Bosch Motorsport

Equipment for High Performance Vehicles

Edition 2006/2

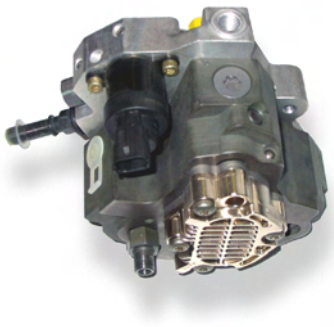
BOSCH

Contents

Diesel System Components

Diesel System Components

Injector CRI 3



HP fuel pump CP 3

Rail

Pressure sensor RDS

Pressure control valve DRV

Component	Specification
Injector CRI 3	6 - 8 holes, 900 ... 1500 ccm/min at 100 bar
High pressure fuel pump CP 3	Pump with control valve and optional gear pump, 0,677 ... 1,087 ccm/rev
Pressure control valve DRV	Pressure range: 100 ... 2000 bar
Pressure sensor RDS	Pressure range: 0 ... 2000 bar
Rail	Common rail for up to 6 cylinders

Further special versions and order numbers on request.

Engine Control Units

Motronic MS 1.10

The MS 1.10 is a highly sophisticated engine management system for high performance engines. The system contains 12 ignition power stages and 24 independent injection power stages. All internal power stages are short circuit protected and most of them are designed with a diagnosis interface. Various engine and chassis parameters can be measured with the different input channels and logged in the integrated flash card memory. Eight vibration sensor inputs allow knock detection and knock control. Four independent wide range lambda circuits allow lambda closed loop engine control.

Functionality
Injection timing
Ignition timing
Lambda control
Boost control (option)
Knock control
Data acquisition
Telemetry

Mechanical data	
Dust and waterproof aluminium housing	
4 connectors in military technology	
264 pins, each pin individually filtered	
Vibration damped circuit boards	
8 flexible housing fixation points	
Size	192 x 200 x 49 mm
Weight	2200 g

Conditions for use	
ECU temperature	-40 ... 75°C
Max. power consumption	30 W at 14 V
Max. vibration	15 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electronic design
In general
8 microcontrollers with 32 bit organisation
2 DSPs with 16 bit organisation
Calculation capacity 530 MIPS
Internal memory up to 1,8 GB
Real time clock
Inputs
2 inputs for Ni-Cr-Ni exhaust gas temperature sensors
4 lambda interfaces LSM or LSU
8 inputs for inductive or Hall effect wheel speed sensors
2 inputs for inductive or Hall effect crankshaft sensors
2 inputs for inductive or Hall effect camshaft sensors
30 universal inputs 0 to 5 V
8 inputs for vibration knock sensors
32 ESIB-inputs, 4 slots for microboards
External data logger lockable via 100 MBit Ethernet

Electronic design (Continuation)
Outputs
24 injection power stages (peak and hold)
12 ignition power stages
2 high current power stages (12 A, low-side)
13 power stages (2 A, low-side)
4 power stages (4 A, lambda-heater)
9 H-bridges (5A)
3 sensor supply 5 V/250 mA
3 sensor supply 10 V/250 mA
Communication interfaces
2 RS232 serial interfaces
1 K-line serial interface
6 CAN interfaces for ext. communication
2 Ethernet TCP/IP 100 Mbps
1 Burst telemetry 11 Mbps internal
Memory
Internal memory up to 1,8 GB for data acquisition, 2 PC-card slots for memory and other peripherals

Software Functions

Injection timing
Injection timing based on cylinder charge model
Minimum 3 sets of lambda mappings as a function of engine charge and engine revolution, selectable by a dashboard switch
Correction of injection time during engine operation as a function of cylinder number, air temperature, water temperature, ambient pressure, fuel pressure and fuel temperature
Load transient compensation
Fuel cut-off as a function of throttle position and engine revolution
Fuel cut-in algorithm
Engine start parameter for injection time as a function of water temperature, number of ignitions after first crankshaft rotation and revolution
Post start enrichment
Injection position timing as a function of engine charge and engine revolution
Altitude correction as a function of ambient pressure, charge and revolution

Lambda control
4 independent circuits for wide range lambda control
Lambda control with adaptation

Ignition timing
Engine start parameters for ignition angle as a function of water temperature, intake air temperature and revolution
Basic ignition maps as a function of engine charge and engine revolution
Correction of ignition angle during engine operation as a function of cylinder number, air and water temperature and ambient pressure
Unequal fire intervals
Solutions for any vee angle, firing order and number of cylinders

Knock control
Knock detection based on eight independent vibration sensor circuits
Knock control maps as a function of cylinder number, engine load and revolution
Adaptation maps for steady-state and transient operation and revolution

Speed limitation
Different realisations of soft or/and hard engine revolution limiters
Pit lane speed limiter

Data acquisition

- Compact flash card memory
- Complete chassis and engine data acquisition
- Engine logbook function
- Lap time, time differences, lap distance calculation
- Fuel consumption calculation

Boost control (option)

- Boost pressure control with min. 12 nominal pressure maps as a function of throttle position and engine revolution, selectable by a dashboard switch
- Closed loop wastegate control
- Self learning adaptation for boost pressure
- Overshoot function
- Undershoot function

Gear box control (option)

- Gear change activated by hydraulic MOOG-valves
- Closed loop clutch control
- Hydraulic activated throttle blip
- Hydraulic locked reverse gear
- Up and downshift with calibratable spark and fuel cut

Slip control (option)

- Measurement of four wheelspeeds
- Gear and track based functionality
- Minimum two nominal slip maps as a function of load and car speed, selectable by a dashboard switch
- PID closed loop controller with gear individual parameter sets
- Self learning adaptation
- Engine torque control as a function of current load, PID controller and adaptation
- Torque reduction by reduced spark advance or/and individual cylinder fuel cut off

Additional engine control functions (option)

- Trumpet control
- Further customer-specific functions on request

Motronic MS 2.9

The MS 2.9 engine management system contains 12 ignition power stages and 24 independent injection power stages. All internal power stages are designed with a diagnosis interface. Various engine and chassis parameters can be measured and logged in the integrated flash card memory. Eight vibration sensor inputs allow knock detection and knock control. Four independent wide range lambda circuits allow lambda closed loop engine control.

Functionality
Injection timing
Ignition timing
Lambda control
Boost control (option)
Knock control
Data acquisition
Telemetry

Mechanical data	
Dust and waterproof aluminium housing	
Connectors in military technology	
Each pin individually filtered	
Vibration damped circuit boards	
Flexible housing fixation points	
Size	194 x 245x 72,1 mm
Weight	2280 g

Conditions for use	
ECU temperature	-40 ... 65°C
Max. power consumption	18 W at 14 V
Max. vibration	15 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electronic data
In general
9 microcontrollers with 16 bit organisation, calculator capacity 70 MIPS
Real time clock
Inputs
4 inputs for Ni-Cr-Ni exhaust gas temperature sensors
4 lambda LSM 11 interfaces
4 inputs for inductive wheel speed sensors (Hall optional)
42 universal inputs 0 ... 5 V
6 differential inputs ± 5 V
1 input for inductive or Hall crankshaft sensor
1 input for inductive or Hall camshaft sensor
8 knock sensor inputs
Outputs
All power stages short circuit protected
12 peak and hold injection power stages with diagnosis interface
12 switched injection power stages with diagnosis interface
12 ignition power stages with diagnosis interface
3 high current power stages (12 A)
12 high speed power stages (2 A)
3 sensor supply 5 V/100 mA
3 sensor supply 10 V/200 mA
Communication interfaces
2 RS232 interface for telemetry and laptrigger
1 2-Mbaud interface for memory and data read out or high speed telemetry
3 CAN interfaces
Memory
Compact Flash Card memory for data acquisition

Motronic MS 2.9.1

The MS 2.9.1 engine management system contains 12 ignition power stages and 12 independent injection power stages. All internal power stages are designed with a diagnosis interface. Various engine and chassis parameters can be measured and logged in the integrated flash card memory. Four vibration sensor inputs allow knock detection and knock control. Four independent wide range lambda circuits allow lambda closed loop engine control.

Functionality
Injection timing
Ignition timing
Lambda control
Boost control (option)
Knock control
Data acquisition
Telemetry

Mechanical data	
Dust and waterproof aluminium housing	
Connectors in military technology	
Each pin individually filtered	
Vibration damped circuit boards	
Flexible housing fixation points	
Size	194 x 245x 72,1 mm
Weight	2280 g

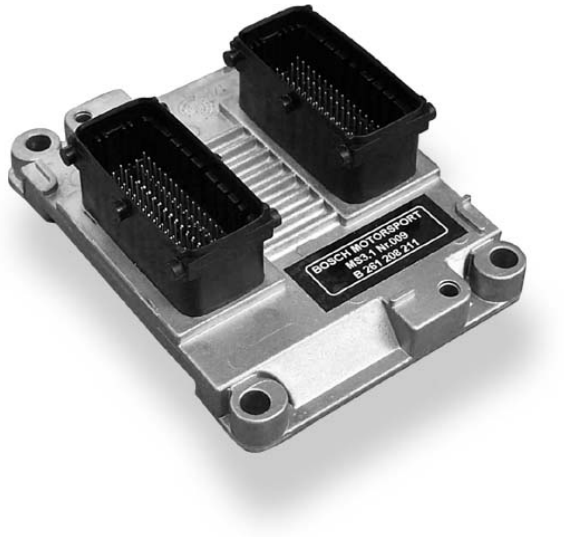
Conditions for use	
ECU temperature	-40 ... 65°C
Max. power consumption	18 W at 14 V
Max. vibration	15 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electronic data
In general
8 microcontrollers with 16 bit organisation, calculator capacity 50 MIPS
Real time clock

Inputs
4 inputs for Ni-Cr-Ni exhaust gas temperature sensors
4 lambda LSM 11 interfaces
4 inputs for inductive wheel speed sensors (Hall optional)
42 universal inputs 0 ... 5 V
6 differential inputs ± 5 V
1 input for inductive or Hall crankshaft sensor
1 input for inductive or Hall camshaft sensor
4 knock sensor inputs
Outputs
All power stages short circuit protected
12 peak and hold injection power stages with diagnosis interface
12 ignition power stages with diagnoses interface
3 high current power stages (12 A)
3 sensor supply 5 V/100 mA
3 sensor supply 10 V/200 mA
Communication interfaces
2 RS232 interface for telemetry and laptrigger
1 2-Mbaud interface for memory and data read out or high speed telemetry
3 CAN interfaces
Memory
Compact Flash Card memory for data acquisition

Motronic MS 3.1

The MS 3.1 is the first Bosch engine management system in full hybrid technique and for engines up to 6 cylinders. Two independent circuits are available for vibration knock detection and knock control. Injection time, injection end timing and ignition timing are calculated from basic maps and can be corrected by different engine parameters. Also two closed loop wide range lambda circuits are available. Various engine parameters can be measured with different input channels and transferred via CAN interface to an optional flash card data logger.



Functionality
Engine management system for 4- and 6-cylinder engines
Sequential fuel injection
Ignition timing
Lambda control
Knock control
Fuel cut off
Component diagnosis

Mechanical data	
Extremely small and flat aluminium pressure casting housing	
Connectors with high pin density	
Extremely shock and vibration proof hybrid technology	
Four housing fixation points	
Size	120 x 90 x 40 mm
Weight	250 g

Conditions for use	
ECU temperature	-40 ... 125°C
Max. power consumption	10 W at 14 V
Max. vibration	50 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electronic data	
In general	
2 microcontrollers with 16 bit organisation calculation capacity 20 MIPS	
Inputs	
2 lambda LSU4 interfaces	
3 analogous inputs 0 ... 5 V for water temperature, oil temperature, intake air temperature	
3 analogous inputs 0 ... 5 V for oil pressure, fuel pressure, ambient pressure	
1 analogous input 0 ... 5 V for throttle position sensor	
1 digital input for lap trigger	
1 digital input for wheel speed sensor	
1 input for inductive crankshaft sensor	
1 input for hall camshaft sensor	
2 knock sensor interfaces	
Outputs	
6 injection power stages with diagnosis interface	
2 high current power stages (8 A) with diagnosis interface for LSU heating	
6 ignition power stages	
Sensors supply output	5 V/100 mA
Separate supply output for throttle position sensor	5 V/100 mA
2 power stages (1 A) for main relay and fuel pump relay control	

Communication interfaces
1 CAN interface
1 K-Line interface

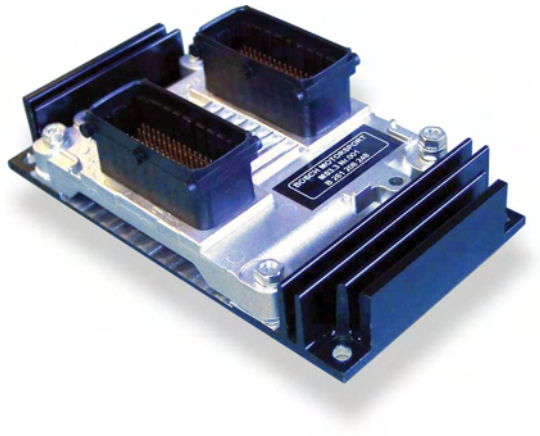
Cable harness connectors	
Order numbers:	**D 261 205 139**
	D 261 205 140

Necessary equipment	
KIC2-standard connector	**B 261 206 859**
KIC2-diagnosis connector with ignition bridge	**B 261 206 866**
KIC2-diagnosis connector without ignition bridge	**B 261 206 867**

Order numbers	
MS 3.1 incl. Modas for notebook	**B 261 208 245**

Motronic MS 3.3

The MS 3.3 is an engine management system in full hybrid technique and for engines up to 8 cylinders. Two independent circuits are available for vibration knock detection and knock control. Injection time, injection end timing and ignition timing are calculated from basic maps and can be corrected by different engine parameters. Also two closed loop wide range lambda circuits are available. Various engine parameters can be measured with different input channels and transferred via CAN interface to an optional flash card data logger.



Functionality
Engine management system for 8-cylinder engines
Sequential fuel injection
Ignition timing
Lambda control
Knock control
Fuel cut off
Component diagnosis

Mechanical data	
Extremely small and flat aluminium pressure casting housing	
Connectors with high pin density	
Extremely shock and vibration proof hybrid technology	
Four housing fixation points	
Size	162 x 90 x 44 mm
Weight	450 g

Conditions for use	
ECU temperature	-40 ... 75°C
Max. power consumption	10 W at 14 V
Max. vibration	50 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electronic data	
In general	
2 microcontrollers with 16 bit organisation calculation capacity 20 MIPS	
Inputs	
2 lambda LSU4 interfaces	
3 analogous inputs 0 ... 5 V for water temperature, oil temperature, intake air temperature	
3 analogous inputs 0 ... 5 V for oil pressure, fuel pressure, ambient pressure	
1 analogous input 0 ... 5 V for throttle position sensor	
1 digital input for lap trigger	
1 digital input for wheel speed sensor	
1 input for inductive crankshaft sensor	
1 input for hall camshaft sensor	
2 knock sensor interfaces	
Outputs	
8 injection power stages with diagnosis interface	
2 high current power stages (8 A) with diagnosis interface for LSU heating	
4 ignition power stages	
Sensors supply output	5 V/100 mA
Separate supply output for throttle position sensor	5 V/100 mA
2 power stages (1 A) for main relay and fuel pump relay control	

Communication interfaces
1 CAN interface
1 K-Line interface

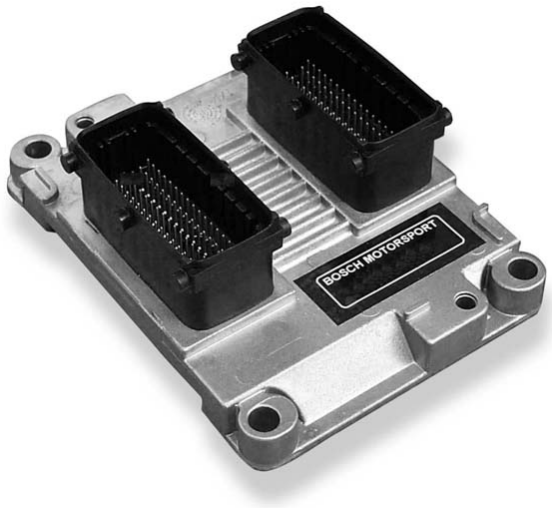
Cable harness connectors	
Order numbers:	**D 261 205 139**
	D 261 205 140

Necessary equipment	
KIC2-standard connector	**B 261 206 859**
KIC2-diagnosis connector with ignition bridge	**B 261 206 866**
KIC2-diagnosis connector without ignition bridge	**B 261 206 867**

Order numbers	
MS 3.3 incl. Modas for notebook	**B 261 208 250**

Motronic MS 3.4

The MS 3.4 is an engine management system in full hybrid technique and specially adapted for motorbikes. It allows engine speeds up to 20.000 rpm. Two independent circuits are available for vibration knock detection and knock control. Injection time, injection end timing and ignition timing are calculated from basic maps and can be corrected by different engine parameters. Also two closed loop wide range lambda circuits are available. Various engine parameters can be measured with different input channels and transferred via CAN interface to an optional flash card data logger.



Functionality
Engine management system for 4-cylinder engines
Sequential fuel injection
Ignition timing
Lambda control
Knock control
Fuel cut off
Component diagnosis
Engine speed up to 20.000 rpm
Variable firing order

Mechanical data	
Extremely small and flat aluminium pressure casting housing	
Connectors with high pin density	
Extremely shock vibration proof hybrid technology	
Four housing fixation points	
Size	120 x 90 x 40 mm
Weight	250 g

Conditions for use	
ECU temperature	-40 ... 125°C
Max. power consumption	10 W at 14 V
Max. vibration	50 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electronic data
In general
2 microcontrollers with 16 bit organisation, calculation capacity 20 MIPS
Inputs
2 lambda LSU4 interfaces
3 analogous inputs 0 ... 5 V for water temperature, oil temperature, intake air temperature
3 analogous inputs 0 ... 5 V for oil pressure, fuel pressure, ambient pressure
1 analogous input 0 ... 5 V for throttle position sensor
1 digital input for lap trigger
1 digital input for wheel speed sensor
1 input for inductive crankshaft sensor
1 input for hall camshaft sensor
2 knock sensor interfaces
Outputs
4 injection power stages with diagnosis interface
2 high current power stages (8 A) with diagnosis interface for LSU heating
4 ignition power stages
Sensors supply output 5 V/100 mA
Separate supply output for throttle position sensor 5 V/100 mA
2 power stages (1 A) for main relay and fuel pump relay control

Communication interfaces
1 CAN interface
1 K-Line interface

Cable harness connectors	
Order numbers:	**D 261 205 139**
	D 261 205 140

Necessary equipment	
KIC2-standard connector	**B 261 206 859**
KIC2-diagnosis connector with ignition bridge	**B 261 206 866**
KIC2-diagnosis connector without ignition bridge	**B 261 206 867**

Order numbers	
MS 3.4 incl. Modas	**B 261 208 276**

Motronic MS 4.0

The MS 4.0 is a highly sophisticated engine management system for high performance engines. The system contains 8 ignition drivers for external power stages and 8 independent injection power stages. Two vibration sensor inputs allow knock detection and knock control. Two independent wide range lambda circuits allow lambda closed loop engine control. Various engine parameters can be measured with different input channels and transferred via CAN interface to an optional flash card data logger.

Mechanical data	
Sheet-metal housing	
Each connector pin individually filtered	
Vibration damped circuit boards	
Size	180 x 162 x 46 mm
Weight	430 g

Functionality
Injection timing
Ignition timing
Lambda control
Knock control
Traction control
Turbo functionality

Conditions for use	
Temperature range	-40 ... 75°C
Max. power consumption	30 W at 14 V
Max. vibration	15 g sinus at 20 Hz ...2 kHz for t < 5 h

Electronic design
Inputs
2 inputs for exhaust gas temperature sensors
2 lambda interfaces LSU
4 inputs for Hall effect wheel speed sensors
1 input for inductive or Hall effect crankshaft sensor
16 universal inputs 0 ... 5 V
2 inputs for vibration knock sensors
7 digital inputs
Outputs
8 injection power stages
8 ignition drivers
20 power stages (2,7 A/0,6 A; low side; PWM)
2 power stages for lambda heater
1 H-bridge (5 A)
2 sensor supply 5 V/100 mA
Communication interfaces
1 K-line serial interfaces
2 CAN interfaces for external communication

Order number	
MS 4.0 incl. Modas	**B 261 208 300**

Motronic MS 4.1

The MS 4.1 is a highly sophisticated engine management system for high performance engines. The system contains 8 ignition drivers for external power stages and 16 independent injection power stages. Various engine and chassis parameters can be measured with the different input channels and logged on the internal data logger. Two vibration sensor inputs allow knock detection and knock control. Two independent wide range lambda circuits allow lambda closed loop engine control.

Mechanical data	
Dust and waterproof aluminium housing	
3 connectors in military technology with high pin density	
165 pins, each pin individually filtered	
Vibration damped circuit boards	
8 flexible housing fixation points	
Size	180 x 162 x 46 mm
Weight	1170 g

Conditions for use	
Temperature range	-40 ... 75°C
Max. power consumption	30 W at 14 V
Max. vibration	15 g sinus at 20 Hz ...2 kHz for t<5 h

Functionality
Injection timing
Ignition timing
Lambda control
Knock control
Data acquisition
Telemetry
Traction control
Turbo functionality

Electronic design
Inputs
2 inputs for exhaust gas temperature sensors
2 lambda interfaces LSU
4 inputs for Hall effect wheel speed sensors
1 input for inductive or Hall effect crankshaft sensor
31 universal inputs 0 ... 5 V
2 inputs for vibration knock sensors
7 digital inputs
Outputs
16 injection power stages
8 ignition drivers
26 power stages (2,7 A/0,6 A; low side; PWM)
2 power stages for lambda heater
1 H-bridge (5 A)
2 sensor supply 5 V/100 mA
Communication interfaces
1 RS232 serial interface
2 K-line serial interfaces
2 CAN interfaces for external communication
1 SPI
Memory
Internal memory up to 48 MB for data acquisition

Motronic MS 4.2

The MS 4.2 is a highly sophisticated engine management system for high performance engines. The system contains 8 ignition drivers for external power stages and 16 independent injection power stages. Various engine and chassis parameters can be measured with the different input channels and logged on the compact flash card data logger. Two vibration sensor inputs allow knock detection and knock control. Two independent wide range lambda circuits allow lambda closed loop engine control.

Mechanical data	
Dust and waterproof aluminium housing	
3 connectors in military technology with high pin density	
165 pins, each pin individually filtered	
Vibration damped circuit boards	
8 flexible housing fixation points	
Size	192 x 162 x 52 mm
Weight	1240 g

Conditions for use	
Temperature range	-40 ... 75°C
Max. power consumption	30 W at 14 V
Max. vibration	15 g sinus at 20 Hz ...2 kHz for t<5 h

Functionality
Injection timing
Ignition timing
Lambda control
Knock control
Data acquisition
Telemetry
Traction control
Turbo functionality

Electronic design
Inputs
2 inputs for exhaust gas temperature sensors
2 lambda interfaces LSU
4 inputs for Hall effect wheel speed sensors
1 input for inductive or Hall effect crankshaft sensor
31 universal inputs 0 ... 5 V
2 inputs for vibration knock sensors
7 digital inputs
Outputs
16 injection power stages
8 ignition drivers
26 power stages (2,7 A/0,6 A; low side; PWM)
2 power stages for lambda heater
1 H-bridge (5 A)
2 sensor supply 5 V/100 mA
Communication interfaces
1 RS232 serial interface
2 K-line serial interfaces
2 CAN interfaces for external communication
1 SPI
Compact Flash Card memory for data acquisition

Order number	
MS 4.2 incl. Modas	**F 01E B01 638**

Power supply units

HPI Box

In combination with a Bosch Motorsport ECU the HPI box enables the running of high pressure injection valves. The injector current is realised by a switched current regulation with a pre-magnetisation phase, booster period, pick-up period, holding period and recharging period.

HPI 2.5

Mechanical data	
Max. number of cylinders	6
Dust and waterproof aluminium housing	
Filtered connectors in military technology with high pin density	
Vibration damped printed circuit boards	
Flexible housing fixation points	
Rail pressure regulation	
Size with connectors	165 x 132 x 51 mm
Weight	2070 g
Booster	internal
Communication interfaces	2 CAN, K-line
Lambda measurement	2 LSU 4.9

Conditions for use	
Operating temperature	-40 ... 85°C
Min. voltage	10 V
Max. vibration	30g sinus at 20 ... 2000 Hz for t<5h

Electronic data	
Optimised for Bosch injection valves HDEV 1.2	
Max. rpm	10000 at I=16 A (peak current) 8500 at I=18 A (peak current) 7000 at I=20 A (peak current)

Order number
on request

PSU 2.12

Mechanical data	
Max. number of cylinders	12
Dust and waterproof aluminium housing	
Filtered connectors in military technology with high pin density	
Vibration damped printed circuit boards	
Flexible housing fixation points	
Rail pressure regulation 2 banks	
Size with connectors	165 x 132 x 51 mm
Weight	2070 g
Booster	internal
Communication interfaces	2 CAN, K-line
Lambda measurement	2 LSU 4.9

Conditions for use	
Operating temperature	-40 ... 85°C
Min. voltage	10 V
Max. vibration	30g sinus at 20 ... 2000 Hz for t<5h

Electronic data	
Optimised for Bosch injection valves HDEV 1.2	
Max. rpm	10000 at I=16 A (peak current) 8500 at I=18 A (peak current) 7000 at I=20 A (peak current)

Order number
on request

Sensors

Pressure Sensors Air

Absolute Pressure Sensor PS-10

Pressure range: 10 x 0,2 ... 1,15 bar nominal

The pressure box is designed for measuring air pressure and specially modified for motorsport use. With its 10 analogous outputs it can take 10 measurements simultaneously.

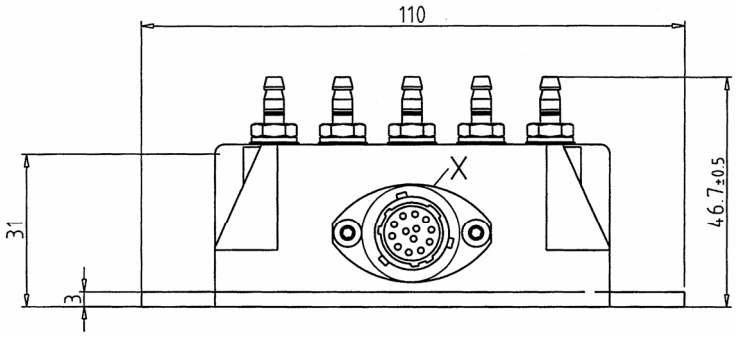
Mechanical data	
Measurement transducer	piezoresistive
Pressure range	10 x 0,2 ... 1,15 bar nominal
Max. pressure	10 bar nominal
Weight	185 g
Dimensions	110 x 87 x 47 mm
Sensor connector	3 mm

Conditions for use	
Temperature range	-40 ... 125°C
Max. vibration	15 g /30 ... 200 Hz

Characteristic	
Sensitivity	4470 mV/bar
Offset	-490 mV
Sensitivity and offset will be delivered with each sensor	

Electronic data	
Power supply	12 V
Compensated range	20 ... 85°C
Non linearity	1,00 %
Therm. zero point drift	< 1,00 %
Therm. sensitivity drift	< 1,00 %
Long time drift	< 1,00 %
Full scale output	0,4 ... 4,65 V
Time of reaction	1 ms (90 %)

Order number	
AS 0-10-35PN	**B 261 206 865**
Offer drawing	**A 261 206 865**



Absolute Pressure Sensor PSA-B

Pressure range: 0,1 ... 1,15 / 0,2 ... 2,5 bar nominal

A piezoresistive pressure sensor modified for precision air pressure measurement, especially air box pressure. It is manufactured in a DR-25 sleeve, various connector options are available.

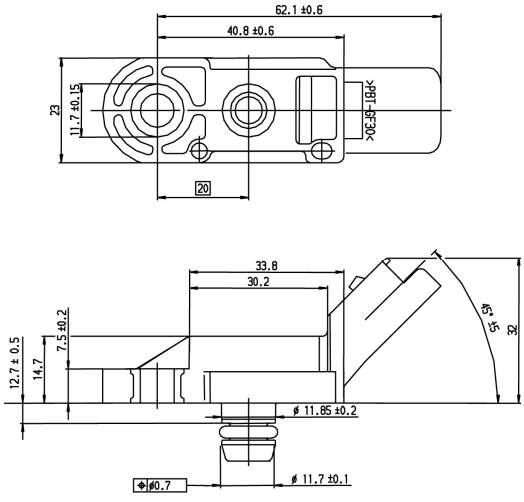
Mechanical data	
Max. pressure	3 [5] bar
Fitting	11,85 mm
Weight	45 g
Sealing	O-ring 7,59 x 2,62

Conditions for use	
Temperature range	-40 ... 125°C
Max. temp. of location	130°C
Max. vibration	250 g/200 ... 500 Hz

Characteristic	
0,1 ... 1,15 bar:	
Sensitivity	4040 mV/bar
Offset	-4,8 mV
0,2 ... 2,5 bar:	
Sensitivity	1848 mV/bar
Offset	30,4 mV

Electronic data	
Power supply	4,75 ... 5,25 V
Full scale output	0,1 ... 4,65 V
Compensated range	40 ... 130°C
Non linearity	0,25 %
Therm. zero point drift	< 0,5 %
Therm. sensitivity drift	< 0,5 %
Long time drift	< 0,5 %

Order numbers	
0,1 ... 1,15 bar:	
AS 6-06-05PC-HE	**B 261 209 702**
Offer drawing	**A 261 209 702**
0,2 ... 2,5 bar:	
AS 6-06-05PC-HE	**B 261 209 710**
Offer drawing	**A 261 260 710**



Absolute Pressure Sensor PSA-C

Pressure range: 0,2 ... 1,05 / 2,5 bar nominal

A piezoresistive pressure sensor for ambient air pressure measurement.

Mechanical data	
Measurement transducer	piezoresistive
Max. pressure	5 bar
Thread	M6
Weight	40 g

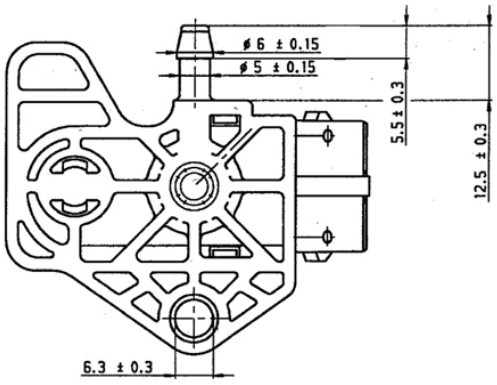
Electronic data	
Power supply	4,75 ... 5,25 V
Full scale output	0,4 ... 4,65 V
Time of reaction	10 ms (90%)
Max. current	< 10 mA
Resistance	> 50 kΩ

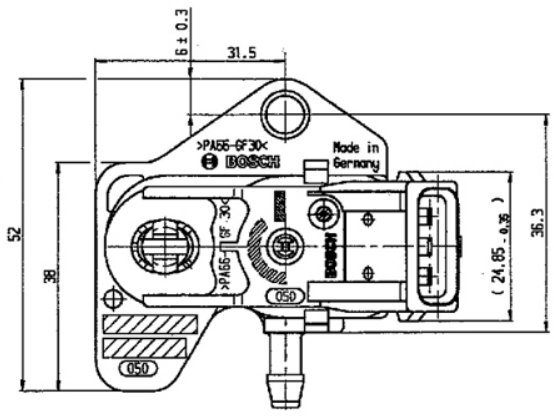
Conditions for use	
Temperature range	-40 ... 125°C
Max. temp. of location	130°C
Max. vibration	15 g /30 ... 200 Hz

Connector	
Cable harness connector	D 261 205 289

Characteristic	
0,2 ... 1,05 bar:	
Sensitivity	5000 mV/bar
Offset	-600 mV
0,2 ... 2,5 bar:	
Sensitivity	1847 mV/bar
Offset	30 mV

Order numbers	
0,2 ... 1,05 bar:	**0 261 230 037**
0,2 ... 2,5 bar:	**0 281 002 389**
Offer drawing	**A 261 260 143**





Absolute Pressure Sensor PSB-2

Pressure range: 0,1 ... 2 bar nominal

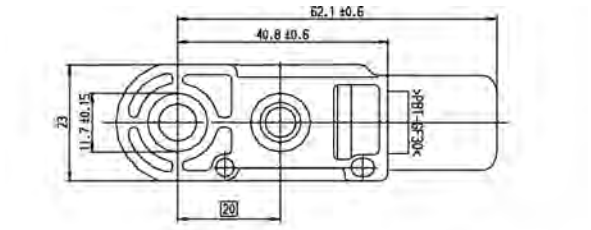
An absolute pressure sensor modified for precision air pressure measurement, especially boost pressure. It is manufactured in a DR-25 sleeve, various connector options are available.

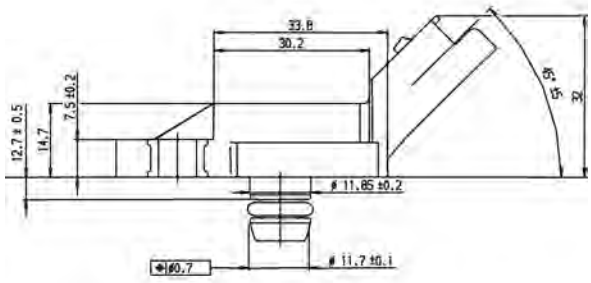
Mechanical data	
Max. pressure	3 bar
Fitting	11,85 mm
Weight	45 g
Sealing	O-ring 7,59 x 2,62

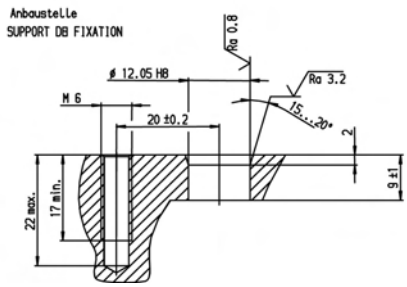
Order numbers	
ASL 6-06-05PC-HE	**B 261 209 337**
Offer drawing	**A 261 209 337**
ASU 6-03-05-PC-HE	**B 261 209 959**
Offer drawing	**A 261 209 959**

Conditions for use	
Temperature range	-40 ... 125°C
Max. temp. of location	130°C
Max. vibration	250 g /200 ... 500 Hz

Electronic data	
Power supply	5 V
Compensated range	40 ... 130°C
Non linearity	0,25 %
Therm. zero point drift	< 0,5 %
Therm. sensitivity drift	< 0,5 %
Long time drift	< 0,5 %
Full scale output	0,4 ... 4,65 V







Absolute Pressure Sensor PSB-4

Pressure range: 0,5 ... 4 bar nominal

An absolute pressure sensor modified for precision air pressure measurement, especially boost pressure. It is manufactured in a DR-25 sleeve, various connector options are available.

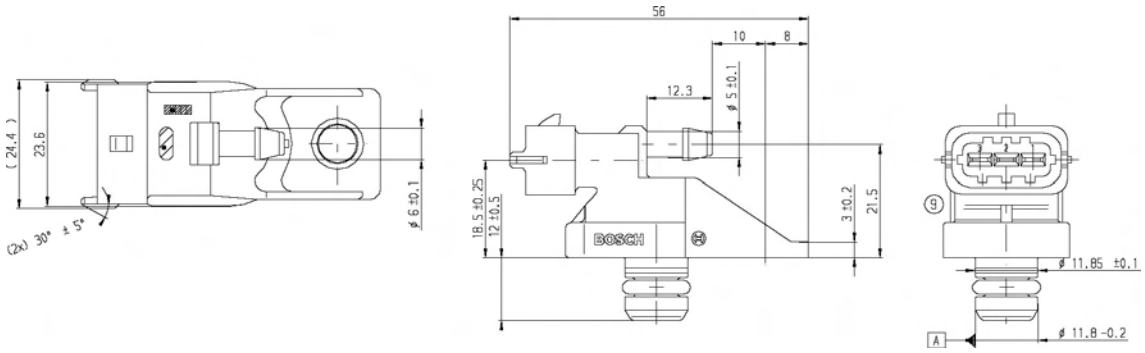
Mechanical data	
Max. pressure	4,5 bar
Fitting	11,85 mm
Weight	45 g
Sealing	O-ring 7,59 x 2,62

Conditions for use	
Temperature range	-40 ... 80°C
Max. temp. of location	130°C
Max. vibration	8 g /10 ... 1000 Hz

Characteristic
Sensitivity and offset will be delivered with each sensor.

Electronic data	
Power supply	5 V
Compensated range	-40 ... 80°C
Non linearity	0,25 %
Therm. zero point drift	< 0,5 %
Therm. sensitivity drift	< 0,5 %
Long time drift	< 0,5 %
Full scale output	0,5 ... 4,5 V

Order numbers	
ASL 6-06-05PC-HE	**B 261 209 348**
Offer drawing	**A 261 209 348**
ASU 6-03-05PN-HE	**B 261 209 954**
Offer drawing	**A 261 209 954**



Absolute Pressure Sensor PSP

Pressure range: 0,2 ... 3 bar nominal

An absolute pressure sensor modified for precision air pressure measurement.

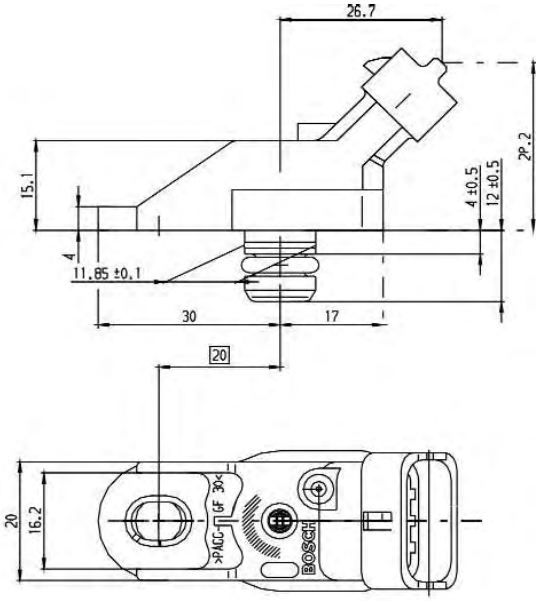
Mechanical data	
Max. pressure	5 bar
Characteristic	20°C/2,5 kΩ
Fitting	∅ 11,8 mm
Weight	17 g
Sealing	O-ring

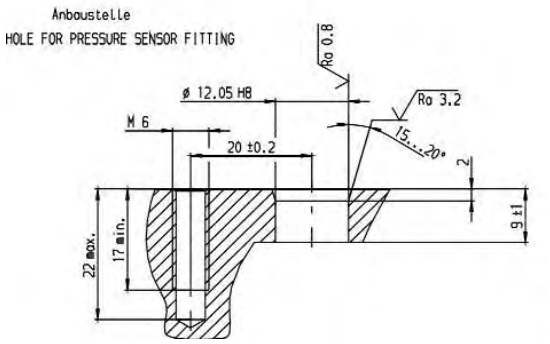
Conditions for use	
Temperature range	-40 ... 130°C
Max. vibration	4 g/20 ... 71 Hz
Max. temp. of location	130 °C

Characteristic	
Sensitivity	1517 mV/bar
Offset	96 mV

Electronic data	
Power supply	5 V
Compensated range	-40 ... 125°C
Non linearity	0,25 %
Therm. zero point drift	< 0,5 %
Therm. sensitivity drift	< 0,5 %
Long time drift	< 0,5 %
Full scale output	0,4 ... 4,65 V

Order number	
AS 6-06-05PC-HE	**B 261 209 690**
Offer drawing	**A 261 260 139**





Absolute Pressure Sensor PST

Pressure range: 0,1 ... 1,15 bar nominal

An absolute pressure sensor with integrated temperature sensor for ambient air and various fluid pressure measurements.

Mechanical data	
Max. pressure	2,3 bar
Characteristic	20°C/2,5 kΩ
Fitting	∅ 17,6 mm
Weight	35 g
Sealing	O-ring 7,65 x 1,63

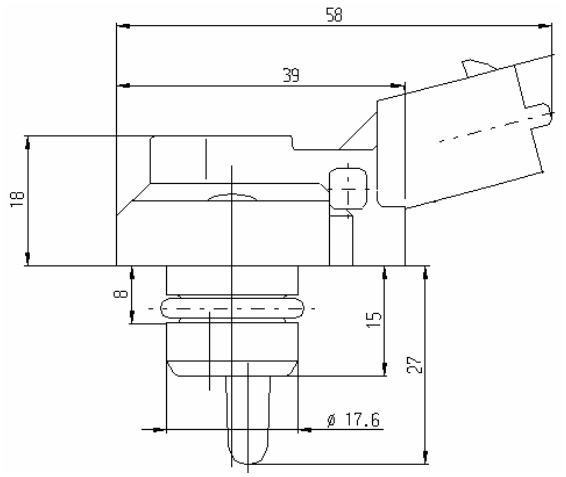
Conditions for use	
Temperature range	-40 ... 125°C
Vibration	250 g/200 ... 500 Hz
Max. temp. of location	130°C

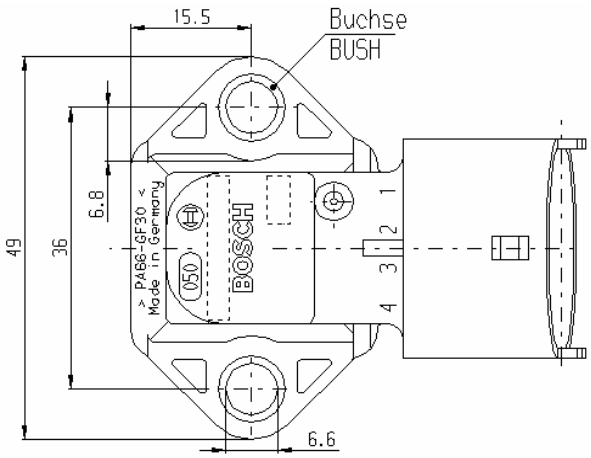
Characteristic	
Sensitivity	4048 mV/bar
Offset	-4,76 mV

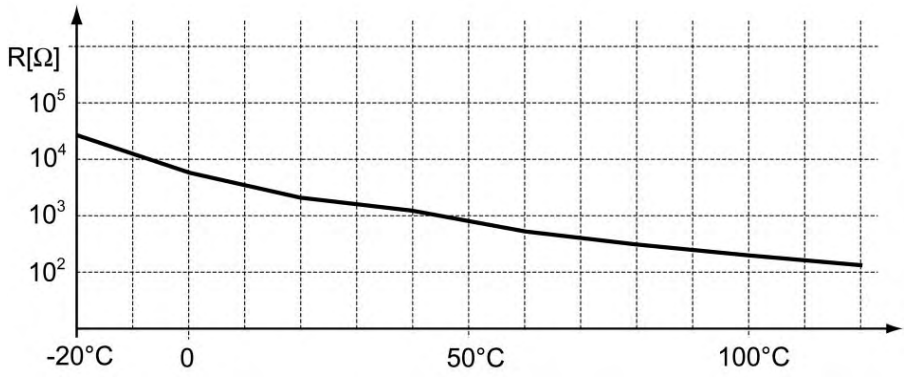
Electronic data	
Power supply	5 V
Compensated range	-40 ... 125°C
Non linearity	0,25 %
Therm. zero point drift	< 0,5 %
Therm. sensitivity drift	< 0,5 %
Long time drift	< 0,5 %
Full scale output	0,4 ... 4,65 V

Connector	
Cable harness connector	**D 261 205 336**

Order numbers	
	0 261 230 022
Offer drawing	**A 261 260 253**
ASL 6-06-05PE-HE	**B 261 209 717**
Offer drawing	**A 261 209 717**







°C	R(Ω)
-40	45 313
-35	34 281
-30	26 114
-25	20 003
-20	15 462
-15	12 002
-10	9 397
-5	7 415
0	5 896
5	4 712
10	3 792
15	3 069
20	2 500
25	2 057
30	1 707
35	1 412
40	1 175
45	987,6
50	833,9
55	702,8
60	595,5

°C	R(Ω)
65	508,3
70	435,7
75	374,2
80	322,5
85	279,6
90	243,2
95	212,7
100	186,6
105	163,8
110	144,2
115	127,3
120	112,7
125	100,2
130	89,30
135	79,65
140	71,20
145	63,86
150	57,41
155	51,82
160	46,88

Pressure Sensors Fluid

Absolute Pressure Sensor PSC-10

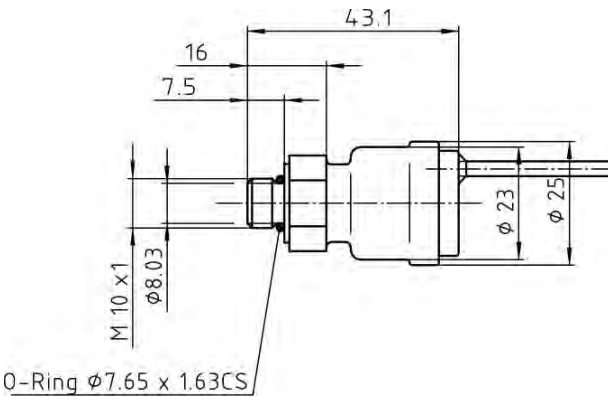
Pressure range: 0 ... 10 bar nominal

A M10 x 1 sensor for various fluid pressure measurement. The sensor range covers pressure measurement up to 10 bar. It is manufactured in a DR-25 sleeve, various connector options are available. Gauge and absolute pressure sensors are available.

Mechanical data	
Measurement transducer	piezoresistive
Max. pressure	20 bar
Thread	M10 x 1
Tightening torque	10 Nm
Wrench size	17 mm
Weight	70 g
Sealing	O-ring 7,65 x 1,63

Conditions for use	
Temperature range	-40 ... 125°C
Max. vibration	15 g/30 ... 200 Hz

Characteristic	
Sensitivity	400 mV/bar
Offset	100 mV



Electronic data	
Power supply	5 ... 6 V/8 ... 16 V
Compensated range	25 ... 85 °C
Current supply	8 ... 16 mA
Non linearity	1 %
Therm. zero point drift	< 1 %
Therm. sensitivity drift	< 1 %
Long time drift	< 1 %
Full scale output	0,5 ... 4,5 V
Time of reaction	1 ms (90 %)

Order numbers	
5 ... 6 V supply	
KPTA 6E6-4P-C-DN	**B 261 209 342**
Offer drawing	**A 261 209 342**
8 ... 16 V supply	
KPTC 6E8-4P-C-DN	**B 261 209 063**
Offer drawing	**A 261 209 063**
AS 6-06-05PN	**B 261 209 068**
Offer drawing	**A 261 209 068**
KPTA 6E6-4P-C-DN	**B 261 209 069**
Offer drawing	**A 261 209 069**
AS 6-08-98PN	**B 261 209 077**
Offer drawing	**A 261 209 077**
ASL 6-06-05PC-HE	**B 261 209 079**
Offer drawing	**A 261 209 079**
ASU 6-03-05-PD-HE	**B 261 209 958**
Offer drawing	**A 261 209 958**

Absolute Pressure Sensor PSC-250

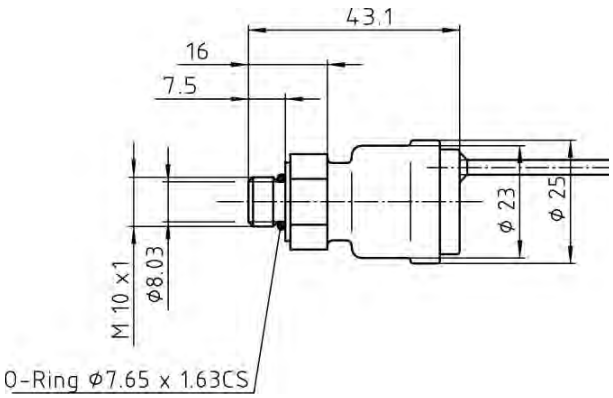
Pressure range: 0 ... 250 bar nominal

A M10 x 1 sensor for various fluid pressure measurement. The sensor range covers pressure measurement from 0 to 250 bar. It is manufactured in a DR-25 sleeve, various connector options are available. Gauge and absolute pressure sensors are available.

