

# 4WRPE10-3X

**Direct - acting high - frequency - response proportional valves with electrical position feedback and integrated amplifier**

Nominal sizes: NS 10

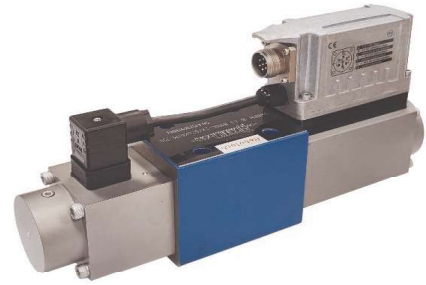
Series: 3X

Max. operating pressure: 350bar

Rated flow: 50、80 l/min( $\Delta p=10\text{bar}$ )

Document number:

RD A1611\_2306a



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## Features

- Driven by single or double electromagnets
- High - frequency - response proportional electromagnet with electrical displacement feedback
- Integrated digital controller, 32 - bit high - speed CPU, optimized PID position control algorithm
- Differential command signal input,  $0 \cdots \pm 10\text{V}$  for type A1,  $4 \cdots 20\text{mA}$  for type F1
- Suitable for electro - hydraulic servo control systems with high control accuracy requirements
- Mounting surface complies with ISO 4401 - 03 - 02 - 0 - 05/ISO 4401 - 05 - 04 - 0 - 05
- Electrical connection is 6P + PE

model

|             |          |           |          |           |          |          |          |           |          |          |          |           |           |          |
|-------------|----------|-----------|----------|-----------|----------|----------|----------|-----------|----------|----------|----------|-----------|-----------|----------|
| <b>4WRP</b> | <b>E</b> | <b>10</b> | <b>E</b> | <b>80</b> | <b>S</b> | <b>J</b> | <b>-</b> | <b>3X</b> | <b>/</b> | <b>M</b> | <b>/</b> | <b>24</b> | <b>A1</b> | <b>*</b> |
| 01          | 02       | 03        | 04       | 05        | 06       | 07       |          | 08        |          | 09       |          | 10        | 11        | 12       |

|    |             |                                                                 |
|----|-------------|-----------------------------------------------------------------|
| 01 | <b>4WRP</b> | 4 main ports design, directional control valve, direct operated |
|----|-------------|-----------------------------------------------------------------|

|    |          |                      |
|----|----------|----------------------|
| 02 | <b>E</b> | Integrated amplifier |
|----|----------|----------------------|

|    |           |       |
|----|-----------|-------|
| 03 | <b>10</b> | NS 10 |
|----|-----------|-------|

Symbols

|    |          |                                                            |
|----|----------|------------------------------------------------------------|
| 04 | <b>E</b> | E, E1, W, W6, etc.; See hydraulic symbol table for details |
|----|----------|------------------------------------------------------------|

Rated flow ( $\Delta p = 35\text{bar}$  / metering notch)

|    |           |                                   |
|----|-----------|-----------------------------------|
| 05 | <b>50</b> | 50 l/min (only for E、E1-、V 和 W6-) |
|    | <b>80</b> | 80 l/min                          |

|             |          |           |          |           |          |          |          |           |          |          |          |           |           |          |
|-------------|----------|-----------|----------|-----------|----------|----------|----------|-----------|----------|----------|----------|-----------|-----------|----------|
| <b>4WRP</b> | <b>E</b> | <b>10</b> | <b>E</b> | <b>80</b> | <b>S</b> | <b>J</b> | <b>-</b> | <b>3X</b> | <b>/</b> | <b>M</b> | <b>/</b> | <b>24</b> | <b>A1</b> | <b>*</b> |
| 01          | 02       | 03        | 04       | 05        | 06       | 07       |          | 08        |          | 09       |          | 10        | 11        | 12       |

#### Flow characteristics

|    |                |                                                                                                                           |
|----|----------------|---------------------------------------------------------------------------------------------------------------------------|
| 06 | <b>S</b>       | Progressive                                                                                                               |
| 07 | <b>No code</b> | Uncovered step change (for spool functions E, E1 -, EA, W6 -, and W8 -, the opening point is at 15% of the control value) |
|    | <b>J</b>       | Covered step change (for spool functions E, E1 -, EA, W6 -, and W8 -, the opening point is at 5% of the control value)    |
| 08 | <b>3X</b>      | Product series (the installation dimensions from 30 to 39 are the same)                                                   |

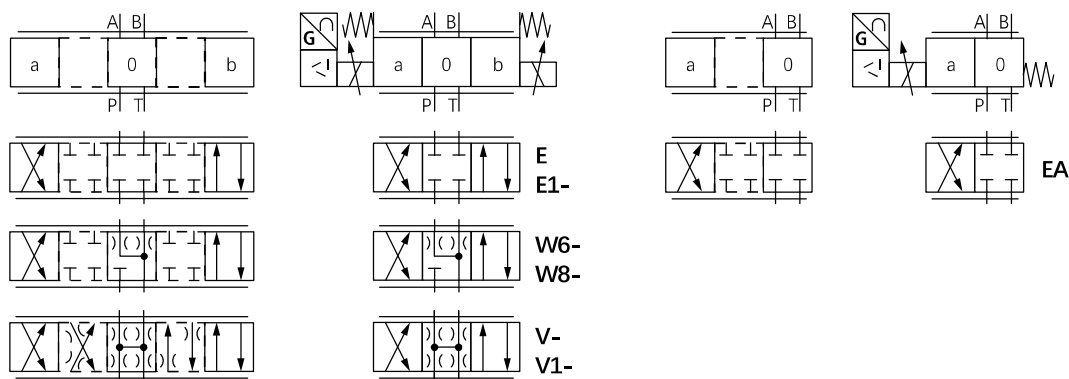
#### Sealing material

|    |           |                        |
|----|-----------|------------------------|
| 09 | <b>M</b>  | NBR seals              |
|    | <b>V</b>  | FKM seals              |
| 10 | <b>24</b> | Supply voltage : 24VDC |

