4/3 directional high-response control valves, direct operated, with integrated control electronics (OBE)

Type 4WRSE

Sizes 6 and 10
Series 3X
Maximum operating pressure 315 bar
Maximum flow 180 l/min

Features

- Direct operated directional high-response control valve with integrated control electronics (OBE) for controlling the direction and magnitude of a flow
- Suitable for position and velocity control
- Actuation by control solenoids
- Electrical position feedback
- High response sensitivity and low hysteresis
- Integrated control electronics (OBE) with interface ±10 V or 4 … 20 mA
- For subplate mounting:
  - Porting pattern to DIN 24340 form A and ISO 4401
  - Subplates to data sheets RE 45052 and RE 45054 (separate order), see pages 12 and 13
Ordering code

### 4WRS E

- **Integrated control electronics (OBE)**: = E
- **Without sleeve**: = No code
- **Size 6**: = 6
- **Size 10**: = 10

#### Spool symbols

- **With symbol V1-:**
  - \( P \rightarrow A: q_v \)
  - \( B \rightarrow T: q_v/2 \)
  - \( A \rightarrow T: q_v \)
- **With symbol Q2-:**
  - \( P \rightarrow A: q_v \)
  - \( B \rightarrow T: q_v \)
  - \( A \rightarrow T: q_v \)

**Note:** Spools V and V1 have an overlap of \(-1.0\% \ldots +1.0\%\).

#### Side of inductive position transducer

- **No code** (standard)
- **C**

### Further details in clear text

- **Seal material**
  - \( V = FKM \) seals, suitable for mineral oils (HL, HLP) to DIN 51524 and phosphate ester (HFD-R)
- **Interface of control electronics**
  - \( A1 = \) Command value input \( \pm 10 \) V
  - \( F1 = \) Command value input \( 4 \ldots 20 \) mA
  - \( K0 = \) With component plug to DIN EN 175201-804
- **Electrical connection**
  - \( G24 = 24 \) V DC
- **Without cable socket**
  - Cable socket – separate order, see page 5
- **Supply voltage of control electronics**
  - \( 3X = \) Component series 30 … 39
  - (30 … 39: unchanged installation and connection dimensions)

#### Nominal flow at 10 bar valve pressure differential

- **Size 6**
  - 04 = 4 l/min (only with symbol V)
  - 10 = 10 l/min
  - 20 = 20 l/min
  - 35 = 35 l/min
- **Size 10**
  - 25 = 25 l/min
  - 50 = 50 l/min
  - 80 = 75 l/min

### Symbols

#### Type 4WRSE..V (standard)

- \( V \) (standard)

#### Type 4WRSE..VC

- \( V \) (standard)

#### Type 4WRSE..Q2 (standard)

- \( Q2 \) (standard)

#### Type 4WRSE..Q2C

- \( Q2 \) (standard)
Standard types

<table>
<thead>
<tr>
<th>Size 6</th>
<th>Material number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
</tr>
<tr>
<td>4WRSE 6 V04-3X/G24K0/A1V</td>
<td>R900938307</td>
</tr>
<tr>
<td>4WRSE 6 V1-10-3X/G24K0/A1V</td>
<td>R900909078</td>
</tr>
<tr>
<td>4WRSE 6 V1-20-3X/G24K0/A1V</td>
<td>R900906155</td>
</tr>
<tr>
<td>4WRSE 6 V1-35-3X/G24K0/A1V</td>
<td>R900904794</td>
</tr>
<tr>
<td>4WRSE 6 V10-3X/G24K0/A1V</td>
<td>R900558830</td>
</tr>
<tr>
<td>4WRSE 6 V20-3X/G24K0/A1V</td>
<td>R900576060</td>
</tr>
<tr>
<td>4WRSE 6 V35-3X/G24K0/A1V</td>
<td>R900579447</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size 10</th>
<th>Material number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
</tr>
<tr>
<td>4WRSE 10 Q2-50-3X/G24K0/A1V</td>
<td>R900916872</td>
</tr>
<tr>
<td>4WRSE 10 V1-80-3X/G24K0/A1V</td>
<td>R900556812</td>
</tr>
<tr>
<td>4WRSE 10 V1-25-3X/G24K0/A1V</td>
<td>R900922997</td>
</tr>
<tr>
<td>4WRSE 10 V1-50-3X/G24K0/A1V</td>
<td>R900579140</td>
</tr>
<tr>
<td>4WRSE 10 V25-3X/G24K0/A1V</td>
<td>R900579637</td>
</tr>
<tr>
<td>4WRSE 10 V50-3X/G24K0/A1V</td>
<td>R900579943</td>
</tr>
<tr>
<td>4WRSE 10 V80-3X/G24K0/A1V</td>
<td>R900579286</td>
</tr>
</tbody>
</table>

Function, section

These 4/3 directional high-response valves are direct operated components of sandwich plate design. They are actuated by control solenoids. The solenoids are controlled by integrated control electronics (OBE).

