

RE 29 093/12.99

Replaces: 01.99



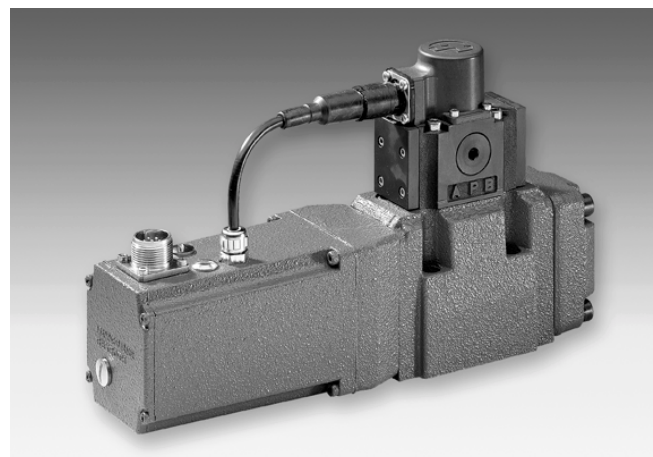
4/3-way high response directional control valve pilot operated Type 4WRDE

Nominal sizes 10, 16, 25, 32

Series 5X

Maximum operating pressure 350 bar

Maximum flow 1600 L/min



Type 4WRDE 10...-5X/6L24.K9/...

Overview of contents

Description	Page
Features	1
Ordering details	2
Preferred types	3
Symbols	3
Function, section	4
Valve features	4
Technical data	5
Electrical connections, plug-in connector	6 and 7
Integrated control electronics	8
Characteristic curves	9 to 13
Unit dimensions	14 to 17
Pilot oil supply	18

Features

- Pilot operated 3-stage high response directional control valve with electrical position feedback of the main spool
- Acquisition of the main spool position by means of an inductive position transducer
- 2-stage pilot control valve, type 4WS2EM 6-2X
- Particularly suitable for closed loop position, velocity, pressure and force control with simultaneous high requirements in dynamic response and response sensitivity
- Subplate mounting:
Porting pattern to DIN 24 340 form A (NS 10 supplemented with ports X and Y)
- Signal integration of the valve's closed loop control circuit, the supply of the position measuring system and the control of the pilot control valve are carried out via the integrated control electronics

Ordering details

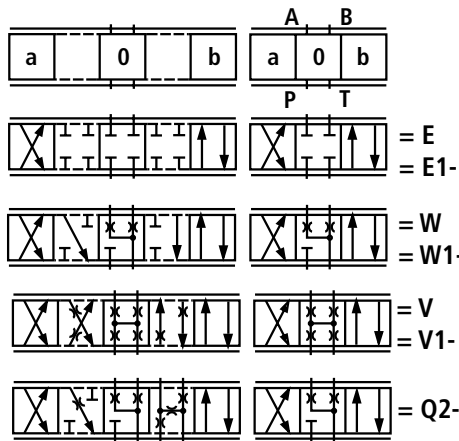
4WRD E / L-5X / 6L 24 K9 / *

3-stage high response directional control valve with electro-hydraulic operation

With integrated control electronics = E

Nominal size 10 = 10
 Nominal size 16 = 16
 Nominal size 25 = 25
 Nominal size 32 = 32

Symbols



With symbol E1-, W8-, V1-:

P → A : q_{Vmax} B → T : $q_V/2$
 P → B : $q_V/2$ A → T : q_{Vmax}

Note:

With spools W, W1- there is, in the neutral position, a connection from A to T and B to T with approx. 3 % of the relevant cross-section.

Further details in clear text

M = ²⁾ NBR seals
 V = FKM seals

No code = Without sandwich plate directional valve

WG152 = With sandwich plate directional valve
 24 V =, plug-in connector 24

Electrical connection

K9 = With component plug
Without plug-in connector
 Plug-in connector – separate order, see pages 6 and 7

Pilot oil supply and drain

No code = External pilot oil supply, External pilot oil drain
 E = Internal pilot oil supply, External pilot oil drain
 ET = Internal pilot oil supply, Internal pilot oil drain
 T = External pilot oil supply, Internal pilot oil drain

Supply voltage

24 = + 24 V DC

6L = Nominal size 6 servo pilot control valve

No code = Standard version

H = High-Flow version
only with NS 25 and a nominal flow 500 L/min

5X = Series 50 to 59
 (50 to 59: unchanged installation and connection dimensions)

Characteristic curve form

L = Linear

Nominal flow in L/min at 10 bar valve pressure differential

50 = or 100 = for nominal size 10
 125 = or 200 = for nominal size 16
 220 = or 350 = or 500 = ¹⁾ for nominal size 25
 600 = for nominal size 32

¹⁾ High-Flow version (only with NS 25)

²⁾ Suitable for mineral oil (HL, HLP) to DIN 51 524

Preferred types

NS10

Material No.	Type
00954164	4WRDE 10 V50L-5X/6L24ETK9/M
00954165	4WRDE 10 V50L-5X/6L24K9/M
00954166	4WRDE 10 V50L-5X/6L24ETK9/WG152M
00952912	4WRDE 10 V50L-5X/6L24K9/WG152M
00954167	4WRDE 10 V100L-5X/6L24ETK9/M
00948580	4WRDE 10 V100L-5X/6L24K9/M
00954168	4WRDE 10 V100L-5X/6L24ETK9/WG152M
00954169	4WRDE 10 V100L-5X/6L24K9/WG152M
00954170	4WRDE 10 V1-50L-5X/6L24ETK9/WG152M
00954171	4WRDE 10 V1-100L-5X/6L24K9/WG152M

NS16

Material No.	Type
00954172	4WRDE 16 V125L-5X/6L24ETK9/M
00945535	4WRDE 16 V125L-5X/6L24K9/M
00954174	4WRDE 16 V125L-5X/6L24ETK9/WG152M
00954175	4WRDE 16 V125L-5X/6L24K9/WG152M
00954176	4WRDE 16 V200L-5X/6L24ETK9/M
00954177	4WRDE 16 V200L-5X/6L24K9/M
00954178	4WRDE 16 V200L-5X/6L24ETK9/WG152M
00954179	4WRDE 16 V200L-5X/6L24K9/WG152M
00954180	4WRDE 16 V1-125L-5X/6L24ETK9/WG152M
00954181	4WRDE 16 V1-200L-5X/6L24K9/WG152M

NS25

Material No.	Type
00954182	4WRDE 25 V220L-5X/6L24ETK9/M
00954183	4WRDE 25 V220L-5X/6L24K9/M
00952713	4WRDE 25 V220L-5X/6L24ETK9/WG152M
00954184	4WRDE 25 V220L-5X/6L24K9/WG152M
00954185	4WRDE 25 V350L-5X/6L24ETK9/M
00954186	4WRDE 25 V350L-5X/6L24K9/M
00954188	4WRDE 25 V350L-5X/6L24ETK9/WG152M
00954189	4WRDE 25 V1-350L-5X/6L24K9/WG152M

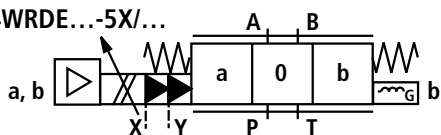
NS32

Material No.	Type
00942444	4WRDE 32 V600L-5X/6L24ETK9/M
00954190	4WRDE 32 V600L-5X/6L24K9/M
00954191	4WRDE 32 V600L-5X/6L24ETK9/WG152M
00954192	4WRDE 32 V600L-5X/6L24K9/WG152M

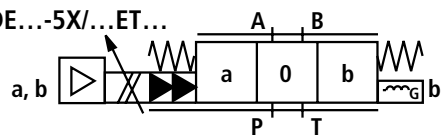
Symbols

Simplified

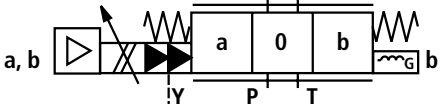
Type 4WRDE...-5X/...



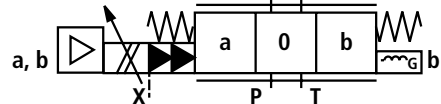
Type 4WRDE...-5X/...ET...



Type 4WRDE...-5X/...E...



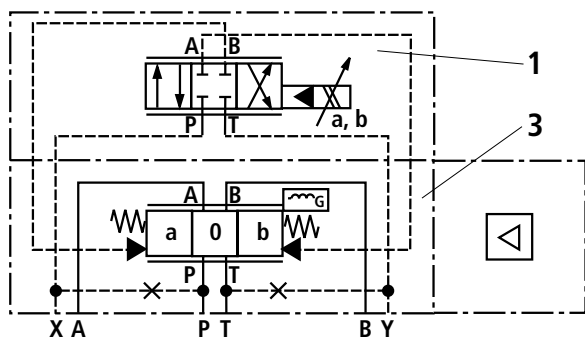
Type 4WRDE...-5X/...T...



Detailed

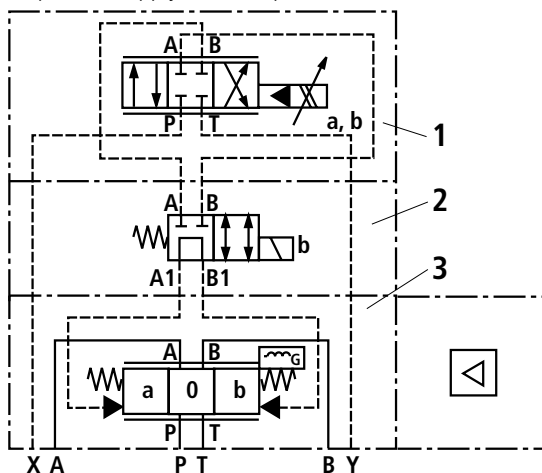
Example: Type 4WRDE...-5X/...

- 1 Pilot control valve
 - 2 Sandwich plate directional control valve
 - 3 Main valve
- External pilot oil supply, external pilot oil drain



Example: Type 4WRDE...-5X/...WG152

- Sandwich plate directional valve for centralising the main stage
External pilot oil supply, external pilot oil drain



Function, section

Valve types 4WRDE are 3-stage high response directional control valves.

They control or closed loop control the size and direction of a fluid flow and are primarily used in closed loop circuits for various tasks.

