HORIBA
Automotive Test Systems

HORIBA Automation Solutions

Vehicle Emission Test System

VETS ONE

HORIBA Europe Automation Division GmbH is a member of the HORIBA Group, with its Corporate Headquarters located in Kyoto, Japan. HORIBA is the leading manufacturer of scientific analysis and measurement instruments.

We, HORIBA Europe Automation Division, develop software that automates the procedures and data acquisition requirements of emission measurement (chassis and engine dynamometer). We offer both standardized and customized solutions for testing environments in the automotive industry.

Our expertise includes government certification requirements (United Nations Economic Commission for Europe, United States Environmental Protection Agency, California Air Resources Board, and others), manufacturing quality assurance (COP), and Research & Development.

To meet the high standards of our international customers, our software systems are developed with strategies and techniques that deliver high-quality, technologically advanced solutions. The focus is on integration of test-cell solutions and database systems for the specific IT environment of the individual customer. For the evaluation and visualization of test results we have developed a series of reporting and analysis tools.

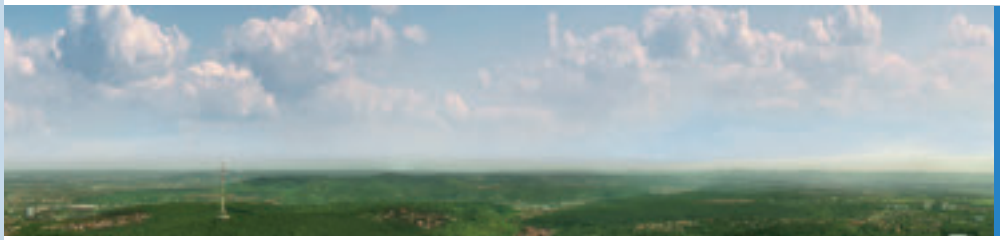
The broad range of our expertise ensures test result clarity and quality characteristics transparency, thus providing solutions for laboratory management and development processes. Along with the integration process, the experience and requirements of our customers flow into the further development and the creation of our new products.

Your Requirements:

- Automation of emission test cells
- Applications for engine dynamometer test cells
- Facility management
- Offline test evaluation
- Database integration
- Analyzer data processing

Our Products:

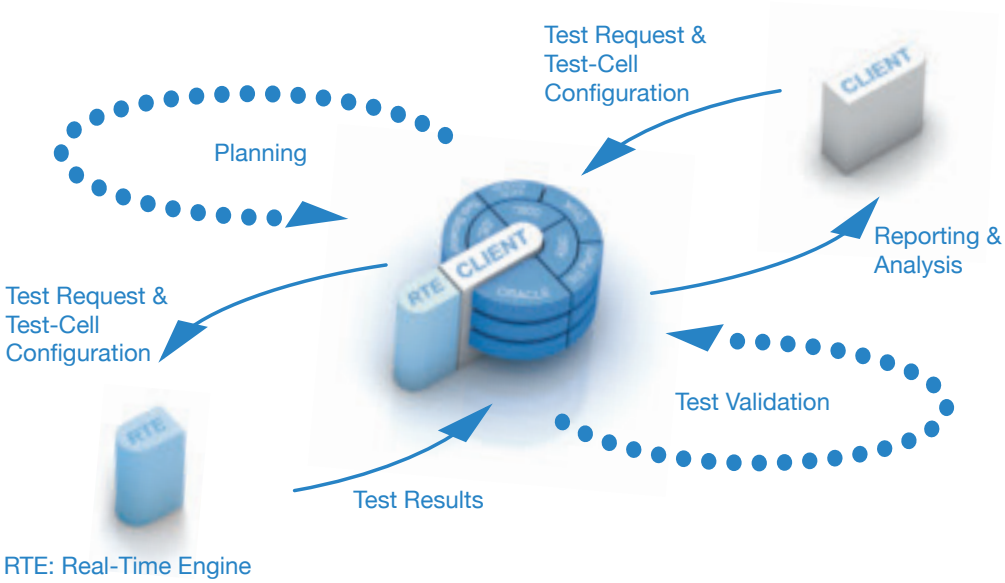
- VETS ONE (Vehicle Emission Test System) – automation system for chassis dynamometer test cells
- DIVA (Data Interpretation Visualization Analysis) – graphical evaluation tool
- Other applications for test-cell requirements (span gas management, MEXA tools, database browsing etc.)



With a greatly motivated working team equipped with a high level of know-ledge, we ensure an excellent standard of our products and services.

