DBR AUTOMATION

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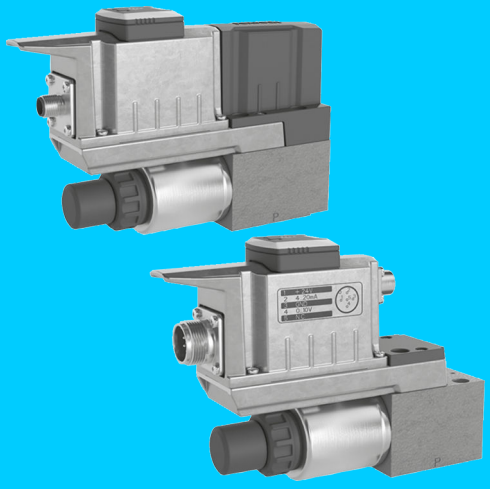
A Bosch Company

Application Manual

DBETE, DBETA

Proportional pressure relief valve, direct operated, with integrated digital electronics (OBED)



RE29263-FK/06.23, 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.

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Table of contents

1 About this documentation

1.1 Validity of the documentation

This documentation is valid for the following products:

- Proportional pressure relief valve, direct operated, with integrated digital electronics (OBED), type DBETE, DBETA

This functional description is only valid in conjunction with "Data Sheet 29263" and "Operating Instructions 07600-B", see ➦ Chapter 1.2 “Required and supplementary documentation” on page 13.

Read the functional description, in particular ➦ Chapter 2 “Safety instructions” on page 14 and the above documents completely before using the proportional pressure relief 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	06.23	Initial version

1.2 Required and supplementary 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 relief valve, direct operated, with or without integrated digital electronics (OBED) type DBET, DBET, DBETE and DBETA	R.29263 ➦ 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	DCTC-31000-268	Manufacturer's Declaration of Conformity
🕮	Pressure transducer for hydraulic applications type HM20	R.30270-MON ➦ https://boschrexroth.com	Installation 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 About 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 direct operated proportional pressure relief valve of seat design.

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 limiting 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 usage. Intended use includes having read and understood this documentation completely, especially ➦ Chapter 2 “Safety instructions” on page 14.

2.3 Improper use

Any use other than described in the section “Intended use” is considered as improper and is therefore not permitted und renders any warranty claims null and void. It is also regarded as improper use if the valve is operated outside the indicated performance limits and operating conditions, especially the required ambient 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 are able to recognize potential hazards and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant requirements 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 who install, operate, dismount or maintain Rexroth products must not consume any alcohol, other drugs or pharmaceuticals that may affect their ability to respond.
- Only use genuine Rexroth accessories and spare parts in order to exclude 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.

Password assignment

In the as-supplied condition of the valve, no administrator password has been assigned. Upon your first login you have to determine a password. It is recommended that your first signing in takes place in a safe environment to make sure that the connection is established with the correct device.

Observe common password recommendations to ensure safety of your data.

Password recommendations:

- **Length** Select a password that contains at least 8 characters. It is recommended using a combination of lowercases, uppercases, numbers and special characters.
- **Uniqueness**: Use a unique password for every module. Reused passwords may pose a security risk.
- **Complexity:** Avoid simple and easy-to-guess passwords like “123456” or “password” Use a combination of random characters to increase the security level.
- **Password manager:** The use of a password manager is recommended for generating and securely storing complex and unique passwords.

If you lose a password you can request a reset password from our service department. Please contact our customer support for further information and assistance.

The responsibility for the security of the password and the adherence to password guidelines lies with the user. Bosch Rexroth will not assume responsibility for loss or damage caused by improper handling of the password.

3 Overview of direct operated proportional pressure relief valves DBET(E,A)-7x

3.1 General information

Proportional pressure relief valves DBET(E,A) are remote control valves of seat design. They are used for limiting a system pressure. The valves are parameterized ex works in accordance with the ordering code and delivered fully functional. For optimum adaptation to the hydraulic application 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 of pressure control).

The hydraulic functionality of the valve is described in more detail in "data sheet 29263".

3.2 Valve types

The following valve types are differentiated in the valve family of direct operated proportional pressure relief valves:

- DBETE
- DBETA with external pressure sensor
- DBETA with integrated pressure sensor

3.2.1 DBETE

The following shows the set-up and function of the valve type DBETE:

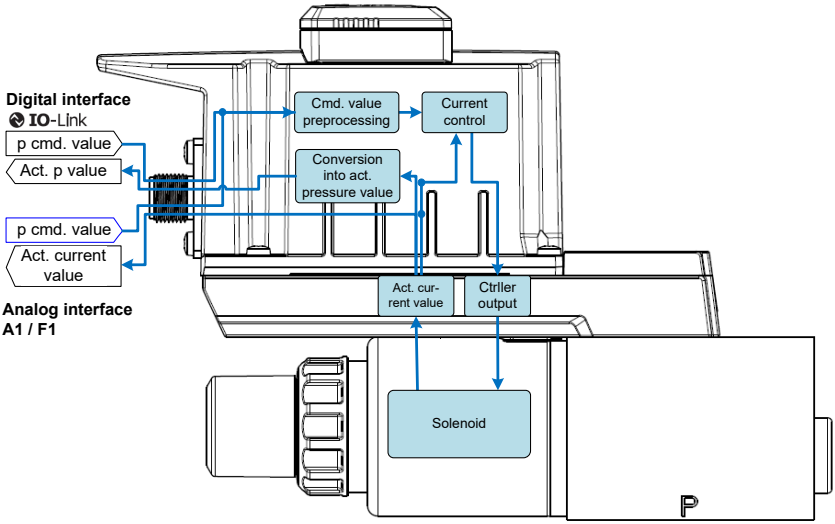


Fig. 1: Overview of DBETE

On the proportional solenoid, there is the digital on-board electronics (OBED). It 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 fed to the proportional solenoid as controller output and used as a basis for corrections. The given pressure command value will then become the actual pressure value.

3.2.2 DBETA with external pressure sensor

The following shows the set-up and function of valve type DBETA with external pressure sensor:

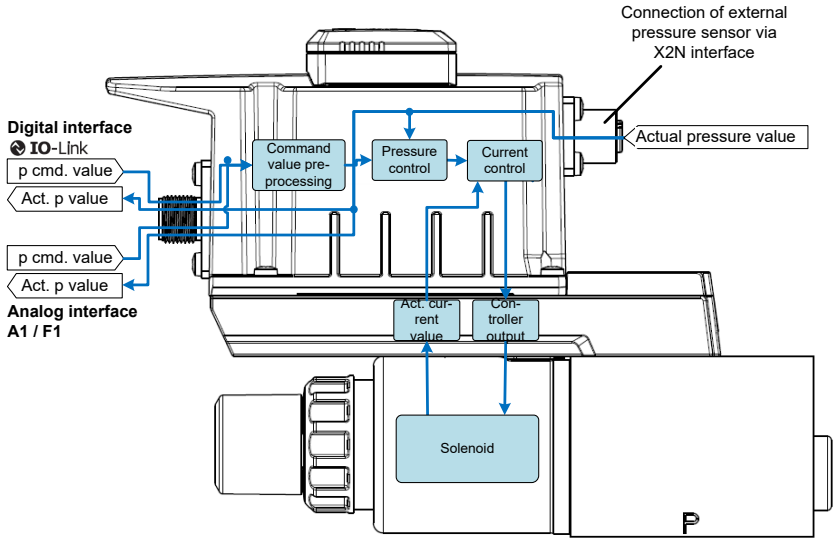


Fig. 2: Overview of DBETA

On the proportional solenoid, there is the digital on-board electronics (OBED). It 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 received from the higher-level control is used for controlling in the on-board electronics. The actual pressure value is detected via an external pressure sensor connected to the interface X2N.

Depending on the nominal pressure of the valve, the following external pressure sensors are recommended, since they are preset ex works:

Nominal pressure of the valve	Recommended pressure sensor	Nominal pressure of pressure sensor
50 bar	HM20-2X/160-H-K35 (R901381347)	160 bar
100 bar	HM20-2X/160-H-K35 (R901381347)	160 bar
200 bar	HM20-2X/400-H-K35-N (R901466598)	400 bar
250 bar	HM20-2X/400-H-K35-N (R901466598)	400 bar
315 bar	HM20-2X/400-H-K35-N (R901466598)	400 bar
350 bar	HM20-2X/400-H-K35-N (R901466598)	400 bar
420 bar	HM20-2X/630-H-K35-N (R901342036)	630 bar
500 bar	HM20-2X/630-H-K35-N (R901342036)	630 bar

3.2.3 DBETA with integrated pressure sensor

The following shows the set-up and function of valve type DBETA with integrated pressure sensor:

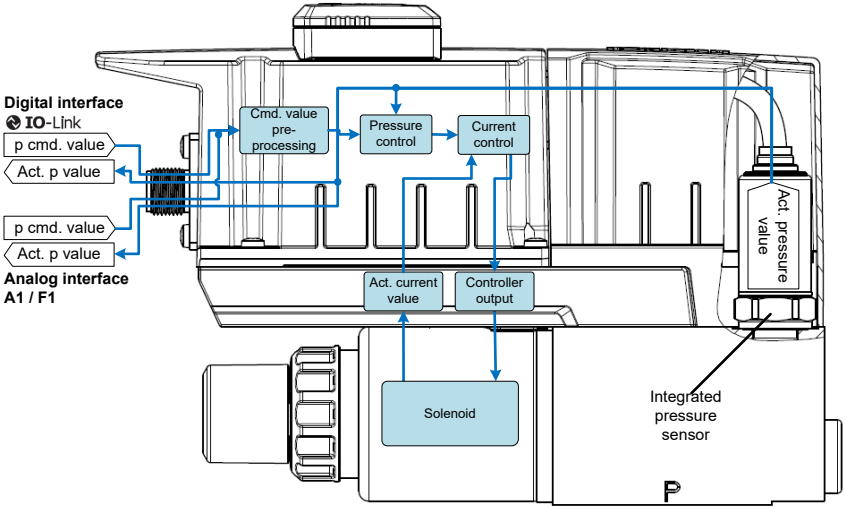


Fig. 3: Overview of DBETA with integrated pressure sensor

On the proportional solenoid, there is the digital on-board electronics (OBED). It 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, 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 received from the higher-level control is used for controlling 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).

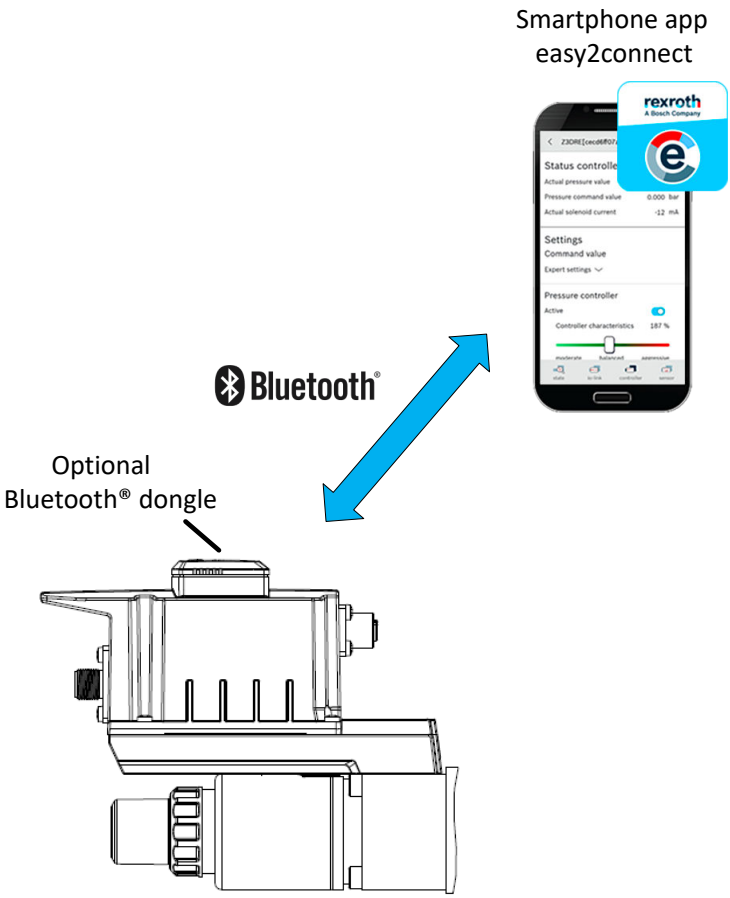


Fig. 4: Overview of Bluetooth dongle

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.

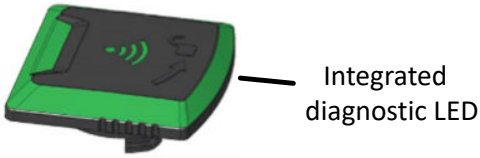


Fig. 5: Overview of diagnostic LED

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.

