

Cylinder Pressure Sensor

for On-Line Combustion Control

Type 6613CG...

Piezoelectric pressure with galvanic isolated 4 ... 20 mA output signal for continuous cylinder pressure measurement for medium and low speed diesel and gas engines.

- Robust design, with excellent long term stability
- Suitable for knock detection
- Very good thermodynamic behaviour

Description

The shoulder sealed M10x1 sensor and the in-line charge amplifier are connected by a robust Fluorelastomer-cable. The patented "antistrain" design, makes the measuring element insensitive to varying mounting conditions. The Quartz-measuring element is extremely stable and provides a very accurate and repeatable output signal over the whole life time. The sensor has been designed for an average life time of 20 000 operating hours, but may vary depending on engine type and application.

Application

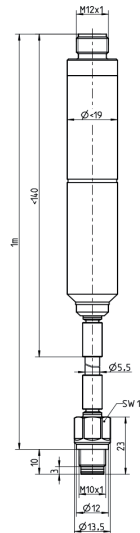
Close loop combustion control and monitoring tasks for e.g. knock detection, cylinder balancing, p_{mi} calculation, etc.

Typ 6613CG1

For 4-stroke engines type 6613CG1 is recommended, this type has a time constant of >10 s, which is fully sufficient for all kind of measurements for 4-stroke engines with >300 1/min.

Typ 6613CG2

This type is especially suitable for 2-stroke engines <300 1/min, the in-line charge amplifier runs with a time constant of >100 s which provides a fully suitable frequency bandwidth for all kind of measuring tasks.



Technical Data

	Type	6613CG1	6613CG2
Measuring range	bar	0 ... 250	0 ... 250
Sensitivity	mA/bar	0,05	0,05
Overload	bar	325	325
Linearity	% FSO	≤±0,5	
Operating temperature range			
Sensor front	°C	-50 ... 350	
at cable connection	°C	-20 ... 200	
at charge amplifier	°C	-20 ... 100	
Thermal shock at 1 500 1/min, $p_{mi} = 9$ bar	bar	≤±0,5	
Change in sensitivity			
200 ±150 °C	%	≤±2	
200 ±50 °C	%	≤±1	
Upper cut-off frequency (-3 dB)	kHz	10	10
Time constant	s	10 ... 30	100 ... 150
Output current	mA	4 ... 20	
Signal range	mA	12,5	
Zero line (no pressure)	mA	6,5	
Supply voltage	VDC	18 ... 32	
Load resistance	Ω	100 ... 600	
max. voltage*	VDC	500	
Plug DIN (mated)	M12x1	IP67	
Weight	g	140	
Tightening torque	N·m	15	
Connector	8 pole	M12x1	

* between case, signal output or power supply

Mounting

4-stroke engines

The sensor should be installed close to the combustion chamber, the length of the pressure bore between sensor and combustion chamber depends mainly on the engine speed, a too long bore may generate pipe oscillations disturbing the measuring signal.

An installation at the indicator valve is not recommended for continuous measuring because the operating temperature may exceed the admissible temperature range.

2-stroke engine

2- stroke engines the sensor should be installed with patented Kistler adapter Type 7523B ... direct at the cylinder cover. The sensor is flush mounted into the flat pressure canal of the adapter with no pockets or corners this significantly reduces the build-up of combustion depositon at the sensor membrane. The indicator valve should be placed right on top of the adapter to minimise the dead volume.

Depending on the amount of combustion residuals the indicator valve should be opened to blow out the combustion residuals from time to time.

For any questions about the installation please contact Kistler.

