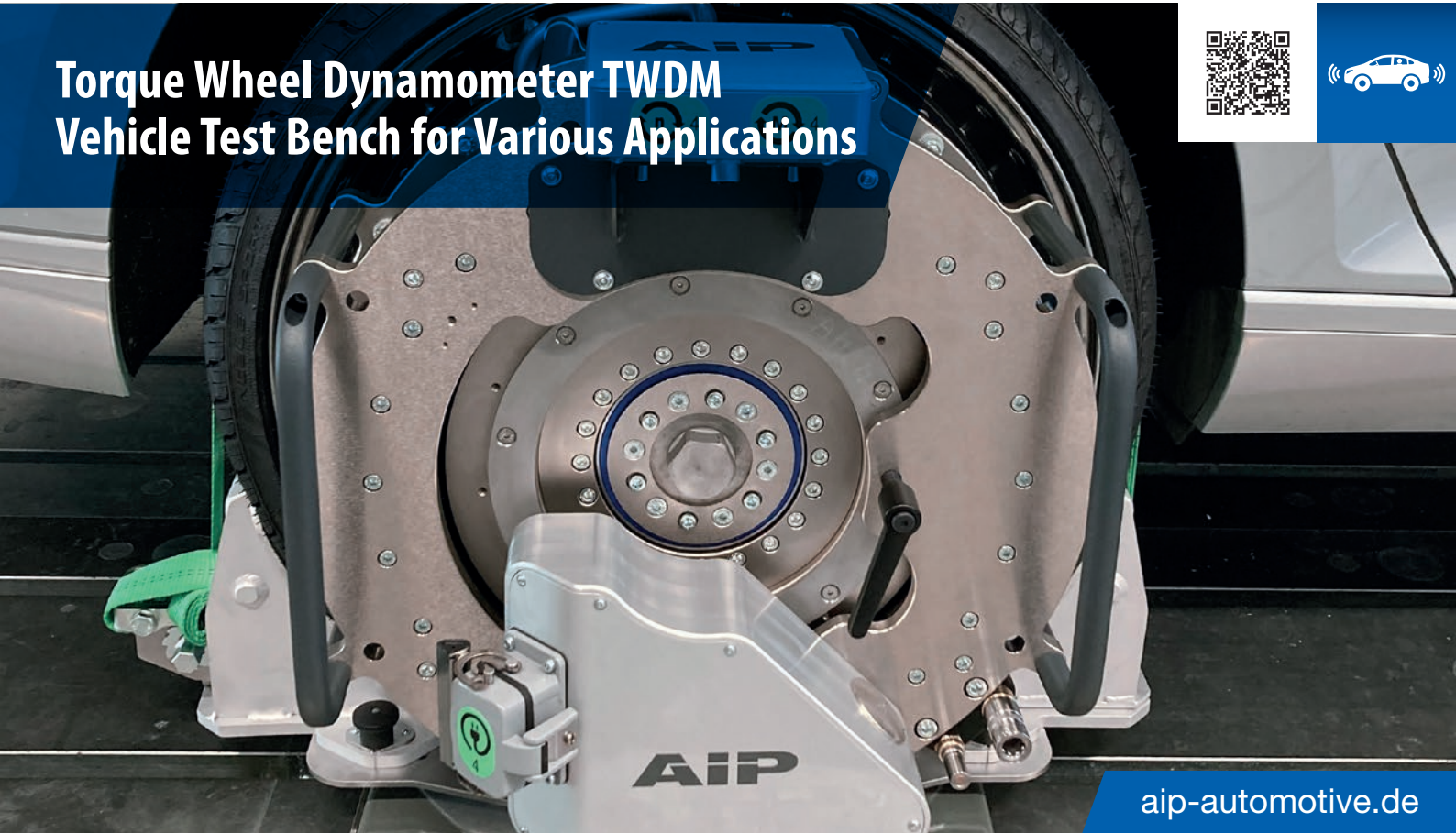
Test Systems for a Clean and Safe Environment

