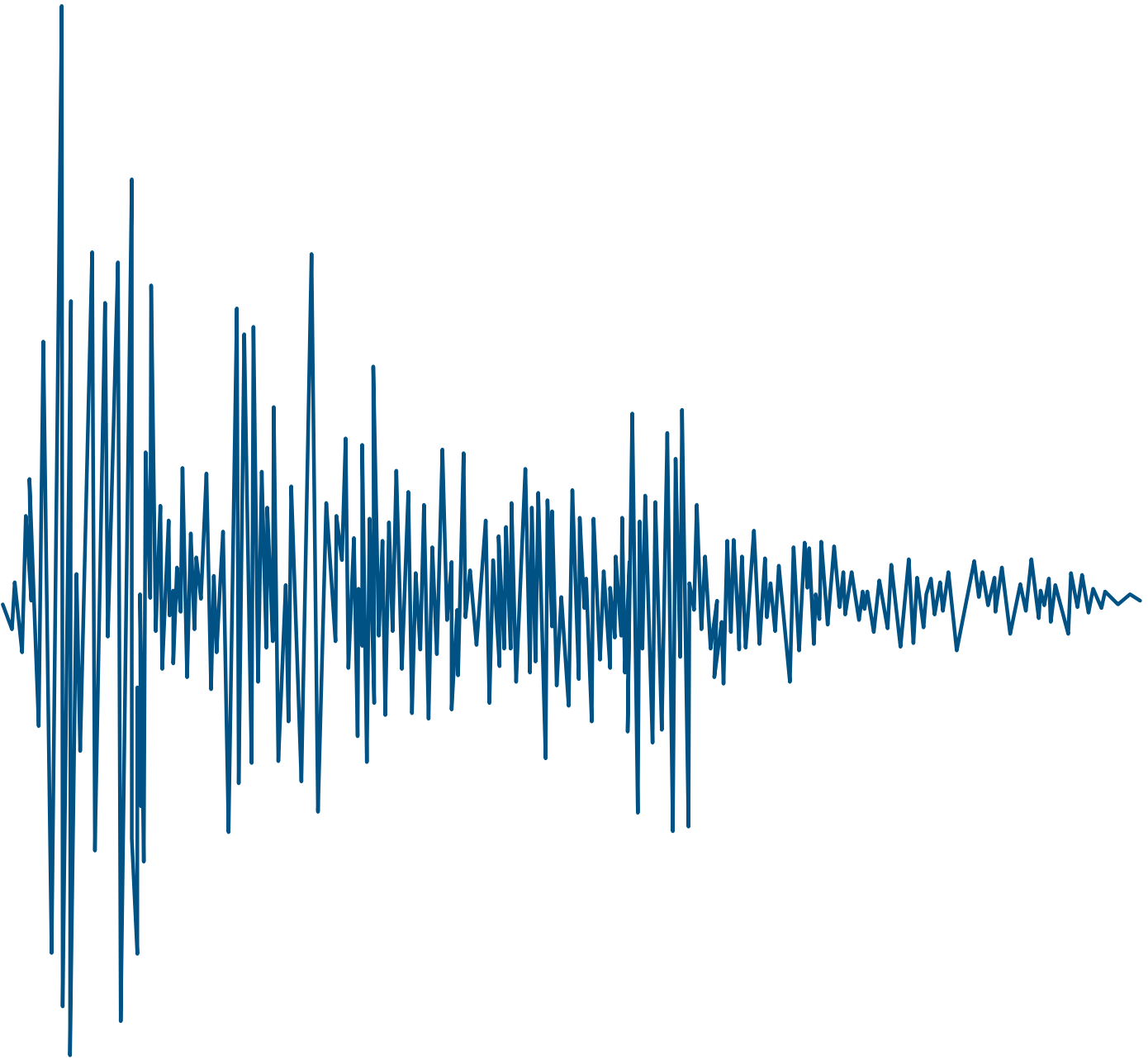




PEI VM
VIBRATION
MONITORING



**Advanced vibrational
diagnostic systems**

About PEI VM

Our company has more than 20 years of experience in the **NVH sector (Noise, Vibration & Harshness)** providing consulting services and measurement systems for many applications, such as **power transmissions, automotive, motorcycle, powertools and packaging**.

