

Bosch Motorsport Equipment for High Performance Vehicles

Edition 2007/3



BOSCH



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Engine Control Units

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
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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

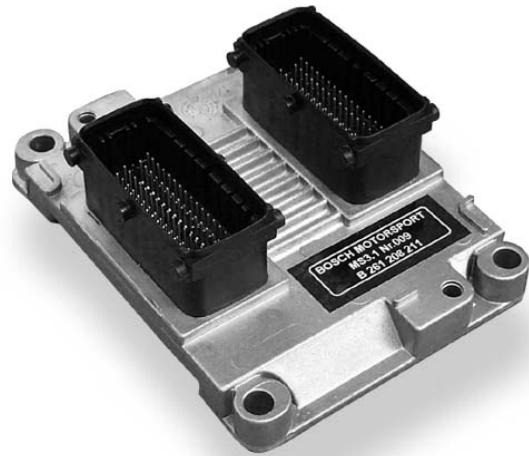
Conditions for use	
ECU temperature	-40 ... 65°C
Max. power consumption	18 W at 14 V
Max. vibration	15 g sinus at 20 Hz ... 2 kHz for t < 5 h

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 Sport

The MS 3 Sport 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. An external data logger or a DDU can be connected via CAN interface. The MS 3 Sport is developed with “EasyHandling” software.



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

Functionality

Asymmetric injection timing possible
Asymmetric ignition timing possible
Dual lambda control
Knock control (optional)
Traction control (optional)
Electronic throttle control (optional)
Support of 60-2 and 36-2 ignition trigger wheels

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

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
15 universal inputs 0 ... 5 V
2 inputs for vibration knock sensors
6 digital inputs

Outputs

6 injection power stages
6 ignition power stages
16 power stages (2 A/1 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
1 CAN interfaces for external communication

Communication interfaces

1 CAN interface
1 K-Line interface

Cable harness connectors

Part numbers: **D 261 205 139**
D 261 205 140

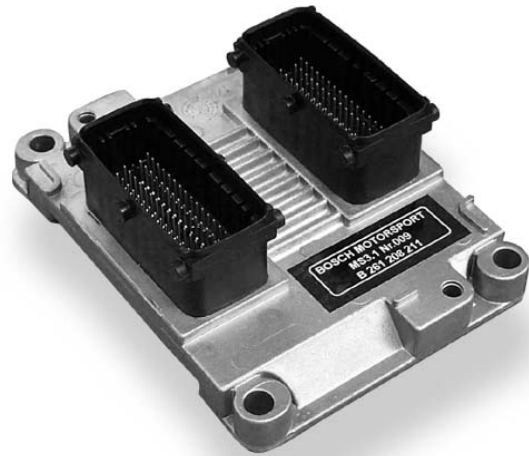
Necessary equipment

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**

Part number**F 01T A20 067**

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. An external data logger or a DDU can be connected via CAN interface.



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

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**

Part numbers

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

Motronic MS 4 Sport

The MS 4 Sport 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 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. The MS 4 Sport is developed with “EasyHandling” software.



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	
Asymmetric injection timing possible	
Asymmetric ignition timing possible	
Dual lambda control	
Knock control (optional)	
Traction control(optional)	
Turbo functionality	
Electronic throttle control (optional)	
Support of 60-2 and 36-2 ignition trigger wheels	

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 data	
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	

Part number	
MS 4 Sport	F 01T A20 049

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 data	
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	

Part number	
MS 4.0 incl. Modas	B 261 208 300

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 data

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

Part number

MS 4.2 incl. Modas	F 01E B01 638
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Motronic MS 4.4 Sport

The MS 4.4 Sport is a highly sophisticated engine management system for high performance engines. The system contains 10 ignition drivers for external power stages and 10 independent injection power stages. Various engine and chassis parameters can be measured with the different input channels and logged on the external data logger. Four vibration sensor inputs allow knock detection and knock control. Two independent wide range lambda circuits allow lambda closed loop engine control. The MS 4.4 Sport is developed with “EasyHandling” software.



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	
Size	174 x 133 x 39(23) mm
Weight	859 g

Functionality	
Asymmetric injection timing possible	
Asymmetric ignition timing possible	
Dual lambda control	
Knock control (optional)	
Traction control(optional)	
Turbo functionality	
Electronic throttle control (optional)	
Support of 60-2 and 36-2 ignition trigger wheels	

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

Electronic data	
Inputs	
1 input for inductive crankshaft sensor	
4 inputs for camshaft control	
4 inputs for Hall effect wheel speed sensors	
2 lambda interfaces LSU 4.9	
39 inputs 0 ... 5 V (20 with switchable pullup)	
4 inputs for vibration knock sensors	
8 digital inputs	
Outputs	
10 injection power stages (2.2A)	
10 ignition drivers for external power stages	
21 power stages (2,7 A/0,6 A; low side)	
2 power stages for lambda heater	
1 H-bridge (7A)	
3 sensor supply 5 V/600 mA	
Communication interfaces	
1 K-line serial interface	
2 CAN interfaces for external communication	
External Memory	
external memory from 128 MB up to 1024 MB for data acquisition	

Part number	
F 01T A20 068	

Motronic MS 4.4

The MS 4.4 is a highly sophisticated engine management system for high performance engines. The system contains 10 ignition drivers for external power stages and 10 independent injection power stages. Various engine and chassis parameters can be measured with the different input channels and logged on the external data logger. Four 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	
Size	174 x 133 x 39(23) mm
Weight	859 g

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

Functionality	
Asymmetric injection timing possible	
Asymmetric ignition timing possible	
Dual lambda control	
Knock control	
Traction control	
Turbo functionality	
Electronic throttle control (optional)	
Support of 60-2 and 36-2 ignition trigger wheels	

Electronic data	
Inputs	
1 input for inductive crankshaft sensor	
4 inputs for camshaft control	
4 inputs for Hall effect wheel speed sensors	
2 lambda interfaces LSU 4.9	
39 inputs 0 ... 5 V (20 with switchable pullup)	
4 inputs for vibration knock sensors	
8 digital inputs	
Outputs	
10 injection power stages (2.2 A)	
10 ignition drivers for external power stages	
21 power stages (2,7 A/0,6 A; low side)	
2 power stages for lambda heater	
1 H-bridge (7 A)	
3 sensor supply 5 V/600 mA	
Communication interfaces	
1 K-line serial interfaces	
2 CAN interfaces for external communication	
External Memory	
external memory from 128 MB up to 1024 MB for data acquisition	

Part number	
F 01T A20 040	

Motronic MS 5

The MS5 is a 1 to 12 cylinder gasoline engine control for engine speeds up to 20.000 rpm. Design is based on our new digital core with a very high computing power and a high-end FPGA for additional performance and flexibility. The new software development process for this unit allows fast response times to algorithm changes. All software functions are designed, tested and simulated with MATLAB/Simulink. Code and documentation are generated automatically. The integration of individual customer functions is possible. The systems flexibility allows the support of any unusual engine configuration or chassis functionality.



Mechanical data	
Dust and waterproof aluminium housing	
4 connectors in military technology with high pin density	
220 pins, each pin individually filtered	
Vibration damped circuit boards	
Size	200 x 170 x 36,5mm
Weight (approx.)	1250g

Conditions for use	
Temp. range (at internal sensors):	-20 ... 85°C
Approx. power cons. (w/o loads):	10 W at 14 V
Power Supply:	
full operation	6,5 to 18 V
recommended	11 to 14 V
absolute maximum	6 to 24 V
Vibration:	
meets standard motorsport requirements, please ask for our test profile	

Basic functionality
Injection timing
Ignition timing
Lambda control with adaptation function
Knock control
Traction control
Launch control
Gearcut function
Calibration interface: CCP or XCP over Ethernet
Interface to BOSCH data logging system

Electronic data**Inputs**

2 thermocouple exhaust gas temperature sensors
2 lambda interfaces (LSU 4.9)
1 crankshaft sensor (2-wire, inductive or hall-effect)
1 camshaft sensor (2-wire, inductive or hall-effect)
2 turbo speed sensors (2-wire, inductive or hall-effect)
4 wheel speed sensors (inductive or hall-effect)
2 gearbox speed sensors (inductive or hall-effect)
45 universal analogue inputs 0 ... 5 V; 12 Bit
14 analogue inputs (angle synchronous or time
synchronous triggering up to 250 ksps, 12 Bit)
4 inputs for vibration knock sensors
1 laptrigger input

Outputs

12 injection power stages (peak & hold)
12 ignition drivers (up to 20A)
16 power stages (2 A; low side; PWM)
4 power stages (4 A; low side; PWM)
4 H-bridge valve driver (+/- 100 mA)
2 H-bridge (5 A)
3 sensor supplies 5 V/400 mA and 1x 10 V/100 mA
6 diagnostic outputs with selectable internal signals
12 outputs with configurable function (FPGA)
1 timebase synch-in/out

Communication interfaces

2 x 100Mbps Ethernet interfaces
1 x RS232 serial interface
4 x 1Mbps CAN interfaces

Motronic MS 15.1

The MS 15.1 is an ECU for Diesel engines with up to 8 cylinders. It is developed for the combination with Bosch solenoid injectors.



Mechanical data	
Dust and waterproof aluminium housing	
4 connectors in military technology with high pin density, 187 pins	
Vibration damped circuit boards	
8 flexible housing fixation points	
Size	210 x 186 x 36 mm
Weight	1780 g

Conditions for use	
Temperature range	-40 ... 75°C
Typical power consumption	140 W at 14 V
Max. vibration	15 g sinus at 20 Hz ...2 kHz for t<5 h

Functionality	
Injection timing:	
2 pilot injections	
2 main injection	
1 post injection	
Lambda measurement	
Data acquisition, external Logger C55	
Telemetry (external unit FM40 in combination with data logger C55)	
Traction control (optional)	
Basic functionality for up to two turbochargers in parallel mode	
Gear cut for sequential gearbox	
Speed limiter	
Optional function packages available	

Electronic design	
Inputs	
2 inputs for thermocouple exhaust gas temp. sensors	
2 lambda interfaces LSU	
4 inputs for wheel speed sensors; basic design for inductive sensors	
4 inputs for turbo speed sensors; basic design for inductive sensors	
1 input for inductive crankshaft sensor	
1 input for hall-effect camshaft sensor	
3 system inputs 0 ... 5 V	
13 universal inputs 0 ... 5 V, fixed pullup	
27 universal inputs 0 ... 5 V, switchable pullup	
3 digital inputs	
Outputs	
8 injection power stages	
12 power stages (low side)	
2 power stages for lambda heater	
2 H-bridge	
2 sensor supply 5 V/ system use	
3 sensor supply 5 V/300 mA	
3 sensor supply 10 V/100 mA	
Communication interfaces	
1 RS232 serial interface	
1 K-line serial interfaces	
3 CAN interfaces (dash, application, customer use)	
2 firewire interfaces for external communication	
Part number	
MS 15.1 solenoid injector	F 01T A20 022

Motronic MS 15.2

The MS 15.2 is an ECU for Diesel engines with up to 6 cylinders. It is developed for the combination with Bosch piezo injectors.



Mechanical data

Dust and waterproof aluminium housing	
4 connectors in military technology with high pin density, 187 pins	
Vibration damped circuit boards	
8 flexible housing fixation points	
Size	210 x 186 x 36 mm
Weight	1780 g

Conditions for use

Temperature range	-40 ... 75°C
Typical power consumption	140 W at 14 V
Max. vibration	15 g sinus at 20 Hz ...2 kHz for t<5 h

Functionality

Injection timing:	
2 pilot injections	
1 main injection	
1 post injection	
Lambda measurement	
Data acquisition, external Logger C55	
Telemetry (external unit FM40 in combination with data logger C55)	
Traction control (optional)	
Basic functionality for up to two turbochargers in parallel mode	
Gear cut for sequential gearbox	
Speed limiter	
Optional function packages available	

Electronic design

Inputs

2 inputs for thermocouple exhaust gas temp. sensors
2 lambda interfaces LSU
4 inputs for wheel speed sensors; basic design for inductive sensors
4 inputs for turbo speed sensors; basic design for inductive sensors
1 input for inductive crankshaft sensor
1 input for halleffect camshaft sensor
3 system inputs 0 ... 5 V
13 universal inputs 0 ... 5 V, fixed pullup
27 universal inputs 0 ... 5 V, switchable pullup
3 digital inputs

Outputs

6 injection power stages
12 power stages (low side)
2 power stages for lambda heater
2 H-bridge
2 sensor supply 5 V/ system use
3 sensor supply 5 V/300 mA
3 sensor supply 10 V/100 mA

Communication interfaces

1 RS232 serial interface
1 K-line serial interfaces
3 CAN interfaces (dash, application, customer use)
2 firewire interfaces for external communication

Part number

MS 15.2 Piezo injector	F 01E A20 023
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Displays

Display DDU Sport

The DDU Sport is a light and compact dashboard unit with a high contrast display. Customised display configurations can be programmed to suit individual customer requirements. All illuminated components are dimmable.

For enhanced flexibility the DDU Sport 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	160 x 110 x 26 mm
Weight	433 g

Display	
LCD-Display / LED background light	
Active area	91 x 56 mm
Resolution	240 x 128
Dot size	0,38 x 0,41 mm

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

Mounting	
4 x M5 threads on backside	

Switches	
4 internal Switches for operation (pages, mode, setting), available also on backside connectors	

Electronic data	
7 sequential shift-LEDs	
64 Mbyte Data logger	
4 Analog Input (0-5 V) 10 bit Resolution	
4 Digital input (HL = 2,5 – 32 V)	
Real Time Clock	
2 x CAN-Bus	
1 x RS232	
1 x 100Mbit LAN	
Voltage supply range: 7,5 – 35 V	
Sensor supply: 5 V, 500mA	

Connector	
Binder 712	

Part number	
F 01T A20 050	

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 12 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

1 x CAN interface for communication with ECU via CCP and free configurable for any ECUs messages
1 x 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 (analogue/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
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Part number

DDU 4 incl. cable, without holder	F 01E B01 461
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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 12 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

1 x CAN interface for communication with ECU via CCP and free configurable for any ECUs messages
1 x CAN interface for communication with network
1 x RS 232 interface for display programming
5 LED shift indicators
4 LED warning lights
6 inputs 0 ... 5 V (analog/digital)

Part number

F 01E B01 459

Communication

Data Logging and Signal Processing

Data Logger C Sport

The data logger C Sport is a device used for data acquisition. It is developed to read in analogue and digital signals. The measured data are stored on an internal 64 MB memory. The data are transmitted with RaceLab via Ethernet to the data logger C Sport.



Mechanical data

Size	102 x 62 x 27 mm
Weight	210 g
Required power supply	7,5 ... 35 V
Dust and splashwater proof aluminium housing	
Flexible housing fixation points	

Conditions for use

Temperature range	-20 ... 65°C
Max. power consumption	4 W at 14 V
Max. vibration	11 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electrical data

1 CAN Bus link (ECU)
1 CAN Bus link (to cascade C Sport or attach DDU Sport)
1 Ethernet connector (for PC connection)
64 MB internal memory
Real time clock
Total calculation capacity approximately 10 MIPS

Options

4 digital inputs
4 analogue single ended inputs 16 bit resolution
4 analogue differential inputs 16 bit resolution
1 digital output

Connector

4 x Binder 712

Part number

F 01T A20 061

CardMemory C40 / C40 Plus

The CardMemory is a device used for data logging. The basic model C40 is designed for data transfer via CAN for MS3.x and MS4.x ECUs. 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 (only C40 Plus)	
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 C40	AS0-14-35 SN
Cable harness connector C40 Plus	AS0-14-35 SN

Part numbers	
C40	F 01T A20 403
C40 Plus	B 261 206 860
C40 Plus incl. chassis adjust	B 261 206 880
Upgrade C40 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

Part 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

Data Logging System DLS

System

The Data Logging System (DLS) is a many-sided and flexible measuring system for acquisition and recording of sensor data in a race car. The measuring channels in the DLS can be administered comfortably and can be adapted individually for every race car. The DLS is a modular system that consists of different hard- and software components.

Hardware

The hardware serves the data acquisition and the recording of physical data in the vehicle. The data logger (CardMemory) and the data acquisition (MSI devices) which delivers the sensor data to the data logger belong to the hardware components. Additional data transfer takes place via burst or via online telemetry.

Software

The software allows the real configuration and consequently the adjustment of the system. It enables you to create measuring projects, to check data, to record measuring channels and to analyse the measuring channels.

DLS components	
Datalogger, System manager	C55
Burst telemetry	BT55, BR55
Online telemetry	FM40
Modular Sensor Interface	MSI55
Extended CAN Modules	EM-50, EM-100, EM-I4 EM-L5, EM-O5, EM-C, EM-D8, EM-D1, EM-A6, EM-H4,
DLS configuration Software	DLS-Desk
System Software	WinDCP, Modas, WinDarab

Technical details
High measuring accuracy by 12 bits of analogue / digital transformation and tenfold oversampling
High recording rate up to 1 ms
High recording duration by CF card up to 2 GB
High-linear analogue filtering and digital filtering for the removal of interference signals.
Flexibly with the extensibility of the components and measuring channels
Temporal synchronisation between the different measuring channels
Connectivity and data transfer via telemetry
Free and individual application by special software

CardMemory C 55

The CardMemory C 55 is a device used for data logging and DLS system management. The measured data are stored on a compact flash card with a maximum capacity of 1024 MB.



Mechanical data

Size	157 x 92 x 30 mm
Weight	500 g
Dust and splashwater proof aluminium housing	

Conditions for use

ECU temperature	-20 ... 65°C
Max. power consumption	20 W at 14 V
Max. vibration	15 g sinus at 1200 Hz for t < 5 h

Electrical data

1 CAN interface
2 Fire wire interfaces
2 Ethernet interfaces
Real time clock
Non volatile flash card memory

Necessary equipment

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
Memory adapter	B 261 206 864

Documents

Dimension sheet	Y261A25051.pdf
3D_modell	Y261A25051.stp
Data sheet	F01EB01630.xls

Part number

F 01E B01 630

Modular Sensor Interface MSI 55

MSI 55 is a high quality data acquisition of analogue and digital sensors.

The MSI 55 offers 16 configurable analogue inputs, 4 frequency inputs, 2 digital I/O and a freely configurable 1 MBit CAN Bus. Data is sent via FireWire interface to the C-55 datalogger.



Mechanical data	
Size	120 x 117 x 38 mm
Weight	600 g
Dust and water proof aluminium housing	
Filtered connectors of military design with high pin density (MIL-38999)	
Vibration damped printed circuit boards	

Conditions for use	
ECU temperature	-20 ... 65°C
Max. power consumption	20 W at 14 V
Max. vibration	15 g sinus at 1200 Hz for t < 5 h

Electronic data	
16 bit digital signal process organisation, calculation power 150 MIPS	
Required power supply	8 ... 18 V
4 differential analogue inputs with switchable amplifier and switchable pullup resistor	
12 single analogue inputs with switchable pullup resistor	
All analogue inputs offer analogue and digital anti-aliasing filter and 12 bit AID resolution	
4 frequency inputs 0 ... 25,5 kHz switchable inductive sensor / hall-effect sensor	
2 digital I/O	
2 PWM outputs 100 mA	
5 V sensor power supply	
3 ... 10 V configurable sensor power supply	
12 V sensor power supply	

Documents	
Dimension sheet	Y261A21876.pdf
3D-modell	Y261A21876.stp
Data sheet	F01TA20024.xls

Part number	
F 01T A20 024	

Burst Telemetry Transmitter BT 55

The burst telemetry system BT 55 / BR 55 adds high speed burst telemetry transmission to a DLS-based data acquisition system. Each time the car passes the pit lane, up to 6 MByte of C 55 measurement data can be transmitted to the Pit network via a WiFi band high speed wireless link.



Mechanical data	
Size	168 x 92 x 30 mm
Weight	540 g
Dust and waterproof housing with LED indicators	

Conditions for use	
Vibration	15 g sinus at 1200 Hz for t<5h
Temperature range	-20 ... 65°C
Max. power consumption	20 W at 14 V
International standard	IEEE 802.11b

Electronic data	
Full duplex radio modem (bidirectional)	
Transmission power	100 mW
Frequency range	2,4 GHz ISM Band
Data rate	max. 11 MBit / s
Required power supply	8 ... 18 V
Max. current	< 2,5 A

Documents	
Dimension sheet	A261208899.pdf
3D-modell	A261208899.stp
Data sheet	B261208899.xls

Part number	
B261 208 899	

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

Part 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
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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

Part number

Speed Box 4	B 261 208 286
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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

Part number

B 261 208 885

Telemetry Accessories

FM 40 Tester

The FM 40 Tester is a tool for checking the performance of the installed telemetry transmitter FM 40 in connection with the RF-cable and the car antenna. Measured parameters are the transmission power as well as the matching of the antenna together with the RF-cables.



Measurement range	
Transmission power	1 ... 15 (60) W
VSWR	1 ... 6
Frequency band	VHF / UHF

Connectors	
RF	BNC male / female

Part number	
B 261 208 894	

Telemetry Antenna Dummy Load

The telemetry antenna dummy load replaces the telemetry car antenna when running the FM40 transmitter in a garage in order to prevent high RF power radiation.



Measurement range	
RF power	15 W
VSWR	1.1
Frequency band	VHF / UHF

Connectors	
RF	BNC male / female

Part number	
B 261 208 890	

Telemetry (Dual Band) Car Antenna



Parameter	
Car Antenna	
Frequency band	UHF
Length	150 mm
Dual Band Car Antenna	
Frequency band	VHF / UHF
Length	440 mm

Connectors	
RF	BNC male

Part number	
Car Antenna	B 261 208 888
Dual Band Car Antenna	B 261 208 862

Antenna Cable Kit For car mounting



Measurement range	
Length	max. 2 m (tbd.)
Attenuation	max. 0.7 dB @ 2 m, 450 MHz

Connectors	
RF	BNC male / female

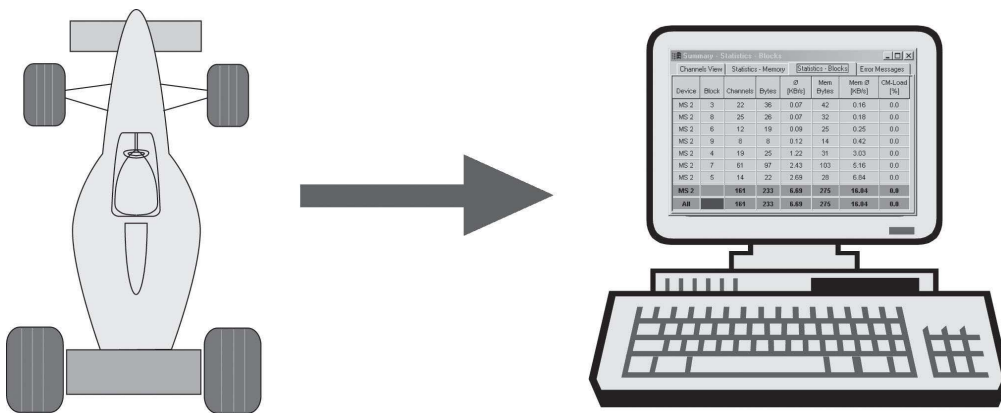
Part number	
	B 261 209 490

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

Part numbers

WinDarab-Light incl. **F 01E B01 402**
Configuration tool WinDCP

WinDarab-Expert incl. **F 01E B01 401**
Configuration tool WinDCP

Upgrade

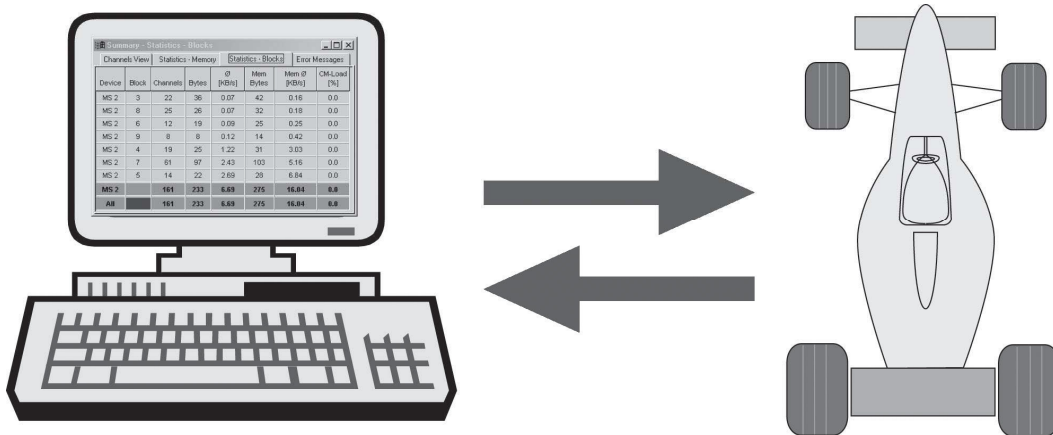
WinDarab-Light to WinDarab-Expert **on request**

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

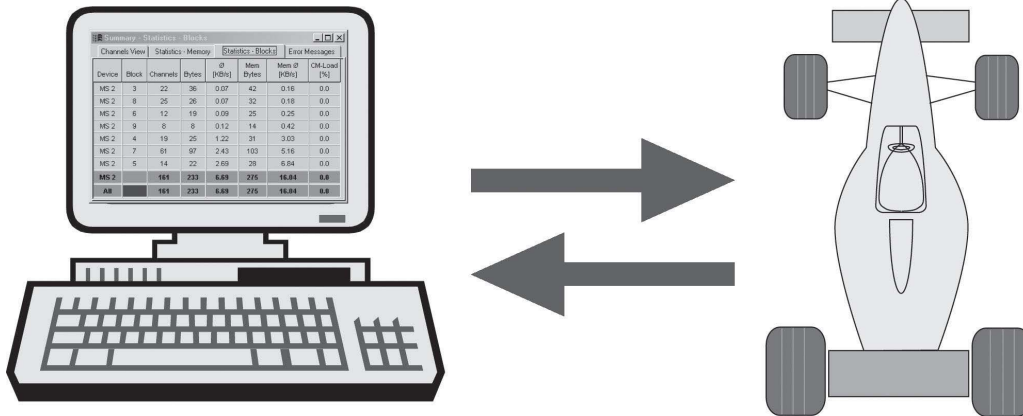
Part number

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 menu. 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

Part number

B 261 206 441

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

Part 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 PC-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 Printer Port Adapter	17 x 60 x 78 mm
Size Converter	35 x 115 x 60 mm
Size Extension Cable	10/25/50 m

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
Max. extension cable length	200 m
Temperature range	-30 ... 70°C

Part numbers	
K-Line Extension Set	F 01E B01 641
Converter	F 01T A20 041
Extension Cable	F01T A21 003_10/_25/_50
Printer Port Adapter	F 01T A20 042

MSA-Box (K-Line / CAN Interface)

The MSA-Box is the low cost unit for PC-supported application with MODAS on K-Line or CAN interface of an ECU.

The MSA-Box is coupled to the PC via the USB interface. This ensures a powerful and universal link to all common PCs. The coupling to the ECU is effected via K-Line or CAN of the diagnosis interface.



Mechanical data	
Size	84 x 33 x 20 mm
Diagnosis cable length	0,5 m
USB cable length	2 m

Conditions for use	
Temperature range	0 ... 70°C

Electronic data	
Input voltage (vehicle side)	8 ... 32 V
Power consumption (powered from USB)	typ. 0,5 W
Processor	ATMEL AT91SAM7X256
Flash Eprom	256 kByte
RAM	64 kByte
USB	USB 2.0, full speed (12 Mbit/s)
K-Line	300 Bd ... up to 320 kBd
CAN	10 kBit/s ... 1 MBit/s

Operating system	
Windows 2000	
Windows XP	

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	
According to ISO 9141-2 for diagnosis tester	
Up to 300 kBaud transfer rate (K-Line) and up to 1 MBit/s transfer rate (CAN)	
Plug suitable for motor vehicles (VS 20)	
Protocols: KWP 2000, CCP	

Part number	
MSA-Box	B 261 208 015

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	
Part 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

Part numbers

B 261 206 862

Cable harness connector **B 261 206 451**

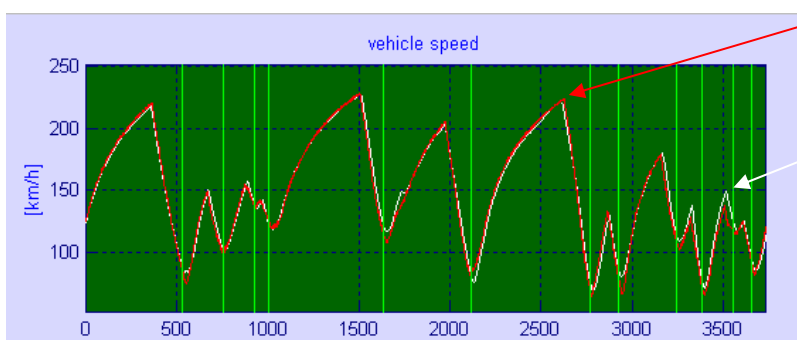
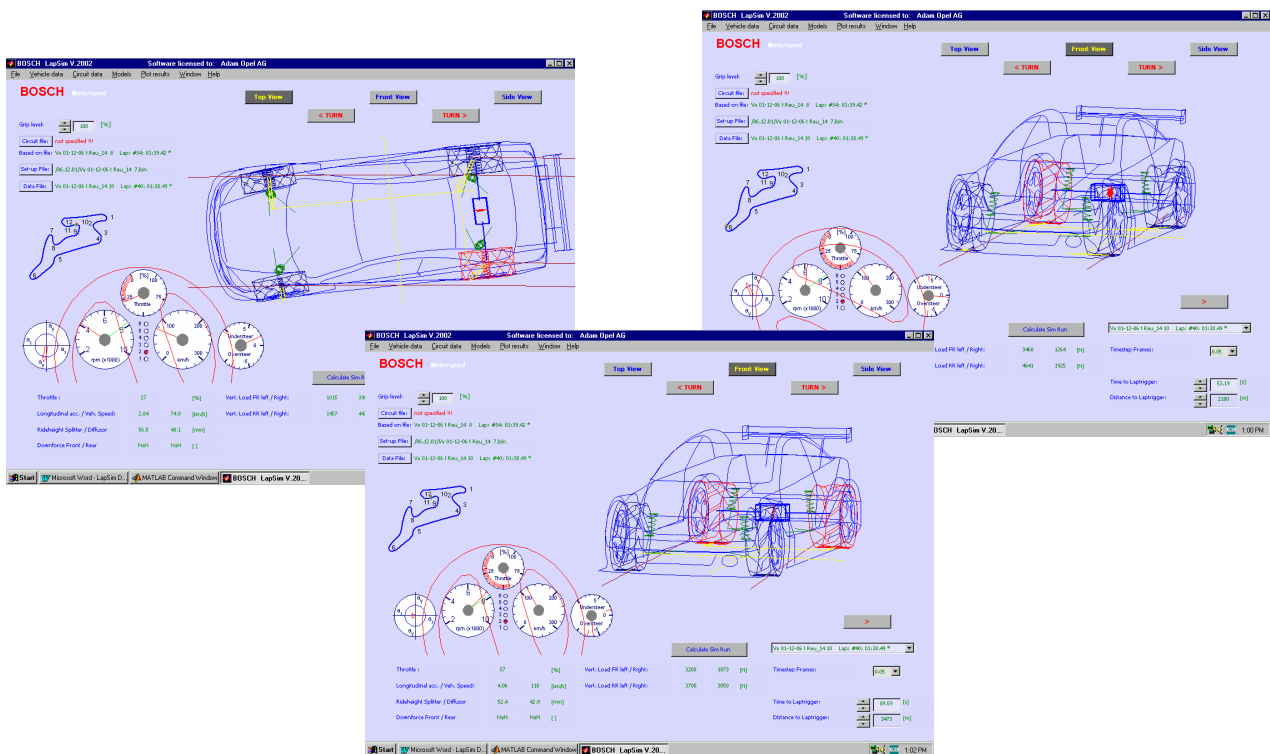
Simulation

LapSim

Data Analysis, Vehicle Identification and Setup Optimisation

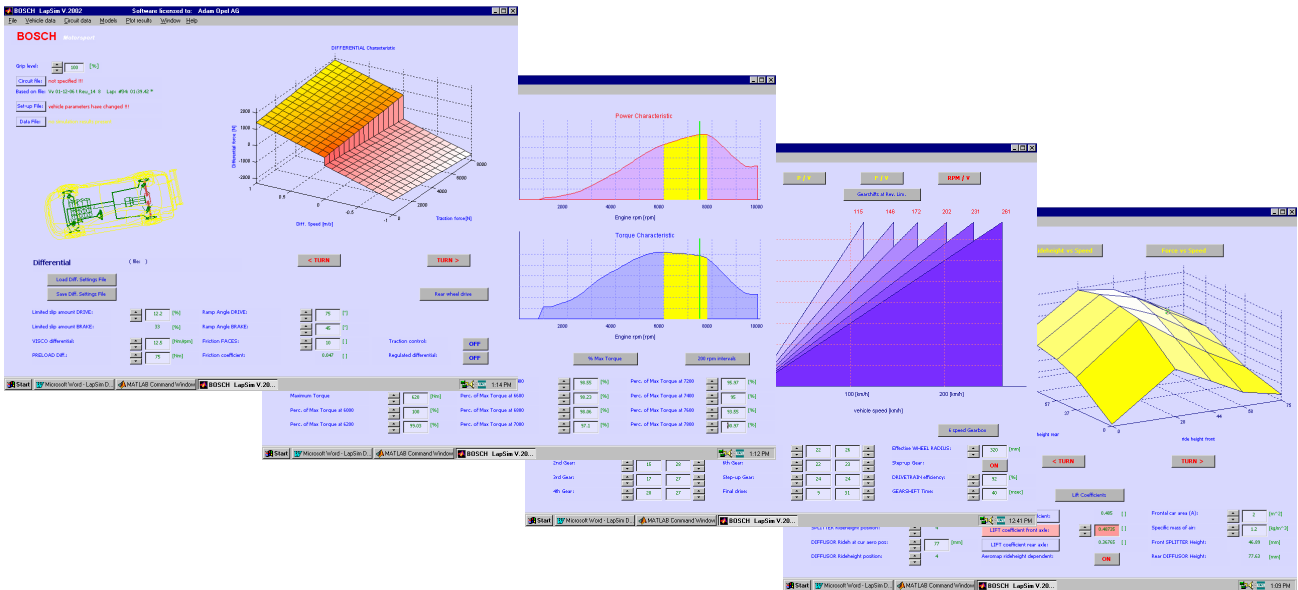
LapSim is both an analysis tool as well as a vehicle simulation program. By further processing the on-car recorded data, using parts of the simulation models, a much more profound analysis of the on-car recorded data can be gained.

