

# Angle Sensor WS1

**RE 95140**

Edition: 06.2017

Replaces: 07.2007



- ▶ Hall-effect semiconductor elements and integrated amplifiers
- ▶ Robust plastic housing with moulded plug
- ▶ Metal inner housing and line filter for high electromagnetic compatibility (EMC)
- ▶ Guide lever with fixing hole

**Features**

- ▶ The angle sensor is used for measuring rotary movements of an adjusting shaft or the angle positions of levers, e.g. to determine the setting of the injection pump lever of a diesel engine.
- ▶ The sensor has a robust, sealed housing and an integrated electronic system specially developed for automotive applications.
- ▶ The voltage supply for the WS1 angle sensor can be delivered directly by the control units (MC or RC).
- ▶ As output variable, the WS1 angle sensor delivers a voltage proportional to the angle of rotation.
- ▶ The sensor contains two internal contact-free measuring systems with a common power supply.
- ▶ For safety-related system solutions, the output signals are partially redundant.

**Special features**

- ▶ Life span designed for more than 30 million cycles
- ▶ Resistant to shock and vibration
- ▶ Molded-in metal bushing for low-wear on lever arm

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## Ordering code

01	02	03	04	05
<b>WS1</b>	<b>T</b>	<b>90</b>	<b>/</b>	<b>1 0</b>

### Type

01	Angle sensor	<b>WS1</b>
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### Safety

02	Partially redundant (2 output signals)	<b>T</b>
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### Version/ Measuring range

03	90° angle of rotation	<b>90</b>
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### Series

04		<b>1</b>
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### Index

05		<b>0</b>
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## Intended use

The sensor must be used exclusive in mobile working machines.

## Material number for WS1

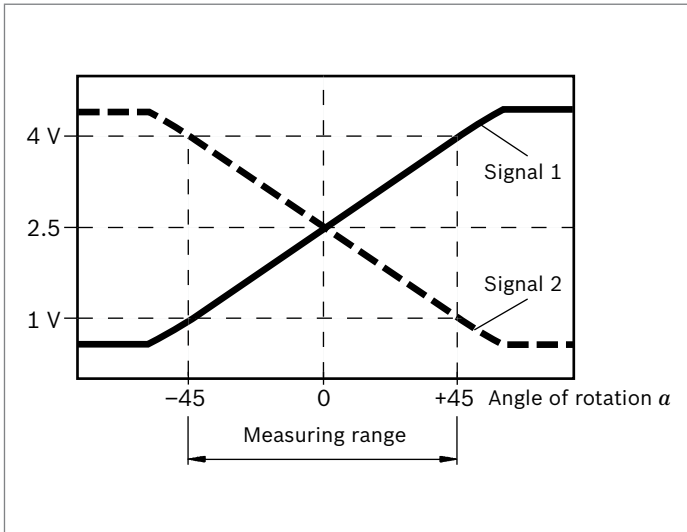
R902602446

## Technical Data

Type	WS1T90/10
Supply voltage $U_b$	5V DC $\pm 0.25$ V
Input current	max. 11 mA
Output voltage $U_a$	0.5 ... 4.5 V (at 5 V power supply)
Linearity of the output voltage $U_a$	$\pm 0.5$ % at $-45^\circ \leq \alpha \leq -15^\circ$
	$\pm 0.25$ % at $-15^\circ \leq \alpha \leq +15^\circ$
	$\pm 0.5$ % at $+15^\circ \leq \alpha \leq +45^\circ$
Accuracy of output voltage $U_a$ at 20°C	$\pm 2$ %
Load impedance to earth	min. 10 k $\Omega$
	max. 22 nF
Short-circuit resistance of the signal outputs to	Supply voltage and earth
Polarity mismatch protection	Supply voltage to earth
Electromagnetic compatibility	Broadcast noise (ISO 11452)
	Line-borne interference (ISO 7637-1)
	200 V <sub>eff</sub> /m
	Values on request
Operating temperature, housing	-40°C ... +100°C, max. +120°C for 1h
Storage temperature, housing	-40°C ... +100°C, max. +130°C for 16h
Vibration resistance (IEC 60086-2)	Oscillation, sinusoidal
	Oscillation, noise
	10 g / 50...500 Hz
	4.5 g rms/ 5...500 Hz
Protection class (DIN/EN 60529)	IP 6k6
	with connected mating plug
	IP 6k9k
Housing material	Plastic
Mass	approx. 95 g
Angle of rotation, mechanical	360° (spinnable)
Angle of rotation, measuring range	$\alpha = \pm 45^\circ$
Actuating torque at lever arm	$\leq 0.1$ Nm
Installation position	any

