

# Draft sensor DP1-25



- ▶ Sensor for draft measurement

## Features

- ▶ Draft sensor according to Category 2 rear three-point attachment (ISO 730-1)
- ▶ Sensor element with hall-effect measuring principle
- ▶ Integrated electronics
- ▶ Output signal ratiometric for supply voltage
- ▶ Output signal proportional to draft
- ▶ Zero point and sensitivity are calibrated

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## Ordering code

01	02	03	04	05	06	07	08
<b>DP1</b>	<b>25</b>		<b>05</b>	<b>1</b>	<b>A</b>	<b>/</b>	<b>10</b> -

### Type

01	Draft measurement pin	<b>DP1</b>
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### Diameter

02	∅25	<b>25</b>
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### Load range

03	±12.5 kN	<b>012</b>
	±15 kN	<b>015</b>
	±25 kN	<b>025</b>

### Supply voltage

04	5 ±0.5 V	<b>05</b>
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### Cable version

05	Cable without protective sleeve	Straight	<b>1</b>
		90° angular	<b>2</b>

### Connector

06	AMP connector, 3-pin	<b>A</b>
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### Series

07		<b>10</b>
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### Cable length

08	170 mm	<b>01</b>
	250 mm	<b>02</b>
	1500 mm	<b>15</b>

## Available variants

Type	Material number
DP1 25 012 05 1 A / 10 - 02	R983089156
DP1 25 012 05 1 A / 10 - 15	R983072445
DP1 25 015 05 1 A / 10 - 15	R983072446
DP1 25 025 05 1 A / 10 - 15	R983072447
DP1 25 012 05 2 A / 10 - 01	R917013907

Further variants on request.

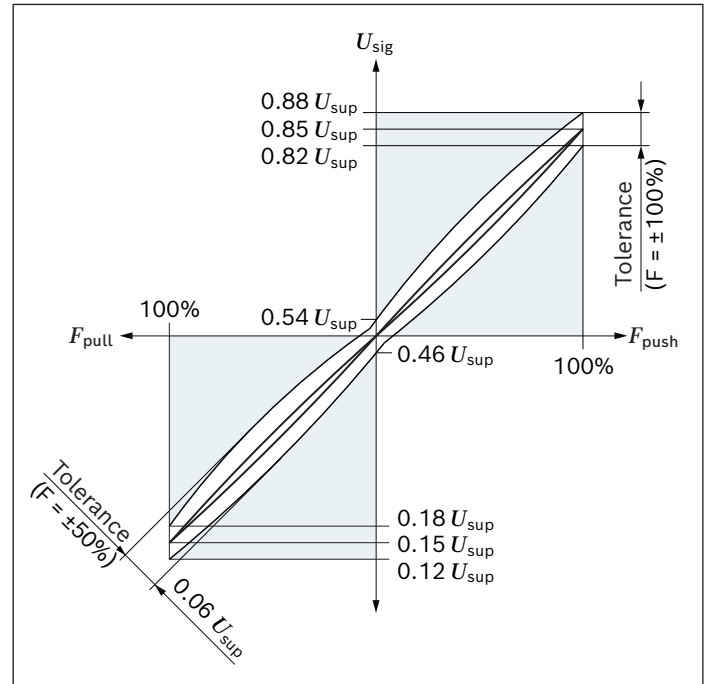
## Description

The draft sensor is designed as a bearing bolt for the upper link of a tractor hitch. The sensor is flexed between two bearings by the operational force. This deflection is recorded using the magnet hall system.

The output voltage is proportional to the acting draft. The signal is amplified in an integrated evaluation circuit. The sensor supplies a ratiometric output voltage (15% to 85% of supply voltage). It is available with various measurement ranges. This sensor is a typical part of an electro-hydraulic hitch control (EHC).

This sensor is designated for the use in agricultural applications.