Mechanical data	
Measurement transducer	piezoresistive
Max. pressure	500 bar
Thread	M10 x 1
Tightening torque	10 Nm
Wrench size	17 mm
Weight	70 g
Sealing	O-ring 7,65 x 1,63

Conditions for use	
Temperature range	-40 ... 125°
Max. vibration	15 g/30 ... 200 Hz

Characteristic	
Sensitivity	16 mV/bar
Offset	500 mV



Electronic data	
Power supply	8 ... 16 V
Compensated range	25 ... 85°C
Current supply	8 ... 16 mA
Non linearity	1 %
Therm. zero point drift	< 1 %
Therm. sensitivity drift	< 1 %
Long time drift	< 1 %
Full scale output	0,5 ... 4,5 V
Time of reaction	1 ms (90 %)

Order numbers	
KPTC 6E8-4P-C-DN	**B 261 209 066**
Offer drawing	**A 261 209 066**
KPTA 6E6-4P-C-DN	**B 261 209 076**
Offer drawing	**A 261 209 076**
AS 6-08-98PN	**B 261 209 078**
Offer drawing	**A 261 209 078**

Absolute Pressure Sensor PSM

Pressure range: 0 ... 2 / 12 / 250 bar nominal

A miniature M10 x 1 absolute pressure sensor for universal precision pressure measurement. It is manufactured in a DR-25 sleeve, various connector options are available. Detailed calibration sheet included.

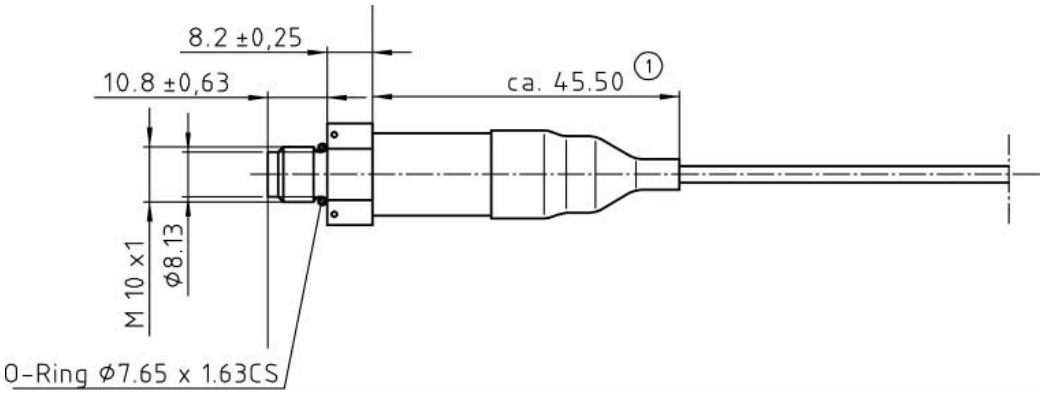
Mechanical data	
Max. pressure	2 x nominal
Thread	M10 x 1
Tightening torque	10 Nm
Wrench size	16 mm
Weight	55 g
Sealing	O-ring 7,65 x 1,63

Conditions for use	
Temperature range	-20 ... 125°C
Vibration	80 g/5 Hz ... 2,5 kHz

Characteristic
Sensitivity and offset will be delivered with each sensor.

Electronic data	
Power supply	8 ... 16 V
Compensated range	20 ... 80°C
Non linearity	0,25 %
Therm. zero point drift	< 0,5 %
Therm. sensitivity drift	< 0,5 %
Long time drift	< 0,5 %
Full scale output	0 ... 5 V

Order numbers	
AS 6-06-05PC-HE	
2 bar	**B 261 209 335**
Offer drawing	**A 261 209 330**
12 bar	**B 261 209 331**
Offer drawing	**A 261 209 331**
250 bar	**B 261 209 332**
Offer drawing	**A 261 209 332**



Absolute Pressure Sensor PSS

Pressure range: 0 ... 10 / 100 / 250 bar nominal

A M10 x 1 pressure sensor for measuring various fluid pressure. Gauge and absolute pressure sensors are available.

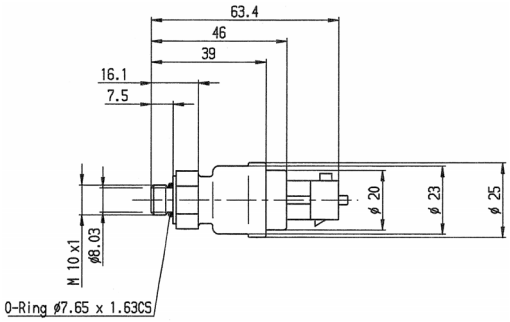
Mechanical data	
Measurement transducer	piezoresistive
Max. pressure	2 x nominal
Thread	M10 x 1
Tightening torque	10 Nm
Wrench size	17 mm
Weight	65 g
Sealing	O-ring 7,65 x 1,63

Conditions for use	
Temperature range	-40 ... 125°C
Vibration	15 g/30 ... 200 Hz

Characteristic	
Sensitivity	
10 bar	400mV/bar
100 bar	40 mV/bar
250bar	16 mV/bar
Offset	
10 bar	100 mV
100 bar	500 mV
250 bar	500 mV

Electronic data	
Power supply	5 ... 6 V/ 8 ... 16 V
Compensated range	20 ... 85°C
Current supply	8 ... 16 mA
Non linearity	1 %
Therm. zero point drift	< 1 %
Therm. sensitivity drift	< 1 %
Long time drift	< 1 %
Full scale output	0,5 ... 4,5 V
Time of reaction	1 ms (90%)

Order numbers	
5 ... 6 V supply, 10 bar	**B 261 209 341**
Offer drawing	**A 261 209 341**
8 ... 16 V supply, 10 bar	**B 261 209 064**
Offer drawing	**A 261 209 064**
5 ... 6 V supply, 100 bar	**B 261 209 347**
Offer drawing	**A 261 209 347**
8 ... 16 V supply, 250 bar	**B 261 209 067**
Offer drawing	**A 261 209 067**



Pressure Sensors differential

Differential Pressure Sensor DP-A

Pressure range: 0 ... 100 mbar differential

This miniature differential pressure sensor is used for precision air pressure measurement. It is typically combined with a pitot tube.

Mechanical data	
Dimensions	37 x 28 x 19 mm
Fixing	2 x M3
Tightening torque	2 Nm
Weight	28 g

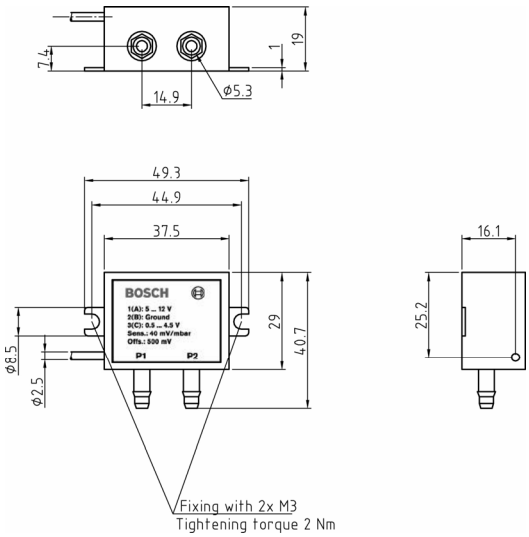
Conditions for use	
Temperature range	-20 ... 70°C

Characteristic	
Sensitivity	40 mV/mbar
Offset	500 mV

Electronic data	
Power supply	4,8 ... 15 V
Output current	10 mA
Compensated range	0 ... 50°C
Non linearity	0,5 %/FSO
Therm. zero point drift	0,05 %/FSO/°C
Therm. sensitivity drift	0,05 %/FSO/°C
Long time drift	± 0,20 %/FSO
Full scale output	0,5 ... 4,5 V

Accessories	
Pitot tube	**B 261 209 700**

Order numbers	
AS 0-06-05PC-HE	**B 261 209 696**
Offer drawing	**A 261 209 696**



Differential Pressure Sensor DP-B

Pressure range: 0 ... 100 mbar differential

This miniature differential pressure sensor is used for precision air pressure measurement. It is typically combined with a pitot tube.

Mechanical data	
Dimensions	38 x 28 x 19 mm
Fixing	2 x M3
Tightening torque	2 Nm
Weight	28 g

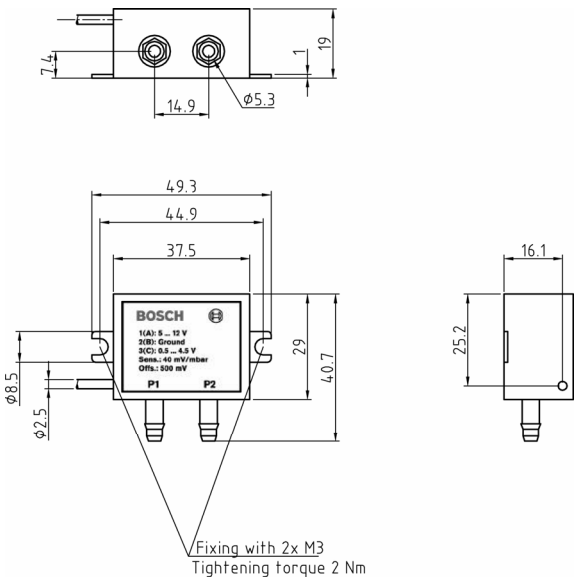
Conditions for use	
Temperature range	-20 ... 70°C

Characteristic	
Sensitivity	40 mV/mbar
Offset	500 mV

Electronic data	
Power supply	4,8 ... 15 V
Output current	10 mA
Compensated range	0 ... 50°C
Non linearity	0,5 %/FSO
Therm. zero point drift	0,05 %/FSO/°C
Therm. sensitivity drift	0,05 %/FSO/°C
Long time drift	± 0,20 %/FSO
Full scale output	0,5 ... 4,5 V

Accessories	
Pitot tube	**B 261 209 700**

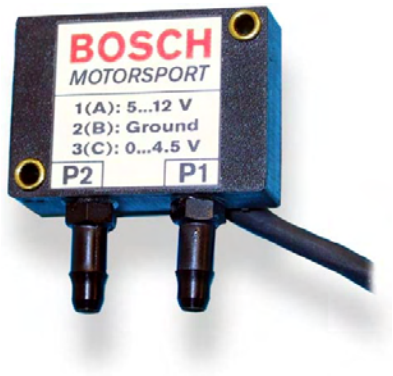
Order number	
AS 0-06-05PC-HE	**B 261 209 697**
Offer drawing	**A 261 209 697**



Differential Pressure Sensor DP-C

Pressure range: 0 ... 100 mbar differential

This low cost miniature differential pressure sensor is used for precision air pressure measurement. It is typically combined with a pitot tube.



Mechanical data	
Dimensions	35 x 25 x 11 mm
Pressure ranges	100 mbar differential
Fixing	2 x M2,5
Tightening torque	2 Nm
Weight	28 g

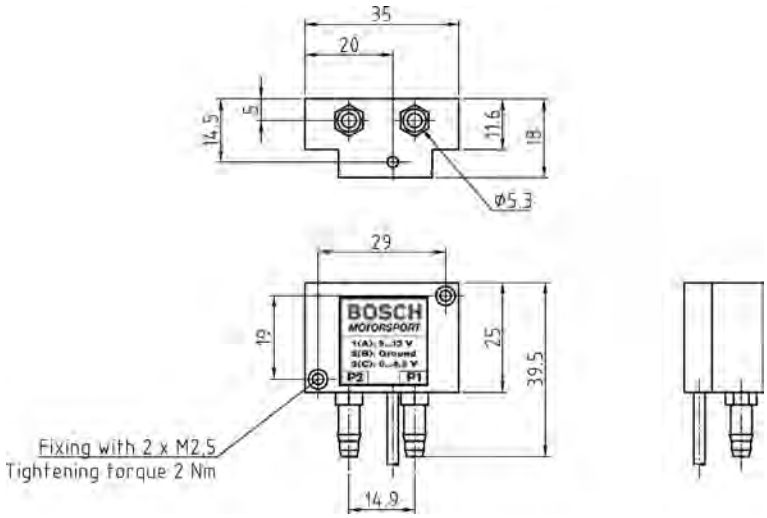
Conditions for use	
Temperature range	-20 ... 70°C

Characteristic	
Sensitivity	40 mV/mbar
Offset	500 mV

Electronic data	
Power supply	4,8 ... 15 V
Output current	10 mA
Compensated range	0 ... 50°C
Non linearity	0,5 %/FSO
Therm. Zero point drift	0,05 %/FSO/°C
Therm. sensitivity drift	0,05 %/FSO/°C
Long time drift	± 0,20 %/FSO
Full scale output	0,5 ... 4,5 V

Accessories	
Pitot tube	**B 261 209 700**

Order number	
AS 0-06-05PC-HE	**B 261 209 701**
Offer drawing	**A 261 209 701**



Differential Pressure Sensor DP-E

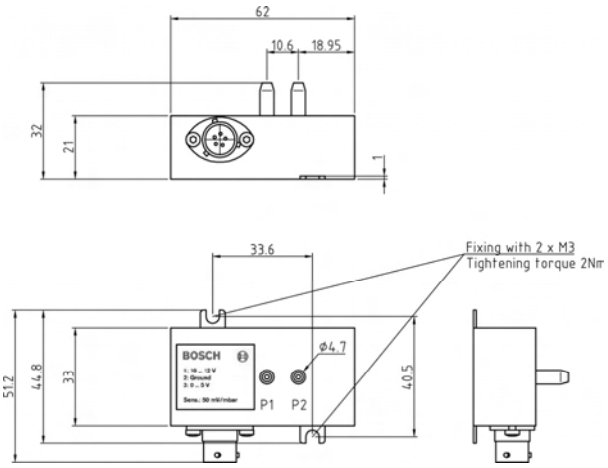
Pressure range: 0 ... 70 / 0 ... 100 mbar differential

A miniature differential pressure sensor for precision temperature compensated air pressure measurement. It is typically used as pitot tube sensor.

Mechanical data	
Dimensions	62 x 33 x 21 mm
Fixing	2 x M3
Tightening torque	2 Nm
Weight	50 g

Conditions for use	
Temperature range	-20 ... 70°C

Characteristic	
Sensitivity	
0 ... 70 mbar	71,42 mV/mbar
0 ... 100 mbar	50 mV/mbar



Electronic data	
Power supply	7,5 ... 24 V
Compensated range	0 ... 70°C
Non linearity	0,25 %/FSO
Therm. zero point drift	0,30 %/FSO
Therm. sensitivity drift	0,20 %/FSO
Long time drift	0,10 %/FSO
Full scale output	0 ... 5 V

Accessories	
Pitot tube	**B 261 209 700**

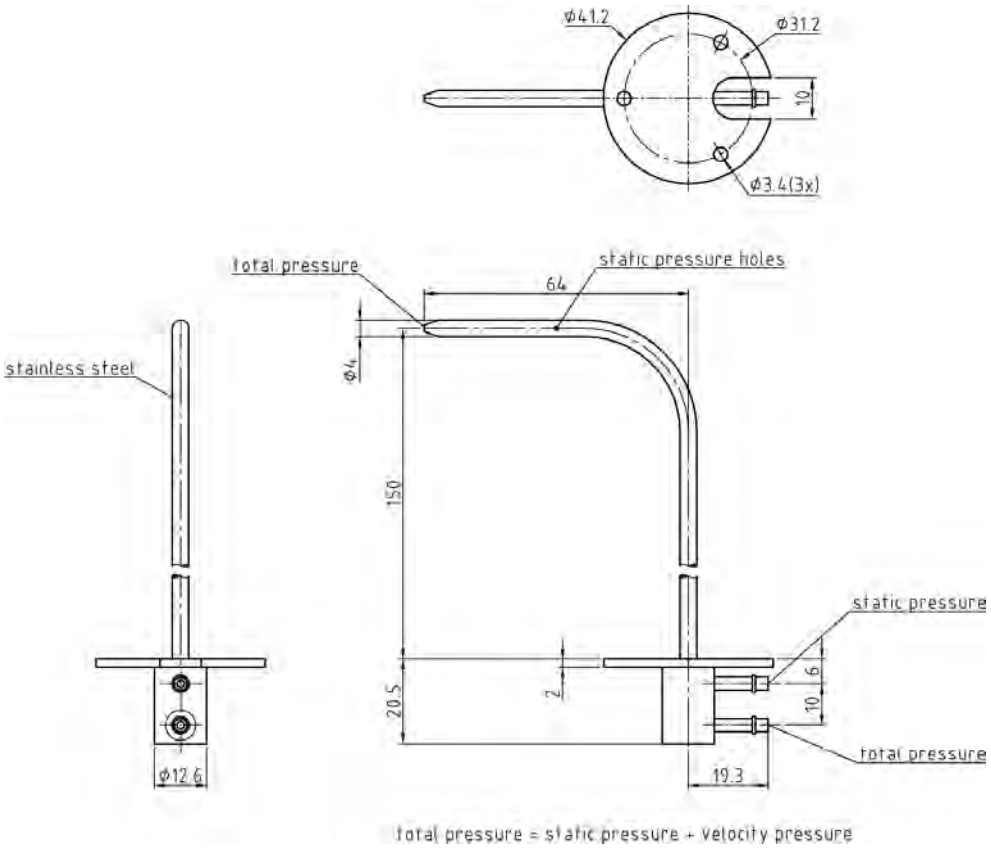
Order numbers	
0 ... 70 mbar	
AS 0-06-05PN-HE	**B 261 209 698**
Offer drawing	**A 261 209 698**
0 ... 100 mbar	
AS 0-06-05PN-HE	**B 261 209 699**
Offer drawing	**A 261 209 699**

Pitot Static Tube PT

The pitot static tube consists basically of two concentric tubes, with the end turned through a right angle so that the tip can be faced into the air stream after insertion through the duct wall. The modified ellipsoidal nose form has a single forward facing hole for sensing total pressure and a ring of side holes for sensing the static pressure. Both these inlets are individually connected to tapping outlets at the tail of the unit. A direction pointer is provided so that the pitot tube can be accurately aligned within the duct.

Mechanical data	
Weight	50 g
Height	150 mm
Tube diameter	4 mm

Order number	
	B 261 209 700
Offer drawing	**A 261 209 700**



Air Velocity Calculations using S.I. Scales

The Standard formula for calculating velocity from velocity pressure is:

$$V = 1.291 \sqrt{Pv}$$

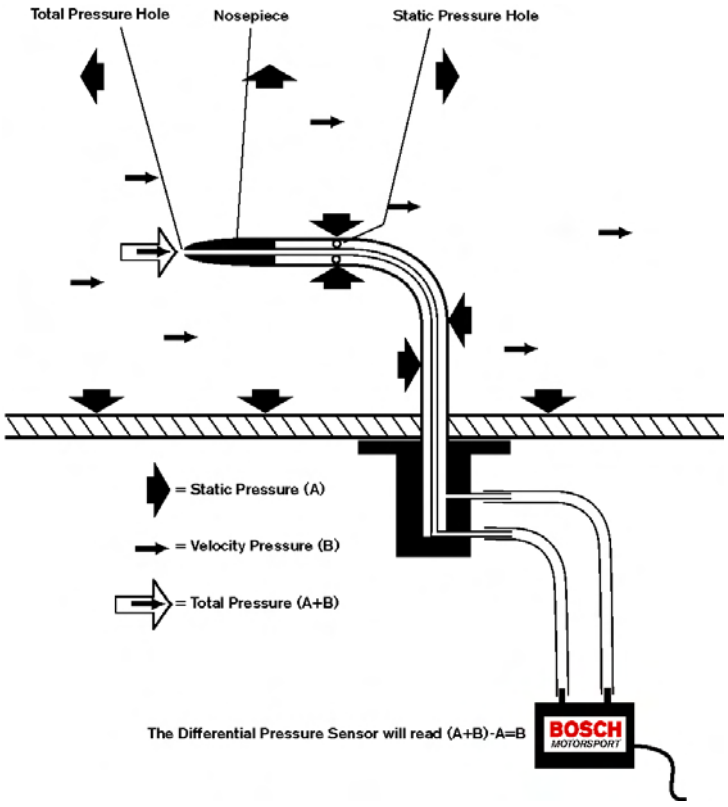
This is only correct for an air density of 1.2 kg/m³. For non-standard air conditions, this equation becomes:

$$V = 1.291 \sqrt{\frac{1013.25}{B}} * \frac{T}{293} * \frac{100000}{100000 + Ps} * Pv$$

V = velocity m/s
B = barometric pressure mbar
T = absolute temperature K (= t°C + 273 where t is airstream temperature)
Ps = static pressure Pa
Pv = velocity pressure Pa

The expression $\frac{100000}{100000 + Ps}$ is a correction for the static pressure in the duct and may normally be ignored if Ps is less than 2500 Pa

Principle of Operation

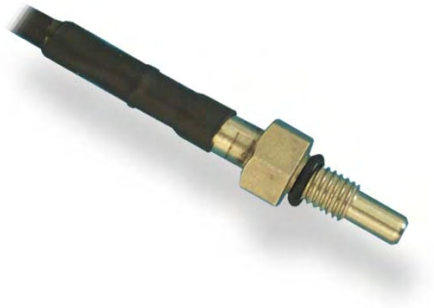


Temperature Sensors

Temperature Sensor NTC M6

Temperature range: 0 ... 200°C

A miniature M6 x 1 NTC sensor for fast response temperature measurement. It is manufactured in a DR-25 sleeve, various connector options are available.



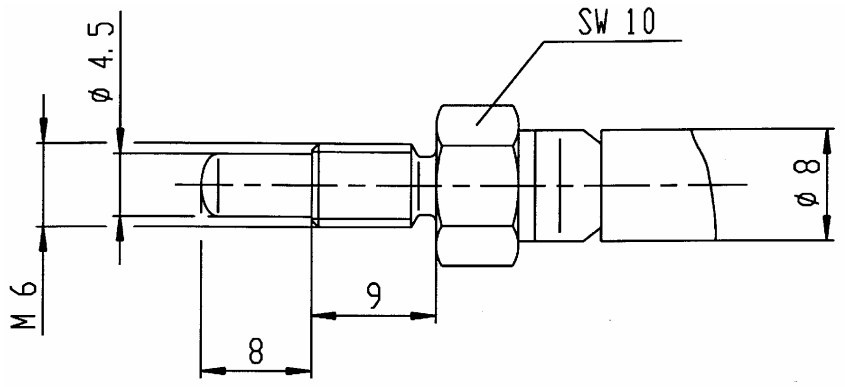
Mechanical data	
Thread	M6 x 1
Tightening torque	3 Nm
Wrench size	10 mm
Sealing	Viton 4,47 x 1, 78
Weight	45 g

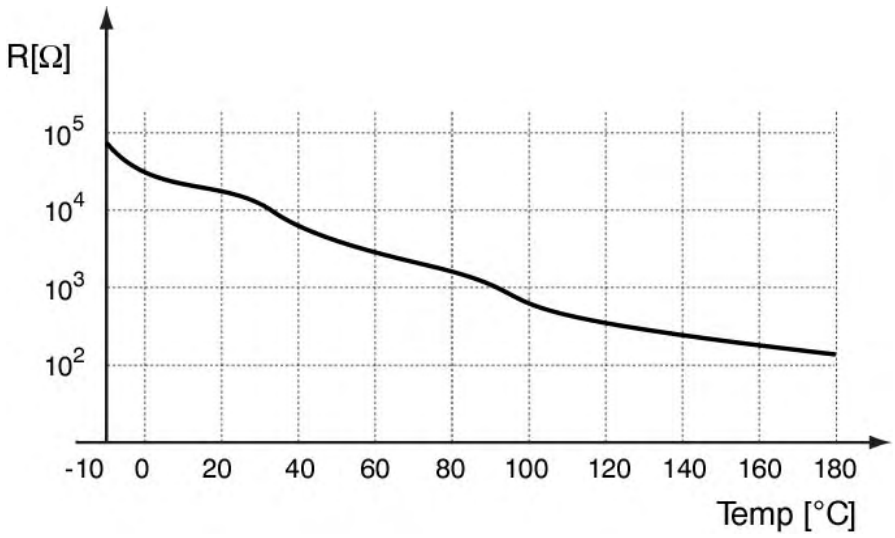
Electronic data	
Nominal resistance	15 kΩ/25°C
Measuring range	0 ... 200°C
Accuracy	± 1,0 K
Response time 90 %	< 7 s

Conditions for use	
Temperature range	-30 ... 200°C
Vibration	80 g/5 ... 500 Hz

Characteristic
NTC 15 kΩ

Order numbers	
KPTA 6E6-4P-C-DN	**B 261 209 172**
Offer drawing	**A 261 209 172**
ASL 6-06-05PN-HE	**B 261 209 386**
Offer drawing	**A 261 209 386**
ASU 6-03-03PN-HE	**B 261 209 982**
Offer drawing	**A 261 209 982**





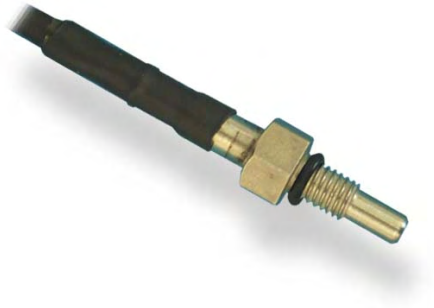
°C	R(Ω)
-10	83317,5
0	49254,0
10	29959,5
20	18732,0
30	12012,0
40	7893,0
50	5356,5
60	3651,0
70	2544,0
80	1804,5

°C	R(Ω)
90	1305,5
100	945,0
110	703,5
120	526,5
130	400,5
140	309,0
150	240,0
160	187,5
170	148,5
180	120,0

Temperature Sensor NTC M6-H

Temperature range: 0 ... 300°C

A miniature M6 x 1 NTC sensor for fast response temperature measurement. It is manufactured in a DR-25 sleeve, various connector options are available.



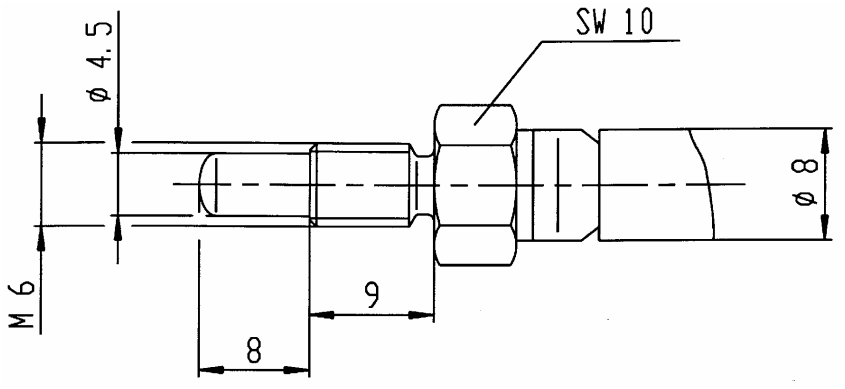
Mechanical data	
Thread	M6 x 1
Tightening torque	3 Nm
Wrench size	10 mm
Sealing	Viton 4,47 x 1, 78
Weight	45 g

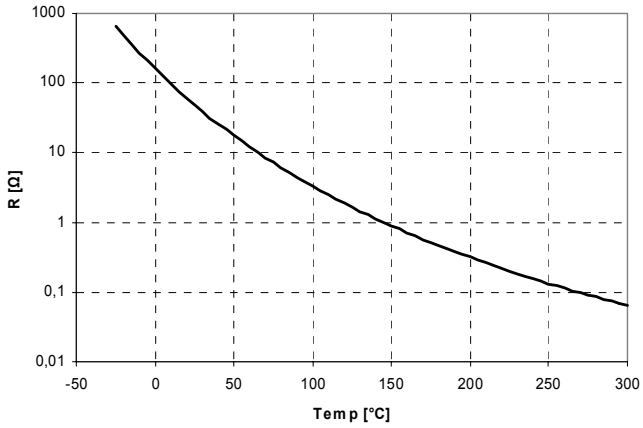
Electronic data	
Nominal resistance	49 kΩ/25°C
Measuring range	0 ... 300°C
Accuracy	± 1,0 K
Response time 90 %	< 7 s

Conditions for use	
Temperature range	-30 ... 300°C
Vibration	80 g/5 ... 500 Hz

Order numbers	
ASU 6-03-PB-HE	**B 261 209 980**
Offer drawing	**A 261 209 980**

Characteristic
NTC 49 kΩ



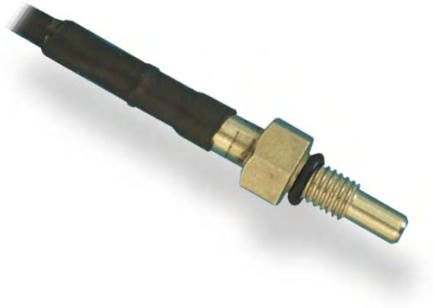


°C	R(Ω)
-25	657,35
-20	487,37
-15	365,04
-10	276,06
-5	210,69
0	162,21
5	125,78
10	98,322
15	77,454
20	61,465
25	49,12
30	39,517
35	31,996
40	26,065
45	21,358
50	17,599
55	14,579
60	12,14
65	10,159
70	8,5415
75	7,2142
80	6,1198
85	5,2134
90	4,4591
95	3,8288
100	3,3
105	2,8545
110	2,4777
115	2,1579
120	1,8855
125	1,6526
130	1,4529
135	1,2811

°C	R(Ω)
140	1,1327
145	1,0043
150	0,89279
155	0,7957
160	0,71092
165	0,6367
170	0,57155
175	0,51432
180	0,46367
185	0,41896
190	0,37935
195	0,34416
200	0,31285
205	0,28492
210	0,25996
215	0,23761
220	0,21755
225	0,19952
230	0,18329
235	0,16864
240	0,15541
245	0,14343
250	0,13257
255	0,1227
260	0,11373
265	0,10555
270	0,098098
275	0,091286
280	0,085054
285	0,079344
290	0,074106
295	0,069295
300	0,064870

Temperature Sensor NTC M8
Temperature range: 0 ... 200°C

This standard fluid temperature sensor combines temperature response with fine mechanical properties. It is manufactured in a DR-25 sleeve, various connector options are available.



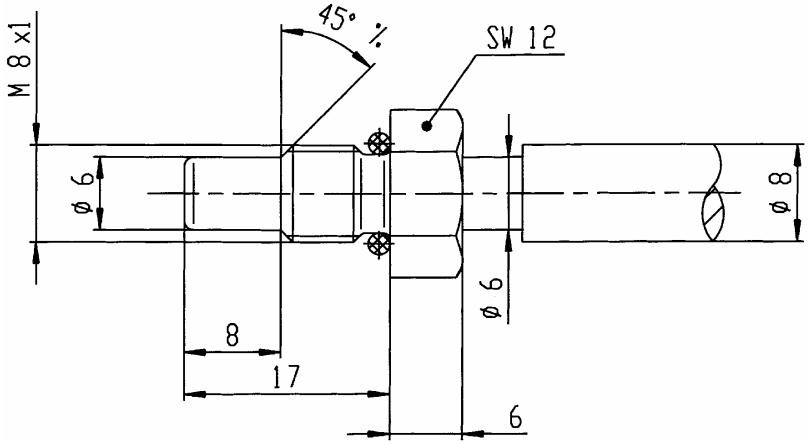
Mechanical data	
Thread	M8 x 1
Tightening torque	3 Nm
Wrench size	12 mm
Sealing	Viton 6,35 x 1,78
Weight	45 g

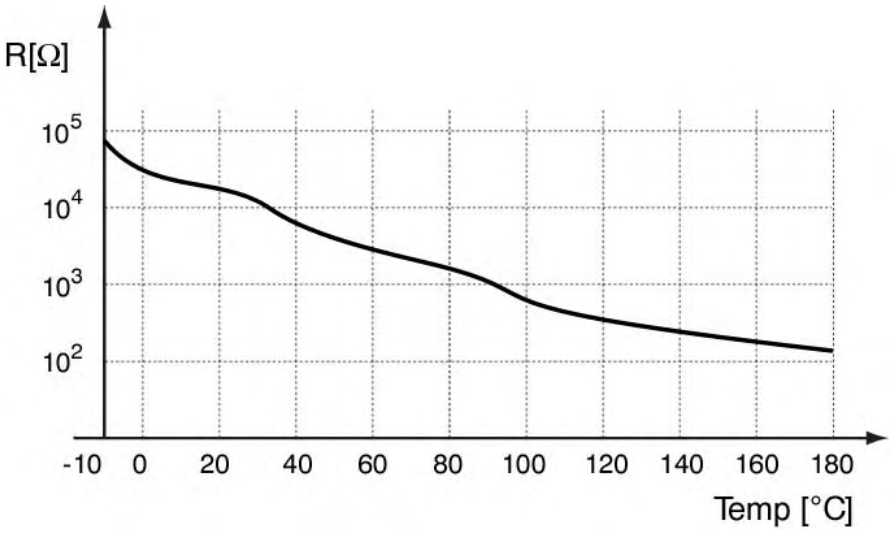
Conditions for use	
Temperature range	-30 ... 200°C
Vibration	80 g/5 ... 500 Hz

Characteristic
NTC 15 kΩ

Electronic data	
Nominal resistance	15 kΩ/25°C
Measuring range	0 ... 200°C
Accuracy	± 1,0 K
Response time 90 %	< 10 s

Order numbers	
KPSE 6E8-33P-DN	**B 261 209 167**
Offer drawing	**A 261 209 167**
KPSE 6E8-3AP-DN	**B 261 209 173**
Offer drawing	**A 261 209 173**
ASL 6-06-05PN-HE	**B 261 209 384**
Offer drawing	**A 261 209 384**
Without connector	**B 261 209 176**
Offer drawing	**A 261 209 176**
ASU 6-03-03PA-HE	**B 261 209 978**
Offer drawing	**A 261 209 978**
ASU 6-03-03PN-HE	**B 261 209 977**
Offer drawing	**A 261 209 977**





°C	R(Ω)
-10	83317,5
0	49254,0
10	29959,5
20	18732,0
30	12012,0
40	7893,0
50	5356,5
60	3651,0
70	2544,0
80	1804,5

°C	R(Ω)
90	1305,5
100	945,0
110	703,5
120	526,5
130	400,5
140	309,0
150	240,0
160	187,5
170	148,5
180	120,0

Temperature Sensor NTC M8-F

Temperature range: 0 ... 200°C

The NTC M8-F is a development based on the NTC M8. It is created for very fast response air temperature measurement.

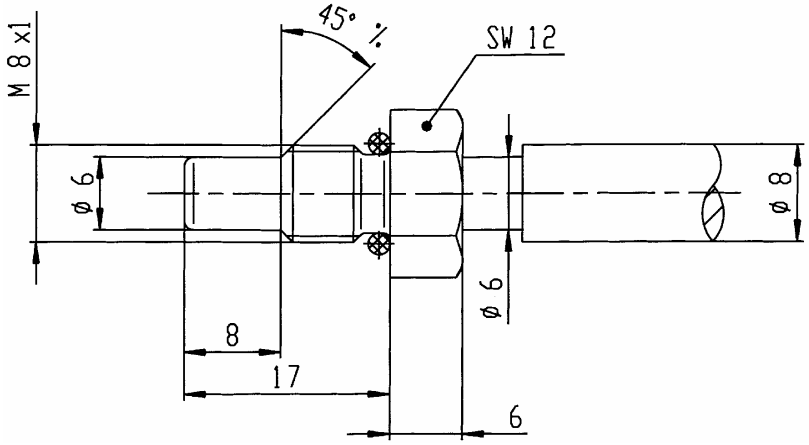
Mechanical data	
Thread	M8 x 1
Tightening torque	3 Nm
Wrench size	12 mm
Sealing	Viton 6,35 x 1,78
Weight	45 g

Electronic data	
Nominal resistance	6,8 kΩ/25°C
Measuring range	0 ... 100°C
Accuracy	± 1,0 K
Response time 90 %	< 5 s

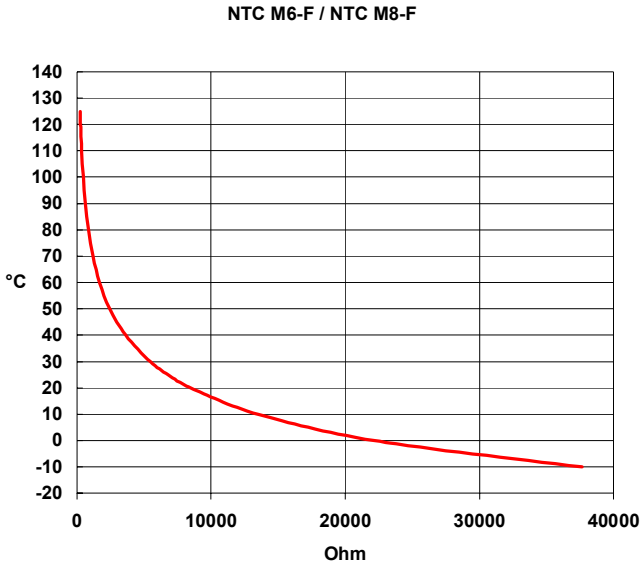
Conditions for use	
Temperature range	-30 ... 100°C
Vibration	80 g/5 ... 500 Hz

Order number	
AS 6-06-05PN-HE	**B 261 209 818**

Characteristic
NTC 6,8 kΩ

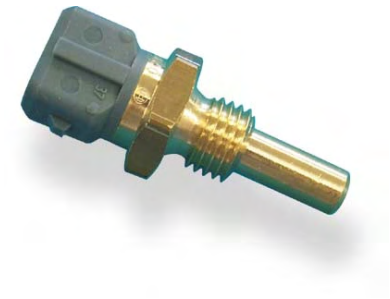


°C	R(Ω)
-20	66115
10	37645
0	22209
10	13533
20	8495
30	5479
40	3624
50	2452
60	1695
70	1195
80	858,2
90	626,7
100	464,8
110	350,4
120	267,1



Temperature Sensor NTC M12
Temperature range: -30 ... 130°C

A shockproof sensor for measurements under pressure up to 25 bar. Good thermal conductivity allows fast response temperature measurement. The integrated connector provides a low-cost connection for automotive applications.



General fields of application: oil-, fuel-, water temperature measurement.

Mechanical data	
Thread	M12 x 1,5
Tightening torque	25 Nm
Wrench size	19 mm
Weight	30 g

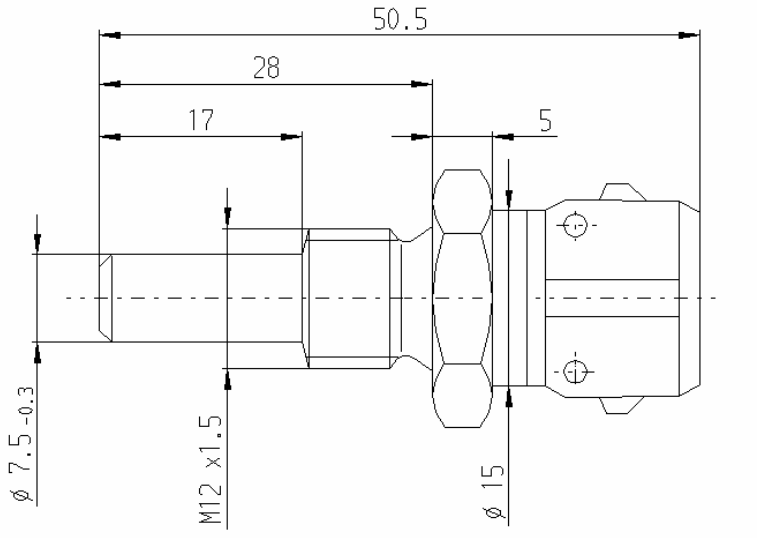
Electronic data	
Nominal resistance	2,5 kΩ/20°C
Measuring range	-30 ... 130°C
Accuracy	± 1,5 K
Response time 90 %	< 10 s

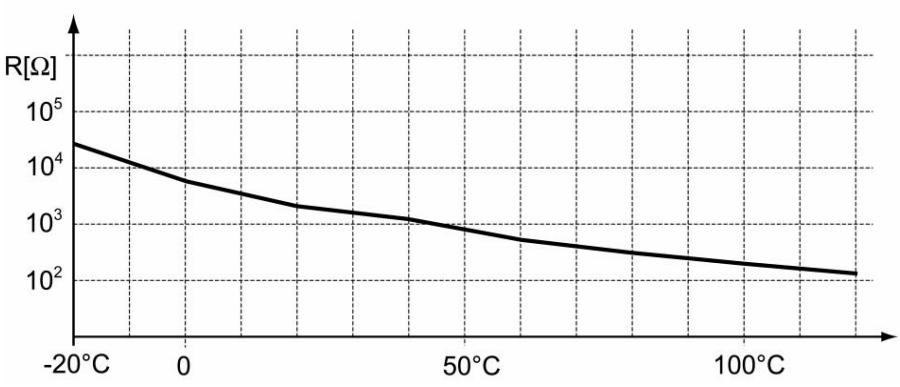
Conditions for use	
Temperature range	-30 ... 130°C
Vibration	60 g/5 ... 250 Hz

Connector	
Cable harness connector	**D 261 205 331**

Chatacteristic
NTC 2,5 kΩ

Order numbers	
D 261 205 331	**0 280 130 026**
KPSE 6E8-33P-DN	**B 261 209 160**
Offer drawing	**A 261 209 160**



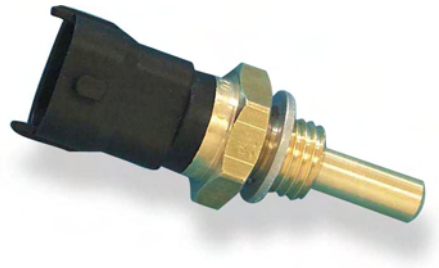


°C	R(Ω)
-40	45 313
-35	34 281
-30	26 114
-25	20 003
-20	15 462
-15	12 002
-10	9 397
-5	7 415
0	5 896
5	4 712
10	3 792
15	3 069
20	2 500
25	2 057
30	1 707
35	1 412
40	1 175
45	987,6
50	833,9
55	702,8
60	595,5

°C	R(Ω)
65	508,3
70	435,7
75	374,2
80	322,5
85	279,6
90	243,2
95	212,7
100	186,6
105	163,8
110	144,2
115	127,3
120	112,7
125	100,2
130	89,30
135	79,65
140	71,20
145	63,86
150	57,41
155	51,82
160	46,88

Temperature Sensor NTC M12-H
Temperature range: -40 ... 150°C

A shockproof sensor for measurements under pressure up to 25 bar. Good thermal conductivity allows fast response temperature measurement. The integrated connector provides a low-cost connection for automotive applications.



General fields of application: oil-, fuel-, water temperature measurement.

Mechanical data	
Thread	M12 x 1,5
Tightening torque	18 Nm
Wrench size	19 mm
Weight	30 g

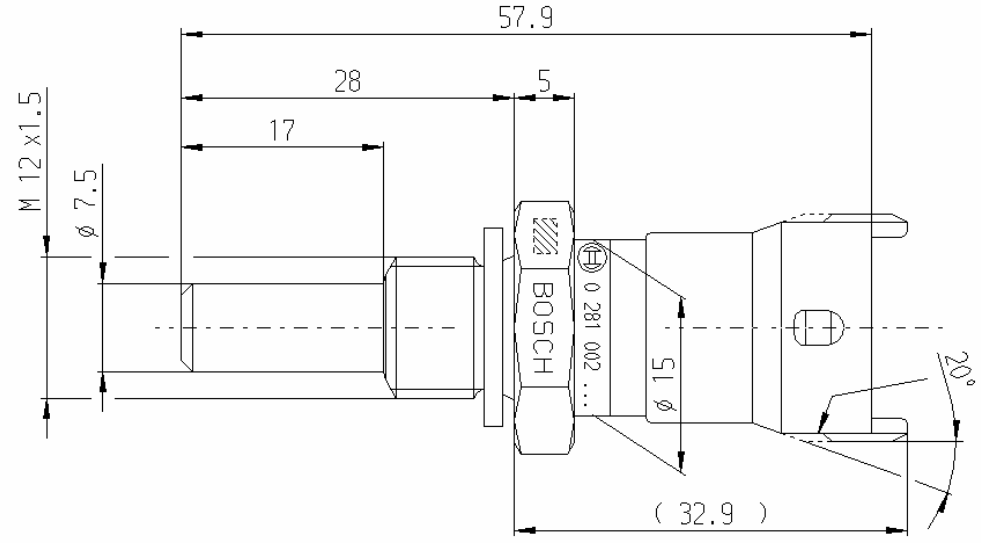
Electronic data	
Nominal resistance	2,5 kΩ/20°C
Measuring range	-40 ... +150°C
Accuracy	± 1,5 K
Response time 90 %	< 10 s

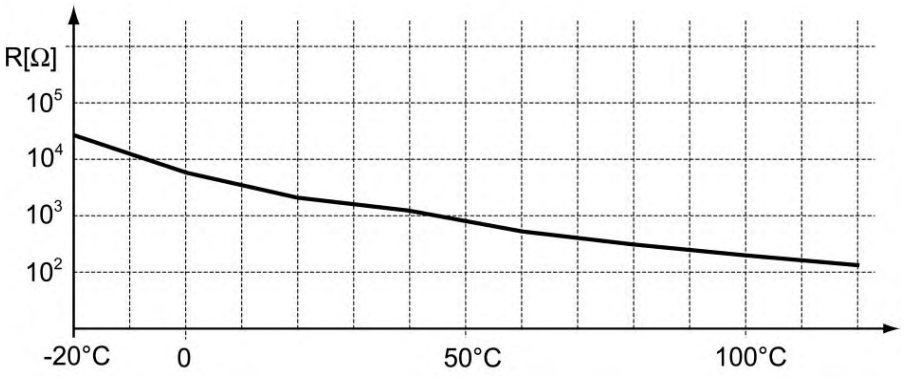
Conditions for use	
Temperature range	-40 ... 150°C
Vibration	30 g/5 ... 250 Hz

Connector	
Cable harness connector	**D 261 205 337**

Characteristic
NTC 2,5 kΩ

Order number	
	0 281 002 170
Offer drawing	**A 280 130 110**



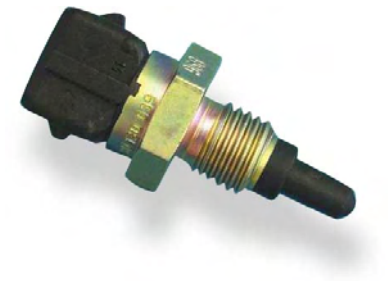


°C	R(Ω)
-40	45 313
-35	34 281
-30	26 114
-25	20 003
-20	15 462
-15	12 002
-10	9 397
-5	7 415
0	5 896
5	4 712
10	3 792
15	3 069
20	2 500
25	2 057
30	1 707
35	1 412
40	1 175
45	987,6
50	833,9
55	702,8
60	595,5

°C	R(Ω)
65	508,3
70	435,7
75	374,2
80	322,5
85	279,6
90	243,2
95	212,7
100	186,6
105	163,8
110	144,2
115	127,3
120	112,7
125	100,2
130	89,30
135	79,65
140	71,20
145	63,86
150	57,41
155	51,82
160	46,88

Temperature Sensor NTC M12-L
Temperature range: -30 ... 130°C

A shockproof sensor for measurements under pressure up to 25 bar. Good thermal conductivity allows fast response temperature measurement. The integrated connector provides a low-cost connection for automotive applications.



