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Control

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Overview

Engine Control Unit MS 6 CUP EVO



- Delivery for OEM with project-specific program status
- HP package for 4 cylinder engines
- Supports Customer Code Area CCA
- 8 GB memory
- · SENT support

Engine Control Unit MS 6.1 EVO



- Optimized for low pressure injection
- Measurement with 21 analog inputs
- Supports Customer Code Area CCA
- 4 GB memory plus 4 GB upgrade
- SENT support

Engine Control Unit MS 6.2 EVO



- Optimized for low pressure injection
- Measurement with 38 analog inputs
- Supports Customer Code Area CCA
- 4 GB memory plus 4 GB upgrade
- SENT support

Engine Control Unit MS 6.3 EVO



- Optimized for low and high pressure injection
- Measurement with 21 analog inputs
- Supports Customer Code Area CCA
- 4 GB memory plus 4 GB upgrade
- SENT support

Engine Control Unit MS 6.4 EVO



- Optimized for low and high pressure injection
- Measurement with 38 analog inputs
- Supports Customer Code Area CCA
- 4 GB memory plus 4 GB upgrade
- SENT support

Engine Control Unit MS 6.4P Engine Control Unit MS 7.4 EVO



- 866 MHz Dual Core Processor for projects with high performance demand
- Supports Customer Code Area CCA
- 4 GB memory plus 16 GB upgrade
- SENT support



- Optimized for low and high pressure injection
- Data logger included
- Gearbox control optionally included
- Gigabit data interface

Engine Control Unit MS 6 CUP EVO



Features

- Delivery for OEM with project-specific program status
- ▶ HP package for 4 cylinder engines
- ► Supports Customer Code Area CCA
- ▶ 8 GB memory
- ► SENT support

The MS 6 CUP EVO engine control unit manages gasoline engines up to 4 cylinders. As a member of our MS 6 family it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 6 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 6 CUP EVO to support complex or unusual engine or chassis configurations.

Application

High pressure injection

Max. 4 cylinders up to 12,500 rpm

Low pressure injection

· Max. 4 cylinders up to 12,500 rpm

Ignition

4 x ignition control, IGBT or BJT, coils with integrated amplifier

Physical engine model for fast application

- determine engine load by throttle position or air pressure signals
- mixture control and basic ignition guided by main signal relative load rl

- Subsystems pit speed-, launch-, rpm-limiter and ASR are integrated inside torque control
- Separated power cut functions to assist various gear cut systems
- · Diagnostics
- · Integrated safety strategy for 1 electronic throttle control

Integrated support of manual gearshift

Electronic throttle control

VVT

Turbo control

Traction control

Launch control

LTE Ethernet telemetry support

Internal logger Partition 1

- 4 GB memory
- 100 free configurable channels, 20 Hz

Internal logger Partition 2

- 4 GB memory
- 200 free configurable channels, 50 Hz

Logging rate

- Usage of all features: 300 kB/s
- Primary logging use case: 600 kB/s
- · Logging data download rate: up to 4 MB/s

Logger Options See Upgrades

Technical Specifications

Mechanical Data

Aluminum housing	
2 Bosch connectors	196 pins in total
Size	226 x 181 x 44 mm
Weight	1,086 g
Protection Classification	IP54
Temp. range (at internal sensors)	-20 to 80°C

Electrical Data

Power supply	6 to 18 V
CPU	Dual Core 667 MHz, FPGA

Inputs

26 analog inputs

4 x reserved for electronic throttle controls

5 x no integrated pull-up

3 x option for angle synchronous measurement, no integrated pull-up

4 x fixed 3.01 kOhm pull-up

10 x switchable 3.01 kOhm pull-up

6 internal measurements

1 x ambient pressure

1 x acceleration 6-axis

	2 x ECU temperature
	2 x ECU voltage
4 fun	action related inputs
	1 x Thermocouple exhaust gas temperature sensor (K-type)
	1 x Lambda interface for LSU 4.9 sensor type
	2 x Knock sensors
18 di	igital inputs
	1 x switchable Hall or inductive sensor for flywheel measure
	ment
	2 x Hall sensor for sync wheel detection
	4x switchable Hall or DF11 sensors for camshaft position c wheel speed
	2 x switchable Hall or inductive sensors for turbo speed measurement
	1 x digital switch Engine ON/OFF
	8 x digital, e.g. SENT
Sens	sor supplies and screens
4 x se	ensor supplies 5 V, 50 mA
3 x se	ensor supplies 5 V, 150 mA
7 x se	ensor grounds
2 x se	ensor screens
Out	outs
15 fu	ınction related outputs
High	Pressure Injection
	4 x controls, magnetic injectors 1 x high pressure pump with MSV control
Low	Pressure Injection
	4 x controls, high impedance injectors
Igniti	on
	4 x controls, IGBT or BJT, coils with integrated amplifier
1 x 8	.5 A H-bridge reserved for electronic throttle
1 x 4	A pwm lowside switch for Lambda heater
13 fr	eely configurable outputs
	2 x 8.5 A H-bridge
	1 x 4 A pwm lowside switch
	2 x 3 A pwm lowside switch
	5 x 2.2 A pwm lowside switch
	3 x 1 A pwm lowside switch
3 out	tputs signals
	1 x engine rpm
	1 x flywheel
	1 x trigger wheel
Soft	ware Tools (free download)
Data	Analysis tool WinDarab V7
Dala	

Mating Connectors (no	t included)
Mating Connector 91 pins	F02U.B00.711-01
Mating Connector 105 pins	F02U.B00.712-01
Norms	
Product Safety	
EN IEC 62368-1:2020+A11:2	2020
Materials	
REACH - Nr. 1907/2006	
EMC	
UNECE10:rev.6/AMD1:2020	
KN41	
ISO11452-2	
ISO11452-4	
ISO10605	
ISO7637-2	
ISO7367-3	
ISO16750-2	
US FCC: Title 47, Part 15 Sub	part B
ICES-003	
Testing	
SAEJ1211	

Communication
2 Ethernet
3 CAN
1 LIN
1 USB
8 SENT
1 RS232
1 Time sync synchronization Ethernet
3 Communication screens

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

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

Please remember that the mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

Hardware Upgrade for CCA per device

Provides the option to run customer developed software code on $\operatorname{\mathsf{Bosch}}\nolimits \operatorname{\mathsf{ECU}}\nolimits$

FULL_LOG_1

Extension for Partition 1

- 1,500 channels
- fastest sampling 1,000 Hz or 1 syncro

FULL_LOG_2

Extension for Partition 2

- 1,500 channels
- · fastest sampling 1,000 Hz or 1 syncro
- · long-term recording
- own data protection code

USB_DATA

Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB flash drive only Adapter cable to PC USB-Port

Mating connector for USB flash drive on car loom side SW licence USB-Port unlocked

Gear Control

Project individual option

Innovation License Device

Activation of engine speed functions* and near/far injection function per unit

Innovation Package Project

Activation of engine speed functions* and near/far injection function per project version

*Engine speed functions: second or backup engine speed sensor, quick engine start, detection of engine reverse rotation

Ordering Information

Engine Control Unit MS 6 CUP EVO

Order number F02U.V03.111-01

CCA Hardware Upgrade per device

Order number F02U.V02.137-01

Software Options

FULL_LOG_1

Order number F02U.V02.304-01

FULL_LOG_2

Order number F02U.V02.305-01

Gear Control

Order number on request

Innovation License Device

Order number **F02U.V02.510-01**

Innovation Package Project

Order number F02U.V02.511-01

Accessories

USB_DATA

Order number F02U.V02.214-01

Breakout Box BOB MS 6 EVO Order number F02U.V02.294-02

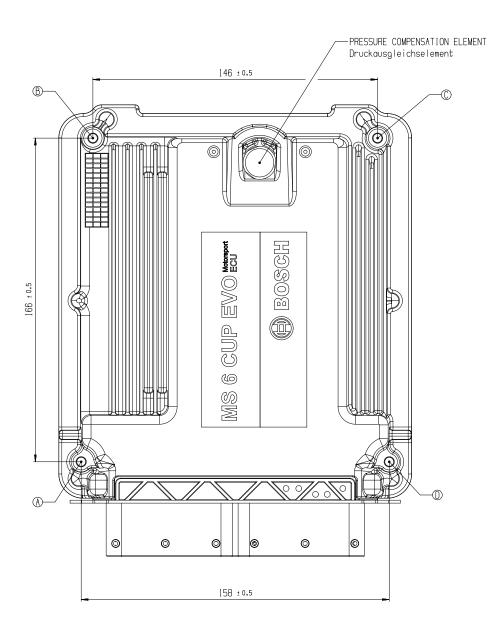
Mating Connector 91 pins

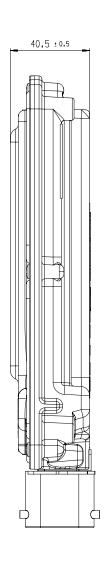
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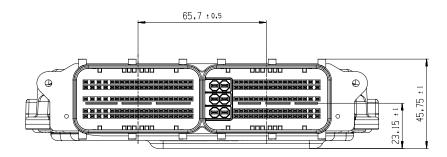
Mating Connector 105 pins

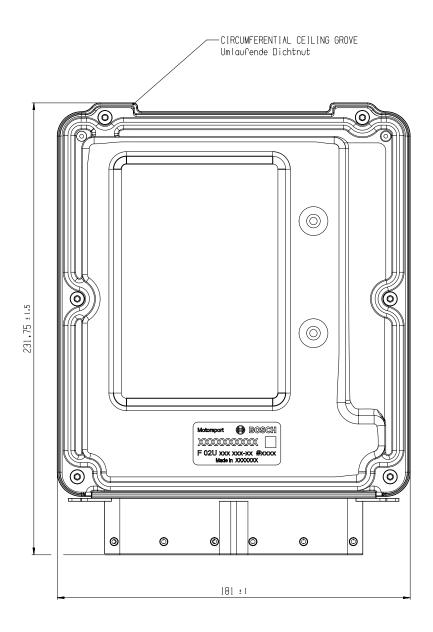
Order number F02U.B00.712-01

Dimensions









Engine Control Unit MS 6.1 FVO



Features

- ▶ Optimized for low pressure injection
- ▶ Measurement with 21 analog inputs
- ► Supports Customer Code Area CCA
- ▶ 4 GB memory plus 4 GB upgrade
- ► SENT support

The MS 6.1 EVO engine control unit manages gasoline engines up to 12 cylinders. As a member of our MS 6 family it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 6 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 6.1 EVO to support complex or unusual engine or chassis configurations.

Application

Low pressure injection

Max. 12 cylinders up to 12,500 rpm, high impedance injectors only

Ignition

• 12 x ignition control, IGBT or BJT, coils with integrated ampli-

Physical engine model for fast application

- determine engine load by throttle position or air pressure sig-
- mixture control and basic ignition guided by main signal relative load rl

- · Subsystems pit speed-, launch-, rpm-limiter and ASR are integrated inside torque control
- Separated power cut functions to assist various gear cut systems
- Diagnostics
- Integrated safety strategy for electronic throttle control

Integrated support of manual gearshift	
Electronic throttle control	Optional, see Upgrades
VVT	Optional, see Upgrades
Turbo control	Optional, see Upgrades
Traction control	Optional, see Upgrades
Launch control	Optional, see Upgrades

LTE Ethernet telemetry support

Internal logger

- 4 GB memory on partition 1 (standard)
- Plus 4 GB memory on partition 2 (optional)
- 100 free configurable channels, 50 Hz

Logging rate

- Usage of all features: 300 kB/s
- Primary logging use case: 600 kB/s
- Logging data download rate: up to 4 MB/s

Logger Options See Upgrades

Technical Specifications

Mechanical Data

Aluminum housing	
2 Bosch connectors	196 pins in total
Size	226 x 181 x 44 mm
Weight	1,086 g
Protection Classification	IP54
Temp. range (at internal sensors)	-20 to 80°C
Flectrical Data	

.ectrical Data

Power supply	6 to 18 V
CPU	Dual Core 667 MHz, FPGA

Inputs

21 analog inputs

6 x reserved for electronic throttle controls

3 x no integrated pull-up

3 x option for angle synchronous measurement, no integrated pull-up

4 x fixed 3.01 kOhm pull-up

5 x switchable 3.01 kOhm pull-up

6 internal measurements

1 x ambient pressure

1 x acceleration 6-axis

2 x ECU temperature

2 x ECU voltage

Norms

8 function related inputs 1 x Thermocouple exhaust gas temperature sensors (K-type) 2 x Lambda interfaces for LSU 4.9 sensor types 1 x Lap trigger/beacon input 4 x Knock sensors 18 digital inputs 1 x switchable Hall or inductive sensor for flywheel measurement 2 x Hall sensor for sync wheel detection 4 x switchable Hall or DF11 sensors for camshaft position or wheel speed 2 x switchable Hall or inductive sensors for turbo speed measurement 1 x digital switch for engine ON/OFF 8 x digital, e.g. SENT Sensor supplies and screens 4 x sensor supplies 5 V / 50 mA 3 x sensor supplies 5 V / 150 mA 7 x sensor grounds 2 x sensor screens Outputs 28 function related outputs Low Pressure Injection 12 x 2.2 A controls, high impedance injectors Ignition 12 x control, IGBT or BJT, coils with integrated amplifier 2 x 8.5 A H-bridge reserved for electronic throttle 2 x 4 A pwm lowside switch for Lambda heater 19 freely configurable outputs 1 x 8.5 A H-bridge 2 x 4 A pwm lowside switch 4 x 3 A pwm lowside switch 8 x 2.2 A pwm lowside switch 4 x 1 A pwm lowside switch 3 output signals 1 x engine rpm 1 x flywheel 1 x trigger wheel Software Tools (free download)

Data Analysis tool WinDarab V7 System Configuration tool RaceCon 2.7.0.9 or later Mating Connectors (not included) Mating Connector 91 pins F02U.B00.711-01

Mating Connector 105 pins

F02U.B00.712-01

Product Safety EN IEC 62368-1:2020+A11:2020 **Materials** REACH - Nr. 1907/2006 **EMC** UNECE10:rev.6/AMD1:2020 **KN41** ISO11452-2 ISO11452-4 ISO10605 ISO7637-2 ISO7367-3 ISO16750-2 US FCC: Title 47, Part 15 Subpart B **ICES-003 Testing**

Communication
2 Ethernet
3 CAN
1 LIN
1 USB
8 SENT
1 RS232
1 Time sync synchronization Ethernet
3 Communication screens

Installation Notes

SAEJ1211

Maintenance Interval: 220 h or a maximum of two years

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

Please remember that the mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Application

Configurable flywheel- and trigger disc geometries, Selectable links between functions and in- or outputs

Function documentation

Automatically created during code generation

MatLab code generation

Support for customer own MatLab function development

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

Engine Function Package 1

- · Electronic Throttle Control
- VVT
- · Turbo Control

Engine Function Package 2

- · Traction Control
- · Launch Control

Measurement Package

17 Additional analogue inputs

- 7 x no integrated pull-up
- 1 x option for angle synchronous measurement, no integrated pull-up
- 1 x fixed 3.01 kOhm pull-up
- 8 x switchable 3.01 kOhm pull-up

Extension of the use of 8 digital channels as analogue / digital inputs (shared)

1 Additional function related inputs

• 1 x Thermocouple K-type

Hardware Upgrade for CCA per device

Provides the option to run customer developed software code on Bosch ECU

FULL_LOG_1

Extension for Partition 1

- 1,500 channels
- · fastest sampling 1,000 Hz or 1 syncro

FULL_LOG_2

Activation of Partition 2

- 1,500 channels
- · 4 GB memory
- fastest sampling 1,000 Hz or 1 syncro
- · long-term recording
- · own data protection code

USB_DATA

- Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB flash drive only
- · Adapter cable to PC USB-Port
- Mating connector for USB flash drive on car loom side
- · SW licence USB-Port unlocked

Gear Control Package 1

Gear control MEGA-Line functionality, has to be used with MEGA-Line components (License model via MEGA-Line)

- -- Link to MEGA-Line Support Request --
- -- Link to MEGA-Line License Request Form --

Gear Control Package 2

Gear control Bosch Motorsport functionality

SW Package MS 6 Drag 1

· Launch Time

- · Launch Distance
- · Torque Pre-Control
- · Launch RPM Control
- · Universal Outputs for Time/Distance Controls

SW Package MS 6 Drag 2 (requires Drag 1 License)

- · Acceleration Sensor MM5.10 included
- · Time/Distance Boost Control
- · Driveshaft Speed Control
- · Driveshaft Gradient Control
- Acceleration Control
- · Wheelie Control

Innovation License Device

Activation of engine speed functions* and near/far injection function per unit

Innovation Package Project

Activation of engine speed functions* and near/far injection function per project version

*Engine speed functions: second or backup engine speed sensor, quick engine start, detection of engine reverse rotation

Ordering Information

Engine Control Unit MS 6.1 EVO

Order number F02U.V03.113-01

CCA Hardware Upgrade per device

Order number F02U.V02.137-01

Software Options

Engine Function Package 1

Order number **F02U.V02.001-01**

Engine Function Package 2

Order number F02U.V02.002-01

Measurement Package

Order number **F02U.V02.000-01**

FULL LOG 1

Order number F02U.V02.304-01

FULL_LOG_2

Order number F02U.V02.305-01

Gear Control Package 1

Order number please contact Mega-Line

Gear Control Package 2

SW Package MS 6 Drag 1

Order number F02U.V0U.409-01

Order number F02U.V02.108-01

SW Package MS 6 Drag 2

Order number F02U.V0U.410-01

Innovation License Device

Order number F02U.V02.510-01

Innovation Package Project

Order number F02U.V02.511-01

Accessories

USB DATA

Order number **F02U.V02.214-01**

Breakout Box BOB MS 6 EVO

Order number F02U.V02.294-02

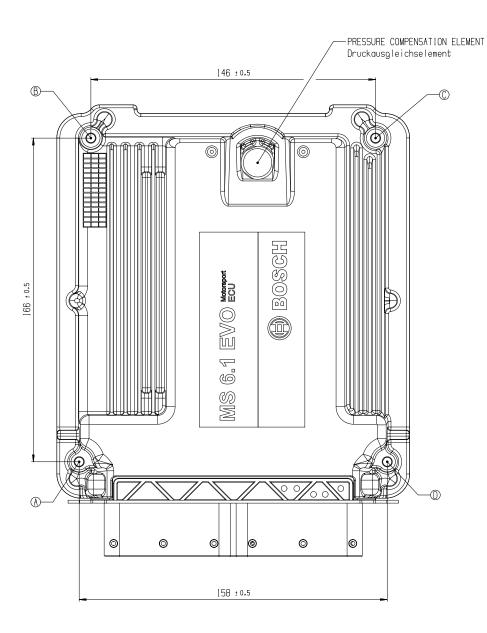
Mating Connector 91 pins

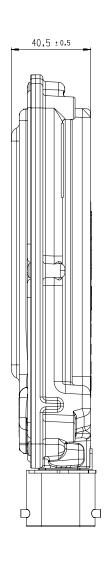
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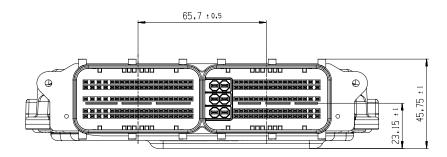
Mating Connector 105 pins

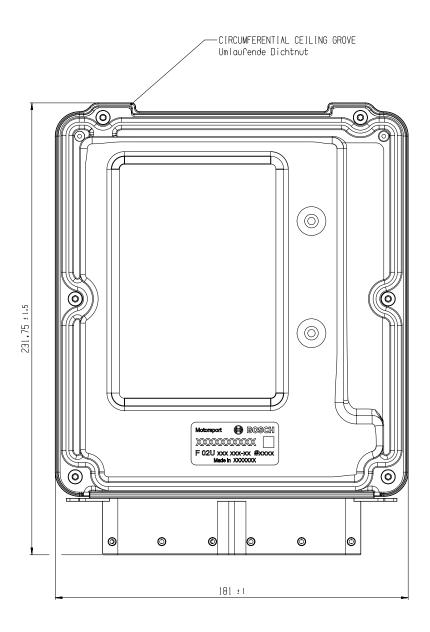
Order number F02U.B00.712-01

Dimensions









Engine Control Unit MS 6.2 EVO



Features

- ▶ Optimized for low pressure injection
- ▶ Measurement with 38 analog inputs
- ► Supports Customer Code Area CCA
- ▶ 4 GB memory plus 4 GB upgrade
- ► SENT support

The MS 6.2 EVO engine control unit manages gasoline engines up to 12 cylinders. As a member of our MS 6 family it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 6 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 6.2 EVO to support complex or unusual engine or chassis configurations.

Application

Low pressure injection

 Max. 12 cylinders up to 12,500 rpm, high impedance injectors only

Ignition

12 x ignition control, IGBT or BJT, coils with integrated amplifier

Physical engine model for fast application

- determine engine load by throttle position or air pressure signals
- mixture control and basic ignition guided by main signal relative load rl

- Subsystems pit speed-, launch-, rpm-limiter and ASR are integrated inside torque control
- Separated power cut functions to assist various gear cut systems
- Diagnostics
- Integrated safety strategy for 2 electronic throttle controls

Integrated support of manual gearshift

Electronic throttle control

VVT

Turbo control

Traction control

Launch control

LTE Ethernet telemetry support

Internal logger

- 4 GB memory on partition 1 (standard)
- Plus 4 GB memory on partition 2 (optional)
- 100 free configurable channels, 50 Hz

Logging rate

- Usage of all features: 300 kB/s
- Primary logging use case: 600 kB/s
- Logging data download rate: up to 4 MB/s

Logger Options See Upgrades

Technical Specifications

Mechanical Data

196 pins in total
226 x 181 x 44 mm
1,086 g
IP54
-20 to 80°C

Electrical Data

Power supply	6 to 18 V
CPU	Dual Core 667 MHz, FPGA

Inputs

38 analog inputs

6 x reserved for electronic throttle controls

10 x no integrated pull-up

4 x option for angle synchronous measurement, no integrated pull-up

5 x fixed 3.01 kOhm pull-up

13 x switchable 3.01 kOhm pull-up

8 analog/digital inputs (shared)

8 x option for angle synchronous measurement / digital (e.g. SENT)

6 internal measurements

1 x ambient pressure

1 x acceleration 6-axis
2 x ECU temperature
2 x ECU voltage
9 function related inputs
2 x thermocouple exhaust gas temperature sensors (K-type)
2 x Lambda interfaces for LSU 4.9 sensor types
1 x lap trigger/beacon input
4 x knock sensors
10 digital inputs
1 x switchable Hall or inductive sensor for flywheel measure- ment
2 x Hall sensor for sync wheel detection
4x switchable Hall or DF11 sensors for camshaft position or wheel speed
2 x switchable Hall or inductive sensors for turbo speed measurement
1 x digital switch for engine ON/OFF
Sensor supplies and screens
4 x sensor supplies 5 V / 50 mA
3 x sensor supplies 5 V / 150 mA $$
7 x sensor grounds
2 x sensor screens
Outputs
28 function related outputs
Low Pressure Injection
12 x 2.2 A low pressure injection for high impedance injectors
Ignition
$12\mbox{x}$ ignition control, IGBT or BJT, coils with integrated amplifier
2 x 8.5 A H-bridge reserved for electronic throttle
2 x 4 A pwm lowside switch for Lambda heater
19 freely configurable outputs
1 x 8.5 A H-bridge
2 x 4 A pwm lowside switch
4 x 3 A pwm lowside switch
8 x 2.2 A pwm lowside switch
4 x 1 A pwm lowside switch
3 output signals
1 x engine rpm
1 x flywheel
1 x trigger wheel
Software Tools (free download)
Data Analysis tool WinDarab V7
System Configuration tool RaceCon 2.7.0.9 or later
, . <u>U </u>

Mating Connectors (not included) F02U.B00.711-01 Mating Connector 91 pins F02U.B00.712-01 Mating Connector 105 pins **Norms Product Safety** EN IEC 62368-1:2020+A11:2020 **Materials** REACH - Nr. 1907/2006 **EMC** UNECE10:rev.6/AMD1:2020 KN41 ISO11452-2 ISO11452-4 ISO10605 ISO7637-2 ISO7367-3 ISO16750-2 US FCC: Title 47, Part 15 Subpart B ICES-003 **Testing**

Communication 2 Ethernet 3 CAN 1 LIN 1 USB 8 SENT 1 RS232 1 Time sync synchronization Ethernet 3 Communication screens

Installation Notes

SAEJ1211

Maintenance Interval: 220 h or a maximum of two years

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

Please remember that the mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Application

Configurable flywheel- and trigger disc geometries, Selectable links between functions and in- or outputs

Function documentation

Automatically created during code generation

MatLab code generation

Support for customer own MatLab function development

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

Hardware Upgrade for CCA per device

Provides the option to run customer developed software code on $\operatorname{\mathsf{Bosch}}\nolimits \mathsf{ECU}$

FULL_LOG_1

Extension for Partition 1

- 1,500 channels
- fastest sampling 1,000 Hz or 1 syncro

FULL_LOG_2

Activation of Partition 2

- 1.500 channels
- 4 GB memory
- fastest sampling 1,000 Hz or 1 syncro
- · long-term recording
- · own data protection code

USB_DATA

Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB flash drive only Adapter cable to PC USB-Port

Mating connector for USB flash drive on car loom side SW licence USB-Port unlocked

Gear Control Package 1

Gear control MEGA-Line functionality, has to be used with MEGA-Line components (License model via MEGA-Line)

- -- Link to MEGA-Line Support Request --
- -- Link to MEGA-Line License Request Form --

Gear Control Package 2

Gear control Bosch Motorsport functionality

SW Package MS 6 Drag 1

Launch Timer

Launch Distance

Torque Pre-Control

Launch RPM Control

Universal Outputs for Time/Distance Controls

SW Package MS 6 Drag 2 (requires Drag 1 License)

Acceleration Sensor MM5.10 included Time/Distance Boost Control Driveshaft Speed Control Driveshaft Gradient Control Acceleration Control Wheelie Control

Innovation License Device

Activation of engine speed functions* and near/far injection function per unit

Innovation Package Project

Activation of engine speed functions* and near/far injection function per project version

*Engine speed functions: second or backup engine speed sensor, quick engine start, detection of engine reverse rotation

Ordering Information

Engine Control Unit MS 6.2 EVO

Order number F02U.V03.115-01

CCA Hardware Upgrade per device

Order number F02U.V02.137-01

Software Options

FULL_LOG_1

Order number F02U.V02.304-01

FULL LOG 2

Order number F02U.V02.305-01

Gear Control Package 1

Order number please contact Mega-Line

Gear Control Package 2

Order number F02U.V02.108-01

SW Package MS 6 Drag 1

Order number F02U.V0U.409-01

SW Package MS 6 Drag 2

Order number F02U.V0U.410-01

Innovation License Device

Order number F02U.V02.510-01

Innovation Package Project

Order number F02U.V02.511-01

Accessories

USB_DATA

Order number F02U.V02.214-01

Breakout Box BOB MS 6 EVO

Order number **F02U.V02.294-02**

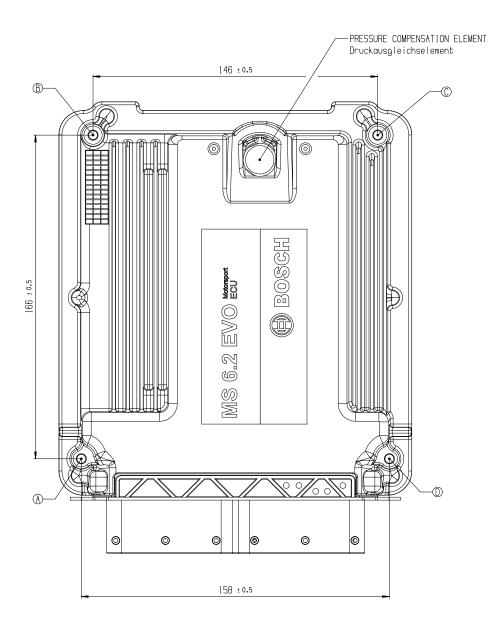
Mating Connector 91 pins

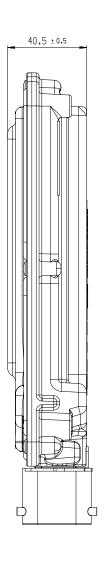
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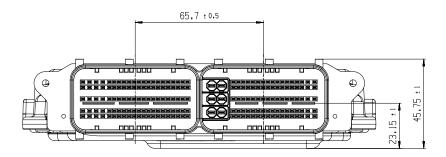
Mating Connector 105 pins

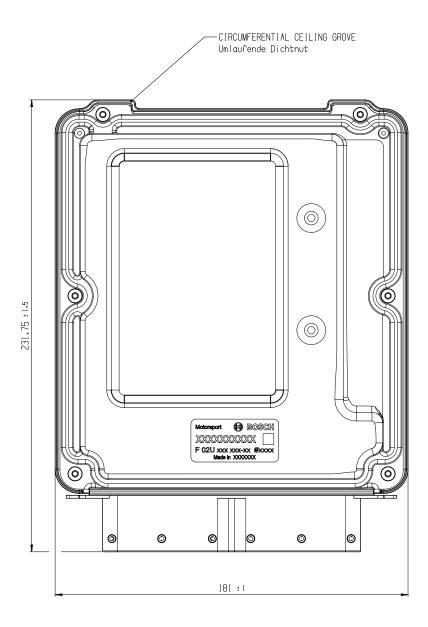
Order number **F02U.B00.712-01**

Dimensions









Engine Control Unit MS 6.3 EVO



Features

- ▶ Optimized for low and high pressure injection
- ▶ Measurement with 21 analog inputs
- ► Supports Customer Code Area CCA
- ▶ 4 GB memory plus 4 GB upgrade
- ► SENT support

The MS 6.3 EVO engine control unit manages gasoline engines up to 12 cylinders. As a member of our MS 6 family it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 6 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 6.3 EVO to support complex or unusual engine or chassis configurations.

Application

High pressure injection

Integrated power stages for the use of:

- 4 cylinders up to 12,500 rpm
- 6 cylinders up to 9,500 rpm
- 8 cylinders up to 8,500 rpm

(depending injection types and pressure ranges)

Low pressure injection

 Max. 12 cylinders up to 12,500 rpm, high impedance injectors only

Ignition

12 x ignition control, IGBT or BJT, coils with integrated amplifier

Physical engine model for fast application

- determine engine load by throttle position or air pressure signals
- mixture control and basic ignition guided by main signal relative load rl
- Subsystems pit speed-, launch-, rpm-limiter and ASR are integrated inside torque control
- Separated power cut functions to assist various gear cut systems
- · Diagnostics
- Integrated safety strategy for 2 electronic throttle controls

Integrated support of manual gearshift

Electronic throttle control

VVT

Turbo control

Traction control

Launch control

LTE Ethernet telemetry support

Internal logger

- 4 GB memory on partition 1 (standard)
- · Plus 4 GB memory on partition 2 (optional)
- 100 free configurable channels, 50 Hz

Logging rate

- · Usage of all features: 300 kB/s
- Primary logging use case: 600 kB/s
- · Logging data download rate: up to 4 MB/s

Logger Options See Upgrades

Technical Specifications

Mechanical Data

Aluminum housing	
2 Bosch connectors	196 pins in total
Size	226 x 181 x 44 mm
Weight	1,086 g
Protection Classification	IP54
Temp. range (at internal sensors)	-20 to 80°C

Electrical Data

Power supply	6 to 18 V
CPU	Dual Core 667 MHz, FPGA

Inputs

21 analog inputs

6 x reserved for electronic throttle controls

3 x no integrated pull-up

3 x option for angle synchronous measurement, no integrated pull-up

4 x fixed 3.01 kOhm pull-up

5 x switchable 3.01 kOhm pull-up

6 internal measurements

1	x ambient pressure
1	x acceleration 6-axis
2	x ECU temperature
2	x ECU voltage
8 fund	tion related inputs
1	x Thermocouple exhaust gas temperature sensors (K-type)
2	x Lambda interfaces for LSU 4.9 sensor types
1	x Lap trigger/beacon input
4	x Knock sensors
18 dig	rital inputs
	x switchable Hall or inductive sensor for flywheel measurement
2	x Hall sensor for sync wheel detection
	x switchable Hall or DF11 sensors for camshaft position or heel speed
	x switchable Hall or inductive sensors for turbo speed meas- rement
1	x digital switch for engine ON/OFF
8	x digital, e.g. SENT
Sens	or supplies and screens
4 x ser	nsor supplies 5 V / 50 mA
3 x ser	nsor supplies 5 V / 150 mA
7 x ser	nsor grounds
2 x ser	nsor screens
Outp	uts
38 fur	nction related outputs
High P	ressure Injection
	x high pressure pump with MSV control x high pressure injection for magnetic injectors
Low P	ressure Injection
1	2 x 2.2 A low pressure injection for high impedance injectors
Ignitio	n
	$2\mathrm{x}$ ignition control, IGBT or BJT, coils with integrated amplier
2 x 8.5	5 A H-bridge reserved for electronic throttle
2 x 4 A	A pwm lowside switch for Lambda heater
19 fre	ely configurable outputs
1	x 8.5 A H-bridge
2	x 4 A pwm lowside switch
4	x 3 A pwm lowside switch
8	x 2.2 A pwm lowside switch
4	x 1 A pwm lowside switch
3 outp	out signals
1	x engine rpm
1	x flywheel

1 x trigger wheel	
Software Tools (free d	ownload)
Data Analysis tool WinDarab V	7
System Configuration tool Rac	ceCon 2.7.0.9 or later
Mating Connectors (no	t included)
Mating Connector 91 pins	F02U.B00.711-01
Mating Connector 105 pins	F02U.B00.712-01
Norms	
Product Safety	
EN IEC 62368-1:2020+A11:	2020
Materials	
REACH - Nr. 1907/2006	
EMC	
UNECE10:rev.6/AMD1:2020	
KN41	
ISO11452-2	
ISO11452-4	
ISO10605	
ISO7637-2	
ISO7367-3	
ISO16750-2	
US FCC: Title 47, Part 15 Subpart B	
ICES-003	
Testing	
SAEJ1211	

Communication

2 Ethernet
3 CAN
1 LIN
1 USB
8 SENT
1 RS232
1 Time sync synchronization Ethernet
3 Communication screens

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

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

Please remember that the mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

High Pressure Injection Package

HP package for flat and V-engines (2nd Bank, MSV2, cylinder 7&8, external cylinder 9-12)

Measurement Package

17 Additional analogue inputs

- 7 x no integrated pull-up
- 1 x option for angle synchronous measurement, no integrated pull-up
- 1 x fixed 3.01 kOhm pull-up
- 8 x switchable 3.01 kOhm pull-up

Extension of the use of 8 digital channels as analogue / digital inputs (shared)

1 Additional function related inputs

• 1 x Thermocouple K-type

Hardware Upgrade for CCA per device

Provides the option to run customer developed software code on Bosch ECU

FULL_LOG_1

Extension for Partition 1

- 1.500 channels
- fastest sampling 1,000 Hz or 1 syncro

FULL_LOG_2

Activation of Partition 2

- 1,500 channels
- 4 GB memory
- fastest sampling 1,000 Hz or 1 syncro
- · long-term recording
- own data protection code

USB_DATA

- Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB flash drive only
- · Adapter cable to PC USB-Port
- · Mating connector for USB flash drive on car loom side
- SW licence USB-Port unlocked

Gear Control Package 1

Gear control MEGA-Line functionality, has to be used with MEGA-Line components (License model via MEGA-Line)

- -- Link to MEGA-Line Support Request --
- -- Link to MEGA-Line License Request Form --

Gear Control Package 2

Gear control Bosch Motorsport functionality

SW Package MS 6 Drag 1

- · Launch Timer
- Launch Distance

- Torque Pre-Control
- Launch RPM Control
- Universal Outputs for Time/Distance Controls

SW Package MS 6 Drag 2 (requires Drag 1 License)

- · Acceleration Sensor MM5.10 included
- · Time/Distance Boost Control
- · Driveshaft Speed Control
- · Driveshaft Gradient Control
- · Acceleration Control
- · Wheelie Control

Innovation License Device

Activation of engine speed functions* and near/far injection function per unit

Innovation Package Project

Activation of engine speed functions* and near/far injection function per project version

*Engine speed functions: second or backup engine speed sensor, quick engine start, detection of engine reverse rotation

Ordering Information

Engine Control Unit MS 6.3 EVO

Order number F02U.V03.110-01

CCA Hardware Upgrade per device

Order number F02U.V02.137-01

Software Options

High Pressure Injection Package

Order number F02U.V01.999-01

Measurement Package

Order number F02U.V02.000-01

FULL_LOG_1

Order number **F02U.V02.304-01**

FULL LOG 2

Order number F02U.V02.305-01

Gear Control Package 1

Order number please contact Mega-Line

Gear Control Package 2

Order number F02U.V02.108-01

SW Package MS 6 Drag 1

Order number F02U.V0U.409-01

SW Package MS 6 Drag 2

Order number F02U.V0U.410-01

Innovation License Device

Order number F02U.V02.510-01

Innovation Package Project

Order number F02U.V02.511-01

Accessories

USB_DATA

Order number F02U.V02.214-01

Breakout Box BOB MS 6 EVO

Order number F02U.V02.294-02

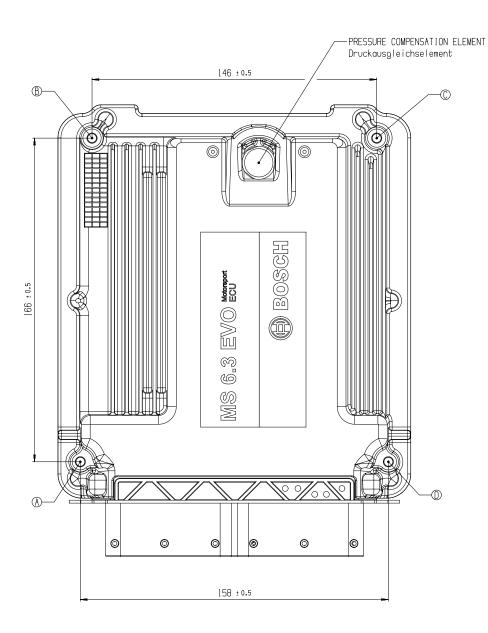
Mating Connector 91 pins

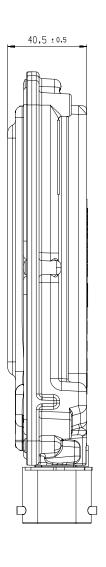
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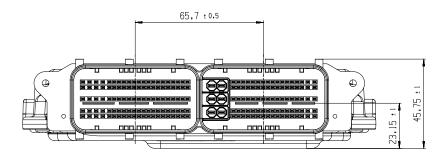
Mating Connector 105 pins

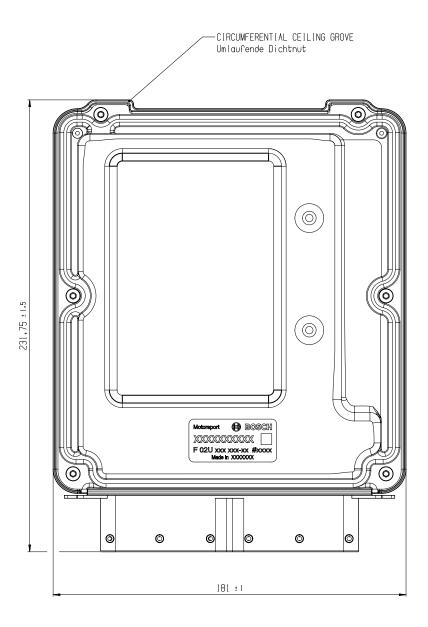
Order number F02U.B00.712-01

Dimensions









Engine Control Unit MS 6.4 EVO



Features

- ▶ Optimized for low and high pressure injection
- ▶ Measurement with 38 analog inputs
- ► Supports Customer Code Area CCA
- ▶ 4 GB memory plus 4 GB upgrade
- ► SENT support

The MS 6.4 EVO engine control unit manages gasoline engines up to 12 cylinders. As a member of our MS 6 family it features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 6 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 6.4 EVO to support complex or unusual engine or chassis configurations.

Application

High pressure injection

Integrated power stages for the use of:

- 4 cylinders up to 12,500 rpm
- 6 cylinders up to 9,500 rpm
- 8 cylinders up to 8,500 rpm

(depending injection types and pressure ranges)

HP package for flat and V-engines inclusive (2nd Bank, MSV2, cylinder 7&8, external cylinder 9-12)

Low pressure injection

 Max. 12 cylinders up to 12,500 rpm, high impedance injectors only

Ignition

12 x ignition control, IGBT or BJT, coils with integrated amplifier

Physical engine model for fast application

- determine engine load by throttle position or air pressure signals
- mixture control and basic ignition guided by main signal relative load rl
- Subsystems pit speed-, launch-, rpm-limiter and ASR are integrated inside torque control
- Separated power cut functions to assist various gear cut systems
- · Diagnostics
- Integrated safety strategy for 2 electronic throttle controls

Integrated support of manual gearshift

Electronic throttle control

V/V/T

Turbo control

Traction control

Launch control

LTE Ethernet telemetry support

Internal logger

- 4 GB memory on partition 1 (standard)
- Plus 4 GB memory on partition 2 (optional)
- 100 free configurable channels, 50 Hz

Logging rate

- Usage of all features: 300 kB/s
- Primary logging use case: 600 kB/s
- Logging data download rate: up to 4 MB/s

Logger Options See Upgrades

Technical Specifications

Mechanical Data

Aluminum housing	
2 Bosch connectors	196 pins in total
Size	226 x 181 x 44 mm
Weight	1,086 g
Protection Classification	IP54
Temp. range (at internal sensors)	-20 to 80°C

Electrical Data

Power supply	6 to 18 V
CPU	Dual Core 667 MHz, FPGA

Inputs

38 analog inputs

6 x reserved for electronic throttle controls

10 x no integrated pull-up

 $4\,\mathrm{x}$ option for angle synchronous measurement, no integrated pull-up

5 x fixed 3.01 kOhm pull-up

13 x switchable 3.01 kOhm pull-up	4 x 1 A pwm lowside switch		
8 analog/digital inputs (shared)	3 output signals		
8 x option for angle synchronous measurement / digital (e.g.	1 x engine rpm		
SENT)	1 x flywheel		
6 internal measurements	1 x trigger wheel		
1 x ambient pressure	Software Tools (free download) Data Analysis tool WinDarab V7		
1 x acceleration 6-axis			
2 x ECU temperature	System Configuration tool Rac	ceCon 2.7.0.9 or later	
2 x ECU voltage	Mating Connectors (no	ot included)	
9 function related inputs	Mating Connector 91 pins	F02U.B00.711-01	
2 x thermocouple exhaust gas temperature sensors (K-type)	Mating Connector 105 pins	F02U.B00.712-01	
2 x Lambda interfaces for LSU 4.9 sensor types	Norms		
1 x lap trigger/beacon input	Product Safety		
4 x knock sensors	EN IEC 62368-1:2020+A11:	2020	
10 digital inputs	Materials		
1 x switchable Hall or inductive sensor for flywheel measurement	REACH - Nr. 1907/2006		
2 x Hall sensor for sync wheel detection	EMC		
4 x switchable Hall or DF11 sensors for camshaft position or	UNECE10:rev.6/AMD1:2020		
wheel speed	KN41		
2 x switchable Hall or inductive sensors for turbo speed meas-	ISO11452-2		
urement	ISO11452-4		
1 x digital switch for engine ON/OFF	ISO10605		
Sensor supplies and screens	ISO7637-2		
4 x sensor supplies 5 V / 50 mA	IS07367-3		
3 x sensor supplies 5 V / 150 mA	ISO16750-2		
7 x sensor grounds	US FCC: Title 47, Part 15 Sub	part B	
2 x sensor screens	ICES-003		
Outputs	Testing		
38 function related outputs	SAEJ1211		
High Pressure Injection 2 x high pressure pump with MSV control	Communication		
8 x high pressure injection for magnetic injectors	O Fil		
Low Pressure Injection	2 Ethernet 3 CAN		
12 x 2.2 A low pressure injection for high impedance injectors	1 LIN		
Ignition	1 USB		
12 x ignition control, IGBT or BJT, coils with integrated ampli-	8 SENT		
fier	1 RS232		
2 x 8.5 A H-bridge reserved for electronic throttle	1 Time sync synchronization E		
2 x 4 A pwm lowside switch for Lambda heater	3 Communication screens	- Chief He C	
19 freely configurable outputs			
1 x 8.5 A H-bridge	Installation Notes		
2 x 4 A pwm lowside switch	Maintenance Interval: 220 h c	or a maximum of two years	
4 x 3 A pwm lowside switch	Depending on your experienc		

of ECUs, we re-

Please remember that the mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

Hardware Upgrade for CCA per device

Provides the option to run customer developed software code on $\operatorname{\mathsf{Bosch}}\nolimits \mathsf{ECU}$

FULL_LOG_1

Extension for Partition 1

- 1,500 channels
- fastest sampling 1,000 Hz or 1 syncro

FULL_LOG_2

Activation of Partition 2

- 1,500 channels
- · 4 GB memory
- fastest sampling 1,000 Hz or 1 syncro
- · long-term recording
- · own data protection code

USB_DATA

Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB flash drive only Adapter cable to PC USB-Port

Mating connector for USB flash drive on car loom side SW licence USB-Port unlocked

Gear Control Package 1

Gear control MEGA-Line functionality, has to be used with MEGA-Line components (License model via MEGA-Line)

- -- Link to MEGA-Line Support Request --
- -- Link to MEGA-Line License Request Form --

Gear Control Package 2

Gear control Bosch Motorsport functionality

SW Package MS 6 Drag 1

Launch Timer

Launch Distance

Torque Pre-Control

Launch RPM Control

Universal Outputs for Time/Distance Controls

SW Package MS 6 Drag 2 (requires Drag 1 License)

Acceleration Sensor MM5.10 included

Time/Distance Boost Control

Driveshaft Speed Control

Driveshaft Gradient Control

Acceleration Control

Wheelie Control

Innovation License Device

Activation of engine speed functions* and near/far injection function per unit

Innovation Package Project

Activation of engine speed functions* and near/far injection function per project version

*Engine speed functions: second or backup engine speed sensor, quick engine start, detection of engine reverse rotation

Ordering Information

Engine Control Unit MS 6.4 EVO

Order number F02U.V03.114-01

CCA Hardware Upgrade per device

Order number F02U.V02.137-01

Software Options

FULL_LOG_1

Order number F02U.V02.304-01

FULL_LOG_2

Order number F02U.V02.305-01

Gear Control Package 1

Order number please contact Mega-Line

Gear Control Package 2

Order number **F02U.V02.108-01**

SW Package MS 6 Drag 1

Order number F02U.V0U.409-01

SW Package MS 6 Drag 2

Order number F02U.V0U.410-01

Innovation License Device

Order number **F02U.V02.510-01**

Innovation Package Project

Order number F02U.V02.511-01

Accessories

USB_DATA

Order number **F02U.V02.214-01**

Breakout Box BOB MS 6 EVO

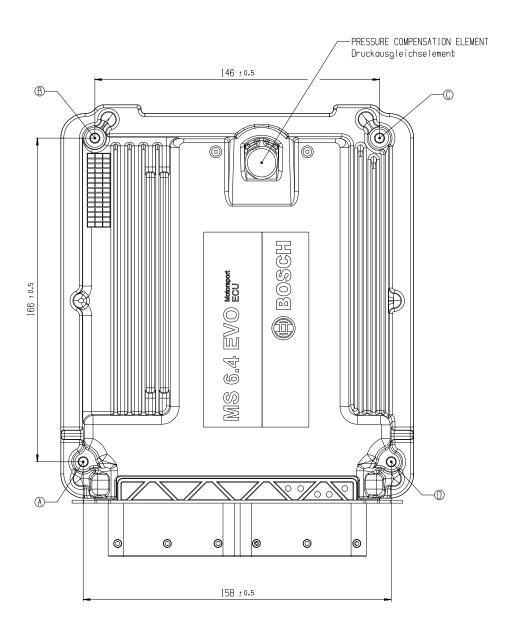
Order number **F02U.V02.294-02**

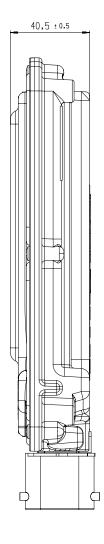
Mating Connector 91 pins

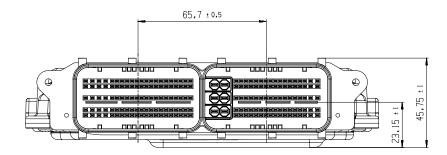
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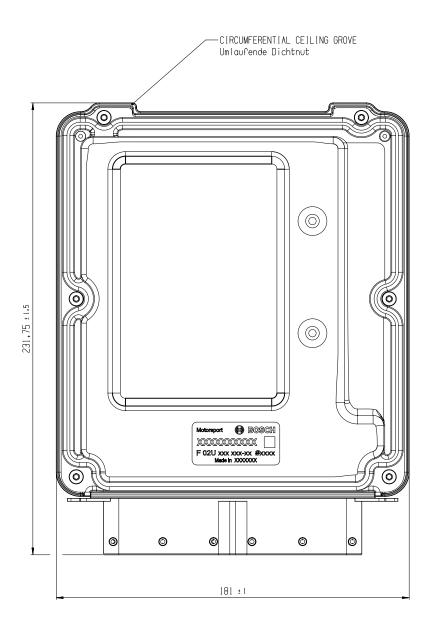
Mating Connector 105 pins

Order number F02U.B00.712-01









Engine Control Unit MS 6.4P EVO



Features

- ▶ 866 MHz Dual Core Processor for projects with high performance demand
- ► Supports Customer Code Area CCA
- ▶ 4 GB memory plus 16 GB upgrade
- ► SENT support

The MS 6.4P EVO engine control unit manages gasoline engines up to 12 cylinders. The MS 6 family provides high control performance, logging capabilities and an extensive feature set to improve performance in your application. It features a powerful digital processing core and a high-end FPGA for ultimate performance and flexibility. Custom functions can be provided quickly and easily as a service or implemented as customer code with MATLAB/Simulink. The MS 6 family is fully integrated into the Bosch Motorsport system architecture.

Hint: Specific Software Version for MS 6.4P EVO needed, not compatible with MS 6.4 EVO software.

Application

High pressure injection

Integrated power stages for the use of:

- 4 cylinders up to 12,500 rpm
- 6 cylinders up to 9,500 rpm
- 8 cylinders up to 8,500 rpm

(depending injection types and pressure ranges)

HP package for flat and V-engines inclusive (2nd Bank, MSV2, cylinder 7&8, external cylinder 9-12)

Low pressure injection

 Max. 12 cylinders up to 12,500 rpm, high impedance injectors only

Ignition

12 x ignition control, IGBT or BJT, coils with integrated amplifier

Physical engine model for fast application

- determine engine load by throttle position or air pressure signals
- mixture control and basic ignition guided by main signal relative load rl
- Subsystems pit speed-, launch-, rpm-limiter and ASR are integrated inside torque control
- Separated power cut functions to assist various gear cut systems
- · Diagnostics
- Integrated safety strategy for 2 electronic throttle controls

Integrated support of manual gearshift

Electronic throttle control

VVT

Turbo control

Traction control

Launch control

LTE Ethernet telemetry support

Internal logger

- 4 GB memory on partition 1 (standard)
- 16 GB memory on partition 1 (optional)
- Plus 4 GB memory on partition 2 (optional)
- 100 free configurable channels, 20 Hz

Logging rate

- · Usage of all features: 400 kB/s
- Primary logging use case: 800 kB/s
- Logging data download rate: up to 5 MB/s

Logger Options See Upgrades

Technical Specifications

Mechanical Data

Aluminum housing	
2 Bosch connectors	196 pins in total
Size	226 x 181 x 44 mm
Weight	1,086 g
Protection Classification	IP54
Temp. range (at internal sensors)	0 to 80°C

Electrical Data

Power supply	6 to 18 V
CPU	Dual Core 866 MHz, FPGA

Inputs

38 analog inputs

6 x reserved for electronic throttle controls

10 x no integrated pull-up

4 x option for angle synchronous measurement, no integrated pull-up

5 x fixed 3.01 kOhm pull-up

4 x 1 A pwm lowside switch

Q 21	nalog/digital inputs (shared)
O al	8 x option for angle synchronous measurement / digital (e.g.
	SENT)
6 in	ternal measurements
	1 x ambient pressure
	1 x acceleration 6-axis
	2 x ECU temperature
	2 x ECU voltage
9 fı	nction related inputs
	2 x thermocouple exhaust gas temperature sensors (K-type)
	2 x Lambda interfaces for LSU 4.9 sensor types
	1 x lap trigger/beacon input
	4 x knock sensors
10	digital inputs
	1 x switchable Hall or inductive sensor for flywheel measurement
	2 x Hall sensor for sync wheel detection
	$4\mathrm{x}$ switchable Hall or DF11 sensors for camshaft position or wheel speed
	$2\mathrm{x}$ switchable Hall or inductive sensors for turbo speed measurement
	1 x digital switch for engine ON/OFF
Sei	nsor supplies and screens
4 x	sensor supplies 5 V / 50 mA
3 x	sensor supplies 5 V / 150 mA
7 x	sensor grounds
2 x	sensor screens
Ou	tputs
38	function related outputs
Hig	h Pressure Injection
	2 x high pressure pump with MSV control 8 x high pressure injection for magnetic injectors
Lov	Pressure Injection
	$12\mathrm{x}2.2\mathrm{A}$ low pressure injection for high impedance injectors
Igni	tion
	$12\mbox{x}$ ignition control, IGBT or BJT, coils with integrated amplifier
	8.5 A H-bridge reserved for electronic throttle
2 x	4 A pwm lowside switch for Lambda heater
19	freely configurable outputs
	1 x 8.5 A H-bridge
	2 x 4 A pwm lowside switch
	4 x 3 A pwm lowside switch
	8 x 2.2 A pwm lowside switch

3 output signals		
1 x engine rpm		
1 x flywheel		
1 x trigger wheel		
Software Tools (free do	ownload)	
Data Analysis tool WinDarab V	7	
System Configuration tool Race	eCon 2.7.0.9 or later	
Mating Connectors (no	t included)	
Mating Connector 91 pins	F02U.B00.711-01	
Mating Connector 105 pins	F02U.B00.712-01	
Norms		
Product Safety		
EN IEC 62368-1:2020+A11:2	020	
Materials		
REACH - Nr. 1907/2006		
EMC		
UNECE10:rev.6/AMD1:2020		
KN41		
ISO11452-2		
ISO11452-4		
ISO10605		
ISO7637-2		
IS07367-3		
ISO16750-2		
US FCC: Title 47, Part 15 Subp	oart B	
ICES-003		
Testing		
SAEJ1211		
Communication		
Communication		
2 Ethernet		
3 CAN		
1 LIN		
1 USB		
8 SENT		

Installation Notes

3 Communication screens

1 Time sync synchronization Ethernet

1 RS232

Maintenance Interval: 220 h or a maximum of two years

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

Please remember that the mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

Hardware Upgrade for CCA per device

Provides the option to run customer developed software code on $\operatorname{\mathsf{Bosch}}\nolimits \mathsf{ECU}$

FULL_LOG_1

Extension for Partition 1

- 1,500 channels
- fastest sampling 1,000 Hz or 1 syncro

PERF LOG 1 (requires FULL LOG 1)

Increase logging partition 1 from 4 GB to 16 GB memory

FULL_LOG_2

Activation of Partition 2

- 1,500 channels
- · 4 GB memory
- fastest sampling 1,000 Hz or 1 syncro
- · long-term recording
- · own data protection code

USB_DATA

Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB flash drive only Adapter cable to PC USB-Port

Mating connector for USB flash drive on car loom side SW licence USB-Port unlocked

Gear Control Package 1

Gear control MEGA-Line functionality, has to be used with MEGA-Line components (License model via MEGA-Line)

- -- Link to MEGA-Line Support Request --
- -- Link to MEGA-Line License Request Form --

Gear Control Package 2

Gear control Bosch Motorsport functionality

Specific project SW for MS 6.4P EVO, based on MS 6.4 EVO SW, offered as engineering service

SW Package MS 6 Drag 1

Launch Timer

Launch Distance

Torque Pre-Control

Launch RPM Control

Universal Outputs for Time/Distance Controls

SW Package MS 6 Drag 2 (requires Drag 1 License)

Acceleration Sensor MM5.10 included Time/Distance Boost Control Driveshaft Speed Control Driveshaft Gradient Control Acceleration Control Wheelie Control

Innovation License Device

Activation of engine speed functions* and near/far injection function per unit

Innovation Package Project

Activation of engine speed functions* and near/far injection function per project version

*Engine speed functions: second or backup engine speed sensor, quick engine start, detection of engine reverse rotation

Ordering Information

Engine Control Unit MS 6.4P EVO

Order number F02U.V03.112-01

CCA Hardware Upgrade per device

Order number F02U.V02.137-01

Engine Control Unit MS 6 EVO RX

FIA-homologated version for WRX Championship Order number on request

Software Options

FULL_LOG_1

Order number F02U.V02.304-01

PERF_LOG_1

Order number F02U.V03.054-01

FULL LOG 2

Order number **F02U.V02.305-01**

Gear Control Package 1

Order number please contact Mega-Line

Gear Control Package 2

Order number **F02U.V02.108-01**

Specific project SW for MS 6.4 Performance, based on MS 6.4 SW, offered as engineering service

Order number on request

SW Package MS 6 Drag 1

Order number **F02U.V0U.409-01**

SW Package MS 6 Drag 2

Order number F02U.V0U.410-01

Innovation License Device

Order number **F02U.V02.510-01**

Innovation Package Project

Order number **F02U.V02.511-01**

Accessories

USB_DATA

Order number F02U.V02.214-01

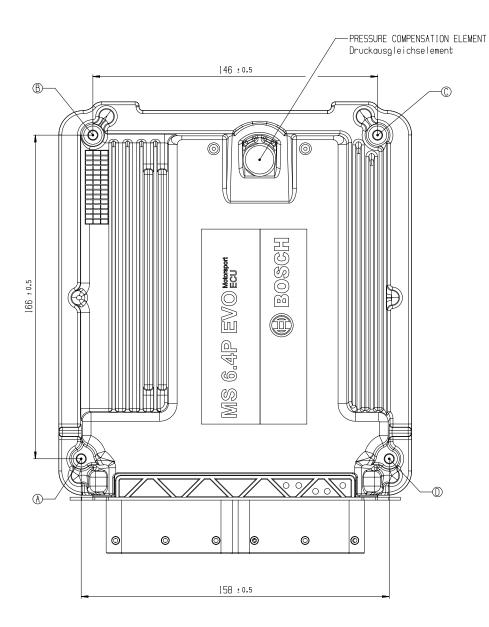
Breakout Box BOB MS 6 EVO

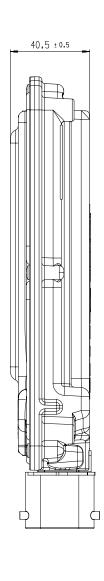
Order number **F02U.V02.294-02**

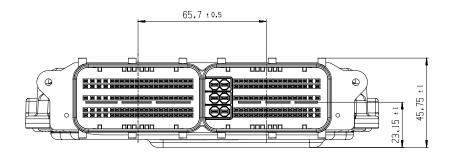
Mating Connector 91 pins

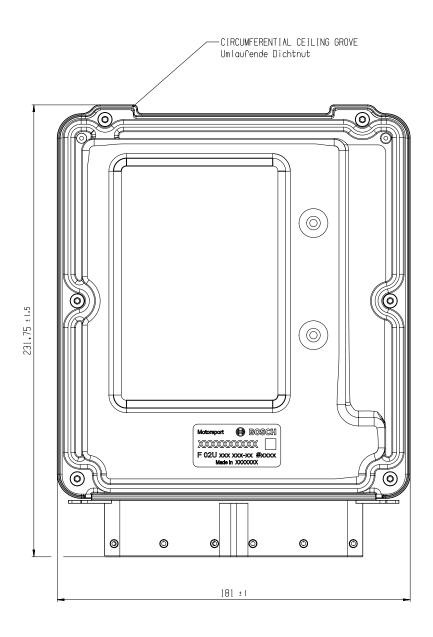
Order number **F02U.B00.711-01**

Mating Connector 105 pins
Order number F02U.B00.712-01









Engine Control Unit MS 7.4



Features

- ▶ Optimized for low and high pressure injection
- ► Data logger included
- ► Gearbox control optionally included
- ► Gigabit data interface

The MS 7.4 engine control unit manages gasoline engines up to 12 cylinders. The MS 7 line features a powerful digital processing core with floating point arithmetic and a high-end FPGA for ultimate performance and flexibility. The MS 7 line utilizes a software development process based on MATLAB/Simulink which significantly speeds up algorithm development by using automatic code and documentation generation. Custom functions can be generated quickly and easily. The flexible hardware design allows the MS 7.4 to support complex or unusual engine or chassis configurations.

Application

High pressure injection

Integrated power stages for triple injection and use of:

- 4 cylinders up to 14,600 rpm
- 6 cylinders up to 9,700 rpm
- 8 cylinders up to 7,300 rpm

(for supply voltages > 10 V, depending injection types and pressure ranges)

HP package for flat and V-engines inclusive (2nd Bank, fuel control valve 2, external cylinder 9-12)

Low pressure injection

 Max. 12 cylinders up to 16,000 rpm, high impedance injectors only

Outputs can be used alternatively as low side switches $2.2\,\mathrm{A}$ with fast decay

Ignition

8 integrated power stages up to 20 A

 alternatively, up to 12 drivers for use with external power stages

Internal logger

- · 4 GB memory on partition 1
- 16 GB memory on partition 1 (optional)
- · 4 GB memory on partition 2
- Diagnostic channels
- Use of 4 GB USB data stick

Logging rates

- · Usage of all features: 400 kB/s
- Primary logging use case: >800 kB/s
- · Logging data download rate: up to 6.2 MB/s

Physical engine model for fast application

- determine engine load by throttle position or air pressure signals
- mixture control and basic ignition guided by main signal relative load rl
- Subsystems pit speed-, launch-, rpm-limiter and ASR are integrated inside torque control
- Separated power cut functions to assist several gear cut systems
- Diagnostics
- Integrated safety strategy for 2 electronic throttle controls

Integrated support of manual gearshift

Electronic throttle control

Variable Valve Timing VVT

Turbo control

Traction control

Launch control

LTE Ethernet telemetry support

Technical Specifications

Mechanical Data

Mechanical Data	
Milled aluminum housing	
4 motorsport connectors, 264 pi	ns in total
Size without connectors	198 x 180 x 42 mm
Weight	1,610 g
Protection Classification	IP67
Temp. range (at internal sensors)	-20 to 85°C
Max. Vibration	Vibration Profile 1 (see Appendix or www.boschmotorsport.com)
Electrical Data	
Power supply	6 to 18 V
CPU	Dual Core 1 GHz, FPGA

Inputs

41 analog inputs

8 analog/digital inputs (shared)

10 digital inputs 21 internal measurements 1 x ambient pressure 1 x acceleration 3-axis 3 x ECU temperature 10 x ECU voltage (e.g. sensor supply) 6 ECU current (e.g. sensor supply) 18 function related inputs 8 x combustion chamber pressure input 2 x thermocouple exhaust gas temperature sensors (K-type) 2 x Lambda interfaces for LSU 4.9 sensor types 1 x digital switch for engine ON/OFF 1 x digital input for beacon receiver 4 x knock sensors Sensor supplies and screens 4 x sensor supplies 5 V / 50 mA 3 x sensor supplies 5 V / 400 mA 1 sensor supply ubat, 250 mA 9 x sensor grounds 2 x sensor screens **Outputs** 42 function related outputs **High Pressure Injection** 2 x high pressure pump with fuel control valve 8 x high pressure injection for magnetic injectors Low Pressure Injection 12 x 2.2 A low pressure injection for high impedance injectors Ignition 12 x ignition control, IGBT or BJT, coils with integrated power stage, or max. 8 cylinders and coils without integrated power stage, 20 A 2 x 8.5 A H-bridge reserved for electronic throttle 2 x 3 A pwm lowside switch for Lambda heater 4 x 12 mA for control of Moog valves 15 freely configurable outputs 1 x 8.5 A H-bridge 2 x 4 A pwm lowside switch 6 x 3 A pwm lowside switch 4 x 2.2 A pwm lowside switch 2 x 1 A pwm lowside switch low dump resistant 5 output signals

5 x MUX outputs for internal signals like flywheel, knock sig-

nals, cylinder pressure

Adaptation and Documentation

Configuration	Configurable flywheel- and trigger disc geometries Selectable links between functions and in- or outputs
Function documentation	Automatically created during code generation
MatLab code generation	Support for customer own Mat- Lab function development

Software Tools (free download)

Data Analysis tool WinDarab V7

System Configuration tool RaceCon 2.7.0.9 or later

Communication

1 Ethernet 1 Gbit
2 Ethernet 100 Mbit
2 Realtime Ethernet
3 CAN
1 LIN
1 USB
1 RS232
1 Time sync synchronization Ethernet
2 Network screens

Installation Notes

Inspection services recommended after 220 h or 24 months, internal battery to be replaced during service.

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

Please remember that the mating connectors and the programming interface cable are not included and must be ordered separately.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

Hardware Upgrade for CCA per device

Enable Customer Code Area

PERF_LOG1

Increase logging partition 1 from 4 GB to 16 GB memory

Gear Control Package 1

Gear control MEGA-Line functionality, has to be used with MEGA-Line components (License model via MEGA-Line)

- -- Link to MEGA-Line Support Request--
- -- Link to MEGA-Line License Request Form --

Gear Control Package 2

Gear control Bosch Motorsport functionality

Cylinder pressure detection base package MS 7.x

Knock detection via cylinder pressure evaluation MS 7.x	
Adapter cable to USB-port	F02U.V01.343-01
Rugged USB flash drive	F02U.V01.342-02
Connector for wiring harness	F02U.002.996-01
Programming interface cable	F02U.V02.327-01
Mating Connectors	
LIFE (red)	AS618-35SN
Actuator (blue)	AS618-35SB
Combined (orange)	AS618-35SC
Sensor (yellow)	AS618-35SA

Ordering Information
Engine Control Unit MS 7.4 Order number F02U.V02.514-02
Software Options
Customer Code Area Order number F02U.V02.137-01
Gear Control Package 1 Order number please contact Mega-Line
Gear Control Package 2 Order number F02U.V02.264-01
Cylinder pressure detection base package MS 7.x Order number F02U.V02.543-01
Knock detection via cylinder pressure evaluation MS 7.x Order number F02U.V02.544-01
Accessories
Breakout Box BOB 66-pole, Connector code blue Order number F02U.V02.295-01
Breakout Box BOB 66-pole, Connector code orange Order number F02U.V02.296-01
Breakout Box BOB 66-pole, Connector code yellow Order number F02U.V02.298-01
Breakout Box BOB MS 7, LIFE-Connector code red Order number F02U.V02.293-02

Engine Control Unit MS 25 Sport



Features

- ▶ 8 injection output stages
- ► For solenoid injectors
- ▶ 96 data inputs
- ► Software options available

The MS 25 Sport is an ECU for Diesel engines with up to 8 cylinders. It is developed for use with Bosch solenoid injectors. The MS 25 Sport utilizes a software development process based on MATLAB® & Simulink®.

The MS 25 Sport is able to operate in 12 V or 24 V systems. The base SW is able to control one hydraulic bank configuration with Fuel Metering Unit (FMU) and Pressure Control Valve (PCV).

Application	
Engine layout	3, 4, 5, 6, 8, <3 on request
Injector type	Solenoid valve injectors
Control strategy	Quantity based
Hydraulic system	Fuel metering unit + Pressure control valve (2 bank optional)
Injection timing	2 pilot injections 1 main injection 2 post injections
Turbo boost control	Single or Bi-Turbo
Lambda measurement	Optional controls on request
Two bank hydraulic control	Optional
Traction control	Optional
Gear cut for sequential gearbox	Optional
Speed limiter	

Optional function packages available	
Calibration interface	CCP via CAN
Interface to Bosch Data Logging System	3 CAN interfaces
Max. vibration	Vibration Profile 1 (see www.bosch-motorsport.com)

	www.bosch-motorsport.com)
Technical Specifications	
Mechanical Data	
Aluminum product housing	Base plate with fluid cooling incl. pressure compensation element (PCE)
2 production type connectors with 192 pins	Separate coding each (192 x 1.2 mm pins)
Vibration damped circuit boards	Engine mountable with additional dampers
8 housing fixation points	
Size	260 x 250 x 81 mm
Protection classification	IP x 6k and IP x 9K
Weight	1,800 g
Temperature range	-40 to 85°C
Electrical Data	
Power supply	12 or 24 V
1 internal atmospheric pressure s	sensor
1 internal ECU temperature senso	or for max. temperature
Inputs	
1 lambda interface LSU	LSU 4.9
7 general frequency inputs	4 wheel speed and one vehicl speed hall effect sensor input and 2 inductive turbo speed
1 input for inductive crankshaft sensor	Hall optional
1 input for Hall-effect camshaft sensor	Inductive optional
29 analog inputs	
14 digital inputs	
Outputs	
8 injection power stages	3 banks for 8 cylinders
2 Fuel Metering Unit (High Pressure Pump)	2 bank system optional
2 Pressure Control Valve (Rail)	2 bank system optional
12 power stages (low side)	
1 power stage for lambda heater	
2 H-bridges	

Software

Mating connector II

SPORT - X2 (Engine)

CONNECTOR KIT; MS 25

Software		
RaceCon Calibration Software	free download	
WinDarab Analysis Software	free download	
Optional Functionality		
Traction control SW upgrade		
2 bank hydraulic control SW upgrade		
Environment (not included)		
Programming interface MS- ABox II	F02U.V00.327-03	
Data logger C 70	F02U.V02.302-01	
Display DDU 9	F02U.V02.300-02	
Mating connectors (not included)		
Mating connector I CONNECTOR KIT; MS 25 SPORT - X1 (Vehicle)	F02U.V0U.147-01	

F02U.V0U.148-01

Communication		
3 CAN interfaces (dash, application, customer use)	J1939 optional	
1 LIN	Optional	

Optional

Installation Notes

1 SENT

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

Please remember that mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

Engine Control Unit MS 25 Sport Order number F02U.V0U.800-02

Overview

Vehicle Control Unit MS 50.4 Vehicle Control Unit MS 50.4P incl. CCA HW Upgrade



- 667 MHz Dual Core Processor exclusively for vehicle control functionality (MAT-LAB based)
- Dual Core Processor exclusively for logging purposes
- High Speed Logging 200 kHz of 6 analog inputs (optional)
- Event logging, Configurable pre-event logging
- 866 MHz Dual Core Processor exclusively for vehicle control functionality (MAT-LAB based)
- Identical, dedicated 667 MHz Identical, dedicated 866 MHz **Dual Core Processor exclus**ively for logging purposes
 - High Speed Logging 200 kHz of 6 analog inputs (optional)
- Real time Ethernet SERCOS 3 Real time Ethernet SERCOS 3
 - Event logging, Configurable pre-event logging

Vehicle Control Unit MS 50.4

Features

- ▶ 667 MHz Dual Core Processor exclusively for vehicle control functionality (MATLAB based)
- ► Identical, dedicated 667 MHz Dual Core Processor exclusively for logging purposes
- ► High Speed Logging 200 kHz of 6 analog inputs (optional)
- ▶ Real time Ethernet SERCOS 3
- ► Event logging, Configurable pre-event logging

The VCU MS 50.4 is a highly powerful processing / logging unit for race applications.

