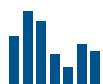


SPEKTRA

Ready for TESTelligence!

DT | Device Testing



SPEKTRA

Ready for TESTelligence!

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Outstanding
international
performance.

Who we are

In **1994**, three engineers decided to take advantage of the opportunities offered by the new, dynamic economy in reunified Germany and founded their own company, SPEKTRA Dresden. It all started with the development and manufacturing of a final test system for the production of the first generation of MEMS-based airbag sensors. Since then SPEKTRA has developed into a stable, mid-sized enterprise in

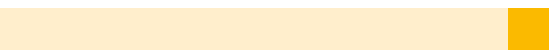
the field of testing, calibration and characterization of various sensors for the measurement of dynamic mechanical quantities. With expertise in mechanical, electrical and software engineering, they develop target-oriented, customized solutions that address the challenges of laboratory and volume production applications. **SPEKTRA is now well known for its outstanding expertise in smart testing.**



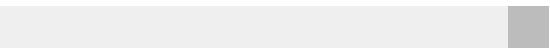
CS | Calibration Solutions



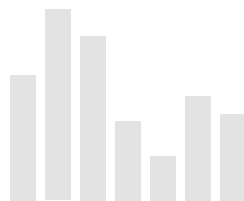
DT | Device Testing



ST | Structural Testing



ES | Engineering Solutions



Ready for TESTelligence!



Our Portfolio

For the development and manufacture of quality products, precision tools are needed to ensure state-of-the-art performance. Do you need equipment for tests in your laboratory or in your production facilities? SPEKTRA offers solutions and services for your measurement tasks. If no standardized device is available, we develop customized test equipment to meet your demands.



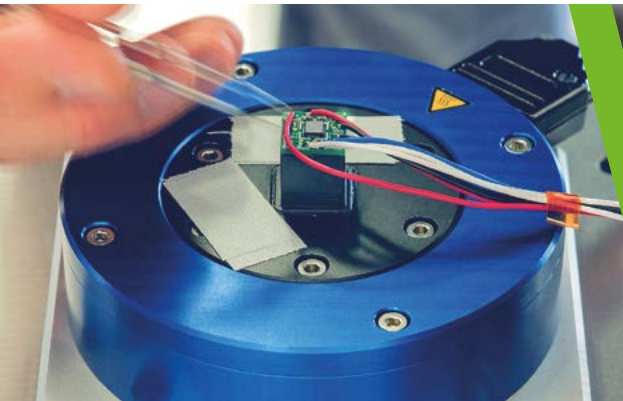
Every
sensor is
measurable



Optimized
developer
solutions



Efficient
parallel
testing



S-TESTLab

- ✓ testing
- ✓ characterization
- ✓ calibration

S-TESTFab

- ✓ final test/component system level test
- ✓ prototype production
- ✓ volume production

| Applications | Device Types | Stimuli |
|--|---|--|
| <ul style="list-style-type: none"> ✓ mobile navigation ✓ Driver Assistance Systems ✓ IoT – Internet of Things ✓ medical applications ✓ virtual reality ✓ airbag sensors ✓ ABS/ESP ... | <ul style="list-style-type: none"> ✓ MEMS type sensors ✓ accelerometers ✓ gyroscopes ✓ pressure sensors ✓ magnetic field sensors ✓ IMU – Inertial Measurement Unit ✓ sensor systems/clusters ... | <ul style="list-style-type: none"> ✓ vibration ✓ shock ✓ rotation ✓ magnetic field ✓ acoustics ✓ dynamic force ✓ dynamic pressure |



S-TEST System Concept

From individual laboratory-scale sensor technology to highfrequency mass production.

TESTelligence for MEMS sensors.

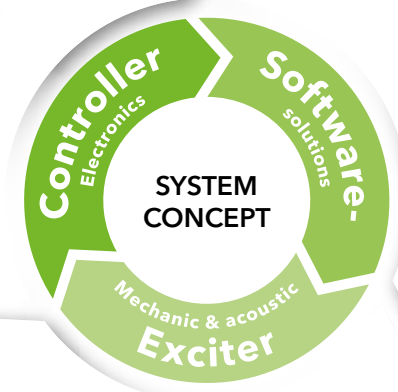
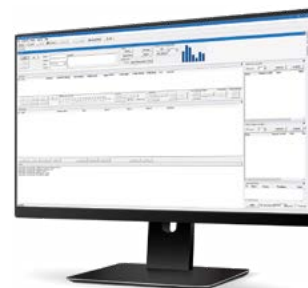
Flexible configuration

Different configurations allow flexible adaptation to almost every test and calibration requirement. From the compact tabletop unit, which enables you to react flexibly to changing technical requirements during the product development phase, to final testing in the volume production by adding the maximum number of UTB cards and combining several individual systems to a powerful one.







