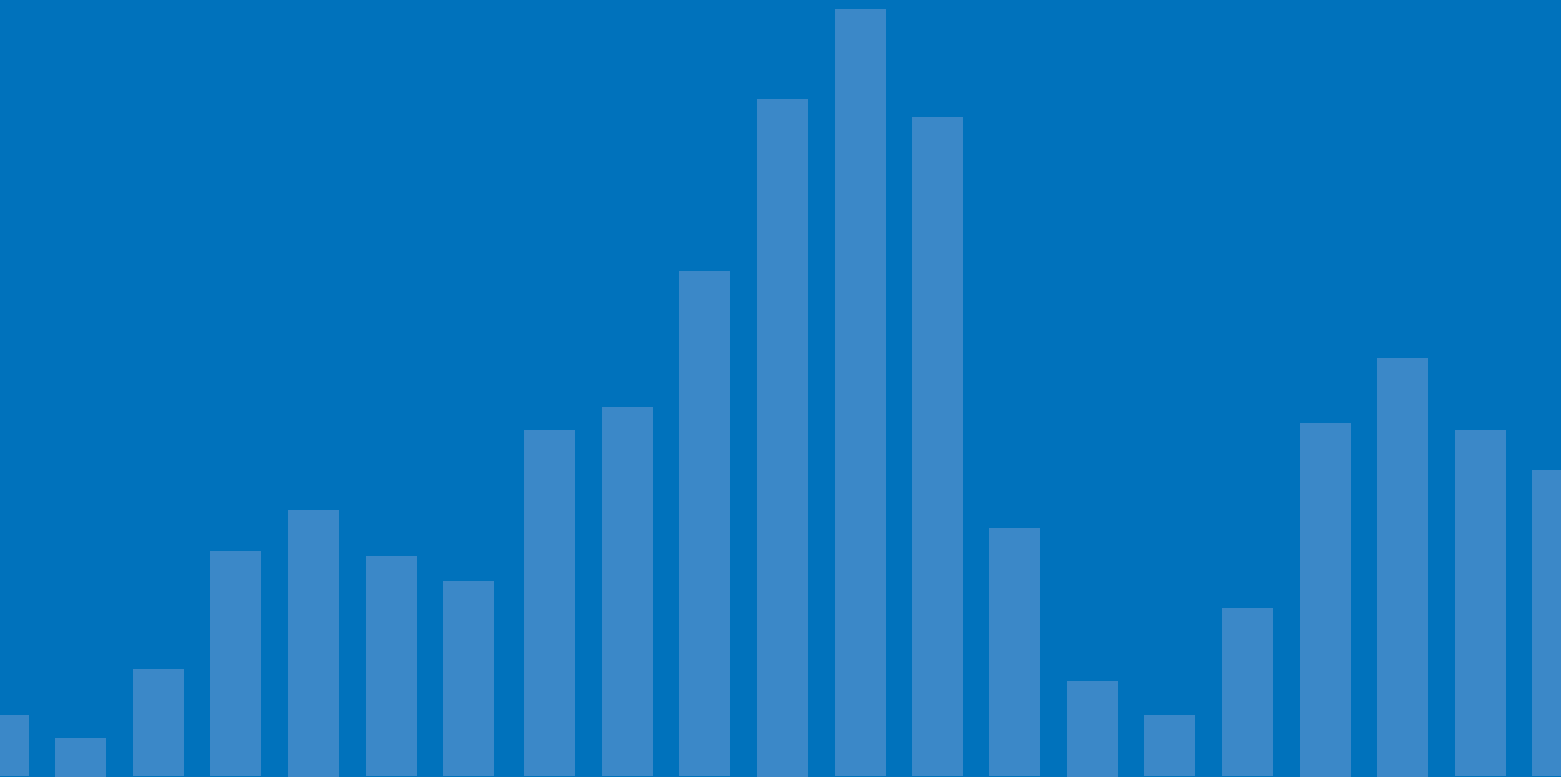
CS

SPEKTRA

CS | Calibration Solutions



Edition 06-2016

International Top-Rate Performance

SPEKTRA - Representatives

Who we are

Our company **SPEKTRA Schwingungstechnik und Akustik GmbH Dresden**, Germany was founded in 1994 and has established itself since then as a renowned manufacturer of components and systems for testing and calibrating instruments for the measurement of dynamic physical quantities such as acceleration, sound pressure, alternating charge. As from 2008, SPEKTRA also includes the APS trademark under which SPEKTRA manufactures and sells long-stroke vibration exciter (shakers) and runs a marketing office in California, USA by the name of **APS Dynamics, Inc.** . Moreover the SPEKTRA Calibration Laboratory, being accredited by DAkkS, offers a wide range of calibration services at a level of measurement uncertainty that normally can be ensured only by the topmost national metrology laboratories.

CS | Calibration Solutions

DT | Device Testing

ST | Structural Testing

ES | Engineering Solutions

CS | Calibration Solutions

This catalog will give you an overview of our product group Calibration Solutions and its main components CS18 Calibration Systems and Calibration Services.