Based on our broad base of platform function, we support you with customized VCU functions for a tailor-made solution.

In addition, you can quickly develop your individual customer software based on MATLAB/Simulink to significantly speed up algorithm development (automatic code and documentation generation, requires CCA package) – including extensive simulation capabilities.

The device offers real time Ethernet functionality to exchange e.g. data used in control algorithms between devices (guaranteed latency time 1 ms).

Application

Processor for customer code	667 MHz Dual Core
Processor for logger	667 MHz Dual Core
Configurable math channels	
User configurable CAN in/out messages	

Internal logger

1,500 channels

Online data compression

- 4 GB memory on partition 1
- · 4 GB memory on partition 2
- · Fastest sampling 1 ms or 1 syncro
- Optional: Sampling rate high speed logger 5 μs
- · Long-term recording
- Own data protection code

Logging rates

- Usage of all features: 600 kB/s
- Primary logging use case: >1,200 kB/s
- Logging data download rate: up to 6.2 MB/s

Copy data of partition 1 to USB data stick

LTE Ethernet telemetry support

RS232 interface for GPS

Technical Specifications

Mechanical Data

Size	166 x 121 x 41 mm
Weight	≤ 660 g
Protection classification	IP67
3 motorsport connectors, 198 p	ins in total
Max. vibration	Vibration profile 1 (see www.bosch-motorsport.com)
Operating temperature internal	-20 to 80°C

Electrical Data

Supply voltage	5 to 18 V
Supply voltage	3 to 10 v

Inputs

20 Analog channels 0 to 5 V, 0.5 % precision between 0.2 and 4.8 V, switchable pull-up

8 Digital PWM inputs f_max=30 kHz Hall-type speed measurement possible,

Switchable pullup 2.15 kOhm, (required for Hall), Tooth count differential $\!\!\!\!^*$

4 Digital PWM inputs f_max=30 kHz Hall- and DF11 type speed measurement possible,

Fixed pullup 2.15 kOhm (required for Hall), Tooth count differential*

4 universal Thermocouple

1 Bosch Laptrigger

1 TimeSync master and slave (specific to Bosch measurement system)

Internal measurements:

- 1 ambient pressure
- 1 ECU temperature
- 20 supply voltage
- 20 supply current
- 1 battery voltage (external VCU supply)
- 1 external VCU supply current
- 4 HS output current
- 3-axis acceleration plus roll/pitch/yaw rate

Outputs

PWM High side	2*; 7.5 A each, PWM, 50 Hz
PWM Low side	4*; 2.2 A each, PWM, 10 kHz

*can be enhanced by Upgrade I/O Package

Power Supplies

12 V, 400 mA each	5*
Switchable 5 V/12 V, 400 mA each	5*
Max overall current	4 A on all 12 V 2 A on all 5 V
Precision 12 V \pm 1 % on the pin Precision 5 V \pm 0.1 % on the pin	

Sensor ground

*can be enhanced by Upgrade I/O Package

Adaptation and Documentation

Function documentation	Automatically created during code generation
MatLab code generation	Support for customer own Mat- Lab function development

Software Tools (free download)	
Data Analysis tool WinDarab 7	
System Configuration tool RaceCon	Logger configuration, calibration and online measurement
Connectors	
Connector LIFE (red) AS018-35PN	Mating connector AS618-35SN (not included)
Connector SENS-A (yellow) AS018-35PA	Mating connector AS618-35SA (not included)
Connector SENS-B (blue) AS018-35PB	Mating connector AS618-35SB (not included)

Communication

3 Ethernet 100 Mbit
2 Realtime Ethernet SERCOS3
4 CAN*
1 LIN
1 USB
1 RS232 interface for GPS
1 Time sync synchronization Ethernet
*can be enhanced by Upgrade I/O Package
1 LIN 1 USB 1 RS232 interface for GPS 1 Time sync synchronization Ethernet

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

Please remember that the mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

Hardware Upgrade for CCA per device

Provides the option to run customer developed software code on Bosch device

Hardware Upgrade for Multi CCA per device

Enables the use of an extra core to utilize more computing power in the device

I/O Package

Communication

4 CAN

Inputs

4 Analog channels

0 to 5 V,

0.5 % precision between 0.2 and 4.8 V, switchable pull-up

4 Digital PWM inputs

f max=30 kHz

Hall-type speed measurement possible,

Fixed pullup 2.15 kOhm (required for Hall),

Tooth count differential**

4 LVDT, 5 pin configuration, excitation frequency 1 to 20 kHz, excitation voltage 0 to 5 V (rms)

Outputs

4 "TTL" Digital output, 10 kHz, PWM, 25 mA each

2 PWM High side; 7.5 A each, PWM, 50 Hz

4 PWM Low side; 2.2 A each, PWM, 10 kHz

Power Supplies

5 x 12 V, 400 mA each

5 switchable 5 V/12 V, 400 mA each

** The tooth count differential between any two of the PWM inputs is available to measure e.g. shaft torsion.

High Speed Logging Package

6 ANA

0 to 5 V, 200 kHz logging rate

CCP MASTER

Enables CCP/XCP master functionality to request data from foreign devices via CAN/CCP protocol or XCP over Ethernet (UDP). (ASAP2 file from ECU manufacturer required)

Real Time Ethernet

Enables the VCU to operate as a real time Ethernet master or slave. Guaranteed latency time of 1 ms. Ideal for time critical data transfer as needed in online control algorithms involving data from different devices.

Two interfaces allow for a ring topology (redundancy in case the RTE line experiences damage).

The VCU features a reasonable set of SERCOS3 instructions although not the full SERCOS3 standard is implemented. The ECU side can act as a SERCOS3 master; the logger side can act as a SERCOS3 slave.

USB Kit

Rugged USB flash drive

Mating connector for USB flash drive on car loom side

Adapter cable to PC USB-port

Ordering Information

Vehicle Control Unit MS 50.4

Order number F02U.V02.965-02

CCA Hardware Upgrade per device

Order number F02U.V02.137-01

Multi CCA Hardware Upgrade VCU per device

Order number F02U.V03.222-01

Vehicle Control Unit MS 50.4 incl. CCA HW Upgrade

Order number F02U.V03.012-01

Software Options

I/O Package

Order number F02U.V02.777-01

High Speed Logging Package

Order number F02U.V02.779-01

CCP_MASTER

Order number **F02U.V02.213-01**

Real Time Ethernet

Order number F02U.V02.782-01

Accessories

Rugged USB flash drive

Order number F02U.V01.342-03

Mating connector for USB flash drive on car loom

side

Order number F02U.002.996-01

Adapter cable to PC USB-Port

Order number F02U.V01.343-01

Opening tool for shellsize 18

Order number F02U.V01.394-01

Breakout Box BOB 66-pole

Connector code: blue

Order number F02U.V02.295-01

Breakout Box BOB 66-pole

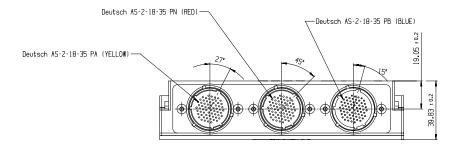
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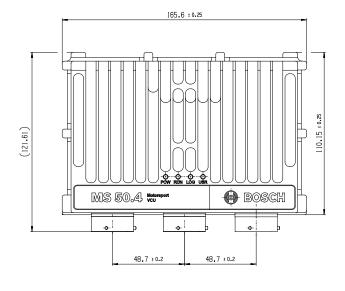
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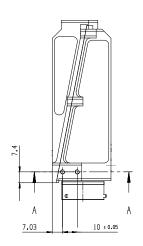
Breakout Box BOB MS 7

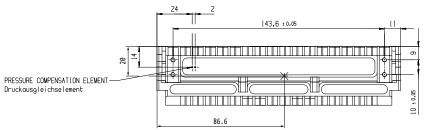
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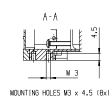
Order number F02U.V02.293-01

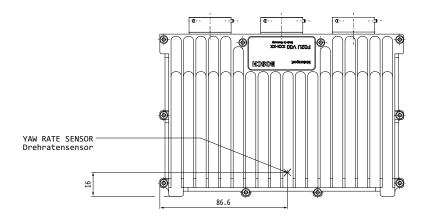












Vehicle Control Unit MS 50.4P incl. CCA HW Upgrade



Features

- ▶ 866 MHz Dual Core Processor exclusively for vehicle control functionality (MATLAB based)
- ► Identical, dedicated 866 MHz Dual Core Processor exclusively for logging purposes
- ► High Speed Logging 200 kHz of 6 analog inputs (optional)
- ▶ Real time Ethernet SERCOS 3
- ► Event logging, Configurable pre-event logging

The VCU MS 50.4P (Performance) is a highly powerful processing / logging unit for race applications

Based on our broad base of platform function, we support you with customized VCU functions for a tailor-made solution.

In addition, you can quickly develop your individual customer software based on MATLAB/Simulink to significantly speed up algorithm development (automatic code and documentation generation) – including extensive simulation capabilities. The device offers real time Ethernet functionality to

exchange e.g. data used in control algorithms between devices (guaranteed latency time 1 ms).

Application

Processor for customer code	866 MHz Dual Core
Processor for logger	866 MHz Dual Core
Configurable math channels	
User configurable CAN in/out me	essages
Online data compression	

Internal logger

1.500 channels

- · 4 GB memory on partition 1
- 16 GB memory on partition 1 (optional)
- 4 GB memory on partition 2
- Fastest sampling 1 ms or 1 syncro
- Optional: Sampling rate high speed logger 5 μs
- · Long-term recording
- · Own data protection code

Logging rate

- · Usage of all features: 800 kB/s
- Primary logging use case: >1,500 kB/s
- · Logging data download rate: up to 7.5 MB/s

Copy data of partition 1 to USB data stick

LTE Ethernet telemetry support

RS232 interface for GPS

Customer Code Area CCA

Provides the option to run customer developed software code on Bosch device

Multi CCA

Enables the use of an extra core to utilize more computing power in the device for running a second customer model

Technical Specifications

Mechanical Data

Size	166 x 121 x 41 mm
Weight	≤ 660 g
Protection classification	IP67
3 motorsport connectors, 198 pins in total	
Max. vibration	Vibration profile 1 (see www.bosch-motorsport.com)
Operating temperature internal	0 to 85°C

Operation outside the temperature limits can be tested on request during the manufacturing tests.

Electrical Data

Supply voltage	5 to 18 V

Inputs

20 Analog channels 0 to 5 V, 0.5 % precision between 0.2 and 4.8 V, switchable pull-up

8 Digital PWM inputs f_max=30 kHz Hall-type speed measurement possible,

Switchable pullup 2.15 kOhm, (required for Hall), Tooth count differential*

4 Digital PWM inputs f_max=30 kHz Hall- and DF11 type speed measurement possible,

Fixed pullup 2.15 kOhm (required for Hall), Tooth count differential*

4 universal Thermocouple

1 Bosch Laptrigger

1 TimeSync master and slave (specific to Bosch measurement system)

Internal measurements:

- 1 ambient pressure
- 1 ECU temperature
- 20 supply voltage
- 20 supply current
- 1 battery voltage (external VCU supply)
- 1 external VCU supply current
- 4 HS output current
- 3-axis acceleration plus roll/pitch/yaw rate

Ou	tn	uit	c
Ou	LN	ıuι	3

PWM High side	2*; 7.5 A each, PWM, 50 Hz
PWM Low side	4*; 2.2 A each, PWM, 10 kHz

*can be enhanced by Upgrade I/O Package

Power Supplies	
12 V, 400 mA each	5*
Switchable 5 V/12 V, 400 mA each	5*
Max overall current	4 A on all 12 V 2 A on all 5 V
Precision $12 \text{ V} \pm 1 \%$ on the pin Precision $5 \text{ V} \pm 0.1 \%$ on the pin	

*can be enhanced by Upgrade I/O Package

Sensor ground

Adaptation and Documentation

Function documentation	Automatically created during code generation
MatLab code generation	Support for customer own Mat- Lab function development

20

Software Tools (free download)

Data Analysis tool WinDarab 7	
System Configuration tool RaceCon	Logger configuration, calibration and online measurement
Connectors	
Connector LIFE (red) AS018-35PN	Mating connector AS618-35SN (not included)
Connector SENS-A (yellow) AS018-35PA	Mating connector AS618-35SA (not included)
Connector SENS-B (blue) ASO18-35PB	Mating connector AS618-35SB (not included)

Communication

3 Ethernet 100 Mbit
2 Realtime Ethernet SERCOS3
4 CAN*
1 LIN
1 USB
1 RS232 interface for GPS
1 Time sync synchronization Ethernet
*can be enhanced by Upgrade I/O Package

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

Please remember that the mating connectors and the programming interface MSA-Box II are not included and must be ordered separately.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

I/O Package

Communication

4 CAN

Inputs

4 Analog channels

0 to 5 V,

0.5 % precision between 0.2 and 4.8 V, switchable pull-up

4 Digital PWM inputs

f max=30 kHz

Hall-type speed measurement possible,

Fixed pullup 2.15 kOhm (required for Hall),

Tooth count differential**

4 LVDT, 5 pin configuration, excitation frequency 1 to 20 kHz,

excitation voltage 0 to 5 V (rms)

Outputs

4 "TTL" Digital output, 10 kHz, PWM, 25 mA each

2 PWM High side; 7.5 A each, PWM, 50 Hz

4 PWM Low side; 2.2 A each, PWM, 10 kHz

Power Supplies

5 x12 V, 400 mA each

5 switchable 5 V/12 V, 400 mA each

** The tooth count differential between any two of the PWM inputs is available two measure e.g. shaft torsion.

PERF_LOG_1

Increase logging partition 1 from 4 GB to 16 GB memory

High Speed Logging Package

6 ANA 0 to 5 V, 200 kHz logging rate

CCP_MASTER

Enables CCP/XCP master functionality to request data from foreign devices via CAN/CCP protocol or XCP over Ethernet (UDP). (ASAP2 file from ECU manufacturer required)

Real Time Ethernet

Enables the VCU to operate as a real time Ethernet master or slave. Guaranteed latency time of 1 ms. Ideal for time critical data transfer as needed in online control algorithms involving data from different devices.

Two interfaces allow for a ring topology (redundancy in case the RTE line experiences damage).

The VCU features a reasonable set of SERCOS3 instructions although not the full SERCOS3 standard is implemented. The ECU side can act as a SERCOS3 master; the logger side can act as a SERCOS3 slave.

USB Accessories

Rugged USB flash drive

Mating connector for USB flash drive on car loom side

Adapter cable to PC USB-port

Ordering Information

Vehicle Control Unit MS 50.4P incl. CCA HW Upgrade

Order number F02U.V03.014-01

Software Options

I/O Package

Order number F02U.V02.777-01

PERF LOG 1

Order number F02U.V03.054-01

High Speed Logging Package

Order number F02U.V02.779-01

CCP_MASTER

Order number F02U.V02.213-01

Real Time Ethernet

Order number F02U.V02.782-01

Accessories

Rugged USB flash drive

Order number F02U.V01.342-03

Mating connector for USB flash drive on car loom side

Order number F02U.002.996-01

Adapter cable to PC USB-Port

Order number F02U.V01.343-01

Opening tool for shellsize 18

Order number F02U.V01.394-01

Breakout Box BOB 66-pole

Connector code: blue

Order number F02U.V02.295-01

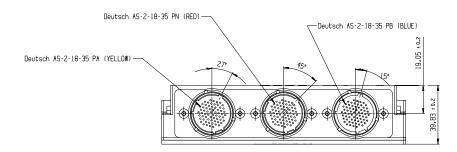
Breakout Box BOB 66-pole

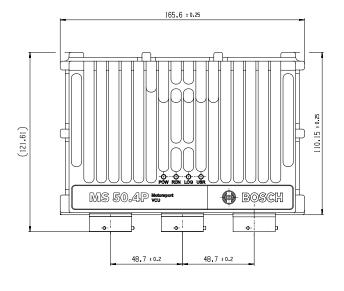
Connector code: yellow Order number **F02U.V02.298-01**

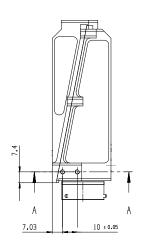
Breakout Box BOB MS 7

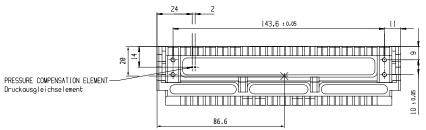
Connector code: red

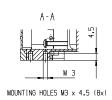
Order number F02U.V02.293-01

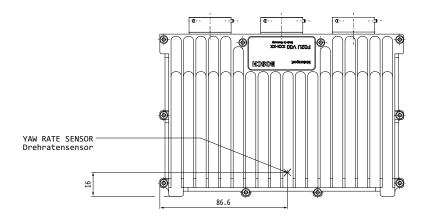












Displays 2

Displays 62

Overview

Display DDU 9



- 667 MHz Dual Core Processor
- Large trans-reflective color display
- Recording on USB flash drive (opt.)
- Supports GPS laptrigger, predated lap time etc.
- Page change based on events possible

Display DDU 10



- Features new user interface menu
- All new display element design generator
- 10 additional LEDs on both sides of the device
- Supports GPS laptrigger, predated lap time etc.
- Page change based on events possible

Display DDU 9



Features

- ▶ 667 MHz Dual Core Processor
- ► Large trans-reflective color display
- ► Recording on USB flash drive (opt.)
- Supports GPS laptrigger, pre-dated lap time etc
- ▶ Page change based on events possible

The display DDU 9 integrates a programmable full color dashboard display with a data logging system for motorsport applications for a very competitive price. Additional input devices can be connected via Ethernet and CAN buses.

Data Analysis Software WinDarab is available free of charge as "WinDarab V7 free" on our website. A basic logging function of 100 channels with recording of 50 ms (4 GB) is always included. The logger can be upgraded to full logging performance (max. 1 ms). In addition a 2nd logging partition of 4 GB (e.g. for long term recording) can be activated. Customers can implement own graphics, pictures etc. on the 12 freely configurable display pages. For quick data transfer from the car e.g. during pit stop, data copy to a USB stick is available as an option. The stick is connected to the wiring harness for the DDU 9.

The device comes with 4 analog and 4 speed inputs as standard; further 12 analog inputs are available as optional upgrade.

Application

Display	• 12 user config	5.7" graphic color display12 user configurable display pages10 multicolor freely configurable (RGB) LEDs	
Resolution		640 x 480 pixel	
Supported im	nage file formats	BMP, GIF, JPG, PNG, TIF	

Processor	667 MHz Dual Core
Converters	10 kHz 12 bit AD converters with digital low pass filter
Internal power source	Li/lon capacitor
Configurable math channels	
Hoor configurable CAN in fout masses	

User configurable CAN in/out messages Online data compression

Internal logger

- 4 GB memory (standard)
- Plus 4 GB memory (optional)
- 100 channels (standard)
- · Up to 1,500 channels (optional)
- 50 ms Sampling rate (standard)
- · max. 1 ms Sampling rate (optional)

Logging rates

- Usage of all features: 600 kB/s
- Primary logging use case: >1,200 kB/s
- · Logging data download rate: up to 6.2 MB/s

LTE Ethernet telemetry support, GSM telemetry support

			• .•
lechn	ical S	nacit	icatione
I CCIIII	icat J	PECII	ications

Technical Specifications	
Mechanical Data	
Size	151 x 126 x 33.5 mm
Weight	540 g
Protection Classification	IP54 to DIN 40050, Section 9, Issue 2008
Operating temperature internal	-20 to 85°C
Operating temperature Display	-20 to 70°C
Max. vibration	Vibration profile 1 (see Appendix or www.boschmotorsport.com)
Electrical Data	
Supply voltage	5 to 18 V
Inputs	
Analog channels	4 standard, additional 12 optional
Input range	0 to 5 V
Resolution	12 bit
Switchable pull up resistor	For all ANA_IN
Wheel speed inputs	4 Hall-effect or DF11, switchable
Outputs	
Sensor supply 5 V ± 1 % (250 mA)	2
Sensor supply 10 V ± 1 % (250 mA)	1
Sensor supply U_Bat 250 mA	1
Sensor ground	4

Environment

External switch for page selection, 12 steps	B 261 209 658-01
External switch for brightness adjustment or page selection, 6 steps	B 261 209 659-01

Connectors and Wires

Motorsport connector on Dis- play	AS216-35PN
Mating connector AS616-35SN	F02U.000.466-01

Pin Configuration

	Comiguration		
Pin	Name	Comment	Status
1	KL_31		Incl.
2	KL_15		Incl.
3	KL_30		Incl.
4	Rev_In_3	Hall or DF11 switchable	Incl.
5	Rev_In_1	Hall or DF11 switchable	Incl.
6	KL_31		Incl.
7	CAN_2_L	CAN speed selectable	Incl.
8	Ethernet_2_TXP		Incl.
9	Ethernet_2_TXN		Incl.
10	Sens_Power_12V	over current protected	Incl.
11	Rev_In_4	Hall or DF11 switchable	Incl.
12	Rev_In_2	Hall or DF11 switchable	Incl.
13	Laptrigger_In		Incl.
14	CAN_2_H	CAN speed selectable	Incl.
15	CAN_1_H	CAN speed selectable	Incl.
16	Ethernet_2_RXP		Incl.
17	Sens_Gnd_4	fused	Incl.
18	Sens_Power 5V	over current protected	Incl.
19	ANA_IN_3	3.01 kOhm switchable	Incl.
20	ANA_IN_4	3.01 kOhm switchable	Incl.
21	Time_Sync	connection to Bosch ECU	Incl.
22	CAN_1_L	CAN speed selectable	Incl.
23	Ethernet_screen		Incl.
24	Ethernet_2_RXN		Incl.
25	Sens_Gnd_3	fused	Incl.
26	Sens_Power 5V	over current protected	Incl.
27	ANA_IN_7	3.01 kOhm switchable	Opt.
28	ANA_IN_1	3.01 kOhm switchable	Incl.
29	USB_Device_DP	to Bosch USB stick	Opt.
30	RS232_TX_Tele- metry		Incl.
31	Ethernet_1_TXP		Incl.
32	Sens_Gnd_2	fused	Incl.

Pin	Name	Comment	Status
33	Sens_Power_10V	over current protected	Incl.
34	ANA_IN_8	3.01 kOhm switchable	Opt.
35	ANA_IN_10	3.01 kOhm switchable	Opt.
36	USB_Device_Gnd	to Bosch USB stick	Opt.
37	USB_Device_DN	to Bosch USB stick	Opt.
38	RS232_RX_Tele- metry	e.g. GSM telemetry	Incl.
39	Ethernet_1_TXN		Incl.
40	Sens_Gnd_1	fused	Incl.
41	ANA_IN_11	3.01 kOhm switchable	Opt.
42	ANA_IN_9	3.01 kOhm switchable	Opt.
43	RS232_TX_GPS		Incl.
44	ANA_IN_16	3.01 kOhm switchable	Opt.
45	USB_Device_Power	to Bosch USB stick	Opt.
46	Ethernet_1_RXP		Incl.
47	ANA_IN_12	3.01 kOhm switchable	Opt.
48	ANA_IN_6	3.01 kOhm switchable	Opt.
49	ANA_IN_2	3.01 kOhm switchable	Incl.
50	ANA_IN_13	3.01 kOhm switchable	Opt.
51	ANA_IN_15	3.01 kOhm switchable	Opt.
52	Ethernet_1_RXN		Incl.
53	ANA_IN_5	3.01 kOhm switchable	Opt.
54	RS232_RX_GPS	for GPS sensor input	Incl.
55	ANA_IN_14	3.01 kOhm switchable	Opt.

Communication

CAN interfaces	2
Ethernet 100BaseT	2
Laptrigger input	1
RS232	Telemetry, GPS
Configuration via RaceCon	Over Ethernet or MSA-Box II

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

CCP_MASTER

Enables CCP/XCP master functionality to request data from foreign devices via CAN/CCP protocol or XCP over Ethernet (UDP). (ASAP2 file from ECU manufacturer required)

FULL_LOG_1

Extension for Partition 1

- 1,500 channels
- fastest sampling 1,000 Hz or 1 synchro

FULL_LOG_2

Enable full logging performance of 4 GB Partition 2

IO_EXTENS

Enable additional 12 analog inputs

USB_DATA

Rugged USB flash drive Bosch File System (BFS) format included, works with Bosch File System (BFS) preformatted USB Flash drive only

Adapter cable to USB-Port

Adapter for wiring harness

SW license USB-Port unlocked

Ordering Information

Display DDU 9

Order number F02U.V02.300-03

Software Options

CCP_MASTER

Order number **F02U.V02.213-01**

FULL_LOG_1

Order number F02U.V02.304-01

FULL_LOG_2

Order number **F02U.V02.305-01**

IO EXTENS

Order number **F02U.V02.205-01**

Accessories

Vehicle Loom Basic

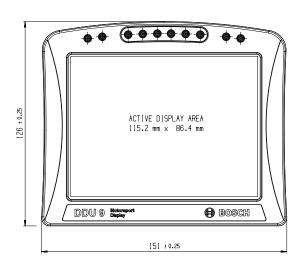
Order number F02U.V02.735-01

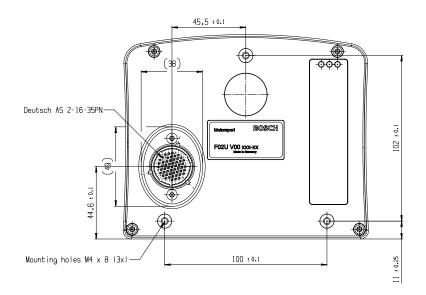
Bench Loom

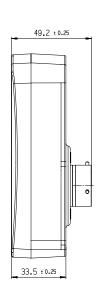
Order number F02U.V02.349-01

USB_DATA

Order number F02U.V02.214-01







Display DDU 10



Features

- Features new user interface menu
- ▶ All new display element design generator
- ▶ 10 additional LEDs on both sides of the device
- ► Supports GPS laptrigger, pre-dated lap time etc
- ▶ Page change based on events possible

The display DDU 10 integrates a programmable full colour dashboard display with a data logging system for motorsport applications. Additional input devices can be connected via Ethernet, CAN buses and RS 232.

Data Analysis Software WinDarab is available free of charge as "WinDarab V7 free" on our website. A basic logging function of 100 channels with recording of 50 ms (4 GB) is always included. The logger can be upgraded to full logging performance (max. 1 ms). In addition, a 2nd logging partition of 4 GB can be activated.

With the DDU 10, a completely new library of graphical elements for the individual design of display pages was implemented and an all-new user interface menu has been developed for the device. A configurable input activates the menu structure and the user can reset for example laptime, fuel consumption and many more, without having to connect a laptop to the DDU. The user can also install own graphics, pictures etc. on the 12 freely configurable display pages. For quick data transfer from the car, e.g. during pit stop, data copy to a USB stick is available as an option.

Application

Display

- 7" graphic color display
- 12 user configurable display pages
- 20 multicolor freely configurable (RGB) LEDs

Resolution	800 x 480 pixel
Supported image file formats	PNG, BMP, JPG, GIF
Processor	667 MHz Dual Core
Converters	10 kHz 12 bit AD converters with digital low pass filter
Internal power source	Li/lon capacitor
Configurable math channels	
User configurable CAN in/out messages	Up to 256 IDs (128 in and out)

Online data compression

Internal logger

- 4 GB memory (standard)
- Plus 4 GB memory (optional)
- 100 channels (standard)
- Up to 1,500 channels (optional)
- 50 ms Sampling rate (standard)
- max. 1 ms Sampling rate (optional)

Logging rates

- Usage of all features: 600 kB/s
- Primary logging use case: 800 kB/s
- Logging data download rate: up to 4 MB/s

Ambient light sensor

mA)

Technical Specifications	
Mechanical Data	
Size	198 x 134 x 35 mm
Weight	875 g
Protection classification	IP67
Operating temperature internal	-20 to 85°C
Max. vibration	Vibration profile 1 (see Appendix or www.boschmotorsport.com)
Electrical Data	
Supply voltage	6 to 18 V
Current consumption (without sensor supply)	2 A (at 12 V)
Inputs	
Analog channels	4 standard, plus 12 optional
Input range	0 to 5 V
Resolution	12 bit
Switchable pull up resistor	For all analog inputs
Wheel speed inputs	4 Hall-effect or DF11, switchable
Outputs	
Sensor supply 5 V ± 1 % (250 mA)	2
Sensor supply 10 V ± 1 % (250	1

Sensor supply U_Bat (250 mA)	1
Sensor ground	4
Environment	
External switch for page selection, 12 steps	B 261 209 658-01
External switch for brightness adjustment or page selection, 6 steps	B 261 209 659-01
Connectors and Wissa	
Connectors and Wires	
LIFE connector on display AS216-35PN	
LIFE connector on display	F02U.000.466-01
LIFE connector on display AS216-35PN Mating connector	F02U.000.466-01
LIFE connector on display AS216-35PN Mating connector AS616-35SN Auxiliary connector on display	F02U.000.466-01 F02U.000.443-01

Pin Configuration

LIFE	connector		
Pin	Name	Comment	Status
1	KL_31		Incl.
2	KL_15		Incl.
3	KL_30		Incl.
4	Rev_In_3	Hall or DF11 switchable	Incl.
5	Rev_In_1	Hall or DF11 switchable	Incl.
6	KL_31		Incl.
7	CAN_2_L	CAN speed selectable	Incl.
8	Ethernet_2_TXP		Incl.
9	Ethernet_2_TXN		Incl.
10	Sens_Power_12V	over current protected	Incl.
11	Rev_In_4	Hall or DF11 switchable	Incl.
12	Rev_In_2	Hall or DF11 switchable	Incl.
13	Laptrigger_In		Incl.
14	CAN_2_H	CAN speed selectable	Incl.
15	CAN_1_H	CAN speed selectable	Incl.
16	Ethernet_2_RXP		Incl.
17	Sens_Gnd_4	fused	Incl.
18	Sens_Power 5V	over current protected	Incl.
19	ANA_IN_3	3.01 kOhm switchable	Incl.
20	ANA_IN_4	3.01 kOhm switchable	Incl.
21	Time_Sync	connection to Bosch ECU	Incl.
22	CAN_1_L	CAN speed selectable	Incl.
23	Ethernet_screen		Incl.
24	Ethernet_2_RXN		Incl.
25	Sens_Gnd_3	fused	Incl.
26	Sens_Power 5V	over current protected	Incl.

LIFE	connector		
27	ANA_IN_7	3.01 kOhm switchable	Opt.
28	ANA_IN_1	3.01 kOhm switchable	Incl.
29	USB_Device_DP	to Bosch USB stick	Opt.
30	RS232_TX_Tele- metry		Incl.
31	Ethernet_1_TXP		Incl.
32	Sens_Gnd_2	fused	Incl.
33	Sens_Power_10V	over current protected	Incl.
34	ANA_IN_8	3.01 kOhm switchable	Opt.
35	ANA_IN_10	3.01 kOhm switchable	Opt.
36	USB_Device_Gnd	to Bosch USB stick	Opt.
37	USB_Device_DN	to Bosch USB stick	Opt.
38	RS232_RX_Tele- metry	e.g. GSM telemetry	Incl.
39	Ethernet_1_TXN		Incl.
40	Sens_Gnd_1	fused	Incl.
41	ANA_IN_11	3.01 kOhm switchable	Opt.
42	ANA_IN_9	3.01 kOhm switchable	Opt.
43	RS232_TX_GPS		Incl.
44	ANA_IN_16	3.01 kOhm switchable	Opt.
45	USB_Device_Power	to Bosch USB stick	Opt.
46	Ethernet_1_RXP		Incl.
47	ANA_IN_12	3.01 kOhm switchable	Opt.
48	ANA_IN_6	3.01 kOhm switchable	Opt.
49	ANA_IN_2	3.01 kOhm switchable	Incl.
50	ANA_IN_13	3.01 kOhm switchable	Opt.
51	ANA_IN_15	3.01 kOhm switchable	Opt.
52	Ethernet_1_RXN		Incl.
53	ANA_IN_5	3.01 kOhm switchable	Opt.
54	RS232_RX_GPS	for GPS sensor input	Incl.
55	ANA_IN_14	3.01 kOhm switchable	Opt.
Auxili	iary connector		
Pin	Name	Comment	Status
1		Unused	
2		Unused	
3		Unused	
4		Unused	
5		Unused	
6		Unused	
7		Unused	
8		Unused	
9	Ethernet_3_TXP		Incl.
10	Ethernet_3_RXP		Incl.
11	Ethernet_3_RXN		Incl.
12	CAN_4_H		Opt.

13		Unused	
14		Unused	
15		Unused	
16		Unused	
17		Unused	
18	Ethernet_screen		Incl.
19	Ethernet_3_TXN		Incl.
20	CAN_4_L		Opt.
21	CAN_3_H		Opt.
22	CAN 3 L		Opt.

Communication

CAN interfaces	2 standard, plus 2 optional
Ethernet 100BaseT	3
Laptrigger input	1
RS232	Telemetry, GPS
Configuration via RaceCon	Over Ethernet or MSA-Box II
CCP-Master, data acquisition fr tion protocol (optional)	rom ECU that support CAN calibra-

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

This product may contain open source software. Information about license terms and other obligations is given in the manual.

Ordering Information

Display DDU 10

Order number F02U.V02.659-02

Software Options

CCP_MASTER

Order number F02U.V02.213-01

FULL_LOG_1

Order number F02U.V02.304-01

FULL_LOG_2

Order number F02U.V02.305-01

IO_EXTENS

Order number F02U.V02.205-01

Accessories

USB_DATA

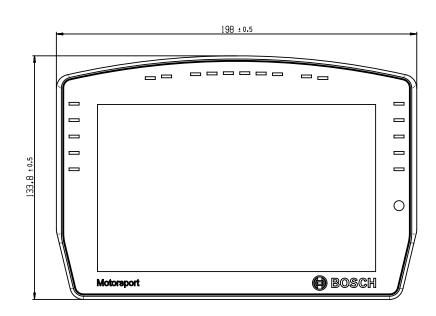
Order number **F02U.V02.214-01**

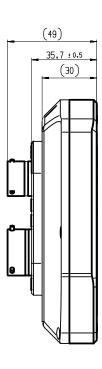
Vehicle Loom Basic

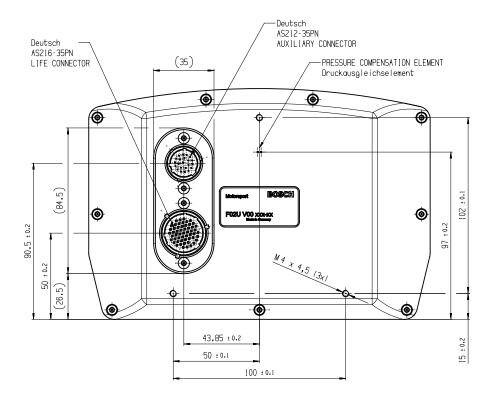
Order number F02U.V02.735-01

Bench Loom

Order number F02U.V02.349-01







Electronics

3

CAN Keypad	
Collision Avoidance Systems	76
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Power Boxes	103
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Test System	135

CAN Keypad CK-M12





Features

- ▶ 12 standard buttons with color indicator rings
- ▶ 9 additional digital switch inputs
- ► Moveable button inserts
- ► CAN input / output

The CAN Keypad CK-M12 allows for simplification of the dashboard by offering 12 buttons and 9 additional wired inputs to be evaluated and transmitted via CAN bus to other devices on the bus. Each button has an individually addressable LED indicating ring that can be used to acknowledge a button press event, indicate status of a device, or alert the driver to a fault condition. No special configuration software is needed, all feedback logic is done by PBX, DDU or ECU. Each keypad is supplied with 15 black inserts, optional insert kits are also available.

Application	
Usage	PBX / DDU / ECU Interface
Temperature range	-40 to 85°C
Technical Specifica	ntions
Mechanical Data	
Weight	280 g
Max. vibration	11 ms 30 G peak
Sealing	IP68
Electrical Data	
Power supply Vs	9 to 32 V
Average current draw	100 mA

Characteristics

Signal output	CAN
CAN transmit rate	100 Hz*
CAN baud rate	1 Mbaud*
TX ID	0x800*
RX ID	0x801*
TX Data	1 bit status for each input
RX Data	4 bit integer for each indicator color, 4 bit integer for bright-
	ness

* Custom CAN IDs / baud Rate Optional Upon Request

Note: CK-M12 DBC file available for CAN configuration

Connectors and Wires

CK-M12 Termination Flying Lead 24AWG

Recommended Connectors

CK-M12	AS610-35PN
Mating	AS110-35SN

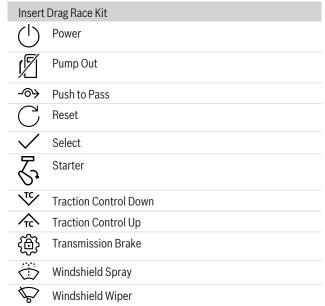
Wire Identification

Wire	Function
Red	12/24 V Power
Black	Ground
Yellow	CAN high (CANH)
Green	CAN low (CANL)
White, Black Trace	Digital Input 1 activated by Ground
White, Brown Trace	Digital Input 2 activated by Ground
White, Red Trace	Digital Input 3 activated by Ground
White, Orange Trace	Digital Input 4 activated by Ground
White, Yellow Trace	Digital Input 5 activated by Ground
White, Green Trace	Digital Input 6 activated by Ground
White, Blue Trace	Digital Input 7 activated by Ground
White, Purple Trace	Digital Input 8 activated by Ground
White, Grey Trace	Digital Input 9 activated by Ground

Insert Kits

Inser	t Road Race Kit
**	A/C
(ABS)	ABS
(Alarm Reset
●	Anti-Lag

Inser	t Road Race Kit		Road Race Kit
\uparrow	Arrow x 4		Reverse
6	Brake Spray		Select
В∕	Boost Decrease	abla	Starter
B	Boost Increase	\	Traction Control Down
-,∯,⁻	Brightness Down	↑ tc\	Traction Control Up
-,\$\dagger	Brightness Up	J	Wet Mode
\otimes	Close Menu	\Diamond	Windshield Spray
$\widetilde{\mathbb{M}}$	Cool Suit	\$	Windshield Wiper
\$6	Cooling Fan	Insert	: Drag Race Kit
%	Day/Night Mode	*	A/C
$\overline{\Box}$	Drink		Alarm Reset
<u></u> -\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Flash Hi Beam		
	Fuel Reserve	®	Anti-Lag
		\uparrow	Arrow x 4
	Fuel Reset	B	Boost Decrease
口	Full Course Yellow	B	Boost Increase
···	Function Toggle	-,∯,- -, B,	Brightness Down
(Gearbox Emergency	- , ↑	Brightness Up
	Hazard Flasher		Burnout
(II)	Heated Windshield	(M)	
<u> </u>	Helmet Fan	\times	Close Menu
O\\	High Beam	88	Cooling Fan
7	Horn	%	Day/Night Mode
	Launch	$\overline{\odot}$	Function Toggle
O\(\)	Low Beam		
MP/	Map Down		Hazard Flasher
♠	Map Up Neutral	O\(\bar{\bar{\bar{\bar{\bar{\bar{\bar{	High Beam
5/2 5/2			Horn
_	Open Menu	*/	Launch
<u></u>	Page Down	(<u>a</u>)	Line Lock
ightharpoons	Page Up	OE MP	Low Beam
	PDU Reset	MP	Map Down
(S)	Pit Switch	MP =	Map Up
(l)	Power	Ā	Nitrous Arm
<u>(a)</u>	Power Steering Reset	ē	Nitrous Purge
	Pump Out	S	Open Menu
-⊗>	Push to Pass	Ţ	Page Down
-09 [* 3	Radiator Spray	_ ↓	-
	Rain Light	\uparrow	Page Up
<u></u>	Reset		PDU Reset



Insert Alpha/Numeric Kit	
A	V
В	W
С	Χ
D	Υ
Е	Z
F	!
G	-
Н	+
I	0
J	1
K	2

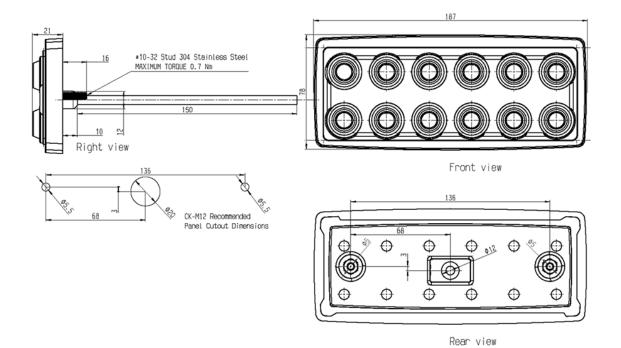
Insert Alpha/Numeric Kit	
L	3
М	4
N	5
0	6
Р	7
Q	8
R	9
S	10
T	11
U	12

Installation Notes		
Installation on flat surface re	ecommended	
Bolt size	#10-32	
Tightening Torque	0.7 +/- 0.1 Nm	

Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information
CAN Keypad CK-M12 Order number F02U.V0U.328-03
Accessories
Insert Road Race Kit Order number F02U.B0U.022-01
Insert Drag Race Kit Order number F02U.B0U.023-01
Insert Alpha/Numeric Kit Order number F02U.B0U.024-01



Overview

Collision Avoidance System Collision Avoidance System CAS-M light



- · Radar sensor with integrated
- · Warning for overtake situations
- · Easy system adaptation
- Universal CAN interface for various displays
- Visualization via display LEDs

CAS-M 3 EVO





- · Approaching vehicle tracking
- · Left/right passing alerts
- Improves visibility of objects in rain, mist or darkness
- · Full Bosch Motorsport tool integration

Collision Avoidance System CAS-M light



Features

- ► Radar sensor with integrated logic
- ► Warning for overtake situations
- ► Easy system adaptation
- ▶ Universal CAN interface for various displays
- ► Visualization via display LEDs

The collision avoidance system CAS-M light helps the driver to focus on the track and warns him if a car is approaching from behind. The system provides information about relative speed and distance of the closest vehicle on the CAN bus. An additional display with CAN bus interface is required (e.g. DDU 9). The information is based on a Bosch radar sensor which contains a FMCW radar transceiver operating in the frequency range of 76.0 - 77.0 GHz. Targets in front of the sensor are reflecting the radar signal and the relative speed and distance is determined via Doppler-effect and beat frequency.

The benefit is even more increased during darkness or in bad weather conditions. The system interface is very intuitive and adaptable to the drivers liking.

Application	
Operating temperature	-40 to 85°C
Storage temperature	-20 to 95°C
Range	150 m
Tracks	1 Object (nearest)
Interface	CAN
CAN rate	500 kbaud or 1 Mbaud
CAN update rate	50 Hz

Horizontal field of view Radar	85° from 0 to 29 m
	70° from 29 to 46 m
	50° from 46 to 73 m
	42° from 73 to 78 m
	20° from 78 to 95 m

	20° from 78 to 95 m
Technical Specifications	
Mechanical Data	
Weight of radar sensor MRR	199 g
Size	60x70x32 mm
Protection Classification	IP 6K6K (DIN 40 050) IP 6K7 (DIN 40 050)
Max. vibration	Randome vibration aeff = 30.8 m/s², 3x8 h (according ISO/DIS 16750-3)
Electrical Data	
Supply voltage	6.5 to 18 V
An external fuse has to be provided (rec. 10 A). External overvoltage protection is required (internal overvoltage protection up to 35 V).	
Reverse polarity voltage protection	-14 V max. t ≤ 60 sec
Connectors and Wires	
Mating connector	F037.B00.168-01
Pin 1	GND
Pin 2	CAN-H
Pin 3	CAN-L
Pin 4	n.c.
Pin 5	n.c.
Pin 6	n.c.

Installation Notes

Pin 7

Pin 8

The system includes a radar sensor and a detailed user manual.

n.c.

V+

Ordering information for suitable wiring looms for the different CAS-M light packages are specified in the user manual.

The system needs to be connected to the vehicle CAN bus (connection to display needed) and supplied with 12 V from the supply system on board.

The rear unit must be mounted 90° to the vehicles vertical and horizontal axis and within ± 200 mm of the vehicle lateral centerline.

Mounting distance of radar over ground: 300 to 1,000 mm

To achieve the expected performance from the radar sensor, it must have a clear and unobstructed view. There should be no material over the radar sensor and the sensor should be allowed a clear 180-degree field of view.

The system needs yaw rate and vehicle speed information.

Cat 6 A standard for Gigabit Ethernet.

See CAS-M light in action on http://youtu.be/EzpSy-eJRi4

Legal

The CAS-M 3 radar sensor is based on the Bosch Engineering MRRe14HBW radar sensor. The MRRe14HBW is frequency certified for the following countries:

Country

Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Iceland, Liechtenstein, Norway, Switzerland

USA

Canada

Japan

Australia

New Zealand

Country

United Kingdom

If the MRRe14HBW and hence the CAS-M 3 radar sensor SCU is not operated within this context, it lies within the customer's responsibility to ensure compliance of the application with national regulations and standards, e.g., electromagnetic compatibility and radio spectrum matters.

Link to the up-to-date EU Declaration of Confirmity DoC:

http://eu-doc.bosch.com

(Please enter the model MRRe14HBW on which CAS-M sensors are based on to find the correct DoC in the database.)

Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

CAS-M light (500 kbaud)

Order number F02U.V02.021-01

CAS-M light (1 Mbaud)

Order number F02U.V02.220-01

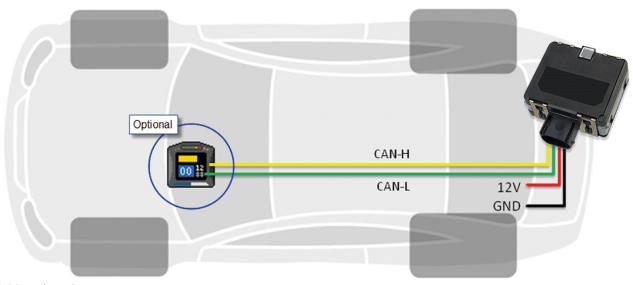
CAS-M light incl. Display DDU 9 (500 kbaud)

Order number F02U.V02.591-01

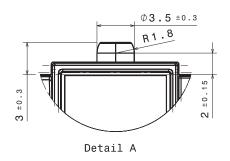
CAS-M light incl. Display DDU 9 (1 Mbaud)

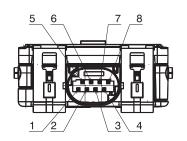
Order number F02U.V02.592-01

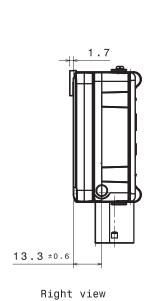
Dimensions

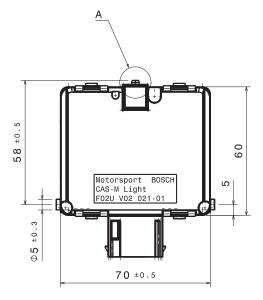


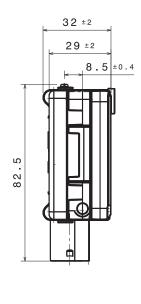
Wiring schematic











Left view

Dimensions

Front view

Collision Avoidance System CAS-M 3 EVO





Features

- ► Approaching vehicle tracking
- ► Left/right passing alerts
- ▶ Improves visibility of objects in rain, mist or darkness
- ► Full Bosch Motorsport tool integration

The Collision Avoidance System-Motorsport 3 EVO (CAS-M 3 EVO) features a high-performance Bosch Motorsport **Display Unit** for fast video processing (right in the picture), and a **Rear Module**, composed from a Bosch mid-range radar sensor for a wider field of view in close-up range and a fast response high definition camera (left in the picture). The CAS-M 3 EVO system provides real time visualization and warns the driver about approaching or overtaking cars via intuitive marking of the cars on the display. It helps prevent the most common collisions and allows drivers to focus on the race. With a momentary glance, the driver can tell how many cars are following and their classification depending on distance and relative speed. The radar tracks up to 40 objects and marks up to four objects on the display. In addition, bright flashing LEDs alert the driver when any car attempts a passing maneuver. All of these features work at night or in the rain when visibility is typically poor. Furthermore, the real time gap of a marked object is measured and can be provided over CAN or Ethernet. The CAS-M 3 EVO system is fully integrated in the

Bosch Motorsport Tool environment and can be configured with RaceCon.

Application		
Range	95 m	
Horizontal field of view		

Radar	85° from 0 to 29 m 70° from 29 to 46 m
	50° from 46 to 73 m
	42° from 73 to 78 m
	20° from 78 to 95 m
Camera	78°
Number of tracked objects	Max. 40
Number of displayed classified objects	Max. 4
Display format	7"
Display resolution	800 x 480 pixel
User configurable CAN in/out me	ssages
User configurable LEDs	

Display Unit	
Size	198 x 134 x 35 mm
Weight	830 g
Protection classification	IP67
Operating temperature internal	-20 to 85°C
Max. vibration	Vibration profile 1 (See Appendix or www.boschmotorsport.com)
Rear Module	
Size	120 x 150 x 115 mm
Weight	880 g
Protection classification	IP67
Operating temperature	0 to 70°C (rearview camera internal temperature*)
Max. vibration	Vibration profile 1 (See Appendix or www.boschmotorsport.com)
*If the temperature limit i	s reached, forced air coc

mmenaea.
6 to 18 V
2 A (at 12 V)
0.7 A (at 12 V)
1x private CAN for radar, 1x CAN
1x private 1GBase-T Ethernet for camera, 1x 100Base-T Ethernet

Time sync synchronization Eth- 1

ernet

Rear Module	
CAN	1x private CAN for radar
Ethernet	1x private 1GBase-T Ethernet
	for camera
Software Tools (free dow	vnload)
Data analysis tool	WinDarab 7 Light
System configuration tool	RaceCon
Connectors and Wires	
Display Unit	
Motorsport connector on	AS212-35PN
device	
Mating connector AS612-35SN	F02U.000.443-01
Rear Module	
Motorsport connector on device	AS212-35PN
Mating connector AS612-35SN	F02U.000.443-01

Pin Configuration

Display Unit		Rear Module for Vehicle Harness	
Pin N	Vo.	Pin No.	
1	GigEthernet_TR3_N (private Eth camera PEC)	14	
2	GigEthernet_TR3_P (PEC)	1	
3	GigEthernet_TR2_N (PEC)	2	
4	GigEthernet_TR2_P (PEC)	3	
5	GigEthernet_TR1_N (PEC)	4	
6	GigEthernet_TR1_P (PEC)	5	
7	GigEthernet_TRO_N (PEC)	6	
8	GigEthernet_TRO_P (PEC)	7	
9	Ethernet_TXP	n/a - Connect to Bosch System Ethernet BSE	
10	Ethernet_RXP	n/a - Connect to BSE	
11	Ethernet_RXN	n/a - Connect to BSE	
12	CAN_High_Vehicle	n/a - Connect to Bosch System CAN	
13	+12 V KL30	n/a - Connect to Vehicle System Power VSP	
14	+12 V KL15	n/a - Connect to VSP	
15	GND KL31	n/a - Connect to VSP	
16	GND KL31	n/a - Connect to VSP	
17	n/c	n/c	
18	ETH_Screen	n/a - Connect to BSE	
19	Ethernet_TXN	n/a - Connect to BSE	
20	CAN Low Vehicle	n/a - Connect to Bosch System CAN	
21	CAN High Radar (private CAN radar PCR)	11	

22	CAN Low Radar (PCR)	12
Rear	Module	Display Unit for Vehicle Harness
1	GigEthernet_TR3_P (private Eth camera PEC)	2
2	GigEthernet_TR2_N (PEC)	3
3	GigEthernet_TR2_P (PEC)	4
4	GigEthernet_TR1_N (PEC)	5
5	GigEthernet_TR1_P (PEC)	6
6	GigEthernet_TRO_N (PEC	7
7	GigEthernet_TRO_P (PEC)	8
8	+12 V Ubat	n/a - Connect to VSP
9	+12 V Ubat	n/a - Connect to VSP
10	+12 V Ubat (opt. to display)	13 (opt. if KL30 not connected)
11	CAN High Radar (PCR)	21
12	CAN Low Radar (PCR)	22
13	n.c.	
14	GigEthernet_TR3_N (PEC)	1
15	GigEthernet Screen	
16	n.c.	
17	CAN Screen	n/c
18	GND	
19	+12 V Ubat (opt. to display)	13 (opt. if KL30 not connected)
20	GND	n/a - Connect to VSP
21	GND (opt. to display)	15 (opt. if KL31 not conneted)
22	GND (opt. to display)	15 (opt. if KL31 not connected)

Communication

1x private CAN for radar, 1x CAN
1x private 1GBase-T Ethernet for camera, 1x 100Base-T Ethernet
1
1x private CAN for radar
1x private 1GBase-T Ethernet for camera

Installation Notes

The rear unit must be mounted 90° to the vehicles vertical and horizontal axis and within \pm 200 mm of the vehicle lateral centerline. Mounting distance of radar over ground: 300 to 1,000 mm

To achieve the expected performance from the radar sensor, it must have a clear and unobstructed view. There should be no material over the radar sensor and the sensor should be allowed a clear 180 degree field of view.

Consider the maximum vibration limits for the mounting position of the rear module. The system is approved referred to vibration profile 1, see www.bosch-motorsport.com.

Check the radar sensor for travel inside the radar bracket. In this case, remove the radar sensor and check the locking pins at both sides of the sensor. Due to vibrations, these pins can be deformed. Exceeding travel of the sensor can damage the electric contacts.

The system needs yaw rate and vehicle speed information.

Cat 6 A standard for Gigabit Ethernet.

This product may contain open source software. Information about license terms and other obligations is given in the manual.

For the private CAN network between display and rear module, no termination resistor is needed in the wiring harness. There are preinstalled termination resistors in the radar sensor and the display.

Safety Notes

It is not permitted to use the system as mirror replacement.

Legal

The CAS-M 3 radar sensor is based on the Bosch Engineering MRRe14HBW radar sensor. The MRRe14HBW is frequency certified for the following countries:

Country

Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Iceland, Liechtenstein, Norway, Switzerland

USA

Canada

Japan

Australia

New Zealand

Country

United Kingdom

If the MRRe14HBW and hence the CAS-M 3 radar sensor SCU is not operated within this context, it lies within the customer's responsibility to ensure compliance of the application with national regulations and standards, e.g., electromagnetic compatibility and radio spectrum matters.

Link to the up-to-date EU Declaration of Confirmity DoC:

http://eu-doc.bosch.com

(Please enter the model MRRe14HBW on which CAS-M sensors are based on to find the correct DoC in the database.)

Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

Collision Avoidance System CAS-M 3 EVO

Order number F02U.V02.648-02

Acceleration Sensor MM5.10

Without wire (1)

Order number F02U.V01.511-02

Acceleration Sensor MM5.10

Wire with open end (2)

Order number F02U.V01.511-92

Acceleration Sensor MM5.10

Wire with motorsport connector (3) Order number F02U.V01.512-03

Accessories

Display Unit

Order number F02U.V02.660-02

Rear Module

Consisting of parts (A) to (E) Order number **F02U.V02.630-02**

Radar Bracket (A)

Order number F037.D00.084-01

Radar Unit (B)

Order number F02U.V02.647-01

Camera Unit (C)

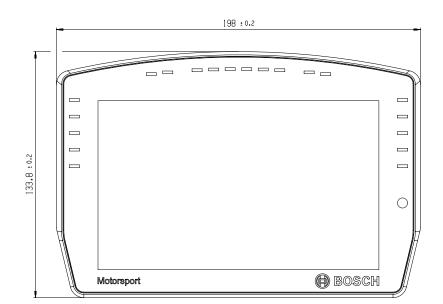
Order number F02U.V02.799-01

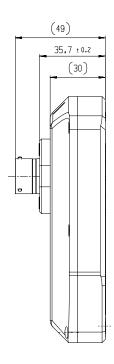
Wiring Harness (D)

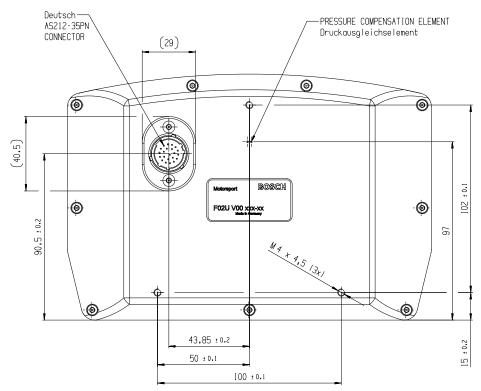
Order number F02U.V02.802-01

Interface Module (Housing and Electronics) (E)

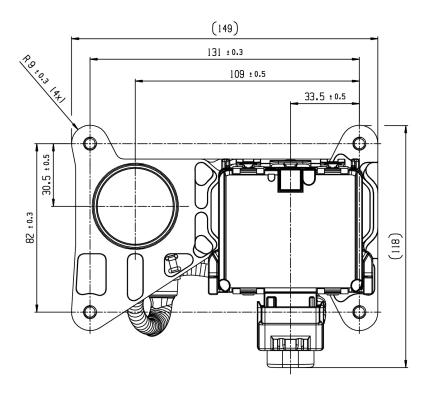
Order number F02U.V02.639-01



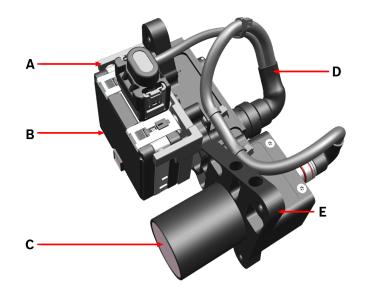




Display



Rear Module



- A: Radar Bracket
- B: Radar Sensor
- C: Camera
- D: Wiring Harness for Radar and Camera E: Interface Module (Housing and Electronics)

Spare Parts of the Rear Module

Overview

Data Logger C 70



- Cutting-edge 667 MHz Dual Core Processor
- Recording on USB flash drive (opt.)
- Supports GPS lap trigger, pre-dated lap time etc.
- High programming flexibility using mathematical functions and conditional channels

Data Logger and Sensor Interface C 80



- Aluminum housing
- Powerful data logger with up to 20 GB memory
- Supports Bosch multi-logger configuration
- USB recording and full telemetry support

USB_DATA



- · Capacity 2 GB
- · Robust brass housing
- High performance push-pull connector
- Compatible with Data Loggers, Displays and VCUs

Data Logger C 70



Features

- ► Cutting-edge 667 MHz Dual Core Processor
- ► Recording on USB flash drive (opt.)
- ► Supports GPS lap trigger, pre-dated lap time
- ► High programming flexibility using mathematical functions and conditional channels

The data logger C 70 integrates a programmable data logging system for motorsport applications for a very competitive price. Additional input devices can be connected via Ethernet and CAN buses. Data Analysis Software WinDarab is available free of charge as "WinDarab V7 free" on our website. The logger can be upgraded to a 2nd logging partition of 4 GB (e.g. for long term recording). For quick data transfer from the car e.g. during pit stop, data copy to a USB stick is available as an option. The stick is connected to the wiring harness for the C 70.

The device comes with 4 analog and 4 speed inputs as standard; further 12 analog inputs are available as optional upgrade.

Processor 667 MHz Dual Core Converters 10 kHz 12 bit AD converters with digital low pass filter Internal power source Li/lon capacitor Configurable math channels User configurable CAN in/out messages Online data compression

Internal logger

- 4 GB memory (standard)
- Plus 4 GB memory (optional)

- 1.500 channels
- · 1 ms Sampling rate

Logging rates

- Usage of all features: 600 kB/s
- Primary logging use case: >1,200 kB/s
- · Logging data download rate: up to 6.2 MB/s

LTE Ethernet telemetry support, GSM telemetry support

Technical Specifications

$NA \wedge A$	han	1001	112+2
INICI	.iiai	IILAL	Data

Size	151 x 126 x 25.5 mm
Weight	450 g
Protection Classification	IP54 to DIN 40050, Section 9, Issue 2008
Operating temperature internal	-20 to 85°C
Max. vibration	Vibration profile 1 (see Appendix or www.boschmotorsport.com)

Electrical Data

Supply voltage	5 to 18 V
Inputs	
Analog channels	4 standard, additional 12 optional
Input range	0 to 5 V
Resolution	12 bit
Switchable pull up resistor	For all ANA_IN
Wheel speed inputs	4 Hall-effect or DF11, switchable
0.1.1	

Outputs

•	
Sensor supply 5 V \pm 1 % (250 mA)	2
Sensor supply $10 \text{ V} \pm 1 \%$ (250 mA)	1
Sensor supply U_Bat 250 mA	1
Sensor ground	4

Connectors and Wires

Motorsport connector on logger	AS216-35PN
Mating connector	F02U.000.466-01
AS616-35SN	

Pin Configuration

Pin	Name	Comment	Status
1	KL_31		Incl.
2	KL_15		Incl.
3	KL_30		Incl.
4	Rev_In_3	Hall or DF11 switchable	Incl.
5	Rev_In_1	Hall or DF11 switchable	Incl.
6	KL_31		Incl.
7	CAN_2_L	CAN speed selectable	Incl.

Din	Namo	Commont	Ctatus
Pin	Name	Comment	Status
8	Ethernet_2_TXP		111011
9	Ethernet_2_TXN		Incl.
10	Sens_Power_12V	over current protected	Incl.
11	Rev_In_4	Hall or DF11 switchable	Incl.
12	Rev_In_2	Hall or DF11 switchable	Incl.
13	Laptrigger_In		Incl.
14	CAN_2_H	CAN speed selectable	Incl.
15	CAN_1_H	CAN speed selectable	Incl.
16	Ethernet_2_RXP		Incl.
17	Sens_Gnd_4	fused	Incl.
18	Sens_Power 5V	over current protected	Incl.
19	ANA_IN_3	3.01 kOhm switchable	Incl.
20	ANA_IN_4	3.01 kOhm switchable	Incl.
21	Time_Sync	connection to Bosch ECU	Incl.
22	CAN_1_L	CAN speed selectable	Incl.
23	Com_screen	Ethernet and USB screen	Incl.
24	Ethernet_2_RXN		Incl.
25	Sens_Gnd_3	fused	Incl.
26	Sens_Power 5V	over current protected	Incl.
27	ANA_IN_7	3.01 kOhm switchable	Opt.
28	ANA_IN_1	3.01 kOhm switchable	Incl.
29	USB_Device_DP	to Bosch USB stick	Opt.
30	RS232_TX_Tele- metry		Incl.
31	Ethernet_1_TXP		Incl.
32	Sens_Gnd_2	fused	Incl.
33	Sens_Power_10V	over current protected	Incl.
34	ANA_IN_8	3.01 kOhm switchable	Opt.
35	ANA_IN_10	3.01 kOhm switchable	Opt.
36	USB_Device_Gnd	to Bosch USB stick	Opt.
37	USB_Device_DN	to Bosch USB stick	Opt.
38	RS232_RX_Tele- metry	e.g. GSM telemetry	Incl.
39	Ethernet_1_TXN		Incl.
40	Sens_Gnd_1	fused	Incl.
41	ANA_IN_11	3.01 kOhm switchable	Opt.
42	ANA_IN_9	3.01 kOhm switchable	Opt.
43	RS232_TX_GPS		Incl.
44	ANA_IN_16	3.01 kOhm switchable	Opt.
45	USB_Device_Power	to Bosch USB stick	Opt.
46	Ethernet_1_RXP		Incl.
47	ANA_IN_12	3.01 kOhm switchable	Opt.
48	ANA_IN_6	3.01 kOhm switchable	Opt.
49	ANA_IN_2	3.01 kOhm switchable	Incl.

Pin	Name	Comment	Status
50	ANA_IN_13	3.01 kOhm switchable	Opt.
51	ANA_IN_15	3.01 kOhm switchable	Opt.
52	Ethernet_1_RXN		Incl.
53	ANA_IN_5	3.01 kOhm switchable	Opt.
54	RS232_RX_GPS	for GPS sensor input	Incl.
55	ANA_IN_14	3.01 kOhm switchable	Opt.

Communication	
CAN interfaces	2
Ethernet 100BaseT	2
Laptrigger input	1
RS232	Telemetry, GPS
Configuration via RaceCon	Over Ethernet or MSA-Box II

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

CCP_MASTER

Enables CCP/XCP master functionality to request data from foreign devices via CAN/CCP protocol or XCP over Ethernet (UDP). (ASAP2 file from ECU manufacturer required)

FULL_LOG_2

Enable logging partition 2 with 4 GB memory

IO_EXTENS

Enable additional 12 analog input channels

USB_DATA

Rugged USB flash drive Bosch File System (BFS) format included, works with BFS preformatted USB flash drive only Adapter cable to USB-Port

Adapter for wiring harness

SW license USB-Port unlocked

Ordering Information

Data Logger C 70

Order number **F02U.V02.302-02**

Software Options

CCP_MASTER

Order number **F02U.V02.213-01**

FULL_LOG_2

Order number F02U.V02.305-01

IO_EXTENS

Order number F02U.V02.205-01

Accessories

Vehicle Loom Basic

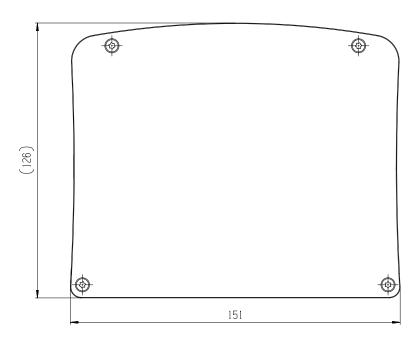
Order number F02U.V02.735-01

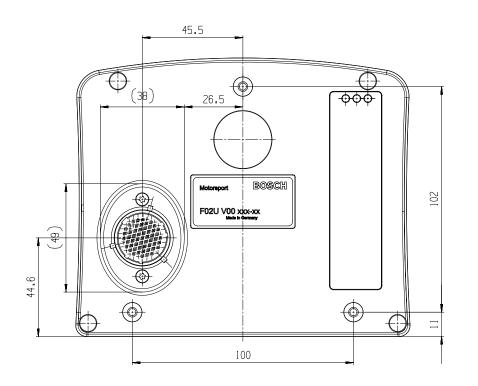
Bench Loom

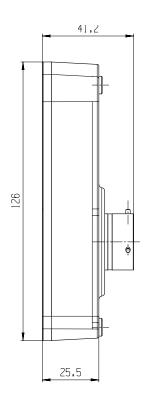
Order number F02U.V02.349-01

USB_DATA

Order number F02U.V02.214-01







Data Logger and Sensor Interface C 80



Features

- ► Aluminum housing
- ▶ Powerful data logger with up to 20 GB memory
- ► Supports Bosch multi-logger configuration
- ▶ USB recording and full telemetry support

We offer the C 80 in two basic versions, on the one hand as a data logger and on the other hand as a sensor interface. Choose between these basic variants and combine or add functionalities now or later.

The data logger C 80 is a professional data logging system for motorsport applications. This allows for synchronized acquisition of engine data from the ECU and chassis data from up to 26 analog and 4 digital input channels. Additional input devices can be connected via Ethernet and CAN buses. Recorded data from the up to 16 GB logger can be downloaded via high speed Ethernet. Software upgrades for the C 80 (field upgradable

by entering a key) activate tailored configurations like a second logging partition of 4 GB, USB recording, CCP/XCP-master for simple data access to third party devices, as well as additional input channels.

Application

Converters	10 kHz 12 bit AD converters with digital low pass filter
Configurable math channels	
User configurable CAN in/out	messages
Sampling rate	
Online data compression	

Internal logger

- 4 GB memory on partition 1 (optional; included in C 80 Logger)
- Plus 16 GB memory on partition 1 (optional)
- Plus 4 GB memory on partition 2 (optional)
- · Up to 1,500 channels
- Fastest sampling 1,000 Hz for all channels

Logging rates

- · Usage of all features: 800 kB/s
- Primary logging use case: >1,500 kB/s
- Logging data download rate: up to 7.5 MB/s

3-port network switch

Telemetry Support via Ethernet (recommended) and RS232

Technical Specifications

Mechanical Data

	moonamout Data	
	Size	105 x 34.5 x 137.5 mm
	Weight	462 g
	Protection Classification	IP67 to DIN 40050, Section 9, Issue 2008
	Max. vibration	Vibration profile 1 (see Appendix or www.boschmotorsport.com)
	Operating temperature (internal)	0 to 85°C
	Operation outside the temperatur	e limits can be tested on request

during the manufacturing tests.