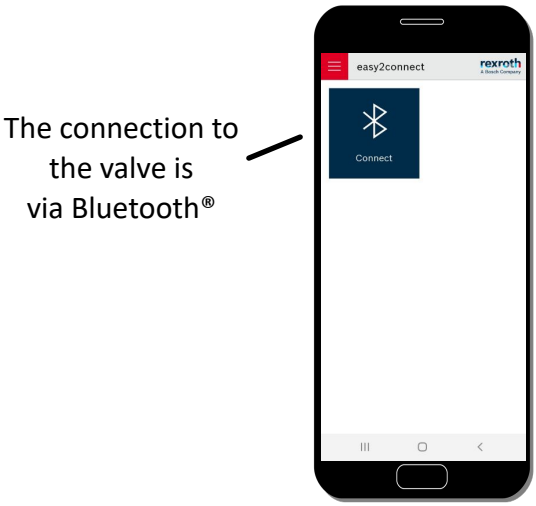


Fig. 6: easy2connect connection

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

- Electronic valve nameplate
- 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.

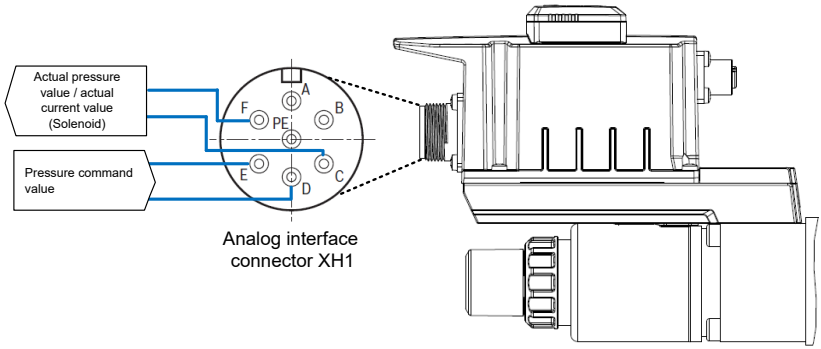


Fig. 7: Analog interface, device connector pinout

Pinout of 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 electrical 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 according 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 provided as a voltage or current signal via pins D and E of the valve connector XH1. 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:

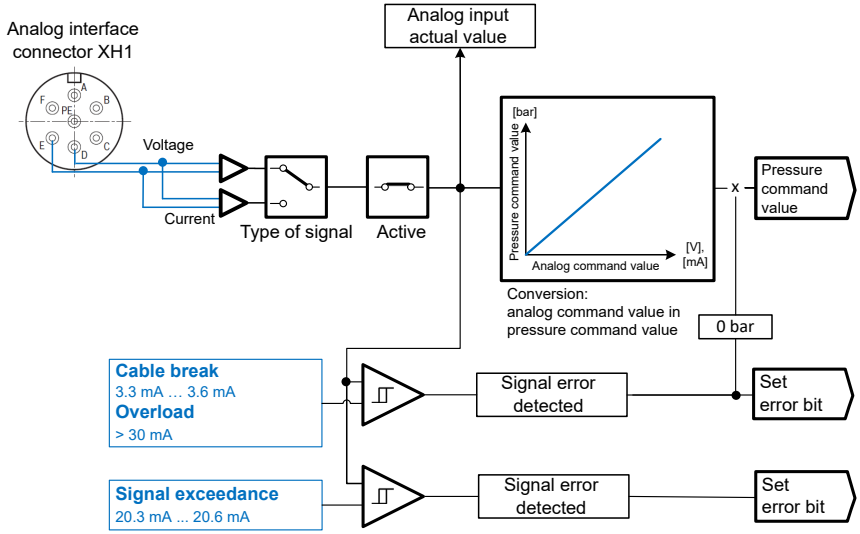


Fig. 8: Functional description of pressure command value

Type of signal

The type of signal is used to set whether the analog command value of the connector XH1 is provided as a voltage signal in the range from 0 to 10 V or as a current signal in the 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 into a pressure command value

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

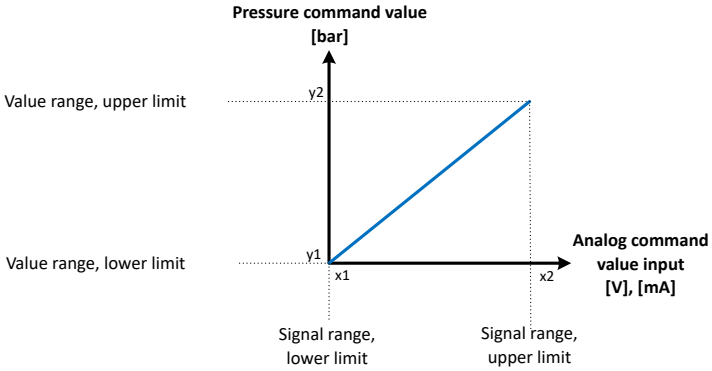


Fig. 9: Conversion of the analog command value into a pressure command value

By 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: Pressure command 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.

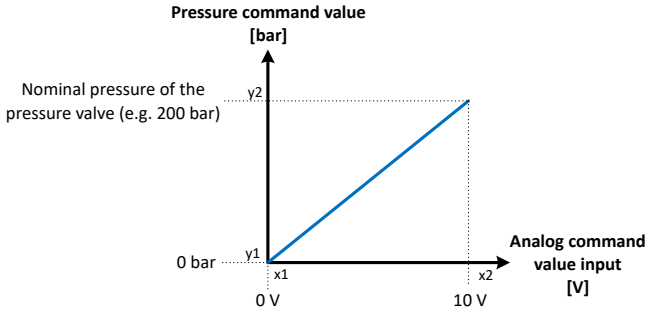


Fig. 11: Version A1

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: Pressure command value 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.

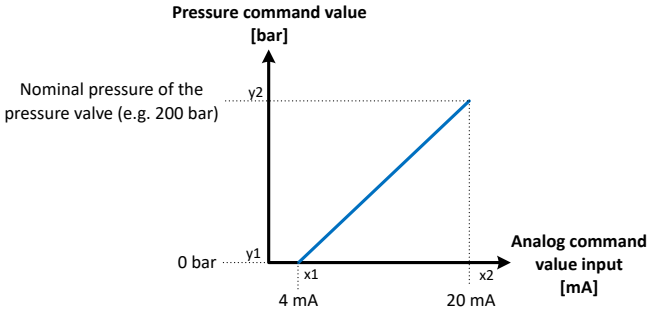


Fig. 13: Version F1

Example:

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

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

Fig. 14: Pressure command value formula

Maximum settable 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 settable 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 overloading 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 overflow occurs, only the associated error bit is set, the pressure command value is not affected.

Once the error has been fixed, the pressure command value is again generated as usual. This does not require manual intervention, such as acknowledging the error.

Signal thresholds for cable break, signal overflow and overload:

The following table shows from which signal threshold a cable break, a signal overflow or overloading is detected and automatically acknowledged.

Command value input configured as	Cable break		Signal overflow		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

Monitoring for cable break, signal overflow 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 settable signal range	
	Lower limit	Upper limit
Current (F1)	≥ 3.6 mA	≤ 20.3 mA

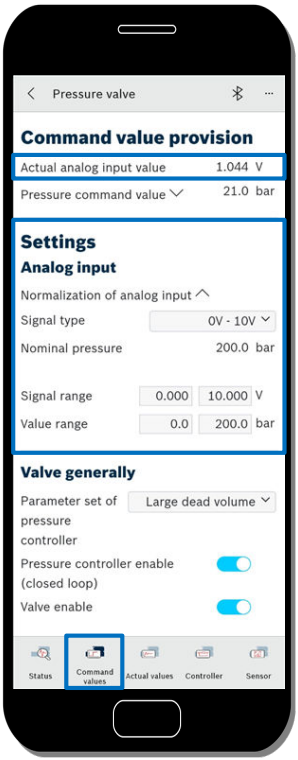
4.2.2 Relevant parameters

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 9.78 “S-0-0800 - Pressure command value” on page 125
➥ Chapter 9.12 “P-0-2875.0.7 - Valve: Nominal pressure” on page 86
➥ Chapter 9.19 “P-0-2885.0.23 - Diagnostics: Error overview” on page 87
➥ Chapter 9.63 “P-0-2907.1.1 - Analog command value input: Actual value” on page 118
➥ Chapter 9.53 “P-0-2900.1.1 - Analog command value input: Control word” on page 111
➥ Chapter 9.54 “P-0-2900.1.8 - Analog command value input: Signal range, lower limit” on page 112
➥ Chapter 9.55 “P-0-2900.1.9 - Analog command value input: Signal range, upper limit” on page 112
➥ Chapter 9.56 “P-0-2900.1.10 - Analog command value input: Value range, lower limit” on page 113
➥ Chapter 9.57 “P-0-2900.1.11 - Analog command value input: Value range, upper limit” on page 114

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 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 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:

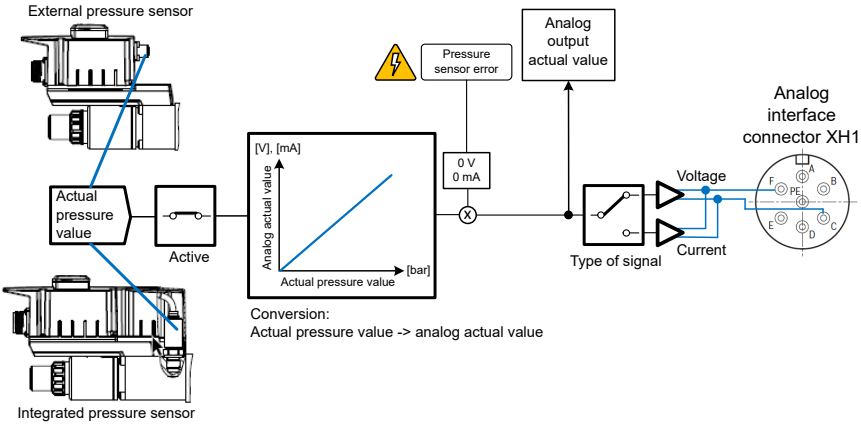


Fig. 16: Functional description of actual pressure value

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:

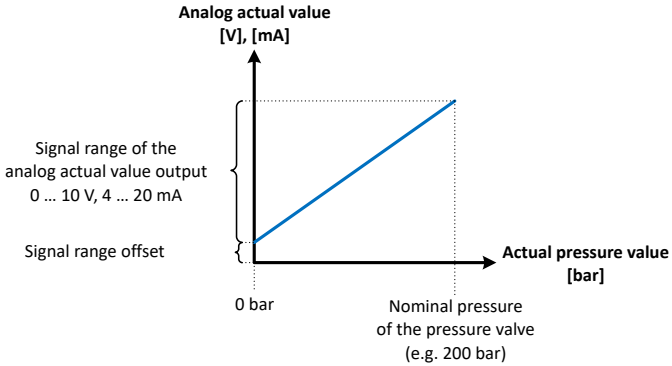


Fig. 17: Conversion of the actual pressure value into an analog actual value

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.

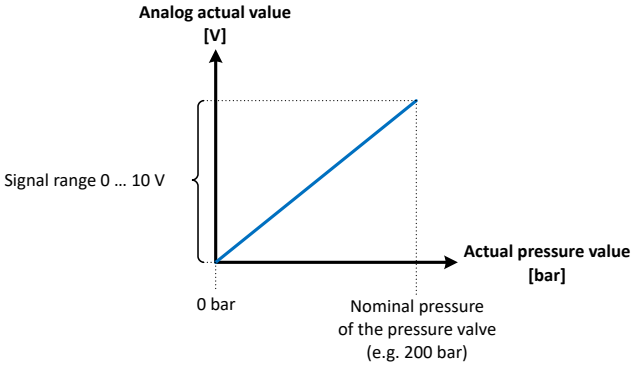


Fig. 19: Version A1

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 value output 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.

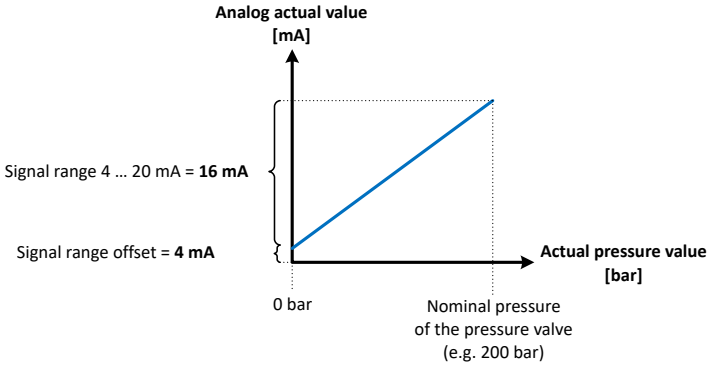


Fig. 21: Version F1

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 value output formula

Pressure sensor error

If there are cable break or overload errors present at the pressure sensor, then the voltage or current signal is output at 0 V or 0 mA to the actual value output. In the case of a signal overflow, 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 9.79 “S-0-0809 - Actual pressure value” on page 125

➦ Chapter 9.12 “P-0-2875.0.7 - Valve: Nominal pressure” on page 86

➦ Chapter 9.65 “P-0-2908.1.1 - Analog actual value output: Actual value” on page 119

➦ Chapter 9.66 “P-0-2908.1.2 - Analog actual value output: Control word” on page 119

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 to be optimized.