One of the keypoints of **PEI VM** is to develop experimental **vibrational diagnostic systems** (hardware and software).

The software is based on advanced algorithms, internally developed by the company, in order to investigate various types of rotating machinery: an easy and user-friendly interface enables the operator, even an inexperienced one, to detect if inside the measured machines there are defective/damaged components.

The consultancy is carried out directly by the customer or in our headquarter (in Zola Predosa, Bologna). Furthermore, in our facility we have a **semi-anechoic chamber** suitable for acoustic characterization and for vibration and acoustic correlation.

We are also an ideal partner to develop customized **software interfaces** for measurement procedures and commissioning tests.

Since 2018 **PEI VM** is a part of **P.E.I. Srl**, a leading manufacturer in Italy and Europe of protective covers for machine tools on the market for more than 40 years, for which we carry out design and calculation activities aimed at product development and innovation.



Noise Vibration Harshness

Automotive ▪ Motorcycle ▪ Trasmissions ▪ Industrial ▪ Packaging ▪ Powertools



PEI VM works with worldwide **leading companies**, who need cutting-edge techniques, immediate response and high flexibility.

Our **VMGears** and **ATB** systems ensures more efficiency competitiveness on the market.

Rotary machines

Gear transmissions

Combustion engines

Electric motors

Vibrational Diagnostic



Research & Development VMGears RD



VMGears RD has innovative algorithms for vibrational diagnostic of each component inside the machine: gears, bearings, pistons, valves, pumping elements, etc..

DETECTION OF DEFECTIVE COMPONENT AND TYPE OF DAMAGE, IT ALLOWS YOU TO INTERVENE BEFORE BEGINNING PRODUCTION



- **VMGears RD** is a portable system for vibrational analysis of rotating machinery, such as gear motors, gearboxes and electric motors.
- **VMGears RD** shows in an easy and quick way events like dented teeth, abnormal meshing, pitch errors, eccentricity, damaged bearings, unbalanced rotors, worn pumping elements and valve fluttering.
- **VMGears RD** enables a vibrational benchmark as compared to the competitors, helping the development of new products.
- **VMGears RD** is a comprehensive system, composed by a dedicated easy-to-use software, an electronic control unit, sensors and wires.

Vibrational Diagnostic



Research & Development

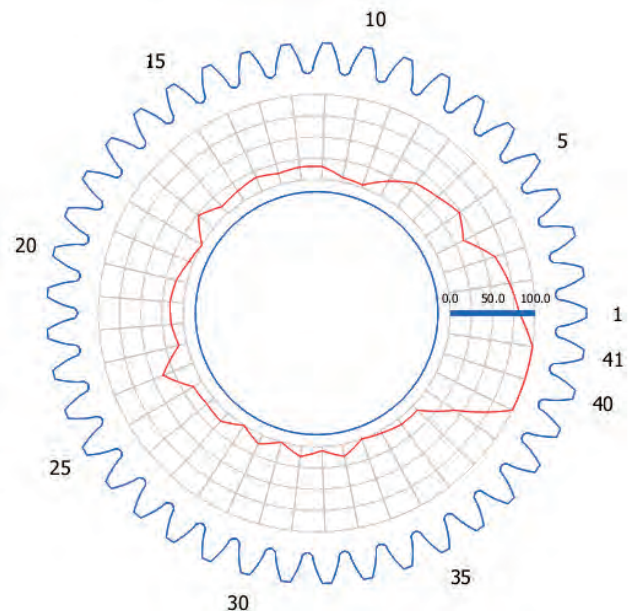
VMGears RD



Diagnostic of internal components
of the assembled machine



- **VMGears RD:** allows you to carry out a vibrational characterization of the product, identifying the critical components during the development of the product and allowing to design the end-of-line test for the production line.
- **VMGears RD** is an expandable system, from three to sixteen channels, which enables to correlate vibration and noise to other physical variables.