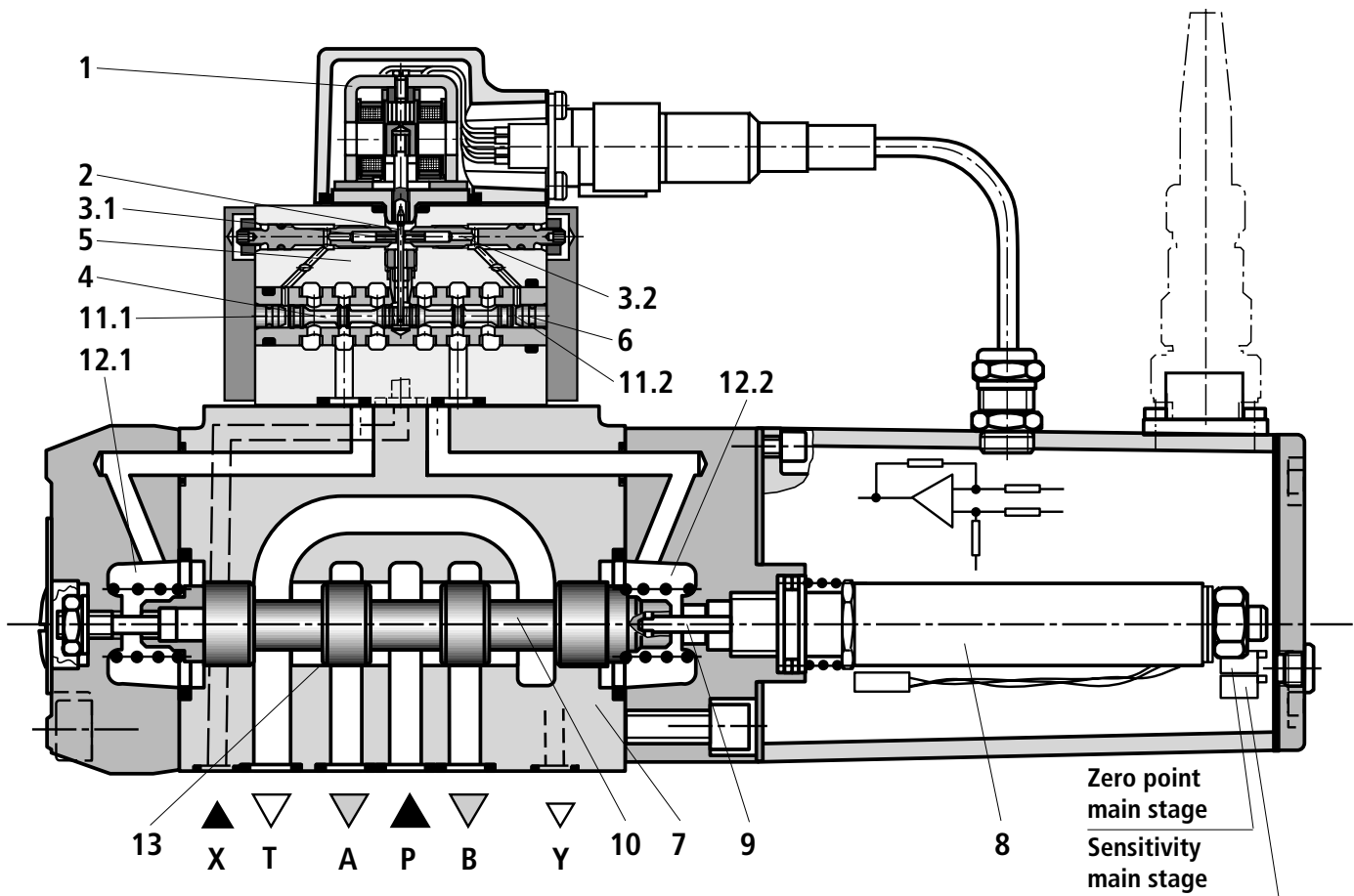
These valves basically consist of the following assemblies:

- 2-stage pilot control valve comprising of torque motor (1) and a hydraulic amplifier (5) designed as a flapper jet valve and spool sleeve unit (6) as a flow amplifier stage for the control of the third stage (7),
- Third stage (7) for flow control,
- An inductive position transducer (8), the core (9) which is attached to main spool (10) of the third stage.

The position of spool (10) is acquired via the inductive position transducer (8). The signal integration of the valve closed loop control circuit, the supply to the position measuring system and the control of the pilot control valve is carried out via the control electronics which are integrated into the valve.

The differential voltage generated by the command/actual value comparison is amplified within the control electronics and is passed onto the 1st stage of the valve as a control deviation. This signal moves the flapper plate (2) between the two control jets (3.1, 3.2). A pressure differential is thereby generated between the two control chambers (11.1, 11.2). Control spool (4) is thereby moved and passes a corresponding oil flow into spring chambers (12.1 or 12.2). Spool (10) and the attached core (9) of the inductive position transducer (8) are moved until the actual value signal once more agrees with the command value signal. In the controlled condition the spool (10) is held in the position defined by the command value.

The spool stroke is proportional to the command value. To control the flow there is a relevant control opening to which the flow is proportional. This is the result of the position of the control spool (10) with regard to the control lands (13), to which the flow is proportional. The valve dynamics are optimised via the electrical amplification. The control electronics are integrated into the valve (oscillator, demodulator).



Valve features

- NS 10 valves are supplemented by ports X and Y (see page 14).
- The third stage is largely made up of components from our proportional valves.
- The control lands of spool and housing for V spools are ground to match each other.
- The zero point adjustment is factory pre-set and can be varied within a range of $\pm 10\%$ of the nominal stroke via a potentiometer in the closed loop control electronics. Access to the integrated closed loop control electronics is possible by removing a plug on the end of the cover housing.
- When the pilot control valve or the control electronics have been replaced, they must be readjusted. Any adjustment must be carried out by fully trained and experienced personnel.
- Maintenance work on the pilot control valve may only be carried out by Mannesmann Rexroth personnel. However, the replacement of the filter elements is excluded from this – see RE 29 564 page 4; Material No. **00218621** and the seal Material No. **00012505**. Care must be taken to ensure that the seal is correctly located and that the cover screws are evenly tightened. The tightening torque of the cover screws is $1.4 \text{ Nm} + 10\%$.

Technical data (for applications outside these parameters, please consult us!)

General		NS10	NS16	NS25	NS25¹⁾	NS32		
Installation and commissioning guidelines		Optional, preferably horizontal, see RE 07 700						
Storage temperature range	°C	– 20 ... + 80						
Ambient temperature range	°C	– 20 ... + 60						
Weight	kg	6.8	8.9	15.2	15.5	35.2		
Hydraulic (measured at $p = 100$ bar, $v = 32$ mm ² /s and $\vartheta = 40$ °C)								
Operating pressure	Pilot control valve Pilot oil supply ²⁾	bar					25 up to 315	
	Main valve, ports P, A, B	bar		Up to 315	Up to 350	Up to 350	Up to 210	Up to 350
Return pressure	Port T	Pilot oil drain, internal	bar				Static < 10	
		Pilot oil drain, external	bar		Up to 315	Up to 250	Up to 250	Up to 210
	Port Y	bar				static < 10		
Nominal flow $q_{Vnom} \pm 10\%$ at $\Delta p = 10$ bar ³⁾			L/min	25	–	–	–	–
				50	125	220	–	–
				100	200	350	500	600
Flow in the main valve (max. permissible)			L/min	170	460	870	1000	1600
Pilot oil flow at port X or Y with a stepped form of input signal from 0 to 100 % (315 bar)			L/min	2.7	5.4	6.5	6.5	18.2
Pressure fluid	Mineral oil (HL, HLP) to DIN 51 524. Further pressure fluids on request!							
Degree of contamination			Maximum permissible degree of contamination of the pressure fluid is to NAS 1638			A filter with a minimum retention rate of $\beta_x \geq 75$ is recommended		
	Pilot control valve		Class 7			x = 5		
	Main valve		Class 9			x = 15		
Pressure fluid temperature range			°C	– 20 up to + 80				
Viscosity range			mm ² /s	20 up to 380				
Hysteresis			%	≤ 0.2				
Response sensitivity			%	≤ 0.1				
Electrical								
Valve protection to DIN 40 050	IP 65							
Voltage type	DC							
Signal type	Analogue							
Nominal current per coil	mA 30							
Resistance per coil			Ω	85				
Inductivity (measured at 60 Hz and $I_{Nom.}$)			H	0.25				
Zero calibration			%	≤ 2				
Zero point drift with change in:	Pressure fluid temperature		% / 20 K	≤ 0.7				
	Operating pressure		% / 100 bar	≤ 0.5				
	Return flow pressure 0 to 10 % from p		%	≤ 0.2				
Control electronics (servo amplifier)	VT 13000 (integrated in the valve, see page 8)							

¹⁾ Type 4WRDE 25 .500L-5XH/6L...K9... (High-Flow version)

²⁾ For optimum system characteristics we recommend, with pressures over 210 bar, an external pilot oil supply

³⁾ q_{Vnom} = nominal flow (of the entire valve) in L/min with a V spool, Δp = valve pressure differential in bar

Note: For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 093-U (declaration regarding environmental compatibility).

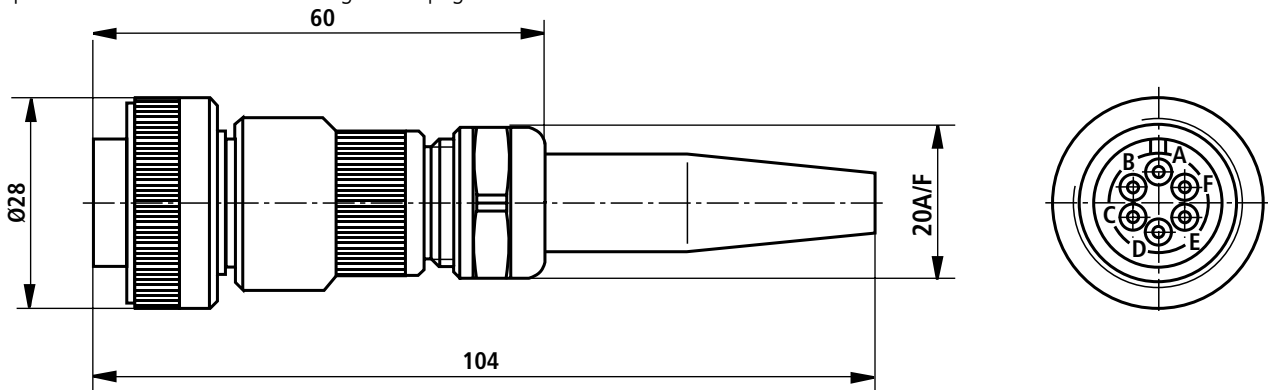
Electrical connections, plug-in connector

Plug-in connector

Plug-in connector compatible with VG 95 328, size 10-6S

Separate order under Material No. **00013159/9** (metal version)

