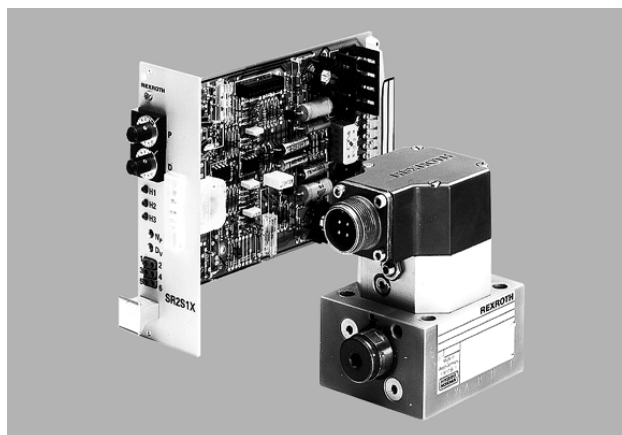


<b>MANNESMANN REXROTH</b>	<b>Servo Pressure Control Valve 3-Way Design Model 3 DS 2 EH 10...and 3 DSE 2 EH 10... (Series 2X)</b>			<b>RA 29 646/06.98</b> Replaces: 05.94
	Size 10 (D 05)	... 4600 PSI (315 bar)	... 21 GPM (80 L/min)	

- Servo valve for the closed loop of system pressure
- Two stage modular design for easy maintenance
- 1<sup>st</sup> stage is a flapper/nozzle design
- Mounts on standard ISO 4401-5, NFPA T3.5.1 M R1 and ANSI B 93.7 D 05 interface, with additional X1 port for external piloting
- For subplates, see RA 45 054
- Can be used in conjunction with several feedback devices
- Dry torque motor which is isolated and cannot be contaminated by the fluid
- 5 different coils available to meet your requirements
- Valve electronics:
  - are available separately (standard plug-in Euro card design) or
  - integrated into the valve
- Valve with integrated electronics are adjusted and tested as a unit

K 4242 - 9



Model 3 DS 2 EH 10-2X/A2... with associated electronics (ordered separately)

**Contents**

Description	Page
Functional description, section	2
Ordering code	3
Explanation of ordering code	3
Technical data, general	
Technical data, hydraulic	4
Technical data, electrical	5
Electrical connections	6
Operating curve, pressure signals	6
Operating curve, pressure-flow relationship	
Operating curve, frequency response	6
Unit dimensions, basic model	7
Unit dimensions, sandwich plate with external pilot oil feed	8
Unit dimensions, sandwich plate with external pilot oil return	8
Flushing plate, flushing instructions	9
External electronic controls	10

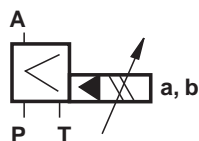
K4245 - 14



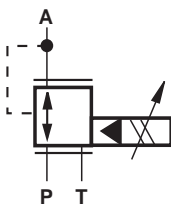
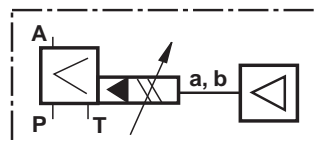
Model 3 DSE 2 EH 10- 2X/A... with integrated electronics

**Symbols (simplified)**

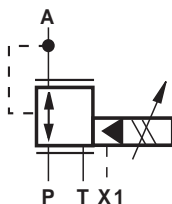
Servo-pressure valve for external electronics



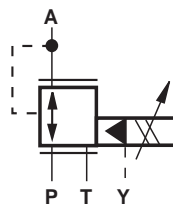
Servo-pressure valve with integrated electronics



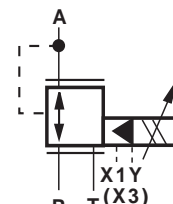
Model 3 DS 2 EH 10.../...  
Model 3 DSE 2 EH 10.../...



Model 3 DS 2 EH 10.../...X..  
Model 3 DSE 2 EH 10.../...X..



Model 3 DS 2 EH 10.../...Y..  
Model 3 DSE 2 EH 10.../...Y..



Model 3 DS 2 EH 10.../...XY..  
Model 3 DSE 2 EH 10.../...XY..



## Functional description

Model 3 DS 2 EH10.. und 3 DSE 2 EH10.. valves are electrically operated 2-stage servo pressure valves with with a hole pattern to DIN 24 340 A 10, ANSI/NFPA **D 05** format with an additional X1 port. They are used to reduce pressure to an actuator.

They basically consist of:

- the first stage with its permanent magnet torque motor (1) and a flapper/nozzle hydraulic amplifier.
- the second stage with a replaceable control sleeve assembly.

### Pilot control (1st stage)

The pilot control is an electrically operated valve and operates on the principle of a flapper/nozzle hydraulic amplifier.

