

**KISTLER**

measure. analyze. innovate.

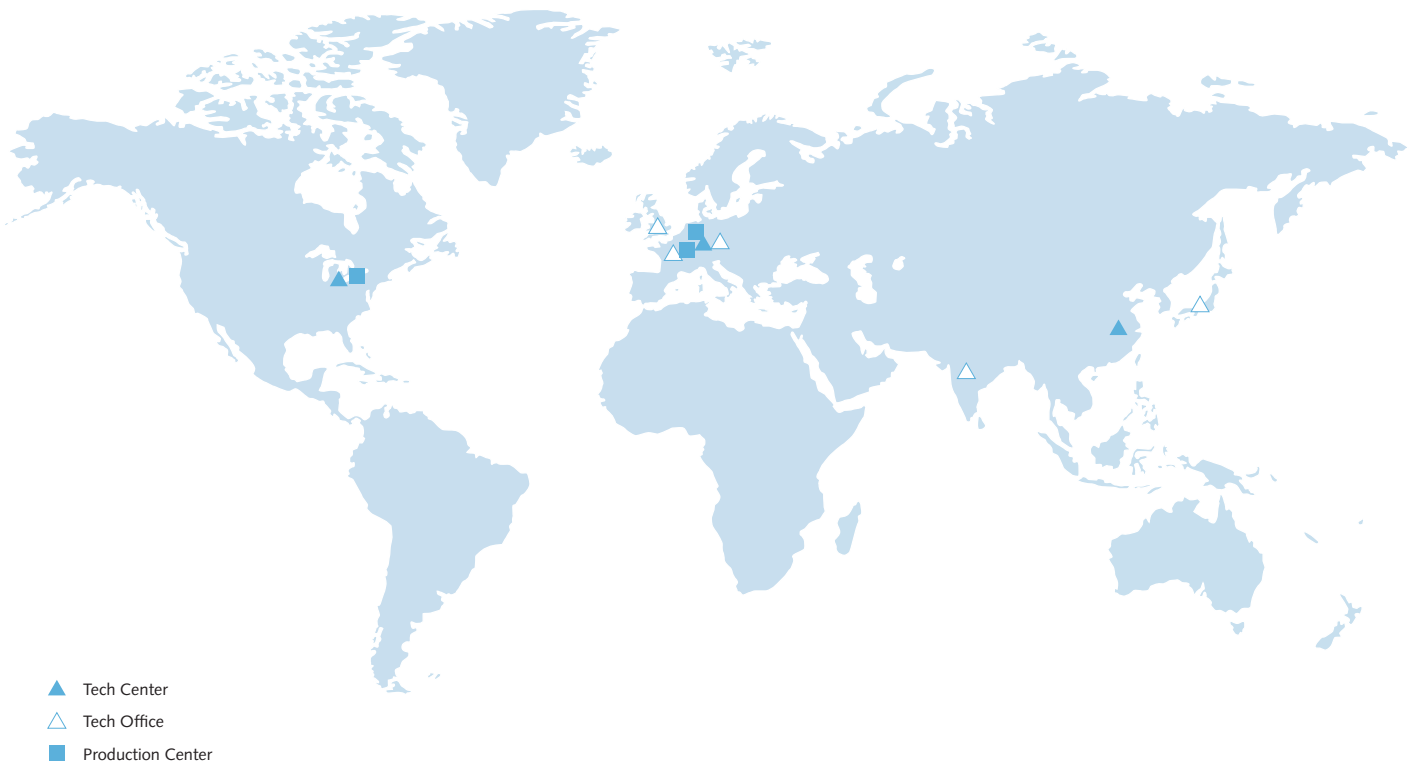
# Confidence in measurement.

Get Better. With Kistler.



## Calibration

Global calibration network



# Kistler Calibration Network

Kistler operates a network of calibration laboratories from its Tech Centers, Tech Offices and Production Centers around the world. This network enables Kistler to locally offer standardized calibration services traceable to national and international standards with short turnaround time and low transport costs.

	USA	China	Germany	Japan	France	Czech	UK	India	Switzerland
Force Sensors	●	●	●	●	●	●			●
Signal Conditioners	●	●	●	●	●	●	●	●	●
Pressure Sensors	●	●	●	●	●	●	●	●	●
Accelerometers	●	●	●						
Data Acquisition (Crash)	●	●	●						
Wheel Force Transducers			●						●
Optical Sensors (Vech. Dyn.)	●		●						
Joining Modules			●						
Torque Sensors	●		●						●

● Accredited calibrations\* available

● Available calibration services

\* refer to page 5

Note: Kistler is constantly expanding its calibration network and capabilities. The table shows a non-exhaustive list of calibration services.