Electrical Data

Supply voltage	8 to 18 V
Max. power consumption (w/o loads)	10 W at 14 V

Inputs

Analog channels	6
Input range	0 to 5 V
Resolution	12 bit
Switchable pull up resistor	3 kOhm
Outputs	
PWM outputs (low side switch 2 A each)	4

1

(250 mA) **Connectors and Wires**

Sensor supply 5 V ± 1 %

Motorsport connectors double density	2 x 41 pins
Mating connector I ASDD612-41SN	F02U.002.216-01
Mating connector II ASDD612-41SA	F02U.004.180-01

Pin Layout ASDD212-41PN

Pin	Name	Description	
1	KL30		

ъ.	N	D ' ('
Pin	Name	Description
2; 3	KL15	
4; 5	KL31	
6	Ethernet Channel0 Tx plus	Wire Ethernet_0 - TX+
7	Ethernet Channel0 Tx minus	Wire Ethernet_0 - TX-
8	Ethernet ChannelO Rx plus	Wire Ethernet_0 - RX+
9	Ethernet ChannelO Rx minus	Wire Ethernet_0 - RX-
10	Ethernet Schirm	Ethernet Schirm
11	Ethernet Channel 1 Tx plus	Wire Ethernet_0 - TX+
12	Ethernet Channel 1 Tx minus	Wire Ethernet_0 - TX-
13	Ethernet Channel1 Rx plus	Wire Ethernet_0 - RX+
14	Ethernet Channel1 Rx minus	Wire Ethernet_0 - RX-
15	Ethernet Channel2 Tx plus	Wire Ethernet_0 - TX+
16	Ethernet Channel2 Tx minus	Wire Ethernet_0 - TX-
17	Ethernet Channel2 Rx plus	Wire Ethernet_0 - RX+
18	Ethernet Channel2 Rx minus	Wire Ethernet_0 - RX-
19	CAN_A_H	CAN_A - HIGH
20	CAN_A_L	CAN_A - LOW
21	CAN_B_H	CAN_B - HIGH
22	CAN_B_L	CAN_B - LOW
23	USB Power	500mA USB_Power
24	USB Data Plus	USB_OTG_Plus
25	USB Data Minus	USB_OTG_Minus
26	USB GND	USB_Ground
27	SENSPWR5_1	
28	SENSGND	
29	Timestamp	
30	LS_GND_1	Low-Side Ground2
31	LS_SWITCH_1	lowside switch 2A
32	LS_SWITCH_2	lowside switch 2A
33	LS_SWITCH_3	lowside switch 2A
34	LS_SWITCH_4	lowside switch 2A
35	LS_GND_2	Low-Side Ground2
36	ANAIN_M1_1	0 to 5V Analog
37	ANAIN_M1_2	0 to 5V Analog
38	ANAIN_M1_3	0 to 5V Analog
39	ANAIN_M1_4	0 to 5V Analog

Pin	Name	Description
40	ANAIN_M1_5	0 to 5V Analog
41	ANAIN_M1_6	0 to 5V Analog
Pin Lay	out ASDD212-41PA	
Pin	Name	Description
1	UBATT_FUSE1	
2	SENSPWR10_1	
3	SENSPWR5_2	
4	SENSPWR5_3	
5	SENSPWR5_4	
6; 7	SENSGND	
8	RS232ATX	RS232A - Transmit
9	RS232A RX	RS232A - Receive
10	RS232BTX	RS232B - Transmit
11	RS232B RX	RS232B - Receive
12	RS232_GND	RS232_GND
13	REV1_P	Hall / Inductive
14	REV1_M	Hall / Inductive
15	REV2_P	Hall / Inductive
16	REV2_M	Hall / Inductive
17	REV3_P	Hall / Inductive
18	REV3_M	Hall / Inductive
19	REV4_P	Hall / Inductive
20	REV4_M	Hall / Inductive
21	ANAIN_M1_7	0 to 5V Analog
22	ANAIN_M1_8	0 to 5V Analog
23	ANAIN_M1_9	0 to 5V Analog
24	ANAIN_M1_10	0 to 5V Analog
25	ANAIN_M1_11	0 to 5V Analog
26	ANAIN_M1_12	0 to 5V Analog
27	ANAIN_M1_13	0 to 5V Analog
28	ANAIN_M1_14	0 to 5V Analog
29	ANAIN_M1_15	0 to 5V Analog
30	ANAIN_M1_16	0 to 5V Analog
31	ANAIN_M2_1	0 to 5V Analog
32	ANAIN_M2_2	0 to 5V Analog
33	ANAIN_M2_3	0 to 5V Analog
34	ANAIN_M2_4	0 to 5V Analog
35	ANAIN_M2_5	0 to 5V Analog
36	ANAIN_M2_6	0 to 5V Analog
37	ANAIN_M2_7	0 to 5V Analog
38	ANAIN_M2_8	0 to 5V Analog
00	ANIAINI NAO O	0.1 5.7.4 1

39

40 41 ANAIN_M2_9

ANAIN_M2_10

LAPTRIGGER

0 to 5V Analog

0 to 5V Analog

Communication	
Configuration via PacaCon o	war Ethornot or MCA Poy II
Configuration via RaceCon over Ethernet or MSA-Box II	
CAN interfaces	2
Ethernet 100BaseT	3
Telemetry	Ethernet or RS232
Lap trigger input	1

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

Depending on your experience calibrating Bosch ECUs, we recommend calibration support from Bosch Motorsport.

Please remember that the mating connectors and the programming interface MSA Box II are not included and must be ordered separately.

Not reverse polarity protected on supply or outputs.

Software

The required software (.pst file) for this device is available in the download area of our homepage www.bosch-motorsport.com.

Download data and save configurations before sending device, as it will be reset during service.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

CCP_MASTER

Enables CCP/XCP master functionality to request data from foreign devices via CAN/CCP protocol or XCP over Ethernet (UDP). (ASAP2 file from ECU manufacturer required)

PERF_LOG_1

Increase logging partition 1 from 4 GB to 16 GB memory, 800 kB/ s (866 MHz)

FULL_LOG_2

Enable logging partition 2 with 4 GB memory. Ideally for protected access by different teams or to use as long-term logger.

IO_EXTENS (included in C 80 Sensor Interface)

HOD DATA	
RS232	GPS
Sensor supply 12 V (1 A), non-regulated	1
Sensor supply 10 V (250 mA)	1
Additional sensor supply 5 V (250 mA each)	3
Rotational channels (input Hall/inductive)	4
Additional analog channels	20

USB DATA

Rugged USB flash drive Bosch File System (BFS) format included, works with BFS preformatted USB flash drive only

Adapter cable to USB-Port

Adapter for wiring harness

SW license USB-Port unlocked

Ordering Information

Data Logger C 80

FULL_LOG_1 included
Order number F02U.V03.083-01

Sensor Interface C 80

IO EXTENS included

Order number **F02U.V03.082-01**

Software Options

CCP_MASTER

Order number F02U.V02.213-01

FULL_LOG_1

Order number F02U.V02.304-01

PERF_LOG_1

Order number **F02U.V03.054-01**

FULL_LOG_2

Order number F02U.V02.305-01

IO_EXTENS

Order number F02U.V02.205-01

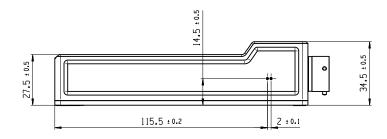
ADV_TELEM

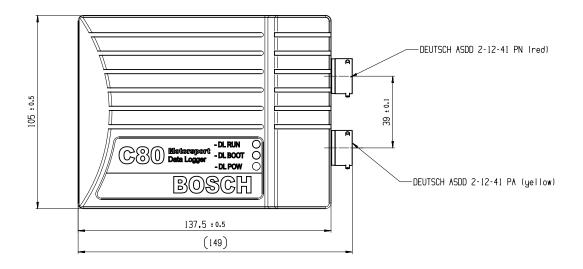
Order number **tbd.**

Accessories

USB DATA

Order number F02U.V02.214-01





USB_DATA



Features

- ► Capacity 2 GB
- ► Robust brass housing
- ► High performance push-pull connector
- ► Compatible with Data Loggers, Displays and VCUs

The Kit USB_DATA enables your DDU, data logger or VCU to store data on a USB flash drive. The Kit includes a rugged USB flash drive, an adapter cable to USB-port and a connection socket to the wiring harness. A key number to unlock the USB-port is also part of the Kit.

The rugged USB flash drive is securely mounted within a rugged brass housing designed to provide full protection against extreme environmental conditions. It is IP68 protected and resistant to extreme operating temperatures (-30 to 85°C). The USB flash drive is equipped with a rugged protection cap.

Application		
Operating temperature range	-30 to 85°C	
Protection class	IP68	
Tightening torque of Backnut for connection socket	1.5 to 2.0 Nm	
Max. vibration	Vibration Profile 3 (see Appendix or www.boschmotorsport.com)	

Technical Specifications

Mechanical Data		
Housing material	Brass	
Weight	42 g	
Length	72 mm	
Bore diameter	15.5 mm	
Electrical Data		
Capacity	2 GB	
Specification	USB 1.1/2.0	
Data rate	USB 2.0 up to 480 MBit/s	
Connectors and Wires		
Pin layout for connection to vehic	ele loom (see also Dimensions)	
Pin 1	Data -	
Pin 2	+5 V	
Pin 3	GND	
Pin 4	Data +	

Content of the Kit

Rugged USB flash drive

Adapter cable to PC USB-Port

Mating connector for USB flash drive on car loom side

Software license for USB-Port unlocked

Installation Notes

The USB flash drive should be fixed on a soft surface to reduce stress.

Ordering Information

USB DATA

Order number **F02U.V02.214-01**

USB Kit for C 60

Order number F02U.V00.872-02

Accessories

Rugged USB flash drive

Order number **F02U.V01.342-03**

Adapter cable to PC USB-Port

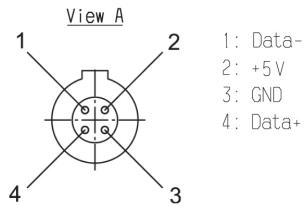
Order number **F02U.V01.343-01**

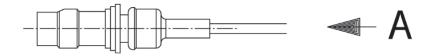
Mating connector for USB flash drive on car loom side

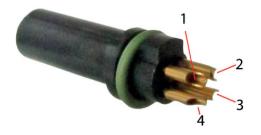
Order number F02U.002.996-01

USB DATA

Order number **F02U.V02.214-01**







Overview

Injection Power Stage HPI 5 Injection Power Stage HPI 5- Injection Power Stage HPI 5-M 4C

• Max. 15,000 rpm (4 cyl. op-







- Max. 8 cylinders
- Max. 14,000 rpm (4 cyl. operation)
- 550 g



- Max. 4 cylinders
- eration) • 400 g



- Max. 8 cylinders
- Max. 8,000 rpm (8 cyl. operation)
- 440 g

Injection Power Stage HPI 5



Features

- ► Max. 8 cylinders
- ► Max. 14,000 rpm (4 cyl. operation)
- ▶ 550 g

The injector power stage HPI 5 is a device for driving injectors and high pressure pumps for gasoline direct injection. Combined with a suitable ECU up to 8 injectors can be driven. The injectors are gathered in 4 groups of 2 injectors each. Within a group only one injector can be switched on at the same time. The 4 groups are totally independent, so that overlapping injection of injectors of different groups is possible. The HPI 5 is mainly designed to drive the Bosch high pressure pump HDP 5. Communication between main ECU and the HPI 5 is realized via CAN interface.

Application	
Max. number of cylinders	8
Max. rpm (8 cyl. operation)	7,000
Max. rpm (4 cyl. operation)	14,000

Technical Specifications			
Mechanical Data			
Aluminum housing			
Each connector pin individually fi	ltered		
Housing temperature	-25 to 85°C		
Size (incl. connectors)	190 x 123 x 36 mm		
Weight	550 g		
Electrical Data	Electrical Data		
Voltage supply	14 V		
Operating voltage	10 to 16 V		
Operation voltage (engine start)	6.5 to 16 V		
Nominal voltage	14 V		
Connectors and Wires			
Mating connector	D261.205.353-01		

Communication

1 CAN (1 Mbaud)

Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

Injection Power Stage HPI 5Optimized for Bosch HDP 5
Order number **F02U.V00.929-02**

Injection Power Stage HPI 5- M 4C



Features

► Max. 4 cylinders

Technical Specifications

- ► Max. 15,000 rpm (4 cyl. operation)
- ▶ 400 g

The injector power stage HPI 5-M 4C is a device for driving injectors and high pressure pumps for gasoline direct injection. Combined with a suitable ECU up to 4 injectors can be driven. Overlapping injection of injectors is possible. The HPI 5-M is mainly designed to drive the Bosch high pressure pump HDP 5. Communication between main ECU and the HPI 5-M is realized via CAN interface.

Max. number of cylinders 4 Max. rpm (4 cyl. operation) 15,000 Optimized for Bosch high pressure injection valve HDEV 5 and Bosch high pressure pump HDP 5

Mechanical Data Aluminum housing Each connector pin individually filtered Housing temperature -25 to 100°C Size (incl. connectors) 167 x 97 x 39 mm **Protection Classification** IP67 to DIN 40050, Section 9, Issue 2008 Weight 400 g **Electrical Data** 14 V Voltage supply Operating voltage 12 to 16 V

Operation voltage (engine start)	6.5 to 16 V	
Nominal voltage	14 V	
Connectors and Wires		
Mating connector	AS616-26SN	

Pin Configuration

16-2	6 (size 16) 26#20 7,5 A	
Pin	Name	Comment
A	O_P_FSCVL1	Flow control valve #1 output low side
В	V_V_BAT_R	Battery plus
С	V_V_BAT_R	Battery plus
D	G_G_BAT	Battery minus
E	G_G_BAT	Battery minus
F	O_P_BANK2_LS4_LS6	Injector control output, Low side of HDEV Injector #4
G	O_P_BANK2_HS4_HS6	Injector control output, High side of HDEV Injector #4
Н	O_P_BANK1_HS2_HS2	Injector control output, High side of HDEV Injector #2
I	O_P_BANK1_LS2_LS2	Injector control output, Low side of HDEV Injector #2
K	O_P_BANK2_LS3_LS3	Injector control output, Low side of HDEV Injector #3
L	O_P_BANK2_HS3_HS3	Injector control output, High side of HDEV Injector #3
M	O_P_BANK1_HS1_HS1	Injector control output, High side of HDEV Injector #1
N	O_P_BANK1_LS1_LS1	Injector control output, Low side of HDEV Injector #1
Р	I_P_HPINJD1_D1	Injector control, input signal for injector #1
R	O_P_FSCVH1	Flow control valve #1 output high side
S	I_P_HPINJD2_D2	Injector control, input signal for injector #2
Т	V_V_BAT_R	Battery plus
U	G_G_BAT	Battery minus
V	I_P_1SEL1	Flow control valve #1, input signal "SEL1"
W	I_P_HPINJD4_D6	Injector control, input signal for injector #4
X	I_S_T15	Input "Terminal 15" (Ignition switch)
Υ	B_D_CANL	CAN Interface, Signal "CAN Low"
Z	B_D_CANH	CAN Interface, Signal "CAN High"
a	I_P_HPINJD3_D3	Injector control, input signal for injector #3

16-2	26 (size 16) 26#20 7,5	5 A
b	I_P_1SEL0	Flow control valve #1, input signal "SELO"
С	I_P_10N	Flow control valve #1, input signal "ON"

Communication

1 CAN (1 Mbaud)

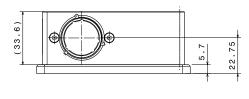
Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

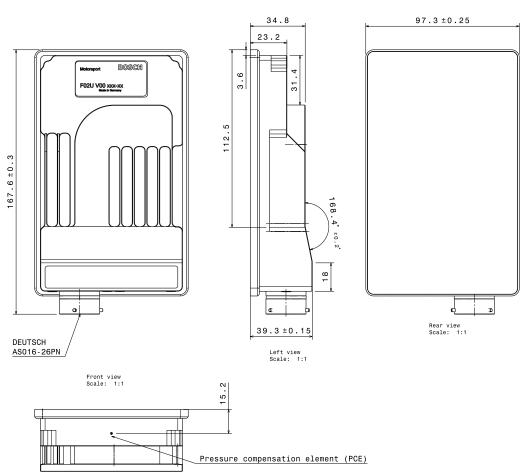
Injection Power Stage HPI 5-M 4C Order number **F02U.V01.629-01**

Dimensions



Bottom view Scale: 1:1

Top view



Injection Power Stage HPI 5- M 8C



Features

- ► Max. 8 cylinders
- ► Max. 8,000 rpm (8 cyl. operation)
- ▶ 440 g

The injector power stage HPI 5-M 8C is a device for driving injectors and high pressure pumps for gasoline direct injection. Combined with a suitable ECU up to 8 injectors can be driven. The injectors are gathered in 4 groups of 2 injectors each. Within a group only one injector can be switched on at the same time. The 4 groups are totally independent, so that overlapping injection of injectors of different groups is possible. The HPI 5-M is mainly designed to drive the Bosch high pressure pump HDP 5. Communication between main ECU and the HPI 5-M is realized via CAN interface.

Application	
Max. number of cylinders	8
Max. rpm (8 cyl. operation)	8,000
Max. rpm (6 cyl. operation)	9,500
Optimized for Bosch high pressure injection valve HDEV 5 and Bosch high pressure pump HDP 5	

Technical Specifications		
Mechanical Data		
Aluminum housing		
Each connector pin individually filtered		
Housing temperature	-25 to 100°C	
Size (incl. connectors)	167 x 97 x 39 mm	
Protection Classification	IP67 to DIN 40050, Section 9, Issue 2008	

Weight	440 g
Electrical Data	
Voltage supply	14 V
Operating voltage	12 to 16 V
Operation voltage (engine start)	6.5 to 16 V
Nominal voltage	14 V
Connectors and Wires	
Mating connector	AS616-26SN
	AS614-19SN

Pin Configuration

16-2	16-26 (size 16) 26#20 7,5 A		
Pin	Name	Comment	
A	O_P_FSCVL1	Flow control valve #1 output low side	
В	V_V_BAT_R	Battery plus	
С	V_V_BAT_R	Battery plus	
D	G_G_BAT	Battery minus	
Е	G_G_BAT	Battery minus	
F	O_P_BANK2_LS4_L S6	Injector control output, Low side of HDEV Injector #4 (6-cyl. engine: #6)	
G	O_P_BANK2_HS4_H S6	Injector control output, High side of HDEV Injector #4 (6-cyl. engine: #6)	
Н	O_P_BANK1_HS2_H S2	Injector control output, High side of HDEV Injector #2 (6-cyl. engine: #2)	
I	O_P_BANK1_LS2_L S2	Injector control output, Low side of HDEV Injector #2 (6-cyl. engine: #2)	
K	O_P_BANK2_LS3_L S3	Injector control output, Low side of HDEV Injector #3 (6-cyl. engine: #3)	
L	O_P_BANK2_HS3_H S3	Injector control output, High side of HDEV Injector #3 (6-cyl. engine: #3)	
М	O_P_BANK1_HS1_H S1	Injector control output, High side of HDEV Injector #1 (6-cyl. engine: #1)	
N	O_P_BANK1_LS1_L S1	Injector control output, Low side of HDEV Injector #1 (6-cyl. engine: #1)	
Р	I_P_HPINJD1_D1	Injector control, input signal for injector #1 (6-cyl. engine: #1)	
R	O_P_FSCVH1	Flow control valve #1 output high side	
S	I_P_HPINJD2_D2	Injector control, input signal for injector #2 (6-cyl. engine: #2)	
Т	V_V_BAT_R	Battery plus	

16-2	6 (size 16) 26#20 7,5 A		
U	G_G_BAT	Battery minus	
V	I_P_1SEL1	Flow control valve #1, input signal "SEL1"	
W	I_P_HPINJD4_D6	Injector control, input signal for injector #4 (6-cyl. engine: #6)	
Χ	I_S_T15	Input "Terminal 15" (Ignition switch)	
Υ	B_D_CANL	CAN Interface, Signal "CAN Low"	
Z	B_D_CANH	CAN Interface, Signal "CAN High"	
a	I_P_HPINJD3_D3	Injector control, input signal for injector #3 (6-cyl. engine: #3)	
b	I_P_1SEL0	Flow control valve #1, input signal "SEL0"	
С	I_P_10N	Flow control valve #1, input signal "ON"	
14-1	14-19 (size 14) 19#20 7,5 A		
Pin	Name	Comment	
Α	I_P_HPINJD6_D5	Injector control, input signal for injector #6 (6-cyl. engine: #5)	

14-19 (size 14) 19#20 7,5 A		
Pin	Name	Comment
Α	I_P_HPINJD6_D5	Injector control, input signal for injector #6 (6-cyl. engine: #5)
В	O_P_BANK1_LS5_L S4	Injector control output, Low side of HDEV Injector #5 (6-cyl. engine: #4)
С	O_P_BANK1_HS5_H S4	Injector control output, High side of HDEV Injector #5 (6-cyl. engine: #4)
D	O_P_BANK2_HS7	Injector control output, High side of HDEV Injector #7 (6-cyl. engine: not used)
Е	O_P_BANK2_LS7	Injector control output, Low side of HDEV Injector #7 (6-cyl. engine: not used)
F	O_P_BANK1_LS6_L S5	Injector control output, Low side of HDEV Injector #6 (6-cyl. engine: #5)
G	O_P_BANK1_HS6_H S5	Injector control output, High side of HDEV Injector #6 (6-cyl. engine: #5)

14-1	14-19 (size 14) 19#20 7,5 A			
Н	O_P_BANK2_HS8	Injector control output, High side of HDEV Injector #8 (6-cyl. engine: not used)		
I	O_P_BANK2_LS8	Injector control output, Low side of HDEV Injector #8 (6-cyl. engine: not used)		
K	I_P_HPINJD8	Injector control output, Low side of HDEV Injector #8 (6-cyl. engine: not used)		
L	G_G_BAT	Battery minus		
М	O_P_FSCVH2	Flow control valve #2 output high side		
N	I_P_2SEL0	Flow control valve #2, input signal "SELO"		
Р	I_P_HPINJD7	Injector control, input signal for injector #7 (6-cyl. engine: not used)		
R	I_P_2SEL1	Flow control valve #2, input signal "SEL1"		
S	O_P_FSCVL2	Flow control valve #2 output low side		
Т	G_G_BAT	Battery minus		
U	I_P_20N	Flow control valve #2, input signal "ON"		
V	I_P_HPINJD5_D4	Injector control, input signal for injector #5 (6-cyl. engine: #4)		

Communication

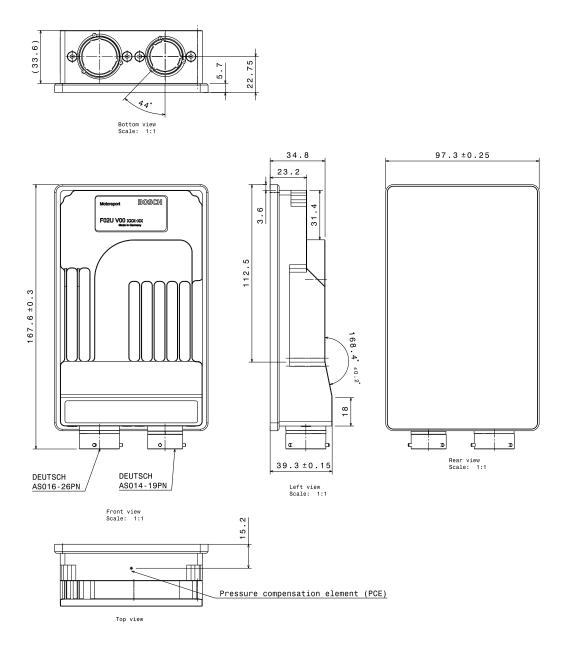
1 CAN (1 Mbaud)

Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

Injection Power Stage HPI 5-M 8C Order number F02U.V01.630-01



Overview

PowerBox PBX 90



- 120 A continuous current
- 36 outputs, 80 A high side switches
- Ethernet, CAN and LIN communication
- · Software-tool integrated
- Easy programming of complex functions

PowerBox PBX 190



- 250 A continuous current
- 52 outputs, 48 V high side switches
- Ethernet, CAN and LIN communication
- Precision current measurement
- Easy programming of complex functions

PowerBox PBX 90



Features

- ▶ 120 A continuous current
- ▶ 36 outputs, 80 A high side switches
- ► Ethernet, CAN and LIN communication
- ► Software-tool integrated
- ▶ Easy programming of complex functions

The PowerBox is an intelligent control and distribution unit for the electric grid in a modern racing car, which is seamlessly integrated into the Bosch Motorsport system architecture. It is capable to replace all conventional relays, fuses and circuit breakers, simplifies wiring harnesses and provides diagnostic capabilities. The integrated PBX-software guarantees an easy programming of complex functions by intuitive handling.

Technical Specifications Mechanical Data Size 214 x 159 x 57.5 mm Weight 830 g Temp. range (at internal -20 to 85°C sensors) **Electrical Data** 5 to 20 V Supply voltage range Current consumption <1A Maximum recommended out-120 A continuously put current >180 A peak current (2 s) Inputs 12 analog inputs (16 bit resolution) switchable pull-up resistors 4 digital inputs switchable pull-up/pull-down resistors

Outputs

4 high power channels up to 40 A (parallel up to 80 A)

4 high power channels up to 25 A

22 high power channels up to 15 A

6 multi purpose outputs up to 15 A (low side, high side, push-pull, PWM; two output stages can be combined to form an H-bridge)

1 sensor supply 5 V with individual ground pin

Software

Function development and calib- Bosch Motorsport PBX Suite ration tool

Conn	Connector X1: 38 way (ABS/ESR) Code 1			
Pin	Signal	Cont. [A]	Peak [A]	
1	HP_OUT3	40	150	
2	OUT22	15	100	
3	PWM_OUT6	15	75	
4	OUT21	15	100	
5	ANA_IN07	0 to 5 V, Pull-up		
6	ANA_IN08	0 to 5 V, Pull-up		
7	PWM_OUT4	15	75	
8	CAN_3_H	1 Mbaud max.		
9	SENSGND	GND for AIN[x]		
10	SENSPWR_5V	0.4		
11	PWM_OUT2	15	75	
12	PWM_OUT1	15	75	
13	HP_OUT4	40	150	
14	ANA_IN03	0 to 5 V, Pull-up		
15	ANA_IN04	0 to 5 V, Pull-up		
16	DIG_IN3	0 to 12 V, Pull-up, Pull-down		
17	DIG_IN4	0 to 12 V, Pull-up, Pull-down		
18	ANA_IN09	0 to 5 V, Pull-up		
19	ANA_IN10	0 to 5 V, Pull-up		
20	CAN_3_L	1 Mbaud max.		
21	BAT_GND	15	100	
22	BAT_GND	15	100	
23	BAT_GND	15	100	
24	BAT_GND	15	100	
25	HP_OUT7	25	150	
26	OUT19	15	100	
27	ANA_IN05	0 to 5 V, Pull-up		
28	OUT20	15	100	
29	ANA_IN06	0 to 5 V, Pull-up		
30	OUT17	15	100	
31	OUT18	15	100	
32	ANA_IN11	0 to 5 V, Pull-up		
33	OUT15	15	100	
34	OUT16	15	100	

35	ANA_IN12	0 to 5 V, Pull-up	
36	PWM_OUT3	15	75
37	PWM_OUT5	15	75
38	HP_OUT8	25	150
Conn	ector X2: 38 way	(ABS/ESR) Code 2	
Pin	Used for	Cont. [A]	Peak [A
1	HP_OUT1	40	150
2	OUT14	15	100
3	OUT13	15	100
4	OUT02	15	100
5	OUT01	15	100
6	TIMESTAMP_I NOUT	1 kHz open drain	
7	CAN_2_H	1 Mbaud max.	
8	CAN_1_H	1 Mbaud max.	
9	ETH_1_RXN	10/100 Mbps	
10	ETH_1_TXN	10/100 Mbps	
11	ETH_2_RXN	10/100 Mbps	
12	ETH_2_TXN	10/100 Mbps	
13	HP_OUT2	40	150
14	BAT_GND	15	100
15	ANA_IN01	0 to 5 V, Pull-up	
16	ANA_IN02	0 to 5 V, Pull-up	
17	DIG_IN1	0 to 12 V, Pull-up, Pull-down	
18	DIG_IN2	0 to 12 V, Pull-up, Pull-down	
19	CAN_2_L	1 Mbaud max.	
20	CAN_1_L	1 Mbaud max.	
21	ETH_1_RXP	10/100 Mbps	
22	ETH_1_TXP	10/100 Mbps	
23	ETH_2_RXP	10/100 Mbps	
24	ETH_2_TXP	10/100 Mbps	
25	HP_OUT5	25	150
26	OUT11	15	100
27	OUT09	15	100
28	OUT12	15	100
29	OUT10	15	100
30	OUT07	15	100
31	OUT08	15	100
32	LIN	Control of Bosch Motorsport L included. Support of other dev	

quest.

Connector X1: 38 way (ABS/ESR) Code 1				
33	OUT05	15	100	
34	SHIELD_GND	shield		
35	OUT06	15	100	
36	OUT03	15	100	
37	OUT04	15	100	
38	HP_OUT6	25	150	
O				

Connector X3: Amphenol Radsok Automotive Pinlock Connector 8 mm (35 mm², 50 mm²)

Pin	Used for	Cont. [A]	Peak [A]
1	BATT_POS	120	180

Communication

3 x CAN

2 x Ethernet

1 x LIN, Control of Bosch Motorsport LIN devices included. Support of other devices on request.

Installation Notes

Inspection services recommended after 220 h or 2 years, no components to replace.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

PowerBox PBX 90

Order number F02U.V01.794-06

CCA Hardware Upgrade per device Order number F02U.V02.137-01

Accessories

Mating Connector X1

Order number F02U.B00.760-01

Mating Connector X2

Order number F02U.B00.761-01

Mating Connector X3

Order number **F02U.003.574-01**

Power Cable 16 mm²

L: 2,000 mm

Order number F02U.V02.047-01

Power Cable 35 mm²

L: 2,000 mm

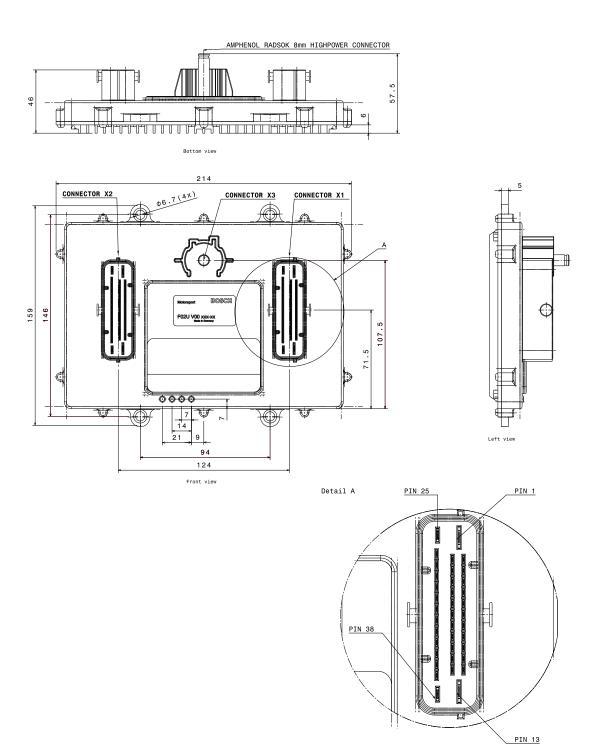
Order number F02U.V02.048-01

Breakout Box BOB PBX 90

Order number F02U.V02.292-01

CAN Keypad CK-M12

Order number F02U.V0U.328-03



PowerBox PBX 190



Features

- ▶ 250 A continuous current
- ▶ 52 outputs, 48 V high side switches
- ▶ Ethernet, CAN and LIN communication
- ▶ Precision current measurement
- ► Easy programming of complex functions

The PowerBox is an intelligent control and distribution unit for the electric grid in a modern racing car, which is seamlessly integrated into the Bosch Motorsport system architecture. It is capable to replace all conventional relays, fuses and circuit breakers, simplifies wiring harnesses and provides diagnostic capabilities. The integrated PBX-software guarantees an easy programming of complex functions by intuitive handling.

Technical Specifications Mechanical Data Size 245 x 183 x 37 mm Weight 1,270 g **Protection Classification** IP67 Internal G-sensors Temp. range (at internal -20 to 85°C sensors) Max. vibration Vibration profile 1 (see www.boschmotorsport.com) **Electrical Data** Supply voltage range 5 to 16 V **Current consumption** <1 A continuously Maximum recommended out-250 A continuously; >310 A put current peak current (2 s)

Inputs

18 analog inputs (16 bit resolution) switchable pull-up resistors

10 digital inputs switchable pull-up/pull-down resistors

Outputs

4 high power channels up to 40 A (parallel up to 80 A)

10 high power channels up to 25 A

26 high power channels up to 15 A

4 high side channels up to 25 A, up to 48 V

8 multi-purpose outputs up to 15 A (low side, high side, push-pull, PWM; two output stages can be combined to form an H-bridge)

2 sensor supplies 5 V with individual ground pin

Software

Function development and cal-Bosch Motorsport PBX Suite ibration tool

Pin Configuration

Connector X1: 37 Pins / 8STA62437SA				
Pin	Signal	Cont. [A]	Peak [A]	
Α	HS_15A X1_A	15	100	
В	HS_15A X1_B	15	100	
С	HS_15A X1_C	15	100	
D	HS_15A X1_D	15	100	
E	HS_15A X1_E	15	100	
F	HS_15A X1_F	15	100	
G	HS_15A X1_G	15	100	
Н	HS_15A X1_H	15	100	
J	HS_15A X1_J	15	100	
K	HS_15A X1_K	15	100	
L	HS_15A X1_L	15	100	
M	HS_15A X1_M	15	100	
N	HS_15A X1_N	15	100	
Р	PWM_15AX1_P	15	60	
R	PWM_15AX1_R	15	60	
S	PWM_15AX1_S	15	60	
T	PWM_15A X1_T	15	60	
U	HS_15A X1_U	15	100	
V	HS_15A X1_V	15	100	
W	HS_15A X1_W	15	100	
Χ	HS_15A X1_X	15	100	
Υ	HS_15A X1_Y	15	100	
Z	HS_15A X1_Z	15	100	
a	HS_15A X1_a	15	100	
b	HS_15A X1_b	15	100	
С	PWM_15A X1_c	15	60	
d	PWM_15A X1_d	15	60	
е	PWM_15A X1_e	15	60	
f	PWM_15A X1_f	15	60	

Connec	tor X1: 37 Pins / 8STA62437SA	A	
g	HS_15A X1_g	15	100
h	HS_15A X1_h	15	100
k	HS_15A X1_k	15	100
m	HS_15A X1_m	15	100
n	HS_15A X1_n	15	100
р	Power KL31	15	-
q	Power KL31	15	-
r	Power KL31	15	-
Connec	tor X2: 1 Pin / 8STA61201BN2	61	
Pin	Signal	Cont. [A]	Peak [A]
1	Power Supply 12 V	200	240
Connec	tor X3: 19 Pins / 8STA62419SN	N.	
Pin	Signal	Cont. [A]	Peak [A]
A	HS 25A X3 A	25	150
В		25	150
С	HS_25A X3_B HS_25A X3_C	25	150
D	HS_25A X3_D	25	150
E	HS_25A X3_E	25	150
F	HS_25A X3_F	25	150
G + H	HS_40A X3_G_H	40	150
J+T	HS_40A X3_J_T	40	150
K + U	HS_40A X3_K_U	40	150
L+N	HS_40A X3_L_N	40	150
M	HS_25A X3_M	25	150
P	HS_25A X3_P	25	150
R	HS_25A X3_R	25	150
S	HS 25A X3 S	25	150
V	Power KL31	25	-
Connec	tor X4: 6 Pins / 8STA61606SA		
Pin	Signal	Cont. [A]	Peak [A]
Α	HS48V_25A X4_A	25	100
В	HS48V 25A X4 B	25	100
C	HS48V_25A X4_C	25	100
D	HS48V_25A X4_D	25	100
E	Supply up to 48 V for X4	25	35
 F	Supply up to 48 V for X4	25	35
Pin	tor X5: 66 Pins / 8STA6-18-358 Signal) N	
1	Analog Input X5_01	0 to 5 V, Pu	II-un
2	Analog Input X5_01 Analog Input X5_02	0 to 5 V, Pu	
3	Analog Input X5_02 Analog Input X5_03	0 to 5 V, Pu	
4	Analog Input X5_04	0 to 5 V, Pu	
5	Analog Input X5_05	0 to 5 V, Pu	
6	Analog Input X5_06	0 to 5 V, Pu	
J	Anaiog input AJ_00	o to o v, ru	ıı up

Connector X5: 66 Pins / 8STA6-18-35SN			
7	Analog Input X5_07	0 to 5 V, Pull-up	
8	Analog Input X5_08	0 to 5 V, Pull-up	
9	CAN 3 Interface Low-Level	Max. 1 Mbaud	
10	Analog Input X5_10	0 to 5 V, Pull-up	
11	Analog Input X5_11	0 to 5 V, Pull-up	
12	Analog Input X5 12	0 to 5 V, Pull-up	
13	Digital Input X5_13	0 to 12 V, Pull-up, Pull-	
	0	down	
14	Digital Input X5_14	0 to 12 V, Pull-up, Pull- down	
15	CAN 3 Interface High-Level	Max. 1 Mbaud	
16	LIN	Control of Bosch Motorsport LIN devices included. Support of other devices on re- quest.	
17	Analog Input X5_17	0 to 5 V, Pull-up	
18	Analog Input X5_18	0 to 5 V, Pull-up	
19	DGND-fused	5 A	
20	DGND-fused	5 A	
21	Digital Input X5_21	0 to 12 V, Pull-up, Pull- down	
22	Digital Input X5_22	0 to 12 V, Pull-up, Pull- down	
23	SERCOS1 TXP		
24	SERCOS1 TXN		
25	do not connect (use for interna	al debugging)	
26	do not connect (use for interna	al debugging)	
27	Analog Input X5_27	0 to 5 V, Pull-up	
28	Digital Input X5_28	0 to 12 V, Pull-up, Pull- down	
29	Digital Input X5_29	0 to 12 V, Pull-up, Pull- down	
30	Analog Input X5_30	0 to 5 V, Pull-up	
31	KL31-fused		
32	SERCOS1 RXP		
33	SERCOS1 RXN		
34	do not connect (use for interna	al debugging)	
35	do not connect (use for interna	al debugging)	
36	Digital Input X5_36	0 to 12 V, Pull-up, Pull- down	
37	Digital Input X5_37	0 to 12 V, Pull-up, Pull- down	
38	Analog_Screen		
39	Analog Input X5_39	0 to 5 V, Pull-up	
40	KL31-fused		
41	SERCOS2 RXP		
42	SERCOS2 RXN		

Conne	ector X5: 66 Pins / 8STA6-18-35	SN	1 x LIN, Control of Bosch Motorsport LIN devices inclu
43	Digital Input X5_43	0 to 12 V, Pull-up, Pull- down	port of other devices on request. 2 x Real time ethernet Sercos (optional)
44	Digital Input X5_44	0 to 12 V, Pull-up, Pull- down	Installation Notes
45	Sensor GND for X5_51	5 A	Inspection services recommended after 220 h or 2 ye
46	Timesync		ponents to replace.
47	COM_Screen		Large Destrictions
48	CAN 1 Interface High-Level	Max. 1 Mbaud	Legal Restrictions
49	SERCOS2 TXP		The sale of this product in Mexico is proh
50	SERCOS2_TXN		Ordering Information
51	Powersupply_5V X5_51	400 mA	PowerBox PBX 190
52	Sensor GND for X5_58	5 A	Order number F02U.V02.626-03
53	ETHERNET1 RXN	10/100 Mbps	CCA Hardware Upgrade per device
54	ETHERNETO RXN	10/100 Mbps	Order number F02U.V02.137-01
55	CAN 2 Interface Low-Level	Max. 1 Mbaud	Accessories
56	CAN 1 Interface Low-Level	Max. 1 Mbaud	Mating Connector X1 Order number F02U.004.387-01
57	Analog Input X5_57	0 to 5 V, Pull-up	Mating Connector X2
58	Powersupply_5V X5_58	400 mA	Socket 25 mm ²
59	ETHERNET1 RXP	10/100 Mbps	Order number F02U.B01.044-01
60	ETHERNET1 TXN	10/100 Mbps	Mating Connector X2 Socket 35 mm ²
61	ETHERNETO TXN	10/100 Mbps	Order number F02U.B01.045-01
62	CAN 2 Interface High-Level	Max. 1 Mbaud	Mating Connector X3
63	Analog Input X5_63	0 to 5 V, Pull-up	Order number F02U.004.386-01
64	ETHERNET1 TXP	10/100 Mbps	Mating Connector X4 Order number F02U.004.388-01
65	ETHERNETO RXP	10/100 Mbps	Mating Connector X5
66	ETHERNETO TXP	10/100 Mbps	Order number F02U.000.472-02
Comi	munication		Connector Opening Tool for Shellsize 24 Order number F02U.V02.434-01

3 x CAN

2 x Ethernet

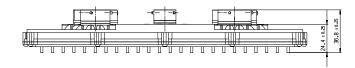
1x LIN, Control of Bosch Motorsport LIN devices included. Support of other devices on request.
2 x Real time ethernet Sercos (optional)
Installation Notes
Inspection services recommended after 220 h or 2 years, no components to replace.
Legal Restrictions
The sale of this product in Mexico is prohibited.
Ordering Information
PowerBox PBX 190 Order number F02U.V02.626-03
CCA Hardware Upgrade per device Order number F02U.V02.137-01
Accessories
Mating Connector X1 Order number F02U.004.387-01
Mating Connector X2 Socket 25 mm ²
Order number F02U.B01.044-01
Mating Connector X2 Socket 35 mm ² Order number F02U.B01.045-01
Mating Connector X3 Order number F02U.004.386-01
Mating Connector X4 Order number F02U.004.388-01
Mating Connector X5

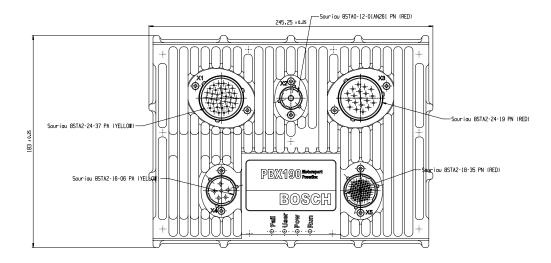
Breakout Box

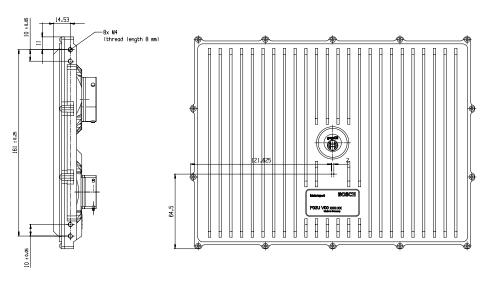
Order number F02U.V02.523-01

CAN Keypad CK-M12

Order number F02U.V0U.328-03







Overview

Data Logger and Sensor Interface C 80



- · Aluminum housing
- Powerful data logger with up to 20 GB memory
- Supports Bosch multi-logger configuration
- USB recording and full telemetry support

Lambdatronic LT4



- Supply of up to 4 Bosch lambda sensors, type LSU 4.2, LSU 4.9 or Mini-LSU 4.9
- Integrated voltage compensation for sensor heater

Lambdatronic LT4 ADV



- Supply of up to 4 Bosch lambda sensors, type LSU ADV
- Integrated voltage compensation for sensor heater

Wheel Speed Signal Splitter



- ABS Wheel Speed Sensor Interface
- Lightweight Aluminum Housing

Data Logger and Sensor Interface C 80



Features

- ► Aluminum housing
- ▶ Powerful data logger with up to 20 GB memory
- ► Supports Bosch multi-logger configuration
- ▶ USB recording and full telemetry support

We offer the C 80 in two basic versions, on the one hand as a data logger and on the other hand as a sensor interface. Choose between these basic variants and combine or add functionalities now or later.

The data logger C 80 is a professional data logging system for motorsport applications. This allows for synchronized acquisition of engine data from the ECU and chassis data from up to 26 analog and 4 digital input channels. Additional input devices can be connected via Ethernet and CAN buses. Recorded data from the up to 16 GB logger can be downloaded via high speed Ethernet. Software upgrades for the C 80 (field upgradable by entering a key) activate tailored configurations like a second logging partition of 4 GB USB re-

by entering a key) activate tailored configurations like a second logging partition of 4 GB, USB recording, CCP/XCP-master for simple data access to third party devices, as well as additional input channels.

Application Converters

Converters 10 kHz 12 bit AD converters with digital low pass filter

Configurable math channels

User configurable CAN in/out messages

Sampling rate

Online data compression

Internal logger

- 4 GB memory on partition 1 (optional; included in C 80 Logger)
- Plus 16 GB memory on partition 1 (optional)
- Plus 4 GB memory on partition 2 (optional)
- Up to 1,500 channels
- Fastest sampling 1,000 Hz for all channels

Logging rates

- Usage of all features: 800 kB/s
- Primary logging use case: >1,500 kB/s
- Logging data download rate: up to 7.5 MB/s

3-port network switch

Telemetry Support via Ethernet (recommended) and RS232

Technical Specifications

Mechanical Data

Size	105 x 34.5 x 137.5 mm
Weight	462 g
Protection Classification	IP67 to DIN 40050, Section 9, Issue 2008
Max. vibration	Vibration profile 1 (see Appendix or www.boschmotorsport.com)
Operating temperature (internal)	0 to 85°C
Operation outside the temperature	erature limits can be tested on request

Operation outside the temperature limits can be tested on request during the manufacturing tests.

Electrical Data

Supply voltage	8 to 18 V
Max. power consumption (w/o loads)	10 W at 14 V

Inputs

2 A each)

•	
Analog channels	6
Input range	0 to 5 V
Resolution	12 bit
Switchable pull up resistor	3 kOhm
Outputs	
PWM outputs (low side switch	4

1

(250 mA) Connectors and Wires

Sensor supply 5 V ± 1 %

Motorsport connectors double density	2 x 41 pins
Mating connector I ASDD612-41SN	F02U.002.216-01
Mating connector II ASDD612-41SA	F02U.004.180-01

Pin Layout ASDD212-41PN

Pin	Name	Description
1	KL30	

D:	Name	December:
Pin	Name	Description
2;3	KL15	
4; 5	KL31	Mr. Fil C Tr
6	Ethernet Channel0 Tx plus	Wire Ethernet_0 - TX+
7	Ethernet Channel0 Tx minus	Wire Ethernet_0 - TX-
8	Ethernet ChannelO Rx plus	Wire Ethernet_0 - RX+
9	Ethernet ChannelO Rx minus	Wire Ethernet_0 - RX-
10	Ethernet Schirm	Ethernet Schirm
11	Ethernet Channel 1 Tx plus	Wire Ethernet_0 - TX+
12	Ethernet Channel 1 Tx minus	Wire Ethernet_0 - TX-
13	Ethernet Channel 1 Rx plus	Wire Ethernet_0 - RX+
14	Ethernet Channel1 Rx minus	Wire Ethernet_0 - RX-
15	Ethernet Channel 2 Tx plus	Wire Ethernet_0 - TX+
16	Ethernet Channel2 Tx minus	Wire Ethernet_0 - TX-
17	Ethernet Channel2 Rx plus	Wire Ethernet_0 - RX+
18	Ethernet Channel2 Rx minus	Wire Ethernet_0 - RX-
19	CAN_A_H	CAN_A - HIGH
20	CAN_A_L	CAN_A - LOW
21	CAN_B_H	CAN_B - HIGH
22	CAN_B_L	CAN_B - LOW
23	USB Power	500mA USB_Power
24	USB Data Plus	USB_OTG_Plus
25	USB Data Minus	USB_OTG_Minus
26	USB GND	USB_Ground
27	SENSPWR5_1	
28	SENSGND	
29	Timestamp	
30	LS_GND_1	Low-Side Ground2
31	LS_SWITCH_1	lowside switch 2A
32	LS_SWITCH_2	lowside switch 2A
33	LS_SWITCH_3	lowside switch 2A
34	LS_SWITCH_4	lowside switch 2A
35	LS_GND_2	Low-Side Ground2
36	ANAIN_M1_1	0 to 5V Analog
37		
	ANAIN_M1_2	0 to 5V Analog
38	ANAIN_M1_3	0 to 5V Analog
39	ANAIN_M1_4	0 to 5V Analog

Pin	Name	Description	
40	ANAIN_M1_5	0 to 5V Analog	
41	ANAIN_M1_6	0 to 5V Analog	
Pin Layout ASDD212-41PA			
Pin	Name	Description	
1	IIBΔTT FUSF1		

Pin	Name	Description
1	UBATT_FUSE1	
2	SENSPWR10_1	
3	SENSPWR5_2	
4	SENSPWR5_3	
5	SENSPWR5_4	
6; 7	SENSGND	
8	RS232ATX	RS232A - Transmit
9	RS232A RX	RS232A - Receive
10	RS232BTX	RS232B - Transmit
11	RS232B RX	RS232B - Receive
12	RS232_GND	RS232_GND
13	REV1_P	Hall / Inductive
14	REV1_M	Hall / Inductive
15	REV2_P	Hall / Inductive
16	REV2_M	Hall / Inductive
17	REV3_P	Hall / Inductive
18	REV3_M	Hall / Inductive
19	REV4_P	Hall / Inductive
20	REV4_M	Hall / Inductive
21	ANAIN_M1_7	0 to 5V Analog
22	ANAIN_M1_8	0 to 5V Analog
23	ANAIN_M1_9	0 to 5V Analog
24	ANAIN_M1_10	0 to 5V Analog
25	ANAIN_M1_11	0 to 5V Analog
26	ANAIN_M1_12	0 to 5V Analog
27	ANAIN_M1_13	0 to 5V Analog
28	ANAIN_M1_14	0 to 5V Analog
29	ANAIN_M1_15	0 to 5V Analog
30	ANAIN_M1_16	0 to 5V Analog
31	ANAIN_M2_1	0 to 5V Analog
32	ANAIN_M2_2	0 to 5V Analog
33	ANAIN_M2_3	0 to 5V Analog
34	ANAIN_M2_4	0 to 5V Analog
35	ANAIN_M2_5	0 to 5V Analog
36	ANAIN_M2_6	0 to 5V Analog
37	ANAIN_M2_7	0 to 5V Analog
38	ANAIN_M2_8	0 to 5V Analog
39	ANAIN_M2_9	0 to 5V Analog
40	ANAIN_M2_10	0 to 5V Analog
41	LAPTRIGGER	

Communication		
Configuration via RaceCon over Ethernet or MSA-Box II		
CAN interfaces	2	
Ethernet 100BaseT	3	
Telemetry	Ethernet or RS232	
Lap trigger input	1	

Installation Notes

Maintenance Interval: 220 h or a maximum of two years

Depending on your experience calibrating Bosch ECUs, we recommend calibration support from Bosch Motorsport.

Please remember that the mating connectors and the programming interface MSA Box II are not included and must be ordered separately.

Not reverse polarity protected on supply or outputs.

Software

The required software (.pst file) for this device is available in the download area of our homepage www.bosch-motorsport.com.

Download data and save configurations before sending device, as it will be reset during service.

Legal Restrictions

The sale of this product in Mexico is prohibited.

Upgrades

CCP_MASTER

Enables CCP/XCP master functionality to request data from foreign devices via CAN/CCP protocol or XCP over Ethernet (UDP). (ASAP2 file from ECU manufacturer required)

PERF_LOG_1

Increase logging partition 1 from 4 GB to 16 GB memory, 800 kB/ s (866 MHz)

FULL_LOG_2

Enable logging partition 2 with 4 GB memory. Ideally for protected access by different teams or to use as long-term logger.

IO_EXTENS (included in C 80 Sensor Interface)

Additional analog channels	20
Rotational channels (input Hall/inductive)	4
Additional sensor supply 5 V (250 mA each)	3
Sensor supply 10 V (250 mA)	1
Sensor supply 12 V (1 A), non-regulated	1
RS232	GPS
HCD DATA	

USB_DATA

Rugged USB flash drive Bosch File System (BFS) format included, works with BFS preformatted USB flash drive only

Adapter cable to USB-Port

Adapter for wiring harness

SW license USB-Port unlocked

Ordering Information

Data Logger C 80

FULL_LOG_1 included
Order number F02U.V03.083-01

Sensor Interface C 80

IO EXTENS included

Order number **F02U.V03.082-01**

Software Options

CCP MASTER

Order number F02U.V02.213-01

FULL_LOG_1

Order number F02U.V02.304-01

PERF_LOG_1

Order number F02U.V03.054-01

FULL_LOG_2

Order number **F02U.V02.305-01**

IO_EXTENS

Order number F02U.V02.205-01

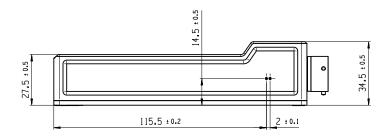
ADV_TELEM

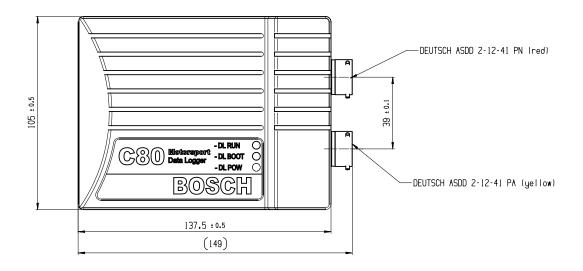
Order number **tbd.**

Accessories

USB DATA

Order number F02U.V02.214-01





Lambdatronic LT4



Features

- ► Supply of up to 4 Bosch lambda sensors, type LSU 4.2, LSU 4.9 or Mini-LSU 4.9
- Integrated voltage compensation for sensor heater

The Lambdatronic LT4 provides controlled pumping current to supply up to 4 Bosch lambda sensors, type LSU 4.2, LSU 4.9 or 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 lambda = 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 motorsport specification. Furthermore the analog signal output can be configured freely.

Application Application Lambda 0.75 to 10.12 Compatible Bosch sensor type LSU 4.2, LSU 4.9, Mini-LSU 4.9 Channels 4 Heater Internal

Technical Specifications Mechanical Data Weight with wire 98 g Sealing 100 % humidity Mounting Velcro Size w/o wire (w*1*h) 54 x 59 x 13 mm

Operating temp. range (housing)	-20 to 85°C	
Storage temp. range	-20 to 85°C	
Max. vibration	Vibration Profile 1 (see Appendix or www.boschmotorsport.com)	
Electrical Data		
Power supply U _s	(6.5) 10 to 14 V	
Max power supply (1 min) $\rm U_{\rm S}$	Max. 26 V	
Thermal dissipation loss	3 W at 14 V	
Current Is	5 A	
Current Is (Heating up)	26 A	
Software Tool (free download)		
System Configuration tool RaceCon 2.7.0.9 or later		
Characteristic		
Signal output 1	CAN	

Characteristic	
Signal output 1	CAN
Signal output 2	4 x 0 to 5 V "analog"
CAN- baud rate	500 kbaud or 1 Mbaud
Signal resolution	2,5 * 10-4 lambda
Signal sampling rate	100 Hz
CAN refresh rate	100 Hz
Connectors and Wires	

Connector	AS614-35PN
Connector loom AS114-35SN	F02U.000.365-01
Sleeve	Viton
Wire size	26
Wire length L	20 cm

WITCHENGUTE	20 (111
Pin Assignment	
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 analog out
13	Shield
14	Pump current LSU 1 IP1
15	Virtual GND LSU 1 VM1
16	Heater PWM LSU 1 Uh-1

17	Heater (Batt +) LSU 1 Uh+1
18	Setup current LSU 1 IA1
19	Nernst voltage LSU 1 UN1
20	Pump current LSU 2 IP2
21	Virtual GND LSU 2 VM2
22	Heater PWM LSU 2 Uh-2
23	Heater (Batt. +) LSU 2 Uh+2
24	Setup current LSU 2 IA2
25	Nernst voltage LSU 2 UN2
26	Pump current LSU 3 IP3
27	Virtual GND LSU 3 VM3
28	Heater PWM LSU 3 Uh-3
29	Heater (Batt +) LSU 3 Uh+3
30	Setup current LSU 3 IA3
31	Nernst voltage LSU 3 UN3
32	Pump current LSU 4 IP4
33	Virtual GND LSU 4 VM4
34	Heater PWM LSU 4 Uh-4
35	Heater (Batt. +) LSU 4 Uh+4
36	Setup current LSU 4 IA4
37	Nernst voltage LSU 4 UN4

Communication

Communication link K-Line	/ CAN
---------------------------	-------

Installation Notes

Typical lifetime: max. 220 h / 2 years

For application with severe conditions and/or high volume, please contact your Bosch Motorsport counterpart in order to define the most appropriate validation program

The LT4 is designed to supply 4 Bosch lambda sensors, type LSU 4.2, LSU 4.9 or Mini-LSU 4.9

The LT4 is featured with voltage compensation for the heating profile $\,$

The unit can be connected to any CAN system (500 kbaud or 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 (e.g. CAN protocol).

Please find further application hints in the offer drawing at our homepage.

Legal Restrictions

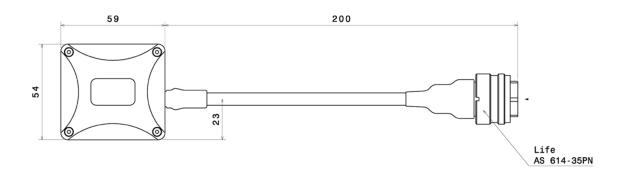
The sale of this product in Mexico is prohibited.

Ordering Information

Lambdatronic LT4

Order number F01T.A20.070-09





Lambdatronic LT4 ADV



Features

- Supply of up to 4 Bosch lambda sensors, type LSU ADV
- ► Integrated voltage compensation for sensor heater

The Lambdatronic LT4 ADV is a control module designed to supply and control up to four Bosch LSU ADV. The lambda sensor LSU ADV offers extended features as an improved robustness, a shorter heating time and less influence from the ambient pressure.

The LSU ADV contains a Nernst cell and a pump cell. The lambda value between the Nernst cell and an internal oxygen reference chamber is controlled to lambda 1.013, independent of the oxygen concentration on the emission side. This happens thanks to the pump current throw the pump cell, responsible for the transmission of oxygen atoms in the sensor ceramic. The current proportional output voltage of the IC is translated in a lambda value. The LT4 ADV provides the sensors temperature and other diagnostics parameters over CAN. The 4 lambda signals can be read by using the CAN or analog output. The main feature and benefit of this unit is its compact design, its lightweight construction, as well as the possibility to control up to 4 Lambda Sensors LSU ADV with multiple user-configurable parameters.

Application	
Application	Lambda 0.75 to 5
Compatible Bosch sensor type	LSU ADV
Channels	4
Heater	Internal

5

6

7

8

9

Mechanical Data	
Weight with wire	98 g
Sealing	100 % humidity
Mounting	Velcro
Size w/o wire (w*l*h)	54 x 59 x 13 mm
Operating temp. range (housing)	-20 to 85°C
Storage temp. range	-20 to 85°C
Max. vibration	Vibration Profile 1 (see Appendix or www.boschmotorsport.com)
Electrical Data	
Power supply U _S	(6.5) 10 to 14 V
Max power supply (1 min) U _s	Max. 26 V
Thermal dissipation loss	3 W at 14 V
Current Is	5 A
Current Is (Heating up)	26 A
Software Tool (free dow	nload)
System Configuration tool Race	Con 2.7.0.9 or later
Characteristic	
Signal output 1	CAN
Signal output 2	4 x 0 to 5 V "analog"
CAN- baud rate	500 kbaud or 1 Mbaud
Signal resolution	2,5 * 10-4 lambda
Signal sampling rate	100 Hz
CAN refresh rate	100 Hz
Connectors and Wires	
Connector	AS614-35PN
Connector loom AS114-35SN	F02U.000.365-01
Sleeve	Viton
Wire size	26
Wire length L	20 cm
Pin Assignment	
Pin	Function
1	+ 12 V (Battery +)
2	+ 12 V (Battery +)
3	Ground (Battery -)
4	Ground (Battery -)

K-Line diagnostic connection

CAN1 + (high)

CAN1 - (low)

Analog out 1

Analog out 2

10	Analog out 3
11	Analog out 4
12	Reference GND for analog out
13	Shield
14	Pump current LSU 1 IP1
15	Virtual GND LSU 1 VM1
16	Heater PWM LSU 1 Uh-1
17	Heater (Batt +) LSU 1 Uh+1
18	Not connected
19	Nernst voltage LSU 1 UN1
20	Pump current LSU 2 IP2
21	Virtual GND LSU 2 VM2
22	Heater PWM LSU 2 Uh-2
23	Heater (Batt. +) LSU 2 Uh+2
24	Not connected
25	Nernst voltage LSU 2 UN2
26	Pump current LSU 3 IP3
27	Virtual GND LSU 3 VM3
28	Heater PWM LSU 3 Uh-3
29	Heater (Batt +) LSU 3 Uh+3
30	Not connected
31	Nernst voltage LSU 3 UN3
32	Pump current LSU 4 IP4
33	Virtual GND LSU 4 VM4
34	Heater PWM LSU 4 Uh-4
35	Heater (Batt. +) LSU 4 Uh+4
36	Not connected
37	Nernst voltage LSU 4 UN4

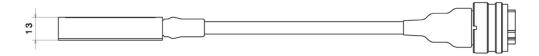
Communication link	K-Line / CAN	
In stallation Nation		
Installation Notes		
Typical lifetime: max. 220 h	/ 2 years	
For application with severe conditions and/or high volume, pleas contact your Bosch Motorsport counterpart in order to define th most appropriate validation program		
The LT4 ADV is designed to LSU ADV	supply 4 Bosch lambda sensors, typ	
The LT4 ADV is featured wit profile.	h voltage compensation for the hea	
The unit can be connected t Mbaud) and analog measuri	o any CAN system (500 kbaud or 1 ng device.	
To avoid signal errors, a cab sensor and box is recomme	ole length of maximum 1.5 m betweended.	
The unit is secure from miss	-pinning.	
The reference ground (GND the measuring device or to t	_REF) has to be connected either to he system ground.	
A ground offset of 2 V (max.) between GND and GND_REF has no to be exceeded.		
See the LT4 ADV function sl CAN protocol).	neet for software documentation (e.	
Please find further applicati homepage.	on hints in the offer drawing at our	

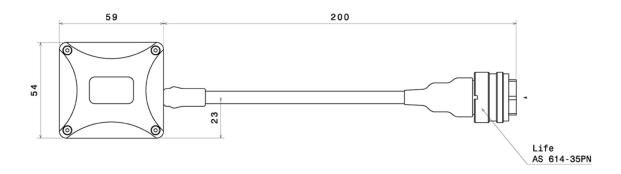
Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

Lambdatronic LT4 ADV
Order number F02U.V01.111-04





Wheel Speed Signal Splitter



Features

► ABS Wheel Speed Sensor Interface

► Lightweight Aluminum Housing

Bosch Motorsport has developed a wheel speed module that converts the Bosch DF11 (differential dual hall sensors) signals to a signal that can be processed by peripheral engine controlling devices and data recording systems. The adapter can be plugged into any Bosch ABS M4 loom.

The operation principle is that it forwards the sensor information to the ABS. In addition it converts the speed info into a digital signal. The type of output is open collector. The connected device needs to contain an internal pull up resistor of 2.15 kOhm to 12 V.

The interface is available in two different housings supporting one connector or two connectors (see photo). The single connector type is used if the signal is fed back into an especially pre-defined ABS loom which connects e.g. to the original chassis loom. The double connector type is used if the speed signal is broadcast to the peripheral device via a separate loom.

The wheel speed signal splitter is designed to be used in combination with the Bosch Motorsport ABS system. Due to safety reasons it is not designed for usage in combination with other ABS systems.

Application	
Application	ABS wheel speed sensor interface
Compatible sensor type	Bosch DF 11
Operating temperature range	-20 to 85°C
Storage temperature range	-20 to 85°C

Technical Specifications		
Mecl	hanical Data	
Weigh	nt	53 g
Size (Single connector type)	101.8 x 63.5 x 30.3 mm
Size (Double connector type)	112.1 x 63.5 x 30.3 mm
Max. v	vibration	Vibration profile 1 (see Appendix or www.boschmotorsport.com)
Elect	trical Data	
Powe	rsupply	12 V
Max.	power supply (1 min)	25 V
Conr	nectors	
Conne	ector 1 (wide)	AS212-35PN
Matin	g connector AS612-35SN	F02U.000.443-01
Conne	ector 2 (small)	AS208-35PN
Matin	g connector AS608-35SN	F02U.000.430-01
Pino	ut Connector 1 (wide	e)
Pin	Description for one connector	Description for two connectors
1	Supply to DF11 (RR)	Supply to DF11 (RR)
2	Signal from DF11 (RR)	Signal from DF11 (RR)
3	Supply to DF11 (RL)	Supply to DF11 (RL)
4	Signal from DF11 (RL)	Signal from DF11 (RL)
5	Supply to DF11 (FR)	Supply to DF11 (FR)
6	Signal from DF11 (FR)	Signal from DF11 (FR)
7	Supply to DF11 (FL)	Supply to DF11 (FL)
8	Signal from DF11 (FL)	Signal from DF11 (FL)
9	Signal to ABS (FL)	Signal to ABS (FL)
10	DF11 supply from ABS (FL)	DF11 supply from ABS (FL)
11	Signal to ABS (FR)	Signal to ABS (FR)
12	DF11 supply from ABS (FR)	DF11 supply from ABS (FR)
13	Signal to ABS (RL)	Signal to ABS (RL)
14	DF11 supply from ABS (RL)	DF11 supply from ABS (RL)
15	Signal to ABS (RR)	Signal to ABS (RR)
16	DF11 supply from ABS (RR)	DF11 supply from ABS (RR)
17	Open collector Signal to ECU (FL)	Not used
18	Open collector Signal to ECU (FR)	Not used
19	UBat 12V	UBat 12V
20	Open collector Signal to ECU (RL)	Not used
21	Open collector Signal to	Not used

ECU (RR)

22	ECU Ground	Not used	
Pino	Pinout Connector 2 (small)		
Pin	Description for one connector	Description for two connectors	
1	n.a.	Open collector Signal to ECU (FL)	
2	n.a.	Open collector Signal to ECU (FR)	
3	n.a.	Open collector Signal to ECU (RL)	
4	n.a.	Open collector Signal to ECU (RR)	

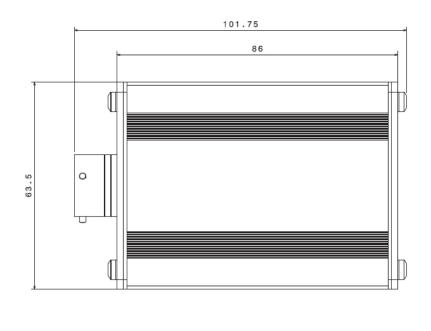
5	n.a.	Not used
6	n.a.	ECU Ground

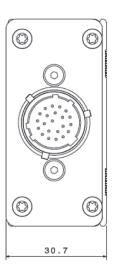
Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information	
Single Connector Type Order number F02U.V00.335-03	
Double Connector Type Order number F02U.V00.203-03	

Dimensions

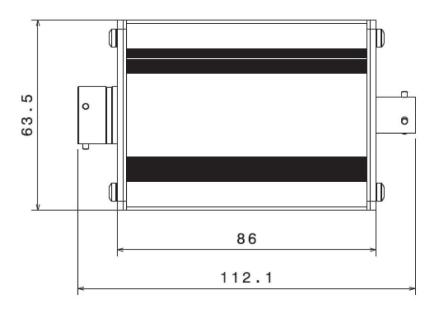


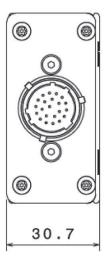


Front view

Left view

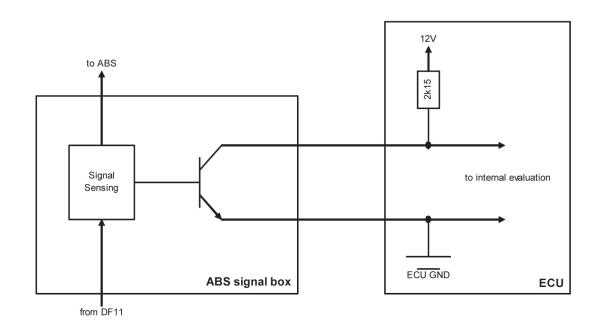
Single Connector Type Housing





Front view Left view

Double Connector Type Housing



Connection Scheme

Overview

RaceConnect



- LTE-based online telemetry system for continuous transfer of vehicle data to scalable, location-independent receivers. Secured data transfer and handling between the racecar and the cloud portal.
- Modular systems architecture and multi-disciplinary engineering expertise yields flexible and fast service enhancement and development according to customer needs.
- The ready-to-use solution requires no further infrastructure at the track.
- Realization of any combination of unidirectional communication routes between transmitter, cloud and receiver, for example, multiple transmitters to one receiver or one transmitter to multiple receivers.
- Full customer control and diagnostics due to accessing racecar data and modem connection status through the cloud interface.

Telemetry Modem LTE65-EU Telemetry Modem LTE65-JP Telemetry Modem LTE65-US



- Optimized for networks in countries of certification
- 4G-LTE connectivity (3G fall-back)
- No infrastructure setup required, built-in SIM card
- Data can be sent/received anywhere 4G or 3G cellular service is available
- Easy configuration at the Bosch RaceConnect website

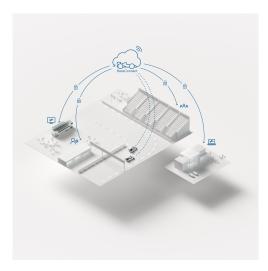


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- 4G-LTE connectivity (3G fall-back)
- No infrastructure setup required, built-in SIM card
- Data can be sent/received anywhere 4G or 3G cellular service is available
- Easy configuration at the Bosch RaceConnect website
- · Cellular priority (USA only)

RaceConnect



Features

- ▶ LTE-based online telemetry system for continuous transfer of vehicle data to scalable, location-independent receivers. Secured data transfer and handling between the racecar and the cloud portal.
- ▶ Modular systems architecture and multi-disciplinary engineering expertise yields flexible and fast service enhancement and development according to customer needs.
- ► The ready-to-use solution requires no further infrastructure at the track.
- ▶ Realization of any combination of unidirectional communication routes between transmitter, cloud and receiver, for example, multiple transmitters to one receiver or one transmitter to multiple receivers.
- ► Full customer control and diagnostics due to accessing racecar data and modem connection status through the cloud interface.

RaceConnect combines years of expertise in component and system development with connectivity and cloud competence. The ready-to-use package for vehicle data transmission, storage and post-processing includes hardware, connectivity solutions, software services and system integration expertise.

Ordering Information

RaceConnect

Please contact us for further information. Order number **on request**

Telemetry Modem LTE65-EU



Features

- Optimized for networks in countries of certification
- ▶ 4G-LTE connectivity (3G fallback)
- No infrastructure setup required, built-in SIM card
- ▶ Data can be sent/received anywhere 4G or 3G cellular service is available
- ► Easy configuration at the Bosch RaceConnect website

The LTE65-EU is a 4G-LTE based telemetry modem designed for real time telemetry data transfer on racetrack for use within Europe. The combination of LTE65-EU with RaceConnect cloud provides a highly flexible telemetry data distribution platform, where one transmitter can send to many receivers and many transmitters can send to one receiver. The usage of 4G-LTE cellular service allows for Plug & Play operation with minimal setup. The system has been validated on Bosch displays, ECUs and loggers; however, 3rd party loggers may also be used.