Software

Our S-TEST software supports efficient testing of MEMS sensors in lab environments and in full production. The architecture fulfills the flexibility demands during sensor development and thus can reduce overall time-to-market.



Exciter

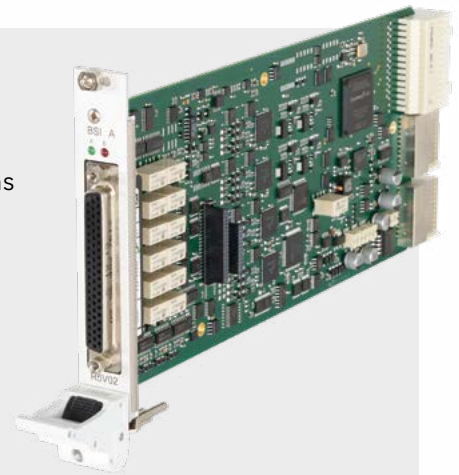
Based on your individual sensor testing requirement you may choose one of our self developed and produced exciter. We offer a wide range of different measured variables or a combination of these. You receive all specially compatible components such as amplifiers, control units and special accessories.

| System | Lab systems | | Fab systems in the field | |
|--------------|---|---|--|---|
| Model | S-TEST / 2 | S-TEST / 16 | S-TEST / 48 | S-TEST / 192 |
| Illustration |  |  |  |  |
| No. of UTB | 2 | 16 | 48 | 192 |
| Interface | Ethernet | Ethernet | Ethernet | Ethernet |
| Cooling | Integrated | Integrated | Modular | Modular |

Universal Tester Board

The Universal Tester Board (UTB) represents the core element of the S-TEST system. It has been developed with a wide range of hardware resources and technical features that allow it to be used flexibly as the main platform for system-level-testing of modern sensor devices. Up to 4 DUT can be connected to one card for an optimum cost-to-benefit ratio.

- ✓ differential input channel
- ✓ matrix multiplexer for up to 16 analog input channels
- ✓ time resolution down to 12.5 ns
- ✓ comparator with adjustable thresholds
- ✓ 4 × PMU (U/I analog sources)
- ✓ -2 ... 20 V DC
- ✓ 5/20/200 µA, 2 mA, 50 mA
- ✓ 16 I/O (digital)
- ✓ pin clock rate up to 20 MHz



System communication interface



- ✓ Gigabit LAN
- ✓ 3 x USB for configuration and maintenance
- ✓ DDS-module for clock generation e.g. for SPI
- ✓ 36 LVDS lines for internal communication
- ✓ 2 x Trigger input
- ✓ 2 x Digital output
- ✓ 5 V supply voltage
- ✓ calibration lines for voltage and resistance

The Communication Controller Board is the main communication interface of the S-TEST system. It is always included and enables network integration, remote access to the S-TEST platform and offers functions like the system and test configuration, firmware upgrade, chassis self-calibration and of course network storage of the test results.

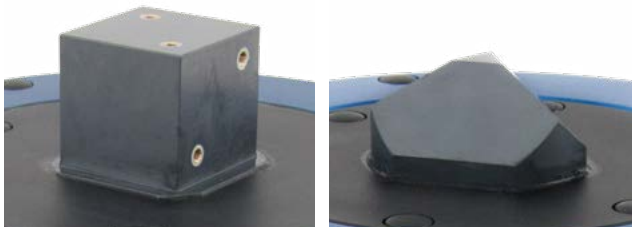
Exciter

High frequency vibration exciter

We offer a huge spectrum of vibration exciter which can generate a precise sine excitation or nearly any other signal. They are designed for high frequency excitation of MEMS sensors. The SE-16 for example provides a solution to test up to 200 kHz. The cube

shaped armature gives the user the possibility to mount devices under test in multiple orientations. The exciter of the SE-2X series are available as a special „T model“ for use in a climate chamber with a working range -40 °C ... +120 °C.