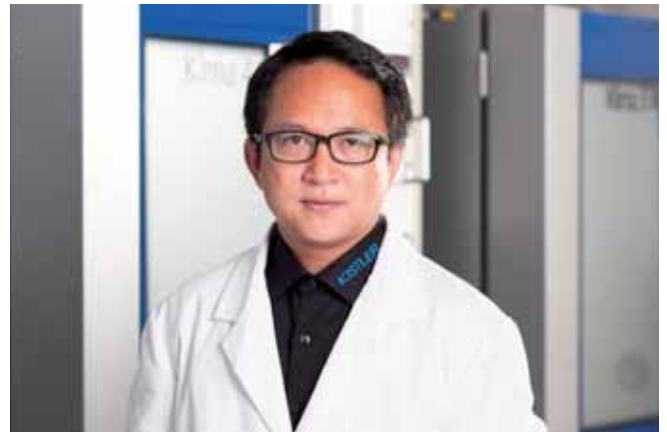
# Calibration Quality Control

The consistent calibration quality at Kistler laboratories is ensured by three measures, together called the Kistler Accreditation: proof of traceability, inter-laboratory comparison and benchmark test.

Proof of traceability (POT) is a declaration stating to which national standard a certain instrument has been compared. POT ensures a direct, metrological link to national and international standards. It furthermore allows a laboratory to estimate calibration and measurement capability (CMC) of a calibration system.

Benchmark test is a laboratory-internal procedure, in which a dedicated unit under test (UUT) is calibrated at regular intervals to confirm a system's stability between system calibrations, i.e. between POTs.

Inter-laboratory comparison compares calibration results from different laboratories. A dedicated UUT is rotated between laboratories to monitor and thus ensure group-wide comparability of calibration results.



Kistler calibration experts serving customers across the globe

# Type-specific and Application-oriented

Kistler engineers and calibration experts have developed application-oriented calibration procedures specifically for Kistler sensors and devices. Measuring range, loading profiles, boundary conditions and evaluation algorithms are defined to suite the sensor and its application. Application-specific boundary conditions such as temperature, frequency and mechanical pre-loading are typically incorporated into the calibration procedure. The calibration of piezoelectric combustion pressure sensors, for example, utilizes a continuous loading profile instead of traditional static loading. The calibration is conducted at elevated temperatures to ensure reliable measurement results during the cylinder pressure measurement in real applications.

These application specific procedures not only ensure traceability to national and international standards but also confirm that the sensor / device is fit for use in a stringent application environment.

## Recalibration intervals

Industry standards typically recommend recalibration intervals of 1 year.

It should, however, be noted that recalibration intervals for sensors and measurement equipment depend heavily on the specific application and the usage thereof.

The table on the right gives an overview of some recommended recalibration intervals for specific measurands and applications.

Application	Sensor Types	Recalibration Interval
<b>Pressure</b>		
Cylinder pressure	6125, 6041, etc.	Every 300 hours or 1 year
Very high pressure >1 000 bar	6213, 6215, etc.	Peak pressure < 5 000 bar every 1 000 cycles Peak pressure > 5 000 bar every 200 cycles
General pressure	601A, 6031, etc.	1-2 years
<b>Force</b>		
Process monitoring for joining and assembling	9313, 9371, etc.	1 year
Vehicle safety	M55155, M55235, etc.	1 year
Test + Measurement	913x, 910x, etc.	1-2 years
<b>Acceleration</b>		
Vehicle Safety	M0064, M0068, etc.	1 year
Test + Measurement	8002, 8275, etc.	1 year
<b>DAS</b>		
Vehicle Safety	MiniDAU, KiDAU, etc.	1 year
<b>Electronics</b>		
various	5018, 5080, etc.	1 year



Charge amplifier calibration with a precision calibrator

# Kistler Calibration Types

## Recalibration

Recalibrations are the calibration services offered by Kistler Tech Centers and Tech Offices worldwide (see map page 2). Adapted from the calibration at the production center, recalibration services inherit the application-oriented procedures for various sensor types, and is characterized through its short turnaround time (5-10 working days). Recalibration is, where available, considered the preferred service for most Kistler sensors and measurement devices.