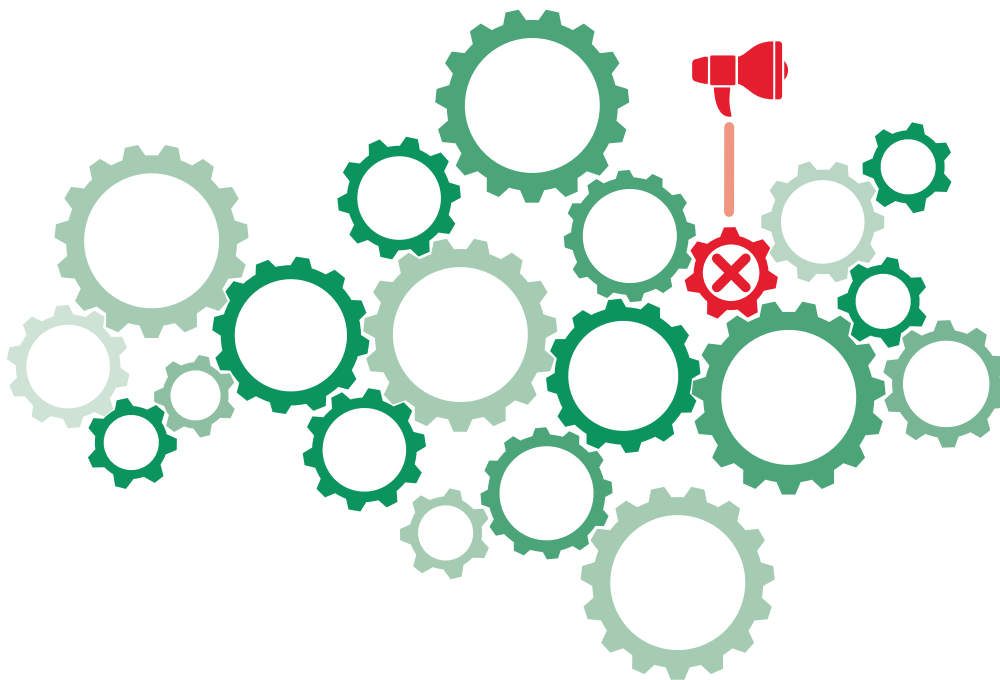




Quality Control VMGears QC



VMGears QC carries out a quality check of both the product and the assembly process, running a targeted analysis of the vibrational signal measured in the end-of-line test or during the product commissioning test. It has a user-friendly interface which provides a prompt visualization of the test results.



Quality Control on the assembly line



End-Of-Line Monitoring



Dedicated indexes for each component

- **VMGears QC** is a Quality Control system installed on the assembly or the production line or integrated into the test bench.
- **VMGears QC** carries out the end-of-line check of gearboxes, transmissions, axles, electric motors and combustion engines.
- **VMGears QC** software has dedicated algorithms developed for different types of machines and their kinematic scheme.
- **VMGears QC** elaborates dedicated indexes for each rotating component inside the machine and each type of defect: these indexes are compared with the respective acceptability thresholds (generally defined by statistical method) to determine if the tested product is **OK** or **NOT OK**.

Vibrational Diagnostic



Quality Control
VMGears QC

Quality control at production end-of-line



- **VMGears QC** could be easily integrated in any line or test bench, interfaced with a supervisor for data exchange (codes, machine parameters, analysis results).
- **VMGears QC** is a comprehensive system, composed by a dedicated software, an electronic unit control, sensors and wires. It can work stand-alone or with a supervisor. The software creates a SQL database easily accessible and exportable.

