Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Profibus protocol
for IFB-P- and IAC-P-valves

RE 29015-02-Z/09.06

Protocol description

Foreword

This description refers to Rexroth IFB-P- and IAC-P- valves on the basis of proportional valves.

IFB-P- valves are valves with integrated electronics, which are controlled via field bus (e.g. 4WREF).

IAC-P- valves include additionally pQ or axis controller functions (devices, e.g. 4WREQ, 4WREA, STW0195-2x, STW0196-1x, STW0240).

The product description is based on the Profibus-DP profile for proportional valves and hydraulic drives, version 1.5.

Further information can be found on the Internet at http://www.boschrexroth.com/iac.

Table of contents

Table of contents

1 Profibus

1.1 Physical properties of the bus

- Standard: IEC 61158
- Bus topology: Line
- Differential signal transmission
- Bus termination specified at both ends of the bus
- Potential separation is recommended

1.2 Properties of Profibus for IFB and IAC-P valves

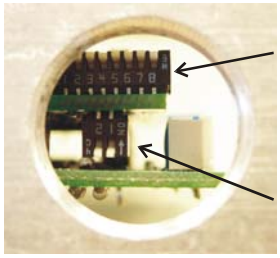
- Support of DP/V0 and DP/V1
- Support of “PROFIBUS – DP Profile Fluid Power Technology“ profile for valves (not for drives !)

1.3 Profibus software

- In conjunction with Profibus, in the case of 2-byte or 4-byte variables, the MSB (= most significant byte) is always sent first
- The ID number of devices is 0109_{HEX}
- The associated GSD file has the designation “BREX0109.GSD“

2 Addresses and baud rate

Valve address



Setting of valve address
+ switch up = 0
+ switch down = 1

Activation of bus termination:
+ both up = active
+ both down = inactive

The address is set by means of DIL switches. The lowest address is 1, the highest one 126.

For use with Profibus, the valve address is set externally by means of DIL switches. Bit B0 is located on right, bit B7 on the left!

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Address range
0	0	0	0	0	0	0	0	00	125 = default or re-programmed
0	0	0	0	0	0	0	1	01	1...126 with parameter channel
up to								up to	
0	1	1	1	1	1	1	0	7E	
1	0	0	0	0	0	0	0	80	1...126 without parameter channel
up to								up to	
1	1	1	1	1	1	1	0	FE	
1	1	1	1	1	1	1	1	FF	Monitor operation Address 125

Baud rate

The baud rate is set automatically. The highest supported baud rate is 12 MBaud.

3 Block model

The device parameters are accessed by means of blocks (also termed “slots”) and indices.
Every device can utilize up to 255 blocks. Each block consists of up to 255 indices.
Indices 1…99 are profile-specific, indices 100…255 are manufacturer-specific.

Blocks/indices can be accessed in two ways:

- DP/V0: Parameter channel (if activated)
- DP/V1: by way of standard C1 or C2 accesses

4 Profibus DP/V0

4.1 Standard telegrams

4 different standard telegrams can be selected by means of the GSD file:

Standard telegram 3:

	Master → Slave		**Slave → Master**	
Octet	MSB	LSB	MSB	LSB
0…7	Parameter channel		Parameter channel	
8…9	Control word	Control word	Status word	Status word
10..11	Command values	Command values	Actual value	Actual value

This telegram is assigned to IFB valves (e.g. 4WREF).

Standard telegram 4:

	Master → Slave		**Slave → Master**	
Octet	MSB	LSB	MSB	LSB
0…1	Control word	Control word	Status word	Status word
2…3	Command values	Command values	Actual value	Actual value

This telegram is assigned to IFB valves (e.g. 4WREF).

Standard telegram 5:

	Master → Slave		**Slave → Master**	
Octet	MSB	LSB	MSB	LSB
0…7	Parameter channel		Parameter channel	
8…9	Control word	Control word	Status word	Status word
10..11	Command value p	Command value p	Actual value p	Actual value p
12..13	Command value Q	Command value Q	Actual value Q	Actual value Q

This telegram is assigned to IAC-P valves (e.g. 4WREQ, STW0195, STW0196, STW0240, 4WREA).

Standard telegram 6:

	Master → Slave		**Slave → Master**	
Octet	MSB	LSB	MSB	LSB
0…1	Control word	Control word	Status word	Status word
2…3	Command value p	Command value p	Actual value p	Actual value p
4…5	Command value Q	Command value Q	Actual value Q	Actual value Q

This telegram is assigned to IAC-P valves (e.g. 4WREQ, STW0195, STW0196, STW0240, 4WREA).

Standard telegrams 1 and 2 are assigned to drives and not provided for IFB or IAC-P devices.

