DBR AUTOMATION

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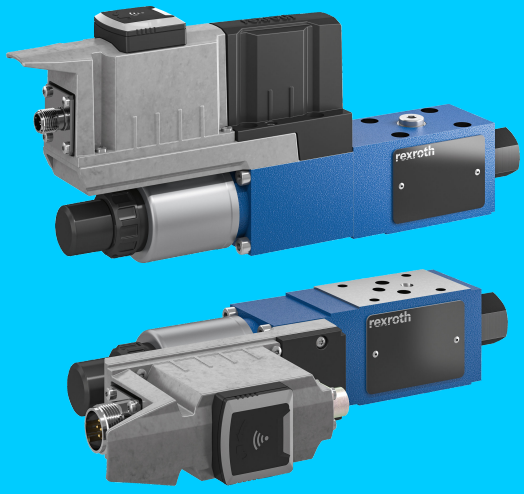
Application Manual

3DRE(E)(A), Z3DRE(E)(A)

Proportional pressure reducing valve with integrated digital electronics



RE29283-FK/03.23, Edition 01

Liability

The specified data is intended for product description purposes only and shall not be deemed to be a guaranteed characteristic unless expressly stipulated in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

Table of contents

1 About this documentation

1.1 Validity of the documentation

This documentation is valid for the following products:

- Proportional pressure reducing valve, pilot-controlled, with integrated digital electronics (OBED), type 3DRE(E)(A) and Z3DRE(E)(A)

This functional description is only valid in conjunction with the "Data Sheet 29283" and the "Operating Instructions 07600-B", see ➦ Chapter 1.2 “Required and amending documentation” on page 12.

Read the functional description, in particular ➦ Chapter 2 “Safety instructions” on page 13 and the above documents, completely before using the proportional pressure reducing valve.

Trademark

Symbol	Meaning
	Bluetooth® is a registered trademark of Bluetooth SIG, Inc.

Editions of this documentation

Table 1: Editions of this documentation

Edition	Status	Comment
01	03.23	Initial version

1.2 Required and amending documentation

Before commissioning the product, make sure to have received and fully understood the documentations identified by the book symbol 🕮 and observe the instructions included in these documentations.

	Title	Document number	Document type
🕮	Hydraulic valves and hydroelectric pressure switches for industrial applications	R.07600-B ➦ https://boschrexroth.com	Operating instructions
🕮	Proportional pressure reducing valve, pilot-controlled, with or without integrated digital electronics (OBED)	R.29283 ➦ https://boschrexroth.com	Data sheet
🕮	Bluetooth® dongle type VT-ZBT-1-1X	R.30581-B ➦ https://boschrexroth.com	Operating instructions
🕮	Bluetooth® dongle type VT-ZBT-1-1X	R.30581 ➦ https://boschrexroth.com	Data sheet

	Title	Document number	Document type
🕮	IO Link Manufacturer's declaration of Conformity for Type (Z)3DRE(E)(A)	DCTC-31000-198	Manufacturer's declaration of conformity
🕮	Pressure transducer for hydraulic applications type HM20	R.30270-MON ➦ https://boschrexroth.com	Assembly instructions

1.3 Representation of information

The safety instructions in the present application documentation contain certain signal words (danger, warning, caution, notice) and, if applicable, a signal graphic (according to ANSI Z535.6-2011)

The signal word is intended to draw attention to the safety instructions and denotes the severity of the hazard.

The signal graphic (warning triangle with exclamation mark), which precedes the signal words danger, warning and caution, indicates hazards for persons.

⚠ DANGER	In the case of non-compliance with these safety instructions, death or severe injury **will occur**.
⚠ WARNING	In the case of non-compliance with these safety instructions, death or severe injury **may occur**.
⚠ CAUTION	In the case of non-compliance with these safety instructions, minor or moderate injury may occur.
NOTICE	In the case of non-compliance with these safety instructions, damage to property may occur.

Designations

The following designations are used in this documentation:

Designation	Meaning
VT-ZBT-1-1X	Bluetooth® dongle

2 Safety instructions

2.1 General information on this chapter

The product has been manufactured according to the generally accepted codes of practice. However, there is still the danger of personal injury and damage to property if you do not observe this chapter and the safety instructions in this documentation.

- Read this documentation completely and thoroughly before working with the product.
- Keep this documentation in a location where it is accessible to all users at all times.
- Always include the required documentation when passing the product on to third parties.

2.2 Intended use

The valve is an electrically pilot-controlled proportional pressure reducing valve with pressure limitation of the actuator.

The valve is exclusively intended for integration into a machine or system or to be assembled with other components to form a machine or system. The product may be commissioned only if it is integrated in the machine/system for which it is designed. The operating conditions and performance limits specified in the *"data sheet"* must be observed.

The valve may be used as follows:

- For reducing a system pressure.

The valve may not be used in potentially explosive atmospheres.

The product is only intended for professional use and not for private use. Intended use includes having read and understood this documentation, especially ➦ Chapter 2 “Safety instructions” on page 13.

2.3 Improper use

Any use deviating from the intended use is improper and thus not admissible. Improper use voids any warranty claims. It is also regarded as improper use if the valve is operated outside the indicated performance limits and operating conditions, especially the required environmental conditions.

Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes responsibility for all risks surrounding improper use.

2.4 Qualification of personnel

The activities described in this documentation require basic knowledge of mechanics, electrics, hydraulics and pneumatics as well as knowledge of the appropriate technical terms. For transporting and handling the product, additional knowledge of how to handle lifting gear and the necessary attachment devices is required. In order to ensure safe use, these activities may only be carried out by an expert in the respective field or an instructed person under the direction and supervision of an expert. Experts are those who can recognize potential dangers and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant conditions pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary expert knowledge.

Expert knowledge means for example for hydraulic products:

- Reading and completely understanding hydraulic schemes,
- in particular, completely understanding the relationships regarding the safety equipment and
- Having knowledge of the function and set-up of hydraulic components.

Bosch Rexroth offers measures supporting training in specific fields. An overview of the training contents can be found online at:

➦ https://boschrexroth.com

2.5 General safety instructions

- Observe the valid regulations on accident prevention and environmental protection.
- Observe the safety regulations and provisions of the country in which the product is used/applied.
- Only use Bosch Rexroth products in a technically perfect condition.
- Observe all information on the product.
- Persons assembling, operating, disassembling or maintaining Rexroth products may not be under the influence of alcohol, other drugs or medication influencing the ability to react.
- Only use original Bosch Rexroth accessories and spare parts in order to prevent any hazard to persons due to unsuitable spare parts.
- Comply with the technical data and environmental conditions specified in the product documentation.
- The installation or use of inappropriate products in safety-relevant applications could result in unintended operating states which in turn could cause personal injuries and/or damage to property. Therefore, only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product, e.g. in explosion protection zones or in safety-related parts of control systems (functional safety).
- Do not commission the product until you can be sure that the end product (for example a machine or system) where the Bosch Rexroth products are installed complies with the country-specific provisions, safety regulations and standards of the application.

2.6 Personal protective equipment

The machine end-user must provide the personal protective equipment (such as gloves, working shoes, safety goggles, working clothes, etc...).

2.7 Obligations of the machine end-user

The machine end-user of the product is responsible for ensuring that:

- the product is only used according to the intended use as defined in this documentation.
- the operating personnel are instructed at regular intervals.
- a danger zone is marked, if required.
- the safety measures for the specific area of application of the product are complied with.

IT security

The operation of installations, systems and machines basically requires the implementation of a holistic IT security concept which is state-of-the-art in terms of technology. Accordingly, Bosch Rexroth products and their properties have to be considered as components of installations, systems and machines for their holistic IT security concept. Unless otherwise documented, Bosch Rexroth products are designed for operation in local, physically and logically secured networks with access restrictions for authorized persons, and they are not classified according to IEC 62443-4-2.

3 Overview of the pilot-controlled proportional pressure reducing valves (Z)3DRE(E,A)

3.1 General information

The valves of this valve family are electrically pilot-controlled 3-way pressure reducing valves with pressure limitation of the actuator. They are used for reducing a system pressure. The valves are parameterized in accordance with the ordering codes ex works and delivered fully functional. For optimum adaptation to the hydraulic use of the valve, the "easy2connect" smartphone app, which is available free of charge, can be used to optimize the parameter setting of the valve (e.g. setting the pressure control).

The more precise hydraulic functionality of the valve can be taken from the "data sheet 29283".

3.2 Valve types

The following valve types are differentiated in the valve family of pilot-controlled proportional pressure reducing valves:

- (Z)3DREE
- (Z)3DREA with external pressure sensor
- (Z)3DREA with integrated pressure sensor

3.2.1 (Z)3DREE

The following shows the set-up and function of the valve type (Z)3DREE:

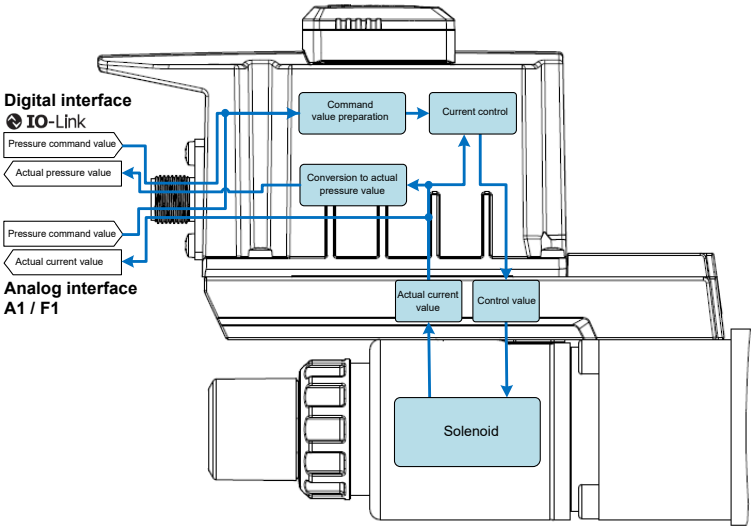


Fig. 1: Overview_(Z)3DREE

On the proportional solenoid, there is the digital on-board electronics (OBED). This is equipped with one of the following electrical interfaces, via which the command and actual values are exchanged digitally or analogously with a higher-level control:

- Digital interface L1, IO-Link (connector XH5)
- Analog interface (connector XH1)
  - Interface "A1", (command value and actual value 0 ... 10 V)
  - Interface "F1", (command value and actual value 4 ... 20 mA)

The pressure command value obtained from the higher-level control is converted in the on-board electronics into a current command value corresponding to the pressure. This current command value is preset and regulated as a control value for the proportional solenoid. The predetermined pressure command value is thus set as the actual pressure value.

3.2.2 (Z)3DREA with external pressure sensor

The following shows the set-up and function of valve type (Z)3DREA with external pressure sensor:

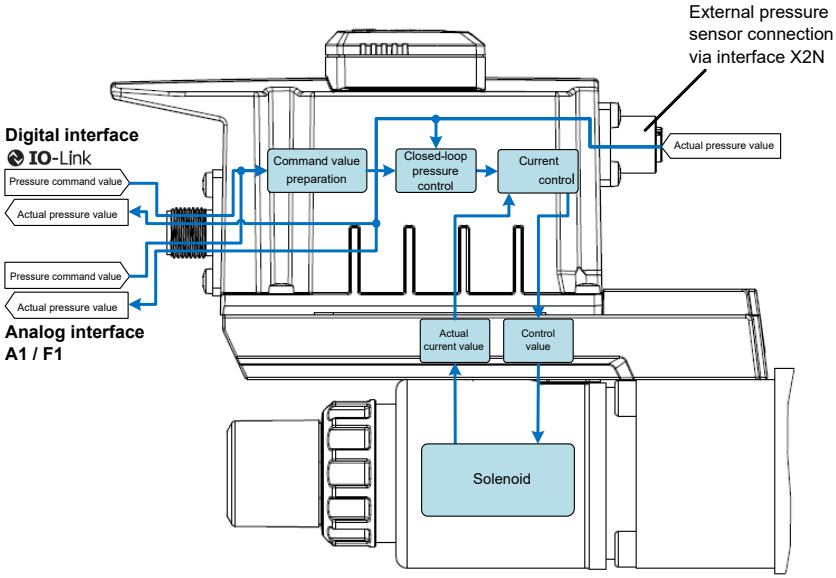


Fig. 2: Overview_(Z)3DREA

On the proportional solenoid, there is the digital on-board electronics (OBED). This is equipped with one of the following electrical interfaces, via which the command and actual values are exchanged digitally or analogously with a higher-level control:

- Digital interface L1, IO-Link (connector XH5)
- Analog interface (connector XH1)
  - Interface "A1", (command value and actual value 0 ... 10 V)
  - Interface "F1", (command value and actual value 4 ... 20 mA)

The pressure command value obtained from the higher-level control is regulated in the on-board electronics. The actual pressure value is detected via an external pressure sensor connected to the interface X2N.

The type HM 20-2X/400-H-C19-0,16-N (R901518764) is recommended as external pressure sensor. This pressure sensor is factory set.

3.2.3 (Z)3DREA with integrated pressure sensor

The following shows the set-up and function of the valve type (Z)3DREA with integrated pressure sensor:

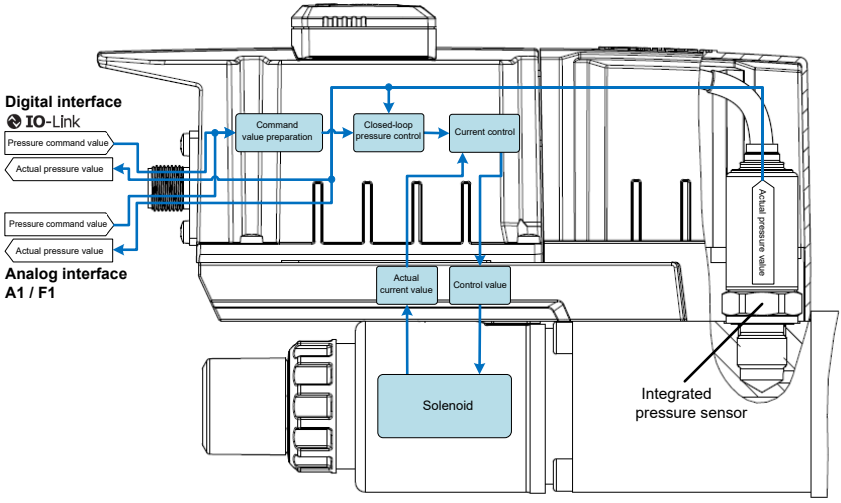


Fig. 3: Overview_(Z)3DREA_Pressure sensor, integrated

On the proportional solenoid, there is the digital on-board electronics (OBED). This is equipped with one of the following electrical interfaces, via which the command and actual values are exchanged digitally or analogously with a higher-level control:

- Digital interface L1, IO-Link (connector XH5)
- Analog interface (connector XH1)
  - Interface "A1", (command value and actual value 0 ... 10 V)
  - Interface "F1", (command value and actual value 4 ... 20 mA)

The pressure command value obtained from the higher-level control is regulated in the on-board electronics. The actual pressure value is detected by a pressure sensor integrated in the valve.

3.3 Optional Bluetooth® dongle

The digital on-board electronics (OBED) provides a digital service interface for the pressure valve via an optional Bluetooth® dongle. As an option, the Bluetooth® dongle can be ordered directly with the pressure valve or retrofitted later (VT-ZBT-1-1X).

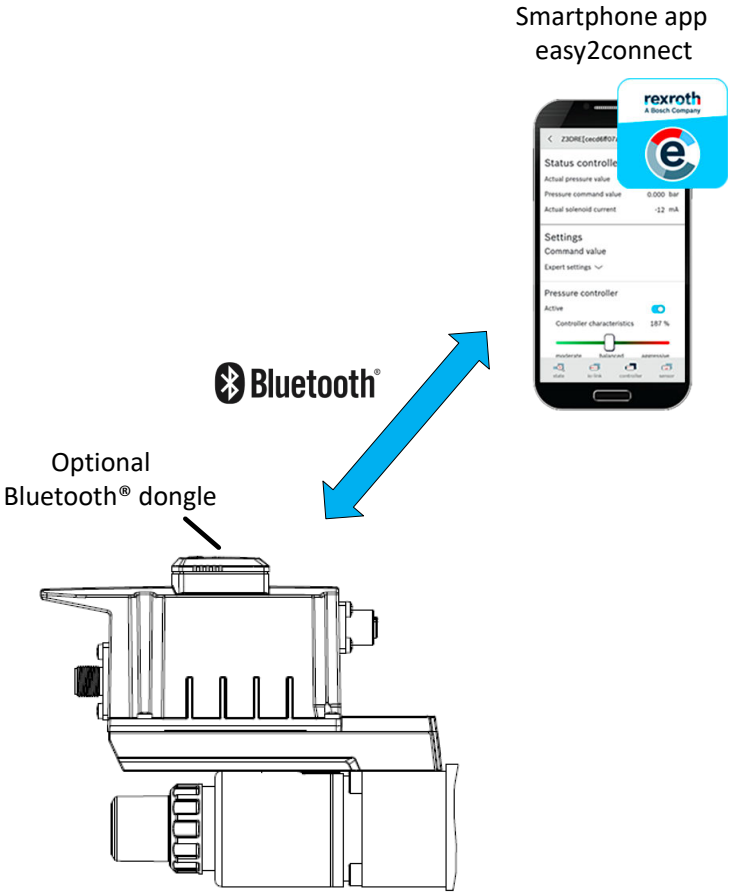


Fig. 4: Overview_BluetoothDongle

With the "easy2connect" smartphone app, a connection via Bluetooth® to the valve can be established via the Bluetooth® dongle. Further information on the "easy2connect" smartphone app can be found in the following chapter.

The Bluetooth® dongle also has an integrated diagnostic LED. The current state of the valve and the dongle are displayed via different colors and different flashing codes of the diagnostic LED.