The torque motor is offset from the neutral position by means of an electrical signal and the flapper plate deflected between the two externally adjustable orifices (6). The adjustment is made so that the return or operating pressure is achieved at port A, depending on the direction of the rated current.

The change in the position of the flapper plate causes a change in flow area in relation to the control orifice (6) and, in conjunction with the fixed orifices (10), a variable pressure differential which is used to operate the control spool (3).

### External Electronics (separate order)

An external electronic servo amplifier may be used to control valve Model 3DS 2 EH 10... This amplifies an analog input signal (signal value, regulated level) so that the servo valve can be controlled.

Various different types of amplifier can be supplied depending on the application (see page 4).

### 2nd Stage

3 way servo pressure valves are used to reduce pump pressure to the required actuator pressure at port A in proportion to the electrical input signal.

When pressure is applied to port P the control spool moves in the direction of the differential area until the pressure in port A causes the valve to move to its null position. This pressure amounts to approximately 45% of P.

Areas (7) and (8) of the control spool (3) in sleeve (4) are subjected to pilot pressure from the 1st stage. The differential area (9) of the control spool (3) is connected to port A and acts as a hydraulic feedback. When the flapper plate (5) is offset pressure in port A rises or falls in proportion to it. This pressure may be set at any pressure between the input (operating) pressure and the return line pressure.

### Pilot oil feed and return

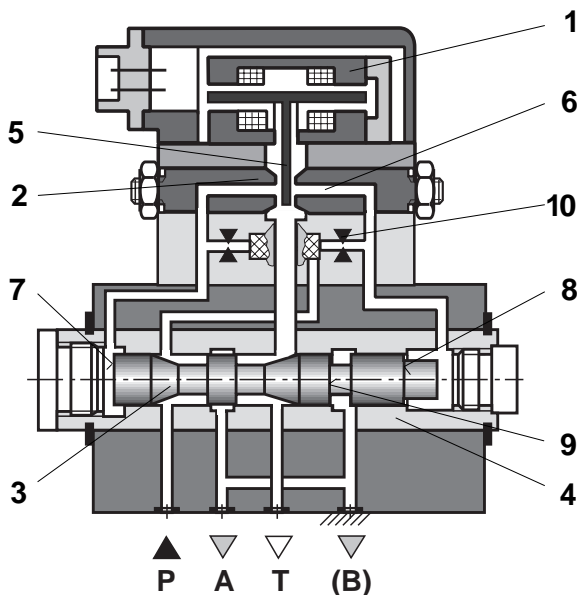
An external pilot oil feed is recommended:

- if the feed or return pressure is not constant
- for extra filtration of the 1st stage

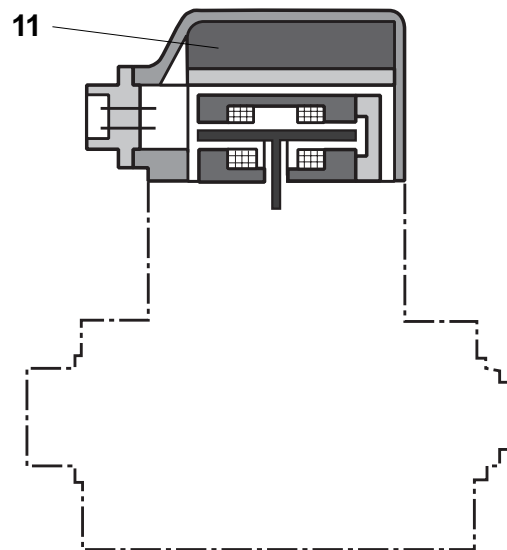
### Integrated Electronics

Instead of the external electronic control, valve Model 3 DSE 2 EH10... has its own specially matched electronic control. The regulator and the output stage are both built into and encapsulated in the pilot stage (11).

The signal value to set the pressure level can be given as a regulated voltage ( $\pm 10V$ ) or as a regulated current ( $\pm 10 mA$ ).



Model 3 DS 2 EH 10...



Model 3 DSE 2 EH 10...