#### Amplifier Commands

|    |           |                                                                                 |
|----|-----------|---------------------------------------------------------------------------------|
| 11 | <b>A1</b> | Control input signal $\pm 10V$ , actual value feedback $\pm 10V$                |
|    | <b>F1</b> | Control input signal 4~(12)-20mA, actual value feedback 4~(12)-20mA             |
|    | <b>A5</b> | Control input signal $\pm 10V$ with enable, actual value feedback $\pm 10V$     |
|    | <b>F5</b> | Control input signal 4~(12)-20mA with enable, actual value feedback 4~(12)-20mA |
|    | <b>C2</b> | Control input signal $\pm 10mA$ , actual value feedback 4~(12)-20mA             |
|    | <b>C6</b> | Control input signal $\pm 10mA$ with enable, actual value feedback 4~(12)-20mA  |
| 13 | <b>*</b>  | Further details in the plain text                                               |

## Symbols



E1-, V1- and W8-valves:

$^1) P \rightarrow A: q_{V\ nom}$      $B \rightarrow T: q_{V\ nom} / 2$   
 $P \rightarrow B: q_{V\ nom} / 2$      $A \rightarrow T: q_{V\ nom}$

## Function, section

### Normal State

After the proportional valve is normally energized, the displacement sensor of the electromagnet feeds back the actual displacement of the spool to the controller. The controller compares the actual displacement value with the command value. If the actual value deviates from the command value, the electromagnetic thrust of the electromagnet will change until the new electromagnetic thrust is equal to the thrust of the feedback spring, thus ensuring that the actual displacement value is equal to the command value.

The flow - through area of the control throttle port of the spool is proportional to the displacement of the spool, that is, proportional to the command value of the valve. If the command value of the valve is zero, the spool is in the middle position. If the command value is not zero, the spool works at the position corresponding to the command value.

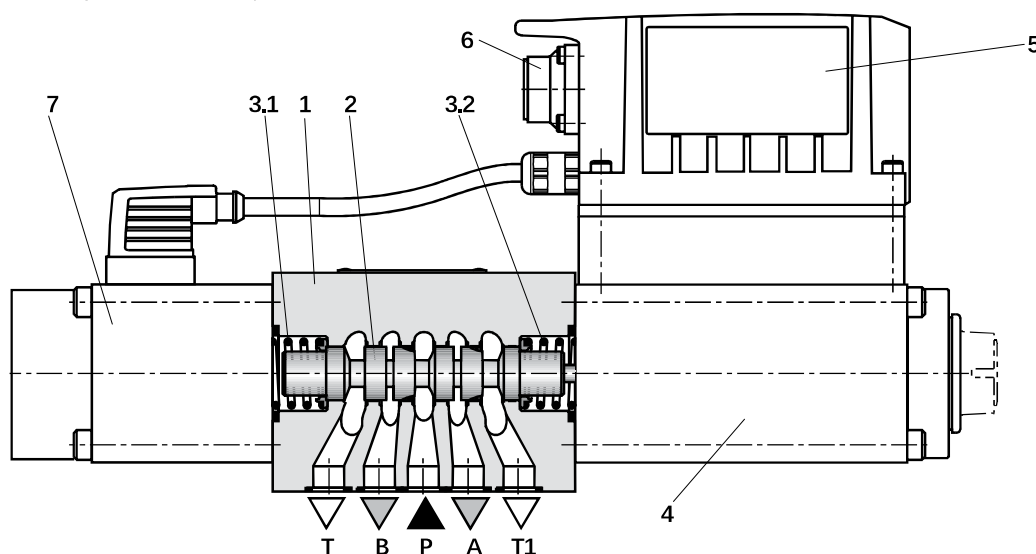
### Fault State

In the following fault cases, the integrated amplifier will de - energize the proportional electromagnet.

- ◆ Below the minimum supply voltage  $\leq 15V$  (restart  $\geq 17.5 V$ ).
- ◆ When the command type is "F1": When the current command value is lower than 2mA (including control cable breakage)

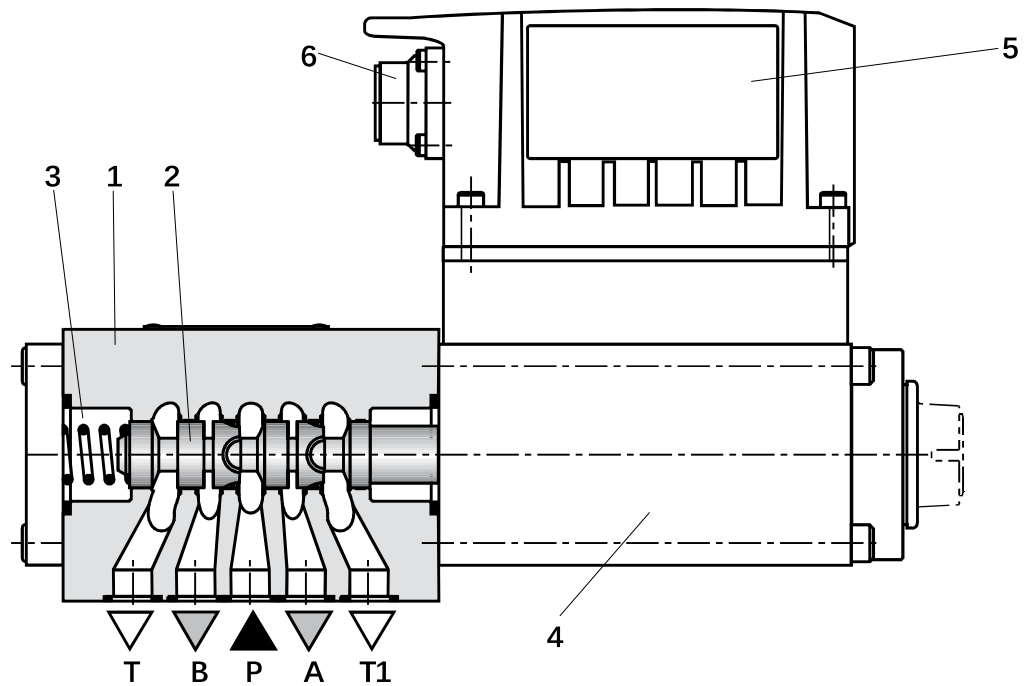
The spool is held in the mechanical center position by the compression spring (when using the spool function V, this position does not correspond to the hydraulic center position).

