

Angle sensor WS1

RE 95140/02.2019

Replaced: 12.2018



- ▶ Hall-measurement principle
- ▶ Measuring range -45° ... $+45^{\circ}$
- ▶ Output signal 0.5 ... 4.5 V ratiometric
- ▶ Supply voltage 5 V
- ▶ Protection class IP69K

Contents

Product description	2
Type code	3
Technical data	4
Diagrams/characteristic curves	5
Symbols/Circuit diagrams	6
Electrical connection	7
Dimensions	8
Accessories	9
Safety Instructions	10

Product description

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.

The sensor does not comply with the EMC directive 2014/30/EC.

Main components

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

Special features

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

Type code

01	02	03		04	05
WS1	T	90	/	1	0

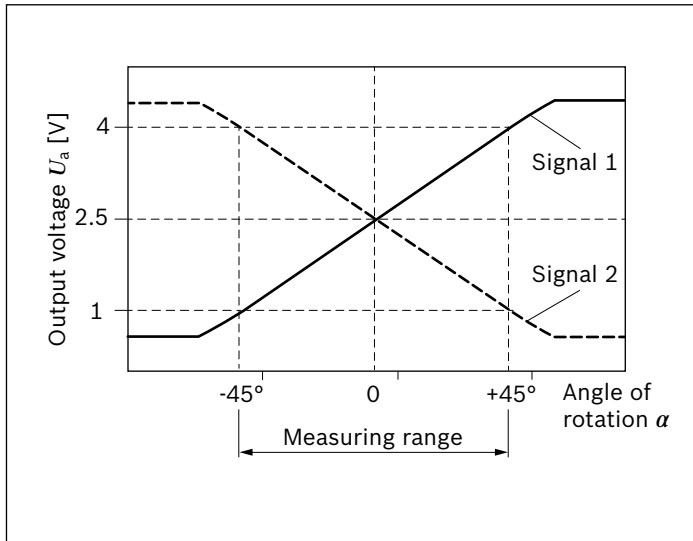
Type		
01	Angle sensor	WS1
Safety		
02	Partially redundant (2 output signals)	T
Version / Measuring range		
03	Angle of rotation 90°C	90
Series		
04		1
Index		
05		0

Type	Material number
WS1 T 90/10	R902602446

Technical data

Type			WS1T90/10
Supply voltage	U_b	DC	5 V $\pm$ 0.25 V
Input current maximum			11 mA
Output voltage	U_a	at 5 V	0.5 V ... 4.5 V
Linearity of the output voltage		at $-45^\circ \leq \alpha \leq -15^\circ$	$\pm$ 0.5%
		at $-15^\circ \leq \alpha \leq +15^\circ$	$\pm$ 0.25%
		at $+15^\circ \leq \alpha \leq +45^\circ$	$\pm$ 0.5%
Accuracy of output voltage		at 20 °C	$\pm$ 2%
load resistance (impedance) to earth			minimum 10 k Ω
			maximum 22nF
Short-circuit resistance of the signal outputs to			Supply voltage and earth
Polarity mismatch protection			Supply voltage to earth
Electromagnetic compatibility (EMC) / Environmental Data			
	Broadcast noise	ISO 11452-3	200 V _{eff} /m
	Line-borne interference	ISO 7637-1	Values on request
Operating temperature			-40 °C ... +100 °C, maximum +120 °C for 1h
Storage temperature			-40 °C ... +100 °C, maximum +130 °C for 16h
Vibration resistance			
	Oscillation, sinusoidal	IEC 60068-2-6	10 g / 50 Hz ... 500 Hz
	Oscillation, noise	IEC 60068-2-64	4.5 g rms / 5 Hz ... 500 Hz
Type of protection		DIN EN IEC 60529:2017-02	IP6k6
	with connected mating plug		IP6k9k
Housing material			Plastic
Weight (approx.)			95 g
Angle of rotation	mechanical		360° (spinnable)
	Measuring range		$\pm$ 45°
Actuating torque at lever arm			$\leq$ 0.1 Nm
Installation position			any