SPEKTRA

Calibration

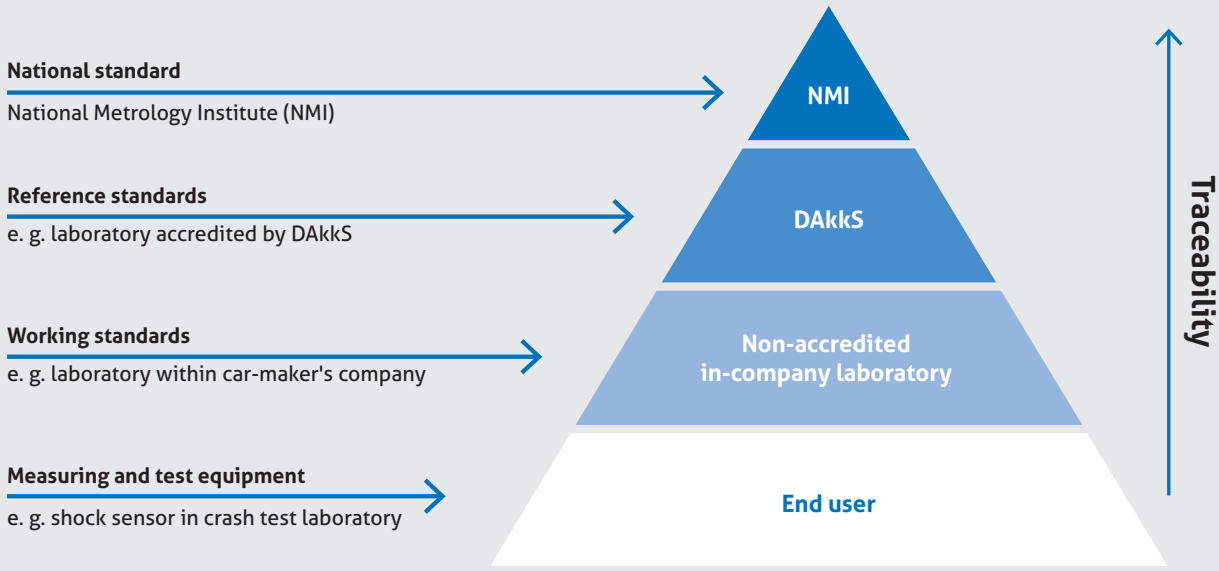
Why Calibration is a must

A calibrated measuring instrument is indispensable for:

- ✓ taking precise measurements with well-known measurement uncertainty
- ✓ taking measurements the results of which are commensurable
- ✓ granting legal security as the results of the measurements taken can be traced to the respective national calibration standards

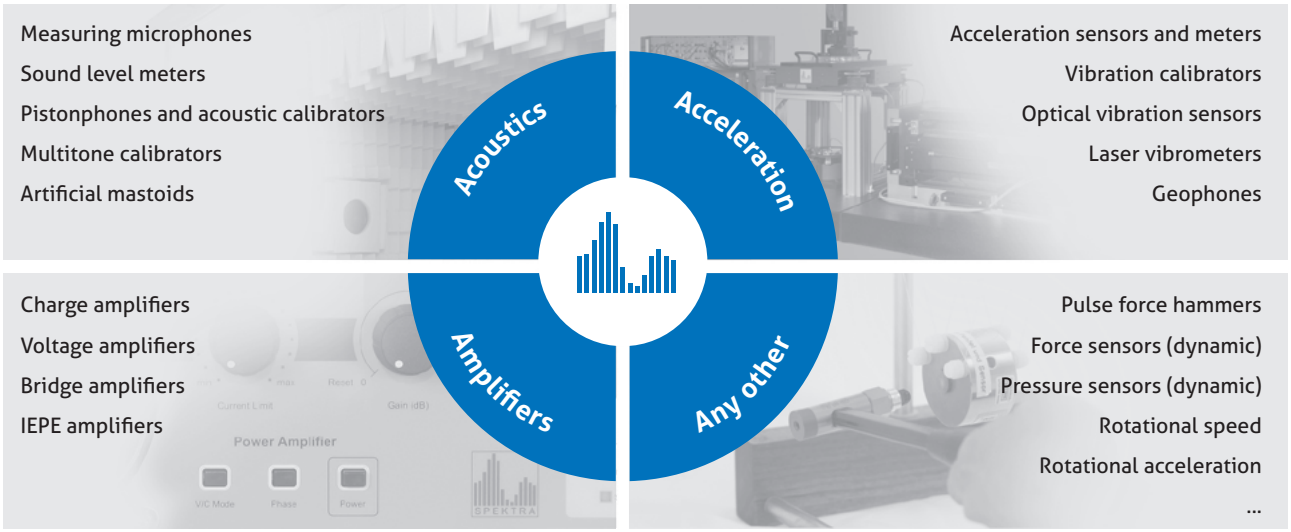
Calibration is performed by determining the values that a measuring instrument reads out when exposed to a precisely defined excitation quantity. If someone intends to take measurements, he or she should precisely know the characteristics of his or her measuring instrument and should be sure that his or her measurement results are commensurable with the measurement results obtained by third parties.

To obtain generally commensurable measurement results, the instruments must be traced to a national standard. This traceability is ensured and maintained by the calibration hierarchy. So everyone who wants to take precise and commensurable measurements should have his or her measuring instrumentation calibrated in regular intervals by an accredited calibration laboratory or perform the calibration routine himself using a traced calibration system.