| Model | SE-16 | SE-21 | SE-29 |
|------------------------------|---|--|---|
| Illustration |  |  |  |
| Frequency | 5 Hz ... 100 kHz (200 kHz) | DC ... 50 kHz | DC ... 50 kHz |
| Acceleration | up to 400 m/s ² | up to 390 m/s ² | up to 450 m/s ² |
| transverse motion, typically | < 10 % | < 5 % | < 5 % |
| Payload, max. | 5 g | 2 kg - vertical 1 kg - horizontal | 2 kg - vertical 1 kg - horizontal |
| Armature | three directions, cube-shaped 15 mm × 15 mm | three directions, ceramic, cube-shaped 30 mm × 30 mm | one direction, ceramic, polished, 15 mm × 15 mm |



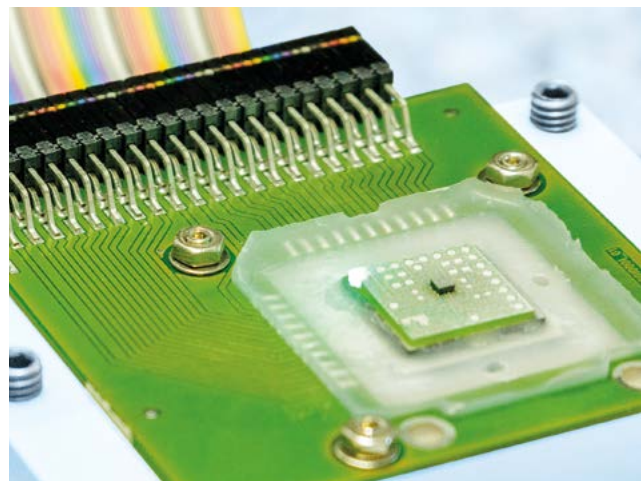
Individual engineering

According to the characteristics of the DUT (Device Under Test) the armature can be modified to fit to your special test requirements. We even adjust the mounting head to help you fix your devices most efficiently, e.g. by drilling screw holes.

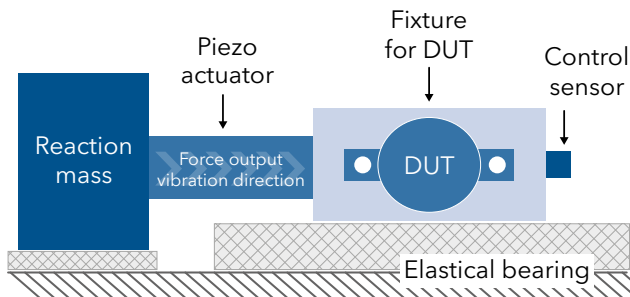


UHF vibration exciter

- ✓ frequency range: 600 kHz ... 2 MHz
- ✓ controlled excitation for mechanical tests of MEMS sensors
- ✓ translational and, for the first time, also rotational excitation (tilting vibration)
- ✓ software-controlled by optimized VCS4xx system



Piezoelectrical excitation



- ✓ high frequency excitation of big & heavy DUT (e.g. sensor cluster with gyroscopes)
- ✓ cube from technical ceramics with piezo-electric drive
- ✓ low weight and high stiffness lead to high resonance frequency
- ✓ vibration tests in climate chamber possible

The Piezocube is a very special exciter without an electro-magnetic drive, as is typical for most exciter. A piezo actuator is used to introduce a vibration into a cube, even at very high frequencies. Its special

design allows different attachment points of your device under test, which easily facilitates a controlled modal analysis, e.g. of a control unit in the automotive industry or other applications.

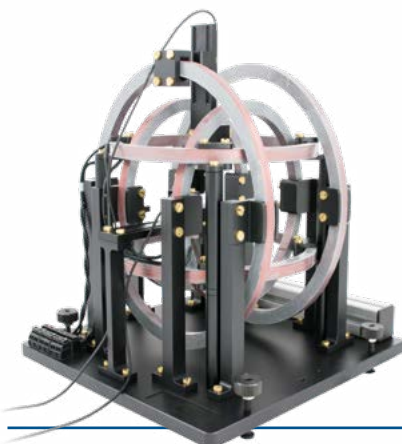
Dynamic rotation excitation

This dynamic rotation exciter was specially designed for periodic excitation over a wide frequency range. A typical example is the characterization of MEMS sensors during the development process. The easy combination with many standard laboratory devices and its overload protection make the DRE-01 a good choice.