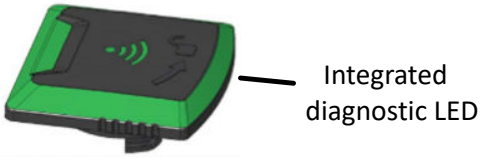


Fig. 5: Overview_Diagnostic LED

For further information on the Bluetooth® dongle, see the "Data Sheet 30581" or the "Operating Instructions 30581-B" .

3.4 "easy2connect" smartphone app

If a Bluetooth® dongle is mounted on the digital on-board electronics (OBED) of the valve, a connection to the valve can be established using the "easy2connect" smartphone app.

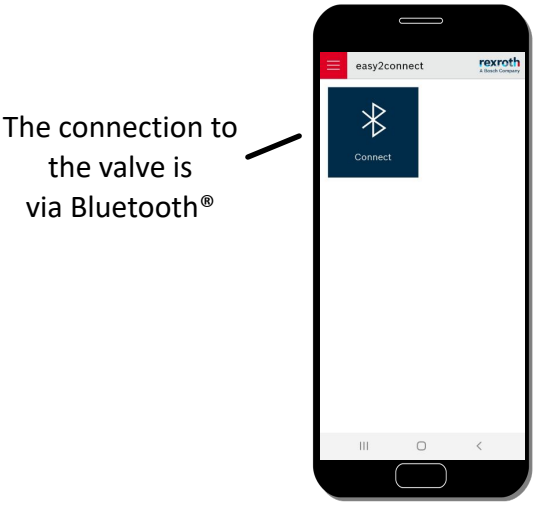


Fig. 6: easy2connect_Connection

The following functionalities are available in the "easy2connect" smartphone app:

- Electronic valve name plate
- Status and diagnosis of the valve
- Force mode, command value presetting via the app

- Optimization of valve parameterization
- Valve and Bluetooth® dongle firmware update

The "easy2connect" smartphone app is available for the iOS and Android operating systems.

The "easy2connect app" can be downloaded from the Apple App Store (iOS) or Google Play Store (Android).

- Apple App Store
  ➦ https://apps.apple.com
- Google Play Store
  ➦ https://play.google.com

4 Analog interface – connector XH1

4.1 Overview

The digital on-board electronics (OBED) of the pressure valve can be ordered with different electrical interfaces. Command and actual values are exchanged with a higher-level control via the interface. A variant is the analog interface, in which the command and actual values are transmitted in an analog form.

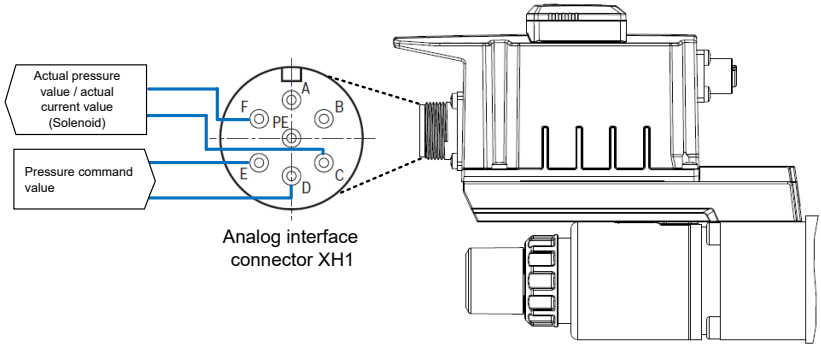


Fig. 7: Analog interface_Connector assignment

Assignment of the connector XH1

The following table shows the assignment of the individual pins for the analog interface of the connector XH1:

Pin	Interface	
	Version A1	**Version F1**
A	24 VDC supply voltage	
B	0 V (ground)	
C	Reference potential actual value on pin F	
D	Command value 0 ... 10 V	Command value 4 ... 20 mA
E	Reference potential command value on pin D	
F	Actual value 0 ... 10 V	Actual value 4 ... 20 mA
PE	Functional ground	

The exact electric specification of the analog interface of the connector XH1 can be found in the "data sheet".

Version A1 and F1

The analog interface of the connector is set ex works, corresponding to the selected order option of the valve, in version A1 or F1.

- **Version A1**
  In version A1, the pressure command value and the actual pressure value or actual current value are mapped to a voltage range of 0 to 10 V.
- **Version F1**
  In version F1, the pressure command value and the actual pressure value or actual current value are mapped to a current range of 4 to 20 mA.

4.2 Pressure command value

4.2.1 Functional description

The pressure command value is predetermined as a voltage or current signal via the pins D and E of the connector XH1 of the valve. In the OBED, the read-in voltage or the read-in current is mapped into a corresponding pressure command value. This principle is shown in the following graphic:

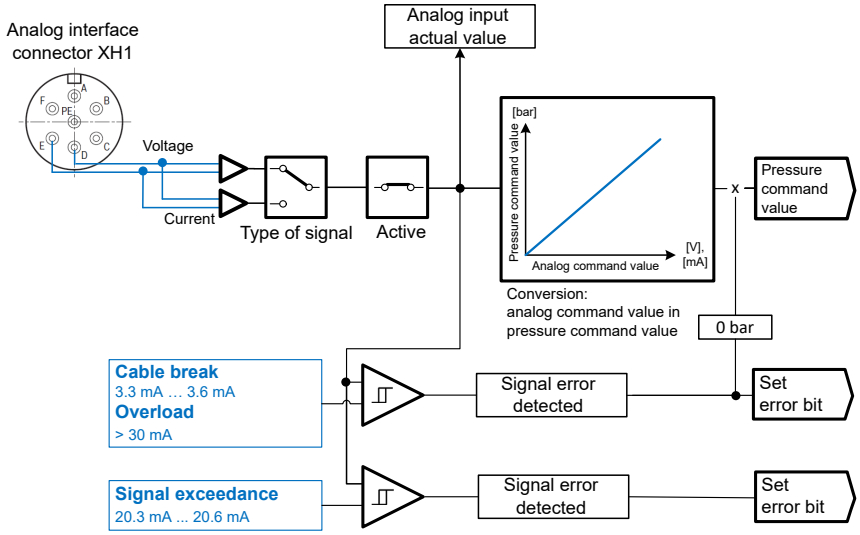


Fig. 8: Pressure command value1

Type of signal

The type of signal is used to set whether the analog command value of the connector XH1 is predetermined as a voltage signal in the range from 0 to 10 V or as a current signal in the current range from 4 to 20 mA.

Activation bit

The mapping of the voltage or current signal of the analog command value input to the corresponding pressure command value is activated via the activation bit.

Conversion of the analog command value to a pressure command value

The conversion of the analog command value into a pressure command value is shown in detail below:

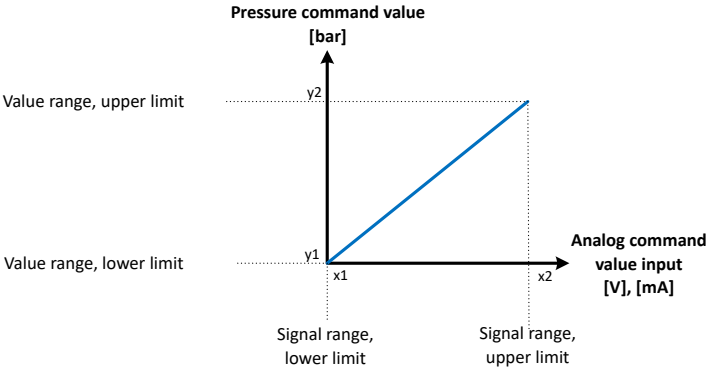


Fig. 9: Pressure command value3

Over the two coordinates x1, y1 (lower limit: signal range, value range) and x2, y2 (upper limit: signal range, value range) a straight equation is defined. The voltage or current signal currently present at the analog command value input is converted into the corresponding pressure command value in bar via this straight equation.

$$Pressure\ command\ value\,(bar) = \frac{Value\ range\ (y2 - y1)}{Signal\ range\ (x2 - x1)} \times ((Command\ value\ input\,(V\ or\ .\ mA) - x1) + y1$$

Fig. 10: Command pressure value formula

Version A1

When the pressure valve is delivered ex works in version A1, the valve is parameterized so that the voltage signal range 0 ... 10 V is mapped to a pressure command value range of 0 ... nominal pressure (in bar) at the analog command value input.

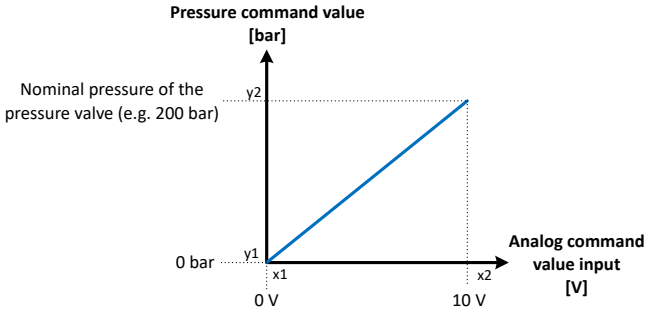


Fig. 11: Pressure command value4

Example:

Nominal pressure of the valve = 200 bar, command value input = 1 V

$$Pressure\ command\ value\,(bar) = \frac{200bar}{10V} \times (1V - 0V) + 0bar = 20bar$$

Fig. 12: Command pressure value 1 formula

Version F1

When the valve is delivered ex works in version F1, the valve is parameterized so that the current signal range 4 ... 20 mA is mapped to a pressure command value range of 0 ... nominal pressure (in bar) at the analog command value input.

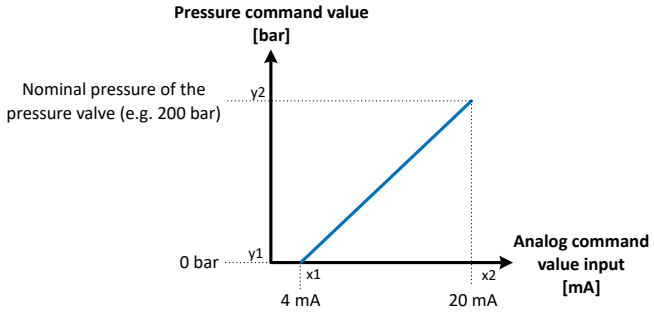


Fig. 13: Pressure command value5

Example:

Nominal pressure of the valve = 200 bar, command value input = 12 mA

$$\textit{Pressure command value (bar)} = \frac{200bar}{16mA} \times (12mA - 4mA) + 0bar = 100bar$$

Fig. 14: Command pressure value 2 formula

Maximum adjustable signal range

As a result of the electronics of the pressure valve, the maximum adjustable signal range of the analog command value input (lower and upper limit) is limited to certain values which can be taken from the following table.

Command value input configured as	Maximum adjustable signal range	
	Lower limit	Upper limit
Voltage (A1)	-0.5 V	10.5 V
Current (F1)	3.2 mA	20.8 mA

Signal monitoring of the command value input (version F1)

In the case of valves which are delivered ex works in version F1, the current signal read in by the command value input is automatically checked for cable break (-> undercurrent), signal overflow (-> over-current) and overload.

If a cable break or overload has been detected, the pressure command value is set to the value 0 bar as error reaction and the corresponding error bit is set. When a signal is exceeded, only the associated error bit is set, the pressure command value is not affected.

Once the error case has been fixed, the pressure command value is restored to normal. This does not require manual intervention, such as acknowledging the error.

Signal thresholds for cable break, signal exceedance and overload:

The following table shows from which signal threshold a cable break, a signal exceedance or an overload is detected and automatically acknowledged.

Command value input configured as	Cable break		Signal exceedance		Overload	
	Identification	Acknowledg-ment	Identification	Acknowledg-ment	Identification	Acknowledg-ment
Current (F1)	< 3.3 mA	≥ 3.6 mA	> 20.3 mA	≤ 20.3 mA	> 30 mA	0 mA

The monitoring for cable break, signal exceedance and overload is only active if the signal range of the command value input (lower and upper limit) is set according to the following table.

Command value input configured as	Maximum adjustable signal range	
	Lower limit	Upper limit
Current (F1)	≥ 3.6 mA	≤ 20.3 mA

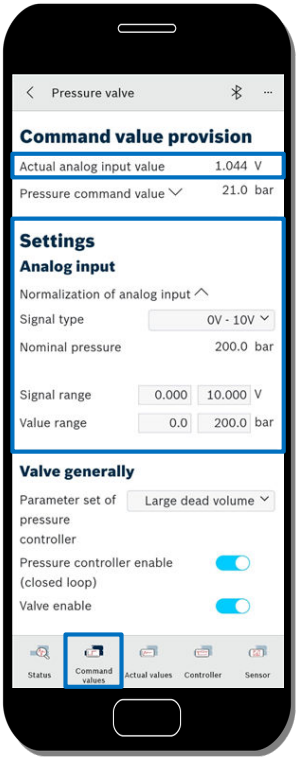
4.2.2 Relevant parameters

The following parameters are relevant for mapping the voltage or current signal of the analog command value input to the corresponding pressure command value.

➥ Chapter 9.66 “S-0-0800 - Pressure command value” on page 106
➥ Chapter 9.12 “P-0-2875.0.7 - Valve: Nominal pressure” on page 77
➥ Chapter 9.19 “P-0-2885.0.23 - Diagnostics: Error overview” on page 79
➥ Chapter 9.51 “P-0-2907.1.1 - Analog command value input: Actual value” on page 99
➥ Chapter 9.41 “P-0-2900.1.1 - Analog command value input: Control word” on page 92
➥ Chapter 9.42 “P-0-2900.1.8 - Analog command value input: Signal range, lower limit” on page 93
➥ Chapter 9.43 “P-0-2900.1.9 - Analog command value input: Signal range, upper limit” on page 94
➥ Chapter 9.44 “P-0-2900.1.10 - Analog command value input: Value range, lower limit” on page 95
➥ Chapter 9.45 “P-0-2900.1.11 - Analog command value input: Value range, upper limit” on page 95

4.2.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, the settings for the pressure command value can be adjusted in the "Command values" screen if the factory settings of the valve are still to be optimized.



Actual value on the analog command value input

Settings for mapping the voltage or current signal of the analog command value input to the corresponding pressure command value

Command values screen

Fig. 15: Command values screen

4.3 Actual pressure value

4.3.1 Functional description

In the case of pressure valves with an integrated or external pressure sensor, the current actual pressure value is output as a voltage or current signal via the pins C and F of the connector XH1 of the valve. In the OBED, the actual pressure value currently measured is converted into a corresponding voltage or current value. This principle is shown in the following figure:

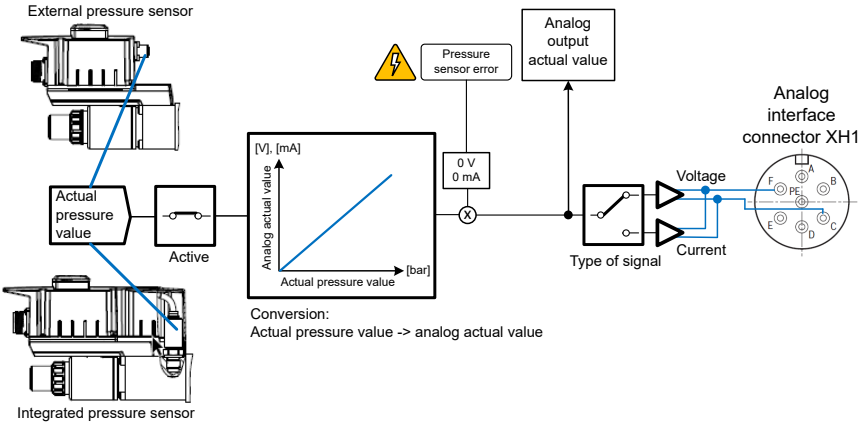


Fig. 16: Actual pressure value1

Type of signal

The type of signal is used to set whether the actual pressure value of the connector XH1 is to be output as a voltage signal in the range from 0 to 10 V or as a current signal in the current range from 4 to 20 mA as an analog signal.

Activation bit

The output of the actual pressure value to the analog actual value output is activated via the activation bit.

Conversion of the actual pressure value into an analog actual value

The following is a detailed illustration of how the actual pressure value currently measured is converted into the corresponding voltage or current signal at the analog command value output:

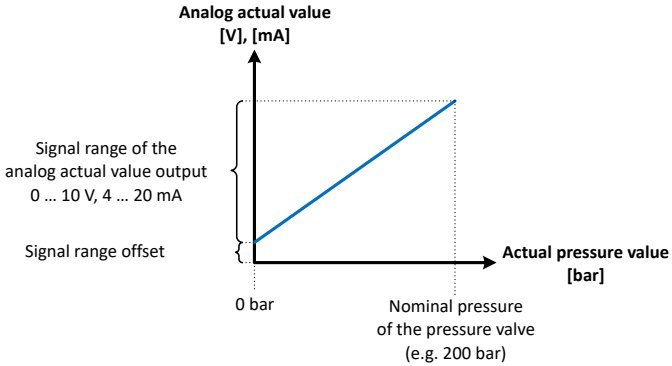


Fig. 17: Actual pressure value3

The current actual pressure value in bar is converted into the corresponding voltage or current signal at the analog actual value output via the following straight line equation.

$$Actual\ value\ output\,(V\ or.\,mA) = \frac{Signal\ range}{Nominal\ pressure} \times Actual\ pressure\ value\,(bar) + Offset\,(Signal\ range)$$

Fig. 18: Actual pressure value formula

Version A1

When the pressure valve is delivered ex works in version A1, the pressure valve is parameterized such that the actual pressure value is mapped in a range of 0 ... nominal pressure (in bar) to a signal range of 0 ... 10 V at the analog actual value output.