Calibration hierarchy

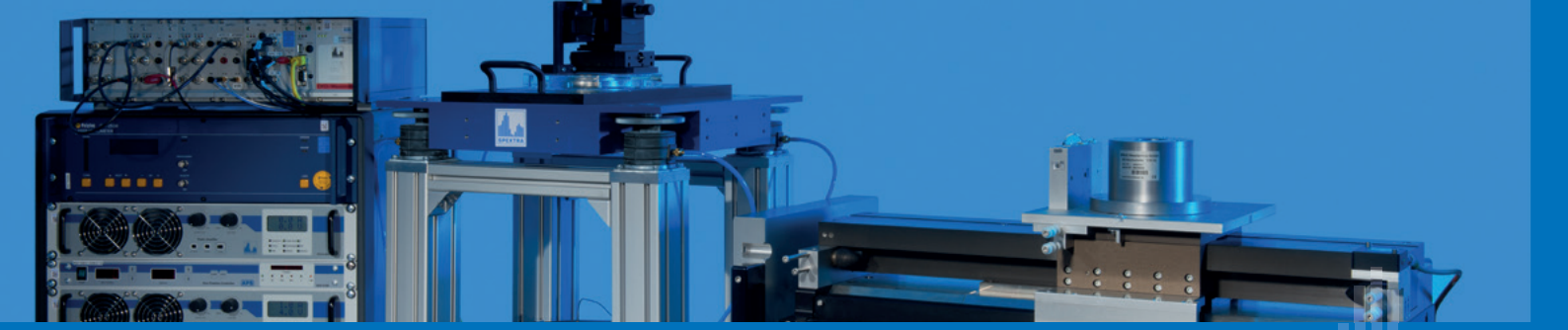
Our Portfolio



Measuring equipment overview

Support in Decision making - Service vs. System owned by Customer

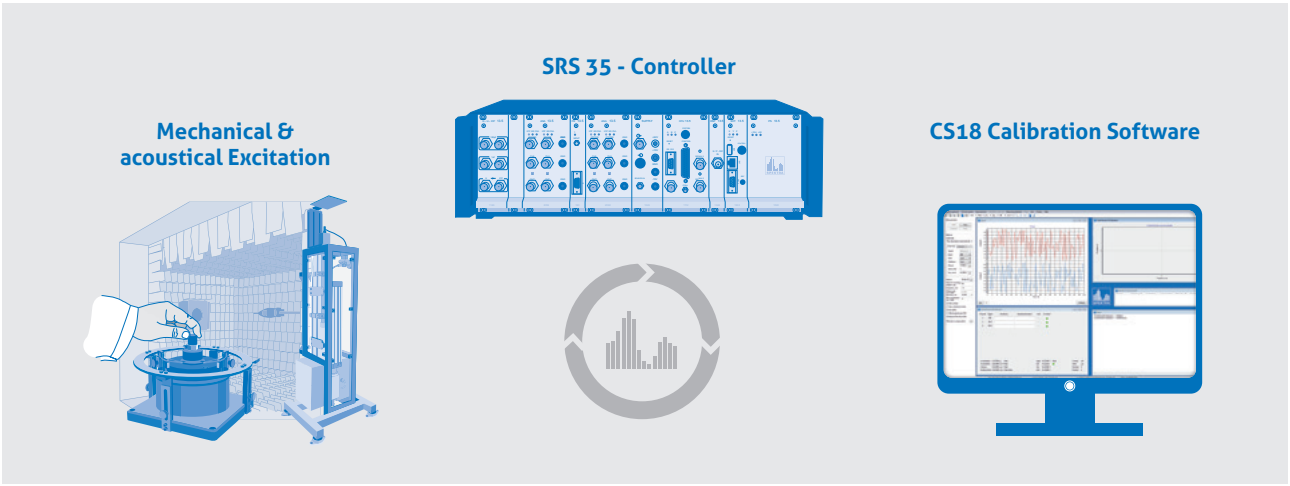
SPEKTRA as a service provider	Company-owned SPEKTRA system
✓ Qualified professional advisory service	✓ Supply of complete turn-key systems
✓ DAkkS accredited calibration laboratory	✓ Modular structure enables the system to be applied to several measurands
✓ Minimized throughput time due to highly efficient flow of work	✓ Hardware and software interfaces available for making connection to customer's systems
✓ Measurement uncertainty on level of national metrology laboratories	✓ Time needed to calibrate measuring and test equipment in permanent use can be minimized – flexibility by enabling immediate calibration
✓ Recommended if the quantity of measuring and test equipment to be calibrated is too small to justify a calibration system equipment investment	✓ Administrative time expenditure for management of test and measurement instrumentation is reduced
✓ Limited space or other constraints make it difficult to justify the acquisition of a calibration system (e. g. disturbing environmental effects cannot be eliminated)	✓ Helps to become intimately familiar with measurement systems quality and performance - improves the proper use of the measuring and test equipment
✓ Cost reduction by outsourcing payroll and system costs of calibration	



CS18 - The SPEKTRA Calibration System

One-stop Concept of the entire System

SPEKTRA supplies all components of calibration systems based on their own research and development:



CS18 - System

Mechan. & acoustical excitation
Robust exciter, well proven in practice, with a wide working range which more often than not extends to the physical boundaries.

SRS 35 - Controller
Electronic measurement and vibration control unit in modular structure, ready for expansion with a variety of analog and digital interfaces.

CS18 calibration software
Developed in conjunction with SPEKTRA's own calibration laboratory and optimized with regard to high efficiency.

Your Benefits

With the CS18 Calibration system, SPEKTRA provides a means to cope with all requirements of traceable calibration and efficient laboratory operation in conformance with all applicable standards.

- ✓ Complete turn-key calibration system
- ✓ Including: Initial tracing to standard by traceable calibration of each supplied system in the SPEKTRA DAkkS Laboratory
- ✓ Modular structure allows calibration with respect to several measurands by means of one system (acceleration, sound pressure, dynamic pressure, ...)
- ✓ Hardware interfaces for the calibration of sensors with digital interfaces (DTI, I2C, CAN,...)
- ✓ Software interfaces for data exchange with instrumentation data bases, ERP systems, ...
- ✓ Systems are available for primary as well as secondary calibration

SRS 35 – Heart of our CS18 Calibration System

Module SRS 35 is the heart of every CS18 Calibration system. It combines signal generator, signal acquisition unit and control unit for driving calibration exciter in one device. The types of exciter to be connected include, for instance, not only vibration exciter (shakers) or shock exciter but also loudspeakers for generating acoustic signals or devices for the excitation of any other physical quantities (pressure, force etc.). Type 35 is modular in structure and can be adapted to the respective measurement task. The unit contains a digital signal processor and an integrated control computer and so can perform a great many signal processing jobs such as real-time control in a vibration control systems independently and without resorting to the controlling PC.