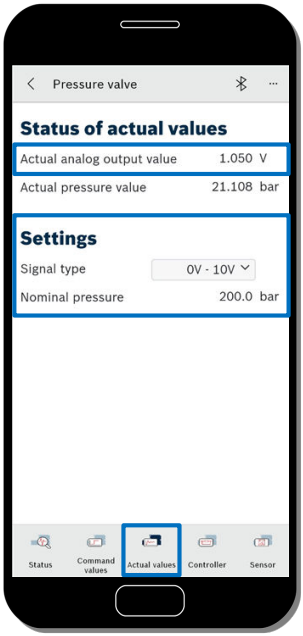


Fig. 23: Actual values screen

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 pins F and C of 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.

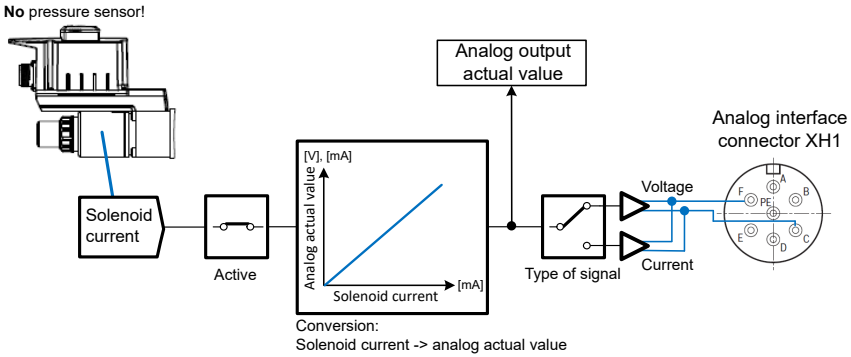


Fig. 24: Functional description of actual current value

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 switched on 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.

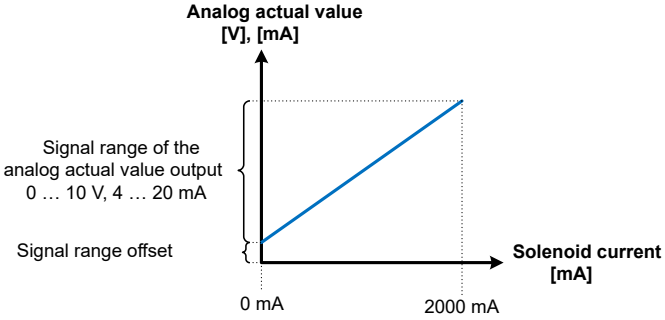


Fig. 25: Conversion of the actual current value into an analog actual value

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.

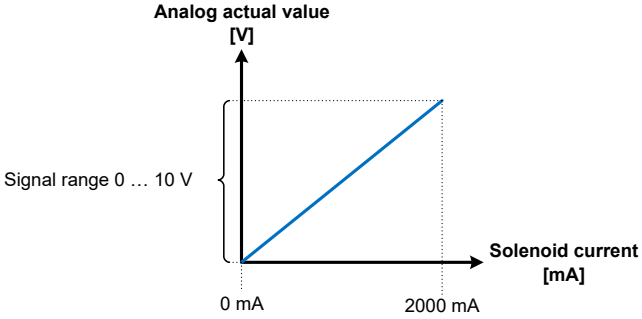


Fig. 27: Version A1

Example:

Solenoid current: 500 mA

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

Fig. 28: Solenoid current 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.

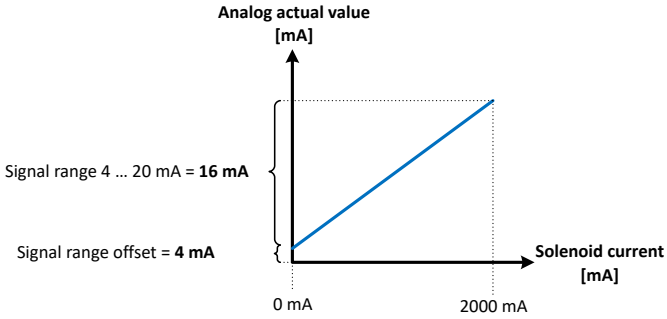


Fig. 29: Version F1

Example:

Actual current value = 500 mA

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

Fig. 30: Solenoid current 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 9.67 “P-0-2915.0.3 - Actual current value: Solenoid A” on page 120
➥ Chapter 9.12 “P-0-2875.0.7 - Valve: Nominal pressure” on page 86
➥ Chapter 9.65 “P-0-2908.1.1 - Analog actual value output: Actual value” on page 119
➥ Chapter 9.66 “P-0-2908.1.2 - Analog actual value output: Control word” on page 119

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

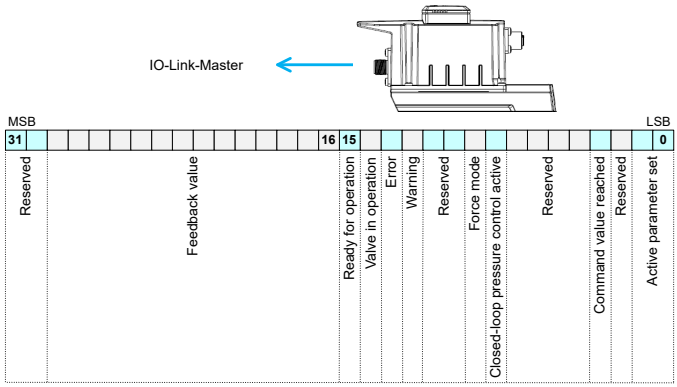
5.1 Process data

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.



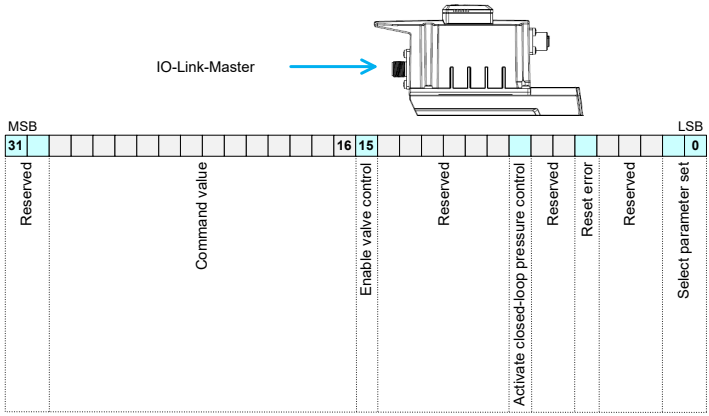
Name	Description	Data type	Bit offset	Bit lenght	Value range / comment
Reserved	--	--	30	2	
Feedback value	Actual pressure value	IntegerT	16	14	Nominal pressure of the valve in bar, factor 0,1 Example: 200 bar -> 0 to 2000
Ready for operation	1: Valve ready for operation 0: Valve not ready for operation	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 82

➥ Chapter 9.8 “P-0-1910.0.2 - IO-Link: Pressure valve status word” on page 83

➥ Chapter 9.11 “P-0-2803 - Pressure command value preprocessing: Internal pressure command value” on page 85

➥ Chapter 9.78 “S-0-0800 - Pressure command value” on page 125

➥ Chapter 9.79 “S-0-0809 - Actual pressure value” on page 125

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 acquisition

6.1 Overview

In the case of closed-loop controlled pressure valves, the actual pressure value is sensed 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.

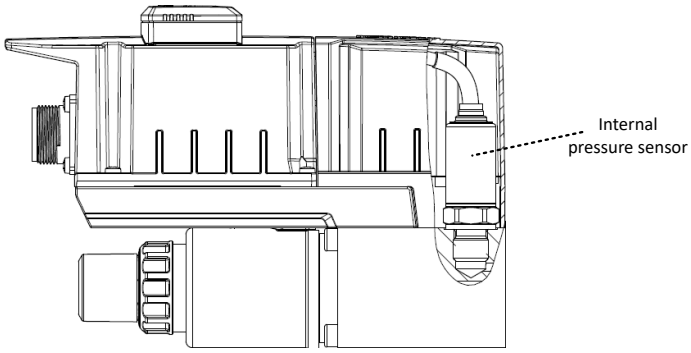


Fig. 33: Internal pressure sensor

6.3 External pressure sensor – interface X2N

For pressure valves with the option of connecting an external pressure sensor, this can be done via the X2N interface. A sensor can be used as external pressure sensor, which provides the actual pressure value as a voltage signal (0 ... 10 V) or as a current signal (4 ...20 mA).

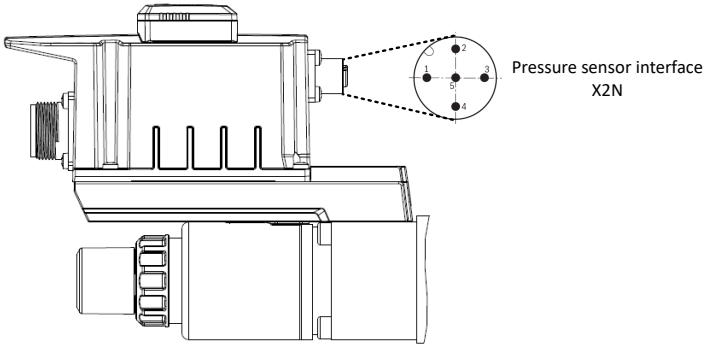


Fig. 34: Pressure sensor

Interface X2N assignment

The following table shows the pinout 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 acquisition

6.4.1 Functional description

The actual pressure value is sensed 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 option of connecting 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 sequence of the actual pressure value acquisition is shown in the following figure.

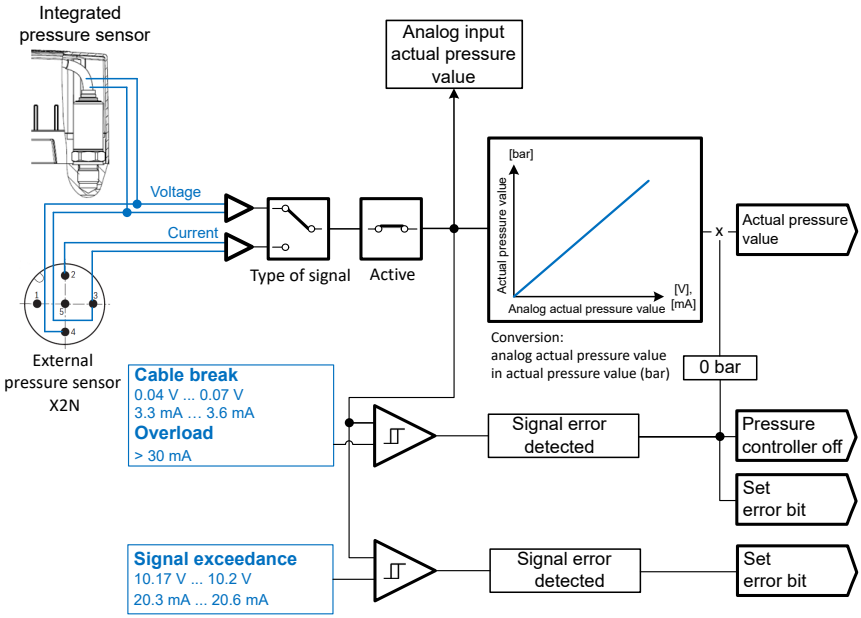


Fig. 35: Actual pressure value acquisition

Type of signal

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

Activation bit

The conversion of the voltage or current signal of the analog actual pressure value in 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.

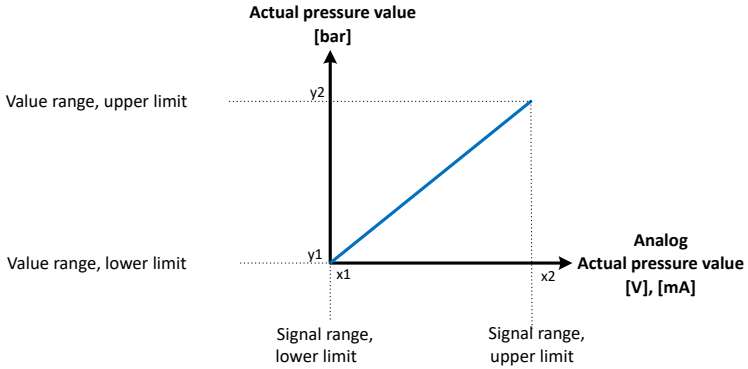


Fig. 36: Conversion of actual pressure value

By 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 in 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 acquisition formula

Maximum settable 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 settable 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 undercurrent) or signal overflow (-> overvoltage or overcurrent). 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 again generated automatically and closed-loop pressure control activated.