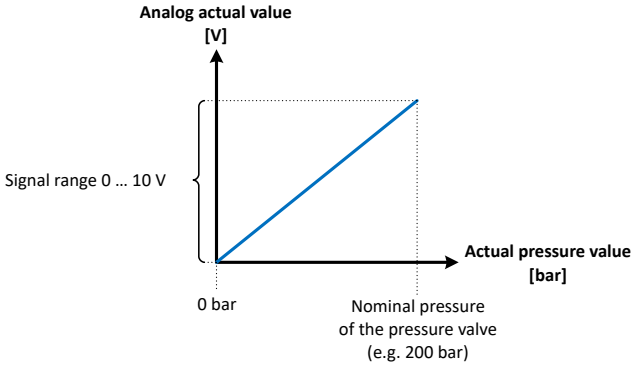


Fig. 19: Actual pressure value4

Example:

Nominal pressure of the valve = 200 bar, actual pressure value = 40 bar

$$Actual\ value\ output(V) = \frac{10V}{200bar} \times 40bar + 0V = 2V$$

Fig. 20: Actual pressure value 1 formula

Version F1

When the pressure valve is delivered ex works in version F1, the pressure valve is parameterized such that the actual pressure value is mapped in a range of 0 ... nominal pressure (in bar) to a signal range of 4 ... 20 mA at the analog actual value output.

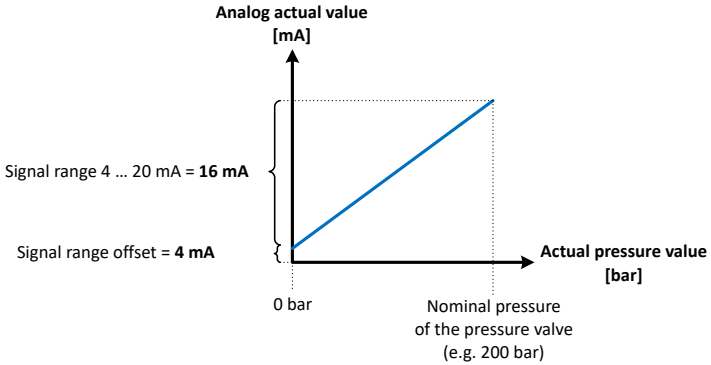


Fig. 21: Actual pressure value5

Example:

Nominal pressure of the valve = 200 bar, actual pressure value = 40 bar

$$Actual\ value\ output\,(mA) = \frac{16mA}{200bar} \times 40bar + 4mA = 7{,}2mA$$

Fig. 22: Actual pressure value 2 formula

Pressure sensor error

If there are cable break or overload errors at the pressure sensor, then the voltage or current signal is output at 0V or 0mA on the actual value output. If the signal is exceeded, the signal at the actual value output is not affected.

4.3.2 Relevant parameters

The following parameters are relevant for mapping the actual pressure value to the corresponding voltage or current signal at the analog actual value output.

➦ Chapter 9.67 “S-0-0809 - Actual pressure value” on page 106

➦ Chapter 9.12 “P-0-2875.0.7 - Valve: Nominal pressure” on page 77

➦ Chapter 9.53 “P-0-2908.1.1 - Analog actual value output: Actual value” on page 100

➦ Chapter 9.54 “P-0-2908.1.2 - Analog actual value output: Control word” on page 101

4.3.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, the settings for the output of the actual pressure value can be adjusted in the "Actual values" screen if the factory settings of the valve are still to be optimized.

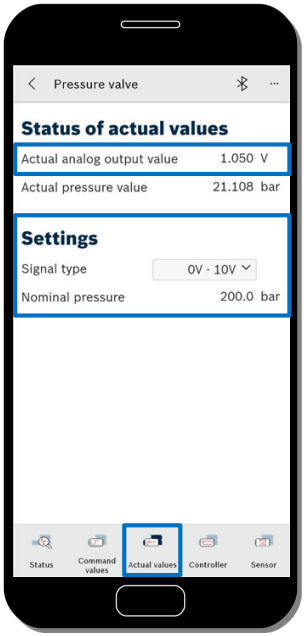


Fig. 23: Actual values screen

4.4 Actual current value (solenoid)

4.4.1 Functional description

In the case of pressure valves without a pressure sensor, the current solenoid current (= actual current value of the solenoid) is output via the pins F and C of the connector XH1 of the valve as a voltage or current signal. In the OBED, the currently measured solenoid current is converted into a corresponding voltage or current value. This principle is shown in the following figure.

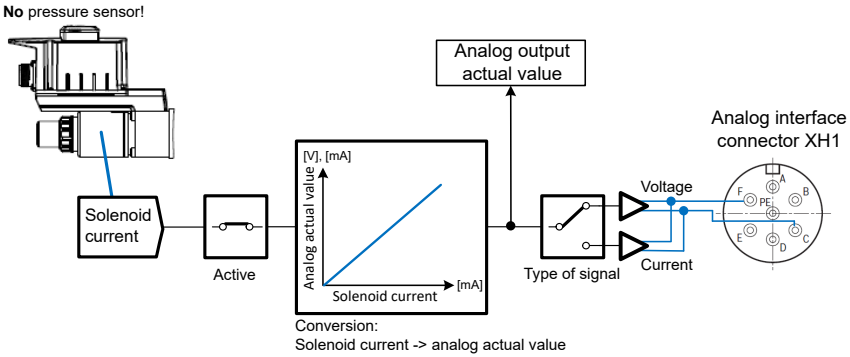


Fig. 24: Actual current value1

Type of signal

The type of signal is used to set whether the solenoid current on the connector XH1 is to be output as an analog voltage signal in the range from 0 to 10 V or as an analog current signal in the current range from 4 to 20 mA.

Activation bit

The output of the solenoid current to the analog actual value output is activated via the activation bit.

Conversion of the actual current value into an analog actual value

The following is a detailed illustration of how the solenoid current currently measured is converted into the corresponding voltage or current signal at the analog actual value output.

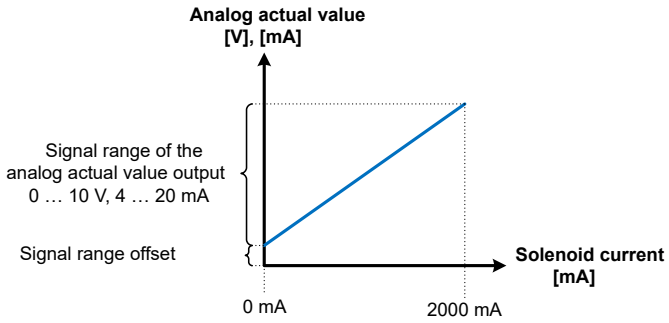


Fig. 25: Actual current value3

The current actual pressure value in bar is converted into the corresponding voltage or current signal at the analog actual value output via the following straight line equation.

$$Actual\ value\ output\ (V\ or\ .mA\ ) = \frac{Signal\ range}{2000 mA} \times Solenoid\ current\ (mA) + Offset\ (Signal\ range)$$

Fig. 26: Solenoid current formula

Version A1

When the pressure valve is delivered ex works in version A1, the pressure valve is parameterized such that the solenoid current is mapped in a range of 0 ... 2000 mA to a signal range of 0 ... 10 V at the analog actual value output.

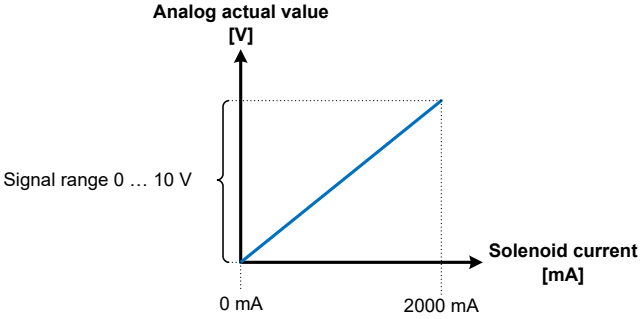


Fig. 27: Solenoid current2

Example:

Solenoid current: 500 mA

$$Actual\ value\ output\ (V) = \frac{10V}{2000mA} \times 500mA + 0V = 2{,}5V$$

Fig. 28: Solenoid current 2 formula

Version F1

When the pressure valve is delivered ex works in version F1, the pressure valve is parameterized such that the solenoid current is mapped in a range of 0 ... 2000 mA to a signal range of 4 ... 20 mA at the analog actual value output.

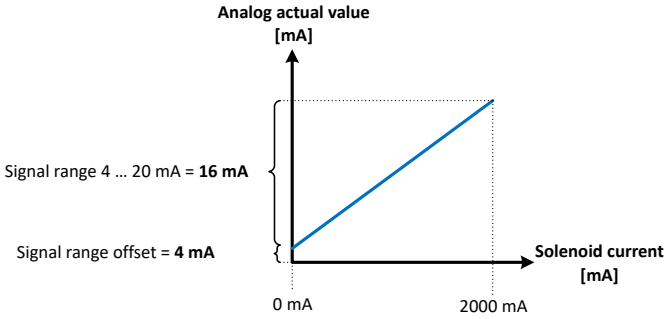


Fig. 29: Solenoid current3

Example:

Actual current value = 500 mA

$$Actual\ value\ output\ (mA) = \frac{16mA}{2000mA} \times 500mA + 4mA = 8mA$$

Fig. 30: Solenoid current 3 formula

4.4.2 Relevant parameters

The following parameters are relevant for mapping the solenoid current to the corresponding voltage or current signal at the analog actual value output.

➥ Chapter 9.55 “P-0-2915.0.3 - Actual current value: Solenoid A” on page 101
➥ Chapter 9.12 “P-0-2875.0.7 - Valve: Nominal pressure” on page 77
➥ Chapter 9.53 “P-0-2908.1.1 - Analog actual value output: Actual value” on page 100
➥ Chapter 9.54 “P-0-2908.1.2 - Analog actual value output: Control word” on page 101

4.4.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, there is currently no screen available in which the output of the solenoid current can be adjusted as a voltage or current signal on the analog actual value output.

5 Digital interface - IO-Link - connector XH5

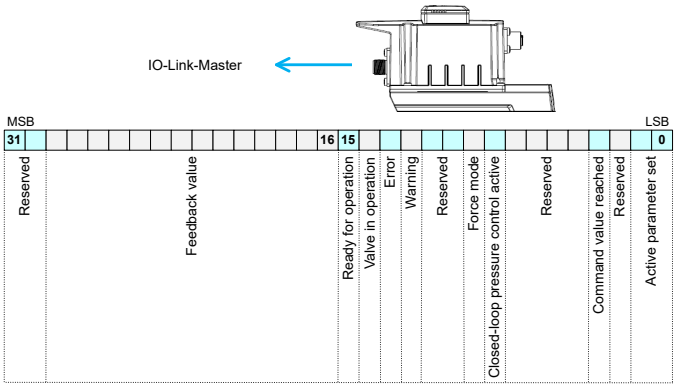
5.1 Process data

5.1.1 General information

The IO-Link process data of the pressure valves consists of a 32-bit rigid mapping of the cyclic data and is composed of a 32-bit value with input data (-> Process data input) and a 32-bit value with output data (-> Process data output). The process data is used for both open and closed-loop controlled pressure valves.

5.1.2 Process data input

The input data consists of the actual pressure value and a 16-bit status word.



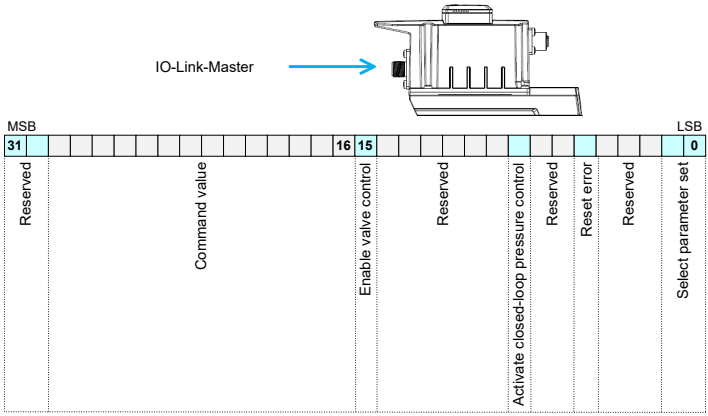
Name	Description	Data type	Bit offset	Bit lenght	Value range / comment
Reserved	--	--	30	2	
Feedback value	Actual pressure value	IntegerT	16	14	Nominal pressure of the valve in bar, factor 0,1 Example: 200 bar -> 0 to 2000
Ready for operation	1: Valve ready for operation 0: Valve not ready for operation	BooleanT	15	1	
Valve in operation	1: Valve control is active 0: Valve control is not active	BooleanT	14	1	Command values are processed cylically.
Error	1: Error occured in the valve 0: Nor error in the valve	BooleanT	13	1	
Warning	1: Warning occured in the valve 0: No warning in the valve	BooleanT	12	1	For future use.
Reserved	--	--	10	2	
Force mode	1: Force-Mode aktiv 0: Force-Mode nicht aktiv	BooleanT	9	1	
Closed-loop pressure control active	1: Closed-loop pressure control active 0: Open-loop pressure control active	BooleanT	8	1	Closed-loop pressure control can only be activated for valves with pressure sensor.
Reserved	--	--	4	4	
Command value reached	1: Pressure command value reached 0: Pressure command value not reached	BooleanT	3	1	
Reserved	--	--	2	1	
Active parameter set	Number of the active parameter set	UIntegerT	0	2	0: Parameter set 0 1: Parameter set 1 2: Parameter set 2 3: Parameter set 3

Fig. 31: Process data input

In the case of pressure valves without a pressure sensor, instead of the actual pressure value, the currently effective pressure command value is returned as the actual value.

5.1.3 Process data output

The output data consists of the pressure command value and a 16-bit control word.



Name	Description	Data type	Bit offset	Bit length	Value range / comment
Reserved	--	--	30	2	
Command value	Acual pressure command value	IntegerT	16	14	Nominal value of the valve in bar, factor 0,1 Example: 200 bar -> 0 to 2000
Enable valve control	1: Valve power stage is active. 0: Valve power stage is not active.	BooleanT	15	1	
Reserved	--	--	9	6	
Activate closed-loop pressure control	1: Activate closed-loop pressure control 0: Activate open-loop pressure control	BooleanT	8	1	Closed-loop pressure control can only be activated for valves with pressure sensor.
Reserved	--	--	6	2	
Error reset	1: Error reset is active. 0: Error reset is not active.	BooleanT	5	1	For future use.
Reserved	--	--	2	3	
Select parameter set	Command value of active parameter set	UIntegerT	0	2	0: Parameter set 0 1: Parameter set 1 2: Parameter set 2 3: Parameter set 3

Fig. 32: Process data output

5.1.4 Relevant parameters

The following parameters are relevant for cyclic IO-Link communication:

➥ Chapter 9.7 “P-0-1910.0.1 - IO-Link: Pressure valve control word” on page 74

➥ Chapter 9.8 “P-0-1910.0.2 - IO-Link: Pressure valve status word” on page 75

➥ Chapter 9.11 “P-0-2803 - Pressure command value preparation: Resulting pressure command value” on page 77

➥ Chapter 9.66 “S-0-0800 - Pressure command value” on page 106

➥ Chapter 9.67 “S-0-0809 - Actual pressure value” on page 106

5.2 Backup/Restore

IO-Link has a data storage function that makes it easy to swap a device. In this case, certain objects of the device are linked to the data storage mechanism and these are stored within the IO-Link master used.

Up to 2048 bytes of object data can be stored per device in the IO-Link master. A checksum is formed over all objects in order to be able to detect changes in the device. In the event of a change, all data storage objects can be automatically reloaded into the device during the IO-Link start-up depending on the configuration in the IO-Link master.

If objects in the device are modified manually, for example, via a Bluetooth connection, a command for updating the data storage objects can be sent to the IO-Link master (data storage upload request). If the master receives this command, the master can read and save again all objects linked to the data storage mechanism, if configured appropriately.

If the user wants to trigger a data storage backup themselves, the command can also be triggered by the IO-Link master (system command "ParamDownloadStore"). The command parameter "P-0-1910.0.3, Data storage upload request" can be used to start the command via the Bluetooth connection. If this value is set to "0x3", a data storage backup is requested in the IO-Link device. As soon as the master has performed the data storage backup, the command parameter is reset to the value "0". The list of objects associated with the data storage mechanism can be read from the IO-Link master during the start-up via "Index 0x0003, Subindex 0x05, Index_List" in the device. The checksum of the data storage objects can be read from the device via "Index 0x0003, Subindex 0x04, Parameter_Checksum".

6 Pressure sensor / Actual pressure value detection

6.1 Overview

In the case of the pressure valves under closed-loop pressure control, the actual pressure value is detected depending on the valve type via an internal pressure sensor which is permanently installed in the valve ex works or via an external pressure sensor which is connected to the valve on the customer side via the interface XN2.

6.2 Internal pressure sensor

For pressure valves with internal pressure sensor, a pressure sensor is installed permanently ex works to match the nominal pressure of the valve. The pressure sensor installed in the valve supplies a voltage signal in the range of 0.1 to 10 V.

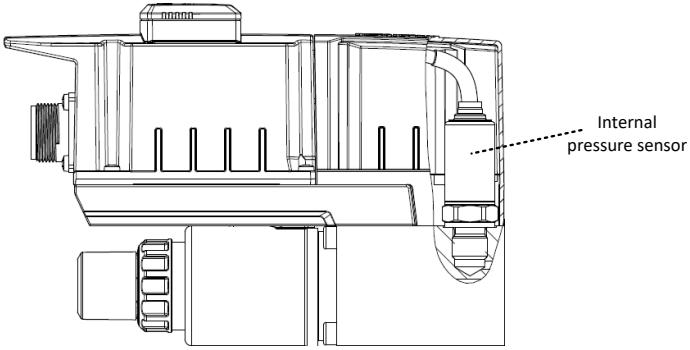


Fig. 33: Internal pressure sensor

6.3 External pressure sensor – interface X2N

In the case of pressure valves with the connection possibility of an external pressure sensor, this can be effected via the interface X2N. A sensor can be used as an external pressure sensor, where the actual pressure value is given as a voltage signal (0 ... 10 V) or as a current signal (4 ...20 mA).

