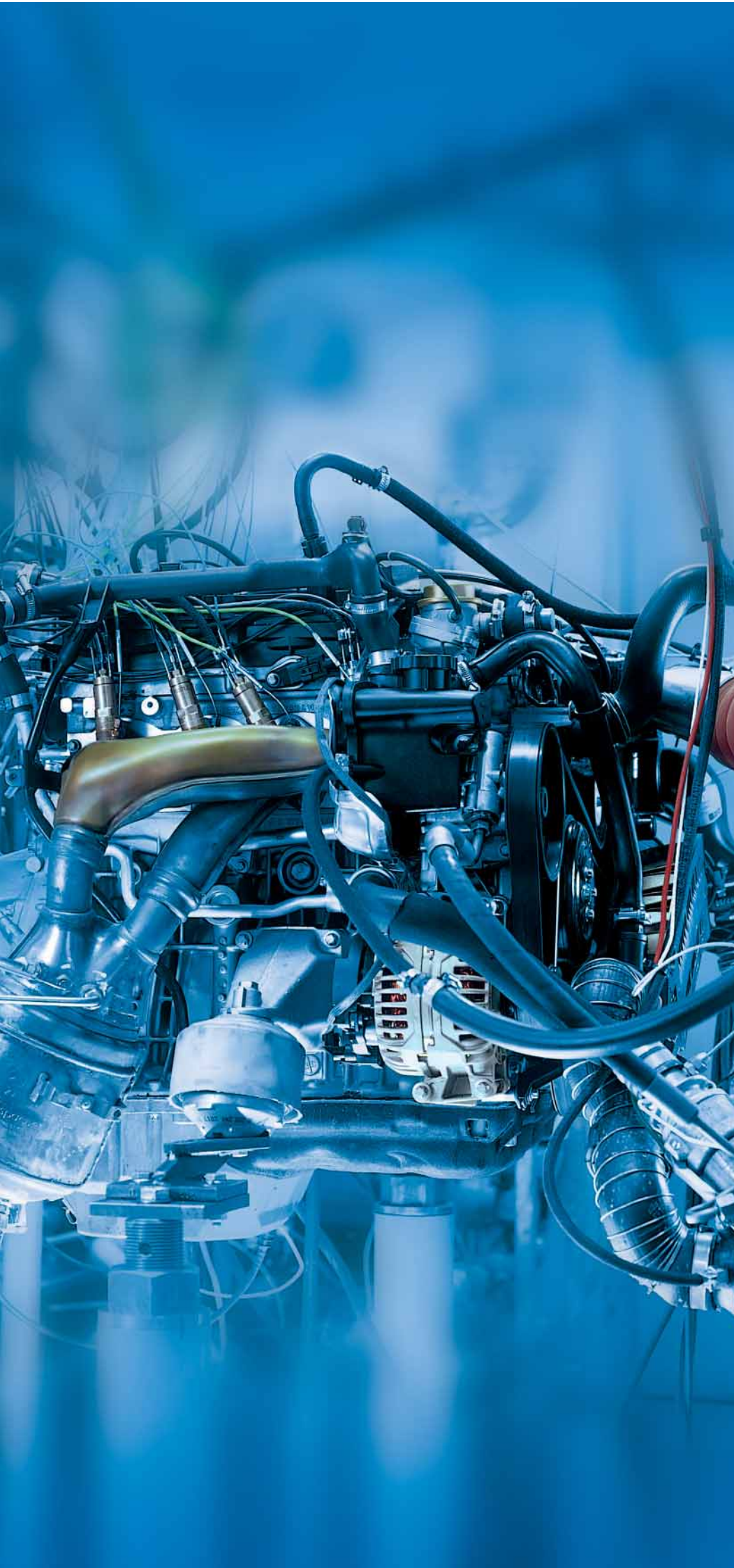


KISTLER

measure. analyze. innovate.

Engine Indication

Pressure Sensors
for Research and
Development



Kistler Pressure Sensors...

From pioneer to technological leader – Kistler has been involved in the development, production and use of piezoelectric sensors since the 50s. The company's sensors have also played a key role in the development of combustion engines over this extended period. This striking success reflects their "inside view" of the combustion chamber as the only source of the information needed to optimize combustion for better efficiency and minimum harmful emissions.