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

Signal thresholds for cable break, signal overflow and overload:

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

Pressure sensor interface	Cable break		Signal overflow		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

Monitoring for cable break, signal overflow 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 settable 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 9.79 “S-0-0809 - Actual pressure value” on page 125

➥ Chapter 9.19 “P-0-2885.0.23 - Diagnostics: Error overview” on page 87

➥ Chapter 9.64 “P-0-2907.2.1 - Analog actual pressure value input: Actual value” on page 118

➥ Chapter 9.58 “P-0-2900.2.1 Analog actual pressure value input: Control word” on page 114

➥ Chapter 9.59 “P-0-2900.2.8 - Analog actual pressure value input: Signal range, lower limit” on page 115

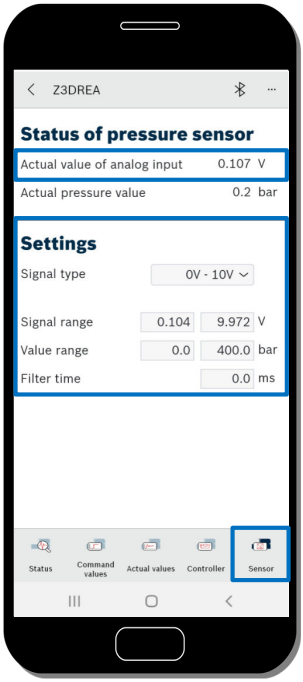
➥ Chapter 9.60 “P-0-2900.2.9 - Analog actual pressure value input: Signal range, upper limit” on page 116

➥ Chapter 9.61 “P-0-2900.2.10 - Analog actual pressure value input: Value range, lower limit” on page 117

➥ Chapter 9.62 “P-0-2900.2.11 - Analog actual pressure value input: Value range, upper limit” on page 117

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 with Bosch Rexroth's Service. During the production of pressure valves, these are optimally set so that the accuracies specified in the “valve data sheet" are achieved in closed-loop pressure control.

7 Controller structure of the pressure valve DBETE

7.1 Overview

On pressure valve type DBETE, no pressure sensor is provided. Thus, with this valve type **no** closed-loop pressure control is possible but only open-loop pressure control. The controller structure for this valve type is shown below.

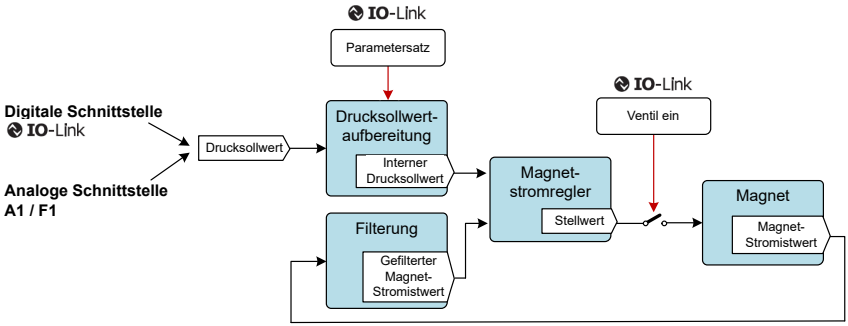


Fig. 39: Controller structure for DBETE

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 preprocessing

The settings of pressure command value preprocessing (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 command value preprocessing can be found in ➦ Chapter 7.2 “Pressure command value preprocessing” on page 52.

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 controller output for the solenoid of the pressure valve from the effective pressure command value predetermined by command value preprocessing 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 57.

Parameter set

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

Parameter set number	Application of the pressure valve
0	Direct operated, small dead volume
1	Direct operated, large dead volume
2	Logic, small dead volume
3	Logic, large dead volume

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 2 “logic, small dead volume" is set ex works. This can be reconfigured via the "easy2connect" smartphone app.

Valve on

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

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

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 solenoid current controller output is fed immediately to the solenoid.

"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.

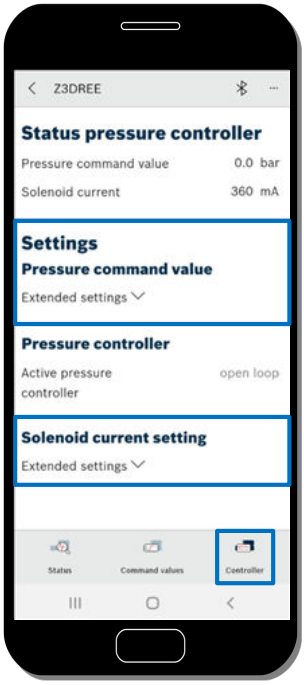


Fig. 40: Pressure command value preprocessing in “easy2connect”

7.2 Pressure command value preprocessing

7.2.1 Functional description

The structure of pressure command value preprocessing is shown below.

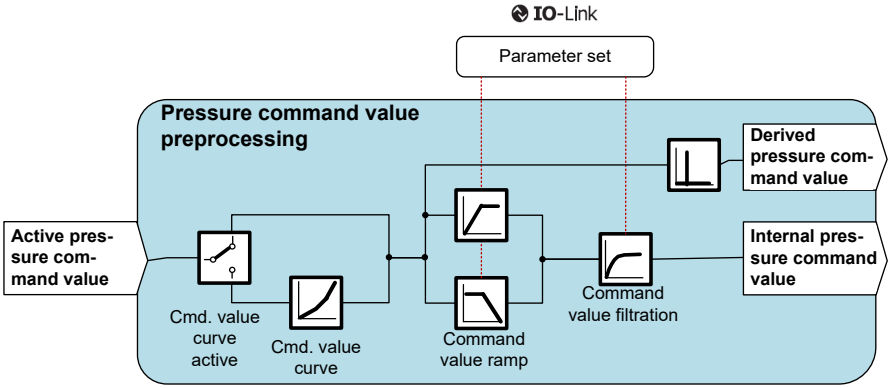


Fig. 41: Pressure command value preprocessing

Command value characteristic curve active

The command value characteristic curve can be activated using switch "Command value characteristic curve active".

With the default setting, the command value characteristic curve is not active in the valve.

Command value characteristic curve

Typically, the pressure command value fed to the valve via the analog A1 or F1 interface (see ➦ Chapter 4 “Analog interface – connector XH1” on page 24) is linear. For applications, in which this is not the case, the command value characteristic curve can be activated to compensate non-linearity in the command value input.

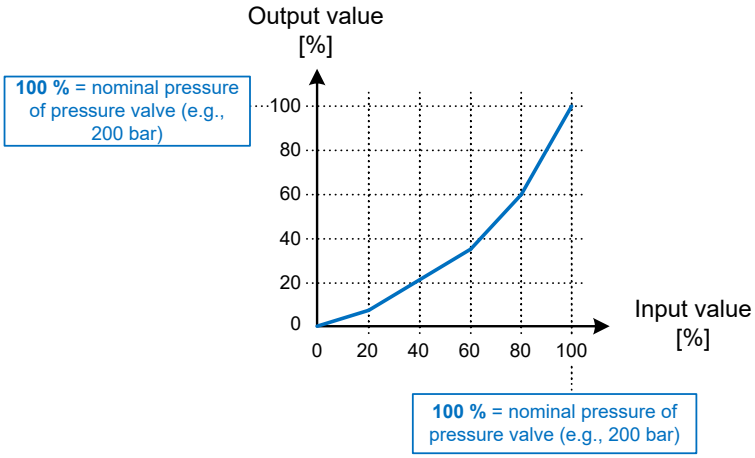


Fig. 42: Command value characteristic curve, pressure command value preprocessing

A command value curve can be defined with a minimum of 2 points and a maximum of 10 points. The individual points of the characteristic curve have to be monotonically increasing or falling. Otherwise, the command value characteristic curve takes no effect. The individual points of the command value curve are given in percent. In this case, 100 % corresponds to the nominal pressure of the valve (e.g. 200 bar).

Example:

Nominal pressure of the valve = 200 bar

Pressure command value at analog command value input = 100 bar

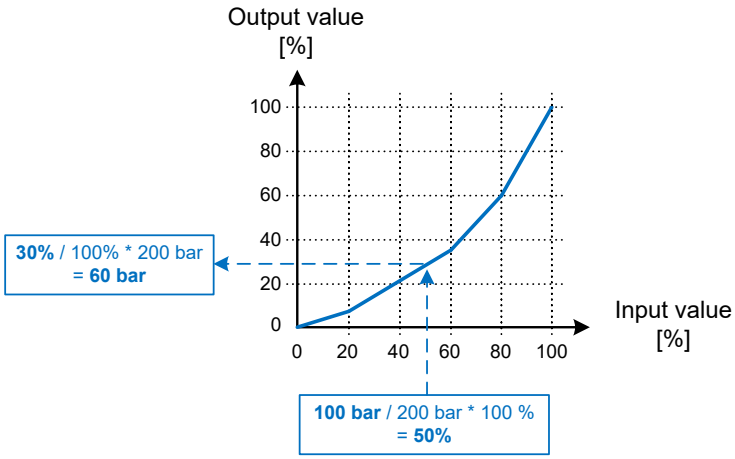


Fig. 43: Command value characteristic curve, pressure command value preprocessing

Pressure command value according to characteristic curve = **60 bar**

Command value ramp

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

Command value filter

The predetermined pressure command value can be smoothened via a PT1 filter, the filter frequency of which can be adjusted.

Parameter set

The pressure valve is supplied with 4 parameter sets for various applications, so that the settings for the pressure command value preprocessing (-> 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 pressure command value preprocessing:

➥ Chapter 9.78 “S-0-0800 - Pressure command value” on page 125

➥ Chapter 9.11 “P-0-2803 - Pressure command value preprocessing: Internal pressure command value” on page 85

➥ Chapter 9.51 “P-0-2894.0.2 - Pressure command value preprocessing: Control word” on page 108
➥ Chapter 9.52 “P-0-2894.0.3 - Pressure command value preprocessing: Characteristic curve” on page 108
➥ Chapter 9.44 “P-0-2892.0.6 - Pressure command value preparation: Ramp time positive” on page 104
➥ Chapter 9.45 “P-0-2892.0.7 - Pressure command value preparation: Ramp time negative” on page 104
➥ Chapter 9.46 “P-0-2892.0.8 - Pressure command value preparation: Filter frequency” on page 104

7.2.3 Setting via "easy2connect"

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

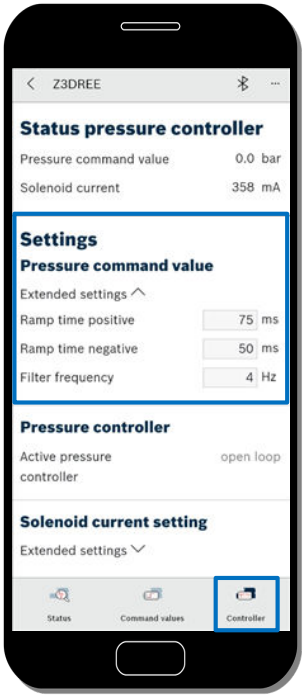


Fig. 44: Pressure command value preprocessing in "easy2connect"

7.3 Solenoid current controller

7.3.1 Functional description

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

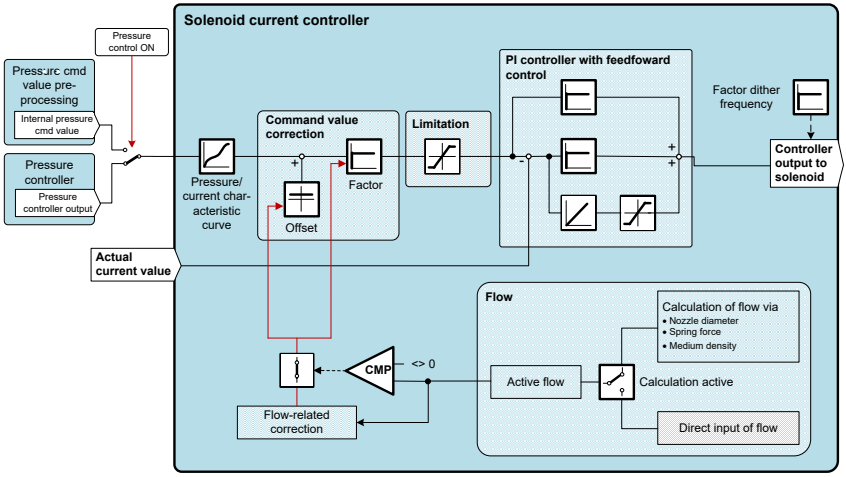


Fig. 45: Solenoid current controller

Pressure command value for solenoid current controller

If closed-loop pressure control is activated, the solenoid current controller receives the pressure controller output as a command value. In the other case, the pressure command value which is set by command value preprocessing takes effect 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 command value preprocessing.

Pressure/current characteristic curve

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

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 flow specified in the valve data sheet. An optimum adaptation to the actual flow and compensation of aging of the pressure valve can be achieved via command value correction by means of a factor and offset.

Flow-related command value correction

It is possible to activate an automatic, flow-related command value correction in which the actual flow of the pressure valve is parameterized. The flow can be set directly or calculated on the basis of the following details:

- Nozzle diameter = diameter of the nozzle installed in the pressure valve
- Spring force = force of the spring installed in the pressure valve
- Medium density = density of the hydraulic fluid used

In order that the flow is actually calculated from the above data, the calculation has to be activated via the corresponding control word.