Module Cal-Q-ICP

- Reference capacitors
- IEPE sensor simulation
- Calibration of signal conditioners

Module ANA

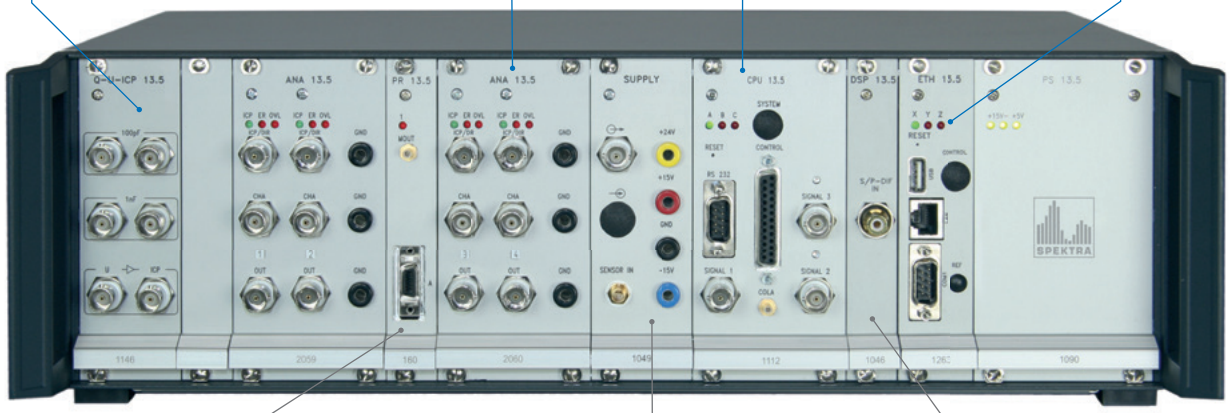
- Two analog input channels in each module
- **Integrated in each channel:**
  Signal conditioner IEPE, charge
  Monitor output

Module CPU 13.5

- Signal generator
- Signal processor
- Vibration controller
- Programmable TTL outputs

Module ETH 13.5

- Ethernet connection to controlling PC



Configuration SRS 35*

*Recommendation; actual configuration may possibly differ

Optional extra – PR-Module

- Signal conditioner for PR sensors
- Programmable voltage supply
- Supports TEDS & ID modules

Optional extra – Supply Module

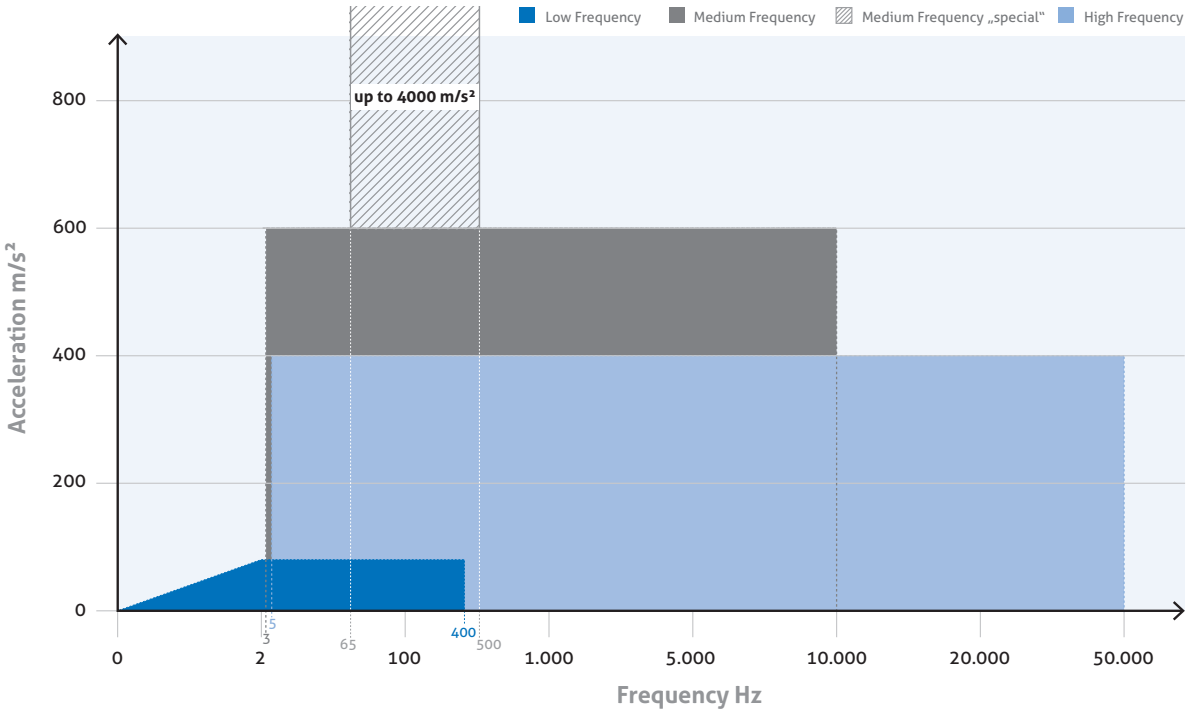
- Voltage supply to VC sensors
- Voltage can be configured

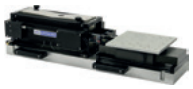
Optional extra – DSP-Module

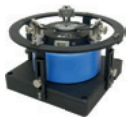
- Digital input for laser vibrometers

Vibration Exciter (Shakers)

SPEKTRA offers vibration exciter for a wide range of amplitudes and frequencies. Taking your specific range of application into account, we will be able to offer you a solution to perform your calibration job.