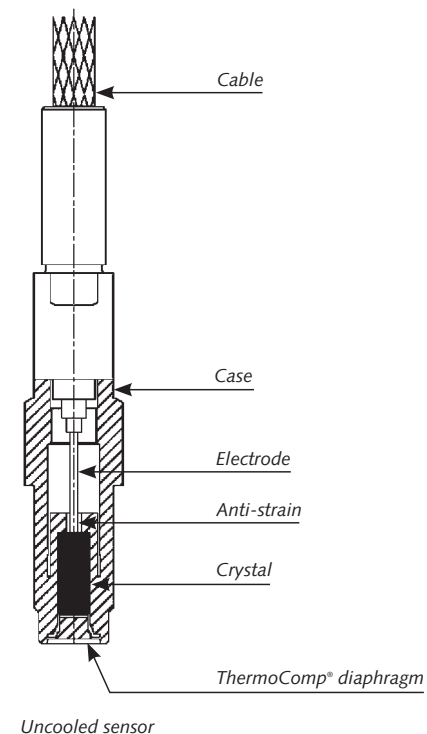
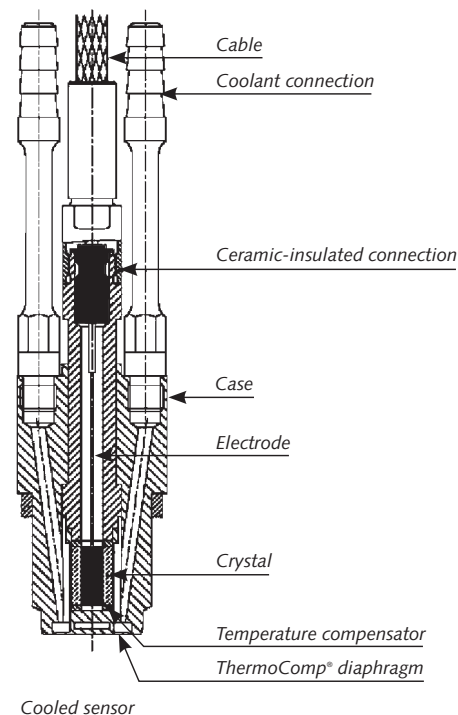
Reliable Development Partner for Research and Industry

From lawnmower engine to marine diesel, Wankel motor to racing power plant – engine development without Kistler pressure sensors is inconceivable. Innovative capacity, close contact with the world's leading engine manufacturers and application expertise help explain why Kistler now sets the pace for engine measurement. Kistler always offers the best solution for accurate pressure measurement over a

wide spectrum of sectors from extremely high-precision research to demanding racing applications.

It achieves all this by drawing on an extensive range of products that supplements piezoelectric and piezoresistive sensors with matching signal conditioning and a diverse selection of accessories. Such comprehensive choice ensures the perfect sensor package with ideal signal conditioning and can always be used for maximum accuracy in each individual pressure indication project. The modularity of our sensors also allows cost effective customization. This further increases the benefits for the customer by always ensuring accurate measurements, even with special sensor configurations or service conditions.

Year after year Kistler invests 10 % of its turnover in R&D in order to maintain its steady flow of technically innovative yet cost-effective state of the art solutions. With a combined workforce of around 800 the Kistler Group is the world market leader in dynamic measurement technology. 20 group companies worldwide and more than 30 distributors ensure close contact with the customer, individualized application engineering support and short lead times.



PiezoStar® – Kistler has been growing their own crystals with high sensitivity and temperature stability for about ten years

...Varied and Innovative in Design

The range of Kistler sensors reflects the multifaceted nature of engine development. Miniature piezoelectric pressure sensors measure cylinder pressures extremely precisely as a basis for thermodynamic analysis of the combustion process. Equally unique are the piezoresistive sensors for very accurate measurement of intake and exhaust manifold pressures.

Piezoelectric Pressure Sensors

The piezoelectric effect – the prefix "piezo" comes from the Greek "piezein", to press – was discovered in 1880 by the Curie brothers. They found that the surfaces of certain crystals – including quartz – become electrically charged when the crystal is mechanically loaded. This electrical charge is exactly proportional to the force acting on the crystal. It is measured in picocoulombs ($1 \text{ pC} = 10^{-12}$ coulombs).

As active designs, piezoelectric sensors can only be used for quasistatic rather than truly static measurement. They are ideal for dynamic applications. Piezoelectric pressure sensors can be employed wherever rapidly changing pressures at temperatures of up to 400°C have to be measured and recorded as accurately as possible.

