4/3 and 4/4 high response directional control valves, direct operated, with electrical position feedback

Type 4WRSEH

Nominal sizes 6 and 10
Series 3X
Maximum operating pressure 315 bar
Maximum flow 80 L/min (NS 6)
Maximum flow 180 L/min (NS 10)

Overview of contents

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<td>14 and 17</td>
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</tbody>
</table>

Features

- Direct operated high response directional control valve for the control of the size and direction of a flow
- Valve spool and bush are of servo quality
- Suitable for closed loop, position, speed and pressure control
- Operated via high response solenoids
- With fail-safe position for the 4/4 high response directional control valve
- Electrical position feedback
- High response sensitivity and low hysteresis
- Integrated control electronics with interface A1 or F1
- For subplate mounting:
  - Porting pattern to DIN 24 340 form A, ISO 4401
  - and CETOP-RP 121 H
  - Subplates to catalogue sheets RE 45 052 and RE 45 054
    (separate order), see pages 14 to 17
Ordering details

<table>
<thead>
<tr>
<th>4WRS</th>
<th>E</th>
<th>H</th>
<th>3X/G24</th>
<th>K0</th>
<th>V</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With integrated control electronics = E
Control spool/bush = H
Nominal size 6 = 6
Nominal size 10 = 10

Further details in clear text

V = FKM seals, suitable for mineral oils (HL, HLP) to DIN 51 524 and phosphate ester (HFD-R)

Control electronics interface
A1 = Command value input ± 10 V
F1 = Command value input 4 to 20 mA

Electrical connections
K0 = With component plug to E DIN 43 563-AM6
Without plug-in connector, Plug-in connector — separate order, see page 6

Control electronics power supply
G24 = + 24 V DC

3X = Series 30 to 39
(30 to 39: unchanged installation and connection dimensions)

Spool overlap
E = 0...0.5% negative
D = 0...0.5% positive

Flow characteristics
L = Linear
P = Inflected characteristic curve 40 %

Nominal flow at a 70 bar pressure differential

<table>
<thead>
<tr>
<th>Nominal size 6</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>04 = 3)</td>
<td>4 L/min</td>
</tr>
<tr>
<td>12</td>
<td>12 L/min</td>
</tr>
<tr>
<td>24</td>
<td>24 L/min</td>
</tr>
<tr>
<td>40 = 2)</td>
<td>40 L/min</td>
</tr>
<tr>
<td>50 = 1)</td>
<td>50 L/min</td>
</tr>
</tbody>
</table>

Nominal size 10

| 50             | 50 L/min |
| 100            | 100 L/min |

1) Only with „V“ in conjunction with flow characteristic „L“
2) Only with „C“ and „V“ in conjunction with flow characteristic „P“
3) Only in conjunction with flow characteristic „L“
4) The spool overlap in % relates to the nominal stroke of the control spool. We recommend, for closed loop applications, the D overlap. Further spool overlaps on request!
Function, section

The 4/3 and 4/4 high response directional control valves are designed as direct operated units of subplate mounting design. They are operated by high response solenoids. The solenoids are controlled via the integrated control electronics.

Design:
The valve basically comprises of:
- Housing (1) with mounting surface
- Control spool (2) in bush (3) with compression springs (4 and 5)
- Solenoids (6 and 7)
- Position transducer (8)
- Integrated control electronics (9)
- Zero point adjustment accessible (10) via Pg9

Functional description:

4/3-way version:
- With solenoids (6 and 7), de-energised the control spool (2) is held in its mechanical centre position by the compression springs (4 and 5)
- Direct operation of the control spool (2) by the energisation of one of the high response solenoids
  - E.g. control of solenoid “b” (7)
    - Moves the control spool (2) to the left in proportion to the electrical input signal
    - Connection from P to A and B to T via orifice type cross-sections with linear or inflected flow characteristics
- By de-energising the solenoid (7) control spool (2) is returned to its centre position via the compression spring (4)

In the de-energised condition the control spool (2) is held in a mechanical centre position via the control springs. This does not relate to the hydraulic centre position!

By closing the electrical valve closed loop circuit and the command value is 0 (0 V at A1 or 12 mA at F1) then the control spool (2) is positioned in the hydraulic centre position.
Function, section

4/4-way version
The function of these valves is basically the same as the 4/3-way version. However, when the solenoid is de-energised the control spool is moved into a fail-safe position via a compression spring.

The 4/4 high response directional control valves are designed as direct operated units of subplate mounting design. They are operated by high response solenoids. The solenoids are controlled via the integrated control electronics.