For pin allocation see block circuit diagram on page 8

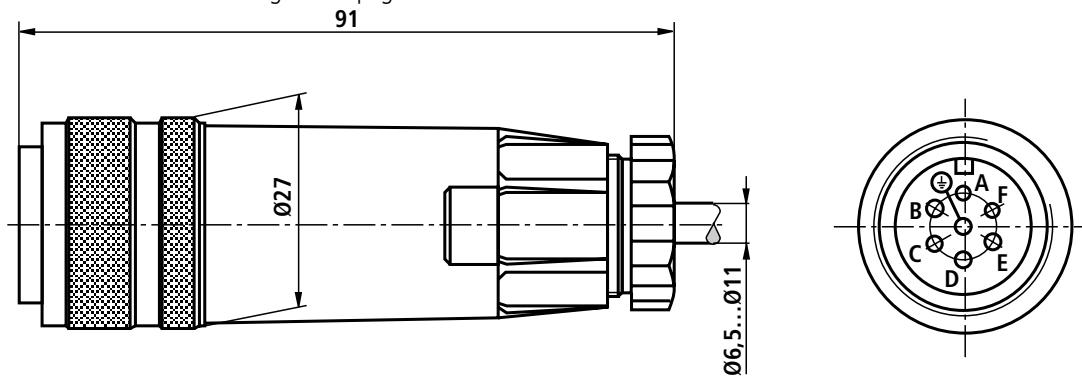


Plug-in connector

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 8

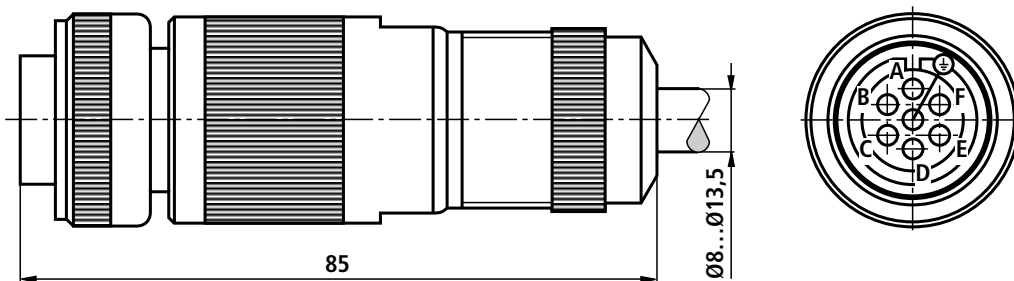


Plug-in connector

Plug-in connector to E DIN 43 563-BF6-3-Pg13.5

Separate order under Material No. **000223890** (metal version)

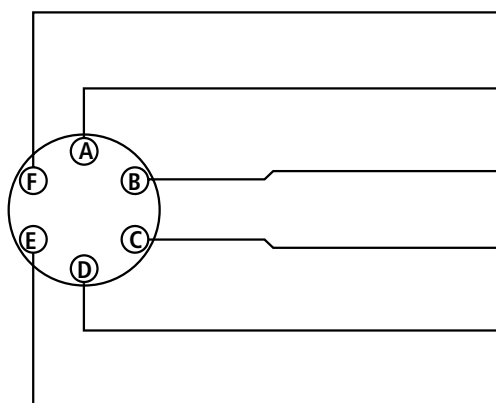
For pin allocation see block circuit diagram on page 8



Electrical connections, plug-in connector

Terminal connections at the valve connection housing

Pin allocation of the component plug



4WRDE + 24 V ¹⁾

Actual value

$\pm 10 \text{ V}$ ($\rightarrow 0 \text{ V}$)

Supply

+ 24 V

Supply

0 V

Enable ²⁾

+ 24 V DC

Differential/command value input $\pm 10 \text{ V}$ ^{3) 4)}

Differential/command value input 0 V

¹⁾ Supply voltage + 24 V \pm 4 V; full bridge rectification; with 2200 mF smoothed; $I_{\text{max}} = 270 \text{ mA}$

²⁾ With a voltage of 4 V to 24 V DC the valve closed loop control circuit is activated.

With hydraulic pressure present and a **non activated enable**, the spool of the main stage is moved into the end position and the cylinder axis moves out of its position **with its maximum velocity**. By using a WG152 sandwich plate directional valve between the pilot valve and main stage, the control chambers

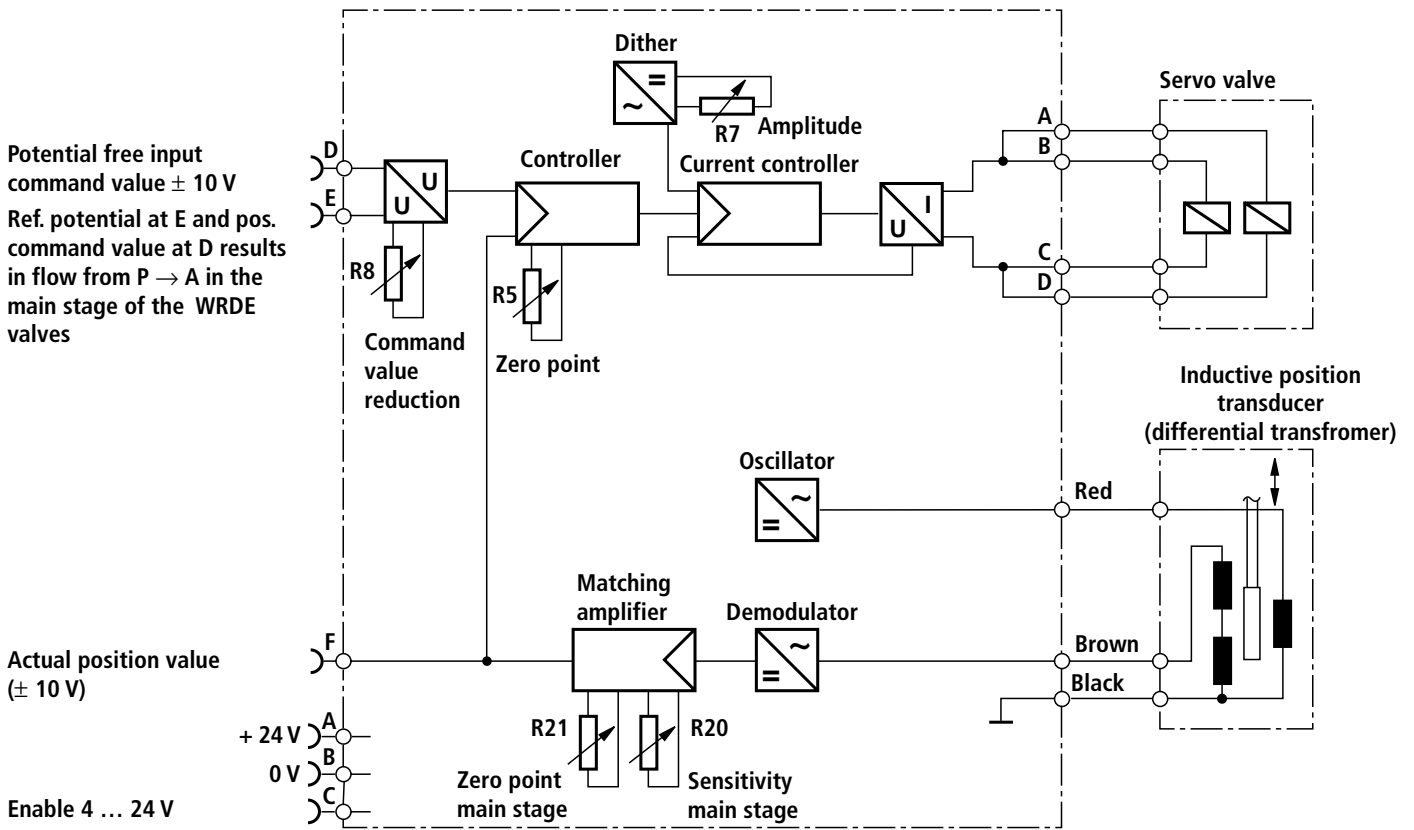
from the pilot control valve to the main spool are unloaded, and the spool of the main stage is centered in the middle position or held in a preferred position by springs.

As a result the cylinder axis moves out of its position at its **minimum velocity**.

³⁾ **A positive command signal at D with respect to E results in a flow from P to A in the main stage!**

⁴⁾ **Current input $\pm 10 \text{ mA}$** optional, input resistance 1 k Ω ; state „- 280“ in the ordering details.

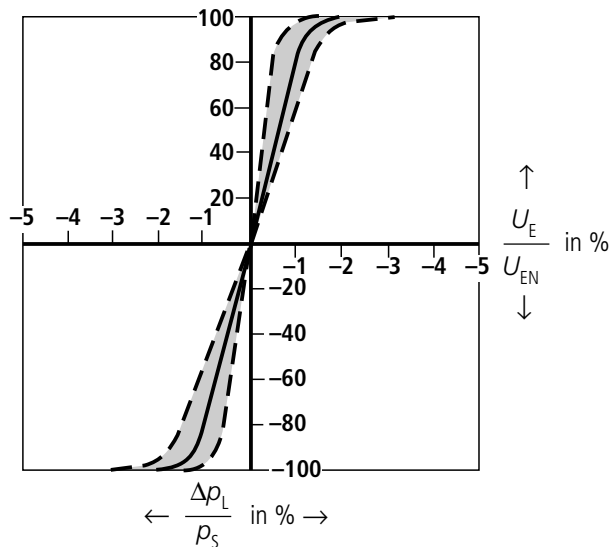
Connection allocation and block circuit diagram for the type VT 13000/4WRDE control electronics



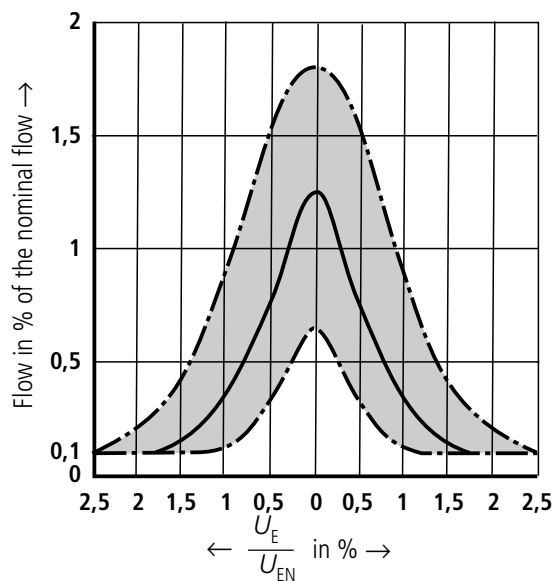
Note: Electrical signals (e.g. actual value) taken via valve electronics must not be used to switch off the machine safety functions!
 (This is in accordance with the regulations to the European standard "Safety requirements of fluid technology systems and components – hydraulics", EN 982!)

