Bosch Motorsport

Equipment for High Performance Vehicles

Edition 2009/2

BOSCH

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Contents

Engine Control Units

Gasoline Engine Control Units

ECU 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 sensor inputs 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 software is provided with an optimized function range.

Application	
Engine layout	up to 6 cylinders, 2 bank
Control strategy	alpha/n
Lambda control	dual
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 positions - each corresponds to different target lambda and spark maps)	✓
Fuel cut off	✓
Turbo boost control	-
Knock control	optional
Electronic throttle control	optional
Traction control	optional
Sequential fuel injection	✓
Asymmetric injection timing	✓
Asymmetric ignition timing	✓
Support of 60-2 and 36-2 ignition trigger wheels	
Max. vibration	*Vibration Profile 3 (see Appendix or www.bosch-motorsport.com)*

Mechanical Data	
Extremely small and flat aluminium pressure casting housing	
Four mounting points on housing	
2 connectors with high pin density	
Extremely shock and vibration proof hybrid technology	
Size	120 x 90 x 40 mm
Weight	250 g
Temperature range	-40 ... 125 °C

Connectors	
Mating connector I	D 261 205 139
Mating connector II	D 261 205 140

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Electrical Data	
Max. power consumption	10 W at 14 V
Inputs	
2 inputs for exhaust gas temperature sensors	
2 LSU lambda sensor interfaces	
4 inputs for Hall-effect wheel speed sensors	
1 input for inductive crankshaft sensor	
1 input for Hall-effect camshaft sensor	
15 universal inputs 0 ... 5 V	
2 knock sensor inputs	
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 interface	
1 CAN interface for external communication	

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Data logger C Sport	**F 01T A20 061**
Data logger C 40	**F 01T A20 403**
Data logger C 40 Plus	**B 261 206 860**
Display DDU Sport (incl. logger)	**F 01T A20 050-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 3 Sport	**F 01T A20 067**

ECU 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 sensor inputs 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.

Application	
Engine layout	up to 6 cylinders, 2 bank
Control strategy	torque-structure based
Lambda control	dual
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 positions - each corresponds to different target lambda and spark maps)	✓
Fuel cut off	✓
Turbo boost control	-
Knock control	✓
Electronic throttle control	-
Traction control	✓
Component diagnosis	✓
Injection timing	✓
Ignition timing	✓
Max. vibration (see Appendix or www.bosch-motorsport.com)	Vibration Profile 3

Mechanical Data	
Extremely small and flat aluminium pressure casting housing	
Four mounting points on housing	
2 connectors with high pin density	
Extremely shock and vibration proof hybrid technology	
Size	120 x 90 x 40 mm
Weight	250 g
ECU temperature	-40 ... 125 °C

Connectors	
Mating connector I	D 261 205 139
Mating connector II	D 261 205 140

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Electrical Data	
Max. power consumption	10 W at 14 V
In general	
2 microcontrollers with 16 bit organization calculation capacity 20 MIPS	
Inputs	
2 lambda LSU 4 interfaces	
3 analog inputs 0 ... 5 V for water temperature, oil temperature, intake air temperature	
3 analog inputs 0 ... 5 V for oil pressure, fuel pressure, ambient pressure	
1 analog input 0 ... 5 V for throttle position sensor	
1 digital input for laptrigger	
1 digital input for wheel speed sensor	
1 input for inductive crankshaft sensor	
1 input for Hall-effect camshaft sensor	
2 knock sensor inputs	
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 K-line serial interface	
1 CAN interface for external communication	

Application Hints
Depending on your experiences with calibration of ECUs we recommend calibration support from Bosch Motorsport.

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Data logger C Sport	**F 01T A20 061**
Data logger C 40	**F 01T A20 403**
Data logger C 40 Plus	**B 261 206 860**
Display DDU Sport (incl. logger)	**F 01T A20 050-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 3.1	**B 261 208 245-01**

ECU MS 4 Sport/Sport Turbo

The MS 4 Sport / Sport Turbo 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 ECU software is provided with an optimized function range.

Application	
Engine layout	up to 8 cylinders, 2 bank
Control strategy	alpha/n
Lambda control	dual
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 positions - each corresponds to different target lambda and spark maps)	✓
Fuel cut off	✓
Turbo boost control	✓ [2]
Knock control	optional
Electronic throttle control	optional
Traction control	optional
Asymmetric injection timing	✓
Asymmetric ignition timing	✓
Support of 60-2 and 36-2 ignition trigger wheels	
Max. vibration	*Vibration Profile 2 (see Appendix or www.bosch-motorsport.com)*

Mechanical Data	
Sheet-metal housing	
Each connector pin individually filtered	
Vibration damped circuit boards	
Size	180 x 162 x 46 mm
Weight	430 g
Temperature range	-40 ... 75 °C

Connectors	
Mating connector I	[1] D 261 205 344 [2] D 261 205 342
Mating connector II	[1] D 261 205 345 [2] D 261 205 343

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Electrical Data	
Max. power consumption	30 W at 14 V
Inputs	
2 inputs for exhaust gas temperature sensors	
2 lambda interfaces LSU	
4 inputs for Hall-effect wheel speed sensors	
1 input for inductive crankshaft sensor	
1 input for Hall-effect camshaft sensor	
16 universal inputs 0 ... 5 V	
2 knock sensor inputs	
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 interface	
2 CAN interfaces for external communication	

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Data logger C Sport	**F 01T A20 061**
Data logger C 40	**F 01T A20 403**
Data logger C40 Plus	**B 261 206 860**
Display DDU Sport (incl. Logger)	**F 01T A20 050-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 4 Sport [1]	**F 01T A20 049-01**
MS 4 Sport Turbo [2]	**F 01T A20 060-01**

ECU MS 4 Sport Package

The **MS 4 Sport Package** consists of the following components:

- MS 4 Sport Engine Control Unit
- Display DDU Sport
  with integrated data logger
- Software tools for calibration
  and data analysis

The key component of this package is the **MS 4 Sport Engine Control Unit** capable of running engines up to 8 cylinders. The ECU includes eight ignition drives for external power stages and eight independent injection power stages. The ECU software set has been optimized to make calibration more approachable for less experienced users.

Various engine parameters can be measured with different input channels and transferred via the CAN interface to the **DDU Sport Display**. The integrated data memory stores up to 512 MB.

For communication between the PC and the ECU or the display, the **MSA-Box** communication interface is required. Please note: The MSA-Box ist not part of the MS 4 Sport Package.

Optional Accessories	
MSA-Box	B 261 208 015-01

Software
Modas Sport for ECU calibration
RaceLab Sport for Display configuration and data analysis

Part Number	
MS 4 Sport Package	**F 01T A20 048-01**

ECU 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 or dash display.

Application	
Engine layout	up to 8 cylinders, 2 bank
Control strategy	torque-structure based
Lambda control	dual
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 positions - each corresponds to different target lambda and spark maps)	✓
Fuel cut off	✓
Turbo boost control	✓
Knock control	✓
Electronic throttle control	✓
Traction control	✓
Injection timing	✓
Ignition timing	✓
Max. vibration (see Appendix or www.bosch-motorsport.com)	Vibration Profile 2

Mechanical Data	
Sheet-metal housing	
Each connector pin individually filtered	
Vibration damped circuit boards	
Size	180 x 162 x 46 mm
Weight	430 g
Temperature range	-40 ... 75 °C

Connectors	
Mating connector I	D 261 205 342
Mating connector II	D 261 205 343

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Application Hint
Depending on your experiences with calibration of ECUs we recommend calibration support from Bosch Motorsport.

Electrical Data	
Max. power consumption	30 W at 14 V
Inputs	
2 inputs for exhaust gas temperature sensors	
2 lambda interfaces LSU	
4 inputs for Hall-effect wheel speed sensors	
1 input for inductive crankshaft sensor	
1 input for Hall-effect camshaft sensor	
16 universal inputs 0 ... 5 V	
2 knock sensor inputs	
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 interface	
2 CAN interfaces for external communication	

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Data logger C Sport	**F 01T A20 061**
Data logger C 40	**F 01T A20 403**
Data logger C 40 Plus	**B 261 206 860**
Display DDU Sport (incl. logger)	**F 01T A20 050-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 4.0	**B 261 208 300-01**

ECU MS 4.4 Sport/Sport Turbo

The MS 4.4 Sport / Sport Turbo 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 ECU Sport software is provided with an optimized function range.

Application	
Engine layout	up to 10 cylinders, 2 bank
Control strategy	alpha/n
Lambda control	dual
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 positions - each corresponds to different target lambda and spark maps)	✓
Fuel cut off	✓
Turbo boost control	✓ [2]
Knock control	optional
Electronic throttle control	optional
Traction control	optional
Asymmetric injection timing	✓
Asymmetric ignition timing	✓
Variable valve timing	optional
Support of 60-2 and 36-2 ignition trigger wheels (10-cylinders only 60-2!)	
Max. vibration	*Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)*

Mechanical Data	
Aluminium housing	
3 high pin density motorsports connectors	
165 pins, each pin individually filtered	
Vibration damped circuit boards	
Size	174 x 133 x 39 (23) mm
Weight	860 g
Temperature range	-40 ... 75 °C

Connectors	
Mating connector I AS 6-16-35 SA	F 02U 000 467-01
Mating connector II AS 6-16-35 SC	F 02U 000 469-01
Mating connector III AS 6-16-35-SB	F 02U 000 468-01

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Electrical Data	
Max. power consumption	20 W at 14 V
Inputs	
1 input for inductive crankshaft sensor	
4 inputs for Hall-effect camshaft sensors	
4 inputs for Hall-effect wheel speed sensors	
2 lambda interfaces LSU 4.9	
39 inputs 0 ... 5 V (20 with configurable pullups)	
4 knock sensor inputs	
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 interface	
2 CAN interfaces for external communication	

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Data logger C Sport	**F 01T A20 061**
Data logger C 40	**F 01T A20 403**
Data logger C40 Plus	**B 261 206 860**
Display DDU Sport (incl. Logger)	**F 01T A20 050-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 4.4 Sport [1]	**F 01T A20 068-01**
MS 4.4 Sport Turbo [2]	**F 01T A20 074-01**

ECU 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.

Application	
Engine layout	up to 10 cylinders, 2 bank
Control strategy	torque-structure based
Lambda control	dual
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 positions - each corresponds to different target lambda and spark maps)	✓
Fuel cut off	✓
Turbo boost control	✓
Knock control	✓
Electronic throttle control	✓
Traction control	✓
Injection timing	✓
Ignition timing	✓
Variable valve timing	optional
Support of 60-2 and 36-2 ignition trigger wheels (10-cylinders only 60-2!)	
Max. vibration	*Vibration profile 1 (see Appendix or www.bosch-motorsport.com)*

Mechanical Data	
Aluminium housing	
3 high pin density motorsports connectors	
165 pins, each pin individually filtered	
Vibration damped circuit boards	
Size	174 x 133 x 39 (23) mm
Weight	859 g
Temperature range	-40 ... 75 °C

Connectors	
Mating connector I AS 6-16-35 SA	F 02U 000 467-01
Mating connector II AS 6-16-35 SC	F 02U 000 469-01
Mating connector III AS 6-16-35-SB	F 02U 000 468-01

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Application Hint
Depending on your experiences with calibration of ECUs we recommend calibration support from Bosch Motorsport.

Electrical Data	
Max. power consumption	20 W at 14 V
Inputs	
1 input for inductive crankshaft sensor	
4 inputs for Hall-effect camshaft sensors	
4 inputs for Hall-effect wheel speed sensors	
2 lambda interfaces LSU 4.9	
39 inputs 0 ... 5 V (20 with configurable pullups)	
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 interface	
2 CAN interfaces for external communication	

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Data logger C 40	**F 01T A20 403**
Data logger C 40 Plus	**B 261 206 860**
Display DDU Sport (incl. logger)	**F 01T A20 050-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 4.4	**F 01T A20 040**

ECU MS 5.1

The MS 5.1 engine control unit manages gasoline engines up to 8 cylinders. As a member of our MS 5 family, it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 5 family utilizes a new software development process based on MATLAB/Simulink, which significantly speeds algorithm development by using automatic code and documentation generation. Custom functions can be quickly and easily generated. The flexible hardware design allows the MS 5.1 to support complex or unusual engine or chassis configurations.

Application	
Engine layout	up to 8 cylinders, 2 bank
Control strategy	torque-structure based
Lambda control	with adaptation function
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 steps)	✓
Fuel cut off	✓
Turbo boost control	✓
Knock control	✓
Electronic throttle control	✓
Traction control	✓
Sequential fuel injection	✓
Asymmetric injection timing	optional
Asymmetric ignition timing	optional
Calibration interface	CCP via CAN or XCP via Ethernet
Interface to Bosch Data Logging System	
Max. Vibration	Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)

Mechanical Data	
Aluminium housing	
3 connectors in motorsport technology with high pin density	
165 pins, each pin individually filtered	
Vibration suppression via multipoint fixed circuit boards	
Size	180 x 155 x 40 mm
Weight	1,060 g
Temp. range (at internal sensors)	-20 ... 85 °C

Connectors	
Mating connector I AS 6-16-35 SA	F 02U 000 467-01
Mating connector II AS 6-16-35 SB	F 02U 000 468-01
Mating connector III AS 6-16-35 SN	F 02U 000 466-01

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Electrical Data	
Approx. power cons. (w/o loads)	9 W at 14 V
Power Supply	
Operating range	6.5 ... 18 V
Recommended	11 ... 14 V
Absolute maximum	6 ... 24 V
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)	
38 universal analog inputs 0 ... 5 V; 12 Bit	
4 analog inputs (angle synchronous or time synchronous triggering up to 250 ksps, 12 Bit)	
4 knock sensor inputs	
1 laptrigger input	
Outputs	
8 injection power stages	
8 ignition power stages (up to 20 A)	
20 power stages (2 A; low side; PWM)	
4 power stages (4 A; low side; PWM)	
2 H-bridges (5 A)	
3 sensor supplies 5 V/400 mA and 1x 10 V/200 mA	
1 protected Ubat output 1A	
6 diagnostic outputs with selectable internal signals	
1 timebase reference synch-in/out	
Communication interfaces	
2 x 100 Mbps Ethernet interfaces	
1 x RS232 serial interface	
3 x 1 Mbps CAN interfaces	

Application Hints
Depending on your experience with ECU calibration, we recommend calibration support from the experienced team at Bosch Motorsport.

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Data logger C 55	**F 01E B01 630**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 5.1	**F 01T A20 071-01**

ECU MS 5.5

The MS 5.5 engine control unit manages gasoline engines up to 8 cylinders. As a member of our MS 5 family, it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 5 family utilizes a new software development process based on MATLAB/Simulink. It significantly speeds algorithm development by using automatic code and documentation generation. Custom functions can be quickly and easily generated. The flexible hardware design allows the MS 5.5 to support complex or unusual engine or chassis configurations.

The MS 5.5 has an internal 2 GB logger, presenting a cost efficient and weight optimized all-in-one solution.

Application	
Engine layout	up to 8 cylinders, 2 bank
Control strategy	torque-structure based
Lambda control	with adaptation function
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 steps)	✓
Fuel cut off	✓
Turbo boost control	✓
Knock control	✓
Electronic throttle control	✓
Traction control	✓
Sequential fuel injection	✓
Asymmetric injection/ignition timing	optional
Calibration interface	CCP via CAN or XCP via Ethernet
Interface to Bosch Data Logging System	
Internal logger	2 GB
Max. Vibration	Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)

Mechanical Data	
Aluminium housing	
3 connectors in motorsports technology with high pin density	
165 pins, each pin individually filtered	
Vibration suppression via multipoint fixed circuit boards	
Size	180 x 155 x 40 mm
Weight (approx.)	1,270 g
Temp. range (at internal sensors)	-20 ... 85 °C

Connectors	
Mating connector I AS 6-16-35 SA	F 02U 000 467-01
Mating connector II AS 6-16-35 SB	F 02U 000 468-01
Mating connector III AS 6-16-35 SN	F 02U 000 466-01

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Electrical Data	
Approx. power cons. (w/o loads)	13 W at 14 V
Power Supply	
Full operation	6.5 ... 18 V
Recommended	11 ... 14 V
Absolute maximum	6 ... 24 V
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)	
38 universal analog inputs 0 ... 5 V; 12 Bit	
4 analog inputs (angle synchronous or time synchronous triggering up to 250 ksps, 12 Bit)	
4 inputs for vibration knock sensors	
1 laptrigger input	
Outputs	
8 injection power stages	
8 ignition power stages (up to 20 A)	
20 power stages (2 A; low side; PWM)	
4 power stages (4 A; low side; PWM)	
2 H-bridges (5 A)	
3 sensor supplies 5 V/400 mA and 1x 10 V/200 mA	
1 protected Ubat output 1A	
6 diagnostic outputs with selectable internal signals	
1 timebase synch-in/out	
Communication interfaces	
2 x 100 Mbps Ethernet interfaces	
1 x RS232 serial interface	
3 x 1 Mbps CAN interfaces	

Application Hints
Depending on your experiences with calibration of ECUs we recommend calibration support from Bosch Motorsport.

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 5.5	**F 02U V00 285-01**

ECU MS 5.2

The MS 5.2 engine control unit manages gasoline engines up to 12 cylinders. As a member of our MS 5 family, it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 5 family utilizes a new software development process based on Matlab® & Simulink®. It significantly speeds algorithm development by using automatic code and documentation generation. Custom functions can be quickly and easily generated. The flexible hardware design allows the MS 5.2 to support complex or unusual engine or chassis configurations.

Application	
Engine layout	up to 12 cylinders, 2 bank
Control strategy	torque-structure based
Lambda control	with adaptation function
Speed limiter	✓
Gear cut for sequential gear box	✓
Map switch (3 positions - each corresponds to different target lambda and spark maps)	✓
Fuel cut off	✓
Turbo boost control	✓
Knock control	✓
Electronic throttle control	✓
Traction control	✓
Sequential fuel injection	✓
Asymmetric injection timing	optional
Asymmetric ignition timing	optional
Calibration interface	CCP via CAN or XCP via Ethernet
Interface to Bosch Data Logging System	
Max. Vibration	Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)

Mechanical Data	
Dust and waterproof aluminium housing	
4 high pin density motorsports connectors	
220 pins, each pin individually filtered	
Vibration resistant circuit board mounting	
Size	200 x 170 x 36.5 mm
Weight (approx.)	1,260 g
Temp. range (at internal sensors)	-20 ... 85 °C

Connectors	
Mating connector I AS 6-16-35 SA	F 02U 000 467-01
Mating connector II AS 6-16-35 SB	F 02U 000 468-01
Mating connector III AS 6-16-35 SC	F 02U 000 469-01
Mating connector IIII AS 6-16-35 SN	F 02U 000 466-01

Software	
Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Electrical Data	
Power cons. (w/o loads)	approx. 10 W at 14 V
Power Supply	
Operating range	6.5 ... 18 V
Recommended	11 ... 14 V
Absolute maximum	6 ... 24 V
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 analog inputs 0 ... 5 V, 12 Bit	
14 analog 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 power stages (up to 20 A)	
16 power stages (2 A; low side; PWM)	
4 power stages (4 A; low side; PWM)	
4 H-bridge valve drivers (± 100 mA)	
2 H-bridges (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 reference synch-in/out	
Communication interfaces	
2 x 100 Mbps Ethernet interfaces	
1 x RS232 serial interface	
4 x 1 Mbps CAN interfaces	

Application Hints
Depending on your experiences with calibration of ECUs we recommend calibration support from Bosch Motorsport.

Optional Accessories	
MSA-Box	**B 261 208 015-01**
Data logger C 55	**F 01E B01 630**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Part Number	
MS 5.2	**F 01T A20 069-01**

Diesel Engine Control Units

ECU MS 15 Sport

The MS 15 Sport is an ECU for Diesel engines with up to 6 cylinders. It is developed for use in combination with Bosch solenoid injectors. The MS 15 Sport software is provided with an optimized function range. The MS 15 Sport can operate in a 12 V or 24 V system.

Application	
Engine layout	up to 6 cyl.
Injector types	solenoid
Injection timing	1 main injection
Control strategy	quantity based
Basic functionality for turbocharger	✓
Speed limiter	✓

Mechanical Data	
Dust and waterproof aluminium housing	
2 connectors with 60 and 94 pins	
6 housing fixation points	
Maximum dimensions without connectors with connectors	 203 x 140 x 38 mm 203 x 167 x 38 mm
Weight	approx. 725 g
ECU internal temperature range	-20 ... 75 °C

Connectors	
Connector K (vehicle: 94 pin)	D 261 205 353-01
Connector A (engine: 60 pin)	D 261 205 354-01

Included Features
Complete SW documentation
Calibration guide
Incl. workbase and configuration of Modas Sport
Preconfigured CAN-messages for DDU Sport
Incl. configuration and evaluation tool Race Lab Sport with preconfigured settings

Optional Accessories	
Display DDU Sport (12 V only)	**F 01T A20 050-01**
Data Logger C Sport	**F 01T A20 061-01**
MSA-Box	**B 261 208 015-01**

Electrical Data	
Power consumption w/o inj.	approx. 5 W
Power consumption @ full load	approx. 120 W
Inputs	
1 input for inductive crankshaft sensor	
1 input for Hall-effect camshaft sensor	
2 inputs for redundant pedal position sensor	
6 analog inputs 0 ... 5 V: fuel: low system and rail pressure boost pressure oil pressure exhaust gas: pressure and temperature	
5 NTC temperature inputs: intake and boost air temperature fuel, coolant and oil temperature	
1 input for Hall vehicle speed sensor	
3 digital inputs: lap beacon, pit speed limiter and fuel reset	
1 internal ambient pressure sensor	
1 internal ECU temperature sensor	
Outputs	
6 injection power stages for solenoid injectors	
9 power stages main, fuel pump, glow plug and 2 fan relays fuel metering unit of high pressure pump turbo actuator (PWM 5.0 Amps) engine speed signal for tachometer diagnostic lamp	
Communication interfaces	
2 CAN interfaces	display / logger calibration software
1 K-Line	software download

Part Number	
MS 15 Sport	**F 02U V00 350-01**

ECU MS 15.1

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

Application	
Engine layout	up to 8 cyl.
Injector type	solenoid
Injection timing	2 pilot injections 2 main injection 1 post injection
Control strategy	quantity based
Lambda measurement	✓
Traction control	optional
Basic functionality for up to two turbochargers in parallel mode	✓
Gear cut for sequential gearbox	✓
Speed limiter	✓
Optional function packages available	
Interface to Bosch Data Logging System	
Max. vibration (see Appendix or *www.bosch-motorsport.com)*	Vibration profile 1

Mechanical Data	
Aluminium housing	
4 connectors in military technology with high pin density, 187 pins	
Vibration damped circuit boards	
8 housing fixation points	
Size	210 x 36 x 199 mm
Weight	1,780 g
Temperature range	-40 ... 75 °C

Electrical Data	
Power consumption w/o inj.	approx. 5 W at 14 V
Power consumption	approx. 140 W at 14 V
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 pull-up	
27 universal inputs 0 ... 5 V, switchable pull-up	
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	
3 CAN interfaces (dash, application, customer use)	
2 firewire interfaces for external communication	

Connectors

Mating connector I AS 6-16-35 SA	F 02U 000 466-01
Mating connector II AS 6-16-35 SB	F 02U 000 468-01
Mating connector III AS 6-16-35 SC	F 02U 000 469-01
Mating connector IV AS 6-12-35 SD	F 02U 000 445-01

Software

Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Optional Accessories

MSA-Box	**B 261 208 015-01**
Data logger C55	**F 01E B01 630**
Modular Sensor Interface MSI 55	**F 01T A20 024**
Display DDU Sport (incl. logger)	**F 01T A20 050-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Application Hints

Depending on your experiences with calibration of Diesel ECUs we recommend calibration support from Bosch Motorsport.

Part Number

MS 15.1 solenoid injector	**F 01T A20 022**

ECU MS 15.2

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

Application	
Engine layout	up to 6 cyl.
Injector type	piezo
Injection timing	2 pilot injections 1 main injection 1 post injection
Control strategy	quantity based
Lambda measurement	✓
Traction control	optional
Basic functionality for up to two turbochargers in parallel mode	✓
Gear cut for sequential gearbox	✓
Speed limiter	✓
Optional function packages available	
Interface to Bosch Data Logging System	
Max. vibration (see Appendix or *www.bosch-motorsport.com)*	Vibration profile 1

Mechanical Data	
Aluminium housing	
4 connectors in motorsports technology with high pin density, 187 pins	
Vibration damped circuit boards	
8 housing fixation points	
Size	210 x 36 x 199 mm
Weight	1,780 g
Temperature range	-40 ... 75 °C

Electrical Data	
Power consumption w/o inj.	approx. 5 W at 14 V
Power consumption	approx. 140 W at 14 V
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	
6 injection power stages	
12 power stages (low side)	
2 power stages for lambda heater	
2 H-bridges	
2 sensor supply 5 V/ system use	
3 sensor supply 5 V/300 mA	
3 sensor supply 10 V/100 mA	
Communication interfaces	
3 CAN interfaces (dash, application, customer use)	
2 firewire interfaces for external communication	

Piezo Specific Functions

Voltage Control

Rail pressure dependent precontrol of the voltage difference between cut off voltage and stationary actuator voltage.

Closed-loop voltage control, injector individual.

Voltage precontrol to improve dynamic behavior.

Discharging Time Control

Voltage dependent precontrol of discharging current.

Closed-loop discharging time control, injector individual.

Discharging time precontrol to improve dynamic behavior.

IVA Injector Voltage Adjustment

Determination of injector voltage demand at reference rail pressure during injector inspection in plant before IQA-measurement.

Injector assignment of voltage setpoint curves within the ECU according to injector's IVA class.

Temperature Compensation

Determination of the temperature dependent changes of voltage demand.

Definition of a temperature dependent correction factor.

Multiplicative correction of the voltage setpoint.

Connectors

Mating connector I AS 6-16-35 SA	F 02U 000 467-01
Mating connector II AS 6-16-35 SB	F 02U 000 468-01
Mating connector III AS 6-16-35 SC	F 02U 000 469-01
Mating connector IV AS 6-12-35 SD	F 02U 000 445-01

Software

Modas Sport Calibration Software	inclusive
WinDarab Analysis Software	on request

Accessories

MSA-Box	**B 261 208 015-01**
Data logger C 55	**F 01E B01 630**
Modular Sensor Interface MSI 55	**F 01T A20 024**
Display DDU Sport (incl. logger)	**F 01T A20 050-01**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Application Hints

Depending on your experiences with calibration of Diesel ECUs we recommend calibration support from Bosch Motorsport.

Part Number

MS 15.2 Piezo injector	**F 01T A20 023**

ECU MS 12

The MS 12 is the high-end ECU for Diesel engines. This ECU offers 12 Piezo injection power stages for use in up to a 12 cylinder engine. Various engine and chassis parameters can be measured with a high number of input channels. All measured data can be transferred via FireWire interface to an optional flash card data logger. Additional MSI 55 (Modular Sensor Interfaces) can be connected to increase the number of inputs. Gear box control strategies are optional.

Application	
Engine layout	up to 12 cyl.
Injector type	piezo
Injection timing	2 pilot injections 1 main injection 1 post injection
Control strategy	quantity based
Lambda measurement	✓
Traction control	✓
Launch control	✓
Turbo boost control	✓
Basic functionality for up to two turbochargers in parallel mode (including variable VTG)	✓
Gear cut for sequential gearbox	✓
Gearbox control	✓
Speed limiter	✓
Optional function packages available	
Interface to Bosch Data Logging System	
Max. vibration (see Appendix or *www.bosch-motorsport.com)*	Vibration profile 1

Mechanical Data	
Aluminium housing	
5 connectors in motorsports technology with high pin density, 242 pins	
Each connector individually filtered	
Vibration damped circuit boards	
8 housing fixation points	
Size	240 x 200 x 57 mm
Weight	2,500 g
Operating temperature range	-20 ... 85 °C

Electrical Data

Power consumption without injection	approx. 5 W at 14 V
Power consumption @ 6500 rpm	max. 160 W at 14 V

Inputs

- 6 inputs for thermocouple sensors (e.g. exhaust gas temperature)
- 2 lambda interfaces LSU
- 4 inputs for wheel speed sensors; basic design for inductive sensors
- 2 gear box speed
- 4 inputs for turbo speed sensors; basic design for inductive sensors
- 2 inputs for inductive crankshaft sensor
- 1 input for Hall-effect camshaft sensor
- 3 system inputs 0 ... 5 V
- 16 PT1000
- 32 universal inputs 0 ... 5 V, switchable pullup
- 3 digital inputs
- 2 LVDT sensor interface
- 1 SSI interface

Outputs

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

Communication interfaces

- 2 K-Line serial interfaces
- 5 CAN interfaces (dash, application, customer use, switchable CAN load resistor)
- 2 firewire interfaces for external communication

Connectors

Mating connector I AS 6-18-35 SA	F 02U 000 473-01
Mating connector II AS 6-18-35 SB	F 02U 000 474-01
Mating connector III AS 6-18-35 SC	F 02U 000 475-01
Mating connector IV AS 6-18-35 SN	F 02U 000 472-01
Mating connector V AS 6-12-35 SD	F 02U 000 445-01

Piezo Specific Functions

Voltage Control

- Rail pressure dependent precontrol of the voltage difference between cut off voltage and stationary actuator voltage.
- Closed-loop voltage control, injector individual.
- Voltage precontrol to improve dynamic behavior.

Discharging Time Control

- Voltage dependent precontrol of discharging current.
- Closed-loop discharging time control, injector individual.
- Discharging time precontrol to improve dynamic behavior.

IVA Injector Voltage Adjustment

- Determination of injector voltage demand at reference rail pressure during injector inspection in plant before IQA-measurement.
- Injector assignment of voltage setpoint curves within the ECU according to injector's IVA class.

Temperature Compensation

- Determination of the temperature dependent changes of voltage demand.
- Definition of a temperature dependent correction factor.
- Multiplicative correction of the voltage setpoint.

Accessories

Data logger C 55	**F 01E B01 630-01**
Modular Sensor Interface MSI 55	**F 01T A20 024**
Display DDU 4	**F 01E B01 461**
Display DDU 6	**F 01E B01 459**

Application Hints

Depending on your experiences with calibration of Diesel ECUs we recommend calibration support from Bosch Motorsport.

Part Number

MS 12 Piezo injector	**F02U V00 241-01**

Injection & Ignition

Injection Valves

Injection Valve EV 6

The development of the EV 6 tooks 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

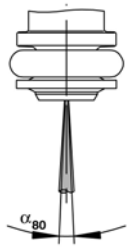
Conditions for use	
Fuel input	axial (top-feed)
Operating temperature	-40 ... 110°C
Permissible fuel temperatures	≤ 70°C
Climate proofness corresponds to saline DIN 53 167	fog test

Technical data

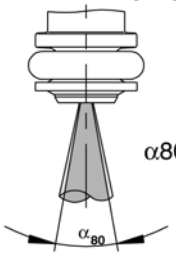
Part numbers	Design	Fuel type	Spray type	Flow rate at 3 bar (N-Heptan)	Spray angle α	Impedance
0 280 155 737	Long	Gasoline	C	261,2 g/min	15°	12 Ω
B 280 431 126	Standard	Gasoline	C	261,2 g/min	25°	12 Ω
B 280 431 127	Standard	Gasoline	C	261,2 g/min	70°	12 Ω
0 280 156 012	Standard	Gasoline	C	310,1 g/min	20°	12 Ω
B 280 431 129	Standard	Gasoline	C	364,3 g/min	70°	12 Ω
B 280 431 131	Standard	Gasoline	C	493,1 g/min	70°	1,2 Ω
B 280 434 499-02	Standard	Gasoline	C	658 g/min	25°	12 Ω

Please request the availability before ordering. Alternatively you can order one of our EV 14 injection valves. Please refer to our data sheet of EV 14.

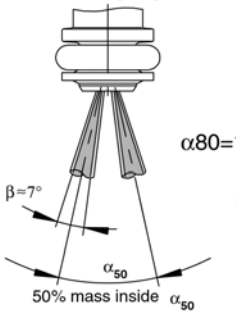
B: Pencil Beam



C: Conical Spray

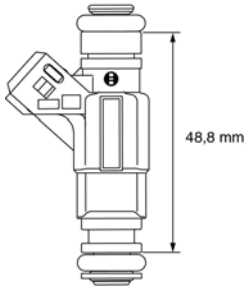


E: 2-Spray

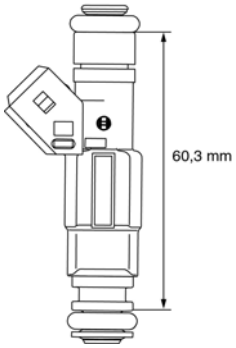


70% mass of single spray inside β

standard

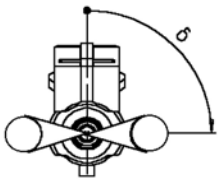


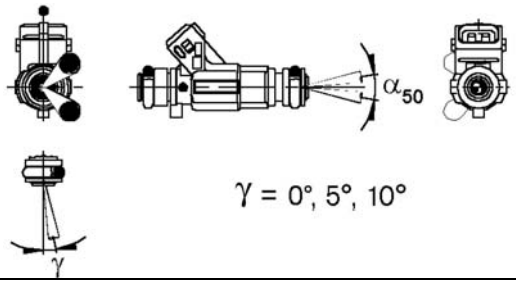
long



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

δ = 0°- 360° possible





γ = 0°, 5°, 10°

Injection Valve EV 12

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

Mechanical data	
System pressure	max. 8 bar
Weight	40 g

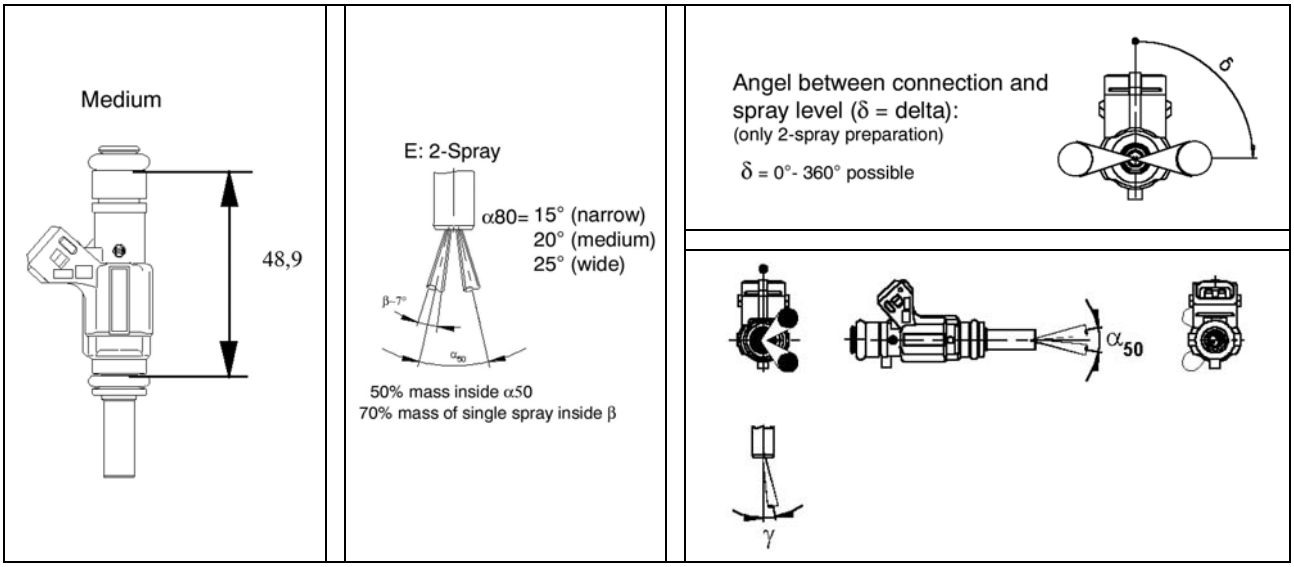
Electronic data	
Solenoid resistance	e.g. 12 Ω
Max. power supply	16 V

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

Technical data

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

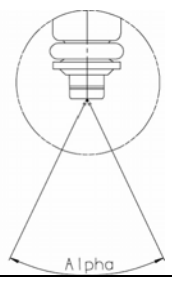
Electrical data	
Solenoid resistance	e.g. 12 Ω
Max. power supply	16 V

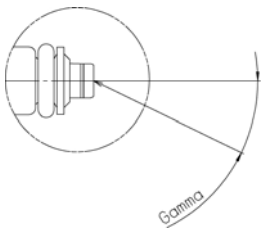
Conditions for use	
Fuel input	axial (top-feed)
Operating temperatures	-40 ... 110 °C
Permissible fuel temperatures	≤ 70 °C
Installation lengths	48,65 mm
Climate proofness corresponds to saline DIN 50 021	fog test

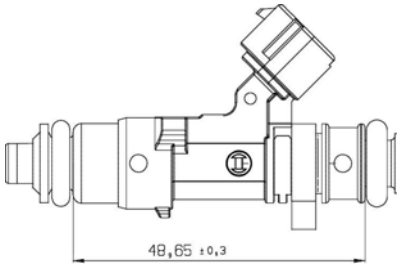
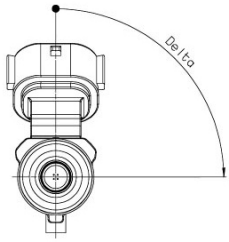
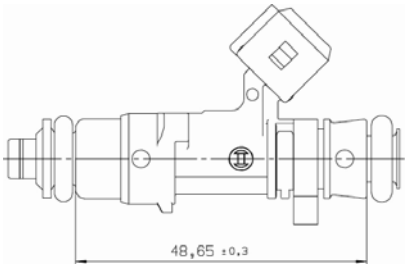
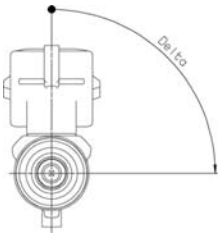
Technical data

Part numbers	Design	Connector	Type	Flow rate at 3 bar (N-Heptan)	Spray angle α	Impedance
B 280 436 038-06	Standard	Sumitomo	C	387,3 g/min	25°	12 Ω
B 280 436 038-10	Standard	Jetronic	C	387,3 g/min	25°	12 Ω
B 280 436 038-05	Standard	Sumitomo	C	387,3 g/min	70°	12 Ω
B 280 436 038-09	Standard	Jetronic	C	387,3 g/min	70°	12 Ω
B 280 436 038-02	Standard	Sumitomo	C	503,5 g/min	25°	12 Ω
B 280 436 038-08	Standard	Jetronic	C	503,5 g/min	25°	12 Ω
B 280 436 038-01	Standard	Sumitomo	C	503,5 g/min	70°	12 Ω
B 280 436 038-07	Standard	Jetronic	C	503,5 g/min	70°	12 Ω

Further special versions on request.





Top view	Side View
  Connector Sumitomo	  Connector Jetronic

HP Injection Valves

HP Injection Valve HDEV 5.1

The HDEV 5.1 is a high pressure injector, which is developed to be used as a port or a direct injection.

The function of the HDEV 5.1 is both to meter out the fuel and to obtain a well-defined mixture of fuel and air. It is an inward opening solenoid injector which is optimized regarding very short opening and closing times, which ensures a very stable linearity at short injection times.

The benefit of this injector is a high spray variability concerning spray angle and spray shape. Also the flow rate can be defined in a big range.

Application	
Application	308 ... 1,026 g/min @ 100 bar
Fuel input	top-feed-injector
Fuel	gasoline
Operating pressure	150 bar
Operating temperature range	-31 ... 130 °C
Storage temperature range	-40 ... 70 °C
Max. Vibration	600 m/s²

Electrical Data	
Booster power supply	65 ... 90 V
Booster current	8.5 ... 12 A
Booster sustain time	355 ... 440 µs
Peak power supply	12 V
Peak current	4.8 ... 7.1 A
Peak sustain time	145 ... 160 µs
Hold power supply	12 V
Hold current	2.5 ... 3.1 A
Coil resistance	1,500 Ω

Mechanical Data	
Weight w/o cable	68 g
Diameter	20.7 mm
Length	87 mm

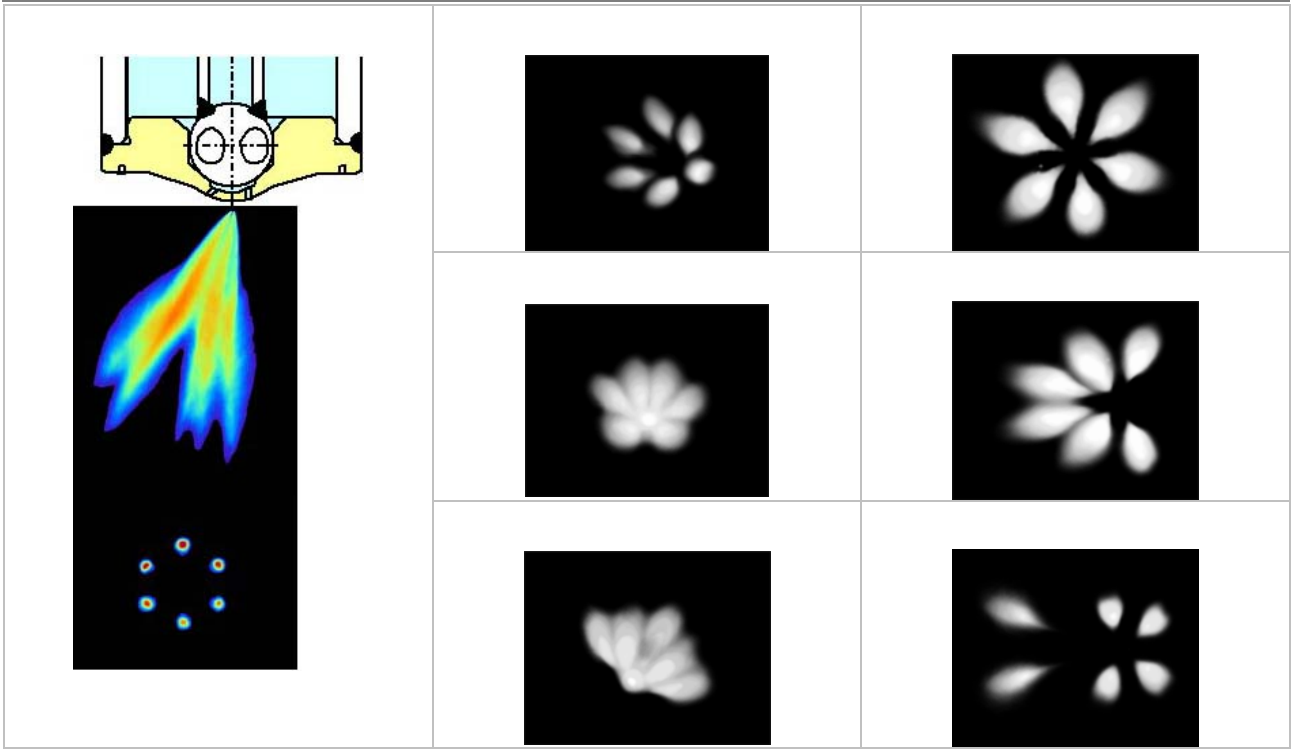
Characteristic	
Spray type	Multihole
Number of holes	4 ... 7 holes
Spray angle overall	110°
Spray angle single beam	8 ... 20°
Static flow tolerance	±5 %
Dynamic flow tolerance	±6 % @ t_i = 1.5 ms
Leakage	≤ 2.5 mm³/min @ 23 °C

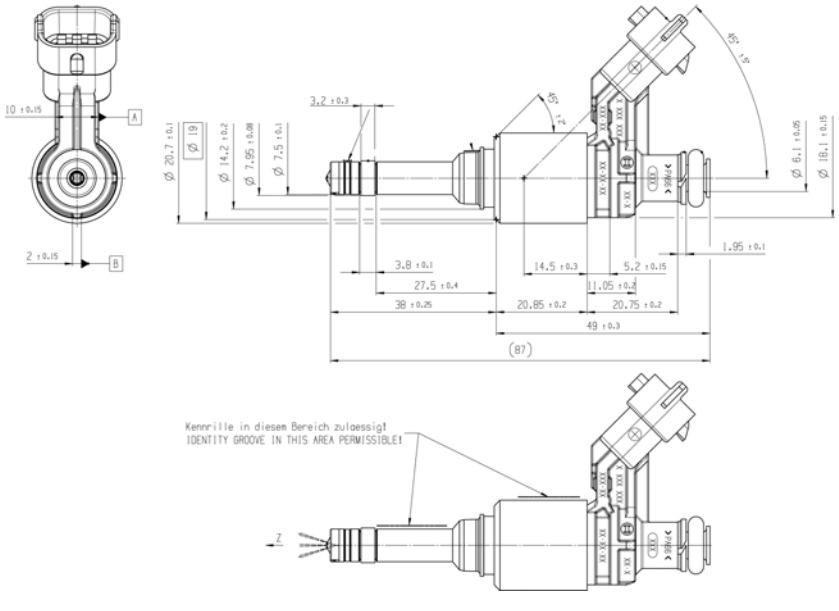
Connectors and Cables	
Connector	Kompakt
Connector loom	A 928 000 453
Pin 1	Pos
Pin 2	Gnd
Pin 3	-
Pin 4	-
Pin 5	-

Application Hint
The injector has to be supplied by a Bosch Motorsport power stage (e.g. HPI 1.1 or HPI 1.16).
If your application conditions will not match the listed performance data, please ask for consultancy at Bosch Motorsport.
The injector can be cleaned (mechanically or chemically) if the tip will not be damaged.
Do not use supersonic cleaning.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
HDEV 5.1	**on request**

Examples of variations, further variations on request





HP Injection 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.

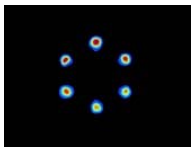
Mechanical data	
System pressure	max. 200 bar
Flow rate	e.g. 1350 g/min at 100 bar
Weight	48 g
Length	51 mm

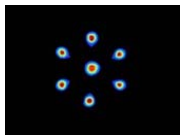
Electrical data	
Resistance	1,1 Ω
Voltage	14 V
Peak current	13,2 A

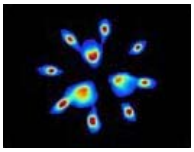
Conditions for use	
Fuel input	axial (top-feed)
Operating temperatures	-30 ... 120 °C
Permissible fuel temperatures	< 80 °C

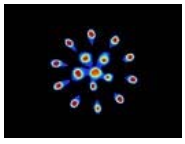
Part number	
Mini-HDEV 1.2	**on request**

Examples of variations, further variations on request

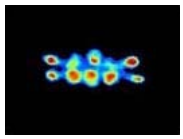

Jets on a circle


Jets on a circle and a middle jet


Jets on two circles


Jets on two circles and a middle jet


Jet configuration regarding the spark plug position


Flat jet configuration

HP Injection 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.

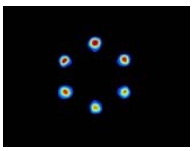
Mechanical data	
System pressure	max. 100 bar
Flow rate	e.g. 1350 g/min at 100 bar
Weight	48 g
Length	51 mm

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

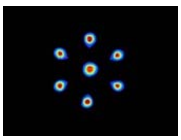
Conditions for use	
Fuel input	axial (top-feed)
Operating temperatures	-30 ... 120 °C
Permissible fuel temperatures	< 80 °C

Part number	
HPI Valve Mini-HDEV LV	**on request**

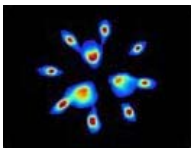
Examples of variations, further variations on request



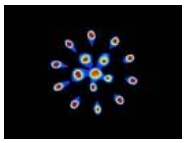
Jets on a circle



Jets on a circle and a middle jet

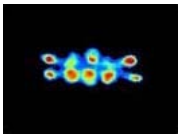


Jets on two circles



Jets on two circles and a middle jet

Jet configuration regarding the spark plug position



Flat jet configuration

HP Injection Valve Mini-HDEV LV 8A

The Mini-HDEV LV 8A is a high pressure injector, which is developed to be used in high performance gasoline engines with a manifold injection system.

The function of the Mini-HDEV LV 8A is both to meter out the fuel and to obtain a well-defined mixture of fuel and air. It is an inward opening solenoid injector which is optimised regarding very short opening and closing times, which ensures a very stable linearity at short injection times. It is suitable for a standard peak and hold power stage based on 12 V.

Its most remarkable features are the small size and weight. Another benefit of this injector is a high spray variability concerning spray angle and spray shape. Also the flow rate can be defined in a big range. An additional advantage of this injector is a high accuracy regarding leakage and linearity.

Application	
Application	335 ... 2000 g/min @ 100 bar
Fuel Input	Top-Feed Injector
Fuel	Gasoline
Fuel Input	Top-Feed Injector
Operating Pressure	100 bar
Operating Temperature Range	-20 °C ... 140 °C
Storage Temperature Range	-20 °C ... 70 °C

Mechanical Data	
Weight w/o cable	48 g
Diameter	20,7 mm
Length	51,6 mm
Max. Vibration	600 m/s² (guide value)

Electrical Data	
Peak Power Supply Us	12 V
Peak Current	7,5 A
Peak Sustain Time	800 µs
Hold Power Supply	12 V
Hold Current	3,5 A
Coil Resistance	270 mΩ

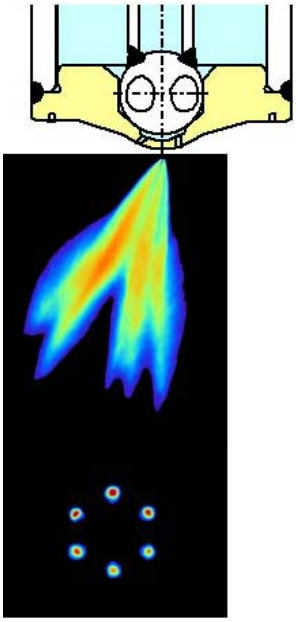
Connectors and Cables	
Cable Size	AWG18
Cable Length	< 100 cm
Sleeve	DR 25
Various military and automotive connectors on request.	

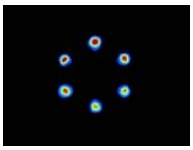
Application Hint
The injector can be supplied by a peak and hold power stage with maximum 8 A @ 12 V.
If your application conditions will not match the listed performance data, please ask for consultancy at Bosch Motorsport.
The injector can be cleaned (mechanically or chemically) if the tip will not be damaged.
Do not use supersonic cleaning.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Characteristic	
Spray Type	Multihole
Number of Holes	6 ... 16
Spray Angle Overall	< 100°
Spray Angle Single Beam	8° ... 18°
Static Flow Tolerance	+/- 4 %
Dynamic Flow Tolerance	+/- 4 % @ ti = 1,5 ms
Leakage	< 2,0 mm³/min @ 23 °C
Fly Time (t_on)	220 µs
Closing Time (t_off)	250 µs
Droplet Size SMD	15 µm
Example Spray Pattern	
Static Flow	335 ... 2000 g/min @ 100 bar

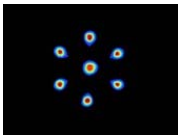
Part Number	
Mini-HDEV LV 8A	on request

Examples of variations, further variations on request

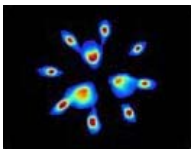




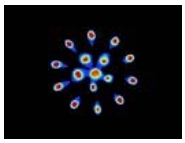
Jets on a circle



Jets on a circle and a middle jet

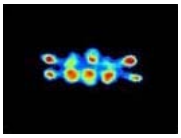


Jets on two circles



Jets on two circles and a middle jet

Jet configuration regarding the spark plug position



Flat jet configuration

Power Stage Units

HPI 1.1

The injector power stage HPI 1.1 is an instrument for driving injectors for gasoline direct injection. Combined with a suitable ECU up to 6 injectors can be driven. The injectors are gathered in 3 groups of 2 injectors each. Within a group only one injector can be switched on at the same time. The 3 groups are totally independent, so that overlapping injection of injectors of different groups is possible. Communication between main ECU and the HPI 1.1 is realized via CAN interface.

HPI 1.1 Active low

The injection control inputs of the HPI 1.1 Active low are inverting (Low = ”ON”) for operation with standard lowside power stages of automotive ECUs.

Application	
Max. number of cylinders	6
Max. rpm (4-cyl. operation)	9,000
Max. rpm (6-cyl. operation)	6,000
Optimised for Bosch high pressure injection valves HDEV 1/HDEV 5	
Max. vibration	*Vibration profile 2 (see Appendix or www.bosch-motorsport.com)*

Mechanical Data	
Sheet-metal housing	
Each connector pin individually filtered	
Vibration damped circuit boards	
Housing temperature	-25 ... 85 °C
Size	180 x 162 x 46 mm
Weight	430 g

Electrical Data	
Power supply	14 V
Internal voltage regulator	-
Operating voltage (normal operation)	11 ... 16 V
Operating voltage (engine start)	6 ... 18 V
Nominal voltage	14.0 V
Communication interfaces	
1 CAN (500 kBaud)	
1 K-Line	

Part Number	
HPI 1.1 Active low (for HDEV 1)	**F 01T A20 000-01**
HPI 1.1 Active low (for HDEV 5)	**F 02U V00 030-01**

HPI 1.1 Active high

The injection control inputs of the HPI 1.1 Active high are non-inverting (High = ”ON”).

Application	
Max. number of cylinders	6
Max. rpm (4-cyl. operation)	9,000
Max. rpm (6-cyl. operation)	6,000
Optimised for Bosch high pressure injection valves HDEV 1/HDEV 5	
Max. vibration	*Vibration profile 2 (see Appendix or www.bosch-motorsport.com)*

Mechanical Data	
Sheet-metal housing	
Each connector pin individually filtered	
Vibration damped circuit boards	
Housing temperature	-25 ... 85 °C
Size	180 x 162 x 46 mm
Weight	430 g

Electrical Data	
Power supply	14 V
Internal voltage regulator	-
Operating voltage (normal operation)	11 ... 16 V
Operating voltage (engine start)	6 ... 18 V
Nominal voltage	14.0 V
Communication interfaces	
1 CAN (500kBaud)	
1 K-Line	

Part Number	
HPI 1.1 Active high (for HDEV 1)	**F 01E B01 645-01**
HPI 1.1 Active high (for HDEV 5)	**F 02U V00 036-01**

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	*Vibration profile 1 (see Appendix or www.bosch-motorsport.com)*

Electrical Data	
Optimised for Bosch injection valves	Mini-HDEV LV
Max. rpm	20,000
Internal voltage regulator	-

Part Number	
HPI 1.16 LV	**F 01T A20 017**

HPI 1.16 LVD

In addition the HPI 1.16 LVD has an internal voltage regulator.

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	*Vibration profile 1 (see Appendix or www.bosch-motorsport.com)*

Electrical Data	
Optimised for Bosch injection valves	Mini-HDEV LV
Max. rpm	20,000
Internal voltage regulator	14 ... 17 V

Part Number	
HPI 1.16 LVD	**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 can be used for example in racing series like DTM, 24 h Le Mans, etc (90 V external required).

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	*Vibration profile 1 (see Appendix or www.bosch-motorsport.com)*

Electrical Data	
Optimised for Bosch HP injection valves HDEV 5.1, Mini-HDEV 1.2	
Max. rpm	12,500
Internal voltage regulator	-

Part Number	
HPI 1.16 HV	**F 01T A20 019**

HPI 1.16 HVD

In addition the HPI 1.16 HVD has an internal voltage regulator.

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	*Vibration profile 1 (see Appendix or www.bosch-motorsport.com)*

Electrical Data	
Optimised for Bosch HP injection valves HDEV 5.1, Mini-HDEV 1.2	
Max. rpm	12,500
Internal voltage regulator	65 ... 90 V

Part Number	
HPI 1.16 HVD	**F 01T A20 018**

Ignition Module IM 3.1 / 3.2

This ignition module IM is an external ignition power stage capable of supplying up to three non-transistorized ignition coils.

The IM input signal should be supplied by an ECU with ignition signal outputs in the range of 10 to 20 mA (e.g.: MS 4.x or MS 4.x Sport).

The IM unit combines the robustness of a high quality production part with good electrical performance to provide an ideal solution for adapting non-transistorized coils to an ECU without internal ignition driver stages.

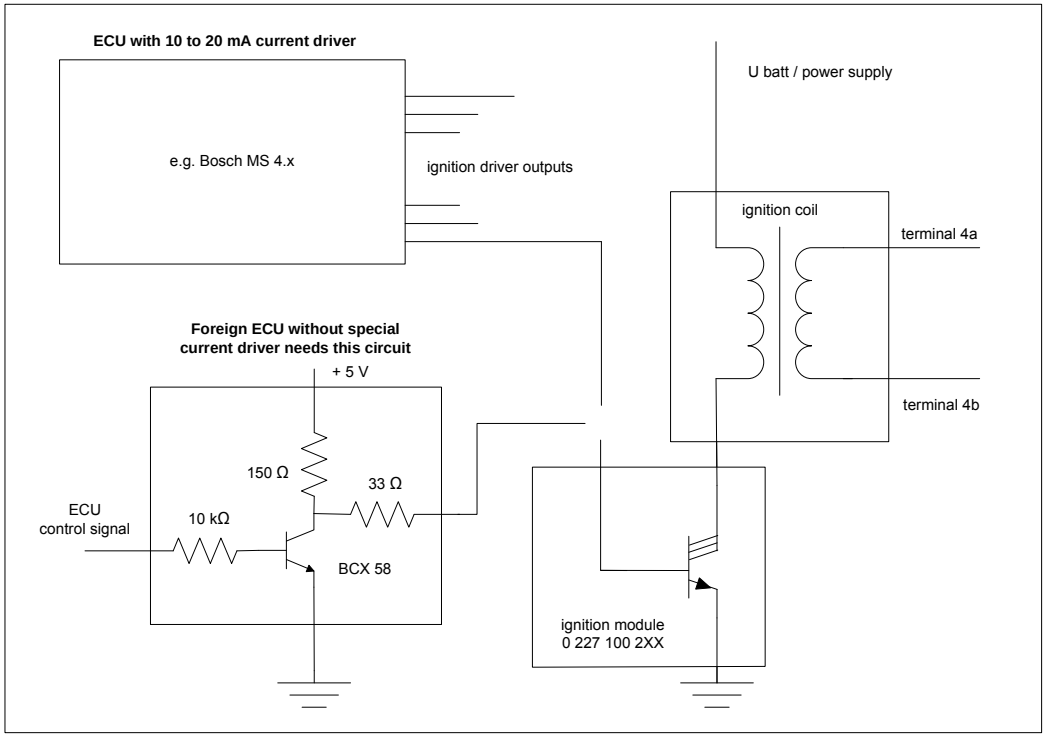
Application	
Primary current	≤ 8.5 A
Clamp voltage	380 V ±30 V
Operating temperature range @ measuring point	-40 ... 120 °C
Storage temperature range	-40 ... 130 °C
Max. vibration	400 m/s² @ 5 ... 2,500 Hz

Electrical Data	
U_{Batt} typical	13.5 V
Voltage supply	6 ... 16.5 V
I_B high active on	min. 10 mA
I_B low off	0 mA
I_B	10 ... 22 mA
I_C typical	≤ 8.5 A
I_C max. @ T_U < 120 °C	< 10 A
U_{CE} satt @ I_C = 5 A	< 3 V
U_{CE} satt @ I_C max	< 9 V

Mechanical Data	
Size	[1] 70.5 x 68 x 20 mm [2] 71 x 48 x 21 mm
Weight w/o cable	47 g
Mounting	2 x M4 screws with spring washer

Characteristic	
Characteristic dwell time	see characteristic dwell time from the ignition coil used
Internal transistor	triple Darlington

Electronic circuit for connecting the ignition modules IM 3.1 / 3.2

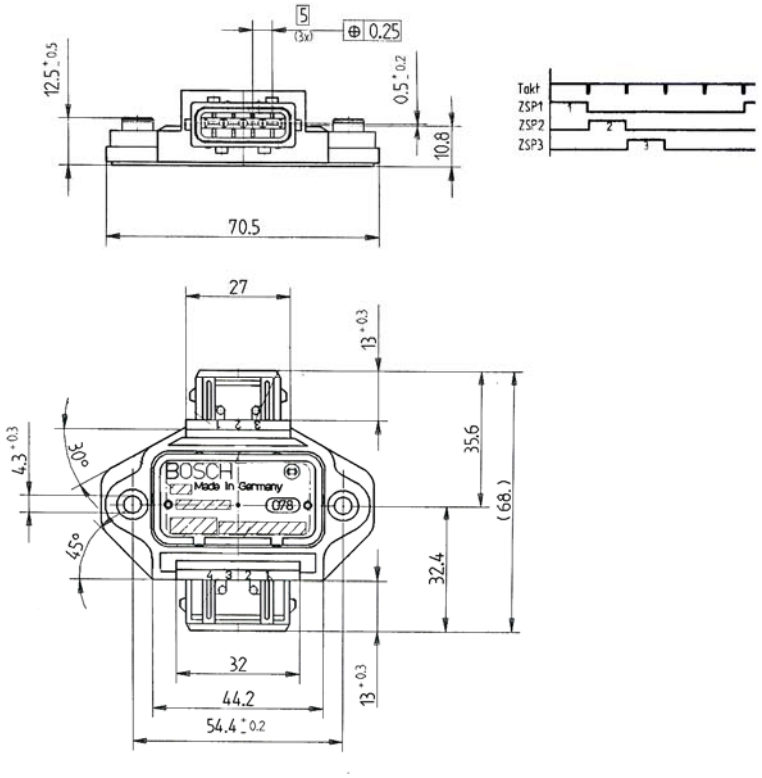


Connectors	
[1] Connector 1 Three Pin Connector @ 3.1	
Connector	Bosch Jetronic 3-pin
Mating connector	D 261 205 289-01
Pin 1	Collector Transistor 1
Pin 2	Collector Transistor 2
Pin 3	Collector Transistor 3
[1] Connector 2 Four Pin Connector @ 3.1	
Connector	Bosch Jetronic 4-pin
Mating connector	D 261 205 351-01
Pin 1	Basis Transistor 3
Pin 2	Gnd
Pin 3	Basis Transistor 2
Pin 4	Basis Transistor 1
[2] Connector 1 Seven Pin Connector @ 3.2	
Connector	Bosch Jetronic 7-pin
Mating connector	F 02U B00 252-01
Pin 1	Collector Transistor 1
Pin 2	Basis Transistor 1
Pin 3	Collector Transistor 2
Pin 4	Gnd
Pin 5	Basis Transistor 2
Pin 6	Collector Transistor 3
Pin 7	Basis Transistor 3

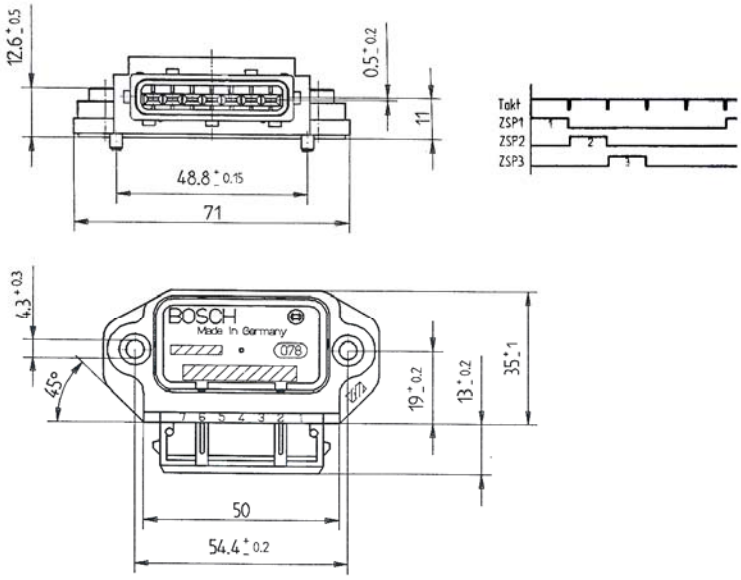
Application Hint
The ignition modules 3.1 / 3.2 can be used with: Coil 2x2, 3x2, P35, P35-T and PS or comparable coils.
Please ensure that the connectors are safe from water.
The IM has to be mounted onto a cooling body. The mounting surface needs a planarity of 0.2 mm.
A heat conductive paste has to be used.
The IM 3.1 / 3.2 are designed for use with engine control units which have no integrated ignition transistor.
Please observe the specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Ignition Module IM 3.1 [1]	**0 227 100 209**
Ignition Module IM 3.2 [2]	**0 227 100 203**

Dimensions IM 3.1



Dimensions IM 3.2



Ignition Module IM 4

This ignition module IM is an external ignition power stage capable of supplying up to four non-transistorized ignition coils.

The IM input signal should be supplied by an ECU with ignition signal outputs in the range of 10 to 20 mA (e.g.: MS 4.x or MS 4.x Sport).

The IM unit combines the robustness of a high quality production part with good electrical performance to provide an ideal solution for adapting non-transistorized coils to an ECU without internal ignition driver stages.

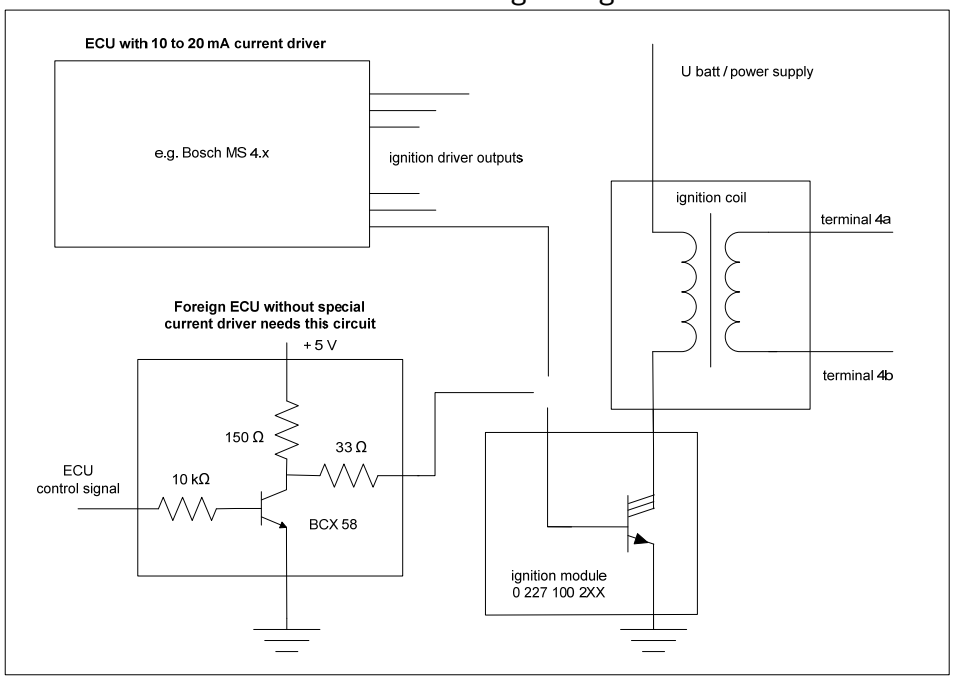
Application	
Primary current	≤ 8.5 A
Clamp voltage	380 V ±30 V
Operating temperature range @ measuring point	-40 ... 120 °C
Storage temperature range	-40 ... 130 °C
Max. vibration	400 m/s² @ 5 ... 2,500 Hz

Electrical Data	
U_{Batt} typical	13.5 V
Voltage supply	6 ... 16.5 V
I_B high active on	min. 10 mA
I_B low off	0 mA
I_B	10 ... 22 mA
I_C typical	< 8.5 A
I_C max. @ T_U < 120 °C	< 10 A
U_{CE} Satt @ I_C = 5 A	< 3 V
U_{CE} Satt @ I_C max	< 9 V

Mechanical Data	
Size	70.5 x 68 x 20 mm
Weight w/o cable	54 g
Mounting	2 x M4 screws with spring washer

Characteristic	
Characteristic dwell time	see characteristic dwell time from the ignition coil used
Internal transistor	triple Darlington

Electronic circuit for connecting the ignition module IM 4

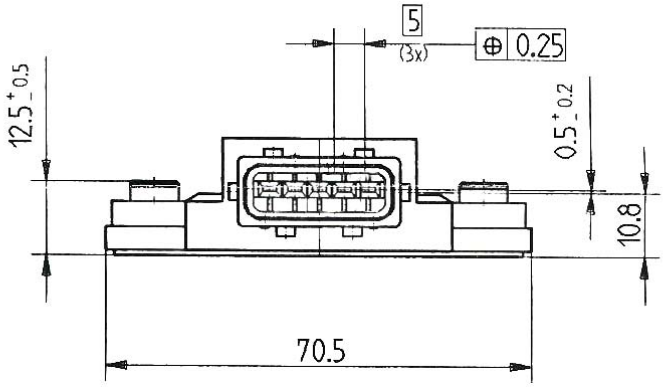


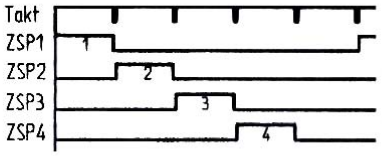
Connectors	
Connector 1 Four Pin Connector	
Connector	Bosch Jetronic 4-pin
Mating connector	D 261 205 351-01
Pin 1	Collector Transistor 4
Pin 2	Collector Transistor 3
Pin 3	Collector Transistor 2
Pin 4	Collector Transistor 1
Connector 2 Five Pin Connector	
Connector	Bosch Jetronic 5-pin
Mating connector	D 261 205 352-01
Pin 1	Basis Transistor 1
Pin 2	Basis Transistor 2
Pin 3	Gnd
Pin 4	Basis Transistor 3
Pin 5	Basis Transistor 4

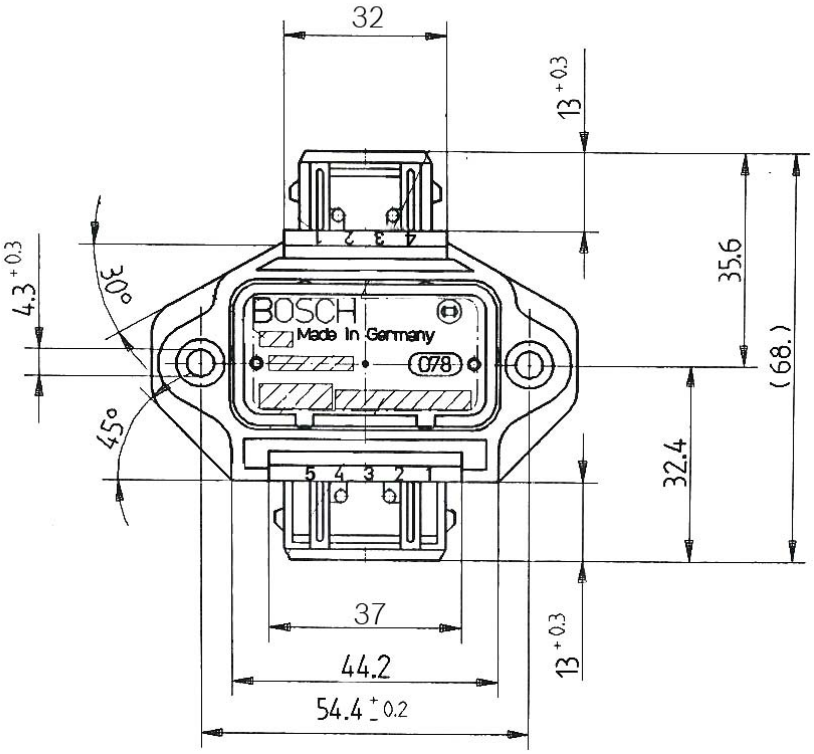
Application Hint
The ignition module 4 can be used with: Coils 2x2, 3x2, P35, P35-T and PS or comparable coils.
Please ensure that the connectors are safe from water.
The IM has to be mounted onto a cooling body. The mounting surface needs a planarity of 0.2 mm.
A heat conductive paste has to be used.
This ignition module is designed for use with engine control units which have no integrated ignition transistor.
Please observe the specified limit values.

Part Number	
Ignition Module IM 4	**0 227 100 211**

Dimensions IM 4







Fuel Pumps

Fuel Pump FP 100

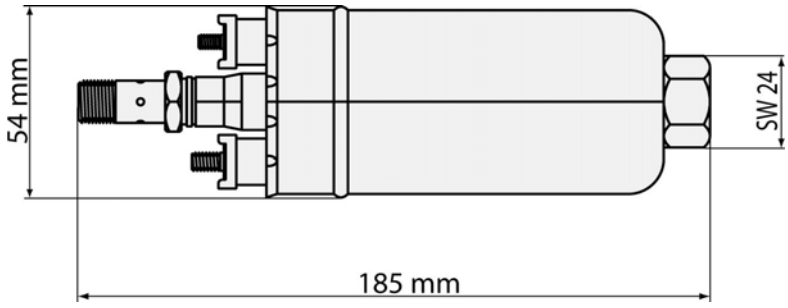
Fuel delivery: >100 l/h, 5 bar

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

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

Accessories
Primary connector

Part number	
FP 100	**Y 580 701 456-02**



Fuel Pump FP 165

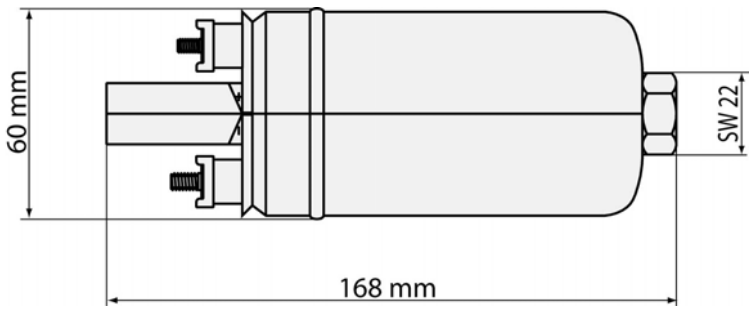
Fuel delivery: >165 l/h, 5 bar

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

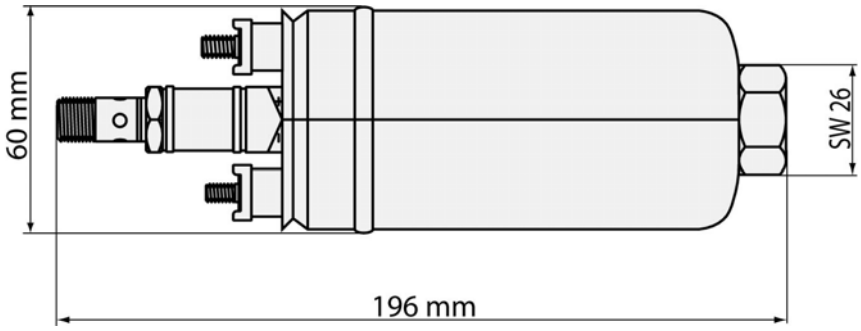
Fuel delivery: >200 l/h, 5/8 bar after a break-in period of 20 h

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



HP Fuel Pump HDP 5

The HDP 5 is a compact designed high pressure single piston pump. The design allows achieving a big delivery volume as well as high efficiency, as needed in motorsports applications. Variation of number of cam lobes and cam lift allows addressing the different flow-requirements.