Limitation of the solenoid current command value

The solenoid current command value is limited to a maximum value of 1800 mA to protect the on-board electronics against overloading.

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 output of the solenoid current controller is fed to the solenoid of the pressure valve with a superimposed dither frequency. 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.
- Corresponding dynamics of the valve are achieved.

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

- Increase in the dynamics of the valve by a smaller dither frequency (→ factor < 1). This results in a larger pressure amplitude.
- Reduction of the actual pressure value amplitude (→ factor > 1). This results in poorer dynamics of the valve.

Ex works, the factor is set to 1.

The dither frequency should only be changed 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 9.26 “P-0-2890.0.6 - Solenoid current: Offset” on page 96

➦ Chapter 9.27 “P-0-2890.0.7 - Solenoid current: P-gain” on page 96
➦ Chapter 9.28 “P-0-2890.0.8 - Solenoid current controller: Dither frequency factor” on page 97
➦ Chapter 9.30 “P-0-2890.0.10 - Pressure controller: Nozzle diameter flow rate” on page 98
➦ Chapter 9.31 “P-0-2890.0.11 - Pressure controller: Spring force flow rate” on page 98
➦ Chapter 9.32 “P-0-2890.0.12 - Pressure controller: Medium density flow rate” on page 98
➦ Chapter 9.33 “P-0-2890.0.13 - Pressure controller: Valve flow rate” on page 98
➦ Chapter 9.35 “P-0-2890.0.15 - Pressure controller: Active flow” on page 99
➦ Chapter 9.36 “P-0-2890.0.16 - Pressure controller, flow control word” on page 100

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.

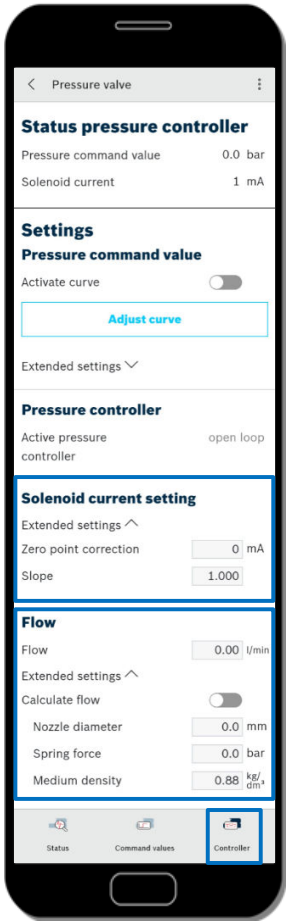


Fig. 46: Solenoid current control in "easy2connect"

8 Controller structure of the pressure valve DBETA

8.1 Overview

In the pressure valve of type DBETA, the actual pressure value is acquired 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.

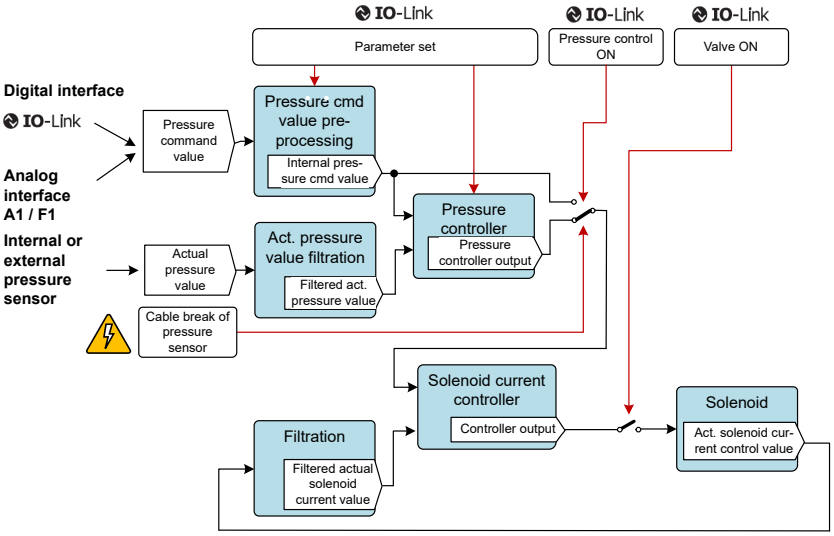


Fig. 47: Controller structure of DBETA

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 preprocessing

The settings of pressure command value preprocessing (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 command value preprocessing can be found in ➦ Chapter 7.2 “Pressure command value preprocessing” on page 52.

Actual pressure value

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

Detailed information on sensing the actual pressure value can be found in ➦ Chapter 6 “Pressure sensor / actual pressure value acquisition” on page 43.

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”.

Pressure controller

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

The pressure controller calculates the corresponding controller output from the effective pressure command value provided by command value preprocessing and the actual pressure value currently sensed. When closed-loop pressure control is activated, this controller output is fed to the solenoid current controller.

The settings of the pressure controller are parameter set-dependent. This means that the settings are adjusted depending on the currently active parameter set.

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 controller output of the pressure controller as command value when closed-loop pressure control is activated. In the other case, the command value which is preset by command value preprocessing acts directly.

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

Detailed information on the solenoid current controller can be found in ➦ Chapter 7.3 “Solenoid current controller” on page 57.

Parameter set

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

Parameter set number	Application of the pressure valve
0	Direct operated, small dead volume
1	Direct operated, large dead volume
2	Logic, small dead volume
3	Logic, large dead volume

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 2 “logic, small dead volume" is set ex works. This can be reconfigured via the "easy2connect" smartphone app.

Closed-loop pressure control on

The pressure controller of the valve is only active if the "closed-loop pressure control on" bit is 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 preset via the process data (PDout). This means that the bit has to 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 solenoid current controller output is only fed to the solenoid when the "valve on" bit is set. By setting this bit, the output stage of the valve is activated, via which the solenoid is activated with the corresponding controller output.

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

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 solenoid current controller output is fed immediately to the solenoid.

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, closed-loop pressure control is again automatically activated.

"easy2connect" smartphone app

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

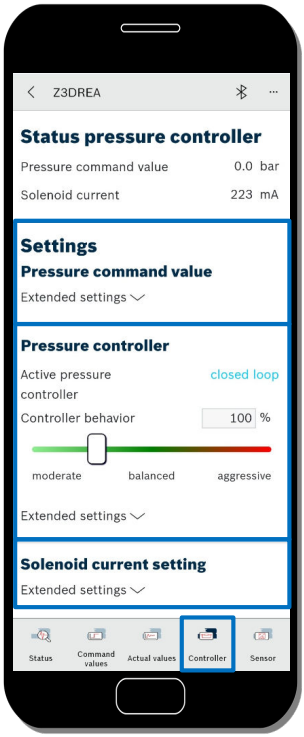


Fig. 48: Pressure command value preprocessing in "easy2connect"

8.2 Pressure command value preprocessing

8.2.1 Functional description

The structure of pressure command value preprocessing is shown below.

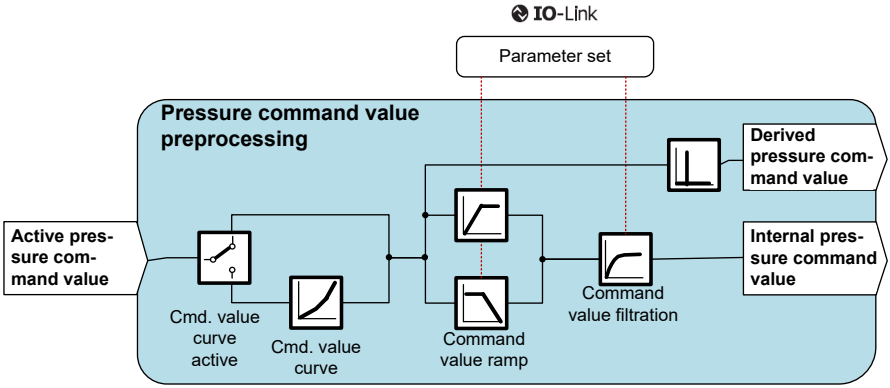


Fig. 49: Pressure command value preprocessing

Command value characteristic curve active

The command value characteristic curve can be activated using switch "Command value characteristic curve active".

With the default setting, the command value characteristic curve is not active in the valve.

Command value characteristic curve

Typically, the pressure command value fed to the valve via the analog A1 or F1 interface (see ➦ Chapter 4 “Analog interface – connector XH1” on page 24) is linear. For applications, in which this is not the case, the command value characteristic curve can be activated to compensate non-linearity in the command value input.

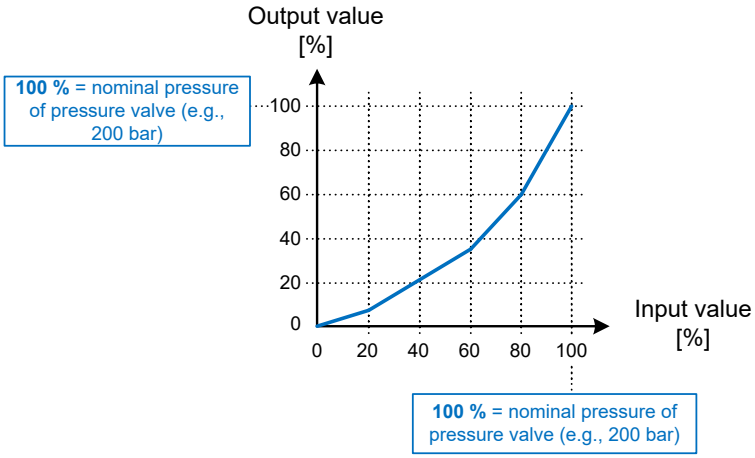


Fig. 50: Command value characteristic curve, pressure command value preprocessing

A command value curve can be defined with a minimum of 2 points and a maximum of 10 points. The individual points of the characteristic curve have to be monotonically increasing or falling. Otherwise, the command value characteristic curve takes no effect. The individual points of the command value curve are given in percent. In this case, 100 % corresponds to the nominal pressure of the valve (e.g. 200 bar).

Example:

Nominal pressure of the valve = 200 bar

Pressure command value at analog command value input = 100 bar

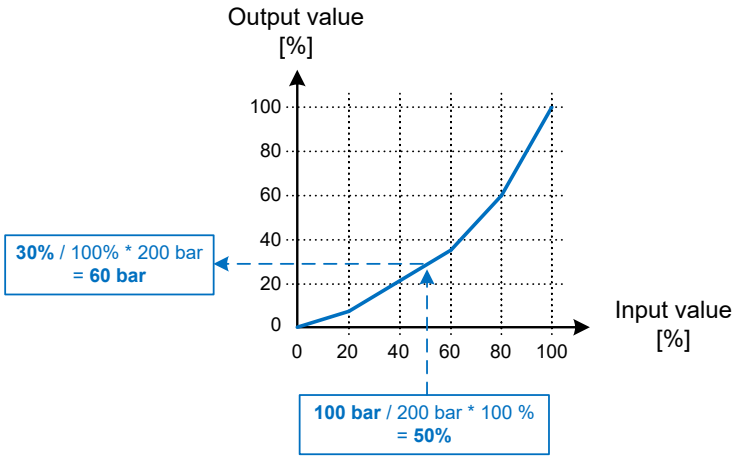


Fig. 51: Command value characteristic curve, pressure command value preprocessing

Pressure command value according to characteristic curve = **60 bar**

Command value ramp

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

Command value filter

The predetermined pressure command value can be smoothened via a PT1 filter, the filter frequency of which can be adjusted.

Parameter set

The pressure valve is supplied with 4 parameter sets for various applications, so that the settings for the pressure command value preprocessing (-> 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 pressure command value preprocessing:

➥ Chapter 9.78 “S-0-0800 - Pressure command value” on page 125

➥ Chapter 9.11 “P-0-2803 - Pressure command value preprocessing: Internal pressure command value” on page 85

➥ Chapter 9.51 “P-0-2894.0.2 - Pressure command value preprocessing: Control word” on page 108
➥ Chapter 9.52 “P-0-2894.0.3 - Pressure command value preprocessing: Characteristic curve” on page 108
➥ Chapter 9.44 “P-0-2892.0.6 - Pressure command value preparation: Ramp time positive” on page 104
➥ Chapter 9.45 “P-0-2892.0.7 - Pressure command value preparation: Ramp time negative” on page 104
➥ Chapter 9.46 “P-0-2892.0.8 - Pressure command value preparation: Filter frequency” on page 104

8.2.3 Setting via "easy2connect"

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

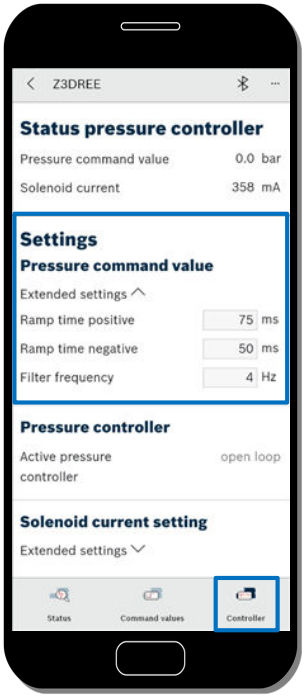


Fig. 52: Pressure command value preprocessing in "easy2connect"

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:

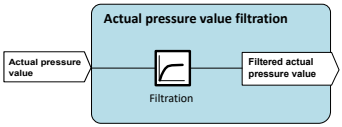


Fig. 53: 29263-FK_Actual pressure value filtration

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 9.79 “S-0-0809 - Actual pressure value” on page 125

➥ Chapter 9.29 “P-0-2890.0.9 - Actual pressure value: Filter frequency” on page 97

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 relief valve DBETA is shown below.