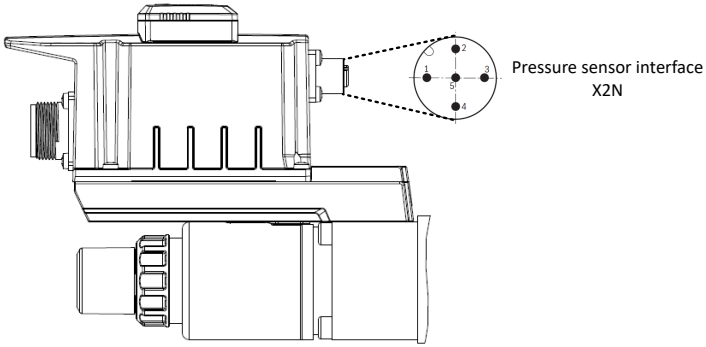


Fig. 34: Pressure sensor

Interface X2N assignment

The following table shows the pin assignment of the pressure sensor interface X2N.

Pin	Signal	Interface
1	U_S	Voltage supply for the pressure sensor from the valve supply via connectors XH1 or XH5
2	I_{Meas}	Current input 4 ... 20 mA for pressure sensors with current interface
3	GND	Reference potential
4	U_{Meas}	Voltage input 0 ... 10 V for pressure sensors with voltage interface
5	n.c.	No connection

The exact electrical specification of the pressure sensor interface X2N can be found in the corresponding "data sheet".

6.4 Actual pressure value detection

6.4.1 Functional description

The actual pressure value is detected as a voltage signal in valves with an internal pressure sensor, since a corresponding sensor is permanently installed ex works. In the case of valves with the connection possibility of an external pressure sensor, the actual pressure value is read in as a voltage or current signal depending on the sensor type used by the customer. In the OBED, the read-in voltage or the read-in current is converted into a corresponding actual pressure value. This progress of the actual pressure value detection is shown in the following figure.

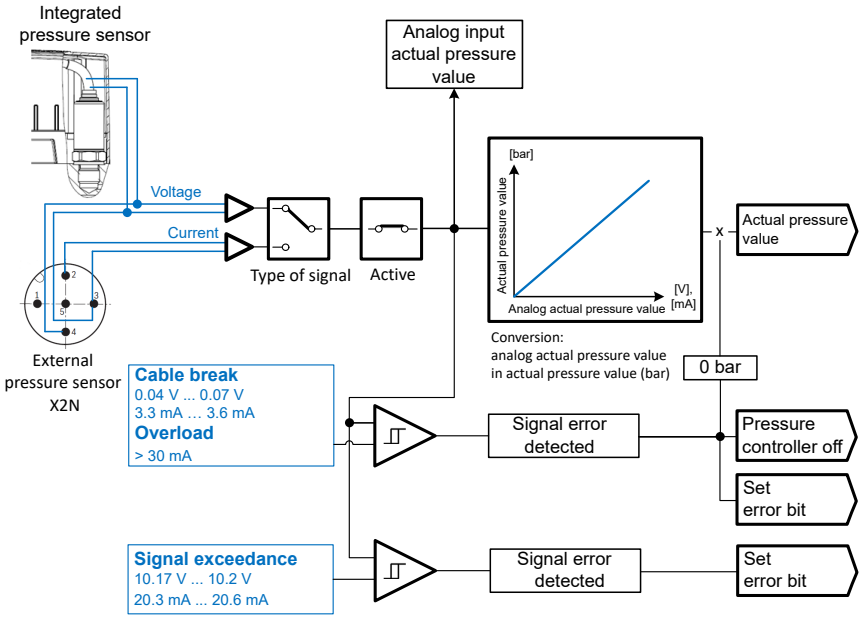


Fig. 35: Actual pressure value detection

Type of signal

The type of signal is used to set whether the analog actual pressure value is detected as a voltage signal in the range from 0 to 10 V or as a current signal in the current range from 4 to 20 mA.

Activation bit

The conversion of the voltage or current signal of the analog actual pressure value into V or mA into the corresponding actual pressure value in bar is activated via the activation bit.

Conversion of the analog actual pressure value (V or mA) into an actual pressure value (bar)

In the following, it is shown in detail how the conversion of the voltage or current signal of the analog actual pressure value into V or mA into the corresponding actual pressure value into bar takes place in principle.

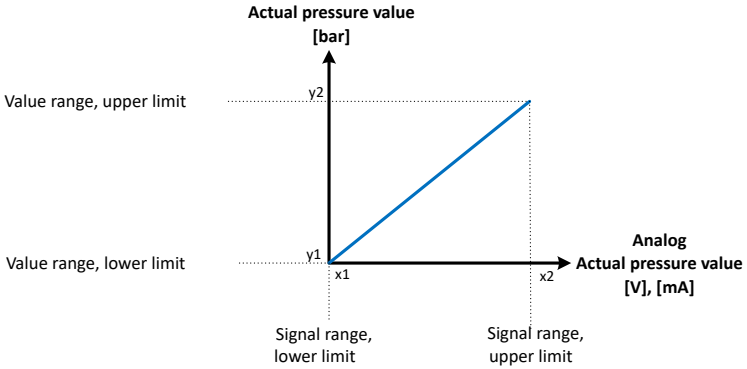


Fig. 36: Conversion of actual pressure value

Over the two points x1, y1 (lower limit: signal range, value range) and x2, y2 (upper limit: signal range, value range) a straight line equation is defined. This straight line equation is used to convert the actual analog pressure value into V or mA currently read in into the corresponding actual pressure value in bar.

$$Actual\ pressure\ value\ (bar) = \frac{Value\ range\ \ (y2 - y1)}{Signal\ range\ \ (x2 - x1)} \times ((Actual\ pressure\ value\ (in\ V\ or.\ mA) - x1) + y1$$

Fig. 37: Actual pressure value detection formula

Maximum adjustable signal range:

As a result of the electronics of the pressure valve, the maximum adjustable signal range of the pressure sensor (lower and upper limit) is limited to certain values which can be taken from the following table.

Pressure sensor interface	Maximum adjustable signal range	
	Lower limit	Upper limit
Voltage	-0.5 V	10.5 V
Current	3.2 mA	20.8 mA

Pressure sensor signal monitoring

Ex works, the voltage or current signal read in by the pressure sensor is automatically monitored for cable break (-> undervoltage or current) or signal overrun (-> overvoltage or current). The current signal is additionally tested for overload.

If a cable break or overload has been detected, as an error reaction, the actual pressure value is set to the value 0 bar and the pressure controller is switched off. Thus, the valve automatically changes to open-loop pressure control mode. Furthermore, the error bit is set in accordance with the detected signal error. As soon as the error case is no longer active, the actual pressure value is automatically regenerated and the closed-loop pressure control activated.

In the event of a signal exceedance, no error reaction takes place; only a corresponding error bit is set.

Signal thresholds for cable break, signal exceedance and overload:

The following table shows from which signal threshold a cable break, a signal exceedance or an overload is detected and automatically acknowledged.

Pressure sensor interface	Cable break		Signal exceedance		Overload	
	Identification	Acknowledgment	Identification	Acknowledgment	Identification	Acknowledgment
Voltage	< 0.04 V	≥ 0.07 V	> 10.2 V	≤ 10.17 V	-	-
Current	< 3.3 mA	≥ 3.6 mA	> 20.3 mA	≤ 20.3 mA	> 30 mA	0 mA

The monitoring for cable break, signal exceedance and overload is only active if the signal range of the pressure sensor (lower and upper limit) is set according to the following table.

Pressure sensor interface	Maximum adjustable signal range	
	Lower limit	Upper limit
Voltage	≥0.07 V	≤10.17 V
Current	≥3.6 mA	≤20.3 mA

6.4.2 Relevant parameters

The following parameters are relevant for setting the actual pressure value detection:

➥ Chapter 9.67 “S-0-0809 - Actual pressure value” on page 106

➥ Chapter 9.19 “P-0-2885.0.23 - Diagnostics: Error overview” on page 79

➥ Chapter 9.52 “P-0-2907.2.1 - Analog actual pressure value input: Actual value” on page 100

➥ Chapter 9.46 “P-0-2900.2.1 Analog actual pressure value input: Control word” on page 96

➥ Chapter 9.47 “P-0-2900.2.8 Analog actual pressure value input: Signal range, lower limit” on page 97

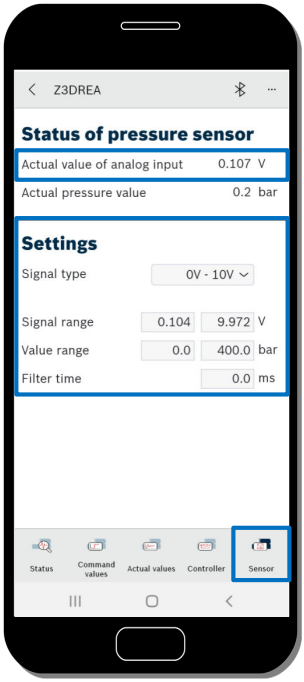
➥ Chapter 9.48 “P-0-2900.2.9 - Analog actual pressure value input: Signal range, upper limit” on page 97

➥ Chapter 9.49 “P-0-2900.2.10 - Analog actual pressure value input: Value range, lower limit” on page 98

➥ Chapter 9.50 “P-0-2900.2.11 - Analog actual pressure value input: Value range, upper limit” on page 99

6.4.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, the settings for the actual pressure value detection can be adjusted in the "Sensor" screen.



Analog actual pressure value of the sensor

Settings for converting the voltage or current signal of the analog actual pressure value of the sensor into V or mA into the corresponding actual pressure value in bar

Sensor screen

Fig. 38: Pressure settings via "easy2connect"

The settings for a pressure valve with internal pressure sensor may only be changed via the "easy2connect" smartphone app after consulting Bosch Rexroth's service. During the production of the pressure valve, these are optimally set so that the accuracies specified in the "data sheet" are achieved during the closed-loop pressure control.

7 Controller structure (Z)3DREE

7.1 Overview

There is no pressure sensor in the pressure valve type (Z)3DREE. Thus, in this valve type **closed-loop pressure control** is not possible but only open-loop pressure control. The rough controller structure for this valve type is shown below.

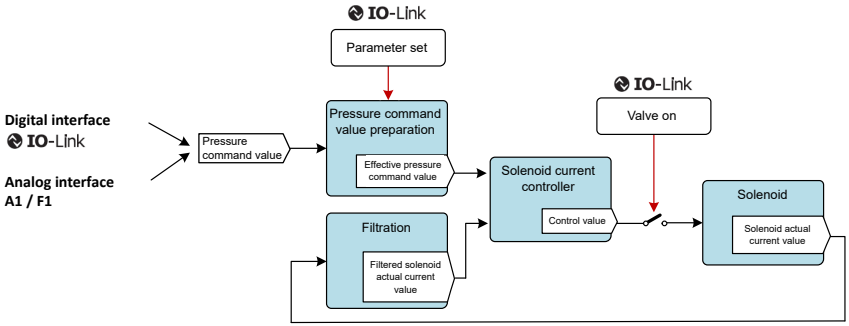


Fig. 39: Controller structure1

Pressure command value

The pressure command value is cyclically preset to the valve. Depending on the valve type, this takes place either digitally via the process data (PDout) of the IO-Link interface or as an analog voltage or current signal via the A1 or F1 interface.

Pressure command value preparation

The settings of the pressure command value preparation (ramps and filters) are parameter set dependent. This means that the settings (ramps and filters) are adjusted depending on the currently active parameter set.

Detailed information about the command value preparation can be found in ➥ Chapter 7.2 “Pressure command value preparation” on page 51.

Solenoid current actual value filtration

The filtration of the actual current value measured internally in the pressure valve is currently fixed and cannot be changed.

Solenoid current controller

The solenoid current controller is realized as a PI controller with feedforward control. The solenoid current controller calculates the associated control value for the solenoid of the pressure valve from the effective pressure command value predetermined by the command value preparation and the current solenoid current actual value.

Detailed information on the solenoid current controller can be found in ➥ Chapter 7.3 “Solenoid current controller” on page 53.

Parameter set

The pressure valve is supplied with 4 parameter sets, so that the settings for the command value preparation can be easily adapted to the application of the pressure valve.

Parameter set number	Application of the pressure valve
0	Small dead volume
1	Large dead volume
2	User-defined 1 (with small dead volume pre-parameterized ex works)
3	User-defined 2 (with large dead volume pre-parameterized ex works)

In the case of the pressure valve with digital IO-Link interface, the active parameter set is preset cyclically via the process data (PDout).

In the case of the pressure valve with an analog A1 or F1 interface, the parameter set 1 "Large dead volume" is set ex works. This can be reconfigured via the "easy2connect" smartphone app.

For application-specific adaptation, it is intended to use parameter sets 2 and 3 first.

Valve on

The output of the control value of the solenoid current controller on the solenoid is only effected when the "valve on" bit is set. By setting this bit, the output stage of the valve is activated, via which the solenoid is actuated with the corresponding control value.

In the case of the pressure valve with digital IO-Link interface, the "valve on" bit is cyclically predetermined via the process data (PDout). This means that the bit must be set via IO-Link in order to activate the output of the control value of the solenoid current controller on the magnet.

In the case of the pressure valve with an analog A1 or F1 interface, the "valve on" bit is set ex works, so that after the pressure valve is switched on, the output of the control value of the solenoid current controller to the solenoid takes place immediately.

"easy2connect" smartphone app

In the "easy2connect" smartphone app, the settings for the pressure command value preparation and for the solenoid current controller can be adjusted in the "Controller" screen.

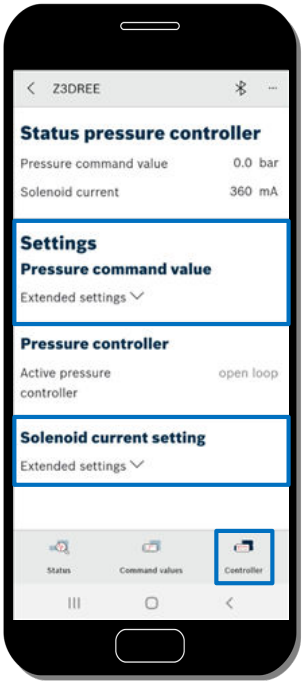


Fig. 40: Controller structure2

7.2 Pressure command value preparation

7.2.1 Functional description

The structure of the pressure command value preparation is shown below.

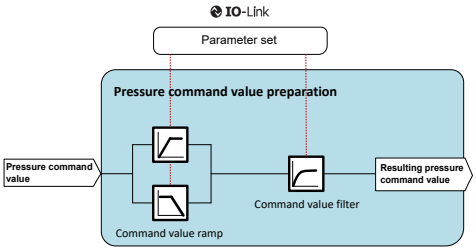


Fig. 41: Pressure command value preparation1

Command value ramp

The predetermined pressure command value is guided over a command value ramp to avoid abrupt changes. Separate ramp times for positive and negative pressure command value changes can be set.

The ramp times are parameter set dependent and can be set individually for each of the 4 available parameter sets, if the factory settings still have to be optimized.

Command value filter

The predetermined pressure command value can be smoothened via a PT1 filter whose filter frequency can be adjusted. The filter frequency is also parameter set dependent.

Parameter set

The pressure valve is supplied with 4 parameter sets, so that the settings for the pressure command value preparation (-> command value ramp and command value filtering) can be easily adapted to the application of the pressure valve.

7.2.2 Relevant parameters

The following parameters are relevant for setting the pressure command value preparation:

➥ Chapter 9.66 “S-0-0800 - Pressure command value” on page 106

➥ Chapter 9.11 “P-0-2803 - Pressure command value preparation: Resulting pressure command value” on page 77

➥ Chapter 9.38 “P-0-2892.0.6 - Pressure command value preparation: Ramp time positive” on page 91

➥ Chapter 9.39 “P-0-2892.0.7 - Pressure command value preparation: Ramp time negative” on page 92

➥ Chapter 9.40 “P-0-2892.0.8 - Pressure command value preparation: Filter frequency” on page 92

7.2.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, the settings for the pressure command value preparation can be adjusted in the "Controller" screen.

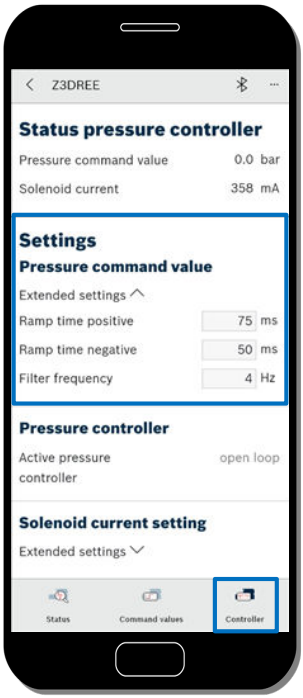


Fig. 42: Pressure command value preparation2

7.3 Solenoid current controller

7.3.1 Functional description

The structure of the solenoid current controller of the pressure valve is shown below.

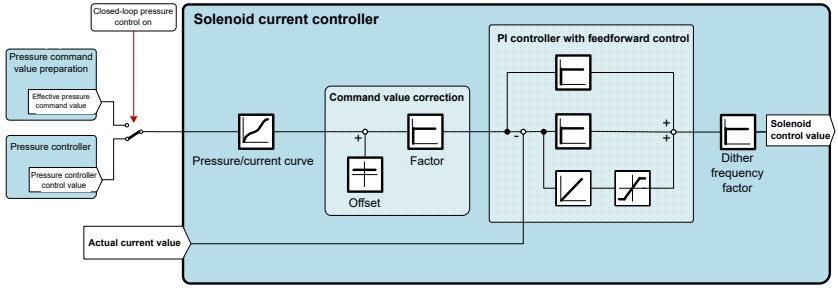


Fig. 43: Solenoid current controller

Pressure command value for solenoid current controller

If closed-loop pressure control is activated, the solenoid current controller receives the control value of the pressure controller as a command value. In the other case, the pressure command value which is predetermined by the command value preparation acts directly.