Mechanical Data	
Nominal fuel delivery	up to 1.1 cm³/ U_{cam}
Nominal pressure	up to 20 MPa
Weight	approx. 780 g
Max. drive speed (pump drive shaft)	3,500 ... 4,650 min^{-1}
Supply pressure	4 ... 7 bar
Mounting on cylinder head or adapter flange	
Operating temperature	-40 °C ... +120 °C
Storage temperature	-40 °C ... +70 °C
Compatible Fuels	unleaded fuels, E22, E85, M15
Fuel temperature	80 °C (short-term 130 °C)
Max. vibration	up to 600 m/s²

Connections	
Intake side	e.g. thread hole M14x1.5
Pressure side	e.g. thread hole M14x1.5

Part Numbers	
Fuel delivery 0.67 cm³/ U_{cam}	on request
Fuel delivery 1.1 cm³/ U_{cam}	on request

Diesel Fuel Pump DFP 300

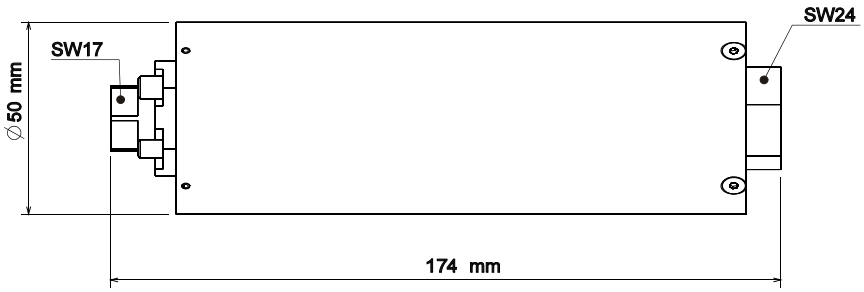
Fuel delivery: >300 l/h, 5 bar relative

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

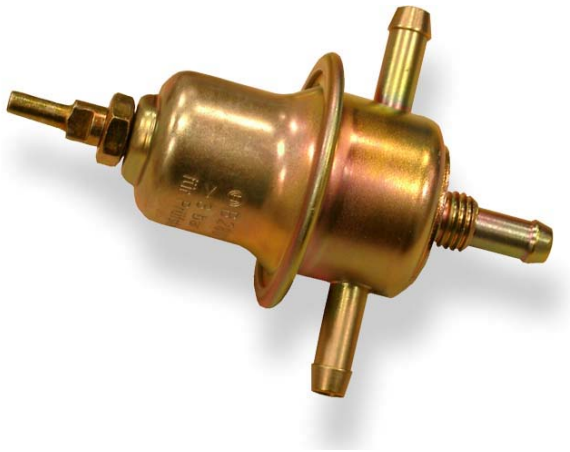
Part numbers	
DFP 300l/h	**B 261 205 366**



Fuel Pressure Regulators

Fuel Pressure Regulator 05-40 A

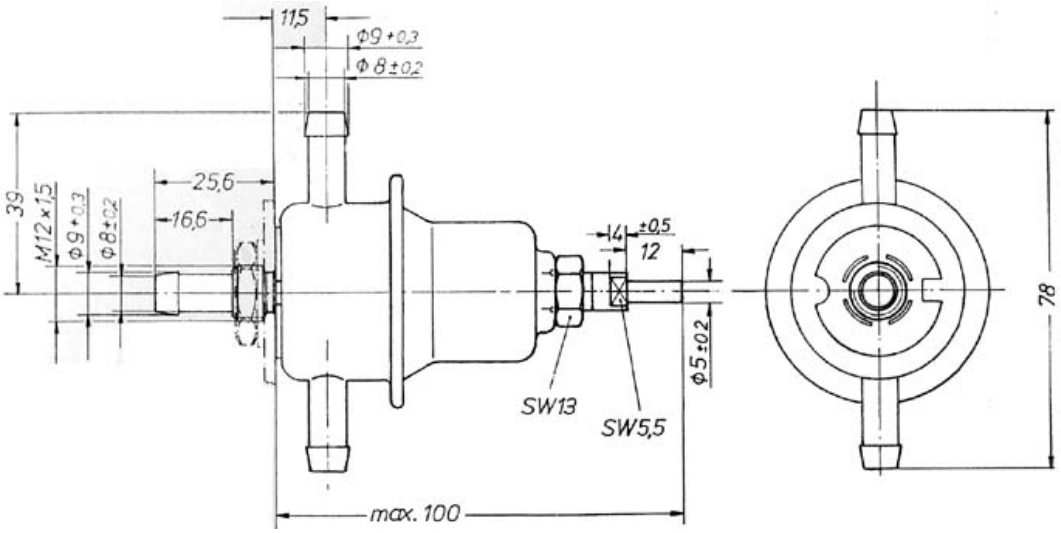
Pressure range: 0,5 ... 4 bar



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

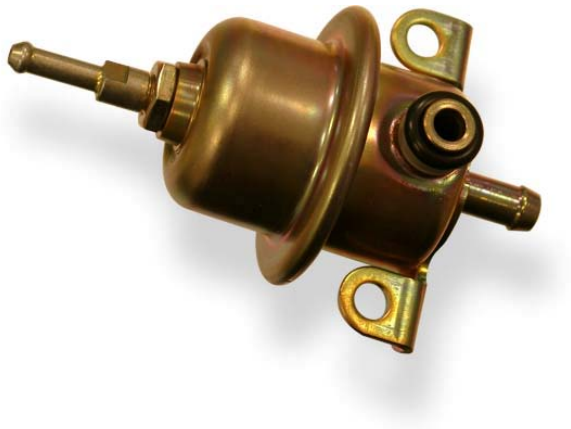
Part number	
	B 280 500 139
Offer drawing	**A 280 500 104**

Description
Sheet steel housing with manifold connection



Fuel Pressure Regulator 14-50

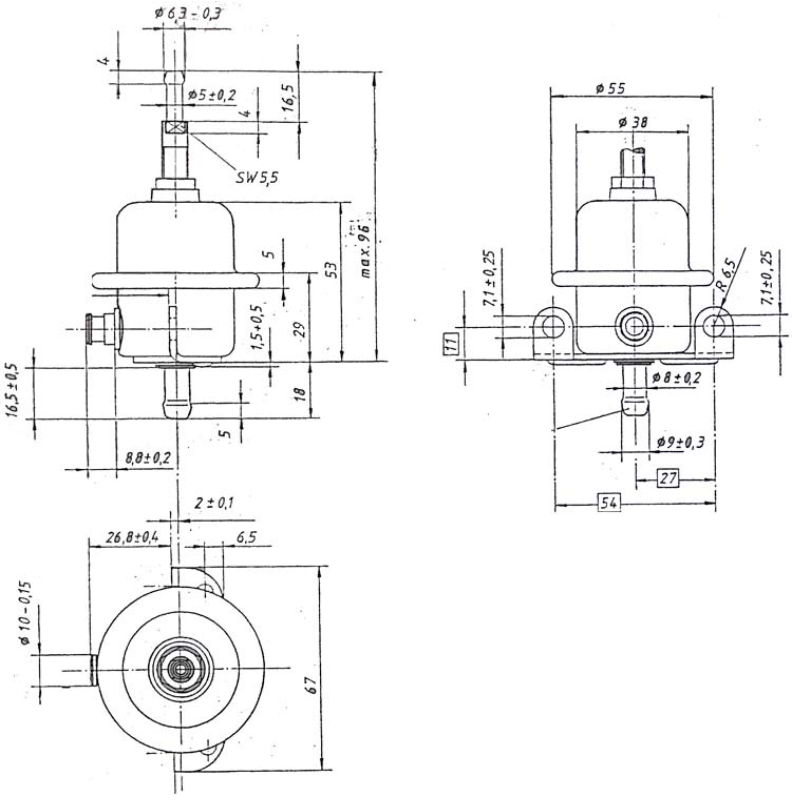
Pressure range: 1,4 ... 5 bar



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

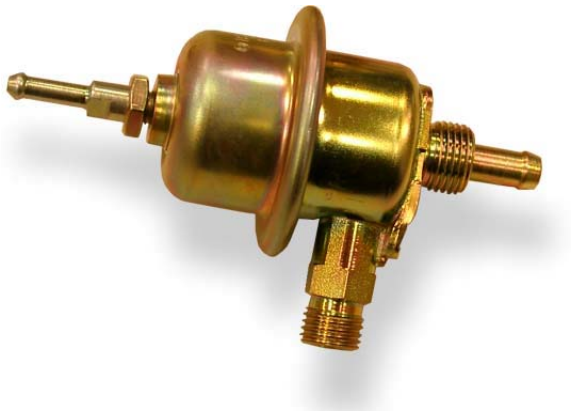
Part number	
1,4 ... 5 bar	**B 280 500 701**

Description
Sheet steel housing with manifold connection



Fuel Pressure Regulator 15-50

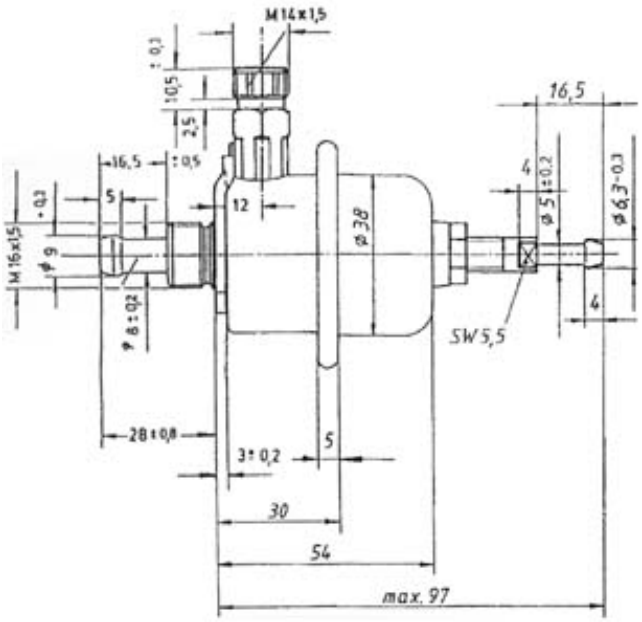
Pressure range: 1,5 ... 5 bar

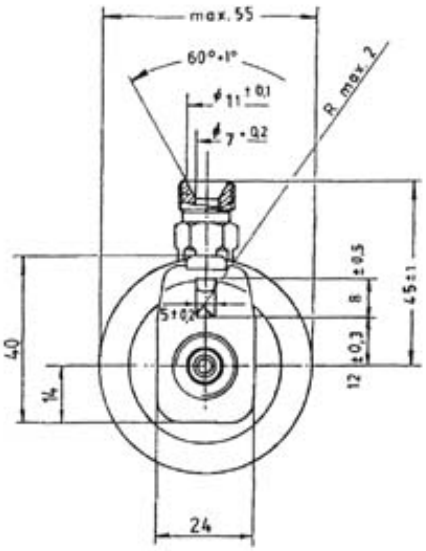


Mechanical data	
Supply	8 mm, O-ring
Reflow	M14 x 1,5
Reflow quantity	min. 15 l/h, max. 220 l/h

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

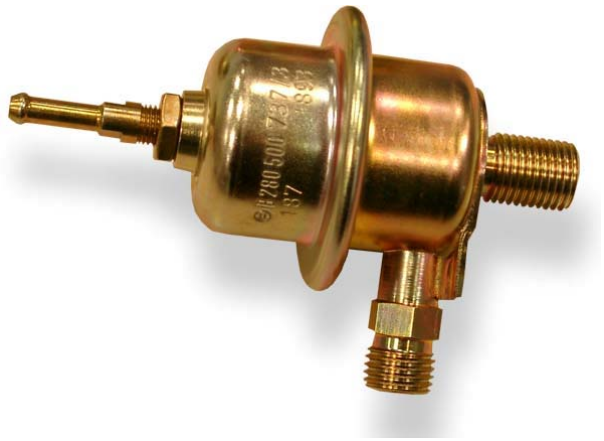
Description
Sheet steel housing with manifold connection





Fuel Pressure Regulator 19-50

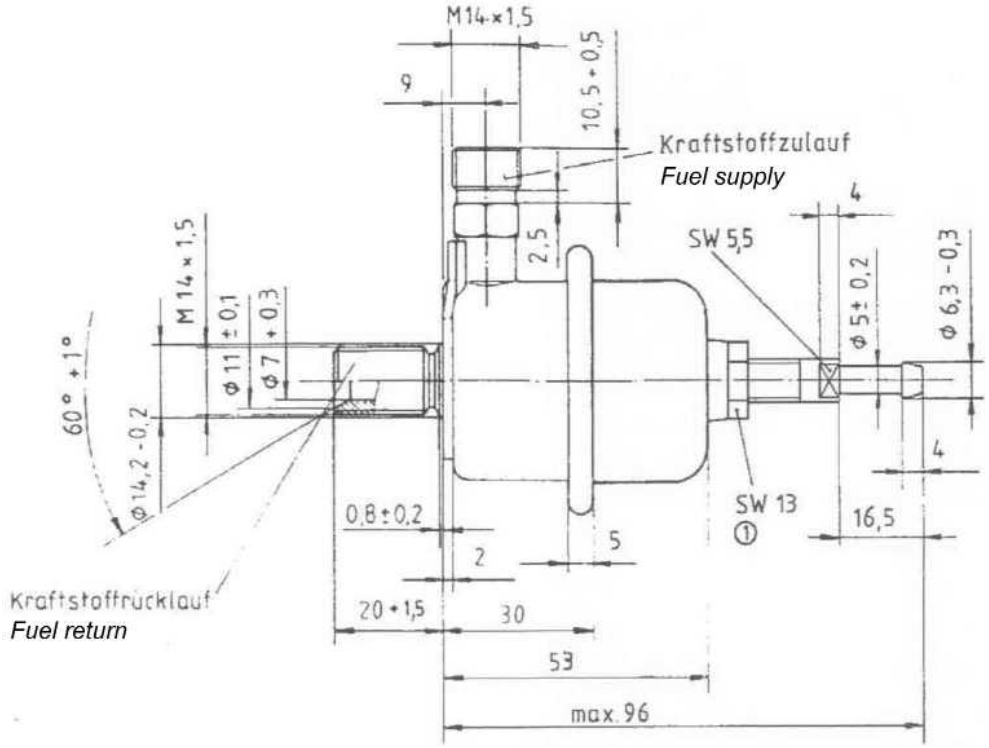
Pressure range: 1,9 ... 5 bar



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

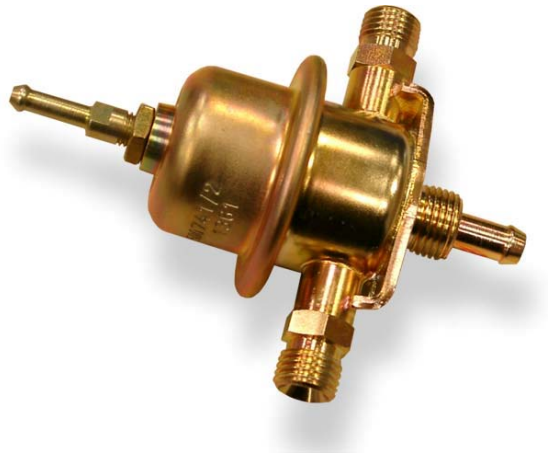
Part number	
	B 280 500 737
Offer drawing	**A 280 500 662**

Description
Sheet steel housing with manifold connection



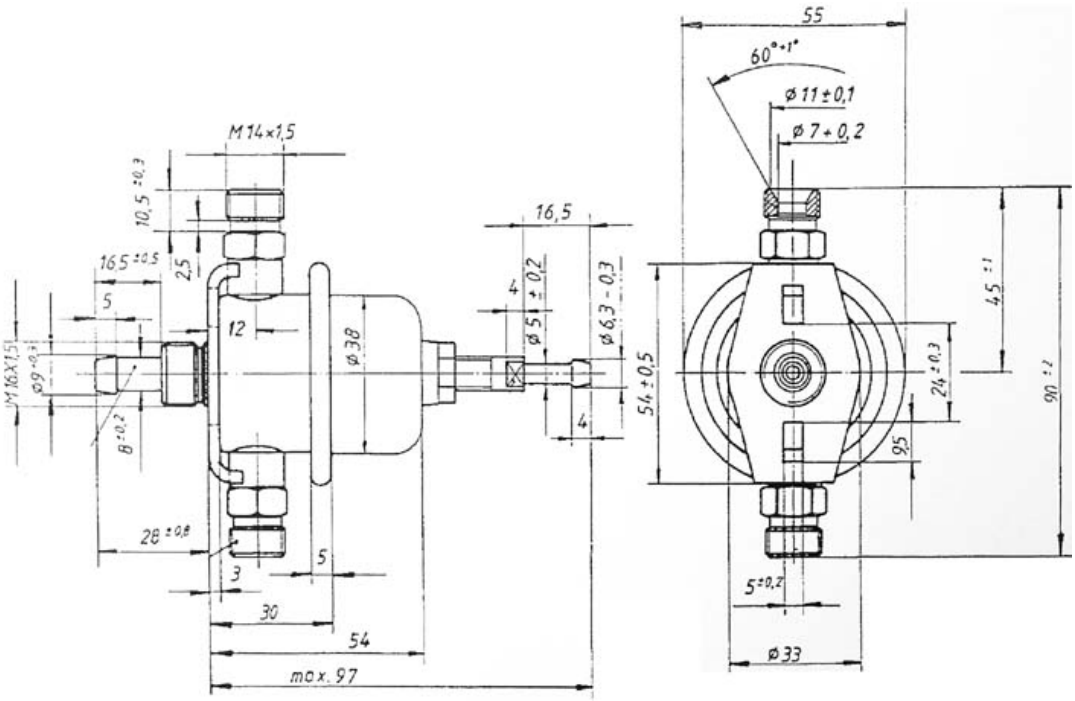
Fuel Pressure Regulator 20x120

Pressure ranges: 3 ... 6 bar/ 3 ... 12 bar



Mechanical data	
Supply	2 x M14x1,5
Reflow	8 mm, tube connector
Reflow quantity	min. 15 l/h, max. 220 l/h
Housing	sheet steel

Part numbers	
3 ... 6 bar	**B 280 500 714**
3 ... 12 bar (without manifold connection)	**B 280 500 742-02**



Fuel Pressure Regulators Mini/Mini M

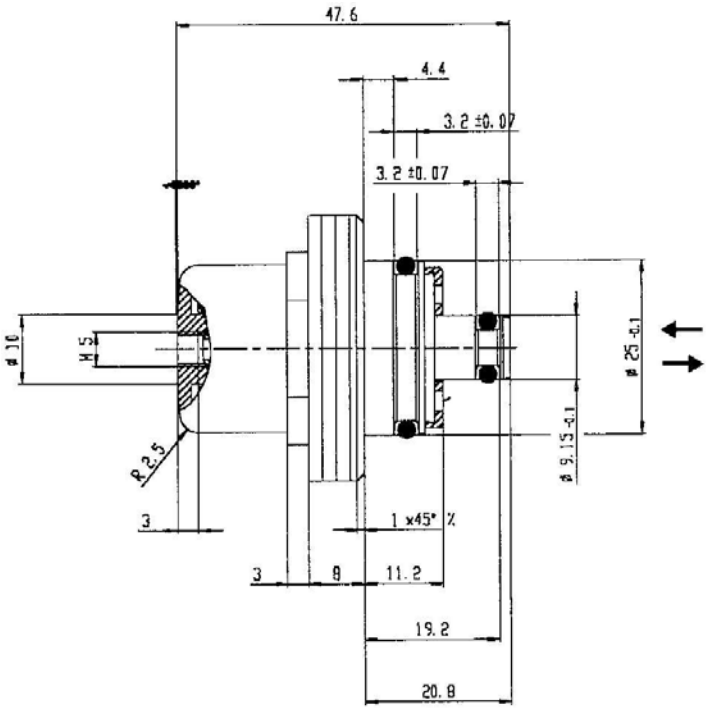
Pressure range: 6/8/10 bar

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

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

Description
Light weight aluminium housing
No manifold connection

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 261 208 123-01**



Erledigung durch Kunden
Effect by customer

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

Fuel Pressure Regulator Mini A

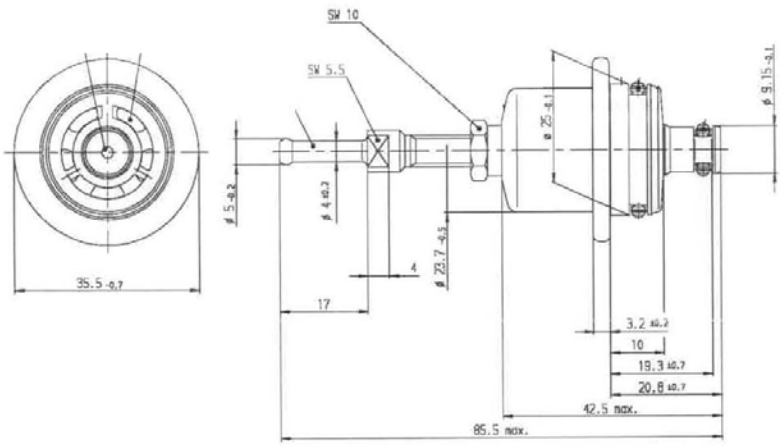
Pressure ranges: 2,2 ... 3,5 bar/3,5 ... 5 bar

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

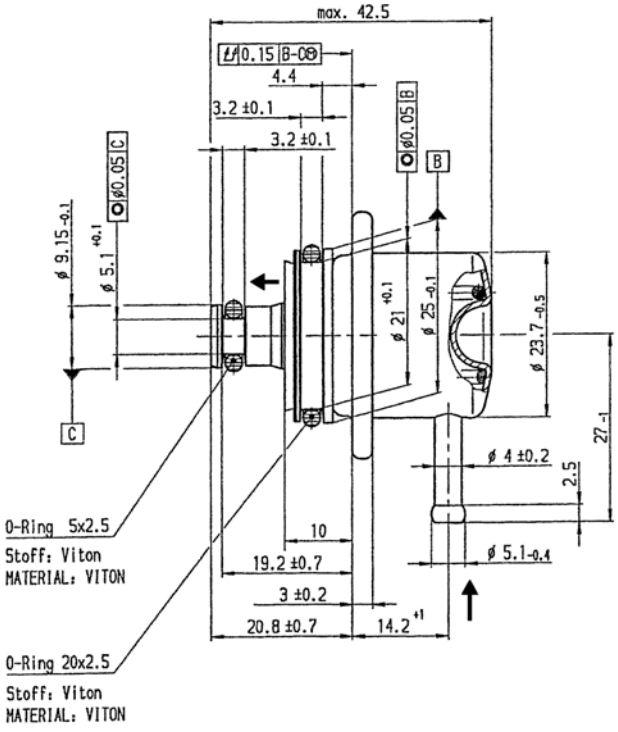
Fuel Pressure Regulator Mini 38

Pressure range: 3,8 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
Set pressure	380 kPa
Set pressure accuracy	2 %
Linearity	1 %
External leak	no fuel leakage at 500 kPa
Bust pressure	> 1500 kPa

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

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 ist unzulässig
  Operation with air is not allowed

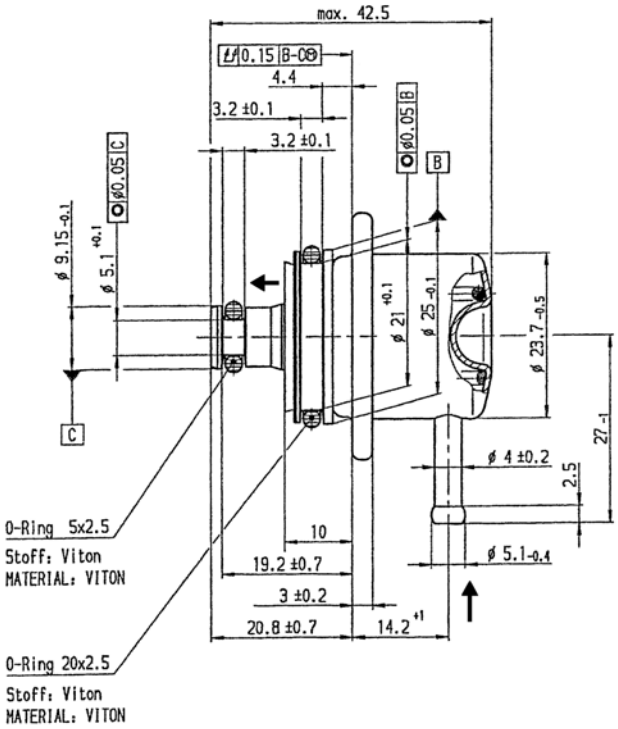
Fuel Pressure Regulator Mini 50

Pressure range: 5,0 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
Set pressure	500 kPa
Set pressure accuracy	2 %
Linearity	1 %
External leak	no fuel leakage at 500 kPa
Bust pressure	> 1500 kPa

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 ist unzulässig
  Operation with air is not allowed

HP Control Valve DSV

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

Mechanical data	
Pressure range	10 ... 200 bar
Flow quantity	max. 220 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)

Electrical data	
Operation voltage	6,5 ... 18 V
Operation current	I_{max} = 2,2 A

Part number	
HP Control Valve DSV	**0 261 540 011**

Diesel System Components

Diesel System Components

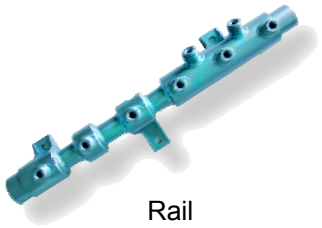
Injector CRI 2

HP fuel pump CP3

Rail

Injector CRI 3

HP fuel pump CP4



Rail

Pressure sensor RDS

Pressure control valve DRV

Component	Specification
Injector CRI 2	Solenoid, 6 - 8 holes, up to 1,500 ccm/min at 100 bar, up to 1,800 bar
Injector CRI 3	Piezo, 6 - 14 holes, up to 1,400 ccm/min at 100 bar, up to 2,200 bar
High pressure fuel pump CP3 / CP4	Pump with control valve and optional gear pump, up to 1,400 ccm/rev
Pressure control valve DRV	Pressure range up to 2,400 bar
Pressure limiting valve DBV	Pressure range up to 2,200 bar
Pressure sensor RDS	Pressure range up to 2,400 bar
Rails	Common rail for up to 6 cylinders per bank

The geometry and characteristics of diesel engine components are more dependent upon the application than for gasoline engines. A single injector design will not fit all Diesel engines due to varying mechanical and nozzle geometry requirements. In addition, the injection system can vary from year to year even within the same make of car.

Bosch Motorsport uses the same technology for racing that was developed by Bosch for production vehicle applications. This includes both solenoid (magnetic) technology used in earlier systems, and the latest cutting-edge piezo technology.

Bosch Motorsport can offer a wide variety of modifications to fit the system to your specifications. These modifications include:

- Definition of suitable base components from other (or larger) engine applications.
- Adaptation of components for mating, fit and orientation to suit the selected application.
- Flow enhancement of injectors and rails.
- Injector nozzle adaptation (flow rate, number of holes, spray cone angle etc.).

Our goal is to offer the best balance of cost and performance for your application. This is why we offer different levels of modifications to choose from. Below is an example of the different levels for a 4-cylinder engine with 4 injectors, 1 high pressure pump, and a single fuel rail:

	1st Level	2nd Level	3rd Level
Description	series components with some minor modifications (e.g. series components from a bigger engine (e.g. pump) plus series injector with sample nozzle)	series components with modification (e.g. modified injector body with sample nozzle)	components manufactured completely to your specification (e.g. heavily modified series components or new products)
Functioning	Solenoid	Piezo	Piezo or Solenoid
Injectors	4 x 650.00 €	4 x 2,100.00 €	On request
High Pressure Pump	1,250.00 €	3,000.00 €	On request
Fuel Rail	500.00 €	1,000.00 €	On request
System Price	4,350.00 €	12,400.00 €	On request
	(Prices will be finalized in your personal offer once part numbers are defined)		

Additional remark:

Bosch Motorsport does not manufacture high pressure fuel lines, but we can assist you in finding a company that can build high pressure lines for your application.

When contacting us for more information on our Diesel components, please have the following information ready so that we may best determine components required for your application:

- The base engine / the car where this engine originally is installed
- Model year and type of car / engine
- The base output level and the desired output level for the engine

- If it is a Bosch application, the part numbers of the components
- Alternatively the car / engine manufacturer part number of the original injection system.

Please note:
If your engine is originally equipped with Bosch components, modifications will be easier than replacing third party components.

We reserve the right to assess a fee for applications where the component specification requires an extraordinary amount of time.

Ignition Coils

Double Fire Coil 3x2

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

The advantage of this coil is that the ECU needs only three internal ignition power stages for supplying a 6-cylinder engine.

The double fire 3x2 coil benefits from series production ensuring robustness and low cost.

Application	
Spark energy	≤ 65 mJ
Primary current	≤ 8,0 A
Operating temperature range @ outer core	-20 ... 120 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 200 m/s² @ 5 ... 250 Hz

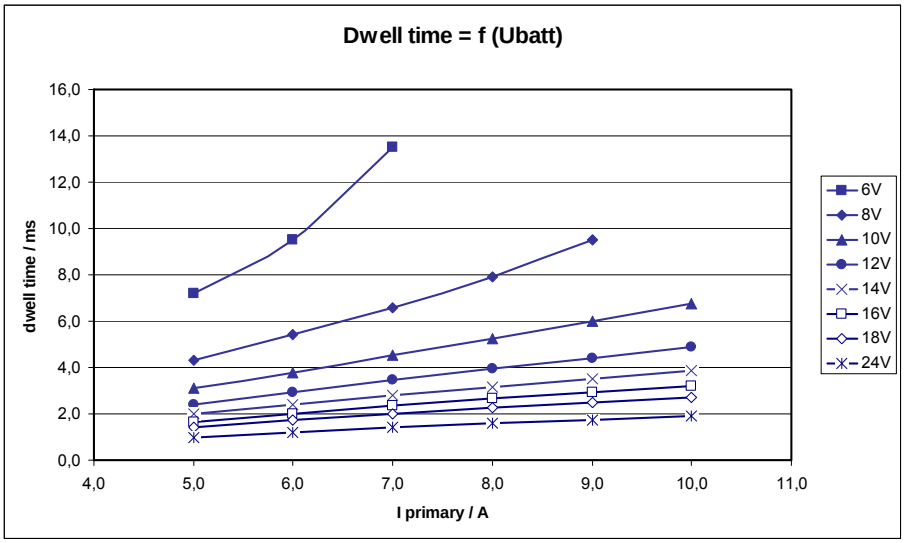
Electrical Data	
Primary resistance with cable	500 mΩ
Secondary resistance	12 kΩ
High voltage rise time	≤ 1,9 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	≤ 35 kV
Spark current	≤ 80 mA
Spark duration @ 1 kV || 1MΩ	≤ 1,9 ms
Noise suppression	No
Suppression diode / EFU	No
Integrated power stage	No
Ion current signal	No

Mechanical Data	
Weight	1490 g
Mounting	screw fastening

Communication	
Measured with power stage	IGBT IRG4BC40S (Uce = 600 V)

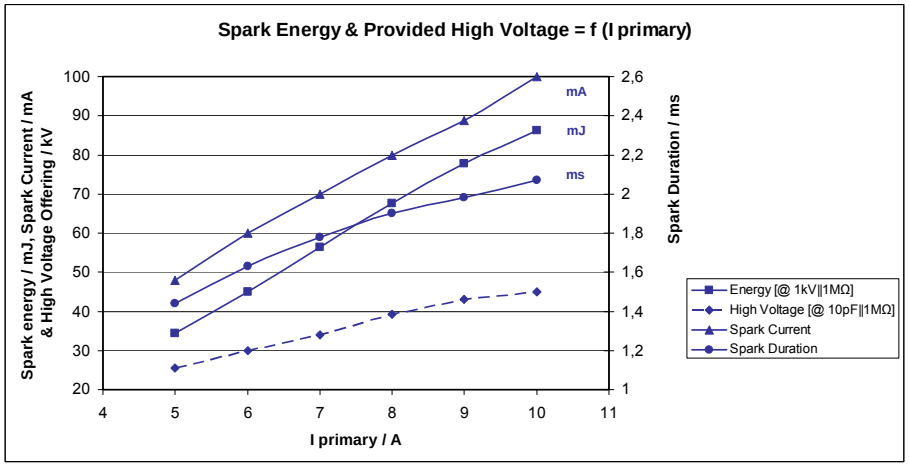
Characteristic Dwell Time [ms]

I primary	Ubatt									
	6 V	8 V	10 V	12 V	14 V	16 V	18 V	20 V	22 V	24 V
5,0	7,2	4,3	3,1	2,4	2,0	1,7	1,4	1,3	1,1	1,0
6,0	9,5	5,4	3,8	2,9	2,4	2,0	1,7	1,5	1,3	1,2
7,0	13,5	6,6	4,5	3,5	2,8	2,4	2,0	1,8	1,6	1,4
8,0		7,9	5,2	3,9	3,2	2,7	2,3	2,0	1,8	1,6
9,0		9,5	6,0	4,4	3,5	2,9	2,5	2,2	1,9	1,8
10,0			6,7	4,9	3,9	3,2	2,7	2,4	2,1	1,9



Characteristic Spark Energy & Provided High Voltage

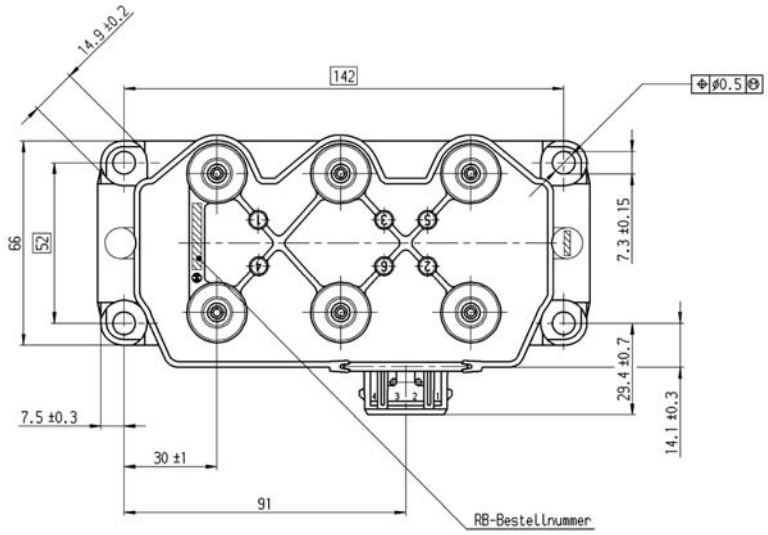
	I primary					
	5 A	6 A	7 A	8 A	9 A	10 A
Spark Energy [mJ]	34,4	45	56,5	67,6	77,7	86,2
Spark Duration [µs]	1,44	1,63	1,78	1,9	1,98	2,07
Spark Current [mA]	48	60	70	80	88,8	100
High Voltage [kV]	25,4	29,9	34	39,3	43	45

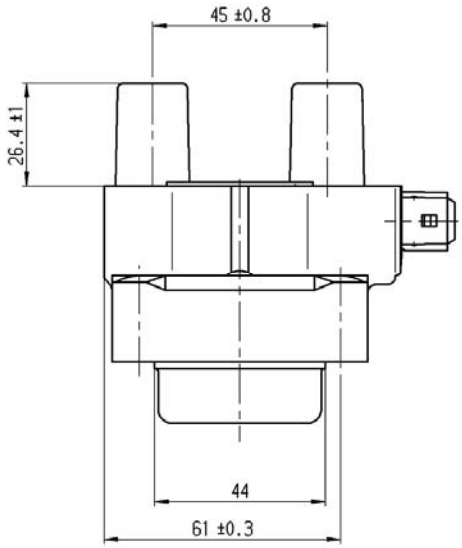


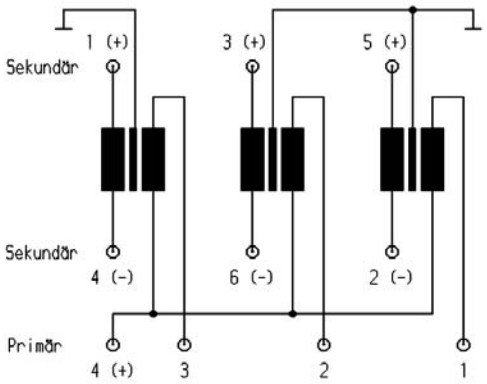
Connectors and Cables	
Connector	Bosch Jetronic
Connector Loom	D 261 205 351-01
Pin 1	Coil 3 ECU Ignition Driver Stage
Pin 2	Coil 2 ECU Ignition Driver Stage
Pin 3	Coil 1 ECU Ignition Driver Stage
Pin 4	Ubatt
Various motorsport and automotive connectors on request.	

Application Hint
The coil can be directly mounted on the engine.
Ignition cables are needed to connect the coil with the spark plug, please pay attention that the spark plugs are connected in the correct ignition firing order.
This coil is only for use with engine control units having two integrated ignition power stages, e.g. IGBT or BIP.
For technical reasons the values of the coils may vary.
Please use only within the specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Coil 3x2	**0 221 503 002**







Double Fire Coil 2x2

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

The advantage of this coil is that the ECU needs only two internal ignition power stages to supply a 4-cylinder engine.

The double fire 2x2 coil benefits from series production ensuring robustness and low cost.

Application	
Spark energy	≤ 70 mJ
Primary current	≤ 8,0 A
Operating temperature range @ outer core	-20 ... 120 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 200 m/s² @ 5 ... 250 Hz

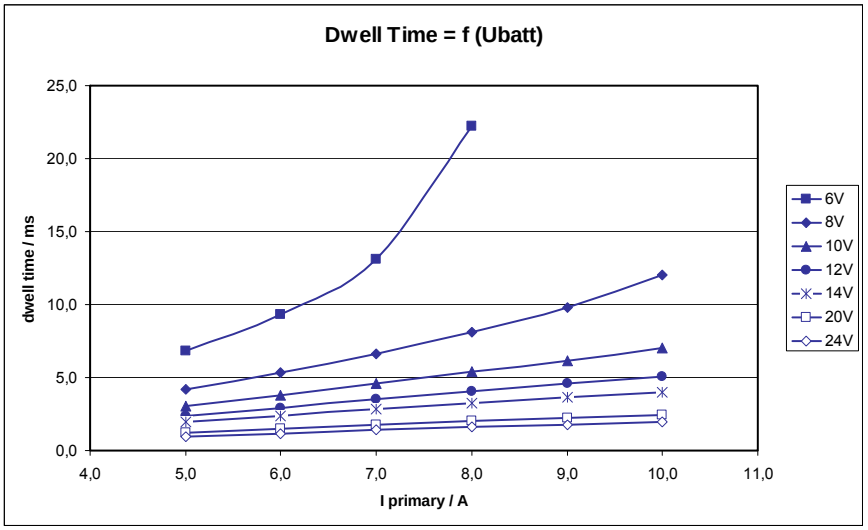
Mechanical Data	
Weight	916 g
Mounting	screw fastening

Electrical Data	
Primary resistance with cable	500 mΩ
Secondary resistance	13,3 kΩ
High voltage rise time	≤ 1,9 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	≤ 35 kV
Spark current	≤ 70 mA
Spark duration @ 1 kV || 1 MΩ	≤ 2,2 ms
Noise suppression	No
Suppression diode / EFU	No
Integrated power stage	No
Ionic current signal	No

Characteristic	
Measured with power stage	IGBT IRG4BC40S (Uce = 600 V)

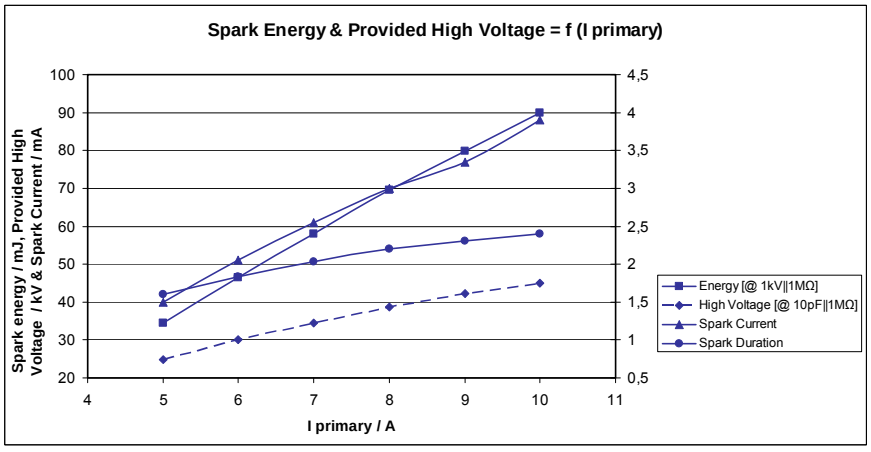
Characteristic Dwell Time [ms]

I primary	Ubatt									
	6 V	8 V	10 V	12 V	14 V	16 V	18 V	20 V	22 V	24 V
5,0 A	6,9	4,2	3,0	2,4	1,9	1,6	1,4	1,2	1,1	1,0
6,0 A	9,3	5,3	3,8	2,9	2,4	2,0	1,7	1,5	1,3	1,2
7,0 A	13,1	6,7	4,6	3,5	2,8	2,4	2,0	1,8	1,6	1,4
8,0 A	22,2	8,1	5,4	4,1	3,3	2,7	2,3	2,0	1,8	1,6
9,0 A	-	9,8	6,2	4,6	3,6	3,0	2,6	2,3	2,0	1,8
10,0 A	-	12,0	7,0	5,1	4,0	3,3	2,8	2,5	2,2	2,0



Characteristic Spark Energy & Provided High Voltage

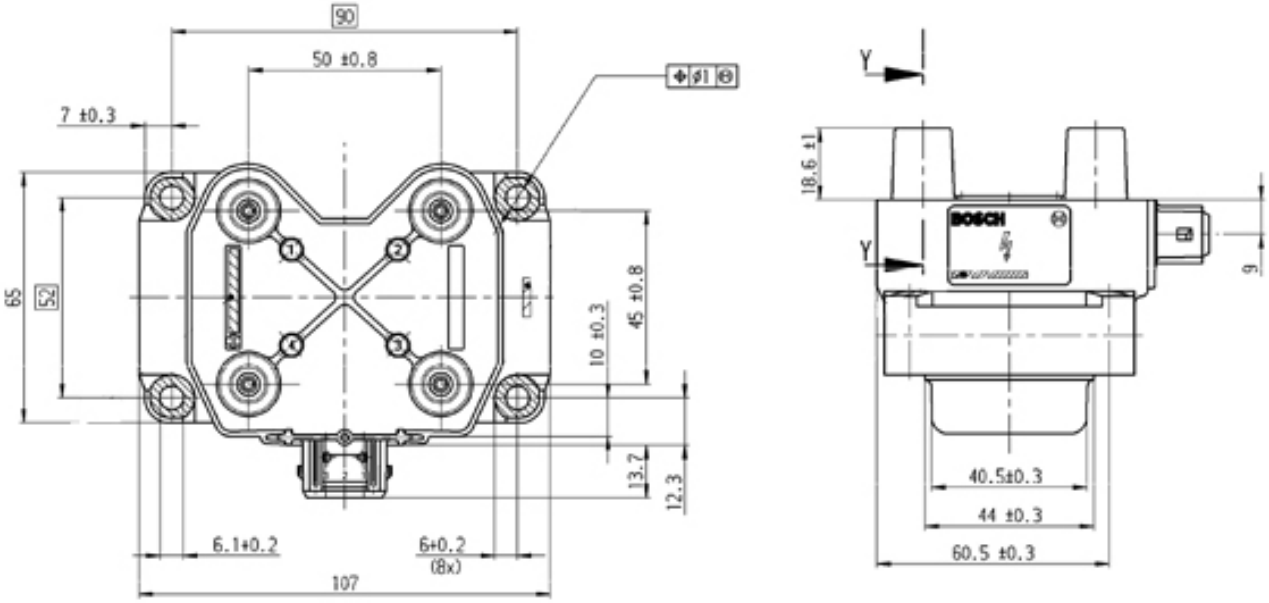
	I primary					
	5 A	6 A	7 A	8 A	9 A	10 A
Spark energy [mJ]	34,5	46,5	58,0	69,6	79,9	89,9
Spark duration [ms]	1,6	1,83	2,03	2,2	2,31	2,4
Spark current [mA]	40	51	61	70	77	88
High voltage [kV]	24,9	30	34,5	38,6	42,2	45



Connectors and Cables	
Connector	Bosch Jetronic
Connector loom	D 261 205 289-01
Pin 1	Coil 2 ECU Ignition Driver Stage
Pin 2	Ubatt
Pin 3	Coil 1 ECU Ignition Driver Stage
Various military and automotive connectors on request.	

Application Hint
The coil can be directly mounted on the engine.
Ignition cables are needed to connect the coil with the spark plug, please pay attention that the spark plugs are connected in the correct ignition firing order.
This coil is only for use with engine control units having two integrated ignition power stages, e.g. IGBT or BIP.
For technical reasons the values of the coils may vary.
Please use only within the specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Coil 2x2	**0 221 503 407**



Double Fire Coil 1x2

The main benefit of this double ended ignition coil is the low weight by very good performance.

The advantage of this coil is that the ECU needs only one internal ignition power stages to supply a 2-cylinder engine.

The double fire 1x2 coil benefits from series production ensuring robustness and low cost.

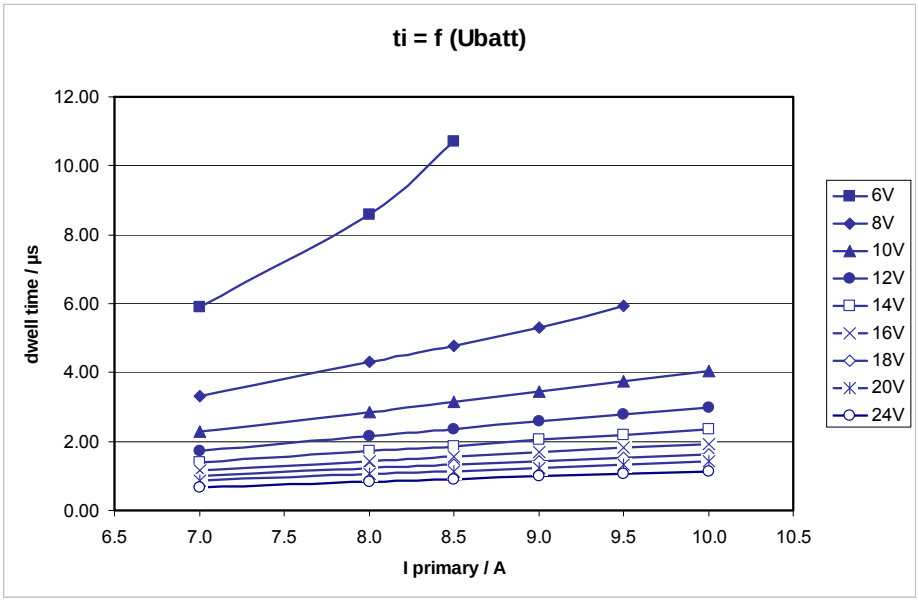
Application	
Spark energy	≤ 70 mJ
Primary current	≤ 10.0 A
Operating temperature range @ outer core	-20 ... 140 °C
Storage temperature range	-40 ... 110 °C
Max. vibration	≤ 400 m/s² @ 5 ... 2500 Hz

Electrical Data	
Primary resistance with cable	400 ± 30 mΩ
Secondary resistance	5.7 ± 0.5kΩ
High voltage rise time	≤ 2.5 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	≤ 35 kV
Spark current	≤ 100 mA
Spark duration @ 1 kV || 1 MΩ	≤ 1.54 ms
Noise suppression	No
Suppression diode / EFU	No
Integrated power stage	No
Ionic current signal	No

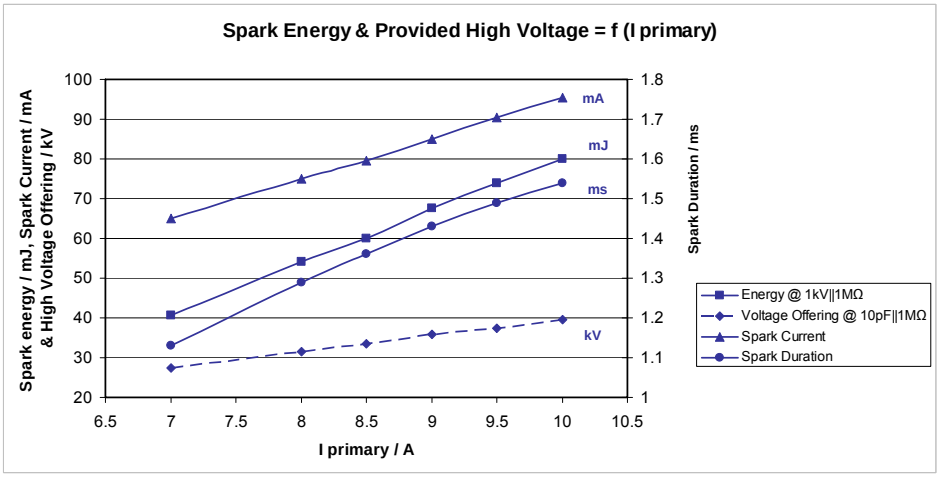
Mechanical Data	
Weight	180 g
Mounting	screw fastening

Characteristic	
Measured with power stage	IGBT IRG4BC40S (Uce = 600 V)

Characteristic Dwell Time [ms]									
I primary	Ubatt								
	6 V	8 V	10 V	12 V	14 V	16 V	18 V	20 V	24 V
7.0	5.90	3.30	2.28	1.73	1.39	1.15	0.98	0.85	0.67
8.0	8.60	4.30	2.86	2.15	1.72	1.42	1.21	1.05	0.82
8.5	10.70	4.76	3.15	2.35	1.87	1.55	1.32	1.14	0.90
9.0		5.32	3.46	2.57	2.04	1.69	1.43	1.24	0.98
9.5		5.92	3.76	2.77	2.19	1.81	1.54	1.33	1.05
10.0		6.60	4.06	2.97	2.35	1.93	1.64	1.42	1.12



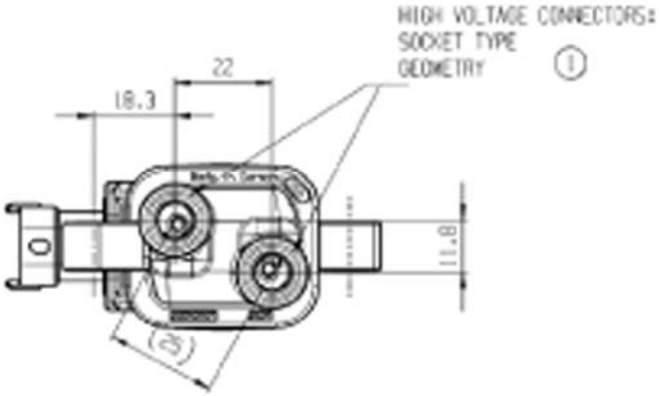
Characteristic Spark Energy & Provided High Voltage						
	I primary					
	7 A	8 A	8.5 A	9 A	9.5 A	10 A
Spark energy [mJ]	40.6	54.2	60.1	67.6	74	80
Spark duration [ms]	1.13	1.29	1.36	1.43	1.49	1.54
Spark current [mA]	65	75	79.5	85	90.5	95.5
High voltage [kV]	27.3	31.5	33.4	35.8	37.4	39.6

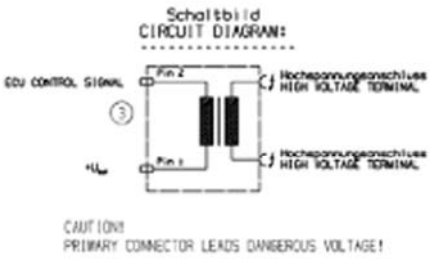


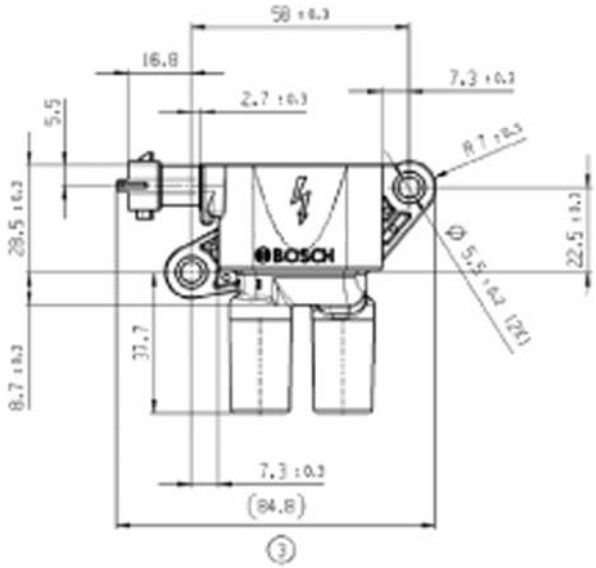
Connectors and Cables	
Connector	Bosch Compact
Connector loom	D 261 205 337-01
Pin 1	U_{batt}
Pin 2	ECU Ignition Driver Stage
Various motorsports and automotive connectors on request.	

Application Hint
The coil can be directly mounted on the engine.
Ignition cables are needed to connect the coil with the spark plug.
This coil is only for use with engine control units having integrated ignition power stages, e.g. IGBT or BIP.
For technical reasons the values of the coils may vary.
Please use only within the specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Coil 1x2	**F 02U 004 129-01**







Single Fire Coil P35 / P35-T

This single fire coil is a low cost concept designed for direct mounting to the cylinder head.

The P35 coil has no integrated power stage and is developed for use with ECUs that have integrated ignition transistors.

The P35-T has an integrated transistor for use with ECUs that have ignition power stages with 10 mA to 20 mA current output.

The length of the spark plug connector can be defined by customer. The single fire coil benefits from series production ensuring robustness and low cost.

Application	
Spark energy	≤ 38 mJ
Primary current	≤ 7,5 A
Operating temperature range @ outer core	-20 ... 140 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 400 m/s² @ 5 ... 2500 Hz

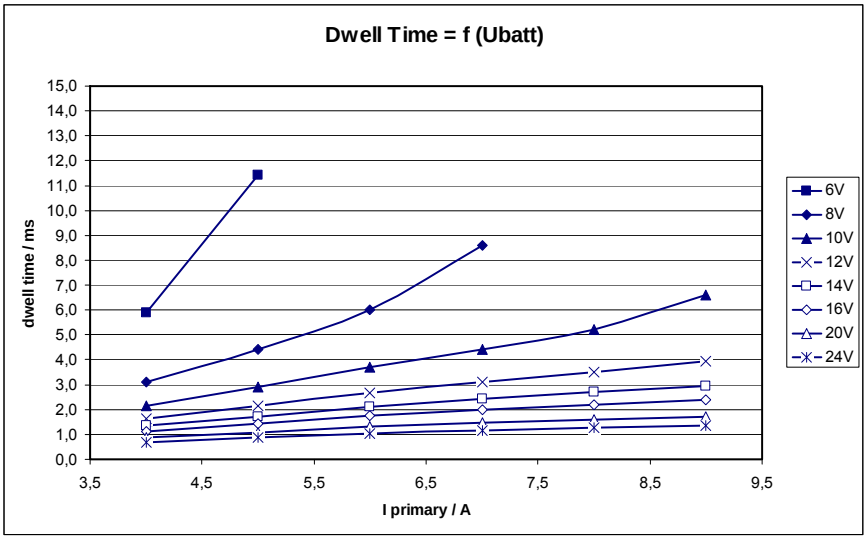
Mechanical Data	
Length	≤ 225 mm
Weight	194 ... 250 g
Mounting	screw fastening

Electrical Data	
Primary resistance with cable	[1|2] 760 mΩ [3|4] Incapable of measurement
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 2,0 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	≤ 34 kV
Spark current	≤ 90 mA
Spark duration @ 1 kV || 1 MΩ	≤ 1,13 ms
Noise suppression	Inductive
Suppression diode / EFU	Yes
Integrated power stage	[1|2] No [3|4] Yes
Ionic current signal	No

Characteristic	
Measured with power stage	[1|2] IGBT IRG4BC40S (Uce = 600 V) [3|4] BIP 373

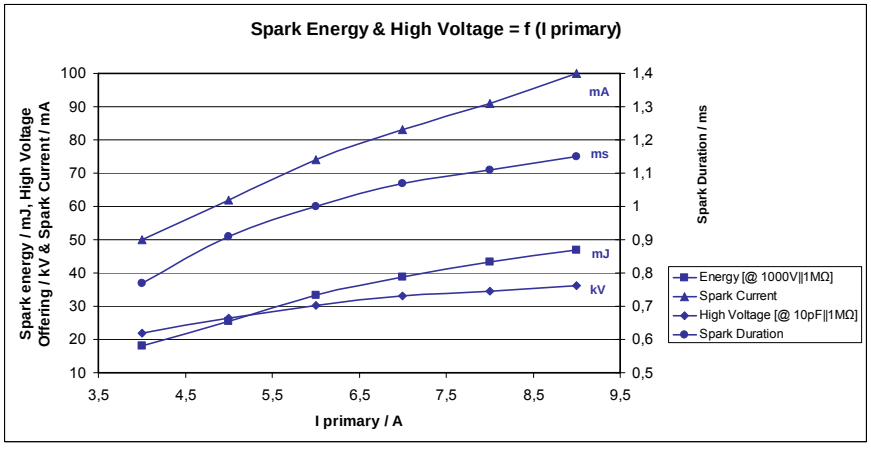
Characteristic Dwell Time [ms]

I primary	U batt									
	6 V	8 V	10 V	12 V	14 V	16 V	18 V	20 V	22 V	24 V
4,0 A	5,9	3,1	2,2	1,6	1,4	1,1	1,0	0,9	0,8	0,7
5,0 A	11,4	4,4	2,9	2,1	1,7	1,4	1,2	1,1	1,0	0,9
6,0 A		6,0	3,7	2,7	2,1	1,8	1,5	1,3	1,2	1,0
7,0 A		8,6	4,4	3,1	2,4	2,0	1,7	1,5	1,3	1,2
8,0 A			5,2	3,5	2,7	2,2	1,9	1,6	1,4	1,3
9,0 A			6,6	3,9	3,0	2,4	2,0	1,7	1,5	1,4



Characteristic Spark Energy & High Voltage

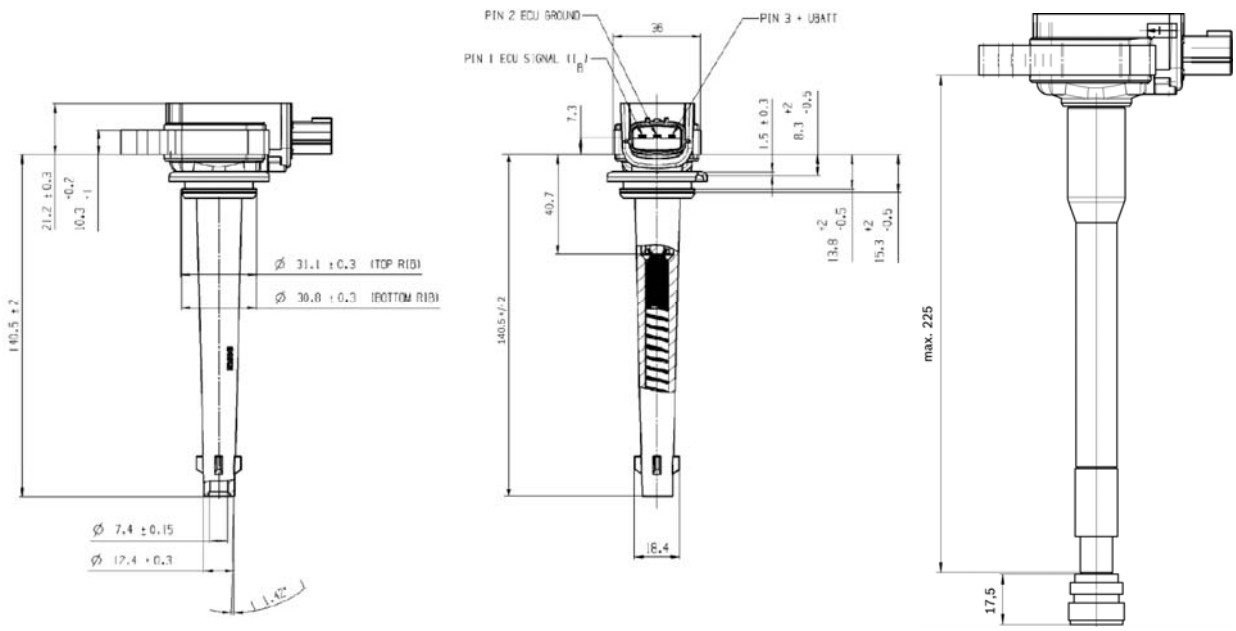
	I primary					
	4 A	5 A	6 A	7 A	8 A	9 A
Spark energy [mJ]	18	25,4	33,4	38,8	43,3	47
Spark duration [ms]	0,77	0,91	1	1,07	1,11	1,15
Spark current [mA]	50	62	74	83	91	100
High voltage [kV]	22	26,5	30,3	33	34,5	36,2



Connectors and Cables	
Connector	Sumitomo
Connector loom	D 261 205 367
Pin 1	[1|2] $ECU_{Ignition\ Driver\ Stage}$ [3|4] $ECU_{Ignition\ Signal}$
Pin 2	ECU_{Gnd}
Pin 3	U_{batt}
Various military and automotive connectors on request.	
Spark plug connector	[1|3] 140,5 mm [2|4] 85 ... 225 mm
Please specify the requested length of the spark plug connector with your order.	

Application Hint
During mounting of the spark plug please pay attention that full clamping and proper contacts are made to ensure safe connection between coil and spark plug.
For coils without "-T", please only use with engine control units with an integrated ignition power stage, e.g. IGBT IRG4BC40S.
The coils with "-T", please only use with engine control units without integrated power stages.
For technical reasons the values of the coils may vary.
Please only use within specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Coil P35 [1]	**0 221 504 030**
Coil P35 [2]	**F02U V00 235 01**
Coil P35-T [3]	**0 221 604 014**
Coil P35-T [4]	**F02U V00 234 01**



Single Fire Coil P50 / P50-M

This single fire coil is a low cost concept designed for direct mounting to the cylinder-head. A high voltage ignition cable can optionally be connected to the secondary output terminal.

The mating ECU must have internal ignition power stages for each single fire coil.

The coil P50-M is especially for motorsports applications. This coil has increased spark energy, increased high voltage rise time and is operable in higher vibration environments.

Application	
Spark energy	≤ 50 mJ
Primary current	≤ 8,5 A
Operating temperature range @ outer core	-20 ... 140 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	[1] ≤ 400 m/s² @ 5 ... 2000 Hz [2] ≤ 800 m/s² @ 5 ... 2000 Hz

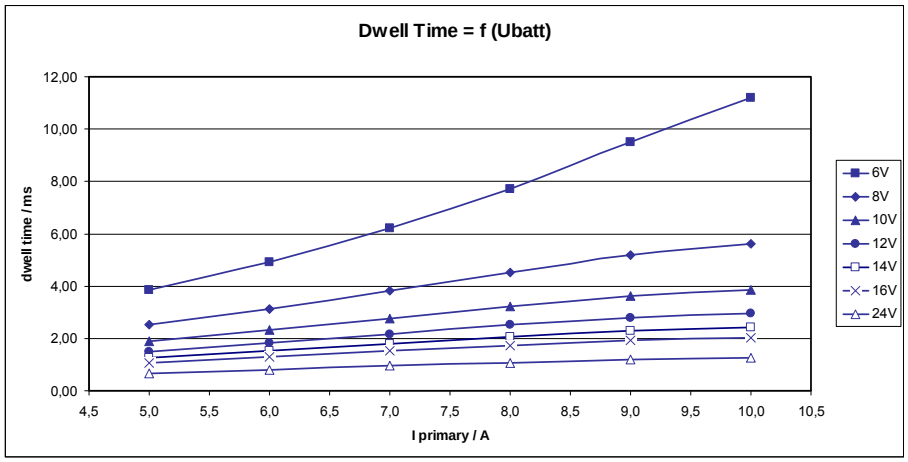
Mechanical Data	
Weight	[1] 223 g [2] 265 g
Mounting	pluggable

Electrical Data	
Primary resistance with cable	370 mΩ
Secondary resistance	incapable of measurement
High voltage rise time	≤ 3,0 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	≤ 35 kV
Spark current	≤ 92 mA
Spark duration @ 1kV || 1MΩ	≤ 1,15 ms
Noise suppression	Yes, with spark plug connector
Suppression diode / EFU	Yes
Integrated power stage	No
Ionic current signal	No

Characteristic
Measured with power stage IGBT IRG4BC40S (Uce = 600 V)

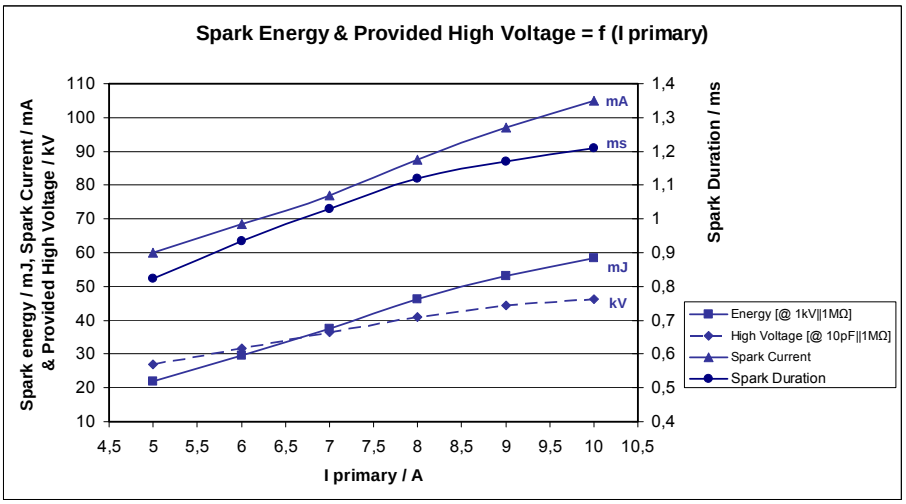
Characteristic Dwell Time [ms]

I primary	Ubatt								
	6 V	8 V	10 V	12 V	14 V	16 V	18 V	24 V	30 V
5,0 A	3,84	2,54	1,90	1,51	1,26	1,07	0,94	0,68	0,53
6,0 A	4,93	3,14	2,33	1,84	1,52	1,30	1,13	0,81	0,63
7,0 A	6,20	3,81	2,76	2,17	1,79	1,53	1,32	0,95	0,74
8,0 A	7,70	4,51	3,21	2,51	2,06	1,74	1,51	1,08	0,84
9,0 A	9,50	5,17	3,62	2,80	2,29	1,93	1,67	1,19	0,93
10,0 A	11,20	5,61	3,87	2,97	2,42	2,04	1,77	1,26	0,98



Characteristic Spark Energy & Provided High Voltage

	I primary					
	5 A	6 A	7 A	8 A	9 A	10 A
Spark energy [mJ]	22	29,7	37,5	46,3	53	58,4
Spark duration [µs]	822	934	1030	1120	1170	1210
Spark current [mA]	60	68,5	77	87,5	97	105
High voltage [kV]	26,8	31,6	36,4	40,9	44,4	46,3

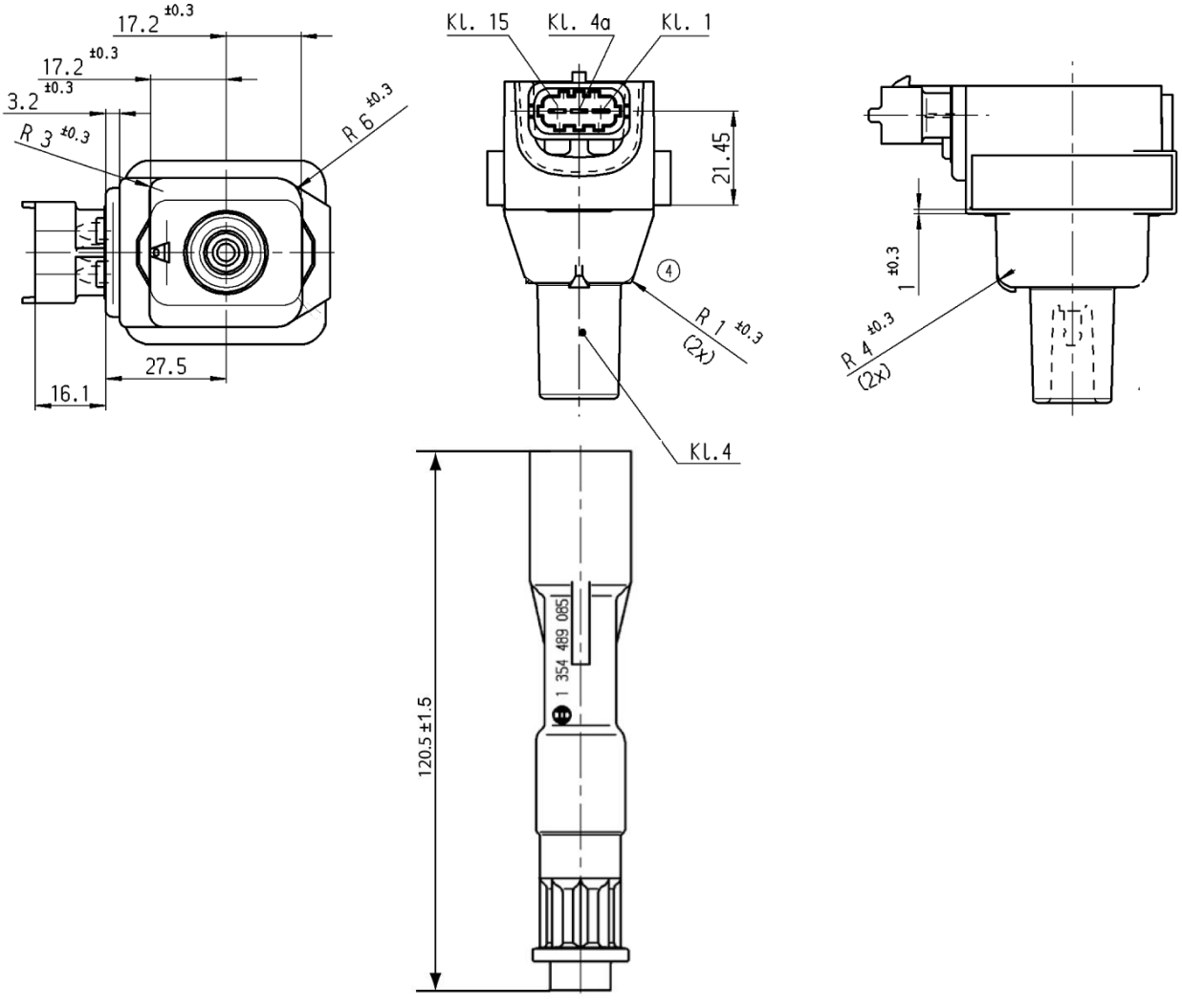


Connectors and Cables	
Connector	Bosch Compact
Connector loom	D 261 205 335-01
Pin 1	U_{batt}
Pin 2	Gnd
Pin 3	ECU Ignition Driver Stage
Various military and automotive connectors on request.	

Application Hint
During mounting of the spark plug please pay attention that full clamping and proper contacts are made to ensure safe connection between coil and spark plug.
This coil is only for use with engine control units having an integrated ignition power stage, e.g. IGBT IRG4BC40S or BIP118.
For technical reasons the values of the coils may vary.
Please only use within specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Accessories	
Accessory spark plug connector	**1 354 489 085**

Part Number	
P50 [1]	**0 221 504 001**
P50-M [2] incl. spark plug connector 1 354 489 085	**B 261 208 315**



Single Fire Coil P100-T

The P100-T is a transistorized coil (integrated power stage BIP 355) developed for engines needing immense spark energy and long spark duration. The integrated power stage requires an ECU with ignition signal outputs in the range of 10 to 20 mA.

This single fire coil is designed for direct cylinder head mounting.

This coil benefits from series production ensuring robustness and low cost.

Application	
Spark energy	≤ 100 mJ
Primary current	≤ 7,5 A
Operating temperature range outer core	-20 ... 140 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 400 m/s² @ 5 ... 2500 Hz

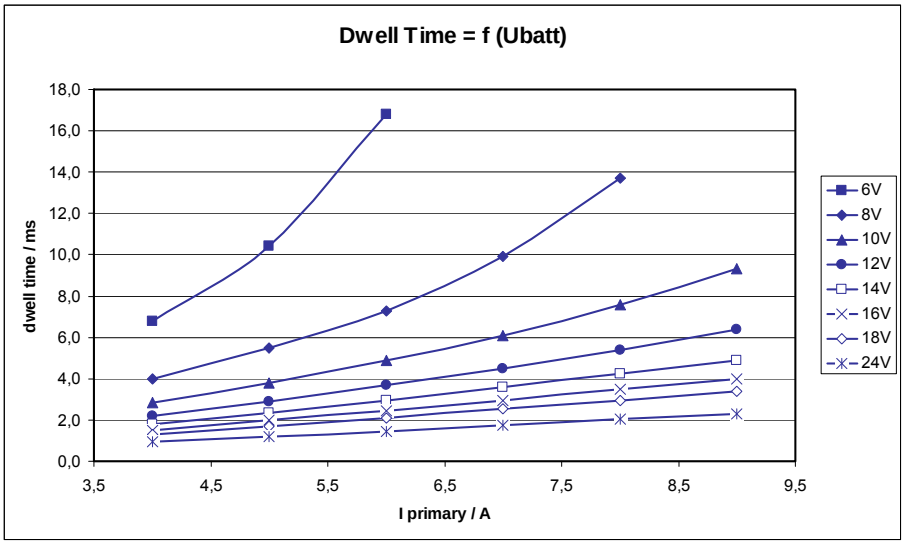
Mechanical Data	
Weight	353 g
Mounting	screw fastening

Electrical Data	
Primary resistance with/without cable	Incapable of measurement
Secondary resistance without noise suppression	Incapable of measurement
High voltage rise time	≤ 1,7 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	≤ 30 kV
Spark current	≤ 110 mA
Spark duration	≤ 1,9 ms
Noise suppression	inductive
Suppression diode / EFU	Yes
Integrated power stage	Yes
Ionic current signal	No

Characteristic	
Measured with power stage	BIP 355

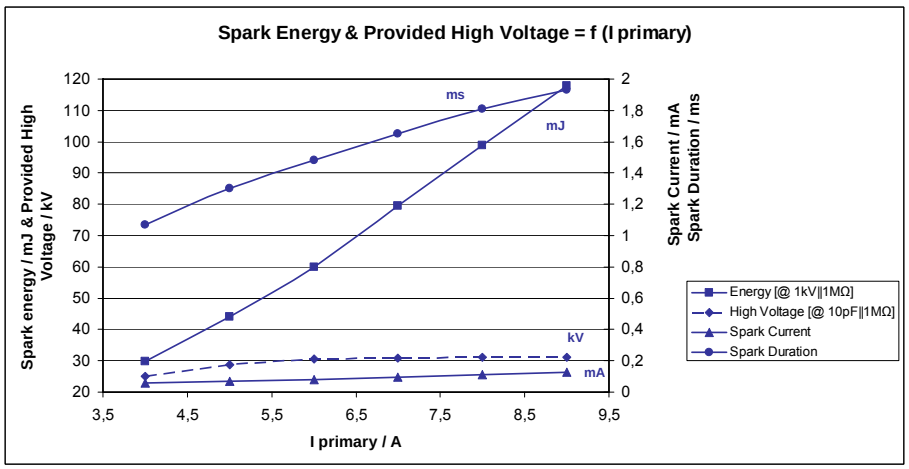
Characteristic Dwell time [ms]

I primary	U batt									
	6V	8V	10V	12V	14V	16V	18V	20V	22V	24V
4,0 A	6,8	4,0	2,9	2,2	1,8	1,5	1,3	1,2	1,0	0,9
5,0 A	10,4	5,5	3,8	2,9	2,4	2,0	1,7	1,5	1,3	1,2
6,0 A	16,8	7,3	4,9	3,7	2,9	2,5	2,1	1,8	1,6	1,5
7,0 A		9,9	6,1	4,5	3,6	3,0	2,5	2,2	2,0	1,8
8,0 A		13,7	7,6	5,4	4,2	3,5	3,0	2,6	2,3	2,0
9,0 A			9,3	6,4	4,9	4,0	3,4	2,9	2,6	2,3



Characteristic Spark Energy & Provided High Voltage

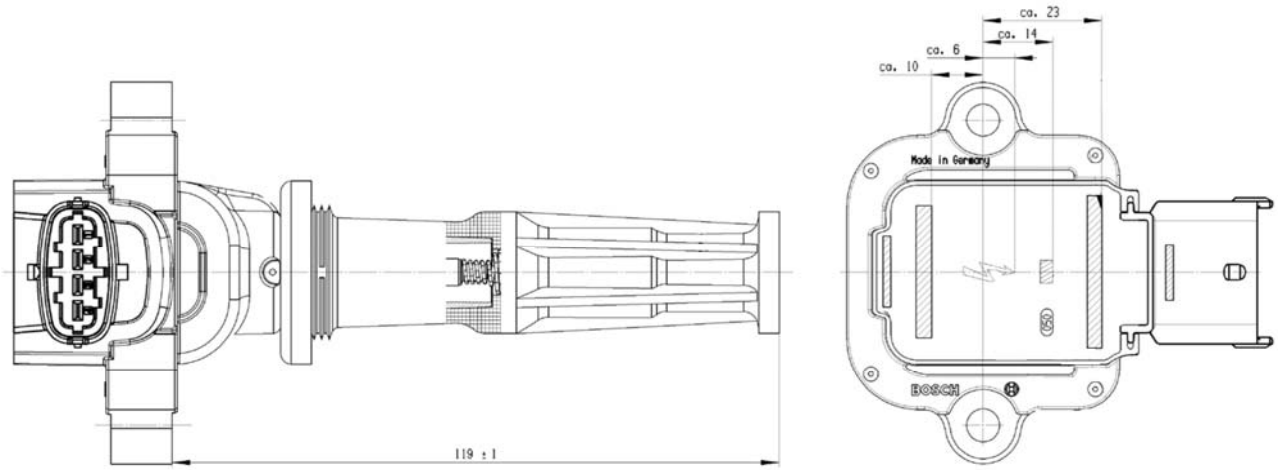
	I primary					
	4 A	5 A	6 A	7 A	8 A	9 A
Spark Energy [mJ]	29,8	44,2	60	79,5	98,9	118
Spark Duration [ms]	1,07	1,3	1,48	1,65	1,81	1,93
Spark Current [mA]	0,06	0,07	0,08	0,095	0,11	0,125
High Voltage [kV]	24,9	28,6	30,7	30,9	31	31



Connectors and Cables	
Connector	Bosch Compact
Connector loom	D 261 205 336-01
Pin 1	ECU$_{\text{Ignition Driver Stage}}$
Pin 2	ECU$_{\text{Gnd}}$
Pin 3	Engine$_{\text{Gnd}}$
Pin 4	U$_{\text{batt}}$
Various military and automotive connectors on request.	

Application Hint
During mounting of the spark plug please pay attention that full clamping and proper contacts are made to ensure safe connection between coil and spark plug.
This coil has an integrated power stage, only use with engine control units with 10 to 20 mA current output driver.
For technical reasons the values of the coils may vary.
Please only use within specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Coil P100-T	**0 221 604 006**



Single Fire Coil M

This coil is the first ignition coil developed and designed specifically for motorsports use. Compared to a production based coil, the single fire coil M can operate in higher temperature and vibration environments.

An additional advantage of this coil is the ability to vary the length of the spark plug connector to customer requirements.

This coil is also available as double fire coil and in a DR-25 sleeve with multiple connector options.

Please note this coil is non-transistorized and must be used with an ECU that has integrated power-stages.

Application	
Spark energy	≤ 38 mJ
Primary current	≤ 10 A
Operating temperature range @ outer core	-20 ... 160 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 800 m/s² @ 5 ... 250 Hz

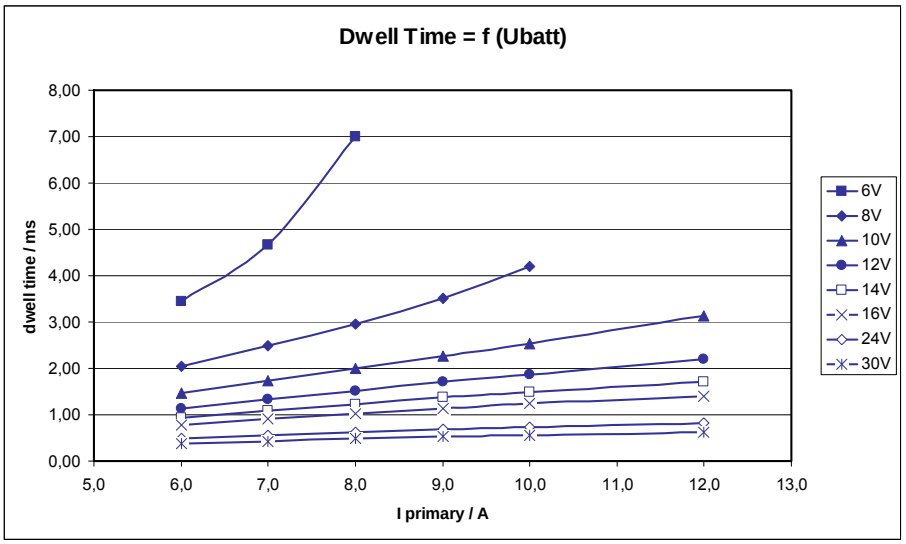
Mechanical Data	
Length	168 mm
Weight	180 g
Mounting	pluggable / pressed

Electrical Data	
Primary resistance with cable	500 mΩ
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 4,0 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	≤ 33 kV
Spark current	≤ 170 mA
Spark duration @ 1 kV || 1 MΩ	≤ 0,53 ms
Noise suppression	without
Suppression diode / EFU	Yes
Integrated power stage	No
Ionic current signal	No

Characteristic
Measured with power stage IGBT IRG4BC40S (Uce = 600 V)

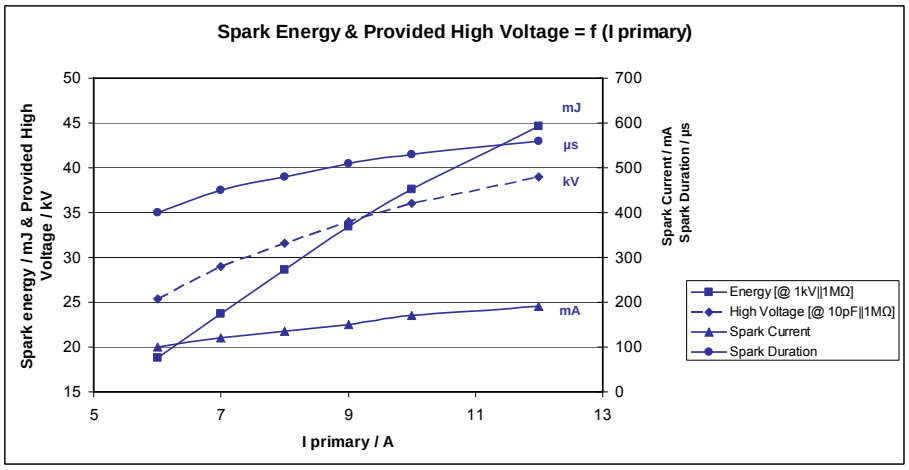
Characteristic Dwell Time [ms]

I primary	Ubatt									
	6 V	8 V	10 V	12 V	14 V	16 V	18 V	24 V	27 V	30 V
6,0 A	3,45	2,05	1,47	1,14	0,93	0,79	0,68	0,48	0,42	0,37
7,0 A	4,66	2,48	1,73	1,33	1,09	0,91	0,78	0,55	0,48	0,43
8,0 A	7,00	2,96	2,00	1,52	1,23	1,03	0,88	0,62	0,54	0,48
9,0 A		3,52	2,27	1,71	1,37	1,14	0,98	0,68	0,60	0,53
10,0 A		4,20	2,54	1,87	1,50	1,24	1,05	0,74	0,64	0,57
12,0 A			3,13	2,19	1,72	1,41	1,19	0,83	0,72	0,63



Characteristic Spark Energy & Provided High Voltage

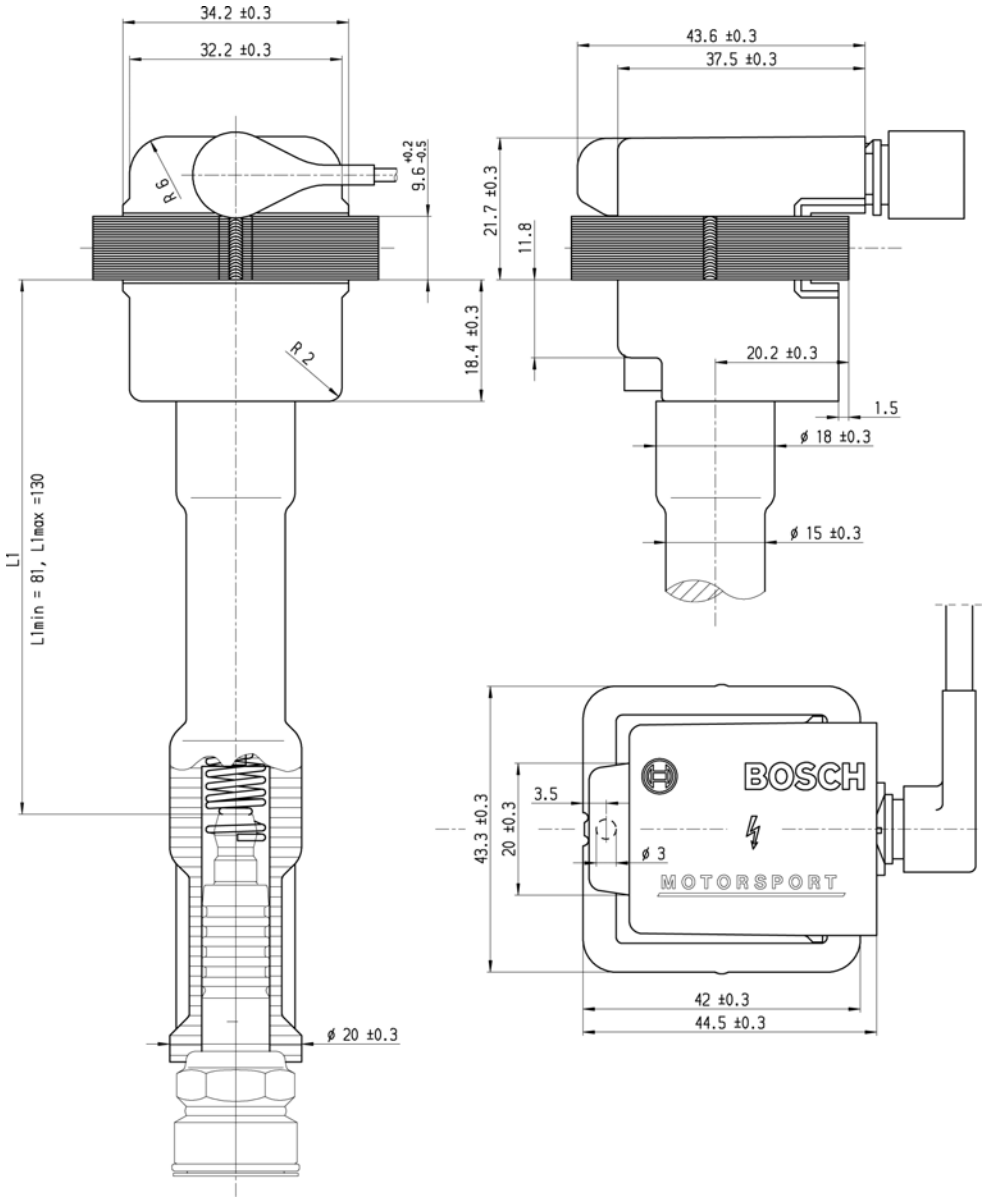
	I primary					
	6 A	7 A	8 A	9 A	10 A	12 A
Spark energy [mJ]	18,8	23,7	28,6	33,4	37,6	44,6
Spark duration [ms]	400	450	480	510	530	560
Spark current [mA]	100	120	135	150	170	190
High voltage [kV]	25,4	29	31,6	34	36	39



Connectors and Cables	
Connector	on request
Connector loom	on request
Pin 1	U_{batt} red
Pin 2	$ECU_{Ignition\ Driver\ Stage}$ white
Various military and automotive connectors on request.	
Cable length	15 ... 100 cm
Please specify the requested cable length and the length of the spark plug connector with your order.	

Application Hint
During mounting of the spark plug please pay attention that full clamping and proper contacts are made to ensure safe connection between coil and spark plug.
This coil is only for use with engine control units having an integrated ignition power stage, e.g. IGBT IRG4BC40S or BIP118.
For technical reasons the values of the coils may vary.
Please regard the specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Coil M	**B 261 209 182**



Single Fire Coil PS / PS-T

These pencil coils are a basic low cost concept designed for cylinder head installation.