Three - position Four - way



1. Valve body
2. Spool
3. Spring
4. Electromagnet (with LVDT)
5. Integrated amplifier (OBE)
6. Seven - core socket
7. Electromagnet (without LVDT)

Two - position Four - way



1. Valve body
2. Spool
3. Spring
4. Electromagnet (with LVDT)
5. Integrated amplifier (OBE)

## Technical Data

### Overview

|                           |                                                                                               |         |  |
|---------------------------|-----------------------------------------------------------------------------------------------|---------|--|
| <b>General</b>            | Direct - acting slide valve                                                                   |         |  |
| Drive                     | High frequency response proportional solenoid with position feedback and integrated amplifier |         |  |
| Installation forms        | Mounting base plate conforming to ISO4401 - 05 - 04 - 0 - 05                                  |         |  |
| Installation positions    | Optional                                                                                      |         |  |
| Ambient temperature range | °C                                                                                            | -20~+60 |  |
| Weight                    | Kg                                                                                            | 7.6     |  |

### Hydraulic parameters (46# hydraulic oil, oil temperature = 40°C ± 5°C)

|                                                                             |                                                              |       |                                  |       |       |       |
|-----------------------------------------------------------------------------|--------------------------------------------------------------|-------|----------------------------------|-------|-------|-------|
| Maximum operating pressure                                                  | Port A, B, P                                                 | bar   | 350                              |       |       |       |
|                                                                             | Port T                                                       | bar   | 200                              |       |       |       |
| Nominal flow $q_{V\ nom}$ ( $\Delta p=5bar$ / metering notch <sup>r1)</sup> |                                                              | l/min | 50                               |       | 80    |       |
| Neutral Unloading Flow ( $\Delta p=5bar$ )                                  | Spool function W6                                            | l/min | A - T                            | B - T | A - T | B - T |
|                                                                             |                                                              |       | 0.7                              | 0.7   | 0.7   | 0.7   |
|                                                                             | Spool function W8                                            | l/min | ---                              | ---   | 0.7   | 0.7   |
| Working fluid                                                               | GB/T7631.2,ISO6743-4,DIN51524Please consult for other fluids |       |                                  |       |       |       |
| Oil temperature range                                                       | °C                                                           |       | -20to +70                        |       |       |       |
| Viscosity                                                                   | mm²/s                                                        |       | 10 to 800(recommended: 20to 100) |       |       |       |
| Oil cleanliness                                                             | ISO4406: 1999 18/16/13 <sup>2)</sup>                         |       |                                  |       |       |       |

### Static/Dynamic

|                                          |    |                                                      |
|------------------------------------------|----|------------------------------------------------------|
| Hysteresis                               | %  | ≤0.2                                                 |
| Manufacturing tolerance for $q_{V\ max}$ | %  | <10                                                  |
| Response time for signal change 0...100% | ms | ≤20                                                  |
| Thermal drift                            | %  | <1 (Temperature change $\Delta T=40^\circ\text{C}$ ) |
| Zero - point compensation                | %  | ±1 (Factory setting)                                 |

### Electrical

|                               |                                                                                 |      |
|-------------------------------|---------------------------------------------------------------------------------|------|
| Duty cycle                    | %                                                                               | 100  |
| Protection class              |                                                                                 | IP65 |
| Voltage type                  | VDC                                                                             | 24   |
|                               | Terminal A                                                                      | VDC  |
|                               | Terminal B                                                                      | VDC  |
| Maximum power consumption     | W                                                                               | 40   |
| External fuse                 | A <sub>F</sub>                                                                  | 2.5  |
| Shielded grounding            | See the "Pin Layout" diagram and the installation complies with CE requirements |      |
| Electromagnetic compatibility | Complies with EN61000 - 6 - 2:2005 - 08 and EN61000 - 6 - 3:2007- 01            |      |

1) The flow rate  $q_x$  at other pressure differences  $\Delta p = q_{V\ nom} \sqrt{\frac{\Delta p_x}{5}}$

2) In the hydraulic system, the fluid cleanliness must meet the requirements of the components. Effective filtration can prevent malfunctions in the hydraulic system and extend the service life of the components.