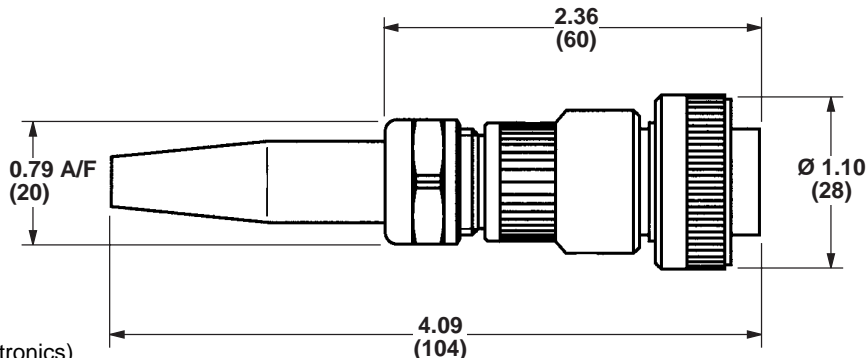
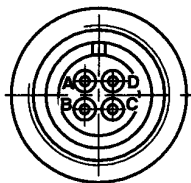
<b>Technical data</b> (for applications outside these parameters please consult us)								
<b>General</b>								
Mounting position	Optional							
Installation position	Optional, however, the pilot pressure must be $\geq 145$ PSI (10 bar)							
Permissible storage temperature	°F (°C)	-4 ... 176 (-20 ... 80)						
Ambient temperature range	°F (°C)	-22 ... 158 (-30 ... 70) -4 ... 140 (-20 ... 60) for Model 3 DSE 2 EH... (with integrated electronics)						
Weight (approx.)	lbs ( kg)	Pressure servo valve (basic model)					2.6 (1.2)	
		additionally:						
		Sandwich plate for external piloting (Models X, XY), see page 8, item 16					0.7 (0.3)	
		Sandwich plate for external drain (Models Y, XY), see page 8, item 21					0.6 (0.25)	
		Flushing block, see page 9					4.4 (2.0)	
<b>Hydraulic</b> , measured at $v = 190$ SUS (41 mm <sup>2</sup> /s) and $t = 122$ °F (50 °C)								
Operating pressure, Ports A, P, X1	PSI (bar)	up to 4600 (315) (note pressure range)						
Return line pressure, Ports T, Y	PSI (bar)	[pressure peaks < 1450 (100 bar)], static <145 (10)						
Hydraulic fluid	Petroleum oils (HM, HL, HLP); Phosphate ester fluids (HFD-R)							
Fluid temperature range	°F (°C)	-4 ... 140 (-20 ... 80)						
Viscosity range	SUS (mm <sup>2</sup> /s)	92 ... 1760 (20 ... 380); preferably 140 ... 208 (30 ... 45)						
Fluid cleanliness	Maximum allowable fluid cleanliness level – class 16/13, according to ISO 4406. Therefore, we recommend a filter with a minimum retention rate of $\beta_5 \geq 100$ without by-pass valve, with clogging indicator directly before the servo valve or as close as possible.							
Controlled pressure in port A in the neutral position	%	$\approx 45\%$ of the operating pressure of the 1st stage						
Controlled pressure range at port A	PSI (bar)	return line pressure < output pressure < operating pressure of 1st stage						
0 flow	GPM (L/min)	$\leq (1.2)$ (dependent upon the inlet pressure range)						
Hysteresis	%	$\leq 2.5$						
Non-linearity	%	$\leq 8$						
Sensitivity	%	$\leq 0.5$						
<b>Electrical</b>								
Insulation	Exceeds NEMA class B; (IP65 non-integrated, IP50 integrated)							
Type of signal	analog							
Pressure change in port A in neutral position with change in:								
Fluid temperature	(bar)	$\leq 0.1p / 50$ °C						
System pressure (0.8 to 1.2) x p in bar	%	$\leq 0.5$ x pressure change of the operating pressure of 1st stage						
Return line pressure (0 to 0.1) x p in bar	%	$\leq 0.4$ x pressure change in port T						
Electrical pilot control		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>8</b>	<b>9</b>
Associated amplifier	The associated electronic amplifier card is not included and must be ordered separately.						Integrated electronics	
		**	*	**	**	**	-	-
*Amplifier SR2 to data sheet RA 29 980 or amplifier VT 1600 to RA 29 716 should be used **Please consult us for electronics								
Nominal current / resistance per coil	A/ $\Omega$	5/500	30/40	7.5/200	20/80	50/28	-	-
Inductivity at 60 Hz and 100 % nominal current	Series circuit	H	8.8	0.25	4.0	1.0	0.44	-
	Parallel circuit	H	2.2	0.06	1.0	0.25	0.11	-
Recommended dither signal: $f = 340$ Hz	The amplitude of the dither depends on the hydraulic installation; maximum limit $\pm 10$ % of nominal current							
Supply voltage ( $\pm 3$ %)	V	-	-	-	-	-	$\pm 15$	-
Command value	regulated current	mA	-	-	-	-	$\pm 10$	-
	regulated voltage	V	-	-	-	-	-	$\pm 10$
Input resistance	k $\Omega$	-	-	-	-	-	1	$\geq 50$

## Plug-in connectors

**For model 3DS2EH 10...** (external electronics)

Plug-in connector – must be ordered separately under part no. **RR00 002 460**;

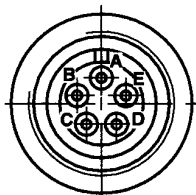
For PIN allocation see below and block circuit diagram on page 10



**For model 3DSE2EH 10...** (integrated electronics)

Plug-in connector – must be ordered separately under part no. **RR00 011 921**;

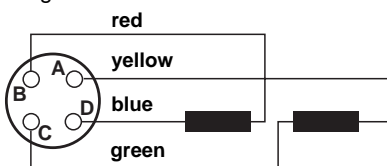
For PIN allocation see below



## Electrical connections

### Model 3 DS 2 EH 10...

Plug connection



Electrical connections to the servo valve can be made either in parallel or in series. For safety reasons and due to the lower coil inductivity produced we recommend parallel connection.