Our product range offers a well-developed efficient test-cell operation. Based on our vast project experience and knowledge, HORIBA Automation provides solutions to meet the requirements of the stringent automotive emission legislation and of R & D laboratories.

VETS ONE is a software system for the automation and management of emission test cells. It controls and collects data from analytical systems, dilution systems, dynamometer, and other instruments, according to customer requirements. The system can easily be operated centrally via a dialog-oriented user interface.



RTE: Real-Time Engine

Independent Test Request and Evaluation Modules

VETS ONE consists of three major components:

1. Client (Windows-based operating system) to request and evaluate emission tests. The VETS ONE application running on this computer contains a complete representation of the test-cell devices and measurement options.

2. Real-Time Engine (Linux-based operating system) to prepare and run the requested emission tests at the test cell. The VETS ONE application on this computer contains the Real-Time Engine responsible for the test control.

3. Central Database Server to provide all the necessary data for requesting, running and evaluating emission tests.

The modular system structure ensures an efficient and safe test operation. By separating the test run from the requesting and evaluation activities, it is possible to carry out several actions simultaneously. A Central Database provides a storage device for all test sequences to guarantee data consistency at any time.

Applications:

- Certification – Homologation
- Research & Development (R&D)
- Conformity of Production (COP)
- Non-emission testing, e.g. power testing
- In-use testing
- Mileage accumulation
- Automation of test cells having diverse requirements
- Emissions testing of gasoline, diesel, and alternative fuel vehicles
- Certification according to EPA, CARB, ECE, Japanese, and other regulations
- Emissions verification and component evaluation

Features:

- Standard and custom configurations to meet any application requirement
- Easy test setup with various types of analysis – bag, modal, catalyst efficiency, EGR, and others
- Automatic test calculations and reports
- Automated calibration and quality control checks
- Integrated driver's aid system
- Flexible driving cycle editors
- Large number of user-definable parameters
- Integration and merging of data from other test applications: particulate mass, impinger, etc.
- Data access via Native SQL and ASAM ODS
- Ability to export test results to other computers and/or analysis packages (DIVA, Excel, etc.)
- Integration with facility Host computers

1965
US: Motor Vehicle Air Pollution Control Act

1966
California: Mandatory limitation of CO and HC

1967
California: Establishment of CARB

1970
EEC: First Directive concerning measures to reduce air pollution from motor vehicle (limit values for CO and HC) using „Big Bag" method

1970
US: Establishment of EPA

1971
CARB - adopts first automobile NO_X standards in the US

Device Support:

- 4WD, 2WD Dynamometer
- Driver's Aid System
- Standard Emission Analyzers
- Special Analyzers: FTIR, MS, LDS, Fast Response (FR)
- Mass Flow Meters
- Constant Volume Sampler (CVS)
- Particulate Measurement System
- Solid Particle Counting System (SPCS)
- Opacimeter
- Smoke Meter
- Impinger
- High-Speed Analog/Digital I/O System
- Weather Station
- Robot Driver
- On-Board Diagnostic System (OBD)
- ECU via ASAP3/ASAM-MCD3
- Vehicle CAN-Bus
- Fast Process I/O Unit