General fields of application: oil-, fuel-, air temperature measurement

Mechanical data	
Thread	M12 x 1,5
Tightening torque	15 Nm
Wrench size	19 mm
Weight	26 g

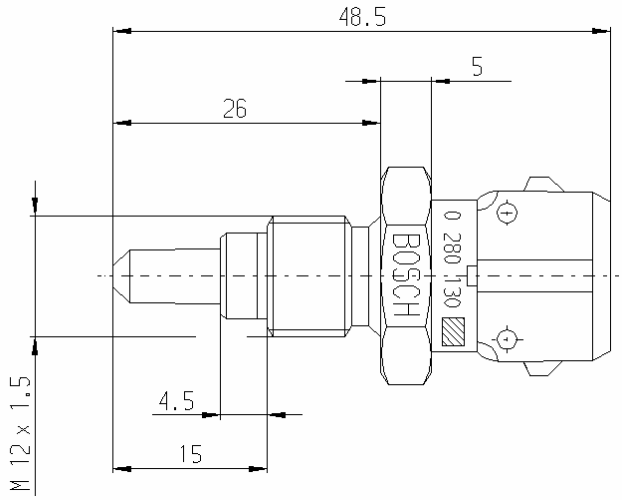
Electronic data	
Nominal resistance	2,5 kΩ/20°C
Measuring range	-30 ... 130°C
Accuracy	± 1,5 K
Response time 90 %	< 10 s

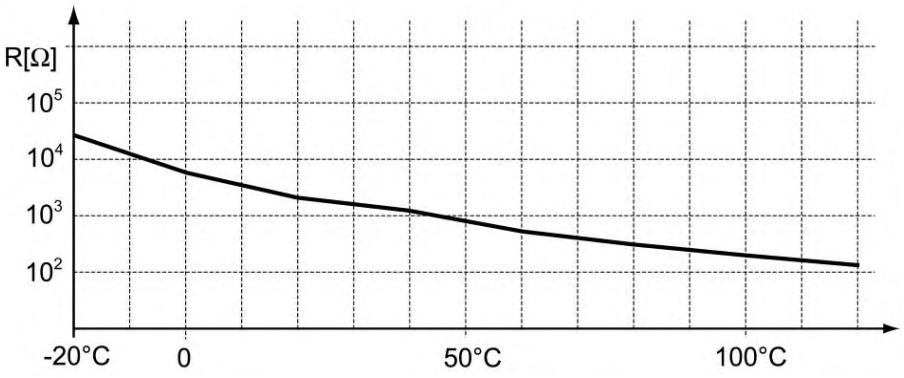
Conditions for use	
Temperature range	-30 ... 130°C
Vibration	60 g/50 ... 250 Hz

Connector	
Cable harness connector	**D 261 205 288**

Characteristic
NTC 2,5 kΩ

Order number	
	0 280 130 039
Offer drawing	**A 280 130 206**





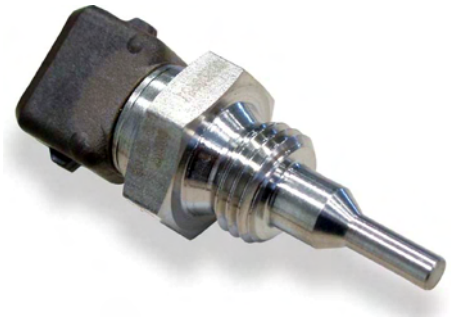
°C	R(Ω)
-40	45 313
-35	34 281
-30	26 114
-25	20 003
-20	15 462
-15	12 002
-10	9 397
-5	7 415
0	5 896
5	4 712
10	3 792
15	3 069
20	2 500
25	2 057
30	1 707
35	1 412
40	1 175
45	987,6
50	833,9
55	702,8
60	595,5

°C	R(Ω)
65	508,3
70	435,7
75	374,2
80	322,5
85	279,6
90	243,2
95	212,7
100	186,6
105	163,8
110	144,2
115	127,3
120	112,7
125	100,2
130	89,30
135	79,65
140	71,20
145	63,86
150	57,41
155	51,82
160	46,88

Temperature Sensor PT100 M14

Temperature range: -50 ... 300°C

A shockproof sensor for measurements under pressure up to 25 bar. Good thermal conductivity allows fast response temperature measurement. The integrated connector provides a low cost connection for automotive applications.



Mechanical data	
Thread	M14 x 1,5
Tightening torque	15 Nm
Wrench size	19 mm
Weight	25 g

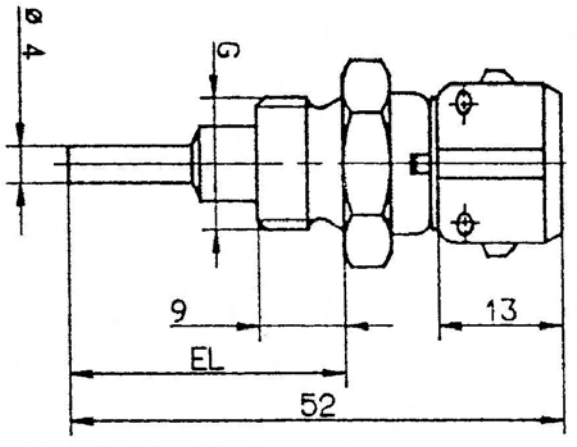
Electronic data	
Nominal resistance	100 Ω/0°C
Measuring range	-50 ... 300°C
Accuracy	± 3,0 K
Response time 90 %	< 10 s

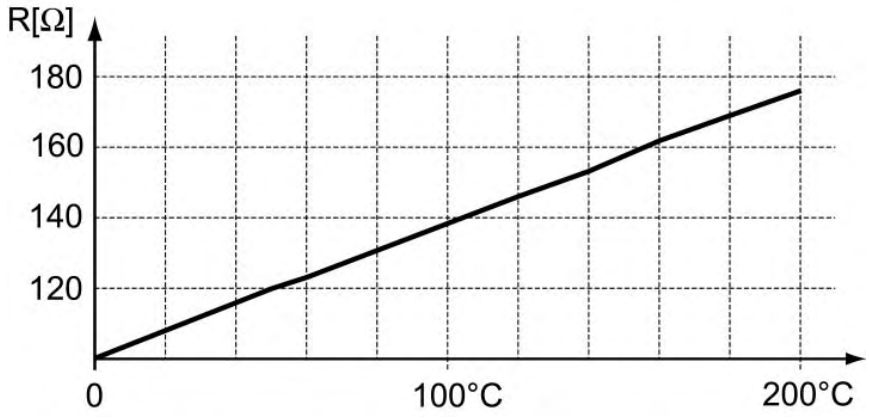
Conditions for use	
Temperature range	-50 ... 300°C
Vibration	40 g/5Hz ... 2kHz

Connector	
Cable harness connector	**D 261 205 288**

Characteristic
PT 100 DIN/IEC 751

Order number	
	B 261 209 174
Offer drawing	**A 261 209 174**





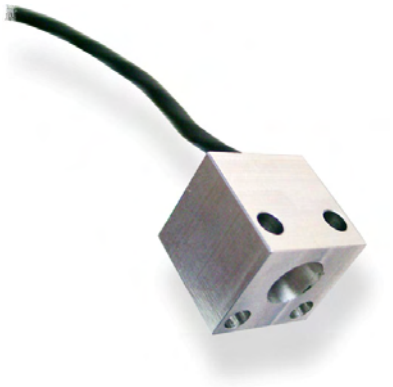
°C	R(Ω)
0	100,00
10	103,90
20	107,79
30	111,67
40	115,54
50	119,40
60	123,24
70	127,07
80	130,89
90	134,70
100	138,50

°C	R(Ω)
110	142,29
120	146,06
130	149,82
140	153,58
150	157,31
160	161,04
170	164,76
180	168,46
190	172,16
200	175,84

Temperature Sensors Infrared

Temperature Sensor TI-C

Temperature range: up to 150°C / up to 900°C



The TI-C is a non-contact infrared temperature sensor that enables mechanics and technicians to monitor critical temperatures for maximum racing performance and safety. Inaccessible, moving or unsafe objects can be measured easily and very fast. It is commonly used for monitoring tire, track, cylinder head and other temperatures.

Infrared temperature sensors absorb ambient infrared radiation given off by a heated surface. The incoming light is converted to an electric signal, which corresponds to a particular temperature.

Mechanical data	
Dimensions	20 x 18,8 x 20 mm
Weight	20 g

Electronic data	
Power supply	5 V
Input current	2 mA
Output voltage swing	0,25 V
Response time	150 ms

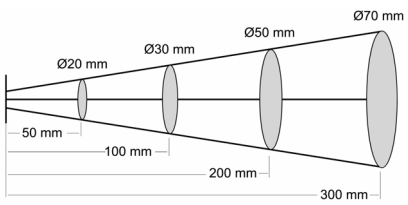
Conditions for use	
Temperature range **TI-C 150**	-25 ... 150°C
Temperature range **TI-C 900**	-25 ... 900°C
Field of view	±3,5°

Connector	
Cable harness connector	ASL 6-06-05-PN-HE

Order numbers	
TI-C 150	**B 261 209 827**
TI-C 900	**B 261 209 988**
Offer drawing	**A 261 209 827**

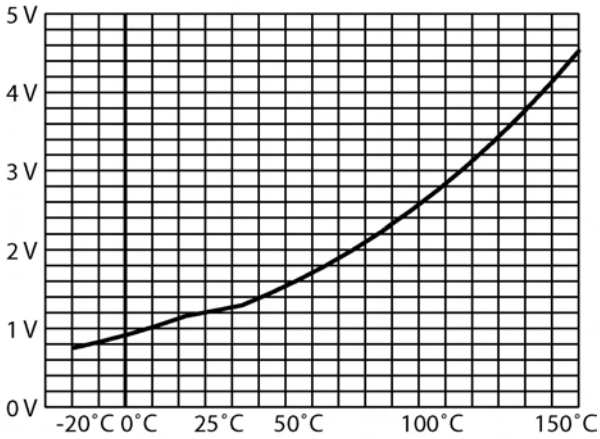
Working area (Example)

Spot size of the sensor for 90 % of irradiance from field view:



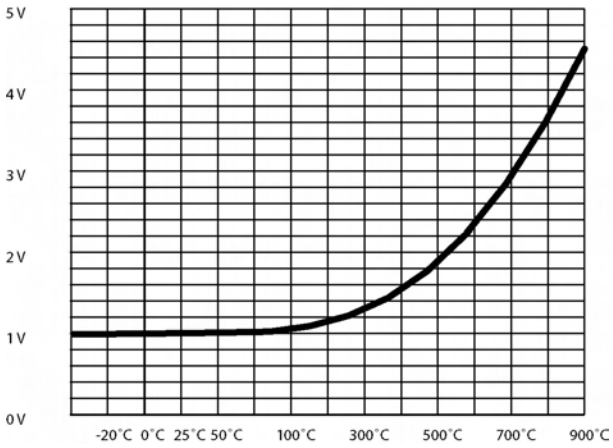
Characteristic TI-C 150

Tobject°C	Vout
-20	0,753
-10	0,836
0	0,930
10	1,038
20	1,159
25	1,225
30	1,295
40	1,447
50	1,616
60	1,803
70	2,010
80	2,238
90	2,487
100	2,760
110	3,058
120	3,382
130	3,733
140	4,113
150	4,524



Characteristic TI-C 900

Tobject°C	Vout
-20	0,991
0	0,995
25	1,000
50	1,006
75	1,014
100	1,024
200	1,091
300	1,221
400	1,440
500	1,772
600	2,234
700	2,839
800	3,596
900	4,505



Temperature Sensor TI-S

Temperature range: up to 150°C / up to 900°C

The TI-S a non-contact infrared temperature sensor that enables mechanics and technicians to monitor critical temperatures for maximum racing performance and safety. Inaccessible, moving or unsafe objects can be measured easily and very fast. It is commonly used for monitoring tire, track, cylinder head and other temperatures.

Infrared temperature sensors absorb ambient infrared radiation given off by a heated surface. The incoming light is converted to an electric signal, which corresponds to a particular temperature.

Mechanical data	
Dimensions	M 12x1, SW 15
Length	24 mm
Weight	10 g

Conditions for use	
Temperature range **TI-S 150**	-25 ... 150°C
Temperature range **TI-S 900**	-25 ... 900°C
Field of view	±3,5°

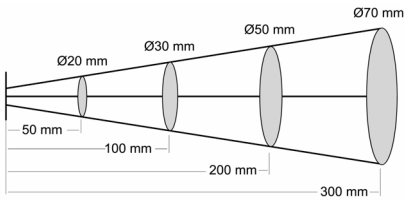
Electronic data	
Power supply	5 V
Input current	2 mA
Output voltage swing	0,25 V
Response time	150 ms

Connector	
Cable harness connector	ASL 6-06-05-PN-HE

Order numbers	
TI-S 150	**B 261 209 826**
TI-S 900	**B 261 209 987**
Offer drawing	**A 261 209 826**

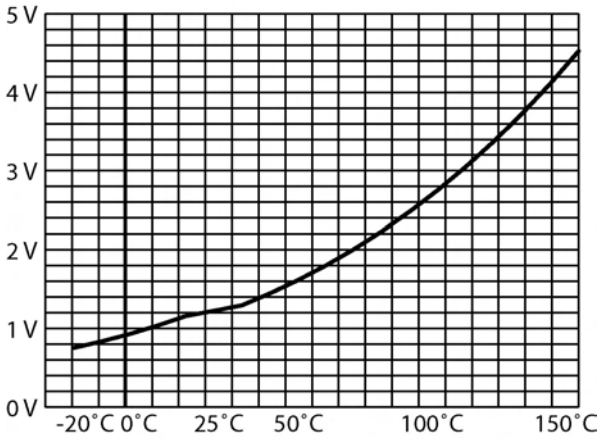
Working area (Example)

Spot size of the sensor for 90 % of irradiance from field view:



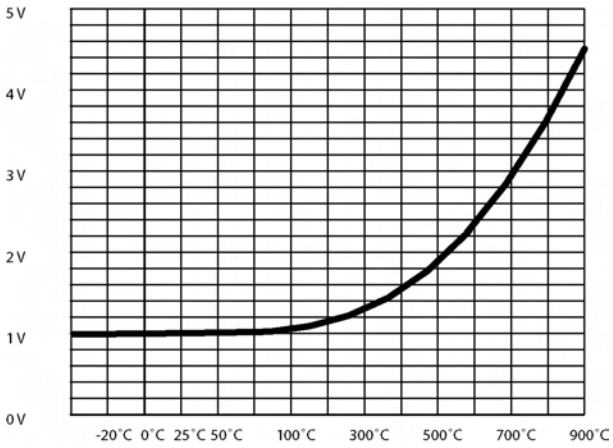
Characteristic TI-S 150

Tobject°C	Vout
-20	0,753
-10	0,836
0	0,930
10	1,038
20	1,159
25	1,225
30	1,295
40	1,447
50	1,616
60	1,803
70	2,010
80	2,238
90	2,487
100	2,760
110	3,058
120	3,382
130	3,733
140	4,113
150	4,524



Characteristic TI-S 900

Tobject°C	Vout
-20	0,991
0	0,995
25	1,000
50	1,006
75	1,014
100	1,024
200	1,091
300	1,221
400	1,440
500	1,772
600	2,234
700	2,839
800	3,596
900	4,505



Thermocouple Probes

Thermocouple Probe TCP-K

Temperature range: 32 ... 1300°C

A flexible K-type thermocouple for measuring exhaust-gas temperatures. The installation fitting allows an adjustable gas-tight mounting at the exhaust pipe. It is manufactured in a DR-25 sleeve, various connector options are available. The sensor length can be modified on request.

Mechanical data	
Thread	M8 x 1
Tightening torque	12 Nm
Wrench size	13 mm
Weight	18 g

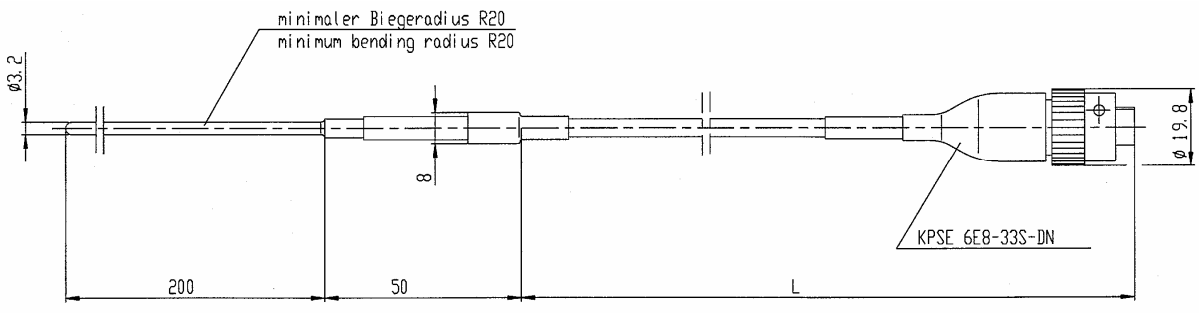
Cutting ring	
Tightening torque	2,5 Nm
Wrench size	11 mm

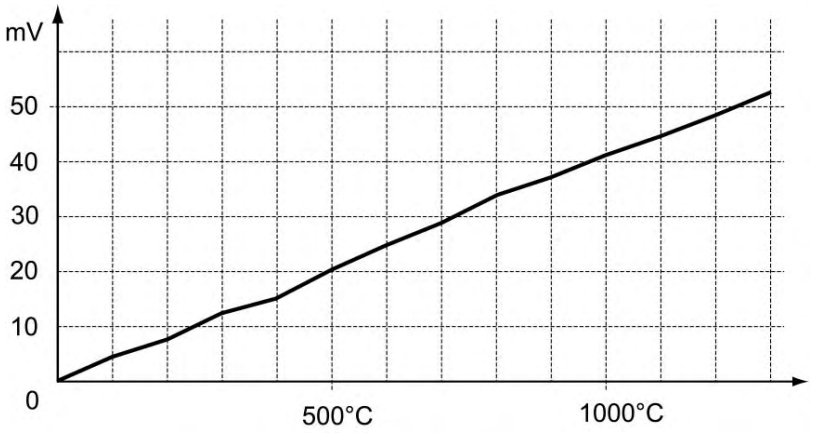
Electronic data	
Thermocouple	NiCr-Ni

Characteristic
DIN IEC 584

Sensor data	
Vibration	80 g/5 ... 500 Hz
Length L	150 ... 740 mm
Weight	60 g

Order numbers	
KPTA 6E6-4SW-C-DN	**B 261 209 169**
Offer drawing	**A 261 209 169**
AS 6-06-98PN	**B 261 209 179**
Offer drawing	**A 261 209 179**
AS 6-06-05PD-HE	**B 261 209 385**
Offer drawing	**A 261 209 385**
ASU 6-03-03-SD-HE	**B 261 209 979**
Offer drawing	**A 261 209 979**
Installation fitting	**B 261 209 159**
Offer drawing	**A 261 209 159**





Input °C	Output mV
0	0
100	4,095
200	8,137
300	12,207
400	16,395
500	20,640
600	24,902

Input °C	Output mV
700	29,128
800	33,277
900	37,325
1000	41,269
1100	45,108
1200	48,828
1300	52,398

Thermocouple Probe TCP-N / TCP-NF
Temperature range: -40 ... 1000°C

A flexible N-type thermocouple for measuring of exhaust-gas temperatures.

TCP-NF is used in FIA F3 since 2005.

Mechanical data	
Thread	M12 x 1
Tightening torque	15 Nm
Wrench size	17 mm
Length	630 mm
Weight	60 g

Conditions for use	
Vibration	80 g/5 ... 500 Hz
DIN EN 60584	
Temperature range	-40 ... 115°C

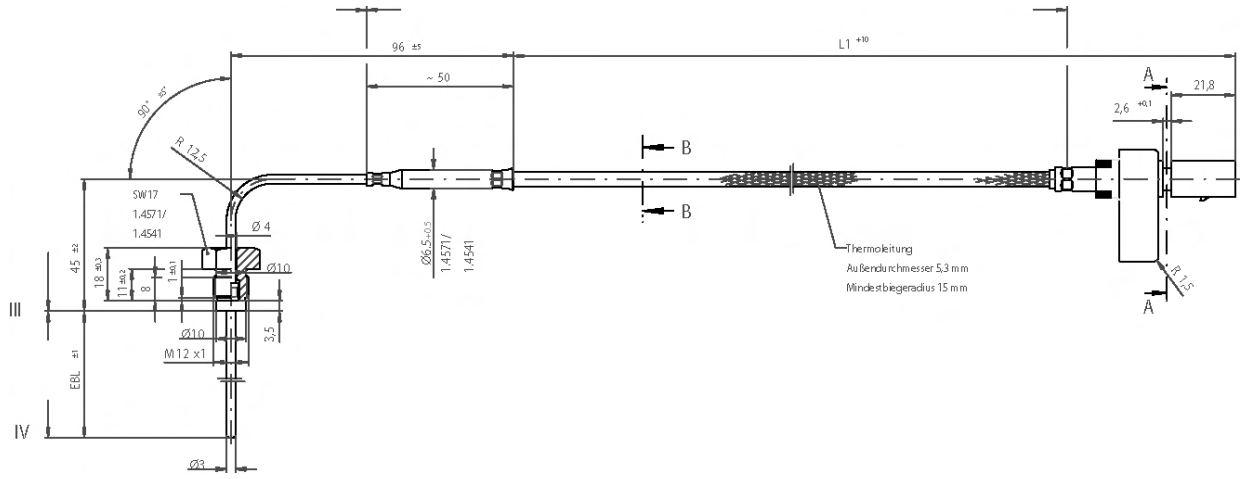
Characteristic
DIN IEC 584

Electronic data	
Power supply	12 V
Full scale output	0,5 ... 4,5 V
Thermocouple	NiCrSi-NiSi
Measuring range	-40 ... 1100°C
Response time:	
TCP-N	20 s
TCP-NF	33 s

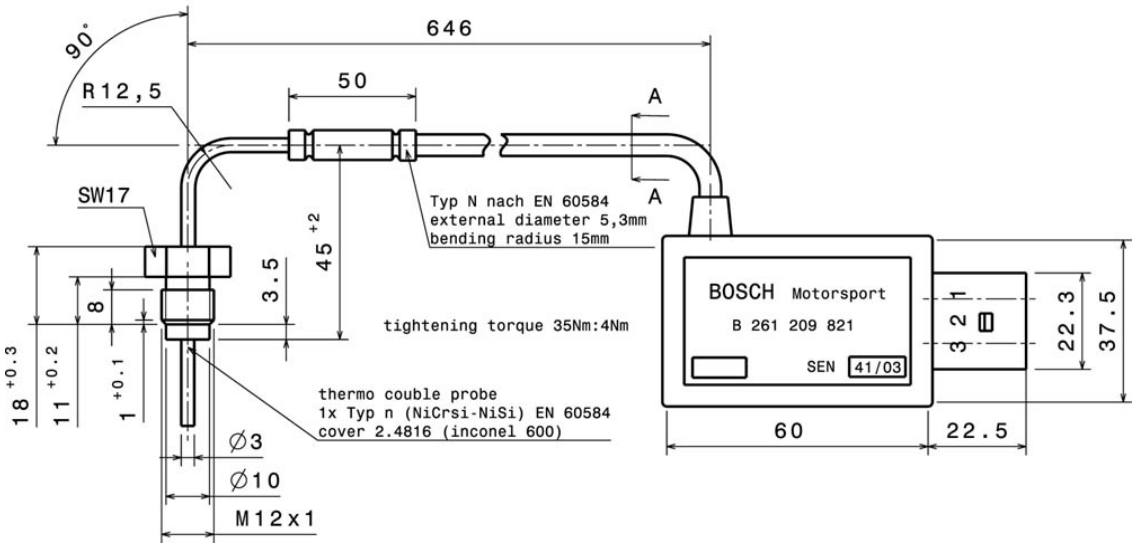
Connector	
TCP-N	1-J0973-70
TCP-NF	D 261 205 357

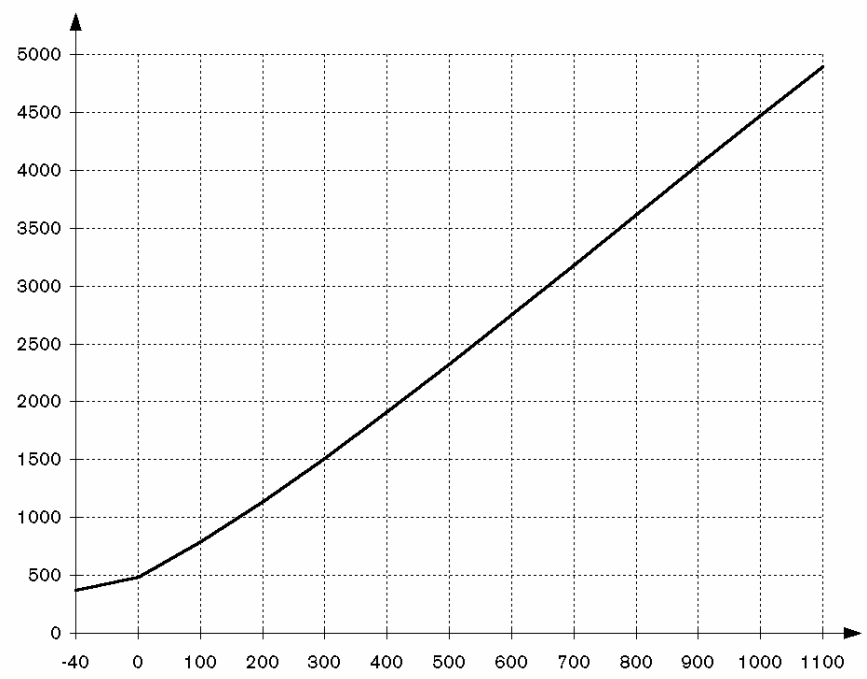
Order numbers	
TCP-N	**B 261 209 387**
Offer drawing	A 261 209 387
TCP-NF	**B 261 209 821**
Offer drawing	A 261 209 821

Design TCP-N



Design TCP-NF





Input °C	Output mV
-40	372
0	485
100	790
200	1135
300	1513
400	1912
500	2327

Input °C	Output mV
600	2752
700	3183
800	3615
900	4046
1000	4473
1100	4845

Speed Sensors Inductive

Inductive Speed Sensor IA

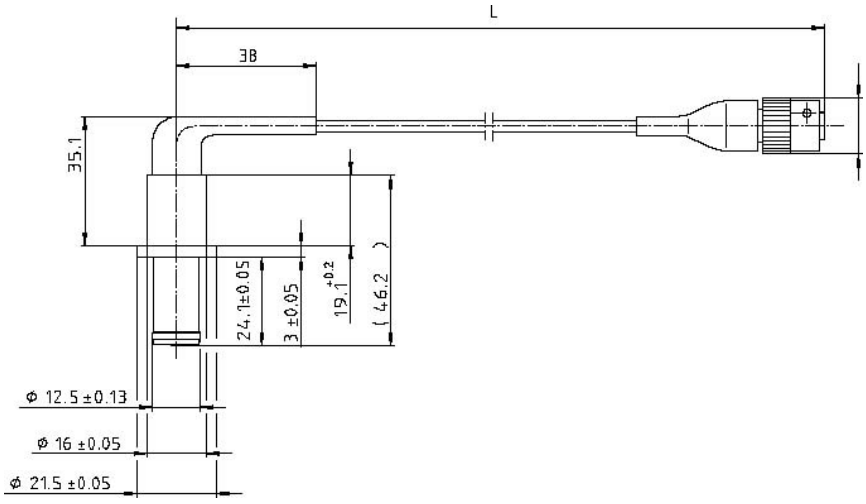
This sensor is designed for incremental measurement of revolutions and angles at engine and chassis applications. It is available in a DR-25 sleeve with various connector options and different installation depths.

Mechanical data	
Magnetic pole	round
Drill diameter	12,9 mm
Tightening torque	8 Nm
Weight	70 g
Installation depth L2	13,2/24,1/32,2/41,5 mm

Conditions for use	
Temperature range	-40 ... 230°C
Vibration	80 g/max. 80 h

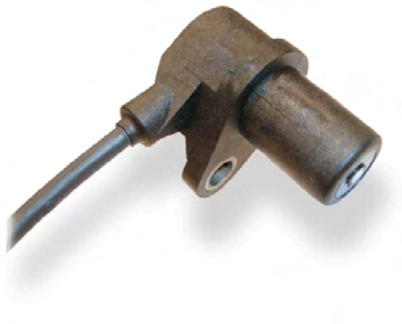
Electronic data	
Electrical strength	1200 V/max. 3 sec.
Resistance	Ri = 1200 Ω
Inductance	max. 400 mH

Order numbers	
L2: 24, 1 mm	
KPTA 6E6-4SW-C-DN	**B 261 209 500**
Offer drawing	**A 261 209 500**
KPSE 6E8-3AS-DN	**B 261 209 023**
Offer drawing	**A 261 209 023**
L2: 32,2 mm	
AS 6-06-05SN-HE	**B 261 209 519**
Offer drawing	**A 261 209 519**
KPSE 6E8-3AS-DN	**B 261 209 022**
Offer drawing	**A 261 209 022**



Inductive Speed Sensor IA-C

This sensor is designed for incremental measurement of revolutions at engine applications.



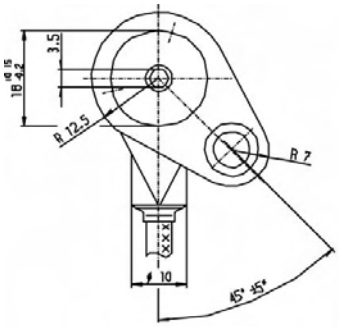
Mechanical data	
Magnetic pole	round
Fixing	M6 x 12
Length	510 mm
Tightening torque	8 Nm
Weight	80 g
Installation depth	24 mm

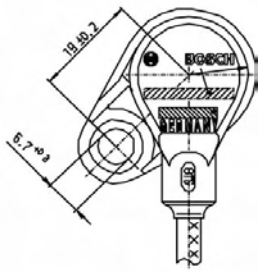
Electronic data	
Resistance	860 Ω/20° ± 10 %
Inductance	370 ± 60 mH/1 kHz

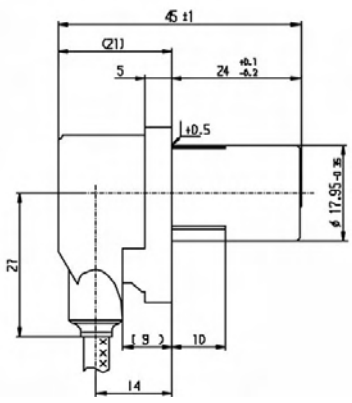
Connector	
Cable harness connector	**D 261 205 334**

Conditions for use	
Temperature range	-40 ... 130°C
Vibration	80 g/max. 80 h

Order number	
	0 261 210 136
Offer drawing	**A 265 461 845**







Inductive Speed Sensor IS

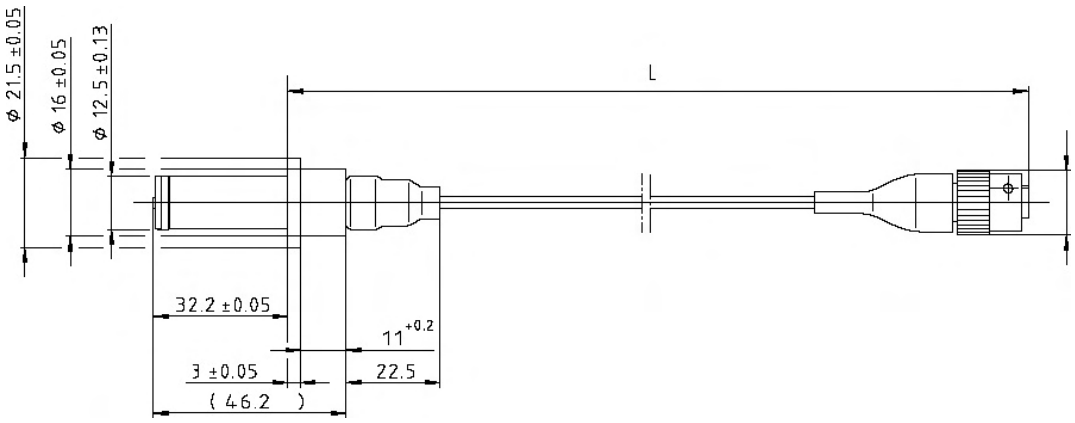
This sensor is designed for incremental measurements of revolutions and angles at engine and chassis applications. It is available in a DR-25 sleeve with various connector options and different installation depths.

Mechanical data	
Magnetic pole	round
Drill hole	12,9 mm
Tightening torque	8 Nm
Weight	70 g
Installation depth L2	13,2/24,1/32,2 mm

Conditions for use	
Temperature range	-40 ... 230°C
Vibration	80 g/max. 80 h

Electronic data	
Electrical strength	1200 V/max. 3 sec.
Resistance	Ri = 1200 Ω
Inductance	max. 400 mH

Order numbers	
L2: 24,1 mm	
KPTA 6E6-4SW-C-DN	**B 261 209 509**
Offer drawing	**A 261 209 509**
L2: 32,2 mm	
AS6-06-05SN-HE	**B 261 209 517**
Offer drawing	**A 261 209 517**
KPTA 6E6-4SW-C-DN	**B 261 209 501**
Offer drawing	**A 261 209 501**
KPSE 6E8-3AS-DN	**B 261 209 021**
Offer drawing	**A 261 209 021**



Inductive Speed Sensor IS-C

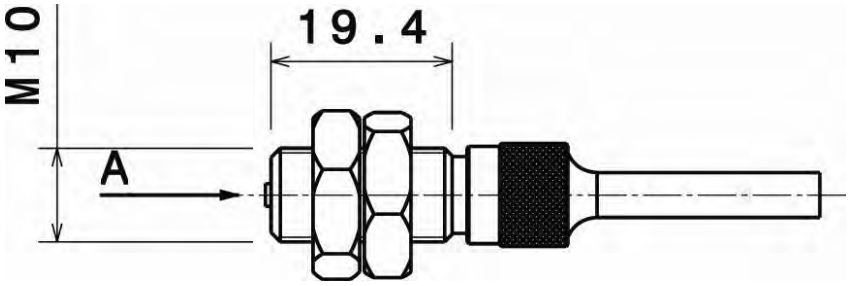
This sensor is designed for incremental measurement of revolutions at chassis applications. We manufacture one version with a metric thread and a second version with an inch thread. The sensor is available in a DR-25 sleeve with various connector options.

Mechanical data	
Magnetic pole	round
Drill hole or	M10 x 1 3/8-24 UNF-2A THD (USA)
Mounting torque	10 Nm (7.3 ft-lb) maximum
Weight	16 g

Conditions for use	
Temperature range	-40 ... 150°C

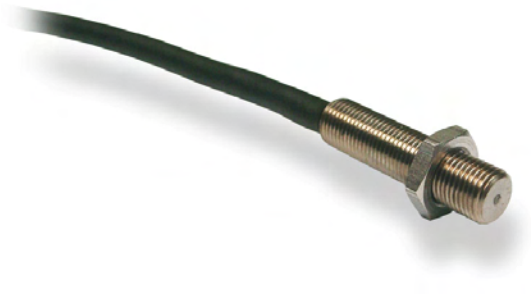
Electronic data	
Resistance	Ri = 340 Ω ± 20 %
Inductance	64 mH ± 20 %

Order numbers	
M10 x 1	
KPTA 6E6-4SW-C-DN	**B 261 209 624**
Offer drawing	**A 261 209 624**
3/8-24 UNF-2A THD	
AS 6-06-05 SN-HE	**B 261 209 609**
Offer drawing	**A 261 209 609**



Inductive Speed Sensor IS-T

This sensor is designed for incremental measurements of revolutions at turbochargers. It is available in a DR-25 sleeve with various connector options.



Mechanical data	
Magnetic pole	round
Fixing	not defined
Drill diameter	250-40UNS-2ATHD
Length	150 ... 600 mm
Wrench size	8 mm
Tightening torque	1,4 Nm
Weight	14 g
Air gap	0,5 mm, 2 kΩ load, 0,75 V pk-pk

Conditions for use	
Temperature range	-54 ... 230°C

Electronic data	
Resistance	140 ... 190 Ω
Inductivity	2,6 mH (typical)

Order number	
AS 6-06-05SN-HE	**B 261 209 662**
Offer drawing	**A 261 209 662**
ASU 603 03-SB-HE	**B 261 209 665**
Offer drawing	**A 261 209 665**

Speed Sensors Hall-effect

Speed Sensor HA-M

This sensor is designed for incremental measurement of revolutions and angles at engine and chassis applications. It is available in a DR-25 sleeve with various connector options.

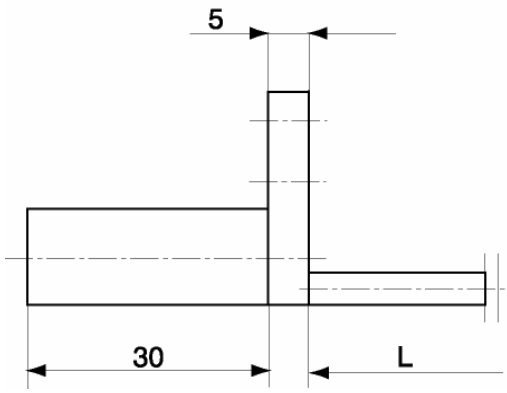
Mechanical data	
Fixing	M6
Drill hole	11,8 mm
Max. distance	1,2 mm
Tightening torque	6 Nm
Weight	12 g

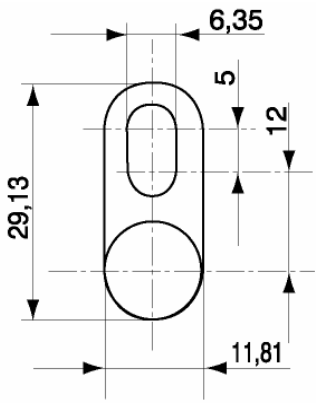
Electronic data	
Power supply	5 ... 18 V
Input current	5,6 mA
Signal output high level	4,2 V
Signal output low level	0,52 V

Conditions for use	
Temperature range	-40 ... 150°C
N min	0 rpm (CAM)
N max	4500 rpm (CAM)

Order numbers	
ASU 6-03-03PN-HE	**B 261 209 283**
Offer drawing	**A 261 209 283**

Please notice
Stray magnetic fields have an influence on the switching behaviour of the sensor element.





Speed Sensor HA-P

This sensor is designed for incremental measurement of revolutions and angles at engine and chassis applications.

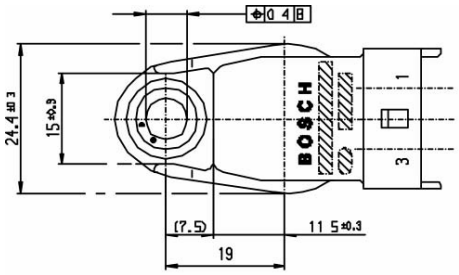
Mechanical data	
Fixing	M6
Drill hole	18 mm
Max. distance	1,52 mm
Tightening torque	6 Nm
Weight	70 g
Installation dimensions	30 mm

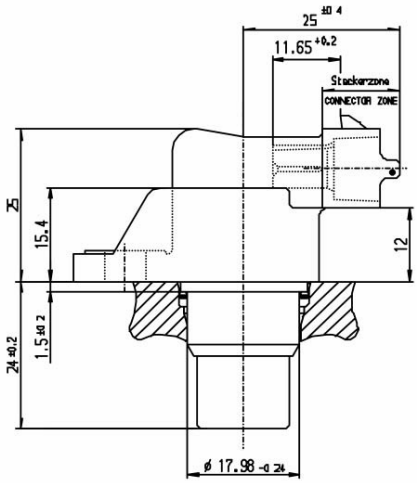
Conditions for use	
Temperature range	-30 ... 130°C
Vibration	100 g/10 Hz ... 2 kHz
Air gap	max. 1,5 mm

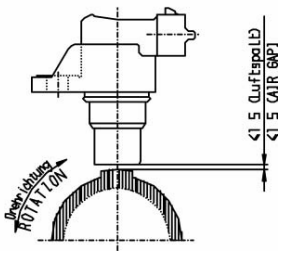
Electronic data	
Power supply	4,5 ... 24 V
Input current	10 mA typ., 20 mA max.
Signal output (active)	0,4 V max.
Output current	20 mA max.

Connector	
Cable harness connector	**D 261 205 335**

Order number	
	0 232 103 037
Offer drawing	**A 232 090 314**







Lambda Sensors

Lambda Sensor LSM 11

A lambda LSM 11 standard production sensor, manufactured in a DR-25 sleeve with a series connector.

Mechanical data	
Length	250 ... 1390 mm
Thread	M18 x 1,5
Tightening torque	60 Nm
Wrench size	22 mm
Weight	160 g
Vibration	30 g/5 Hz ... 2 kHz

Fuel additives	
Sulphur (weight)	0,2 %
Lead	0,6 g/l

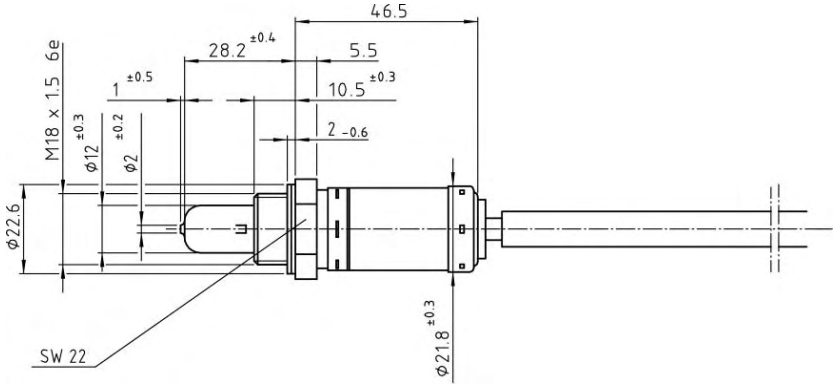
Temperature ranges	
Ceramic tip	250 ...850°C
Hexagon nut	< 570°C
Cable duct	< 250°C
Connector	< 130°C

Electronic data	
Heater supply voltage	12 ... 14 V
Heater power	18 W
Sensor element	ZrO_2 (Zirconium-Oxide-Ceramic)
Lambda measuring range	0,68 ... 1,32
Accuracy at lambda < 1	< 1,5 %

Installation instructions
Please observe the installation instructions on page 79.

Connectors
1 284 485 110
1 224 485 018

Order number	
	0 258 104 002
Offer drawing	**A 258 104 002**



Lambda Sensor LSM 11-PM

A lambda LSM 11 standard production sensor, manufactured in a DR-25 sleeve , various connector options are available.

Mechanical data	
Length	250 ... 1390 mm
Thread	M18 x 1,5
Tightening torque	60 Nm
Wrench size	22 mm
Weight	160 g
Vibration	30 g/5 Hz ... 2 kHz

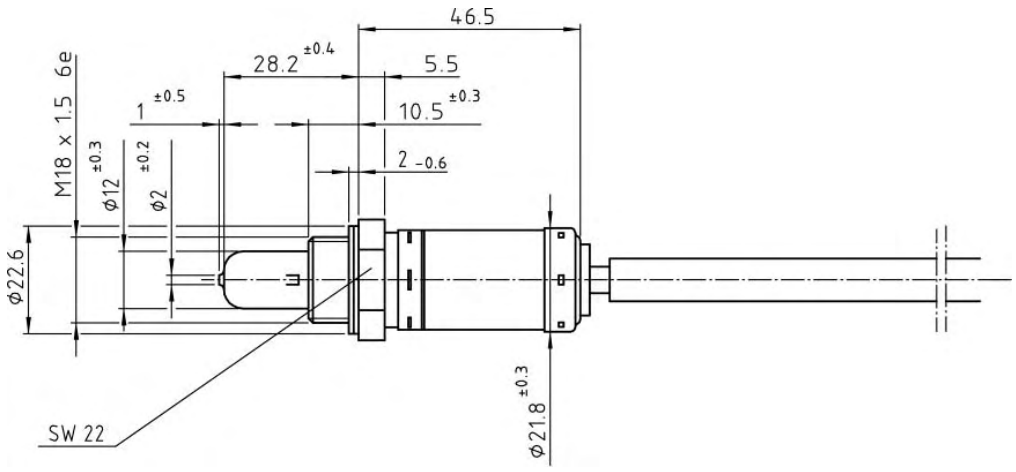
Fuel additives	
Sulphur (weight)	0,2 %
Lead	0,6 g/l

Temperature ranges	
Ceramic tip	250 ... 800°C
Hexagon nut	< 570°C
Cable duct	< 250°C
Connector	< 130°C

Electronic data	
Heater supply voltage	12 ... 14 V
Heater power	18 W
Sensor element	ZrO_2 (Zirconium-Oxide-Ceramic)
Lambda measuring range	0,68 ... 1,32
Accuracy at lambda < 1	< 1,5 %

Installation instructions
Please observe the installation instructions on page 79.

Order number	
KPTC 6E8-4P-C-DN	**B 261 209 105**
Offer drawing	**A 261 209 105**



Lambda Sensor LSM 11-RM

An individually selected wide-band LSM 11 lambda sensor. It is specially modified for motorsport use, manufactured in a Viton sleeve. Various connector options are available.

Mechanical data	
Length	250 ... 1390 mm
Thread	M18 x 1,5
Tightening torque	60 Nm
Wrench size	22 mm
Weight	160 g
Vibration	70 g/5 Hz ... 2 kHz

Fuel additives	
Sulphur (weight)	0,2 %
Lead	0,6 g/l

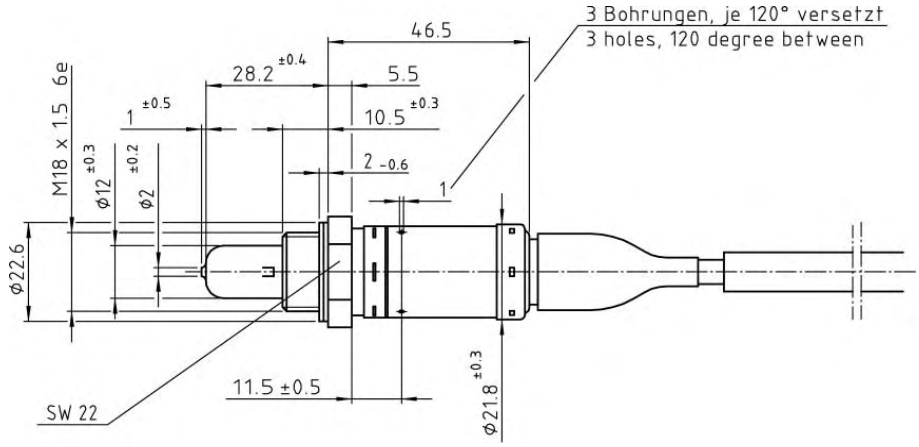
Temperature ranges	
Ceramic tip	250 ... 850°C
Hexagon nut	< 570°C
Cable duct	< 250°C
Connector	< 130°C

Electronic data	
Heater supply voltage	12 ... 14 V
Heater power	18 W
Sensor element	ZrO_2 (Zirconium-Oxide-Ceramic)
Lambda measuring range	0,68 ... 1,32
Accuracy at lambda < 1	< 1,5 %

Installation instructions

Please observe the installation instructions on page 79.

Order number	
KPTC 6E8-4P-C-DN	**B 261 209 101**
Offer drawing	**A 261 209 101**



Lambda Sensor LSU 4.2

The wide-band lambda sensor LSU 4.2 is a planar ZrO_2 dual cell limiting current sensor with integrated heater. It is used to measure the oxygen content and the lambda value of engine exhaust gases. Its output signal in the range of lambda = 0,7 to air makes the LSU capable to be used as an universal sensor for lambda = 1 measurement as well as for other lambda ranges.

The connector module carries a trimming resistor, which defines the characteristics of the sensor and is necessary for the sensor function. The wide band sensor LSU operates only in conjunction with a special control unit.