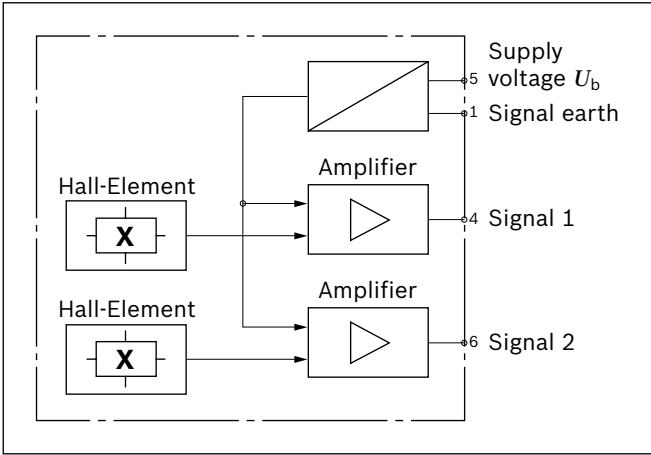
Diagrams/characteristic curves



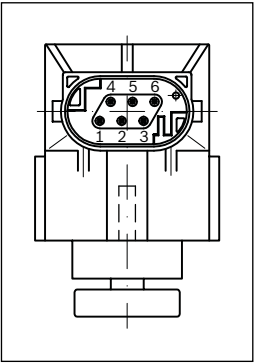
At supply voltage U_b 5V.

(The output voltage is proportional to the supply voltage)