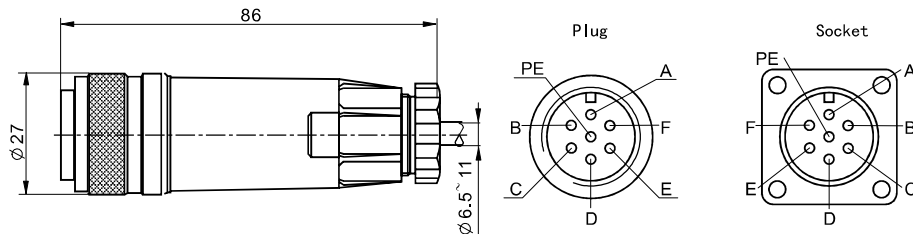
## Electrical connection

### 7-core plug for electrical connection

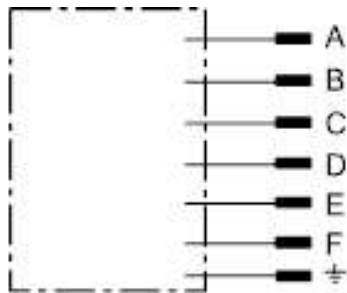
| Function          | Slot | A1Signal                                                        | F1 Signal                                         | C2 Signal                                         | A5 Signal                                                     | F5 Signal                                         | C6 Signal                                         |
|-------------------|------|-----------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| Power+            | A    | 24VDC (21~40VDC)                                                |                                                   |                                                   |                                                               |                                                   |                                                   |
| Power-            | B    | GND                                                             |                                                   |                                                   | GND, Enable/Actual Value Reference Potential                  |                                                   |                                                   |
|                   | C    | Feedback Value Reference Point                                  |                                                   |                                                   | Enable Input 24VDC (Enable $\geq$ 11VDC, Disable $\leq$ 5VDC) |                                                   |                                                   |
| Input command+    | D    | $\pm 10V$<br>Input Impedance<br>>50k $\Omega$                   | 4-20V<br>Input Impedance<br><250 $\Omega$         | $\pm 10V$<br>Input Impedance<br><250 $\Omega$     | $\pm 10V$<br>Input Impedance<br>>50k $\Omega$                 | 4-20V<br>Input Impedance<br><250 $\Omega$         | $\pm 10V$<br>Input Impedance<br><250 $\Omega$     |
| Input command-    | E    | Input command Reference potential                               |                                                   |                                                   |                                                               |                                                   |                                                   |
| Position feedback | F    | Actual value $\pm 10V$<br>Maximum load 5mA                      | Actual value 4-20mA,<br>maximum load 300 $\Omega$ | Actual value 4-20mA,<br>maximum load 300 $\Omega$ | Actual value $\pm 10V$<br>Maximum load 5mA                    | Actual value 4-20mA,<br>maximum load 300 $\Omega$ | Actual value 4-20mA,<br>maximum load 300 $\Omega$ |
|                   | PE   | PE Internally Short - Connected to the Heat Sink and Valve Body |                                                   |                                                   |                                                               |                                                   |                                                   |

### 7 - core Plug Conforming to DIN EN 175201 - 804 (Ordered Separately)

Dimensions in mm



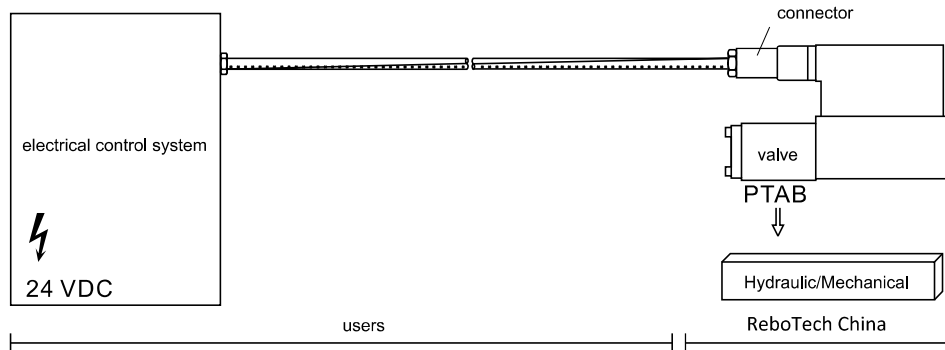
Plug pin assignment



Metal Nut Structure (Preferred Model)  
 Ordered Separately, Order No: R00050406  
 Plastic Nut Structure  
 Ordered Separately, Order No: R00050408  
 Fully Metal Structure  
 Ordered Separately, Order No: R00050407

## Electrical connection

### Electrical connection



Type: Multi - core Cable

High - quality Stranded Wire, in accordance with VDE 0295, Class 6  
 Protective Conductor, Green/Yellow  
 Copper Braided Shielding

Types: **eg** Olflex-FD 855 CP ( Lappkabe )

Wire Number: Determined by the Valve's Signal, Plug Model, and Plug Pin Assignment

Cable Diameter  $\Phi$ :  $0.75\text{mm}^2$ , Length up to 20m;  
 $1\text{mm}^2$ , Length up to 40m

Outer Diameter  $\Phi$ : 9.4...11.8 mm;  
 12.7...13.5mm

Note:

- Nominal Supply Voltage 24 VDC
- If the voltage drops below 18 VDC, an internal quick close occurs, similar to the "enable switch"
- For type F1:
  - When the command signal ID - E  $\geq 3$  mA, the valve operates
  - When the command signal ID - E  $\leq 2$  mA, the valve does not operate
- The electrical signals generated by the integrated controller (e.g., LVDT feedback signals) are not allowed to be used as safety - related function signals for the equipment! Please refer to the European standard "BS EN 982 Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulic power transmission"!

### Control Value

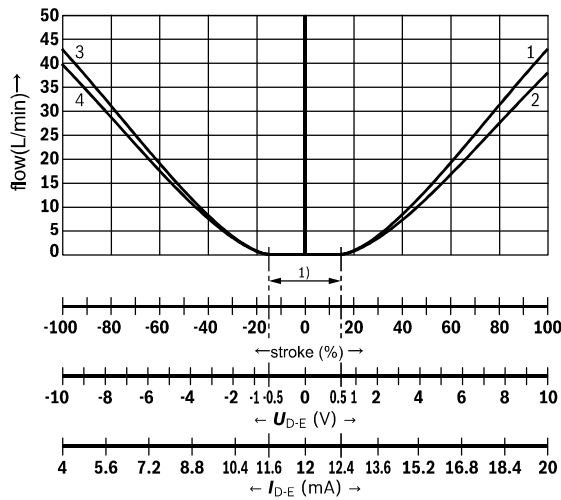
|                        |         |                          |
|------------------------|---------|--------------------------|
| Input signal (0~+100%) | 0~+10V  | Working position P→A/B→T |
|                        | 12~20mA |                          |
|                        | 0~+10mA |                          |
| Input signal (0~100%)  | 0~-10V  | Working position P→B/A→T |
|                        | 12~4mA  |                          |
|                        | 0~-10mA |                          |