### ▼ Characteristic curve



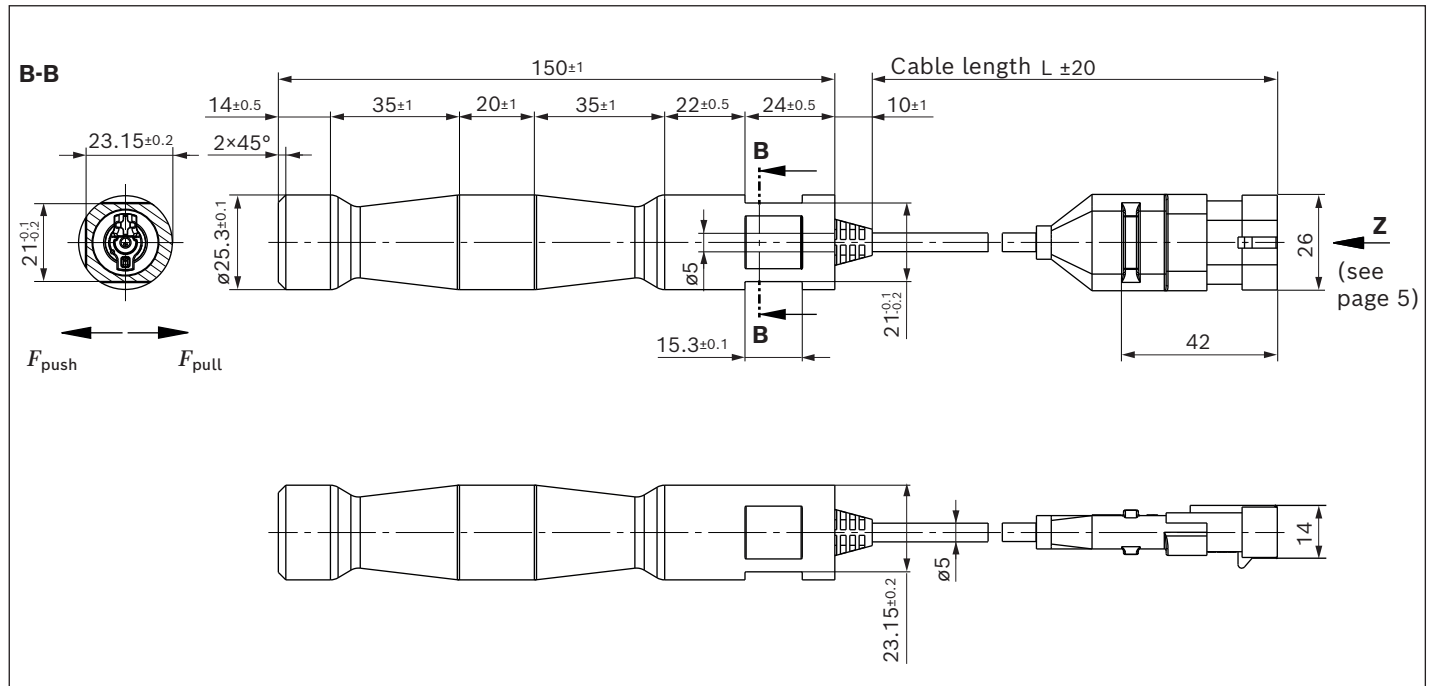
In the course of the service life, a higher off-set of the characteristic curve can occur up to a maximum of 400 mV.

