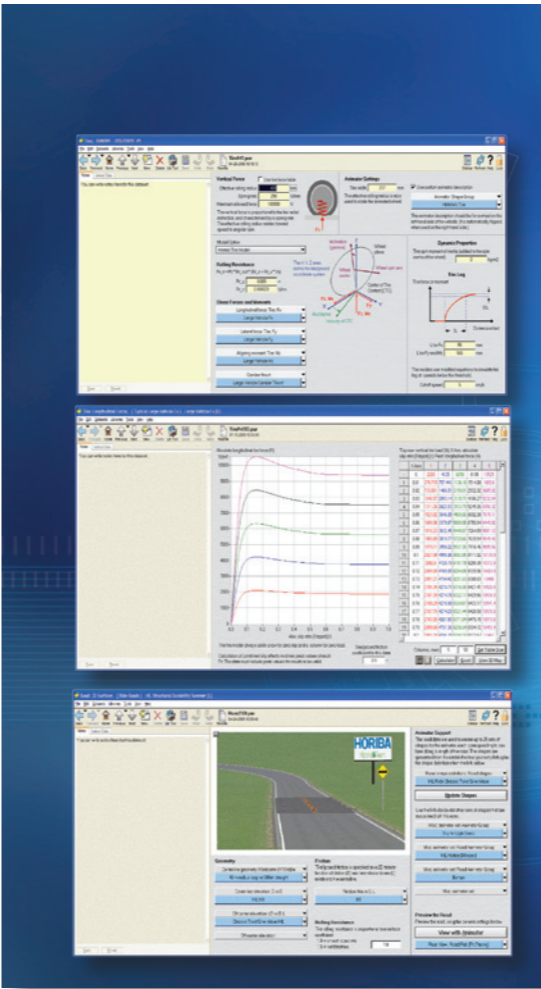
The flexible system architecture realizes easy integration of customer specific functions into the test system. A standardized interface ensures integration into HORIBA STARS world-class Automation or other automation systems via Ethernet User Datagram Protocol (UDP). All reference values and control modes as well as SPARC Powertrain parameters can be preset and read out during testing.

STARS

SPARC



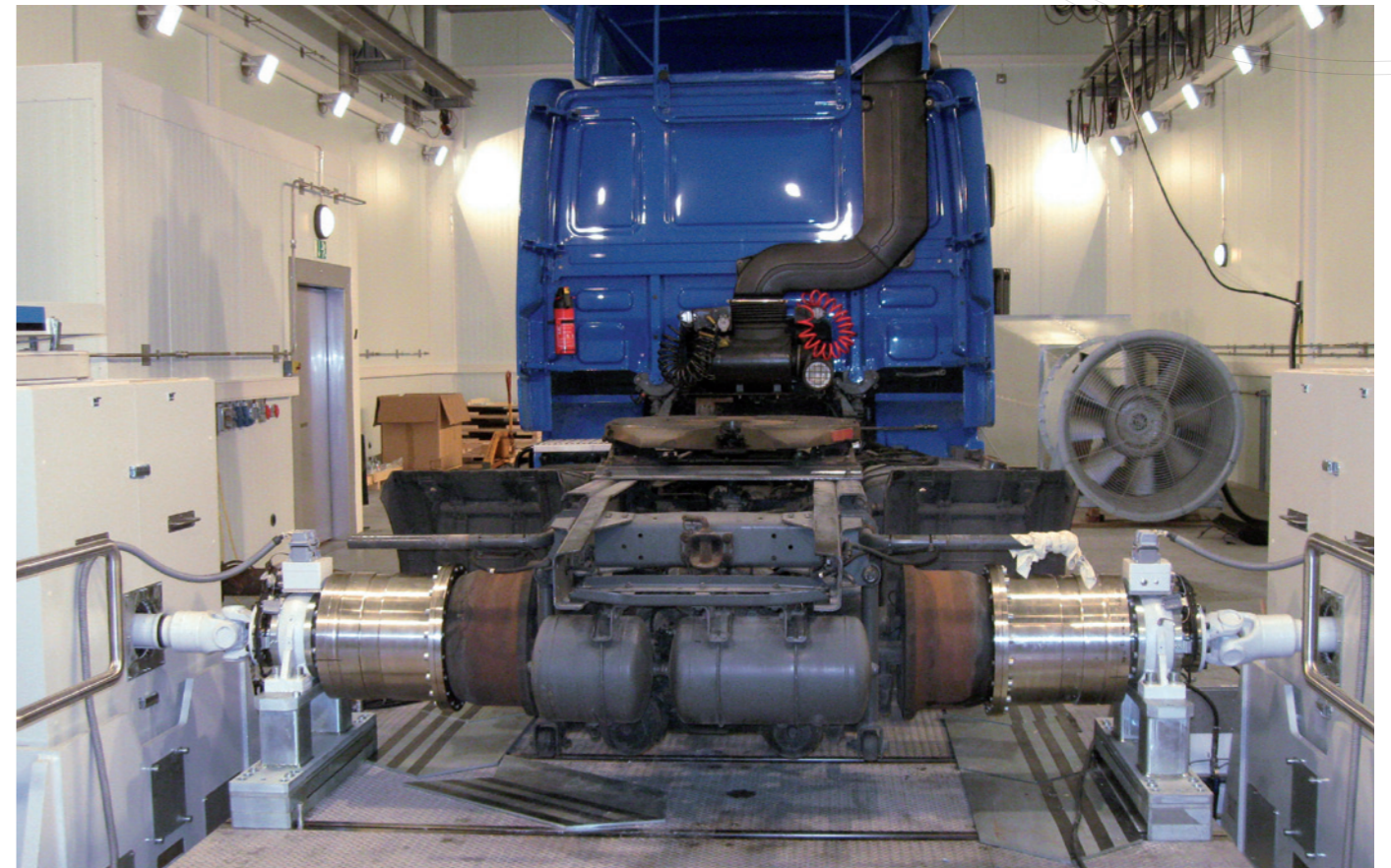
Various operating modes allow easy and secure handling of the test system when disconnected from an automation system.



A large variety of customized options are available. HORIBA offers a wide range of additional testing equipment such as NVH or climate testing facilities. Furthermore, HORIBA provides powerful hardware-in-the-loop simulation. CarSim and TruckSIM allow complete vehicle and track simulation in real time, whereas the Graphical User Interface (GUI) provides 3D visualization of the simulation.

In addition, third-party products, software and simulation tools can easily be integrated into the test system.

Powertrain test configuration in a climate chamber for temperatures from -45 °C to +80 °C and altitudes of up to 4,000 m.



All configurations can be additionally controlled and modified via a manual control panel, thus reducing setup time and optimizing setup mode.

Software Highlights

- Manual control panel for reduced setup times
- Various operating modes for rapid, safe and easy handling
- Easy integration of customer specific functions via Ethernet UDP
- Optimum results with STARS Automation
- Compatible with all automation systems

HORIBA continues contributing to the preservation of the global environment through analysis and measuring technology.



Please read the operation manual before using this product to assure safe and proper handling of the product.

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