**Parallel connection:** For plug connection connect A to B and C to D.  
For cable connection connect yellow to brown and green to white.

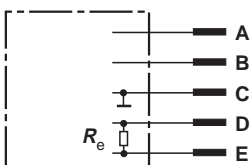
**Series connection:** For plug connection connect B to C.  
For cable connection connect brown to green.

An electrical input of A (+) to D (-) for plug connection

gives: pressure in port A < 45 % of operating pressure in 1st stage

Reversing the direction of the current gives: pressure in port A > 45 % of operating pressure in 1st stage

### Model 3 DSE 2 EH 10...



integral electronics

**Command value:**

	Plug connection	Current input signal	Voltage input signal
		Control "8"	Control "9"
Supply voltage (±3%)	A	+ 15 V	+ 15 V
	B	- 15 V	- 15 V
	C	0 V ⊥	0 V ⊥
Command value	D	± 10 mA	± 10 V
	E	Re = 1 kΩ	Re ≥ 50 kΩ
Current passing through plug connection	A	maximum	maximum
	B	100 mA	100 mA
	D	±10 mA	±0.2 mA
	E		

A negative command value with respect to connection E at connection D:

gives output pressures less than 45% of the operating pressure at the 1st stage.

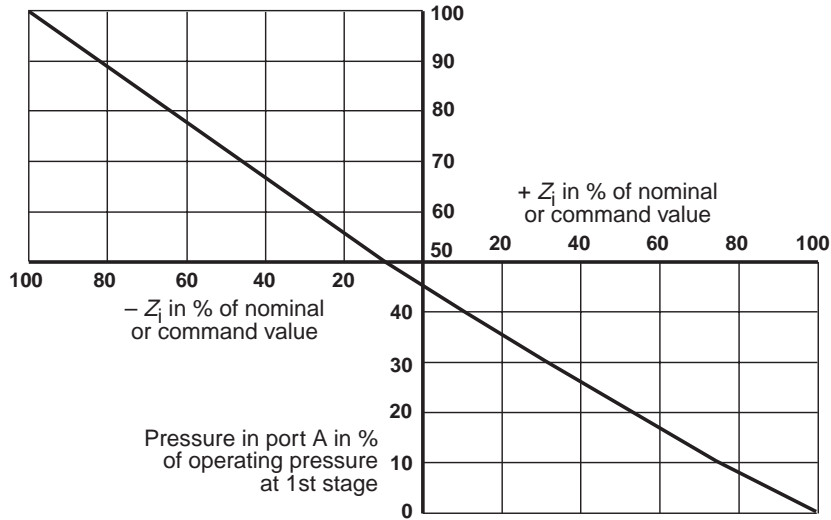
A positive command value with respect to connection E at connection D:

gives output pressures greater than 45% of the operating pressure at the 1st stage.