Due to the direct link with the simulation model, vehicle parameters can be validated like aerodynamics, 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.



Real Car

Simulation Model



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 Win-Darab Files → creates automatic database

Data comparison

Calculation of differences lap by lap

Functions

Min/max-calculations

Histograms

Mathematical functions

Filter functions incl. FFT

x/y-plots

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.

Part numbers

LapSim Basic Version

for free

LapSim Expert

B 261 206 432

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	

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	

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

Part numbers	
IR-02-Receiver	
KPSE 6E8 3AP DN A34	B 261 206 884
ASL-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 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 24-Receiver	
Size	125 x 37 x 28 mm
Weight	130 g
Internal antenna with radome	
Dust and waterproof aluminium housing	
HF 24-Transmitter	
Size	290 x 118 x 93 mm
Weight	1880 g
Dust and waterproof	
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 24-Receiver	0,8 W
Power consumption HF 24-Transmitter	1 W

Electronic data	
System	
RF wideband chirp transmission with a narrow beam transmitter antenna	
Working frequency band	(2,40 ... 2,47) GHz
User codes	16
HF 24-Receiver	
Sensitivity	-92 dBm @ BER 10-3; 1 Mbps
Supply voltage	(6,5 ... 30) V
Connectortype	ASL 606-05PD-HE
Pin 1	+12 V
Pin 2	GND
Pin 3	Trigger Out
Mechanical drawing	Y 261 A25 087
HF 24-Transmitter	
Transmission power	10 dBm
Supply voltage	(10 ... 30) V
Selection main / sub trigger	
Low battery detection	
Mechanical drawing	Y 261 A25 038

Part numbers	
HF 24-Receiver	B 261 206 894
HF 24-Transmitter	B 261 206 895
Tripod	B 261 206 897

Application hints
HF 24-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. If the battery level becomes critical, the "low bat indicator" becomes red. When the battery level drops below 10 V the transmitter stops working. The green transmitter indicator stops flashing.

The transmitter should be placed at the border of the lane in a height of about 1,5 ... 2,0 m.

HF 24-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 3.3 kOhm to +5 VDC
(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.

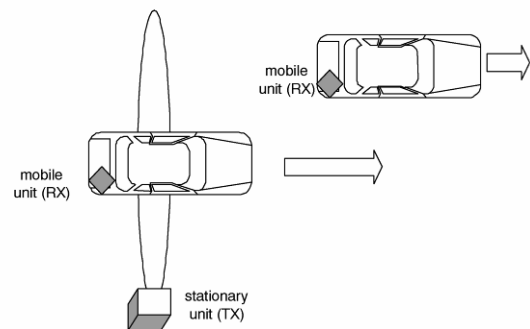
Function description

The transmitter sends via the directional antenna coded signals across the race track.

The receiver at the race car checks permanently the team code and the signal parameters. If the trigger condition is detected the receiver generates the appropriate output signal (main/sub trigger).

The trigger point is located at broadside of the transmitter antenna.

After detecting the trigger point and releasing the trigger signal the receiver is passive for a period of two seconds avoiding a multiple trigger signal.



Diesel Systems Components

Diesel System Components



Injector CRI 2



HP fuel pump CP3



Rail



Pressure sensor RDS



Pressure control valve DRV

Component	Specification
Injector CRI 2	6 - 8 holes, 900 ... 1500 ccm/min at 100 bar
High pressure fuel pump CP3	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 part numbers 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.



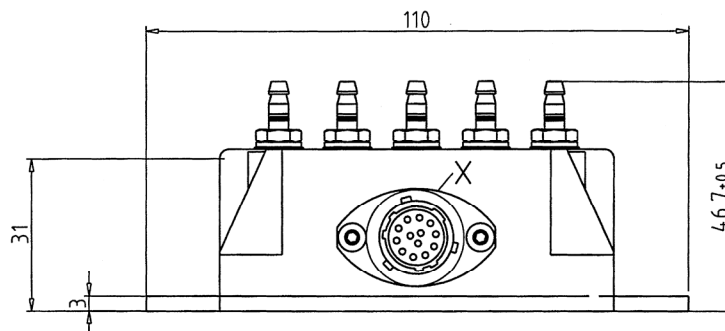
Mechanical data	
Measurement transducer	piezoresistive
Pressure range	10 x 0,2 ... 1,15 bar nominal
Max. pressure	10 bar nominal
Weight	185 g
Dimensions	110 x 87 x 47 mm
Sensor connector	3 mm

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 %)

Part 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.



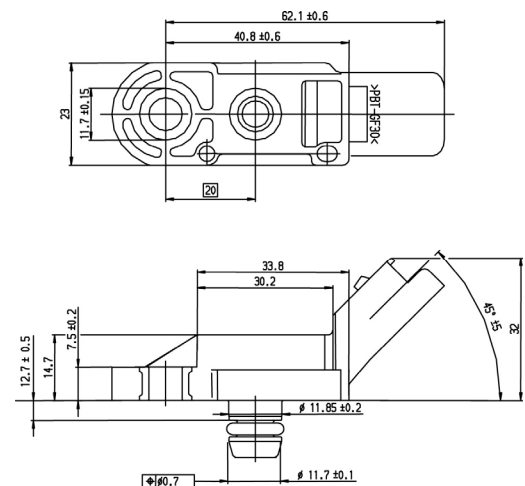
Mechanical data	
Max. pressure	5 bar
Fitting	11,85 mm
Weight	45 g
Sealing	O-ring 7,59 x 2,62

Conditions for use	
Temperature range	-40 ... 125°C
Max. temp. of location	130°C
Max. vibration	120 m/sec ² at 10 ... 1500 Hz

Characteristic	
0,1 ... 1,15 bar:	
Sensitivity	4047 mV/bar
Offset	-4,3 mV
0,2 ... 2,5 bar:	
Sensitivity	1848 mV/bar
Offset	30 mV

Electronic data	
Power supply	4,75 ... 5,25 V
Full range output	0,4 ... 4,65 V
Compensated range	10 ... 85 °C
Accuracy of measurement	± 16 mbar
Output resistance	10 kΩ
Max. current	12,5 mA

Part numbers	
0,1 ... 1,15 bar:	
ASL 6-06-05PC-HE	B 261 209 702
Offer drawing	A 261 209 702
0,2 ... 2,5 bar:	
ASL 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

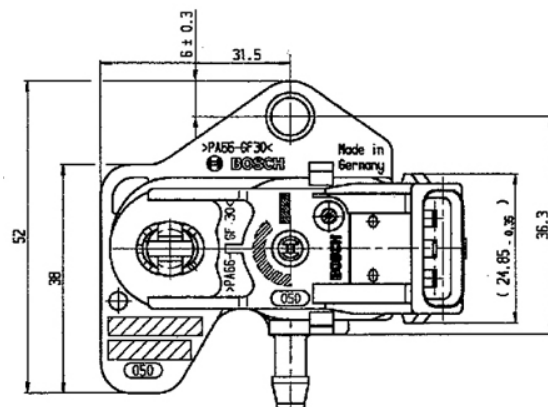
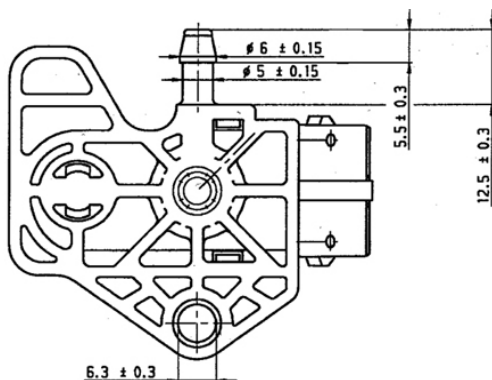
Conditions for use	
Temperature range	-40 ... 125°C
Max. temp. of location	130°C
Max. vibration	15 g / 30 ... 200 Hz

Characteristic	
0,2 ... 1,05 bar:	
Sensitivity	5000 mV/bar
Offset	-600 mV
0,2 ... 2,5 bar:	
Sensitivity	1532 mV/bar
Offset	724 mV

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	< 12,5 mA
Resistance	> 50 kΩ

Connector	
Cable harness connector	D 261 205 289

Part 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.



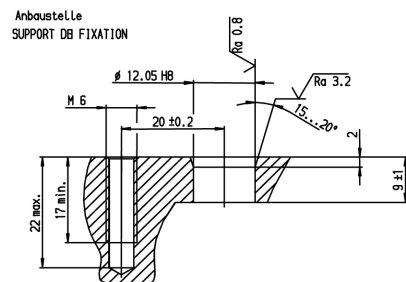
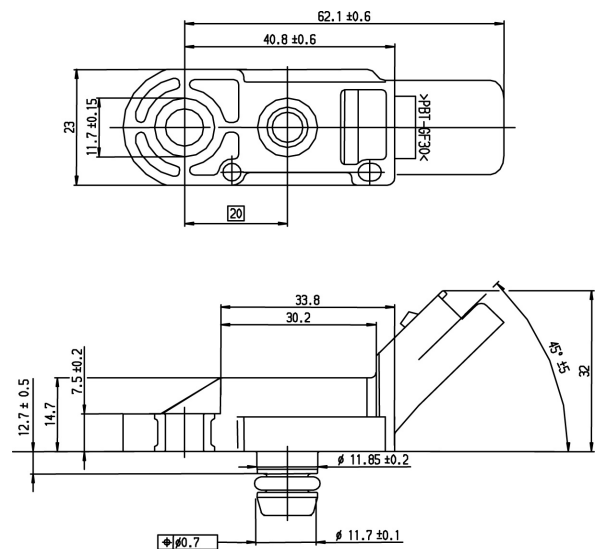
Mechanical data	
Max. pressure	3 bar
Fitting	11,85 mm
Weight	45 g
Sealing	O-ring 7,59 x 2,62

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

Characteristic	
Sensitivity and offset will be delivered with each sensor.	

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
Max. current	12 mA

Part number	
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



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.



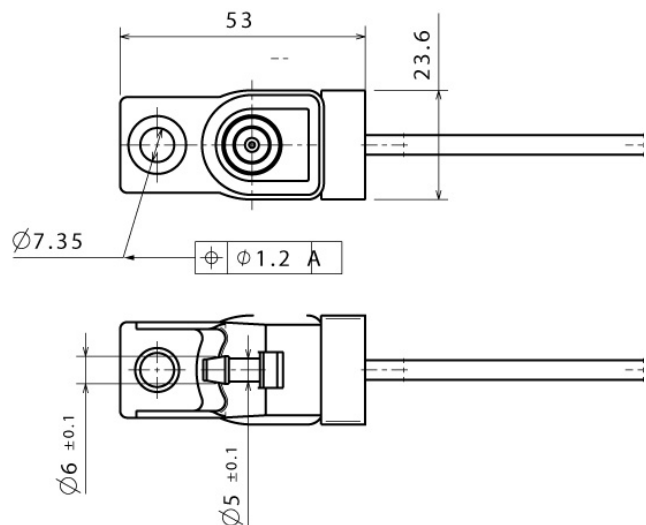
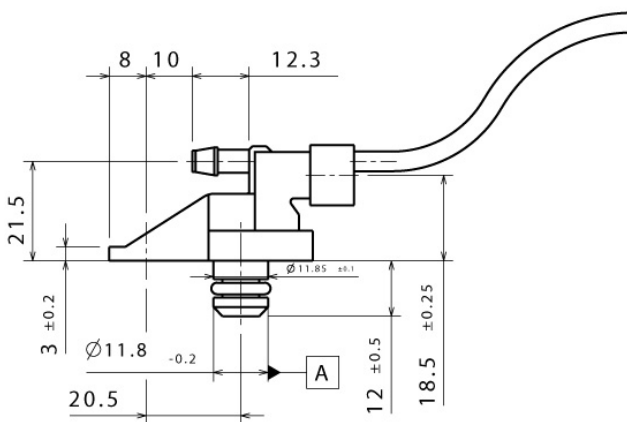
Mechanical data	
Max. pressure	4,5 bar
Fitting	11,85 mm
Weight	45 g
Sealing	O-ring 7,59 x 2,62

Conditions for use	
Temperature range	-40 ... 80°C
Max. temp. of location	80°C
Max. vibration	2 g /10 ... 1000 Hz

Characteristic
Sensitivity and offset will be delivered with each sensor.

Electronic data	
Power supply	5 V
Compensated range	0 ... 80°C
Accuracy of measurement	+/- 4 mbar
Full scale output	0,5 ... 4,5 V
Max. current	12 mA

Part number	
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.



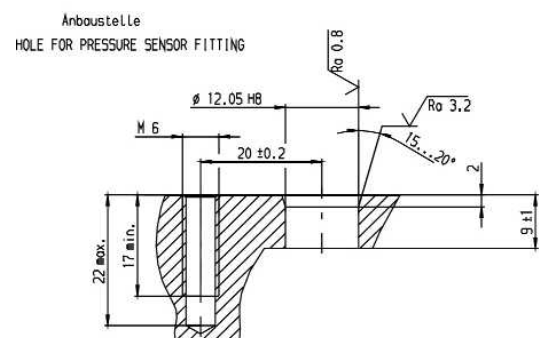
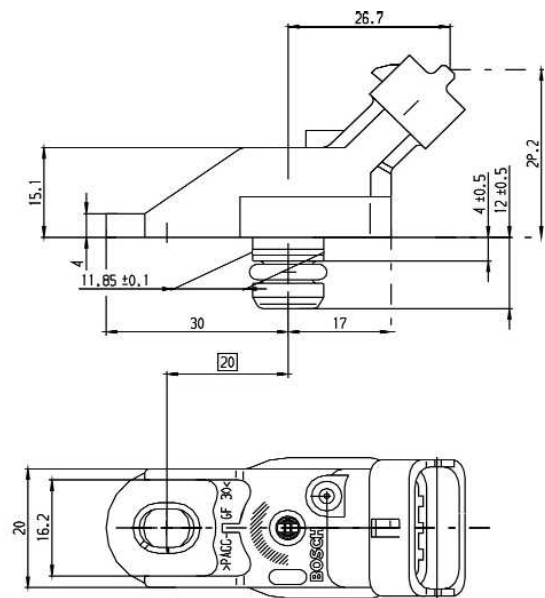
Mechanical data	
Max. pressure	5 bar
Fitting	Ø 11,8 mm
Weight	17 g
Sealing	O-ring

Conditions for use	
Temperature range	-40 ... 125 °C
Max. vibration	25,5 g/100 ... 500 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	0,35 ... 4,85 V
Max. current	12 mA

Part number	
ASL 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	5 bar
Characteristic	20°C/2,5 kΩ
Fitting	∅ 17,6 mm
Weight	35 g
Sealing	O-ring 7,65 x 1,63

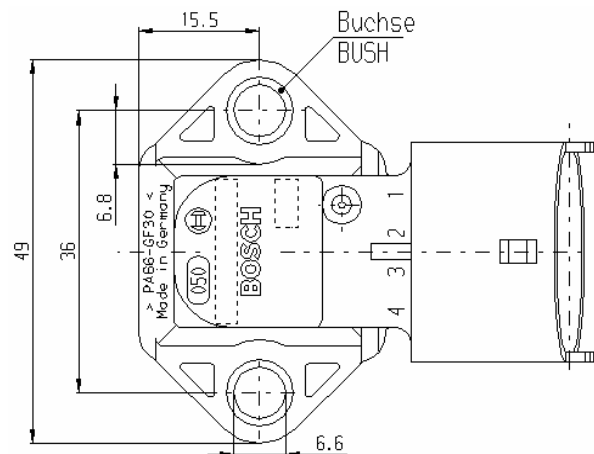
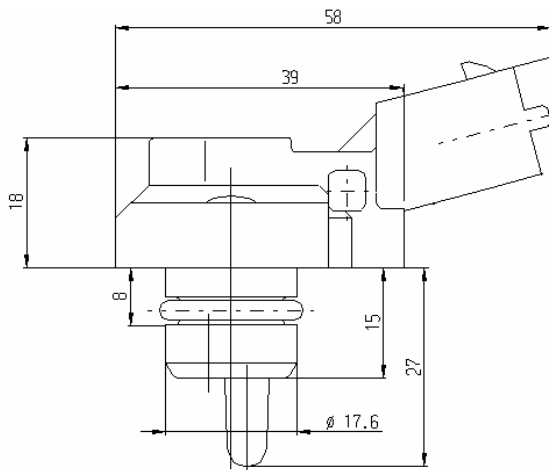
Conditions for use	
Temperature range	-40 ... 125°C
Vibration	25,5 g/200 ... 500 Hz
Max. temp. of location	130°C

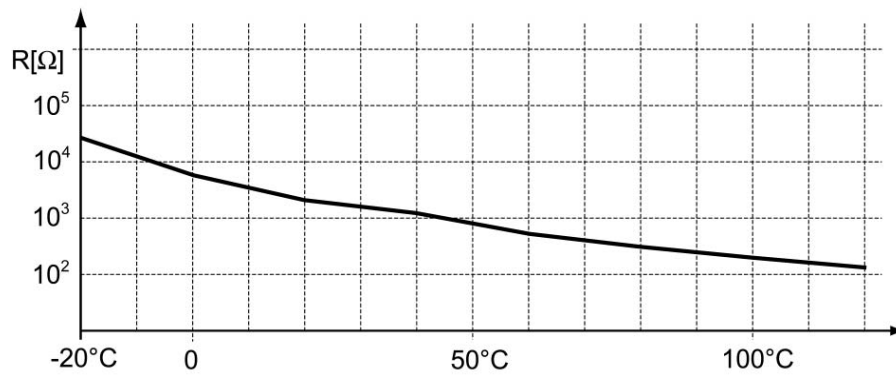
Characteristic	
Sensitivity	4047 mV/bar
Offset	-4,3 mV

Electronic data	
Power supply	5 V
Compensated range	10 ... 85°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

Part number	
	0 261 230 022
Offer drawing	A 261 260 253
ASL 6-06-05PE	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 Sensor Fluid

Absolute Pressure Sensor PSC-10

Pressure range: 0 ... 10 bar nominal

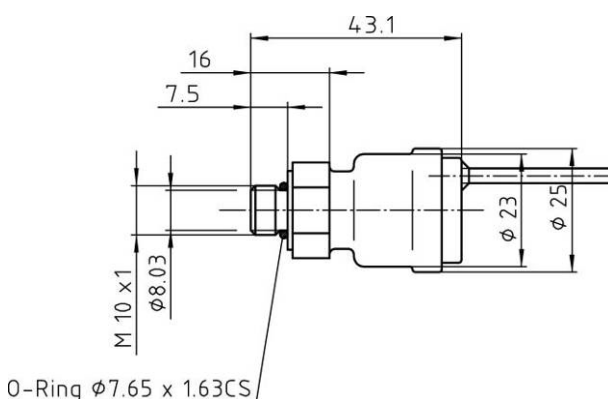
A M10 x 1 sensor for various fluid pressure measurement. The sensor range covers pressure measurement up to 10 bar. It is manufactured in a DR-25 sleeve, various connector options are available. Gauge and absolute pressure sensors are available.



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 %)

Part 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.



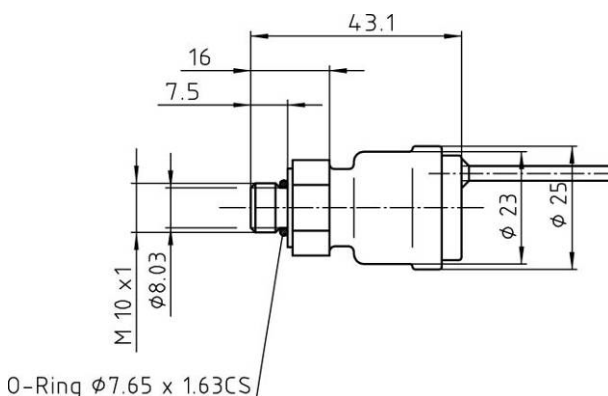
Mechanical data	
Measurement transducer	piezoresistive
Max. pressure	500 bar
Thread	M10 x 1
Tightening torque	10 Nm
Wrench size	17 mm
Weight	70 g
Sealing	O-ring 7,65 x 1,63

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 %)

Part 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.



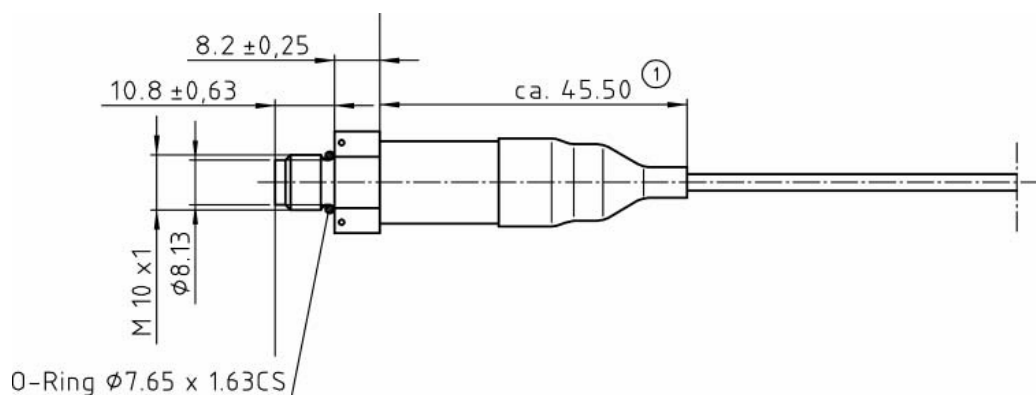
Mechanical data	
Max. pressure	2 x nominal
Thread	M10 x 1
Tightening torque	10 Nm
Wrench size	16 mm
Weight	55 g
Sealing	O-ring 7,65 x 1,63

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

Part 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.



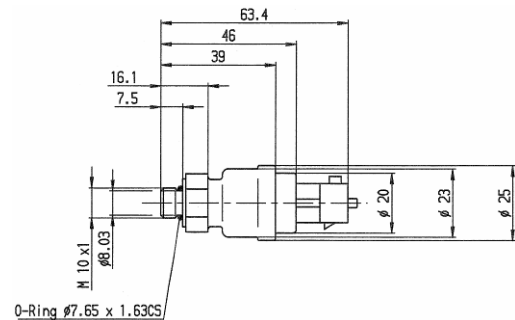
Mechanical data	
Measurement transducer	piezoresistive
Max. pressure	2 x nominal
Thread	M10 x 1
Tightening torque	10 Nm
Wrench size	17 mm
Weight	65 g
Sealing	O-ring 7,65 x 1,63

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%)

Part 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

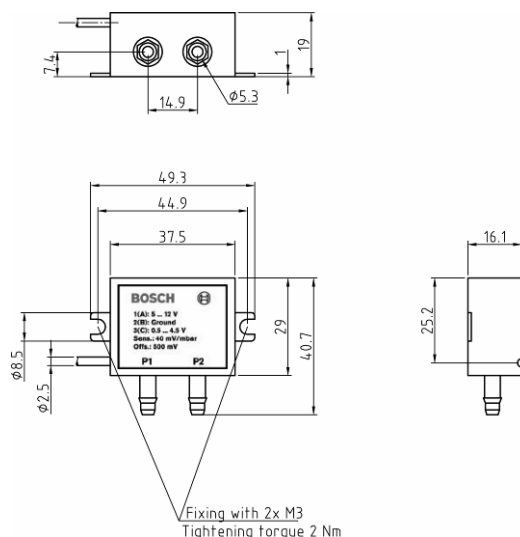
Conditions for use	
Temperature range	-20 ... 70°C

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

Part 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

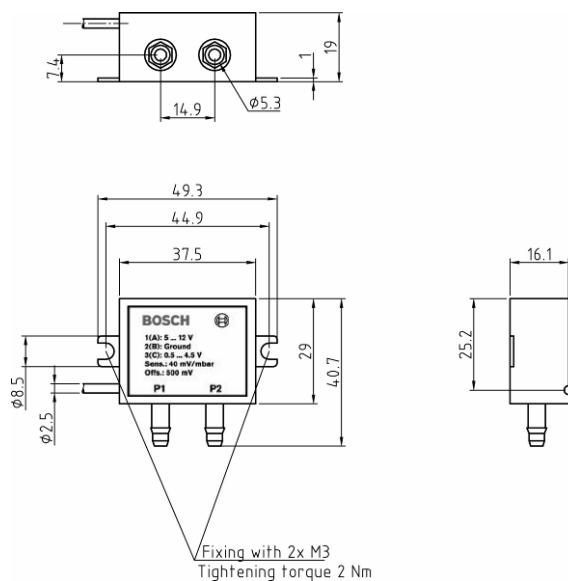
Conditions for use	
Temperature range	-20 ... 70°C

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

Part 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	10 Ncm
Weight	28 g

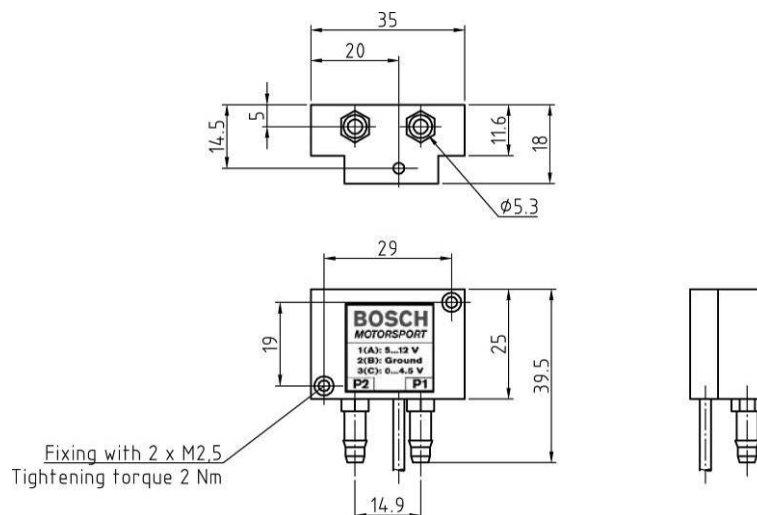
Conditions for use	
Temperature range	-20 ... 70°C

Characteristic	
Sensitivity	35 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 V

Accessories	
Pitot tube	B 261 209 700

Part number	
ASL 0-06-05PC-HE	B 261 209 701
Offer drawing	A 261 209 701



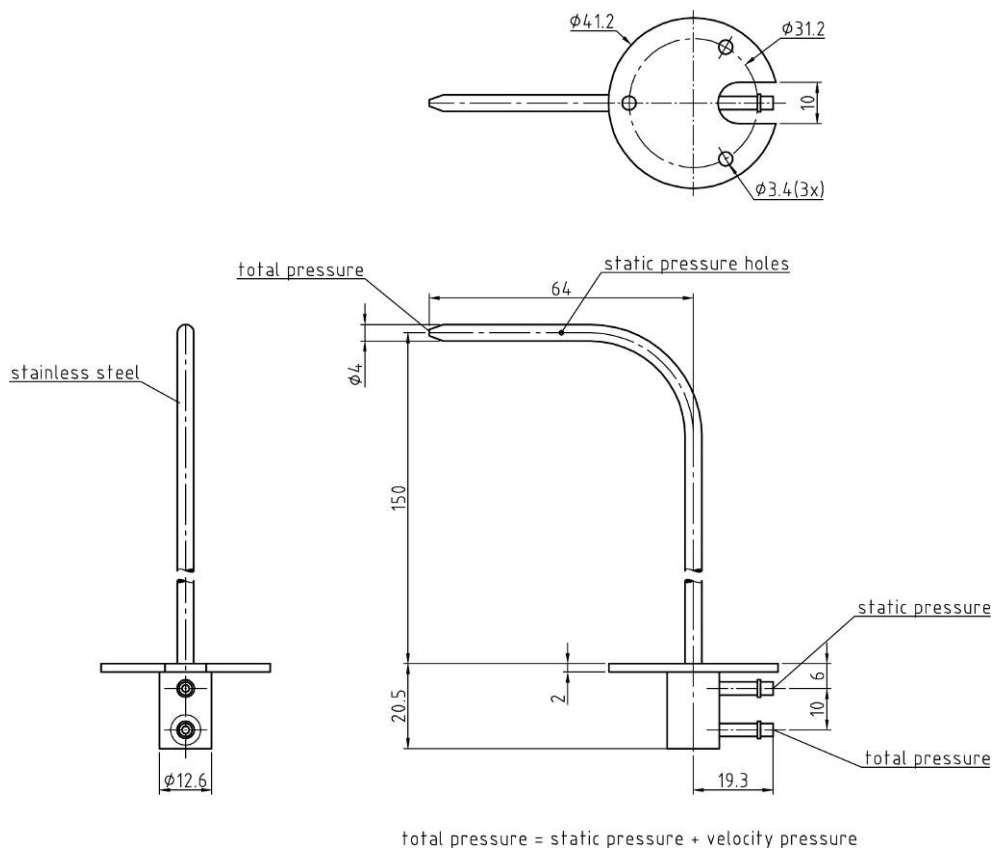
Pitot Static Tube PT

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

Part 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:

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

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

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

V = velocity m/s

B = barometric pressure mbar

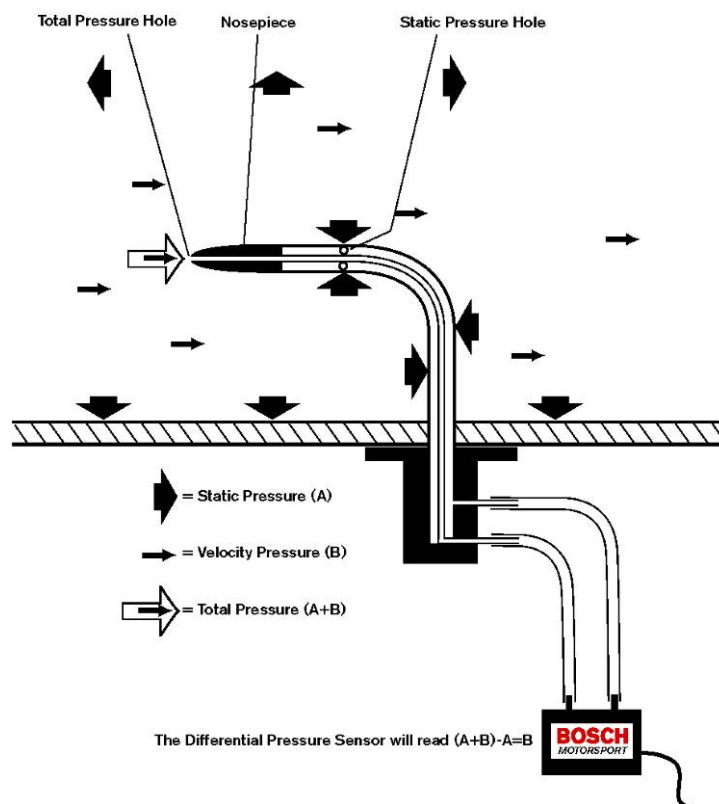
T = absolute temperature K (= $t^{\circ}\text{C} + 273$ where t is airstream temperature)

P_s = static pressure Pa

P_v = velocity pressure Pa

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

Principle of Operation



Temperature Sensors

Temperature Sensors TI-16 / TI-100

These infrared temperature sensors can be used to measure the surface temperature of various applications, such as tires, brake discs, and cylinder heads.

