

## Sensors and Systems

Quality Monitoring and Process Control  
during Injection Molding.



**Kistler – Your Partner for Process Efficiency and Cost Effectiveness**

The Kistler Group is one of the world's leading manufacturers of sensors and systems for measuring pressure, force, torque and acceleration. Kistler systems are used to analyze measuring signals with high-precision and therefore substantially increase process efficiency and operational success.

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Cavity pressure monitoring during injection molding reduces the costs of quality assurance

# Focus on Process Efficiency.

**100 % quality in production – this is the primary objective of all injection molding operations. The safest way to achieve zero-defect production during injection molding of plastics is through the integration of quality assurance within the process itself. Kistler provides the technology, competence and assistance you need to realize your full potential.**

## **Optimized Process Efficiency Thanks to Kistler Technology**

Kistler focuses on cavity pressure to systematically and effectively achieve zero-defect production during injection molding. As the most informative process value, it describes the conditions immediately during the creation of the part. Sensors and systems based on cavity pressure detect whether scrap have occurred or not at the earliest possible moment.

## **Lower QA Costs for Processors and OEMs**

Process-integrated cavity pressure monitoring during injection molding reduces the costs of quality assurance. This cost-effective solution protects the processing company against the delivery of defective parts to the customer and it guarantees that the assembly will not be disturbed.



## **Injection molding with Kistler – now online**

Use our animation to experience convincing, first-class Kistler solutions – the sure way to achieve 100 % quality in your production:

[www.kistler.com/injection-molding](http://www.kistler.com/injection-molding)



# Direct Cavity Pressure and Temperature Measurement – Installation-Compatible Sensors

Front diameter

1 mm

Measured variables (p: pressure; T: temperature)

p

p+T

T

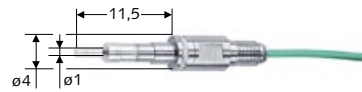
Technical Data

Type

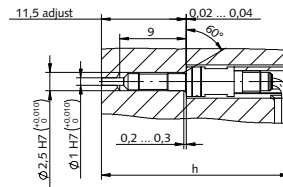
6183C...<sup>1)</sup>

6188A...

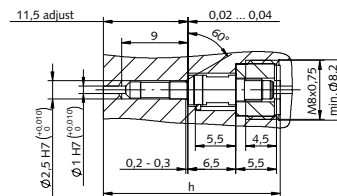
6193B...<sup>1)</sup>



## Installation sketch



Installation with spacer sleeve



Installation with mounting nut

h = minimum installation height, see table

## Measuring range

Temperature (Thermocouple Type K)	°C	–	0 ... 200	0 ... 450
Pressure	bar	0 ... 2000	0 ... 2000	–
Sensitivity	pC/bar	≈-2,5	≈-4,8	–

## Sensor front

Machinable	•	–	•
Option: Abrasion protection (not machinable)	•	–	–

## Cable technology

Single-wire, with/without connector <sup>2)</sup>	•	•	–
Single-wire, with crimp contact <sup>3)</sup>	•	–	–
Coaxial, with standard <sup>4)/</sup> customer specific cable length <sup>5)</sup>	–	–	–
Conductive spacer sleeve	•	–	–
Compensating cable with standard <sup>6)/</sup> customer specific cable length <sup>7)</sup>	–	•	•
Exchangeable cable	•	at Kistler	–

## Operating temperature

Melt temperature	°C	<450	<450	<450
Mold temperature	°C	<200	<200	<450

## Applications + characteristics

Thermoplastics smallest front diameter waterproof (IP67)	Thermoplastics	Thermoplastics Elastomers LSR
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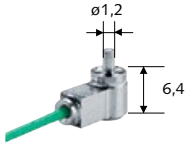
## Accessories

Spacer sleeve	Type	6464A1 <sup>8)</sup>	6464A3 <sup>8)</sup>	6464A3 <sup>8)</sup>
Minimum installation height	mm	25,5	36	24,5
Mounting nut	Type	6460A1	–	–
Minimum installation height	mm	24	–	–
Data sheet, see <a href="http://www.kistler.com">www.kistler.com</a>		6183C (003-109)	6188A (000-887)	6193B (000-637)

• Variant available – Variant not available <sup>1)</sup> Standard product <sup>2)</sup> Cable can be shortened by user, standard length 1.5/5 m

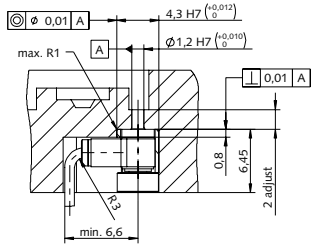
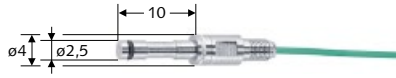
1,2 mm

p
6184A...

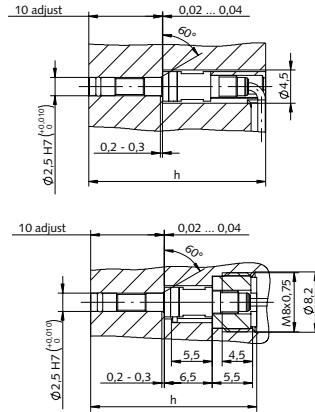


2,5 mm

p	p	p+T	T
6182C... <sup>1)</sup>	6178A...	6189A... <sup>1)</sup>	6195B...



Installation with thrust washer  
minimum installation height, see table



Installation with  
spacer sleeve

Installation with  
mounting nut

-
0 ... 2000
≈-1,2

•
•

•
•
-
-
-
-

<450
<200

Thermoplastics
low installation height
cable outlet 90°

6470 (thrust washer) <sup>8)</sup>
8,5
6465 <sup>8)</sup>
11,6
6184A (000-600)

-	-	0 ... 200	0 ... 450
0 ... 2000	0 ... 200	0 ... 2000	-
≈-2,5	≈-12	≈-6,5	-

•	•	-	-
•	-	-	-

•	•	•	-
•	•	-	-
-	-	-	-
•	-	-	-
-	-	•	•
•	-	at Kistler	-

<450	<450	<450	<450
<200	<200	<200	<450

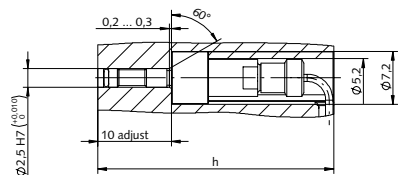
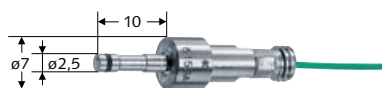
Thermoplastics	Foam injection molding	Thermoplastics	Thermoplastics
small front diameter	Compression molding		Elastomers
waterproof (IP67)	Thermoplastics		LSR
	high sensitivity		

6464A1 <sup>8)</sup>	6464A1 <sup>8)</sup>	6464A3 <sup>8)</sup>	6464A3 <sup>8)</sup>
24	21	33	23
6460A1	6458	-	-
22,5	22,5	-	-
6182C (003-110)	6178A (000-514)	6189A (000-536)	6195B (000-637)

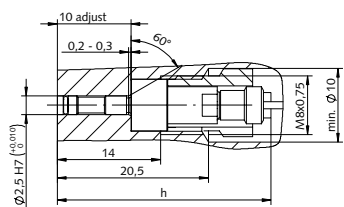
<sup>3)</sup> Connection to contact element 1712/1714A, Customer-specific length (lmin = 0.1 m/lmax = 1.5 m) <sup>4)</sup> l=0.2/0.4/0.6/0.8 m

2,5 mm

p	T
6159A... <sup>1)</sup>	6194B...