4.2 Use of standard telegrams

Command value input

The command value input depends on the valve type

Valve type	Controller mode	Command value	Representation of figures
WREF	2	Command value = spool position command value	0xC000…0x4000 = -100…+100%
WREQ/ STW0195/ STW0196	5	p command value	0…pressure reference directly in 0.1 bar increments
		Q command value (spool position)	0xC000…0x4000 = -100…+100%
WREQ	-3	p command value	0…pressure reference directly in 0.1 bar increments
		Q command value (flow)	Negative flow reference (P-B) … positive flow reference (P-A) in 0.1 l/min increments
STW0240/ WREA	-9	Q command value = cylinder position command value	0…0x4000 = 0…+100%
		not used	

Reading actual values

The actual value representation depends on the valve type

Valve type	Controller mode	Actual value	Representation of figures
WREF	2	Actual value = actual spool position value	0xC000…0x4000 = -100…+100%
WREQ/ STW0195/ STW0196	5	Actual p value	Pressure in 0.1 bar steps (if need be negative at differential pressure control).
		Actual Q value (spool position)	0xC000…0x4000 = -100…+100%
WREQ	-3	Actual p value	Pressure in 0.1 bar steps (if need be negative at differential pressure control).
		Actual Q value (flow)	Negative flow reference (P-B) … positive flow reference (P-A) in 0.1 l/min increments
STW0240/ WREA	-9	Actual Q value = actual cylinder position value	0…0x4000 = 0…+100%
		Actual valve spool position value	0xC000…0x4000 = -100…+100%

Control word input

Bits	Function
0	Disabled (D)
1	Hold (H)
2	Device Mode Active Enabled (M)
3	Reset Fault (R)
4	Reserved
5	Reserved
6	Reserved
7	Reserved
8	Activate pressure controller
9	Reserved
10	Reserved
11	Reserved
12	Reserved
13	Reserved
14	Reserved
15	Reserved

Representation of the status word

Bits	Function
0	Disabled
1	Hold
2	Device Mode Active
3	Ready
4	Local control
5	Reserved
6	Reserved
7	Reserved
8	Pressure controller activated (only pQ)
9	Ramp running
10	Reserved
11	Reserved
12	Monitor function: Command value reached
13	Reserved
14	Reserved
15	Reserved

Parameter channel (Master → Slave)

Structure of the parameter channel (request):

Byte	Meaning
0	Command: 0 = No 0x10 = read parameter 0x20 = write word (16 bits) 0x30 = write double word (32 bits) 0xA0 = write byte (8 bits)
1	Block number (slot number) 0…255
2	Index (1…255)
3	0
4	Byte 3 (MSB in the case of double word accesses)
5	Byte 2
6	Byte 1 (MSB in the case of word accesses)
7	Byte 0 (LSB)

Accesses to objects having a data length of more than 4 bytes (e.g. strings) are not possible under DP/V0. This requires DP/V1 accesses.

Parameter channel (Slave → Master)

Structure of the parameter channel (reply):

Byte	Meaning
0	Reply: 0x00 = no reply 0x10 = a word was transmitted (16 bits) 0x20 = a double word was transmitted (32 bits) 0x70 = error 0xB0 = one byte was transmitted (8 bits)
1	Block number (slot number) read 0…255
2	Read index (1…255)
3	0
4	Byte 3 (MSB in the case of double word accesses)
5	Byte 2
6	Byte 1 (MSB in the case of word accesses)
7	Byte 0 (LSB)

5 Profibus DP/V1

It is also possible to access valve parameters by means of DP/V1 accesses.

The Rexroth application tool WIN-PED 6 ® uses C2 master DP/V1 access, for example, for configuring the device.

Under DP/V1, it is also possible to access strings having a length of more than 4 bytes.

6 Parameterization

The most important valve parameters are described in the following. Blocks and indices are represented in decimal figures.

Basic settings

Device mode

Entry in the object directory	Value	Meaning
Device mode (M429) Block: 0 Index: 39	0	No device mode activated
	1	Command value transmission via the bus
	2	Command value transmission via analog inputs
	5	Internal command value input via command value profile
	Other values within the range of -128...+127	Not defined or reserved for future applications

Local control

Entry in the object directory	Value	Meaning
Local control (M431) Block: 0 Index: 41	0	The control word is transmitted via the bus
	1	The valve uses the current command value also without control word (with 11+PE plug-in connector, analog enable required)
	Other values within the range of -128...+127	Not defined or reserved for future applications

Controller mode

The controller mode is pre-set for the relevant valve type and may be read only , even if writing or changing will not result in a fault message.

Entry in the object directory	Value	Meaning
Controller mode (M430) Block: 0 Index: 40	1	Open-loop position control (flow-controlled valve, e.g. WRAF)
	2	Closed-loop position control (valve with closed-loop position control, e.g. WREF)
	5	IAC-P valve (Q open loop controlled, e.g. WREQ, STW0195, STW0196)
	-3	IAC-P valve (Q closed-loop controlled, e.g. WREQ)
	-9	Valve with integrated axis controller (e.g. WREA, STW0240)
	Other values within the range of -128...+127	Not defined or reserved for future applications

Settings for command value conditioning

Q reference (only IAC-P with closed-loop flow control)

100% reference values can be read out for the analog Q command value and the analog actual Q value. The values are pre-set to suit the relevant valve and should not be increased.

Entry in the object directory	Range of values	Meaning
Q_reference A (M509) Block 92 Index: 20	100...30000	Reference value for closed-loop flow control P to A in 0.1l/min.
Q_reference B (M510) Block: 92 Index: 21	100...30000	Reference value for closed-loop flow control P to B in 0.1l/min.

Pressure reference (only IAC-P valve with pQ function)

The pressure reference is used as 100% reference value for the analog pressure command value input and the actual pressure value output.