The PS coil has no integrated power stage and is developed for use with ECUs that have integrated ignition transistors.

The PS-T has an integrated transistor for use with ECUs that have ignition power stages with 10 mA to 20 mA current output.

The coils are only designed for spark plug shaft mounting. It is a basic concept for ignition applications.

Application	
Spark energy	≤ 42 mJ
Primary current	≤ 7,5 A
Operating temperature range outer core	-20 ... 140 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 800 m/s² @ 5 ... 2500 Hz

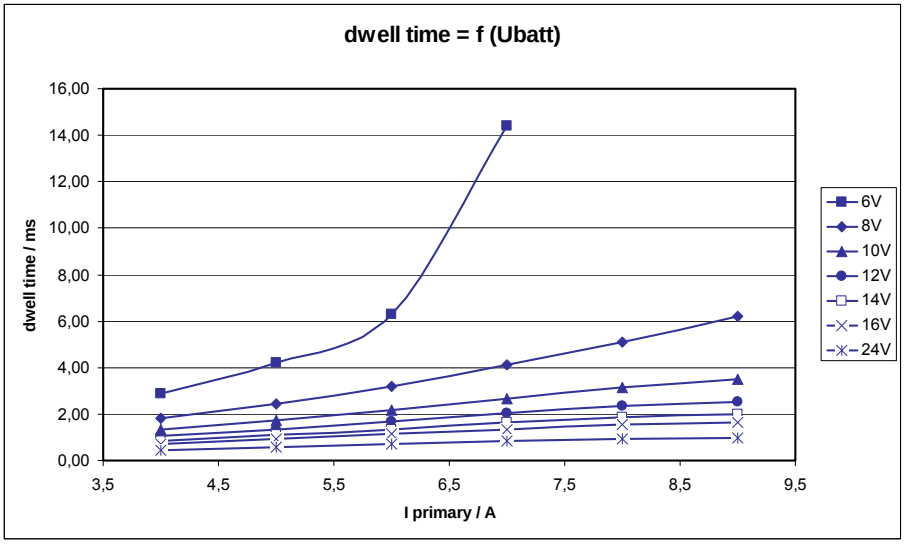
Electrical Data	
Primary resistance with cable	[1] 570 mΩ [2] incapable of measurement
Secondary resistance	incapable of measurement
High voltage rise time	≤ 1,5 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	[1] ≤ 30 kV [2] ≤ 27 kV
Spark current	≤ 80 mA
Spark duration @ 1 kV || 1 MΩ	≤ 1,1 ms
Noise suppression	Inductive
Suppression diode / EFU	Yes
Integrated power stage	[1] No [2] Yes
Ionic current signal	No

Mechanical Data	
Diameter	22 mm
Weight	[1] 189 g [2] 202 g
Mounting	screw fastening

Characteristic
Measured with power stage [1] IGBT IRG4BC40S (Uce=600V) respectively BIP372 [2] BIP 355

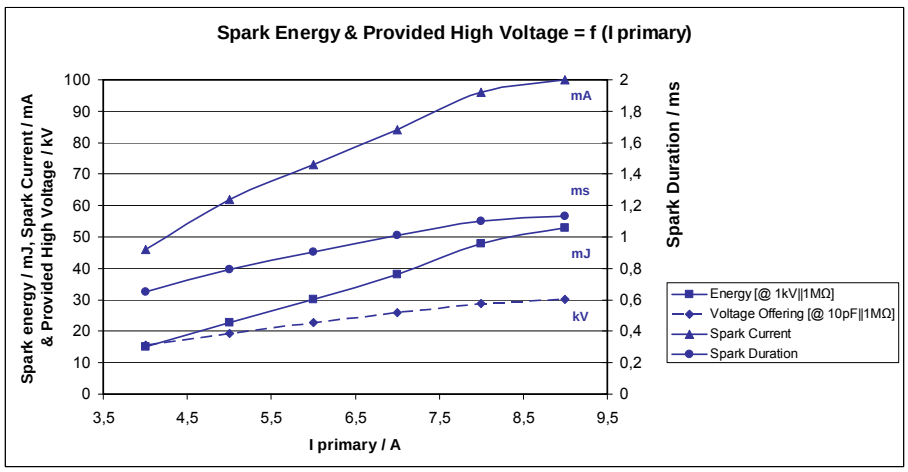
Characteristic Dwell Time [ms]

I primary	Ubatt									
	6 V	8 V	10 V	12 V	14 V	16 V	18 V	20 V	22 V	24 V
4,0 A	2,90	1,83	1,33	1,05	0,86	0,73	0,64	0,56	0,50	0,46
5,0 A	4,20	2,45	1,74	1,35	1,11	0,93	0,82	0,71	0,64	0,58
6,0 A	6,30	3,17	2,18	1,68	1,35	1,14	0,98	0,86	0,77	0,70
7,0 A	14,40	4,10	2,68	2,02	1,62	1,35	1,16	1,02	0,91	0,82
8,0 A		5,10	3,16	2,33	1,85	1,54	1,32	1,15	1,02	0,92
9,0 A		6,20	3,49	2,53	1,99	1,65	1,41	1,23	1,09	0,98



Spark Energy & Provided High Voltage

	I primary					
	4 A	5 A	6 A	7 A	8 A	9 A
Spark energy [mJ]	15	22,8	30,2	38,2	47,9	52,9
Spark duration [ms]	0,65	0,793	0,904	1,01	1,101	1,13
Spark current [mA]	46	62	73	84	96	100
High voltage [kV]	15,6	19,3	22,7	26	28,8	30,2

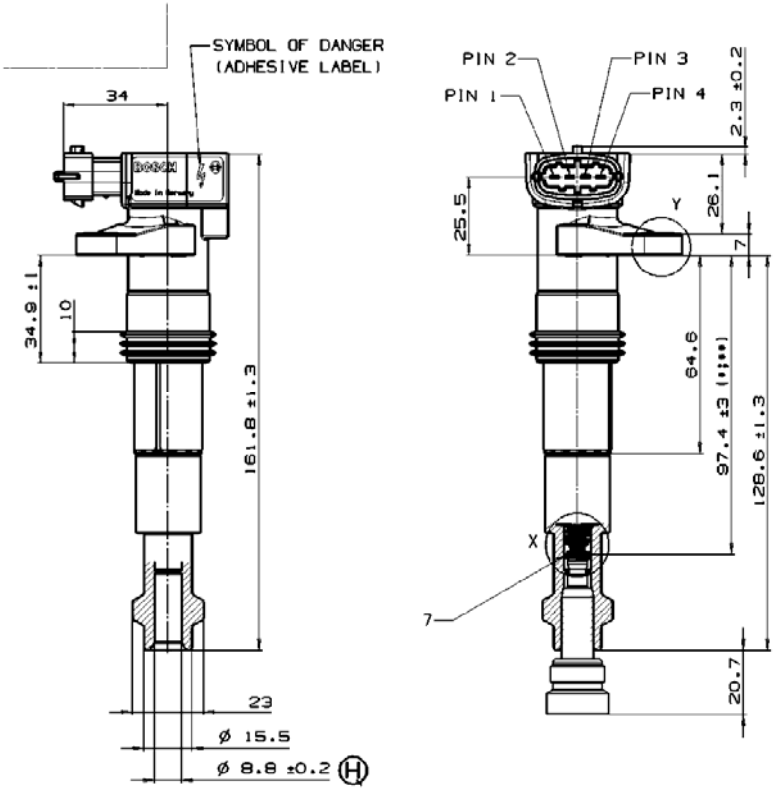


Connectors and Cables	
Connector	[1] AMP C-O-28 44 25 [2] Bosch Compact
Connector loom	[1] D 261 205 350-01 [2] D 261 205 336-01
Pin 1	[1] Gnd [2] ECU Imp
Pin 2	[1] ECU collector [2] ECU Gnd
Pin 3	[1] U_{batt} [2] Engine Gnd
Pin 4	[1] n.a. [2] U_{batt}
Various motorsport and automotive connectors on request.	

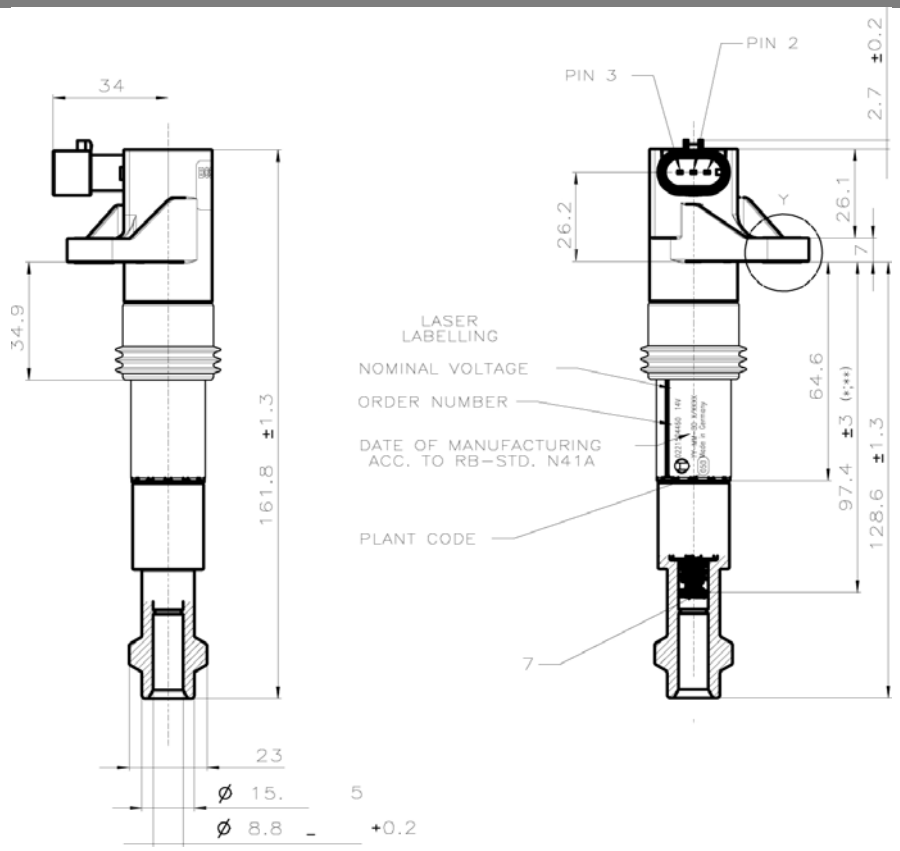
Application Hint
During mounting of the spark plug please pay attention that full clamping and proper contacts are made to ensure safe connection between coil and spark plug.
The coil PS is only for use with engine control units having an integrated ignition power stage, e.g. IGBT IRG4BC40S.
The coil PS-T is only for use with engine control units having current output drivers with 10 to 20 mA, e.g. MS 4.x or MS 4.x Sport.
For technical reasons the values of the coils may vary.
Please regard the specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Coil PS [1]	**0 221 504 460**
Coil PS-T [2]	**0 221 604 103**

Coil PS



Coil PS-T


34
34.9
161.8 ±1.3
23
Ø 15. 5
Ø 8.8 +0.2
PIN 2
PIN 3
±0.2
2.7
26.1
26.2
7
Y
LASER LABELLING
NOMINAL VOLTAGE
ORDER NUMBER
DATE OF MANUFACTURING ACC. TO RB-STD. N41A
PLANT CODE
64.6
97.4 ±3 (*,**)
128.6 ±1.3
7

Single Fire Coil S22 / S22-T

This single fire coil was developed for the use in high performance engines. It is designed to mount directly on the spark plug.

This coil optionally provides an ionic current measurement and an integrated ignition power stage. The design of the upper part (cable side) and the lower part (spark plug side) can be designed per customer specification.

The main benefits of this high performance coil are its robustness in hard racing applications and high energy efficiency.

Application	
Spark energy	≤ 60 mJ
Primary current	≤ 16 A
Operating temperature range @ outer core	[1] 0 ... 160 °C [2] 0 ... 150 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 800 m/s² @ 5 ... 2500 Hz

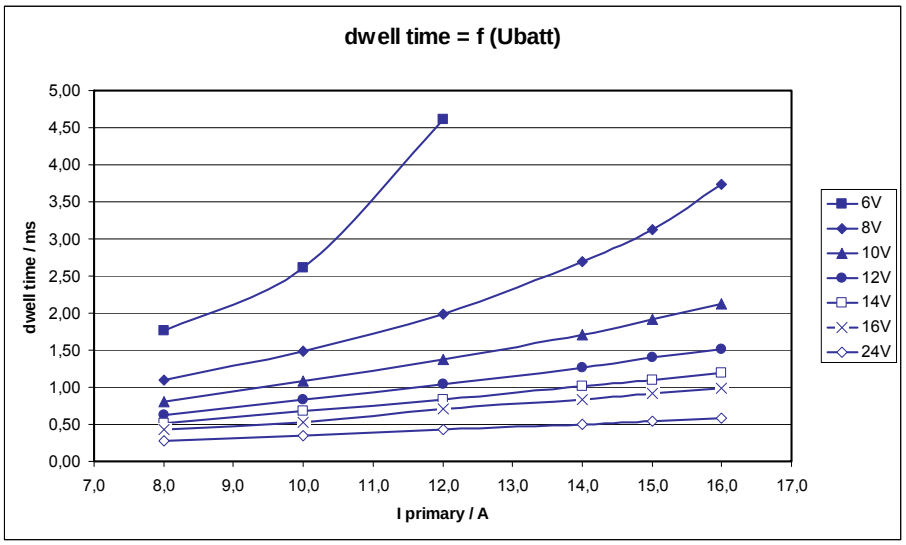
Mechanical Data	
Diameter	22 mm
Weight	150 g
Mounting	pluggable / pressed

Electrical Data	
Primary resistance with cable	[1] 330 mΩ [2] incapable of measurement
Secondary resistance	incapable of measurement
High voltage rise time	≤ 5,0 kV/µs
Max. high voltage @ 1 MΩ || 10 pF	≤ 25 kV
Spark current	≤ 300 mA
Spark duration @ 1 kV || 1 MΩ	≤ 0,43 ms
Noise suppression	inductive
Suppressor diode / EFU	Yes
Integrated power stage	[1] No [2] Yes
Ionic current signal	optional

Characteristic Data
Measured with power stage [1] IGBT IRG4BC40S (Uce = 600V) [2] IGBT IRF5036S (Uce = 400V)

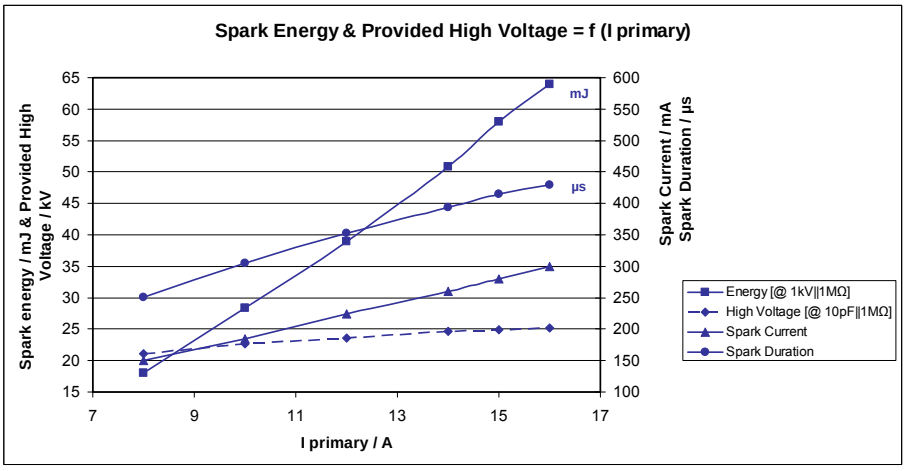
Characteristic Dwell Time [ms]

I primary	Ubatt							
	6 V	8 V	10 V	12 V	14 V	16 V	20 V	24 V
8,0 A	1,76	1,10	0,80	0,62	0,51	0,44	0,34	0,27
10,0 A	2,61	1,49	1,08	0,83	0,68	0,53	0,44	0,35
12,0 A	4,61	1,99	1,37	1,04	0,84	0,70	0,53	0,43
14,0 A		2,70	1,71	1,27	1,01	0,84	0,63	0,50
15,0 A		3,12	1,91	1,40	1,10	0,91	0,68	0,54
16,0 A		3,74	2,12	1,52	1,19	0,99	0,73	0,58



Characteristic Spark Energy & Provided High Voltage

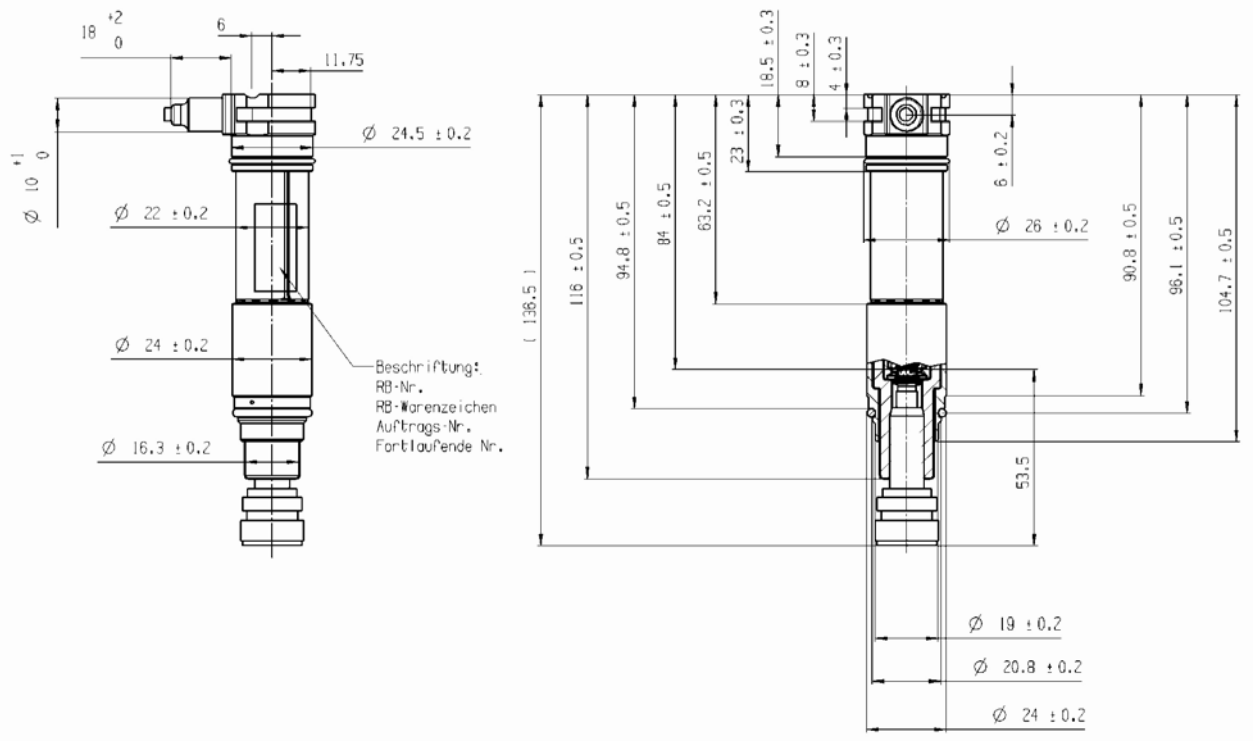
	I primary					
	8 A	10 A	12 A	14 A	15 A	16 A
Spark Energy [mJ]	18,1	28,3	39	50,8	58	64
Spark Duration [µs]	251	305	353	394	415	430
Spark Current [mA]	150	185	225	260	280	300
High Voltage [kV]	21,1	22,7	23,6	24,6	24,9	25,2



Connectors and Cables	
Connector	on request
Connector Loom	on request
Pin 1	U_{batt} red
Pin 2	[1] ECU collector white [2] ECU Imp yellow
Pin 3	[1] Engine GND black [2] ECU GND blue
Pin 4 [1] optional ionic current signal screen cable white	[2] Engine GND black
Pin 5 [2] optional ionic current signal screen cable white	[1] n.a.
Various motorsport and automotive connectors on request.	
Cable Size	AWG 20/22
Cable Length	max. 100 cm
Please specify your requested cable length with your order.	

Application Hint
During mounting of the spark plug please pay attention that full clamping and proper contacts are made to ensure safe connection between coil and spark plug.
For coils without "-T", please only use with engine control units with an integrated ignition power stage, e.g. IGBT IRG4BC40S.
For coils with "-T", please only use with engine control units without integrated power stages.
For technical reasons the values of the coils may vary.
Please regard the specified limit values.
Operation with limit values of 16 A can reduce the life time of the ignition coil. In case of permanent operation please use 12 A. This will bring a spark energy of 40 mJ.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Coil S22 [1]	**0 221 B00 115 01**
Coil S22-T [2]	**0 221 B00 116 01**



Single Fire Coil S19 / S19-T

This single fire coil was developed for the use in Formula 1 high performance engines. It is designed to mount directly on the spark plug.

This coil optionally provides an ionic current measurement and/or an integrated ignition power stage. The design of the upper part (cable side) and the lower part (spark plug side) can be designed per customer specification.

The main benefits of this high performance coil are its robustness in hard racing applications and high energy efficiency.

Application	
Spark energy	≤ 34 mJ
Primary current	≤ 25 A
Operating temperature range @ outer core	[1] 0 ... 160 °C [2] 0 ... 140 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 800 m/s² @ 5 ... 2500 Hz

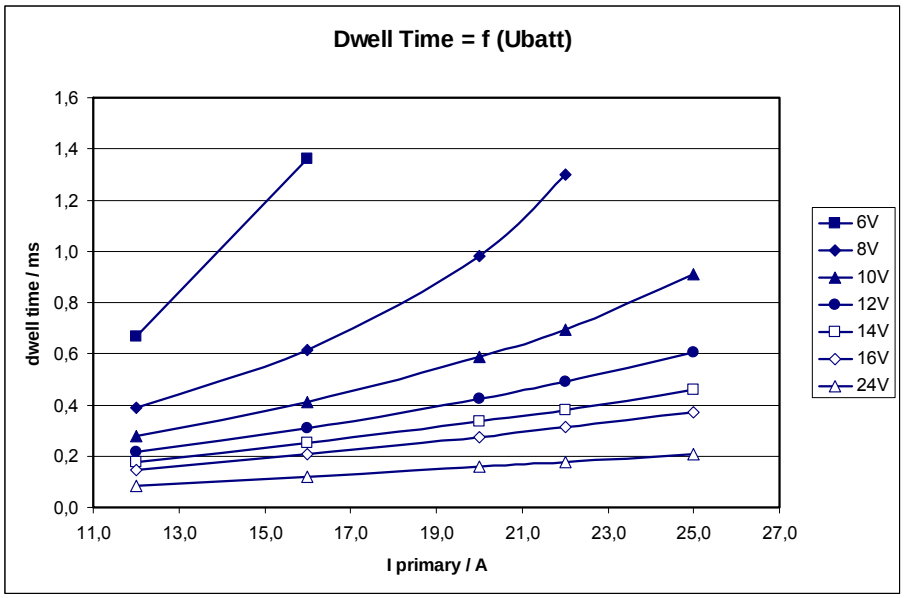
Mechanical Data	
Diameter	18,5 mm
Weight	100 g
Mounting	pluggable / pressed

Electrical Data	
Primary resistance with cable	[1] 200 mΩ [2] Incapable of measurement
Secondary resistance	Incapable of measurement
High voltage rise time	[1] ≤ 7,5 kV/µs [2] ≤ 6,5 kV/µs
Provided high voltage @ 1 MΩ || 10 pF	[1] ≤ 33 kV [2] ≤ 31 kV
Spark current	≤ 320 mA
Spark duration @ 1 kV || 1 MΩ	≤ 0,27 ms
Noise suppression	inductive
Suppressor diode / EFU	Yes
Integrated power stage	[1] No [2] Yes
Ionic current signal	optional

Characteristic
Measured with power stage [1] IGBT IRG4BC40S (Uce = 600 V) [2] IGBT IRF5036S (Uce = 400 V)

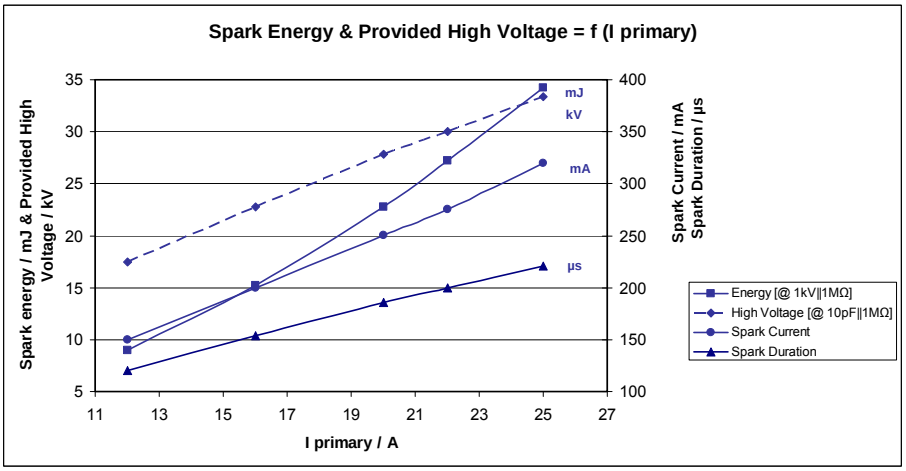
Characteristic Dwell Time [ms]

I primary	U batt								
	6 V	8 V	10 V	12 V	14 V	16 V	24 V	27 V	30 V
12,0 A	0,7	0,390	0,278	0,216	0,176	0,148	0,084	0,077	0,068
16,0 A	1,4	0,613	0,411	0,310	0,250	0,208	0,119	0,107	0,094
20,0 A		0,980	0,586	0,426	0,335	0,276	0,157	0,139	0,122
22,0 A		1,300	0,695	0,491	0,382	0,313	0,175	0,155	0,136
25,0 A			0,910	0,606	0,460	0,371	0,208	0,180	0,157



Characteristic Spark Energy & Provided High Voltage

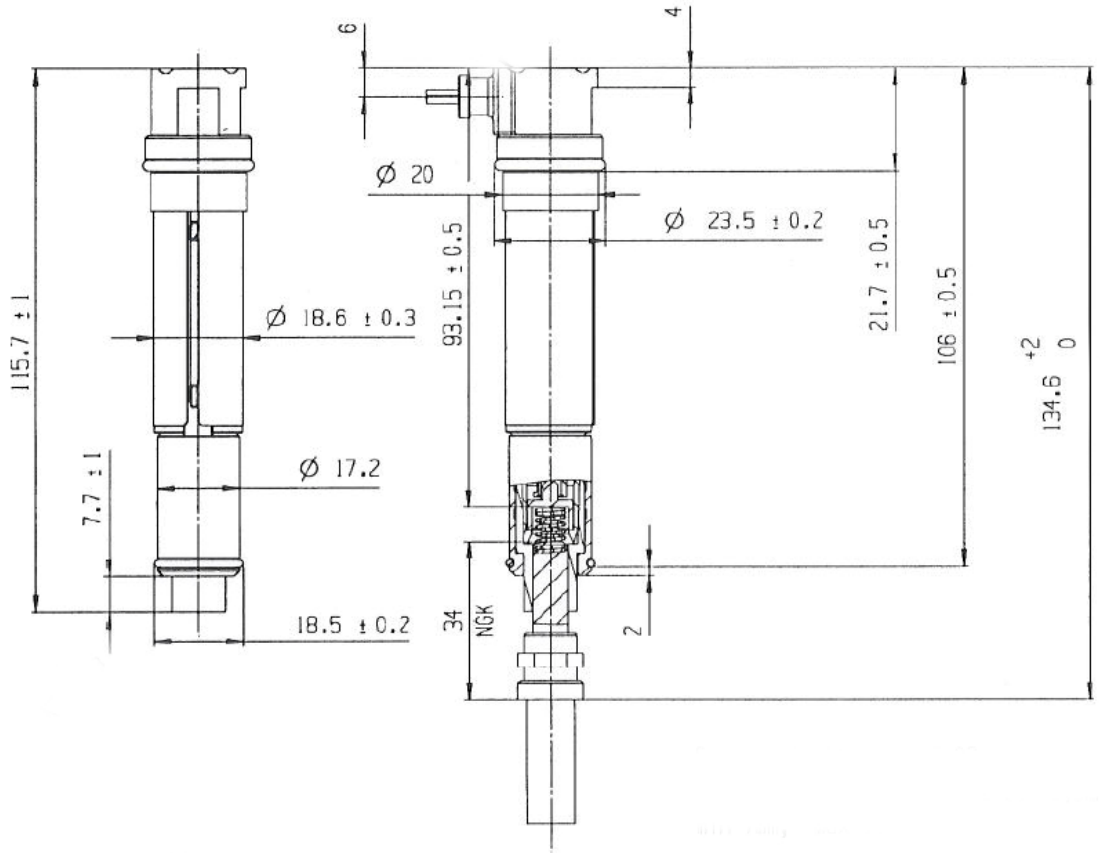
	I primary				
	12 A	16 A	20 A	22 A	25 A
Spark energy [mJ]	9	15,2	22,8	27,2	34,2
Spark duration [µs]	120	154	186	200	221
Spark current [mA]	150	200	250	275	320
High voltage [kV]	15,1	19,6	24	26	29
High voltage [kV]	17,5	22,8	27,8	30	33,4



Connectors and Cables	
Connector	on request
Connector loom	on request
Pin 1	U_{batt} red
Pin 2	[1] ECU collector white [2] ECU Imp yellow
Pin 3	[1] Engine GND black [1] ECU GND blue
Pin 4 [1] optional ionic current signal screen cable white	[2] Engine GND black
Pin 5 [2] optional ionic current signal screen cable white	[1] n.a.
Various military and automotive connectors on request.	
Cable size	AWG 20/22
Cable length	max. 100 cm
Please specify the requested cable length with your order.	

Application Hint
During mounting of the spark plug please pay attention that full clamping and proper contacts are made to ensure safe connection between coil and spark plug.
For coils without "-T", please only use with engine control units with an integrated ignition power stage, e.g. IGBT IRG4BC40S.
For coils with "-T", please only use with engine control units without integrated power stages.
For technical reasons the values of the coils may vary.
Please regard the specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Single Fire Coil S19 [1]	**0 221 B00 113 01**
Single Fire Coil S19-T [2]	**0 221 B00 114 01**



Single Fire Coil S16 / S16-T

This single fire coil was exclusively developed for the use in Formula 1 high performance engines. It is designed to mount directly on the spark plug.

This coil optionally provides an ionic current measurement and/or an integrated ignition power stage.

The design of the upper part (cable side) and the lower part (spark plug side) can be designed per customer specification.

The main benefits of this high performance coil are its robustness in hard racing applications and high energy efficiency.

Application	
Spark energy	≤ 28 mJ
Primary current	≤ 25 A
Operating temperature range @ outer core	[1] 0 ... 160 °C [2] 0 ...140 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	≤ 800 m/s² @ 5 ... 2500 Hz

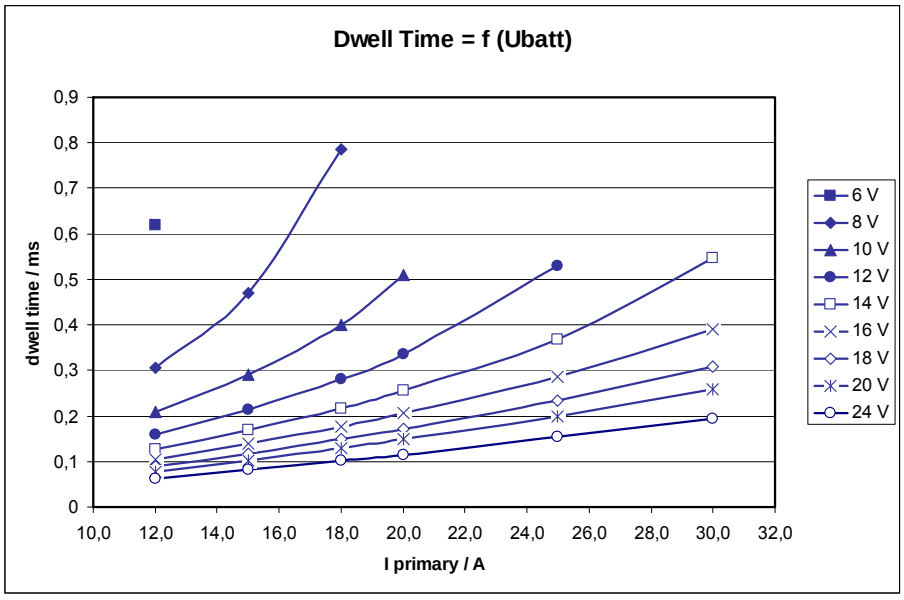
Mechanical Data	
Diameter	16 mm
Weight w/o cable	50 g
Mounting	pluggable / pressed

Electrical Data	
Primary resistance with cable	[1] 230 mΩ [2] Incapable of measurement
Secondary resistance	Incapable of measurement
High voltage rise time	[1] ≤ 9 kV/µs [2] ≤ 8 kV/µs
Provided high voltage @ 1 MΩ || 10 pF	[1] ≤ 31 kV [2] ≤ 30 kV
Spark current	≤ 460 mA
Spark duration @ 1 kV || 1 MΩ	≤ 0,113 ms
Noise suppression	inductive
Suppressor diode / EFU	Yes
Integrated power stage	[1] No [2] Yes
Ionic current signal	optional

Characteristic
Measured with power stage [1] IGBT IRG4BC40S (Uce = 600 V) [2] IGBT IRF5036S (Uce = 400 V)

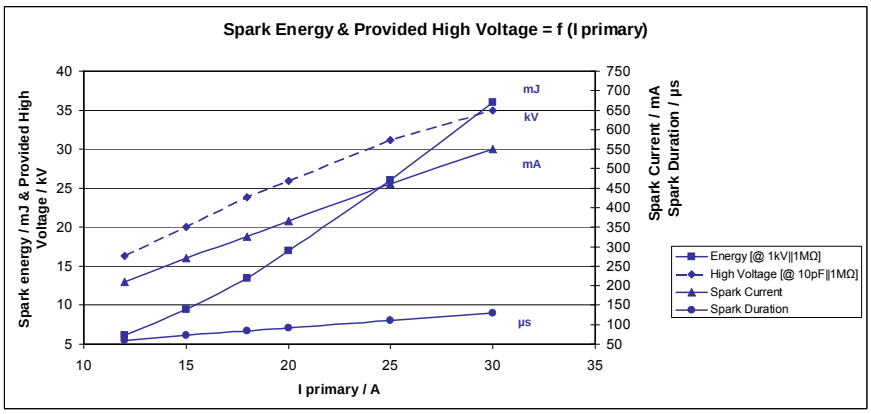
Characteristic Dwell Time [ms]

I primary	U batt								
	6 V	8 V	10 V	12 V	14 V	16 V	18 V	20 V	24 V
12,0 A	0,62	0,307	0,209	0,158	0,127	0,105	0,09	0,078	0,062
15,0 A		0,469	0,291	0,214	0,169	0,14	0,118	0,103	0,081
18,0 A		0,786	0,401	0,28	0,217	0,177	0,15	0,129	0,101
20,0 A			0,509	0,335	0,256	0,206	0,172	0,148	0,115
25,0 A				0,529	0,369	0,285	0,234	0,199	0,153
30,0 A				1,4	0,548	0,39	0,309	0,258	0,194



Characteristic Spark Energy & Provided High Voltage

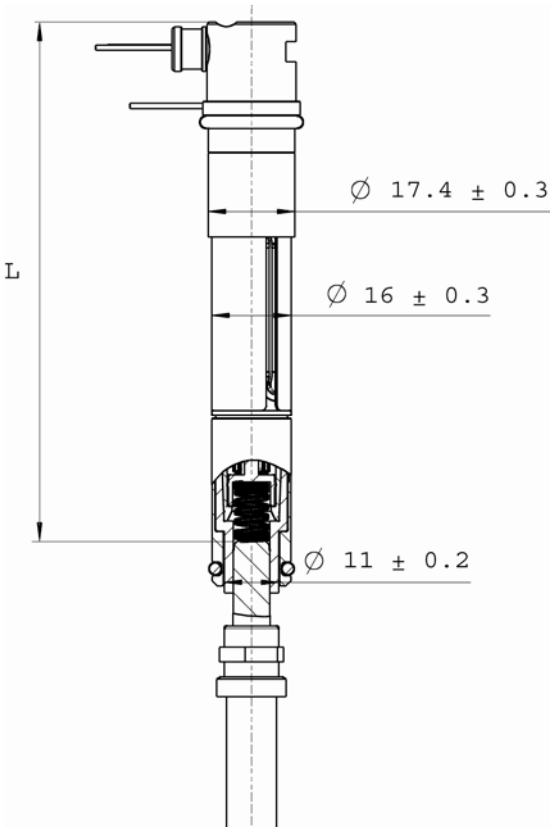
	I primary					
	12 A	15 A	18 A	20 A	25 A	30 A
Spark Energy [mJ]	6,1	9,5	13,5	17	26	36
Spark Duration [µs]	59	72	84	92	110	130
Spark Current [mA]	210	270	325	365	460	550
High Voltage [kV]	16,3	20	23,8	25,9	31,2	35



Connectors and Cables	
Connector	on request
Connector loom	on request
Pin 1	U_{batt} red
Pin 2	[1] ECU collector white [2] ECU imp yellow
Pin 3	[1] Engine GND black [2] ECU GND blue
Pin 4 [1] optional ionic current signal screen cable white [2] Engine GND black	
Pin 5 [2] optional ionic current signal screen cable white	[1] n.a.
Various military and automotive connectors on request.	
Cable size	AWG 20/22
Cable length	max. 100 cm
Please specify the requested cable length with your order.	

Application Hint
During mounting of the spark plug please pay attention that full clamping and proper contacts are made to ensure safe connection between coil and spark plug.
For coils without "-T", please only use with engine control units with an integrated ignition power stage, e.g. IGBT IRG4BC40S.
For coils with "-T", please only use with engine control units without integrated power stages.
For technical reasons the values of the coils may vary.
Please regard the specified limit values.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Single Fire Coil S16 [1]	**0 221 B00 111 01**
Single Fire Coil S16-T [2]	**on request**



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.

Starters & Alternators

Starters

Starter 1.4 kW

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

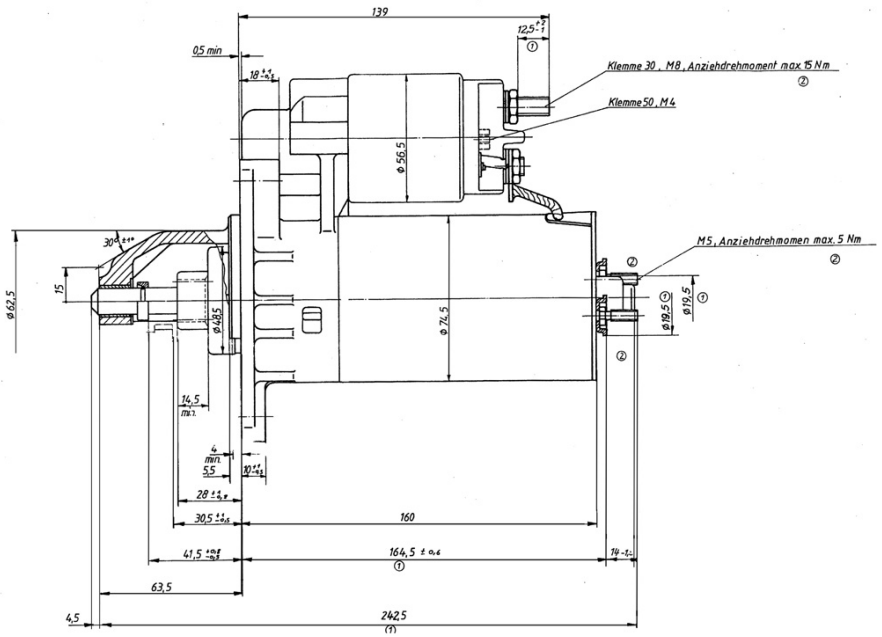
Further special versions on request.

Mechanical Data	
Weight	3,200 g
Revolutions	3,600 x 1/min
Modul	2/11

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

Electrical Data	
Performance	1.4 kW

Part Number	
Starter 1.4 kW	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 counter-clockwise version.

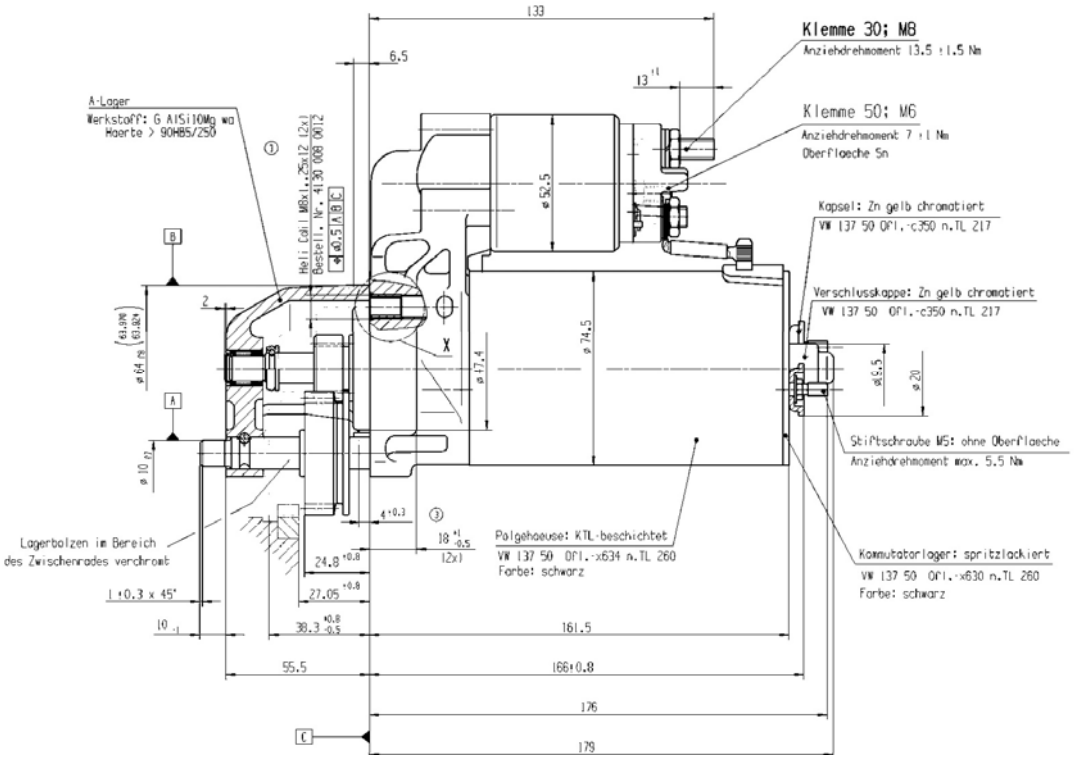
Further special versions on request.

Mechanical Data	
Weight	3,700 g
Revolutions	3,600 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	
Starter 1.7 kW	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 and counter-clockwise version.

Further special versions on request.

Mechanical Data	
Weight	4,050 g
Revolutions	4,700 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	
Starter 2.0 kW	on request

Alternators

Alternator GCM1
110/130/140 A/140 A Nascar

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

Mechanical Data	
Case material	aluminium
Weight	3,400 g
Current regulator unit	integrated
Max. rotations	18,000 x 1/min
Diameter	108 mm
Length without shaft stub	128 mm
Distance between mounting points	154 mm

Electrical Data	
Rated current	110/130/140 A
Supply voltage	13.5 V
Cut-in speed	3,000 x 1/min
Coupling	screws
Battery B+	M6
Control lamp D+	flat-pin connector, see drawing
Internal D+ resistor	only GCM1 140 A Nascar

Application Hint

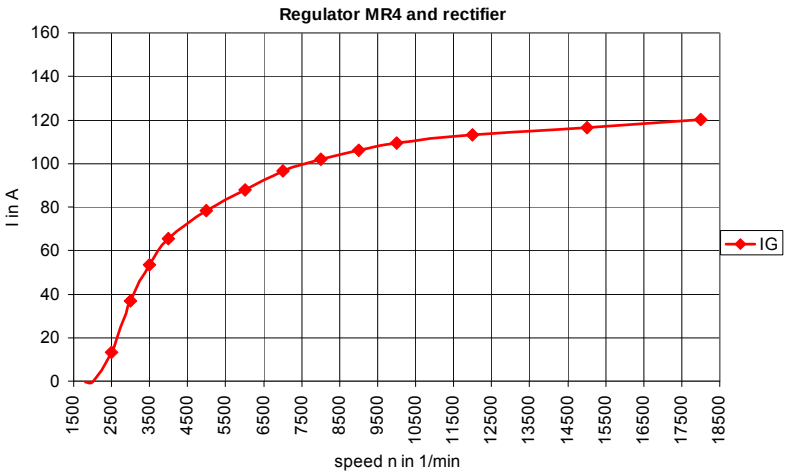
An external cooling can contribute to increase the performance. It will only be effective if the incoming air is 30 °Kelvin cooler than the ambient air. Otherwise, the restriction of the air flow will negate any cooling benefits. If these conditions are met, the cooling air should be distributed over the center axis at the rear of the alternator for optimal cooling. For the cooling air to be effective we must be sure that we do not encounter any vacuum effects. If there is a vacuum effect present the use of external blower fan will be required. Care should be taken that no excessive external contaminants are introduced into the cooling air stream. This could severely short the alternator service life. It would be prudent to perform comparative measurements on the alternator to determine the effectiveness of the external cooling air.

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

Part Numbers	
110 A	
Anticlockwise rotation	**B 261 208 606-02**
Clockwise rotation	**B 261 208 607-02**
130 A	
Anticlockwise rotation	**B 261 208 604-02**
Clockwise rotation	**B 261 208 605-02**
140 A	
Anticlockwise rotation	**F 01E B01 857-02**
Clockwise rotation	**B 261 208 603-02**
140 A Nascar	
Clockwise rotation	**F 02U V00 004-05**

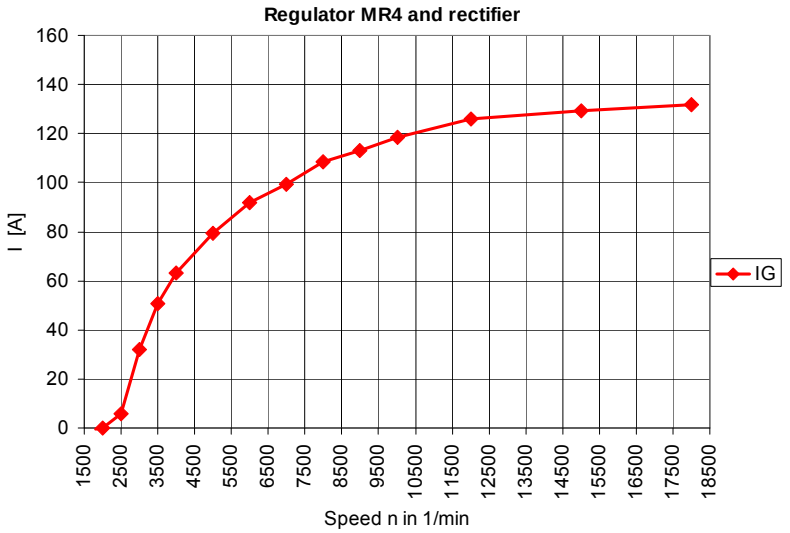
Characteristic 110 A

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



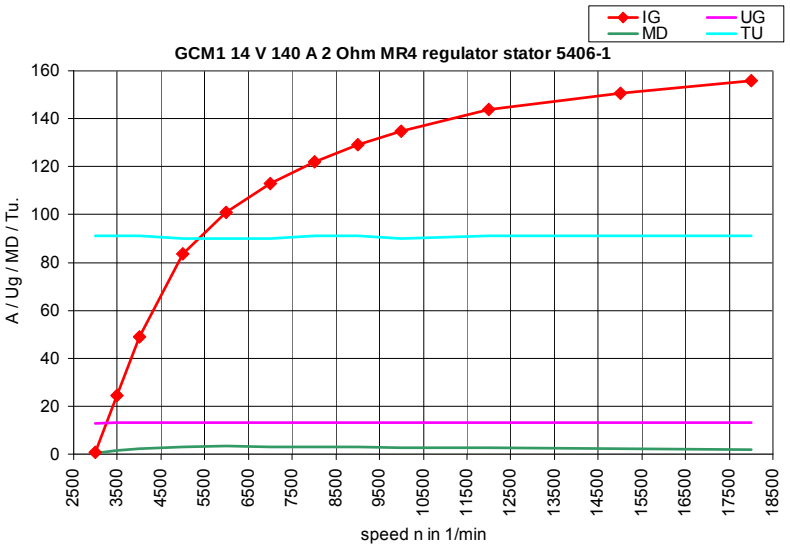
Characteristic 130 A

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

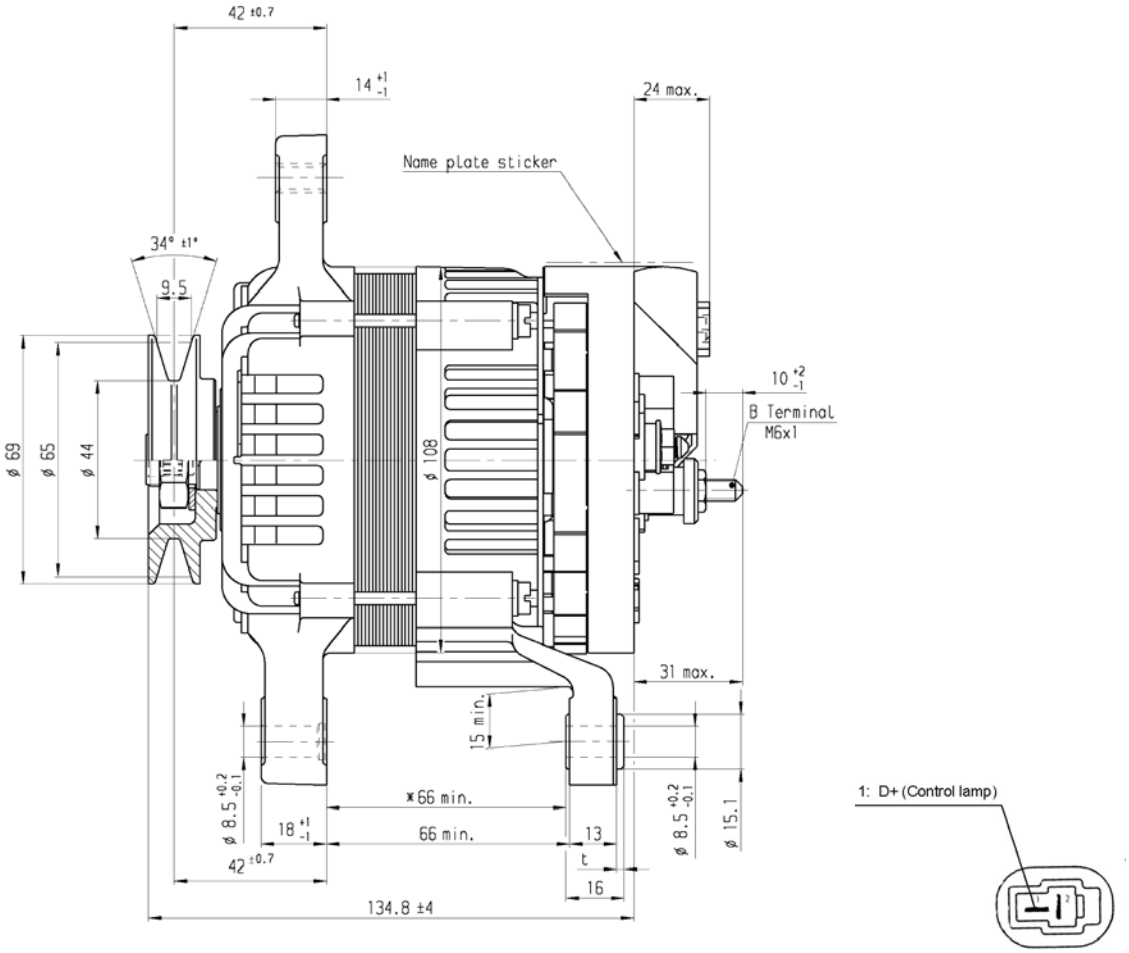


Characteristic 140 A/Nascar

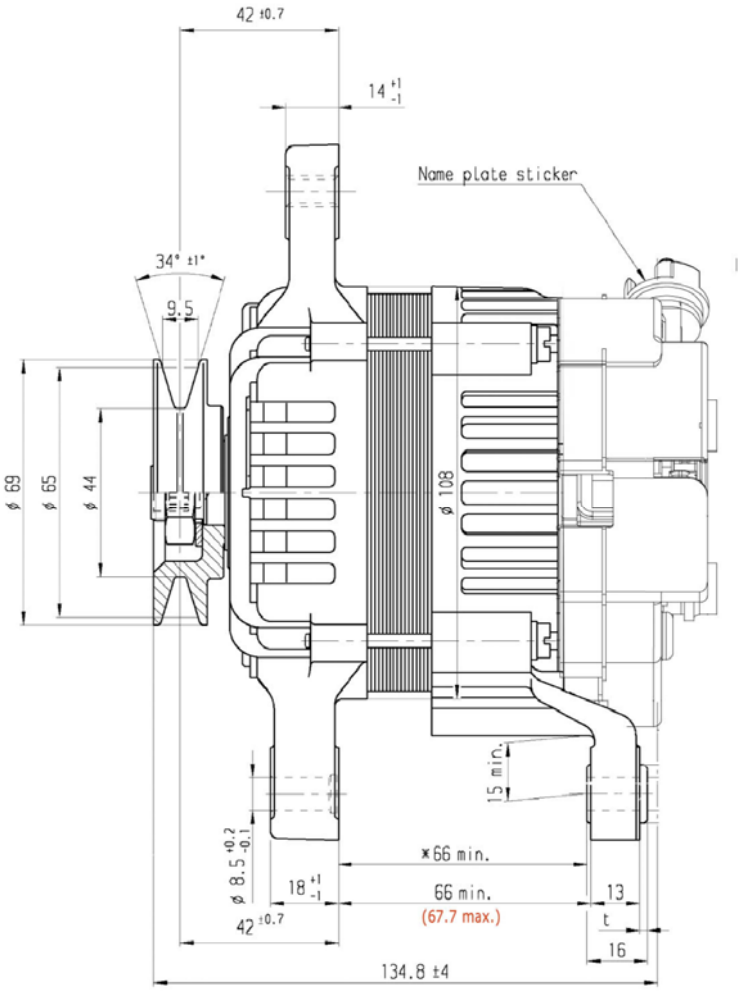
Rpm	IG (A) at 90 °C
2000	0
2500	0
3000	1
3500	25
4000	49
5000	83
6000	101
7000	113
8000	122
9000	129
10000	135
12000	144
15000	151
18000	156



Design 110/130/140 A



Design 140 A Nascar



Sensors

Absolute Position Sensor

Absolute Position Sensor APS-C

This sensor is designed to measure the angular position of a still standing or rotating shaft.

The device uses Hall sensor technology to detect the magnetic flux density distribution of a magnet which is mounted on the shaft. The absolute angle position value from the sensor is transmitted over CAN through a control unit. The sensor can be calibrated and configured with Hard- and Software tools.

The main feature and benefit of this sensor is the combination of a contact less measuring system in a wide temperature range with military spec connector.

Application	
Application	0 ... 360 °
Angle reference type	absolute
Measuring principle	Hall-effect
Operating temperature range	-40 ... 120 °C
Storage temperature range	-40 ... 120 °C
Communication link	CAN
Application tool	EM-C or RaceCon

Electrical Data	
Power supply Us	(6.5 V) 10 ... 17 V
Max. power supply	26 V
Current Is	70 mA

Mechanical Data	
Fixation	3 x M5
Sealing	O-ring
Weight w/o wire	39 g
Size w/o wire	see Dimensions
Max. vibration	*Vibration Profile 1* *(see Appendix or www.bosch-motorsport.com)*

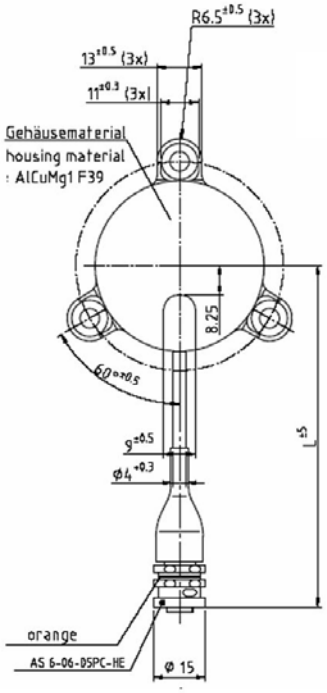
Characteristic	
Signal output	CAN
CAN Baudrate	1 Mbaud
CAN refresh rate	700 Hz
Signal resolution	0.703152 °

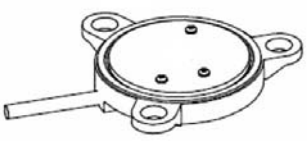
Connectors and Wires	
Connector	ASU 6-03-05PB-HE
Mating connector	ASU 0-03-05SB-HE
Pin 1	U_S
Pin 2	GND
Pin 3	CAN+
Pin 4	CAN-
Pin 5	Calibration Pin
Sleeve	DR-25
Wire size	AWG 24
Wire length	15 ... 100 cm
Various motorsport and automotive connectors on request.	

Accessories	
Magnet for APS-C	**F02U 002 465-01**

Application Hint
The sensor is designed to measure the absolute angle of the camshaft for quick start application.
The unit can be connected to any CAN system (1 MBaud).
The unit is secure from miss-pinning.
Before the first operation, the sensor has to be calibrated.
To meet the specifications and to avoid errors, the distance between sensor and the magnet has to be less than 2 mm.
To avoid measurement errors, the eccentricity between sensor and magnet has to be as small as possible (< 0,3 mm).
To change the CAN-ID of the sensor, it can be programmed by the external CAN module EM-C.
The angle position value can be set to zero via the external CAN module EM-C or by using the calibration pin.
Please note that for a correct functionality of the sensor a magnet with a material remanence of 1.03 Tesla is needed (not included, available on request).
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
APS-C	**F 02U V00 086-01**





Acceleration Sensor

Accelerometer AM 600-2, AM 600-3

This sensor is designed to measure the physical effects of lateral acceleration in two/three axes (e.g. for analysis of acceleration and deceleration behaviour of race cars).

In order to achieve this, the sensor features two/three measuring elements for acceleration, in two/three integrated circuits. The sensing element consists of a micro machined sensor chip and an evaluation ASIC – allowing for high precision measurement applications.

The main benefits of this high performance coil are its robustness in hard racing applications and high energy efficiency.

Application	
Application	[1] x, y ±4,5 g [2] x, y, z ±4,5 g
Max. vibration	5000 m/s² in operation
Storage temperature range	-55 ... 105 °C
Operating temperature range	-40 ... 85 °C

Electrical Data	
Power supply	5 V
Power supply max.	6 V
Full scale output	2,5 = 0 g; 440 mV/g
Supply current	7 mA
Supply current max.	12 mA

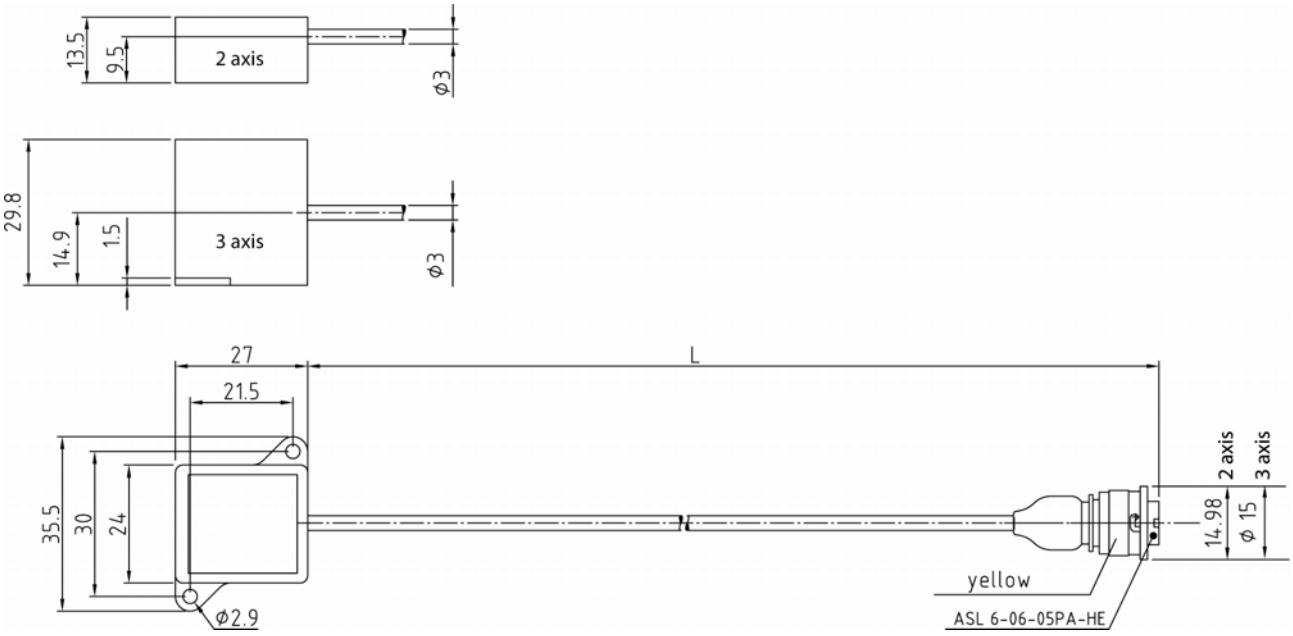
Mechanical Data	
Weight w/o cable	[1] 30 g [2] 50 g
Size	[1] 24 x 27 x 13,5 mm [2] 24 x 27 x 29,8 mm
Mounting	2 x M3
Tightening torque	2 Nm

Characteristic	
Sensitivity	440 mV/g
Offset	2500 mV @ 0 g
Tolerance of sensitivity	±3 %
Non-linearity of sensitivity	±2 %

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	[1] Sig_x [2] Sig_y
Pin 4	[1] Sig_y [2] Sig_x
Pin 5	[1] Scr [2] Sig_z
Various military and automotive connectors on request.	
Sleeve	DR-25
Cable size	AWG 24
Cable length	15 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint
The AM 600 can be connected directly to most control units and data logging systems.
Please avoid abrupt temperature changes.
For mounting please use only the integrated fixed hole.
Please ensure that the environmental conditions do not exceed the sensor specifications.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Numbers	
[1] AM 600-2	**B 261 209 311-01**
[2] AM 600-3	**B 261 209 313-01**



Gear Shift Sensors

Gear Shift Sensor GSS-2

This sensor is designed to measure force relative to gear shifting in order to control the engine operation allowing the driver to maintain no-lift-shift/full throttle during shifting (up and down).

A circuit of precise resistors and an integrated amplifier supply a force dependent output voltage signal. As soon as this signal exceeds a certain threshold value in the ECU, the ignition and injection can be adjusted automatically according to the individual ECU application.

The main feature and benefit of this sensor is the combination of high quality production part and robust design with metal housing and motorsport spec connection. Furthermore this sensor has a dual way functionality.

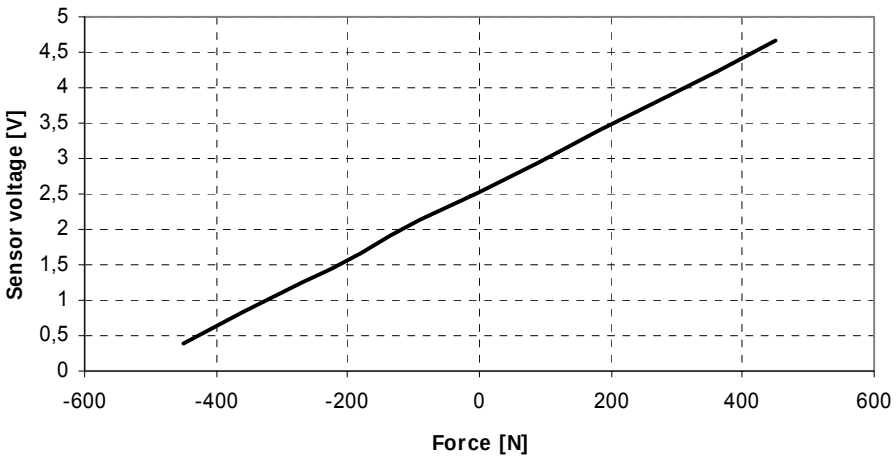
Application	
Application	-450 ... 450 N
Operating Temperature Range	0 ... 80 °C
Max. Vibration (stochastic peak level)	800 m/s² @ 5 Hz ... 2 kHz

Electrical Data	
Supply voltage	12 V

Characteristic	
Signal Output	0,5 ... 4,5 V
Zero Output	2,5 V

Mechanical Data	
Weight w/o cable	90 g
Size	65 x 16 x 16 mm
Mounting	2 x M10x1
Tightening Torque	22 Nm
Mech. Range programmable up to	450 N
F_{max}	800 N
Mech. load limit	1800 N
Max. cycles @ 300 N	300 000 cycles

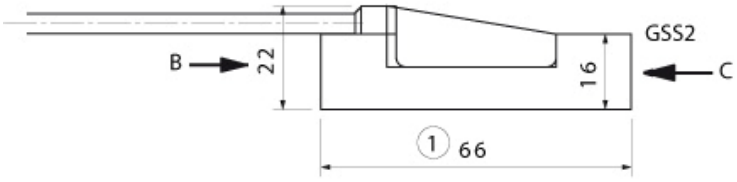
Force [N]	Voltage [V]
450	4,673
360	4,225
270	3,797
180	3,397
90	2,941
0	2,538
-90	2,141
-180	1,672
-270	1,255
-360	0,820
-450	0,402

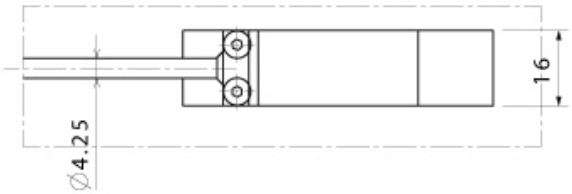


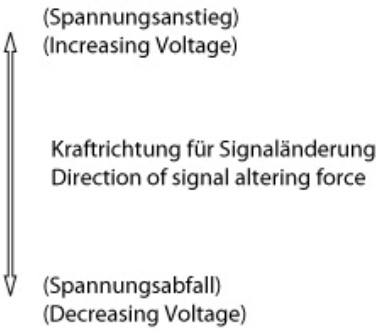
Connectors and Cables	
Connector	ASL 6-06-05PC-HE
Mating connector	ASL 0-06-05SC-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	Scr
Various motorsport and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 100 cm
Please specify the requested cable length with your order.	

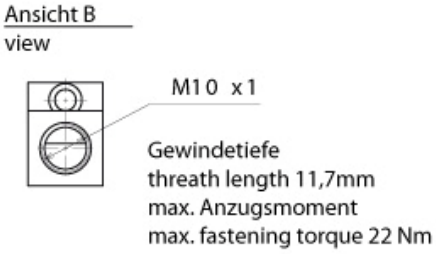
Application Hint
The GSS-2 can be connected directly to most control units and data logging systems.
Please avoid abrupt temperature changes.
For mounting please use only the integrated thread.
Please ensure that the environmental conditions do not exceed the sensor specifications.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

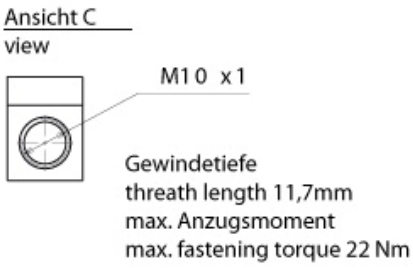
Part Number	
Gear Shift Sensor GSS-2	**B 261 209 227**











Gear Shift Sensor GSS-M

This sensor is specifically designed for the use with motorcycle applications. The sensor measures the relative force during gear shifting directly relaying data to the ECU in order to gain max power from rapid up or down shifting.

An electronic circuit composed of a precise strain gauge and an integrated amplifier supplies a force-dependent output signal. As soon as this signal exceeds a certain threshold, the ignition and injection can be adjusted automatically according to the individual ECU application. The carbon fibre housing achieves excellent protection for the electronics and reduces the overall weight of the sensor.

The main features and benefits of this sensor are its small dimensions, its minimal weight, its precise temperature compensation and its combination of high quality production and robust design with a motorsport spec connector.

Application	
Application	-1,000 ... +1,000 N
Operating temperature range	0 ... 80 °C
Max. vibration (stochastic peak level)	800 m/s^2 @ 5 Hz ... 2 kHz

Electrical Data	
Power supply	12 V

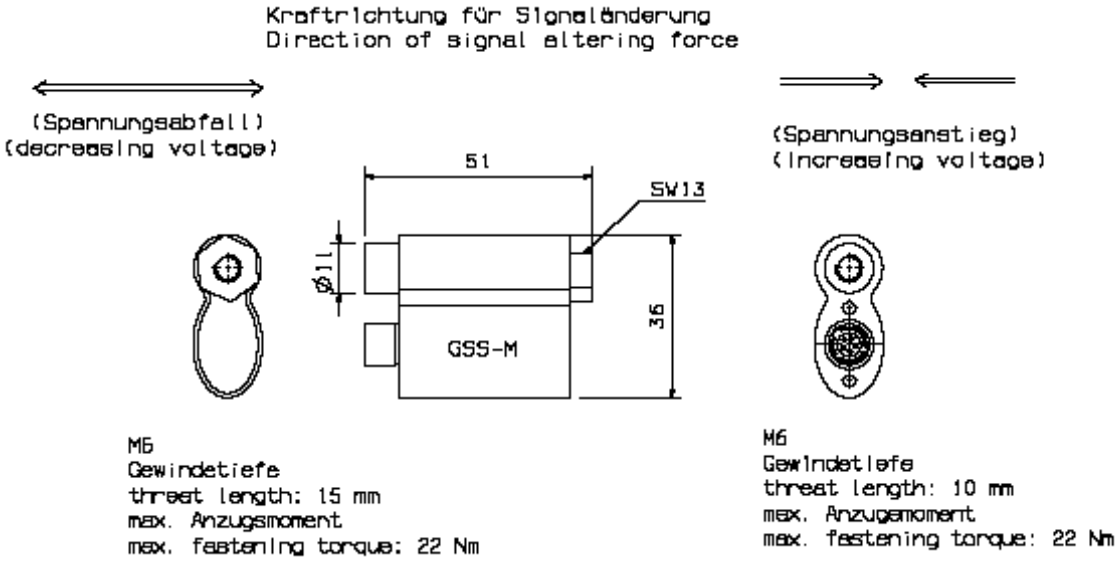
Characteristic	
Signal output	0.2 ... 4.8 V
Zero output	(20 ... 70 °C) 2.5 V ±100 mV

Mechanical Data	
Weight	30 g
Size	51 x 36 x 16 mm
Mounting	2 x M6
Tightening torque	22 Nm
F_{max}	± 1,000 N
Mech. load limit	± 3,000 N

Connectors	
Connector	ASU 0-03-05PN-HE
Mating connector	ASU 6-03-05SN-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	Scr

Application Hint
The GSS-M can be connected directly to most control units and data logging systems.
Please avoid abrupt temperature changes.
For mounting please use only the integrated thread.
Please ensure that the environmental conditions do not exceed the sensor specifications.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Gear Shift Sensor GSS-M	**F 02U V00 354-01**



Knock Sensors

Knock Sensor KS-P

This sensor is used for detecting structural born vibrations in spark ignition engines due to uncontrolled combustion. This sensor is suitable for operation in extreme conditions.

Due to the inertia of the seismic mass, the sensor moves in correlation to the engine block vibration; this motion results in a compressive force which is converted into a voltage signal via a piezoceramic sensor element. As a result, upper and lower voltage thresholds can be defined directly correlating to an acceleration magnitude.

The main benefits of this sensor are its robust mechanical design, compact housing and precise determination of structure-related noise. The small packaging is accomplished by integrating the connector directly to the sensor.

Application	
Application	1 ... 20 kHz
Operating temperature range	-40 ... 130 °C
Storage temperature range	0 ... 100 °C
Max. vibration	≤ 800 m/s²

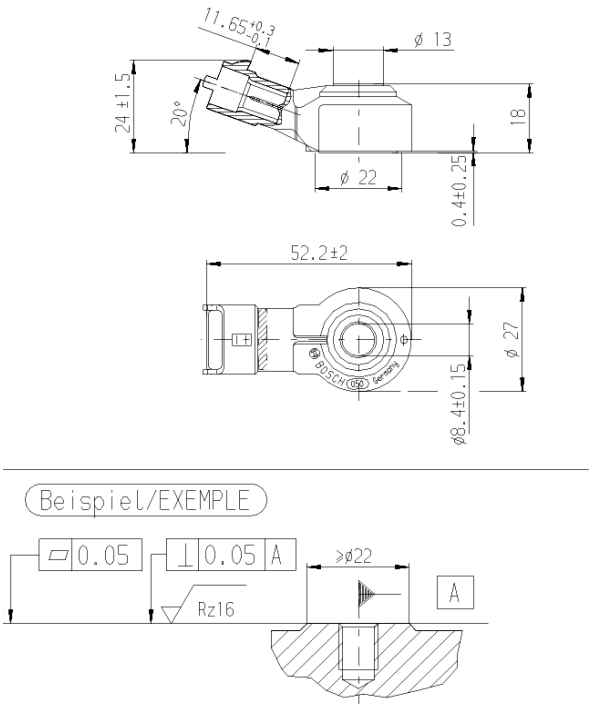
Mechanical Data	
Male thread (for cast)	M8x25
Male thread (for Al)	M8x30
Installation torque	20 ± 5 Nm
Weight w/o cable	48 g
Protection	IP 54

Electrical Data	
Range of frequency	1 ... 20 kHz
Sensitivity @ 5 kHz	26 ± 8 mV/g
Max. sensivity changing (life time)	-17 %
Linearity between 5 ... 15 kHz (from 5 kHz value)	-10 ... 20 %
Linearity between 15 ... 20 kHz (linear increasing with freq)	20 ... 50 %
Main resonance frequency	> 25 kHz
Impedance	> 1 MΩ
Temperature dependence of sensitivity	-0,06 mV/g °C
Capacity field	800 ... 1400 pF

Connectors and Cables	
Connector	Y 280 A62 566A
Connector loom	D 261 205 337
Pin 1	Sig +
Pin 2	Sig -
Pin 3	Scr
Various military and automotive connectors on request.	

Application Hint
The KS-P sensor can be connected to all Bosch Motorsport ECUs featuring knock control.
The sensor must rest directly on the brass compression sleeve during operation.
To ensure low-resonance coupling of the sensor to the measurement location, the contact surface must be clean and properly machined to provide a secure flush mounting.
The sensor cable is to be routed such that no resonance vibration can occur.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Knock Sensor KS-P	**0 261 231 120**



Knock Sensor KS-R

This sensor is used for detecting structural born vibrations in spark ignition engines due to uncontrolled combustion. This sensor is suitable for operation in extreme conditions.

Due to the inertia of the seismic mass, the sensor moves in correlation to the engine block vibration; this motion results in a compressive force which is converted into a voltage signal via a piezoceramic sensor element. As a result, upper and lower voltage thresholds can be defined directly correlating to an acceleration magnitude.

The main benefits of this sensor are its robust mechanical design, compact housing and precise determination of structure-related noise. Connection to this sensor can be tailored to customer requirements through specified cable lengths and various connector options.

Application	
Application	1 ... 20 kHz
Operating temperature range	-40 ... 130 °C
Storage temperature range	0 ... 100 °C
Max. vibration	≤ 800 m/s²

Mechanical Data	
Male thread (for cast)	M8 x 25
Male thread (for Al)	M8 x 30
Installation torque	20 ± 5 Nm
Weight w/o cable	82 g
Protection	IP 54

Electrical Data	
Range of frequency	1 ... 20 kHz
Sensitivity @ 5 kHz	26 ± 8 mV/g
Max. sensivity changing (life time)	-17 %
Linearity between 5 ... 15 kHz (from 5 kHz value)	-10 ... 20 %
Linearity between 15 ... 20 kHz (linear increasing with freq)	20 ... 50 %
Main resonance frequency	> 25 kHz
Impedance	> 1 MΩ
Temperature dependence of sensitivity	-0,06 mV/g °C
Capacity field	800 ... 1400 pF

Connectors and Cables	
Connector	A 261 230 076
Connector loom	D 261 205 289
Pin 1	Sig +
Pin 2	Sig -
Pin 3	Scr
Various military and automotive connectors on request.	
Sleeve	Elastomer
Cable size	AWG 24
Cable length L	50 cm
Please specify the requested cable length with your order.	

Application Hint

The KS-R sensor can be connected to all Bosch Motorsport ECU featuring knock control.

The sensor must rest directly on the brass compression sleeve during operation.

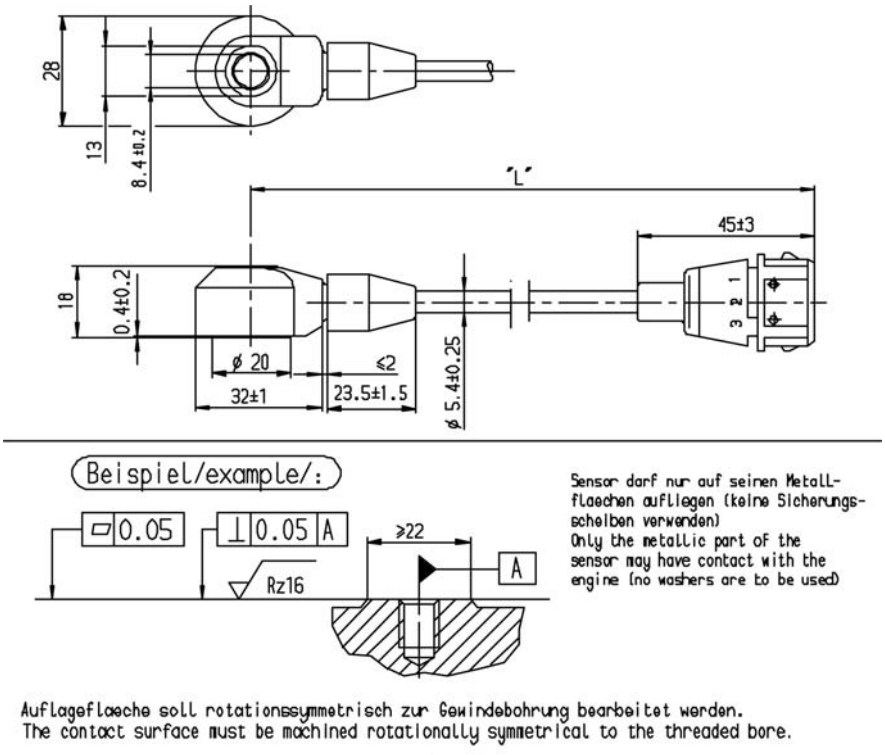
To ensure low-resonance coupling of the sensor to the measurement location, the contact surface must be clean and properly machined to provide a secure flush mounting.

The sensor cable is to be routed such that no resonance vibration can occur.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

Knock Sensor KS-R	**0 261 231 047**



Lambda Sensors

Lambda Sensor LSM 11

This sensor is designed to measure the oxygen content and Lambda value of exhaust gases in automotive engines (gasoline or Diesel).

The sensor's exhaust-gas produces a step-type sensor voltage profile in the area around λ = 1. Measurements are taken of the residual oxygen content in the exhaust gas. The active sensor ceramic (ZrO_2) is heated from inside by means of ceramic Wolfram heater so that the temperature of the sensor ceramic remains above the functional limit of 350 °C regardless of the exhaust-gas temperature.

The main benefit of the LSM is the high resolution signal in the area around λ = 1.

Application	
Application	1.025 ... 1.5 λ
Fuel	Gasoline/Diesel
Exhaust gas temperature range (operating)	250 ... 800 °C
Exhaust gas temperature range (max.)	930 °C
Hexagon temperature	< 570 °C
Cable and protective sleeve temperature	< 250 °C
Connector temperature	< 120 °C
Storage temperature range	-40 ... 100 °C
Max. vibration (stochastic peak level)	800 m/s^2

Electrical Data	
Power supply H+ nominal	12 ... 14 V
Heater power steady state	18 W

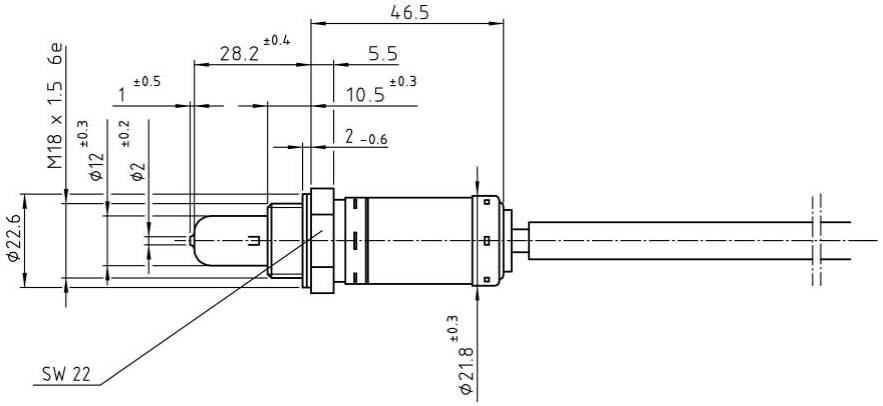
Mechanical Data	
Weight w/o cable	160 g
Length	86 mm
Thread	M18x1.5
Wrench size	22 mm
Tightening torque	50 ... 60 Nm

Characteristic		
Signal output		Ip meas / Ua (AWS)
Accuracy @ λ = 1.7		1.70 ±0.05 %
U_A [mV]	Lambda [λ @ 400 °C]	Lambda [λ @ 650 °C]
60	1.030	1.035
50	1.050	1.055
40	1.090	1.097
30	1.150	1.160
20	1.260	1.270
15	1.380	1.380
13	1.495	1.495

Connectors and Cables	
Connector	1 284 485 110-black
Connector II	1 284 485 018
Sleeve	fiber glas / silicon coated
Cable size	AWG 24
Cable length L	250 cm
Various motorsport and automotive connectors on request.	
Other cable lengths are on request.	

