Combustion Monitoring with Pressure Sensors.

Get Better. With Kistler.

Marine & Stationary Engines
Reliable Pressure Sensors: In Service for Over Ten Years

Kistler measurement technology for cylinder pressure monitoring
Kistler’s piezoelectric pressure sensors are used in continuous operation for closed loop combustion control in internal combustion engines. They enable the performance of engines to be controlled constantly. This allows combustion optimization for a better efficiency and minimizes emissions. In addition to this, predictive maintenance becomes easier.

Extremely robust and suitable for demanding environments
Kistler sensors do not only provide excellent measurement accuracy but are also extremely robust and suitable for demanding environments. For example, Kistler sensors recently passed the figure of 100,000 hours of operation in large 2-stroke engines in the US gas pipeline industry. For more than 10 years, these pressure sensors have been monitoring and controlling engines in the compressor stations and thereby makes a vital contribution to securing nationwide gas supplies in the USA.

Optimal Solution for Closed Loop Combustion Control
More than 10 years ago the sensor Type 6613C was introduced for peak pressure monitoring in large engines. Since then, this sensor has undergone continual development in order to fulfill growing market requirements.

With the new Types 6613CG and 7614CG, Kistler offers an optimal solution for closed loop combustion control for gas, diesel and dual fuel engines. Both types are based on the same measuring element and a new generation of industrial charge amplifier with a galvanic isolated 4 … 20 mA output signal.
Type 7614CG with M14 provides the possibility of either shoulder or front-end sealing. Type 6613CG with M10 thread minimizes the mounting space required. The new sensors are approved by the leading classification societies and ATEX.

Custom Solutions for OEM Customers
The longstanding success of Kistler is based on close co-operation with our customers. To ensure the maximum benefit from cylinder pressure monitoring, the sensor must be matched to the special requirements of the user. We are always happy to assist our customers from the project stage to the serial solution and more above.
## Engine Monitoring and Control – Online
### Cylinder Pressure Sensors for Continuous Operation

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Type 7614CG1/6613CG1</th>
<th>Type 6613CG2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>4-stroke engines</td>
<td>2-stroke engines</td>
</tr>
<tr>
<td>Frequency range</td>
<td>Hz 0,1 ... 10 000</td>
<td>0,01 ... 10 000</td>
</tr>
<tr>
<td>Pressure range</td>
<td>bar 0 ... 250</td>
<td>0,01 ... 250</td>
</tr>
<tr>
<td>Overload</td>
<td>bar 350</td>
<td>350</td>
</tr>
<tr>
<td>Linearity</td>
<td>% FSO &lt;±0,5</td>
<td>&lt;±0,5</td>
</tr>
<tr>
<td>Operating temp.</td>
<td>°C –40 ... 350</td>
<td>–40 ... 350</td>
</tr>
<tr>
<td>Signal output</td>
<td>4 ... 20 mA / 3 wires galvanic isolated</td>
<td>4 ... 20 mA / 3 wires galvanic isolated</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>50 μA/bar</td>
<td>50 μA/bar</td>
</tr>
</tbody>
</table>

### Properties
- Type 7614CG1 front end sealing or shoulder sealing
- Excellent lifetime
- Suitable for knock detection
- Signal 4 ... 20 mA / 3 wires galvanic isolated
- Excellent lifetime
- Reduced build-up combustion deposits in combination with Kistler adapter Type 7523B...
- Signal 4 ... 20 mA / 3 wires galvanic isolated

### Recommended for
- Close loop combustion control and monitoring tasks for e.g. knock detection, cylinder balancing
- Close loop combustion control and monitoring tasks, cylinder balancing MIP

### Data sheet
- 6613CG_003-043
- 7614CG_003-044
- 6613CG_003-043

### Installation
- Cylinder head*
- Cylinder cover*

### Certificates
- Available with all major Marine approvals and ATEX
- Available with all major Marine approvals and ATEX

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*Direct access to combustion chamber

*Recessed installation

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Sensor installed close to the combustion chamber, to avoid disturbances through gas oscillations. Type 7614CG1 is front end sealed to protect the mounting thread from contact with combustion gases. Type 6613CG1 requires minimum mounting space.