The main features of these sensors are their compact size, robust design, and high signal quality at a low cost. In addition, they offer the ability to change the temperature range and emissivity by request.



Mechanical data	
Dimensions	M12 x 1, SW 14
Weight incl. cable 1 m	42 g
Optical resolution	10:1

Electronic data	
Power supply U_s	5 ... 28 V
Full scale output	0 ... 5 V
Current I_s	9 mA

Application	
TI-16 r (rubber)	0 ... 160°C
TI 16 s (steel)	0 ... 160°C
TI-100 s (steel)	0 ... 1000°C
TI-100 c (carbon)	0 ... 1000°C

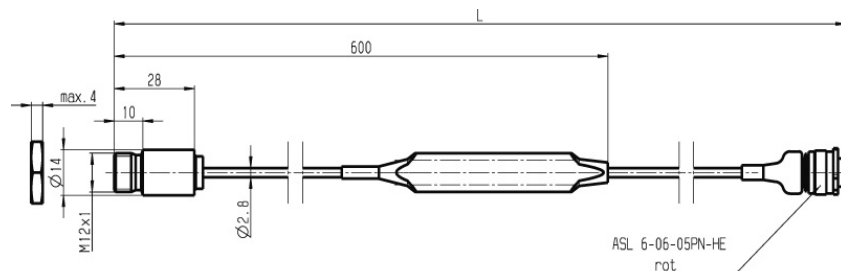
Emissivity (pre defined)	
TI-16 r (rubber)	0,95
TI-16 s (steel)	0,8
TI-100 s (steel)	0,8
TI-100 c (carbon)	0,75

Conditions for use	
Operating temperature range	-20 ... 120 °C

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

Part numbers	
TI-16 r (rubber)	F 01T A21 207
TI-16 s (steel)	F 01T A21 209
TI-100 s (steel)	F 01T A21 210
TI-100 c (carbon)	F 01T A21 211

Dimensions



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.



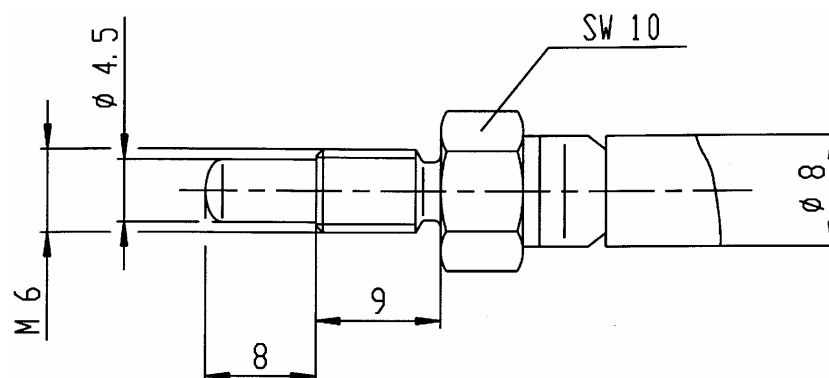
Mechanical data	
Thread	M6 x 1
Tightening torque	3 Nm
Wrench size	10 mm
Sealing	Viton 4,47 x 1, 78
Weight	45 g

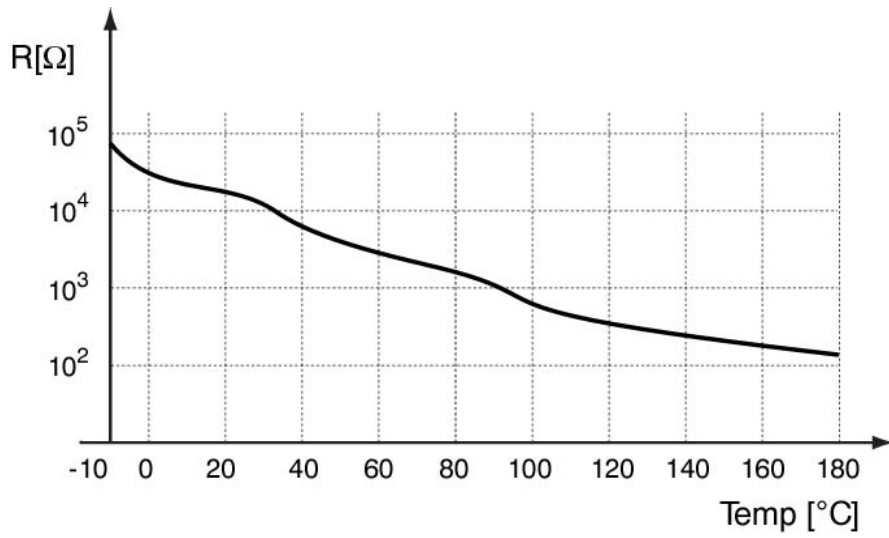
Electronic data	
Nominal resistance	15 kΩ/25°C
Measuring range	0 ... 200°C
Accuracy	± 1,0 K
Response time 90 %	< 7 s

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

Part 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

Characteristic
NTC 15 kΩ





$^{\circ}\text{C}$	$R(\Omega)$
-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

$^{\circ}\text{C}$	$R(\Omega)$
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.



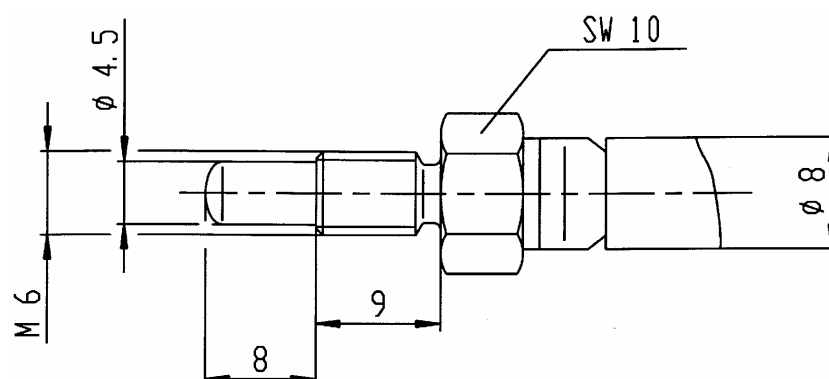
Mechanical data	
Thread	M6 x 1
Tightening torque	3 Nm
Wrench size	10 mm
Sealing	Viton 4,47 x 1, 78
Weight	45 g

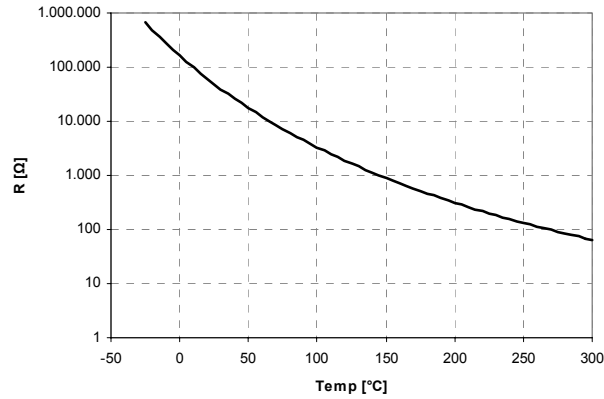
Electronic data	
Nominal resistance	49 k Ω /25°C
Measuring range	0 ... 300°C
Accuracy	$\pm 1,0$ K
Response time 90 %	< 7 s

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

Part number	
ASU 6-03-PB-HE	B 261 209 980
Offer drawing	A 261 209 980

Characteristic	
NTC 49 k Ω	





$^{\circ}\text{C}$	$R(\Omega)$
-25	657.350
-20	487.370
-15	365.040
-10	276.060
-5	210.690
0	162.210
5	125.780
10	98.322
15	77.454
20	61.465
25	49.120
30	39.517
35	31.996
40	26.065
45	21.358
50	17.599
55	14.579
60	12.140
65	10.159
70	8.541,5
75	7.214,2
80	6.119,8
85	5.213,4
90	4.459,1
95	3.828,8
100	3.300
105	2.854,5
110	2.477,7
115	2.157,9
120	1.885,5
125	1.652,6
130	1.452,9
135	1.281,1

$^{\circ}\text{C}$	$R(\Omega)$
140	1.132,7
145	1.004,3
150	892,79
155	795,7
160	710,92
165	636,7
170	571,55
175	514,32
180	463,67
185	418,96
190	379,35
195	344,16
200	312,85
205	284,92
210	259,96
215	237,61
220	217,55
225	199,52
230	183,29
235	168,64
240	155,41
245	143,43
250	132,57
255	122,7
260	113,73
265	105,55
270	98,098
275	91,286
280	85,054
285	79,344
290	74,106
295	69,295
300	64,870

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.



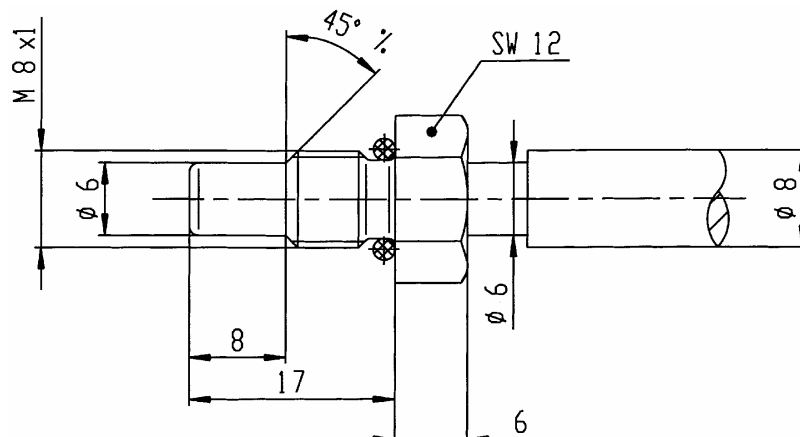
Mechanical data	
Thread	M8 x 1
Tightening torque	3 Nm
Wrench size	12 mm
Sealing	Viton 6,35 x 1,78
Weight	45 g

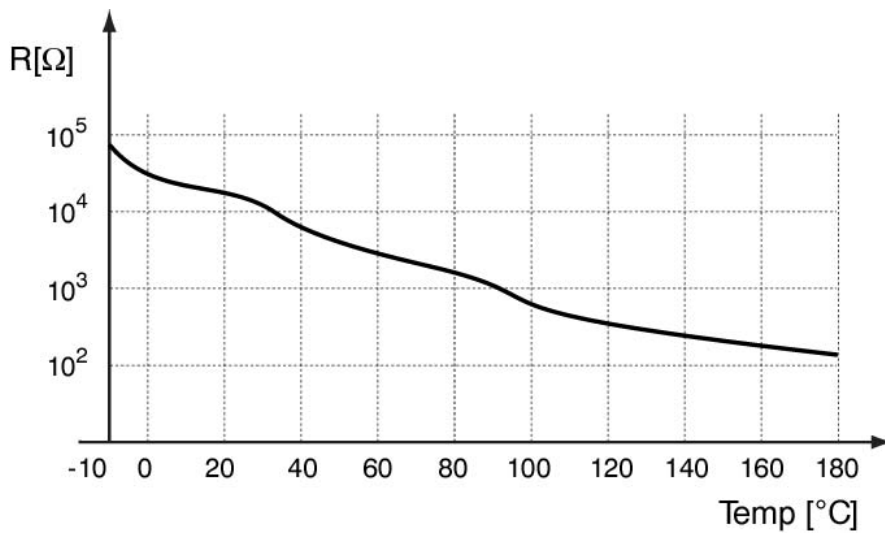
Conditions for use	
Temperature range	-30 ... 200°C
Vibration	80 g/5 ... 500 Hz

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

Part 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





$^{\circ}\text{C}$	$R(\Omega)$
-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

$^{\circ}\text{C}$	$R(\Omega)$
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.



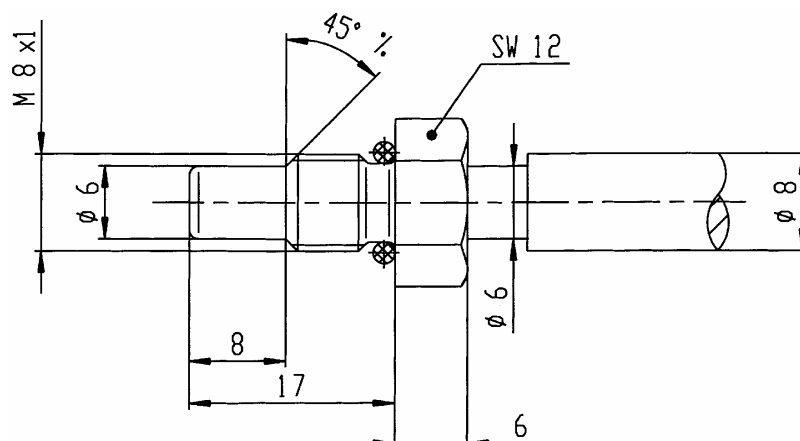
Mechanical data	
Thread	M8 x 1
Tightening torque	3 Nm
Wrench size	12 mm
Sealing	Viton 6,35 x 1,78
Weight	45 g

Electronic data	
Nominal resistance	6,8 k Ω /25°C
Measuring range	0 ... 100°C
Accuracy	$\pm 1,0$ K
Response time 90 %	< 5 s

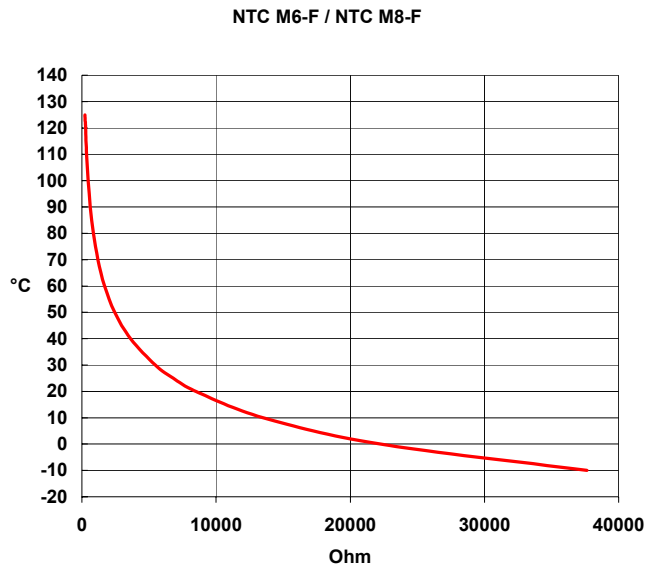
Conditions for use	
Temperature range	-30 ... 100°C
Vibration	80 g/5 ... 500 Hz

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

Characteristic	
NTC 6,8 k Ω	



°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

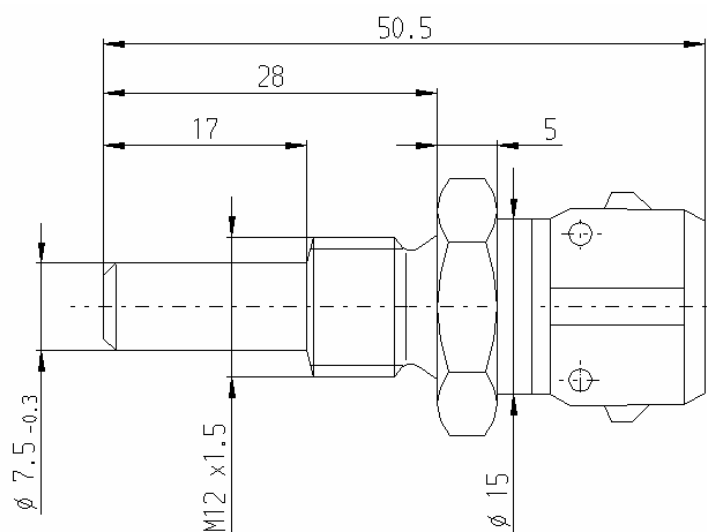
Electronic data	
Nominal resistance	2,5 k Ω /20°C
Measuring range	-30 ... 130°C
Accuracy	$\pm 1,5$ K
Response time 90 %	< 10 s

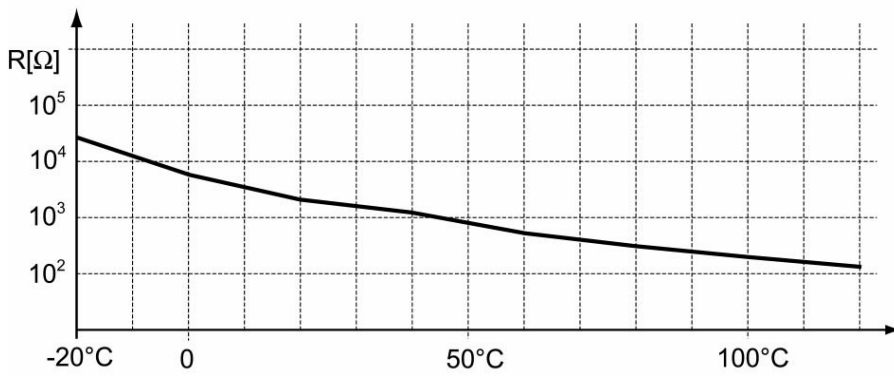
Conditions for use	
Temperature range	-30 ... 130°C
Vibration	60 g/5 ... 250 Hz

Connector	
Cable harness connector	D 261 205 331

Characteristic	
NTC	2,5 k Ω

Part numbers	
D 261 205 331	O 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

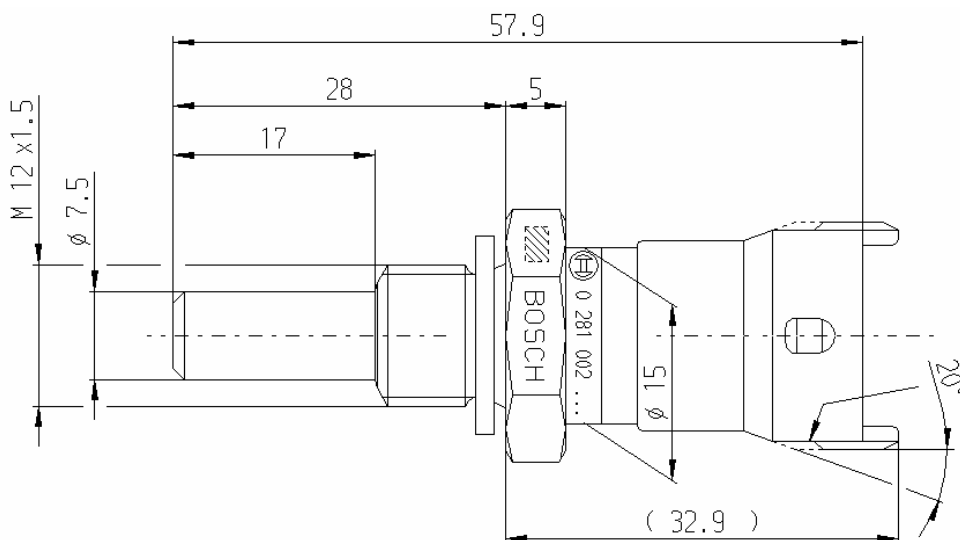
Electronic data	
Nominal resistance	2,5 k Ω /20°C
Measuring range	-40 ... +150°C
Accuracy	$\pm 1,5$ K
Response time 90 %	< 10 s

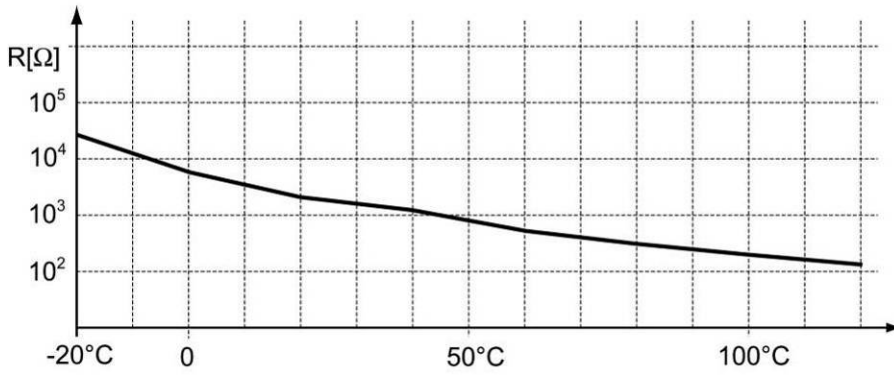
Conditions for use	
Temperature range	-40 ... 150°C
Vibration	30 g/5 ... 250 Hz

Connector	
Cable harness connector	D 261 205 337

Characteristic	
NTC	2,5 k Ω

Part number	
Part 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

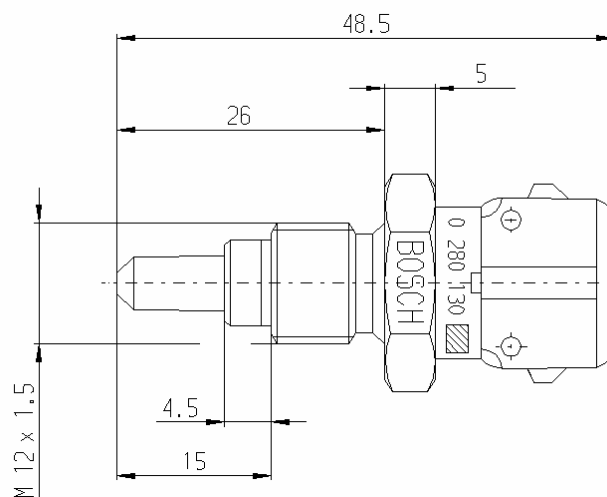
Electronic data	
Nominal resistance	2,5 k Ω /20°C
Measuring range	-30 ... 130°C
Accuracy	$\pm 1,5$ K
Response time 90 %	< 10 s

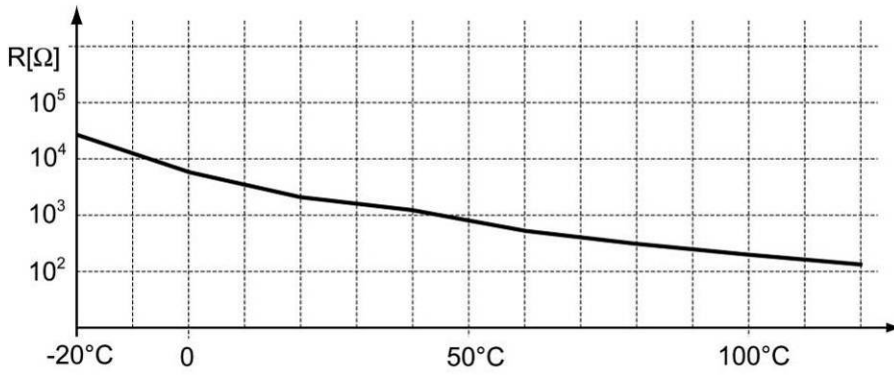
Conditions for use	
Temperature range	-30 ... 130°C
Vibration	60 g/50 ... 250 Hz

Connector	
Cable harness connector	D 261 205 288

Characteristic	
NTC 2,5 k Ω	

Part number	
	0 280 130 039
Offer drawing	A 280 130 206





$^{\circ}\text{C}$	$R(\Omega)$
-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

$^{\circ}\text{C}$	$R(\Omega)$
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 PT 100 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

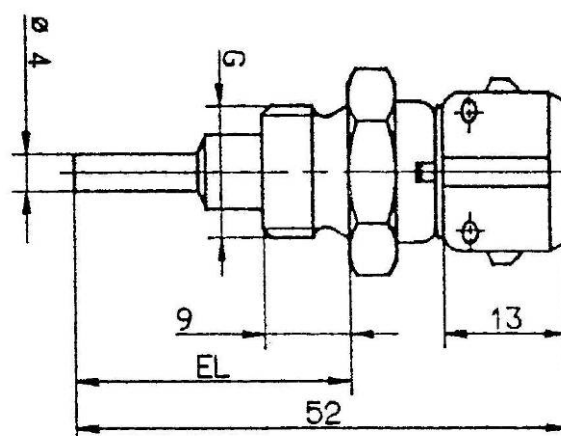
Electronic data	
Nominal resistance	100 Ω/0°C
Measuring range	-50 ... 300°C
Accuracy	± 3,0 K
Response time 90 %	< 10 s

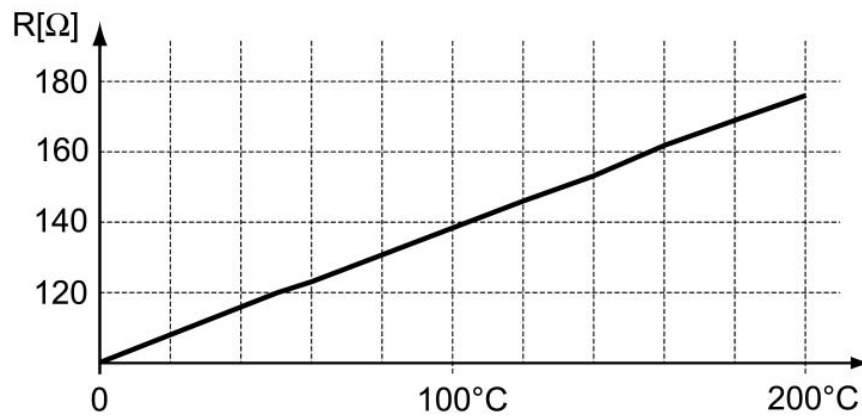
Conditions for use	
Temperature range	-50 ... 300°C
Vibration	40 g/5Hz ... 2kHz

Connector	
Cable harness connector	D 261 205 288

Characteristic	
PT 100 DIN/IEC 751	

Part number	
	B 261 209 174
Offer drawing	A 261 209 174





$^{\circ}\text{C}$	$R(\Omega)$
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

$^{\circ}\text{C}$	$R(\Omega)$
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

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
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Characteristic

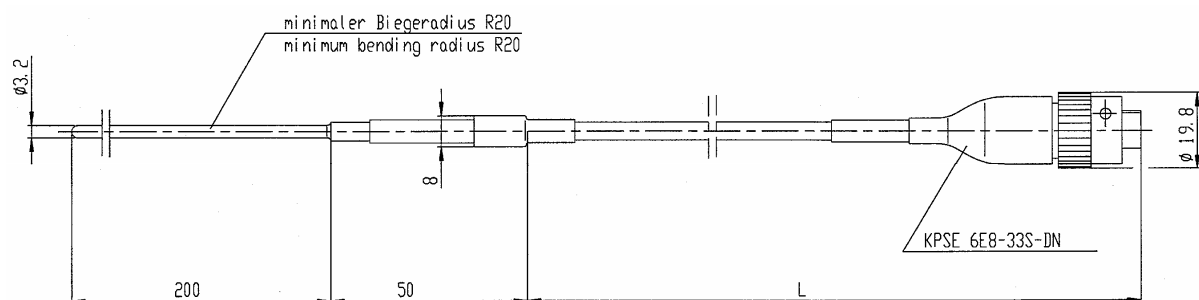
DIN IEC 584

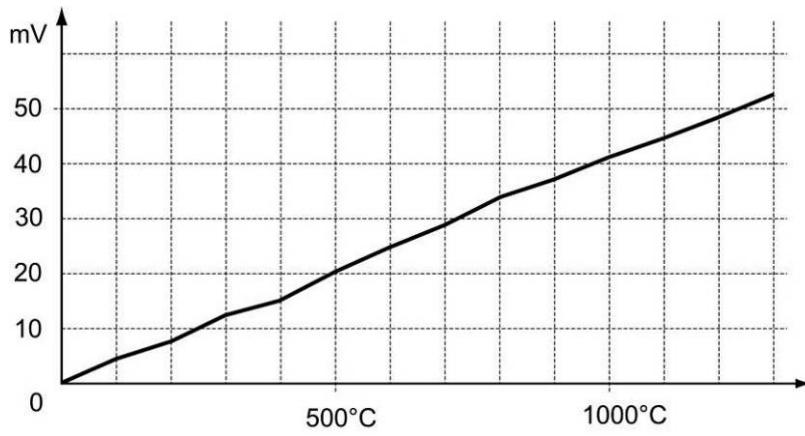
Sensor data

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

Part 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

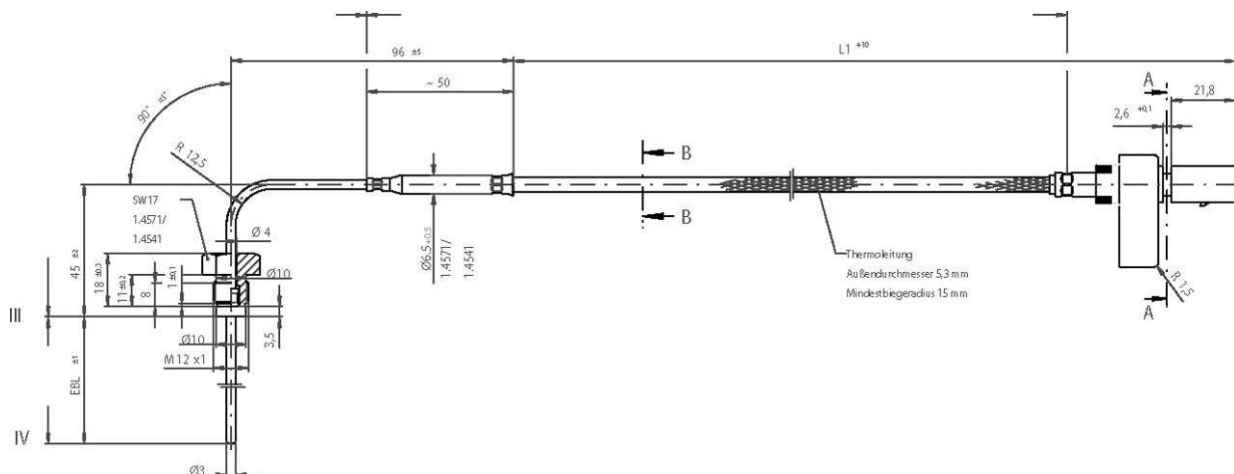
Characteristic	
DIN IEC 584	

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

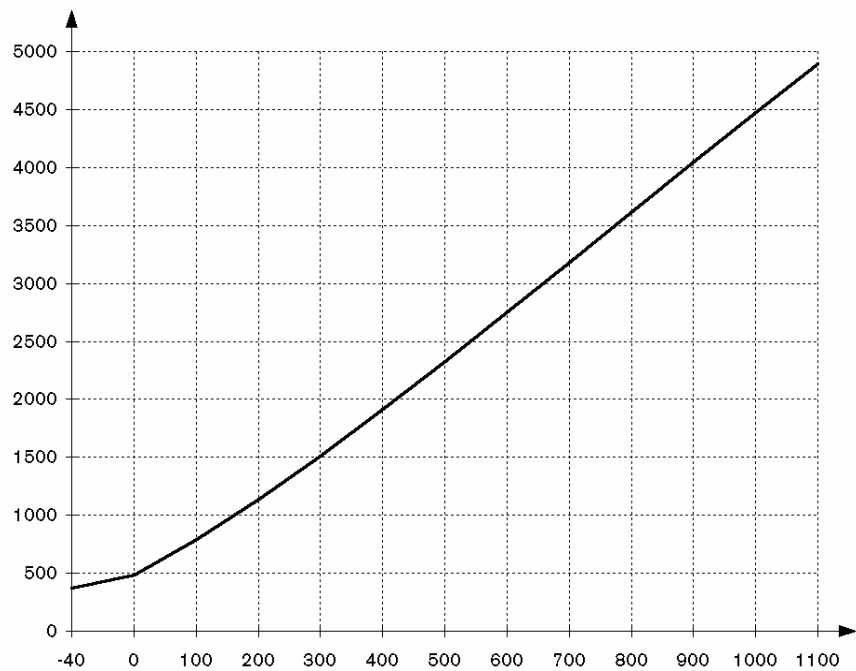
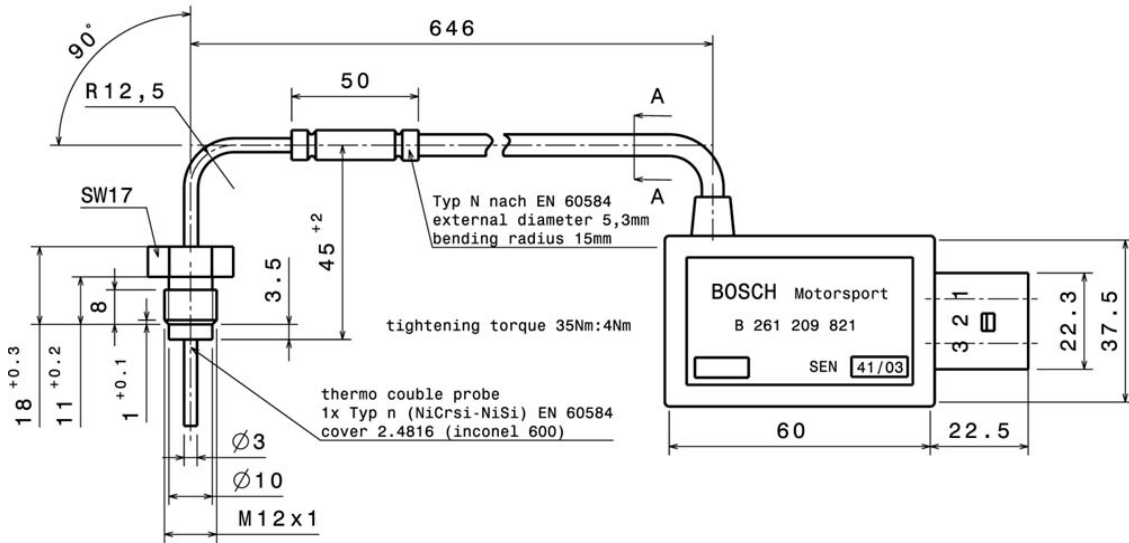
Connector	
TCP-N	1-J0973-70
TCP-NF	D 261 205 357

Part 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.