Mechanical data	
Length	460 mm/600 mm
Thread	M18 x 1,5
Tightening torque	60 Nm
Wrench size	22 mm
Weight	120 g
Vibration	30 g/5 Hz ... 2 kHz

Fuel additives
In accordance with DIN EN 228 for commercially available unleaded fuel.

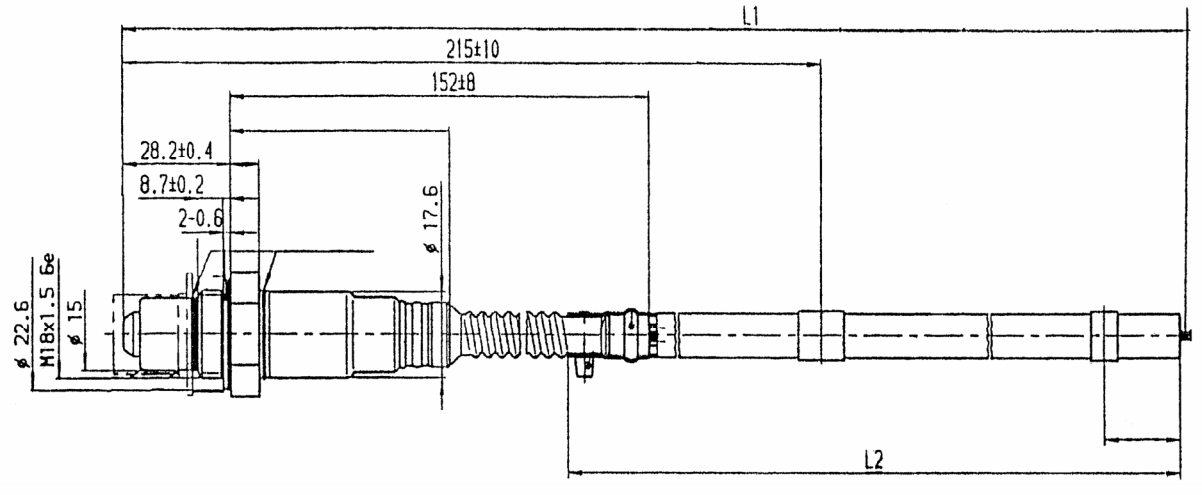
Temperature ranges	
Exhaust gas at sensor element	850°C
Hexagon of the sensor housing	< 570°C
Cable grommet (PTFE formed house) -Sensor side -Cable side	 < 250°C < 200°C
Cable and protection sleeve	< 250°C
Connector	< 120°C

Electronic data	
Heater supply voltage	9 V
Heater power	10 W
Sensor element	ZrO_2 (Zirconium-Oxide-Ceramic)
Lambda measuring range	0,70 ... ∞

Installation instructions
Please observe the installation instructions on page 79.

Connector	
Cable harness connector	**D 261 205 138**

Order numbers	
L: 460 mm	**0 258 006 066**
L: 600 mm	**0 258 006 065**
Offer drawing	**A 258 400 021**


L1
215±10
152±8
28.2±0.4
8.7±0.2
2-0.6
ø 17.6
ø 22.6
M18x1.5 6e
ø 15
L2

Lambda Sensor LSU 4.9

This wide-band lambda is a planar ZrO_2 dual cell limiting current sensor with integrated heater. It is especially designed for high vibration and ambient temperature applications. Its output signal in the range of lambda = 0,65 to air makes the LSU capable to be used as an universal sensor for lambda = 1 measurement as well as for other lambda ranges.

The connector module carries a trimming resistor, which defines the characteristics of the sensor and is necessary for the sensor function. The wide band sensor LSU operates only in conjunction with a special control unit.

Mechanical data	
Length	1000 mm
Thread	M18 x 1,5
Tightening torque	60 Nm
Wrench size	22 mm
Weight	120 g
Vibration	30 g/5 Hz ... 2 kHz

Temperature ranges	
Exhaust gas at sensor element	930°C
Hexagon of the sensor housing	< 570°C
Cable grommet cable side	< 250°C pemanent < 200°C short time
Cable and protection sleeve	< 250°C
Connector	< 150°C

Electronic data	
Heater supply voltage	7,5 V
Heater power	7,5 W
Sensor element	ZrO_2
Lambda measuring range	0,65 ... ∞

Installation instructions
Please observe the installation instructions on page 79.

Fuel additives
In accordance with DIN EN 228 for commercially available unleaded fuel

Order number	
1 928 404 687 serial connector	**0 258 017 025**

Installation instructions

The Lambda sensor should be installed at a point which permits the measurement of a representative exhaust-gas mixture, and which does not exceed the maximum permissible temperature. The sensor is screwed into a mating thread and tightened with 50 ... 60 Nm.

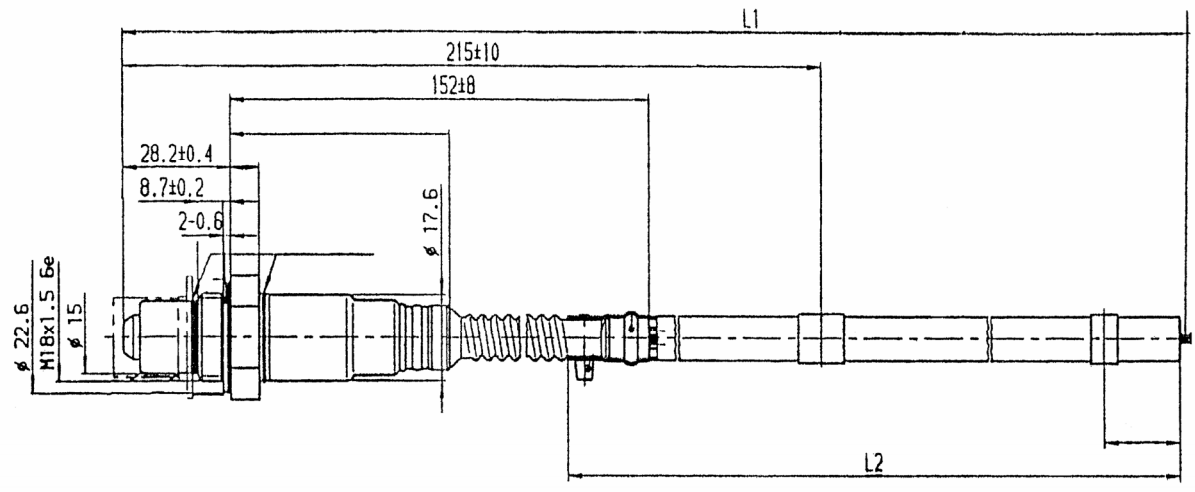
- Install at a point where the gas is as hot as possible.
- Observe the maximum permissible temperatures.
- As far as possible install the sensor vertically, whereby the electrical connections should point upwards.
- The sensor is not to be fitted near to the exhaust outlet so that the influence of the outside air can be ruled out. The exhaust-gas passage opposite the sensor must be free of leaks in order to avoid the effects of leak-air.
- Protect the sensor against condensation water.
- The sensor body must be ventilated from the outside in order to avoid overheating.
- The sensor is not to be painted, nor is wax to be applied or any other forms of treatment. Only the recommended grease is to be used for lubricating the threads.
- The sensor receives the reference air through the connection cable. This means that the connector must be clean and dry. Contact spray, and anti-corrosion agents etc. are forbidden.

The connection cable must not be soldered. It must only be crimped, clamped, or secured by screws.

Connector Pin out

For connector 1 928 404 687

Pin	Name	Description
1	IP	Pump current
2	VM	Virtual ground
3	Gnd heater	Ground for heater
4	Ubat heater	External power supply
5	RT	Trim Resistor
6	UN	Nernst voltage



Lambda Sensor Mini-LSU 4.9

This wide-band lambda is a planar ZrO_2 dual cell limiting current sensor with integrated heater. It is especially designed for high vibration and ambient temperature applications. Its output signal in the range of lambda = 0,65 to air makes the LSU capable to be used as an universal sensor for lambda = 1 measurement as well as for other lambda ranges.

The connector module carries a trimming resistor, which defines the characteristics of the sensor and is necessary for the sensor function. The wide band sensor LSU operates only in conjunction with a special control unit.

Mechanical data	
Length	60 mm
Thread	M16x1,5
Tightening torque	30 Nm
Wrench size	17 mm
Weight	28 g

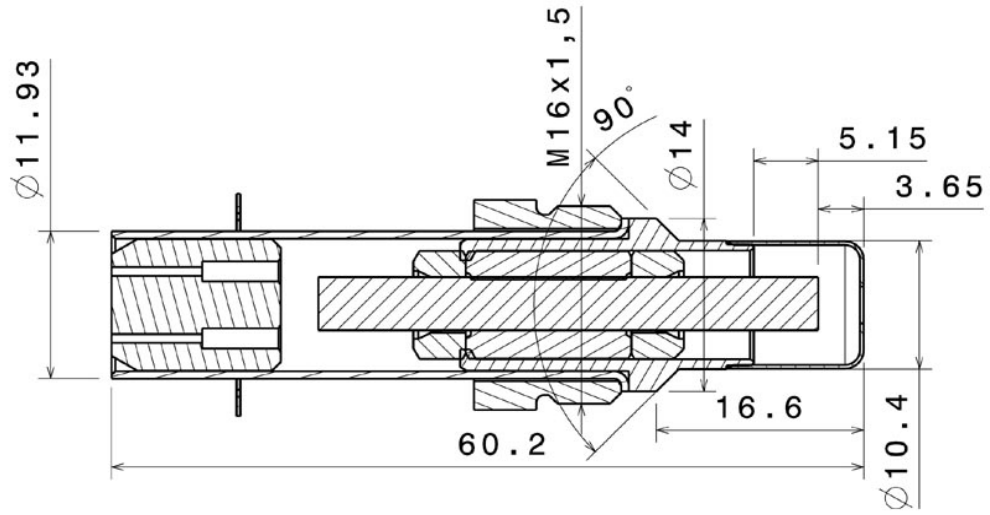
Temperature ranges	
Exhaust gas at sensor element	850°C
Hexagon of the sensor housing	< 570°C
Cable grommet cable side	< 310°C pemanent < 500°C short time
Cable and protection sleeve	< 250°C
Connector	< 120°C

Fuel additives
In accordance with DIN EN 228 for commercially available unleaded fuel

Electronic data	
Heater supply voltage	7,5 V
Heater power	7,5 W
Sensor element	ZrO_2
Lambda measuring range	0,65 ... ∞

Connector Pin out		
For connectors 1 928 404 682 and AS 007-35PN		
Pin	**Name**	**Description**
1	IP	Pump current
2	VM	Virtual ground
3	Gnd heater	Ground for heater
4	Ubat heater	External power supply
5	RT	Trim Resistor
6	UN	Nernst voltage

Order numbers	
1 928 404 682 serial connector	**B 258 490 103**
AS 007-35PN	**B 261 209 353**


⌀11.93
M16x1,5
90°
⌀14
5.15
3.65
16.6
60.2
⌀10.4

AWS_LSU 4.9

The AWS_LSU 4.9 is used in combination with the lambda sensor Mini-LSU 4.9. The box supplies two LSU 4.9 lambda probes. It includes two heaters and converts each specific sensor signal into two separate lambda signals. Further more, the temperature of the sensor, the duty cycle of the heater and diagnosis of the probe is available. The signal output is via CAN-message.

Mechanical data	
Weight	80 g
Size	38 x 43 x 16 mm
Cable length	150 mm

Conditions for use	
Operating temperature	10 ... 60°C

Diagnosis	
λ_{Value} = 0,0069:	failed sensor (short cut or not connected)
λ_{Value} = 0,0686:	probe did not reach 600°C (up to 30 sec)
λ_{Value} = 0,1373:	heating periode

Electronic data	
Power supply	5 ... 20V
Rent consumption	120 mA at 12 V + heater current (max. 2 A per probe)
Channels	2 A/F
Resolution	0,01
Sampling rate	100 Hz per channel

CAN-ID

For each probe, the following CAN-IDs will receive the A/F value as **16-bit unsigned Integer** and the heating value and the temperature values as **8-bit unsigned byte** (Motorola-type):

CAN -ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x290	A/F1		A/F2		Temp1	Temp2	Heat1	Heat2

A/F_{Value}	= 0,001 * A/Fx
λ_{Value}	= A/F_{Value} / 14,57 = A/F_{Digits} / 14570 = A/F_{Digits} * 0,00006863418
Heiz-Temp	= $Tempx_{Digits}$ * 2 + 496,9°C

Order number

F 01E B01 622

Knock Sensors

Knock Sensor KS-P

This sensor is designed to measure the structure borne noise resulted from irregular engine combustion. The robust sensor is suitable for use under extreme conditions.

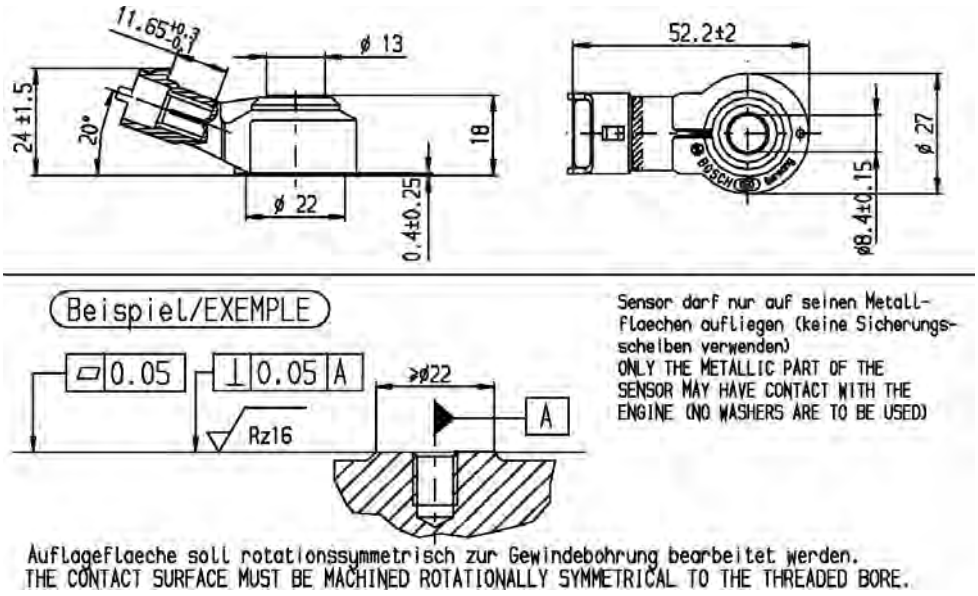
Mechanical data	
Thread	M8 x 30 (aluminium engine block) M8 x 25 (cast iron engine block)
Weight	48 g
Tightening torque	15 ... 25 Nm
Mounting position	random

Conditions for use	
Temperature range	-40 ... 150°C
Vibration, constant	≤ 80 g
Vibration, short	≤ 400 g

Electronic data	
Main resonance frequency	> 20 kHz
Impedance R:	> 1MΩ
C	1100 ± 300 pF
Measuring range	0,1 ... 400 g
Sensitivity at 5 kHz	26 ± 8 mV/g
Range of frequency	1 ... 20 kHz

Connector	
Cable harness connector	**D 261 205 337**

Order number	
	0 261 231 120
Offer drawing	**A 261 230 170**



Knock Sensor KS-R

This sensor is designed for knock detection and control. It is also available in a DR-25 sleeve with various connector options. Other sensors are available on request.

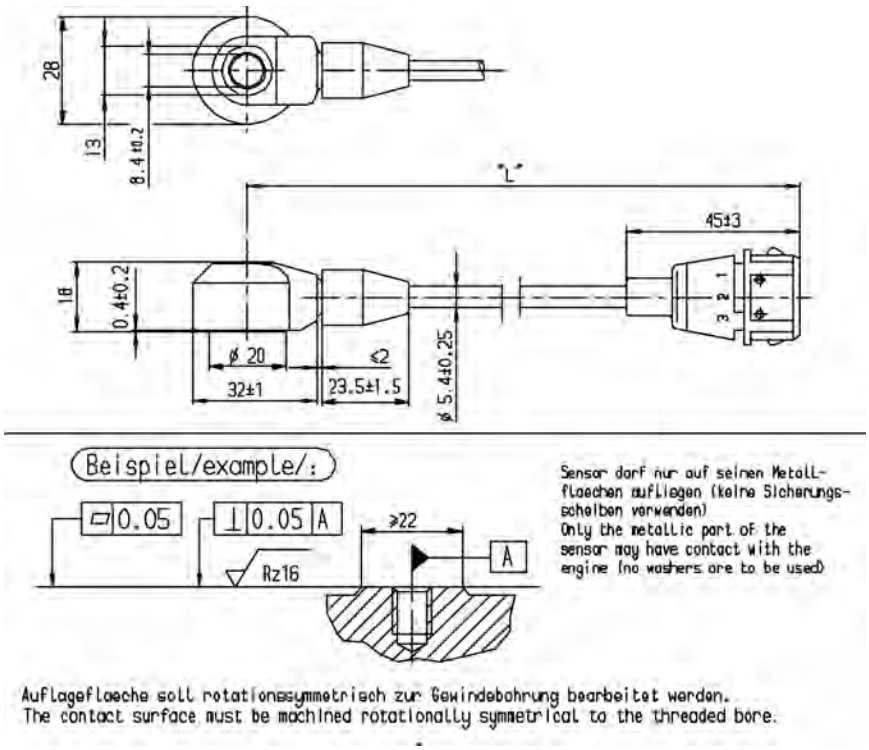
Mechanical data	
Thread	M8 x 30 (aluminium engine block) M8 x 25 (cast iron engine block)
Weight	82 g
Tightening torque	15 ... 25 Nm
Length	100 ... 500 mm

Conditions for use	
Temperature range	-40 ... 180°C

Electronic data	
Main resonance frequency	> 25 kHz
Impedance R:	> 1MΩ
C	1200 ± 400 pF
Measuring range	0,1 ... 400 g
Sensitivity at 5 kHz	26 + 8 - 5 mV/g
Range of frequency	1 ... 20 kHz

Connector	
Cable harness connector	**D 261 205 289**

Order number	
	0 261 231 047
Offer drawing	**A 261 230 073-03**



Rotary Potentiometers

Rotary Potentiometer RP 55

Possible range: 55°

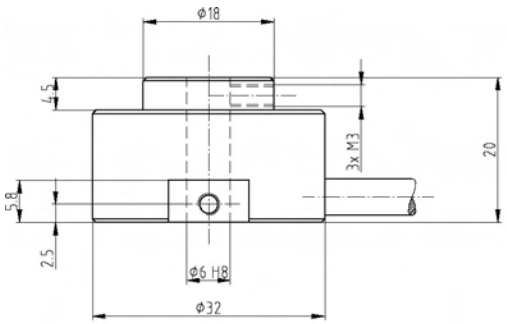
This sensor is designed to measure throttle position, chassis data acquisition and more. The sensor is manufactured in an aluminium housing. Various range and connector options are available on request.

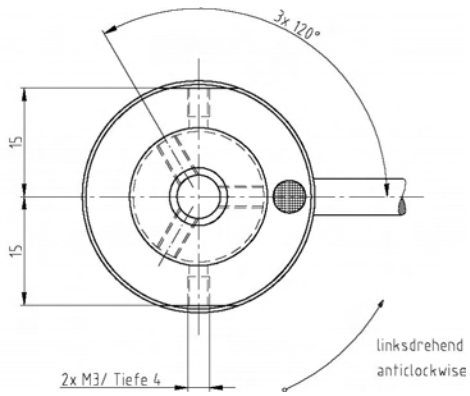
Mechanical data	
Mounting	2 x M3
Standard shaft	6 mm
Length	160 ... 300 mm
Mech. range	360°
Tightening torque	0,5 Nm
Weight	41 g
Life expectancy	> 50 x 10^6 rotations

Electronic data	
Nominal resistance	5 kΩ
Resistance tolerance	20 %
Linearity	± 0,25 %
Temp. coefficient	5 ppm/°C
Max. current	10 mA
Max. power supply	50 V
Usual power supply	5 V

Conditions for use	
Temperature range	-25 ... 75°C
Vibration	10 g/30 ... 500 Hz

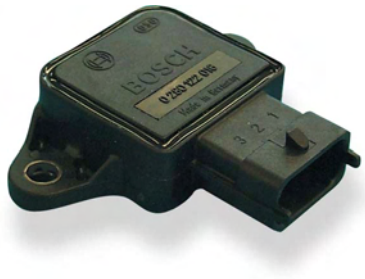
Order number	
ASL-6-06-05PA-HE	**B 261 209 578**
Offer drawing	**A 261 209 578**





Rotary Potentiometer RP 86
Possible range: 86°

This sensor is designed to measure rotational movement, especially throttle positions. Each sensor is individually laser-calibrated.



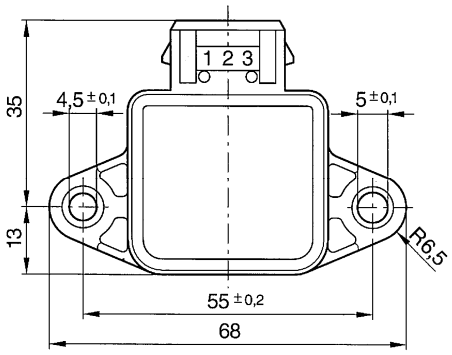
Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	< 86°
Max. rotation speed	120 x 1/min
Tightening torque	1,5 ... 2,5 Nm
Weight	60 g
Life expectancy	> 2 x 10^5 rotations

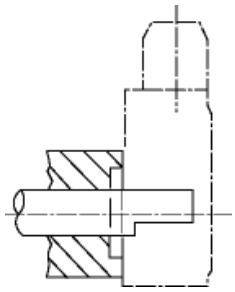
Electronic data	
Nominal resistance	2,5 kΩ
Resistance tolerance	20 %
Non-linearity	0,9 %
Repetitive accuracy	0,01 %
Temp. coefficient	< 5 ppm/°C
Max. power supply	42 V
Usual power supply	5 V

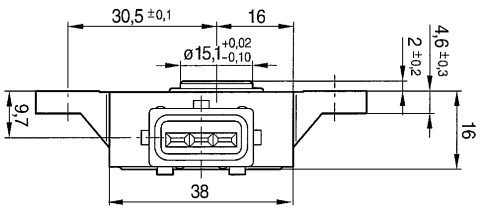
Conditions for use	
Temperature range	-40 ... 130°C
Vibration	40 g/5 Hz ... 2 kHz

Connector	
Cable harness connector	**D 261 205 334**

Order number	
	0 280 122 016
Offer drawing	**A 280 121 252**







motorsport@bosch.com

Rotary Potentiometer RP 100
Possible range: 100°

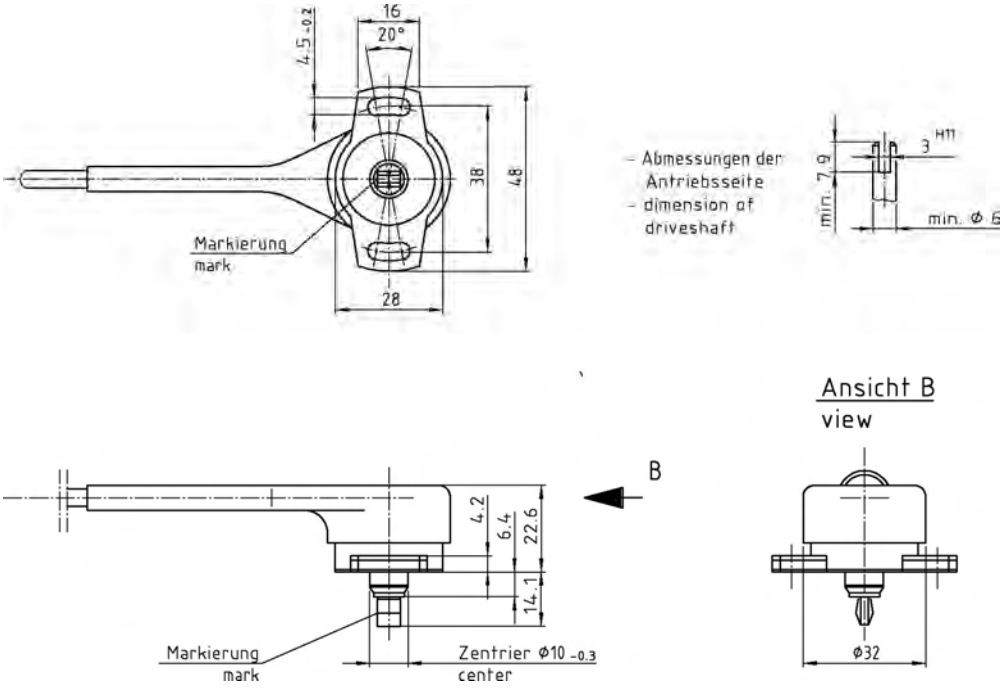
This sensor is designed to measure rotational movement. Each sensor is individually laser-calibrated. It is manufactured in a DR-25 sleeve, various connector options are available.

Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10^5 rotations

Electronic data	
Nominal resistance	3 kΩ
Resistance tolerance	20 %
Non-linearity	0,9 %
Repetitive accuracy	0,01 %
Temp. coefficient	< 5 ppm/°C
Max. power supply	42 V
Usual power supply	5 V

Conditions for use	
Temperature range	-20 ... 150°C
Vibration	40 g/5 Hz ... 2 kHz

Order number	
ASL 6-06-05PA-HE	**B 261 209 127**
Offer drawing	**A 261 209 127**



Rotary Potentiometer RP 100 twin
Possible range: 2 x 100°

The Rotary Potentiometer RP 100 twin is used in applications where redundant signals are necessary to ensure that the system runs failsafe. A typical field of application are electronic throttle control systems where angle movement is measured by the RP 100 twin.

The sensor is manufactured in a DR-25 sleeve. Various connector options are available.

Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	± 360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	g
Lifetime	> 50 x 10^5 rotations
Protection	IP 65

Conditions for use	
Temperature range	-40 ... 150°C
Vibration	20 g/5 Hz ... 2 kHz

Electronic data	
Nominal resistance	3 kΩ
Resistance tolerance	20 %
Non-linearity	±1 %
Repetitive accuracy	≤ 0,01 %
Temp. coefficient	< 5 ppm/°C
Max. power supply	42 V
Usual power supply	5 V

Order numbers	
Anticlockwise	
AS 6-07-35PN	**B 261 209 594**
Offer drawing	**A 261 209 594**
Clockwise	
AS 6-07-35PN	**B 261 209 591**
Offer drawing	**A 261 209 591**

Rotary Potentiometer RP 130
Possible range: 130°

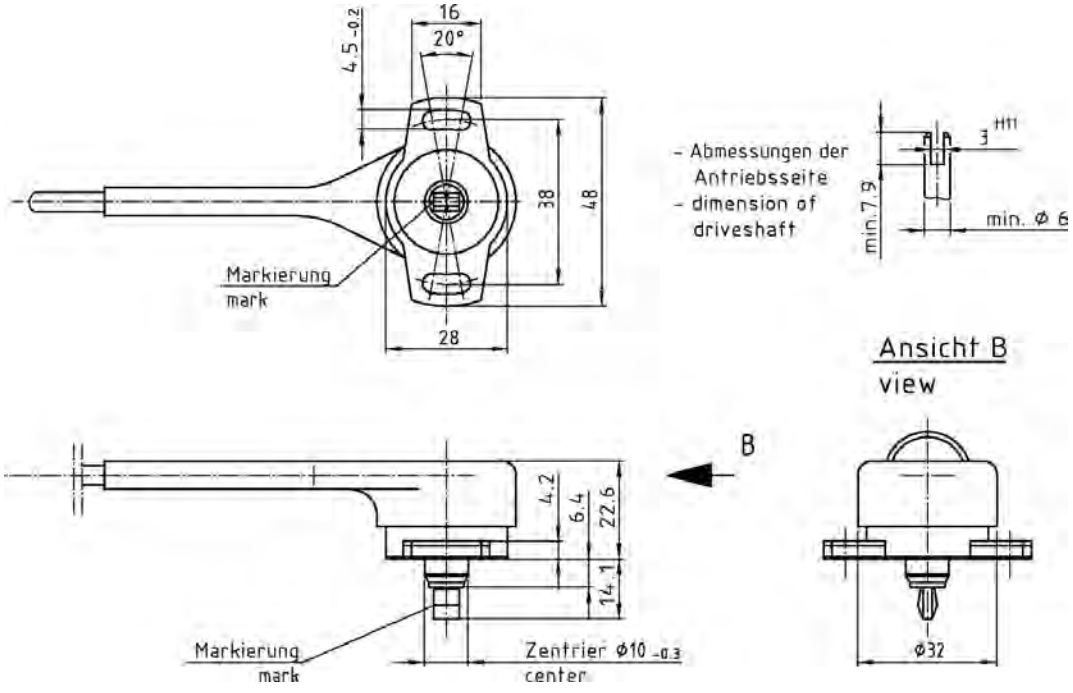
This sensor is designed to measure rotational movement. Each sensor is individually laser-calibrated. It is manufactured in a DR-25 sleeve, various connector options are available.

Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10^5 rotations

Electronic data	
Nominal resistance	3 kΩ
Resistance tolerance	20 %
Non-linearity	0,9 %
Repetitive accuracy	0,01 %
Temp. coefficient	< 5 ppm/°C
Max. power supply	42 V
Usual power supply	5 V

Conditions for use	
Temperature range	-20 ... 150°C
Vibration	40 g/5 Hz ... 2 kHz

Order number	
ASL 6-06-05PA-HE	**B 261 209 128**
Offer drawing	**A 261 209 128**



Rotary Potentiometer RP 130-M
Possible range: 130°

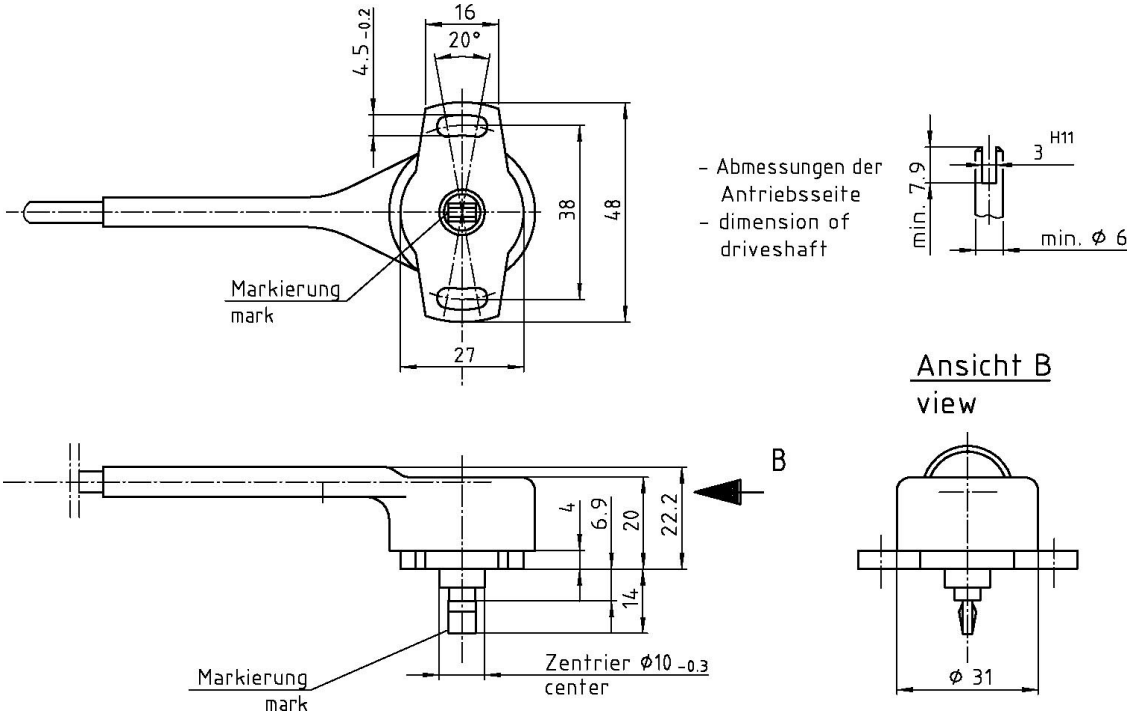
This sensor is designed to measure rotational movement. Each sensor is individually laser-calibrated. It is manufactured in a DR-25 sleeve, various connector options are available. Metal housing.

Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10^5 rotations

Electronic data	
Nominal resistance	3 kΩ
Resistance tolerance	20 %
Non-linearity	0,9 %
Repetitive accuracy	0,01 %
Temp. coefficient	< 5 ppm/°C
Max. power supply	42 V
Usual power supply	5 V

Conditions for use	
Temperature range	-55 ... 125°C
Vibration	40 g/5 Hz ... 2 kHz

Order number	
KPTA 6E6-4P-C-DN	**B 261 209 576**
Offer drawing	**A 261 209 576**



Rotary Potentiometer RP 308
Possible range: 308°

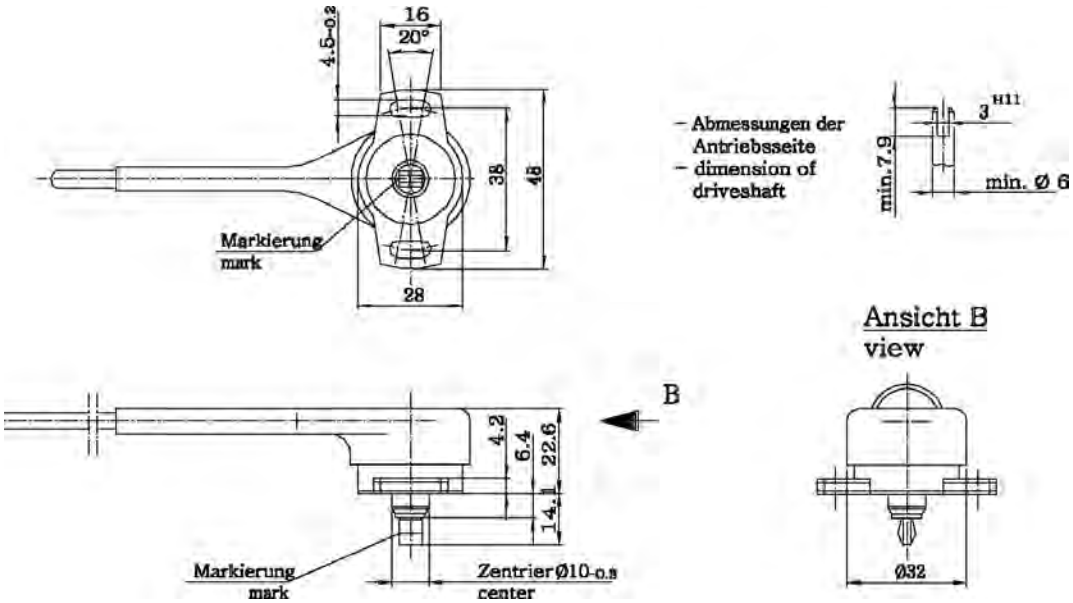
This sensor is designed to measure rotational movement. Each sensor is individually laser-calibrated. It is manufactured in a DR-25 sleeve, various connector options are available.

Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	± 360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10^5 rotations

Electronic data	
Nominal resistance	5 kΩ
Resistance tolerance	20 %
Non-linearity	0,9 %
Repetitive accuracy	0,01 %
Temp. coefficient	< 5 ppm/°C
Max. power supply	42 V
Usual power supply	5 V

Conditions for use	
Temperature range	-20 ... 150°C
Vibration	40 g/5 Hz ... 2 kHz

Order numbers	
ASL 6-06-05PA-HE	**B 261 209 570**
Offer drawing	**A 261 209 570**



Rotary Potentiometer RP 350-M
Possible range: 350°

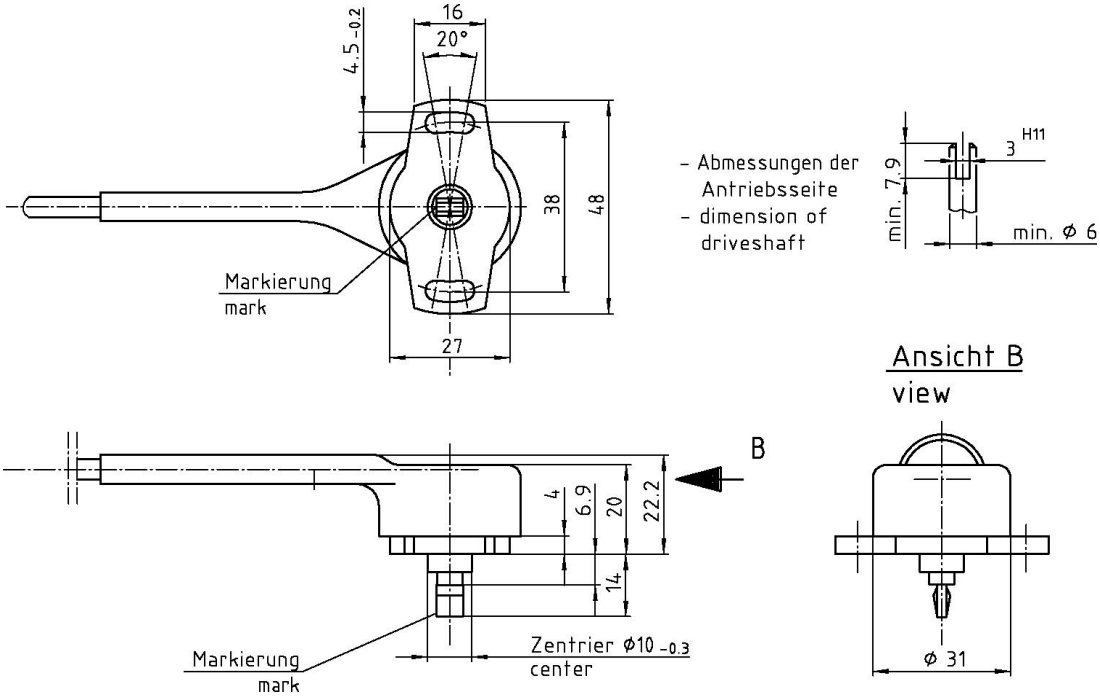
This sensor is designed to measure rotational movement. Each sensor is individually laser-calibrated. It is manufactured in a DR-25 sleeve, various connector options are available. Metal housing.

Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10^5 rotations

Electronic data	
Nominal resistance	6 kΩ
Resistance tolerance	20 %
Non-linearity	0,9 %
Repetitive accuracy	0,01 %
Temp. coefficient	< 5 ppm/°C
Max. power supply	42 V
Usual power supply	5 V

Conditions for use	
Temperature range	-55 ... 125°C
Vibration	40 g/5 Hz ... 2 kHz

Order number	
ASL 6-06-05PA-HE	**B 261 209 577**
Offer drawing	**A 261 209 577**

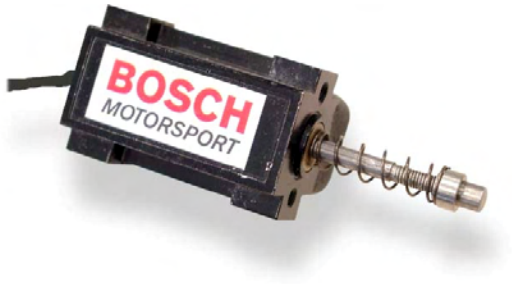


Linear Potentiometers

Linear Potentiometer LP 10

Possible mechanical range: 10 mm

This sensor is designed to measure stabilizer movement. It is manufactured in a DR-25 sleeve. Various connector options are available.

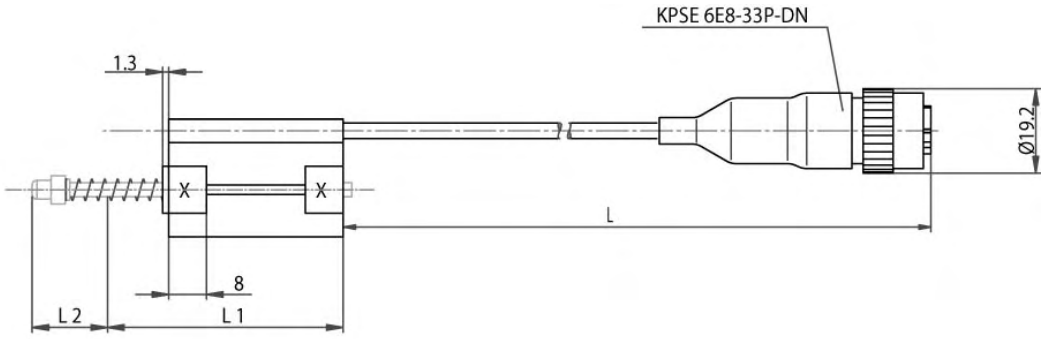


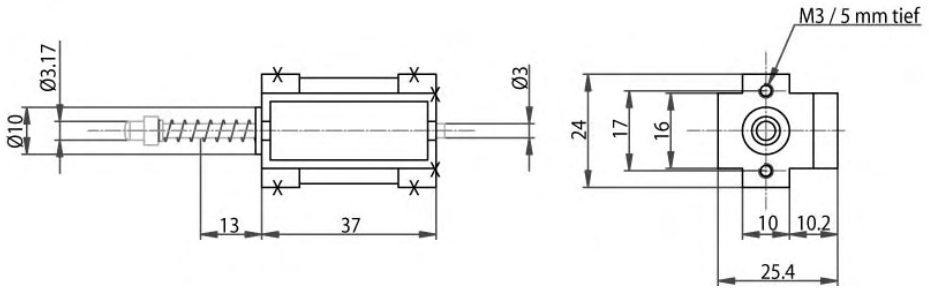
Mechanical data	
Mounting	2 x M3
Cable length	150 ... 1000 mm
Weight	70 g

Conditions for use	
Temperature range	-25 ... 75°C

Electronic data	
Nominal resistance	1 kΩ ± 20 %
Max. current	1 mA
Non-linearity	1 %
Usual power supply	5 V
Power consumption	0,3 W

Order number	
KPSE 6E8-33P-DN	**B 261 209 535**
Offer drawing	**A 261 209 535**





Linear Potentiometer LP 25 twin
Possible mechanical range: 25 mm

The Linear Potentiometer LP 25 twin is used in applications where redundant signals are necessary to ensure that the system runs failsafe. A typical field of application are electronic throttle control systems. Various connector options are available.

Mechanical data	
Possible mech. range [L2]	50 mm
Min. length [L1]	120 mm
Cable length [L]	150 ... 1000 mm
Mounting hole	∅ 3 mm
Protection	IP 66
Max. shaft velocity	10 m/sec
Weight	approx. 50 g

Conditions for use	
Temperature range	-30 ... 100°C

Electronic data	
Nominal resistance [25 ... 50 mm]	1 kΩ
Non-linearity	0,25 %
Usual power supply	5 V
Max. power supply	45 V

Order numbers	
AS 6-07-35PN	**B 261 209 858**
Offer drawing	**A 261 209 858**

Linear Potentiometer LP 50
Possible mechanical range: 50 mm

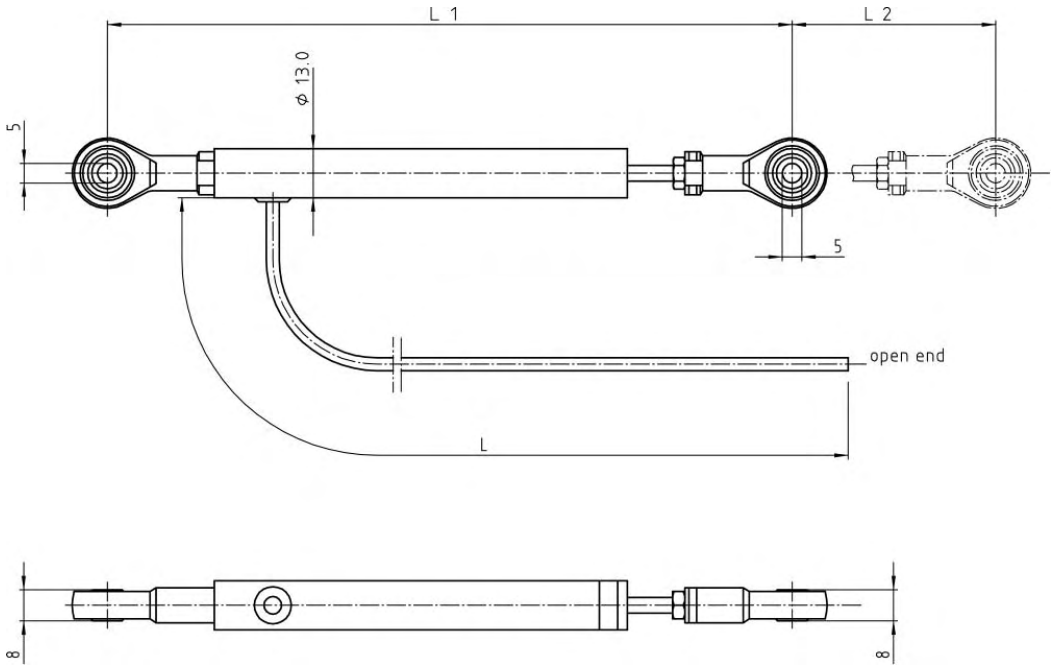
This sensor is designed to measure gear position, throttle position or suspension movement. It is manufactured in a DR-25 sleeve, various connector options are available.

Mechanical data	
Possible mech. range [L2]	50 mm
Min. length [L1]	172 mm
Cable length [L]	150 ... 1000 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Tightening torque	10 Nm
Max. shaft velocity	1000 mm/sec
Weight [25 ... 150 mm]	90 ... 150 g

Electronic data	
Nominal resistance [25 ... 150 mm]	2 kΩ
Max. current	< 1 mA
Non-linearity	0,25 %
Usual power supply	5 V
Max. power supply	42 V

Order number	
KPTA 6E6-4P-C-DN	**B 261 209 136**
Offer drawing	**A 261 209 136**

Conditions for use	
Temperature range	-20 ... 85°C
Vibration	10 g/5 ... 500 Hz
Shock	30 g/11 ms



Linear Potentiometer LP 50 twin
Possible mechanical range: 50 mm

The Linear Potentiometer LP 50 twin is used in applications where redundant signals are necessary to ensure that the system runs failsafe. A typical field of application are electronic throttle control systems. Various connector options are available.

Mechanical data	
Possible mech. range [L2]	50 mm
Min. length [L1]	120 mm
Cable length [L]	150 ... 1000 mm
Mounting hole	∅ 3 mm
Protection	IP 66
Max. shaft velocity	10 mm/sec
Weight	approx. 60 g

Conditions for use	
Temperature range	-30 ... 100°C

Electronic data	
Nominal resistance [25 ... 50 mm]	2 kΩ
Non-linearity	0,25 %
Usual power supply	5 V
Max. power supply	45 V

Order numbers	
AS 6-07-35N	**B 261 209 859**
Offer drawing	**A 261 209 859**

Linear Potentiometer LP 75
Possible mechanical range: 75 mm

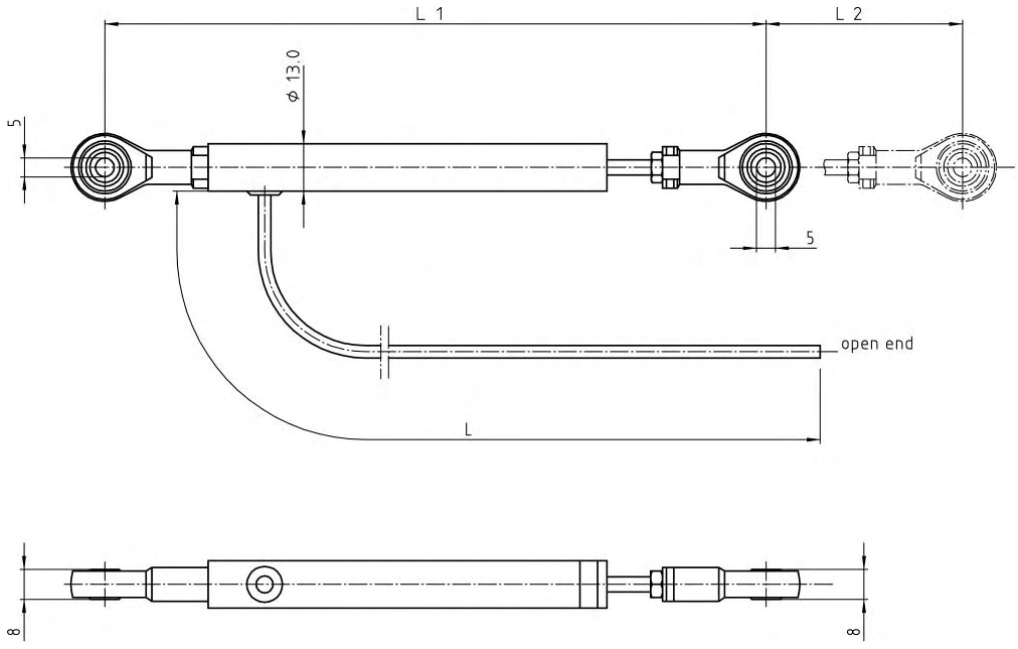
This sensor is designed to measure gear position, throttle position or suspension movement. It is manufactured in a DR-25 sleeve, various connector options are available.