Design:
The valve basically comprises of:

- Housing (1) with mounting surface
- Control spool (2) in bush (3) with compression springs (4)
- Solenoid (5) and cover (6)
- Position transducer (7)
- Integrated control electronics (8)
- Zero point adjustment accessible (9) via the Pg9

Functional description:

- With the solenoid (5) de-energised, a fail-safe position for the control spool (2) via compression spring (4) results
- Direct operation of the control spool (2) by the energisation of the high response solenoid (5)

E.g. control of the solenoid

→ Moves the control spool (2) in proportion to the electrical input signal

→ Connection from P to A and B to T via orifice type cross-sections with linear or inflected flow characteristics

→ By de-energising the solenoid (5) → the control spool (2) is moved back into the fail-safe condition via the compression spring (4)
## Technical data (for applications outside these applications, please consult us!)

### General

<table>
<thead>
<tr>
<th></th>
<th>NS 6</th>
<th>NS 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation</td>
<td>Optional, preferably horizontal</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>°C</td>
<td>– 20 to + 80</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>°C</td>
<td>– 20 to + 50</td>
</tr>
<tr>
<td>Weight</td>
<td>Valve with 1 solenoid</td>
<td>kg</td>
</tr>
<tr>
<td></td>
<td>Valve with 2 solenoids</td>
<td>kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hydraulic (measured at \( p = 100 \) bar, \( v = 46 \text{ mm}^2/\text{s} \) and \( \vartheta = 40 \° \text{C} \))

<table>
<thead>
<tr>
<th>Operating pressure</th>
<th>Ports A, B, P</th>
<th>up to 315</th>
<th>up to 315</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port T</td>
<td>bar</td>
<td>up to 315</td>
<td>up to 210</td>
</tr>
<tr>
<td>Application limits C3, C4</td>
<td>Nominal flow</td>
<td>L/min</td>
<td>04</td>
</tr>
<tr>
<td>Application limit ( \Delta p ) with symbol C3</td>
<td>bar</td>
<td>315</td>
<td>315</td>
</tr>
<tr>
<td>Application limit ( \Delta p ) with symbol C4</td>
<td>bar</td>
<td>315</td>
<td>315</td>
</tr>
<tr>
<td>Nominal flow ( q_{v,nom} ) ± 10% at ( \Delta p = 70 ) bar</td>
<td>L/min</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>( \Delta p ) = valve pressure differential</td>
<td></td>
<td>24</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>50 (with V spool with flow „L“);</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>40 (with C and V spools</td>
<td>with flow characteristic „P“)</td>
<td></td>
</tr>
<tr>
<td>Max. permissible flow</td>
<td>L/min</td>
<td>80</td>
<td>180</td>
</tr>
<tr>
<td>Pressure fluid</td>
<td>Mineral oil (HL, HLP) to DIN 51 524 and phosphate ester (HFD-R), further pressure fluids on request</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of contamination</td>
<td>Maximum permissible degree of pressure fluid contamination to NAS 1638 A filter with a minimum retention rate of ( \beta_x \geq 75 ) is recommended</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure fluid temperature range</td>
<td>°C</td>
<td>– 20 to + 80</td>
<td></td>
</tr>
<tr>
<td>Viscosity range</td>
<td>mm²/s</td>
<td>20 to 380, preferably 30 to 46</td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>%</td>
<td>&lt; 0.05</td>
<td></td>
</tr>
<tr>
<td>Reversal span</td>
<td>%</td>
<td>&lt; 0.03</td>
<td></td>
</tr>
<tr>
<td>Response sensitivity</td>
<td>%</td>
<td>&lt; 0.03</td>
<td></td>
</tr>
</tbody>
</table>

### Electrical

<table>
<thead>
<tr>
<th></th>
<th>IP 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage type</td>
<td>DC</td>
</tr>
<tr>
<td>Signal type</td>
<td>analogue</td>
</tr>
<tr>
<td>Zero point alignment</td>
<td>%</td>
</tr>
<tr>
<td>Zero point displacement with changes to:</td>
<td>NS 6</td>
</tr>
<tr>
<td>Pressure fluid temperature</td>
<td>%/10 K</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>%/100 bar</td>
</tr>
</tbody>
</table>

### Control electronics

<table>
<thead>
<tr>
<th></th>
<th>VT 13070 (integrated into the valve, see page 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note:</td>
<td>For details regarding the <strong>environmental simulation test</strong> covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 069-U (declaration regarding environmental compatibility).</td>
</tr>
</tbody>
</table>

4WRSEH 5/18  
RE 29 069/02.03
**Electrical connections, plug-in connector**

**Plug-in connector**
Plug-in connector to E DIN 43 563-BF6-3/Pg11
Separate order under material No. 00021267 (plastic version)
For pin allocation see block circuit diagram on page 7