Entry in the object directory	Range of values	Meaning
Pressure reference (M425) Block: 22 Index: 27	100... p_sensor in 0.1 bar	Pressure reference The settable maximum value p_sensor corresponds to the pressure range of the pressure sensors used in 0.1 bar (pressure_sensor_value)

Ramp generator for the position command value / Q command value

This parameter is used for activating or selecting a ramp type:

Entry in the object directory	Value	Meaning
Ramp type “position” (M400) Block: 21 Index: 43	0	Ramp is switched off
	1	Ramp type 1: Only one ramp time defined
	2	Ramp type 2: Separate ramp times for extending and retracting
	3	Ramp type 3: Separate ramp times for each quadrant
	Other values within the range of -128...+127	Not defined or reserved for future applications

The various ramp times are saved in the non-volatile EEPROM. The ramp times always refer to a one-sided stroke of 0 → 100%.

Entry in the object directory	Range of values	Meaning
Position ramp, acceleration (M401) Block: 21 Index: 44	0…65535 (in ms)	• Only ramp time for type 1 • Acceleration time (0→ +100% and 0→ -100%) for type 2 • Not used for type 3
Position ramp, negative acceleration (M403) Block: 21 Index: 47		• Not used for types 1 and 2 • Acceleration time in negative direction (0→ -100%) for type 3
Position ramp, positive acceleration (M402) Block: 21 Index: 50		• Not used for types 1 and 2 • Acceleration time in positive direction (0→ +100%) for type 3
Position ramp, deceleration (M404) Block: 21 Index: 53		• Deceleration times (+100→ 0% and -100→ 0%) for type 2 • Not used for types 1 and 3
Position ramp, negative deceleration (M406) Block: 21 Index: 56		• Not used for types 1 and 2 • Deceleration time in negative direction (-100 → 0%) for type 3
Position ramp, positive deceleration (M405) Block: 21 Index: 59		• Not used for types 1 and 2 • Deceleration time in positive direction (+100→ 0%) for type 3

Ramp generator for pressure command value (only IAC-P valve with pQ function)

This parameter is used for activating or selection a ramp type for the pressure ramp:

Entry in the object directory	Value	Meaning
Pressure ramp: Ramp type (M451) Block: 22 Index: 43	0	Ramp is switched off
	1	Ramp type 1: Only one ramp time defined
	2	Ramp type 2: Separate ramp times for extending and retracting
	3	Ramp type 3: Separate ramp times for each quadrant
	Other values within the range of -128...+127	Not defined or reserved for future applications

The various ramp times are saved in the non-volatile EEPROM. The ramp times always refer to a one-sided stroke of 0 → 100%.

Entry in the object directory	Range of values	Meaning
Pressure ramp, acceleration (M452) Block: 22 Index: 44	0…65535 (in ms)	• Only ramp time for type 1 • Acceleration time (0→ +100% and 0→ -100%) for type 2 • Not used for type 3
Pressure ramp, negative acceleration (M454) Block: 22 Index: 47		• Not used for types 1 and 2 • Acceleration time in negative direction (0→ -100%) for type 3
Pressure ramp, positive acceleration (M453) Block: 22 Index: 50		• Not used for types 1 and 2 • Acceleration time in positive direction (0→+100%) for type 3
Pressure ramp, deceleration (M455) Block: 22 Index: 53		• Deceleration times (+100→ 0% and -100→ 0%) fortype 2 • Not used for types 1 and 3
Pressure ramp, negative deceleration (M457) Block: 22 Index: 56		• Not used for types 1 and 2 • Deceleration time in negative direction (-100→ 0%) for type 3
Pressure ramp, positive deceleration (M456) Block: 22 Index: 59		• Not used for types 1 and 2 • Deceleration time in positive direction (+100→ 0%) for type 3

Dead band compensation for valve position

Dead band compensation is used for compensating for the spool overlap (e.g. E- or W-spool).

Entry in the object directory	Value/ range of values	Meaning
Type of dead band compensation (M407) Block 21 Index: 106	0	Dead band compensation switched off
	1	Dead band compensation activated
	Other values within the range of -128...+127	Not defined or reserved for future applications
Jump height on A-side (M408) Block: 21 Index: 107	0... 16384 = 0...100%	Adjustment of jump height on the A-side of the valve
Jump height on B-side (M409) Block: 21 Index: 111	0... 16384 = 0...100%	Adjustment of the height on the B-side of the valve
Threshold value (M410) Block: 21 Index: 113	0... 16384 = 0...100%	Setting of the threshold value for the jump (identical for A- and B-side)

Zero point correction of valve position

This parameter can be used for correcting the zero point of the valve.

Entry in the object directory	Range of values	Meaning
Position offset (M411) Block 21 Index: 128	-16384... +16383	Zero point correction Here, a value of 16384 corresponds to a change of +100%

Limitation

The command values are limited to 100% after conditioning. This is required for safety reasons and cannot be changed.

Command value profile

6 pairs of values can be saved in the command value profile. The parameter “value pair selection“ can be used for selecting a pair of values for processing. The command value profile is activated by means the parameter “device mode”.