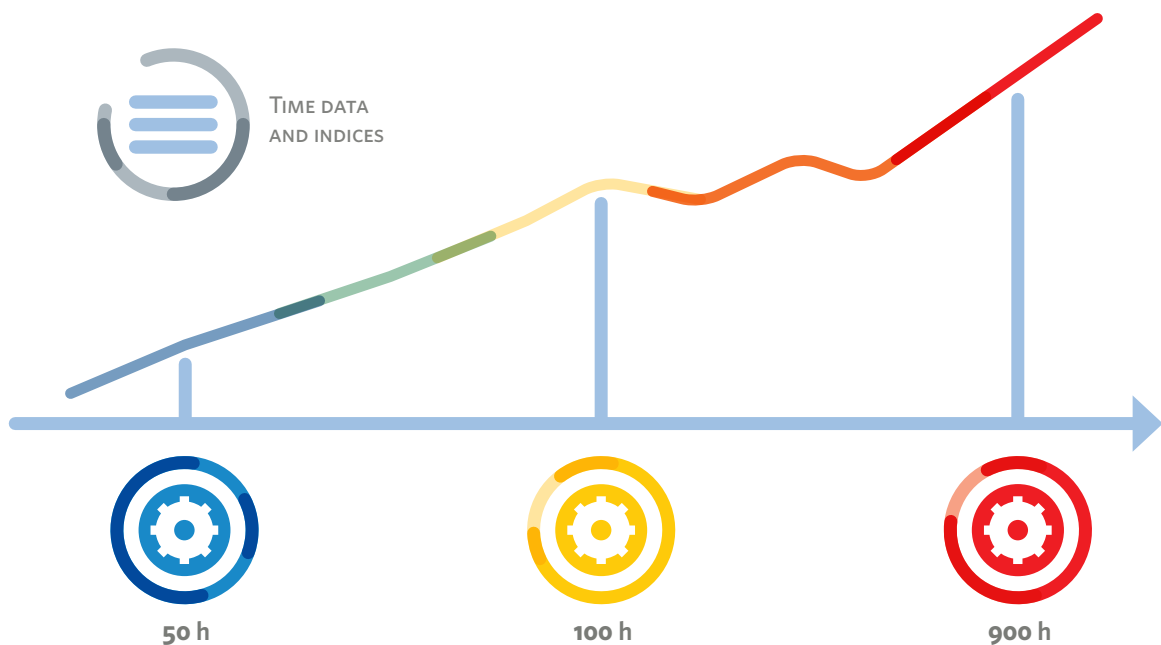




Monitoring VMGears DM



VMGears DM is used in endurance tests of various rotating machines in order to monitor over time the defects and their evolution, i.e. dent teeth, pitting, pitch errors, eccentricity, impacts, piston slap, unbalanced rotors, etc..



- **VMGears DM** is a comprehensive system, composed by a dedicated software, an electronic unit control, sensors and wires. The system is built to measure and analyze vibrational data continuously and fills automatically a database, which could be connected to the company network and be accessible at any time.
- **VMGears DM** is a remote monitoring system of rotating machines, i.e. reducers, electric motors, pumps and generators.
- **VMGears DM** is a comprehensive system, composed by a dedicated software, a pc and monitor, an electronic unit control, sensors and wires. It's programmed to periodically measure and analyze according to a predefined continuous test cycle. The system outputs indexes, each one related to a specific type of possible defect, and it monitors the trend over time of these indicators, giving a warning if a threshold is exceeded.
- **VMGears DM** is a system which can be hardware customized according to the customer needs.

