FAQ Title: 12V Proportional valve coils

Category: Proportional and Servo Valves
Sub-Category: Proportional Valves

Question:
How or when should I apply 12V solenoids or coils to proportional valves?

Answer:
- Proportional solenoids, or coils, are current controlled devices where voltage alone really doesn't determine the answer. It is better to use the maximum current required and the warm coil resistance to calculate whether a solenoid/coil can be driven in a 12V system.
- For example the 4WRA-2X valves (RE29055) require a maximum current of 2.5A and have a warm resistance of 3 ohms. The Ohm's law formula to calculate the voltage when the resistance and current are known is V=I(current) X R(ohms). With the values that the 4WRA-2X valve requires only 7.5V is needed to supply the required current not taking into consideration any line loss. So the 4WRA-2X could be used in a system that only has 12Vdc available but the current to the coils would need to be regulated so as not to overdrive them.
- An example showing a valve that can't be used in a 12V system is to look at the DBET-6X(RE29162). Maximum current required is 1.6A and the warm resistance is 8.05 ohms. The minimum voltage needed would be 12.88Vdc. So a 12Vdc system would not be able to drive the DBET-6X fully.
- The data sheets offered as attachments provide the max current and warm resistance values to assist in applying the correct valve for the application’s requirements. For example, page 6 of RE 29 055, defines both these values.

Attachments:
RE29055, RE29162
For information regarding the available spare parts see: www.boschrexroth.com/spc

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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<td>12...15</td>
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</tbody>
</table>

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
Ordering details

Without integrated electronics (OBE) = No code
With integrated electronics (OBE) = E

Nominal size 6 = 6
Nominal size 10 = 10

Spool symbols

<table>
<thead>
<tr>
<th>P</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>0</td>
</tr>
<tr>
<td>b</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>a</td>
<td>0</td>
</tr>
<tr>
<td>p</td>
<td>t</td>
</tr>
</tbody>
</table>

With spool symbols E₁⁻ and W₁⁻:
P → A: \( q_{V_{\text{max}}} \)
P → B: \( q_{V}/2 \)
A → T: \( q_{V_{\text{max}}} \)

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 ± 10 V
F1 = Command value input 4 to 20 mA
No code = For 4WRAE

**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

G₂₄ = Supply voltage 24 VDC

2X = Component series 20 to 29
(20 to 29: unchanged installation and connection dimensions)

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

<table>
<thead>
<tr>
<th>NS6</th>
<th>07 = 7 l/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 = 15 l/min</td>
<td></td>
</tr>
<tr>
<td>30 = 26 l/min</td>
<td></td>
</tr>
<tr>
<td>NS10</td>
<td>30 l/min</td>
</tr>
<tr>
<td>60 = 60 l/min</td>
<td></td>
</tr>
</tbody>
</table>

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…

Types 4WRA…EA…; 4WRA…WA…

Types 4WRAE…EA…; 4WRAE…WA…
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)

**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 "a" (5)
    - 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)

Type 4WRA 6…-2X/…

Valve with 2 spool positions:
(Type 4WRA…-A…)
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).

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></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</td>
<td>4WRA</td>
<td>°C</td>
<td>–20 to +70</td>
</tr>
<tr>
<td>temperature range</td>
<td>4WRAE</td>
<td>°C</td>
<td>–20 to +50</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, \( \nu_{oil} = 40 \, ^\circ C \pm 5 \, ^\circ C \))

<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_{V,nom} ) 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>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nominal size</strong></td>
<td><strong>NS</strong> 6 10</td>
</tr>
<tr>
<td><strong>Voltage type</strong></td>
<td>DC</td>
</tr>
<tr>
<td><strong>Command value signal with type WRAE</strong></td>
<td>Voltage input „A1“ V ±10, Current input „F1“ mA 4 to 20</td>
</tr>
<tr>
<td><strong>Max. current per solenoid</strong></td>
<td>A 2.5</td>
</tr>
<tr>
<td><strong>Solenoid coil resistance</strong></td>
<td>Cold value at 20 °C Ω 2, Max. warm value Ω 3</td>
</tr>
<tr>
<td><strong>Duty</strong></td>
<td>% 100</td>
</tr>
<tr>
<td><strong>Max. coil temperature</strong></td>
<td>°C 150</td>
</tr>
</tbody>
</table>
| **Electrical connections**                     | 4WRA with component plug to DIN EN 175301-803 or ISO 4400 plug-in connector to DIN EN 175301-803 or ISO 4400 2)
| **Valve protection to EN 60529**               | IP65 with mounted and fixed plug-in connector |

### Control electronics

For 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

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

### Supply voltage

<table>
<thead>
<tr>
<th><strong>4WRAE, 4WRA</strong> 3)</th>
<th><strong>Nominal voltage</strong> VDC 24</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lower limiting value</strong></td>
<td>V 21 / 22 (4WRA); 19 (4WRAE)</td>
</tr>
<tr>
<td><strong>Upper limiting value</strong></td>
<td>V 35</td>
</tr>
<tr>
<td><strong>Amplifier current consumption</strong></td>
<td>A 1.8 Max. impulse current A 3</td>
</tr>
</tbody>
</table>

---

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

**Note:** For details regarding the environmental simulation test covering EMC (electro-magnetic 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**