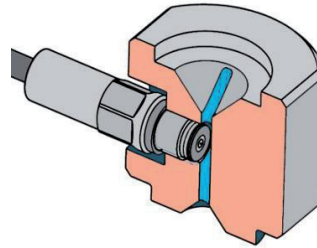


Fig. 3: Schematic view of sensor Type 6613CG... installed in ring adapter

General Specifications

Degree of protection (mated)	(EN 60529)	IP	67
CE approval	EMC Regulations	2004/108/EG	
	EMC Standards	EN 61000-6-2	
		EN 61000-6-3	
		EN 61326-1	(Class A+B)
Marine qualification	IACS	E10	(planned)

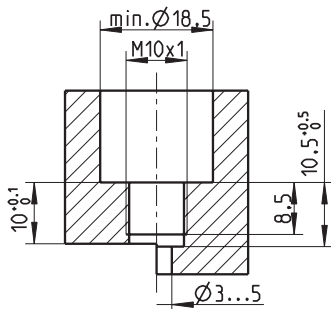


Fig. 1: Mounting bore (4-stroke application)

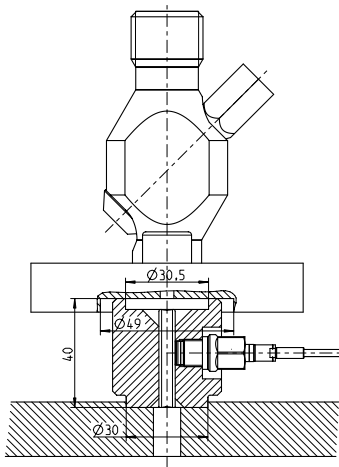
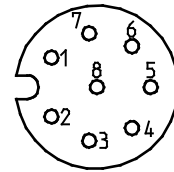


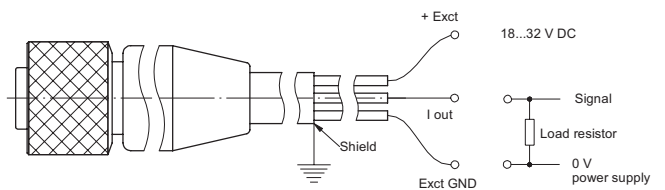
Fig. 2: Mounting with ring adapter Type 7523B... (2-stroke application)

Connector

- 1 Exct GND
- 2 don't connect
- 3 don't connect
- 4 don't connect
- 5 **Signal output**
- 6 don't connect
- 7 don't connect
- 8 **+ Exct (18 ... 32 V)**



Connection of Types 7614CG.../6613CG... to data acquisition system with connecting cable Type 1700A69A...



Important:

Shield must be connected to the case/shield of the data acquisition system (or engine control).

Shield and Exct GND must not be connected!

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This information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.

Optional Accessories	Type/Art. No.
• Torque wrench 8 ... 40 N·m	1300A11
• Fork wrench SW 12 for Type 1300A11	1300A13
• Tubular socket	1300B6
• Connecting cable, l = 10 m	1700A69
• Connecting cable, l = 20 m	1700A69A1
• Connecting cable, l = 30 m	1700A69A2
• Connecting cable, l = 50 m	1700A69A3
• Connecting cable, l = 3 m	1700A69A4
• Connecting cable, l = 1,5 m	1700A69A5
• Adapter for MAN–ME engines*	7523B10
• Adapter for RTA-engines*	7523B11

*dimensions needs to be checked by the customer

Ordering Code	Type
• 4-stroke engine >300 1/min	6613CG1
• 2-stroke engine <300 1/min	6613CG2

Cylinder Pressure Sensor

for On-Line Combustion Control

Type 7614CG1

Piezoelectric pressure with galvanic isolated 4 ... 20 mA output signal for continuous cylinder pressure measurement for medium and low speed diesel and gas engines

- Robust design, with excellent long term stability
- Suitable for knock detection
- Very good thermodynamic behaviour
- Front end sealing or shoulder sealing

Description

The M14x1,25 sensor and the in-line charge amplifier are connected by a robust Fluorelastomer-cable. The patented "antistrain" design, makes the measuring element is insensitive to varying mounting conditions. The Quartz-measuring element is extremely stable and provides a very accurate and repeatable output signal over the whole life time. The sensor has been designed for an average life time of 20 000 operating hours, but may vary depending on engine type and application.