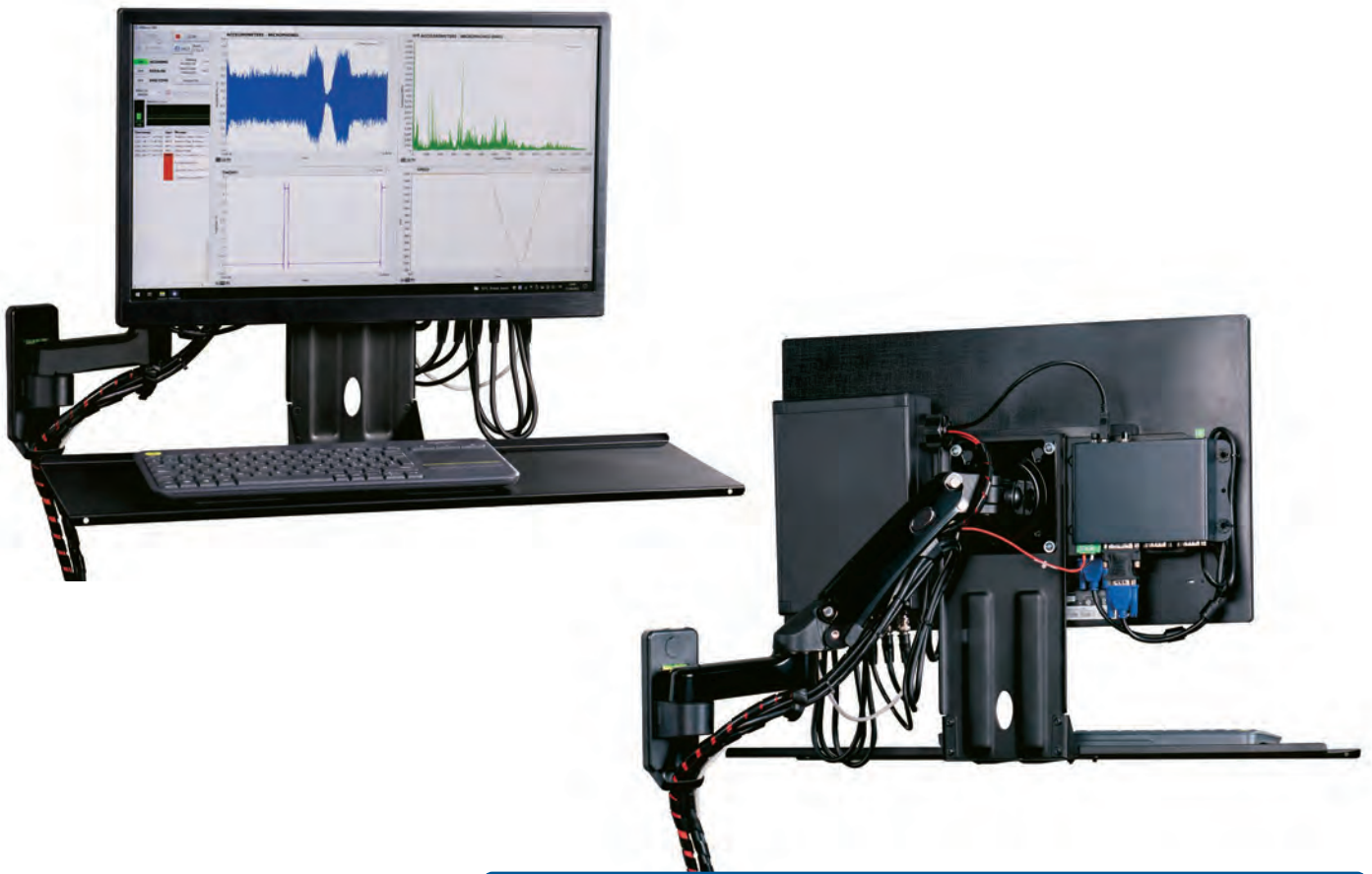
Vibrational Diagnostic



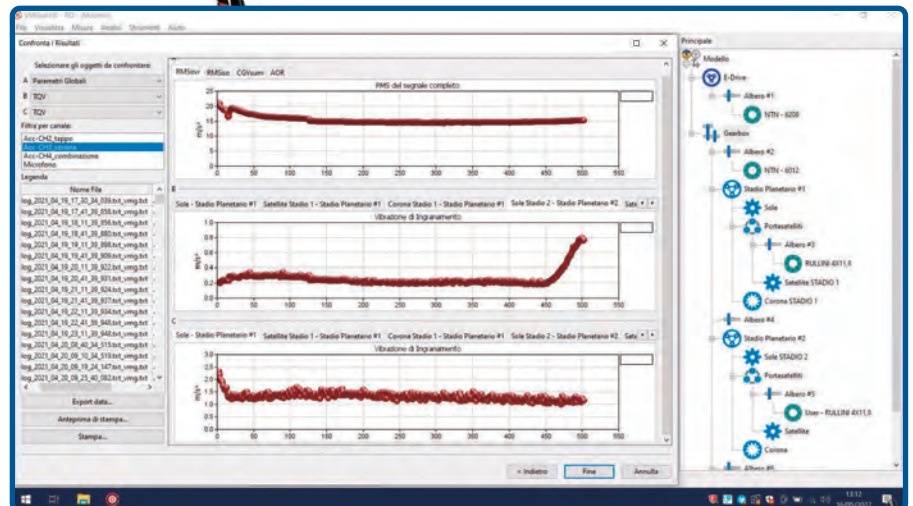
Monitoring VMGears DM



Stress Test to evaluate the reliability of the product



VMGears DM works in background during the endurance test. Unlike a simple datalogger, which saves raw signal data that must be processed afterward, **VMGears DM** performs the analysis on-board and outputs the trend curve of each vibrational index.