<table>
<thead>
<tr>
<th>Pin allocation of the component plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>F</td>
</tr>
</tbody>
</table>

<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**

- PE is connected to the cooling body and the valve housing
- Protective conductor screwed to the valve housing and cover
- Ramp can be externally adjusted from 0 to 2.5 s; the same applies for \( T_{up} \) and \( T_{down} \)
- Output stages current regulated
- Low voltage detection is **not** carried out for component type 4WRAE 10-2X.
Characteristic curves (measured with HLP46, $\nu_{\text{oil}} = 40^\circ C \pm 5^\circ C$)

**NS6**

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

- Command value in % → Flow in l/min

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

- Command value in % → Flow in l/min

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

- Command value in % → Flow in l/min

- $\Delta p = 10$ bar constant
- $\Delta p = 20$ bar constant
- $\Delta p = 30$ bar constant
- $\Delta p = 50$ bar constant
- $\Delta p = 100$ bar constant

**Characteristic curves (measured with HLP46, $\nu_{\text{oil}} = 40^\circ C \pm 5^\circ C$)**

**NS10**

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

- Command value in % → Flow in l/min

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

- Command value in % → Flow in l/min

- $\Delta p = 10$ bar constant
- $\Delta p = 20$ bar constant
- $\Delta p = 30$ bar constant
- $\Delta p = 50$ bar constant
- $\Delta p = 100$ bar constant

$\Delta p =$ Valve pressure differential (inlet pressure $p_P$ minus load pressure $p_L$ and minus return pressure $p_T$)
Characteristic curves (measured with HLP46, \( \theta_{oil} = 40 \degree C \pm 5 \degree C \))

Transient functions with stepped form of electrical input signals

Types 4WRA and 4WRAE

---

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

- \( \text{P} \rightarrow \text{A} / \text{B} \rightarrow \text{T} \)
- \( \text{P} \rightarrow \text{B} / \text{A} \rightarrow \text{T} \)

- **Flow in l/min**
- **Valve pressure differential in bar**

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

- \( \text{P} \rightarrow \text{A} / \text{B} \rightarrow \text{T} \)
- \( \text{P} \rightarrow \text{B} / \text{A} \rightarrow \text{T} \)

- **Flow in l/min**
- **Valve pressure differential in bar**

---

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

- \( \text{P} \rightarrow \text{A} / \text{B} \rightarrow \text{T} \)
- \( \text{P} \rightarrow \text{B} / \text{A} \rightarrow \text{T} \)

- **Flow in l/min**
- **Valve pressure differential in bar**

---

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

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)

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

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 $\mu_{total} = 0.09$ to 0.14)
  Tightening torque $M_A = 7$ Nm ± 10%
  Material No. R913000064 (separate order)
  or
- 4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9
  (friction value $\mu_{total} = 0.12$ to 0.17)
  Tightening torque $M_A = 8.9$ Nm ± 10%
Unit dimensions: Type 4WRAE 6 ...K31/..V (nominal dimensions in mm) NS6

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)

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 $M_a = 7$ Nm ± 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 $M_a = 8.9$ Nm ± 10%

Tolerance to:
- General tolerances to ISO 2768-mK

Required surface finish of the valve mounting surface

Rzmax 4

0.01/100mm

Unit dimensions: 4WRAE 6...K31/..V

- General tolerances to ISO 2768-mK

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

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
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

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-H2 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 $M_A = 15.5 \text{ Nm} \pm 10\%$

Note: The valves are bled before delivery.

Tolerances to:
- General tolerances to ISO 2768-mK

Required surface finish of the valve mounting surface

- Rzmax 4
- 0.01/100mm

Unit dimensions: Type 4WRA 10 (nominal dimensions in mm) NS10
Unit dimensions: Type 4WRAE 10 (nominal dimensions in mm) NS10

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
   Note: The valves are bled before delivery.
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-flZn-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%
Proportional pressure relief valve

Types DBET and DBETE

Nominal size 6
Component series 6X
Maximum operating pressure 350 bar
Maximum flow 2 L/min

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<tr>
<td>Unit dimensions, type DBETE</td>
<td>11</td>
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</tbody>
</table>

Features

- Direct operated valve for limiting a system pressure
- Operated via a proportional solenoid
- Proportional solenoid with central thread and removable coil
- For subplate mounting:
  Porting pattern to ISO 4401-03-02 subplates to catalogue sheet RE 45052, (separate order, see pages 10 and 11)
- Internal control electronics for type DBETE:
  • Low example spread of the command value-pressure-characteristic curve
  • CE: For the type DBETE with integrated control electronics the EMC directive 89/336/EWG is complied with
    • EN 61000-6-3: 2002-08
    • The compliance of the identified products with the specifications of the stated directive can be proven by fully complying with the stated standards (see page 5 „Environmental simulation test“).
- External control electronics for type DBET (separate order, see page 5)
  • Analogue amplifier in Eurocard format and modular design
  • Independent up and down ramps
  • Fine calibration of the command value-pressure-characteristic curve is possible externally on the control electronics

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

| DBET | 6X | G24 | *
|------|----|-----|-----

Proportional pressure relief valve

For external control electronics = ohne Bez.
With integrated electronics = E

Component series 60 to 69 = 6X
(60 to 69: unchanged installation and connection dimensions)

Max. pressure stage
Up to 50 bar = 50
Up to 100 bar = 100
Up to 200 bar = 200
Up to 315 bar = 315
Up to 350 bar = 350

Control electronics supply voltage = G24
24 V DC

Further details in clear text
V = FKM seals

Integrated control electronics interface for the DBETE:
A1 = Command value input 0 to 10 VDC
F1 = Command value input 4 to 20 mA

Electrical connections for the DBET:
K4 = Without plug-in connector, with component plug to DIN EN 175301-803
Plug-in connector, separate order, see page 6

K31 = For the DBETE:
Without plug-in connector, with component plug to DIN EN 175201-804
Plug-in connector, separate order, see page 6

Other types of protection on request!