With a pressure valve without a pressure sensor, closed-loop pressure control is not possible. In this case, the solenoid current controller always receives the command value directly from the command value preparation.

Pressure/current curve

The pressure command value transferred to the solenoid current controller is converted into the corresponding solenoid current command value via the pressure/current characteristic.

Solenoid current command value correction

The valve is set ex works over the complete pressure range (→ 0 bar to the nominal pressure of the valve) for the volume flow specified in the valve data sheet. An optimum adaptation to the actual volume flow and compensation of the aging of the pressure valve can be effected via the command value correction by means of a factor and offset.

Solenoid current controller (PI controller with feedforward control)

The actual solenoid current controller is realized as a PI controller with feedforward control. The solenoid current controller is set for the valve ex works, meaning that the customer is not required to make any settings.

Dither frequency factor

The control value of the solenoid current controller is output at a superimposed dither frequency to the magnet of the pressure valve. The dither frequency for the pressure valve is set ex works so that the two following conditions are optimally met:

- The dither has as little influence as possible on the amplitude of the actual pressure value.
- A corresponding dynamic of the valve is achieved.

The dither frequency can be adjusted via the factor in such a way that the pressure valve is optimized in response to one of the conditions:

- Increasing the dynamics of the valve by a smaller dither frequency (→ factor < 1), which results in a higher pressure amplitude.
- Reduction of the actual pressure value amplitude (→ factor > 1), which results in a worse dynamic of the valve.

Ex works, the factor is set to 1.

A change to the dither frequency should only be made after consultation with the Bosch Rexroth service department.

7.3.2 Relevant parameters

The following parameters are relevant for mapping the voltage or current signal of the analog command value input to the corresponding pressure command value.

➦ Chapter 9.25 “P-0-2890.0.6 - Solenoid current: Offset” on page 86

➦ Chapter 9.26 “P-0-2890.0.7 - Solenoid current: P-gain” on page 87

➦ Chapter 9.27 “P-0-2890.0.8 - Solenoid current controller: Dither frequency factor” on page 87

7.3.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, the settings for the solenoid current controller can be adjusted in the "Controller" screen.

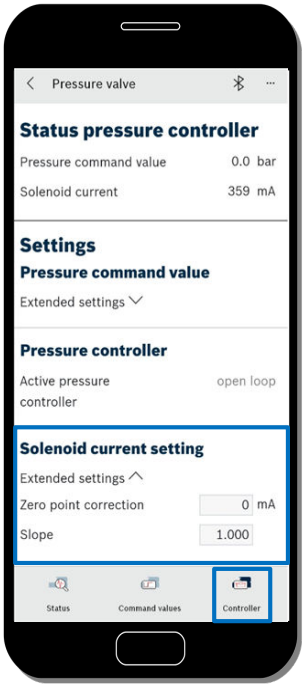


Fig. 44: "Controller" screen

8 Controller structure (Z)3DREA

8.1 Overview

In the pressure valve of type (Z)3DREA, the actual pressure value is detected via an internal or external pressure sensor. Thus, in this valve type, in addition to the open-loop pressure control, a closed-loop pressure control is also possible. The controller structure for this valve type is shown below.

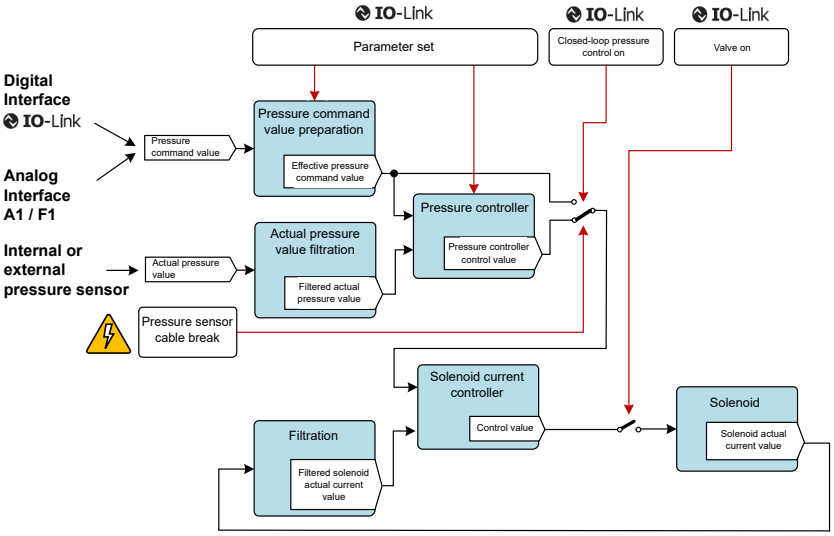


Fig. 45: Controller structure3

Pressure command value

The pressure command value is cyclically preset to the valve. Depending on the valve type, this takes place either digitally via the process data (PDout) of the IO-Link interface or as an analog voltage or current signal via the A1 or F1 interface.

Pressure command value preparation

The settings of the pressure command value preparation (ramps and filters) are parameter set dependent. This means that the settings (ramps and filters) are used depending on the currently active parameter set.

Detailed information about the command value preparation can be found in ➦ Chapter 7.2 “Pressure command value preparation” on page 51.

Actual pressure value

The actual pressure value is detected depending on the valve type via an internal or external pressure sensor.

Detailed information on detecting the actual pressure value can be found in ➦ Chapter 6.4 “Actual pressure value detection” on page 44.

Actual pressure value filtration

The actual pressure value is smoothened via a PT1 filter.

Detailed information about the filtration can be found in ➦ Chapter 6 “Pressure sensor / Actual pressure value detection” on page 42.

Pressure controller

The pressure controller is realized as a PI controller with active damping and feedforward control. The pressure controller can be easily set by using a slider.

The pressure controller calculates the corresponding control value from the effective pressure command value predetermined by the command value preparation and the actual pressure value currently detected. When the closed-loop pressure control is activated, this control value is supplied to the solenoid current controller. The settings of the pressure controller are parameter set dependent. This means that the settings are used depending on the active parameter set.

Detailed information about the pressure controller can be found in ➦ Chapter 8.4 “Closed-loop pressure control” on page 63.

Solenoid current actual value filtration

The filtration of the actual current value measured internally in the pressure valve is currently fixed and cannot be changed.

Solenoid current controller

The solenoid current controller is realized as a PI controller with feedforward control. The solenoid current controller receives the control value of the pressure controller as the command value when the closed-loop pressure control is activated. In the other case, the command value which is predetermined by the command value preparation acts directly.

The solenoid current controller calculates the associated control value for the solenoid of the pressure valve from the pressure command value and the current solenoid current actual value.

Detailed information on the solenoid current controller can be found in ➦ Chapter 7.3 “Solenoid current controller” on page 53.

Parameter set

The pressure valve is supplied with 4 parameter sets, so that the settings for the command value preparation can be easily adapted to the application of the pressure valve.

Parameter set number	Application of the pressure valve
0	Small dead volume
1	Large dead volume
2	User-defined 1 (with small dead volume pre-parameterized ex works)
3	User-defined 2 (with large dead volume pre-parameterized ex works)

In the case of the pressure valve with digital IO-Link interface, the active parameter set is preset cyclically via the process data (PDout).

In the case of the pressure valve with an analog A1 or F1 interface, the parameter set 1 "Small dead volume" is set ex works. This can be reconfigured via the "easy2connect" smartphone app.

For application-specific adaptation, it is intended to use parameter sets 2 and 3 first.

Closed-loop pressure control on

The pressure controller of the valve is only active if the "closed-loop pressure control on" bit is also set. Otherwise, the valve is in "open-loop pressure control" mode. In the case of the pressure valve with digital IO-Link interface, the "closed-loop pressure control on" bit is cyclically predetermined via the process data (PDout).

This means that the bit must be set via IO-Link for the pressure controller to be active. In the case of the pressure valve with an analog A1 or F1 interface, the "closed-loop pressure control on" bit is set ex works, so that the pressure controller is activated immediately after the pressure valve is switched on.

Valve on

The output of the control value of the solenoid current controller on the solenoid is only effected when the "valve on" bit is set. By setting this bit, the output stage of the valve is activated, via which the solenoid is actuated with the corresponding control value.

In the case of the pressure valve with digital IO-Link interface, the "valve on" bit is cyclically predetermined via the process data (PDout). This means that the bit must be set via IO-Link in order to activate the output of the control value of the solenoid current controller on the magnet.

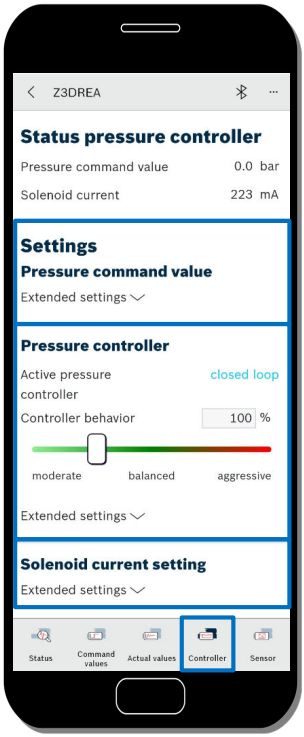
In the case of the pressure valve with an analog A1 or F1 interface, the "valve on" bit is set ex works, so that after the pressure valve is switched on, the output of the control value of the solenoid current controller to the solenoid takes place immediately.

Pressure sensor cable break

If a cable break of the pressure sensor is detected, the switch-over into open-loop pressure control takes place if closed-loop pressure control is currently active. As soon as the cable break is no longer present, the closed-loop pressure control is again automatically activated.

"easy2connect" smartphone app

In the "easy2connect" smartphone app, the settings for the pressure command value preparation, for the pressure controller and for the solenoid current controller can be adjusted in the "Controller" screen.



Settings for the pressure command value preparation

Settings for the pressure controller

Settings for the solenoid current controller

Controller screen

Fig. 46: Controller structure4

8.2 Pressure command value preparation

8.2.1 Functional description

The structure of the pressure command value preparation is shown below.

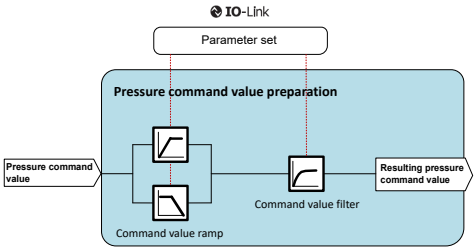


Fig. 47: Pressure command value preparation1

Command value ramp

The predetermined pressure command value is guided over a command value ramp to avoid abrupt changes. Separate ramp times for positive and negative pressure command value changes can be set.

The ramp times are parameter set dependent and can be set individually for each of the 4 available parameter sets, if the factory settings still have to be optimized.

Command value filter

The predetermined pressure command value can be smoothened via a PT1 filter whose filter frequency can be adjusted. The filter frequency is also parameter set dependent.

Parameter set

The pressure valve is supplied with 4 parameter sets, so that the settings for the pressure command value preparation (-> command value ramp and command value filtering) can be easily adapted to the application of the pressure valve.

8.2.2 Relevant parameters

The following parameters are relevant for setting the pressure command value preparation:

➥ Chapter 9.66 “S-0-0800 - Pressure command value” on page 106

➥ Chapter 9.11 “P-0-2803 - Pressure command value preparation: Resulting pressure command value” on page 77

➥ Chapter 9.38 “P-0-2892.0.6 - Pressure command value preparation: Ramp time positive” on page 91

➥ Chapter 9.39 “P-0-2892.0.7 - Pressure command value preparation: Ramp time negative” on page 92

➥ Chapter 9.40 “P-0-2892.0.8 - Pressure command value preparation: Filter frequency” on page 92

8.2.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, the settings for the pressure command value preparation can be adjusted in the "Controller" screen.

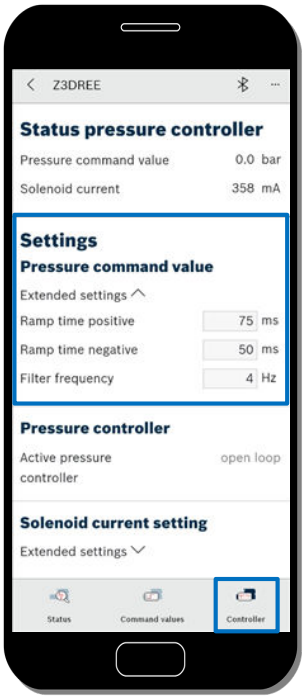


Fig. 48: Pressure command value preparation2

8.3 Actual pressure value filtration

8.3.1 Functional description

The actual pressure value detected via the internal or external pressure sensor is filtered for closed-loop pressure control. The following figure shows this filtration:

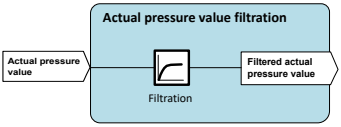


Fig. 49: 29263-FK_Actual pressure value filtration

Filtration

The actual pressure value detected via the internal or external pressure sensor is smoothened via a PT1 filter whose filter frequency can be adjusted. The reasonable value range for the filter frequency is between 10 Hz and 200 Hz.

By increasing the filter frequency, better dynamics in the closed-loop pressure control can be achieved if the hydraulic conditions for this are fulfilled (e.g. small dead volume).

From the factory, the filter frequency is set as a compromise for the various applications of the pressure valve (e.g. small dead volume, large dead volume).

8.3.2 Relevant parameters

The following parameters are relevant for setting the filtration of the actual pressure value:

➥ Chapter 9.67 “S-0-0809 - Actual pressure value” on page 106

➥ Chapter 9.28 “P-0-2890.0.9 - Actual pressure value: Filter frequency” on page 88

8.3.3 "easy2connect" smartphone app

In the "easy2connect" smartphone app, there is currently no screen available in which the filtration of the actual pressure value can be set.

8.4 Closed-loop pressure control

8.4.1 Functional description

The structure of the pressure controller of the pressure reducing valve (Z)3DREA is shown below.

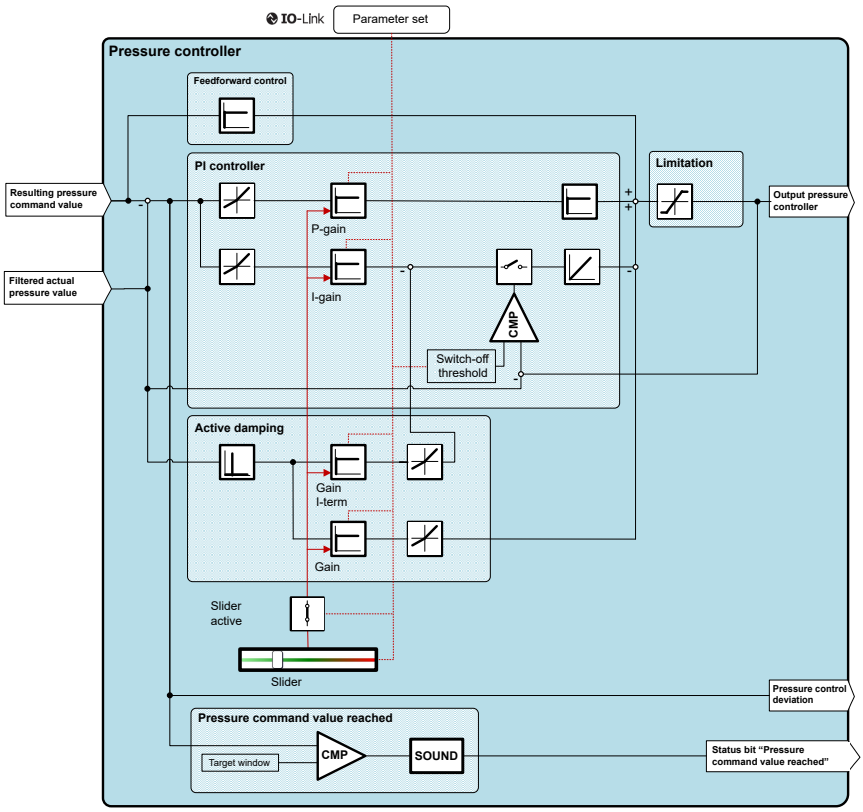


Fig. 50: Closed-loop pressure control

Pressure controller components

- Feedforward control
- PI controller with switching integrator
- Active damping
- Limitation

Feedforward control

With feedforward control (command value feedforward), the current pressure command value flows into closed-loop control as a percentage. In this way, the pressure control deviation is minimized.

Feedforward control of the pressure controller is optimally set ex works for the pressure reducing valve according to the nominal pressure. A customer setting is therefore not currently provided.

PI controller with switching integrator

With the PI controller, the P and I-gains can be set.

The PI controller integrator is automatically switched off if the following condition is met:

(output pressure controller-filtered actual pressure value) > Switch-off threshold Integrator * Nominal pressure dependent switch-off threshold

Nominal value of pressure valve	Nominal pressure dependent switch-off threshold
50 bar	10 bar
100 bar	10 bar
200 bar	14 bar
315 bar	22 bar

The integrator of the PI controller is automatically activated again if the above condition is no longer fulfilled.

Whether the I-term of the control value of the pressure controller is to be frozen or deleted during the switching off of the integrator is set via the control word of the pressure controller.

Active damping

In the pressure controller, within the framework of active damping, the change in the actual pressure value (→ velocity) is fed back to closed-loop control with a scaling factor in order to achieve a better controller behavior. The gain of the active damping and of the I-term can be parameterized.

Slider

With the aid of the slider, the controller behavior of the pressure controller can be easily set between moderate, balanced and aggressive. When the slider is pressed, the corresponding values for the following 4 parameters of the pressure controller are calculated at the same time:

- PI controller P-gain
- PI controller I-gain
- Active damping gain
- Active damping I-term gain

The slider can also be disabled so that the 4 parameters can be set independently.

Pressure controller output limit

The output of the pressure controller is fixedly limited to 0% to 115% of the nominal pressure of the valve. If, for example, the nominal pressure of the valve is 200 bar, the output of the pressure controller is limited to 0 bar to 230 bar.