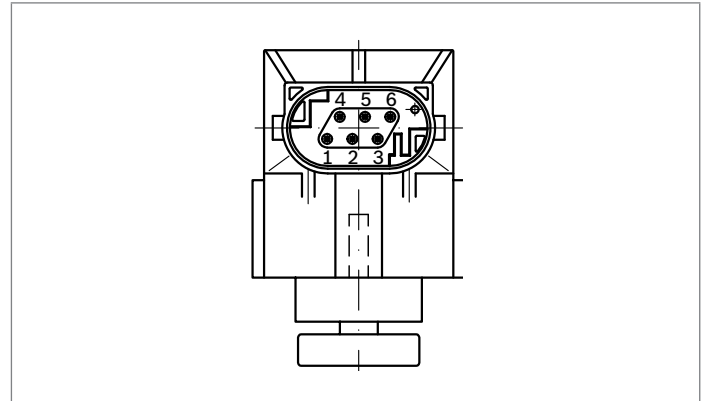
### Characteristic

Output voltage  $U_a$  at supply voltage  $U_b$  5 V  
(The output voltage is proportional to the supply voltage)

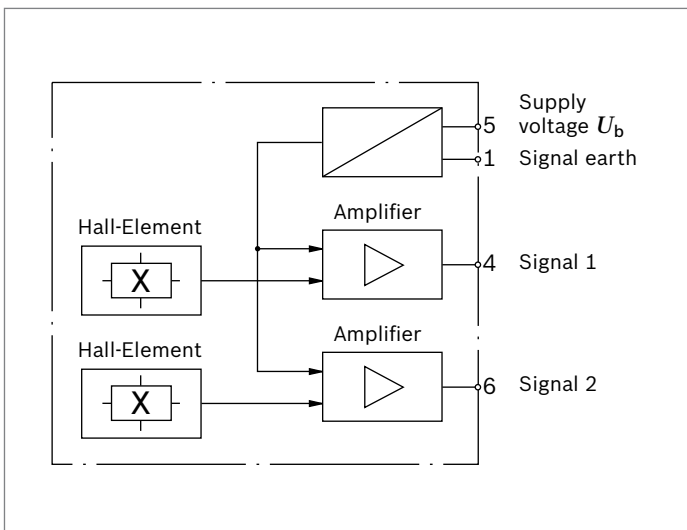


### Pin Assignment

Pinnumber	Connection
1	Ground
2	-
3	-
4	Signal 1
5	Supply voltage $U_b$
6	Signal 2