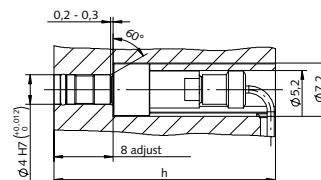
Installation with spacer sleeve



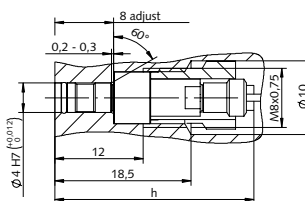
Installation with mounting nut

4 mm

p	p	p+T
6157B... <sup>1)</sup>	6167A...	6190C... <sup>1)</sup>



Installation with spacer sleeve



Installation with mounting nut

-	0 ... 450
0 ... 2000	-
≈-2,5	-
•	-
•	-
•	-
•	-
•	-
-	-
-	•
•	-
<450	<450
<200	<450

-	-	0 ... 200
0 ... 2000	0 ... 200	0 ... 2000
-9,4 (Unisens)	≈-16,5	≈-9
•	-	-
•	-	-
•	•	•
•	-	-
•	•	-
-	-	-
-	-	•
•	•	•
<450	<450	<450
<300	<200	<200

Thermoplastics small front diameter	Thermoplastics Elastomers LSR
6459	6459
32	37
6457 <sup>8)</sup>	6457 <sup>8)</sup>
29	29
6159A (000-032)	6194B (000-637)

Thermoplastics Elastomers LSR	low viscosity materials with diaphragm	Thermoplastics Elastomers LSR
6459	6459	6459
30	30	37
6457 <sup>8)</sup>	6457 <sup>8)</sup>	6457 <sup>8)</sup>
27	27	30
6157B (000-030)	6167A (000-033)	6190C (000-680)

<sup>5)</sup> Customer-specific length (l<sub>min</sub> = 0.1 m/l<sub>max</sub> = 5 m) <sup>6)</sup> l=0.4/0.8/1.2/1,6/2 m <sup>7)</sup> Customer-specific length (l<sub>min</sub> = 0.15 m/l<sub>max</sub> = 5 m) <sup>8)</sup> Delivered accessories

T
6192B...

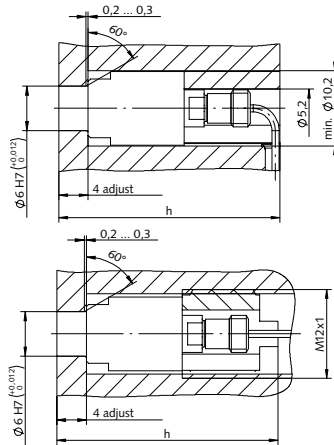
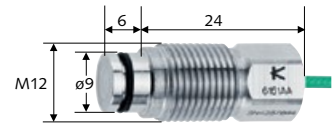
6 mm

p	p	p
6152A... <sup>1)</sup>	6162A...	6163A...



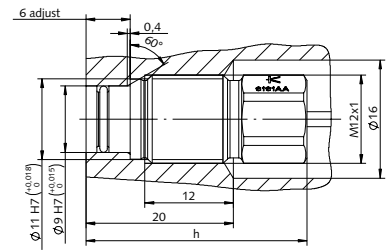
9 mm

p
6161A... <sup>1)</sup>



Installation with spacer sleeve

Installation with mounting nut



0 ... 450
-
-
•
-
-
-
-
-
•
-
<450
<450

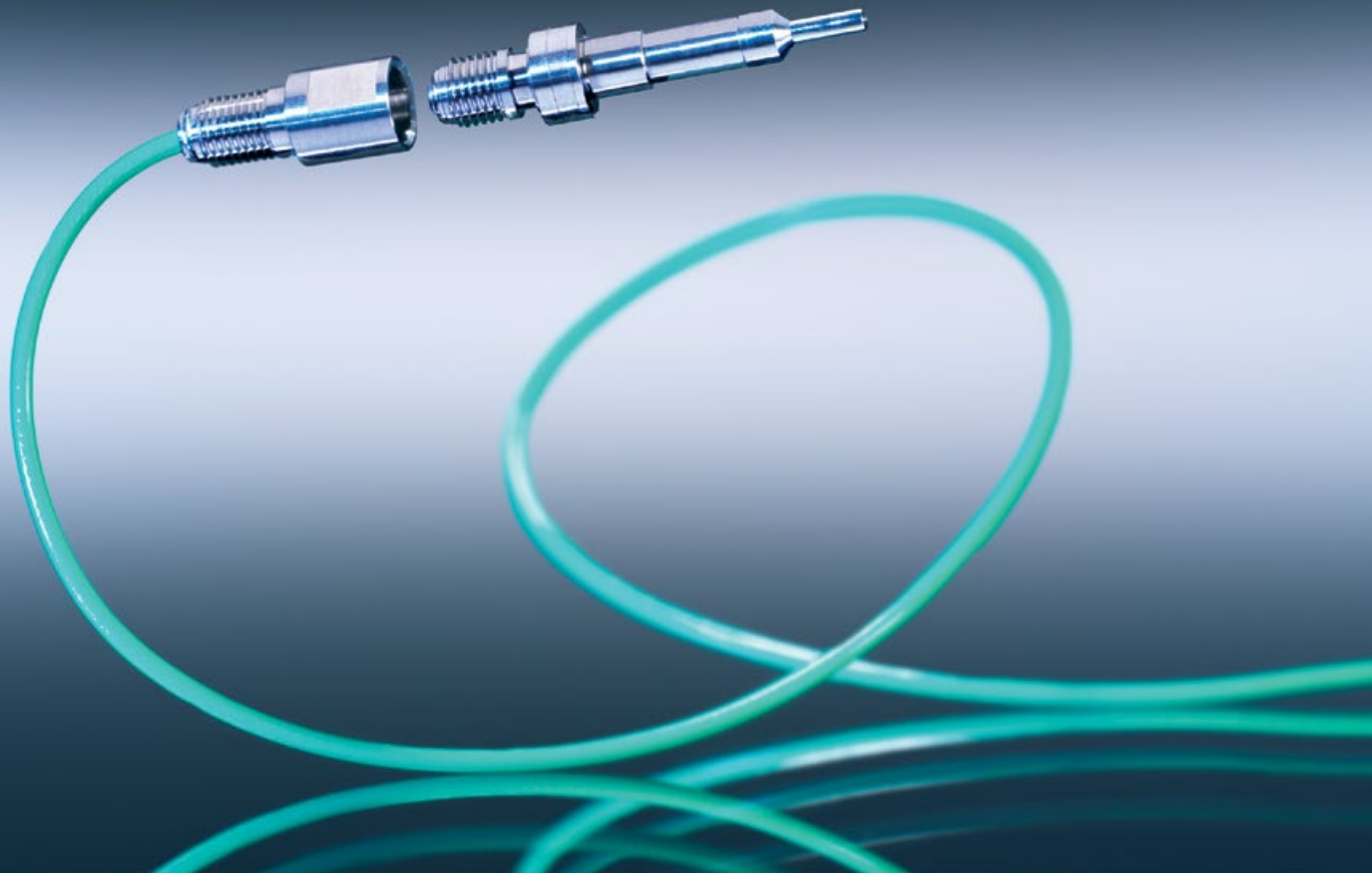
-	-	-
0 ... 2000	0 ... 200	0 ... 1000
-9,4 (Unisens)	≈-18,5	≈-3,9
•	-	-
•	-	-
•	•	•
-	-	-
-	-	-
-	-	-
-	-	-
•	-	-
•	•	•
<450	<450	<450
<300	<200	<200

-
0 ... 200
≈-18,4
-
-
-
-
-
-
-
•
<450
<200

Thermoplastics Elastomers LSR
6459
35
6457 <sup>8)</sup>
27
6192B (000-637)

Thermoplastics Thermosets Elastomers LSR	Fiber-reinforced composites SMC/RTM welded front gap	Fiber-reinforced composites High pressure RTM Composites welded front gap
6462	6462	6462
32	32	32
6453 <sup>8)</sup>	6453 <sup>8)</sup>	6453 <sup>8)</sup>
30	30	30
6152A (000-028)	6162A (000-888)	6163A (000-889)

Fiber-reinforced composites SMC/RTM welded front gap
-
30
-
-
6161A (003-053)



Kistler offers a great variety of sensors for any injection molding process – depending on the installation location, part geometry and plastic material

# Sensors for Every Measurement Task.

**Exact and reproducible pressure measuring values can only be obtained with reliable and accurate measuring sensors. Piezoelectric sensors by Kistler are robust and maintenance-free.**

Kistler sensors provide a nearly unlimited lifetime, deliver highly linear measuring results and work temperature independent. They measure the smallest pressure variations up to 2000 bar and/or temperature changes of up to 300 °C with high resolutions.

