4/2- and 4/3-way proportional directional valves, direct operated, without electrical position feedback, without/with integrated electronics (OBE)

Types 4WRA and 4WRAE

Nominal sizes 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow: 42 l/min (NS6)
75 l/min (NS10)

Overview of contents

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Features

- Direct operated proportional directional valve without electrical position feedback and integrated electronics (OBE) for type 4WRAE
- Control the direction and magnitude of a flow
- Actuation by means of proportional solenoids with central thread and removable coil
- For subplate mounting:
  - Connection position to ISO 4401
  - Subplates to catalogue sheets RE 45052 (NS6) or RE 45054 (NS10) separate order, see page 12 to 15
- Spring centred control spool
- Control electronics
  - 4WRAE:
    - integrated electronics (OBE) with voltage input or current input (A1 resp. F1)
  - 4WRA:
    - digital or analogue amplifier in Eurocard format (separate order)
    - analogue module amplifier

For information regarding the available spare parts see:
www.boschrexroth.com/spc
Ordering details

<table>
<thead>
<tr>
<th></th>
<th>4WRA</th>
<th>-2X/</th>
<th>G24</th>
<th>/</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without integrated electronics (OBE)</td>
<td>= No code</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With integrated electronics (OBE)</td>
<td>= E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal size 6</td>
<td>= 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal size 10</td>
<td>= 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Spool symbols

```
A B
a 0 b
```

With spool symbols E₁⁻ and W₁⁻:

- P → A: \( q \max \)
- B → T: \( q \/2 \)
- P → B: \( q \/2 \)
- A → T: \( q \max \)

Note:

- With spools W and WA, in the neutral position, there is a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.

Further details in clear text

**Seal material**

- \( V = \) FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524

**Electronic interfaces A1 or F1**

- **A1** = Command value input \( \pm 10 \) V
- **F1** = Command value input 4 to 20 mA

- **No code** = For 4WRA

**Electrical connections**

- For 4WRA:
  - **K₄** ² = Without plug-in connector, with component plug to DIN EN 175301-803 plug-in connector – separate order, see page 7

- For 4WRAE:
  - **K₃₁** ² = Without plug-in connector, with component plug to DIN EN 175201-804 plug-in connector – separate order, see page 7

**Special protection**

- **No code** = Without special protection
- **J** ¹ = Sea water resistant (only for NS6)

- For details regarding the sea water resistant versions see RE 29055-M

**Nominal flow** at a valve pressure differential \( \Delta p = 10 \) bar

- **NS6**
  - 07 = 7 l/min
  - 15 = 15 l/min
  - 30 = 26 l/min

- **NS10**
  - 30 = 30 l/min
  - 60 = 60 l/min

¹ Other types of electrical protection on request

² Only for NS6: for version "J" = sea water resistant only state "K₃₁"!
Symbols

Without integrated electronics
Type 4WRA…

With integrated electronics (OBE)
Type 4WRAE…
Function, section

The 4/2- and 4/3-way proportional directional valves are designed as direct operated components for subplate mounting. They are actuated by means of proportional solenoids with central thread and removable coil. The solenoids are controlled either by external control electronics (type 4WRA) or by integrated control electronics (type 4WRAE).

Design:
The valves basically consist of:
- Housing (1) with mounting surface
- Control spool (2) with compression springs (3 and 4)
- Solenoids (5 and 6) with central thread
- Optional integrated electronics (7)

Valve with 2 spool positions:
(Type 4WRA…-2X/…)

In principle, the function of this valve version corresponds to that of the valve with 3 spool positions. However, the valves with 2 spool positions are only fitted with solenoid "a". Instead of the the 2nd proportional solenoid a plug (8.1) is fitted for NS 6 or for NS 10 a cover (8.2).

Function:
- With the solenoids (5 and 6) de-energised, the control spool (2) is held in the central position by compression springs (3 and 4)
- Direct actuation of the control spool (2) by energising a proportional solenoid
  - E.g. energisation of solenoid "b" (6)
  - The control spool (2) is moved to the left in proportion to the electrical input signal
  - Connection from P to A and B to T via orifice-like cross-sections with progressive flow characteristics
- De-energisation of the solenoid (6)
  - The control spool (2) is returned to the central position by compression spring (3)

Note for type 4WRA 6…-2X/…:
Draining of the tank line is to be avoided. With the appropriate installation conditions, a back pressure valve is to be installed (back pressure approx. 2 bar).
Technical data (for applications outside these parameters, please consult us!)