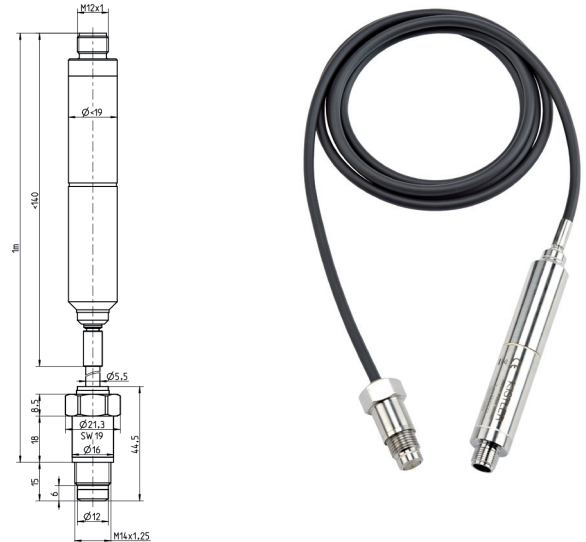
The sensor can be installed either front end sealed or shoulder sealed. The front end sealing protects the thread from direct contact the the combustion gas, which prevents the mounting thread from seizing.

Application

Close loop combustion control and monitoring tasks for e.g. knock detection, cylinder balancing, MIP calculation, etc.

Typ 7614CG1

For 4-stroke engines Type 7614CG1 is recommended, this type has a time constant of >10 s, which is sufficient for all kind of measurements for 4-stroke engines with >300 1/min.



Technical Data

Measuring range	bar	0 ... 250
Sensitivity	mA/bar	0,05
Overload	bar	325
Linearity	% FSO	≤±0,5
Operating temperature range		
Sensor front	°C	-50 ... 350
at cable connection	°C	-20 ... 200
at charge amplifier	°C	-20 ... 100
Thermal shock at 1 500 1/min, p _{mi} = 9 bar	bar	≤±0,5
Change in sensitivity		
200 ±150 °C	%	≤±2
200 ±50 °C	%	≤±1
Upper cut-off frequency (-3 dB)	kHz	10
Time constant	s	10 ... 30
Output current	mA	4 ... 20
Signal range	mA	12,5
Zero line (no pressure)	mA	6,5
Supply voltage	VDC	18 ... 32
Load resistance	Ω	100 ... 600
max. Voltage*	VDC	500
Plug DIN (mated)	M12x1	IP67
Weight	g	160
Tightening torque	N·m	25
Connector	8 pole	M12x1

* between case, signal output or power supply

Mounting

The sensor should be installed close to the combustion chamber, the length of the pressure bore between sensor and combustion chamber depends mainly on the engine speed, a too long bore may generate pipe oscillations disturbing the measuring signal.

An installation at the indicator valve is not recommended for continuous measuring because the operating temperature may exceed the admissible temperature range.

For any questions about the installation please contact Kistler.