The cavity pressure can be determined directly, indirectly, contact-free or combined with the contact temperature. Directly measuring sensors are in contact with the melt in the cavity and measure the pressure without transmission pins. They can be installed in a bore with or without adapter. The front of many sensors can be adapted to the surface of the cavity in such a way that no mark can be identified on the part. As an alternative, the force can be measured behind an ejector pin or measuring pin and it can be converted to pressure by using the pin diameter.

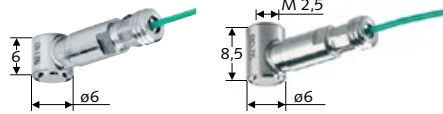
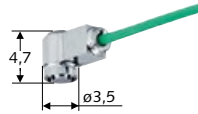
This is recommended if the space is not large enough for a direct measuring sensor. The cavity pressure can be measured contact-free with a measuring pin through the compression of the mold steel for optical components with Class-A surface or components that do not permit marks. CAD files are available to help with the positioning of the sensors in the mold.

# Indirect Cavity Pressure Measurement

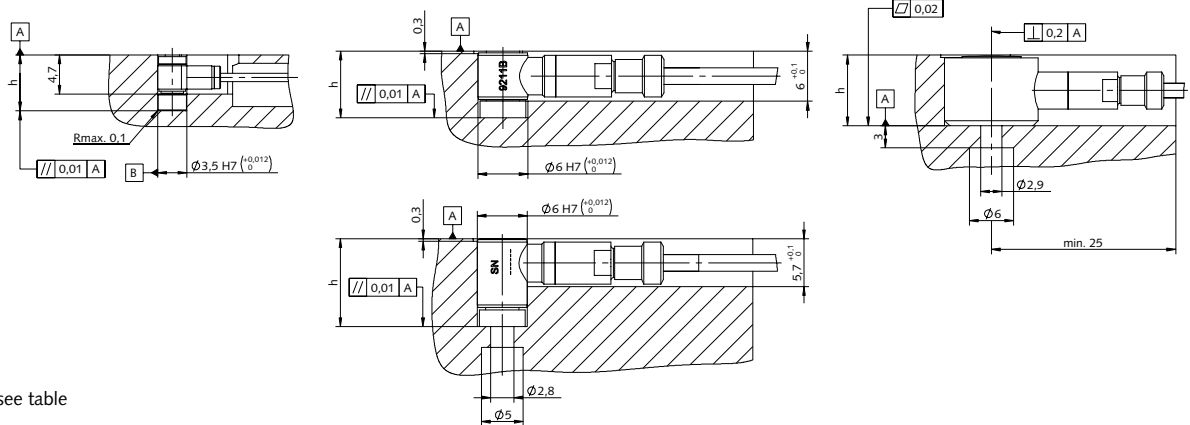
Front diameter	3,5 mm
Technical Data	Type 9210A... <sup>1)</sup>

6 mm	9211B... <sup>1)</sup>	9213B...
------	------------------------	----------

12,6 mm	9204B... <sup>1)</sup>
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## Installation sketch



h = minimum installation height, see table

## Measuring range

Force <sup>2)</sup>	kN	0 ... 0,25
Overload	kN	0,3
Sensitivity	pC/N	≈ -10

0 ... 2,5	0 ... 2,5
3	3
≈ -4,4	≈ -4,4

0 ... 10
12
≈ -1,6

## Cable technology

Single-wire, with/without connector <sup>3)</sup>	•
Coaxial	-
Exchangeable cable	-
Operating temperature range	°C -40 ... 200

•	•
•	•
•	•
-40 ... 200	-40 ... 200

•
•
•
-40 ... 200

## Applications + characteristics

all injection molding processes  
smallest force sensor cable output at the side, especially for modularly designed molds

all injection molding processes  
especially for multi-cavity molds

all injection molding processes  
with M2.5 fastening thread especially for multi-cavity and small molds

all injection molding processes  
with M2.5 fastening thread

## Accessories

Thrust washer	Type 9406 <sup>4)</sup>
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9411 <sup>4)</sup>	9413 <sup>4)</sup>
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-
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## Important installation dimensions

Dimensions	mm	3,5
Construction height	mm	4,7
Minimum installation height	mm	6,7
Data sheet, see <a href="http://www.kistler.com">www.kistler.com</a>		9210A (000-601)

6	6
8	10,5
9211B (000-555)	9213B (000-556)

12,6
9,5
9,6
9204B (000-128)

<sup>1)</sup> Standard product

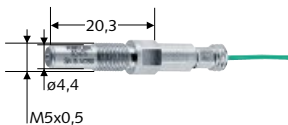
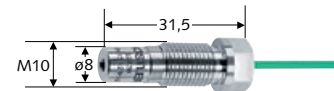
<sup>2)</sup> Conversion formula for pressure sensitivity: Pressure sensitivity [pC/bar] = nominal force sensitivity [pC/N], area of the ejector pin [mm<sup>2</sup>] x 0.1

<sup>3)</sup> Cables can be shortened by the user, standard length 1.5/5m

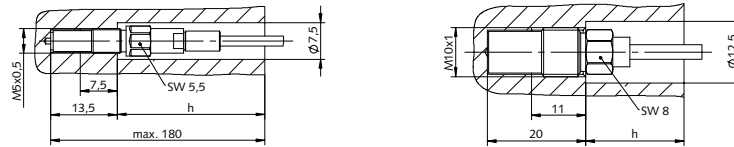
<sup>4)</sup> Delivered accessories

<sup>5)</sup> Elongation is proportional to the cavity pressure

# Contactless Cavity Pressure Measurement

Longitudinal measuring pin	M5	M10
Technical Data	Type 9247A...	9243B...
		 <p>Shown: Type 9243B... with hollow bolt Type 6427A1</p>

## Installation sketch



h = minimum installation depth, see table

## Measuring range

Strain <sup>5)</sup>	$\mu\epsilon$	$\pm 1400$	$\pm 1500$
Overload	$\mu\epsilon$	$\pm 2000$	$\pm 2000$
Sensitivity	$\rho C / \mu\epsilon$	$\approx -8,6$	$\approx -15$

## Cable technology

Single-wire with/without connector <sup>3)</sup>		•	–
Coaxial		•	•
Exchangeable cable		•	•
Operating temperature range	$^{\circ}\text{C}$	$-40 \dots 200$	$-40 \dots 200$

## Applications + characteristics

optical components Class-A surfaces	optical components Class-A surfaces
Measurement of the compression of the steel caused by the cavity pressure	Measurement of the compression of the steel caused by the cavity pressure

## Accessories

Hollow bolt	Type	–	6427A1 <sup>4)</sup>
Reamer	Type	1300A79	1300A21
Socket key AF inside	mm	5,5	8
Preload Tester	Type	5991	5991

## Important installation dimensions

Minimum installation depth	mm	24,3	10,5
Distance to cavity wall	mm	3–5	4–7
Data sheet, see <a href="http://www.kistler.com">www.kistler.com</a>		9247A (000-143)	9243B (000-538)



Kistler offers the optimal connection technology for each mold concept – precisely adapted to the installation situation, number of cavities and maintenance requirements

# Connection Technology for Any Installation.

**An increasing number of cavities and a more complex part geometry complicate the design of injection molding tools. It is required that the molds are maintenance-friendly, easily mounted and removable. Kistler has supported this change with its connection technology for pressure and temperature sensors.**

The single-wire technology and the multi-channel cable technology by Kistler provide a correct and reliable transmission of the sensor signals to the process monitoring system. The single-wire technology consists only of a cable with one conductor for a very small cross-section. It can be flexibly installed in drilled channels and shortened as required.