Application	
Data interface	RS232 or Ethernet
2 444	
Max. transmit rate	2 Mbps
Max. receive rate	5 Mbps
Max. receive streams	10
Ethernet	100 BaseT
RS232 baud rates	19.2, 57.6 and 115.2 kB/sec
Display	3 LEDs for device status
Configuration	Bosch RaceConnect website

Supplier of SIM card Europe	Vodafone
Annual Subscription	
Data Volume Standard	500 MB / 20 hours per month
Data Volume optional	2 GB / 60 hours per month
Data Volume optional	10 GB / 100 hours per month

Data Volume optional	10 GB / 100 hours per month
Technical Specifications	
Mechanical Data	
Size	114 x 65.5 x 22 mm
Weight	171 g
Protection classification	IP67
Operating temperature ambient	-30 to 65°C
Storage temperature	-30 to 85°C
Max. vibration	Vibration Profile 1 (see www.bosch-motorsport.com
Electrical Data	
Supply voltage range	8 to 18 V 24 V operation possible on agreement with customer
Max. power consumption	6 W
Antenna impedance	50 Ohm
Antenna max. gain	5.78 dBi
Connectors and Wires	
Connector on device	ASDD006-09PN
Mating connector	ASDD606-09SN
Pin Configuration	
1	Battery plus
2	RS232 Rx
3	Reset
4	RS232Tx
5	Battery negative
6	Eth RX+
7	Eth RX-
8	Eth TX+
9	Eth TX-

Legal Restrictions

Operation of this device is permitted in EU countries only.

The sale of this product in Mexico is prohibited.

Ordering Information

Telemetry Modem LTE 65EU

Order number F02U.V02.932-01

Modem LTE 65EU + Pro Subscription (1 year)

Order number F02U.V02.933-01

Modem LTE 65EU + Pro-High Subscription (1 year)

Order number F02U.V02.934-01

Basic Kit Racer - GT

2 Modems + 2 Racer Subscriptions (1 year) + Car Antenna + Pit Antenna + Pit Harness

Order number F02U.V02.936-01

Basic Kit Pro - GT

2 Modems + 2 Pro Subscriptions (1 year) + Car Antenna + Pit Antenna + Pit Harness Order number **F02U.V02.937-01**

Basic Kit Pro-High - GT

2 Modems + 2 Pro-High Subscriptions (1 year) + Car Antenna + Pit Antenna + Pit Harness Order number F02U.V02.938-01

Software Options

Racer Subscription (1 year)

500 MB / 20 hours per month Order number **F02U.V02.929-01**

2 GB / 60 hours per month Annual Subscription

Order number F02U.V02.930-01

10 GB / 100 hours per month Annual Subscription

Order number **F02U.V02.931-01**

Accessories

Car Antenna - GT

Quantity 1 required per modem Order number **F02U.00U.054-01**

Car Antenna - Open Wheel

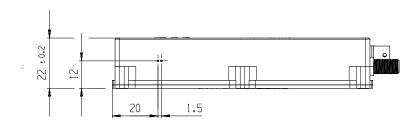
Quantity 2 required per modem Order number **F02U.00U.069-01**

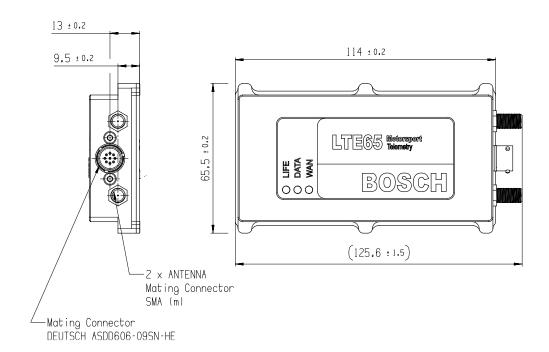
Pitstand Antenna

Quantity 1 required per modem Order number **F02U.00U.070-01**

Pitstand Harness

Order number **F02U.V02.804-02**





Telemetry Modem LTE65-JP



Features

- Optimized for networks in countries of certification
- ▶ 4G-LTE connectivity (3G fallback)
- No infrastructure setup required, built-in SIM card
- ▶ Data can be sent/received anywhere 4G or 3G cellular service is available
- ► Easy configuration at the Bosch RaceConnect website

The LTE65-JP is a 4G-LTE based telemetry modem designed for real time telemetry data transfer on racetrack for use within Japan. The combination of LTE65-JP with RaceConnect cloud provides a highly flexible telemetry data distribution platform, where one transmitter can send to many receivers and many transmitters can send to one receiver. The usage of 4G-LTE cellular service allows for Plug & Play operation with minimal setup. The system has been validated on Bosch displays, ECUs and loggers; however, 3rd party loggers may also be used.

Application	
Data interface	RS232 or Ethernet
Max. transmit rate	2 Mbps
Max. receive rate	5 Mbps
Max. receive streams	10
Ethernet	100 BaseT
RS232 baud rates	19.2, 57.6 and 115.2 kB/sec
Display	3 LEDs for device status
Configuration	Bosch RaceConnect website

Supplier of SIM card Europe	Vodafone
Annual Subscription	
Data Volume Standard	500 MB / 20 hours per month
Data Volume optional	2 GB / 60 hours per month
Data Volume optional	10 GB / 100 hours per month

Data volume optional	10 GB / 100 nours per mont
Technical Specifications	
Mechanical Data	
Size	114 x 65.5 x 22 mm
Weight	171 g
Protection classification	IP67
Operating temperature ambient	-30 to 65°C
Storage temperature	-30 to 85°C
Max. vibration	Vibration Profile 1 (see www.bosch-motorsport.com
Electrical Data	
Supply voltage range	8 to 18 V 24 V operation possible on agreement with customer
Max. power consumption	6 W
Antenna impedance	50 Ohm
Antenna max. gain	5.78 dBi
Connectors and Wires	
Connector on device	ASDD006-09PN
Mating connector	ASDD606-09SN
Pin Configuration	
1	Battery plus
2	RS232 Rx
3	Reset
4	RS232 Tx
5	Battery negative
6	Eth RX+
7	Eth RX-
8	Eth TX+
9	Eth TX-

Legal Restrictions

Operation of this device is permitted in Japan only. The sale of this product in Mexico is prohibited.

Ordering Information

Modem LTE 65JP

Order number F02U.V03.042-01

Modem LTE 65JP + Racer Subscription (1 year)

Order number F02U.V03.043-01

Modem LTE 65JP + Pro Subscription (1 year)

Order number F02U.V03.044-01

Modem LTE 65JP + Pro-High Subscription (1 year)

Order number F02U.V03.045-01

Basic Kit Racer - GT

2 Modems + 2 Racer Subscriptions (1 year) + Car Antenna + Pit Antenna + Pit Harness Order number **F02U.V03.046-01**

Basic Kit Pro - GT

2 Modems + 2 Pro Subscriptions (1 year) + Car Antenna + Pit Antenna + Pit Harness Order number **F02U.V03.047-01**

Basic Kit Pro-High - GT

2 Modems + 2 Pro-High Subscriptions (1 year) + Car Antenna + Pit Antenna + Pit Harness Order number F02U.V03.048-01

Software Options

Racer Subscription (1 year)

500 MB / 20 hours per month Order number **F02U.V02.929-01**

Pro Subscription (1 year)

2 GB / 60 hours per month Order number **F02U.V02.930-01**

Pro-High Subscription (1 year)

10 GB / 100 hours per month Order number **F02U.V02.931-01**

Accessories

Car Antenna - GT

Quantity 1 required per modem Order number **F02U.00U.054-01**

Car Antenna - Open Wheel

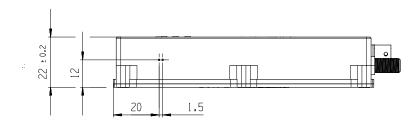
Quantity 2 required per modem Order number **F02U.00U.069-01**

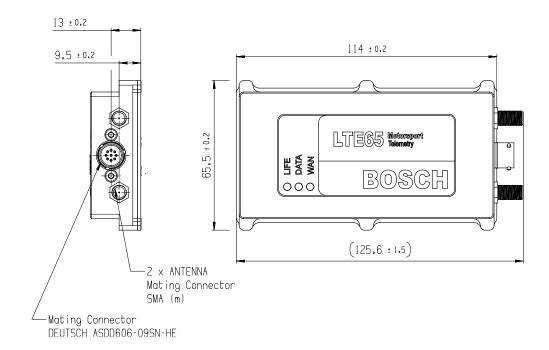
Pitstand Antenna

Quantity 1 required per modem Order number **F02U.00U.070-01**

Pitstand Harness

Order number F02U.V02.804-02





Telemetry Modem LTE65-US



Features

- ▶ 4G-LTE connectivity (3G fallback)
- No infrastructure setup required, built-in SIM card
- Data can be sent/received anywhere 4G or 3G cellular service is available
- ► Easy configuration at the Bosch RaceConnect website
- ► Cellular priority (USA only)

The LTE65-US is a 4G-LTE based telemetry modem designed for real time telemetry data transfer on racetrack for use within the USA and Canada. The combination of LTE65-US with RaceConnect cloud provides a highly flexible telemetry data distribution platform, where one transmitter can send to many receivers and many transmitters can send to one receiver. The usage of 4G-LTE cellular service allows for Plug & Play operation with minimal setup. The system has been validated on Bosch displays, ECUs and loggers; however, 3rd party loggers may also be used.

Application	
Data interface	RS232 or Ethernet
Max. transmit rate	2 Mbps
Max. receive rate	5 Mbps
Max. receive streams	10
Ethernet	100 BaseT
RS232 baud rates	19.2, 57.6 and 115.2 kB/sec
Display	3 LEDs for device status
Configuration	Bosch RaceConnect website

Supplier of SIM card Europe	Vodafone
Annual Subscription	
Data Volume Standard	500 MB / 20 hours per month
Data Volume optional	2 GB / 60 hours per month
Data Volume optional	10 GB / 100 hours per month

Data volume optional	10 GB / 100 nours per montr
Technical Specifications	
Mechanical Data	
Size	114 x 65.5 x 22 mm
Weight	171 g
Protection classification	IP67
Operating temperature ambient	-30 to 65°C
Storage temperature	-30 to 85°C
Max. vibration	Vibration Profile 1 (see www.bosch-motorsport.com)
Electrical Data	
Supply voltage range	8 to 18 V 24 V operation possible on agreement with customer
Max. power consumption	6 W
Antenna impedance	50 Ohm
Antenna max. gain	5.78 dBi
Connectors and Wires	
Connector on device	ASDD006-09PN
Mating connector	ASDD606-09SN
Pin Configuration	
1	Battery plus
2	RS232 Rx
3	Reset
4	RS232Tx
5	Battery negative
6	Eth RX+
7	Eth RX-
8	Eth TX+
9	Eth TX-

Legal Restrictions

Operation of this device is permitted in the USA and Canada only.

The sale of this product in Mexico is prohibited.

Ordering Information

Telemetry Modem LTE65-US

Subscription required, antenna not included Order number on request

Modem + Racer Subscription

Order number F02U.V0U.417-01

Modem + Pro Subscription

Order number F02U.V0U.418-01

Modem + Pro-High Subscription

Order number F02U.V0U.419-01

Basic Kit Racer - GT

2 Modems + 2 Racer Subscriptions + GT Car Antenna + Pit Antenna + Pit Harness Order number **F02U.V0U.420-01**

Basic Kit Pro - GT

2 Modems + 2 Pro Subscriptions + GT Car Antenna + Pit Antenna + Pit Harness Order number **F02U.V0U.421-01**

Basic Kit Pro High - GT

2 Modems + 2 Pro High Subscriptions + GT Car Antenna + Pit Antenna + Pit Harness Order number **F02U.V0U.422-01**

Basic Kit Racer - Open Wheel

2 Modems + 2 Racer Subscriptions + 2 Open Wheel Car Antennas + Pit Antenna + Pit Harness Order number **F02U.V0U.426-01**

Basic Kit Pro - Open Wheel

2 Modems + 2 Pro Subscriptions + 2 Open Wheel Car Antennas + Pit Antenna + Pit Harness Order number **F02U.V0U.427-01**

Basic Kit Pro High - Open Wheel

2 Modems + 2 Pro High Subscriptions + 2 Open Wheel Car Antennas + Pit Antenna + Pit Harness Order number F02U.V0U.428-01

Software Options

Racer Subscription (1 year)

500 MB / 20 hours per month Order number **F02U.V0U.355-01**

Pro Subscription (1 year)

2 GB / 60 hours per month Order number **F02U.V0U.357-01**

Pro-High Subscription (1 year)

10 GB / 100 hours per month Order number F02U.V0U.358-01

Accessories

Car Antenna - GT

Quantity 1 required per modem Order number **F02U.00U.054-01**

Car Antenna - Open Wheel

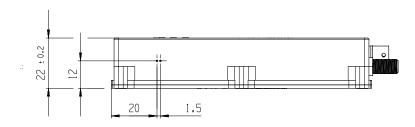
Quantity 2 required per modem Order number **F02U.00U.069-01**

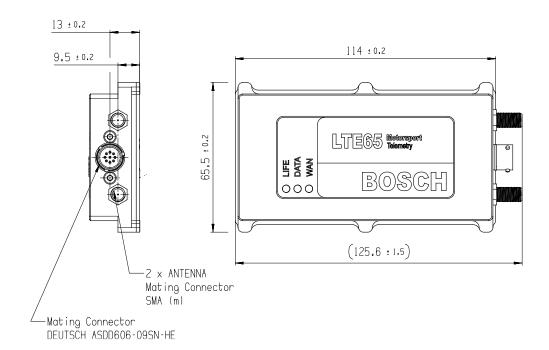
Pitstand Antenna

Quantity 1 required per modem Order number **F02U.00U.070-01**

Pitstand Harness

Order number F02U.V02.804-02





µLC Test System



Features

- ► User-friendly interface
- ► Functions can be extended with Expansion Boards
- ▶ Prepared for test automation
- ► Favorable test setup, consuming low space
- Simulation of typical automotive interfaces combined in one unit

The new and modern hardware-in-the-loop test system μ LC Test System is suitable for mobile application, measuring a compact 17 x 11 x 6 cm. Initial test setup typically takes under ten minutes, since the system allows for a simple test setup.

It is a compact open-loop test system for quality assurance of control unit development and combines the simulation of all typical automotive sensors and communication protocols in one unit. Its interface is user-friendly and enables an easy operation and evaluation.

The μ LC Test System is especially used for automotive control units with typical interfaces for sensors and bus systems such as analog/digital inputs and outputs, PWM signals, SENT, CAN, LIN and speed sensors.

Application

Engine Speed Simulation

- Up to 20,000 rpm
- Supported sensors: Hall, inductive, DG23i, TL4953
- Up to 2 crankshafts, up to 4 camshafts
 - each is independently configurable
 - auxiliary shaft
 - -~ -180 to 180° camshaft adjustment $\,$
- · Oscilloscope trigger signal for easier monitoring
- Error simulation for engine position management EPM

Vehicle Busses

- 2 * CAN, up to 1 MBit/s, switchable 120 Ohm CAN bus terminator
- LIN Master/Slave
- SENT, full J2716 Jan. 2012 standard
 4 Outputs, alternative to PWM output

Analog Interfaces

- 8 * 10 bit DAC 0 to 5 V, max. 5 mA Internal or external supply
- 4 * 12 bit DAC 0 to 5 V. max. 5 mA
- 6 * 12 bit ADC 0 to 40 V. GND reference

Digital Interfaces

- 6 * Digital Out, max. 200 mA in total Output modes: Ground, 12 V, High impedance
- 2 * Relays, max. 10 A, separate ECU power supply possible and incl. main relay sensing
- 2 * PWM input, 1 Hz to 20 kHz
- 4 * PWM output, max. 90 mA in total, 0.1 Hz to 20 kHz

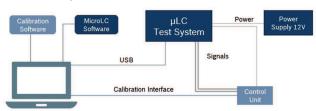
Output voltages: 12 V, 5 V, GND

 Complex PWM with sub signals, each separately adjustable in frequency, duty cycle and pulse count

Additional Features

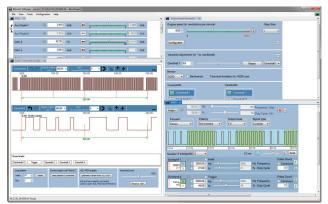
- · Throttle body simulation
- · Cylinder pressure simulation
 - Up to 8 cylinders with one device
 - Expandable with multiple devices
- · USB connection completely galvanic decoupled
- · All in- and outputs short-circuit protected and ESD protected
- EMC tested
- Expansion boards for additional HW features
- Multi device support with sync option for engine speed signals

Test Setup



Note: Calculation intensive modules like cylinder pressure simulation can cause a limitation of e.g. the max. engine speed.

Technical Specifications Operating voltage 12 V DC Current consumption typ. < 1 A ECU voltage 12 V / 24 V DC ECU current 10 A Permissible operation temperat-0 to 40°C ure Housing material Aluminum 175 x 107 x 61 mm **Dimensions** Weight 690 g



The screenshot shows the MicroLC Software with analog outputs, crank-/ camshaft, RPM and complex PWM.

Update and Support Subscription

• Free in the first year of use, chargeable from the second year

Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

µLC Test System

Order number F02U.V02.303-02

Software Options

Update and Support Subscription

Order number F02U.V02.838-01

Accessories

Expansion Board Current Loop Interface

Order number F02U.V02.889-01

Expansion Board Digital Outputs

Order number **F02U.V02.904-01**

Expansion Board CAN-FD



Features

- ▶ 2 independent channels
- ► Compatible with CAN and CAN-FD
- ► Switchable termination resistor

The **Expansion Board CAN-FD** extends the functions of the **µLC Test System** without intervening in the software and without additional enabling mechanisms. The card has two channels that are compatible with classic CAN as well as with CAN-FD. For CAN-FD, data bit rates of up to 5 Mbit/s are supported.

- Adjustable bit rates and sample points with optional Transmission Delay compensation for high bit rates
- · Direct import of dbc and Fibex files
- · Short circuit proof

Techni	ical S	necit	ıcatı	ions
1001111	out c	Pecil	- Cut	.0113

Parameter	Value
$U_Bus,prot$	±56 V
U _{CM}	±30 V
R_{Term}	120 Ohm
Parameter	Value
Max. data rate (CAN)	1 Mbit/s
Max. data rate (CAN-FD)	5 Mbit/s
Filter	Range-Filter for 11bit- and 29bit-IDs
Resolution timestamp	1 ms
Adjustable cycle times	1 ms - 65 s

Ordering Information

Expansion Board CAN-FDOrder number **F02U.V03.095-01**

Expansion Board Current Loop Interface



Features

- ► All common wheel speed sensors can be simulated
- ▶ Simulation of gear speeds possible
- Speed calculation based on wheel circumference
- ► Current limits freely adjustable from 0 mA to 40 mA

The **Expansion Board Current Loop Interface** extends the functions of the μ LC **Test System** without intervening the software and without activating additional mechanisms. The numbered outputs are available for this purpose. Using the five provided channels it is possible to simulate up to five independent sensors. With integrated Lua scripting and the provided API it is possible to create automated tests.

TS Engine speed -3,000 to 12,000 rpm Local pattern / 48 to 60 teeth Signal duration forwards

TS		
Signal duration backwards	80 to 100 μs	
Gaps	0 to 10	
Prefixed bit	35 to 45	(de)activatable
Duty Cycle	737,000 µs	
Stand still signal duration	1,340 to 1,540 µs	
Stand still signal	150,000 µs	(de)activatable
AK		
Engine speed	-3,125 to 3,125 rpm	
Local pattern / teeth	48 to 60	
Parity	Even / odd parity	
LR-Bit		(de)activatable
LMO-Bit		(de)activatable
LM1-Bit		(de)activatable
LM2-Bit		(de)activatable
Stand still signal	150,000 µs	
PWM-i		
Engine speed	-2,500 to 2,500 rpm	
Local pattern / teeth	48 to 60	
Duration LR	35 to 55 μs	(de)activatable
Duration DR_L	80 to 100 μs	
Duration DR_R	170 to 190 μs	
Duration DR_L_EL	350 to 370 µs	(de)activatable
Duration DR_R_EL	710 to 730 µs	(de)activatable
Stand still signal duration	1,430 to 1,450 µs	
Stand still signal period	737,000 µs	
PWM-s		
Engine speed	-5,000 to 5,000 rpm	
Local pattern / teeth	48 to 60	
Ordering Inform	nation	

Ordering Information

Expansion Board Current Loop InterfaceOrder number **F02U.V02.889-01**

Expansion Board Digital Outputs



Features

- ▶ 14 additional digital outputs included
- ► Short circuit proof
- ► Change to individual states possible: Low, High, High-Z

The **Expansion Board Digital Outputs** extends the functions of the μ LC **Test System** without interventing the software and without activating additional mechanisms. Digital Outputs provides 14 digital outputs, which can be switched individually to the states **Low**, **High** or **High-Z**. All outputs can be switched simultaneously.

Application

Output voltage	Min	Max	
μLC 3.1	-1 V	24 V	

Technical Specifications

DC characteristics

Parameters	Conditions	Value
U_{out}	Output = Low	<1.1 V
U_{in} - U_{out}	Output = High	<1.8 V
R_{out}	Output = High-Z	>10 MOhm
lout, prot	Channel shutdown threshold	±1A
∑l _{out} , _{prot}	Shutdown threshold total cur- rent all outputs	±3.33 A

Timing measured at U_{in} = 24 V

Parameters	Conditions	Value
t_{rise}	Load of 500 Ohm to GND	58 µs
	Load of 500 Ohm to 24 V	0.3 μs
	Without load	62 µs
t_{fall}	Load of 500 Ohm to GND	0.8 μs
	Load of 500 Ohm to 24 V	5.5 µs
	Without load	12 µs
t _{restart} *		33.6 ms

^{*:} Restart time after overcurrent

Ordering Information

Expansion Board Digital Outputs Order number **F02U.V02.904-01**

Fuel & Spark

4

Fuel Pressure Regulators	142
Fuel Pumps	151
Ignition Coils	162
Ignition Modules	188
Injection Valves	193

Overview

Fuel Pressure Regulator Mini 2



- 5 to 10 bar
- 30 to 400 l/h reflow
- Adjusted at 105 l/h
- · Aluminum housing
- All versions Methanol compatible

Fuel Pressure Regulator Mini 5



- 5 bar
- 15 to 220 l/h reflow
- Adjusted at 105 l/h
- · Sheet steel housing

Fuel Pressure Regulator Mini A



- 2.2 to 3.5 bar/3.5 to 5 bar
- 15 to 220 l/h reflow
- · Pressure adjustable
- · Sheet steel housing

FPR Adaptor light



- · Aluminum housing
- Fits to production type regulators and Motorsport regulators (FPR Mini 2, Mini 5, Mini A)
- · Very light weight

Fuel Pressure Regulator Mini 2



Features

- ▶ 5 to 10 bar
- ▶ 30 to 400 l/h reflow
- ► Adjusted at 105 l/h
- ► Aluminum housing
- ▶ All versions Methanol compatible

Fuel pressure regulators are used to maintain constant fuel pressure at the injection valves. We offer this regulator for gasoline as well as for methanol applications.

The main benefit of this regulator includes a higher pressure range and a higher return flow rate in comparison to the production type regulators.

Application	
Pressure range	See ordering information
Reflow quantity	30 to 400 l/h
Fuel compatibility	Gasoline, E85, M100
Operating temperature	-40 to 120°C
Storage temperature	-40 to 100°C
Max. vibration	$<600 \text{ m/s}^2 \text{ at } 5 \text{ to } 250 \text{ Hz}$
Valve leakage	Q_{leck} [cm ³ /min] \leq 9 (pneumatic) at p [kPa] = 0.8 x P _{nom}

Technical Specifications

Variations

Please see Ordering Information

Mechanical Data

Diameter	38.1+0.1-0.2 mm
Weight	Ca. 61 g
Mounting	Fastening with a clip

Connectors and Wires

Connector supply	Diam. 25 mm, O-ring 25x2.5
Connector reflow	Diam. 9.1 mm, O-ring 5x2.5

Installation Notes

Never run the regulator without the integrated filter.

Please oil O-rings lightly with clean and silicone free engine oil before you install the regulator.

Please make a leak test after you have installed the regulator.

When the pressure regulator is removed and will be reused, the Orings must be tested for fractures.

Operation of the pressure regulator with a medium other than gasoline is not allowed.

Using the FPR Adaptor light F02U.V02.248-01, you can rebuild the regulator an inline type.

This pressure regulator is not designed for in-tank mounting.

Ordering Information

Fuel Pressure Regulator Mini 2

Pressure Range 5.0 bar Order number **F02U.V02.166-01**

Fuel Pressure Regulator Mini 2

Pressure Range 6.0 bar Order number **F02U.V02.168-01**

Fuel Pressure Regulator Mini 2

Pressure Range 7.0 bar Order number **F02U.V02.170-01**

Fuel Pressure Regulator Mini 2

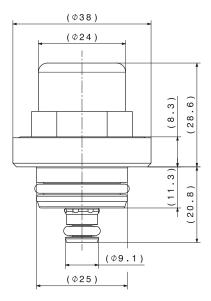
Pressure Range 8.0 bar Order number **F02U.V02.171-01**

Fuel Pressure Regulator Mini 2

Pressure Range 10.0 bar Order number **F02U.V02.172-01**

FPR Adaptor light

Order number F02U.V02.248-01



 $Complete\ dimensions\ on\ offer\ drawing\ at\ www.bosch-motorsport.com$

Fuel Pressure Regulator Mini 5



Features

▶ 5 bar

flow rate.

- ▶ 15 to 220 l/h reflow
- ► Adjusted at 105 l/h
- ► Sheet steel housing

Fuel pressure regulators are used to maintain constant fuel pressure at the injection valves. We modified this production type based regulator especially for motorsport use and increased the

pressure level. The main benefit of this regulator include the competitively priced high quality and the high return

Pressure range 5 bar Reflow quantity 15 to 220 I/h Reference pressure connector Diam. 5 mm, tube connector

Fuel compatibility	Gasoline (E85 or M15 with shortened lifetime)
Operating temperature	-40 to 120°C
Storage temperature	-40 to 100°C
Max. vibration	$<600 \text{ m/s}^2 \text{ at } 5 \text{ to } 250 \text{ Hz}$
Valve leakage	Q_{leck} [cm ³ /min] \leq 9 (pneumatic) at p [kPa] = 0.8 x P _{nom}

Technical Specifications	S
Mechanical Data	
Diameter	34.9 mm
Weight	48.5 g
Mounting	Fastening with a clip
Characteristic	
Set pressure accuracy	±2 % at 105 l/h
Connectors and Wires	
Connector supply	Diam. 25 mm, O-ring
Connector reflow	Diam. 9.15 mm, O-ring

Installation Notes

The tube connector at the housing can be used to supply reference pressure to the regulator. This can be atmospheric pressure, air box pressure or manifold pressure.

Never run the regulator without the integrated filter.

Please oil O-rings lightly with clean and silicone free engine oil before you install the regulator.

Please make a leak test after you have installed the regulator.

When the pressure regulator is removed and will be reused, the Orings must be tested for fractures.

Operation of the pressure regulator with a medium other than gasoline is not allowed.

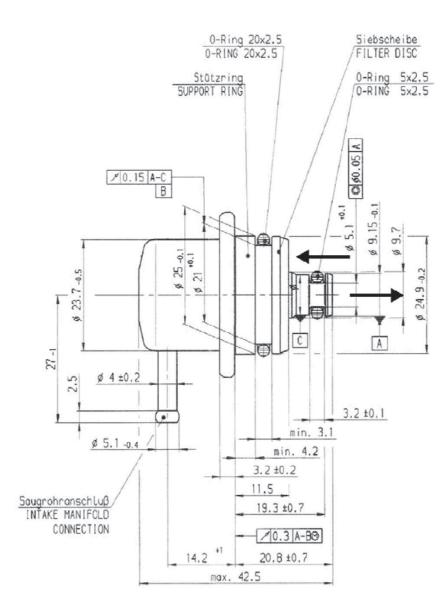
This pressure regulator is not designed for in-tank mounting.

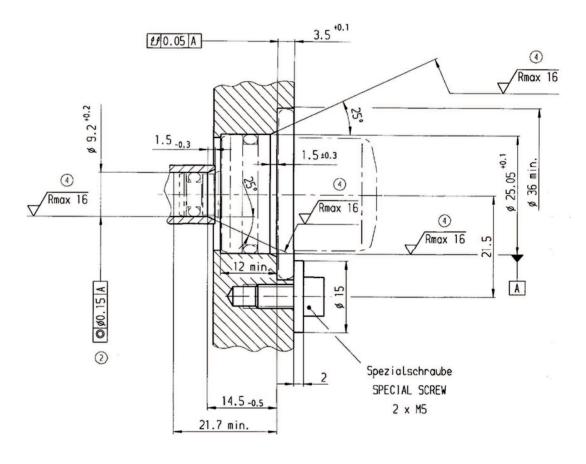
Ordering Information

Fuel Pressure Regulator Mini 5 Order number 0280.B02.722-03

FPR Adaptor light

Order number F02U.V02.248-01





Installation Recommendation

Fuel Pressure Regulator Mini A



Features

- ▶ 2.2 to 3.5 bar/3.5 to 5 bar
- ▶ 15 to 220 l/h reflow
- ▶ Pressure adjustable
- ► Sheet steel housing

Fuel pressure regulators are used to maintain constant fuel pressure at the injection valves. This regulator based on a production type regulator was specially designed for motorsport applications. The main benefit of this regulator is the adjustability of the fuel pressure.

Application	
Pressure range	2.2 to 3.5 bar
	3.5 to 5.0 bar
Reflow quantity	15 to 220 l/h
Reference pressure connector	Diam. 5 mm, tube connector
Fuel compatibility	Gasoline, E85, M15

Operating temperature	-40 to 120°C
Storage temperature	-40 to 100°C
Max. vibration	$<400 \text{ m/s}^2 \text{ at } 5 \text{ to } 250 \text{ Hz}$
Valve leakage	Q_{leck} [cm ³ /min] \leq 9 (pneumatic) at p [kPa] = 0.8 x P_{nom}

Technical Specifications

Mechanical Data

Diameter	34.9 mm
Weight	58 g
Mounting	Fastening with a clip
Connectors and Wire	es
Connector supply	Diam. 25 mm, O-ring
Connector reflow	Diam. 9.15 mm, O-ring

Installation Notes

The tube connector at the housing can be used to supply reference pressure to the regulator. This can be atmospheric pressure, air box pressure or manifold pressure.

Never run the regulator without the integrated filter.

Please oil O-rings lightly with clean and silicone free engine oil before you install the regulator.

Please make a leak test after you have installed the regulator.

When the pressure regulator is removed and will be reused, the Orings must be tested for fractures.

Operation of the pressure regulator with a medium other than gasoline is not allowed.

This pressure regulator is not designed for in-tank mounting.

Ordering Information

Fuel Pressure Regulator Mini A

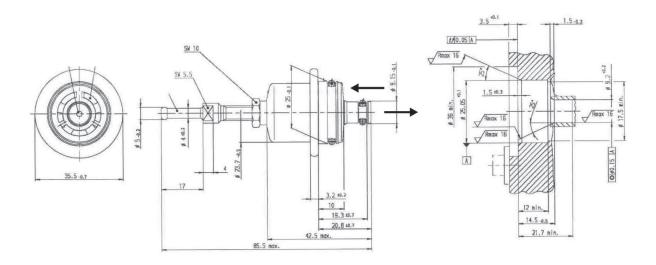
Pressure Range 2.2 to 3.5 bar Order number **B280.550.340-03**

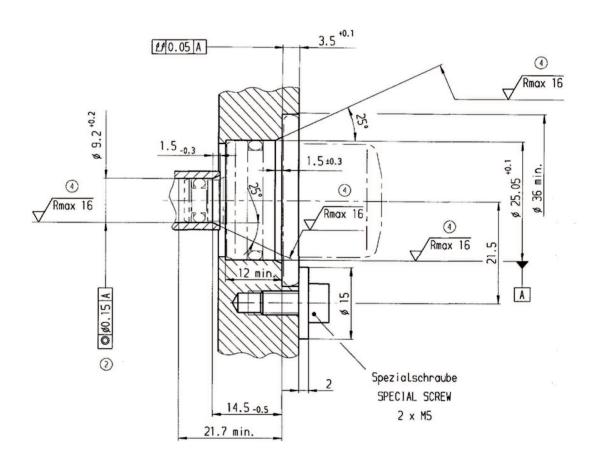
Fuel Pressure Regulator Mini A

Pressure Range 3.5 to 5.0 bar Order number **B280.550.341-04**

FPR Adaptor light

Order number F02U.V02.248-01





Installation Recommendation

FPR Adaptor light



Features

- ► Aluminum housing
- ► Fits to production type regulators and Motorsport regulators (FPR Mini 2, Mini 5, Mini A)
- ► Very light weight

This adaptor offers the opportunity to convert a rail pressure regulator into an inline pressure regulator. The adaptor is able to hold a production type regulator as well as a motorsport regulator. Delivery without regulator.

Application	
Fuel compatibility	Gasoline, E85/M100
Operating temperature range	-40 to 120°C
Storage temperature range	-40 to 100°C

 $<600 \text{ m/s}^2 \text{ at 5 to } 250 \text{ Hz}$

Technical Specifications

Max. vibration

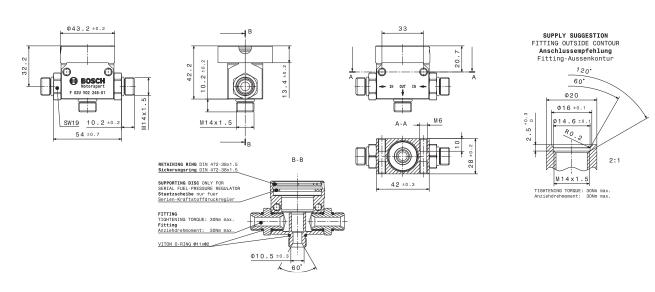
Mechanical Data	
Diameter	50 mm
Heigth	55 mm
Weight	92 g
Mounting	Screw fastening with M6 screws into housing or M5 screws through housing
Connectors and Wires	
Connector supply	2 x M14 x 1.5

M14 x 1.5

Ordering Information

Connector reflow

FPR Adaptor light
Order number F02U.V02.248-01



Overview

Fuel Pump FP 165



- >165 l/h
- Max. 5 bar
- 980 g
- · Fuel lines screwed

Fuel Pump FP 200-7



- >200 l/h
- Max. 7,5 bar
- 850 g
- · Fuel lines screwed
- Internal pre-filter on suction side with 300 μm

Fuel Pump FP 200-E



- >200 l/h
- Max. 8 bar
- 850 g
- · Fuel lines screwed
- Internal pre-filter on suction side with 300 μm

HP Fuel Pump HDP 5



- Max. 1.1 cm³/rot_{cam}
- 200 bar
- 780 g
- Integrated Flow Control Valve
- Internal Pressure Relief Valve

HP Fuel Pump HDP 5-LW



- Max. 1.1 cm³/rot_{cam}
- Max. 500 bar
- 585 g
- Integrated Flow Control Valve
- · Internal Pressure Relief Valve



Fuel Pump FP 165



Features

- ▶ >165 l/h
- ► Max. 5 bar
- ▶ 980 g
- ► Fuel lines screwed

The FP 165 is an inline roller cell pump for the installation outside the fuel tank.

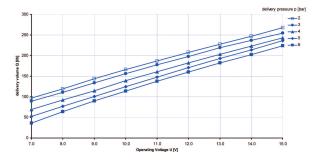
It is capable of providing 165 l/h at 5 bar. Bio-fuel can be delivered up to E85 (shortens lifetime!). The FP 165 is a production type fuel pump, combining good quality at a low price.

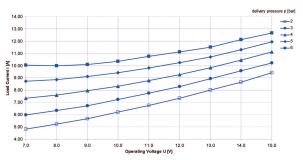
Application Fuel pressure 5 bar Delivery rate at 5 bar and 22°C 205 ± 5 l/h at 14 V Pressure limiting valve 7 to 12.5 bar rel. Up to E85 with shorter lifetime Fuel compatibility Diesel compatibility Not released -20 to 90°C Operating temperature range Storage temperature range -40 to 70°C Max. vibration 3 mm at 10 to 18 Hz \leq 40 m/s² at 18 to 60 Hz

Technical Specifications Mechanical Data

Diameter	60 mm
Length	168 mm
Weight	980 g

Mounting	Clamping
Electrical Data	
Supply voltage	6 to 16.5 V
Operating voltage	13.8 V
Load current at 5 bar and 22°C	11.0 ± 2 A
Characteristic	
Surface coating	None
Color	Silver
Non-return valve	Internal
Fuel filtering	External, on pressure side





Connectors and Wires

Electrical connector	+M4/-M5
Electrical mating connector	with ring wire M4 and M5
Mechanical connector intake side	M14x1.5
Mechanical connector pressure side	M12x1.5

Installation Notes

With E26/E85 fuel run-time max. 500 h.

For technical reasons the values may vary.

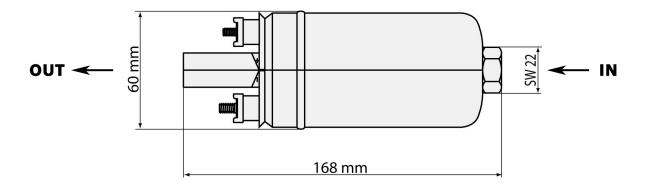
Please use within the specified limit values only.

Please find further application hints in the offer drawing at our homepage.

Ordering Information

Fuel Pump FP 165

Order number 0580.254.979



Fuel Pump FP 200-7



Features

- ▶ >200 l/h
- ► Max. 7,5 bar
- ▶ 850 g
- ▶ Fuel lines screwed
- ▶ Internal pre-filter on suction side with 300 µm

The FP 200-7 is an inline roller cell pump for the installation outside the fuel tank (installation in the tank is not proven).

It is capable of providing 200 l/h at 7 bar. Bio-fuel can be delivered up to E100 (shortens lifetime!). The FP 200-7 is compatible with Gasoline and Diesel fuel. It is the replacement for the 0580.254.044 aftermarket fuel pump with higher performance.

Application	
Fuel pressure	Up to 7,5 bar
Gasoline delivery rate at 5 bar and 22°C	>220 to 270 l/h
Diesel delivery rate at 7 bar and 22°C	>185 to 235 l/h
Pressure limiting valve	8,0 to 10,0 bar
Fuel compatibility	Up to E100 with shorter life- time
Diesel compatibility	Given
Operating temperature range	-40 to 80°C ≤90°C for ≤5 h over 1.000 h lifetime ≤105°C for ≤1 h over 50 h life- time
Storage temperature range	-30 to 60°C

Max. vibration	10 Hz 19,4 (m/s ²) ² /Hz
IEC 60068-2-34	300 Hz 0,654 (m/s ²) ² /Hz
	1.000 Hz 0,059 (m/s ²) ² /Hz

Technical Specifications

Mechanical Data

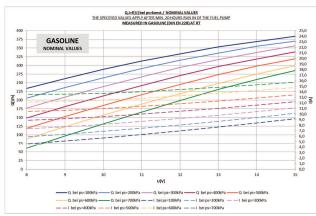
Diameter	60 mm
Length	197 mm
Weight	750 g
Mounting	Clamping

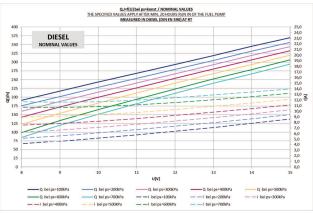
Electrical Data

Supply voltage	6 to 15 V (26 V for 60 s)
Operating voltage	13 V
Load current at 5 bar and 22°C	≤ 17 A

Characteristic

Color	Silver
Non-return valve	External
Fuel filtering	External, on pressure side
Over-pressure valve	Internal





Connectors and Wires

Electrical connector	+M4/-M5
Electrical mating connector	With ring wire M4 and M5
Mechanical connector intake side	M18x1.5
Mechanical connector pressure side	M12x1.5

Installation Notes

Up to E100 with shorter lifetime

For technical reasons the values may vary.

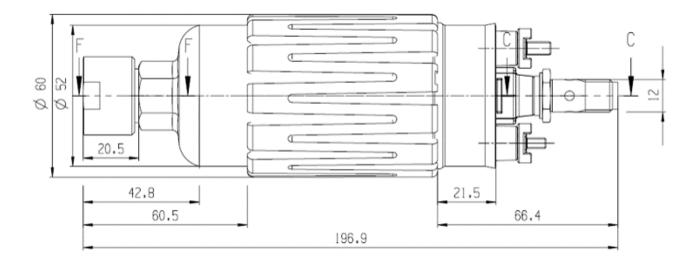
Please use within the specified limit values only.

Please find further application hints in the offer drawing at our homepage.

Ordering Information

Fuel Pump FP 200-7

Order number F.02U.V03.136-01



Fuel Pump FP 200-E



Features

- ▶ >200 l/h
- ► Max. 8 bar
- ▶ 850 g
- ▶ Fuel lines screwed
- ▶ Internal pre-filter on suction side with 300 µm

The FP 200-E is an inline roller cell pump for the installation outside the fuel tank (installation in the tank is not proven).

It is capable of providing 200 l/h at 8 bar. Bio-fuel can be delivered up to E100 (shortens lifetime!). The FP 200-E is compatible with Gasoline and Diesel fuel.

Application	
Fuel pressure	Max. 8,0 bar
Gasoline delivery rate at 8 bar and 22°C	>200 l/h
Diesel delivery rate at 7 bar and 22°C	>180 l/h
Pressure limiting valve	Without. Subsequent assembly possible on pressure side by customer
Fuel compatibility	Up to E100 with shorter lifetime
Diesel compatibility	Given
Operating temperature range	-40 to 80°C ≤90°C for ≤5 h over 1.000 h lifetime ≤105°C for ≤1 h over 50 h lifetime
Storage temperature range	-30 to 60°C

Max. vibration	$10 \text{Hz} 19,4 (\text{m/s}^2)^2 / \text{Hz}$
IEC 60068-2-34	300 Hz 0,654 (m/s ²) ² /Hz
	1.000 Hz 0,059 (m/s ²) ² /Hz

Technical Specifications

MAC	hanica	al Data
IVICC	Hallic	at Data

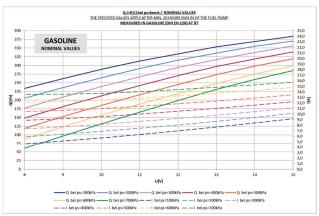
Diameter	60 mm
Length	197 mm
Weight	750 g
Mounting	Clamping

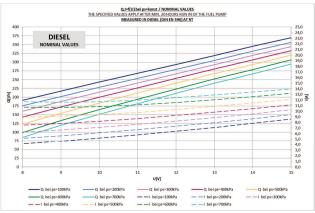
Electrical Data

Supply voltage	6 to 15 V (26 V for 60 s)
Operating voltage	13 V
Load current at 8 bar and 22°C	< 20 A

Characteristic

Color	Silver
Non-return valve	External
Fuel filtering	External, on pressure side
Over-pressure valve	Without





Connectors and Wires

Electrical connector	+M4/-M5
Electrical mating connector	With ring wire M4 and M5
Mechanical connector intake side	M18x1.5
Mechanical connector pressure side	M12x1.5

Installation Notes

Up to E100 with shorter lifetime

For technical reasons the values may vary.

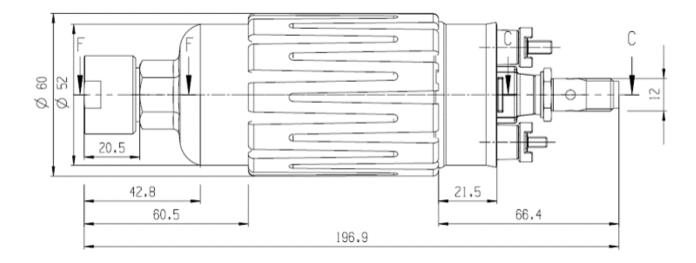
Please use within the specified limit values only.

Please find further application hints in the offer drawing at our home page. $\label{eq:please} % \begin{center} \begin{cente$ Be careful, there is no over-pressure valve inside.

Ordering Information

Fuel Pump FP 200-E

Order number 0580.B00.12U-50



HP Fuel Pump HDP 5



Features

- ► Max. 1.1 cm³/rot_{cam}
- ▶ 200 bar
- ▶ 780 g
- ► Integrated Flow Control Valve
- ► Internal Pressure Relief Valve

The HDP 5 is a compact high pressure single piston pump. The design allows achieving a big delivery volume as well as high efficiency, as needed in motorsport applications. Modifications in the number of cam lobes and cam lifts allow different flow requirements to be addressed.

The HDP 5 is equipped with an internal pressure relief valve to limit the maximum fuel pressure. It does not require a fuel return line into the fuel tank. The pump has an integrated demand control for metering the amount of fuel supplied into the high pressure fuel system. It can be ordered with a compact connector or a motorsport connector. Depending on the requirements of your engine (e.g. fuel consumption over rotation ratio) we recommend different types of tappets, piston springs and cam profiles. Please notice: Fuel delivery and maximum driveshaft speed depend on cam profile and type of tappet.

Application

For high pressure manifold injection or gasoline direct injection

Technical Specifications

Mechanical Data

Mass flow	Please see extra sheet
Efficiency	Please see extra sheet
Body design	Series

Flow capacity and max. engine speed	Depending on cam profile		
Nominal pressure Standard version	200 bar		
Possible customization			
Rev B (iPRV)	500 bar or customization		
Rev C (EVO)	= Rev B + reduced internal restrictions + introduction of EVO parts (outlet valve)		
Rev D (Piston)	= Rev C + bigger piston diameter		
Flange hole circle diameter	66 mm or 75 mm		
Flange orientation	free		
Electrical connector orient- ation	45° or customization		
Hydraulic connection design	M14 x 1.5 or customization		
Hydraulic connection ori- entation	LP 240° or customization, HP 180° or customization		
Weight	Approx. 780 g		
Supply pressure	4 to 7 bar		
Operating temperature	-40 to 120°C		
Storage temperature	-40 to 70°C		
Compatible fuels	Unleaded fuels, E22, E85, M15		
Fuel temperature	80°C, short term 130°C		
Max. vibration	300m/s^2		
Connectors and Wires			
Electrical connector design	Series wire + compact connector		
	Series wire + motorsport connector		
	Motorsport wire + open end		
	Motorsport wire + motorsport		

Installation Notes

Mounting on cylinder head or adapter flag.

Available cam profiles on request.

Select the cam profile on fuel consumption requirements.

Avoid interference with FCV and hydraulic connections at flange orientation.

connector

Avoid interference with flange at electrical connector orientation.

Please specify the electrical connector design and the wire length with your order.

Ordering Information

Standard version

Series wire + compact connector Order number **F02U.V00.912-03**

Standard version

Series wire + motorsport connector Order number **F02U.V01.114-03**

Rev B (iPRV)

Order number on request

Rev C (EVO)

Order number on request

Rev D (Piston)

Order number on request

Accessories

Flat tappet (26 mm)

Order number F02U.V01.156-01

Roller tappet (26 mm)

Order number **F02U.V01.163-01**

HP Fuel Pump HDP 5-LW



Features

- ► Max. 1.1 cm³/rot_{cam}
- ► Max. 500 bar
- ▶ 585 g
- ► Integrated Flow Control Valve
- ► Internal Pressure Relief Valve

The HDP 5-LW is a compact high pressure single piston pump with a light weight housing. The design allows achieving a big delivery volume as well as high efficiency, as needed in motorsport applications. Modifications in the number of cam lobes and cam lifts allow different flow requirements to be addressed.

The HDP 5-LW is equipped with an internal pressure relief valve to limit the maximum fuel pressure. This pump does not require a fuel return line into the fuel tank

The pump has an integrated demand control for metering the amount of fuel supplied into the high pressure fuel system. It can be ordered with a compact connector or a motorsport connector. Depending on the requirements of your engine (e.g. fuel consumption over rotation ratio) we recommend different types of tappets, piston springs and cam profiles. Please notice: Fuel delivery and maximum driveshaft speed depend on cam profile and type of tappet.

Application

For high pressure manifold injection or gasoline direct injection

Technical Specifications

Mechanical Data

Mass flow Please see extra shee

Efficiency	Please see extra sheet
Body design	Lightweight
Flow capacity and max. engine speed	Depending on cam profile
Nominal pressure	500 bar or customization
Possible customization	
Rev C (EVO)	= Rev B + reduced internal restrictions + introduction of EVO parts (outlet valve)
Rev D (Piston)	= Rev C + bigger piston diameter
Flange hole circle diameter	66 mm or 75 mm
Flange orientation	Free
Electrical connector orientation	0° or customization
Hydraulic connection design	M14 x 1.5 or customization
Weight	Approx. 585 g
Supply pressure	4 to 7 bar
Operating temperature	-40 to 120°C
Storage temperature	-40 to 70°C
Compatible fuels	Unleaded fuels, E22, E85, M1
Fuel temperature	80°C, short term 130°C
Max. vibration	300m/s^2
Connectors and Wires	
Electrical connector design	Series wire + compact connector
	Series wire + motorsport con- nector
	Motorsport wire + open end
	Motorsport wire + motorsport connector
Hydraulic connection orienta-	Fixed

Installation Notes

Mounting on cylinder head or adapter flag.

Available cam profiles on request.

Select the cam profile on fuel consumption requirements.

Avoid interference with FCV and hydraulic connections at flange orientation.

Avoid interference with flange at electrical connector orientation.

Please specify the electrical connector design and the wire length with your order.

Ordering Information

Rev B (iPRV)

Order number on request

Rev C (EVO)

Order number on request

Rev D (Piston)

Order number on request

Accessories

Flat tappet (26 mm)

Order number **F02U.V01.156-01**

Roller tappet (26 mm)

Order number **F02U.V01.163-01**

Overview

Ignition Coil C90i-E8



- Max. 40 kV
- Max. 90 mJ
- Max. 5.0 kV/μs
- Max. 15,000 1/min
- Fits to spark plugs with a ceramic diameter of 8 mm

Ignition Coil C90i-E10



- Max. 40 kV
- Max. 90 mJ
- Max. 5.0 kV/μs
- Max. 15,000 1/min
- Fits to spark plugs with a ceramic diameter of 10 mm

Ignition Coil C90i-pro



- Max. 40 kV
- Max. 90 mJ
- Max. 5.0 kV/μs
- Max. 15,000 1/min
- Developed for Turbo-GDI engines

Ignition Coil C90i-pro evo



- Max. 40 kV
- Max. 90 mJ
- Boosted spark current
- Max. 15,000 1/min
- Developed for engines with high gas turbulences

Ignition Coil C90i-WG



- Max. 35 kV
- Max. 90 mJ
- Connection for high voltage wire
- Max. 15,000 1/min
- Developed for Turbo-GDI engines

Ignition Coil P50/P50-M



- Max. 35 kV
- Max. 50 mJ
- Max. 3.0 kV/μs
- Max. 10,000 1/min
- High voltage contacting via high voltage wire and spark plug connector possible

Ignition Coil P65



- Max. 35 kV
- Max. 65 mJ
- Max. 10,000 1/min
- · Developed for GDI engines

Ignition Coil P65-T



- Max. 33 kV
- Max. 65 mJ
- Max. 10,000 1/min (with reduced dwell time)
- · Developed for GDI engines

Ignition Coil P65-TWG



- Max. 33 kV
- Max. 65 mJ
- Connection for high voltage wire
- Max. 10,000 1/min (with reduced dwell time)
- Developed for GDI engines

Ignition Coil P65-WG



- Max. 35 kV
- Max. 65 mJ
- Connection for 30 kV high voltage wire with locking pin (European standard)
- Max. 10,000 1/min
- Developed for GDI engines

Ignition Coil P65-WS



- Max. 35 kV
- Max. 65 mJ
- Connection for high voltage wire according to SAE (American standard)
- Max. 10,000 1/min
- · Developed for GDI engines

Ignition Coil PS-T



- Max. 27 kV
- Max. 42 mJ
- Max. 1.5 kV/μs
- Max. 10,000 1/min

Ignition Coil C90i-E8



Features

► Max. 40 kV

► Max. 90 mJ

► Max. 5.0 kV/µs

► Max. 15,000 1/min

► Fits to spark plugs with a ceramic diameter of 8 mm

This single fire coil was developed for the use e.g. in GDI (turbocharged) high performance engines. It is designed for direct cylinder head mounting. For this single fire coil the customer can define the

length of the spark plug connector. The main benefits of this high performance coil are its high energy capability and a very good provided high voltage.

Application	
Spark energy	≤ 90 mJ
Primary current	≤ 16 A
Operating temperature range outer core	0 to 160°C
Storage temperature range	-40 to 100°C
Max. vibration	$\leq 480 \text{ m/s}^2 \text{ at } 50 \text{ to } 2,000 \text{ Hz}$

Technical Specifications

Mechanical Data

Length	80 to 225 mm, depending on customer requirements	
Weight w/o wire	< 270 g	
Mounting	Screw fastening	
Fits to spark plugs with a ceramic diameter of 8 mm		

Electrical Data

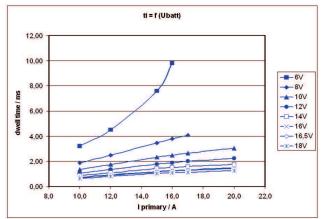
Electricat Data	
Primary resistance	185 mOhm
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 5.0 kV/µs
Max. high voltage at 1 MOhm 10 pF	≤ 40 kV
Spark current	≤ 160 mA
Spark duration at 1 kV \parallel 1 MOhm	≤ 1.1 ms
Noise supression	Inductive and 1 kOhm resistance
Suppression diode / EFU	Internal
Characteristic	
Characteristic Measured with power stage	IGBT IRG4BC40S (Uce=600 V)
	IGBT IRG4BC40S (Uce=600 V)
Measured with power stage	IGBT IRG4BC40S (Uce=600 V) On request
Measured with power stage Connectors and Wires	· ,
Measured with power stage Connectors and Wires Connector	On request
Measured with power stage Connectors and Wires Connector Mating connector	On request On request
Measured with power stage Connectors and Wires Connector Mating connector Pin 1	On request On request U _{batt} red
Measured with power stage Connectors and Wires Connector Mating connector Pin 1 Pin 2	On request On request U _{batt} red ECU ignition power stage blue
Measured with power stage Connectors and Wires Connector Mating connector Pin 1 Pin 2 Pin 3	On request On request U _{batt} red ECU ignition power stage blue Engine GND black

Various motorsport and automotive connectors are available on request.

Please specify the required wire length and the length of the spark plug connector with your order

Characteristic dwell times [ms]

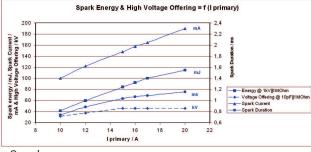
U _{batt}	l primary					
	10 A	12 A	15 A	16 A	17 A	20 A
6 V	3.2	4.5	7.6	9.8		
8 V	1.88	2.49	3.47	3.79	4.10	
10 V	1.35	1.76	2.34	2.51	2.67	3.05
12 V	1.06	1.35	1.77	1.89	2.00	2.24
14 V	0.87	1.11	1.43	1.52	1.60	1.79
16 V	0.74	0.93	1.20	1.28	1.34	1.49
16.5 V	0.71	0.90	1.15	1.23	1.29	1.43
18 V	0.64	0.81	1.03	1.10	1.15	1.27



Dwell time

Spark energy and provided high voltage

l prim.	Spark energy	-duration	-current	Hi voltage
10 A	41.4 mJ	0.74 ms	100 mA	31.6 kV
12 A	59.5 mJ	0.882 ms	122 mA	37.4 kV
15 A	84.4 mJ	1.034 ms	148 mA	45.7 kV
16 A	92.6 mJ	1.07 ms	158 mA	46 kV
17 A	100 mJ	1.09 ms	165 mA	46 kV
20 A	115 mJ	1.16 ms	190 mA	46 kV



Spark energy

Installation Notes

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 BIP.

For technical reasons the values of the coils may vary.

Please regard the specified limit values (see "Electrical Data").

Usage above Iprim = 16 A or 40 kV may reduce the lifetime.

Please find further application hints in the offer drawing at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

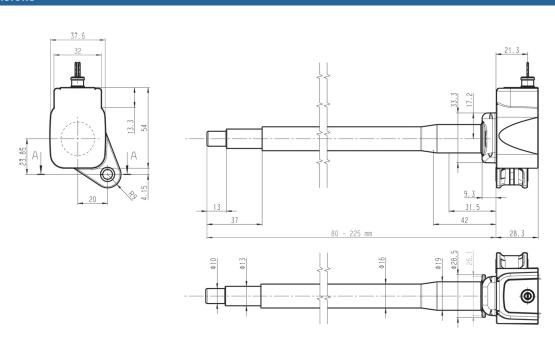
Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil C90i-E8

Order number depending on customer requirements



Ignition Coil C90i-E10



Features

► Max. 40 kV

► Max. 90 mJ

► Max. 5.0 kV/µs

► Max. 15,000 1/min

► Fits to spark plugs with a ceramic diameter of 10 mm

This single fire coil was developed for the use e.g. in GDI (turbocharged) high performance engines. It is designed for direct cylinder head mounting. For this single fire coil the customer can define the length of the spark plug connector.

The main benefits of this high performance coil are its high energy capability and a very good provided high voltage.

Application	
Spark energy	≤ 90 mJ
Primary current	≤ 16 A
Operating temperature range outer core	0 to 160°C
Storage temperature range	-40 to 100°C
Max. vibration	$\leq 480 \text{ m/s}^2 \text{ at } 50 \text{ to } 2,000 \text{ Hz}$

Technical Specifications

Mechanical Data

Length	114 to 225 mm, depending on customer requirements
Weight w/o wire	< 270 g
Mounting	Screw fastening
Fits to spark plugs with a ce	ramic diameter of 10 mm

Electrical Data

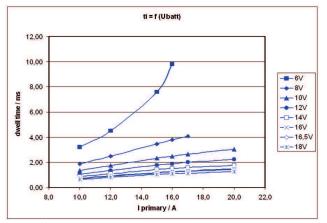
Electricat Data	
Primary resistance	185 mOhm
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 5.0 kV/µs
Max. high voltage at 1 MOhm 10 pF	≤ 40 kV
Spark current	≤ 160 mA
Spark duration at 1 kV \parallel 1 MOhm	≤ 1.1 ms
Noise suppression	Inductive and 1 kOhm resistance
Suppression diode / EFU	Internal
Characteristic	
Measured with power stage	IGBT IRG4BC40S (Uce=600 V)
Connectors and Wires	
Connector	On request
Mating connector	On request
Pin 1	U _{batt} red
Pin 2	ECU ignition power stage blue
Pin 3	Engine GND black
Wire length	100 cm
Wire size	AWG 20/22

Various motorsport and automotive connectors are available on request.

Please specify the required wire length and the length of the spark plug connector with your order

Characteristic dwell times [ms]

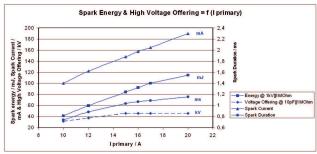
U batt	l primary					
	10 A	12 A	15 A	16 A	17 A	20 A
6 V	3.2	4.5	7.6	9.8		
8 V	1.88	2.49	3.47	3.79	4.10	
10 V	1.35	1.76	2.34	2.51	2.67	3.05
12 V	1.06	1.35	1.77	1.89	2.00	2.24
14 V	0.87	1.11	1.43	1.52	1.60	1.79
16 V	0.74	0.93	1.20	1.28	1.34	1.49
16.5 V	0.71	0.90	1.15	1.23	1.29	1.43
18 V	0.64	0.81	1.03	1.10	1.15	1.27



Dwell time

Spark energy and provided high voltage

l prim.	Spark energy	-duration	-current	Hi voltage
10 A	41.4 mJ	0.74 ms	100 mA	31.6 kV
12 A	59.5 mJ	0.882 ms	122 mA	37.4 kV
15 A	84.4 mJ	1.034 ms	148 mA	45.7 kV
16 A	92.6 mJ	1.07 ms	158 mA	46 kV
17 A	100 mJ	1.09 ms	165 mA	46 kV
20 A	115 mJ	1.16 ms	190 mA	46 kV



Spark energy

Installation Notes

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 BIP.

For technical reasons the values of the coils may vary.

Please regard the specified limit values (see "Electrical Data").

Usage above Iprim = 16 A or 40 kV may reduce the lifetime.

Please find further application hints in the offer drawing at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

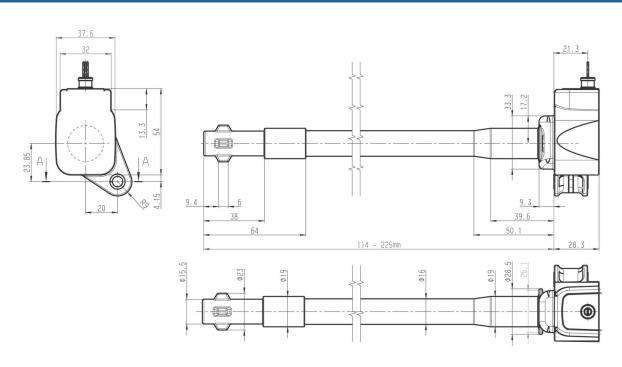
Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil C90i-E10

Order number depending on customer requirements



Ignition Coil C90i-pro



Features

► Max. 40 kV

► Max. 90 mJ

► Max. 5.0 kV/µs

► Max. 15,000 1/min

▶ Developed for Turbo-GDI engines

This single fire coil was developed for the use e.g. in GDI (turbocharged) high performance engines. It is designed for direct cylinder head mounting. The main benefits of this high performance coil are its high energy capability and a very good provided high voltage.

Application Spark energy ≤ 90 mJ Primary current ≤ 16 A Operating temperature range outer core 0 to 160°C Storage temperature range -40 to 100°C Max. vibration ≤ 480 m/s² at 50 to 2,000 Hz

Technical Specifications				
Mechanical Data				
168 mm				
250 g				
screw fastening				
185 mOhm				
Incapable of measurement				
≤ 5.0 kV/µs				

Max. high voltage at 1 MOhm 10 pF	≤ 40 kV
Spark current	≤ 160 mA
Spark duration at 1 kV \parallel 1 MOhm	≤ 1.1 ms
Noise suppression	Inductive
Suppression diode / EFU	Internal
Characteristic	
Measured with power stage	IGBT IRG4BC40S (Uce=600 V)
Connectors and Wires	
Connectors and Wires Connector	On request
	On request On request
Connector	<u> </u>

Various motorsport and automotive connectors are available on request.

Engine GND black

Ceramic diameter d = 10 mm

 $100\,\text{cm}$

AWG 20/22

Please specify the required wire length and the length of the spark plug connector with your order

Characteristic dwell times [ms]

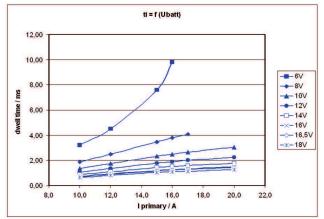
Pin 3

Wire length

For spark plugs

Wire size

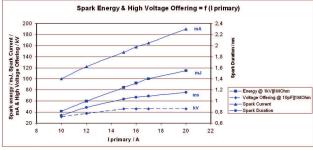
$\mathbf{U}_{\mathrm{batt}}$		l primary				
	10 A	12 A	15 A	16 A	17 A	20 A
6 V	3.2	4.5	7.6	9.8		
8 V	1.88	2.49	3.47	3.79	4.10	
10 V	1.35	1.76	2.34	2.51	2.67	3.05
12 V	1.06	1.35	1.77	1.89	2.00	2.24
14 V	0.87	1.11	1.43	1.52	1.60	1.79
16 V	0.74	0.93	1.20	1.28	1.34	1.49
16.5 V	0.71	0.90	1.15	1.23	1.29	1.43
18 V	0.64	0.81	1.03	1.10	1.15	1.27



Dwell time

Spark energy and provided high voltage

I prim.	Spark energy	-duration	-current	Hi voltage
10 A	41.4 mJ	0.74 ms	100 mA	31.6 kV
12 A	59.5 mJ	0.882 ms	122 mA	37.4 kV
15 A	84.4 mJ	1.034 ms	148 mA	45.7 kV
16 A	92.6 mJ	1.07 ms	158 mA	46 kV
17 A	100 mJ	1.09 ms	165 mA	46 kV
20 A	115 mJ	1.16 ms	190 mA	46 kV



Spark energy

Installation Notes

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 BIP.

For technical reasons the values of the coils may vary.

Please regard the specified limit values (see "Electrical Data").

Usage above Iprim = 16 A or 40 kV may reduce the lifetime.

Please find further application hints in the offer drawing at our homepage.

Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

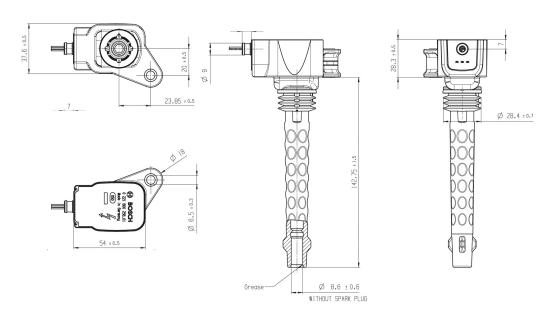
Ordering Information

Single Fire Coil C90i-pro

Sample manufactured Order number **0221.B00.256-01**

Single Fire Coil C90i-pro

Order number F037.000.996



Ignition Coil C90i-pro evo



Features

- ► Max. 40 kV
- ► Max. 90 mJ
- ▶ Boosted spark current
- ► Max. 15,000 1/min
- ► Developed for engines with high gas turbulences

This single fire coil was developed for engines that need a stable spark because of their higher turbulences at the air fuel mixture inside the cylinder. It is designed for direct cylinder head mounting. The main benefits of this high performance coil are its high energy capability and a very good provided high voltage.

Application	
Spark energy	≤ 90 mJ
Primary current	≤ 16 A
Operating temperature range outer core	0 to 160°C
Storage temperature range	-40 to 100°C
Max. vibration	$\leq 480 \text{ m/s}^2 \text{ at } 50 \text{ to } 2,000 \text{ Hz}$

Mechanical Data	
Length	168 mm
Weight w/o wire	250 g

Technical Specifications

Mounting

Flootwicel Date

Electrical Data	
Primary resistance	185 mOhm
Secondary resistance	Incapable of measurement

screw fastening

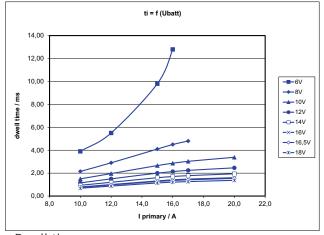
High voltage rise time	≤ 5.0 kV/µs
Max. high voltage at 1 MOhm 10 pF	≤ 40 kV
Spark current	≤ 265 mA
Spark duration at $1 \text{ kV} \parallel 1$ MOhm	≤ 0.65 ms
Noise suppression	Inductive
Suppression diode / EFU	Internal
Characteristic	
Measured with power stage	IGBT IRG4BC40S (Uce=600 V)
Connectors and Wires	
Connector	On request
Mating connector	On request
Pin 1	$U_{batt}red$
Pin 2	ECU ignition power stage blue
Pin 3	Engine GND black
Wire length	100 cm
Wire size	AWG 20/22
For spark plugs	Ceramic diameter d = 10 mm
Various motorsport and automoquest.	otive connectors are available on re-

Characteristic dwell times [ms]

plug connector with your order

U batt	l primary					
	10 A	12 A	15 A	16 A	17 A	20 A
6 V	3.90	5.50	9.80	12.80		
8 V	2.15	2.90	4.10	4.50	4.80	
10 V	1.50	1.96	2.66	2.86	3.03	3.38
12 V	1.15	1.50	2.00	2.13	2.24	2.46
14 V	0.94	1.20	1.60	1.70	1.78	1.94
16 V	0.79	1.00	1.32	1.41	1.48	1.60
16.5 V	0.76	0.97	1.27	1.35	1.42	1.54
18 V	0.68	0.69	1.14	1.21	1.26	1.37

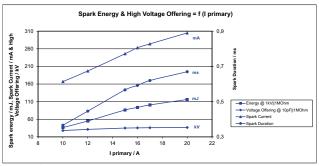
Please specify the required wire length and the length of the spark



Dwell time

Spark energy and provided high voltage

I prim.	Spark energy	-duration	-current	Hi voltage
10 A	36.5 mJ	0.366 ms	167 mA	28 kV
12 A	55 mJ	0.446 ms	197 mA	31.3 kV
15 A	86.2 mJ	0.567 ms	246 mA	35 kV
16 A	93.6 mJ	0.592 ms	263 mA	35.6 kV
17 A	100.7 mJ	0.62 ms	274 mA	36 kV
20 A	116 mJ	0.67 ms	305 mA	36.6 kV



Spark Energy

Installation Notes

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 BIP.

For technical reasons the values of the coils may vary.

Please regard the specified limit values (see "Electrical Data").

Usage above Iprim = 16 A or 40 kV may reduce the lifetime.

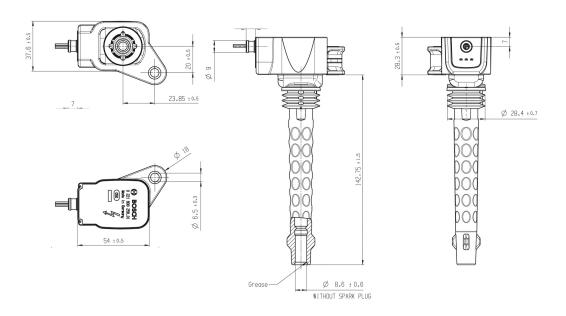
Please find further application hints in the offer drawing at our homepage.

Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil C90i-pro evoOrder number **F037.000.997**



Ignition Coil C90i-WG



Features

- ► Max. 35 kV
- ► Max. 90 mJ
- ► Connection for high voltage wire
- ► Max. 15,000 1/min
- ► Developed for Turbo-GDI engines

This single fire coil was developed for the use e.g. in GDI (turbocharged) high performance engines. It is designed to connect a high voltage wire on the coil. The main benefit of this high performance coil is its high energy capability.

Application Spark energy ≤ 90 mJ Primary current ≤ 16 A Operating temperature range outer core 0 to 160°C Storage temperature range -40 to 100°C Max. vibration ≤ 250 m/s² at 50 to 2,000 Hz

Technical Specifications			
83 mm			
210 g			
screw fastening			
185 mOhm			
Incapable of measurement			
≤ 5.0 kV/µs			
≤ 35 kV			

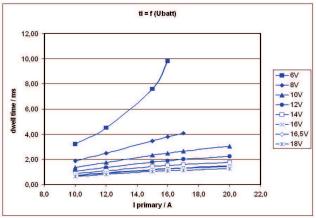
Spark current	≤ 160 mA
Spark duration at 1 kV \parallel 1 MOhm	≤ 1.1 ms
Noise suppression	Inductive
Suppression diode / EFU	Internal
Characteristic	
Measured with power stage	IGBT IRG4BC40S (Uce=600 V)
Connectors and Wires	
Connector primary side	On request
Mating connector primary side	On request
Pin 1	U _{batt} red
Pin 2	ECU ignition power stage blue
Pin 3	Engine GND black
Wire length	100 cm
Wire size	AWG 20/22
30 kV grid connectors	See Accessories
Various motorsport and automot quest.	ive connectors are available on re-

Characteristic dwell times [ms]

motorsport connector.