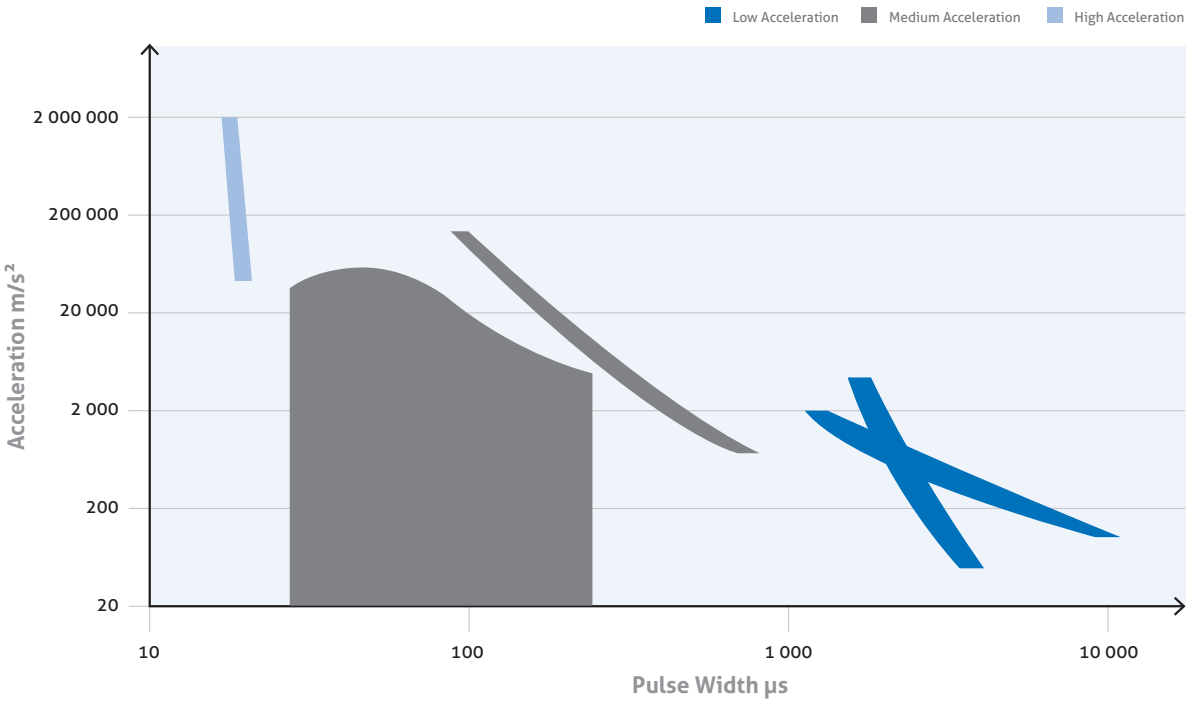
Model	APS 600	APS 113-AB	APS 129	APS 500	SE-13
Illustration					
Frequency	0 Hz ... 100 Hz	0 Hz ... 200 Hz	0 Hz ... 200 Hz	0 Hz ... 200 Hz	0 Hz ... 400 Hz
Acceleration*	20 m/s²	73 m/s²	22 m/s²	61 m/s²	60 m/s²
Payload*	25 kg	1,5 kg	23 kg (horizontal) 11 kg (vertical)	3 kg (horizontal) 1,3 kg (vertical)	50 kg

Model	SE-10	SE-101 RES-HA	SE-09
Illustration			
Frequency	3 Hz ... 10 kHz	65 Hz ... 500 Hz	5 Hz ... 50 kHz
Acceleration*	600 m/s²	4000 m/s²	400 m/s²
Payload*	500 g	300 g	350 g

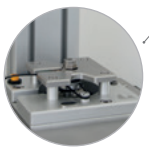
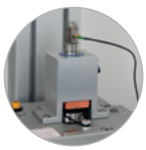
* Maximum

Shock Exciter

SPEKTRA offers shock exciter that cover a wide range of amplitudes and shock durations.

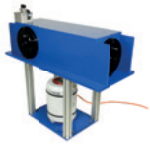


Model	SE-222 HOP-VHS	SE-221 HOP-HS	SE- 220 HOP-MS
Illustration			
Acceleration	100 km/s² ... 2.000 km/s²	100 km/s² ... 1.000 km/s²	20 m/s² ... 40 km/s²
Payload*	15 g	30 g	30 g
Pulse Width	40 µs (full-sine)	50 µs (full-sine)	80 µs ... 360 µs (full-sine)

Model	SE-201 PN-LMS		SE-210 SP-LS
Illustration	Medium shock anvil   Low shock anvil 		
Acceleration	2 km/s² ... 100 km/s²	50 m/s² ... 2,5 km/s²	100 m/s² ... 2 km/s²
Payload*	80 g	80 g	300 g
Pulse Width	0,1 ms ... 0,5 ms	2 ms ... 5 ms	1 ms ... 10 ms

* Maximum

Acoustic Exciter

Model	SQ-01	SQ-03
Illustration		
Application	Free field calibration	Very low frequency pressure chamber calibration
Frequency	125 Hz ... 20 kHz	0,1 Hz ... 31,5 Hz
Sound Pressure Level	74 dB ... 94 dB	114 dB ... 124 dB

Model	SQ-4.1	SQ-4.2
Illustration		
Application	Pressure chamber calibration of 1" microphones	Pressure chamber calibration of ½" microphones
Frequency	31,5 Hz ... 8 kHz	31,5 Hz ... 16 kHz
Sound Pressure	64 dB ... 124 dB	64 dB ... 124 dB

Pressure Exciter

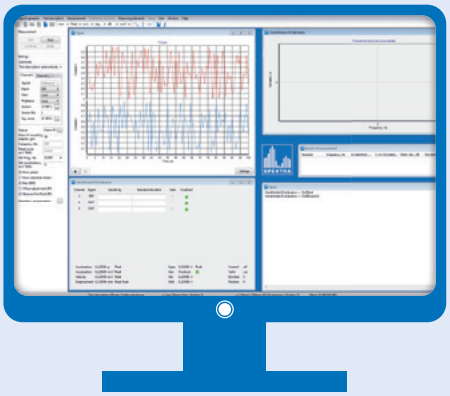
Model	DPE-01	DPE-02
Illustration		
Application	Pressure sine calibration	Pressure shock calibration
Frequency	10 Hz ... 2 kHz	-
Pulse Width	-	< 2 ms
Pressure	100 Pa ... 16 kPa	20 MPa ... 4.000 MPa

Any other Exciter

We extend our portfolio continuously with the aim of offering the appropriate solution to any of your calibration jobs. For instance, we are able to supply exciter for the calibration of dynamic force and rotational speed if so requested.