Preferred types

<table>
<thead>
<tr>
<th>Type DBET</th>
<th>Type</th>
<th>Material No.</th>
<th>Type</th>
<th>Material No.</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>R901000842</td>
<td>DBET-6X/50G24K4V</td>
<td>R901000845</td>
<td>DBET-6X/100G24K4V</td>
<td>R901000846</td>
<td>DBET-6X/200G24K4V</td>
</tr>
</tbody>
</table>

Symbols

For external control electronics (type DBET)

With integrated control electronics (type DBETE)
The function and design of this valve is the same as the valve type DBET. On the proportional solenoid there is an additional housing (6) which contains the control electronics.

The supply and command value voltages are fed to the component plug (7). The command value-pressure-characteristic curve is factory pre-set to a low example spread. For further details regarding the control electronics, see page 6.
### Technical data (for applications outside these parameters, please consult us!)

<table>
<thead>
<tr>
<th>General</th>
<th>DBET</th>
<th>DBETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range °C</td>
<td>–20 to +80</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range °C</td>
<td>–20 to +70</td>
<td>–20 to +50</td>
</tr>
<tr>
<td>Weight kg</td>
<td>2.0</td>
<td>2.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hydraulic (measured with HLP 46; ( \vartheta_{oil} = 40 , ^\circ C \pm 5 , ^\circ C ))</th>
<th>DBET</th>
<th>DBETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating pressure Port P</td>
<td></td>
<td>350</td>
</tr>
<tr>
<td>Max. settable pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure stage 50 bar bar</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Pressure stage 100 bar bar</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Pressure stage 200 bar bar</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>Pressure stage 315 bar bar</td>
<td></td>
<td>315</td>
</tr>
<tr>
<td>Pressure stage 350 bar bar</td>
<td></td>
<td>350</td>
</tr>
<tr>
<td>Min. settable pressure (with a zero command value 0 V or 4 mA) bar</td>
<td></td>
<td>See char. curves on pages 8 and 9</td>
</tr>
<tr>
<td>Return pressure Port T</td>
<td></td>
<td>Separate and at zero pressure to tank</td>
</tr>
<tr>
<td>Max. flow L/min</td>
<td></td>
<td>2.1</td>
</tr>
<tr>
<td>Pressure fluid</td>
<td>Mineral oil (HL, HLP) to DIN 51 524</td>
<td>Other pressure fluids on request!</td>
</tr>
<tr>
<td>Pressure fluid temperature range °C</td>
<td>–20 to +80</td>
<td></td>
</tr>
<tr>
<td>Viscosity range mm²/s</td>
<td>20 to 380 preferably to 30 to 46</td>
<td></td>
</tr>
<tr>
<td>Maximum permissible contamination degree of pressure fluid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleanliness class to ISO 4406 (c)</td>
<td>class 20/18/15 ²</td>
<td></td>
</tr>
<tr>
<td>Hysteresis %</td>
<td>&lt; 4 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Reversal span %</td>
<td>&lt; 0.5 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Response sensitivity %</td>
<td>&lt; 0.5 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Linearity (flow 0.8 L/min) %</td>
<td>±3 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Example spread of the com. value-pressure-char. curves at 0.8 L/min; pressure rising At com. value 20% %</td>
<td>&lt;±1.5 of the max. settable pressure ³</td>
<td></td>
</tr>
<tr>
<td>At com. value 100% %</td>
<td>&lt;±1.5 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Step response (( T_u + T_g )) 0 → 100% or 100% → 0</td>
<td></td>
<td>80 (depending on the system!)</td>
</tr>
<tr>
<td>Pipe volume &lt; 20 cm³; ( q_V = 0.8 , L/min ) ms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Take into account the notes regarding flow limitation on pages 8 and 9, pressure stages 315 and 350 bar

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.

3) Zero point calibration is factory pre-set

4) Calibration is possible on the control electronics
## Technical data
(for applications outside these parameters, please consult us!)