Application Hint
The LSM 11 can be connected to most Bosch Motorsport ECUs.
The lambda sensor should be installed at point which permits the measurement of a representative exhaust-gas mixture and which does not exceed the maximum permissible temperature.
Install at a point where the gas is as hot as possible.
Observe the maximum permissible temperature.
Sensors should be installed as close to vertical as possible (wire upwards).
The sensor is not to be fitted near to the exhaust pipe outlet, so that the influence of the outside air can be ruled out.
The exhaust system upstand and surrounding the sensor must be sealed in order to avoid the effects of leakage air.
Protect the sensor against condensation water.
The sensor is supplied with reference air via the connecting cables. The connectors must therefore be clean and dry. The use of contact spray anti-corrosion agents or the like is not permitted.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LSM 11	**0 258 104 002**



Lambda Sensor LSM 11-PM

This sensor is designed to measure the oxygen content and Lambda value of exhaust gases in automotive engines (gasoline or Diesel).

The catalytic effect of the electrode surface at the sensor's exhaust-gas produces a step-type sensor voltage profile in the area around λ = 1. Measurements are taken of the residual oxygen content in the exhaust gas. The active sensor ceramic (ZrO_2) is heated from inside by means of ceramic Wolfram heater so that the temperature of the sensor ceramic remains above the 350 °C function limit irrespective of the exhaust-gas temperature. The high resolution signal in the area around λ = 1 in combination with a robust motorsport connector is the main benefit of the LSM 11-PM.

Application	
Application	1.025 ... 1.5 lambda
Fuel	Gasoline/Diesel
Exhaust gas temperature range (operating)	250 ... 800 °C
Exhaust gas temperature range (maximum)	930 °C
Hexagon temperature	≤ 570 °C
Cable and protective sleeve temperature	≤ 250 °C
Connector temperature	≤ 120 °C
Storage temperature range	-40 ... 100 °C
Max. vibration (stochastic peak level)	800 m/s^2

Electrical Data	
Power supply H+ nominal	160 V
Heater power steady state	18 W

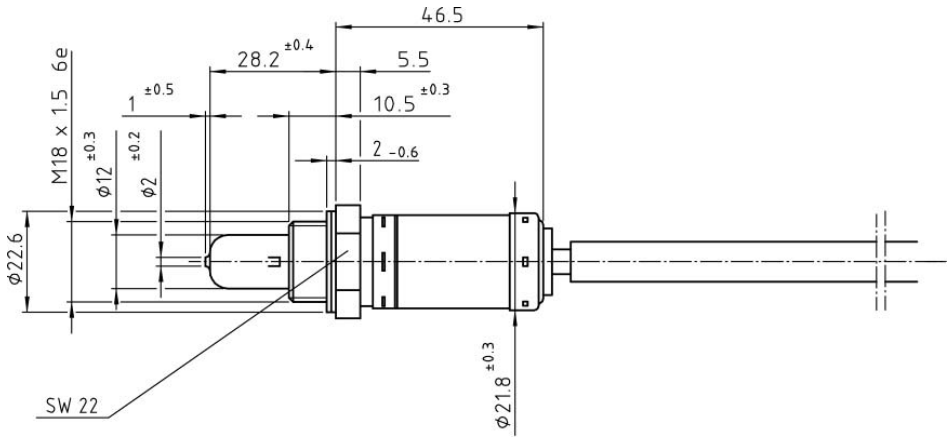
Mechanical Data	
Weight w/o cable	160 g
Length	86 mm
Thread	M18x1.5
Wrench size	22 mm
Tightening torque	50 ... 60 Nm

Characteristic		
Signal output		Ip meas / Ua (AWS)
Accuracy @ lambda = 1.7		1.70 ±0.05
U_A [mV]	**Lambda [λ @ 400 °C]**	**Lambda [λ @ 650°C]**
60	1.030	1.035
50	1.050	1.055
40	1.090	1.097
30	1.150	1.160
20	1.260	1.270
15	1.380	1.380
13	1.495	1.495

Connectors and Cables	
Connector	KPTC 6E8-4P-C-DN
Connector loom	KPTC 120062-55
Pin 1	Uh+
Pin 2	Uh-
Pin 3	Sig+
Pin 4	Sig-
Sleeve	Fiber glas / Silicone coated
Cable size	AWG 24
Cable length L	30 ... 100 cm
Various motorsport and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The LSM 11-PM can be connected to most Bosch Motorsport ECUs.
The lambda sensor should be installed at point which permits the measurement of a representative exhaust-gas mixture, which does not exceed the maximum permissible temperature.
Install at a point where the gas is as hot as possible.
Observe the maximum permissible temperature.
Sensors should be installed as close to vertical as possible (wire upwards).
The sensor is not to be fitted near to the exhaust pipe outlet, so that the influence of the outside air can be ruled out.
The exhaust system upstand and surrounding the sensor must be sealed in order to avoid the effects of leakage air.
Protect the sensor against condensation water.
The sensor is supplied with reference air via the connecting cables. The connectors must therefore be clean and dry. The use of contact spray anti-corrosion agents or the like is not permitted.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LSM 11-PM	**B 261 209 105-01**



Lambda Sensor LSU 4.2

This sensor is designed to measure the oxygen content and Lambda value of exhaust gases in automotive engines (gasoline or Diesel).

The wide band lambda sensor LSU 4.2 is a planar ZrO_2 dual cell limiting current sensor with integrated heater. Its monotonic output signal in the range of $\lambda = 0.65$ to air makes the LSU capable of being used as an universal sensor for $\lambda = 1$ measurement as well as for other Lambda ranges. The connector module contains a trimming resistor, which defines the characteristic of the sensor. The LSU operates only in combination with a special LSU-IC, used in most Bosch Motorsport ECUs.

The main benefit of the LSU is the very robust design combined with the high Bosch production quality standard.

Application	
Application	0.65 λ ... ∞
Fuel	Gasoline/Diesel
Exhaust gas temperature range (operating)	930 °C
Exhaust gas temperature range (max.)	< 1,030 °C
Hexagon temperature	< 570 °C
Cable and protective sleeve temperature	< 250 °C
Connector temperature	< 120 °C
Storage temperature range	-40 ... 100 °C
Max. vibration (stochastic peak level)	1000 m/s²

Mechanical Data	
Weight w/o cable	120 g
Length	84 mm
Thread	M18x1.5
Wrench size	22 mm
Tightening torque	40 ... 60 Nm

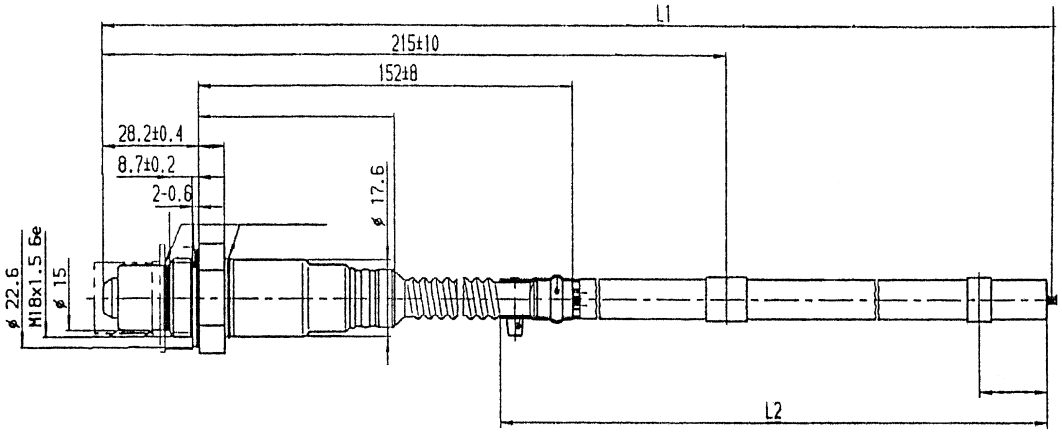
Electrical Data	
Power supply H+ nominal	9 V
Heater power steady state	10 W
Heater control frequency	> 2 Hz
Nominal resistance of nernst cell	80 Ω
Max. current load for nernst cell	10(DC)/250(AC) µA

Characteristic	
Signal output	Ip meas / Ua (AWS)
Accuracy @ λ = 1	1.016 ±0.007
Accuracy @ λ = 0.8	0.80 ±0.01
Accuracy @ λ = 1.7	1.70 ±0.05

Connectors and Cables	
Connector	Y 928 K00 050
Connector loom	D 261 205 138
Pin 1	IP/APE
Pin 2	UN/RE
Pin 3	VM/IPN
Pin 4	Uh-/H-
Pin 5	Uh+/H
Pin 6	IA/RT
Various motorsport and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The LSU 4.2 can be connected to most Bosch Motorsport ECUs.
The lambda sensor should be installed at point which permits the measurement of a representative exhaust-gas mixture, which does not exceed the maximum permissible temperature.
Install at a point where the gas is as hot as possible.
Observe the maximum permissible temperature.
As far as possible install the sensor vertically (cable upwards).
The sensor is not to be fitted near to the exhaust pipe 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 is not to be painted, nor is wax to be applied or any other forms of treatment. Use only the recommended grease for lubricating the thread.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LSU 4.2	**0 258 006 065**



Lambda Sensor LSU 4.9

This sensor is designed to measure the oxygen content and Lambda value of exhaust gases in automotive engines (gasoline or Diesel).

The wide band lambda sensor LSU 4.9 is a planar ZrO_2 dual cell limiting current sensor with integrated heater. Its monotonic output signal in the range of λ = 0.65 to air makes the LSU capable of being used as an universal sensor for λ = 1 measurement as well as for other Lambda ranges. The connector module contains a trimming resistor, which defines the characteristic of the sensor. The LSU operates only in combination with a special LSU-IC, used in most Bosch Motorsport ECUs and lambda control boxes like LT4.

The main benefit of the LSU is the robust design combined with the high Bosch production quality standard.

Application	
Application	0.65 λ ... ∞
Fuel	Gasoline/Diesel
Exhaust gas pressure	< 4 bar
Exhaust gas temperature range (operating)	< 930 °C
Exhaust gas temperature range (max.)	< 1,030 °C
Hexagon temperature	< 600 °C
Cable and protective sleeve temperature	< 250 °C
Connector temperature	< 140 °C
Storage temperature range	-40 ... 100 °C
Max. vibration (stochastic peak level)	< 1,000 m/s^2

Mechanical Data	
Weight w/o cable	120 g
Length	84 mm
Thread	M18x1.5
Wrench size	22 mm
Tightening torque	40 ... 60 Nm

Electrical Data	
Power supply H+ nominal	7,5 V
System supply voltage H+ (min)	10.8 V
Heater power steady state	7.5 W
Heater control frequency	≥ 100 Hz
Nominal resistance of nernst cell	300 Ω
Max Current load for nernst cell	250 µA

Connectors and Cables	
Connector	[1] 1 928 404 687 [2] AS 6-07-35PN
Mating connector	[1] D 261 205 356-01 [2] AS 0-07-35SN
Pin 1	IP / APE
Pin 2	VM / IPN
Pin 3	Uh- / H-
Pin 4	Uh+ / H
Pin 5	IA / RT
Pin 6	UN / RE
Sleeve	fiber glas / silicone coated
Cable size	AWG 24
Cable length L	32.5 cm
Various motorsport and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The LSU 4.9 can be connected to most Bosch Motorsport ECUs and lambda control units like LT4.

The lambda sensor should be installed at point which permits the measurement of a representative exhaust-gas mixture, which does not exceed the maximum permissible temperature.

Install at a point where the gas is as hot as possible.

Observe the maximum permissible temperature.

As far as possible install the sensor vertically (cable upwards).

The sensor is not to be fitted near to the exhaust pipe 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 is not to be painted, nor is wax to be applied or any other forms of treatment. Use only the recommended grease for lubricating the thread.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Characteristic		
Signal output		Ip meas / Ua (AWS)
Accuracy @ λ = 1		1.016 ±0.007
Accuracy @ λ = 0.8		0.80 ±0.01
Accuracy @ λ = 1.7		1.70 ±0.05
IP	**U_A [V]**	**Lambda [λ]**
-1.243	0.192	0.750
-0.927	0.525	0.800
-0.800	0.658	0.822
-0.652	0.814	0.850
-0.405	1.074	0.900
-0.183	1.307	0.950
-0.106	1.388	0.970
-0.040	1.458	0.990
0	1.500	1.003
0.015	1.515	1.010
0.097	1.602	1.050
0.193	1.703	1.100
0.250	1.763	1.132
0.329	1.846	1.179
0.671	2.206	1.429
0.938	2.487	1.701
1.150	2.710	1.990
1.385	2.958	2.434
1.700	3.289	3.413
2.000	3.605	5.391
2.150	3.762	7.506
2.250	3.868	10.119

Part Number	
LSU 4.9	[1] **0 258 017 025**
LSU 4.9	**[2] B 261 209 358-02**

Lambda Sensor Mini-LSU 4.9

This sensor is designed to measure the oxygen content and Lambda value of exhaust gases in automotive engines (gasoline or Diesel).

The wide band lambda sensor Mini-LSU 4.9 is a planar ZrO_2 dual cell limiting current sensor with integrated heater. Its monotonic output signal in the range of λ = 0.65 to air makes the LSU capable of being used as an universal sensor for λ = 1 measurement as well as for other Lambda ranges. The connector housing contains a trimming resistor, which defines the characteristic of the sensor. The LSU operates only in combination with a special LSU-IC, used in most Bosch Motorsport ECUs and lambda control units like LT4.

The main benefit of the Mini-LSU 4.9 is its very compact design in combination with the high quality Bosch production quality standard.

Application	
Application	0.65 ... ∞ lambda
Fuel	Gasoline/Diesel
Exhaust Gas Pressure	< 4 bar
Exhaust Gas Temperature Range (operating)	< 930 °C
Exhaust Gas Temperature Range (max.)	< 1,030 °C
Hexagon Temperature	< 1,050 °C
Cable and Protective Sleeve Temperature	< 250 °C
Connector Temperature	< 150 °C
Storage Temperature Range	-40 ... 100 °C
Max. Vibration (stochastic peak level)	< 1,000 m/s^2

Mechanical Data	
Weight w/o Cable	28 g
Length	60 mm
Thread	M16x1.5
Wrench Size	17 mm
Tightening Torque	60 Nm

Electrical Data	
Power Supply H+ Nominal	7.5 V
System Supply Voltage H+ (min)	10.8 V
Heater Power steady State	7.5 W
Heater Control Frequency	≥ 100 Hz
Nominal Resistance of Nernst Cell	300 Ohm
Max. Current Load for Nernst Cell	250 µA

Connectors and Cables	
Connector	1 928 404 682
Connector Loom	09 4421 01
Pin 1	IP
Pin 2	VM
Pin 3	UH-
Pin 4	UH+
Pin 5	RT
Pin 6	UN
Sleeve	Fiber Glas / Silicone coated
Cable Size	AWG22
Cable Length L	30 ... 100 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The Mini-LSU 4.9 can be connected to most Bosch Motorsport ECUs and Lambda Control Units like LT4.

The lambda sensor should be installed at point which permits the measurement of a representative exhaust-gas mixture and which does not exceed the maximum permissible temperature.

Install at a point where the gas is as hot as possible.

Observe the maximum permissible temperature.

Sensors should be installed as close to vertical as possible (wire upwards).

The sensor is not to be fitted near to the exhaust pipe outlet, so that the influence of the outside air can be ruled out.

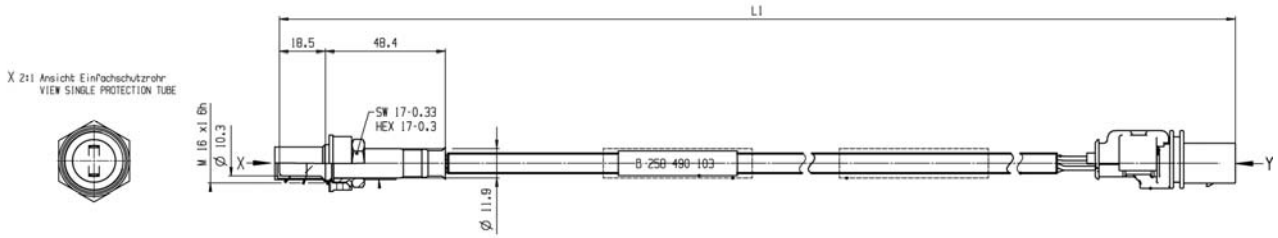
The exhaust system upstand and surrounding the sensor must be sealed in order to avoid the effects of leakage air.

Protect the sensor against condensation water. The sensor is not to be painted, nor is wax to be applied or any other forms of treatment. Use only the recommended grease for lubricating the thread.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Characteristic		
Signal Output		Ip meas / Ua (AWS)
Accuracy @ λ = 1		1.016 ±0.007
Accuracy @ λ = 0.8		0.80 ±0.01
Accuracy @ λ = 1.7		1.70 ±0.05
IP	**U_A [V]**	**Lambda**
-1.243	0.192	0.750
-0.927	0.525	0.800
-0.800	0.658	0.822
-0.652	0.814	0.850
-0.405	1.074	0.900
-0.183	1.307	0.950
-0.106	1.388	0.970
-0.040	1.458	0.990
0.000	1.500	1.003
0.015	1.515	1.010
0.097	1.602	1.050
0.193	1.703	1.100
0.250	1.763	1.132
0.329	1.846	1.179
0.671	2.206	1.429
0.938	2.487	1.701
1.150	2.710	1.990
1.385	2.958	2.434
1.700	3.289	3.413
2.000	3.605	5.391
2.150	3.762	7.506
2.250	3.868	10.119

Part Number	
Mini-LSU 4.9	**B 258 490 103-20**



Linear Potentiometers

Linear Potentiometer LP 10

The LP 10 is a linear potentiometer which is designed to measure the stabilizer movement.

Its operating mode is based on the linear tape potentiometer principle where the distance travelled between the moving ends to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with a hard metal housing and low power consumption.

Application	
Application	0 ... 10 mm
Temperature range	-20 ... 85 °C
Storage temperature range	-40 ... 85 °C

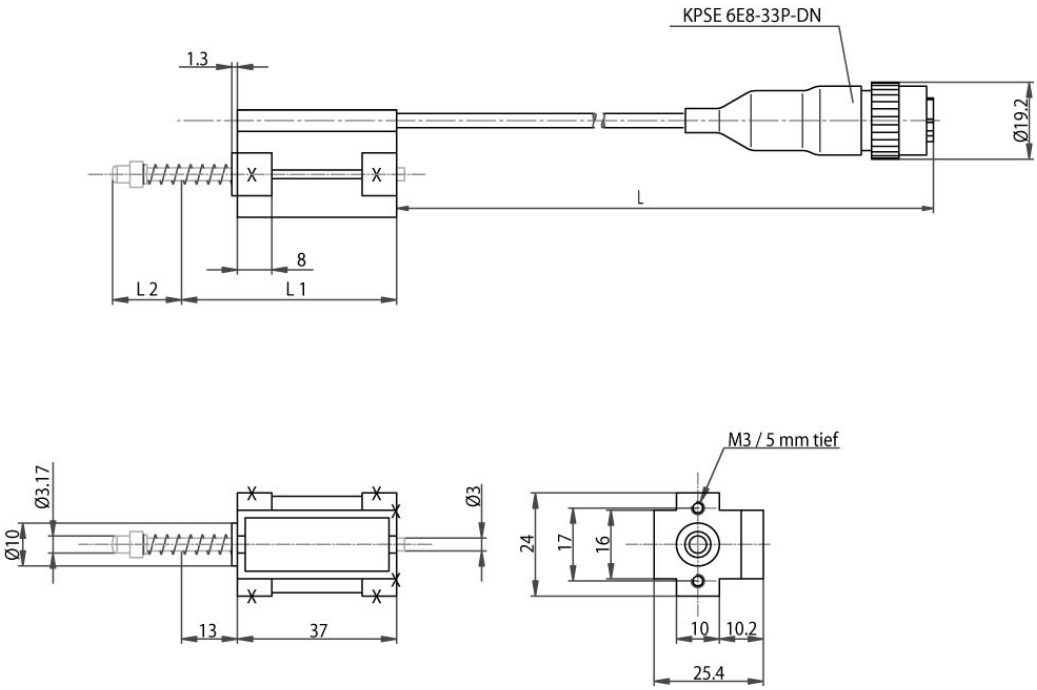
Electrical Data	
Power supply	5 V
Nominal resistance	1 kΩ
Resistance tolerance	20 %
Non-linearity	1 %
Max. current	1 mA

Connectors and Cables	
Connector	KPSE 6E8-33P-DN
Connector loom	KPSE 0E8-33S-DN
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm

Mechanical Data	
Weight w/o cable	70 g
Min. length	50 mm
Mounting	2 x M3
Tightening torque	2 Nm

Application Hint
The LP 10 can be connected directly to most electronic control units and data logging systems.
Optional mounting modifications are available.
Each mounting orientation is possible.
Comes with a spring return shaft.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 10	**B 261 209 535**


KPSE 6E8-33P-DN
1.3
Ø19.2
L
8
L 2
L 1
M3 / 5 mm tief
Ø3.17
Ø10
Ø3
24
17
16
13
37
10
10.2
25.4

Linear Potentiometer LP 25

The LP 25 is a linear potentiometer which is designed to measure the gear position, throttle position or suspension movement.

Its operating mode is based on the linear tape potentiometer principle where the distance travelled between the moving ends to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with an anodised aluminium cylindrical housing and low power consumption.

Application	
Application	0 ... 25 mm
Temperature range	-40 ... 85 °C

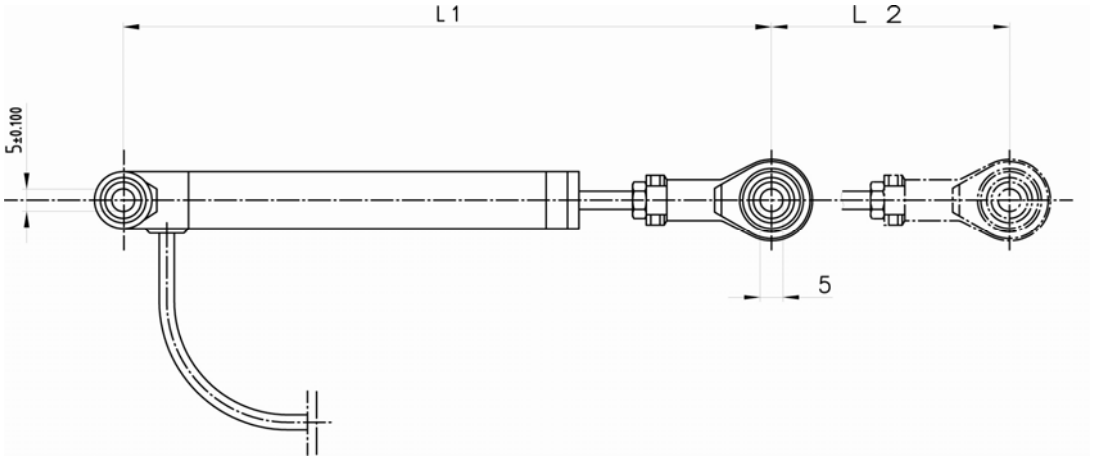
Electrical Data	
Power supply	5 V
Power supply max.	22 V
Nominal resistance	1 kΩ
Resistance tolerance	10 %
Non-linearity	0.25 %

Connectors and Cables	
Connector	ASL 6-06-05SA-HE
Connector loom	ASL 0-06-05PA-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 200 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Mechanical Data	
Weight w/o cable	68 g
Min. length	147 mm
Mounting	2 x M5
Tightening torque	10 Nm
Protection	IP65
Max. shaft velocity	1 m/sec

Application Hint
The LP 25 can be connected directly to most electronic control units and data logging systems.
Optional mounting modifications are available.
Each mounting orientation is possible.
Comes with a spring return shaft.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 25	**B 261 209 547**


L1
L 2
5±0.100
5

Linear Potentiometer LP 25 twin

The LP 25 twin is a linear potentiometer which is designed to measure the relative position of two point e.g. the gear position, throttle position or suspension movement and for use in electronic throttle control systems.

Its operating mode is based on the linear tape potentiometer principle where the distance travelled between the moving end to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with an anodised aluminium cylindrical housing, low power consumption and infinite resolution.

Application	
Application	0 ... 25 mm
Temperature range	-30 ... 100 °C

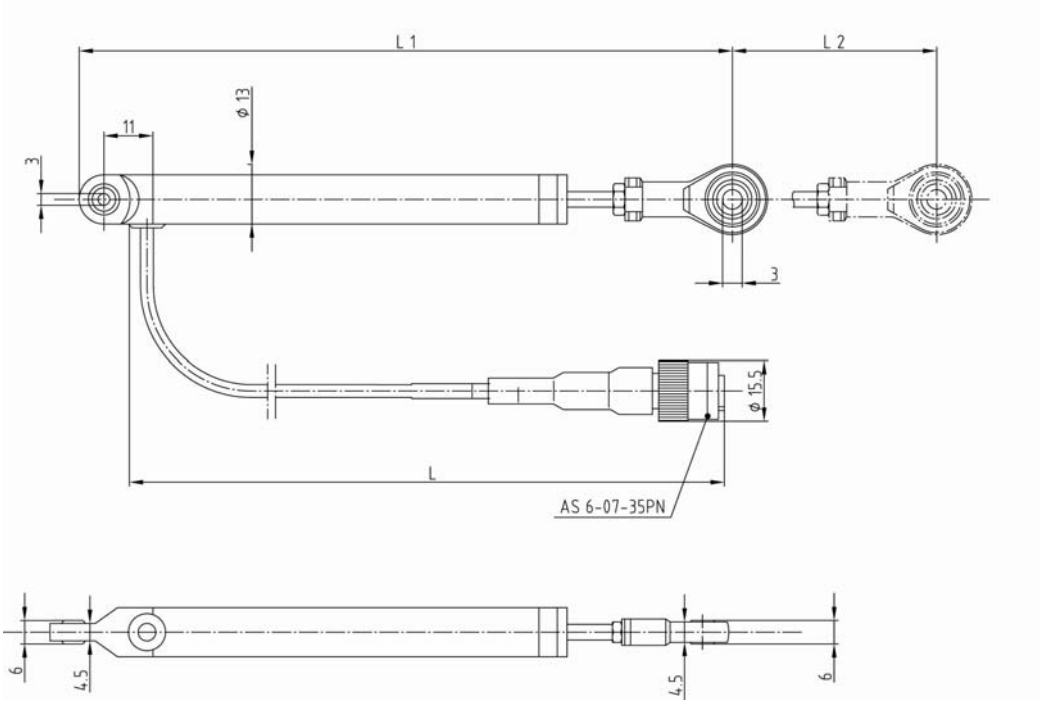
Electrical Data	
Power supply	5 V
Power supply max.	22 V
Nominal resistance	1 kΩ
Resistance tolerance	10 %
Non-linearity	0.25 %

Mechanical Data	
Weight w/o cable	60 g
Min. length	95 mm
Mounting	Ø 3 mm
Protection	IP66
Max. shaft velocity	< 10 m/sec

Application Hint
The LP 25 twin can be connected directly to most electronic control units and data logging systems.
Application where redundant signals are necessary to ensure system runs failsafe.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Connectors and Cables	
Connector	AS 6-07-35PN
Connector loom	AS 0-07-35SN
Pin 1	Us 1
Pin 2	Gnd 1
Pin 3	Sig 1
Pin 4	Us 2
Pin 5	Gnd 2
Pin 6	Sig 2
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Part Number	
LP 25 twin	**B 261 209 858**



Linear Potentiometer LP 50

The LP 50 is a linear potentiometer which is designed to measure the relative position of two point e.g. the gear position, throttle position or suspension movement.

The operating mode of this sensor is based on the linear tape potentiometer principle where the distance travelled between the moving end to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with an anodised aluminium cylindrical housing, low power consumption and infinite resolution.

Application	
Application	0 ... 50 mm
Temperature range	-40 ... 105 °C
Storage temperature range	-55 ... 125 °C
Max. vibration	100 m/s² @ 10 ... 500 Hz

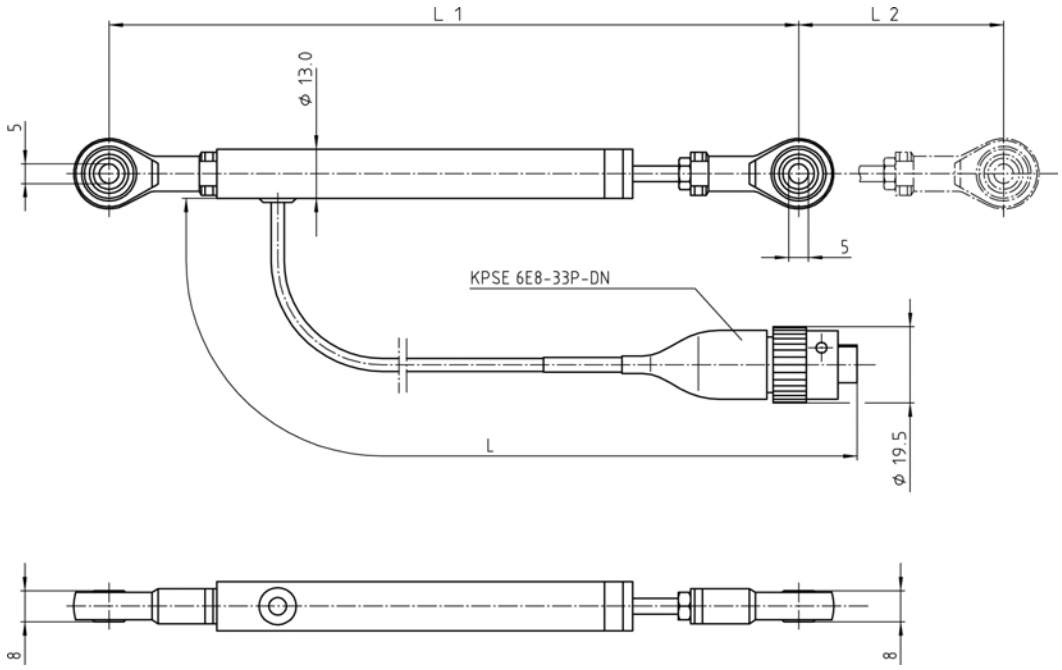
Mechanical Data	
Weight w/o cable	27 g
Min. length	172 mm
Mounting	2 x M5
Tightening torque	10 Nm
Protection	IP64
Max. shaft velocity	1.5 m/sec

Electrical Data	
Power supply	5 V
Power supply max.	42 V
Nominal resistance	4.7 kΩ
Resistance tolerance	20 %
Non-linearity	0.25 %
Max. current	1 mA

Connectors and Cables	
Connector	KPSE 6E8-33P-DN
Mating connector	KPSE 0E8-33S-DN
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm
Various motorsport and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The LP 50 can be connected directly to the most electronic control units and data logging systems.
Ball joints at shaft end and case.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 50	**B 261 209 133-01**


L 1
L 2
ø 13.0
5
5
KPSE 6E8-33P-DN
L
ø 19.5
8
8

Linear Potentiometer LP 50 twin

The LP 50 twin is a linear potentiometer which is designed to measure the relative position of two point e.g. the gear position, throttle position or suspension movement and for use in electronic throttle control systems.

It works base on the linear tape potentiometer principle where the distance traveled between the moving end to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with an anodised aluminium cylindrical housing, low power consumption and infinite resolution.

Application	
Application	0 ... 50 mm
Temperature range	-30 ... 100 °C

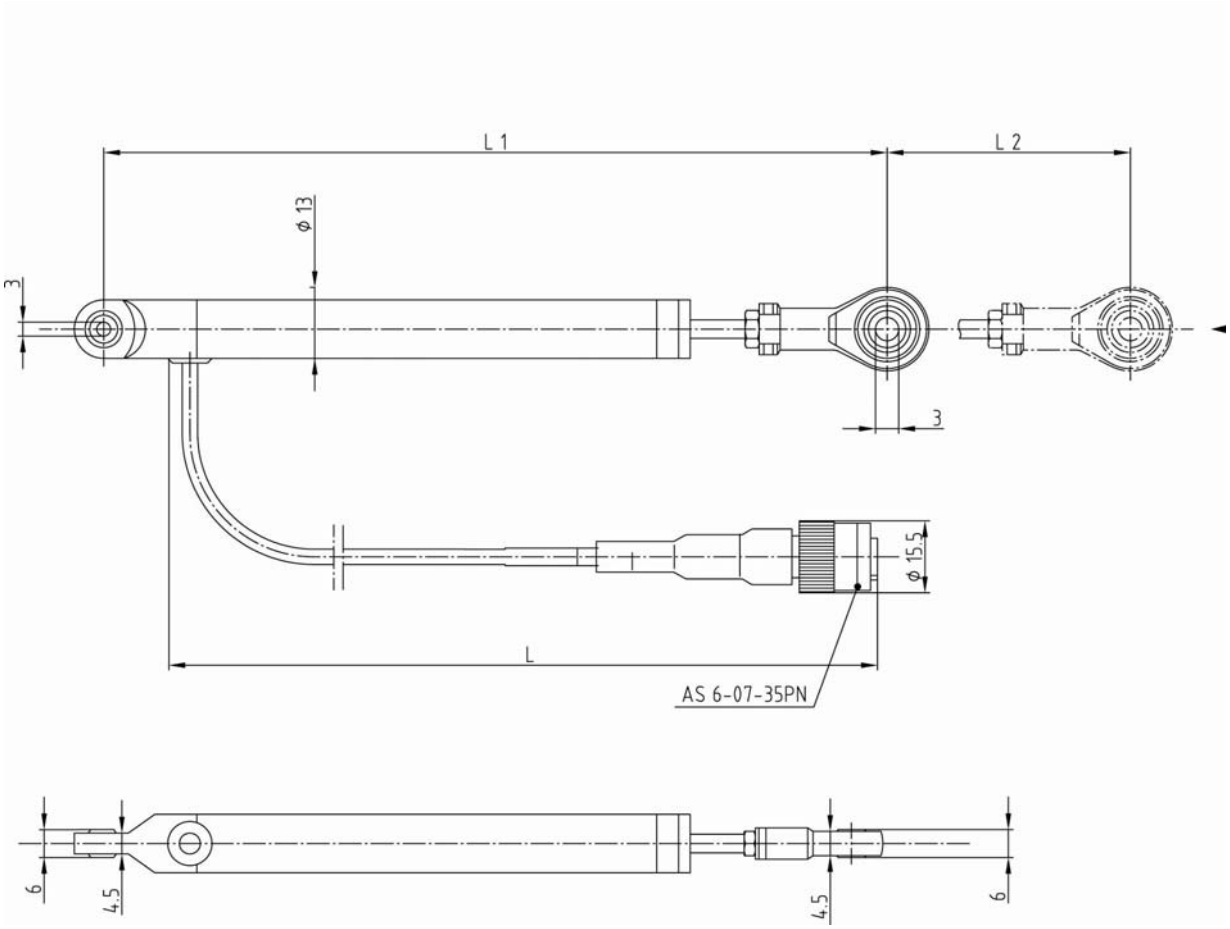
Electrical Data	
Power supply	5 V
Power supply max.	< 45 V
Nominal resistance	2 kΩ
Resistance tolerance	10 %
Non-linearity	0.25 %

Mechanical Data	
Weight w/o cable	66 g
Min. length	120 mm
Mounting	Ø 3 mm
Protection	IP66
Max. shaft velocity	< 10 m/sec

Connectors and Cables	
Connector	AS 6-07-35PN
Connector loom	AS 0-07-35SN
Pin 1	Us 1
Pin 2	Gnd 1
Pin 3	Sig 1
Pin 4	Us 2
Pin 5	Gnd 2
Pin 6	Sig 2
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The LP 50 twin can be connected directly to most electronic control units and data logging systems.
Application where redundant signals are necessary to ensure system runs failsafe.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 50 twin	**B 261 209 859**



Linear Potentiometer LP 75

The LP 75 is a linear potentiometer which is designed to measure the gear position, throttle position or suspension movement.

Its operating mode is based on the linear tape potentiometer principle where the distance travelled between the moving ends to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with hard metal housing and low power consumption.

Application	
Application	0 ... 75 mm
Temperature range	-30 ... 100 °C
Max. vibration	126 m/s² @ 10 ... 12 kHz

Electrical Data	
Power supply	5 V
Power supply max.	67 V
Nominal resistance	3 kΩ
Resistance tolerance	10 %
Non-linearity	0.15 %

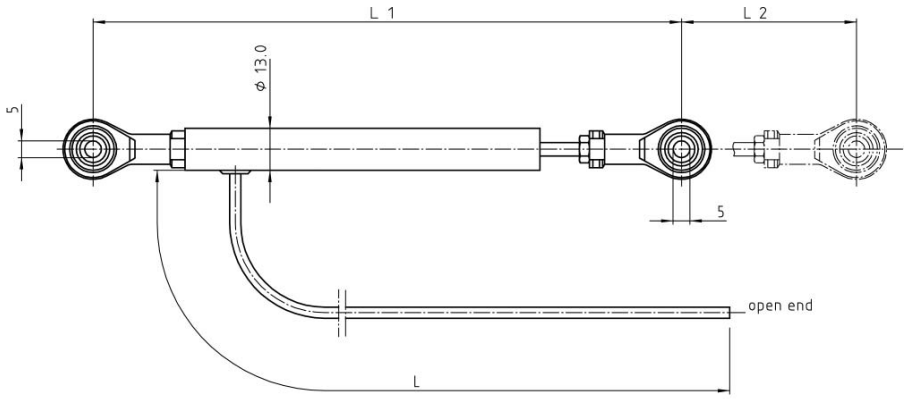
Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Mechanical Data	
Weight w/o cable	78 g
Min. length	223.6 mm
Mounting	2 x M5
Tightening torque	10 Nm
Protection	IP66
Max. shaft velocity	10 m/sec

Characteristic	
Signal output	0.5 ... 99.5 %

Application Hint
The LP 75 can be connected directly to most electronic control units and data logging systems.
Ball joints at shaft end and case.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 75	**B 261 209 856**


L 1
L 2
ø 13.0
5
5
open end
L

Linear Potentiometer LP 75F

The LP 75F is a linear potentiometer which is designed to measure the gear position, throttle position or suspension movement.

The operating mode of this sensor is based on the linear tape potentiometer principle where the distance travelled between the moving end to the wiper is proportional to the resistance between them.

The advantage of this LP is its compact and lightweight design together with its wider operating temperature range.

Application	
Application	0 ... 75 mm
Temperature range	-30 ... 100 °C
Max. vibration	126 m/s² @ 10 ... 12 kHz

Electrical Data	
Power supply	5 V
Power supply max.	67 V
Nominal resistance	3 kΩ
Resistance tolerance	10 %
Non-linearity	0.15 %

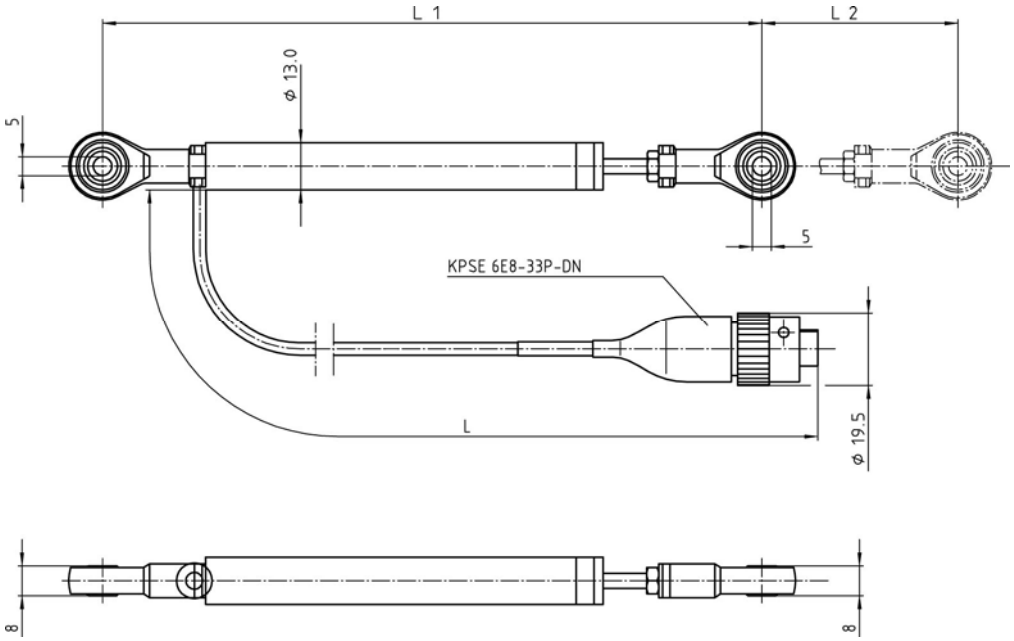
Connectors and Cables	
Connector	KPSE 6E8-33P-DN-A34
Connector loom	KPSE 0E8-33S-DN
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Mechanical Data	
Weight w/o cable	78 g
Min. length	223.6 mm
Mounting	2 x M5
Tightening torque	10 Nm
Protection	IP66
Max. shaft velocity	10 m/sec

Characteristic	
Signal output	0.5 ... 99.5 %

Application Hint
The LP 75F can be connected directly to most electronic control units and data logging systems.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 75F	**B 261 209 852**


L 1
L 2
ø 13.0
5
5
KPSE 6E8-33P-DN
L
ø 19.5
8
8

Linear Potentiometer LP 100

The LP 100 is a linear potentiometer which is designed to measure the relative position of two point e.g. the gear position, throttle position or suspension movement.

Its operating mode is based on the linear tape potentiometer principle where the distance travelled between the moving end to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with an anodised aluminium cylindrical housing, low power consumption and infinite resolution.

Application	
Application	0 ... 100 mm
Temperature range	-30 ... 100 °C
Max. vibration	126 m/s² @ 10 ... 12kHz

Electrical Data	
Power supply	5 V
Power supply max.	74 V
Nominal resistance	4 kΩ
Resistance tolerance	10 %
Non-linearity	0.15 %

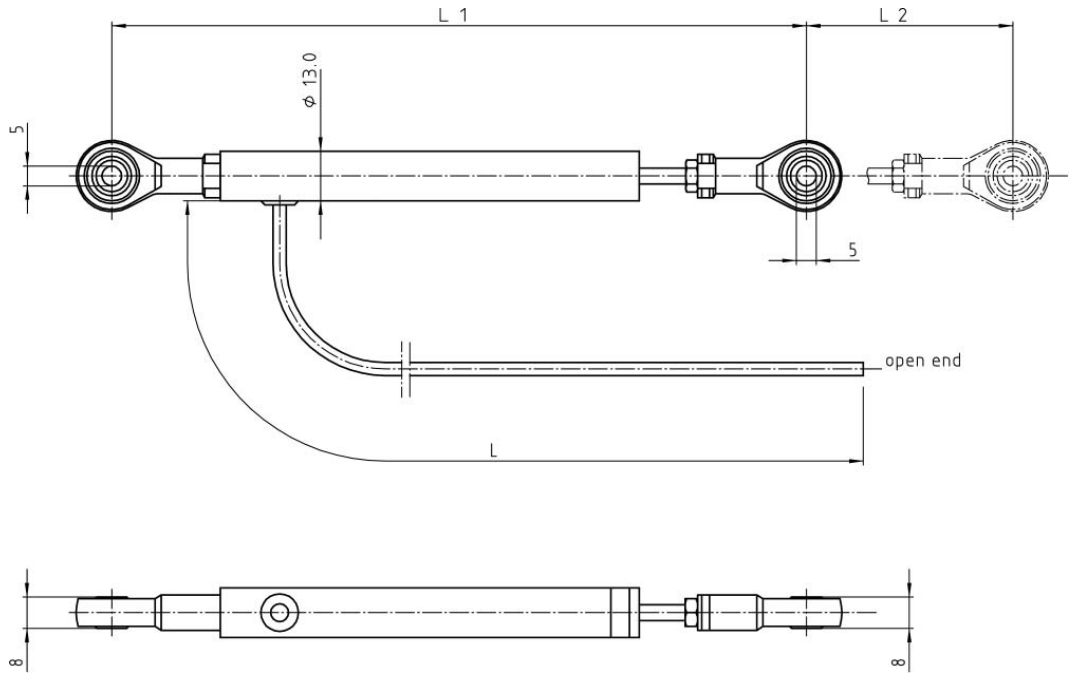
Mechanical Data	
Weight w/o cable	85 g
Min. length	284.6 mm
Mounting	2 x M5
Tightening torque	10 Nm
Protection	IP66
Max. shaft velocity	10 m/sec

Characteristic	
Signal output	0.5 ... 99.5 %

Application Hint
The LP 100 can be connected directly with most electronic control units and data logging systems.
Ball joints at shaft end and case.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Part Number	
LP 100	**B 261 209 857**



Linear Potentiometer LP 100F

The LP 100F is a linear potentiometer which is designed to measure the gear position, throttle position or suspension movement.

Its operating mode is based on the linear tape potentiometer principle where the distance travelled between the moving ends to the wiper is proportional to the resistance between them.

The advantage of this LP is its compact and lightweight design together with its wider operating temperature range.

Application	
Application	0 ... 100 mm
Temperature range	-30 ... 85 °C
Max. vibration	126 m/s² @ 10 ... 12 kHz

Electrical Data	
Power supply	5 V
Power supply max.	74 V
Nominal resistance	4 kΩ
Resistance tolerance	10 %
Non-linearity	0.15 %

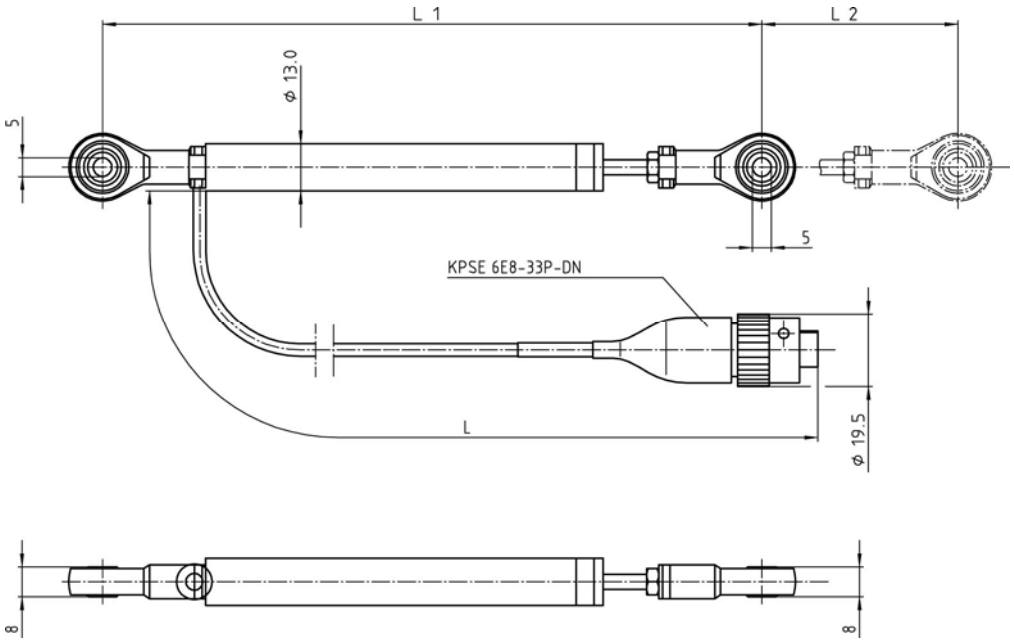
Connectors and Cables	
Connector	KPSE 6E8-33P-DN-A34
Connector loom	KPSE 0E8-33S-DN
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Mechanical Data	
Weight w/o cable	85 g
Min. length	248.6 mm
Mounting	2 x M5
Tightening torque	10 Nm
Protection	IP65
Max. shaft velocity	10 m/sec

Characteristic	
Signal output	0.5 ... 99.5 %

Application Hint
The LP 100F can be connected directly to most electronic control units and data logging systems.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 100F	**B 261 209 853**


L 1
L 2
ø 13.0
5
5
KPSE 6E8-33P-DN
L
ø 19.5
8
8

Linear Potentiometer LP 125

The LP 125 is a linear potentiometer which is designed to measure the gear position, throttle position or suspension movement.

The operating mode of this sensor is based on the linear tape potentiometer principle where the distance travelled between the moving ends to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with an anodised aluminium cylindrical housing, low power consumption and infinite resolution.

Application	
Application	0 ... 125 mm
Temperature range	-40 ... 85 °C

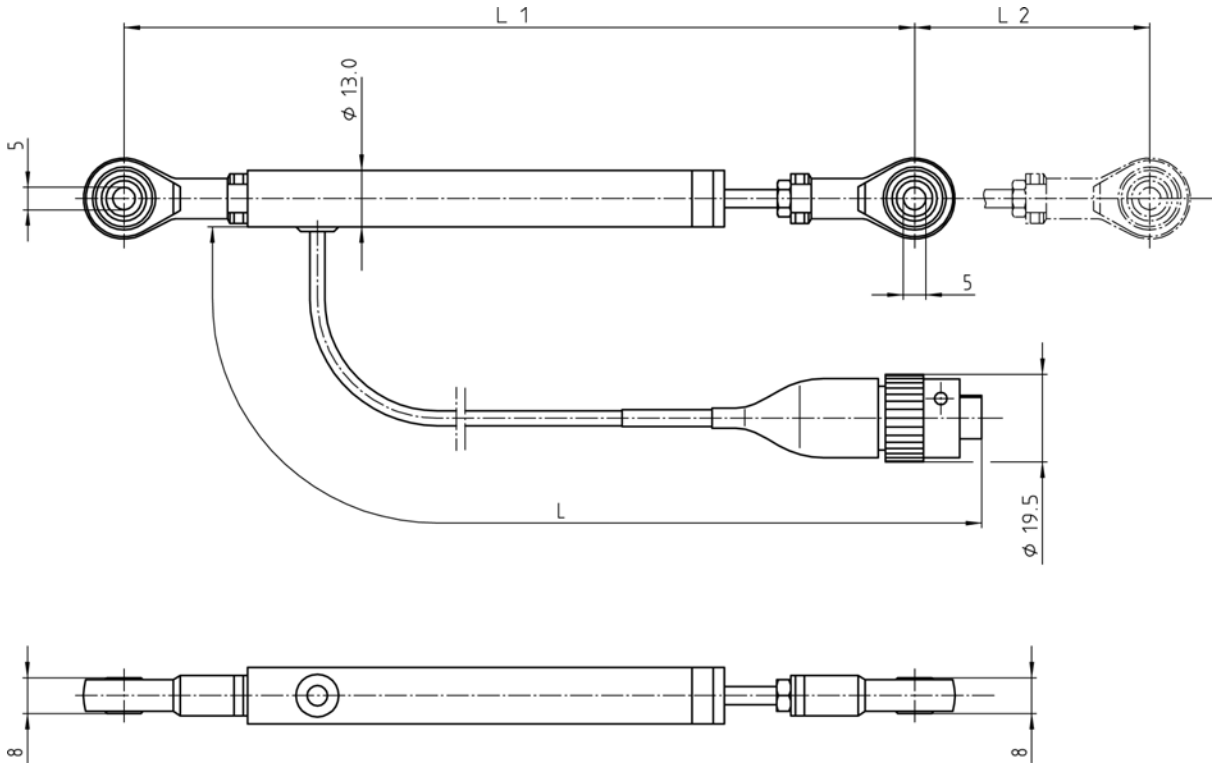
Electrical Data	
Power supply	5 V
Power supply max.	110 V
Nominal resistance	5 kΩ
Resistance tolerance	10 %
Non-linearity	0.15 %

Connectors and Cables	
Connector	KPSE 6E8-33P-DN-A34
Connector loom	KPSE 120061-30
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 90 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Mechanical Data	
Weight w/o cable	108 g
Min. length	252 mm
Mounting	2 x M5
Tightening torque	10 Nm
Protection	IP64
Max. shaft velocity	1 m/sec

Application Hint
The LP 125 can be connected directly to most electronic control units and data logging systems.
Ball joints at shaft end and case.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 125	**B 261 209 531**


L 1
L 2
ϕ 13.0
5
5
L
ϕ 19.5
8
8

Linear Potentiometer LP 150

The LP 150 is a linear potentiometer which is designed to measure the relative position of two point e.g. the gear position, throttle position or suspension movement.

Its operating mode is based on the linear tape potentiometer principle where the distance travelled between the moving end to the wiper is proportional to the resistance between them.

The advantage of this LP is its precise and compact design with an anodised aluminium cylindrical housing, low power consumption and infinite resolution.

Application	
Application	0 ... 150 mm
Temperature range	-40 ... 85 °C

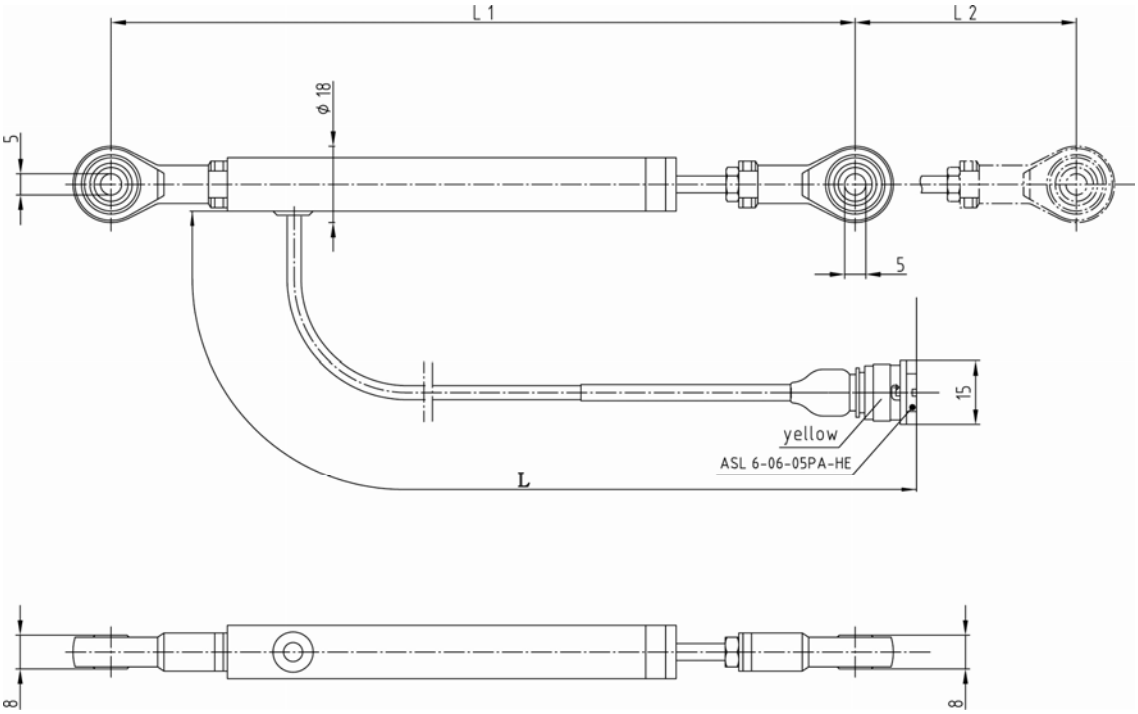
Electrical Data	
Power supply	5 V
Power supply max.	130 V
Nominal resistance	6 kΩ
Resistance tolerance	10 %
Non-linearity	0.15 %

Mechanical Data	
Weight w/o cable	118 g
Min. length	282 mm
Mounting	2 x M5
Tightening torque	10 Nm
Protection	IP65
Max. shaft velocity	1 m/sec

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 25 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The LP 150 can be connected directly to most electronic control units and data logging systems.
Ball joints at shaft end and case.
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
LP 150	**B 261 209 534**


L 1
L 2
ϕ 18
5
5
15
yellow
ASL 6-06-05PA-HE
L
8
8

Pressure Sensors Air

Pressure Sensor Air PSA-B

This sensor is designed to measure the absolute air pressure, especially the air box pressure of gasoline or Diesel engines.

A piezo-resistive sensor element and electronic systems for signal-amplification and temperature-compensation are integrated on a silicon chip. The output of the sensor is an analog, ratiometric signal. Two different pressure ranges are available (0.1 ... 1.15 bar or 0.2 ... 2.5 bar).

The main feature and benefit of this sensor is the combination of both high quality production part and motorsport spec connection.

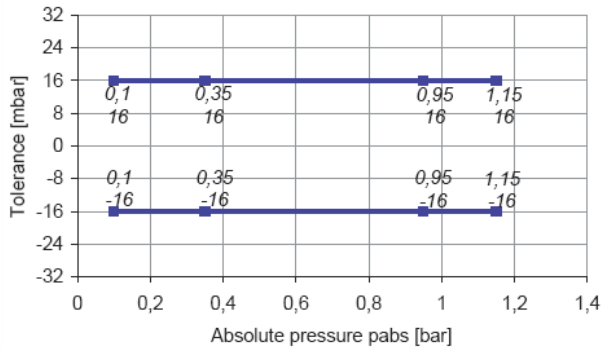
Application	
Application	*[1]* 0.1 ... 1.15 bar (a) *[2]* 0.2 ... 2.50 bar (a)
Pressure reference type	absolute
Max. pressure	5 bar
Operating temp. range	-40 ... 130 °C
Media temp. range	-40 ... 130 °C
Storage temp. range	-40 ... 130 °C
Max. vibration	2,500 m/s² @ 200 Hz 1,250 m/s² @ 440 Hz sine

Electrical Data	
Power Supply U_S	4.75 ... 5.25 V
Max. Power Supply	16 V
Full Scale Output U_A @ 5 V	0.3 ... 4.8 V
Current I_S	9 mA

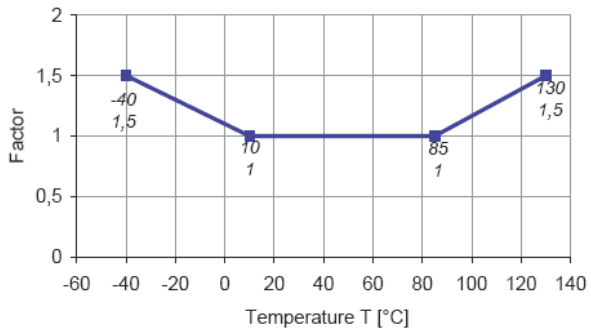
Mechanical Data	
Mounting	M6
Fitting	12.05 mm
Weight w/o cable	17 g
Sealing	O-ring 7.59 x 2.62 mm

Characteristic	
Response time T10/90	1 ms
Compensated range	10 ... 85 °C
Tolerance (FS) @ U_S = 5 V	*[1]* ± 0.016 bar *[2]* ± 0.034 bar
Tolerance (FS)	*[1]* ± 1.39 % *[2]* ± 1.36 %
Sensitivity	*[1]* 4,040 mV/bar *[2]* 1,848 mV/bar
Offset	*[1]* -4.8 mV *[2]* 30.4 mV

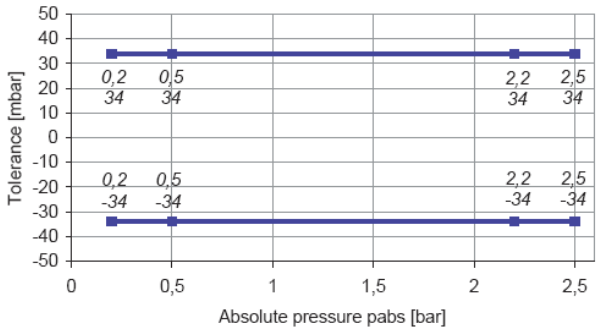
Tolerance *[1]*



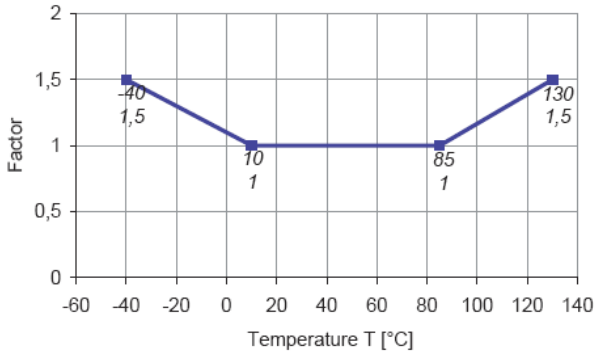
Expansion of Tolerance f(T) *[1]*



Tolerance *[2]*



Expansion of Tolerance f(T) *[2]*



Connectors and Cables

Connector	ASL 6-06-05PC-HE
Mating connector	ASL 0-06-05SC-HE
Pin 1	-
Pin 2	GND
Pin 3	SIG
Pin 4	U_S
Pin 5	-
Various motorsport and automotive connectors on request.	
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint

The PSA-B is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.

The sensor can be connected directly to most control units.

To avoid noise, an ECU-input circuit with a RC-lowpass filter (τ = 2 ms) is recommended.

Use engine oil (5W40) as O-Ring grease (no silicone based grease).

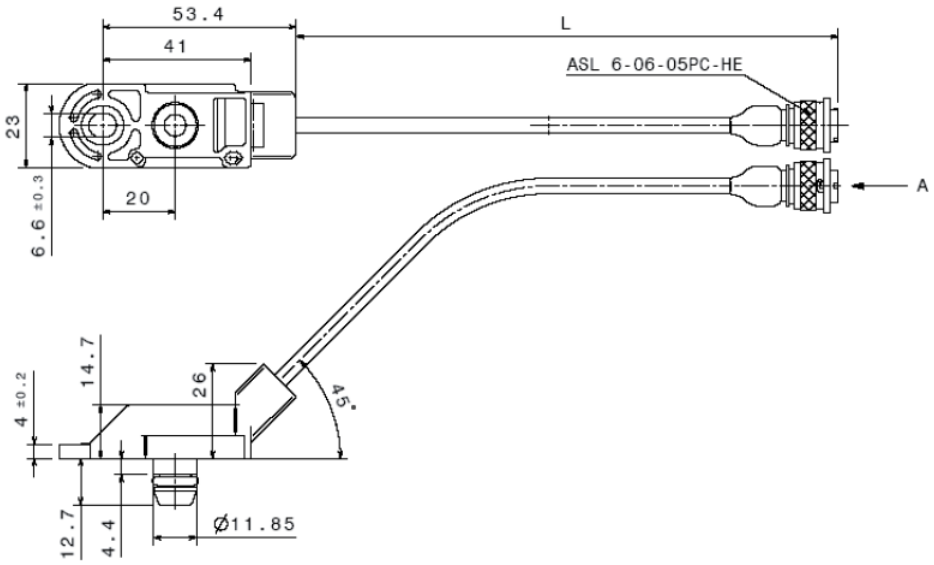
Avoid miss-pinning (max. 5 minutes @ I = 0.3 A).

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Numbers

PSA-B *[1]*	**B 261 209 702-01**
PSA-B *[2]*	**B 261 209 710-01**
Adapter for PSA-B	**B 261 209 725**


53.4
41
L
ASL 6-06-05PC-HE
23
20
6.6 ±0.3
A
14.7
26
4 ±0.2
45°
12.7
4.4
Ø11.85

Pressure Sensor Air PSA-C

This sensor is designed to measure the absolute air pressure, especially the air box pressure of gasoline or Diesel engines.

A piezo-resistive sensor element and electronic systems for signal amplification and temperature compensation are integrated on a silicon chip. The pressure which has to be measured can be connected via a tube to the sensor. The output of the sensor is an analog, ratiometric signal.

The main feature and benefit of this sensor is the combination of the high quality of the production part and a low price.

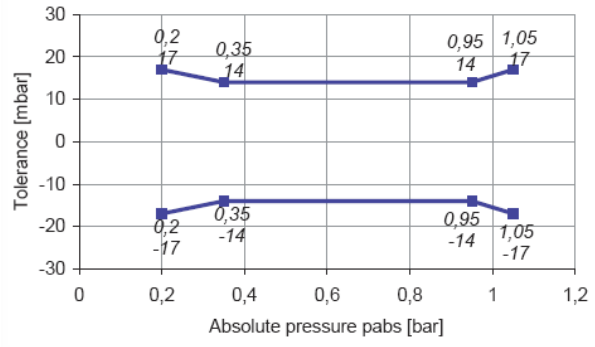
Application	
Application	*[1]* 0,2 ... 1,05 bar (a) *[2]* 0,2 ... 2,50 bar (a)
Pressure Reference Type	absolute
Max. Pressure p_{abs} max	5 bar
Operating Temp. Range	-40 ... 130 °C
Media Temp. Range	-40 ... 130 °C
Storage Temp. Range	-40 ... 130 °C
Max. Vibration	200 m/s² @ 10 ... 10.000 Hz

Electrical Data	
Power Supply U_S	4,75 ... 5,25 V
Max Power Supply U_S max.	16 V
Full Scale Output U_A @ 5 V	0,3 ... 4,8 V
Current I_S	9 mA

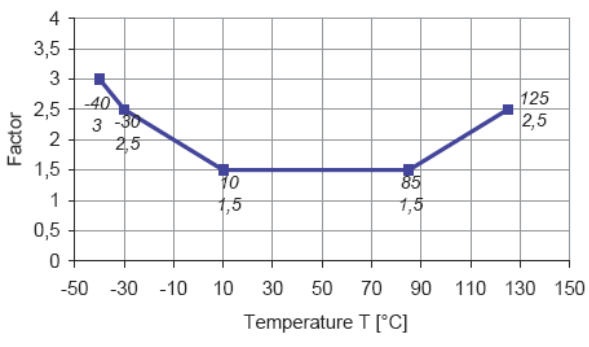
Mechanical Data	
Mounting	M6
Fitting	6 mm
Weight w/o Cable	40 g

Characteristic	
Response Time T10/90	10 ms
Compensated Range	10 ... 85 °C
Tolerance (FS) @ U_S = 5 V	*[1]* ± 0,017 bar *[2]* ± 0,042 bar
Tolerance (FS)	*[1]* ± 1,62 % *[2]* ± 1,68 %
Sensitivity	*[1]* 5.000 mV/bar *[2]* 1.532 mV/bar
Offset	*[1]* -600 mV *[2]* 724 mV

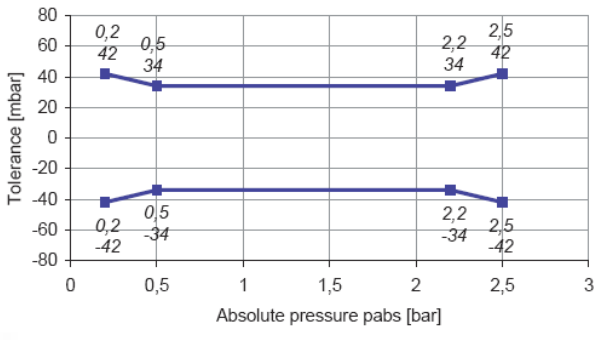
Tolerance *[1]*



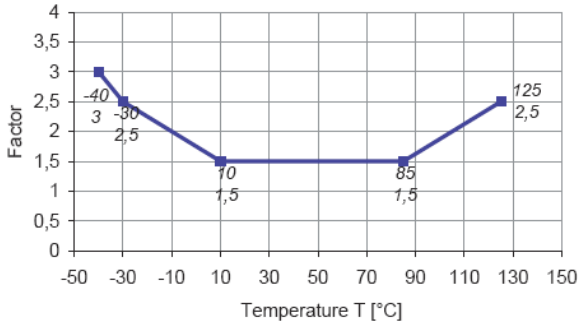
Expansion of Tolerance f(T) *[1]*



Tolerance *[2]*



Expansion of Tolerance f(T) *[2]*



Connectors and Cables

Connector	Bosch Jetronic
Connector Loom	D 261 205 289
Pin 1	U_S
Pin 2	GND
Pin 3	SIG
Pin 4	-
Pin 5	-

Various military and automotive connectors on request.

Application Hint

The PSA-C is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.

Avoid liquid entering the measuring cell.

The sensor can be connected directly to most control units.

To avoid noise, an ECU-input circuit with a RC-lowpass filter (τ = 2 ms) is recommended.

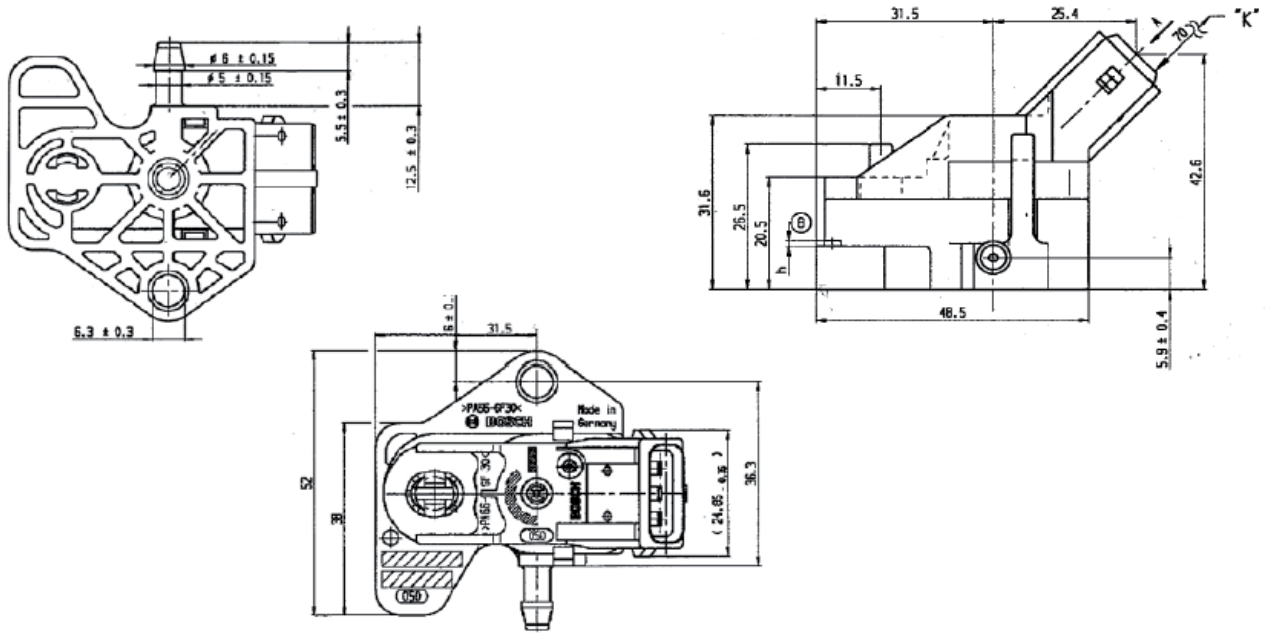
Avoid miss-pinning (max. 5 minutes @ I = 0,3 A).

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Numbers

PSA-C *[1]*	**0 261 230 037**
PSA-C *[2]*	**0 281 002 389**



Pressure Sensor Air PSB-2

This sensor is designed to measure the absolute air pressure, especially the air box and boost pressure of gasoline or Diesel engines very precisely.

A piezo-resistive sensor element and electronic systems for signal-amplification and temperature-compensation are integrated on a silicon chip. The output of the sensor is an analog, ratiometric signal.

The main feature and benefit of this sensor is the combination of both high quality production part and military spec connection. Cause of the individual calibration data provided with each part, a very small tolerance can be achieved.

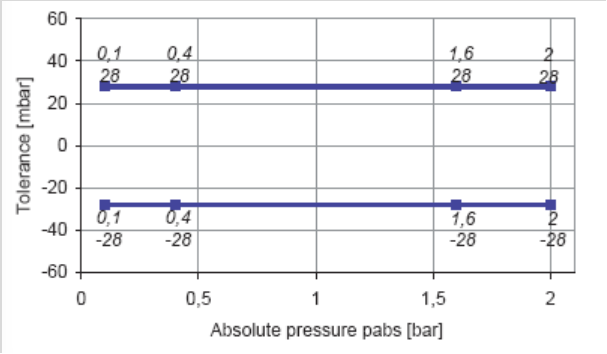
Application	
Application	0,1 ... 2,0 bar (a)
Pressure Reference Type	absolute
Max. Pressure	5 bar
Operating Temp. Range	-40 ... 130 °C
Media Temp. Range	-40 ... 130 °C
Storage Temp. Range	-40 ... 130 °C
Max. Vibration	200 m/s^2 @ 10 ... 10.000 Hz

Electrical Data	
Power Supply U_S	4,75 ... 5,25 V
Max Power Supply U_S max	16 V
Full Scale Output U_A @ 5 V	0,3 ... 4,8 V
Current I_S	9 mA

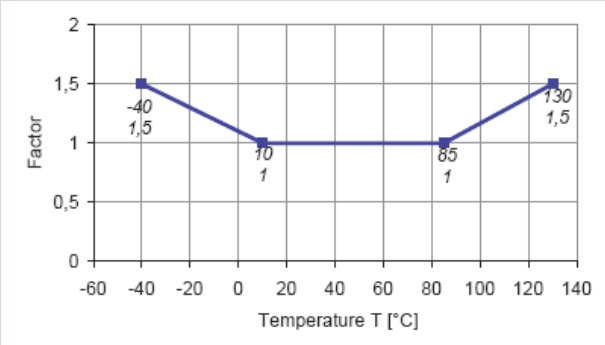
Mechanical Data	
Mounting	M6
Fitting	12,05 mm
Weight w/o Cable	17 g
Sealing	O-ring 7,59 x 2,62 mm

Characteristic	
Response Time T10/90	1 ms
Compensated Range	10 ... 85 °C
Tolerance (FS) @ U_S = 5 V	± 0,028 bar
Tolerance (FS)	± 1,4 %
Sensitivity	2236,84 mV/bar (an individual calibration sheet will be delivered)
Offset	176,315 mV (an individual calibration sheet will be delivered)

Tolerance



Expansion of Tolerance f(T)



Connectors and Cables

Connector	ASL 6-06-05PC-HE
Connector Loom	ASL 0-06-05SC-HE
Pin 1	-
Pin 2	GND
Pin 3	SIG
Pin 4	U_S
Pin 5	-
Various military and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint

The PSB-2 is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.

The sensor can be connected directly to most control units.

To avoid noise, an ECU-input circuit with a RC-lowpass filter (τ = 2 ms) is recommended.

Use engine oil (5W40) as O-Ring grease (no silicone based grease).

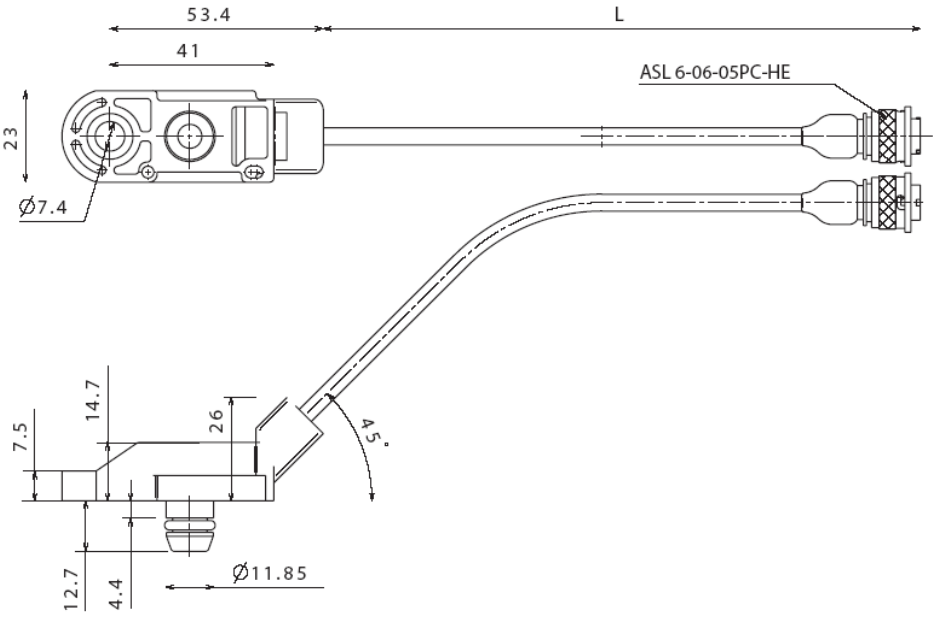
Avoid miss-pinning (max. 5 minutes @ I = 0,3 A).

To optimise the accuracy of this sensor, we offer an individually calibration data sheet of each sensor.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

PSB-2	**B 261 209 337**



Pressure Sensor Air PSB-4

This sensor is designed to measure the absolute air pressure, especially the air box and boost pressure of gasoline or Diesel engines very precisely and in a big range.

A piezo-resistive sensor element, electronic systems for signal-amplification and temperature-compensation are integrated on a silicon chip. The output of the sensor is an analog, ratiometric signal.

Cause of the individual calibration a very small tolerance can be achieved. Furthermore the sensor is characterized by a very quick response.

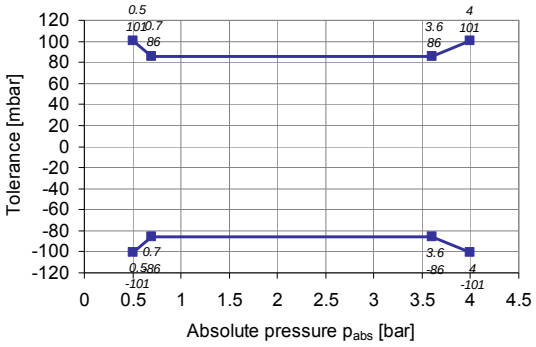
Application	
Application	0.5 ... 4 bar (a)
Pressure Reference Type	absolute
Max. Pressure	6 bar
Operating Temp. Range	-40 ... 130 °C
Media Temp. Range	-40 ... 130 °C
Storage Temp. Range	-40 ... 130 °C
Max. Vibration	20 m/s² @ 10 ... 1,000 Hz

Electrical Data	
Power Supply U_S	4.75 ... 5.25 V
Max Power Supply U_S max.	16 V
Full Scale Output U_A @ 5 V	0.3 ... 4.8 V
Current I_S	9 mA

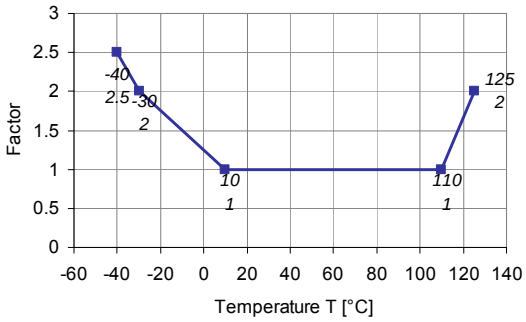
Mechanical Data	
Mounting	M6
Fitting	12.05 mm
Weight w/o Cable	20 g
Sealing	O-ring 7.59 x 2.62 mm

Characteristic	
Response Time T10/90	0.2 ms
Compensated Range	0 ... 80 °C
Tolerance (FS) @ U_S = 5 V	± 0.056 bar
Tolerance (FS)	± 1.4 %
Sensitivity	1142.857 mV/bar (an individual calibration sheet will be delivered)
Offset	-71.42 mV (an individual calibration sheet will be delivered)

Tolerance



Expansion of Tolerance f(T)



Connectors and Cables

Connector	ASL 6-06-05PC-HE
Mating connector	ASL 0-06-05SC-HE
Pin 1	-
Pin 2	GND
Pin 3	SIG
Pin 4	U_S
Pin 5	-
Various motorsport and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint

The PSB-4 is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.

The sensor can be connected directly to most control units.

To avoid noise, an ECU-input circuit with a RC-lowpass filter (τ = 2 ms) is recommended.

Use engine oil (5W40) as O-Ring grease (no silicone based grease).

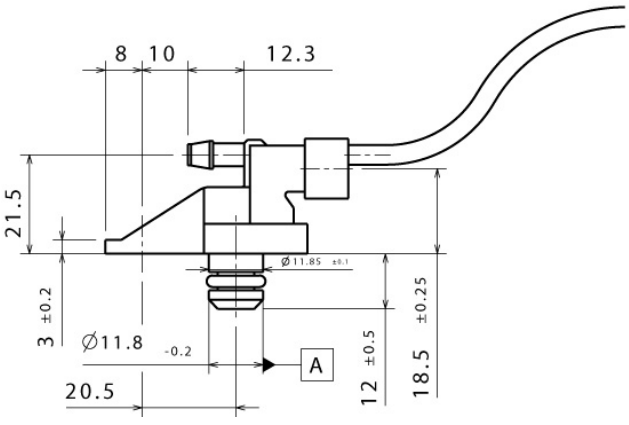
Avoid miss-pinning (max. 5 minutes @ I = 0.3 A).

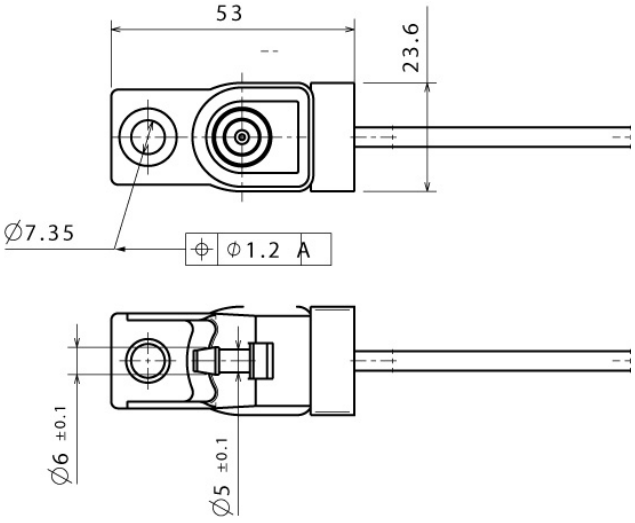
To optimize the accuracy of this sensor, we offer an individually calibration data sheet of each sensor.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

PSB-4	**B 261 209 348**





Pressure Sensor Air PSP

This sensor is designed to measure the absolute air pressure, specially the air box pressure of gasoline or Diesel engines.

A piezo-resistive sensor element, electronic systems for signal-amplification and temperature compensation is integrated on a silicon chip. The output of the sensor is an analog, ratiometric signal.

The main feature and benefit of this sensor is the combination of both high quality production part and motorsport spec connection.