Parameter set

The pressure valve is supplied with 4 parameter sets, so that the parameterization of the pressure controller can be adapted very simply to the respective application of the pressure valve. The following settings of the pressure controller are parameter set dependent:

- PI controller P-gain
- PI controller I-gain
- Active damping gain
- Active damping I-term gain
- Slider
- Switch-off threshold of the I-term of the PI controller

Status bit “Pressure command value reached”

The status bit "Pressure command value reached" indicates whether the pressure control deviation (-> difference between pressure command value and actual pressure value) within a target window.

If the pressure control deviation is within the target window, the status bit is set. If the pressure control deviation leaves the target window for a period of more than 10 ms, the status bit is reset again.

The status bit "Pressure command value reached" is formed when the following conditions are met:

- Enable for the valve is set
- Pressure detection of the valve is active

8.4.2 Relevant parameters

The following parameters are relevant for setting the pressure controller:

➦ Chapter 9.11 “P-0-2803 - Pressure command value preparation: Resulting pressure command value” on page 77

➦ Chapter 9.67 “S-0-0809 - Actual pressure value” on page 106

➦ Chapter 9.69 “S-0-0827 - Pressure control deviation” on page 107

➦ Chapter 9.22 “P-0-2890.0.3 - pressure controller: Slider (controller behavior)” on page 85

➦ Chapter 9.23 “P-0-2890.0.4 - pressure controller: Control word” on page 85

➦ Chapter 9.33 “P-0-2892.0.1 - pressure controller: I-gain” on page 89

➦ Chapter 9.34 “P-0-2892.0.2 - pressure controller: P-gain” on page 89

➦ Chapter 9.35 “P-0-2892.0.3 - pressure controller: Gain, active damping” on page 90

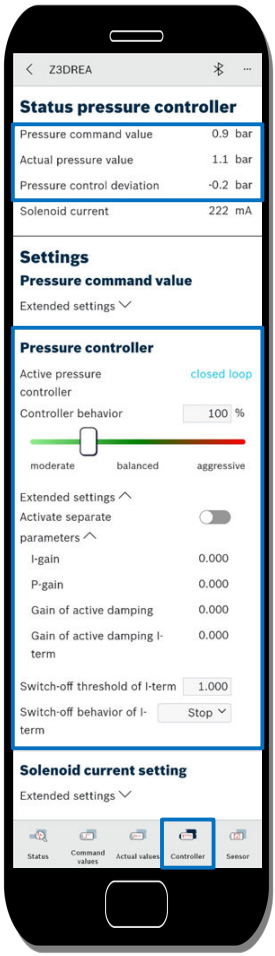
➦ Chapter 9.36 “P-0-2892.0.4 - pressure controller: Gain, I-term active damping” on page 90

➦ Chapter 9.37 “P-0-2892.0.5 - pressure controller: Integrator switch-off threshold” on page 91

➦ Chapter 9.1 “P-0-0115 - Valve status word” on page 70

8.4.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, the settings for the pressure controller can be adjusted in the "Controller" screen.



Relevant process variables for closed-loop pressure control

Settings for the pressure controller

Controller screen

Fig. 51: 29283-FK_Closed-loop pressure control 2

8.5 Solenoid current controller

8.5.1 Functional description

The structure of the solenoid current controller of the pressure valve is shown below.

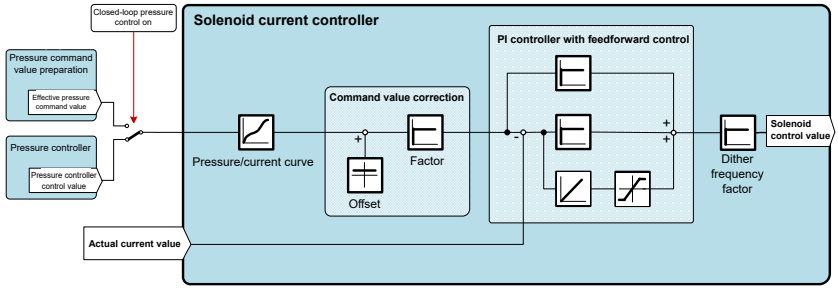


Fig. 52: Solenoid current controller

Pressure command value for solenoid current controller

If closed-loop pressure control is activated, the solenoid current controller receives the control value of the pressure controller as a command value. In the other case, the pressure command value which is predetermined by the command value preparation acts directly.

With a pressure valve without a pressure sensor, closed-loop pressure control is not possible. In this case, the solenoid current controller always receives the command value directly from the command value preparation.

Pressure/current curve

The pressure command value transferred to the solenoid current controller is converted into the corresponding solenoid current command value via the pressure/current characteristic.

Solenoid current command value correction

The valve is set ex works over the complete pressure range (→ 0 bar to the nominal pressure of the valve) for the volume flow specified in the valve data sheet. An optimum adaptation to the actual volume flow and compensation of the aging of the pressure valve can be effected via the command value correction by means of a factor and offset.

Solenoid current controller (PI controller with feedforward control)

The actual solenoid current controller is realized as a PI controller with feedforward control. The solenoid current controller is set for the valve ex works, meaning that the customer is not required to make any settings.

Dither frequency factor

The control value of the solenoid current controller is output at a superimposed dither frequency to the magnet of the pressure valve. The dither frequency for the pressure valve is set ex works so that the two following conditions are optimally met:

- The dither has as little influence as possible on the amplitude of the actual pressure value.
- A corresponding dynamic of the valve is achieved.

The dither frequency can be adjusted via the factor in such a way that the pressure valve is optimized in response to one of the conditions:

- Increasing the dynamics of the valve by a smaller dither frequency (→ factor < 1), which results in a higher pressure amplitude.
- Reduction of the actual pressure value amplitude (→ factor > 1), which results in a worse dynamic of the valve.

Ex works, the factor is set to 1.

A change to the dither frequency should only be made after consultation with the Bosch Rexroth service department.

8.5.2 Relevant parameters

The following parameters are relevant for mapping the voltage or current signal of the analog command value input to the corresponding pressure command value.

➦ Chapter 9.25 “P-0-2890.0.6 - Solenoid current: Offset” on page 86

➦ Chapter 9.26 “P-0-2890.0.7 - Solenoid current: P-gain” on page 87

➦ Chapter 9.27 “P-0-2890.0.8 - Solenoid current controller: Dither frequency factor” on page 87

8.5.3 Setting via "easy2connect"

In the "easy2connect" smartphone app, the settings for the solenoid current controller can be adjusted in the "Controller" screen.

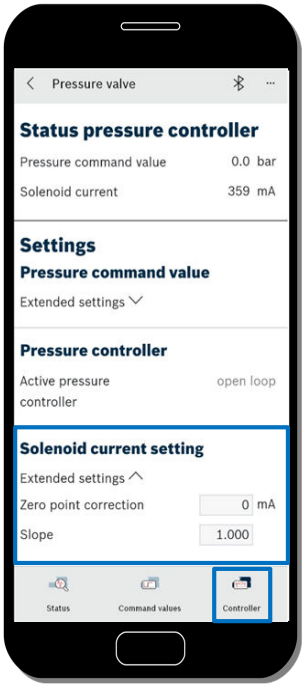


Fig. 53: "Controller" screen

9 Parameter descriptions

9.1 P-0-0115 - Valve status word

9.1.1 Description

This parameter indicates the current status of the pressure valve.

Status word set-up:

Bit	Name / Function	Comment
0-1	Reserved	
2	**Warning** 0: no warning 1: Warning active	
3-7	Reserved	

Bit	Name / Function	Comment
8-9	**Operating mode** 0b00: Open-loop pressure control active 0b01: Closed-loop pressure control active 0b10: reserved 0b11: reserved	
10-11	Reserved	
12	**Pressure command value reached** 0: Actual pressure value did not reach the pressure command value 1: Actual pressure value has reached the pressure command value according to the defined target window	See also further explanation of the status bit following this table.
13	**Error** 0: No error 1: Error active	
14	Reserved	
15	**Enable** 0: no enable 1: Enable active	

Status bit “Pressure command value reached”

The status bit "Pressure command value reached" is formed when the following conditions are met:

- Enable for the valve is set
- Pressure detection of the valve is active

When the status bit is formed, it is tested whether the difference between the pressure command value and the actual pressure value (pressure control deviation see S-0-0827) lies within a target window. The target window is permanently set to 2% of the nominal pressure of the valve (e.g. the nominal pressure of the valve is 200 bar → target window is 4 bar). If the pressure control deviation is within the target window, the corresponding status bit is set in the valve status (see P-0-0115). If the pressure control deviation leaves the target window for a period of more than 10 ms, the status bit in the valve status (see P-0-0115) is reset.

9.1.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.2 P-0-0116 - Valve control word

9.2.1 Description

This parameter displays the currently effective control word of the pressure valve. This parameter is described by the corresponding control word of the interface of the pressure valve (→ analog or digital interface) or the control word of the force mode:

- Pressure valve with analog interface (→ connector XH1): Active control word = P-0-4028
- Pressure valve with digital IO-Link interface (→ connector XH5): Active control word = P-0-1910.0.1
- Force mode in the pressure valve active: Active control word = P-0-0120

Set-up of the control word:

Bit	Name / Function	Comment
0-1	**Parameter set number**	
	0b00: Parameter set 0	
	0b01: Parameter set 1	
	0b10: Parameter set 2	
	0b11: Parameter set 3	
2-7	Reserved	
8-9	**Operating mode**	
	0b00: Open-loop pressure control active	
	0b01: Closed-loop pressure control active	
	0b10: reserved	
	0b11: reserved	
10-14	Reserved	
15	**Enable**	
	0: no enable	
	1: Enable active	

9.2.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.3 P-0-0120 - Force mode, control word

9.3.1 Description

When the force mode is active, the parameter is used for the control system of the pressure valve and is mapped into the control word (→ P-0-0116). To activate the force mode, the corresponding bit must be set in the parameter P-0-4085.

Set-up of the control word:

Bit	Name / Function	Comment
0-1	**Parameter set number**	
	0b00: Parameter set 0	
	0b01: Parameter set 1	
	0b10: Parameter set 2	
	0b11: Parameter set 3	
2-7	Reserved	
8-9	**Operating mode**	
	0b00: Open-loop pressure control active	
	0b01: Closed-loop pressure control active	
	0b10: reserved	
	0b11: reserved	
10-14	Reserved	
15	**Enable**	
	0: no enable	
	1: Enable active	

9.3.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.4 P-0-0190 - Valve electronics operating hours

9.4.1 Description

This parameter displays the operating time of the valve's electronics in seconds. With the aid of this parameter, the entire duty cycle of the electronics since delivery of the valve can thus be displayed.

9.4.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.5 P-0-0670.0.3 - Command: Load factory default values

9.5.1 Description

With this command, the condition as supplied of the valve can be restored in conjunction with command S-0-262. If the two commands S-0-0262 and P-0-0670.0.3 are executed in sequence, all configuration parameters of the valve are reset to the delivered condition.

After executing the commands, the S-0-0264 must be actuated so that the reset parameter values are stored in the valve in a remanent manner.

9.5.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.6 P-0-1520 - Valve electronics type

9.6.1 Description

This parameter displays the type designation of the valve electronics.

9.6.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.7 P-0-1910.0.1 - IO-Link: Pressure valve control word

9.7.1 Description

In this parameter, in the case of pressure valves with digital IO-Link interface (→ connector XH5), the control word is written which is received by the IO-Link master. The control word received via IO-Link is mapped into the effective control word of the pressure valve (→ P-0-0116).

Set-up of the control word:

Bit	Name / Function	Comment
0-1	**Parameter set number**	
	0b00: Parameter set 0	
	0b01: Parameter set 1	
	0b10: Parameter set 2	
	0b11: Parameter set 3	
2-4	Reserved	
5	**Delete error**	For future use
	0: Delete error not active	
	1: Delete error active	

Bit	Name / Function	Comment
6-7	Reserved	
8	**Activate closed-loop pressure control** 0: Activate open-loop pressure control 1: Activate closed-loop pressure control	Closed-loop pressure control can only be activated for valves with a pressure sensor.
9-14	Reserved	
15	**Enable valve control** 0: Valve output stage is not active 1: Valve output stage is active	

9.7.2 IO-Link mapping

Parameter set	Index	Subindex
-	75	0

9.8 P-0-1910.0.2 - IO-Link: Pressure valve status word

9.8.1 Description

In this parameter, for pressure valves with digital IO-Link interface (→ connector XH5), the status word is written which is transmitted to the IO-Link master.

Status word set-up:

Bit	Name / Function	Comment
0-1	**Parameter set number** 0b00: Parameter set 0 active 0b01: Parameter set 1 active 0b10: Parameter set 2 active 0b11: Parameter set 3 active	
2	Reserved	
3	**Pressure command value reached** 0: Actual pressure value did not reach the pressure command value 1: Actual pressure value has reached the pressure command value according to the defined target window	See also further explanation of the status bit following this table.
4-7	Reserved	

Bit	Name / Function	Comment
8-9	**Closed-loop pressure control active** 0: Open-loop pressure control active 1: Closed-loop pressure control active	Closed-loop pressure control is only possible with valves with a pressure sensor.
9	**Force mode** 0: Force mode not active 1: Force mode active	
10-11	Reserved	
12	**Warning** 0: No warning in valve 1: Warning in valve	For future use
13	**Error** 0: No error in valve 1: Error in valve	
14	**Valve in control** 0: Valve control is not active 1: Valve control is active	Pressure command values are processed cyclically
15	**Ready for operation** 0: Valve not ready for operation 1: Valve ready for operation	

Bit 3 - pressure command value reached:

The "Pressure command value reached" status bit is only set when the difference between the pressure command value and the actual pressure value is in the defined target window. In addition, the following conditions must be fulfilled for the status bit to be formed:

- The bit for enabling the valve is set.
- The valve pressure sensor is active.

9.8.2 IO-Link mapping

Parameter set	Index	Subindex
-	76	0

9.9 P-0-1910.0.3 - IO-Link: Start data storage backup

9.9.1 Description

This command can be used to trigger a data storage backup. To start the command, set it to "0x3". As a result, a data storage backup is requested in the IO-Link master. As soon as the master has performed the data storage backup, the parameter is reset to the value "0".

9.9.2 IO-Link mapping

Parameter set	Index	Subindex
-	77	0

9.10 P-0-1910.0.4 - IO-Link: Device ID

9.10.1 Description

This parameter displays the current IO-Link valve device ID.

9.10.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.11 P-0-2803 - Pressure command value preparation: Resulting pressure command value

9.11.1 Description

The parameter indicates the resulting pressure command value at the output of the pressure command value preparation. It is the input value for the pressure controller when closed-loop pressure control is active or for the solenoid current controller when the valve is in the open-loop pressure control mode.

9.11.2 IO-Link mapping

Parameter set	Index	Subindex
-	90	0

9.12 P-0-2875.0.7 - Valve: Nominal pressure

9.12.1 Description

The nominal pressure of the pressure valve can be read out via this parameter.

9.12.2 IO-Link mapping

Parameter set	Index	Subindex
-	83	0

9.13 P-0-2878.0.1 - Force mode: Pressure command value

9.13.1 Description

This parameter sets the pressure command value for force mode.

9.13.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.14 P-0-2885.0.1 - Valve electronics temperature

9.14.1 Description

This parameter displays the temperature of the valve electronics inside the controller housing.

9.14.2 IO-Link mapping

Parameter set	Index	Subindex
-	72	0

9.15 P-0-2885.0.3 - Actual supply voltage

9.15.1 Description

This parameter displays the valve supply voltage in volts.

9.15.2 IO-Link mapping

Parameter set	Index	Subindex
-	73	0

9.16 P-0-2885.0.20 - Diagnostics: Valve communication - Dongle

9.16.1 Description

This diagnostic parameter can be used to read out how often the serial connection between the valve controller and the Bluetooth dongle has been established.

9.16.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.17 P-0-2885.0.21 - Diagnostics: Valve communication - IO-Link

9.17.1 Description

This diagnostic parameter can be used to read out how often the serial connection between the valve controller and the IO-Link controller has been established.

9.17.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.18 P-0-2885.0.22 - Diagnostics: Life counter

9.18.1 Description

This parameter provides a free-running 1ms counter. The counter is used exclusively for diagnostic purposes.

9.18.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.19 P-0-2885.0.23 - Diagnostics: Error overview

9.19.1 Description

This status parameter displays an overview of the errors currently present in the valve. The errors are represented by individual bits. The status of the bits is updated cyclically.

Status parameter set-up

Bit	Name / Function	Comment
Analog command value input (→ connector XH1) configured as current input		
0	**Cable break** 0: No cable break 1: Cable break detected	A cable break is made on the input at a **current < 3.3 mA** detected. See also further notes on the command value input following this table.
1	**Signal exceedance** 0: No signal overflow 1: Signal overflow detected	A signal overflow is detected on the input at a **current >= 20.6 mA**. See also further notes on the command value input following this table.

