Speed sensor
DSA series 12

RE 95133
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- Hall-effect sensor for contactless speed measuring
- For installation in axial piston units
- Two versions
  - With two frequency signals
  - With frequency signal and direction of rotation signal for easy connection to controllers

Features

- Diagnostic capabilities in combination with the control unit input circuit
  - Cable break
  - Short-circuit
  - Detection of standstill
- 12 V and 24 V nominal voltage
- Sealing for pressures of up to max. 10 bar
- High type of protection IP67/IP69K
- Compact design
- Robust design due to full metal housing
- Simple installation without setting work
- Developed for Rexroth axial piston units
- Evaluation with BODAS controllers possible

Contents

Type code

01	02	03	04	05		06	07
DSA				**D**	**/**	**12**	**P**

Model

01	Hall-speed sensor	**DSA**

Design

02	One frequency output, one output for direction of rotation	**1**
	Two frequency outputs	**2**

Shaft length

03	18.4 mm	**S18**
	32 mm	**S32**

Cable length

04	250 mm	**K0250**
	1500 mm	**K1500**

Connection

05	DEUTSCH DT04-4P connector	**D**

Series

06	Series 1, Index 2	**12**

Seal

07	HNBR (nitrile rubber)	**P**

Description

In conjunction with a gear wheel, the DSA speed sensor is suitable for generating frequency signals proportional to the speed. The sensor displays a static behavior, i.e. it guarantees impulse generation up to a speed equating to a frequency of 0 Hz. The monitoring element comprises a Hall-ASIC supplying two square-wave signals. The internal two-channel structure demands the perfect alignment of the sensor.
The frequency f of the square wave voltage output by the sensor is calculated from the number of teeth z on the circumference of the gear wheel and the rotational speed n of the drive or output shaft according to the following formula:

$$f = \frac{z \times n}{60}$$

f [sec^{-1}]
n [rpm]
z = number of teeth

The number of teeth are specified in the data sheets of the respective axial piston unit.

Two basic variants available

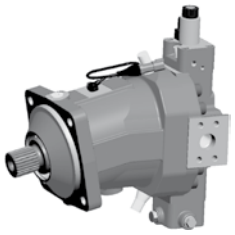
- DSA1 returns a square-wave signal that is proportional to the speed as well as a switching signal for detecting the direction of rotation.
- DSA2 returns two square-wave signals (at least 15° phase shift) for redundant recording of the speed. In addition, this can be used, for example, to calculate the direction of rotation using an RC controller from Rexroth.

Example applications

Due to its compact, sturdy design, the sensor is suitable for example, for integrated use with Rexroth axial piston units. Various different BODAS controllers with application software are available for evaluating the DSA speed sensor. Further information can also be found on the internet at www.boschrexroth.com/mobile-electronics.