### General

<table>
<thead>
<tr>
<th>Nominal size</th>
<th>NS</th>
<th>6</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation</td>
<td>optional, preferably horizontal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>°C</td>
<td>–20 to +80</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>°C</td>
<td>–20 to +70</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>4WRA</td>
<td>kg</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>4WRAE</td>
<td>kg</td>
<td>2.2</td>
</tr>
</tbody>
</table>

### Hydraulic (measured with HLP46, $\nu_{ol} = 40 {^\circ C \pm 5{^\circ C}}$)

<table>
<thead>
<tr>
<th>Max. operating pressure</th>
<th>Ports A, B, P</th>
<th>bar</th>
<th>315</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port T</td>
<td>bar</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Nominal flow $q_{\text{V,nm}}$ at $\Delta p = 10$ bar</td>
<td>l/min</td>
<td>7, 15, 26</td>
<td>30, 60</td>
</tr>
<tr>
<td>Max. permissible flow</td>
<td>l/min</td>
<td>42 (80)$^1$</td>
<td>75 (140)$^1$</td>
</tr>
<tr>
<td>Pressure fluid</td>
<td>mineral oil (HL, HLP) to DIN 51524 other pressure fluids on request!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure fluid temperature range</td>
<td>°C</td>
<td>–20 to +80 (preferably +40 to +50)</td>
<td></td>
</tr>
<tr>
<td>Viscosity range</td>
<td>mm$^2$/s</td>
<td>20 to 380 (preferably 30 to 46)</td>
<td></td>
</tr>
<tr>
<td>Max. permissible degree of pressure fluid contamination cleanliness class to ISO 4406 (c)</td>
<td>class 20/18/15 $^2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>%</td>
<td>≤ 5</td>
<td></td>
</tr>
<tr>
<td>Reversal error</td>
<td>%</td>
<td>≤ 1</td>
<td></td>
</tr>
<tr>
<td>Response sensitivity</td>
<td>%</td>
<td>≤ 0.5</td>
<td></td>
</tr>
</tbody>
</table>

$^1$ Max. permissible flow with a dual flow path

$^2$ The cleanliness class stated for the components must be adhered too in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.

For the selection of filters see catalogue sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.
Technical data (for applications outside these parameters, please consult us!)

**Electrical**

<table>
<thead>
<tr>
<th>Nominal size</th>
<th>NS</th>
<th>6</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage type</td>
<td>DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Command value signal Voltage input „A1“</td>
<td>V</td>
<td>±10</td>
<td></td>
</tr>
<tr>
<td>with type WRAE Current input „F1“</td>
<td>mA</td>
<td>4 to 20</td>
<td></td>
</tr>
<tr>
<td>Max. current per solenoid</td>
<td>A</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Solenoid coil resistance Cold value at 20 °C</td>
<td>Ω</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Max. warm value</td>
<td>Ω</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Duty</td>
<td>%</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Max. coil temperature</td>
<td>°C</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

**Electrical connections**

- 4WRA with component plug to DIN EN 175301-803 or ISO 4400
- 4WRAE with component plug to DIN EN 175201-804
- Valve protection to EN 60529 IP65 with mounted and fixed plug-in connector

**Control electronics**

- 4WRA
  - Digital amplifier in Eurocard format 2) VT-VSPD-1-2X (to RE 30523 - middle of 2006)
  - Analogue amplifier in Eurocard format 2) VT-VSPA2-1-2X/… to RE 30110
  - Analogue module amplifier 2) VT-MSPA2-1-1X to RE 30228

- 4WRAE
  - Analogue command value module VT-SWMA-1-1X/… to RE 29902
  - Analogue command value module VT-SWMKA-1-1X/… to RE 29903
  - Digital command value card VT-HACD-1-1X/… to RE 30143
  - Analogue command value card VT-SWKA-1-1X/… to RE 30255

**Supply voltage**

- Nominal voltage VDC 24
- Lower limiting value V 21 / 22 (4WRA); 19 (4WRAE)
- Upper limiting value V 35
- Amplifier current $I_{max}$ A 1.8
- Max. impulse current A 3

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1) Due to the occurring surface temperature of the solenoid coils, the European Standards DIN EN 563 and DIN EN 982 must be taken into account!

