

KISTLER

measure. analyze. innovate.

**NVH testing –
from sensor to
answer**

NVH testing: data acquisition and analysis

KiNOVA and KiSUITE



Kistler's solution for NVH testing – from sensor to answer

Customers constantly expect higher standards of comfort, while legislation is pushing transportation to become more efficient and environment-friendly – so the automotive industry has focused its recent development work on new and more efficient propulsion systems as well as innovative vehicle architectures. In any situation, reducing and controlling Noise, Vibration and Harshness (NVH) issues is becoming a priority for automotive engineers as they seek to improve overall vehicle performance, perceived comfort and brand image.

In the context of such a disruptive process, NVH specialists are tasked with translating new customer expectations and perceptions into quantifiable measures, reliable technologies and effective solutions. If they want to succeed in this mission, they cannot accept any compromises on the reliability and accuracy of their testing tools. Kistler responds to this challenge by offering automotive customers the full range of support they need – from sensor to answer – with a portfolio that includes acceleration and force sensors, analysis software, cables and data acquisition systems.

Acceleration sensor portfolio

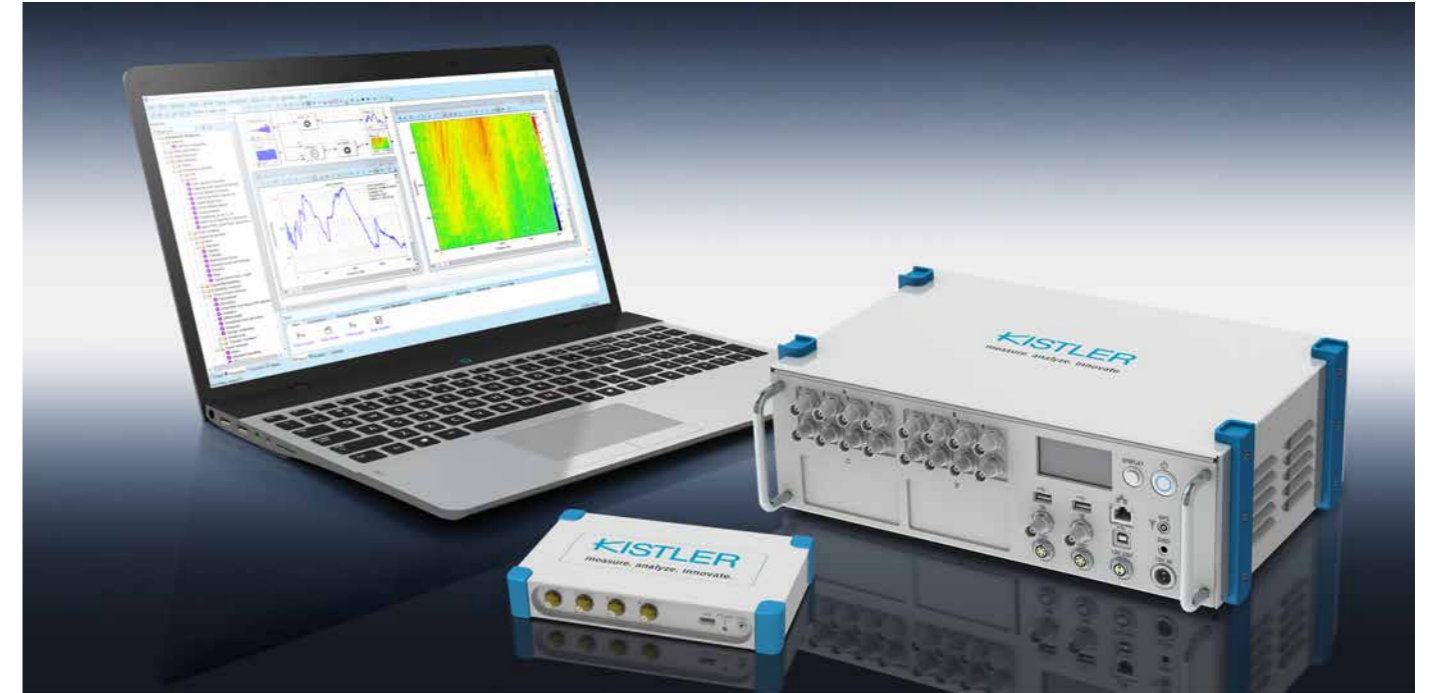
Our extensive range of accelerometers for automotive NVH testing includes solutions for almost every powertrain and vehicle application. Alongside industry-standard quartz and ceramic sensing elements, Kistler offers highly sensitive IEPE accelerometers based on unique PiezoStar crystal technology – the solution of choice for high-temperature measurements. For internal combustion engine applications, Kistler offers its accelerometers in the 8766A and 8765A series – chosen by engineers worldwide to measure with high accuracy, confidence and flexibility even under extreme conditions, thanks to the exceptional thermal stability and temperature performance of the PiezoStar crystal. Measurements on electric motors may

require ground isolation, lower acceleration ranges and broader frequency ranges. Sensors such as the 8764B, 8763B and 8766A offer precisely the features needed for these applications, and they are equally suitable for classical structural and modal investigations. For vehicle ride quality and durability, capacitive MEMS accelerometers such as the 8316A and 8396A ensure highly accurate measurements even when very low-frequency vibrations are present.