CS18 Software

Every good hardware needs to be complemented by software with the necessary high performance.



- ✓ **Simple to operate**
- ✓ **Integrated sensor database**
- ✓ **Data export to Word®, Excel®, ...**
- ✓ **Automation interface**
- ✓ **Calibration database server (Optional)**
- ✓ **Interface to foreign databases (Optional)**
- ✓ **Calibration of digital sensors (e. g. DTI)**

The CS18 software was created in close cooperation with the SPEKTRA Calibration laboratory accredited by DAkkS. It meets the demands of every efficiently operating calibration laboratory already in its basic configuration and can easily be adapted to the workflows of any company.

Easy-to-accomplish generation of calibration setups

- ✓ Storage of complete calibration courses in setup files (to be started by mouse click)
- ✓ Simple drawing-up of setups by guided procedures
- ✓ A Software wizard helps to create setups just by a few mouse clicks
- ✓ Automatic loading of the item under test into the setup when using TEDS or ID modules
- ✓ Fail-safe operation of testing the setup based on the performance data of the exciter

Integrated sensor database

- ✓ High-performance search masks will find any test item that has ever been calibrated by the system
- ✓ Administration of sensor type templates
- ✓ Easy introduction of new test items based on sensor type (input of serial number will do)
- ✓ Administration of calibration intervals, ID numbers (TEDS, DALLAS-ID, etc.) and other sensor data

Easy-to-accomplish data storage and data export

- ✓ Storage of setup and calibration data in calibration log files in conformance with **ISO 17025**
- ✓ Easy-to-accomplish export of data into text or spreadsheet routines (e. g. MS Word®, MS Excel®) to create calibration certificates ready for print-out
- ✓ **Optional:** Data export into any other data format by means of VB scripts or other software (by using Windows COM interface technology)
- ✓ **Optional:** Storage of calibration log files on database server (to cope with large volumes of data)

Modes for ...

The CS18 software is organized in so-called modes of operation which facilitates the drawing-up of test settings. In each mode of operation the software will display only those setup parameters that are presently relevant and so makes operator attendance easy and efficient.

... Vibration calibration systems

Standard

- **Sine calibration:** Calibration of acceleration sensors and velocity sensors with sinusoidal excitation at fixed frequencies
- **Sweep:** Excitation with continuously varied sinusoidal signals – determination of transfer function of sensors (to detect any resonances and discontinuities)
- **Measurement:** Calibration of vibration calibrators
- **Signal generation:** Calibration of vibration measuring instruments with indicators of their own

Optional Extras

- **Multi-sine:** Calibration of acceleration sensors and velocity sensors with simultaneous sinusoidal excitation at a number of frequencies.
- **PR sensor test:** Software module for signal conditioner for piezo-resistive sensors. To determine the resistances of measuring bridge, offset, drift and any other electrical parameters.
- **Calibration of signal conditioners:** Calibration of IEPE, charge, instrumentation amplifiers in frequency range 0,1 Hz to 50 kHz
- **Calibration of digital sensors (e. g. DTI)**
- **Noise:** Calibration of acceleration sensors with noise excitation

... Shock calibration systems

Standard

- **Shock calibration:** Calibration of acceleration sensors with shock-type excitation. Enables automatic performance of calibration on SPEKTRA Shock exciter.

Optional Extras

- **PR sensor test:** Software module to signal conditioner for piezo-resistive sensors. To determine the resistances of measuring bridge, offset, drift and any other electrical parameters.
- Calibration of signal conditioners: Calibration of IEPE, charge, instrumentation amplifiers in frequency range 0,1 Hz to 50 kHz
- **Calibration of digital sensors (e. g. DTI)**

... Acoustical calibration systems

Standard	Optional Extras
✓ **Microphone calibration (free-field):** Calibration of complete microphones and microphone cartridges with sinusoidal excitation in an anechoic chamber (free-field conditions) ✓ **Calibration of sound level meters (pressure):** Calibration of sound level meters by means of a pressure chamber (pistonphone, acoustic calibrator, acoustic coupler) ✓ **Microphone calibration (pressure):** Calibration of microphones by means of a pressure chamber (pistonphone, acoustic calibrator, acoustic coupler) ✓ **Calibration of sound level meters (free-field):** Calibration of sound level meters with sinusoidal excitation in an anechoic chamber (free-field conditions) ✓ **Calibration of acoustical calibrators:** Calibration of acoustical calibrators or pistonphones by means of a reference calibrator (substitution method)	✓ **Calibration of signal conditioners:** Calibration of signal conditioners (ICP, charge, PR and instrumentation amplifiers) ✓ **Sound level meters (electrical tests):** Testing of sound level meters with electric signals