Structure:
The valve basically consists of:
- Housing (1) with connection face
- Control spool (2) with compression springs (3 and 4)
- Solenoids (5 and 6)
- Position transducer (7)
- Integrated control electronics (OBE) (8)
- Zero point adjustment (9) accessible via Pg9 cover

Type 4WRSE 10 V…

Functional description:
- When solenoids (5 and 6) are de-energised, control spool (2) is held by compression springs (3 and 4) in the central position
- Direct operation of control spool (2) through energisation of the control solenoid
  - e.g. controlling of solenoid “b” (6)
    - Control spool (2) is pushed to the left in proportion to the electrical input signal
    - Connection open from P → A and B → T via orifice-like cross-sections with linear flow characteristics
- De-energisation of solenoid (6)
  - Control spool (2) is returned by compression spring (3) to the central position

In the de-energised state, control spool (2) is held by the return springs of the solenoid at a mechanical central position. With spool symbols “V” and “Q”, this does not correspond to the hydraulic central position!

When the electrical valve control loop is closed, control spool (2) is positioned at the hydraulic central position.
## Technical data (for applications outside these parameters, please consult us!)

### General

<table>
<thead>
<tr>
<th></th>
<th>Size 6</th>
<th>Size 10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>kg</td>
<td></td>
</tr>
<tr>
<td><strong>Installation orientation</strong></td>
<td>Optional, preferably horizontal</td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature range</strong></td>
<td>°C</td>
<td>–20 ... +50</td>
</tr>
<tr>
<td><strong>Storage temperature range</strong></td>
<td>°C</td>
<td>–20 ... +80</td>
</tr>
</tbody>
</table>

### Hydraulic (measured with HLP46, $\vartheta_{oil} = 40 \degree C \pm 5 \degree C$ and $p = 100$ bar)

<table>
<thead>
<tr>
<th>Operating pressure</th>
<th>Ports P, A, B bar</th>
<th>up to 315</th>
<th>up to 315</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal flow $q_{V_{nom}}$</td>
<td>l/min</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>($\Delta p = \text{valve pressure differential}$)</td>
<td></td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Max. permissible flow</td>
<td>l/min</td>
<td>80</td>
<td>180</td>
</tr>
</tbody>
</table>

**Hydraulic fluid**: Mineral oil (HL, HLP) to DIN 51524 and phosphate ester (HFD-R), further hydraulic fluids on enquiry.

| **Hydraulic fluid temperature range** | °C | –20 ... +80 |
| **Viscosity range** | mm²/s | 20 ... 380, preferably 30 ... 46 |
| **Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)** | Class 18/16/13 1) |
| **Hysteresis** | % | $\leq 0.05$ |
| **Range of inversion** | % | $\leq 0.03$ |
| **Response sensitivity** | % | $\leq 0.03$ |
| **Zero point balancing** | % | $\leq 1$ |
| **Zero point drift with change in:** | Size 6 | Size 10 |
| Hydraulic fluid temperature | %/10 K | < 0.1 | < 0.1 |
| Operating pressure | %/100 bar | < 0.5 | < 0.3 |

### Electrical

| **Operating voltage** | Nominal value (limits) VDC | 24 (19.4 ... 35) |
| **Current consumption** | Size 6 A | max. 2 | Impulse load: 4 A |
| | Size 10 A | max. 2.8 | Impulse load: 4 A |
| **Interface “A1”** | Command value signal V | $\pm 10$ | $R > 50 \kappa \Omega$ |
| | Actual value signal V | $\pm 10$ | $I_{\text{max}} = 2 \text{ mA}$ |
| **Interface “F1”** | Command value signal mA | 4 ... 20 | $R_{\text{l}} > 100 \Omega$ |
| | Actual value signal mA | 4 ... 20 | max. load resistance 500 $\Omega$ |
| **Duty cycle** | % | 100 |
| **Coil temperature 1)** | °C | up to 150 |
| **Type of protection of valve to EN 60529** | IP 65 with cable socket correctly mounted and locked |

1) Due to the surface temperatures of solenoid coils, observe European standards EN 563 and EN 982!