In addition to quartz, particularly for uncooled sensors, Kistler uses crystals developed and grown in-house. These PiezoStar® crystals are characterized by high sensitivity and high thermal stability.

Piezoresistive Pressure Sensors

The piezoresistive principle is based on the semiconductor effect first described in 1954, which states that under mechanical stress semiconductors change their electrical resistance. Compared with the conventional strain gage measurement of the time, this opened up completely new applications. Since then further similar breakthroughs have included the thin film technique on metal and its thick layer counterpart on ceramic.

Piezoresistive sensors from Kistler measure static pressures in gases and liquids. The results achieved under even the most adverse conditions are precise and reproducible.

Applications at a Glance

1. Precision measurement of cylinder pressures with cooled PiezoStar® cylinder pressure sensor for combustion analysis, gas exchange analysis and combustion development.

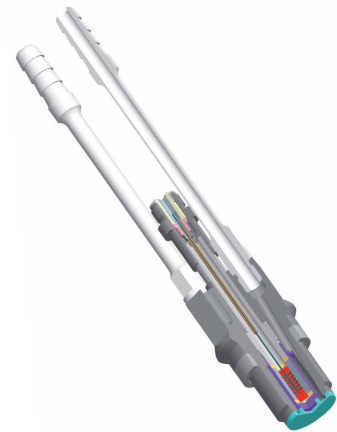
2. Measurement of cylinder pressures without additional mounting bore for the sensor.

Measuring spark plugs: For knocking analysis and use in the vehicle.

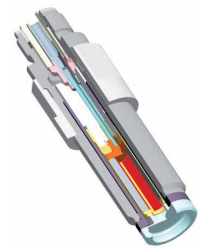
Glow plug adapters: For measurement in DI diesel engines. Also available as measuring glow plugs for cold start measurements.

3. Pressure indication with uncooled piezoelectric PiezoStar® sensors for thermodynamic analysis and engine calibration.

4. Low-pressure indication in the inlet and exhaust with piezoresistive pressure sensors. Cooling or switching adapters are used for this purpose in the exhaust. Such instrumentation is employed for gas exchange analysis and optimization.



M8 cooled piezoelectric pressure sensor, Type 6041A...



M5 uncooled piezoelectric pressure sensor, Type 6052C...

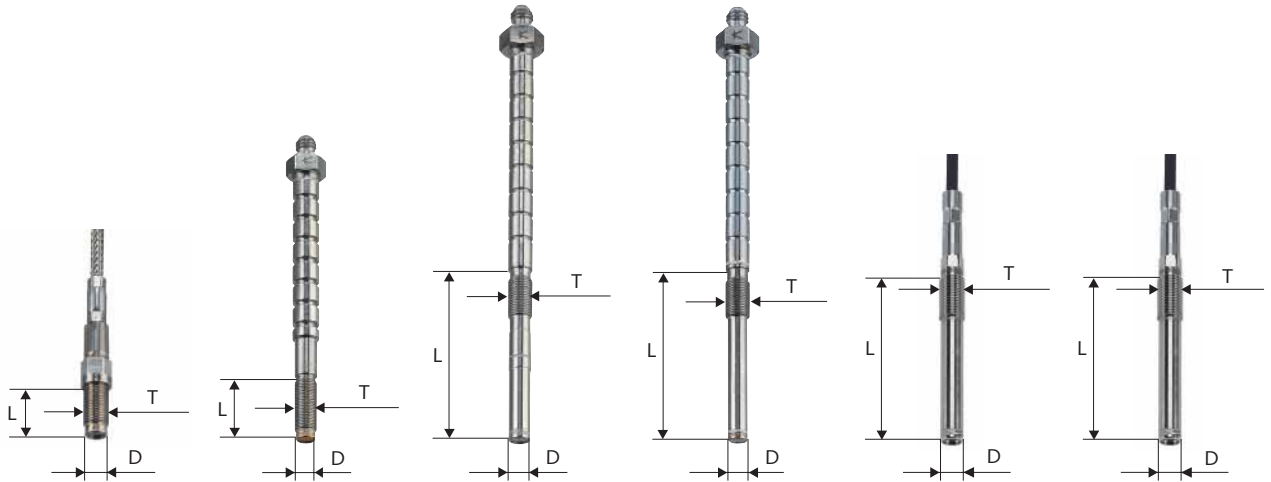


M5 piezoresistive absolute pressure sensor, Type 4005B...