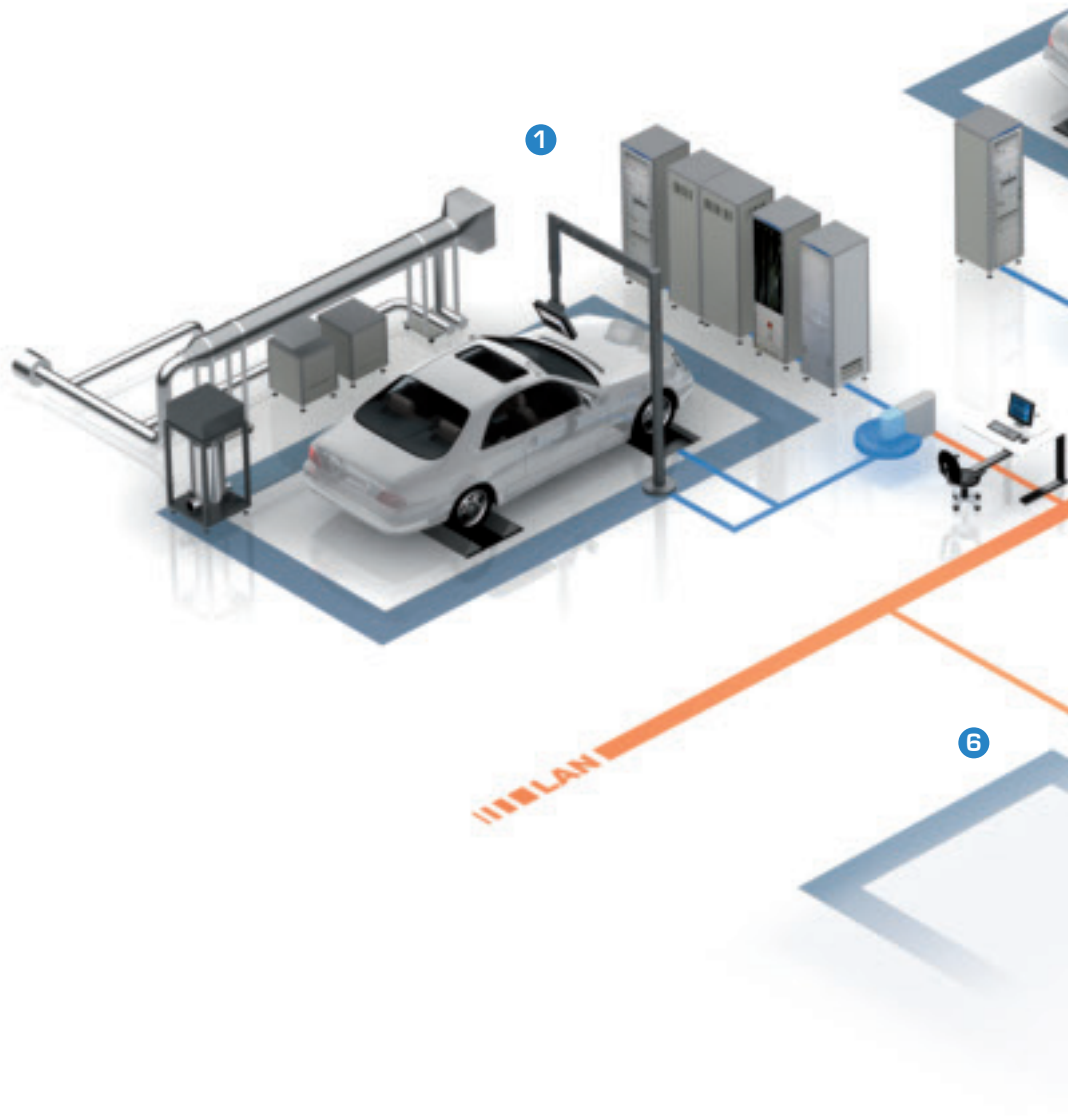
Application Support:

- ERP Systems
- Gas Management Systems
- SHED
- Vehicle Canister Loading Systems
- Other Testing Applications

Automating Your Entire Lab

VETS ONE can be fully embedded into an existing laboratory environment.

VETS ONE automates the processes running on the dynamometer, measurement benches and other test-cell devices during a chassis emissions test.



1975
US: Use of catalytic converters forces the adoption of unleaded fuel

1977
EEC: Directive supplement: limit values for NO_x

1984
EEC: Introduction of CVS for emissions measurement

1989
India: First emission regulations for idle emission limits

1990
EEC: Addition of PM mass emission limit for compression ignition engines

1992
Japan: The Motor Vehicle NO_x Law

1994
EPA: Tier 1

1995
First VETS ONE installation (Germany)

1996
EU: Euro 2

2000
EU: Euro 3, incl. deletion of 40 sec idle, -7°C, OBD testing

References

Meeting the universal needs of test laboratories, VETS ONE automates a vast number of chassis test cells worldwide for automotive manufacturers, component suppliers, and regulatory agencies.

We have successfully implemented VETS ONE systems at the following customers: ADAC, AVTOVAZ, BOSCH, DENSO, DINEX, ELCAR, FIAT, FORD, IAV, IDIADA, ISUZU, MERCEDES BENZ, NISSAN, PSA, RENAULT, RENAULT SAMSUNG MOTORS, SHELL, TOYOTA, TÜV, VOLVO, and others.