Customized force measurement

Measuring dynamic interface forces on powertrain mountings is the key to optimizing vehicle performance, ensuring durability and controlling NVH. These applications impose specific geometrical constraints and unique operating load conditions that are largely beyond the capabilities of conventional force sensors. They are unique applications – so they demand unique solutions.

Kistler offers customized force measurement systems for powertrain NVH testing that are fully tailored to each customer's requirements. Based on piezoelectric measurement technology, they are ideally suited to meet the challenges presented by powertrain engineering – now and in the future. These highly rigid PE sensors can attain high frequencies, and their very broad measuring range makes it easy to capture dynamic forces with different orders of magnitude. Backed by more than 60 years of experience in piezoelectric sensor technology, Kistler has the ability to provide complete solutions that can precisely measure up to six components (three forces and three torques) to match customers' geometrical and load requirements. From design and engineering through to production, commissioning and service: as our customer, you can turn to one single source for everything you need.



KiNOVA and KiSUITE – data acquisition and analysis

As new automotive engineering paradigms take shape, NVH experts also need the right tools to reliably acquire and freely postprocess testing data. Kistler's KiNOVA product line meets this need. It gives engineers precise acquisition systems and complete freedom to customize and automate data analysis processes, as the basis for revealing new insights efficiently.

Efficient data acquisition – anywhere

KiNOVA Lite is the engineer's ultra-portable companion in situations where up to four input signals need to be captured on the spot. Despite its compact dimensions, KiNOVA Lite delivers uncompromising accuracy thanks to its outstanding signal acquisition capabilities. For test bench and in-vehicle applications, KiNOVA Pro offers higher level of flexibility and performance. The hardware can be customized with a variety of cards and up to 32 channels per device. Multiple units can be daisy-chained to deliver increased measurement capability. And in almost every environment, KiNOVA Pro's built-in internal data storage and battery enable standalone operation with no need for external connections. KiNOVA XL allows addressing high channel count applications. Each system can host up to 96 channels and multiple units can be stacked. Additionally, KiNOVA XL Plus embeds an internal processor and storage, making it the right solution not only for laboratory and test bench, but also for mobile and standalone applications.

KiNOVA Acquisition is the acquisition software which gives engineers full control on live data visualization and test scheduling with all KiNOVA hardware.

Data analysis without boundaries

Noise and vibration data analysis can be performed without any boundary with KiSUITE, Kistler's software package for KiNOVA hardware.

KiSUITE Analysis is Kistler's powerful yet intuitive platform for noise and vibration data analysis, workflow customization and reporting automation. Engineers can perform almost any thinkable analysis on testing data by cascading functions selected from the vast choice offered by KiSUITE Analysis. The user can further customize the functions via programming, thus removing any boundary to data insights.

Specific testing applications can be addressed with KiSUITE extension modules. They include advanced functionalities which boost the capabilities of KiSUITE Analysis for specific domains of noise and vibration engineering. KiSUITE modules allow addressing:

- hammer impact testing – KiSUITE HITS
- powertrain NVH optimization – KiSUITE NVH
- analysis of rotating components – KiSUITE Rotating Machinery
- acoustic performance – KiSUITE Acoustics
- Source Contribution Analysis – KiSUITE SCA
- deflection visualization – KiSUITE Structural Animation

To discover more about Kistler's solutions for NVH testing, visit our website: www.kistler.com

KiNOVA – data acquisition hardware

Ultra-portable solution for on-the-spot NVH testing

Highlights

- Quick setup and measurement
- High quality data acquisition
- Small, lightweight



Key specifications:

- 4 configurable input channels – voltage, IEPE and analog
- One channel can be configured as tachometer input
- Sampling rate of up to 144 kHz/ch at 24 bit
- 100 dB dynamic range; -130 dB noise floor and anti-alias protection
- USB controlled and powered
- 365 g and 30x167x97 mm
- Rugged, MIL-STD-810G

The flexible, powerful solution for NVH testing in any situation

Highlights

- Customizable and expandable
- Standalone operation
- Rugged and portable



Key specifications:

- Four configurable slots for a variety of cards
- Up to 32 channels per system – connected systems for higher channel count
- Sampling rate of up to 300 kHz/ch at 24 bit (independently on separate cards)
- 2 built-in tachometer inputs – up to 800 kHz
- Built-in SSD storage: 128 GB and internal battery
- Programmable standalone mode for independent operation
- Both USB and Ethernet connections
- 5 kg and 115x360x225 mm
- Rugged, MIL-STD-810G

Solution for high channel count NVH testing

Highlights

- High channel count
- Rack-mounted or portable
- For in-vehicle and test bench use

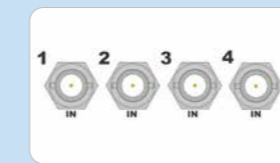


Key specifications:

- 12 configurable slots for a variety of cards
- Up to 96 channels per system and up to 1024 channels in total
- Sampling rate of up to 300 kHz/ch at 24 bit (independently on separate cards)
- 2 built-in tachometer inputs – up to 800 kHz
- Built-in SSD storage: 256 GB
- Programmable standalone mode for independent operation
- USB or Ethernet connections
- 9 kg and 185 x 450 x 400 mm
- Can be rack-mounted

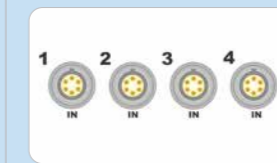
Configure KiNOVA Pro and XL to match your application requirements

KiNOVA systems can be configured with the following cards. KiNOVA Pro can host up to 4 of them per chassis, while KiNOVA XL up to 12.



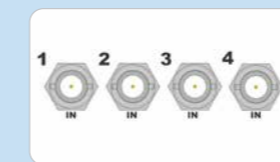
Card no. 1:
Analog card
– 4 channels

- 100 kHz/ch at 24 bit
- 400 kHz/ch at 16 bit
- One channel for tachometer input



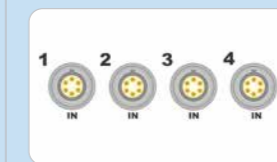
Card no. 2:
Analog card with bridge completion
– 4 channels

- 100 kHz/ch at 24 bit
- 400 kHz/ch at 16 bit
- One channel for tachometer input
- Programmable: 1/4, 1/2, full bridge input



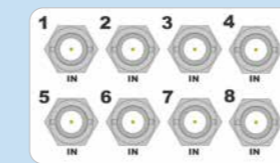
Card no. 1H:
Analog high speed card
– 4 channels

- 300 kHz/ch at 24 bit
- 800 kHz/ch at 16 bit
- One channel for tachometer input



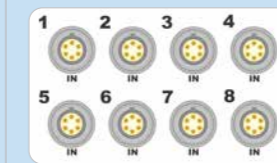
Card no. 2H:
Analog high speed card with bridge completion
– 4 channels

- 300 kHz/ch at 24 bit
- 800 kHz/ch at 16 bit
- One channel for tachometer input
- Programmable: 1/4, 1/2, full bridge input



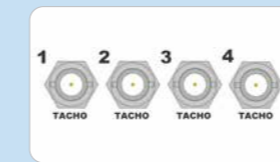
Card no. 3:
Analog card
– 8 channels

- 100 kHz/ch at 24 bit
- One channel for tachometer input



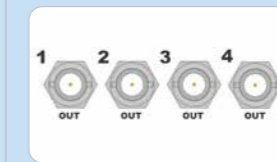
Card no. 4:
Analog cards with bridge completion
– 8 channels

- 100 kHz/ch at 24 bit
- One channel for tachometer input
- Programmable: 1/4, 1/2, full bridge input



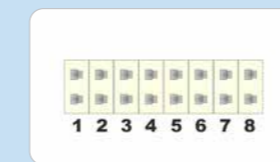
Card no. 5:
Advanced tachometer card
– 4 channels

- High resolution – 4 ns, 240 MHz



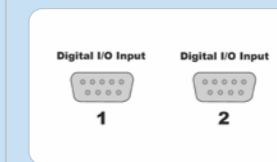
Card no. 6:
Digital to analog converter card
– 4 channels

- 48 kHz/channel at 24 bit
- Analog output range +/- 4 V
- Digital interpolating filter



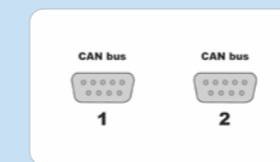
Card no. 7:
Thermocouple card
– 8 channels

- 500 Hz/ch at 24 bit
- Thermocouple inputs



Card no. 8:
Digital input/output card
– 2 channels

- 8 digital input and output channels
- TTL-compatible



Card no. 9:
CAN bus input card
– 2 channels

- Link interface: ISO 11898
- Bus rates: 125k, 250k, 500k, 1Mbit/s

For card no. 3 and 4:
Lemo connectors are possible to optimize the card allocation in KiNOVA XL and XL Plus.