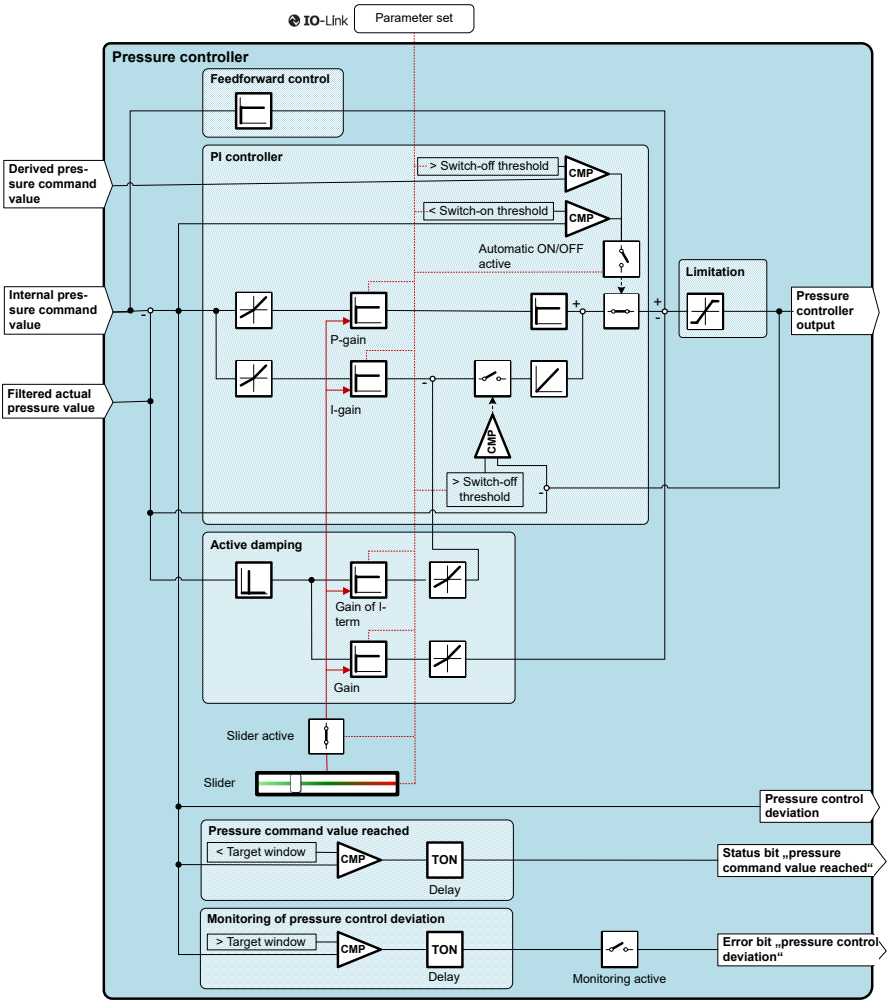


Fig. 54: Closed-loop pressure control

Pressure controller components

The pressure controller consists of the following components:

- Feedforward control
- PI controller with switching I-term
- Active damping
- Limitation

Feedforward control

With feedforward control (command value feedforward), the current pressure command value will be factored in as a percentage in closed-loop control. In this way, the pressure control deviation is minimized. The feedforward control of the pressure controller is optimally set ex works for the pressure relief valve according to its nominal pressure. A customer setting is therefore not provided today.

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 of pressure controller - filtered actual pressure value) > switch-off threshold of integrator * nominal pressure-dependent switch-off threshold*

Nominal value of pressure valve	Nominal pressure-dependent switch-off threshold
50 bar	5 bar
100 bar	10 bar
200 bar	20 bar
250 bar	25 bar
315 bar	31.5 bar
350 bar	35 bar
420 bar	42 bar
500 bar	50 bar

The integrator of the PI controller is automatically re-activated if the above condition is no longer met.

Whether the I-term of the pressure controller output is to be frozen or deleted while the integrator is being switched off is set via the control word of the pressure controller.

Automatic switching off and switching on of the PI-term

To prevent overshoots in the case of command value jumps, automatic switching off of the pressure controller PI-term can be activated. When an adjustable pressure control deviation is reached, the PI controller is automatically switched on again. The height of the command value jump at which the PI controller is to be switched off is configured as a function of direction. Equally, the control deviation, at which the PI controller becomes active again, is set as a function of direction.

To make sure that automatic switching on and off of the PI controller works properly, the flow for the pressure valve has to be correctly parameterized on the solenoid current controller, see ➦ Chapter 7.3 “Solenoid current controller” on page 57.

Active damping

Within the framework of active damping, in the pressure controller, the change in the actual pressure value (→ velocity) is fed back to the control process with a scaling factor in order to achieve a better controller behavior. The gain of 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 operated, the corresponding values for the following 4 parameters of the pressure controller are calculated simultaneously:

- 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 of one another.

Limitation

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
- Direction-dependent switch-off thresholds of the PI controller during a command value step change
- Direction-dependent switch-on thresholds of the PI controller after a command value step change

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) is 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 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

Monitoring of the pressure control deviation

Monitoring of the pressure control deviation can be activated. When monitoring is active, it is checked whether the pressure control deviation is within a parameterized window.

If the control deviation is outside the defined window when a set delay has elapsed, a corresponding error bit is set. Apart from setting the bits, no further error reaction is triggered on the pressure valve.

As soon as the pressure control deviation is again within the defined window, the error bit is reset without delay.

In order that monitoring of the pressure control deviation is active, the following conditions have to be fulfilled additionally.

- Enable for the valve is set
- Pressure controller is active
- Pressure sensing of the valve is active.

8.4.2 Relevant parameters

The following parameters are relevant for setting the pressure controller:

➥ Chapter 9.79 “S-0-0809 - Actual pressure value” on page 125

➥ Chapter 9.81 “S-0-0827 - Pressure control deviation” on page 125

➥ Chapter 9.11 “P-0-2803 - Pressure command value preprocessing: Internal pressure command value” on page 85

➥ Chapter 9.23 “P-0-2890.0.3 - Pressure controller: Slider (controller behavior)” on page 94

➥ Chapter 9.24 “P-0-2890.0.4 - Pressure controller: Control word” on page 95

➥ Chapter 9.34 “P-0-2890.0.14 - Pressure controller: Control deviation delay” on page 99

➥ Chapter 9.37 “P-0-2890.0.17 - Pressure controller: Command value reaches window” on page 100

➥ Chapter 9.38 “P-0-2890.0.18 - Pressure controller: Control deviation window” on page 101

➥ Chapter 9.39 “P-0-2892.0.1 - Pressure controller: I-gain” on page 101

➥ Chapter 9.40 “P-0-2892.0.2 - Pressure controller: P-gain” on page 102

➥ Chapter 9.41 “P-0-2892.0.3 - Pressure controller: Gain, active damping” on page 102

➥ Chapter 9.42 “P-0-2892.0.4 - Pressure controller: Gain, I-term active damping” on page 103

➥ Chapter 9.43 “P-0-2892.0.5 - Pressure controller: Integrator switch-off threshold” on page 103

➥ Chapter 9.47 “P-0-2892.0.10 - Pressure controller: Switch-on threshold, control deviation negative” on page 105

➥ Chapter 9.48 “P-0-2892.0.11 - Pressure controller: Switch-on threshold for control deviation positive” on page 106

➥ Chapter 9.49 “P-0-2892.0.12 - Pressure controller: Switch-off command value jump negative” on page 106

➥ Chapter 9.50 “P-0-2892.0.13 - Pressure controller: Switch-off threshold for command value jump positive” on page 107

➦ Chapter 9.22 “P-0-2885.0.40 - Diagnostics: Configuration of monitoring” on page 94

8.4.3 Setting via "easy2connect"

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

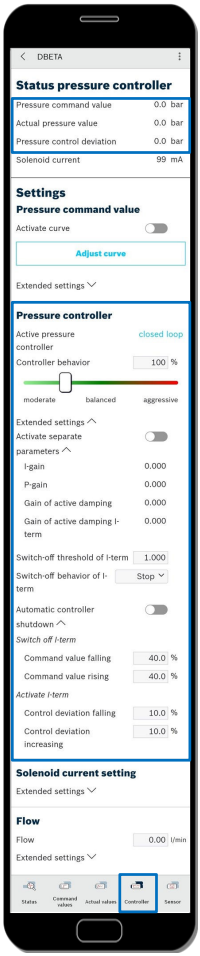


Fig. 55: Pressure control in "easy2connect"

8.5 Solenoid current controller

8.5.1 Functional description

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

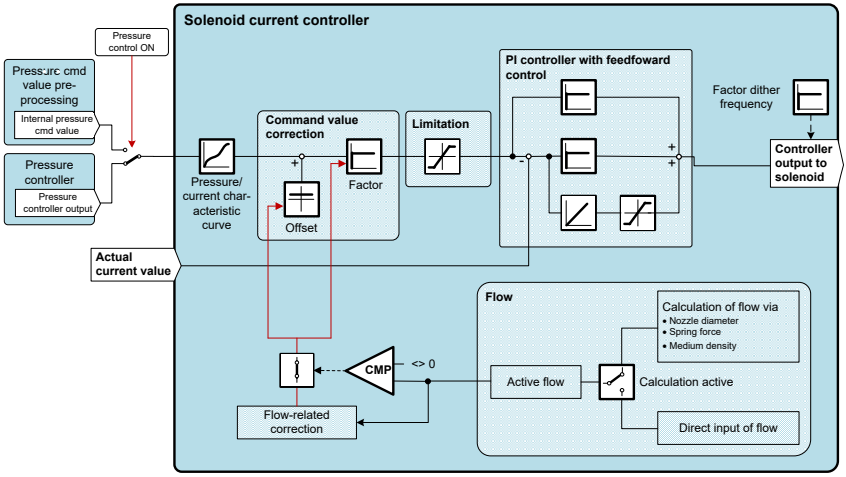


Fig. 56: Solenoid current controller

Pressure command value for solenoid current controller

If closed-loop pressure control is activated, the solenoid current controller receives the pressure controller output as a command value. In the other case, the pressure command value which is set by command value preprocessing takes effect 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 command value preprocessing.

Pressure/current characteristic curve

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

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 flow specified in the valve data sheet. An optimum adaptation to the actual flow and compensation of aging of the pressure valve can be achieved via command value correction by means of a factor and offset.

Flow-related command value correction

It is possible to activate an automatic, flow-related command value correction in which the actual flow of the pressure valve is parameterized. The flow can be set directly or calculated on the basis of the following details:

- Nozzle diameter = diameter of the nozzle installed in the pressure valve
- Spring force = force of the spring installed in the pressure valve
- Medium density = density of the hydraulic fluid used

In order that the flow is actually calculated from the above data, the calculation has to be activated via the corresponding control word.

Limitation of the solenoid current command value

The solenoid current command value is limited to a maximum value of 1800 mA to protect the on-board electronics against overloading.

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 output of the solenoid current controller is fed to the solenoid of the pressure valve with a superimposed dither frequency. 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.
- Corresponding dynamics of the valve are achieved.

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

- Increase in the dynamics of the valve by a smaller dither frequency (→ factor < 1). This results in a larger pressure amplitude.
- Reduction of the actual pressure value amplitude (→ factor > 1). This results in poorer dynamics of the valve.

Ex works, the factor is set to 1.

The dither frequency should only be changed 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 9.26 “P-0-2890.0.6 - Solenoid current: Offset” on page 96

➦ Chapter 9.27 “P-0-2890.0.7 - Solenoid current: P-gain” on page 96
➦ Chapter 9.28 “P-0-2890.0.8 - Solenoid current controller: Dither frequency factor” on page 97
➦ Chapter 9.30 “P-0-2890.0.10 - Pressure controller: Nozzle diameter flow rate” on page 98
➦ Chapter 9.31 “P-0-2890.0.11 - Pressure controller: Spring force flow rate” on page 98
➦ Chapter 9.32 “P-0-2890.0.12 - Pressure controller: Medium density flow rate” on page 98
➦ Chapter 9.33 “P-0-2890.0.13 - Pressure controller: Valve flow rate” on page 98
➦ Chapter 9.35 “P-0-2890.0.15 - Pressure controller: Active flow” on page 99
➦ Chapter 9.36 “P-0-2890.0.16 - Pressure controller, flow control word” on page 100

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.