**Note**: For details with regard to environment simulation testing in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29067-U (declaration on environmental compatibility).
# Electrical connection

<table>
<thead>
<tr>
<th>Component plug pin assignment</th>
<th>Contact</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>A</td>
<td>Interface A1: 24 VDC (19.4 … 35 VDC), $I_{\text{max}} = 2$ A (size 6), $I_{\text{max}} = 2.8$ A (size 10), impulse load: 4 A</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Interface F1: 0 V</td>
</tr>
<tr>
<td>Actual value reference potential</td>
<td>C</td>
<td>Interface A1: Connect reference potential for contact F to ⊥ on the control side (star-shape)</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Interface F1: Reference potential for contact F</td>
</tr>
<tr>
<td>Command value signal</td>
<td>D</td>
<td>Interface A1: $\pm 10$ V, $R_i &gt; 50$ kΩ</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Interface F1: $\pm 10$ V, $I_{\text{max}} = 2$ mA</td>
</tr>
<tr>
<td>Actual value</td>
<td>F</td>
<td>Interface A1: 4 … 20 mA, $R_i &gt; 100$ Ω</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Interface F1: 4 … 20 mA, max. load resistance 500 Ω</td>
</tr>
<tr>
<td>Protective conductor</td>
<td>PE</td>
<td>Connected to heat sink and valve body</td>
</tr>
</tbody>
</table>

**Command value:**
- Positive command value at D (interface A1) or 12 … 20 mA (interface F1) and reference potential at E causes a flow from P $\rightarrow$ A and B $\rightarrow$ T.
- Negative command value at D (interface A1) or 12 … 4 mA (interface F1) and reference potential at E causes a flow from P $\rightarrow$ B and A $\rightarrow$ T.

**Actual value:**
- Interface A1: Positive signal at F and reference potential at C means flow from P $\rightarrow$ A. Interface F1: 12 … 20 mA means flow from P $\rightarrow$ A.

**Connecting cable:**
- Recommendation: – up to 25 m cable length: Type LiYCY 7 x 0.75 mm²
- up to 50 m cable length: Type LiYCY 7 x 1.0 mm²
- Outer diameter 6.5 … 11 mm or 8 … 13.5 mm, respectively
- Connect shield to ⊥ only on the supply side.

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**Cable sockets**

**Cable socket** (plastic version)
to DIN EN 175201-804
Separate order,
material no. R900021267

**Cable socket** (metal version)
to DIN EN 175201-804
Separate order,
material no. R900223890
Integrated control electronics (OBE)

Block circuit diagram / pin assignment of integrated control electronics (OBE)

Interface A1

<table>
<thead>
<tr>
<th>Interface</th>
<th>Integrated control electronics (OBE)</th>
<th>Valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comm. value</td>
<td>Differential amplifier</td>
<td>Side of inductive position transducer</td>
</tr>
<tr>
<td>Reference potential</td>
<td>Controller</td>
<td>Standard</td>
</tr>
<tr>
<td>Actual value</td>
<td>Logic</td>
<td>“C”</td>
</tr>
<tr>
<td>Reference potential</td>
<td>Undervoltage detector</td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>Controller</td>
<td></td>
</tr>
<tr>
<td>24 V</td>
<td>Logic</td>
<td></td>
</tr>
<tr>
<td>0 V</td>
<td>Logic</td>
<td></td>
</tr>
<tr>
<td>Protective conductor 1</td>
<td>Demodulator</td>
<td></td>
</tr>
<tr>
<td>PE connection connected to heat sink and valve body</td>
<td>Oscillator</td>
<td></td>
</tr>
<tr>
<td>Standard “C”</td>
<td>Pos. transducer</td>
<td></td>
</tr>
</tbody>
</table>

Interface F1

<table>
<thead>
<tr>
<th>Interface</th>
<th>Integrated control electronics (OBE)</th>
<th>Valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comm. value</td>
<td>Differential amplifier</td>
<td>Side of inductive position transducer</td>
</tr>
<tr>
<td>Reference potential</td>
<td>Controller</td>
<td>Standard</td>
</tr>
<tr>
<td>Actual value</td>
<td>Logic</td>
<td>“C”</td>
</tr>
<tr>
<td>Reference potential</td>
<td>Undervoltage detector</td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
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</tr>
<tr>
<td>24 V</td>
<td>Logic</td>
<td></td>
</tr>
<tr>
<td>0 V</td>
<td>Logic</td>
<td></td>
</tr>
<tr>
<td>Protective conductor</td>
<td>Demodulator</td>
<td></td>
</tr>
<tr>
<td>PE connection connected to heat sink and valve body</td>
<td>Oscillator</td>
<td></td>
</tr>
<tr>
<td>Standard “C”</td>
<td>Pos. transducer</td>
<td></td>
</tr>
</tbody>
</table>

Note:

Electrical signals brought out via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions! (See also European standard EN 982, "Safety requirements for fluid power systems and components - hydraulics")

1) PE connection connected to heat sink and valve body
2) Connect pin C to ⊥ on the control side
3) Output stage current regulated
4) Zero point externally adjustable
Characteristic curves (measured with HLP46, $\theta_{\text{oil}} = 40^{\circ}\text{C} \pm 5^{\circ}\text{C}$)

Pressure/signal characteristic curves (V spool) $p_S = 100$ bar

Size 6
Type 4WRSE 6 V...