Bit	Name / Function	Comment
2	**Overload** 0: No overload 1: Overload detected	An overload is detected on the input at a **current > 30 mA**. See also further notes on the command value input following this table.
3	Reserved	
Analog command value input (→ connector XH1) configured as voltage input		
4-7	Reserved	
Analog actual pressure value input (→ pressure sensor) configured as current input		
8	**Cable break** 0: No cable break 1: Cable break detected	A cable break is made on the input at a **current < 3.3 mA** detected. See also further notes on the actual pressure value input following this table.
9	**Signal exceedance** 0: No signal overflow 1: Signal overflow detected	A signal overflow is detected on the input at a **current >= 20.6 mA** See also further notes on the actual pressure value input following this table.
10	**Overload** 0: No overload 1: Overload detected	An overload is detected on the input at a **current > 30 mA**. See also further notes on the actual pressure value input following this table.
11	Reserved	
Analog actual pressure value input (→ pressure sensor) configured as voltage input		
12	**Cable break** 0: No cable break 1: Cable break detected	A cable break is made on the input at a **voltage < 0.04 V** detected. + See also further notes on the actual pressure value input following this table.
13	**Signal exceedance** 0: No signal overflow 1: Signal overflow detected	A signal overflow is detected on the input at a **voltage >= 10.2 V**. See also further notes on the actual pressure value input following this table.
14-15	Reserved	
Pressure controller		
16-19	Reserved	
Firmware		
20	**Compatibility check error** 0: No error 1: Firmware on valve controller and IO-Link controller are incompatible.	
21-23	Reserved	
Internal analog input for temperature measurement		

Bit	Name / Function	Comment
24	**Cable break**	
	0: No cable break	
	1: Cable break detected	
25	**Signal exceedance**	
	0: No signal overflow	
	1: Signal overflow detected	
26-27	Reserved	
Internal analog input for measuring the supply voltage		
28	**Cable break**	
	0: No cable break	
	1: Cable break detected	
29	**Signal exceedance**	
	0: No signal overflow	
	1: Signal overflow detected	
30-31	Reserved	

Analog command value input: Configuration and monitoring

The analog command value input (→ connector XH1) is configured as a voltage or current input via the control word P-0-2900.1.1.

For the command value input, monitoring for cable break, signal overload and overload is only active if the signal range is set via the parameters P-0-2900.1.8 and P-0-2900.1.9 according to the following table.

Configuration as	Signal range (lower limit) P-0-2900.1.8	Signal range (upper limit) P-0-2900.1.9
Current	>= 3.6 mA	<= 20.3 mA

Analog actual pressure value input: Configuration and monitoring

The analog actual pressure value input is configured as a voltage or current input via the control word P-0-2900.2.1.

For the actual pressure value input, monitoring for cable break, signal overload and overload is only active if the signal range is set via the parameters P-0-2900.2.8 and P-0-2900.2.9 according to the following table.

Configuration as	Signal range (lower limit) P-0-2900.2.8	Signal range (upper limit) P-0-2900.2.9
Voltage	>= 0.07 V	<= 10.17 V
Current	>= 3.6 mA	<= 20.3 mA

9.19.2 IO-Link mapping

Parameter set	Index	Subindex
-	114	0

9.20 P-0-2885.0.24 - Diagnostics: Error overview (permanent)

9.20.1 Description

This status parameter displays an overview of the errors which have occurred since the last time the valve was switched on. The errors are represented by individual bits. Once set bits are not reset.

Status parameter set-up

Bit	Name / Function	Comment
Analog command value input (→ connector XH1) configured as current input		
0	**Cable break** 0: No cable break 1: Cable break detected	A cable break is made on the input at a **current < 3.3 mA** detected. See also further notes on the command value input following this table.
1	**Signal exceedance** 0: No signal overflow 1: Signal overflow detected	A signal overflow is detected on the input at a **current >= 20.6 mA**. See also further notes on the command value input following this table.
2	**Overload** 0: No overload 1: Overload detected	An overload is detected on the input at a **current > 30 mA**. See also further notes on the command value input following this table.
3	Reserved	
Analog command value input (→ connector XH1) configured as voltage input		
4-7	Reserved	
Analog actual pressure value input (→ pressure sensor) configured as current input		
8	**Cable break** 0: No cable break 1: Cable break detected	A cable break is made on the input at a **current < 3.3 mA** detected. See also further notes on the actual pressure value input following this table.
9	**Signal exceedance** 0: No signal overflow 1: Signal overflow detected	A signal overflow is detected on the input at a **current >= 20.6 mA**. See also further notes on the actual pressure value input following this table.
10	**Overload** 0: No overload 1: Overload detected	An overload is detected on the input at a **current > 30 mA**. See also further notes on the actual pressure value input following this table.
11	Reserved	
Analog actual pressure value input (→ pressure sensor) configured as voltage input		
12	**Cable break** 0: No cable break 1: Cable break detected	A cable break is detected on the input at a **voltage < 0.04 V**. See also further notes on the actual pressure value input following this table.

Bit	Name / Function	Comment
13	**Signal exceedance** 0: No signal overflow 1: Signal overflow detected	A signal overflow is detected on the input at a **voltage >= 10.2 V**. See also further notes on the actual pressure value input following this table.
14-15	Reserved	
Pressure controller		
16-19	Reserved	
Firmware		
20	**Compatibility check error** 0: No error 1: Firmware on valve controller and IO-Link controller are incompatible.	
21-23	Reserved	
Internal analog input for temperature measurement		
24	**Cable break** 0: No cable break 1: Cable break detected	
25	**Signal exceedance** 0: No signal overflow 1: Signal overflow detected	
26-27	Reserved	
Internal analog input for measuring the supply voltage		
28	**Cable break** 0: No cable break 1: Cable break detected	
29	**Signal exceedance** 0: No signal overflow 1: Signal overflow detected	
30-31	Reserved	

Analog command value input: Configuration and monitoring

The analog command value input (→ connector XH1) is configured as a voltage or current input via the control word P-0-2900.1.1.

For the command value input, monitoring for cable break, signal overload and overload is only active if the signal range is set via the parameters P-0-2900.1.8 and P-0-2900.1.9 according to the following table.

Configuration as	Signal range (lower limit) P-0-2900.1.8	Signal range (upper limit) P-0-2900.1.9
Current	>= 3.6 mA	<= 20.3 mA

Analog actual pressure value input: Configuration and monitoring

The analog actual pressure value input is configured as a voltage or current input via the control word P-0-2900.2.1.

For the actual pressure value input, monitoring for cable break, signal overload and overload is only active if the signal range is set via the parameters P-0-2900.2.8 and P-0-2900.2.9 according to the following table.

Configuration as	Signal range (lower limit) P-0-2900.2.8	Signal range (upper limit) P-0-2900.2.9
Voltage	>= 0.07 V	<= 10.17 V
Current	>= 3.6 mA	<= 20.3 mA

9.20.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.21 P-0-2885.0.30 - Diagnostics: Firmware update status

9.21.1 Description

This 32-bit parameter displays status information about individual bits in the event of a firmware update of the IO-Link subsystem.

Bit	Name / Function	Comment
0	**Initialization** 0: Firmware update not started 1: Firmware update started	
1	**Check firmware integrity** 0: no action 1: Saved firmware integrity check started	
2	**Integrity check status** 0: Integrity check failed 1: Integrity check successful	
3	**Firmware transfer** 0: no transfer 1: Firmware is transferred to the subsystem	
4	**Result of firmware update** 0: Unable to complete update 1: Firmware update successfully transferred to subsystem	
5 - 18	Internal debug information	

9.21.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.22 P-0-2890.0.3 - pressure controller: Slider (controller behavior)

9.22.1 Description

This parameter sets the value of the slider for the pressure controller. Via the slider, the controller behavior of the pressure controller can be easily set between moderate, balanced and aggressive.

9.22.2 IO-Link mapping

Parameter set	Index	Subindex
0	100	1
1	100	2
2	100	3
3	100	4

9.23 P-0-2890.0.4 - pressure controller: Control word

9.23.1 Description

Functions of the pressure controller can be activated or deactivated via the control word.

Set-up of the control word:

Bit	Name / Function	Comment
0-3	Reserved	
4	**I-term switch-off behavior** 0: I-term of the pressure controller is frozen during switching off. 1: I-term of the pressure controller will be deleted during switching off.	
5	**Automatic switch-off of the PI-term** 0: not active 1: active	see also further explanation of the control bit following this table
6-7	Reserved	

Bit	Name / Function	Comment
8	**Slider** 0: Slider not active 1: Slider active	
9-15	Reserved	

Bit 5 - Automatic switch-off of the PI-term:

In case of command value jumps, the automatic switch-off of the PI-term of the pressure controller can be activated via the control bit. After an adjustable closed-loop error has been reached, the PI controller is automatically switched on again. This feature can prevent the pressure controller from overshooting in the case of command value jumps. By means of the parameters P-0-2892.0.12 and P-0-2892.0.13, the height of the command value step at which the switch-off of the PI controller takes place is predetermined as a function of direction. With the parameters P-0-2892.0.10 and P-0-2892.0.11, the control deviation is set as a function of direction, at which the PI controller becomes active again.

9.23.2 IO-Link mapping

Parameter set	Index	Subindex
0	81	1
1	81	2
2	81	3
3	81	4

9.24 P-0-2890.0.5 - Pressure command value preparation: Gain

9.24.1 Description

This parameter can be used to change the gain of the pressure command value.

Notice: The parameter shall be used only for internal testing purposes of the pressure controller and the solenoid current controller.

9.24.2 IO-Link mapping

Parameter set	Index	Subindex
-	93	0

9.25 P-0-2890.0.6 - Solenoid current: Offset

9.25.1 Description

This parameter can be used to set an offset for the solenoid current.

The valve is set ex works over the complete pressure range (→ 0 bar to the nominal pressure of the valve) for the optimal volume flow specified in the valve data sheet. Due to the aging of the pressure valve or due to a volume flow differing from the valve data sheet, this optimum adjustment no longer fits. This can be corrected accordingly via the offset for the solenoid current and the gain in P-0-2890.0.7.

9.25.2 IO-Link mapping

Parameter set	Index	Subindex
-	94	0

9.26 P-0-2890.0.7 - Solenoid current: P-gain

9.26.1 Description

This parameter will set the gain of the solenoid current.

The valve is set ex works over the complete pressure range (→ 0 bar to the nominal pressure of the valve) for the optimal volume flow specified in the valve data sheet. Due to the aging of the pressure valve or due to a volume flow differing from the valve data sheet, this optimum adjustment no longer fits. This can be corrected accordingly via the gain for the solenoid current and the offset in P-0-2890.0.6.

9.26.2 IO-Link mapping

Parameter set	Index	Subindex
-	95	0

9.27 P-0-2890.0.8 - Solenoid current controller: Dither frequency factor

9.27.1 Description

In this parameter is the factor by which the dither frequency calculated by the solenoid current controller is multiplied.

The dither frequency for the pressure valve is set ex works so that the two following conditions are optimally met:

- The dither has as little influence as possible on the **amplitude of the actual pressure value**.
- A corresponding **dynamic of the valve** is achieved.

The dither frequency can be adjusted via the factor in such a way that the pressure valve is optimized in response to one of the conditions:

- **Increasing the dynamics** of the valve by a smaller dither frequency (→ factor < 1), which results in a higher pressure amplitude.
- **Reduction of the actual pressure value amplitude** (→ factor > 1), which results in a worse dynamic of the valve.

Ex works, the factor is set to 1.

Attention: A change to the dither frequency should only be made after consultation with the Bosch Rexroth service department.

9.27.2 IO-Link mapping

Parameter set	Index	Subindex
-	96	0

9.28 P-0-2890.0.9 - Actual pressure value: Filter frequency

9.28.1 Description

In this parameter, the frequency of the PT1 filter is set, with which the actual pressure value detected via the pressure sensor is smoothened.

9.28.2 IO-Link mapping

Parameter set	Index	Subindex
-	91	0

9.29 P-0-2890.0.10 - pressure controller: Nozzle diameter flow rate

9.29.1 Description

This parameter specifies the diameter of the nozzle installed in the pressure valve. This information is required for the automatic calculation of the flow rate of the pressure valve (see P-0-2890.0.16).

9.29.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.30 P-0-2890.0.11 - pressure controller: Spring force flow rate

9.30.1 Description

This parameter specifies the force of the spring installed in the pressure valve in [bar]. This information is required for the automatic calculation of the flow rate of the pressure valve (see P-0-2890.0.16).

9.30.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.31 P-0-2890.0.12 - pressure controller: Medium density flow rate

9.31.1 Description

This parameter specifies the density of the oil used in [kg/dm]. This information is required for the automatic calculation of the flow rate of the pressure valve (see P-0-2890.0.16).

9.31.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.32 P-0-2890.0.13 - pressure controller: Valve flow rate

9.32.1 Description

This parameter specifies the flow rate of the pressure valve to be taken into account in the pressure controller when the automatic calculation of the flow rate is not activated (see also P-0-2890.0.16).

9.32.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.33 P-0-2892.0.1 - pressure controller: I-gain

9.33.1 Description

This parameter set the I-gain of the pressure controller.

9.33.2 IO-Link mapping

Parameter set	Index	Subindex
0	101	1
1	101	2
2	101	3
3	101	4

9.34 P-0-2892.0.2 - pressure controller: P-gain

9.34.1 Description

This parameter is used to set the proportional gain (P-gain) of the pressure controller.

9.34.2 IO-Link mapping

Parameter set	Index	Subindex
0	102	1
1	102	2
2	102	3
3	102	4

9.35 P-0-2892.0.3 - pressure controller: Gain, active damping

9.35.1 Description

In the pressure controller, within the framework of active damping, the change in the actual pressure value (→ velocity) is fed back to closed-loop control with a scaling factor in order to achieve a better controller behavior.

This parameter is used to set the factor by which the change in the actual pressure value is to be returned. The resulting value is subtracted from the output of the PI controller of the pressure controller.

Notice: The change in the actual pressure value (→ velocity) is determined with a clock pulse of 1 ms.

9.35.2 IO-Link mapping

Parameter set	Index	Subindex
0	103	1
1	103	2
2	103	3
3	103	4

9.36 P-0-2892.0.4 - pressure controller: Gain, I-term active damping

9.36.1 Description

In the pressure controller, within the framework of active damping, the change in the actual pressure value (→ velocity) is fed back to closed-loop control with a scaling factor in order to achieve a better controller behavior.

This parameter is used to set the factor by which the change in the actual pressure value is to be returned to the integrator part of the pressure controller. The resulting value is subtracted from the input signal of the integrator of the pressure controller.

Notice: The change in the actual pressure value (→ velocity) is detected with a sampling rate of 10 ms.

9.36.2 IO-Link mapping

Parameter set	Index	Subindex
0	104	1

Parameter set	Index	Subindex
1	104	2
2	104	3
3	104	4

9.37 P-0-2892.0.5 - pressure controller: Integrator switch-off threshold

9.37.1 Description

This parameter set the threshold at which the integrator of the pressure controller is switched off.

Switch-off behavior of the integrator The control word P-0-2890.0.4 defines whether the I-term of the control value of the pressure controller should be frozen or deleted during the switching off of the integrator.

9.37.2 IO-Link mapping

Parameter set	Index	Subindex
0	105	1
1	105	2
2	105	3
3	105	4

9.38 P-0-2892.0.6 - Pressure command value preparation: Ramp time positive

9.38.1 Description

The pressure command value is guided over a command value ramp to avoid abrupt changes. With this parameter, the ramp time for positive pressure command value changes is set.

9.38.2 IO-Link mapping

Parameter set	Index	Subindex
0	106	1
1	106	2
2	106	3
3	106	4

9.39 P-0-2892.0.7 - Pressure command value preparation: Ramp time negative

9.39.1 Description

The pressure command value is guided over a command value ramp to avoid abrupt changes. With this parameter, the ramp time for negative pressure command value changes is set.

9.39.2 IO-Link mapping

Parameter set	Index	Subindex
0	107	1
1	107	2
2	107	3
3	107	4

9.40 P-0-2892.0.8 - Pressure command value preparation: Filter frequency

9.40.1 Description

The pressure command value can be smoothened via a PT1 filter. Its filter frequency is set by this parameter.

9.40.2 IO-Link mapping

Parameter set	Index	Subindex
0	108	1
1	108	2
2	108	3
3	108	4

9.41 P-0-2900.1.1 - Analog command value input: Control word

9.41.1 Description

This parameter contains the control word for configuring the analog command value input of the pressure valve on the connector XH1. The analog command value input can be set as a voltage or current input via the control word.

Set-up of the control word:

Bit	Name / Function	Comment
0	**Activating the command value input** 0: Not active 1: Active	The conversion of the voltage or current signal on the command value input into the pressure command value (→ S-0-0800) is activated via the activation bit.
1-3	Reserved	-
4-5	**Type of signal** 0b00: Voltage (0-10V) 0b01: Current (4-20mA) 0b10: reserved 0b11: reserved	
6-15	Reserved	-

Conversion of the analog command value into V or mA into the pressure command value in bar

The voltage in V applied to the command value input or the current applied in mA is converted into a corresponding pressure command value in bar (→ S-0-0800). The conversion into pressure command value is defined by the following 4 parameters:

- P-0-2900.1.8
- P-0-2900.1.9
- P-0-2900.1.10
- P-0-2900.1.11

A signal range (e.g. 0-10 V) is defined via the two parameters P-0-2900.1.8 and P-0-2900.1.9, which is converted to a value range (e.g. 0-100 bar). The value range is set using the parameters P-0-2900.1.10 and P-0-2900.1.11.

9.41.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.42 P-0-2900.1.8 - Analog command value input: Signal range, lower limit

9.42.1 Description

In this parameter, the lower limit of the signal range for the analog command value input on the connector XH1 is set. Depending on the type of signal set in the control parameter P-0-2900.1.1, a value in V or mA is input in this parameter. This parameter is one of the parameters via which the conversion of the analog command value into V or mA into the pressure command value into bar is set.

Conversion of the analog command value into V or mA into the pressure command value in bar

The voltage in V applied to the command value input or the current applied in mA is converted into a corresponding pressure command value in bar (→ S-0-0800). The conversion into pressure command value is defined by the following 4 parameters:

- P-0-2900.1.8
- P-0-2900.1.9
- P-0-2900.1.10
- P-0-2900.1.11

A signal range (e.g. 0-10 V) is defined via the two parameters P-0-2900.1.8 and P-0-2900.1.9, which is converted to a value range (e.g. 0-100 bar). The value range is set using the parameters P-0-2900.1.10 and P-0-2900.1.11.

9.42.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.43 P-0-2900.1.9 - Analog command value input: Signal range, upper limit

9.43.1 Description

In this parameter, the upper limit of the signal range for the analog command value input on the connector XH1 is set. Depending on the type of signal set in the control parameter P-0-2900.1.1, a value in V or mA is input in this parameter. This parameter is one of the parameters via which the conversion of the analog command value into V or mA into the pressure command value into bar is set.