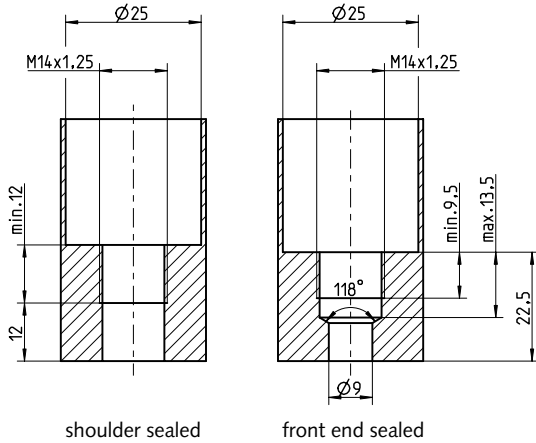


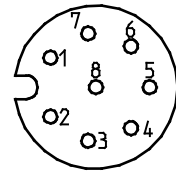
Fig. 1: Mounting bore

General Specifications

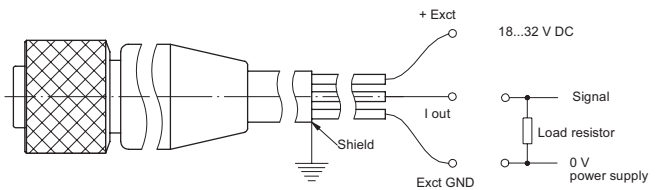
Degree of protection (mated)	(EN 60529)	IP	67
CE approval	EMC Regulations	2004/108/EG	
	EMC Standards	EN 61000-6-2	
		EN 61000-6-3	
		EN 61326-1	(Class A+B)
Marine qualification	IACS	E10	(planned)

Connector

- 1 Exct GND
- 2 don't connect
- 3 don't connect
- 4 don't connect
- 5 **Signal output**
- 6 don't connect
- 7 don't connect
- 8 **+ Exct (18 ... 32 V)**



Connection of Types 7614CG.../6613CG... to data acquisition system with connecting cable Type 1700A69A...



Important:

Shield must be connected to the case/shield of the data acquisition system (or engine control).
Shield and Exct GND must not be connected!

Optional Accessories

• Torque wrench 8 ... 40 N·m	1300A11
• Fork wrench SW 12 for Type 1300A11	1300A13
• Tubular socket	1300A145
• Connecting cable, l = 10 m	1700A69
• Connecting cable, l = 20 m	1700A69A1
• Connecting cable, l = 30 m	1700A69A2
• Connecting cable, l = 50 m	1700A69A3
• Connecting cable, l = 3 m	1700A69A4
• Connecting cable, l = 1,5 m	1700A69A5

Cylinder Pressure Sensor for Continuous Monitoring

Type 6613CA

Sensor designed with optimum service life for continuous cylinder pressure monitoring in diesel and gas engines. Because of its low thermal shock and high stability over the long term, this sensor is suitable for demanding monitoring and control tasks.

- Small thermal shock
- Long life: >20 000 h
- Insensitive to integral mounting

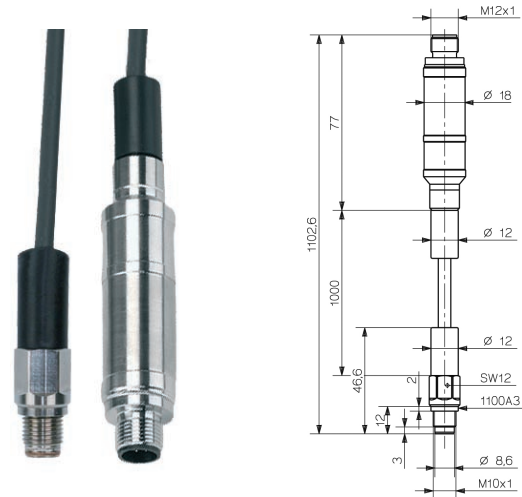
Description

The quartz measuring element and the charge amplifier incorporated in the plug are interconnected by an integral cable. The charge amplifier has two measuring ranges and selectable time constants. The short time constant guarantees stability of the output signal even with rapid changes in load and speed. The long time constant allows static calibration of the measuring chain. The measuring range and/or time constants are selected by appropriate interconnection of the plug pins. As a result of its patented "antistrain" design, the measuring element is insensitive to integral mounting, and largely insensitive to dirt and contamination. The rugged diaphragm permits the sensor to be used for knock detection.

The life expectancy of the sensor has been designed so that a life of >20 000 h can be achieved in a diesel and gas engine running. With heavy-oil operation, the service life depends very much on the corrosion occurring, while extreme contamination can reduce measuring accuracy.

