### Single-Component Sensors

**Piezoelectric Force Sensors**
- Direct force measurement
- Wide measuring range
- High rigidity, fast response
- Easy installation
- High sensitivity
- Compact design

**Piezoelectric Strain Sensors**
- Indirect force measurement
- High sensitivity
- Easy installation
- Excellent retro-fit solution

**Strain Gage Load Cells**
- Static loads

Application Areas: Press fitting, crimping, clinching, stamping, punching, staking, bonding, material testing, impact testing and welding force monitoring, product testing

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Measurement Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fx, Fy, Fz</td>
<td>–2,5 ... 2,5 kN</td>
</tr>
<tr>
<td>Fx, Fy</td>
<td>–0,1 ... 0,1 kN</td>
</tr>
<tr>
<td>Fz</td>
<td>–10 ... 10 kN</td>
</tr>
</tbody>
</table>

### Multicomponent Force Sensors and Measuring Platforms

- Wide measuring range
- High rigidity
- Low crosstalk
- High sensitivity
- Compact design
- Fz, Fy, Fx
- Welding Force Measurement

Application Areas: Product testing, process development machining forces and Welding Force Measurement

<table>
<thead>
<tr>
<th>Sensor Type</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Fz, Fy, Fx</td>
<td>–250 ... 250 kN</td>
</tr>
<tr>
<td>Fx</td>
<td>–75 ... 75 kN</td>
</tr>
<tr>
<td>Fy</td>
<td>–75 ... 75 kN</td>
</tr>
</tbody>
</table>

### NC Joining Systems

- High measuring accuracy dual range piezo sensor resp. strain gage force sensor for Type 2153A...
- Force or Force-Distance control
- Repeatability, <0,01 mm
- High velocity, up to 300 mm/s
- Low maintenance

Application Areas: Precision assembly and joining tasks in automated production plants

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Measurement Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fz</td>
<td>–500 ... 500 N</td>
</tr>
<tr>
<td>Fy</td>
<td>–500 ... 500 N</td>
</tr>
<tr>
<td>Fx</td>
<td>–1,5 ... 1,5 kN</td>
</tr>
</tbody>
</table>
**Torque Sensors**

**Rotating Torque Sensors**
- Strain gage system
- Integrated electronics
- Non-contact signal transmission (except Type 4501A...)
- Optional rotational angle or speed measurement

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>4501A...</td>
<td>0 ... 2 N·m to 0 ... 1 000 N·m</td>
</tr>
<tr>
<td>4502A...</td>
<td>0 ... 0,5 N·m to 0 ... 1 000 N·m</td>
</tr>
<tr>
<td>4520A...</td>
<td>0 ... 1 N·m to 0 ... 1 000 N·m</td>
</tr>
<tr>
<td>4503B...</td>
<td>0 ... 0,2 N·m to 0 ... 5 000 N·m</td>
</tr>
<tr>
<td>4550A.../4551A...</td>
<td>0 ... 100 N·m to 0 ... 5 000 N·m</td>
</tr>
</tbody>
</table>

**Reaction Torque Sensors**
- Piezoelectric system
- Compact with wide measuring range
- High sensitivity, fast response
- High interference immunity
- Central bore to accept shafts

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>9329A...</td>
<td>-1 N·m ... 1 kN·m</td>
</tr>
<tr>
<td>9389A...</td>
<td>0 ... 1 000 N·m</td>
</tr>
</tbody>
</table>

Available also as 2-component sensor \( F_z, M_z \) (Type 9345B, 9365B)

**Application Areas:** Engine and electric motor testing, torque to turn, nut runners, drag torque, calibration, product testing and test stands

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**Process Monitoring & Visualization**

- In-process monitoring
- X-Y monitoring \( F(x), M(a), F(t), M(t) \) resp. \( y(x), y(t), x(t), y(x,t) \)
- Digital I/O
- TCP/IP Ethernet interface
- Data exporting via Fieldbus
- Multiple input signal types

**Application Areas:** Press fitting, component insertions, riveting, crimping, clinching, forming, bonding, material testing and torque/angle, product testing

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**Other Sensors and Accessories**

- Pressure
- Acceleration
- Displacement electronics and cables
- Calibration equipment
- Force and welding verification kits
- Data collection and analysis software

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**Support and Services**

- Consulting and engineering
- Commissioning and configuration
- Customer training and instruction
- Modification, repair and spare parts
- Kistler calibration services
- Web services

Kistler offers a wide range of product and application support and services for our products.