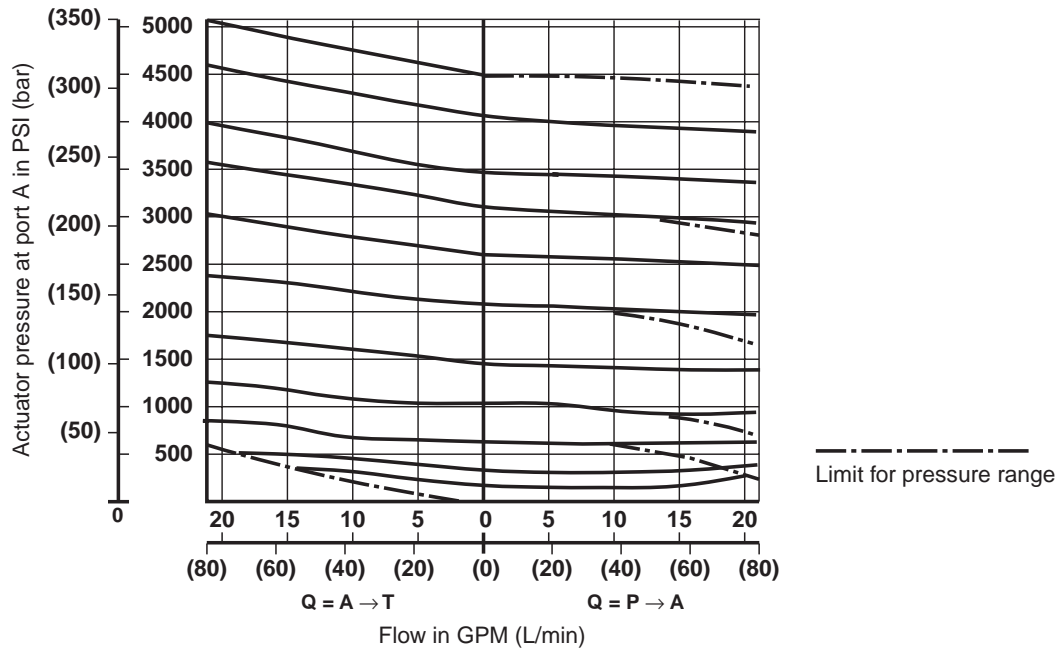


**Operating curves, measured at  $v = 190 \text{ SUS}$  ( $41 \text{ mm}^2/\text{s}$ ) and  $t = 122 \text{ F}$  ( $50 \text{ }^\circ \text{C}$ )**

**Pressure – Signal curve**  
(shown without hysteresis)

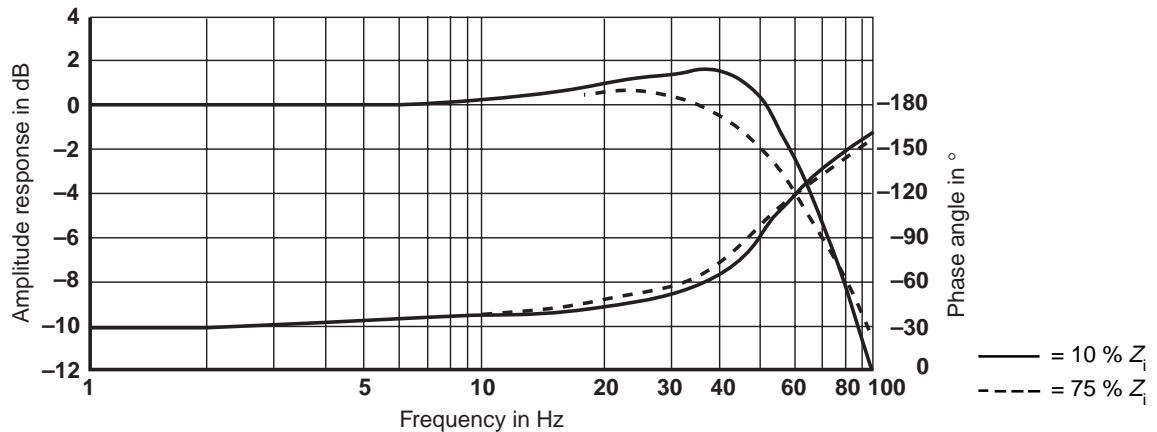


**Pressure – flow relationship**



**Frequency response curves\***

\* Typical frequency response curves measured at:  $Q = 3 \text{ GPM}$  ( $10 \text{ L/min}$ ); volume in actuator  $A = 1.83 \text{ in}^3$  ( $30 \text{ cm}^3$ )  
operating pressure =  $1015 \text{ PSI}$  ( $70 \text{ bar}$ )