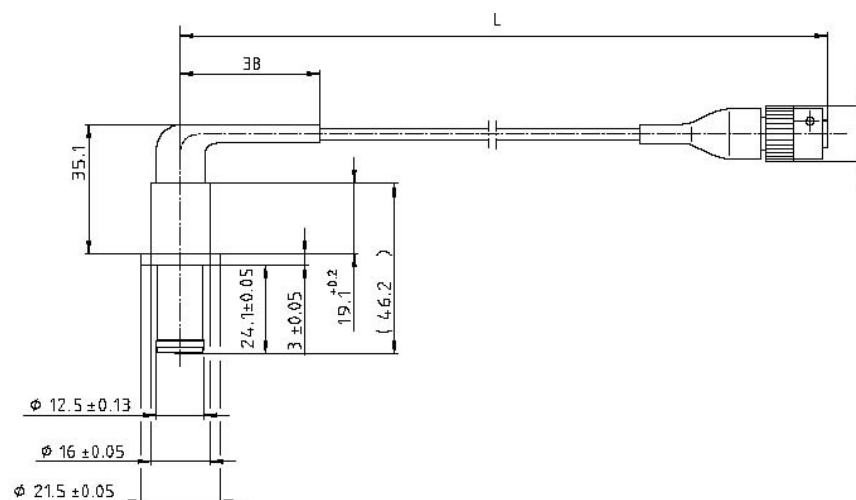


Mechanical data	
Magnetic pole	round
Drill diameter	12,9 mm
Tightening torque	8 Nm
Weight	70 g
Installation depth L2	13,2/24,1/32,2/41,5 mm

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

Part 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.



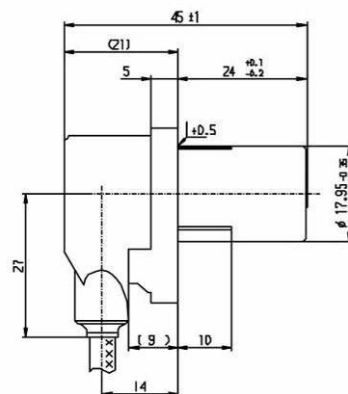
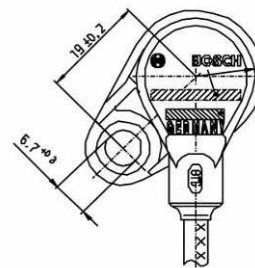
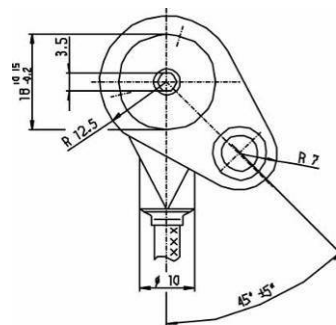
Mechanical data	
Magnetic pole	round
Fixing	M6 x 12
Length	510 mm
Tightening torque	8 Nm
Weight	80 g
Installation depth	24 mm

Electronic data	
Resistance	860 Ω /20° \pm 10 %
Inductance	370 \pm 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

Part 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.

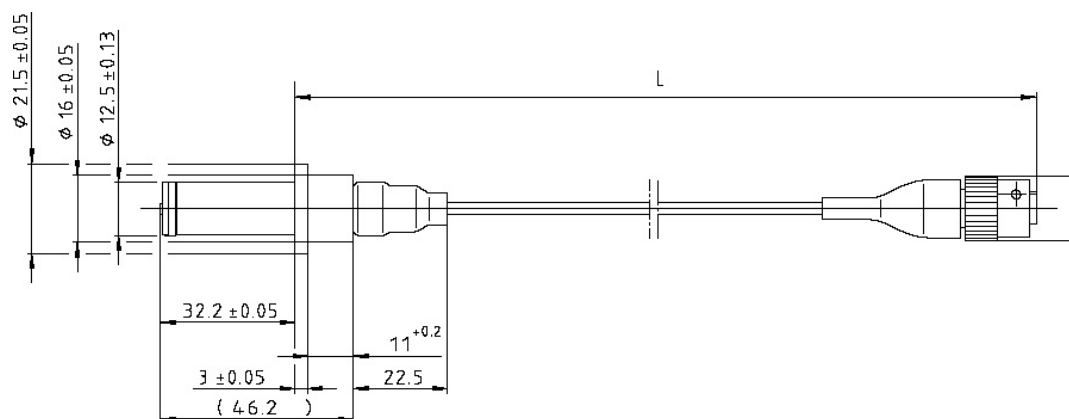


Mechanical data	
Magnetic pole	round
Drill hole	12,9 mm
Tightening torque	8 Nm
Weight	70 g
Installation depth L2	13,2/24,1/32,2 mm

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

Electronic data	
Electrical strength	1200 V/max. 3 sec.
Resistance	$R_i = 1200 \Omega$
Inductance	max. 400 mH

Part 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.

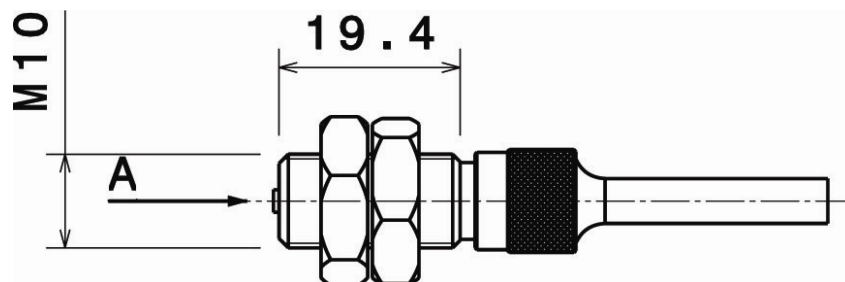


Mechanical data	
Magnetic pole	round
Drill hole	M10 x 1 or 3/8-24 UNF-2A THD (USA)
Mounting torque	10 Nm (7.3 ft-lb) maximum
Weight	16 g

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

Electronic data	
Resistance	$R_i = 340 \Omega \pm 20 \%$
Inductance	$64 \text{ mH} \pm 20 \%$

Part 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 k Ω 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)

Part numbers	
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.



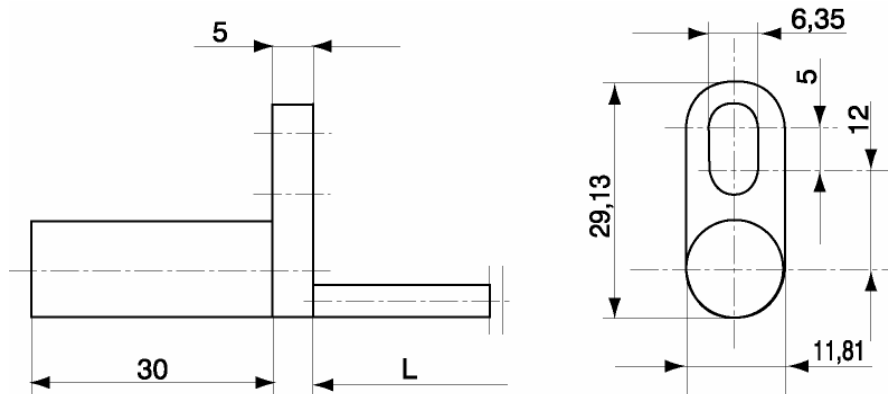
Mechanical data	
Fixing	M6
Drill hole	11,8 mm
Max. distance	1,2 mm
Tightening torque	6 Nm
Weight	12 g

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

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

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

Part number	
ASU 6-03-03PN-HE	B 261 209 283
Offer drawing	A 261 209 283



Speed Sensor HA-P

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



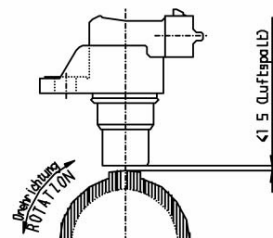
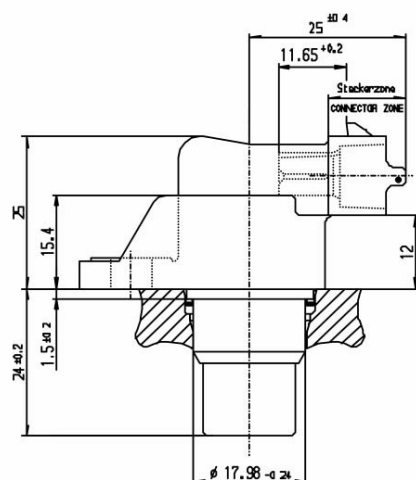
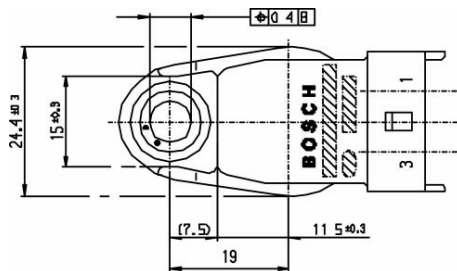
Mechanical data	
Fixing	M6
Drill hole	18 mm
Max. distance	1,52 mm
Tightening torque	6 Nm
Weight	70 g
Installation dimensions	30 mm

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

Part 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

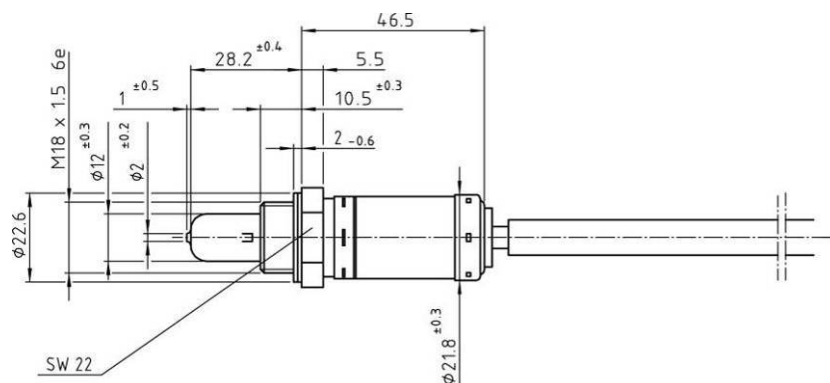
Temperature ranges	
Ceramic tip	250 ...850°C
Hexagon nut	< 570°C
Cable duct	< 250°C
Connector	< 130°C

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 106.

Connectors	
	1 284 485 110
	1 224 485 018

Part 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

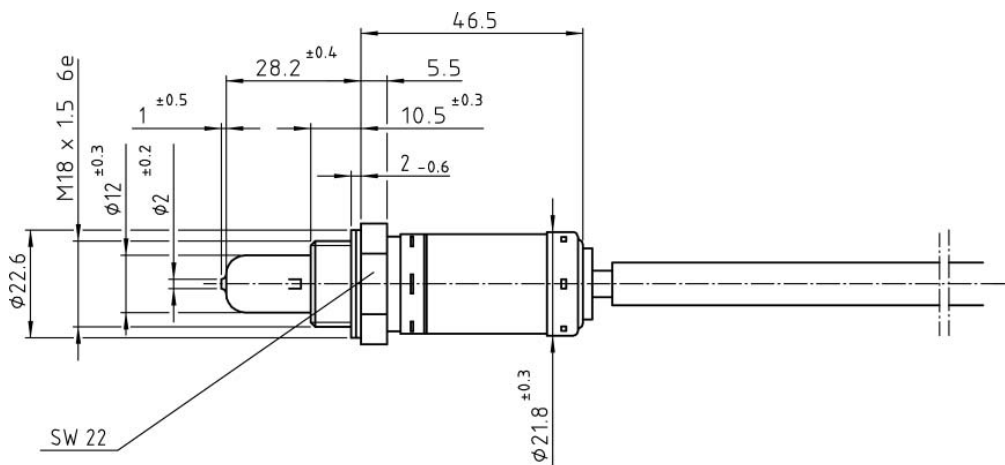
Fuel additives	
Sulphur (weight)	0,2 %
Lead	0,6 g/l

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 106 .	

Part 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

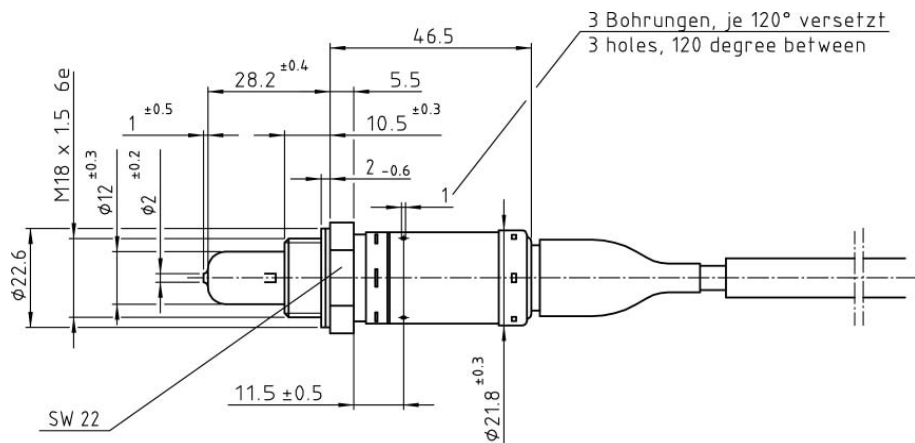
Fuel additives	
Sulphur (weight)	0,2 %
Lead	0,6 g/l

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 106.

Part 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 ZrO₂ 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.	

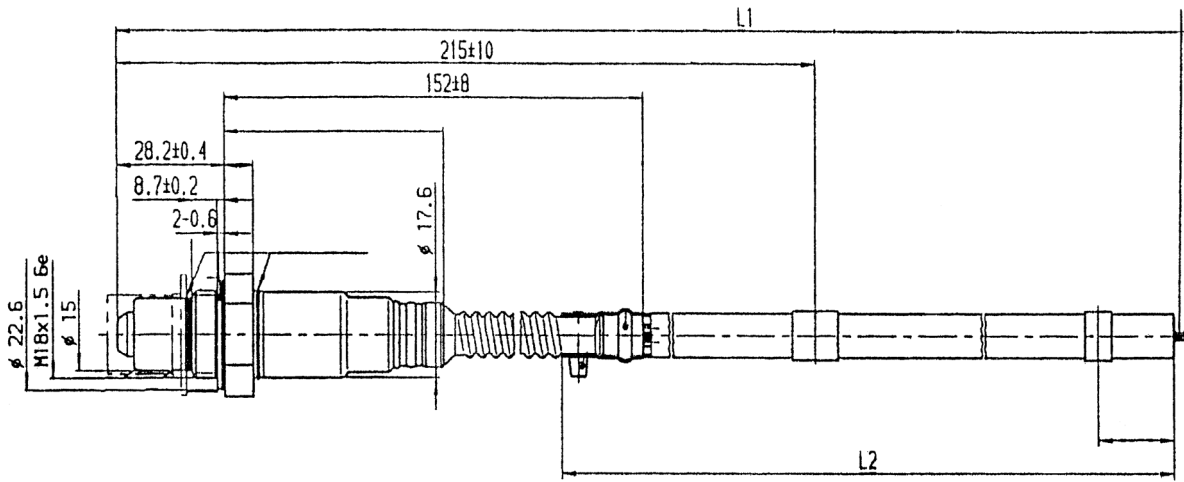
Temperature ranges	
Exhaust gas at sensor element	850°C
Hexagon of the sensor housing	< 570°C
Cable grommet (PTFE formed house)	
-Sensor side	< 250°C
-Cable side	< 200°C
Cable and protection sleeve	< 250°C
Connector	< 120°C

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 106.	

Connector	
Cable harness connector	D 261 205 138

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



Lambda Sensor LSU 4.9

This wide-band lambda is a planar ZrO₂ 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 permanent < 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 106.

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

Part 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.

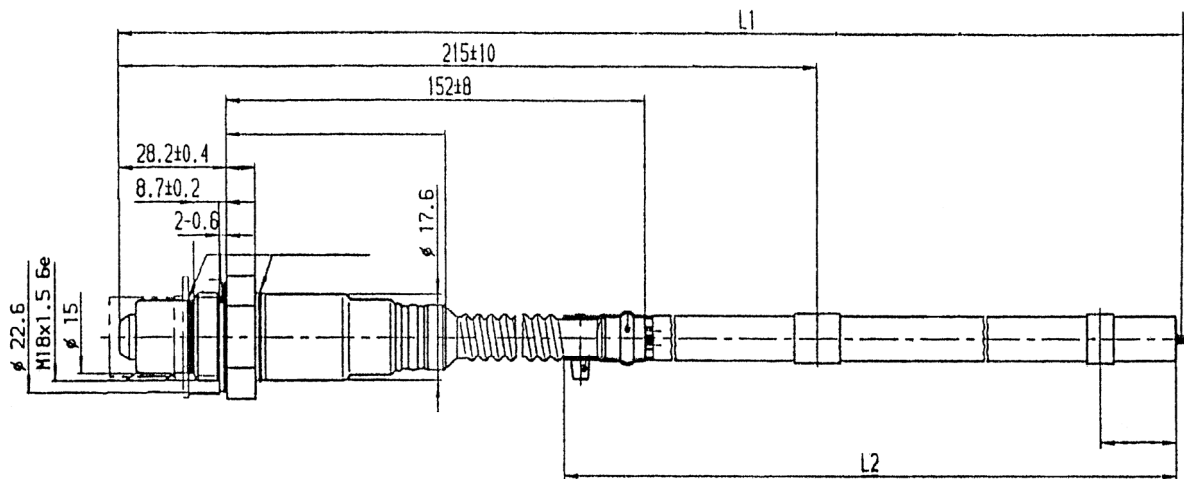
- Install at a point where the gas is as hot as possible.
- Observe the maximum permissible temperatures.
- As far as possible install the sensor vertically, whereby the electrical connections should point upwards.
- The sensor is not to be fitted near to the exhaust outlet so that the influence of the 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 pinout

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 ZrO₂ 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

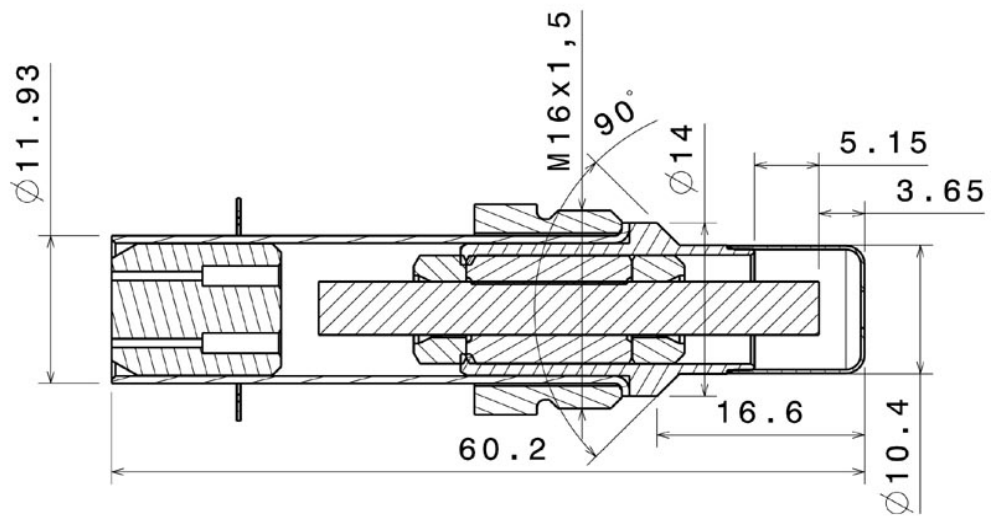
Temperature ranges	
Exhaust gas at sensor element	850°C
Hexagon of the sensor housing	< 570°C
Cable grommet cable side	< 310°C permanent < 500°C short time
Cable and protection sleeve	< 250°C
Connector	< 120°C

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

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



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	
$\lambda_{\text{Value}} = 0,0069$:	failed sensor (short cut or not connected)
$\lambda_{\text{Value}} = 0,0686$:	probe did not reach 600°C (up to 30 sec)
$\lambda_{\text{Value}} = 0,1373$:	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/FValue						= 0,001 * A/Fx		
λ_{Value}						= A/FValue / 14,57 = A/F _{Digits} / 14570 = A/F _{Digits} * 0,00006863418		
Heiz-Temp						= Temp _{Digits} * 2 + 496,9°C		

Part 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.



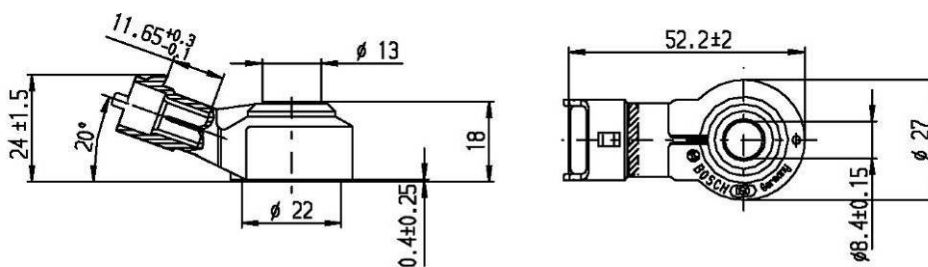
Mechanical data	
Thread	M8 x 30 (aluminium engine block) M8 x 25 (cast iron engine block)
Weight	48 g
Tightening torque	15 ... 25 Nm
Mounting position	random

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

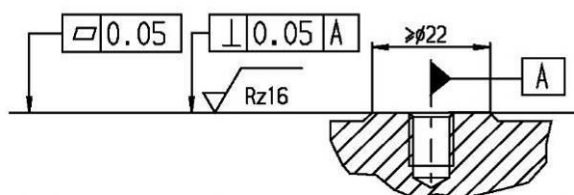
Electronic data	
Main resonance frequency	> 20 kHz
Impedance R:	> 1MΩ
C	1100 ± 300 pF
Measuring range	0,1 ... 400 g
Sensitivity at 5 kHz	26 ± 8 mV/g
Range of frequency	1 ... 20 kHz

Connector	
Cable harness connector	D 261 205 337

Part number	
	0 261 231 120
Offer drawing	A 261 230 170



Beispiel/EXEMPLE



Sensor darf nur auf seinen Metallfläachen aufliegen (keine Sicherungsscheiben verwenden)
ONLY THE METALLIC PART OF THE SENSOR MAY HAVE CONTACT WITH THE ENGINE (NO WASHERS ARE TO BE USED)

Auflagefläache soll rotationssymmetrisch zur Gewindebohrung bearbeitet werden.
THE CONTACT SURFACE MUST BE MACHINED ROTATIONALLY SYMMETRICAL TO THE THREADED BORE.

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.



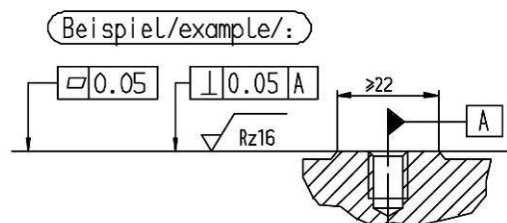
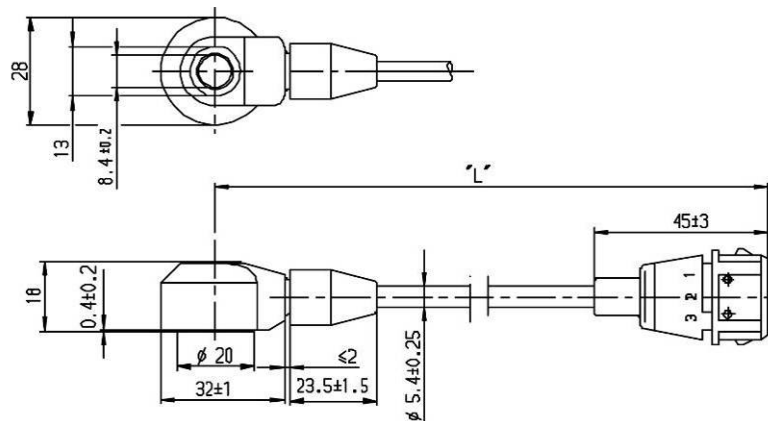
Mechanical data	
Thread	M8 x 30 (aluminium engine block) M8 x 25 (cast iron engine block)
Weight	82 g
Tightening torque	15 ... 25 Nm
Length	100 ... 500 mm

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

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



Sensor darf nur auf seinen Metallflächen aufliegen (keine Sicherungselben verwenden)
Only the metallic part of the sensor may have contact with the engine (no washers are to be used)

Auflagefläche soll rotationssymmetrisch zur Gewindebohrung bearbeitet werden.
The contact surface must be machined rotationally symmetrical to the threaded bore.

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.

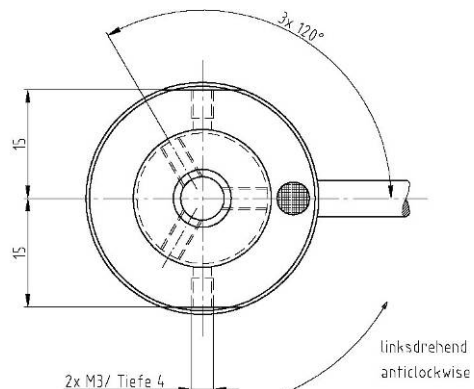
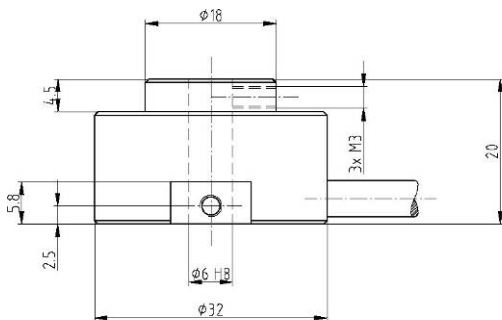


Mechanical data	
Mounting	2 x M3
Standard shaft	6 mm
Length	160 ... 300 mm
Mech. range	360°
Tightening torque	0,5 Nm
Weight	41 g
Life expectancy	> 50 x 10 ⁶ rotations

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

Part 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.



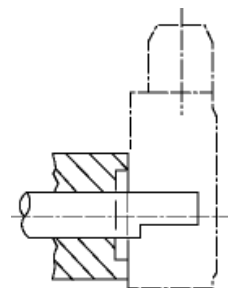
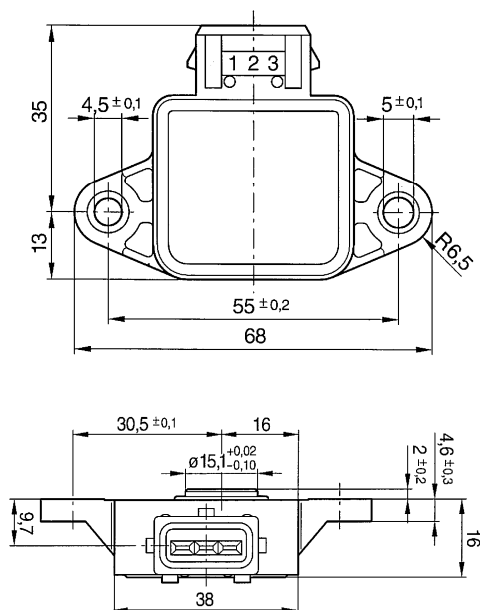
Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	< 86°
Max. rotation speed	120 x 1/min
Tightening torque	1,5 ... 2,5 Nm
Weight	60 g
Life expectancy	> 2 x 10 ⁵ rotations

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

Part number	
	0 280 122 016
Offer drawing	A 280 121 252



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.