Conversion of the analog command value into V or mA into the pressure command value in bar

The voltage in V applied to the command value input or the current applied in mA is converted into a corresponding pressure command value in bar (→ S-0-0800). The conversion into pressure command value is defined by the following 4 parameters:

- P-0-2900.1.8
- P-0-2900.1.9
- P-0-2900.1.10
- P-0-2900.1.11

A signal range (e.g. 0-10 V) is defined via the two parameters P-0-2900.1.8 and P-0-2900.1.9, which is converted to a value range (e.g. 0-100 bar). The value range is set using the parameters P-0-2900.1.10 and P-0-2900.1.11.

9.43.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.44 P-0-2900.1.10 - Analog command value input: Value range, lower limit

9.44.1 Description

In this parameter, the lower limit of the value range for the analog command value input on the connector XH1 is set. In this parameter, a value is entered in bar. This parameter is one of the parameters via which the conversion of the analog command value into V or mA into the pressure command value into bar is set.

Conversion of the analog command value into V or mA into the pressure command value in bar

The voltage in V applied to the command value input or the current applied in mA is converted into a corresponding pressure command value in bar (→ S-0-0800). The conversion into pressure command value is defined by the following 4 parameters:

- P-0-2900.1.8
- P-0-2900.1.9
- P-0-2900.1.10
- P-0-2900.1.11

A signal range (e.g. 0-10 V) is defined via the two parameters P-0-2900.1.8 and P-0-2900.1.9, which is converted to a value range (e.g. 0-100 bar). The value range is set using the parameters P-0-2900.1.10 and P-0-2900.1.11.

9.44.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.45 P-0-2900.1.11 - Analog command value input: Value range, upper limit

9.45.1 Description

In this parameter, the upper limit of the value range for the analog command value input on the connector XH1 is set. In this parameter, a value is entered in bar. This parameter is one of the parameters via which the conversion of the analog command value into V or mA into the pressure command value into bar is set.

Conversion of the analog command value into V or mA into the pressure command value in bar

The voltage in V applied to the command value input or the current applied in mA is converted into a corresponding pressure command value in bar (→ S-0-0800). The conversion into pressure command value is defined by the following 4 parameters:

- P-0-2900.1.8
- P-0-2900.1.9
- P-0-2900.1.10
- P-0-2900.1.11

A signal range (e.g. 0-10 V) is defined via the two parameters P-0-2900.1.8 and P-0-2900.1.9, which is converted to a value range (e.g. 0-100 bar). The value range is set using the parameters P-0-2900.1.10 and P-0-2900.1.11.

9.45.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.46 P-0-2900.2.1 Analog actual pressure value input: Control word

9.46.1 Description

This parameter contains the control word for the configuration of the analog input of the pressure valve to which the internal or external pressure sensor is connected. The analog input can be set as a voltage or current input via the control word.

Set-up of the control word:

Bit	Name / Function	Comment
0	**Analog input activation** 0: Not active 1: Active	The conversion of the voltage or current signal on the analog input into the actual pressure value (→ S-0-0809) is activated via the activation bit.
1-3	Reserved	-
4-5	**Type of signal** 0b00: Voltage (0-10 V) 0b01: Current (4-20 mA) 0b10: reserved 0b11: reserved	
6-15	Reserved	-

Conversion of the analog actual pressure value into V or mA into the actual pressure value in bar

A voltage in V or a current in mA is present at the analog input to which the internal or external pressure sensor of the valve is connected. This voltage or current signal is converted into a corresponding actual pressure value in bar (→ S-0-0809). The conversion into the actual pressure value is defined by the following 4 parameters:

- P-0-2900.2.8
- P-0-2900.2.9
- P-0-2900.2.10
- P-0-2900.2.11

A signal range (e.g. 0.1-10 V) is defined via the two parameters P-0-2900.2.8 and P-0-2900.2.9, which is converted to a value range (e.g. 0-400 bar). The value range is set using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.46.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.47 P-0-2900.2.8 Analog actual pressure value input: Signal range, lower limit

9.47.1 Description

In this parameter, the lower limit of the signal range for the analog input is set, to which the internal or external pressure sensor of the valve is connected. Depending on the type of signal set in the control parameter P-0-2900.2.1, a value in V or mA is input in this parameter. This parameter is one of the parameters via which the conversion of the analog actual pressure value into V or mA into the actual pressure value into bar is set.

Conversion of the analog actual pressure value into V or mA into the actual pressure value in bar. A voltage in V or a current in mA is present at the analog input to which the internal or external pressure sensor of the valve is connected. This voltage or current signal is converted into a corresponding actual pressure value in bar (→ S-0-0809). The conversion into the actual pressure value is defined by the following 4 parameters:

- P-0-2900.2.8
- P-0-2900.2.9
- P-0-2900.2.10
- P-0-2900.2.11

A signal range (e.g. 0.1-10 V) is defined via the two parameters P-0-2900.2.8 and P-0-2900.2.9, which is converted to a value range (e.g. 0-400 bar). The value range is set using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.47.2 IO-Link mapping

Parameter set	Index	Subindex
-	86	0

9.48 P-0-2900.2.9 - Analog actual pressure value input: Signal range, upper limit

9.48.1 Description

In this parameter, the upper limit of the signal range for the analog input is set, to which the internal or external pressure sensor of the valve is connected. Depending on the type of signal set in the control parameter P-0-2900.2.1, a value in V or mA is input in this parameter. This parameter is one of the parameters via which the conversion of the analog actual pressure value into V or mA into the actual pressure value into bar is set.

Conversion of the analog actual pressure value into V or mA into the actual pressure value in bar

A voltage in V or a current in mA is present at the analog input to which the internal or external pressure sensor of the valve is connected. This voltage or current signal is converted into a corresponding actual pressure value in bar (→ S-0-0809). The conversion into the actual pressure value is defined by the following 4 parameters:

- P-0-2900.2.8
- P-0-2900.2.9
- P-0-2900.2.10
- P-0-2900.2.11

A signal range (e.g. 0.1-10 V) is defined via the two parameters P-0-2900.2.8 and P-0-2900.2.9, which is converted to a value range (e.g. 0-400 bar). The value range is set using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.48.2 IO-Link mapping

Parameter set	Index	Subindex
-	87	0

9.49 P-0-2900.2.10 - Analog actual pressure value input: Value range, lower limit

9.49.1 Description

In this parameter, the lower limit of the value range for the analog input is set, to which the internal or external pressure sensor of the valve is connected. In this parameter, a value is entered in bar. This parameter is one of the parameters via which the conversion of the analog actual pressure value into V or mA into the actual pressure value into bar is set.

Conversion of the analog actual pressure value into V or mA into the actual pressure value in bar

A voltage in V or a current in mA is present at the analog input to which the internal or external pressure sensor of the valve is connected. This voltage or current signal is converted into a corresponding actual pressure value in bar (→ S-0-0809). The conversion into the actual pressure value is defined by the following 4 parameters:

- P-0-2900.2.8
- P-0-2900.2.9
- P-0-2900.2.10
- P-0-2900.2.11

A signal range (e.g. 0.1-10 V) is defined via the two parameters P-0-2900.2.8 and P-0-2900.2.9, which is converted to a value range (e.g. 0-400 bar). The value range is set using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.49.2 IO-Link mapping

Parameter set	Index	Subindex
-	88	0

9.50 P-0-2900.2.11 - Analog actual pressure value input: Value range, upper limit

9.50.1 Description

In this parameter, the upper limit of the value range for the analog input is set, to which the internal or external pressure sensor of the valve is connected. In this parameter, a value is entered in bar. This parameter is one of the parameters via which the conversion of the analog actual pressure value into V or mA into the actual pressure value into bar is set.

Conversion of the analog actual pressure value into V or mA into the actual pressure value in bar

A voltage in V or a current in mA is present at the analog input to which the internal or external pressure sensor of the valve is connected. This voltage or current signal is converted into a corresponding actual pressure value in bar (→ S-0-0809). The conversion into the actual pressure value is defined by the following 4 parameters:

- P-0-2900.2.8
- P-0-2900.2.9
- P-0-2900.2.10
- P-0-2900.2.11

A signal range (e.g. 0.1-10 V) is defined via the two parameters P-0-2900.2.8 and P-0-2900.2.9, which is converted to a value range (e.g. 0-400 bar). The value range is set using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.50.2 IO-Link mapping

Parameter set	Index	Subindex
-	89	0

9.51 P-0-2907.1.1 - Analog command value input: Actual value

9.51.1 Description

This parameter indicates the voltage currently applied to the analog command value input (→ connector XH1) or the current applied.

For this parameter to display a corresponding value, the following conditions must be met:

- The analog command value input was activated via the control parameter P-0-2900.1.1.
- The parameters for converting the analog command value (V or mA) into the pressure command value in bar are correctly configured. These are the following parameters:
  - P-0-2900.1.8
  - P-0-2900.1.9
  - P-0-2900.1.10
  - P-0-2900.1.11

Depending on the type of signal set in the control parameter P-0-2900.1.1, a value in V or mA is displayed in this parameter.

9.51.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.52 P-0-2907.2.1 - Analog actual pressure value input: Actual value

9.52.1 Description

This parameter indicates the currently applied voltage or current at the analog input of the pressure valve to which the internal or external pressure sensor is connected.

In order for a corresponding voltage or current value to be displayed in this parameter, the following conditions must be met:

- The analog input was activated via the control parameter P-0-2900.2.1.
- The parameters for converting the analog actual pressure value (V or mA) into the actual pressure value in bar are correctly configured. These are the following parameters:
  - P-0-2900.2.8
  - P-0-2900.2.9
  - P-0-2900.2.10
  - P-0-2900.2.11

Depending on the type of signal set in the control parameter P-0-2900.2.1, a value in V or mA is displayed in this parameter.

9.52.2 IO-Link mapping

Parameter set	Index	Subindex
-	84	0

9.53 P-0-2908.1.1 - Analog actual value output: Actual value

9.53.1 Description

This parameter indicates the current output voltage or output current at the analog actual value output of the pressure valve (→ connector XH1).

For this parameter to display a corresponding value, the following conditions must be met:

- The analog actual value output was activated via the control parameter P-0-2900.2.1.

Depending on the type of signal set in the control parameter P-0-2900.2.1, a value in V or mA is displayed in this parameter.

9.53.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.54 P-0-2908.1.2 - Analog actual value output: Control word

9.54.1 Description

This parameter contains the control word for configuring the analog actual value output of the pressure valve on the connector XH1. The analog actual value output can be set as a voltage or current output via the control word.

Set-up of the control word:

Bit	Name / Function	Comment
0	**Activation of the actual value output** 0: Not active 1: Active	The output of the actual pressure value to the analog actual value output is activated via the activation bit.
1-3	Reserved	-
4-5	**Type of signal** 0b00: Voltage (0-10 V) 0b01: Current (4-20 mA) 0b10: reserved 0b11: reserved	The type of signal is used to set whether the actual pressure value is output as a voltage signal in the range from 0 to 10 V or as a current signal in the current range from 4 to 20 mA.
6-15	Reserved	-

9.54.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.55 P-0-2915.0.3 - Actual current value: Solenoid A

9.55.1 Description

This parameter displays the current actual current value in the solenoid of the pressure valve. The actual current value is shown in mA.

9.55.2 IO-Link mapping

Parameter set	Index	Subindex
-	82	0

9.56 P-0-4028 - Valve: Control word

9.56.1 Description

In this parameter, the control word of the pressure valve is used for pressure valves with an analog interface (→ connector XH1). This parameter is mapped into the effective control word of the pressure valve (→ P-0-0116).

Set-up of the control word:

Bit	Name / Function	Comment
0-1	**Parameter set number**	
	0b00: Parameter set 0	
	0b01: Parameter set 1	
	0b10: Parameter set 2	
	0b11: Parameter set 3	
2-7	Reserved	
8-9	**Operating mode**	
	0b00: Open-loop pressure control active	
	0b01: Closed-loop pressure control active	
	0b10: reserved	
	0b11: reserved	
10-14	Reserved	
15	**Enable**	
	0: no enable	
	1: Enable active	

9.56.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.57 P-0-4073 - IO link: Diagnosis

9.57.1 Description

This parameter displays the state of the IO interface of the valve as a string.

Displayed string	Meaning
"not active"	No cyclic data exchange via IO-Link
"cyclic"	Cyclic data exchange via IO-Link.

9.57.2 IO-Link mapping

Parameter set	Index	Subindex
-	69	0

9.58 P-0-4085 - Force mode: Configuration

9.58.1 Description

This parameter is used to configure the force mode.

Bit	Name / Function	Comment
0-3	Reserved	
4	**Valve enable forcing** 0: Not active 1: Active	If the bit is set (active), the enable that is set via P-0-0120 is active. Otherwise, the valve enable which is specified via parameter P-0-4028 (→ pressure valve with analog interface) or P-0-1910.0.1 (→ pressure valve with digital IO-Link interface) is active.
5	**Parameter set forcing** 0: Not active 1: Active	If the bit is set (active), the parameter set that is set via P-0-0120 is active. Otherwise, the parameter set which is specified via P-0-4028 (→ pressure valve with analog interface) or P-0-1910.0.1 (→ pressure valve with digital IO-Link interface) is active.
6	**Pressure command value forcing** 0: Not active 1: Active	If the bit is set (active), then the pressure command value acts in P-0-2878.0.1. Otherwise, the pressure command value is active in S-0-0800, which is specified via the analog interface or the digital IO-Link interface.
7	**Operating mode forcing** 0: Not active 1: Active	If the bit is set (active), the operating mode that is set via P-0-0120 is active. Otherwise, the operating mode which is specified via P-0-4028 (→ pressure valve with analog interface) or P-0-1910.0.1 (→ pressure valve with digital IO-Link interface) is active.
8-15	Reserved	

9.58.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.59 S-0-0017 - List of all valve parameters

9.59.1 Description

This parameter contains the list with the identifiers of all parameters present in the valve (→ configuration parameters and process parameters). The desired functionality of the valve is set by means of the configuration parameters (e.g. command value preparation, controller). Current actual values and states of the valve are displayed via the process parameters (e.g. actual current value, error status)

Parameter list depending on the logged in user

The contents of the list depends on the user currently logged in to the valve and their access rights. The user currently logged into the valve is displayed in parameter P-0-2909.0.1.

9.59.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.60 S-0-0030 - Firmware version

9.60.1 Description

The parameter contains the firmware version of the valve as a string. The string is structured as follows:

FWA-HYDRVX-**<firmware derivative>**-**<major version>**.**<minor version>**.**<patch version>**-E1

e.g. FWA-HYDRVX-HVP-1.1.0-E1

9.60.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.61 S-0-0140 - Valve designation

9.61.1 Description

This parameter displays the valve ordering information according to the type key.

Notice: The parameter S-0-1300.0.4 also contains the ordering information of the valve. For compatibility reasons, this parameter is currently required in addition to the S-0-1300.0.4.

9.61.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.62 S-0-0192 - List of all configuration parameters

9.62.1 Description

This parameter contains the list of all configuration parameters present in the valve. The desired functionality of the valve is set via the configuration parameters (e.g. command value preparation, controller). Th configuration parameters for the valve are optimally set ex works and their values are stored in the valve.

Parameter list depending on the logged in user

The contents of the displayed parameter list depends on the user currently logged in to the valve and their access rights. The user currently logged into the valve is displayed in parameter P-0-2909.0.1.

Saving the configuration parameters

If configuration parameters are changed, they are not automatically stored, but must be remanently secured in the valve via command S-0-0264.

9.62.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.63 S-0-0254 - Current parameter set

9.63.1 Description

This parameter indicates which parameter set is currently active. The following assignment applies:

- 0 = parameter set 0 is active
- 1 = parameter set 1 is active
- 2 = parameter set 2 is active
- 3 = parameter set 3 is active

9.63.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.64 S-0-0262 - Command: Load default values

9.64.1 Description

With this command, the condition as supplied of the valve can be restored in conjunction with command P-0-0670.0.3. If the two commands S-0-0262 and P-0-0670.0.3 are executed in sequence, all configuration parameters of the valve are reset to the values with which the valve was delivered ex works.

After executing the commands, the command S-0-0264 must be executed so that the reset parameter values are stored in the valve in a remanent manner.

When the valve condition as supplied is restored, the admin password is **not** reset.

9.64.2 IO-Link mapping

System command
130

9.65 S-0-0264 - Command: Save configuration parameters

9.65.1 Description

With this command, the configuration parameters are permanently saved in the valve. The parameter S-0-0192 contains the list of configuration parameters.

9.65.2 IO-Link mapping

System command
161

9.66 S-0-0800 - Pressure command value

9.66.1 Description

This parameter shows the current pressure command value at which either analog, via the analog desired value input (→ connector XH1), or digital, via the IO-Link interface (→ connector XH5), is preset.

9.66.2 IO-Link mapping

Parameter set	Index	Subindex
-	78	0

9.67 S-0-0809 - Actual pressure value

9.67.1 Description

This parameter displays the current actual pressure value.

9.67.2 IO-Link mapping

Parameter set	Index	Subindex
-	79	0

9.68 S-0-0814 - Tank pressure

9.68.1 Description

This parameter is where the tank pressure for the pressure valve is set.

Notice: This parameter is currently only required for the production of the pressure valve to determine the internal pressure/current characteristic curve.

9.68.2 IO-Link mapping

Parameter set	Index	Subindex
-	74	0

9.69 S-0-0827 - Pressure control deviation

9.69.1 Description

This parameter displays the current pressure control deviation.

9.69.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

10 Appendix

10.1 List of addresses

Contacts for service and spare parts

Bosch Rexroth AG
Bürgermeister-Dr.-Nebel-Straße 8
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Phone +49 (0) 9352/40 50 60
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For questions about the product

Phone +49 (0) 9352/40 30 20

Email my.support@boschrexroth.de

The addresses of our sales and service network and sales organizations can be found at www.boschrexroth.com/adressen

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