Selection of value pair (M508) Block: 91 Index: 26	0...5	Selection of a value pair:
Pressure command value (M502) Block: 91 Index: 20	0...32767	Pressure command value in 0.1 bar (only pQ)
Position/Q command value (M503) Block: 91 Index: 21	-32768...+32767	Position or Q command value in %. A value of 16384 corresponds to 100%. In the case of closed-loop flow control, a resolution of 0.1 l/min is used.
Waiting time (M504) Block: 91 Index: 22	0...4294967296 ms	When the waiting time has elapsed, the next call-up is made.
Pressure ramp (M505) Block: 91 Index: 23	0…65535 ms	Ramp time for pressure (only pQ)
Position/Q ramp (M506) Block: 91 Index: 24	0…65535 ms	Ramp time for position / Q
Next value (M507) Block: 91 Index: 25	0...5	Indicates the next call-up.

Settings for actual value conditioning

Nominal pressure of pressure sensors (only IAC-P with pQ function)

With the help of this parameter the nominal pressure of the pressure sensors used can be read.

Entry in the object directory	Range of values	Meaning
Nominal pressure sensor pressure (M426) Block: 90 Index: 80	Pressure in 0.1 bar	Nominal pressure of pressure sensor(s)

The value is factory-set and should only be read, but not overwritten, since this could result in malfunction of the valve.

Pressure zero point correction (only IAC-P with pQ function)

This parameter is used for correcting the zero point of pressure.

Entry in the object directory	Range of values	Meaning
Pressure offset (M424) Block: 22 Index: 128	-16384... +16383 in 0.1 bar	Pressure offset

Calibration of pressure sensor gain (only IAC-P with pQ function)

The gain of the pressure sensor can be re-calibrated. If several pressure sensors are used, the calibration refers collectively to all sensors.

Entry in the object directory	Range of values	Meaning
Gain, pressure sensor input (M423) Block: 92 Index: 23	0... +65535	Calibration of the input gain of pressure sensors A set value of 32768 corresponds to a calibration value of 1 (pre-set).

Calibration of the area ratio (only IAC-P with pQ function and activated closed-loop force control)

The area ratio of a cylinder can be set here. This parameter is used only, when closed-loop force control is activated.

Entry in the object directory	Range of values	Meaning
Area ratio of cylinder (M481) Block: 90 Index: 54	0... +65535	A set value of 4096 corresponds to an area ratio of 1. A value greater than 1 must be selected, if the valve controls with its port A the cap side of a single rod cylinder; a smaller value must be selected, if port B controls the cap side. If a double rod cylinder is used, the valve should remain set to 4096.

Calibration of external feedback (only with IAC-P with axis controller function)

The external feedback (gain and offset) must be calibrated during commissioning. These parameters are used only when the axis controller is activated.

Entry in the object directory	Range of values	Meaning
Gain of external feedback (M525) Block: 92 Index: 40	-32768... +32767	A set value of 8192 corresponds to a calibration value of 100%.
Offset of external feedback (M526) Block: 92 Index: 41	-32768... +32767	A set value of 32768 corresponds to a calibration value of +100%

Controller settings (only IAC-P valve with pQ function)

Controller parameters for closed-loop pressure control

Entry in the object directory	Value	Meaning
P-part in the large signal range (M412) Block: 90 Index: 40	0...65535	P-part of the PID-controller in the large signal range. A value of 4096 represents a gain of 1.
P-part in the small signal range (M413) Block: 90 Index: 45	0...65535	P-part of the PID-controller in the small signal range. A value of 4096 represents a gain of 1.
Changeover threshold of P-part (M414) Block: 90 Index: 46	0...32768	If the amount of the control deviation is below the threshold value, the P-part is used for the small signal range, and in the case of higher values, the P-part is used for the large signal range. A value of 32768 corresponds to a control deviation of 100%. At a value of 0, only the parameter for the large signal range is active.
I-part in the large signal range (M415) Block: 90 Index: 41	0...65535	I-part of the PID-controller in the large signal range. A value of 0 switches the I-part off. A value of 1310 corresponds to an integral-action time of 100ms; greater values shorten the integral-action time accordingly.
I-part in the small signal range (M416) Block: 90 Index: 47	0...65535	I-part of the PID-controller in the small signal range. A value of 1310 corresponds to an integral-action time of 100ms; greater values shorten the integral-action time accordingly.
Changeover threshold of I-part (M417) Block: 90 Index: 48	0...65535	If the amount of the control deviation is below the threshold value, the I-part is used for the small signal range, whereas in the case of higher values, the I-part is used for the large signal range. A value of 65535 corresponds to 100%. At a value of 0, only the parameter for the large signal range is active.
I-window (M418) Block: 90 Index: 42	0...65535	If the control deviation is within the I-window, the I-part is frozen. This serves to prevent beats. A value of 65535 corresponds to 100%. A value of 0 prevents the deactivation of the I-part.