## Characteristic curves (HLP46 at 40 °C ± 5 °C)

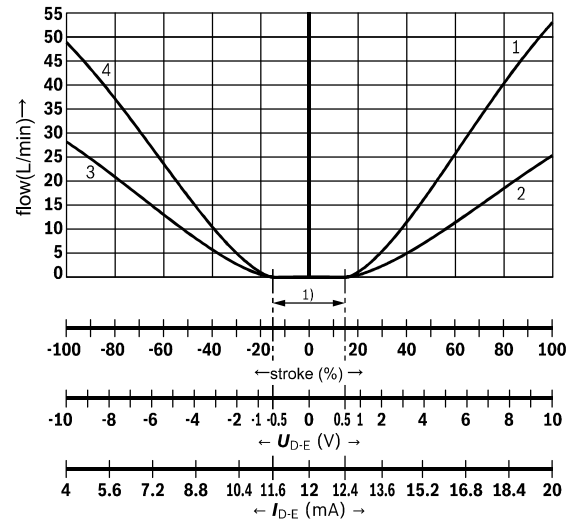
### 4WRPE10 Flow Characteristic Curve

1) Step compensation; 1- P-A; 2- B-T; 3- P-B; 4- A-T

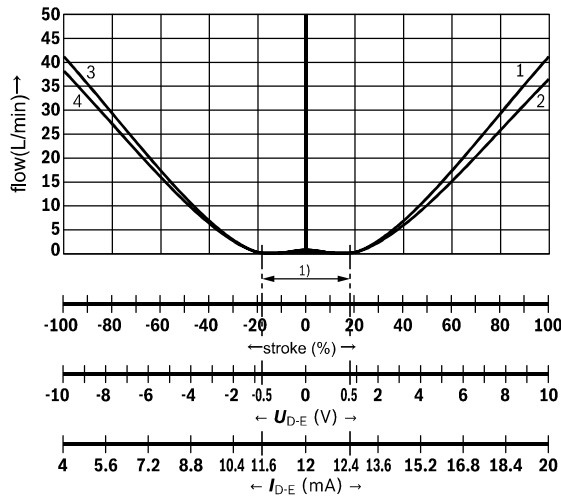
Spool Function E (Rated Flow 50 l/min,  $\Delta p = 5$  bar/ control edge)



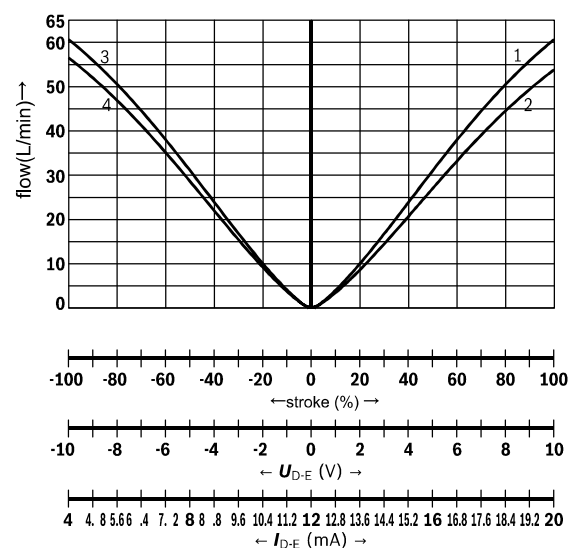
Spool Function E (Rated Flow 50 l/min,  $\Delta p = 5$  bar/ control edge)



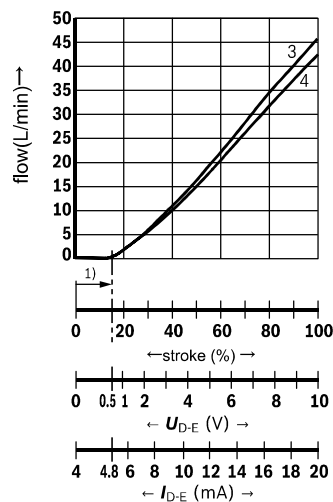
Spool Function W6 (Rated Flow 50 l/min,  $\Delta p = 5$  bar/ control edge)



Spool Function V (Rated Flow 50 l/min,  $\Delta p = 5$  bar/ control edge)

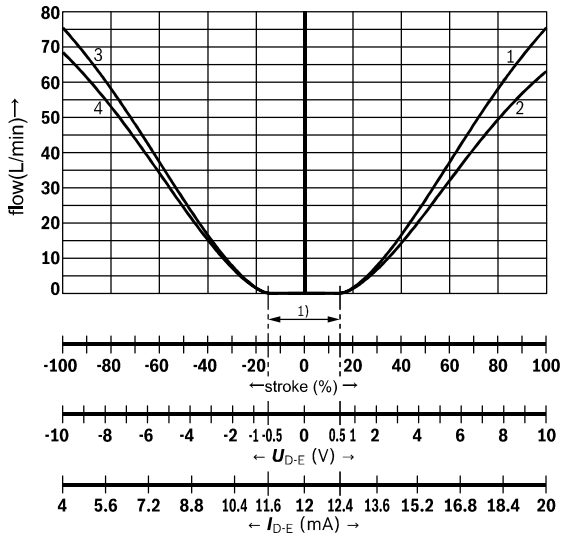


Spool Function EA (Rated Flow 50 l/min,  $\Delta p = 5$  bar/ control edge)

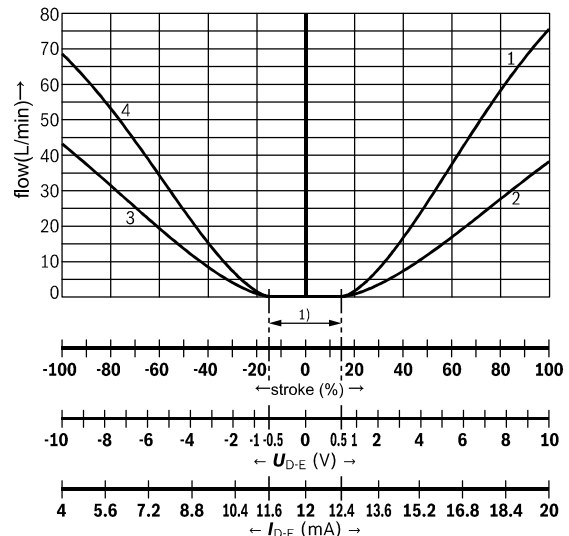


# 4WRPE10 Flow Characteristic Curve 1) Step compensation; 1- P-A; 2- B-T; 3- P-B; 4- A-T

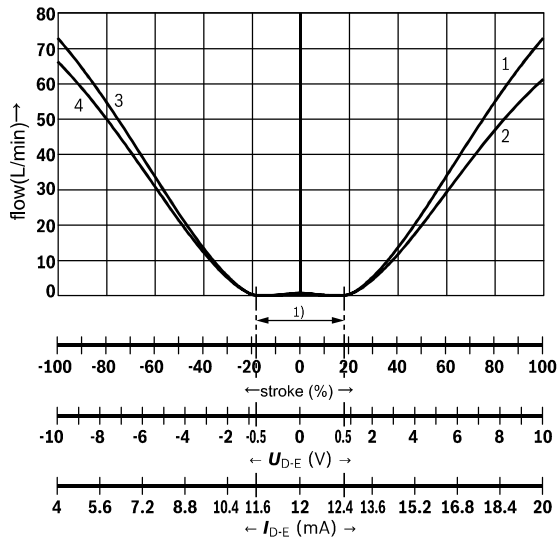
Spool Function E (Rated Flow 80 l/min,  $\Delta p = 5$  bar/control edge)



