4/3 directional control valve, pilot operated, with electric position feedback and integrated electronics (OBE)

Type 4WRVE 10...27, symbols V, V1

Sizes 10, 16, 25, 27
Component series 2X
Maximum operating pressure P, A, B 350 bar (size 27: 280 bar)
Rated flow 40...430 l/min (Δp = 10 bar)

Table of contents

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features</td>
<td>1</td>
</tr>
<tr>
<td>Ordering code</td>
<td>2</td>
</tr>
<tr>
<td>Function, section</td>
<td>3</td>
</tr>
<tr>
<td>Symbols</td>
<td>4</td>
</tr>
<tr>
<td>Test and service devices</td>
<td>4</td>
</tr>
<tr>
<td>Technical data</td>
<td>5 and 6</td>
</tr>
<tr>
<td>Electrical connection</td>
<td>7</td>
</tr>
<tr>
<td>Technical notes for the cable</td>
<td>7</td>
</tr>
<tr>
<td>Integrated electronics</td>
<td>8</td>
</tr>
<tr>
<td>Characteristic curves</td>
<td>9 to 11</td>
</tr>
<tr>
<td>Unit dimensions</td>
<td>12 to 14</td>
</tr>
</tbody>
</table>

Features

- Pilot operated high-response 4/3 directional control valve size 10 to size 27, with control spool and bushing in servo quality
- Integrated electronics (OBE) with position controller for pilot control and main stage, calibrated in the factory
- Main stage in servo quality with position feedback
- Flow characteristics
  - M = progressive with fine control edge
  - P = inflected characteristic curve
  - L = linear
- Electric port 11P+PE
  - Differential amplifier signal input with interface B5 ±10 V

Information on available spare parts:
www.boschrexroth.com/spc
Ordering code

with integrated electronics = E

Size
= 10
= 16
= 25
= 27 1)

Control spool symbols
4/3 directional design

For V1:
P → A: \( q \)  
P → B: \( q/2 \)  
A → T: \( q \)  
B → T: \( q/2 \)

Rated flow
at 10 bar valve pressure differential  
(5 bar/control edge)

Size 10
40 l/min \(^2\) = 40
55 l/min \(^3\) = 55
70 l/min \(^2\) = 70
85 l/min \(^3\) = 85

Size 16
90 l/min \(^2\) = 90
120 l/min \(^3\) = 120
150 l/min \(^2\) = 150
200 l/min \(^3\) = 200

Size 25
300 l/min \(^2\) = 300
370 l/min \(^3\) = 370

Size 27
430 l/min \(^1\) \(^3\) = 430

1) Size 27 is the high-flow version of size 25, the connection bores P, A, B, T are designed with \( \varnothing 32 \) mm in the main stage. In the manifold, ports P, A, B, T can be drilled with max. \( \varnothing 30 \) mm in deviation from standard ISO 4401-08-08-0-05. Thus, the valves allow for higher flow values \( Q_A : Q_B \)

2) \( Q_m \): Flow characteristics "P"

3) \( Q_N \): Flow characteristics "M" or "L"

Further details in the plain text

Seal material
\( M = \) NBR seals
suitable for mineral oils
(HL, HLP)
according to DIN 51524

Interface of the control electronics
\( B5 = \) Command value input ±10 V

Electrical connection
without mating connector,
with unit connector according to DIN 43563-AM6
Mating connector – separate order

Pilot oil supply "x", pilot oil return "y"

No code = "x" = external, "y" = external

\( E = \) "x" = internal, "y" = external

\( ET = \) "x" = internal, "y" = internal

Supply voltage of the electronics
\( G24 = \) +24 V direct current

Component series 20 to 29
(unchanged installation and connection dimensions)

Flow characteristics
\( M = \) Progressive with linear fine control (up to 20%)
\( P = \) Inflected characteristic curve, linear (inflection at 40%)
\( L = \) Linear
Function, section

Structure
The valve consists of 3 main assemblies:
- Pilot control valve (1) with control spool and bushing, return springs, double stroke solenoid and inductive position transducer
- Main stage (2) with centering springs and position feedback
- Integrated control electronics (3)

Functional description
In the integrated electronics, the specified command value is compared with the actual position value of the main stage control spool. In case of control deviations, the double stroke solenoid is activated which adjusts the pilot control spool due to the changed magnetic force. The flow released through the control cross-sections causes the displacement of the main control spool, the stroke/control cross-section of which is controlled proportionally to the command value. If the command value is 0 V, the electronic controls the control spool of the main stage in the center position.
The pilot control valve is supplied with the pilot oil either internally through port P or externally through port X. The return to the tank can be implemented internally via port T or externally via port Y.
If deactivated or in case of no release, the pilot control valve is undefined in P-B/A-T (preferred) or P-A/B-T, the main stage can be completely controlled.
Symbols

Type ...~3X...