$\mathbf{U}_{\mathrm{batt}}$	l primary					
	10 A	12 A	15 A	16 A	17 A	20 A
6 V	3.2	4.5	7.6	9.8		
8 V	1.88	2.49	3.47	3.79	4.10	
10 V	1.35	1.76	2.34	2.51	2.67	3.05
12 V	1.06	1.35	1.77	1.89	2.00	2.24
14 V	0.87	1.11	1.43	1.52	1.60	1.79
16 V	0.74	0.93	1.20	1.28	1.34	1.49
16.5 V	0.71	0.90	1.15	1.23	1.29	1.43
18 V	0.64	0.81	1.03	1.10	1.15	1.27

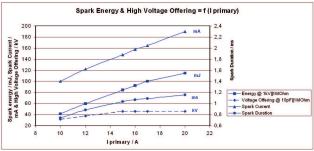
Please specify the required wire length if you order the coil with a



Dwell time

Spark energy and provided high voltage

I prim.	Spark energy	-duration	-current	Hi voltage
10 A	41.4 mJ	0.74 ms	100 mA	31.6 kV
12 A	59.5 mJ	0.882 ms	122 mA	37.4 kV
15 A	84.4 mJ	1.034 ms	148 mA	45.7 kV
16 A	92.6 mJ	1.07 ms	158 mA	46 kV
17 A	100 mJ	1.09 ms	165 mA	46 kV
20 A	115 mJ	1.16 ms	190 mA	46 kV



Spark energy

Installation Notes

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 (high voltage wire).

This coil is only for use with engine control units having an integrated ignition power stage, e.g. IGBT IRG4BC40S or BIP.

For technical reasons the values of the coils may vary.

Please regard the specified limit values (see "Electrical Data").

Usage above Iprim = 16 A or 35 kV may reduce the lifetime.

Please find further application hints in the offer drawing at our homepage.

Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil C90i-WG

Order number F02U.V02.430-01

Accessories

High Voltage Connector straight

Please ask your local Bosch Service Order number **0356.200.015**

High Voltage Connector angled

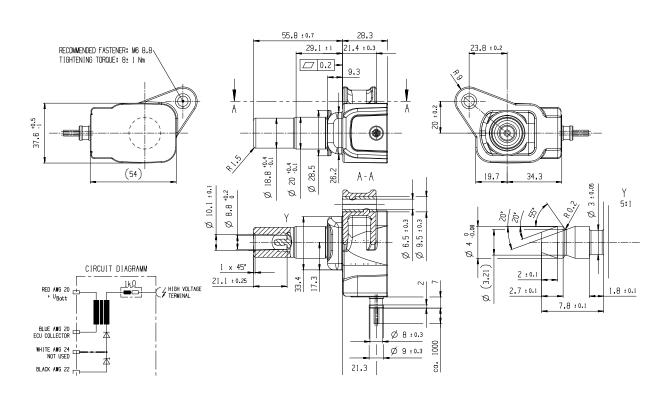
Please ask your local Bosch Service Order number **0356.250.035**

M3 Connector inside (required for every HV Connector)

Please ask your local Bosch Service Order number **1350.521.001**

High Voltage Wire 50 m

Please ask your local Bosch Service Order number **5956.563.015**



Ignition Coil P50/P50-M



Features

► Max. 35 kV

► Max. 50 mJ

► Max. 3.0 kV/µs

► Max. 10,000 1/min

► High voltage contacting via high voltage wire and spark plug connector possible

The single fire coil P50 is a low cost concept designed for direct mounting to the cylinder head. A high voltage ignition wire can optionally be connected to the secondary output terminal.

The coil P50 requires an ECU with internal ignition power stages for each single fire coil.

The coil P50-M is specifically for motorsport applications. This coil is operable in higher vibration environments.

Application	
Spark energy	≤ 50 mJ
Primary current	≤ 8.5 A
Operating temperature range at outer core	-20 to 140°C
Storage temperature range	-40 to 100°C
Max. vibration	Please see Variations

Technical Specifications

Variations

	P50	P50-M
Max. vibration	\leq 400 m/s ² at 5 to 2,000 Hz	\leq 800 m/s ² at 5 to 2,000 Hz
Weight	223 g	265 g
Spark plug connector	-	+

Mechanical Data

Weight	Please see Variations
Mounting	Pluggable
Electrical Data	
Primary resistance with wire	370 mOhm
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 3.0 kV/µs
Max. high voltage at 1 MOhm∥10 pF	≤ 35 kV
Spark current	≤ 92 mA
Spark duration at 1 kV ∥ 1 MOhm	≤ 1.15 ms
Noise suppression	With spark plug connector
Suppression diode / EFU	Integrated
Characteristic	

Measured with power stage Connectors and Wires

Connector	Bosch Compact
Mating connector 3-pole Compact	D261.205.335-01
Pin 1	ECU ignition power stage
Pin 2	Engine GND
Pin 3	U_{batt}

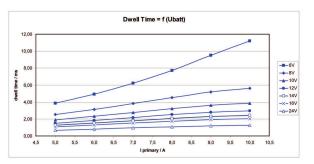
IGBT IRG4BC40S (U_{ce}=600 V)

Various motorsport and automotive connectors are available on request.

For spark plugs Ceramic diameter d=10 mm

Characteristic dwell times [ms]

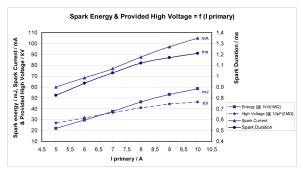
U batt			Ιp	rimary		
	5.0 A	6.0 A	7.0 A	8.0 A	9.0 A	10 A
6 V	3.84	4.93	6.2	7.7	9.5	11.2
8 V	2.54	3.14	3.81	4.51	5.17	5.61
10 V	1.9	2.33	2.76	3.21	3.62	3.87
12 V	1.51	1.84	2.17	2.51	2.8	2.97
14 V	1.26	1.52	1.79	2.06	2.29	2.42
16 V	1.07	1.3	1.53	1.74	1.93	2.04
18 V	0.94	1.13	1.32	1.51	1.67	1.77
24 V	0.68	0.81	0.95	1.08	1.19	1.26
30 V	0.53	0.63	0.74	0.84	0.93	0.98



Dwell time

Spark energy and provided high voltage

I prim.	Spark energy	-duration	-current	Hi voltage
5 A	22 mJ	0.82 ms	60 mA	26.8 kV
6 A	29.7 mJ	0.93 ms	68.5 mA	31.6 kV
7 A	37.5 mJ	1.03 ms	77 mA	36.4 kV
8 A	46.3 mJ	1.12 ms	87.5 mA	40.9 kV
9 A	53 mJ	1.17 ms	97 mA	44.4 kV
10 A	58.4 mJ	1.21 ms	105 mA	46.3 kV



Spark energy

Installation Notes

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 P50 has no integrated transistor and requires an ECU with internal ignition power stages, e.g. IGBT IRG4BC40S or BIP.

For technical reasons the values of the coils may vary.

Please regard the specified limit values.

Usage above Iprim > 8.5 A or 35 kV may reduce the lifetime.

Please find further application hints in the offer drawing at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil P50

Order number 0221.504.001

Ignition Coil P50-M

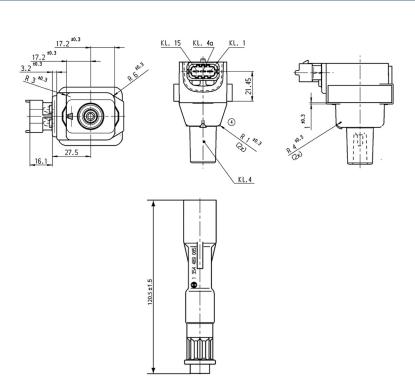
Motorsport version

Order number F02U.V00.869-01

Accessories

Accessory spark plug connector

Order number 1354.489.085



Ignition Coil P65



Features

► Max. 35 kV

► Max. 65 mJ

► Max. 10,000 1/min

► Developed for GDI engines

This single fire coil is a low cost concept, designed to get connected to the spark plug via a high voltage wire. The high voltage connector is specified according to the SAE standard.

The performance of the coil fulfills the demands of modern GDI engines.

The main benefits of this product are the high packaging flexibility and its high electrical performance at low costs.

Application	
Spark energy	≤ 65 mJ
Primary current	≤ 7.5 A
Operating temperature range at outer core	-20 to 140°C
Storage temperature range	-40 to 100°C
Max. vibration	\leq 250 m/s ² at 5 to 2,500 Hz

Technical Specifications		
Mechanical Data		
Length	180 mm	
Weight w/o wire	225 g	
Mounting	Screw fastening	
Fits to spark plugs with a ce	ramic diameter of 10 mm	
Electrical Data		
Primary resistance	570 mOhm	

Secondary resistance	Incapable of measurement
High voltage rise time	≤ 1.9 kV/µs
Max. high voltage at 1 MOhm 10 pF	≤ 35 kV
Spark current	≤ 74 mA
Spark duration at 1 kV 1 MOhm	≤ 2.0 ms
Noise suppression	Inductive and 1 kOhm resistance
Suppression diode / EFU	Integrated
Characteristic	
Measured with power stage	IGBT IRG4BC40S (U _{ce} =600 V)
Connectors and Wires	
Connector	Tyco AMP
Mating connector	D261.205.350-01
Pin 1	Engine GND
Pin 2	U_{batt}
Pin 3	ECU ignition power stage

Characteristic dwell times [ms]

U batt		l primary				
	5.0 A	6.0 A	7.0 A	7.5 A	8.0 A	8.5 A
6 V	8.74	18.5				
8 V	4.5	6.4	9	10.8	13.9	
10 V	3.1	4.2	5.4	6	6.6	7.2
12 V	2.36	3.1	3.88	4.25	4.63	4.92
14 V	1.9	2.48	3.05	3.32	3.57	3.77
16 V	1.61	2.06	2.53	2.73	2.93	3.08
18 V	1.55	2	2.43	2.62	2.81	2.95
20 V	1.39	1.77	2.16	2.33	2.48	2.6
22 V	1.22	1.54	1.88	2.02	2.15	2.26
24 V	0.97	1.23	1.49	1.6	1.71	1.78

Measured values are without loom resistance. Loom resistance must be less than the primary resistance. The needed dwell time is to be verified through current measurement

Spark energy and provided high voltage

I prim.	Spark energy	-duration	-current	Hi voltage
5 A	37.8 mJ	1.46 ms	49 mA	24.3 kV
6 A	54.5 mJ	1,74 ms	59 mA	28.9 kV
7 A	69.8 mJ	1.97 ms	69 mA	33.2 kV
7.5 A	77.6 mJ	2.04 ms	74 mA	35.8 kV
8 A	83.0 mJ	2.11 ms	77 mA	37.7 kV
8.5 A	88.0 mJ	2.16 ms	81 mA	39.0 kV

Installation Notes

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 P65 has no integrated transistor and requires an ECU with internal ignition power stages, e.g. IGBT IRG4BC40S or BIP.

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 at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

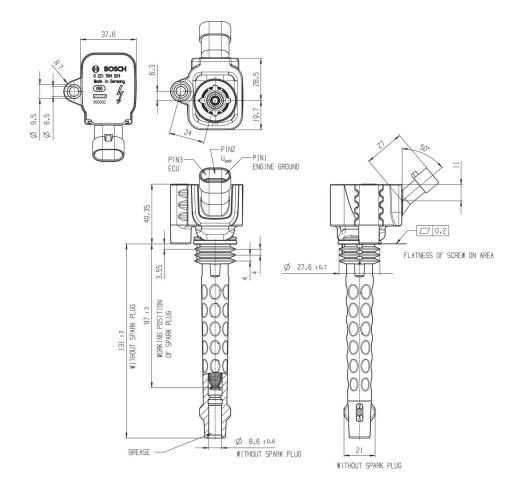
Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil P65

Order number 0221.504.024



Ignition Coil P65-T



Features

► Max. 33 kV

► Max. 65 mJ

► Max. 10,000 1/min (with reduced dwell time)

► Developed for GDI engines

This single fire coil is a low cost concept designed for direct mounting on the cylinder head. The coil P65-T has an integrated transistor and requires an ECU with internal ignition drivers.

Application	
Spark energy	≤ 65 mJ
Primary current	≤ 7.0 A
Operating temperature range at outer core	-40 to 140°C
Storage temperature range	-40 to 140°C
Max. vibration	\leq 480 m/s ² at 5 to 2,000 Hz

Technical Specifications Mechanical Data

Length	143 mm
Weight	223 g
Mounting	Screw fastening

Fits to spark plugs with a ceramic diameter of 10 mm

FI	lectrical	Data

Primary resistance with wire	Incapable of measurement
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 1.4 kV/µs
Max. high voltage at 1 MOhm 10 pF	≤ 33 kV

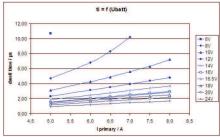
Spark current	≤ 70 mA
Spark duration at 1 kV 1 MOhm	≤ 1.85 ms
Noise suppression	Inductive and 1 kOhm resistance
Integrated suppression diode / EFU	
Integrated power stage	
Characteristic	
Measured with power stage	BIP 385
Connectors and Wires	

Connector	Tyco 0-1488991-1
Mating connector	F02U.B00.555-01
Pin 1	ECU ignition signal
Pin 2	ECU GND
Pin 3	Uhatt

Characteristic dwell times [ms]

U batt	l primary					
	5.0 A	5.5 A	6.0 A	6.5 A	7.0 A	7.5 A
Max. 1000 /min	10	9	8	7	6	5
6 V	10.7	11.6				
8 V	4.7	5.4	6.8	8.3	10.2	
10 V	3.1	3.55	4.25	4.87	5.6	6.3
12 V	2.32	2.66	3.12	3.51	3.94	4.36
14 V	1.86	2.1	2.45	2.75	3.07	3.36
16 V	1.55	1.77	2.03	2.26	2.51	2.73
16.5 V	1.49	1.7	1.95	2.17	2.40	2.61
18 V	1.34	1.51	1.73	1.92	2.13	2.31
20 V	1.16	1.33	1.51	1.67	1.85	2.0
24 V	0.93	1.05	1.19	1.32	1.45	1.57

Measured values are without loom resistance. Loom resistance must be less than the primary resistance. The needed dwell time is to be verified through current measurement

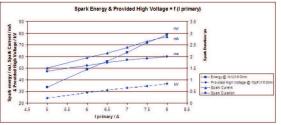


Dwell time

Spark energy and provided high voltage

I prim.	Spark energy	-duration	-current	Hi voltage
5 A	33.7 mJ	1.37 ms	50 mA	24.4 kV
5.5 A	42 mJ	1.54 ms	54 mA	27.0 kV

6 A	48.9 mJ	1.62 ms	59 mA	29.1 kV
6.5 A	55.9 mJ	1.74 ms	63 mA	31.2 kV
7 A	63.6 mJ	1.85 ms	68 mA	33.2V
7.5 A	71.9 mJ	1.92 ms	73 mA	34.7 kV



Spark energy

Installation Notes

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 P65-T has an integrated transistor and requires an ECU with internal ignition drivers with 10 to 20 mA current output.

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 at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

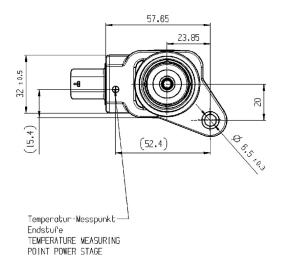
Design Note

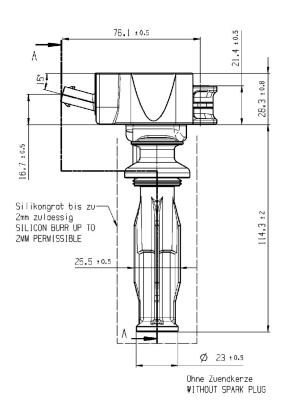
We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

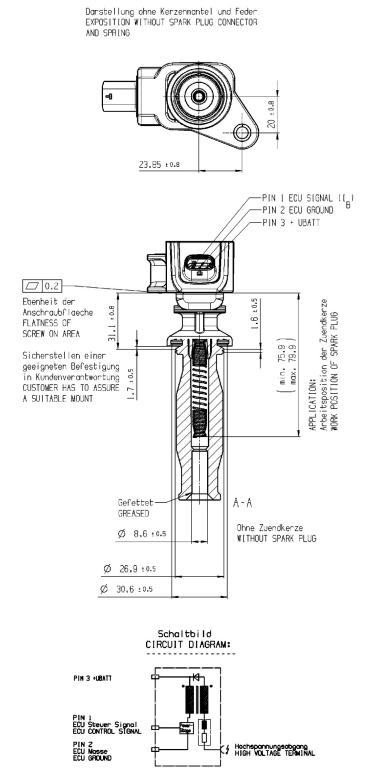
Ordering Information

Ignition Coil P65-T

Order number 0221.604.024







Ignition Coil P65-TWG



Features

- ► Max. 33 kV
- ► Max. 65 mJ
- ► Connection for high voltage wire
- ► Max. 10,000 1/min (with reduced dwell time)
- ► Developed for GDI engines

This single fire coil is a low cost concept designed to connect a high voltage wire on the coil.

The coil has an integrated transistor and requires an ECU with internal ignition drivers.

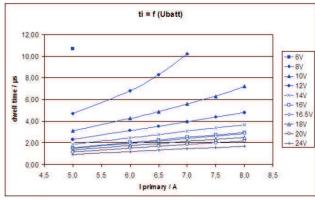
Application	
Spark energy	≤ 65 mJ
Primary current	≤ 7.0 A
Operating temperature range at outer core	-40 to 140°C
Storage temperature range	-40 to 140°C
Max. vibration	$\leq 250 \text{ m/s}^2 \text{ at } 5 \text{ to } 2,000 \text{ Hz}$

Technical Specifications	
Mechanical Data	
Length	83 mm
Weight	210 g
Mounting	Screw fastening
Electrical Data	
Primary resistance with wire	Incapable of measurement
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 1.4 kV/µs
Max. high voltage at	≤ 33 kV
Spark current	≤ 70 mA

Spark duration at 1 kV \parallel 1 MOhm	≤ 1.85 ms
Noise suppression	Inductive and 1 kOhm resistance
Integrated suppression diode / EFU	
Integrated power stage	
Characteristic	
Measured with power stage	BIP 385
Connectors and Wires	
Connector primary side	Tyco 0-1488991-1
Mating connector primary side	F02U.B00.555-01
Pin 1	ECU ignition signal
Pin 2	ECU GND
Pin 3	U_{batt}
30 kV grid connector	See Accessories

Characteristic dwell times [ms]

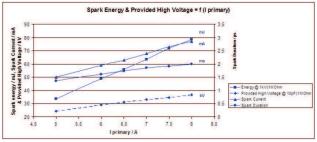
U _{batt}	l primary							
	5.0 A	5.5 A	6.0 A	6.5 A	7.0 A	7.5 A		
Max. 1000 /min	10	9	8	7	6	5		
6 V	10.7	11.6						
8 V	4.7	5.4	6.8	8.3	10.2			
10 V	3.1	3.55	4.25	4.87	5.6	6.3		
12 V	2.32	2.66	3.12	3.51	3.94	4.36		
14 V	1.86	2.1	2.45	2.75	3.07	3.36		
16 V	1.55	1.77	2.03	2.26	2.51	2.73		
16.5 V	1.49	1.7	1.95	2.17	2.40	2.61		
18 V	1.34	1.51	1.73	1.92	2.13	2.31		
20 V	1.16	1.33	1.51	1.67	1.85	2.0		
24 V	0.93	1.05	1.19	1.32	1.45	1.57		



Dwell time

Spark energy and provided high voltage

l prim.	Spark energy	-duration	-current	Hi voltage
5 A	33.7 mJ	1.37 ms	50 mA	24.4 kV
5.5 A	42 mJ	1.54 ms	54 mA	27.0 kV
6 A	48.9 mJ	1.62 ms	59 mA	29.1 kV
6.5 A	55.9 mJ	1.74 ms	63 mA	31.2 kV
7 A	63.6 mJ	1.85 ms	68 mA	33.2V
7.5 A	71.9 mJ	1.92 ms	73 mA	34.7 kV



Spark Energy

Installation Notes

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 (high voltage wire).

The coil P65-T has an integrated transistor and requires an ECU with internal ignition drivers with 10 to 20 mA current output.

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 at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil P65-TWG

Order number F02U.V02.429-01

Accessories

High Voltage Connector straight

Please ask your local Bosch Service Order number **0356.200.015**

High Voltage Connector angled

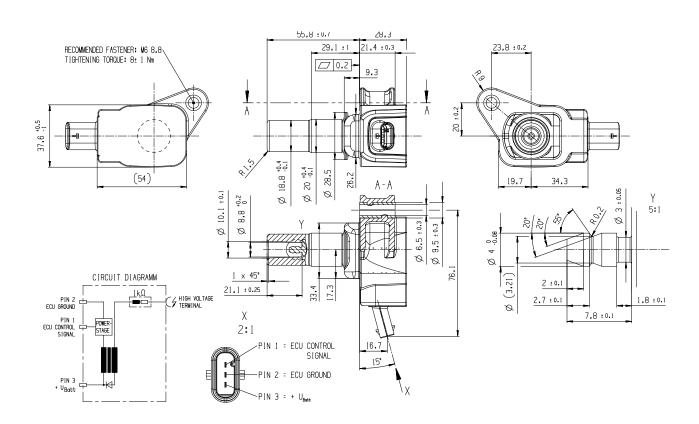
Please ask your local Bosch Service Order number **0356.250.035**

M3 Connector inside (required for every HV Connector)

Please ask your local Bosch Service Order number **1350.521.001**

High Voltage Wire 50 m

Please ask your local Bosch Service Order number **5956.563.015**



Ignition Coil P65-WG



Features

- ► Max. 35 kV
- ► Max. 65 mJ
- ► Connection for 30 kV high voltage wire with locking pin (European standard)
- ► Max. 10,000 1/min
- ► Developed for GDI engines

Technical Specifications

This single fire coil is a low cost concept, designed to get connected to the spark plug via a high voltage wire. The high voltage connector is specified according to the European standard.

The performance of the coil fulfills the demands of modern GDI engines.

The main benefits of this product are the high packaging flexibility and its high electrical performance at low costs.

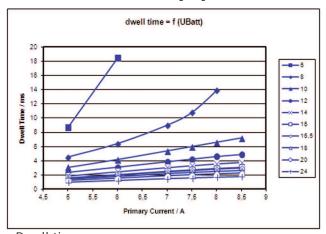
≤ 65 mJ
≤ 7.5 A
-20 to 140°C
-40 to 100°C
\leq 250 m/s ² at 5 to 2,500 Hz

Mechanical Data	
Length	See offer drawing
Weight w/o wire	< 222 g
Mounting	Screw fastening

Electrical Data

Primary resistance	570 mOhm
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 1.9 kV/µs
Max. high voltage at 1 MOhm 10 pF	≤ 35 kV
Spark current	≤ 74 mA
Spark duration at 1 kV \parallel 1 MOhm	≤ 2.0 ms
Noise suppression	Inductive and 1 kOhm resistance
Suppression diode / EFU	Integrated
Characteristic	
Measured with power stage	IGBT IRG4BC40S (U _{ce} =600 V)
Connectors and Wires	
Connector	Tyco AMP
Mating connector	D261.205.350-01
Pin 1	Engine GND
Pin 2	U_{batt}
	ECU ignition power stage

Characteristic dwell times [ms]

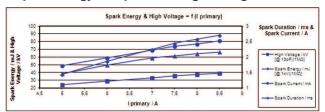


Dwell time

U batt			Iр	rimary		
	5.0 A	6.0 A	7.0 A	7.5 A	8.0 A	8.5 A
6 V	8.74	18.5				
8 V	4.5	6.4	9	10.8	13.9	
10 V	3.1	4.2	5.4	6	6.6	7.2
12 V	2.36	3.1	3.88	4.25	4.63	4.92
14 V	1.9	2.48	3.05	3.32	3.57	3.77
16 V	1.61	2.06	2.53	2.73	2.93	3.08
18 V	1.55	2	2.43	2.62	2.81	2.95
20 V	1.39	1.77	2.16	2.33	2.48	2.6
22 V	1.22	1.54	1.88	2.02	2.15	2.26
24 V	0.97	1.23	1.49	1.6	1.71	1.78

Measured values are without loom resistance. Loom resistance must be less than the primary resistance. The needed dwell time is to be verified through current measurement

Spark energy and provided high voltage



Spark energy

I prim.	Spark energy	-duration	-current	Hi voltage
5 A	37.8 mJ	1.46 ms	49 mA	24.3 kV
6 A	54.5 mJ	1,74 ms	59 mA	28.9 kV
7 A	69.8 mJ	1.97 ms	69 mA	33.2 kV
7.5 A	77.6 mJ	2.04 ms	74 mA	35.8 kV
8 A	83.0 mJ	2.11 ms	77 mA	37.7 kV
8.5 A	88.0 mJ	2.16 ms	81 mA	39.0 kV

Installation Notes

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 P65 has no integrated transistor and requires an ECU with internal ignition power stages, e.g. IGBT IRG4BC40S or BIP.

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 at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil P65-WG

Order number F02U.V01.927-01

Accessories

High Voltage Connector straight

Please ask your local Bosch Service Order number **0356.200.015**

High Voltage Connector angled

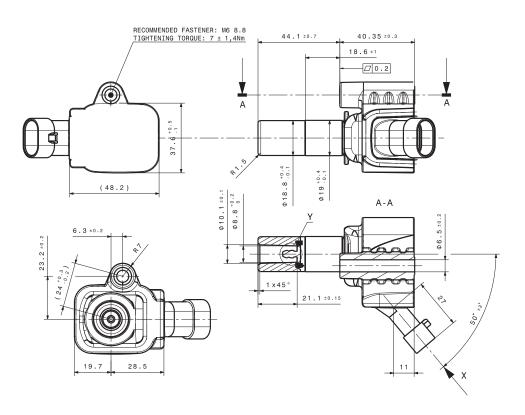
Please ask your local Bosch Service Order number **0356.250.035**

M3 Connector inside (required for every HV Connector)

Please ask your local Bosch Service Order number 1350.521.001

High Voltage Wire 50 m

Please ask your local Bosch Service Order number **5956.563.015**



Ignition Coil P65-WS



Features

- ► Max. 35 kV
- ► Max. 65 mJ
- ► Connection for high voltage wire according to SAE (American standard)
- ► Max. 10,000 1/min
- ► Developed for GDI engines

This single fire coil is a low cost concept, designed to get connected to the spark plug via a high voltage wire. The high voltage connector is specified according to the SAE standard.

The performance of the coil fulfills the demands of modern GDI engines.

The main benefits of this product are the high packaging flexibility and its high electrical performance at low costs.

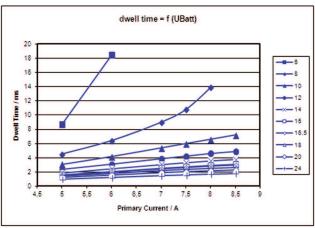
≤ 65 mJ
≤ 7.5 A
-20 to 140°C
-40 to 100°C
\leq 250 m/s ² at 5 to 2,500 Hz

Technical Specifications			
Mechanical Data			
Length	See offer drawing		
Weight w/o wire	< 222 g		
Mounting	Screw fastening		

Electrical Data

Primary resistance	570 mOhm
Secondary resistance	Incapable of measurement
High voltage rise time	≤ 1.9 kV/µs
Max. high voltage at 1 MOhm 10 pF	≤ 35 kV
Spark current	≤ 74 mA
Spark duration at 1 kV \parallel 1 MOhm	≤ 2.0 ms
Noise suppression	Inductive and 1 kOhm resistance
Suppression diode / EFU	Integrated
Characteristic	
Measured with power stage	IGBT IRG4BC40S (U _{ce} =600 V)
Connectors and Wires	
Connector	Tyco AMP
Mating connector	D261.205.350-01
Pin 1	Engine GND
Pin 2	U_{batt}
Pin 3	ECU ignition power stage

Characteristic dwell times [ms]

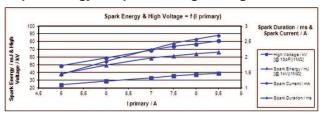


Dwell time

U batt			l p	rimary		
Datt	5.0 A	6.0 A	7.0 A	7.5 A	8.0 A	8.5 A
6 V	8.74	18.5				
8 V	4.5	6.4	9	10.8	13.9	
10 V	3.1	4.2	5.4	6	6.6	7.2
12 V	2.36	3.1	3.88	4.25	4.63	4.92
14 V	1.9	2.48	3.05	3.32	3.57	3.77
16 V	1.61	2.06	2.53	2.73	2.93	3.08
18 V	1.55	2	2.43	2.62	2.81	2.95
20 V	1.39	1.77	2.16	2.33	2.48	2.6
22 V	1.22	1.54	1.88	2.02	2.15	2.26
24 V	0.97	1.23	1.49	1.6	1.71	1.78

Measured values are without loom resistance. Loom resistance must be less than the primary resistance. The needed dwell time is to be verified through current measurement

Spark energy and provided high voltage



Spark energy

I prim.	Spark energy	-duration	-current	Hi voltage
5 A	37.8 mJ	1.46 ms	49 mA	24.3 kV
6 A	54.5 mJ	1,74 ms	59 mA	28.9 kV
7 A	69.8 mJ	1.97 ms	69 mA	33.2 kV
7.5 A	77.6 mJ	2.04 ms	74 mA	35.8 kV
8 A	83.0 mJ	2.11 ms	77 mA	37.7 kV
8.5 A	88.0 mJ	2.16 ms	81 mA	39.0 kV

Installation Notes

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 P65 has no integrated transistor and requires an ECU with internal ignition power stages, e.g. IGBT IRG4BC40S or BIP.

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 at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

Design Note

We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

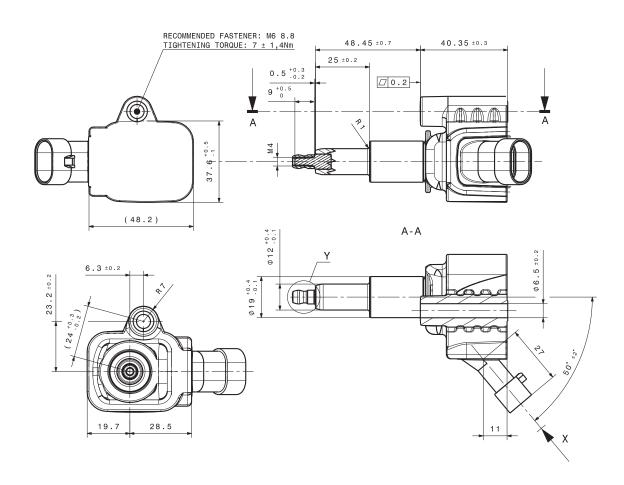
Ignition Coil P65-WS

Order number F02U.V01.926-01

Accessories

High Voltage Connector angled

Please ask your local Bosch Service Order number **0356.250.035**



Ignition Coil PS-T



Features

► Max. 27 kV

► Max. 42 mJ

► Max. 1.5 kV/µs

► Max. 10,000 1/min

This pencil coil is a basic low cost concept designed for cylinder head installation.

The coil PS-T has an integrated transistor and requires an ECU with internal ignition drivers. The coil is 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 at outer core Storage temperature range -40 to 100°C Max. vibration ≤ 800 m/s² at 5 to 2.500 Hz

Max. vibration \leq 800 m/s² at 5 to 2,500 Hz **Technical Specifications Mechanical Data** Diameter 22 mm Weight 202 g Mounting Screw fastening **Electrical Data** Primary resistance with wire Incapable of measurement Secondary resistance Incapable of measurement High voltage rise time $\leq 1.5 \, \text{kV/} \mu \text{s}$ Max. high voltage at ≤ 27 kV 1 MOhm || 10 pF

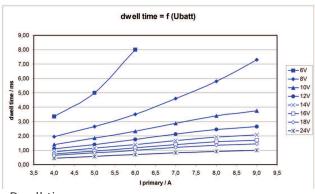
Spark current	≤ 80 mA
Spark duration at 1 kV \parallel 1 MOhm	≤ 1.1 ms
Noise suppression	Inductive
Suppression diode / EFU	Integrated
Power stage	Integrated
Characteristic	
Measured with power stage	BIP 355
Connectors and Wires	
Connector	Bosch Compact
Mating connector 4-pole Compact	D261.205.336-01
Pin 1	ECU ignition signal
Pin 2	ECU GND
Pin 3	Engine GND
Pin 4	U _{batt}
Various motorsport and automot	tive connectors are available on re-

Various motorsport and automotive connectors are available on request.

Characteristic dwell times [ms]

U batt	l primary					
	4.0 A	5.0 A	6.0 A	7.0 A	8.0 A	9.0 A
6 V	2.90	4.20	6.30	14.4	-	-
8 V	1.83	2.45	3.17	4.10	5.10	6.20
10 V	1.33	1.74	2.18	2.68	3.16	3.49
12 V	1.05	1.35	1.68	2.02	2.33	2.53
14 V	0.86	1.11	1.35	1.62	1.85	1.99
16 V	0.73	0.93	1.14	1.35	1.54	1.65
20 V	0.56	0.71	0.86	1.02	1.15	1.23
22 V	0.50	0.64	0.77	0.91	1.02	1.09
24 V	0.46	0.58	0.70	0.82	0.92	0.98

Measured values are without loom resistance. Loom resistance must be less than the primary resistance. The needed dwell time is to be verified through current measurement

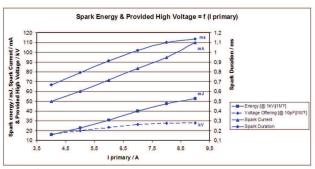


Dwell time

Spark energy and provided high voltage

I prim.	Spark energy	-duration	-currant	Hi voltage
4 A	15.0 mJ	0.650 ms	46 mA	15.6 kV

5 A	22.8 mJ	0.793 ms	62 mA	19.3 kV
6 A	30.2 mJ	0.904 ms	73 mA	22.7 kV
7 A	38.2 mJ	1.010 ms	84 mA	26.0 kV
8 A	47.9 mJ	1.101 ms	96 mA	28.8 kV
9 A	52.9 mJ	1.130 ms	100 mA	30.2 kV



Spark energy

Installation Notes

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-T has an integrated transistor and requires an ECU with internal ignition drivers, 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 at our homepage.

In case of ignition-caused malfunctions, please use screened sensor wires.

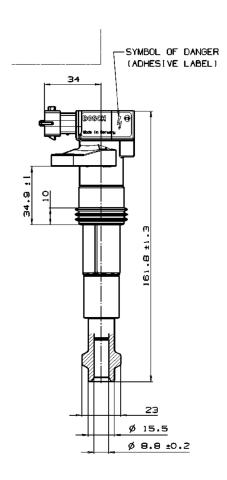
Design Note

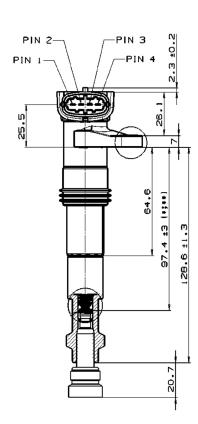
We strongly recommend the design of the spark plug shaft has to ensure that there are no sharp edges in the shaft geometry due to design or machining. Only in compliance with this recommendation, a proper function can be ensured.

Ordering Information

Ignition Coil PS-T

Order number 0221.604.103





Overview

Ignition Module IM 3.2



- Max. 3 cylinders
- 47 g
- Fits to all ECUs without internal ignition power stage like MS 6
- Especially adapted for Coils P50(-M) and P65

Ignition Module IM 4



- Max. 4 cylinders
- 54 g
- Fits to all ECUs without internal ignition power stage like MS 6
- Especially adapted for Coils P50(-M) and P65

Ignition Module IM 3.2



Features

- ► Max. 3 cylinders
- ▶ 47 g
- ► Fits to all ECUs without internal ignition power stage like MS 6
- ► Especially adapted for Coils P50(-M) and P65

This module 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 6.

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 ± 30 V
Operating temperature range at measuring point	-40 to 120°C
Storage temperature range	-40 to 130°C
Max. rpm (ensure chilled mounting position)	8,000
Max. vibration	$400 \text{m/s}^2 \text{at} 5 \text{to} 2,500 \text{Hz}$

Technical Specifications

Mechanical Data

Size	71 x 48 x 21 mm
Weight w/o wire	47 g

Mounting	2 x M4 screws with spring washer
Operating temperature	-40 to 110°C
Permissible fuel temperatures	≤ 70°C
Electrical Data	
U _{Batt} typical	13.5 V
Voltage supply	6 to 16.5 V
I _B high active on	min. 10 mA
I _B low off	0 mA
I _B	10 to 22 mA
I _c typical	≤ 8.5 A
$I_{\rm C}$ max. at $T_{\rm U}$ < 120°C	< 10 A
U_{CE} satt at I_{C} = 5 A	< 3 V
U_{CE} satt at I_{C} max	< 9 V
Characteristic	
Characteristic dwell time	See characteristic dwell time from the ignition coil used
Characteristic dwell time	from the ignition coil used
Characteristic dwell time Internal transistor	from the ignition coil used
Characteristic dwell time Internal transistor Connectors and Wires	from the ignition coil used Triple Darlington
Characteristic dwell time Internal transistor Connectors and Wires Connector Mating connector	from the ignition coil used Triple Darlington Bosch Jetronic 7-pole
Characteristic dwell time Internal transistor Connectors and Wires Connector Mating connector 7-pole Jetronic	from the ignition coil used Triple Darlington Bosch Jetronic 7-pole F02U.B00.252-01
Characteristic dwell time Internal transistor Connectors and Wires Connector Mating connector 7-pole Jetronic Pin 1	from the ignition coil used Triple Darlington Bosch Jetronic 7-pole F02U.B00.252-01 Collector transistor 1
Characteristic dwell time Internal transistor Connectors and Wires Connector Mating connector 7-pole Jetronic Pin 1 Pin 2	from the ignition coil used Triple Darlington Bosch Jetronic 7-pole F02U.B00.252-01 Collector transistor 1 Basis transistor 1
Characteristic dwell time Internal transistor Connectors and Wires Connector Mating connector 7-pole Jetronic Pin 1 Pin 2 Pin 3	from the ignition coil used Triple Darlington Bosch Jetronic 7-pole F02U.B00.252-01 Collector transistor 1 Basis transistor 1 Collector transistor 2
Characteristic dwell time Internal transistor Connectors and Wires Connector Mating connector 7-pole Jetronic Pin 1 Pin 2 Pin 3 Pin 4	from the ignition coil used Triple Darlington Bosch Jetronic 7-pole F02U.B00.252-01 Collector transistor 1 Basis transistor 1 Collector transistor 2 Gnd

Installation Notes

This ignition module can be used with Coils P50(-M) and P65 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.

Please do not activate more than one ignition output stage parallel within a module.

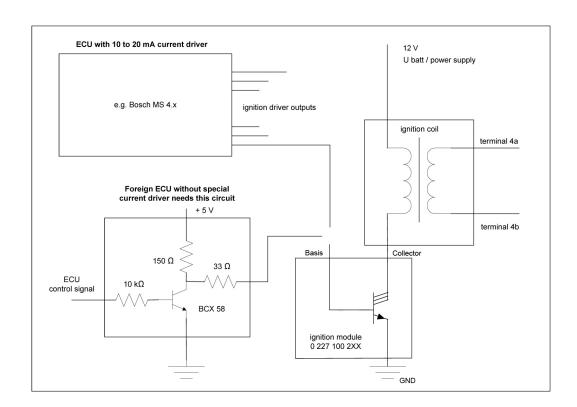
Please find further application hints in the offer drawing at our homepage.

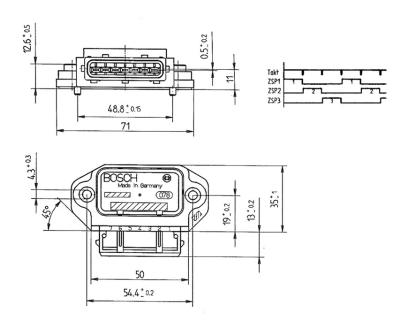
Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

Ignition Module IM 3.2 Order number 0227.100.203





Ignition Module IM 4



Features

- ► Max. 4 cylinders
- ▶ 54 g
- ► Fits to all ECUs without internal ignition power stage like MS 6
- ► Especially adapted for Coils P50(-M) and P65

This module 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 6.

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 ± 30 V
Operating temperature range at measuring point	-40 to 120°C
Storage temperature range	-40 to 130°C
Max. rpm (ensure chilled mounting position)	8,000
Max. vibration	400 m/s^2 at 5 to 2,500 Hz

Technical Specifications

Mechanical Data

Size	70.5 x 68 x 20 mm

Weight w/o wire	54 g
Mounting	2 x M4 screws with spring washer
Electrical Data	
U _{Batt} typical	13.5 V
Voltage supply	6 to 16.5 V
$I_{\scriptscriptstyle B}$ high active on	min. 10 mA
$I_{\rm B}$ low off	0 mA
I_{B}	10 to 22 mA
I _c typical	< 8.5 A
$I_{\rm C}$ max. at $T_{\rm U}$ < 120°C	< 10 A
U_{CE} satt at I_{C} = 5 A	< 3 V
U _{CE} satt at I _C max	< 9 V

Connectors and Wires

Connector (Coil T1)	Bosch Jetronic 4-pole
Mating connector Jetronic 4-pole	D261.205.351-01
Pin 1	Collector transistor 4
Pin 2	Collector transistor 3
Pin 3	Collector transistor 2
Pin 4	Collector transistor 1
Connector (ECU)	Bosch Jetronic 5-pole
Mating connector Jetronic 5-pole	D261.205.352-01
Pin 1	Basis transistor 1
Pin 2	Basis transistor 2
Pin 3	Gnd
Pin 4	Basis transistor 3
Pin 5	Basis transistor 4

Installation Notes

This ignition module can be used with Coils P50(-M) and P65 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.

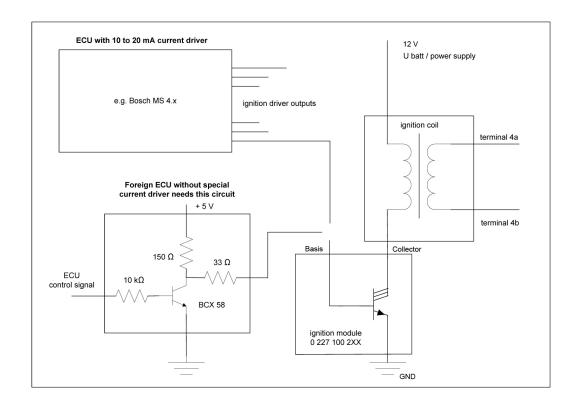
Please observe the specified limit values.

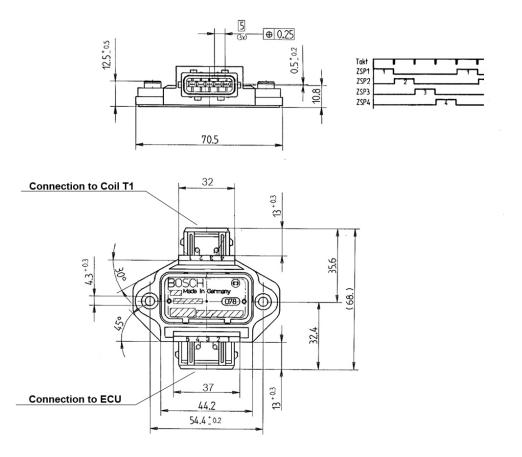
Legal Restrictions

The sale of this product in Mexico is prohibited.

Ordering Information

Ignition Module IM 4Order number **0227.100.211**





Overview

Injection Valve EV 14



- Flow rate at 3 bar: up to 1,000 g/min (n-heptane)
- Max. 8 bar
- Conical spray or 2-spray
- · With or without extension
- Spray angle $15 \text{ to } 85^{\circ}$

HP Injection Valve HDEV 5.2



- Flow rate at 100 bar: up to 1,640 g/min (n-heptane)
- Max. 500 bar
- Multi hole
- Spray angle 8 to 20°

Injection Valve EV 14



Features

- ► Flow rate at 3 bar: up to 1,000 g/min (n-heptane)
- ► Max. 8 bar
- ► Conical spray or 2-spray
- ▶ With or without extension
- ► Spray angle 15 to 85°

EV 14 injection valves are the latest revision of the EV 6 injection valve technology. EV 14 xT are the latest revision of the EV 12.

EV 14 is designed for a wide range of flow rates and spray patterns. Compact size and three standard versions simplify mounting in a variety of applications.

Technical Specifications

Mechanical Data	
System pressure	Max. 5 bar (8 bar for motorsport use)
Weight	≤ 30 g
Installation lengths	33.6, 48.65 or 60.65 mm
Fuel input	Top-feed injector
Operating temperature	-40 to 110°C
Permissible fuel temperatures	≤ 70°C
Climate-proof corresponding to s	saline fog test DIN 50 021
Housing design	Compact (K), Standard (S), Long (L)
Spray type	C (Conical Spray) or E (2- Spray)

Flow rate at 3 bar (n-heptane)	151 to 1,462 cm³/min 103.5 to 1,000 g/min
Spray angle a	15 to 85°
Bent angle γ	0 to 15°
Coil resistance	See variations
Fuel compatibility	E85 Use with different media is not permitted.
Electrical Data	
Power supply	6 to 16.5 V
Connectors and Wires	
Connectors	Jetronic, Sumitomo, Motorsport connectors

Installation Notes

Please ask for more information before ordering.

Ordering Information

EV 14 ES, 116 g/min n-heptane Order number **0280.158.200**

EV 14 CL, 150 g/min n-heptane Order number **0280.158.107**

EV 14 ES, 150 g/min n-heptane Order number **0280.158.013**

EV 14 CKxT, 237 g/min n-heptane Order number **0280.158.038**

EV 14 EL, 237 g/min n-heptane Order number **0280.158.116**

EV 14 CS, 387 g/min n-heptane Order number B280.436.038-09

EV 14 CS, 387 g/min n-heptane Order number **B280.436.038-10**

EV 14 ESxT, 429 g/min n-heptane Order number **0280.158.123**

EV 14 CS, 503 g/min n-heptane Order number **B280.436.038-08**

EV 14 CS, 503 g/min n-heptane Order number **B280.436.038-07**

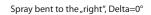
EV 14 CKxT, 670 g/min n-heptane Order number **0280.158.040**

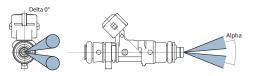
EV 14 CS, 670 g/min n-heptane Order number **B280.436.487-01**

EV 14 ES, 697 g/min n-heptane Order number **B280.436.469-01**

Accessories

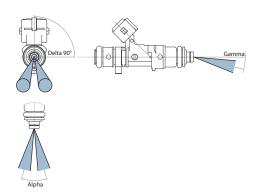
Clip for locking bush of plastic
Order number 2431.314.021
Clip for locking bush of steel
Order number 2431.314.018



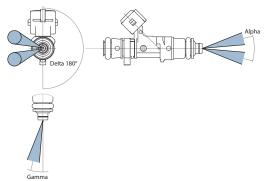




Spray bent "down" (away from electr. connector), Delta=90°

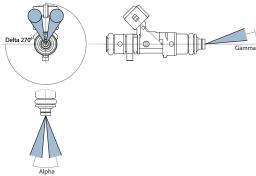


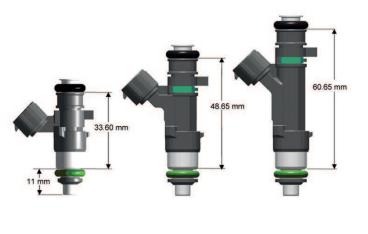
Spray bent to the "left", Delta=180°



Delta Angel







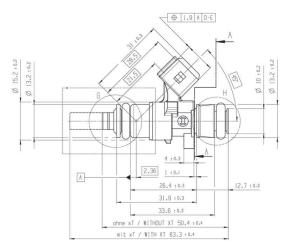
EV 14K Compact

EV 14S Standard

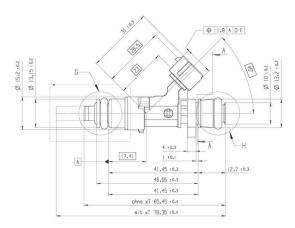
EV 14L Long

EV 14 xT with Extension

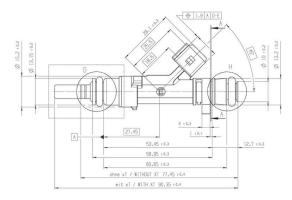
Housing Variations



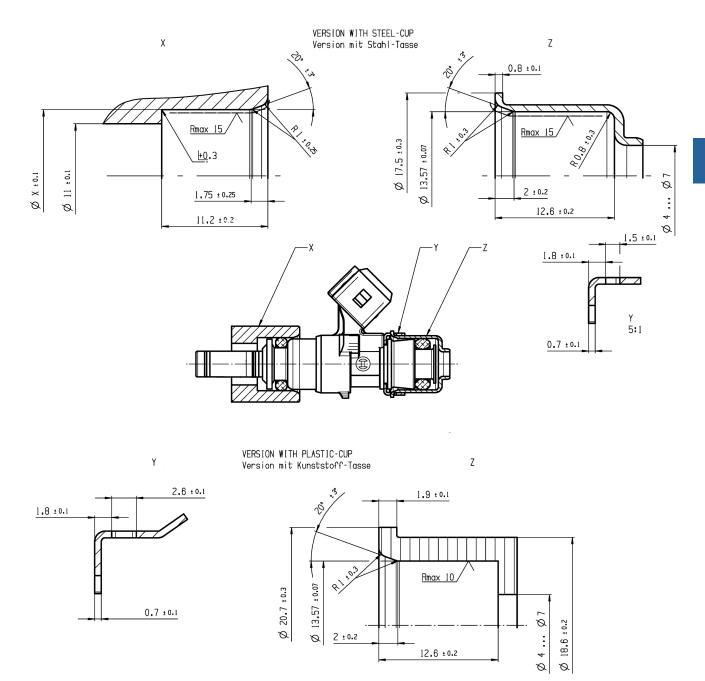
EV 14 Compact



EV 14 Standard



EV 14 Long



Mounting Instructions

Variations of Motorsport Valves

Part No.	B280.436.038-07	B280.436.038-08	B280.436.038-09	B280.436.038-10	B280.436.487-01
Flow rate/min	503 g/736 cm ³	503 g/736 cm ³	387 g/566 cm ³	387 g/566 cm ³	670 g/980 cm ³
Туре	С	С	С	С	С
Housing	S	S	S	S	S
α	70°	25°	70°	25°	30°
γ	0°	0°	0°	0°	0°
δ	-	-	-	-	0°
Resistance	12 Ohm				

Variations of Production Type Valves

Part No.	0280.158.200	0280.158.107	0280.158.013	0280.158.038	0280.158 116
Flow rate/min	$116\mathrm{g}/170\mathrm{cm}^3$	$150\mathrm{g}/219\mathrm{cm}^3$	$150\mathrm{g}/219\mathrm{cm}^3$	237 g/347 cm ³	237 g/347 cm ³
Туре	Е	С	E	С	Е
Housing	S	L	S	KxT	L
α	15°	20°	19°	20°	22°
γ	90°	0°	0°	0°	5°
δ	0°	0°	90°	0°	90°
Resistance	12 Ohm	12 Ohm	12 Ohm	12 Ohm	12 Ohm

Part No.	0280.158.123	0280.158.040
Flow rate/min	429 g/627 cm ³	670 g/980 cm ³
Туре	E	С
Housing	SxT	KxT
a	25°	30°
γ	0°	0°
δ	90°	0°
Resistance	12 Ohm	12 Ohm

Further variations are available on request.

HP Injection Valve HDEV 5.2



Features

- ► Flow rate at 100 bar: up to 1,640 g/min (nheptane)
- ► Max. 500 bar
- ► Multi hole
- ► Spray angle 8 to 20°

The HDEV 5.2 is a high pressure injector, which is developed to be used as a port or a direct injector. The function of the HDEV 5.2 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. Bosch offers the spray targeting design according to the individual customer requirements. If your application conditions will not match the listed performance data, please ask for consultancy at Bosch Motorsport. In addition to the specific designed sample, Bosch offers cost effective production HDEV 5.2 on request.

Application	
Application at 100 bar (typical)	308 to 1,640 g/min
Fuel input	Top-feed injector
Fuel	Gasoline
Operating pressure	Up to 500 bar
Operating temperature range	-31 to 130°C

Storage temperature range	-40 to 70°C
Max. vibration	600m/s^2

Max. vibration	600 m/s ²
Technical Specifications	
Mechanical Data	
Weight w/o wire	68 g
Diameter	20.7 mm

Diameter	20.7 mm
Length	87 mm
Flow rate at 100 bar (n- heptane)	up to 1,640 g/min
Number of holes	4 to 7 holes (typical)
Spray type	Multi hole
Spray angle overall	110° (typical)
Spray angle single beam	8 to 20°
Static flow tolerance	±4%
Dynamic flow tolerance	±6 % at ti = 1.5 ms
Leakage	≤2.5 mm³/min at 23°C
Floatrical Data	

Electrical Data	
Booster supply	65 V
Booster current	13.4 A
Booster time	480 μs
Power supply	12 V
Pick up current	9.4 A
Pick up time	704 µs
Hold power supply	12 V
Hold current	3.7 A hysteresis 0.8 A
Coil resistance	1,500 mOhm (ambient temp.)
Connectors and Wires	

Connectors and Wires	
Mating connector Compact	D261.205.359-01
Connector Jetronic (wire)	D261.205.288-01
Connector motorsport (wire)	On request
Pin 1	Pos
Pin 2	Gnd

Installation Notes

The injector has to be supplied by a Bosch Motorsport Power Stage Unit (e.g. HPI 5 or HPI 1.16).

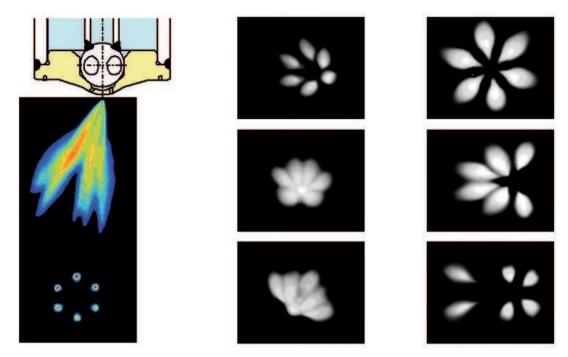
Listed electrical values may vary according to the application.

The injector can be cleaned (mechanically or chemically), if the tip will not be damaged.

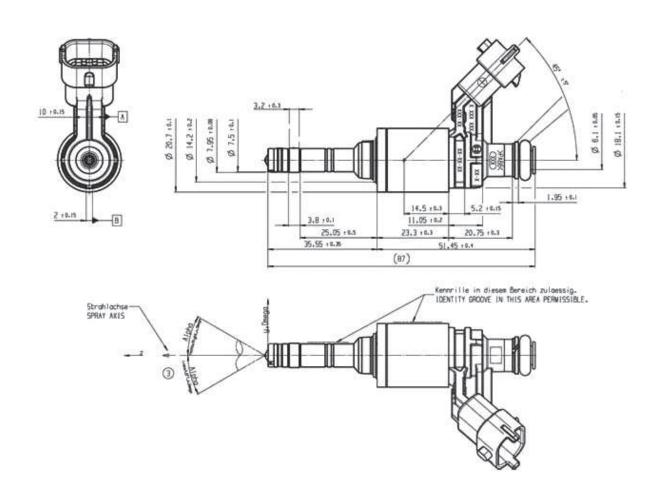
Do not use supersonic cleaning.

Ordering Information

HP Injection Valve HDEV 5.2Order number **on request**



Spray variations, further variations on request



Actuators

5

Alternators	202
Electronic Throttle Body	211
Wiper Motor	214

Overview

Alternator B0



- >140 A
- 3,400 g
- Clockwise rotation
- Lightweight aluminum pulley
- · Multifunctional regulator

Alternator B3 LIN



- >200 A
- 4,800 g
- Clockwise rotation
- Steel pulley
- Motorsport optimized LIN1.3 regulator with latest ASIC technology

Alternator B5



- >150 A
- 5,600 g
- · Clockwise rotation
- Steel pulley
- Multifunctional regulator

Alternator B0



Features

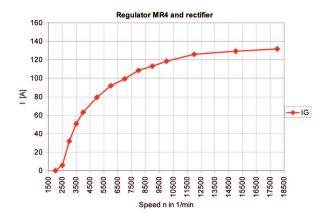
- ▶ >140 A
- ▶ 3,400 g
- ► Clockwise rotation
- ► Lightweight aluminum pulley
- ► Multifunctional regulator

This alternator is modified for motorsport demand and splash protected. The stator windings are handmade and optimized for higher current output; the rotor is extra fine balanced and impregnated. Modifications are available on request.

Application Ambient temperature range -30 to 90°C Vibration protection high Installation without rubber mounting

Technical Specifications	;
Mechanical Data	
Case material	Aluminum
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	>140 A
Output voltage	13.5 V

Cut-in speed	3,000 x 1/min
Coupling	screws
Battery B+	M6
Tightening torque at B+	14 Nm
Control lamp D+	flat-pin connector, see drawing
Characteristic	
Rpm [1/min]	I _G [A] at 90°C
2,000	0
2,500	6
3,000	32
3,500	51
4,000	63
5,000	80
6,000	90
7,000	98
8,000	105
9,000	111
10,000	116
12,000	121
15,000	127



131

Installation Notes

18,000

Typical lifetime before service: max. 6,000 km / 30 h

For application with severe conditions and/or high volume, please contact your Bosch Motorsport counterpart in order to define the most appropriate validation program.

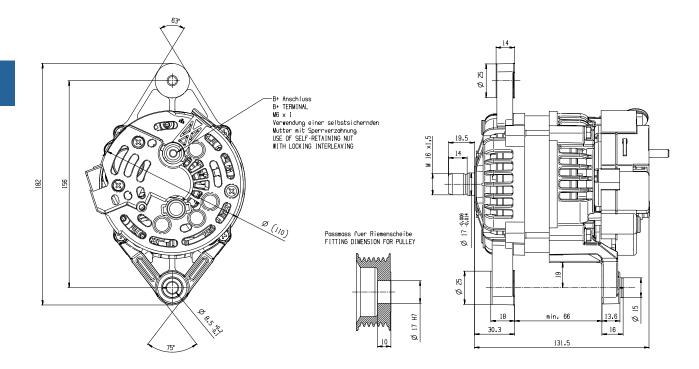
An external cooling can contribute to increase the performance. It will only be effective if the incoming air is 30°Kelvin cooler than the ambient air. Otherwise, the restriction of airflow will negate any cooling benefits. If these conditions are met, the cooling air should be distributed over the center axis at the rear of the alternator for optimal cooling. The alternator fans are not able to generate negative pressure. It is possible to use external blower to support the al-

ternator. Debris at alternator cooling area can reduce cooling effect. This could also shorten the alternator service life. Installation without rubber mounting.

Ordering Information

Alternator B0

Order number F02U.V02.996-01



Alternator B3 LIN



Features

- ▶ >200 A
- ▶ 4,800 g
- ► Clockwise rotation
- ► Steel pulley
- ► Motorsport optimized LIN1.3 regulator with latest ASIC technology

The B3 LIN is a powerful 12 V motorsport alternator. It has an optimized hand wound stator winding (3 phase triangle), high current diodes (special Zener diode chips from Bosch production to retain load-dumps) and an extra fine balanced rotor with impregnated winding.

The LIN regulator (special Bosch developed ASIC) controls the alternator output voltage at B+ connection. The main benefit of this alternator is the high power output in a small low weight package. Furthermore, it is optimized concerning vibration endurance.

Application	
Application	>200 A at 7,000 rpm/85°C
Max. ambient temperature	105°C, high current only with supported cooling air
Max. ambient temperature (short-term)	120°C, high current only with supported cooling air
Rotating direction	Clockwise
Fixed frequency regulation with	pulse width modulation
Stand-by-mode	
High side output stage with defi freewheeling "diode"	ned ramp steepness and FET as
Emergency start at default mod	е
Adjustable set values via LIN int	erface

Outputs of status information via LIN interface

Technical Specifications	
Mechanical Data	
Body material	Cast aluminum
Weight w/o pulley	4.8 kg
Max. rotations	18,000 x 1/min
Moment of inertia	22 kg*cm ²
Outer diameter w/o screw	136 mm
Length w/o pulley	117 mm
Battery B+ connection	M8x1.25
Tightening torque at B+	22 Nm
Electrical Data	
Regulating voltage	14.4 V default, up to 16 V via LIN
Temperature compensation	-10 mV/K
High temperature cut off derating	-250 mV/K
Excitation resistor (L)	Internal (external on request)
Cut-in-speed	3,000 x 1/min
LIN Protocol	
LIN Version (LinProtVer)	1.3
LIN Speed	19.2 kbaud
Message ID	0xE9
Frame-content (Variant)	A
HT _{KN}	144°C
GenID	5

LIN Protocol Rx-Frame

0

1

LINF	rotocoi	. Kx-Frame	
Byte	Bit	Value	Explanation
1	0 to 5	Voltage set value	Value from 10.6 V to 16.0 V
2	0 to 3	LR ramp time	Value from 0 % to 100 %
2	4 to 7	LR cut-off speed	Value from 2.400 rpm to 8.000 rpm
3	0 to 4	Excitation current limit	Value 2 A to 7.7 A
4	0 to 2	DataSelect Tx3/ Byte4	Values see TCD
4	3	Blindzone	3.1 % or 12.6 %
4	4 to 6	HT cut-off thresh- hold	Value from -16 to +12
4	7	Parameter set	Normal or [w/o battery]
LIN F	Protocol	. Tx-Frame 1	
Byte	Bit	Value	Explanation

Flag HAT cut-off

no HT cut-off /

HT cut-off

Byte	Bit	Value	Explanation
1	1	Flag Mechanical status	Alternator running / Alternator stopped
1	2	Flag Electrical error	not set / set
1	3 to 7	Duty cycle	Value from 0 % to 100 %
2	0 to 5	Excitation current limit	Value from 0 A to 7.75 A
2	6	Flag Communication error	Com. Ok / ComError
2	7	Fleg Timeout	no Timeout / Timeout

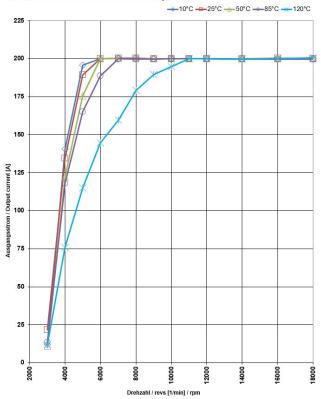
LIN Protocol Tx-Frame 2

Byte	Bit	Value	Explanation
1	0 to 2	Alternator Manufac- turer ID	Value "Bosch"
1	3 to 7	Alternator ID	Application specific
2	0 to 2	Chip Manufacturer ID	Application specific
2	3 to 7	Chip ID	Application specific

Characteristic

Characterist	.10
Rpm [1/min]	IG [A] at 85°C
3,000	14
4,000	118
5,000	165
6,000	189
7,000	200
8,000	200
9,000	200
10,000	200
11,000	200
12,000	200
14,000	200
16,000	200
18,000	200

Stromkennlinie über Umbegungstemperatur Current curve over environment temperature



Installation Notes

Typical lifetime before service: max. 6,000 km / 30 h

For application with severe conditions and/or high volume, please contact your Bosch Motorsport counterpart in order to define the most appropriate validation program.

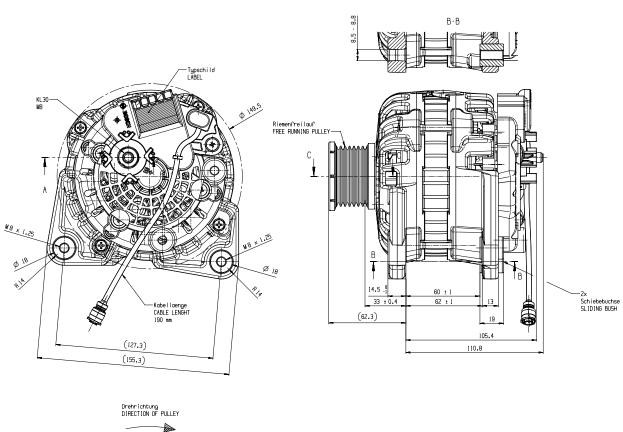
Ground connection for power and regulator is through the case. Ensure that the case has a high current, low electrical resistance connection to vehicle ground.

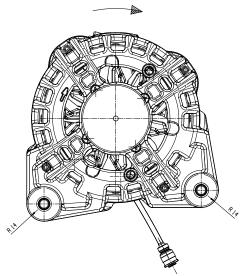
Rectifier diodes are designed and proved for B+ continuous output current of 210 A. The alternator is able to support more current, but this must be restricted for short time to prevent the destroying of rectifier diodes.

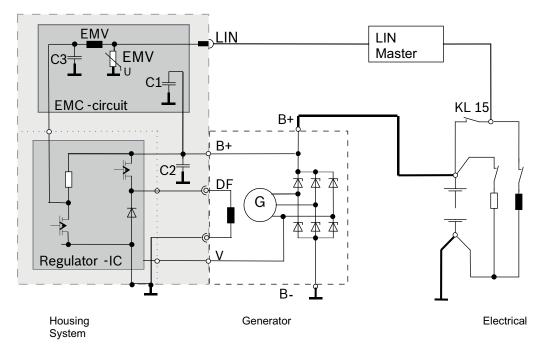
Ordering Information

Alternator B3 LIN

Order number F02U.V02.950-01







Schematic Diagram

Alternator B5



Features

- ▶ >150 A
- ▶ 5,600 g
- ► Clockwise rotation
- ► Steel pulley
- ► Multifunctional regulator

The B5 alternator is typical for Cup racecars. Robustness increase for motorsport use. Free-running pulley for reduction of wear.

The multifunctional regulator with special developed ASIC by Bosch controls the output voltage at B+ connection.

Three-arm design allows the use of a clamping arm.

Application	
Application	>122 A at 6,000 rpm/80°C
Max. ambient temperature	105°C, high current only with supported cooling air
Max. ambient temperature (short-term)	120°C, high current only with supported cooling air
Rotating direction	Clockwise

Technical Specifications

	Data

Body material	Cast Aluminum
Weight w/o pulley	5.6 kg
Max. rotations	13,000 x 1/min
Moment of inertia	26 kg*cm ²
Outer diameter w/o screw	156 mm
Length w/o pulley	172 mm
Battery B+ connection	M8

Tightening torque at B+	15 Nm
Electrical Data	
Regulating voltage	14.4 V
Temperature compensation	-10 mV/K
High temperature cut off derating	-250 mV/K
Excitation resistor (L)	External
Cut-in-speed	1,400 x 1/min

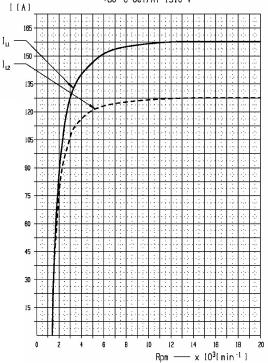
Characteristic

Rpm [1/min]	I_{G} [A] at 80°C
2,000	75
4,000	114
6,000	123
8,000	125
10,000	126
12,000	127
13,000	127.5

Please note: Measured with U=13.1 V and t=20 min

Kennlinien CHARACTERICTIC CURVES





Installation Notes

Typical lifetime before service: max. 6,000 km / 30 h

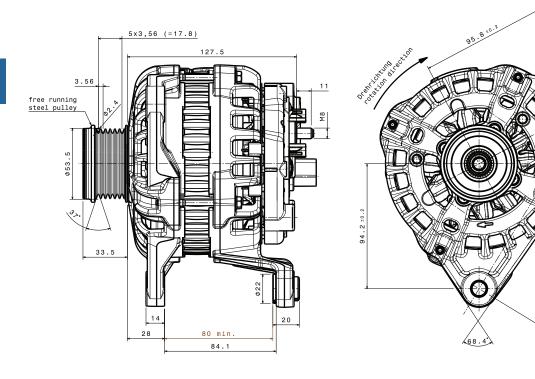
For application with severe conditions and/or high volume, please contact your Bosch Motorsport counterpart in order to define the most appropriate validation program.

Ground connection for power and regulator is through the case. Ensure that the case has a high current, low electrical resistance connection to vehicle ground.

Ordering Information

Alternator B5

Order number F02U.V01.747-03



54 mm

Electronic Throttle Body



Features

- ▶ Many bore diameters available
- ▶ Throttle position sensor is redundant
- ► For flex-fuel, CNG, LPG
- ▶ Idle default position

The throttle body is designed to control the fresh air of spark ignition engines in combination with an electronic throttle control system. ETB applications with flex-fuel, CNG and LPG are permissible if injected in the air flow after the throttle body.

A typical ETC system includes the following components: electronic throttle body, accelerator pedal module and electronic control unit.

You will find the available bore diameters in the variations table.

Application	
Temperature range	-40 to 140°C
Max. vibration	50 to 250 m/s ² at 50 Hz to 2 kHz

Technical Specifications Mechanical Data Available bore diameters 32 mm 40 mm 44 mm 46 mm 50 mm

52 mm

60 mm 68 mm 82 mm
6 to 16 V
5 ± 0.2 V
<10.0 A
0 to 5 V for 0 to 90°
5 to 0 V for 0 to 90°

Connectors and Wires

Various motorsport and automotive connectors are available on request.

Please specify the required wire length with your order.

Installation Notes

For correct mounting please respect the hints on the next page "Mounting position".

The ETB can be connected directly to control units with ETC functionality.

Please find further application hints in the offer drawing at our homepage.

Two redundant sensors control the up to date throttle position.

All ETBs have an idle air position.