I control range (M419) Block: 90 Index: 43	0...65535	The I-controller is only activated when the control deviation is within the I control range. A value of 65535 corresponds to a control deviation of 100%. Here, the I-controller is always active.
D-part (M420) Block: 90 Index: 51	0...65535	D-part of the PID-controller. A value of 4096 corresponds to a derivative action of 1 ms. Greater values prolong the derivative action time accordingly.
Velocity feedback (M421) Block: 90 Index: 53	0...65535	Velocity feedback of the PID-controller. The parameter acts like the D-part, but only on the actual value. A value of 4096 corresponds to a derivative action of 1 ms. Greater values prolong the derivative action time accordingly.
First-order time delay (M422) Block: 90 Index: 52	0…65535 in ms	First-order delay for the D-part and the velocity feedback of the PID-controller.
Demand value (control variable) limitation P-B (M482) Block: 90 Index: 55	-16364...0	Limitation of the demand value (control variable) during closed-loop pressure control in A. The parameter limits the stroke in the direction P-B. A value of –16364 permits a –100% aperture P-B (no limitation), whereas 0 does not permit a stroke in the negative direction.
Demand value (control variable) limitation P-A (M483) Block: 90 Index: 56	0...16364	Limitation of the demand value (control variable) during closed-loop pressure control in B. The parameter limits the stroke in the direction P-A. A value of 16364 permits a 100% aperture P-A (no limitation), whereas 0 does not permit a stroke in the positive direction.

Controller parameters for closed-loop flow control (only IAC-P with closed-loop flow control)

Entry in the object directory	Value	Meaning
P-part for P-A (M512) Block: 92 Index: 24	0...65535	P-part of the PID-controller for direction P-A. A value of 4096 represents a gain of 1.
P-part for P-B (M521) Block: 92 Index: 33	0...65535	P-part of the PID-controller for direction P-B. A value of 4096 represents a gain of 1.
I-part for P-A (M513) Block: 92 Index: 25	0...65535	I-part of the PID-controller for direction P-A. A value of 0 switches the I-part off. A value of 1310 corresponds to an integral-action time of 100ms; greater values shorten the integral-action time accordingly.
I-part for P-B (M522) Block: 92 Index: 34	0...65535	I-part of the PID-controller for direction P-B. A value of 0 switches the I-part off. A value of 1310 corresponds to an integral-action time of 100ms; greater values shorten the integral-action time accordingly.
D-part (M517) Block: 92 Index: 29	0...65535	D-part of the PID-controller. A value of 4096 corresponds to a derivative action of 1 ms. Greater values prolong the derivative action time accordingly.
Velocity feedback (M518) Block: 92 Index: 30	0...65535	Velocity feedback of the PID-controller. The parameter acts like the D-part, but only on the actual value. A value of 4096 corresponds to a derivative action of 1 ms. Greater values prolong the derivative action time accordingly.
First-order time delay (M519) Block: 92 Index: 31	0…65535 in ms	First-order delay for the D-part and the velocity feedback of the PID-controller.
Dead band Q controller (M524) Block: 92 Index: 36	0... 16384	Dead band window for the Q- controller. When the Q command value is within this range, which is symmetrical around zero, the Q controller is switched off. Here, a value of 16384 corresponds to a window width of 100%

Controller settings (only IAC-P with axis controller functionality)

Entry in the object directory	Value	Meaning
P-part (M600) Block: 92 Index: 24	0...65535	P-part of the PID-controller. A value of 4096 represents a gain of 1.
I-part (M601) Block: 92 Index: 25	0...65535	I-part of the PID-controller. A value of 0 switches the I-part off. A value of 655 corresponds to an integral-action time of 100ms; greater values shorten the integral-action time accordingly.
Direction-dependent gain (M602) Block: 92 Index: 28	0...65535	Direction-dependent output gain of the PID-controller. The output to the valve position controller is raised or lowered by the value set for the direction P-B or A-T, respectively. When a value of 4096 is set, the direction-dependent gain is 1.
I-window (M606) Block: 92 Index: 32	0...65535	If the control deviation is within the I-window, the I-part is frozen. This serves to prevent beats. A value of 65535 corresponds to 100%. A value of 0 prevents the deactivation of the I-part.
I control range (M607) Block: 92 Index: 35	0...65535	The I-controller is only activated when the control deviation is within the I control range. A value of 65535 corresponds to a control deviation of 100%. Here, the I-controller is always active.
D-part (M603) Block: 92 Index: 29	0...65535	D-part of the PID-controller. A value of 4096 corresponds to a derivative action of 1 ms. Greater values prolong the derivative action time accordingly.
Velocity feedback (M604) Block: 92 Index: 30	0...65535	Velocity feedback of the PID-controller. The parameter acts like the D-part, but only on the actual value. A value of 4096 corresponds to a derivative action of 1 ms. Greater values prolong the derivative action time accordingly.
First-order time delay (M605) Block: 92 Index: 31	0…65535 in ms	First-order delay for the D-part and the velocity feedback of the PID-controller.

Further objects

Process parameters

These values are usually written and read via the DP/V0 process data channel. For checking purposes, a direct address access is also possible.

Entry in the object directory	Value	Meaning
Control word (M427) Block: 0 Index: 37	0...65535	Control word of the valve in the case of digital control
Q command value (M442) Block: 21 Index: 21	-32768...+32767	Reading provides the current position / Q command value of the valve. Writing is not accepted. Here, the value of 16384 corresponds to +100%. In the case of closed-loop Q control, the command value is given directly in 0.1l/min (positive for P-A, and negative for P-B).
Pressure command value (M447) Block: 22 Index: 21	0...+32767	Reading provides the current pressure command value of the valve (only with pQ). Writing is not accepted. The resolution is 0.1 bar.
Status word (M428) Block: 0 Index: 38	0...65535	Status word of the valve. Corresponds to the status word in the PDO.
Actual Q value (M443) Block: 21 Index: 144	-32768...+32767	Actual value of the valve. A value of 16384 corresponds to a change of +100%. In the case of closed-loop Q control, the actual flow value is output. The value is shown in 0.1 l/min (positive for P-A, and negative for P-B).
Actual pressure value (M448) Block: 22 Index: 144	-32768...+32767	Actual pressure value of the valve with a resolution of 0.1 bar (only with pQ; if need be negative at differential pressure control).