Type ...~3X...E...

Type ...~3X...ET...

Type ...~3X...T...

Test and service devices

- Type VT-VETSY-1 service case with test device, see RE 29685
- Measuring adapter 11P+PE type VT-PA-1, see RE 30067
Technical data

**general**

<table>
<thead>
<tr>
<th>Type</th>
<th>Spool valve, pilot operated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuation</td>
<td>Directional control valve size 6 - OBE, with position controller for pilot control valve and main stage</td>
</tr>
<tr>
<td>Type of connection</td>
<td>Subplate mounting, porting pattern according to ISO 4401-...</td>
</tr>
<tr>
<td>Installation position</td>
<td>Any</td>
</tr>
<tr>
<td>Ambient temperature range °C</td>
<td>–20...+50</td>
</tr>
<tr>
<td>Weight kg</td>
<td><strong>Size 10</strong> 8.0</td>
</tr>
<tr>
<td>Vibration resistance, test condition</td>
<td>Max. 25 g, room vibration test in all directions (24 h)</td>
</tr>
</tbody>
</table>

**hydraulic** (measured with HLP 46, \( \theta_{oi} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C} \))

| Viscosity range recommended mm²/s | 20...100 |
| Viscosity range max admissible mm²/s | 10...800 |

| Hydraulic fluid temperature range °C | –20...+65 |

| Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c) | Class 18/16/13 |

| Flow direction | According to symbol |

<table>
<thead>
<tr>
<th>Rated flow at ( \Delta p = 5 , \text{bar per edge} )</th>
<th>l/min</th>
<th><strong>Size 10</strong></th>
<th><strong>Size 16</strong></th>
<th><strong>Size 25</strong></th>
<th><strong>Size 27</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating pressure Ports P, A, B external pilot oil supply bar</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>Max. operating pressure Ports P, A, B internal pilot oil supply bar</td>
<td>250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. operating pressure Ports T, X, Y bar</td>
<td>250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. pilot oil pressure “pilot control stage” bar</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( Q_{\text{max}} ) l/min</td>
<td>170</td>
<td>450</td>
<td>900</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>( Q_{\text{p}} ) pilot control valve l/min</td>
<td>8</td>
<td>24</td>
<td>40</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Zero flow pilot control valve at 100 bar cm³/min</td>
<td>&lt;180</td>
<td>&lt;300</td>
<td>&lt;500</td>
<td>&lt;500</td>
<td></td>
</tr>
<tr>
<td>Zero flow main stage at 100 bar cm³/min</td>
<td>&lt;400</td>
<td>&lt;600</td>
<td>&lt;1000</td>
<td>&lt;1000</td>
<td></td>
</tr>
</tbody>
</table>

**static / dynamic**

| Hysteresis % | <0.1 hardly measurable |
| Manufacturing tolerance \( Q_{\text{max}} \) % | <10 |
| Actuating time for signal step (at \( X = 100 \, \text{bar} \)) 0...100 % | 12 | 15 | 23 | 23 |
| Actuating time for signal step (at \( X = 10 \, \text{bar} \)) 0...10 % | 6 | 7 | 10 | 10 |
| Actuating time for signal step (at \( X = 10 \, \text{bar} \)) 0...100 % | 40 | 50 | 90 | 90 |
| Actuating time for signal step (at \( X = 10 \, \text{bar} \)) 0...10 % | 20 | 20 | 30 | 30 |

| Switch-off behavior | after electrical shut-off: Pilot control valve not defined in P-B/A-T or P-A/B-T, main stage can be completely controlled (PB/AT or PA/BT) |
| Temperature drift | Zero shift \(<1\% \) at \( \Delta T = 40 \, ^\circ\text{C} \) |
| Zero compensation | ex factory ±1 % |

1) The cleanliness classes specified for the components must be complied with in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components. For the selection of the filters, see technical data sheets RE 50070, RE 50076 and RE 50081.