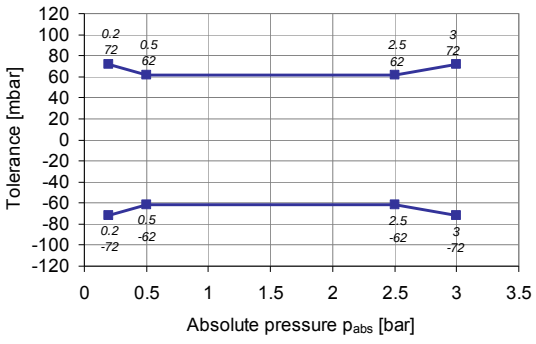
Application	
Application	0.2 ... 3 bar (a)
Pressure Reference Type	absolute
Max. Pressure pabs max	5 bar
Operating Temp. Range	-40 ... 125 °C
Media Temp. Range	-40 ... 125 °C
Storage Temp. Range	-40 ... 130 °C
Max. Vibration	0.19 mm @ 100 ... 200 Hz 250 m/s² @ 200 ... 500 Hz

Electrical Data	
Power Supply U_S	4.5 ... 5.5 V
Max Power Supply U_S max	16 V
Full Scale Output U_A @ 5 V	0.3 ... 4.8 V
Current I_S	9 mA

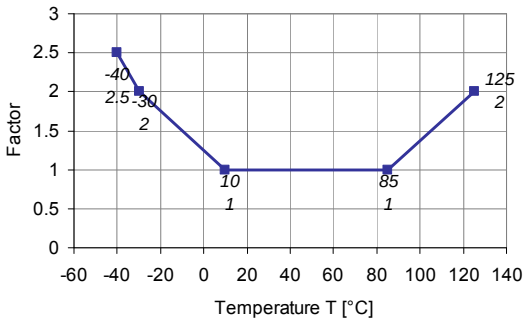
Mechanical Data	
Mounting	M6
Fitting	12.05 mm
Weight w/o Cable	17 g
Sealing	O-ring 7.59 x 2.62 mm

Characteristic	
Response Time T10/90	0.2 ms
Compensated Range	10 ... 85 °C
Tolerance (FS) @ U_S = 5 V	± 0.042 bar
Tolerance (FS)	± 1.4 %
Sensitivity	1,518 mV/bar
Offset	96 mV

Tolerance



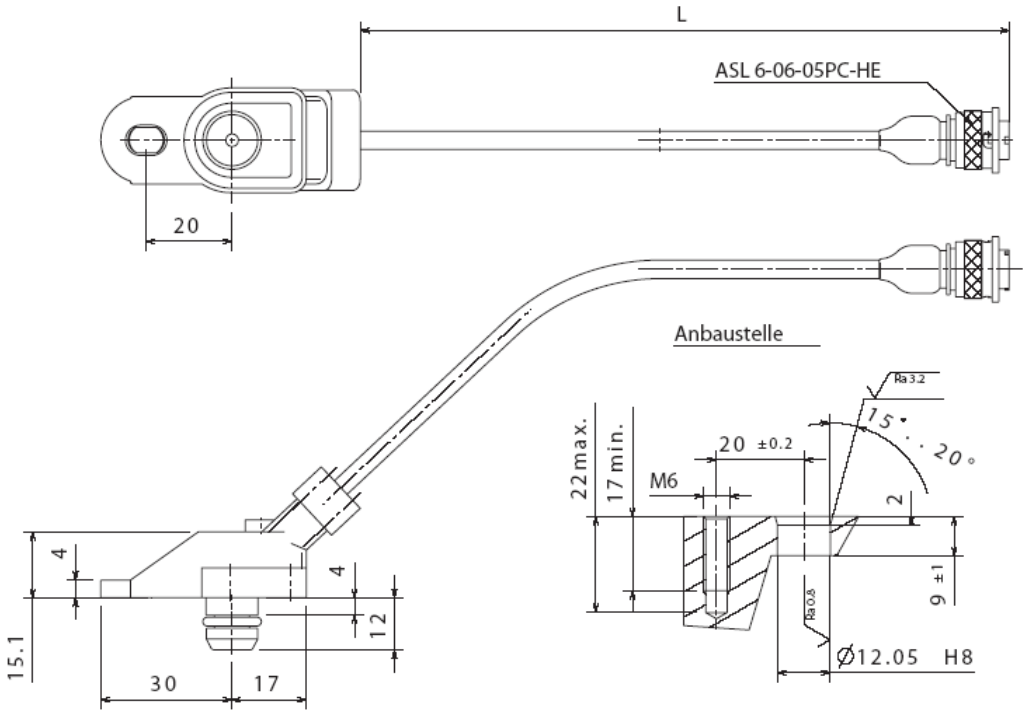
Expansion of Tolerance f(T)



Connectors and Cables	
Connector	ASL 6-06-05PC-HE
Mating connector	ASL 0-06-05SC-HE
Pin 1	-
Pin 2	GND
Pin 3	SIG
Pin 4	Us
Pin 5	-
Various motorsport and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint
The PSP is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.
The sensor can be connected directly to most control units.
To avoid noise, an ECU-input circuit with a RC-lowpass filter (τ = 2 ms) is recommended.
Use engine oil (5W40) as O-Ring grease (no silicone based grease).
Avoid miss-pinning (max. 5 minutes @ I = 0.3 A).
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
PSP	**B 261 209 690**



Pressure Sensor Air PST

This sensor is designed to measure the absolute air pressure, especially the air box pressure of gasoline or Diesel engines and the air temperature.

A piezo-resistive sensor element, electronic systems for signal amplification and temperature compensation are integrated on a silicon chip. The output of the sensor is an analog, ratiometric signal. A NTC-resistor is used for the temperature measurement.

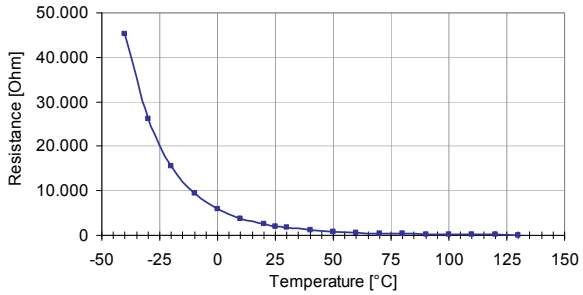
The main feature of this sensor is the integration of two sensors (air pressure and air temperature) in one housing. A further benefit of the PST is the high quality of the production part at a low price.

Application	
Application 1	0,1 ... 1,15 bar (a)
Application 2	-40 ... 125 °C
Pressure Reference Type	absolute
Max. Pressure p_{abs} max	5 bar
Operating Temp. Range	-40 ... 125 °C
Media Temp. Range	-40 ... 125 °C
Storage Temp. Range	-40 ... 130 °C
Max. Vibration	0,19 mm @ 100 ... 200 Hz 250 m/s² @ 200 ... 500 Hz sine

Mechanical Data	
Mounting	M6
Fitting	18 mm
Weight w/o Cable	30 g
Sealing	O-ring 13,95 x 2,62 mm

Electrical Data	
Power Supply U_S	4,5 ... 5,5 V
Max Power Supply U_S max.	16 V
Full Scale Output U_A @ 5 V	0,3 ... 4,8 V
Current I_S	9 mA

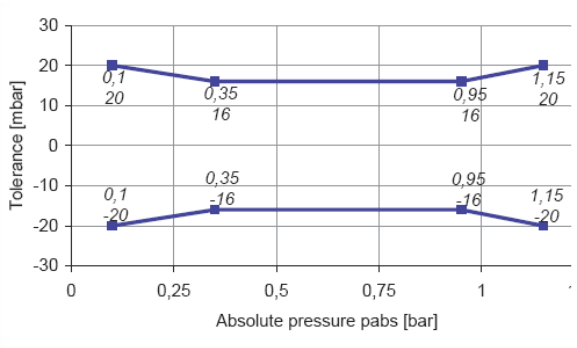
Characteristic Application 1	
T [°C]	R [Ohm]
-40	45.313
-30	26.114
-20	15.462
-10	9.397
0	5.896
10	3.792
20	2.500
25	2.057
30	1.707
40	1.175
50	834
60	596
70	436
80	323
90	243
100	187
110	144
120	113
130	89



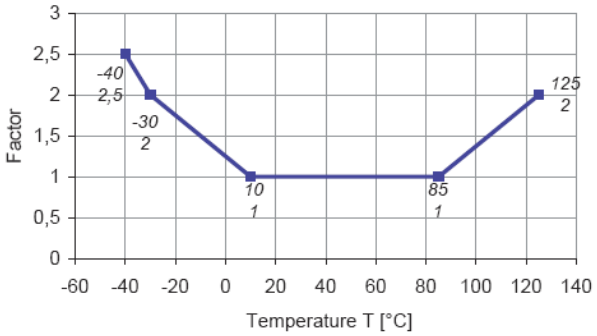
Characteristic Application 2	
Response Time T10/90	0,2 ms
Compensated Range	10 ... 85 °C
Tolerance (FS) @ Us = 5 V	± 0,016 bar
Tolerance (FS)	± 1,39 %
Sensitivity	4.047 mV/bar
Offset	-4,76 mV

Resistance @ 20 °C	2,5 kOhm
Tolerance	5 %
Response Time τ 63	45 s @ air ; v = 6 m/s

Tolerance



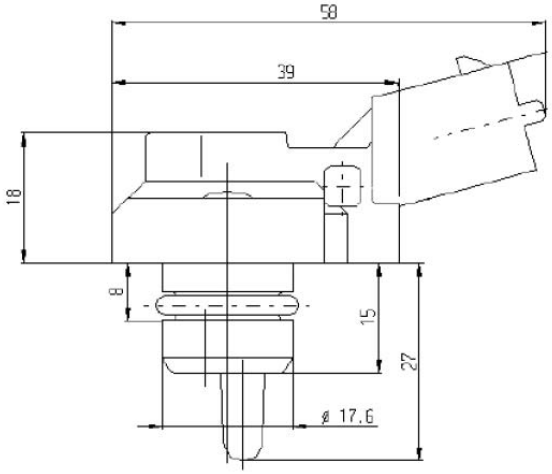
Expansion of Tolerance f(T)

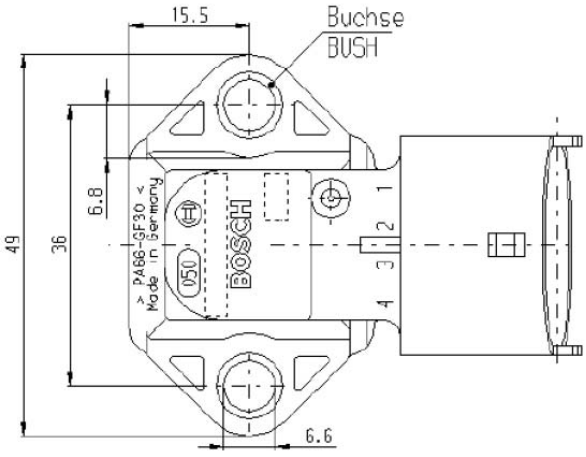


Connectors and Cables	
Connector	Bosch Compact
Connector Loom	D 261 205 336
Pin 1	Gnd
Pin 2	Sig NTC
Pin 3	Us
Pin 4	Sig
Pin 5	-
Various military and automotive connectors on request.	

Application Hint
The PST is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.
The sensor can be connected directly to most control units.
To avoid noise, an ECU-input circuit with a RC-lowpass filter (τ = 2 ms) is recommended.
For the temperature measurement, a 1 kOhm pull-up at 5 V is recommended.
Use engine oil (5W40) as O-Ring grease (no silicone based grease).
Avoid miss-pinning (max. 5 minutes @ I = 0,3 A).
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
Absolute Pressure Sensor PST	**0 261 230 022**





Pressure Sensors Differential

Pressure Sensor Differential DP-A

This sensor is designed to measure the relative pressure of various kinds of applications (e.g. non-corrosive, non-ionic working fluids, such as dry air and dry gases).

The sensor supplies two pressure connections (horizontal / vertical). This enables you to use this as a differential pressure measuring device. A typical application is the measuring of the vehicle speed by using a pitot tube.

The main feature and benefit of this sensor is the combination of high quality production part and robust design with metal housing and military spec connection. The sensor also provides a very fine resolution at small pressure ranges.

Application	
Application	0 ... 0,1 bar (r)
Pressure Reference Type	relative
Max. Pressure	1,4 bar
Operating Temp. Range	-20 ... 70 °C
Media Temp. Range	-20 ... 70 °C
Storage Temp. Range	-40 ... 85 °C
Max. Vibration	200 m/s², 10 ... 500 Hz

Electrical Data	
Power Supply U_S	4,8 ... 15 V
Max. Power Supply U_S max.	15 V
Full Scale Output U_A @ 5 V	0,5 ... 4,5 V
Current I_S	12 mA

Mechanical Data	
Mounting	M3x2
Fitting	4,5 mm
Installation Torque	2 Nm
Weight w/o Cable	58 g
Size	37(49) x 29(41) x 19 mm
Pressure Port	5 mm

Characteristic	
Response Time T10/90	0,1 ms
Compensated Range	0 ... 50 °C
Thermal Effects @ 0 ... 50 °C rel to 25 °C	0,1 % FS/°C
Non-Linearity and Hysteresis	0,1 % FS
Long Term Stability (1 Mio cyl. or 1 year)	± 0,2 % FS
Sensitivity	40.000 mV/bar
Offset	500 mV

Connectors and Cables	
Connector	ASL 6-06-05PC-HE
Connector Loom	ASL 0-06-05SC-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Various military and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint

Media: Non-corrosive, non-ionic working fluids, such as dry air and dry gases.

The DP-A can be connected directly to most control units.

Any mounting orientation is possible.

Take care about the range of supplied pressure: P2 ≥ P1.

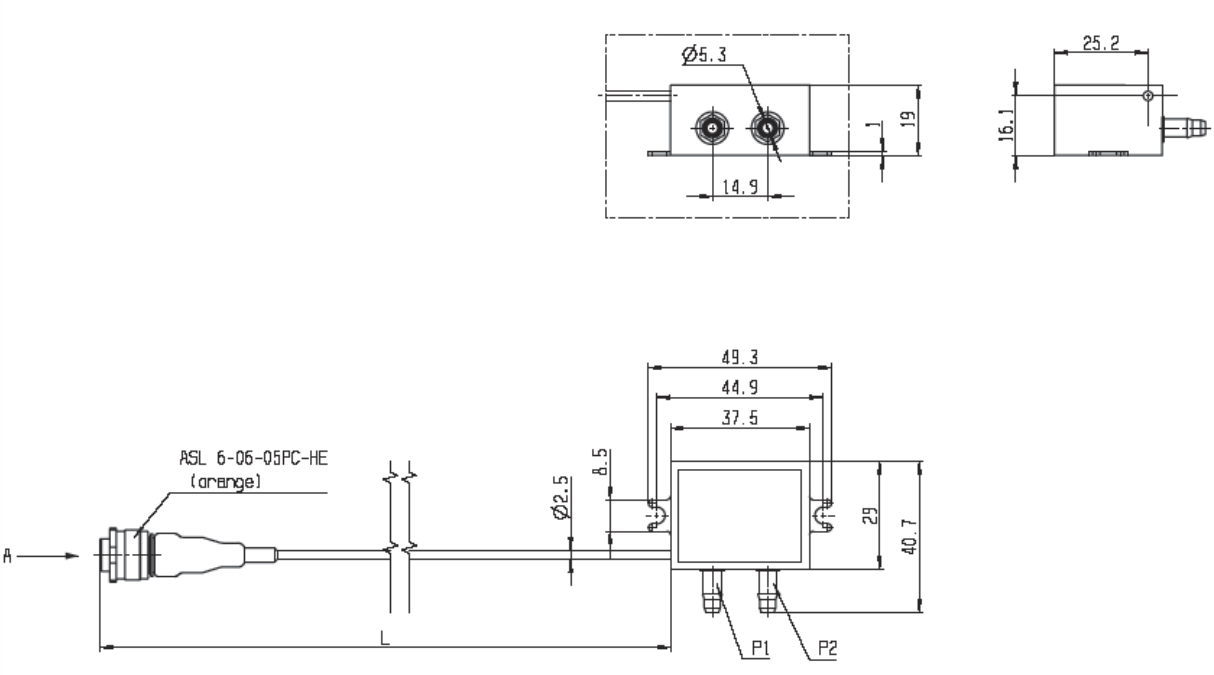
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Accessories

Pitot static tube PT	**B 261 209 700**

Part Numbers

DP-A	**B 261 209 696**



Pressure Sensor Differential DP-C

This sensor is designed to measure the relative pressure of various kinds of applications (e.g. non-corrosive, non-ionic working fluids, such as dry air and dry gases).

The sensor supplies two pressure connections (horizontal / vertical). This enables you to use this as a differential pressure measuring device. A typically application is the measuring of the vehicle speed by using a pitot tube.

The main feature and benefit of this sensor is the combination of high quality, small size, and military spec connection. The sensor provides a very fine resolution at small pressure ranges.

Application	
Application	0 ... 0,1 bar (r)
Pressure Reference Type	relative
Max. Pressure p_absmax	1,4 bar
Operating Temperature Range	-20 ... 70 °C
Media Temperature Range	-20 ... 70 °C
Storage Temperature Range	-40 ... 85 °C
Max. Vibration	200 m/s², 10 ... 500 Hz

Electrical data	
Power supply U_S	4,8 ... 15 V
Max Power Supply U_S max.	15 V
Full Scale Output U_A	0,5 ... 4,5 V
Current I_S	12 mA

Mechanical data	
Mounting	2 x M2,5
Fitting	2,6 mm
Installation Torque	2 Nm
Weight w/o Cable	24 g
Size	35 x 25(40) x 18 mm
Pressure Port	5 mm

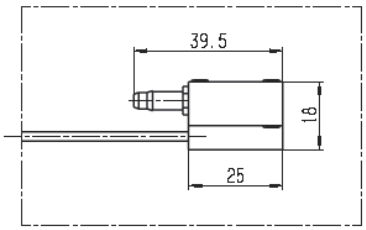
Characteristic	
Response Time T10/90	0,1 ms
Compensated Range	0 ... 50 °C
Thermal Effects @ 0 ... 50 °C rel to 25 °C	0,1 % FS/°C
Non-Linearity and Hysteresis	0,1 % FS
Long Term Stability (1 Mio cyl or 1 year)	± 0,2 % FS
Sensitivity	40 mV/mbar
Offset	500 mV

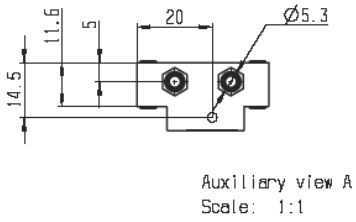
Connectors and Cables	
Connector	ASL 6-06-05PC-HE
Connector Loom	ASL 0-06-05SC-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 100 cm

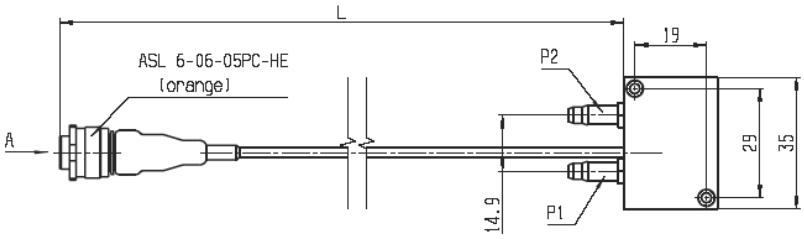
Application Hint
Media: Non-corrosive, non-ionic working fluids, such as dry air and dry gases.
The DP-C can be connected directly to most control units.
Any mounting orientation is possible.
Take care about the range of supplied pressure: P2 ≥ P1.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Accessories	
Pitot static tube PT	**B 261 209 700**

Part Number	
DP-C	**B 261 209 701**







Pitot Static Tube PT

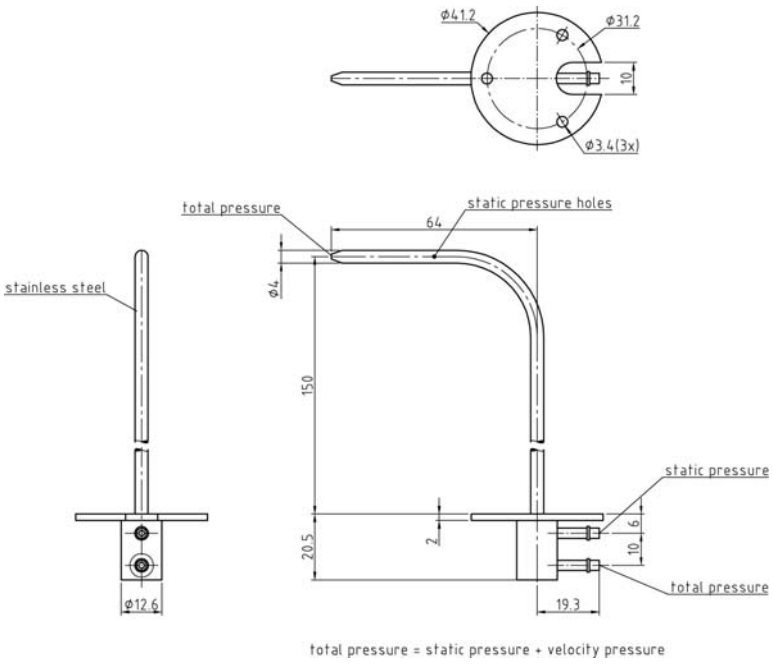
The pitot tube PT is designed to measure the vehicle speed independent from the wheel speed. Its main application is the aerodynamic car setup.

The pitot static tube consists basically of two concentric tubes. The ellipsoidal nose form has a single forward facing hole for sensing total pressure and a ring of side holes for sensing the static pressure. Measuring the difference of both pressures (see Bosch differential pressure sensor), the velocity related to the air can be calculated.

The main feature of the pitot tube is the very precise manufacturing and the universal mounting device.

Mechanical Data	
Weight	50 g
Height	150 mm

Part Number	
Pitot Static Tube PT	**B 261 209 700**



Application Hint

The standard formula for calculating the velocity from velocity pressure is:

V = 1.291 √Pv $V = 1.291 * \sqrt{Pv}$

This is only valid for an air density of 1.2 kg/m³. For all other conditions, the equation becomes:

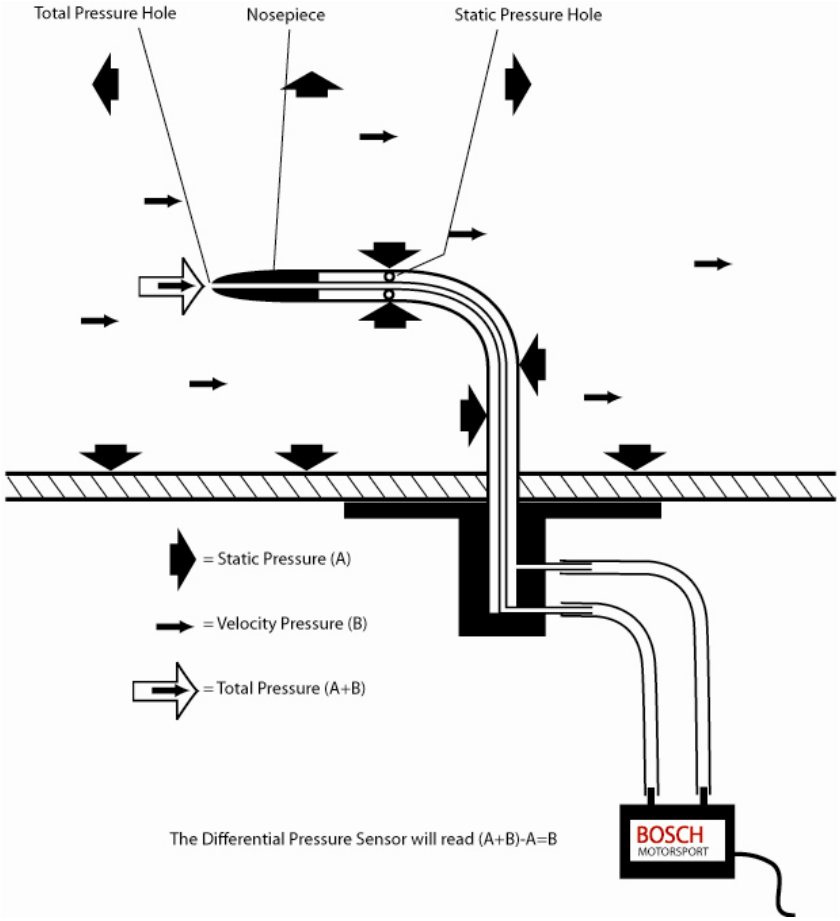
$$V = 1.291 \frac{\sqrt{1{,}013.25}}{B} * \frac{T}{293} * \frac{100{,}000}{100{,}000 + Ps} * Pv$$

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

The expression $\frac{100{,}000}{100{,}000 + Ps}$ is a correction for the static pressure in the duct and can be ignored, if Ps is less than 2,500 Pa.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com)

Principle of Operation



Pressure Sensors Fluid

Pressure Sensor Fluid PSS-10

This sensor is designed to measure the absolute pressure of various kinds of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air). Different supply voltages are available.

In our sensors we are using mainly stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. In this way complete media compatibility is guaranteed.

The main benefit of this sensor is the high quality of a production part at a low price.

Application	
Application	0,5 ... 11 bar (a)
Pressure Reference Type	absolute
Max. Pressure	20 bar
Operating Temp. Range	-40 ... 125 °C (140 °C)
Media Temp. Range	-40 ... 125 °C (140 °C)
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	100 m/s² eff/rms @ 10 ... 2.000 Hz

Mechanical Data	
Male Thread	M10x1
Wrench Size	17 mm
Installation Torque	15 Nm
Weight w/o Cable	45 g
Sealing	O-ring 7,65 x 1,63 mm

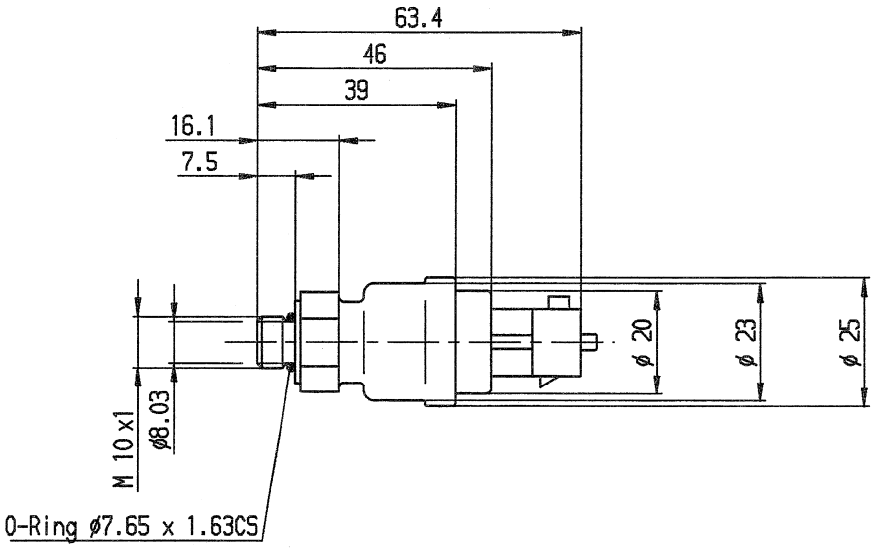
Electrical Data	
Power Supply U_S	*[1]* 4,75 ... 5,25 V *[2]* 8 ... 30 V
Max Power Supply U_S max	± 30 V
Full Scale Output U_A	
	[1] 10 ... 90 % Us ratiometric
	[2] 0,5 ... 4,5 V non-ratiometric
Current I_S	8 mA

Characteristic	
Response Time T10/90	*[1]* 1,5 ms *[2]* 1,0 ms
Compensated Range	0 ... 90 °C
Tolerance (FS) @ U_S = 5 V	± 0,1 bar
Tolerance (FS)	± 1 %
Sensitivity	*[1]* 400 mV/bar @ U_S = 5 V *[2]* 400 mV/bar
Offset	*[1]* 100 mV @ U_S = 5 V *[2]* 100 mV

Connectors and Cables	
Connector	Bosch Compact
Connector Loom	*[1]* D 261 205 339 *[2]* D 261 205 334
Pin 1	GND
Pin 2	SIG
Pin 3	Us
Pin 4	-
Pin 5	-
Various military and automotive connectors on request.	

Application Hint
The PSS 10 can be connected directly to most control units.
The sensor has a protection for over voltage, reverse polarity and short-circuit.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Numbers	
PSS-10 *[1]*	**B 261 209 341-01**
PSS-10 *[2]*	**B 261 209 064**



Pressure Sensor Fluid PSS-10R

This sensor is designed to measure the relative pressure of various kinds of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air). Different supply voltages are available.

In our sensors we are using mainly stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. In this way complete media compatibility is guaranteed.

The main benefit of this sensor is the high quality of a production part at a low price.

Application	
Application	0 ... 10 bar (r)
Pressure Reference Type	relative
Max. Pressure	20 bar
Operating Temp. Range	[1] -40 ... 125 °C (140 °C) [2] -40 ... 125 °C
Media Temp. Range	[1] -40 ... 125 °C (140 °C) [2] -40 ... 125 °C
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	100 m/s² eff/rms @ 10 ... 2.000 Hz

Mechanical Data	
Male Thread	M10x1
Wrench Size	17 mm
Installation torque	15 Nm
Weight w/o Cable	45 g
Sealing	O-ring 7,65 x 1,63 mm

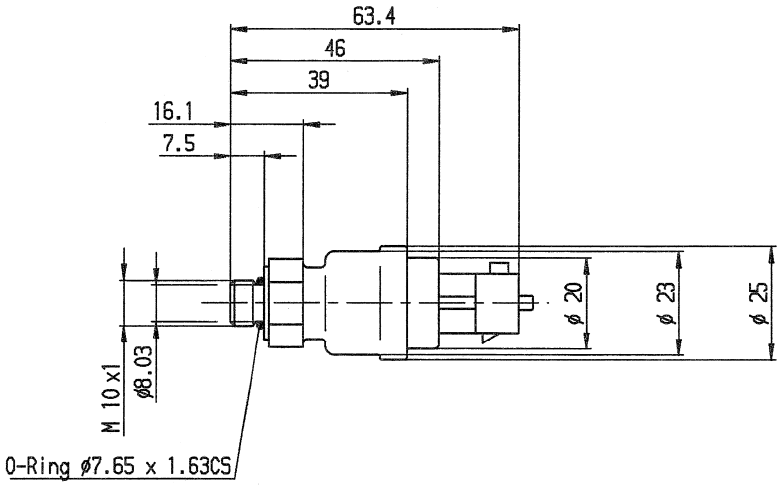
Electrical Data	
Power Supply US	[1] 4,75 ... 5,25 V [2] 8 ... 30 V
Max Power Supply Us max	± 30 V
Full Scale Output U_A	[1] 10 ... 90 % U_S ratiometric [2] 0,5 ... 4,5 V non-ratiometric
Current I_S	8 mA

Characteristic	
Response Time T10/90	[1] 1,5 ms [2] 1,0 ms
Compensated Range	0 ... 90 °C
Tolerance (FS) @ U_S = 5 V	± 0,1 bar
Tolerance (FS)	± 1 %
Sensitivity	[1] 400 mV/bar @ U_S = 5 V [2] 400 mV/bar
Offset	[1] 500 mV @ U_S = 5 V [2] 500 mV

Connectors and Cables	
Connector	Bosch Compact
Connector Loom	[1] D 261 205 339 [2] D 261 205 334
Pin 1	Gnd
Pin 2	Sig
Pin 3	Us
Pin 4	-
Pin 5	-
Various military and automotive connectors on request.	

Application Hint
The PSS-10R can be connected directly to most control units.
The sensor has a protection for over voltage, reverse polarity and short-circuit.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Numbers	
PSS-10R *[1]*	**F 01T A21 312**
PSS-10R *[2]*	**F 01T A21 307**



Pressure Sensor Fluid PSS-100R

This sensor is designed to measure the relative pressure of various kinds of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air). Different supply voltages are available.

In our sensors we are using mainly stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. In this way complete media compatibility is guaranteed.

The main benefit of this sensor is the high quality of a production part at a low price.

Application	
Application	0 ... 100 bar (r)
Pressure Reference Type	relative
Max. Pressure	200 bar
Operating Temp. Range	*[1]* -40 ... 125 °C (140 °C) *[2]* -40 ... 125 °C
Media Temp. Range	*[1]* -40 ... 125 °C (140 °C) *[2]* -40 ... 125 °C
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	100 m/s² eff/rms @ 10 ... 2.000 Hz

Mechanical Data	
Male Thread	M10x1
Wrench Size	17 mm
Installation Torque	15 Nm
Weight w/o Cable	45 g
Sealing	O-ring 7,65 x 1,63 mm

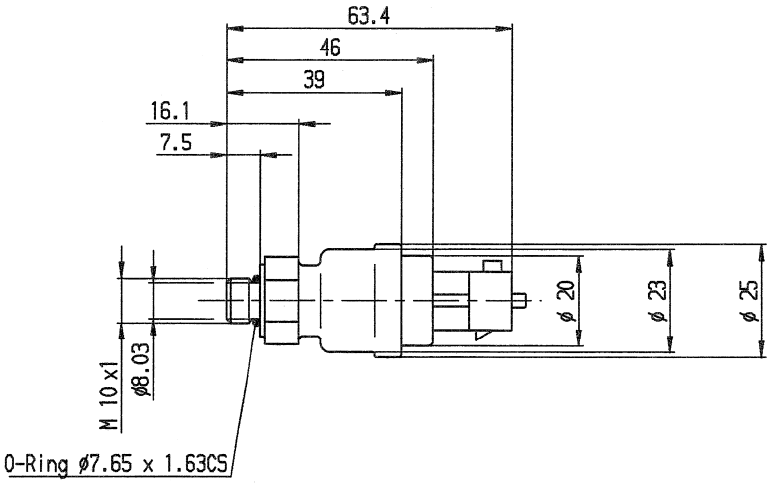
Electrical Data	
Power Supply U_S	*[1]* 4,75 ... 5,25 V *[2]* 8 ... 30 V
Max Power Supply	± 30 V
Full Scale Output U_A	*[1]* 10 ... 90 % U_S ratiometric *[2]* 0,5 ... 4,5 V non-ratiometric
Current I_S	*[1]* 8 mA *[2]* 10 mA

Characteristic	
Response Time T10/90	*[1]* 1,5 ms *[2]* 1,0 ms
Compensated Range	0 ... 90 °C
Tolerance (FS) @ U_S = 5 V	± 0,1 bar
Tolerance (FS)	± 1 %
Sensitivity	*[1]* 40 mV/bar @ U_S = 5 V *[2]* 40 mV/bar
Offset	*[1]* 500 mV @ U_S = 5 V *[2]* 500 mV

Connectors and Cables	
Connector	Bosch Compact
Connector Loom	*[1]* D 261 205 339 *[2]* D 261 205 334
Pin 1	GND
Pin 2	SIG
Pin 3	Us
Various military and automotive connectors on request.	

Application Hint
The PSS-100R can be connected directly to most control units.
The sensor has a protection for over voltage, reverse polarity and short-circuit.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Numbers	
PSS-100R *[1]*	**B 261 209 347**
PSS-100R *[2]*	**F 01T A21 310**



Pressure Sensor Fluid PSS-250R

This sensor is designed to measure the relative pressure of various kinds of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air). Different supply voltages are available.

In our sensors we are using mainly stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. In this way complete media compatibility is guaranteed.

The main feature and benefit of this sensor is the combination of both high quality production part and military spec connection.

Application	
Application	0 ... 250 bar (r)
Pressure Reference Type	relative
Max. Pressure	500 bar
Operating Temp. Range	*[1]* -40 ... 125 °C (140 °C) *[2]* -40 ... 125 °C
Media Temp. Range	*[1]* -40 ... 125 °C (140 °C) *[2]* -40 ... 125 °C
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	100 m/s² eff/rms @ 10 ... 2.000 Hz

Mechanical Data	
Male Thread	M10x1
Wrench Size	17 mm
Installation torque	15 Nm
Weight w/o Cable	45 g
Sealing	O-ring 7,65 x 1,63 mm

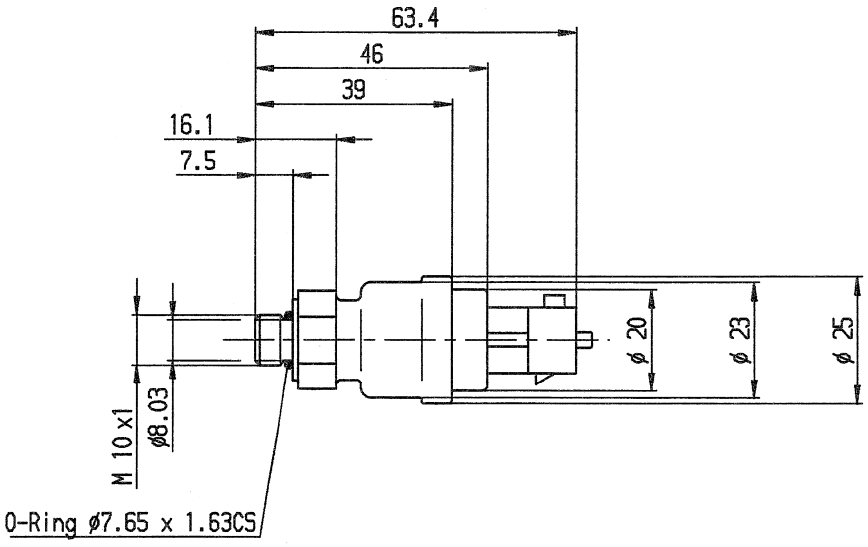
Electrical Data	
Power Supply U_S	*[1]* 4,75 ... 5,25 V *[2]* 8 ... 30 V
Max Power Supply Us max	± 30 V
Full Scale Output U_A	*[1]* 10 ... 90 % U_S ratiometric *[2]* 0,5 ... 4,5 V non-ratiometric
Current I_S	8 mA

Characteristic	
Response Time T10/90	*[1]* 1,5 ms *[2]* 1,0 ms
Compensated Range	0 ... 90 °C
Tolerance (FS) @ Us = 5 V	± 0,1 bar
Tolerance (FS)	± 1 %
Sensitivity	*[1]* 16 mV/bar @ Us = 5 V *[2]* 16 mV/bar
Offset	*[1]* 500 mV @ Us = 5 V *[2]* 500 mV

Connectors and Cables	
Connector	Bosch Compact
Connector Loom	*[1]* D 261 205 339 *[2]* D 261 205 334
Pin 1	GND
Pin 2	SIG
Pin 3	Us
Pin 4	-
Pin 5	-
Various military and automotive connectors on request.	

Application Hint
The PSS-250R can be connected directly to most control units.
The sensor has a protection for over voltage, reverse polarity and short-circuit.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
PSS-250R *[1]*	**B 261 209 965-01**
PSS-250R *[2]*	**B 261 209 067-01**



Pressure Sensor Fluid PSC-10

This sensor is designed to measure the absolute pressure of various kind of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air). Different supply voltages are available.

In our sensors we are using mainly stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. In this way complete media compatibility is guaranteed.

The main feature and benefit of this sensor is the combination of both high quality production part and military spec connection.

Application	
Application	0,5 ... 11 bar (a)
Pressure Reference Type	absolute
Max. Pressure	20 bar
Operating Temp. Range	-40 ... 125 °C (140 °C)
Media Temp. Range	-40 ... 125 °C (140 °C)
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	100 m/s² eff/rms @ 10 ... 2000 Hz

Mechanical Data	
Male Thread	M10x1
Wrench Size	17 mm
Installation Torque	15 Nm
Weight w/o Cable	45 g
Sealing	O-ring 7,65 x 1,63 mm

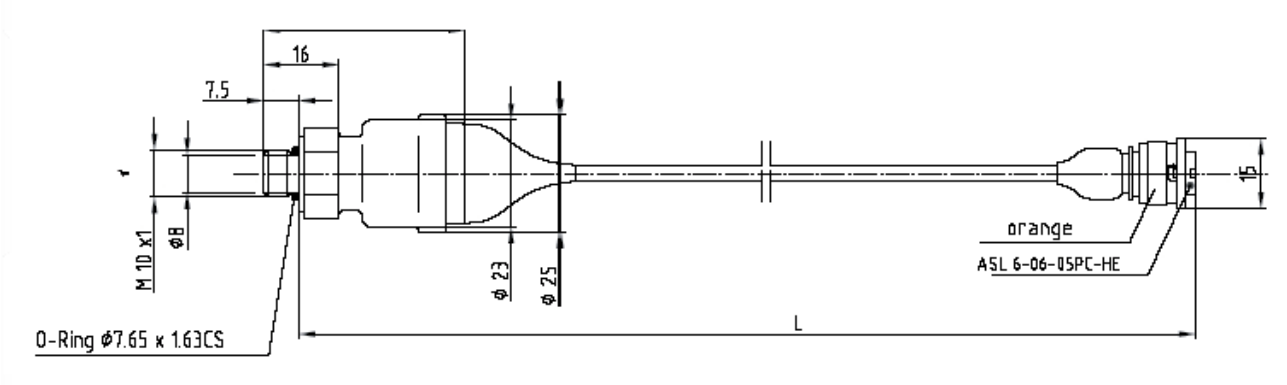
Electrical Data	
Power Supply U_S	[1] 4,75 ... 5,25 V [2] 8 ... 30 V
Max Power Supply	± 30 V
Full Scale Output U_A	[1] 10 ... 90 % U_S ratiometric [2] 0,5 ... 4,5 V non-ratiometric
Current I_S	8 mA

Characteristic	
Response Time T10/90	[1] 1,5 ms [2] 1,0 ms
Compensated Range	0 ... 90 °C
Tolerance (FS) @ U_S = 5 V	0,1 bar
Tolerance (FS)	± 1 %
Sensitivity	[1] 400 mV/bar @ U_S = 5 V [2] 400 mV/bar
Offset	[1] 100 mV @ U_S = 5 V [2] 100 mV

Connectors and Cables	
Connector	KPTC 6E8-4P-C-DN
Connector Loom	KPTC 6E8-4P-C-DN
Pin 1	[2] U_S
Pin 2	GND
Pin 3	SIG
Pin 4	[1] U_S
Pin 5	-
Various military and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	13 ... 95 cm
Please specify the requested cable length with your order.	

Application Hint
The PSC can be connected directly to most control units.
The sensor has a protection for over voltage, reverse polarity and short-circuit.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Numbers	
PSC-10 [1]	**F 01T A21 304-01**
PSC-10 [2]	**B 261 209 079-01**



Pressure Sensor Fluid PSC-10R

This sensor is designed to measure the relative pressure of various kinds of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air).

In our sensors we are using mainly stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. In this way complete media compatibility is guaranteed.

The main feature and benefit of this sensor is the combination of both high quality production part and military spec connection.

Application	
Application	0 ... 10 bar (r)
Pressure Reference Type	relative
Max. Pressure	20 bar
Operating Temp. Range	*[1]* -40 ... 125 °C (140 °C) *[2]* -40 ... 125 °C
Media Temp. Range	*[1]* -40 ... 125 °C (140 °C)
	[2] -40 ... 125 °C
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	100 m/s² eff/rms @ 10 ... 2.000 Hz

Mechanical Data	
Male Thread	M10x1
Wrench Size	17 mm
Installation Torque	15 Nm
Weight w/o Cable	45 g
Sealing	O-ring 7,65 x 1,63 mm

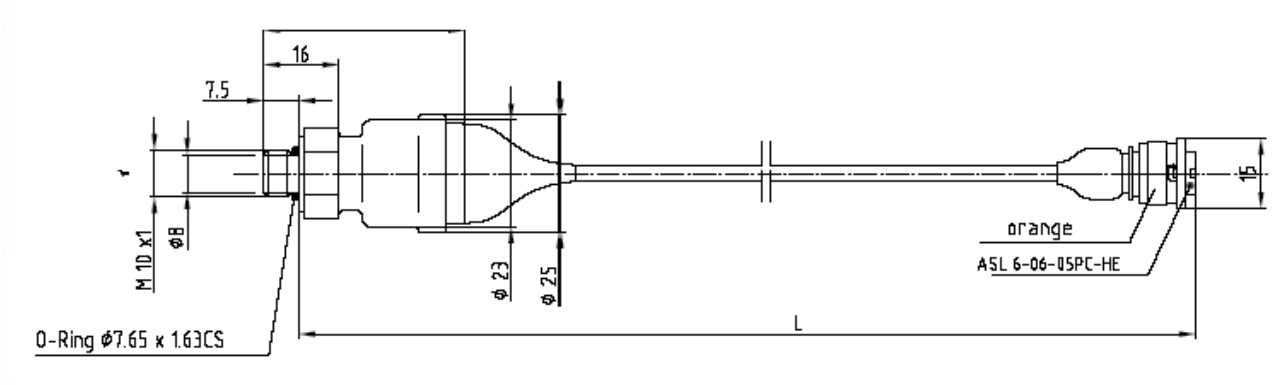
Electrical Data	
Power Supply U_S	*[1]* 4,75 ... 5,25 V *[2]* 8 ... 30 V
Max Power Supply U_S max.	± 30 V
Full Scale Output U_A	*[1]* 10 ... 90 % U_S ratiometric *[2]* 0,5 ... 4,5 V non-ratiometric
Current I_S	8 mA

Characteristic	
Response Time T10/90	*[1]* 1,5 ms *[2]* 1,0 ms
Compensated Range	0 ... 90 °C
Tolerance (FS) @ U_S = 5 V	± 0,1 bar
Tolerance (FS)	± 1 %
Sensitivity	*[1]* 400 mV/bar @ U_S = 5 V *[2]* 400 mV/bar
Offset	*[1]* 500 mV @ U_S = 5 V *[2]* 500 mV

Connectors and Cables	
Connector	ASL 6-06-05PC-HE
Connector Loom	ASL 0-06-05SC-HE
Pin 1	*[2]* Us
Pin 2	GND
Pin 3	SIG
Pin 4	*[1]* Us
Pin 5	-
Various military and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	13 ... 95 cm
Please specify the requested cable length with your order.	

Application Hint
The PSC-10R can be connected directly to most control units.
The sensor has a protection for over voltage, reverse polarity and short-circuit.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Numbers	
PSC-10R *[1]*	**F 01T A21 303**
PSC-10R *[2]*	**F 01T A21 305**



Pressure Sensor Fluid PSC-250R

This sensor is designed to measure the relative pressure of various kinds of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air). Different supply voltages are available.

In our sensors we are using mainly stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. In this way complete media compatibility is guaranteed.

The main feature and benefit of this sensor is the combination of both high quality production part and military spec connection.

Application	
Application	0 ... 250 bar (r)
Pressure Reference Type	relative
Max. Pressure	500 bar
Operating Temp. Range	*[1]* -40 ... 125 °C (140 °C) *[2]* -40 ... 125 °C
Media Temp. Range	*[1]* -40 ... 125 °C (140 °C) *[2]* -40 ... 125 °C
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	100 m/s² g eff/rms @ 10 ... 2.000 Hz

Electrical Data	
Power Supply U_S	*[1]* 4,75 ... 5,25 V *[2]* 8 ... 30 V
Max Power Supply U_S max	± 30 V
Full Scale Output U_A	*[1]* 10 ... 90 % U_S ratiometric *[2]* 0,5 ... 4,5 V non-ratiometric
Current I_S	8 mA

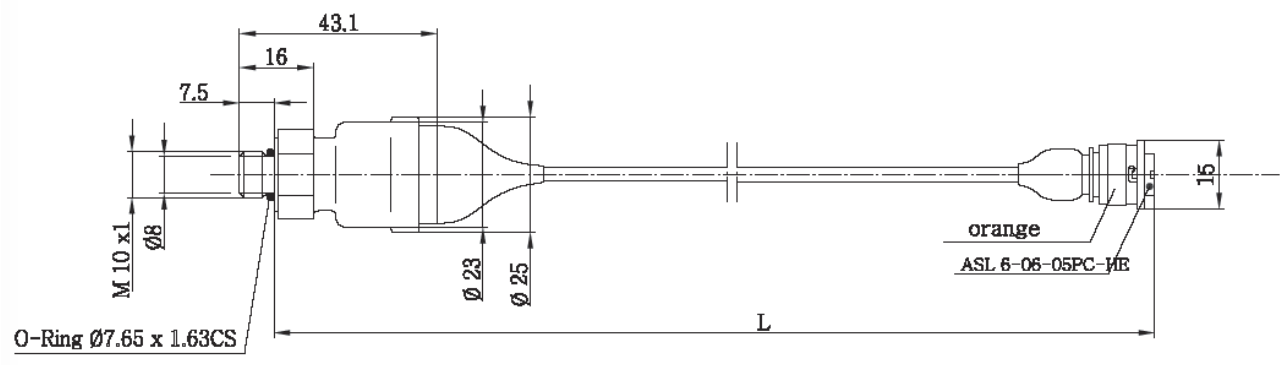
Mechanical Data	
Male Thread	M10x1
Wrench Size	17 mm
Installation Torque	15 Nm
Weight w/o Cable	45 g
Sealing	O-ring 7,65 x 1,63 mm

Characteristic	
Response Time T10/90	*[1]* 1,5 ms *[2]* 1,0 ms
Compensated Range	0 ... 90 °C
Tolerance (FS) @ U_S = 5 V	*[1]* ± 0,1 bar *[2]* ± 2,5 bar
Tolerance (FS)	± 1 %
Sensitivity	*[1]* 16 mV/bar @ U_S = 5 V *[2]* 16 mV/bar
Offset	*[1]* 500 mV @ U_S = 5 V *[2]* 500 mV

Connectors and Cables	
Connector	ASL 6-06-05PC-HE
Connector Loom	ASL 0-06-05SC-HE
Pin 1	*[2]* Us
Pin 2	GND
Pin 3	SIG
Pin 4	*[1]* Us
Pin 5	-
Various military and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	13 ... 95 cm
Please specify the requested cable length with your order.	

Application Hint
The PSC-250R can be connected directly to most control units.
The sensor has a protection for over voltage, reverse polarity and short-circuit.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Numbers	
PSC-250R *[1]*	**F 01T A21 306**
PSC-250R *[2]*	**F 01T A21 311**



Pressure Sensor Fluid PSM

This sensor is designed to measure the abolute pressure of various kinds of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air). Different pressure ranges are available.

The sensor utilises a flush metal diaphragm as a force collector. The force is transferred to a solid state piezo-resistive sensing element via a thin intervening film of noncompressible silicone oil. The housing is welded hermetically.

The main feature and benefit of this sensor is a very high durability concerning vibrations.

Application	
Application	*[1]* 0 ... 12 bar (a) *[2]* 0 ... 250 bar (a)
Pressure Reference Type	absolute
Max. Pressure	*[1]* 24 bar *[2]* 500 bar
Operating Temp. Range	-20 ... 120 °C
Media Temp. Range	-20 ... 120 °C
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	1.000 m/s^2 max @ 5 ... 5.000 Hz (sine)

Characteristic	
Compensated Range	0 ... 120 °C
Tolerance (FS) @ U_S = 5 V	*[1]* ± 0,12 bar *[2]* ± 2,50 bar
Tolerance (FS)	± 1 %
Sensitivity/Offset	(an individual calibration sheet will be delivered)

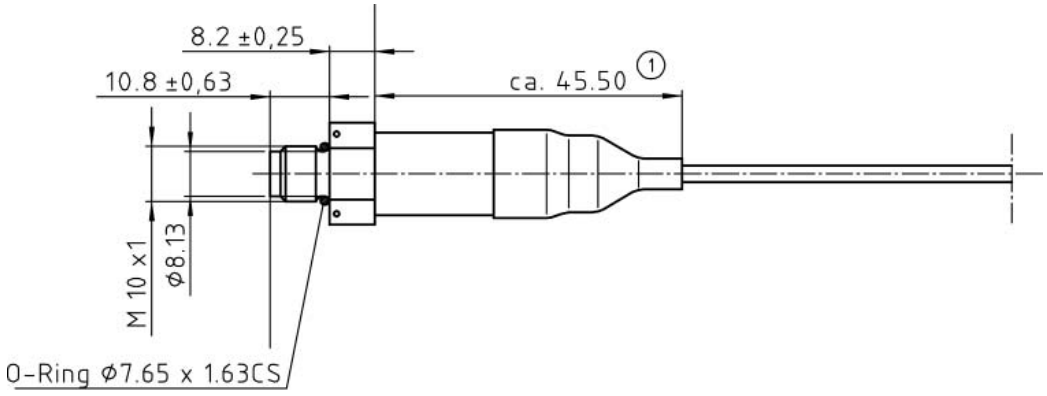
Mechanical Data	
Male Thread	M10x1
Wrench Size	16 mm
Installation Torque	10 Nm
Weight w/o Cable	24,5 g
Sealing	O-ring 7,65 x 1,63 mm

Electrical Data	
Power Supply U_S	8 ... 16 V
Full Scale Output U_A 4,9 V	± 1,5 %
Current I_S	25 mA

Connectors and Cables	
Connector	ASL 6-06-05PC-HE
Connector Loom	ASL 0-06-05SC-HE
Pin 1	U_S
Pin 2	GND
Pin 3	SIG
Pin 4	-
Pin 5	SCR
Various military and automotive connectors on request.	
Sleeve	Viton
Cable Size	AWG 24
Cable Length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint
The PSM can be connected directly to most control units.
Each mounting orientation is possible.
100 % relative humidity is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Numbers	
PSM *[1]*	**B 261 209 331**
PSM *[2]*	**B 261 209 332**



Pressure Sensor Fluid PSM-S

This sensor is designed to measure the absolute pressure of various kinds of applications (e.g. Diesel, gasoline, water, engine oil, transmission oil, air). Different pressure ranges are available.

The sensor utilises a flush metal diaphragm as a force collector. The force is transferred to a solid state piezo-resistive sensing element via a thin intervening film of no compressible silicone oil. The housing is welded hermetically.

The main feature and benefit of this sensor is the very compact size and a very high durability concerning vibrations.

Application	
Application	*[1]* 0 ... 12 bar (a) *[2]* 0 ... 70 bar (a)
Pressure Reference Type	absolute
Max. Pressure pabs max	*[1]* 36 bar *[2]* 210 bar
Operating Temp. Range	-55 ... 140 °C
Media Temp. Range	-55 ... 140 °C
Storage Temp. Range	-20 ... 50 °C
Max. Vibration	15.000 m/s² max @ 5 ... 10.000 Hz (sine)

Mechanical Data	
Male Thread	M8x1
Wrench Size	13 mm
Installation Torque	6 Nm
Weight w/o Cable	20 g
Sealing	O-ring 6,07 x 1,62 mm

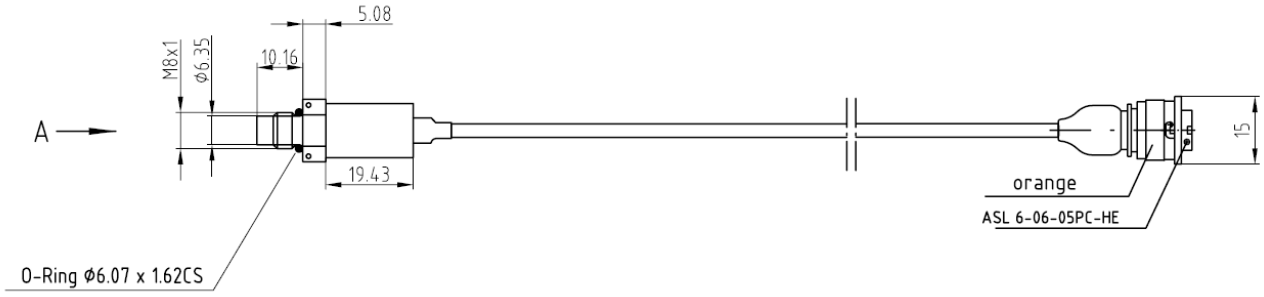
Electrical Data	
Power Supply U_S	8 ... 16 V
Full Scale Output U_A	4,7 V ± 1,5 %

Characteristic	
Compensated Range	0 ... 125 °C
Tolerance (FS) @ Us = 5 V	*[1]* ± 0,24 bar *[2]* ± 0,7 bar
Tolerance (FS)	*[1]* ± 2 % *[2]* ± 1 %
Sensitivity/Offset	(an individual calibration sheet will be delivered)

Application Hint
The PSM-S can be connected directly to most control units.
Each mounting orientation is possible.
100 % relative humidity is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Connectors and Cables	
Connector	ASL 6-06-05PC-HE
Connector Loom	ASL 0-06-05SC-HE
Pin 1	Us
Pin 2	GND
Pin 3	SIG
Pin 4	-
Pin 5	SCR
Various motorsport and automotive connectors on request.	
Sleeve	Viton
Cable Size	AWG 24
Cable Length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Part Numbers	
PSM-S *[1]*	**F 01T A21 315**
PSM-S *[2]*	**F 01T A21 316**



Ride Height Sensor

Ride Height Sensor RHS

This sensor is designed to measure the distance to the ground.

To enable very precise measurement the sensor utilizes infrared measuring technology.

The main feature and benefit of this sensor is the combination of a durable, high quality production part design with a military spec connector.

Application	
Application	60 ... 140 mm
Operating temperature range	-10 ... 60 °C

Electrical Data	
Power supply	12 ... 24 V
Response time	5 ms
Input current	< 40 mA

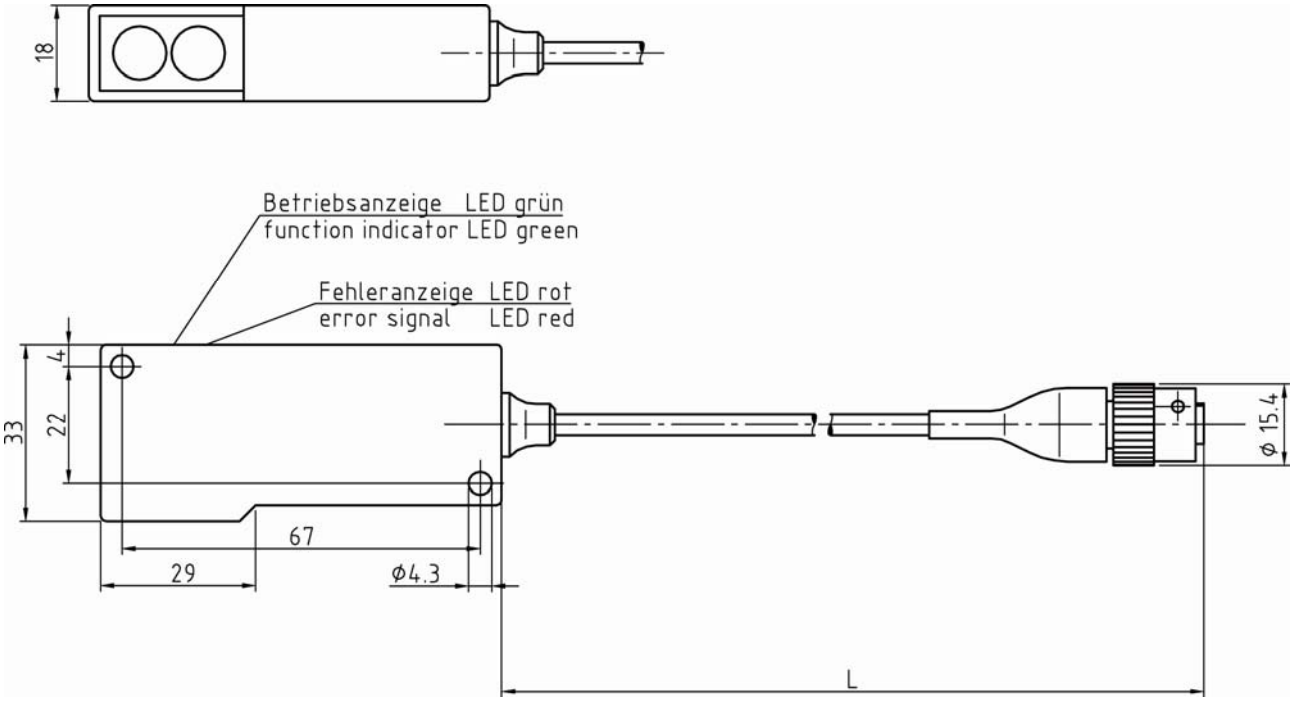
Connectors and Cables	
Connector	ASL 6-06-05PD-HE
Connector loom	ASL 0-06-05SD-HE
Pin 1	U_{Supply}
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Various military and automotive connectors on request.	
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Mechanical Data	
Weight w/o cable	105 g
Size	75 x 33 x 18 mm
Housing	plastic, fibreglass
Protection class	IP 67

Characteristic	
Signal output	0,25 ... 4,75 V
Output current	500 µA (analog output)
Alarm output	PNP (200 mA)
Resolution	0,5 ... 1 mm
Linearity	1 % FS
Light source	IR
Max. allowed ambient light	< 10.000 lux
Wave length	660 nm

Application Hint
The RHS can be connected directly to most control units and data logging systems.
The measurable range of the sensor is 60 ... 140 mm.
Please avoid abrupt temperature changes.
Sensor should only be mounted via the integrated mounting hole.
Please ensure that the environmental conditions do not exceed the sensor specifications.
Further application hints can be found in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
RHS	**B 261 209 674**



Rotary Potentiometers

Rotary Potentiometer RP 50-/130-/350-M

This sensor is designed to measure rotational movement, e.g. throttle angle, spring travel, gearbox position or steering angle.

A throttle rotation moves an internal slider (wiper) on a resistive element which is supplied with voltage. Thus voltage proportional to the angle can be measured. The housing and the bearings are made of high temperature resistant plastic. The mounting plate is protected with a metal cover to ensure a good fixation. The sensors are fitted in a shrink down boot for additional protection.

The main benefit of these sensors is the combination of high accuracy, very robust aluminium housing and motorsports spec connection.

Application	
Application	[1] 0 ... 50° [2] 0 ... 130° [3] 0 ... 350°
Operating temperature range	-55 ... 125 °C

Electrical Data	
Power supply Us	5 V
Maximal power supply	42 V
Total resistance	[1] 3 kΩ [2] 4 kΩ [3] 8 kΩ
Current Is	1 µA
Max. allowable contact current	[1|3] 1 mA [2] 10 mA

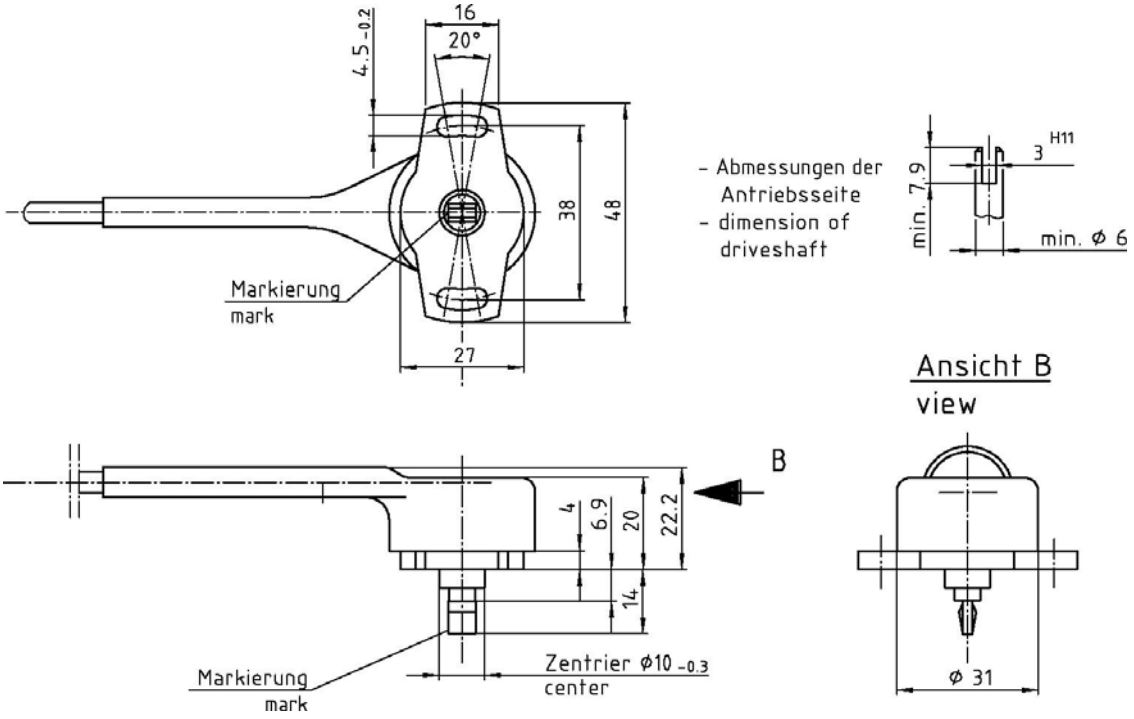
Mechanical Data	
Weight w/o cable	38 g
Protection class	IP66
Mounting	2 x M4
Housing	aluminium alloy

Characteristic	
Direction of rotation	anti-clockwise
Both rotation directions are available on request.	
Redundancy	No

Connectors and Cables	
Connector	[1|3] ASL 6-06-05PA-HE [2] KPTA 6E6-4P-C-DN
Connector loom	[1|3] ASL 0-06-05SA-HE [2] KPTA 1E6-4S-C-DN
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length	16 ... 30 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The products of the RP series can be connected directly to most control units.
The sensor has no internal mechanical stops.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Both rotation directions and other rotation angles available on request.
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
RP 50-M [1]	**B 261 209 571**
RP 130-M [2]	**B 261 209 576**
RP 350-M [3]	**B 261 209 577**



Rotary Potentiometer RP 55

This sensor is designed to measure rotational movement, e.g. spring travel.

A rotation moves an internal slider (wiper) on a resistive element which is supplied with voltage. Thus a voltage proportional to the angle can be measured. The housing is made of shock resistant aluminium. The internals are made of high temperature resistant synthetic material.

The main benefit of this sensor is the special way of mounting with a quill shaft.

Application	
Application	0 ... 55°
Operating temperature range	-25 ... 75 °C
Storage temperature range	-25 ... 105 °C
Max. vibration	100 m/s² @ 30 ... 500 Hz

Electrical Data	
Power supply Us	5 V
Total resistance	5 kΩ
Current Is	1 µA
Max. allowable contact current	10 mA

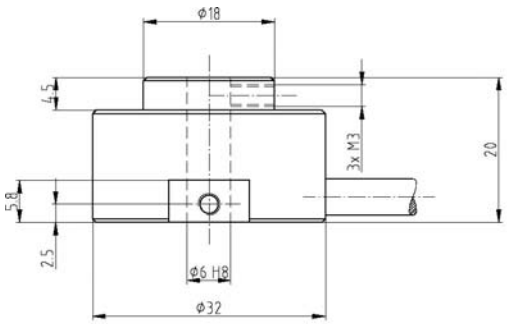
Mechanical Data	
Weight w/o cable	59 g
Protection class	IP63
Mounting	di 6 mm
Lifetime	5 x 10⁶ rotations
Housing	aluminium alloy

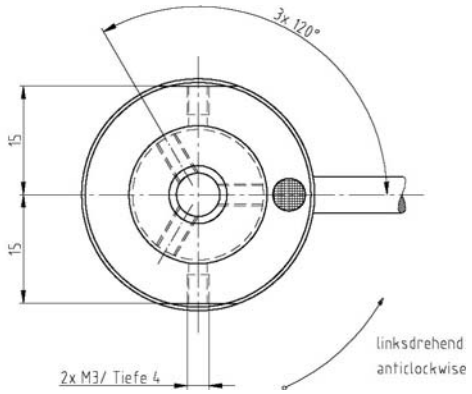
Characteristic	
Temp. coefficient	50 ppm/°K
Direction of rotation	Anti-Clockwise
Redundancy	No

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	16 ... 30 cm
Various motorsports and automotive connectors are available on request.	
Please specify the requested cable length with your order.	

Application Hint
The products of the RP series can be connected directly to most control units.
The sensor has no internal mechanical stops.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Both rotation directions and other rotation angles are available on request.
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
RP 55	**B 261 209 578**





Rotary Potentiometer RP 86

This sensor is designed to measure rotational movement, e.g. throttle angle or spring travel.

A throttle rotation moves an internal slider (wiper) on a resistive element which is supplied with voltage. Thus voltage proportional to the angle can be measured. The housing and the bearings are made of high temperature resistant plastic.

The main benefit of this sensor is the combination of a high quality production part and extremely short dimensions.

Application	
Application	0 ... 86°
Angle between internal mechanical stops	95°
Operating temperature range	-40 ... 130 °C
Max. vibration	700 m/s²

Electrical Data	
Power supply U_S	5 V
Max. power supply	42 V
Total resistance	2 kΩ ±20 %
Current I_S	18 µA

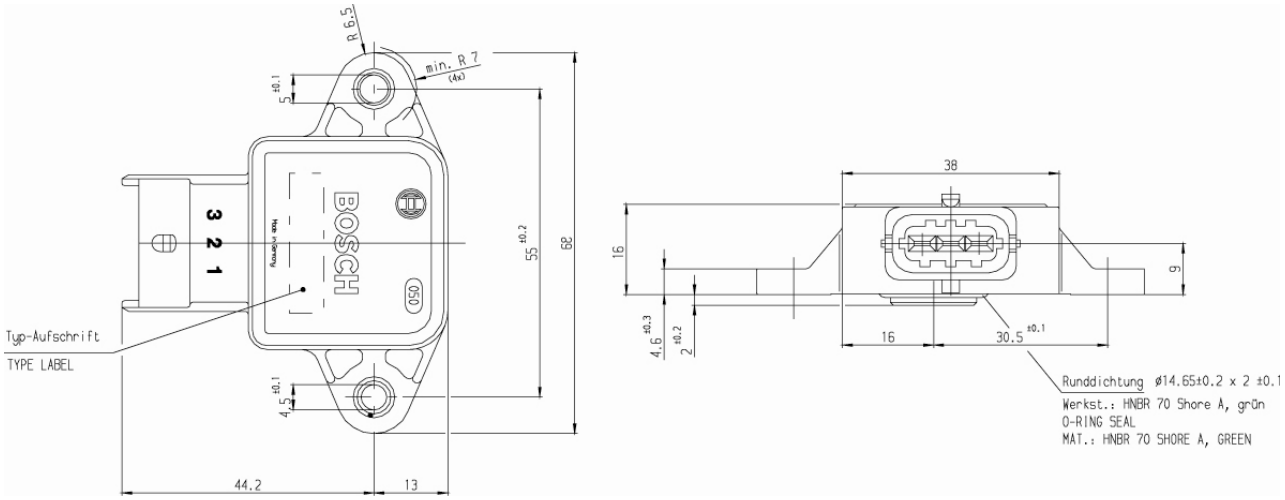
Connectors and Cables	
Connector	Bosch Compact
Connector loom	D 261 205 334
Pin 1	U_S
Pin 2	Sig
Pin 3	Gnd
Various motorsports and automotive connectors on request.	
Various cable options are available on request.	
Please specify the requested cable length with your order.	

Mechanical Data	
Weight w/o cable	26 g
Mounting	2 x M4
Lifetime	2 x 10^6 rotations
Housing	synthetic material

Characteristic	
Max. rotation speed	120 min^{-1}
Direction of rotation	Anti-Clockwise
Both rotation directions are available on request.	
Redundancy	No

Application Hint
The products of the RP series can be connected directly to most control units.
The sensor has an internal mechanical stop and a Ø 14.65x2 sealing.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Both rotation directions and other rotation angles available on request.
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
RP 86	**0 280 122 016**



Rotary Potentiometer RP 100/130/308

This sensor is designed to measure rotational movement, e.g. throttle angle, spring travel, gearbox position or steering angle.

A throttle rotation moves an internal slider (wiper) on a resistive element which is supplied with voltage. Thus voltage proportional to the angle can be measured. The housing and the bearings are made of high temperature resistant plastic. The mounting plate is protected with a metal cover to ensure a good fixation. The sensor is fitted in a shrink down boot for additional protection.

The main benefit of this sensor is the combination of both high accuracy and motorsports spec connection.

Application	
Application	[1] 0 ... 100° [2] 0 ... 130° [3] 0 ... 308°
Operating temperature range	-40 ... 150 °C
Max. vibration	200 m/s^2 @ 5 ... 2,000 Hz

Electrical Data	
Power supply Us	5 V
Maximal power supply	42 V
Total resistance	[1|2] 3 kΩ ±20 % [3] 5 kΩ ±20 %
Current Is	1 µA
Max. allowable contact current	10 mA

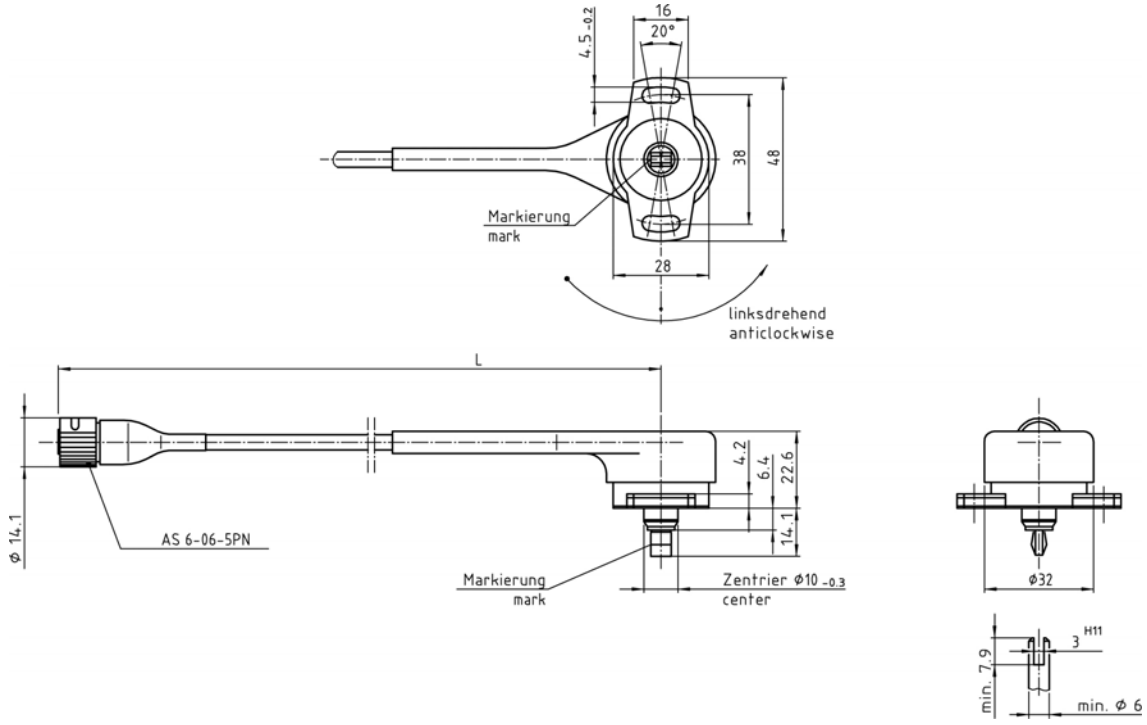
Mechanical Data	
Weight w/o cable	32 g
Protection class	IP65
Mounting	2 x M4
Lifetime	50 x 10^6 rotations
Housing	synthetic material

Characteristic	
Max. rotation speed	120 min^{-1}
Temp. coefficient	5 ppm/°K
Direction of rotation	anti-clockwise
Both rotation directions are available on request	
Redundancy	No

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	16 ... 30 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The products of the RP series can be connected directly to most control units.
The sensor has no internal mechanical stops.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Both rotation directions and other rotation angles available on request.
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
RP 100 [1]	**B 261 209 127 01**
RP 130 [2]	**B 261 209 128**
RP 308 [3]	**B 261 209 570**



Rotary Potentiometer RP 100 twin

This sensor is designed to measure rotational movement, e.g. gearbox position or throttle angle.

A throttle rotation moves an internal slider (wiper) on a resistive element which is supplied with voltage. Thus voltage proportional to the angle can be measured. The housing and the bearings are made of high temperature resistant plastic. The mounting plate is protected with a metal cover to ensure a good fixation. The sensor is fitted in a shrink down boot for additional protection.

The main benefit of this sensor is the extremely high reliability through the redundant sensor design.

Application	
Application	0 ... 100°
Operating temperature range	-40 ... 150 °C
Max. vibration	200 m/s² @ 5 ... 2,000 Hz

Electrical Data	
Power supply Us	5 V
Maximal power supply	42 V
Total resistance	3 kΩ ±20 %
Current Is	1 µA
Max. allowable contact current	10 mA

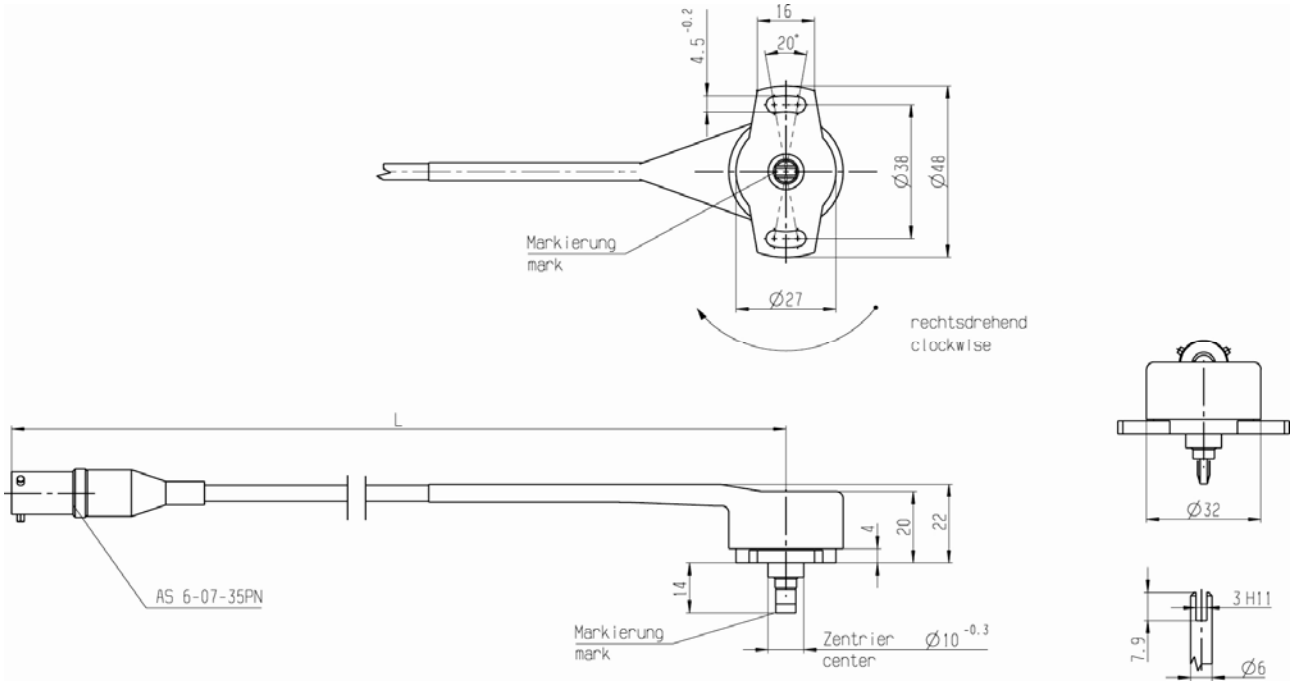
Mechanical Data	
Weight w/o cable	32 g
Protection class	IP65
Mounting	2 x M4
Lifetime	50 x 10⁶ rotations
Housing	synthetic material

Characteristic	
Max. rotation speed	120 min⁻¹
Temp. coefficient	5 ppm/°K
Direction of rotation	anti-clockwise
Both rotation directions are available on request	
Redundancy	Yes

Connectors and Cables	
Connector	AS 6-07-35PN
Connector loom	AS 0-07-35SN
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	Us
Pin 5	Gnd
Pin 6	Sig
Sleeve	DR-25
Cable size	AWG 24
Cable length L	16 ... 30 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The products of the RP series can be connected directly to most control units.
The sensor has no internal mechanical stops.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Both rotation directions and other rotation angles available on request.
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
RP 100 twin	**B 261 209 591**



Rotary Potentiometer Mini-RP 100-M

This sensor is designed to measure rotational movement, e.g. throttle angle or spring travel.

A throttle rotation moves an internal slider (wiper) on a resistive element which is supplied with voltage. Thus voltage proportional to the angle can be measured. The housing and the bearings are made of high temperature resistant plastic. The mounting plate is protected with a metal cover to ensure a good fixation. The sensor is fitted in a shrink down boot for additional protection.

The main benefit of this sensor is the combination of high accuracy, motorsports spec connection and a very small and robust aluminium housing.