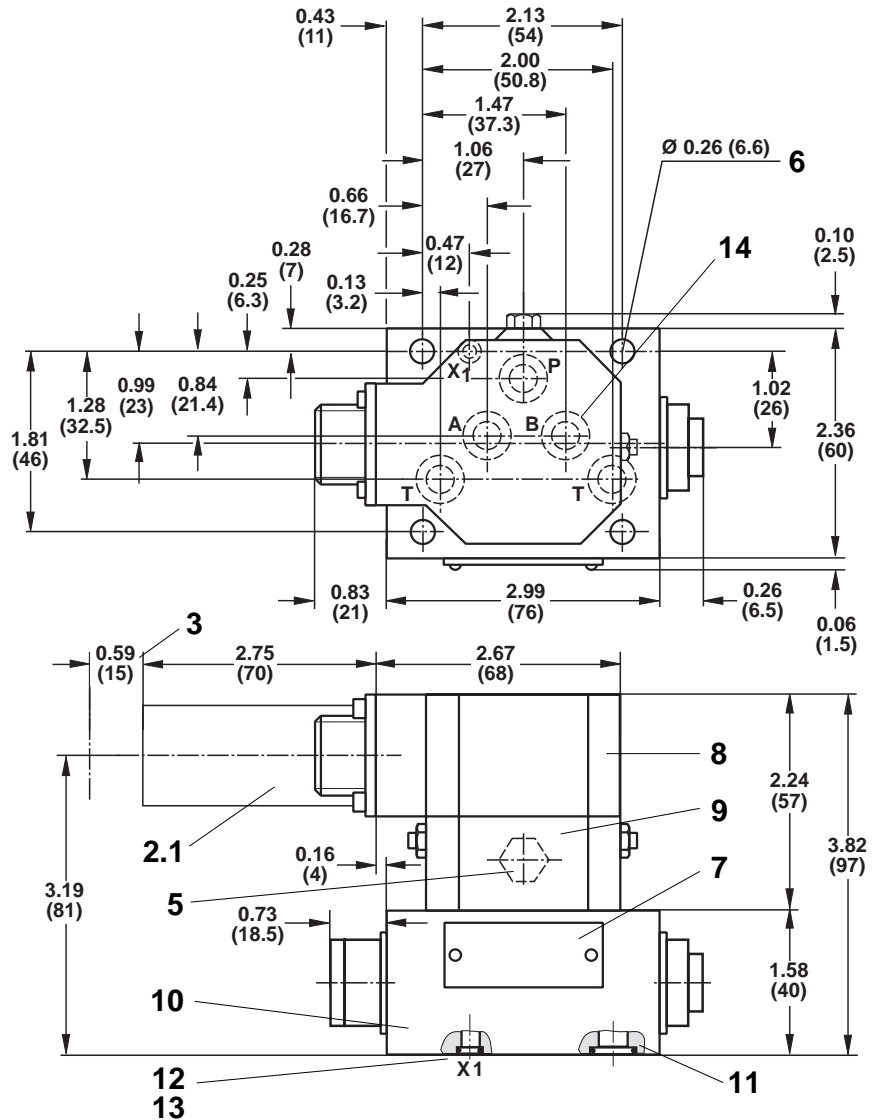


**Unit dimensions: dimensions in inches (millimeters)**

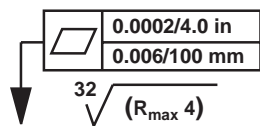
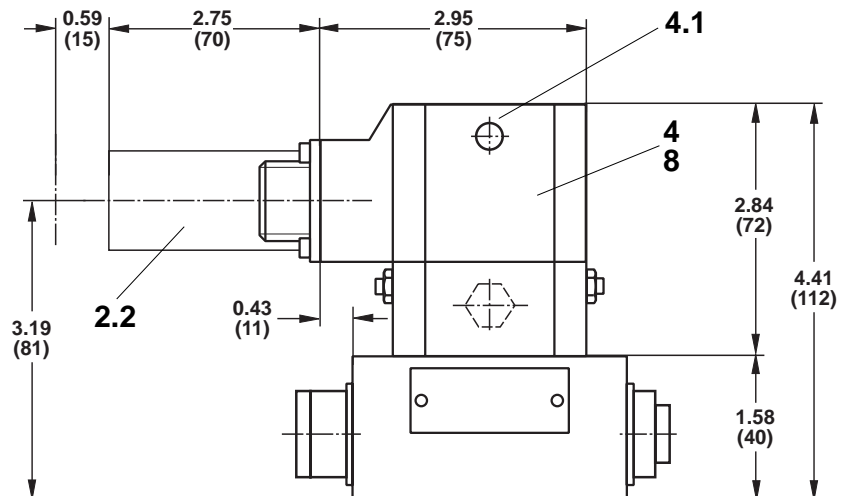
**Model 3 DS 2 EH 10...**

(for external electronic control)

- 2.1 Plug Model MS 3106 E 14S-2S  
plug to non-integrated valve  
order separately **RR00 002 460**
  - 2.2 Plug Model MS 3106 E 14S-5S  
plug to integrated valve
  - 3 Space required to remove plug  
**RR00 011 921**
  - 4 Cover for integrated electronics
  - 4.1 Zero point adjustment – remove the  
plug (2.5 mm A/F) to access the  
potentiometer to set the zero point
  - 5 Interchangeable filter element  
(10 mm A/F)
  - 6 Valve mounting bolts  
4) 1/4-20 UNC x 2" (M6 x 50);  
Tightening torque 7.7 lb-ft (10.4 Nm)
  - 7 Nameplate
  - 8 Top cover can be rotated 180 °
  - 9 Pilot control (1st stage)
  - 10 2nd stage
  - 11 O-ring 12 mm x 2 mm  
R-ring 13.0 mm x 1.6 mm x 2.0 mm  
for port A, (B), P and T
  - 12 O-ring 7 mm x 1.5 mm  
R-ring 7.3 mm x 1.4 mm x 1.5 mm  
for port X<sub>1</sub>
  - 13 X<sub>1</sub> port for external pilot feed (optional)  
Port drilling 3 ... 5 mm dia.  
The position of the X<sub>1</sub> port should be  
carefully noted.
- Warning:**  
**System pressure is always present at  
port X<sub>1</sub>**  
If the X port X<sub>1</sub> is to be used, an  
additional sandwich plate is required.  
To be ordered separately  
(see page 8 item 16).
- 14 **Warning:**  
Port B in the subplate is under  
pressure and must be plugged.
- Subplates:** to data sheet RA 45 054  
must be ordered separately.  
G 66/12 (SAE-6; 9/16-18)  
G 67/12 (SAE-8; 3/4-16)  
G 534/12 (SAE-12; 1-1/16-12)  
G 535/12 (SAE-12; 1-1/16-12) ] with  
G 536/12 (SAE-16; 1-5/16-12) ] port X