Monitor parameters

The monitor function requires the entry of a threshold value and a time. When the value to be monitored is within the threshold, bit 12 is set in the status word of the send telegram. When the value to be monitored leaves the window and if it is still outside after the monitoring time has elapsed, the bit is reset.
If the digital output at pin 11 of the 11+PE plug-in connector is configured as “monitor output“, it is also set accordingly.

Which value is monitored as a standard depends on the controller mode.

Entry in the object directory	Value	Meaning
Pressure controller monitoring time (M458) Block: 22 Index: 216	0...65535	Indication of the monitoring time in ms
Monitor threshold (M459) Block: 22 Index: 204	0...65535	A value of 16384 corresponds to a pressure threshold of +100%.
Monitoring time for Q controller (M531) Block: 92 Index: 216	0...65535	Indication of the monitoring time in ms
Monitor threshold for Q controller (M532) Block: 92 Index: 204	0...65535	A value of 16384 corresponds to a flow threshold of +100%.
Monitoring time for axis controller (M608) Block: 92 Index: 216	0...65535	Indication of the monitoring time in ms
Monitor threshold for axis controller (M609) Block: 92 Index: 204	0...65535	A value of 16384 corresponds to a position threshold of +100%.

Other parameters

Entry in the object directory	Value	Meaning
Gain of external axis controller input (M525) Block: 92 Index: 40	-32768... +32767	Adjustment of the input gain of the external analog sensor input for the axis controller. A value of 8192 corresponds to a gain of +1.
Offset of external axis controller input (M526) Block: 92 Index: 41	-16384... +16383	Adjustment of the offset of the external analog sensor input for the axis controller. A value of +16383 corresponds to a +50% offset.

Internal status

The internal status can be utilized for troubleshooting. However, depending on the valve version, different bit places are used!

Entry in the object directory	Bit place	Meaning when bit place = 1
Status double word (M461) Block 90 Index 20	1	Output stage OFF
	2	Parameter loss
	4	Ramp active
	8	Watchdog
	16	Analog enable applied
	32	Cable break LVDT
	64	Undervoltage: Signal supply
	128	Undervoltage: Power supply
	256	Cable break, pressure command value
	512	Cable break, sensor, sandwich plate in A
	1024	Cable break, Q command value
	2048	Parameter error
	4096	Cable break, sensor, sandwich plate in A
	8192	Cable break, sensor, sandwich plate in P
	16384	Cable break, sensor, sandwich plate in T
	32768	Cable break, external sensor
	65536	Position monitor: within window
	131072	Pressure monitor: within window
	262144	Overpressure
	524288	Shutdown overpressure

7 Parameter list

No.	Block (hex)	Index (hex)	Minimum value	Maximum value	Designation	Controller mode			
						2	5	-3	-9
M 3	0	14	0	0	Manufacturer's name	X	X	X	X
M 2	0	1A	0	0	Hardware version	X	X	X	X
M 1	0	18	0	0	Software version	X	X	X	X
M 4	5A	14	0	0	Internal status	X	X	X	X
M 427	0	25	0	65535	Control word	X	X	X	X
M 428	0	26	0	65535	Status word	X	X	X	X
M 429	0	27	0	5	Device mode	X	X	X	X
M 430	0	28	0	255	Controller mode	X	X	X	X
M 431	0	29	0	1	Local control	X	X	X	X
M 442	15	15	-16384	16384	Q command value	X	X	X	X
M 443	15	90	-16384	16384	Actual Q value	X	X	X	X
M 444	15	18	-16384	16384	Q reference value	X	X	X	X
M 445	15	1B	-16384	16384	Position reference	X	X	X	X
M 446	15	1E	-16384	16384	Q hold command value	X	X	X	X
M 411	15	80	-16384	16384	Position offset	X	X	X	X
M 400	15	2B	0	3	Q-ramp, ramp type	X	X	X	X
M 401	15	2C	0	65535	Q-ramp, acceleration	X	X	X	X
M 402	15	32	0	65535	Q ramp: Acceleration in the positive direction	X	X	X	X
M 403	15	2F	0	65535	Q ramp: Acceleration in the negative direction	X	X	X	X
M 404	15	35	0	65535	Q-ramp, deceleration	X	X	X	X
M 405	15	3B	0	65535	Q ramp: Deceleration in the positive direction	X	X	X	X
M 406	15	38	0	65535	Q ramp: Deceleration in the negative direction	X	X	X	X
M 407	15	6A	0	1	Activation of dead band compensation	X	X	X	X
M 408	15	6B	0	8192	Dead band compensation, jump height P->A	X	X	X	X
M 409	15	6F	0	8192	Dead band compensation, jump height P->B	X	X	X	X
M 410	15	71	0	8192	Threshold value for dead band compensation	X	X	X	X
M 447	16	15	0	4000	Pressure command value		X	X	
M 448	16	90	-10000	10000	Actual pressure value		X	X	
M 425	16	1B	0	10000	Pressure reference for pressure controller		X	X	
M 450	16	1E	0	10000	Pressure hold command value		X	X	
M 424	16	80	-10000	10000	Pressure controller offset		X	X	
M 451	16	2B	0	3	Pressure ramp, ramp type		X	X	
M 452	16	2C	0	65535	Pressure ramp, acceleration		X	X	
M 453	16	32	0	65535	Pressure ramp, acceleration in the positive direction		X	X	
M 454	16	2F	0	65535	Pressure ramp, acceleration in the negative direction		X	X	
M 455	16	35	0	65535	Pressure ramp, deceleration		X	X	