Application	
Application	0 ... 100°
Operating temperature range	-40 ... 150 °C
Storage temperature range	0 ... 100 °C
Max. vibration	200 m/s² @ 5 ... 2,000 Hz

Electrical Data	
Power supply U_s	5 V
Maximal power supply	42 V
Total resistance	3 kΩ ±20 %
Current I_s	1 µA
Max. allowable contact current	10 mA

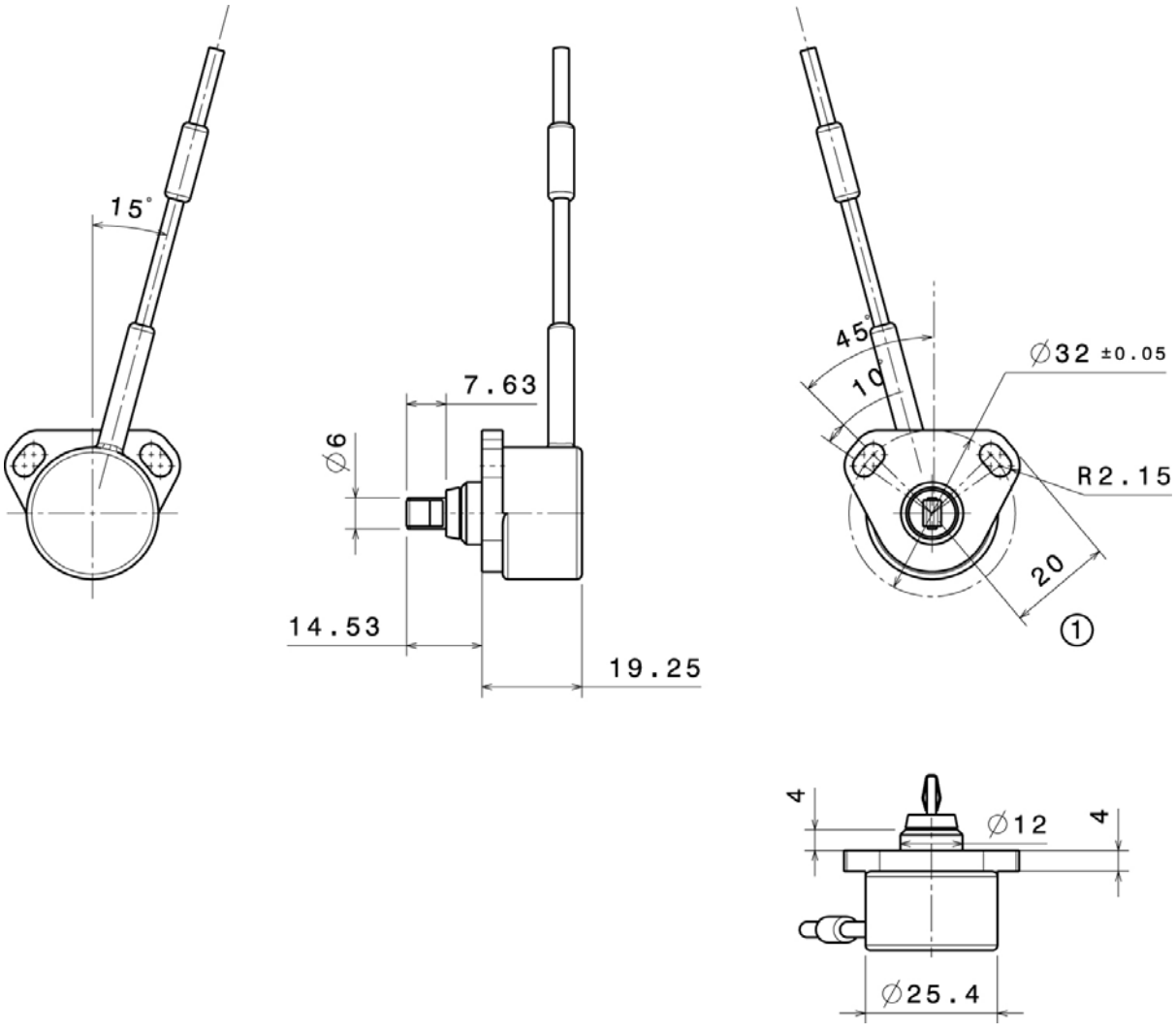
Mechanical Data	
Weight w/o cable	32 g
Protection class	IP65
Mounting	2 x M4
Lifetime	50 x 10^6 rotations
Housing	aluminium alloy

Characteristic	
Max. rotation speed	120 min^{-1}
Temp. coefficient	5 ppm/°K
Direction of rotation	anti-clockwise
Both rotation directions are available on request.	
Redundancy	No

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	16 ... 30 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint
The products of the RP series can be connected directly to most control units.
The sensor has no internal mechanical stops.
Each mounting orientation is possible.
The sensor meets all EMV, EMC and ESD automotive standards.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Both rotation directions and other rotation angles available on request.
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
Mini-RP 100-M	**B 261 209 587**



Rotary Potentiometer RP 345-M

This sensor is designed to measure rotational movement, e.g. throttle angle, spring travel, gearbox position or steering angle.

A throttle rotation moves an internal slider (wiper) on a resistive element which is supplied with voltage. Thus voltage proportional to the angle can be measured. The housing is made of shock resistant aluminium. The internal is made of high temperature resistant synthetic material. The mounting plate is protected with a metal cover to ensure a good fixation. The sensor is fitted in a shrink down boot for additional protection.

The main benefit of this sensor is the combination of both high accuracy and very though aluminium housing.

Application	
Application	0 ... 345°
Operating temperature range	-40 ... 150 °C
Max. vibration	200 m/s^2 @ 5 ... 2,000 Hz

Electrical Data	
Power supply U_S	5 V
Maximal power supply	42 V
Total resistance	5 kΩ ±20 %
Current I_S	1 µA
Max. allowable contact current	10 mA

Mechanical Data	
Weight w/o cable	32 g
Protection class	IP65
Mounting	2 x M4
Lifetime	50 x 10^6 rotations
Housing	aluminium alloy

Characteristic	
Max. rotation speed	120 min^{-1}
Temp. coefficient	5 ppm/°K
Direction of rotation	anti-clockwise
Both rotation directions are available on request.	
Redundancy	No

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	16 ... 30 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The products of the RP series can be connected directly to most control units.

The sensor has no internal mechanical stops.

Each mounting orientation is possible.

The sensor meets all EMV, EMC and ESD automotive standards.

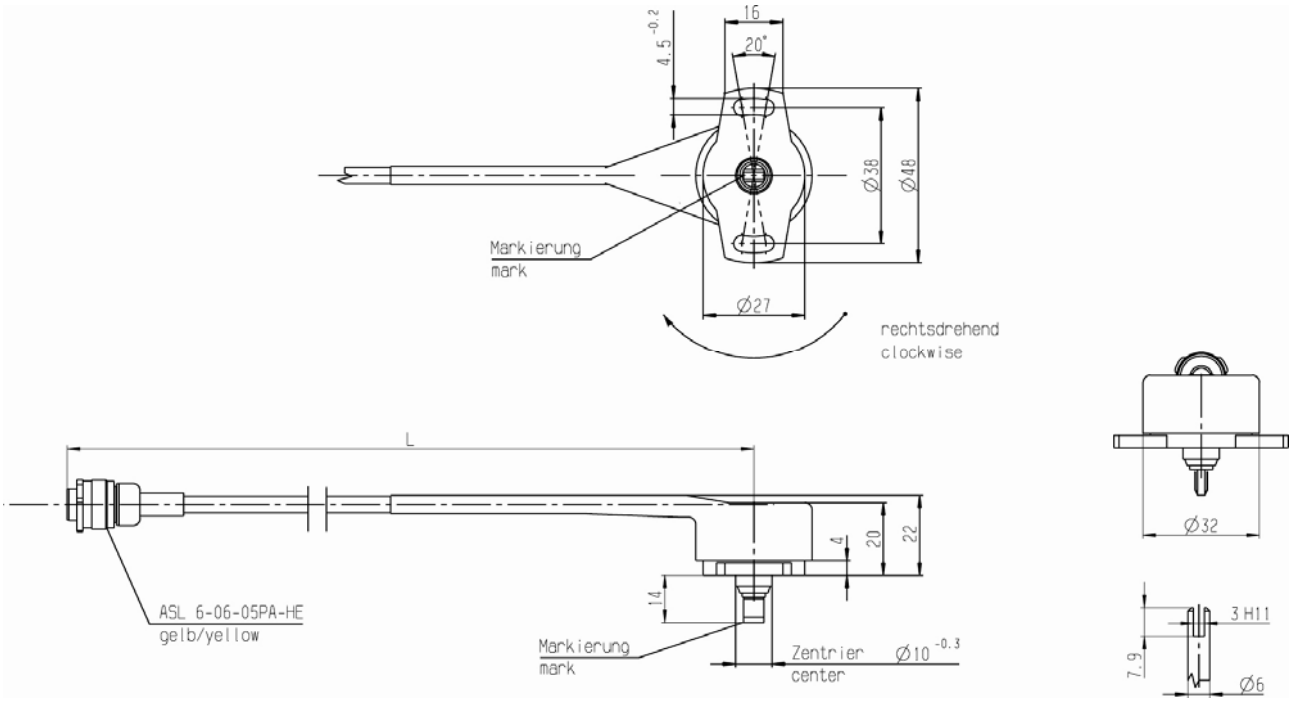
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Both rotation directions and other rotation angles available on request.

Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number

RP 345-M	**F 01T A21 400**



Speed Sensors

Inductive Speed Sensor IA

This sensor is designed for incremental measurement of rotational speed (e.g. crankshaft or wheelspeed).

The inductive sensor consists of a bar magnet with a soft magnetic pole pin supporting an induction coil with two connections. When a ferromagnetic ring gear turns past this sensor, it generates a voltage in the coil which is directly proportional to the periodic variation in the magnetic flux. The rotational speed is reflected on a periodic interval between the voltage's zero transition points.

The main benefit of this sensor is the combination of a high quality production part and robust, high temperature resistance. Additionally the installation depth can be changed according to the customer request.

Application	
Application	speed
Max. frequency	≤ 15 kHz
Target wheel air gap AG	0.8 ± 0.3 mm
Operating temp. range (sensing head)	-40 ... 230 °C
Storage temperature range	0 ... 100 °C
Max. vibration	800 m/s² max. 80 h

Electrical Data	
Coil resistance	1,200 Ω
Inductance max.	400 mH
Output voltage max.	190 V_{P-P}

Mechanical Data	
Magnetic pole	round
Bore diameter	12.5 mm
Weight w/o wire	30 g
Installation depth L2	32.2 mm

Environment	
Target wheel diameter D	160.43 mm
Thickness t	> 5 mm
Width of teeth b1	4.1 mm
Width of gap b2	4.3 mm
Depth of teeth h1	3.5 mm
Depth of teeth h2	1.75 mm
Number of teeth	60-2

Connectors and Wires	
Connector	ASL 6-06-05SN-HE
Mating connector	ASL 0-06-05PN-HE
Pin 1	-
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	Scr
Various motorsport and automotive connectors available on request.	
Sleeve	DR-25
Wire	AWG 24
Wire length L	10 ... 100 cm
Please specify the required wire length with your order.	

Application Hint

The inductive speed sensor IA is developed for wheels made of ferromagnetic material.

If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.

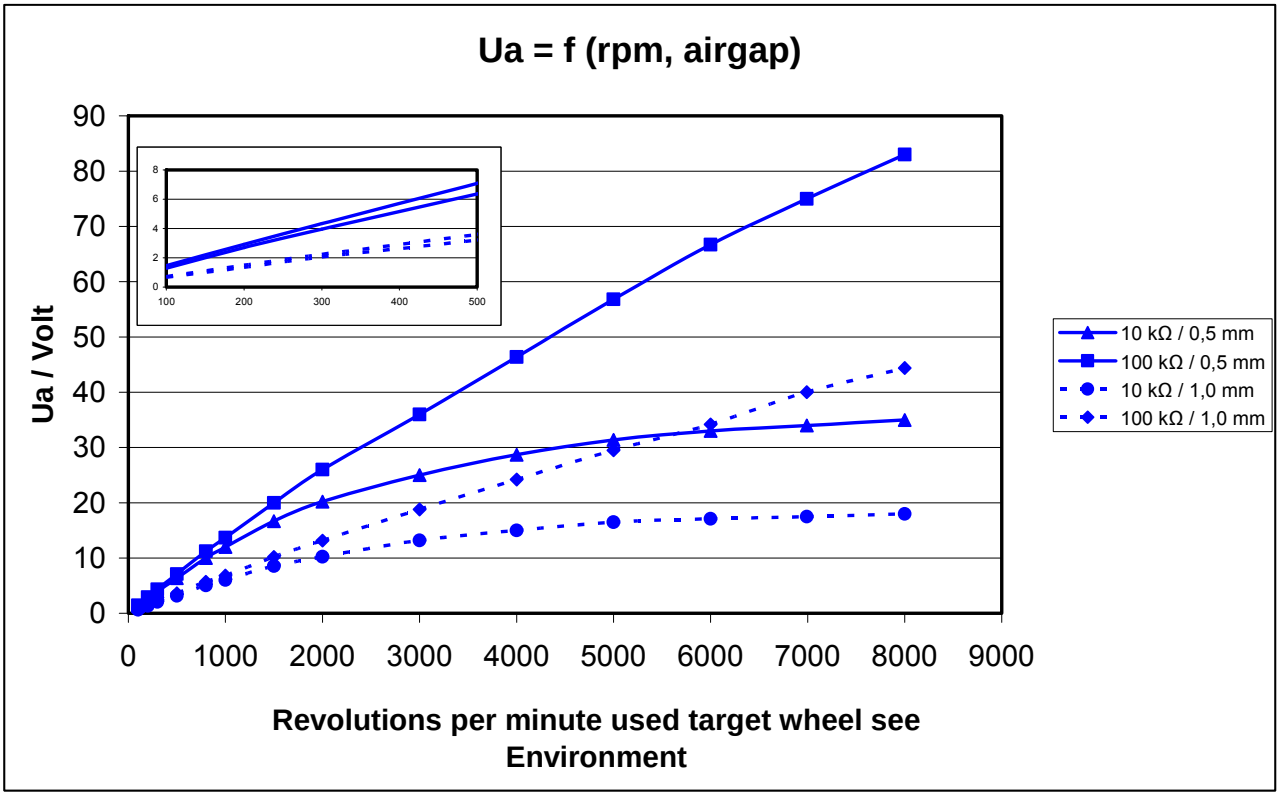
The installation depth L_2 can be changed individually according to customer request.

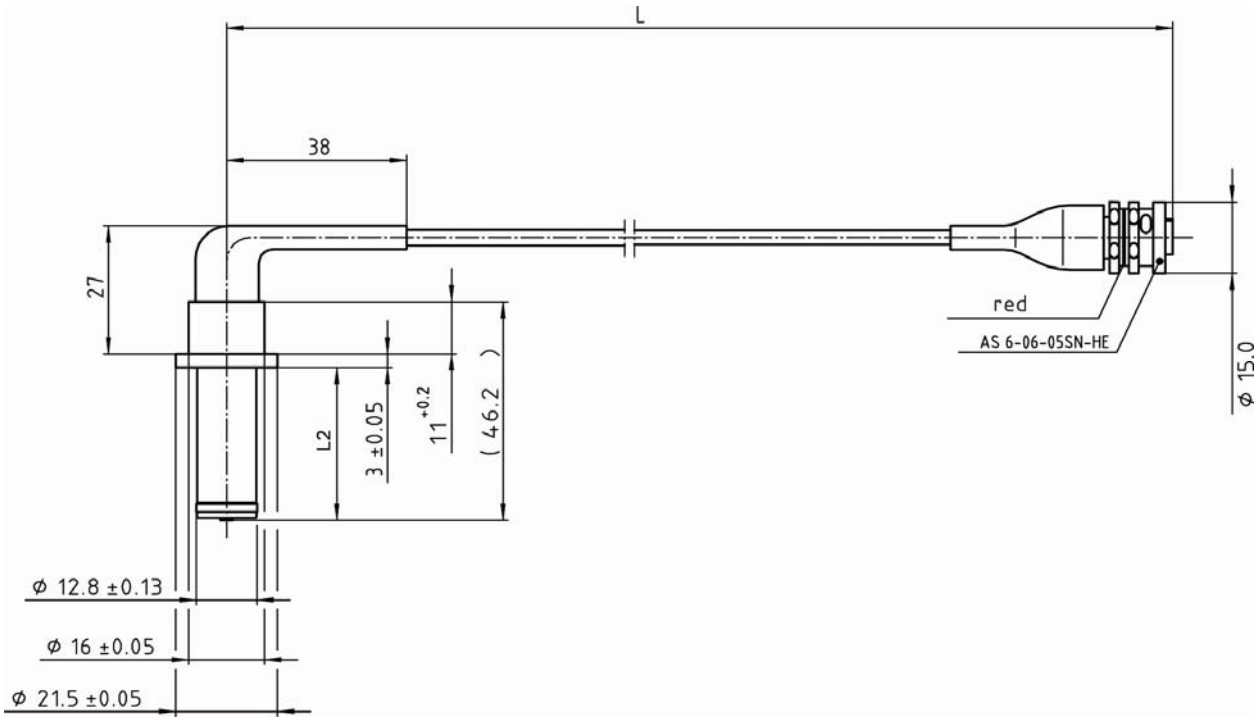
Please contact our technical consultancy for more information.

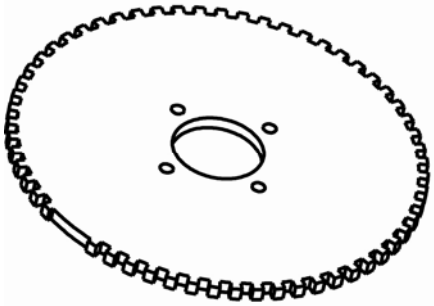
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

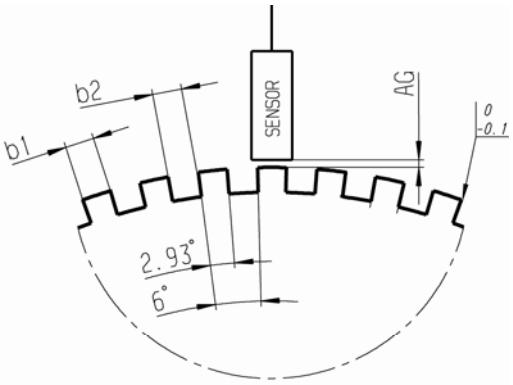
Part Number

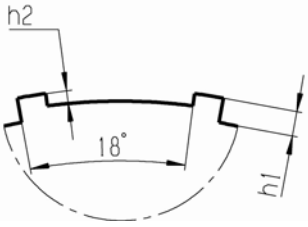
Inductive Speed Sensor IA	**B 261 209 519**




L
38
27
red
AS 6-06-05SN-HE
ø 15.0
L2
3 ±0.05
11 +0.2
(46.2)
ø 12.8 ±0.13
ø 16 ±0.05
ø 21.5 ±0.05




b2
b1
SENSOR
AG
0
-0.1
2.93°
6°


h2
18°
h1

Inductive Speed Sensor IA-C

This sensor is designed for incremental measurement of rotational speed (e.g. crankshaft or wheelspeed).

The inductive sensor consists of a bar magnet with a soft magnetic pole pin supporting an induction coil with two connections. When a ferromagnetic ring gear turns past this sensor, it generates a voltage in the coil which is directly proportional to the periodic variation in the magnetic flux. The rotational speed is reflected on a periodic interval between the voltage's zero transition points.

It is available in a DR-25 sleeve with various connectors options.

The main benefit of this sensor is the combination of a high quality production part and robust, compact design.

Application	
Application	speed
Max. frequency	≤ 15 kHz
Target wheel air gap AG	0.8 ± 0.3 mm
Operating temp. range (sensing head)	-40 ... 130 °C
Storage temperature range	-40 ... 100 °C
Max. vibration	800 m/s² max. 80 h

Electrical Data	
Coil resistance	860 Ω ± 10 %
Inductance max.	370 mH ± 15 %
Output voltage max.	200 V_{P-P}

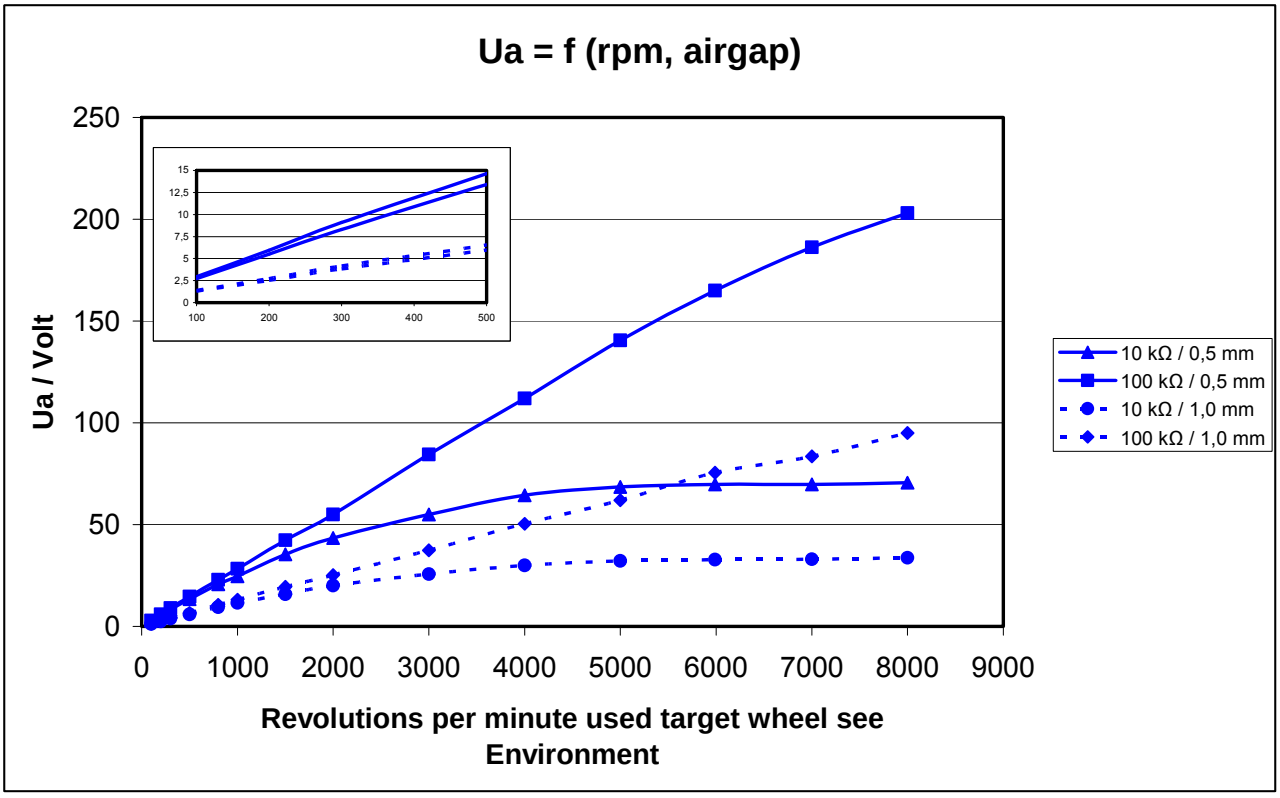
Mechanical Data	
Magnetic pole	round
Bore diameter	18 mm
Tightening torque	8 Nm
Weight w/o wire	40 g
Installation depth L2	23.7 mm

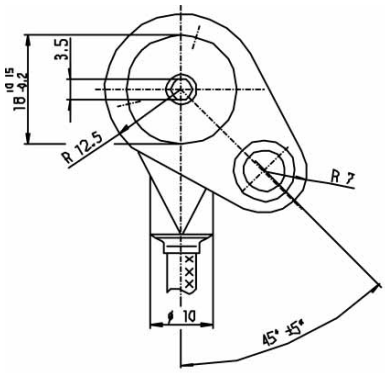
Environment	
Target wheel diameter D	160.43 mm
Thickness t	> 5 mm
Width of teeth b1	4.1 mm
Width of gap b2	4.3 mm
Depth of teeth h1	3.5 mm
Depth of teeth h2	1.75 mm
Number of teeth	**60-2**

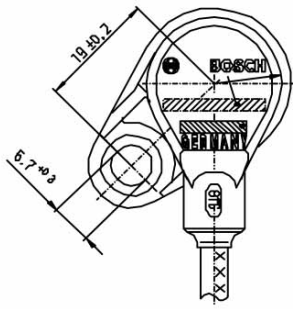
Connectors and Wires	
Connector	1 928 404 227
Mating connector	D 261 205 335
Pin 1	Sig+
Pin 2	Sig-
Pin 3	Scr
Various motorsport and automotive connectors available on request.	

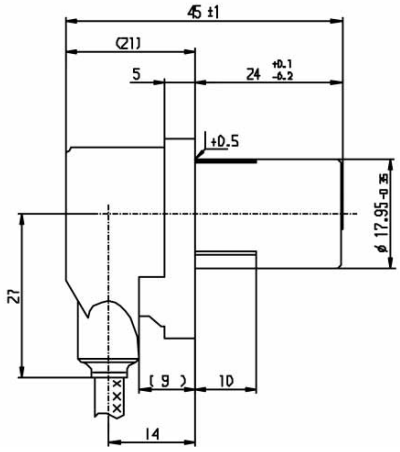
Application Hint
The inductive speed sensor IA-C is developed for wheels made of ferromagnetic material.
If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.
Please contact our technical consultancy for more information.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

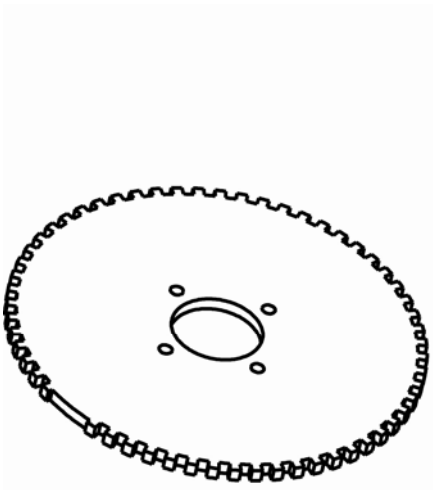
Part Number	
Inductive Speed Sensor IA-C	**0 261 210 136**

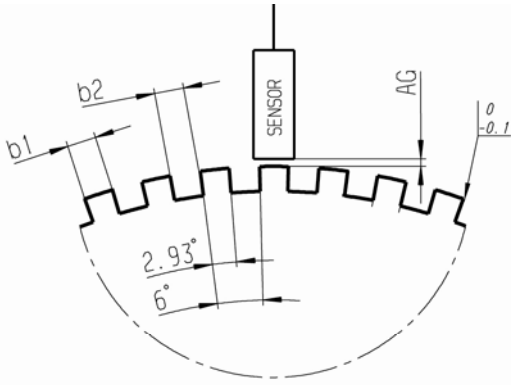


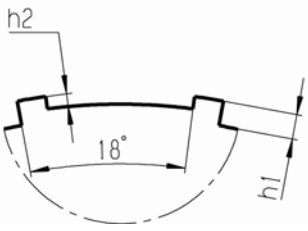

3.5
R 12.5
R 7
10
45° 45°


19 ±0.2
BOSCH
GERMANY
6.7 +0.3
XXX


45 ±1
(21)
5
24
+0.5
ø 17.95
27
(9)
10
14
XXX




b2
b1
SENSOR
AG
0
-0.1
2.93°
6°


h2
18°
h1

Inductive Speed Sensor IS

This sensor is designed for incremental measurement of rotational speed (e.g. crankshaft or wheelspeed).

The inductive sensor consists of a bar magnet with a soft magnetic pole pin supporting an induction coil with two connections. When a ferromagnetic ring gear turns past this sensor, it generates a voltage in the coil which is directly proportional to the periodic variation in the magnetic flux. The rotational speed is reflected on a periodic interval between the voltage's zero transition points.

The main benefit of this sensor is the combination of a high quality production part and robust, high temperature resistance. Additionally the installation depth can be changed according to the customer request.

Application	
Application	speed
Max. frequency	≤ 15 kHz
Target wheel air gap AG	0.8 ± 0.3 mm
Operating temp. range (sensing head)	-40 ... 230 °C
Storage temperature range	0 ... 100 °C
Max. vibration	800 m/s² max. 80 h

Electrical Data	
Coil resistance	1,200 Ω
Inductance max.	400 mH
Output voltage max.	190 V P-P

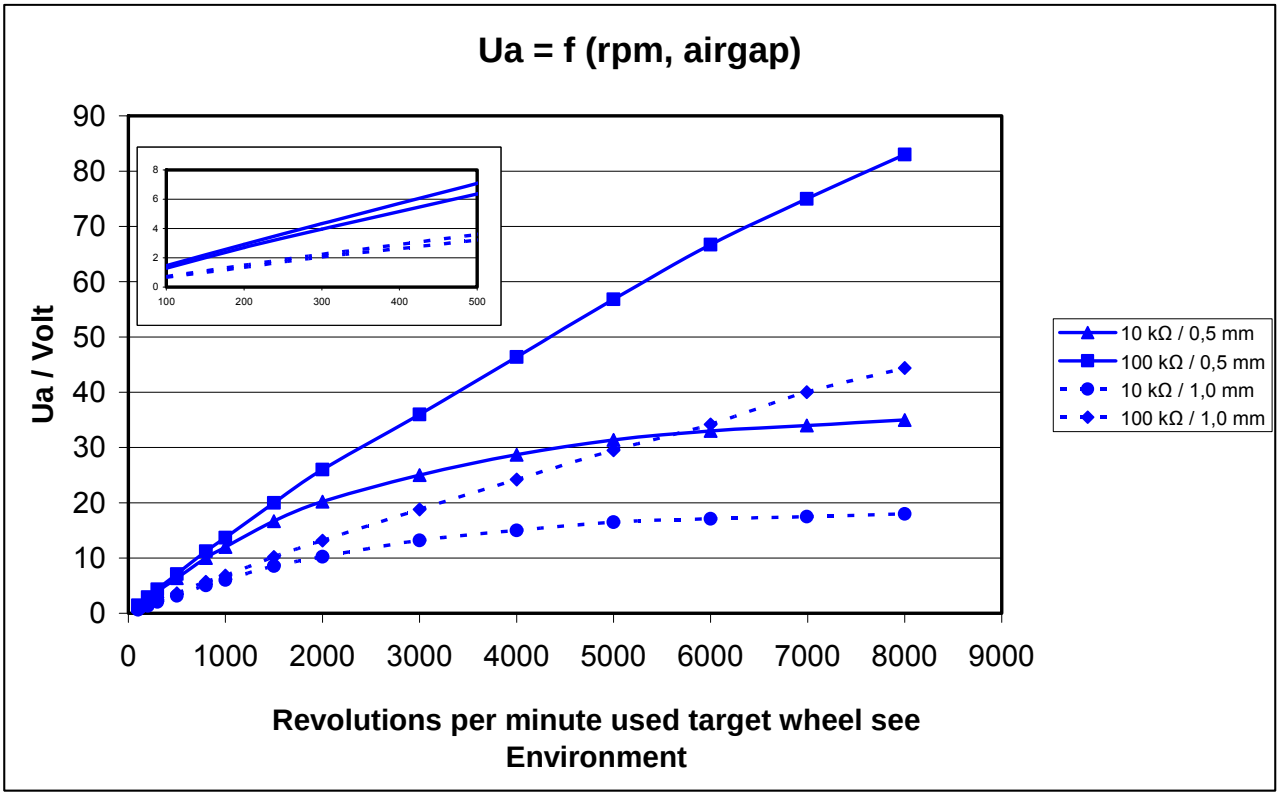
Mechanical Data	
Magnetic pole	round
Bore diameter	12.5 mm
Tightening torque	8 Nm
Weight w/o wire	30 g
Installation depth L_2	32.2 mm

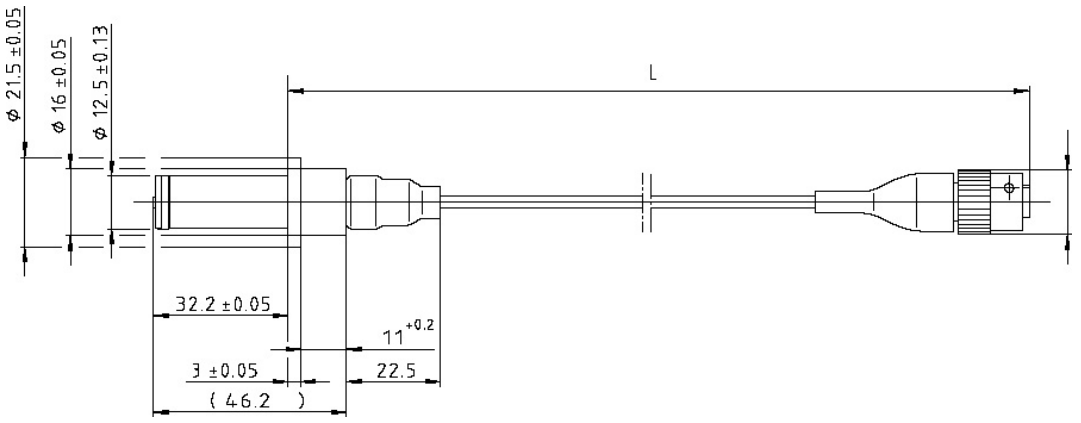
Environment	
Target wheel diameter D	160.43 mm
Thickness t	> 5 mm
Width of teeth b1	4.1 mm
Width of gap b2	4.3 mm
Depth of teeth h1	3.5 mm
Depth of teeth h2	1.75 mm
Number of teeth	60-2

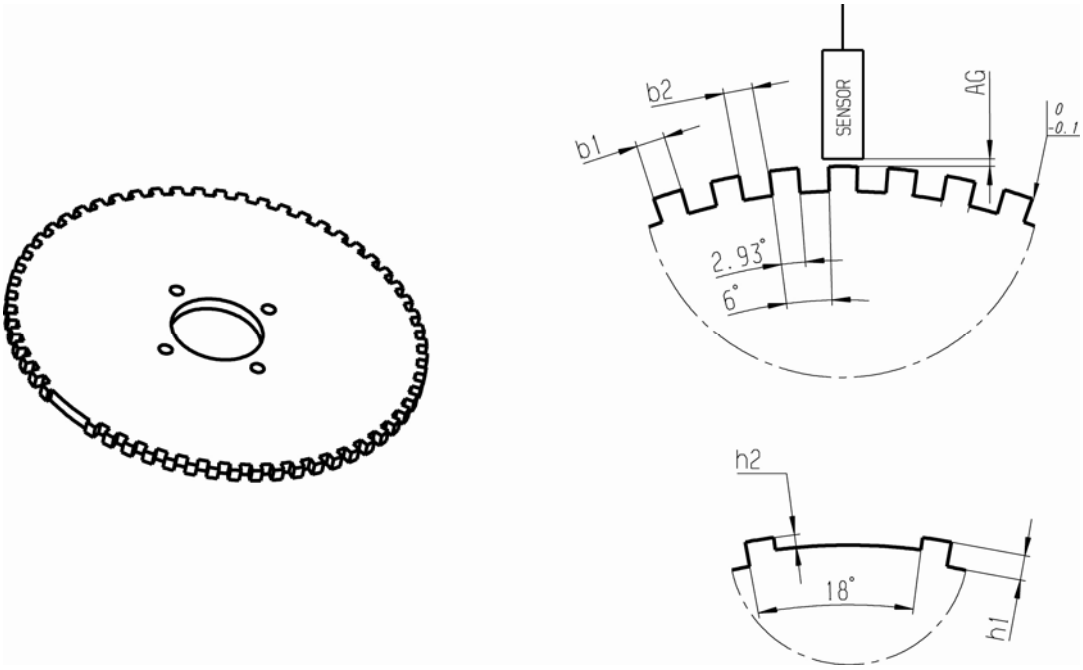
Connectors and Wires	
Connector	ASL 6-06-05SN-HE
Mating connector	ASL 0-06-05PN-HE
Pin 1	-
Pin 2	Sig-
Pin 3	Sig+
Pin 4	-
Pin 5	Scr
Various motorsport and automotive connectors available on request.	
Sleeve	DR-25
Wire	AWG 24
Wire length L	10 ... 100 cm
Please specify the required wire length with your order.	

Application Hint
The inductive speed sensor IS is developed for wheels made of ferromagnetic material.
If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.
The installation depth L_2 can be changed individually according to customer request.
Please contact our technical consultancy for more information.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Inductive Speed Sensor IS	**B 261 209 517**




Ø 21.5 ±0.05
Ø 16 ±0.05
Ø 12.5 ±0.13
L
32.2 ±0.05
11 +0.2
3 ±0.05
22.5
(46.2)


b2
b1
SENSOR
AG
0
-0.1
2.93°
6°
h2
18°
h1

Inductive Speed Sensor IS-C

This sensor is designed for incremental measurement of rotational speed (e.g. crankshaft or wheelspeed).

The inductive sensor consists of a bar magnet with a soft magnetic pole pin supporting an induction coil with two connections. When a ferromagnetic ring gear turns past this sensor, it generates a voltage in the coil which is directly proportional to the periodic variation in the magnetic flux. The rotational speed is reflected on a periodic interval between the voltage's zero transition points.

The main benefit of this sensor is the combination of a high quality production part with very compact design, and high temperature resistance.

Application	
Application	speed
Max. frequency	≤ 15 kHz
Target wheel air gap AG	0.8 ± 0.3 mm
Operating temp. range (sensing head)	-40 ... 230 °C
Storage temperature range	0 ... 100 °C
Max. vibration	800 m/s² max. 80 h

Electrical Data	
Coil resistance	340 Ω
Inductance max.	64 mH

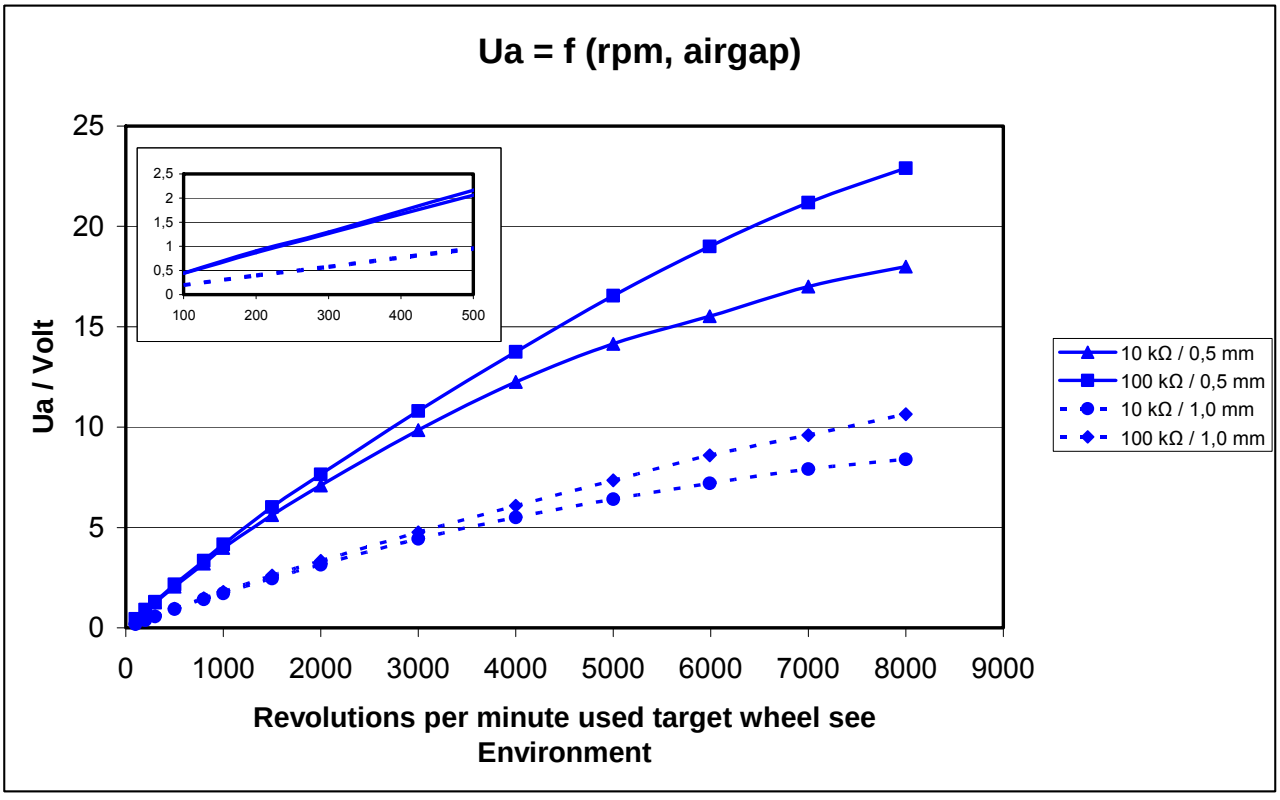
Mechanical Data	
Magnetic pole	round
Bore diameter	12.9 mm
Tightening torque	8 Nm
Weight w/o wire	25 g
Installation depth L_2	24.1 mm

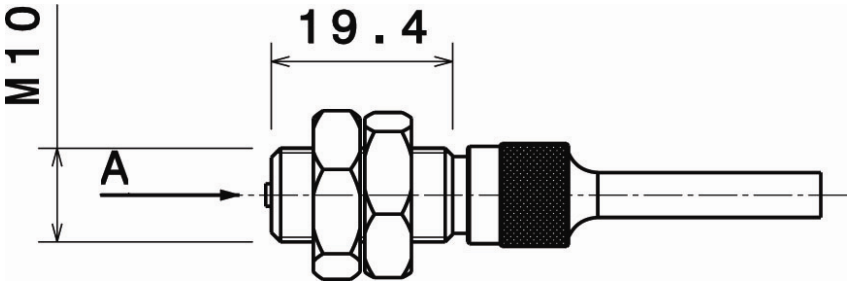
Environment	
Target wheel diameter D	160.43 mm
Thickness t	> 5 mm
Width of teeth b1	4.1 mm
Width of gap b2	4.3 mm
Depth of teeth h1	3.5 mm
Depth of teeth h2	1.75 mm
Number of teeth	60-2

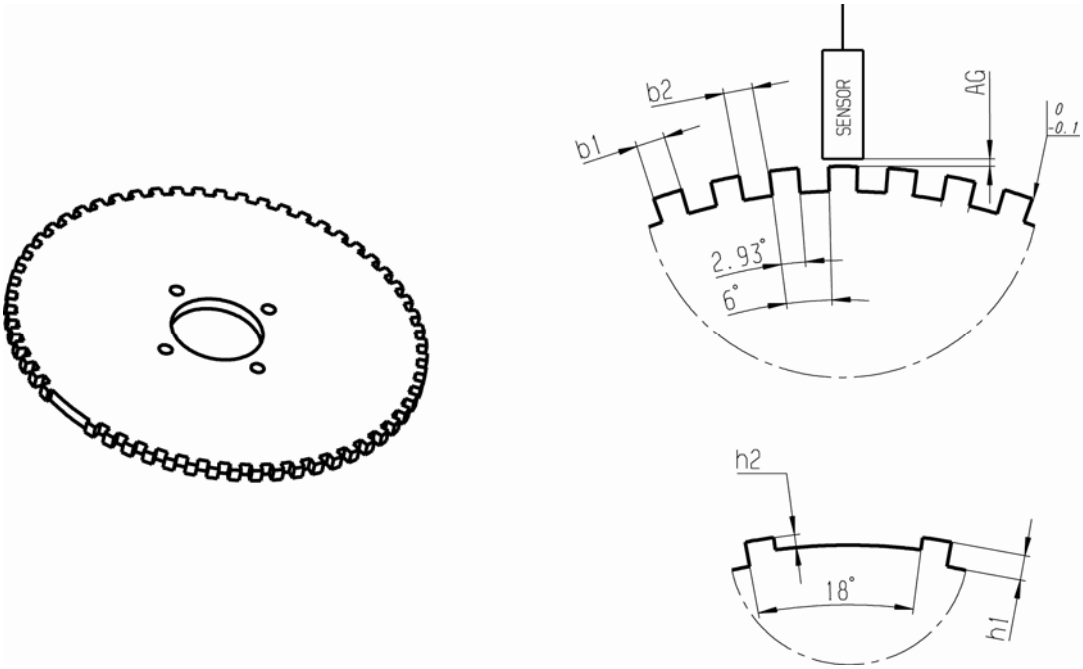
Connectors and Wires	
Connector	[1] ASL 6-06-05SN-HE
Mating connector	[1] ASL 0-06-05PN-HE
Pin 1	-
Pin 2	GND
Pin 3	Sig
Pin 4	-
Pin 5	Scr
Various motorsport and automotive connectors available on request.	
Sleeve	DR-25
Wire	AWG 24
Wire length	max. 50 cm
Please specify the required wire length with your order.	

Application Hint
The inductive speed sensor IS-C is developed for wheels made of ferromagnetic material.
If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.
This sensor is also available with a M10x1 male thread.
Please contact our technical consultancy for more information.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Inductive Speed Sensor IS-C	**B 261 209 609**






b2
b1
SENSOR
AG
0
-0.1
2.93°
6°
h2
18°
h1

Inductive Speed Sensor IS-T

This sensor is designed for incremental measurement of rotational speed of a turbo charger.

The inductive sensor consists of a bar magnet with a soft magnetic pole pin supporting an induction coil with two connections. When a ferromagnetic ring gear turns past this sensor, it generates a voltage in the coil which is directly proportional to the periodic variation in the magnetic flux. The rotational speed is reflected on a periodic interval between the voltage's zero transition points.

The main benefit of this sensor is robustness, a very compact design and high temperature resistance.

Application	
Application	speed
Target wheel air gap AG	0.5 mm
Operating temp. range (sensing head)	-40 ... 230 °C
Storage temperature range	0 ... 100 °C
Max. vibration	800 m/s² max. 80 h

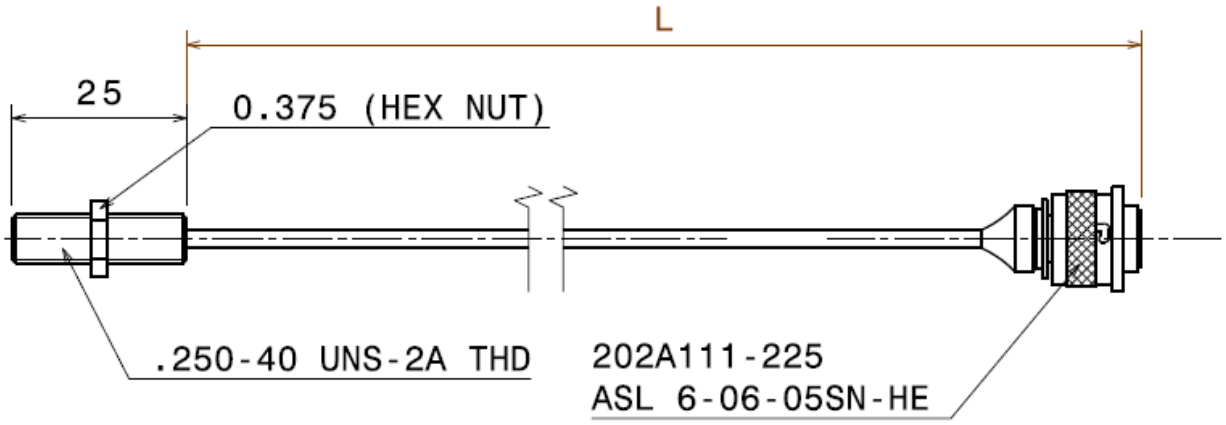
Mechanical Data	
Magnetic pole	round
Bore diameter	6.3 mm
Tightening torque	1.4 Nm
Weight w/o wire	14 g
Installation depth L_2	20 mm

Electrical Data	
Coil resistance	30 Ω
Inductance max.	2.6 mH

Connectors and Wires	
Connector	ASL 6-06-05SN-HE
Mating connector	ASL 0-06-05PN-HE
Pin 1	-
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	Scr
Various motorsport and automotive connectors available on request.	
Sleeve	DR-25
Wire	AWG 24
Wire length L	10 ... 100 cm
Please specify the required wire length with your order.	

Application Hint
This inductive speed sensor IS-T is developed for wheels made of ferromagnetic material by turbo charger.
If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.
Please contact our technical consultancy for more information.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Speed Sensor IS-T	**B 261 209 662**



Hall-Effect Speed Sensor HA-M

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft, crankshaft or wheelspeed).

Due to the rotation of a ferromagnetic target wheel in front of the HA-M, the magnetic field is modulated at the place of the Hall probe. A Hall-effect sensor element with integrated signal conditioning circuit detects this change and generates a digital output signal. We offer this sensor with two different types of output: Active - high and Active - low.

The main feature and benefit of this sensor is the combination of a high quality production part and robust design with metal housing and spec motorsport connectors.

Application	
Application	speed
Max. frequency	≤ 10 kHz
Target wheel air gap	0.5 ... 1.5 mm
Temperature range	- 40 ... 160 °C
Output type	[1] Active low [2] Active high
External magnetic fields	< 1 mT
Max. vibration	1,200 m/s² @ 10 Hz ... 2 kHz

Mechanical Data	
Weight w/o wire	12 g
Mounting	1 x M6
Bore diameter	11.8 mm
Installation depth L_2	30 mm
Tightening torque	6 Nm

Characteristic	
Accuracy repeatability of the falling edge of tooth	< 4 % (≤ 6 kHz) < 8 % (≤ 10 kHz)
Signal output	0.52 V ... < U_S

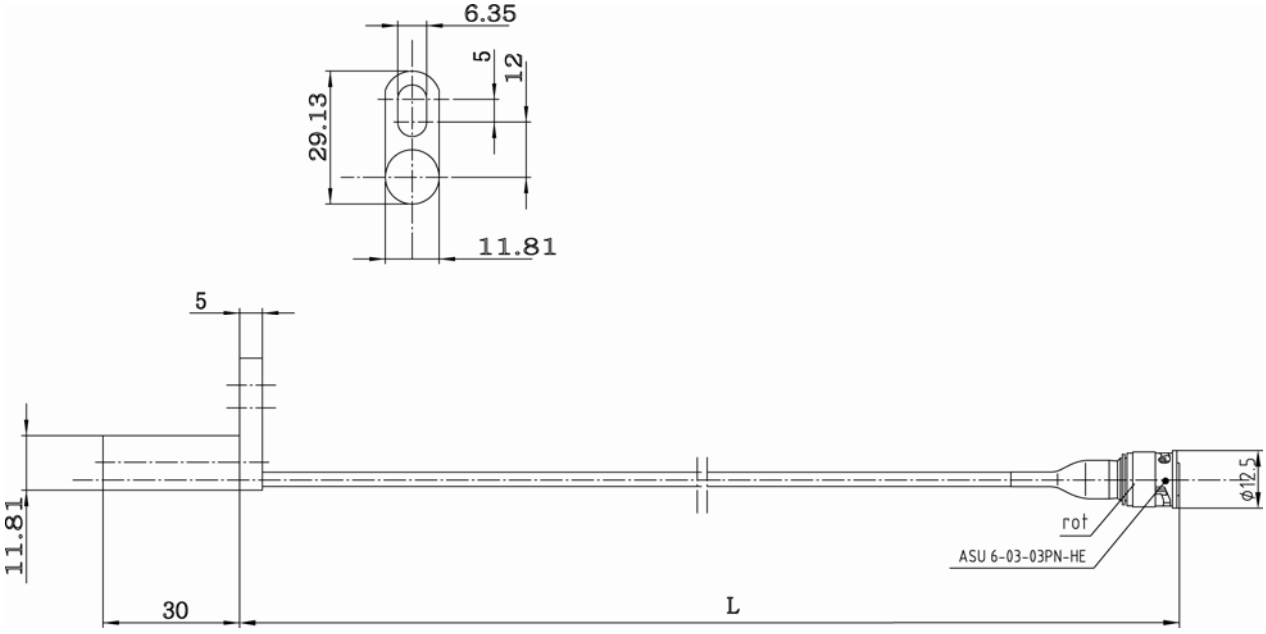
Electrical Data	
Power supply	5 ... 18 V
Current I_S	5 ... 18 mA

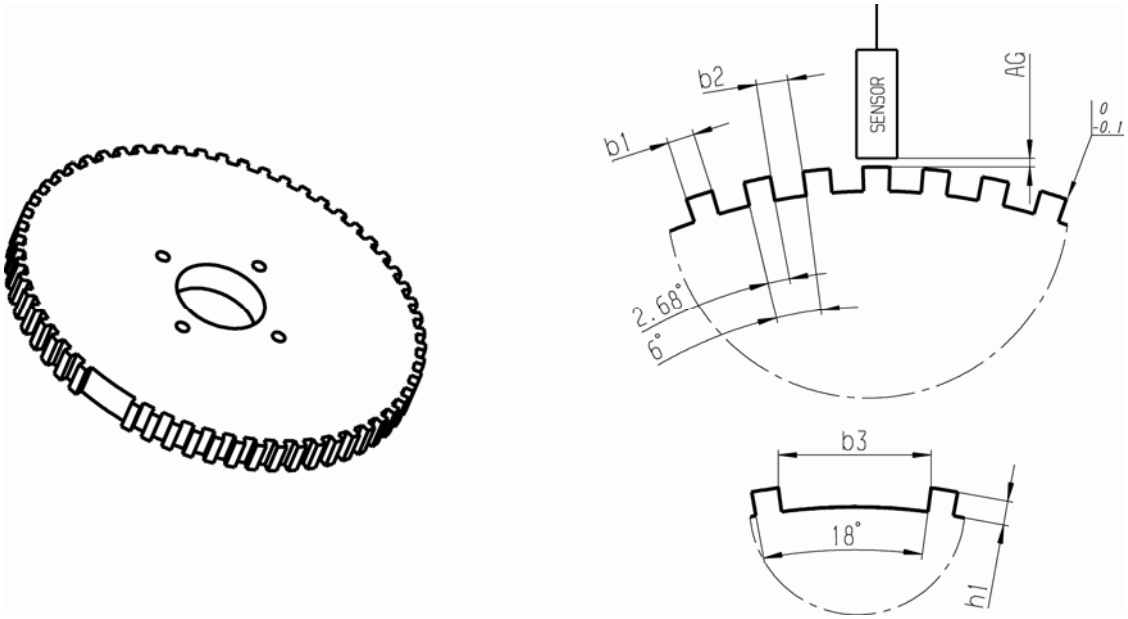
Connectors and Wires	
Connector	ASU 6-03-03PN-HE
Mating connector	ASU 0-03-03SN-HE
Pin 1A	U_S
Pin 2B	Gnd
Pin 3C	Sig
Various motorsport and automotive connectors available on request.	
Sleeve	DR-25
Wire size	AWG 24
Wire length	15 ... 100 cm
Please specify the required wire length with your order.	

Environment	
Target wheel diameter D	162.34 mm
Thickness t	12.5 mm
Width of teeth b1	3.8 mm
Width of gap b2	4.7 mm
Width of sync. gap b3	20.79 mm
Depth of teeth h	3.4 mm
Number of teeth	60-2

Application Hint
The HA-M can be connected directly to most control units and data logging systems.
Please avoid abrupt temperature changes.
For mounting please use only the integrated lug.
If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.
Please ensure that the environmental conditions do not exceed the sensor specifications.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Numbers	
Speed sensor HA-M	**[1] B 261 209 283-01**
Speed sensor HA-M	**[2] B 261 209 295-01**




b2
SENSOR
AG
0
-0.1
b1
2.68°
6°
b3
18°
h1

Hall-Effect Speed Sensor HA-P

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft, crankshaft or wheelspeed).

Due to the rotation of a ferromagnetic target wheel in front of the HA-P, the magnetic field is modulated at the place of the Hall probe. A hall-effect sensor element with integrated signal conditioning circuit detects this change and generates a digital output signal.

The main feature and benefit of this sensor is the combination of a high quality production part and robust design with metal housing.

Application	
Application	speed
Max. frequency	≤ 10 kHz
Target wheel air gap	0.5 ... 1.4 mm
Temperature range	- 40 ... 150 °C
Max. vibration	1,000 m/s² @ 10 Hz ... 2 kHz

Mechanical Data	
Weight w/o wire	70 g
Mounting	with screw 1 x M6
Bore diameter	18 mm
Installation depth L_2	24 mm
Tightening torque	8 Nm

Characteristic	
Accuracy repeatability of the falling edge of tooth	< 1.5 % (≤ 6 kHz) < 2 % (≤ 10 kHz)
Signal output	0.4 V ... < U_S

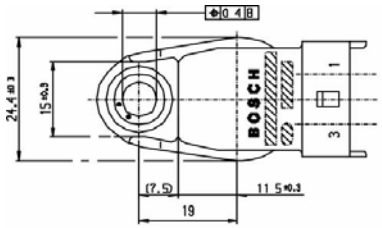
Electrical Data	
Power supply	4.5 ... 24 V
Current I_S	10 mA

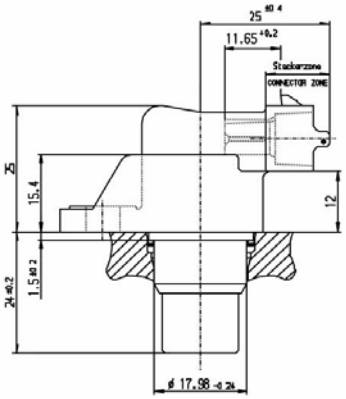
Connectors and Wires	
Connector	1 928 404 227
Mating connector	D 261 205 335
Pin 1A	Gnd
Pin 2B	Sig
Pin 3C	U_S
Pin 4D	-
Pin 5E	-

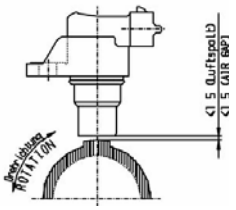
Environment	
Target wheel diameter D	162.34 mm
Thickness t	12.5 mm
Width of teeth b1	3.8 mm
Width of gap b2	4.7 mm
Width of sync. gap b3	20.79 mm
Depth of teeth h	3.4 mm
Number of teeth	60-2

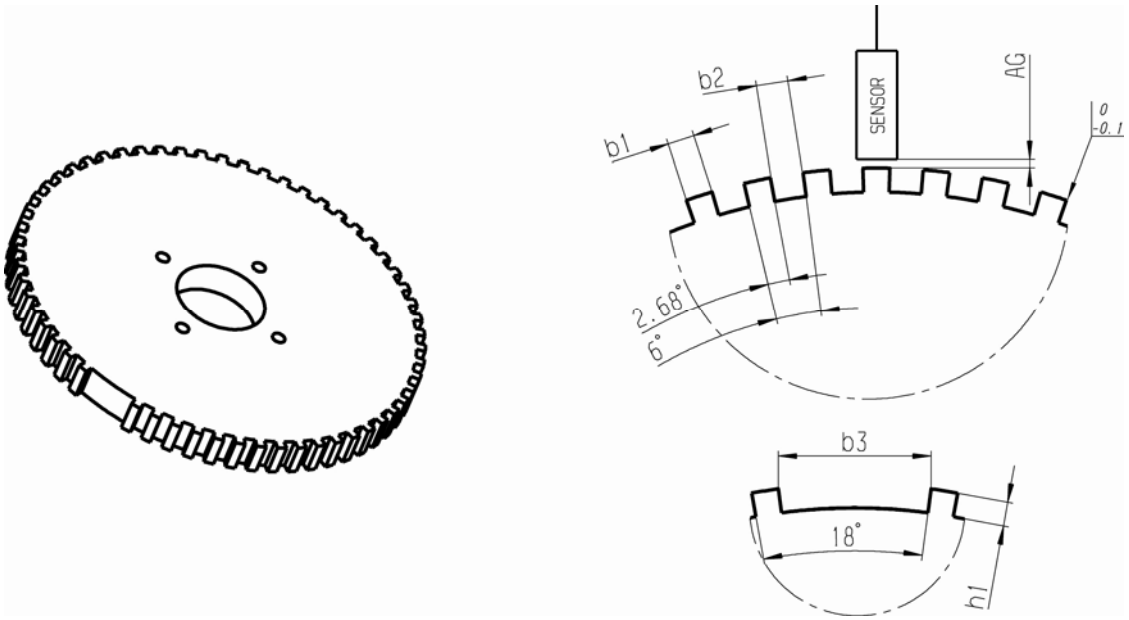
Application Hint
The HA-P can be connected directly to most control units and data logging systems.
Please avoid abrupt temperature changes.
For mounting please use only the integrated lug.
If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.
Please ensure that the environmental conditions do not exceed the sensor specifications.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Numbers	
Speed sensor HA-P	**0 232 103 037**









Hall-Effect Speed Sensor Mini-HA-P

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft, crankshaft or wheelspeed).

Due to the rotation of a ferromagnetic target wheel in front of the Mini-HA-P, the magnetic field is modulated at the place of the Hall probe. A Hall-effect sensor element with integrated signal conditioning circuit detects this change and generates a digital output signal.

The main feature and benefit of this sensor is the combination of a high quality production part and robust design with a very small housing.

Application	
Application	speed
Max. frequency	≤ 10 kHz
Target wheel air gap	0.2 ... 1.5 mm
Temperature range	-40 ... 150 °C
Output type	Active low
External magnetic fields	≤ 0.3 mT
Max. vibration	1,200 m/s² @ 10 Hz ... 2 kHz

Mechanical Data	
Weight w/o wire	19.2 g
Mounting	with screw 1 x M6
Bore diameter	11.5 mm
Installation depth L_2	9 mm
Tightening torque	8 Nm

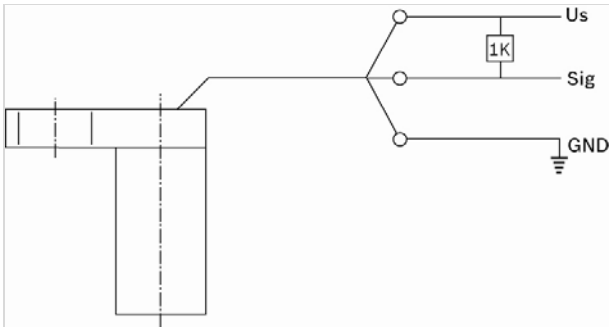
Characteristic	
Accuracy repeatability of the falling edge of tooth	< 3 % (≤ 6 kHz) < 5 % (≤ 10 kHz)
Signal output	0.4 V ... < U_S

Electrical Data	
Power supply	5 ... 18 V
Current Is	10 mA

Connectors and Wires	
Connector	[1] ASL 6-06-05PC-HE [2] 1 928 404 227
Mating connector	[1] ASL 0-06-05SC-HE [2] D 261 205 335
Pin 1	[1] U_S [2] Gnd [3] U_S red
Pin 2	[1] Gnd [2] Sig [3] Sig green
Pin 3	[1] Sig [2] U_S [3] Gnd black
Pin 4	[1] -
Pin 5	[1] -
Various motorsport and automotive connectors available on request.	
Sleeve	HT cable ø 5.2 mm
Wire size	AWG 20
Wire length L	< 27 cm
Please specify the required wire length with your order.	

Environment	
Target wheel diameter D	162.34 mm
Thickness t	12.5 mm
Width of teeth b1	3.8 mm
Width of gap b2	4.7 mm
Width of sync. gap b3	20.79 mm
Depth of teeth h	3.4 mm
Number of teeth	60-2

Required Connection



Application Hint

The Mini-HA-P can be connected directly to most control units and data logging systems.

Please avoid abrupt temperature changes.

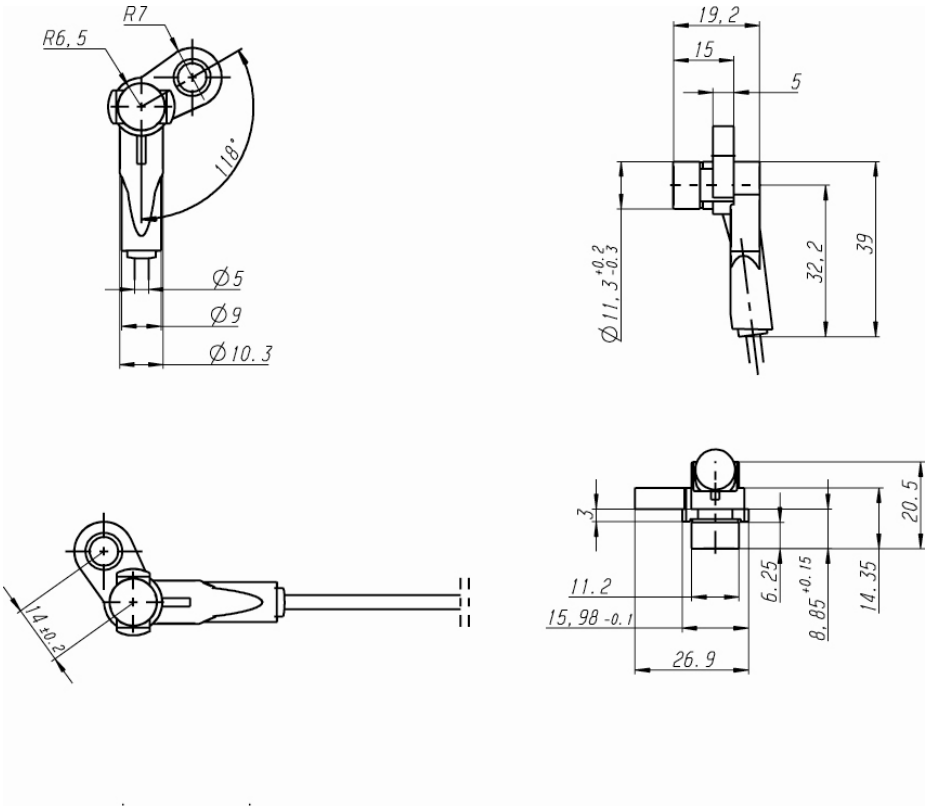
For mounting please use only the integrated lug.

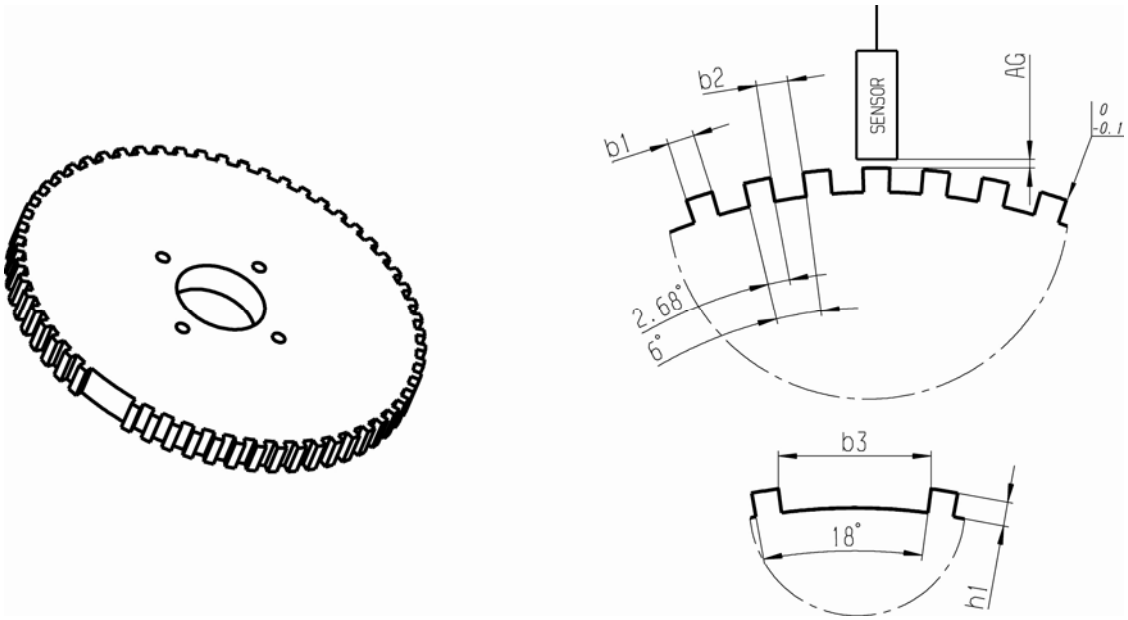
If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.

Please ensure that the environmental conditions do not exceed the sensor specifications.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Speed Sensor Mini-HA-P [1]	**F 02U V00 258-01**
Speed Sensor Mini-HA-P [2]	**F 02U V00 299-01**
Speed Sensor Mini-HA-P [3]	**F 02U 002 407-01**




b2
SENSOR
AG
0
-0.1
b1
2.68°
6°
b3
18°
h1

Hall-Effect Speed Sensor HA-D 90

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft, crankshaft or wheelspeed).

Due to the rotation of a ferromagnetic target wheel in front of the HA-D, the magnetic field is modulated at the place of the Hall probe.

The main feature and benefit of this sensor is a very good detection of the falling edge, due to a differential measuring method. This sensor is a combination of a high quality production part and robust design with a small housing.

Application	
Application	speed
Max. frequency	≤ 10 kHz
Target wheel air gap AG	0.4 ... 1.0 mm
Temperature range	-40 ... 150 °C
Output type	Active high
External magnetic fields	≤ 50 mT
Max. vibration	1,200 m/s² @ 10 Hz ... 2 kHz

Connectors and Wires	
Connector	ASL 6-06-05PC-HE
Mating connector	ASL 0-06-05SC-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Various motorsport and automotive connectors available on request.	
Sleeve	DR-25
Wire size	AWG 24
Wire length L	15 ... 100 cm
Please specify the required wire length with your order.	

Mechanical Data	
Weight w/o wire	12 g
Mounting	with screw 1 x M6
Bore diameter	11.8 mm
Installation depth L_2	30 mm
Tightening torque	6 Nm

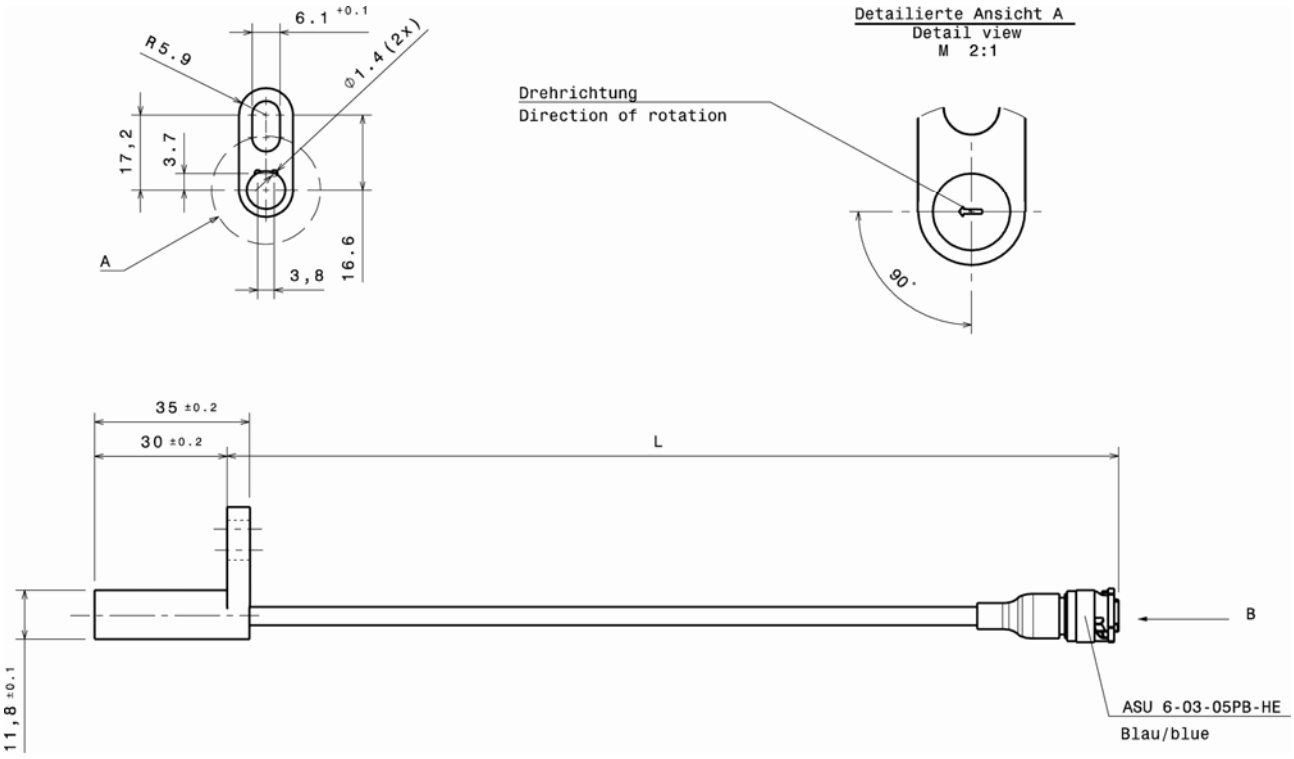
Electrical Data	
Power supply	5 ... 18 V
Current I_S	20 mA

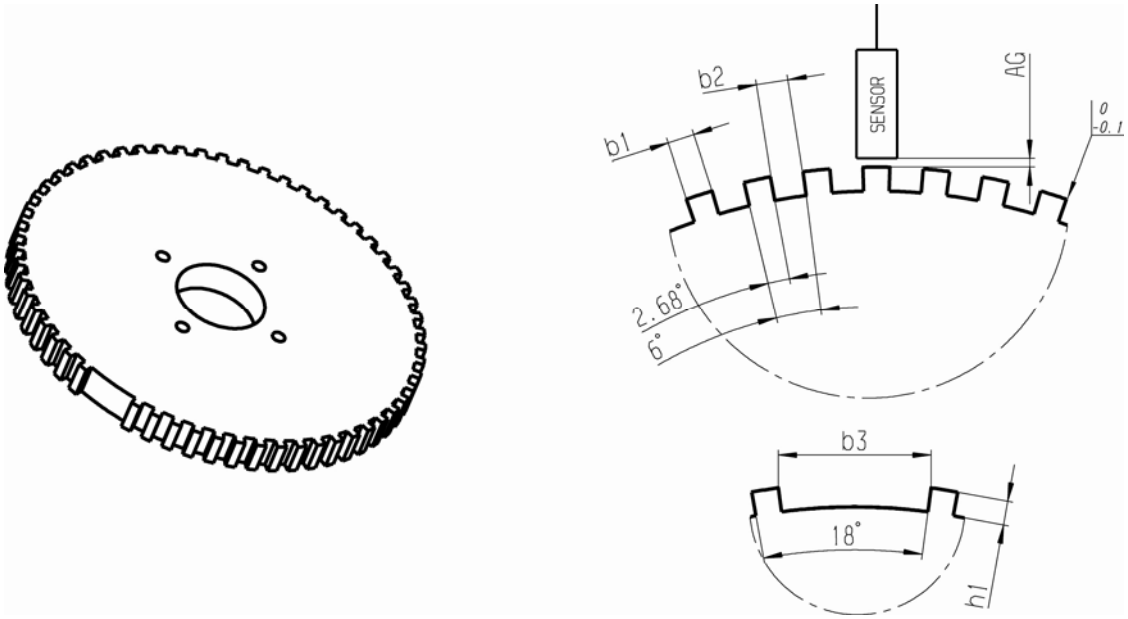
Characteristic	
Accuracy repeatability of the falling edge of tooth	< 1.0 % (≤ 6 kHz) < 1.5 % (≤ 10 kHz)
Signal output	0.52 V... < U_S

Environment	
Target wheel diameter D	162.34 mm
Thickness t	12.5 mm
Width of teeth b1	3.8 mm
Width of gap b2	4.7 mm
Width of sync. gap b3	20.79 mm
Depth of teeth h	3.4 mm
Number of teeth	60-2

Application Hint
The HA-D can be connected directly to most control units and data logging systems
Please specify the angle between the mounting and the target wheel.
Please avoid abrupt temperature changes.
For mounting please use only the integrated lug.
If a wheel with different dimensions is used (see Environment), the technical function has to be tested individually.
Please ensure that the environmental conditions do not exceed the sensor specifications.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Speed Sensor HA-D 90	**F 02U V00 334-01**




b2
SENSOR
AG
0
-0.1
b1
2.68°
6°
b3
18°
h1

Temperature Sensors

Temperature Sensor NTC M6

This sensor is designed to measure the fluid temperatures of oil, water, fuel e.g. For example, this signal is used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

The NTC-resistor has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises and the resistance decreases. The NTC-sensor is a lacquer-coated thermistor disk which is connected via a copper-clad Fe wire to a AWG 24 cable. To achieve a perfect temperature measurement, the thermistor is molded into a high performance heat paste.

The main benefit of the sensor is the combination of both high quality production part and a robust, compact design.

Application	
Application	-55 ... 125 °C
Storage Temperature Range	0 ... 100 °C
Max. Vibration	800 m/s², 5 ... 500 Hz

Electrical Data	
Characteristic	NTC
Max. Power @ 25 °C	200 mW
Nominal Resistance @ 25 °C	15 kOhm

Mechanical Data	
Male Thread	M6x1
Wrench Size	10 mm
Installation Torque	3 Nm
Weight w/o Cable	8,5 g
Sealing	4,47 x 1,78 mm

Characteristic	
Accuracy @ 25 °C	± 1,1 °C
Accuracy @ 100 °C	± 4,4 °C
Relative Resistance Tolerance @ 25 °C	± 5 %
Response Time τ_{63} in still water	< 9 s

Characteristic Application

T [°C]	R [Ω]
-55	1.493.300
-35	366.720
-20	145.880
-10	83.317
0	49.254
10	29.959
20	18.732
25	15.000
30	12.012
40	7.894
50	5.356
60	3.651
70	2.545
80	1.804
90	1.301
100	945
110	704
120	528
125	460

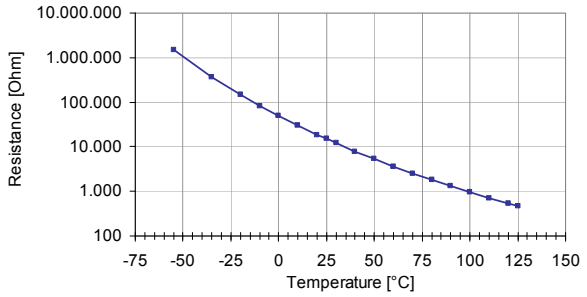
Application Hint

The NTC M6 can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kOhm).

Any mounting orientation is possible.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

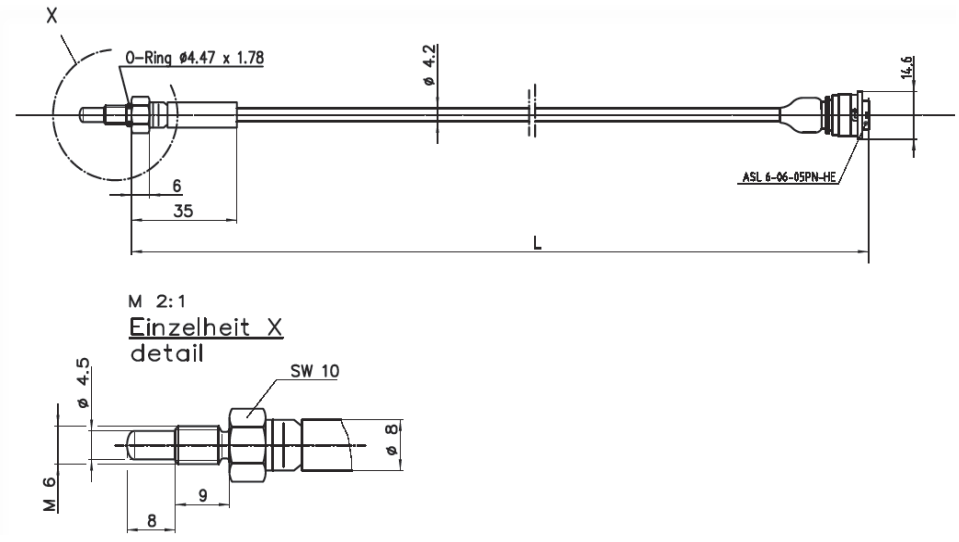


Connectors and Cables

Connector	ASL 6-06-05PN-HE
Connector Loom	ASL 0-06-05SN-HE
Pin 1	-
Pin 2	GND
Pin 3	SIG
Pin 4	-
Pin 5	-
Various military and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 50 cm
Please specify the requested cable length with your order.	

Part Number

Temperature Sensor NTC M6	**B 261 209 386-01**



Temperature Sensor NTC M6-H

This sensor is designed to measure high temperatures of air, oil, water, fuel e.g. For example, this signal is used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

The NTC-resistor has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises and the resistance decreases. The NTC-sensor is a lacquer-coated thermistor disk which is connected via a copper-clad Fe wire to an AWG 24 cable. To achieve a perfect temperature measurement, the thermistor is moulded into a high performance heat past.

The main benefit of the sensor is the combination of both high quality production part and a robust, compact design. It is especially designed to measure high temperatures (up to 300 °C).

Application	
Application	-25 ... 300 °C
Storage temperature range	0 ... 100 °C
Max. vibration	800 m/s², 5 ... 500 Hz

Electrical Data	
Characteristic	NTC
Max. power at 25 °C	200 mW
Nominal resistance @ 25 °C	49.12 kΩ

Mechanical Data	
Male thread	M6x1
Wrench size	10 mm
Installation torque	3 Nm
Weight w/o cable	8,5 g
Sealing	4.47 mm x 1.78 mm

Characteristic	
Accuracy @ 25 °C	± 1.84 °C
Accuracy @ 100 °C	± 1.5 °C
Relative resistance tolerance @ 25 °C	8 %
Response time τ_{63} in still water	< 7 s

Characteristic Application

T [°C]	R [Ω]
-25	657,350
-15	365,040
0	162,210
10	98,322
25	49,120
40	26,065
60	12,140
80	6,119
100	3,300
120	1,885
140	1,132
160	710
180	463
200	312
220	217
240	155
260	113
280	85
300	64

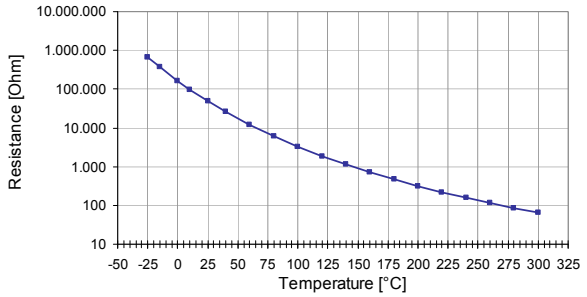
Application Hint

The NTC M6-H can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kΩ).

Any mounting orientation is possible.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

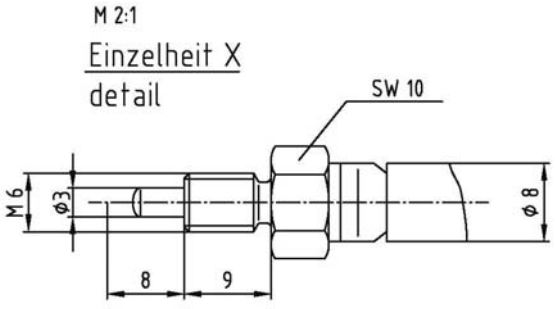


Connectors and Cables

Connector	ASL 6-06-05PN-HE
Mating connector	ASL 0-06-05SN-HE
Pin 1	-
Pin 2	GND
Pin 3	SIG
Pin 4	-
Pin 5	-
Various motorsport and automotive connectors on request.	
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 50 cm
Please specify the requested cable length with your order.	

Part Number

NTC M6-H	**B 261 209 989-01**



Temperature Sensor NTC M8

This sensor is designed to measure the fluid temperatures of oil, water, fuel e.g. For example, this signal is used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

The NTC-resistor has a negative temperature coefficient; this means, that with increasing temperature the conductivity rises and the resistance decreases. The NTC-sensor is a lacquer-coated thermistor disk which is connected via a copper-clad Fe wire to an AWG 24 cable. To achieve a perfect temperature measurement, the thermistor is moulded into a high performance heat paste.