Piezoelectric Sensors

Sensors and Measuring Probes, Uncooled

Measurement of Cylinder Pressures

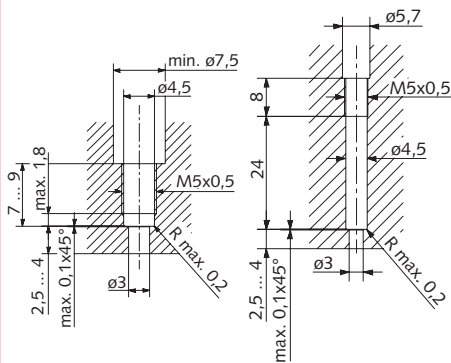


Technical Data	Type 6052C...	Type 6053CC...	Type 6055C...	Type 6057A...	Type 6056A...	Type 6058A...
Pressure range bar	0 ... 250 / ... 300*	0 ... 250 / ... 300*	0 ... 250 / ... 300*	0 ... 250	0 ... 250	0 ... 250
Sensitivity pC/bar	-20	-20	-20	-15	-20	-17
Temperature range °C	-50 ... 350	-50 ... 350	-50 ... 350	-50 ... 350	-50 ... 350	-50 ... 350
Dimensions	D mm	4,4	4,4	4,0	4,4	4,0
	L mm	10	14,5	35	33,5	33,5
	T	M5x0,5	M5x0,5	M5x0,5	M5x0,5	M5x0,5
Characteristics	Low thermal sensitivity drift, low thermal shock error and long life thanks to front seal, compensated for acceleration, very high sensitivity.	Low thermal sensitivity drift, compensated for acceleration, only requires 6 mm mounting bore, low thermal shock error and long life thanks to front seal, very high sensitivity.	Suitable for measurements with glow plug adapter Type 6535Q..., low thermal sensitivity drift, compensated for acceleration, low thermal shock error and long life thanks to front seal, very high sensitivity.	Low thermal shock error thanks to front seal, very high sensitivity thanks to new piezoelectric crystal, suitable for glow plug adapters.	Low thermal sensitivity drift, compensated for acceleration, only requires 4,5 mm mounting bore, low thermal shock error and long life thanks to front seal, very high sensitivity, specifically for glow plug adapters.	Low thermal sensitivity drift, compensated for acceleration, only requires 4,1 mm mounting bore, low thermal shock error and long life thanks to front seal, very high sensitivity, specifically for glow plug adapters.
Data Sheet	6052C_000-552	6053CC_000-571	6055C_000-572	6057A_000-019	6056A_000-529	6058A_000-573