**Model 3 DSE 2 EH 10... (with integrated electronics)**



Required surface finish of  
interface when mounting the  
valve without our subplate





**Unit dimensions, Sandwich plate for externally piloted valves: dimensions in inches millimeters)**

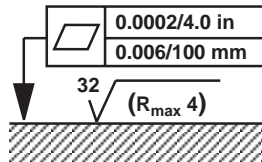
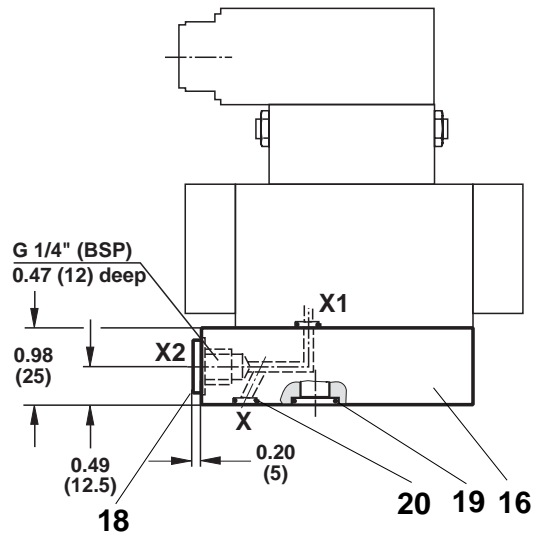
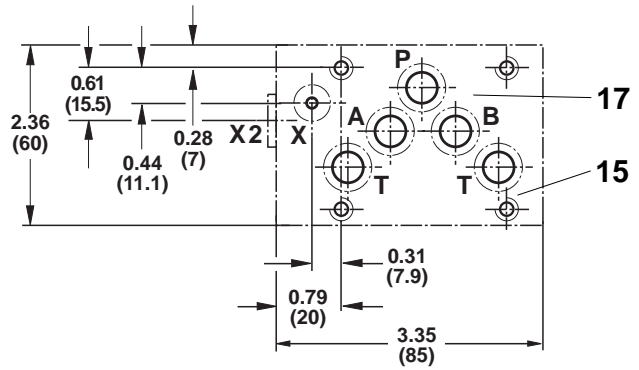
**External pilot feed (Models X and XY)**

Port X<sub>1</sub> is always present in the servo valve.

When installing the servo valve to a subplate without an X<sub>1</sub> connection, an additional sandwich plate (16) is required. This sandwich plate is not included within the ordering code for the valve, and must be ordered separately.

Port X or X<sub>2</sub> can be used for the pilot oil supply.

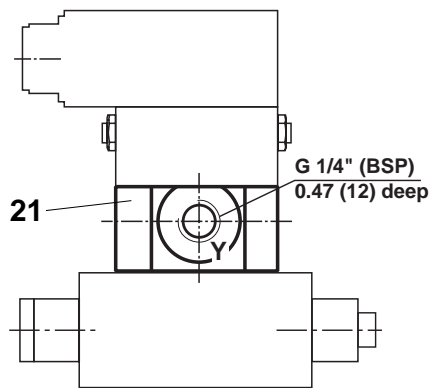
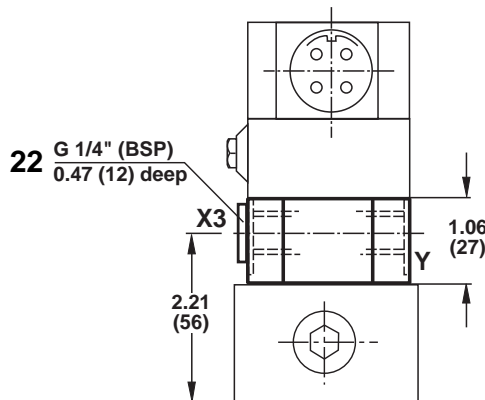
- 15 Valve mounting bolts  
4) 1/4-10 UNC x 3" (M6 x 75);  
tightening torque 7.7 lb-ft (10.4 Nm)
- 16 Sandwich plate with  
Buna-N seals, **Ordering Code RR00 319 482**  
Viton seals, **Ordering Code RR00 319 483**
- 17 Mounting surface for the sandwich plate (16)
- 18 1/4" BSP plug, **Ordering Code RR00 001 973**  
O-ring 14 mm x 2 mm
- 19 O-ring 12 mm x 2 mm ports A, (B), P, T  
R-ring 13.0 mm x 1.6 mm x 2.0 mm
- 20 O-ring 10.82 mm x 1.78 mm for port X  
R-ring 11.18 mm x 1.6 mm x 1.78 mm



Required surface finish of interface when mounting the valve without our subplate

**Unit dimensions, Sandwich plate for externally piloted valves: dimensions in inches millimeters)**

**Externally piloted (Models "Y" and "XY")**



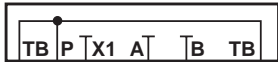
- 21 Sandwich plate included in supply
- 22 In Model "XY", port X<sub>3</sub> can be used instead of port X<sub>1</sub> for the pilot oil feed.