... any other measurands

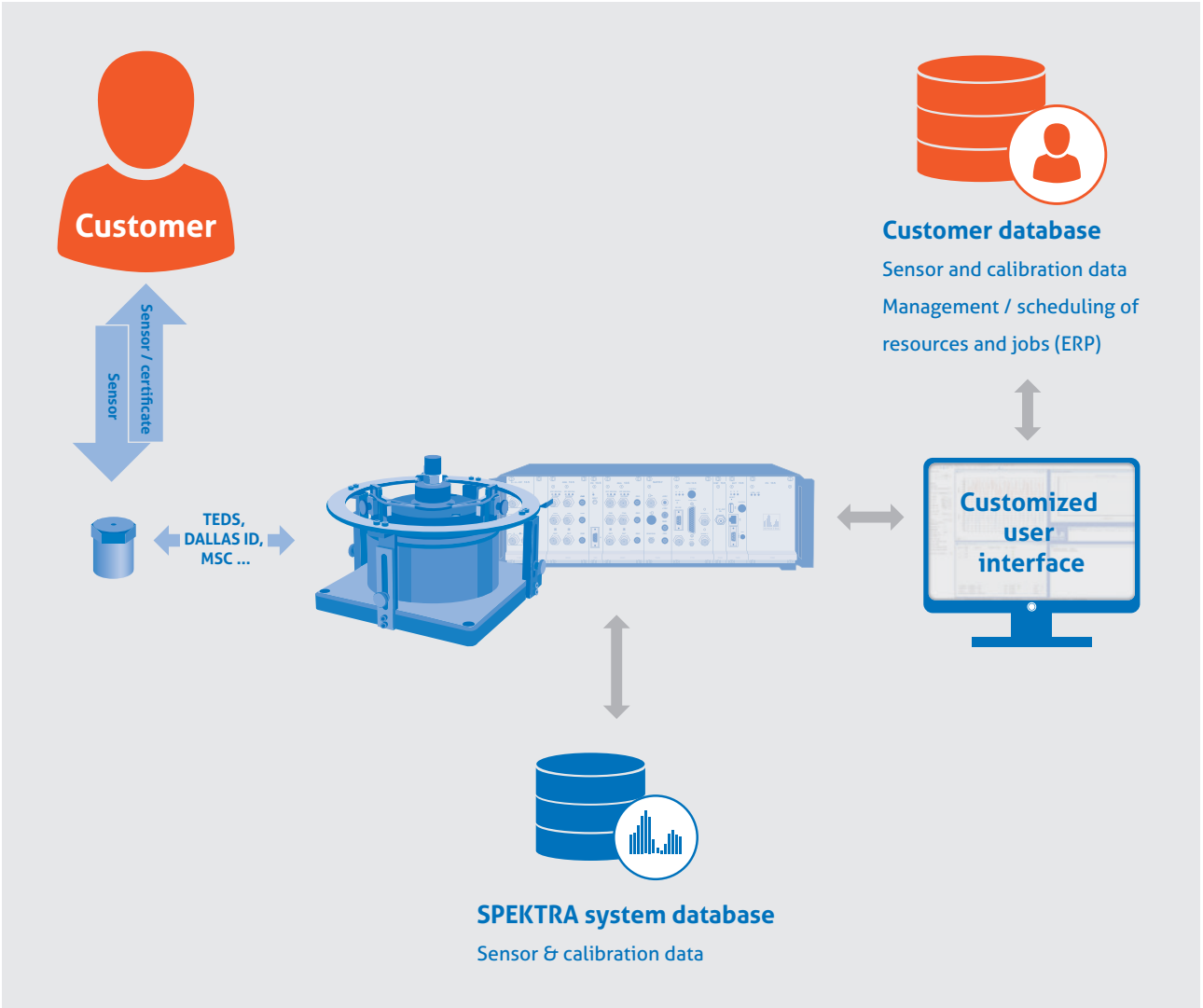
It is a matter of course that our offer of services also includes tailor-made software solutions to special problems with the aim of integrating them seamlessly into your CS18 system. Examples of possible problems are calibration of dynamic force and rotational speed.

Harmonization with Workflow in Company

Every business company is organized in its own way, making use of different software tools. As a rule, a calibration system cannot be regarded as an island; normally it is integrated in the company's workflow and must exchange data with other software.

For instance, data about calibration jobs need to be imported from ERP and calibration data need to be exported to instrumentation databases or crash-test software data bases. The CS18 software includes the appropriate automation software interfaces by means of which any CS18 calibration system can be adapted to any software environment and workflow.

Even complex calibration procedures can be accomplished in this manner by using small add-on programs. User-specific solutions of this kind can be implemented by the customer himself using common software tools or tailor-made by the experienced SPEKTRA software team.



Workflow calibration system

How to find your optimum Calibration System

All CS18 Calibration systems are flexible in structure and so can easily be adapted to the customer's requirements. For instance, one system may include several vibration exciter for the purpose of covering a wider frequency range.

Shock and vibration exciter can be combined in one system as well. It is even possible to a certain degree to combine an acoustical calibration system with exciter for the calibration of acceleration sensors.

Please make use of our orientation guide at **spektra-dresden.com/products/calibration-systems.html**

Typical Solutions

For a first orientation the following table shows a few examples of calibration systems tailored to typical applications by common customers.

CS18 MF Standard calibration system for acceleration sensors	**CS18 HF** Calibration system for the high-frequency range	**CS18 VLF** Calibration system for geophones and seismic sensors
• Sine calibration of acceleration and vibration velocity sensors • Frequency range: **3 Hz to 10 kHz** • Acceleration amplitude up to **600 m/s²** • Maximum sensor weight **500 g**	• Sine calibration of acceleration and vibration velocity sensors • Frequency range: **5 Hz to 20 kHz** • Acceleration amplitude up to **400 m/s²** • Maximum sensor weight up to **350 g** • Optional extra: Primary calibration[1]	• Sine calibration of acceleration and vibration velocity sensors • Frequency range: **0,1 Hz to 400 Hz** • Maximum sensor weight **50 kg** • Optional extra: Primary calibration[1]

CS18 LMS Shock calibration system for the automotive industry	**CS18 (V)HS** Calibration system for extremely high acceleration	**CS18 FF** Free-field calibration of acoustic measurement instruments
• Shock calibration of acceleration sensors • Large amplitude range from **50 m/s² to 100 km/s²** • Shock duration of up to **5 ms** (e.g. for sensors in crash tests) • Calibration of sensors with DTI interface feasible • Automatic calibration run	• Shock calibration of acceleration sensors • Maximum amplitudes of up to **1.000 km/s² (2.000 km/s²)** • very high reliability and repeatability • Automatic calibration run • Optional extra: Primary calibration[1]	• True free-field calibration of microphones and sound level meters • Compact anechoic chamber, arrangeable in user's lab • Frequency range: **125 Hz to 20 kHz** • Calibration of calibrators and pistonphones feasible, too

[1] **Primary calibration:** The distinction between primary and secondary calibration is in the employed reference standard. In primary calibration the device under test is compared with a fundamental physical constant. In the case of calibration of acceleration, the fundamental physical constant is represented by the wavelength of a Helium-Neon Laser light source.