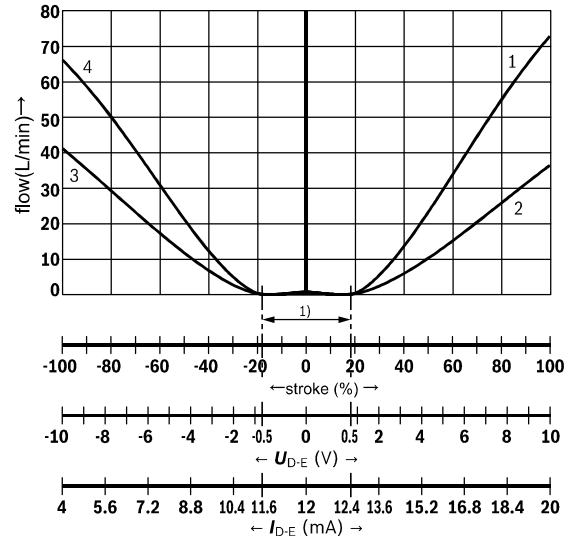
Spool Function E1 (Rated Flow 80 l/min,  $\Delta p = 5$  bar/control edge)



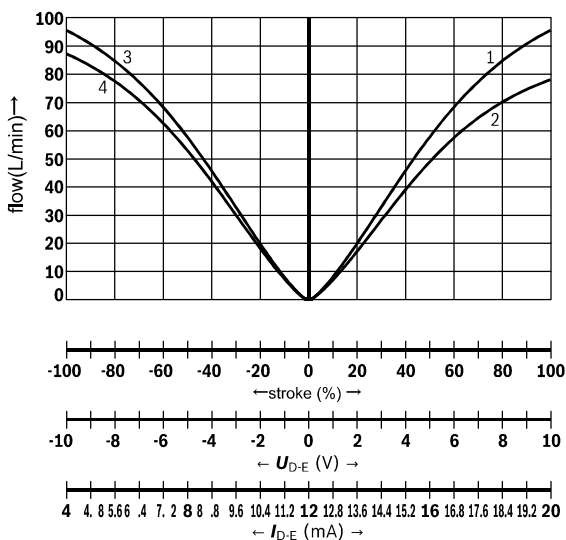
Spool Function W6 (Rated Flow 80 l/min,  $\Delta p = 5$  bar/control edge)



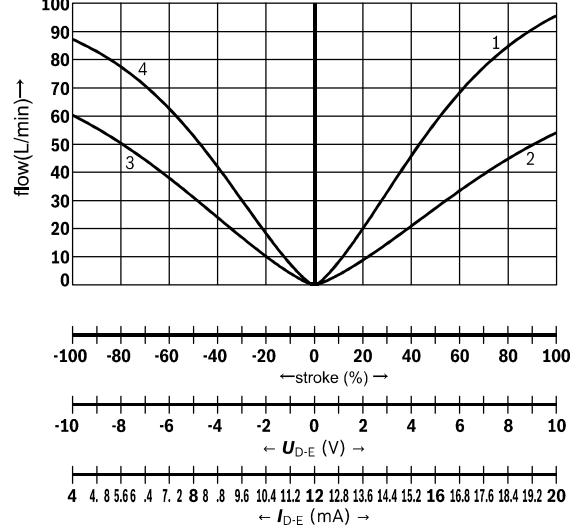
Spool Function W8 (Rated Flow 80 l/min,  $\Delta p = 5$  bar/control edge)



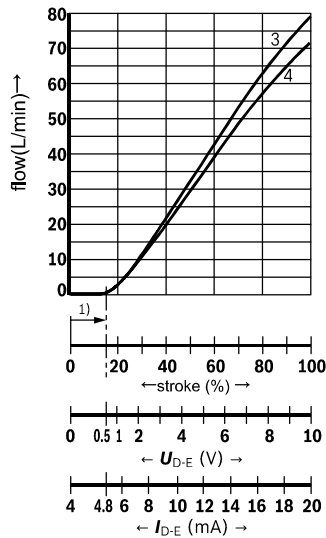
Spool Function V (Rated Flow 80 l/min,  $\Delta p = 5$  bar/control edge)



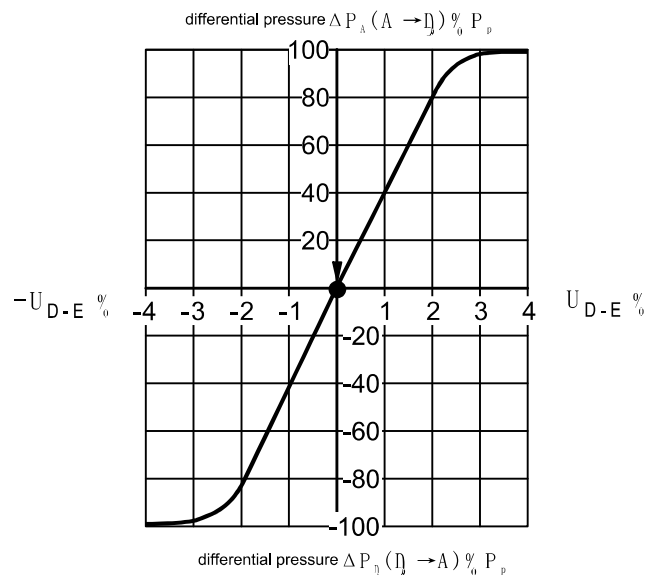
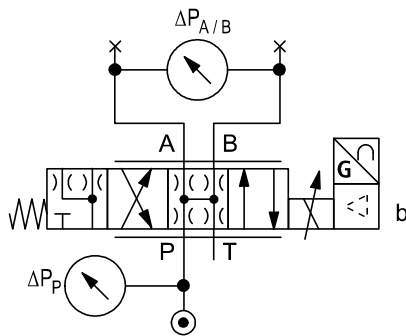
Spool Function V1 (Rated Flow 80 l/min,  $\Delta p = 5$  bar/control edge)