Characteristic curves (measured at $p_s = 100 \text{ bar}$, $v = 32 \text{ mm}^2/\text{s}$ and $\vartheta = 40 \text{ }^\circ\text{C}$)

Pressure-signal-characteristic curve (V spool)

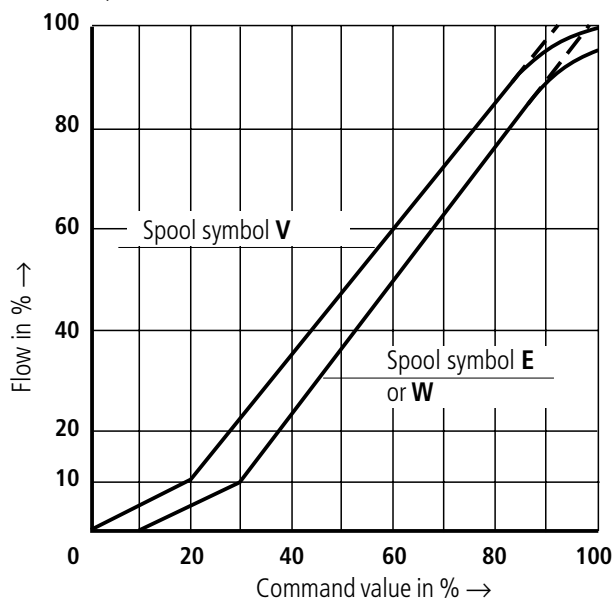


Zero flow of the main stage (V spool) without pilot control valve

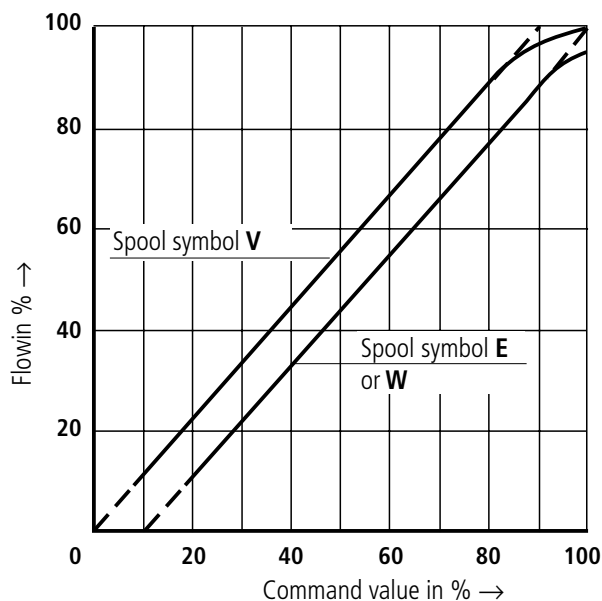


Flow/command value functions (at 10 bar valve pressure differential or 5 bar per control land)

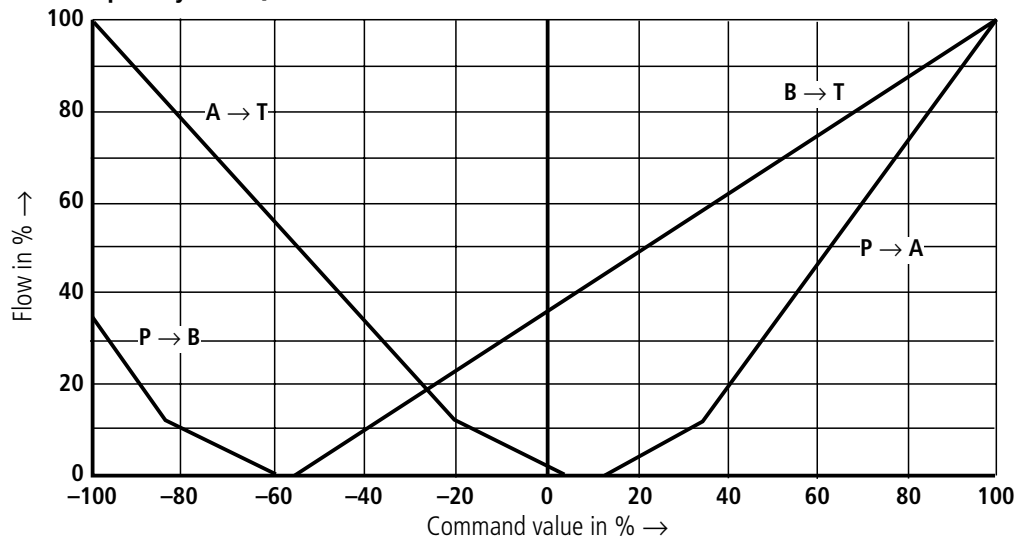
Spool with characteristic curve **P**



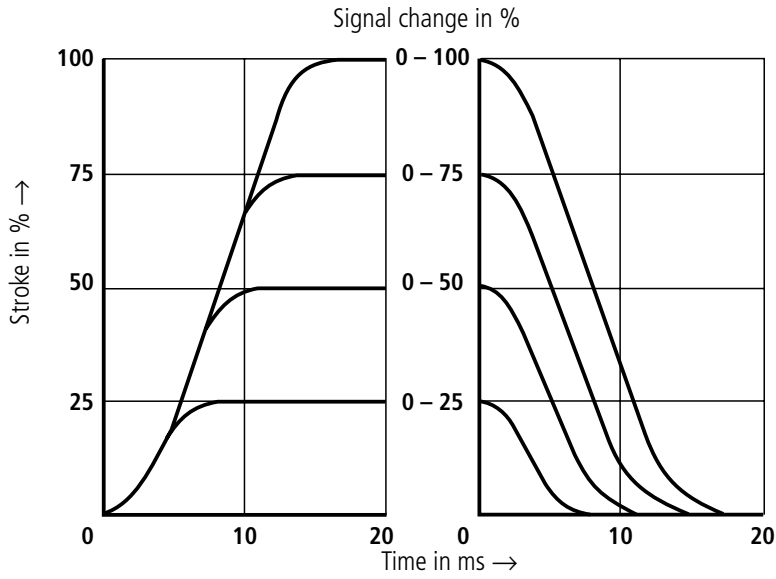
Spool with characteristic curve **L**



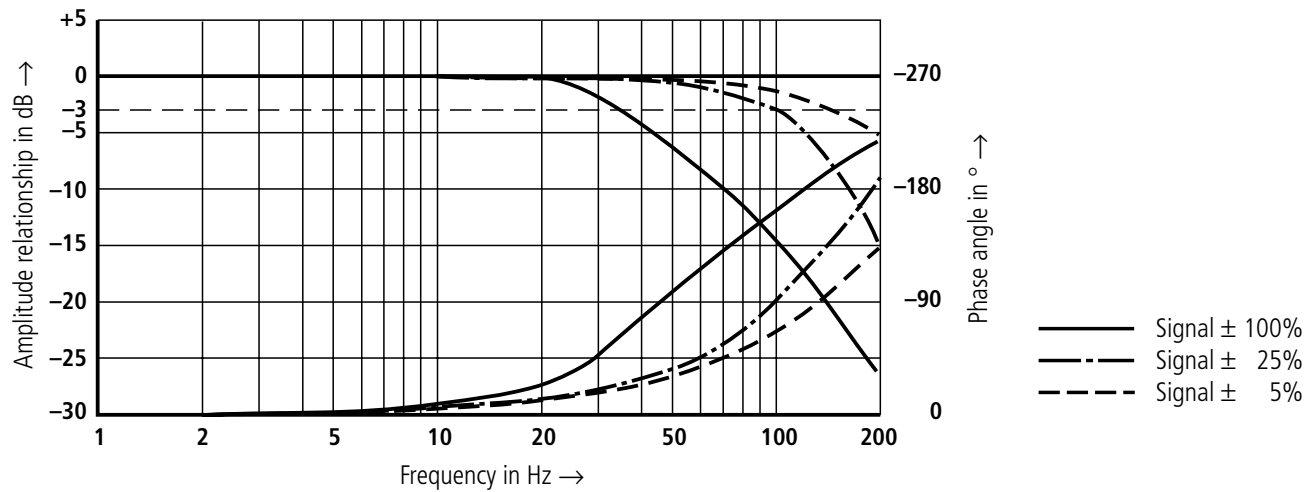
Spool symbol **Q2-**



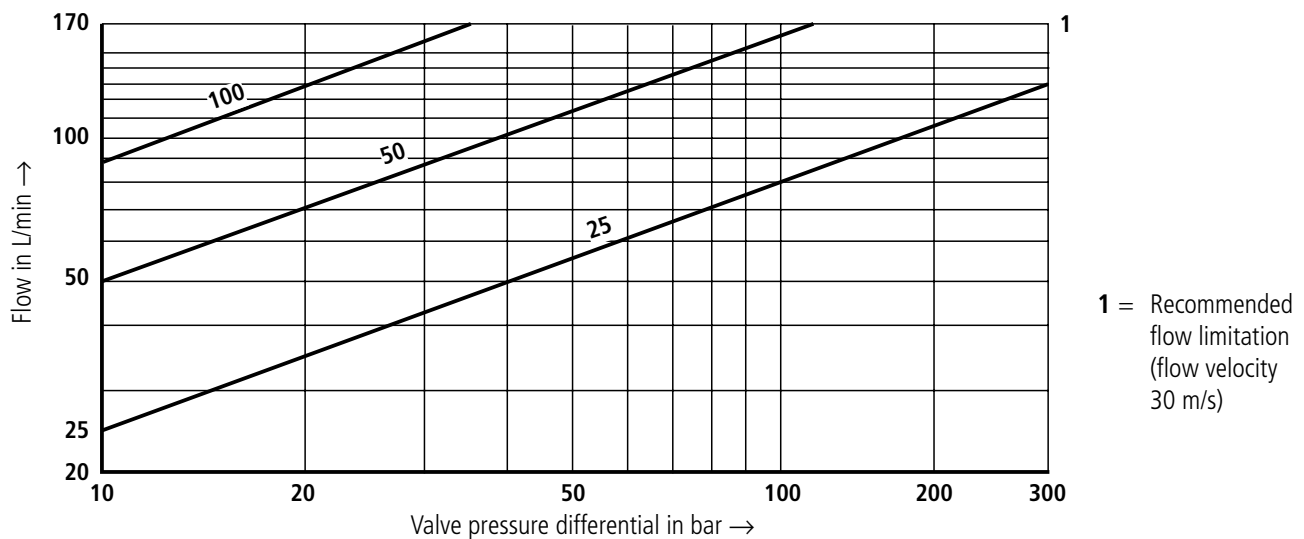
Transient function with a stepped form of electrical input signal



Frequency response characteristic curves



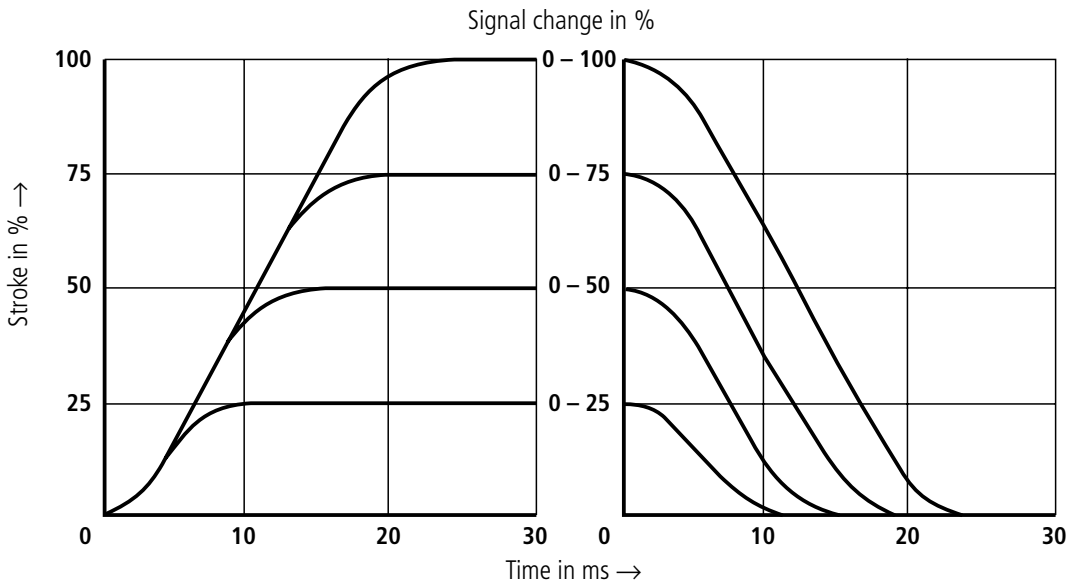
Flow/load function at max. value opening (tolerance $\pm 10 \%$)