### Electrical

<table>
<thead>
<tr>
<th>Parameter</th>
<th>DBET</th>
<th>DBETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>Nominal voltage (VDC)</td>
<td>24</td>
</tr>
<tr>
<td>Lower limiting value</td>
<td>VDC</td>
<td>21</td>
</tr>
<tr>
<td>Upper limiting value</td>
<td>VDC</td>
<td>35</td>
</tr>
<tr>
<td>Min. control current (with a 0 V or 4 mA comm. value)</td>
<td>mA</td>
<td>100</td>
</tr>
<tr>
<td>Max. control current</td>
<td>mA</td>
<td>1600</td>
</tr>
<tr>
<td>1)</td>
<td></td>
<td>1600</td>
</tr>
<tr>
<td>Coil resistance</td>
<td>Cold value at 20°C (Ω)</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Max. warm value (Ω)</td>
<td>8.05</td>
</tr>
<tr>
<td>Duty</td>
<td>%</td>
<td>100</td>
</tr>
<tr>
<td>Electrical connections</td>
<td>Component plug and plug-in connector to DIN EN 175301-803</td>
<td>DIN EN 175201-804</td>
</tr>
<tr>
<td>Valves protection to DIN 40050</td>
<td>IP</td>
<td>65 with mounted and locked plug-in connector</td>
</tr>
</tbody>
</table>

### Control electronics

| Component plug and plug-in connector to catalogue sheet RE 30115          | VT-VSPA1-2-1X | VT-VSPA1K-2-1X | – |
|• Amplifier in Eurocard format (separate order) to catalogue sheet RE 30115 | Analogue      |                  | – |
|• Amplifier of modular design (separate order) to catalogue sheet RE 30223 | Analogue      | VT-MSPA1-1-1X    | – |

1) Dependent on the amplifier, see control electronics (external amplifier)

---

### Note!
For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29162-U (declaration regarding environmental compatibility).
Electrical connections, plug-in connectors

For type DBET (for external control electronics)
Plug-in connector (black) to DIN EN 175301-803
Separate order under Material No. R901017011

For type DBETE (with integrated control electronics)
Plug-in connector to DIN EN 175201-804
For pin allocation see block circuit diagram on page 7
Soldered contacts: from 0.5 to 1.5 mm²
(valid for both plug-in connectors)

Material No. R900021267
(plastic version)
Separate order

Material No. R900223890
(metal version)
Separate order

Component plug pin allocation for type DBETE ¹)

<table>
<thead>
<tr>
<th>Contact</th>
<th>Interface „A1“ pin allocation</th>
<th>Interface „F1“ pin allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>A</td>
<td>24 VDC ( (u(t) = 21 \text{ V to } 35 \text{ V}) ); ( I_{\text{max}} \leq 2 \text{ A} )</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0 V</td>
</tr>
<tr>
<td>Act. value ref. potential</td>
<td>C</td>
<td>Ref. contact F; 0 V</td>
</tr>
<tr>
<td>Differential amplifier input</td>
<td>D</td>
<td>0 to 10 V ( \text{Re} &gt; 100 \text{ k}\Omega )</td>
</tr>
<tr>
<td>Measurement output (act. value)</td>
<td>E</td>
<td>Command value ref. potential</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>0…1.6 V act. value (1 mV ( \Delta 1 \text{ mA} ))</td>
</tr>
<tr>
<td></td>
<td>PE</td>
<td>Connected with the solenoid and valve housing</td>
</tr>
</tbody>
</table>

¹) Also see the supply voltage on page 7
**Integrated control electronics (OBE), block circuit diagram**

**Function**

The electronics are supplied with a voltage via connections „A“ and „B“. The command value is applied to the differential amplifier connections „D“ and „E“. The ramp generator forms from a command value jump (0%...100% or 100%...0%) a delayed increase or decrease of the solenoid current. The increase and decrease times are fixed and cannot be changed.

Via the characteristic curve generator the command value-solenoid-characteristic curve is so matched to the valve so that unlinearities in the hydraulics are compensated for and a linear command value-pressure-characteristic curve results.

The current controller regulates the solenoid current independent of the solenoid coil resistance.

The power stage of the electronics for controlling the proportional solenoids is a chopper amplifier with a clock pulse frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width-modulated (PWM).

To test the solenoid current it is possible, at the plug, to measure a voltage between pin „F“(+) and pin „C“(–), that reacts in proportion to the solenoid current. 1 mA solenoid current is 1 mV.

**Supply voltage**

Power supply with rectifier

Single phase rectification or AC bridge:

\[ U_{\text{eff}} = 21 \text{ to } 35 \text{ V} \]

Output current: \( I_{\text{eff}} = \text{max. } 1.85 \text{ A} \)

Supply cable:

- Recommended 6-core 0.75 or 1 mm\(^2\) plus earth and screen
- Outside diameter is dependent on the plug-in connector (page 6)
- Only connect the screen to PE on the supply side
- Max. permissible length 100 m

The minimum supply voltage at the power supply is dependent on the length of the supply cable (see diagram).

For lengths > 50 m a 2200 \( \mu \text{F} \) condenser must be fitted in the supply cable in the vicinity of the valve.
**Characteristic curves** (measured with HLP 46, \( \theta_{\text{oil}} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C} \))

Pressure in port P in relation to the command value  \( \text{Flow} = 0.8 \, \text{L/min} \)

1) The example spread can be reduced at the external amplifier, for type and catalogue sheet see page 5, (command value attenuation potentiometer „Gw“). The description is contained within the amplifier catalogue sheet.

Max. permissible current 1750 mA (can be measured at the amplifier measurement socket „I“).

So that more than one valve can be calibrated to the same characteristic curve, with a 100% command value the pressure should not be set higher than the maximum settable pressures stated on page 4.