AiP automotive

Torque Wheel Dynamometer TWDM
Vehicle Test Bench for Various Applications



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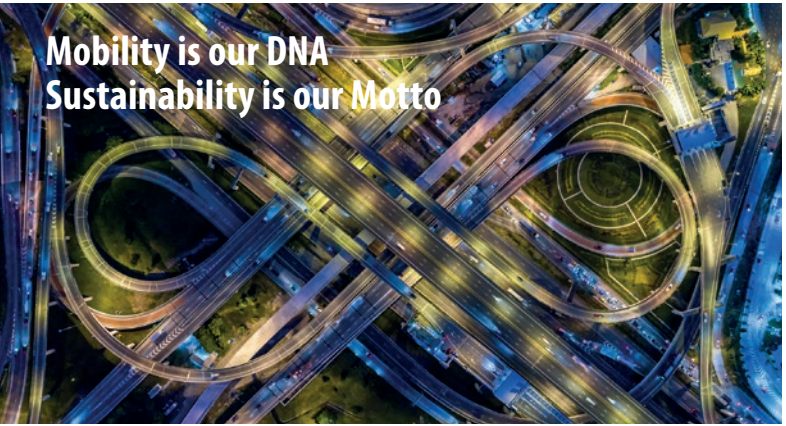
New Groundbreaking Test Systems for Vehicle Testing



AIP designs and manufactures individual customized test systems for development- (RND) and production centers for many of the well-known vehicle manufacturers in Germany and abroad. Our goal is technology- and service leadership in the field of vehicle testing technology.

Get first-hand information about our innovations:

- **Battery Fast Charging Stations**
- **Torque Wheel Dynamometers**
- **Powertrain 4x4 Dynamometers (Road to Rig)**
- **ADAS Testing Systems**
- **Battery Simulator**

State-of-the-art, environmentally friendly production techniques and the constant further development of our products and services, create since decades a sustainable level of customer satisfaction and trust. We are in demand and valued internationally for this.

The recent development of many new products increasingly includes the areas of measurement technology and software development / automation, in addition to classic mechanical and electrical engineering.

In particular, AIP supplies vehicle test benches (for complete vehicles and vehicle components) for the realistic, reproducible simulation of road trips in laboratory operation, e.g. in the areas of emission measurement, endurance testing, measurement of electromagnetic compatibility / compliance, acoustic and harshness (“squeeze and raddle”) vibration measurement.

AIP’s innovative testing technologies are also used in the areas of E-Mobility, fuel cell technology, autonomous driving and in the development and quality assurance of driver assistance systems (ADAS).

In addition to the vehicle test benches for road driving simulation, AIP has developed an extremely high level of awareness in the areas of measurement technology and flexible customized test bench automation (MCS / HOST), worldwide.

Innovative projects for e.g. VW Group, Porsche, BMW, Mercedes, AUDI, TESLA as well as for leading suppliers from France, Sweden, and Asia emphasize our high-ranking expertise in this important future section.

High-Performance Solutions for a Wide Range of Applications

The AIP comprehensive system solutions are modular in design / budget and easily adaptable to various vehicle types and customer requirements.

- Mobile and stationary charging stations for E-Mobility
- Range determination
- Energy consumption measurement
- Acoustic measurement (NVH)
- Endurance testing, COP
- Performance measurement, e.g. in a wind tunnel
- Battery abuse center test benches
- Functional testing, e.g., in climatic- and altitude chambers
- Verification electro-magnetic compliance (EMC)
- Hydraulic-/electric road simulation testing (shaker, E-pulser)
- Emission measurement systems (NVH, EMC)
- Test automation (MCS Master Control Sytem / HOST)
- Robot driver / Throttle actuator
- Test Stand Accessories
- Drivers aid systems