KiSUITE – data acquisition and analysis software

Data acquisition

KiNOVA Acquisition

Easy setup of acquisition hardware and fully customizable data visualization.

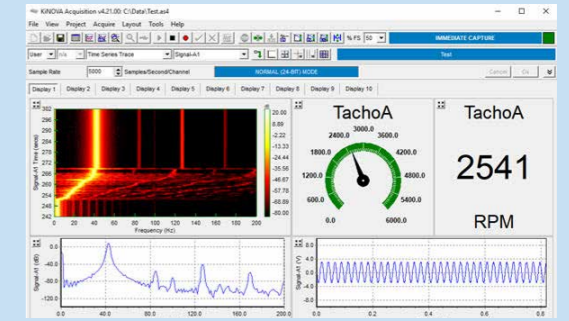
Highlights

- Rich and intuitive interface
- Detailed setup of channel parameters
- Customizable visualization options

Software functions

- Setup of channels parameters
- Wide variety of graphical displays for live data visualization – time, frequency, Nth octave, RMS, sound intensity, cross spectra, signal vs signal, transfer function, waterfall, speed curve, digital grid, digital panel and more

- Wide variety of triggering functions
- Setup of standalone acquisition
- Calibration suite
- Remote data statistics
- Export functionalities



Data analysis

KiSUITE Analysis

Powerful and customizable software platform for signal processing, data analysis, workflow automation and reporting – 220+ functions for unlimited insights.

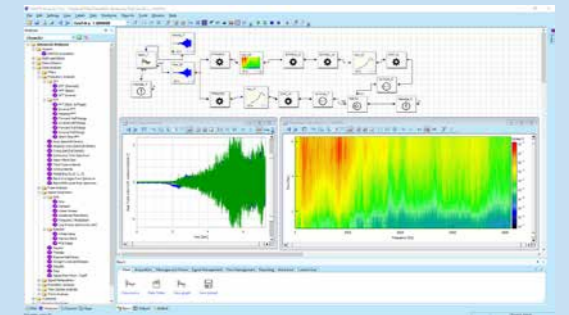
Highlights

- Powerful analysis toolbox
- Fully customizable worksheets
- Automated reporting

Software functions

- Math and calculus
- Import and export functions
- Filters
- Pulse analysis for tacho signals
- Frequency analysis functions
- Time domain analysis

- Probability analysis and signal statistics
- Signal generation and manipulation
- Trend analysis and event extraction
- Built-in scripting language
- Automated reporting
- Workflow-embedded data acquisition function



Application-oriented modules

KiSUITE NVH module

Application

Powertrain NVH assessment and optimization.

Key functionalities

- Spectral analysis and waterfalls
- Speed analysis - even with no tacho
- Order analysis
- Sound quality metrics

KiSUITE Rotating Machinery module

Application

Analysis of machineries undergoing cyclical excitation, torsional vibration and presenting rotating components.

Key functionalities

- Advanced tacho analysis
- Time sampled analysis
- Synchronous sampled analysis
- Wavelets and time-frequency analysis

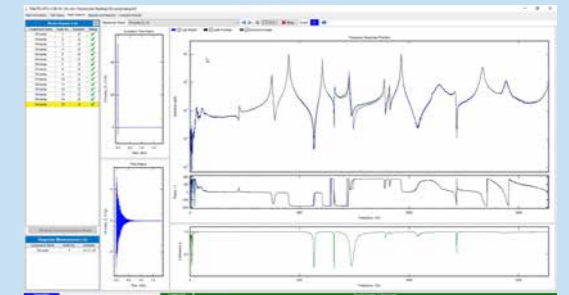
KiSUITE HITS

Application

Hammer impact testing software for frequency response function acquisition and analysis.

Key functionalities

- Standalone software
- Guided step-by-step process for FRFs acquisition
- Real-time calculation and comparison
- Automatic signal processing



KiSUITE Structural Animation module

Application

Creation of geometries and data animation, both in frequency and time domain.

Key functionalities

- Creation of geometries
- Association of test data to geometry
- Motion visualization in time and frequency
- Operating deflection shape

KiSUITE SCA module

Application

Identification of source contributions with minimal effort.

Key functionalities

- Source contribution analysis
- Efficiency – minimum testing effort
- Visualization of data and contributions

KiSUITE Acoustics module

Application

Assessment of the acoustic performance of components and assemblies.

Key functionalities

- 1/N octave operations
- Sound level meter calculations
- Sound intensity calculation
- Psychoacoustics and sound quality

KiNOVA Services

To guarantee optimal operation and performance of hardware and software.

Offering

- Hardware calibration
- Software support
- Extended warranty
- Training



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www.kistler.com/applications

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