**Technical data**

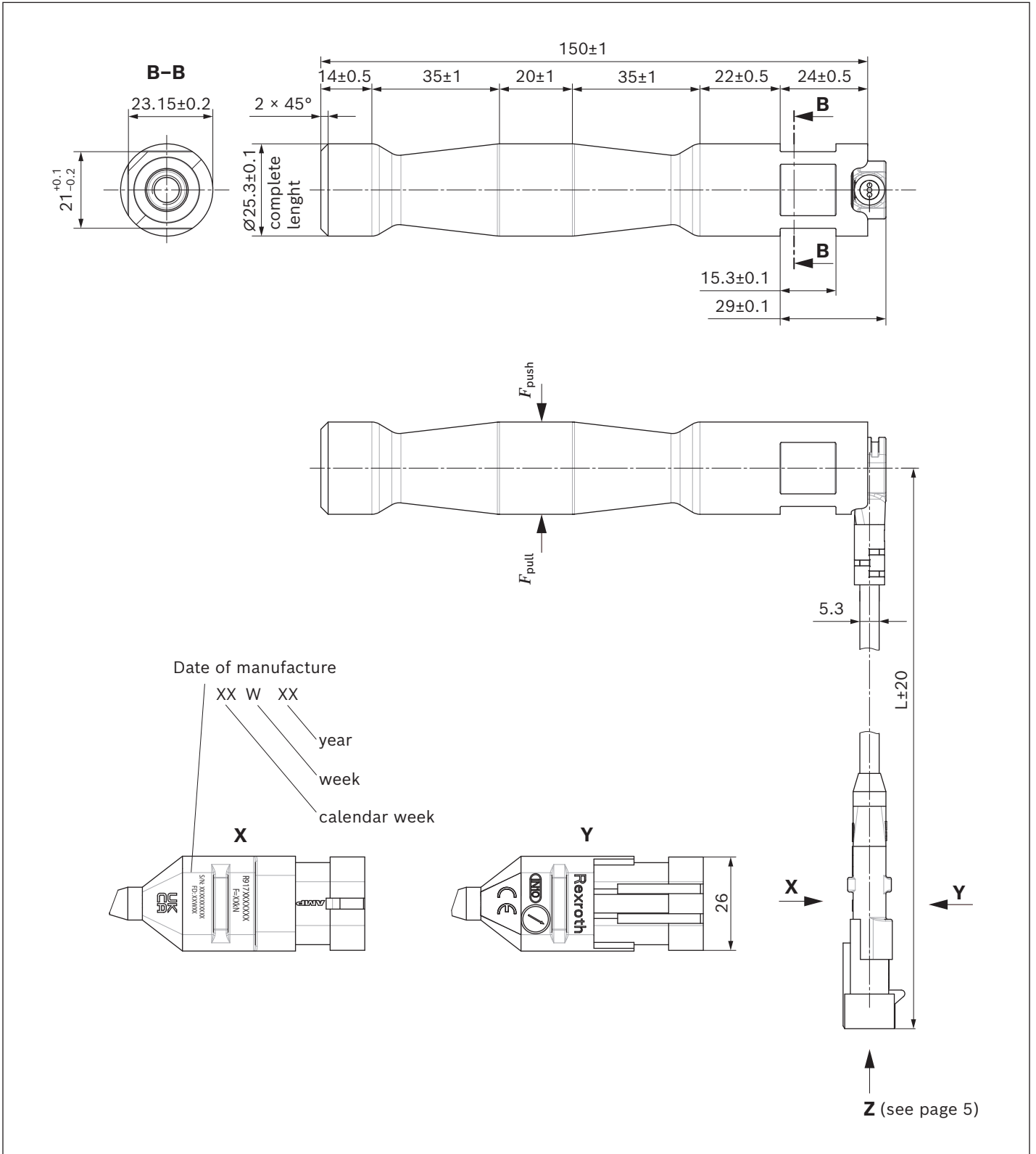
Type	012	015	025
Load range $F$	$\pm 12.5$ kN	$\pm 15$ kN	$\pm 25$ kN
Standard overload range	$\pm 50$ kN		
Supply voltage $U_{sup}$	$5 \pm 0.5$ V		
Signal voltage $U_{sig}$	15% to 85% $U_{sup}$		
Load resistance to ground	$\geq 10$ k $\Omega$		
Operating temperature range	$-40$ °C to $+85$ °C		
Type of protection with installed mating connector	IP67 and IP69K, DIN EN 60068-2-27:2010, DIN EN 60068-2-6:2008 and DIN EN 60068-2-64:2009		
Mating connector	3-pin connector with single-wire seal		
Electromagnetic compatibility EMV according to ISO 11452-2:2004 according to ISO 11452-4:2001	400 MHz to 1 GHz: $200$ V/m $\leq \pm 0.5\%$ $U_{sup}$ 1 GHz to 4 GHz: $100$ V/m $\leq \pm 0.5\%$ $U_{sup}$ 1 MHz to 400 MHz: $100$ mA		
ROHS	EU-RoHS2 compliant		
Hysteresis	6%		
Linearity	2%		
Storage time	5 years at an average relative humidity of 60% and a temperature between $-10$ °C and $+30$ °C. For short periods of time, a storage temperature of $-20$ °C to $+40$ °C is permissible for up to 100 hours.		
Functional safety according to ISO 25119	The sensor can support a machine safety function up to incl. AgPL c (according to ISO 25119:2018)		
CE conformity	According to EN ISO 14982:2009		
Current consumption	$\leq 15$ mA		
ESD	Contact	8 kV	
	Air	25 kV	
	Networks:	Power ON test	330 pF/2 k $\Omega$
		Unpowered test	150 pF/ 2000 $\Omega$
Signal delay time	0.5 ms		
Clamping voltage	5% and 95% from $U_{sup}$		
Resolution	8 bit		