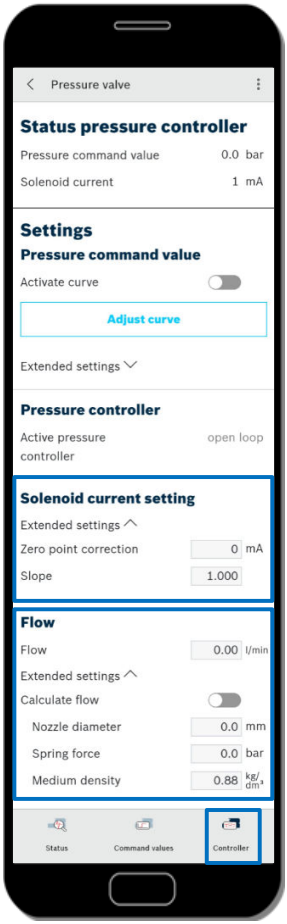


Fig. 57: Solenoid current control in "easy2connect"

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	Designation/function	Comment
0-1	Reserved	
2	**Warning** 0: No warning 1: Warning active	
3-7	Reserved	
8-9	**Operating mode** 0b00: Open-loop pressure control active 0b01: Closed-loop pressure control active 0b10: Reserved 0b11: Reserved	
10	Reserved	
11	**Firmware update** 0: Firmware update is not executed 1: Firmware update is executed	While the firmware is updating, open- or closed-loop controlling is not possible. In addition, no commands can be started.
12	**Pressure command value reached** 0: Actual pressure value has not reached 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 sensing of the valve is active.

The status bit “pressure command value reached" indicates whether the pressure control deviation (→ difference between the pressure command value and the actual pressure value, see S-0-0827) is within a target window. The target window is configured via parameter P-0-2890.0.17.

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 longer than 10 ms, the status bit is reset again.

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	

Bit	Name / Function	Comment
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

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

Set-up of the control word:

Bit	Designation/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-0-0262. If the two commands S-0-0262 and P-0-0670.0.3 are executed successively, 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 has to be executed so that the reset parameter values are permanently stored in the valve.

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	
6-7	Reserved	
8	**Activate closed-loop pressure control**	Closed-loop pressure control can only be activated for valves with a pressure sensor.
	0: Activate open-loop pressure control	
	1: Activate closed-loop pressure control	
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	

Bit	Name / Function	Comment
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	
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 preprocessing: Internal pressure command value

9.11.1 Description

The parameter indicates the resulting pressure command value at the output of pressure command value preprocessing. 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	Designation/function	Comment
Analog command value input (→ connector XH1) configured as current input		

Bit	Designation/function	Comment
0	**Cable break** 0: No cable break 1: Cable break detected	A cable break is recognized on the input at a **current < 3.3 mA**. See also further notes on the command value input following this table.
1	**Signal overflow** 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	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 recognized on the input at a **current < 3.3 mA**. See also further notes on the actual pressure value input following this table.
9	**Signal overflow** 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	Designation/function	Comment
13	**Signal overflow** 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	**Pressure control deviation** 0: Pressure control deviation within the target window 1: Pressure control deviation outside the target window	
17-19	Reserved	
Firmware		
20	**Compatibility check error** 0: No error 1: Firmware on valve controller and IO-Link controller are incompatible.	
21-23	Reserved	
Temperature monitoring		
24	**Undertemperature** 0: No error 1: Undertemperature recognized	
25	**Overtemperature** 0: No error 1: Overtemperature recognized	
26-27	Reserved	
Monitoring of supply voltage		
28	**Undervoltage** 0: No error 1: Undervoltage recognized	
29	**Overvoltage** 0: No error 1: Overvoltage recognized	
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 overflow 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 overflow 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	Designation/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 recognized on the input at a **current < 3.3 mA**. See also further notes on the command value input following this table.
1	**Signal overflow** 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	Designation/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 recognized on the input at a **current < 3.3 mA**. See also further notes on the actual pressure value input following this table.
9	**Signal overflow** 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.
13	**Signal overflow** 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	**Pressure control deviation** 0: Pressure control deviation within the target window 1: Pressure control deviation outside the target window	

Bit	Designation/function	Comment
17-19	Reserved	
Firmware		
20	**Compatibility check error** 0: No error 1: Firmware on valve controller and IO-Link controller are incompatible.	
21-23	Reserved	
Temperature monitoring		
24	**Undertemperature** 0: No error 1: Undertemperature recognized	
25	**Overtemperature** 0: No error 1: Overtemperature recognized	
26-27	Reserved	
Monitoring of supply voltage		
28	**Undervoltage** 0: No error 1: Undervoltage recognized	
29	**Overvoltage** 0: No error 1: Overvoltage recognized	
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 overflow 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 overflow 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-0-2885.0.40 - Diagnostics: Configuration of monitoring

9.22.1 Description

Monitoring functions in the valve can be activated or deactivated via the control word.

Bit	Designation/function	Comment
0	**Monitoring of the pressure control deviation** 0: Not active 1: Active	See also explanations on the operating principle of pressure control monitoring after this table
1-31	Reserved	

Monitoring of the pressure control deviation

Monitoring of the pressure control deviation can be activated via control word P-0-2885.0.40. When active, the monitoring function checks whether the pressure control deviation (see S-0-0827) is within a window that is defined via parameter P-0-2890.0.18.

If the pressure control deviation is outside the determined window after the time set in P-0-2890.0.14 elapsed, the corresponding error bits are set in the valve status (see P-0-0115) and in the error overview (see P-0-2885.0.3 and P-0-2885.0.24). Apart from setting the bits, no further error reaction is triggered on the pressure valve.

As soon as the pressure control deviation is again within the defined window (see P-0-2890.0.18), the error bits are reset without delay.

In order that monitoring of the pressure control deviation is active, the following conditions have to be fulfilled additionally.

- Enable for the valve is set.
- Pressure controller is active.
- Pressure sensing of the valve is active.

9.22.2 IO-Link mapping

Parameter set	Index	Subindex
-	71	0

9.23 P-0-2890.0.3 - Pressure controller: Slider (controller behavior)

9.23.1 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.

9.23.2 IO-Link mapping

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

9.24 P-0-2890.0.4 - Pressure controller: Control word

9.24.1 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	
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.

9.24.2 IO-Link mapping

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

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

9.25.1 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.

9.25.2 IO-Link mapping

Parameter set	Index	Subindex
-	93	0

9.26 P-0-2890.0.6 - Solenoid current: Offset

9.26.1 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.

9.26.2 IO-Link mapping

Parameter set	Index	Subindex
-	94	0

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

9.27.1 Description

This parameter is used for setting the amplification 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 flow specified in the valve data sheet. Due to aging of the pressure valve or due to a flow differing from the valve data sheet, this optimum adjustment no longer fits. This can be corrected accordingly via the amplification for the solenoid current and the offset in P-0-2890.0.6.

9.27.2 IO-Link mapping

Parameter set	Index	Subindex
-	95	0

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

9.28.1 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.

9.28.2 IO-Link mapping

Parameter set	Index	Subindex
-	96	0

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

9.29.1 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.

9.29.2 IO-Link mapping

Parameter set	Index	Subindex
-	91	0

9.30 P-0-2890.0.10 - Pressure controller: Nozzle diameter flow rate

9.30.1 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).

9.30.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.31 P-0-2890.0.11 - Pressure controller: Spring force flow rate

9.31.1 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).

9.31.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.32 P-0-2890.0.12 - Pressure controller: Medium density flow rate

9.32.1 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).

9.32.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.33 P-0-2890.0.13 - Pressure controller: Valve flow rate

9.33.1 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).

9.33.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.34 P-0-2890.0.14 - Pressure controller: Control deviation delay

9.34.1 Description

This parameter sets the delay for triggering the error “pressure control deviation”. The operating principle of monitoring is explained in more detail in the following.

Monitoring of the pressure control deviation

Monitoring of the pressure control deviation can be activated via control word P-0-2885.0.40. When active, the monitoring function checks whether the pressure control deviation (see S-0-0827) is within a window that can be defined via parameter P-0-2890.0.18.

If the pressure control deviation is outside the determined window after the time set in P-0-2890.0.14 elapsed, the corresponding error bits are set in the valve status (see P-0-0115) and in the error overview (see P-0-2885.0.3 and P-0-2885.0.24). However, apart from setting the bits, no further error reaction is triggered on the pressure valve.

As soon as the pressure control deviation is again within the defined window (see P-0-2890.0.18), the error bits are reset without delay.

In order that monitoring of the pressure control deviation is active, the following conditions have to be fulfilled additionally.

- Enable for the valve is set.
- Pressure controller is active.
- Pressure sensing of the valve is active.

9.34.2 IO-Link mapping

Parameter set	Index	Subindex
-	97	0

9.35 P-0-2890.0.15 - Pressure controller: Active flow

9.35.1 Description

This parameter displays the currently active flow in the pressure controller. The active flow is firmly set by P-0-2890.0.13, if automatic calculation of the flow via has not been activated via control word P-0-2890.0.16. If automatic flow calculation has been switched on, the flow is calculated on the basis of parameters P-0-2890.0.10, P-0-2890.0.11 and P-0-2890.0.12.

9.35.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.36 P-0-2890.0.16 - Pressure controller, flow control word

9.36.1 Description

This control word is used to set how the flow is determined that is to be considered in the pressure controller.

Set-up of the control word:

Bit	Designation/function	Comment
0	**Automatic flow calculation** 0: Not active. The value in P-2890.0.13 is used as flow. 1: Active. The flow is automatically calculated.	See also further explanation of the control bit following this table.
1-15	Reserved	

Bit 0 - automatic flow calculation:

If automatic flow calculation has been activated, the flow is determined on the basis of the following parameters:

- P-0-2890.0.10
- P-0-2890.0.11
- P-0-2890.0.12

9.36.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.37 P-0-2890.0.17 - Pressure controller: Command value reaches window

9.37.1 Description

This parameter is used to set the target window for forming the status bit “pressure command value reached”. The value of the target window is given in percent and refers to the nominal pressure of the valve (see P-0-2875.0.7). The operating principle of the status bit is explained in more detail in the following.

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 sensing of the valve is active.

The status bit “pressure command value reached" indicates whether the pressure control deviation (→ difference between the pressure command value and the actual pressure value, see S-0-0827) is within a target window. The target window is configured via parameter P-0-2890.0.17.

If the pressure control deviation is within the target window, then the corresponding status bit is set in the valve status (see P-0-0115). If the pressure control deviation leaves the target window for longer than 10 ms, the status bit is reset again.

9.37.2 IO-Link mapping

Parameter set	Index	Subindex
-	80	0

9.38 P-0-2890.0.18 - Pressure controller: Control deviation window

9.38.1 Description

This parameter is used to set the target window for monitoring the pressure control deviation. The target window is specified in percent and refers to the nominal pressure of the valve (see P-0-2875.0.7). The operating principle of monitoring is explained in more detail in the following.

Monitoring of the pressure control deviation

Monitoring of the pressure control deviation can be activated via control word P-0-2885.0.40. When active, the monitoring function checks whether the pressure control deviation (see S-0-0827) is within a window that is defined via parameter P-0-2890.0.18.

If the pressure control deviation is outside the determined window after the time set in P-0-2890.0.14 elapsed, the corresponding error bits are set in the valve status (see P-0-0115) and in the error overview (see P-0-2885.0.3 and P-0-2885.0.24). Apart from setting the bits, no further error reaction is triggered on the pressure valve.

As soon as the pressure control deviation is again within the defined window (see P-0-2890.0.18), the error bits are reset without delay.

In order that monitoring of the pressure control deviation is active, the following conditions have to be met additionally.

- Enable for the valve is set.
- Pressure controller is active.
- Pressure sensing of the valve is active.

9.38.2 IO-Link mapping

Parameter set	Index	Subindex
-	98	0

9.39 P-0-2892.0.1 - Pressure controller: I-gain

9.39.1 Description

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

9.39.2 IO-Link mapping

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

9.40 P-0-2892.0.2 - Pressure controller: P-gain

9.40.1 Description

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

9.40.2 IO-Link mapping

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

9.41 P-0-2892.0.3 - Pressure controller: Gain, active damping

9.41.1 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.

9.41.2 IO-Link mapping

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

9.42 P-0-2892.0.4 - Pressure controller: Gain, I-term active damping

9.42.1 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.

9.42.2 IO-Link mapping

Parameter set	Index	Subindex
0	104	1
1	104	2
2	104	3
3	104	4

9.43 P-0-2892.0.5 - Pressure controller: Integrator switch-off threshold

9.43.1 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.

9.43.2 IO-Link mapping

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

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

9.44.1 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.

9.44.2 IO-Link mapping

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

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

9.45.1 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.