Sensors and Measuring Probes, Uncooled

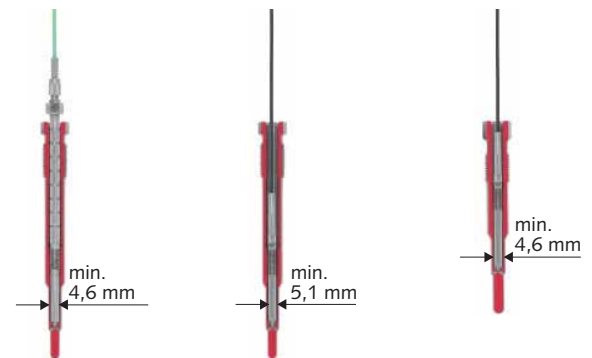
Measurement of Cylinder Pressures

Mounting Bore**



Glow Plug Adapters

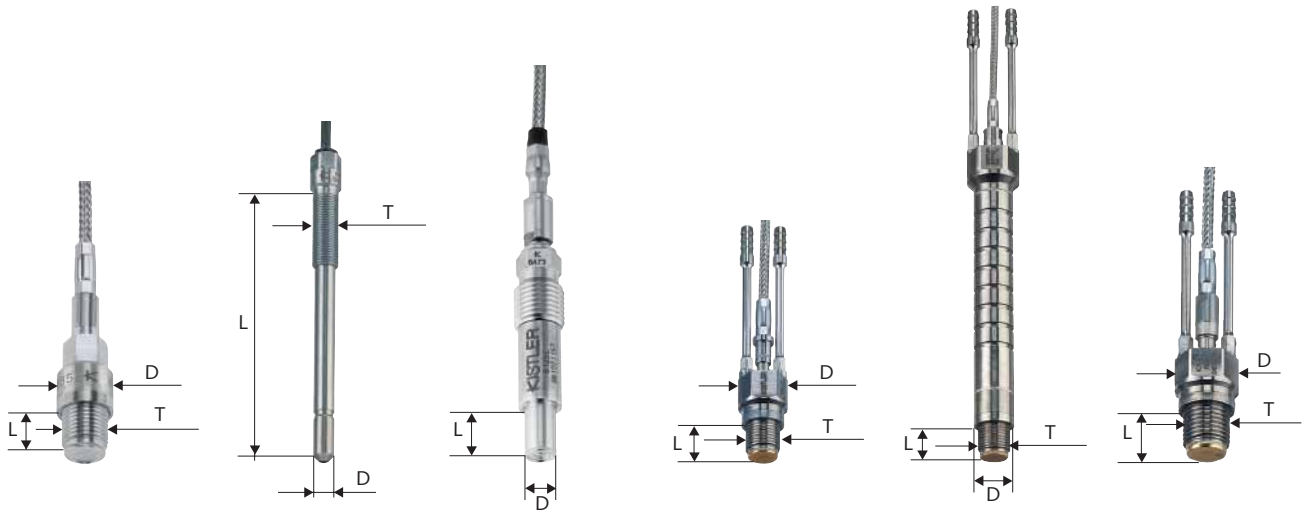
Measurement of Diesel Cylinder Pressures



	Type 6052C...	Type 6056A...	Technical Data	Type 6535Q...	Type 6542Q...	Type 6544Q...
* ...U20 version			Recommended sensors	6055, 6057	6056A...	6058A...
** The indicated dimensions are only for a general overview. Please take the actual dimensions and tolerances from the data sheet.			Pressure range bar	0 ... 250	0 ... 250	0 ... 250
			Data Sheet	6531Q_000-075	6542Q_000-570	6544Q_000-570

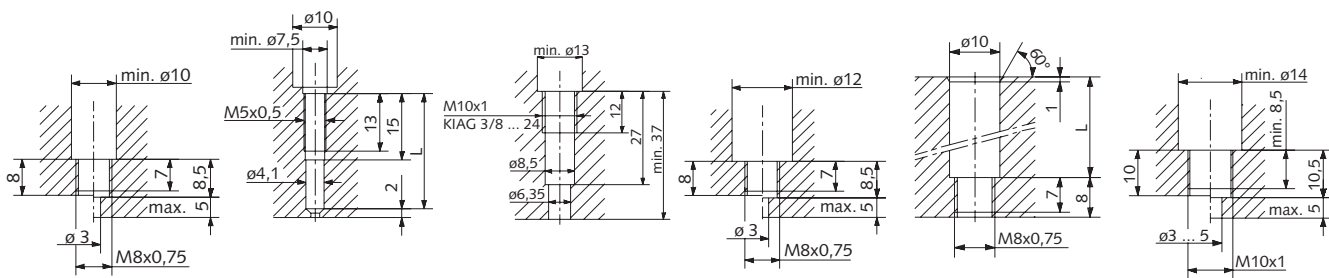
Sensors and Measuring Probes, Cooled

Measurement of Cylinder Pressures



Technical Data	Type 6045A...	Type 6081A...	Type 6125C...	Type 6041A...	Type 6043A...	Type 6061B...
Pressure range bar	0 ... 250 / ... 300*	0 ... 250	0 ... 250 / ... 300	0 ... 250 / ... 300*	0 ... 250 / ... 300*	0 ... 250 / ... 300*
Sensitivity pC/bar	-45	-9,5	-37	-20	-20	-25
Temperature range °C	-20 ... 350	-50 ... 350	-50 ... 350	-50 ... 350	-50 ... 350	-50 ... 350
Dimensions	D mm	9,8	4,0	6,2	11,5	9,8
	L mm	8	30 ... 60	10	8	10
	T	M8x0,75	M5x0,5		M8x0,75	M8x0,75
Characteristics	High-temperature pressure sensor, shoulder-sealing, mounts in M8x0,75 bore, mounting dimensions compatible with Type 6041A..., long life, very low thermal shock error for precise measurement results.	Miniature sensor for pressure indication measurements, easily handled and robust, available in different lengths, 90° taper for flexible mounting.	Universal sensor with ground insulation, low load change drift, very low thermal shock error.	Smallest cooled cylinder pressure sensor with M8 thread, double diaphragm with optimized thermal shock resistance, long life thanks to TiN coating and steel-sheathed cable.	Cooled cylinder pressure probe with M8 thread, long life thanks to TiN coating and steel-sheathed cable, double diaphragm with optimized thermal shock resistance.	Cooled cylinder pressure sensor, double diaphragm with optimized thermal shock resistance, long life thanks to TiN coating and steel-sheathed cable.
Data sheet	6045A_000-618	6081A_000-494	6125B_000-025	6041A_000-013	6043A_000-014	6061A_000-020