Example Laboratory:

1. Chassis Dyno Test Cell No.1:
   - Operator working site with VETS ONE client and RTE, driver's aid, 4WD dyno, exhaust analyzers and CVS, particulate measurement system, SPCS, diesel tunnel, mixing-T
2. Preconditioning and Application Test Cell:
   - Operator working site with RTE, driver's aid and 4WD dyno
3. Offices within Company Network
   - VETS ONE clients for requesting and analyzing testing results configuring quality checks, laboratory setup, creating new test cycles, etc.
4. Chassis Dyno Test Cell No.2:
   - Operator working site with VETS ONE RTE, driver's aid, 4WD dyno, exhaust analyzers and CVS, mixing-T
5. Central Database:
   - Storage of lab device settings, cycle configuration, quality assurance, vehicles, fuels, gas bottle administration data, formula, test requests and planning info, administration data and test results, data of other test cells and applications, etc.
6. Further Test Cells or Applications:
   - Engine test cells, gas management systems, SHED chambers, etc. integrated in the VETS ONE Automation System

2001 Japan: Automotive NO_x and PM Law

2001 VETS ONE goes international South Africa, Russia

2001 VETS ONE: Integration of Unattended Mode

2003 India: National Auto Fuel Policy

2004 EPA: Tier 2

2004 VETS ONE: New GUI Architecture

2004 CARB: LEV 2 introduced, phased in by 2007

2005 EU: Euro 4

2006 EPA: Tier 3

2007 > 100 VETS ONE installations in the field

2007 VETS ONE on COP test cells

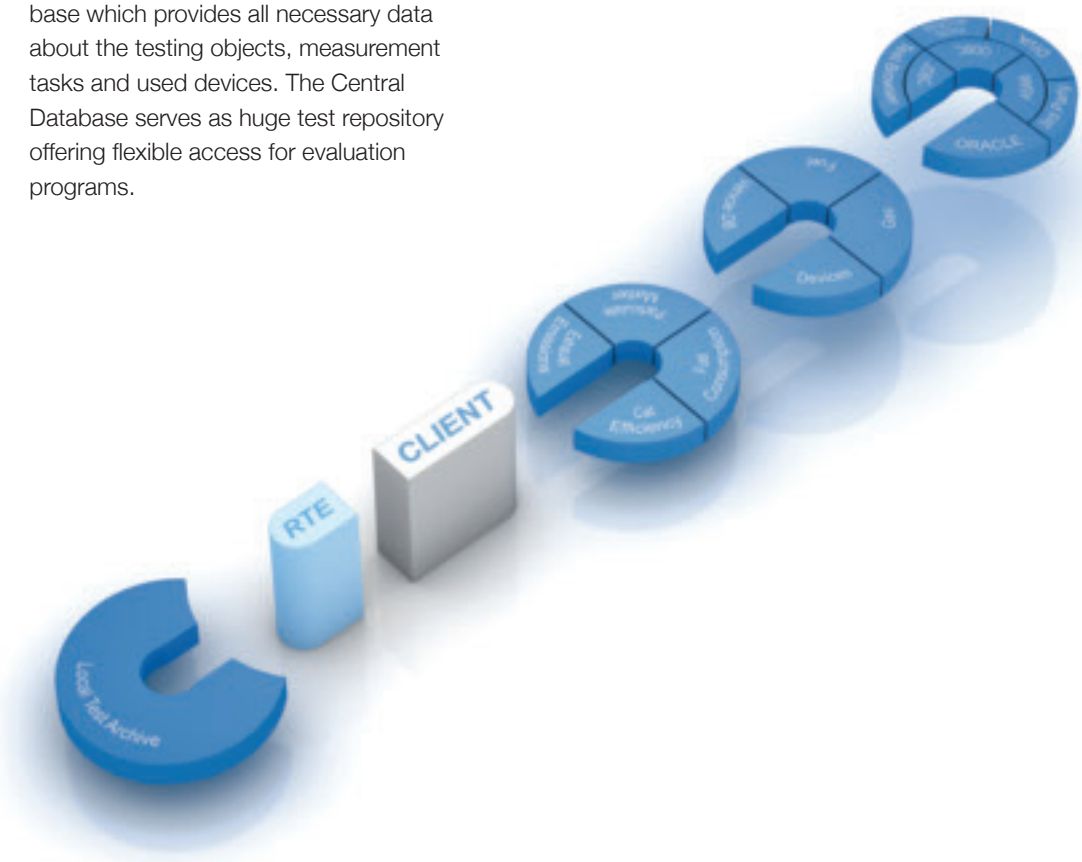
2007 US: Supreme Court decides that EPA must regulate GHG emissions

Features:

- Client-server architecture
- Multiple clients for requesting and evaluation
- Test requesting and evaluation separated from the test run
- Multi-test-cell capacity
- Common formula calculation engine
- Common database for vehicles, devices, and consumables (fuels, gases etc.)
- Common test archive (ORACLE / ASAM ODS database)
- Robust industrial server hardware with RAID system

Central Data Administration

VETS ONE is based on a Central Database which provides all necessary data about the testing objects, measurement tasks and used devices. The Central Database serves as huge test repository offering flexible access for evaluation programs.