**Plug-in connector**
Plug-in connector to E DIN 43 563-BF6-3-Pg13.5
Separate order under material No. 000223890 (metal version)
For pin allocation see block circuit diagram on page 7

**Component plug allocation**

<table>
<thead>
<tr>
<th>Contact</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>A 24 VDC ($u(t) = 19.4 \text{ V to } 35 \text{ V}$); $i_{\text{max}} = 2 \text{ A (NS 6)}$ $i_{\text{max}} = 2.8 \text{ A (NS 10)}$; impulse load 4 A</td>
</tr>
<tr>
<td>Ref. (actual value)</td>
<td>B 0 V</td>
</tr>
<tr>
<td>Differential amplifier input (command value)</td>
<td>C Ref. potential for actual value (contact F); A1: $R_e &gt; 50 \Omega$ F1: $R_e &lt; 10 \Omega$</td>
</tr>
<tr>
<td>Measurement output (act. value)</td>
<td>D A1: $\pm 10 \text{ V command value, } R_e &gt; 50 \Omega$ or F1: 4...20 mA, $R_e &gt; 100 \Omega$</td>
</tr>
<tr>
<td></td>
<td>E 0 V ref. potentialal</td>
</tr>
<tr>
<td></td>
<td>F $\pm 10 \text{ V actual value (limiting load 2 mA); or F1: 4...20 mA, max. load impedance 500 } \Omega$</td>
</tr>
<tr>
<td></td>
<td>PE Connected with cooling body and valve housing</td>
</tr>
</tbody>
</table>

**Actual value:** Interface A1: A positive signal at F and the reference potential at C results in a flow from P to A.

**Note for A1:** Connect pin C on the control side (star form) with $⊥$.

Interface F1: 12...20 mA results in a flow from P to A.

**Command value:** A positive command value at D (interface A1) or 12...20 mA (interface F1) and the reference potential at E results in a flow from P to A and B to T.

A negative command value at D (interface A1) or 12...4 mA (interface F1) and the reference potential at E results in a flow from P to B and A to T.

**Connection cable:** Recommended:
- 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

Outside diameter 6.5 to 11 mm
Only connect the screen to $⊥$ on the supply side.
Integrated control electronics VT 13070

Block circuit diagram / connection allocation for the integrated control electronics

<table>
<thead>
<tr>
<th>Interface</th>
<th>Integrated control electronics</th>
<th>Valve</th>
</tr>
</thead>
</table>

### VT 13070 for 4/3-way version

- **Command value Ref. potential**
- **Actual value Ref. potential**
- **Supply voltage**
- **Protective conductor**

### Interface Integrated control electronics Valve

Inductive position transducer location

"No code" (standard)  
"C"

#### Notes:

1) Connection PE is connected with the cooling body and the valve housing
2) **Note for A1**: Connect pin C on the control side to ⊥
3) Output stage, current controller
4) Zero point externally adjustable

**Note:** Electrical signal (e.g. actual value) taken via valve electronics must not be used to switch off the machine safety functions!

(This is in accordance with the regulations to the European standard "Safety requirements of fluid technology systems and components – hydraulics", EN 9821)
Characteristic curves (measured at \( \nu = 46 \text{ mm}^2/\text{s} \) and \( \vartheta = 40 ^\circ \text{C} \))

Pressure-signal-characteristic curve \( p_S = 100 \text{ bar} \)

NS 6  Type 4WRSEH 6 … L.-3X/…

NS 10  Type 4WRSEH 10 … L.-3X/…

Leakage flow (typical)

NS 6  Type 4WRSEH 6 V50 L.-3X/…

NS 10  Type 4WRSEH 10 V100 L.-3X/…
Characteristic curves (typical flow characteristic curve at 70 bar valve pressure differential or 35 bar per control land)

NS 6

\[ q_{V \text{ nom}} = 4, 12, 24 \text{ L/min} \text{ flow characteristic L} \]
\[ q_{V \text{ nom}} = 40, 50 \text{ L/min} \text{ flow characteristic L} \]
\[ q_{V \text{ nom}} = 4, 12, 24 \text{ L/min} \text{ flow characteristic P} \]
\[ q_{V \text{ nom}} = 40, 50 \text{ L/min} \text{ flow characteristic P} \]

Zero travel dependent on series spread 0 % … 0.5 % for overlap „D“
Zero travel dependent on series spread — 0.5 % … 0 % for overlap „E“