Mounting Bore**



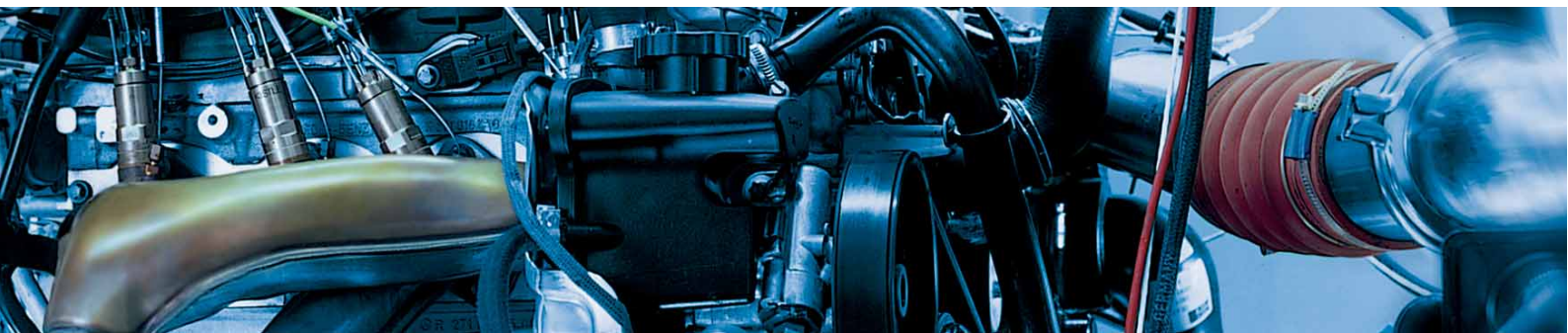
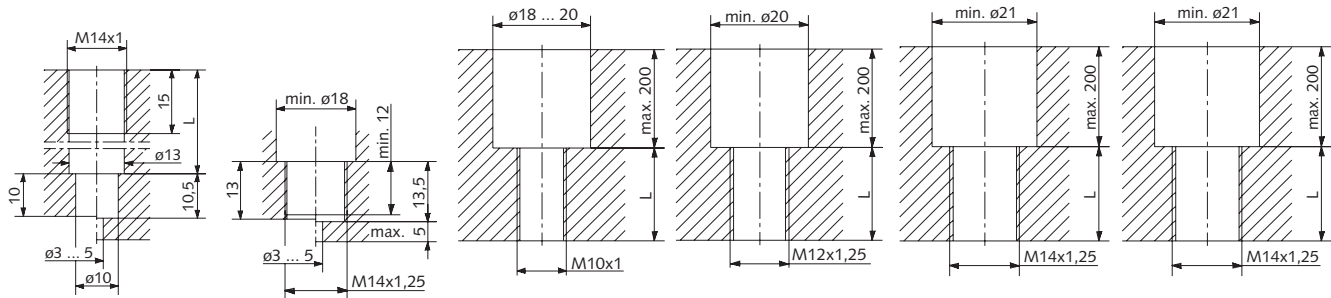
Measuring Spark Plugs