TISAX® RESULT AVAILABLE

ISO 9001 Certification of Quality Management — AIP automotive

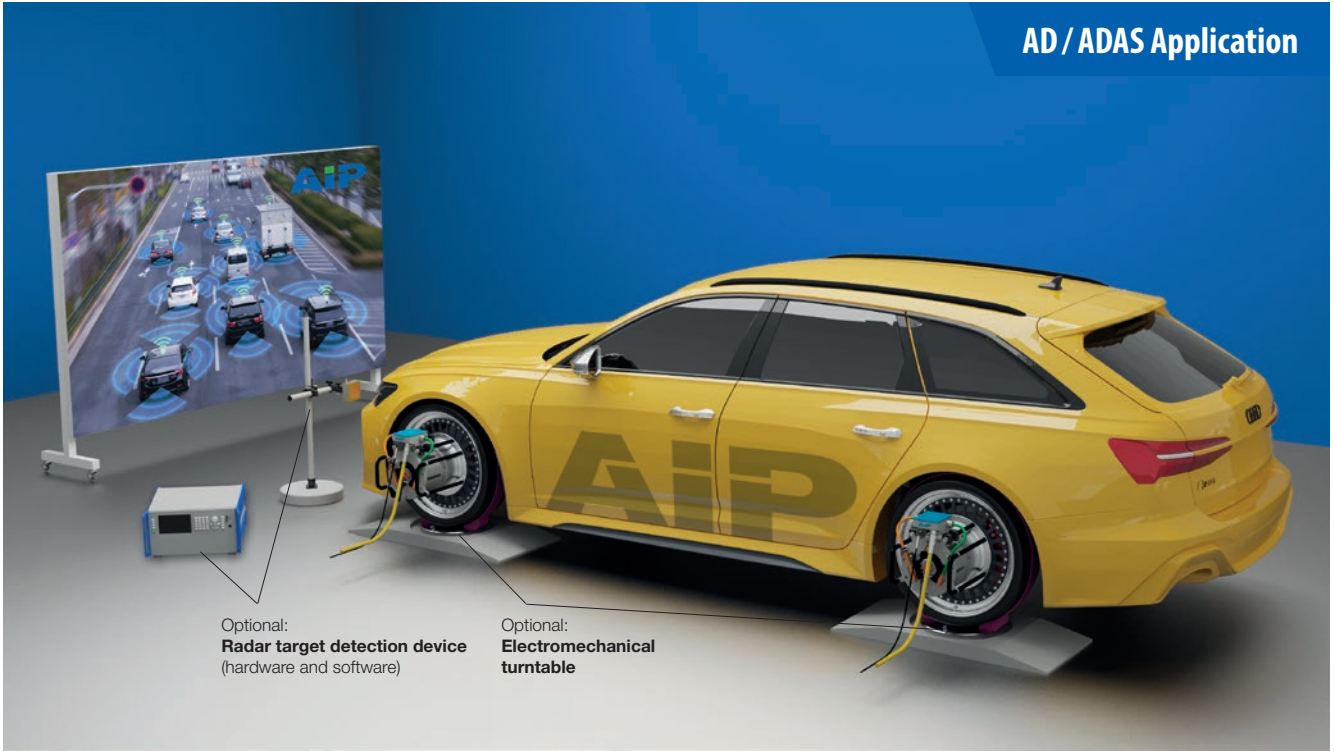
ISO 14001 Certification of Environmental Management — AIP automotive

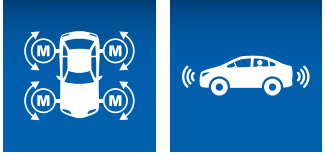
ISO 45001 Certified Management for Security and Health — AIP automotive

ISO/IEC 17025 DAkkS German Accreditation Office — AIP automotive

Torque Wheel Dynamometer TWDM

2/4WD Test Bench with Torque Motors and Optional Turntables to Perform Steer- and Drive Simulation Testing





The ViL platform is based on an innovative and patented concept for a Torque-Wheel DynamoMeter (TWDM) consisting of four wheels with integrated torque motor in combination with an electromechanical turntable. The TWDM rotates the wheel hub relative to the rim (AIP 'drive-through rim' design) when the wheel is in a standing position.