NS 10

\[ q_{V \text{ nom}} = 50 \text{ L/min} \text{ flow characteristic L} \]
\[ q_{V \text{ nom}} = 100 \text{ L/min} \text{ flow characteristic L} \]
\[ q_{V \text{ nom}} = 50 \text{ L/min} \text{ flow characteristic P} \]
\[ q_{V \text{ nom}} = 100 \text{ L/min} \text{ flow characteristic P} \]

Zero travel dependent on series spread 0 % … 0.5 % for overlap „D“
Zero travel dependent on series spread — 0.5 % … 0 % for overlap „E“
Characteristic curves (measured at: $p_s = 10$ bar; $v = 46$ mm$^2$/s; $\vartheta = 40$ °C)

Transient function with a jump form of electrical input signal

**4/3-way version**

**4/4-way version**

Frequency response characteristic curves

**4/3-way version**

**4/4-way version**
**Characteristic curves** (measured at: $p_s = 10$ bar; $\nu = 46$ mm$^2$/s; $\theta = 40$ °C)

**Flow-load function at the max. valve opening** (tolerance $\pm 10\%$)

4/3-way version

4/4-way version
Transient function with a jump form of electrical input signal

4/3-way version

4/4-way version

Frequency response characteristic curves

4/3-way version

4/4-way version
Characteristic curves (measured at: $p_s = 10$ bar; $v = 46$ mm$^2$/s; $\vartheta = 40$ °C)

Flow-load function at the max. valve opening (tolerance ± 10%)

4/3-way version

4/4-way version

Recommended flow limitation
$q_V = 180$ L/min
(flow velocity 30 m/s)
Unit dimensions: NS 6

Type 4WRSEH 6 V... (standard)

1. Valve housing
2.1 High response solenoid "a" with inductive position transducer
2.2 High response solenoid "b"
3.1 High response solenoid "b" with inductive position transducer
3.2 High response solenoid "a"
4. Plug-in connector to E DIN 43 563 BF6-3/Pg11 (separate order, see page 6)
5. Space required to remove the plug-in connector
6. Space requed for the cable bend radius when removing the plug-in connector
7. Cable bend radius
8. Name plate
9. R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)
10. Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 052 and valve fixing screws must be ordered separately.

Subplates:
- G 341/01 (G 1/4)
- G 342/01 (G 3/8)
- G 502/01 (G 1/2)

Valve fixing screws:
- 4 off M5 x 30 DIN 912-10.9; $M_A = 7.1 \text{Nm}$
Unit dimensions: NS 6

Type 4WRSEH 6 C.B...

1 Valve housing
2 Cover
3.1 High response solenoid „b”
   with inductive position transducer
3.2 High response solenoid „a”
   with inductive position transducer
4 Plug-in connector to E DIN 43 563 BF6-3/Pg11
   (separate order, see page 6)
5 Space required to remove the plug-in connector
6 Space required for the cable bend radius when
   removing the plug-in connector
7 Cable bend radius
8 Name plate
9 R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)
10 Machined valve mounting surface,
   position of ports to DIN 24 340 form A,
   ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 052 and valve fixing screws must
be ordered separately.

Subplates:
- G 341/01 (G 1/4)
- G 342/01 (G 3/8)
- G 502/01 (G 1/2)

Valve fixing screws:
- 4 off M5 x 30 DIN 912-10.9; $M_A = 7.1$ Nm
Unit dimensions: NS 10

Type 4WRSEH 10 V... (standard)

1 Valve housing
2.1 High response solenoid "a" with inductive position transducer
2.2 High response solenoid "b"
3.1 High response solenoid "b" with inductive position transducer
3.2 High response solenoid "a"
4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order; see page 6)
5 Space required to remove the plug-in connector
6 Space required for the cable bend radius when removing the plug-in connector
7 Cable bend radius
8 Name plate
9 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 66/01 (G 3/8); G 67/01 (G 1/2)
G 534/01 (G 3/4)

Valve fixing screws:
4 off M6 x 40 DIN 912-10.9; $M_A = 12.2$ Nm
Unit dimensions: NS 10

Type 4WRSEH 10 C.B...

1 Valve housing
2 Cover
3.1 High response solenoid „b“ with inductive position transducer
3.2 High response solenoid „a“ with inductive position transducer
4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)
5 Space required to remove the plug-in connector
6 Space required for the cable bend radius when removing the plug-in connector
7 Cable bend radius
8 Name plate
9 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 66/01 (G 3/8); G 67/01 (G 1/2)
G 534/01 (G 3/4)

Valve fixing screws:
4 off M6 x 40 DIN 912-10.9; \( M_A = 12.2 \text{ Nm} \)
The data specified above only serves to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The details stated do not release you from the responsibility for carrying out your own assessment and verification. It must be remembered that our products are subject to a natural process of wear and ageing.
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