Mechanical data	
Possible mech. range [L2]	75 mm
Min. length [L1]	197 mm
Cable length [L]	150 ... 1000 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Tightening torque	10 Nm
Max. shaft velocity	1000 mm/sec
Weight [25 ... 150 mm]	90 ... 150 g

Electronic data	
Nominal resistance [25 ... 150 mm]	3 kΩ
Max. current	< 1 mA
Non-linearity	0,15 %
Usual power supply	5 V
Max. power supply	42 V

Order number	
KPSE 6E8-33P-DN	**B 261 209 530**
Offer drawing	**A 261 209 530**

Conditions for use	
Temperature range	-20 ... 85°C
Vibration	10 g/5 ... 500 Hz
Shock	30 g/11 ms



Linear Potentiometer LP 75F
Possible mechanical range: 75 mm

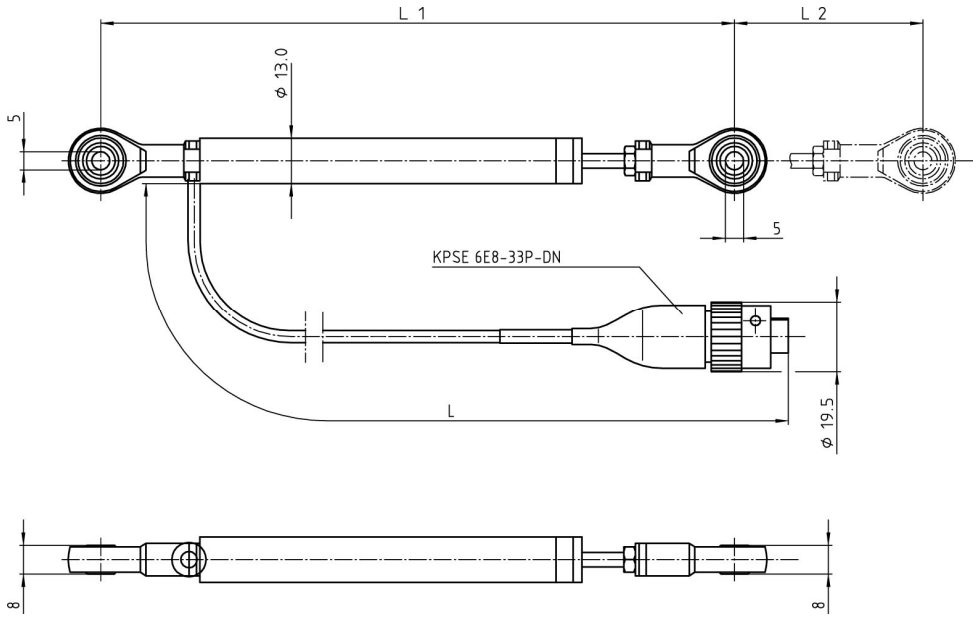
This sensor is designed to measure gear position, throttle position or suspension movement. It is manufactured in a DR-25 sleeve, various connector options are available. Optionally a protective sleeve for the telescopic shaft can be ordered.

Mechanical data	
Cable length L	150 ... 1000 mm
Min. length L1	220 mm
Possible mech. range L2	79 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Max. shaft velocity	10 m/sec
Weight	52 g

Conditions for use	
Temperature range	-30 ... 100°C

Electronic data	
Nominal resistance	3 kΩ
Max. current	< 1 mA
Non-linearity	0,15 %
Usual power supply	5 V
Max. power supply	47 V

Order numbers	
KPSE 6E8-33P-DN	**B 261 209 852**
Offer drawing	**A 261 209 852**



Linear Potentiometer LP 100
Possible mechanical range: 100 mm

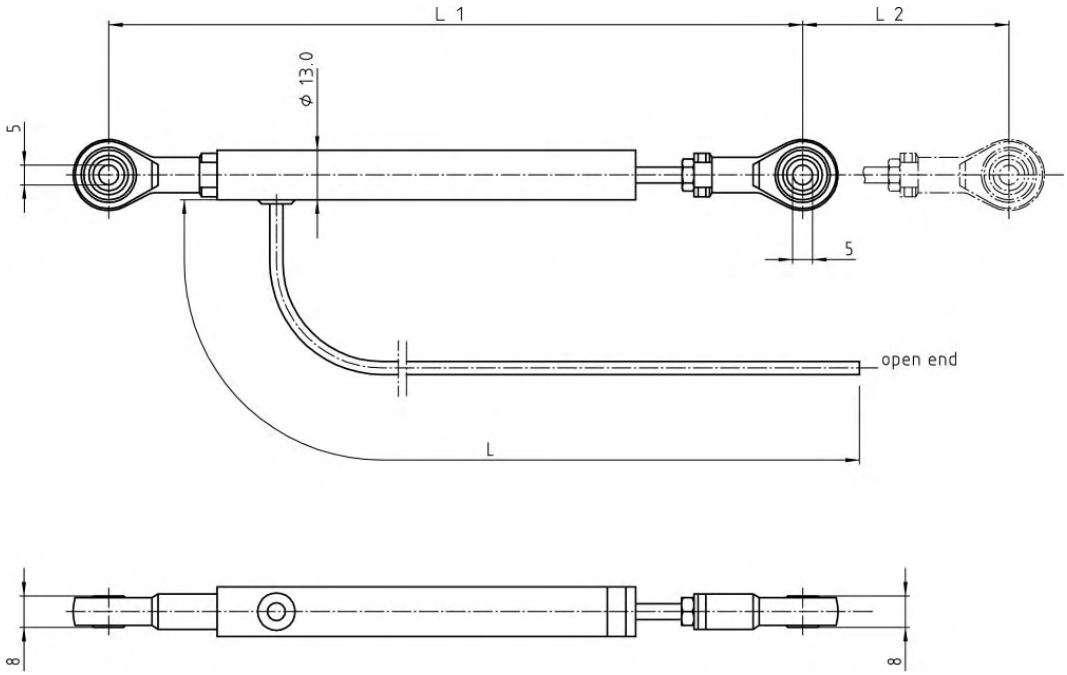
This sensor is designed to measure gear position, throttle position or suspension movement. It is manufactured in a DR-25 sleeve, various connector options are available.

Mechanical data	
Possible mech. range [L2]	100 mm
Min. length [L1]	220 mm
Cable length [L]	150 ... 1000 mm
Mounting	2 x M5
Tightening torque	10 Nm
Sealing	O-ring shaft seal
Max. shaft velocity	1000 mm/sec
Weight [25 ... 150 mm]	90 ... 150 g

Conditions for use	
Temperature range	-20 ... 85°C
Vibration	10 g/5 ... 500 Hz
Shock	30 g/11 ms

Electronic data	
Nominal resistance [25 ... 150 mm]	4 kΩ
Max. current	< 1 mA
Non-linearity	0,15 %
Usual power supply	5 V
Max. power supply	42 V

Order numbers	
KPSE 6E8-33P-DN	**B 261 209 134**
Offer drawing	**A 261 209 134**
KPTA 6E6-4P-C-DN	**B 261 209 137**
Offer drawing	**A 261 209 137**



Linear Potentiometer LP 100F

Possible mechanical range: 100 mm

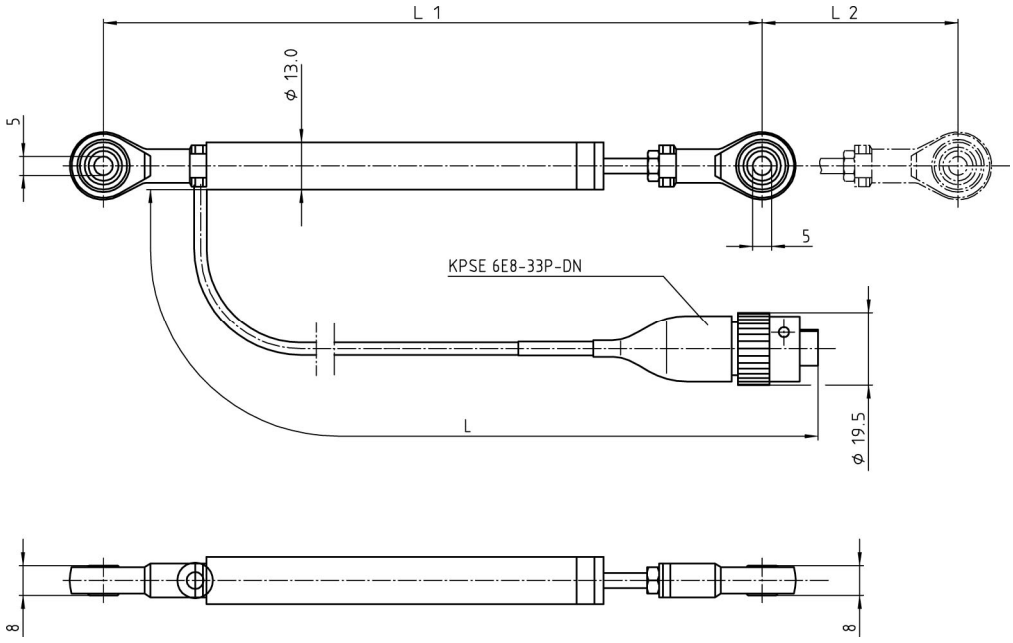
This sensor is designed to measure gear position, throttle position or suspension movement. It is manufactured in a DR-25 sleeve, various connector options are available. Optionally a protective sleeve for the telescopic shaft can be ordered.

Mechanical data	
Cable length L	150 ... 1000 mm
Min. length L1	244 mm
Possible mech. range L2	104 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Max. shaft velocity	10 m/sec
Weight	62 g

Electronic data	
Nominal resistance	4 kΩ
Max. current	< 1 mA
Non-linearity	0,15 %
Usual power supply	5 V
Max. power supply	74 V

Conditions for use	
Temperature range	-30 ... 100°C

Order number	
KPSE 6E8-33P-DN	**B 261 209 853**
Offer drawing	**A 261 209 853**



Linear Potentiometer LP 150

Possible mechanical range: 150 mm

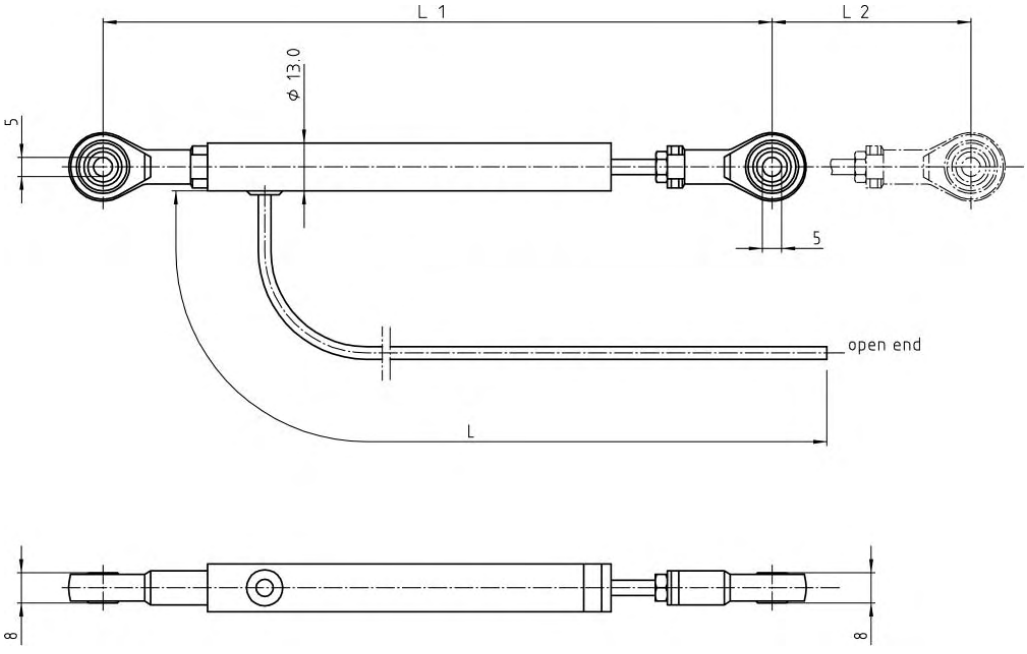
This sensor is designed to measure gear position, throttle position or suspension movement. It is manufactured in a DR-25 sleeve, various connector options are available.

Mechanical data	
Possible mech. range [L2]	150 mm
Min. length [L1]	278 mm
Cable length [L]	150 ... 1000 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Tightening torque	10 Nm
Max. shaft velocity	1000 mm/sec
Weight [25 ... 150 mm]	90 ... 150 g

Conditions for use	
Temperature range	-20 ... 85°C
Vibration	10 g/5 ... 500 Hz
Shock	30 g/11 ms

Electronic data	
Nominal resistance [25 ... 150 mm]	6 kΩ
Max. current	< 1 mA
Non-linearity	0,15 %
Usual power supply	5 V
Max. power supply	42 V

Order numbers	
KPTA 6E6-4P-C-DN	**B 261 209 138**
Offer drawing	**A 261 209 138**
AS 6-06-05PA-HE	**B 261 209 534**
Offer drawing	**A 261 209 534**



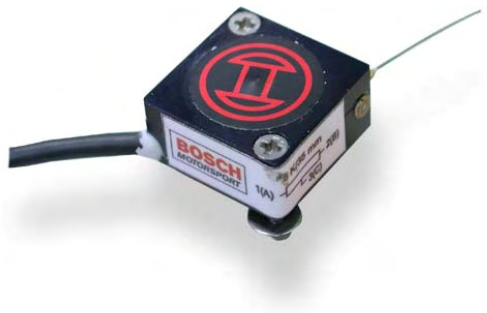
Wire Potentiometers

Wire Potentiometer WP 35

Possible mechanical range: 35 mm

Wire sensors are suitable for measuring linear and non-linear motions. The compact style allows flexible and easy installation. Due to the small size, precise measurement is possible even in difficult applications.

Various connector options available.



Mechanical data	
Possible mech. range	38,1 mm
Mounting	2 x 2-56 THD
Cable length	150 ... 450 mm
Tightening torque	1,5 ... 2,5 Nm
Weight	15 g
Life expectancy	50 x 10^6 rotations
Protection	IP 54
Dimensions	19 x 19 x 9,7 mm

Conditions for use	
Temperature range	-65 ... 125°C
Max. cable acceleration	15 g
Max. cable tension	1,7 N
Shock	100 g for 6 ms
Vibration	10 Hz ... 2 kHz at 15 g

Accessories
Holder

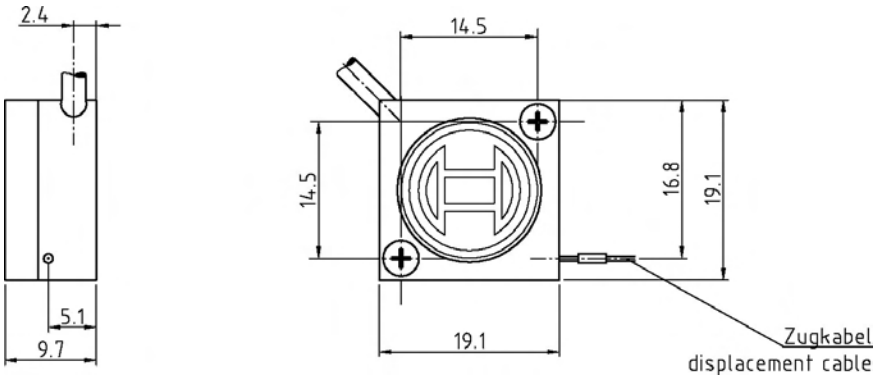
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	50 V

Order numbers	
ASL 6-06-05PA-HE	**B 261 209 541**
Offer drawing	**A 261 209 541**
Holder	**B 261 209 864**

! Caution !

User, please observe the following:

- Ensure electrical connections are performed according to the enclosed Position Transducer User´s Guide.
- Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.



Wire Potentiometer WP 50
Possible mechanical range: 50 mm

Wire sensors are suitable for measuring linear and non-linear motions. The compact style allows flexible and easy installation. Due to the small size, precise measurement is possible even in difficult applications.

Various connector options available. We offer repair service for this product.

Mechanical data	
Possible mech. range	50,8 mm
Mounting	2 x 2-56 THD
Cable length	150 ... 450 mm
Tightening torque	1,5 ... 2,5 Nm
Weight	28 g
Life expectancy	50 x 10^6 rotations
Protection	IP 54
Dimensions	24,4 x 11,4 mm

Conditions for use	
Temperature range	-65 ... 125°C
Max. cable acceleration	40 g
Max. cable tension	3,3 N
Shock	100 g for 6 ms
Vibration	10 Hz ... 2 kHz at 15 g

Accessories
Holder

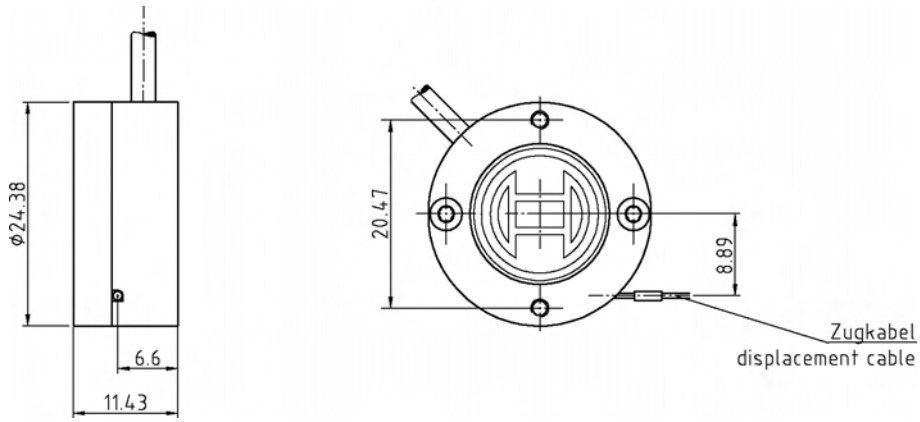
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	50 V

Order numbers	
ASL 6-06-05PA-HE	**B 261 209 542**
Offer drawing	**A 261 209 542**
Holder	**B 261 209 864**

! Caution !

User, please observe the following:

- Ensure electrical connections are performed according to the enclosed Position Transducer User´s Guide.
- Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.



Wire Potentiometer WP 75
Possible mechanical range: 75 mm

Wire sensors are suitable for measuring linear and non-linear motions. The compact style allows flexible and easy installation. Due to the small size, precise measurement is possible even in difficult applications.

Various connector options available. We offer repair service for this product.

Mechanical data	
Possible mech. range	76,2 mm
Mounting	2 x 2-56 THD
Cable length	150 ... 450 mm
Tightening torque	1,5 ... 2,5 Nm
Weight	28 g
Life expectancy	50 x 10^6 rotations
Protection	IP 54
Dimensions	32,5 x 11,4 mm

Conditions for use	
Temperature range	-65 ... 125°C
Max. cable acceleration	17 g
Max. cable tension	3,3 N
Shock	100 g for 6 ms
Vibration	10 Hz ... 2 kHz at 15 g

Accessories
Holder

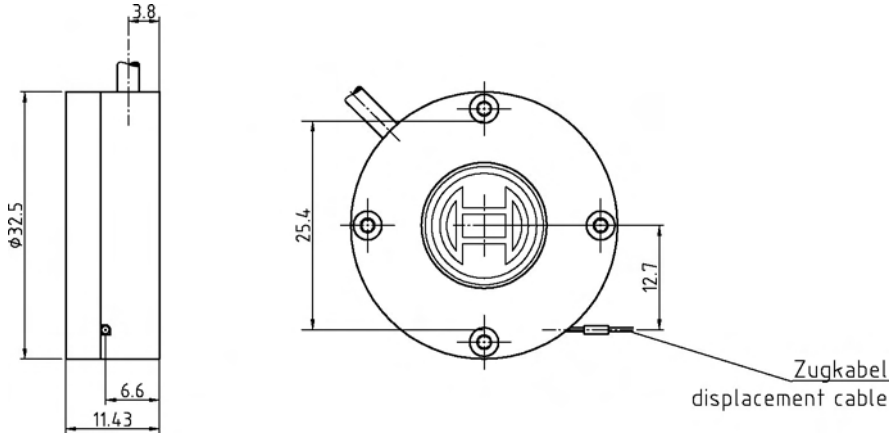
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	38 V

Order numbers	
ASL 6-06-05PA-HE	**B 261 209 543**
Offer drawing	**A 261 209 543**
Holder	**B 261 209 865**

! Caution !

User, please observe the following:

- Ensure electrical connections are performed according to the enclosed Position Transducer User´s Guide.
- Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.



Wire Potentiometer WP 100
Possible mechanical range: 100 mm

Wire sensors are suitable for measuring linear and non-linear motions. The compact style allows flexible and easy installation. Due to the small size, precise measurement is possible even in difficult applications.

Various connector options available. We offer repair service for this product.

Mechanical data	
Possible mech. range	101,6 mm
Mounting	2 x 2-56 THD
Cable length	150 ... 450 mm
Tightening torque	1,5 ... 2,5 Nm
Weight	57 g
Life expectancy	50 x 10^6 rotations
Protection	IP 54
Dimensions	43,3 x 12,5 mm

Conditions for use	
Temperature range	-65 ... 125°C
Max. cable acceleration	9 g
Max. cable tension	2,8 N
Shock	100 g for 6 ms
Vibration	10 Hz ... 2 kHz at 15 g

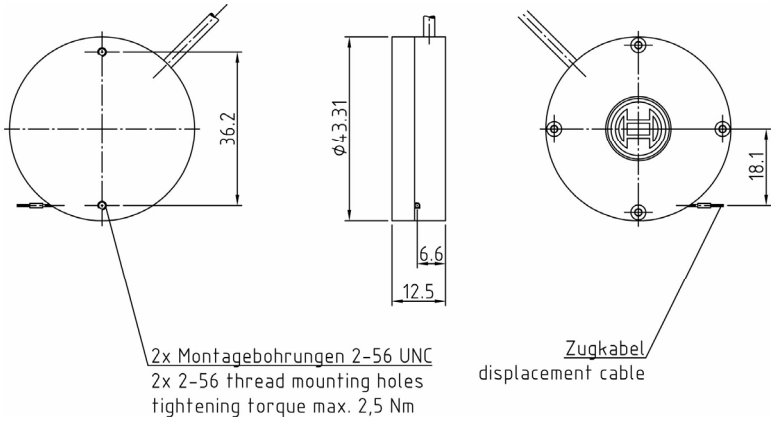
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	38 V

Order numbers	
KPTA 6E6-4P-C-DN	**B 261 209 863**
Offer drawing	**A 261 209 863**
Holder	**B 261 209 866**

! Caution !

User, please observe the following:

- Ensure electrical connections are performed according to the enclosed Position Transducer User´s Guide.
- Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.

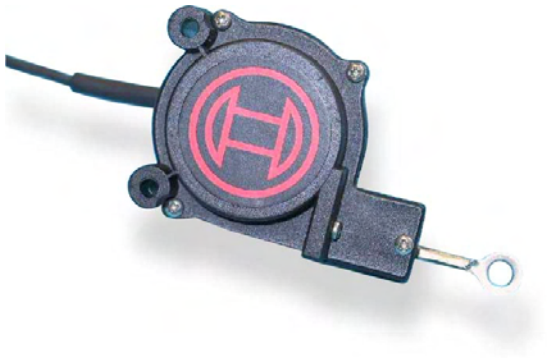


Wire Potentiometer WP 120

Possible mechanical range: 120 mm (96 mm on request)

Wire sensors are suitable for measuring linear and non-linear motions. The compact style allows flexible and easy installation. Due to the small size, precise measurement is possible even in difficult applications.

Manufactured in a DR-25 sleeve, various connector options available.



Mechanical data	
Possible mech. range	120 mm
Mounting	2 x M3
Cable length	150 ... 1000 mm
Tightening torque	1,5 ... 2,5 Nm
Weight	90 g
Life expectancy	1 x 10^6 rotations

Conditions for use	
Temperature range	-15 ... 60°C
Max. moving speed	10 m/s

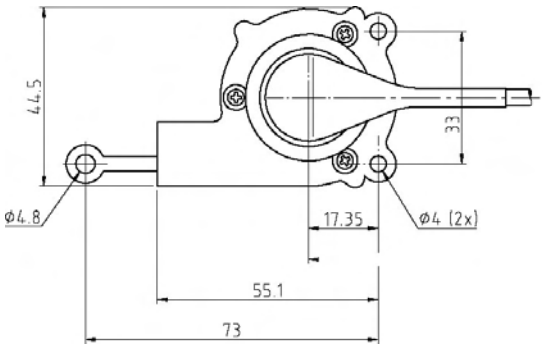
Electronic data	
Nominal resistance	1,0 kΩ
Non-linearity	± 1 %
Usual power supply	5 V
Max. power supply	25 V

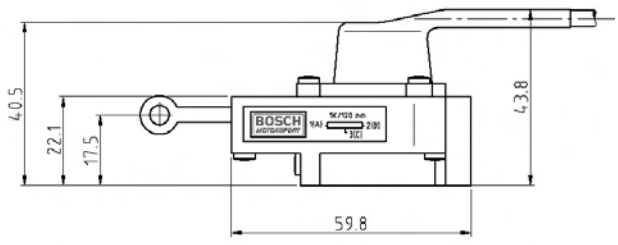
Order numbers	
120 mm	
KPTA 6E6-4P-C-DN	**B 261 209 536**
Offer drawing	**A 261 209 536**
96 mm	**on request**

! Caution !

User, please observe the following:

- Ensure electrical connections are performed according to the enclosed Position Transducer User´s Guide.
- Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.





Wire Potentiometer WP 125
Possible mechanical range: 125 mm

Wire sensors are suitable for measuring linear and non-linear motions. The compact style allows flexible and easy installation. Due to the small size, precise measurement is possible even in difficult applications.

Various connector options available. We offer repair service for this product.

Mechanical data	
Possible mech. range	127,5 mm
Mounting	2 x 2-56 THD
Cable length	150 ... 450 mm
Tightening torque	1,5 ... 2,5 Nm
Weight	85 g
Life expectancy	50 x 10^6 rotations
Protection	IP 54
Dimensions	50,5 x 13,2 mm

Conditions for use	
Temperature range	-65 ... 125°C
Max. cable acceleration	8 g
Max. cable tension	2,5 N
Shock	100 g for 6 ms
Vibration	10 Hz ... 2 kHz at 15 g

Accessories
Holder

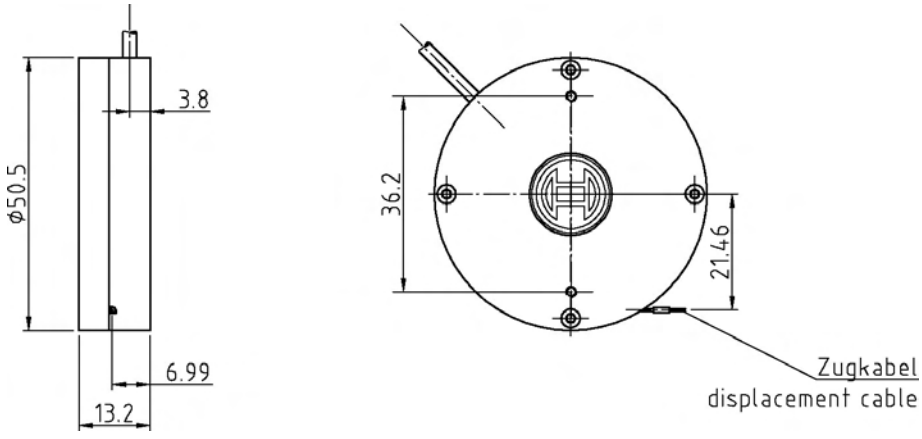
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	38 V

Order numbers	
ASL 6-06-05PA-HE	**B 261 209 545**
Offer drawing	**A 261 209 545**
Holder	**B 261 209 866**

! Caution !

User, please observe the following:

- Ensure electrical connections are performed according to the enclosed Position Transducer User´s Guide.
- Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.



Acceleration Sensor

Accelerometer AM 600

These accelerometers are available to measure up to three axes in a single, robust package. With reference to its fitting position, longitudinal, transversal and horizontal acceleration up to 4,5 g can be measured.

Manufactured in DR-25 sleeve; various connector options available.

Mechanical data	
Weight 2 axes	30 g
3 axes	50 g
Length	150 ... 1000 mm
Measuring range	± 4,5 g
Overload	± 600 g
Dimensions	
2 axes	24 x 27 x 13,5 mm
3 axes	24 x 27 x 29,8 mm
Fixing	2 x M3
Tightening torque	2 Nm

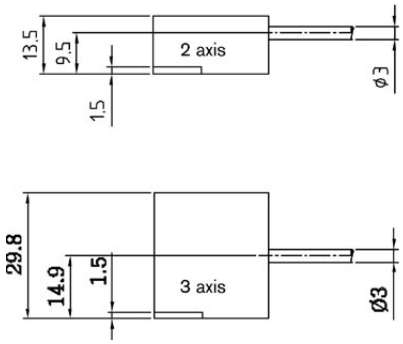
Electronic data	
Supply voltage	5 V DC
Max. supply voltage	6 V DC
Signal output	2,5 V = 0 g; 440 mV/g
Supply current	7 mA
Max. current	12 mA
Tolerance of sensitivity	± 3 %
Non-linearity of sensitivity	± 2 %

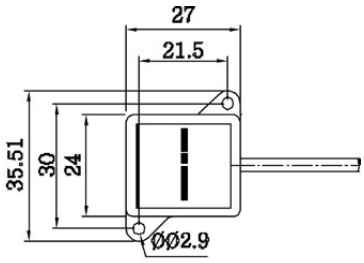
Connector	
Cable harness connector	ASL 6-06-05PA-HE

Conditions for use	
Temperature range	-40 ... 85°C

Characteristic	
Offset x, y, z	2,5 V at 0 g
Sensitivity x, y, z	440 mV/g

Order numbers	
2 axes	**B 261 209 311**
Offer drawing	**A 261 209 311**
3 axes	**B 261 209 313**
Offer drawing	**A 261 209 313**

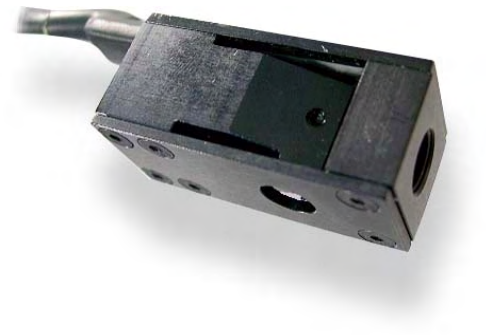




Gear Shift Sensors

Gear Shift Sensor GSS

This sensor is specially designed for precision gear shift force measurement. It can be integrated into the gear shift lever of a sequential gear box. It is manufactured in a DR-25 sleeve, various connector options are available.



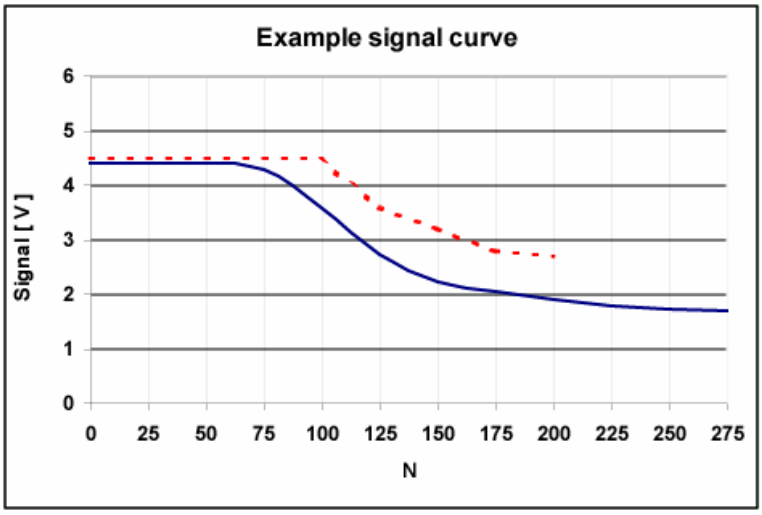
Mechanical data	
Weight	90 g
Max. deviation	± 10°
Fixing	2 x M10 x 1
Tightening torque	16 Nm
Dimensions	22 x 22 x 50 mm
Mech. Range	programmable up to 150 Nm

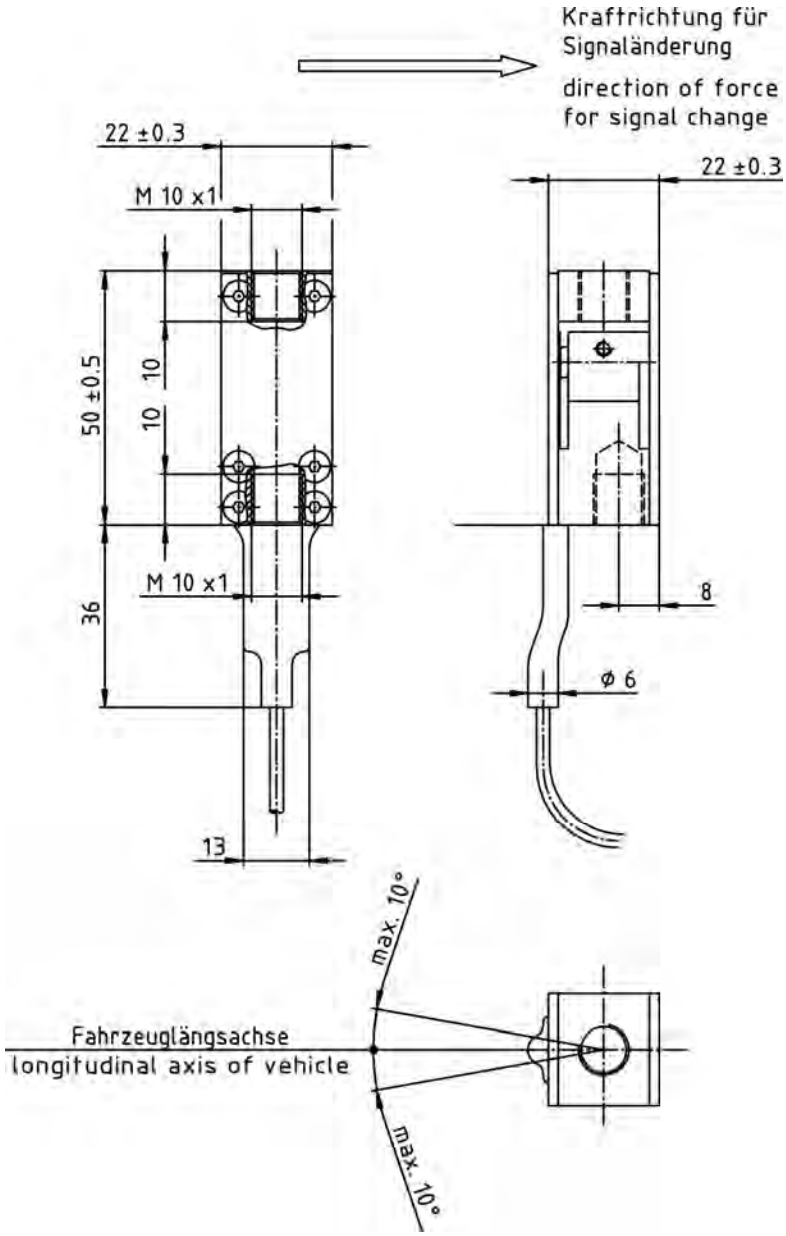
Conditions for use	
Temperature range	0 ... 80°C
Vibration	80 g/5 Hz ... 2 kHz

Characteristic
Individual characteristic will be delivered with each sensor.

Electronic data	
Supply voltage	10 V
Input current	< 1 mA
Signal output	1 ... 4 V ± 0,5 V
Zero output	4 V ± 0,3 V

Order numbers	
KPSE 6E8-33P-DN	**B 261 209 222**
Offer drawing	**A 261 209 222**
KPTA 6E6-4P-C-DN	**B 261 209 224**
Offer drawing	**A 261 209 224**
AS-6-06-05PC-HE	**B 261 209 225**
Offer drawing	**A 261 209 225**




Kraftrichtung für
Signaländerung
direction of force
for signal change
22 ±0.3
M 10 x1
50 ±0.5
10
10
M 10 x1
36
13
22 ±0.3
8
ø 6
max. 10°
Fahrzeuglängsachse
longitudinal axis of vehicle
max. 10°

Gear Shift Sensor GSS-2

This sensor is specially designed for precision gear shift force measurement. It can be integrated into the gear shift lever of a sequential gear box. It is manufactured in a DR-25 sleeve, various connector options are available.

Mechanical data	
Weight	90 g
Max. deviation	± 10°
Fixing	2 x M10 x 1
Tightening torque	16 Nm
Dimensions	65 x 16 x 16 mm
Mech. range	programmable up to 450 Nm
Fmax	800 Nm
Mech. load limit	1800 Nm

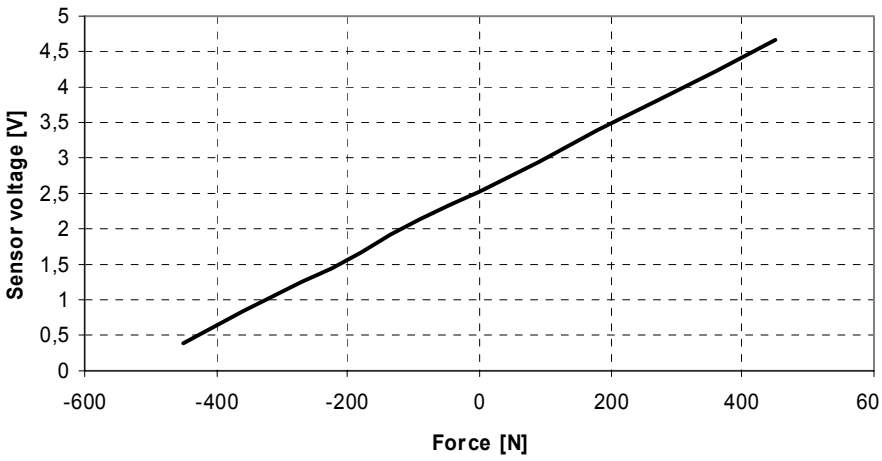
Electronic data	
Supply voltage	12 V
Signal output	0,5 ... 4,5 V
Zero output	2,5 V

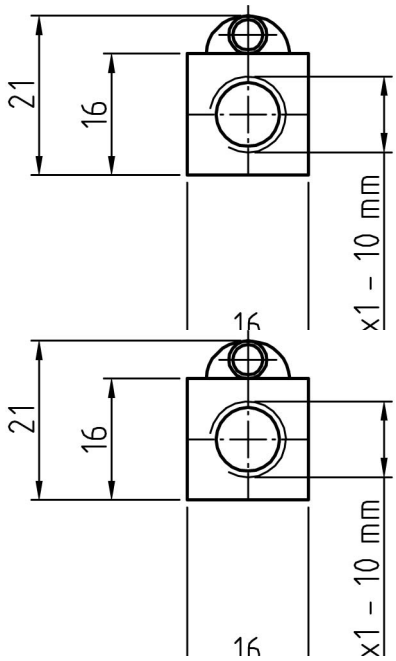
Conditions for use	
Temperature range	0 ... 80°C
Vibration	80 g/5 Hz ... 2 kHz

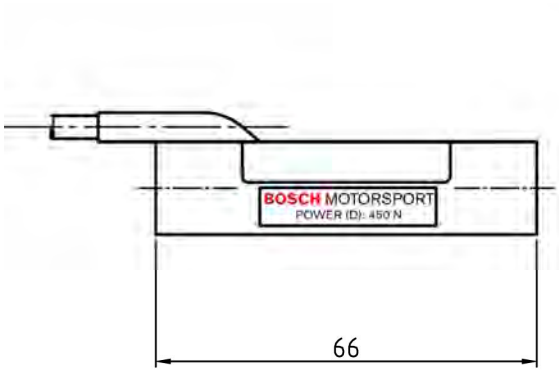
Characteristic
Individual characteristic will be delivered with each sensor.

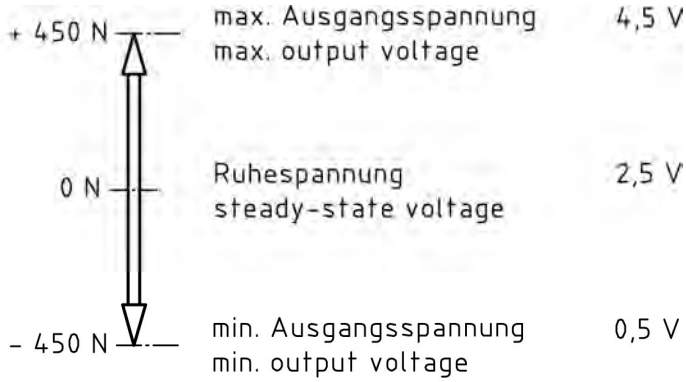
Order number	
ASL-6-06-05PC-HE	**B 261 209 227**
Offer drawing	**A 261 209 227**

Force [N]	Voltage [V]
450	4,673
360	4,225
270	3,797
180	3,397
90	2,941
0	2,538
-90	2,141
-180	1,672
-270	1,255
-360	0,820
-450	0,402









Kraftrichtung für Signaländerung

direction of force for signal change

Ride Height System

Ride Height System RHS

This infrared sensor is designed to measure chassis adjust like vehicle ride height, pitch and roll. The sensor is available in a DR-25 sleeve with various connector options on request.

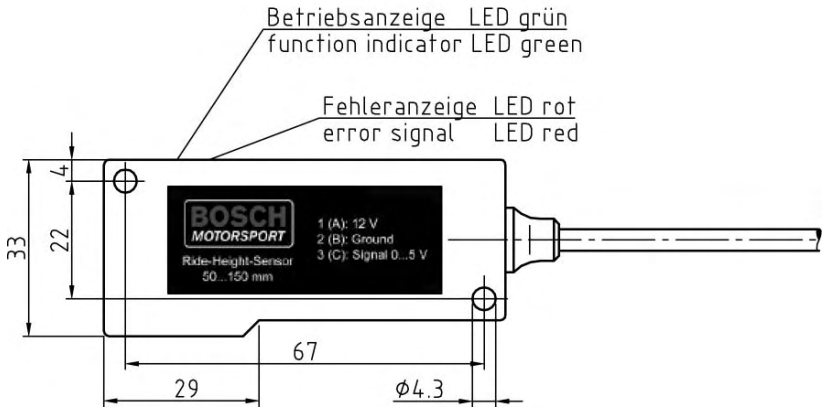
Mechanical data	
Weight	105 g
Measuring range	60 ... 140 mm
Dimensions	75 x 33 x 18 mm
Housing	plastic, fibreglass
Protection class	IP 67

Electronic data	
Supply voltage	12 ... 24 V
Signal output	0,25 ... 4,75 V
Alarm output	PNP
Response time	5 ms
Resolution	0,5 ... 1 mm
Linearity	2 % FS

Conditions for use	
Temperature range	-10 ... 60°C

Characteristic	
Light source	IR
Max. allowed ambient light	< 10000 lux
Wave length	660 nm

Order numbers	
KPTA 6E6-4P-C-DN	**B 261 209 671**
Offer drawing	**A 261 209 671**
ASL 6-06-05PD-HE	**B 261 209 672**
Offer drawing	**A 261 209 672**



Displays

Display DDU 4

The DDU 4, exclusively developed for Bosch Motorsport ECUs, is a light and compact dashboard unit with a high contrast colour display. Up to 6 customised display configurations can be programmed to suit individual customer requirements. All illuminated components are dimmable.

For enhanced flexibility the DDU 4 can be interfaced to a range of stand-alone I/O modules that provide the driver with additional information or alternatively enable the driver to interface with multiple vehicle functions.

Mechanical data	
Dimensions	164 x 117 x 37 mm
Weight	753 g

Display	
1x active matrix TFT high contrast colour display Active area	111 x 83 mm
Resolution	320 x 240
Dot size	0,116 x 0,348 mm

Conditions for use	
Vibration	18 g/20 Hz ... 20 kHz
Temperature	-10 ... 75°C
Display panel with optical double-sided antiglare coating for highest contrast and display accuracy	

Electronic data
1x CAN interface for communication with ECU
1x CAN interface for communication with network
1x RS 232 interface for display programming
5 LED shift indicators (5 drivers, open collector, 2,2 A)
10 LED multi purpose indication lights
8 inputs 0 ... 5 V (analog/digital)
2 x 0,5 A universal outputs
Dedicated battery voltage measurement

Holders	
Aluminium	**F 01E B01 457**
Carbon fibre	**F 01E B01 458**

Switches	
External switches for display position and dimming of display and LEDs	**B 261 209 659**

Order number	
DDU 4 incl. cable, without holder	**F 01E B01 461**

Display DDU 6

The DDU 6, exclusively developed for Bosch Motorsport ECUs, is a light and compact, steering wheel mounted dashboard unit. It is equipped with a high contrast colour display. Up to 6 customised display configurations can be programmed to suit individual customer requirements. All illuminated components are dimmable.

For enhanced flexibility the DDU 6 can be interfaced to a range of stand-alone I/O modules that facilitate multiple functions like switching, light indication, car and race information display.

Mechanical data	
Dimensions	165 x 104 x 32 mm
Weight	342 g

Display	
1x active matrix TFT high contrast colour display Active area	54 x 72 mm
Resolution	240 x 320

Conditions for use	
Vibration	15 g/20 Hz ... 2 kHz
Temperature	-10 ... 65°C

Electronic data
1x CAN interface for communication with ECU
1x CAN interface for communication with network
1x RS 232 interface for display programming
5 LED shift indicators
4 LED warning lights
6 inputs 0 ... 5 V (analog/digital)

Order number
F 01E B01 459

Actuators

Injection Valves

Injection Valve EV 6

The development of the EV 6 took into account all the essential functional requirements which originate from injector operation in multipoint electronic fuel injection systems (EFI).

This resulted in: low weight, “dry” solenoid winding, plastic encapsulation, finely matched flow-rate classes, good valve-seat sealing, excellent hot-start capabilities, close tolerances of the specified functional values, high level of corrosion resistance and long service life.