The main benefit of the sensor is the combination of both high quality production part and a robust, compact design.

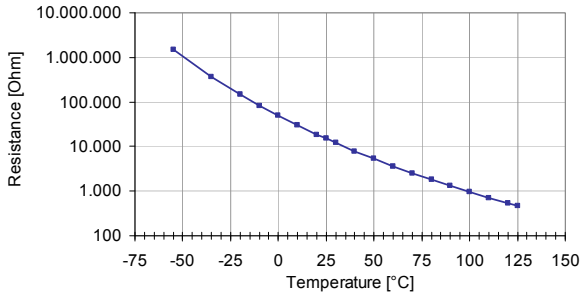
Application	
Application	-55 ... 125 °C
Storage Temp. Range	0 ... 100 °C
Max. Vibration	800 m/s², 5 ... 500 Hz

Electrical Data	
Characteristic	NTC
Max. Power at 25 °C	200 mW
Nominal Resistance @ 25 °C	15 kΩ

Mechanical Data	
Male Thread	M8x1
Wrench Size	12 mm
Installation Torque	3 Nm
Weight w/o Cable	10 g
Sealing	6.35 x 1.78 mm

Characteristic	
Accuracy @ 25 °C	± 1.1 °C
Accuracy @ 100 °C	± 4.4 °C
Relative Resistance Tolerance	± 5 %
Response Time τ_{63} in still water	< 11 s

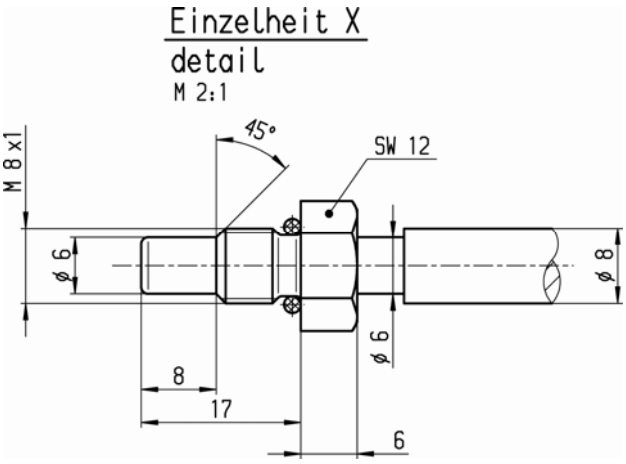
Characteristic Application	
T [°C]	R [Ω]
-55	1.493.300
-35	366.720
-20	145.880
-10	83.317
0	49.254
10	29.959
20	18.732
25	15.000
30	12.012
40	7.894
50	5.356
60	3.651
70	2.545
80	1.804
90	1.301
100	945
110	704
120	528
125	460



Connectors and Cables	
Connector	ASL 6-06-05PN-HE
Connector Loom	ASL 0-06-05SC-HE
Pin 1	-
Pin 2	Sig-
Pin 3	Sig+
Pin 4	-
Pin 5	-
Various motorsport and automotive connectors on request.	
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 50 cm
Please specify the requested cable length with your order.	

Application Hint
The NTC M8 can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kΩ).
Any mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
NTC M8	**B 261 209 384-01**



Temperature Sensor NTC M12

This sensor is designed to measure the fluid temperatures of oil, water, fuel e.g. For example, this signal is used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

The NTC-resistor has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises. The conductive element of the temperature sensor is made of semiconducting heavy metal oxide and oxidized mixed crystals, which are equipped with a protective housing.

The main benefit of the sensor is the combination of both high quality production part and a robust, compact design. Furthermore the sensor is available with a series or military spec connector.

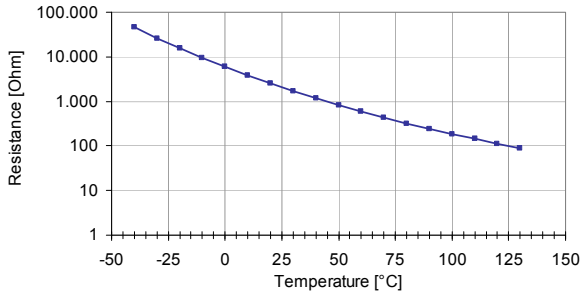
Application	
Application	-40 ... 130 °C
Storage Temp. Range	0 ... 100 °C
Max. Vibration	600 m/s^2

Electrical Data	
Characteristic	NTC
Nominal Resistance @ 20 °C	2,5 kΩ ± 5 %

Mechanical Data	
Male Thread	M12x1,5
Wrench Size	19 mm
Installation Torque	25 Nm
Weight w/o Cable	29 g

Characteristic	
Accuracy @ 25 °C	± 1,4 °C
Accuracy @ 100 °C	± 3,4 °C
Response Time τ_{63} in still water	< 15 s

Characteristic Application	
T [°C]	R [Ω]
-40	45.313
-30	26.114
-20	15.462
-10	9.397
0	5.896
10	3.792
20	2.500
30	1.707
40	1.175
50	834
60	596
70	436
80	323
90	243
100	187
110	144
120	113
130	89



Connectors and Cables	
Connector	Bosch Jetronic
Connector Loom	D 261 205 288
Pin 1	SIG+
Pin 2	SIG-
Pin 3	-
Pin 4	-
Pin 5	-
Various military and automotive connectors on request.	

Application Hint

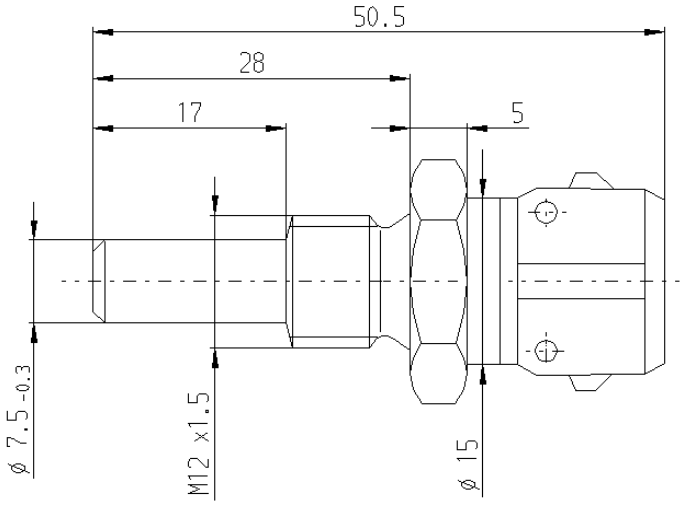
The NTC M12 can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kΩ).

Each mounting orientation is possible.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
NTC M12	**0 280 130 026**



Temperature Sensor NTC M12-H

This sensor is designed to measure the temperature of oil, water, fuel, air e.g. For example, this signal is used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

The NTC-resistor has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises. The conductive element of the temperature sensor is made of semi conducting heavy metal oxide and oxidized mixed crystals, which are equipped with a protective housing.

The main benefit of the sensor is the combination of both high quality production part and a robust, compact design. It also provides a short response time.

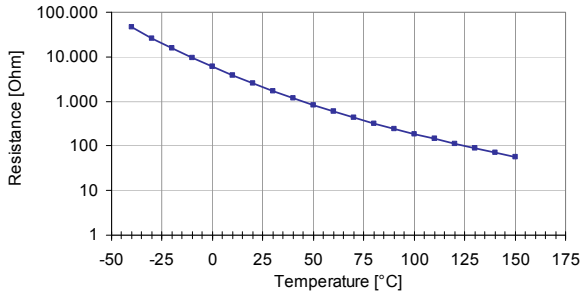
Application	
Application	-40 ... 150 °C
Storage Temperature Range	-30 ... 60 °C
Max. Vibration	300 m/s²

Electrical Data	
Characteristic	NTC
Nominal Resistance ±5 %	2,5 kΩ @ 20 °C

Mechanical Data	
Male Thread	M12x1,5
Wrench Size	19 mm
Installation Torque	18 Nm
Weight w/o Cable	28,3 g
Sealing	Al-washer

Characteristic	
Accuracy @ 25 °C	±1,4 °C
Accuracy @ 100 °C	±0,8 °C
Response Time τ_{63} in still water	< 15 s

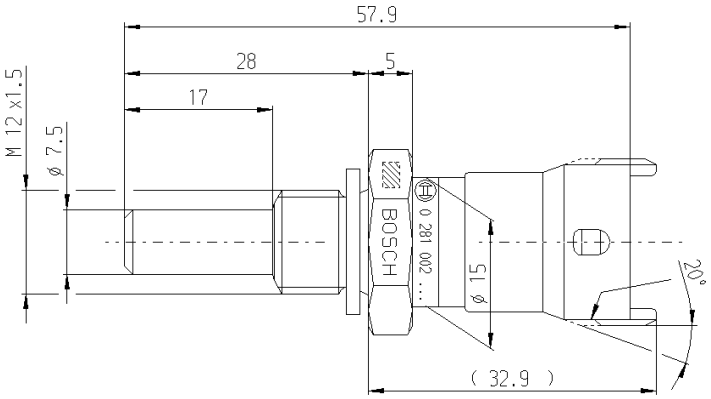
Characteristic Application	
T [°C]	R [Ω]
-40	45.313
-30	26.114
-20	15.462
-10	9.397
0	5.896
10	3.792
20	2.500
30	1.707
40	1.175
50	834
60	596
70	436
80	323
90	243
100	187
110	144
120	113
130	89
140	71
150	57



Connectors and Cables	
Connector	Bosch Compact
Connector Loom	D 261 205 337
Pin 1	Sig+
Pin 2	Sig-
Various military and automotive connectors on request.	

Application Hint
The NTC M12-H can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kΩ).
Each mounting orientation is possible.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number	
NTC M12-H	**0 281 002 170**



Temperature Sensor NTC M12-L

This sensor is designed to measure the temperature of air. For example, this signal is used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

The NTC-resistor has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises. The conductive element of the temperature sensor is made of semiconducting heavy metal oxide and oxidized mixed crystals, which are equipped with a protective housing.

The main benefit of the sensor is the combination of both high quality production part and a robust, compact design. It also provides a short response time.

Application	
Application	-30 ... 60 °C
Storage Temperature Range	-30 ... 60 °C
Max. Vibration	300 m/s², 50 ... 250 Hz

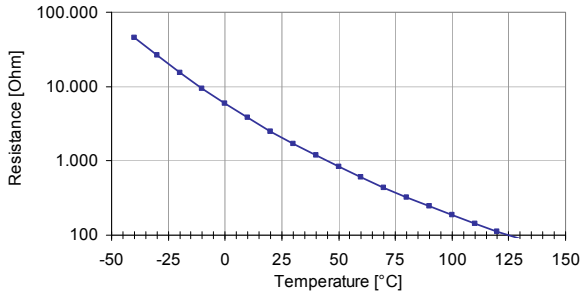
Electrical Data	
Characteristic	NTC
Nominal Resistance ±5 %	2,5 kΩ @ 20 °C

Mechanical Data	
Male Thread	M12x1,5
Wrench Size	19 mm
Installation Torque	15 Nm
Weight w/o Cable	24,6 g

Characteristic	
Accuracy @ 25 °C	±1,4 °C
Accuracy @ 100 °C	±3,4 °C
Response Time τ_{63} in still water	< 10 s

Characteristic Application

T [°C]	R [Ω]
-40	45.313
-30	26.114
-20	15.462
-10	9.397
0	5.896
10	3.792
20	2.500
30	1.707
40	1.175
50	834
60	596
70	436
80	323
90	243
100	187
110	144
120	113
130	89
140	71



Connectors and Cables

Connector	Bosch Compact
Connector Loom I	D 261 205 289
Pin 1	Sig+
Pin 2	Sig-

Various military and automotive connectors on request.

Application Hint

The NTC M12-L can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kΩ).

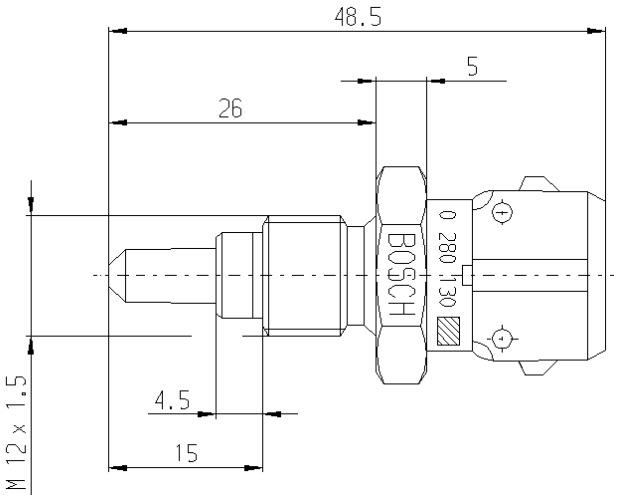
Each mounting orientation is possible.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number

NTC M12-L	**0 280 130 039**



Temperature Sensors Infrared

Temperature Sensor Infrared TI-16-r / TI-16-s

This infrared temperature sensor is designed for a non contact surface temperature measurement of various parts (e.g. tires, brake discs, and cylinder heads) based on IR radiation.

Using ruggedized silicon-coated optics, internal electronics and cabling packaged inside a stainless steel housing, this sensor measures the emitted infrared radiation of an object and calculates its temperature. The output signal has a linear characteristic (temperature vs. output voltage).

The main features of this sensor are its compact size, robust design, and high signal quality at a low cost. In addition, it offers the ability to change the temperature range, the output voltage and emissivity by request.

Application	
Application	0 ... 160 °C
Operating Temp. Range (sensing head)	-20 ... 120 °C
Operating Temp. Range (electronics)	-20 ... 70 °C
Storage Temperature Range	-40 ... 85 °C
Relative Humidity	10 ... 95 %
Max. Vibration any axis	3 m/s² @ 11 ... 200 Hz 50 m/s², 11 ms shock

Mechanical Data	
Male Thread	M12x1 mm
Wrench Size	14 mm
Length Housing	28 mm
Weight with Cable 1 m	42 g

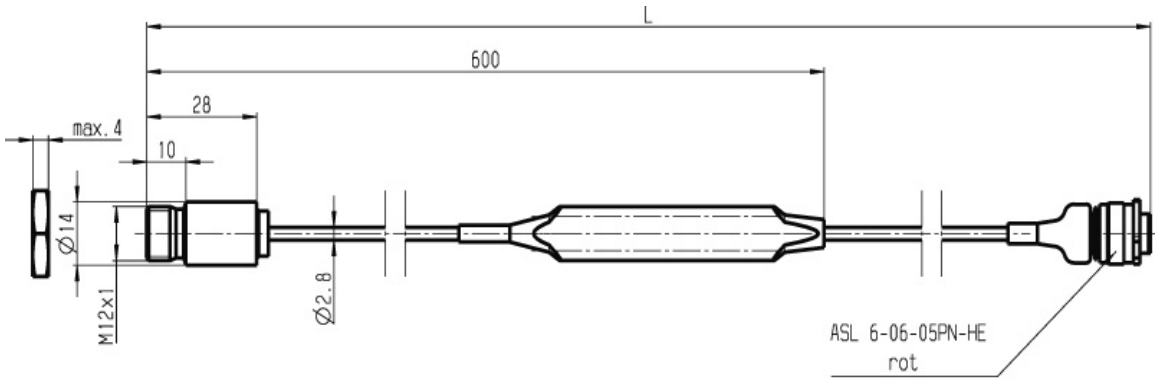
Electrical Data	
Power Supply U_S	5 ... 28 V
Max Power Supply U_S	28 V
Full Scale Output U_A	0 ... 5 V
Current I_S	9 mA

Characteristic	
Emissivity (predefined)	[1] 0,95 (rubber) [2] 0,80 (steel)
Optical Resolution	10 : 1
Spectral Range	8 ... 14 µm
Compensated Range	-20 ... 120 °C
Temperature resolution @ T_{obj} < 100 °C	0,1 °C
System Accuracy @ 23 °C t_{amb}, or max. value	± 1,5 °C or 1,5 %
Repeatability @ 23 °C t_{amb}, or max. value	± 0,75 °C or 0,75 %
Sensitivity	31,25 mV/°C
Offset	0 mV

Connectors and Cables	
Connector	ASL 6-06-05PN-HE
Connector Loom	ASL 0-06-05SN-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	Prg
Pin 5	Scr
Various military and automotive connectors on request.	
Sleeve	Viton
Cable Size	AWG 26
Cable Length L	70 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint
The TI-16 can be connected directly to most control units and data logging systems.
The temperature measurement range can be changed anywhere in the range of -20 °C to 1000 °C per request.
The emissivity can be changed by request.
The predefined emissivity can differ from the real emissivity.
To determine the emissivity, please contact Bosch Motorsport for assistance.
The sensor is protected against reverse polarity and short-circuit.
Sensor can be mounted in any orientation.
Do not disconnect the electronics housing from the sensor.
The sensor meets the EMV qualification 89/336/EWG.
Please avoid abrupt temperature changes.
For mounting please use only the integrated thread.
Please ensure that the environmental conditions do not exceed the sensor specifications.
To clean the lens use only a soft, wet (water or water based glass cleaner) cloth -> NO DISSOLVER cleaner!
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Numbers	
TI-16-r [1]	**F 01T A21 207**
TI-16-s [2]	**F 01T A21 209**



Temperature Sensor Infrared TI-100-s / TI-100-c

This infrared temperature sensor is designed for a non contact surface temperature measurement of various parts (e.g. tires, brake discs, and cylinder heads) based on IR radiation.

Using ruggedized silicon-coated optics, internal electronics and cabling packaged inside a stainless steel housing, this sensor measures the emitted infrared radiation of an object and calculates its temperature. The output signal has a linear characteristic (temperature vs. output voltage).

The main features of this sensor are its compact size, robust design, and high signal quality at a low cost. In addition, it offers the ability to change the temperature range, the output voltage and emissivity by request.

Application	
Application	0 ... 1000 °C
Operating Temp. Range (sensing head)	-20 ... 120 °C
Operating Temp. Range	- 20 ... 70 °C (electronics)
Storage Temperature Range	-40 ... 85 °C
Relative Humidity	10 ... 95 %
Max. Vibration any axis	3 m/s² @ 11 ... 200 Hz 50 m/s², 11 ms shock

Mechanical Data	
Male Thread	M12x1 mm
Wrench Size	14 mm
Length Housing	28 mm
Weight with Cable 1 m	42 g

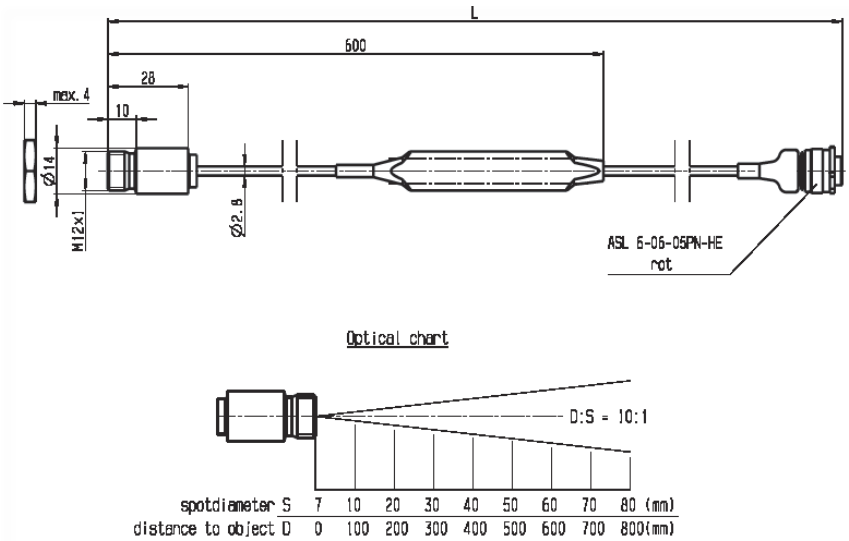
Electrical Data	
Power Supply U_S	5 ... 28 V
Max Power Supply U_S	28 V
Full Scale Output U_A	0 ... 5 V
Current I_S	9 mA

Characteristic	
Emissivity (pre defined)	[1] 0,80 (steel) [2] 0,75 (carbon)
Optical Resolution	10 : 1
Spectral Range	8 ... 14 µm
Compensated Range	-20 ... 120 °C
Temperature resolution @ T_{obj} < 100 °C	0,1 °C
System Accuracy @ 23 °C t_{amb}, or max. value	± 1,5 °C or 1,5 %
Repeatability @ 23 °C t_{amb}, or max. value	± 0,75 °C or 0,75 %
Sensitivity	5 mV/°C
Offset	0 mV

Connectors and Cables	
Connector	ASL 6-06-05PN-HE
Connector Loom	ASL 0-06-05SN-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	Prg
Pin 5	Scr
Various military and automotive connectors on request.	
Sleeve	Viton
Cable Size	AWG 26
Cable Length L	70 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint
The TI-100 can be connected directly to most control units and data logging systems.
The temperature measurement range can be changed anywhere in the range of -20 °C to 1.000 °C per request.
The emissivity can be changed by request.
The predefined emissivity can differ from the real emissivity.
To determine the emissivity, please contact Bosch Motorsport for assistance.
The sensor is protected against reverse polarity and short-circuit.
Sensor can be mounted in any orientation.
Do not disconnect the electronics housing from the sensor.
The sensor meets the EMV qualification 89/336/EWG.
Please avoid abrupt temperature changes.
For mounting please use only the integrated thread.
Please ensure that the environmental conditions do not exceed the sensor specifications.
To clean the lens use only a soft, wet (water or water based glass cleaner) cloth -> NO DISSOLVER cleaner!
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Numbers	
TI-100-s (steel) [1]	**F 01T A21 210**
TI-100-c (carbon) [2]	**F 01T A21 211**



Thermocouple Probes

Thermocouple Probe TCP-K

This sensor is designed to measure exhaust gas temperatures up to 1,300 °C.

Thermocouples are temperature sensors, which supply a temperature corresponding voltage, due to its thermo electrical behaviour, without any additional external energy. The mantle thermocouple has a metal mantle which includes two inner wires made of thermo material (NiCr-Ni). The wires are isolated.

The main feature and benefit of this sensor is a very quick response time, the combination of high quality production part and robust design with metal housing and motorsports spec connection.

Application	
Application	-200 ... 1,300 °C
Operation Temp. Range of ext. Electronics	-55 ... 125 °C
Max. Vibration	800 m/s² @ 5 ... 500 Hz

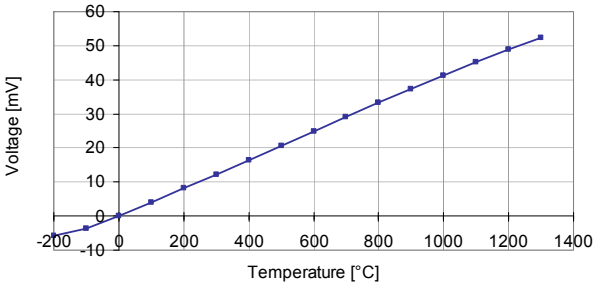
Electrical Data	
Voltage Supply	NiCr/Ni Typ K
Full Scale Output	DIN IEC 584-1

Mechanical Data	
Male Thread	see adapter
Wrench Size	see adapter
Installation Torque	see adapter
Weight w Cable	47 g
Sensor Tip Bend Radius	R 20

Connectors and Cables	
Connector	ASL 6-06-05PD-HE
Connector Loom	ASL 0-06-05SD-HE
Pin 1	-
Pin 2	Sig+
Pin 3	Sig-
Pin 4	-
Pin 5	Src
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 75 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Characteristic Application	
Measuring Range	± 1.5 °C
Response Time	< 4 s

T [°C]	U [mV]
-200	-5.891
-100	-3.554
0	0.000
100	4.096
200	8.138
300	12.209
400	16.397
500	20.644
600	24.905
700	29.129
800	33.275
900	37.326
1,000	41.276
1,100	45.119
1,200	48.838
1,300	52.410



Application Hint

The TCP-K can be connected to Bosch Motorsport ECUs with thermocouple inputs or to external devices, which amplify the sensor voltage.

The sensor can be mounted individually according to the customer request.

The sensor tip is flexible/ bendable and can be fixed by a special adapter (see B 261 209 159).

The length of the sensor tip can be modified on request.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

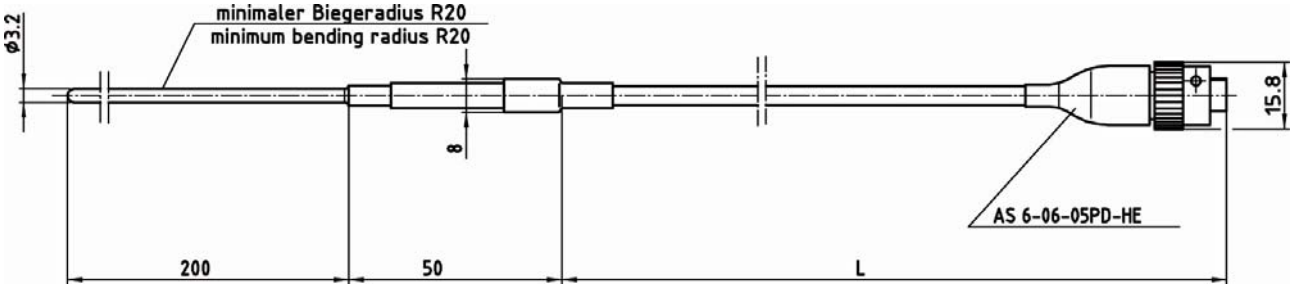
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Accessories

Adapter TCP-K	**B 261 209 159**

Part Number

TCP-K	**B 261 209 385**



Thermocouple Probe TCP-NF

This sensor is designed to measure exhaust gas temperatures up to 1,100 °C.

Thermocouples are temperature sensors, which supply a temperature corresponding voltage, due to it thermoelectrically behaviour, with out any additional external energy. The mantle thermocouple has a metal mantle which includes two inner wires made of thermo material (NiCr-Ni). The wires are isolated. The voltage will be amplified by a integrated electronic, which is powered by 12 V and supplies an output signal from 0 to 5 V.

The main feature and benefit of this sensor is the combination of high quality production part, robust design and the integrated amplifier.

Application	
Application	-40 ... 1,100 °C
Usage temperature range	-40 ... 115 °C
Max. vibration	800 m/s² @ 5... 500 Hz

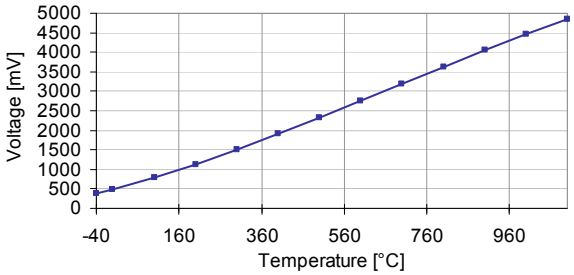
Electrical Data	
Supply voltage Us	12 V
Full scale output	0.5 ... 4.5 V

Mechanical Data	
Male thread	M12x1
Wrench size	17 mm
Installation torque	45 Nm
Weight with wire	110 g
Length	630 mm

Characteristic

Response time	33 s

T [°C]	U [mV]
-40	372
0	485
100	790
200	1,135
300	1,513
400	1,912
500	2,327
600	2,752
700	3,183
800	3,615
900	4,046
1,000	4,473
1,100	4,845



Connectors and Wires

Connector	F 02U B00 292-01
Mating connector	D 261 205 357
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Wire size	AWG 24
Wire length	15 ... 75 cm
Various motorsport and automotive connectors on request.	
Please specify the requested wire length with your order.	

Application Hint

The TCP-NF can be connected to Bosch Motorsport ECUs with a 0 ... 5 V analog signal inputs (w/o pull-up resistor) or to external devices.

The sensor can be mounted individually according to the customer request.

The signal output will be 0 V, if the sensor, the power, or the signal wire failed.

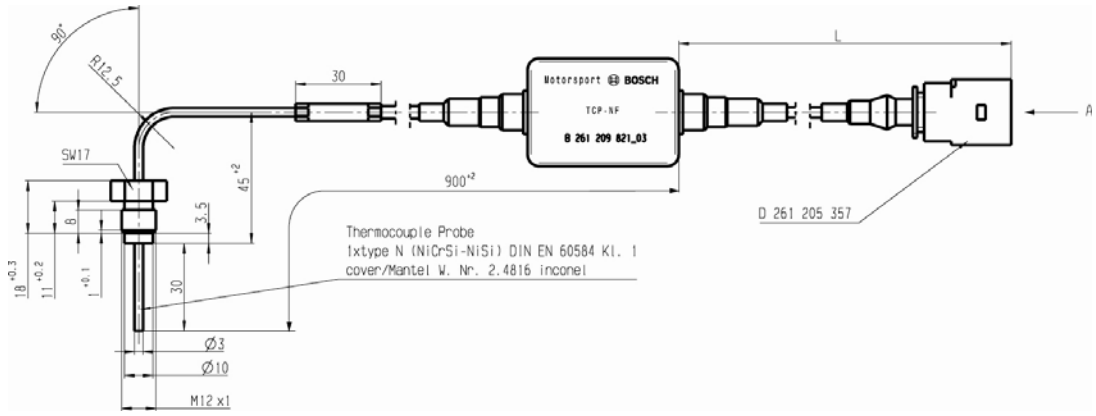
The signal output will be > 5 V, if the ground wire failed, or due to a short cut of the power and signal wire.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number

Thermocouple Probe TCP-NF	**B 261 209 821-03**



Thermocouple Probe TCP-KA

This sensor is designed to measure exhaust gas temperatures up to 1,250 °C.

Thermocouples are temperature sensors which supply a temperature corresponding voltage, due to its thermoelectric behaviour, without any additional external energy source. The thermocouple is made of two thermowires (NiCr-Ni) and housed and isolated in a metal mantle. The thermovoltage will be amplified by an integrated electronic circuit which is powered with 12 V and supplies an output signal from 0 to 5 V.

The main feature and benefit of this sensor is the combination of high quality production part, robust design and its integrated amplifier.

Application	
Application	0 ... 1,250 °C
Operating Temp. Range (ext. electronics)	0 ... 120 °C

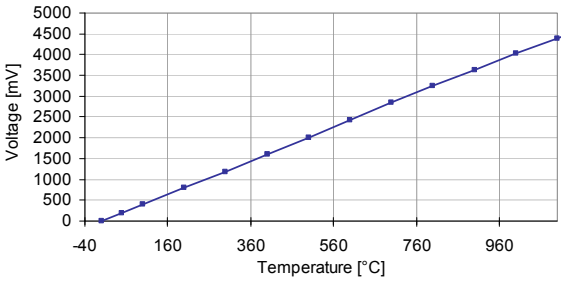
Mechanical Data	
Male Thread	M12x1
Wrench Size	17 mm
Installation Torque	15 Nm
Weight w Cable	85 g
Length	250 mm

Electrical Data	
Voltage Supply	12 V
Full Scale Output	0 ... 5 V

Connectors and Cables	
Connector	F 02U B00 292-01
Connector Loom	D 261 205 357
Pin 1	Sig
Pin 2	Gnd
Pin 3	U_S
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 75 cm
Various motorsport and automotive connectors on request.	
Please specify the requested cable length with your order.	

Characteristic Application	
Measuring Range	0 ... 1,250 °C
Response Time	20 s

T [°C]	U [mV]
0	0
50	197
100	399
200	793
300	1,190
400	1,598
500	2,012
600	2,427
700	2,839
800	3,243
900	3,638
1,000	4,022
1,100	4,396
1,200	4,759
1,250	5,000



Application Hint

The TCP-KA can be connected to Bosch Motorsport ECUs with a 0 ... 5 V analog signal input (w/o pull-up resistor) or to external data logging devices.

The sensor can be mounted individually according to the customers request.

Recommended bending radius of the cable is no less than 15 ... 20 mm to ensure the sensor works properly and for a longer lifespan of the sensor.

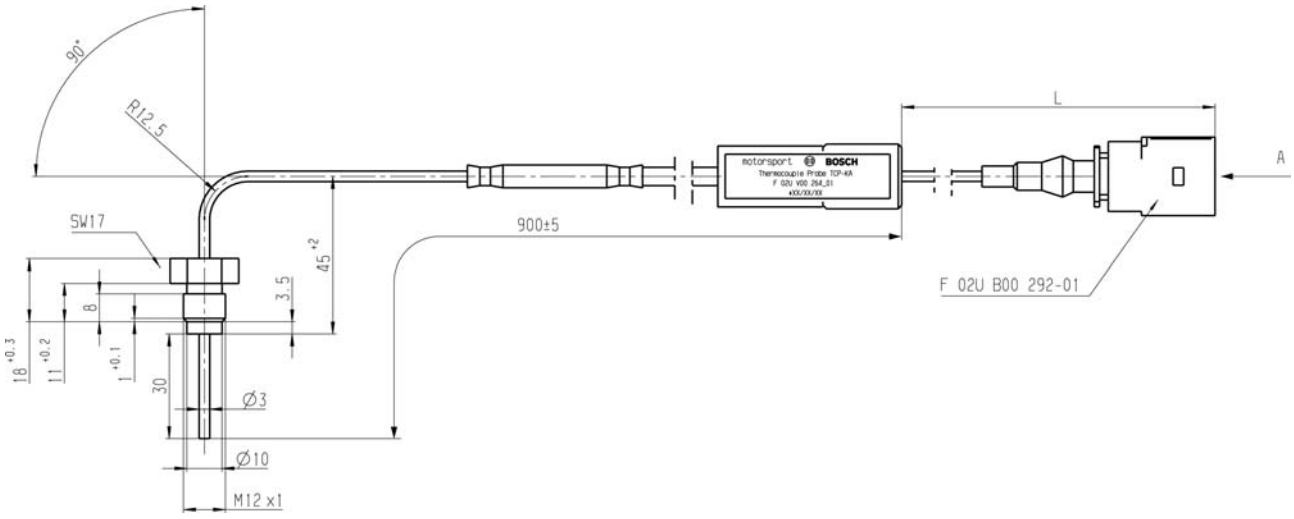
Please note that the electronics operating temperature is from 0 to 120 °C.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Free download of the sensor configuration file (*.sdf) for Bosch Data Logging System (http://www.bosch-motorsport.com).

Part Number

TCP-KA	**F 02U V00 264-01**


90°
R12.5
SW17
900±5
L
A
F 02U B00 292-01
motorsport
BOSCH
Thermocouple Probe TCP-KA
F 02U V00 254_01
8
3.5
45 +2
18 +0.3
11 +0.2
1 +0.1
30
Ø3
Ø10
M12 x1

Wire Potentiometers

Wire Potentiometer WP 35

The WP 35 is a wire potentiometer which is designed to measure position, direction, or rate of motion of moving mechanical components.

This sensor converts mechanical movement into electrical signal using a stainless steel cable wounded on a threaded drum that is coupled to a precision rotary sensor. Hence the electrical output is proportional to the distance travelled.

The advantage of this WP is its compact style which allows for flexible and easy installation. Due to its small size, precise measurement is possible even in difficult applications.

Application	
Application	0 ... 38 mm
Temperature range	-65 ... 125 °C
Max. cable acceleration	290 m/s²
Max. cable tension	1.7 N
Shock	1,000 m/s² for 6 ms
Vibration	150 m/s² @ 10 ... 2,000 Hz

Electrical Data	
Power supply	5 V
Power supply max.	35 V
Nominal resistance	5 kΩ
Resistance tolerance	10 %
Non-linearity	1 %
Max. current	12 mA

Mechanical Data	
Weight w/o cable	15 g
Possible mechanical range	38.1 mm
Mounting	2 x 2-56 UNC
Tightening torque	2.5 Nm
Life expectancy	5 x 10⁶ cycles
Protection	IP54
Dimensions	19.1 x 19.1 x 9.7 mm

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 45 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The WP 35 can be connected directly to most electronic control units and data logging systems.

Holder for specific mounting orientation is available on request.

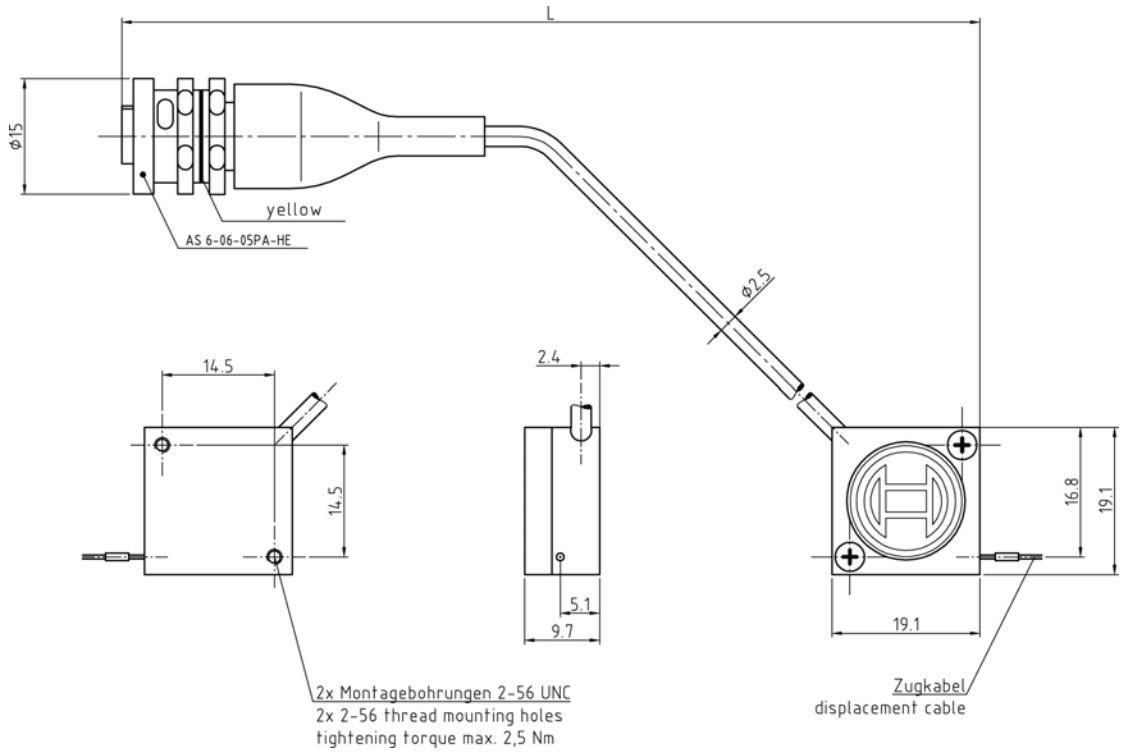
The angle of the displacement cable should be in the range of ± 5 ... 10° from normal direction to avoid damaging the housing.

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.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

WP 35	**B 261 209 541**



Wire Potentiometer WP 50

The WP 50 is a wire potentiometer which is designed to measure position, direction, or rate of motion of moving mechanical components.

This sensor converts mechanical movement into electrical signal using a stainless steel cable wounded on a threaded drum that is coupled to a precision rotary sensor. Hence the electrical output is proportional to the distance travelled.

The advantage of this WP is its compact style which allows for flexible and easy installation. Due to its small size, precise measurement is possible even in difficult applications.

Application	
Application	0 ... 50 mm
Temperature range	-65 ... 125 °C
Max. cable acceleration	400 m/s²
Max. cable tension	3.3 N
Shock	1,000 m/s² for 6 ms
Vibration	150 m/s² 10 ... 2,000 Hz

Electrical Data	
Power supply	5 V
Power supply max.	35 V
Nominal resistance	5 kΩ
Resistance tolerance	10 %
Non-linearity	0.5 %
Max. current	12 mA

Mechanical Data	
Weight w/o cable	15 g
Possible mechanical range	50.8 mm
Mounting	2 x 2-56 UNC
Tightening torque	2.5 Nm
Life expectancy	100 x 10⁶ cycles
Protection	IP54
Dimensions	Ø 24.4 x 11.4 mm

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 45 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The WP 50 can be connected directly to most electronic control units and data logging systems.

Holder for specific mounting orientation is available on request.

The angle of the displacement cable should be in the range of ± 5 ... 10° from normal direction to avoid damaging the housing.

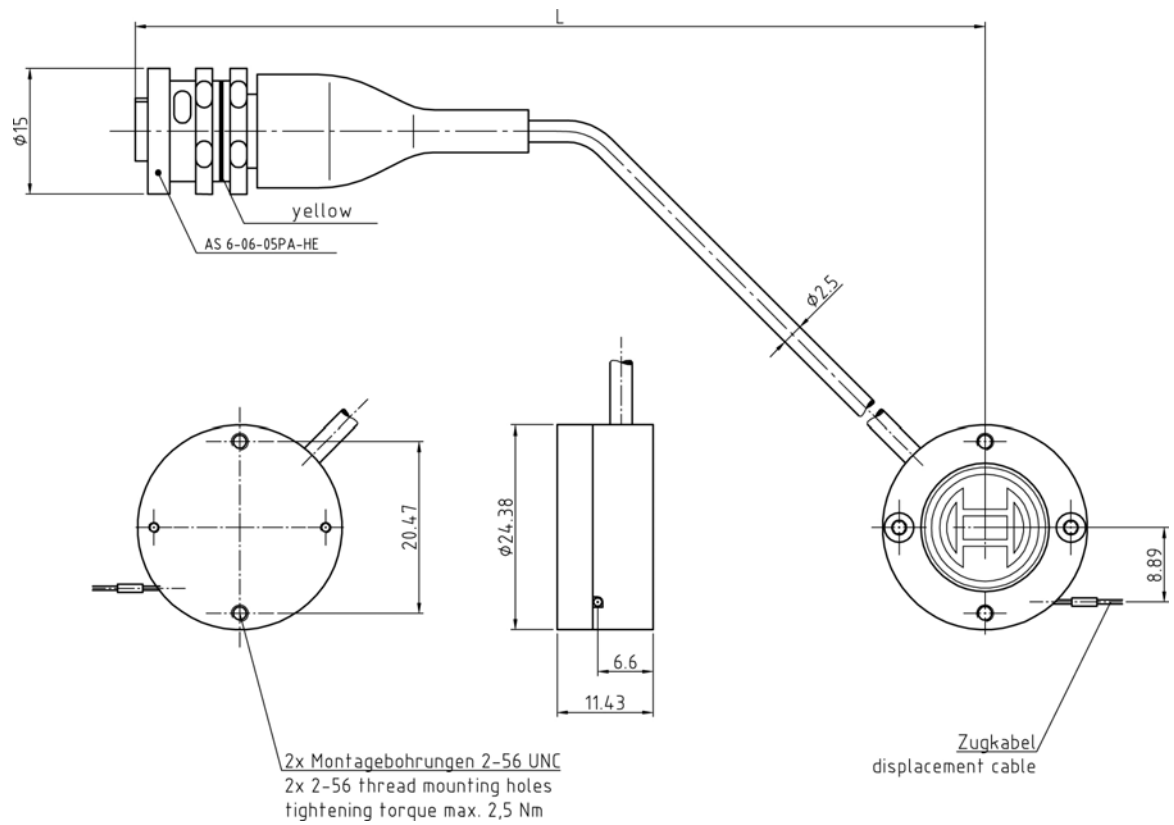
Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.

Repair service is available for this product.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

WP 50	**B 261 209 542**



Wire Potentiometer WP 75

The WP 75 is a wire potentiometer which is designed to measure position, direction, or rate of motion of moving mechanical components.

This sensor converts mechanical movement into electrical signal using a stainless steel cable wounded on a threaded drum that is coupled to a precision rotary sensor. Hence the electrical output is proportional to the distance travelled.

The advantage of this WP is its compact style which allows for flexible and easy installation. Due to its small size, precise measurement is possible even in difficult applications.

Application	
Application	0 ... 75 mm
Temperature range	-65 ... 125 °C
Max. cable acceleration	170 m/s^2
Max. cable tension	2.8 N
Shock	1,000 m/s^2 for 6 ms
Vibration	150 m/s^2 @ 10 ... 2,000 Hz

Electrical Data	
Power supply	5 V
Power supply max.	35 V
Nominal resistance	5 kΩ
Resistance tolerance	10 %
Non-linearity	0.5 %
Max. current	12 mA

Mechanical Data	
Weight w/o cable	28 g
Possible mechanical range	76.2 mm
Mounting	2 x 2-56 UNC
Tightening torque	2.5 Nm
Life expectancy	100 x 10^6 cycles
Protection	IP54
Dimensions	Ø 24.4 x 11.4 mm

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 45 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The WP 75 can be connected directly to most electronic control units and data logging systems.

Holder for specific mounting orientation is available on request.

The angle of the displacement cable should be in the range of ± 5 ... 10° from normal direction to avoid damaging the housing.

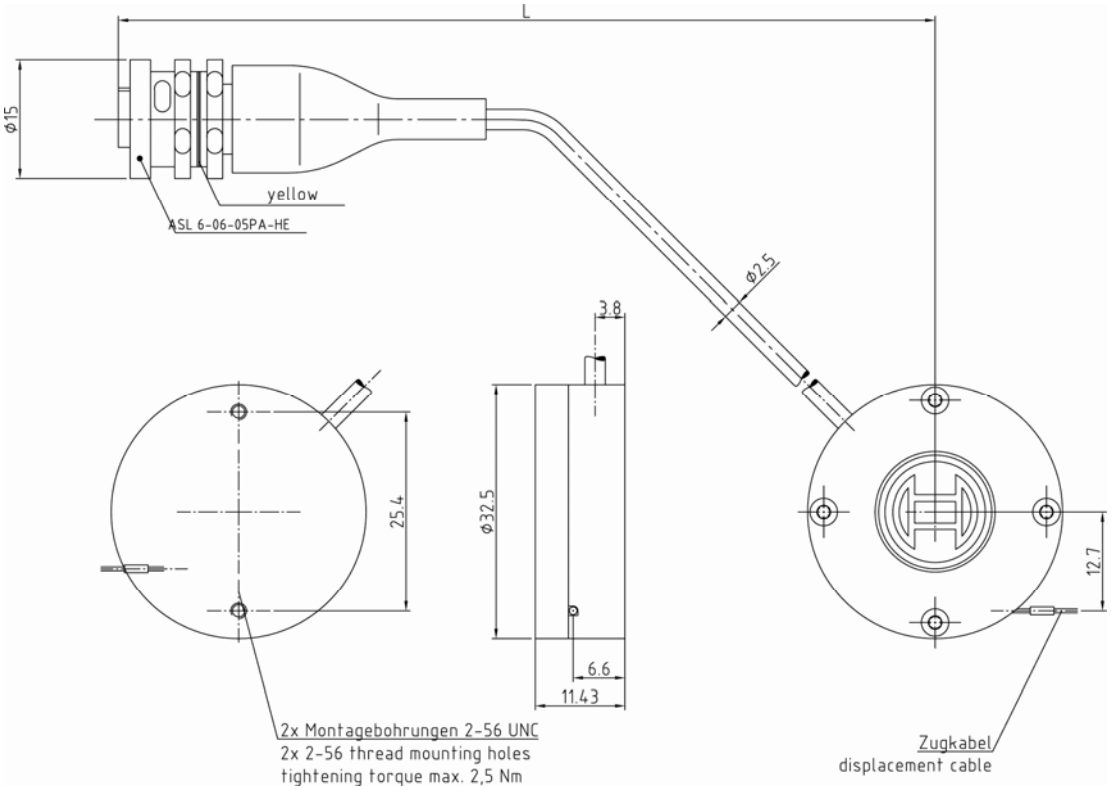
Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.

Repair service is available for this product.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

WP 75	**B 261 209 543**



Wire Potentiometer WP 100

The WP 100 is a wire potentiometer which is designed to measure position, direction, or rate of motion of moving mechanical components.

This sensor converts mechanical movement into electrical signal using a stainless steel cable wounded on a threaded drum that is coupled to a precision rotary sensor. Hence the electrical output is proportional to the distance travelled.

The advantage of this WP is its compact style which allows for flexible and easy installation. Due to its small size, precise measurement is possible even in difficult applications.

Application	
Application	0 ... 100 mm
Temperature range	-65 ... 125 °C
Max. cable acceleration	90 m/s^2
Max. cable tension	3.3 N
Shock	1,000 m/s^2 for 6 ms
Vibration	150 m/s^2 @ 10 ... 2,000 Hz

Electrical Data	
Power supply	5 V
Power supply max.	35 V
Nominal resistance	5 kΩ
Resistance tolerance	10 %
Non-linearity	0.5 %
Max. current	12 mA

Mechanical Data	
Weight w/o cable	57 g
Possible mechanical range	101.6 mm
Mounting	2 x 2-56 UNC
Tightening torque	2.5 Nm
Life expectancy	100 x 10^6 cycles
Protection	IP54
Dimensions	Ø 43.3 x 12.5 mm

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 45 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The WP 100 can be connected directly to most electronic control units and data logging systems.

Holder for specific mounting orientation is available on request.

The angle of the displacement cable should be in the range of ± 5 ... 10° from normal direction to avoid damaging the housing.

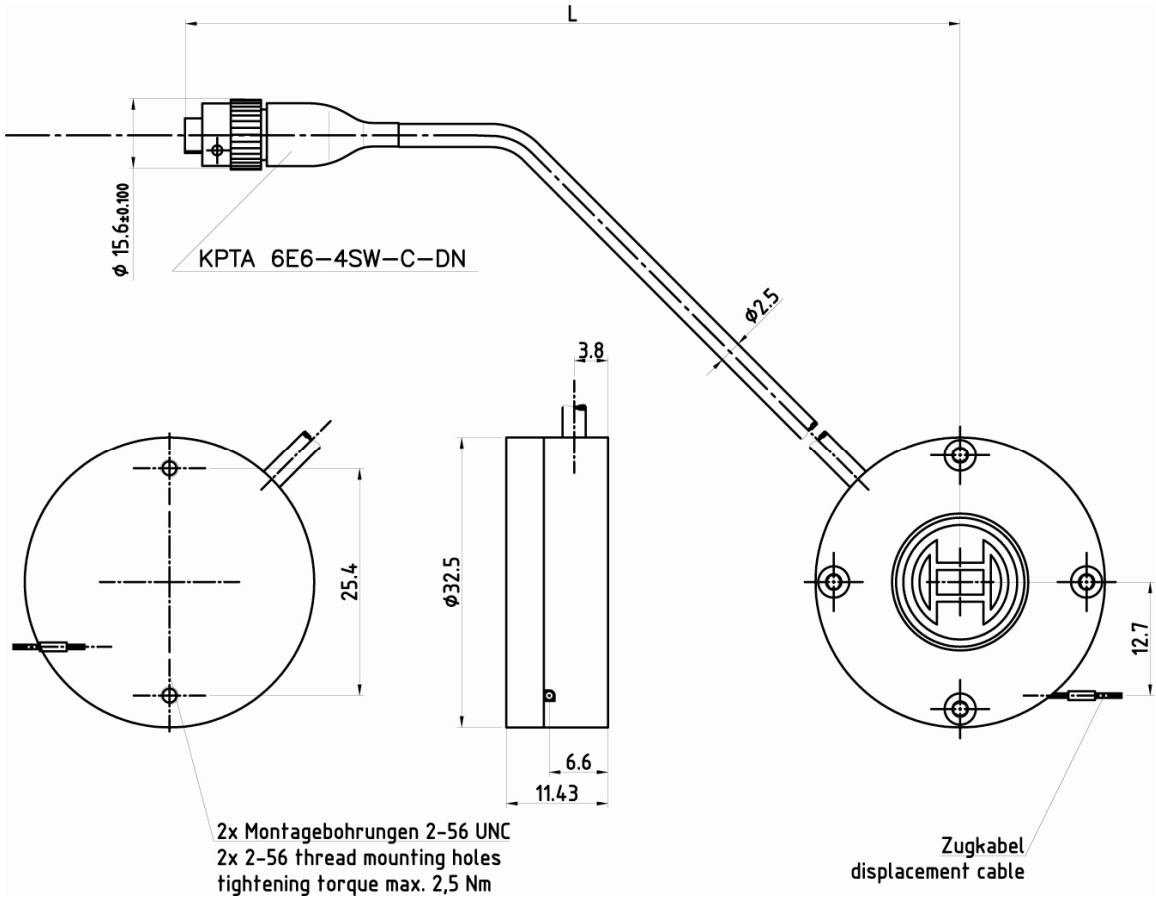
Do not allow the cable to snap back (freely retract). This will cause damage and void the warranty. Tension must be maintained on the cable at all times.

Repair service is available for this product.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

WP 100	**B 261 209 544**



Wire Potentiometer WP 120

The WP 120 is a wire potentiometer which is designed to measure position, direction or rate of motion of moving mechanical components.

This sensor converts mechanical movement into electrical signal using a stainless steel cable wounded on a threaded drum that is coupled to a precision rotary sensor. Hence the electrical output is proportional to the distance travelled.

The advantage of this WP is its compact style which allows for flexible and easy installation. Due to its small size, precise measurement is possible even in difficult applications.

Application	
Application	0 ... 120 mm
Temperature range	-15 ... 60 °C
Max. cable tension	2.2 N

Electrical Data	
Power supply	5 V
Power supply max.	25 V
Nominal resistance	1 kΩ
Resistance tolerance	0.15 %
Non-linearity	1 %

Mechanical Data	
Weight w/o cable	85 g
Possible mechanical range	120 mm
Mounting	2 x Ø 4 & Ø 4.8
Life expectancy	1 x 10^6 cycles
Dimensions	45.7 x 44.5 x 59.7 mm

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	Us
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Pin 5	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 50 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The WP 120 can be connected directly to most electronic control units and data logging systems.

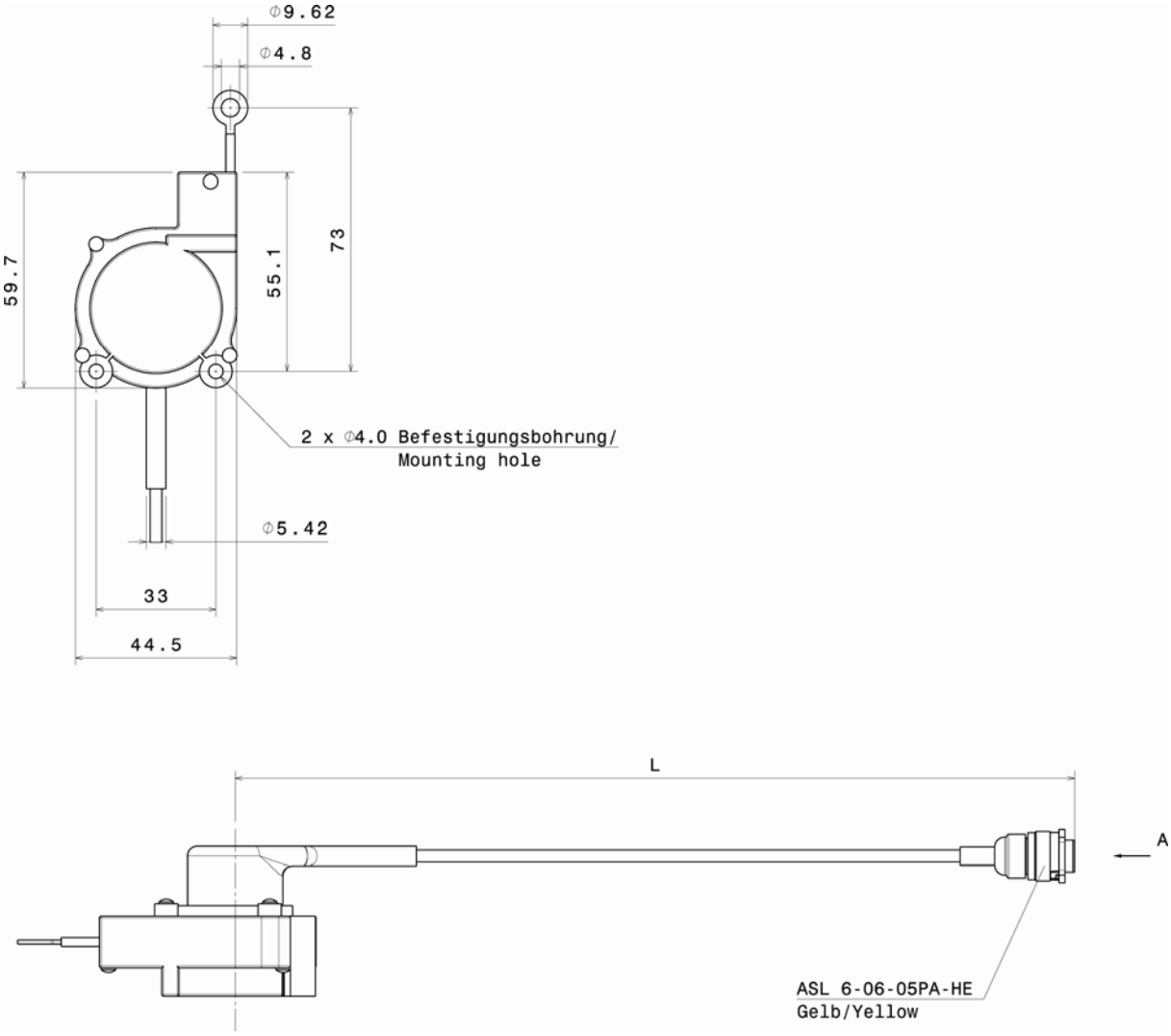
The angle of the displacement cable should be in the range of ± 5 ... 10° from normal direction to avoid damaging the housing.

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.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

WP 120	**F 01T A21 250**



Wire Potentiometer WP 125

The WP 125 is a wire potentiometer which is designed to measure position, direction, or rate of motion of moving mechanical components.

This sensor converts mechanical movement into electrical signal using a stainless steel cable wounded on a threaded drum that is coupled to a precision rotary sensor. Hence the electrical output is proportional to the distance travelled.

The advantage of this WP is its compact style which allows for flexible and easy installation. Due to its small size, precise measurement is possible even in difficult applications.

Application	
Application	0 ... 125 mm
Temperature range	-65 ... 125 °C
Max. cable acceleration	80 m/s^2
Max. cable tension	2.8 N
Shock	1,000 m/s^2 for 6 ms
Vibration	150 m/s^2 @ 10 ... 2,000 Hz

Electrical Data	
Power supply	5 V
Power supply max.	35 V
Nominal resistance	5 kΩ
Resistance tolerance	10 %
Non-linearity	0.5 %
Max. current	12 mA

Mechanical Data	
Weight w/o cable	85 g
Possible mechanical range	127.5 mm
Mounting	2 x 2-56 UNC
Tightening torque	2.5 Nm
Life expectancy	100 x 10^6 cycles
Protection	IP54
Dimensions	Ø 50.5 x 13.2 mm

Connectors and Cables	
Connector	ASL 6-06-05PA-HE
Connector loom	ASL 0-06-05SA-HE
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig
Pin 4	-
Sleeve	DR-25
Cable size	AWG 24
Cable length L	15 ... 45 cm
Various motorsports and automotive connectors on request.	
Please specify the requested cable length with your order.	

Application Hint

The WP 125 can be connected directly to most electronic control units and data logging systems.

Holder for specific mounting orientation is available on request.

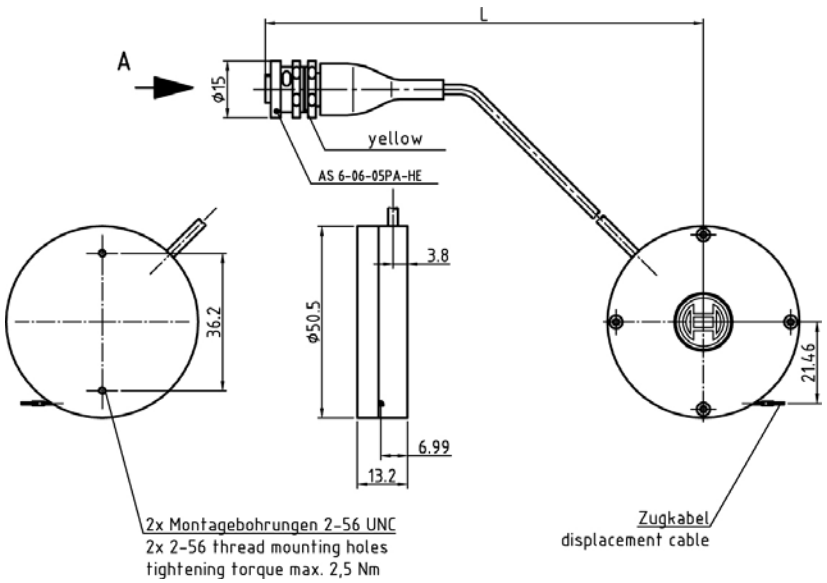
The angle of the displacement cable should be in the range of ± 5 ... 10° from normal direction to avoid damaging the housing.

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.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

WP 125	**B 261 209 545**



Yaw Rate Sensor

Yaw Rate Sensor YRS 2

This sensor is designed to measure the physical effects of yawing and lateral acceleration. In order to achieve this, the sensor features both a measuring element for yaw rate and one for acceleration, with one appropriate integrated circuit.

A rotation around the third orthogonal axis, a yaw rate, creates a Coriolis force on the accelerometers, which is detected by the element. Apart from the measuring element for yaw rate, a pure surface micromachined measuring element for acceleration is utilised to measure the vehicles lateral acceleration. This enables a very precisely application.

The main feature and benefit of this sensor is the combination of high quality production part and low price.

Application	
Application I	±100 °/s
Application II	±1.8 g
Operating Temperature Range	-40 ... 85 °C
Response Time	< 1 s

Electrical Data	
Power Supply	8 ... 16 V
Input current	75 mA
Max Input current	120 mA
Upper Output Limit 4,5	4.35 ... 4.65 V
Lower Output Limit 0,5	0.35 ... 0.65 V
Reference Voltage Output 2.5	2.464 ... 2.536 V

Mechanical Data	
Weight w/o Cable	90 g
Size	34 x 80 x 84 mm

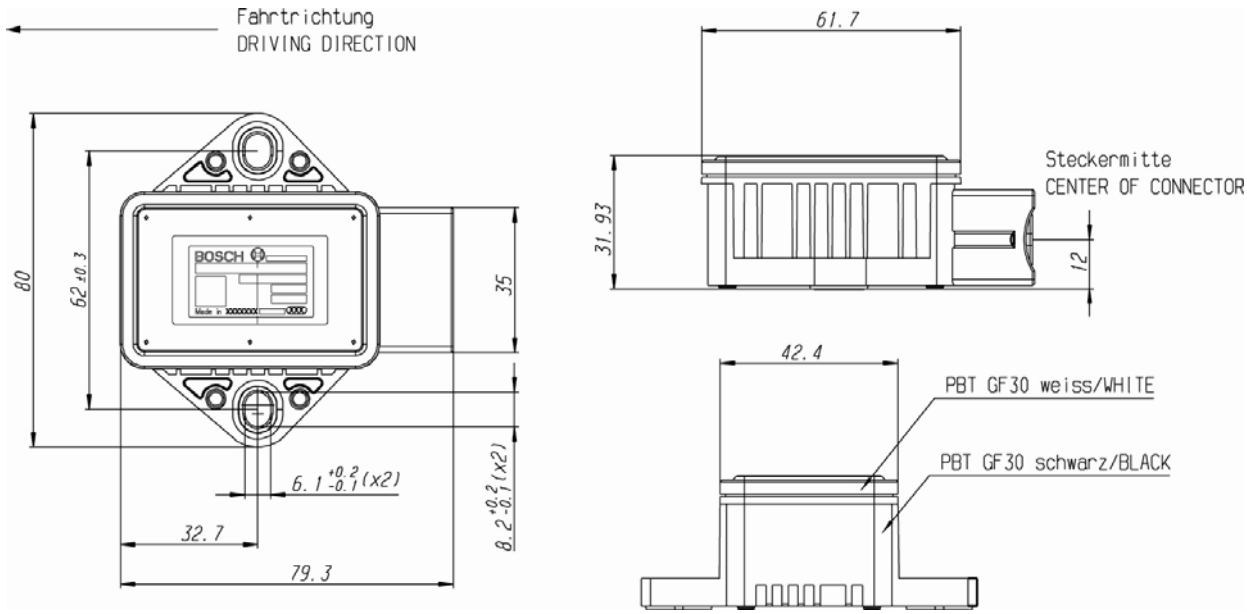
Characteristic Application I	
Measuring Range	100 °/s
Overrange Limit	1000 °/s
Nominal Scale Factor	18 mV/°/s

Characteristic Application II	
Measuring Range	±2 g
Overrange Limit	±4 g
Nominal Scale Factor	1 V/g

Connectors and Cables	
Connector	AMP 114-18063-076
Connector Loom	F 02U 002 235-01
Pin 1	Ref
Pin 2	Bite
Pin 3	Sig_{YRS}
Pin 4	Sig_{AY}
Pin 5	Gnd
Various motorsport and automotive connectors on request.	
Sleeve	DR-25
Cable Size	AWG 24
Cable Length L	15 ... 100 cm
Please specify the requested cable length with your order.	

Application Hint
The YRS 2 can be connected directly to most control units and data logging systems.
The sensor is protected against reverse polarity and short-circuits.
Please avoid abrupt temperature changes.
For mounting please use only the integrated thread.
Please ensure that the environmental conditions do not exceed the sensor specifications.
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number	
Yaw Rate Sensor YRS 2	**0 265 005 262**



Yaw Rate Sensor YRS 3

This sensor is designed to measure the physical effects of yawing, lateral and longitudinal acceleration. In order to achieve this, the sensor features both a measuring element for yaw rate and two for acceleration, with one appropriate integrated circuit.

A rotation around the third orthogonal axis, a yaw rate, creates a Coriolis force on the accelerometers, which is detected by the element. Apart from the measuring element for yaw rate, a pure surface micromachined measuring element for acceleration is utilised to measure the vehicles lateral and longitudinal acceleration. This enables a very precise application.

The main feature and benefit of this sensor is its wide measuring range, the standardized 1 Mbaud/s CAN-signal output and the combination of high quality production part and robust design.

Application	
Application I	±160 °/s
Application II	±4.1 g
Operating Temperature Range	-40 ... 85 °C
Response Time	< 1 s

Electrical Data	
Power Supply	7 ... 18 V
Max Input current	130 mA
CAN speed	1 Mbaud/s

Mechanical Data	
Weight w/o Cable	65 g
Size	34 x 80 x 84 mm

Characteristic Application I	
Measuring Range	±160 °/s
Overrange Limit	±1,000 °/s
Absolute Resolution	0.1 °/s
Cut-off Frequency (-3 dB)	15 Hz

Characteristic Application II	
Measuring Range	±4.1 g
Overrange Limit	±10 g
Absolute Resolution	0.01 g
Cut-off Frequency (-3 dB)	15 Hz

Connectors and Cables	
Connector	AMP 114-18063-076
Connector loom	F 02U B00 240-01
Pin 1	GND
Pin 2	CANL
Pin 3	CANH
Pin 4	UBAT
Pin 5	-

CAN Parameters	
Byte order	LSB (Intel)
CAN speed	1 Mbaud/s
Bit mask	Signed
Offset (all signals)	0x8000 hex
Quantisation Yaw Rate 1	0.005 [°/s/digit]
Quantisation Yaw Ang. Acc	0.125 [°/s²/digit]
Quantisation Acc X-Axis	0.0001274 [g/digit]
Quantisation Acc Y-Axis	0.0001274 [g/digit]

Application Hint

The YRS 3 can be connected directly to most control units and data logging systems.

The sensor is protected against reverse polarity and short-circuit.

Please avoid abrupt temperature changes.

For mounting please use only the integrated fixing holes.

Please ensure that the environmental conditions do not exceed the sensor specifications.

Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Part Number

Yaw Rate Sensor YRS 3	**0 265 005 838**

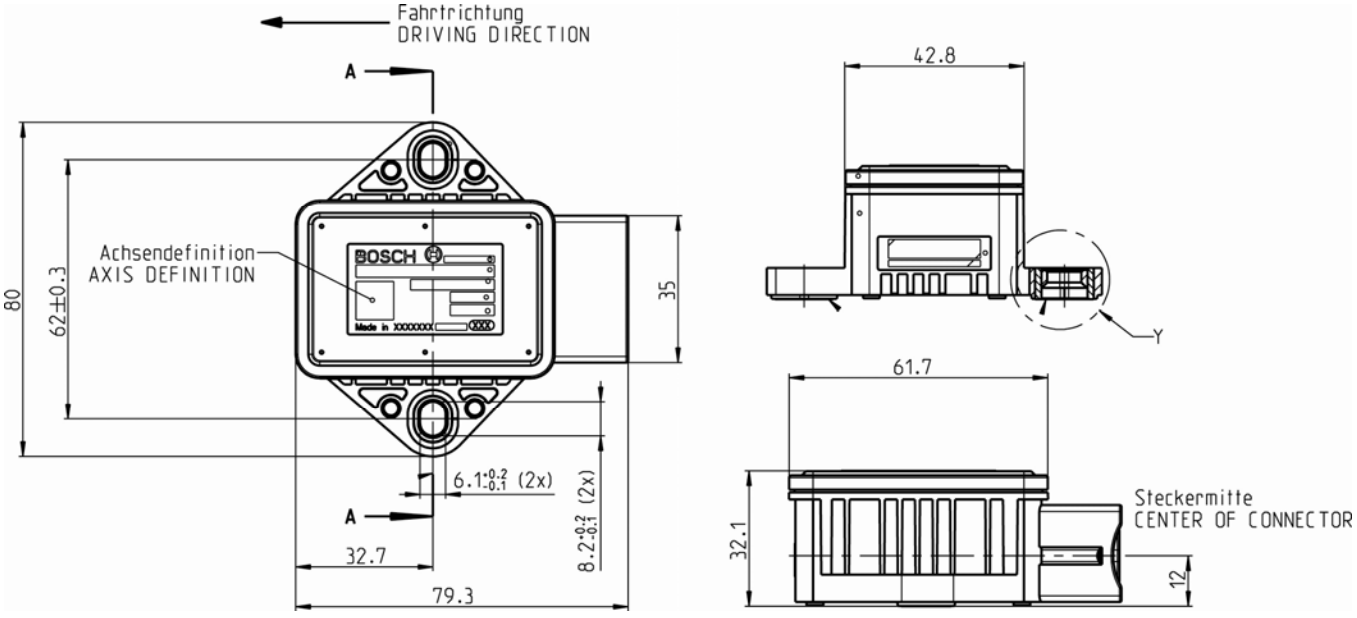
CAN Message

CAN_ID_01 0x70

Byte	0	1	2	3	4	5	6	7
Value	Yaw Rate 1		Reserved		Acc Y Axis		Reserved	Unused

CAN_ID_02 0x80

Byte	0	1	2	3	4	5	6	7
Value	Yaw Angular Acceleration		Reserved		Acc X Axis		Reserved	Unused



Electronic Throttle Control

Electronic Throttle Grip ETG

Drive by wire system for motorcycles

NEW!

This new Electronic Throttle Grip (ETG) eliminates the throttle cables connecting the throttle grip and the throttle body and replaces them with a single electrical connection.

The grip is spring loaded to return to the idle position where a damping element and 10° free play below the idle position provide optimal control and feel for the rider. The grip includes two redundant sets of magnetic sensors to ensure a maximum safety and reliability.

There is an integrated switch denoting three power settings for the bike: OFF, IGN ON and START.

Application	
Temperature range	0 ... 80 °C
Max. vibration	800 m/s² @ 5 Hz ... 2 kHz

Mechanical Data	
Size of housing	80 x 60 x 160 mm
Weight	326 g
Mounting	handlebar ø 22.2 mm
Working angle + free play	60° + 10°
Tightening torque	4.5 Nm

Electrical Data	
Supply voltage	2 x 5 V

Characteristic	
Output Signal I	0.15 V ... 2.325 V (0° ... 70°)
Output Signal II	0.3 V ... 4.65 V (0° ... 70°)

Application Hint
The ETG can be connected directly to control units with ETC functionality.
Please avoid abrupt temperature changes.

Connector	
Connector	AS 6-10-35PN
Mating connector	AS 1-10-35SN
Pin 1	terminal 30
Pin 2	terminal 15
Pin 3	terminal 50 (Starter)
Pin 4	-
Pin 5	5 V supply (Signal I)
Pin 6	5 V supply (Signal II)
Pin 8	Gnd (Signal I)
Pin 9	Gnd (Signal II)
Pin 12	Signal I (screened)
Pin 13	Signal II (screened)

Part Number
El. Throttle Grip ETG

Cs

Chassis & Brake Control

ABS M4 Kit

The ABS M4 kit is developed for the operation in front or rear drive vehicles. A vehicle specific wire harness is included in the kit. The ABS M4 is specifically adapted for motorsports use. Individual car parameters can be calibrated with the included software.

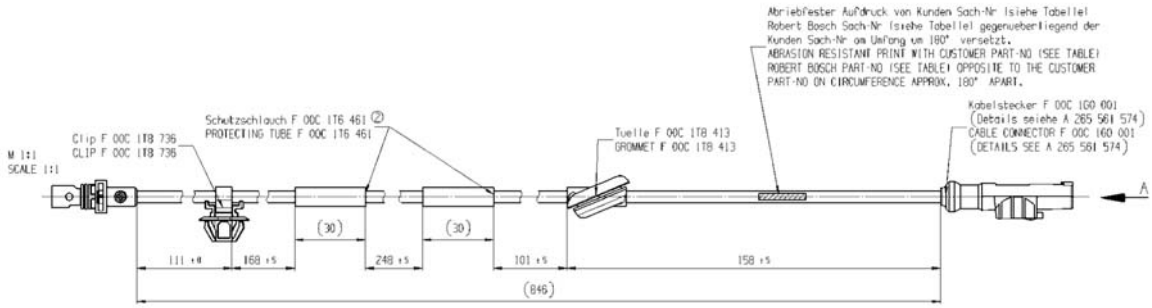
Mechanical Data	
Hydraulic unit with attached ECU	
Dust and splash proof production housing	
Vibration damped circuit board	
38 pin connector	
2 hydraulic valves per wheel	
2 brake circuits (front and rear)	
2 hydraulic high pressure pumps	
2 hydraulic accumulators 3 ccm/each	
Standard fittings	2 x master cylinders M12x1 4 x brake cylinders M10x1
Size	125 x 80.3 x 129.6 mm
Weight	1,850 g
Operating temperature	-30 ... +130 °C
Max. shock	50 g less than 6 ms

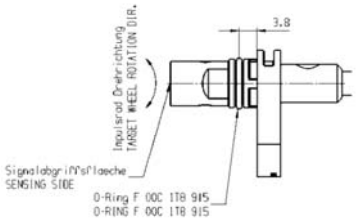
Content of Kit
Hydraulic unit with attached ECU
Pressure sensor
Yaw/acceleration sensor
12 position function switch
4 wheel speed sensors DF11 standard
ABS warning light
Programming and diagnostic software
Vehicle specific wire harness
Vibrations dampening boards

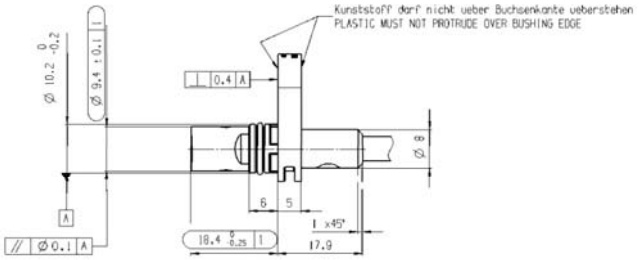
Electrical Data	
Power Supply and Consumption	
Supply voltage	8 ... 16 V, max. 26 V for 5 min
Max. peak voltage	35 V for 200 ms
Power consumption	8 W stand-by, 230 W in operation
Inputs	
4 active wheel speed DF11	
Brake pressure (front brake circuit)	
Longitudinal acceleration	
Lateral acceleration	
Yaw rate	
12 position function switch	
10 switch positions are preconfigured for different setups	
2 switch positions programmable	
Brake light switch	
Outputs	
ABS warning light (MIL)	
Control of internal ABS valves	
Control of pump motor	
Communication	
CAN interface	

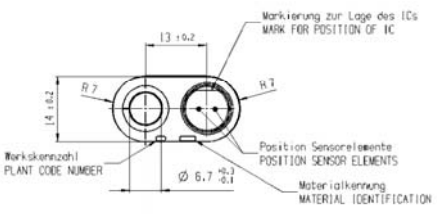
Optional Accessories	
Data logger C Sport	F 01T A20 061
Display DDU Sport	F 01T A20 050
MSA-Box	B 261 208 015-01
Single-wheel-speed interface without connectors	F 02U V00 225-01
Four-wheel-speed interface with production connectors	F 02U V00 209-01
Four-wheel-speed interface with motorsports connectors	F 02U V00 203-01
Adapter wire harness for connection of data logger C Sport	F02U V00 309-01

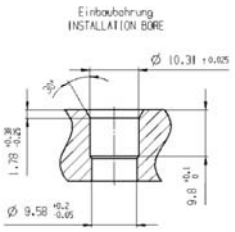
Part Numbers
ABS M4 Kit 1 (wire harness and wheel speed sensors with production-type connectors) **F 02U V00 289-01**
ABS M4 Kit 2 (wire harness and wheel speed sensors with motorsports connectors) **F 02U V00 290-01**
Different variations of DF11 sensors for vehicle individual applications on request.











Material/MATERIAL

Gehaeuse: Polyamid waermestabilisiert
HOUSING: POLYAMIDE HEAT STABILIZED

Leitung: Mantelleitung zweiadrig Aussen Ø : 5.0+0.3; Mantelisolierung: Polyurethan-Elastomer 95± 5 Shore A.
CABLE: MOLDED CABLE COVER TWO CORES, D_o : 5.0+0.3 COVER INSULATION: POLY-URETHANE ELASTOMER 95± 5 SHORE A.

Buchse: Stahl
BUSHING: STEEL

Displays

Display DDU Sport

The DDU Sport is a light and compact dashboard unit with a high contrast monochrome 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.

The display has an integrated logger with a memory capacity of 512 MB. Engine data of the ECU can be received via CAN interface.

Data acquisition and calibration software RaceLab Sport and one set of mating connectors are inclusive.

Application	
LCD display / LED background light	
4 programmable pages	
Active area	91 x 56 mm
Resolution	240 x 128 pixel
Dot size	0.38 x 0.41 mm
Mounting	4 x M5 threads on reverse side
4 internal switches for operation (pages, mode, setting), available also on reverse side connectors	

Mechanical Data	
Dimensions	160 x 110 x 26 mm
Weight	433 g
Max. Vibration *(see Appendix or www.bosch-motorsport.com)*	*Vibration Profile 1*
Temperature	-10 ... 65 °C

Electrical Data
7 sequential shift LEDs
512 MB Data logger integrated
4 analog inputs (0 ... 5 V) 10 bit resolution
4 digital inputs (HL = 2.5 ... 32 V)
Real Time Clock
2 x CAN-Bus
1 x 100 Mbit LAN
Voltage supply range: 7,5 ... 35 V
Sensor supply: 5 V, 500 mA

Software
Data acquisition and calibration with RaceLab Sport via Ethernet

Connectors	
Mating connector	3 x Binder 712 99 0425 00 08
Connector 1 (red)	
Pin 1	Input, digital 1
Pin 2	Input, digital 2
Pin 3	Input, digital 3
Pin 4	Input, digital 4
Pin 5	Input, terminal 30
Pin 6	Input, terminal 15
Pin 7	Input/Output, GND
Pin 8	Output, U_S
Connector 2 (green)	
Pin 1	Input, KEY4
Pin 2	Input, KEY3
Pin 3	Input, KEY2
Pin 4	Input, KEY1
Pin 5	Input, AIN3
Pin 6	Input, AIN2
Pin 7	Input, AIN1
Pin 8	Input, AIN0
Connector 3 (blue)	
Pin 1	Input/Output, CANB-LOW
Pin 2	Input/Output, CANB-HIGH
Pin 3	Input/Output, CANA-LOW
Pin 4	Input/Output, CANA-HIGH
Pin 5	Input, RX- LAN
Pin 6	Input, RX+ LAN
Pin 7	Output, TX- LAN
Pin 8	Output, TX+ LAN

Part Number	
DDU Sport	**F 01T A20 050**

Display DDU 4

The DDU 4 is a light and compact dashboard unit with a high contrast colour display. Up to 12 customized display pages can be programmed to suit individual customer requirements. All illuminated components are dimmable.

Mathematic functions and alarms can be programmed and linked to display values and LEDs. Using the CAN interface the DDU 4 can be connected to any ECU.

Application	
1x active matrix TFT high contrast colour display	
Active area	111 x 83 mm
Resolution	320 x 240 pixel
Dot size	0.116 x 0.348 mm

Mechanical Data	
Dimensions	164 x 117 x 37 mm
Weight	753 g
Max. Vibration	*Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)*
Temperature	-10 ... 75 °C
Display panel with optical double-sided antiglare coating for highest contrast and display accuracy.	

Electrical Data
1 x CAN interface for communication with ECU via CCP and free configurable for any ECU messages
5 LED shift indicators (5 drivers, open collector, 2.2 A)
10 LED multi purpose indication lights
Dedicated battery voltage measurement

Software
Configuration with RaceCon over MSA-Box

Accessories	
Aluminium holder	F 01E B01 457
Carbon fibre holder	F 01E B01 458
External switches for page select and brightness adjustment	B 261 209 659
MSA-Box	B 261 208 015-01

Connectors	
Connector	AS 6-12-35PN
Pin 1	U_{batt}
Pin 2	Serial_RXD
Pin 3	Serial_TXD
Pin 4	GND_shield
Pin 5	CAN1_HI
Pin 6	CAN1_LO
Pin 7	GND
Pin 8	AGND
Pin 9	ANA1
Pin 10	ANA2
Pin 11	ANA3
Pin 12	ANA4
Pin 13	ANA5
Pin 14	U_{batt} out
Pin 15	UNI_OUT1
Pin 16	CAN2_HI
Pin 17	CAN2_LO
Pin 18	ANA6
Pin 19	ANA7
Pin 20	ANA8
Pin 21	ANA9
Pin 22	UNI_OUT2

Part Number	
DDU 4 incl. cable, without holder	**F 01E B01 461**

Display DDU 6

The DDU 6 is a light and compact, steering wheel mounted dashboard unit. It is equipped with a high contrast colour display. Up to 12 customized display configurations can be programmed to suit individual customer requirements. All illuminated components are dimmable.