Parameter list 7

No.	Block (hex)	Index (hex)	Minimum value	Maximum value	Designation	Controller mode			
						2	5	-3	-9
M 456	16	3B	0	65535	Pressure ramp: Deceleration in the positive direction		X	X	
M 457	16	38	0	65535	Pressure ramp: Deceleration in the negative direction		X	X	
M 458	16	D8	0	65535	Deceleration time for the pressure monitor window for the pressure controller		X	X	
M 459	16	CC	0	16384	Threshold of the pressure monitor window for the pressure controller		X	X	
M 460	77	0A	0	15	Behavior without analog enable		X	X	X
M 461	5A	14	0	4294836225	Internal status	X	X	X	X
M 462	5A	15	-16384	16384	Valve position	X	X	X	X
M 412	5A	28	0	65535	P-part of the pressure controller in the large signal range.		X	X	
M 415	5A	29	0	65535	I-part of the pressure controller in the large signal range.		X	X	
M 418	5A	2A	0	65536	Disable window of pressure controller I-part		X	X	
M 419	5A	2B	0	65535	Enable window of pressure controller I-part		X	X	
M 413	5A	2D	0	65535	P-part of the pressure controller in the small signal range		X	X	
M 414	5A	2E	0	32768	Changeover threshold of P-part for the pressure controller		X	X	
M 416	5A	2F	0	65535	I-part of the pressure controller in the small signal range		X	X	
M 417	5A	30	0	65535	Changeover threshold of I-part for the pressure controller		X	X	
M 479	5A	31	0	32768	Command value feedforward P-A		X	X	
M 480	5A	32	0	32768	Command value feedforward P-B		X	X	
M 420	5A	33	0	65535	D-part of pressue controller		X	X	
M 422	5A	34	0	65535	First-order time delay for the pressure controller		X	X	
M 421	5A	35	0	65535	Velocity feedback for the pressure controller		X	X	
M 481	5A	36	0	65535	Area ratio for differential pressure control		X	X	
M 482	5A	37	-32768	16384	Limitation of demand value P-A for the pressure controller		X	X	
M 483	5A	38	-16384	32768	Limitation of demand value P-B for the pressure controller		X	X	
M 484	5A	39	0	65535	Delayed activation of the pressure controller		X	X	
M 492	5A	4B	0	255	Threshold, short-circuiting of pressure controller integrator		X	X	
M 426	5A	50	0	10000	Nominal pressure of the pressure sensor		X	X	
M 501	5A	5C	0	65535	Setting of pins 3 and 11		X	X	X
M 502	5B	14	0	10000	Sequence control: Pressure command value		X	X	
M 503	5B	15	-16384	16384	Sequence control: Q command value	X	X	X	X
M 504	5B	16	0	4294836225	Sequence control: Dwell time	X	X	X	X

No.	Block (hex)	Index (hex)	Minimum value	Maximum value	Designation	Controller mode			
						2	5	-3	-9
M 505	5B	17	0	65535	Sequence control: Pressure ramp		X	X	
M 506	5B	18	0	65535	Sequence control: Q ramp	X	X	X	X
M 507	5B	19	0	5	Sequence control: Next call-up	X	X	X	X
M 508	5B	1A	0	5	Sequence control: Active parameter set	X	X	X	X
M 509	5C	14	0	32000	Flow reference P-A			X	
M 510	5C	15	0	32000	Flow reference P-B			X	
M 423	5C	17	0	65536	Pressure sensor calibration value for pressure controller		X	X	
M 512	5C	18	0	65535	P-part of Q controller P-A			X	
M 513	5C	19	0	65535	I-part of Q controller P-A			X	
M 514	5C	1A	-10000	10000	Q controller offset			X	
M 517	5C	1D	0	65535	D-part of Q controller			X	
M 518	5C	1E	0	65535	Velocity feedback of Q controller			X	
M 519	5C	1F	0	65535	First-order time delay of Q controller			X	
M 521	5C	21	0	65535	P-part of Q controller P-B			X	
M 522	5C	22	0	65535	I-part of Q controller P-B			X	
M 524	5C	24	0	16384	Dead band of Q controller			X	
M 525	5C	28	-32768	32767	Gain of external axis controller input				X
M 526	5C	29	-16384	16383	Offset of external axis controller input				X
M 527	5C	32	0	32000	System pressure			X	
M 528	5C	33	0	32000	Tank pressure			X	
M 531	5C	D8	0	65535	Time of Q controller pressure monitor window			X	
M 532	5C	CC	0	16384	Threshold for Q controller monitor window			X	
M 533	5A	5D	0	65535	Filter	X	X	X	X
M 600	5C	18	0	65535	P-part of closed-loop position control				X
M 601	5C	19	0	65535	I-part of closed-loop position control				X
M 602	5C	1C	0	65535	Position control gain pB/pA				X
M 603	5C	1D	0	65535	D-part of closed-loop position control				X
M 604	5C	1E	0	65535	Velocity feedback of closed-loop position control				X
M 605	5C	1F	0	65535	Time constant for closed-loop position control				X
M 606	5C	20	0	32768	Disable threshold for closed-loop position control, small signal				X
M 607	5C	23	0	32768	Enable threshold for closed-loop position control, large signal				X
M 608	5C	D8	0	65535	Time of position controller monitor window				X
M 609	5C	CC	0	16384	Monitor window threshold for position controller				X