In contrast to existing test benches or roller dynamometers, no structural measures are necessary for the TWDM. By using optional electro-mechanical turntable plates, different steering angles can be set, which also allows speed-dependent steering counter forces to be taken into account. Accordingly, the steering of the vehicle remains in its original state with the TWDM and does not need to be manipulated, which is a huge advantage compared to the state-of-the-art test bench technology.

Even incline, decline, tyre slip on ice or snow, can be replicated by using the TWDM in combination with a powerful real-time road drive environment simulation. The resulting ViL platform is therefore particularly well suited for the evaluation of automated driving functions. Optionally in combination with AD / ADAS hard- and software.

Advantages

- No expensive structural requirements necessary
- No fixation of the vehicle chassis necessary
- Mobile design for location independent testing
- Simultaneous Steer & Drive testing
- No modification of vehicle steering necessary
- Accessibility to the vehicle for stimulation of sensors (ADAS)

Applications, e.g.:

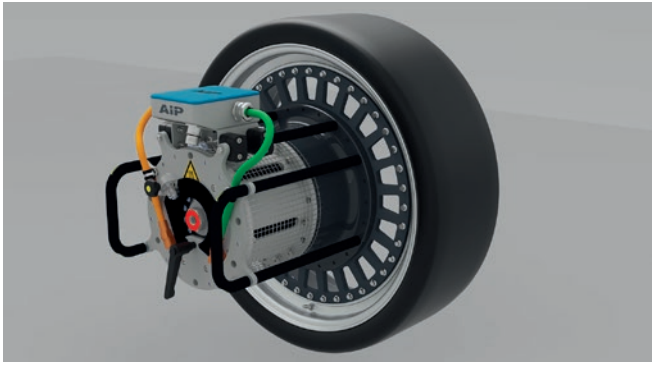
- Testing E-Architecture
- AD / ADAS testing
- Steer- and drive simulation testing
- R2R testing
- Range testing

Application Examples

Variants of the TWDM

Examples

TWDM Mobile (Air Cooled)
(Base Version)



	Mobile
Nominal torque [Nm]	39
Nominal speed [min^{-1}]	400
Max. power [kW]	20
Max. torque [Nm]	332
Max. speed [min^{-1}]	850

TWDM Performance (Liquid Cooled)

	Base performance	Mid performance	High performance
Nominal torque [Nm]	525	1050	1023
Nominal speed [min^{-1}]	460	467	1400
Max. power [kW]	40	75	280
Max. torque [Nm]	800	1600	2200
Max. speed [min^{-1}]	1800	1800	2000

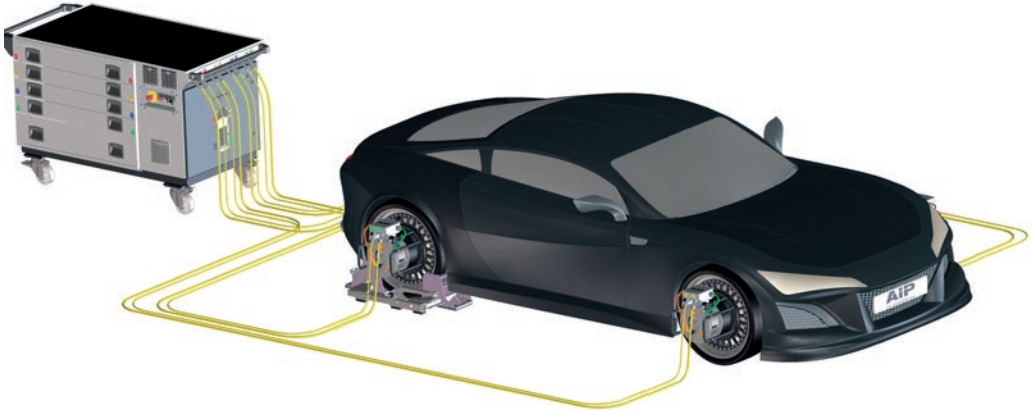
Tyre size 215/30 R20 (Outside dia. approx. 640 mm) is available for all variants.