Example

A6VM axial piston variable motor with mounted DSA speed sensor



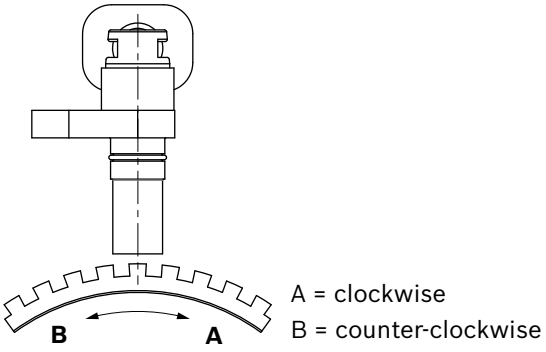
Technical Data

Model			**DSA**
Nominal voltage			12 and 24 V DC
Residual ripple (DIN 40389, Part 1)			Maximum ±2 V DC
Supply voltage U_B			8 to 32 V
Current consumption			maximum 15 mA at 24 V DC (without load)
Current capacity of outputs			≤ ±50 mA
Frequency range			0 Hz to 20 kHz
Short-circuit resistance of the outputs against every other connection			Yes
Reverse voltage protection			Yes
Electromagnetic compatibility			
Line-bound interference (ISO 7637-1/-2/-3)			Values on request
Load dump		at 12 V	70 V
		at 24 V	123 V
Stripline (DIN 11452-5)			0.01 MHz to 1000 MHz, 220 V/m
Free field (DIN 11452-2)			80 MHz to 4000 MHz, 150 V/m
Overvoltage resistance			33 V
Isolation			Housing and electronics are galvanically isolated
Vibration resistance			
	Sinusoidal vibration (EN 60068-2-6)		2 mm / 5 to 57 Hz 30 g / 57 to 2000 Hz 10 cycles per axis
	Random-shaped vibration (EN 60068-2-64)		0.1 g^2 / Hz 20 to 2000 Hz
Shock resistance			
	Transport shock (EN 60068-2-27)		50 g / 11 ms 3 x in every direction (positive/negative)
	Continuous shock (EN 60068-2-29)		40 g / 6 ms 1000 x in every direction (positive/negative)
Resistance to moisture			95% (+25 °C to +55 °C)
Salt spray resistance DIN EN 60068			240 h
Type of protection (EN 60529) when installed and plugged			
	see mating connector DT06-4S-EP04		IP67 and IP69k
Operating temperature range			
	Sensor zone		-40 °C to +125 °C
	Cable zone and plug		-40 °C to +115 °C
Storage temperature range (IEC 68-2-1 Aa, IEC 68-2-2 Ba)			-40 °C to +50 °C
Pressure capability of measuring surface			3 bar nominal, 10 bar maximum (brief pressure peaks)

Output signals

- Push-Pull outputs: $I_{max} \leq \pm 50$ mA
- Frequency signals can be evaluated in the measuring range from 0 Hz to 20 kHz.

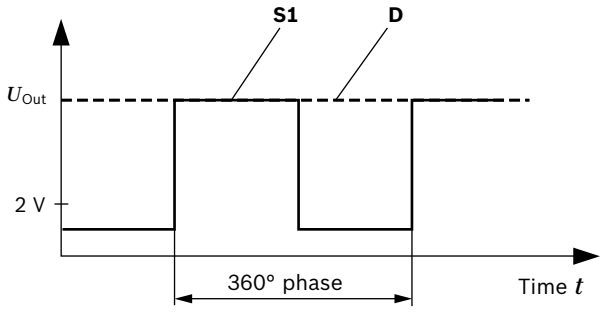
▼ **Assigning the direction of rotation to the sensor**



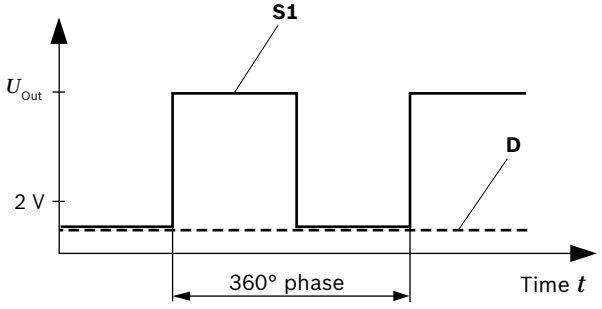
Signal output DSA1

- One square-wave signal (**S1**) and one digital direction of rotation signal (**D**) on a gear wheel

▼ **Clockwise**



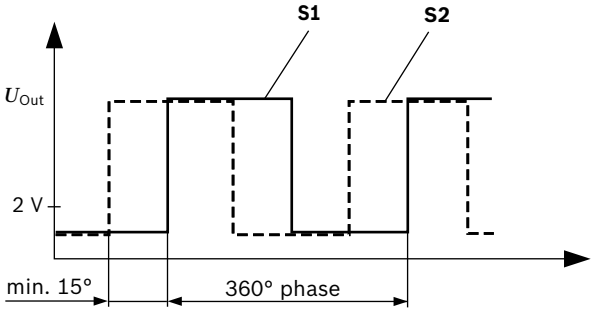
▼ **Counter-clockwise**



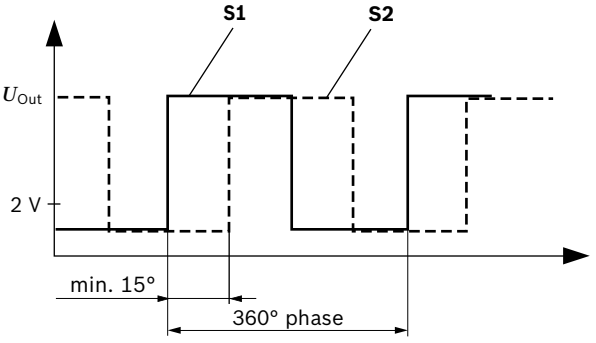
Signal output DSA2

- Two phase-shifted square-wave signals with minimum defined phase shift of 15° between output 1 (**S1**) and output 2 (**S2**).