Application

Type 6613CA has been specially developed for the monitoring and control of medium and large size diesel and gas engines. Cylinder pressure measurements can be made with high precision because of its very good thermodynamic characteristics.



Technical Data

Measuring range		
Range I	bar	0 ... 250
Range II	bar	0 ... 100
Sensitivity		
Range I (±0,5 %)	mV/bar	10
Range II (±0,5 %)	mV/bar	25
Overload	bar	300
Linearity	% FSO	≤±1
Sensitivity to acceleration	bar/g	0,001
Operating temperature range		
Sensor	°C	-50 ... 350
Plug with charge amplifier	°C	-10 ... 85
Thermal shock at 1 500 1/min, p _{mi} = 9 bar	bar	≤±0,5
Change in sensitivity		
200 ±150 °C	%	≤±2
200 ±50 °C	%	≤±1
Frequency range (-3 dB)	Hz	0,032 ... 20 000
Output voltage (with 1 mA load)		
max.	V	4,4 ... 5
min.	V	>0
Signal range	V	2,5
Zero point	V	2 ... 2,2
Supply voltage	VDC	7 ... 32
Output impedance	Ω	100
Plug DIN	M12x1	IP67
Weight	g	140
Tightening torque	N·m	15
Connector	8 pin	M12x1

6613C_000-404e-07.09

Installation

In order to minimize thermal stress on the sensor, it should be located so that good heat dissipation to colder components is possible. This can normally be achieved by a set-back location. Optimum sensor life is achieved at an average temperature of 200 ... 300 °C in the sensor body. An angled gas channel can also reduce the effect of flame on the diaphragm, and thereby minimize the short term drift of the sensor. In order to prevent singing oscillations, the lengths of the gas channel should not exceed 30 mm. Strong gas oscillations occur when the gas column between sensor and combustion chamber resonates. Superimposed on the cylinder pressure, these pressure oscillations impose an additional load on the sensor, resulting in reduced life of the sensor.

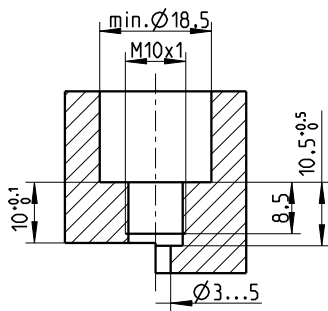


Fig. 1: Sensor bore



Fig. 2: Type 6613CA installed in indicator with additional stop valve for the sensor

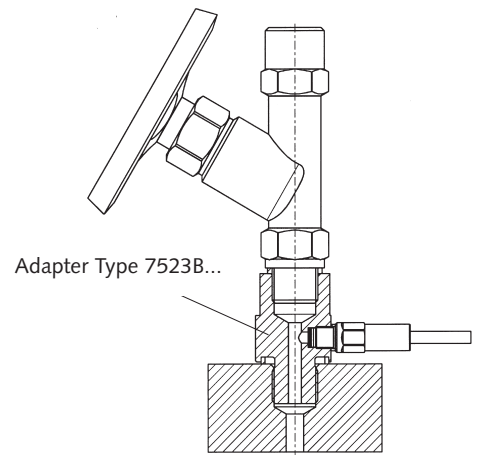


Fig. 3: Sensor installed with adapter Type 7523B... underneath the indicator valve

Accessories Included

- Cr-Ni seal

Type
1100A3

Optional Accessories

- Torque wrench 8 ... 40 N·m*
- Fork wrench SW 12 for 1300A11*
- Adapter M14 x 1,25
- Adapter BSP R1/2"
- Adapter M20x1,5 ... M20x1,5
- Adapter BSW3/4 ... BSW3/4
- Adapter G1/2" x G1/2"
- Tubular socket wrench

Type
1300A11
1300A13
6582A1
6582A2
7523B01
7523B02
7523B03
1300A6

* refer to data sheet special tools and sensor dummies (1300_000-068)