Kistler's single-wire technology allows to connect up to eight different sensors in molds with multi-cavities or with several sensors per cavity. This is a space-saving way to connect them all to the process monitoring system while giving them a distinctive, unmis-

takable connection. The signals of combined pressure/temperature measurements can also be transmitted with the multi-channel cable technology and a thermocouple amplifier.

For complex and modular molds, contact elements connect cables in different mold elements. Contact surfaces in both elements establish the electrical connection. This significantly simplifies the tool installation in comparison to the conventional mold installation.

Another option is the use of conductive spacer sleeves. If the installation is not angled, the spacer sleeve can be screw connected to the sensor instead of a cable, which significantly simplifies the production of the installation bore for the sensor. A contact element will be installed on the other side, which guarantees safe charge transmission.

# Cavity Pressure Sensor Connection Technology

## Single-Wire Connection Cable



Technical Data	Type	1666A... <sup>1)</sup>	1674AZsp	1900A17...
Sensorconnection		M4 <sup>2)</sup>	M4 <sup>2)</sup>	M3 <sup>3)</sup>
Length	m	1,5/5	0,04 ... 1,5 <sup>4)</sup>	1,5/5/Zsp <sup>4)</sup>
Operating temperature range	°C	0 ... 200	0 ... 200	0 ... 200
Color		green	green	green

## Contact Elements for Single-Wire Technology



Shown: Type 1714A0

Technical Data	Type	1712A0 <sup>1)</sup>	1714A0 <sup>1)</sup>
Number of channels		1	4
Structural dimension	mm	M8 × 5,2 (for each element)	ø 12 × 9,5 (for each element)
Axial offset during installation	mm	max. 0,3	(guided connection)
Operating temperature range	°C	0 ... 120	0 ... 120
Data sheet, see <a href="http://www.kistler.com">www.kistler.com</a>		1712A (000-721)	

## Conductive Spacer Sleeve for Single-Wire Technology



Technical Data	Type	1720A...
Sensorconnection		M3 <sup>3)</sup>
Contact element		1712A1
Length	mm	40
Operating temperature range	°C	0 ... 200

## Coaxial Connection Cables



Shown: Type 1645C

Technical Data	Type	1963A...	1955A...	1645C...
Sensorconnection		M4 <sup>2)</sup>	M4 <sup>2)</sup>	M4 <sup>2)</sup>
Length	m	0,4/sp <sup>5)</sup>	0,4/sp <sup>5)</sup>	0,2/0,4/0,6/0,8/sp <sup>5)</sup>
Operating temperature range	°C	0 ... 200	0 ... 300	0 ... 200
Covering		Steel-braided	Steel-braided	Fluoropolymer

## Combined Pressure/Temperature Connection Cable



Technical Data	Type	2219B...	2219BG	2219BG1
Sensorconnection		6190CA... with connectors	6190CAG without connector for use with Type 2205A...	6190CAG1 without connector for use with Type 2205A...
Length	m	0,4/0,8/1,2/1,6/ 2/sp <sup>6)</sup>	2	5
Operating temperature range	°C	0 ... 200	0 ... 200	0 ... 200

<sup>1)</sup> Standard product

<sup>2)</sup> Types 6159A.../6157B.../6177A.../6167A.../6152A.../6172A.../6162A.../6163A.../9211B.../9213B.../9204B...

<sup>3)</sup> Types 6182C.../6183C...

<sup>4)</sup> Customer-specific length (l<sub>min</sub> = 0.04 m/l<sub>max</sub> = 1.5 m), with crimp contact

<sup>5)</sup> Customer-specific length (l<sub>min</sub> = 0.1 m/l<sub>max</sub> = 2 m)

<sup>6)</sup> Customer-specific length (l<sub>min</sub> = 0.1 m/l<sub>max</sub> = 5 m)

# Multi-Channel Technology Cavity Pressure Sensors

## Multi-Channel Connector for Single-Wire Technology



Single-wire sensors for these connectors have the expansion G and G1 (e.g. Type 6157BAG)

Technical Data	Type	1708B... <sup>1)</sup>	1710B... <sup>1)</sup>
Number of channels		4, with mold identification up to 125 °C	8, with mold identification up to 125 °C
Used for sensors		all single-wire sensors	all single-wire sensors
Connection		cut and grip technology	cut and grip technology
Operating temperature range °C		0 ... 200	0 ... 200
Data sheet, see <a href="http://www.kistler.com">www.kistler.com</a>		1708B (003-138)	1710B (003-138)

## Extension Cable with Flexible Steel-braided Covering



Technical Data	Type	1995A... <sup>1)</sup>	1997A... <sup>1)</sup>
Number of channels		4	8
Length	m	1/2/5/sp <sup>2)</sup>	1/2/5/sp <sup>2)</sup>
Connector at the system		4-channel	8-channel
Connector in mold		4-channel	8-channel
Operating temperature range °C		0 ... 200	0 ... 200

# Single-Channel Technology Cavity Pressure Sensors

## Single-Channel Connector for Single-Wire Technology



Technical Data	Type	1839
Used for sensors		all single-wire sensors
Connection		cut and grip technology
Operating temperature range °C		0 ... 200

## Extension Cable Single-Channel Technology Pressure



Shown: Type 1661A...

Technical Data	Type	1667B... <sup>1)</sup>	1661A...	1672B...	1662A...
Length	m	2/5/10/sp <sup>3)</sup>	2/5/10/sp <sup>3)</sup>	2/5/10/sp <sup>3)</sup>	1/2/5/sp <sup>3)</sup>
Connector at the system		BNC	BNC	TNC	TNC
Connector in mold		1-channel	1-channel	1-channel	1-channel
Operating temperature range °C		0 ... 200	0 ... 200	0 ... 200	0 ... 200
Covering		Viton®	Steel	Viton®	Steel

# Cable Technology Cavity Pressure Sensors

## Multi-Channel Temperature Amplifier for Temperature Sensors without Connector



Technical Data	Type	2205A...
Measuring range	°C	0 ... 200 or 0 ... 400
Thermocouple	Type	K/J/N
Number of channels		2 or 4
Operating temperature range	°C	0 ... 125
<b>Properties</b>	2- or 4-channel temperature amplifier for the installation in molds for thermocouples Type K/J/N.	
<b>Application</b>	Connection of up to 4 pressure/temperature sensors (temperature signal) or 4 temperature sensors to CoMo Injection Type 2869B...	
<b>Accessories</b>	External housing Type 5700A23, installation support Type 1300A20	
<b>Data sheet, see <a href="http://www.kistler.com">www.kistler.com</a></b>	<b>2205A (000-591)</b>	

## High Temperature Extension Cable for Temperature Sensors with Connector



Cables are also used for the thermocouple in the combined sensor Types 6189A... and 6190CA...