### Block Circuit Diagram



### Mating Connector

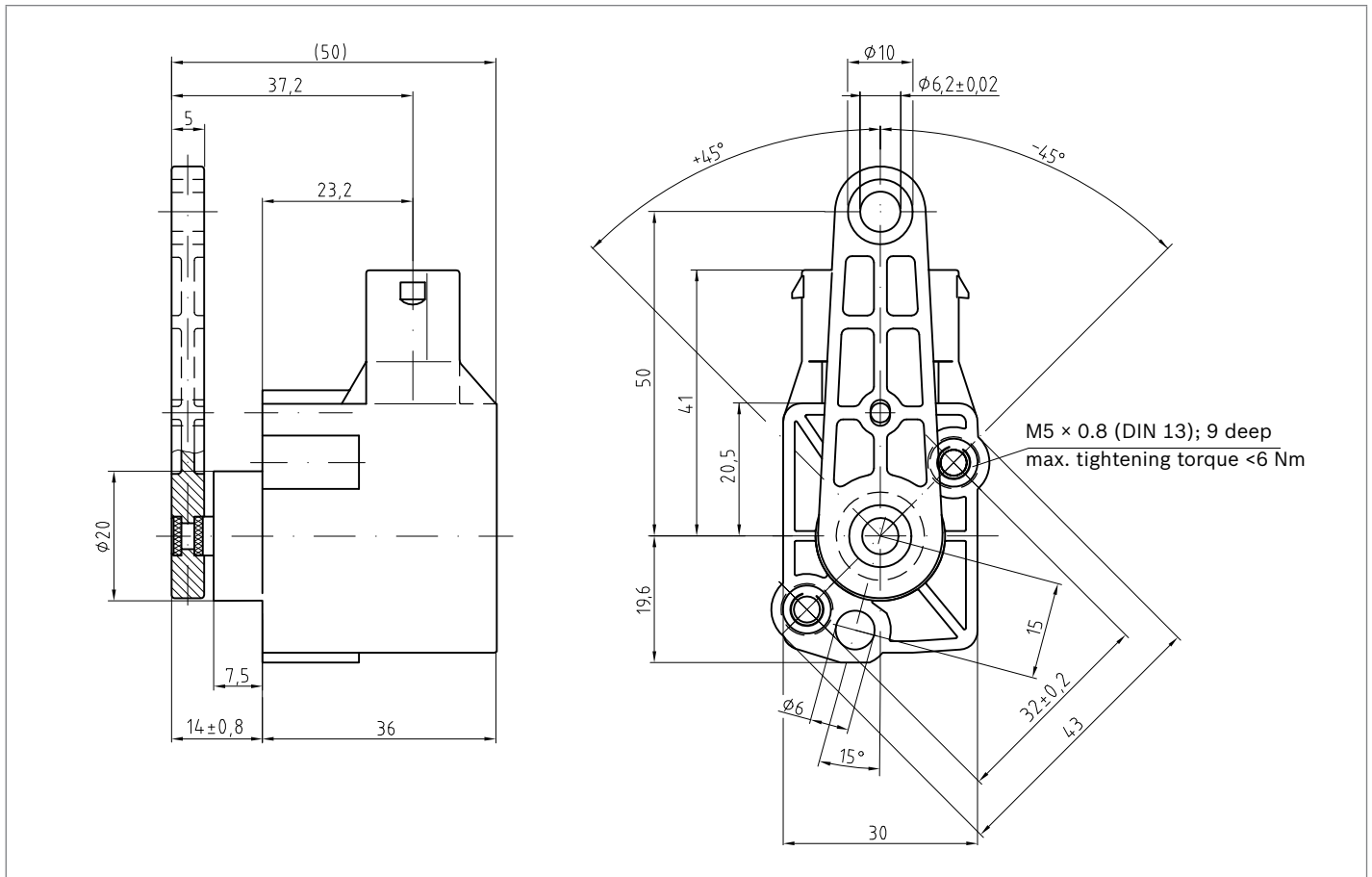
AMP Mating Connector 6-pin, comprising:

Designation	Number	Material number
MQS female connector 6-pin, code A	1	1-967616-1
Sleeve contacts	7	0-0963727-1
Blanking plugs	3	0-0967056-1
Single lead seals	6	0-0967067-1

The connector is not included as standard.

Female connector AMP Mating Connector 6-pin can be ordered from Rexroth under the Mat. No. R902601914.