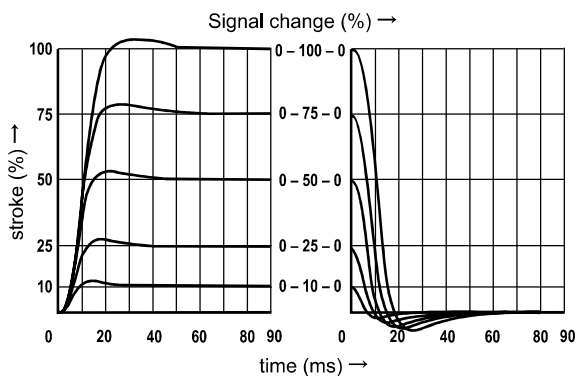
Spool Function EA (Rated Flow 80 l/min,  $\Delta p = 5$  bar/control edge)



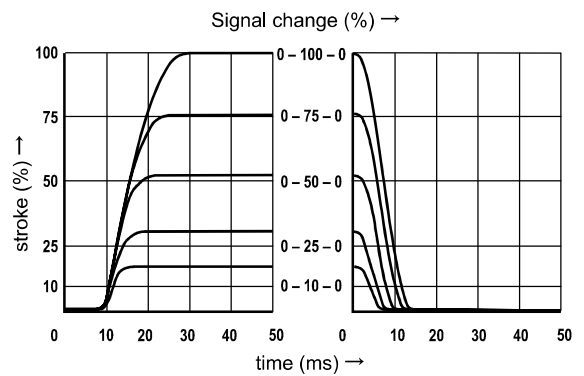
Pressure gain curve (Spool function V)



Step response curve (Spool function V)

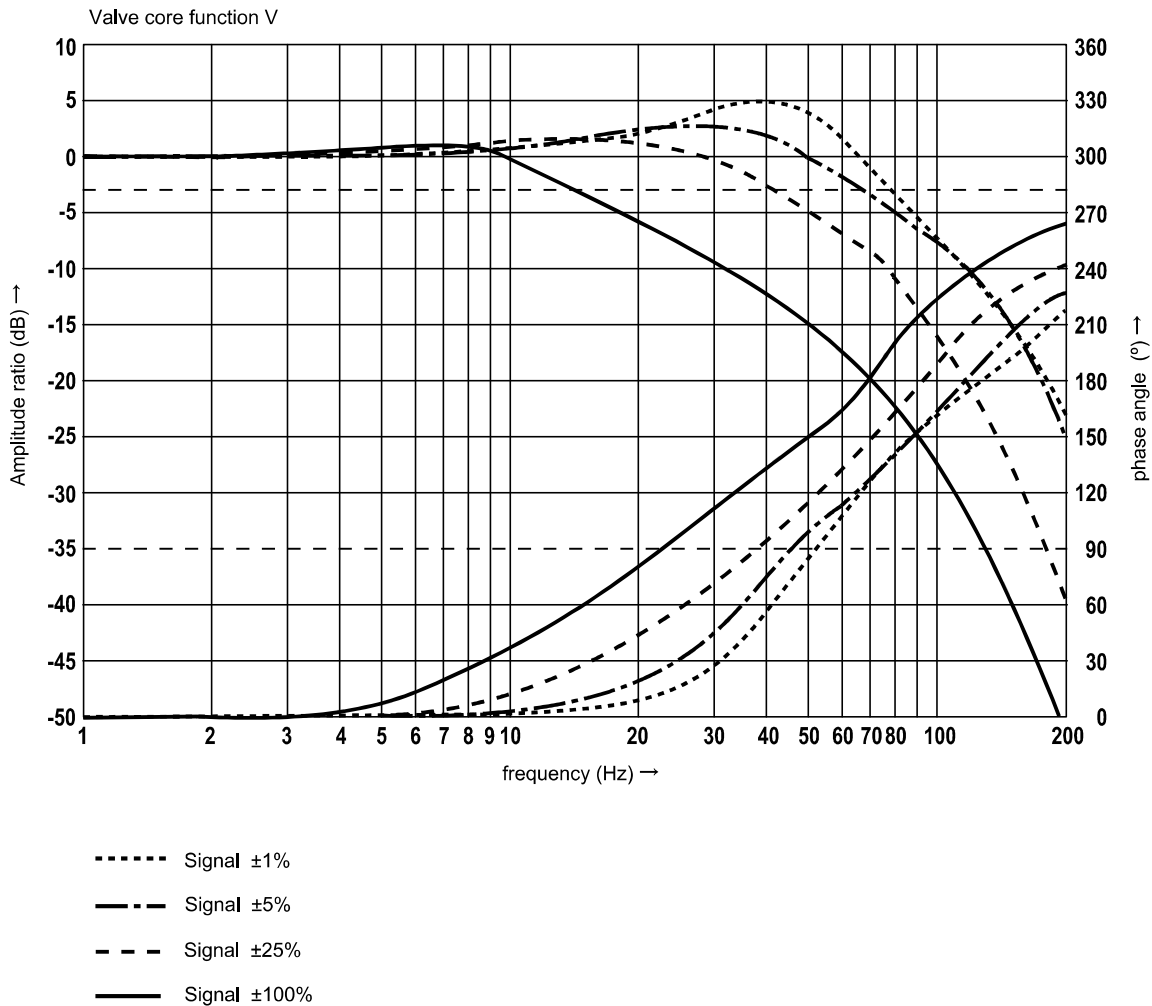


Step response curve (Spool function EA)