- Controlled laboratory conditions
- Localized services
- Application-oriented
- Short turnaround time

## EOL Calibration

The End-of-Line (EOL) calibration / test is the final production step before the shipment to customer. The EOL calibration can also be ordered as after sales service, i.e. an exact repetition of the calibration / test, as conducted before delivery. EOL Calibration is the preferred service when recalibration is not available. EOL Calibrations are available at Kistler production center, where the respective device was produced and is thus often associated with a turnaround time of 10-30 working days.

- Exact repetition of the original calibration
- Device / application-oriented
- Calibration at the production center

## Accredited calibration

Calibration accredited to ISO/IEC 17025. Calibration procedures are defined in internationally recognized standards and procedural guidelines, or procedures developed by the respective laboratory and audited by a recognised accreditation body. Accredited calibrations are, typically, used for the calibration of working and transfer standards. Accredited calibrations are available at accredited Kistler laboratories worldwide.

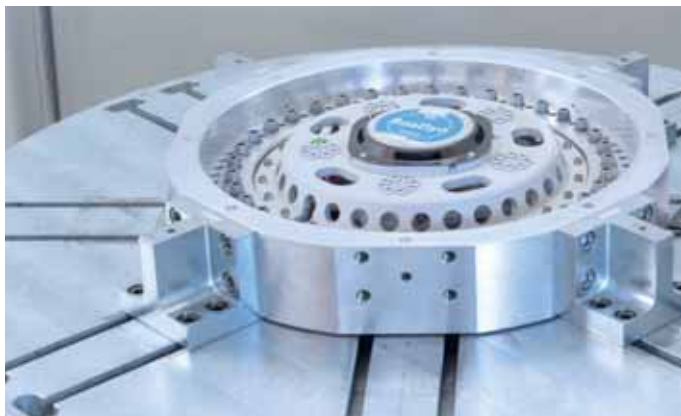
- ISO 17025 conform

## In-situ calibration

In-situ calibrations are, where possible, performed at the customer site, e.g. on sensors and devices installed in a production line or test facility, i.e. wherever the device is in use. This type of calibration ensures minimum downtime and eliminates any transport risks. Furthermore, the Kistler service technicians' in-depth knowledge of measurement techniques and systems often contribute to improving customer processes.

- Minimized downtime
- No transport or logistic costs
- On-site diagnostics and trouble shooting

# Equipment Highlights



## Hexapod calibration system for Production Centers

UUTs	Wheel force transducers
Calibration Range	$F_{x,y,z}: \pm 50 \text{ kN}$ $M_{x,y,z}: \pm 10 \text{ kN}\cdot\text{m}$
Location	Germany



## 3-Component force calibration system for Production Centers

UUTs	Multi-component force platforms and dynamometers
Calibration Range	$F_{x,y}: 0 \dots 100 \text{ kN}$ $F_z: 0 \dots 500 \text{ kN}$
Location	Switzerland



## Multi-channel high temperature pressure calibration system for Production Centers

UUTs	<ul style="list-style-type: none"> <li>Combustion pressure sensors</li> <li>Measuring spark plugs</li> </ul>
Calibration Range	10 ... 600 bar (@RT) 20 ... 400 bar (@ HT)
Boundary condition	RT ... 350 °C
Location	Switzerland



## Vibration calibration system for Tech Centers / Offices

UUTs	Vibration accelerometers
Calibration Range	0 ... $\pm 20 \text{ g}$
Boundary condition	5 ... 20 000 Hz
Location	Germany, USA*, China*

\*Laboratories in USA and China: calibration range is 0 ...  $\pm 60 \text{ g}$  and the frequency range is 3 ... 10 000 Hz



#### Force calibration system for Tech Centers / Offices

UUTs	<ul style="list-style-type: none"> <li>• Load washers</li> <li>• Force links</li> <li>• Press force sensors</li> <li>• In-dummy sensors</li> </ul>
Calibration Range	0 ... 50 kN
Location	China, USA, Germany, Switzerland



#### Jockey-weight torque standard machine for Production Centers

UUTs	Rotating torque sensors
Calibration Range	0,4 ... 5 000 N·m
Location	Germany



#### Precision calibrator for Tech Centers / Offices

UUTs	<ul style="list-style-type: none"> <li>• Charge amplifiers</li> <li>• High-level voltage amplifiers</li> </ul>
Calibration Range	0 ... $\pm 2\,000\,000$ pC
Location	China, Japan, USA, Germany, France, England, Czech, Switzerland and India



#### Displacement calibration system for Production Centers and Tech Centers / Offices

UUTs	Non-contact optical height sensors
Calibration Range	50 ... 750 mm
Location	Germany, USA

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