Size 10
Type 4WRSE 10 V...

Typical leakage flow

Size 6
Type 4WRSE 6 V.35...

Size 10
Type 4WRSE 10 V.80...
Characteristic curves of size 6 (measured with HLP46, $\vartheta_{oil} = 40 ^\circ C \pm 5 ^\circ C$)

**Typical flow characteristic curve (V, V1 spool)**
at 10 bar valve pressure differential or 5 bar per control land

$1 = \text{Nominal flow 35 l/min}$
$2 = \text{Nominal flow 10 l/min}$

Spool ... 20 between characteristic curves 1 and 2

Zero point passage depending on manufacturing tolerance
Valve overlap –1 % ... +1 %

**Typical flow characteristic curve (Q2 spool)**
at 10 bar valve pressure differential or 5 bar per control land
Characteristic curves of size 10 (measured with HLP46, $\theta_{oil} = 40 \, ^\circ C \pm 5 \, ^\circ C$)

Typical flow characteristic curve (V, V1 spool)

at 10 bar valve pressure differential or 5 bar per control land

![Graph showing typical flow characteristic curve (V, V1 spool)]

1 = Nominal flow 75 l/min
2 = Nominal flow 25 l/min
Spool ... 50 between characteristic curves 1 and 2

Zero point passage depending on manufacturing tolerance
Valve overlap $-1 \%$ ... $+1 \%$

Typical flow characteristic curve (Q2 spool)

at 10 bar valve pressure differential or 5 bar per control land

![Graph showing typical flow characteristic curve (Q2 spool)]

Tolerance range of mechanical zero position

$= Nominal flow 75 l/min$

$= Nominal flow 25 l/min$

Spool ... 50 between characteristic curves 1 and 2
Characteristic curves of size 6 (measured with HLP46, $\vartheta_{oil} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C}$)

Transient function with stepped electrical input signals

Frequency response characteristic curves

Flow/load function at max. valve aperture (tolerance $\pm 10\%$)
Characteristic curves of size 10 (measured with HLP46, $\theta_{oil} = 40 ^\circ C \pm 5 ^\circ C$)

Transient function with stepped electrical input signals

Frequency response characteristic curves

Flow/load function at max. valve aperture (tolerance $\pm 10\%$)

Measured at:
- $p_0 = 10$ bar
- $\nu = 46 \text{ mm}^2/\text{s}$
- $\theta = 40 ^\circ C$

Recommended flow limitation
- $q_v = 180 \text{ l/min}$
Unit dimensions of size 6 (nominal dimensions in mm)

Type 4WRSE 6… (standard)

1. Valve housing
2.1 Control solenoid "a" with inductive position transducer
2.2 Control solenoid "b"
3.1 Control solenoid "b" with inductive position transducer
3.2 Control solenoid "a"
4. Cable socket to DIN EN 175201-804 (separate order, see page 5)
5. Space required to remove cable socket
6. Additional space required for bending radius of connecting cable
7. Nameplate
8. R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
9. Machined valve mounting face, position of ports to DIN 24340 form A6 and ISO 4401-03-02-0-94 without locating bore

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

**Subplates:**
- G 341/01 (G1/4)
- G 342/01 (G3/8)
- G 502/01 (G1/2)

4 hexagon socket head cap screws
ISO 4762 – M5x30-10.9-flZn-240h-L
(friction coefficient total = 0.09 to 0.14)
Tightening torque $M_t = 7$ Nm ± 10%
material no. R913000316 (separate order)

Required surface quality of mating part
Unit dimensions of size 10 (nominal dimensions in mm)

Type 4WRSE 10 … (standard)

1 Valve housing
2.1 Control solenoid "a" with inductive position transducer
2.2 Control solenoid "b"
3.1 Control solenoid "b" with inductive position transducer
3.2 Control solenoid "a"
4 Cable socket to DIN EN 175201-804 (separate order, see page 5)
5 Space required to remove cable socket
6 Additional space required for bending radius of connecting cable
7 Nameplate
8 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
9 Machined valve mounting face, position of ports to DIN 24340 form A10 and ISO 4401-05-04-0-94

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

Subplates:
- G 66/01 (G3/8)
- G 67/01 (G1/2)
- G 534/01 (G3/4)

4 hexagon socket head cap screws
ISO 4762 – M6x40-10.9-IZn-240h-L
(friction coefficient total = 0.09 to 0.14)
Tightening torque $M_t = 12.5$ Nm $\pm 10$
material no. R913000058 (separate order)

Required surface quality of mating part
Notes