Technical Data	Type	2290A...	2295A...
Length	m	2/5/10/sp <sup>4)</sup>	2/5/sp <sup>4)</sup>
Connector at the system		open ends	1-channel temperature
Connector in mold		1-channel	1-channel
Operating temperature range	°C	0 ... 200	0 ... 200

<sup>1)</sup> Standard product

<sup>2)</sup> Customer-specific length (l<sub>min</sub> = 0.3 m/l<sub>max</sub> = 20 m)

<sup>3)</sup> Customer-specific length (l<sub>min</sub> = 0.2 m/l<sub>max</sub> = 5 m)

<sup>4)</sup> Customer-specific length (l<sub>min</sub> = 0.1 m/l<sub>max</sub> = 30 m)



Kistler provides the optimally configured system technology for any quality assurance strategy

# Process Monitoring Systems for Every Application.

**CoMo Injection is the process monitoring system by Kistler for cavity pressure technology, which provides process optimization, control, monitoring and documentation of the molding process. The system provides in-house containment with good part/bad part separation. The system is qualified for any application and provides the lowering of the quality costs through the automatic identification of reject parts.**

CoMo Injection is compact, industry-friendly and easily configurable. It includes a process-oriented operating philosophy and integrates flexibly into various production environments. The system has up to 16 inputs for piezoelectric cavity pressure sensors and up to 8 inputs for voltage signals, which can be used for temperature or analog machine signals. It includes several individual inputs and outputs for the integration into a machine control system or for the actuation of handling systems and scrap gates.

CoMo Injection can be integrated into the production network. This permits the networking of several devices to centrally collect all data. All integrated devices can be reached and configured from each PC and no additional software installation is required.

Additional options for a CoMo Injection upgrade include the automatic hot runner balancing MultiFlow and the central data base CoMo DataCenter.

# Process Monitoring Systems

## CoMo Injection Process Monitoring System



Shown: Type 2869B3...

Technical Data	Type	2869B0... <sup>2)</sup>	2869B1... <sup>1)</sup>	2869B2... <sup>1)</sup>	2869B3... <sup>1)</sup>
Charge inputs (connector)		4 (1 × 4-channel)	8 (2 × 4-channel)	8 (1 × 8-channel)	16 (2 × 8-channel)
Number of measuring ranges		4	4	4	4
Automatic measuring range selection charge		yes	yes	yes	yes
Number of voltage inputs (connector)		–	4 (1 × 4-channel)	4 (1 × 4-channel)	8 (2 × 4-channel)
Voltage measuring range	V	–	0 ... 10	0 ... 10	0 ... 10
Voltage inputs	Type	–	differential	differential	differential
Digital outputs		12	12	12	12
Digital inputs		6	6	6	6
Monitoring boxes		48	48	48	48
Real-time threshold per channel		–	2 per channel	2 per channel	2 per channel
Measuring time	s	<600	<600	<600	<600
Dimensions	L×H×W	208×70×172	208×70×172	208×70×172	208×70×172
Operating temperature range	°C	0 ... 50	0 ... 50	0 ... 50	0 ... 50
Protection class		IP67	IP67	IP67	IP67

<b>Properties</b>	CoMo Injection Type 2869B... is a complete system for data acquisition, process visualization, process monitoring and control during injection molding. The display Type 5629B3 can be used as an option. The display can be selected directly via the Type number 2869B... and is included in the systemset. Details can be found in the data sheet.
<b>Application</b>	Process optimization, process monitoring, process control and documentation of the injection molding process. CoMo Injection can be used to control the injection molding process in real-time.
<b>Accessories</b>	CoMo DataCenter database Type 2829B... Automatic hot runner balancing MultiFlow Type 2809A... Additional options Type 2806A... for CoMo Injection Basic Type 2869B0... Details and additional accessories can be found in the data sheet.
<b>Data sheet, see <a href="http://www.kistler.com">www.kistler.com</a></b>	<b>2869B (000-665)</b>

## Touch Display for CoMo Injection Type 2869B...



Technical Data	Type	5629B3 <sup>1)</sup>
Display size		12,1 "
<b>Properties</b>		Touch display for the control of CoMo Injection without PC. In Type 2869B..., the display can be selected directly and is then included in the scope of delivery.
<b>Application</b>		Direct connection to CoMo Injection or network connection for the control and visualization of several CoMo Injections.
<b>Data sheet see <a href="http://www.kistler.com">www.kistler.com</a></b>		<b>2869B (000-665)</b>

<sup>1)</sup> Standard product

<sup>2)</sup> The functional scope of CoMo Injection Basic Type 2869B0... is limited compared to Type 2869B1/B2/B3... and can be expanded to the full scope by adding Type 2806A...

# Modules

## MultiFlow Hot Runner Balancing Type 2809A2



<b>Properties</b>	Software for the automatic optimization of the hot runner temperatures with the objective to fill all cavities of a multi-cavity mold synchronously and evenly. Closed control loop based on the analysis of the cavity pressure progressions and automatic determination of the target temperature values, as well as its transfer to the hot runner control device or the injection molding machine. Support for many hot runner controllers. See data sheet for details.
<b>Application</b>	Automatic balancing of the hot runners of the multi cavity molds monitored by CoMo Injection Type 2869B... during production start and series production.
<b>Accessories</b>	Ethernet serial converter Type 2808A2 (hardware)
<b>Data sheet see www.kistler.com</b>	<b>2869B (000-665)</b>

## CoMo DataCenter Type 2829C...



<b>Properties</b>	Database and Curve Viewer for the access to and the analysis of process data that were acquired with CoMo Injection <sup>1)</sup> . Data transfer via Ethernet from CoMo Injection. Analysis through comfortable user interface. Data export into other systems via the open database structure. A standard database is included in the scope of delivery. However, existing databases can also be used.
<b>Application</b>	Process analysis, production analysis and efficiency evaluation of production orders monitored with CoMo Injection Type 2869B... . Insight into the running production, storage, display and analysis of the process and quality information generated by CoMo Injection. Analysis on the basis of cycles or trends of significant process values. In addition, statistical options for the evaluation of the entire production exist, for example, machine utilization or efficiency.
<b>Data sheet see www.kistler.com</b>	<b>2829C (000-548)</b>

<sup>1)</sup> One license is required for each CoMo Injection Type 2869B...

# Connection Cable for CoMo Injection Type 2869B...

## Cable for Display Type 5629B3



<b>Technical Data</b>	<b>Type</b>	<b>1200A103A...</b>
Length	m	0,5/2/5/10/15
Use		Connection to display Type 5629B3

## Cable for Digital Signals



<b>Technical Data</b>	<b>Type</b>	<b>1500A42A...<sup>2)</sup></b>	<b>1500A43A...<sup>2)</sup></b>
Connection		open ends	open ends
Length	m	0 <sup>3)</sup> /7/sp <sup>4)</sup>	0 <sup>3)</sup> /7/sp <sup>4)</sup>
Use		Connection to handling system or scrap gate (digital outputs Type 2869B...), 15-pole	Connection to machine signals (digital inputs/outputs Type 2869B...), 9-pole

## Proximity Switch



<b>Technical Data</b>	<b>Type</b>	<b>2231A1</b>
Use		Trigger (start signal)

## Cable for Analog Signals



<b>Technical Data</b>	<b>Type</b>	<b>1500A47A...</b>
Connection		open ends
Length	m	0 <sup>3)</sup> /7/sp <sup>4)</sup>
Use		Connection of analog signals, 15-pole

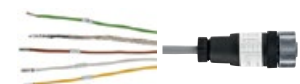
## Cable for Thermocouple Amplifier Type 2205A...