Measurement of Cylinder Pressures



Technical Data	Type 6067C...	Type 7061B...	Type 6113A...	Type 6115A...	Type 6117B...	Type 6118A...
Pressure range bar	0 ... 250	0 ... 250	0 ... 200	0 ... 200	0 ... 200	0 ... 200
Sensitivity pC/bar	-25	-80	-9,5	-9,5	-15	-9,5
Temperature range °C	-50 ... 350	-50 ... 350	-50 ... 250	-50 ... 250	-50 ... 350	-50 ... 250
Dimensions	D mm	9,9	16	19/26,5	19/26,5	flat: 19/22/26,5 tapered: 17,5/23,5/25,4
	L mm	9,5	13	M10x1	M12x1,25	M14x1,25
	T		M14x1,25			
Characteristics	Cooled cylinder pressure sensor, double diaphragm with optimized thermal shock resistance, long life, special mounting sleeve for easy mounting and dismantling of sensor.	Largest cooled cylinder pressure sensor, with M14 thread, double diaphragm optimized for thermal shock, long life thanks to TiN coating and steel-sheathed cable.	High natural frequency, front of sensor flush, measurement in M10 spark plug bore, replaceable ceramic insulator. Reduced eccentricity of 1,6 mm.	High natural frequency, front of sensor flush, wide choice of heat values and spark positions, replaceable ceramic insulator. Reduced eccentricity of 1,7 mm.	Measurement without pressure indication bore, high natural frequency, front of sensor flush, wide choice of heat values and spark positions, replaceable cable. Eccentricity 2,2 mm.	High natural frequency, front of sensor flush, wide choice of heat values and spark positions. Reduced eccentricity of 0,8 mm.
Data Sheet	6067C_000-021	7061B_000-052	6113A_000-574	6115A_000-416	6117B_000-022	6118_000-629

Mounting Bore**



Piezoresistive Sensors

DCE Sensors

Oil-filled Sensors

Block Type Sensors

Low-pressure Measurement on Intake and Exhaust Side

Measurement of Injection Pressures



Technical Data	Type 4005BA...FV200S	Type 4007BA...FS	Type 4043/45A...V200S	Type 4073/75A...V200S	Type 4065A...S	Type 4067...S
Pressure range	bar 0 ... 5 / ... 10 / ... 20 / ... 50 / ... 100 / ... 200	0 ... 5 / ... 20	0 ... 1/ ... 500	0 ... 10 / ... 500	0 ... 200 / ... 1000	0 ... 1000 / ... 5000
Temperature range	°C -40 ... 125	-40 ... 200	-20 ... 50 / 20 ... 120	-20 ... 50 / 20 ... 120	20 ... 120	20 ... 120
Dimensions	D mm L mm T	6,2 4 M5x0,5/M5x0,8	12 14 M14x1,25	9,5 35 M12x1	5 25,3 M7x0,75	8,5 18,6 M10x1
Characteristics	Miniature sensor for measuring pressures in the inlet system of engines as well for oil and fuel pressure, very small dimensions (M5x0,5) permitted by direct chip exposure (DCE) measuring principle, very high natural frequency, maximum operating temperature 125 °C.	Miniature sensor for measuring pressures in the inlet and exhaust system of engines, very small dimensions (M5x0,5) permitted by direct chip exposure (DCE) measuring principle, very high natural frequency, maximum operating temperature 200 °C.	Built-in temperature compensation, high natural frequency, good linearity, available as V200S version with cable connection, for SCP.	Built-in temperature compensation, high natural frequency, good linearity, available as V200S version with cable connection, for SCP.	High-pressure sensor with M7 thread for measurements in injection and hydraulic systems.	High-pressure sensor with M10 thread for measurements in injection and hydraulic systems.
Data Sheet	4005B_000-594	4007BA_000-614	4043A_000-003	4073A_000-003	4065A_000-005	4067_000-006

Cooling Adapters

Switching Adapters

Clamp Adapter

Low-pressure Measurement on Intake and Exhaust Side

Injection Pressure



Technical Data	Type 7511	Type 7525A...	Type 7531	Type 7533A...	Technical Data	Type 6533
Recommended sensors	4075A..., 4045...	4005..., 4007BA...	4075A...	4005B/7B, 4045/25	Recommended sensors	4067, 6229
Coolant flow rate	0,8	0,5	0,5	0,5	Pipe diameter	mm 6 ... 13
Dimensions	T L mm	G1/2" 7	M14x1,25 12,5	G1/2" 13	Dimensions	WxHxD 28x32,5x11
Weight	g 260	20	260	185	Data Sheet	6533_000-070
Data Sheet	7511_000-077	7525_000-628	7531_000-077	7533_000-606		