9.45.2 IO-Link mapping

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

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

9.46.1 Description

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

9.46.2 IO-Link mapping

Parameter set	Index	Subindex
0	108	1
1	108	2

Parameter set	Index	Subindex
2	108	3
3	108	4

9.47 P-0-2892.0.10 - Pressure controller: Switch-on threshold, control deviation negative

9.47.1 Description

The control deviation for the automatic activation of the PI-term of the pressure controller for the negative direction (→ falling pressure command value) is set in this parameter.

Automatic switch-off and switch-on of the pressure controller 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 word P-0-2890.0.4. After an adjustable control error has been reached, the PI controller is automatically switched on again.

Switching to open-loop controlled operation (→ switch-off of the pressure controller) can be set separately for negative and positive command value jumps (→ falling or increasing command value) using the following parameters:

- P-0-2892.0.12: Switch-off threshold of the PI-term for negative command value jumps (→ falling pressure command value)
- P-0-2892.0.13: Switch-off threshold of the PI-term for positive command value jumps (→ increasing pressure command value)

The control deviation for reactivating the PI-term of the pressure controller can also be set separately for the negative and the positive direction using the following parameters.

- P-0-2892.0.10: Control deviation for the activation of the PI-term for the negative direction (→ falling pressure command value)
- P-0-2892.0.11: Control deviation for the activation of the PI-term for the positive direction (→ increasing pressure command value)

9.47.2 IO-Link mapping

Parameter set	Index	Subindex
0	110	1
1	110	2
2	110	3
3	110	4

9.48 P-0-2892.0.11 - Pressure controller: Switch-on threshold for control deviation positive

9.48.1 Description

The control deviation for the automatic activation of the PI-term of the pressure controller for the positive direction (→ increasing pressure command value) is set in this parameter.

Automatic switch-off and switch-on of the pressure controller 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 word P-0-2890.0.4. After an adjustable control error has been reached, the PI controller is automatically switched on again.

Switching to open-loop controlled operation (→ switch-off of the pressure controller) can be set separately for negative and positive command value jumps (→ falling or increasing command value) using the following parameters:

- P-0-2892.0.12: Switch-off threshold of the PI-term for negative command value jumps (→ falling pressure command value)
- P-0-2892.0.13: Switch-off threshold of the PI-term for positive command value jumps (→ increasing pressure command value)

The control deviation for reactivating the PI-term of the pressure controller can also be set separately for the negative and the positive direction using the following parameters.

- P-0-2892.0.10: Control deviation for the activation of the PI-term in the negative direction (→ falling pressure command value)
- P-0-2892.0.11: Control deviation for the activation of the PI-term in the positive direction (→ increasing pressure command value)

9.48.2 IO-Link mapping

Parameter set	Index	Subindex
0	111	1
1	111	2
2	111	3
3	111	4

9.49 P-0-2892.0.12 - Pressure controller: Switch-off command value jump negative

9.49.1 Description

The threshold for the automatic deactivation of the PI-term of the pressure controller for the negative command value jumps (→ falling pressure command value) is set in this parameter.

Automatic switch-off and switch-on of the pressure controller 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 control word P-0-2890.0.4. After an adjustable control error has been reached, the PI controller is automatically switched on again.

Switching to open-loop controlled operation (→ switch-off of the pressure controller) can be set separately for negative and positive command value jumps (→ falling or increasing command value) using the following parameters:

- P-0-2892.0.12: Switch-off threshold of the PI-term for negative command value jumps (→ falling pressure command value)
- P-0-2892.0.13: Switch-off threshold of the PI-term for positive command value jumps (→ increasing pressure command value)

The control deviation for reactivating the PI-term of the pressure controller can also be set separately for the negative and the positive direction using the following parameters.

- P-0-2892.0.10: Control deviation for the activation of the PI-term in the negative direction (→ falling pressure command value)
- P-0-2892.0.11: Control deviation for the activation of the PI-term in the positive direction (→ increasing pressure command value)

9.49.2 IO-Link mapping

Parameter set	Index	Subindex
0	112	1
1	112	2
2	112	3
3	112	4

9.50 P-0-2892.0.13 - Pressure controller: Switch-off threshold for command value jump positive

9.50.1 Description

The threshold for the automatic deactivation of the PI-term of the pressure controller for positive command value jumps (→ increasing pressure command value) is set in this parameter.

Automatic switch-off and switch-on of the pressure controller PI-term:

In case of command value jumps, the automatic switch-off of the PI-term of the pressure controller can be activated via control word P-0-2890.0.4. After an adjustable control error has been reached, the PI controller is automatically switched on again.

Switching to open-loop controlled operation (→ switch-off of the pressure controller) can be set separately for negative and positive command value jumps (→ falling or increasing command value) using the following parameters:

- P-0-2892.0.12: Switch-off threshold of the PI-term for negative command value jumps (→ falling pressure command value)
- P-0-2892.0.13: Switch-off threshold of the PI-term for positive command value jumps (→ increasing pressure command value)

The control deviation for reactivating the PI-term of the pressure controller can also be set separately for the negative and the positive direction using the following parameters.

- P-0-2892.0.10: Control deviation for the activation of the PI-term in the negative direction (→ falling pressure command value)
- P-0-2892.0.11: Control deviation for the activation of the PI-term in the positive direction (→ increasing pressure command value)

9.50.2 IO-Link mapping

Parameter set	Index	Subindex
0	113	1
1	113	2
2	113	3
3	113	4

9.51 P-0-2894.0.2 - Pressure command value preprocessing: Control word

9.51.1 Description

Functions of pressure command value preprocessing can be activated or deactivated via the control word.

Bit	Designation/function	Comment
0	**Command value characteristic curve** 0: Characteristic curve not active 1: Characteristic curve active	
1-15	Reserved	

9.51.2 IO-Link mapping

Parameter set	Index	Subindex
-	92	0

9.52 P-0-2894.0.3 - Pressure command value preprocessing: Characteristic curve

9.52.1 Description

A pressure command value characteristic curve can be set in this parameter. The command value characteristic curve serves to compensate non-linearity in the pressure command value input. In order that the pressure command value characteristic curve takes effect, the relevant bit has to be set in the control word P-0-2894.0.2.

This parameter can be used to define a command value characteristic curve with at least 2 points and a maximum of 10 points. The individual points of the characteristic curve have to be monotonically increasing or falling. Otherwise, the command value characteristic curve takes no effect.

The individual points of the command value characteristic curve are defined by means of corresponding x- and y-value pairs. The x- and y-values have the unit [%] and are interpreted with 2 decimal points.

Structure of the parameter for the command value characteristic curve

Element	Designation/function	Comment
0	**Type ID** ID of the parameter	Fixed value = 0x00001001
1	**Version** Version of the parameter	Fixed value = 01.00 = 0x01000000
2	**Number of characteristic curve points**	This element shows the number of valid points of the command value characteristic curve. 2 points = 4 3 points = 6 ... 9 points = 18 10 points = 20
3	Reserved	
4	**x[0]**	x-value of the 1st characteristic curve point in %
5	**y[0]**	y-value of the 1st characteristic curve point in %
6	**x[1]**	x-value of the 2nd characteristic curve point in %
7	**y[1]**	y-value of the 2nd characteristic curve point in %
8	**x[2]**	x-value of the 3rd characteristic curve point in %
9	**y[2]**	y-value of the 3rd characteristic curve point in %
10	**x[3]**	x-value of the 4th characteristic curve point in %
11	**y[3]**	y-value of the 4th characteristic curve point in %
12	**x[4]**	x-value of the 5th characteristic curve point in %
13	**y[4]**	y-value of the 5th characteristic curve point in %
14	**x[5]**	x-value of the 6th characteristic curve point in %

Element	Designation/function	Comment
15	**y[5]**	y-value of the 6th characteristic curve point in %
16	**x[6]**	x-value of the 7th characteristic curve point in %
17	**y[6]**	y-value of the 7th characteristic curve point in %
18	**x[7]**	x-value of the 8th characteristic curve point in %
19	**y[7]**	y-value of the 8th characteristic curve point in %
20	**x[8]**	x-value of the 9th characteristic curve point in %
21	**y[8]**	y-value of the 9th characteristic curve point in %
22	**x[9]**	x-value of the 10th characteristic curve point in %
23	**y[9]**	x-value of the 10th characteristic curve point in %

Example of a command value characteristic curve: In this example, the command value characteristic curve has 2 points.

1st point: x = 5 % and y = 5 %

2nd point: x = 100 % and y = 100 %

Element	Designation/function	Value
0	Type ID	0x00001001
1	Version	0x01000000
2	Number of characteristic curve points	4
3	Reserved	0
4	x[0]	500
5	y[0]	500
6	x[1]	10000
7	y[1]	10000
8	x[2]	0
9	y[2]	0
10	x[3]	0
11	y[3]	0
12	x[4]	0
13	y[4]	0
14	x[5]	0
15	y[5]	0
16	x[6]	0

17	y[6]	0
18	x[7]	0
19	y[7]	0
20	x[8]	0
21	y[8]	0
22	x[9]	0
23	y[9]	0

9.52.2 IO-Link mapping

Parameter set	Index	Subindex
-	115	0

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

9.53.1 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.

9.53.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.54.1 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.

9.54.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.55.1 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.

9.55.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.56.1 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.

9.56.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.57.1 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.

9.57.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.58.1 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	Designation/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	-

Bit	Designation/function	Comment
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 in 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

The two parameters P-0-2900.2.8 and P-0-2900.2.9 define a signal range (e.g. 0.1-10 V), which is translated into a value range (e.g. 0-400 bar). The value range is determined using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.58.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.59.1 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 in V or mA into the actual pressure value in 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

The two parameters P-0-2900.2.8 and P-0-2900.2.9 define signal range (e.g. 0.1-10 V), which is converted into a value range (e.g. 0-400 bar). The value range is determined using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.59.2 IO-Link mapping

Parameter set	Index	Subindex
-	86	0

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

9.60.1 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 in V or mA into the actual pressure value in bar is set.

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

A voltage in V or a current in mA is applied 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

The two parameters P-0-2900.2.8 and P-0-2900.2.9 define a signal range (e.g. 0.1-10 V), which is translated into a value range (e.g. 0-400 bar). The value range is determined using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.60.2 IO-Link mapping

Parameter set	Index	Subindex
-	87	0

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

9.61.1 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 in V or mA into the actual pressure value in bar is set.

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

A voltage in V or a current in mA is applied 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

The two parameters P-0-2900.2.8 and P-0-2900.2.9 define a signal range (e.g. 0.1-10 V), which is translated into a value range (e.g. 0-400 bar). The value range is determined using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.61.2 IO-Link mapping

Parameter set	Index	Subindex
-	88	0

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

9.62.1 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 in V or mA into the actual pressure value in bar is set.

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

A voltage in V or a current in mA is applied 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

The two parameters P-0-2900.2.8 and P-0-2900.2.9 define a signal range (e.g. 0.1-10 V), which is translated into a value range (e.g. 0-400 bar). The value range is determined using the parameters P-0-2900.2.10 and P-0-2900.2.11.

9.62.2 IO-Link mapping

Parameter set	Index	Subindex
-	89	0

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

9.63.1 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.

9.63.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.64.1 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.

9.64.2 IO-Link mapping

Parameter set	Index	Subindex
-	84	0

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

9.65.1 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.

9.65.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.66.1 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	-

9.66.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.67.1 Description

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

9.67.2 IO-Link mapping

Parameter set	Index	Subindex
-	82	0

9.68 P-0-4028 - Analog valve: Control word

9.68.1 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	Designation/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	

9.68.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.69 P-0-4073 - IO link: Diagnosis

9.69.1 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.

9.69.2 IO-Link mapping

Parameter set	Index	Subindex
-	69	0

9.70 P-0-4085 - Force mode: Configuration

9.70.1 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	

9.70.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.71.1 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 preprocessing, 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 is or her access rights. The user currently logged into the valve is displayed in parameter P-0-2909.0.1.

9.71.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.72 S-0-0030 - Firmware version

9.72.1 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

9.72.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.73 S-0-0140 - Valve designation

9.73.1 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.

9.73.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.74.1 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.

9.74.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

9.75 S-0-0254 - Current parameter set

9.75.1 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

9.75.2 IO-Link mapping

Parameter set	Index	Subindex
-	-	-

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

9.76.1 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.

9.76.2 IO-Link mapping

System command
130

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

9.77.1 Description

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

9.77.2 IO-Link mapping

System command
161

9.78 S-0-0800 - Pressure command value

9.78.1 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.

9.78.2 IO-Link mapping

Parameter set	Index	Subindex
-	78	0

9.79 S-0-0809 - Actual pressure value

9.79.1 Description

This parameter displays the current actual pressure value.

9.79.2 IO-Link mapping

Parameter set	Index	Subindex
-	79	0

9.80 S-0-0814 - Tank pressure

9.80.1 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.

9.80.2 IO-Link mapping

Parameter set	Index	Subindex
-	74	0

9.81 S-0-0827 - Pressure control deviation

9.81.1 Description

This parameter displays the current pressure control deviation.

9.81.2 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
97816 Lohr am Main, Germany
Phone +49 (0) 9352/40 50 60
Email: service@boschrexroth.de

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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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