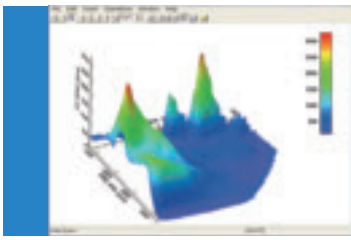


Advantages:

- Maximum number of tests
- Multiple access to the Central Database for registered users to request, evaluate and run tests simultaneously
- Simple and central data maintenance for multiple test cells
- Robust and stable system

DIVA

DIVA is a software tool for the evaluation and graphical analysis of test data. It was developed by HORIBA to aid engineers with evaluating emission test data. However, the evaluation features can be applied to almost any engineering application: chassis/engine dynamometer, powertrain, wind tunnel, etc.



Open System for External Sources

For complete test-process management, essential data from other external systems can be acquired and saved by VETS ONE.

2008
EU: proposed regulations on CO_2 emission reductions

2011
EU: Euro 5+, Reduction of PM mass to 4.5 mg/km, Introduction of particle number limit for compression ignition vehicles of 6 x 10^{11}/km

2008
VETS ONE: Euro 5/5+/6 integration

2009
California phases in reduction in GHG emissions

2011
US: Adoption of 5 test cycle formula for Fuel Economy based on FTP75, FTP20, US06, SC03, HWFET

Quality Validation of the Test Results

After the driving cycle is completed, the test results are automatically calculated and checked for tolerances. These checks allow a quick and compact quality statement of the test.
The quality check result is displayed directly on the operator monitor so they may add comments as required.
The test result limits can be configured and maintained by the customer.

Driving Cycles

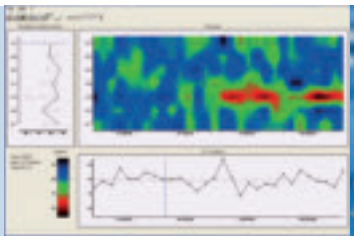
The VETS ONE standard application contains the most common driving cycles, such as the NEDC or MVEG, FTP75, SC03, US06, HWFET, Japan 11-Mode (cold start), 10-15-Mode (hot start), motorcycle tests and many more. The basic VETS ONE package also contains tests which can be configured freely like the Steady State or Engine Mapping test, where engine and emission concentrations are checked at certain defined points within the speed and force operating range. New customer-specific driving cycles can be created by the customer.

Central Administration of Test Objects, Consumables and Formulas

The formulas used for calculation and emission-relevant data are stored and maintained in the Central Database.
If a new formula is required for several customer test cells, it need only be added once in the Central Database and then is immediately available for the subsequent emission tests at any test-cell locations.
In the same manner, other records such as vehicles, tires, fuels and calibration gases are all maintained centrally.

Features:

- Automatic and manual quality validation
- Customer-defined quality criteria
- Large number of standard driving cycles included (European, US and Japan)
- New driving cycles can be customer-created
- Central administration of formulas and consumables
- Multiple test cells – one database
- Quality checks of measuring devices (maintenance checks)
- Multilingual user interface, trainings and technical support
- User access management (specific role permisson assignment)



Quality Checks of Test-Cell Devices

To ensure your measuring devices are operating properly, VETS ONE offers a number of ready-to-run quality checks.
The results of these checks are stored in the Central Database thus providing a transparent history of your measuring device accuracy.

Multi-Lingual Support

The VETS ONE user interface supports three different languages: English, French and German.
Technical support and training are also offered in the same languages.

Secure Operation

To ensure secure system operation, users are assigned roles and associated access rights to specific application areas.

Advantages:

- Powerful system with highly configurable functions to assure quality and reliability of test results
- Reduced downtime through regular, documented quality checks
- Secure operation (role-based user interface)

2013
California: LEV 3 to be introduced ?
Reductions in NMOG, NO_X ?

2014
EU: Euro 6: Lower limit values for $HC+NO_X$, particle number limit applies to spark ignition vehicles

2017
GTR: Global Test Regulations - Introduction of World Harmonized Light Duty Test Procedure (WLTP) ?

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