## Dimensions

### ▼ DP1-25 with straight cable version

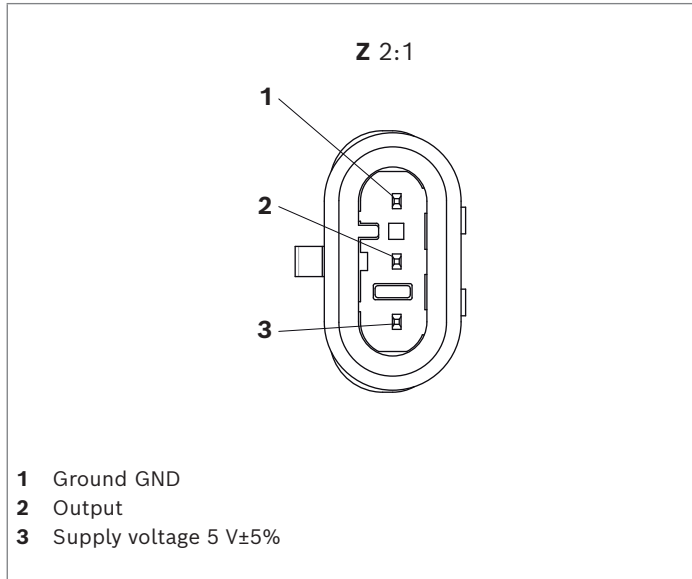


▼ **DP1-25 with 90° angular cable version**

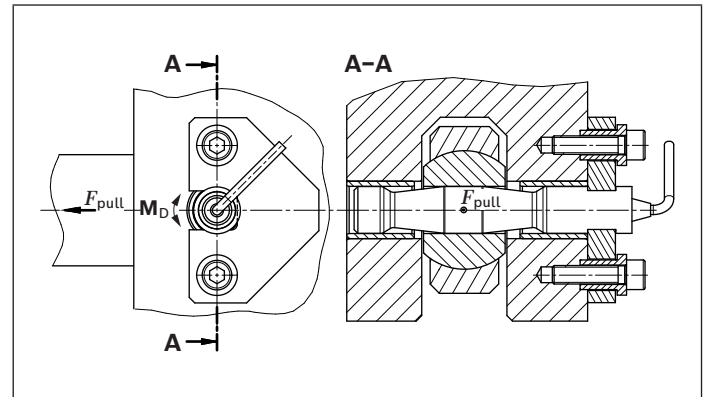


## Connector AMP Superseal

### ▼ Pin assignment



## Installation drawing



- ▶ See installation drawing RA51761184, to minimize measuring uncertainties
- ▶ Defined draft application, e.g., ball bushing
- ▶ Floating mount in radial direction with key plate

### Mating connector R902602132<sup>1)</sup>

Designation	Ordering code	Quantity
Socket housing	AMP 282087-1	1
Socket contacts	AMP 183025-1	3
Single-wire seals	AMP 281934-2	3

<sup>1)</sup> The mating connector is not included in the scope of supply.

## Safety-related characteristics in accordance with ISO 25119

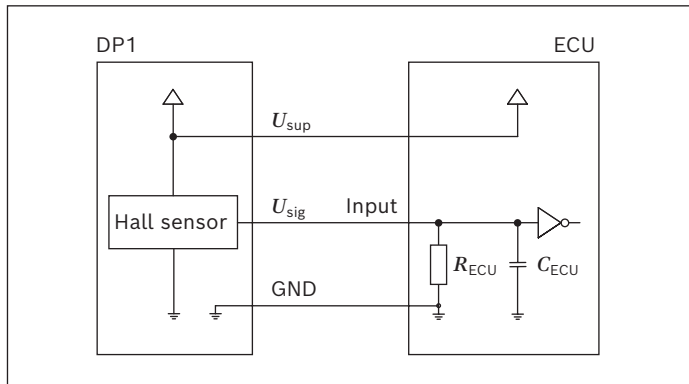
Safety function of the draft sensor DP1-25 is defined as the system integrity, i.e. DP1-25 shall sense and calculate the force applied on it correctly and convert the force into corresponding analog voltage output without failure.