Shown: Type 1457A1A...

<b>Technical Data</b>	<b>Type</b>	<b>1457A1A...</b>	<b>1457B2A...</b>
Connection		Connector	open ends
Length	m	2/5/sp <sup>4)</sup>	7/sp <sup>4)</sup>
Use		Connection Type 2205A... or Type 5689A10 to 2869B..., 15-pole	Connection Type 2205A... to Type 5689A10

## Supply for CoMo Injection



Shown: Type 1500A45A...

<b>Technical Data</b>	<b>Type</b>	<b>1500A45A...</b>	<b>5781A2</b>
Type		Connecting cable	Power connector supply
Length	m	0 <sup>3)</sup> /7/sp <sup>4)</sup>	
Input voltage		24 VDC	100 ... 240 VAC
Output voltage	VDC	24	24
Connection		Open ends	Power connector
Use		Supply with external 24 V	Supply from grid 100 ... 240 V

<sup>2)</sup> Standard product    <sup>3)</sup> connector only

<sup>4)</sup> Customer-specific length (lmin = 0.3 m/lmax = 30 m)



Kistler offers the right accessories – for installation or testing of the sensor

# Accessories for Simple Handling and Installation.

**Kistler offers a comprehensive assortment of tools, as well as calibration and test equipment. Please contact our local distribution partners for a quotation of our accessory offerings.**

Accessories for sensors, such as the socket wrench for mounting nuts or the extraction tool, simplify the handling and the installation of sensors. Our Sensor Tester set for cavity pressure sensors, which can be used to test the sensitivity of the sensor as well as the insulation of the entire measuring chain, is suitable for the easy check of the installation.

# Molds

## Extraction Tools for Sensors



Technical Data	Type	1315A	1358A	1362A
Outside diameter	mm	ø5,8	ø3,8	ø5,8
Length	mm	150	150	150
Thread	Type	M5	M3×0,35	M5
Sensors	Type	6152AA..., 6152AC..., 6157BA..., 6159A..., 6167A..., 6177A..., 6190B/C..., 6192A/B..., 6194A/B..., 9223A...	6158A..., 6178A..., 6182C..., 6183C..., 6189A..., 6193A/B..., 6195A/B...	6152AB/AD..., 6157BB/BD..., 6190A...

## Socket Wrench for Mounting Nut



Technical Data	Type	1383	1356	1363
Outside diameter	mm	ø10	ø5	ø4,4
Length	mm	300	150	60
Sensors	Type	6152A..., 6157B..., 6159A..., 6167A..., 6172A..., 6177A..., 6190A/B/C..., 6192A/B..., 6194A/B...	6158A..., 6178A..., 6182C..., 6183C..., 6193A/B..., 6195A/B...	6184A...

## Repair Set for Single-Wire Cable



Technical Data	Type	1207
Number of repair sets		5

# Calibration and Test Equipment

## Preload Tester



Technical Data	Type	5991
Measuring range	pC	±100 000
Output voltage	V	0 ... ±1
Description		Battery operated preload tester for charge measurements
Use		Measurement and test of the preload of a sensor that measures contactless. Output for the monitoring function.
Data sheet see <a href="http://www.kistler.com">www.kistler.com</a>		5991 (000-340)

## Sensor Tester for Cavity Pressure Sensors



Technical Data	Type	5495B...
For sensors		all
Description		Battery operated Handheld Tester with test pin and connection cable for testing the sensor insulation and sensitivity.
Use		Function control of installed sensors and cables
Data sheet see <a href="http://www.kistler.com">www.kistler.com</a>		5495 (003-157)

## CoMo Injection Lab Conversion Kit



Shown: CoMo Injection Type 2869B3 with Lab Conversion Kit Types 5419A11, 5419A31 and 5419A21 (v.l.)

Technical Data	Type	5419A11	5419A21	5419A22
Number of channels		8	4	4
Charge input		BNC	–	–
Voltage input		–	D-Sub 9-pin	BNC
Operating temperature range	°C	0 ... 50	0 ... 50	0 ... 50
Weight	g	200	200	200
Dimensions (B×H×W)	mm	90×44×85	90×44×79	90×44×87
Protection class		IP54	IP54	IP54

Technical Data	Type	5419A31	5419A32	
Number of channels		4	4	
Voltage input		Terminal	Terminal	
Thermocouple	Type	K	J	
Measuring range	°C	0 ... 400	0 ... 400	
Operating temperature range	°C	0 ... 50	0 ... 50	
Weight	g	200	200	
Dimensions (B×H×W)	mm	90×44×85	90×44×85	
Protection class		IP54	IP54	

<b>Properties</b>	CoMo Injection Lab Conversion Kits permit the connection of individual pressure, temperature and combined pressure/temperature sensors to CoMo Injection Type 2869B1/B2/B3 process monitoring systems. Modules for individual charge and voltage signals, as well as with integrated amplifiers for thermocouples Types K or J.
<b>Application</b>	Use of sensor systems for test purposes that require a higher variability than the standard multi channel cable technology of CoMo Injection with respect to the connections.
<b>Accessories</b>	Mounting kit Type 5419A00, see data sheet for more details.
<b>Data sheet see <a href="http://www.kistler.com">www.kistler.com</a></b>	<b>5419A (003-072)</b>

# Adapters for Multi-Channel Technology Cavity Pressure Sensors

## Adapter Boxes Single-Channel Technology to Multi-Channel Technology



Shown: Type 5415A1

Technical Data	Type	5415A1	5415A2
Number of channels		4	8
Connector at the system		4-channel	8-channel
Connector in mold		4 × 1-channel BNC	8 × 1-channel BNC
Operating temperature range °C		0 ... 200	0 ... 200

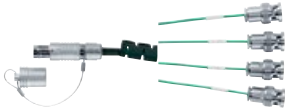
## Adapter Boxes Multi-Channel Technology



Shown: Type 5415A3

Technical Data	Type	5415A3	5415A4
Number of channels		8	8
Connector at the system		8-channel	2 × 4-channel
Connector in mold		2 × 4-channel	8-channel
Operating temperature range °C		0 ... 200	0 ... 200

## Adapter Cable Multi-Channel Technology to Single-Channel Technology



Technical Data	Type	1991A...	1999A1A0,5	1999A2A0,5
Number of channels		1	4	8
Length	m	2/5/sp <sup>1)</sup>	0,5	0,5
Connector at the system		4-channel	4 × BNC	8 × BNC
Connector in mold		1-channel	4-channel	8-channel
Operating temperature range °C		0 ... 200	0 ... 200	0 ... 200

<sup>1)</sup> Customer-specific length (l<sub>min</sub> = 0.3 m/l<sub>max</sub> = 20 m)



From the competent consultation through the installation to the fast supply of spare parts: Kistler is present worldwide with comprehensive service and training offerings

# Kistler Service: Customized Solutions from A–Z.

**Kistler offers sales and service where plastic processors produce high quality injection molding parts.**

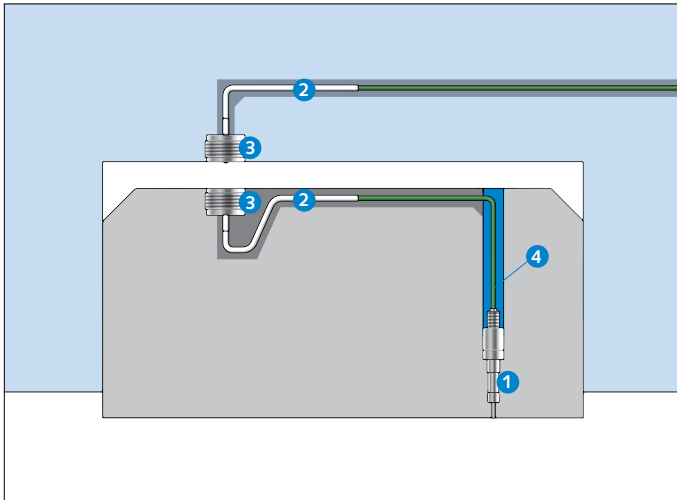
In addition to sensors and systems, Kistler offers a variety of services – from the competent consultation to the installation to the fast, worldwide supply of spare parts. An overview of our service offering can be found under [www.kistler.com](http://www.kistler.com). Please contact our local distribution partners for detailed information about our training offering (see p. 23).