2) Separate order

3) With Bosch Rexroth AG control electronics

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Note: For details regarding the environmental simulation test covering EMC (electromagnetic compatibility), climate and mechanical loading see RE 29055-U (declaration regarding environmental compatibility).
Electrical connection, plug-in connectors

For type WRA
(without integrated electronics – not for version "J" = sea water resistant)

Connection on component plug

Connection on plug-in connector

Plug-in connector CECC 75 301-803-A002FA-H3D08-G
to DIN EN 175301-803 or ISO 4400
Solenoid a, colour grey
Separate order: Material No. R901017010
Solenoid b, colour black
Separate order: Material No. R901017011

For type WRAE
(with integrated electronics (OBE) and for version "J" = sea water resistant)

For pin allocation, see block circuit diagram on page 8

Plug-in connector to DIN EN 175201-804
Separate order: Material No. R900021267
(plastic version)

Plug-in connector to DIN EN 175201-804
Separate order: Material No. R900223890
(metal version)
**Integrated electronics (OBE) for type WRAE**

### Pin allocation of the component plug

<table>
<thead>
<tr>
<th>Pin allocation</th>
<th>Contact</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>A</td>
<td>24 VDC (19 to 35 VDC)</td>
</tr>
<tr>
<td>voltage</td>
<td>B</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>n.c. ¹)</td>
</tr>
<tr>
<td>Differential</td>
<td>D</td>
<td>Com. value (± 10 V / 4 to 20 mA)</td>
</tr>
<tr>
<td>amplifier input</td>
<td>E</td>
<td>reference potential</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>n.c.</td>
</tr>
</tbody>
</table>

### Integrated control electronics (see below)

Com. value: Positive command value (0 to 10 V or 12 to 20 mA) at D and reference potential to E causes flow from P to A and B to T.

Negative command value (0 to – 10 V or 12 to 4 mA) at D and reference potential to E causes flow from P to B and A to T.

For valves with a solenoid on side „A“ (spool variants EA and WA) a positive command value at D and reference potential to E (NS 6: 4 to 20 mA and NS 10: 12 to 20 mA) causes flow from P to B and A to T.

Connection cable: Recommendation: – up to 25 m cable length type LiYCY 5 x 0.75 mm²

– up to 50 m cable length type LiYCY 5 x 1.0 mm²

External diameter 6.5 to 11 mm

Connect screen to PE only on the supply side.

¹) Contacts C and F must not be connected!

### Block circuit diagram / connection allocation

2) PE is connected to the cooling body and the valve housing

3) Protective conductor screwed to the valve housing and cover

4) Ramp can be externally adjusted from 0 to 2.5 s; the same applies for \( T_{up} \) and \( T_{down} \)

5) Output stages current regulated

6) Low voltage detection is **not** carried out for component type 4WRAE 10-2X.
Characteristic curves (measured with HLP46, \(\nu_{oil} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C}\))

### NS6

#### 7 l/min nominal flow at 10 bar valve pressure differential

- Flow in l/min vs Command value in %
- Curves for different \(\Delta p\) values (10, 20, 30, 50, 100 bar)

#### 15 l/min nominal flow at 10 bar valve pressure differential

- Flow in l/min vs Command value in %
- Curves for different \(\Delta p\) values (10, 20, 30, 50, 100 bar)

\(\Delta p = \text{Valve pressure differential (inlet pressure } p_P \text{ minus load pressure } p_L \text{ and minus return pressure } p_T\)

### NS10

#### 30 l/min nominal flow at 10 bar valve pressure differential

- Flow in l/min vs Command value in %
- Curves for different \(\Delta p\) values (10, 20, 30, 50, 100 bar)

#### 60 l/min nominal flow at 10 bar valve pressure differential

- Flow in l/min vs Command value in %
- Curves for different \(\Delta p\) values (10, 20, 30, 50, 100 bar)