2) Flow with different \( \Delta p \)

\[
Q_x = Q_{\text{nom}} \cdot \sqrt{\frac{\Delta p}{5}}
\]
**Technical data**

**Electric, control electronics integrated in the valve**

<table>
<thead>
<tr>
<th>Relative duty cycle</th>
<th>% 100 ED, max. power consumption 30 VA (24 V=)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection class</td>
<td>IP 65 according to DIN 40050</td>
</tr>
</tbody>
</table>

**Port**

<table>
<thead>
<tr>
<th>Supply 24 V=nom 1)</th>
<th>Plug-in connector, 11P+PE</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>2)</td>
<td></td>
<td>+24 V=nom, fuse protection 2.5 Aec (output stages)</td>
</tr>
<tr>
<td>3)</td>
<td></td>
<td>0 V power ground</td>
</tr>
<tr>
<td>4)</td>
<td></td>
<td>+24 V=nom Signal part</td>
</tr>
<tr>
<td>5)</td>
<td></td>
<td>0 V Signal ground</td>
</tr>
</tbody>
</table>

**Input signal ±10 V**

<table>
<thead>
<tr>
<th>Input signal (LVDT)</th>
<th>Differential amplifier, $R_i = 100 , \text{k}\Omega$</th>
</tr>
</thead>
<tbody>
<tr>
<td>6)</td>
<td>$U_{IN}$</td>
</tr>
<tr>
<td>7)</td>
<td>$U_{IN}$</td>
</tr>
</tbody>
</table>

**Release input**

<table>
<thead>
<tr>
<th>Release input</th>
<th>&gt; 8.5 V to 24 V=nom (max. 40 V=)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8)</td>
<td>$R_i = 10 , \text{k}\Omega$</td>
</tr>
</tbody>
</table>

**Messages**

<table>
<thead>
<tr>
<th>Messages</th>
<th>Acknowledgement release +24 V=</th>
</tr>
</thead>
<tbody>
<tr>
<td>9)</td>
<td>Error message: no error +24 V=</td>
</tr>
</tbody>
</table>

**Protective earthing conductor**

<table>
<thead>
<tr>
<th>Protective earthing conductor</th>
<th>Connect only if 24 V = system transformer does not comply with standard VDE 0551</th>
</tr>
</thead>
</table>

**Electromagnetic compatibility**

<table>
<thead>
<tr>
<th>EN 61000-6-2: 2005-08</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 61000-6-3: 2007-01</td>
</tr>
</tbody>
</table>

1) $24 \, \text{V=nom} = \text{min. 21 V=} \quad \text{– max. 40 V=}$

2) $U_b$ (pin 1) = output stage supply
   - valve "OFF" < 13.4 V=
   - valve "ON" > 16.8 V=
   - no error message (pin 11)

3) $U_b$ (pin 9) = electronics supply
   - valve "OFF" < 16.8 V=
   - error message (pin 11)
   - valve "ON" > 19.5 V=
   - no error message (pin 11)

4) inputs: voltage resistant up to max. 50 V

5) Messages are loadable with max. 20 mA and short-circuit proof against ground

**Note**

Pilot operated 4/3 directional control valves fulfill their function only in active closed control loops and do not have a secured basic position when deactivated. Therefore, "additional isolator valves" are required in many applications and must be taken into account for the On/Off series.
Electrical connection

Electric data, see page 6

1 Control
2 Provided by the customer
3 Mating connector
4 Valve
5 Contact surface
6 Provided by Rexroth

Technical notes for the cable

Version:
- Multi-wire cable
- Litz wire structure, very fine wires according to VDE 0295, class 6
- Protective earthing conductor, green-yellow
- Cu shield braid

Type:
- e.g. Oilflex-FD 855 CP (company Lappkabel)

Number of wires:
- Depends on the valve type, connector type and signal assignment

Line Ø:
- 0.75 mm² up to a length of 20 m
- 1.0 mm² up to a length of 40 m

Outer Ø:
- 9.4...11.8 mm – Pg11
- 12.7...13.5 mm – Pg16

Note
Electric signals taken out via control electronics (e.g. actual value) must not be used for the deactivation of safety-relevant machine functions!
(See also the European standard “Safety requirements for fluid power systems and their components - Hydraulics”, EN 982!)
Integrated electronics

