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.

With a greatly motivated working team equipped with a high level of knowledge, 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.

**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-plant 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

**Events:**

1963
- US: First Federal Clean Air Act

1966
- California: Mandatory limitation of CO and HC

1965
- US: Motor Vehicle Air Pollution Control Act

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

1971
- CARB adopts first automobile NOx standards in the US
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.
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

### Timeline
- **2001**: VETS ONE goes international - South Africa, Russia
- **2001**: VETS ONE: Integration of Unattended Mode
- **2004**: EPA: Tier 2 introduced, phased in by 2007
- **2004**: VETS ONE: New GUI Architecture
- **2005**: CARB: LEV 2 introduced, phased in by 2007
- **2007**: EPA: Tier 3
- **2008**: India: National Auto Fuel Policy
- **2006**: EU: Euro 4
- **2007**: VETS ONE on CDP test cells
- **2007**: EU: Euro 5
- **2007**: US Supreme Court decides that EPA must regulate GHG emissions
- **2007**: > 100 VETS ONE installations in the field
- **2000**: EU: Euro 3, incl. deletion of 40 sec idle, -7°C, OBD testing
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

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

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.

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 CO₂ emission reductions

2009
California phases in reduction in GHE emissions

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

2011
US: Adoption of 5 test cycle formula for Fuel Economy based on FTP75, FTP20, US06, SDC3, 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 permission assignment)

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)

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.

SIGNIFICANCE and Reliable Test Results

2013
California: LEV 3 to be introduced?
Reductions in NMHC, NOx?

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

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