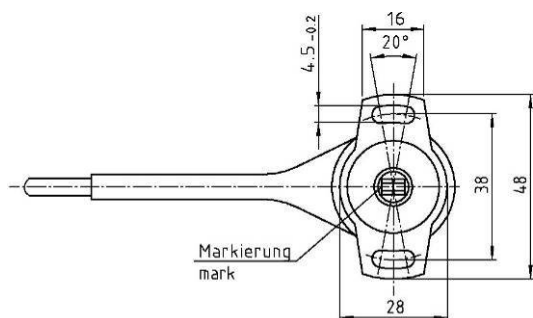


Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10 ⁵ rotations

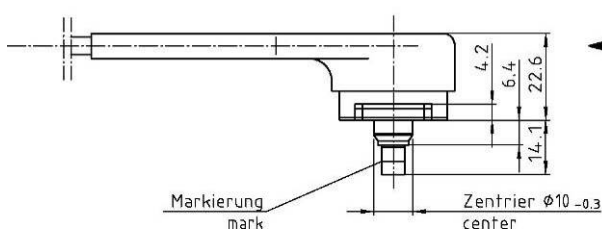
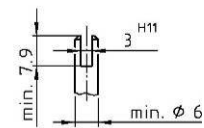
Electronic data	
Nominal resistance	3 kΩ
Resistance tolerance	20 %
Non-linearity	0,9 %
Repetitive accuracy	0,01 %
Temp. coefficient	< 5 ppm/°C
Max. power supply	42 V
Usual power supply	5 V

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

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

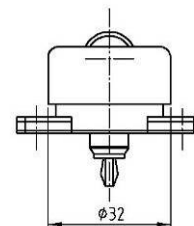


- Abmessungen der Antriebsseite
- dimension of driveshaft



▲ B

Ansicht B
view



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

Part 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.

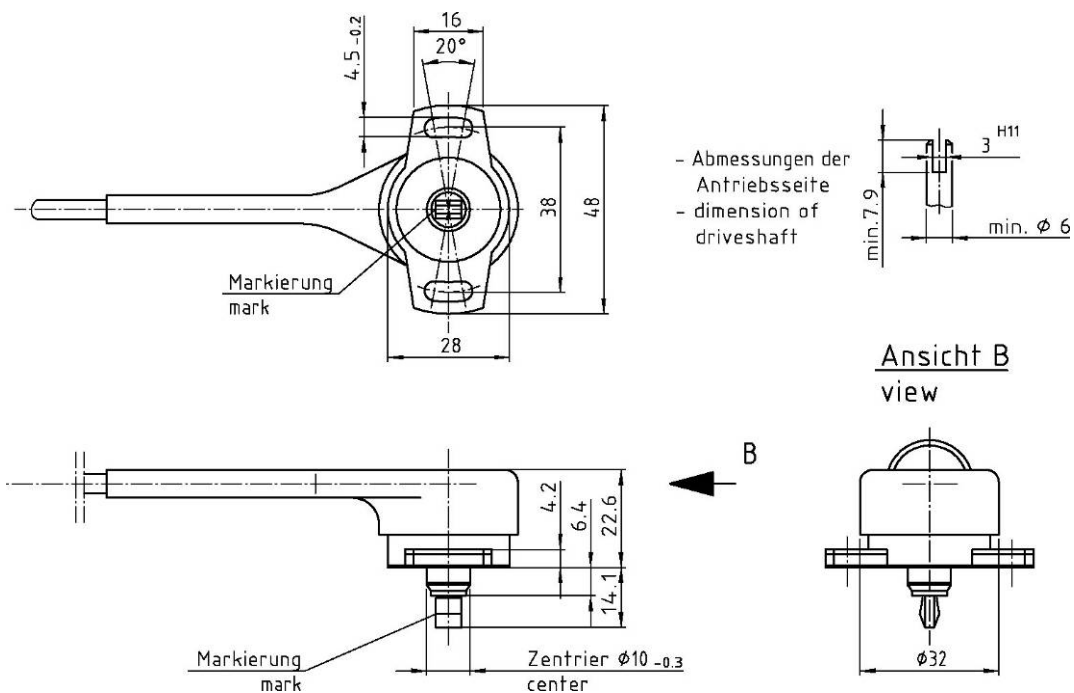


Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10 ⁵ rotations

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

Part 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.

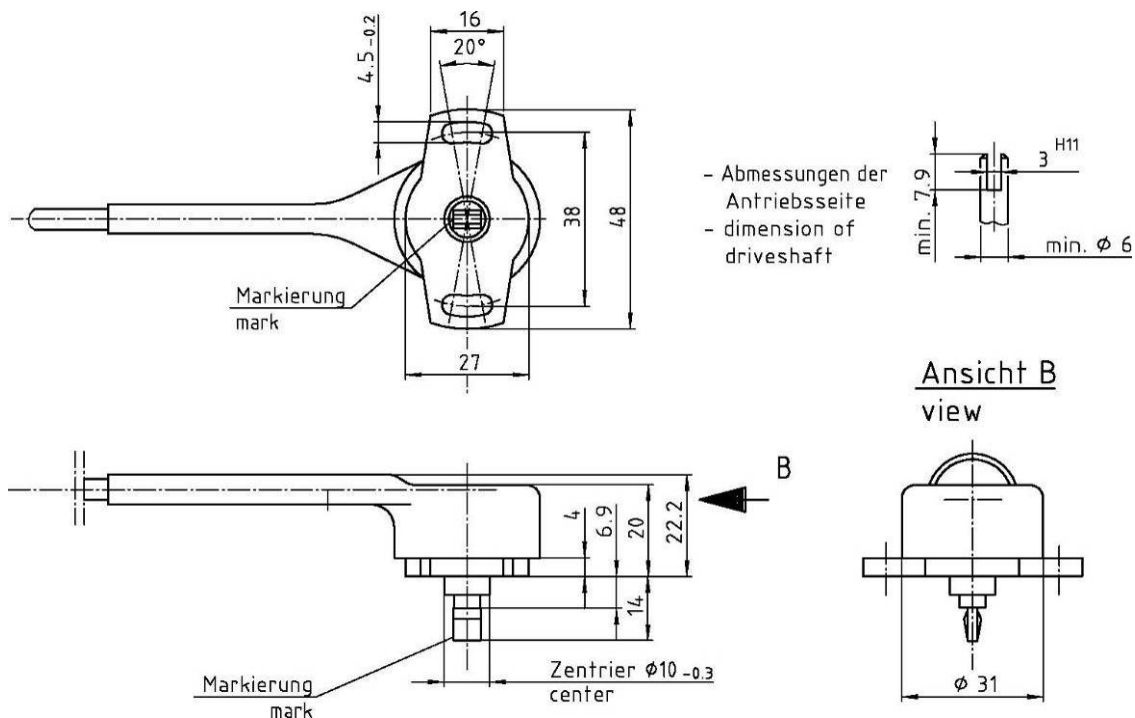


Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10 ⁵ rotations

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

Part 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.

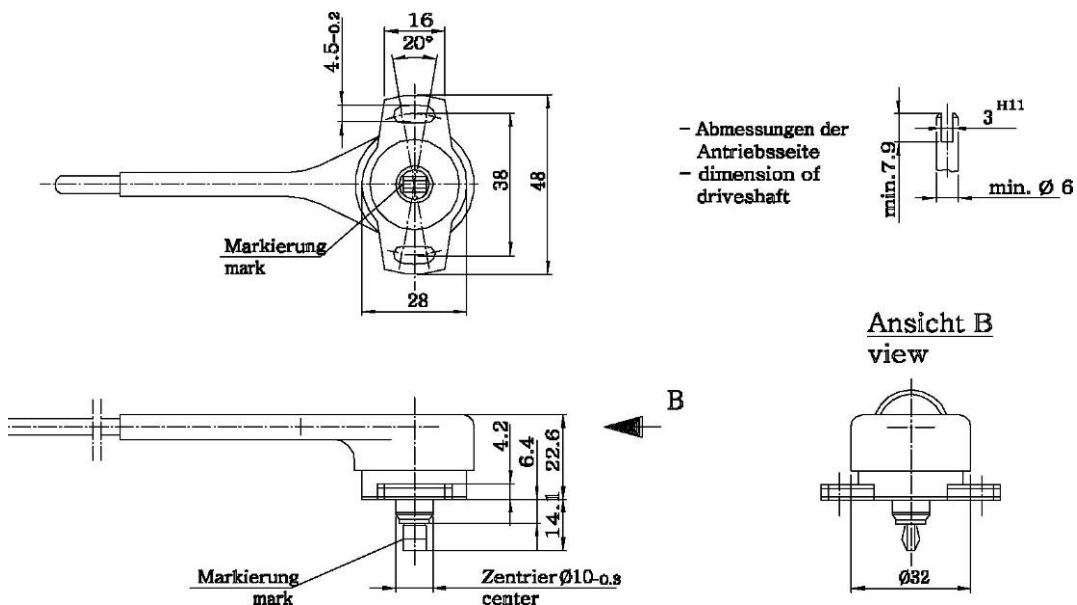


Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	± 360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10 ⁵ rotations

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

Part number	
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.

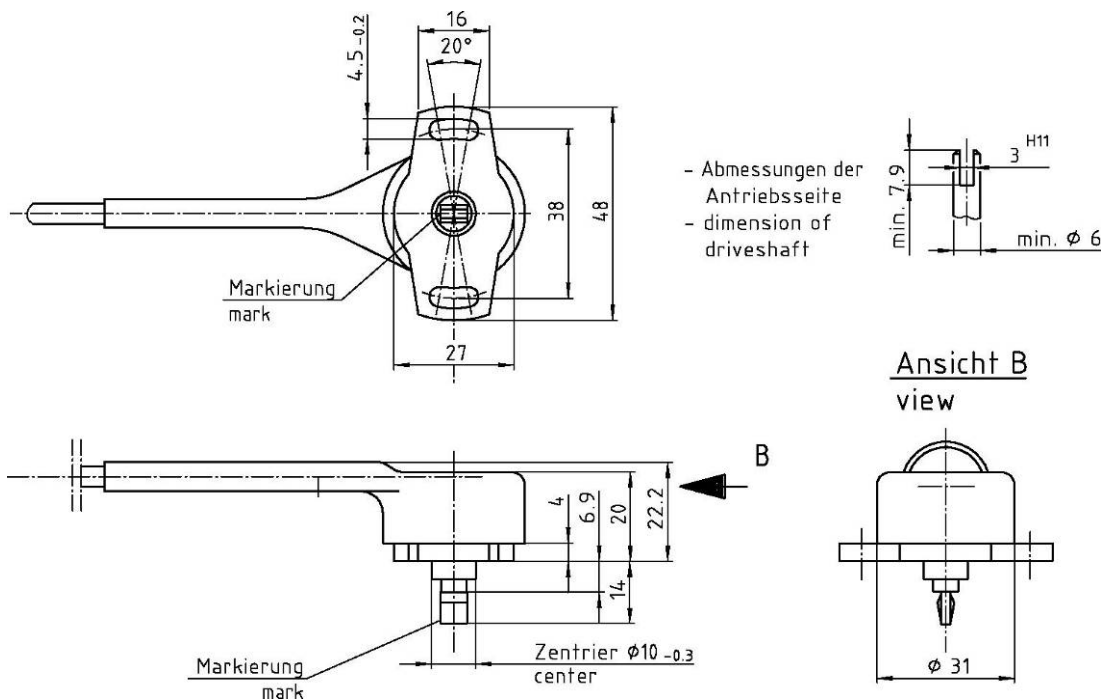


Mechanical data	
Mounting	2 x M4
Length	160 ... 300 mm
Mech. range	360°
Max. rotation speed	120 x 1/min
Tightening torque	0,5 Nm
Weight	60 g
Lifetime	> 50 x 10 ⁵ rotations

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

Part 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.

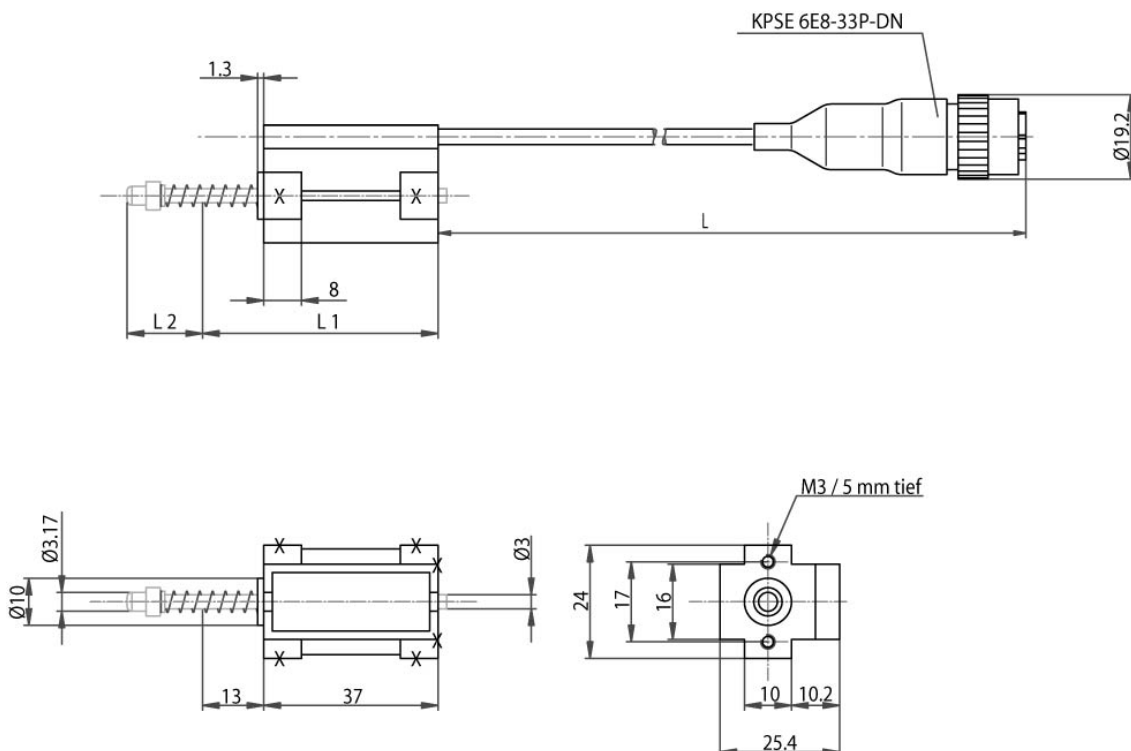


Mechanical data	
Mounting	2 x M3
Cable length	150 ... 1000 mm
Weight	70 g

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

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

Part 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.

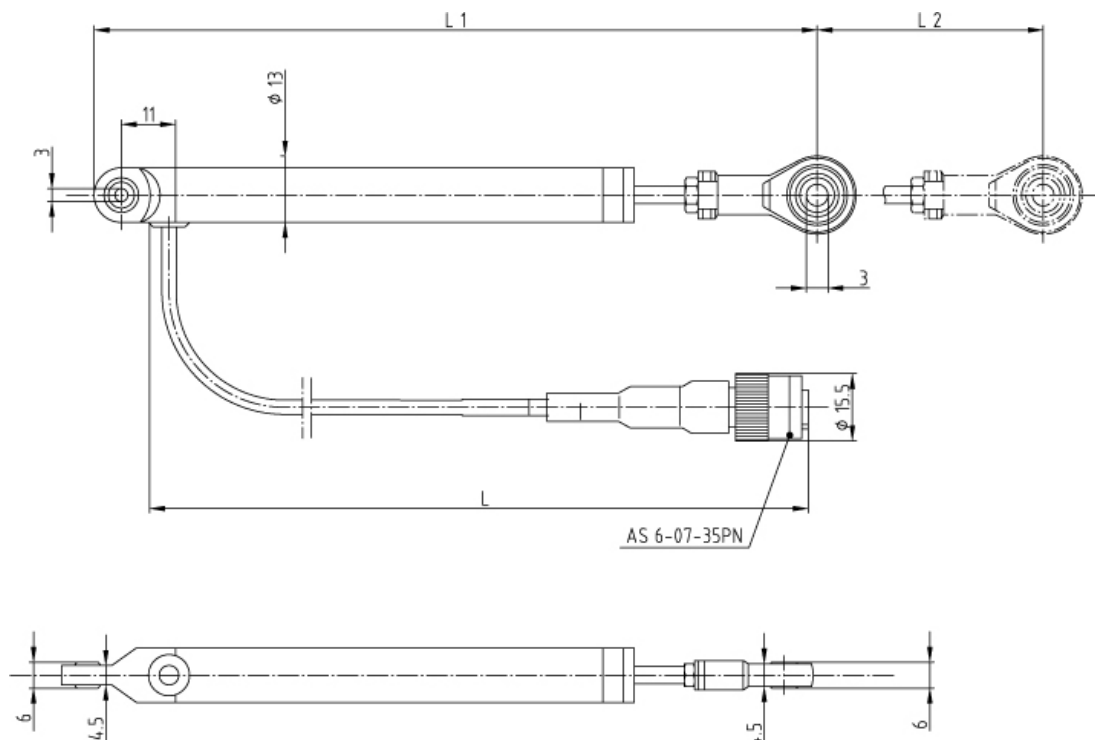


Mechanical data	
Possible mech. range [L2]	50 mm
Min. length [L1]	120 mm
Cable length [L]	150 ... 1000 mm
Mounting hole	∅ 3 mm
Protection	IP 66
Max. shaft velocity	10 m/sec
Weight	approx. 50 g

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

Part number	
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.

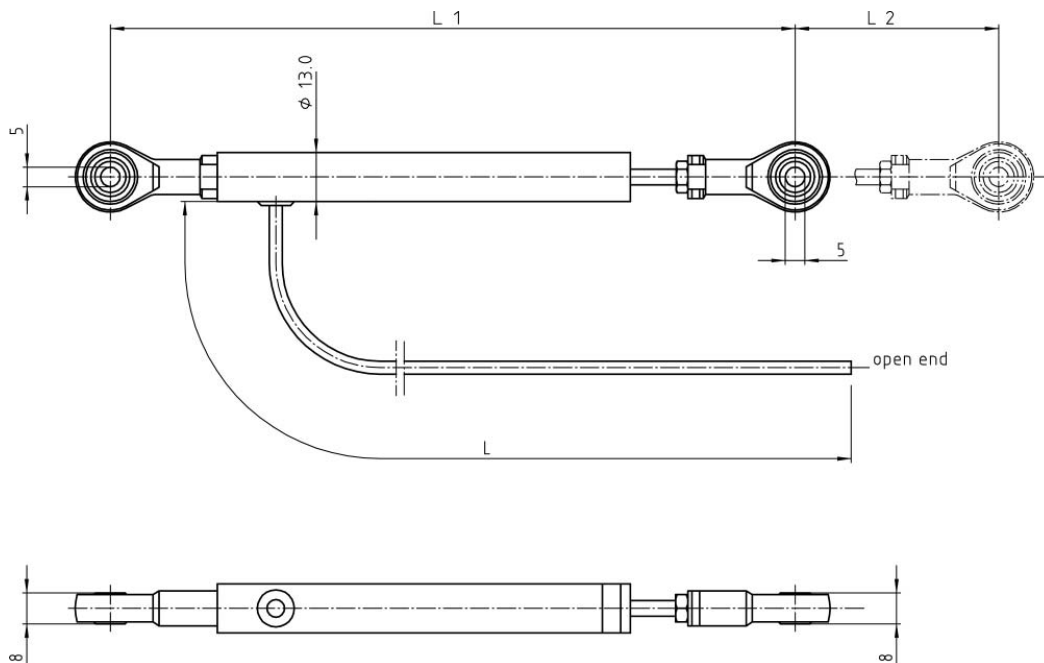


Mechanical data	
Possible mech. range [L2]	50 mm
Min. length [L1]	172 mm
Cable length [L]	150 ... 1000 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Tightening torque	10 Nm
Max. shaft velocity	1000 mm/sec
Weight [25 ... 150 mm]	90 ... 150 g

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

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

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



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.

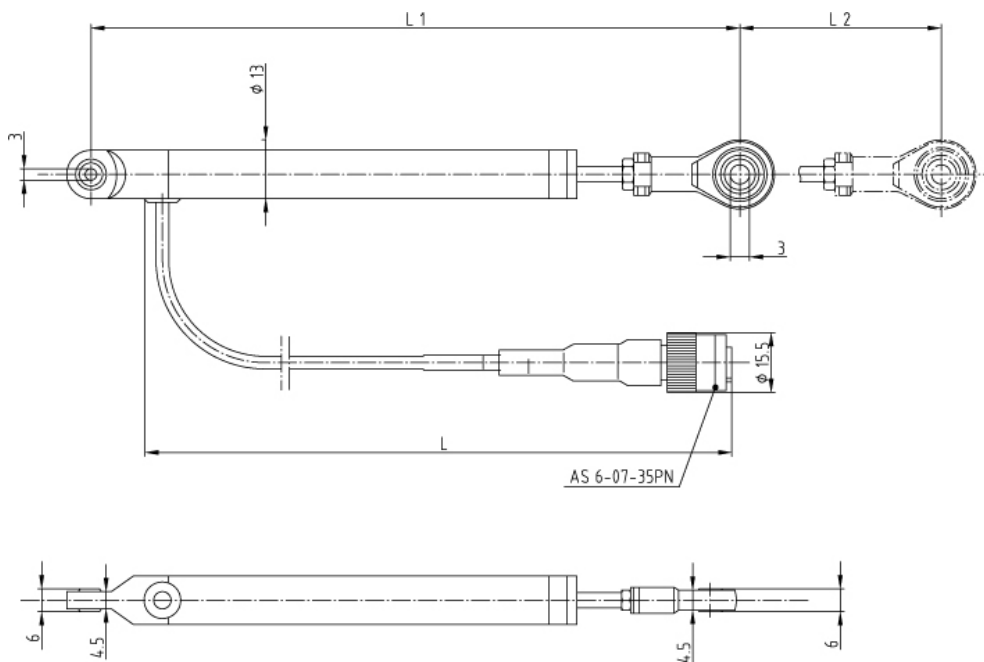


Mechanical data	
Possible mech. range [L2]	50 mm
Min. length [L1]	120 mm
Cable length [L]	150 ... 1000 mm
Mounting hole	∅ 3 mm
Protection	IP 66
Max. shaft velocity	10 mm/sec
Weight	approx. 60 g

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

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

Part number	
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.

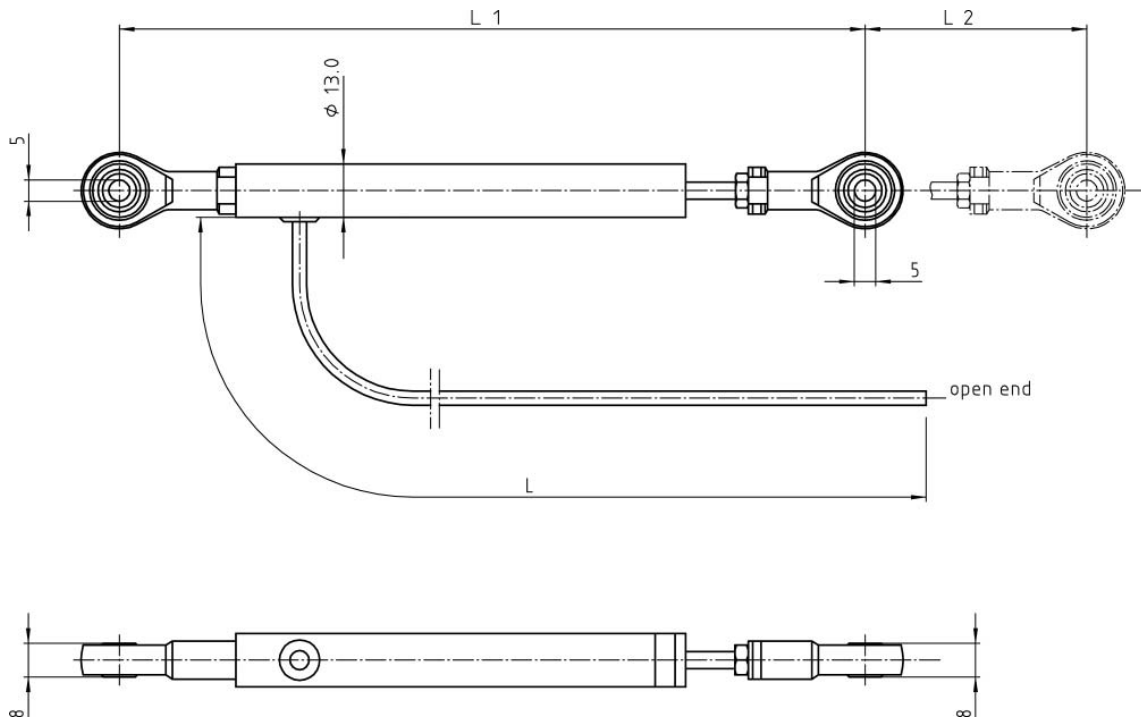


Mechanical data	
Possible mech. range [L2]	75 mm
Min. length [L1]	197 mm
Cable length [L]	150 ... 1000 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Tightening torque	10 Nm
Max. shaft velocity	1000 mm/sec
Weight [25 ... 150 mm]	90 ... 150 g

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

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

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



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.

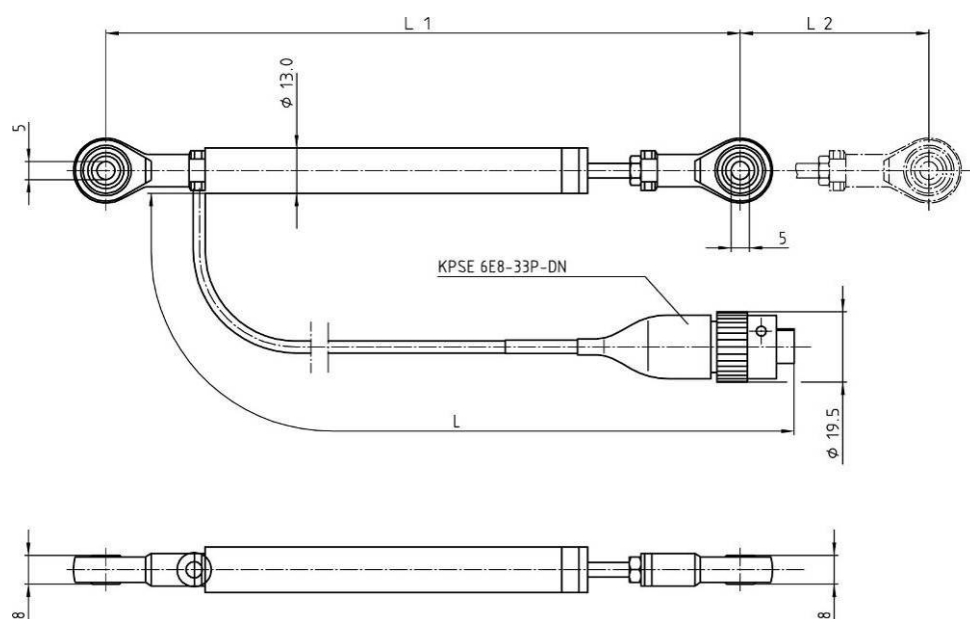


Mechanical data	
Cable length L	150 ... 1000 mm
Min. length L1	220 mm
Possible mech. range L2	79 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Max. shaft velocity	10 m/sec
Weight	52 g

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

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

Part number	
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.

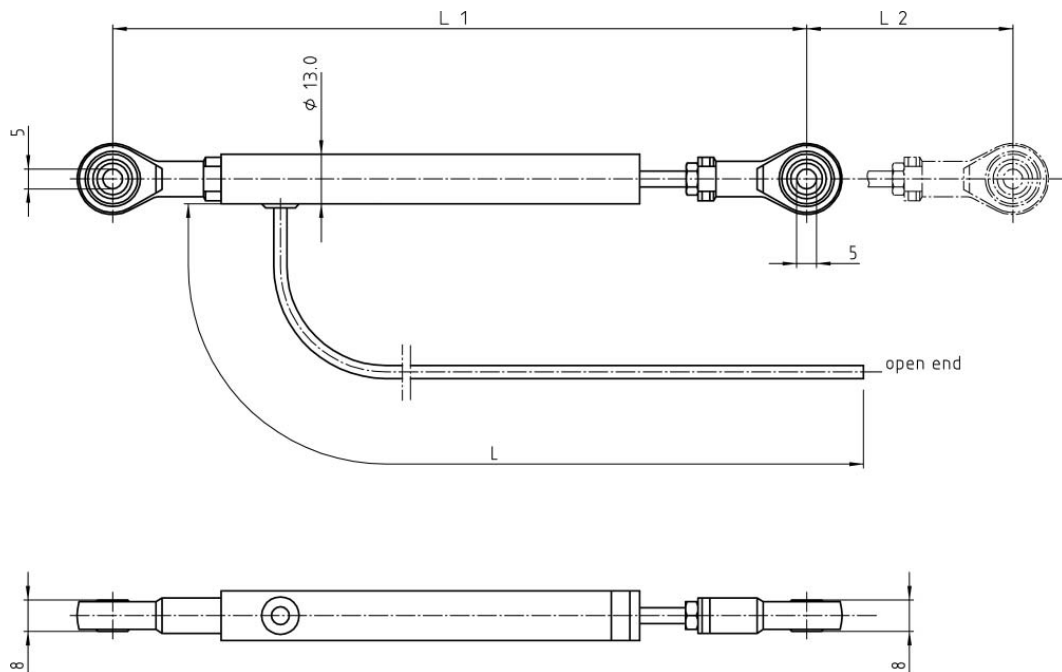


Mechanical data	
Possible mech. range [L2]	100 mm
Min. length [L1]	220 mm
Cable length [L]	150 ... 1000 mm
Mounting	2 x M5
Tightening torque	10 Nm
Sealing	O-ring shaft seal
Max. shaft velocity	1000 mm/sec
Weight [25 ... 150 mm]	90 ... 150 g

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

Part 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.

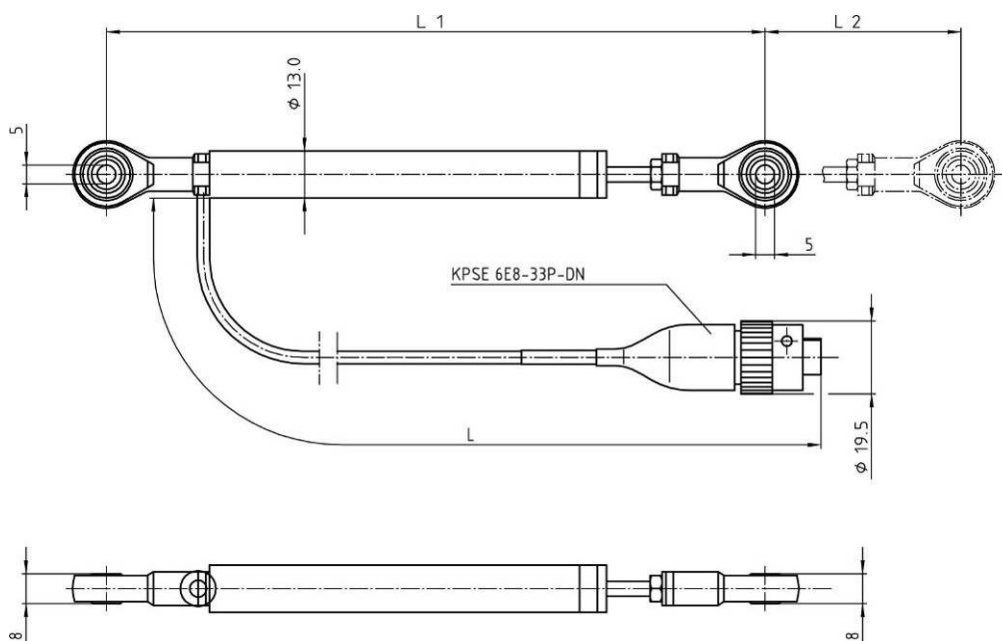


Mechanical data	
Cable length L	150 ... 1000 mm
Min. length L1	244 mm
Possible mech. range L2	104 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Max. shaft velocity	10 m/sec
Weight	62 g

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

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

Part 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.