Sensor flush mounted to the slotted gas channel of the patented adapter Type 7523B..., no pockets or corners. Build-up of deposits is significantly reduced. Kistler offers patented ring adapters for all types of low speed engines.
### Engine Diagnostic – Offline

#### Sensors

<table>
<thead>
<tr>
<th>Type 6613CP</th>
<th>Type 7613C</th>
<th>Type 6013CSF</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Type 6613CP" /></td>
<td><img src="image" alt="Type 7613C" /></td>
<td><img src="image" alt="Type 6013CSF" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engine Peak Meter Type 2516B11</th>
<th>Engine Peak Meter Type 2516B10</th>
<th>Engine Peak Meter Type 2516B...</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,1 ... 90 000</td>
<td>0,01 ... 70 000</td>
<td>90 000</td>
</tr>
<tr>
<td>0 ... 250</td>
<td>0 ... 250</td>
<td>0 ... 250</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>&lt;± 1</td>
<td>&lt;± 0,5</td>
<td>&lt;± 1</td>
</tr>
<tr>
<td>–40 ... 350</td>
<td>–40 ... 350</td>
<td>–40 ... 350</td>
</tr>
<tr>
<td>Piezotron® 0 ... 5 V</td>
<td>Piezotron® 0 ... 5 V</td>
<td>PiezoSmart® 0 ... 5 000 pC</td>
</tr>
<tr>
<td>20 mV/bar ±10 %</td>
<td>20 mV/bar ±1,5 %</td>
<td>20 pC/bar</td>
</tr>
</tbody>
</table>

**Properties**

- Mounting thread M10x1
- Robust design
- Excellent lifetime

- Mounting thread M14x1,25
- For highest accuracy
- Small thermal shock

- Automatic parameter setting of Engine Peak Meter Type 2516B3...
- Mounting thread M10x1
- Very robust sensor
- PiezoSmart® with sensor identification

**Recommended for**

- Close loop combustion control and monitoring tasks for e.g. knock detection, cylinder balancing
- Periodic engine diagnostic for 4 stroke engines.

**Certificates**

- Available with all major Marine approvals and ATEX

**For installation of Type 6613CP at the indicator valve a Thompson adapter Type 6513A is required.**

**For installation of Type 6013CSF at the indicator valve a Thompson adapter Type 6513A is required.**

*Lower cut-off frequency is only 0,1 Hz*
Cylinder Balancing and Troubleshooting of Large Engines

The Kistler Engine Peak Meter was designed for high measuring accuracy and ease of operation. These features have turned this service instrument into an important tool for cylinder balancing and trouble-shooting large engines. The new Peak Meter makes the operation even simpler. The main element of PiezoSmart® is a TEDS chip (TEDS = Transducer Electronic Data Sheet) integrated in the sensor connector which contains the essential sensor data such as measuring range, sensitivity, serial number, etc. This data is automatically exchanged with the Peak Meter, what minimizes the effort needed for setting up the instrument and removes possible handling errors when entering parameters.

The PiezoSmart® sensor Type 6013CSF is particularly suitable for engine diagnostics at the indicator valve of medium speed and low speed engines. This new version offers an economical solution for ship operators already using a MAN Handheld Calibration Device (HCD) for their main engine but who need an additional pressure indicator for other engines. The pressure sensor of the HCD is fully compatible with the Kistler Peak Meter Type 2516B3 and can be used for these engines as well.

PiezoSmart® – Automatic Sensor Identification

PiezoSmart® is an active system for identifying individual piezoelectric and piezoresistive pressure sensors. Plug and measure (automatic configuration of measuring chain parameters) reduces the risk of error and additional functions guarantee the quality of the measured data. Two points of particular importance to the end user are that:

- PiezoSmart® is suitable for all engine pressure sensors and all existing cable and connector combinations
- PiezoSmart® modularity allows for the upgrading of existing or used sensors with sensor identification

All piezoelectric and piezoresistive pressure sensors from Kistler are available with PiezoSmart®. Charge or voltage amplifiers automatically set the correct parameters by exchanging data with the TEDS of the pressure sensor. The main benefits for you are:

- Correct assignment of the sensor data is always guaranteed – this ensures accurate readings from the start
- Measurement can take place independently without any database
- The modular system design allows system configurations which meet specific customer requirements

Engine Peak Meter Type 2516B...

The Type 2516B... is easy to use for monitoring engines with a speed of up to 4 000 min⁻¹. The software for the data evaluation contained in the accessories included allows changes in peak pressure to be shown graphically and recorded.

- Immediate on-site data evaluation
- 2x20 memory locations
- Software for data evaluation included
- Easy to operate

Available with different sensors:
Type 2516B10 with sensor Type 7613C
- Highest accuracy
Type 2516B11 with sensor Type 6613CP
- More economic
- Robust design
Type 2516B31 with Type 6013CSF
- PiezoSmart® technology with automatic sensor identification. No parameter setting