Mechanical data	
System pressure	max. 8 bar
Weight	45, 8 g

Electrical data	
Solenoid resistance	e.g. 12 Ω
Max. power supply	16 V

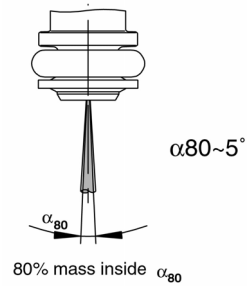
Conditions for use	
Fuel input	axial (top-feed)
Operating temperature	-40 ... 110°C
Permissible fuel temperatures	≤ 70°C
Climate proofness corresponds to saline 53 167	fog test DIN

Technical data

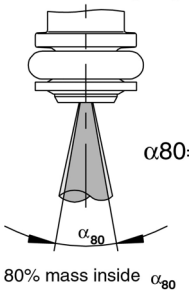
Order numbers	Design	Fuel type	Spray type	Flow rate at 3 bar (N-Heptan)	Spray angle α	Impedance
B 280 431 126	Standard	Gasoline	C	261,2 g/min	25°	12 Ω
B 280 431 127	Standard	Gasoline	C	261,2 g/min	70°	12 Ω
0 280 155 737	Long	Gasoline	C	261,2 g/min	15°	12 Ω
B 280 431 128	Standard	Gasoline	C	364,3 g/min	25°	12 Ω
B 280 431 129	Standard	Gasoline	C	364,3 g/min	70°	12 Ω
B 280 431 130	Standard	Gasoline	C	493,1 g/min	25°	1,2 Ω
B 280 431 131	Standard	Gasoline	C	493,1 g/min	70°	1,2 Ω
0 280 156 012	Standard	Gasoline	C	310,1 g/min	20°	12 Ω
B 280 434 499_01	Standard	Methanol	C	658 g/min	25°	12 Ω
B 280 434 499_02	Standard	Gasoline	C	658 g/min	25°	12 Ω

Further injection valves on request

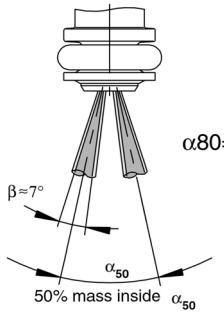
B: Pencil Beam



C: Conical Spray

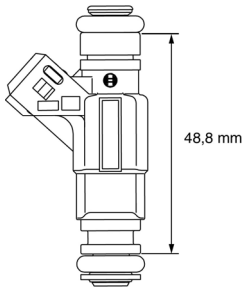


E: 2-Spray

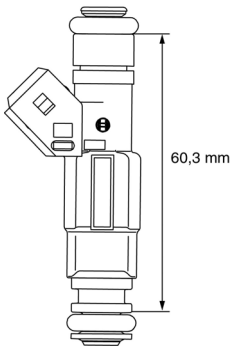


70% mass of single spray inside β

standard

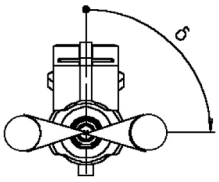


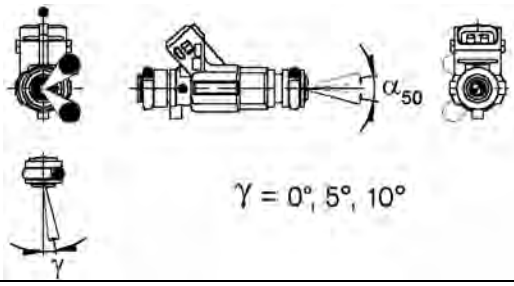
long



Angel between connection and spray level (δ = delta):
(only 2-spray preparation)

δ = 0°- 360° possible





Injection Valve EV 12

The EV 12 injector is a development based on the EV 6. Its main feature is the fact that the position of its injection point can be varied. Compared with the EV 6, the EV 12 injection point can be moved forward up to 20 mm.

Mechanical data	
System pressure	max. 8 bar
Weight	40 g

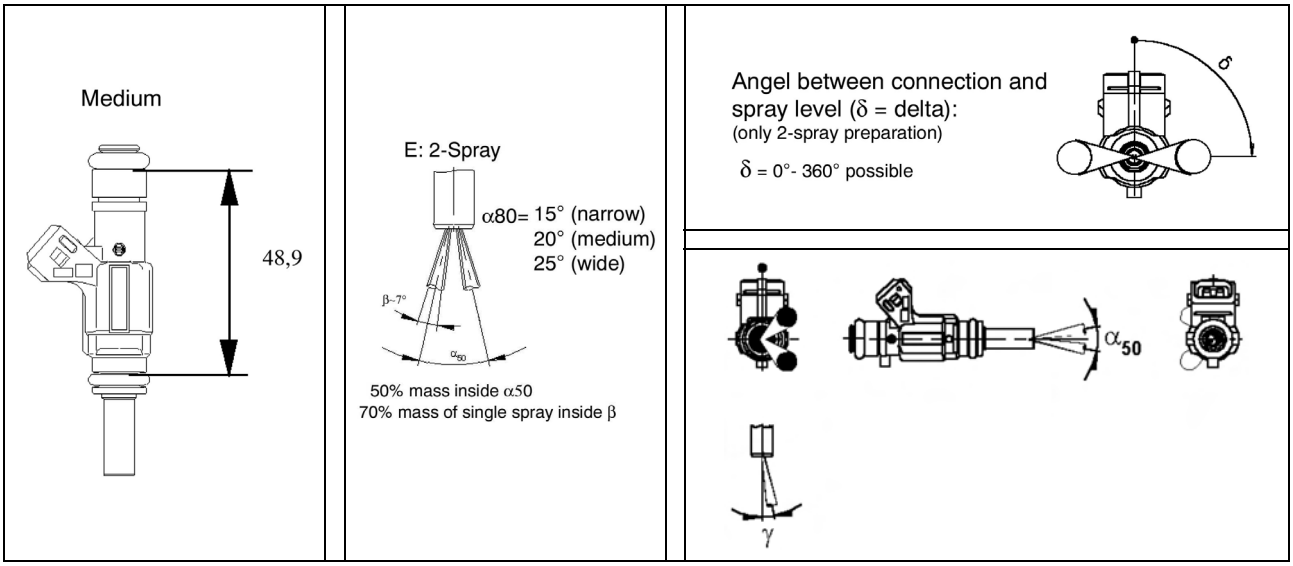
Electronic data	
Solenoid resistance	e.g. 12 Ω
Max. power supply	16 V

Conditions for use	
Fuel input	axial (top-feed)
Operating temperatures	-40 ... 110°C
Permissible fuel temperatures	≤ 70°C
Climate proofness corresponds to saline 167	fog test DIN 53

Technical data

Order numbers	Design	Type	Flow rate at 3 bar (N-Heptan)	Spray angle α	β	γ	δ	Impedance
0 280 155 892	Medium	E	269 g/min	15°	7°	10°	270°	12 Ω
0 280 155 897	Medium	E	217 g/min	15°	7°	10°	270°	12 Ω

Further special versions on request



Injection Valve EV 14

The EV 14 injector is a further development based on the EV 6. It is even more compact, what allows its integration into the fuel rail.

In addition, this injector is also available with a variety of installation lengths, what makes an individual adaptation to the intake manifold possible.

Mechanical data	
System pressure	max. 8 bar
Weight	25 g
Spray angle	25° or 70°

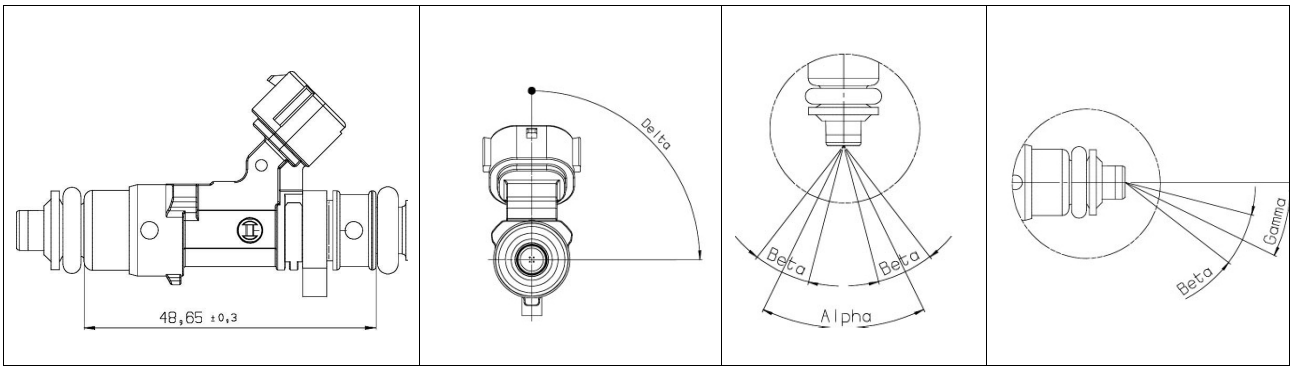
Electronic data	
Solenoid resistance	e.g. 12 Ω
Max. power supply	16 V

Conditions for use	
Fuel input	axial (top-feed)
Operating temperatures	-40 ... 110°C
Permissible fuel temperatures	≤ 70°C
Installation lengths	48,65 mm
Climate proofness corresponds to saline 021	fog test DIN 50

Technical data

Order numbers	Design	Type	Flow rate at 3 bar (N-Heptan)	Spray angle α	Impedance
B 280 436 038_06	Standard	C	387,3 g/min	25°	12 Ω
B 280 436 038_02	Standard	C	503,5 g/min	25°	12 Ω
B 280 436 038_05	Standard	C	387,3 g/min	70°	12 Ω
B 280 436 038_01	Standard	C	503,5 g/min	70°	12 Ω

Further special versions on request



HPI Valve HDEV 1.2

The HDEV 1.2 can be used in combination with direct injection systems as well as in high pressure manifold injection systems.

Its most remarkable features are the small size and weight and the freedom in defining both – spray and jet. Every jet is free definable in terms of position, flow rate and penetration. Moreover, asymmetric sprays are possible.

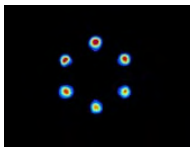
Mechanical data	
System pressure	max. 200 bar
Flow rate	e.g. 30 ccm/sec at 100 bar
Weight	78 g
Length	85 mm

Electrical data	
Resistance	0,9 Ω
Voltage	90 V
Peak current	20 A

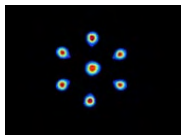
Conditions for use	
Fuel input	axial (top-feed)
Operating temperatures	-30 ... 120°C
Permissible fuel temperatures	< 80°C

Order number
on request

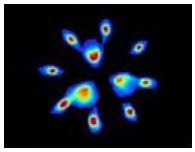
Examples of variations, further variations on request



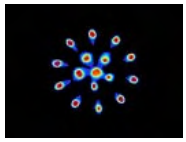
Jets on a circle



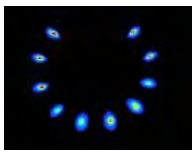
Jets on a circle and a middle jet



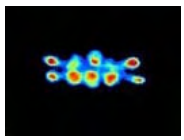
Jets on two circles



Jets on two circles and a middle jet



Jet configuration regarding the spark plug position



Flat jet configuration

HPI Valve Mini-HDEV 1.2

The Mini HDEV 1.2 can be used in combination with direct injection systems as well as in high pressure manifold injection systems.

Its most remarkable features are the small size and weight and the freedom in defining both – spray and jet. Every jet is free definable in terms of position, flow rate and penetration. Moreover, asymmetric sprays are possible.

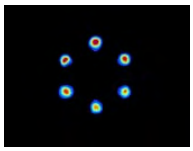
Mechanical data	
System pressure	max. 200 bar
Flow rate	e.g. 30 ccm/sec at 100 bar
Weight	48 g
Length	51 mm

Electrical data	
Resistance	0,9 Ω
Voltage	90 V
Peak current	20 A

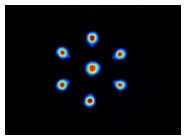
Conditions for use	
Fuel input	axial (top-feed)
Operating temperatures	-30 ... 120°C
Permissible fuel temperatures	< 80°C

Order number
on request

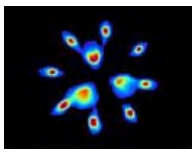
Examples of variations, further variations on request



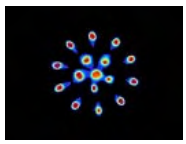
Jets on a circle



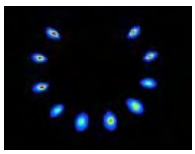
Jets on a circle and a middle jet



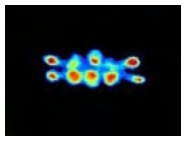
Jets on two circles



Jets on two circles and a middle jet



Jet configuration regarding the spark plug position



Flat jet configuration

Ignition Coils

Single Fire Coil M

This ignition coil is specially designed for motorsport use. The electronic design connects high energy output with a small housing. The coil is available in a DR-25 sleeve with different options of connectors.

Electronic data	
High voltage	35 kV
I prim. (stand.)	10 A
Inductivity (prim.)	1,8 mH
Inductivity (sec.)	4,7 H
Resistance (prim.)	0,5 Ω
Resistance (sec.)	4,4 kΩ
Spark energy	33 mJ
U prim. (clamp.)	500 V
Voltage gradient	3,3 kV/µs

Mechanical data	
Weight	180 g
Vibration	80 g/5 ... 250 Hz

Conditions for use	
Temperature range	-20 ... 130°C

Order number	
	B 261 209 192
Offer drawing	**A 261 209 192**

Dwell time (ms)				
Ubatt	**4 A**	**6 A**	**8 A**	**10 A**
8 V	1,30	2,40	3,20	4,20
10 V	1,00	1,60	2,40	3,40
12 V	0,80	1,25	1,80	2,40
14 V	0,65	1,05	1,40	1,80
16 V	0,55	0,85	1,18	1,46

Single Fire Coil P

This coil is low cost concept for cylinder head installation.

Electronic data	
High voltage	35 kV
I prim. (stand.)	8,5 A
Inductivity (prim.)	2,8 mH
Inductivity (sec.)	16 H
Resistance (prim.)	0,37 Ω
Resistance (sec.)	8,8 kΩ
Spark energy	45 ... 55 mJ
U prim. (clamp.)	260 V
Voltage gradient	1,6 kV/µs

Conditions for use	
Temperature range	-40 ... 140°C

Mechanical data	
Weight	260 g
Vibration	40 g/5 Hz ... 2 kHz

Connector	
Cable harness connector	**D 261 205 334**

Order number	
	B 261 208 315
Offer drawing	**A 221 152 139**

Dwell time (ms)

Ubatt	4 A	5 A	6 A	7 A	8 A
8 V	2,90	4,00	5,50	7,80	
10 V	2,00	2,70	3,50	4,40	5,20
12 V	1,65	2,10	2,65	3,17	3,52
14 V	1,35	1,75	2,15	2,55	2,90
16 V	1,10	1,40	1,75	2,05	2,35

Single Fire Coils PS and PS-T

These ignition coils are low cost concept for cylinder head installation.

Type PS-T has an integrated transistor for use in combination with ECUs without internal ignition power stages.

Electronic data	
High voltage	>30 kV
I prim. (stand.)	7,3 A
Resistance (prim.)	0,5 Ω
Spark energy	35 mJ
U prim. (clamp.)	300 V
Voltage gradient	1,5 kV/µs

Dwell time, temperature of coil ca. 50°C	
Ubatt	**7,3 A**
8 V	6,2 ms
10 V	3,2 ms
12 V	2,4 ms
14 V	1,8 ms
16 V	1,5 ms

Mechanical data	
Weight Type **PS**	190 g
Weight Type **PS-T**	208 g
Vibration	40 g/5 Hz ... 2 kHz
Diameter	22 mm

Conditions for use	
Temperature range	-40 ... 140°C

Order numbers	
Type **PS**	**0 221 504 460**
Offer drawing	**A 221 141 014_009**
Type **PS-T**	**0 221 604 103**
Offer drawing	**A 221 614 016_009**

Single Fire Coil S

This ignition coil is specially designed for cylinder head mounting. The electronic design combines high energy output with a small housing. It is available in a DR-25 sleeve with different options of connectors. Electric data and dimensions can be individually adapted to customer's requirements.
This coil is part of the higher performance segment.

Mechanical data	
Weight	148 g
Vibration	80 g/5 Hz ... 2,5 kHz
Diameter	22 mm

Conditions for use	
Temperature range	-40 ... 140°C

Dwell time (ms), temperature of coil ca. 50°C	
Ubatt	**12,5 A**
8 V	3350 µs
10 V	1750 µs
12 V	1250 µs
14 V	960 µs
16 V	800 µs

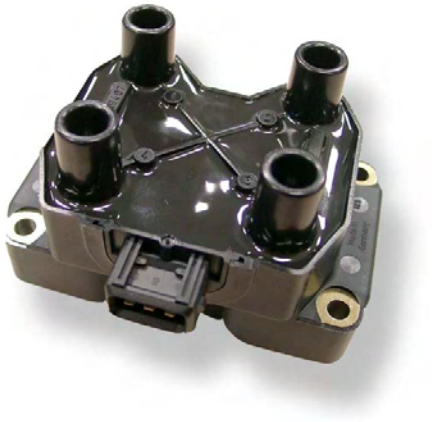
Electronic data	
High voltage	>30 kV
I prim. (stand.)	12 A
Resistance (prim.)	0,2 Ω
Spark energy	33 ... 40 mJ
U prim. (clamp.)	390 V
Voltage gradient	3,3 kV/µs

Order number	
	B 221 141 834_02
Offer drawing	**A 221 141 834_02**

Double Fire Coil 2x2

2 x 2 Sparks

This dual spark ignition coil is designed for low-cost applications in 4-cylinder engines.



Mechanical data	
Weight	900 g
Vibration	20 g/5 ... 250 Hz

Conditions for use	
Temperature range	-20 ... 120°C

Primary connector	
Cable harness connector	**D 261 205 289**

Electronic data	
High voltage	33 kV
I prim. (stand.)	7,5 A
Inductivity (prim.)	3,7 mH
Inductivity (sec.)	38 H
Resistance (prim.)	0,5 Ω
Resistance (sec.)	13,3 kΩ
Spark energy	70 mJ
U prim. (clamp.)	320 V
Voltage gradient	1,1 kV/µs

Order number	
	0 221 503 407
Offer drawing	**A 221 151 089**

Dwell time (ms)			
Ubatt	**5 A**	**6 A**	**8 A**
8 V	6,0	8,5	12,0
10 V	3,8	4,9	7,0
12 V	2,8	3,5	5,0
14 V	2,3	2,8	3,9
16 V	2,0	2,4	3,0

Double Fire Coil 3x2
3 x 2 Sparks

This dual spark ignition coil is designed for low-cost applications in 6-cylinder engines.

Mechanical data	
Weight	1300 g
Vibration	20 g/5 ... 250 Hz

Conditions for use	
Temperature range	-20 ... 120°C

Primary connector	
Offer drawing	**1 284 485 118**

Electronic data	
High voltage	33 kV
I prim. (stand.)	7,5 A
Inductivity (prim.)	3,7 mH
Inductivity (sec.)	38 H
Resistance (prim.)	0,5 Ω
Resistance (sec.)	13,3 kΩ
Spark energy	70 mJ
U prim. (clamp.)	320 V
Voltage gradient	1,1 kV/µs

Order number	
	0 221 503 002
Offer drawing	**A 221 151 810-006**

Dwell time (ms)			
Ubatt	**5 A**	**6 A**	**8 A**
8 V	6,0	8,5	12,0
10 V	3,8	4,9	7,0
12 V	2,8	3,5	5,0
14 V	2,3	2,8	3,9
16 V	2,0	2,4	3,0

Spark Plugs

Spark Plugs

The engines of competition vehicles are exposed to high thermal stress because of running them at full load most of the time.

Spark plugs for this operating conditions often have precious metal center electrodes (platinum, silver) and a short insulator base. This causes a very small heat absorption and a good heat derivation through the center electrode.

Corresponding to the various field of operations we manufacture over 1400 different types of spark plugs in production. You can get these standard spark plugs from your local Bosch-service and most spare parts dealers. The range of products includes versions with various seats and threads, thread lengths and electrode positions, the design parts air-gap, surface-gap and surface-air-gap types. You can choose between versions with one to four ground electrodes, the center electrode can be made from various materials.

Moreover we offer special versions and small batches which you should not hesitate asking for.

Fuel Pumps

Fuel Pump FP 100

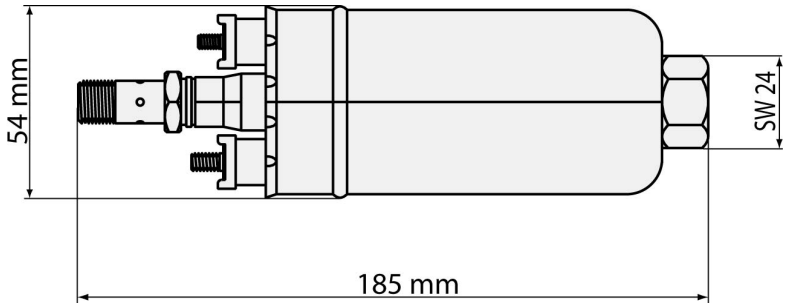
Fuel delivery: >100 l/h, 5 bar

Description	
Fuel delivery	>100 l/h
High temperature reduction	30 l/h
Supply voltage	13,5 V
Current consumption	5 A (5 bar)
Weight	725 g
Non return valve	external

Accessories
Primary connector

Order number	
	Y 580 700 118
Offer drawing	Y 580 700 118

Connections	
Intake side	M16 x 1,5
Pressure side	M12 x 1,5
Electrical	+: M4 / -: M5



Fuel Pump FP 165

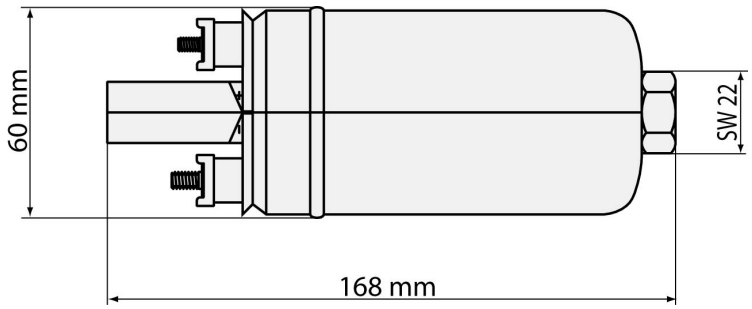
Fuel delivery: >165 l/h, 5 bar

Description	
Fuel delivery	>165 l/h
High temperature reduction	30 l/h
Supply voltage	13,5 V
Current consumption	10 A (5 bar)
Weight	980 g
Non return valve	internal

Connections	
Intake side	M14 x 1,5
Pressure side	M12 x 1,5
Electrical	+: M4 / -: M5

Accessories
Primary connector

Order number	
	0 580 254 979
Offer drawing	**A 580 152 325**



Fuel Pump FP 200

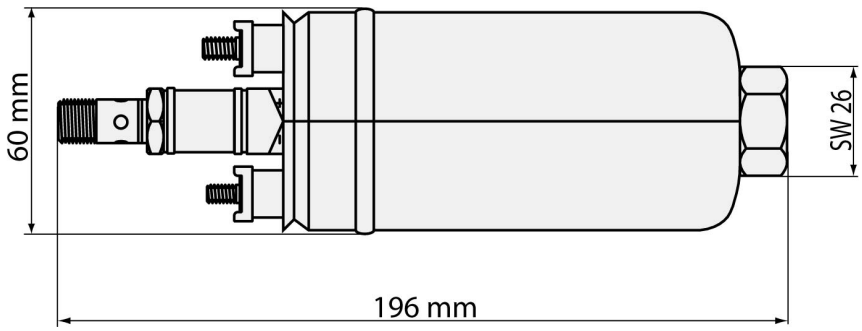
Fuel delivery: >200 l/h, 5/8 bar after a break-in period of 20 h

Description	
Fuel delivery	>200 l/h
High temperature reduction	30 l/h
Supply voltage	13,5 V
Current consumption	13 A
Weight	1030 g
Non return valve	external

Connections	
Intake side	M18 x 1,5
Pressure side	M12 x 1,5
Electrical	+: M6 / -: M5

Accessories
Primary connector

Order numbers	
5 bar	**0 580 254 044**
8 bar	**B 261 205 413**
Offer drawing	**A 580 152 519**



HPI Fuel Pump HDP 1

The HDP 1 is a high pressure radial pump with three pistons. Designing it we set great value on a big delivery volume, as needed in motorsport applications. Variations in bore and stroke affect different deliveries.

This type of pump was used by different 24h-Le Mans winners.

Mechanical data	
Fuel delivery	0,66 ccm/0,80 ccm per rotation
Length	76,8 mm
Weight	1000 g
Enveloping circle	121,4 mm
Supply pressure	4 ... 6 bar
Output pressure	120 bar permanent 200 bar short time
Max. operating temperature	80°C
Max. temperature of location	130°C
Max. rotation per minute	9000

Connections	
Intake side	e.g. thread hole M10 x 1
Pressure side	e.g. thread hole M10 x 1

Order numbers	
Fuel delivery 0,66 ccm	**B 438 172 058**
Fuel delivery 0,80 ccm	**B 438 172 061**

Fuel Pressure Regulators

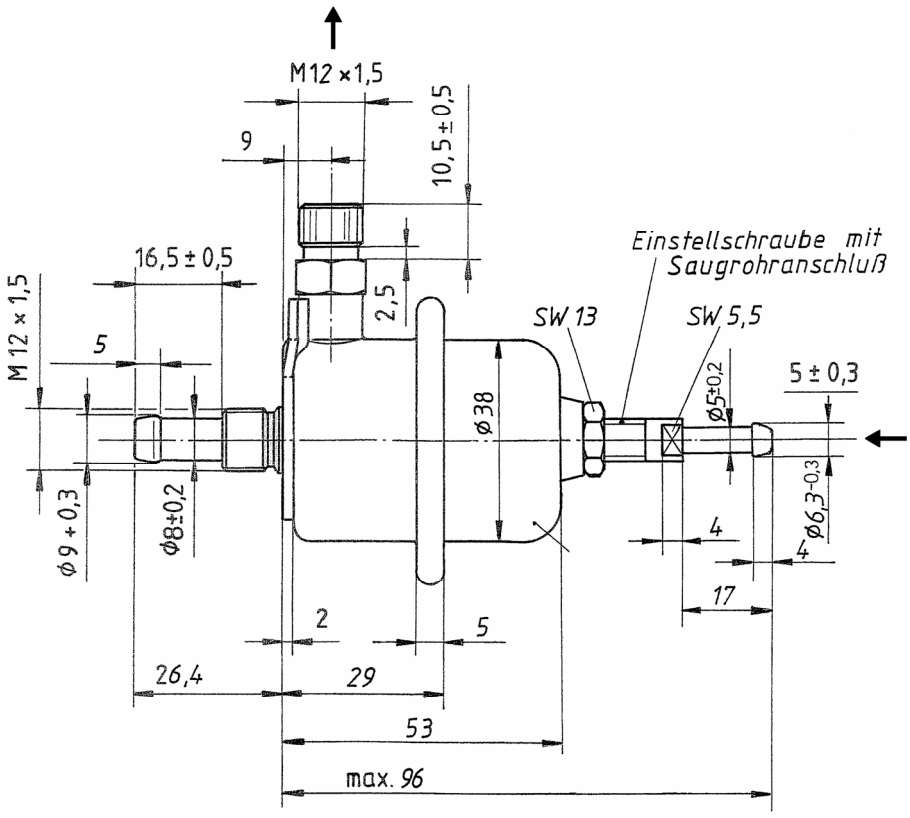
Fuel Pressure Regulator 34

Pressure range: 3,4 bar

Mechanical data	
Supply	M12 x 1,5
Reflow	8 mm, tube connector

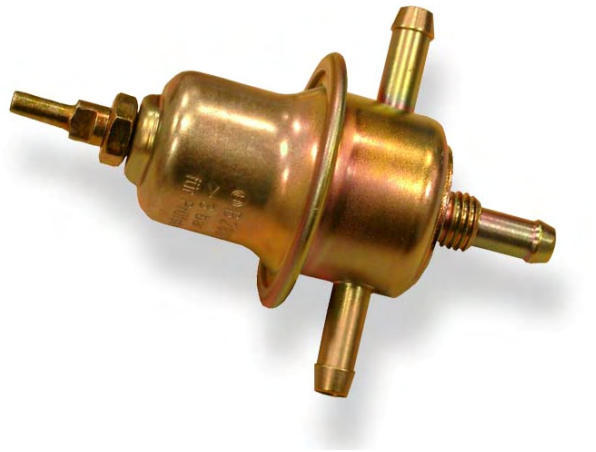
Order number	
	B 280 500 740
Offer drawing	**A 280 500 740**

Description
Sheet steel housing with manifold connection



Fuel Pressure Regulator 05-40 A

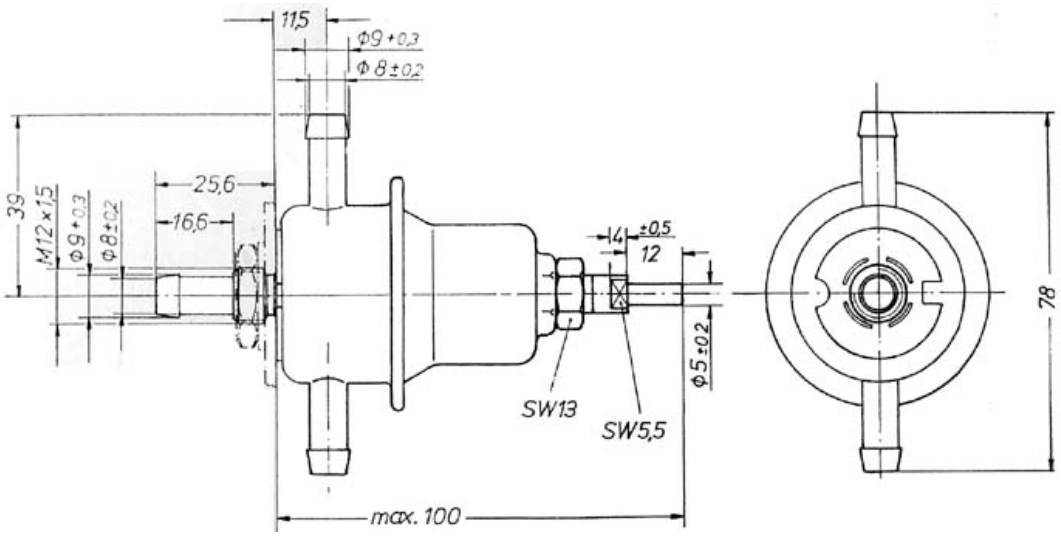
Pressure range: 0,5 ... 4 bar



Mechanical data	
Supply	8 mm, tube connector
Reflow	8 mm, tube connector
Reflow quantity	min. 15 l/h, max. 220 l/h

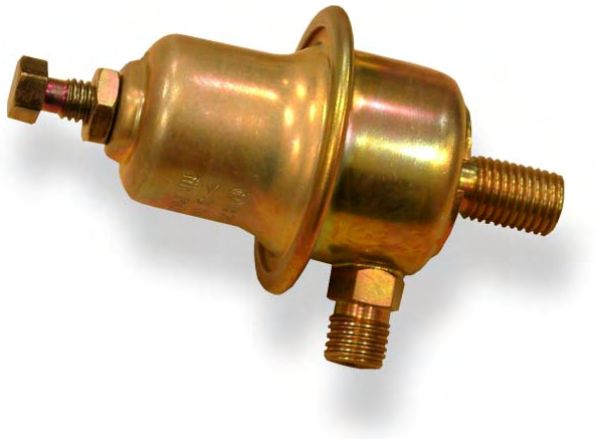
Order number	
	B 280 500 139
Offer drawing	**A 280 500 104**

Description
Sheet steel housing with manifold connection



Fuel Pressure Regulator 05-40 B

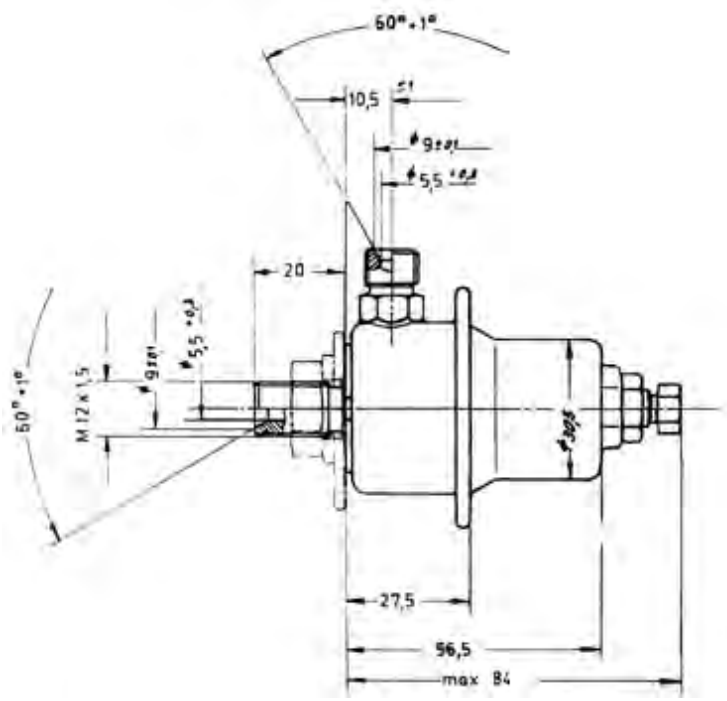
Pressure range: 0,5 ... 4 bar

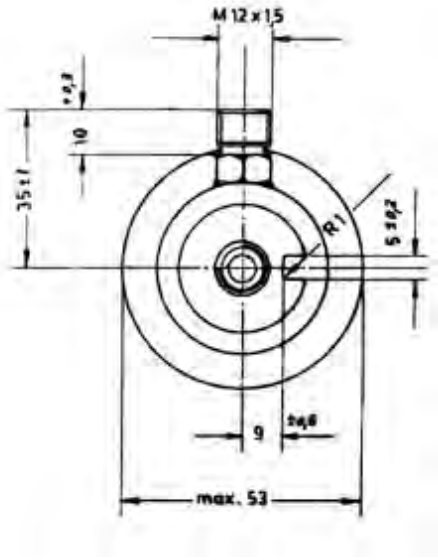


Mechanical data	
Supply	M12 x 1,5
Reflow	M12 x 1,5

Order number	
	B 280 500 168
Offer drawing	**A 280 500 168**

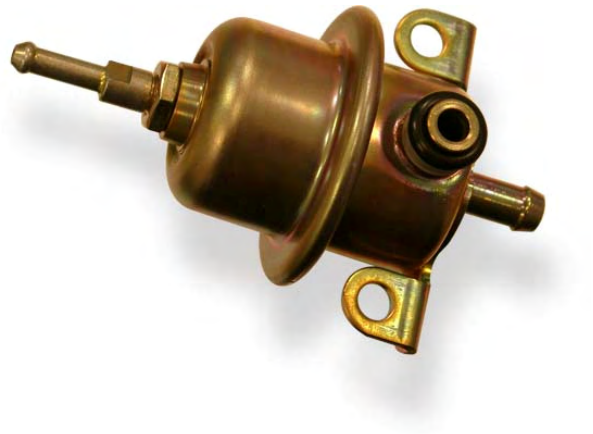
Description
Sheet steel housing with manifold connection





Fuel Pressure Regulator 14 x 60

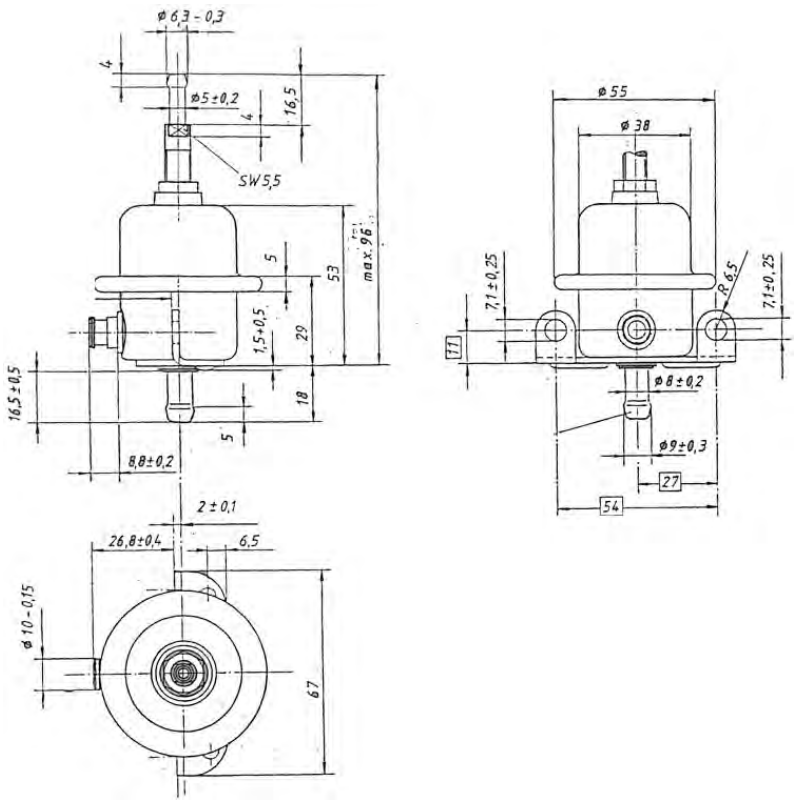
Pressure range: 1,4 ... 5 bar/3,2 ... 6 bar



Mechanical data	
Supply	10 mm, O-ring
Reflow	8 mm, tube connector
Reflow quantity	min. 15 l/h, max. 220 l/h

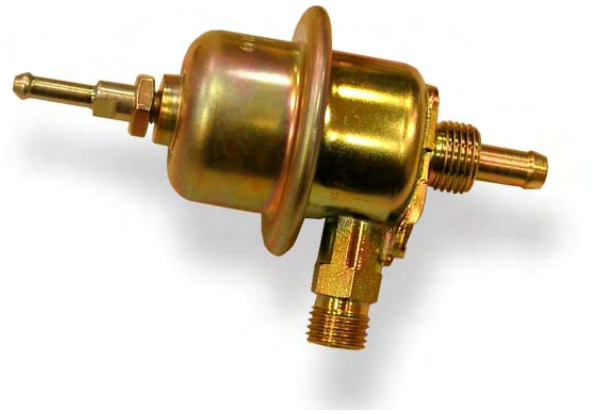
Order numbers	
1,4 ... 5 bar	**B 280 500 701**
3,2 ... 6 bar	**B 280 500 581**
Offer drawing	**A 280 500 581**

Description
Sheet steel housing with manifold connection



Fuel Pressure Regulator 15-50

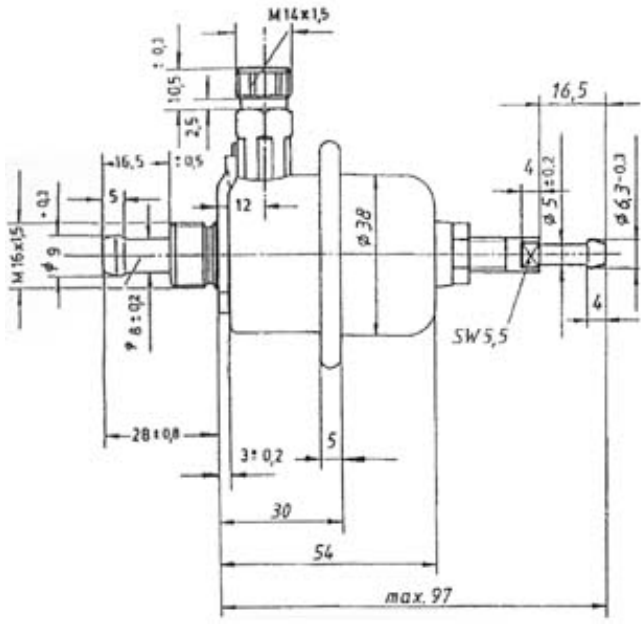
Pressure range: 1,5 ... 5 bar

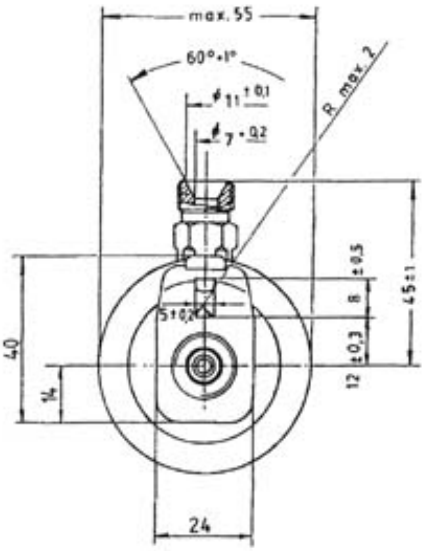


Mechanical data	
Supply	8 mm, O-ring
Reflow	M14 x 1,5
Reflow quantity	min. 15 l/h, max. 220 l/h

Order number	
	B 280 500 743
Offer drawing	**A 280 500 743**

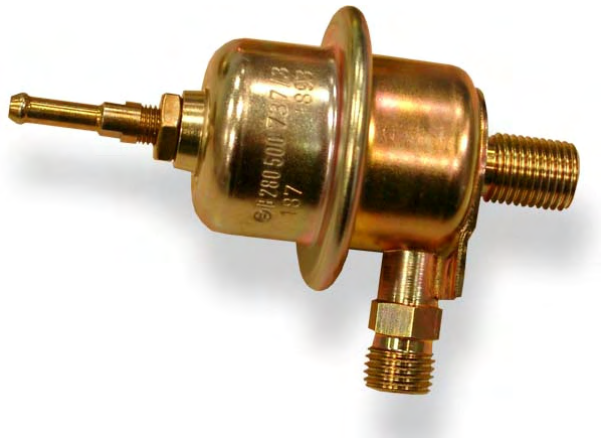
Description
Sheet steel housing with manifold connection





Fuel Pressure Regulator 19-50

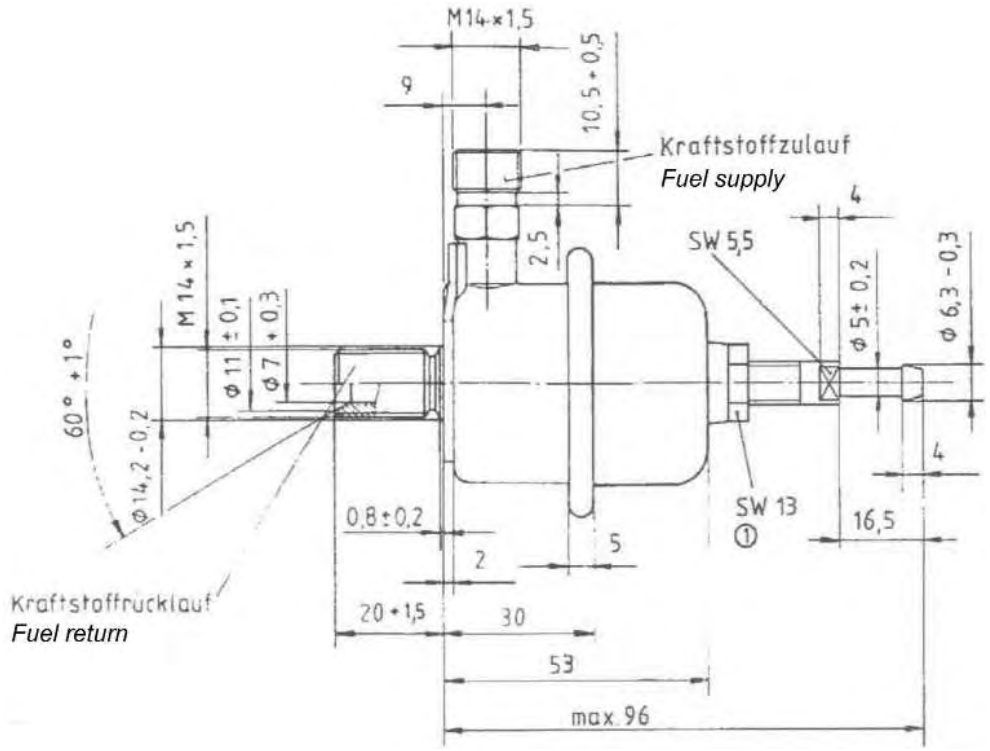
Pressure range: 1,9 ... 5 bar



Mechanical data	
Supply	M14 x 1,5
Reflow	M14 x 1,5
Reflow quantity	min. 15 l/h, max. 220 l/h

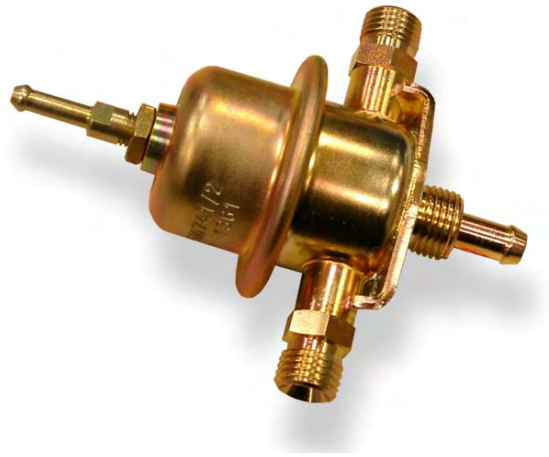
Order number	
	B 280 500 737
Offer drawing	**A 280 500 662**

Description
Sheet steel housing with manifold connection



Fuel Pressure Regulator 20x120

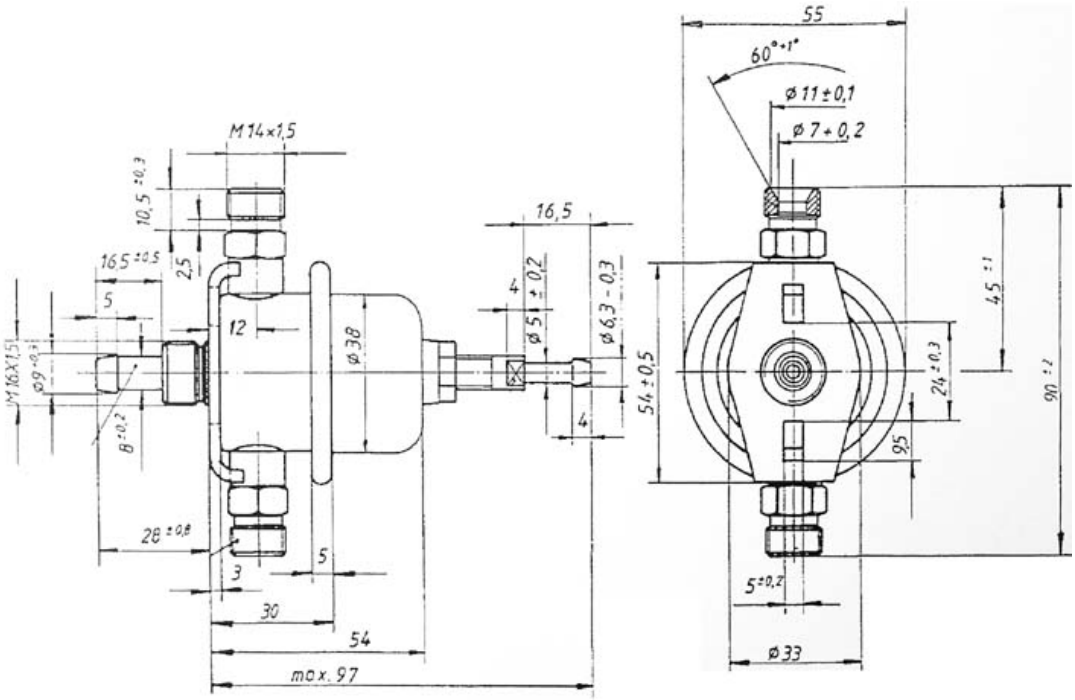
Pressure ranges: 2 ... 5 bar/ 3 ... 6 bar/ 4,5 ... 12 bar



Mechanical data	
Supply	2 x M14 x 1,5
Reflow	8 mm, tube connector
Reflow quantity	min. 15 l/h, max. 220 l/h

Order numbers	
2 ... 5 bar	**B 280 500 741**
3 ... 6 bar	**B 280 500 714**
4,5 ... 12 bar	**B 280 500 566**
Offer drawing	**A 280 500 714**