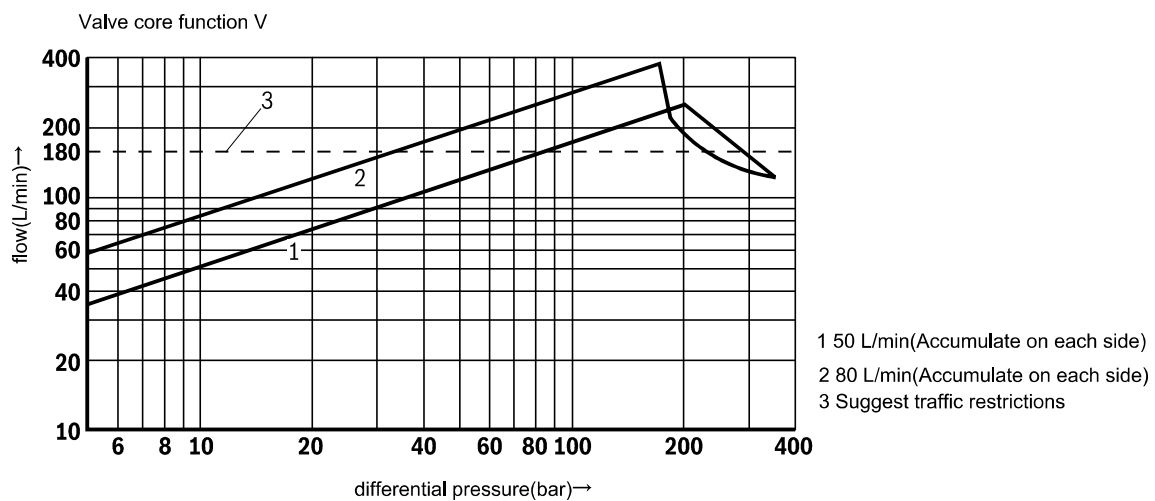


## Characteristic curves (HLP46 at 40 °C ± 5 °C)

### Frequency response curve (Spool function V)

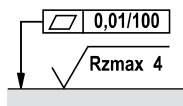
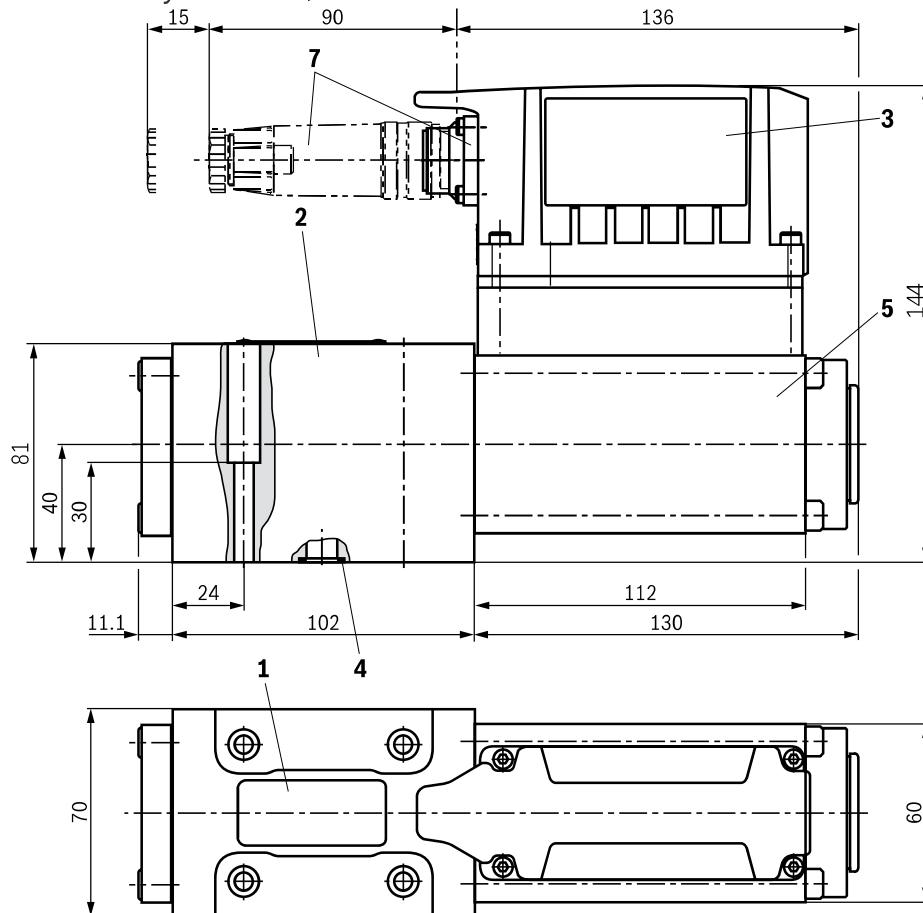


### Power limit (±10%) (for spool function V; for function of type EA, please consult the manufacturer)

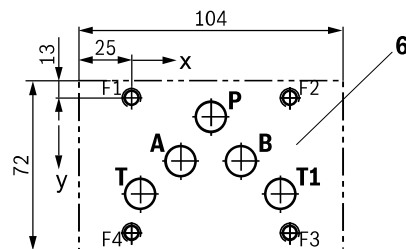




## Two-position four-way model I , Dimensions in mm



Surface quality required for valve contact surface



| Dimensions mm   | P        | A        | T        | (T1)     | B        | F1 | F2 | F3 | F4 |
|-----------------|----------|----------|----------|----------|----------|----|----|----|----|
| Aperture/Thread | 11.2 max | 11.2 max | 11.2 max | 11.2 max | 11.2 max | M6 | M6 | M6 | M6 |
| x               | 27       | 16.7     | 3.2      | 50.8     | 37.3     | 0  | 54 | 54 | 0  |
| y               | 6.3      | 21.4     | 32.5     | 32.5     | 21.4     | 0  | 0  | 46 | 46 |

1. Nameplate
2. Valve body
3. Integrated controller
4. Seals for oil ports P/T/A/B

5. Proportional electromagnet with LVDT
6. Hydraulic valve mounting surface, complying with the oil port connection positions and standard tolerances of ISO4401
7. Seven - core plug, complying with DIN EN 175201 - 804