### Dimensions



## Safety instructions

### General Instructions

- ▶ Before finalizing your design, request a binding installation drawing.
- ▶ The proposed circuits do not imply any technical liability for the system on the part of Bosch Rexroth.
- ▶ It is not permissible to open the sensor or to modify or repair the sensor. Modifications or repairs to the wiring could result in dangerous malfunctions.
- ▶ Connections in the hydraulic system may only be opened in depressurized state.
- ▶ The sensor may only be assembled/disassembled in depressurized and deenergized state.
- ▶ System developments, installation and commissioning of electronic systems for controlling hydraulic drives must only be carried out by trained and experienced specialists who are sufficiently familiar with both the components used and with the complete system.
- ▶ While commissioning the sensor, the machine may pose unforeseen dangers. Before commissioning the system, you must therefore ensure that the vehicle and the hydraulic system are in a safe condition.
- ▶ Make sure that nobody is in the machine's danger zone.
- ▶ No defective or incorrectly functioning components may be used. If the sensor should fail or demonstrate faulty operation, it must be replaced.
- ▶ Despite every care being taken when compiling this document, it is not possible to take into account all feasible applications. If instructions for your specific application are missing, you can contact Bosch Rexroth.
- ▶ Sensors do not fall under the scope of EMC-RL 2004/108/EC or 2014/30/EU. A declaration of conformity and the CE marking for individually sold sensors is not required, since the sensors are only sold to machine manufacturers (OEM) or to companies with the necessary expertise (i.e. certified Bosch Rexroth partners or companies with trained and qualified service personnel). Furthermore, the responsibility of the above mentioned companies for machine EMC testing remains unaffected in principle.
- ▶ The use of sensors by private users is not permissible, since these users do not typically have the required level of expertise.

### Notes on the installation location and position

- ▶ Do not install the sensor close to parts that generate considerable heat (e.g. exhaust).
- ▶ Lines are to be routed with sufficient distance from hot or moving vehicle parts.
- ▶ A sufficiently large distance to radio systems must be maintained.
- ▶ The connector of the sensor is to be unplugged during electrical welding and painting operations.
- ▶ Cables/wires must be sealed individually to prevent water from entering the device.

### Notes on transport and storage

- ▶ Please inspect the device for any damages which may have occurred during transport. If there are obvious signs of damage, please immediately inform the transport company and Bosch Rexroth.
- ▶ If it is dropped, the sensor must not be used any longer as invisible damage could have a negative impact on reliability.

### Notes on wiring and circuitry

- ▶ Lines to the sensors must be designed as short as possible and be shielded. The shielding must be connected to the electronics on one side or to the machine or vehicle ground via a low-resistance connection.
- ▶ The sensor should only be plugged and unplugged when it is in a de-energized state.
- ▶ The sensor lines are sensitive to radiation interference. For this reason, the following measures should be taken when operating the sensor:
  - Sensor lines should be attached as far away as possible from large electric machines.
  - If the signal requirements are satisfied, it is possible to extend the sensor cable.
- ▶ Lines from the sensor to the electronics must not be routed close to other power-conducting lines in the machine or vehicle.
- ▶ The wiring harness should be fixated mechanically in the area in which the sensor is installed (spacing < 150 mm). The wiring harness should be fixated so that in-phase excitation with the sensor occurs (e.g. at the sensor mounting points).
- ▶ If possible, lines should be routed in the vehicle interior. If the lines are routed outside the vehicle, make sure that they are securely fixed.

- ▶ Lines must not be kinked or twisted, must not rub against edges and must not be routed through sharp-edged ducts without protection.

#### **Intended use**

- ▶ The sensor is designed for use in mobile working machines provided no limitations/restrictions are made to certain application areas in this data sheet.
- ▶ Operation of the sensor must generally occur within the operating ranges specified and released in this data sheet, particularly with regard to voltage, temperature, vibration, shock and other described environmental influences.
- ▶ Use outside of the specified and released boundary conditions may result in danger to life and/or cause damage to components which could result in consequential damage to the mobile working machine.

#### **Improper use**

- ▶ Any use of the sensor other than that described in chapter “Intended use” is considered to be improper.
- ▶ Use in explosive areas is not permissible.
- ▶ Damages which result from improper use and/or from unauthorized, interference in the component not described in this data sheet render all warranty and liability claims with respect to the manufacturer void.

#### **Use in safety-related functions**

- ▶ The customer is responsible for performing a risk analysis of the mobile working machine and determining the possible safety-related functions.
- ▶ In safety-related applications, the customer is responsible for taking suitable measures for ensuring safety (sensor redundancy, plausibility check, emergency switch, etc.).
- ▶ Product data that is necessary to assess the safety of the machine can be provided on request or are listed in this data sheet.

#### **More detailed information**

- ▶ Further information about the sensor can be found at [www.boschrexroth.com/mobile-electronics](http://www.boschrexroth.com/mobile-electronics).
- ▶ The sensor must be disposed according the national regulations of your country.