Ordering Information

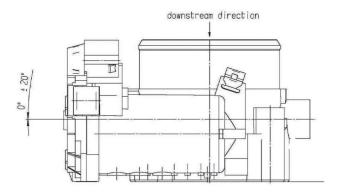
Electronic Throttle Body 32 mm Order number 0280.750.148
Electronic Throttle Body 40 mm Order number 0280.750.149
Electronic Throttle Body 44 mm Order number 0280.750.137
Electronic Throttle Body 46 mm Order number F02U.V01.171-01
Electronic Throttle Body 50 mm Order number 0280.Y05.107-10
Electronic Throttle Body 52 mm Order number F02U.V01.184-01
Electronic Throttle Body 54 mm Order number 0280.750.150
Electronic Throttle Body 60 mm Order number 0280.750.151
Electronic Throttle Body 68 mm Order number 0280.750.156
Oraci number 0200.130.130
Electronic Throttle Body 82 mm Order number 0280.750.101

Dimensions

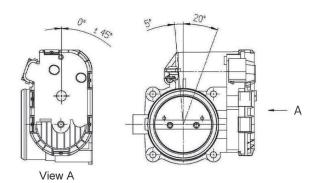
Mounting position

Mounting position of the Throttle Actuator

- Horizontal inclination of the Throttle shaft: ±20°
 Horizontal inclination of the cover: ±180°
 Mounting positions which deviate from this need separate testing.
 It has to be prevented that when mounted in the vehicle, no condensed moisture can soak into the Throttle shaft bore holes le.g. from the crankcase ventilation!



IN CASE OF MOUNTING POSITION WITH OC-MOTOR ON TOP A COMBINATION OF THE ANGLES SHOWN BELOW IS NOT ALLOWED!



Variations

	Electronic Throttle	Electronic Throttle	Electronic Throttle	Electronic Throttle	Electronic Throttle
	Body 32 mm	Body 40 mm	Body 44 mm	Body 46 mm	Body 50 mm
Bore Diameter (mm)	32	40	44	46	50
Connector	D261.205.358-01	D261.205.358-01	D261.205.358-01	D261.205.356-01	D261.205.358-01
Pin 1 A	Motor -	Motor -	Motor -	Motor -	Motor -
Pin 2 B	Poti -	Poti -	Poti -	Poti -	Poti -
Pin 3 C	Poti +	Poti +	Poti +	Poti +	Poti +
Pin 4 D	Motor +	Motor +	Motor +	Motor +	Motor +
Pin 5 E	Poti 2	Poti 2	Poti 2	Poti 2	Poti 2
Pin 6 F	Poti 1	Poti 1	Poti 1	Poti 1	Poti 1
Flange diameter (mm)	40	50	50	58	58
Hole circle diameter(mm)	50 x 50	50 x 50	50 x 50	53 x 53	53 x 53
Weight (kg)	0.9	0.9	0.9	0.95	0.95
Max. air flow rate*	394 kg/h at 85° angle	695 kg/h at 85° angle	not specified	978 kg/h at 85° angle	not specified
Opening direction**	counterclockwise	counterclockwise	counterclockwise	counterclockwise	counterclockwise
	Body 52 mm	Body 54 mm	Body 60 mm	Body 68 mm	Body 82 mm
	Electronic Throttle	Electronic Throttle	Electronic Throttle	Electronic Throttle	Electronic Throttle
			-		-
Bore Diameter (mm)	52	54	60	68	82
Connector	D261.205.356-01	D261.205.358-01	D261.205.358-01	D261.205.358-01	D261.205.358-01
Pin 1 A	Poti 1	Motor -	Motor -	Motor -	Motor -
Pin 2 B	Poti -	Poti -	Poti -	Poti -	Poti -
Pin 3 C	Motor -	Poti +	Poti +	Poti +	Poti +
Pin 4D	Poti 2	Motor +	Motor +	Motor +	Motor +
Pin 5 E	Motor +	Poti 2	Poti 2	Poti 2	Poti 2
Pin 6 F	Poti +	Poti 1	Poti 1	Poti 1	Poti 1
Flange diameter (mm)	58	70	68.5	75	90
Hole circle diameter (mm)	53 x 53	60 x 60	60 x 60	65 x 65	75 x 75
Weight (kg)	0.95	0.95	0.95	1.1	1.1
Max. air flow rate*	not specified	not specified	not specified	not specified	not specified
Opening direction**	counterclockwise	counterclockwise	counterclockwise	counterclockwise	counterclockwise
*ambient conditions:	Air pressure : 1,000 mbar				
	Differential pressure Δp:	600 mbar ± 25 mbar			
	B I I I I I I I I I I I I I I I I I I I				
	Rel. humidity rF: 40 %				

Wiper Direct Actuator WDA



Features

- ► Analog and LIN versions available
- ► Optimized hardware for motorsport applications
- ► Customer specific calibration of wiping angles and speed

The WDA is a wiper motor designed to execute reversing movements instead of rotating 360° like a conventional wiper.

Its function and many operating modes are managed by integrated control electronics. The user is able to control the desired operating mode simply by switching its analog inputs to ground (Analog version) or via LIN (LIN version). The gear, the motor and the electronics are all installed in the same housing.

The main benefit of this wiper motor is its direct rotation movement which replaces external gears and the possibility of programming the operating speed and end positions of all its function modes, upon request.

Application	
Operating temperature range	-40 to 85°C
Technical Specifications	
WDA Analog Operating modes	StopIntervalSpeed 1Speed 2
WDA LIN Operating modes	StopIntervalSpeed 1Speed 2Single stroke

Mechanical Data

0:				474-		4		
Size	Max. wipe cycles/min			104.7 x 174.7 x 117.1 mm Depending on wipe angle				
				ding on wip	oe an	gle		
Max. wipe angl	ie		160°					
Max. torque			35 Nm					
Weight Max. vibration			or 100 in com locks (g of Vibration of Work of Vibra bination wi see www.b sport.com)	tion I th sil	Prof entl	ile 1	L
Electrical D	Data							
Power supply			9 to 16	6 V				
Supply current min.	t at 40 cy	cles/	Typ. 3					
Supply current min.	t at 60 cy	cles/	Тур. 6	.3 A				
LIN Protoco	ol							
LIN Version			2.0					
LIN Speed			19.2 k	baud				
Message ID			0x31					
BYTE 0 Value	0	0	KI. X	Kl. 15	Сс	ount	er	
Bit	7	6	5	4	3	2	1	0
BYTE 1 Value	SPD2	SP	D1 INT	SST	IN	TM	ode	
Bit	7	6	5	4	3	2	1	0
BYTE 2 Value	0	0	0	0	0	0	0	0
Bit	7	6	5	4	3	2	1	0
BYTE 3 Value	0	0	0	0	0	0	0	0
Bit	7	6	5	4	3	2	1	0
BYTE 4 Value	0	0	0	0	0	0	0	0
Bit 4 value	7	6	5	4	3	2	1	0
DIL	1	0	<u> </u>	4	3	2	1	U
BYTE 5 Value	0	0	0	0	0	0	0	0
Bit	7	6	5	4	3	2	1	0
Byte Bit	Signa	al	Explanation	l		lues ez]	5	
0 0 to 3	Coun	iter	The counter increased w LIN-messag	ith each	0 t	o 1	5	
0 4	Kl. 1	5	Clamp 15 B be enabled tion			N=1 F=(
0 5	KI. X		Clamp X Bit enabled for			N=1 F=(

0 to 3	INT Mode	Interval Mode (en- abled if operation mode interval is set)	Interval speed: 1=1 2=5 3=9 4=13
4	SST	Single stroke opera- tion mode (enabled once if Bit is set tem- porary)	ON=1 OFF=0
5	INT	Operation mode interval	ON=1 OFF=0
6	SPD1	Operation mode speed 1	ON=1 OFF=0
7	SPD2	Operation mode speed 2	ON=1 OFF=0
	STOP	Operation mode stop is enabled if SST, INT, SPD1 and SPD2 are OFF (default)	
	5 6	Mode 4 SST 5 INT 6 SPD1 7 SPD2	Mode abled if operation mode interval is set) 4 SST Single stroke operation mode (enabled once if Bit is set temporary) 5 INT Operation mode interval 6 SPD1 Operation mode speed 1 7 SPD2 Operation mode speed 2 STOP Operation mode stop is enabled if SST, INT, SPD1 and SPD2 are

Connectors and Wires

Connector	CEP2M-AMP-4
Mating connector	F02U.B00.542-01
Various motorsport and a	utomotive connectors available on re-
quest	

Pinout Analog

Pin 1	AN2
Pin 2	AN1
Pin 3	Gnd
Pin 4	U _s

Pinout LIN

i illout Elit	
Pin 1	LIN
Pin 2	Special functions, e.g. Master/Slave
Pin 3	Gnd
Pin 4	U _s

Installation Notes

Typical lifetime: max. 220 h / 1 year

For application with severe conditions and/or high volume, please contact your Bosch Motorsport counterpart in order to define the most appropriate validation program

The WDA Analog can be operated by switching the analog inputs between ground and voltage supply.

The WDA LIN can be operated by all ECUs with LIN 2.X Master function. Further information about the LIN-Frame available upon request.

Make sure that the wiper is in its workspace when restarting after a power failure (upper and lower limit).

Please contact us to define the desired angle of all the operating modes.

The acceleration values can be exceeded by using silentblocks (F02U 003 027-01).

Please ensure that the environmental conditions do not exceed the specifications.

Please find further application hints in the offer drawing at our homepage.

Please deliver the calibration sheet with your order placement.

LIN ID 0x32 (Tx) is used for internal WDA diacnostic porpouses. Make sure that the LIN ID 0x32 is not used in your LIN network by any other device.

Delivery Status

The motor will be delivered with three mounting screws. The screws are pre-assembled with a few thread turns.

- Self-tapping screw referred to DIN 7500
- PE M6x20
- Maximum tightening torque: 8 Nm

Ordering Information

WDA LIN

Order number F02U.V00.838-04

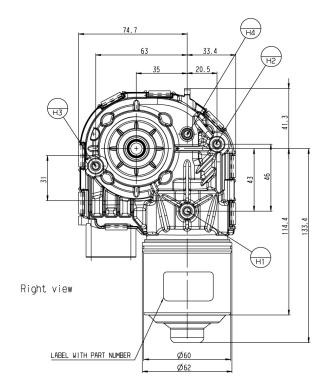
WDA Analog

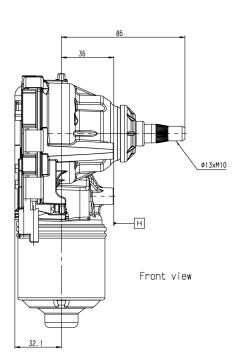
Order number F02U.V00.938-03

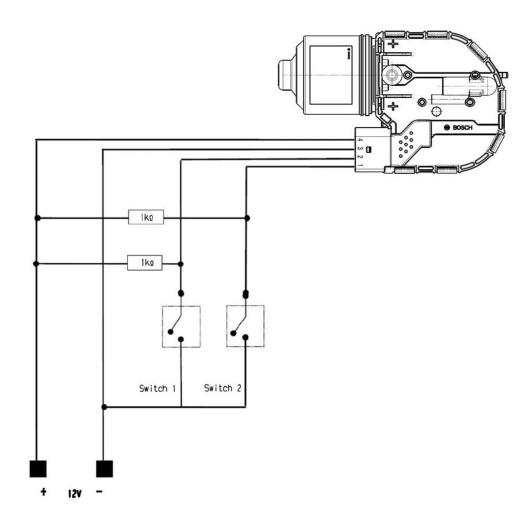
Accessories

Silentblock

Order number F02U.003.027-01







Operating modes referring analog inputs configuration

	Ca .	
Operating Mode	AN1 (Pin 2)	AN2 (Pin 1)
Stop	Power Supply	Power Supply
Interval	Power Supply	GND
Speed 1	GND	GND
Speed 2	GND	Power Supply

Operating modes referring switch configuration

Operating Mode	Switch 1	Switch 2
Stop	opened	opened
Interval	opened	closed
Speed 1	closed	closed
Speed 2	closed	opened

Sensors

6

Air Pressure	220
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Overview

Pressure Sensor Air PS-AA

Pressure Sensor Air PS-AS

Pressure Sensor Air PSA-N



- Application: 0.1 to 1.15 bar or 0.2 to 2.5 bar
- Response time: 1 ms
- Pressure reference type: Absolute
- Power supply: 5 V
- Weight: 20 g



- Application: 0.2 to 3.0 bar
- Response time: 1 ms
- Pressure reference type: Absolute
- Power supply: 5 V
- Weight: 21 g



- Application: 0.1 to 1.15 bar
- Response time: 0.1 ms
- Pressure reference type: Absolute
- Power supply: 11 to 16 V
- Weight: 21 g

Pressure Sensor Air PS-AA



Features

▶ Application: 0.1 to 1.15 bar or 0.2 to 2.5 bar

▶ Response time: 1 ms

▶ Pressure reference type: Absolute

▶ Power supply: 5 V

▶ Weight: 20 g

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

An integrated circuit combines a piezo-resistive sensor element and electronic systems for signal-amplification and temperature-compensation. The output of the sensor is an analog, ratio metric signal. Two different pressure ranges are available (0.1 to 1.15 bar or 0.2 to 2.5 bar).

Application	
Application	Please see variations
Pressure reference type	absolute
Max. pressure	5 bar
Operating temp. range	-40 to 130°C
Media temp. range	-40 to 130°C
Storage temp. range	0 to 40°C
Max. vibration	According to ISO 16750-3

Technical Specifications

Variations

	PS-AA (0.1 to 1.15 bar)	PS-AA (0.2 to 2.50 bar)
Tolerance (FS) at U _s = 5 V	± 0.016 bar	± 0.034 bar
Tolerance (FS)	± 1.52 %	± 1.48 %

Sensitivity	4,048 mV/bar	1,848 mV/bar
Offset	-4.8 mV	30.4 mV
Mechanical Da	ta	
Mounting	M6	
Fitting	12.0	5 ± 0.8 mm
Weight w/o wire	20 g	
Sealing	O-rin	g 7.59 x 2.62 mm
Electrical Dat		
Power supply U_s	4.75	to 5.25 V
Max. power supply	16 V	

Characteristic

Current I_s

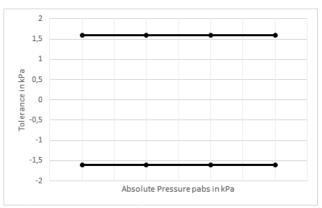
Full scale output U_A at 5 V

Response time T10/90	1 ms
Compensated range	10 to 85°C
Tolerance (FS) at U _s = 5 V	Please see variations
Tolerance (FS)	Please see variations
Sensitivity	Please see variations
Offset	Please see variations

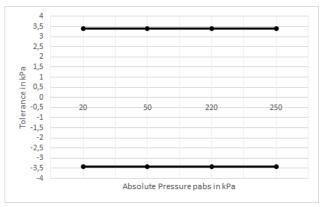
0.4 to 4.65 V

 $9\,\text{mA}$

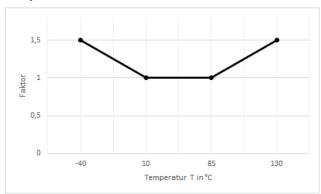
Tolerance 0.1 to 1.15 bar



Tolerance 0.2 to 2.5 bar



Expansion of Tolerance



Connectors and Wires

Connector	RB-COMP 1.1a/3P/Kod.1
Mating connector	D261.205.366-01
Pin 1	U_s
Pin 2	Gnd
Pin 3	Sig

Various motorsport and automotive connectors are available on request.

Installation Notes

The PS-AA is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.

The sensor can be connected directly to most control units.

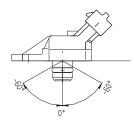
To avoid noise, an ECU-input circuit with a RC-low pass filter (tau = 2 ms) is recommended.

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

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

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

To avoid damage caused by condensate the maximum mounting position from vertical is +-60°.



Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Air PS-AA

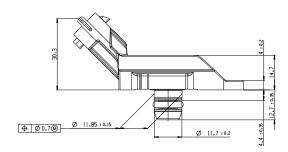
0.1 to 1.15 bar

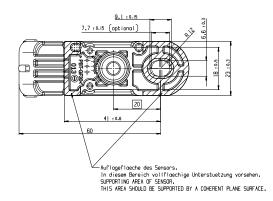
Order number 0261.230.216

Pressure Sensor Air PS-AA

0.2 to 2.5 bar

Order number 0261.230.284





Pressure Sensor Air PS-AS



Features

► Application: 0.2 to 3.0 bar

► Response time: 1 ms

▶ Pressure reference type: Absolute

▶ Power supply: 5 V

▶ Weight: 21 g

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

An integrated circuit combines a piezo-resistive sensor element and an electronic for signal-amplification and temperature compensation. The output of the sensor is an analog, ratio metric signal.

Application	
Application	0.2 to 3 bar (a)
Pressure reference type	absolute
Max. pressure	5 bar
Operating temp. range	-40 to 130°C
Media temp. range	-40 to 130°C
Storage temp. range	0 to 40°C
Max. vibration	According to ISO 16750-3

Technical Specifications	
Mechanical Data	
Mounting	M6
Fitting	12.05 ± 0.8 mm
Weight w/o wire	21 g
Sealing	O-ring 7.59 x 2.62 mm

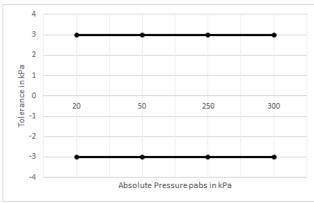
Electrical Data

4.75 to 5.25 V
16 V
0.4 to 4.65 V
9 mA

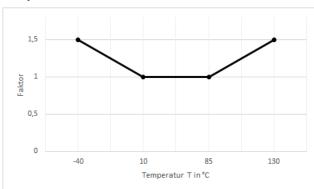
Characteristic

Response time T10/90	1 ms
Compensated range	10 to 85°C
Tolerance (FS) at $U_S = 5 \text{ V}$	± 0.030 bar
Tolerance (FS)	± 1.07 %
Sensitivity	1,518 mV/bar
Offset	96 mV

Tolerance



Expansion of Tolerance



Connectors and Wires

Connector	RB-COMP 1.1a/3P/Kod.1
Mating connector	D261.205.366-01
Pin 1	U_S
Pin 2	Gnd
Pin 3	Sig

Various motorsport and automotive connectors are available on request.

Installation Notes

The PS-AS is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.

The sensor can be connected directly to most control units.

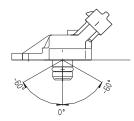
To avoid noise, an ECU-input circuit with a RC-low pass filter (tau = 2 ms) is recommended.

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

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

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

To avoid damage caused by condensate the maximum mounting position from vertical is $+-60^{\circ}$.

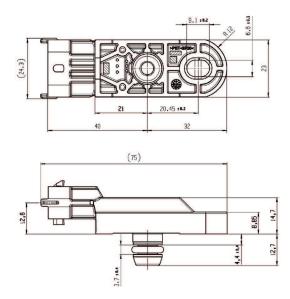


Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Air PS-AS Order number 0281.002.996



Pressure Sensor Air PSA-N



Features

► Application: 0.1 to 1.15 bar

► Response time: 0.1 ms

▶ Pressure reference type: Absolute

▶ Power supply: 11 to 16 V

Technical Specifications

▶ Weight: 21 g

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

An integrated circuit combines a piezo-resistive sensor element and electronics for signal-amplification and temperature compensation. The output of the sensor is analog.

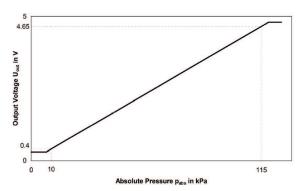
Application	
Application	0.1 to 1.15 bar
Pressure reference type	absolute
Max. pressure	5 bar
Operating temp. range	-40 to 125°C
Media temp. range	-40 to 125°C
Storage temp. range	-40 to 130°C
Max. vibration	0.19mm at $100 \text{to} 200 \text{Hz}$ 250m/s^2 at $200 \text{to} 500 \text{Hz}$

Toomilout oppositioning		
Mechanical Data		
Mounting	2 x #4-40 screws	
Fitting	Flat O-ring boss	
Weight w/o wire	21 g	
Sealing	O-ring 4.5 x 1.5 mm	

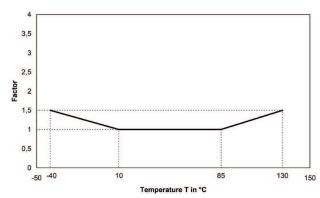
Electrical Data

11 to 16 V
0.5 to 4.7 V
9 mA
1.0 ms
10 to 85°C
± 0.016 bar
± 1.52 %
4,041.62 mV/bar
-4.16 mV

Tolerance



Expansion of Tolerance



Connectors and Wires

Wire length L

Connector	ASL606-05F	PC-HE
Mating connector ASL006-05SC-HE	F02U.000.2	28-01
Pin	Function	Wire color
1	U_s	WHT/ORG
2	Gnd	WHT/BLU
3	Sig	WHT
4	-	
5	-	

Various motorsport and automotive connectors are available on request.

Sleeve DR-25

Wire size AWG 24

64.5 cm

Installation Notes

The PSA-N 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-low pass filter (tau 0 2 ms) is recommended.

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

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

Surface finish of the mounting surface should not exceed 0.8 micro meters RMS.

Surface flatness tolerance at sensor mount interface must not exceed \pm 0.025 mm after sensor is torqued in place.

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Fullfilled Legal Standards/Legal Requirements

EMC Requirement

UNECE10

Ordering Information

Pressure Sensor Air PSA-N

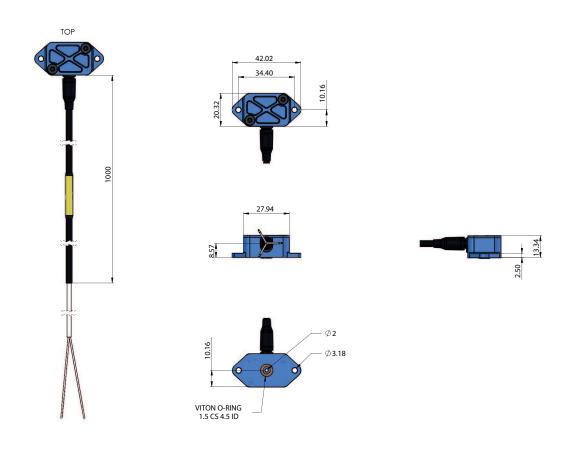
AS terminated

Order number F02U.V0U.197-03

Pressure Sensor Air PSA-N

Flying Lead

Order number F02U.V0U.197-90



Overview

Pressure Sensor Fluid PSC-10



- · Application: 0 to 10 bar
- Response time: 1.5 ms (5 V Variant) or 1 ms (12 V Variant)
- Pressure reference type: Absolut
- Power supply: 5 or 12 V
- Weight: 45 g

Pressure Sensor Fluid PSC-260



- · Application: 0 to 260 bar
- Response time: 2 ms
- Pressure reference type: Absolut
- Power supply: 5 V
- Weight: 35 g

Pressure Sensor Fluid PSM-SA



- Application: 0 to 3.5, 6, 10, 20, 35, 60, 70, 100, 200, 350, 700 bar
- Response time: 1 ms
- Pressure reference type: Absolut
- Power supply: 8 to 30 V
- Weight: 13 g

Pressure Sensor Fluid PSS-10



- · Application: 1 to 11 bar
- Response time: 1.5 ms
- Pressure reference type: Absolut
- Power supply: 5 V
- Weight: 45 g

Pressure Sensor Fluid PSS-250R



- · Application: 0 to 250 bar
- Response time: 1.5 ms
- Pressure reference type: Relative
- Power supply: 5 V
- Weight: 45 g

Pressure Sensor Fluid PSS-140/260/420/600



- Application: 0 to 140, 260, 420, 600 bar
- Response time: 2 ms
- Pressure reference type: Absolut
- Power supply: 5 V
- Weight: 35 g

Pressure Sensor Fluid PSC-10



Features

- ► Application: 0 to 10 bar
- ► Response time: 1.5 ms (5 V Variant) or 1 ms (12 V Variant)
- ▶ Pressure reference type: Absolut
- ▶ Power supply: 5 or 12 V
- ▶ Weight: 45 g

This sensor is designed to measure absolute pressure of various kinds of media e.g. Diesel, gasoline, water, engine oil, transmission oil or air. The sensor is available for two different supply voltage ranges. The sensor uses stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. This guarantees a complete media compatibility.

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

Application	
Application	0 to 10 bar (a)
Pressure reference type	absolute
Max. pressure	20 bar
Operating temp. range	-40 to 125°C
Media temp. range	-40 to 125°C
Storage temp. range	-20 to 50°C
Bio fuel compatibility	E85/M100
Max. vibration	$100~\text{m/s}^2~\text{rms}$ at $10~\text{to}~2,000~\text{Hz}$

Technical Specifications

Variations

	PSC-10 (5 V)	PSC-10 (12 V)
Power supply U _s	4.75 to 5.25 V	9 to 30 V
Full scale output U _A	10 to 90 % U _s ratiometric	0 to 5 V non-ra- tiometric
Response time T10/90	1.5 ms	1.0 ms
Sensitivity	400 mV/bar at $U_s = 5 \text{ V}$	500 mV/bar
Offset	500 mV at $U_s = 5 \text{ V}$	0 mV
Pin 1	-	U _s
Pin 2	Gnd	Gnd
Pin 3	Sig	Sig
Pin 4	Us	-
Pin 5	-	-

Mechanical Data

Male thread	M10x1
Wrench size	17 mm
Installation torque	15 Nm
Weight w/o wire	45 g
Sealing	O-ring 8.1 x 1.6 mm

Electrical Data

Power supply U _s	Please see variations
${\it Max power supply U_s max}$	± 30 V
Full scale output U _A	Please see variations
Current I _s	8 mA

Characteristic

Response time T10/90	Please see variations
Compensated range	0 to 90°C
Tolerance (FS) at US = 5 V	± 0.1 bar
Tolerance (FS)	± 1 %
Sensitivity	Please see variations
Offset	Please see variations

Connectors and Wires

Connector	ASL606-05PC-HE
Mating connector ASL006-05SC-HE	F02U.000.228-01
Sleeve	DR-25
Wire size	AWG 24
Wire length L	13 to 95 cm
Various motorsport and automotiv quest.	ve connectors are available on re-

Please specify the required wire length with your order.

Installation Notes

The PSC-10 can be connected directly to most control units.

The sensor has a protection for over voltage, reverse polarity and short-circuit.

Please do not fix the sensor directly to the engine block to avoid undesired strong vibrations.

Each mounting orientation is possible.

The sensor meets all EMV, EMC and ESD automotive standards.

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Fluid PSC-10

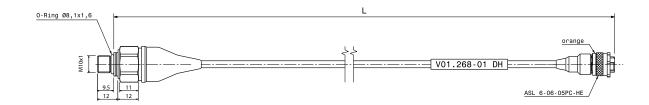
4.75 to 5.25 V

Order number F02U.V01.268-01

Pressure Sensor Fluid PSC-10

9 to 30 V

Order number F02U.V01.295-01



Pressure Sensor Fluid PSC-260



Features

► Application: 0 to 260 bar

► Response time: 2 ms

▶ Pressure reference type: Absolut

▶ Power supply: 5 V

▶ Weight: 35 g

The PSC-260 is specially designed to measure absolute pressure in gasoline direct injection applications. This sensor is also compatible with other kind of fluids e.g. Diesel, engine oil, transmission oil or brake fluid.

The sensor uses a thin layer technique to achieve high accuracy pressure measurements. The stainless steel measuring cells with piezoresistive bridges are hermetically welded with stainless steel pressure ports. The internal reference ensures ambient pressure independent measurements.

The main benefits of this sensor are its high accuracy, its wide measurement range and its robust and compact design.

Application	
Application	0 to 260 bar (a)
Pressure reference type	absolute
Max. pressure	320 bar
Operating temp. range	-40 to 130°C (140°C)
Media temp. range	-40 to 130°C (140°C)
Storage temp. range	-30 to 60°C
Max. vibration	560 m/s^2 at $800 \text{ to } 900 \text{ Hz}$ 350 m/s^2 at $1.000 \text{ to } 2.500 \text{ Hz}$

Technical Specifications		
Mechanical Data		
Male thread	M10 x 1	
Wrench size	27 mm	
Installation torque	22 Nm in steel 32.5 Nm in aluminum	
Weight w/o wire	35.2 g	
Sealing	sealed cone	
Electrical Data		
Power supply U _s	4.75 to 5.25 V	
Max power supply U _s max	16 V	
Full scale output U _A	10 to $90\%U_{\scriptscriptstyle S}$ ratio metric	
Current I _s	12 mA	
Characteristic		
Load capacity	10 nF	
Output resistance	10 Ohm	
Tolerance (FS)	+ 1 % (0 to 100°C)	
	+ 1.5 % (-40 to 0°C and 100 to 130°C)	
Sensitivity		
Sensitivity Offset	130°C)	
	130°C) 15.38 mV/bar at U _s = 5 V	
Offset	130°C) 15.38 mV/bar at U _s = 5 V	
Offset Connectors and Wires	130°C) 15.38 mV/bar at U _s = 5 V 500 mV at U _s = 5 V	
Offset Connectors and Wires Connector Mating connector	130°C) 15.38 mV/bar at $U_s = 5 V$ 500 mV at $U_s = 5 V$ ASL606-05PC-HE	

ASLU06-05SC-HE	
Pin 1	-
Pin 2	Gnd
Pin 3	Sig
Pin 4	U _s
Pin 5	-
Various motorsport and automotivities quest.	ve connectors are available on re-
Please specify the required wire le	ength with your order.

Sleeve DR-25 Wire length L 13 to 95 cm

Installation Notes

The PSC-260 can be connected directly to most control units. Please consider the TCI for the electrical connection of the sensor. The sensor has a protection for overvoltage, reverse polarity and short-circuit.

Please do not fix the sensor directly to the engine block to avoid undesired strong vibrations.

Each mounting orientation is possible.

Please consider using the adapter F02U.002.711-01.

The sensor meets all EMV, EMC and ESD automotive standards.

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

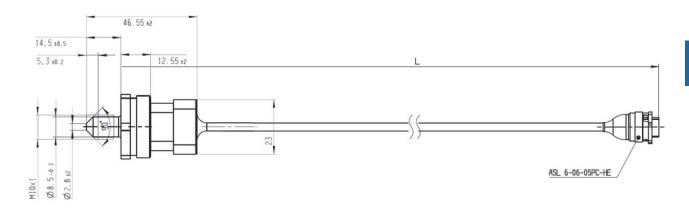
Pressure Sensor Fluid PSC-260 Order number F02U.V00.990-03

Accessories

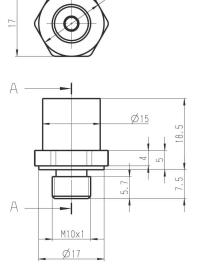
Adapter

Order number F02U.002.711-01

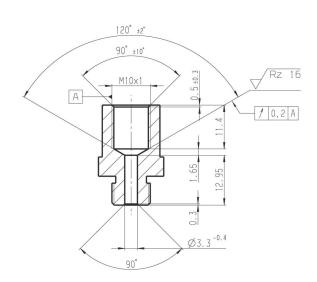
Dimensions



Sensor







Pressure Sensor Fluid PSM- SA



Features

► Application: 0 to 3.5, 6, 10, 20, 35, 60, 70, 100, 200, 350, 700 bar

► Response time: 1 ms

▶ Pressure reference type: Absolut

▶ Power supply: 8 to 30 V

▶ Weight: 13 g

This sensor is designed to measure absolute pressure of various kinds of media e.g. Diesel, gasoline, water, engine oil, transmission oil or air.

The sensor utilizes 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. An individual calibration sheet will be delivered with each sensor. The main feature and benefit of this sensor is a good protection against vibrations.

Application		
Pressure measurement range versions	3.5 to 700 bar	
Pressure reference type	absolute	
Operating temp. range	-40 to 150°C	
Vibration	2 g (10 Hz to 60 Hz) and 20 g (60 Hz to 1 KHz)	
Shock (1/2 sine)	50 g (11 ms) and 200 g (6 ms)	
Bio fuel compatibility	E85/M100	

01:1
01 1 1 1
Stainless steel
M8x1
11 mm
2.5 Nm max.
13 g + 20 g per meter of cab
O-ring 6.35 x 1.6 VITON
IP66
8 to 32 V DC
< 8 mA
± 0.05 % FSO typ.
± 0.25 % FSO
400 Hz
$0.5 \text{ to } 4.5 \text{ V} = 4 \text{ V} \pm 50 \text{ mV}$
20 to 120°C
Offset = 0.1 % span/year; Span = 0.1 %/year
$0.5 \text{ V} \pm 50 \text{ mV} (0.5 \pm 100 \text{ m})$ for ranges $\leq 10 \text{ bar or } 150 \text{ p}$
(an individual calibration sho will be delivered)
\pm 1 % FSO/100°C (\pm 2 % FSO/100°C for ranges \leq 10 or 150 psi)
$\pm 1 \%/100$ °C ($\pm 1.5 \%/100$ ° for ranges ≤ 10 bar or 150 p
ASU603-05PC-HE
F02U.000.208-01
Us
Gnd
Sig
-
Scr
Viton
AWG 24
15 to 100 cm

Installation Notes

The PSM-SA can be connected directly to most control units.

Please specify the required wire length with your order.

Each mounting orientation is possible.

Please do not fix the sensor directly to the engine block to avoid undesired strong vibrations.

100 % relative humidity is possible.

The sensor meets all EMV, EMC and ESD automotive standards.

Please find further application hints in the offer drawing at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Fluid PSM-SA

0 to 3.5 bar

Order number F02U.V01.946-01

Pressure Sensor Fluid PSM-SA

0 to 6 bar

Order number F02U.V01.947-01

Pressure Sensor Fluid PSM-SA

0 to 10 bar

Order number F02U.V01.948-01

Pressure Sensor Fluid PSM-SA

0 to 20 bar

Order number F02U.V01.949-01

Pressure Sensor Fluid PSM-SA

0 to 35 bar

Order number **F02U.V01.950-01**

Pressure Sensor Fluid PSM-SA

0 to 60 bar

Order number F02U.V01.951-01

Pressure Sensor Fluid PSM-SA

0 to 70 bar

Order number F02U.V01.724-01

Pressure Sensor Fluid PSM-SA

0 to 100 bar

Order number F02U.V01.952-01

Pressure Sensor Fluid PSM-SA

0 to 200 bar

Order number F02U.V01.953-01

Pressure Sensor Fluid PSM-SA

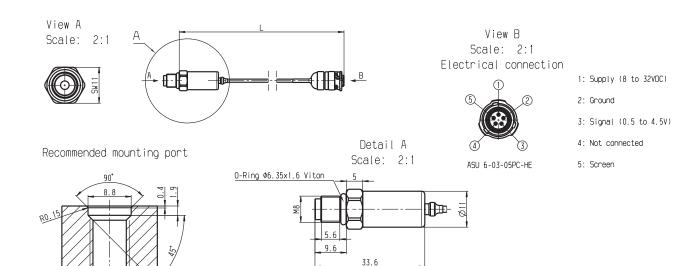
0 to 350 bar

Order number F02U.V01.954-01

Pressure Sensor Fluid PSM-SA

0 to 700 bar

Order number F02U.V02.064-01



Pressure Sensor Fluid PSS-10



Features

► Application: 1 to 11 bar

► Response time: 1.5 ms

▶ Pressure reference type: Absolut

▶ Power supply: 5 V

▶ Weight: 45 g

This sensor is designed to measure absolute pressure of various kinds of media e.g. Diesel, gasoline, water, engine oil, transmission oil or air.

The sensor uses stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique. These are hermetically welded together with stainless steel pressure ports. This guarantees a complete media compatibility.

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

Application	
Application	1 to 11 bar (a)
Pressure reference type	absolute
Max. pressure	20 bar
Operating temp. range	-40 to 125°C (140°C)
Media temp. range	-40 to 125°C (140°C)
Storage temp. range	-20 to 50°C
Bio fuel compatibility	E85/M100
Max. vibration	$100 \ \text{m/s}^2 \text{rms}$ at $10 \ \text{to} \ 2,000$ Hz

Technical Specifications

Mechanical Data

Wrench size	17 mm
Installation torque	15 Nm
Weight w/o wire	45 g
Sealing	O-ring 7.65 x 1.63 mm
Electrical Data	
Power supply U _s	4.75 to 5.25 V
$Max\ power\ supply\ U_{S}\ max$	± 30 V
Full scale output U _A	10 to 90 % $\rm U_{\rm S}$ ratiometric
Current I _s	8 mA
Characteristic	
Response time T10/90	1.5 ms
Compensated range	0 to 90°C
Tolerance (FS) at U _S = 5 V	± 0.1 bar
Tolerance (FS)	± 1 %
Sensitivity	400 mV/bar at U_s =5 V
Offset	100 mV at U_s =5 V
Connectors and Wires	
Connector	Bosch Compact
Mating connector	3-pole Compact D261.205.339-01
Pin 1	Gnd
Pin 2	Sig
Pin 3	U _s

Installation Notes

Pin 4

Pin 5

The PSS-10 can be connected directly to most control units.

The sensor has a protection for over voltage, reverse polarity and short-circuit.

Please do not fix the sensor directly to the engine block to avoid undesired strong vibrations.

Each mounting orientation is possible.

The sensor meets all EMV, EMC and ESD automotive standards.

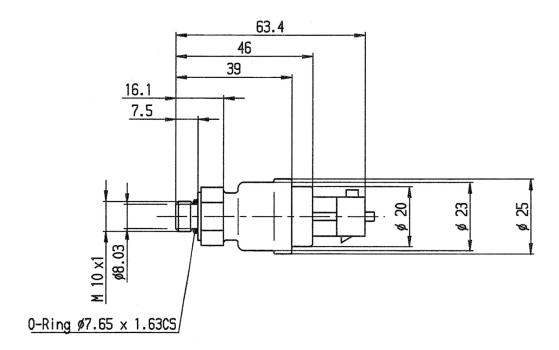
Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Fluid PSS-10 Order number B261.209.341-01



Pressure Sensor Fluid PSS-250R



Features

▶ Application: 0 to 250 bar

▶ Response time: 1.5 ms

▶ Pressure reference type: Relative

▶ Power supply: 5 V

▶ Weight: 45 g

This sensor is designed to measure the pressure of media in relation to the ambient pressure (e.g. Diesel, gasoline, water, engine oil, transmission oil or air). The sensor is available for two different supply voltage ranges.

The sensor uses stainless steel measuring cells with piezo-resistive measuring bridges in thin layer technique, which are hermetically welded together with stainless steel pressure ports. This guarantees a complete media compatibility.

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

Application	
Application	0 to 250 bar (r)
Pressure reference type	relative
Max. pressure	500 bar
Operating temp. range	-40 to 125°C (140°C)
Media temp. range	-40 to 125°C (140°C)
Storage temp. range	-20 to 50°C
Bio fuel compatibility	E85/M100
Max. vibration	$100 \ \text{m/s}^2 \text{rms}$ at $10 \ \text{to} \ 2,000$ Hz

Technical Specifications

Male thread	M10x1
Wrench size	17 mm
Installation torque	15 Nm
Weight w/o wire	45 g
Sealing	O-ring 7.65 x 1.63 mm
Electrical Data	
Power supply U _s	4.75 to 5.25 V
Max power supply U _s max	± 30 V
Full scale output U _A	10 to 90 % U _s ratiometric
Current I _s	8 mA
Characteristic	
Response time T10/90	1.5 ms
Compensated range	0 to 90°C
Tolerance (FS)	± 2.5 bar
Tolerance (FS)	± 1 %
Sensitivity	16 mV/bar at $U_s = 5 \text{ V}$
Offset	500 mV at $U_s = 5 \text{ V}$
Connectors and Wires	
Connector	Bosch Compact
Mating connector	3-pole Compact D261.205.339-01
Pin 1	Gnd
Pin 2	Sig
Pin 3	Us
Pin 4	-
Pin 5	-

Installation Notes

The PSS-250R can be connected directly to most control units.

The sensor has a protection for over voltage, reverse polarity and short-circuit.

Please do not fix the sensor directly to the engine block to avoid undesired strong vibrations.

Each mounting orientation is possible.

The sensor meets all EMV, EMC and ESD automotive standards.

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

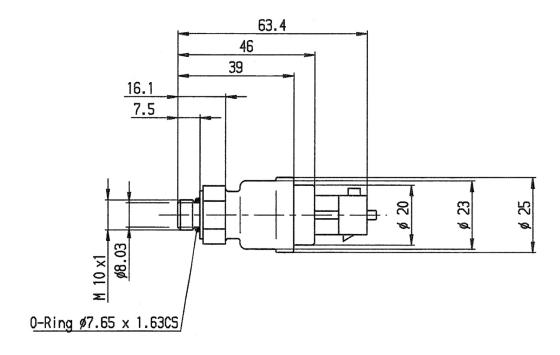
The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Fluid PSS-250R

4.75 to 5.25 V

Order number **B261.209.965-01**



Pressure Sensor Fluid PSS-140/260/420/600



Features

▶ Application: 0 to 140, 260, 420, 600 bar

► Response time: 2 ms

▶ Pressure reference type: Absolut

▶ Power supply: 5 V

► Weight: 35 g

The PSS is specially designed to measure absolute pressure in gasoline direct injection applications. This sensor is also compatible with other kind of fluids e.g. Diesel, engine oil, transmission oil or brake fluid.

The sensor uses a thin layer technique to achieve high accuracy pressure measurements. The stainless steel measuring cells with piezoresistive bridges are hermetically welded with stainless steel pressure ports. The internal reference ensures ambient pressure independent measurements.

The main benefits of this sensor are its high accuracy, its wide measurement range and its robust and compact design.

Application			
Application and max. pressure	Please see Variations		
Pressure reference type	absolute		
Operating and media temp. range	-40 to 130°C (140°C)		
Storage temp. range	-30 to 60°C		
Max. vibration	210 m/s^2 at $147 \text{ to } 1,350 \text{ Hz}$ 175 m/s^2 at $1,350 \text{ to } 2,000 \text{ Hz}$		

Technical Specifications

Variations

PSS	-140	-260	-420	-600
Application (bar) 0 to	140	260	420	600
Max. pressure (bar)	180	320	560	660
Sensitivity at U _s = 5 V (mV/bar)	28.57	15.38	9.52	6.67

Mechanical Data

Male thread	M10 x 1
Wrench size	27 mm
Installation torque	22 ± 2 Nm in aluminum 32.5 ± 2.5 Nm in steel
Weight w/o wire	35.2 g
Sealing	sealed cone

Electrical Data

Power supply U _s	4.75 to 5.25 V
Max power supply U _s max	16 V
Full scale output U _A	10 to 90 % $\rm U_{\rm s}$ ratiometric
Current I _s	12 mA

Characteristic

Load capacity	10 nF
Output resistance	10 Ohm
Tolerance (FS)	+ 1 % (0 to 100°C) + 1.5 % (-40 to 0°C and 100 to 130°C)
Sensitivity	Please see Variations
Offset	500mV at $U_S = 5 \text{V}$

Connectors and Wires

Connector	Bosch Compact
Mating connector	3-pole Compact D261.205.366-01
Pin 1	Gnd
Pin 2	Sig
Pin 3	Us

Installation Notes

The PSS- can be connected directly to most control units. Please consider the TCI for the electrical connection of the sensor.

The sensor has a protection for overvoltage, reverse polarity and short-circuit.

Please do not fix the sensor directly to the engine block to avoid undesired strong vibrations.

Each mounting orientation is possible.

Please consider using the adapter F02U.002.711-01.

The sensor meets all EMV, EMC and ESD automotive standards.

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Fluid PSS-140 Order number 0261.545.053

Pressure Sensor Fluid PSS-260 Order number 0261.545.040

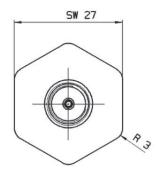
Pressure Sensor Fluid PSS-420 Order number 0261.545.136

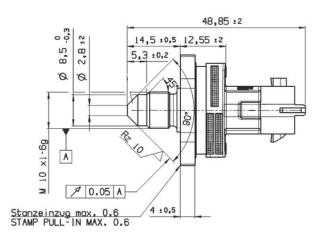
Pressure Sensor Fluid PSS-600 Order number 0261.B23.789-06

Accessories

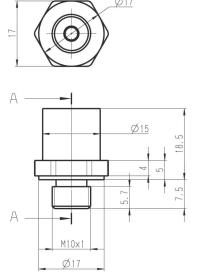
Adapter

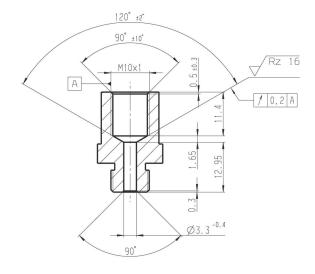
Order number F02U.002.711-01





Sensor





Adapter

Overview

Knock Sensor KS4-P



- Frequency: 3 to 25 kHz
- Weight: 48 g
- Height sensor head: 18 mm

Knock Sensor KS4-R



- Frequency: 3 to 25 kHz
- Weight: 82 g
- Height sensor head: 18 mm

Knock Sensor KS4-R2



- Frequency: 3 to 30 kHz
- Weight: 60 g
- Height sensor head: 14 mm

Knock Sensor KS4-P



Features

► Frequency: 3 to 25 kHz

▶ Weight: 48 g

► Height sensor head: 18 mm

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 3 to 25 kHz Operating temperature range -40 to 150°C Storage temperature range -30 to 60°C Max. vibration ≤ 800 m/s²

Technical Specifications

Mechanical Data	
Male thread (for cast)	M8x25
Male thread (for AI)	M8x30
Installation torque	20±5 Nm

Weight w/o wire	48 g
Protection	IP X9K
Electrical Data	
Range of frequency	3 to 25 kHz
Sensitivity at 5 kHz	$26 \pm 8 \text{mV/g}$
Max. sensitivity changing (lifetime)	-17 %
Linearity between 5 to 15 kHz (from 5 kHz value)	-10 to 10 %
Linearity between 15 to 20 kHz (linear increasing with freq)	20 to 50 %
Main resonance frequency	30 kHz
Impedance	> 1 MOhm
Temperature dependence of sensitivity	0.04 mV/g°C
Capacity field	1,150 ± 200 pF

Connectors and Wires

Mating connector 2-pole	2-Pin RB-Kp.1 (F02U.B00.966-01) or 2-Pin Jetronic (D261.205.288-01)
Pin 1	Sig+
Pin 2	Sig-

Installation Notes

The KS4-P 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.

Please route the sensor wire in a way that prevents resonance vibration.

Please find further application hints in the offer drawing at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

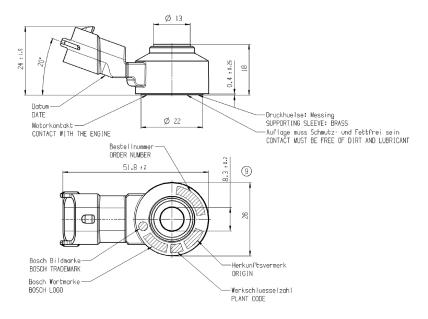
Ordering Information

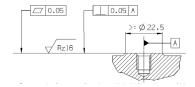
Knock Sensor KS4-P

Mating Connector: 2-Pin RB-Kp.1 Order number **0261.231.173**

Knock Sensor KS4-P

Mating Connector: 2-Pin Jetronic Order number **0261.231.188**





Knock Sensor KS4-R



Features

► Frequency: 3 to 25 kHz

► Weight: 82 g

► Height sensor head: 18 mm

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 wire lengths and various connector options.

Application	
Application	3 to 25 kHz
Operating temperature range	-40 to 130°C
Storage temperature range	-30 to 60°C
Max. vibration	\leq 800 m/s ²

Technical Specifications	
Mechanical Data	
Male thread (for cast)	M8x25
Male thread (for AI)	M8x30
Installation torque	20 ± 5 Nm
Weight w/o wire	82 g

Protection	IP 54
Electrical Data	
Range of frequency	3 to 25 kHz
Sensitivity at 5 kHz	28.8 mV/g
Max. sensitivity changing (life-time)	-17 %
Linearity between 5 to 15 kHz (from 5 kHz value)	-10 to 10 %
Linearity between 15 to 20 kHz (linear increasing with freq)	20 to 50 %
Main resonance frequency	> 30 kHz
Impedance	> 1 MOhm
Temperature dependence of sensitivity	0.04 mV/g°C
Capacity field	1,150 ± 200 pF

Connectors and Wires

Connector	A 261 230 252
Mating connector 2-pole	2-Pin RB-Kp.1 (D261.205.337-01), L=530 mm or 2-Pin RB-Kp.3 (F02U.B00.967-01), L=400 mm
Pin 1	Sig +
Pin 2	Sig -
Sleeve	PUR
Wire size	$0.5\mathrm{mm}^2$
Wire length L	See Ordering Information
Various motorsport and autor	motive connectors on request.

Installation Notes

The KS4-R 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.

Please route the sensor wire in a way that prevents resonance vibration.

Please find further application hints in the offer drawing at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

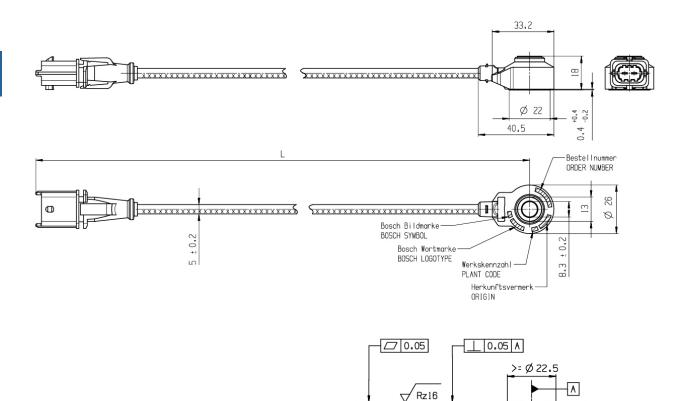
Ordering Information

Knock Sensor KS4-R

Mating Connector 2-Pin RB-Kp.1, L = 530 mm Order number **0261.231.218**

Knock Sensor KS4-R

Mating Connector 2-Pin RB-Kp.3, L = 400 mm Order number **0261.231.223**



Knock Sensor KS4-R2



Features

► Frequency: 3 to 30 kHz

► Weight: 60 g

► Height sensor head: 14 mm

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.

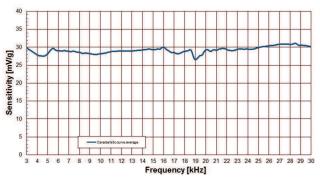
Due to the inertia of the seismic mass, the sensor moves in correlation to the engine block vibration; this motion results in a compressive force which is converted into a voltage signal via a piezoceramic sensor element. As a result, upper and lower voltage thresholds can be defined directly correlating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

The main benefits of this sensor are its robust mechanical design, compact housing and precise determination of structure-related noise. This version is an optimized part for Motorsport applications based on a series application development. Compared to the previous version, the advantage of this new modification is that this product has an extended frequency and higher operating temperature rating.

Application	
Application	3 to 30 kHz
Operating temperature range	-40 to 150°C
Storage temperature range	-30 to 60°C
Max. vibration	\leq 800 m/s ² at 0 to 24 kHz \leq 4,000 m/s ² at 5 to 24 kHz (short-term)

Technical Specifications		
Mechanical Data		
Fixing screw for cast iron	M8x25	

Fixing screw for aluminum	M8x30
Installation torque	20 + 5 Nm
Weight w/o Connector	60 g
Protection	IP 54
Electrical Data	
Range of frequency	3 to 30 kHz
Max. sensitivity changing (life-time)	-17 %
Linearity between 5 to 15 kHz (from 5 kHz value)	-10 to 10 %
Linearity between 15 to 20 kHz (linear increasing with freq)	20 to 50 %
Main resonance frequency	> 30 kHz



Ratio of frequency and sensitivity

Impedance	> 1 MOhm
Temperature dependence of sensitivity	0.04 mV/g°C
Capacity field	1,150 ± 200 pF
Connectors and Wires	
Connector	ASX602-03PC-HE
Mating connector ASX002-03SC-HE	F02U.002.840-01
Pin 1	Sig
Pin 2	Gnd
Pin 3	Scr
Sleeve	Elastomer
Wire size	0.5mm^2
Wire length L	150 to 450 mm
Various motorsport and automotive connectors on request.	

Installation Notes

The KS4-R2 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.

Please route the sensor wire in a way that prevents resonance vibration.

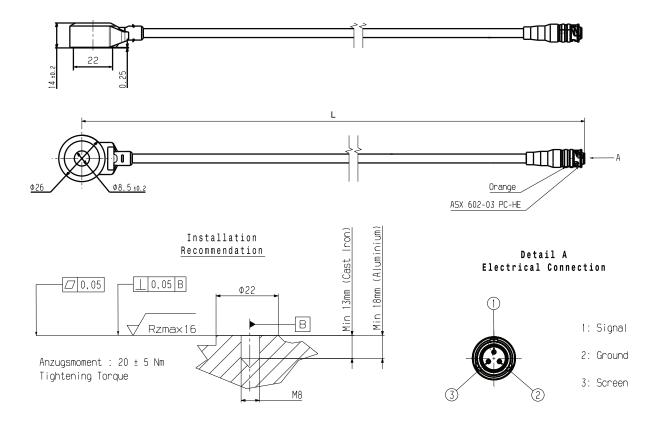
Please find further application hints in the offer drawing at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Knock Sensor KS4-R2
Order number F02U.V01.884-01



Overview

Lambda Sensor LSU 4.9

- Application: lambda 0.65 to
- Exhaust gas temperature: 930°C (1,030 for a short time)
- Thread: M18x1.5
- Weight: 120 g

Lambda Sensor LSU ADV/ **ADV** pre Turbo



- Application: lambda 0.65 to
- Exhaust gas temperature: 930°C (1,030 for a short time)
- Thread: M18x1.5
- Weight: 120 g

Lambda Sensor Mini-LSU 4.9



- Application: lambda 0.65 to
- Exhaust gas temperature: 930° C (1,030 for a short time)
- Hexagon temperature: 600°C Hexagon temperature: 820°C Hexagon temperature: 700°C
 - Thread: M16x1.5
 - Weight: 28 g

Lambda Sensor LSU 4.9



Features

- ► Application: lambda 0.65 to ∞
- ► Exhaust gas temperature: 930°C (1,030 for a short time)
- ► Hexagon temperature: 600°C

► Thread: M18x1.5

▶ Weight: 120 g

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

The wide band lambda sensor LSU 4.9 is a planar $\rm ZrO_2$ dual cell limiting current sensor with integrated heater. Its monotonic output signal in the range of lambda 0.65 to air makes the LSU 4.9 capable of being used as a 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 main benefit of the LSU 4.9 is the robust design combined with the high Bosch production quality standard.

This lambda sensor operates only in combination with a special LSU-IC, used in most Bosch Motorsport ECUs and lambda control units like LT4. You'll find this unit and more on our homepage at Electronics/Sensor Interfaces.

Application		
Application	lambda 0.65 to ∞	
Fuel compatibility	gasoline/Diesel/E85	
Exhaust gas pressure	≤ 2.5 bar (higher with decrease accuracy)	
Exhaust gas temperature range (operating)	< 930°C	

Exhaust gas temperature range (max.) for short time	< 1,030°C
Hexagon temperature	< 600°C
Wire and protective sleeve temperature	< 250°C
Connector temperature	< 140°C
Storage temperature range	-40 to 100°C
Max. vibration (stochastic peak level)	300 m/s^2

Technical Specifications

Mechanical Data

-0.405

0.900

Variations		
LSU 4.9 with automotive co	connector	
Connector	1928.404.687	
Mating connector	D261.205.356-01	
Wire length L	95.0 cm	
LSU 4.9 with motorsport connector		

Connector	AS607-35PN
Mating connector	AS007-35SN
Wire length L	20.0 to 90.0 cm

Weight w/o wire	120 g
Thread	M18x1.5
Wrench size	22 mm
Tightening torque	40 to 60 Nm

Electrical Data		
Power supply H+ nominal	7.5 V	
System supply voltage	10.8 V to 16.5 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 μΑ	

Heater control f	requency	≥ 100 Hz	
Nominal resistance of Nernst cell		300 Ohm	
Max current loa	d for Nernst cell	250 μΑ	
Characterist	ic		
Signal output		I _P meas	
Accuracy at lam	bda 0.8	0.80 ± 0.01	
Accuracy at lambda 1		1.016 ± 0.007	
Accuracy at lambda 1.7		1.70 ± 0.05	
I _P [mA]	lambda	U _A [V], v=17	U _A [V], v=8
-2.000	0.650	-	0.510
-1.602	0.700	-	0.707
-1.243	0.750	0.192	0.884
-0.927	0.800	0.525	1.041
-0.800	0.822	0.658	1.104
-0.652	0.850	0.814	1.177

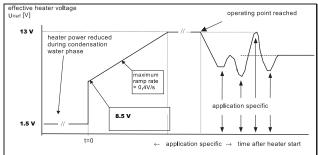
1.074

1.299

-0.183	0.950	1.307	1.409
-0.106	0.970	1.388	1.448
-0.040	0.990	1.458	1.480
0	1.003	1.500	1.500
0.015	1.010	1.515	1.507
0.097	1.050	1.602	1.548
0.193	1.100	1.703	1.596
0.250	1.132	1.763	1.624
0.329	1.179	1.846	1.663
0.671	1.429	2.206	1.832
0.938	1.701	2.487	1.964
1.150	1.990	2.710	2.069
1.385	2.434	2.958	2.186
1.700	3.413	3.289	2.342
2.000	5.391	3.605	2.490
2.150	7.506	3.762	2.565
2.250	10.119	3.868	2.614

Please note: U_A is not an output signal of the lambda sensor, but the output of the evaluation circuit. Only I_P correlates with the oxygen content of the exhaust gas. Amplification factor v=17 is typically used for lean applications (lambda>1), amplification factor v=8 is typically used for rich applications (lambda<1).

Heater Strategy



Connectors and Wires

Connector	Please see variations
Mating connector	Please see variations
Sleeve	fiber glass / silicone coated
Pin 1	Pump current APE / IP
Pin 2	Virtual ground IPN / VM
Pin 3	Heater voltage H- / Uh-

Pin 4	Heater voltage H+ / Uh+
Pin 5	Trim resistor RT / IA
Pin 6	Nernst voltage UN / RE
Wire length Please see variations	
Various motorsport and automotive connectors are available on	

Various motorsport and automotive connectors are available on request.

Installation Notes

This lambda sensor operates only in combination with a special LSU-IC, used in most Bosch Motorsport ECUs and lambda control units like LT4. You'll find this unit and more on our homepage at Accessories/Expansion Modules.

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 (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-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 at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Lambda Sensor LSU 4.9

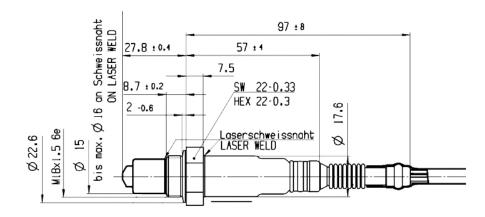
With automotive connector Order number **0258.017.025**

Lambda Sensor LSU 4.9

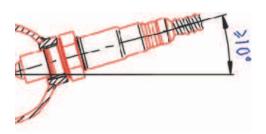
With motorsport connector Order number **B261.209.358-03**

6

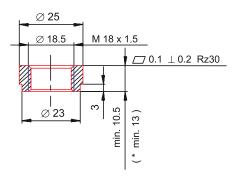
Dimensions



Mounting recommendation



Recommended design of the mating thread in the exhaust pipe: THexagon > 600°C or TGas > 930°C



Lambda Sensor LSU ADV/ADV pre Turbo



Features

► Application: lambda 0.65 to ∞

► Exhaust gas temperature: 930°C (1,030 for a short time)

► Hexagon temperature: 820°C

► Thread: M18x1.5

▶ Weight: 120 g

This sensor is designed to measure the proportion of oxygen in exhaust gases of automotive engines (gasoline or Diesel). A version with a protection tube of Inconel for pre-turbo-(supercharger) mounting is available.

The wide band lambda sensor LSU ADV is a planar ZrO₂ dual cell limiting current sensor with integrated heater. Its monotonic output signal in the range of lambda 0.65 to air makes the LSU ADV capable of being used as a universal sensor for lambda 1 measurement as well as for other lambda ranges. The LSU ADV has no trimming resistor inside the connector what results in just 5 connector pins. Compared to LSU 4.9, the LSU ADV has a wider working temperature range.

LSU ADV operates only in combination with a special evaluation unit used in lambda control unit LT4 ADV. You'll find this unit and more on our homepage at Electronics/Sensor Interfaces.

Application	
Application	lambda 0.65 to ∞
Fuel compatibility	gasoline/Diesel/E85
Exhaust gas pressure	≤ 2.5 bar (higher with decrease accuracy)

Exhaust gas temperature (operating)	≤ 930°C (≤ 980°C pre Turbo Version)
Max. exhaust gas temperature for short time	≤ 1,030°C
Hexagon temperature (operating)	≤ 650°C
Max. hexagon temperature for short time	≤ 700°C
Max. temperature at welding seam	≤ 820°C (pre Turbo Version)
Max. temperature difference between hexagon and welding seam	≤ 330°C
Wire and protective sleeve temperature	≤ 250°C
Connector temperature	≤ 140°C
Storage temperature range	-40 to 100°C
Max. vibration (stochastic peak level)	300 m/s ²

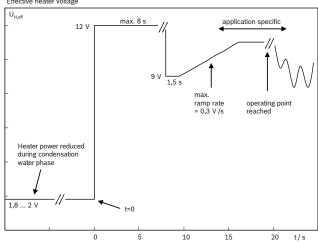
Technical S	Specifications						
Mechanical Data							
Weight w/o w	ire	120 g					
Thread		M18x1.5					
Wrench size		22 mm					
Tightening tor	que	40 to 60 Nm					
Electrical	Data						
Power supply	H+ nominal	7.5 V					
System supply voltage Heater power steady state Heater control frequency Nominal resistance of Nernst cell		10.8 V to 16.5 V 8.7 W ≥ 100 Hz 300 Ohm					
				Max current lo	oad for Nernst cell	≤ 80 μΑ	
				Switch-on tim	е	≤5s	
				Characteristic Signal output Accuracy at lambda 0.8 Accuracy at lambda 1 Accuracy at lambda 1.7			
I_P meas $-0.652 \pm 0.032 \text{ mA}$ $-0.018 \pm 0.008 \text{ mA}$							
		0.515 ± 0.022 mA					
		I _P [mA]	lambda			U _A [V], v=17	U _A [V], v=8
-1,38000	0,650	0,048	0,817				
-1.11000	0.700	0.332	0.950				
-0.88000	0.750	0.574	1.064				
-0.65000	0.800	0.816	1.178				
-0.47500	0.850	1.000	1.265				
-0.37000	0.880	1.111	1.317				
0.01000							

-0.30000	0.900	1.184	1.351
-0.16000	0.950	1.332	1.421
-0.07600	0.980	1.420	1.462
-0.04800	0.990	1.449	1.476
-0.02000	1.000	1.479	1.490
0.01167	1.030	1.512	1.506
0.03278	1.050	1.534	1.516
0.06444	1.080	1.568	1.532
0.08556	1.100	1.590	1.542
0.17000	1.180	1.679	1.584
0.23080	1.260	1.743	1.614
0.36000	1.430	1.879	1.678
0.40148	1.500	1.922	1.699
0.52000	1.700	2.047	1.758
0.54740	1.780	2.076	1.771
0.77000	2.430	2.310	1.881
1.40000	5.000	2.973	2.193

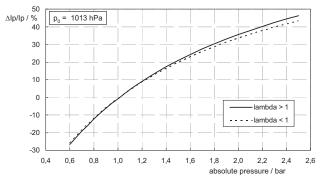
Please note: UA is not an output signal of the lambda sensor, but the output of the evaluation circuit. Only IP correlates with the oxygen content of the exhaust gas. Amplification factor v=17 is typically used for lean applications (lambda>1), amplification factor v=8 is typically used for rich applications (lambda<1).

Heater Strategy

Effective heater voltage



Pressure Compensation



Connectors and Wires

LSU ADV with automotive connector

Connector	1 928 404 669		
Mating connector	F02U.B00.725-01		
Pin 1	IP/APE		
Pin 2	VM/IPN		
Pin 3	Uh-/H-		
Pin 4	Uh+ / H+		
Pin 5	nc		
Pin 6	UN/RE		
Wire length L	95.0 cm		
LSU ADV pre Turbo with automotive connector			
Connector	1254.488.136		
Mating connector	F02U.B00.937-01		
Pin 1	IP/APE		
Pin 2	VM/IPN		
Pin 3	Uh- / H-		
Pin 4	Uh+ / H+		
Pin 5	UN / RE		
LSU ADV pre Turbo with motorsport connector			
Connector	AS607-35PA		
Mating connector	AS007-35SA		
Pin 1	Uh+/H		
Pin 2	Uh- / H-		
Pin 3	IP / APE		
Pin 4	VM / IPN		
Pin 5	UN / RE		
Pin 6	nc		
Please specify the required wire length with your order.			
Sleeve	fiber glass / silicone coated		
Various motorsport and au	tomotive connectors are available on re-		
•			

Installation Notes

quest.

This lambda sensor operates only in combination with a special evaluation unit used in lambda control unit LT4 ADV. You'll find this unit and more on our homepage at Accessories/Expansion Modules.

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 (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-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 at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Lambda Sensor LSU ADV

Automotive connector, wire length 95 cm Order number **0258.027.010**

Lambda Sensor LSU ADV

Motorsport connector, wire length customer specific (max. 90 cm)

Order number F02U.V01.861-01

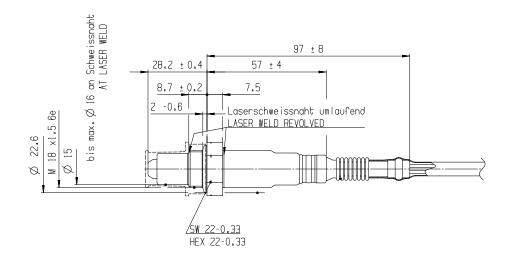
Lambda Sensor LSU ADV pre Turbo

Automotive connector, wire length 65 cm Order number **0258.027.00F**

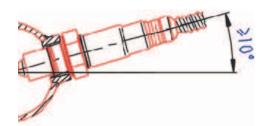
Lambda Sensor LSU ADV pre Turbo

Motorsport connector, wire length 33 cm Order number **F02U.V02.908-02**

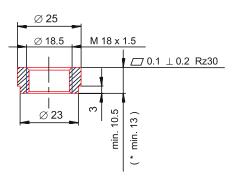
Dimensions



Mounting recommendation



Recommended design of the mating thread in the exhaust pipe *: THexagon > 600°C or TGas > 930°C



Lambda Sensor Mini-LSU 4.9



Features

- ► Application: lambda 0.65 to ∞
- ► Exhaust gas temperature: 930°C (1,030 for a short time)
- ► Hexagon temperature: 700°C

► Thread: M16x1.5

▶ Weight: 28 g

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

The wide band lambda sensor Mini-LSU 4.9 is a planar ZrO₂ 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 a universal sensor for lambda = 1 measurement as well as for lean and rich ranges. The connector housing contains a trimming resistor, which defines the characteristic of the sensor. The main benefit of the Mini-LSU 4.9 is its very compact design in combination with the high Bosch production quality standard. The Mini-LSU is produced and tested in a handmade process.

The complete light weight housing is made of Inconel which makes it resistant against high temperatures. The sensor element is more than 50 % smaller than it is in the production lambda sensor. It is connected over silver coated steel cables to make it more reliable against vibrations.

This lambda sensor operates only in combination with a special LSU-IC, used in most Bosch Motorsport ECUs and lambda control units like LT4. You'll find this unit and more on our homepage at Electronics/Sensor Interfaces.

Application	
Application	lambda 0.65 to ∞

Fuel compatibility	gasoline/Diesel/E85
Exhaust gas pressure	≤ 2.5 bar (higher with decrease accuracy)
Exhaust gas temperature range (operating)	< 930°C
Exhaust gas temperature range (max.) for short time	< 1,030°C
Hexagon temperature	≤ 700°C
Wire and protective sleeve temperature	< 250°C
Connector temperature	< 150°C
Storage temperature range	-40 to 100°C
Max. vibration (stochastic peak level)	300 m/s² (see Installation Notes)

Technical Specifications

		- •			
Va	ria	ıtı	റ	n	S

-2.000

0.650

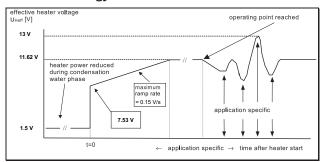
0.510

Variations				
Mini-LSU 4.9	Mini-LSU 4.9 with automotive connector			
Connector		1928.404.682	2	
Mating conne	ector	D261.205.356	6-01	
Wire length L	-	950 mm		
Mini-LSU 4.9	9 with motorsport	connector		
Connector		AS607-35PN		
Mating conne	ector	AS007-35SN		
Wire length L	-	200 to 1,400 r	nm	
Mechanica	al Data			
Weight w/o v	vire	28 g		
Thread		M16x1.5		
Wrench size		17 mm		
Tightening to	rque	60 Nm		
Electrical	Data			
Power supply	/ H+ nominal	7.5 V		
System supp (min)	ly voltage H+	10.8 V		
Heater powe	r steady state	7.5 W		
Heater contro	ol frequency	100 Hz		
Nominal resis	stance of Nernst	300 Ohm		
Max. current cell	load for Nernst	250 μΑ		
Character	istic			
Signal output	t	I _P meas		
Accuracy at I	ambda 0.8	0.80 ± 0.01		
Accuracy at l	ambda 1	1.016 ± 0.007		
Accuracy at I	ambda 1.7	1.70 ± 0.05		
I _P [mA]	lambda	U _A [V], v=17	U A [V], v=8	

-1.602	0.700	-	0.707
-1.243	0.750	0.192	0.884
-0.927	0.800	0.525	1.041
-0.800	0.822	0.658	1.104
-0.652	0.850	0.814	1.177
-0.405	0.900	1.074	1.299
-0.183	0.950	1.307	1.409
-0.106	0.970	1.388	1.448
-0.040	0.990	1.458	1.480
0	1.003	1.500	1.500
0.015	1.010	1.515	1.507
0.097	1.050	1.602	1.548
0.193	1.100	1.703	1.596
0.250	1.132	1.763	1.624
0.329	1.179	1.846	1.663
0.671	1.429	2.206	1.832
0.938	1.701	2.487	1.964
1.150	1.990	2.710	2.069
1.385	2.434	2.958	2.186
1.700	3.413	3.289	2.342
2.000	5.391	3.605	2.490
2.150	7.506	3.762	2.565
2.250	10.119	3.868	2.614
D I ()			

Please note: U_A is not an output signal of the lambda sensor, but the output of the evaluation circuit. Only I_P correlates with the oxygen content of the exhaust gas. Amplification factor v=17 is typically used for lean applications (lambda>1), amplification factor v=8 is typically used for rich applications (lambda<1).