We always have the right solution for you no matter how complex your installation issue seems. The next page shows typical, practical examples.

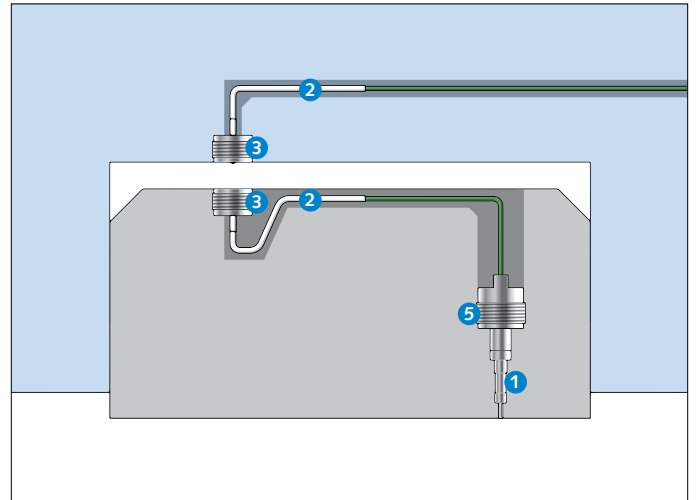
## **Kistler Service at a Glance:**

- Consultation
- Support during the commissioning of systems
- Process optimization
- Periodic on-site calibration of sensors
- Education and training events
- Development services

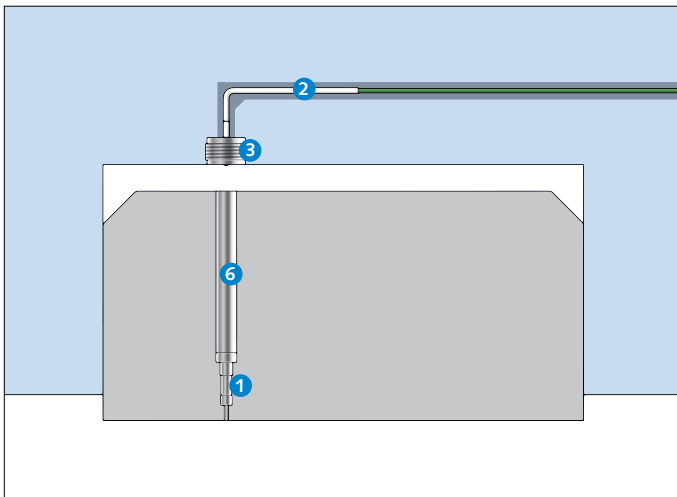
## Installation Examples



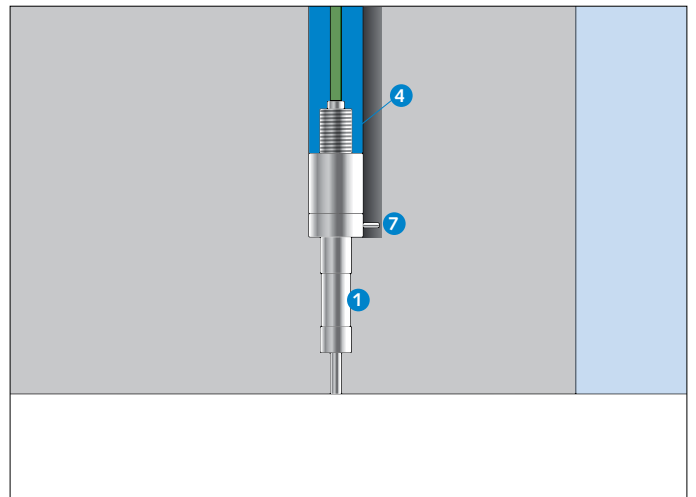
Installation with spacer sleeve and contact elements, cable with protective tube



Installation with mounting nut and contact elements, cable with protective tube



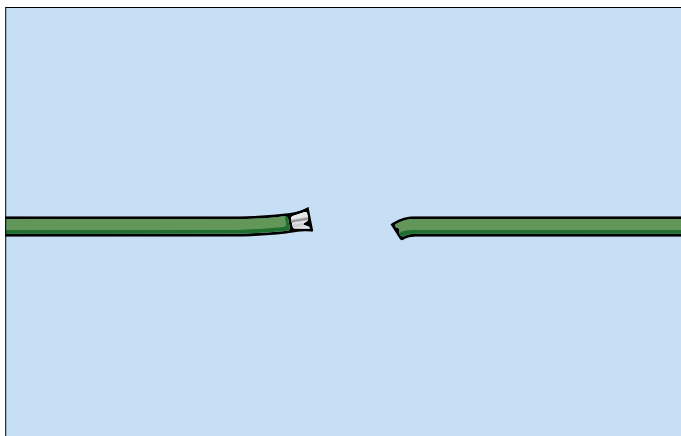
Installation with conductive spacer sleeve and contact element, cable with protective tube



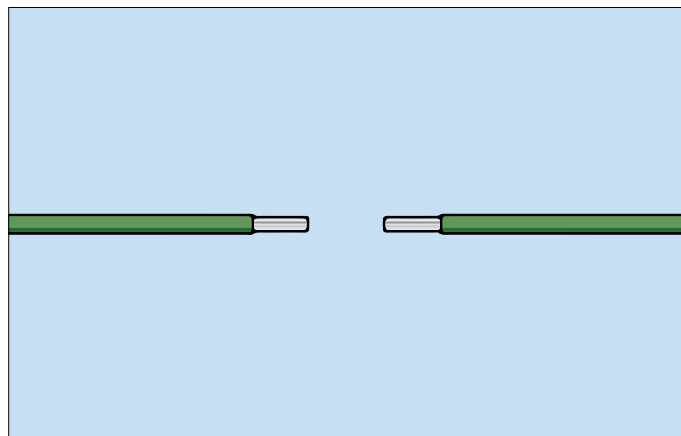
Sensor with machinable front and keyway pin, installation with spacer sleeve

- ① Sensor
- ② Protective tube
- ③ Contact element
- ④ Spacer sleeve
- ⑤ Mounting nut
- ⑥ Conductive spacer sleeve
- ⑦ Keyway Pin

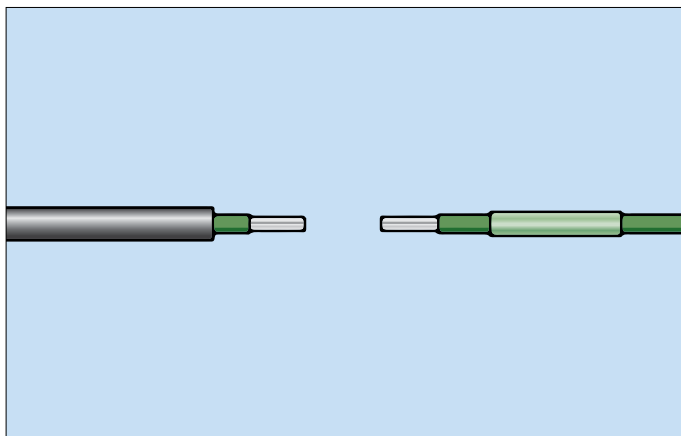
## Repair of Damaged or Sheared-Off Single-Wire Cables with Repair Set 1207