Symbols/Circuit diagrams



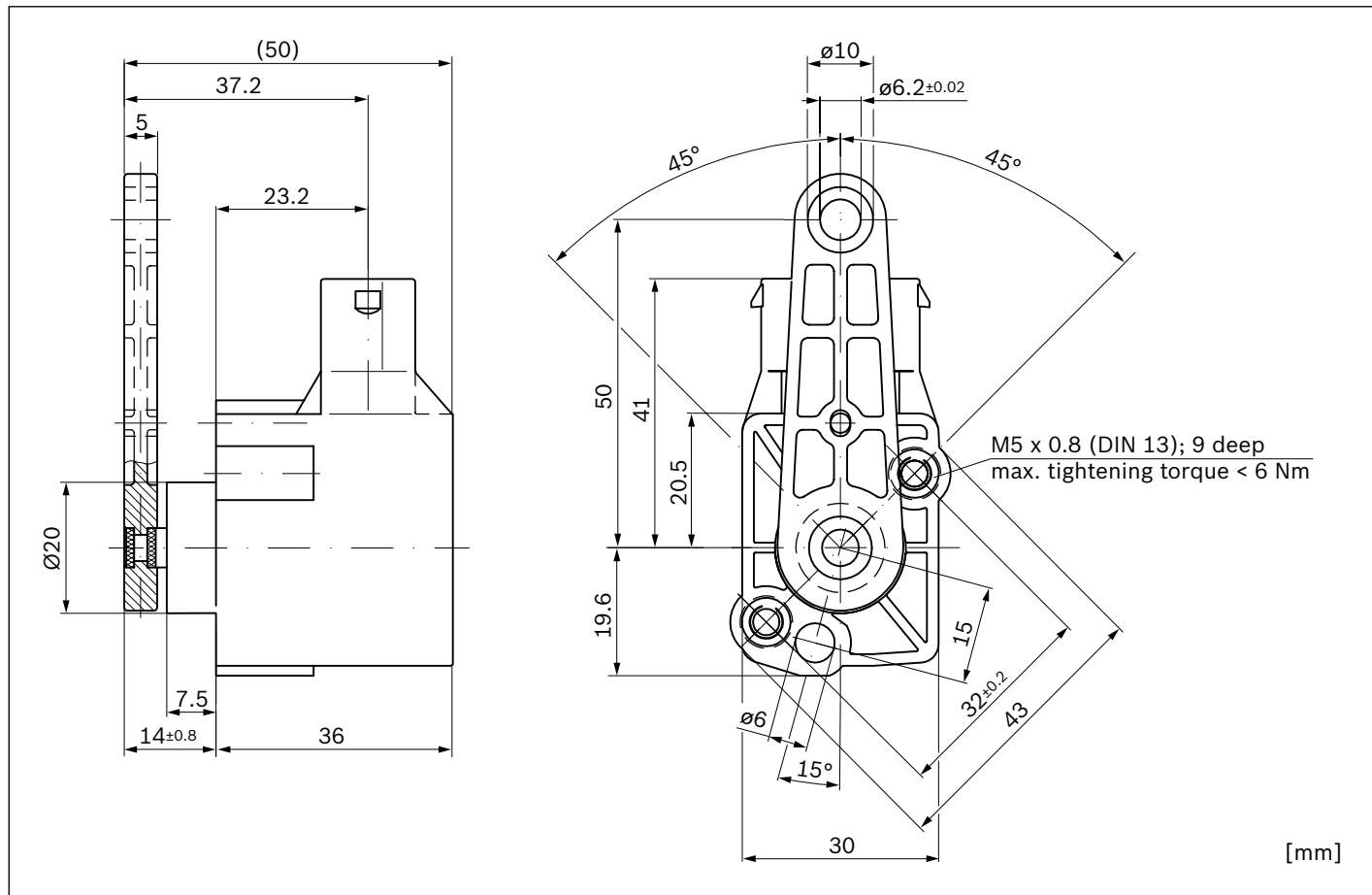
Electrical connection



Pin Assignment

Pin number	Connection	
1	Signal ground	
2	-	
3	-	
4	Signal	1
5	Supply voltage	U_b
6	Signal	2

Dimensions



Accessories

		Material number
AMP MQS female connector 6-pin		R902601914
comprising:		
1	MQS female connector 6-pin, code A	1-967616-1
7	Sleeve contacts	0-0963727-1
3	Blanking plugs	0-0967056-1
6	Single lead seals	0-0967067-1
The connector is not included as standard!		

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.
- ▶ Opening the sensor or carrying out modifications to or repairs on the sensor is prohibited. Modifications or repairs to the wiring could lead to dangerous malfunctions.
- ▶ The sensor may only be assembled/disassembled in a deenergized state.
- ▶ Only trained and experienced specialists who are adequately familiar with both the components used and the complete system should implement system developments or install and commission electronic systems for controlling hydraulic drives.
- ▶ When commissioning the sensor, the machine may pose unforeseen hazards. 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.
- ▶ Do not use defective components or components not in proper working order. 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 consider 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 Directive 2014/30/EC. A declaration of conformity and the CE marking for individually sold sensors is not required, since these are passive sensors.
- ▶ The use of sensors by private users is not permitted, 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 sufficient distance to radio systems must be maintained.
- ▶ Before electric welding and painting operations, the sensor must be disconnected from the power supply and the sensor connector must be removed.
- ▶ Cables/wires must be sealed individually to prevent water from entering the sensor.

Notes on transport and storage

- ▶ Please examine the sensor for any damage which may have occurred during transport. If there are obvious signs of damage, please inform the transport company and Bosch Rexroth immediately.
- ▶ 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 so that they are as short as possible and 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 mating connector must only be plugged and unplugged when it is in a deenergized state.
- ▶ The sensor lines are sensitive to spurious 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 secured so that in-phase excitation with the sensor occurs (e.g. at the sensor mounting point).
- ▶ 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 approved in this data sheet, particularly with regard to voltage, temperature, vibration, shock and other described environmental influences.
- ▶ Use outside of the specified and approved boundary conditions may result in danger to life and/or cause damage to components which could result in sequential damage to the mobile working machine.
- ▶ Serious personal injury and/or damage to property may occur in case of non-compliance with the appropriate regulations.

Improper use

- ▶ Any use of the sensor other than that described in the chapter "Intended use" is considered to be improper.
- ▶ Use in explosive areas is not permitted.
- ▶ Damages which result from improper use and/or from unauthorized, unintended interventions in the device 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 proper measures to ensure safety (sensor redundancy, plausibility check, emergency switch, etc.).

Further information

- ▶ Further information about the sensor can be found at www.boschrexroth.com/mobileelektronik.
- ▶ The sensor must be disposed of in accordance with the national regulations of the country in which it is used.

Bosch Rexroth AG

Robert-Bosch-Straße 2
71701 Schwieberdingen
Germany
Service Tel. +49 9352 40 50 60
info.bodas@boschrexroth.de
www.boschrexroth.com

© Bosch Rexroth AG 2019. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.
The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.