**Pressure in port P in relation to the flow**

1) With characteristic curve 5, the command value must not exceed a flow of 1.4 L/min

2) max. op. pressure

---

1. At 20% zero point calibration, factory set.
2. Command value in % → Com. value in %
**Characteristic curves** (measured with HLP 46, $\theta_{\text{oil}} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C})

Pressure in port P in relation to the flow

Valid for all pressure stages:
- Curve 1 = 0 % command value
- Curve 2 = 25 % command value
- Curve 3 = 50 % command value
- Curve 4 = 75 % command value
- Curve 5 = 100 % command value

The characteristic curves were measured without any back pressure in port T. ($p_T = 0 \, \text{bar}$)

1) With pressure stage 350 bar, characteristic curve 5, the command value must not exceed a flow of 0.8 L/min

**Min. settable pressure in port P with a 0 V or 4 mA command value in relation to the flow**

Valid for all pressure stages:
- Curve 1 = 0 % command value
- Curve 2 = 25 % command value
- Curve 3 = 50 % command value
- Curve 4 = 75 % command value
- Curve 5 = 100 % command value

The characteristic curves were measured without any back pressure in port T. ($p_T = 0 \, \text{bar}$)

Min. control current $\leq 100 \, \text{mA}$

(This current is set with a command value of 0 V or 4 mA)
Unit dimensions: type DBET (in mm)

1 Proportional solenoid
2 Valve housing
3 Name plate
4 Same sealing rings for ports P, T, A and B
5 Plug-in connector to DIN EN 175301-803 (separate order, see page 6)
6 Space required to remove the plug-in connector
7 Blind counterbores A and B
8 Machined valve mounting surface port location to ISO 4401-03-02

Deviations from the standard:
- Locating pin is not provided
- “A” and “B” ports are not drilled

Subplates to catalogue sheet RE 45052 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:
- (not included within the scope of supply)

Due to strength (tensile) reasons only use the following valve fixing screws:

4 S.H.C.S. DIN 912 - M5 x 45 - 10.9;
Coating to DIN EN ISO 10683 flZn - 240h - L
(friction value 0.09 - 0.14 to VDA 235-102);
$M_A = 7 \text{ Nm} \pm 10\%$
separate order Mat. No. R913000140

The required surface finish of the mating piece when not fitting the valve onto a subplate

The unit dimensions diagram includes measurements and notes on each component.
Unit dimensions: type DBETE (in mm)

1. Proportional solenoid
2. Valve housing
3. Integrated control electronics
4. Same sealing rings for ports P, T, A and B
5. Plug-in connector to DIN EN 175301-803 (separate order, see page 6)
6. Space required to remove the plug-in connector
7. Cable bend radius
8. Cable fixing
9. Blind counterbores A und B
10. Machined valve mounting surface port location to ISO 4401-03-02
   Deviations from the standard:
   - Locating pin is not provided
   - "A" and "B" ports are not drilled
11. Name plate
12. Block circuit diagram

Subplates to catalogue sheet RE 45052 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:
(not included within the scope of supply)
Due to strength (tensile) reasons only use the following valve fixing screws:

4 S.H.C.S. DIN 912 - M5 x 45 - 10.9;
Coating DIN EN ISO 10863 fZn - 240h - L
(friction value 0.09 - 0.14 to VDA 235-102);
Max. = 7 Nm ± 10%
Separate order Mat. No. R913000140

The required surface finish of the mating piece when not fitting the valve onto a sub-plate

R 40
0.01/100 mm
Rzmax 4
12
10
9
8
7
6
5
4
3
2
1
Proportional pressure relief valve

Types DBET and DBETE

Nominal size 6
Component series 6X
Maximum operating pressure 350 bar
Maximum flow 2 L/min

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<td>8 and 9</td>
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<td>10</td>
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<tr>
<td>Unit dimensions, type DBETE</td>
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</tr>
</tbody>
</table>

Features

- Direct operated valve for limiting a system pressure
- Operated via a proportional solenoid
- Proportional solenoid with central thread and removable coil
- For subplate mounting:
  - Porting pattern to ISO 4401-03-02 subplates to catalogue sheet RE 45052, (separate order, see pages 10 and 11)
- Internal control electronics for type DBETE:
  - Low example spread of the command value-pressure-characteristic curve
  - CE: For the type DBETE with integrated control electronics the EMC directive 89/336/EWG is complied with
    - EN 61000-6-3: 2002-08
    - The compliance of the identified products with the specifications of the stated directive can be proven by fully complying with the stated standards (see page 5 „Environmental simulation test“).
- External control electronics for type DBET (separate order, see page 5)
  - Analogue amplifier in Eurocard format and modular design
  - Independent up and down ramps
  - Fine calibration of the command value-pressure-characteristic curve is possible externally on the control electronics

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

Proportional pressure relief valve

For external control electronics = ohne Bez.
With integrated electronics = E

Component series 60 to 69 = 6X
(60 to 69: unchanged installation and connection dimensions)

Max. pressure stage
Up to 50 bar = 50
Up to 100 bar = 100
Up to 200 bar = 200
Up to 315 bar = 315
Up to 350 bar = 350

Control electronics supply voltage = G24
24 V DC

Further details in clear text

V = FKM seals

Integrated control electronics interface for the DBETE:
A1 = Command value input 0 to 10 VDC
F1 = Command value input 4 to 20 mA

Electrical connections for the DBET:
K4 = Without plug-in connector, with component plug to DIN EN 175301-803
Plug-in connector, separate order, see page 6

K31 = For the DBETE:
Without plug-in connector, with component plug to DIN EN 175201-804
Plug-in connector, separate order, see page 6

Other types of protection on request!