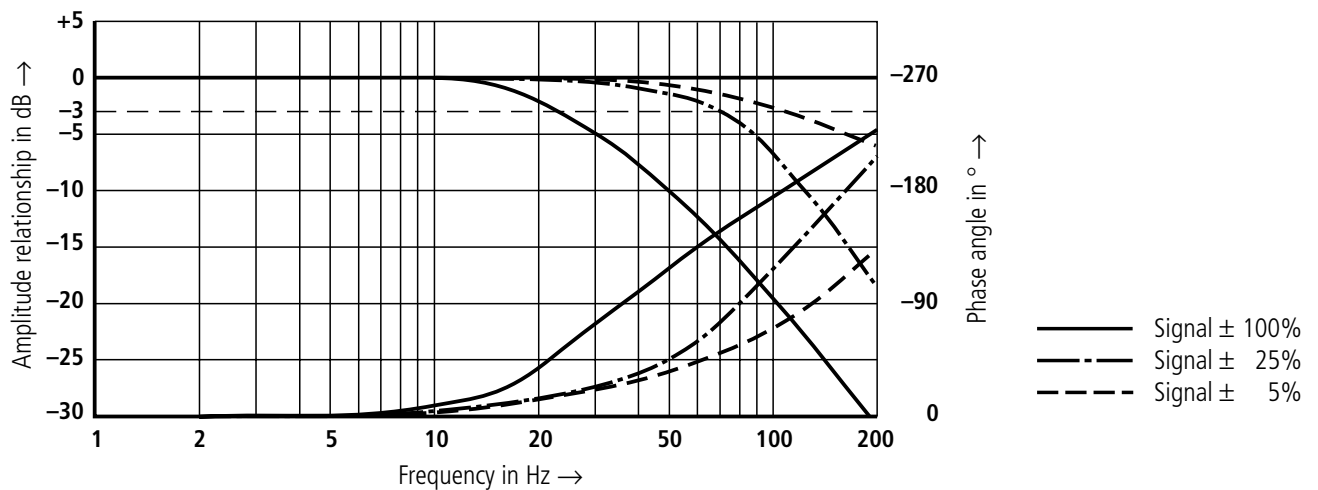
Characteristic curves (measured at $p_s = 140 \text{ bar}$, $v = 32 \text{ mm}^2/\text{s}$ and $\vartheta = 40 \text{ }^\circ\text{C}$)

NS16

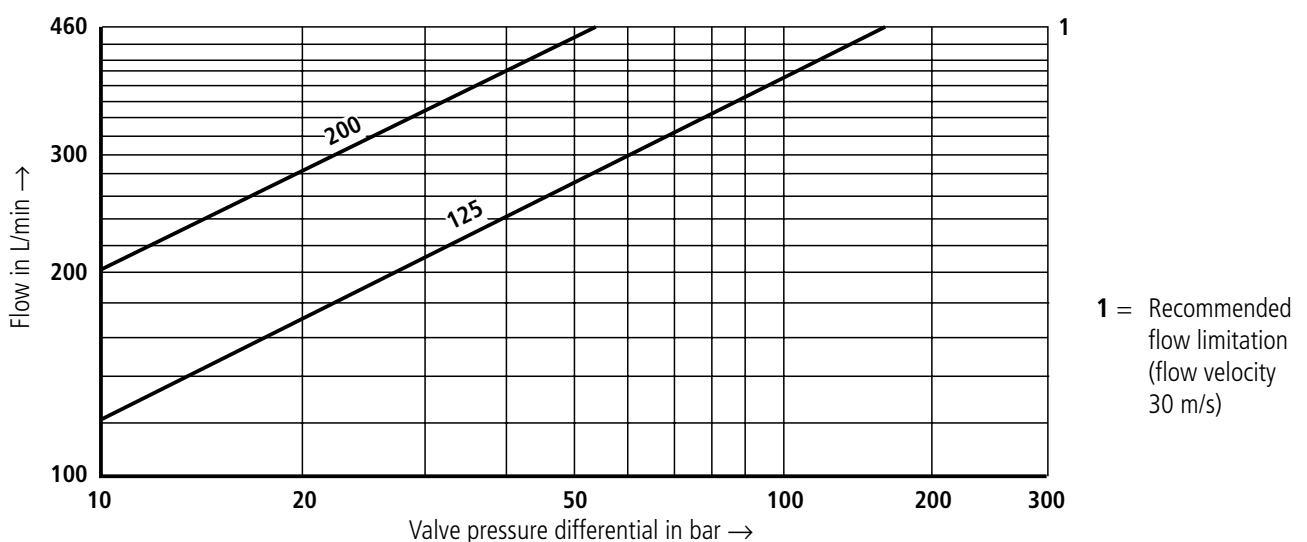
Transient function with a stepped form of electrical input signal



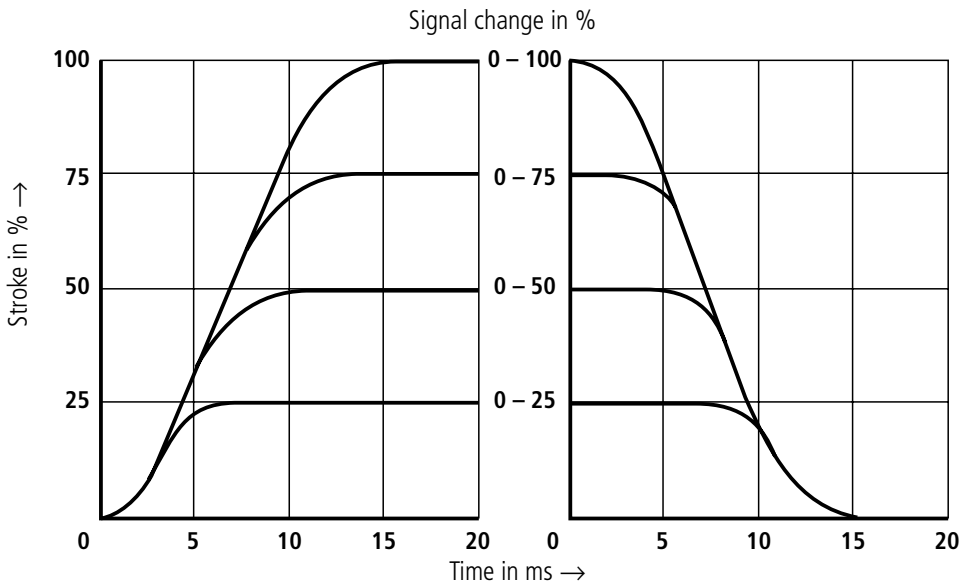
Frequency response characteristic curves



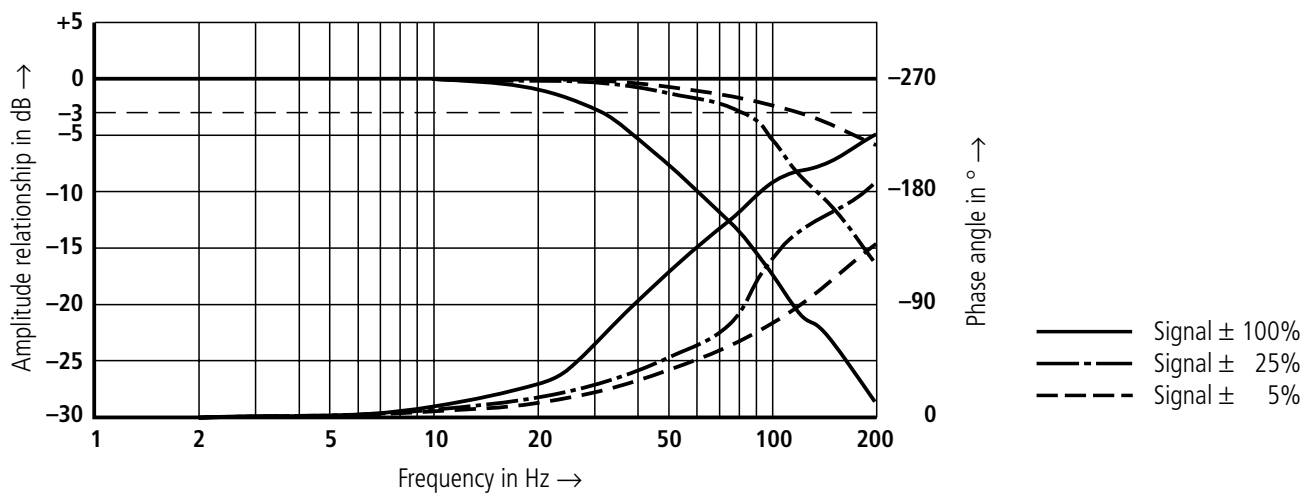
Flow/load function at max. valve opening (tolerance $\pm 10 \%$)



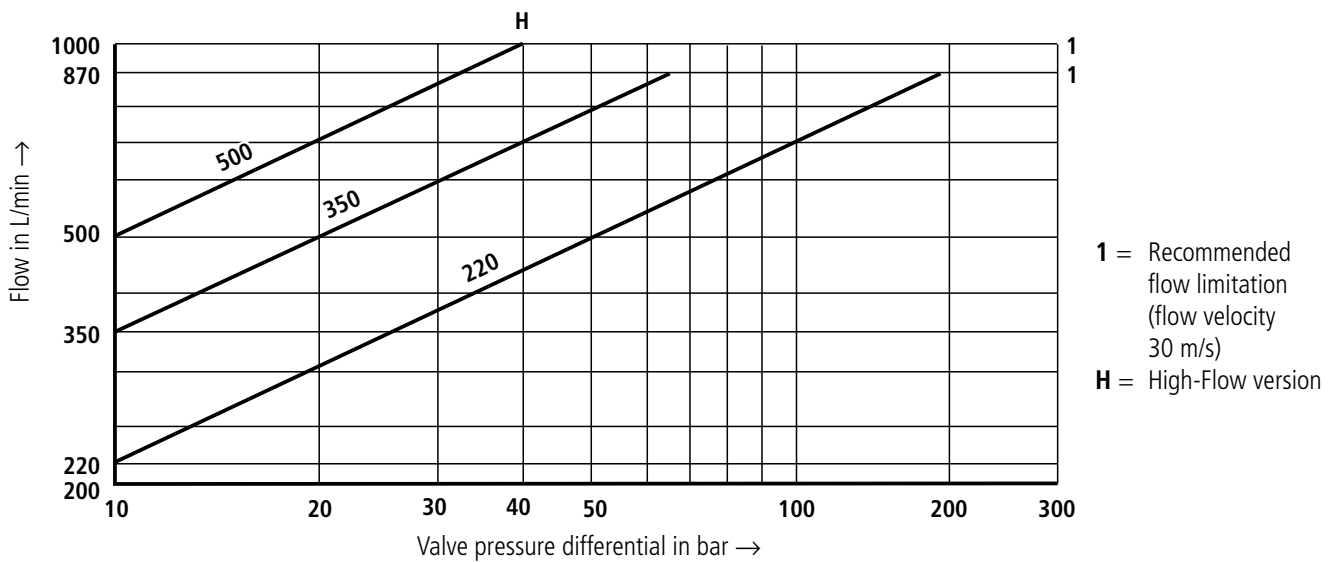
Transient function with a stepped form of input signal