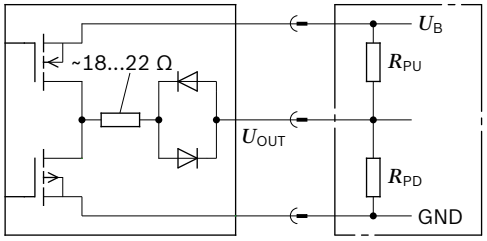
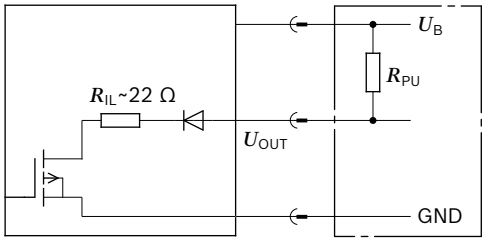
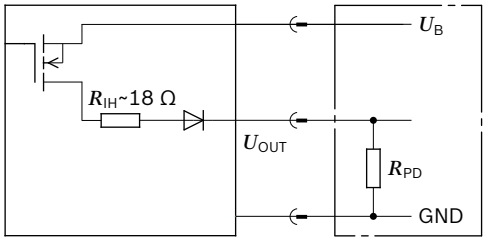
▼ **Clockwise**



▼ **Counter-clockwise**



The output voltage U_{Out} depends on the sensor resistance R_I, the external load resistances R_{PU}, R_{PD} and the supply voltage. The calculation is performed using the following formulas.

	DSA1 direction of rotation signal D **R_{IL} = 22 Ω; R_{IH} = 18 Ω**	**DSA1 frequency signal S1** **DSA2 frequency signal S1, S2** **R_{IL} = 22 Ω; R_{IH} = 18 Ω**
Pull-up and pull-down 	$U_{Out\ Low} \approx 0.7\ V + \frac{(U_B - 0.7\ V) \times R_{IL}}{R_{PU} + R_{IL}}$ $U_{Out\ High} \approx \frac{(U_B - 0.9\ V) \times R_{PD}}{R_{PD} + R_{IH}}$	$U_{Out\ Low} \approx \frac{U_B \times R_{IL}}{R_{PU} + R_{IL}}$ $U_{Out\ High} \approx \frac{(U_B - 0.2\ V) \times R_{PD}}{R_{PD} + R_{IH}}$
Pull-up 	$U_{Out\ Low} \approx 0.7\ V + \frac{(U_B - 0.7\ V) \times R_{IL}}{R_{PU} + R_{IL}}$ $U_{Out\ High} > U_{Supply} - 1.2\ V$	$U_{Out\ Low} \approx \frac{U_B \times R_{IL}}{R_{PU} + R_{IL}}$ $U_{Out\ High} > U_{Supply} - 1.2\ V$
Pull-down 	$U_{Out\ Low} < 0.6\ V$ $U_{Out\ High} \approx \frac{(U_B - 0.9\ V) \times R_{PD}}{R_{PD} + R_{IH}}$	$U_{Out\ Low} < 0.6\ V$ $U_{Out\ High} \approx \frac{(U_B - 0.2\ V) \times R_{PD}}{R_{PD} + R_{IH}}$

Short-circuit protection for DSA1 and DSA2

The output stage includes a thermal short-circuit limitation. This works as follows:

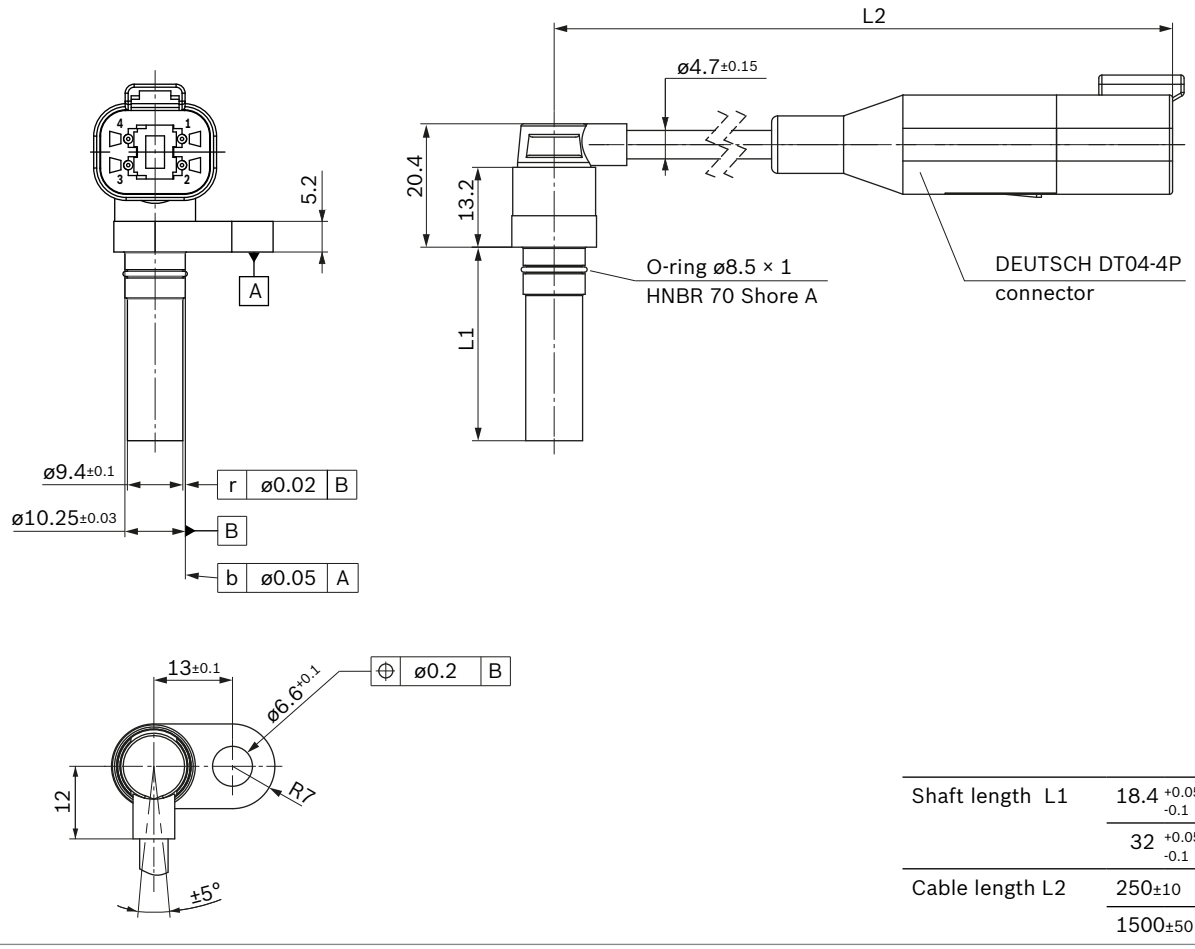
- If the output stage is overloaded by an output current over the maximum specified 50 mA, the output stage is deactivated. It becomes high-impedance for 50 µs.
- From this moment until the output stage is reactivated, the output level is exclusively determined by the load at the output terminal (pull-up/pull-down).
- After the 50 µs, the output stage is reactivated to show the signal level (high or low) valid at this moment.
- This shutdown process is repeated for as long as the output stage is thermally overloaded.
- The time behavior of the shutdown results from the temperature conditions on the output stage and is dependent
  - on the ambient temperature and cooling
  - of the short-circuit current
  - Signal path (ratio high/low frequency)

The output voltage on detection of short-circuit is dependent on the (short-circuit) resistances at the output and can be calculated using the formulas, (see pages 4 and 5).

Cable break detection for DSA1 and DSA2

In the event of a line break (supply and/or ground), both signal output levels become high-impedance.
In the event of a line break (signal 1 or 2), the corresponding signal output level becomes high-impedance.
In the event of an error, the voltage is only determined by the voltage divider of the external evaluation unit.