Preferred types

<table>
<thead>
<tr>
<th>Type DBET</th>
<th>Type</th>
<th>Material No.</th>
<th>Type</th>
<th>Material No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R901000842</td>
<td>DBET-6X/50G24K4V</td>
<td>R901029966</td>
<td>DBETE-6X/50G24K31A1V</td>
<td></td>
</tr>
<tr>
<td>R901000845</td>
<td>DBET-6X/100G24K4V</td>
<td>R901029967</td>
<td>DBETE-6X/100G24K31A1V</td>
<td></td>
</tr>
<tr>
<td>R901000846</td>
<td>DBET-6X/200G24K4V</td>
<td>R901029968</td>
<td>DBETE-6X/200G24K31A1V</td>
<td></td>
</tr>
<tr>
<td>R901000847</td>
<td>DBET-6X/315G24K4V</td>
<td>R901029969</td>
<td>DBETE-6X/315G24K31A1V</td>
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<tr>
<td>R901000848</td>
<td>DBET-6X/350G24K4V</td>
<td>R901029970</td>
<td>DBETE-6X/350G24K31A1V</td>
<td></td>
</tr>
</tbody>
</table>

Symbols

For external control electronics (type DBET)  With integrated control electronics (type DBETE)
**Function, section**

**General**
The type DBET proportional pressure relief valves are fine control valves of poppet design and are used to limit a system pressure. They are operated by a proportional solenoid with central thread and removable coil. The inner chamber is connected with port T and is filled with pressure fluid. With these valves it is possible to infinitely vary the system pressure, which is to be limited, in relation to the electrical command value.

These valves basically comprise of the housing (1), a proportional solenoid (2), the valve seat (3) and the valve poppet (4).

**Basic principle**
To adjust the system pressure a command value is applied to the control electronics. The electronics apply an electrical current to the solenoid which is in relation to the command value. The proportional solenoid converts the electrical current into a mechanical force that acts via the armature pin (5) on the valve poppet (4). The valve poppet (4) presses directly onto the valve seat (3) and closes the connection between P and T. If the hydraulic force on the valve poppet (4) is the same as the solenoid force, then the valve controls the set pressure in that the valve poppet (4) lifts off the valve seat (3) and permits pressure fluid to flow from port P to T. At a zero command value the control electronics only apply a minimum control current to the proportional solenoid (2) and thereby sets the minimum settable pressure.

**Type DBET**

**Type DBETE** (with integrated control electronics)
The function and design of this valve is the same as the valve type DBET. On the proportional solenoid there is an additional housing (6) which contains the control electronics.

The supply and command value voltages are fed to the component plug (7). The command value-pressure-characteristic curve is factory pre-set to a low example spread. For further details regarding the control electronics, see page 6.
### Technical data (for applications outside these parameters, please consult us!)

<table>
<thead>
<tr>
<th>General</th>
<th>DBET</th>
<th>DBETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range °C</td>
<td>–20 to +80</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range °C</td>
<td>–20 to +70</td>
<td>–20 to +50</td>
</tr>
<tr>
<td>Weight kg</td>
<td>2.0</td>
<td>2.15</td>
</tr>
</tbody>
</table>

#### Hydraulic (measured with HLP 46; $\vartheta_{oil} = 40 ^\circ C \pm 5 ^\circ C$)

<table>
<thead>
<tr>
<th></th>
<th>DBET</th>
<th>DBETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating pressure Port P</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>Max. settable pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure stage 50 bar bar</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Pressure stage 100 bar bar</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Pressure stage 200 bar bar</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Pressure stage 315 bar bar</td>
<td>315</td>
<td></td>
</tr>
<tr>
<td>Pressure stage 350 bar bar</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>Min. settable pressure (with a zero command value 0 V or 4 mA) bar</td>
<td>See char. curves on pages 8 and 9</td>
<td></td>
</tr>
<tr>
<td>Return pressure Port T bar</td>
<td></td>
<td>Separate and at zero pressure to tank</td>
</tr>
<tr>
<td>Max. flow L/min</td>
<td>2</td>
<td>1)</td>
</tr>
<tr>
<td>Pressure fluid</td>
<td>Mineral oil (HL, HLP) to DIN 51 524</td>
<td>Other pressure fluids on request!</td>
</tr>
<tr>
<td>Pressure fluid temperature range °C</td>
<td>–20 to +80</td>
<td></td>
</tr>
<tr>
<td>Viscosity range mm²/s</td>
<td>20 to 380 preferably to 30 to 46</td>
<td></td>
</tr>
<tr>
<td>Maximum permissible contamination degree of pressure fluid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleanliness class to ISO 4406 (c)</td>
<td>class 20/18/15</td>
<td></td>
</tr>
<tr>
<td>Hysteresis %</td>
<td>&lt; 4 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Reversal span %</td>
<td>&lt; 0.5 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Response sensitivity %</td>
<td>&lt; 0.5 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Linearity (flow 0.8 L/min)</td>
<td>±3 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Example spread of the com. value-pressure-char. curves at 0.8 L/min; pressure rising</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At com. value 20% %</td>
<td>&lt; ±1.5 of the max. settable pressure</td>
<td>3)</td>
</tr>
<tr>
<td>At com. value 100% %</td>
<td>&lt; ±5 of the max. settable pressure</td>
<td>4)</td>
</tr>
<tr>
<td>Step response ($T_p + T_g$) 0 → 100% or 100% → 0 ms</td>
<td>&lt; ±1.5 of the max. settable pressure</td>
<td></td>
</tr>
<tr>
<td>Pipe volume &lt; 20 cm³; $q_V = 0.8$ L/min</td>
<td>80 (depending on the system!)</td>
<td></td>
</tr>
</tbody>
</table>