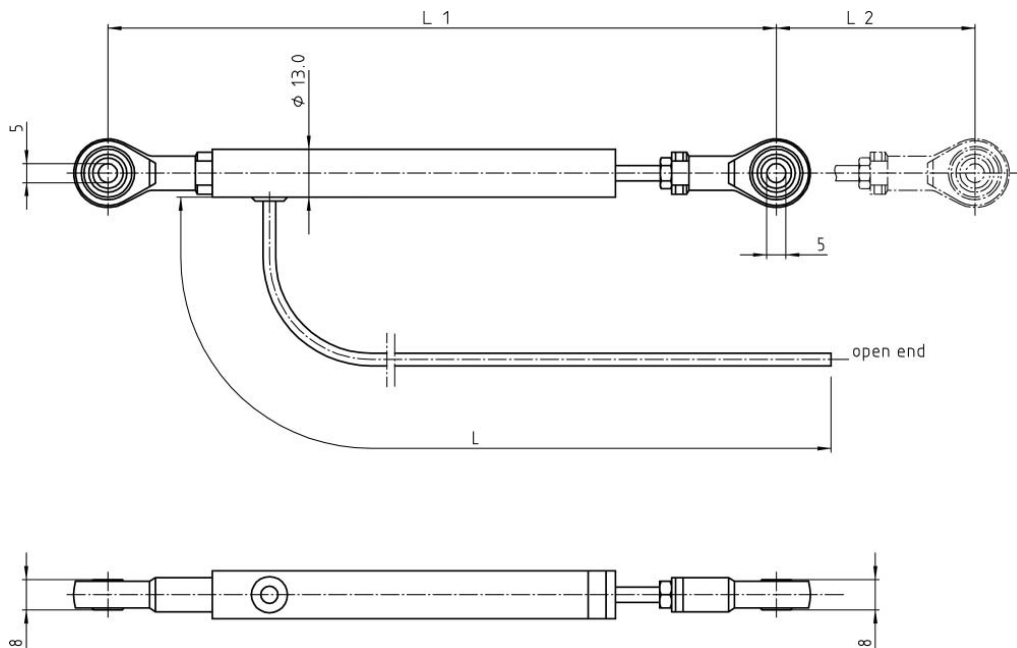


Mechanical data	
Possible mech. range [L2]	150 mm
Min. length [L1]	278 mm
Cable length [L]	150 ... 1000 mm
Mounting	2 x M5
Sealing	O-ring shaft seal
Tightening torque	10 Nm
Max. shaft velocity	1000 mm/sec
Weight [25 ... 150 mm]	90 ... 150 g

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

Part 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	

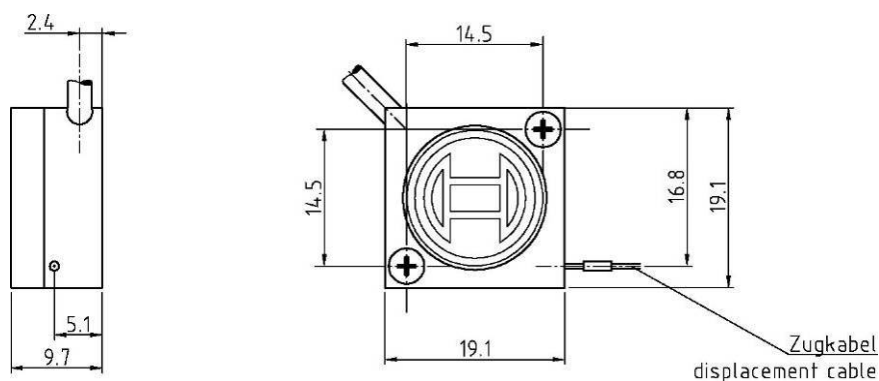
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	50 V

Part 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	

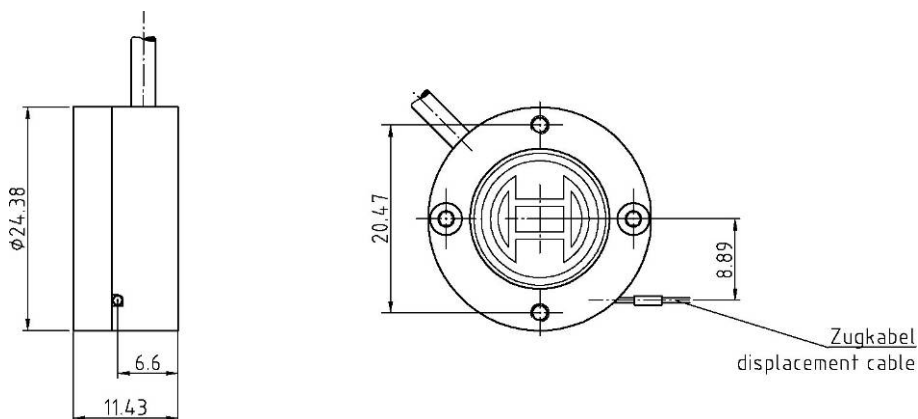
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	50 V

Part 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	

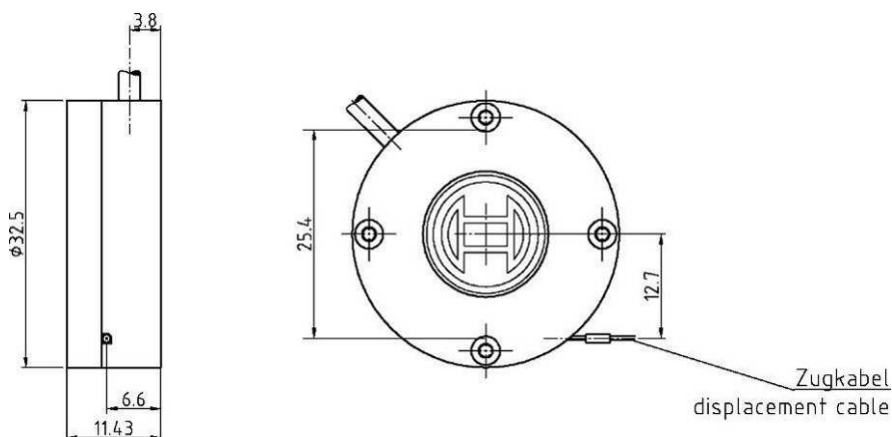
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	38 V

Part 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

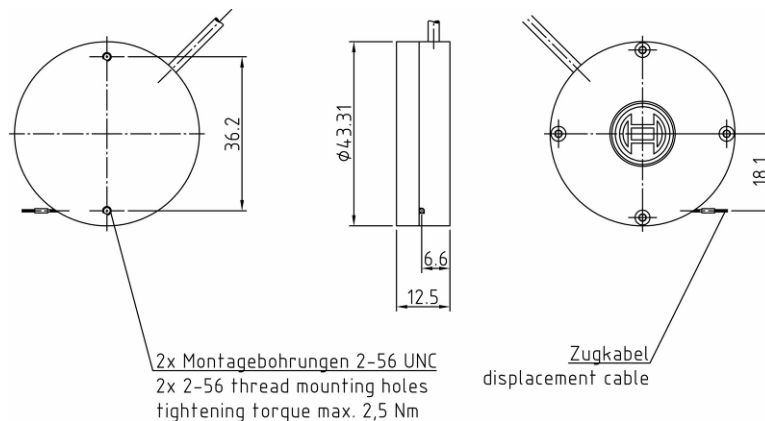
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	38 V

Part 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

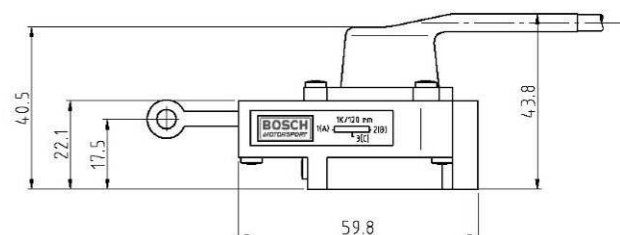
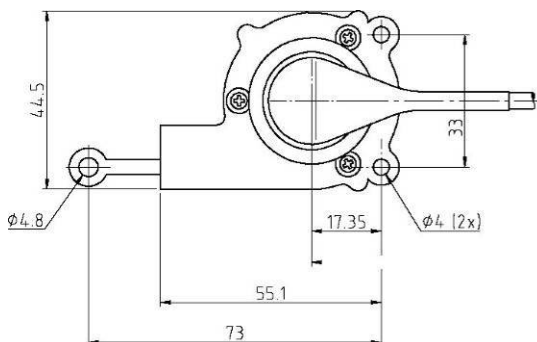
Electronic data	
Nominal resistance	1,0 kΩ
Non-linearity	± 1 %
Usual power supply	5 V
Max. power supply	25 V

Part 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	

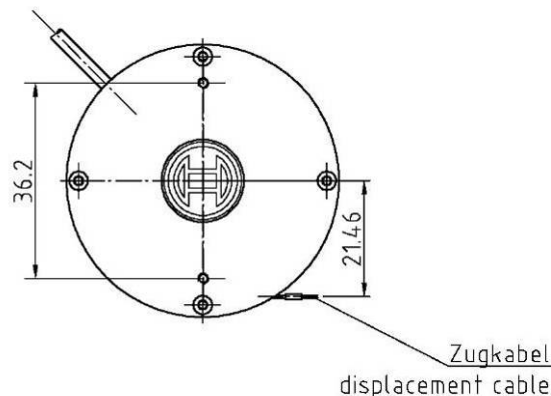
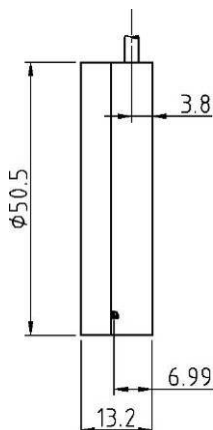
Electronic data	
Nominal resistance	5,0 kΩ ± 10 %
Non-linearity	± 0,5 %
Usual power supply	5 V
Max. power supply	38 V

Part 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.

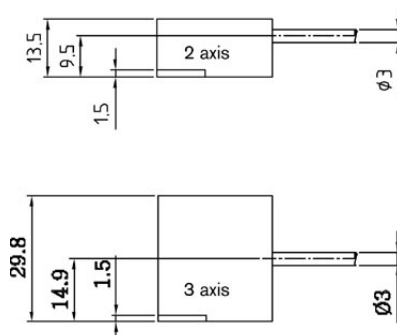
Manufactured in DR-25 sleeve; various connector options available.



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

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

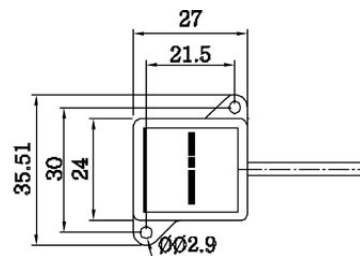
Characteristic	
Offset x, y, z	2,5 V at 0 g
Sensitivity x, y, z	440 mV/g



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

Part 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.



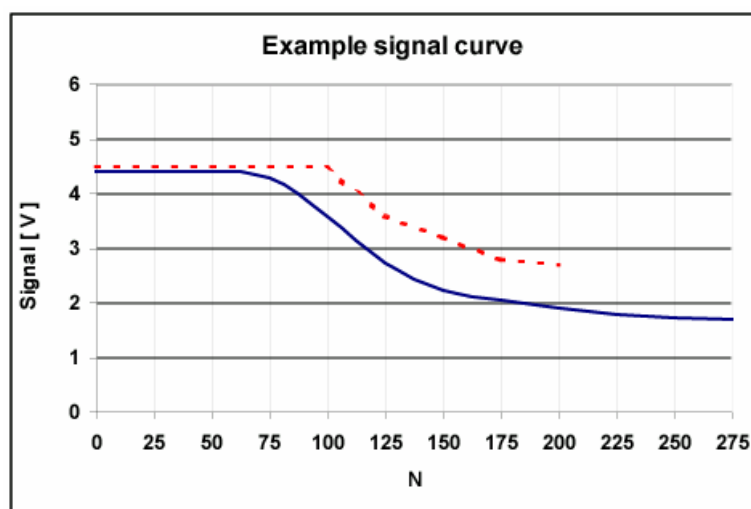
Mechanical data	
Weight	90 g
Max. deviation	$\pm 10^\circ$
Fixing	2 x M10 x 1
Tightening torque	16 Nm
Dimensions	22 x 22 x 50 mm
Mech. Range	programmable up to 150 N

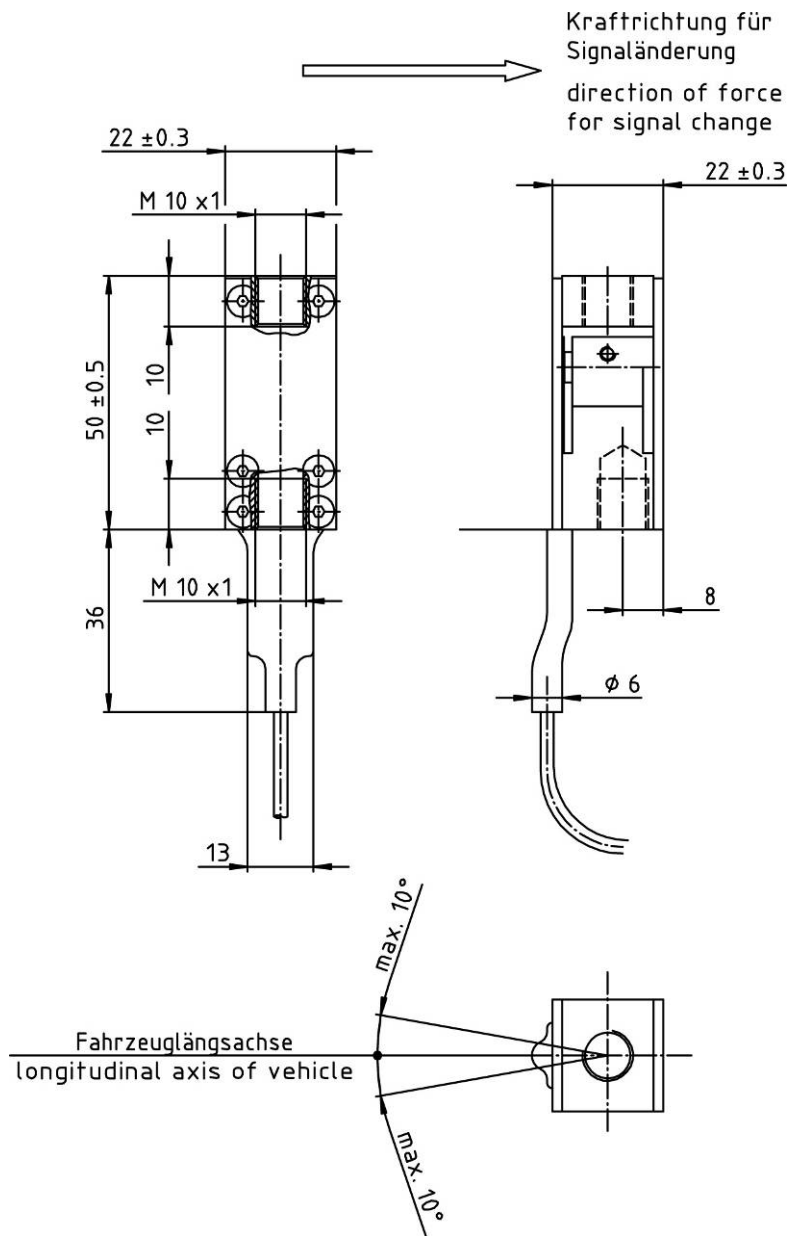
Conditions for use	
Temperature range	0 ... 80°C
Vibration	80 g/5 Hz ... 2 kHz

Characteristic
Individual characteristic will be delivered with each sensor.

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

Part 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





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	$\pm 10^\circ$
Fixing	2 x M10 x 1
Tightening torque	16 Nm
Dimensions	65 x 16 x 16 mm
Mech. range	programmable up to 450 N
Fmax	800 N
Mech. load limit	1800 N

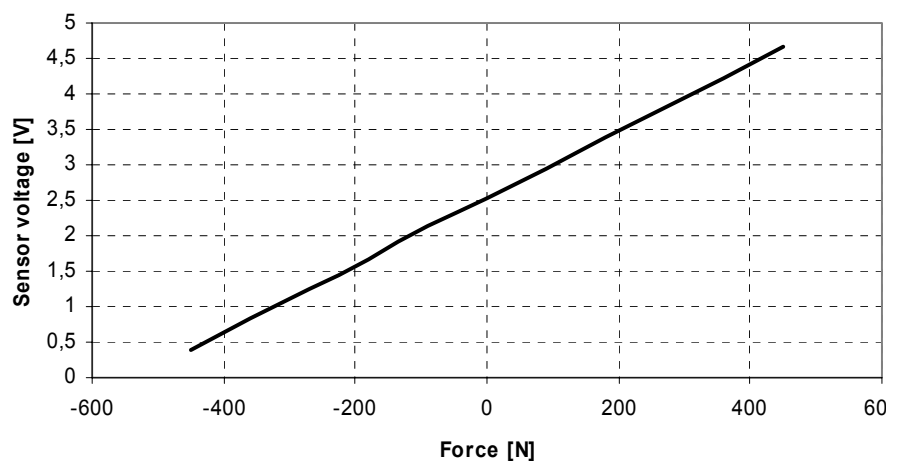
Electronic data	
Supply voltage	12 V
Signal output	0,5 ... 4,5 V
Zero output	2,5 V

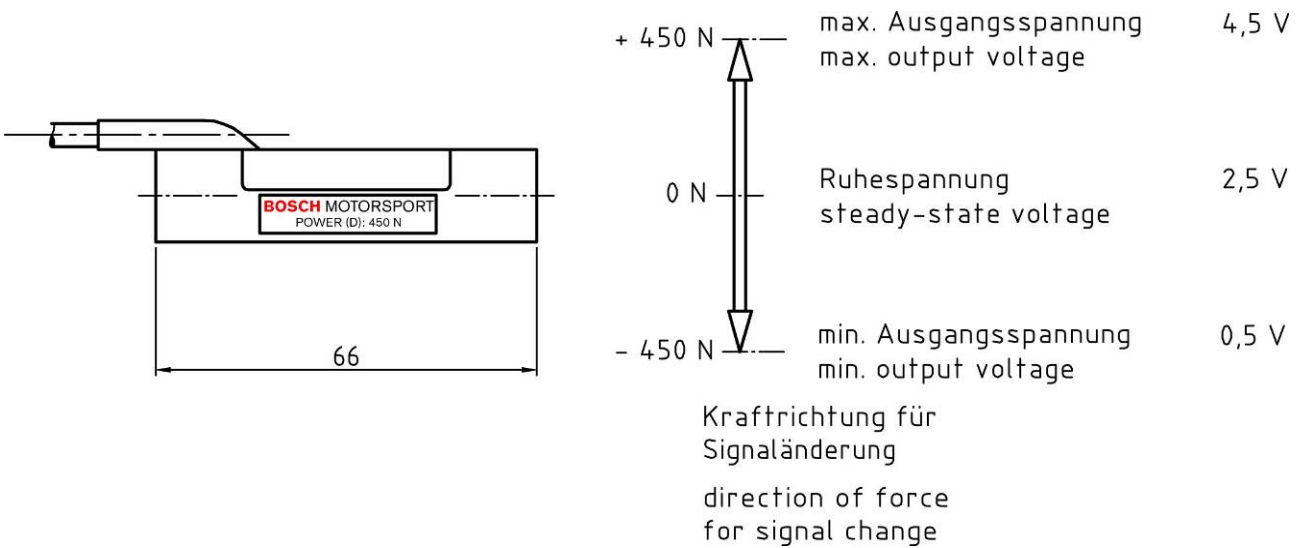
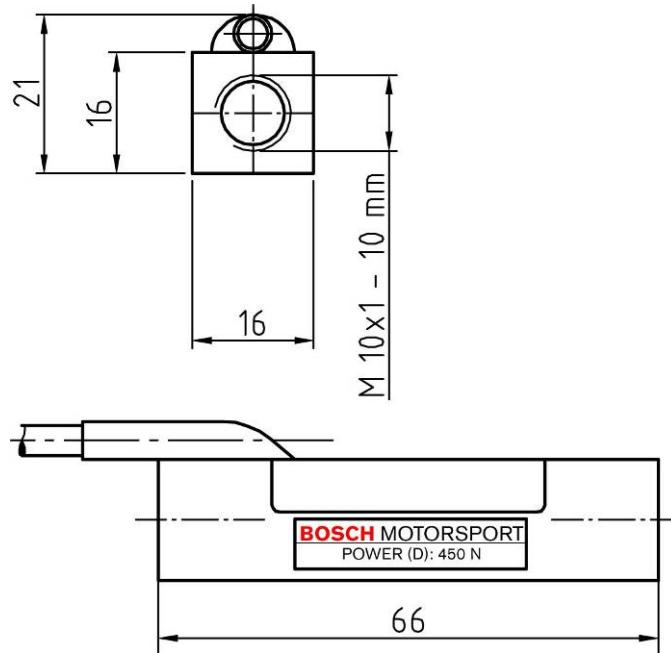
Conditions for use	
Temperature range	0 ... 80°C
Vibration	80 g/5 Hz ... 2 kHz

Characteristic
Individual characteristic will be delivered with each sensor.

Part 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





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.



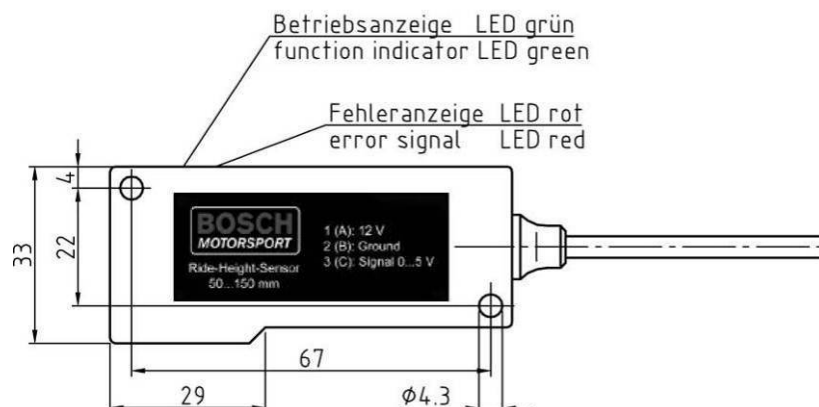
Mechanical data	
Weight	105 g
Measuring range	60 ... 140 mm
Dimensions	75 x 33 x 18 mm
Housing	plastic, fibreglass
Protection class	IP 67

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

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

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

Part 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



Yaw Rate Sensor

Yaw Rate Sensor YRS 2

This sensor is designed to measure the yaw rate and lateral acceleration of the vehicle. In order to achieve this, the sensor features both a measuring element for yaw rate and one for lateral acceleration, with one appropriate circuit. The measuring element for yaw rate is built using surface and bulk micromachining technology. Two surface micromachined accelerometers are located on two out of phase oscillating seismic masses.



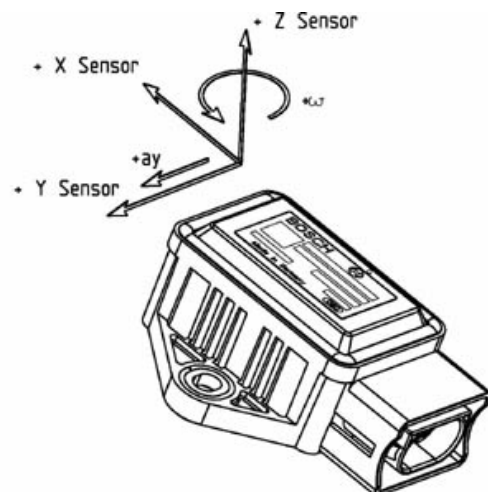
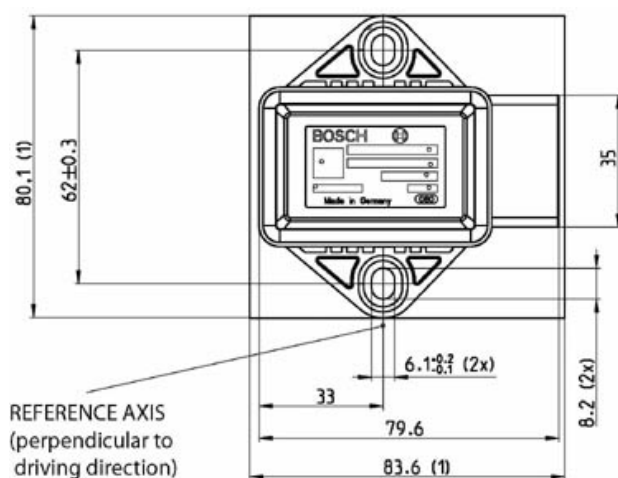
Mechanical data	
Measuring range	100°/s
Overload	1000°/s
Weight	90 g

Conditions for use	
Temperature range	-40 ... 85°C
Shock	300 g

Connector	
Cable harness connector	D 261 205 358

Electronic data	
Supply voltage	8,0 ... 16 V
Current consumption	< 75 mA
Output range	0,5 ... 4.5 V
Reference voltage	2,5 V
Sensitivity	18 mVs/° [-100 ... 100°/s]
Non linearity	< 4 %

Part number	
	0 265 005 262
Offer drawing	0 274 A00 005



Vehicle Components

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.



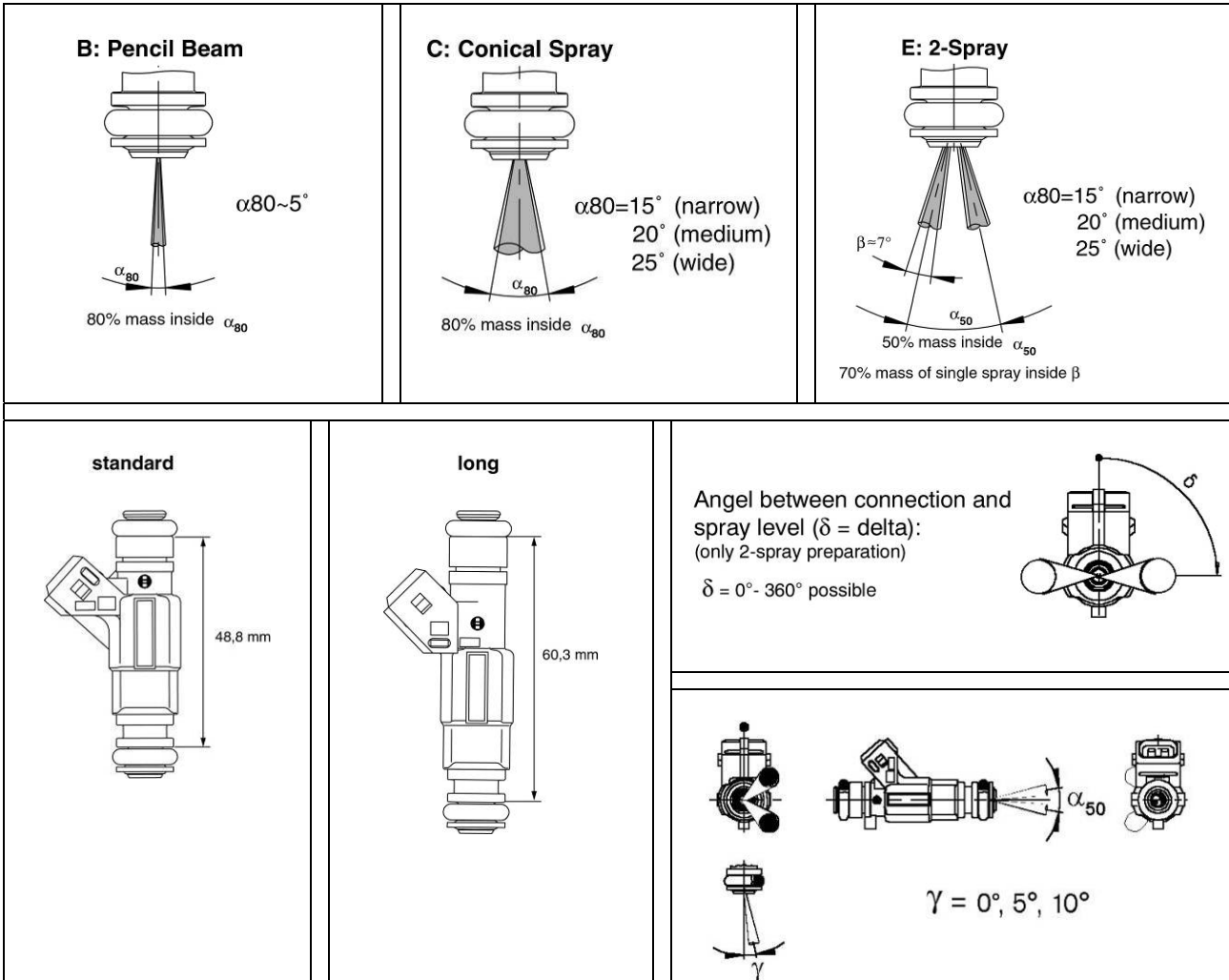
Mechanical data	
System pressure	max. 8 bar
Weight	45, 8 g

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 fog test	DIN 53 167

Technical data						
Part 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.



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.



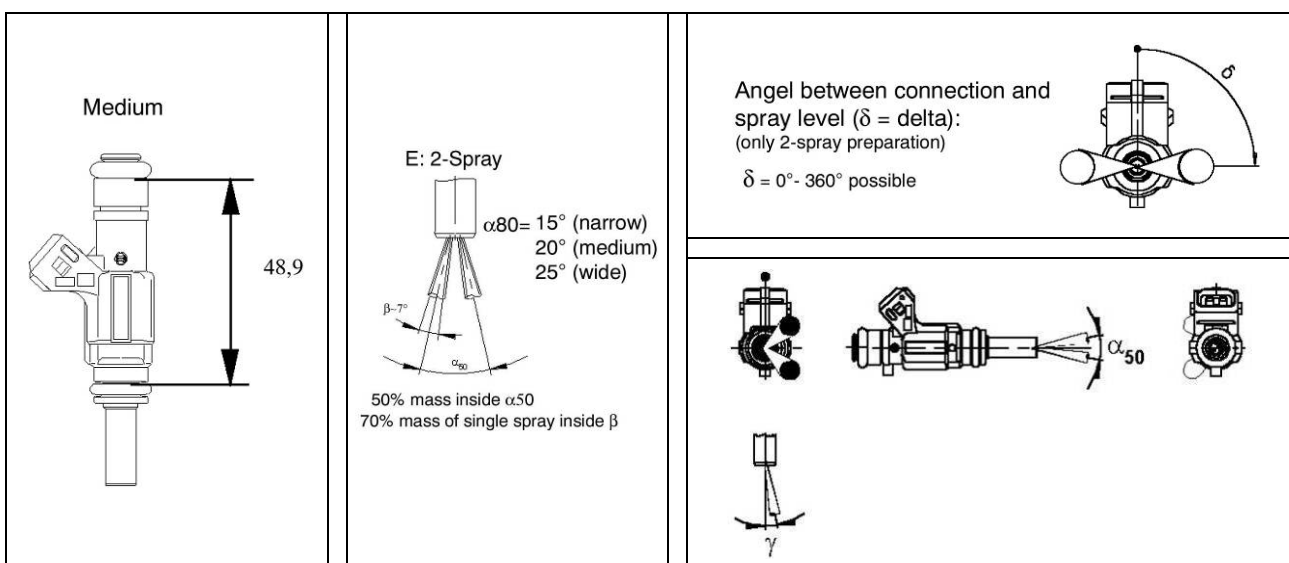
Mechanical data	
System pressure	max. 8 bar
Weight	40 g

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	$\leq 70^\circ\text{C}$
Climate proofness corresponds to saline fog test	DIN 53 167

Technical data								
Part numbers	Design	Type	Flow rate at 3 bar (N-Heptan)	Spray angle				Impedance
				α	β	γ	δ	
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.