TWDM Mobile Setup

Example (Base Version)

Movable media supply trolley to store power cables. Incl. docking station for TWDM power cables and the power cable for the grid.

Watch our TWDM setup image video

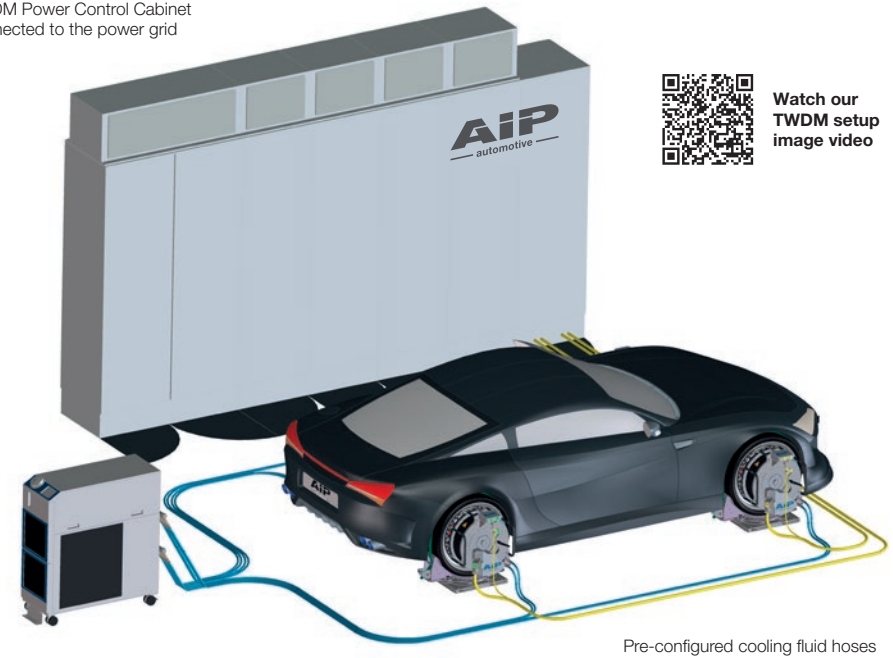


Pre-configured power supply cables for up to 4 TWDM units

TWDM Performance Setup

Example

TWDM Power Control Cabinet
connected to the power grid



Watch our TWDM setup image video

Movable trolley with continuous liquid cooler incl. docking station for TWDM cooling fluid hoses (in / out)

Integral cooling fluid tank, filling- / drainage, manual

Liquid cooler power supply from grid

Pre-configured cooling fluid hoses (inflow and backflow – blue) and power cables (yellow) for up to 4 TWDM units

AD / ADAS System Stimulation

Torque Wheel Dynamometer

The test vehicle benches with motorized drive-through rims on turntables, integrated on the floor (plenum) e.g. of a test cell. This setup allows steering movements during the driving simulation, with the vehicle stationary. Simulation of cornering, lane change, automatic parking/unparking, distance warning. Emergency braking behavior, etc.

While the wheels are stationary, the motorized, specially mounted drive-through rims drive the vehicle drivetrain in a synchronized manner, simulating behavior similar to real road driving.

An embedded video system and radar target simulator integrated in the test cell floor in front of the vehicle projects a realistic roadway with different vehicles, obstacles, etc.