!	The details for minimum and maximum values only indicate the max. permissible range of figures. The range of useful values can be restricted in dependence on the individual mode!

8 Overview of interfaces

8.1 IFB (field bus valves)

6+PE plug-in connector

Pin	Name
A	Voltage supply 24VDC (range 19...35V u(t))
B	Voltage supply GND
C	Reference for actual value output
D	Command value input for position or solenoid current (±10V or 4…20mA)
E	Reference for command value input
F	Actual value output (only position; ±10V or 4…20mA)
PE	Ground connection

Bus plug-in connector 1 (M12, 5 pins, female, B-coded)

Pin	Name
1	5V output
2	Bus A cable
3	GND
4	Bus B cable
5	Shield (optional)

Bus plug-in connector 2 (M12, 5 pins, male, B-coded)

Pin	Name
1	5V output
2	Bus A cable
3	GND
4	Bus B cable
5	Shield (optional)

8.2 IAC-P

11+PE plug-in connector

Pin	Name
1	24VDC power supply for output stage
2	Power supply GND
3	Enable 24VDC
4	Command value input for position or flow (±10V or 4…20mA)
5	Reference for command value inputs
6	Actual value output for position or flow (±10V or 4…20mA)
7	Command value input for pressure (only with pQ function; ±10V or 4…20mA)
8	Actual value output for pressure (only with pQ function; ±10V or 4…20mA)
9	24VDC signal supply for controller/field bus
10	Signal supply GND (no electrical insulation vis-à-vis pin 2) moreover, reference for pins 3,6,8,and 11
11	Switching output 24VDC (default: Error output)
PE	Ground connection

Bus plug-in connector 1 (M12, 5 pins, female, B-coded)

Pin	Name
1	5V output
2	Bus A cable
3	GND
4	Bus B cable
5	Shield (optional)

Bus plug-in connector 2 (M12, 5 pins, male, B-coded)

Pin	Name
1	5V output
2	Bus A cable
3	GND
4	Bus B cable
5	Shield (optional)

Connection of external sensor (M12, 5 pins, female, A-coded, only for IAC-P with external sensor connection)

Pin	Name
1	Voltage output +24V (level corresponds to pin 9 of the 11+PE plug-in connector)
2	Input of external actual value (cylinder position, etc., 0…10V or 4...20mA)
3	GND
4	nc
5	nc

9 Commissioning

9.1 Factory settings

Bus valves / IAC-P valves are delivered with the following basic configuration:

- The bus address is NOT pre-set and must be set by means of DIP switches before commissioning.
- Analog command value input
- In the case of the 11+PE plug-in connector, the enable must be used; with the 6+PE plug-in connector the enable is internally wired.

9.2 Parameterization

When the valve is switched on for the first time, the following functions are directly available:

- Analog command value input and actual value output
- Parameterization via the CAN bus

  The valve is parameterized directly by means of direct accesses to the object directory entries. The parameters are saved in the internal, non-volatile EEPROM

Once the parameters are entered, it is possible to start the transmission of analog command values immediately. If the command values are to be transmitted digitally via the bus, this must be activated first.

9.3 Command value input via Profibus

A precondition for transmitting command values via the bus is the configuration of the objects “device mode“ (M429) and “local control“ (M431). Both should be set to digital command value input.

- For the enable, the 3 bits D, H and M of the control word must be set and transmitted to the valve simultaneously with the command value (see telegram definitions).
- If one of these 3 bits is transmitted with “0“, the enable is withdrawn.
- The control bits have a direct influence on the corresponding status bits (reply slave → master).

9.4 Starting after a fault

- After an error was detected, the enable is immediately withdrawn internally. The ready bit is set to 0 in the status word.
- To restart the valve, the Reset Fault (R) bit must be set once by means of the control word in order to reset the fault (evaluation of edge 0→ 1).

10 Commissioning software

The commissioning software used for IFB and IAC-P valves is the PC program WIN-PED 6.

To establish the communication, an interface adapter and a special bus cable are required. The ordering details can be found in the relevant RE data sheet of the valve.

The applications tool is used for the configuration and diagnosis of devices, especially during commissioning.

The commissioning software WIN-PED 6works with so-called machine data. These are identified with “M...” in the overview of the bus parameters in order to provide a context, e.g. M400 for the type of position ramp.

Commissioning software 10

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
D-97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de