Please contact us for solutions with regard to your range of application.
We look forward to answering your questions.

Telephone: +49 351 400 24 0
Fax: +49 351 400 24 99
Email: sales@spektra-dresden.com
Web: www.spektra-dresden.com

Calibration Services

What is so special with our Laboratory?

In its DAkkS accredited laboratory, SPEKTRA Schwingungstechnik und Akustik GmbH Dresden employs exactly the same instrumentation that is on offer to our system customers. Our extremely efficient workflow is the reason why we can offer extremely short throughput periods:

- ✓ Secondary calibration at throughput times of between **5 and 7 workdays**
- ✓ Primary calibration at throughput times of between **7 and 10 workdays**
- ✓ Express service within 48 hours or 72 hours possible at extra charge
- ✓ Very low measurement uncertainty at levels that normally can be ensured only by the topmost national metrology laboratories

Our Service Offer

DAkkS and factory calibration

Our DAkkS Calibration laboratory is accredited for measurands acceleration and sound pressure level as well as electric measuring quantities in conformance with **DIN EN ISO/ IEC 17025**.

- ✓ Vibration sensors, vibrometers and geophones
- ✓ Vibration calibrators, acoustic calibrators
- ✓ Laser vibrometers
- ✓ Force sensors (dynamic) / pulse hammers
- ✓ Tilt sensors
- ✓ Signal conditioners
- ✓ Measurement microphones and sound level meters
- ✓ Audiometers: Ear simulators / artificial mastoids
- ✓ Special calibration jobs on request: e. g. calibration in special environmental conditions, temperature

In-situ calibration

- ✓ Vibration test stands
- ✓ Sensor balancing systems
- ✓ Production test stands

You are kindly invited to take a look at our accreditation certificate published online at **spektra-dresden.com**

Professional Training

Do you want to optimize your business workflow and further increase the success of your company's activities? Exploit your potential yet more intensely – with tailor-made professional training by SPEKTRA. Regardless of whether you are a member of the calibration laboratory staff or have joined a project team or you are a user of products, our training courses will make you fit for your job – based on facts, in a compact and dedicated manner and in line with the needs and targets of your branch.

Basic training courses

- ✓ Calibration in vibration engineering
- ✓ Calibration in acoustical engineering

Product-related training courses

- ✓ CS18 Calibration system (vibration, shock, acoustics)
- ✓ VCS Vibration control systems

General user training

- ✓ How to draw up a measurement uncertainty budget
- ✓ Customer specific projects, individual products

All training courses on offer can also be performed individually at the customer's location. We look forward to adapting the contents of the training course to your special demands. Do not hesitate to contact us for advice – we will find the appropriate solution. This is how to contact us:

Email: sales@spektra-dresden.com
Telefon: +49 351 400 24 0

Please take a look at our comprehensive catalog of training courses to learn the details about participation preconditions, durations and prices.

Selected References

SPEKTRA Schwingungstechnik und Akustik GmbH Dresden, Germany has business contacts worldwide. Through our trade partners we help a wide variety of customers solve an equally wide variety of problems all over the globe.

National Metrology Laboratories

PTB · NIST National Institute of Standards and Technology U.S. Department of Commerce · Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra Eidgenössisches Institut für Metrologie METAS · NIMT · Australian Government National Measurement Institute · GUM · KRISS Korea Research Institute of Standards and Science · CMI Czech Metrology Institute · KEBS Kenya Bureau of Standards · CEM Centro Español de Metrología · CENAM Centro Nacional de Metrología · cea

Automotive

Audi · BMW · Changan · Daimler · Ford · Porsche · Jinheng Automotive Safety Technology Holdings Limited · MAN · Magna Steyr · Škoda · Ashok Leyland · Volkswagen · Humanetics · Takata · TÜV SÜD · Continental · Bosch

Aviation

Airbus · Safran · Astrium · mtu · IABG · Rolls-Royce

Sensor Manufacturers

Kistler measure. analyze. innovate. · ASC Advanced Sensors Calibration · MMF · DMT · Syscom · measurement Specialties

Other Industries

Sandia National Laboratories · Siemens · Wir messen es. testo · Trescal · Halliburton · Australian Government Department of Defence Defence Science and Technology Organisation

How to find us

SPEKTRA Schwingungstechnik und Akustik GmbH Dresden
Heidelberger Str. 12
DE - 01189 Dresden

Telephone:	+49 351 400 24 0
Fax:	+49 351 400 24 99
Email:	sales@spektra-dresden.com
Web:	www.spektra-dresden.com

Managing Directors:	Dr. Holger Nicklich, Martin Nicklich
Commercial register:	Amtsgericht Dresden, HRB 10328
VAT-ID:	DE 166 333 013

APS Dynamics, Inc.
32124 Paseo Adelanto, Suite 3
San Juan Capistrano, CA 92675

Telephone:	+1-949-234-9791
Fax:	+1-760-683-3184
Email:	sales@spektra-usa.com
Web:	www.spektra-usa.com