This sandwich plate is **not** to be used with mechanical feedback or electrical feedback with integrated electronics.



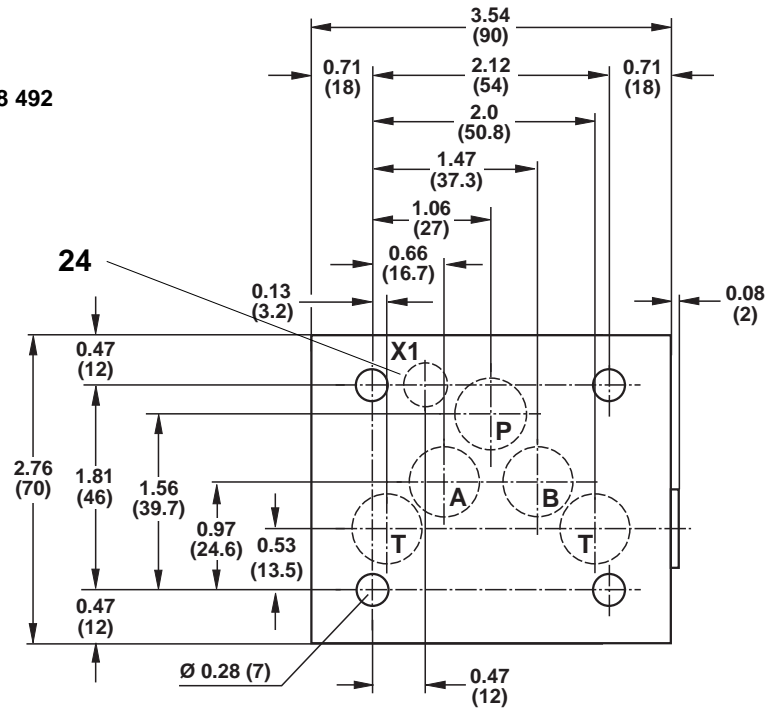
**Unit Dimensions, Flushing plate: dimensions in inches (millimeters)**

**Symbol**



with NBR - seals  
**Ordering code: RR00 308 492**

- 23** O-ring 12 mm x 2 mm (ports A, B, P, T)  
 R-ring 13.0 mm x 1.6 mm x 2.0 mm
- 24** O-ring 7 mm x 1.5 mm (port X<sub>1</sub>)  
 R-ring 7.3 mm x 1.4 mm x 1.5 mm
- 25** Valve mounting bolts  
 4) socket head cap screws  
 1/4-20 UNC x 2" (M6 x 50)  
 tightening torque = 11.4 lb-ft (15.5 Nm)



In order to guarantee the perfect functioning of servo valves the installation must be flushed prior to start-up.

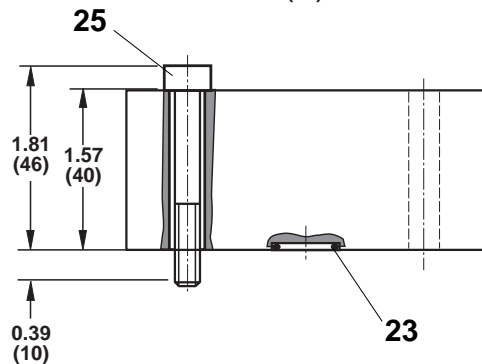
As a guide, to the flushing time required, the following formula can be used:

$$t \geq \frac{V}{Q} \cdot 5$$

*t* = Flushing time in minutes  
*V* = Tank contents in gallons (litres)  
*Q* = Pump flow in GPM (L/min)

If the tank needs to be refilled with more than 10% of its capacity, the flushing process should be repeated.

**Note:** A directional control valve with mounting pattern according to ISO 4401-5, NFPA/ANSI D 05 is better than a flushing plate. Such a valve allows the actuator ports and lines to also be flushed.



**Notes**

Empty rectangular area for notes.

**Mannesmann Rexroth Corporation**



*Rexroth Hydraulics Div., Industrial, 2315 City Line Road, Bethlehem, PA 18017-2131 Tel. (610) 694-8300 Fax: (610) 694-8467*  
*Rexroth Hydraulics Div., Mobile, 1700 Old Mansfield Road, Wooster, OH 44691-0394 Tel. (330) 263-3400 Fax: (330) 263-3333*