Kistler Worldwide

Europe

Austria

Kistler GmbH
Lemböckgasse 49f
1230 Wien
Tel. +43 1 867 48 67 0
sales.at@kistler.com

Czech Republic/Slovakia

Kistler, s.r.o.
Zelený pruh 99/1560
140 00 Praha 4
Tel. +420 296 374 878
sales.cz@kistler.com

Denmark/Norway/Sweden

Kistler Nordic AB
Aminogatan 34
431 53 Mölndal
Tel. +46 31 871 566
info.se@kistler.com

Finland

Kistler Nordic AB
Särkiniementie 3
00210 Helsinki
Tel. +358 9 612 15 66
sales.fi@kistler.com

France

Kistler France
ZA de Courtabœuf 1
15, avenue du Hoggar
91953 Les Ulis cedex
Tel. +33 1 69 18 81 81
info.fr@kistler.com

Germany

Kistler Instrumente GmbH
Daimlerstrasse 6
73760 Ostfildern
Tel. +49 711 34 07 0
info.de@kistler.com

Italy

Kistler Italia s.r.l.
Via Ruggero di Lauria, 12/B
20149 Milano
Tel. +39 02 481 27 51
sales.it@kistler.com

Netherlands

Kistler B.V. Nederland
Leeghwaterstraat 25
2811 DT Reeuwijk
Tel. +31 182 304 444
sales.nl@kistler.com

Switzerland/Liechtenstein

Kistler Instrumente AG
Verkauf Schweiz
Eulachstrasse 22
8408 Winterthur
Tel. +41 52 224 12 32
sales.ch@kistler.com

United Kingdom

Kistler Instruments Ltd.
13 Murrell Green Business Park
London Road
Hook, Hampshire RG27 9GR
Tel. +44 1256 74 15 50
sales.uk@kistler.com

Asia

Japan

Kistler Japan Co., Ltd.
23rd floor, New Pier Takeshiba North Tower
1-11-1, Kaigan, Minato-ku
Tokyo 105-0022
Tel. +81 3 3578 0271
sales.jp@kistler.com

China, People's Republic of

Kistler China Ltd.
Room 925, Yuan Chen Xin Building
No. 12 E1, Yuminlu Road Deshengmenwai
Beijing 100029
Tel. +86 10 8225 2163
sales.cn@kistler.com

India

Kistler Instruments (Pte) Ltd.
India Liaison Office
2B Century Plaza
560/562 Anna Salai
Teynampet, Chennai 600 018
Tel. +91 44 4213 2089
sales.in@kistler.com

Korea, Republic of

Kistler Korea Co., Ltd.
Gyeonggi Venture Anyang
Technical College Center 801
572-5, Anyang-Dong, Manan-Gu,
Anyang-City, Gyeonggi-Do 430-731
Tel. +82 31 465 6013
sales.kr@kistler.com

Singapore

Kistler Instruments (Pte) Ltd.
50 Bukit Batok Street 23
#04-06 Midview Building
Singapore 659578
Tel. +65 6316 7331
sales.sg@kistler.com

Taiwan

Kistler Representative Office in Taiwan
Room 9, 8F, No. 6, Lane 180
Sec. 6, Mincyuan E. Road
Taipei 114
Tel. +886 2 7721 2121
sales.tw@kistler.com

Thailand

Kistler Instrument (Thailand) Co., Ltd.
26/56 TPI Tower, 20th Floor
Nanglingee Rd., (Chan Tat Mai Rd.)
Thungmahamek, Sathorn
Bangkok 10120
Tel. +66 2678 6779-80
sales.thai@kistler.com

America

USA/Canada/Mexico

Kistler Instrument Corp.
75 John Glenn Drive
Amherst, NY 14228-2171
Tel. +1 716 691 5100
sales.us@kistler.com

Australia

Australia

Kistler Instruments Australia Pty Ltd
5 Glenn Court
Rowville, Victoria 3178
Tel. +61 3 9755 8222
sales.au@kistler.com

Other countries

Kistler Instrumente AG
Export Sales
Eulachstrasse 22, 8408 Winterthur
Switzerland
Tel. +41 52 224 11 11
sales.export@kistler.com

www.kistler.com

KISTLER
measure. analyze. innovate.

Headquarters

Switzerland

Kistler Group
Eulachstrasse 22, 8408 Winterthur
Tel. +41 52 224 11 11
Fax +41 52 224 14 14
info@kistler.com