Frequency response characteristic curves



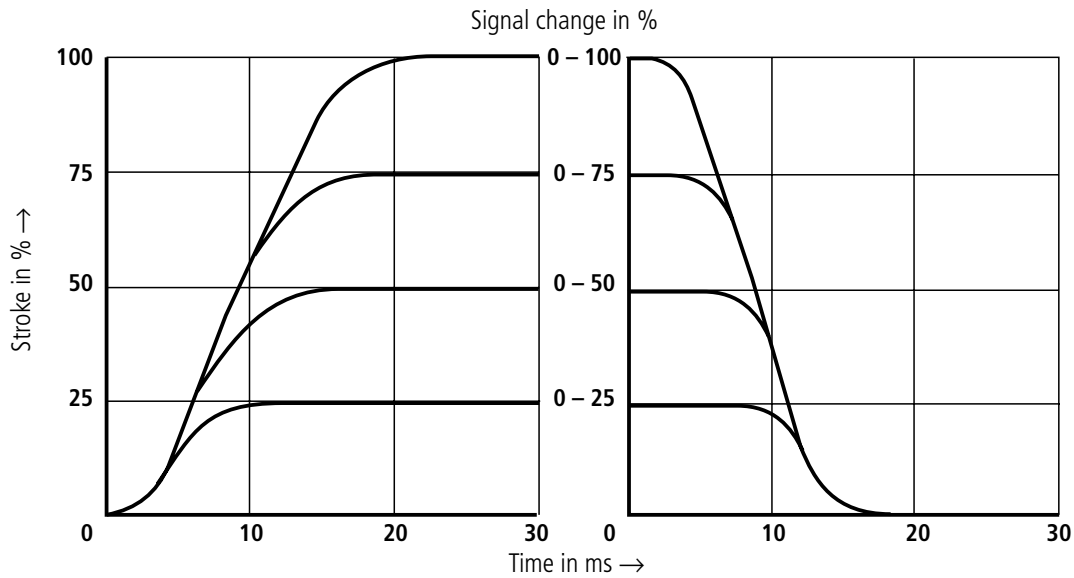
Flow/load function at max. valve opening (tolerance $\pm 10 \%$)



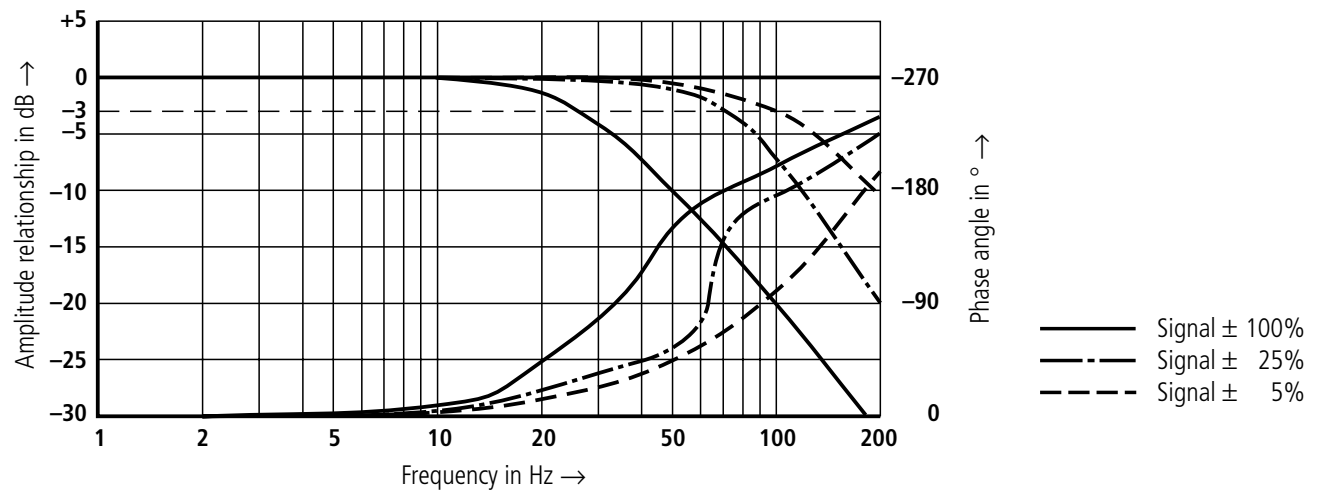
Characteristic curves (measured at $p_s = 140 \text{ bar}$, $v = 32 \text{ mm}^2/\text{s}$ and $\vartheta = 40 \text{ }^\circ\text{C}$)

NS32

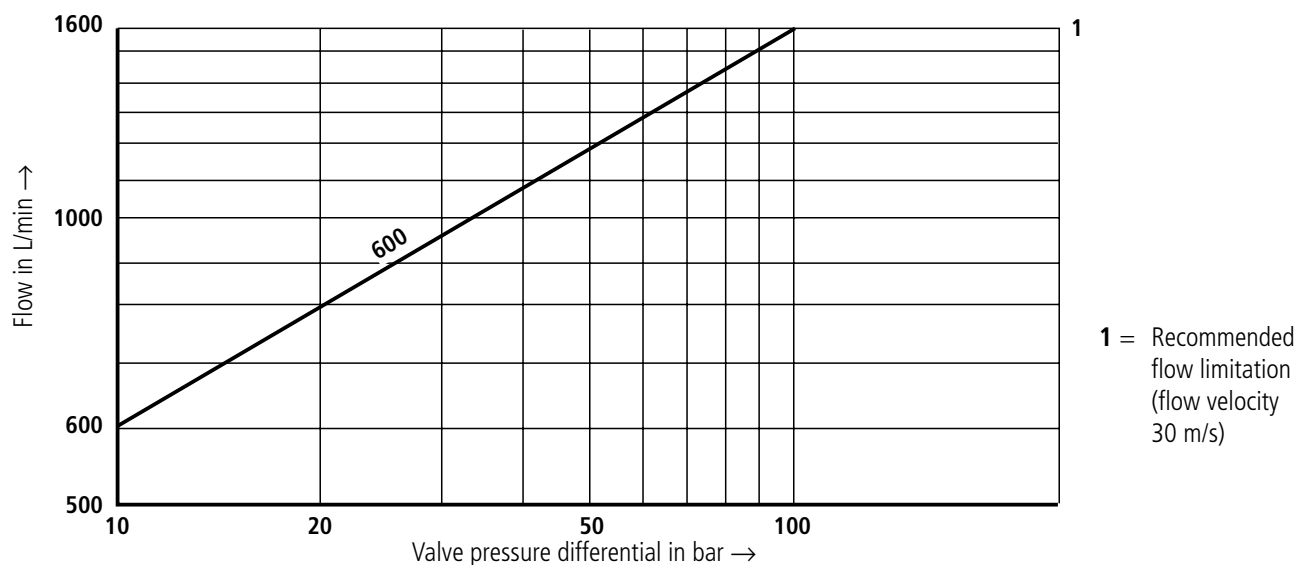
Transient function with a stepped form of electrical input signal



Frequency response characteristic curves

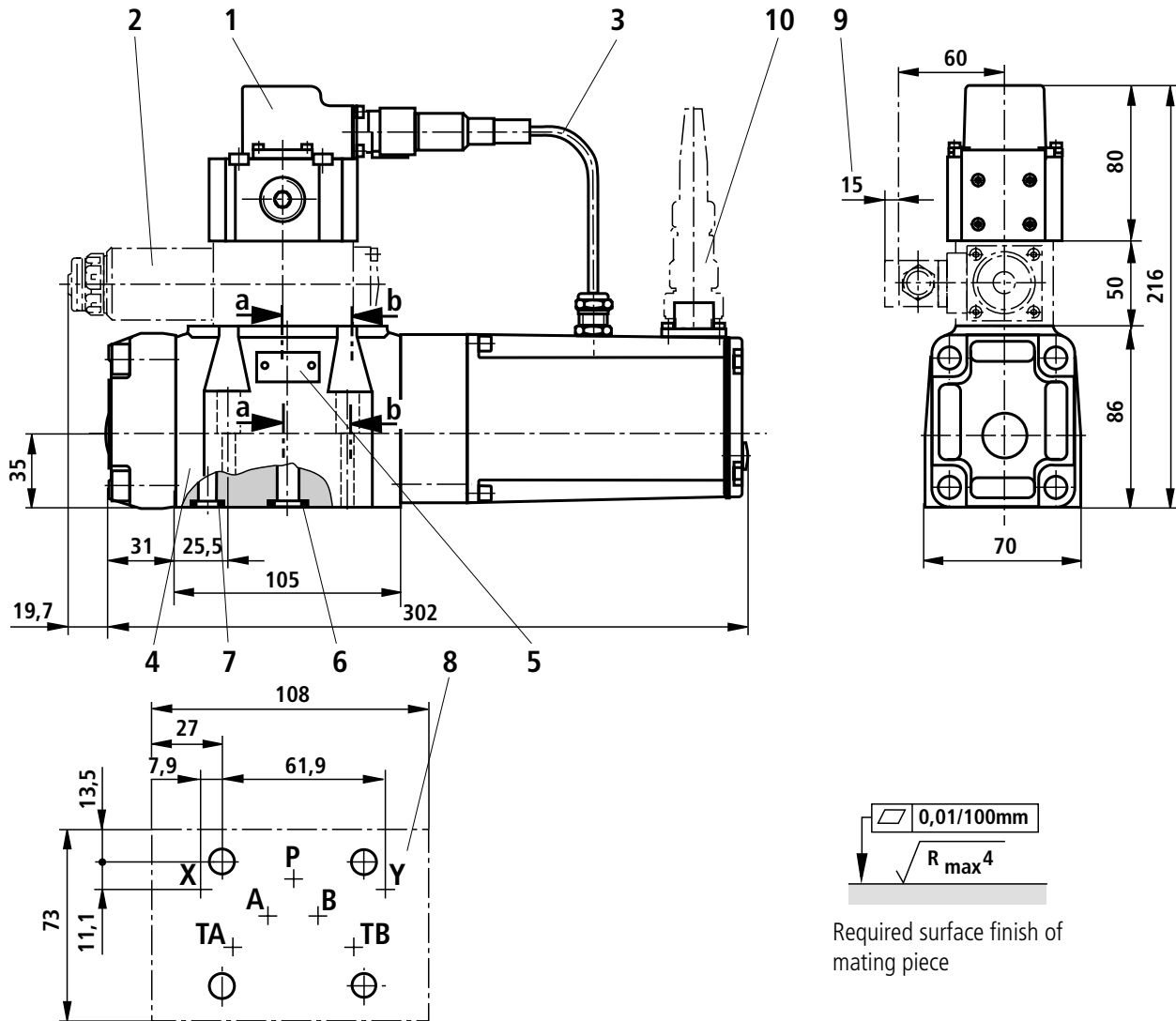


Flow/load function at max. valve opening (tolerance $\pm 10 \%$)