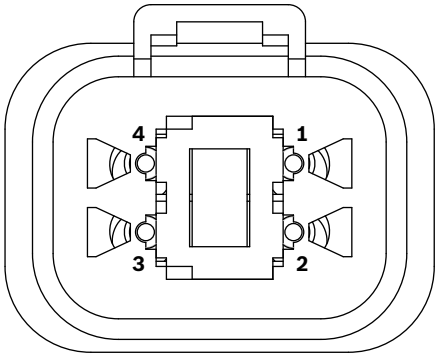
Dimensions



Shaft length L1	18.4 $^{+0.05}_{-0.1}$
	32 $^{+0.05}_{-0.1}$
Cable length L2	250±10
	1500±50

DEUTSCH DT04-4P connector

Pin assignment



1 Supply voltage U_B
2 Ground GND
3 Frequency S1
4 Direction of rotation D (DSA1) / frequency S2 (DSA2)

Mating connector

Designation	Number	Material number
Mating plug set		R902601805
Housing	1	DT06-4S-EP04
Wedge	1	W4S
Sockets	4	0462-201-16141

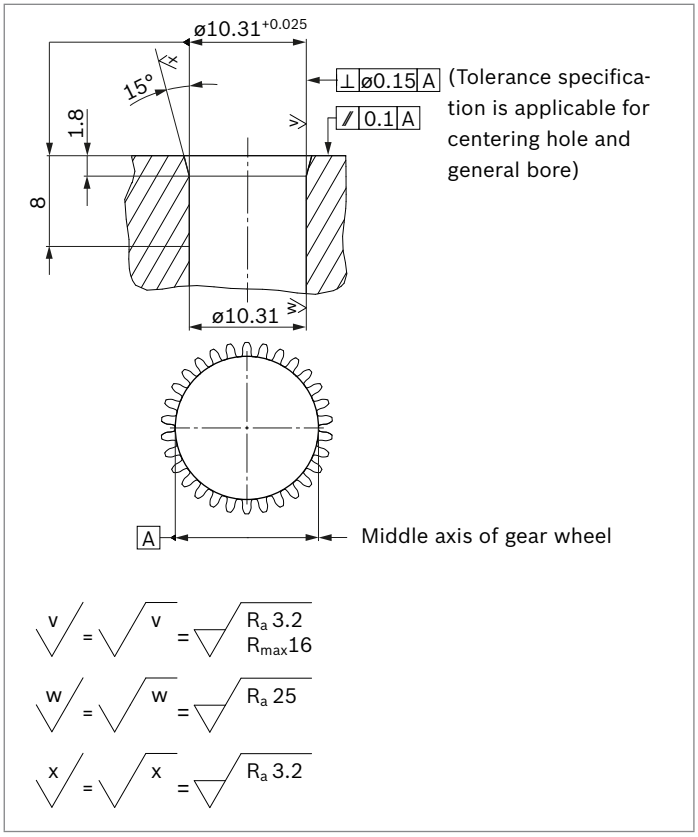
The mating connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.

Installation Instructions

General Instructions

- The protective cap is to be removed before installation. The sensor must be handled with care to prevent damage to the face.
- When installing the sensor, the O-ring could be damaged.
- The sensor in not sensitive to oil and lubrication grease.
- The sensor is ready for operation within 2 ms after the voltage supply is applied and outputs the frequency signal/frequency signals at the latest after two mechanical flanks.
- Once the internal calibration is complete (standard 3, max. eight mechanical flanks), the phase shift between **S1** and **S2** or the rotary direction signal in the work area are also complete.

Installation hole



Ideal gear wheel

- The gear wheel material must be magnetically soft.
- The following have been tested to date:
  - non-alloy steel
  - tempered steel
  - nitriding steel

  (e.g. St37, USt37, C45R, 34CrAlMo5-10).

Instructions

Function only approved with Rexroth axial piston unit. Deviating air gap and eccentricities can impede the function of the sensor. Consultation is therefore required before use in other applications.

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.

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.
- The sensor must be disposed according the national regulations of your country.

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