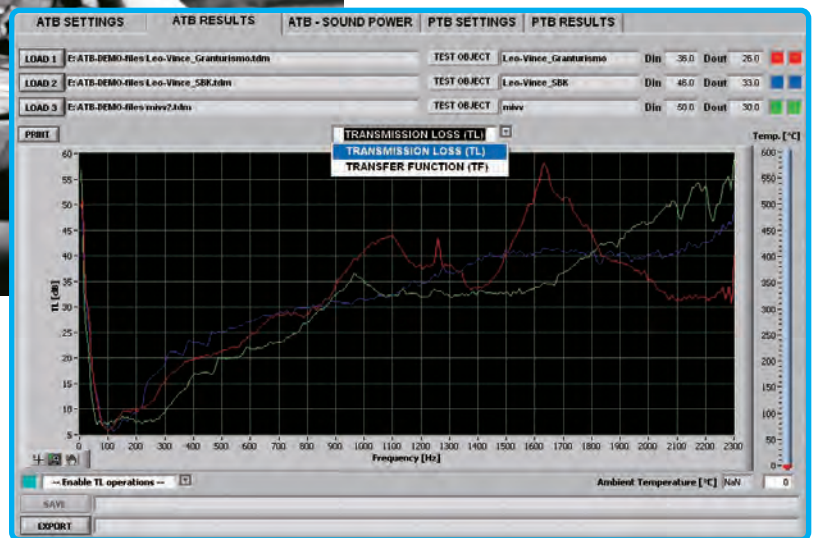




Acoustic Test Bench

ATB

Test bench dedicated to measure the Transmission Loss and the back-pressure for aspiration or exhaust system



- The **ATB** test bench characterizes the acoustic performance of a muffler measuring the Transmission Loss (TL). It can be done on aspiration and exhaust systems of two or four wheels vehicles.
- Furthermore, the **ATB** test bench has a software feature to estimate the level of noise that a specific muffler would generate if installed on an engine with known excitations from experimental test analysis or models. Therefore, the ATB helps the optimization of the muffler's layout, performing easy test on a test bench, without physically mounting the muffler on the vehicle.
- The TL is an intrinsic feature of a muffler that describes how much the muffler can decrease the intensity of an acoustic excitation in input. Depending on the design of the muffler, the attenuation of the noise is a function of frequency, therefore the TL is a key indicator for a correct design of the muffler.
- The muffler could also be a plastic 3D printed prototype. The test procedure is quick and easy: the test can start once the muffler is placed on the test bench and the acoustic hosts are connected to the input and output terminals (the duration of the test is a few tens of seconds).



Acoustic Test Bench

ATB

Test bench dedicated to measure the Transmission Loss and the back-pressure for aspiration or exhaust system



Exhaust system analysis



Noise level evaluation

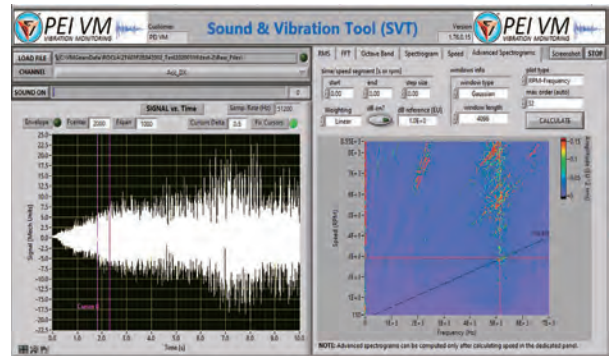
- The **ATB** is a modular bench that allows to mount additional elements to carry out different type of measurement, usually is added a PTB module dedicated to the fluxing of the muffler (back-pressure curve as function of flow) to achieve a complete characterization of the product.
- The **ATB** is usually employed in R&D, however it may be used as system for production quality control too.