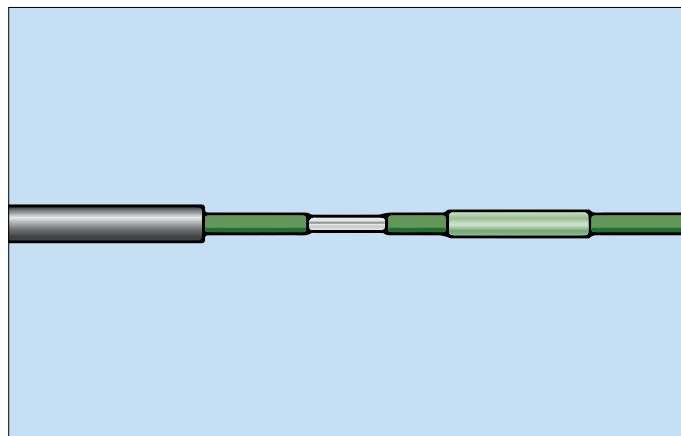
1. Defective cable



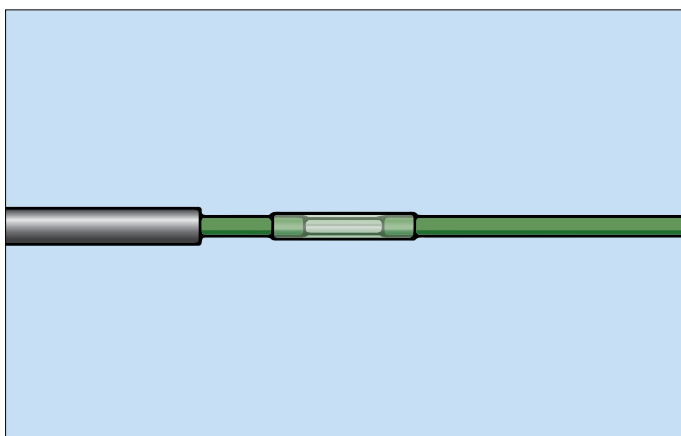
2. Strip the cable ends



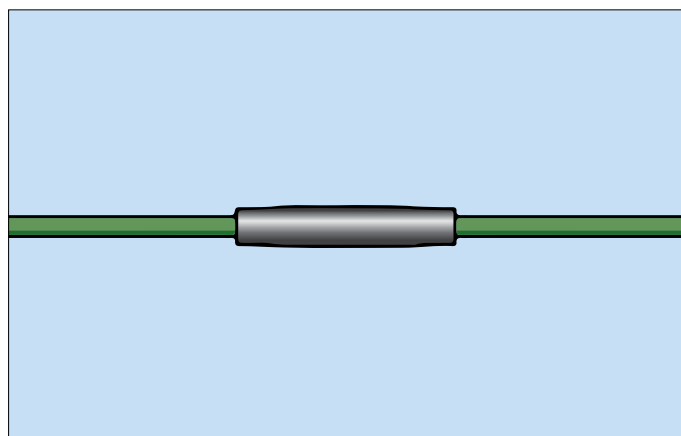
3. Install fluorocarbon polymer and heat shrink tubing, tin-coat cable ends



4. Solder cable ends together



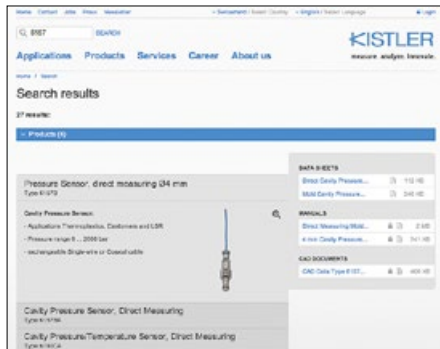
5. Insulate soldering point with fluorocarbon polymer tubing



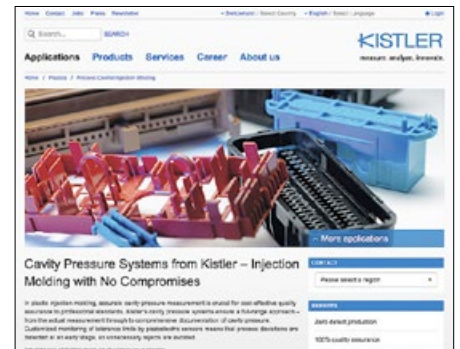
6. For fixation, envelop the repair point with heat shrink tubing

# Kistler – Worldwide Presence for Our Customers.

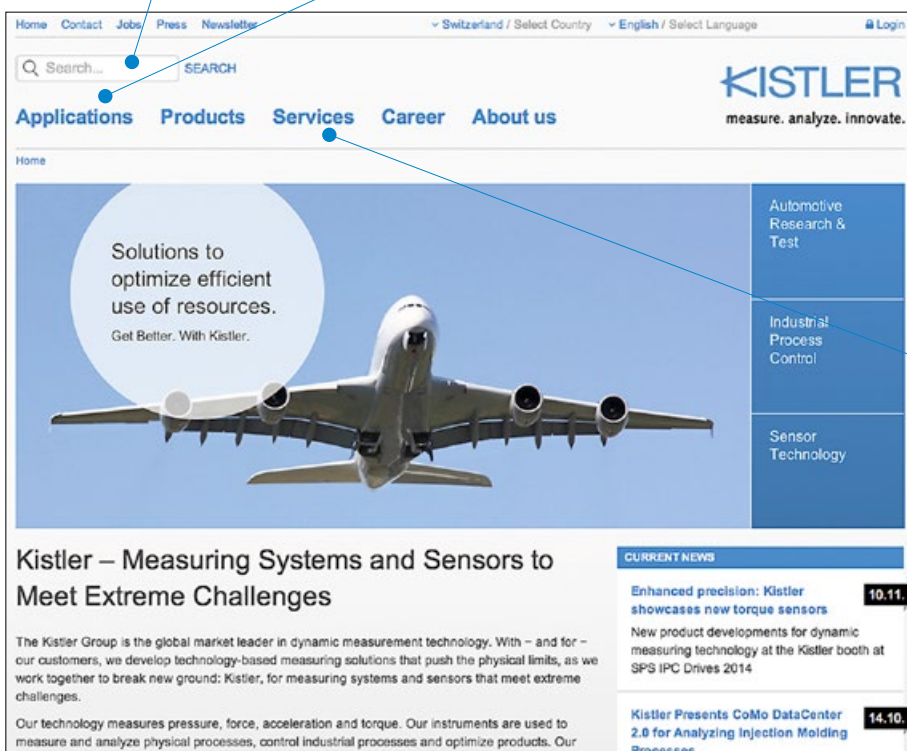
The Kistler Group, with 1200 employees, is the world market leader in dynamic measuring technology. 28 Group companies and more than 30 agencies guarantee close contact to the customer, individual application support and short delivery times.



**Data Sheets and Documents**  
Use our Online Search to download data sheets, brochures or CAD data.



**Our Representatives Are Here to Help**  
Whether you would like a consultation or require support during installation – our website provides the contact information for your local representative.



**Education and Training Events**  
Education and training courses, during which our sensors and measuring systems are explained by Kistler experts, are the most efficient way for you to obtain the required user knowledge.

**Kistler Group**

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Kistler Group includes the Kistler Holding AG and  
all its subsidiaries in Europe, Asia, Americas and Australia.

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[www.kistler.com](http://www.kistler.com)

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measure. analyze. innovate.