Heater Strategy



Resistance/LSU Temperature

Temp (°C)
1030
888
840
806
780
761
744
729

550	703
650	686
800	665
1000	642
1200	628
2500	567

Connectors and Wires

Connector	Please see variations
Mating connector	Please see variations
Sleeve	fiber glass / silicone coated
Pin 1	Pump current APE / IP
Pin 2	Virtual ground IPN / VM
Pin 3	Heater voltage H- / Uh-
Pin 4	Heater voltage H+ / Uh+
Pin 5	Trim resistor RT / IA
Pin 6	Nernst voltage UN / RE
Wire length	Please see variations

Various motorsport and automotive connectors are available on request.

Installation Notes

This lambda sensor operates only in combination with a special LSU-IC, used in most Bosch Motorsport ECUs and lambda control units like LT4. You'll find this unit and more on our homepage at Accessories/Expansion Modules.

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 up stand 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 at our homepage.

A higher maximum vibration profile is possible and should be determined by the customer's individual application.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

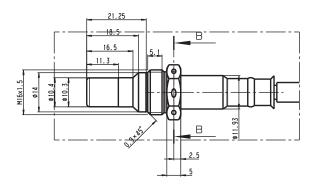
Lambda Sensor Mini-LSU 4.9

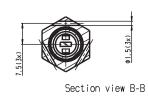
With automotive connector Order number **B258.490.103-30**

Lambda Sensor Mini-LSU 4.9

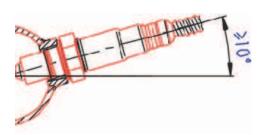
With motorsport connector Order number **F02U.V02.227-02**

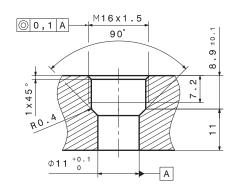
Dimensions





Mounting recommendation





Overview

Pressure Sensor Combined PSM-SAT



- Pressure: 0 to 3.5, 6, 10, 20, 35, 60, 70, 100, 200, 350, 700 bar
- Temperature: -40 to 150°C
 Power supply: 8 to 32 V
- Weight: 15 g

Pressure Sensor Combined PST 1/PST 3



- Pressure: 0.1 to 1.15 bar or 0.2 to 3 bar
- Temperature: -40 to 150°C or -40 to 140°C
- Power supply: 5 V
- Weight: 24 g

Pressure Sensor Combined PST 4



- Pressure: 0.4 to 4 bar
- Temperature: -40 to 130°C
- Power supply: 5 V
- Weight: 22 g

Pressure Sensor Combined PST-F 2 280 bar



- · Pressure: 0 to 280 bar
- Temperature: -40 to 140°C
- Power supply: 5 V
- Weight: 36 g

Pressure Sensor Combined PST-F 2 350 bar



- Pressure: 0 to 350 barTemperature: -40 to 140°C
- Power supply: 5 V
- Weight: 36 g

Pressure Sensor Combined PSM-SAT



Features

► Pressure: 0 to 3.5, 6, 10, 20, 35, 60, 70, 100, 200, 350, 700 bar

► Temperature: -40 to 150°C

▶ Power supply: 8 to 32 V

▶ Weight: 15 g

This sensor is designed to measure absolute pressure of various kinds of media e.g. Diesel, gasoline, water, engine oil, transmission oil or air plus temperature.

The sensor utilizes 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. An individual calibration sheet will be delivered with each sensor. The main feature and benefit of this sensor is a good protection against vibrations.

Application	
Pressure measurement range versions	3.5 to 700 bar
Pressure reference type	absolute
Operating temp. range	-40 to 150°C
Shock (1/2 sine)	50 g (11 ms) and 200 g (6 ms)
Bio fuel compatibility	E85/M100
Max. vibration	2 g (10 Hz to 60 Hz) and 20 g (60 Hz to 1 KHz)

Technical Specifications Mechanical Data Housing Stainless steel

Male thread	M8x1
Wrench size	12 mm
Installation torque	2.5 Nm max.
Weight	15 g + 20 g per meter of cab
Sealing	O-ring 6.35 x 1.6 VITON
Ingress Protection	IP66
Electrical Data	
Supply voltage	8 to 32 V DC
Max current	< 8 mA
Non-Repeatability	± 0.05 % FSO typ.
CNL & H	± 0.25 % FSO
Bandwidth (-3 dB)	400 Hz
Output "FSO"	$0.5 \text{ to } 4.5 \text{ V} = 4 \text{ V} \pm 50 \text{ mV}$
Characteristic	
Compensated range	20 to 120°C
Long term stability	Offset = 0.1 % span/year; Span = 0.1 %/year
Zero offset at 23°C	$0.5 \text{ V} \pm 50 \text{ mV} (0.5 \pm 100 \text{ m})$ for ranges $\leq 10 \text{ bar or } 150 \text{ p}$
Sensitivity/Offset	(an individual calibration she will be delivered)
Thermal zero shift "TZS"	± 1 % FSO/100°C (± 2 % FSO/100°C for ranges ≤ 10 l or 150 psi)
Thermal sensitivity shift "TSS"	$\pm 1 \%/100^{\circ}\text{C} (\pm 1.5 \%/100^{\circ}\text{C})$ for ranges ≤ 10 bar or 150 p
Temperature sensor RTD	1,000 Ohms Platinum DIN El 60751 63 % response time: 3 s max
Connectors and Wires	
Connector	ASU603-05PC-HE
Mating connector ASU003-05SC-HE	F02U.000.208-01
Pin 1	Power Supply
Pin 2	Ground
Pin 3	Pressure Signal
Pin 4	Temperature Signal +
Pin 5	Temperature Signal -
Sleeve	Viton
Wire size	AWG 24
Wire length L	15 to 100 cm
v	tive connectors are available on

Installation Notes

The PSM-SAT can be connected directly to most control units.

Each mounting orientation is possible.

Please do not fix the sensor directly to the engine block to avoid undesired strong vibrations.

100 % relative humidity is possible.

The sensor meets all EMV, EMC and ESD automotive standards.

Please find further application hints in the offer drawing at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Fluid PSM-SAT

0 to 3.5 bar

Order number F02U.V01.955-02

Pressure Sensor Fluid PSM-SAT

0 to 6 bar

Order number F02U.V01.956-02

Pressure Sensor Fluid PSM-SAT

0 to 10 bar

Order number F02U.V01.980-02

Pressure Sensor Fluid PSM-SAT

0 to 20 bar

Order number F02U.V01.957-02

Pressure Sensor Fluid PSM-SAT

0 to 35 bar

Order number **F02U.V01.958-02**

Pressure Sensor Fluid PSM-SAT

0 to 60 bar

Order number **F02U.V01.962-02**

Pressure Sensor Fluid PSM-SAT

0 to 100 bar

Order number F02U.V01.964-02

Pressure Sensor Fluid PSM-SAT

0 to 200 bar

Order number F02U.V01.965-02

Pressure Sensor Fluid PSM-SAT

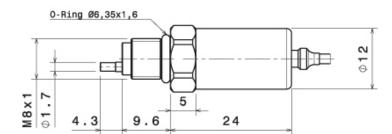
0 to 350 bar

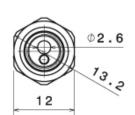
Order number F02U.V01.966-02

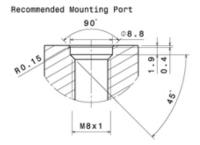
Pressure Sensor Fluid PSM-SAT

0 to 700 bar

Order number F02U.V02.065-02







Pressure Sensor Combined PST 1/PST 3



Features

▶ Pressure: 0.1 to 1.15 bar or 0.2 to 3 bar

► Temperature: -40 to 150°C or -40 to 140°C

▶ Power supply: 5 V

▶ Weight: 24 g

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

An integrated circuit combines a piezo-resistive sensor element and electronic systems for signal-amplification and temperature-compensation. The output of the sensor is an analog, ratio metric signal. Two different pressure ranges are available (0.1 to 1.15 bar or 0.2 to 3 bar).

Application	
Application 1	0.1 to 1.15 bar or 0.2 to 3 bar (a)
Application 2	-40 to 130°C
Reference	Absolute
Max. pressure	5 bar
Operating temp. range	-40 to 130°C
Media temp. range	-40 to 130°C
Storage temp. range	0 to 40°C
Max. vibration	According to ISO 16750-3

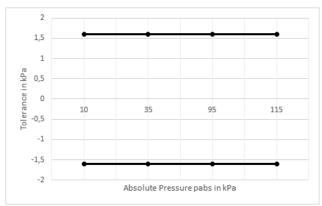
Technical Specifications

Variations

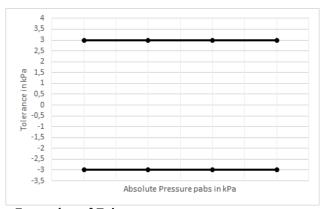
PST 1 (0.1 to 1.15 **PST 3** (0.2 to 3 bar) bar)

Tolerance (FS) at U _S = 5 V	± 0.016 b	ar	± 0.030 bar
Tolerance (FS)	± 1.52 %		± 1.07 %
Sensitivity	4,048 mV	/bar	1,518 mV/bar
Offset	-4.76 mV		96.43 mV
Mechanical Data	l		
Mounting		M6	
Fitting		12.05 ± 0).8 mm
Weight w/o wire		24 g	
Sealing		O-ring 7.5	9 x 2.62 mm
Electrical Data			
Power supply U _s		4.75 to 5.	.25 V
Max. power supply		16 V	
Full scale output U_A at	5 V	0.4 to 4.6	5 V
Current I _s		9 mA	
Characteristic 1			
Response time T10/9	0	1 ms	
Compensated range		10 to 85°	0
Tolerance (FS) at U_s =	= 5 V	Please see	e variations
Tolerance (FS)		Please see	e variations
Sensitivity		Please see variations	
Offset		Please see	evariations
Characteristic 2			
T [°C]		R [Ohm]	
-40		45,303	
-30		26,108	
-20		15,458	
-10		9,395	
0		5,895	
10		3,791	
20		2,499	
25		2,056	
30		1,706	
40		1,174	
50 60		833.8 595.4	
70		435.6	
80		322.5	
90		243.1	
100		186.6	
110		144.2	
120		112.7	
130		89.28	

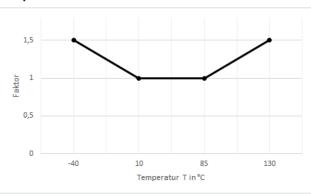
Tolerance 0.1 to 1.15 bar



Tolerance 0.2 to 3 bar



Expansion of Tolerance



Connectors and Wires

Connector	Bosch Compact
Mating connector	D261.205.360-01
Pin 1	Ground

Pin 2 Temperature Signal Pin 3 Power Supply Pin 4 Pressure Signal

Various motorsport and automotive connectors are available on request.

Installation Notes

The PST 1/PST 3 is designed for engines using ROZ95, ROZ98, M15, E22 and Diesel.

The sensor can be connected directly to most control units.

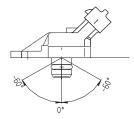
To avoid noise, an ECU-input circuit with a RC-low pass filter (tau = 2 ms) is recommended.

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

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

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

To avoid damage caused by condensate the maximum mounting position from vertical is $+-60^{\circ}$.



Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Combined PST 1

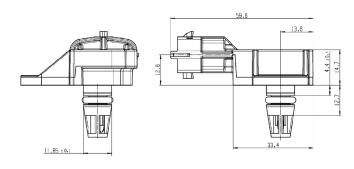
0.1 to 1.15 bar

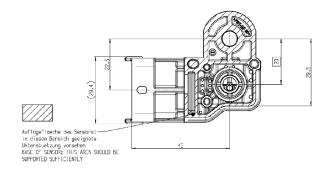
Order number 0261.230.333

Pressure Sensor Combined PST 3

0.2 to 3 bar

Order number **0261.230.280**





Pressure Sensor Combined PST 4



Features

▶ Pressure: 0.4 to 4 bar

► Temperature: -40 to 130°C

▶ Power supply: 5 V

▶ Weight: 22 g

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

An integrated circuit combines a piezo-resistive sensor element and electronic systems for signalamplification and temperature-compensation. The output of the sensor is an analog, ratio metric signal.

Application Application 1 0.4 to 4 bar (a) Application 2 -40 to 130°C Reference Absolute Max. pressure 6 bar Operating temp. range -40 to 130°C Media temp. range -40 to 130°C 0 to 40°C Storage temp. range Max. vibration According to ISO 16750-3

Technical Specifications

Mechanical Data

Mounting	M6 + Washer
Weight without wire	22 g
Fitting	12.05 ± 0.8 mm
Sealing	O-ring 7.59 x 2.62 mm

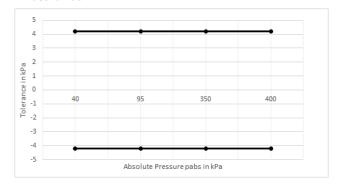
Electrical Data

Power supply U _s	4.75 to 5.25 V
$Max\ power\ supply\ U_s\ max$	16 V
Full scale output U _A	0.386 to 4.5 V
Current I _s	12 mA
Characteristic 1	
Response time T10/90	1 ms
Compensated range	10 to 85°C
Tolerance (FS) at U _s = 5 V	0.042 bar
Sensitivity	1,143 mV/bar
Offset	-71.43 mV
Characteristic 2	
T [°C]	R [Ohm]
-40	45,303
-30	26,108
-20	15,458
-10	9,395
0	5,895
10	3,791
20	2,499
25	2,056
30	1,706
40	1,174
50	833.8
60	595.4
70	435.6
80	322.5
90	243.1
100	186.6
110	144.2

Tolerance

120

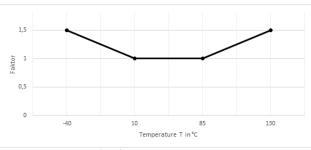
130



112.7

89.28

Expansion of Tolerance



Connectors and Wires

Connector	Bosch Compact
Mating connector	D261.205.360-01
Pin 1	Ground
Pin 2	Temperature Signal
Pin 3	Power Supply
Pin 4	Pressure Signal

Installation Notes

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

The sensor can be connected directly to most control units.

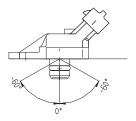
To avoid noise, an ECU-input circuit with a RC-low pass filter (tau = 2 ms) is recommended.

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

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

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

To avoid damage caused by condensate the maximum mounting position from vertical is +-60°.

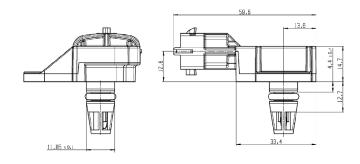


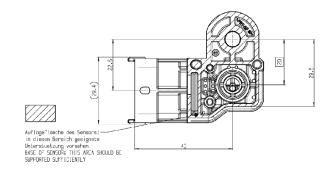
Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Combined PST 4 Order number 0261.230.423





Pressure Sensor Combined PST-F 2 280 bar



Features

▶ Pressure: 0 to 280 bar

► Temperature: -40 to 140°C

▶ Power supply: 5 V

► Weight: 36 g

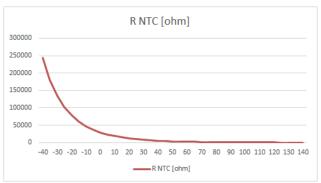
This sensor is designed to measure absolute gasoline pressure and gasoline temperature in direct injection systems.

The pressure measurement is based on the expansion of a steel diaphragm, where strain gauges are placed to a Wheatstone bridge. The measured signal is proportional to the pressure and is processed in an application specific integrated circuit.

The temperature measurement is conducted by an NTC thermistor. The main feature of this sensor is its compact design and the integration of two functions (temperature and pressure measurements) in a common housing.

Application	
Application 1	0 to 280 bar
Reference	Absolute
Max. pressure	340 bar
Application 2	-40 to 140°C
Resistance at 25°C	10 kOhm
Operating temp. range	-40 to 140°C
Media temp. range	-40 to 140°C
Storage temp. range	-40 to 60°C
Biofuel compatibility	E26, E85
Max. vibration	$210 \text{m/s}^2 \text{RMS}$ at 147 to 1,350 Hz 175 m/s² RMS at 1,350 to 2,000 Hz

Male thread M10x1 Weight without wire 36 g Wrench size 27 mm Installation torque 37.5 ± 2.5 Nm Sealing Sealed cone Electrical Data Power supply U _S 4.75 to 5.25 V Max power supply U _S max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _S ratiometric Current I _S 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of	Technical Specifications	
Weight without wire 36 g Wrench size 27 mm Installation torque 37.5 ± 2.5 Nm Sealing Sealed cone ELectrical Data Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in oil dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C */- 1 S % at -40 to 0°C and 100 to 130°C Sensitivity at U _s = 5 V 14.3 mV/bar Offset So mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240	Mechanical Data	
Wrench size 27 mm Installation torque 37.5 ± 2.5 Nm Sealing Sealed cone Electrical Data Power supply U _s Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature: 9 s (r	Male thread	M10x1
Wrench size 27 mm Installation torque 37.5 ± 2.5 Nm Sealing Sealed cone Electrical Data Power supply U _s Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature: 9 s (r	Weight without wire	36 g
Electrical Data Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in oil dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1.8 w at -40 to 0°C and 100 to 130°C Sensitivity at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141	•	27 mm
Electrical Data Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature: 9 s (response t	Installation torque	37.5 ± 2.5 Nm
Power supply U _s		Sealed cone
Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in oil dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1.5 % at -40 to 0°C and 100 to 130°C Sensitivity at U _s = 5 V 14.3 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 243.241 -30 135.753 -20 78,716 -10 47.258 0 29.287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4	Electrical Data	
Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in oil dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 100 to 130°C Sensitivity at U _s = 5 V 14.3 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 86	Power supply U _s	4.75 to 5.25 V
Full scale output U _A 0.5 to 4.5 V U _S ratiometric Current I _S 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in oil dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _S +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 100 to 130°C Sensitivity at U _S = 5 V 14.3 mV/bar Offset 500 mV at U _S = 5 V Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 1		16 V (18 V for max. 1 h)
Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in oil dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 100 to 130°C Sensitivity at U _s = 5 V 14.3 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3		0.5 to 4.5 V U _s ratiometric
Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in oil dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/-1.5 % at -40 to 0°C and 100 to 130°C Sensitivity at U _s = 5 V 14.3 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	Current I _s	12 mA
Temperature: 9 s (response time of temperature signal in oil dip bath 20 to 100°C) Compensated range	Characteristic 1	
Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 100 to 130°C Sensitivity at U _s = 5 V 14.3 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	Response time T10/90	Temperature: 9 s (response time of temperature signal in oil
$ +/- 1.5 \% \text{ at } -40 \text{ to } 0^{\circ}\text{C} \text{ and } 100 \text{ to } 130^{\circ}\text{C} $ Sensitivity at $\text{U}_{\text{S}} = 5 \text{ V} $ $ 14.3 \text{ mV/bar} $ $ 500 \text{ mV at } \text{U}_{\text{S}} = 5 \text{ V} $ $ \textbf{Characteristic 2} $ $ T \begin{bmatrix} ^{\circ}\text{C} \end{bmatrix} \qquad \text{R [Ohm]} $ $ -40 \qquad \qquad 243,241 $ $ -30 \qquad \qquad 135,753 $ $ -20 \qquad \qquad 78,716 $ $ -10 \qquad \qquad 47,258 $ $ 0 \qquad \qquad 29,287 $ $ 10 \qquad \qquad 18,684 $ $ 20 \qquad \qquad 12,240 $ $ 25 \qquad \qquad 10,000 $ $ 30 \qquad \qquad 8,218 $ $ 40 \qquad \qquad 5,642 $ $ 50 \qquad \qquad 3,955 $ $ 60 \qquad \qquad 2,826 $ $ 70 \qquad \qquad 2,055 $ $ 80 \qquad \qquad 1,519 $ $ 90 \qquad \qquad 1,141 $ $ 100 \qquad \qquad 868.4 $ $ 110 \qquad \qquad 669.9 $ $ 120 \qquad \qquad 523.2 $ $ 130 \qquad \qquad 413.3 $	Compensated range	-40 to 130°C
Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	Tolerance (FS) at U _s	+/- 1.5 % at -40 to 0°C and 100
Characteristic 2 T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	Sensitivity at $U_s = 5 \text{ V}$	14.3 mV/bar
T [°C] R [Ohm] -40 243,241 -30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	Offset	500 mV at $U_S = 5 \text{ V}$
-40243,241-30135,753-2078,716-1047,258029,2871018,6842012,2402510,000308,218405,642503,955602,826702,055801,519901,141100868.4110669.9120523.2130413.3	Characteristic 2	
-30 135,753 -20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	T [°C]	R [Ohm]
-20 78,716 -10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	-40	243,241
-10 47,258 0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	-30	135,753
0 29,287 10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	-20	78,716
10 18,684 20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	-10	47,258
20 12,240 25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	0	29,287
25 10,000 30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	10	18,684
30 8,218 40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	20	12,240
40 5,642 50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3		
50 3,955 60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	25	10,000
60 2,826 70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3		8,218
70 2,055 80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	30 40	8,218 5,642
80 1,519 90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	30 40 50	8,218 5,642 3,955
90 1,141 100 868.4 110 669.9 120 523.2 130 413.3	30 40 50 60	8,218 5,642 3,955 2,826
100 868.4 110 669.9 120 523.2 130 413.3	30 40 50 60 70	8,218 5,642 3,955 2,826 2,055
110 669.9 120 523.2 130 413.3	30 40 50 60 70 80	8,218 5,642 3,955 2,826 2,055 1,519
120 523.2 130 413.3	30 40 50 60 70 80 90	8,218 5,642 3,955 2,826 2,055 1,519 1,141
130 413.3	30 40 50 60 70 80 90 100	8,218 5,642 3,955 2,826 2,055 1,519 1,141 868.4
	30 40 50 60 70 80 90 100	8,218 5,642 3,955 2,826 2,055 1,519 1,141 868.4 669.9
140 330.0	30 40 50 60 70 80 90 100 110	8,218 5,642 3,955 2,826 2,055 1,519 1,141 868.4 669.9 523.2
	30 40 50 60 70 80 90 100 110 120 130	8,218 5,642 3,955 2,826 2,055 1,519 1,141 868.4 669.9 523.2 413.3



Connectors and Wires

Connector	Hirschmann
Mating connector	F02U.B00.596-01
Pin 1	Ground
Pin 2	Pressure Signal
Pin 3	Temperature Signal
Pin 4	Power Supply

Various motorsport and automotive connectors are available on request.

Installation Notes

The sensor can be connected directly to most control units.

For temperature measurement please use a pull-up resistor with an optimal value of 4.6 kOhm.

The sensor has a protection for overvoltage, reverse polarity and short-circuit.

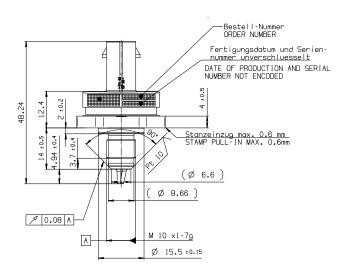
Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

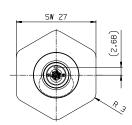
Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Combined PST-F 2 280 bar Order number 0261.545.115





Pressure Sensor Combined PST-F 2 350 bar



Features

▶ Pressure: 0 to 350 bar

► Temperature: -40 to 140°C

▶ Power supply: 5 V

► Weight: 36 g

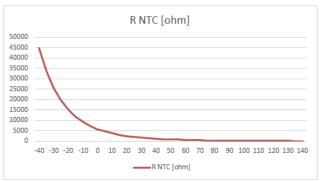
This sensor is designed to measure absolute gasoline pressure and gasoline temperature in direct injection systems

The pressure measurement is based on the expansion of a steel diaphragm, where strain gauges are placed to a Wheatstone bridge. The measured signal is proportional to the pressure and is processed in an application specific integrated circuit.

The temperature measurement is conducted by an NTC thermistor. The main feature of this sensor is its compact design and the integration of two functions (temperature and pressure measurements) in a common housing.

Application	
Application 1	0 to 350 bar
Reference	Absolute
Max. pressure	390 bar
Application 2	-40 to 140°C
Resistance at 25°C	2 kOhm
Operating temp. range	-40 to 140°C
Media temp. range	-40 to 140°C
Storage temp. range	-40 to 60°C
Biofuel compatibility	E26, E85
Max. vibration	$210 \text{m/s}^2 \text{RMS}$ at $147 \text{to} 1,350 \text{Hz}$ $175 \text{m/s}^2 \text{RMS}$ at $1,350 \text{to} 2,000 \text{Hz}$

dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C	Technical Specifications	;
Weight without wire 36 g Wrench size 27 mm Installation torque 37.5 ± 2.5 Nm Sealing Sealed cone Electrical Data Power supply Us Power supply Us 4.75 to 5.25 V Max power supply Us max 16 V (18 V for max. 1 h) Full scale output UA 0.5 to 4.5 V Us ratiometric Current Is 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in ordip bath 20 to 100°C Compensated range -40 to 130°C Tolerance (FS) at Us +/- 1% at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at Us = 5 V 11.43 mV/bar Offset 500 mV at Us = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480	Mechanical Data	
Wrench size 27 mm Installation torque 37.5 ± 2.5 Nm Sealing Sealed cone Electrical Data Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in or dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C and 10 to 130°C Sensitivity at U _s = 5 V 11.43 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167	Male thread	M10x1
Installation torque 37.5 ± 2.5 Nm Sealing Sealed cone Electrical Data Power supply U _S 4.75 to 5.25 V Max power supply U _S max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _S ratiometric Current I _S 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in ordip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _S +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _S = 5 V 11.43 mV/bar Offset 500 mV at U _S = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Weight without wire	36 g
Sealed cone Electrical Data Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature: signal in ordip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _s = 5 V 11.43 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70	Wrench size	27 mm
Electrical Data Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in ordip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1.8 at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _s = 5 V 11.43 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 <	Installation torque	37.5 ± 2.5 Nm
Power supply U _s 4.75 to 5.25 V Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in ordip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _s = 5 V 11.43 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4	Sealing	Sealed cone
Max power supply U _s max 16 V (18 V for max. 1 h) Full scale output U _A 0.5 to 4.5 V U _s ratiometric Current I _s 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in or dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _s = 5 V 11.43 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 <	Electrical Data	
Full scale output U _A 0.5 to 4.5 V U _S ratiometric Current I _S 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in ordip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _S +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _S = 5 V 11.43 mV/bar Offset 500 mV at U _S = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Power supply U _s	4.75 to 5.25 V
Current I₅ 12 mA Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in or dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U₅ +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10° to 130°C Sensitivity at U₅ = 5 V 11.43 mV/bar Offset 500 mV at U₅ = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Max power supply U _s max	16 V (18 V for max. 1 h)
Characteristic 1 Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in or dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _s = 5 V 11.43 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Full scale output U _A	0.5 to 4.5 V $U_{\rm S}$ ratiometric
Response time T10/90 Pressure: 0.2 to 0.8 ms Temperature: 9 s (response time of temperature signal in or dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Current I _s	12 mA
Temperature: 9 s (response time of temperature signal in or dip bath 20 to 100°C) Compensated range -40 to 130°C Tolerance (FS) at U _s +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _s = 5 V 11.43 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Characteristic 1	
Tolerance (FS) at U _S +/- 1 % at 0 to 100°C +/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _S = 5 V 11.43 mV/bar Offset 500 mV at U _S = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Response time T10/90	Temperature: 9 s (response time of temperature signal in oil
+/- 1.5 % at -40 to 0°C and 10 to 130°C Sensitivity at U _s = 5 V 11.43 mV/bar Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 20,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Compensated range	-40 to 130°C
Offset 500 mV at U _s = 5 V Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Tolerance (FS) at U _S	+/- 1.5 % at -40 to 0°C and 100
Characteristic 2 T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Sensitivity at U _s = 5 V	11.43 mV/bar
T [°C] R [Ohm] -40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Offset	500 mV at $U_S = 5 \text{ V}$
-40 44,864 -30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	Characteristic 2	
-30 25,524 -20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	T [°C]	R [Ohm]
-20 15,067 -10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	-40	44,864
-10 9,195 0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	-30	25,524
0 5,784 10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	-20	15,067
10 3,740 20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	-10	9,195
20 2,480 25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	0	5,784
25 2,038 30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	10	3,740
30 1,683 40 1,167 50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	20	2,480
401,167508256059470434,980323,490244100186,6110144,5	25	2,038
50 825 60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	30	1,683
60 594 70 434,9 80 323,4 90 244 100 186,6 110 144,5	40	1,167
70 434,9 80 323,4 90 244 100 186,6 110 144,5	50	
80 323,4 90 244 100 186,6 110 144,5		
90244100186,6110144,5		
100 186,6 110 144,5		
110 144,5		
120 113,3		
130 89,8		
140 71,9	140	71,9



Connectors and Wires

Connector	Bosch Trapezoid
Mating connector	F02U.B00.751-01
Pin 1	-
Pin 2	Temperature Signal
Pin 3	Ground
Pin 4	Pressure Signal
Pin 5	Power Supply

Various motorsport and automotive connectors are available on request.

Installation Notes

The sensor can be connected directly to most control units.

For temperature measurement please use a pull-up resistor with an optimal value of 4.6 kOhm.

The sensor has a protection for overvoltage, reverse polarity and short-circuit.

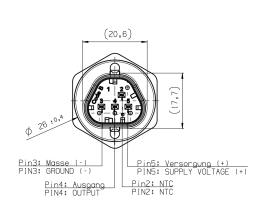
Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

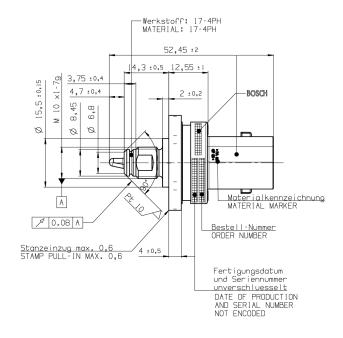
Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Pressure Sensor Combined PST-F 2 350 bar Order number 0261.B35.596-01





Rotary Position Sensor RPS-F



Features

- ▶ Rotational movement measurement
- ► Hall effect technology
- ▶ Measurement range: 0 to 360° possible
- ► Analog output 0.2 to 4.8 V
- ▶ Dual output, fully redundant possible

This sensor is designed to measure rotational movement of throttle position.

The electrical circuit is designed with a magnetic rotary sensor using a Hall element and digital signal processing; sensor output is ratiometric. The angular position is provided by a two pole magnet integrated in the sensor shaft.

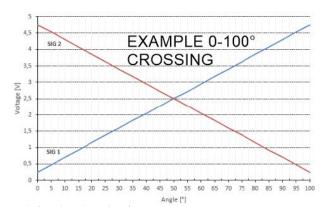
The main benefit of this sensor is its contactless Hall effect technology and its robust design for motorsport applications which includes fully redundant power and ground.

Application Application 0 to 360° possible Operating temperature range 0 to 150°C Max. vibration 200 m/s² at 5 to 2,000 Hz

Technical Specifications	
Mechanical Data	
Weight w/o wire	< 36 g
Protection class	IP58
Mounting	2 x M4 screw
Lifetime	$5x10^6$ operations of $\pm65^\circ$
Housing	Aluminum

Electrical Data

Power supply U _s	5 ± 0.5 V regulated
Max. overvoltage	24 V
Half voltage tolerance	± 2°
Supply current	< 12.5 mA
Resolution	< 0.1°
Output voltage range	Ratiometric analog
Output load	> 10 kOhm
Characteristic	
Characteristic Max. rotation speed	600 RPM
	600 RPM ± 0.008° Rotation/°C 30°C nominal
Max. rotation speed	± 0.008° Rotation/°C



Flying lead and Wires

Red	U _s 1
Blue	Gnd 1
White	Sig 1
Orange	U _s 2
Green	Gnd 2
Yellow	Sig 2
Sleeve	DR-25
Wire size	AWG 26
Wire length L	100 cm

Installation Notes

The products of the RP series can be connected directly to most control units.

The sensor is designed with contactless Hall effect technology.

Any mounting orientation is possible.

Sensor is at mid point of electrical angle when shaft and wire exit are aligned as shown in the offer drawing.

Please find further application hints in the offer drawing at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Fulfilled Legal Standards/Legal Requirements

EMC Requirement

UNECE10

Ordering Information

Rotary Position Sensor RPS-F

Single output, 360° range Order number **F02U.V0U.400-01**

Rotary Position Sensor RPS-F

Dual output, 100° range, crossing signals (throttle)

Order number **F02U.V0U.401-01**

Rotary Position Sensor RPS-F

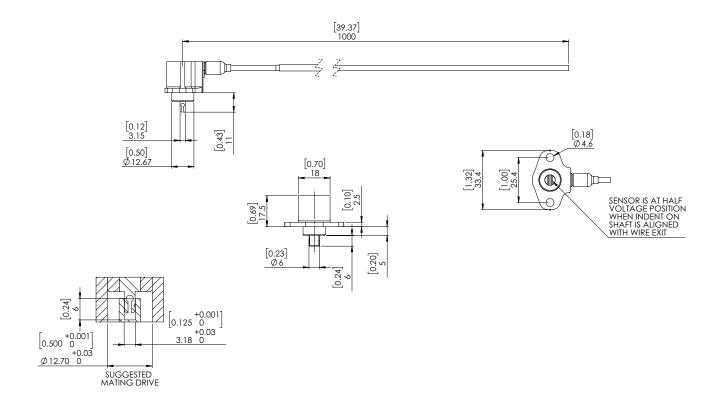
Dual output, 40° range, second signal 50 % of first (pedal)

Order number F02U.V0U 402-01

Rotary Position Sensor RPS-F

Dual output, 100° range, second signal 50 % of first (pedal)

Order number F02U.V0U.403-01



Overview

Speed Sensor Hall-Effect HA- Speed Sensor Hall-Effect HA- Speed Sensor Hall-Effect HA- Di M N









- Max. frequency: ≤10 kHz
- Air gap: 0.4 to 1.0 mm
- Bore diameter: 11.8 mm
- Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz
- · Weight w/o wire: 12 g
- Max. frequency: ≤ 10 kHz
- Air gap: 0.4 to 1.0 mm
- · Bore diameter: 12 mm
- Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz
- Weight w/o wire: 12 g
- Max. frequency: ≤ 4.2 kHz
- Air gap: 0.5 to 1.0 mm
- Bore diameter: 11.8 mm
- Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz
- · Weight w/o wire: 12 g
- Max. frequency: $\leq 4.2 \text{ kHz}$
- Air gap: 0.4 to 1.5 mm
- · Bore diameter: 10 mm
- Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz
- Weight w/o wire: 8 g

Speed Sensor Hall-Effect HA- Speed Sensor Hall-Effect P Mini-HA-P



- Max. frequency: ≤ 4.2 kHz
- Air gap: 0.5 to 1.0 mm
- Bore diameter: 18 mm
- Max. vibration: 1,000 m/s² at 10 Hz to 2 kHz
- Weight w/o wire: 70 g



- Max. frequency: ≤ 10 kHz
- Air gap: 0.2 to 1.0 mm
- Bore diameter: 11.5 mm
- Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz
- Weight w/o wire: 20 g

Speed Sensor Hall-Effect Mini-HA-P sealed



- Max. frequency: ≤ 10 kHz
- Air gap: 0.2 to 1.5 mm
- · Bore diameter: 16 mm
- Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz
- · Weight w/o wire: 20 g

Speed Sensor Hall-Effect HA-D 90



Features

► Max. frequency: ≤10 kHz

► Air gap: 0.4 to 1.0 mm

▶ Bore diameter: 11.8 mm

▶ Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz

► Weight w/o wire: 12 g

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft*, crankshaft or wheel speed), but it is not a "true power-on" sensor.

Due to the rotation of a ferromagnetic target wheel in front of the HA-D 90, 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.

*: see Installation Notes

Application	
Application	Speed
Max. frequency	≤10 kHz
Target wheel air gap AG	0.4 to 1.0 mm
Temperature range	-40 to 150°C
Output circuit	Open collector for 1 kOhm
Output type	Active high
External magnetic fields	≤50 mT
Max. vibration	1,200 m/s ² at 10 Hz to 2 kHz

Technical Specifications		
Mechanical Data		
Weight w/o wire	12 g	
Mounting	Screw 1 x M6	
Bore diameter	11.8 mm	
Installation depth L2	30 mm	
Tightening torque	6 Nm	
Electrical Data		
Power supply	5 to 18 V	
Current IS	20 mA	
Characteristic		
Accuracy repeatability of the	< 1.0 % (≤ 6 kHz)	
falling edge of tooth	< 1.5 % (≤ 10 kHz)	
Signal output	0.52 V to < 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	
Connectors and Wires		
Connector	ASL606-05PC-HE	
Mating connector ASL006-05SC-HE	F02U.000.228-01	
Pin 1	U _s	
Pin 2	Gnd	
Pin 3	Sig	
Pin 4	Nc	
Pin 5	Nc	
Various motorsport and automotive connectors available on request.		
Sleeve	DR-25	
Wire size	AWG 24	
Wire length L	15 to 100 cm	
Please specify the required wire le	ength with your order.	

Installation Notes

The HA-D 90 is no true-power-on sensor. It needs the falling edge of two teeth for correct working. After a time of 0.68 s without rotation of the detected wheel it needs again the falling edge of two teeth

The HA-D 90 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 plug.

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.

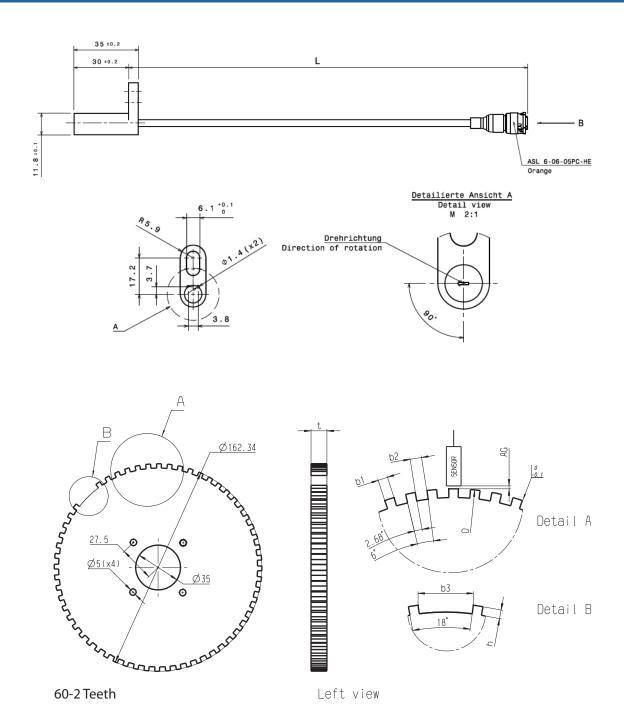
Please find further application hints in the offer drawing at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Speed Sensor Hall-Effect HA-D 90 Order number F02U.V00.334-01



Speed Sensor Hall-Effect HA-Di



Features

► Max. frequency: ≤ 10 kHz

► Air gap: 0.4 to 1.0 mm

▶ Bore diameter: 12 mm

▶ Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz

► Weight w/o wire: 12 g

This sensor is designed for incremental measurement of rotational speed (e.g. crankshaft or wheel speed).

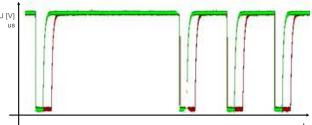
Due to the rotation of a ferromagnetic target wheel in front of the HA-Di, the magnetic field of the builtin magnet is modulated at the place of the sensors diff.

The main feature and benefit of this sensor is the detection of the rotational direction.

Application	
Application	Speed
Max. frequency	≤ 10 kHz forward ≤ 6 kHz backward
Target wheel air gap AG	0.4 to 1.0 mm
Temperature range	-40 to 150°C
Output circuit	Open collector for 1 kOhm
External magnetic fields	≤ 100 mT
Max. vibration	1,200 m/s ² at 10 Hz to 2 kHz

Technical Specifications	
Mechanical Data	
Weight w/o wire	12 g
Mounting	Screw 1 x M5

Bore diameter	12 + 0.2 mm
Installation depth L2	30 mm
Tightening torque	6 Nm
Electrical Data	
Power supply	5 to 16 V (24 V for max. 5 min.)
Current IS	<20 mA
Power-on time	1 ms
Characteristic	
Signal output width forward	37 to 53 μs (45)
Signal output width backward	75 to 105 μs (90)
Accuracy (tolerance)	±1.5° (for forward direction)
Signal output	$0.52\mathrm{V}\mathrm{to}<\mathrm{U}_\mathrm{S}$
A (1.5 × 1.5	



Signal output width (forward: green, backward: red)

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

Alternative Target Wheel

Target wheel diameter	118 to 370 mm
Width of teeth b1	2.2 to 3.8 mm
Width of gap b2	≥4 mm
Depth of teeth h	≥4 mm
Target wheel width	≥5 mm
Relative magnetic permeability	μ (r) ≥1000

Connectors and Wires

Connector	ASL606-05PC-HE
Mating connector ASL006-05SC-HE	F02U.000.228-01
Pin 1	U_s
Pin 2	Gnd
Pin 3	Sig
Pin 4	Nc
Pin 5	Nc

Various motorsport and automotive connectors available on request.

Sleeve	DR-25
Wire size	AWG 24
Wire length L	15 to 100 cm

Please specify the required wire length with your order.

Installation Notes

The HA-Di is no true-power-on sensor. It needs the falling edge of trigger wheel teeth for correct working. After a time of 0.68 s without rotation of the detected wheel it needs again the falling edge of two teeth.

Please specify the angle between the mounting and the target wheel.

Please avoid abrupt temperature changes.

For mounting please use only the integrated plug.

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 at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Speed Sensor Hall-Effect HA-Di 0

Order number **F02U.V01.802-01**

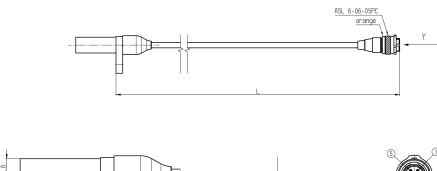
Speed Sensor Hall-Effect HA-Di 90 Order number F02U.V01.803-01

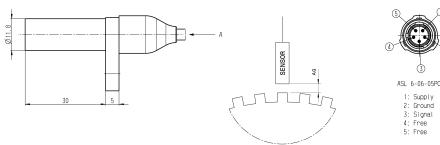
Speed Sensor Hall-Effect HA-Di 180 Order number F02U.V01.804-01

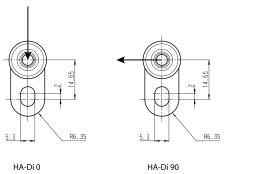
Speed Sensor Hall-Effect HA-Di 270

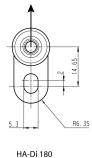
Order number F02U.V01.805-01

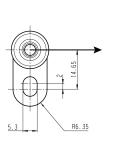
Dimensions





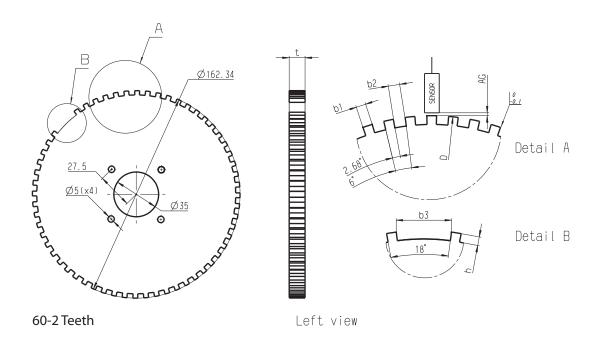






HA-Di 270

Direction of rotation of the target wheel, View A



Speed Sensor Hall-Effect HA- M



Features

► Max. frequency: ≤ 4.2 kHz

► Air gap: 0.5 to 1.0 mm

▶ Bore diameter: 11.8 mm

▶ Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz

► Weight w/o wire: 12 g

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft, crankshaft or wheel speed).

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 motorsport connectors.

Application	
Application	Speed
Max. frequency	≤ 4.2 kHz
Target wheel air gap	0.5 to 1.5 mm
Temperature range	- 40 to 160°C
Output circuit	Open collector for 1 kOhm
Output type	Please see Ordering Information
External magnetic fields	< 1 mT
Max. vibration	$1,200\text{m/s}^2$ at 10Hz to 2kHz

Technical Specifications

Variations

variations	
Active low with connector / act	ive high with connector
Connector	ASU603-03PN-HE
Mating connector ASU003-03SN-HE	F02U.000.199-01
Pin 1	U _s
Pin 2	Gnd
Pin 3	Sig
Active high, without connector	
Red	U_s
Black	Gnd
Green	Sig
Mechanical Data	
Weight w/o wire	12 g
Mounting	1 x M6
Bore diameter	11.8 mm
Installation depth L2	30 mm
Tightening torque	6 Nm
Electrical Data	
Power supply	5 to 18 V
Current I _s	5.6 to 18 mA
Characteristic	
Accuracy repeatability of the falling edge of tooth	< 4 % (≤ 4.2 kHz)
Signal output	0.52 V to < Us
Connectors and Wires	
Various motorsport and automotiquest.	ive connectors available on re-
Pin layout	Please see Variations
Sleeve	DR-25
Wire size	AWG 24
Wire length L	10 to 100 cm
Please specify the required wire l	ength with your order.

Installation Notes

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 plug.
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 at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Speed Sensor Hall Effect HA-M

Active low

Order number **B261.209.283-01**

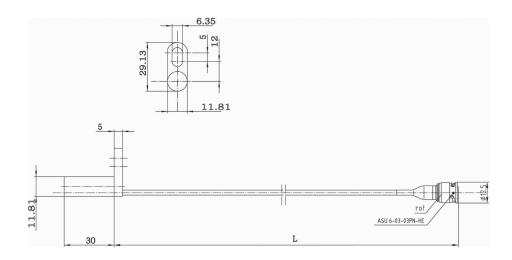
Speed Sensor Hall Effect HA-M

Active high

Order number **B261.209.295-01**

Speed Sensor Hall Effect HA-M

Active high, without connector Order number **F02U.V00.627-01**



Speed Sensor Hall-Effect HA-N



Features

► Max. frequency: ≤ 4.2 kHz

► Air gap: 0.4 to 1.5 mm

▶ Bore diameter: 10 mm

► Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz

► Weight w/o wire: 8 g

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft, crankshaft or wheel speed). Due to the rotation of a ferromagnetic target wheel in front of the HA-N, 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 HA-N combines a robust sensing element with a lightweight aluminum housing that is well suited for motorsport use. The sensor element used was specifically selected for its resistance to demagnetization at high temperatures and is programmed for an active low output. This sensor element is approved for NASCAR competition as a camshaft speed sensor.

Application	
Application	Rotational speed
Max. frequency	≤ 4.2 kHz
Target wheel air gap AG	0.5 to 1.5 mm
Temperature range	-40 to 160°C
Output circuit	Open collector for 1 kOhm
Output type	Active low
External magnetic fields	< 1 mT
Max. vibration	$1,200\text{m/s}^2$ at 10Hz to 2kHz

Technical Specifications

Mechanical Data	
Weight w/ wire	13 g w/ 254 mm cable length and AS connector 28.5 g w/ 1,000 mm cable length flying lead
Bore diameter	10 mm
Installation depth L2	14 mm
Tightening torque	6 Nm
Electrical Data	
_tooti.tout Dutu	
Power supply	5 to 18 V
	5 to 18 V 5.6 to 18 mA
Power supply	
Power supply Current IS	

Connectors and Wires

Sensor AS connector	
Connector	ASL606-05PA-HE
Mating connector	ASL006-05SA-HE
Pin 1	V_s
Pin 2	GND
Pin 3	Signal
Pin 4	Not used
Pin 5	Not used
Shrink sleeve	DR-25
Wire size	AWG 24
Wire length L	254 mm
Sensor Flying lead	
WHT/ORG	V_s
WHT/BLU	GND
WHT	Signal
Shrink sleeve	DR-25
Wire size	AWG 24
Wire length L	1,000 mm

Installation Notes

The HA-N can be directly connected to most control units and data logging systems.

If a trigger wheel with different dimensions is used (see Environment), the technical function must be tested.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Speed Sensor Hall-Effect HA-N

Sensor AS connector

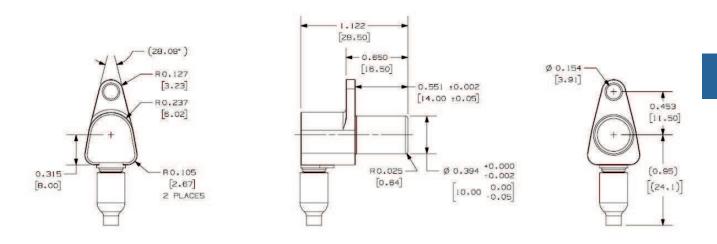
Order number F02U.V0U.714-01

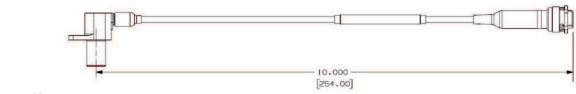
Speed Sensor Hall-Effect HA-N

Sensor Flying lead

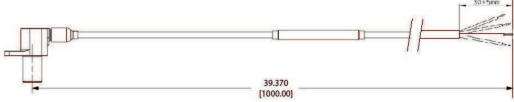
Order number F02U.V0U.714-90

Dimensions





Sensor AS connector



Sensor Flying lead

Speed Sensor Hall-Effect HA-P



Features

► Max. frequency: ≤ 4.2 kHz

► Air gap: 0.5 to 1.0 mm

▶ Bore diameter: 18 mm

► Max. vibration: 1,000 m/s² at 10 Hz to 2 kHz

▶ Weight w/o wire: 70 g

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft or wheel speed).

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 Speed Max. frequency ≤ 4.2 kHz Target wheel air gap 0.5 to 1.4 mm Temperature range -40 to 150°C Output type Active low Output circuit Open collector for 1 kOhm Max. vibration 1,000 m/s² at 10 Hz to 2 kHz

Technical Specifications

Mechanical Data	
Weight w/o wire	70 g

Mounting	With screw 1 x M6	
Bore diameter	18 mm	
Installation depth L2	24 mm	
Tightening torque	8 Nm	
Electrical Data		
Power supply	4.5 to 24 V	
Current IS	10 mA	
Characteristic		
Accuracy repeatability of the falling edge of tooth	< 1.5 % (≤6 kHz) < 2 % (≤10 kHz)	
Signal output	0.4 V to < US	
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	
Connectors and Wires		
Connector	1928.404.227	
Mating connector 3-pole Compact	D261.205.335-01	
Pin 1	Gnd	
Pin 2	Sig	
Pin 3	U _S	

Installation Notes

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 plug.

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.

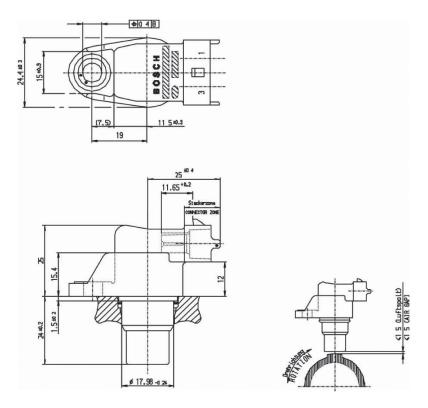
Please find further application hints in the offer drawing at our homepage.

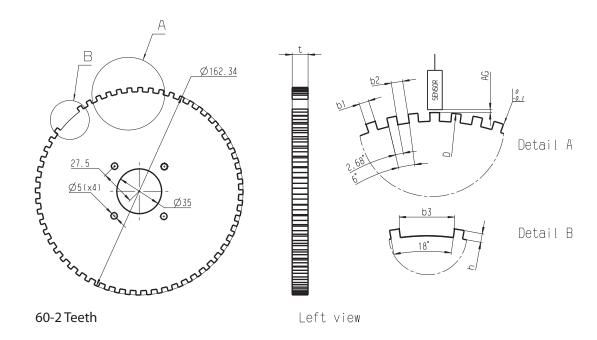
Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Speed Sensor Hall-Effect HA-P Order number 0232.103.037





Speed Sensor Hall-Effect Mini-HA-P



Features

► Max. frequency: ≤ 10 kHz

► Air gap: 0.2 to 1.0 mm

▶ Bore diameter: 11.5 mm

► Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz

► Weight w/o wire: 20 g

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft or wheel speed).

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.

Speed
≤ 10 kHz
0.2 to 1.5 mm
-40 to 150°C
Open collector for 1 kOhm
Active low
≤ 0.3 mT
$1,200\text{m/s}^2$ at 10Hz to 2kHz

Technical Specifications			
Variations			
Connector	ASL606-05	5PC-HE	1234.482.092
Mating connector	ASL006-05	SC-HE	F02U.B00.555-01
Pin 1	U_S		U_S
Pin 2	Gnd		Sig
Pin 3	Sig		Gnd
Pin 4	Nc		-
Pin 5	Nc		-
Mechanical Data	a		
Weight w/o wire		19.2 g	
Mounting		With scre	ew 1 x M6
Bore diameter	11.5 mm		
Installation depth L2		9 mm	
Tightening torque		8 Nm	
Electrical Data			

Characterist	tic

Power supply Current IS

Accuracy repeatability of the falling edge of tooth	< 3 % (≤ 6 kHz) < 5 % (≤ 10 kHz)
Signal output	$0.4\mathrm{V}\mathrm{to}<\mathrm{U}_\mathrm{S}$
Environment	
Target wheel diameter D	162.34 mm
Thickness t	12.5 mm
Width of teeth b1	3.8 mm

5 to 18 V

10 mA

 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

Connectors and Wires

Connector	Please see Variations
Various motorsport and autom quest.	otive connectors available on re-
Sleeve	HT wire ø 5.2 mm
Wire size	AWG 20
Wire length L	< 27 cm
Please specify the required wire length with your order.	

Installation Notes

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 plug.

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 at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

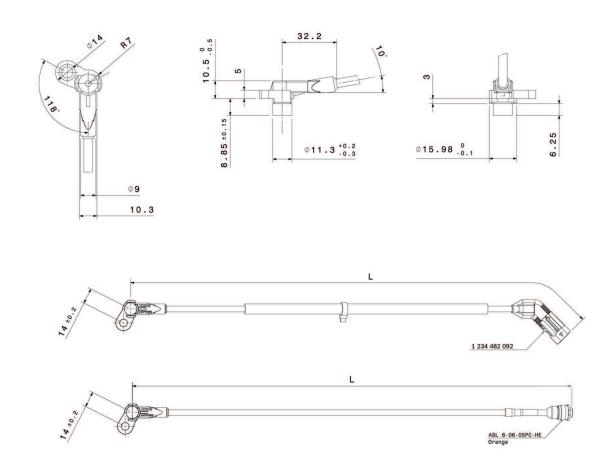
Ordering Information

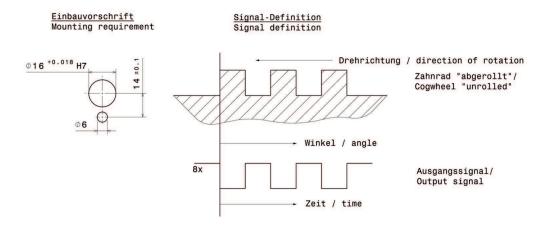
Speed Sensor Hall-Effect Mini-HA-P

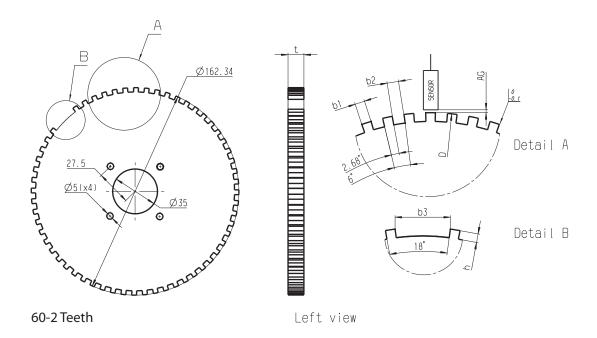
Connector ASL606-05PC-HE Order number **F02U.V00.564-02**

Speed Sensor Hall-Effect Mini-HA-P

Connector 1 234 482 092 Order number **F02U.V00.566-02**







Speed Sensor Hall-Effect Mini-HA-P sealed



Features

► Max. frequency: ≤ 10 kHz

► Air gap: 0.2 to 1.5 mm

▶ Bore diameter: 16 mm

▶ Max. vibration: 1,200 m/s² at 10 Hz to 2 kHz

► Weight w/o wire: 20 g

This sensor is designed for incremental measurement of rotational speed (e.g. camshaft, crankshaft and wheelspeed).

Due to the rotation of a ferromagnetic target wheel in front of the Mini-HA-P sealed, 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 a robust design with a very small housing.

Speed
≤ 10 kHz
0.2 to 1.5 mm
-40 to 150°C
Open collector for 1 kOhm
Active low
≤ 0.3 mT
$1,200\text{m/s}^2$ at 10Hz to 2kHz

Technical Specifications Variations

Connector	ASL606-05PC-HE	Without connector
Mating connector	ASL006-05SC-HE F02U.000.228-01	-
Pin 1	U_S	U _s (red)
Pin 2	Gnd	Sig (green)
Pin 3	Sig	Gnd (black)
Pin 4	Nc	-
Pin 5	Nc	-
Wire length L	10 - 27 cm	27 cm

1	e	c	h	а	n	i	ca	L	D	a	ta	
ш	•	·		u			~u		$\boldsymbol{\smile}$	u	·u	

Weight w/o wire	19.2 g
Mounting	With screw 1 x M6
Bore diameter	16 mm
Installation depth L2	12 mm
Tightening torque	8 Nm

Electrical Data

Power supply	5 to 18 V
Current IS	10 mA

Characteristic

Accuracy repeatability of the	< 3 % (≤6 kHz)
falling edge of tooth	< 5 % (≤10 kHz)
Signal output	$0.4 \mathrm{V}$ to $<\mathrm{U}_{\mathrm{S}}$

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

Connectors and Wires

Connector	Please see Variations
Sleeve	HT wire ø 5.2 mm
Wire size	AWG 20
Wire length L	Please see Variations
Various motorsport and automot quest.	tive connectors are available on re-

Installation Notes

The Mini-HA-P sealed can be connected directly to most control units and data logging systems.

Please specify the required wire length with your order.

Please avoid abrupt temperature changes.

For mounting please use only the integrated plug.

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 at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

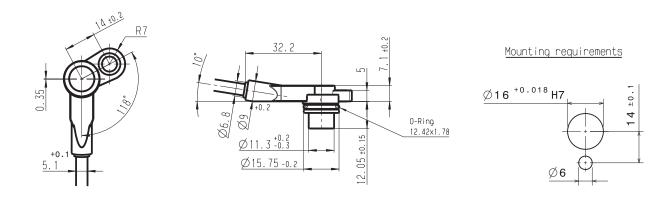
Speed Sensor Hall-Effect Mini HA-P sealed

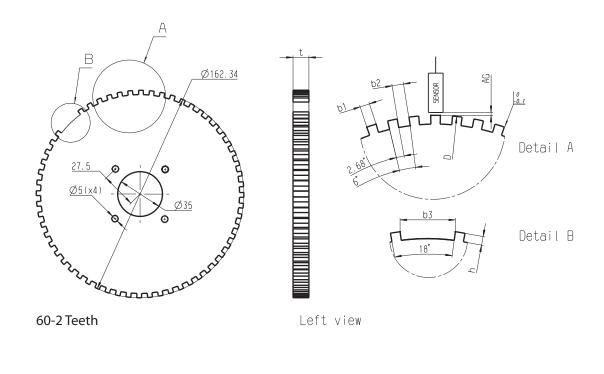
Connector ASL606-05PC-HE Order number **F02U.V00.500-01**

Speed Sensor Hall-Effect Mini HA-P sealed

Without connector

Order number F02U.V00.570-01





Steering Wheel Angle Sensor LWS



Features

► Steering Wheel Angle: ± 780°

► Angular Speed: 0 to 1,016°/s

▶ 500 kbaud CAN-output

This sensor is designed to measure rotational movement and angular speed, e.g. steering wheel angle and steering wheel speed.

In order to achieve this, the sensor is using the giant magneto resistive (GMR) effect. The detection of the absolute angle is realized by means of toothed measuring gears with different ratio including small magnets. Corresponding GMR elements that change their electrical resistance according to the magnetic field direction detects the angle position of the measuring gears.

The measured voltages are A/D converted and a microcontroller performs the angle calculations. The steering angle and the steering angle speed are provided on a CAN-interface.

Application	
Steering wheel angle	± 780°
Angular speed	0 to 1,016°/s
Operating temperature range	-40 to 85°C

Technical Specifications

Mechanical Data

Weight	Approx. 34 g
Size	83 x 60 x 21.35 mm
Protection class	IP5K0

Electrical Data

Power supply	7 to 16 V		
Max input current	< 150 mA		
CAN speed	500 kbaud		

CAN Message							
CANID	010x2B0LWS_Standard						
Byte	Value / Bit						
	7/6/5/4/3	2	1	0			
0	LWS_ANGLE						
1	LWS_ANGLE						
2	LWS_SPEED						
3	Reserved	TRIM	CAL	OK			
4	Reserved						
CAN ID 02 0x7C0 LWS_Config							
Byte	Value / Bit						
	7/6/5/4/3	2	1	0			

Truth Table

Reserved

Reserved

0

1

TRIM	OK	CAL	ANGLE	SPEED	Sensor state
1	1	1	Value	Value	Sensor is calibrated and sensor information is valid.
1	1	0	7FFFh	Value	Sensor is not calibrated, speed information is valid.
1	0	0	7FFFh	FFh	Sensor is in failure mode, sensor information is not valid.
0	0	0	7FFFh	FFH	Sensor is in failure mode, sensor information is not valid.

CCW

Other combinations for TRIM, OK and CAL are not valid.

Signal Overview

OK	Failure status
1	Sensor information valid
0	Sensor information invalid, an internal sensor fault occurred
CAL	Calibration status
1	Sensor calibrated
0	Sensor not calibrated
TRIM	Trimming Status
1	Sensor trimmed
0	Sensor not trimmed, this is handled as a sensor failure (OK = 0)
CCW	Command code word
	Command Code Word
3h	Sets the signal LWS_Angle to 0°

Characteristics

Steering Wheel Angle	
Measuring range	± 780°
Absolute physical resolution	0.1°
Nonlinearity	± 2.5°
Hysteresis	0 to 5°
Angular Speed	
Measuring range	0 to 1,016°/s
Over range limit	± 2,500°/s
Absolute physical resolution	4°/s
Connectors and Wires	

Connectors and Wires

Pin 6	Not connected
Pin 5	Not connected
Pin 4	CAN Low
Pin 3	CAN High
Pin 2	12 V
Pin 1	Gnd
Mating connector	F02U.B00.656-01
Connector	Bosch 7 pole

LSB (Intel)

CAN speed	500 kbaud
CAN update rate	100 Hz / 10 ms

Installation Notes

The LWS can be connected directly to most control units and data logger systems via CAN bus.

Please avoid abrupt temperature changes.

Please ensure that the environmental conditions do not exceed the sensor specifications.

Please find further application hints in the offer drawing.

A zero adjustment is needed before using the sensor for the first time. To do so, reset the calibration with CCW = 5h. After resetting the calibration, a new calibration needs to be started with CCW = 3h. The sensor is now newly calibrated and can be used immediately.

Zero the sensor after every assembly.

Safety Note

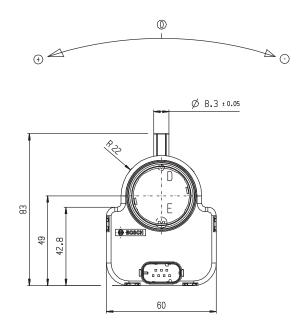
The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

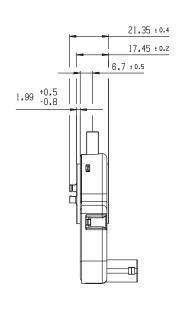
Ordering Information

Steering Wheel Angle Sensor LWS Order number F02U.V02.894-01

Dimensions

Byte order





Housing Size

Overview

Temperature Sensor NTC M5-HS



- Application: -55 to 300°C
- Accuracy at 25°C: ± 0.3°C
- Accuracy at 100°C: ± 1.3°C
- Male thread: M5
- Nominal resistance: 10 kOhm ± 1 % (at 25°C)

Temperature Sensor NTC M6-HS



- Application: -55 to 300°C
 - Accuracy at 25°C: ± 0.3°C
- Accuracy at 100°C: ± 1.3°C
- Male thread: M6 x 1
- Nominal resistance: 10 kOhm
 Nominal resistance: 10 kOhm ± 1 % (at 25°C)

Temperature Sensor NTC M8-HS



- Application: -55 to 300°C
- Accuracy at 25°C: ± 0.3°C
- Accuracy at 100°C: ± 1.3°C
- Male thread: M8 x 1
- ± 1 % (at 25°C)

Temperature Sensor NTC M12



- Application: -40 to 130°C
- Accuracy at 25°C: ± 1.4°C
- Accuracy at 100°C: ± 3.4°C
- Male thread: M12 x 1.5
- Nominal resistance: 2.5 kOhm ± 5 % (at 20°C)

Temperature Sensor NTC M12-H



- Application: -40 to 130°C
- Accuracy at 25°C: ± 1.4°C
- Accuracy at 100°C: ± 3.4°C
- Male thread: M12 x 1.5
- Nominal resistance: 2.5 kOhm ± 5 % (at 20°C)

Temperature Sensor NTC M12-L



- Application: -40 to 130°C
- Accuracy at 25°C: ± 1.4°C
- Accuracy at 100°C: ± 3.4°C
- Male thread: M12 x 1.5
- Nominal resistance: 2.5 kOhm ± 5 % (at 20°C)

Temperature Sensor NTC M5- HS



Features

► Application: -55 to 300°C

► Accuracy at 25°C: ± 0.3°C

► Accuracy at 100°C: ± 1.3°C

► Male thread: M5

▶ Nominal resistance: 10 kOhm ± 1 % (at 25°C)

This sensor is designed to measure temperatures up to 300°C of oil, water, fuel or air. 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-sensing element has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises and the resistance decreases. To improve a good protection against the ambient temperature, the housing is made of stainless steel and partly filled with an isolation-paste. The main benefit of the sensor is a very compact design and its very short response time.

Application	
Application	-55 to 300°C
Storage temperature range	0 to 100°C
Bio fuel compatibility	-

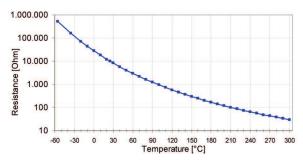
Technical Specifications	
Mechanical Data	
Male thread	M5
Wrench size	8 mm
Installation torque	8 Nm
Weight w/o wire	6 g

Sealing	O-Ring 4 x 1 mm
Electrical Data	
Characteristic	NTC
Nominal resistance at 25°C	10 kOhm ± 1 %
Characteristic	
Accuracy at 25°C (homogeneous cond.)	± 0.3°C
Accuracy at 100°C (homogeneous cond.)	± 1.3°C
Response time tau 63 in still water	<4s

Characteristic Application T[°C] R [Ohm] -55 519,910 -35 158,090 -20 71,668 -10 44,087 0 27,936 10 18,187 20 12,136 10,000 25 30 8,284 40 5,774 50 4,103 60 2,967 70 2,182 80 1,629 90 1,234 100 946.6 120 578.1 140 368.8 160 244.4 180 167.6 200 118.5 220 86.08 240 64.08 260 48.76 280 37.86

29.94

300



Connectors and Wires

Connector	ASL606-05PN-HE
Mating connector ASL006-05SN-HE	F02U.000.231-01
Pin 1	-
Pin 2	Sig-
Pin 3	Sig+
Pin 4	-
Pin 5	-

Various motorsport and automotive connectors are available on request.

Wire size	AWG 24
Wire length L	15 to 50 cm
Please specify the required wire length with your order.	

Installation Notes

The NTC M5-HS can be connected directly to most control units using a pull-up resistance (typically 1 or 3 kOhm).

Any mounting orientation is possible.

Please find further application hints in the offer drawing at our homepage.

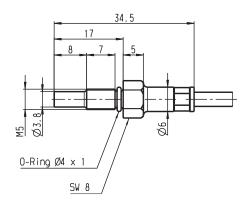
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Temperature Sensor NTC M5-HS Order number **F02U.V00.510-01**



Temperature Sensor NTC M6- HS



Features

► Application: -55 to 300°C

► Accuracy at 25°C: ± 0.3°C

► Accuracy at 100°C: ± 1.3°C

► Male thread: M6 x 1

▶ Nominal resistance: 10 kOhm ± 1 % (at 25°C)

This sensor is designed to measure temperatures up to 300°C of oil, water, fuel or air. 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-sensing element has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises and the resistance decreases. To improve a good protection against the ambient temperature, the housing is made of stainless steel and partly filled with an isolation-paste. The main benefit of the sensor is a very compact design and its very short response time.

Application	
Application	-55 to 300°C
Storage temperature range	0 to 100°C
Bio fuel compatibility	-

Technical Specifications	
Mechanical Data	
Male thread	M6x1
Wrench size	10 mm
Installation torque	8 Nm
Weight w/o wire	6.5 g

230

240

250

260

270

Sealing	O-Ring 4.47 x 1.78 mm
Electrical Data	
Characteristic	NTC
Nominal resistance at 25°C	10 kOhm ± 1 %
Characteristic	
Accuracy at 25°C (homogeneous cond.)	± 0.3°C
Accuracy at 100°C (homogeneous cond.)	± 1.3°C
Response time tau 63 in still water	<4s
Characteristic Application	on
T [°C]	R [Ohm]
-55	519,910
-35	158,090
-20	71,668
-10	44,087
0	27,936
10	18,187
20	12,136
25	10,000
30	8,284
40	5,774
50	4,103
60	2,967
70	2,182
80	1,629
90	1,234
100	946.6
110	735.5
120	578.1
130	459.4
140	368.8
150	298.9
160	244.4
170	201.6
180	167.6
190	140.4
200	118.5
210	100.7
220	86.08

74.05

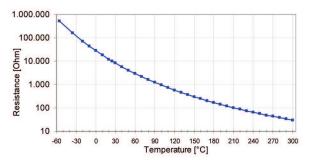
64.08

55.75

48.76

42.87

280	37.86
290	33.59
300	29.94



Connectors and Wires

Connector	ASL606-05PN-HE
Mating connector ASL006-05SN-HE	F02U.000.231-01
Pin 1	-
Pin 2	Sig-
Pin 3	Sig+

Pin 5 -

Various motorsport and automotive connectors are available on request.

Wire siz	ze	AWG 24	
Wire le	ngth L	15 to 50 cm	
		1 1 1 1 1 1 11 11	

Please specify the required wire length with your order.