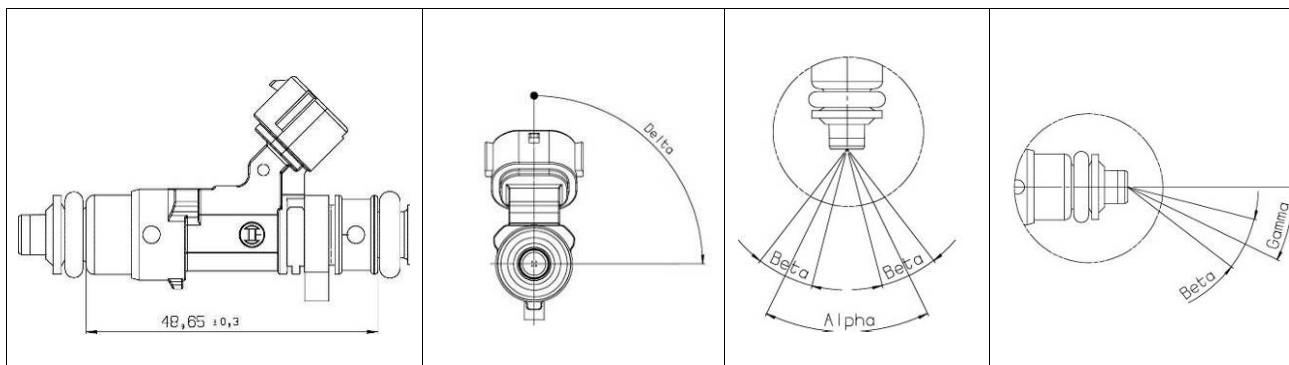
Mechanical data	
System pressure	max. 8 bar
Weight	25 g
Spray angle	25° or 70°

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 fog test	DIN 50 021

Technical data						
Part 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.



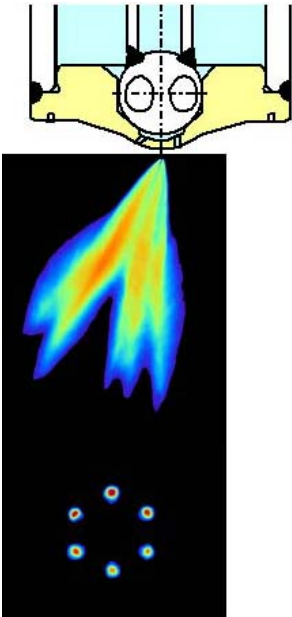
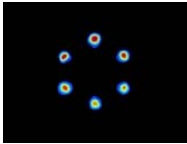
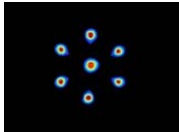
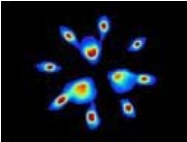
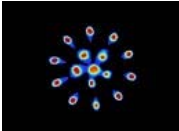

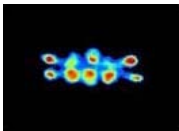
Mechanical data	
System pressure	max. 200 bar
Flow rate	e.g. 30 ccm/sec at 100 bar
Weight	78 g
Length	85 mm

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

Part number	
	on request

Examples of variations, further variations on request

	 <p>Jets on a circle</p>	 <p>Jets on a circle and a middle jet</p>
	 <p>Jets on two circles</p>	 <p>Jets on two circles and a middle jet</p>
	 <p>Jet configuration regarding the spark plug position</p>	 <p>Flat jet configuration</p>

HPI Valve Mini-HDEV 1.2

The Mini HDEV 1.2 can be used 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.



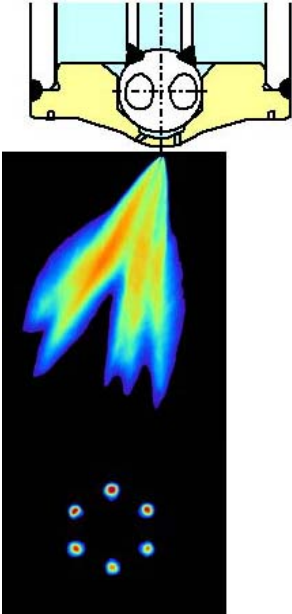
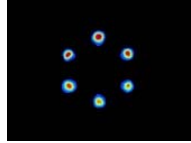
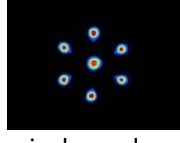
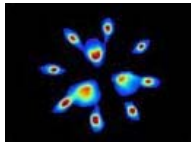
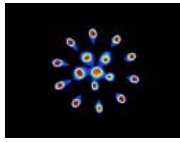
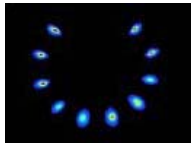
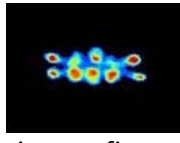
Mechanical data	
System pressure	max. 200 bar
Flow rate	e.g. 30 ccm/sec at 100 bar
Weight	48 g
Length	51 mm

Electrical data	
Resistance	1,1 Ω
Voltage	14 V
Peak current	13,2 A

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

Part number
on request

Examples of variations, further variations on request

	 <p>Jets on a circle</p>	 <p>Jets on a circle and a middle jet</p>
	 <p>Jets on two circles</p>	 <p>Jets on two circles and a middle jet</p>
	 <p>Jet configuration regarding the spark plug position</p>	 <p>Flat jet configuration</p>

HPI Valve Mini-HDEV LV

The Mini-HDEV LV can be used 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.



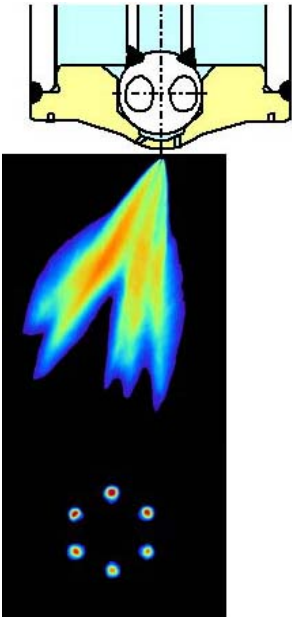
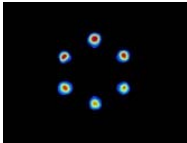
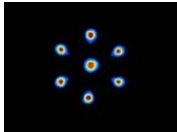
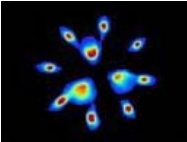
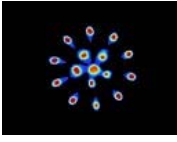

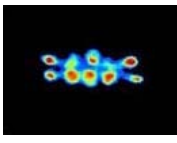
Mechanical data	
System pressure	max. 100 bar
Flow rate	e.g. 30 ccm/sec at 100 bar
Weight	48 g
Length	51 mm

Electrical data	
Resistance	<0,2 Ω
Voltage	14 V
Peak current	26 A

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

Part number	
on request	

Examples of variations, further variations on request

	 <p>Jets on a circle</p>	 <p>Jets on a circle and a middle jet</p>
	 <p>Jets on two circles</p>	 <p>Jets on two circles and a middle jet</p>
	 <p>Jet configuration regarding the spark plug position</p>	 <p>Flat jet configuration</p>

Power Stage Units

HPI 1.16 LV / LVD

In combination with a Bosch Motorsport ECU the HPI 1.16 Box enables the running of high pressure injection valves. The injector current is realised by a switched current regulation with booster period, pick-up period, holding period and recharging period.

This HPI Box can be used for example in Formula 1 race cars.



HPI 1.16 LV

Mechanical data	
Max. number of cylinders	10
Dust and waterproof aluminium housing	
Filtered connectors in military technology with high pin density	
Vibration damped printed circuit boards	
Flexible housing fixation points	
Size without connectors	135 x 101 x 43 mm
Weight	560 g
Communication interfaces	1 CAN, 1 K-Line

Conditions for use	
Housing temperature	-25 ... 85 °C
Operating voltage	8 ... 18 V
Nominal voltage	14,0 V
Max. vibration	15 g sinus and random at 20 ... 2000 Hz for 5 h

Electronic data	
Optimised for Bosch injection valves Mini-HDEV LV	
Max. rpm	20.000
Internal voltage regulator	-

Part number	
F 01T A20 017	

HPI 1.16 LVD

Mechanical data	
Max. number of cylinders	10
Dust and waterproof aluminium housing	
Filtered connectors in military technology with high pin density	
Vibration damped printed circuit boards	
Flexible housing fixation points	
Size without connectors	135 x 101 x 43 mm
Weight	710 g
Communication interfaces	1 CAN, 1 K-Line

Conditions for use	
Housing temperature	-25 ... 70 °C
Operating voltage	8 ... 18 V
Nominal voltage	14,0 V
Max. vibration	15 g sinus and random at 20 ... 2000 Hz for 5 h

Electronic data	
Optimised for Bosch injection valves Mini-HDEV LV	
Max. rpm	20.000
Internal voltage regulator	14 ... 17 V

Part number	
F 01T A20 016	

HPI 1.16 HV / HVD

In combination with a Bosch Motorsport ECU the HPI 1.16 Box enables the running of high pressure injection valves. The injector current is realised by a switched current regulation with booster period, pick-up period, holding period and recharging period.

This HPI Box can be used for example in racing series like DTM, 24 h Le Mans, etc.



HPI 1.16 HV

Mechanical data	
Max. number of cylinders	10
Dust and waterproof aluminium housing	
Filtered connectors in military technology with high pin density	
Vibration damped printed circuit boards	
Flexible housing fixation points	
Size without connectors	135 x 101 x 43 mm
Weight	575 g
Communication interfaces	1 CAN, 1 K-Line

Conditions for use	
Housing temperature	-25 ... 85 °C
Operating voltage	8 ... 18 V
Nominal voltage	14,0 V
Max. vibration	15 g sinus and random at 20 ... 2000 Hz for 5 h

Electronic data	
Optimised for Bosch injection valves Mini-HDEV 1.2	
Max. rpm	12.500
Internal voltage regulator	-

Part number	
F 01T A20 019	

HPI 1.16 HVD

Mechanical data	
Max. number of cylinders	10
Dust and waterproof aluminium housing	
Filtered connectors in military technology with high pin density	
Vibration damped printed circuit boards	
Flexible housing fixation points	
Size without connectors	135 x 101 x 43 mm
Weight	725 g
Communication interfaces	1 CAN, 1 K-Line

Conditions for use	
Housing temperature	-25 ... 70 °C
Operating voltage	8 ... 18 V
Nominal voltage	14,0 V
Max. vibration	15 g sinus and random at 20 ... 2000 Hz for 5 h

Electronic data	
Optimised for Bosch injection valves Mini-HDEV 1.2	
Max. rpm	12.500
Internal voltage regulator	65 ... 90 V

Part number	
F 01T A20 018	

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

Part 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 k Ω
Spark energy	45 ... 55 mJ
U prim. (clamp.)	260 V
Voltage gradient	1,6 kV/ μ s

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

Part 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 Coil PT

This ignition coil is low cost concept for cylinder head installation.

The Single Fire Coil PT has an integrated transistor for use in combination with ECUs without internal ignition power stages.



Mechanical data	
Weight	197 g
Incl. HV-Connector	
Vibration	40 g/5 Hz ... 2,5 kHz

Dwell time, temperature of coil ca 50°C		
Ubatt	6 A	7A
8 V	6 ms	8,6 ms
10 V	3,6 ms	4,41 ms
12 V	2,6 ms	3,11 ms
14 V	2,08 ms	2,41 ms
16 V	1,75 ms	1,98 ms

Electronic data	
High voltage	34 kV
I prim. (stand.)	7 A
Spark current	78 mA
Spark energy	~ 43 mJ
Voltage gradient	2,8 kV/μs

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

Part number	
	0 221 604 014
Offer drawing	A 0 221 604 014

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

Part 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

Part 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

Part 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

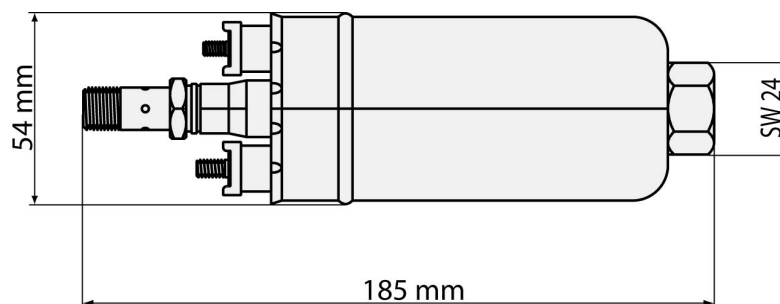


Description	
Fuel delivery	>100 l/h
High temperature reduction	30 l/h
Supply voltage	13,5 V
Current consumption	5 A (5 bar)
Weight	725 g
Non return valve	external

Accessories
Primary connector

Part number
Y 580 701 456

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

Accessories

Primary connector

Part number

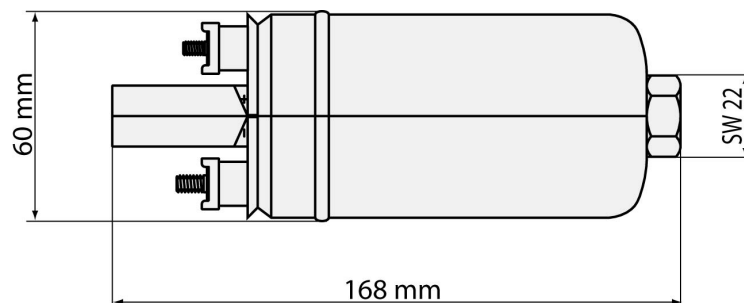
0 580 254 979

Offer drawing

A 580 152 325

Connections

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



Fuel Pump FP 200

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

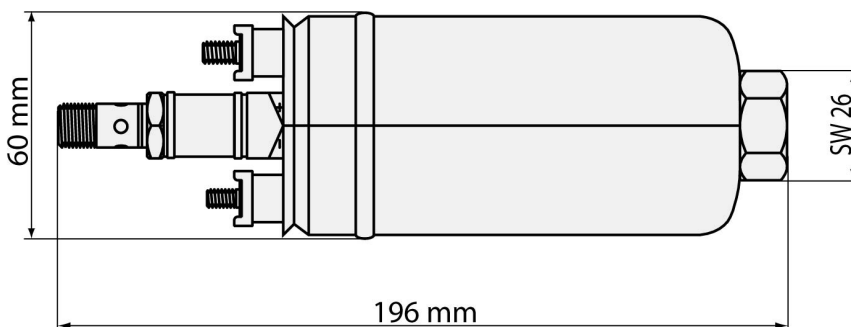


Description	
Fuel delivery	>200 l/h
High temperature reduction	30 l/h
Supply voltage	13,5 V
Current consumption	13 A
Weight	1030 g
Non return valve	external

Accessories	
Primary connector	

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

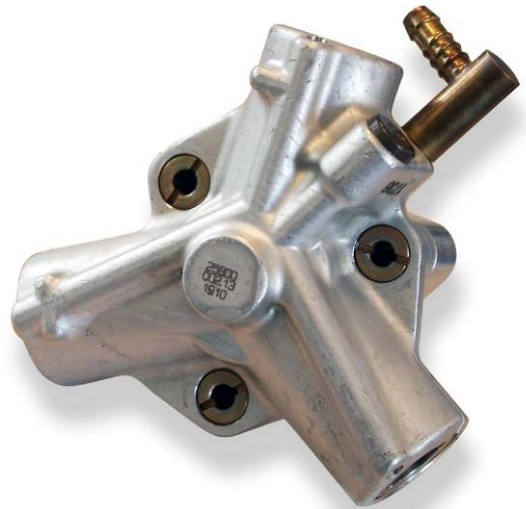
Connections	
Intake side	M18 x 1,5
Pressure side	M12 x 1,5
Electrical	+: M6 / -: M5



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

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

Diesel Fuel Pump DFP 300

Fuel delivery: >300 l/h, 5 bar relative

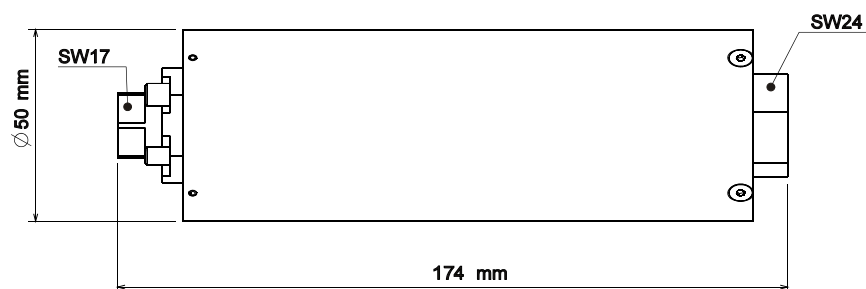
This electrical diesel fuel pump without non-ferrous metal is especially designed for diesel applications. A modified rotor provides higher fuel delivery than the series version. Its tight housing with screwed connectors fits to any intank or inline fuel circuit. This pump results in an excellent weight-to-power ratio.



Description	
Fuel delivery at fuel temp. < 90 °C	>300 l/h
Fuel delivery increase after break-in period of 20 h	20 l/h
Supply voltage	13,5 V
Current consumption	17,2 A
Weight	700 g
Non return valve	internal
Housing version	inline
Allowed diesel spec.	EN590

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

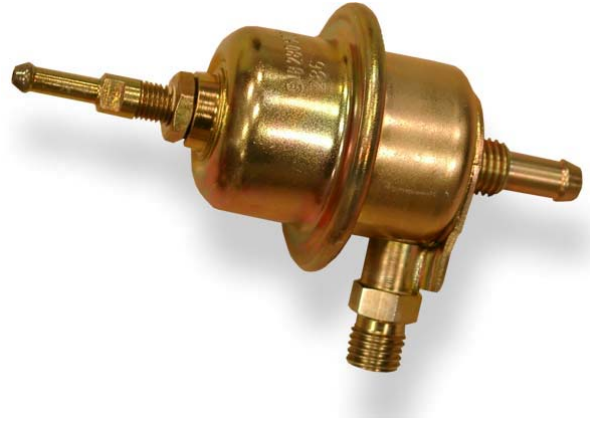
Part number	
DFP 300l/h	B 261 205 366
Offer drawing	A 261 205 366



Fuel Pressure Regulators

Fuel Pressure Regulator 34

Pressure range: 3,4 bar



Mechanical data

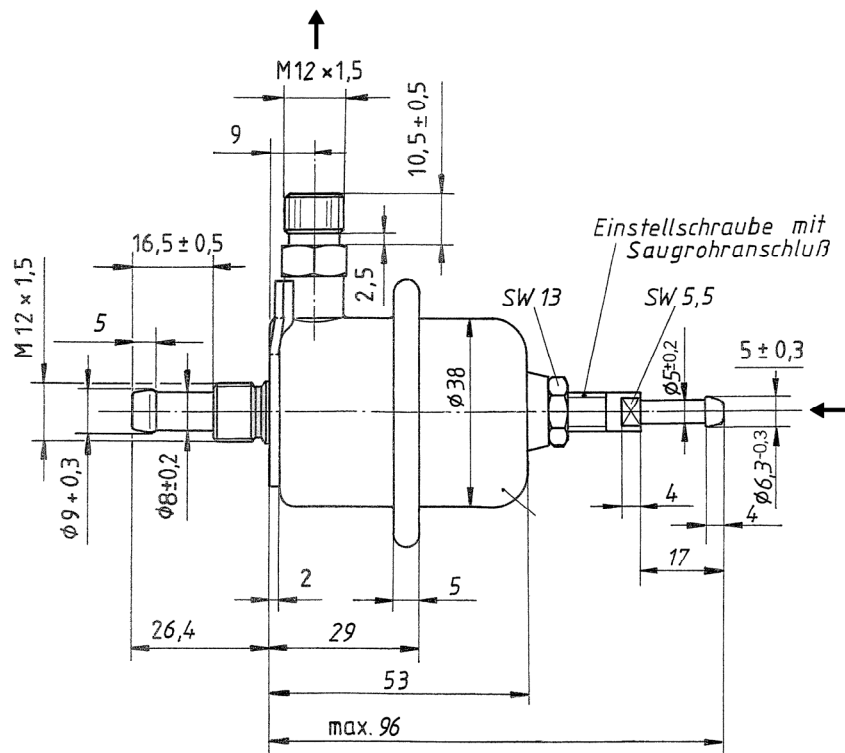
Supply	M12 x 1,5
Reflow	8 mm, tube connector

Part number

	B 280 500 740
Offer drawing	A 280 500 740

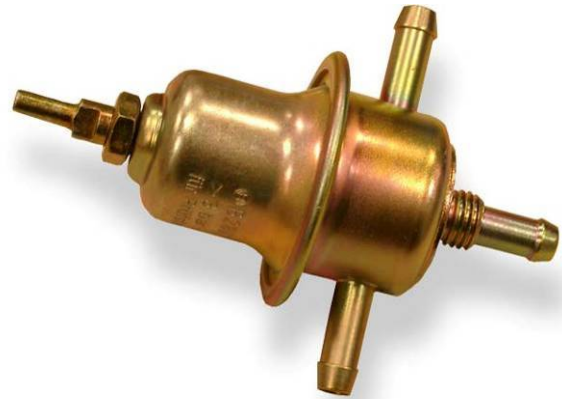
Description

Sheet steel housing with manifold connection



Fuel Pressure Regulator 05-40 A

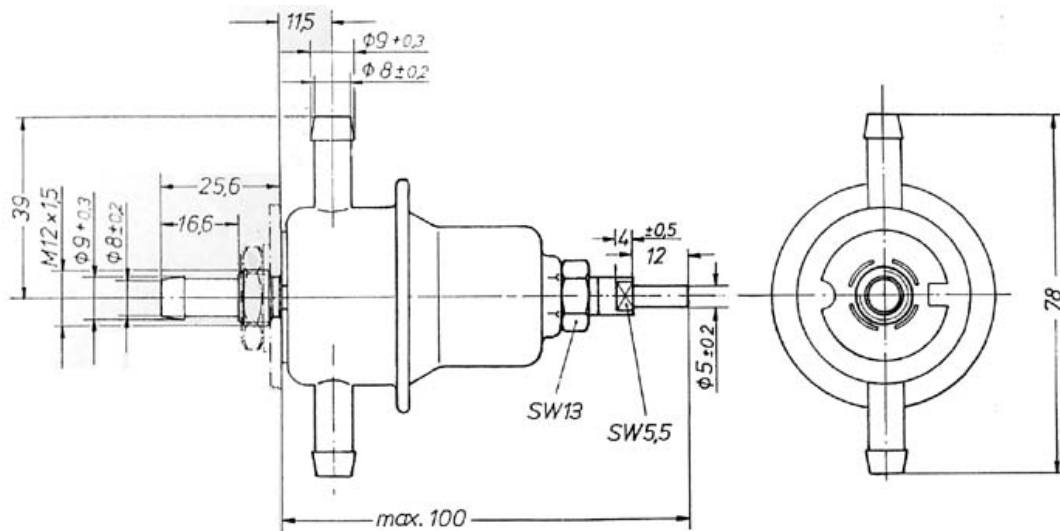
Pressure range: 0,5 ... 4 bar



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

Part number	
	B 280 500 139
Offer drawing	A 280 500 104

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

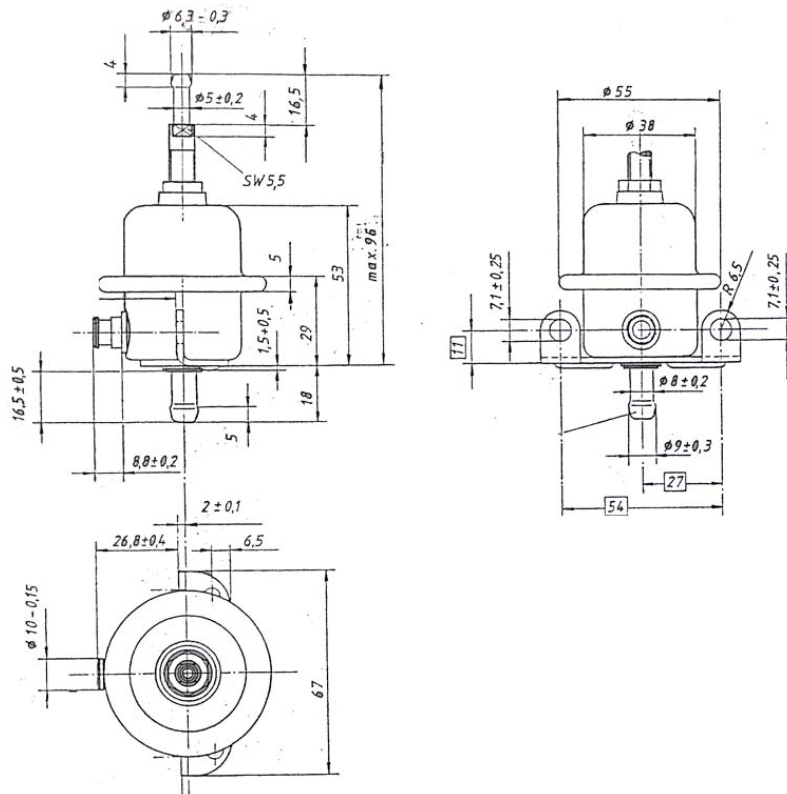
Supply	10 mm, O-ring
Reflow	8 mm, tube connector
Reflow quantity	min. 15 l/h, max. 220 l/h

Part numbers

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

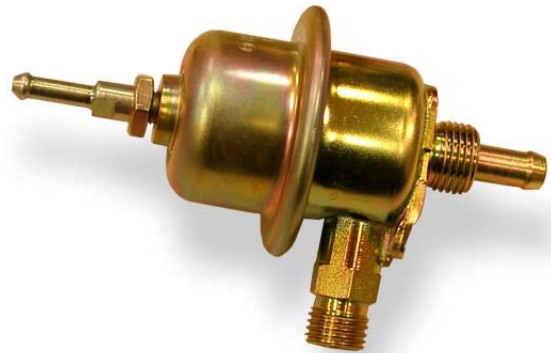
Description

Sheet steel housing with manifold connection



Fuel Pressure Regulator 15-50

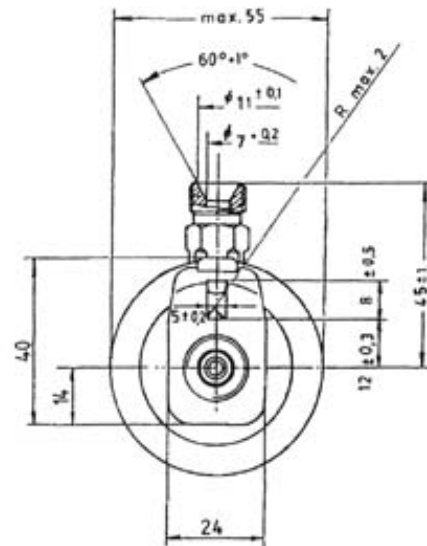
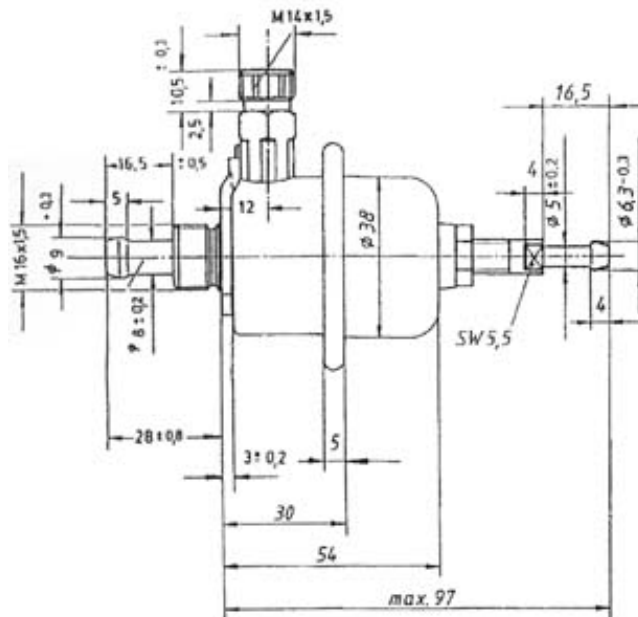
Pressure range: 1,5 ... 5 bar