Unit dimensions: NS10

(Dimensions in mm)



- 1 Pilot control valve
- 2 Sandwich plate directional valve (only included in version "...WG152")
- 3 Cabling
- 4 Main valve
- 5 Name plate
- 6 R-ring 13 x 1.6 x 2 (O-ring 12 x 2) (ports A, B, P, T)
- 7 R-ring 11.18 x 1.6 x 1.78 (O-ring 10.82 x 1.78) (ports X, Y)
- 8 Machined valve mounting area, position of ports to DIN 24 340 form A10
- 9 Space required to remove plug-in connector
- 10 Plug-in connector, separate order, see page 3

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

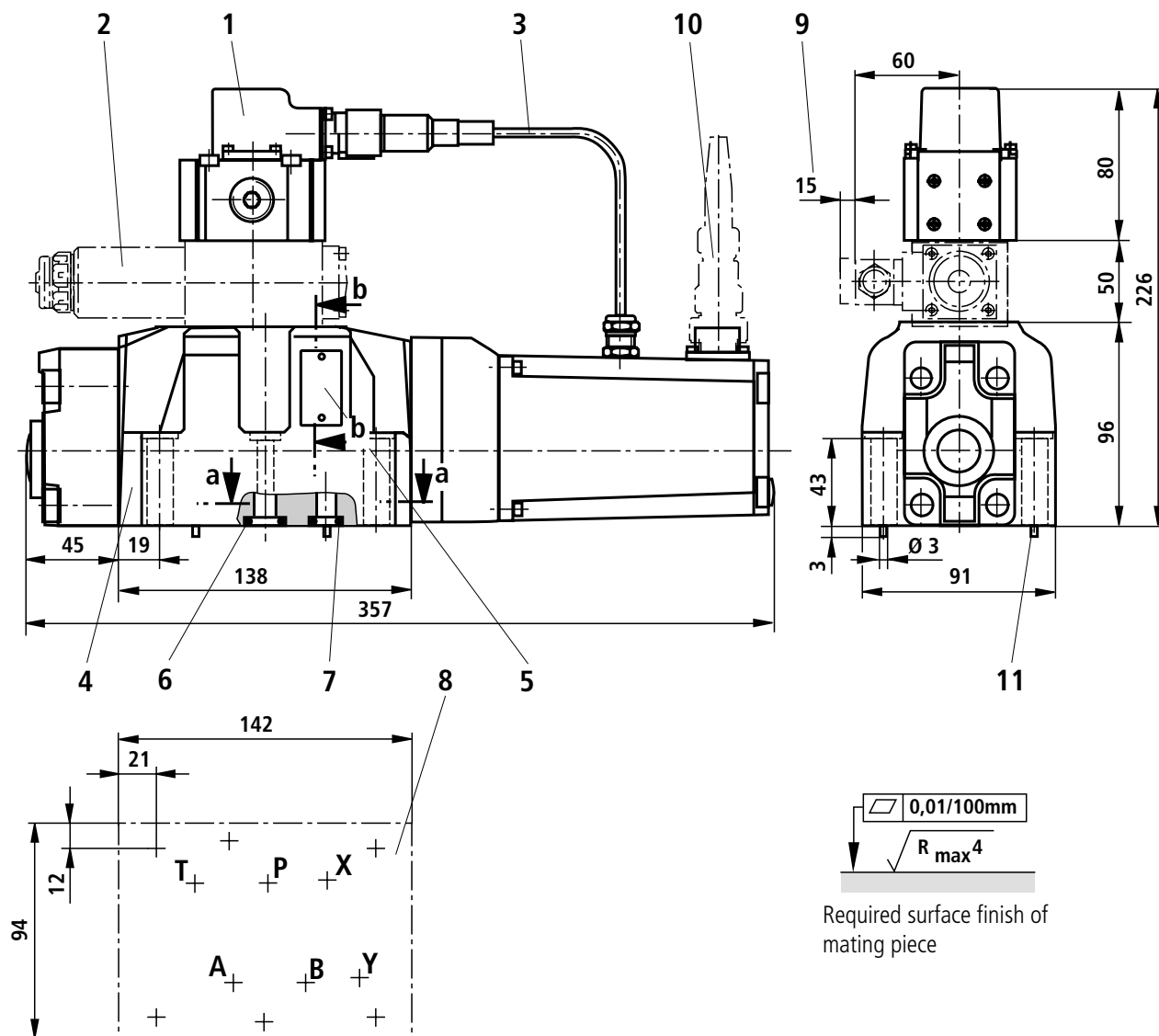
Subplates:
 G 534/01 (G 3/4)
 G 535/01 (G 3/4) with ports X and Y
 G 536/01 (G 1) with ports X and Y

Valve fixing screws:
 4 off M6 x 45 DIN 912-10.9; $M_A = 15.5 \text{ Nm}$

For sectional view, see page 18

Unit dimensions: NS16

(Dimensions in mm)



- 1 Pilot control valve
- 2 Sandwich plate directional valve (only included in version "...WG152")
- 3 Cabling
- 4 Main valve
- 5 Name plate
- 6 R-ring 22.53 x 2.3 x 2.62 (O-ring 22 x 2.5) (ports A, B, P, T)
- 7 R-ring 10 x 2 x 2 (O-ring 10 x 2) (ports X, Y)
- 8 Machined valve mounting area, position of ports to DIN 24 340 form A16
- 9 Space required to remove plug-in connector
- 10 Plug-in connector, separate order, see page 6
- 11 Locating pin (2 off)

Subplates to catalogue sheet RE 45 056 and valve fixing screws must be ordered separately.

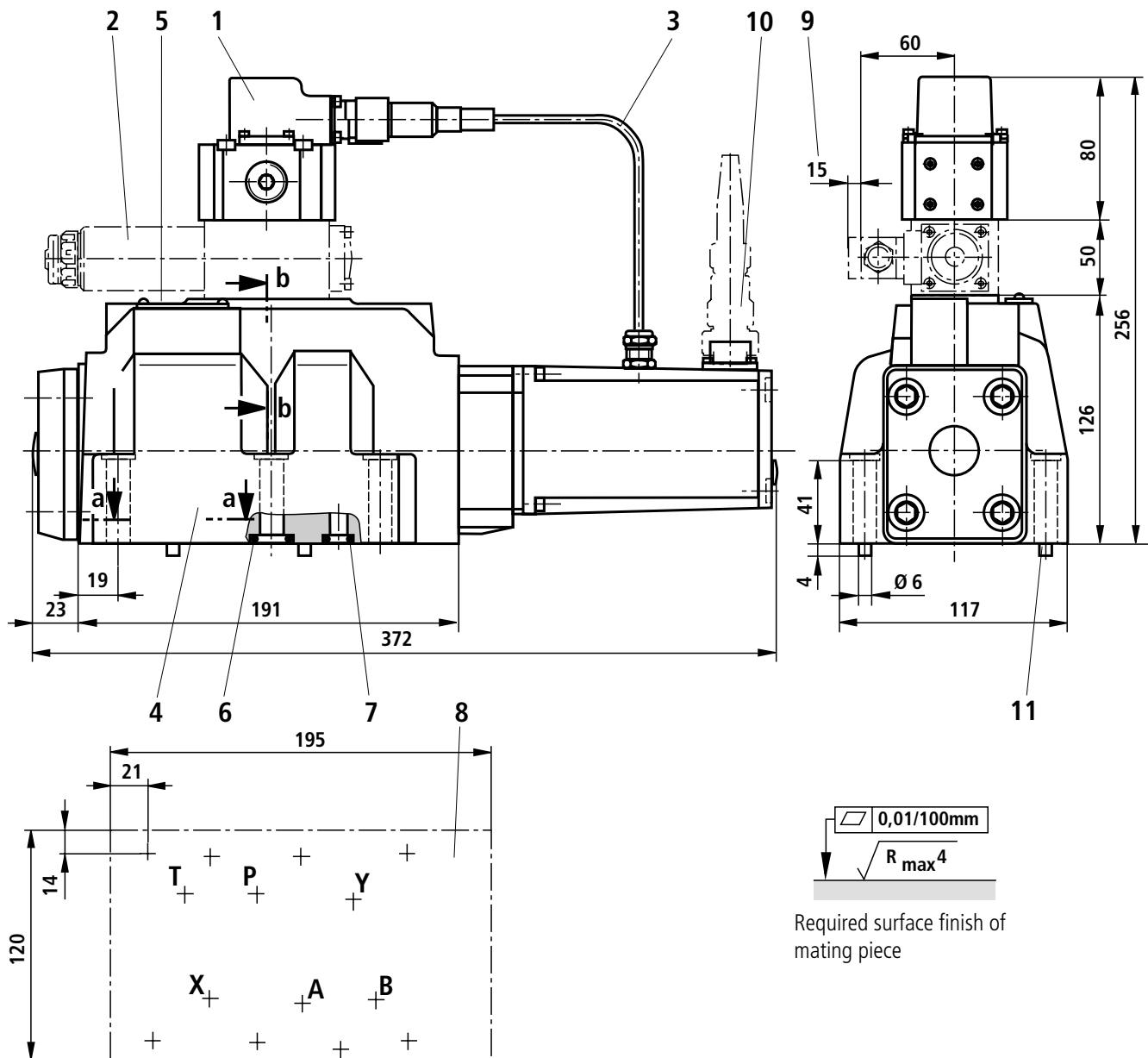
Subplates: G 172/01 (G 3/4) G 172/02 (M27 x 2)
G 174/01 (G 1) G 174/02 (M33 x 2)

Valve fixing screws:
2 off M6 x 60 DIN 912-10.9; $M_A = 15.5 \text{ Nm}$
4 off M10 x 60 DIN 912-10.9; $M_A = 75 \text{ Nm}$

For sectional view, see page 18

Unit dimensions: NS25

(Dimensions in mm)



Required surface finish of mating piece

- 1 Pilot control valve
- 2 Sandwich plate directional valve (only included in version "...WG152")
- 3 Cabling
- 4 Main valve
- 5 Name plate
- 6 R-ring 27.8 x 2.6 x 3 (O-ring 27 x 3) (ports A, B, P, T)
- 7 R-ring 19 x 3 x 3 (O-ring 19 x 3) (ports X, Y)
- 8 Machined valve mounting area, position of ports to DIN 24 340 form A25
- 9 Space required to remove plug-in connector
- 10 Plug-in connector, separate order, see page 6
- 11 Locating pin (2 off)

Subplates to catalogue sheet RE 45 058 and valve fixing screws must be ordered separately.