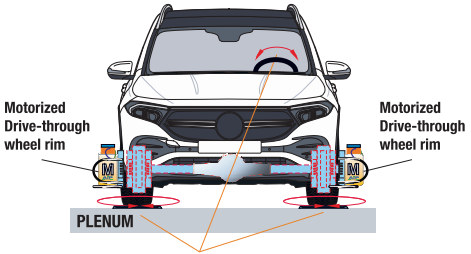
Application Examples

E-Mobility

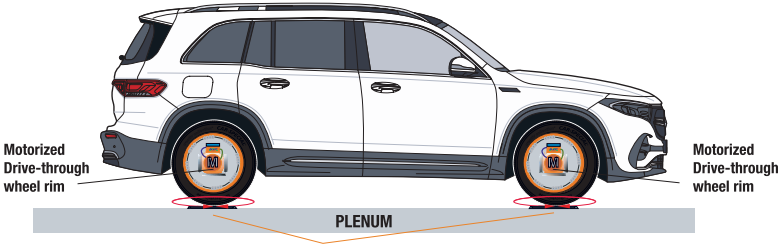
EMC

AD / ADAS System Stimulation

Torque Wheel Dynamometer Working Principle (Patented)



Flat Design Turntable
for road cornering (curve drive) simulation, steering movement



Flat Design Turntable
for road cornering (curve drive) simulation, steering movement

Application Examples

E-Mobility

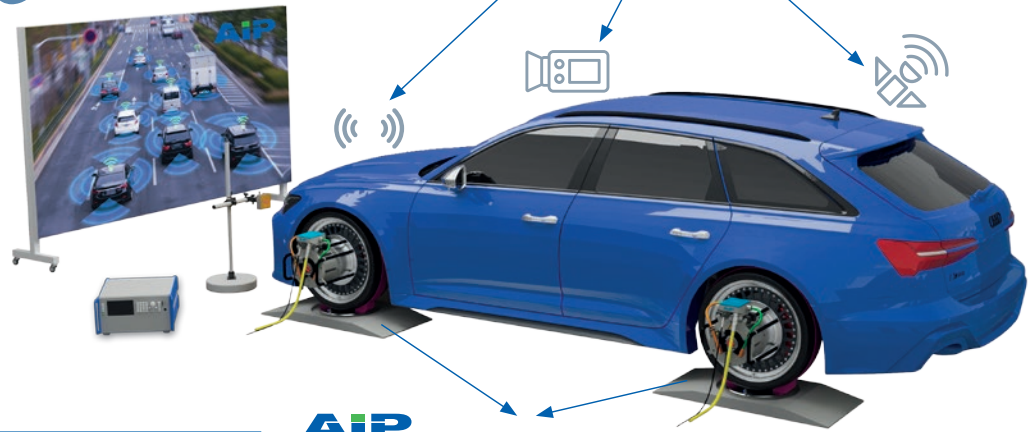
EMC

ViL Development Platform (Example)

Simulation
- Surrounding
- Scenarios based on maneuver catalogue

IPG

Sensor stimulation +
Sensor simulation or bypassing
(Radar, Lidar, Camera, GPS ...)



AIP automotive

Steer- / Wheel Dynamometer

Application Examples

E-Mobility

EMC

AIP Master Control System MCS

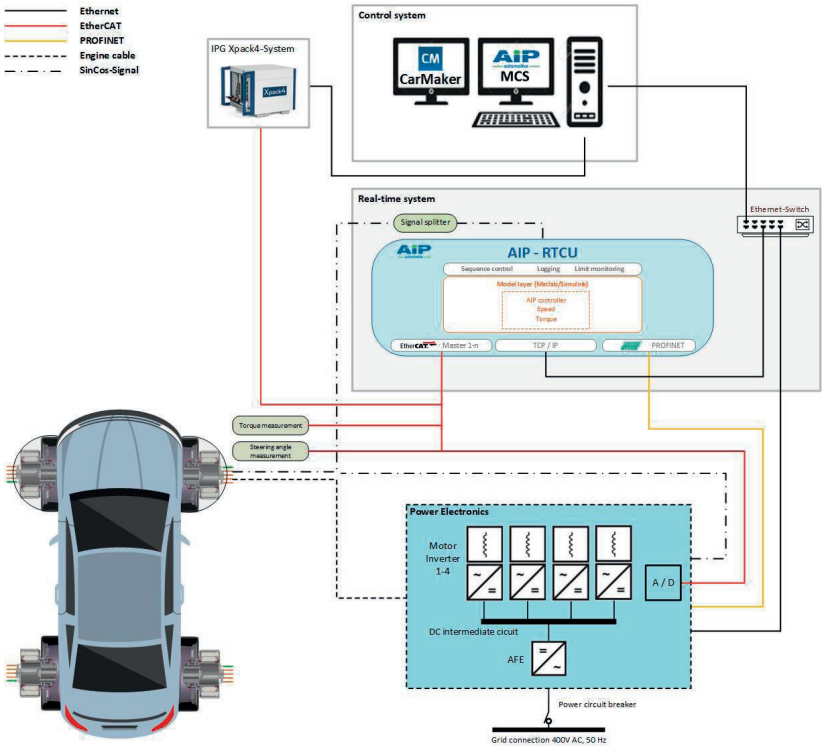
Control System Consisting of Hard- and Software