\(\Delta p = \text{Valve pressure differential (inlet pressure } p_P \text{ minus load pressure } p_L \text{ and minus return pressure } p_T\)

1. \(\Delta p = 10\) bar constant
2. \(\Delta p = 20\) bar constant
3. \(\Delta p = 30\) bar constant
4. \(\Delta p = 50\) bar constant
5. \(\Delta p = 100\) bar constant
**Characteristic curves** (measured with HLP46, $\theta_{oil} = 40 \, ^\circ C \pm 5 \, ^\circ C$)

**Transient functions with stepped form of electrical input signals**

Types 4WRA and 4WRAE

![Graph showing characteristic curves](image)

**Performance limit, nominal flow 7 l/min**

$P \rightarrow A / B \rightarrow T$

or

$P \rightarrow B / A \rightarrow T$

![Graph showing performance limit, nominal flow 7 l/min](image)

**Performance limit, nominal flow 15 l/min**

$P \rightarrow A / B \rightarrow T$

or

$P \rightarrow B / A \rightarrow T$

![Graph showing performance limit, nominal flow 15 l/min](image)

**Performance limit, nominal flow 30 l/min**

$P \rightarrow A / B \rightarrow T$

oder

$P \rightarrow B / A \rightarrow T$

![Graph showing performance limit, nominal flow 30 l/min](image)

1. Com. value = 40 %
2. Com. value = 50 %
3. Com. value = 60 %
4. Com. value = 70 %
5. Com. value = 80 %
6. Com. value = 90 %
7. Com. value = 100 %

If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.
Characteristic curves (measured with HLP46, $\nu_{\text{oil}} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C}$)

Transient functions with stepped form of electrical input signals

Performance limit, nominal flow 30 l/min

Performance limit, nominal flow 60 l/min

If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

1 Com. value = 40 %
2 Com. value = 50 %
3 Com. value = 60 %
4 Com. value = 70 %
5 Com. value = 80 %
6 Com. value = 90 %
7 Com. value = 100 %
Unit dimensions: Type 4WRA 6 (nominal dimensions in mm)

Subplates to catalogue sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates:
- G341/01 (G1/4)
- G342/01 (G3/8)
- G502/01 (G1/2)

Valve fixing screws (separate order)
The following valve fixing screws are recommended:
- 4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9-flZn-240h-L
  (friction value $\mu_{\text{total}} = 0.09$ to 0.14)
  Tightening torque $M_A = 7 \text{ Nm} \pm 10\%$
  Material No. R913000064 (separate order)
or
- 4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9
  (friction value $\mu_{\text{total}} = 0.12$ to 0.17)
  Tightening torque $M_A = 8.9 \text{ Nm} \pm 10\%$

1. Valve housing
2. Proportional solenoid "a"
3. Proportional solenoid "b"
4.1 Plug-in connector "A", colour grey, separate order, see page 7
4.2 Plug-in connector "B", colour black, separate order, see page 7
5. Name plate
6. Identical seal rings for ports A, B, P and T
7. Plug for valves with one solenoid
   (2 switched positions, versions EA or WA)
8. Space required to remove the plug-in connector
9. Machined valve mounting surface,
   Connection location to ISO 4401 (with locating pin hole)
   Code: 4401-03-02-0-94 (explanation to ISO 5783)
   Deviation from the standard:
   - without locating pin hole „G“
   - ports P, A, B and T mit Ø8 mm

Required surface finish of the valve mounting surface

Tolerances to: General tolerances ISO 2768-mK
Unit dimensions: Type 4WRAE 6 ...K31/...V (nominal dimensions in mm)

1. Valve housing
2. Proportional solenoid "a"
3. Proportional solenoid "b"
4. Plug-in connector to DIN EN 175201-804, separate order, see page 7
5. Name plate
6. Identical seal rings for ports A, B, P und T
7. Plug for valves with one solenoid (2 switched positions, versions EA or WA)
8. Integrated electronics (OBE)
9. Space required for the connection cable and to remove the plug-in connector
10. Machined valve mounting surface, Connection location to ISO 4401 (with locating pin hole) Code: 4401-03-02:0-94 (explanation to ISO 5783) Deviation from the standard:
   - without locating pin hole „G“
   - ports P, A, B and T mit Ø8 mm