Subplates: G 151/01 (G 1) G 154/01 (G 1 1/4)
G 154/08 (flange) G 156/01 (G 1 1/2)

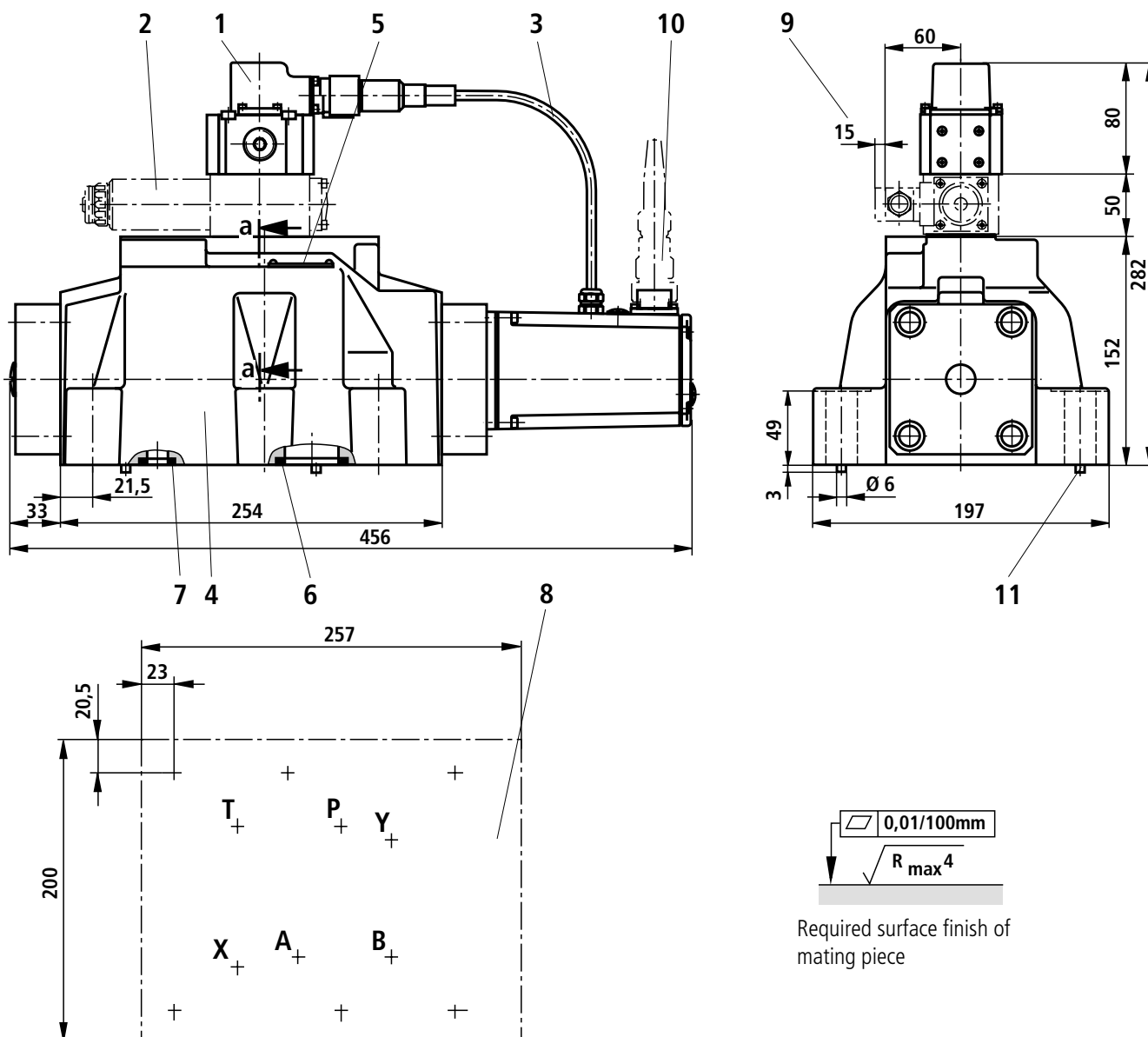
Valve fixing screws:
6 off M12 x 60 DIN 912-10.9; $M_A = 130 \text{ Nm}$

Attention: Only install the sandwich plate directional valve between the main valve and the adaptor plate!

For sectional view, see page 18

Unit dimensions: NS32

(Dimensions in mm)



- 1 Pilot control valve
- 2 Sandwich plate directional valve (only included in version "...WG152")
- 3 Cabling
- 4 Main valve
- 5 Name plate
- 6 R-ring 42.5 x 3 x 3 (O-ring 42 x 3) (ports A, B, P, T)
- 7 R-ring 19 x 3 x 3 (O-ring 19 x 3) (ports X, Y)
- 8 Machined valve mounting area, position of ports to DIN 24 340 form A32
- 9 Space required to remove plug-in connector
- 10 Plug-in connector, separate order, see page 6
- 11 Locating pin (2 off)

Subplates to catalogue sheet RE 45 060 and valve fixing screws must be ordered separately.

Subplates: G 157/01 (G 1 1/2) G 157/02 (M48 x 2)
G 158/10 (flange)

Valve fixing screws:
6 off M20 x 80 DIN 912-10.9; $M_A = 430 \text{ Nm}$

For sectional view, see page 18

Pilot oil supply

Type 4WRD...-5X/...

**External pilot oil supply
External pilot oil drain**

This version has an external pilot oil supply from a separate control circuit (external).

The pilot oil drain is fed separately via port Y to tank (external) and not into the T port of the main valve.

Type 4WRD...-5X/...E...

**Internal pilot oil supply
External pilot oil drain**

In this version the pilot oil supply is taken from the P port of the main valve (internal).

The pilot oil drain is fed separately via port Y to tank (external) and not into the T port of the main valve.

Port X in the subplate must be plugged.

Type 4WRD...-5X/...ET...

**Internal pilot oil supply
Internal pilot oil drain**

In this version the pilot oil supply is taken from the P port of the main valve (internal).

The pilot oil drain is fed directly into the T port of the main valve (internal). Port Y in the subplate must be plugged.

Type 4WRD...-5X/...T...

**External pilot oil supply
Internal pilot oil drain**

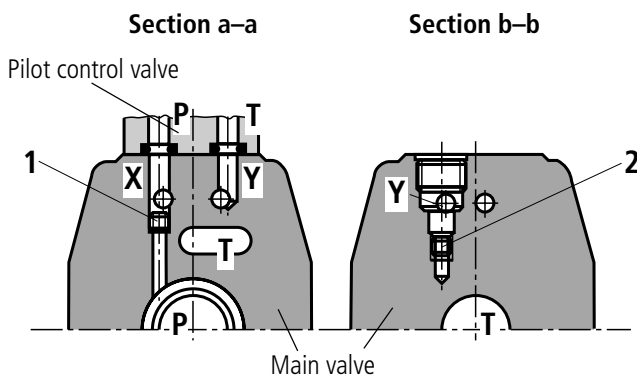
This version has an external pilot oil supply from a separate control circuit (external).

The pilot oil drain is fed directly into the T port of the main valve (internal). Port Y in the subplate must be plugged.

Pos. 1 and 2: Plugs M6 DIN 906-8.8 3A/F

NS10

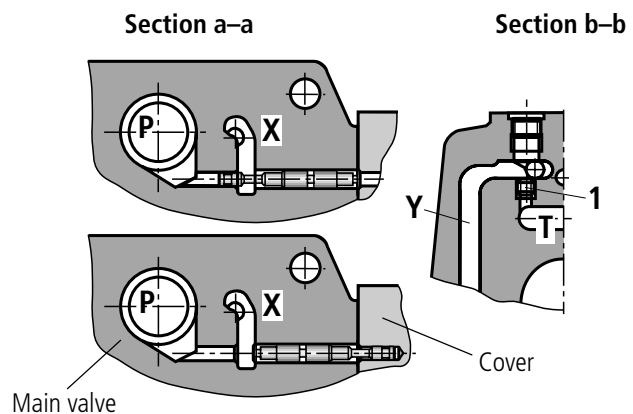
For cross-section, see page 14



Pilot oil supply (section a-a)	external: 1 closed	internal: 1 open
Pilot oil drain (section b-b)	external: 2 closed	internal: 2 open

NS16

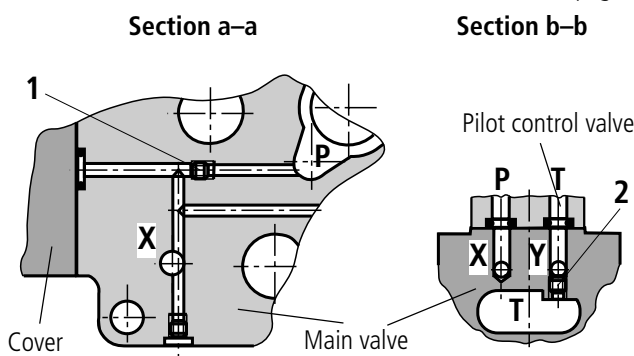
For cross-section, see page 15



Pilot oil supply (section a-a)	external: P closed	internal: P open
Pilot oil drain (section b-b)	external: 1 closed	internal: 1 open

NS25

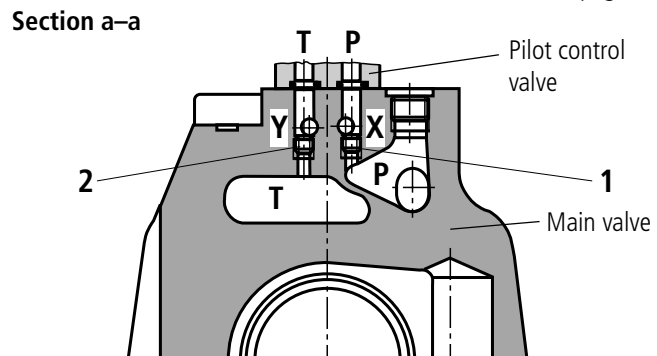
For cross-section, see page 16



Pilot oil supply (section a-a)	external: 1 closed	internal: 1 open
Pilot oil drain (section b-b)	external: 2 closed	internal: 2 open

NS32

For cross-section, see page 17



Pilot oil supply	external: 1 closed	internal: 1 open
Pilot oil drain	external: 2 closed	internal: 2 open

Mannemann Rexroth AG Rexroth Hydraulics

D-97813 Lohr am Main
Jahnstraße 3-5 • D-97816 Lohr am Main
Telefon 0 93 52 / 18-0
Telefax 0 93 52 / 18-23 58 • Telex 6 89 418-0
eMail product.support@rexroth.de
Internet www.rexroth.com

Mannemann Rexroth Limited

Cromwell Road, St Neots,
Cams, PE19 2ES
Tel: 0 14 80/22 32 56
Fax: 0 14 80/21 90 52
E-mail: info@rexroth.co.uk

The specified data is for product description purposes only and may not be deemed to be guaranteed unless expressly confirmed in the contract.