1) Take into account the notes regarding flow limitation on pages 8 and 9, pressure stages 315 and 350 bar
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.
3) Zero point calibration is factory pre-set
4) Calibration is possible on the control electronics
## Technical data (for applications outside these parameters, please consult us!)

### Electrical

<table>
<thead>
<tr>
<th></th>
<th>DBET</th>
<th>DBETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>Nominal voltage VDC</td>
<td>24</td>
</tr>
<tr>
<td>Lower limiting value</td>
<td>VDC</td>
<td>21</td>
</tr>
<tr>
<td>Upper limiting value</td>
<td>VDC</td>
<td>35</td>
</tr>
<tr>
<td>Min. control current</td>
<td>mA</td>
<td>100</td>
</tr>
<tr>
<td>Max. control current</td>
<td>mA</td>
<td>1600</td>
</tr>
<tr>
<td>Coil resistance</td>
<td>Cold value at 20°C Ω</td>
<td>5.5</td>
</tr>
<tr>
<td>Max. warm value</td>
<td>Ω</td>
<td>8.05</td>
</tr>
<tr>
<td>Duty</td>
<td>%</td>
<td>100</td>
</tr>
</tbody>
</table>

### Electrical connections

- Component plug and plug-in connector to DIN EN 175301-803
- Component plug and plug-in connector to DIN EN 175201-804

### Valve protection
d to DIN 40050

<table>
<thead>
<tr>
<th></th>
<th>DBET</th>
<th>DBETE</th>
</tr>
</thead>
</table>
|                             |      | 65     

### Control electronics

<table>
<thead>
<tr>
<th></th>
<th>DBET</th>
<th>DBETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>External amplifier</td>
<td></td>
<td>Integrated into the valve, see page 11</td>
</tr>
<tr>
<td>• Amplifier in Eurocard format (separate order) to catalogue sheet RE 30115</td>
<td>Analogue</td>
<td>VT-VSPA1-2-1X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VT-VSPA1K-2-1X</td>
</tr>
<tr>
<td>• Amplifier of modular design (separate order) to catalogue sheet RE 30223</td>
<td>Analogue</td>
<td>VT-MSPA1-1-1X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
</tr>
</tbody>
</table>

1) Dependent on the amplifier, see control electronics (external amplifier)

---

**Note!**

For details regarding the environmental simulation test covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29162-U (declaration regarding environmental compatibility).
Electrical connections, plug-in connectors

For type DBET (for external control electronics)
Plug-in connector (black) to DIN EN 175301-803
Separate order under Material No. R901017011

For type DBETE (with integrated control electronics)
Plug-in connector to DIN EN 175201-804
For pin allocation see block circuit diagram on page 7
Soldered contacts: from 0.5 to 1.5 mm²
(valid for both plug-in connectors)

Material No. R900021267
(plastic version)
Separate order

Material No. R900223890
(metal version)
Separate order

Component plug pin allocation for type DBETE ¹)

<table>
<thead>
<tr>
<th>Contact</th>
<th>Interface „A1“ pin allocation</th>
<th>Interface „F1“ pin allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>A</td>
<td>24 VDC (u(t) = 21 V to 35 V); ( I_{\text{max}} \leq 2 \text{ A} )</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0 V</td>
</tr>
<tr>
<td>Act. value ref. potential</td>
<td>C</td>
<td>Ref. contact F; 0 V</td>
</tr>
<tr>
<td>Differential amplifier input</td>
<td>D</td>
<td>0 to 10 V ( \text{Re} &gt; 100 \text{ k(\Omega)} )</td>
</tr>
<tr>
<td>Measurement output (act. value)</td>
<td>E</td>
<td>Command value ref. potential</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>0...1.6 V act. value (1 mV ( \Delta 1 \text{ mA} ))</td>
</tr>
<tr>
<td></td>
<td>PE</td>
<td>Connected with the solenoid and valve housing</td>
</tr>
</tbody>
</table>

¹) Also see the supply voltage on page 7
Integrated control electronics (OBE), block circuit diagram

Function

The electronics are supplied with a voltage via connections „A“ and „B“. The command value is applied to the differential amplifier connections „D“ and „E“. The ramp generator forms from a command value jump (0%...100% or 100%...0%) a delayed increase or decrease of the solenoid current. The increase and decrease times are fixed and cannot be changed.

Via the characteristic curve generator the command value-solenoid-characteristic curve is so matched to the valve so that unlinearities in the hydraulics are compensated for and a linear command value-pressure-characteristic curve results.