Description
Sheet steel housing with manifold connection



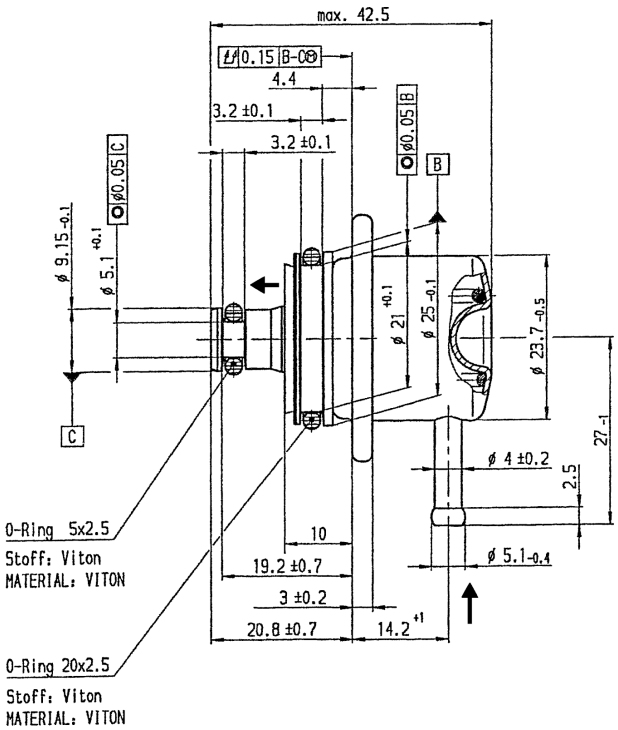
Fuel Pressure Regulator Mini 38

Pressure range: 3,8 bar

Mechanical data	
Set pressure	380 kPa
Set pressure accuracy	2 %
Linearity	1 %
External leak	no fuel leakage at 500 kPa
Bust pressure	> 1500 kPa

Conditions for use	
Temperature range	-40 ... 120° C
Vibration	< 600 m/s²
Weight	45 g

Order number	
	0 280 160 616
Offer drawing	**A 280 160 616**



Erledigung durch Kunden
Effect by customer

- O-Ringe leicht mit sauberem Motorenöl einölen
  Oil O-rings lightly with clean engine oil
- Nach der Montage an Kraftstoffzuteiler ist Dichtheitsprüfung durchzuführen
  Leaktest after installation
- Bei Ausbau und Wiederverwendung des Druckreglers müssen die O-Ringe überprüft werden
  When the pressure regulator is removed and will be reused, the O-rings must be checked
- Betrieb des Druckreglers mit Luft ist unzulässig
  Operation with air is not allowed

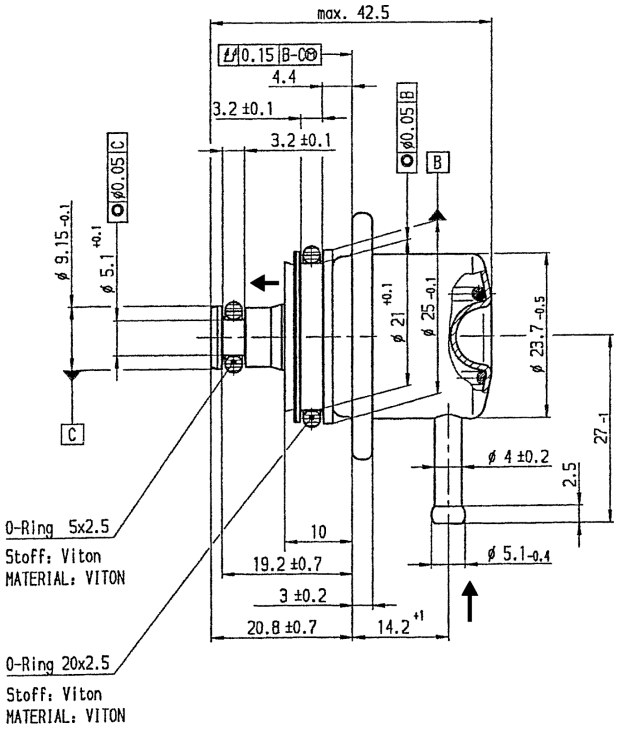
Fuel Pressure Regulator Mini 50

Pressure range: 5,0 bar

Mechanical data	
Supply	4 mm, tube connector
Reflow	9,15 mm, O-ring

Description
Sheet steel housing with manifold connection

Order number	
	B 280 550 113
Offer drawing	**A 280 550 058**



Erledigung durch Kunden
Effect by customer

- O-Ringe leicht mit sauberem Motorenöl einölen
  Oil O-rings lightly with clean engine oil
- Nach der Montage an Kraftstoffzuteiler ist Dichtheitsprüfung durchzuführen
  Leaktest after installation
- Bei Ausbau und Wiederverwendung des Druckreglers müssen die O-Ringe überprüft werden
  When the pressure regulator is removed and will be reused, the O-rings must be checked
- Betrieb des Druckreglers mit Luft ist unzulässig
  Operation with air is not allowed

Fuel Pressure Regulator Mini A

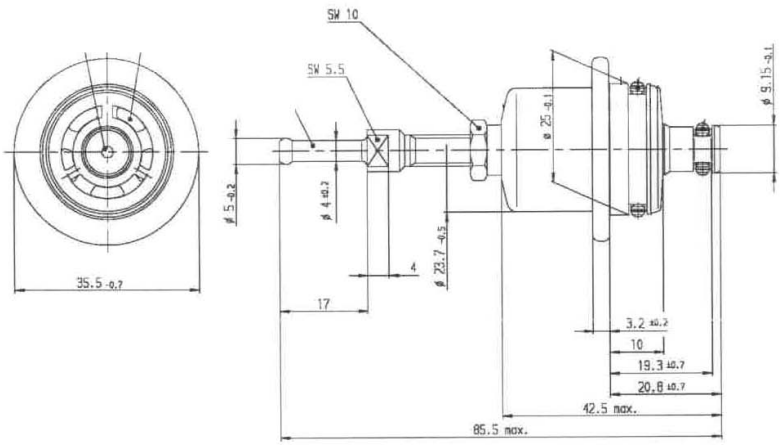
Pressure ranges: 2,2 ... 3,5 bar/3,5 ... 5 bar

Mechanical data	
Supply	24,6 mm, O-ring
Reflow	9,15 mm, O-ring
Reflow quantity	min. 15 l/h, max. 220 l/h

Description
Light weight aluminium housing
No manifold connection

Accessories	
Pre-filter	**1 287 431 008**

Order numbers	
2,2 ... 3,5 bar	**B 280 550 340**
3,5 ... 5 bar	**B 280 550 341**
Offer drawing	**A 280 550 340**



Erledigung durch Kunden
Effect by customer

- O-Ringe leicht mit sauberem Motorenöl einölen
  Oil O-rings lightly with clean engine oil
- Nach der Montage an Kraftstoffzuteiler ist Dichtheitsprüfung durchzuführen
  Leaktest after installation
- Bei Ausbau und Wiederverwendung des Druckreglers müssen die O-Ringe überprüft werden
  When the pressure regulator is removed and will be reused, the O-rings must be checked
- Betrieb des Druckreglers mit Luft ist unzulässig
  Operation with air is not allowed

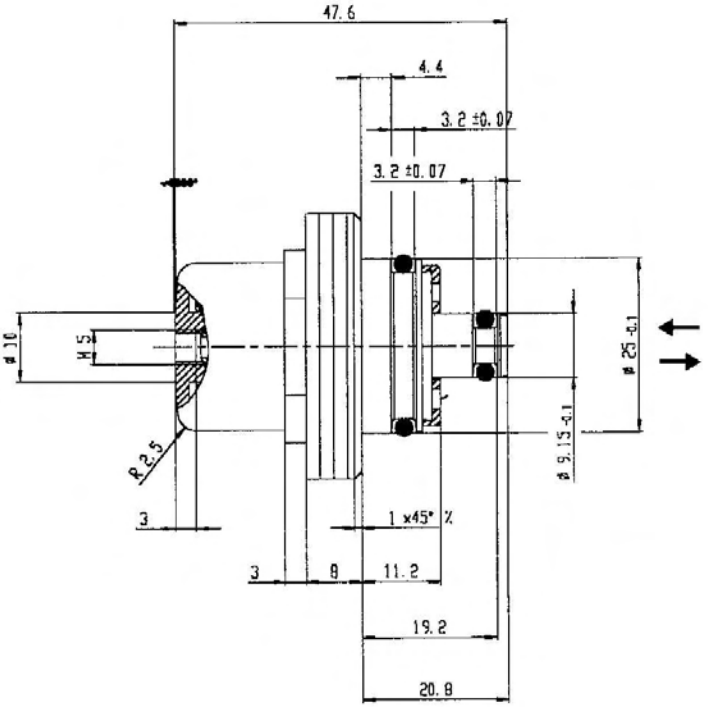
Fuel Pressure Regulators Mini/Mini M
Pressure range: 6/8/10 bar

We offer this mini pressure regulator in two fuel-specific versions: the standard version for use with petrol and a M-version for use with methanol.

Mechanical data	
Supply	25 mm, O-ring
Reflow	9,15 mm, O-ring
Reflow quantity	min. 30 l/h, max. 400 l/h

Description
Light weight aluminium housing
No manifold connection

Order numbers	
Standard version	
6 bar	**B 261 208 106**
8 bar	**B 261 208 108**
10 bar	**B 261 208 109**
Methanol version	
6 bar	**B 261 208 121**
8 bar	**B 261 208 122**
10 bar	**B 261 208 123**
Offer drawing	**A 261 208 101**



Erledigung durch Kunden
Effect by customer

- O-Ringe leicht mit sauberem Motorenöl einölen
  Oil O-rings lightly with clean engine oil
- Nach der Montage an Kraftstoffzuteiler ist Dichtheitsprüfung durchzuführen
  Leaktest after installation
- Bei Ausbau und Wiederverwendung des Druckreglers müssen die O-Ringe überprüft werden
  When the pressure regulator is removed and will be reused, the O-rings must be checked
- Betrieb des Druckreglers mit Luft ist unzulässig
  Operation with air is not allowed

HPI Control Valve DSV

The DSV is especially designed for regulation of pressure in the common rail of high pressure injection systems.

Mechanical data	
Pressure range	4 ...120 bar
Back pressure	4 bar
Flow quantity	max. 100 l/h
Weight	135 g
Size	32 x 54 x 56 mm
Housing	Aluminium
Operating temperature	-20 ... 130°C
Max. temperature of location	140°C (max. 5 min)

Electrial data	
Operation voltage	6,5 ... 18 V
Operation current	I_{max} = 1,8 A

Order number
B 261 209 568

Starters

Starter 1,4 kW

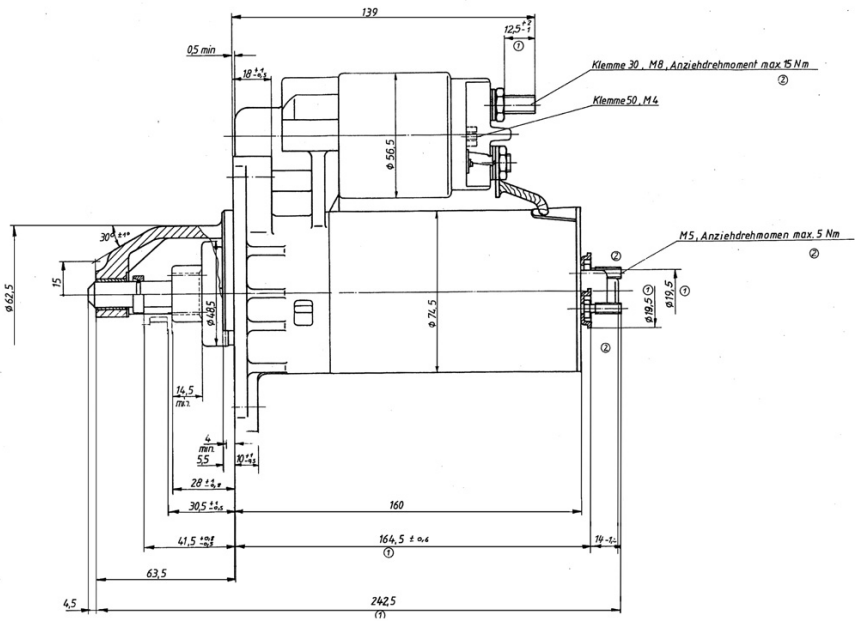
This starter is specially constructed for motorsport demand. It is a pre-engaged drive starter in clockwise version.

Mechanical data	
Weight	3200 g
Revolutions	3600 x 1/min
Modul	2/11

Electrical data	
Performance	1,4 kW

Conditions for use	
Max. temperature	150°C
Vibration	high protection

Order number	
	B 261 206 115
Offer drawing	**A 001 111 036**



Further special versions on request

Starter 1,7 kW

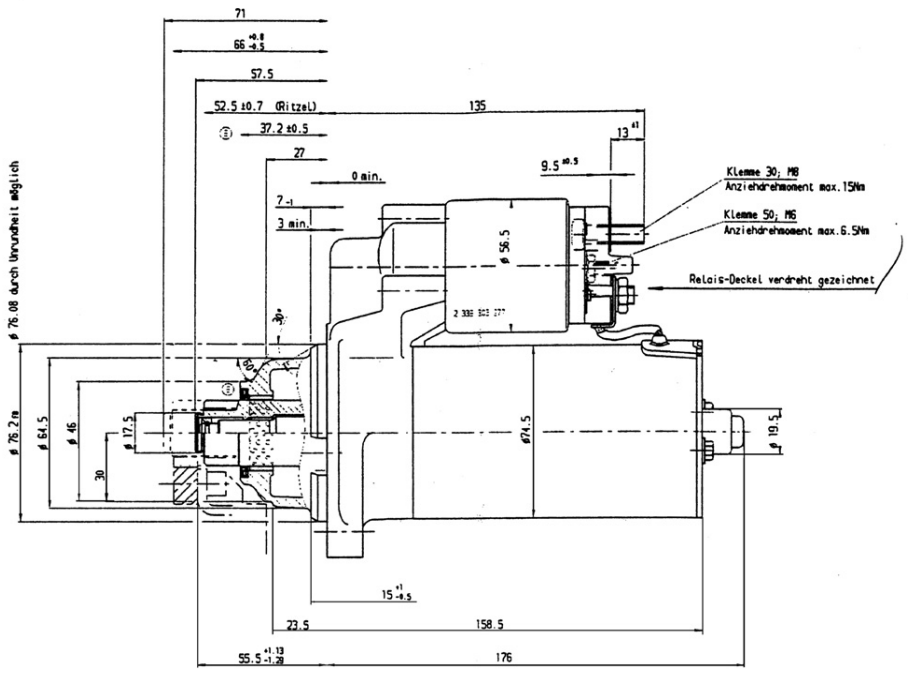
This starter is specially constructed for motorsport demand. It is a pre-engaged drive starter, we offer it in clockwise and anticlockwise version on request.

Mechanical data	
Weight	3700 g
Revolutions	3600 x 1/min
Transmission ratio	i 5,0
Modul	2/11

Electrical data	
Performance	1,7 kW

Order number	
	B 261 208 186
Offer drawing	**A 261 208 186**

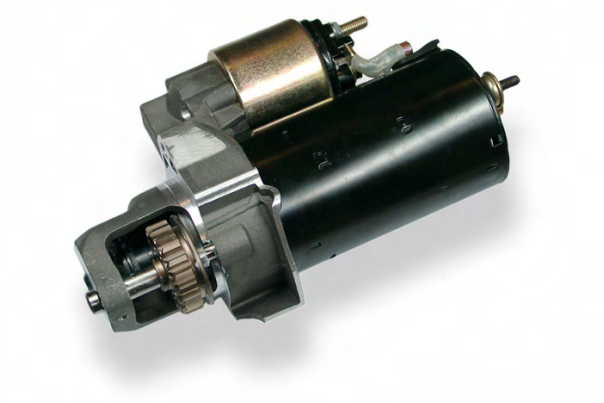
Conditions for use	
Max. temperature	150°C
Vibration	high protection



Further special versions on request

Starter 2,0 kW

This starter is specially constructed for motorsport demand. It is a pre-engaged drive starter, we offer it in clockwise version.



Mechanical data	
Weight	4050 g
Revolutions	4700 x 1/min
Transmission ratio	i 5,0
Modul	2/11

Conditions for use	
Max. temperature	150°C
Vibration	high protection

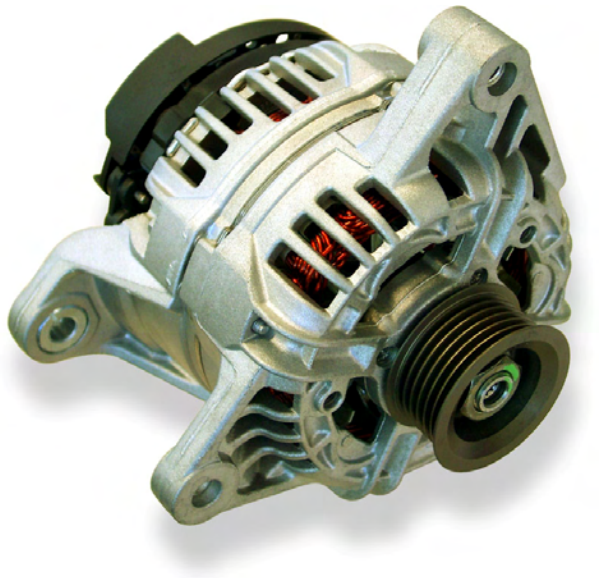
Electrical data	
Performance	2,0 kW
Max. current	A

Order number	
	B 001 116 174
Offer drawing	**A 001 116 174**

Alternators

Alternator 90 A

This alternator is modified for motorsport demand. It is a clockwise rotation type and is series part in the Porsche Cup cars. We deliver the alternator inclusive fan and pulley. Modifications are available on request.



Mechanical data	
Case material	aluminium
Weight	5400 g
Current regulator unit	integrated
Rotation	clockwise
Max. rotations	17500 x 1/min
Dimensions	
Diameter	143 mm
Length without shaft stub	144 mm
Between mounting points	157 mm

Conditions for use	
Temperature range	-10 ... 90°C
Vibration	high protection
Installation without rubber mounting	

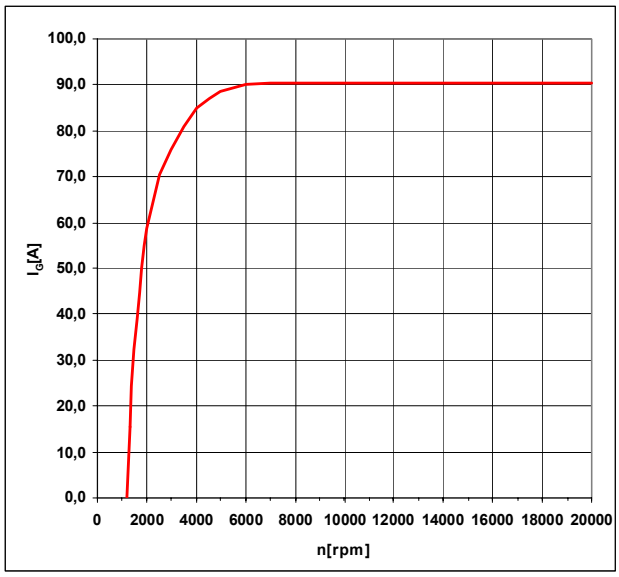
Electric connections	
Battery B+	M8
Control lamp D+	flat-pin connector, see drawing

Electronic data	
Rated current	90 A
Supply voltage	14 V
Cut-in speed	1300 x 1/min
Coupling	screws

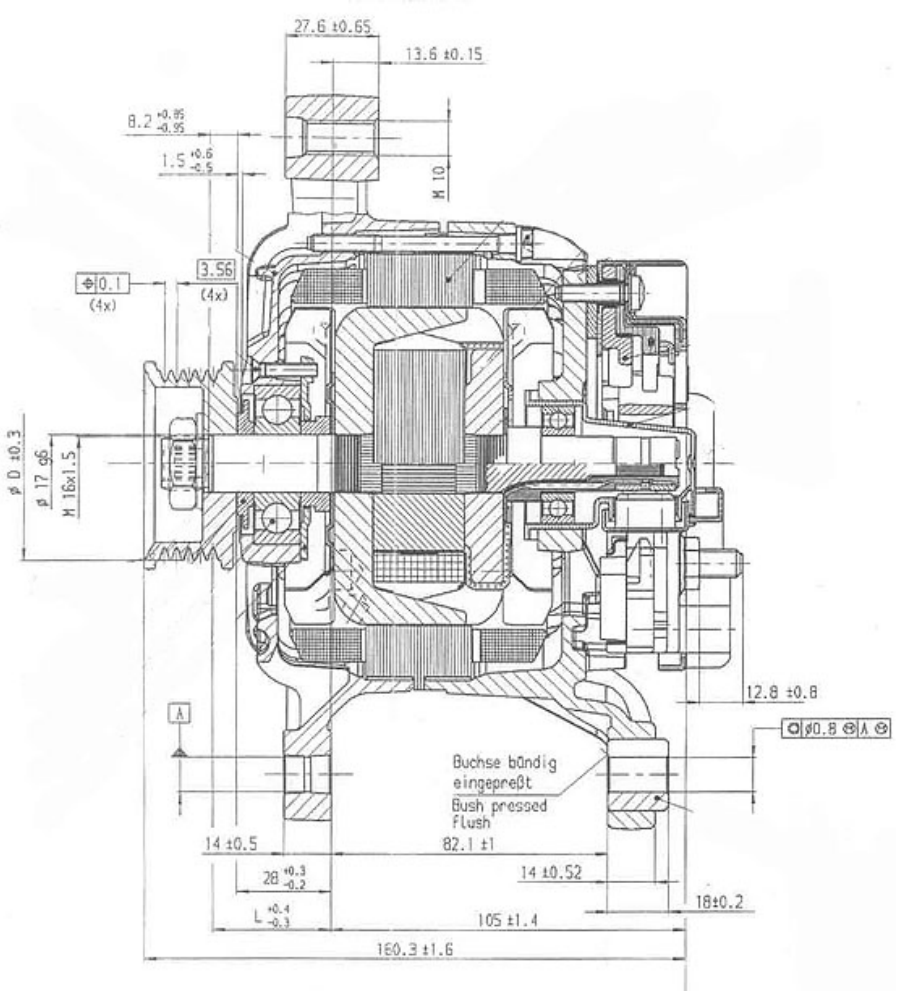
Order number	
	B 120 416 264
Offer drawing	**A 124 315 014**

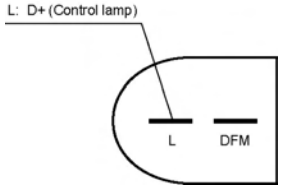
Characteristic

rpm	IG (A) 25°C
1000	0
1300	15,5
1500	32,5
1700	44,8
2000	58,5
3000	76,0
4000	85,0
5000	88,5
6000	90,0
7000	90,3
8000	90,5
9000	90,5
10000	90,5
15000	90,5
20000	90,5



Design





Alternator GC 100 A

This alternator is modified for motorsport demand and splash protected. Clockwise and anticlockwise versions are possible, modifications are available on request.

Mechanical data	
Case material	aluminium
Weight	4500 g
Current regulator unit	integrated
Max. rotations	18 000 x 1/min
Dimensions	
Diameter	125 mm
Length without shaft stub	133 mm
Distance between mounting points	154 mm

Conditions for use	
Temperature range	-10 ... 90°C
Vibration	high protection
Installation without rubber mounting and in a well ventilated area	

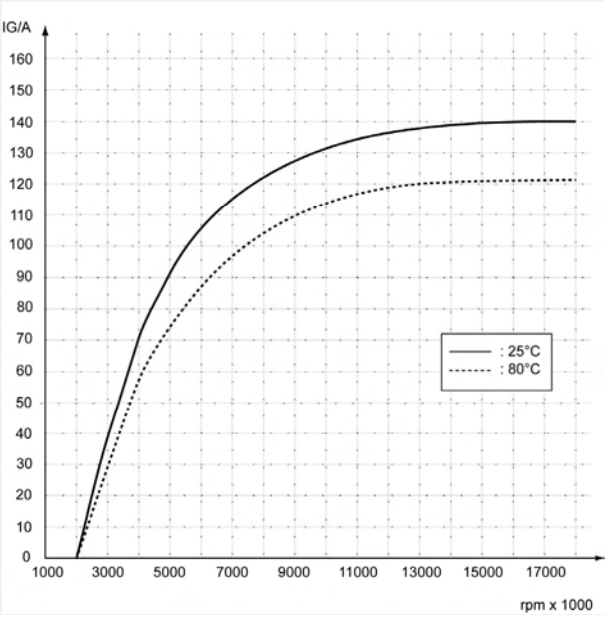
Electric connections	
Battery B+	M8
Control lamp D+	M5

Electronic data	
Rated current	100 A
Supply voltage	14 V
Cut-in speed	1500 x 1/min
Coupling	screws

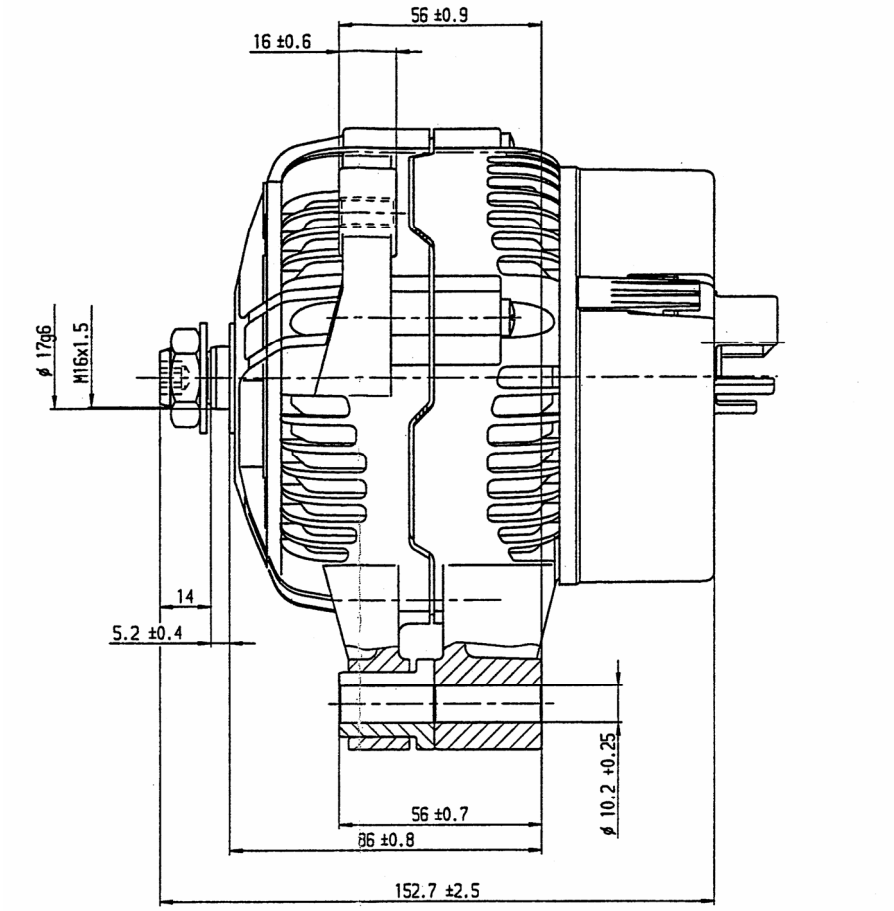
Order numbers	
Anticlockwise rotation	**B 120 310 176**
Clockwise rotation	**B 120 310 175**
Offer drawing	**A 120 310 175**

Characteristic

Rpm	IG (A) 25°C	IG (A) 80°C
1000	0,0	0,0
2000	57,1	41,5
3000	90,3	64,7
4000	106,6	71,7
5000	115,6	79,3
6000	121,0	82,9
7000	124,8	86,9
8000	127,2	89,5
9000	128,8	91,9
10000	129,9	93,1
12000	131,2	96,0
15000	132,7	99,9
18000	133,6	102,5



Design



Alternator GCM1
110/130/140 A

This alternator is modified for motorsport demand and splash protected. The stator windings are handmade, the rotor is extra fine balanced. Clockwise and anticlockwise versions are possible, modifications are available on request.

Mechanical data	
Case material	aluminium
Weight	3400 g
Current regulator unit	integrated
Max. rotations	18 000 x 1/min
Dimensions	
Diameter	108 mm
Length without shaft stub	128 mm
Distance between mounting points	154 mm

Conditions for use	
Temperature range	-30 ... 90°C
Vibration	high protection
Installation without rubber mounting	

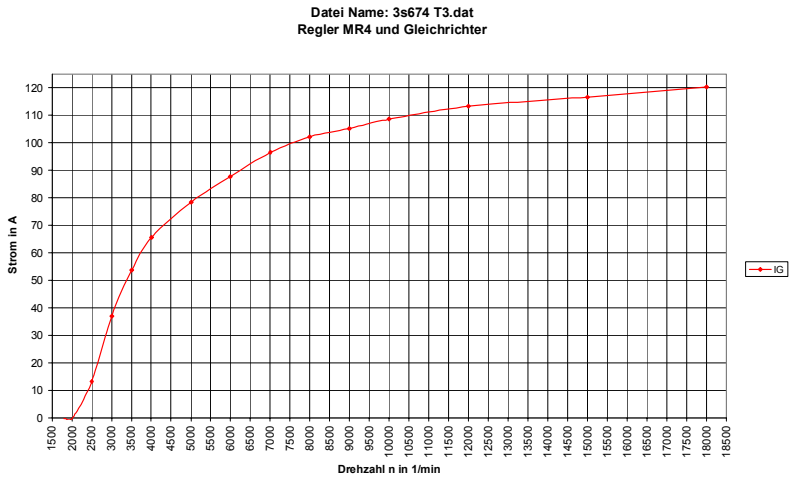
Electric connections	
Battery B+	M6
Control lamp D+	flat-pin connector, see drawing

Electronic data	
Rated current	110/130/140 A
Supply voltage	13,5 V
Cut-in speed	3000 x 1/min
Coupling	screws

Order numbers	
110 A	
Anticlockwise rotation	**B 261 208 606**
Clockwise rotation	**B 261 208 607**
130 A	
Anticlockwise rotation	**B 261 208 604**
Clockwise rotation	**B 261 208 605**
140 A	
Anticlockwise rotation	**B 261 208 602**
Clockwise rotation	**B 261 208 603**
Offer drawing	**0 124 OAD 32A**

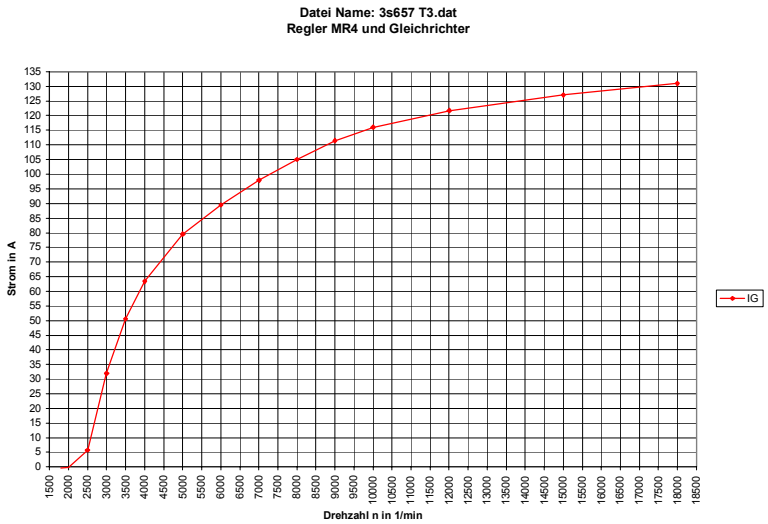
Characteristic 110 A

Rpm	IG (A) at 90°C
2000	0
2500	13
3000	37
3500	54
4000	65
5000	78
6000	88
7000	96
8000	102
9000	105
10000	108
12000	113
15000	117
18000	120



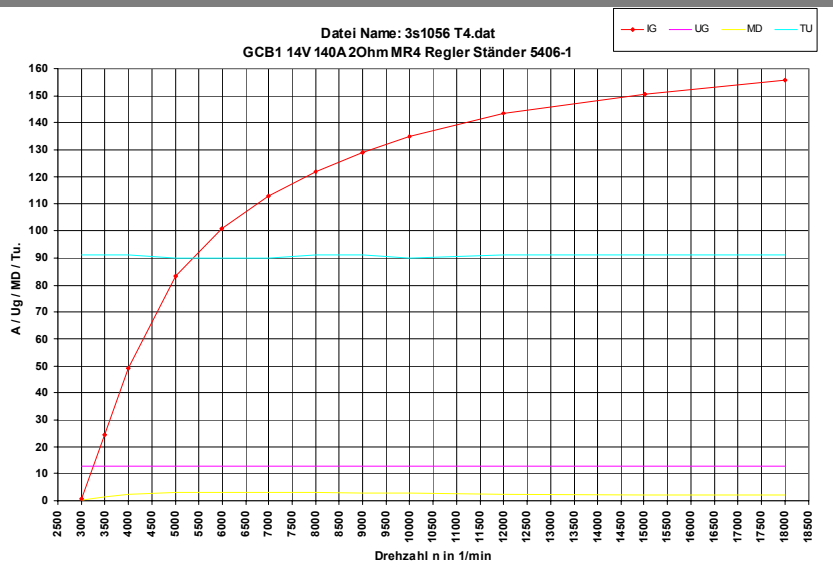
Characteristic 130 A

Rpm	IG (A) at 90°C
2000	0
2500	6
3000	32
3500	51
4000	63
5000	80
6000	90
7000	98
8000	105
9000	111
10000	116
12000	121
15000	127
18000	131

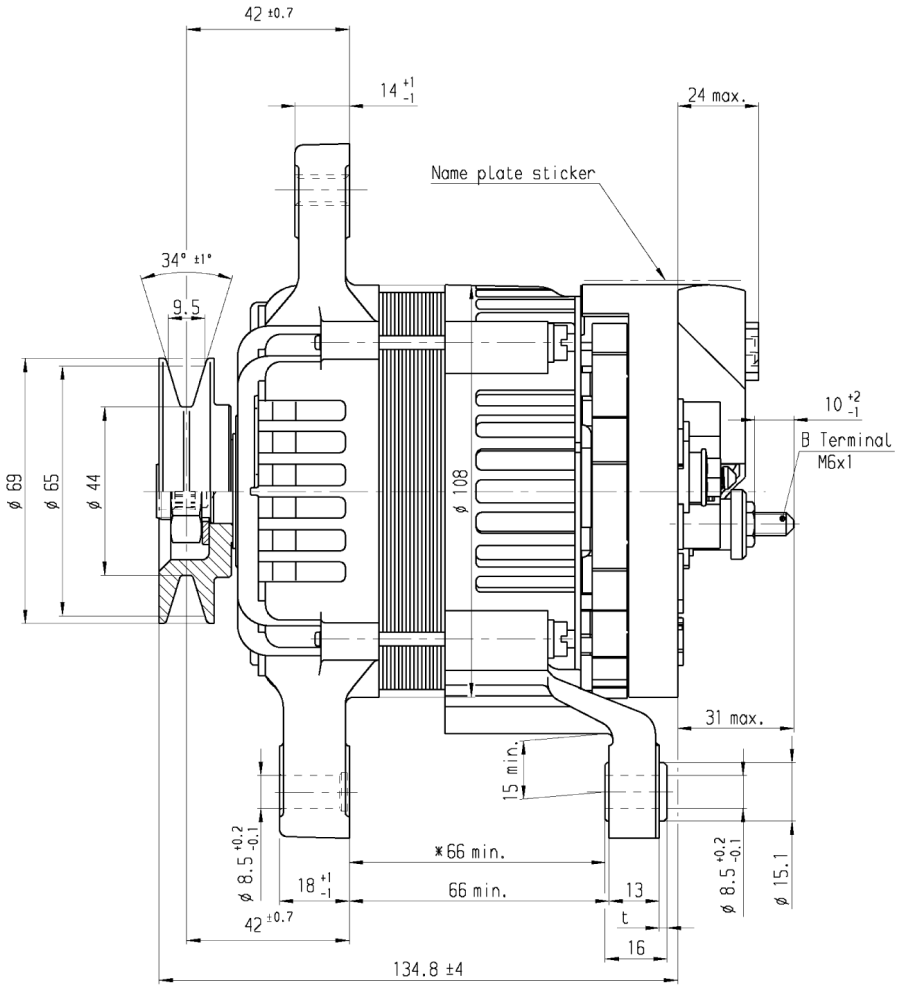


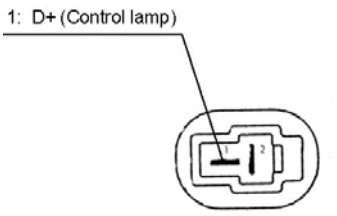
Characteristic 140 A

Rpm	IG (A) at 90°C
2000	0
2500	0
3000	1
3500	25
4000	49
5000	83
6000	101
7000	113
8000	122
9000	129
10000	135
12000	144
15000	151
18000	156



Design

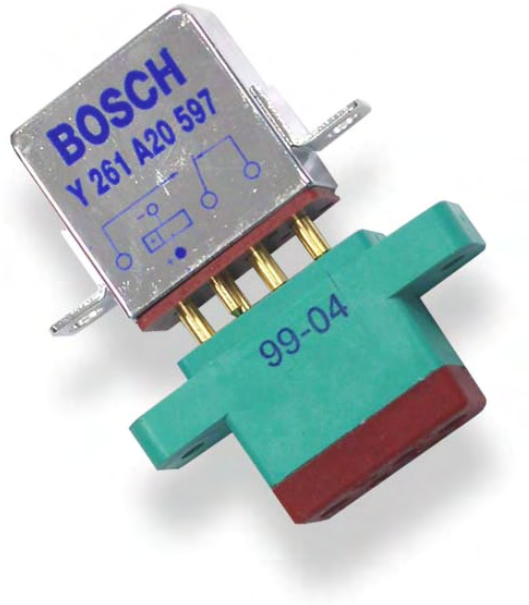

42 ±0.7
14 +1 -1
24 max.
Name plate sticker
34° ±1°
9.5
ø 69
ø 65
ø 44
ø 108
10 +2 -1
B Terminal
M6x1
31 max.
15 min.
ø 8.5 +0.2 -0.1
18 +1 -1
42 ±0.7
*66 min.
66 min.
13
t
16
134.8 ±4
ø 8.5 +0.2 -0.1
ø 15.1


1: D+ (Control lamp)

Relay

Relay 25 A

A miniature DC-contactor for electrical power control. The rated current is 25 A for secondary power distribution with high inrush current like hydraulic- and fuel motor loads. The base part allows a quick change of the relay.



Mechanical data	
Drill hole	3,1 mm
Weight	61 g

Electronic data	
Supply voltage	12 ... 14,5 V
Max. current	25 A
Min. switches	20 000

Conditions for use	
Temperature range	-30 ... 125°C
Vibration	30 g/70 Hz ... 3 kHz
Shock	100 g (11 ms)

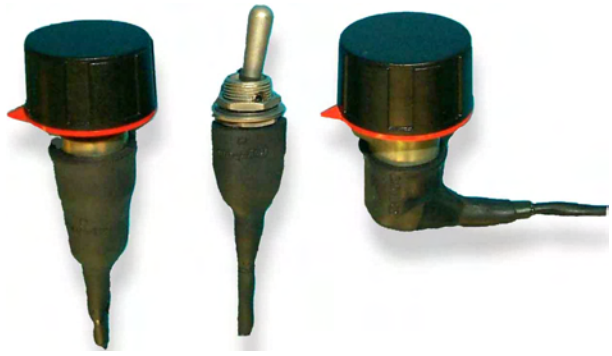
Order numbers	
Relay	**Y 261 A20 597**
Offer drawing	**Y 261 A25 338**
Base	**Y 261 A20 598**
Offer drawing	**Y 261 A25 338**

Switches

Switches

We offer a wide range of switches for the special demands of motorsport.

You can combine all types with every design and every connector cable equivalent to your individual requirement.



Type
For MAP Function
For display-toggle-function
3 steps for MAP-function
4 steps
4 steps for MAP-function
6 steps for display switch over
12 steps

Connector cables
Without
KPTA 6E6-4P-C-DN
KPTC 6E8-3P-C-DN
ASL 6-06-05PN-HE

Extras
With integrated resistor network
Lockable
Variable number of steps
Variable form of rotary waver switch
Without end stop

Application range
Motor functions
Dashboard functions
Display switch over
Display dimmer

Design
Straight
90° angled

Order numbers

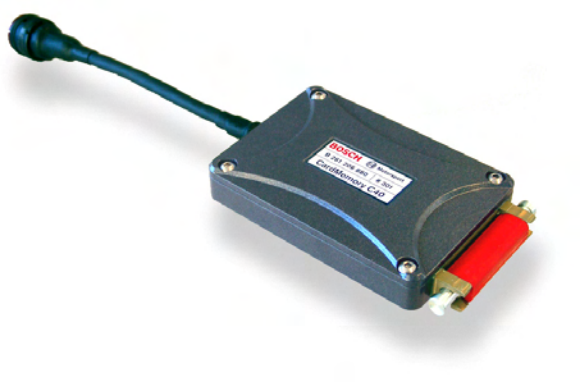
Model	Design	Connector	
12 steps	Straight	KPTC 6E8-3P-C-DN	**B 261 209 143**
12 steps	90° angled	KPTC 6E8-3P-C-DN	**B 261 209 144**
12 steps	straight	KPTC 6E6-4P-C-DN	**B 261 209 146**
4 steps	straight	KPTC 6E6-4P-C-DN	**B 261 209 147**
12 steps without	straight	KPTC 6E6-4P-C-DN	**B 261 209 148**
4 steps LED dimmer display		KPTC 6E8-3P-C-DN	**B 261 209 527**
4 steps display dimmer DDU		KPTC 6E8-3P-C-DN	**B 261 209 528**
4 steps display dimmer DDU	90° angled	KPTC 6E8-4P-C-DN	**B 261 209 630**
12 steps	straight	ASL 6-06-05PN-HE	**B 261 209 643**
for MAP function	straight	ASL 6-06-05PN-HE	**B 261 209 644**
4 steps display dimmer DDU	straight	ASL 6-06-05PN-HE	**B 261 209 646**
4 steps LED dimmer DDU	straight	ASL 6-06-05PN-HE	**B 261 209 647**
6 steps display dimmer and switch over DDU	straight	ASL 6-06-05PN-HE	**B 261 209 659**

Communication

Data Logging

CardMemory

The CardMemory is a device used for data acquisition. The basic model C5 is designed with a 5 pin connector, for data transfer via CAN. The extended model C40 Plus is developed to read in additional 15 analogous signals and 1 rev signal. The measured data are stored on a compact flash card.



Mechanical data	
Dust and splashwater proof aluminium housing	
Flexible housing fixation points	
Connector	with 5 or 40 pins
Size	150 x 90 x 22 mm
Weight	330 g

Conditions for use	
ECU temperature	-40 ... 75°C
Max. power consumption	7 W at 14 V
Max. vibration	15 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electrical data
1 microcontroller with 16 bit organisation
1 CAN interface
Real time clock
Non volatile flash card memory
Total calculation capacity approximately 10 MIPS

Options	
15 analogous inputs with 10 bit resolution and 5 ms sample rate time	
1 inductive crankshaft sensor interface	
Sensor supply outputs	5 V/100 mA 10 V/100 mA
Calibration functions are realised with an additional software tool	

Necessary equipment	
Flash card 128 MB	**F 01E B01 105_0B**
Flash card 256 MB	**F 01E B01 106_0B**
Flash card 512 MB	**F 01E B01 107_0B**
Flash card 1024 MB	**F 01E B01 108_0B**
Flash card 2048 MB	**F 01E B01 109_0B**
Memory adapter	**B 261 206 864**
C40 adapter cable	**B 261 209 433**

Connector	
Cable harness connector C5	**AS6-06-05SN HE**
Cable harness connector C40 Plus	**AS0-14-35 SN**

Order numbers	
C5	**B 261 206 858**
C40 Plus	**B 261 206 860**
Upgrade C5 to C40 Plus	**on request**
Software chassis adjust	**on request**

Accessories

Compact flash cards, adapters and drivers are necessary to use the Card memory. For some optional functions additional cables and software are on offer.

Compact flash cards are offered with a storage capacity of up to 2048 MB. The compact flash card adapter is used to insert the card to the PCMCIA slot of the PC for data download and card formatting.

In conjunction with the memory C40 Plus, a software tool for additional calibration functions is offered. Together with an individual cable harness it is possible to calibrate further sensors for chassis data logging. To connect memory C40 to the vehicle cable harness the special C40 adapter cable is necessary.

Conditions for use	
Operating temperature	-40 ... 84°C
Humidity	5 % to 95 %, non condensing
Vibration	15 g peak to peak
Shock	max. 2,0 g

Order numbers	
Flash card 128 MB	**F 01E B01 105_0B**
Flash card 256 MB	**F 01E B01 106_0B**
Flash card 512 MB	**F 01E B01 107_0B**
Flash card 1024 MB	**F 01E B01 108_0B**
Flash card 2048 MB	**F 01E B01 109_0B**
Memory adapter	**B 261 206 864**
Flash card adapter	**B 261 205 814**
Software Chassis Adjust	**B 261 206 870**
C40 adapter cable	**B 261 209 433**

Signal Processing

Sensor Interface Box ESIB

ESIB is a special device for measuring the signals of multiple sensors. The flexible use of microboards allows the adaptation to a great variety of measuring tasks.

For data recording the integrated CAN-bus can be linked to a Bosch Motronic or Card-Memory.