Block diagram/Pinout
version B5: $U_E \pm 10$ V

Pin assignment 11P+PE
version B5: $U_E \pm 10$ V
($R = 100$ kΩ)

Output stage supply
Enable
or LVDT signal (test)
Release acknowledgement
Electronic supply
Error message
Protective earthing conductor

Input signal | Valve position
-------------|------------------
$U_4 - U_6 > 0$ V | A B
$U_4 - U_6 = 0$ V | P T
$U_4 - U_6 < 0$ V | A B
**Characteristic curves** (measured with HLP 46, \( \theta_{\text{oil}} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C} \))

**Flow – signal function** \( Q = f (U_e) \)

Flow characteristics M

Flow characteristics P

Flow characteristics L
Characteristic curves (measured with HLP 46, $\theta_{\text{Oil}} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C}$)

Pressure gain $\Delta = f (U_E)$

Step function  $0 \rightarrow 100\%$

Size 10

Size 16

Size 25/27
**Characteristic curves** (measured with HLP 46, $\theta_{oil} = 40 ^\circ C \pm 5 ^\circ C$)

**Bode diagram**

**Size 10**

![Bode diagram for Size 10](image)

**Size 16**

![Bode diagram for Size 16](image)

**Size 25/27**

![Bode diagram for Size 25/27](image)
Unit dimensions size 10 (dimensions in mm)

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring 12x2 (ports P, A, B, T, T1)
8 O-ring 10x2 (ports X, Y)
9 Mating connector not included in the scope of delivery, see technical data sheet RE 08008 (separate order)
10 Machined valve mounting face, porting pattern according to ISO 4401-05-05-0-05
   Deviating from the standard:
   ports P, A, B, T, T1 Ø 10.5 mm
Subplates, see technical data sheet RE 45055 (separate order)
Valve mounting screws (separate order)
The following valve mounting screws are recommended:
4 hexagon socket head cap screws
ISO 4762-M6x40-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torque $M_a = 11+3$ Nm
Mat. no. 2910151209
Unit dimensions size 16 (dimensions in mm)

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring 23x2.5 (ports P, A, B, T)
8 O-ring 9x2 (ports X, Y)
9 Mating connector not included in the scope of delivery, see technical data sheet RE 08008 (separate order)

10 Machined valve mounting face, porting pattern according to ISO 4401-07-0-05
Deviating from the standard:
ports P, A, B, T Ø 20 mm

Subplates, see technical data sheet RE 45057
(separate order)

Valve mounting screws (separate order)
The following valve mounting screws are recommended:

2 hexagon socket head cap screws
ISO 4762-M6x45-10.9-N67F82170
(galvanized according to Bosch standard N67F82170)
tightening torque \( M_A = 11 + 3 \) Nm
Mat. no. 2910151211

4 hexagon socket head cap screws
ISO 4762-M6x40-10.9-N67F82170
(galvanized according to Bosch standard N67F82170)
tightening torque \( M_A = 50 + 10 \) Nm
Mat. no. 2910151301

Required surface quality of the valve mounting face

Rzmax 4

0.01/100
Unit dimensions size 25/27 (dimensions in mm)

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring (ports P, A, B, T)
   Size 25: 28x3
   Size 27: 34.6x2.62
8 O-ring 15x2.5 (ports X, Y)
9 Mating connector not included in the scope of delivery,
   see technical data sheet RE 08008 (separate order)

10 Machined valve mounting face, porting pattern according to ISO 4401-08-08-0-05
   Deviating from the standard:
   size 25: Ports P, A, B, T Ø 25 mm
   size 27: Ports P, A, B, T Ø 32 mm

Subplates, see technical data sheet RE 45059
(separate order)

Valve mounting screws (separate order)
The following valve mounting screws are recommended:

6 hexagon socket head cap screws
ISO 4762-M12x60-10.9-N67F82170
(galvanized according to Bosch standard N67F82170)
tightening torque size 25 $M_t = 90 \pm 30 \text{ Nm}$,
size 27 $M_t = 90 \pm 15 \text{ Nm}$

Mat. no. 2910151354

Required surface quality of the valve mounting face
Notes