Mathematic functions and alarms can be programmed and linked to display values and LEDs.

Using the CAN interface the DDU 6 can be connected to any ECU.

Application	
1x active matrix TFT high contrast colour display	
Active area	54 x 72 mm
Resolution	240 x 320 pixel
Integrated switches for page select and brightness adjustment.	

Mechanical Data	
Dimensions	165 x 104 x 32 mm
Weight	342 g
Max. Vibration	*Vibration profile 1 (see Appendix or www.bosch-motorsport.com)*
Temperature	-10 ... 65 °C

Electrical Data
1 x CAN interface for communication with ECU via CCP and free configurable for any ECU messages
5 LED shift indicators
4 LED warning lights

Connectors	
Connector	AS 6-12-35PN
Pin 1	U_{batt}
Pin 2	GND
Pin 3	CAN1_HI
Pin 4	CAN1_LO
Pin 5	Serial_RXD
Pin 6	Serial_TXD

Software
Configuration with RaceCon over MSA-Box

Accessories	
MSA-Box	**B 261 208 015-01**

Part Number	
DDU 6	**F 01E B01 459**

Data Logging Systems

Data Loggers

Data Logger C Sport

The data logger C Sport is a very compact and lightweight data logger. It offers analog and digital signals. The measured data is stored on an internal 512 MB memory. Engine data of the ECU can be received via CAN interface.

Acquisition and calibration software RaceLab Sport and one set of mating connectors are inclusive.

Mechanical Data	
Size	102 x 62 x 27 mm
Weight	210 g
Aluminium housing	
Flexible housing fixation points	
Temperature range	-20 ... 65 °C
Max. vibration	*Vibration Profile 1 (see Appendix)*

Software
Data acquisition and calibration with RaceLab Sport via Ethernet

Electrical Data	
Max. power consumption	4 W at 14 V
Required power supply	7.5 ... 35 V
1 CAN Bus link (ECU)	
1 CAN Bus link (to cascade C Sport or attach DDU Sport)	
1 Ethernet connector (for PC connection)	
512 MB internal memory	
Real time clock	
4 digital inputs	
4 analog single ended inputs 16 bit resolution	
4 analog differential inputs 16 bit resolution	
1 digital output	

Compatible ECUs
ECU MS 3.1, MS 3 Sport, MS 4.0, MS 4 Sport, MS 4 Sport Turbo, MS 4.4, MS 4.4 Sport, MS 4.4 Sport Turbo

Connectors	
Mating connector	4 x Binder 712 99 0425 00 08
Connector 1 (bottom right)	
Pin 1	Input, terminal 15
Pin 2	Input, terminal 30
Pin 3	Output
Pin 4	Output, TX+ LAN
Pin 5	Output, TX- LAN
Pin 6	Input, RX+ LAN
Pin 7	Input, RX- LAN
Pin 8	Input/Output, GND
Connector 2 (top right)	
Pin 1	Input/output, CANB-LOW
Pin 2	Input/output, CANB-HIGH
Pin 3	Input, digital 1
Pin 4	Input, digital 2
Pin 5	Input, digital 3
Pin 6	Input, digital 4
Pin 7	Output, U_S
Pin 8	Input/output, GND
Connector 3 (top left)	
Pin 1	Input, analog 6+
Pin 2	Input, analog GND 5/6
Pin 3	Input, analog 7+
Pin 4	Input, analog 8+
Pin 5	Input, analog GND 7/8
Pin 6	Input, CANA-LOW
Pin 7	Input, CANA-HIGH
Pin 8	Input, analog 5+
Connector 4 (bottom left)	
Pin 1	Diff. input, analog 1-
Pin 2	Diff. input, analog 2+
Pin 3	Diff. input, analog 2-
Pin 4	Diff. input, analog 3+
Pin 5	Diff. input, analog 3-
Pin 6	Diff. input, analog 4+
Pin 7	Diff. input, analog 4-
Pin 8	Diff. input, analog 1+

Part Number	
C Sport	**F 01T A20 061**

CardMemory C 40 / C 40 Plus

The CardMemory is a device used for data logging. The basic model C 40 is designed for data transfer via CAN for Bosch Motorsport ECUs. The extended model C 40 Plus is developed to read in additional 15 analog signals and 1 rev signal. The measured data are stored on a compact flash card (not included).

Mechanical Data	
Aluminium housing	
Flexible housing fixation points	
Size	150 x 90 x 22 mm
Weight	330 g
ECU temperature	-40 ... 75 °C
Max. vibration	15 g sinus at 20 Hz ... 2 kHz for t < 5 h

Electrical Data	
Max. power consumption	7 W at 14 V
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 analog inputs with 10 bit resolution and 5 ms sample rate time (only C 40 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	

Accessories	
Flash card 128 MB	F 01E B01 105 01
Flash card 256 MB	F 01E B01 106 01
Flash card 512 MB	F 01E B01 107 01
Flash card 1,024 MB	F 01E B01 108 01
Flash card 2,048 MB	F 01E B01 109 01
Memory adapter (incl.)	B 261 206 864
C 40 adapter cable	B 261 209 433

Compatible ECUs
MS 3.1, MS 3 Sport, MS 4.0, MS 4 Sport, MS 4 Sport Turbo, MS 4.4, MS 4.4 Sport, MS 4.4 Sport Turbo

Connectors	
Mating connector C 40	AS0-14-35 SN
Mating connector C 40 Plus	AS0-14-35 SN

Part Numbers	
C 40	**F 01T A20 403**
C 40 Plus	**B 261 206 860**
C 40 Plus incl. chassis adjust	**B 261 206 880-02**
All C 40 incl. memory adapter B 261 206 864	
Upgrade C 40 to C 40 Plus	**on request**
Software chassis adjust	**on request**

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

Data Logging System DLS

System Overview

The Data Logging System (DLS) is a scalable, versatile, and flexible measurement system for conditioning and acquisition of sensor data in a race car. The DLS product family consists of several hardware and software components which allow easy adoption to various measurement requirements.

Core component of the DLS is the C 55 data logger. It performs system configuration and management tasks and also serves as a communication hub for the PC configuration software. The C 55 communicates via its network interfaces with the ECU and up to eight MSI 55 sensor interface boxes to enable synchronized acquisition of engine and chassis data. The MSI 55 sensor interfaces provide high quality signal conditioning and data conversion functionality.

Additionally the FM 40 telemetry transmitter and the BT 60 burst telemetry device can be connected.

Various CAN expansion modules can be connected to provide additional input channels or output functionality.

DLS Components	
Data logger, System manager	C 55
Burst telemetry	BT 60, BR 60
Online telemetry	FM 40
Modular Sensor Interface	MSI 55
Extended CAN Modules EM-L5, EM-C,EM-D8, EM-D1, EM-A6, EM-H4,	EM-I4
DLS configuration Software	RaceCon
System Software	RaceCon, WinDarab

Technical Details
High measuring accuracy by 12 bits A/D converter resolution and tenfold oversampling
High recording rate up to 1 ms
High recording duration by CF card up to 1 GB
Online compression of measurement data
Highly linear analog and digital filters
Modular concept allows scalable system
Synchronized acquisition of ECU and chassis channels
Connectivity and data transfer via telemetry
Online calibration and system diagnosis with RaceCon (included)

CardMemory C 55

The CardMemory C 55 is a device used for data logging and DLS system management. The measured data is stored on a removable compact flash card with a maximum capacity of 1,024 MB (flash card not included).

The C 55 supports two parallel measurement configurations and recording rates from 1 s to 1 ms. Data from different Bosch ECUs can be recorded via the Ethernet and FireWire buses. For sensor signal acquisition up to eight MSI 55 devices connected via FireWire are supported.

Long range as well as high-speed burst telemetry is possible utilizing the FM 40 and BT 60 devices.

Mechanical Data	
Size	157 x 92 x 30 mm
Weight	500 g
Aluminium housing	
Operating Temperature	-20 ... 65 °C
Max. vibration *(see Appendix or www.bosch-motorsport.com)*	*Vibration profile 1*

Electrical Data	
Max. power consumption	20 W at 14 V
1 CAN interface	
2 Fire wire interfaces	
2 Ethernet interfaces (100 MBit)	
Real time clock	
Non volatile flash card memory	

Accessories	
Flash card 256 MB	F 01E B01 106-01
Flash card 512 MB	F 01E B01 107-01
Flash card 1,024 MB	F 01E B01 108-01
Memory adapter	B 261 206 864

Compatible ECUs
MS 5.1, MS 5.2, MS 15.1, MS 15.2

Part Number	
CardMemory C 55 **(incl. memory adapter B 261 206 864)**	**F 01E B01 630**

Modular Sensor Interface MSI 55

The MSI 55 is a high quality signal conditioning and data acquisition unit for analog and digital sensors.

The MSI 55 offers 16 configurable analog inputs. Each analog input channel features a 4th order analog prefilter, 10x oversampling and highly linear digital filtering. The cut-of frequency of the digital filters is automatically adjusted to match the acquisition rate. The latency of the digital filters is corrected during recoding, yielding zero filter delay in the recorded data. The evaluation of each MSI measurement channel is individually configurable. Data is sent via FireWire interface to the C 55 data logger.

Mechanical Data	
Size	120 x 117 x 38 mm
Weight	600 g
Aluminium housing	
Filtered connectors of motorsports design with high pin density	
Vibration damped printed circuit boards	
Operating temperature	-20 ... 65 °C
Max. vibration	15 g sinus at 1,200 Hz for t < 5 h

Electrical Data	
Max. power consumption	20 W at 14 V
16 bit digital signal processor, 150 MIPS	
Required power supply	8 ... 18 V
4 differential analog inputs with switchable amplifier and switchable pullup resistor	
12 single ended analog inputs with switchable pullup resistor	
All analog inputs offer analog and digital anti-aliasing filter and 12 bit ADC resolution	
4 frequency inputs 0 ... 25.5 kHz for 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	
Freely configurable 1 Mbit CAN Bus	

Part Number	
MSI 55	**F 01T A20 024**

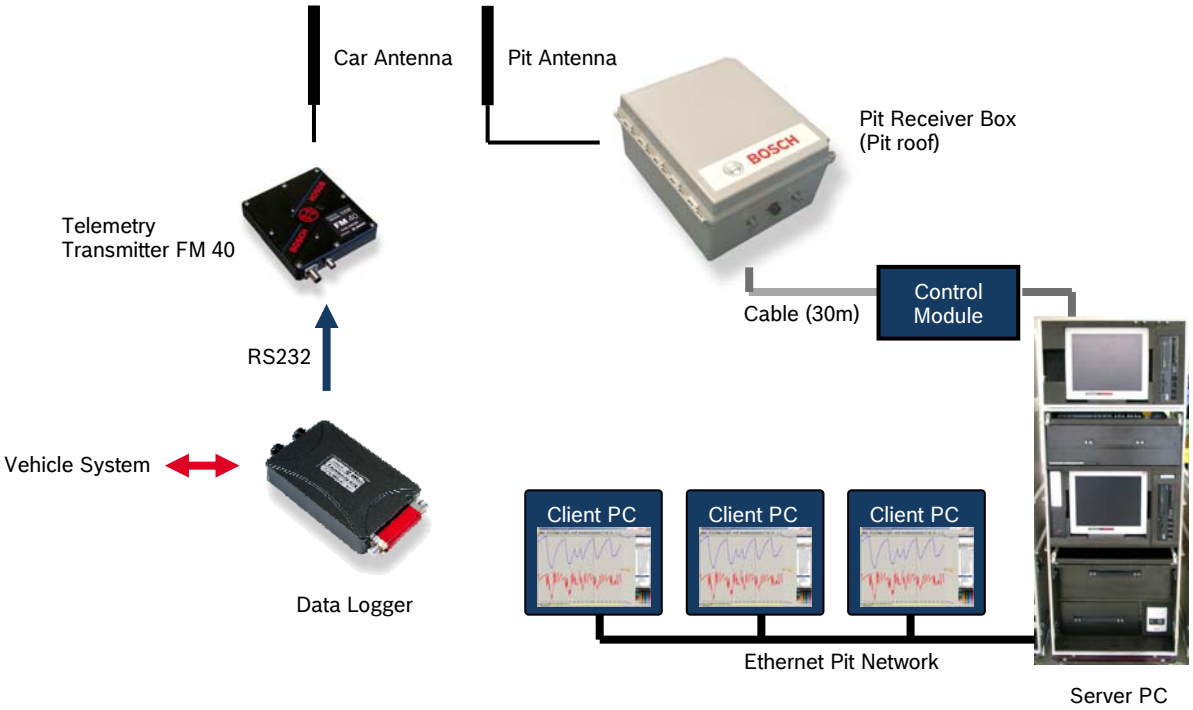
Telemetry

Online Telemetry System Overview

The Bosch Motorsport Online Telemetry System enables the transmission of online measurement data from a car on a racetrack. The vehicle part of the system consists of a data logger (C 40, C 55 or C 60) and the FM 40 telemetry transmitter. From the data logger data is sent via a RS232 connection to the FM 40 . The FM 40 adds framing and error correction information to the data stream and modulates its RF output which is fed via an antenna cable to the TX antenna.

In the pits, the RF signal is picked up by a RX antenna connected to the pit receiver box. Inside the receiver box, the signal is filtered and amplified by a low noise filter amplifier. It is then sent to a UHF modem. The modem demodulates the data stream and performs error correction if necessary. The output stream passes the data converter and is transferred via a connection cable to the server PC in the garage. This PC decodes the car's telemetry stream and distributes the information over the pit network.

Due to the high transmission power of 1 ... 10 W of the Bosch FM 40 telemetry transmitter, near 100 % coverage is achieved on most tracks, even under race conditions with high RF interference.



Telemetry Unit FM 40

The FM 40 is a half-duplex radio modem suitable for real-time telemetry transmission from a car on the racetrack.

The unit is offered in different hardware versions for several frequency bands in the 430 ... 470 MHz range. Within the selected band, the transmission frequency is software programmable in a ±1 MHz range. The high RF output power of up to 10 W gives excellent range and good track coverage.

From the data acquisition system transmit data is fed into the FM 40 via a RS232 interface. Typically the FM 40 is operated as an unidirectional telemetry transmitter. For other applications, half duplex bidirectional operation is also possible.

Mechanical Data	
Size	151 x 138 x 28 mm
Weight	720 g
Housing with LED indicators	
Car antenna compatible to existing Bosch telemetry systems.	

Conditions for Use	
Max. vibration	60 m/s² @ 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

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

Electrical Data	
Half duplex radio modem (bidirectional)	
Internal data buffer and protocol management	
Frequency range	430 ... 470 MHz (hardware adjustable)
	F(center) ±1 MHz (software programmable)
Transmission power	1 ... 10 W
Receiver sensitivity error detection and forward error correction (FEC)	-116 dBm
RF channel bandwidth	12,5 kHz @ 9.6 kbps 25 kHz @ 19.2 kbps
Data interface	RS232
Data rate	9.6 / 19.2 kbps
Required power supply	10 ... 18 V
Max. current	< 2,5 A

Part Number	
FM 40	**B 261 208 898-01**

Pit Receiver Box

The Pit Receiver Box integrates all electronic components necessary to receive telemetry data from a car equipped with a FM 40 transmitter in one weatherproof package. Typically the receiver box is mounted on the pit roof as close as possible to the RX antenna, thus minimizing cable loss. The connection cable to the receiving PC in the garage, which can be up to 50 m long, also supplies power to the Pit Receiver Box.

Different versions of the receiver box are offered to support several system configurations.

Mechanical data	
Weight	4.2 kg

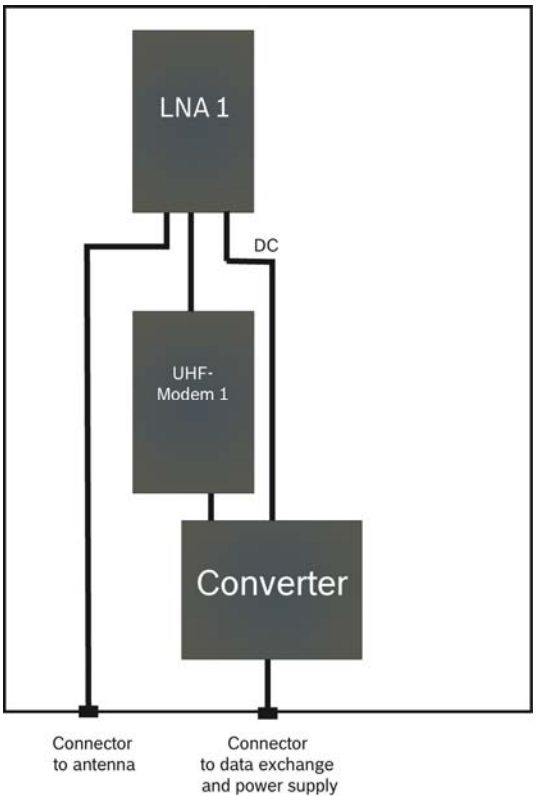
Conditions for use	
Working temperature range	-20 ... + 50 °C
Max. distance receiver box to PC (with cable B 261 209 481)	50 m
Antenna connector	BNC (Jack) 50 Ω
Data and power connector	motorsports type

Electrical data	
Frequency range	400 ... 470 MHz
Working frequency band	fc ±1 MHz
Channel spacing	12.5/25 kHz
Sensitivity	≤ -116 dBm @ BER 10^{-3}
Serial interface	RS232 (19.2 kBit/s, no parity, 8 data bit, 1 stop bit, no flow control)
Radio data rate	19.2 kbps (25 kHz channel) 9.6 kbps (12.5 kHz channel)
Operating voltage	12 V (10 ... 14 V)
Power consumption	approx. 7 W

Pit Receiver Box 1

The Pit Receiver Box 1 contains all electronic components and cables necessary to receive data from a single car, preassembled in a weatherproof box.

The external RX antenna is connected to a low noise filter amplifier (LNA 1). The amplified signal is then fed into the UHF receiver which decodes the data stream. The data converter is used to transmit the data via the connection cable to the server PC in the garage.

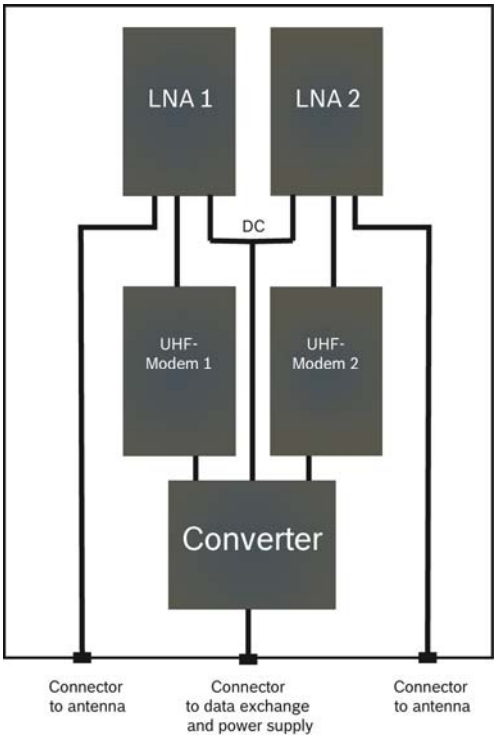


Part Number	
Pit Receiver Box 1	**F 01T A20 451-01**

Pit Receiver Box 1/R

The Pit Receiver Box 1/R includes two separate receiver systems which enable the parallel reception of two telemetry data streams. Two RX antennas can be connected to the twin low noise filter amplifiers (LNA 1, LNA 2).

Typical application are the reception of telemetry data from two cars or a system configuration with one car and a telemetry relay station.

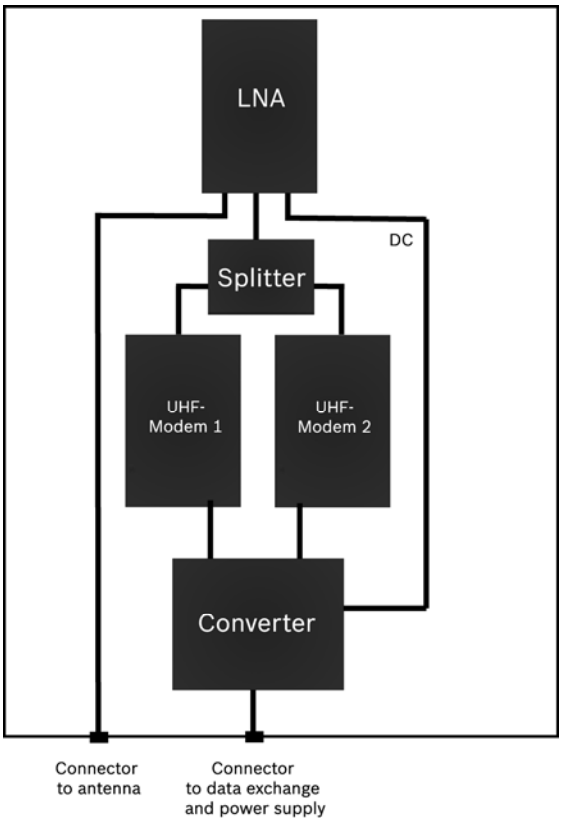


Part Number	
Pit Receiver Box 1/R	**F 01T A20 453**

Pit Receiver Box 2

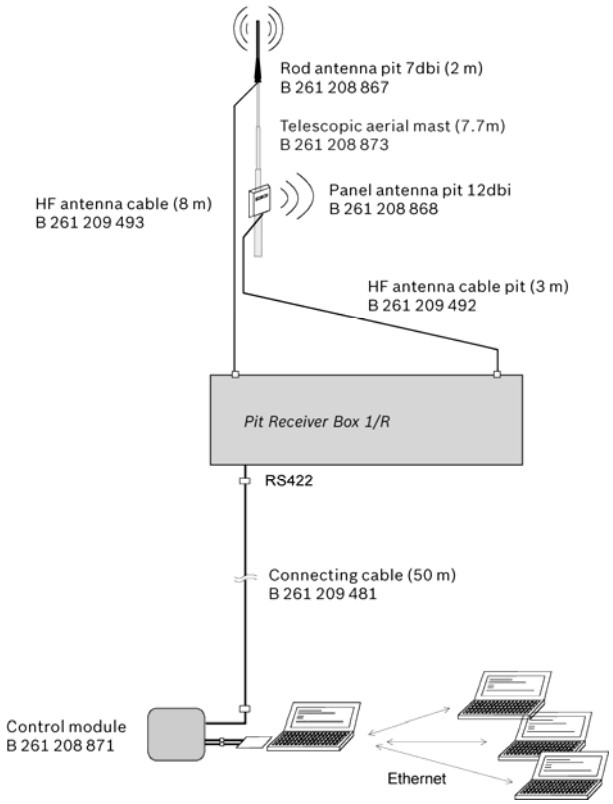
The Pit Receiver Box 2 contains two UHF receivers fed by a single RX antenna and low noise filter amplifier (LNA). This enables parallel telemetry data reception from two cars, provided both transmitters operate in the same frequency band.

Part Number	
Pit Receiver Box 2	**F 01T A20 455**



Pit Receiver Package 1/R and 1

The Pit Receiver Packages 1/R and 1 contain antennas, rf cables, data cables and the controller box, i.e. everything that is required to start operation.



Part Number	
Pit Receiver Package 1/R	**F 01T A20 454**

Content Pit Receiver Package 1/R	
Pit Receiver Box 1/R	F 01T A20 453
HF antenna cable (8 m)	B 261 209 493
Rod antenna pit 7 dbi (2 m)	B 261 208 867
HF antenna cable pit (3 m)	B 261 209 492
Panel antenna pit 12 dBi	B 261 208 868
Connecting cable (50 m)	B 261 209 481
Control module RS232/RS422 pit	B 261 208 871
Telescopic aerial mast (7.7 m)	B 261 208 873

Part Number	
Pit Receiver Package 1	**F 01T A20 452**

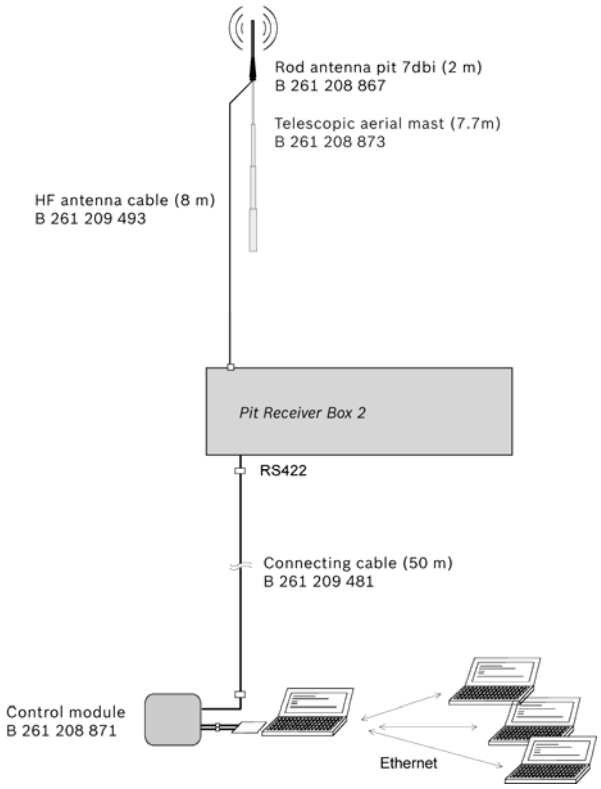
Content Pit Receiver Package 1	
Pit Receiver Box 1	F 01T A20 451
HF antenna cable (8 m)	B 261 209 493
Rod antenna pit 7 dbi (2 m)	B 261 208 867
Connecting cable (50 m)	B 261 209 481
Control module RS232/RS422 pit	B 261 208 871
Telescopic aerial mast (7.7 m)	B 261 208 873

Pit Receiver Package 2

The Pit Receiver Package 2 contains antennas, rf cables, data cables and the controller box, i.e. everything that is required to start operations.

Part Number	
Pit Receiver Package 2	**F 01T A20 456**

Content Pit Receiver Package 2	
Pit Receiver Box 2	F 01T A20 455
HF antenna cable (8 m)	B 261 209 493
Rod antenna pit 7 dBi (2 m)	B 261 208 867
Connecting cable (50 m)	B 261 209 481
Control module RS232/RS422 pit	B 261 208 871
Telescopic aerial mast (7.7 m)	B 261 208 873



Telemetry Accessories
FM 40 Tester

The FM 40 Tester is used to check the performance of telemetry components installed in the car which includes the FM 40 in conjunction with the RF cable and the antenna. The FM 40 tester indicates RF output power as well as defective RF cables or car antennas enabling quick detection of faulty components.

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

Connectors	
RF	BNC male / female

Part number	
FM 40 Tester	**B 261 208 894**

Telemetry Antenna Dummy Load

The telemetry antenna dummy load replaces the telemetry car antenna when running the FM 40 transmitter in the workshop or the garage. It reduces high power RF radiation.

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

Connectors	
RF	BNC male / female

Part number	
Telemetry Antenna Dummy Load	**B 261 208 900-01**

Telemetry Car Antenna

Rugged telemetry antennas for car mounting.

Dual Band Single Band

Parameter	
Single Band Car Antenna	
Frequency band	UHF
Type	1/4λ
Pattern (hor.)	omni
Length	150 mm
Dual Band Car Antenna	
Frequency band	VHF / UHF
Gain	1/4λ / 5/8λ
Pattern (hor.)	omni
Length	440 mm

Connectors	
RF	BNC male

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

Antenna Cable Kit
For car mounting

RF cable for the installation of telemetry antennas in the car. Intended for single hole mounting.

Measurement range	
Length	max. 2 m (tbd.)
Drill hole diameter	12,5 mm
Attenuation	max. 0.7 dB @ 2 m, 450 MHz

Connectors	
RF	BNC male / female

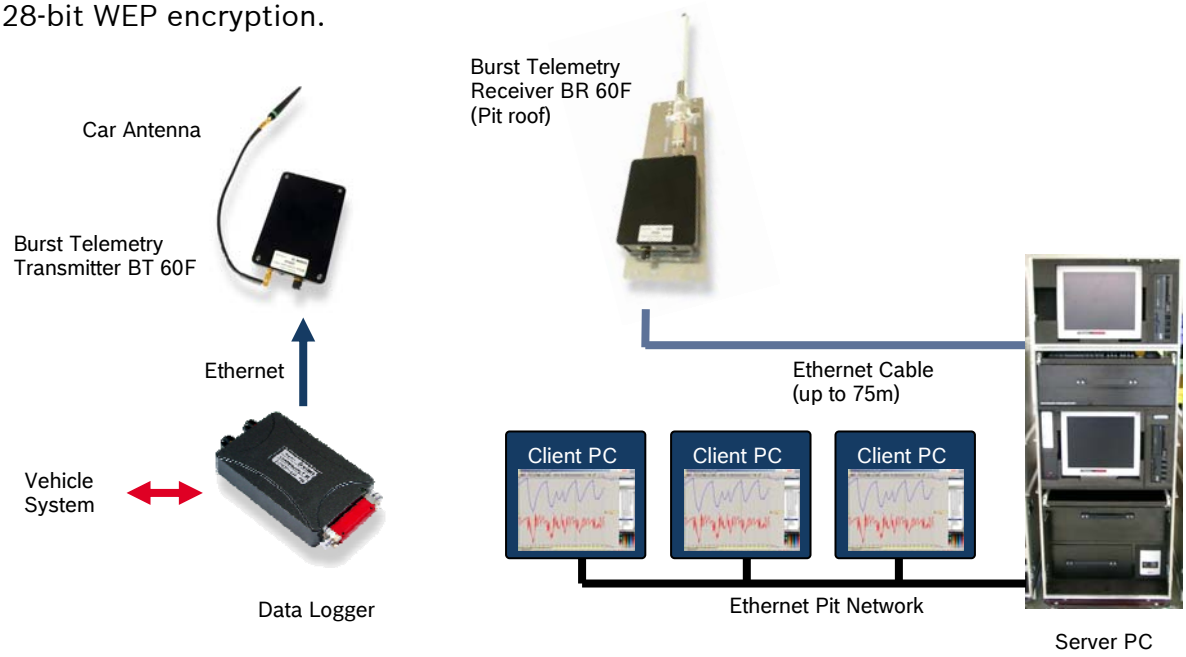
Part number	
Antenna Cable Kit	**B 261 209 490-01**

Burst Telemetry System Overview

The Bosch Motorsport Burst Telemetry System ideally complements the FM 40 long range telemetry. High-resolution measurement data, as stored in the data logger of the data acquisition system, is transferred automatically to the pit server PC when the car passes the pits or the car is in the garage. This gives two advantages: high resolution measurement data is already available in the pit network while the car is still out on track, enabling instant analysis and saving valuable track time. While the car is in the garage, the burst telemetry system gives a significant handling advantage: measurement data is transferred automatically to the pit server PC, e.g. after engine test runs.

The RF system operates in the license-free 5.1 ... 5.8 GHz ISM band. The 32 selectable non-overlapping channels allow great flexibility in channel selection. The robust OFDM transmission scheme in combination with the high-quality band filter yield excellent performance even in environments with high RF noise. Typically good data reception can be achieved in a radius of approx. 300 m around the pit station, depending on antenna location and track topology. If necessary, reception range can be extended by an optional remote receiver station.

During the running lap, the data acquisition system stores engine and chassis data in non-volatile memory. When a laptrigger is received, the current file is closed and data is prepared for burst transmission. As soon as the car reaches the reception range of the pit receiver, data transmission starts automatically. An intelligent algorithm chooses the lapfile to transmit and resumes transmission if the link has been interrupted. Typically 6 Mbytes of measurement data can be transferred per lap during a race. The bi-directional transmission scheme ensures error-free reception. Privacy of measurement data is ensured by 128-bit WEP encryption.



Burst Telemetry System
Car Module BT 60F

The BT 60F car module is the vehicle component of the Bosch Motorsport Burst Telemetry System. The compact and lightweight unit receives measurement data via a 100 MBit Ethernet connection from the data acquisition system and communicates with the pit module over the RF antenna. The system operates in the 5.1 ... 5.8 GHz ISM band and offers 32 non-overlapping channels. An internal high quality band filter eliminates out-of-band RF noise, which enables fully encrypted high speed data transmission at 12 MBit under race conditions. Online diagnosis and performance monitoring is possible via the data acquisition system.

Mechanical Data	
Size	139 x 96 x 22 mm
Weight	370 g
Antenna Connector	SMA(f)
Interface Connector	AS008-35SA (Deutsch)

Conditions for Use	
Max. Vibration (see Appendix or www.bosch-motorsport.com)	Vibration profile 1
Temperature range	-20 ... +85 °C
Max. power consumption	3.5 W
Radio air interface	IEEE 802.11a
Wireless approvals	FCC Part 15.247, IC RS210,CE
Encryption	WEP/WPA

Content BT60F Set	
Radio modem	**F 02U V00 039-02**
Antenna (high band)	**F 02U V00 040-01**
Antenna (low band)	**F 02U V00 134-01**
Antenna socket	**F 02U V00 041-01**
Antenna cable	**F 02U V00 042-01**

Electrical Data	
Radio modem	Full duplex (bidirectional)
Transmission power	+26 dBm
Receiver sensitivity	-91 dBm @ 12 Mbps
Frequency range	5.1 ... 5.8 GHz ISM Band
Air data rate	typ. 12 (max. 54) Mbps
Data interface	Ethernet TP10/100
Antenna	Gain = 3 dBi; omnidirectional
Power supply	8 ... 18 V
Rated current	0.25 A @ 12 VDC

Part Number	
BT 60F Set	**F 02U V00 038-02**

Pit Module BR 60F

The BR 60F pit module is the stationary component of the Bosch Motorsport Burst Telemetry System. The high gain omnidirectional antenna is mounted directly at the receiver, minimizing cable loss. The weatherproof housing allows outdoor mounting of the unit, e.g. on the pit roof. 12 V DC power and 100 MBit Ethernet connection to the pit server PC is supplied via the connecting cable, which can be up to 75m long. The system operates in the 5.1 ... 5.8 GHz ISM band and offers 32 non-overlapping channels. The high quality band filter eliminates out-of-band RF noise. This enables fully encrypted high speed data transmission at 12 MBit under race conditions. A directional antenna is available as an option.

Mechanical Data	
Size (overall incl. antenna)	705 x 145 x 47 mm
Weight	1,250 g
Interface Connector	AS008-35SA (Deutsch)

Conditions for Use	
Temperature range	-20 ... +85 °C
Max. power consumption	3.5 W
Radio air interface	IEEE 802.11a
Wireless approvals	FCC Part 15.247, IC RS210, CE
Encryption	WEP/WPA

Content BR 60F Set	
Radio modem	**F 02U V00 048-01**
Antenna	**F 02U V00 131-01**
Antenna filter	**F 02U V00 132-01**
Fitting system	**F 02U V00 133-01**
Interface cable to the pit PC	**B 261 209 742-01**

Electrical Data	
Radio modem	Full duplex (bidirectional)
Transmission power	+26 dBm
Receiver sensitivity	-91 dBm @ 12 Mbps
Frequency range	5.1 ... 5.8 GHz ISM Band
Air data rate	typ. 12 (max. 54) Mbps
Data interface	Ethernet TP10/100
Antenna	Gain = 10 dBi; omnidirectional
Power supply	8 ... 18 V
Rated current	0.25 A @ 12 VDC

Part Number	
BR 60F Set	**F 02U V00 047-02**

Laptrigger Systems

Lap Trigger IR-02

This lap trigger 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 lap trigger IR is not compatible with IR-02. If both lap triggers 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
Aluminium housing	
IR-02-Transmitter	
Size with diode	90 x 40 x 28 mm
Weight	124 g

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	

Electrical 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 261 206 884-01**
ASL-6-06-05PD-HE	**B 261 206 887**
KPTA 6E6-4P-C-DN	**B 261 206 888-01**
IR-02-Transmitter	**B 261 206 890-01**

Lap Trigger HF 24

This lap trigger system HF 24 consists of a high frequency transmitter station and a receiver which is installed in the car.

The system allows an exact lap time 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	
Aluminium housing	
HF 24 Transmitter	
Size	290 x 118 x 93 mm
Weight	1880 g
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

Electrical Data	
System	
RF wideband chirp transmission	
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
Connector type	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
Transmitter antenna	flat panel
Supply voltage	10 ... 30 V
Supply current	90 mA
Selection main / sub trigger	
Low battery detection	
Mechanical drawing	Y 261 A25 038

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 than it turns into 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:

low side switch with R = 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 it detects a trigger condition.

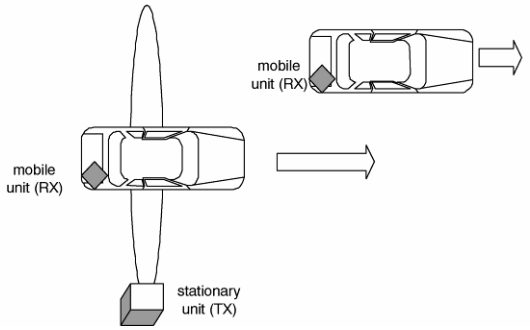
Function Description

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.



Part Numbers

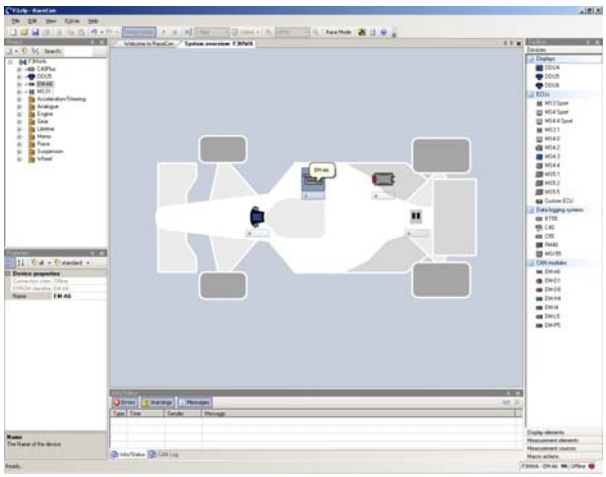
HF 24 Receiver	**B 261 206 894**
HF 24 Transmitter	**B 261 206 895**
Tripod	**B 261 206 897**

Software

Calibration

RaceCon

RaceCon is an all integrated software tool for configuration / calibration of Bosch Motorsport hardware products, such as ECUs, displays, loggers. The communication is based on Bosch Motorsport MSA-Box interface.



General Functions
Calibration maps & curves of Bosch Motorsport ECUs
Datafile download and upload of Bosch Motorsport ECUs
Parameterfile download and upload
Diagnostic functionality for Bosch Motorsport ECUs
Datafile / Workbase management
Integrated flash functionality
Configuration Bosch Motorsport Displays (DDU 4, DDU 6, DDU 8)
Integrated Bosch Sensor Wizard
Configuration of Bosch Motorsport Data Loggers
Configuration of Bosch Motorsport DLS System
Configuration of Bosch Motorsport CAN Modules
CAN / CCP - Log functionality (Baud rate changeable)
Quick data access over Race Mode

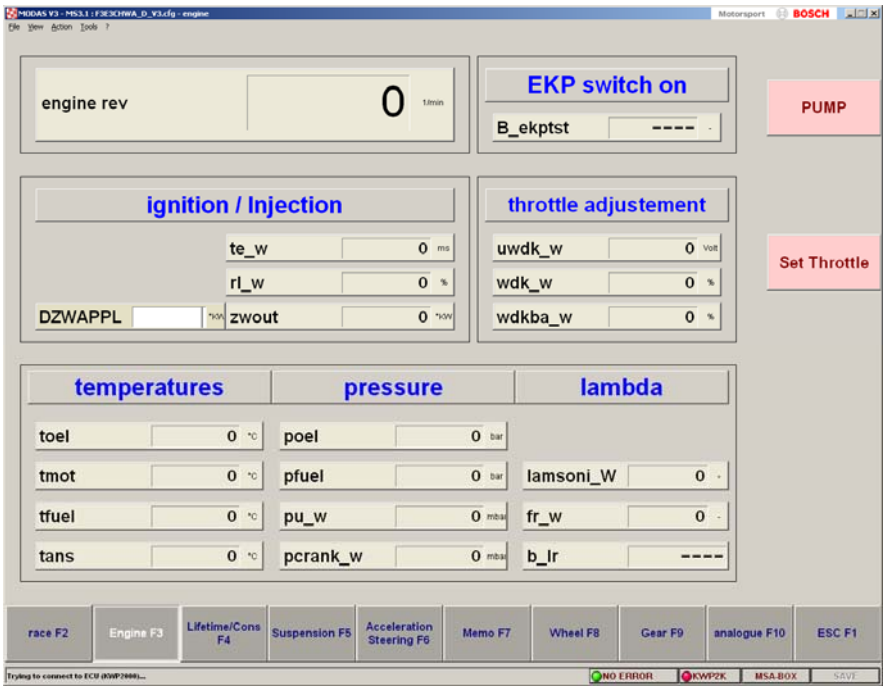
Required hardware components
PC:
IBM PC Pentium/AMD Athlon compatible, min. 1.6 GHz
Min. 2 GB RAM
Min. 1 GB free HD space
VGA / WGA monitor (min. 1,024 x 768)
Operating systems:
Windows XP 32 Bit, Vista 32 Bit

Optional Accessories	
MSA-Box	B 261 208 015-01

Part Number	
RaceCon	included

Modas

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



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

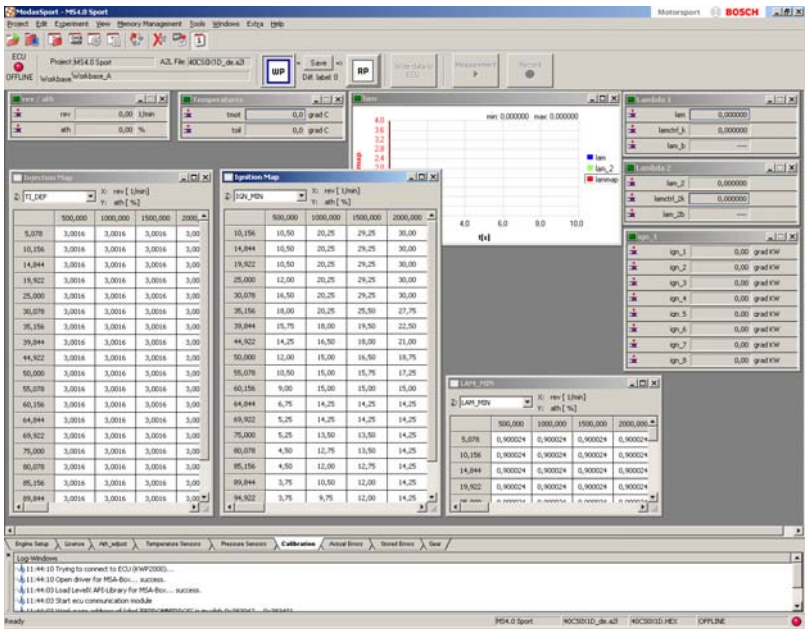
Required hardware components
PC
IBM PC compatible min. 1.6 GHz
Approx. 512 MB RAM
Approx. 100 MB free harddisc space
VGA monitor (1024 x 768 p)
Operating systems
Windows XP 32 Bit, Vista 32 Bit

Performance description
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
Diagnosis system
Visualisation, processing, documentation and evaluation of diagnosis data

Part number	
Modas V3	**Free download at www.bosch-motorsport.com**

Modas Sport

Modas Sport is the calibrating tool for Bosch Motorsport ECUs. It integrates a lot of sensefull features to manage our engine control units at the dyno and the racetrack.



Feature Description
Calibration Tool for MS 3, MS 4.x, MS 5.x, MS 15, MS 3 Sport, MS 4 Sport, MS 15 Sport
Visualization, processing and management of calibration, measurement and documentation data
Measuring system
Numeric data visualization
Bitwise, decimal, hexadecimal data visualization
Recording of measurement data (needs WinDarab to analyze)
Oszilloskop (graphic data visualization)
Calibration system
Visualization and manipulation of parameters (calibration data)
Parameter File Manager
Data File Manager (Copy & Compare)
Macro Manager
Potiboard support integrated
Administration
Workbase Management
Integrated K-Line Flashing Tool

Interface
CAN (CCP) / K-Line (KWP2000)

Required Hardware Components	
PC	
IBM PC compatible min. 1.6 GHz	
Approx. 512 MB RAM	
Approx. 100 MB free harddisc space	
VGA monitor (1024 x 768 p)	
Operating systems	
Windows XP 32 Bit, Vista 32 Bit	

Optional Accessories	
MSA-Box	B 261 208 015-01
Windarab Data Anaylsis Software	free

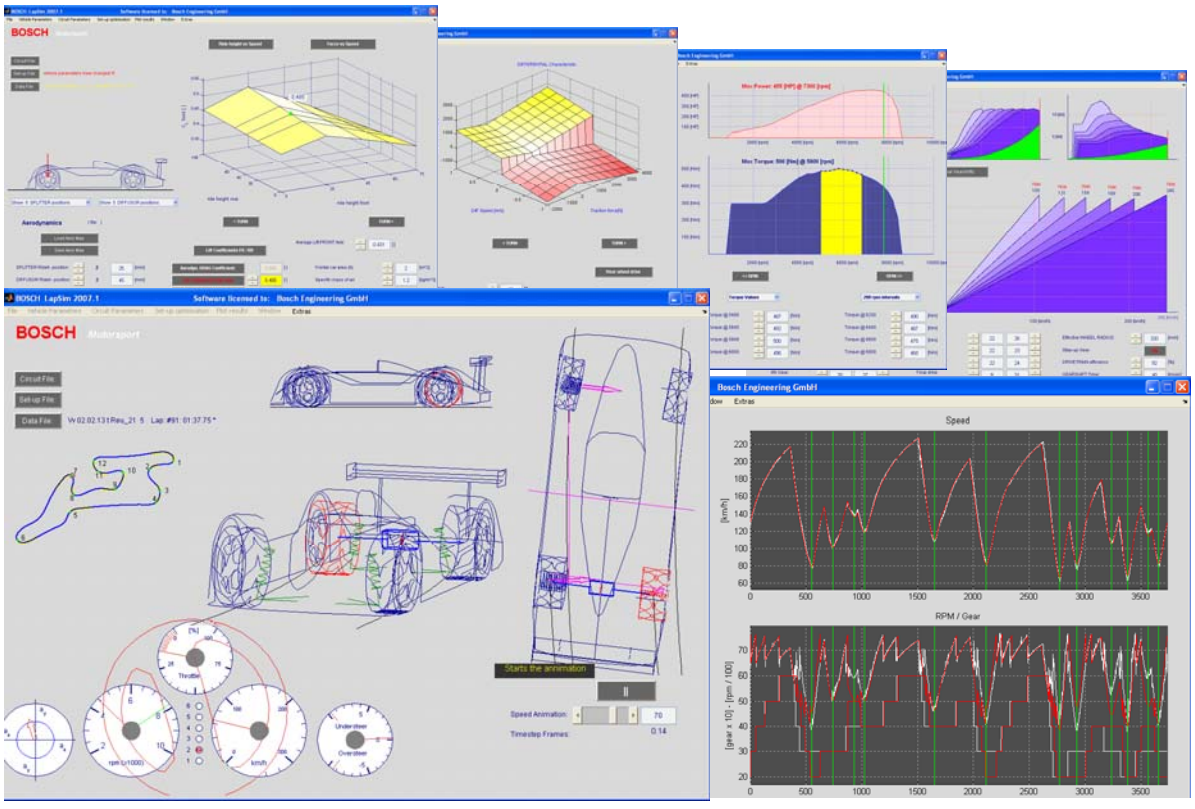
Part Number	
Modas Sport	on request

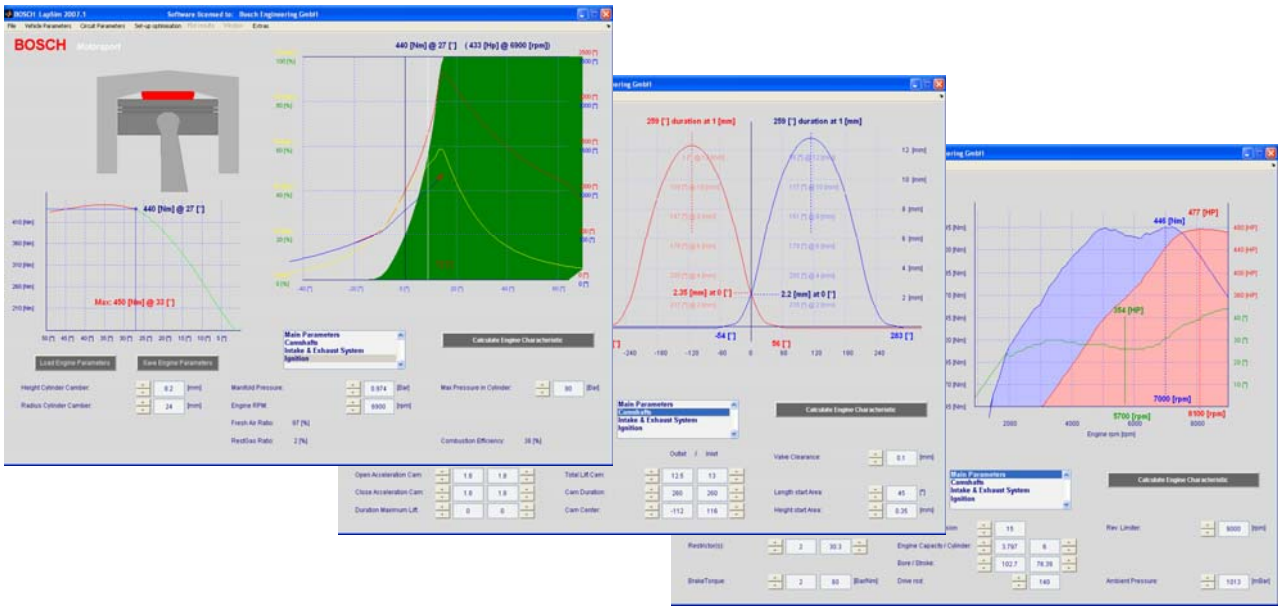
Simulation

LapSim

LapSim Chassis 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 vehicle behaviour 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.

LapSim Engine supplies an easy to use engine simulation package capable of generating a torque/power and a corresponding ignition curves out of the main parameters of an engine. The model is able to simulate any 4-stroke spark ignition (SI) race engine currently seen on the market, with or without air restrictor(s). To summarize, the engine software is aiming for 95% accuracy but 5% the effort of complex engine software packages. The engine software avoids a vast number of variables in order to define every engine detail, in order to improve usability as well as computational performance. The engine package is integrated in the lap simulation.





Data analysis

Post processing of the on-car recorded data with simulation models. Calculating vehicle handling state, aerodynamics, differential function, etc.
Determination of tyre parameters out of on-car recorded data. Possibility to analyse tyre performance over the laps.
Direct comparison between several outings and/or simulation model.
3D Animation of vehicle behaviour for a better and more thorough understanding.
By comparing recorded data with simulation data a validation possibility of vehicle parameters and vehicle functioning is made.
LapSim software adds all vehicle parameters to WinDarab Files and creates automatic database.

Chassis Simulation model

Practical Pacejka like 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 Aero maps
Ride height dependent suspension kinematics
Calculation time 3-4 times faster than real car
(PVI - 3 GHz)
Automatic set-up optimisation

Engine Simulation model

Engine model generates torque/power curve as well as ignition angle
Normally aspirate engines, with or without restrictor
2,3,4 and 5 valve cylinder heads
2-zone burn model in order to cope with all possible compression ratios and chamber geometries
Ignition point is determined by adjustable maximum pressure in cylinder
Fully adjustable camshaft profile
Engine model generates pressure curve over 720° crankshaft, which is integrated to calculate engine torque/power
10 seconds calculation time for 0 - 10.000 rpm range

Part numbers

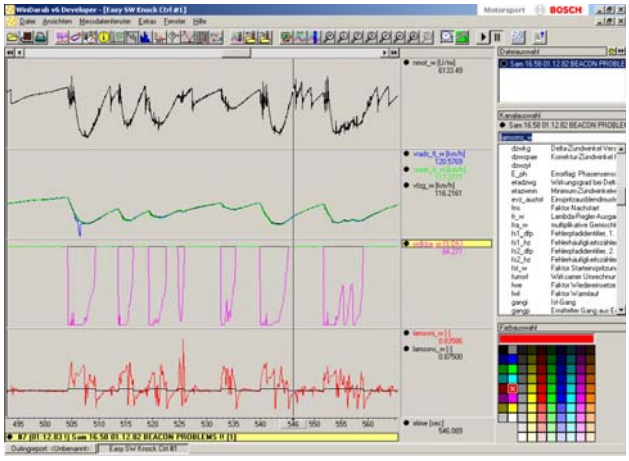
LapSim Chassis Basic Version	**Free download at www.bosch-motorsport.com**
LapSim Chassis License	**B 261 206 432**
LapSim Engine License	**F 01T A20 056**
LapSim Engine & Chassis License	**F 01T A20 057**
Upgrade LapSim Engine License	**F 01T A20 058**
Upgrade LapSim Chassis License	**F 01T A20 059**
Update LapSim Chassis or Engine	**F 02U V00 287-01**
Update LapSim Chassis & Engine	**F 02U V00 288-01**

Analysis

WinDarab

Data Analysis Software

WinDarab is an evaluation tool for monitoring and analyzing of logged data. It is Windows-based and specially designed for motorsports use. Depending on the functionality the software is available in different versions, WinDarab-Light and WinDarab-Expert. Additional we offer a „Free“ version without dongle.



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 (analog and digital)
Number of displays available
Various display set-ups selectable and storable
Laptrigger signal included

Required hardware components
PC:
IBM PC Pentium/AMD Athlon compatible, min. 1.6 GHz
Min. 1 GB RAM
Min. 1 GB free HD space
VGA / WGA monitor (min. 1,024 x 768)
Operating systems:
Windows XP 32 Bit, Vista 32 Bit

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-Free	**Free download at www.bosch-motorsport.com**
WinDarab-Light	**F 01E B01 402**
WinDarab-Expert	**F 01E B01 418**
Upgrade	**on request**

Encryption of data / access rights

The on-board recorded measuring data will be encrypted in the data logger via a so-called project key. Each project key belongs to a specified project or customer.

Reading or viewing data with WinDarab „Light“ or „Expert“, is either possible with

- a dongle with key information on it or
- a project license with corresponding key information on the PC.

The project license can be installed on many PCs, whereas the single-user license needs the stuck dongle for operation. So the data are secured against misuse.

Dongle-free working with WinDarab „Free“

To install WinDarab on many PCs (like the project licenses) we offer WinDarab „Free“ exclusively for free available Bosch Motorsport software and project keys. To ensure our customers data we will not offer a WinDarab „Free“ installation for customers program datasets or project keys.

WinDarab Feature List			
	Free	**Light**	**Expert**
Function			
Limited number of opened files	2	4	–
Limited number of measuring data windows	1	2	–
Limited number of areas in measuring data windows	2	4	–
Views - Histogram	•	•	•
Views - (x/y)-Plot	•	•	•
Views - Distribution	–	•	•
Views - Min/Max-Tables		•	•
Views - Fourier-Transformation		•	•
Views - Outing report		–	•
Views - Lap analysis		–	•
Views - Flowcharts	–	–	•
Views - Instrument Panel (numeric/bargraph/round scale)	•	•	•
User defined Physical Units	•	•	•
Language Support German/English	•	•	•
Racetrack generation via speed/lateral G or GPS	•	•	•
ASCII Export	•	•	•
Matlab Import (seperated tool)	•	•	•
Extras - Functions/Conditions/Differences		–	•
Extras - Settings - Comments		–	•
Measuring data window - Area channel name - View options		–	•
Desktop load/save	•	•	•
Free dongle read-in (single user license)		•	•
Free read-in (project license)		•	•
Telemetry		•	•
Data security (data recording, Darab files)	–	•	•

Accessories

Communication Interface

MSA-Box
(K-Line / CAN Interface)

The MSA-Box is the low cost unit for PC-supported calibration 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
Temperature range	0 ... 70 °C

Electrical 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

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

Operating system
Windows 2000
Windows XP

Connectors and Wires	
Connector AS 6-12-35PN	F 02U 000 441-01
Mating connector AS 0-12-35SN	F 02U 000 258-01
Pin 1	terminal 30 (permanent pos)
Pin 2	terminal 15 (switched pos)
Pin 3	GND
Pin 4	CAN_High
Pin 10	K-line
Pin 16	CAN_Low
Pin 22	SCR
Diagnosis wire length	2 m
USB wire length	0.5 m

Part Number	
MSA-Box	**B 261 208 015-01**

Handheld Test Devices

RS 2000

With the RS 2000 you can simulate crank shaft-, cam shaft- and wheel-speed-signals quickly and comfortable.

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.

Electrical data	
Power supply	12 V

Part numbers	
RS 2000	**B 261 206 862 01**
Cable harness connector	**B 261 206 451**

Expansion Modules

Lambdatronic LT4

The Lambdatronic LT4 provides controlled pumping current to supply up to 4 Bosch (Mini-)LSU 4.9. The lambda value, the sensor temperature and diagnostics are available via CAN and analog signal.

The LSU contains a Nernst and a pump cell. The lambda in the Nernst cell is controlled to λ = 1.013 independent of the oxygen contents on the emission side, through a current through the pump cell. The current proportional output voltage of the IC is a measure of the lambda value.

The main feature and benefit of this unit is the combination of the Bosch well known lambda IC and a very compact box size with motorsports specification. Furthermore the analog signal output can be configured freely.

Application	
Application	0.75 ... 10.12 λ
Compatible Sensor Type	Bosch (Mini-)LSU 4.9
Nr. of Channels	4
Heater	internal
Operating Temp Range (housing)	-20 ... 85 °C
Storage Temperature Range	-20 ... 85 °C
Communication Link	K-Line / CAN
Max. Vibration	*Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)*

Electrical Data	
Power Supply U_s	(6.5) 10 ... 17 V
Max Power Supply (1 min) U_s max	26 V
Thermal Dissipation Loss	3 W @ 14 V
Current I_s	5 A
Current I_s (Heating up)	26 A

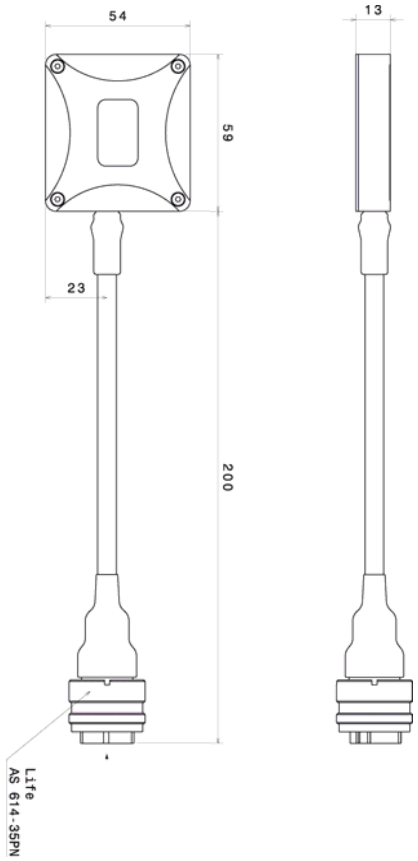
Mechanical Data	
Weight with Cable	98 g
Sealing	100 % humidity
Mounting	Velcro
Size w/o Cable (w*l*h)	54 x 59 x 13 mm

Characteristic	
Signal Output 1	CAN
Signal Output 2	4 x 0 ... 5 V
CAN- Baudrate	1 Mbaud
Signal Resolution	$2,5 * 10^{-4}$ lambda
Signal Sampling Rate	100 Hz
CAN Refresh Rate	100 Hz

Software	
Configuration with Modas	included

Connectors and Cables	
Connector	AS 6-14-35PN
Connector Loom	AS 1-14-35SN
Sleeve	Viton
Cable Size	26
Cable Length L	20 cm

Part Number	
Lambdatronic LT4	**F 01T A20 070-04**



Application Hint
The LT4 is designed to supply 4 Bosch (Mini)-LSU 4.9.
The unit can be connected to any CAN system (1 Mbaud) and analog measuring device.
To avoid signal errors, a cable length of maximum 1,5 m between sensor and box is recommended.
The unit is secure from miss-pinning.
The reference ground (GND_REF) has to be connected either to the measuring device or to the system ground.
A ground offset of 2 V (max.) between GND and GND_REF has not to be exceeded.
See the LT4 function sheet for software documentation (CAN protocol e.g.).
Please find further application hints in the offer drawing (http://www.bosch-motorsport.com).

Pin	Function
1	+ 12 V (Battery +)
2	+ 12 V (Battery +)
3	Ground (Battery -)
4	Ground (Battery -)
5	K-Line Diagnostic Connection
6	CAN1 + (high)
7	CAN1 – (low)
8	Analog out 1
9	Analog out 2
10	Analog out 3
11	Analog out 4
12	Reference GND for anal. out
13	Shield
14	Pump Current LSU1 IP1
15	Virtual GND LSU1 VM1
16	Heater PWM LSU1 Uh-1
17	Heater (Batt +) LSU1 Uh+1
18	Setup Current LSU1 IA1
19	Nernst Voltage LSU1 UN1

Pin	Function
20	Pump Current LSU2 IP2
21	Virtual GND LSU2 VM2
22	Heater PWM LSU2 Uh-2
23	Heater (Batt +) LSU2 Uh+2
24	Setup Current LSU2 IA2
25	Nernst Voltage LSU2 UN2
26	UN1Pump Current LSU3 IP3
27	Virtual GND LSU3 VM3
28	Heater PWM LSU3 Uh-3
29	Heater (Batt +) LSU3 Uh+3
30	Setup Current LSU3 IA3
31	Nernst Voltage LSU3 UN3
32	Pump Current LSU4 IP4
33	Virtual GND LSU4 VM4
34	Heater PWM LSU4 Uh-4
35	Heater (Batt +) LSU4 Uh+4
36	Setup Current LSU4 IA4
37	Nernst Voltage LSU4 UN4

AWS LSU 4.9

The AWS LSU 4.9 is used in combination with the lambda sensor (Mini-)LSU 4.9. The box is able to supply two (Mini-)LSU 4.9 lambda sensors. It includes two heaters and converts each specific sensor signal into two separate lambda signals. Furthermore, 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.

Please note: Lambda sensors are not part of the AWS LSU 4.9.

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

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

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

Electrical Data	
Power supply	5 ... 20 V
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 sensor, the following CAN-IDs will receive the A/F value as **16-bit unsigned Integer** and the heating value and the temperature values as **8-bit unsigned byte** (Motorola-type):

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

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

Pin assignment life connector		
Pin	Name	Description
1	GND	Ground
2	GND LSU 1/2	Ground LSU heater
3	Vext	External power supply 5 ... 20 V
4	LSU heater	External power supply for LSU 1/2 heater
9	CAN H	CAN Bus high
10	CAN L	CAN Bus low
11	TxD	TxD serial interface
12	RxD	RxD serial interface

Pin assignment LSU-1/2 in connector		
Pin	Name	Description
1	LSU1 IP	Inv. Input of pump current amp
2	LSU1 VM	Virtual ground
3	GND heater 1	Ground for heater 1
4	Vext heater 1	External power supply 5 ... 20 V LSU1
5	LSU1 IA	Non Inv. input of pump current amp
6	LSU1 UN	Inv. input of pump current control
7	LSU2 IP	Non Inv. input of pump current amp
8	LSU2 VM	Virtual ground
9	GND heater 2	Ground for heater 2
10	Vext heater 2	External power supply 5 ... 20 V LSU2
11	LSU2 IA	Non Inv. input of pump current amp
12	LSU2 UN	Inv. input of pump current control

Accessories	
Lambda Sensor LSU 4.9	**0 258 017 025**
Lambda Sensor LSU 4.9	**B 261 209 356**
Lambda Sensor Mini-LSU 4.9	**B 258 490 103-20**

Part Number	
AWS LSU 4.9	**F 01E B01 622**

CAN Module EM-A6

6 analog Channels

The extended module EM-A6 measures up to 6 analog channels, converts the values to a 10 bit format and combines them to a CAN-Message. The module has a CAN-Interface (CAN2.0 B) which is used for transmitting the information from and to the module.

Weight and space required for the wiring harness can be reduced by daisy-chaining multiple extended modules because power and communication lines are routed through the device.

Application	
Operating temperature range	-20 °C ... 85 °C

Mechanical Data	
Size	155 x 38 x 32.1 mm
Weight	153 g
Max. vibration *(see Appendix or www.bosch-motorsport.com)*	*Vibration Profile 1*

Electrical Data	
Power supply	10 V ... 18 V
Supply current (without load)	max. 80 mA
ADC resolution	10 Bit (4.8 mV)
Update rate	5 ms
CAN speed	1 MBaud

Communication/Configuration Interface
CAN2.0 B, using interface MSA-Box and RaceCon
CAN-ID programmable via RaceCon
Pull-ups switchable via RaceCon

Loom Side Connector
ASL606-05PN-HE red
ASL606-05PD-HE green
ASL606-05SN-HE red

Connector ASL206-05SN-HE (red); ANAx	
Pin-No.	Function
1	UB_SG
2	AGND
3	ANA_INx
4	Vref50
5	N/C

Connector ASL206-05SD-HE (green), XOUT	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-High
4	CAN-Low
5	GND

Connector ASL206-05PN-HE (red), XIN	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Low
4	CAN-High
5	GND

CAN Protocol

Byte order

Big endian (high-byte/low-byte, Motorola)

CAN Frame 1

Byte	0	1	2	3	4	5	6	7
Value	Row counter = 0	AD channel 1		AD channel 2		AD channel 3		unused

CAN Frame 2

Byte	0	1	2	3	4	5	6	7
Value	Row counter = 1	AD channel 4		AD channel 5		AD channel 6		unused

U [V] = raw value * 5 V / 1024

Part Number

CAN Module EM-A6	**F 01T A20 007**

CAN Module EM-C

Module for programming APS-C

The extended EM-C module is part of the measurement equipment. It displays the current angle of the camshaft that is measured by the Bosch camshaft angle sensor APS-C and transmitted via CAN. The EM-C module receives this message and displays the angle (-180° ... +180°) in its bright red dot-matrix display.

Moreover, the EM-C module features a reset-button which, during engine assembly, enables the engine builder to precisely set the APS-C sensor reference to “zero” when the camshaft is at the desired “zero” position. The module has a 500 kBaud CAN-Interface (CAN2.0 B) which is used for transmitting the information from and to the module.

The module is delivered with a connection adapter between housing and connector.

Mechanical Data	
Size	94,2 x 30,0 x 24,2 mm
Weight	97 g

Electrical Data	
Power Supply	8 V ... 18 V
Supply Current (100 % brightness, dots on)	max. 300 mA

Communication/Configuration Interface
CAN2.0 B, using interface MSA-Box and RaceCon
Programmable CAN-ID

Loom Side Connector
AS6-06-05SN-HE

Connector ASL-006-05PN-HE	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Hi
4	CAN-LO
5	N/C

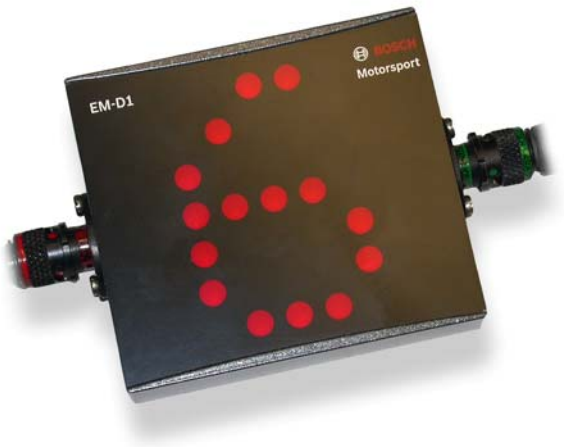
Part Number	
CAN Module EM-C	**F 01T A20 025**

CAN Module EM-D1

Large, single Character

The extended module EM-D1 displays 1 character of arbitrary information on a large bright red dot-matrix display with 16 intensity levels. The module has a CAN-Interface (CAN2.0 B) which is used for transmitting the information from and to the module.

Weight and space required for the wiring harness can be reduced by daisy chaining multiple extended modules because the power and communication lines are routed through the devices.



Application	
Operating Temperature	-20 °C ... 85 °C

Mechanical Data	
Max. Vibration	*Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)*
Size	69,45 x 62,45 x 16,83 mm
Weight	87 g

Electrical Data	
Power Supply	8 V ... 18 V
Supply Current (100 % brightness, dots on)	max. 395 mA

Communication/Configuration Interface
CAN2.0 B, using interface MSA-Box and RaceCon
Programmable CAN-ID and characters

Loom Side Connector
ASU-6-03-05SN-HE (red)
ASU-6-03-05PD-HE (green)

Input Connector ASU-0-03-05PN-HE (red)	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Hi
4	CAN-LO
5	N/C

Output Connector ASU-0-03-05SD-HE (green)	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Hi
4	CAN-LO
5	N/C

Part Number	
CAN Module EM-D1	**F 01T A20 006**

CAN Module EM-D8

8 Characters

The extended module EM-D8 displays up to 8 characters of arbitrary information given in a CAN frame on a bright red dot-matrix display. The module has a CAN-Interface (CAN2.0 B) which is used for transmitting the information from and to the module.

Weight and space required for the wiring harness can be reduced by daisy chaining multiple extended modules because the power and communication lines are routed through the devices.

Application	
Operating Temperature	-20 °C ... 85 °C

Mechanical Data	
Max. Vibration	*Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)*
Size	85,4 x 32,3 x 17,1 mm
Weight	51 g

Electrical Data	
Power Supply	8 V ... 18 V
Supply Current (100 % brightness, dots on)	max. 300 mA

Communication/Configuration Interface
CAN2.0 B, using interface MSA-Box and RaceCon
Programmable CAN-ID
Programmable text message

Loom Side Connector
ASU-6-03-05SN-HE (red)
ASU-6-03-05PD-HE (green)

Input Connector ASU-0-03-05PN-HE (red)	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Hi
4	CAN-LO
5	N/C

Output Connector ASU-0-03-05SD-HE (green)	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Hi
4	CAN-LO
5	N/C

Note that ASU-0-03-05PN-HE is the default connector on every device while ASU-0-03-05SD-HE is an optional extra connector if daisy chaining of devices is intended.

Part Number	
CAN Module EM-D8 (with output connector)	**F 01T A20 004**
CAN Module EM-D8 (without output connector)	**F 01T A20 046**

CAN Module EM-H4

4 Hall Speed sensors

The extended module EM-H4 acquires the signal periods of up to 4 Hall-effect speed sensors and transmits them as 16-bit values to a CAN-Interface (CAN2.0 B) in a single CAN-message.

The module is delivered with an adapter between housing and connector.

Application	
Operating Temperature Range	-20 ... 85 °C

Mechanical Data	
Max. Vibration	*Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)*
Size	85,4 x 32,3 x 17,1 mm

Electrical Data	
Power Supply	8 V ... 18 V
Supply Current	max. 70 mA
Input	10 ... 10000 impulses/s

Communication/Configuration Interface
CAN2.0 B, using interface MSA-Box and RaceCon
Programmable CAN-ID
CAN speed 1 Mbaud
Update rate 10 ms

Loom Side Connector
AS-6-10-35SN-HE

CAN Protocol

Byte order

Big endian (high-byte/low-byte, Motorola)

Byte	0	1	2	3	4	5	6	7
Value	Front left		Front right		Rear left		Rear right	

Signal period [ms] = 3,2 µs * raw value / 1000

Connector AS-0-10-35PN-HE	
Pin-No.	Function
1	UBATT
2	GND
3	N/C
4	CAN-Hi
5	CAN-LO
6	Front left
7	Front right
8	Rear left
9	Rear right
10	GND
11	SHIELD
12	N/C
13	N/C

Part Number	
CAN Module EM-H4	**F 01T A20 008 01**

CAN Module EM-I4

4 inductive Speed Sensors

The extended module EM-I4 acquires the signal periods of up to 4 inductive speed sensors and transmits them as 16-bit values with 3,2us quantization to a 1 MBaud CAN-Interface (CAN2.0 B) in a single CAN-message.

The module is delivered with an adapter between housing and connector.

Application	
Operating Temperature	-20 °C ... 85 °C

Mechanical Data	
Max. Vibration	*Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)*
Size	85,4 x 32,3 x 17,1 mm

Electrical Data	
Power Supply	8 V ... 18 V
Supply Current	max. 70 mA
Input	10 to 10 000 impulses/s

Communication/Configuration Interface
CAN2.0 B, using interface MSA-Box and RaceCon
Programmable CAN-ID
CAN speed 1 Mbaud
Update rate 10 ms

Loom Side Connector
AS-6-10-35SN-HE

CAN Protocol								
Byte order: Big endian (high-byte/low-byte, Motorola)								
Byte	0	1	2	3	4	5	6	7
Value		Front left		Front right		Rear left		Rear right

Signal period [ms] = 3,2 µs * raw value / 1000

Connector AS-0-10-35PN-HE	
Pin-No.	Function
1	UBATT
2	GND
3	N/C
4	CAN-Hi
5	CAN-LO
6	Front left
7	Front right
8	Rear left
9	Rear right
10	GND
11	SHIELD
12	N/C
13	N/C

Part Number	
CAN Module EM-I4	**F 01T A20 009**

CAN Module EM-L5

5 LEDs

The extended module EM-L5 uses 5 ultra bright LED lights with selectable levels of intensity to display e. g. the gear shift request signal from the ECU to the driver. The module has a 1 MBaud CAN-Interface (CAN2.0 B) which is used for transmitting the information from and to the module.

Weight and space required for the wiring harness can be reduced by daisy chaining multiple extended modules because the power and communication lines are routed through the devices.

Application	
Operating Temperature	-20 °C ... 85 °C

Mechanical Data	
Max. Vibration	*Vibration Profile 1 (see Appendix or www.bosch-motorsport.com)*
Dimensions	85,4 x 32,3 x 17,1 mm
Weight	50 g

Electrical Data	
Power Supply (Note!)	10 V ... 15 V
Supply Current (100 % brightness, all LEDs on)	max. 200 mA

Communication/Configuration Interface
CAN2.0 B, using interface MSA-Box and RaceCon
Programmable CAN-IDs
Programmable thresholds for LEDs
Display of an arbitrary information of the CAN Bus or reading of two channels (speed and gear)

Loom Side Connector
ASU-6-03-05SN-HE (red)
ASU-6-03-05PD-HE (green)

Input Connector ASU-0-03-05PN-HE (red)	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Hi
4	CAN-LO
5	N/C

Output Connector ASU-0-03-05SD-HE (green)	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Hi
4	CAN-LO
5	N/C

Note that ASU-0-03-05PN-HE is the default connector on every device while ASU-0-03-05SD-HE is an optional extra connector if daisy chaining of devices is intended.

Part Number	
CAN Module EM-L5 (with output connector)	**F 01T A20 002**
CAN Module EM-L5 (without output connector)	**F 01T A20 045**

CAN Module EM-P5

5 low Power Outputs

The extended module EM-P5 has 5 open collector outputs and is used to switch small loads. Each of these output stages can drive a maximum load current of 100 mA. The module has a 1 MBaud CAN-Interface (CAN2.0 B) for the signal input.

The module is delivered with a Y-connection adapter.

Application	
Operating Temperature	-20 °C ... 85 °C

Mechanical Data	
Size	85,4 x 32,3 x 17,1 mm
Weight	63 g
Max. Vibration *(see Appendix or www.bosch-motorsport.com)*	*Vibration Profile 1*

Electrical Data	
Power Supply	8 V ... 18 V
Supply Current (without Load)	max. 50 mA

Communication/Configuration Interface
CAN2.0 B, using interface MSA-Box and RaceCon
Programmable CAN-ID
Programmable thresholds and hysteresis for each output

Loom Side Connector
ASU-0-03-05SN-HE (red)
ASU-0-03-05PD-HE (green)

Input Connector ASU-0-03-05PN-HE (red)	
Pin-No.	Function
1	UBATT
2	GND
3	CAN-Hi
4	CAN-LO
5	N/C

Output Connector ASU-0-03-05SD-HE (green)	
Pin-No.	Function
1	L1 (Open collector output)
2	L2 (Open collector output)
3	L3 (Open collector output)
4	L4 (Open collector output)
5	L5 (Open collector output)
Note that both connectors are at the end of the connection adapter.	

Application Hint
Load must always be switched via terminal 15 or main relay, it must not be switched via terminal 30.
Please note, that the EM-P5 is not short-circuit resistant.

Part Number	
CAN Module EM-P5	**F 01T A20 003**

ThermoCAN Module

4 Type K Thermocouple Sensors

The extended ThermoCAN module has 4 inputs for Type K thermocouple sensors. All 4 channels are galvanically isolated. The module has a 1 MBaud CAN-Interface (CAN2.0 B) for the signal input.

Application	
Operating Temperature	0 °C ... 70 °C
Temperature Range	-200 °C ... 1 000 °C
Supports NiCrNi Type K sensors	

Mechanical Data	
Max. Vibration *(see Appendix or www.bosch-motorsport.com)*	*Vibration Profile 1*
Size	70,0 x 40,0 x 16,0 mm
Weight	170 g

Electrical Data	
Power Supply	8 V ... 18 V
Supply Current (without load)	max. 70 mA
Sampling Rate	max. 200 Hz

Communication/Configuration Interface
Fix CAN-ID, must be changed by Bosch Motorsport

Loom Side Connector
ASL-606-05PD-HE (green)
ASL-006-05SA-HE (yellow)

Sensor Connector ASL-006-05SD-HE (green)	
Pin-No.	Function
1	n.c.
2	Signal minus
3	Signal positive
4	n.c.
5	screen

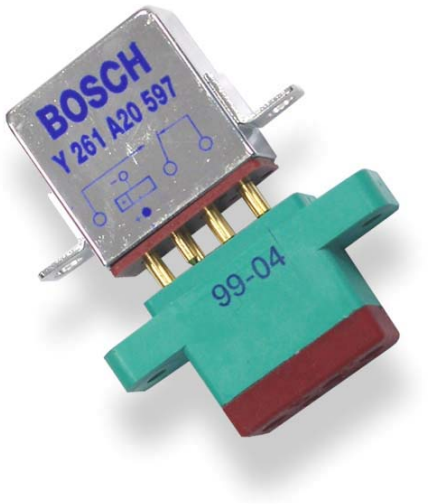
Comm. Connector ASL-606-05PA-HE (yellow)	
Pin-No.	Function
1	8-18 V positive
2	GND
3	CAN High
4	CAN Low
5	n.c.

Part Number	
ThermoCAN Module	**F 01T A20 028**

Relay

Relay 25 A

The relay 25 A is 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	-45 ... 125 °C
Vibration	30 g/70 Hz ... 3 kHz
Shock	100 g (11 ms)

Electrical Data	
Power supply	12 ... 14.5 V
Min. switches	50,000
Coil resistance @ 25 °C	80 Ω
Max. current	25 A
Current vs. time characteristic (the relay shall be compatible with a 25 A circuit breaker)	
I [A]	**t [s]**
30 A	3,600 s (1 h)
50 A	5 s
100 A	1.2 s
250 A	0.2 s
350 A	0.1 s

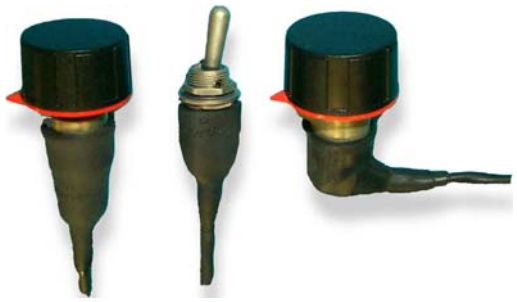
Part Numbers	
Relay	**Y 261 A20 597-01**
Base	**Y 261 A20 598-01**

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

Design
Straight
90° angled

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

Part numbers

Model	Design	Connector	
12 steps	straight	ASL 6-06-05PN-HE	**B 261 209 643-01**
for MAP function	straight	ASL 6-06-05PN-HE	**B 261 209 644-01**
4 steps display dimmer DDU	straight	ASL 6-06-05PN-HE	**B 261 209 646-01**
4 steps LED dimmer DDU	straight	ASL 6-06-05PN-HE	**B 261 209 647-01**
6 steps display dimmer and switch over DDU	straight	ASL 6-06-05PN-HE	**B 261 209 659-01**
All models can be ordered with 90° angled.			

Appendix

General Information

ESD, Handling and Transport

Please be mindful of the specifications concerning ESD. Never grab into the connectors. Please follow the regulations when transporting devices (e.g. ESD packaging materials).

Battery

Some of the devices use Lithium-Ion batteries. Please use extra caution to be certain that the correct removal procedure is followed. Abide by the maintenance cycle schedule to ensure correct operation. Bosch Motorsport recommends maintenance once a year.

Installation

The correct installation extends reliability and durability. Please follow the specifications regarding temperature, humidity, vibration and liquid compatability.

Vibration Profile 1

Broadband noise: 8h/Direction	
Frequency (Hz)	**Acceleration density [(m/s²)²/Hz]**
20	50,4
55	26,0
180	1,0
300	1,0
360	0,56
1.000	0,6
2.000	0,6
Effective Value a_{Eff}	55,4 m/s²

Sinus: 8h/Direction	
Frequency (Hz)	**Acceleration [m/s²]**
100	50
180	200
250	200
350	60
2.000	60

Vibration Profile 2

Broadband noise: 8h/Direction	
Frequency (Hz)	**Acceleration density [(m/s²)²/Hz]**
10	10
50	10
66,7	1
100	1
1.000	0,1
Effective Value a_{Eff}	26,9 m/s²

Vibration Profile 3

Sinus		
Alteration rate of frequency: 1 oct./min		
Frequency [Hz]	**Amplitude of acceleration [m/s²]**	**Amplitude of oscillation lane [µm]**
20	50	
85	50	
85		175
200		175
200	280	
220	280	
300	125	
440	125	

Broadband noise	
Frequency [Hz]	**Acceleration density [(m/s²)²/Hz]**
10	14,0
50	7,0
60	3,5
300	0,51
500	45,6
1.500	15,26
Effective Value a_{Eff}	168 m/s²

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