Subplates to catalogue sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates: G341/01 (G1/4) G342/01 (G3/8) G502/01 (G1/2)

Valve fixing screws (separate order)
The following valve fixing screws are recommended:
- 4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9-flZn-240h-L (friction value μtotal = 0.09 to 0.14) Tightening torque \( M_A = 7 \text{ Nm} \pm 10\% \)
  Material No. R913000064 (separate order) or
- 4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9 (friction value μtotal = 0.12 to 0.17) Tightening torque \( M_A = 8.9 \text{ Nm} \pm 10\% \)

Tolerance to: General tolerances to ISO 2768-mK

Required surface finish of the valve mounting surface

Rzmax 4

0.01/100mm

Unit dimensions: Type 4WRAE 6 ...K31/...V (nominal dimensions in mm)
Unit dimensions: Type 4WRA 10 (nominal dimensions in mm)

Subplates to catalogue sheet RE 45054 and valve fixing screws must be ordered separately.

Subplates:
- G66/01 (G3/8)
- G67/01 (G1/2)
- G534/01 (G3/4)

Valve fixing screws (separate order)
The following valve fixing screws are recommended:
- 4 S.C.H.S. ISO 4762 - M6 x 40 - 10.9-12Zn-240h-L
  (friction value $\mu_{\text{total}} = 0.09$ to 0.14)
  Tightening torque $M_A = 12.5 \text{ Nm} \pm 10\%$
  Material No. R913000058 (separate order)
  or
- 4 S.C.H.S. ISO 4762 - M6 x 40 - 10.9
  (friction value $\mu_{\text{total}} = 0.12$ to 0.17)
  Tightening torque $M_A = 15.5 \text{ Nm} \pm 10\%$

1. Valve housing
2. Proportional solenoid "a"
3. Proportional solenoid "b"
4.1 Plug-in connector "A", colour grey, separate order, see page 7
4.2 Plug-in connector "B", colour black, separate order, see page 7
5. Name plate
6. Valve bleed screw
Note: The valves are bled before delivery.
7. Identical seal rings for ports A, B, P and T (T1)
8. Cover for valves with one solenoid
   (2 switched positions, versions EA or WA)
9. Space required to remove the plug-in connector
10. Machined valve mounting surface,
    Connection location to ISO 4401 (with locating pin hole)
    Code: 4401-05-04-0-94 (explanation to ISO 5783)
    Deviation from the standard: Port T1 Ø11.2 mm

Tolerances to:
- General tolerances to ISO 2768-mK

Required surface finish of the valve mounting surface

Unit dimensions: Type 4WRA 10 (nominal dimensions in mm)
Unit dimensions: Type 4WRAE 10 (nominal dimensions in mm)

1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug-in connector to DIN EN 175201-804, separate order, see page 7
5 Name plate
6 Valve bleed screw
7 Identical seal rings for ports A, B, P, T
8 Cover for valves with one solenoid (2 switched positions, versions EA or WA)
9 Integrated electronics (OBE)
10 Space required for the connection cable and to remove the plug-in connector
11 Machined valve mounting surface, connection location to ISO 4401 (with locating pin hole)
   Code: 4401-05-04-0-94 (explanation to ISO 5783)
   Deviation from the standard: Port T1 Ø11.2 mm

Tolerances to:
- General tolerances to ISO 2768-mK

Subplates to catalogue sheet RE 45054 and valve fixing screws must be ordered separately.

Subplates:
- G66/01 (G3/8)
- G67/01 (G1/2)
- G534/01 (G3/4)

Valve fixing screws (separate order)
The following valve fixing screws are recommended:
- 4 S.H.C.S. ISO 4762 - M6 x 40 - 10.9-f1Zn-240h-L
  (friction value $\mu_{\text{total}} = 0.09$ to 0.14)
  Tightening torque $M_a = 12.5$ Nm ± 10%,
  Material No. R913000058 (separate order)
  or
- 4 S.H.C.S. ISO 4762 - M6 x 40 - 10.9
  (friction value $\mu_{\text{total}} = 0.12$ to 0.17)
  Tightening torque $M_a = 15.5$ Nm ± 10%