Connecting Cables

Type 1700A69, plug M12x1 at sensor side, one free cable end, Cable length l = 10 m, 3-wires	black = GND	standard cable without range selection,
	blue = signal 2,5 Vpp = 250 bar	
	brown = power supply 7 ... 32 VDC	
Type 1700A71, plug M12x1 at sensor side, one free cable end, Cable length l = 10 m, 4-wires	black = GND	standard cable, enables range selection, Range I/Range II
	blue = signal 2,5 Vpp = 250 bar	
	brown = power supply 7 ... 32 VDC	
	white = range selection (see manual)	
Type 1787A..., plug M12x1 at sensor side, Cable length A5 = 5 m, A20 = 20 m 8-wires	Pin allocation, see manual of Type 6613CA Chapt. 3.2.5	For calibration only, enables selection of range and time constant

Ordering Code

Cylinder pressure sensor for continuous monitoring

Type

6613CA

6613C_000-404e-07.09

Cylinder Pressure Sensor for Continuous Monitoring

Type 6351A

Sensor with M5 mounting thread and swivel nut designed with optimum service life for continuous cylinder pressure monitoring in diesel and gas engines. Thanks to its very small size, it is particularly suitable for compact engines where there is only a limited amount of space available for mounting a sensor. Because of its very high long term stability and low thermal shock, this sensor is suitable for demanding monitoring and control tasks.

- Very small size
- Easy mounting
- Long service life

Description

The piezoelectric sensor is connected to the charge amplifier by an integral cable. The small but very robust sensor can be used both for performance evaluation and determining the knock limit on gas engines. Because the time constant in the charge amplifier is short, a stable output signal is ensured, even during rapid changes in engine load and engine speed. The life expectancy of the sensor has been designed so that an average service life of >16 000 hours can be achieved in a 4-stroke engine running at 1500 rpm.

Application

This sensor is especially suitable for fast running diesel and gas engines; the very small size permits the sensor to be incorporated into engine components (e.g. mounting in the gas injection valve). The sensor is not suitable for slow running 2-stroke engines or engines using heavy fuel oil.



Technical data

Measuring range		
Range	bar	0 ... 250
Sensitivity		
Range I ($\pm 0,5\%$)	mV/bar	15
Overload	bar	300
Linearity	% FSO	$\leq \pm 1\%$
Sensitivity to acceleration	bar/g	0,001
Operating temperature range		
Sensor	$^{\circ}\text{C}$	-50 ... 250
Connector with charge amplifier	$^{\circ}\text{C}$	-10 ... 85
Thermal shock at 1 500 rpm, $p_{mi} = 9 \text{ bar}$		
	bar	$\leq \pm 0,5$
Change in sensitivity		
200 \pm 50 $^{\circ}\text{C}$	%	$\leq \pm 2$
200 \pm 50 $^{\circ}\text{C}$	%	$\leq \pm 1$
Frequency range (-3 dB)	Hz	0,032 ... 20 000
Output voltage (with 1 mA load)		
max.	V	4,4 ... 5
min.	V	>0
Signal span	V	4
Zero point	V	1 ... 1,1
Supply voltage	VDC	7 ... 32
Output impedance	Ω	100
DIN connector	M12x1	IP67
Weight	g	140
Tightening torque	N·m	2
Connector	8 pin	M12x1

Mounting

In order to minimize thermal stress on the sensor, it should be located so that good heat dissipation to colder components can occur. Optimum sensor life is achieved at an average temperature of 200 ... 250 °C in the sensor body. In addition, an angled gas channel can reduce the effect of flame on the diaphragm and thereby minimize the short term drift of the sensor. The gas channel (distance from sensor diaphragm to combustion chamber) must be selected in such a way that no pipe oscillations occur. Superimposed on the cylinder pressure, these gas oscillations impair the signal quality and reduce the service life of the sensor.