- ✓ frequency range: 1 Hz... 5 kHz
- ✓ very low cross-acceleration
- ✓ up to 100 g payload
- ✓ customizable table for DUT mounting
- ✓ max. angular acceleration: $2.5 \cdot 10^6 \text{ }^\circ/\text{s}^2$
- ✓ max. angular velocity: 5 300 $^\circ/\text{s}$
- ✓ internal reference sensors available



Magnetic excitation



Our magnet unit is developed to provide a very precise three-dimensional magnetic field for your DUT - constant or oscillating and in any desired direction in space. The frequency can go up to 150 kHz. If required, you can combine the magnetic excitation with different measures.

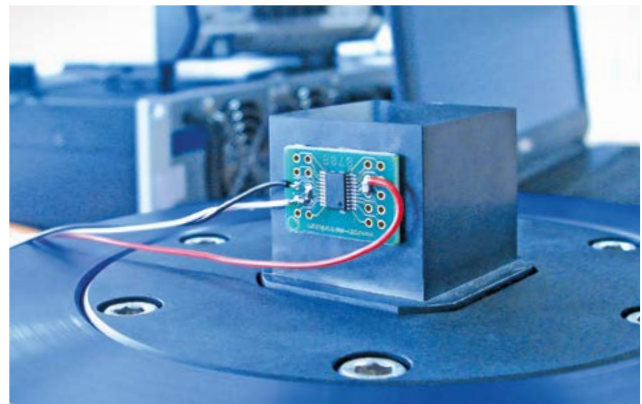
- ✓ generation of 3D AC/DC magnetic fields for MEMS characterization and EMC tests of small components
- ✓ flux density up to 10 mT
- ✓ size of homogeneous field up to $40 \times 40 \times 40 \text{ mm}$



From Lab to Fab

Easy entry into the world of sensor testing.
The right lab system for every task.

The **S-TEST Lab** systems offer solutions for system testing on a wide range of sensor types. Thanks to the compact test hardware, it is possible to check whether the sensors are functioning and performing correctly, even in the early stages of development. The system components, which can be configured in a flexible manner, allow a quick response to a wide range of test requirements. Early testing in the laboratory also reduces the subsequent implementation time for mass-production tests.



MEMS



**Electronic
Control Units**



Gyroscope



Acceleration



**Magnetic
field**



**Pressure
and force**

Sensor development and characterization



Lab system components

- ✓ **Sensor communication:** configurable and compact test interface for digital sensors
- ✓ **Exciter:** for a wide range of sensor types
- ✓ **Amplifiers:** individual operating modes and protective functions
- ✓ **Controller:** for high performance exciter
- ✓ **Software:** feat. suitable operating modes

Scalable end-of-line system level tests for sensor mass production.

Variable, easy and efficient.



For a cost-effective, full production system-level testing (SLT), the SPEKTRA **S-TEST Fab** system is scalable to test up to hundreds of devices in parallel. Test engineers can prepare final production tests already in the lab by using the same components. Their optimized and modular design allows easy test capacity increase and can be used to test a wide variety of digital sensors. We also offer autonomous calibration equipment to simplify the calibration and the maintenance of your S-TEST system.

Electrical and functional testing



Features

- ✓ electrical and functional characterization of new devices
- ✓ verification of datasheet information
- ✓ development of test procedures for volume production
- ✓ analysis of field returns
- ✓ debugging of sensor design flaws



Services and consulting

In our accredited laboratory, a variety of SPEKTRA testing and characterization systems are available for carrying out measurements and tests of all kinds. Our services include device excitation with various stimuli (vibration, shock, pressure, sound) and sensitivity tests (temperature, magnetic field). We also offer combined stimuli measurements or tests (e.g. temperature-vibration, temperature-magnetic field). Rely on our engineers for feasibility studies and consulting in sound and vibration engineering.



Training and learnings

The SPEKTRA CAMPUS provides various live webinars and eLearnings to help you maximize your potential. Discover topics for beginners to advanced users in the areas of device testing, MEMS sensors and our solutions.

Would you like to optimize your work processes with tailored training sessions? Whether as an employee in the calibration laboratory, part of a project team or product user, our seminars will enable you for better performance in your daily tasks.