Acquisition and analysis system for dynamic signals

SVT Sound & Vibration Toolkit

General purpose signal analyzer of dynamic signals, i.e vibration, noise and pressure signals.

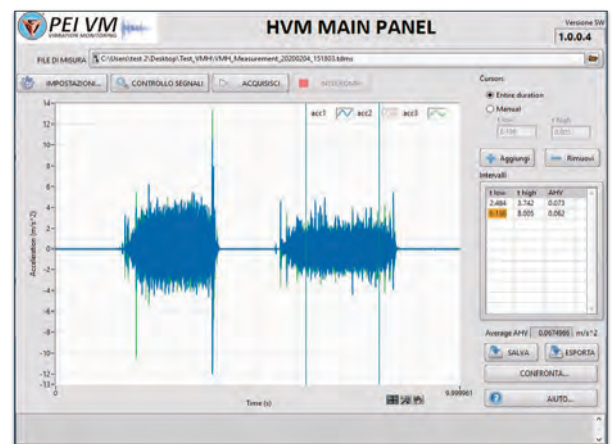
Main functions: rms-dynamic analysis, octave band, FFT (on time-windowed signal), Waterfall/Campbell analysis with different processing format (rpm/frequency, time/frequency, order/frequency), setting of orders of excitation, different export format of the results (in text formats).



Hand-Transmitted Vibration measurement system

HVM Hand-Transmitted Vibration Monitoring

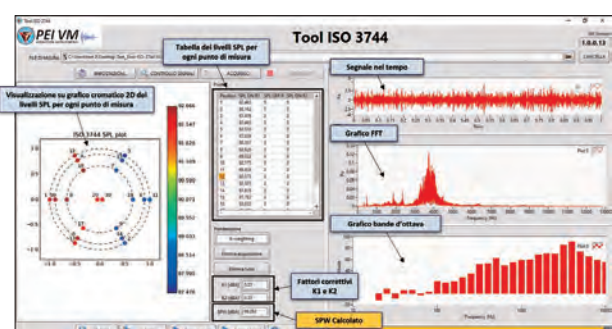
HVM is designed to homologate hand-held tools, such as drills, screwdrivers, pressure washers, etc... that transfer potentially harmful vibrations to the human body and which therefore necessarily must be homologated through a vibration measurement procedure regulated by ISO 5349.



Sound power measurement system

SPM Sound Power Module

Dedicated system to the measurement of the sound power according to the prescriptions of the ISO 3744 and ISO 3746 standards.



Semi-Anechoic

chamber



- **PEI VM** has a semi-anechoic chamber suitable for various types of test, in particular:
- Sound power measurements according to the prescriptions of the ISO 3744 / ISO 3746 standards.
 - Measurements for correlation between vibration and noise (problem solving).
 - Measurements for correlation between combustion pressure and noise (for combustion engines).
 - Measurements to compare prototypes.
 - Sound Attenuation measurements.

Welcome to P.E.I.

The strategy of success of the P.E.I. Group emerges from the intuition of the founding partners in recognising the importance of workplace safety, which has led, beginning from the 1980s, to the significant development of the market for protective covers in machine tools.

Innovation, quality and constantly keeping an eye on the sales prices are the driving values of the P.E.I. Group, a leading manufacturer in Italy and Europe of protective covers for machine tools.

The experience gained in over 40 years presence on the market has led to an amalgamation of commercial and managerial competence with extensive know-how in production engineering. By striving for constant technical innovation, the Group has succeeded in attaining over 70 international patents.