Installation Notes

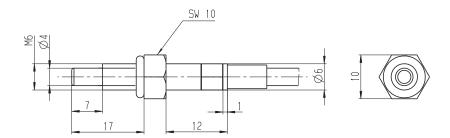
The NTC M6-HS can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kOhm).

Any mounting orientation is possible.

Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging at our homepage.

Ordering Information

Temperature Sensor NTC M6-HS Order number F02U.V00.486-01



Temperature Sensor NTC M8- HS



Features

► Application: -55 to 300°C

► Accuracy at 25°C: ± 0.3°C

► Accuracy at 100°C: ± 1.3°C

► Male thread: M8 x 1

▶ Nominal resistance: 10 kOhm ± 1 % (at 25°C)

This sensor is designed to measure temperatures up to 300°C of oil, water, fuel or air. 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-sensing element has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises and the resistance decreases. To improve a good protection against the ambient temperature, the housing is made of stainless steel and partly filled with an isolation-paste. The main benefit of the sensor is a very robust design and its very short response time.

Application	
Application	-55 to 300°C
Storage temperature range	0 to 100°C
Bio fuel compatibility	-

Technical Specifications	
Mechanical Data	
Male thread	M8x1
Wrench size	12 mm
Installation torque	8 Nm
Weight w/o wire	8 g

240

250

260

270

Sealing	O-Ring 6.35 x 1.78 mm
Electrical Data	
Characteristic	NTC
Nominal resistance at 25°C	10 kOhm ± 1 %
Characteristic	
Accuracy at 25°C (homogeneous cond.)	± 0.3°C
Accuracy at 100°C (homogeneous cond.)	± 1.3°C
Response time tau 63 in still water	< 4 s
Characteristic Application	on
T [°C]	R [Ohm]
-55	519,910
-35	158,090
-20	71,668
-10	44,087
0	27,936
10	18,187
20	12,136
25	10,000
30	8,284
40	5,774
50	4,103
60	2,967
70	2,182
80	1,629
90	1,234
100	946.6
110	735.5
120	578.1
130	459.4
140	368.8
150	298.9
160	244.4
170	201.6
180	167.6
190	140.4
200	118.5
210	100.7
220	86.08
230	74.05
240	64.00

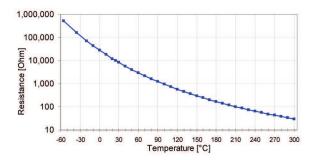
64.08

55.75

48.76

42.87

280	37.86
290	33.59
300	29.94



Connectors and Wires

Connector	ASL606-05PN-HE
Mating connector ASL006-05SN-HE	F02U.000.231-01
Pin 1	-
Pin 2	Sig-
Pin 3	Sig+
Pin 4	-
Pin 5	-

Various motorsport and automotive connectors are available on request.

Wire size	AWG 24
Wire length L	15 to 50 cm

Please specify the required wire length with your order.

Installation Notes

The NTC M8-HS can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kOhm).

Any mounting orientation is possible.

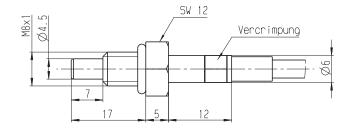
Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Temperature Sensor NTC M8-HS Order number **F02U.V00.509-01**



Temperature Sensor NTC M12



Features

► Application: -40 to 130°C

► Accuracy at 25°C: ± 1.4°C

► Accuracy at 100°C: ± 3.4°C

▶ Male thread: M12 x 1.5

► Nominal resistance: 2.5 kOhm ± 5 % (at 20°C)

This sensor is designed to measure fluid temperature e.g. oil, water or fuel. This signal may be used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

The NTC sensing element has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises. The sensing 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 a high quality production part and a robust and compact design.

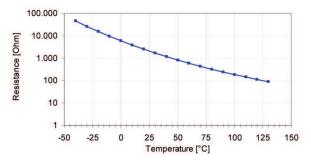
Application Application -40 to 130°C Storage temp. range 0 to 100°C Bio fuel compatibility E85/M22 Max. vibration 600 m/s²

Technical Specifications Mechanical Data Male thread M12x1.5 Wrench size 19 mm Installation torque 25 Nm

Weight w/o wire	29 g
Sealing	Not included
Electrical Data	
Characteristic	NTC
Nominal resistance at 20°C	2.5 kOhm ± 5 %
Characteristic	
Accuracy at 25°C	± 1.4°C
Accuracy at 100°C	± 3.4°C
Response time tau 63 in still water	< 15 s

Characteristic Application

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
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 Wires

Connector	Bosch Jetronic
Mating connector 2-pole Jetronic	D261.205.288-01
Pin 1	SIG+
Pin 2	SIG-

Installation Notes

The NTC M12 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. www.bosch-motorsport.com

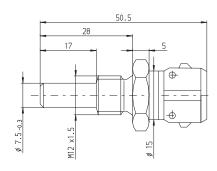
Free download of the sensor configuration file (*.sdf) for the Bosch Data Logging at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Temperature Sensor NTC M12 Order number 0280.130.026



Temperature Sensor NTC M12-H



Features

► Application: -40 to 130°C

► Accuracy at 25°C: ± 1.4°C

► Accuracy at 100°C: ± 3.4°C

► Male thread: M12 x 1.5

▶ Nominal resistance: 2.5 kOhm ± 5 % (at 20°C)

This sensor is designed to measure fluid temperature e.g. oil, water or fuel. This signal may be used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

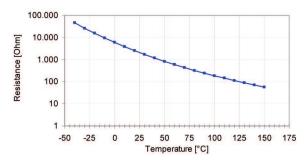
The NTC sensing element has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises. The sensing element of the temperature sensor is made of semiconducting heavy metal oxide and oxidized mixed crystals, which are equipped with a protective housing. The main benefit of the sensor is the combination of a high quality production part and a robust and compact design.

Application	
Application	-40 to 150°C
Storage temperature range	-30 to 60°C
Bio fuel compatibility	E85/M22
Max. vibration	300 m/s ²

Technical Specifications	
Mechanical Data	
Male thread	M12x1.5
Wrench size	19 mm

Installation torque	18 Nm
Weight w/o wire	28.3 g
Sealing	Al-washer
Electrical Data	
Characteristic	NTC
Nominal resistance at 20°C	2.5 kOhm ± 6 %
Characteristic	
Accuracy at 25°C	± 1.4°C
Accuracy at 100°C	± 0.8°C
Response time tau 63 in still water	< 15 s

Characteristic Application	
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
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 Wires

Connector	Bosch Compact
Mating connector 2-pole Compact	D261.205.337-01

Pin 1	SIG+
Pin 2	SIG-

Installation Notes

The NTC M12-H can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kOhm).

Any mounting orientation is possible.

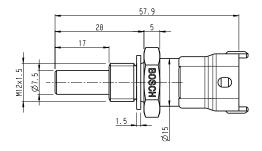
Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

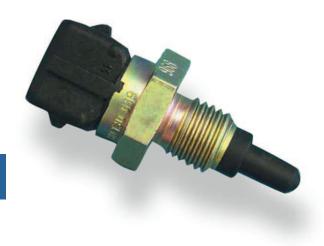
The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Temperature Sensor NTC M12-H Order number 0281.002.170



Temperature Sensor NTC M12-L



Features

► Application: -40 to 130°C

► Accuracy at 25°C: ± 1.4°C

► Accuracy at 100°C: ± 3.4°C

► Male thread: M12 x 1.5

▶ Nominal resistance: 2.5 kOhm ± 5 % (at 20°C)

This sensor is designed to measure air temperature e.g. in the air box or ambient temperature. This signal may be used as a control value for engine control units or as a measurement value which is logged in a data acquisition system.

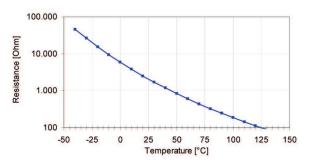
The NTC sensing element has a negative temperature coefficient. This means, that with increasing temperature the conductivity rises. The sensing element of the temperature sensor is made of semiconducting heavy metal oxide and oxidized mixed crystals, which are equipped with a protective housing. The main benefit of the sensor is the combination of a high quality production part and a robust and compact design.

Application	
Application	-40 to 140°C
Storage temp. range	-30 to 60°C
Bio fuel compatibility	E85/M22
Max. vibration	300m/s^2 at $50 \text{to} 250 \text{Hz}$

Technical Specifications	
Mechanical Data	
Male thread	M12x1.5
Wrench size	19 mm

Installation torque	15 Nm
Weight w/o wire	24.6 g
Sealing	Not included
Electrical Data	
Characteristic	NTC
Nominal resistance at 20°C	2.5 kOhm ± 5%
Characteristic	
Accuracy at 25°C	± 1.4°C
Accuracy at 25°C Accuracy at 100°C	± 1.4°C ± 3.4°C

Characteristic Application	
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
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 Wires

Connector	Bosch Compact
Mating connector 2-pole Jetronic	D261.205.288-01
Pin 1	SIG+
Pin 2	SIG-

Installation Notes

The NTC M12-L can be connected directly to most control units using a pull-up resistor (typically 1 or 3 kOhm).

Any mounting orientation is possible.

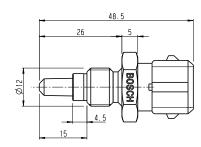
Please find further application hints in the offer drawing and free download of the sensor configuration file (*.sdf) for the Bosch Data Logging System at our homepage.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Temperature Sensor NTC M12-L Order number 0280.130.039



Overview

Acceleration Sensor MM5.10 Acceleration Sensor MM5.10-R



- Application 1: ±163°/s (roll rate/ yaw rate)
- Application 2: ±4.2 g (X, Y and Z acceleration)
- Weight w/o wire: 35 g
- Size: 80 x 56 x 21 mm
- Power supply: 7 to 18 V



- Application 1: ±163°/s (roll rate/ yaw rate)
- Application 2: ±4.2 g (X, Y and Z acceleration)
- Weight w/o wire: 28 g
- Size: 34 x 34 x 16.5 mm
- Power supply: 7 to 18 V

Acceleration Sensor MM5.10



Features

► Application 1: ±163°/s (roll rate/ yaw rate)

▶ Application 2: ±4.2 g (X, Y and Z acceleration)

► Weight w/o wire: 35 g

► Size: 80 x 56 x 21 mm

▶ Power supply: 7 to 18 V

The MM5.10 was designed to measure the physical effects of rotational and linear acceleration. In order to achieve this, the sensor includes MEMS measuring elements connected to an appropriate integrated circuit.

A rotational acceleration around the integrated sensing elements generates a Coriolis force which changes the internal capacity of the micro machined sensing parts. Furthermore, a pure surface micro machined element is used to measure the vehicle linear acceleration in all 3 axis. This combination of rotational and linear acceleration sensors enables a precise measurement of the vehicle dynamics. The main feature and benefit of this sensor is the

The main feature and benefit of this sensor is the combination of 3 linear and 2 rotational accelerometers and its high speed 1 Mbaud CAN-signal output.

Application	
Application I	±163°/s (roll rate/yaw rate)
Application II	±4.2 g (X, Y and Z acceleration)
Operating temperature range	-20 to 85°C

Technical Specifications	
Mechanical Data	
Weight w/o wire	35 g
Size	80 x 56 x 21 mm

Electrical Data

Electrical Data	
Power supply	7 to 18 V
Max input current	90 mA
CAN speed	1 Mbaud or 500 kbaud
CAN Message	
CAN ID 01 0x174	
Byte	Value
0	Yaw rate
1	
2	Reserved
3	
4	Acc Y-axis
5	
6	Reserved
7	Unused
CAN ID 02 0x178	
Byte	Value
0	Roll rate
1	
2	Reserved
3	
4	Acc X-axis
5	
6	Reserved
7	Unused
CAN ID 03 0x17C	
Byte	Value
0	Reserved
1	December
2	Reserved
4	Acc Z-axis
5	MUL L-AXIS
6	Reserved
7	Unused
Characteristic	5.74304
Characteristic Application I	
Measuring range	± 160°/s
Over range limit	± 1,000°/s
Absolute physical resolution	0.1°/s
Cut-off frequency (-3 dB)	15 Hz; 30 Hz; 60 Hz
Characteristic Application II	
Measuring range	±4.2 g
Over range limit	±10 g
Absolute physical resolution	0.01 g
Cut-off frequency (-3 dB)	15 Hz; 30 Hz; 60 Hz
, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	

Connectors and Wires

Connector (1)	AMP 114-18063-076
Mating connector (1)	F02U.B00.435-01
Pin 1	Gnd
Pin 2	CANL
Pin 3	CANH
Pin 4	UBat
Wire with open end (2)	
Red wire	UBat
Black wire	Gnd
White wire	CANH
Blue wire	CANL
Connector (3)	ASL606-05PC-HE
Mating connector (3)	ASL006-05SC-HE
Pin 1	UBat
Pin 2	Gnd
Pin 3	CANH
Pin 4	CANL
Pin 5	Not connected
Sleeve	DR-25
Wire size with open end (2)	4 x AWG24
Wire length L	15 to 100 cm
CAN Baramatara	

CAN Parameters

Byte order	LSB (Intel)
CAN speed	1 Mbaud or 500 kbaud
Bit mask	unsigned
Offset (all signals)	0x8000 hex
Quantization Yaw Rate	0.005 [°/s/digit]
Quantization Roll Rate	0.005 [°/s/digit]
Quantization Acc X-axis	0.0001274 [g/digit]

Quantization Acc Y-axis	0.0001274 [g/digit]
Quantization Acc Z-axis	0.0001274 [g/digit]

Installation Notes

Mounting position: Connector opposite to driving direction.

The MM5.10 can be connected directly to most control units and data logging systems.

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 at our homepage and calibration sheet.

Please deliver the calibration sheet with your order placement.

Please note:

CAN IDO 0x0170 (Rx) or 0x75 (Rx) is used for synchronization and configuration of the sensor (SYNC). Make sure that the CAN ID 0x170 (Rx) or 0x75 (Rx) is not used in your CAN network by any other device.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Acceleration Sensor MM5.10

Without wire (1)

Order number F02U.V01.511-02

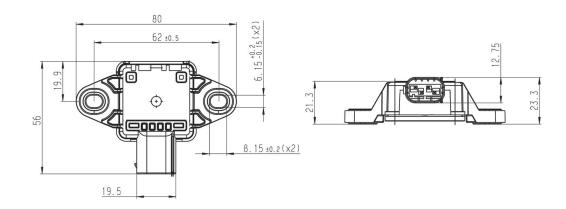
Acceleration Sensor MM5.10

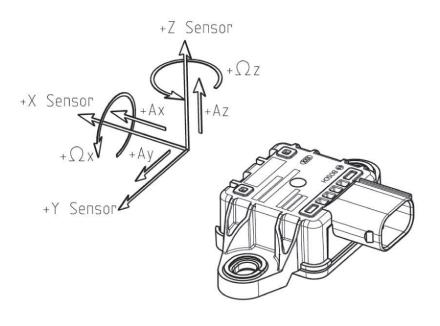
Wire with open end (2)

Order number F02U.V01.511-92

Acceleration Sensor MM5.10

Wire with motorsport connector (3) Order number **F02U.V01.512-03**





Axis Scheme

Acceleration Sensor MM5.10-R



Features

► Application 1: ±163°/s (roll rate/ yaw rate)

► Application 2: ±4.2 g (X, Y and Z acceleration)

► Weight w/o wire: 28 g

► Size: 34 x 34 x 16.5 mm

▶ Power supply: 7 to 18 V

The MM5.10-R was designed to measure the physical effects of rotational and linear acceleration. In order to achieve this, the sensor includes MEMS measuring elements connected to an appropriate integrated circuit.

A rotational acceleration around the integrated sensing elements generates a Coriolis force which changes the internal capacity of the micro machined sensing parts. Furthermore, a pure surface micro machined element is used to measure the vehicle lineal acceleration in all 3 axes. This combination of rotational and linear acceleration sensors enables a precise measurement of the vehicle dynamics.

The main features and benefits of this sensor are the aluminum compact housing, the combination of 3 linear and 2 rotational accelerometers and its high speed 1 Mbaud CAN-signal output.

ApplicationApplication I $\pm 163^{\circ}$ /s (roll rate/yaw rate)Application II $\pm 4.2 \, \mathrm{g}$ (X, Y and Z acceleration)Operating temperature range $-20 \, \mathrm{to} \, 85^{\circ}\mathrm{C}$

Technical Specifications		
Mechanical Data		
Weight w/o wire	28 g	

Size	34 x 34 x 16.5 mm
Electrical Data	
Power supply	7 to 18 V
Max input current	90 mA
CAN speed	1 Mbaud or 500 kbaud
CAN Message	
CAN ID 01 0x174	
Byte	Value
0	Yaw rate
1	
2	Reserved
3	
4	Acc Y-axis
5	
6	Reserved
7	Unused
CAN ID 02 0x178	
Byte	Value
0	Roll rate
1	
2	Reserved
3	
4	Acc X-axis
5	
6	Reserved
7	Unused
CAN ID 03 0x17C	
Byte	Value
0	Reserved
1	
2	Reserved
3	
4	Acc Z-axis
5	
6	Reserved
7	Unused
Characteristic	
Characteristic Application I	
Measuring range	± 160°/s
Over range limit	± 1,000°/s
Absolute physical resolution	0.1°/s
Cut-off frequency (-3 dB)	15 Hz; 30 Hz; 60 Hz
Characteristic Application II	
Measuring range	±4.2 g
Over range limit	±10 g

Absolute physical resolution	0.01 g
Cut-off frequency (-3 dB)	15 Hz; 30 Hz; 60 Hz
Connectors and Wires	
Connector	ASX002-05PA-HE
Mating connector	ASX602-05SA-HE
Pin 1	UBat
Pin 2	CANH
Pin 3	Not connected
Pin 4	CANL
Pin 5	Gnd
Sleeve	DR-25
CAN Parameters	
Byte order	LSB (Intel)
CAN speed	1 Mbaud or 500 kbaud
Bit mask	unsigned
Offset (all signals)	0x8000 hex
Quantization Yaw Rate	0.005 [°/s/digit]
Quantization Roll Rate	0.005 [°/s/digit]
Quantization Acc X-axis	0.0001274 [g/digit]
Quantization Acc Y-axis	0.0001274 [g/digit]
Quantization Acc Z-axis	0.0001274 [g/digit]

Installation Notes

Mounting position: Connector opposite to driving direction.

The MM5.10-R can be connected directly to most control units and data logging systems.

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 at our homepage and calibration sheet.

Please deliver the calibration sheet with your order placement.

Please note

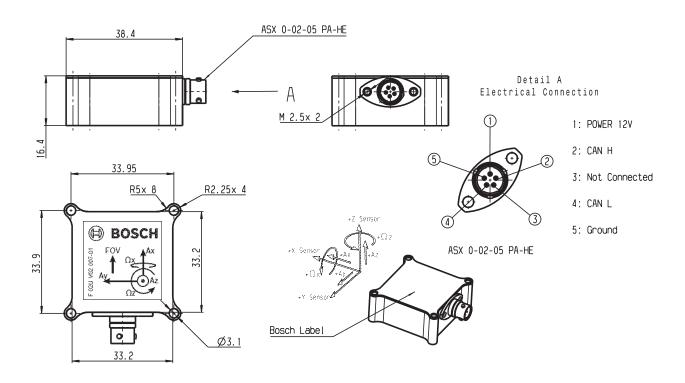
CAN IDO 0x0170 (Rx) is used for synchronization and configuration of the sensor (SYNC). Make sure that the CAN ID 0x170 is not used in your can network by any other device.

Safety Note

The sensor is not intended to be used for safety related applications without appropriate measures for signal validation in the application system.

Ordering Information

Acceleration Sensor MM5.10-R Order number F02U.V02.007-01



Brake 7

Antilock Braking Systems ABS	310
Electronic Brake System EBS	317

Overview

ABS M5 Kit

ABS M5 Kit Clubsport

ABS M5 Kit Porsche Cup







- wheel and four-wheel drive vehicles
- Suitable for front-wheel, rear- Suitable for front-wheel, rear- Plug & Play ABS M5 Kit for wheel and four-wheel drive vehicles
 - · Generic wiring harness to fit all engine bay and front foot well locations for the hydraulic module
 - Same ABS hardware as standard ABS M5 Kit
- Porsche 997 Cup and 991 Cup Gen 1 and Gen 2
- Tested and developed on racetracks like Spa and Nordschleife
- · Detailed installation instruction available at our website
- 1 Mbaud CAN

ABS M5 Kit



Features

► Suitable for front-wheel, rear-wheel and fourwheel drive vehicles

We developed ABS M5 for the operation in front-, rear- or 4-wheel drive vehicles. A vehicle specific wiring harness is included in the Kit.

The ABS M5 is specifically adapted for motorsport use. Individual car parameters like e.g. vehicle weight, vehicle track, wheel weights, wheel circumferences, wheel base or number of increments can be calibrated with software free of charge. Please contact your Bosch Motorsport dealer for further information.

Technical Specifications

Variations

Option		Kit 1	Kit 2	Clubsport
	F02U.V05.2	89-01	90-01	91-01 92-01 93-01 94-01 95-01
Customized wiri	ng loom	+	+	-
ABS-Off position position 1	n optional on	+	+	-
Selection of ABS Bosch 12-positi specified CAN si	on switch or via	+	+	+*
Motorsport conr wheel speed ser		-	+	-
Flexible CAN ter	minals	+	+	+**
Downforce depe	ending slip regu-	+***	+***	-

Option	Kit 1	Kit 2	Clubsport
Lateral acceleration slip regulation	+	+	-
Corner inside wheel slip reduction regulation	+	+	-
Find more details under Dimensi	ons.		

- +*: fixed Kit Content
- +**: Adjustable via Coding Plug
- +***: Enabled with customer specific calibration

Mechanical Data

Hydraulic unit	
Serial housing, dust- and damp- proof	
Vibration damped circuit board	
38 pin connector	
2 hydraulic valves per wheel	
2 brake circuits (front and rear)	
2 hydraulic high pressures pump	S
2 hydraulic accumulators	3 cm³/each
Standard fittings	2 x master cylinders M12 x 1 4 x brake cylinders M10 x 1
Size	122 x 110 x 122 mm
Operating temperature	-30 to 130°C
Max. shock	50 g less than 6 ms
Max. working speed	360 km/h = 100 m/s = 224 mph
Pressure Medium	

DOT 4 brake fluid DOT 5.1 brake fluid

Electrical Data

Liectificat Data		
Supply voltage	10 to 16 V max. 24 V for 5 min	
Max. peak voltage	35 V for 200 ms	
Power consumption Pump	230 W	
Power consumption Relay	170 W	
Power consumption Electronics	8 W	
Inputs		
4 active wheel speed DF11i, DF1	1S or DF11V	
Brake pressure (front brake circuit / rear brake circuit)		
Longitudinal acceleration, lateral acceleration, yaw rate (MM5.10 sensor)		
11 adjustment settings (applicable for OEMs)		
ABS function can be deactivated (Pos. 1 or Pos. 12)		

Outputs

ABS warning light (MIL)

EBD warning light (MIL) if needed

TTL wheel speed signal FL / FR / RL / RR

Content of Kit and Weights

Content of Kit and Weights			
1,910 g			
40 g/each			
60 g			
50 g			
50 g/each			
50 g			
Depends on version			
1,540 g			
80 g			
212 g			
F02U.V02.302-02			
F02U.V02.300-03			
F02U.V02.659-02			
F02U.V00.327-03			

Communication	
ABS and Yaw rate sensor	CAN1
Diagnostics	MSA Box II

Wheel speed signal splitter with F02U.V00.335-03

Installation Notes

Maintenance Interval (brake fluid change, bleeding): 220 h or a maximum of two years. The load on the hydraulic unit in racing is much higher than in pure road operation, therefore we recommend a replacement of the unit after two

У	ears.
(Ordering Information
-	ABS M5 Kit 1 Order number F02U.V05.289-01
-	ABS M5 Kit 2 Order number F02U.V05.290-01
[ABS M5 Kit Clubsport DF11i, 500 kbaud Order number F02U.V05.291-01
[ABS M5 Kit Clubsport DF11i, 1 Mbaud Order number F02U.V05.292-01
[ABS M5 Kit Clubsport DF11S, 500 kbaud Order number F02U.V05.293-01
[ABS M5 Kit Clubsport DF11S, 1 Mbaud Order number F02U.V05.294-01
[ABS M5 Kit Clubsport DF11V, 500 kbaud Order number F02U.V05.295-01
[ABS M5 Kit Clubsport DF11V, 1 Mbaud Order number F02U.V05.296-01

Dimensions

ABS M5 Kit Variations

1 motorsport connector

	ABS M5 Kit 1	ABS M5 Kit 2	ABS M5 Kit Clubsport	ABS M5 Kit Clubsport	ABS M5 Kit Clubsport
Труе	Kit 1	Kit 2	1 Mbaud, DF11i	500 kbaud, DF11i	1 Mbaud, DF11S
Wiring harness	Specific	Specific	Generic	Generic	Generic
4 wheelspeed sensors DF11S	Included, with standard connectors	Included, with motorsport connectors	Not included	Not included	Included, with standard connectors
Wheel speed signal splitter	included*	Included*	included*	included*	included*
Fuses	Not included	Not included	Not included	Not included	Not included
Brake pipe fittings	Not included	Not included	Not included	Not included	Not included

	ABS M5 Kit Clubsport	ABS M5 Kit Clubsport	ABS M5 Kit Clubsport	ABS M5 Kit Porsche 991 Cup Gen 1	ABS M5 Kit Porsche 991 Cup Gen 2
Труе	500 kbaud, DF11S	500 kbaud, DF11V	1 Mbaud, DF11V	Model year 2015	Model year 2017
Wiring harness	Generic	Generic	Generic	Specific	Specific
4 wheelspeed sensors	Included, with standard	Not included	Not included	Included, Porsche specific	Included, Porsche specific
DF11S	connectors			DF11S	DF11S
Wheel speed signal splitter	included*	included*	included*	Included, DF11	Included, DF11
TTL					
Fuses	Not included	Not included	Not included	Included	Included
Brake pipe fittings	Not included	Not included	Not included	Included	Included

^{*}TTL splitter incl. in ABS Hardware, DF11 splitter optional

ABS M5 Kit Clubsport



	ire	

- Suitable for front-wheel, rear-wheel and fourwheel drive vehicles
- Generic wiring harness to fit all engine bay and front foot well locations for the hydraulic module
- ▶ Same ABS hardware as standard ABS M5 Kit

The ABS M5 Kit Clubsport is developed for the operation in front-, rear- or 4-wheel drive vehicles. A generic wiring harness is included in the kit. This enables us to provide the kit with a significantly reduced price in comparison to the standard ABS M5 Kit with individual loom.

The ABS M5 Kit Clubsport is specifically adapted for motorsport use. Individual car parameters like e.g. vehicle weight, vehicle track, wheel weights, wheel circumferences, wheel base or number of increments can be calibrated with software free of charge. Please contact your Bosch Motorsport dealer for further information.

Technical Specifications		
Mechanical Data		
Hydraulic unit		
Serial housing, dust- and damp-proof		
Vibration damped circuit board		
38 pin connector		
2 hydraulic valves per wheel		
2 brake circuits (front and rear)		
2 hydraulic high pressures pumps		
2 hydraulic accumulators 5 cm ³ /each		
Standard fittings	2 x master cylinders M12 x 1 4 x brake cylinders M10 x 1	
Size	122 x 110 x 122 mm	

Weight	1,910 g			
Operating temperature	-30 to 130°C			
Max. shock	50 g less than 6 ms			
Max. working speed	360 km/h = 100 m/s = 224 mph			
Pressure Medium				
DOT 4 brake fluid				
DOT 5.1 brake fluid				
Electrical Data				
Supply voltage	10 to 16 V max. 24 V for 5 min			
Max. peak voltage	35 V for 200 ms			
Power consumption Pump	230 W			
Power consumption Relay	170 W			
Power consumption Electronics	8 W			
Inputs				
4 active wheel speed DF11i, DF1				
Brake pressure (front brake circu				
Longitudinal acceleration, lateral sensor)	acceleration, yaw rate (MM5.10			
11 adjustment settings				
ABS function can be deactivated (Pos. 12)				
Outputs				
450 : 1:1:/44!!				
ABS warning light (MIL)				
TTL wheel speed signal FL / FR / I				
TTL wheel speed signal FL / FR / I Content of Kit and Weigh	its			
TTL wheel speed signal FL / FR / I Content of Kit and Weight Hydraulic unit	1,910 g			
TTL wheel speed signal FL / FR / I Content of Kit and Weight Hydraulic unit 2 pressure sensors	1,910 g 40 g/each			
TTL wheel speed signal FL / FR / I Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor	1,910 g 40 g/each 60 g			
TTL wheel speed signal FL / FR / I Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch	1,910 g 40 g/each 60 g 50 g			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard	1,910 g 40 g/each 60 g			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL)	1,910 g 40 g/each 60 g 50 g 50 g/each			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL) Standard wiring harness	1,910 g 40 g/each 60 g 50 g 50 g/each			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL) Standard wiring harness Mounting and vibration-damping boards	1,910 g 40 g/each 60 g 50 g 50 g/each 50 g 1,540 g 80 g			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL) Standard wiring harness Mounting and vibration-damp-	1,910 g 40 g/each 60 g 50 g 50 g/each			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL) Standard wiring harness Mounting and vibration-damping boards Mounting board for hydraulic	1,910 g 40 g/each 60 g 50 g 50 g/each 50 g 1,540 g 80 g			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL) Standard wiring harness Mounting and vibration-damping boards Mounting board for hydraulic unit	1,910 g 40 g/each 60 g 50 g 50 g/each 50 g 1,540 g 80 g			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL) Standard wiring harness Mounting and vibration-damping boards Mounting board for hydraulic unit Optional Accessories	1,910 g 40 g/each 60 g 50 g 50 g/each 50 g 1,540 g 80 g			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL) Standard wiring harness Mounting and vibration-damping boards Mounting board for hydraulic unit Optional Accessories Data logger C 70	1,910 g 40 g/each 60 g 50 g 50 g/each 50 g 1,540 g 80 g 212 g			
TTL wheel speed signal FL / FR / II Content of Kit and Weight Hydraulic unit 2 pressure sensors Yaw/acceleration sensor 12 position function switch 4 wheel speed sensors DF11 standard ABS warning light (MIL) Standard wiring harness Mounting and vibration-damping boards Mounting board for hydraulic unit Optional Accessories Data logger C 70 Display DDU 9	1,910 g 40 g/each 60 g 50 g 50 g/each 50 g 1,540 g 80 g 212 g F02U.V02.302-02 F02U.V02.300-03			

1 motorsport connector

Communication		
ABS and Yaw rate sensor	CAN1	
Diagnostics	MSA Box II	

Ordering Information
ABS M5 Kit Clubsport DF11i, 500 kbaud Order number F02U.V05.291-01
ABS M5 Kit Clubsport DF11i, 1 Mbaud Order number F02U.V05.292-01
ABS M5 Kit Clubsport DF11S, 500 kbaud Order number F02U.V05.293-01
ABS M5 Kit Clubsport DF11S, 1 Mbaud Order number F02U.V05.294-01
ABS M5 Kit Clubsport DF11V, 500 kbaud Order number F02U.V05.295-01
ABS M5 Kit Clubsport DF11V, 1 Mbaud Order number F02U.V05.296-01

ABS M5 Kit Porsche Cup



Features

- ► Plug & Play ABS M5 Kit for Porsche 997 Cup and 991 Cup Gen 1 and Gen 2
- ► Tested and developed on racetracks like Spa and Nordschleife
- ► Detailed installation instruction available at our website

▶ 1 Mbaud CAN

The ABS M5 Kit Porsche Cup is a derivative of the successful ABS M5 kit and specifically designed for Porsche 997 Cup and 991 Cup. A vehicle specific wiring harness is included in the kit. Individual car parameters like e.g. vehicle weight, vehicle track, wheel weights, wheel circumferences, wheel base or number of increments can be calibrated with software free of charge. Please contact your Bosch Motorsport dealer for further information.

Technical Specifications

-				
Variations				
	997 Cup (System DF11S)	991 Cup (System DF11i)		
4 wheel speed sensors	Included, Porsche specific DF11S	Not included, series sensors fit		
ABS warning light (MIL)	Included	Included (LED type)		
Brake pipe fittings	Not included	Included		
Fuses	Not included	Included		
Holder for Hydraulic unit	Included, standard	Included, Porsche specific		
Mechanical Data				
Hydraulic unit				
Vibration damped circuit board				

38 pin connector				
2 hydraulic valves per wheel				
2 brake circuits (front and rear)				
2 hydraulic accumulators 5 cm ³ /e	each			
Standard fittings	2 x master cylinders M12 x 1 4 x brake cylinders M10 x 1			
Size	122 x 110 x 122 mm			
Weight	1,910 g			
Operating temperature	-30 to 130°C			
Max. shock	50 g less than 6 ms			
Max. working speed	360 km/h = 100 m/s = 224 mph			
Pressure Medium				
DOT 4 brake fluid				
DOT 5.1 brake fluid				
Electrical Data				
Supply voltage	10 to 16 V, max. 24 V for 5 min			
Max. peak voltage	35 V for 200 ms			
Power consumption pump	230 W			
Power consumption relay	170 W			
Power consumption electronics	8 W			
Inputs				
4 active wheel speed DF11				
2 brake pressure (front brake circ	cuit, rear brake circuit)			
Longitudinal acceleration				
Lateral acceleration				
12 position function switch:	 11 maps preconfigured 1 switch position for ABS function OFF 			
Outputs				
ABS warning light (MIL)				
CAN channels: see manual				
Optional Accessories				
Data logger C 70	F02U.V02.302-02			
Display DDU 9	F02U.V02.300-03			
Content of Kit				
Hydraulic unit				
Holder for Hydraulic unit	See Variations			
4 Wheel speed sensors	See Variations			
2 pressure sensors				
MM5.10 acceleration sensor				
Vibrations damping board for				
acceleration sensor				
12 position function switch				
ABS warning light (MIL)	See Variations			
Specific wiring harness				

Brake pipe fittings	See Variations
Fuses	See Variations
Fuse mounting bracket	

Required Content

Brake pipes not included, available at Bosch Motorsport dealer

Communication

CAN via MSA Box II

Ordering Information

ABS M5 Kit Porsche 997 Cup Order number F02U.V05.289-20

ABS M5 Kit Porsche 991 Cup Gen 1

2015 Model Year

Order number F02U.V05.289-18

ABS M5 Kit Porsche 991 Cup Gen 2

2017 Model Year

Order number F02U.V05.289-19

Electronic Brake System EBS



Features

► Suitable for one axle use

We developed EBS for the operation in electric or hybrid vehicles on one axle. A vehicle specific wiring harness can be purchased (vehicle specific definition is needed).

The EBS is specifically adapted for motorsport use. Individual car parameters like e.g. brake pads friction can be calibrated with software free of charge. Please contact your Bosch Motorsport dealer for further information.

Technical Specifications

Mechanical Data		
Hydraulic unit		
Serial housing, dust- and damp-proof		
Vibration damped circuit board		
38 pin connector		
6 hydraulic valves for inlet/outlet		
1 separation backup valve		
1 electric pump motor		
1 hydraulic accumulator	160 bar/90 cm ³	
Standard fittings	M12 x 1	
Size	176 x 144 x 157 mm	
Operating temperature	-30 to 130°C	
Max. shock	50 g less than 6 ms	
Max. working pressure	130 bar; max. recommended locking pressure 120 bar	
Pressure Medium		
DOT 4 brake fluid		
DOT 5.1 brake fluid		

Electrical Data

Supply voltage	10 to 16 V max. 24 V for 5 min	
Max. peak voltage	35 V for 200 ms	
Max. peak at start	<165 A	
Current consumption Pump	<40 A	
Current consumption Relay	<16.5 A	
Power consumption Electronics	<1.5 A	
Inputs		
1 x PWM Target (Pressure or Torque)		
1 x PWM input calliper pressure		
1 x CAN1; 500 k or 1 Mb selectable		
1 x CAN1 DC (Daisy Chain)		
EBS function switch 6 positions via CAN1		
Outputs		
EBS warning light (MIL) via CAN1		
EBS diagnostic via CAN1		
Optional Accessories / S _I	pare Parts	

Mounting board for hydraulic unit (recommended)	0265.Y5H. 505-01
Pressure sensor PSS-260 (2 required)	0261.545.040
Rubber unit Ø 18	2260.306.017
Rubber unit Ø 23	2260.306.016
Communication interface MSA Box II	F02U.V00.327-03

Component Weights

Hydraulic unit	3,630 g
2 pressure sensors	40 g/each
Mounting board for hydraulic unit	300 g
Vehicle specific wiring harness with motorsport connectors	Depends on version

Pin Configuration

Pin C	onnguration
1	UB_MR
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	GND_MR

14	CAN1M
15	CAN1M-DC
16	
17	
18	
19	
20	
21	
22	
23	
24	
24 25	UB_VR
	UB_VR CAN1P
25	
25 26	CAN1P
25 26 27	CAN1P CAN1P-DC
25 26 27 28	CAN1P CAN1P-DC
25 26 27 28 29	CAN1P CAN1P-DC
25 26 27 28 29 30	CAN1P CAN1P-DC WAU_IN
25 26 27 28 29 30 31	CAN1P CAN1P-DC WAU_IN

38	GND_ECU
37	P Caliper PWM in
36	P_Target_PWM
35	

Communication

EBS	CAN1
Diagnostics	MSA Box II

Installation Notes

Maintenance Interval (brake fluid change, bleeding): 220 h or a maximum of two years.

The load on the hydraulic unit in racing is much higher than in pure road operation, therefore we recommend a replacement of the unit after one year.

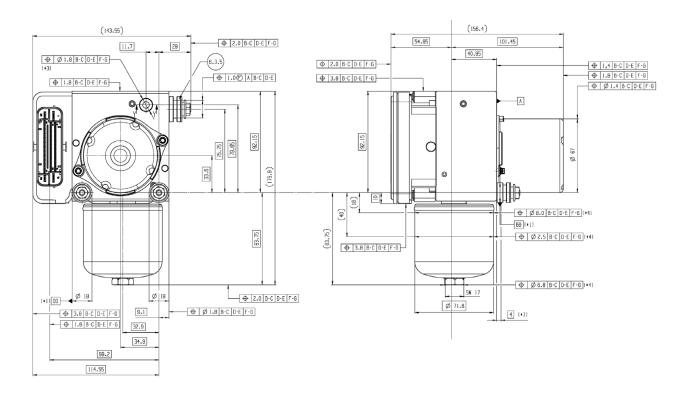
Legal Restrictions

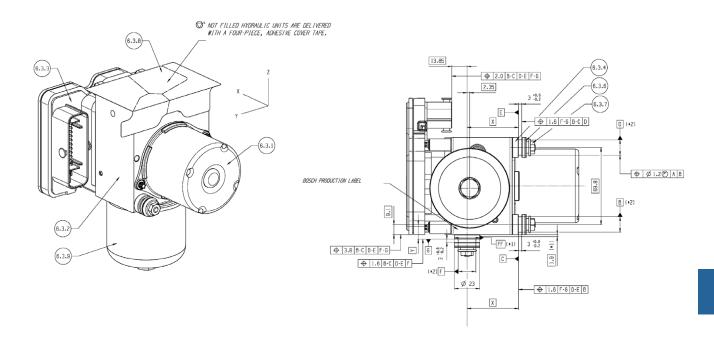
The sale of this product in Mexico is prohibited.

The use of the system is not permitted in South Korea.

Ordering Information

Electronic Brake System EBS Order number F02U.V02.900-01





Software

8

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System Configuration	327
Customer Code Area	328
Simulation	329

Analysis Tool WinDarab V7



Features

- ▶ State of the art user interface
- ► Versatile diagrams
- ► Numerous analysis functions
- ▶ Customizable mathematical channels and filters
- ► Software based license without dongle

WinDarab V7 is an evaluation tool for monitoring and analyzing of logged data and is specially designed for motorsport use. Monitor vehicle data using online telemetry and compare logged data by reading out your data logger. WinDarab V7 features a state of the art user interface and reads out both engine and chassis data.

The follower of WinDarab V6 offers simplified and ergonomic handling as well as new features and a revised license system to work without a dongle. Choose between the *Free* and the *Expert* version depending on your purpose.

The enormous bandwidth of features makes Win-Darab V7 a perfect evaluation tool for motorsport engineers.

Application
Diagrams
Oscilloscope
X-/Y-plot to create scatterbands
Histogram
3D-diagram
Analysis
Overlay of different laps
Time or distance based analysis
Absolute and relative values
One-touch channel statistics (min./max., avg., etc.)

Regression lines, user defined lines Lap reports and lap based comparisons Replay offline data in realtime **Advanced Analysis** User defined math channels User defined conditions to filter data FFT analysis **Racetracks** Racetrack creation based on v/acc or GPS data Racetrack segmentation **Telemetry** Replay online data in realtime Gauges for realtime visualization **User Interface** Flexible display setup and arrangement Storable display setup and arrangement Lap browser **Data Transmission** Direct data input without intermediate hardware Protection/encryption of logged data files ASCII import and export **License System** Dongle-free working in all WinDarab V7 variations Activation/update via internet Annual maintenance for up-to-date versions **Environment** 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)

Recommended Operation System Windows 10

Technical Specifications

Variations

	Free	Expert
Max. open files	4	unlimited
Max. measuring data windows	2	unlimited
Max. areas in measuring data windows	4	unlimited
Histogram	+	+
x/y-plot	+	+
Distribution	+	+
min/max-tables	+	+
Fourier-transformation	+	+

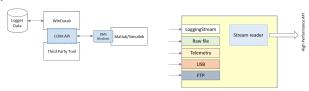
Outing report	+	+
Lap analysis	-	+
Flowcharts	-	+
Instrument panel	+	+
User defined physical units	+	+
Racetrack generation via speed/lateral G or GPS	+	+
ASCII export	+	+
Available operators for math channels.	+, -, *, /, ^, sqr (x), sqrt (x)	All
Extras settings/comments	-	+
Desktop load/save	+	+
Telemetry	+	+

Programming interface (API) -	Opt.	
Installation Notes		
Yearly maintenance is recommended, no con	mponents to replace.	
Ordering Information		
WinDarab Free Version Order number free download at our h	omepage	
WinDarab Expert Order number F02U.V01.308-01		
Software Options		
Software licence COM-API for WinDarab Expert Order number F02U.V01.682-01		
Yearly maintenance Order number F02U.V01.345-01		

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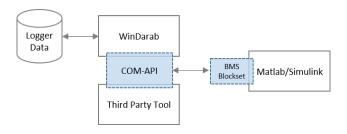
Overview

COM-API for WinDarab Ex- Data Direct Access API pert



- Gives external tools access to WinDarab functionalities
- Has read access to raw files, Stream-Logging and Telemetry
- Supports USB and FTP data transfer from logger and USB sticks

COM-API for WinDarab Expert



Features

Gives external tools access to WinDarab functionalities

Using COM-API allows some control over WinDarab:

- Attaching to or creating new instances of WinDarab Application
- · Data Domain (opened files and overlays)
- · Cursor position View range
- · Marked/Tagged range

Users can also compile their application as a Win-Darab Plugin. This allows custom buttons and menus on the WinDarab Ribbon. Apart from plugins, applications using COM-API are *out of process communica*tion.

COM-API can create new measurement files

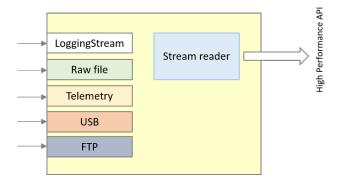
- A 3rd party application/plugin can use the UserDataFile class to create new measurement files with application generated channel data
- Files created with the new API are written in WinDarab file format v2 which is supported since WinDarab v7.6.
- A brief example how to write a file can be found in the BM-S2ApiSamples.Net project, see the source in CreateUserData-File.cs.

The application of COM-API requires the Expert-version of WinDarab, it doesn't work with the Free-version.

Ordering Information

COM-API for WinDarab Expert
Order number F02U.V01.682-01

Data Direct Access API



Features

- ► Has read access to raw files, Stream-Logging and Telemetry
- Supports USB and FTP data transfer from logger and USB sticks

The Bosch Data Direct Access API provides access to the logged data and telemetry data of Bosch Motorsport data logger devices. It can be included in user specific applications to monitor and analyse car data in the most efficient and flexible way. The Bosch Data Direct Access is a .NET class library for converting measurement data from data logger devices to an application-defined data format. The supported source data can be delivered by

- · Telemetry streams from Bosch loggers
- · Raw measurement files from Bosch loggers
- Supports USB and FTP data transfer from logger and USB stick Updates for new features are included; single seat licenses are provided and have a runtime of one year. The Bosch Data Direct Access API is the first module of the all-new Bosch Data Management world for reading and writing different types of data in the Bosch Motorsport data systems.

Application

General Features

Full Flow Control

Telemetry

- Online (incl. Support Bosch Cloud Telemetry)
- Logging Stream

Access to raw files in Bosch loggers

Supports Multilogging

Environment

PC Hardware

- IBM PC Pentium/AMD Athlon compatible, min. 1.6 GHz Min.
- 1 GB RAM Min.
- 1 GB free HD disk space
- Recommended Operation System Windows 10

Recommended Development Environment

- · Microsoft Visual Studio 2019
- .NET Core 3.1 or newer
- .NET 4.7.2 or newer

Technical Specifications

Functions and classes

ActiveStreamChangedEventHandler()

BlockReceivedEventHandler()

CarAvailableEventHandler()

DeviceEventEventHandler()

DeviceEventSeverity

DisposedEventHandler()

LapEventHandler()

MediaChangeEventHandler()

NotifyEventHandler()

PasswordRequiredHandler()

Installation Notes

Windows examples for several use cases included in delivery

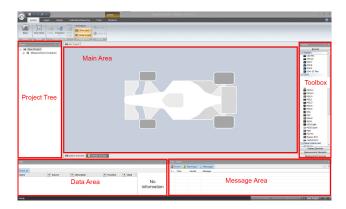
Yearly renew of license necessary

Ordering Information

Data Direct Access API

One License, one seat for one year Order number **F02U.V03.264-01**

RaceCon



Features

► An all integrated software tool for configuration and calibration

RaceCon is an all integrated software tool for configuration and calibration of Bosch Motorsport hardware products, such as ECUs, displays, loggers. The communication is based on Bosch Motorsport MSA-Box interface.

Application

Calibration of ECU maps and curves

ECU data file up- and download

Parameter file up- and download

Diagnostic functionality for Bosch Motorsport ECUs

Data file / Work base management

Integrated flash functionality

Integrated Bosch sensor database

Configuration of Bosch Motorsport displays

Configuration of Bosch Motorsport data loggers

Configuration of Bosch Motorsport CAN modules

Communication via K-Line/CAN/Ethernet (KWP/CCP/XCP)

CAN communication log functionality (baud rate changeable)

Quick data access over Race Mode

Technical Specifications

Intuitive design, easy to use

Environment

PC

IBM PC Pentium/AMD Athlon compatible, min. 1.6 GHz

Min. 2 GB RAM

Min. 1 GB free hard disc space

VGA/WGA monitor (min. 1,024 x 768)

Recommended Operation System Windows 10

Optional Accessories

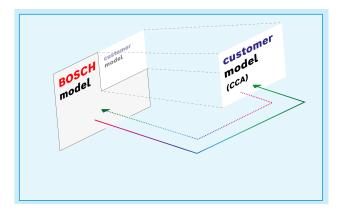
MSA-Box II F02U.V00.327-03

Ordering Information

RaceCon

Order number free download at our homepage

CCA Development Environ- ment



Features

- Calculation directly in Bosch main device possible
- ► Communication binding via Software free cuts
- ▶ Unlimited bandwidth interfaces
- ► One Box Design (compact solution, no extra weight)

We provide the option to run software code on our ECUs that has been developed by the customer. This code is run in the customer code area (CCA) and is protected against access of anyone else. Within ECUs and VCUs, this feature can be run in parallel to all further functionality.

We deliver it with a full environment for Matlab/Simulink, a compiled Bosch model as library and a package of Matlab/Simulink interfaces to all I/Os.

Technical Specifications

General Functions

Support for generating executables that include algorithm, devicedriver and real-time operating system

Multitasking scheduling using time synchronous (and asynchronous) tasks, task pre-emption and temporary task overruns

Environment for Matlab/Simulink

Full I/O access with Bosch-Motorsport device drivers

Full read access to all Bosch signals

Development Environment with reduced Bosch "unit_blockset"

Real time calibration

Calibration and measurement interface XCP via Ethernet

SW-Download via Bosch Motorsport calibration tool RaceCon

Software option for all ECUs and VCUs

Free maintenance for the first 12 month, afterwards with costs.

System Requirements

MathWorks Requirements

- MATLAB R2018b
- · Simulink R2018b
- MATLAB Coder
- Embedded Coder
- · Simulink Coder
- Stateflow
- · Compiler for Mathworks
- · Microsoft Visual C++ 2017

Operating System

- · Windows 10
- Microsoft Visual C++ 2005 Redistributable (x64)
- Microsoft Visual C++ 2008 Redistributable (x86)
- Microsoft Visual C++ 2008 Redistributable (x64)
- Microsoft .NET Framework 2.0, 3.5.1, 4.8
- Microsoft Excel 2016(32bit) or Office365(64bit)

DocGen

• basic-miktex-21.2-x64.exe from https://miktex.org/download

Additional (not included)

Multi CCA for VCU

Enables the use of an extra core to utilize more computing power in the device for running a second customer model

Ordering Information

CCA Development Environment

Order number F02U.V02.370-01

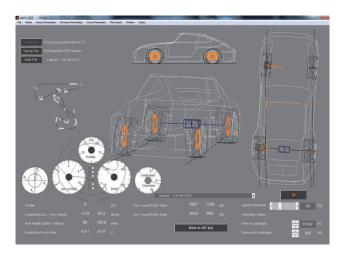
Multi CCA Development Environment for VCU Order number F02U.V03.223-01

CCA Hardware Upgrade per device

Order number F02U.V02.137-01

Multi CCA Hardware Upgrade VCU per device Order number F02U.V03.222-01

Simulation Tool LapSim



Features

- ► Professional Simulation Tool
- ▶ Free / Chassis / Engine Versions available
- ▶ Find the Operation Manual here.
- ▶ Find the Installation Manual here.

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 behavior can be gained. Due to the direct link with the simulation model, vehicle parameters can be validated like aerodynamics, tire behavior, engine power, as well as driver performance. The visualization of the vehicle behavior 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.

Application

Data Analysis

Post processing of the on-car recorded data with simulation models. Calculating vehicle handling state, aerodynamics, differential function, etc.

Determination of tire parameters out of on-car recorded data. Possibility to analyze tire performance over the laps.

Direct comparison between several outings and/or simulation model.

3D Animation of vehicle behavior 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 tire model. Tire parameters can easily be determined out of on-car recorded data. No tire 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 optimization

Engine Simulation model

Engine model generates torque/power curve as well as ignition angle

Normally aspirated 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 to 10,000 rpm range

Ordering Information

LapSim Chassis Free Version

Order number free download at our homepage

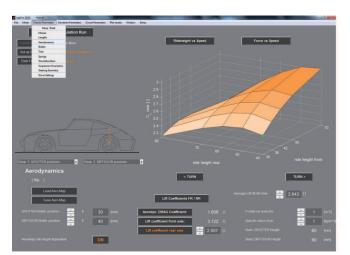
LapSim Chassis License

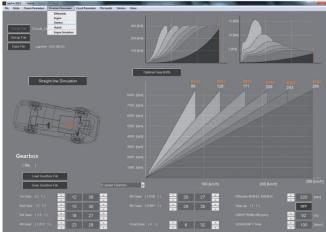
Order number **B261.206.432-01**

LapSim Chassis and Engine License

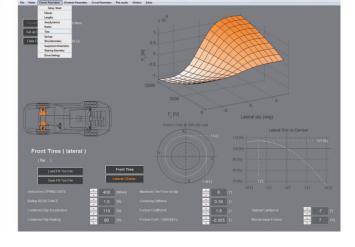
Order number **F01T.A20.057-01**

Dimensions



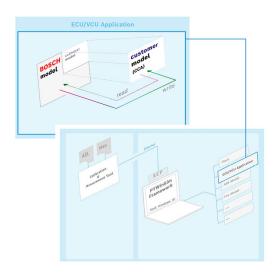






A few Screenshots

Simulation Packages



Features

- ► Simulate Bosch model and Customer model together in the same simulation environment
- ▶ Develop Bosch Motorsport control systems (ECU/VCU) in a simulation environment with other plant models (e.g. tire, ABS)
- ► Enables use of Bosch models (via *PTWinSim*) in other simulation environments like rFpro
- ► Execute your control system faster than realtime on a Windows 10 PC
- ► Perform real-time analysis on telemetry streams or other data sources

These simulation packages allow customers that use Bosch Motorsport control systems to simulate the functionality without using the hardware. These packages enable the user to run Bosch Motorsport and customer code area functions within the PTWin-Sim® environment.

PTWinSim® provides a framework and supporting functionality enabling several applications to execute in a coherent time frame on a variety of hosts. Applications ranging from Engine Control Unit code to vehicle system models with complex control algorithms are simply adapted for the simulation environment. Furthermore, with WinDarab COM API, Bosch Motorsport customers can use WinDarab datasets as stimuli and logging for their simulated control system.

Device Simulation Runtime provides the runtime licenses to run a Bosch Motorsport simulation package within PTWinSim®. This requires an individual and project specific simulation software, which needs to be ordered separately.

CCA Simulation Package also provides the option for users of CCA to generate their own simulation software. Device Simulation Runtime is included.

Technical Specifications

Recommended Operation System Windows 10, min. Update Version 1803

Required and not included Software

MathWorks Requirements	CCA S.P.*	Device S.P.*
MATLAB R2018b	Х	
Simulink	Х	
Real-Time Workshop	Х	
Real-Time Workshop Embedded Coder	Х	
Fixed-Point Toolbox	Х	
Simulink Fixed-Point	Х	
Stateflow	Х	
Stateflow Coder	Х	
Vehicle Network Toolbox	Х	
Min. PTWinSim 4.09	Х	Х
Compiler		
Microsoft Visual Studio, Version 2017	Х	Х
Application tool		
RaceCon 2.7 or later	Х	Х

^{*}S.P.: Simulation Package

Ordering Information

CCA Simulation Package

CCA Simulation development target to build and execute customer code.

Including 1 Device Simulation Runtime license and 1 year maintenance.

Order number **F02U.V02.893-01**

Device Simulation Runtime

Device Simulation Runtime license to execute simulation on a PC and 1 year maintenance Order number **F02U.V02.891-01**

CCA Simulation Package Annual Maintenance
Order number F02U.V02.892-01

Device Simulation Runtime Annual MaintenanceOrder number **F02U.V02.890-01**

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Overview

Breakout Box BOB 66-pole



Breakout Box BOB MS 6



Breakout Box BOB MS 7



Breakout Box BOB PBX 90



- Compact, lightweight housing in low-profile design with high-density packaging
- Robust 4 mm standard jacks for measuring leads
- Signal integrity of high-speed data links ensured by product-specific version
- Standard configurations and fully customized versions available
- No more lost jumpers due to patented 90° rotatable connectors

- Compact, lightweight housing in low-profile design with high-density packaging
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Breakout Box BOB PBX 190



- Compact, lightweight housing in low-profile design with high-density packaging
- Robust 4 mm standard jacks for measuring leads
- Signal integrity of high-speed data links ensured by product-specific version
- No more lost jumpers due to patented 90° rotatable connectors

Breakout Box BOB 66-pole



Features

- Compact, lightweight housing in low-profile design with high-density packaging
- Robust 4 mm standard jacks for measuring leads
- ➤ Signal integrity of high-speed data links ensured by product-specific version
- ► Standard configurations and fully customized versions available
- ► No more lost jumpers due to patented 90° rotatable connectors

The Breakout Box BOB enables the operator to perform measurements and modify connections during operation. The jumpers allow to individually open or close each single connection without removing the jumper. Jacks provide access to all signals for measurement purposes. The box is essential for development and test environments in the lab and vehicle.

Technical Specifications

Mechanical Data

Size	225 x 130 x 35 mm
------	-------------------

Weight	1,100 g
4 mm standard jacks for meas- uring leads	66
Connectors and Wires	
F02U.V02.295-01 code blue	
Connector on housing	AS018-35PB
Connector on wire	AS618-35SB
F02U.V02.296-01 code orange	
Connector on housing	AS018-35PC
Connector on wire	AS618-35SC
F02U.V02.297-01 code red	
Connector on housing	AS018-35PN
Connector on wire	AS618-35SN
F02U.V02.298-01 code yellow	
Connector on housing	AS018-35PA
Connector on wire	AS618-35SA
F02U.V02.299-01 code violet (universal)	
Connector on housing	AS018-35PU
Connector on wire	AS618-35SU
Wire length L (all)	Ca. 50 cm

Ordering Information

Breakout Box BOB 66-pole

Connector code: orange Order number **F02U.V02.296-01**

Breakout Box BOB 66-pole

Connector code: red

Order number **F02U.V02.297-01**

Breakout Box BOB 66-pole

Connector code: violet (universal use)

Order number F02U.V02.299-01

Accessories

Breakout Box BOB 66-pole

Connector code: blue

Order number F02U.V02.295-01

Breakout Box BOB 66-pole

Connector code: yellow Order number **F02U.V02.298-01**

Breakout Box BOB MS 6



Features

- Compact, lightweight housing in low-profile design with high-density packaging
- ► Robust 4 mm standard jacks for measuring leads
- Signal integrity of high-speed data links ensured by product-specific version
- ► Standard configurations and fully customized versions available
- ► No more lost jumpers due to patented 90° rotatable connectors

The Breakout Box BOB enables the operator to perform measurements and modify connections during operation. The jumpers allow to individually open or close each single connection without removing the jumper. Jacks provide access to all signals for measurement purposes. The box is essential for development and test environments in the lab and vehicle. This version was especially developed for use with Engine Control Units MS 6.

Technical Specifications

Mechanical Data Size $355 \times 270 \times 50 \text{ mm}$ Weight 4,100 g 4 mm standard jacks for meas-176 uring leads Ethernet connectors 4 Ethernet wire 2 x inclusive **USB** connectors 2 inclusive USB jumper **Connectors and Wires**

2 x 60 cm

Ordering Information

Wire length L

Breakout Box BOB MS 6
Order number F02U.V02.294-01

Breakout Box BOB MS 7



Features

- ► Compact, lightweight housing in low-profile design with high-density packaging
- ► Robust 4 mm standard jacks for measuring leads
- ► Signal integrity of high-speed data links ensured by product-specific version
- ► Standard configurations and fully customized versions available
- ► No more lost jumpers due to patented 90° rotatable connectors

The Breakout Box BOB enables the operator to perform measurements and modify connections during operation. The jumpers allow to individually open or close each single connection without removing the jumper. Jacks provide access to all signals for measurement purposes. The box is essential for development and test environments in the lab and vehicle. This version was especially developed for use with the LIFE connector of Engine Control Units MS 7 and Vehicle Control Unit VCU.

Ordering Information

Breakout Box BOB MS 7

Connector code: red

Order number F02U.V02.293-01

Breakout Box BOB PBX 90



Features

- ► Compact, lightweight housing in low-profile design with high-density packaging
- ► Robust 4 mm standard jacks for measuring leads
- ➤ Signal integrity of high-speed data links ensured by product-specific version
- Standard configurations and fully customized versions available
- ➤ No more lost jumpers due to patented 90° rotatable connectors

The Breakout Box BOB enables the operator to perform measurements and modify connections during operation. The jumpers allow to individually open or close each single connection without removing the jumper. Jacks provide access to all signals for measurement purposes. The box is essential for development and test environments in the lab and vehicle. This version was especially developed for use with PowerBox PBX 90.

Technical Specifications Mechanical Data Size 255 x 220 x 45 mm Weight 2,400 g 4 mm standard jacks for meas-68 uring leads **Ethernet connectors** 4 Ethernet wire 2 x inclusive **Connectors and Wires** Wire length L 2 x 60 cm

Breakout Box BOB PBX 90 Order number F02U.V02.292-01

Ordering Information

Breakout Box BOB PBX 190



Features

- ► Compact, lightweight housing in low-profile design with high-density packaging
- ► Robust 4 mm standard jacks for measuring leads
- ► Signal integrity of high-speed data links ensured by product-specific version
- ► No more lost jumpers due to patented 90° rotatable connectors

The Breakout Box BOB enables the operator to perform measurements and modify connections during operation. The jumpers allow to individually open or close each single connection without removing the jumper. Jacks provide access to all signals for measurement purposes. The box is essential for development and test environments in the lab and vehicle. This version was especially developed for use with PowerBox PBX 190.

Technical Specifications	
Mechanical Data	
Size	355 x 265 x 50 mm
Weight	5,800 g
4 mm standard jacks for measuring leads	112
Ethernet connectors	8
Ethernet wire	4 x inclusive
Connectors and Wires	
Wire length L	2 x 4 x 55 cm

Breakout Box BOB PBX 190 Order number F02U.V02.523-01

Com Interface MSA-Box II



Features

► Communication interface for PC-supported calibration on K-line, CAN or Ethernet interface

The MSA-Box II is the low cost unit for PC-supported calibration and configuration on Ethernet, K-Line or CAN interface of an ECU.

The MSA-Box II 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 Ethernet, K-Line or CAN-interface of the diagnosis interface.

Technical Specifications	
Mechanical Data	
Size	84 x 38 x 25 mm
Temperature range	0 to 70°C
Compact design	
Fully suitable for motor vehicle use	
All inputs and outputs to the PC with galvanic separation	

Electrical Data

Input voltage (vehicle side)	8 to 32 V
Power supply through the conne mains with galvanic separation	ection to the ECU from board
Power consumption (powered by USB)	Typ. 0.5 W
USB	USB 2.0, high speed (480 MBit/sec)
Ethernet	100 MBit/sec
K-Line	300 Bd up to 320 kBd
CAN	10 kBit/s up to 1 MBit/s
Recommended Operation Syste	m Windows 10

Connectors and Wires

Connector AS612-35PN	F02U.000.441-01
Mating connector ASO12-35SN	F02U.000.258-01
Pin 1	Terminal 30 (permanent pos)
Pin 2	Terminal 15 (switch pos)
Pin 3	GND
Pin 4	CAN_High
Pin 10	K-Line
Pin 8	RxD+
Pin 9	RxD-
Pin 11	TxD+
Pin 12	TxD-
Pin 16	CAN_Low
Pin 22	SCR
Diagnosis wire length	2 m
USB wire length	0.5 m

Ordering Information

Com Interface MSA-Box II
Order number F02U.V00.327-03

Connector Opening Tool for AS series



Features

▶ Quick and easy opening of ECU connectors

The Connector Opening Tool helps you to open connectors of ECUs like MS 7.4.

Technical Specifications Mechanical Data Material Stainless steel Ordering Information Opening tool for shellsize 16 Order number F02U.V01.393-01 Opening tool for shellsize 18 Order number F02U.V01.394-01

Connectors



Features

- ► Bosch Jetronic and Compact connectors inclusive contacts and sealings
- ► Autosport connectors from Deutsch, Tyco, etc.
- ► Connectors with 3 to 128 pins

Convenient to the Wiring Harnesses, we have a wide range of connectors on offer.

From single pin and Bosch series connectors above TE-connectors to Deutsch-motorsport connectors, you can choose from a big variation.

You can get from us different Deutsch-motorsport connectors of the series AS, ASL, ASU, ASX and ASDD. According to the series, these are 3 to 128-pin connectors.

At Bosch connectors you can choose from connectors of the Jetronic or Compact series. Furthermore you receive convenient contacts and sealings to our Bosch-connectors.

If you are interested, give us a call!

Customized Wiring Harnesses



Features

- ► One-stop-shop for consulting, manufacturing, development and service
- Manufacture of individual pieces and small batches
- ► Use of the highest quality materials
- ► Full test coverage based on the latest testing equipment for all products
- ► The complete package, from a single pin to a complete wiring harness

Our expertise

Bosch Motorsport specialists have decades of experience in design and manufacture of customized wiring solutions for race cars and prototypes. Increasing complexity in race cars necessitates a high degree of understanding in the electrical architecture of the project. We provide to you the extensive system know-how and the expertise of our spe-

As a system supplier, we are familiar with the full spectrum of electronic requirements of the components in a racecar – from high current and high voltage applications to high-speed data networks.

Our offer

cialists.

Whether it is complete vehicle wiring, test equipment or a simple adapter – we design, plan, construct and test according to your individual requirements and requests.

If you want to build your wiring yourself, we also offer consulting and development support independently from our manufacturing services. Give us a call!

Appendix

10

General Information	346

Vibration Profiles 347

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).

Service

To ensure full functionality every time, Bosch Motorsport recommends annual functional testing of all equipment.

Battery

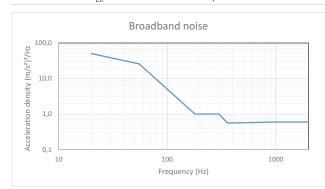
Some of the devices use Lithium-Ion batteries. Please use extra caution to be certain that the correct removal procedure is followed. Abide by the maintenance cycle schedule to ensure correct operation. Bosch Motorsport recommends maintenance once a year.

Installation

The correct installation extends reliability and durability. Please follow the specifications regarding temperature, humidity, vibration and liquid compatibility.

Broadband noise: 8h/direction

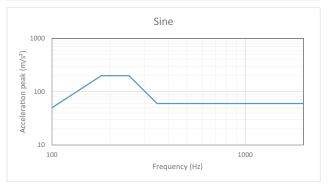
Frequency (Hz)	Acceleration density (m/s²)²/Hz
20	50.4
55	26.0
180	1.0
300	1.0
360	0.56
1,000	0.6
2,000	0.6
Effective value a _{eff}	55.4 m/s ²



Sine: 8h/direction

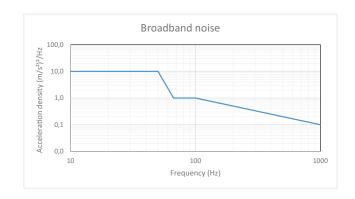
Alteration rate of frequency: 2.4 oct./min

Frequency (Hz)	Acceleration peak (m/s2)
100	50
180	200
250	200
350	60
2,000	60



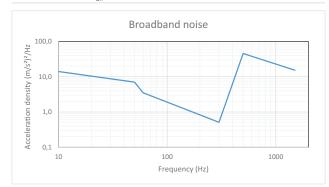
Broadband noise: 8h/direction

Frequency (Hz)	Acceleration density (m/s ²) ² /Hz
10	10.0
50	10.0
66.7	1.0
100	1.0
1,000	0.1
Effective value a _{Eff}	26.9m/s^2



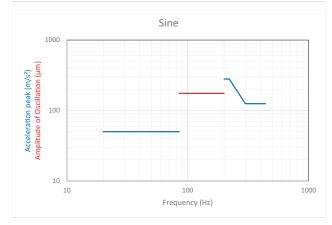
Broadband noise

Frequency (Hz)	Acceleration density (m/s ²) ² /Hz
10	14.0
50	7.0
60	3.5
300	0.5
500	45.6
1,500	15.3
Effective value a _{Eff}	168m/s^2



SineAlteration rate of frequency: 1 oct./min

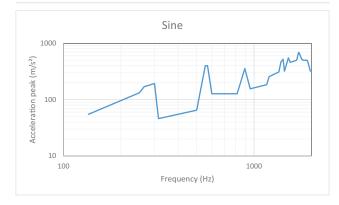
Frequency (Hz)	Amplitude of acceleration (m/s²)	Amplitude of oscillation lane (µm)
20	50	
85	50	
85		175
200		175
200	280	
220	280	
300	125	
440	125	



Sine 80h/direction

Frequency (Hz)	Acceleration peak (m/s²)
135	55
250	132
265	170
300	193
315	46
500	65
555	400
570	400
600	127
815	127
895	356
955	156
1,165	184
1,200	256
1,350	310
1,385	470
1,420	520

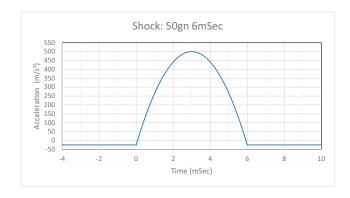
Frequency (Hz)	Acceleration peak (m/s²)
1,445	320
1,515	550
1,550	460
1,675	500
1,710	670
1,720	690
1,780	520
1,810	500
1,900	500
1,925	448
1,975	320



Shock Profile

Shock: 10 shocks (pos. and neg.) / direction 50gn 6mSec ISO 16750-3

Time (mSec)	Acceleration Density (m/s²)²/Hz
-4	-25
0	-25
3	500
6	-25
10	-25



Icons	Fuel Pressure Regulator Mini 5	
μLC Test System	Fuel Pressure Regulator Mini A	
μες rest system133	Fuel Pump FP 165	
	Fuel Pump FP 200-7	
A	Fuel Pump FP 200-E	156
ABS M5 Kit 311		
ABS M5 Kit Clubsport 313	G	
ABS M5 Kit Porsche Cup		0.40
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Acceleration Sensor MM5.10-R 306		
Alternator B0	Н	
Alternator B3 LIN	HP Fuel Pump HDP 5	158
Alternator B5	HP Fuel Pump HDP 5-LW	
Analysis Tool WinDarab V7	HP Injection Valve HDEV 5.2	
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Breakout Box BOB MS 7	Ignition Coil C90i-E8	
Breakout Box BOB PBX 190	Ignition Coil C90i-pro	
Breakout Box BOB PBX 90	Ignition Coil C90i-pro evo	
Dreakout box bob i bx 30	Ignition Coil C90i-WG	
	Ignition Coil P50/P50-M	
C	Ignition Coil P65	
CAN Keypad CK-M12 72	Ignition Coil P65-T	
CCA Development Environment	Ignition Coil P65-TWG	
Collision Avoidance System CAS-M light	Ignition Coil P65-WG	
Collision Avoidance System CAS-M 3 EVO 80	Ignition Coil P65-WSIgnition Coil PS-T	
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Engine Control Unit MS 7.4	Pressure Sensor Air PS-AA	
Expansion Board CAN-FD	Pressure Sensor Air PSA-N	
Expansion Board Current Loop Interface	Pressure Sensor Air PS-AS	
LAPANSION DOALD DIGITAL OULPUIS 139	Pressure Sensor Combined PSM-SAT	
	Pressure Sensor Combined PST 1/PST 3	
F	Pressure Sensor Combined PST 4	
FPR Adaptor light 150	Pressure Sensor Combined PST-F 2 280 bar.	
Fuel Pressure Regulator Mini 2 143	Pressure Sensor Combined PST-F 2 350 bar	
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Bosch Engineering GmbH Motorsport

For more infomation please visit www.bosch-motorsport.com or send an email to motorsport@bosch.com

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