The current controller regulates the solenoid current independent of the solenoid coil resistance.

The power stage of the electronics for controlling the proportional solenoids is a chopper amplifier with a clock pulse frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width-modulated (PWM).

To test the solenoid current it is possible, at the plug, to measure a voltage between pin „F“(+)-pin „C“(–), that reacts in proportion to the solenoid current. 1 mA solenoid current is 1 mV.

Supply

Power supply with rectifier

Single phase rectification or AC bridge:

\[ U_{eff} = 21 \text{ to } 35 \text{ V} \]

Output current: \[ I_{eff} = \text{max. } 1.85 \text{ A} \]

Supply cable:

- Recommended 6-core 0.75 or 1 mm² plus earth and screen
- Outside diameter is dependent on the plug-in connector (page 6)
- Only connect the screen to PE on the supply side
- Max. permissible length 100 m

The minimum supply voltage at the power supply is dependent on the length of the supply cable (see diagram).

For lengths > 50 m a 2200 \( \mu \text{F} \) condenser must be fitted in the supply cable in the vicinity of the valve.
Characteristic curves (measured with HLP 46, $\theta_{\text{oil}} = 40^\circ\text{C} \pm 5^\circ\text{C}$)

Pressure in port P in relation to the command value  
Flow = 0.8 L/min

1) The example spread can be reduced at the external amplifier, for type and catalogue sheet see page 5, (command value attenuation potentiometer „Gw“). The description is contained within the amplifier catalogue sheet.

Max. permissible current 1750 mA (can be measured at the amplifier measurement socket „I“)

So that more than one valve can be calibrated to the same characteristic curve, with a 100% command value the pressure should not be set higher than the maximum settable pressures stated on page 4.

Pressure in port P in relation to the flow

1) With characteristic curve 5, the command value must not exceed a flow of 1.4 L/min

2) With characteristic curve 5, the command value must not exceed a flow of 1.4 L/min
**Characteristic curves** (measured with HLP 46, $\theta_{oil} = 40 \, ^\circ\text{C} \pm 5 \, ^\circ\text{C})

Pressure in port P in relation to the flow

Valid for all pressure stages:
- Curve 1 = 0 % command value
- Curve 2 = 25 % command value
- Curve 3 = 50 % command value
- Curve 4 = 75 % command value
- Curve 5 = 100 % command value

The characteristic curves were measured without any back pressure in port T. ($p_T = 0 \, \text{bar}$)

1) With pressure stage 350 bar, characteristic curve 5, the command value must not exceed a flow of 0.8 L/min

---

Min. settable pressure in port P with a 0 V or 4 mA command value in relation to the flow

Note

The characteristic curves were measured without any back pressure in port T. ($p_T = 0 \, \text{bar}$)

Min. control current $\leq 100 \, \text{mA}$

(This current is set with a command value of 0 V or 4 mA)
Unit dimensions: type DBET (in mm)

1 Proportional solenoid
2 Valve housing
3 Name plate
4 Same sealing rings for ports P, T, A and B
5 Plug-in connector to DIN EN 175301-803 (separate order, see page 6)
6 Space required to remove the plug-in connector
7 Blind counterbores A and B
8 Machined valve mounting surface
   port location to ISO 4401-03-02
Deviations from the standard:
   - Locating pin is not provided
   - “A” and “B” ports are not drilled

Subplates to catalogue sheet RE 45052 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:
   (not included within the scope of supply)
Due to strength (tensile) reasons only use the following valve fixing screws:

4 S.H.C.S. DIN 912 - M5 x 45 - 10.9;
Coating to DIN EN ISO 10683 flZn - 240h - L
   (friction value 0.09 - 0.14 to VDA 235-102);
   $M_A = 7 \text{ Nm} \pm 10\%$
   separate order Mat. No. R913000140

The required surface finish of the mating piece when not fitting the valve onto a subplate

0.01/100 mm

$\sqrt{Rz_{\text{max}}}$
Unit dimensions: type DBETE (in mm)

1 Proportional solenoid
2 Valve housing
3 Integrated control electronics
4 Same sealing rings for ports P, T, A and B
5 Plug-in connector to DIN EN 175301-803 (separate order, see page 6)
6 Space required to remove the plug-in connector
7 Cable bend radius
8 Cable fixing
9 Blind counterbores A und B
10 Machined valve mounting surface port location to ISO 4401-03-02
   Deviations from the standard:
   - Locating pin is not provided
   - "A" and "B" ports are not drilled
11 Name plate
12 Block circuit diagram

Subplates to catalogue sheet RE 45052 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:
(not included within the scope of supply)
Due to strength (tensile) reasons only use the following valve fixing screws:
4 S.H.C.S. DIN 912 - M5 x 45 - 10.9;
Coating DIN EN ISO 10683 flZn - 240h - L
(friction value 0.09 - 0.14 to VDA 235-102);
$M_s = 7\text{ Nm} \pm 10\%$
Separate order Mat. No. R913000140

The required surface finish of the mating piece when not fitting the valve onto a subplate

The unit dimensions of type DBETE are shown in the diagram. The diagram includes dimensions such as Ø12.9, 147.5, 56.5, 37, 44.5, 114.5, and 91.5, among others. The diagram also shows the port locations P, T, A, and B, as well as the cable bend radius and other critical dimensions.