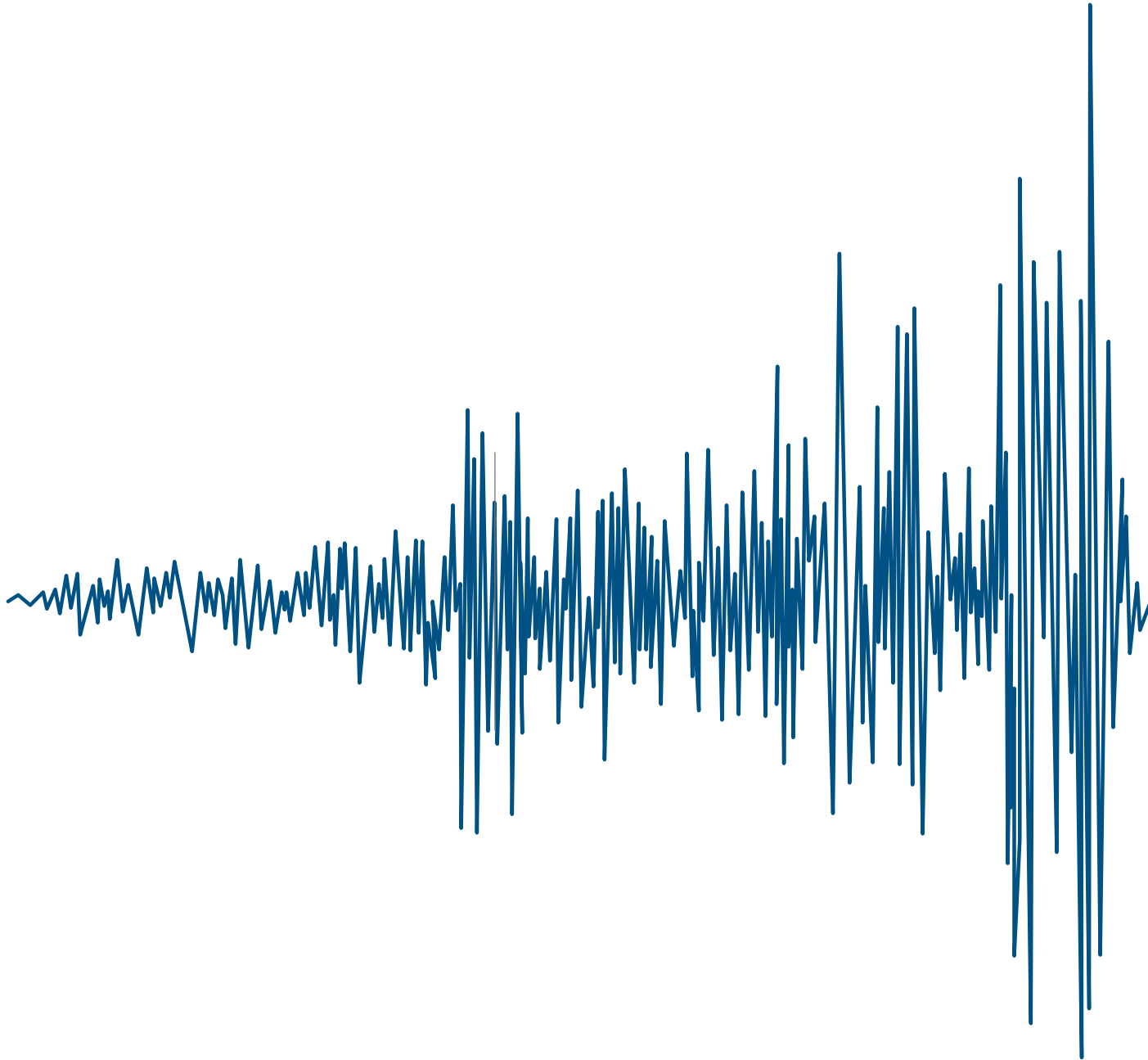
In order to offer bellows, aprons, roll-up and telescopic covers suitable for the continuously evolving customer or market requirements, the P.E.I. Group invests more than 4% of its annual turnover in Research and Development.

The commercial structure of the P.E.I. Group consists of a widespread network of commercial technicians and thus guarantees coverage across the whole territory of Italy and Germany as well as a major part of the rest of Europe. Through trade agreements, products "made by P.E.I." are distributed worldwide. The past few years the Group has experienced a strong growth and turnover abroad has reached 50% of the total turnover.





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