Ordering code

Cylinder pressure sensor for continuous monitoring

Type

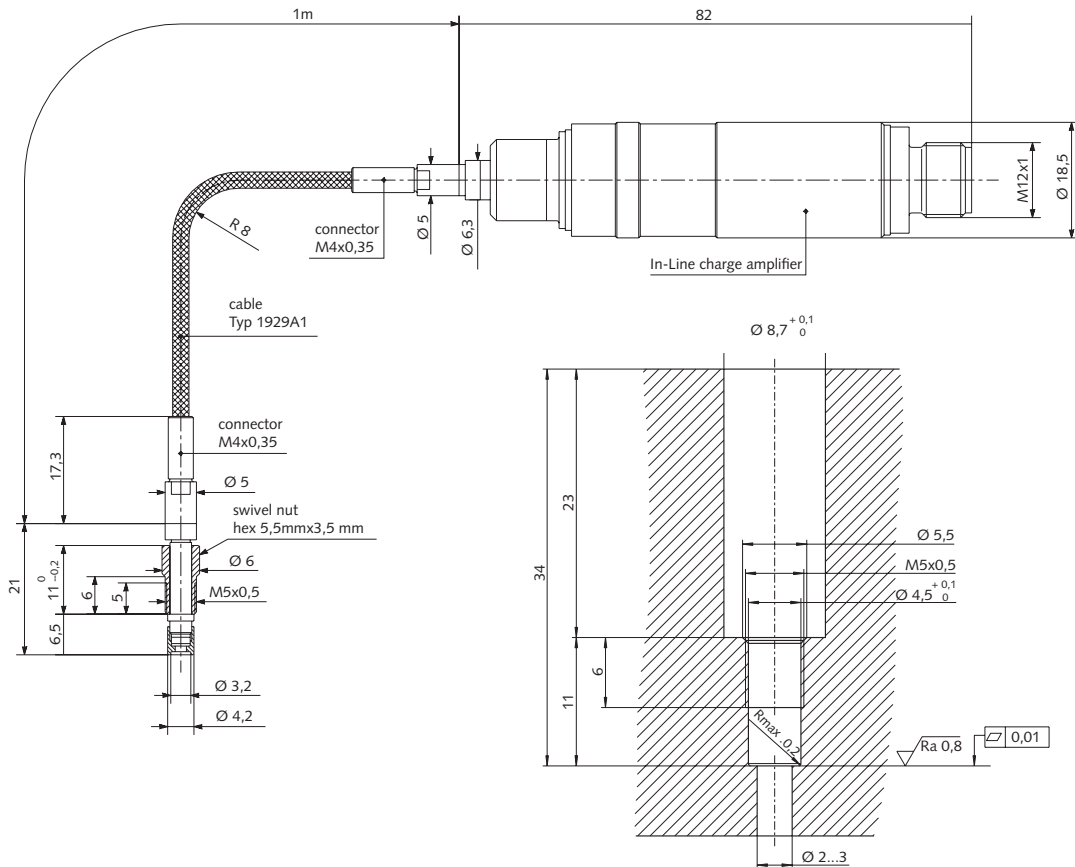
6351A

Accessories

- Torque wrench 1... 6 N·m
- Mounting wrench A/F 5,5
- Connecting cable M12x1; (10m)
- Connecting cable M12x1; (20m)

Type

- 1300A17
- 1300A9
- 1700A69
- 1700A69A1



Connecting cables

Type 1700A69, plug M12x1, sensor side, cable length l = 10 m, one free cable end with 3 wires	black = GND	Standard cable, without range selection
	blue = signal 2,5 Vpp = 250 bar	
	brown = power supply 7 ... 32 VDC	
Type 1787A..., plug M12x1, sensor side, cable length A5 = 5 m, A20 = 20 m one free cable end with 8 wires	Pin allocation, see instruction manual chapter 3.2.5	For calibration only, measurement ranges and time constants can be changed