- ▶ DP1-25 possesses a Category 1 architecture (single channel)
- ▶ DP1-25 fulfills the requirements of basic and well-tried safety principles
- ▶ DP1-25 contains no safety-related software

### ▼ Temperature profile and $MTTF_D$ and $DC_{avg}$

Temperature [°C]	Self heating [°C]	Working hours [%]	$MTTF_D$ [years]	$DC_{avg}$ [%]
10	5	2		
20	5	2		
30	5	3		
40	5	3		
50	5	12.5	1361	67 <sup>1)</sup>
60	5	12.5		
70	5	20		
80	5	25		
85	5	20		

### ▼ Failure detection possibilities



In case of an open circuit failure of the GND cable, output  $U_{sig}$  of the DP1-25 is dependent of the ECU internal resistor  $R_{ECU}$ . During machine system integration, an open circuit failure of the GND cable shall be simulated and the corresponding output signal ( $U_{OC-GND}$ ) of the DP1-25 shall be measured. Please make sure (e.g. by adding additional resistors) that  $U_{OC-GND} > 95\% U_{sup}$ .

1) It is assumed that the machine control unit will

- Monitor the sensor supply voltage, and switch off the sensor in case of overcurrent, over- and undervoltage.
- React to the sensor out of range signal, and bring the machine into machine safe state

8 **DP1-25** | Draft sensor  
 Safety-related characteristics in accordance with ISO 25119

Failures of the DP1-25 that will cause out-of-range output signals and therefore detectable by the machine control system are listed in the following table:

Failure	Failure reaction	Failure response time
Connector/ wire break of $U_{sig}$ , and/or DP1-25 internal failures that lead to the same effect	Sensor output out-of-range: $U_{sig} < 5\% U_{sup}$	immediately
$U_{sig}$ short circuit to $U_{sup}$ and/or DP1-25 internal failures that lead to the same effect	Sensor output out-of-range: : $U_{sig} = U_{sup}$	immediately
$U_{sig}$ short circuit to GND and/or DP1-25 internal failures that lead to the same effect	Sensor output out-of-range: $U_{sig} = 0\text{ V}$	immediately
Connector/ wire break of $U_{sup}$ , and/or DP1-25 internal failures that lead to the same effect	Sensor output out-of-range: $U_{sig} < 5\% U_{sup}$	5 ms <sup>1)</sup>
Connector/ wire break of GND, and/or DP1-25 internal failures that lead to the same effect	Sensor output out-of-range: $U_{sig} > 95\% U_{sup}$	5 ms <sup>1)</sup>
Hall IC internal failures	Sensor output out-of-range: $U_{sig} < 4\% U_{sup}$	5 ms

1) Failure response time is valid for control unit with  
 $R_{ECU} \geq 50\text{ k}\Omega$  and  $C_{ECU} = 100\text{ nF}$



## 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.
- ▶ 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.
- ▶ 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.
- ▶ 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 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 tractor and determining the possible tractor safety functions.
- ▶ It is customer's responsibility to evaluate the complete safety-related system and to determine the suitability of DP1-25 for any tractor safety functions.
  - DP1-25 is able to support a safety level up to AgPL c, if integrated properly into a Category 2 tractor safety system following all relevant instructions in this datasheet.
  - The DP1-25 failure responses are listed in the table (page 6). It shall not be used if the failure responses including the response time is determined to be insufficient for the machine safety functions.

- ▶ The machine control system shall monitor the sensor supply voltage, and switch off the sensor in case of overcurrent, over- and undervoltage.
- ▶ The machine control system shall monitor the sensor output and react to the out-of-range voltages by bringing the machine into the safe state.
- ▶ If DP1-25 is operated outside the mechanical specification, this can result in a zero shift of the sensor output or even the breakage. Appropriate methods must be implemented by the machine manufacturer to prevent and detect these failures.
- ▶ An efficient field observation process shall be established by the customer. Any field failures involving the DP1-25 should be immediately notified to Bosch Rexroth, even if it is not covered by warranty.

### Disposal

- ▶ Disposal of the sensor and packaging must be in accordance with the national environmental regulations of the country in which the sensor is used.

### More detailed information

- ▶ Further information about the sensor can be found at [www.boschrexroth.com/mobile-electronics](http://www.boschrexroth.com/mobile-electronics).

#### Bosch Rexroth AG

Robert-Bosch-Straße 2  
71701 Schwieberdingen, Germany  
Service Tel. +49 9352 40 50 60  
[info.bodas@boschrexroth.de](mailto:info.bodas@boschrexroth.de)  
[www.boschrexroth.com](http://www.boschrexroth.com)

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