Mechanical data	
Dust and water proof aluminium housing	
Filtered connectors of military design with high pin density (MIL-38999)	
Vibration damped printed circuit boards	
Flexible housing fixation points	
Size	120 x 114 x 38 mm
Weight	550 g

Electronic data
1 microcontroller with 16 bit organisation, calculation power 16 MIPS
0,5 MB RAM and up to 9 MB non-volatile flash RAM

Conditions for use	
ECU temperature	-40 ... 85°C
Max. power consumption	7 W at 14 V
Max. vibration	15 g/20 Hz ... 2 kHz for t < 5 h

Variations	
ESIB Basic	Flexible use of microboards
ESIB-Lam 8	Lambda measurement with 8 channels
ESIB-Lam 8S	Lambda measurement with 8 channels and further signals
ESIB-Thermo 8S	Exhaust-gas temperature measurement with 8 channels and further signals
ESIB-Ana 16S	Measuring of 16 analog signals and 6 wheelspeed signals
ESIB-Ana 24	Measuring of 24 analog signals

ESIB Basic

Flexible use of microboards

Functionality
28 multifunctional input/output connector pins configured with insertion of function specific microboards
Max. 6 microboards
Data transfer via CAN for data logging or via K-Line for online measuring

Outputs
Serial CAN protocol to main ECU with 1 Mbps serial K-Line or RS232 up to 500 Kbps
8 PWM power stages with 2,0 A output current
Precise and independent 10 V and 5 V sensor supply available

Inputs
Depending on microboards used

Alternative microboards	
I8L:	8 ch analog input
I8H:	8 ch analog input (high resolution)
I6W:	6 ch wheel speed detection
L4M:	4 ch lambda measurement (LSM-type)
O4B:	4 ch universal output
I2D:	2 ch differential input
I4D:	4 ch differential input
I2T:	2 ch LVDT
E4T:	4 ch exhaust-gas temp.measurement

ESIB-Lam 8

Lambda measurement with 8 channels

Functionality
Lambda measuring with 8 wide range lambda sensors
Data transfer via CAN for data logging or via K-Line for online measuring

Outputs
Serial CAN protocol to main ECU with 1 Mbps serial K-Line or RS232 up to 500 Kbps
8 PWM power stages with 2,0 A output current
Precise and independent 10 V and 5 V sensor supply available

Inputs
8 channels wide band lambda measuring from λ 0,8 to 1,3

Integrated microboards
2 x L4M

Order number
B 261 208 228

ESIB-Lam 8S

Lambda measurement with 8 channels and further signals

Functionality

- Lambda measuring with 8 wide range lambda sensors
- Vehicle speed and track distance with inductive or hall effect speed sensor
- Engine revolutions
- Throttle position
- Lap trigger signal
- Lateral acceleration
- 5 analog inputs
- Data transfer via CAN for data logging or via K-Line for online measuring

Outputs

- Serial CAN protocol to main ECU with 1 Mbps serial K-Line or RS232 up to 500 Kbps
- 8 PWM power stages with 2,0 A output current
- Precise and independent 10 V and 5 V sensor supply available

Inputs

- 8 channels wide band lambda measuring from λ 0,8 to 1,3
- 8 channels ADC 0 ... 5 V
- 4 wheelspeed interfaces inductive or hall effect, free programmable

Integrated microboards

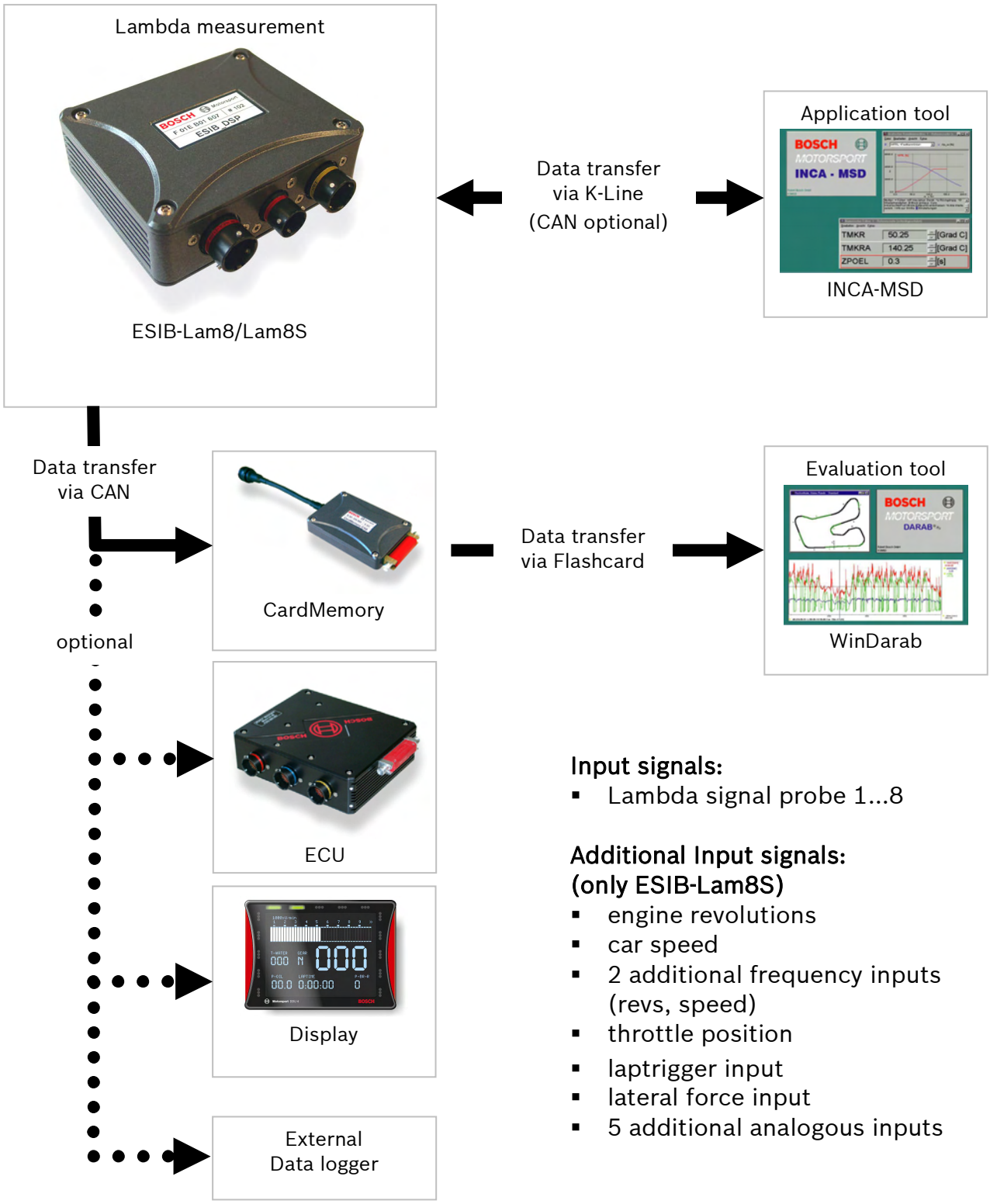
- 2 x L4M
- 1 x I8L
- 1 x 6W

Order number

B 261 208 229

ESIB-Lam8/Lam8S

System Overview



Input signals:

- Lambda signal probe 1...8

Additional Input signals:
(only ESIB-Lam8S)

- engine revolutions
- car speed
- 2 additional frequency inputs (revs, speed)
- throttle position
- laptrigger input
- lateral force input
- 5 additional analogous inputs

ESIB-Thermo 8S

Exhaust-gas temperature measurement with 8 channels and further signals

Functionality
8 exhaust-gas temperatures
Vehicle speed and track distance with inductive or hall effect speed sensor
Engine revolutions
Throttle position
Lap trigger signal
Lateral acceleration
5 analog inputs
Data transfer via CAN for data logging or via K-Line for online measuring

Outputs
Serial CAN protocol to main ECU with 1 Mbps serial K-Line or RS232 up to 500 Kbps
8 PWM power stages with 2,0 A output current
Precise and independent 10 V and 5 V sensor supply available

Inputs
8 channels thermocouple probe sensor, Type K, DIN IEC 584
8 channels ADC 0 ... 5 V
4 wheelspeed interfaces inductive or hall effect, free programmable

Integrated microboards
2 x E4T
1 x I8L
1 x 6W

Order number
B 261 208 262

ESIB-Ana 16S

Measuring of 16 analog signals and 6 wheelspeed signals

Functionality
16 multifunctional analog inputs
6 wheelspeed inputs
Data transfer via CAN for data logging or via K-Line for online measuring

Outputs
Serial CAN protocol to main ECU with 1 Mbps serial K-Line or RS232 up to 500 Kbps
8 PWM power stages with 2,0 A output current
Precise and independent 10 V and 5 V sensor supply available

Inputs
16 channels ADC 0 ... 5 V
6 wheelspeed interfaces inductive or hall effect, free programmable

Integrated microboards
2 x I8L
1 x 6W

Order number
B 261 208 227

ESIB-Ana 24

Measuring of 24 analog signals

Functionality

24 multifunctional analog inputs

Data transfer via CAN for data logging
or via K-Line for online measuring

Outputs

Serial CAN protocol to main ECU with 1 Mbps serial K-Line or RS232 up to 500 Kbps

8 PWM power stages with 2,0 A output current

Precise and independent 10 V and 5 V sensor supply available

Inputs

24 channels ADC 0 ... 5 V

Integrated microboards

3 x I8L

Order number

B 261 208 226

Speed Box 2

This box determines the speed signals of two wheels and passes the higher value on. This enables the logging of vehicle speed even with one wheel locked.

Mechanical data	
Size	40 x 40 x 38 mm
Weight	89 g
Environmental	IP65

Conditions for use	
Operating temperature	10 ... 60°C

Connectors	
Input	2 x KPSE 120061-28
Output	1 x KPSE 6E8-3AP-DN

Electronic data	
Supply voltage	6 ... 18 V
Supply current	4 mA

Order numbers	
Speed Box 2 incl. cable harness	**B 261 208 281**
Speed Box 2	**B 261 208 284**
Cable harness	**B 261 208 285**

Speed Box 4

This box determines the speed signals of four wheels and converts them into a CAN-message. The message includes the time between each tooth-gap. The box is optimized for the MS 3-use.

Mechanical data	
Size	70 x 40 x 19 mm
Weight	90 g

Conditions for use	
Operating temperature	10 ... 60°C

Connector	
	AS0-10-35PN

Electronic data	
Power supply	4 ... 18 V
Current consumption	120 mA at 12 V
Channels	4 Speed
Channel input	1 ... 150 V

Order number	
Speed Box 4	**B 261 208 286**

Telemetry

Telemetry Unit FM 40

The FM 40 is a real-time telemetry system used to get always actual data from the car out on the track. It fits most of the Bosch Motorsport management systems and is designed to transmit many various car and engine data due to its high speed data rate.

In typical applications data are sent from the car to the receiving station. With the optional software for bi-directional transmission, data can be sent in both directions.

Mechanical data	
Size	151 x 138 x 28 mm
Weight	720 g
Dust and waterproof housing with LED indicators	
Car antenna compatible to existing Bosch telemetry systems	

Conditions for use	
Vibration	6 g/20 Hz ... 2 kHz
Temperature range	0 ... 60°C
Max. power consumption	25 W at 14 V
International standard	I-ETS 300 220 ETS 300 113 FCC

Electronic data	
Semi duplex radio modem (bidirectional)	
Internal data buffer and protocol management	
Transmission power	1 ... 10 W
Frequency range	430 ... 470 MHz (hardware adjustable)
Receiver sensitivity	-116 dBm error detection and forward error correction (FEC)
Data rate	max. 19200 bps
Required power supply	10 ... 18 V
Max. current	< 2,5 A

Connectors	
RF	BNC female
Power / data	CGK SOT 8N35 PN

Order number
B 261 208 885

Analysing

WinDarab

Data Recording, Analysing and Influencing

WinDarab is an evaluation tool for monitoring and analysing of logged data. It is Windows-based and specially designed for motorsport use. Depending on the functionality the software is available in two different versions, WinDarab-Light and WinDarab-Expert. For selection of monitored data channels and setting of sample rates the integrated configuration tool WinDCP is used.

Data evaluation
Auto load and auto store
Adjustable axis: time or distance
Direct read in of memory data without reader
Graphic display of all measured and stored channels
Various displays available (analogous and digital)
Number of displays available
Various display set-ups selectable and storable
Laptrigger signal included

Functionality
Creating of race tracks
Several segments adjustable for each race track
Lap reports and lap comparison
Inform displays
Data extract and export

Functions
Min/max-calculations
Histograms
Mathematical functions
Filter functions incl. FFT
x/y-plots

Data comparison
Calculation of differences lap by lap

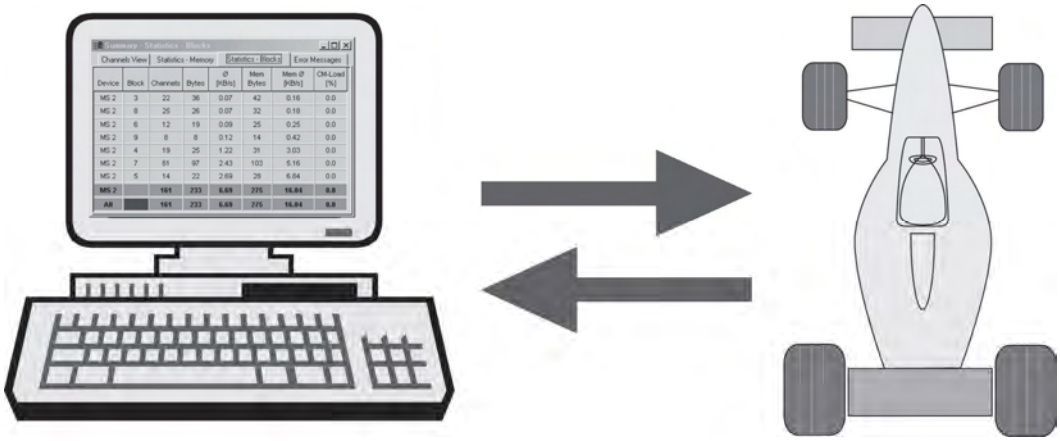
Order numbers	
WinDarab-Light incl. Configuration tool WinDCP	**F 01E B01 402**
WinDarab-Expert incl. Configuration tool WinDCP	**F 01E B01 401**
Upgrade WinDarab-Light to WinDarab-Expert	**on request**

Application

INCA-MSD

INCA is a software tool for measuring and calibrating of defined engine parameters. According to different levels of functionality INCA is available in two different versions:

- The basic version INCA-Light is made for the quick use.
- The highly sophisticated version INCA-Expert is made for calibration and optimization.



Performance description
INCA-MSD is a combination of:
• **Project management:**
Visualization, processing and management of calibration, measurement and documentation data.
• **Programming system**:
Programming and management of program (code) and calibration data.
• **Measuring system**:
Acquisition, visualization, documentation and evaluation of measurement data.
• **Calibration system:**
Visualization and manipulation of parameters (calibration data).
• **Diagnosis system:**
Visualization, processing, documentation and evaluation of diagnosis data.

General functions
Online measurement and calibration
Basic configuration of a number of views
User-configurable menus of the diagnostic services and the displays on the screen
Easy switch between the configured views
Universal use for different ECUs
Controlled by mouse or menu, fast grip via keyboard and shortcuts
Data acquisition via central main window

Measurement system function

The measurements can be displayed in various ways: e.g. oscilloscopes, vertical or horizontal bar charts, numerical displays for numerical values or bit displays for binary values.

The oscilloscope allows you to have several scalar or binary measured signals displayed simultaneously.

Once measuring has been completed, you can complete the evaluation of the data either directly or in detail evaluation programs, such as the VS 100 program provides.

INCA processes characteristics and measured signals in the form of variables. These are structured alphabetically according to the DAMOS/ASAP 2 definition, but are also
available in an additional hierarchical display.

Using an editor, you define individual functions and so react in this way to different application tasks, such as the integration of different external data sources (thermo-scan, lambda display).

Free selection of measuring cells.

Calibration system function

INCA provides you with various editors for different characteristics, e.g. the tabular editor for processing curves and maps.

These curves and maps can be spread over several windows so that all values can be displayed at the same time.

To evaluate the data, use either the provided VSW program or copy the data to a spreadsheet program using the Windows buffer.

Free selection of calibration cells.

Functionality of potentiometer board: up to 12 pots with individually configuration.

Evaluation function

Calibration comparison function

A lot of auxiliary functions are supporting the user during the period of working in.

Required hardware components

PC:

IBM PC/AT compatible, 586 processor or higher, 166 MHz

Approx. 64 MB RAM

Approx. 30 MB harddisc space

VGA monitor

Operating systems:

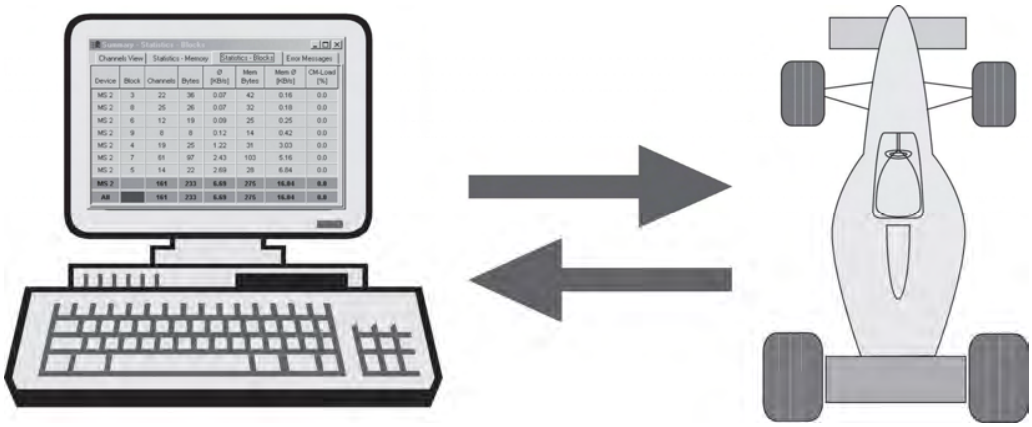
Windows 98, 2000, NT and XP

Order number

INCA-Expert	**B 261 206 423**

Modas

Modas is a software tool for measuring and calibrating defined engine values and curves. It is specially designed for race track use. Developing Modas we set great store by easy handling and quick access to the ECU.



General functions
Online measurement and calibration
Universal use for different ECUs
Modas facilitates operating and working in by using the Windows standard. In the office Modas is controlled by mouse or menue. If Modas is used in a mobile way a fast grip is possible by keyboard and shortcuts.

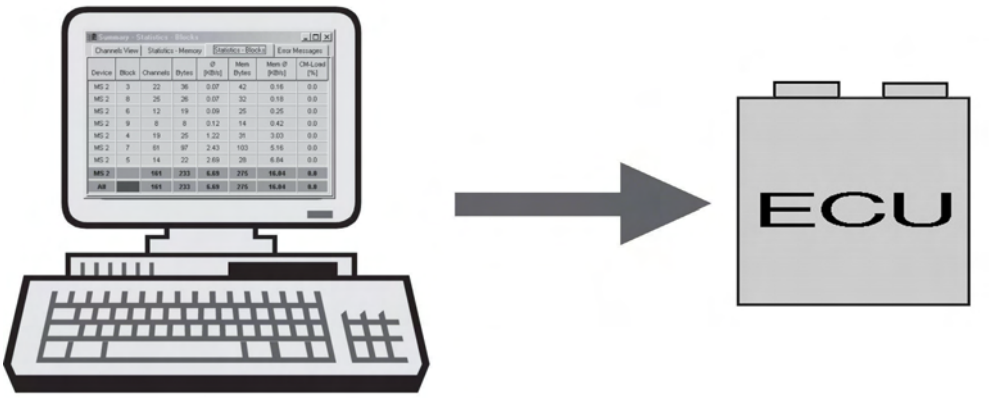
Required hardware components:
PC:
IBM PC/AT compatible, 586 processor or higher, 166 MHz
Approx. 64 Mbyte of RAM
Approx. 30 Mbyte harddisc space
VGA monitor
Operating systems:
Windows 98, 2000, NT and XP

Performance description
Modas is a combination of
• **Project (Data) management:**
Visualisation, processing and management of calibration, measurement and documentation data
• **Programming system:**
Programming and management of calibration data
• **Calibration system:**
Visualisation and manipulation of parameters
(Calibration data)
• **Diagnosis system:**
Visualisation, processing, documentation and evaluation of diagnosis data

Order number
B 261 206 441

ProF/Win
for Windows 98SE , 2000, NT and XP

ProF/Win is used for programming the Flash EPROM of an ECU with the newest version of a program or data. This takes place via the diagnostic interface of the ECU using the K-line protocol, KWP2000 (physical addressing).



Functions

Programming new program versions and data records in an ECU application phase

Prerequisites

The following hardware components are required when using ProF/Win with ECU (MS 3.1):

PC

Pentium processor, SVGA 800 x 600
Frequence 266 MHz,
366 MHz recommended

Operating systems

Windows 98, 2000, NT and XP

Storage capacity

64 MB RAM, 128 MB RAM recommended,
40 MB on harddisc

Hardware interface

KIC, version 1.12 or higher

Latest version of the INCA devices recommended

Cable

PC to KIC

Hardware module KIC

Diagnostic interface:

ISO 9141-2 with K-line,
max. 250 kBaud, adjustable via SW,
galvanical separation

Diagnostic protocol:

KWP 2000 (with variations)

Order number

on request

KIC 2
(K-Line Interface Compact)

KIC 2 is part of the INCA module family. Within this family, the KIC 2 is the low cost unit for PC-supported application on the serial diagnosis interface of an ECU.

KIC 2 is coupled to the PC via the parallel printer interface. This ensures a powerful and universal link to all common PCs. The coupling to the ECU is effected via the K-line of the diagnosis interface. The functionality of KIC 2 is essentially determined by the operating programs of the PC.

Details
Compact design
Fully suitable for motor vehicle use
Power supply through the connection to the ECU from board mains with galvanic separation
All inputs and outputs to the PC galvanically separated
Firmware update possible via PC
According to ISO 9141-2 for diagnosis tester
Up to 250 kBaud transfer rate
Plug suitable for motor vehicles (VS 20)
Protocols: McMess, KP 2000, Keyword 71

Mechanical data	
Size	17 x 60 x 78 mm

Electronic data	
Input voltage	6 ... 30 V
Power consumption	typ. 1 W at 13,5 V
Power consumption in stand by	30 mW at 13,5 V
Processor	µP 87C520, 12 kByte
Flash Eprom	2 x 48 kByte
Centronics linterface	40 g/5Hz ... 2kHz
Temperature range	-30 ... 70°C
Control P-module output	
Output voltage	0 ... 4,096 V
Quantisation	ΔV=1,0 mV
Resolution	12 bit

Order numbers	
KIC 2, standard connector	**B 261 206 859**
KIC 2, diagnosis connector with ignition bridge	**B 261 206 866**
KIC 2, diagnosis connector without ignition bridge	**B 261 206 867**

K-Line Extension Set

The K-Line Extension Set is an extension for KIC 2 and therefore also a part of the INCA module family. Within this family, the KIC 2 is the low cost unit for PC-supported application on the serial diagnosis interface of an ECU. The K-Line Extension Set enables a much longer distance than the KIC 2 can.

The set consists of three parts: The Printer port adapter, the K-Line adapter and the extension cable (length is user defined). The user can handle the set in the same way like a standard K-Line interface.

Details
Long distance K-Line function
Compact design
Fully suitable for motor vehicle use
Power supply through the connection to the ECU from board mains with galvanic separation
All inputs and outputs to the PC galvanically separated
Firmware update possible via PC
According to ISO 9141-2 for diagnosis tester
Up to 250 kBaud transfer rate
Plug suitable for motor vehicles (VS 20)
Protocols: McMess, KP 2000, Keyword 71

Mechanical data	
Size	17 x 60 x 78 mm

Electronic data	
Input voltage	6 ... 30 V
Power consumption	typ. 1 W at 13,5 V
Power consumption in stand by	30 mW at 13,5 V
Centronics interface	
Max. extension cable length	200 m
Temperature range	-30 ... 70°C
Control P-module output	
Output voltage	0 ... 4,096 V
Quantisation	ΔV=1,0 mV
Resolution	12 bit

Order numbers	
K-Line Extension Set	**F 01E B01 641**

Potiboard POP
(Parameter Operating Panel)

POP is part of the INCA module family. It is designed for online mapping on dyno supporting the INCA calibration function. POP is coupled to the PC via serial link on the SMB bus.

Details
Robust design
External power supply
Modification of calibration data by potentiometer operation
4 potentiometers, individual assignment to 4 characteristic values (fixed values, characteristic lines or maps)
Additive or multiplicative modification selectable
POP configuration saved together with the INCA display

Order number
B 261 206 428

Handheld Test Devices

Lambda Tester

This tester simulates the output signals of the lambda sensor in a quick and comfortable way. It allows you to check the function of the lambda control loop's hardware and software just before installing it into the vehicle.

Technical data	
Power supply	9 V
Output signals	40 / 800 / 900 mV
Internal resistance	10 / 50 / 100 Ω
Representable lambda values	0,65 ...1,08

Function

High precious simulation of various lambda values

Order number

B 261 206 879

RS 2000

With RS 2000 you can simulate crankshaft-, camshaft- and wheel-speed-signals quickly and comfortably.

Functions
Infinitely variable simulation of Hall- and inductive signal
Compatible with all Bosch-Motorsport-ECUs from MS 1.9 to MS 4.1
Adjustable on cylinder numbers from 4 to 12
Usable for increment- and segment-systems

Electronic data	
Power supply	12 V

Order numbers	
	B 261 206 862
Cable harness connector	**B 261 206 451**

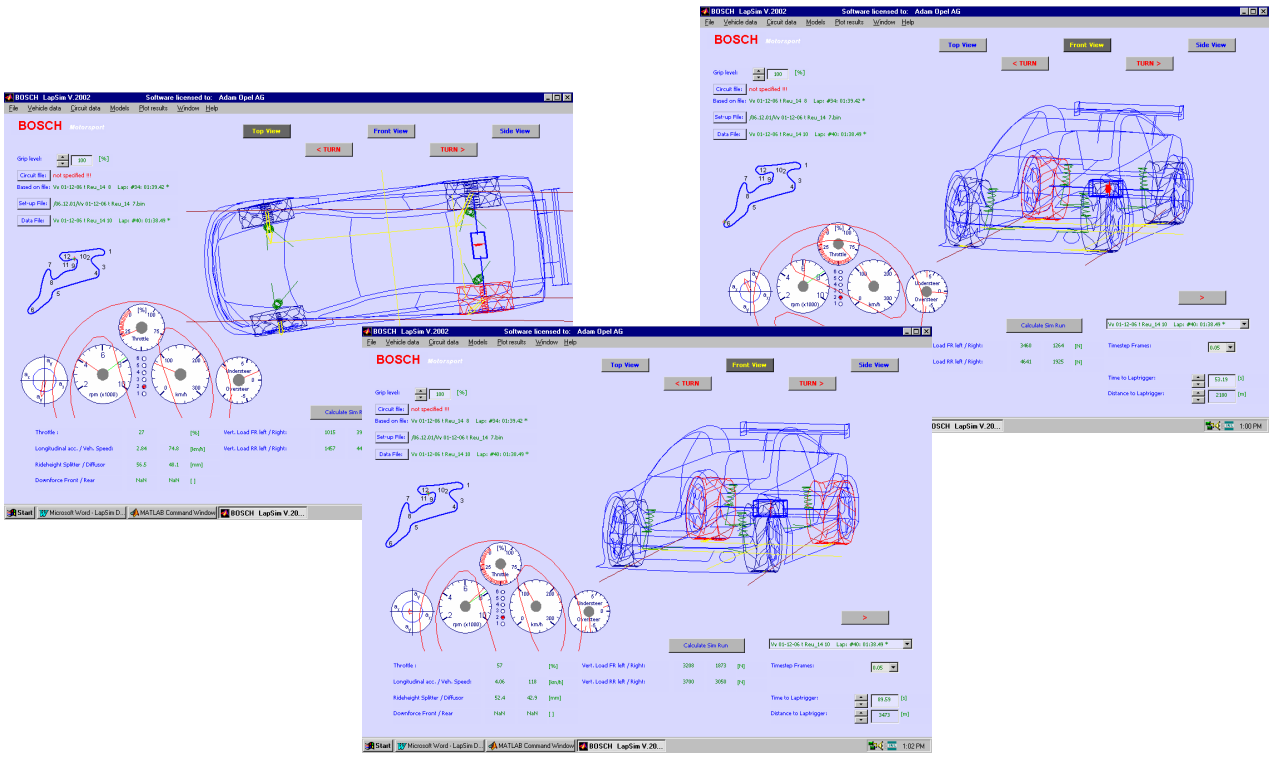
Simulation

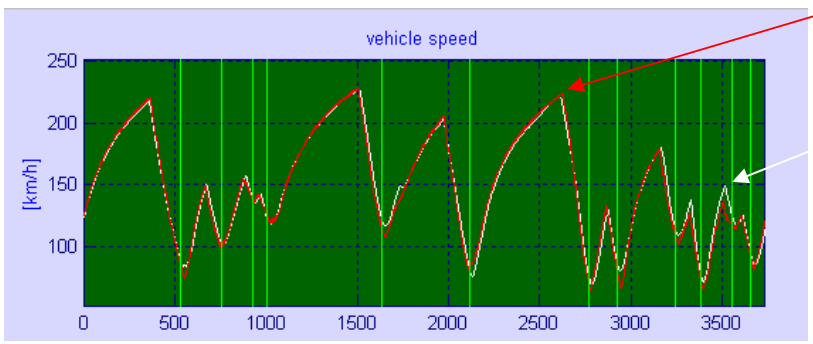
LapSim

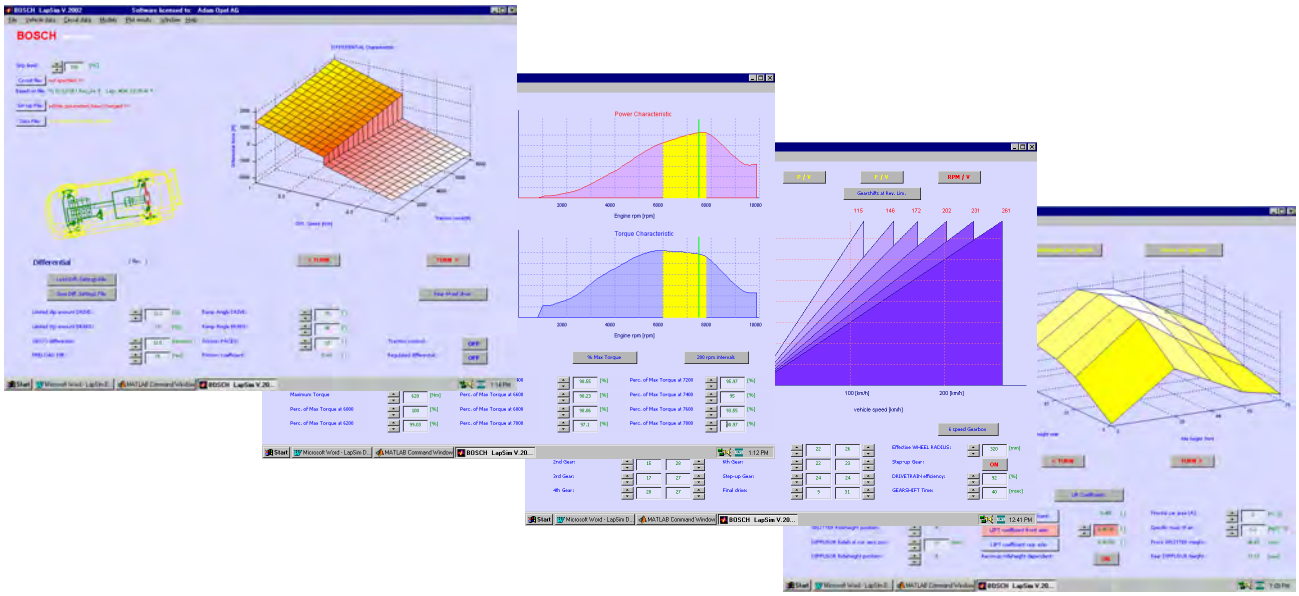
Data Analysis, Vehicle Identification and Setup Optimisation

LapSim is both an analysis tool as well as a vehicle simulation program. By further processing the on-car recorded data, using parts of the simulation models, a much more profound analysis of the on-car recorded data can be gained.

Due to the direct link with the simulation model, vehicle parameters can be validated like aero-dynamics, tyre behaviour, engine power, as well as driver performance. The visualisation of the vehicle behaviour creates a much easier and better understanding of the influence of several vehicle parameters on the performance independent of the technical background of the user.







Data analysis

Post processing of the on-car recorded data with simulation models. Calculating vehicle handling state, aerodynamics, differential function, etc.

Determination of tyre parameters out of on-car recorded data. Possibility to analyse tyre performance over the laps

Direct comparison between several outings and/or simulation model

3D Animation of vehicle behaviour for a better and more thorough understanding

By comparing recorded data with simulation data a validation possibility of vehicle parameters and vehicle functioning is made.

LapSim software adds all vehicle parameters to WinDarab Files → creates automatic database

Simulation model

Practical Pacjeka Tyre model. Tyre parameters can easily be determined out of on-car recorded data. No Tyre data required.

Full vehicle model including limited slip (or visco-) differential

3D Aeromaps, ride height dependent suspension kinematics.

Calculation time 1 to 1 to real car
(PIII - 1 GHz)

Automatic set-up optimisation

Useful vehicle parameter menus for rideheight versus speed, shift points, spring characteristics,etc.

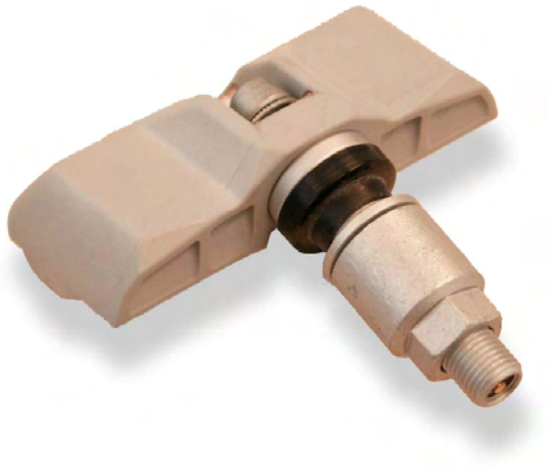
Order number

LapSim	**B 261 206 432**

Tyre Monitoring System

Tyre Monitoring Transmitter Type A

Measures and transmits tyre pressure and temperature, provides continuous monitoring of tyres during test, practice and race conditions. Installs in a standard 11,3 mm valve hole compliant with ETRTO standards (typical production car rim).



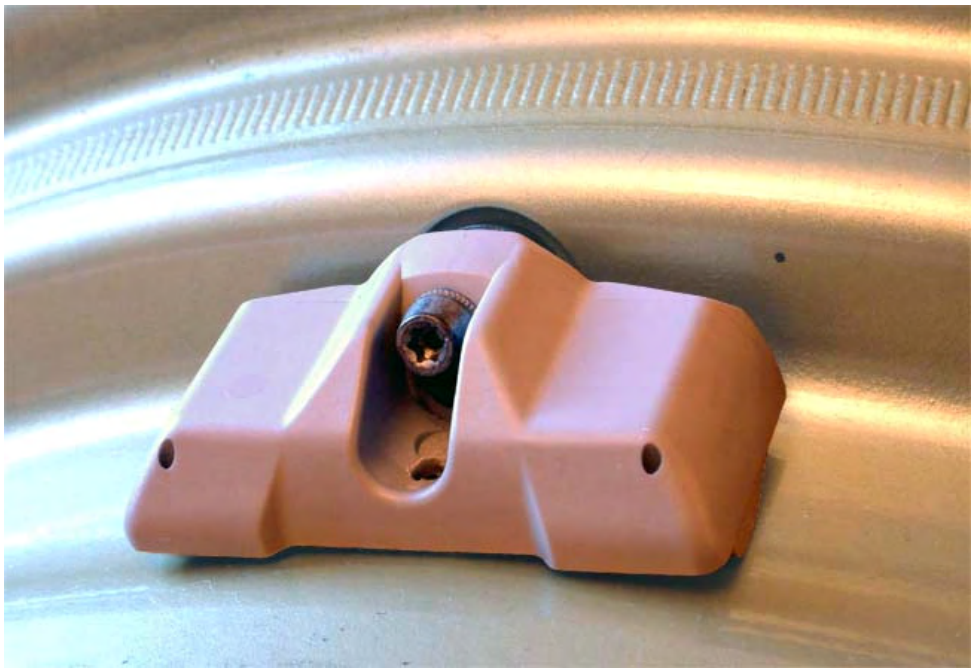
Transmitted data is encrypted and carries a unique serial number ensuring reliable error free data transmission. Each sensor is individually calibrated to a traceable standard, resulting in very high accuracy across the wide operating temperature range (-20 to 125°C).

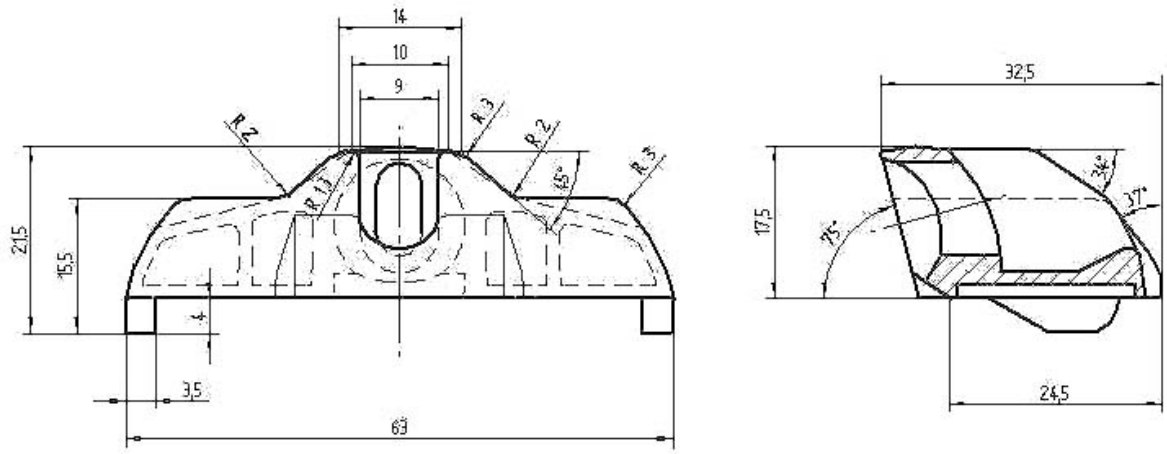
Calibration for any required range up to 10 bar can be provided, the resolution will be typically 200 bits at any temperature over the full pressure range.

Sensor Specification	
Pressure measuring range	0 ... up to 10 bar
Measuring resolution	max. pressure/200
e.g. 5 bar →	5/200 = 25 mbar resolution
Pressure accuracy	+/- 1 %
Temperature measuring range	-20 ... 125°C
Resolution	1°C
Housing	moulded plastic
Weight	23 g (39 g with valve stam)
Transmit rate	adaptive up to 1 Hz
Battery	Lithium Thionyl cell
Radio frequency	433,92 MHz
RF emission category	MPT 1340, ETS 300-220
Typical TX range	20 m (free space)

Operating modes
Active mode: When pressure is above 0,17 bar and temperature is above active threshold (typically 40°C). Transmit interval 1 sec (2 sec option)
Power save mode: When pressure is above 0,17 bar and temperature is below active threshold. Transmit interval 60 sec (120 sec option). If pressure change 25 mbar additional transmissions made
Sleep mode: If pressure is below 0,17 bar the sensor makes no transmissions.
Expected battery live: >1 500 000 transmissions (approx. 750 hrs active, 9000 hrs power save, 15 000 hrs sleep mode). Battery replacement can be carried out by factory or authorised service agent

Order number
on request



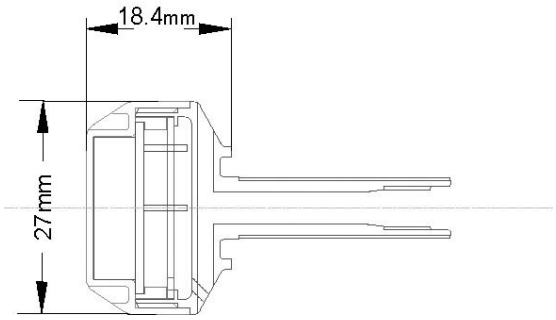

14
10
9
R2
R3
R2
R3
R1
45°
21,5
15,5
4
3,5
63
32,5
17,5
34°
37°
75°
24,5

Tyre Monitoring Transmitter Type B

Measures and transmits tyre pressure and temperature, provides continuous monitoring of tyres during test, practice and race conditions. Installs in a standard 11,3 mm valve hole (8,8 mm optional) with O-ring seal as a valve replacement, accepts standard valve core. All valve threads conform to ISO 4570:2002.

Transmitted data is encrypted and carries a unique serial number ensuring reliable error free data transmission. Each sensor is individually calibrated to a traceable standard, resulting in very high accuracy across the wide operating temperature range (145°C).

Calibration for any required range up to 10 bar can be provided, the resolution will be typically 200 bits at any temperature over the full pressure range.



Sensor Specification	
Pressure measuring range	0 ... up to 10 bar
Measuring resolution	max. pressure/200
e.g. 5 bar →	5/200 = 25 mbar resolution
Pressure accuracy	+/- 1 %
Temperature measuring range	10 ... 145°C
Resolution	1°C
Housing	Al 7075 T6 (Titanium option)
Weight	23 g (29 g Titanium)
Transmit rate	adaptive up to 2 Hz
Battery	High-temp Lithium Thionyl cell
Radio frequency	433,92 MHz
RF emission category	MPT 1340, ETS 300-220
Typical TX range	20 m (free space)

Operating modes
Active mode: When pressure is above 0,17 bar and temperature is above active threshold (typically 40°C). Transmit interval 1 sec (0,5 sec optional)
Power save mode: When pressure is above 0,17 bar and temperature is below active threshold. Transmit interval 30 sec (60 sec optional). If pressure change 25 mbar additional transmissions made
Sleep mode: If pressure is below 0,17 bar the sensor makes no transmissions.
Expected battery live: >1 500 000 transmissions (approx. 500 hrs active, 6000 hrs power save, 15 000 hrs sleep mode). Battery replacement can be carried out by factory or authorised service agent

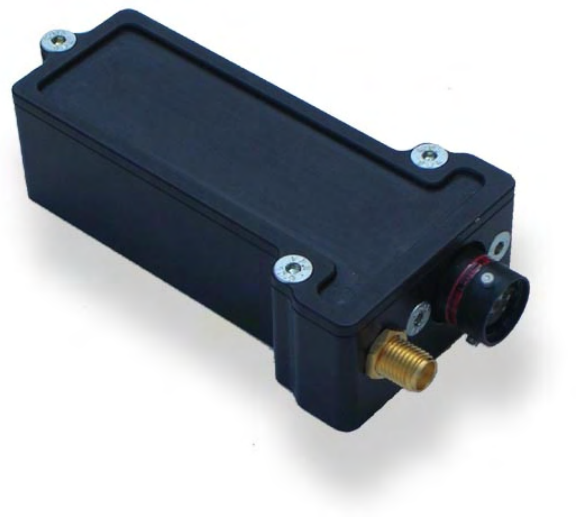
Order numbers		
T6	8,8 mm	**on request**
Ti	8,8 mm	**on request**
T6	11,3 mm	**on request**
Ti	11,3 mm	**on request**

Tyre Monitoring Receiver

Compact, lightweight data receiver monitors RF signals from the wheel transmitters. It decodes the sensor messages and sends calibrated pressure and temperature data to vehicle logging system via CAN or RS232 interface.

Each receiver recognises data from only its team sensor codes. The receiver holds a current library of team sensors that can be easily updated using a PC software utility.

Optional internal data logger, records last 30 minutes of pressure and temperature data.



Technical data	
CAN interface	Conforms to CAN 2.0A bus rate up to 1 Mbps
RS 232 interface	9,6 ... 19,2 K baud
Data output	pressure, temperature, message count
Additional flags	sensor over temp, sensor battery status
Main connector	AS007-35PN
RF connector	SMA (helical wound antenna supplied)
Power supply	7,5 ... 24 V, 45 mA
Housing	Al 7075 T6, black hard anodised (IP65)
Weight	69 g
Dimensions	82 x 42 x 23 mm
Operating conditions	0 ... 85°C
Radio frequency	433,92 MHz
Internal data logger	256 Kb, approx. 30 min

Order number
on request

Laptrigger Systems

Laptrigger IR-02

This laptrigger system consists of an infrared transmitter station and a receiver installed in the car. The system allows an exact laptime measurement.

Section time measurement for comparison of different car setups is also available if several transmitters are used.

Notice: our old laptrigger IR is not compatible with IR-02. If both laptriggers are used at the same time, the transmitters have to be positioned with a minimum distance of 5 m.

Mechanical data	
IR-02-Receiver	
Size	42 x 20 x 10 mm
Weight	39 g
Dust and waterproof aluminium housing	
IR-02-Transmitter	
Size with diode	90 x 40 x 28 mm
Weight	124 g
Dust and waterproof aluminium housing	

Electronic data	
IR-02-Receiver	
Frequency codes	16
Supply voltage	8 ... 16 V
Output voltage	5 V
IR-02-Transmitter	
Frequency codes	16 plus 16 offset codes for section times
Supply voltage	8 ... 16 V

Conditions for use	
Working range	15 m
Ambient temperature	-25 ... 70°C
Same height between receiver and transmitter	
Visibility connection between receiver and transmitter	
Avoid direct exposure to sunlight	

Order numbers	
IR-02-Receiver	
KPSE 6E8 3AP DN A34	**B 261 206 884**
AS-6-06-05PD-HE	**B 261 206 887**
KPTA 6E6-4P-C-DN	**B 261 206 888**
IR-02-Transmitter	**B 261 206 890**

Laptrigger HF

This Laptrigger system consists of a high frequency transmitter station and a receiver which is installed in the car.

The system allows an exact laptime measurement. Section time measurement for comparison of different car setups is also available if several transmitters are used.

Mechanical data	
HF-Receiver	
Size	60 x 98 x 24 mm
Weight	130 g
Patch antenna fixed to housing, antenna coated with foil for mechanical protection	
Dust and waterproof aluminium housing	
HF-Transmitter	
Size	200 x 77 x 45 mm
Weight	1300 g
Dust and waterproof PVC housing	

Conditions for use	
Working range	up to 150 m
Ambient temperature	-10 ... 70°C
Power consumption HF-Receiver	2,0 W
Power consumption HF-Transmitter	3,5 W

Electronic data	
HF-Receiver	
32 kByte EPROM	
1 microcontroller	8 bit
Transmitting frequency	5,5 Ghz
Supply voltage	7,5 ... 15 V
HF-Transmitter	
32 kByte EPROM	
1 microcontroller	8 bit
Transmitting frequency	5,5 Ghz
Supply voltage	7,5 ... 15 V
Adjustable transmission power	max. 15 mW

Order numbers	
HF-Receiver	**B 261 206 856**
HF-Transmitter	**B 261 206 857**

Laptrigger HF 24

This Laptrigger HF 24 system consists of a high frequency transmitter station and a receiver which is installed in the car.

The system allows an exact laptime measurement. Section time measurement for comparison of different car setups is also available if several transmitters are used. We offer optionally a tripod for mounting the transmitter anywhere along the race track.

Mechanical data	
HF-Receiver	
Size	125 x 37 x 28 mm
Weight	130 g
Internal antenna covered with small radome for mechanical protection	
Dust and waterproof aluminium housing	
HF-Transmitter	
Size	290 x 118 x 93 mm
Weight	1880 g
Dust and waterproof PVC / Teflon housing	
Tripod	
Maximum height:	~ 150 cm
Minimum height:	~ 65 cm
Weight	1370 g

Conditions of use	
Working range	up to 50 m
Ambient temperature	-10 ... 85°C
Power consumption HF-Receiver	0,8 W
Power consumption HF-Transmitter	1 W

Electronic data	
System	
RF wideband chirp transmission synchronised with switched TX antenna beams	
Working frequency band	(2,40 ... 2,47) GHz
User codes	16
HF-Receiver	
Sensitivity	-92 dBm @ BER 10^{-3}; 1 Mbps
Supply voltage	(6,5 ... 30) V
Connectortype	ASL 606-05PD-HE
Mechanical drawing	Y 261 A25 087
HF-Transmitter	
Transmission power	10 dBm
Supply voltage	(10 ... 30) V
Selection main / sub trigger	
Low battery detection	
Mechanical drawing	Y 261 A25 038

Order numbers	
HF-Receiver	**B 261 206 894**
HF-Transmitter	**B 261 206 895**
Tripod	**B 261 206 897**

Application hints
HF-Transmitter
Before setting the main switch to ON, select the code and the working mode (main / sub trigger)
The Transmitter reads the switches for code and main / sub trigger only once at power up
After setting the main switch to ON the transmitter executes a 10 sec. self test and then the transmitter indicator begins to flash green, e.g. the transmitter is running
The battery condition is permanently checked and if the voltage drops below 10 V the low bat indicator turns on red and the transmitter stops running
The detection performs at broadside of the transmitter
The transmitter should be placed at the border of the lane in a height of about 1,5 ... 2,0 m
HF-Receiver
Before switching on the DC power the code has to be selected
After switching ON the receiver executes a 10 sec. self test and then it is in the working mode
When a trigger is detected the output pin goes low for a certain time: -20 msec low @ main trigger -40 msec low @ sub trigger
Standard output configuration: switching stage with 3.3kOhm to +5VDC (can be modified according to user demands)
The white antenna radome must be turned to the transmitter side and should not be mounted behind metallic covers or carbon fiber filled elements
Green indicator flashes when detect a trigger condition

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