The AIP test bench automation MCS - Master Control System serves as a central test bench and sequence control system. The control system takes over the integral control and monitoring of comprehensive test bench systems and configurations:

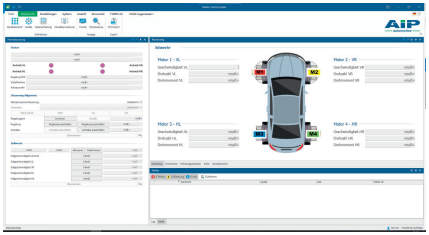
- Project-/test-/parameter- management
- Test bench control
- Plug-in management
- Creation and monitoring of test sequences
- Test program sequence control
- Data recording control incl. reporting
- Limit value monitoring
- Visualization of the test sequence and GUI

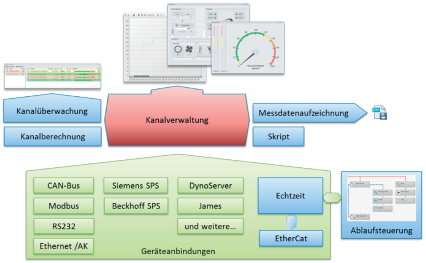
Both AIP devices and testing technology, as well as third-party systems/testing technology, building- and air conditioning technology (TGA & MSR) can be integrated, controlled, regulated and displayed.

EtherCAT ™ is used as the preferred bus. Various measurement technology systems can be integrated and controlled on a customer-specific basis.



MCS Graphical User Interface





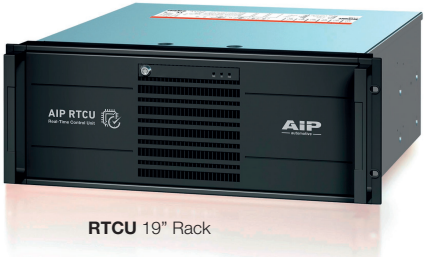
Control System RTCU

The RTCU (Real-Time Control Unit) control system is AIP's consistently refined, cross-product and scalable control platform.

The RTCU essentially consists of the following components:

- RTCU – Ultra-compact industrial PC for real-time control and decentralised data processing via the Industrial Ethernet system 'EtherCAT'
- EtherCAT measurement data acquisition for decentralized data acquisition within the test bench per drive

The flexible control system can be commanded individually. Each drive can be operated individually or within a synchronous unit in any type of control. Assigning a drive to a synchronization unit is flexible. Several drives or synchronization units can be operated side by side or in parallel.



RTCU 19" Rack

RTCU Compact

Application Examples

- E-Mobility
- Fuel Cell
- Climatic Chambers
- NVH
- Battery Safety Center
- R&D Application
- Durability, COP, BSR

Our Headquarters in the Beautiful Allgäu

Our headquarters are located in Haldenwang in the heart of the Allgäu region, approx. 120 km southwest of Munich.

For more than 25 years, AIP has been developing, testing, and manufacturing future oriented automotive testing technologies to promote a clean and safe environment.

The Allgäu is the southern region of Germany and one of the most popular tourist areas in the country. It is especially known for its intact and charming nature.

The famous Neuschwanstein Castle in the heart of the Allgäu region

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