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

Part number	
	B 280 500 743
Offer drawing	A 280 500 743

Description	
Sheet steel housing with manifold connection	



Fuel Pressure Regulator 19-50

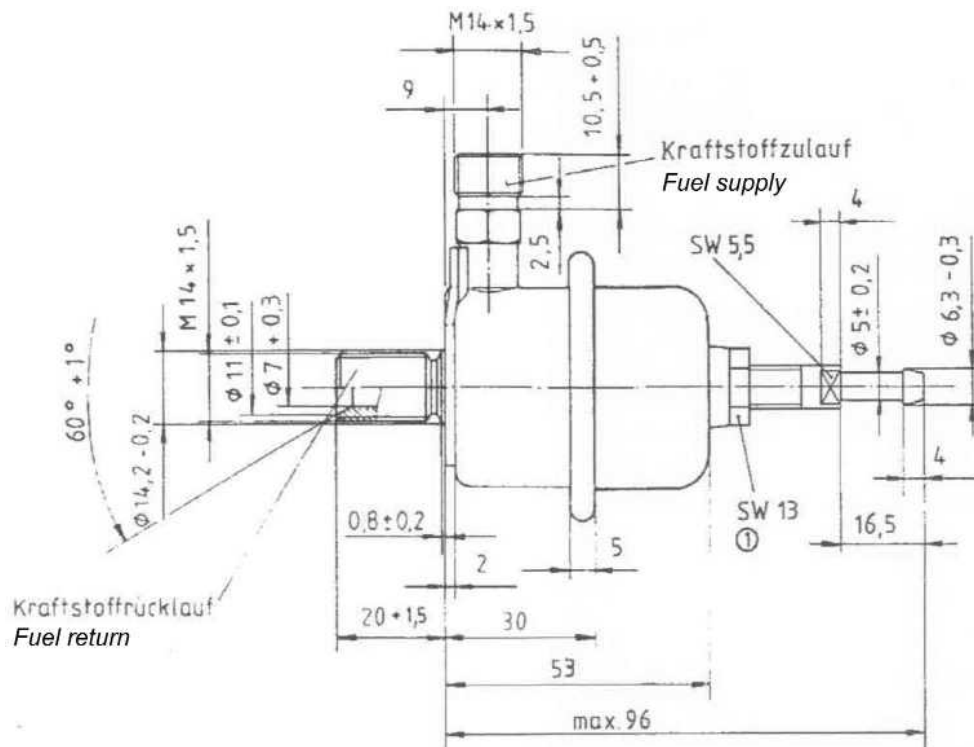
Pressure range: 1,9 ... 5 bar



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

Part number	
	B 280 500 737
Offer drawing	A 280 500 662

Description	
Sheet steel housing with manifold connection	



Fuel Pressure Regulator 20x120

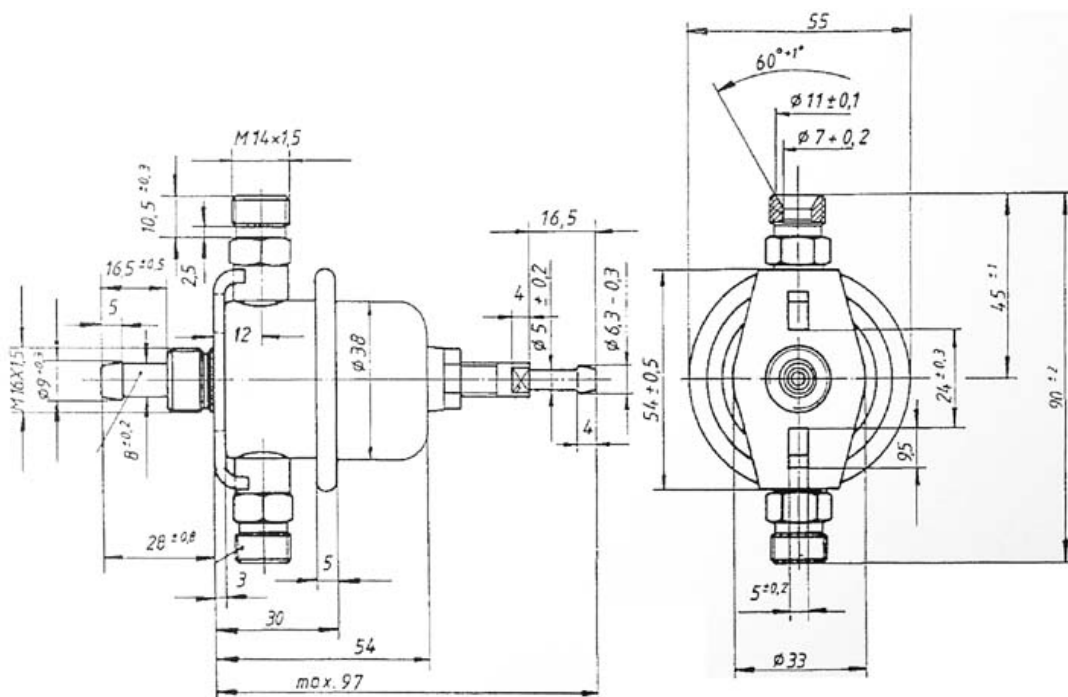
Pressure ranges: 2 ... 5 bar/ 3 ... 6 bar/ 4,5 ... 12 bar



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

Part 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

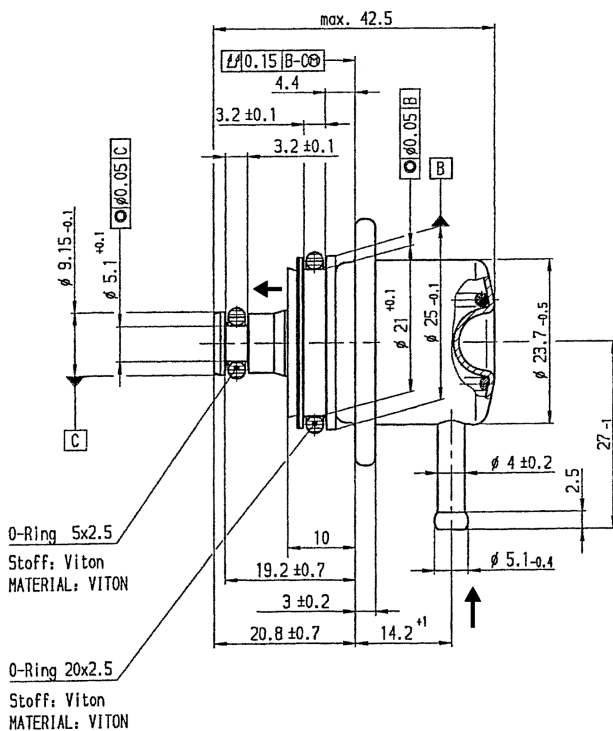
Pressure range: 3,8 bar



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/s ²
Weight	45 g

Part 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

Fuel Pressure Regulator Mini 50

Pressure range: 5,0 bar



Mechanical data

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

Description

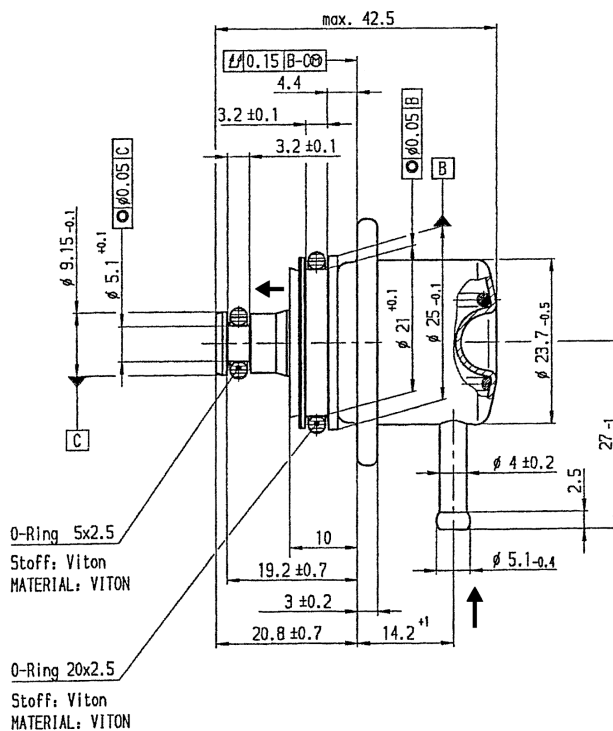
Sheet steel housing with manifold connection

Part 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

Fuel Pressure Regulator Mini A

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

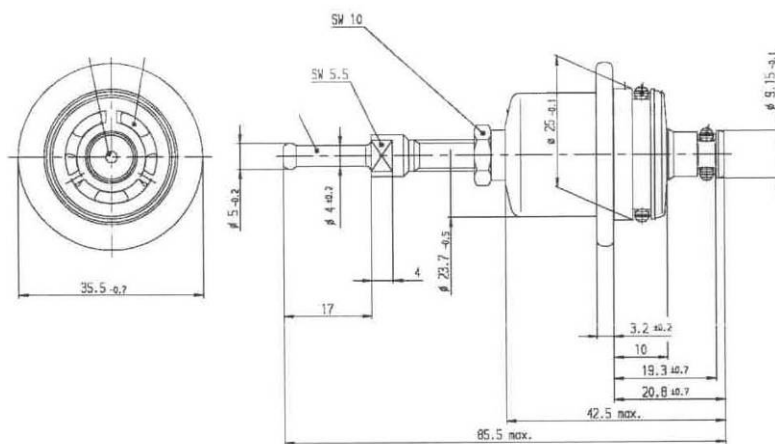


Mechanical data	
Supply	24,6 mm, O-ring
Reflow	9,15 mm, O-ring
Reflow quantity	min. 15 l/h, max. 220 l/h
Weight	58 g

Description	
Light weight aluminium housing	
No manifold connection	

Accessories	
Pre-filter	1 287 431 008

Part 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 Regulator Mini/Mini M

Pressure range: 6/8/10 bar

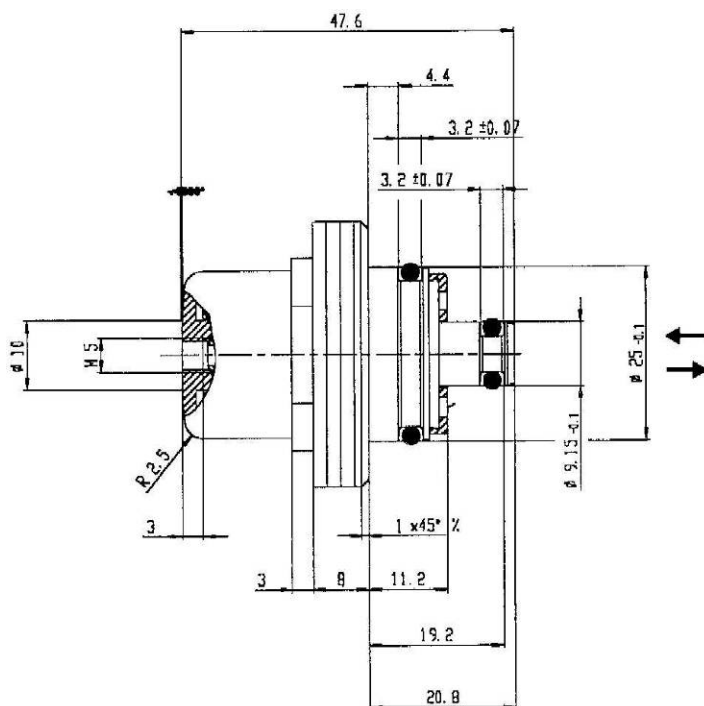
We offer this mini pressure regulator in two fuel-specific versions: the standard version for use with petrol and a M-version for use with methanol.



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	

Part 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

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	$I_{\max} = 1,8 \text{ A}$

Part 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.

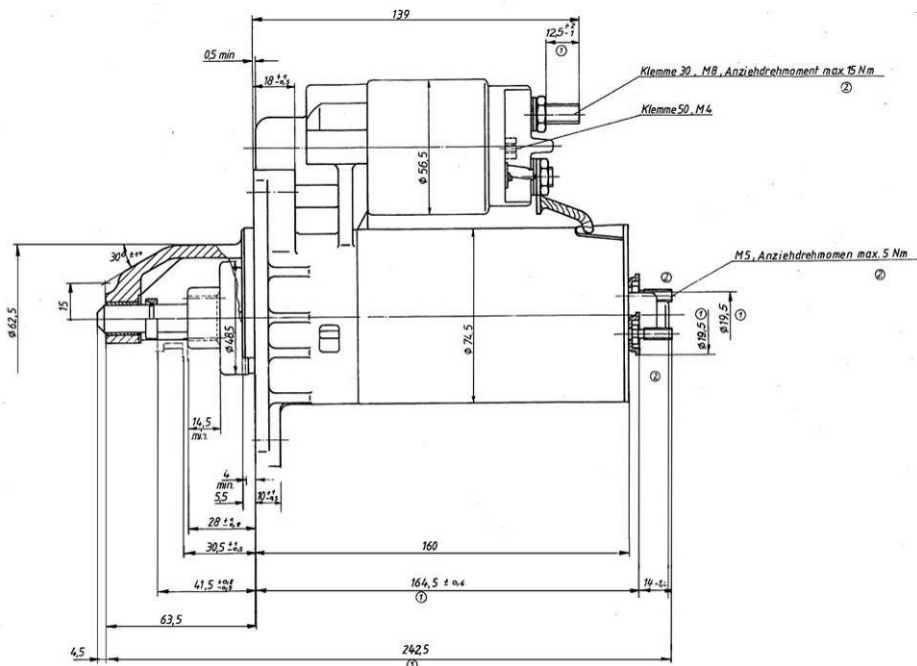


Mechanical data	
Weight	3200 g
Revolutions	3600 x 1/min
Modul	2/11

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

Electrical data	
Performance	1,4 kW

Part 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.

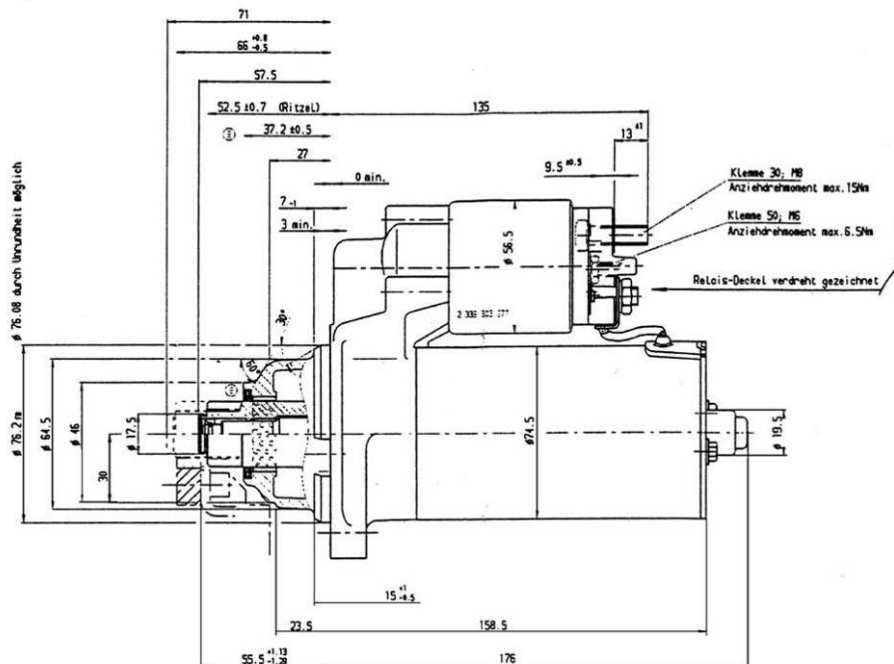


Mechanical data	
Weight	3700 g
Revolutions	3600 x 1/min
Transmission ratio	i 5,0
Modul	2/11

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

Electrical data	
Performance	1,7 kW

Part number	
	B 261 208 186
Offer drawing	A 261 208 186



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

Part 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	

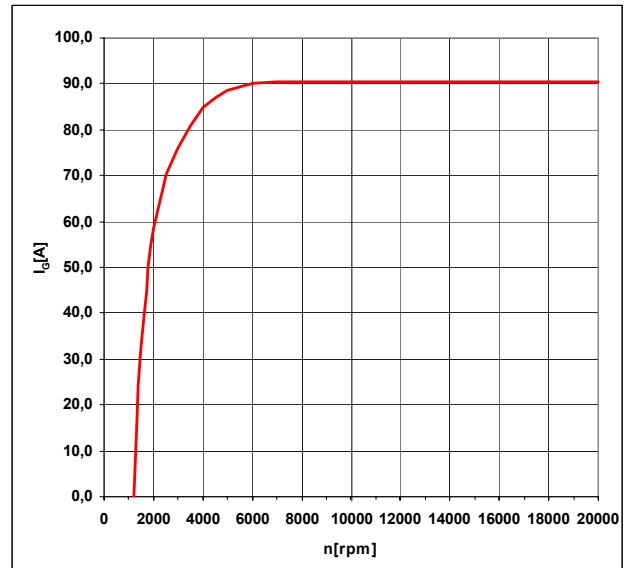
Electric connections	
Battery B+	M8
Control lamp D+	flat-pin connector, see drawing

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

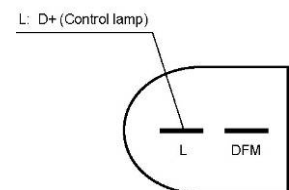
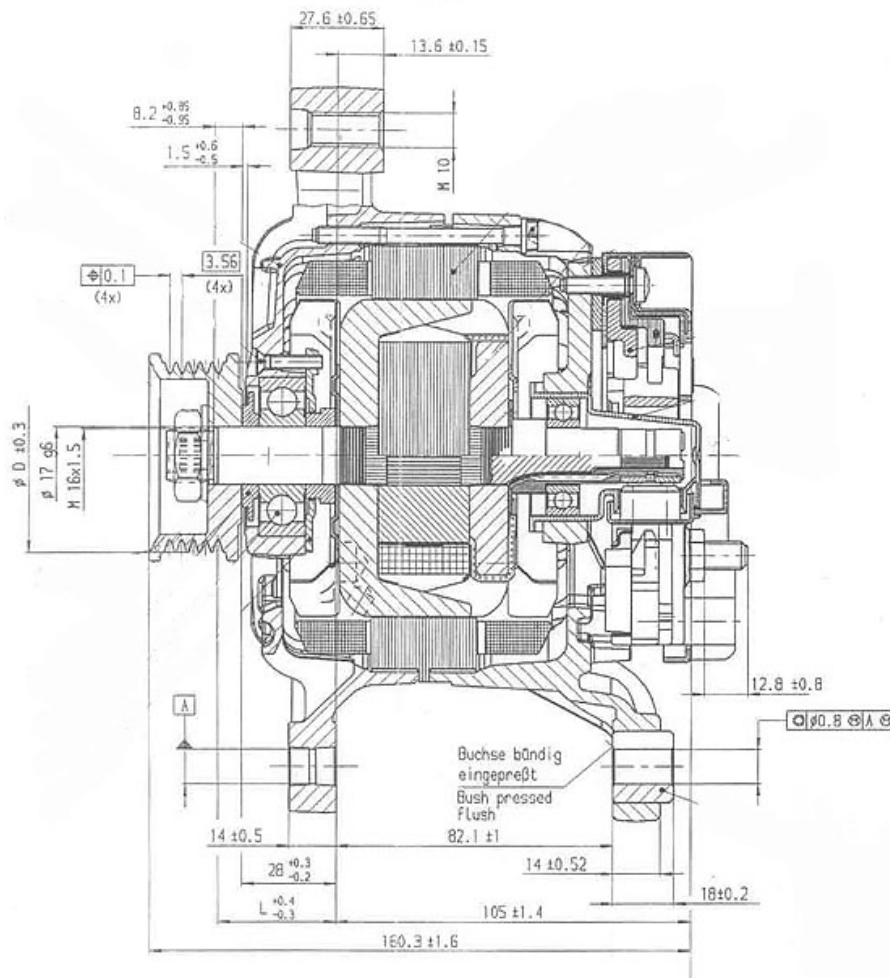
Part number	
	B 120 416 264
Offer drawing	A 124 315 014

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 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	

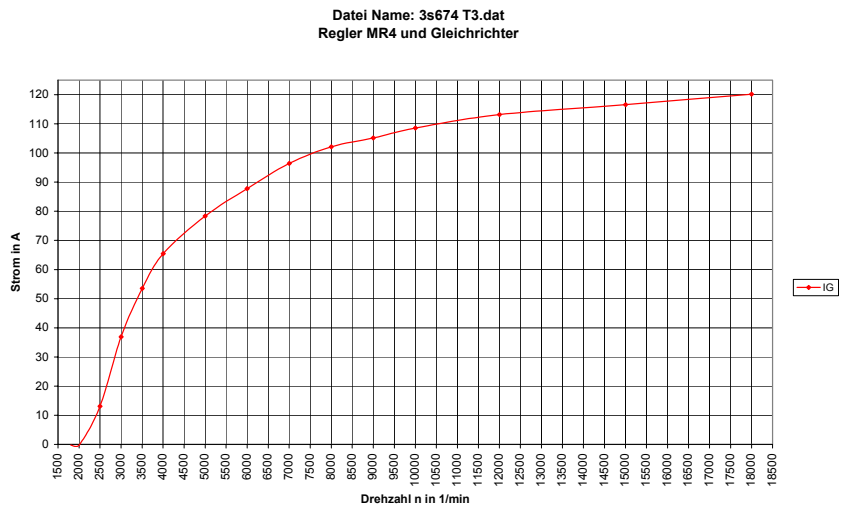
Electric connections	
Battery B+	M6
Control lamp D+	flat-pin connector, see drawing

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

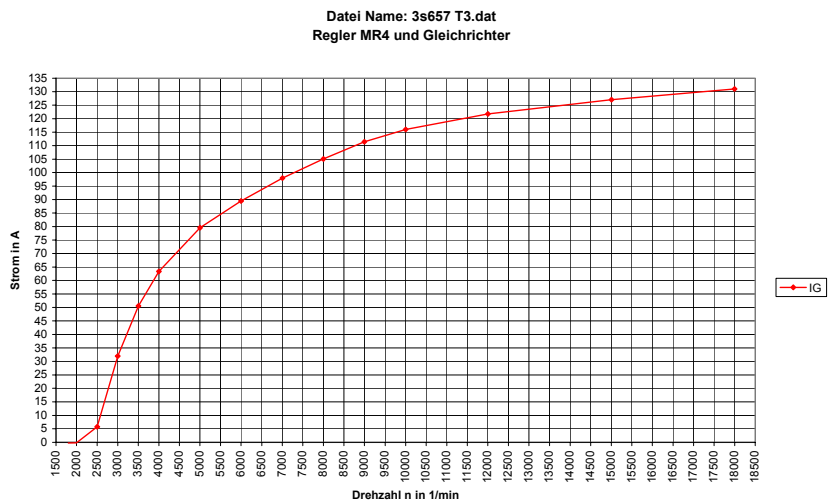
Part numbers	
110 A	
Anticlockwise rotation	B 261 208 606
Clockwise rotation	B 261 208 607
130 A	
Anticlockwise rotation	B 261 208 604
Clockwise rotation	B 261 208 605
140 A	
Anticlockwise rotation	B 261 208 602
Clockwise rotation	B 261 208 603
Offer drawing	
	0 124 OAD 32A

Characteristic 110 A

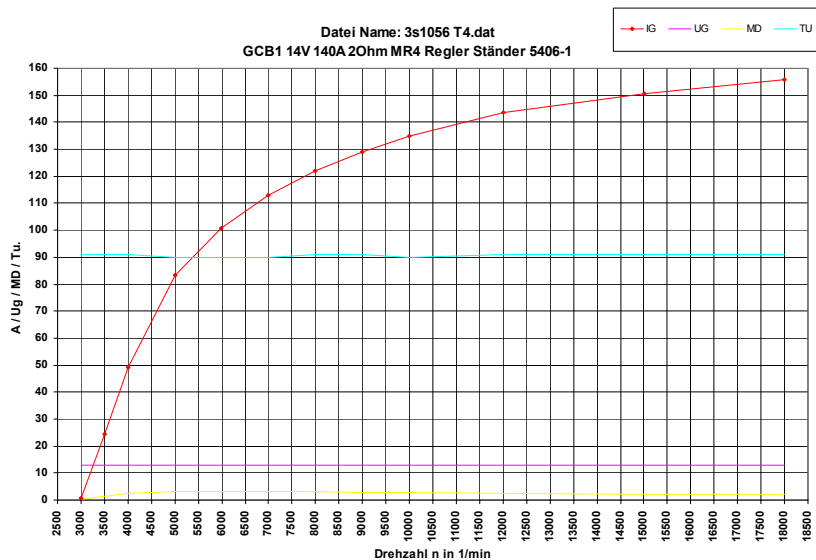
Rpm	IG (A) at 90°C
2000	0
2500	13
3000	37
3500	54
4000	65
5000	78
6000	88
7000	96
8000	102
9000	105
10000	108
12000	113
15000	117
18000	120


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



Alternator F1-01

This alternator with permanent excitation is modified for motorsport demand and splash fluid protected. The stator windings are hand made. The rotor is extra fine balanced and designed for high rotation speed operation. Clockwise and anti-clockwise versions are available while modifications are available on request.



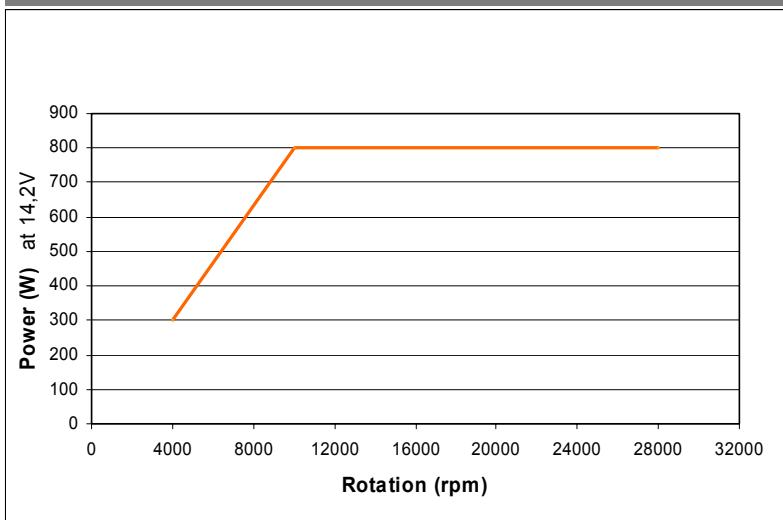
Mechanical data	
Weight	890 g
Voltage regulator unit	external; separately available
Max. rotation speed	28 000 x 1/min
Cooling options	water/oil/air
Dimensions	
Diameter	73 mm
Length	75 mm

Conditions for use	
Temperature range	- 10°C ... 180°C
Installation	mounting flange

Electrical connections	
Cable harness with bare wires.	
Broad connector range available. Mounting on request.	

Electrical rating (with external voltage regulator unit)	
Rated current	56 A
Output voltage	14,2 V
Power output @10000 rpm	max. 800 W

Part numbers	
F 01E B01 861	
Please specify rotation direction, cooling option and connector choice when ordering	

F1-01


Alternator F1-02

This alternator with permanent excitation is modified for motorsport demand and splash fluid protected. The stator windings are hand made. The rotor is extra fine balanced and designed for high rotation speed operation. Clockwise and anti-clockwise versions are available while modifications are available on request.



Mechanical data	
Weight	1190 g
Voltage regulator unit	external; separately available
Max. rotation speed	28 000 x 1/min
Cooling options	water/oil/air
Dimensions	
Diameter	73 mm
Length	87 mm

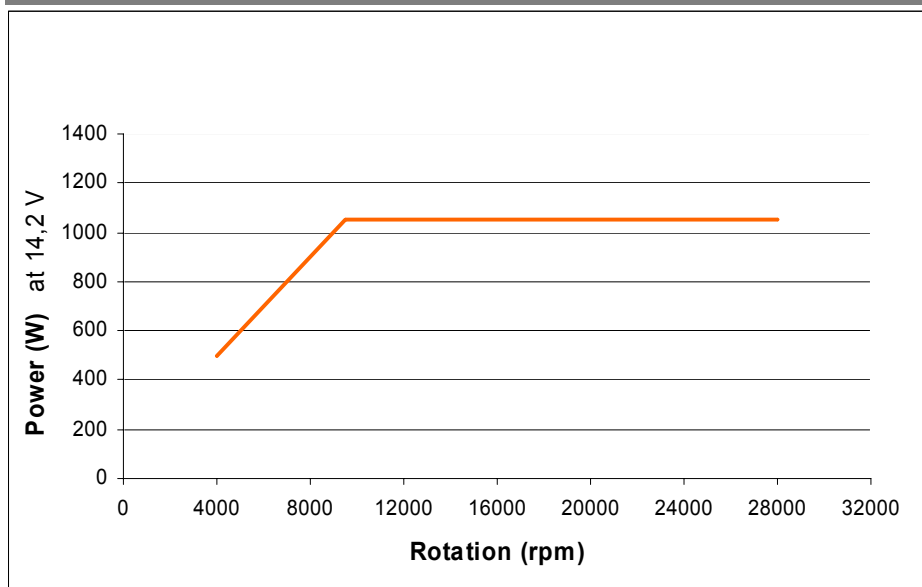
Conditions for use	
Temperature range	- 10°C ... 160°C
Installation	mounting flange

Electrical connections	
Cable harness with bare wires.	
Broad connector range available. Mounting on request.	

Electrical Rating (with external voltage regulator unit)	
Rated current	74 A
Output voltage	14,2 V
Power Output @10000 rpm	max. 1050 W

Part numbers	
F 01E B01 862	
Please specify rotation direction, cooling option and connector choice when ordering	

F1-02



Alternator F1-03

This alternator with permanent excitation is modified for motorsport demand and splash fluid protected. The stator windings are hand made. The rotor is extra fine balanced and designed for high rotation speed operation. Clockwise and anti-clockwise versions are available while modifications are available on request.



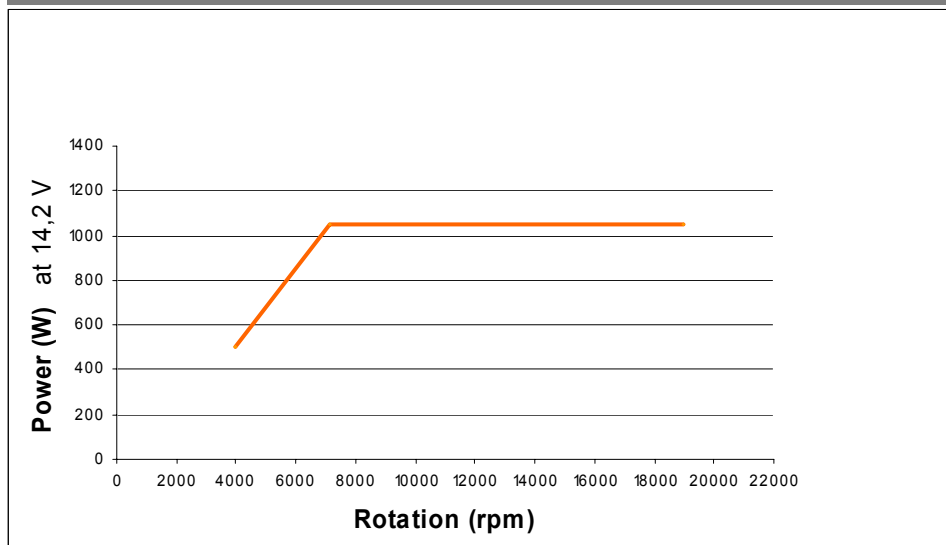
Mechanical data	
Weight	1740 g
Voltage regulator unit	external; separately available
Max. rotation speed	19 000 x 1/min
Cooling options	water/oil/air
Dimensions	
Diameter	73 mm
Length	97 mm

Conditions for use	
Temperature range	- 10°C ... 160°C
Installation	mounting flange

Electrical connections	
Cable harness with bare wires.	
Broad connector range available. Mounting on request	

Electrical Rating (with external voltage regulator unit)	
Rated current	74 A
Output voltage	14,2 V
Power output @8000 rpm	max. 1050 W

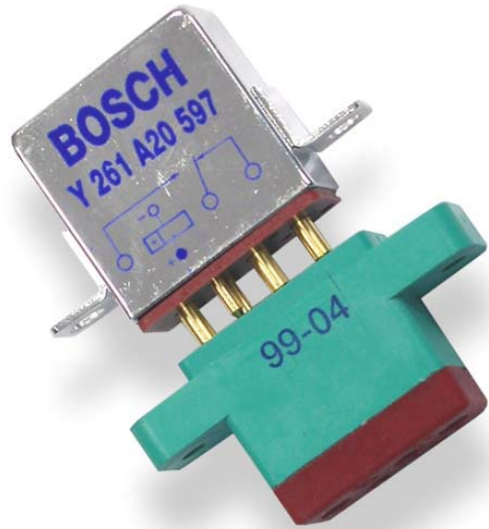
Part numbers	
F 01E B01 863	
Please specify rotation direction, cooling option and connector choice when ordering	

F1-03


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

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

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

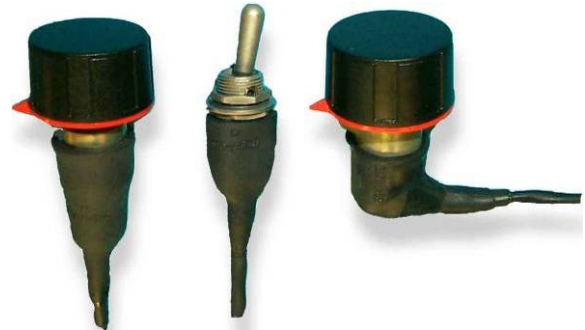
Part numbers	
Relay	Y 261 A20 597
Offer drawing	Y 261 A25 338
Base	Y 261 A20 598
Offer drawing	Y 261 A25 338

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

Part 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

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